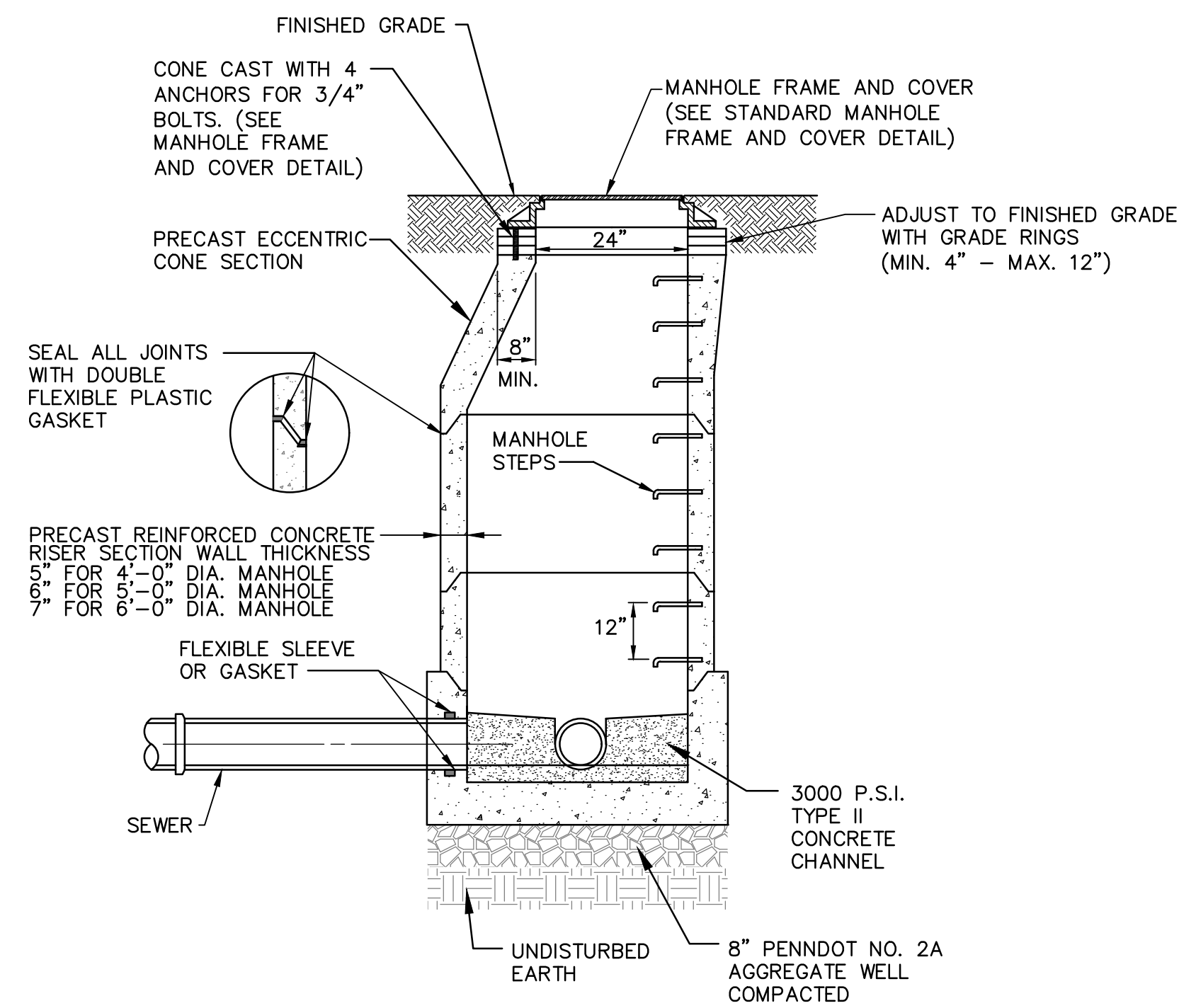
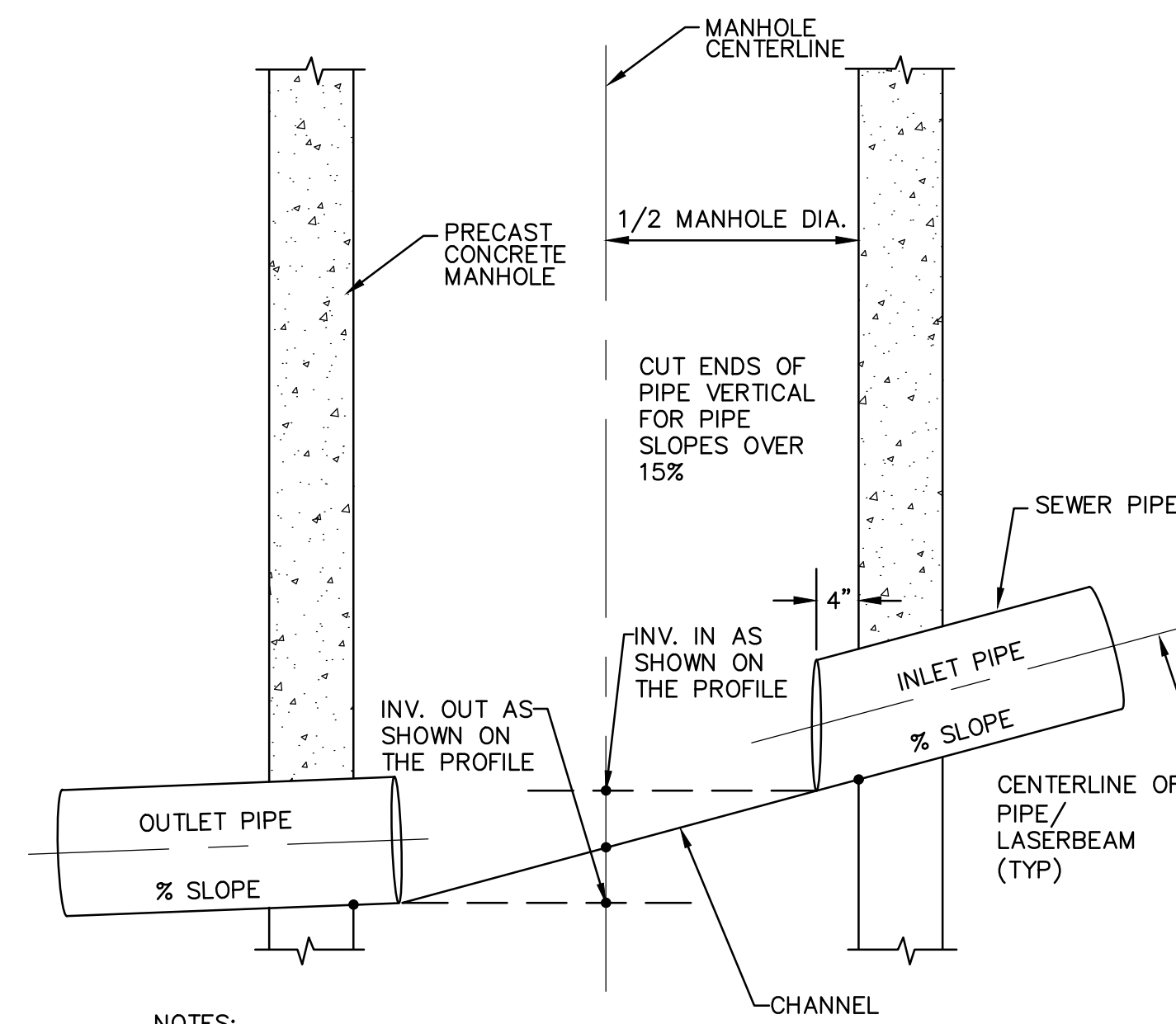


**STANDARD MANHOLE FRAME AND COVER**  
NOT TO SCALE



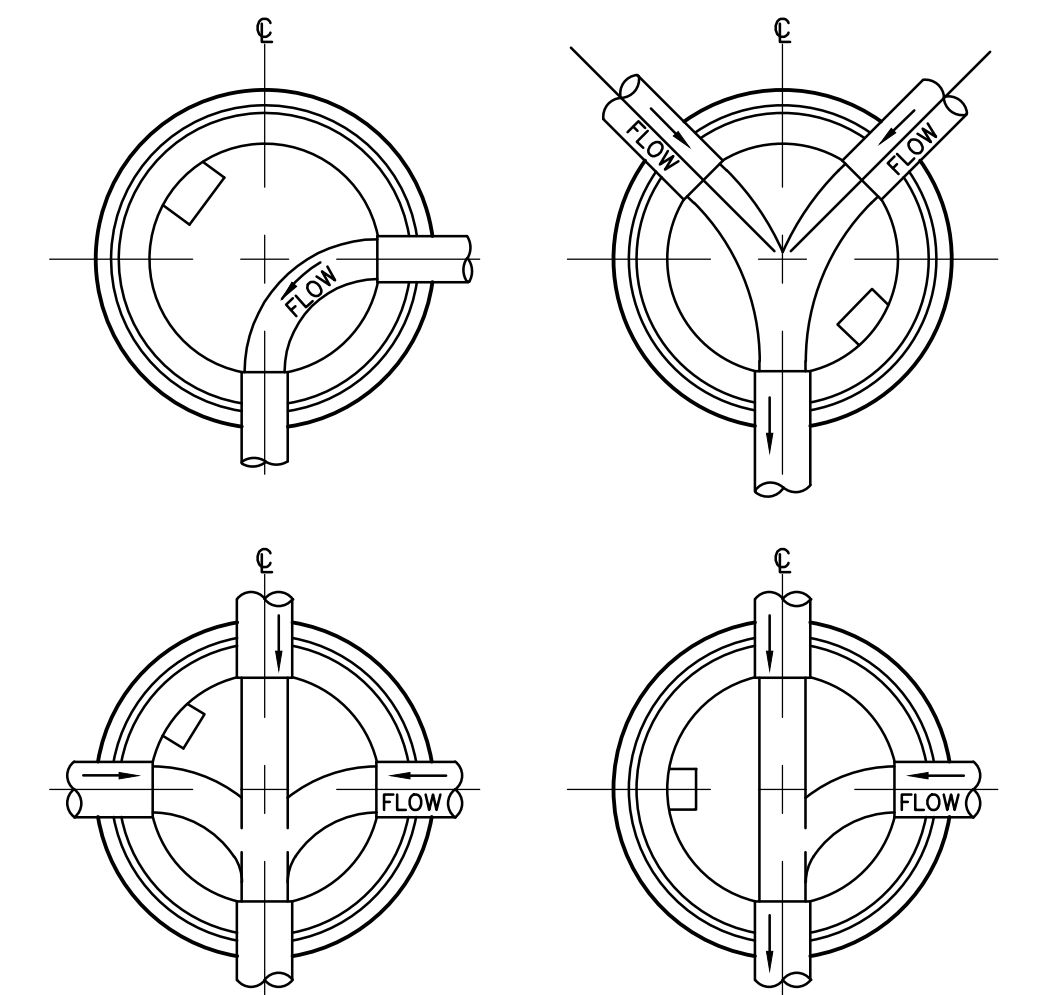
**STANDARD SEWER MANHOLE DETAIL**  
NOT TO SCALE

- NOTES:
- FOR MANHOLES IN PAVED AREAS, INSTALL FRAME AND COVERS 1/8" BELOW FINAL PAVEMENT GRADE.
  - THE ENTIRE OUTER SURFACE OF THE MANHOLE SHALL BE COATED WITH 2 COATS BITUMASTIC.
  - 100% COMPACTION OF MANHOLE BACKFILL REQUIRED.
  - FLOW CHANNEL BENCH HEIGHT TO MATCH CROWN OF PIPE.



