

STANDARD SPECIFICATIONS & DETAILS FOR CONSTRUCTION

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TOWN OF LAKE LURE

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SECTION “S”

WATER AND SEWER LINE SPECIFICATIONS

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PART 1: GENERAL**1.01 SCOPE OF WORK**

- A. The work under this section consists of furnishing all materials, labor, equipment and services required for the complete installation of encasement pipe and carrier pipes under highways and railroads by boring and jacking as shown on the drawings and specified herein.

All work in connection with constructing encasement pipes under highways and railroads shall comply with all current requirements of governing highway and railroad agencies. The Contractor shall be familiar with these requirements.

The Contractor shall inspect the locations at the proposed crossings and shall familiarize himself with the conditions under which the work will be performed, and with all necessary details and the suitability of his equipment and methods for the work required.

PART 2: PRODUCTS**2.01 MATERIALS**

- A. Encasement pipe shall be smooth wall welded steel conforming to ASTM Designation A139, Grade B. Minimum pipe diameter and wall thickness shall be as follows:

Pipe - Nominal Diameter Inches	Wall Thickness Inches
16	.250
20	.250
24	.250
30	.312
36	.500

Carrier Pipe Diameter	*Min. Encasement Pipe Diameter	Wall Thickness	
		Roadway	Railroad
8-inch DIP or PVC	18 inches	0.250 inches	0.312 inches
10-inch DIP or PVC	20 inches	0.250 inches	0.344 inches
12-inch DIP or PVC	24 inches	2.250 inches	0.406 inches
15-inch PVC	30 inches	0.312 inches	0.465 inches
16-inch DIP	30 inches	0.312 inches	0.469 inches
18-inch DIP or PVC	30 inches	0.312 inches	0.469 inches
18-inch RCP	36 inches	0.375 inches	0.562 inches
20-inches	36 inches	0.375 inches	0.562 inches
21-inch RCP or PVC	36 inches	0.375 inches	0.562 inches
24-inch DIP or PVC	36 inches	0.375 inches	0.562 inches
24-inch RCP	42 inches	0.500 inches	0.625 inches

***Minimum Encasement Pipe Diameter to be utilized unless a larger size is noted on the drawings or in the Bid Schedule**

PART 3: EXECUTION

3.01 INSTALLATION

- A. Encasements shall be installed by boring and jacking unless field conditions require otherwise. It shall be the Contractor's responsibility to notify the Town or other appropriate regulatory agency immediately if conditions do not permit a jack and bore installation.
- B. The encasement pipe shall be of the diameter indicated on the chart above.
- C. Installation of encasement pipe shall include all related work and services such as mobilization of equipment, constructing and maintaining working pits, right-of-way maintenance and restoration, traffic maintenance, mining, excavations, dewatering, sheeting, shoring and bracing for embankments, operating pits, and as elsewhere required shall be placed and maintained in order that work may proceed safely and expeditiously.
- D. Installation of the casing pipe shall be carried out without disturbance of the embankment, pavement, tracks, or other railroad or highway facilities and without obstructing the passage of traffic at any time.
- E. The driven portions of the casing shall be advanced from the lower end of the casing unless specific permission to do otherwise is obtained by the Contractor from the Town or other appropriate regulatory agency.

- F. The alignment and grade shall be carefully maintained and the encasement pipe installed in a straight line.
- G. The space outside the encasement and the ground shall be filled with grout, sand or pea gravel, as directed by the Town and other appropriate regulatory agencies. Those agencies will direct that this space be filled if the space is large enough to cause any earth settling.
- H. Before the pipe is installed in the casing, bolt-on metal skids painted with bitumastic paint shall be rigidly fastened to the barrel of the pipe. After completion of the casing, the Contractor shall insert the pipeline in pre-jointed segments. No contact will be permitted between the casing and the carrier pipeline.
- I. Work done within NCDOT controlled roadway shall also be done in strict accordance with all NCDOT requirements. Prior to beginning work within NCDOT rights-of-way, developer shall provide copies of all NCDOT approvals to the Town.

END OF SECTION

PART 1: GENERAL**1.01 SCOPE OF WORK**

- A. This specification covers the requirements for furnishing and installing valves and other appurtenances for the various water system improvements shown on the Drawings.
- B. Furnish all labor, equipment, materials and incidentals necessary to install and complete water valve and appurtenance installation in accordance with the plans and specifications approved by the Town. All valves and appurtenance material shall be of the type and class specified herein.
- C. All water valve and appurtenance excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.02 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall unload valves and appurtenances so as to avoid deformation or other injury thereto. The Contractor shall store valves and appurtenances above storm drainage levels. All valves shall be drained and so stored as to protect them from freezing.
- B. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

1.03 WARRANTY

All materials shall be guaranteed to be free from defects in materials and workmanship for a period of one (1) year after final acceptance by the Town.

PART 2: PRODUCTS

2.01 MATERIALS

A. GATE VALVES

All gate valves shall be designed for a minimum working pressure of 200 psi unless otherwise specified. Valves shall have a clear waterway equal to the full nominal diameter of the pipe. Valves shall be opened by turning counterclockwise. Each valve shall have the initials or name of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure. Valves shall be operated by handwheel for above ground installations or 2" square operating nut for below ground installations. Valves shall have an arrow cast in the metal indicating the direction of opening.

Valves to be installed underground (Buried) shall be of the non-rising stem type and shall have mechanical joint connections.

Valves installed above ground or in structures shall have rising stems with outside stem and yoke and 18" diameter minimum hand wheel and shall have flanged ends with 125# flanges unless others noted.

1. Gate Valves 2" and Smaller

- a. Gates valves 2" and smaller shall be all brass, single disc type, double seat tapered wedge type built to manufacturer's standards with material and construction conforming to AWWA C-500.
- b. Each valve shall have a 2" operating nut. Valves shall have screwed ends conforming to NPT standards.

2. Resilient Seated Wedge Valve

- a. Gate valves 3" through 24" diameter size shall be of cast iron or ductile iron body, resilient seated wedge type meeting the requirements set forth in AWWA C-509 and AWWA C-500. Valves shall be manufactured by Mueller Co., Model A-2360.
- b. Gate valves shall have body, bonnet and gate manufactured of cast iron or ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in Table 2, Section 4.4 of AWWA C-509 and C-500. The valve body and bonnet shall be coated on both the

interior and exterior surfaces with a fusion bonded epoxy paint conforming to AWWA C-550.

- c. The gate shall be fully covered with a rubber cover over all exterior and interior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part which houses the stem nut. The gate and rubber coat shall conform to ASTM D429.
- d. Valve stems shall be cast bronze. The stuffing box shall use "O"-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.
- e. Valves larger than 12" diameter shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve.

3. Double Disc Type Gate Valves

- a. Gate valves larger than 24" diameter size shall be of the ductile iron body, double disc parallel seat type meeting the requirements set forth in AWWA C-500. All valves shall be Mueller and parts shall be interchangeable. Valves shall have a working pressure of 150 psi.
- b. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces.
- c. The gates shall be high strength cast iron, sturdily proportioned without pockets on the backs. All cam surfaces shall open to the bottom. Gate rings shall be rolled into a dovetail groove under pressure to make a single insertable finish.
- d. Valves shall use bottom wedging type design with a two part floating wedge contact. The wedge and hook shall be separate castings and not a single piece.
- e. Valve stems shall be cast bronze. The stuffing box shall use "O"-ring seal type with two rings located above the thrust

collar. The rings shall be replaceable with the valve fully open and under pressure.

- f. Valves shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve. Valves shall have bronze rollers, tracks, and scrapers.
- g. All valves shall be supplied with a bypass as a part of the valve. Bypass shall be a minimum of 3" diameter with a 3" resilient seated wedge valve.

B. VALVE BOXES

Valve boxes shall be provided for all valves installed below grade. All valve boxes shall be cast iron and shall conform to ASTM A48. Valve boxes shall be of the adjustable screw type with a base to fit the valve yoke with a removable cover with the word "water" cast thereon.

C. FIRE HYDRANTS

- 1. Fire hydrants shall comply with all of the applicable requirements of the AWWA C-502, latest revision, for dry-barrel fire hydrants and with these specifications. Hydrants shall be of the traffic model type incorporating a break-away flange arrangement which will permit the upper section of the hydrant barrel to separate from the lower section upon impact. Each hydrant shall include an automatic system designed to lubricate the entire length of the threaded part of the valve stem each time the hydrant is operated. It shall be further equipped with "O"-ring seals to insure that threads on the valve stem do not come into contact with water at any time.
- 2. Hydrants shall open counterclockwise with 5-1/4" compression base valve opening against pressure and be capable of withstanding 250 psi working pressures and 500 psi hydrostatic test pressures, unless otherwise specified. The pentagonal operating nut shall be 1-1/2" from the point to the flat. Hydrants shall be equipped with one (1) 4-1/2" pumper nozzle and two (2) 2-1/2" hose nozzles, all with National Standard Threads per Appendix A of AWWA C-502, and chained nozzle caps. Nozzles shall be reverse threaded into the fire hydrant barrel.

3. Unless otherwise indicated on the plans approved by the Town, all hydrants shall have 6" or larger mechanical joint bottom connections, 5¼" valve openings and a bury to the bottom of the ditch plus the main line diameter. All hydrants shall be painted the manufacturer's standard red unless otherwise specified. Following installation and testing all hydrants shall be painted with two (2) 6-mil coats of epoxy paint.
4. All fire hydrants shall be Mueller Super Centurion.
5. All iron parts within fire hydrants shall be ductile iron.
6. The bury length (distance from ground line to insert of the hydrant inlet) shall be 4'-0" unless ground conditions shown on the Town approved plans warrant a deeper bury.
7. The hydrant main valve shall be 5¼" minimum and shall be of the full compression design, opening against and closing with pressure. The valve seat ring shall thread into a bronze sub-seat, and all gaskets sealing the seat ring shall be a bronze-to-bronze surface.
8. Drain valves shall be all bronze and allow complete draining of all residual water in the hydrant barrel.
9. All bolting and fasteners below ground shall be stainless steel.
10. The operating machine shall utilize two (2) "O"-ring seals between the revolving nut and bronze-sheathed upper section of the valve rod. The top of the rod shall also be fitted with a travel stop nut to limit downward travel of the rod. All-weather grease shall be used to provide permanent lubrication. A thermoplastic thrust washer shall be used to reduce friction in the thrust collar while opening the hydrant.
11. The hydrant inlet shall be mechanical joint. Joint restraint, if specified, shall be accomplished for mechanical joint by use of mechanical joint gripper glands.

D. AIR RELIEF VALVE

1. The air relief valve shall be rated for a working pressure of 150 psi and hydrostatic test pressure of 300 psi and shall automatically function to release to atmosphere small amounts of air that accumulate in the pipeline. Once the air has been exhausted, the valve shall seat tightly to prevent water leakage.

2. All air release valves shall be Golden Anderson Fig. 910.

E. MANHOLE SECTIONS AND APPURTENANCES

1. Precast concrete manhole bases, risers and cones shall conform to ASTM C478, latest revision, for precast reinforced concrete manhole sections. Tapered sections and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes and where shown or specified. Cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.
2. Minimum compressive strength of concrete shall be 4000 psi and the maximum permissible absorption shall be 6.5%. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. The tongue or the groove of the joint shall contain one line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes. Precast manhole sections shall fit together readily and shall have a self-contained "O"-ring rubber gasket conforming to ASTM C443.
3. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Town. The manhole sections shall be perpendicular to their longitudinal axis, within the limits listed in ASTM C478.
4. Castings for manhole frames and covers shall be tough, even grained soft gray iron, free from burnt on sand and other injurious defects and conform to the requirements of ASTM A48, latest revision, Class 30, with "WATER" cast into the cover.
5. Brick for manholes and other structures shall conform to applicable requirements of ASTM C62, latest revision, Grade SW.

F. TAPPING SLEEVE AND VALVE

1. Tapping sleeves shall consist of two piece split ductile iron, jointed by bolts manufactured of high strength cast iron and incorporating a longitudinal compound rubber gasket. The sleeves shall include split end gasket and two piece mechanical joint glands suitable for the class of pipe around which sleeves are to be placed. Glands will be

joined by steel bolts and fastened to the bell openings of the sleeves to form totally enclosed rubber water tight seals around the periphery of the pipe and along the longitudinal joints.

2. The sleeves shall have flanged outlets which will accommodate the tapping valves. Valves will be identical to resilient wedge gate valves elsewhere specified with inlet and outlet ends adaptable to the tapping machine and to provide mechanical joint connections to discharge pipes.

PART 3: EXECUTION

3.01 INSTALLATION

A. EXCAVATION

1. The work covered by this section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.
2. Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, water pipe, manholes, catch basins, hydrants, watergates, sewer services, water taps, drainage structures, drainage ditches and other unclassified excavation as may be deemed necessary by the Town.
3. The excavation shall be done to the lines, grades, typical sections, and details shown on the approved plans or established by the Town or authorized representative. All work covered by this section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots which protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Town.
4. All excavation shall be by open cut unless otherwise authorized by the Town. If the bottom of the excavation is found to consist of rock or any materials that cannot be excavated to give a uniform bearing surface, the material shall be removed to a depth at least 6" below established bottom grade and backfilled to grade with suitable bedding material thoroughly compacted in place. Any excavations carried below the depths indicated, without specific directions, shall be backfilled in the same manner. The excavation shall be of

sufficient width to allow a clearance of not less than 6" between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary.

5. Sheeting, Bracing Trenches, and Trench Boxes

Sheeting and Bracing shall be provided in accordance with all applicable federal, state, and local safety and health regulations.

6. No sheeting or bracing shall extend closer than 2'-0" off the ground surface, or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. It is understood that the Town will be under no obligation to pay for sheeting or bracing left in place by the Contractor. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom.

7. Excavated materials to be used for backfill will be approved by the Town, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance.

B. **INSTALLING VALVES AND APPURTENANCES**

1. Thrust Blocks

- a. All plugs, caps, tees, bends, reducers and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum dimensions shown on the drawings or as directed. Thrust blocks shall be made of concrete having a compressive strength of 28 days of 3000 psi and shall bear directly against the undisturbed trench wall. Where possible, the backing shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a polyethylene film placed between the fittings and the poured concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three days after installation of the concrete thrust blocks unless otherwise

approved by the Town. Where trench conditions are, in the opinion of the Town, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.

- b. Concrete for thrust blocks shall consist of a mix of Portland Cement, Fine Coarse aggregate and water to produce concrete with a minimum compressive strength at 28 days of not less than 3000 psi when tested in accordance with ASTM C39 or C42. Sakrete or any similar material will not be permitted under any circumstances.

2. Valves

Before setting each valve, the Contractor shall make sure the interior is clean and test opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the plans, and at the exact locations shown. Trench backfill shall be tamped thoroughly for a distance of 3'-0" on each side of valves boxes.

3. Valve Boxes

A valve box shall be installed over each underground valve. All boxes shall be set plumb with their top flush with finished grade.

4. Fire Hydrant

Fire hydrants shall be located as shown on the approved plans. Each hydrant shall be connected to the main with a 6" branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18" above the finished grade. Hydrants shall be rodded to the 6" or larger branch tee. Unless otherwise specified, the backfill around hydrants shall be thoroughly compacted to the final grade immediately after installation in order to put the hydrant into service as soon as practicable. Not less than seven (7) cubic feet of clean crushed stone shall be placed around the base of the hydrant to insure drainage of the hydrant barrel. A cap block shall be set under the fire hydrant foot for a solid bottom.

5. Air Relief Valves

Each air relief valve shall be installed at the exact location shown in a precast concrete manhole as shown in detail on the approved

plans. Manhole sections shall be set plumb and on a firm foundation. Each joint between sections and all wall openings shall be sealed inside and out with a 2:1 sand-cement mortar and made watertight. When so directed, the Contractor shall install a flat slab top, precast with a standard frame and cover. Flat slab tops shall be traffic bearing.

C. BACKFILLING AND COMPACTION

1. Backfill trenches immediately after approval of the pipeline construction.

2. Roadways and Road Crossings

Use select backfill placed in uniform layers not exceeding 6" in thickness for full trench depth and width, thoroughly compacted with mechanical tampers under optimum moisture conditions to 95% compaction (100% for the top 2'-0" of subgrade beneath pavements). Replace removed paving and base course with new material of equal or better quality and of the same texture and color as the adjacent roadway.

3. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to 95% of the Standard Proctor Test (100% for the top 2'-0" of subgrade beneath pavements) for the various types of backfill material. Methods of backfilling shall be in strict accordance with the pipe manufacturer's recommendations. All backfill material shall have been approved by the Town. Select backfill material shall be used when requested by the Town.
4. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.
5. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the approved plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material. Pipe which becomes mis-aligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor.

6. The Contractor shall maintain all pipes installed in a condition that they will function continuously from the time the pipe is installed until the project is accepted.

7. Cleanup

Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.

3.02 QUALITY CONTROL

A. TESTING

Testing of valves and appurtenances shall be incidental to the testing of the water lines, and shall be performed as part of that testing.

END OF SECTION

SECTION 02660

WATER PIPE AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, equipment, materials and incidentals necessary to install and complete installation of ductile iron and polyvinyl chloride (PVC) water lines in accordance with the plans. All pipe and appurtenance material shall be of the type and class specified herein.
- B. All water pipe excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.02 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall unload pipe so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a large size and shall not be rolled or dragged over gravel or rock during handling. When any joint or section of pipe or other material is damaged during transporting, unloading, handling or storing, the undamaged portions of the pipe or material may be used or if damaged sufficiently, the Town will reject the material as being unfit for installation.
- B. If any defective material is discovered after installation, it shall be removed and replaced with sound pipe or shall be repaired by the Contractor in an approved manner and at his own expense.

PART 2: PRODUCTS

2.01 MATERIALS

A. DUCTILE IRON PIPE

- 1. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs, and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Town at the plant, trench, or other point of delivery, for the purpose of culling and rejecting material which does not conform to the requirements of these specifications. Such material shall be marked by the Town, and the Contractor shall remove it from the project site upon notice being received of its rejection.

2. As specific specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new number, except provisions in revised specifications which are clearly inapplicable.
3. Ductile Iron Pipe shall be manufactured in accordance with AWWA C151. All Ductile Iron Pipe shall be 350 psi class unless otherwise specified and shall be lined with a cement mortar lining not less than 1/16" thick conforming to AWWA C104. Pipe wall thickness for all Ductile Iron Pipe shall conform to "Thickness Design for Ductile Iron Pipe," AWWA C150. The standard laying condition shall be type 2. The exterior of all Ductile Iron Pipe shall have a protective coating of a coal tar or asphaltic material a minimum of 1 mil thickness conforming to AWWA C151.

a. Flanged Joints

- i. Flanged pipe shall have flanges with long hubs, shop fitted on the threaded end of the pipe.
- ii. Where required, flanges shall be tapped for stud bolts. Flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true, and covered with coal tar pipe varnish or otherwise protected against corrosion of flange faces. Flange faces shall be cleaned to bare metal with wire brushed before installation of pipe.
- iii. Ductile iron flanged joint pipe shall have a thickness of Class 350 minimum and shall conform to AWWA C110 and AWWA C115. Pipe shall be ordered in lengths needed as no pipe shall be cut, threaded or flanged in the field. All pipe shall have 125 lb. flanges conforming to AWWA C110 unless otherwise specified.
- iv. Flanged joints shall be made up with through bolts of the required size. Bolts shall be zinc plated, with good and sound, well fitting threads, so that the nuts may be turned freely by hand.
- v. Flanged joints shall be made up using only full face gaskets with a minimum thickness of 1/8". Ring gaskets are not acceptable. Gasket material shall be rubber or approved equal as recommended by the Manufacturer.

- vi. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together.

b. Mechanical Joints

- i. All mechanical joint pipe shall be manufactured in accordance with AWWA C111. Pipe shall be manufactured in accordance with AWWA C151, and the pipe thickness shall be 350 psi class as determined by AWWA C150 unless otherwise noted.
- ii. All bolts shall be tightened by means of torque wrenches in such a manner that the follower shall be brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.
- iii. Bolts for mechanical joints shall be high grade steel, low alloy type, with tee or hex head and American Standard threads. Mechanical joint gland shall be gray iron and shall utilize a plain rubber gasket.

c. Slip Joints

- i. Slip or "push-on" joints shall be manufactured in accordance with AWWA C111. Pipe thickness shall be 350 psi class as determined by AWWA C150.
- ii. Bells of "slip" joint pipe shall be contoured to receive a bulbshaped circular rubber gasket, and plain ends shall have a slight taper to facilitate installation. The lubricant used in making up the joints shall be furnished by the pipe manufacturer. The jointing shall be done by guiding the plain end into the bell until contact is made with the gasket and by exerting a sufficient compressive force to drive the joint home until plain end makes full contact with the base of the bell. No joint may exceed a maximum deflection of eleven inches (11") in an 18-foot joint of pipe (3°).

4. Fittings

- a. All ductile iron pipe fittings for pipe shall be mechanical joint type in accordance with AWWA C153 (ductile iron, compact

type) for 3"-24", and AWWA C110 (ductile iron, full body type) for pipe larger than 24". Where flanged pipe is used ductile iron fittings shall be flanged in accordance with AWWA C153 or C110 where applicable for exposed piping. All flanges shall be Class 125 unless otherwise noted.

- b. All fittings shall be lined with cement mortar not less than 1/16" thick in conformance with AWWA C104 and suitable for a minimum of 250 psi working pressure unless otherwise specified.
- c. All mechanical joints shall be manufactured in accordance with AWWA C111.

PART 3: EXECUTION

3.01 INSTALLATION

A. EXCAVATION

1. Trenches will be defined as all excavation for the installation of water pipe, hydrants, valves, water services, water taps, and other excavations as may be necessary to complete the installation.
2. The excavation shall be done to the lines, grades, typical sections, and details shown on the approved plans or established by the Town. All work covered by this section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots which protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Town.
3. All excavation shall be by open cut unless otherwise authorized by the Town or their authorized representative. If the bottom of the excavation is found to consist of rock or any materials that cannot be excavated to give a uniform bearing surface, the material shall be removed to a depth at least 6" below established bottom grade and backfilled to grade with #67 washed stone. Any excavations carried below the depths indicated, without specific directions, shall be backfilled in the same manner. The excavation shall be of sufficient width to allow a clearance of not less than 6" between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and

consequently, proper allowance must be made for additional space required for sheeting the trench where necessary.

4. Sheeting and bracing shall be provided in accordance with all applicable federal, state, and local safety and health regulations.
5. No sheeting or bracing shall extend closer than 2'-0" off the ground surface, or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom.
6. Excavated materials to be used for backfill will be approved by the Town, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance.
7. Materials which are excess to the needs of the project will be disposed of by the Contractor.
8. In order to protect existing pavement structures and to make clean-up easier the Contractor shall place a 6" layer of sand on all asphalt or concrete surfaces prior to placing excavated material.
9. Pipe Foundations
 - a. The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections as shown on the plans for the type of pipe being installed. Unless otherwise noted all pipe shall be installed using a Type 2 trench foundation as defined in AWWA C151.
 - b. The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the approved plans. Any deviation or field adjustment will require the approval of the Town.
 - c. Whenever the nature of the ground will permit, the excavations at the bottom of the trench shall have the shape and dimensions of the outside lower third of the

circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade.

- d. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and #67 washed stone of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe.
- e. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6". #67 washed stone shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.
- f. Where the foundation material is found to be of poor supporting value, the Town may permit minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as directed by the Town, within limits established on the approved plans, and backfilling with #67 washed stone as approved by the Town.
- g. The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing and no pipes shall be laid until the water has been removed from the trench. Water so removed from the trench must be disposed of in such a manner as not to cause injury to work completed or in progress.
- h. Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the Town will require the pipe to be laid on a washed stone foundation.

B. INSTALLING PIPE AND APPURTENANCES

1. Laying Pipe

- a. All piping is to be installed in strict accordance with the manufacturer's recommendations, AWWA C600, AWWA C605 and the contract material specifications. Installation manuals from various material suppliers will be furnished to the Town for their review and approval prior to installation of any materials. The Town may augment any manufacturer's installation recommendations if, in their opinion, it will best serve the interest of the Town.
- b. No pipe shall be laid except in the presence of the Town or their Representative, or with special permission from the Town.
- c. Proper tools, implements and facilities satisfactory to the Town shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe, fittings, valves, and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean and free of defects. It shall be laid on the prepared foundations, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line.
- d. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.
- e. When cutting short lengths of pipe, a pipe cutter, as approved by the Town, will be used and care will be taken to make the cut at right angles to the center line of the pipe or on the exact skew as shown on the plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder or coarse file to match the manufactured taper.
- f. All pipe joints shall be constructed in strict accordance with the pipe manufacturer's specifications and materials and any deviation must have prior approval of the Town.
- g. The maximum deflection per joint of flexible joint pipe shall be that deflection recommended by the manufacturer. However, at no time will a deflection greater than 3° (11") be allowed.

- h. All water lines shall have a minimum 12" vertical separation from storm sewer and shall have a minimum of 10'-0" horizontal separation from sanitary sewer or 18" vertical separation with the water line over the sewer line. In the event these separations cannot be met, both water line and sanitary sewer shall be constructed of ductile iron pipe as directed by the Town or as shown on the approved drawings.

2. Thrust Blocks

- a. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum dimensions shown on the approved drawings or as directed by the Town. Thrust blocks shall be made of ready mix concrete having a compressive strength of 28 days of 3000 psi and shall bear directly against the undisturbed trench wall. Where possible, the concrete shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a 20 mil polyethylene film placed between the fittings and the concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three days after installation of the concrete thrust blocks unless otherwise approved by the Town. Where trench conditions are, in the opinion of the Town, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.
- b. Concrete for thrust blocks shall consist of a ready mix of Portland Cement, fine and coarse aggregate, and water to produce concrete with a minimum compressive strength at 28 days of not less than 3000 psi when tested in accordance with ASTM C39. Sakrete or any similar material will not be permitted under any circumstances.

3. Exposed Pipe

- a. Exposed pipe to be installed inside tanks, wetwells, vaults and buildings shall be installed as shown on the approved drawings and field painted as described below. All exposed ductile iron pipe shall utilize flanged joints unless otherwise noted.

- b. All exposed cast or ductile iron pipe, fittings and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint manufacturer. Color of paint shall be as selected by the Town.

C. BACKFILLING AND COMPACTION

1. Backfill trenches immediately after approval of the pipeline construction.
2. Use backfill material carefully placed in uniform layers not exceeding 6" in thickness to a depth of 3'-0" over the top of the pipe. Place material and fill the area under the pipe haunches. Place each layer, moisten as necessary; then uniformly compact by use of hand, pneumatic, or mechanical tampers exercising care to prevent lateral displacement. Areas of backfill 2'-0" over top of pipe to top of trench, shall be backfilled with material containing no rocks larger than 6" in the greatest dimension and shall be free of material with an exceptionally high void content. The initial backfill shall meet the same requirements except no rocks over 4" in diameter will be allowed.
3. If material excavated from the trench is unsuitable to be used as backfill, "Select Backfill" shall be transported to the site by the Contractor from outside the project limits to be used as backfill material.
4. Moisten backfill as necessary above 2'-0" over the top of the pipe and place in 8" layers. Compact each layer with hand, pneumatic or mechanical compactor. Puddling or flooding of trench for consolidation of backfill or use of wheel rolling by construction equipment will not be permitted.
5. Use select backfill placed in uniform layers not exceeding 6" in thickness for full trench depth and width, thoroughly compacted with mechanical tampers under optimum moisture conditions to 95% compaction (100% for the top 2'-0" of subgrade beneath pavements). Replace removed paving and base course with new material of equal or better quality and of the same texture and type as the adjacent roadway.
6. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to 95% of the maximum dry density as determined by Standard Proctor Test (100% for the top 2'-0" of subgrade beneath pavements) for the various types of backfill material. Methods of backfilling shall be in strict accordance

with the pipe manufacturer's recommendations. All backfill material shall have been approved by the Town. Select backfill material shall be used when requested by the Town.

7. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.
8. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the approved plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material. Pipe which becomes mis-aligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor.
9. The Contractor shall maintain all pipes installed in a condition that they will function continuously from the time the pipe is installed until the project is accepted.
10. Cleanup
 - a. Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.
 - b. Cleanup and seeding is part of the pipeline installation. No more than 3,000 L.F. of water line may be laid prior to completion of cleanup of the first section of pipeline laid.

3.02 QUALITY CONTROL

A. TESTING

1. After the pipeline has been satisfactorily constructed, complete with the required fire hydrants, services, and all other appurtenances, and the trench sufficiently backfilled, the newly constructed pipeline and valved sections shall be subjected to a hydrostatic pressure test. Each completed section of the pipeline shall be plugged at both ends and slowly filled with water. At no time shall more than 4,000

linear feet of main be tested. As the main is being filled with water in preparation of the tests, all air shall be expelled from the pipe. The main shall be subjected to hydrostatic pressure of 200 pounds per square inch (at the lowest point of the line section under test) for a period of two (2) hours unless otherwise specified. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.

2. Air removal. Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air valves are not located at all high points, corporation cocks shall be installed at these points to expel the air as the line is filled with water. At the conclusion of a successful pressure test, the corporation cocks shall be removed and the pipe plugged.
3. Examination. Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with reliable material, and the test shall be repeated until satisfactory results are obtained.
4. The test allowance shall be determined at 15 minute intervals by means of volumetric measurement of the water added during the test until the rate has stabilized at the constant value for three consecutive 15 minute periods.
5. Test Allowance is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the makeup water is less than shown in the following table:

ALLOWABLE MAKEUP WATER PER 1000 FEET OF PIPELINE* (gph)

Avg. Test Pressure Psi (bar)	Nominal Pipe Diameter												
	3	4	6	8	10	12	14	16	18	20	24	30	36
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70

*If the pipeline under test contains sections of various diameters, the allowable makeup water will be the sum of the computed makeup water for each size.

In inch-pound units:

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

Where:

L = testing allowance (makeup water) in gallons per hour

S = length of pipe tested

D = nominal diameter of pipe, in inches

P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

6. No leakage will be allowed under the above tests for piping under or in buildings and structures.
7. Cracked or defective pipe, joints, fittings, valves, or hydrants discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.
8. Tests of insulated and concealed piping shall be made before the piping is covered or concealed.
9. The Contractor shall notify the Town when the work is ready for testing with all testing done in the presence of the Town. All labor, equipment, water and materials, including meters and gauges shall be furnished by the Contractor.

B. STERILIZATION

1. After the pressure-leakage test is completed and before the use of water is permitted from any portion of newly constructed water line

which will hold or carry potable water, it shall be flushed, cleaned, and chlorinated in the presence of and directed by the Town, or their Representative.

2. Pipelines may, at the option of the Contractor, be chlorinated in sections isolated by means of gate valves or other approved means.
3. Each unit of the completed water line shall be sterilized as specified below as prescribed by AWWA C651 "continuous feed" method. The unit to be sterilized shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall provide a chlorine dosage of not less than 50 parts per million and shall be introduced into the water line in an approved manner. The retention time shall be at least 24 hours and shall produce not less than 25 PPM of chlorine at the extreme end of the line at the end of the retention period. All valves on the lines being sterilized shall be opened and closed several times during the contact period.
4. Following chlorination, all treated water shall be thoroughly flushed from the pipe until the replacement water shall, upon test, both chemically and bacteriologically, be proven equal to the water quality served to the public from the existing water supply system. The Contractor shall be responsible for taking the necessary precautions, such as dechlorination, to ensure that the flushing does not harm the environment and complies with all appropriate regulatory requirements. The Contractor shall pay all costs for bacteriological tests. Bacteriological tests shall be performed by a State Approved laboratory.
5. During the flushing period, each fire hydrant on the line shall be opened and closed several times. The Town or their authorized Representative will take samples of water in properly sterilized containers for bacterial examination. The sterilization procedure shall be repeated until tests indicate the absence of pollution for at least two full days. The unit will not be accepted until satisfactory bacteriological results have been obtained. The samples shall not be taken from a fire hydrant.
6. Final connections to existing mains shall be made where indicated on the drawings or as directed after satisfactory samples have been obtained.

END OF SECTION

PART 1: GENERAL**1.01 SCOPE OF WORK**

The work covered under this section shall consist of furnishing all materials, labor, equipment and services for the complete installation of a domestic water service connection from the water main line to the property to be served.

PART 2: PRODUCTS**2.01 MATERIALS**

- A. The service line shall be constructed of HDPE tubing.
- B. Corporation stops shall be manufactured by Mueller Co. and be ground key design.
- C. Meter box shall be standard rectangular meter box design. Meter box shall be sized to accept a 5/8" water meter, specifically 14-1/8" x 19-1/2" x 12". Meter box shall have a non-locking cast iron lid.
- D. The inlet and outlet pipes that pass through the box wall shall be brass and shall be locked in place with brass hex nuts on straight external pipe threads. The inlet and outlet of these nipples shall have external tapered pipe threads and shall be protected by Polyethylene Cap Plugs. An In-Line quarter turn shut off valve with internal tapered pipe thread inlet and water meter coupling outlet shall be used upstream of the water meter. The valves shall be soft seating with a padlock wing. The valves internal components shall be removable from the top of the valve body. An In-Line Dual Check Valve with independent acting checks shall be used downstream of the water meter. The check valve shall have a meter coupling inlet and shall be contained inside the box. The internal parts of the check valve shall be removable without disconnecting the check valve the outlet piping. All brass materials used in contact with the water shall have a minimum copper content of 80% and a maximum zinc content of 10%. Water meter yoke shall be manufactured by Mueller Co., type 110.

PART 3: EXECUTION

3.01 INSTALLATION

- A. The standard service connection shall connect to the main at a brass corporation stop tapped to the main line. Service saddle shall be manufactured by Mueller Co., epoxy coated ductile iron with steel alloy straps. Corporation Stops shall be Mueller ground key design.
- B. The water service line shall be constructed of HDPE tubing placed at a depth providing a minimum cover of 3'-0".
- C. Meters shall be provided and installed by the Contractor. Meters shall be Hersey 400 Series IIS.

END OF SECTION

SECTION 02730 SANITARY SEWER PIPE AND APPURTENANCES

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, equipment, materials and incidentals necessary to install and complete the sanitary sewer and/or force main installation in accordance with the approved plans. All pipe and appurtenance material shall be of the type and class specified herein.
- B. All sewer pipe and force main excavation, bedding, pipe laying, jointing and coupling of pipe joints and backfilling shall be completed as described herein.

1.02 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall unload pipe and appurtenances so as to avoid deformation or other injury thereto. Pipe shall not be placed within pipe of a larger size and shall not be rolled or dragged over gravel or rock during handling. The Contractor shall store the pipe and appurtenances on sills above storm drainage level and deliver for laying after the trench is excavated. When any material is damaged during transporting, unloading, handling or storing, the undamaged portions may be used as needed, or, if damaged sufficiently, the Town will reject the material as being unfit for installation.

PART 2: PRODUCTS

2.01 MATERIALS

- A. PIPE
 - 1. All materials shall be first quality with smooth interior and exterior surfaces, free from cracks, blisters, honeycombs and other imperfections, and true to theoretical shapes and forms throughout. All materials shall be subject to the inspection of the Town at the plant, trench, or other point of delivery, for the purpose of culling and rejecting materials which do not conform to the requirements of these specifications. Such material shall be marked by the Town and the Contractor shall remove it from the project site upon notice being received of its rejection.
 - 2. As particular specifications are cited, the designation shall be construed to refer to the latest revision under the same specification number, or to superseding specifications under a new

number except provisions in revised specifications which are clearly inapplicable.

3. Ductile Iron Sewer Pipe (DIP) – Gravity Sewer and Force Mains

- a. Ductile Iron Pipe shall be as manufactured in accordance with ASTM A 746, ANSI Specification A21.50 and A21.51 and shall be Class 350 unless otherwise approved by the Town.
- b. The pipe interior shall be cement mortar lined and seal coated, standard thickness, in accordance with ANSI Specification A21.4.
- c. The exterior of all pipe shall be coated with either a coal or asphaltic base bituminous pipe coating in accordance with ANSI Specification A21.8.
- d. Pipe shall be furnished with Slip Joints, Mechanical Joints, or Flanged Joints as indicated on the approved drawings and in accordance with the specifications described below:
- e. Slip Joints - This pipe joint shall be done by guiding the plain end of the pipe into the bell end until contact is made with a gasket and by exerting a sufficient compressive force to drive the plain end through the gasket until the plain end makes full contact with the base of the bell.
 - i. Bells of slip-joint pipe shall be contoured to receive a circular rubber gasket and plain ends shall have a slight taper to facilitate installation.
 - ii. The circular gasket shall be furnished by the pipe manufacturer and shall be manufactured in accordance with ANSI Specification A21.11.
 - iii. The pipe manufacturer shall also furnish the lubricant used to assist in the pipe installation.
- f. Mechanical Joints - This pipe joint is essentially the same as the slip joint except it is furnished with a cast iron clamp which acts as a retainer to hold circular rubber gasket in place. All mechanical type joints shall be furnished by the pipe manufacturer and manufactured in accordance with ANSI Specification A21.11.
 - i. All bolts shall be tightened by means of torque wrenches in such a manner that the following shall be

brought up toward the pipe evenly. If effective sealing is not obtained by tightening the bolts to the specified torques, the joint shall be disassembled and reassembled after thorough cleaning.

- g. Flanged Joints - The flanged pipe joint is composed of a flat steel plate shop fitted on the threaded end of the ductile iron pipe. The flanges shall be accurately faced at right angles to the pipe axis and shall be drilled smooth and true.
 - i. Flanged joints shall be furnished with 125 lb. flanges drilled in accordance with ANSI Specification B16.1.
 - ii. In general, flanged joints shall be made up with through bolts of the required size. Stud or tap bolts shall be used only where shown or required.
 - iii. Gaskets for flanged joints shall be the ring type of cloth inserted rubber or rubber with a minimum thickness of 1/8".
 - iv. Connecting flanges shall be in proper alignment and no external force shall be used to bring them together. Bolts and gaskets shall be furnished by the installer of piping for joints connecting the piping with equipment, as well as for those between pipe and fittings, whether such equipment and piping is furnished by the installer or not.
- h. Long Span Pipe – “Long span” type ductile iron pipe shall be used for unsupported spans greater than 20'-0". “Long span” ductile iron pipe and associated pipe joints shall be designed by the pipe manufacturer specifically for elevated crossings with unsupported spans shown on the drawings. The Contractor shall submit shop drawings from the pipe manufacturer for the long span pipe. Shop drawings shall include material specifications for the pipe and joints, and shall specify locations of joints with respect to the pier locations shown on the drawings. Long span ductile iron pipe shall be as manufactured by American, U.S. Pipe, or approved equal.

4. Polyvinyl Chloride Sewer Pipe (PVC)

- a. Gravity - Polyvinyl Chloride Pipe shall be as manufactured in accordance with ASTM D-3034, latest edition, and shall be suitable for use as a gravity sanitary sewer pipe. The

standard dimension ratio (SDR) shall be 35 unless otherwise specified on the contract drawings.

- b. All polyvinyl chloride pipe joints shall be of an integral bell and spigot of the same material as the pipe. It shall have a solid cross-section with rubber "O" ring securely locked in place at the point of manufacture.
- c. Force Main - Polyvinyl chloride pipe shall be as manufactured in accordance with ASTM D-2241, latest edition, and shall be suitable for use as a sanitary sewer force main pipe. The standard dimension ratio (SDR) shall be 18 or 21 as shown on the approved drawings. PVC force main piping shall have a green exterior color. Under no circumstances shall pipe with a blue exterior color be accepted.
- d. Where PVC pipe is installed in iron pipe size (IPS), an IPS gasket shall be furnished with each fitting to insure compatibility.

5. Fittings

Whenever the sanitary sewer force main has a significant change in alignment or grade it will be necessary to furnish and install a fitting made of either cast/ductile iron or galvanized steel.

The specifications for the force main fittings are described below:

- a. Cast Iron/Ductile Iron - All cast iron and ductile iron fittings shall be mechanical joint manufactured in accordance with ANSI Specification A-21.1 and AWWA Standard C-110 for underground piping.

The interior of the fittings shall be cement mortar lined and seal coated in accordance with ANSI Specification A21.4 and AWWA C-104.

6. Gate Valves

All gate valves shall be designed for a working pressure of 200 psi unless otherwise specified and shall have a clear waterway equal to the full nominal diameter of the pipe and shall be opened by turning counterclockwise. Each valve shall have the initials of the maker, pressure rating and year of manufacture cast on the body. Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the specified working pressure. Valves shall be operated by handwheel or operating nut as herein specified and shall have an arrow cast in the metal indicating the

direction of opening. Valves to be installed underground shall be non-rising stem type while valves installed above ground or in buildings and structures shall have rising stems. All gate valves 16" or larger shall have a 3" bypass with valve.

a. Gate Valves 2" and Smaller

- i. Gates valves 2" and smaller shall be all brass, single disc type, double seat tapered wedge type built to manufacturer's standards with material and construction conforming to AWWA C-500.
- ii. Each valve shall have a 2" operating nut. Valves shall have screwed ends conforming to NPT standards.

b. Resilient Seated Wedge Valve

- i. Gate valves 3" through 24" diameter size shall be of the ductile iron body, resilient seated wedge type meeting the requirements set forth in AWWA C-509 and AWWA C-500. All valves shall be from one manufacturer and parts interchangeable.
- ii. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in Table 2, Section 4.4 of AWWA C-509 and C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces with a fusion bonded epoxy paint conforming to AWWA C-550.
- iii. The gate shall be fully covered with a rubber cover over all exterior and interior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part which houses the stem nut. The gate and rubber coat shall conform to ASTM D429.
- iv. Valve stems shall be cast bronze. The stuffing box shall use "O"-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.
- v. Valves larger than 12" diameter shall be designed for horizontal installation with beveled gear boxes with

reduction gears to reduce the number of turns required to operate valve.

- vi. Gate valves shall be manufactured by Mueller Co., A-2360 Resilient Wedge.

c. Double Disc Type Gate Valves

- i. Gate valves larger than 24" diameter size shall be of the ductile iron body, double disc parallel seat type meeting the requirements set forth in AWWA C-500. All valves shall be from one manufacturer and parts interchangeable. Valves shall have a working pressure of 150 psi.
- ii. Gate valves shall have body, bonnet and gate manufactured of ductile iron conforming to ASTM A-536. The shell thickness of all components shall conform to the thicknesses in C-500. The valve body and bonnet shall be coated on both the interior and exterior surfaces.
- iii. The gates shall be high strength cast iron, sturdily proportioned without pockets on the backs. All cam surfaces shall open to the bottom. Gate rings shall be rolled into a dovetail groove under pressure to make a single insertable finish.
- iv. Valves shall use bottom wedging type design with a two part floating wedge contact. The wedge and hook shall be separate castings and not a single piece.
- v. Valve stems shall be cast bronze. The stuffing box shall use "O"-ring seal type with two rings located above the thrust collar. The rings shall be replaceable with the valve fully open and under pressure.
- vi. Valves shall be designed for horizontal installation with beveled gear boxes with reduction gears to reduce the number of turns required to operate valve. Valves shall have bronze rollers, tracks, and scrapers.
- vii. All valves shall be supplied with a bypass as a part of the valve. Bypass shall be a minimum of 3" diameter with a 3" resilient seated wedge valve.

7. Sewage Combination Air Relief Valves

- a. The combination air valve shall be designed specifically for use on sanitary sewer pressure (force) mains. It shall be designed to exhaust large volumes of air from the system during filling of the main or on pump start-up. It shall also allow large volumes of air to enter the system during draining (prevents vacuum from forming). In addition, the valve shall release small amounts of accumulated air while the system is in normal operation (under pressure).
- b. The combination air valve shall be provided in a single body constructed of cast iron. The float and stem shall be constructed of stainless steel. The needle and seat shall be constructed of Buna-N. The valve shall be equipped with an inlet valve.
- c. Combination air valves shall be manufactured by APCO, Val-Matic, GA Industries, or approved equal.

8. Flexible Couplings

Whenever it becomes necessary to join sewer pipe lines of dissimilar materials or pipe sizes it shall be required to use a flexible coupling. The coupling shall be made of virgin polyvinyl chloride (PVC) and shall not harden and shall be impervious to all known soil conditions. The coupling shall provide a permanent leakproof seal approved by the Southern Building Code Congress and manufactured in accordance with ASTM #C-594-70. The couplings shall be as manufactured by Fernco Joint Sealer Company or an approved equal.

9. Manholes

- a. Precast concrete manhole bases, risers and cones shall conform to ASTM C 478, latest revision of Precast Reinforced Concrete Manhole Sections. Tapered section and transition sections, where required, shall be of eccentric cone design, having the same wall thickness and reinforcement as the cylindrical ring sections. Flat slab tops shall be required for very shallow manholes and where shown or specified. Cast iron manhole covers and assemblies shall be cast into slab tops for access into manholes.

- b. Minimum compressive strength of concrete shall be 4,000 psi and the maximum permissible absorption shall be 6.5%. Risers shall be reinforced with a single cage of steel placed within the center third of the wall. The tongue or the groove of the joint shall contain one (1) line of circumferential reinforcement equal in area to that in the barrel of the manhole riser. The minimum cross-sectional area of steel per linear foot shall be 0.12 square inches for larger sizes. Precast manhole section shall fit together readily and shall have a self-contained "O" ring rubber gasket conforming to ASTM C-443.
- c. The quality of materials, the process of manufacture, and the finished manhole sections shall be subject to inspection and approval by the Town and his representative. The manhole sections shall be perpendicular to their longitudinal axis within the limits listed in ASTM C 478.
- d. Frames and Covers
 - i. Frames and covers shall be cast iron of superior quality, tough and even texture. Castings shall be gray iron conforming to ASTM A 48, size as indicated, free from blow holes, porosity, hard spots, shrinkage distortion, or other defects, and well cleaned. The bearing surface between frame and cover shall be machined to prevent rocking and rattling.
 - ii. The standard manhole casting shall be designed for heavy duty use with a 190 pound frame and 125 pound cover. Acceptable products include U.S. Foundry USF 669 ring and KL cover, or an approved equal. Frame and cover shall meet North Carolina DOT 840.54 standard unless otherwise noted.
 - iii. Special waterproof manhole frame and covers shall be installed only at those locations indicated on the contract drawings. Watertight rings and lids shall be U.S. Foundry 669-KL-BWTL with a 125-pound cover. Ring shall have a flat type gasket and cover shall be bolted down with a minimum of four (4) bolts.
 - iv. The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole. Concrete brick, set in mortar, shall be used to adjust the top of the frame and cover to finished

grade; however, no more than four (4) courses of brick will be used for adjustment.

e. Manhole Steps

- i. Steps shall be a copolymer polypropylene plastic reinforced with a ½ inch diameter, grade 60 bar and have serrated tread and tall end lugs. Step pull out strength shall be a minimum of 2,000 pounds when tested according to ASTM C-497.
- ii. Steps shall be required in all structures with a depth greater than four (4) feet. Steps shall be vertically aligned and uniformly spaced for the entire depth of the structure. Steps shall be located in the structures along the vertical face of the eccentric cone and so as to land upon a bench.
- iii. Steps shall be vertically spaced no greater than sixteen (16) inches on center. Step width shall be a minimum of twelve (12) inches. Steps shall protrude from the wall of the structure a minimum of five (5) inches and a maximum of seven (7).
- iv. Secure steps to the wall with a compression fit in tapered holes. Steps shall not be vibrated or driven into freshly cast concrete. Steps shall not be grouted in place.

f. Manhole Inverts

- i. Manhole inverts and benches shall be constructed in accordance with the standard details shown on the approved drawings. Invert shall be a U-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe. The benches shall be constructed with a slope of 1" per foot to the channel.
- ii. The channel and invert shall be constructed with a minimum of 2000 psi concrete or brick fill with concrete finish minimum 1" thick. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve with as large a radius as the diameter of the manhole will allow.

g. Manhole Drops

Standard drop manholes will be constructed only at those locations shown on the approved drawings or as otherwise approved by the Town. The design of the drop connection shall be in accordance with the standard detail drawing.

h. Manhole Vents

- i. Where designated on the approved drawings, a 4" diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped in to the upper most section of the manhole, anchored in concrete and extended vertically to the elevation shown on the drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.
- ii. The pipe material shall be Schedule 40 Galvanized Steel with two (2) coats of epoxy paint approved by the Town.

PART 3: EXECUTION

3.01 INSTALLATION

A. EXCAVATION

1. The work covered by this section consists of the excavation and satisfactory disposal of all materials excavated in the construction of trenches.
2. Trenches will be defined as all excavation for the installation of storm sewers, sanitary sewers, water pipe, manholes, catch basins, hydrants, watergates, sewer services, water taps, drainage structures, drainage ditches and other excavation as may be necessary to complete the installation.
3. The excavation shall be done to the lines, grades, typical sections, and details shown on the approved plans or established by the Town. All work covered by this section shall be coordinated with the grading, construction of drainage structures, and other work along the project, and shall be maintained in a satisfactory condition so that adequate drainage is provided at all times. Any roots which protrude into the trench shall be trimmed flush with the sides of the trench. Trenches for pipe lines shall be completed before the pipe is installed unless otherwise permitted by the Town.

4. All trenches shall be excavated in accordance with all Federal, State, and Local Health and Safety regulations having jurisdiction at the project site.
5. All excavation shall be by open cut unless otherwise authorized by the Town. If the bottom of the excavation is found to consist of rock or any materials that cannot be excavated to give a uniform bearing surface, the material shall be removed to a depth at least 6" below established bottom grade and backfilled to grade with sand thoroughly compacted in place. Any excavations carried below the depths indicated, without specific directions, shall be backfilled in the same manner. The excavation shall be of sufficient width to allow a clearance of not less than 6" between the side of the trench and the outside of the pipe, or in case of pipe with a bell, the outside of the bell of the pipe. This rule will apply at all times, and consequently, proper allowance must be made for additional space required for sheeting the trench where necessary.
6. Sheeting, Bracing Trenches, and Trench Boxes
 - a. Sheeting and bracing shall be provided in accordance with all applicable Federal, State and Local safety and health regulations.
 - b. No sheeting or bracing shall extend closer than 2'-0" off the ground surface, or within subgrade, and no timbers shall be left in the trench that may form pockets or cavities that cannot easily be filled during the operation of backfilling and settling or compacting the trench backfill. Failure to sheet and brace trenches or other excavation shall be the Contractor's risk, and he will be held responsible for caving, settlement, and all other damage resulting therefrom
7. Excavated materials to be used for backfill will be approved by the Town, and if acceptable shall be neatly deposited at the sides of the trenches where space is available. Where stockpiling of excavated material is required, the Contractor shall so maintain his operations as to provide for natural drainage and not present an unsightly appearance. Materials which are excess to the needs of the project will be disposed of by the Contractor.
8. Pipe Foundations
 - a. The preparation of the pipe bedding shall be in accordance with the typical trench cross-sections as shown on the standard details for the type of pipe being installed.

- b. The pipe foundation shall be prepared to be uniformly firm and shall be true to the lines and grades as shown on the approved plans. Any deviation or field adjustment will require the approval of the Town. When a representative of the Town is present on the site and is so requested by the Contractor, he may check the position of grades and lines but the Contractor shall be responsible for the finished work conforming to exact and proper line and grade.
- c. Whenever the nature of the ground will permit, the excavations at the bottom of the trench shall have the shape and dimensions of the outside lower third of the circumference of the pipe, care being taken to secure a firm bearing support uniformly throughout the length of the pipe. A space shall be excavated under and around each bell to sufficient depth to relieve it of any load and to allow ample space for filling and finishing the joint. The pipe, when thus bedded firmly, shall be on the exact grade.
- d. In case the bed shaped in the bottom of the trench is too low, the pipe shall be completely removed from position, and earth of suitable quality shall be placed and thoroughly tamped to prepare a new foundation for the pipe. In no case shall the pipe be brought to grade by blocking up under the barrel or bell of same, but a new and uniform support must be provided for the full length of the pipe.
- e. Where rock or boulders are encountered in the bottom of the trench, the same shall be removed to such depth that no part of the pipe, when laid to grade, will be closer to the rock or boulders than 6". A suitably tamped and shaped foundation of approved material shall be placed to bring the bottom of the trench to proper subgrade over rock or boulders.
- f. Where the foundation material is found to be of poor supporting value, the Town may permit minor adjustment in the location of the pipe to provide a more suitable foundation. Where this is not practical, the foundation shall be conditioned by removing the existing foundation material by undercutting to the depth as directed by the Town, within limits established on the approved plans, and backfilling with either an approved material secured from unclassified excavation or borrow along the project, or foundation conditioning material consisting of crushed stone or gravel approved by the Town as being suitable for the purpose

intended. The selection of the type of backfill material to be used for foundation conditioning will be made by the Town.

- g. The Contractor shall remove all water which may be encountered or which may accumulate in the trenches by pumping or bailing and no pipes shall be laid until the water has been removed from the trench. Water so removed from the trench must be disposed of in such a manner as not to cause injury to work completed or in progress.
- h. Whenever the bottom of the trench shall be of such nature as to provide unsatisfactory foundation for the pipe, the Town will require the pipe to be laid on a washed stone foundation per detail. Class I embedment for DIP shall be used only for wet conditions and only as directed by the Town.

B. INSTALLING PIPE AND APPURTENANCES

1. Laying Pipe

- a. The layout of gravity sanitary sewer lines and invert elevations at governing points are as shown on the approved drawings.
- b. The Contractor shall do all layout work for lines and grades from that information shown on the approved drawings or as furnished by the Town.
- c. When a laser beam instrument is used to set line and grade, the unit must be maintained in good working order, and the calibration checked daily for both alignment and percent grade. In the event the required accuracy of alignment and grade is not adhered to, the Town will prohibit the use of laser beams.
- d. Pipe shall be laid with bell ends facing in the direction of pipe laying, unless directed otherwise by the Town. In all cases, pipe is to be installed in strict accordance with the manufacturer's recommendations and the contract material specifications. The Town may augment any manufacturer's installation recommendations if, in their opinion, it will best serve the interest of the Town.

