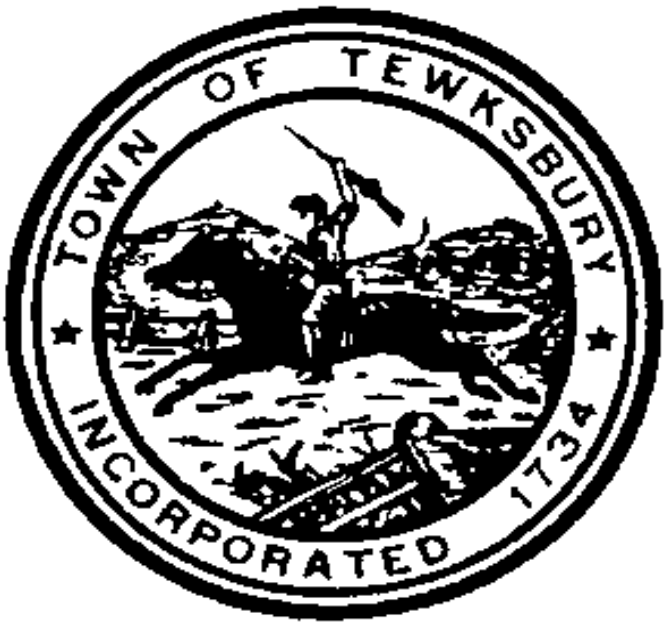
Sewer Construction Standards



Town of Tewksbury, Massachusetts

Effective: January, 2013

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CONSTRUCTION STANDARD DETAILS

ABBREVIATIONS AND REFERENCES

AASHTO	-	The American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute AGA - American Gas Association
AISC	-	American Institute of Steel Construction
AISI	-	American Iron and Steel Institute
ANSI	-	American National Standards Institute
API	-	American Petroleum Institute
ASCE	-	American Society of Civil Engineers
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society for Testing and Materials
AWPA	-	American Wood Preservers Association
AWS	-	American Welding Society
AWWA	-	American Water Works Association
Fed. Spec.	-	Federal Specifications
DIPRA	-	Ductile Iron Pipe Research Association
IEEE	-	Institute of Electrical and Electronic Engineers
NCPI	-	National Clay Pipe Institute
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
NEWWA	-	New England Water Works Associations
OSHA	-	Occupational Safety and Health Act
SSPC	-	Steel Structures Painting Council

REFERENCE STANDARDS

A. American Association of State Highways and Transportation Officials (AASHTO)

1. AASHTO M144 - Standard Specification for Calcium Chloride

B. American Concrete Institute (ACI)

1. ACI 318 - Building Code Requirement for Structural Concrete

C. American National Standards Institute (ANSI)

1. ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings

D. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Standard Specification for Gray Iron Castings
2. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs 60,000 PSI Tensile Strength
3. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

4. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)

5. ASTM C33 – Standard Specification for Concrete Aggregates

6. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)

7. ASTM C150 - Standard Specification for Portland Cement

8. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes

9. ASTM D422 – Test Method for Particle Size Analysis of Soils

10. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

11. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

12. ASTM D4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials

13. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

14. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

15. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

16. ASTM D2922 – Density of Soil in Place by Nuclear Methods (Shallow Depth)

17. ASTM D3017 – Standard Test Method for Water Content of Soil in Place by Nuclear Methods (Shallow Depth)

18. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

19. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

21. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter

22. ASTM F1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air Lines

E. American Water Works Association (AWWA)

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pressure Pipe and Fittings
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-in Through 48-in for Water and Other Liquids
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
5. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
7. AWWA C153 - Ductile-Iron Compact Fittings, 3-in Through 16-in for Water and Other Liquids
8. AWWA C600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances
9. AWWA C651 - Disinfection Water Mains

F. National Sanitation Foundation (NSF)

1. Standard No. 14 – Plastic Piping Components and Related Materials

Where reference is made to one of the above standards, the revision in effect at the time of issuance of the permit shall apply.

SECTION 1

PIPE LOCATIONS

1.01 Pipelines shall be located substantially as indicated on the approved plans. The Superintendent reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.02 Where fittings are noted on the plans, such notation is for the Drain Layer's convenience and does not relieve him/her from laying and jointing different or additional items where required.

SECTION 2

OPEN EXCAVATIONS

2.01 Adequately safeguard all open excavations by providing temporary barricades, cautions signs, lights and other means to prevent accidents to persons and damage to property. Provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Remove bridges provided for access during construction when no longer required.

2.02 The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Superintendent. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Superintendent may require special construction procedures such as limiting the length of the open trench, prohibiting stacking excavated material in the street, and requiring that the trench shall not remain open overnight.

2.03 Effective January 1, 2009, any Drain Layer proposing to excavate within the Town of Tewksbury's boundaries must also apply for an excavation and trench permit pursuant to M.G.L. c. 82A §1 and 520 CMR 14.00.

SECTION 3

MAINTENANCE OF TRAFFIC

3.01 Unless permission to close a street is received in writing from the Tewksbury Police Department, place all excavated material so that vehicular and pedestrian traffic may be maintained at all times. If the Drain Layer's operations cause traffic hazards, the Drain Layer shall repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Superintendent.

3.02 Detours around construction will be subject to the approval of the Superintendent and the Tewksbury Police Department. Where detours are permitted, provide all necessary barricades and signs as required to divert the flow of traffic.

3.03 Expedite construction operations while traffic is detoured. Periods when traffic is being detoured will be strictly controlled by the Superintendent. The Drain Layer shall submit a traffic management plan for review and approval prior to implementing any detours.

SECTION 4

CARE AND PROTECTION OF PROPERTY

4.01 The Drain Layer shall be responsible for the preservation of all public and private property and use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Drain Layer, restore such property to a condition similar or equal to that existing before the damage was done, or make good the damage in other manner acceptable to the Superintendent.

SECTION 5

PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

5.01 The Drain Layer shall assume full responsibility for the protection of all buildings, structures and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables, whether or not they are shown on the approved plans.

5.02 Carefully support and protect all such structures and utilities from injury of any kind. The Drain Layer shall immediately repair any damage resulting from construction operations.

5.03 The Drain Layer shall bear full responsibility for obtaining all locations of underground structures and utilities (both public and/or private) including existing water services, drain lines and sewers.

5.04 The Drain Layer shall be responsible for notifying DIGSAFE and private utility mark-out companies prior to excavating. Maintain services to buildings and pay all costs or charges resulting from damage thereto.

5.05 At pipe crossings the drain layer shall place screened gravel bedding so that the existing utility or pipe is firmly supported for its entire exposed length. The bedding shall extend to the mid-diameter of the pipe crossed.

SECTION 6

TREE REMOVAL WITHIN RIGHT-OF-WAY

6.01 Any trees within Town Right-of-Way that need to be cut/trimmed or removed to facilitate sewer construction must be posted with the Town's Tree Warden. Trees must be posted for a two week period prior to removal. The Drain Layer shall be responsible for contacting and coordinating with the Tree Warden and following all state/local requirements, as necessary.

SECTION 7

PROVISIONS FOR CONTROL OF EROSION

7.01 The Drain Layer shall take sufficient precautions during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens and calcium chloride into the supplies and surface waters of the State. Special precautions shall be taken in the use of construction equipment to prevent operations which promote erosion.

7.02 Disposal of drainage shall be approved by the Superintendent. Prevent the flow or seepage of drainage back into the drainage area. Drainage shall not be disposed of until silt and other sedimentary materials have been removed. Particular care shall be taken to prevent the discharge of unsuitable drainage to a water supply or surface water body.

7.02 Should the Drain Layer propose to discharge water from dewatering and drainage operations to a wetland, stream, river, or other surface water resource, the Drain Layer shall prepare a Stormwater Pollution Prevention Plan and file a National Pollutant Discharge Elimination System (NPDES) Notice of Intent for discharge. The Drain Layer shall also comply with the requirements of the Tewksbury Conservation Commission Order of Conditions, including but not limited to:

A. Prior to beginning any work on the sites, provide notification by letter to the Tewksbury Conservation Commission that the Drain Layer is the party responsible for the work on the project, with the Drain Layers contact information to which notification shall be directed.

B. Provide required signage.

C. Install erosion and sedimentation control as shown on the approved plans prior to site preparation activities. The Drain Layer shall be required to contact the Tewksbury Conservation Commission agent to inspect siltation installed under this contract prior to excavation.

7.03 The Drain Layer shall conduct the work in compliance with all permits and insure that all environmental sign-offs and approvals are obtained. The Drain Layer shall have a copy of the Order of Conditions, the SWPPP, and the Erosion and Sedimentation Control Plan on-site at all times.

SECTION 8

PIPE SEPARATION REQUIREMENTS

8.01 Water main relocation is not required if a water main has a minimum horizontal separation from a new sewer of at least 10 feet, or is above a new sewer with a vertical clearance greater than or equal to 18-in. Where the vertical clearance is less than 18-in and an existing water main crosses over or through the proposed new sewer, the water main shall be replaced.

8.02 If the sewer crosses over the water main, regardless of the vertical separation, both pipes shall be concrete encased for a distance of 10 feet either side of the respective centerline. The use of restrained mechanical joints on ductile iron water pipe will be acceptable in lieu of concrete encasement.

SECTION 9

DUST CONTROL

9.01 The Drain Layer shall perform dust control operations, in an approved manner, whenever necessary or when directed by the Superintendent, even though other work on the project may be suspended. Dust control shall be generally accomplished by the use of water; however the use of calcium chloride may be used when necessary to control dust nuisance.

9.02 Calcium chloride shall conform to AASHTO M144 Type I except requirements for “total alkali chlorides” and other impurities shall not apply. Methods of controlling dust shall meet all air pollutants standards as set forth by Federal and State regulatory agencies.

SECTION 10

TRAFFIC REGULATIONS

10.01 The Drain Layer shall perform all work in accordance with the Manual on Uniform Traffic Control Devices (MUTCD), the approved plans and these standards. The Drain Layer shall furnish, install, operate and maintain equipment, services and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow during construction.

10.02 The Drain Layer shall submit a Traffic Management Plan to the Superintendent for approval. The plan shall detail all temporary changes in traffic control equipment, street or road closure, detours, etc. The Drain Layer shall make every effort to adhere to the approved plan. When necessary, the Drain Layer shall update this plan and forward these changes to the Superintendent, Town of Tewksbury Police Department, Fire Department and School Department for approval. The Superintendent reserves the right to modify the plan throughout the course of the work.

10.03 The Drain Layer shall remove temporary equipment and facilities when no longer required and restore grounds to original conditions. The Drain Layer shall notify all property owners at least 48 hours in advance of any work that will interfere with access to their residence or place of business.

10.04 No road shall be closed to traffic without the prior consent of the Superintendent. Traffic control, including but not restricted to signing and devices, shall be provided for all openings in roads by the Drain Layer in accordance with State standards.

SECTION 11

ENVIRONMENTAL PROTECTION

11.01 The control of environmental pollution requires consideration of air, water, and land, involves management of noise and solid waste, as well as pollutants. The work shall be scheduled and conducted in a manner that will minimize the erosion of soils in the area of the work.

11.02 Provide erosion control measures such as diversion channels, sedimentation, or filtration systems, sedimentation, basins, berms, staked hay bales, seeding, mulching or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area.

11.03 All phases of sedimentation and erosion shall comply with the Town of Tewksbury Conservation Commission requirements. The Drain Layer shall be responsible for filing an NPDES Construction Dewatering Permit prior to commencement of the Work. A copy of the permit and the application shall be filed with the Superintendent and the Town of Tewksbury Conservation Commission.

11.04 Care shall be taken to prevent, or reduce to a minimum, any damage to any stream from pollution by debris, sediment or other material, or from the manipulation of equipment and/or materials in or near such streams.

11.05 Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Such waters will be diverted through a settling basin or filter before being directed into the streams.

11.06 The Drain Layer shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water or any storm water. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.

SECTION 12

DEWATERING AND DRAINAGE

12.01 The primary purpose of groundwater control is to preserve the undisturbed bearing capacity of subgrade soils in the areas of the proposed pipeline and associated structures. In areas where pipelines and structures bear on soil, the Drain Layer shall lower the groundwater to at least 2 feet below the bottom of any part of the excavation within the pipeline alignments or structure footprints.

12.02 Additional groundwater lowering may be necessary beyond the 2 feet requirement to preserve the undisturbed bearing capacity of the subgrade soils, depending on construction methods and equipment used and on the prevailing groundwater and soil conditions. The Drain Layer is responsible for lowering the groundwater level to whatever level is dictated by the selected construction methods and site conditions.

12.03 Deep wells, well points and sump and any other groundwater control system components shall be designed to prevent loss of fines from surrounding soils. Sand filters shall be used with all dewatering installations unless screens are properly sized to prevent passage of fines from surrounding soils.

12.04 Dewatering and drainage system designs shall be prepared by a licensed professional engineer registered in the Commonwealth of Massachusetts, having a minimum of 5 years of professional experience in the design and construction of dewatering and drainage systems in similar subsurface and groundwater conditions. Submit an original statement by the professional engineer stating that the dewatering and drainage system designs have been prepared by the professional engineer and that the professional engineer will be responsible for their execution. The dewatering system shall include design calculations. The Drain Layer shall not proceed with any excavation until the dewatering and drainage submittal has been reviewed by the Superintendent.

12.05 Pipe and masonry shall not be laid in water or submerged within 24 hours after being placed. Water shall not flow over new masonry within 4 days of placement. In no event shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours.

12.06 Prevent flotation of the pipe by promptly placing backfill.

12.07 Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed capacity of the subgrade soils at proposed bottom of excavation. If the subgrade of the trench bottom becomes disturbed due to inadequate drainage, excavate below normal grade and refill with screened gravel.

12.08 Water entering the excavation from precipitation or surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sump and pumped from the excavation to maintain a bottom free from standing water. Existing or new sanitary sewer shall not be used to dispose of drainage.

SECTION 13

EARTHWORK

13.01 Excavation shall extend to the width and depth shown on the approved plans or as specified herein and shall provide suitable room for installing pipe, structures and appurtenances. The Drain Layer shall design, furnish, install, monitor and maintain all trench support required for excavation, including sheeting, bracing and supports and shall remove from the excavation all materials which may be deemed unsuitable for backfilling.

13.02 The bottom of the excavation shall be firm, dry and in all respects acceptable. If conditions warrant, the Drain Layer shall deposit gravel for pipe bedding, or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened of disturbed by any cause whatever.

13.03 Prior to the general placement of the fill and during such placement, the Superintendent may select areas within the limits of the fill for testing the degree of compaction obtained. When feasible, test results will be obtained prior to initial trench paving. If test results are unsatisfactory, trench pavement shall be removed, subsoils compacted, and trench pavement replaced, all at the Drain Layer's expense.

13.04 Temporary dewatering and drainage system shall be in place and operational prior to beginning excavation work. Any organic soils, or soft or loose soil encountered at or below the pipe or structure subgrade elevation shall be overexcavated and replaced with compacted structural fill, screened gravel or other approved material.

13.05 Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed for pipelines.

13.06 Rock shall be removed at a minimum of 8-inch clearance around the bottom and sides of all pipes being laid. Where pipe is to be laid directly on the trench bottom, final excavation at the bottom of the trench shall be performed manually, providing a flat-bottom true to grade upon undisturbed material. Where excavation for structure is required, recompact the bottom of the trench with a minimum of 4 passes of a hand operated vibratory compactor.

13.07 Fragments of boulder and ledge smaller than 6-in may be used in trench backfill providing that the quantity is not excessive. Rock fragments shall not be placed until the last pipe has at least 2-ft of earth cover.

13.08 Bituminous paving and frozen material shall not be used has backfill under any circumstances. Backfill around structures shall be selected common fill material, performed with approved compaction equipment.

13.09 Structural fill shall be placed below structures in layers having a maximum thickness of 8-in in open areas and 4-in in confined areas including points where conduit and piping join structures, measured before compaction.

13.10 Each layer of structural fill shall be compacted to at least 95 percent of maximum dry density determined by the ASTM Compaction Test, Designation D1557. Compaction of structural fill in open areas shall consist of heavy vibratory roller. Compaction of structural fill in confined areas shall be accomplished by hand operated vibratory equipment. As a minimum, compaction of structural fill shall consist of four coverages of the approved equipment. No compaction shall be done when the material is too wet either from rain, or excess application of water.

13.11 All road surfaces shall be broomed and hose-cleaned immediately after backfilling. Dust control measures shall be employed at all times.

13.12 The Drain Layer shall notify the Superintendent in advance of compaction activities and make prepared subgrade surfaces available to the inspector for observation and testing.

SECTION 14

GRANULAR FILL MATERIALS

14.01 Bank-run gravel shall consist of hard, durable stone and coarse sand, essentially free from frost, frozen lumps, loam and clay, deleterious materials and shall conform to the gradation requirements found in Section M1.03.0 Type b of the Massachusetts Highway Department "Standard Specifications for Highways and Bridges".

Sieve	Percent Passing
3-in	100
1/2 –in	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-10

14.02 Processed gravel shall consist of hard, durable stone and coarse sand, essentially free from frost, frozen lumps, loam and clay, wood, brick, concrete, construction debris, recycled asphalt products or other deleterious materials and shall conform to the gradation requirements found in Section M1.03.1 of the Massachusetts Highway Department "Standard Specifications for Highway and Bridges".

Sieve	Percent Passing
3-in	100
1 1/2 –in	70-100
3/4 –in	50-85
No. 4	30-60
No. 200	0-10

14.03 Screened gravel shall consist of hard, durable, particles of proper size and gradation, free from sand, loam, clay, excess fines and deleterious materials. The size of the particles shall be uniformly graded gravel such that not less than 95 percent of the particles that will pass a ½-in sieve, 40 to 70 percent will pass the 3/8-in sieve, and not more than 5 percent will pass a No. 4 sieve, Crushed stone conforming to Section M.2.014 of the Massachusetts Highway Department "Standard Specifications for Highway and Bridges" may be used as pipe bedding in lieu of screened gravel. Structural fill shall be gravel, sandy gravel, or gravelly sand free of organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable material and shall be graded within the following limits:

Sieve	Percent Passing
3-in	100
No. 4	20-70
No. 40	5 to 35
No. 200	0-10

14.04 Common fill shall consist of mineral soil, substantially free of clay, organic material, loam, wood, trash, snow, ice, frozen soil and other objectionable materials which may be compressible, or which cannot be compacted properly. Common fill shall not contain stones larger than 6-in in any dimensions, broken concrete, masonry, rubble, asphalt pavement, or other similar materials. Common fill shall not have more than 30 percent passing the No. 200 sieve. It shall have physical properties such that it can be readily spread and compacted.

14.05 Crushed stone shall consist of sound, durable stone, free of any foreign material, angular in shape, free from structural defects and comparatively free of chemical decay. The stone shall be a maximum size of 2-in and a minimum size of ½-in.

14.06 Sand shall conform to ASTM C33 for fine aggregate.

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SECTION 15

PRECAST CONCRETE MANHOLES

15.01 Precast concrete barrel sections and transition top sections, shall conform to ASTM C478 and meet the following requirements:

A. The wall thickness shall not be less than 5-in for 48-in diameter reinforced barrel sections, 6-in for 60-in diameter reinforced barrel sections, and 7-in for 72-in diameter reinforced barrel sections.

B. Top sections shall be eccentric except that barrel sections shall be used where shallow pipe cover requires a top section less than 4-ft as shown on the approved drawings..

C. Barrel sections shall have tongue and groove joints.

D. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.

E. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of H-20 loading plus the weight of the soil above at 120 pcf.

F. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on the inside of each precast section.

G. Precast concrete bases shall be constructed and installed as shown on the approved drawings. The thickness of the bottom slab of the precast bases shall not be less than the manhole barrel sections or top slab whichever is greater.

H. Knock out panels shall be provided in precast manhole sections at the locations shown on the approved drawings. They shall be integrally cast with the section, 2,1/2-in thick and shall be sized as shown on the approved drawings. There shall be no steel reinforcing in knock out panels.

I. Precast concrete platforms for manholes exceeding 20 feet in depth shall be minimum 6-in thick and contain a manhole opening and light duty cast iron frame and ·cover with vent holes and lifting handles.

15.02 Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30.

15.03 Sewer manhole covers shall have a diamond pattern, pickholes and the word "SEWER" cast in 3-in letters. Drain manholes shall have the word "DRAIN" cast in 3-in letters. Manhole frame and covers shall be LeBaron Foundry; Mechanics Iron Foundry; Neenah Foundry or equal. The following model numbers refer to LeBaron products:

A. Manhole Frame and Cover in Streets - LC 328

B. Manhole Frame and Cover in Cross-Country Ateas - LCB 328 (bolted and gasketed)

C. Designated "Seal Tite" manholes ~ LC 328 with "Seal Tite" covers

D. Designated watertight manhole frame and cover in streets - LBW308

15.04 Tongue and groove joints of precast manhole sections shall be sealed with either a round rubber O-ring gasket or a preformed flexible joint sealant. The O-ring shall conform to ASTM C443. The preformed flexible joint sealant shall be Kent Seal No.2 by Hamilton-Kent; Ram-Nek by K.T. Snyder Company or equal. Joints shall be designed and manufactured so that the completed joint will withstand an internal water pressure of 15 psi without leakage or displacement of the gasket or sealant.

15.05 Manhole rungs shall be either of the following types:

A. Manhole rungs shall be of cast aluminum alloy 6061-T6, drop front design, 12-in wide with an abrasive step surface. The manhole rungs shall conform to the requirements of OSHA.

B. Manhole rungs shall be steel reinforced copolymer polypropylene plastic. Rungs shall be 14-in wide, M.A. Industries Type PS2-PF-SL or equal. Copolymer polypropylene shall conform to ASTM D4101, PP0344 B33534 Z02. Steel reinforcing shall be 1I2-in diameter, grade 60 conforming to ASTM A615 and shall be continuous throughout the rung. The portion of the legs to be embedded in the precast section shall have fills and be tapered to ensure a secure bond.

15.06 The bricks used for brick masonry shall be good, sound, hard and uniformly burned, regular and uniform in shape and size, of compact texture and satisfactory to the Superintendent. Underburned or salmon brick will not be acceptable and only whole brick shall be used unless otherwise permitted. In case bricks are rejected by the Superintendent, they shall be immediately removed from the site of the work and satisfactory bricks substituted therefore.