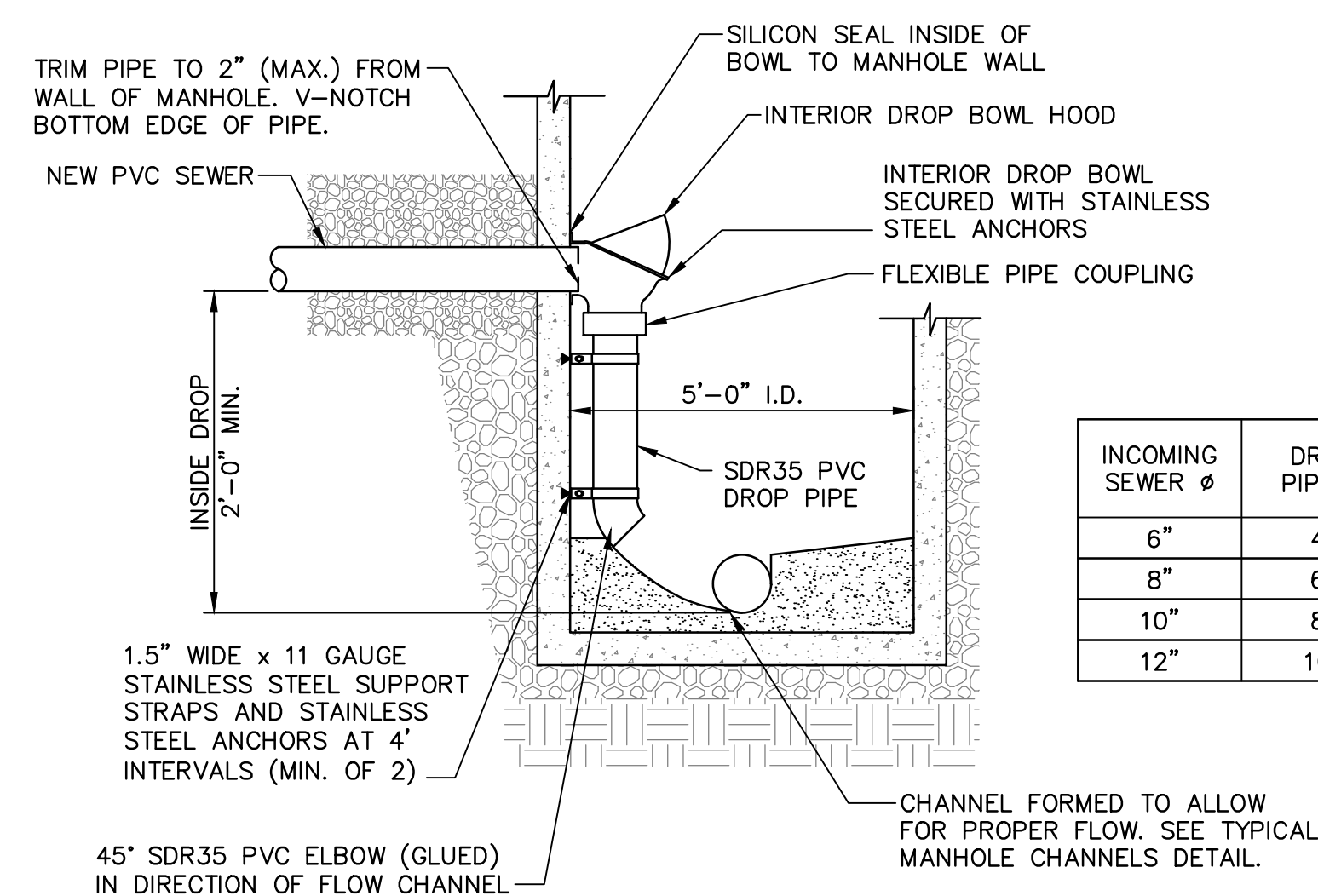
**MANHOLE INVERT DETAIL**  
NOT TO SCALE

- NOTES:
- INLET & OUTLET INVERT ELEVATIONS ARE TO THE CENTER OF THE MANHOLE
  - PROFILE DISTANCE AND SLOPE ARE FROM CENTERLINE OF MANHOLE TO CENTERLINE OF MANHOLE. SLOPE TO BE ADJUSTED AS REQUIRED IN FIELD TO MAINTAIN CENTERLINE INVERT IN AND OUT.
  - FOR EXISTING MANHOLES, WHEN EX INV IS NOT SPECIFIED AS OUT OR IN, ELEVATION IS AT CENTER OF MANHOLE.



**DETAIL OF TYPICAL MANHOLE CHANNELS FOR NEW MANHOLES AND FLOW CHANNEL RECONSTRUCTIONS**  
NOT TO SCALE

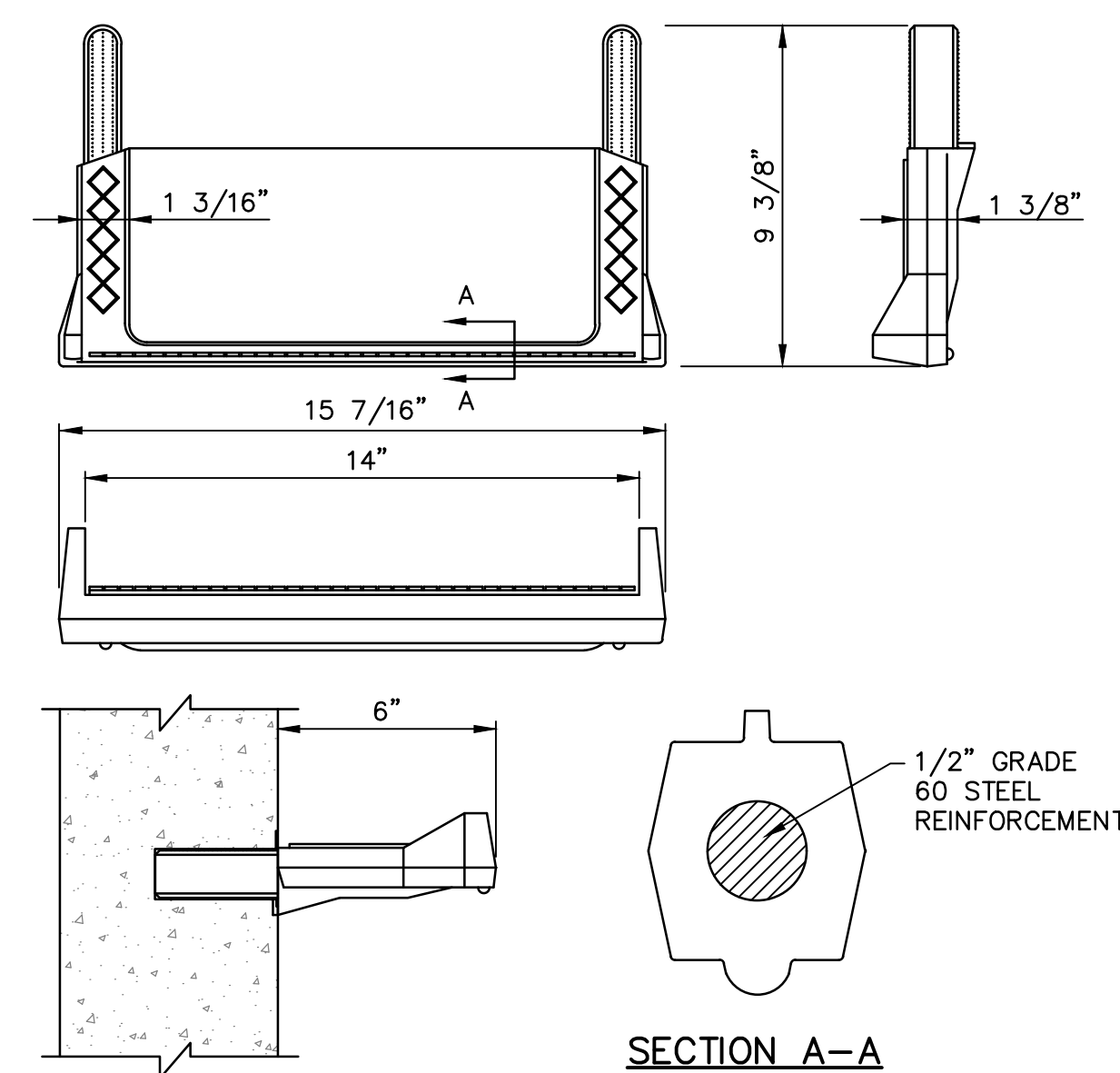
- NOTES:
- ALL BENCHES FOR NEW MANHOLES SHALL SLOPE A MINIMUM OF 2" PER FOOT TOWARD FLOW CHANNEL
  - FOR EXISTING MANHOLES, RECONSTRUCT FLOW CHANNELS TO PERMIT UNOBSTRUCTED FLOWS TO THE OUTLET PIPE. LAYOUT OF THE RECONSTRUCTED FLOW CHANNELS SHALL CONFORM TO THE REQUIREMENTS OF SECTION 33 09 00 AND THIS DETAIL.



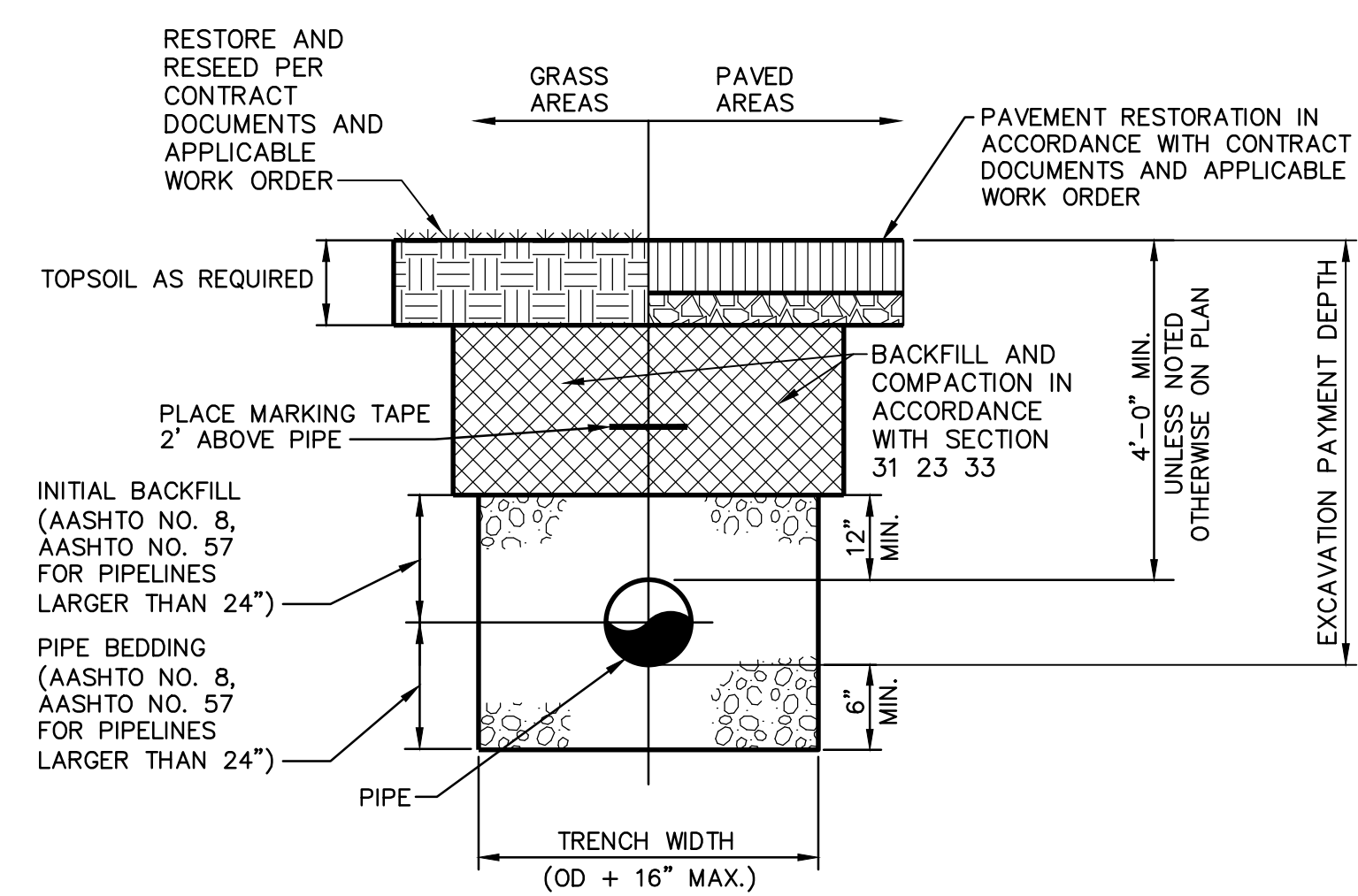
**INTERIOR DROP MANHOLE**  
NOT TO SCALE