- e. Proper tools, implements, and facilities satisfactory to the Town shall be provided and used for the safe and convenient prosecution of pipe laying. All pipe and other materials used in the laying of pipe will be lowered into the trench piece by piece by means of suitable equipment in such a manner to prevent damage to the pipe, materials, to the protective coating on the pipe materials, and to provide a safe working condition to all personnel in the trench. Each piece of pipe being lowered into the trench shall be clean, sound and free from defects. It shall be laid on the prepared foundation, as specified elsewhere to produce a straight line on a uniform grade, each pipe being laid so as to form a smooth and straight inside flow line. Pipe shall be removed at any time if broken, injured or displaced in the process of laying same, or of backfilling the trench.
- f. When cutting short lengths of pipe, a pipe cutter, as approved by the Town, will be used and care will be taken to make the cut at right angles to the centerline of the pipe or on the exact skew as shown on the approved plans. In the case of push-on pipe, the cut ends shall be tapered with a portable grinder, or coarse file to match the manufactured taper.
- g. During times when pipe laying is not in progress, the open ends of pipe shall be closed and no trench water or other material shall be permitted to enter the pipe.
- h. Where the pipe is laid on a grade of 20% or greater, the laying shall start at the bottom of the slope and proceed upward with the bell end of the new pipe upgrade. All pipe laid on a grade of 20% or greater shall require thrust blocking or keying as shown on the drawings and standard details.
- i. Where pipe lines of different materials are joined together, a standard sewer repair coupling shall be used. The couplings shall be Eastern Standard Sewer Repair Couplings (Mission Rubber Company), the Fernco Joint Sealer Company or an equal product approved by the Town.
- j. All gravity sewer shall have minimum 12" vertical separation from storm sewer and shall have minimum 10'-0" horizontal separation from water mains or 18" vertical separation below the bottom of the water main. In the event these separations cannot be met, sanitary sewer and the water main, if applicable, shall be constructed of ductile iron pipe as directed by the Town or as shown on the approved

drawings. In addition, all gravity sewer shall have a minimum 100'-0", horizontal separation from wells or other water supplies.

2. Manholes

- a. Sanitary sewer manholes shall be installed at each break in line or grade in each sanitary sewer line as shown on the approved drawings.
- b. The manhole foundation shall be prepared so as to provide a firm, level area on which to place the precast concrete manhole base section. When poor foundation soil is encountered or excess groundwater exists, the foundation shall be excavated 12" below the final subgrade elevation backfilled with washed stone to provide a proper foundation.
- c. The manhole sections shall be lifted from the side of the excavation to the bottom of the trench with equipment and support slings capable of safely handling the heavy concrete pieces. The manhole shall be set plumb and adjusted to the final finished surface grade with brick and mortar.
- d. Pipe openings shall be exactly aligned to that of the pipe entering and leaving the manhole. The gravity sanitary sewer pipe lines shall be placed in the manhole openings, properly aligned, and set to grade. Sanitary sewer shall be connected to the manholes using lock joint flexible manhole sleeves or equal.
- e. For large diameter pipe where a flexible rubber sleeve is not available, the pipe line shall be sealed into the manhole using an expanding type or non-shrink type grout.
- f. For manhole steps, refer to the precast manhole section above.

3. Manhole Frames and Covers

The frame and cover shall be properly set in a bed of mortar and aligned to fit the top section of the manhole. Concrete brick, set in mortar, shall be used to adjust the top of the frame and cover to finished grade; however, no more than four (4) courses of brick will be used for adjustment.

4. Manhole Inverts

- a. Manhole inverts and benches shall be constructed in accordance with the standard details shown on the drawings. Invert shall be a U-shaped channel with a height of 0.8 of the diameter and be a smooth continuation of the pipe. The benches shall be constructed with a slope of 1" per foot to the channel.
- b. The channel and invert shall be constructed with a minimum of 2000 psi concrete or brick fill with concrete finish minimum 1" thick. Where sewer changes directions at the manhole, channel shall be constructed with a smooth curve with as large a radius as the diameter of the manhole will allow.

5. Manhole Drops

Standard drop manholes will be constructed only at those locations shown on the approved drawings or as otherwise approved by the Town. The design of the drop connection shall be in accordance with the standard detail drawing.

6. Manhole Vents

- a. Where designated on the approved drawings, a 4" diameter vent pipe shall be installed as an integral part of the manhole. The vent pipe is to be tapped in to the upper most section of the manhole, anchored in concrete and extended vertically to the elevation shown on the approved drawings. The pipe shall have a reverse bend and screen to prohibit rain and foreign materials from entering pipe.
- b. The pipe material shall be Schedule 40 Galvanized Steel with two coats of epoxy paint approved by the Town.

7. Fittings (Force Main)

- a. All plugs, caps, tees, bends, and other fittings shall be provided with adequate thrust blocks. Thrust blocks shall be constructed to the minimum dimensions shown on the drawings or as directed. Thrust blocks shall be made of concrete and shall bear directly against the undisturbed trench wall. Where possible, the backing shall be so placed that the fitting joints will be accessible for repair. All bolts and pipe joints shall be protected against contact with thrust block concrete by the installation of a polyethylene film placed between the fittings and the poured concrete. Where any section of a main is provided with concrete thrust blocks, the hydrostatic pressure test shall not be made until three

days after installation of the concrete thrust blocks unless otherwise approved by the Town.

- b. Where trench conditions are, in the opinion of the Town, unsuitable for thrust blocks, the Contractor shall provide steel tie rods and socket clamps to adequately anchor the piping. All tie rods and clamps shall be given a bituminous protective coating or shall be galvanized.
- c. Concrete for thrust blocks shall consist of a mix of Portland Cement, fine and coarse aggregate and water to produce concrete with a minimum compressive strength at 28 days of not less than 3000 psi when tested in accordance with ASTM Specifications C 39 or C 42. Sakrete or any similar material will not be permitted under any circumstances.

8. Gate Valve and Valve Box (Force Main)

- a. When shown on the contract drawings, a standard gate valve shall be installed in the sanitary sewer force main. Before setting each valve, the Contractor shall make sure the interior is clean and shall test the valve for proper opening and closing. Valves shall be set with stems plumb, unless horizontal installation is called for on the approved drawings, and at the exact location(s) shown on the approved drawings.
- b. A standard type valve box shall be installed over each underground sanitary sewer force main valve. All valve boxes shall be set plumb with their top set flush with the finished grade.
- c. Trench backfill shall be properly tamped for a distance of 3'-0" on each side of the valve and valve box.

9. Sewage Combination Air Relief Valve (Force Main)

- a. A sanitary sewage combination air relief valve shall be installed at the actual high points in the line.
- b. A combination air relief valve installation shall consist of the force main tap, air relief valve, precast concrete manhole sections, and standard heavy duty iron frame and cover.

10. Exposed Pipe

- a. Exposed pipe to be installed inside tanks, wetwells, vaults and buildings shall be installed and field painted as described below. All exposed ductile iron pipe shall utilize flanged joints unless otherwise noted.
- b. All exposed cast or ductile iron pipe, fittings and valves shall be field painted with two (2) coats of epoxy paint as recommended by the paint manufacturer. Color of paint shall be as selected by the Town.

C. BACKFILLING AND COMPACTION

- 1. Backfill trenches immediately after approval of the pipeline construction.

2. Pipes

- a. PVC pipe shall be installed using Class I embedment for 6" below the pipe and to the spring line per the standard detail. Class I embedment shall be defined as #67 washed stone or approved equal per NCDOT Standard Specifications.
- b. For DIP pipe with backfill material other than Class I embedment, use backfill carefully placed in uniform layers not exceeding 6" in thickness to a depth of 2'-0" over the top of the pipe. Place material and fill the area under the pipe haunches. Place each layer, moisten; then uniformly compact by use of hand, pneumatic, or mechanical tampers exercising care to prevent lateral displacement. Areas of backfill 2'-0" over top of pipe to top of trench, shall be backfilled with a material containing no rocks larger than 6" in the greatest dimension and shall be free of material with an exceptionally high void content. The initial backfill shall meet the same requirements except no rocks over 4" in diameter will be allowed.
- c. Moisten backfill above 2'-0" over the top of the pipe and place in 8" layers. Compact each layer with hand, pneumatic or mechanical compactor. Puddling or flooding of trench for consolidation of backfill or use of wheel rolling by construction equipment will not be permitted.
- d. Foundation stone as required for wet or unstable conditions per the details, shall be defined as #57 or #67 stone per NCDOT Standard Specifications or approved equal.

Foundation stone shall be used only as directed by the Town.

3. If material excavated from the trench is unsuitable to be used as backfill, "select backfill" shall be transported to the site by the Contractor from outside the project limits to be used as backfill material.

4. Roadways and Road Crossings

Use backfill placed in uniform layers not exceeding 6" in thickness for full trench depth and width, thoroughly compacted with mechanical tampers under optimum moisture conditions to 95% compaction (100% for the top 2'-0" of subgrade beneath pavements). Replace removed paving and base course with new material of equal or better quality and of the same texture and color as the adjacent roadway.

5. All backfill shall be compacted so as not to damage the pipe and appurtenances and shall be compacted to 95% of the Standard Proctor Test (100% for the top 2'-0" of subgrade beneath pavements) for the various types of backfill material. Methods of backfilling shall be in strict accordance with the pipe manufacturer's recommendations. All backfill material shall have been approved by the Town. Select backfill material shall be used when requested by the Town.
6. Care shall be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill shall be kept free from stones, frozen lumps, chunks of highly plastic clay, or other objectionable material. All pipe backfill areas shall be graded and maintained in such a condition that erosion or saturation will not damage the pipe bed or backfill.
7. Heavy equipment shall not be operated over any pipe until it has been properly backfilled and has a minimum cover as required by the approved plans. Where any part of the required cover is above the proposed finish grade, the Contractor shall place, maintain, and finally remove such material. Pipe which becomes mis-aligned, shows excessive settlement, or has been otherwise damaged by the Contractor's operations, shall be removed and replaced by the Contractor.
8. The Contractor shall maintain all pipes installed in a condition that they will function continuously from the time the pipe is installed until the project is accepted.

9. Cleanup

- a. Grade all areas disturbed to a finish ordinarily obtained from a blade grader with no abrupt changes in grade or irregularities that will hold water. Prior to final inspection and acceptance, remove all rubbish and excess material and leave area in a neat, satisfactory condition.
- b. Cleanup and seeding is part of the pipeline installation. No more than 3,000 LF of sewer line may be laid prior to completion of cleanup of the first section of pipeline laid.

3.02 QUALITY CONTROL

A. TESTING

1. Line Cleaning

- a. Prior to inspection of any section(s) of gravity sanitary sewer pipe or force main the Contractor shall completely clean the lines of all debris, silt, etc. The pipe line shall be ready for use by the Town and shall be proved to be in first class condition and constructed properly in accordance with the approved drawings these specifications,
- b. The Contractor shall maintain the project, insofar as his construction work is concerned, in first class condition for such time as is necessary to satisfy the Town that all installations are correct and acceptable.

2. Inspection and Testing (Gravity Sewer)

- a. Alignment and grade between manholes shall be tested by the Town by flashing a light between manholes. A full circle of light shall be seen when reviewed from the adjoining end of the line. All defects disclosed as a result of this test shall be corrected by the Contractor at his expense.
- b. PVC pipe shall pass a go-no go Mandrel sized to 95% of the pipe diameter with the pipe in place and properly backfilled. All pipe which will not pass the Mandrel shall be relaid or replaced by the Contractor. The allowable deflection (less than 5%) shall be calculated using the pipe stiffness formula in ASTM D 2321. The mandrel test shall not take place until the final backfill has been in place for 30 days (minimum).

- c. When the sewers are completed they shall be inspected by the Town for conformance with the provisions of the approved plans and these specifications, particularly line and grade, and tested to determine the amount of ground water infiltration into the sewer. All visible and audible leaks will be stopped and the remaining infiltration will be measured using a V-notch weir and/or other devices, which shall be furnished by the Contractor. The Contractor shall also furnish all required assistance for measuring the infiltration.
- d. If infiltration into the whole system or any segment thereof exceeds 100 gallons per 24 hours per inch of diameter per mile of sewer, necessary corrective measures shall be taken by the Contractor to limit the infiltration to the maximum specified above. The Town shall decide the number and length of segments of sewer line on which the testing shall be performed.
- e. All gravity sanitary sewer lines shall be subjected to a low pressure air test to determine the presence of damaged pipe or faulty installation. The Contractor will furnish all facilities and personnel for conducting the test(s).
- f. The acceptance air test shall be made after backfilling has been completed and compacted and in the presence of the Town. The test shall be performed as described under ASTM C 828, latest edition, Standard Practice for Low Pressure Air Testing of V.C. Pipe lines.
- i. Compressor capacity shall be sufficient to pressurize the sewer main to 4 PSIG within a time equal to or less than the required test time. The following equation may be used to insure compliance with this requirement:

$$C = \frac{0.17 \times D^2 \times L}{T} + Q$$

Where: C=Required Compressor Capacity (cfm)
T=Required Test Time (min)
D=Pipe Internal Diameter (feet)
L=Length of Test Section (feet)
Q=Allowable Air Loss Rate (cfm)

The following allowable air loss rates will be used for all pipe tests:

PIPE SIZE	Q (cfm)	PIPE SIZE	Q(cfm)
4"	2.0	15"	4.0
6"	2.0	18"	5.0
8"	2.0	21"	5.5
10"	2.5	24"	6.0
12"	3.0		

- ii. The sewer section shall be plugged at both ends and air pressure shall be applied until the pressure inside the pipe reaches 4 PSIG. When a stable condition has been reached, the pressure shall be bled back to 3.5 PSIG. At 3.5 PSIG, the time and pressure shall be observed and recorded. If groundwater is present at the sewer, the height of the groundwater above the top of the pipe shall be added to the above air pressure readings (height of water in feet X 0.433 = air pressure in psig). A minimum of five (5) readings will be required for each test.
- iii. If the time for the air pressure to decrease from 3.5 PSIG to 2.5 PSIG is equal to or greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these times are not attained, pipe breakage, joint leakage, or leaking plugs are indicated and the cause must be determined and corrected. After repairs have been made, the sewer sections shall be retested. This process shall be repeated until all sewer sections pass the air tests.

LENGTH TESTED	Minimum Test Time for Pipe									
	Pipe Size	4"	6"	8"	10"	12"	15"	18"	21"	24"
	25	0:04	0:10	0:17	0:22	0:26	0:31	0:36	0:44	0:53
	50	0:09	0:20	0:35	0:44	0:53	1:02	1:12	1:29	1:47
	75	0:13	0:30	0:53	1:06	1:20	1:34	1:48	2:14	2:40
	100	0:17	0:40	1:11	1:29	1:47	2:05	2:24	2:58	3:33
	125	0:22	0:50	1:29	1:51	2:13	2:36	3:00	3:43	4:27
	150	0:26	1:00	1:47	2:13	2:40	3:07	3:36	4:27	5:20
	175	0:31	1:10	2:04	2:35	3:07	3:39	4:12	5:12	6:14
	200	0:35	1:20	2:22	2:58	3:33	4:10	4:48	5:57	7:07
	225	0:40	1:30	2:40	3:20	4:00	4:41	5:24	6:41	8:00
	250	0:44	1:40	2:58	3:42	4:27	5:13	6:00	7:26	8:54
	275	0:49	1:50	3:16	4:05	4:53	5:44	6:36	8:10	9:47
	300	0:53	2:00	3:33	4:27	5:20	6:15	7:12	8:55	10:41
	325	0:58	2:10	3:51	4:49	5:47	6:47	7:48	9:40	11:34
	350	1:02	2:20	4:09	5:11	6:14	7:18	8:25	10:24	12:28
	375	1:06	2:30	4:27	5:34	6:40	7:49	9:01	11:09	13:21
	400	1:11	2:40	4:45	5:56	7:07	8:21	9:37	11:54	14:14
	425	1:15	2:50	5:02	6:18	7:34	8:52	10:13	12:38	15:08
	450	1:20	3:00	5:20	6:40	8:00	9:23	10:49	13:23	16:01
	475	1:24	3:10	5:38	7:03	8:27	9:54	11:25	14:07	16:55
	500	1:29	3:20	5:56	7:25	8:54	10:26	12:01	14:52	17:48
	525	1:33	3:30	6:14	7:47	9:21	10:57	12:37	15:37	18:42
	550	1:38	3:40	6:31	8:09	9:47	11:28	13:13	16:21	19:35
	575	1:42	3:50	6:49	8:32	10:14	12:00	13:49	17:06	20:28
	600	1:47	4:00	7:07	8:54	10:41	12:31	14:25	17:51	21:22

- iv. For testing a sewer system with one or more installed service lateral pipes, an effective pipe length shall be added to the total sewer main pipe length. The equation used to calculate Effective Pipe Length is as follows:

$$L_e = \frac{d^2 \times l}{D^2}$$

Where: L_e =Effective Pipe Length (added to Total Test Length)

d =Diameter of Service Lateral Pipe

l =Length of Sewer Lateral

D =Diameter of Sewer Main Pipe being tested

- g. Failure of any section of the pipeline to meet the requirements of this test shall cause the Contractor to determine the source(s) of leakage, and repair or replace all defective materials or workmanship. The repaired section(s) of line shall be re-tested to insure conformance with the requirements of these specifications.

3. Inspection and Testing (Force Main)

- a. When the sanitary sewer force main is completed, the Town shall inspect the line for conformance with the provisions of the approved drawings and these specifications, particularly with respect to alignment and depth.
- b. All newly constructed sanitary sewer force main and valved sections shall be subjected to a hydrostatic pressure-leakage test. Force mains shall be tested in sections not to exceed 4,000 lineal feet per test section. The Contractor shall install sufficient additional valves if not shown on the approved drawings to allow testing.
- c. Each completed section of the pipeline shall be plugged at both ends and slowly filled with water. As the main is being filled with water in preparation of the test, all air shall be expelled from the pipe. The main shall be subjected to hydrostatic pressure of 100 pounds per square inch for a period of two hours unless otherwise specified. Pressure shall be applied to the main by means of a hand pump for small lines or by use of a gasoline pump or fire engine for larger lines.
- d. The rate of leakage shall be determined at 15 minute intervals by means of volumetric measure of the water added during the test until the rate has stabilized at the constant value for three consecutive 15 minute periods.
- e. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than ten (10) gallons per inch of pipe diameter per mile of pipe per 24 hours.
- f. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this test shall be removed and replaced with sound materials, and the test shall be repeated until the test results are satisfactory. Precautions shall be taken to remove or otherwise protect equipment in, or attached to, pipe to prevent damage or injury thereto.
- g. Tests of insulated and concealed piping shall be made before the piping is covered or concealed. No leakage will be allowed under the above tests for piping in buildings, structures or on bridges.

- h. The Contractor shall notify the Town when the work is ready for testing with all testing done in the presence of the Town. All labor, equipment, water and materials, including meters and gauges, shall be furnished by the Contractor.

4. Inspection and Testing (Manholes)

Manholes shall be constructed to provide a true circular inside diameter with properly corbeled tops, satisfactory inverts and properly placed steps and castings. Any visible leaks in the manholes shall be completely stopped to the satisfaction of the Town.

END OF SECTION

PART 1: GENERAL**1.01 SCOPE OF WORK**

- A. The work covered under this section shall consist of furnishing all materials, labor, equipment, and services for the complete installation of a sanitary sewer service connection from the sanitary sewer (gravity) main line to the edge of the property to be served as shown on the approved project drawings.

PART 2: PRODUCTS**2.01 MATERIALS**

- A. Main line connections shall use a "wye" branch constructed by the same material as the main line.
- B. Sewer service lines shall be constructed of either PVC (Schedule 40) or Ductile Iron (CL350) as shown on approved plans.
- C. When joining pipes of different materials, a flexible, watertight, rubber transition coupling shall be used.

PART 3: EXECUTION**3.01 INSTALLATION****A. CONNECTION TO MAIN**

The standard sewer service connection shall be 4" in diameter unless shown otherwise on the approved drawings, and shall connect to the main at a "wye" branch connection installed with the pipe line as it is being laid. The "wye" branch shall be of the same material as the main pipe line. Direct taps into the sewer main will not be acceptable unless approved by the Town prior to the laying of the main line.

B. CONNECTION TO MANHOLE

When directed by the Town, a sewer service connection shall be made into a manhole. The connection shall be made at the manhole invert. The invert shall be rebuilt so as to provide a smooth transition from

service connection to main line. Inverts and benches shall be constructed in such a way as to prevent the deposition of solids in the manhole.

C. SERVICE LINES

The service line shall be installed from the "wye" branch connection to the edge of the public or utility right-of-way as shown on the approved plans.

Less than 3'-0" of cover will require the use of ductile iron pipe.

D. CLEANOUT AND PLUG

At the edge of the public or utility right-of-way, a "cleanout" shall be installed. The cleanout shall consist of a "wye" branch connection, 45° bend, riser pipe, and threaded plug installed flush with finished ground elevation.

The end of the Town's sewer service connection shall terminate at the end of the pipe which will normally extend five feet beyond the "wye" branch for the cleanout. A watertight plug shall be installed at the end of this line until such time as the property owner connects his facilities to the sewer system.

END OF SECTION

SECTION 03301 MISCELLANEOUS CONCRETE CONSTRUCTION

PART 1: GENERAL

1.01 SCOPE OF WORK

- A. This section covers concrete construction, complete, including reinforcement therefore.

PART 2: PRODUCTS

2.01 MATERIALS

A. REINFORCING

Bar reinforcement shall be intermediate grade new billet steel conforming to the requirements of ASTM A-615. Unless otherwise noted, all reinforcing bars shall be grade 60. Wire fabric reinforcement shall consist of steel wire conforming to the requirements of ASTM A-185, latest revision.

B. CONCRETE

All concrete shall be equivalent to ready mix concrete manufactured and delivered in accordance with the requirements of ASTM C-94, latest revision and having a compressive strength at 28 days of 4000 psi, except as noted herein. The concrete manufacturer shall assume the responsibility of the design of the concrete mix in accordance with Alternate No. 2 of ASTM C-94. Air entrained concrete shall be used for all concrete exposed to the elements.

- a. Cement shall be Type 1 or Type 1A "Portland" cement conforming to ASTM C-150, latest revision or ASTM C-175, latest revision respectively.
- b. Aggregates shall conform to ASTM C-33, latest revision. Coarse aggregate shall be crushed rock or gravel and graded from 3/4" to #4 sieve for walls and slabs and from 2" to #4 sieve for mass or foundation concrete. Fine aggregate shall be natural sand.

- c. Mixing water shall be proportioned so that slump when measured with standard slump cone does not exceed the following:
 - i. Slabs in grade.....Max. 4", Min. 3"
 - ii. Footings.....Max. 5", Min. 3"
 - iii. All others.....Max. 6", Min. 3"
- d. Premolded joint filler strips shall be resilient compressive, bituminous and fiber material saturated, with at least 35% and not over 50% by weight of asphalt. Poured type joint composition for expansion joints shall be elastic compound made up of asphalt and colloidal mineral fillers.

PART 3: EXECUTION

3.01 FORMS

- A. Forms shall be wood, metal, structural hardboard or other suitable material that will produce the required surface finish. Forms placed for successive pours for continuous surfaces shall be fitted to accurate alignment to assure a smooth completed surface free from irregularities, and shall be sufficiently tight to prevent the loss of mortar. No forms shall be left permanently in place without approval of the Town. Holes resulting from removal of form ties shall be filled solid within 12 hours after removal of forms with cement mortar.

3.02 PLACEMENT

- A. Concrete shall be placed as nearly as possible in its final position. Runways for wheeled equipment shall not be supported on the reinforcement. Concrete shall be placed and compacted in layers not over 18 inches deep. Vibrators may be used provided they are used under experienced supervision and the mixture is dry enough to prevent segregation. Form vibrators shall not be used. Vibration shall not be used for transporting or moving concrete inside the forms. No more concrete shall be placed than can be consolidated and finished the same day as placed. Free fall of concrete shall be limited so that no segregation of materials occurs.

3.03 JOINTS

- A. Joints in foundation walls shall be keyed. Before depositing of concrete is resumed, the hardened surface shall be roughened, cleaned and wetted surfaces shall be slushed with a coating of neat cement grout against which the new concrete shall be placed before the new grout has attained its set.

3.03 FINISHING

- A. After stripping forms, all voids and honeycombs shall be patched by chipping and scarifying the defective area and treating it with an approved bonding tended that all such voids be patched, not merely plastered. Grout mixture shall consist of one part Portland cement and one part sand. Immediately following removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not to be exposed or waterproofed.
- B. Slabs shall be struck off and consolidated by approved machine or hand methods, so that upon completion, the surface shall be true to grade as shown on drawings and free of surface voids. All floors shall have monolithic steel trowel finish unless otherwise indicated on the drawings. Exterior walks shall be compacted, screeded and floated to a true even surface with wood floats and then broomed.

END OF SECTION

APPROVED MATERIALS

ANY MATERIALS NOT LISTED HEREIN WILL REQUIRE SPECIFIC APPROVAL BY THE TOWN OF LAKE LURE PRIOR TO INSTALLATION.

DUCTILE IRON WATER LINE

GRIFFIN PIPE PRODUCTS, CO.
TYTON JOINT CLASS 350

GATE VALVES

IN GROUND

3" – 12"
2"
TAPPING 2" – 12"

MUELLER A-2360 RESILIENT WEDGE – M.J. x M.J.
MUELLER A-2360 RESILIENT WEDGE – THD x THD
MUELLER T-2360 RESILIENT WEDGE – M.J. x M.J.

IN BUILDINGS & VAULTS

3" – 12"
1" – 2"

MUELLER 2360 SERIES OS&Y RESILIENT WEDGE
FLANGED ENDS
CRANE FIG. 459 OR JENKINS FIG. 820J RISING
STEM THREADED ENDS

FIRE HYDRANT

MUELLER SUPER CENTURION 3-WAY A-423, 5/4"
MAIN VALVE, MECHANICAL JOINT CONNECTION,
COLOR = MFR. STANDARD RED

MECHANICAL JOINT FITTINGS

TYLER /UNION C153 DUCTILE IRON COMPACT FITTINGS

FLANGED FITTINGS

TYLER UNION C110 FLANGED FITTINGS

TYTON JOINT (SLIP JOINT) RESTRAINTS

U.S. PIPE FIELD LOK 350 GASKET INSTANT JOINT
RESTRAINT

AIR RELEASE VALVE

GA INDUSTRIES FIGURE 910, 1" NPT INLET

WATER SERVICE TUBING

HDPE, COPPER TUBE SIZE OD SDR 9 WITH A
MAXIMUM RECOMMENDED WORKING PRESSURE
OF 200 P.S.I.