A. Bricks for the channels and shelves shall comply with ASTM C32 for Sewer Brick, Grade SS (from clay or shale) except that the mean of five tests for absorption shall not exceed 8 percent and no individual brick exceed 11 percent.

B. Bricks for building up and leveling manhole frames shall conform to ASTM C62.

15.07 Mortar used in the brickwork shall be composed of one part Type IT Portland cement conforming to ASTM C150 to two parts sand to which a small amount of hydrated lime not to exceed 10 lbs to each bag of cement shall be added.

15.08 The sand used shall be washed, cleaned, screened, sharp and well graded as to different sizes and with no grain larger than will pass a No.4 sieve. It shall be free from vegetable matter, loam, organic or other materials of such nature or of such quantity as to render it unsatisfactory.

15.09 The hydrated lime shall also conform to ASTM C207.

15.10 Manhole pipe connections may be accomplished in the following ways:

A. A tapered hole filled with non-shrink waterproof grout, Hallemite; Waterplug; Embeco or equal, after the pipe is inserted is acceptable, providing the grout is placed carefully to completely fill around the pipe. If this method is used, place concrete encasement to assure a total 12-in of concrete including manhole thickness around the pipe stub. For PVC pipe, a waterstop gasket and stainless steel clamp shall be attached to the pipe prior to grouting.

B. The "Lock Joint Flexible Manhole Sleeve" shall be cast in the precast manhole base. The stainless steel strap shall be protected from corrosion with a bituminous coat.

C. "A-Lok" shall be a rubber like gasket cast in the precast manhole base. The rubber gasket shall be cast into a formed opening in the manhole.

D. "KOR-N-SEAL" joint shall be installed as recommended by the manufacturer. The stainless steel clamp shall be protected from corrosion with a bituminous coat.

15.11 MANHOLE INSTALLATION

A. Manholes shall be constructed to the dimensions shown on the approved drawings and as specified herein. All work shall be protected against flooding and flotation.

B. The bases of manholes and catch basins shall be placed on a bed of 12-in screened gravel as shown on the approved drawings. The bases shall be set at a grade to assure that a maximum of 8-in thickness of brickwork will bring the manhole frame and cover to final grade.

C. Precast concrete barrel sections shall be set plumb and with sections in true alignment with a 1/4-in maximum tolerance to be allowed. The joints of precast barrel sections shall be sealed with either a rubber O-ring set in a recess or the preformed flexible joint sealant used in sufficient quantity to fill 75 percent of the joint cavity. The outside and inside joint shall be filled with non-shrink mortar and finished flush with the adjoining surfaces. Allow joints to set for 24-hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the manholes, the inside joints shall be caulked with lead wool. Install the precast sections in a manner that will result in a watertight joint.

D. Holes in the concrete barrel sections required for handling or other purposes shall be plugged with a non-shrinking grout or non-shrinking grout in combination with concrete plugs and finished flush on the inside.

E. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting manhole sections in place to prevent any subsequent jarring which may loosen the mortar joints.

15.12 Manhole pipe connections shall be accomplished in the ways specified herein. Pipe stubs for future extensions shall also be connected and the stub end closed by a suitable watertight plug. Aluminum manhole rungs shall be grouted into precast sections, on 12-in centers, by the manufacturer. Holes in riser and cone sections for rungs shall be preformed during casting. Holes for rungs shall be 1-1/8-in in diameter and shall be a minimum of 3 l/2-in deep. Rungs shall be grouted into the sections immediately after they are cast and placed in the curing area, or immediately after holes are cored into base sections. Holes shall be filled with grout consisting of Portland Type II cement and mortar sand in a 1-1/2 ratio mixed to a putty consistency. Those parts of the rungs which are embedded shall receive a heavy coating of zinc chromate or other approved paint. Steel reinforced polypropylene plastic manhole rungs shall be driven into tapered holes in the precast riser and cone sections during the manufacture of the sections. Holes for rungs shall be preformed during the casting of the sections and shall not be drilled out after casting. The preformed holes shall be a minimum 1/2-in deep and shall taper from 1-1/8-in to 1-3/8-in diameter.

15.13 BRICKWORK

A. Mortar shall be mixed only in such quantity as may be required for immediate use and shall be used before the initial set has taken place. Mortar shall not be retained for more than 1 hour and shall be constantly worked over with hoe or shovel until used. Anti-freeze mixtures will not be allowed in the mortar. No masonry shall be laid when the outside temperature is below 40 degrees F unless provisions are made to protect the mortar, bricks and finished work from frost by heating and enclosing the work with tarpaulins or other suitable material. The Superintendent’s decision as to the adequacy of protection against freezing shall be final.

B. Channels and shelves shall be constructed of brick and concrete as shown on the approved drawings. The brick lined channels shall correspond in shape with the lower half of the pipe. The top of the shelf shall be set at the elevation of the crown of the highest pipe and shall be sloped I-in per foot to drain toward the flow through channel. Brick surfaces exposed to sewage flow shall be constructed with the nominal 2-in by 8-in face exposed (i.e., bricks on edge).

C. Manhole covers and frames shall be set in a full mortar bed and bricks, a maximum of 8-in thick, shall be utilized to assure frame and cover are set to the existing grade. If full width paving is the permanent paving, the manhole

15.14 LEAKAGE TESTS

A. All manholes shall be tested for leakage by either vacuum testing or exfiltration testing. Vacuum testing shall only be performed on manholes prior to backfilling. Once a manhole has been backfilled, only exfiltration testing will be allowed. The Superintendent shall observe all leakage testing.

15.15 VACUUM TEST

A. The test shall be made using an inflatable compression band, vacuum pump, and appurtenances specifically designed for testing manholes. Test procedures shall be in accordance with the equipment manufacturer's recommendations. The Drain Layer shall be fully familiar with the vacuum testing equipment and shall provide a minimum of 4 hours of instruction by a factory-authorized representative at the outset of the project.

B. Each manhole shall be tested immediately after assembly including the connection of pipes and prior to backfilling.

C. All lift holes shall be plugged with nonshrink grout and all pipes entering the manhole shall be plugged and braced to prevent the plug from being drawn into the manhole.

D. After the test equipment is in place the test shall be run at the following rate and test times:

1. For 4.0 ft or 5.0 ft diameter manholes.

    a. Initial pressure test - 10-in Hg.

    b. Test time - 1-in Hg drop to 9-in Hg in 1 minute minimum allowable for 0-10 ft deep manholes; 1 minute 15 seconds minimum allowable for 10-15 ft deep manholes; 1 minute 30 seconds minimum allowable for 15-25 ft deep manholes.

2. If the pressure drop exceeds 1-in Hg in the specified time the manhole shall be repaired in accordance with approved procedures and retested.

3. If a manhole fails to meet a 1-in Hg drop in the specified time after repairs, the unit shall be water exfiltration tested and repaired as necessary.

15.16 EXFILTRATION TEST

A. Assemble manhole in place; fill and point all lifting holes and exterior joints within six feet of the ground surface with an approved non-shrinking mortar. Test prior to placing the shelf and invert and before filling and pointing the horizontal joints below 6-ft of depth. Lower groundwater table below bottom of the manhole for the duration of the test. Plug all pipes and other openings into the manhole and brace to prevent blow out.

B. Fill manhole with water to the top of the cone section. A period of time may be permitted to allow for absorption. Following this period, refill manhole to the top of the cone, if necessary and allow at least eight hours to pass. At the end of the test period, refill the manhole to the top of the cone again, measuring the volume of water added. Extrapolate the refill amount to a 24-hour leakage rate. The leakage for each manhole shall not exceed one gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed three gallons per vertical foot per day, repairs by approved methods may be made. If leakage due to a defective section of joint exceeds three gallons per vertical foot per day, the manhole shall be rejected. Uncover the rejected manhole as necessary and disassemble, reconstruct or replace it. Retest the manhole and, if satisfactory, fill and point the interior joints.

C. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc. It will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete.

D. An infiltration test may be substituted for an exfiltration test if the groundwater table is above the highest joint in the manhole and if approved by the Superintendent. If there is no leakage into the manhole, the manhole will be considered water-tight.

E. All new manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind, prior to final inspection.

SECTION 16

SEWER TESTING AND CLEANING

16.01 TESTING (GRAVITY PIPELINES)

A. Testing and cleaning of pipe shall be as follows and shall be completed within 120 days of pipe installation.

B. Allowable Deflection Test

1. Pipe deflection measured not less than 90 days after the backfill has been completed as specified shall not exceed 5 percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.

2. Deflection shall be measured with a rigid mandrel (Go/No Go) device cylindrical in shape and constructed with a minimum of nine evenly spaced arms or prongs. Drawings of the mandrel with complete dimensions shall be submitted to the Superintendent for approval for each diameter of pipe to be tested, prior to any testing. The mandrel shall be hand pulled through shall sewer lines. The Superintendent shall observe all testing.

3. Any section of sewer not passing the mandrel shall be uncovered and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested.

4. On locations where mandrel testing is not a suitable option, an alternative method of pipe inspection may be utilized, such as visual inspection by camera, or other method approved by the Superintendent.

C. Low Pressure Air Test

1. For making low-pressure air tests, the Drain Layer shal1 use equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. The equipment shal1 be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig. The leakage test using low-pressure air shall be made on each manhole-to-manhole section of pipeline. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. Pneumatic plugs shall resist internal test pressure without requiring external bracing or blocking. All air used shall pass through a single control panel.

2. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe at the time of the test. However, the internal air pressure in the sealed line shall not be allowed to exceed 8 psig. When the maximum pressure exerted by the groundwater exceeds 4 psi, the Drain Layer shall conduct only an infiltration test.

3. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig (greater than the maximum pressure exerted by groundwater that may be above the invert of the pipe) shall not be less than that shown in the tables prepared by the National Clay Pipe Institute.

4. If the pipe section does not pass the air test, either sectionalize the section tested to determine the location of the leak or perform a hydrostatic leak test. Once the leak has been located the pipe shall be repaired and retested.

16.02 TESTING (PRESSURE SEWERS)

A. Furnish all necessary equipment and labor to perform pressure and leakage testing on the pipelines. Pressure sewers shall be tested to 50 psi. The procedures and method for carrying out the pressure and leakage tests shall be approved by the Superintendent.

B. Furnish all necessary equipment and labor for carrying out a pressure test and leakage test on the pipelines. The procedures and method for carrying out the pressure and leakage tests shall be approved by the Superintendent.

C. Make any taps and furnish all necessary caps, plugs, etc., as required in conjunction with testing a portion of the pipe. Furnish a test pump, gauges, and any other equipment required in conjunction with carrying out the hydrostatic tests.

D. All pipelines shall be subjected to a hydrostatic pressure of 150 psi and this pressure maintained for at least two hours. The leakage test shall be conducted at the maximum operating pressure and this pressure shall be maintained for at least two hours during the test. For water mains, hydrant branch gate valves shall remain open during this test. The amount of leakage, which will be permitted, shall be in accordance with the following formula:

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

where: L is allowable leakage, in gallons per hour
S is the length of the pipe tested, in feet
D is the nominal diameter, in inches
P is the average pressure during the test, in PSI gauge

E. The Drain Layer shall, at his own expense, locate and make repairs as necessary until the leakage is within the specified allowances and shall repair all visible leaks.

16.03 All sewers shall be tested for leakage by an infiltration test if the groundwater level is a minimum of 2-ft above the crown of the pipe for the full length of the section tested. When sewers cannot be tested by an infiltration test as specified above, they shall be tested by an exfiltration test using water or air. Test the first section of pipeline as soon as it is installed to demonstrate that the work conforms to this Section. Testing of pipe shall closely follow pipe laying. No more than 1000-ft of pipe shall remain untested at any time. All testing specified herein, including mandrel testing shall be completed within 90 days of pipe installation.

16.04 INFILTRATION TEST

A. Pipe shall be tested for infiltration after the backfill has been placed and the groundwater allowed to return to normal elevation. Infiltration tests shall be made under the supervision of the Superintendent and the length of line to be tested shall not be less than the length between adjacent manholes and not more than the total length of each size of pipe. The allowable infiltration shall be 100 gals per inch of diameter per day per mile of pipe in each section tested.

B. There shall be no gushing or spurting leaks. If any inspection of the completed sewer or any part thereof shows pipes or joints which allow noticeable infiltration of water, the defective work or material shall be replaced or repaired as directed. Rates of infiltration shall be determined by means of V-notch weirs, pipe spigots, or by plugs in the end of the pipe to be furnished and installed in an approved manner and at such times and locations as may be directed by the Superintendent.

16.05 EXFILTRATION TEST

A. Leakage tests by exfiltration shall be made before or after backfilling at the discretion of the Superintendent. The length of pipe to be tested shall be such that the head over the crown at the upstream crown is not less than 2-ft and the head over the downstream crown is not more than 6-ft. The pipe shall be plugged by pneumatic bags or mechanical plugs in such a manner that the air can be released from the pipe while it is being filled with water.

B. Before any measurements are made, the pipe shall be kept full of water long enough to allow absorption and the escape of any trapped air to take place. Following this, a test period of at least I hour shall begin. Provisions shall be made for measuring the amount of water required to maintain the water at a constant level during the test period, if any joint shows an appreciable amount of leakage, the jointing material shall be removed and the joint repaired. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant level in the pipe does not exceed 100 gals per inch of diameter per day per mile of pipe and if all the leakage is not confined to a few joints, workmanship shall be considered satisfactory. If the amount of leakage indicates defective joints or broken pipes, they shall be corrected or replaced.

16.06 CLEANING

A. At the conclusion of the work, thoroughly clean all pipelines by flushing or power jetting with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered the pipes during the construction period. Debris cleaned from the lines shall be removed from the low end of the pipeline. If after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe or following a heavy rain, the Superintendent will examine the pipes for leaks. If any defective pipes or joints are discovered, they shall be repaired.

SECTION 17

DUCTILE IRON PIPE AND FITTINGS.

17.01 Inspection of the pipe will be made by the Superintendent after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job. All pipe and fittings shall have a bituminous outside coating in accordance with. ANSI/AWWA C151 and C110, respectively. All pipe and fittings shall be cement-mortar lined and seal coated in accordance with ANSI/AWWA C104 double thickness. Joints for pipe and fittings shall be push-on or mechanical joints conforming to ANSI/AWWA C111 or C153 except where flanged joints are shown on the approved drawings. Two bronze wedges shall be inserted in every joint for every length of new water main. Restrained joints shall be suitable for 350 psi working pressure and fabricated of heavy section ductile iron casting. Gaskets shall meet the material requirements of ANSI/AWWA C111 for mechanical joint gaskets. Bolts and nuts as required shall be low carbon steel conforming to ASTM A307, Grade B. Restrained joints for push-on joint pipe shall be TR Flex by U.S. Pipe and Foundry Company, or equal. Restrained joints for mechanical joint pipe and fittings shall employ a ductile iron retainer gland. Twist-off nuts shall be used to ensure anchoring of the gland. Retainer glands shall be "Megalug" as manufactured by EBBA Iron, Inc., Eastland, TX, or approved equal. Sleeve type flexible couplings shall be of steel and shall be Style 38 by Dresser Mfg. Div., equal by Smith-Blair, JCM Industries Inc. or equal. Couplings shall be furnished with black steel bolts and nuts and with pipe stop removed from the middle ring. Gaskets shall be of a material suitable for exposure to liquid within the pipe.

17.02 Pre-insulated ductile iron pipe shall have 2 inches of rigid polyurethane foam with a polyethylene or PVC jacket, as manufactured by Urecon, Perma Pipe, Tricon, Thermal Pipe Systems, or equal. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe, lining or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe linings or coatings shall be repaired. Handling and laying of pipe and fittings shall be in accordance with the manufacturer's instruction and as specified herein.

17.03 All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when laid, shall conform to the lines and grades required. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 except as otherwise provided herein. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Drain Layer, at his own expense.

17.04 For all gravity sewers (regardless of excavation conditions) and pressure pipe (sewer force main or water main) excavated in rock, a minimum 8-in bedding of screened gravel shall be placed and tamped up to mid-diameter of the pipe, with select common fill placed and compacted from mid-diameter to I-foot above the top of the pipe. For pressure pipe excavated in earth, the bottom quadrant of the pipe shall be bed on undisturbed earth (provided it is firm and even) and select

common fill shall be placed and compacted at the sides and up to I-foot over the top of the pipe. Blocking will not be permitted.

17.05 All pipe shall be sound and clean before laying. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plugs or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the approved drawings, shall be provided, if required, for crossing utilities, which may be encountered upon opening the trench. Solid sleeves shall be used only where approved by the Superintendent.

17.06 When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be jointed with a bell shall be beveled to conform to the manufactured spigot end. Cement lining shall be undamaged.

17.07 The Drain Layer shall have on hand at the start of the job, a sufficient number of various bends for each size of pipe to ensure pipe laying is not delayed. These shall be used as job conditions require.

17.08 PUSH-ON JOINTS

A. Push-on joints shall be made in accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe to be laid shall then be aligned and inserted in the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

17.09 MECHANICAL JOINTS

A. Mechanical joints shall be made in accordance with Appendix A of ANSI/AWWA C111 and the manufacturer's instructions. Thoroughly clean and lubricate the joint surfaces and rubber gasket with soapy water before assembly. Bolts shall be tightened to the specified torques. Under no conditions shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage.

17.10 SLEEVE TYPE COUPLINGS

A. Couplings shall be installed where shown. Couplings shall not be assembled until adjoining push-on joints have been assembled. After installation, apply a heavy bituminous coating to bolts and nuts.

17.11 CONNECTIONS TO STRUCTURES (PRESSURE PIPING)

A. Wherever a pipe 3-in in diameter or larger passes from concrete to earth horizontally, two flexible joints spaced from 2 to 4 feet apart depending on pipe size shall be installed, within 2 feet of the exterior face of the wall, whether or not shown on the approved drawings.

B. Wall pipes shall have a thrust collar located at mid-depth of wall.

17.12 CLEANING

A. At the conclusion of the work thoroughly clean all of the new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material, which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed. After the pipelines are cleaned and if the groundwater level is above the pipe, or following a heavy rain, the pipe will be examined for leaks. If defective pipes or joints are discovered at this time, they shall be repaired or replaced by the Drain Layer.

SECTION 18

POLYVINYL CHLORIDE (PVC) PIPE.

18.01 Inspections of the pipe may also be made by the Superintendent or other representatives of the Superintendent after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipes may have been accepted as satisfactory at the place of manufacturer. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

18.02 All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Superintendent.

18.03 PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in. loading, transporting and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards and as specified herein.

18.04 Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

18.05 While stored, pipe shall be adequately supported from below at not more than 3-ft intervals to prevent deformation. The pipe shall be stored in stacks no higher than that given in the following table:

Pipe Diameter (inches)	Max. No. of Rows Stacked
5	8 or less
4	12 to 21
3	24 to 30

18.06 Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup or direct or indirect sunlight will not be permitted.

16.07 PVC solid wall gravity pipe and fittings shall be Type PSM, PVC SDR 35 with full diameter dimensions and shall conform to ASTM 03034 or Type PS-46 PVC conforming to ASTM F789, for sizes 4 through 15-in and shall conform to ASTM F679 for sizes 18 through 27-in. Straight pipe shall be furnished in lengths of not more than 14-ft and wyes shall be furnished in lengths of not more than 3-ft. Saddle wyes or tee wyes will not be allowed.

16.08 PVC pressure pipe and fittings shall be Type SDR 21 and shall conform to all requirements of ASTM D224.

16.09 Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup or direct or indirect sunlight will not be permitted.

16.10 REDUNDANT CHECK VALVE

A. Each 1-1/2-in pressure sewer service connection, which connects to a common pressure sewer, shall include a separate check valve for installation between the property line and the sewer main.

B. The valve shall be 1-1/2-in gravity-operated flapper type check valve. This valve shall provide a full-port passageway when open and shall introduce a friction loss of less than 6 inches of water at maximum rated pump flow. Working parts shall be made of a 300 series stainless steel or fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, fatigue resistance, and trouble free operation. The check valve flapper shall include a non-fouling, integral hinge made from fabric reinforced synthetic elastomer. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom for assured seating even at very low back pressure. Valve body shall be injection molded from non-corroding, glass fiber reinforced PVC for durability.

16.11 PRESSURE SEWER CURB STOPS

A. Curb stops shall be compression type Water Works inverted-ground-key type oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections and PVC adaptors and shall be designed for a hydrostatic test pressure not less than 150 psi.

B. Service boxes shall be cast iron. Extension service boxes of the required length and having slide, type adjustment shall be installed at all service box locations. The boxes shall have housings of sufficient size to completely cover the service stop and shall be complete with identifying covers cast with the letter "S" for sewer.

16.12 INSTALLATION OF PVC PIPE AND FITTINGS

A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 11/6-in per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. PVC pipe and fittings shall be installed in

accordance with requirements of the manufacturer, ASTM 02321 or as otherwise provided herein.

C. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the approved drawings. Blocking under the pipe will not be permitted. Screened gravel bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Screened gravel bedding shall then be placed to 12-in above the top of the pipe. The initial 3-ft of backfill above the bedding shall be placed in 1-ft layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial 3-ft of backfill shall be approved by the pipe manufacturer's representative prior to use.

D. All pipe shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the approved drawings, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.

E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end.

F. The Superintendent may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such and immediately removed from the job site.

G. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be “pulled” or "cramped".

H. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

I. Precautions shall be taken to prevent flotation of the pipe in the trench.

J. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe

bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. If trench boxes, moveable sheeting, shoring or plates have been installed below the top of the pipe, they shall be moved slowly taking care not to disturb pipe, bedding or backfill. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

16.13 JOINTING POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

A. PVC sewer pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the manufacturer. The pipe manufacturer shall furnish information and supervise the installation of at least the first five joints.

B. All manhole connections shall be as shown on the approved drawings except that concrete and mortared connections shall be equipped with an integral a-ring or other sealant such that a positive watertight seal is established.

16.14 WYE BRANCHES, CHIMNEYS, AND STUBS

A. Pipe stubs for manhole connections shall not exceed 3.25-ft in length unless directed otherwise by the Superintendent. Install caps where required.