- NOTES:
- SEE SANITARY SEWER MANHOLE DETAIL FOR ADDITIONAL INFORMATION.
  - INSTALL MANHOLE STEPS IN LOCATION THAT DOES NOT CONFLICT WITH DROP CONNECTION.
  - INTERIOR DROP MANHOLE FOR EXISTING SANITARY MANHOLE SHALL ALSO BE IN ACCORDANCE WITH CONNECTION TO EXISTING MANHOLE DETAIL.

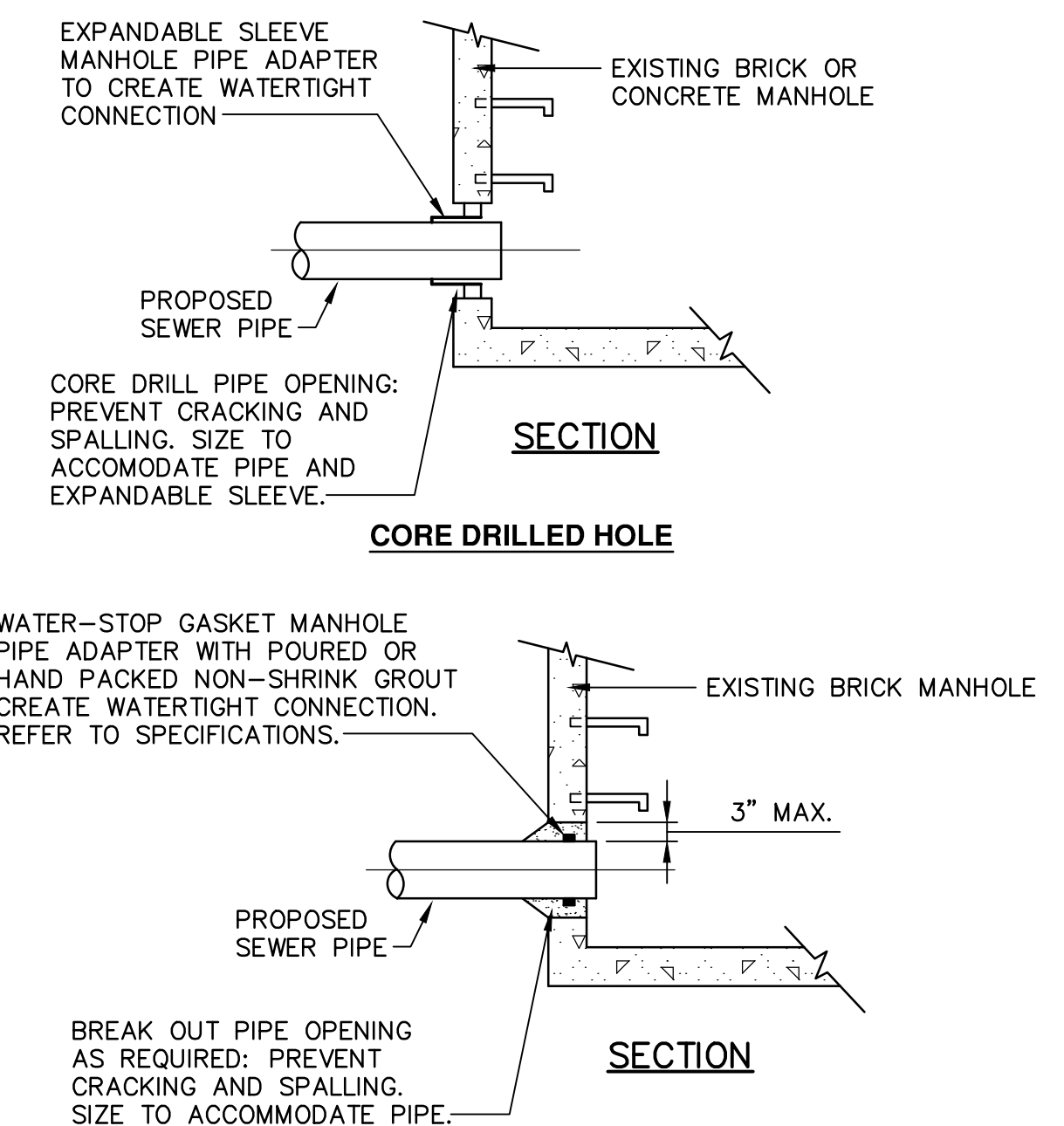
INCOMING SEWER Ø	DROP PIPE Ø
6"	4"
8"	6"
10"	8"
12"	10"



**COPOLYMER POLYPROPYLENE PLASTIC MANHOLE STEP**  
NOT TO SCALE



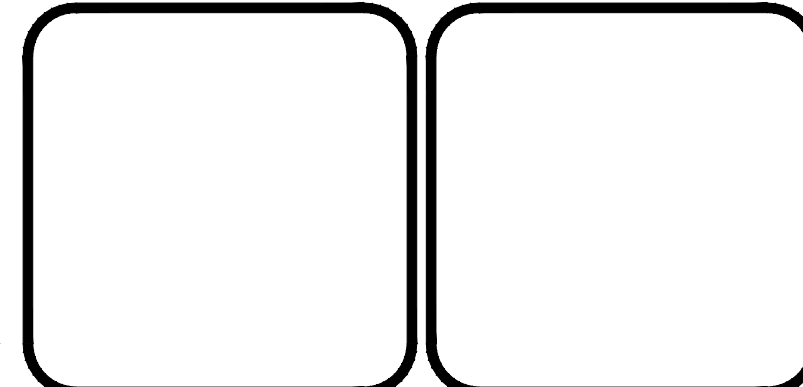
**PIPE TRENCH DETAIL**  
NOT TO SCALE



**CONNECTION TO EXISTING MANHOLE DETAIL**  
NOT TO SCALE

- NOTES:
- KEEP GROUNDWATER, SURFACE WATER AND DEBRIS FROM ENTERING EXISTING FACILITIES.
  - MAINTAIN EXISTING FLOW DURING CONSTRUCTION.
  - BREAKOUT EXISTING CONCRETE/BRICK BENCH AS REQUIRED AND FORM NEW CHANNEL WITH NON-SHRINK GROUT TO ALLOW FOR PROPER FLOW. SEE TYPICAL MANHOLE CHANNEL DETAIL.

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AN EMPLOYEE-OWNED COMPANY

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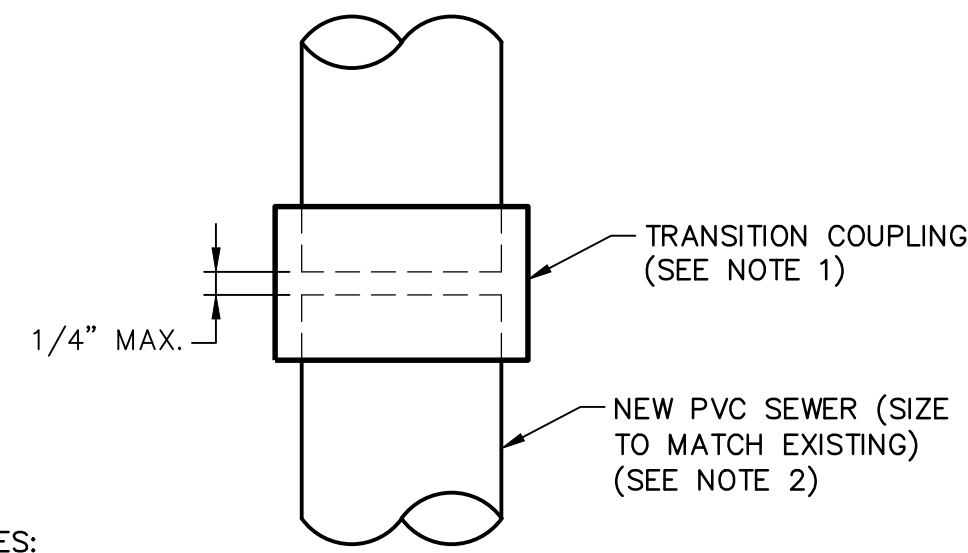
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STANDARD DETAIL DRAWINGS

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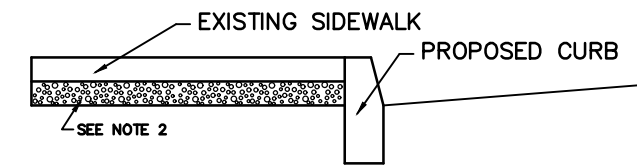
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DESIGN - CJK  
CADD - RSF  
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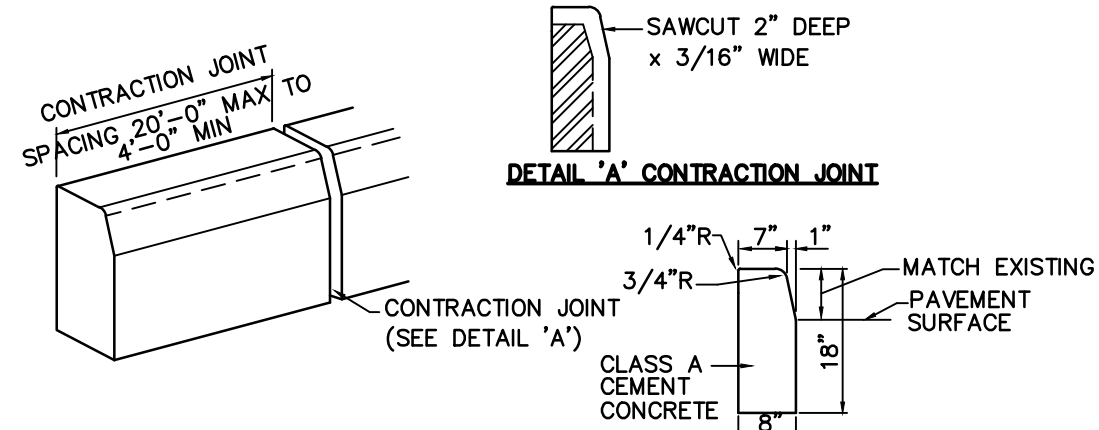


- NOTES:**
- FOR CONNECTIONS TO EXISTING PVC PIPING UTILIZE PVC REPAIR COUPLING. FOR CONNECTIONS TO EXISTING PIPING OTHER THAN PVC AND BRICK USE SHIELDED FLEXIBLE TYPE COUPLING. SEE SECTION 33 31 00 FOR SPECIFICATIONS.
  - INSTALL NEW PVC IN ACCORDANCE WITH SECTION 33 31 00 AND PIPE TRENCH DETAIL.