MANHOLE COVER – AIR VALVES

U.S. FOUNDRY USF 668 RING AND KL COVER, MARKED
"AIR VALVE" OR "AIR RELEASE VALVE"

TAPPING SADDLES

MUELLER EPOXY COATED DUCTILE IRON WITH STEEL
ALLOY STRAPS AND CC TAP

VALVE BOXES

FASTECH ADJUSTABLE SCREW TYPE, SERIES 3102 -3103
MARKED "WATER"

METER BOX

STANDARD RECTANGULAR METER BOX, 19½"X14"X12"
WITH CAST IRON LID

CORPORATION STOP

MUELLER 110 COMPRESSION CONNECTION (GROUND
KEY TYPE)

FLUSHING HYDRANT

THE KUPFERLE FOUNDRY CO., "MAINGUARD #77"
2" INLET, 2½" NST NOZZLE

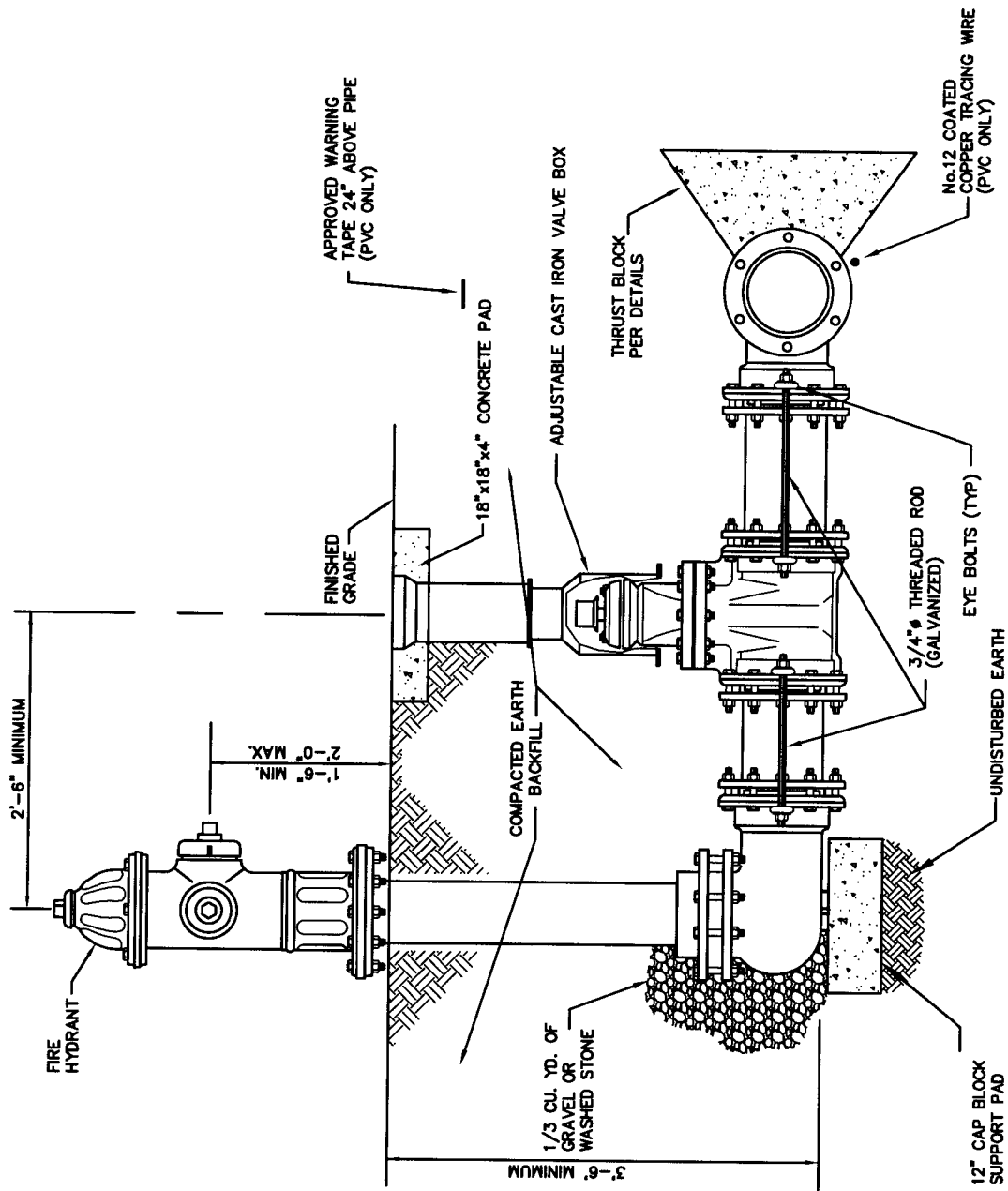
TAPPING SLEEVE

MUELLER H-615 MECHANICAL JOINT TAPPING SLEEVE

SECTION “W”

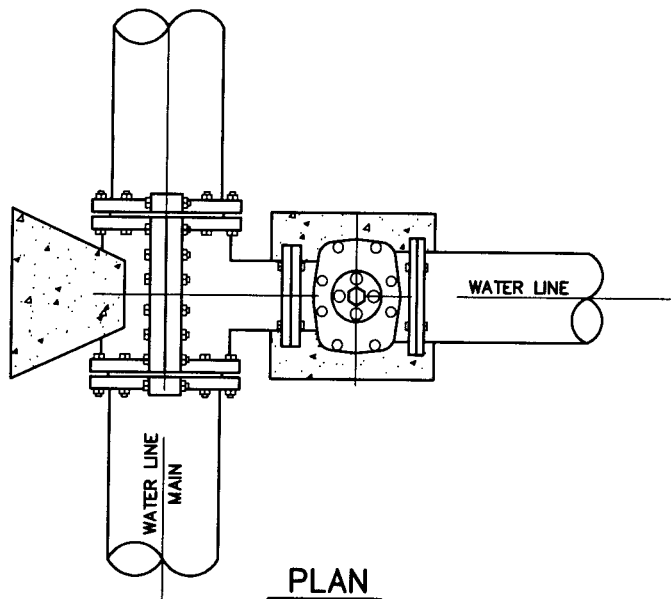
WATER AND SEWER LINE DETAILS

W1	Fire Hydrant
W2	Tapping Sleeve and Valve
W3	Typical Deadman
W4.1	Thrust Blocks for Bends and Reducers
W4.2	Thrust Blocks for Plugs and Tees
W4.3	Thrust Block Dimension “A”
W7	Typical Trench Details
W8	Gate Valve Installation
W9	2” Gate Valve Installation
W10	Not Used
W11	Air Release Valve Installation
W12	Offset Air Release Valve Installation
W13	2” Blow-Off for PVC SDR-21 Water Line
W14	5/8” Water Meter Box Detail
W15	Not Used
W16	Water Line Creek Crossing
W17	Encasement Detail
W18	Not Used
W19.1	Fire Sprinkler System Backflow Preventer Vault
W19.2	Fire Sprinkler System Backflow Preventer Vault – Section A-A
W21.1	Meter, By-Pass and Vault
W21.2	Meter, By-Pass and Vault – Section A-A
W23	Not Used
W24	Not Used
W25	Cleanout Detail
W26	Elevated Crossing
W27	Sewage Forcemain Air Release Valve
W28	Manhole Demolition and Abandonment
W29	Manhole Forcemain Connection
W30	Inside Drop Manhole
W31	Manhole Inverts
W32	Outside Drop Manhole
W33	New Manhole Over Existing Sewer Line
W34	Manhole Ring and Cover
W35	Manhole Steps
W36	Precast Concrete Manhole
W37	Vented Manhole
W38	Keying Pipes on Slopes
W39	Sewer Line Abandonment
W40	Sanitary Sewer Service
W41	Transition Couplings Dissimilar Material Pipes
W42	Two Pipes In Same Trench – Trench Detail
W43.1	Typical Trench Details 1 of 2
W43.2	Typical Trench Details 2 of 2
W45	Typical Trench Details – Forcemain



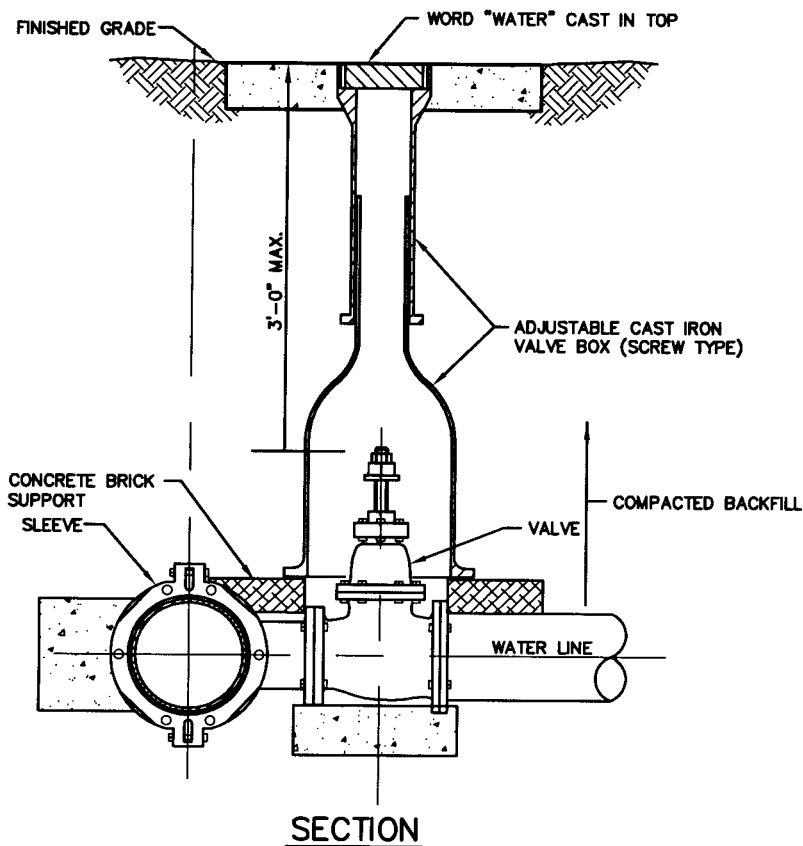
TYPICAL ROD TYPE FIRE HYDRANT INSTALLATION

FIRE HYDRANT



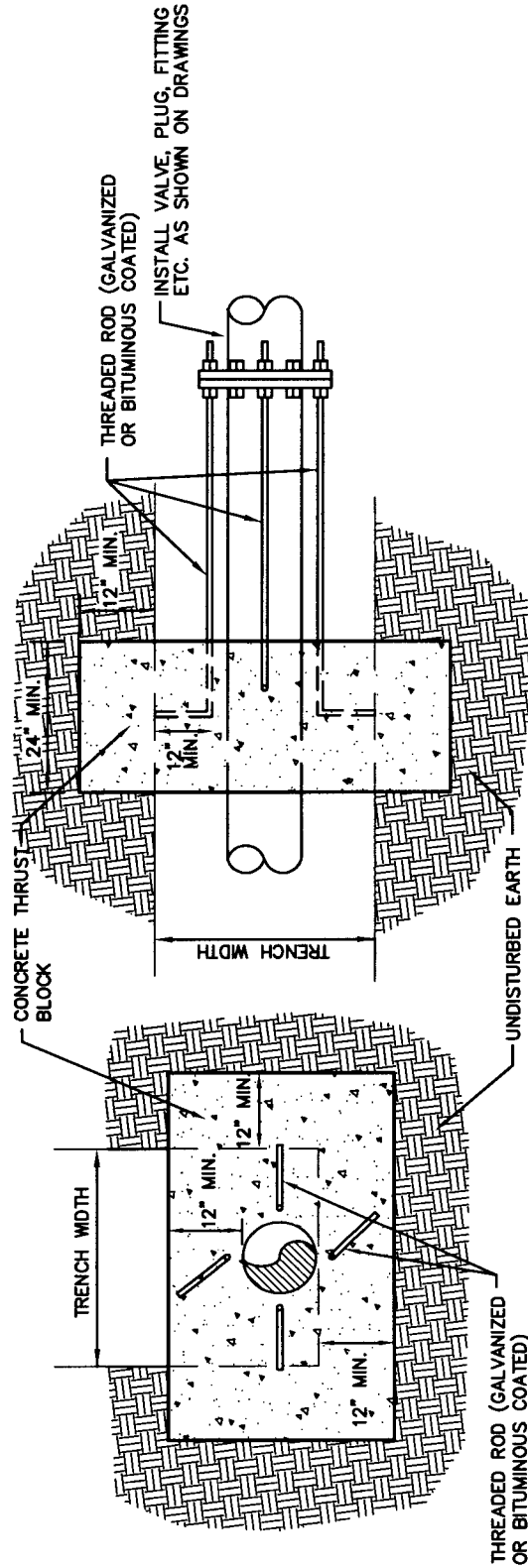
NOTES

- 1- TAPPING SLEEVE SHALL BE MUELLER, CLOW, AMERICAN OR APPROVED EQUAL.
- 2- TAPPING VALVE SHALL BE MUELLER, CLOW, AMERICAN OR APPROVED EQUAL.
- 3- SOLID CONCRETE OR BRICK BLOCKING SHALL BE USED AS FOOTING FOR DUCTILE IRON PIPE. PVC PIPE SHALL REQUIRE A 3000 PSI FOOTING.
- 4- CONCRETE SHALL NOT CONTACT BOLTS OR ENDS OF MECHANICAL JOINT FITTINGS.
- 5- SEE APPROPRIATE STANDARD DETAIL FOR THRUST BLOCK DIMENSIONS.
- 6- COVER FITTINGS WITH POLYETHYLENE PLASTIC PRIOR TO POURING THRUST BLOCKS



TAPPING SLEEVE AND VALVE WITH BOX INSTALLATION

TAPPING SLEEVE AND VALVE

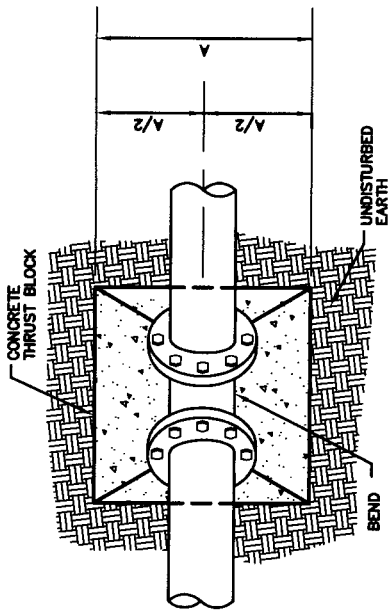
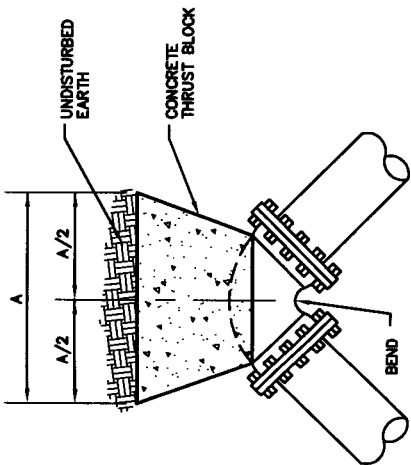


NOTES:

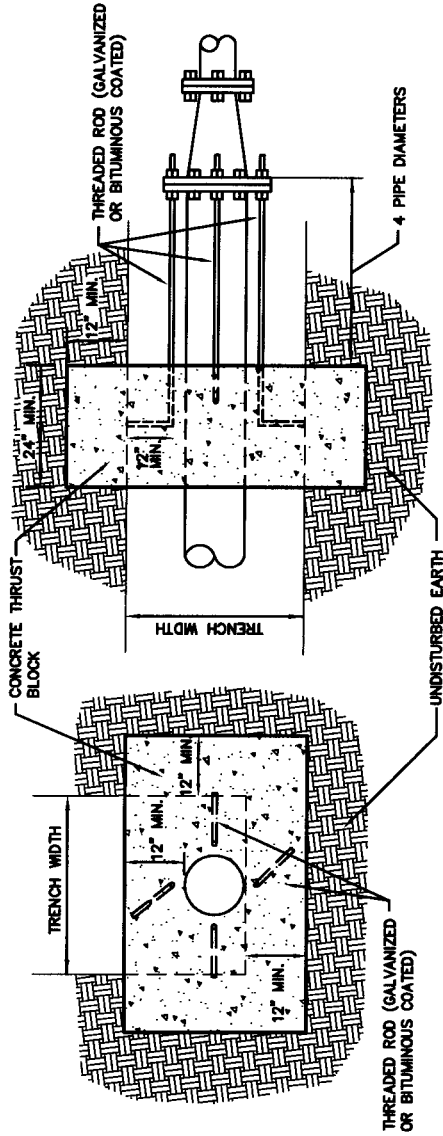
1. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. THE FITTING SHALL BE WRAPPED IN A LAYER OF POLYETHYLENE PLASTIC PRIOR TO POURING THE THRUST BLOCK.
2. ROD AND EYE BOLT DIAMETER SHALL BE A MINIMUM OF 3/4" AND SHALL MATCH THE SIZE OF THE BOLT PROVIDED WITH THE FITTING.
3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

TYPICAL DEADMAN

TYPICAL DEADMAN



TYPICAL THRUST BLOCKS FOR BENDS

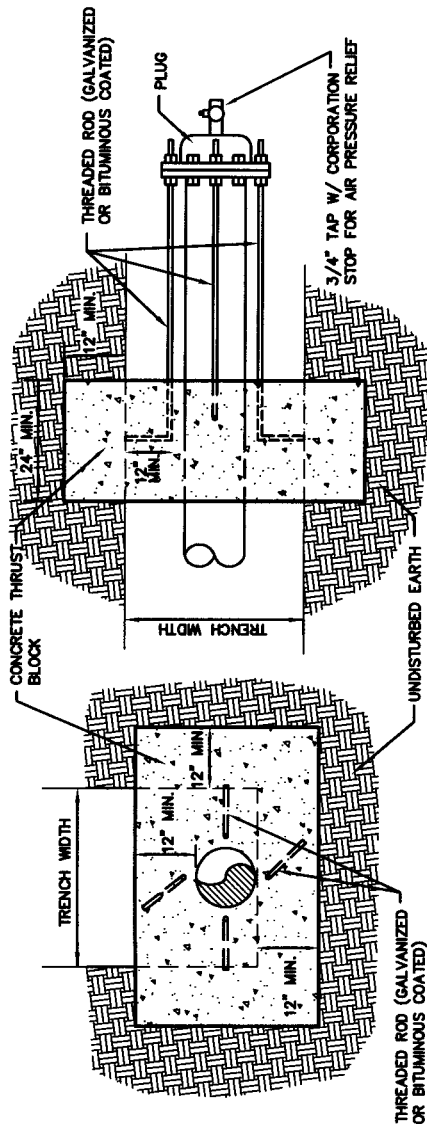


NOTES:

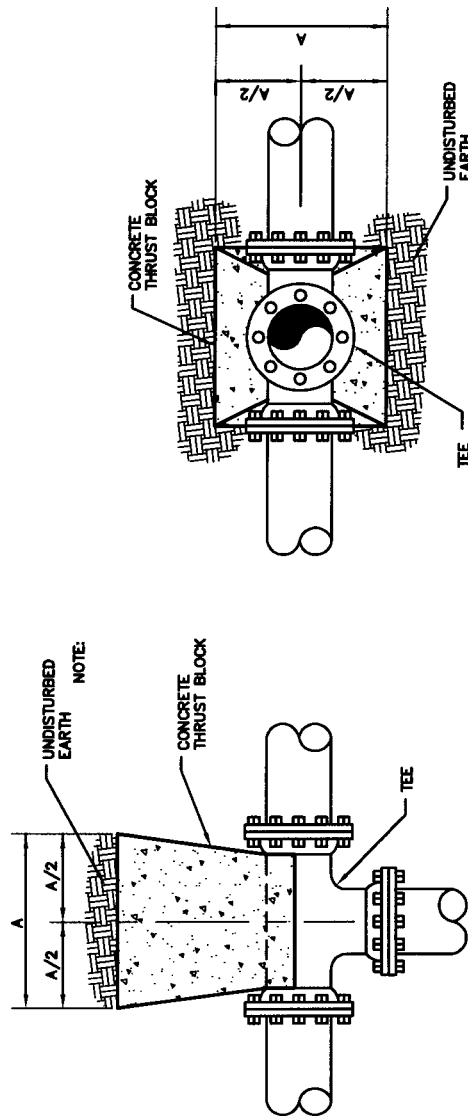
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3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

TYPICAL THRUST BLOCK FOR REDUCERS

THRUST BLOCKS FOR BENDS AND REDUCERS



TYPICAL THRUST BLOCK FOR PLUGS



- NOTES:
1. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. THE FITTING SHALL BE WRAPPED IN A LAYER OF POLYETHYLENE PLASTIC PRIOR TO POURING THE THRUST BLOCK.
 2. ROD AND EYE BOLT DIAMETER SHALL BE A MINIMUM OF 3/4" AND SHALL MATCH THE SIZE OF THE BOLT PROVIDED WITH THE FITTING.
 3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

TYPICAL THRUST BLOCKS FOR TEES

THRUST BLOCKS FOR PLUGS AND TEES

THRUST BLOCK DIMENSION "A"

NOTES:

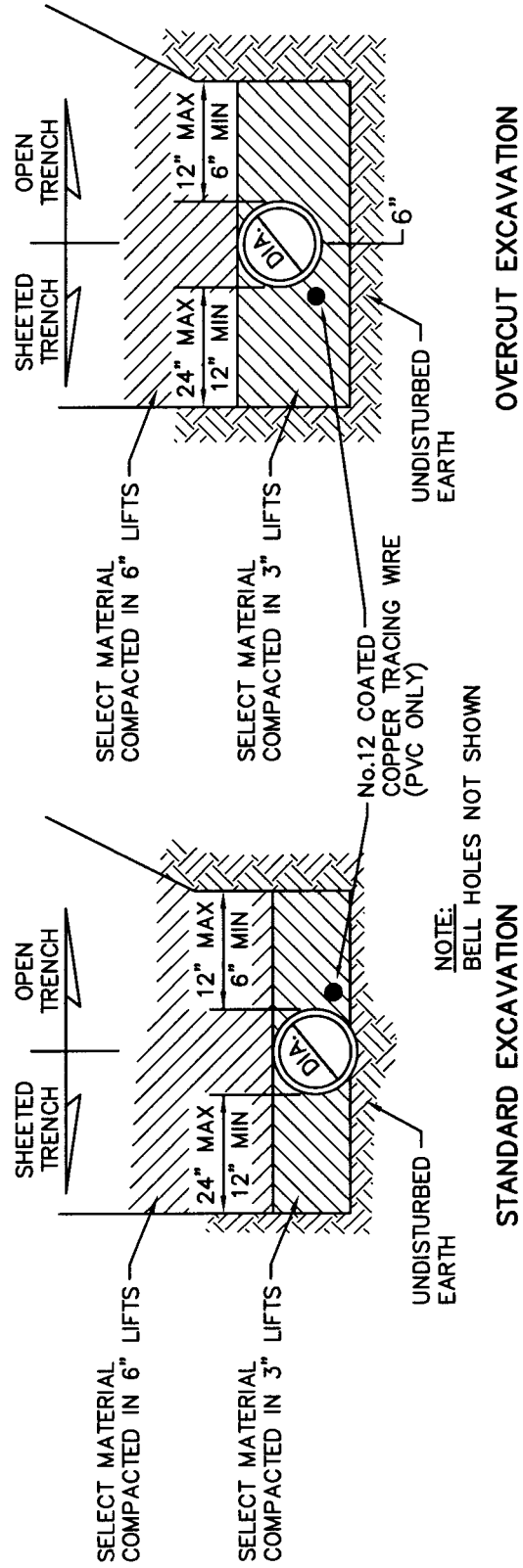
1. FITTING JOINTS SHALL NOT BE POURED IN CONCRETE OR HAVE CONCRETE SPILLED ON THE BOLTS OR NUTS. THE FITTING SHALL BE WRAPPED IN A LAYER OF POLYETHYLENE PLASTIC PRIOR TO POURING THE THRUST BLOCK.
2. ROD AND EYE BOLT DIAMETER SHALL BE A MINIMUM OF 3/4" AND SHALL MATCH THE SIZE OF THE BOLT PROVIDED WITH THE FITTING.
3. CONTRACTOR SHALL REPLACE FITTING BOLTS WITH THREADED ROD FOR 1/2 OF THE BOLTS SUPPLIED WITH EACH FITTING. RODS SHALL BE EQUALLY SPACED.

TYPE

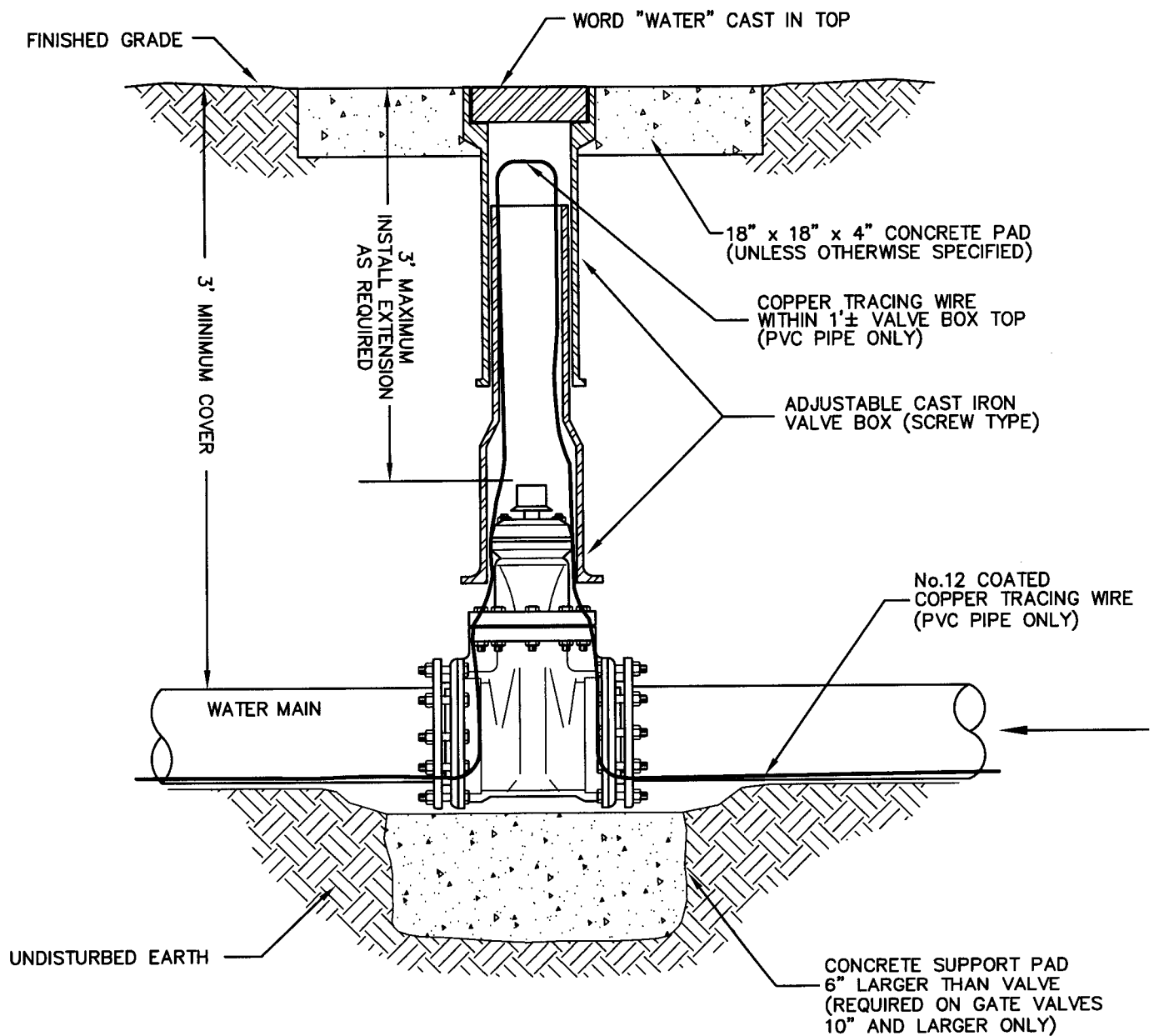
SIZE	11-1/4" BEND	22-1/2" BEND	45° BEND	90° BEND	TEE	PLUG
2-6	12	12	12	16	16	14
8	12	12	16	22	22	18
10	12	14	20	28	28	22
12	12	18	24	32	32	28
14	14	20	28	38	38	32
16	16	22	32	42	42	36
18	18	26	36	48	48	40
20	20	28	40	52	52	44
24	24	34	46	64	64	54
30	30	42	58	78	78	66
36	36	50	70	94	94	80
42	40	58	80	108	108	92
48	46	66	90	124	124	104

THRUST BLOCK DIMENSION "A"