16.15 SERVICE CONNECTIONS

A. Service connections shall be installed at a minimum slope of 2 percent at the locations and to the limits determined in the field. In each case the end shall be capped and backed with a 2-in by 4-in wood post extending to 1.5-feet below finished ground surface.

B. Service connections shall be 6-in diameter unless otherwise shown on the approved drawings. Metallic tape is required over pipe located within 1-4’ below ground surface before backfilled.

C. Provide clean out spacing when there are more than two bends, and/or when the installed piping is greater than 100’ in length. The removal of the plug on the sewer service stub will need to be performed in the presence of a representative from the water/sewer division or the engineering division.

D. Pressure sewer service connections shall be 1-1/2-in PVC. Each pressure sewer service connection, which connects to a common pressure sewer or force main, shall be provided with a redundant check valve and curb stop with box.

SECTION 19

SUBMERSIBLE SEWAGE PUMPING STATIONS

19.01 These regulations are intended to give a general description of what is required, but do not purport to cover all of the details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, shop testing, delivery and complete installation and field testing of all materials, equipment and appurtenances to complete the pumping station whether specifically mentioned in these regulations or not.

19.02 Any and all proposed submersible sewage pumping stations installation shall be reviewed prior to any such discharge by the Superintendent who may, at their discretion, confer with the Town's consultant engineering firm.

19.03 The Town reserves the right to charge the applicant for all reviews, meetings, consultations, follow-ups and related activities relevant to the resolution and disposition of the proposed discharges. The most current market value, plus overhead, shall be made billable for the services of the Town's consultant engineering firm. The method of payment for these services shall be in form of a check made payable to the Town of Tewksbury prior to the introduction of these wastes to the collection system.

19.04 DESCRIPTION OF PUMPING SYSTEM

A. The submersible pumping station shall be installed where shown on the approved drawings. Two non-clog submersible pumps shall be installed at the pump station. The two pumps shall operate in an alternating sequence. Pumps shall be automatically started from an upper level switch and automatically stopped from a low-level switch. An alternating switch (with manual by-pass) shall be provided in the control panel such that the operation of one pump shall switch the next automatic start to the other pump. The pumps shall also be capable of manual operation from the control panel. Both pumps shall not be capable of running at the same time.

19.05 SUBMITTALS

A. Submit to the Superintendent for approval, shop drawings showing details of construction and installation of all equipment furnished under this section. Drain Layer's initial submittal on pumping stations shall be received by the Superintendent within 90 days of the beginning of the project. Final approval of all pumping station submittals, shall be obtained within 180 days of beginning of project. Installation of the pumping station shall commence as soon as possible after final approval of submittals and startup/testing of the station shall be completed within one calendar year of beginning of project. The following shall be included in the submittals:

1. Shop drawings and materials of construction and performance of electric motors, pumps, controls, pipes, valves and fittings, equipment, conduit, wiring, wiring devices, transformer, precast concrete structures, rails and bracket.

2. Manufacturer's rating curves showing pump characteristics of pressure, capacity, and brake horsepower. This information shall be prepared specifically for the pump proposed. Catalog sheet showing a family of curves will not be acceptable.

3. Literature and drawings describing the equipment in sufficient detail, including materials of construction and parts list, to indicate full conformance with the detail specifications.

4. Complete parts list for equipment furnished.

5. Certified pump test data contained in Item 2 above.

6. Motor data such as HP, Volts, RPM, lock rotor amps and p.f. as described herein.

7. Complete wiring diagrams and schematics of all power, control and alarm systems.

8. Floor plans, sections and elevations showing a complete layout to scale of all equipment, piping, electrical conduits and wall sleeve locations.

9. Details of electrical control panel.

10. Design calculations and plan to prevent flotation of pumping chamber and valve vault.

B. In the event that it is impossible to conform with certain details of the specifications due to different manufacturing techniques, describe completely all non-conforming aspects. Upon receipt of approval of submitted material, provide six certified prints and one reproducible tracing of all drawings for the pumping station.

19.06 OPERATING INSTRUCTIONS

A. Complete operating and maintenance instructions shall be furnished for all equipment included under these regulations. The maintenance instructions shall include troubleshooting data and full preventative maintenance schedules.

19.07 SPARE PARTS AND TOOLS

A. The Drain Layer shall furnish one set of all special tools required for the proper servicing of all equipment supplied under these regulations, packed in a suitable steel tool chest with a lock. Special tools shall include any tools not available in ordinary hardware stores.

B. The Drain Layer shall furnish the manufacturer's standard set of spare parts including at least the following for each pumping station:

1. One complete motor and pump assembly.

2. Complete set of "O"-rings and gaskets.

3. One complete seal per pump.

4. Snap ring.

5. One complete set of bearings per pump.

6. Complete set of rubber sealing flange gaskets.

19.08 SHIPPING INSTRUCTIONS

A. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation. Spare equipment should be stored in climate controlled environment.

B. All equipment and parts must be properly protected against any damage during a prolonged period at the site. Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Superintendent.

C. The finished surfaces of all exposed flanges shall be protected by wooden blind flanges, strongly built and securely bolted thereto. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion. No shipment shall be made until approved by the Superintendent in writing.

19.09 POWER SUPPLY

A. The Pumping Stations shall be designed for operation on a 120/240-volt, single phase, 3 wire grounded, 60 Hertz power supply.

19.10 QUALITY ASSURANCE

A. All equipment specified under these regulations shall be furnished by a single pump station manufacturer and shall be products of manufacturers regularly engaged in the production of such equipment. The pump station manufacturer shall have the sole responsibility for the proper functioning of the complete pumping station. All mechanical and electrical pump station elements are to be a complete factory built package unit with all appurtenances supplied by one station manufacturer, including the electrical pedestal and emergency generator, where required.

B. The pump station manufacturer shall have a minimum of 10 years experience in the design and manufacture of sewage pumping stations. The manufacturer shall have built pump stations of similar type, size and capacity and have, in the opinion of the Superintendent, sufficient experience and test data to cover the design of the station specified. The manufacturer shall submit documentation demonstrating competence in the design, manufacture, and installation of pump stations of similar capacity and complexity and

provide documentation on five pumping systems which have been operating for five or more years in the United States.

19.11 PUMPING STATION CHAMBER AND VALVE VAULT

A. The Drain Layer shall furnish and install a complete underground pumping station and valve vault of precast concrete construction. The size and design characteristics of the pumping station and valve vault shall be as shown on the approved drawings and as specified herein.

B. Precast concrete barrel sections and precast base shall conform to Specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C478 and shall meet the following requirements:

1. The wall thickness shall not be less than 7-in for the 72-in diameter reinforced barrel sections, and not less than 9-in for the 96-in diameter reinforced barrel sections.

2. Barrel sections shall have tongue and groove gasketed joints.

3. Precast concrete bases shall be constructed and installed as shown on the approved drawings. The thickness of the bottom slab of the precast bases shall not be less than the manhole barrel sections or top slab, whichever is greater.

4. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on the inside of each precast section. Precast concrete barrel sections with precast top slabs shall be designed for a minimum of H-20 loading plus the weight of the soil above. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.

5. The pumping station and valve vault shall be designed to resist flotation when the groundwater elevation is at the existing ground surface elevation. The Drain Layer shall submit to the Superintendent plans and calculations designed by a professional structural engineer registered in the Commonwealth of Massachusetts. The station weight plus the weight of soil above projection, but excluding equipment and soil friction shall prevent buoyancy.

6. Entrance hatch to the pump station shall be aluminum, double leaf 30-in x 48-in complete with upper guide holder, chain holder, cable holder and flush stainless steel drop handle. Provide stain1ess steel spring hinges for ease in opening and closing. Hatch to withstand a loading of 300 pounds per square foot and open 90 degrees. Provide hold-open arm, with red vinyl grip handle, to automatically lock cover in open position against wind.. Provide a stainless steel recessed hasp/staple covered by a hinged lid flush with the surface. Provide padlocks (Master Lock Pro Series, Model 6842) keyed to the Town's specifications and in the quantity specified by the Superintendent. The frame shall be securely mounted directly above the pumps. The hatch installation shall be in accordance with manufacturer's instructions.

19.12 PUMPING SYSTEM

A. The Drain Layer shall furnish and install one complete automatic, underground pumping system for the pump station. The principal equipment included in the pumping system shall include two non-clog submersible pumps; pump frames, braces and lifting mechanism; piping; valves within a separate valve chamber; control panel and pedestal; and, four float type micro switches.

B. The station shall be supplied with pump mounting plates with upper and lower rail supports attached to the concrete station with stainless steel expansion bolts. Two 314-in diameter stainless steel pipe or fiberglass I-beam rails shall be installed between the mounting plates. The rails shall be used to raise and lower the pumps into the station. A stainless steel lifting chain shall be attached to the top of the station chamber and to the top of the pump assembly.

19.13 PUMPS

A. The non-clog pumps and motors shall be designed and manufactured so they can operate completely submerged in the sewage and with motor unsubmerged indefinitely without overheating. The electrical power cord, control cord, or combination cord shall be sealed by use of a cord grip, with individual conductors additionally sealed into a cord cap assembly with epoxy sealing compound. The cord grip shall have a male tapered pipe thread, threaded into a female tapered pipe thread in a cord cap. The cord cap shall be sealed into the motor housing with an O-ring. The pumps shall be supplied with a sufficient length of cord to connect directly to the control panel located adjacent to the station without junction boxes inside the station.

B. The centrifugal pump impeller unit shall be attached to a common motor and pump shaft made of stainless steel. Pump and motor housings are to be high quality grey iron castings. Impeller shall be cast iron. All fasteners shall be of Type 316 stainless steel.

C. The pump-motor shaft shall be sealed by two mechanical carbon and tungsten carbide faced seals within an oil filled chamber to provide clean, constant lubrication. The shaft shall be supported by a ball radial and thrust bearing and two row angular contact bearings, between the shaft seals to minimize overhang, both permanently lubricated by grease.

D. The motor winding and rotor are to be mounted in a sealed, submersible type housing which is able to transmit heat from motor winding to outer housing. Motor winding shall be Class H insulated and securely held in the housing with machine screws so that it may be removed in the field without the use of heat or a press.

E. Pump motors shall have cooling characteristics suitable to permit continuous operation in a totally, partially or non-submerged condition. The pump and motor shall be capable of running without damage for extended periods. Pump and motor shall be explosion-proof, suitable for Class I, Division I, Group C or D applications. Motor shall be provided with pilot thermal sensors embedded in the stator windings. All pumps shall have factory installed moisture detectors (seal failure probes) in the seal chamber.

F. The power and control cable(s) shall be suitable for submersible pump and Class I, Division I, Group C or D applications. Cable sizing shall conform to Massachusetts Electrical Code specifications for pump motors. Cable entry to each pump motor shall be designed for submersible pump applications. The cable entry junction box and motor shall be separated by a stator load sealing gland which shall isolate the motor interior from foreign materials gaining access through the pump top.

G. The manufacturer shall submit rating curves and details of construction for the pumps to the Superintendent for approval. The curves shall indicate head, discharge, efficiency, and horsepower characteristics throughout the full operating range.

H. The impeller shall be of the enclosed, non-clog type with the forward ends of the blades generously rounded to avoid catching trash. The blades shall be tapered toward the periphery of the impeller so as to generate the maximum possible shutoff head, and the outer tips of the blades shall occupy only a negligible portion of the area of the impeller throat or periphery. The impeller shall be accurately balanced before assembling.

19.14 CONTROLS

A. Sealed tilt type switches shall be supplied to control sump level and alarm signal. The switches shall be sealed in a solid polyurethane float for corrosion and shock resistance. The support wire shall have a heavy Neoprene jacket. A weight shall be attached to each cord above the float to hold each switch in place in the sump. The weight shall be placed above or inside the float to effectively prevent sharp bends in the cord when the float operates. The float switches shall hang in the sump supported only by the cord. Four float switches shall be used to control and signal level; one for high level alarm, one for pump turn-on, one for pump turn-off and one for low-level alarm. Switches shall operate intrinsically safe relays located in the pump control panel.

B. Level settings shall be set at the elevations stated on the approved drawings. On sump level rise, the "pump off" level switch shall be energized. When the level reaches the "pump on" level switch, it shall be energized and send a signal to the control panel and automatically turn on a pump. One pump shall operate until the "pump oft" switch automatically turns the pump off. Under normal operation, the duty and standby pumps shall alternate service after each pump cycle is complete and the in-service pump called to stop. If sump level rises to the high water level or falls to the low water level, the alarm level switches shall be energized and initiate an alarm signal that there is a malfunction at the pumping station. Upon high water level alarm the duty pump shall be called to stop and the standby pump shall be started in its place. The high water alarm shall also disable the alternation circuit to prevent restarting of the faulty pump. A momentary contact pushbutton shall be provided and mounted within the control panel to reset the alternator circuit once both pumps have become operational. Once sump level drops below the "pump oft" level switch, power to the pump shall be shut off. The alternator shall switch to and indicate that the alternate pump has been started, once the "pump on" level switch is energized again. If the sump level continues to fall, the low water level switch shall be de-energized and cut-out the motor. Should the duty

pump fail to start, the standby pump shall be automatically started after a one minute time delay. The failed pump shall be locked out, an alarm transmitted and the standby pump shall continue to operate through every cycle. Both pumps shall not be capable of running at the same time when operating in the automatic or manual modes. Each pump shall be capable of being operated manually from the control panel. All level switches shall be adjustable for level setting from the surface. Float switches and cable shall be suitable for submersible service and Class I, Division I, Group C or D applications. Switches shall be connected to the control panel. Each float switch shall be supplied with a sufficient length of cord such that the switches can be connected directly to the control panel located adjacent to the station without junction boxes inside the station. Floats shall be weighted or connected to a lower support bracket to prevent float wandering in the station. The lower support bracket shall be removable from ground level. The control panel in the pedestal cabinet will be located on a concrete pad adjacent to the Pump Station as shown on the approved drawings. Provide intrinsically safe relays for motor control, alarms and failure circuits to overcome the circuit lengths. The thermal and moisture sensors integral to each motor shall cut out the motor if sensor is tripped.

19.14 PUMP CONTROL PANEL

A. Provide a factory assembled, wired, and tested pump control panel as follows:

1. The control panel shall be located in the pedestal cabinet as shown on the approved drawings. The panel shall be designed to accept the power supply specified in the Power Supply paragraph.

2. The panel shall have a NEMA Type 12 enclosure with the following:

    a. A combination circuit breaker disconnect (22 K.A for 240V) and non-reversing, full voltage type motor starter sized for the motor used, with an H-O-A selector switch for each pump..

    b. An automatic alternator with ALTERNATE, PUMPl, and PUMP2 selector switch. In the ALTERNATE position, the operation of the pumps shall automatically switch between pumping cycles. In either PUMP position, the alternator shall prevent the other pump from operating.

    c. Running time meters.

    d. Pilot lights to indicate individually pump 1 running, pump 1 fault (overload, leak), pump 2 running, pump 2 fault (overload, leak), high level alarm and low level alarm. "Run" lights shall be red, "off" lights shall be green and alarm lights shall be amber.

    e. Normally opened and normally closed sets of isolated contacts for pump I fault, pump I nm status, pump 2 fault, pump 2 run status, high level alarm, low level alarm, and general intrusion alarm (contact operates on any electrical pedestal condition) wired to a terminal strip for the Town’s use.

f. Terminal strips for panel control and alarm interconnections.

g. An intrinsically safe barrier relay between each float level switch and the terminal strip. Relays shall be GEM Safe-Pac Division of Delaval or approved equal.

h. Control power circuit protectors as necessary.

i. Power loss relay. The relay shall shut down pumps during the loss of incoming power to the pump control panel and allow pumps to restart after a minimum of 15 sec. time delay after the power is restored.

j. Control relays shall be as specified. Securely fasten relays to the removable back panel with stainless steel screws and lock washers. Back panel shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component

k. All operating controls and instruments shall be securely mounted on the control compartment door. Controls and instruments shall be clearly labeled to indicate function. All switches shall be of oil tight construction. Indicator lamps shall be oil tight Lamps shall be easily replaceable from the front of the control compartment door without removing lamp module from its mounted position.

l. An elapsed time meter shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenths of hours."

m. The control panel shall accept the signal from the heat and moisture detectors integral to the motor and alarm on detection.

19.15 PIPING AND VALVES

A. Ductile iron pipe shall conform to the physical and chemical requirements of ANSI/AWWA A21.51/C151, and shall have dimensions and wall thicknesses and flanges in accordance with ANSI/AWWA A21.15/C115, Thickness Class 53, rated working pressure of250 psi. Flanges shall be faced and drilled after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe. Gaskets shall be full face rubber with cloth insertion, lI8-in thick and shall conform to the dimensions shown in Table Al of ANSI/AWWA A21.l5/C115. Interior piping details shall be submitted to the Superintendent for approval before the station manufacture is started.

B. Flanged joints shall be supplied with bolts, bolt studs with a nut on each end, or studs with nuts where the flange is tapped. The number and size of bolts shall conform to the same Standard as the flange. Bolts and nuts shall, except as otherwise specified shall conform to the ASTM A307, Grade B. Fittings shall be ductile iron or gray-iron as specified above. Except as specified below flanges and flanged fittings shall conform to ANSI/AWWA A21.10/C110 for 150 psi minimum pressure rating. All pipe and fittings shall have a cement

mortar lining and bituminous seal coat on the inside and a bituminous seal coat on the outside, all in accordance with ANSI/AWWA A21.A1 C104 except that cement mortar lining shall be 1/8-in. in thickness. A plus tolerance of l/8-in will be permitted. The gate valves shall be of the flanged, resilient seat, iron body, bronze mounted, OS&Y. They shall comply with AWWA Specification C509. The check valves shall be flanged, 150 psi working pressure, bronze-mounted, with bronze seat ring and bronze gate ring. Check valves shall comply with the applicable portions of AWWA Standard Specifications for Check Valves. Valves shall be fitted with an extended hinge arm with outside lever and spring. . Vent piping shall be Schedule 40 PVC with screen. Sleeve type couplings for ductile iron pipe shall be of cast iron or ductile iron construction and shall be Dresser Style 253, Dresser Div., Bradford, PA; Ford Style FCl; Smith-Blair Style 441, Smith-Blair, Inc., San Francisco, CA or equal. The pipe stop shall be removed from the middle ring. Gaskets shall be of a composition suitably resistant to the contents of the liquid within the pipe. Bolts and nuts shall be of stainless steel. Flap valves shall be of circular port design with offset single pivot hinge. They shall be of iron body bronze mounted type and furnished with flanged end, Style 47 by M&H Valve Company or equal.

19.16 AUTOMATIC TELEPHONE DIALING

A. The Drain Layer shall furnish and install a Mission Communication Model 110 wireless monitoring and alarm remote transmission unit with AC power loss indicator. It shall have a vandal resistant, low profile, antenna mounted on the outside of the pedestal cabinet. The local representative for this unit is Hayes Pump, Inc., of Concord, Massachusetts. No other unit will be accepted. Install the unit in the space provided in the electrical pedestal and connect all alarm leads.

19.17 SAFETY NET

A. An OSHA-approved removable safety net shall be installed within the opening of each access casting/hatch. The safety nets shall be the Hatch Net 120 as manufactured by Safe Approach, Inc. of Auburn, Maine, or equal.

19.18 INSPECTION

A. The Superintendent shall have the right to inspect all materials or equipment to be furnished under these regulations, prior to their shipment from the point of manufacturer.

19.19 EXCAVATION AND BACKFILL

A. Earth excavation and backfill are specified under Section 13 & 14, but are to be done as a part of the work under this Section, including any necessary sheeting and bracing. The Drain Layer shall be responsible for handling groundwater to provide firm, dry undisturbed subgrade for the structures, shall prevent water rising on new concrete within 24 hours after placing, and shall guard against flotation or other damage resulting from groundwater or flooding.