**TRANSITION COUPLING DETAIL**  
NOT TO SCALE



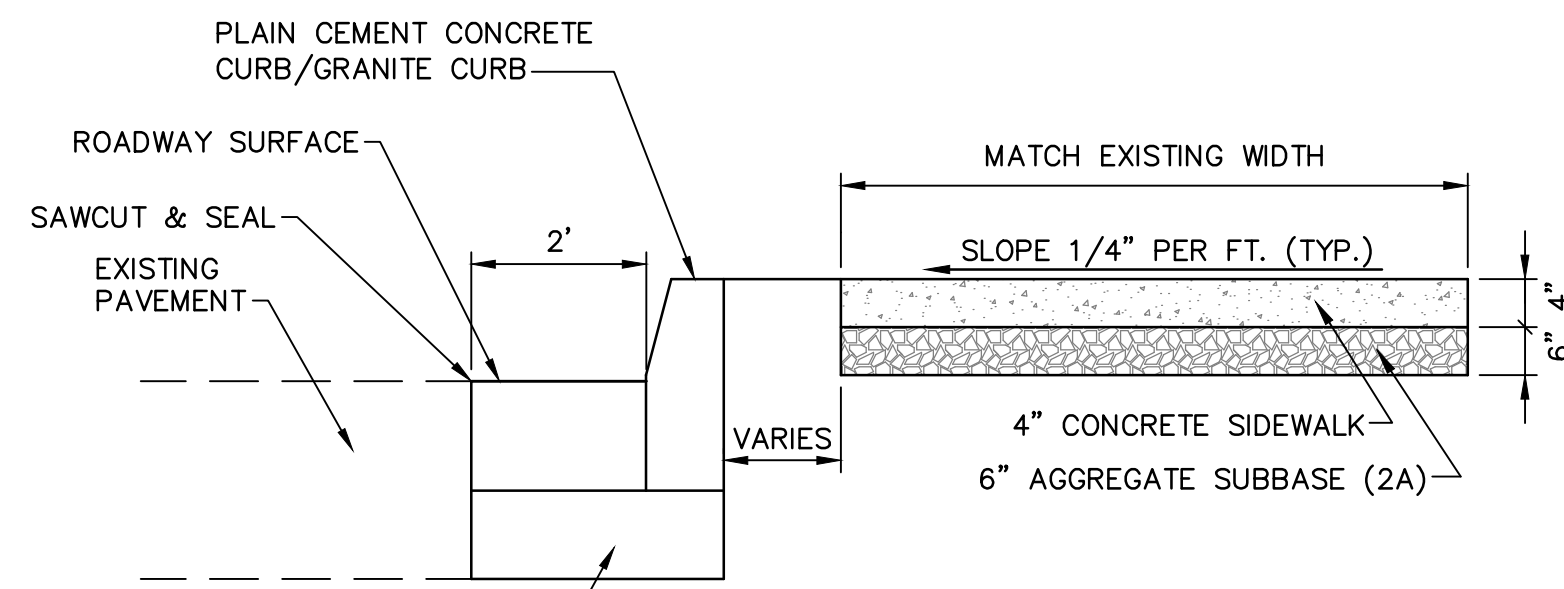
**CURB CONSTRUCTION DETAIL**



**TYPICAL CROSS-SECTION**

- NOTES:**
- CONSTRUCT CURBING IN ACCORDANCE WITH PENNDOT SPECIFICATIONS PUBLICATION 40B AND ROADWAY CONSTRUCTION DRAWINGS (RC-64)
  - PROTECT AND MAINTAIN EXISTING SIDEWALK FOUNDATION MATERIAL DURING CURB CONSTRUCTION. REPLACE MATERIAL DISTURBED DURING CONSTRUCTION AS INCIDENTAL TO CONCRETE CURB CONSTRUCTION. REPLACEMENT MATERIAL MUST CONSIST OF A MATERIAL THAT CAN BE ADEQUATELY COMPACTED IN PLACE.
  - EXISTING PAVEMENT REMOVAL AND PAVEMENT RESTORATION TO FACILITATE CURB INSTALLATION IS INCIDENTAL TO CURB INSTALLATION.

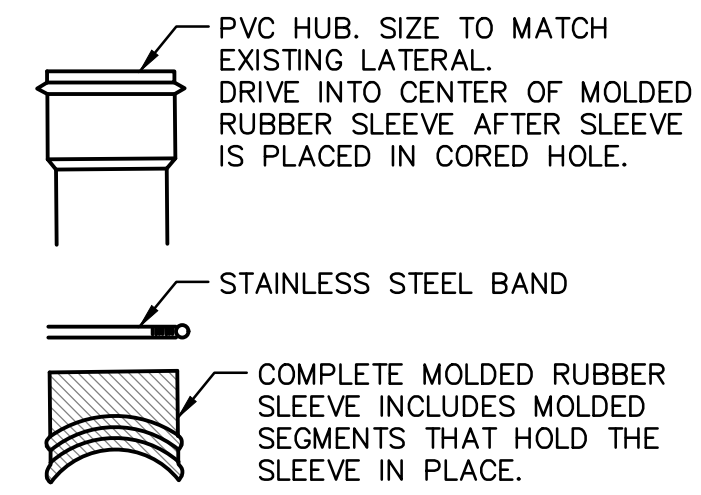
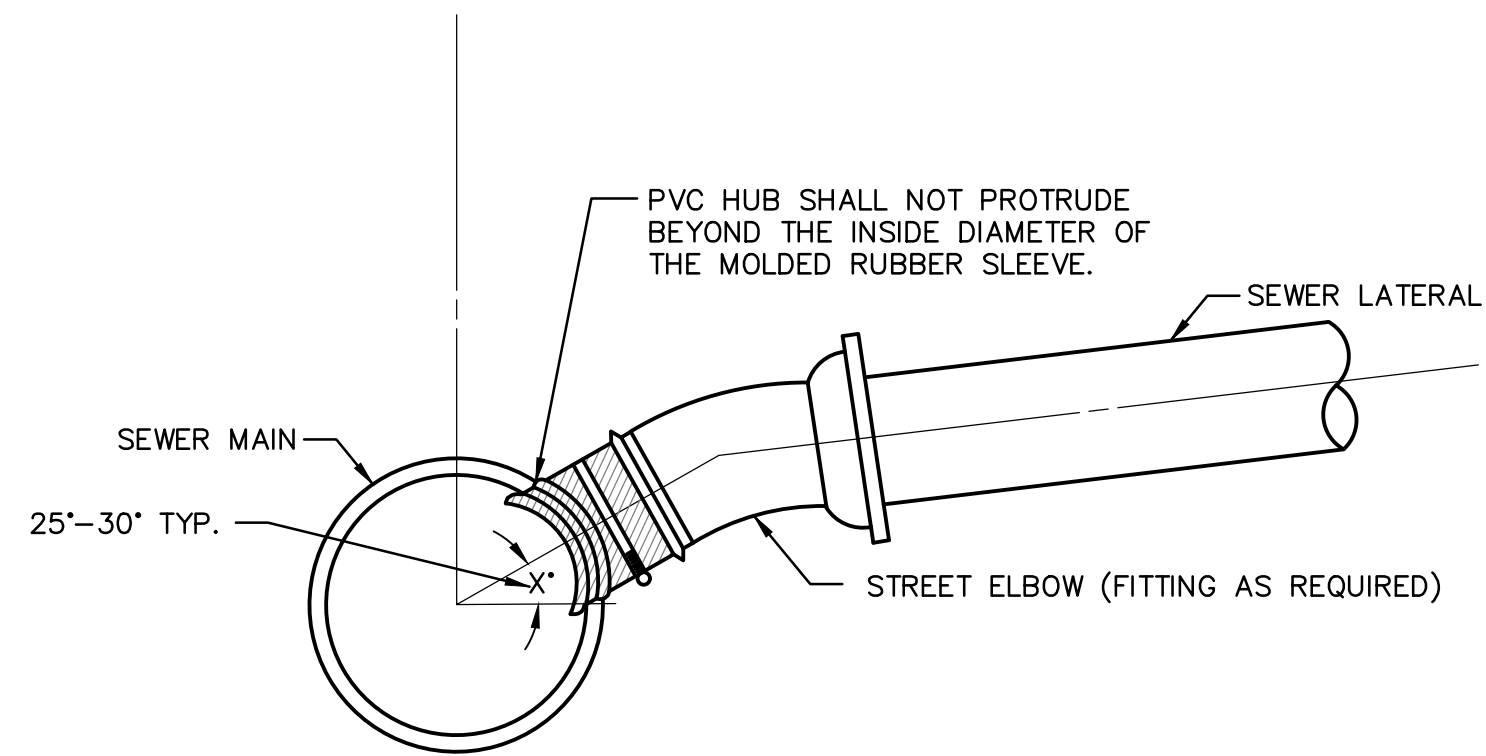
**CONCRETE CURB DETAIL**  
NOT TO SCALE