TYPICAL TRENCH DETAILS

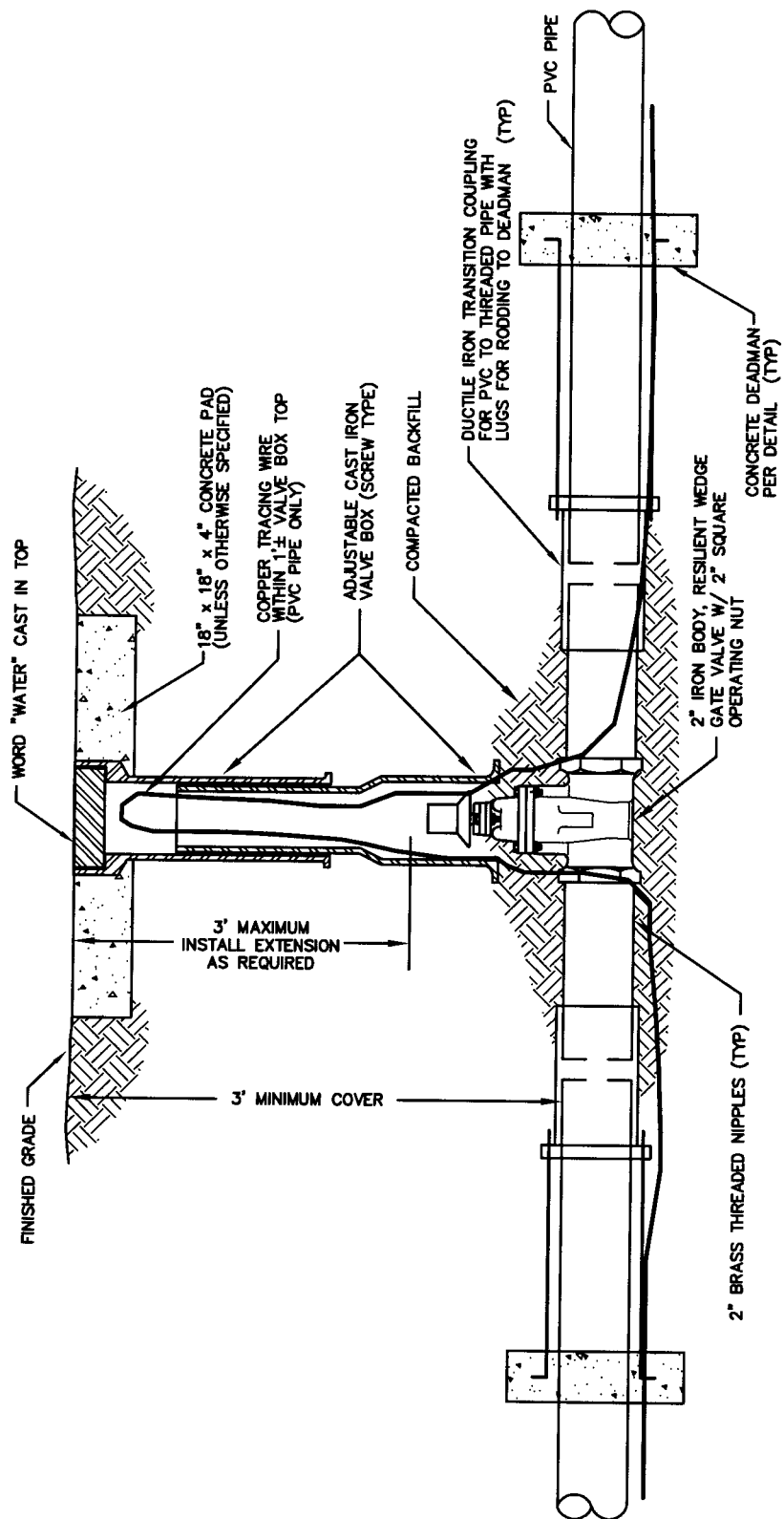


TYPICAL TRENCHING DETAILS



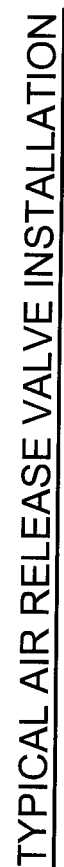
TYPICAL VERTICAL GATE VALVE INSTALLATION

GATE VALVE INSTALLATION

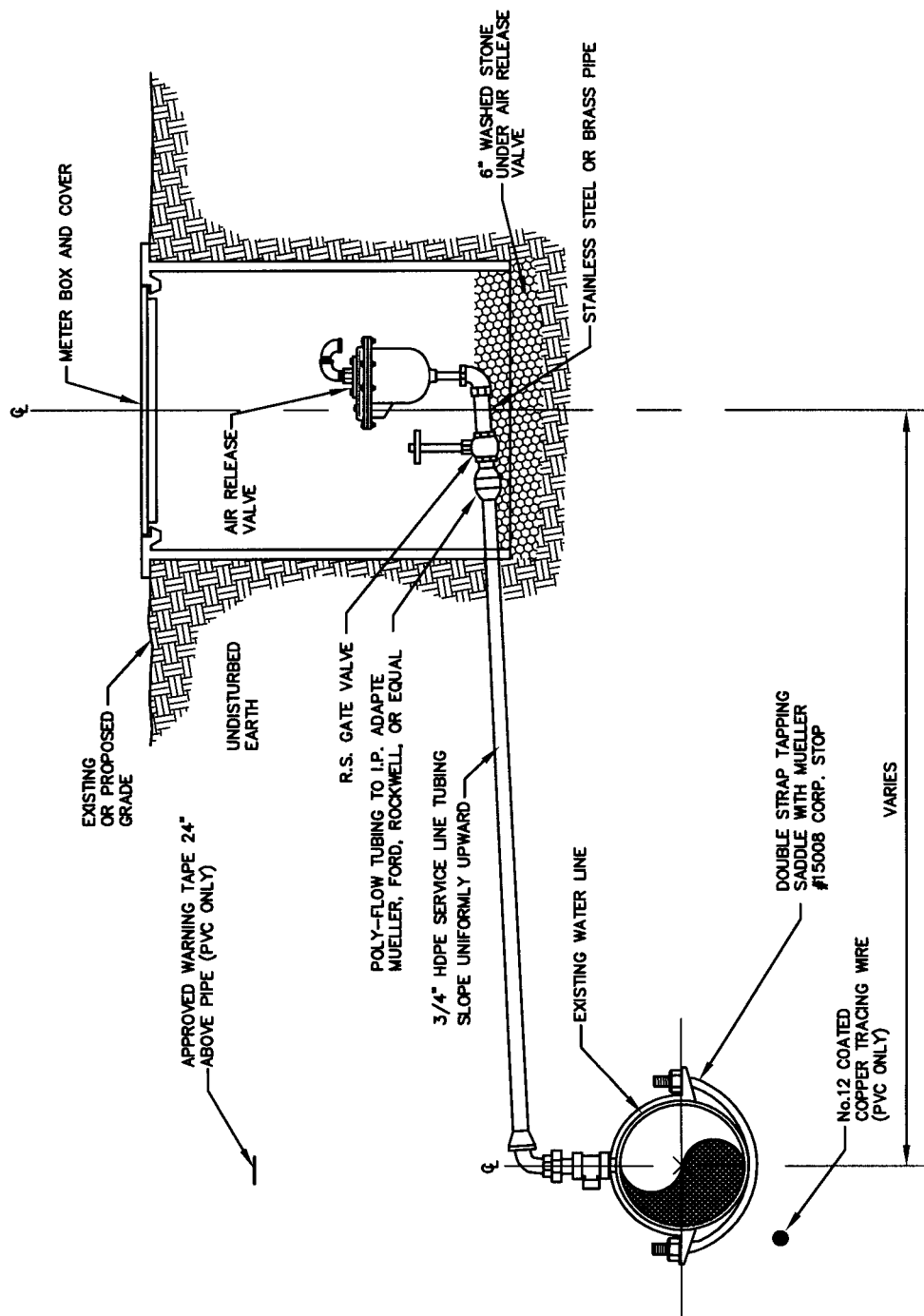


2" GATE VALVE INSTALLATION

2" GATE VALVE INSTALLATION



STANDARD DETAIL - W11

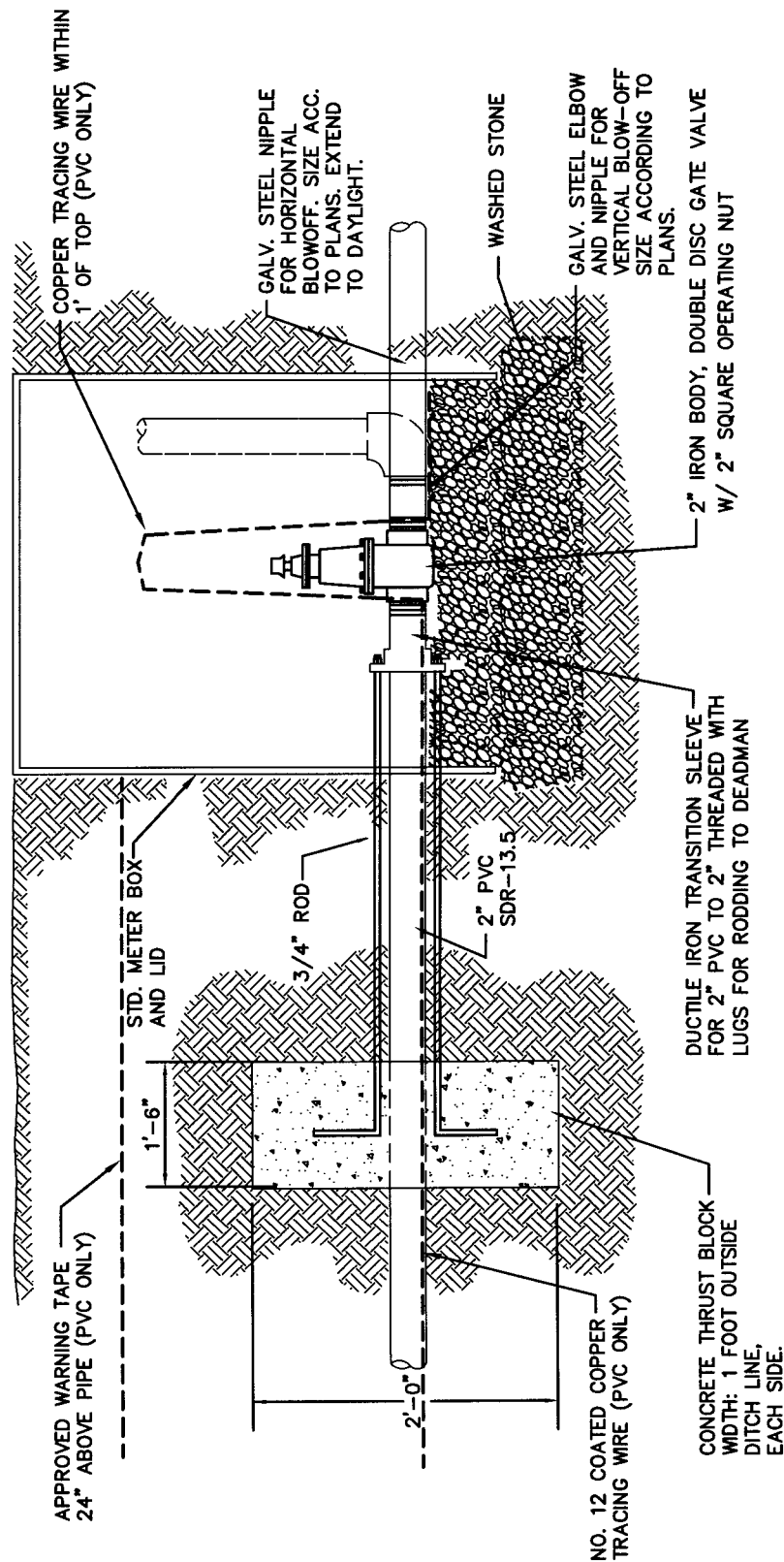


OFFSET AIR RELEASE VALVE INSTALLATION

OFFSET AIR RELEASE VALVE INSTALLATION

NOTE:

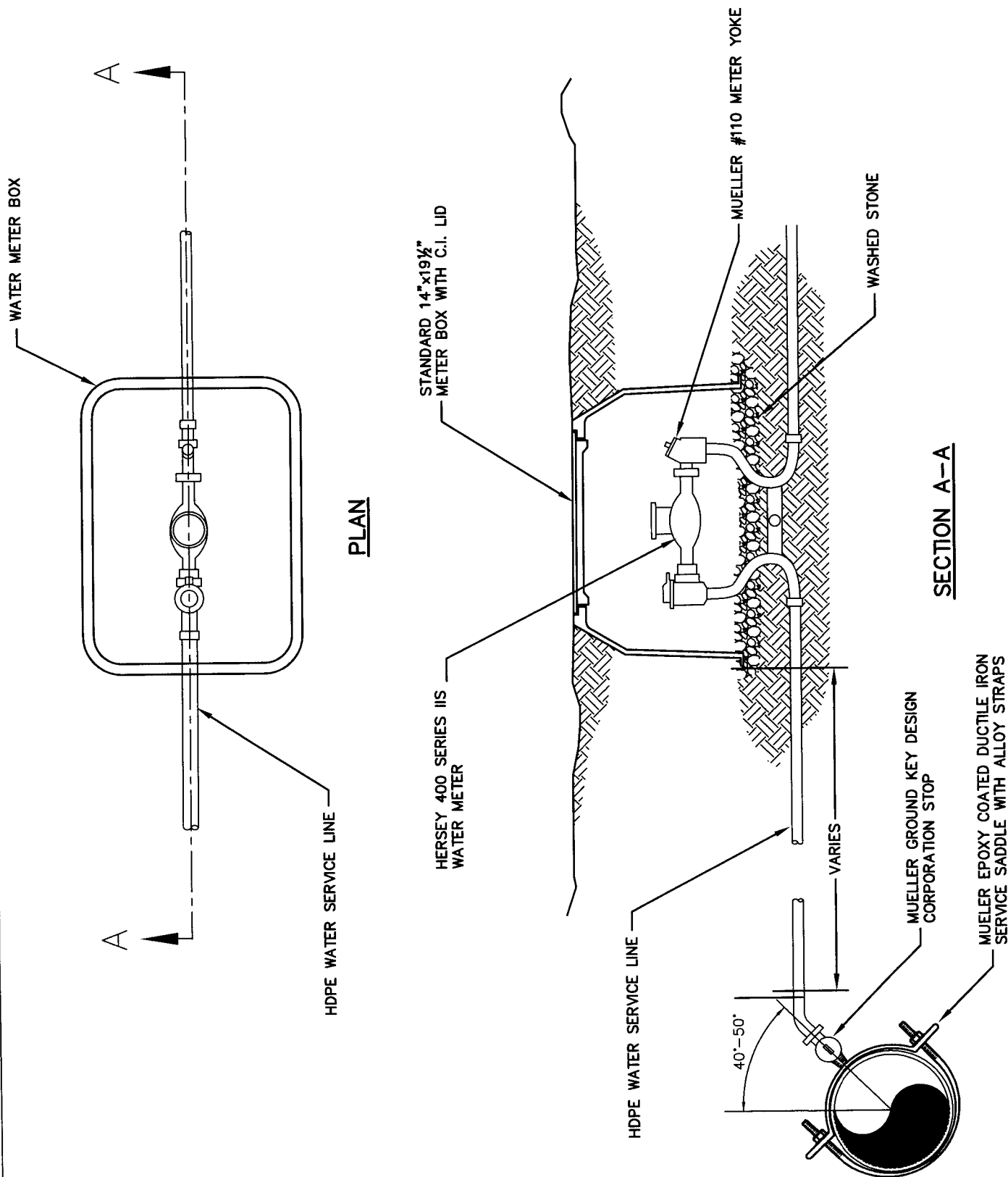
1. GLUED JOINTS WILL NOT BE PERMITTED.
2. VERTICAL BLOW-OFF ARRANGEMENT TO BE USED ONLY WHEN HORIZONTAL BLOW-OFF IS NOT POSSIBLE.



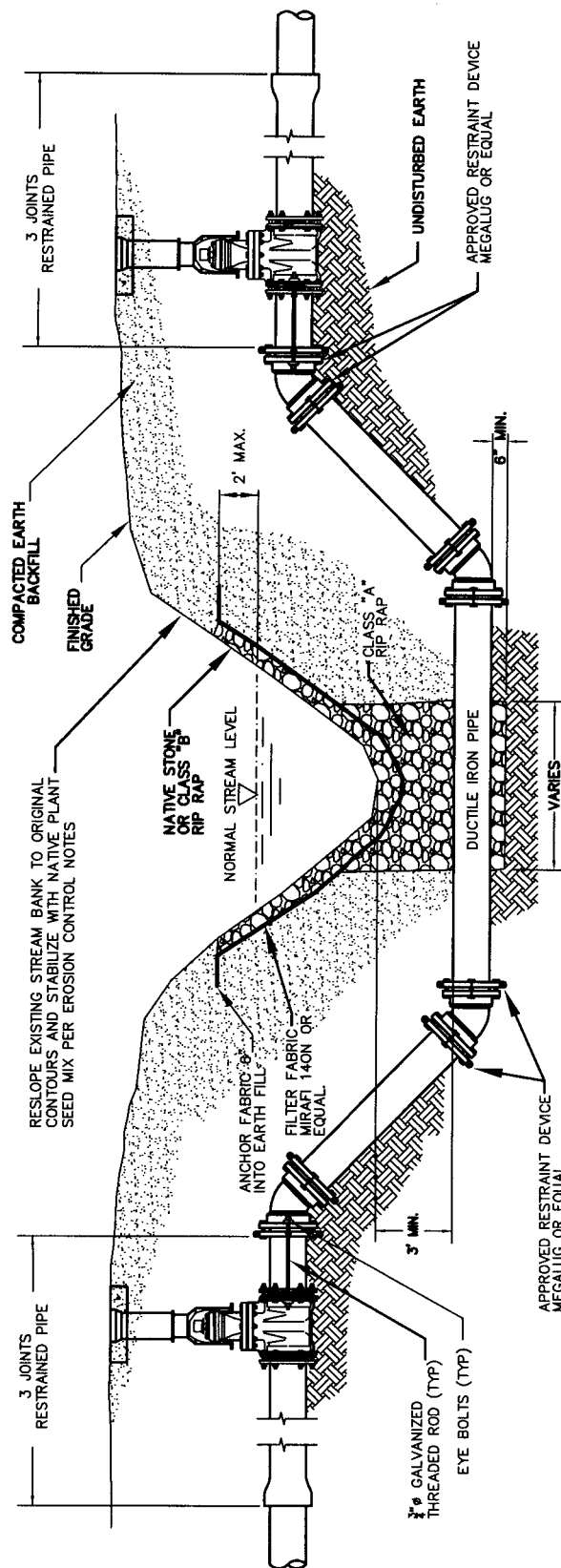
BLOW-OFF DETAIL (PVC WATER LINE)

NOT TO SCALE

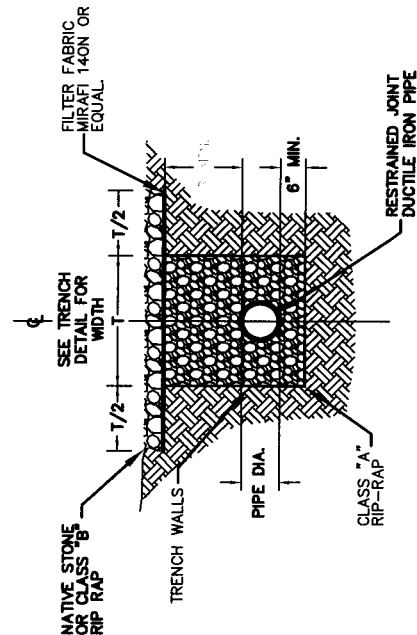
2" BLOW-OFF FOR PVC SDR-21 WATER LINE



5/8" WATER METER DETAIL



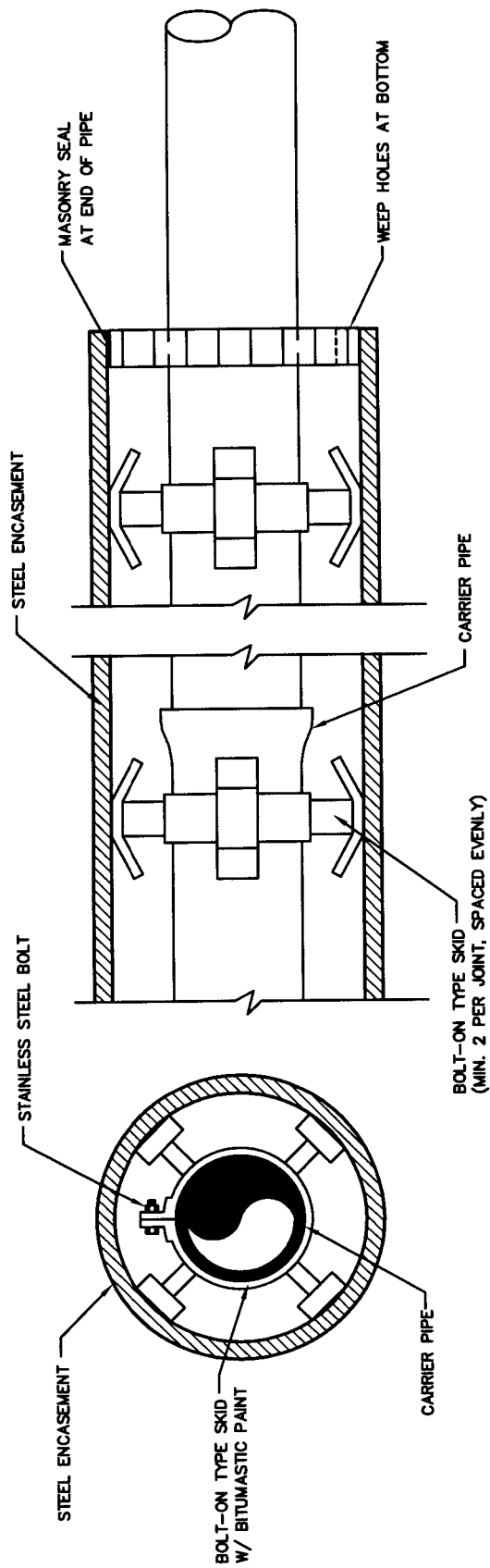
- NOTES:
1. CONTRACTOR SHALL RESTRAIN 3 JOINTS PAST THE LAST FITTING AT THE TOP OF THE BANK OR AS SPECIFIED BY THE TOWN.
 2. APPROVED RESTRAINING DEVICES INCLUDE RETAINING GLANDS (MEGALUGS), FIELD LOCK GASKETS AND RESTRAINT SYSTEMS SHALL BE PROVIDED BY APPROVED PIPE MANUFACTURERS.
 3. SEE TRENCH DETAIL FOR ACTUAL TRENCH WIDTH.



WATER LINE CREEK CROSSING

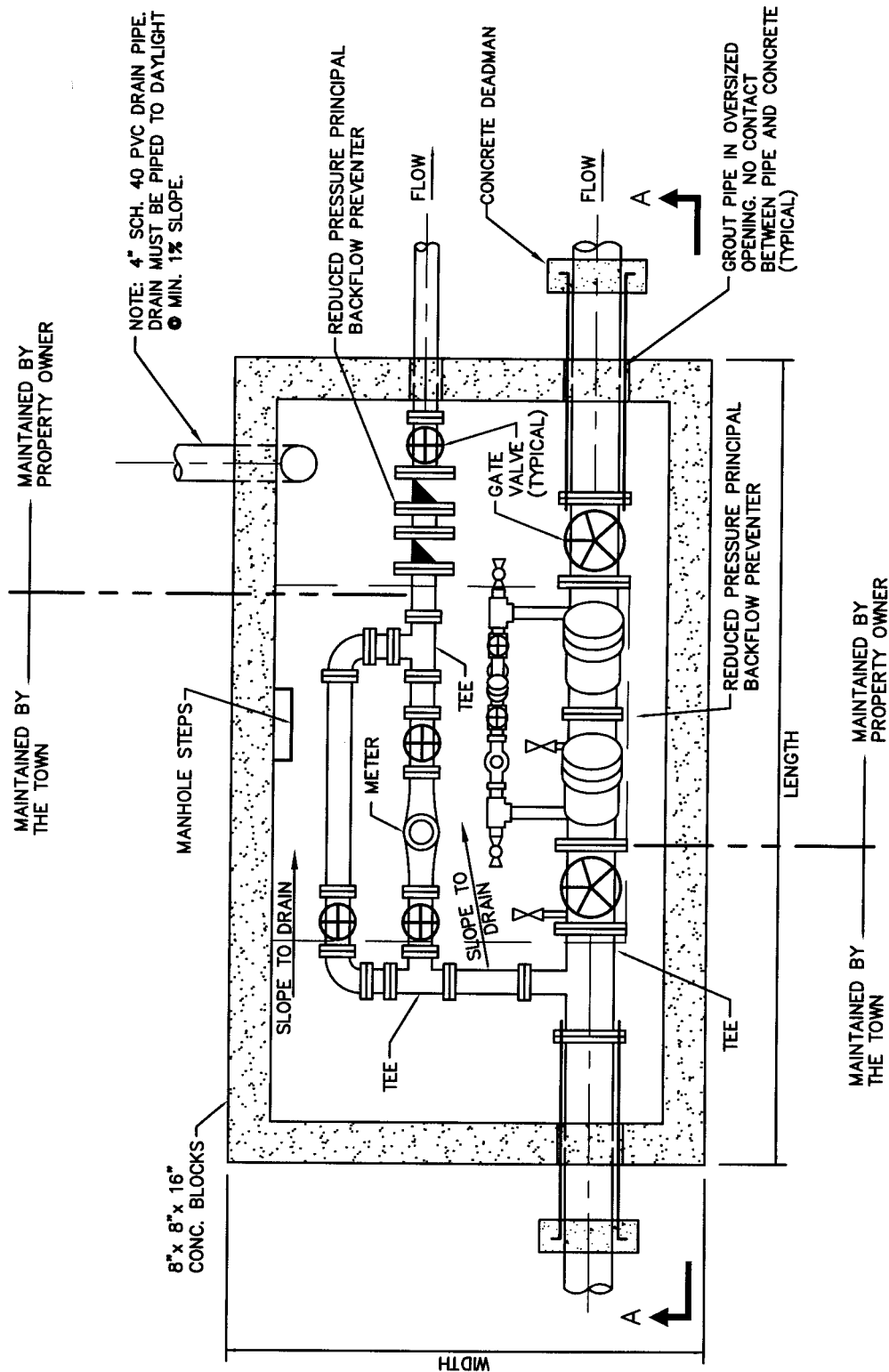
(NO FERTILIZER TO BE USED WITHIN 10' OF BANK)