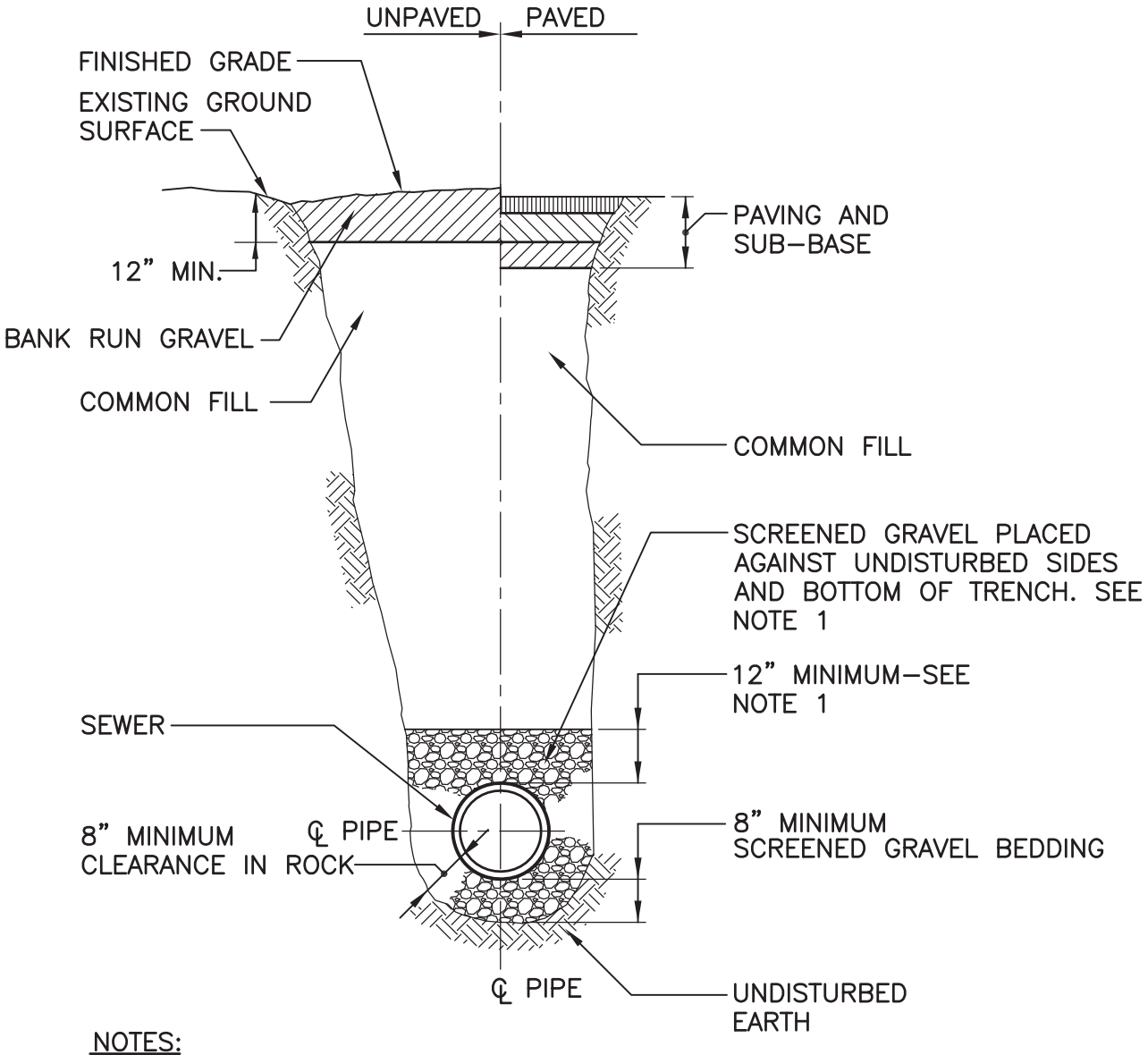
19.20 INSTALLATION

A. Installation of the pumping station shall commence as soon as possible after final submittal approval. Startup/testing of the station shall be completed within one calendar year of beginning of project. All workmanship and materials shall be of the highest quality. Anchor bolts previously set shall be used to secure the station to the concrete base to prevent flotation. Stainless steel bolts shall be protected by painting with two coats of heavy bituminous coating. The Drain Layer shall insure against flotation of the station as specified herein. All pumps, pump supports, and pump control pumps shall be installed in accordance with the instructions of the manufacturer and as shown on the approved drawings. The Drain Layer shall submit a certificate from the equipment manufacturer stating that the installation of his equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

19.21 FIELD TEST

A. The Drain Layer shall conduct in the presence of the Superintendent such test as necessary to indicate that the pumps conform to the head and capacities specified. Hydrant water shall be used to successfully test each pump a minimum of four times. A 14 day operating period of the pumps will be required before acceptance. If pump performance does not meet the Specifications, corrective measures shall be taken by the Drain Layer or the pumps shall be removed and replaced with pumps which satisfy the conditions specified. The decision of the Superintendent shall be final. The manufacturer shall furnish the services of a qualified factory representative to check over the completed pump installation with the Superintendent and provide training to the Superintendent for the proper operation and maintenance of the pumps. Compensation for such services shall be paid for by the Drain Layer. A minimum of 6 hours of service shall be provided.

B. The Pumping station and valve vault structures shall be tested as required for manholes under Section 15.



NOTES:

1. FOR PIPES OTHER THAN PVC, SELECT COMMON FILL MAY BE USED FROM MID–DIAMETER OF PIPE TO 12" ABOVE TOP OF PIPE.
2. TRENCHES LOCATED ON THE ROAD SHOULDER SHALL BE THE SAME AS IN STREET EXCEPT FOR PAVING.
3. PROVIDE AT LEAST ONE IMPERVIOUS DAM IN GRAVEL BEDDING BETWEEN EACH MANHOLE OR EVERY 300 FT., WHICHEVER IS LESS.

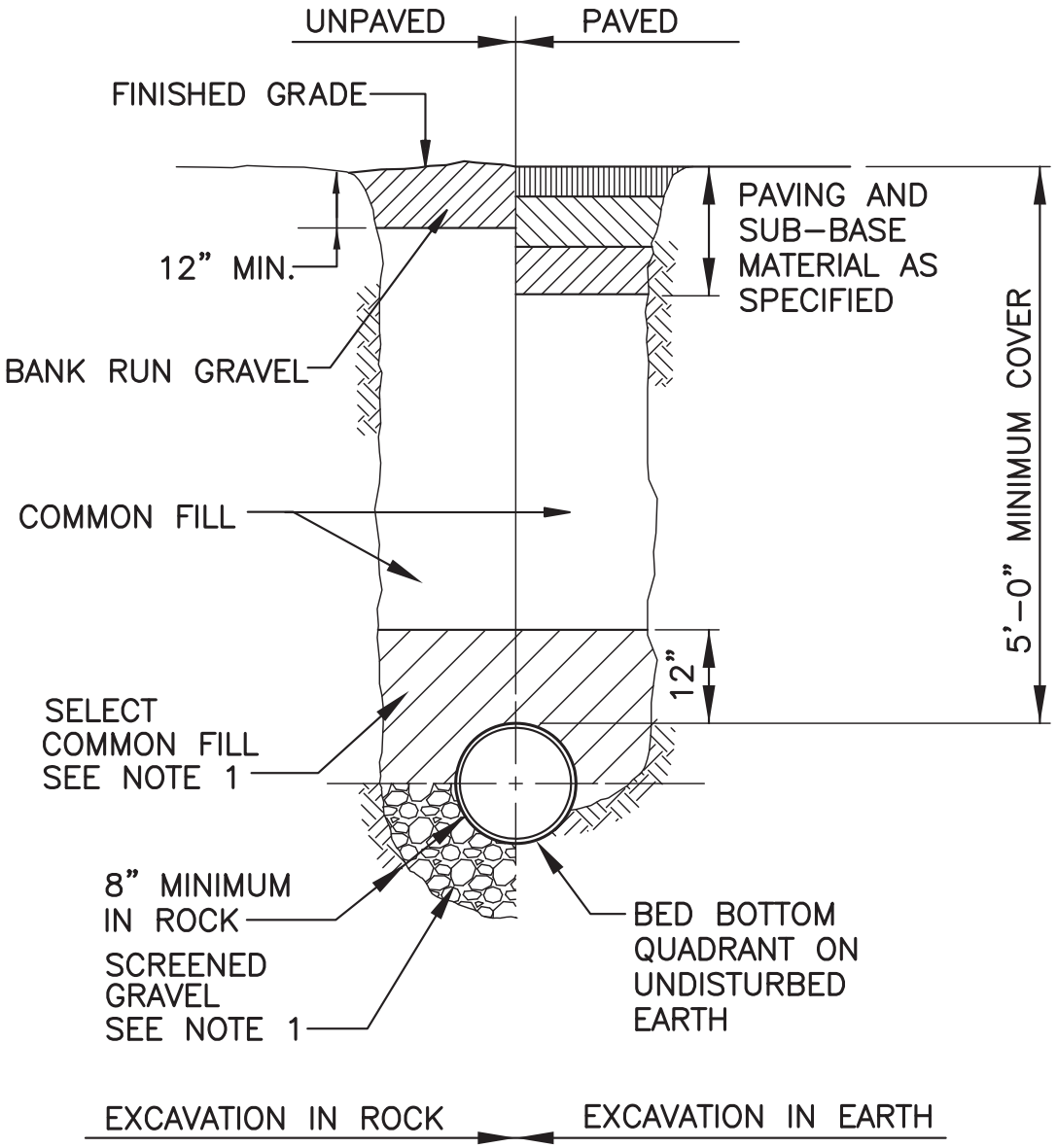
TYPICAL TRENCH DETAIL FOR SEWER PIPE

NTS

TOWN OF TEWKSBURY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

SEWER
CONSTRUCTION
STANDARDS

DETAIL
A-1
DATE
JULY 2012



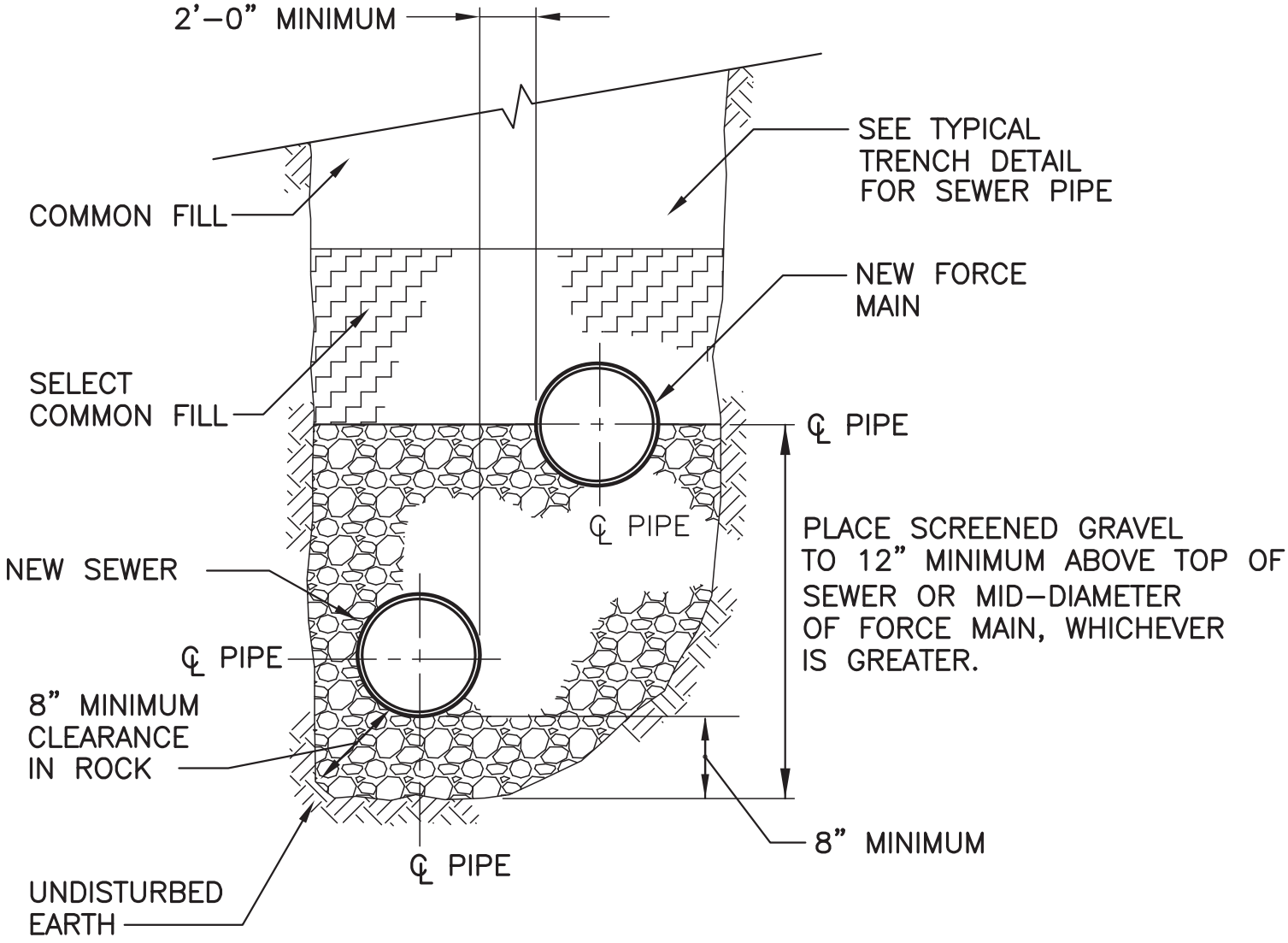
TYPICAL TRENCH DETAIL FOR DI WATER MAIN OR DI FORCE MAIN

NTS

NOTES:

1. FOR WATER MAINS, SCREENED GRAVEL BEDDING AND SELECT COMMON FILL BACKFILL SHALL BE REPLACED WITH SAND.

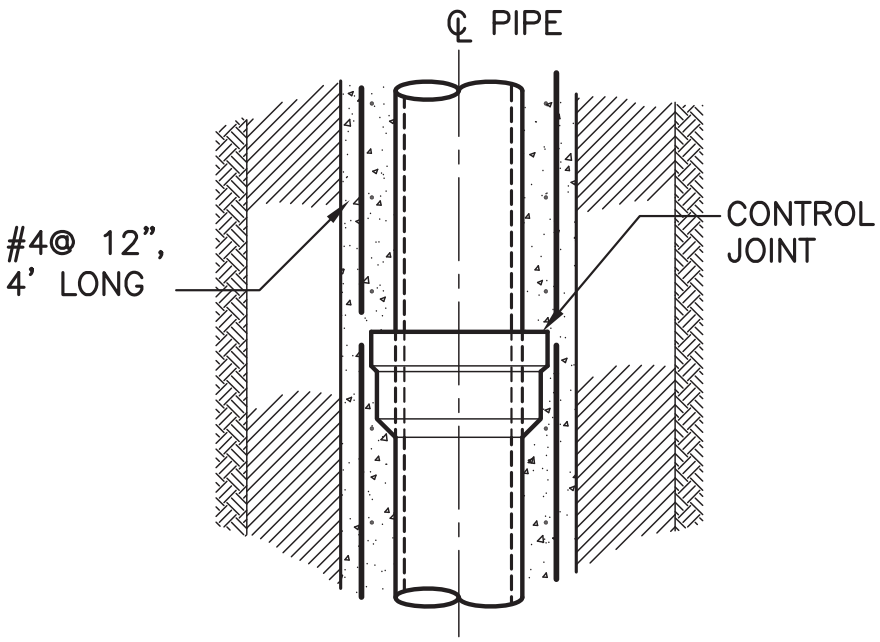
TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-2 DATE JULY 2012



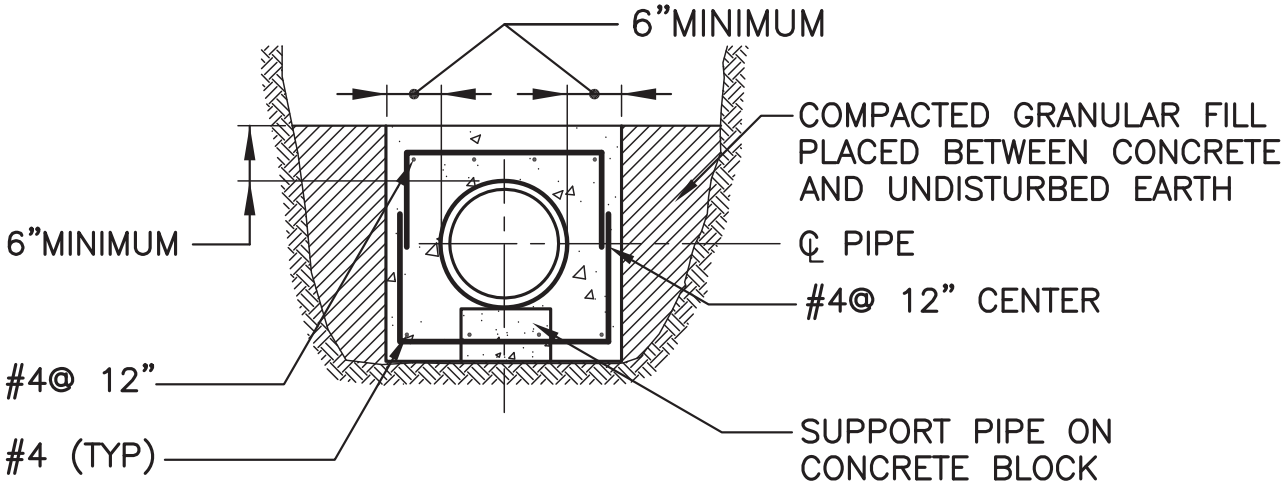
COMMON TRENCH FOR SEWER AND FORCE MAIN

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-3 DATE JULY 2012



PLAN



SECTION

NOTES:

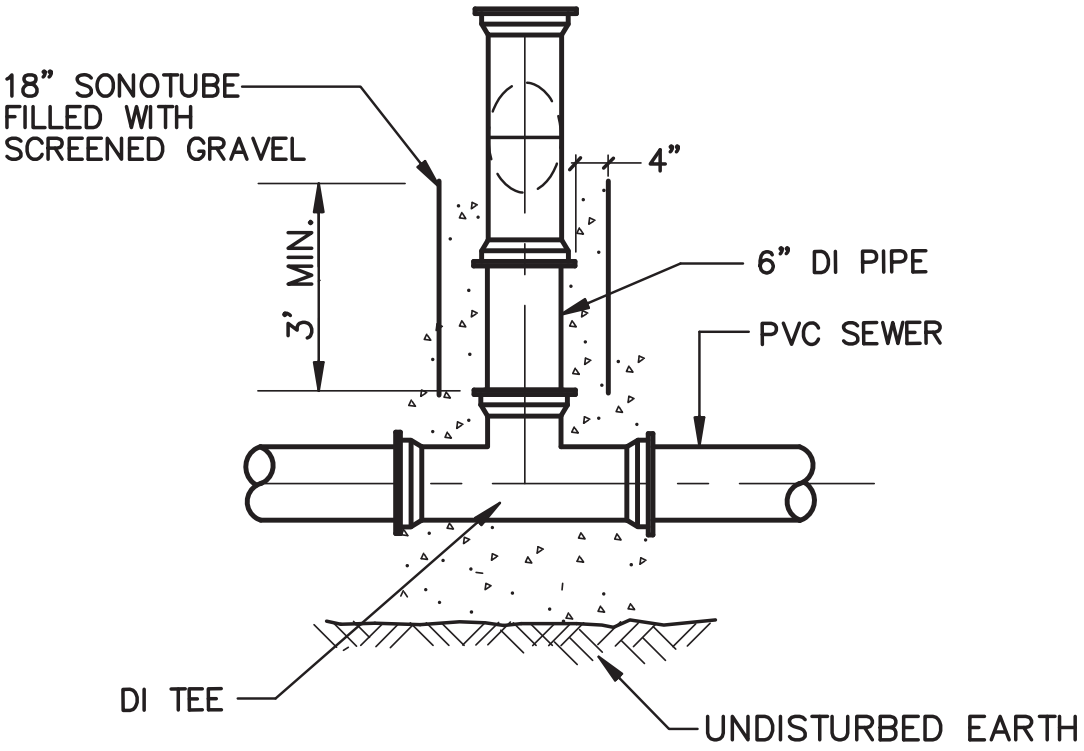
1. CONTROL JOINTS SHALL COINCIDE WITH PIPE JOINTS. MAXIMUM DISTANCE BETWEEN CONTROL JOINTS SHALL BE 24'±

2. REINFORCING STEEL TO BE USED ONLY WHEN DEPTH OF COVER TO TOP OF SURFACE OF CONCRETE IS 5'–0" OR LESS

CONCRETE ENCASEMENT DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-4 DATE JULY 2012

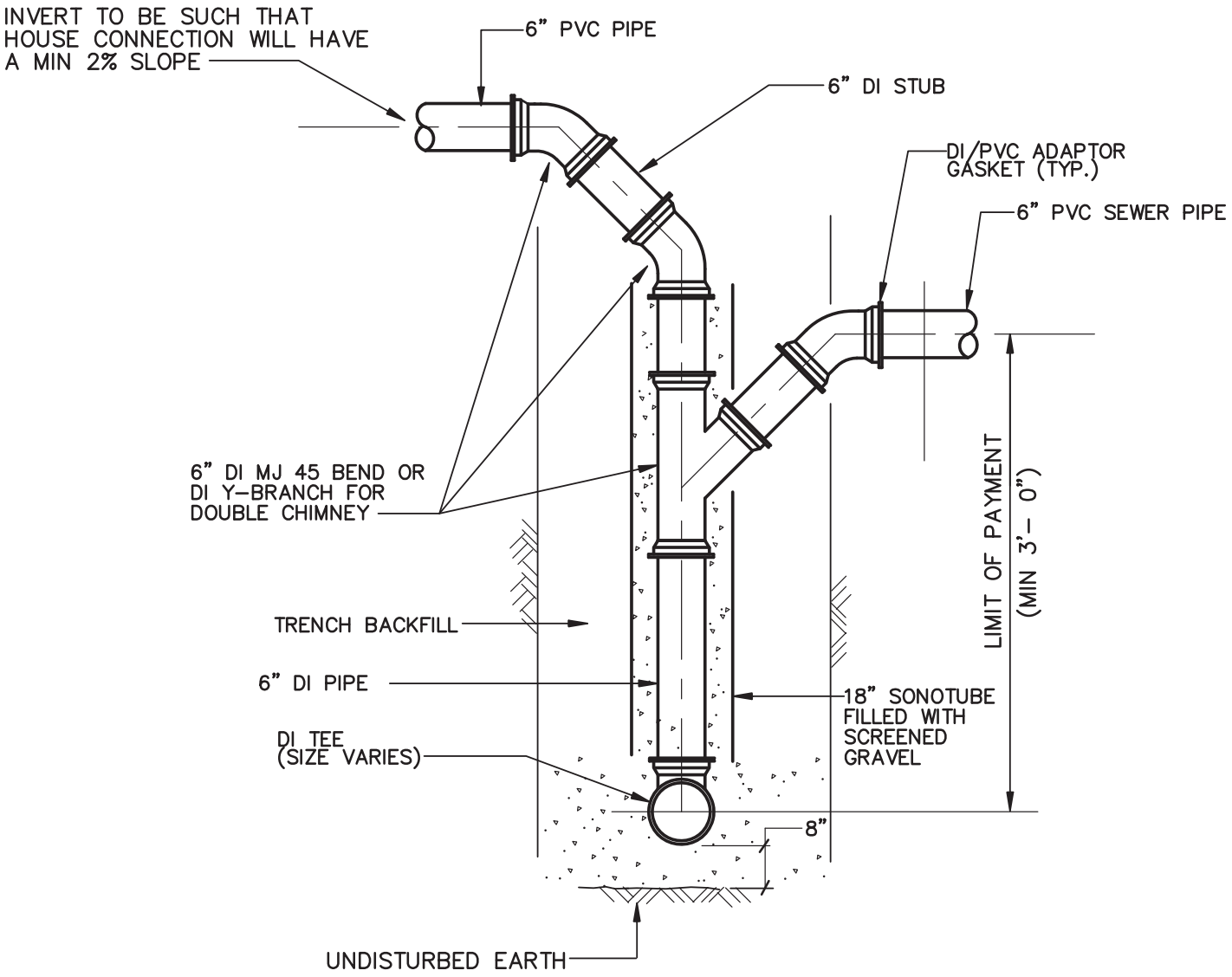


ELEVATION

DI CHIMNEY DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-5.1 DATE JULY 2012