PAVEMENT RESTORATION PER PENNDOT/CITY OF HARRISBURG REQUIREMENTS

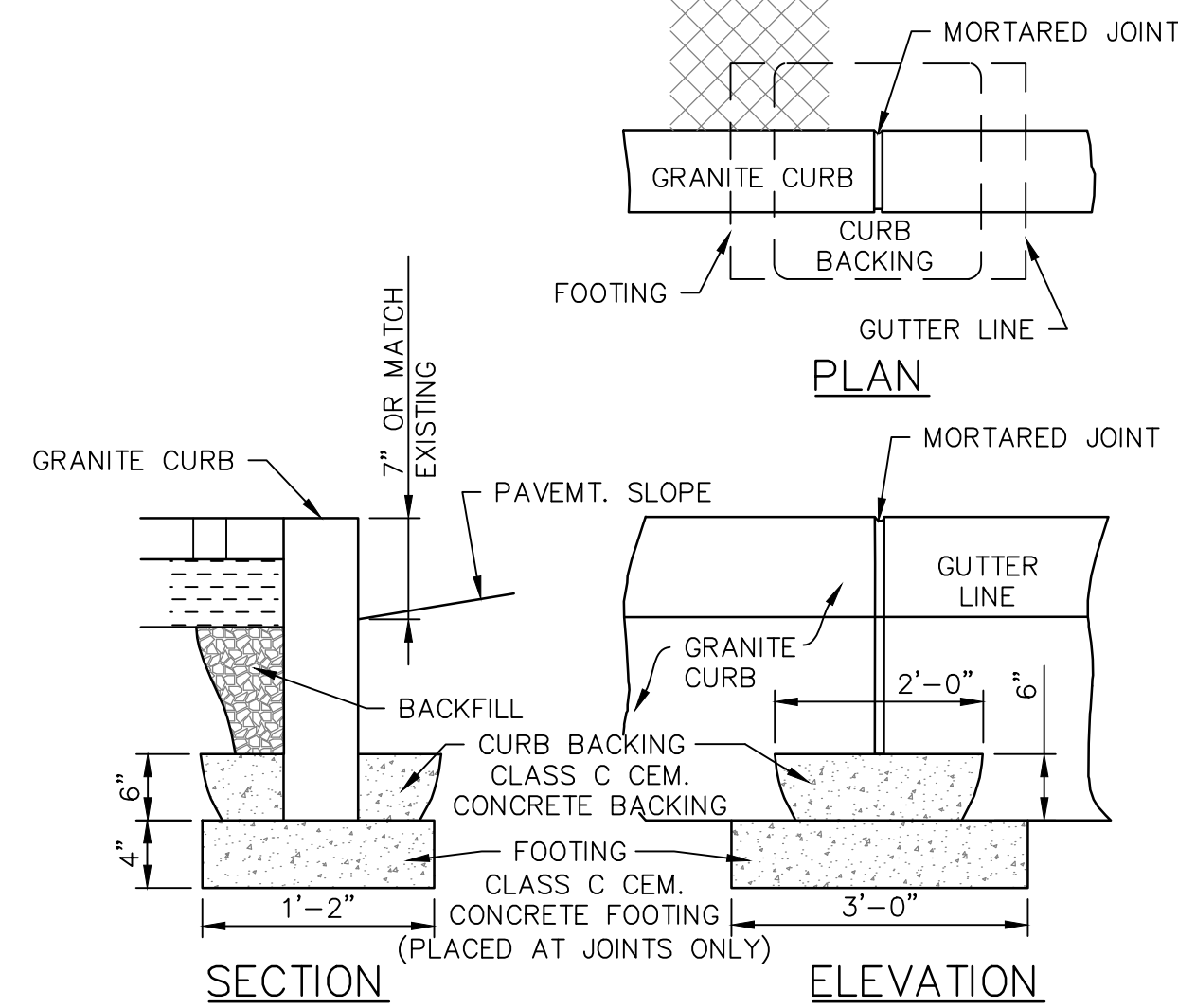
- NOTE:**
- SIDEWALK TO HAVE MEDIUM BROOM FINISH PERPENDICULAR TO DIRECTION OF PEDESTRIAN TRAFFIC.
  - CONSTRUCT IN ACCORDANCE WITH PENNDOT PUBLICATION 40B.
  - SEE SITE PLAN FOR SIDEWALK LOCATION.
  - REMOVE DISTURBED SECTIONS OF SIDEWALK AT EXISTING JOINTS AND REPLACE IN KIND.
  - EXISTING PAVEMENT REMOVAL AND PAVEMENT RESTORATION TO FACILITATE CURB INSTALLATION IS INCIDENTAL TO CURB INSTALLATION.

**SIDEWALK TYPICAL SECTION**  
NOT TO SCALE



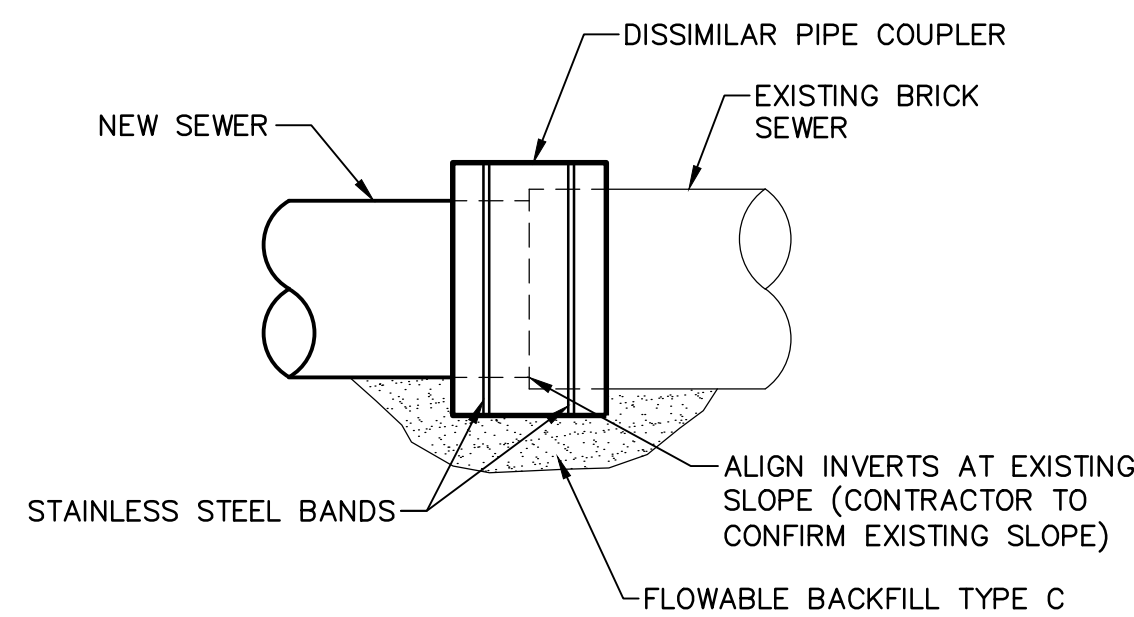
- NOTES:**
- ALL INSERT-A-TEE HOLES SHALL BE MACHINED DRILLED AND CORED. CENTERLINE OF TAP SHALL BE ABOVE SPRINGLINE AS SHOWN.
  - STAINLESS STEEL BAND SHALL BE USED TO SECURE UPPER HALF OF MOLDED RUBBER SLEEVE TO THE PVC HUB IN ACCORDANCE WITH MANUFACTURE REQUIREMENTS.

**INSERT-A-TEE LATERAL CONNECTION DETAIL**  
NOT TO SCALE

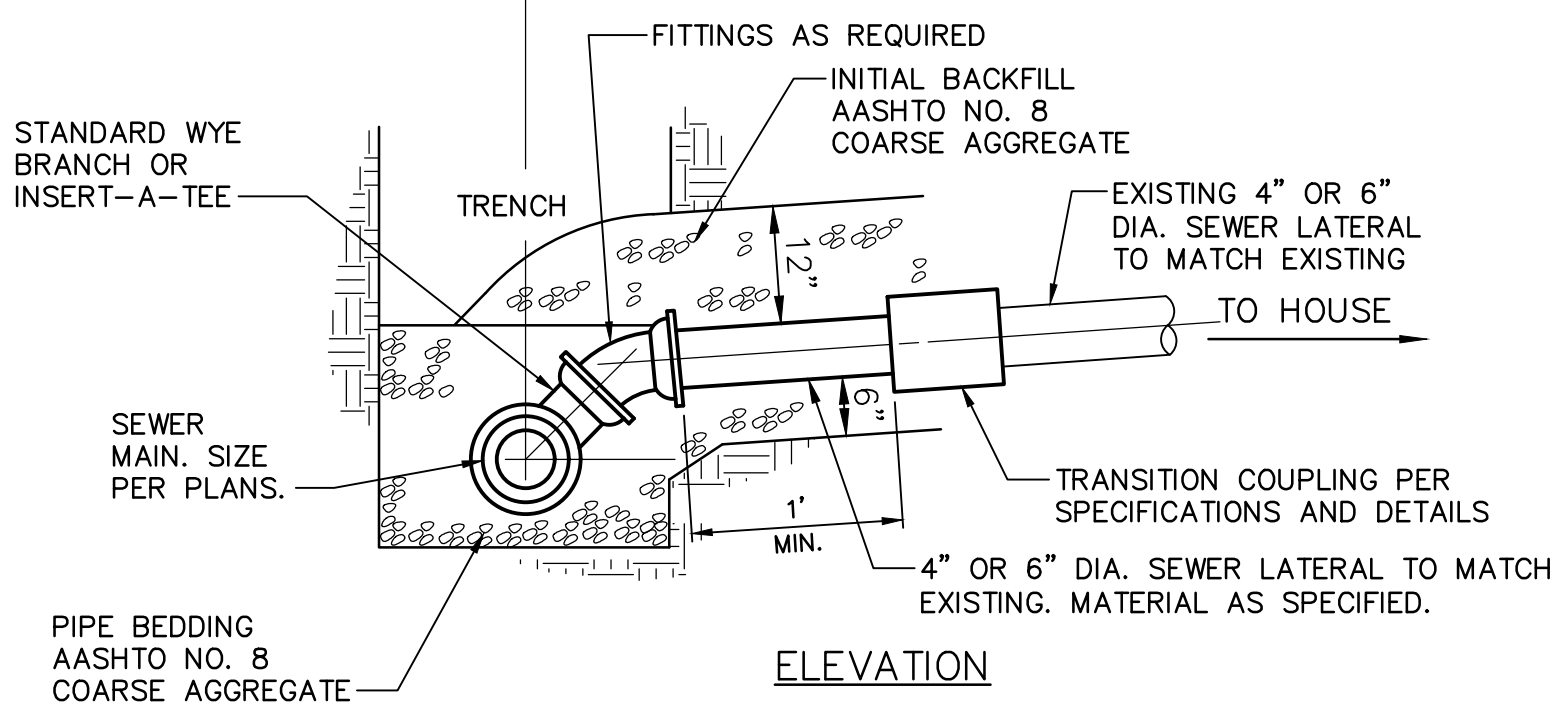
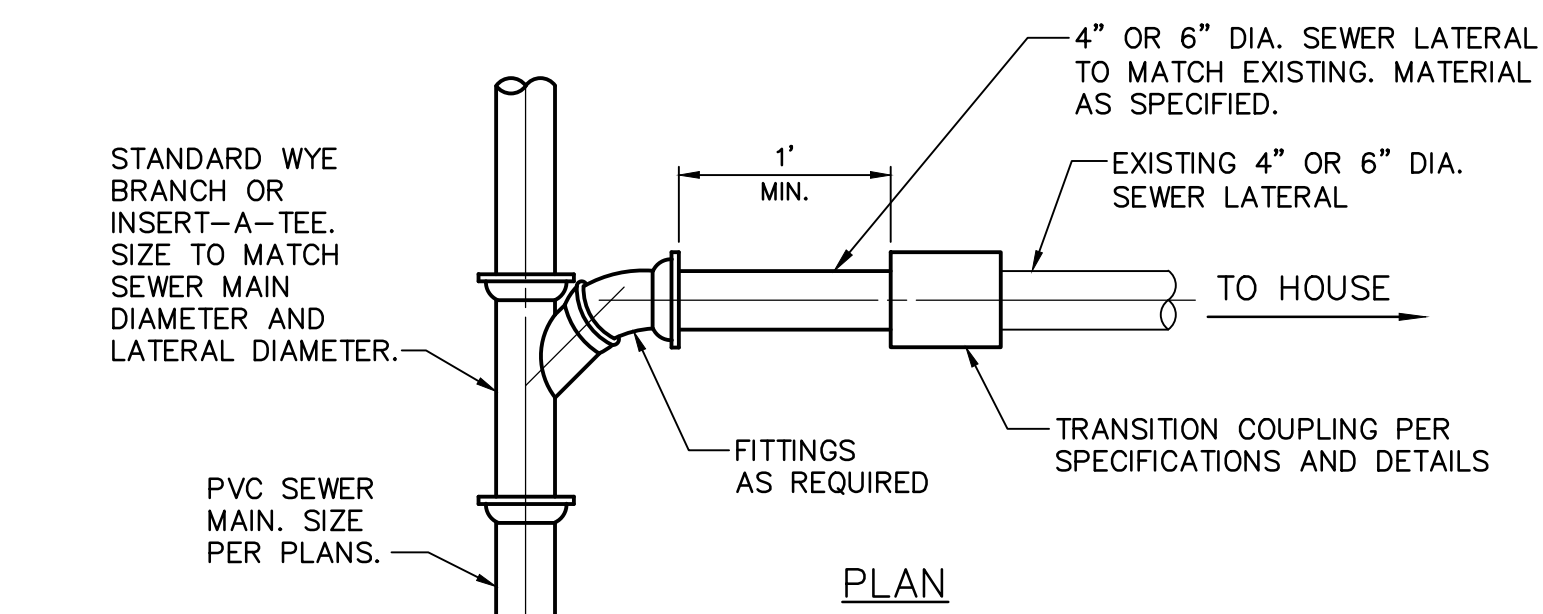