WATER LINE CREEK CROSSING



ENCASEMENT DETAIL

ENCASEMENT DETAIL



PLAN

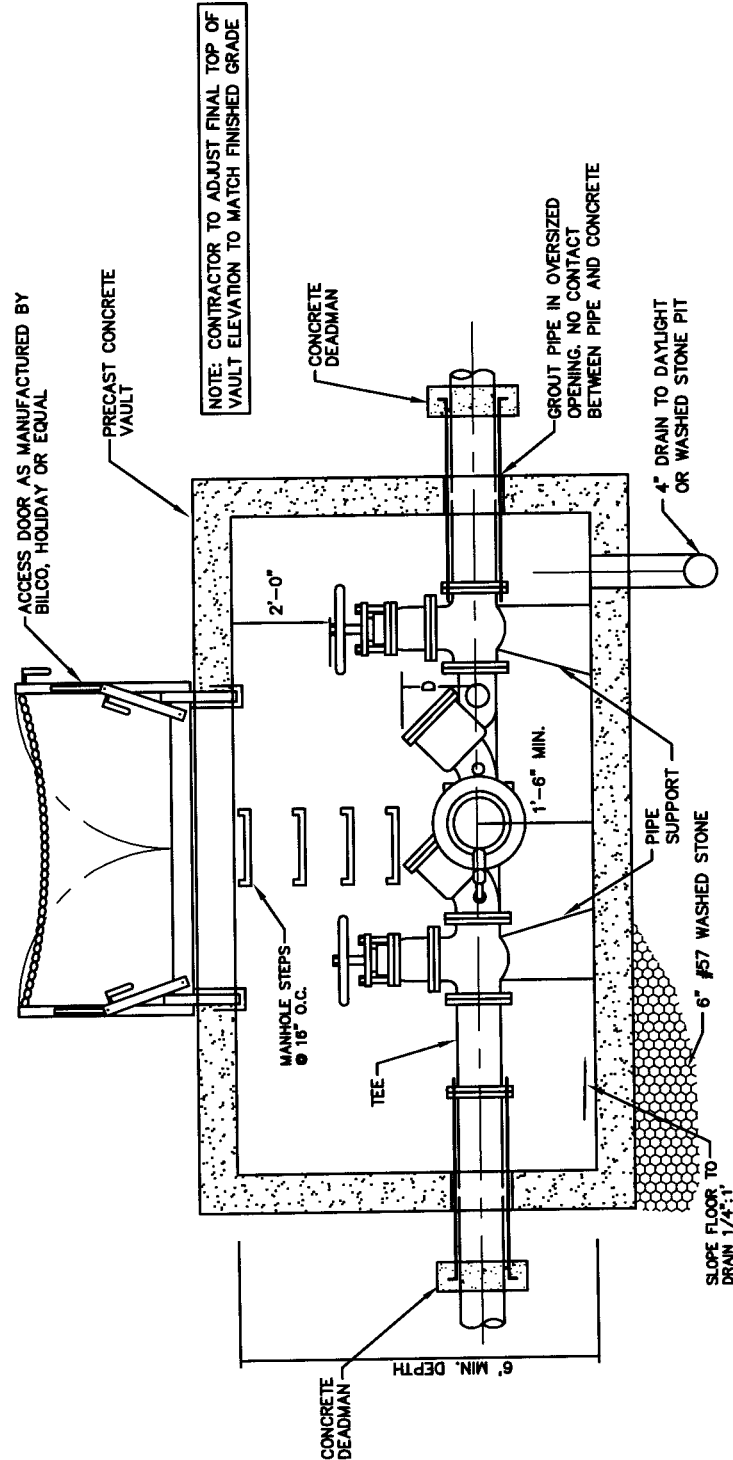
BACKFLOW PREVENTER AND VAULT

NOT TO SCALE

FIRE SPRINKLER SYSTEM BACKFLOW PREVENTER VAULT

FIRE LINE SIZE	PIT DIMENSIONS			ACCESS DOOR SIZE
	LENGTH	WIDTH	DEPTH	
6 INCH	8'-0"	6'-0"	6'-6"	BILCO JD/2 4'-0" x 4'-0"
8 INCH	9'-0"	6'-0"	7'-0"	BILCO JD/2 4'-0" x 4'-0"
10 INCH	10'-0"	6'-0"	7'-6"	BILCO JD/3 4'-0" x 6'-0"

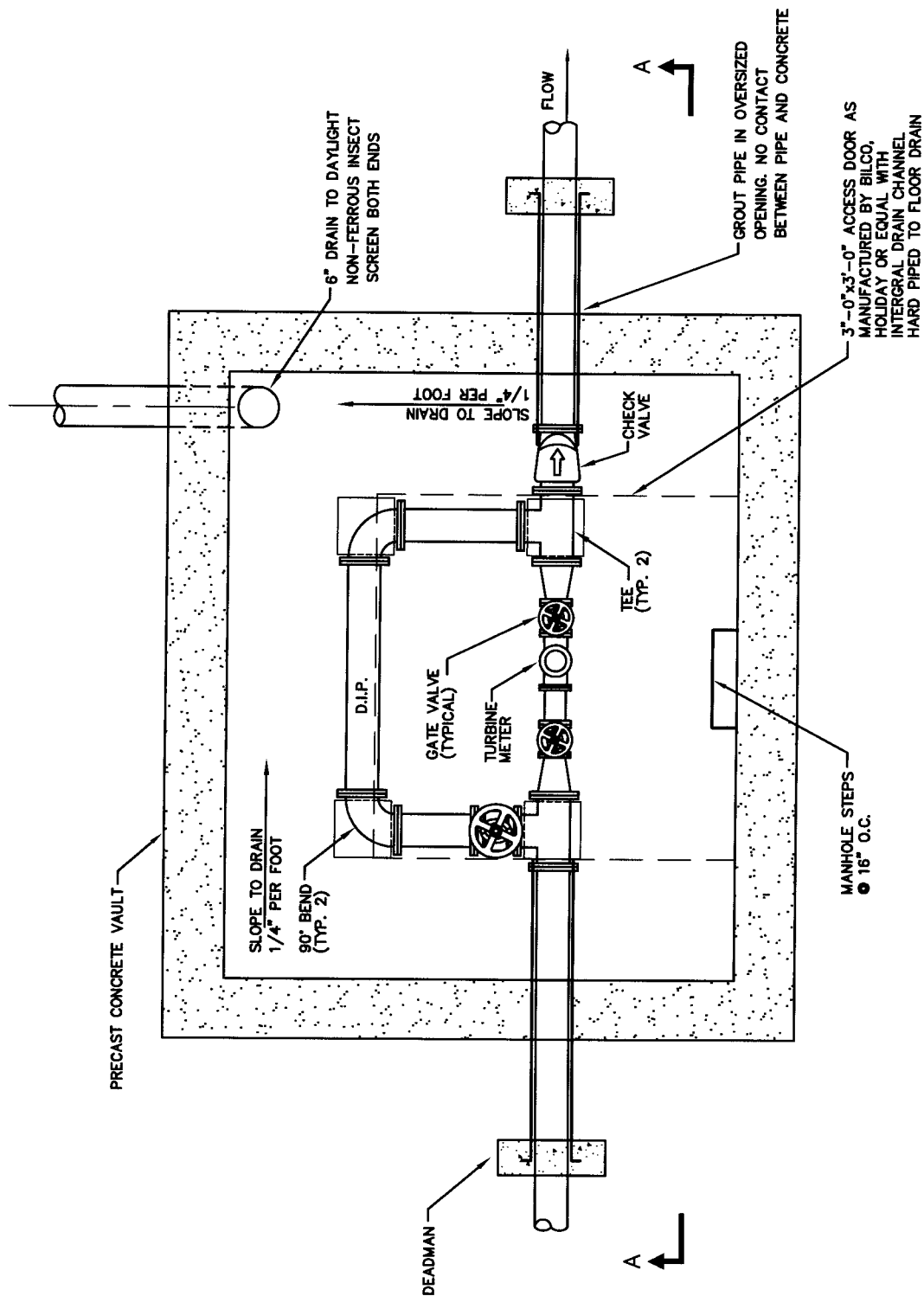
FIRE SPRINKLER SYSTEM BACKFLOW PREVENTER VAULT SECTION A-A



SECTION AA

BACKFLOW PREVENTER AND VAULT

NOT TO SCALE

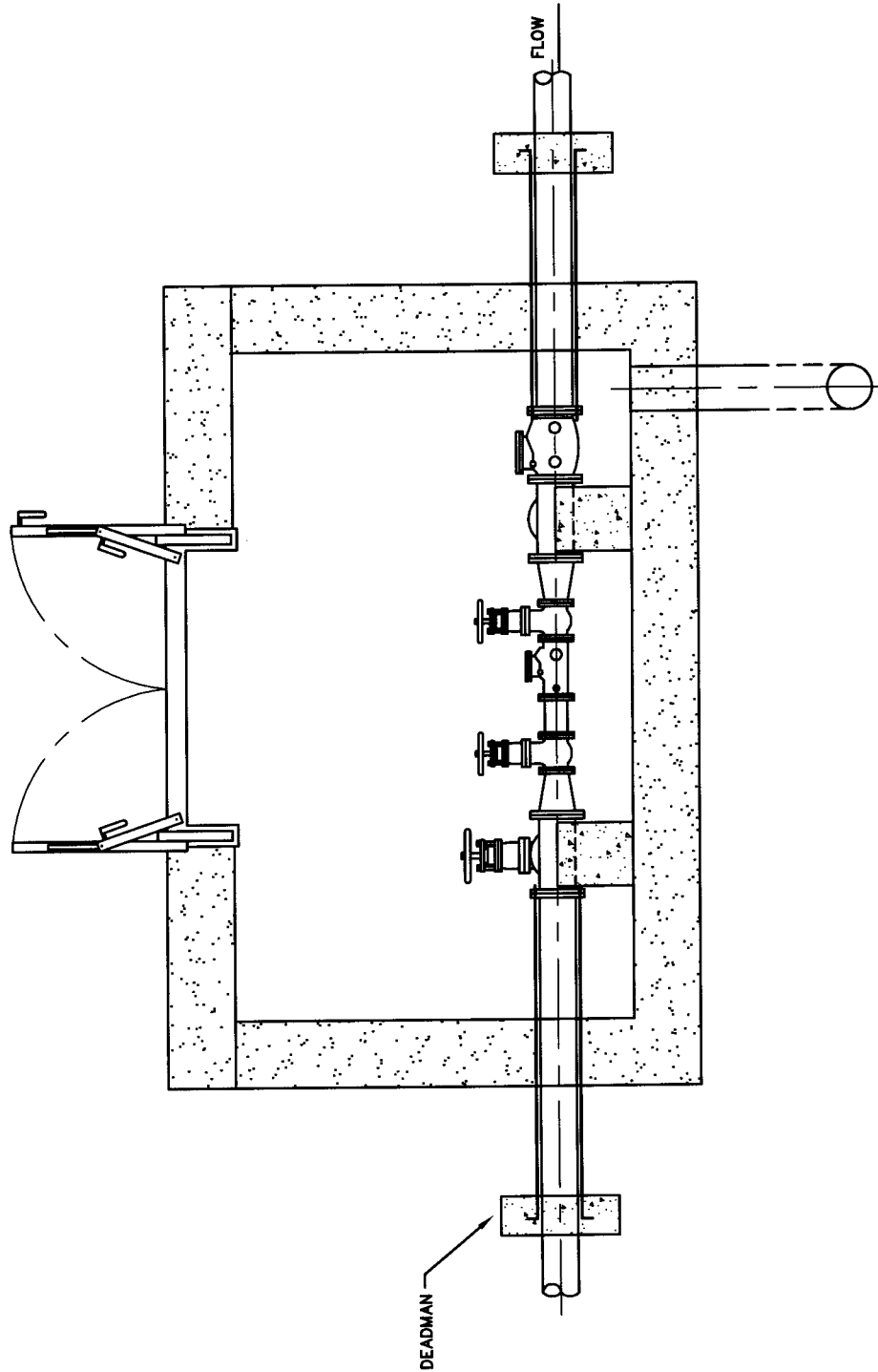


PLAN

METER, BY-PASS AND VAULT

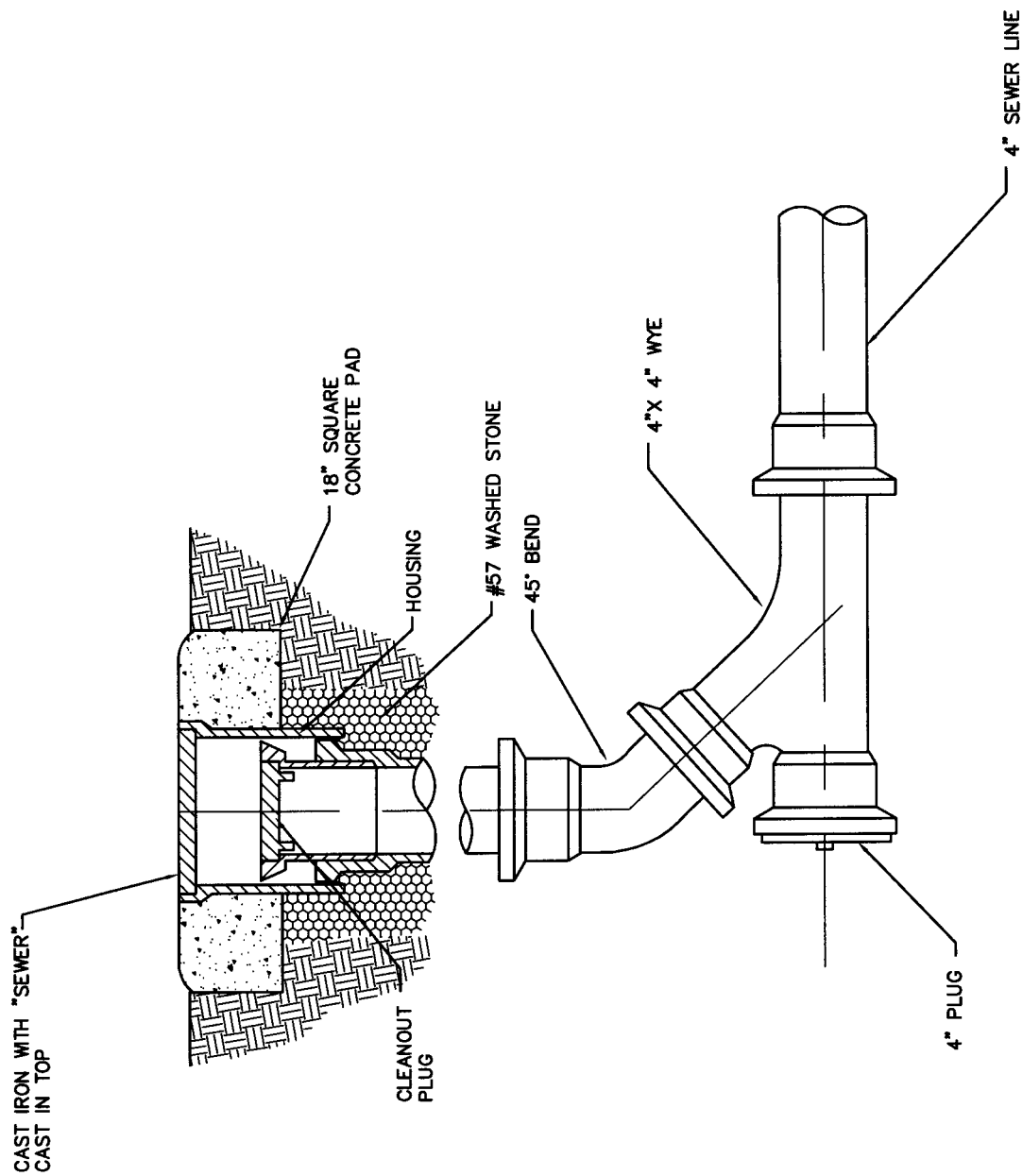
NOT TO SCALE

METER, BY PASS AND VAULT



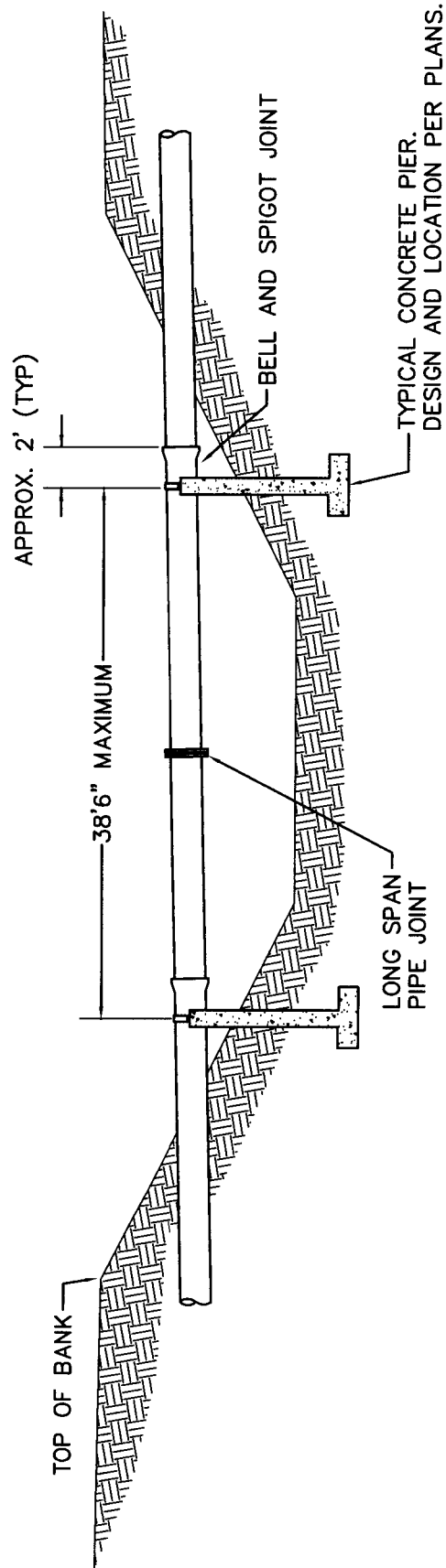
METER, BY-PASS AND VAULT
SECTION AA

METER BY-PASS AND VAULT - SECTION A-A



CLEANOUT DETAIL
N.T.S.

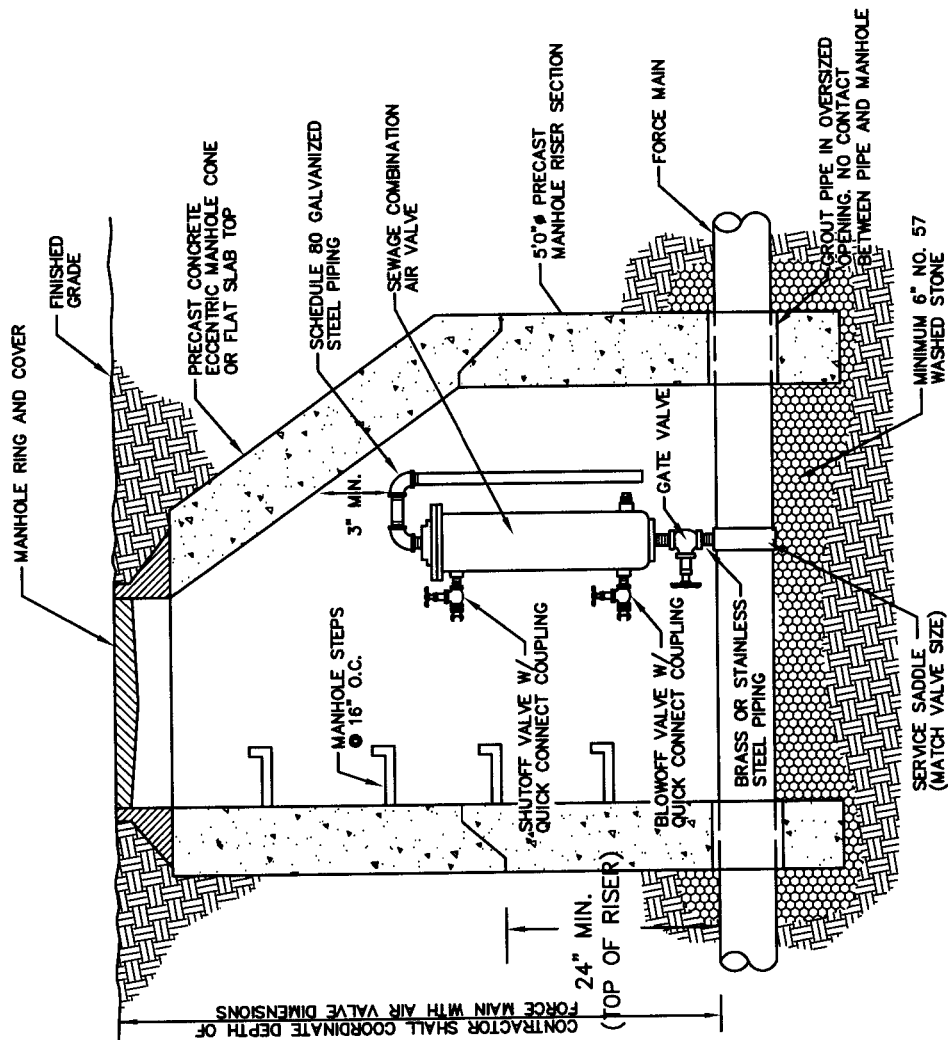
CLEANOUT DETAIL



NOTE: LONG SPAN PIPE SHALL BE USED FOR UNSUPPORTED SPANS GREATER THAN 20'. SEE SPECIFICATIONS FOR LONG SPAN PIPE REQUIREMENTS. SHOP DRAWINGS FOR LONG SPAN PIPE SHALL BE SUBMITTED AND APPROVED PRIOR TO INSTALLATION.

TYPICAL ELEVATED CROSSING

ELEVATED CROSSING



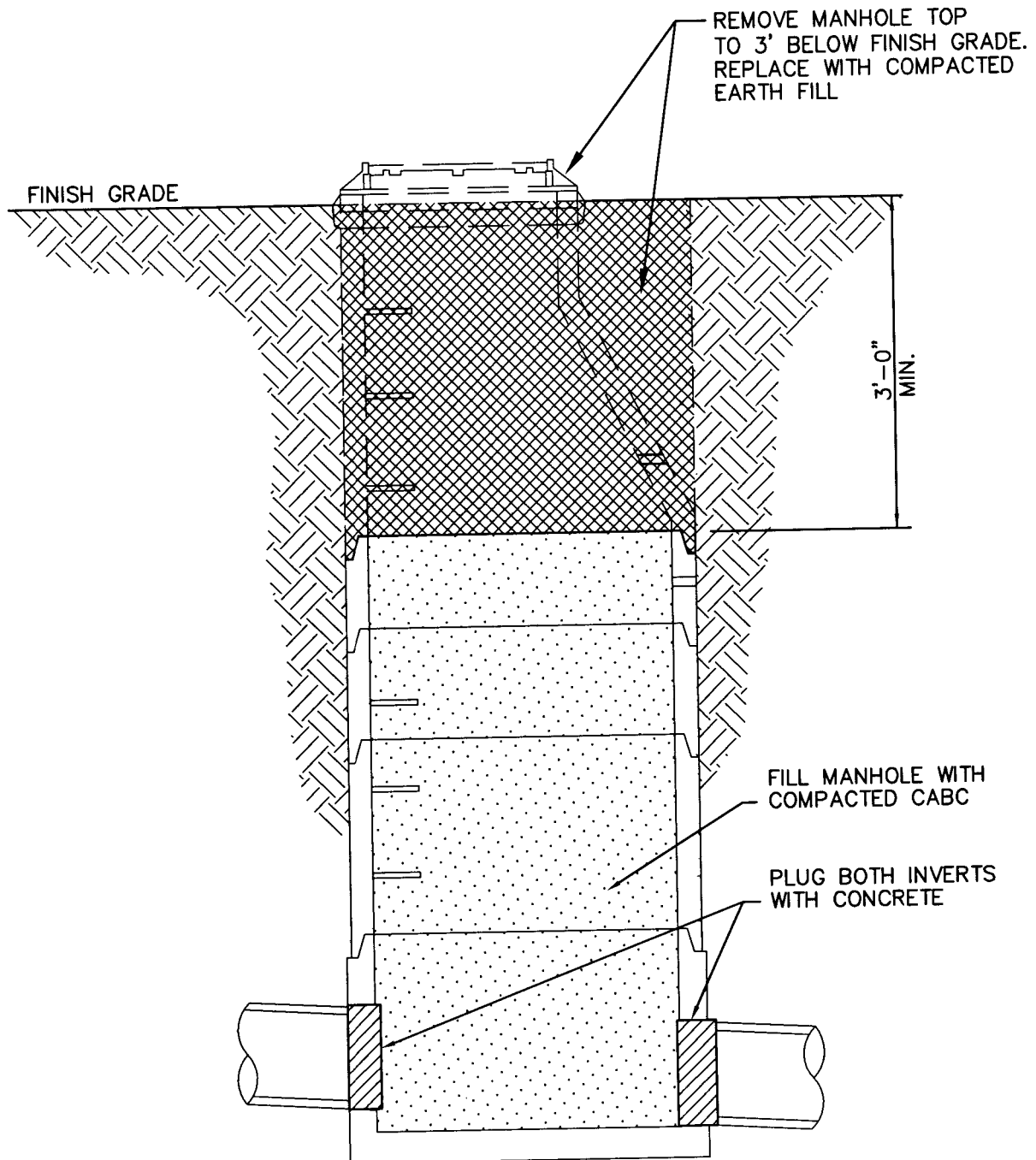
NOTES:

1. COMBINATION AIR VALVE TO BE INSTALLED AT ACTUAL HIGH POINT OF LINE.
2. COMBINATION AIR VALVE SHALL BE OFFSET IN MANHOLE TO PROVIDE ACCESS.
3. VALVE SIZE AS SHOWN ON DRAWINGS OR DETAILED IN THE SPECIFICATIONS.
4. ALL PIPING FOR COMBINATION AIR VALVE SHALL BE BRASS OR STAINLESS STEEL.
5. CONTRACTOR SHALL ADJUST THE DEPTH OF THE FORCE MAIN AT ALL HIGH POINTS TO ACCOMMODATE THE INSTALLATION OF THE COMBINATION AIR VALVE.