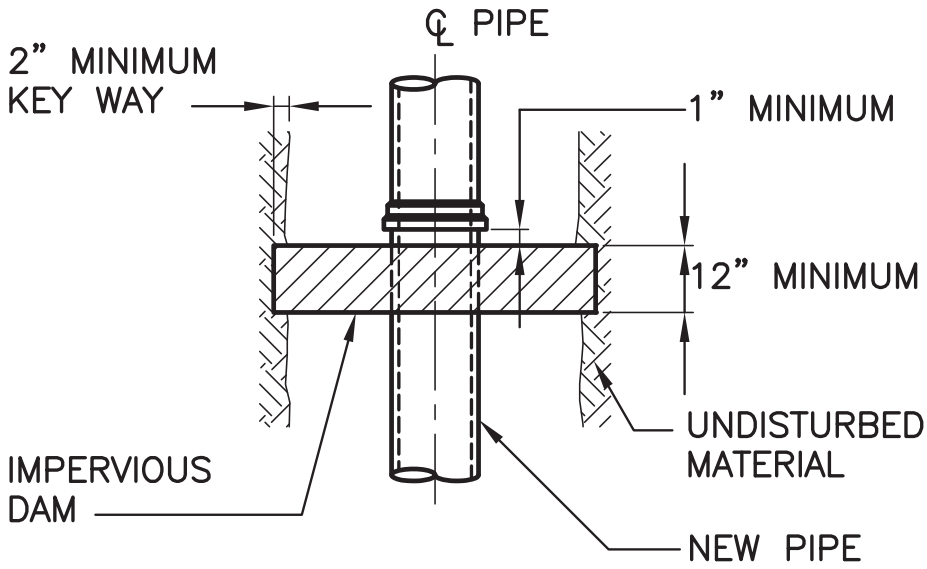


SECTION

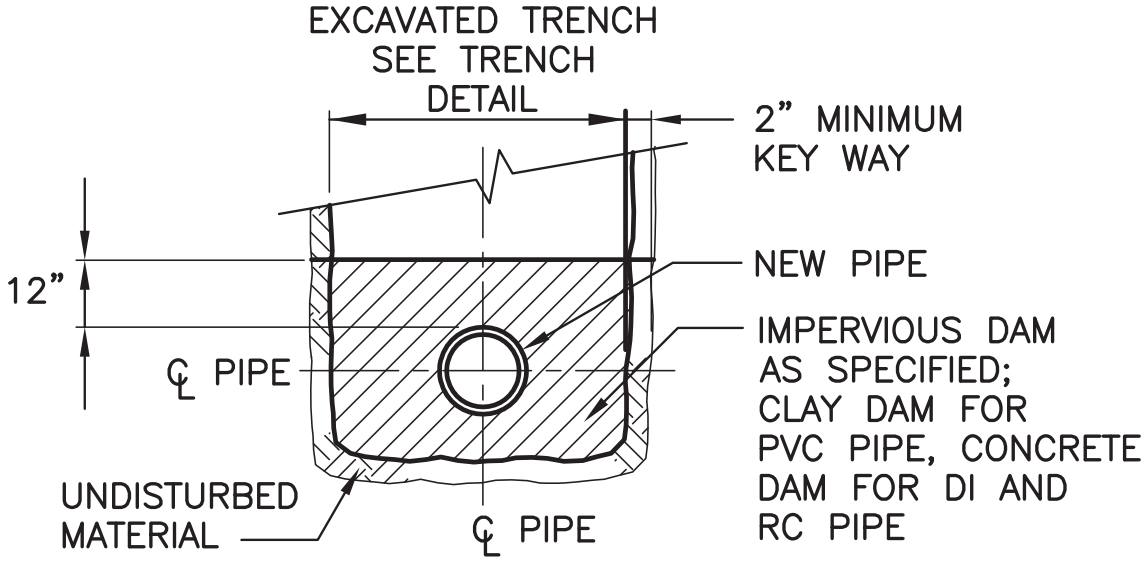
DI CHIMNEY DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-5.2 DATE JULY 2012



PLAN



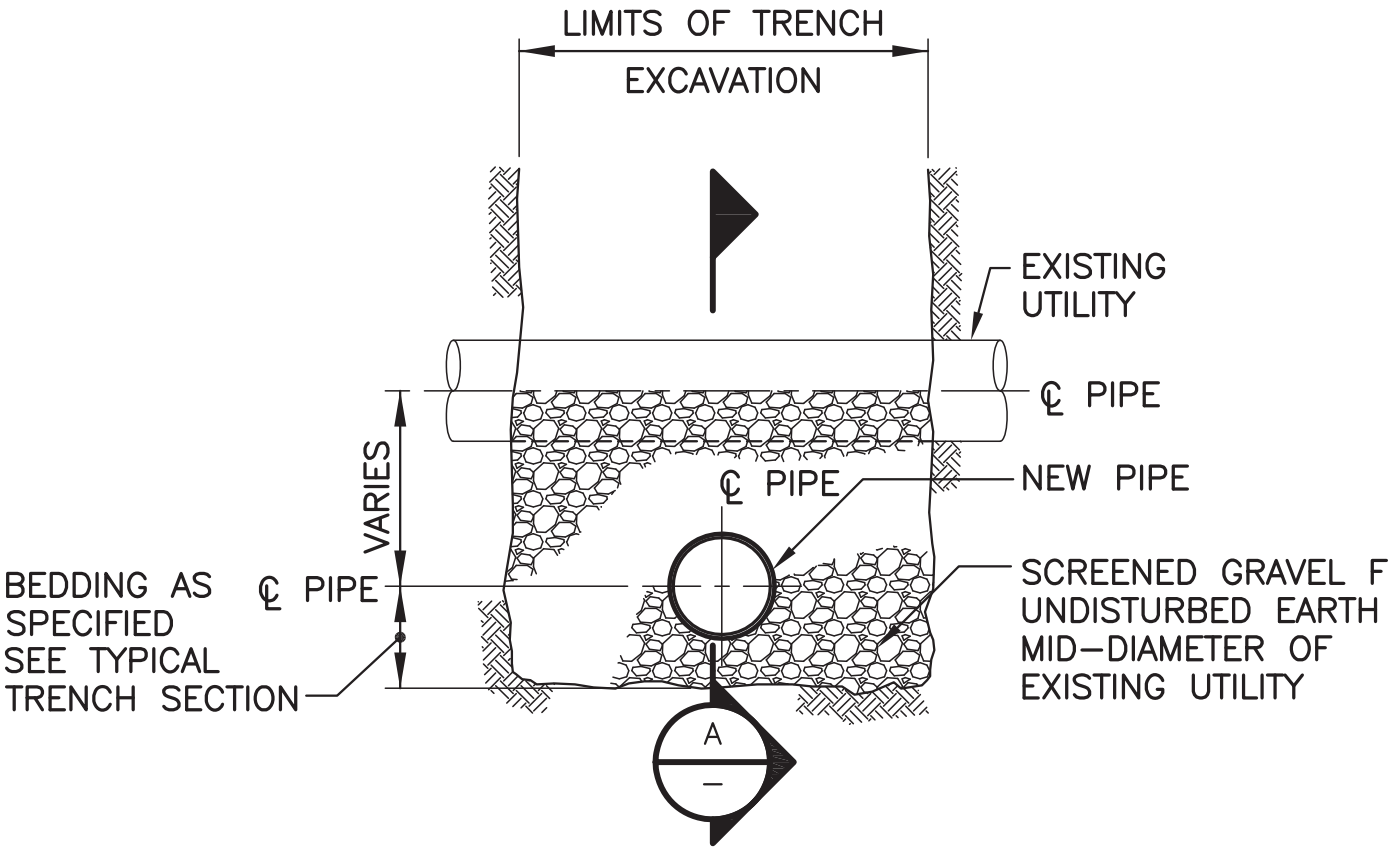
SECTION

NOTE: FOR PIPES OTHER THAN PVC, TOP OF DAM TO BE AT MID–DIAMETER OF PIPE.

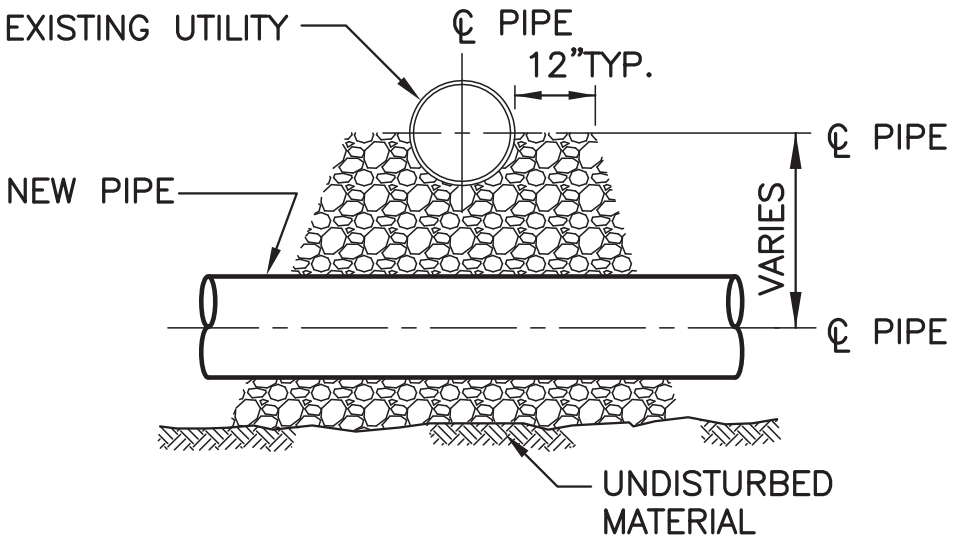
PIPE TRENCH DAM DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-6 DATE JULY 2012



TYPICAL SECTION

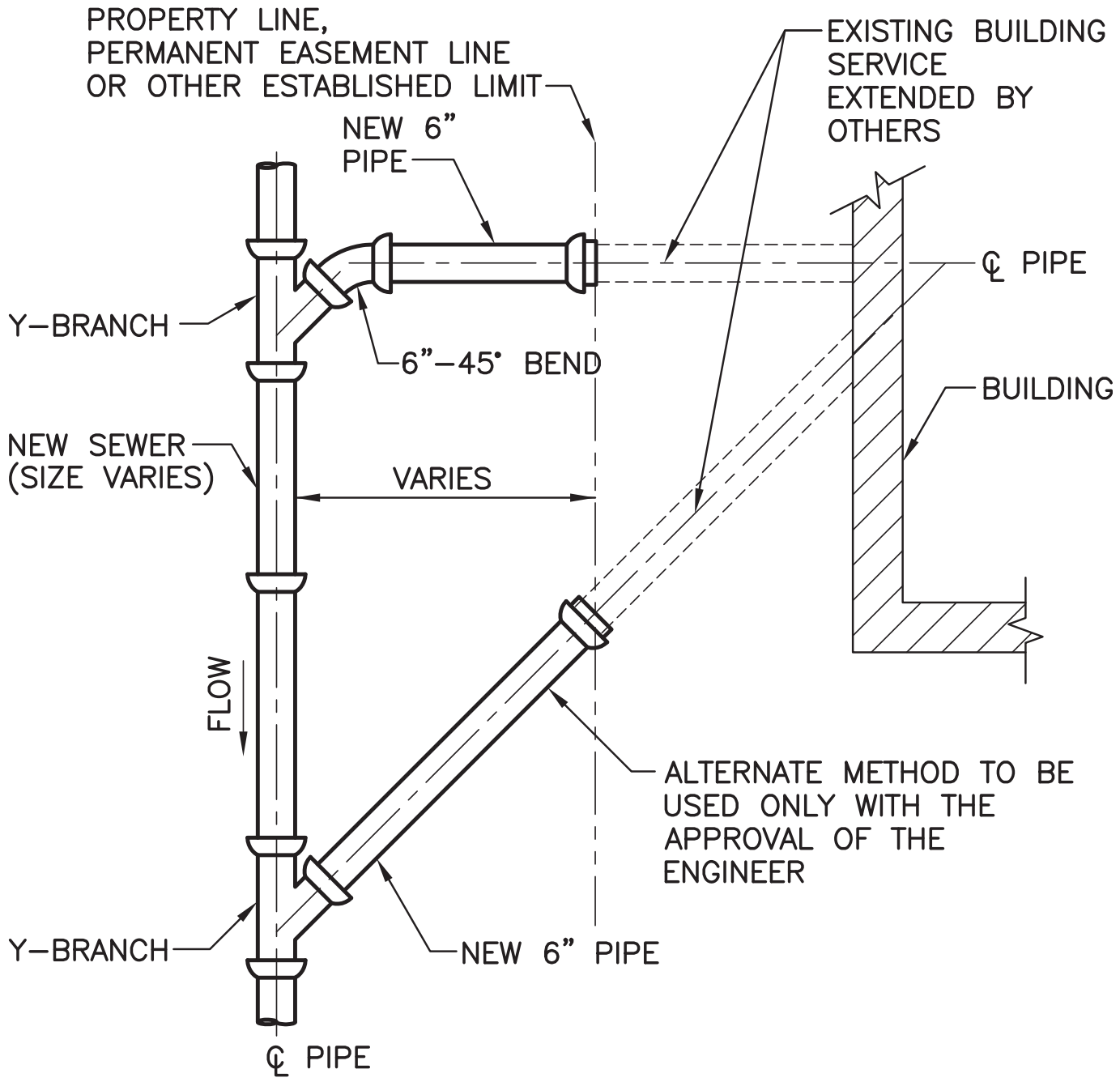


SECTION A–A

EXISTING UTILITY CROSSING DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-7 DATE JULY 2012

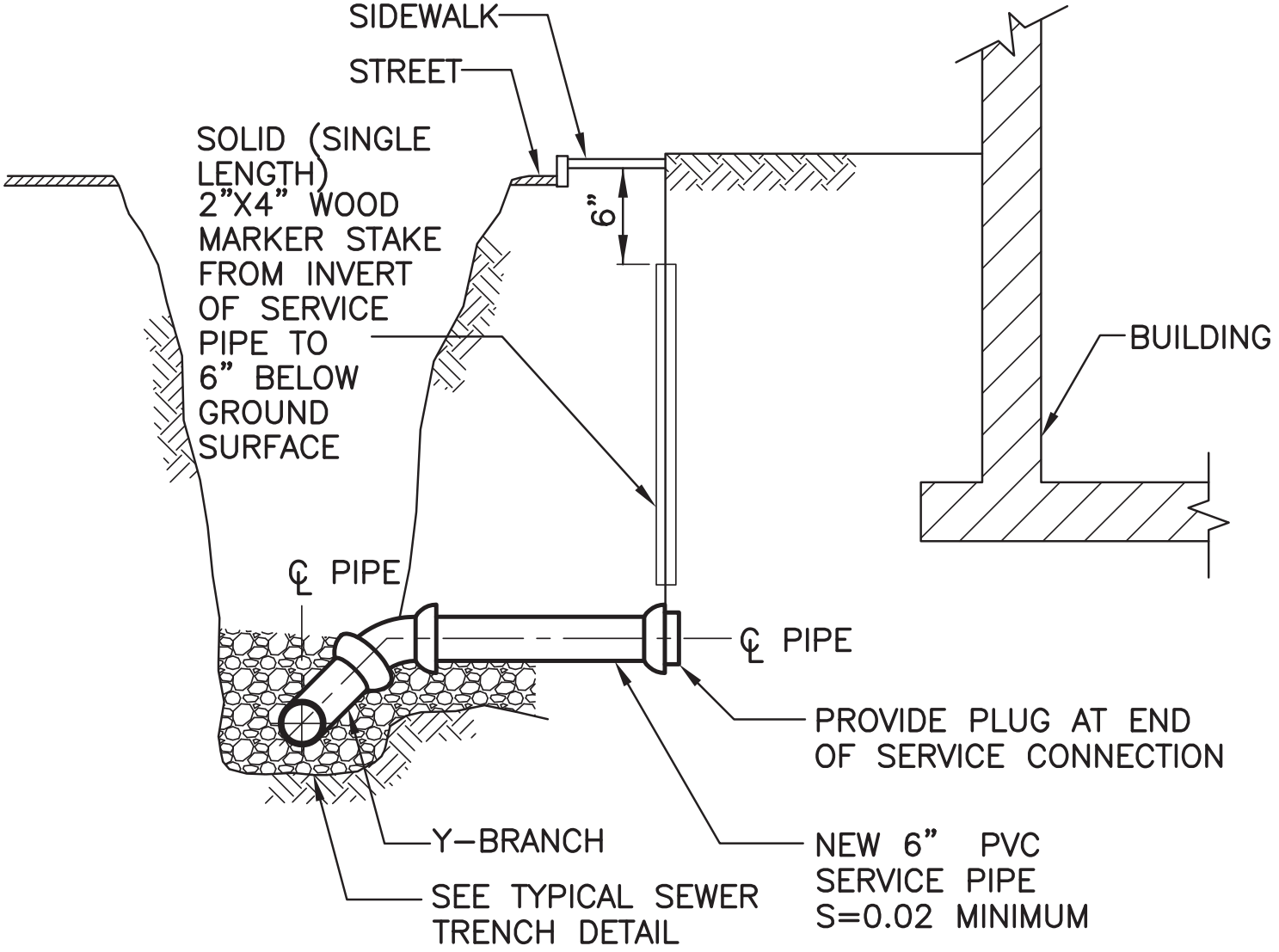


PLAN

SEWER SERVICE CONNECTION DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-8.1 DATE JULY 2012

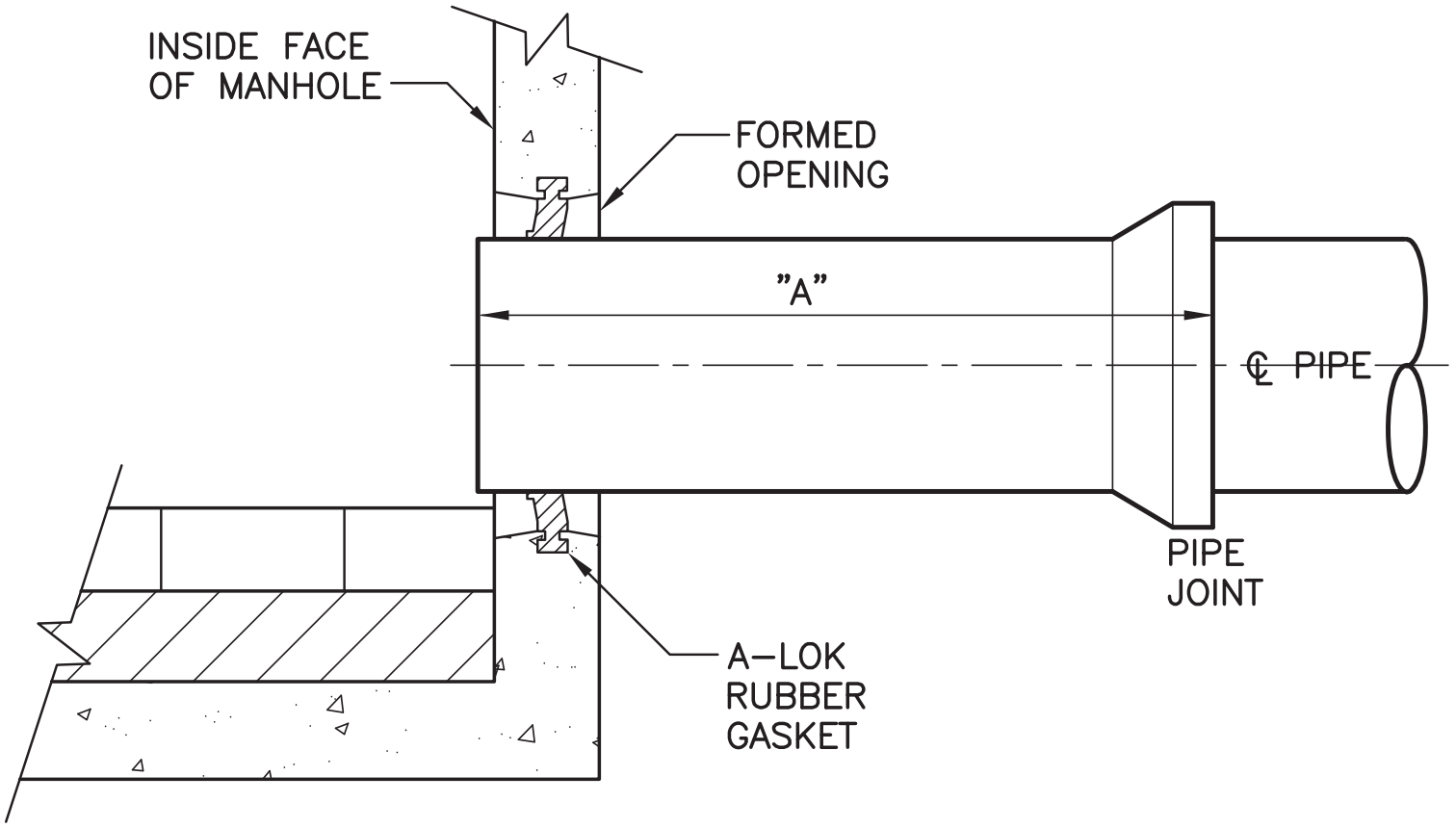


SECTION

SEWER SERVICE CONNECTION DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-8.2 DATE JULY 2012