- NOTES:**
- PROTECT AND MAINTAIN EXISTING SIDEWALK FOUNDATION MATERIAL DURING CURB CONSTRUCTION. REPLACE MATERIAL DISTURBED DURING CONSTRUCTION AS INCIDENTAL TO CONCRETE CURB CONSTRUCTION. REPLACEMENT MATERIAL MUST CONSIST OF A MATERIAL THAT CAN BE ADEQUATELY COMPACTED IN PLACE.
  - EXISTING PAVEMENT REMOVAL AND PAVEMENT RESTORATION TO FACILITATE CURB INSTALLATION IS INCIDENTAL TO CURB INSTALLATION.
  - REMOVE DISTURBED SECTIONS OF GRANITE CURB AT EXISTING JOINTS AND REPLACE OR RESET IN KIND.

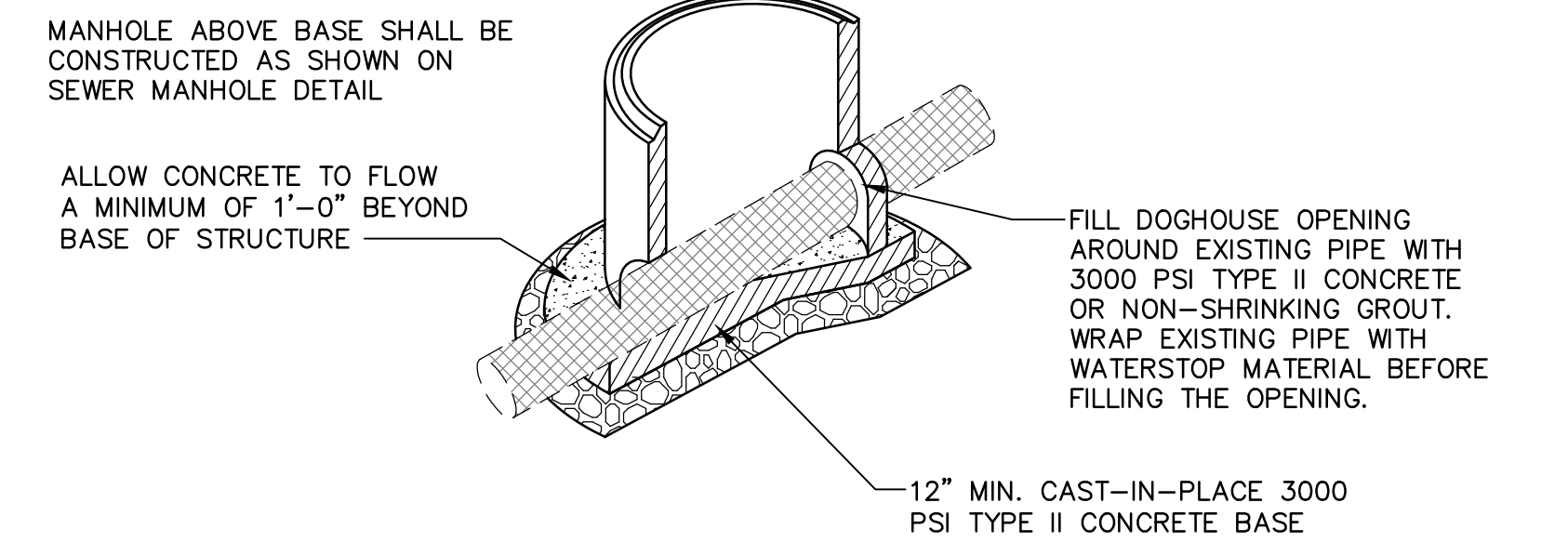
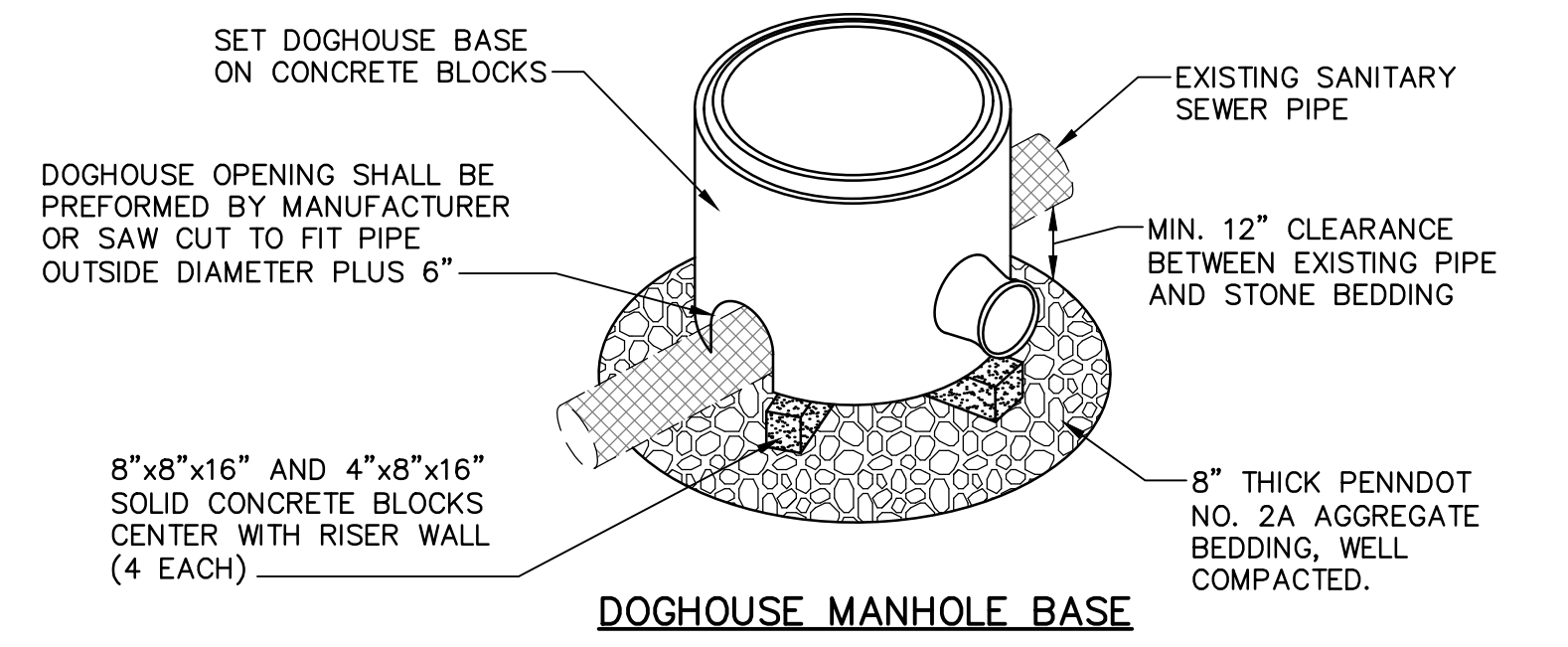
**GRANITE CURB DETAIL**  
NOT TO SCALE