SEWAGE FORCE MAIN COMBINATION AIR VALVE

NOT TO SCALE

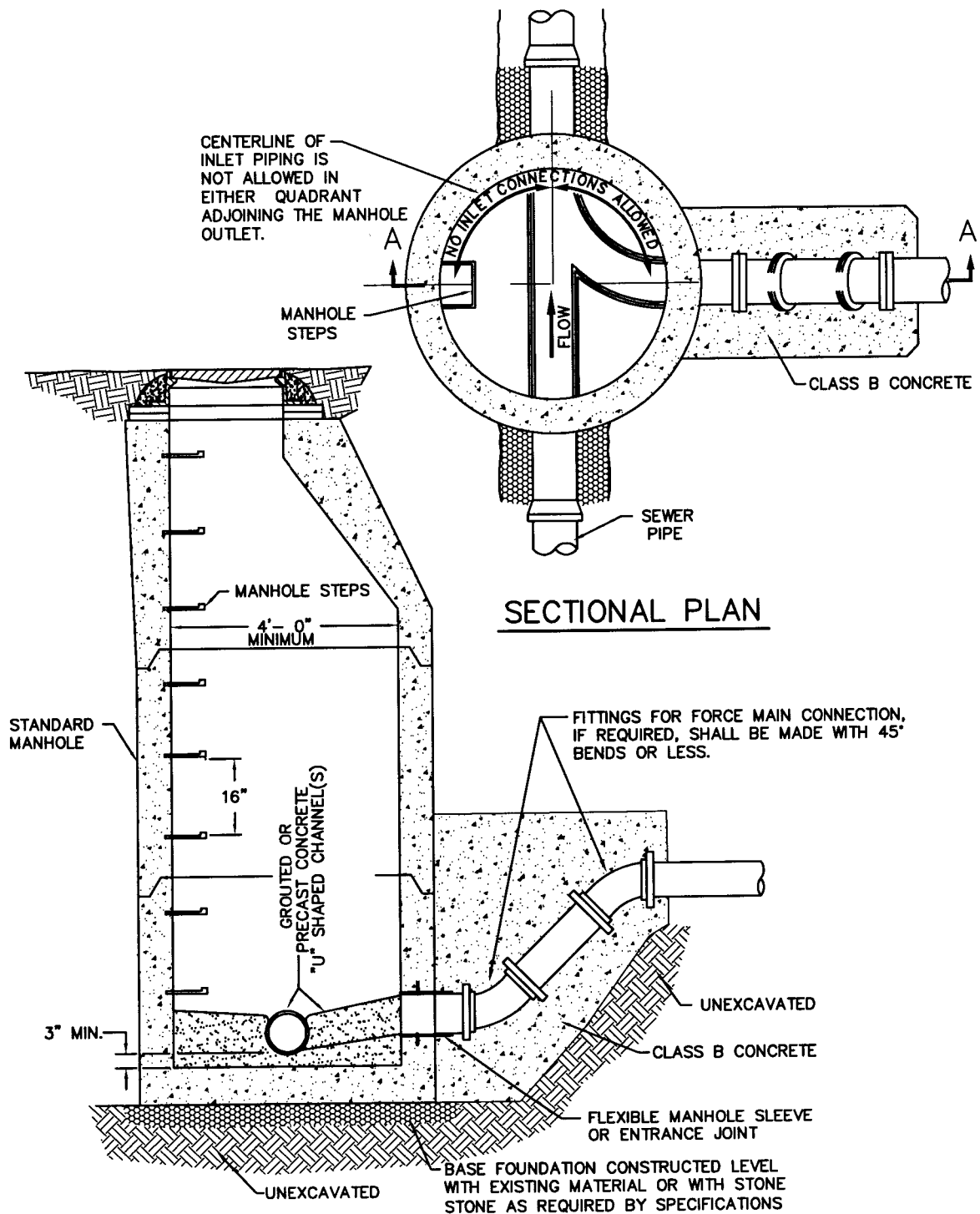
SEWAGE FORCE MAIN AIR RELEASE VALVE



ELEVATION VIEW

MANHOLE DEMOLITION AND ABANDONMENT

MANHOLE DEMOLITION AND ABANDONMENT

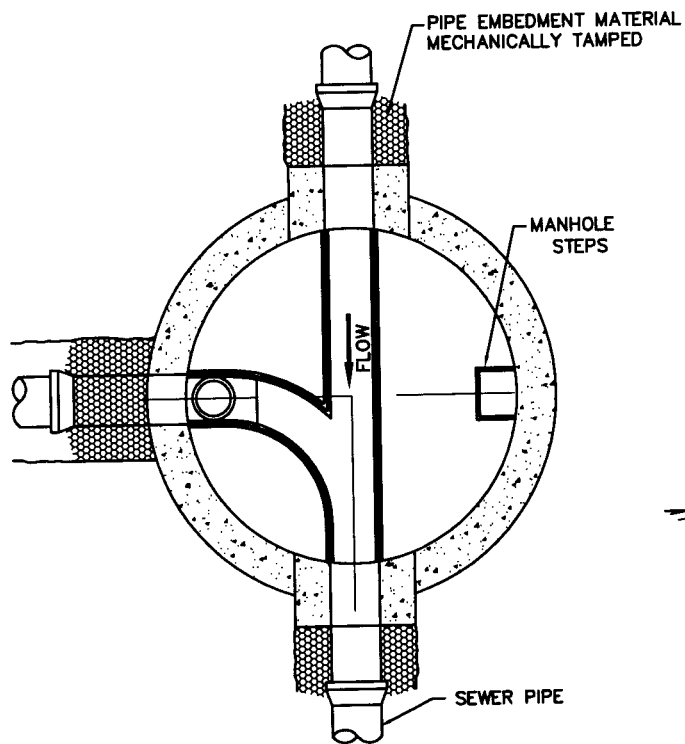


NOTE: IF FORCE MAIN CONNECTION IS MADE TO EXISTING MANHOLE, INVERT FOR FORCE MAIN SHALL BE CONSTRUCTED ON TOP OF EXISTING INVERT BENCH

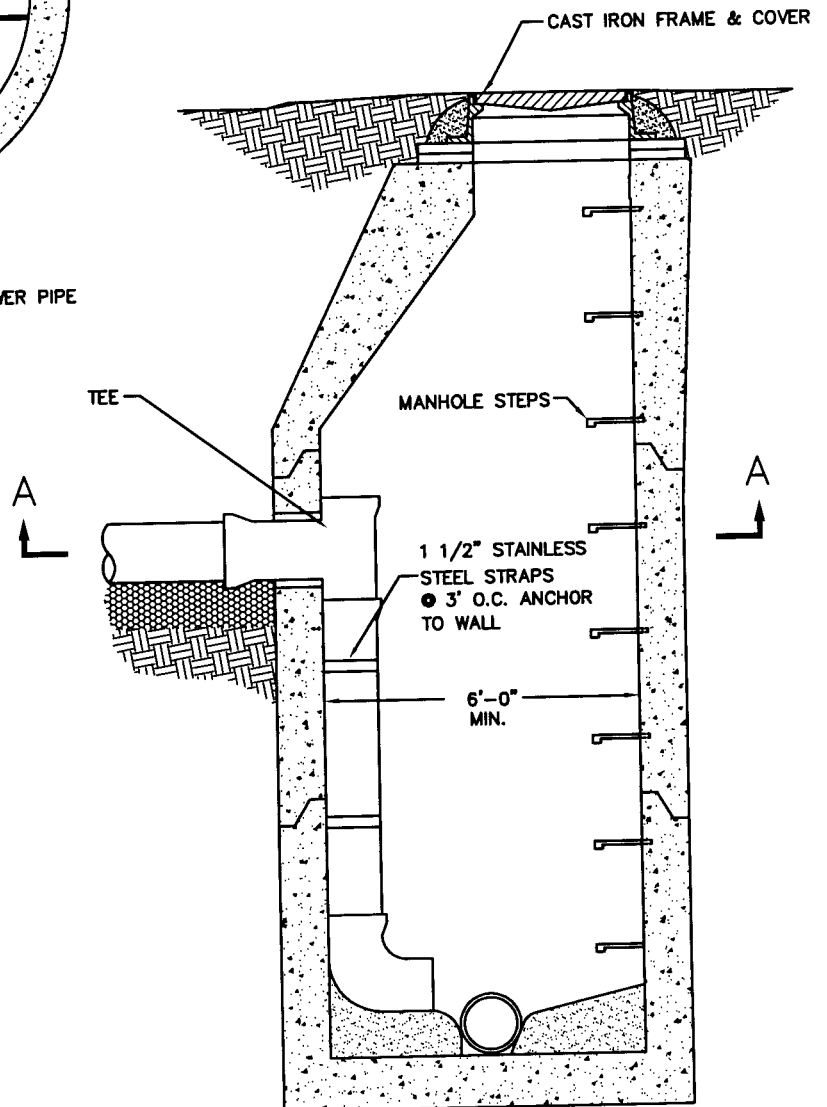
SECTION A-A

FORCE MAIN CONNECTION

MANHOLE FORCEMAIN CONNECTION



SECTION A-A



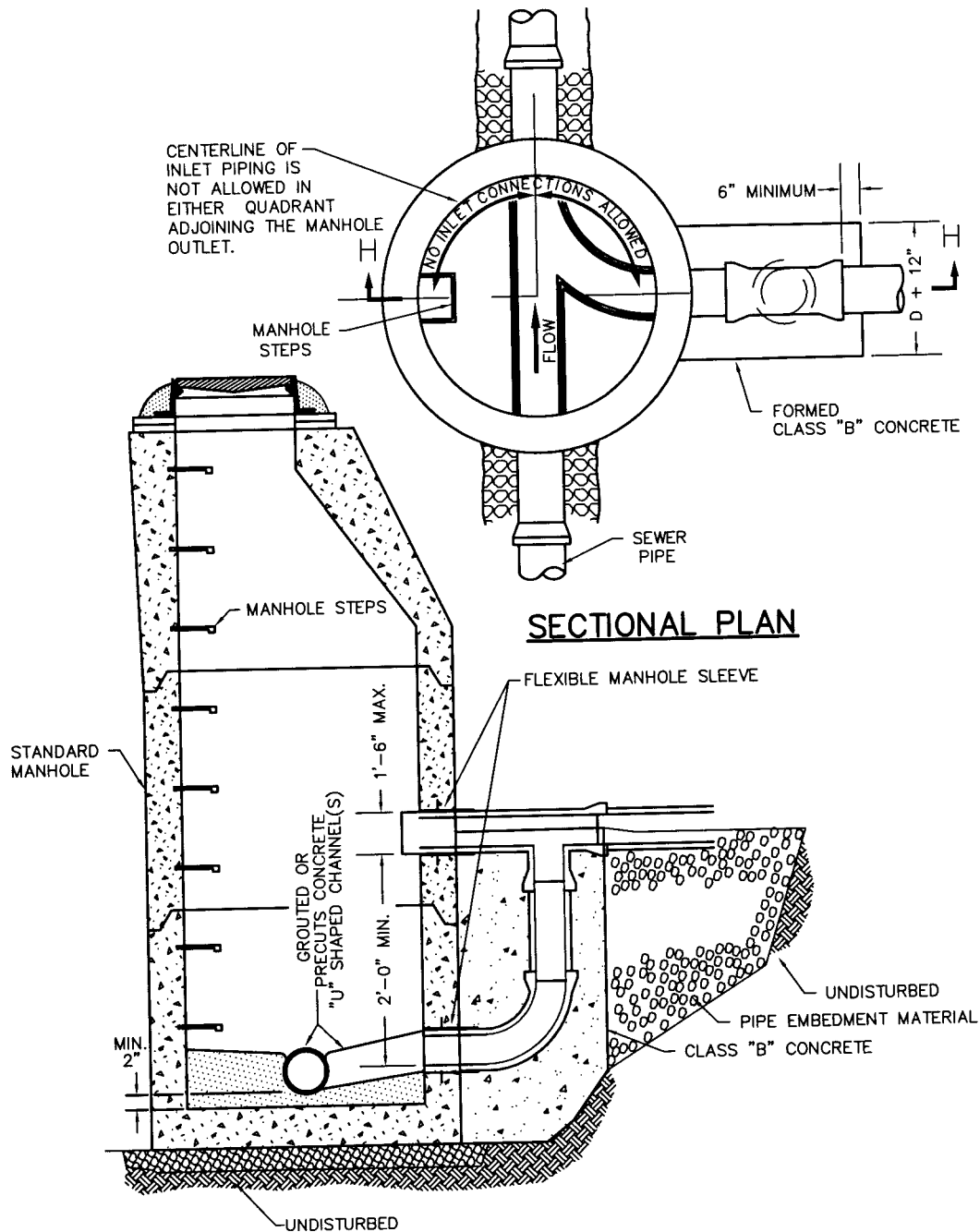
INSIDE DROP MANHOLE

INSIDE DROP MANHOLE



MANHOLE INVERTS

MANHOLE INVERTS



SECTION H-H

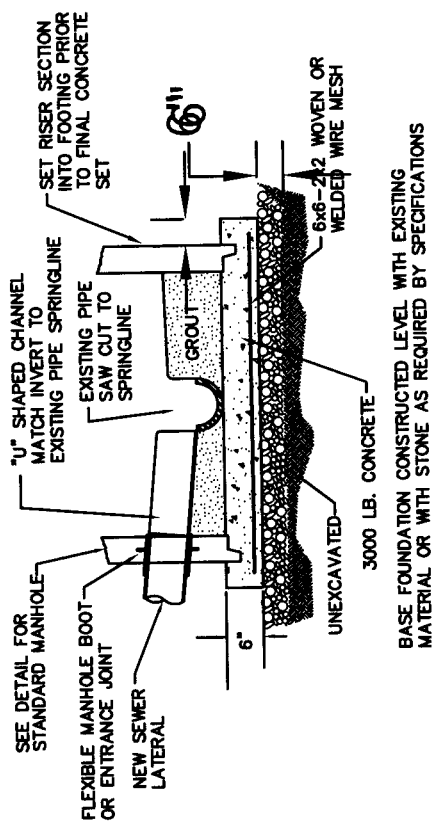
NOTE:

1. DROP CONNECTION IS NOT PERMITTED FOR HIGH VELOCITY SEWER MAINS MAINTAIN MINIMUM OF 8" OF CLEARANCE BETWEEN DROP CONNECTION AND MANHOLE STEPS.
2. BASE FOUNDATION TO CONSTRUCTED LEVEL WITH EXISTING MATERIAL OR CONDITIONED WITH STONE AS REQUIRED BY SPECIFICATIONS

OUTSIDE DROP MANHOLE

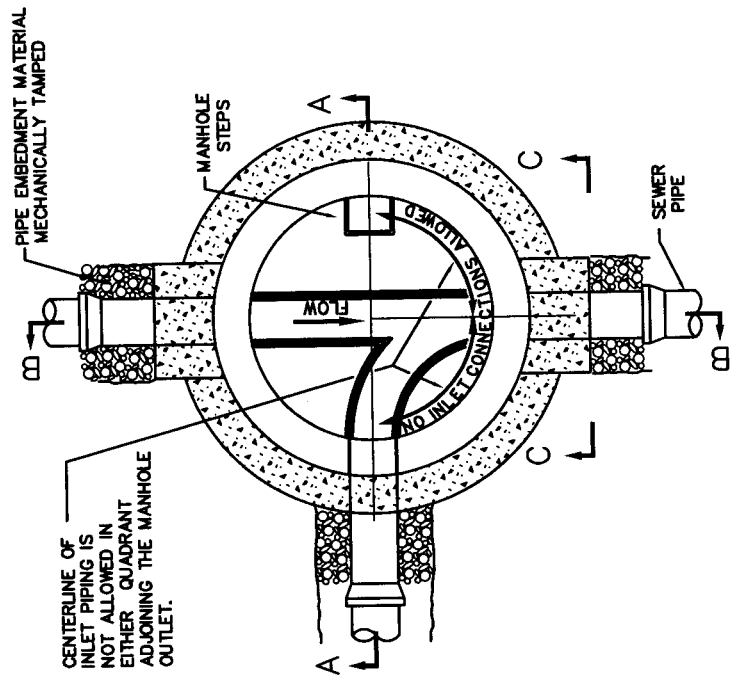
OUTSIDE DROP MANHOLE

NEW MANHOLE OVER EXISTING SEWER LINE



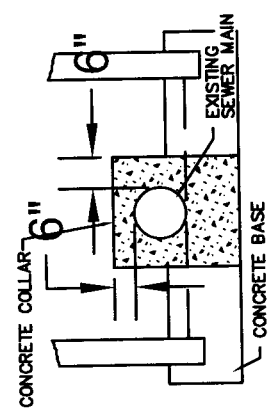
SECTION "A - A"

BASE FOUNDATION CONSTRUCTED LEVEL WITH EXISTING MATERIAL OR WITH STONE AS REQUIRED BY SPECIFICATIONS

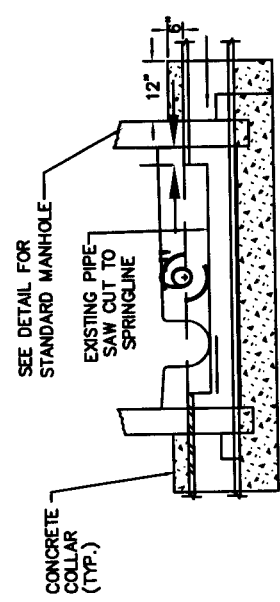


SECTIONAL PLAN

NEW MANHOLE CONSTRUCTED OVER EXISTING SEWER PIPE

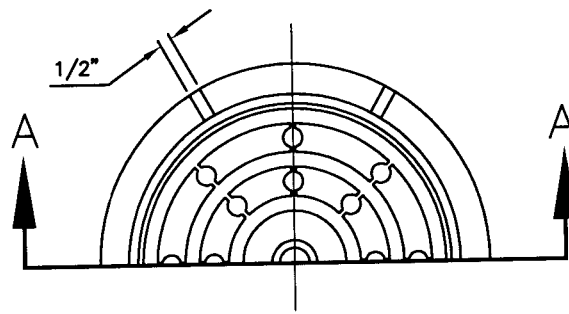


SECTION "C - C"

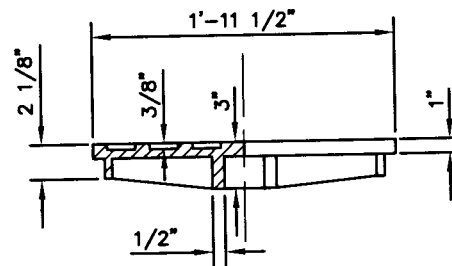


SECTION "B - B"

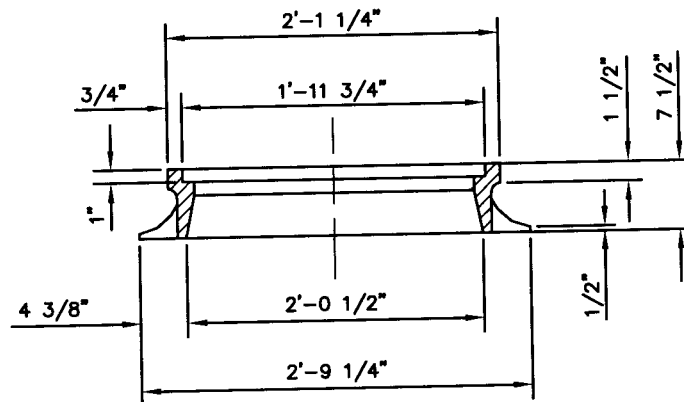
- NOTES:
1. THIS DETAIL MUST BE USED FOR CONSTRUCTION OF ALL MANHOLES OVER EXISTING SEWER MAINS.
 2. LATERALS 6" AND LARGER SHALL BE CONNECTED AT MANHOLES ONLY.
 3. FLOW SHALL BE MAINTAINED DURING CONSTRUCTION.
 4. MANHOLE BASE SHALL BE CAST IN PLACE.



HALF PLAN OF MANHOLE
RING & COVER



SECTION A-A
MANHOLE COVER

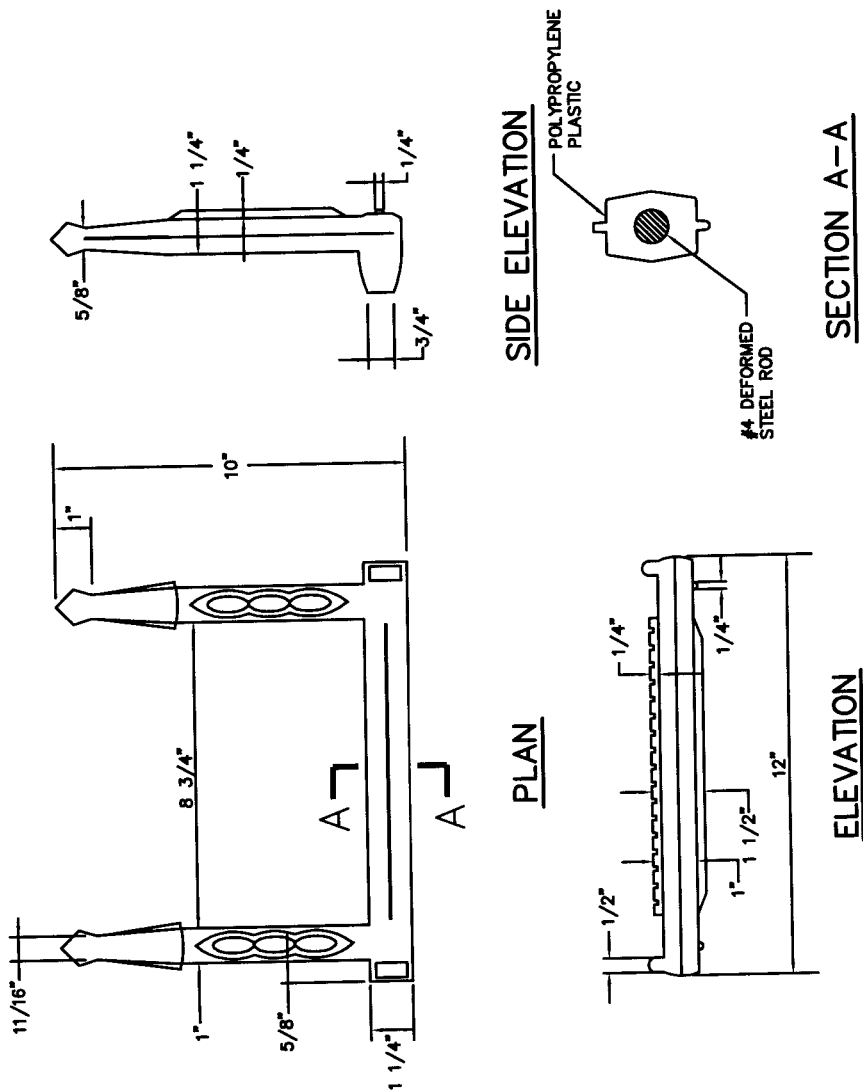


SECTION A-A
MANHOLE RING

NOTE: TRAFFIC BEARING RING AND COVER.
MINIMUM WEIGHT 315 POUNDS

MANHOLE RING & COVER

MANHOLE RING AND COVER

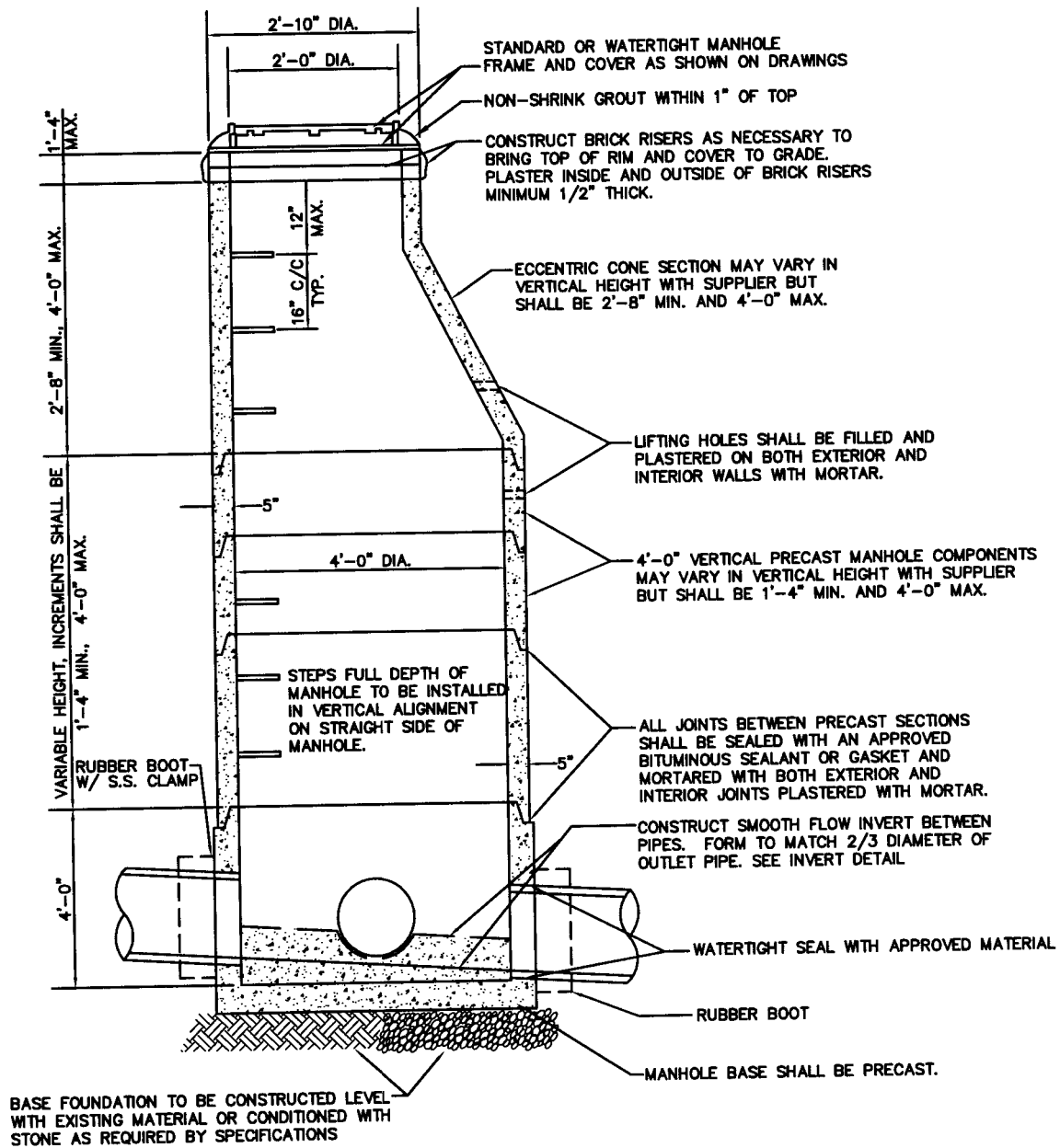


MANHOLE STEPS

CONSTRUCTION NOTES

1. ALL STEPS SHALL PROTRUDE A MINIMUM OF 5" AND A MAXIMUM OF 7" FROM INSIDE FACE OF STRUCTURE WALL.
2. STEPS DIFFERING IN DIMENSIONS, CONFIGURATION, OR MATERIALS FROM THOSE SHOWN MAY ALSO BE USED PROVIDED THE CONTRACTOR HAS FURNISHED THE TOWN WITH DETAILS OF THE PROPOSED STEPS AND HAS RECEIVED PRIOR WRITTEN APPROVAL FROM THE TOWN FOR THE USE OF SAID STEPS.

MANHOLE STEPS



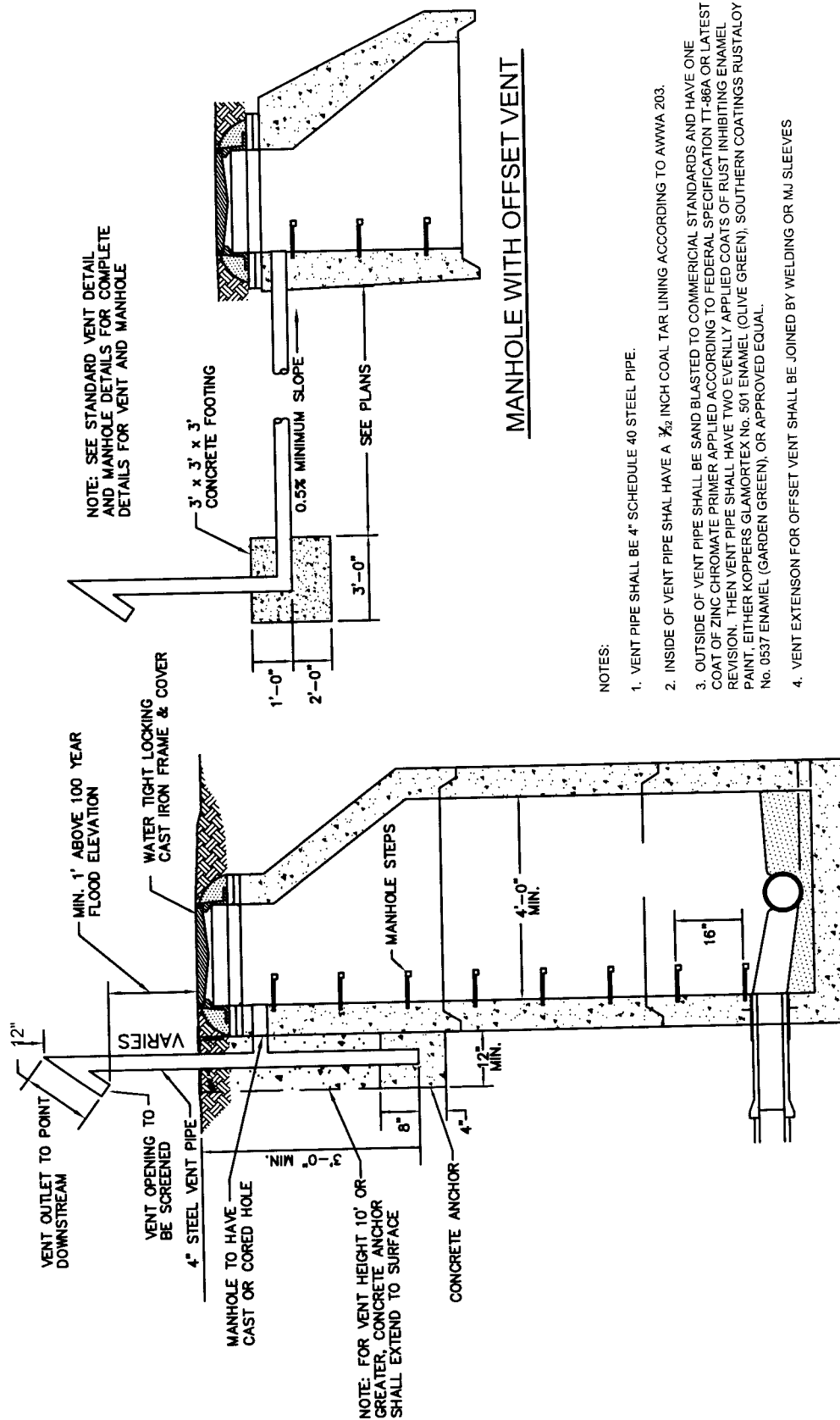
ELEVATION VIEW

PRECAST MANHOLE NOTES:

1. ALL PRECAST MANHOLE COMPONENTS SHALL MEET REQUIREMENTS OF ASTM C-478, LATEST REVISION.
2. ALL MANHOLES SHALL BE CONSTRUCTED PLUMB
3. ALL MANHOLE GRADES SHOWN ON THE PLANS ARE FOR THE INVERT OF THE MANHOLE CENTER.
4. IF MANHOLE IS SET IN LOCATION OF HIGH WATER TABLE OR UNDERGROUND WATER IS ENCOUNTERED, THE CONTRACTOR SHALL INSTALL UNDERDRAINS AND STONE AS DIRECTED IN THE FIELD BY THE TOWN.
5. STEPS SHALL BE INSTALLED ON STRAIGHT SIDE OF MANHOLE.