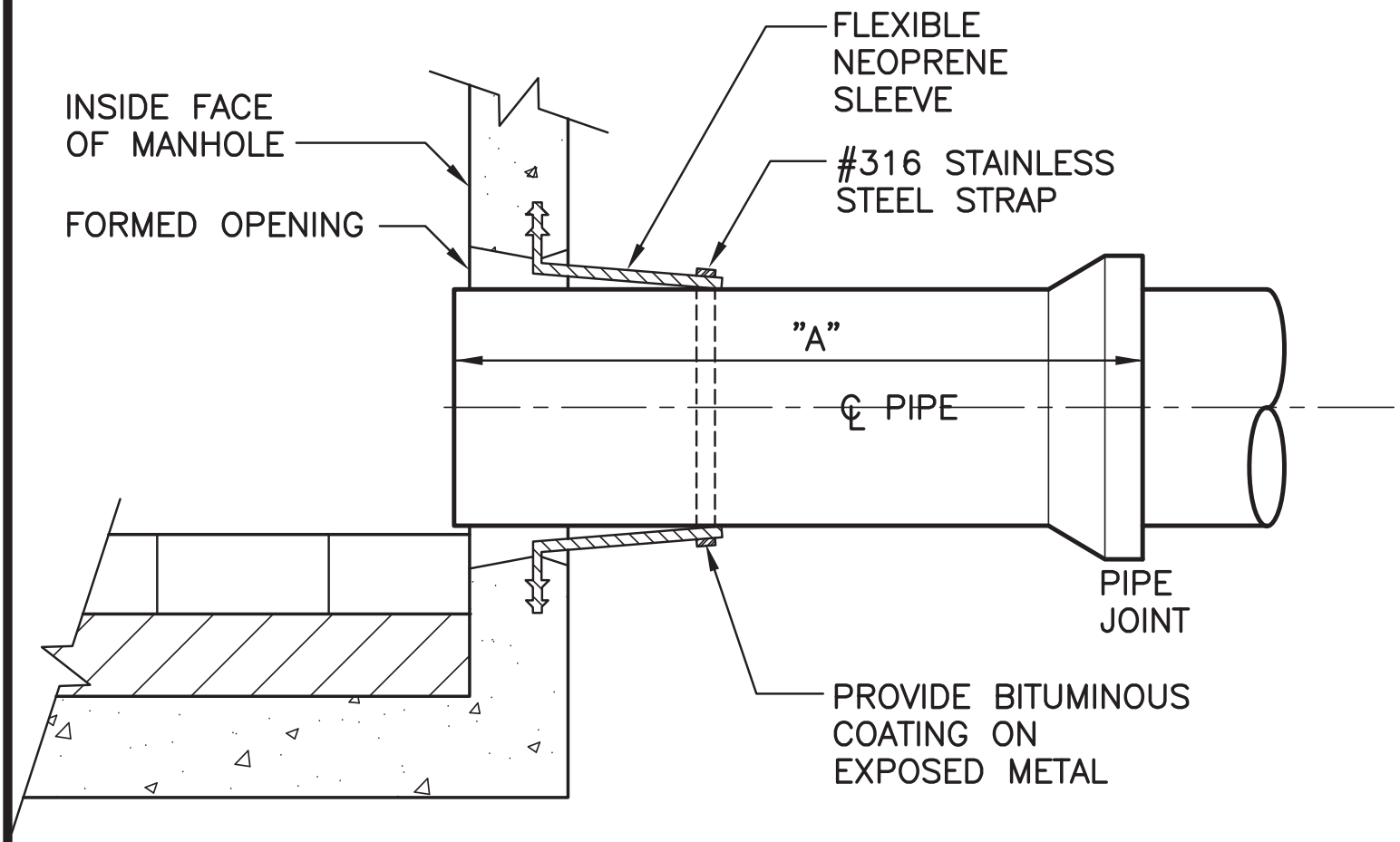


A–LOK SYSTEM

PIPE CONNECTION DETAILS

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-9.1 DATE JULY 2012

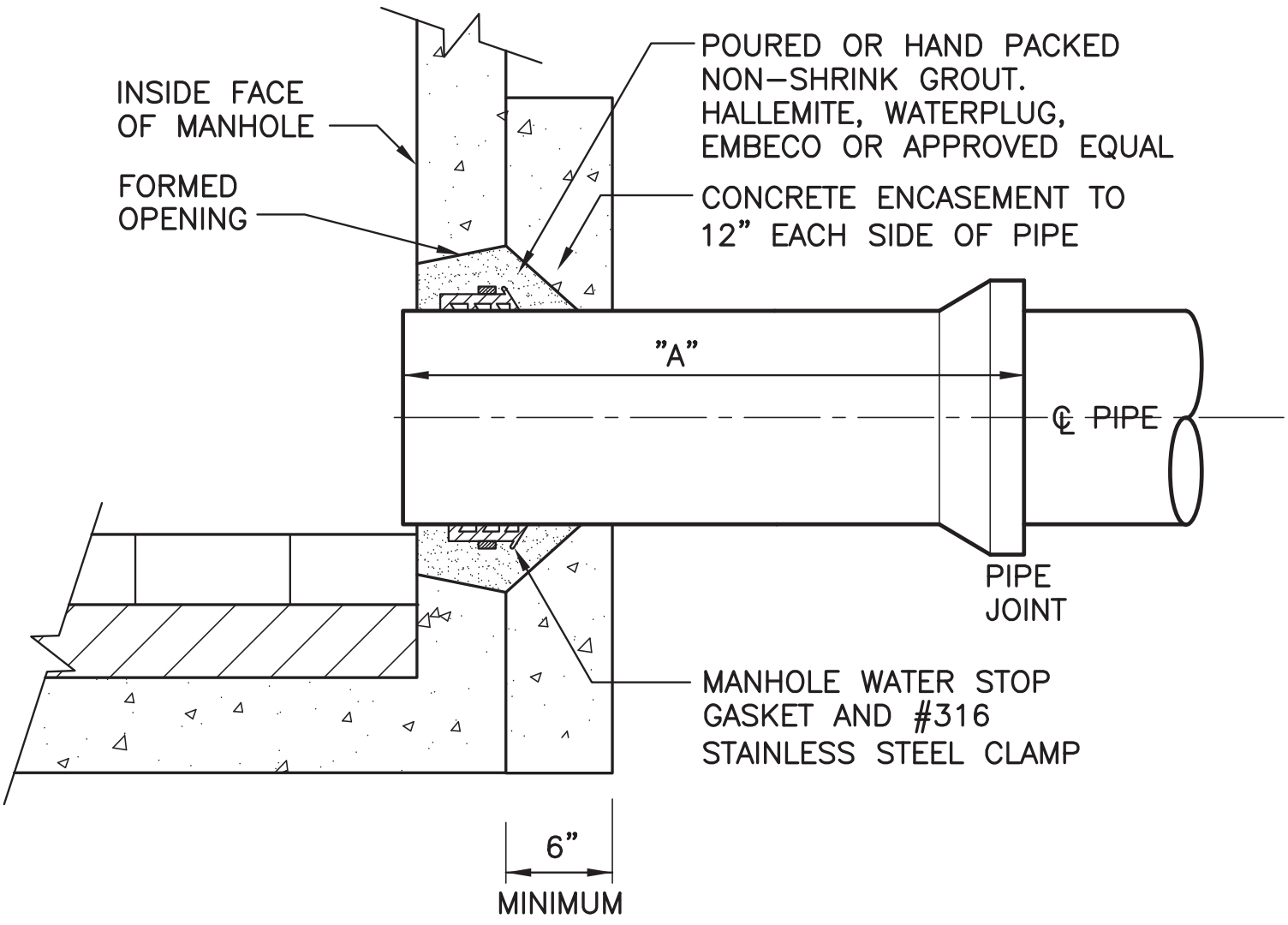


FLEXIBLE SLEEVE

PIPE CONNECTION DETAILS

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-9.2 DATE JULY 2012

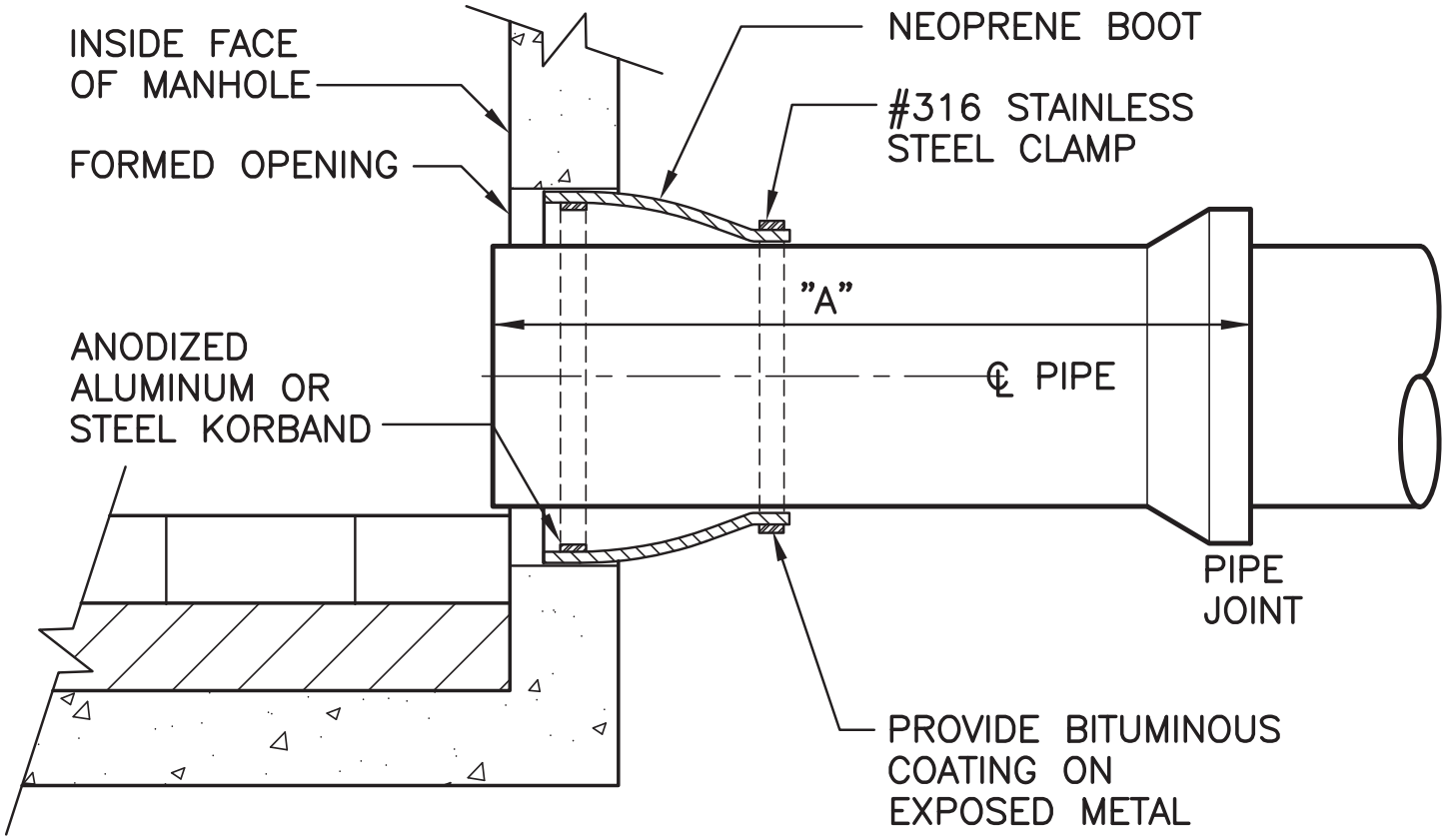


CONCRETE ENCASEMENT

PIPE CONNECTION DETAILS

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-9.3 DATE JULY 2012

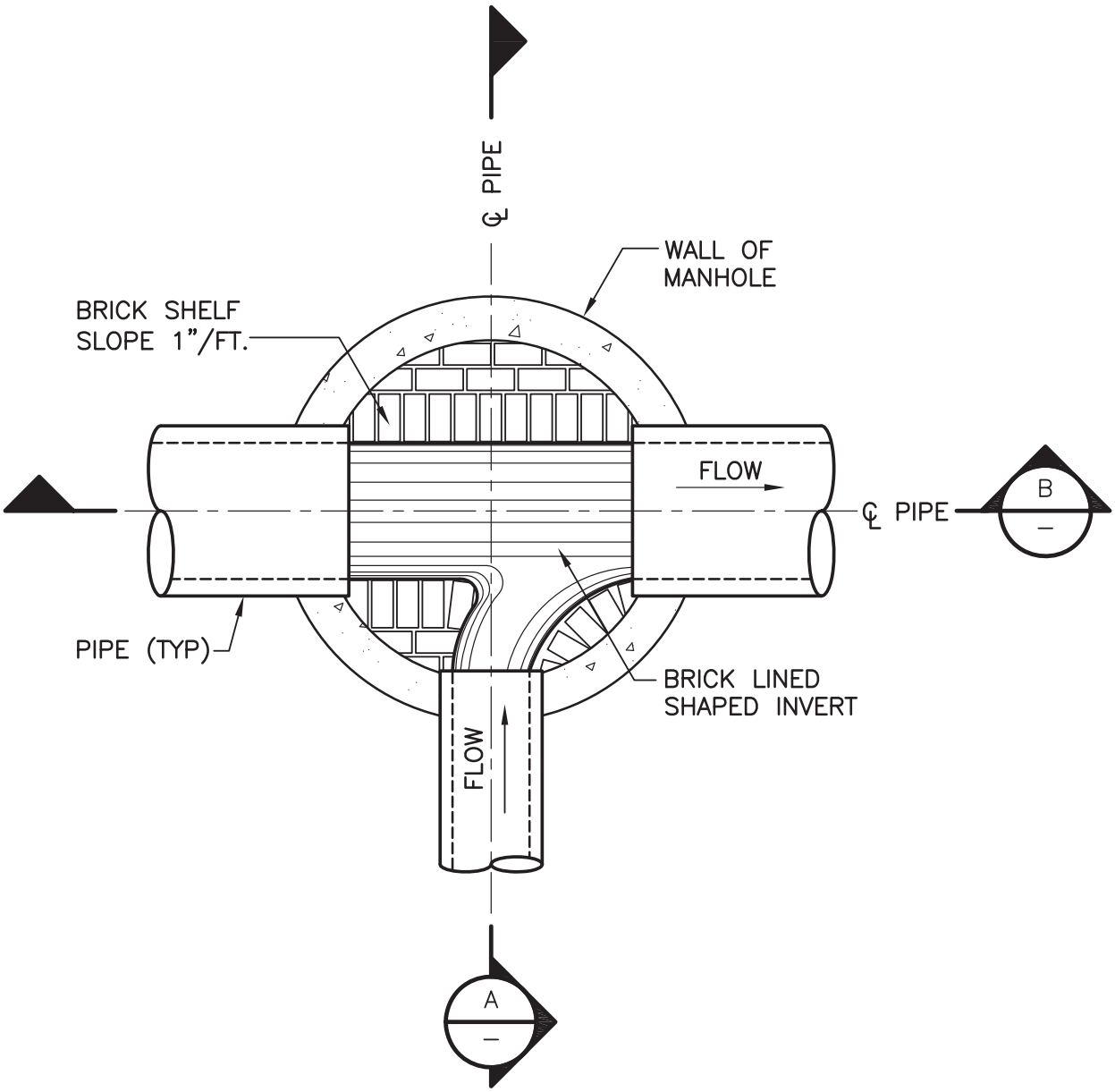


KOR–N–SEAL BOOT

PIPE CONNECTION DETAILS

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-9.4 DATE JULY 2012

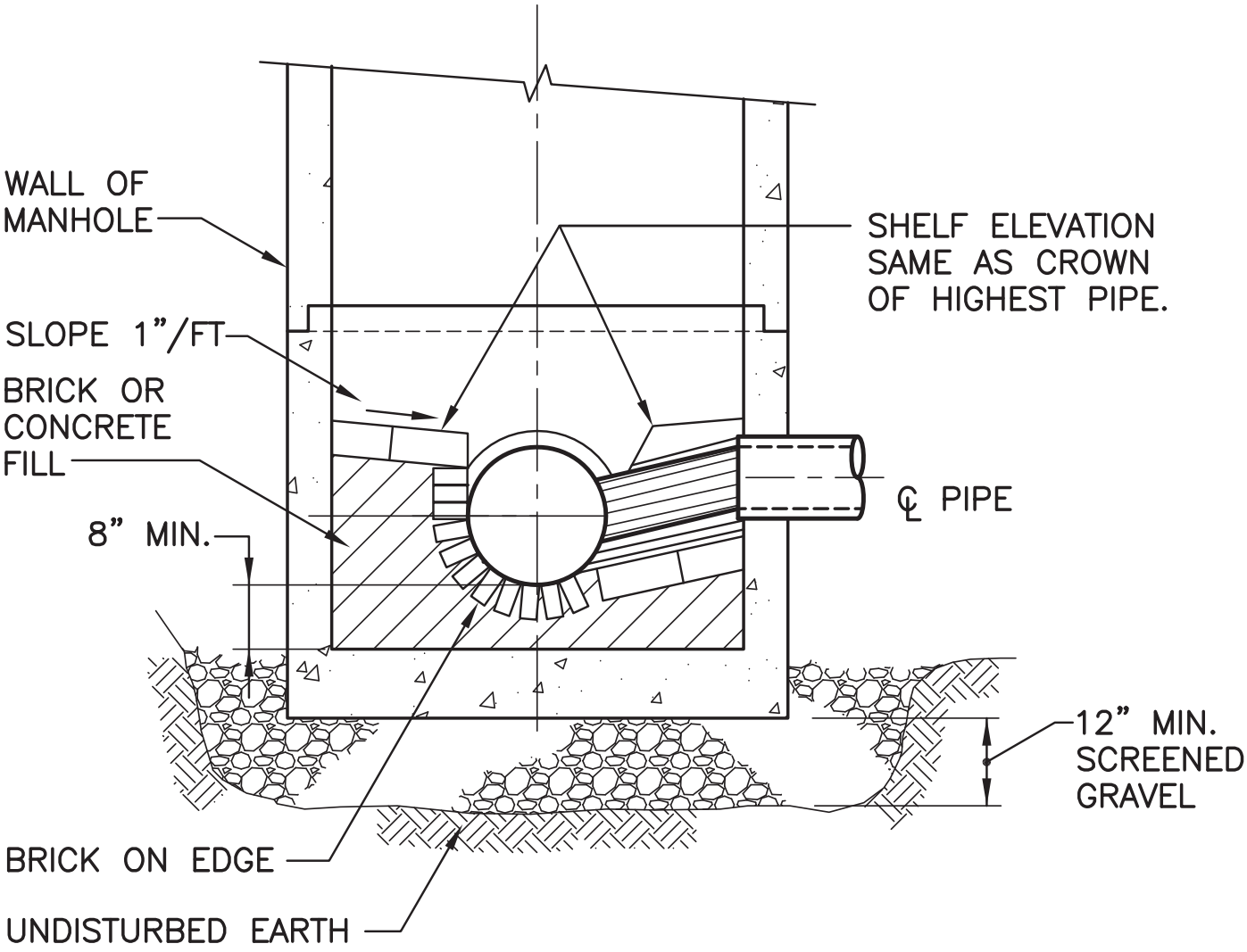


PLAN

TYPICAL PRECAST SEWER MANHOLE

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-10.1 DATE JULY 2012

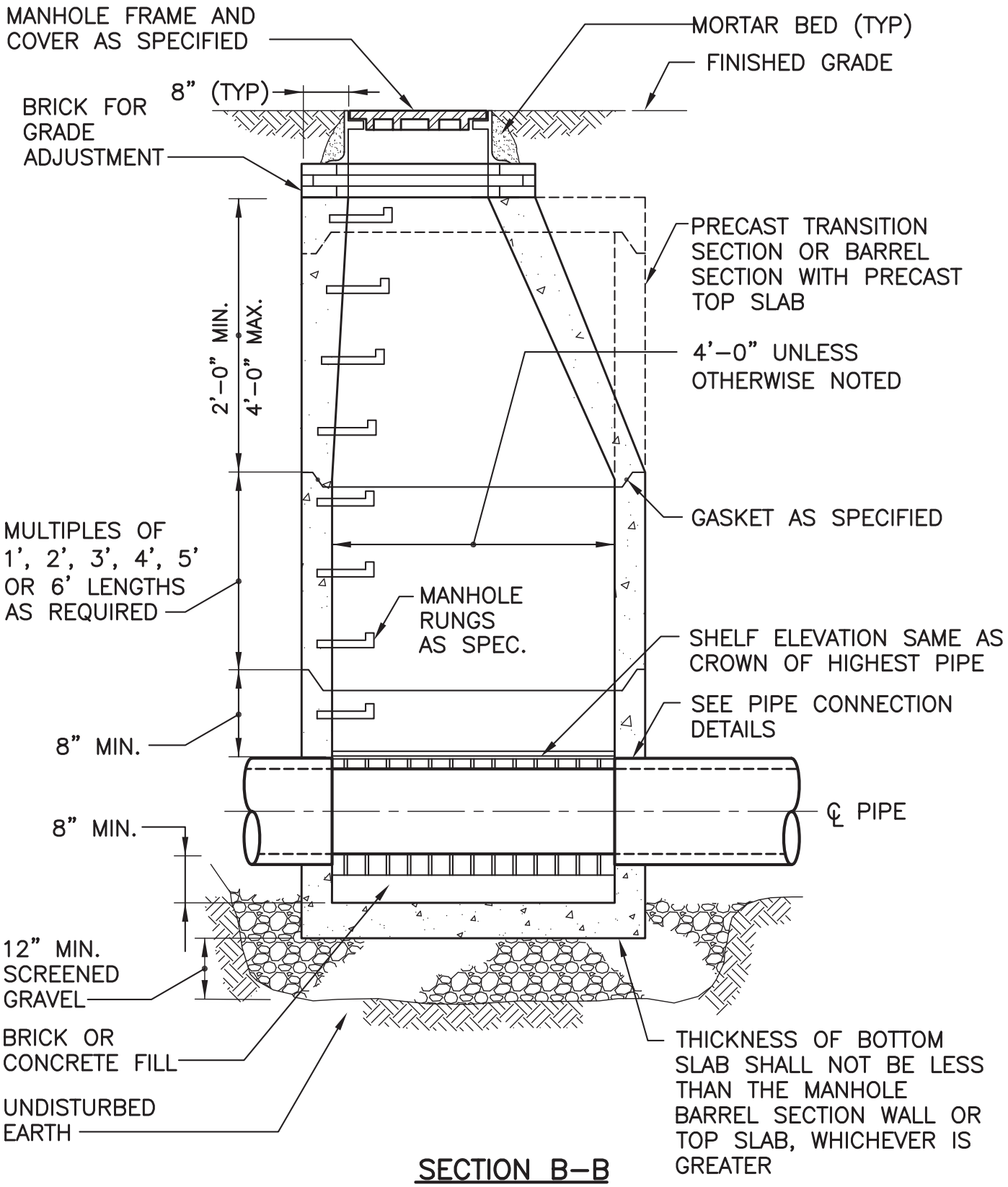


SECTION A–A

TYPICAL PRECAST SEWER MANHOLE

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-10.2 DATE JULY 2012