**CONNECTION TO EXISTING BRICK SEWER DETAIL**  
NOT TO SCALE

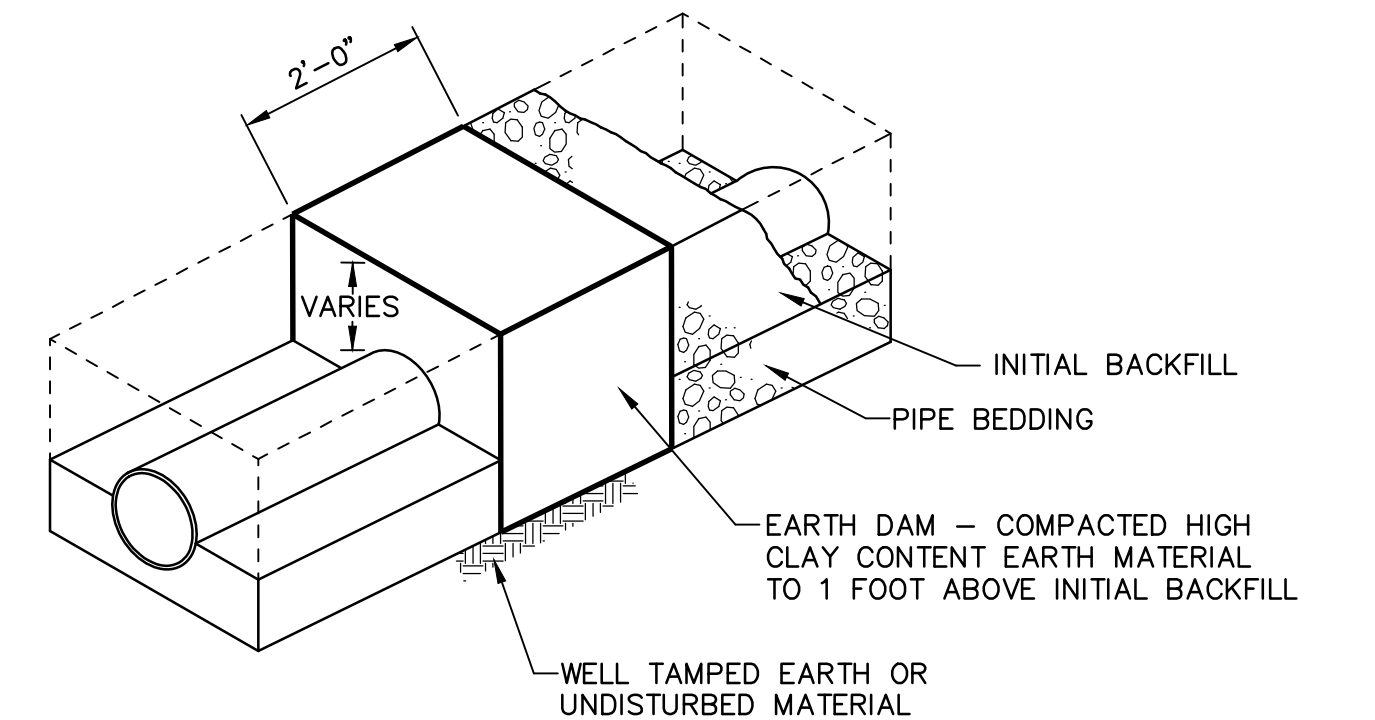


**LATERAL RECONNECTION TO NEW SEWER DETAIL**  
NOT TO SCALE

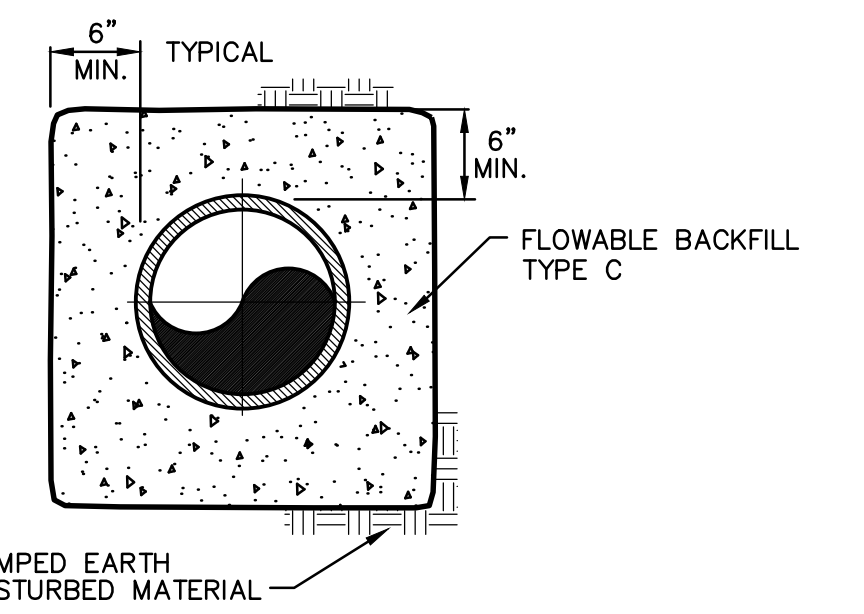


- NOTES:**
- CONSTRUCT A FORMED INVERT FROM EXISTING SEWER PIPE TO ALLOW FLOW TO THE NEW SEWER LINE.
  - FLOW CHANNEL BENCH HEIGHT TO MATCH CROWN OF EXISTING PIPE.
  - CUT AND REMOVE THE TOP HALF OF EXISTING PIPE TO WITHIN 6" OF THE MANHOLE WALLS AFTER THE INVERT AND SHELF HAVE BEEN FORMED, AND THE MANHOLE HAS BEEN FULLY TESTED IN ACCORDANCE WITH THE SPECIFICATIONS.
  - PRECAST CONCRETE MANHOLE BASES SHALL BE FABRICATED IN ACCORDANCE WITH SECTION 33 39 00.

**DOGHOUSE SANITARY MANHOLE BASE**  
NOT TO SCALE



**CLAY DIKE DETAIL**  
NOT TO SCALE



**CONCRETE ENCASEMENT DETAIL**  
NOT TO SCALE



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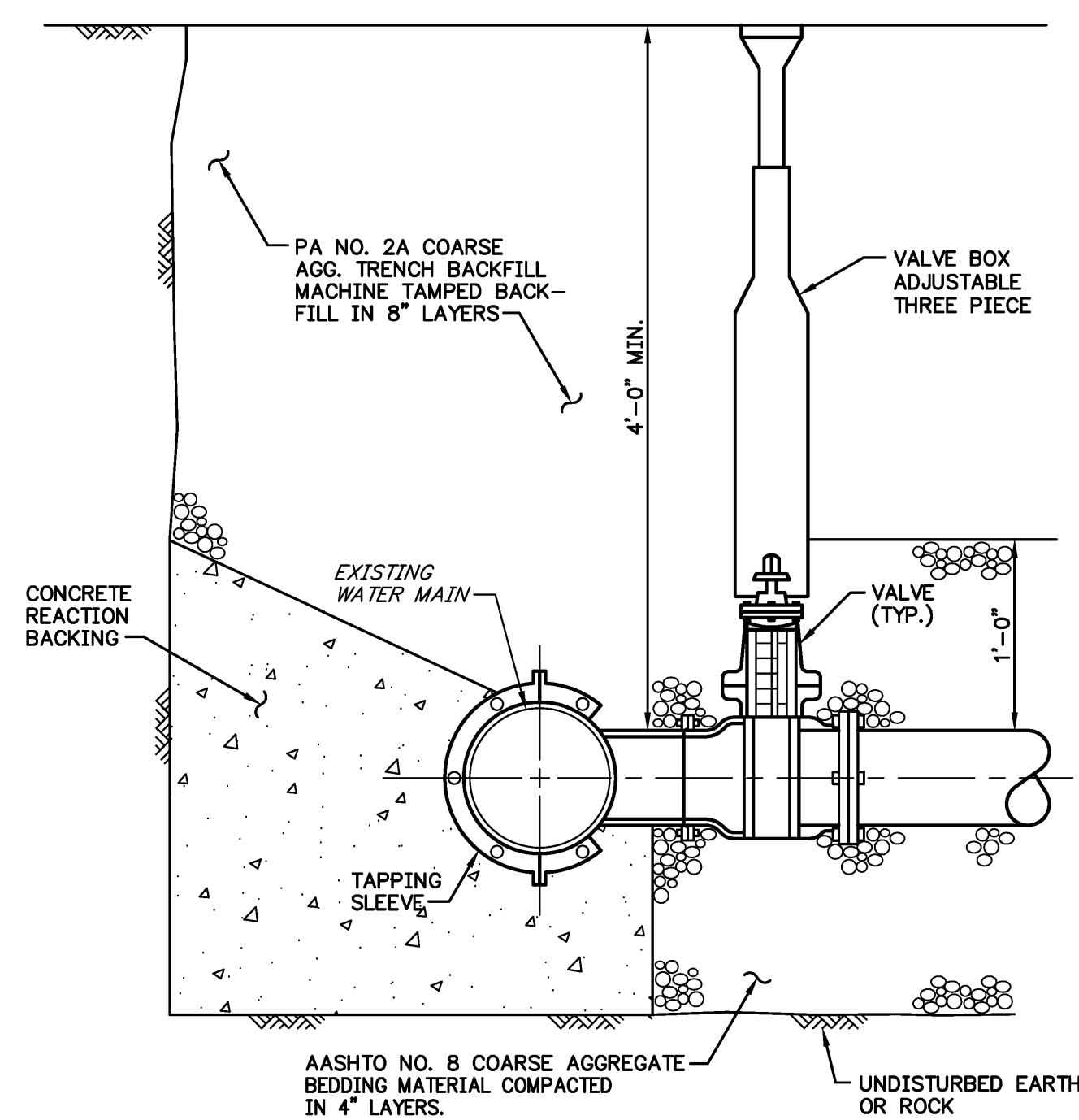
STANDARD DETAIL DRAWINGS

CITY OF HARRISBURG DAUPHIN COUNTY PENNSYLVANIA

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CADD - RSF  
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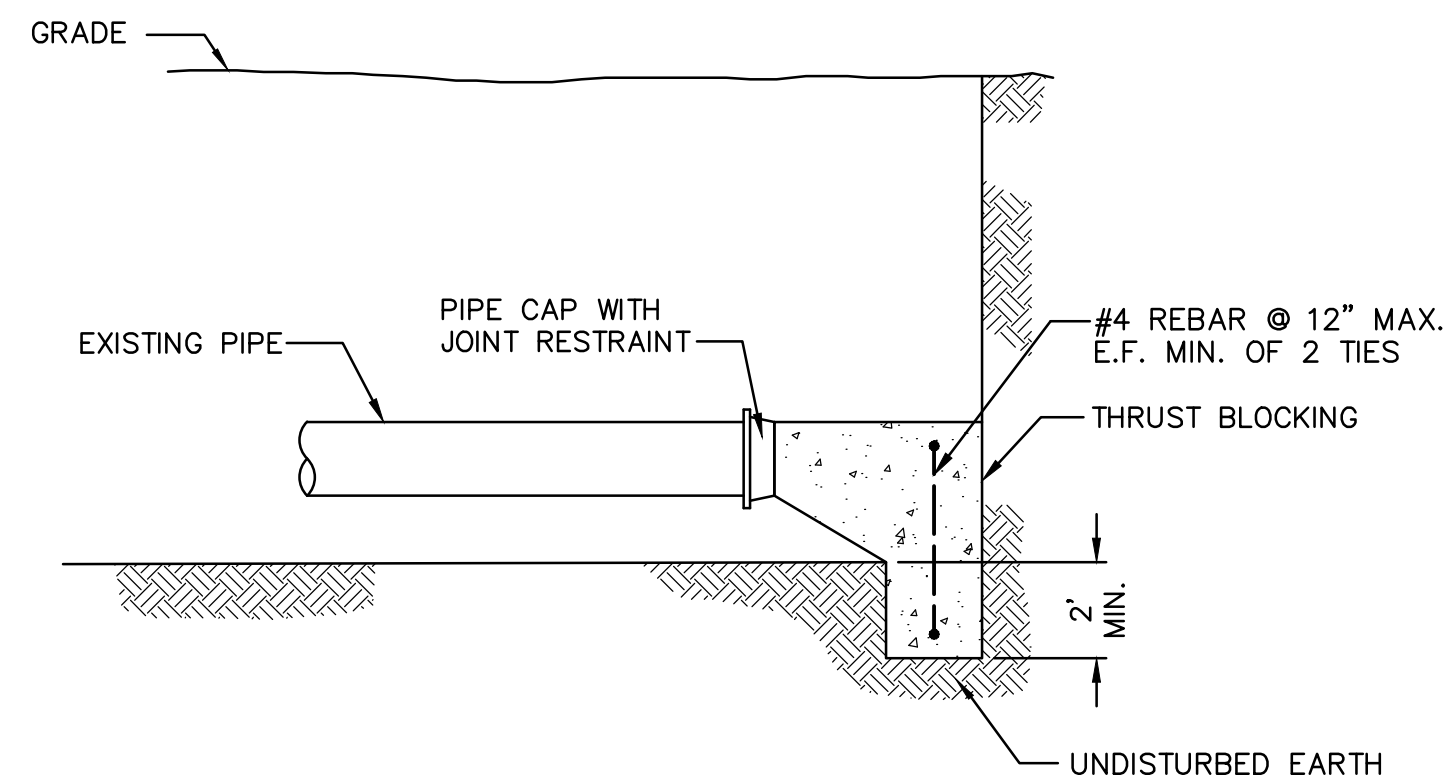
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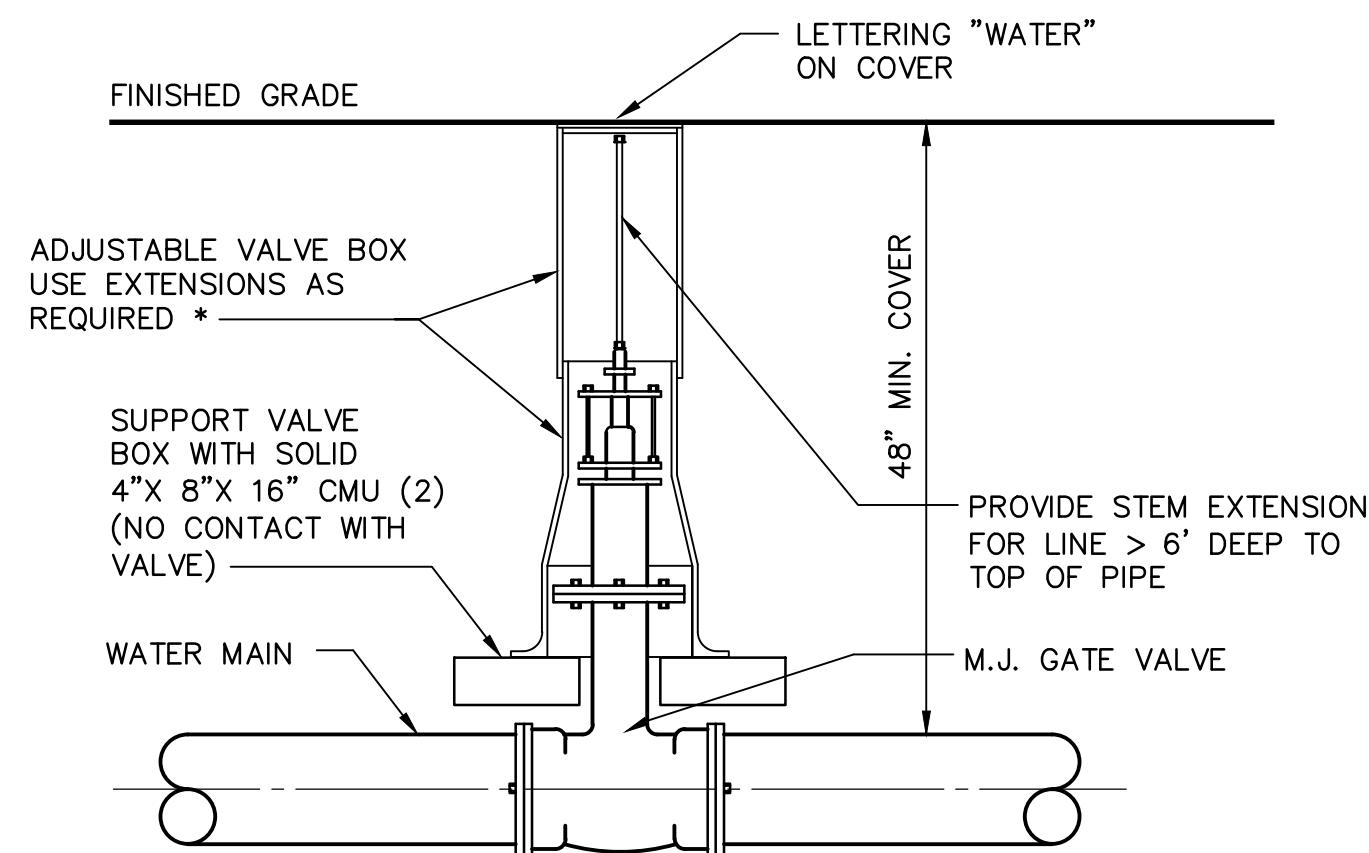