PRECAST CONCRETE MANHOLE

PRECAST CONCRETE MANHOLE

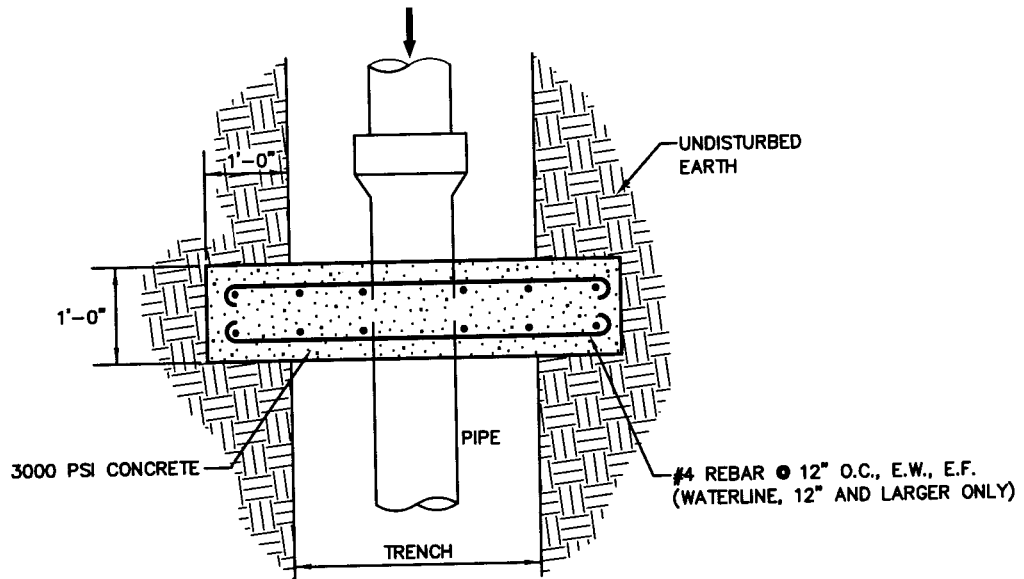


VENTED MANHOLE

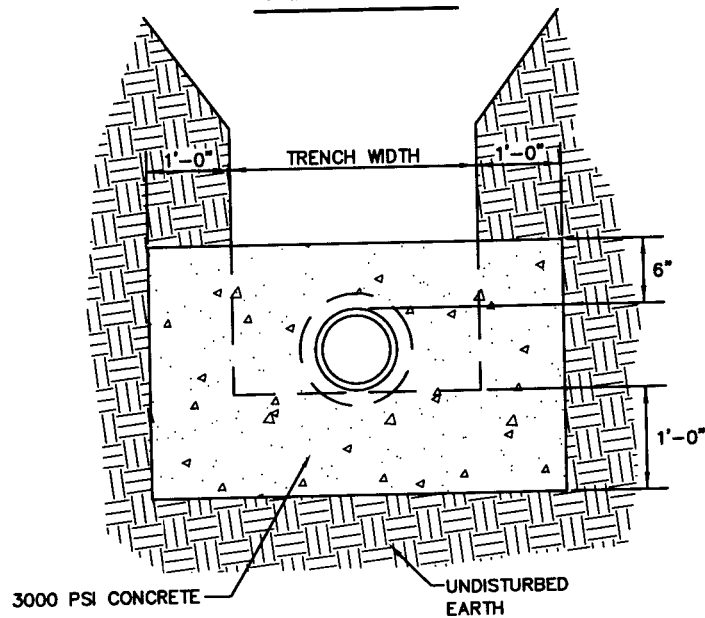
STANDARD MANHOLE VENT

STANDARD MANHOLE WITH VENTED STACK

NOT TO SCALE



PLAN VIEW



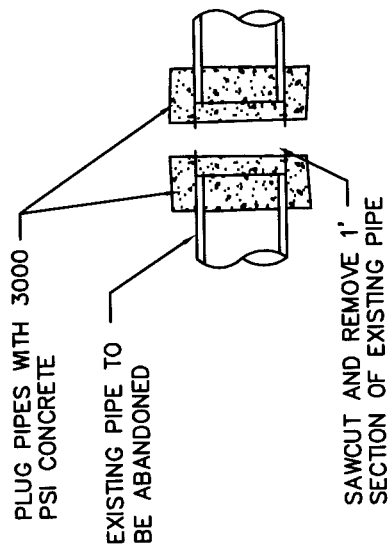
ELEVATION

NOTES:

1. KEYS FOR SLOPES EQUAL TO OR GREATER THAN 20% ONLY.
2. INSTALL AT DISTANCE SHOWN ON PLANS.

KEYING PIPES ON SLOPES

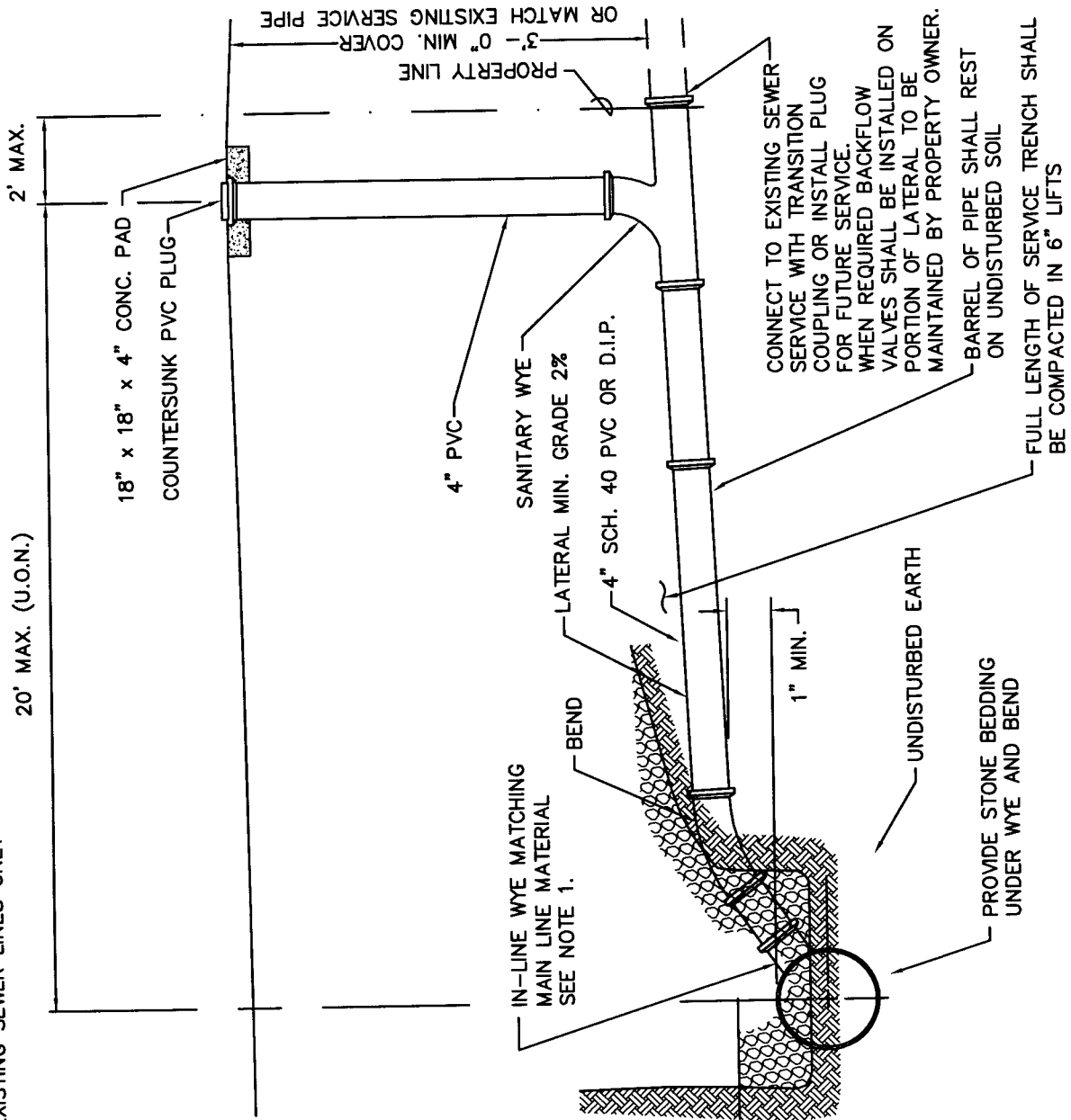
KEYING PIPES ON SLOPES



SEWER LINE ABANDONMENT

SEWER LINE ABANDONMENT

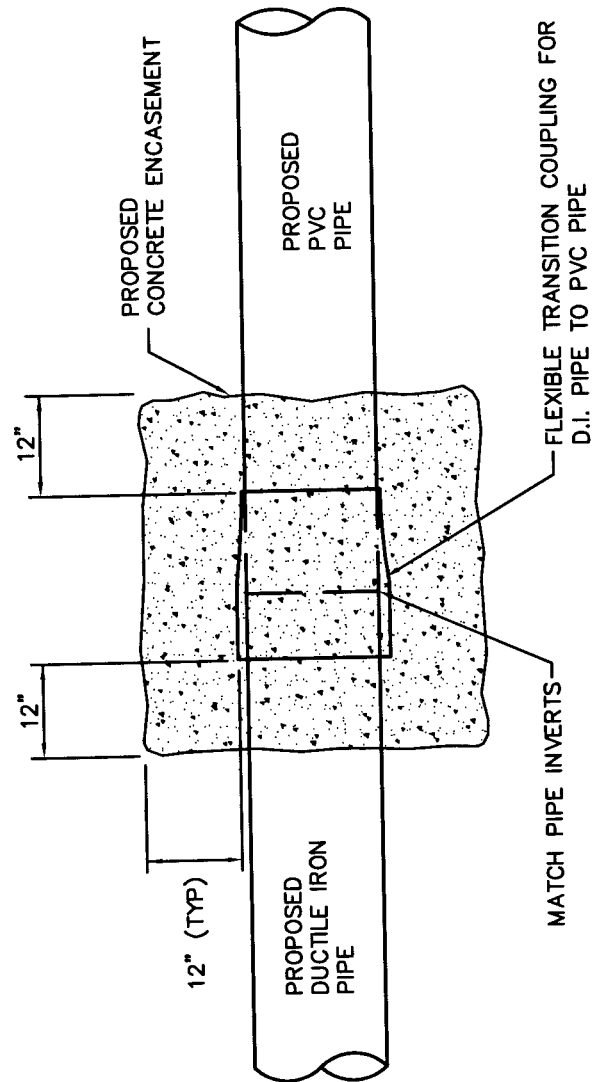
NOTE:
1. TAPPING SADDLES ARE APPROVED FOR
CONNECTIONS TO EXISTING SEWER LINES ONLY



SANITARY SEWER SERVICE

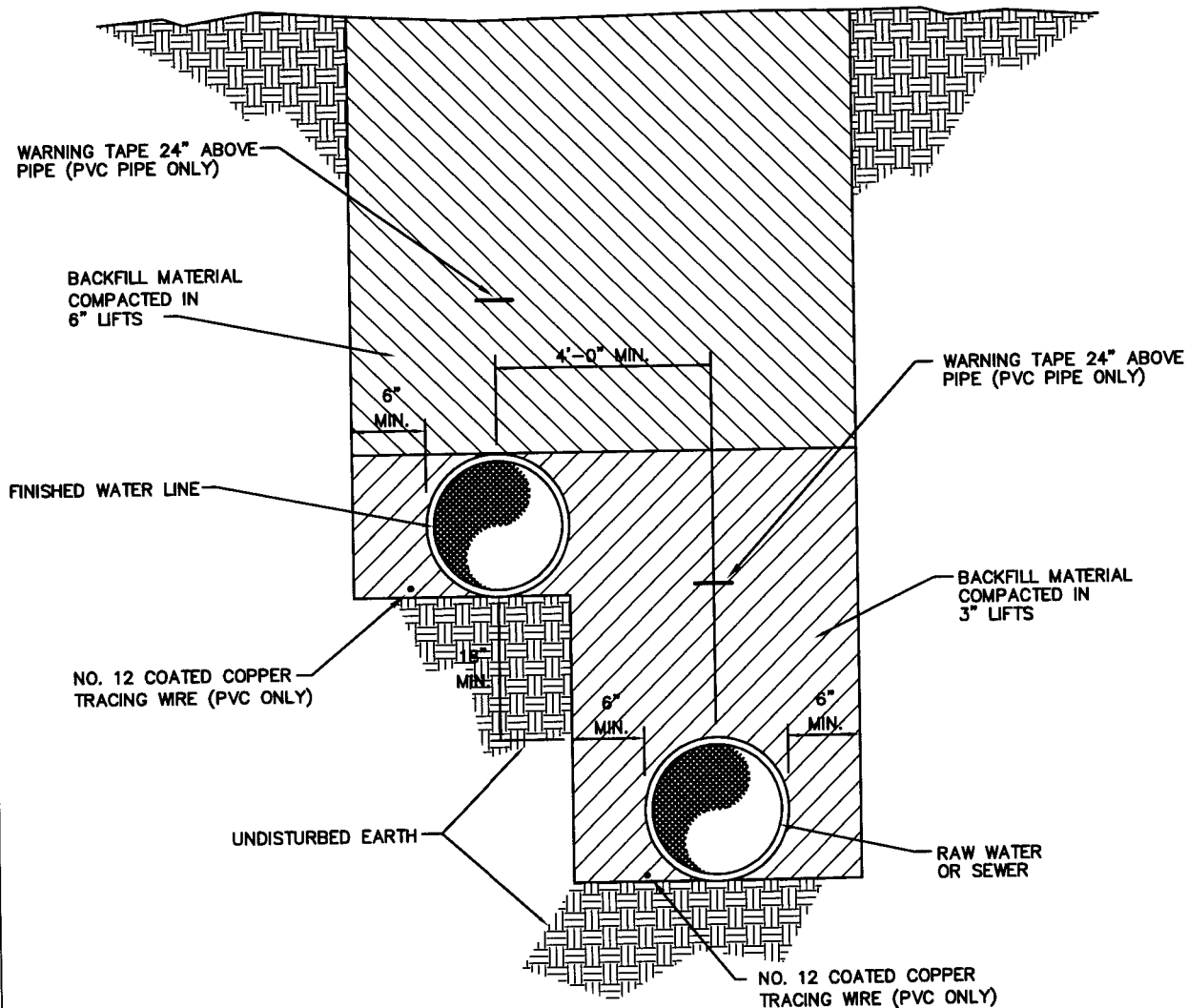
NOT TO SCALE

SANITARY SEWER SERVICE



TRANSITION COUPLING
DISSIMILAR MATERIAL PIPES

TRANSITION COUPLING
DISSIMILAR MATERIAL PIPES



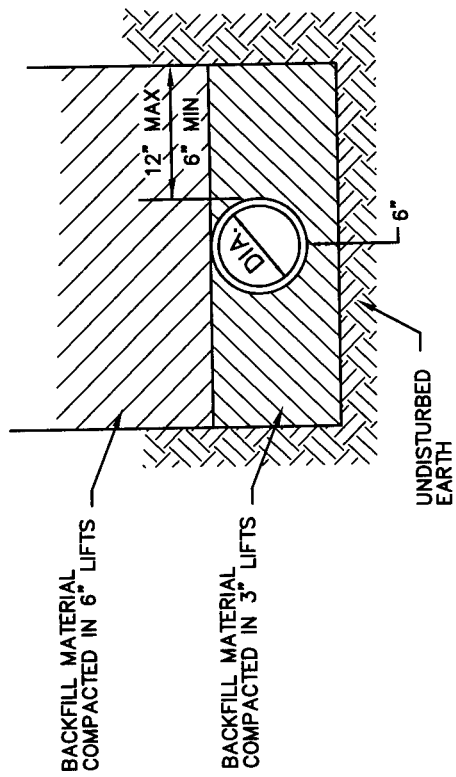
NOTE:

CONTRACTOR SHALL FURNISH AND INSTALL METALLIC WARNING TAPE 24" ABOVE THE PIPE AND COPPER TRACING WIRE FOR PVC PIPE INSTALLATION ONLY.

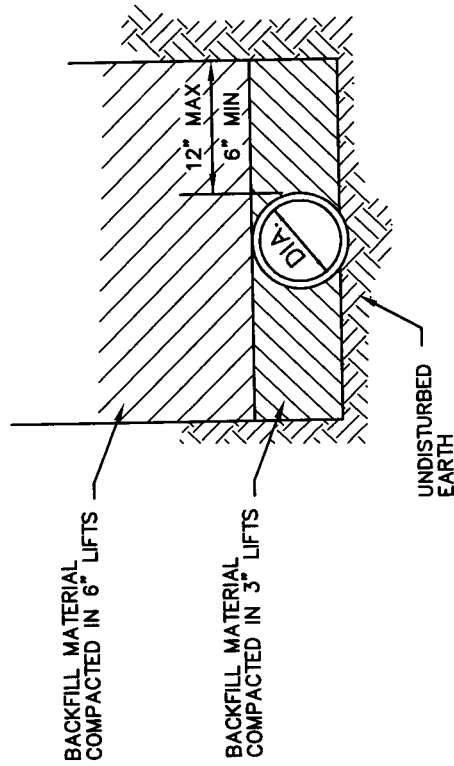
NOTE: 1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.

TYPICAL TRENCHING DETAIL-
TWO PIPES IN SAME TRENCH

TWO PIPES IN SAME TRENCH
TRENCH DETAIL

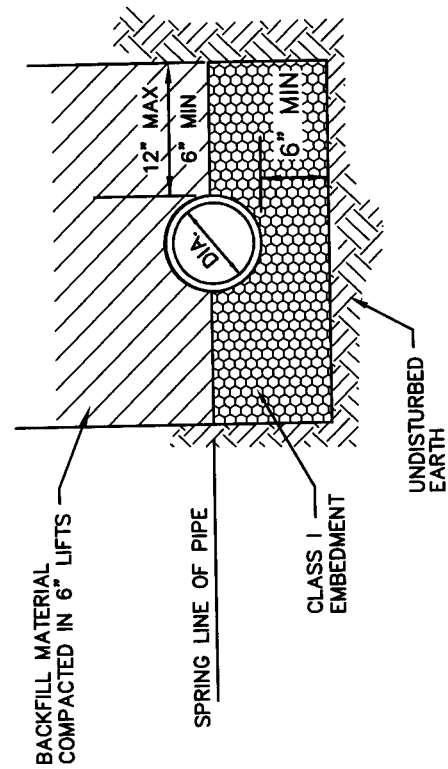


OVERCUT EXCAVATION



STANDARD EXCAVATION

DUCTILE IRON GRAVITY SEWER

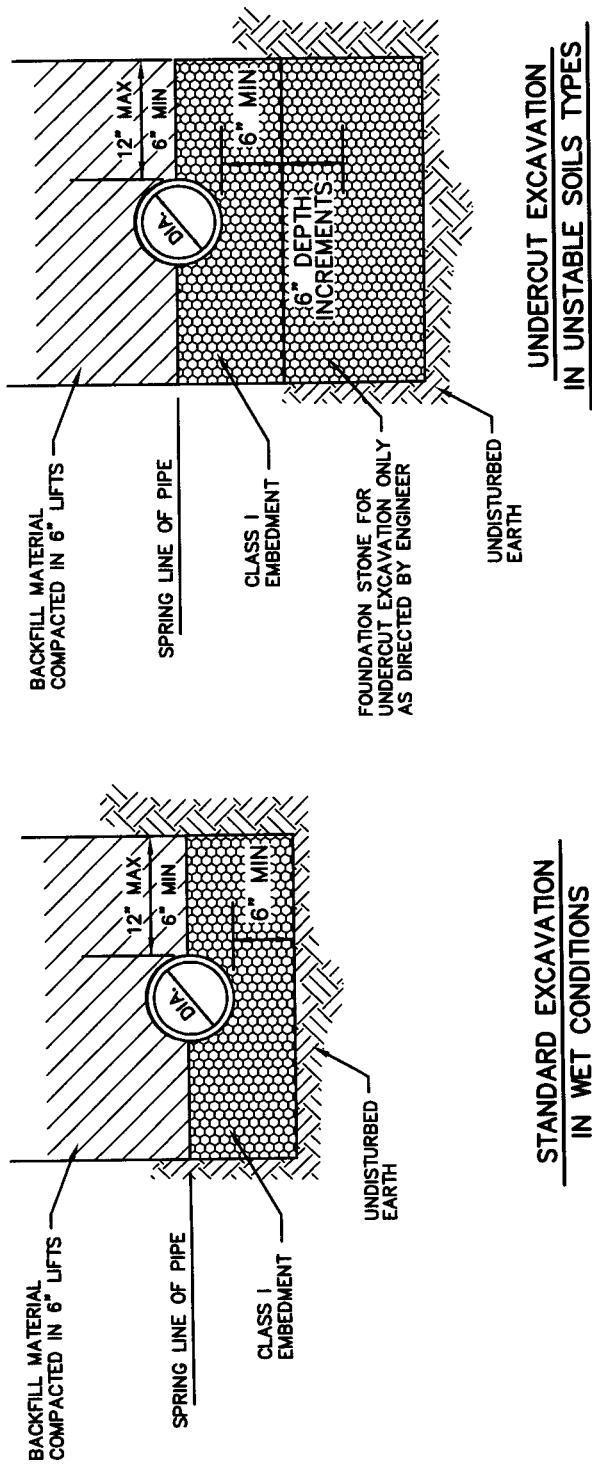


STANDARD EXCAVATION

PVC GRAVITY SEWER

TYPICAL TRENCH DETAILS - 1 OF 2

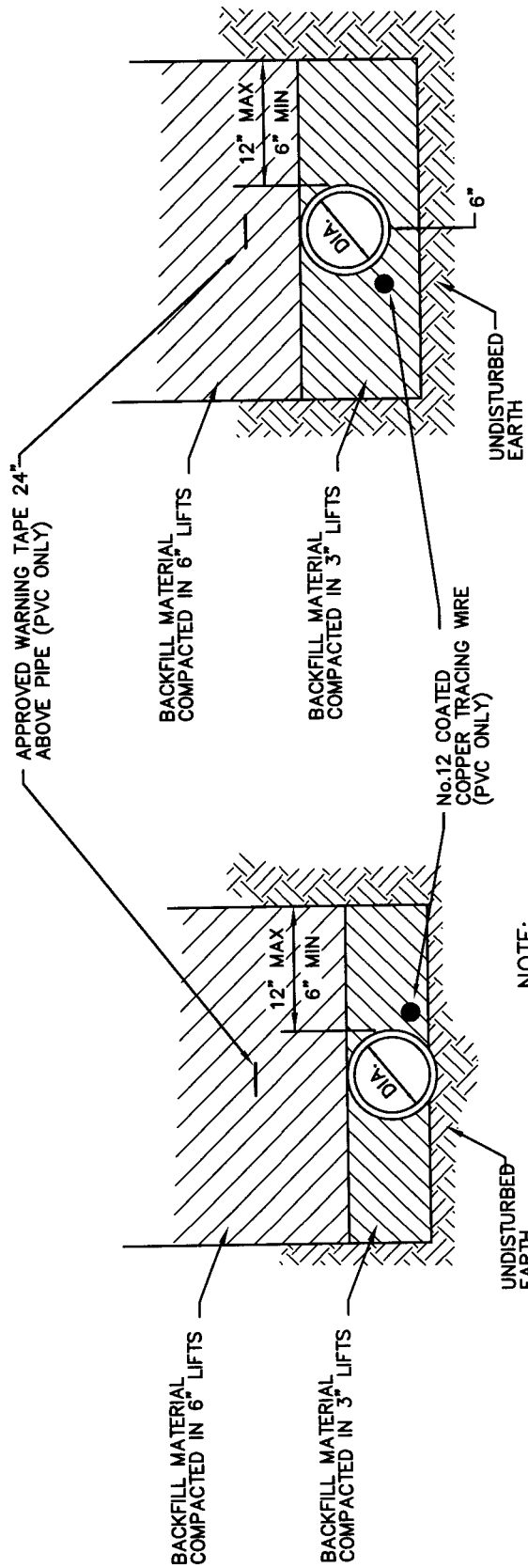
TYPICAL TRENCH DETAILS - 2 OF 2



PIPE IN WET OR UNSTABLE CONDITIONS
ALL PIPE TYPES
(AS DIRECTED BY TOWN)

- NOTE: 1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.
2. CLASS 1 EMBEDMENT SHALL BE NCDOT STANDARD # 67 STONE OR APPROVED EQUAL. FOUNDATION STONE SHALL BE NCDOT STANDARD # 57 OR # 67 STONE OR APPROVED EQUAL.

TYPICAL GRAVITY SEWER TRENCHING DETAILS



NOTE:
BELL HOLES NOT SHOWN

STANDARD EXCAVATION

OVERCUT EXCAVATION

NOTE: 1. CONSTRUCTION OF TRENCHES SHALL COMPLY WITH ALL FEDERAL, STATE AND LOCAL SAFETY AND HEALTH REGULATIONS WHICH HAVE JURISDICTION AT THE PROJECT SITE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BE FAMILIAR WITH THE APPLICABLE REGULATIONS AND FOLLOW THEM ACCORDINGLY.

TYPICAL TRENCHING DETAILS

SEWER FORCE MAIN

TYPICAL TRENCH DETAILS - FORCEMAIN