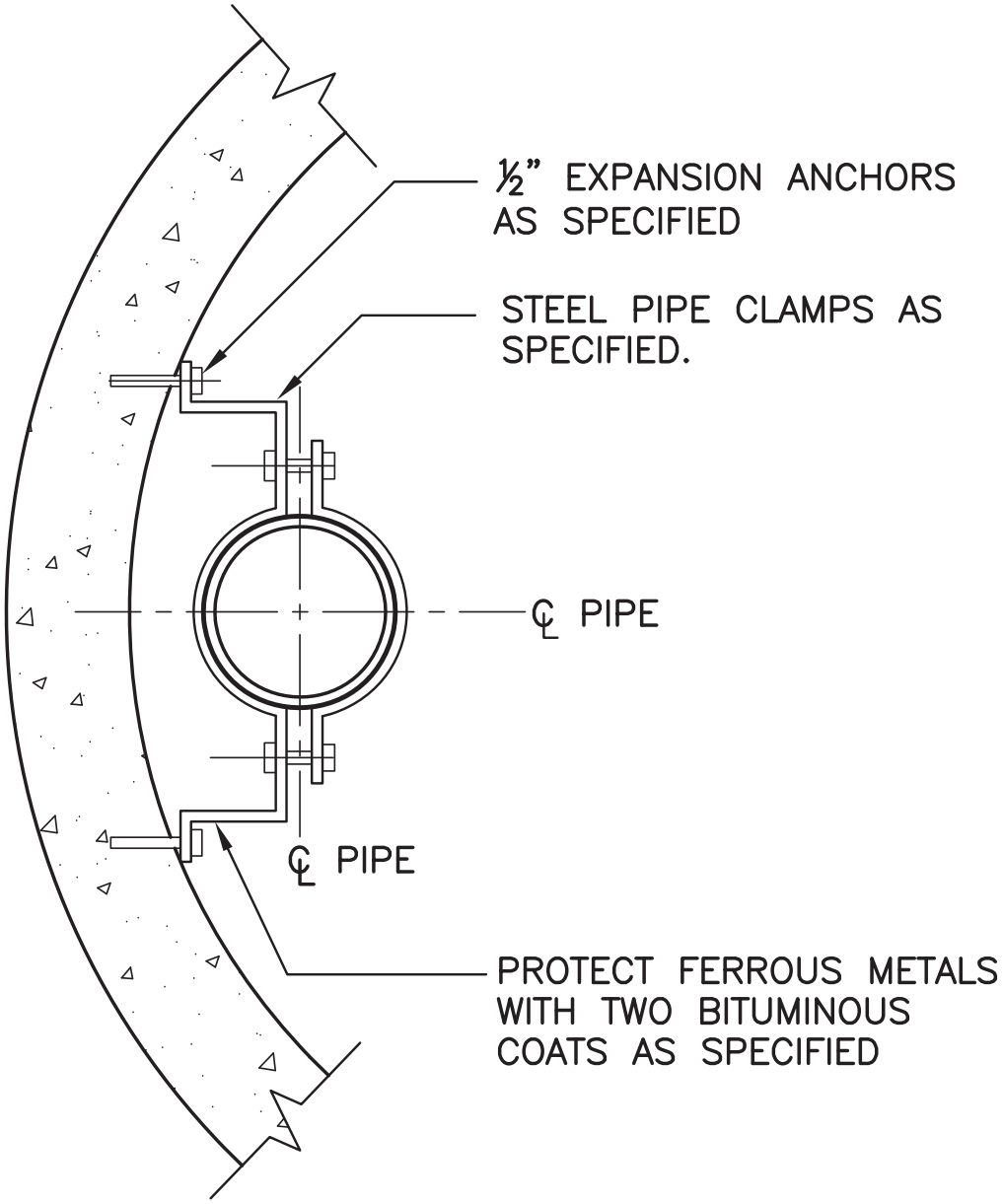


SECTION B–B

TYPICAL PRECAST SEWER MANHOLE

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-10.3 DATE JULY 2012

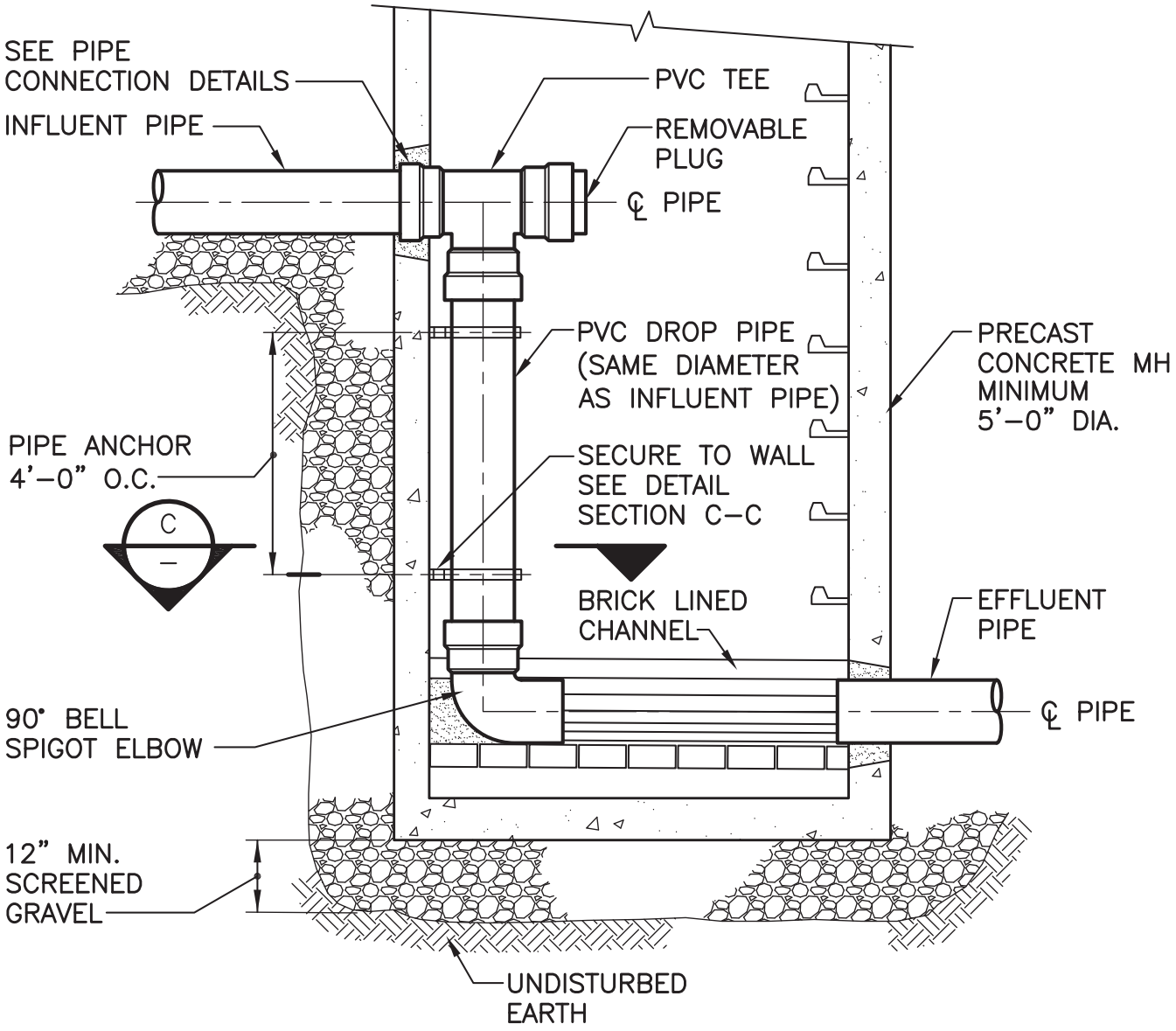


SECTION C–C

PVC DROP CONNECTION ANCHOR DETAIL

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-11 DATE JULY 2012



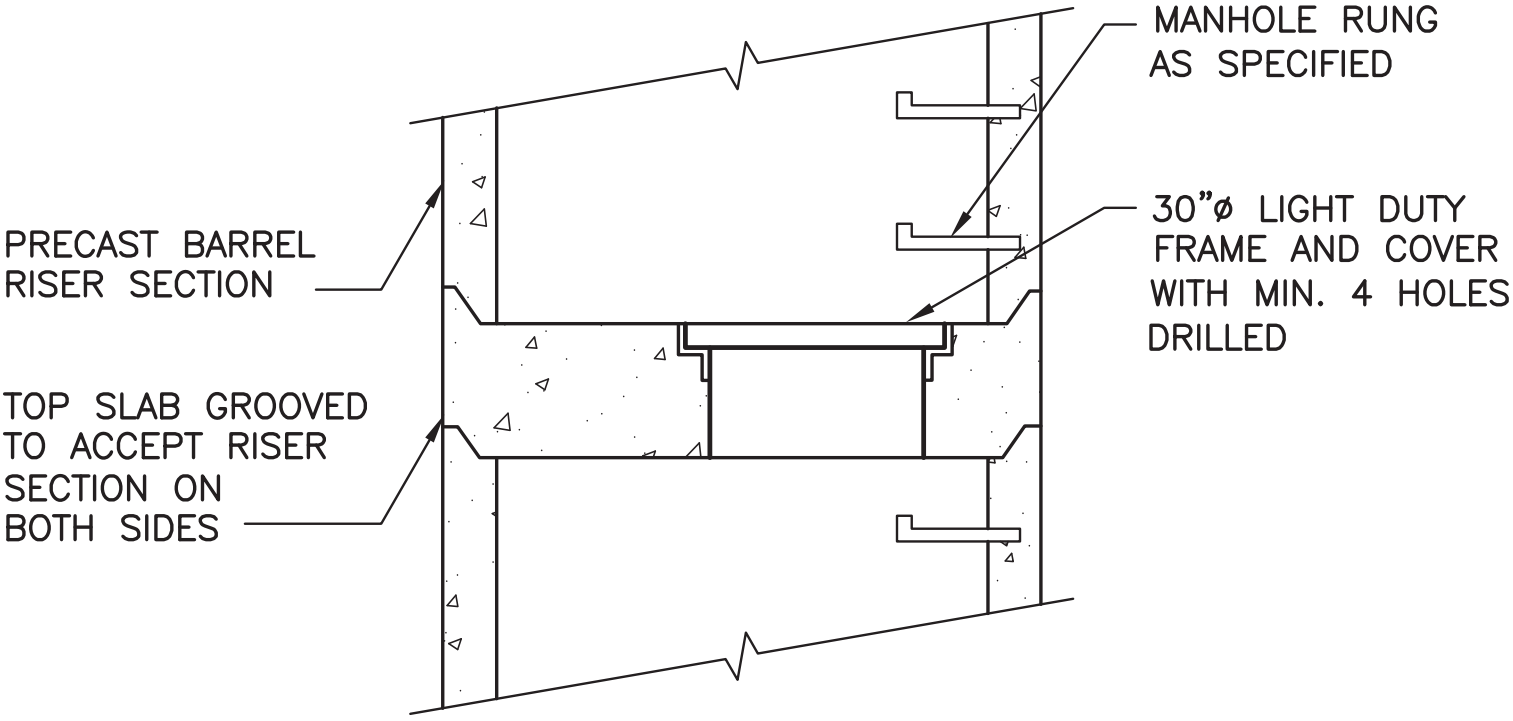
NOTE: MINIMUM 5'–0" DIA. MANHOLES SHALL BE USED AT ALL DROP MANHOLE LOCATIONS.

SECTION

PVC DROP CONNECTION (INTERNAL)

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-12 DATE JULY 2012

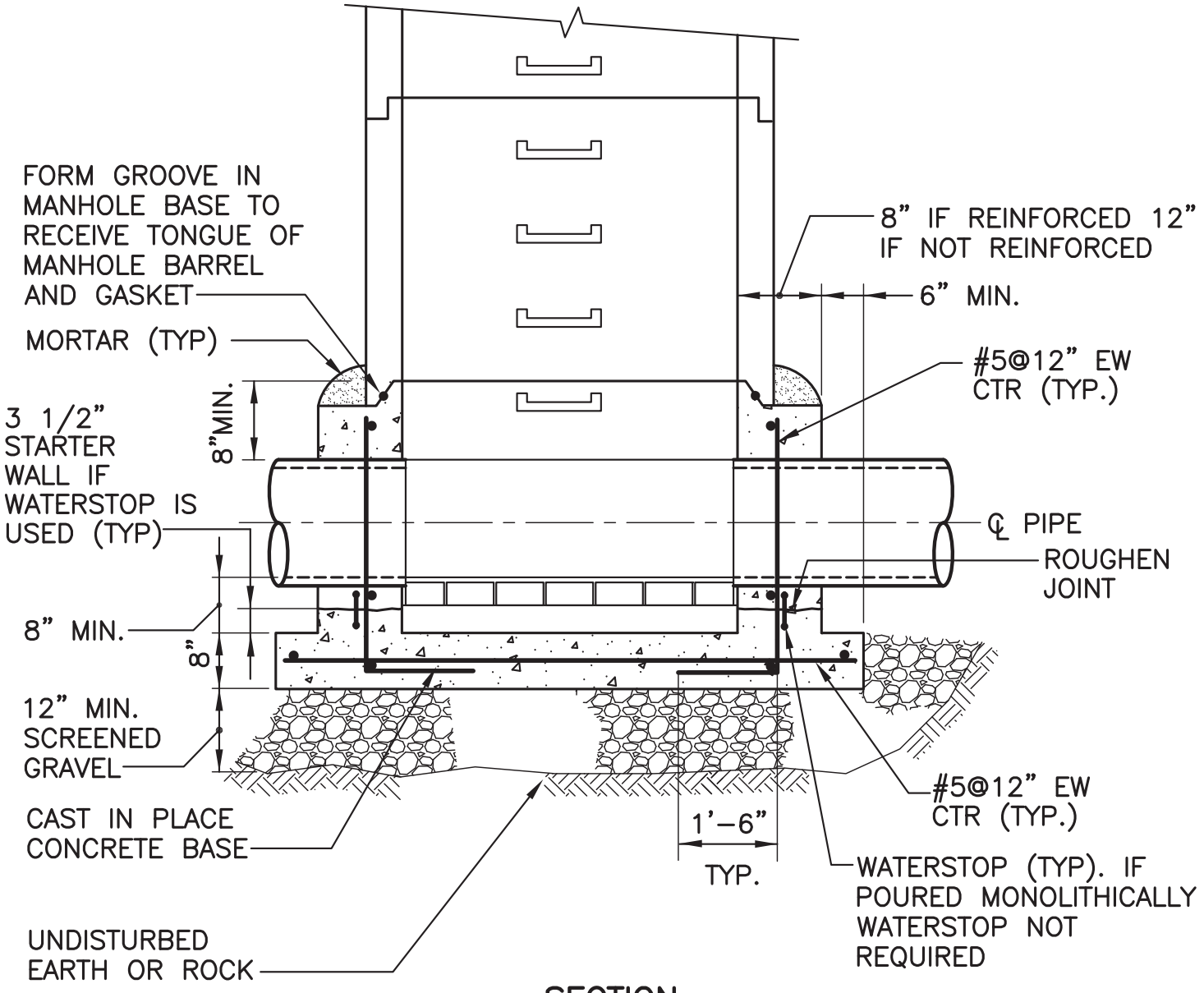


INTERMEDIATE LANDING FOR PRECAST MANHOLES

(FOR USE WITH DEEP MANHOLES)

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-13 DATE JULY 2012



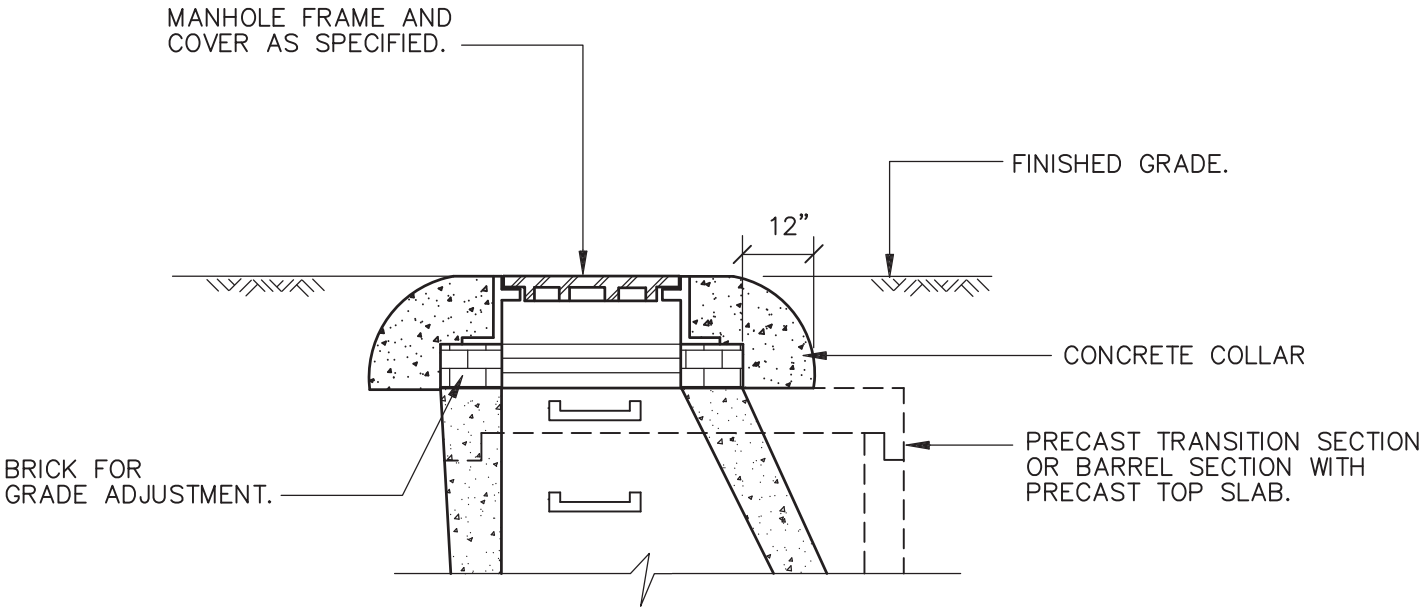
SECTION

TYPICAL PRECAST MANHOLE WITH CAST-IN-PLACE BASE

NTS

FOR ALL OTHER REQUIREMENTS OTHER THAN CAST-IN-PLACE BASE, SEE TYPICAL PRECAST SEWER MANHOLE DETAIL.

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-14 DATE JULY 2012



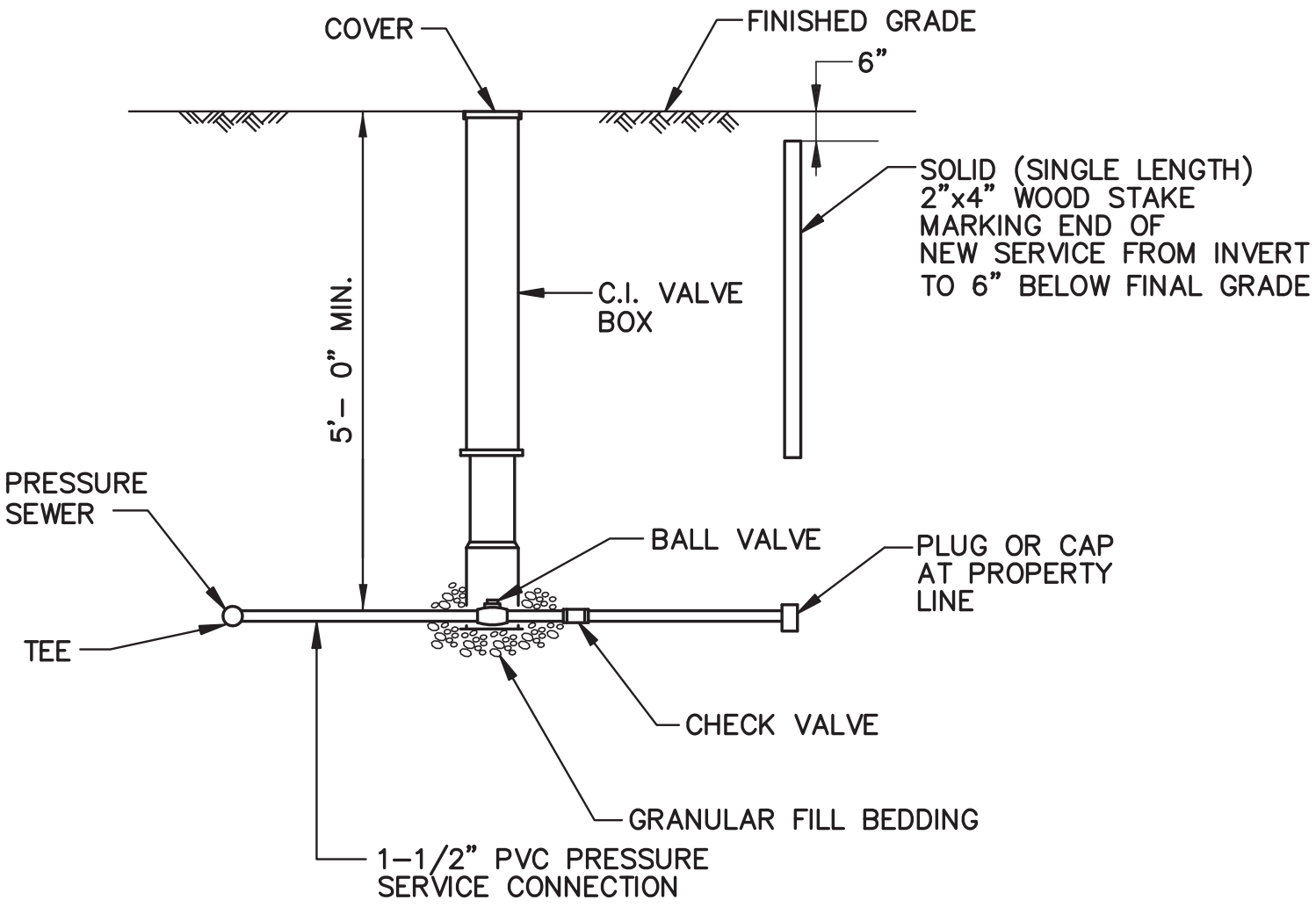
GRAVEL ROAD CONCRETE COLLAR DETAIL

NTS

TOWN OF TEWKSBURY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

SEWER
CONSTRUCTION
STANDARDS

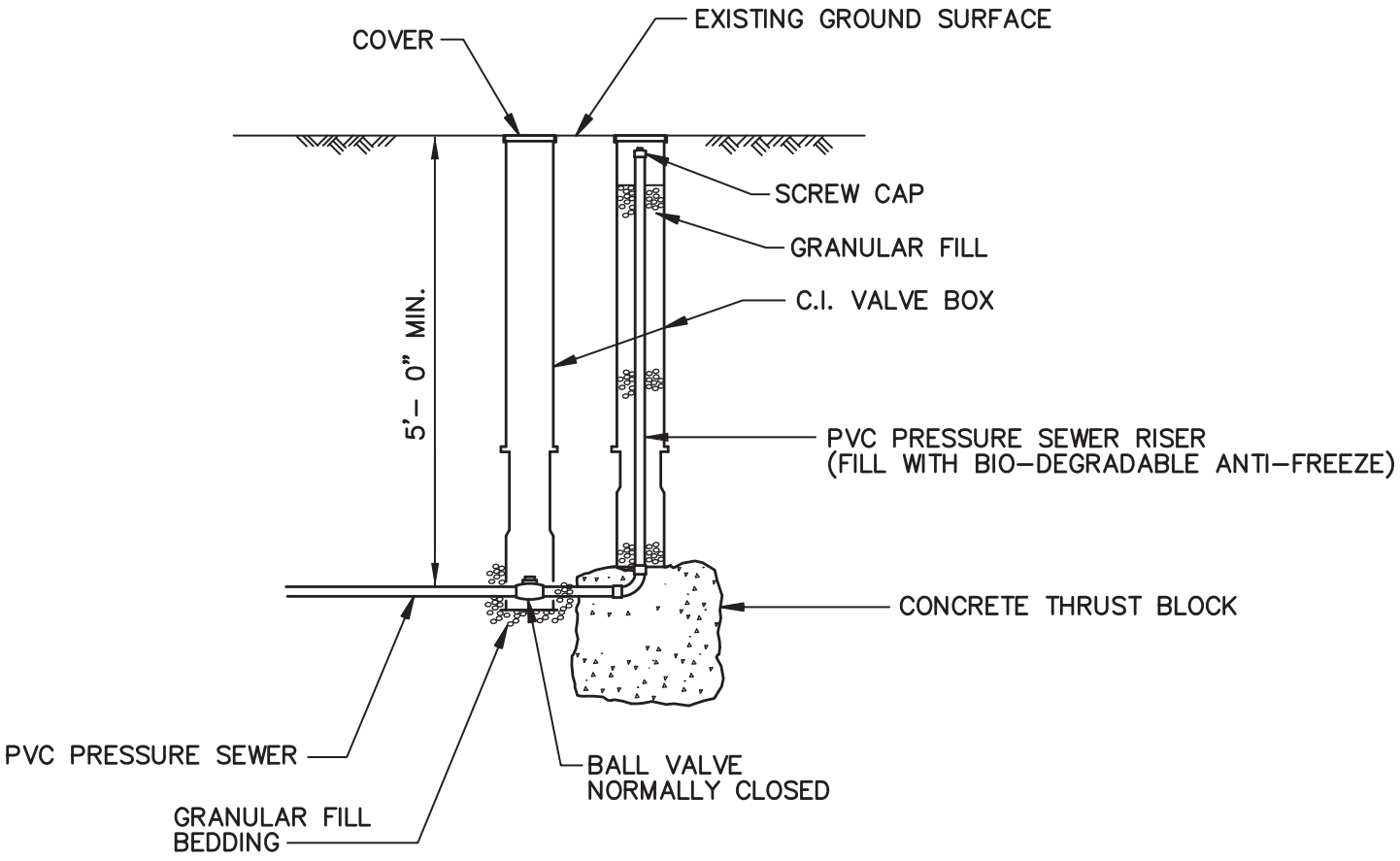
DETAIL
A-15
DATE
JULY 2012



SERVICE LINE CONNECTION TO PRESSURE SEWER

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-16 DATE JULY 2012



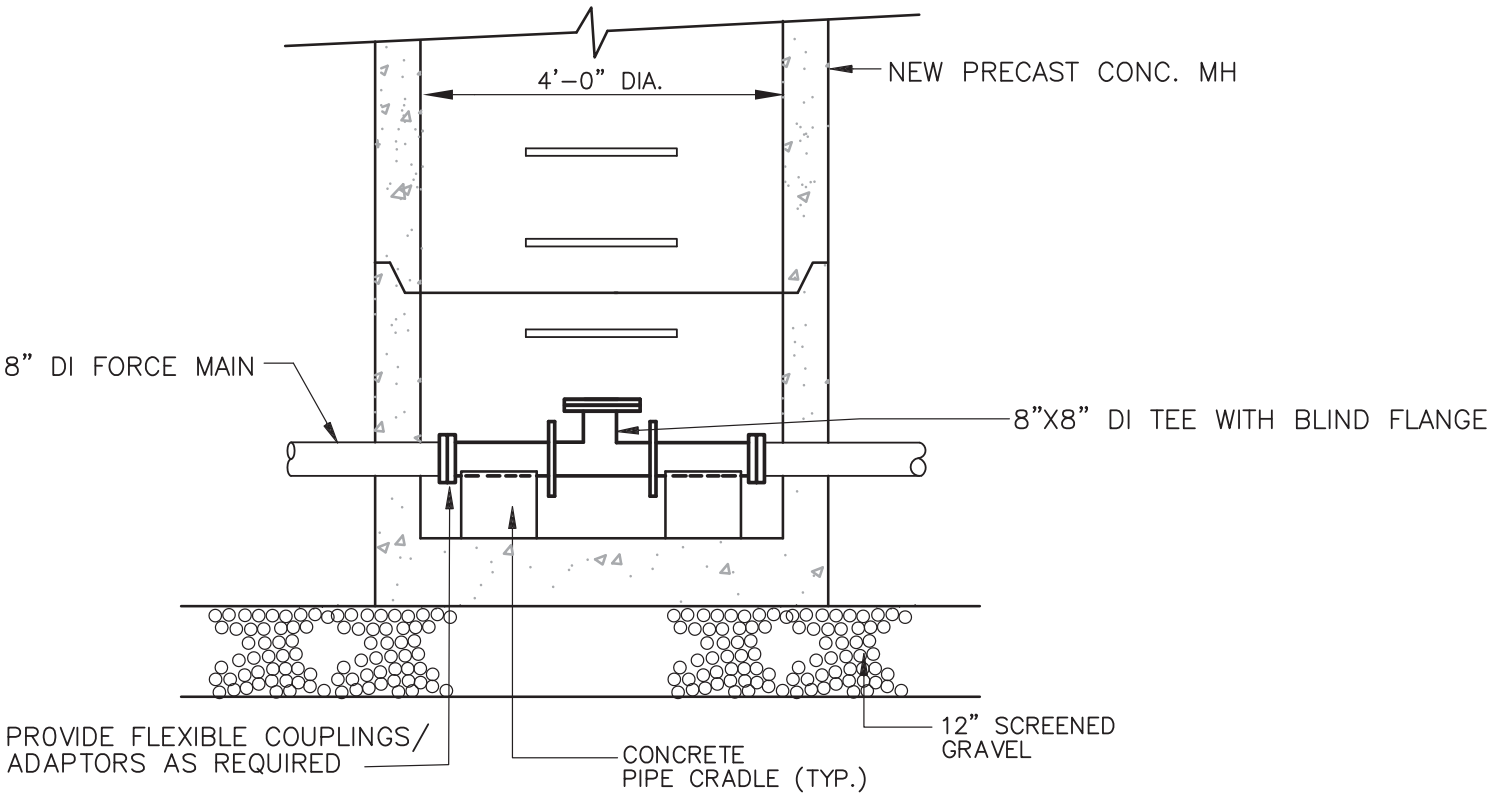
PRESSURE SEWER FLUSHING CONNECTION

NTS

TOWN OF TEWKSBURY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION

SEWER
CONSTRUCTION
STANDARDS

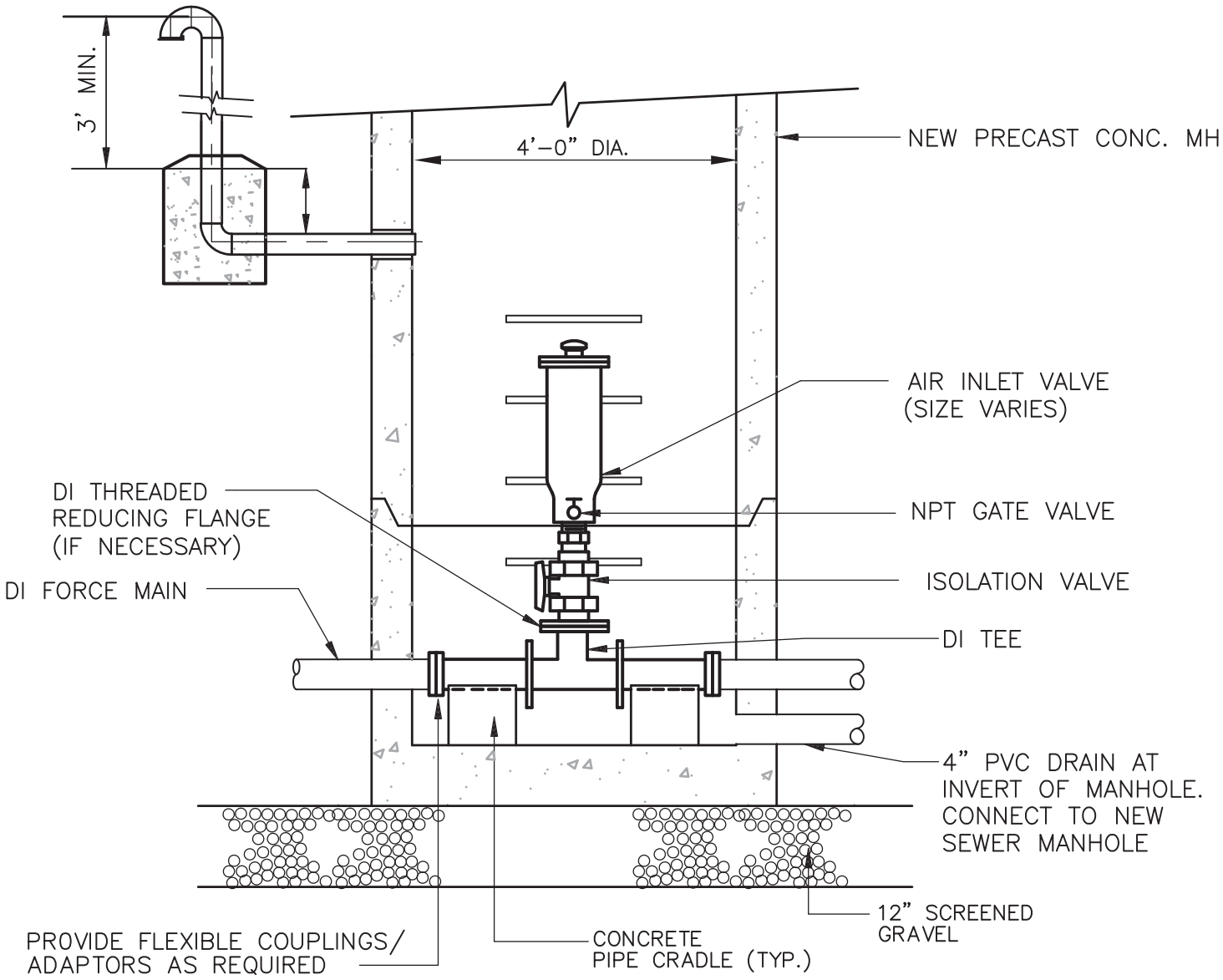
DETAIL
A-17
DATE
JULY 2012



FORCE MAIN CLEANOUT DETAIL

NTS

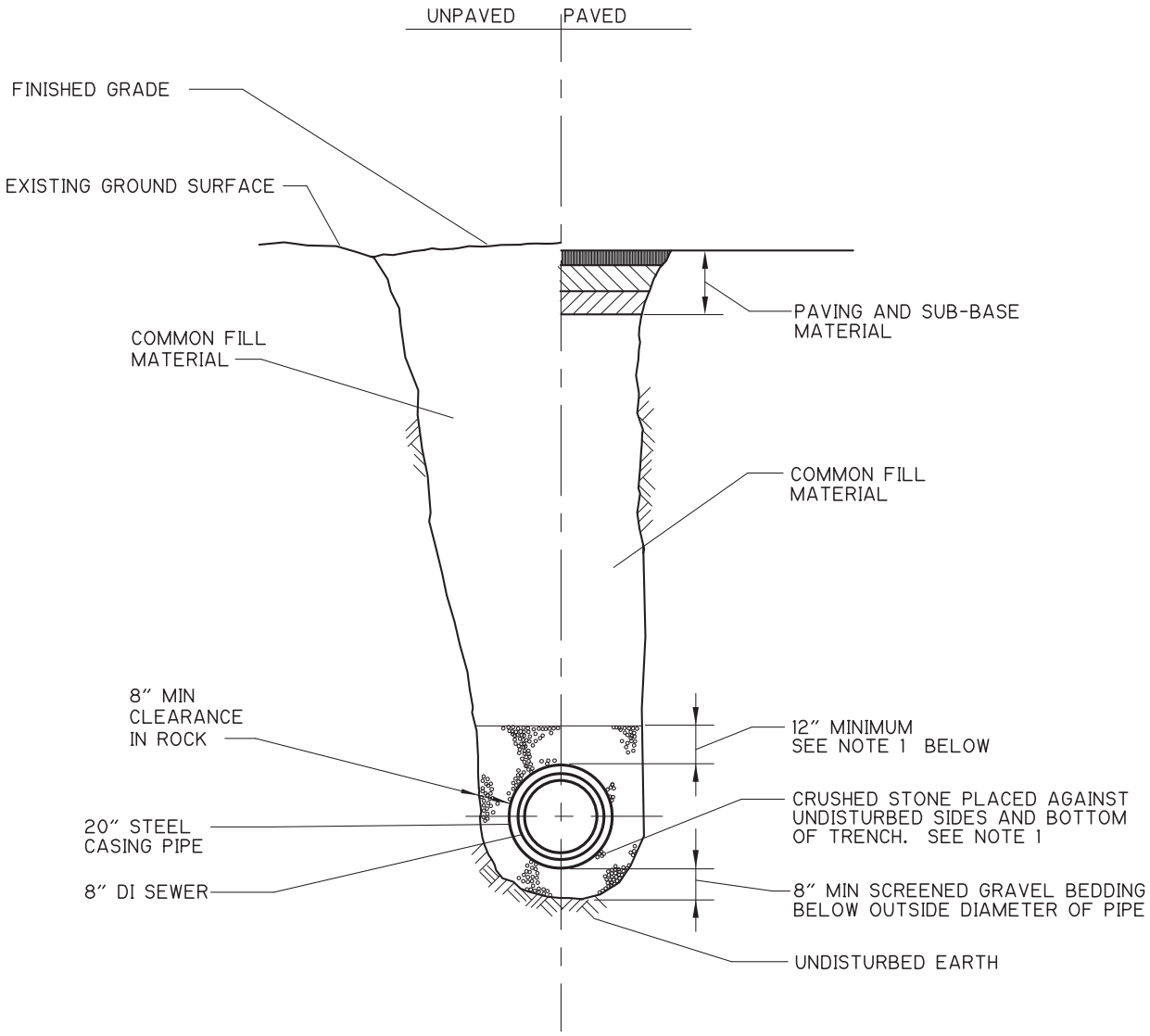
TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-18 DATE JULY 2012



AIR INLET VALVE

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-19 DATE JULY 2012

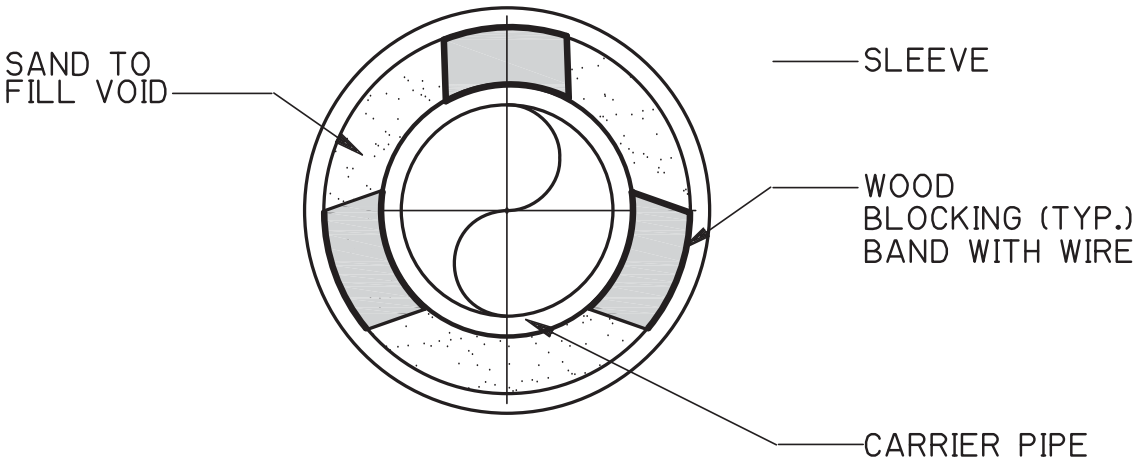


TRENCH FOR SEWER PIPE AT RAILROAD CROSSING

DETAIL

NTS

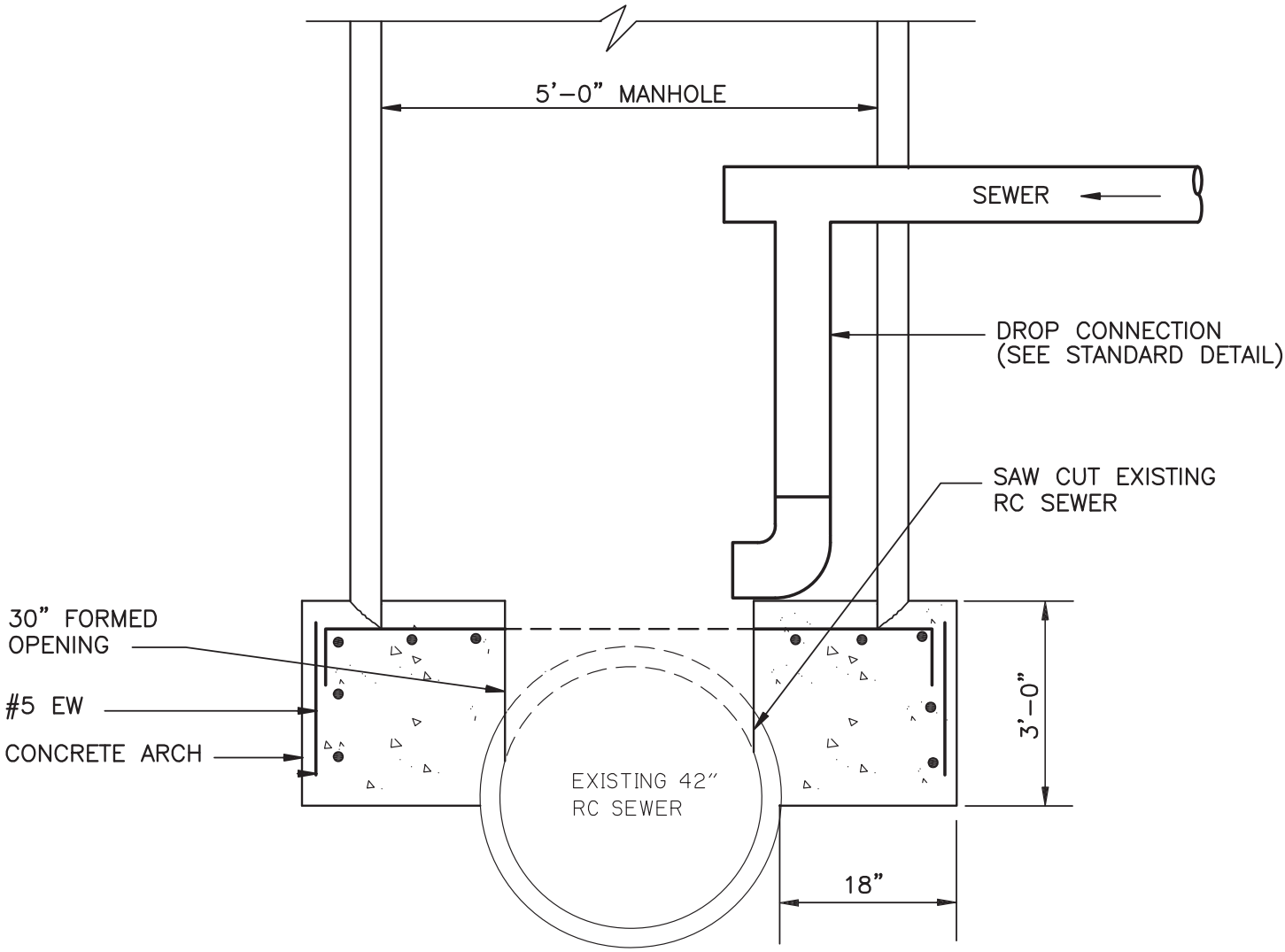
TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-20.1 DATE JULY 2012



TYPICAL JACKING SLEEVE SECTION

NTS

TOWN OF TEWKSBURY DEPARTMENT OF PUBLIC WORKS ENGINEERING DIVISION	SEWER CONSTRUCTION STANDARDS	DETAIL A-20.2 DATE JULY 2012



CONNECTION TO EXISTING SEWER

NTS