**NOTE:**  
ALL M.J. FITTINGS TO BE WRAPPED IN 40 MIL. PLASTIC PRIOR TO POURING REACTION BACKINGS

**TAPPING SLEEVE AND VALVE DETAIL**  
NOT TO SCALE

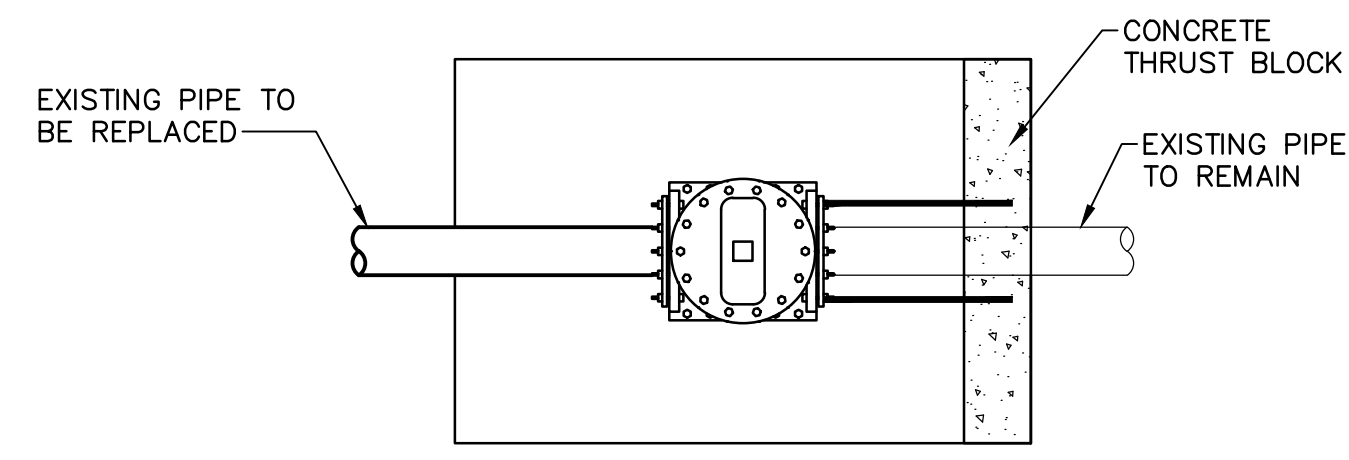


**PIPE CAP AND THRUST BLOCK DETAIL**  
NOT TO SCALE

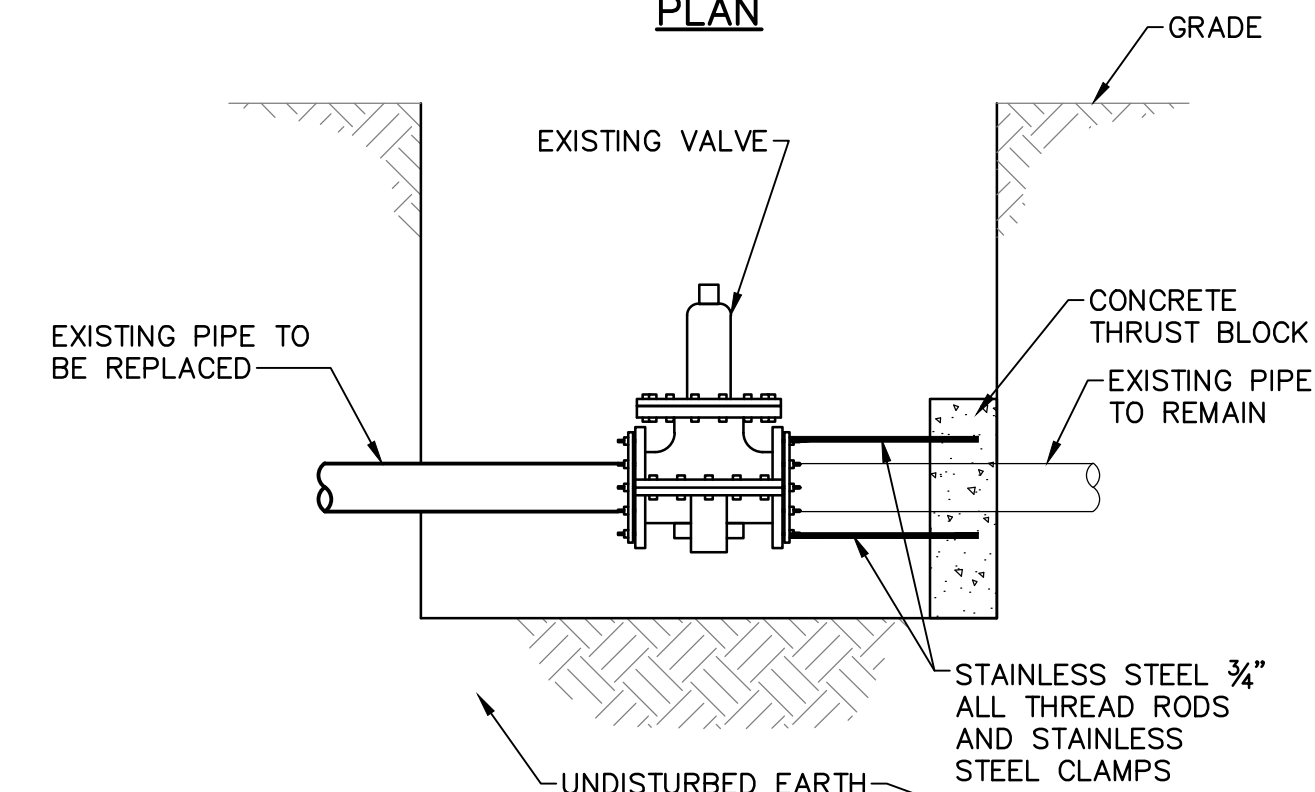


**NOTE:**  
IF EXTENSIONS ARE NECESSARY CONTRACTOR SHALL SET "PLUMB" AND ALIGN PROPERLY FOR ACCESS TO OPERATING NUT.

**TYPICAL GATE VALVE AND VALVE BOX DETAIL**  
NOT TO SCALE



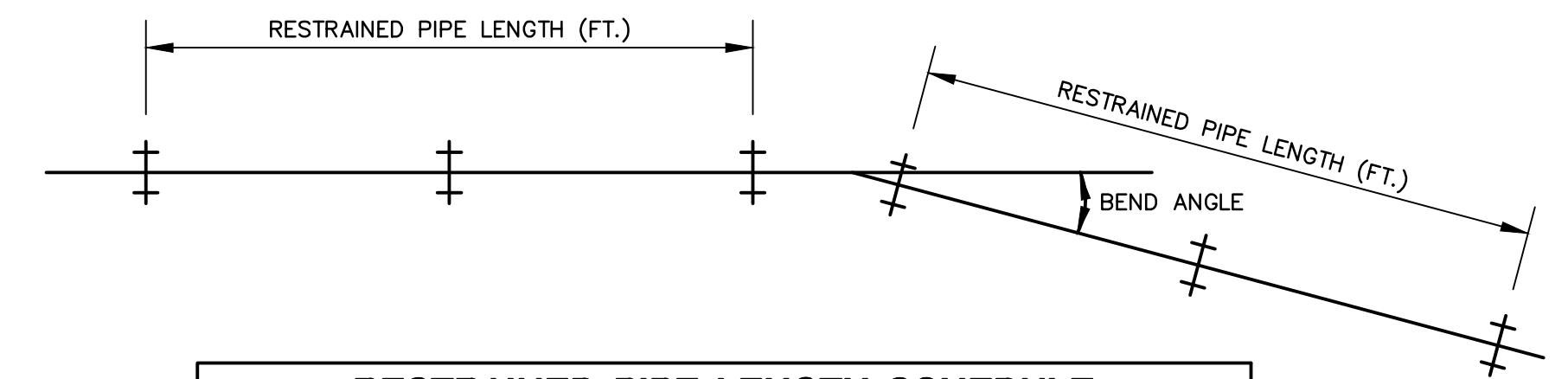
**PLAN**



**ELEVATION**

**NOTES:**  
1. VALVE BOX, BEDDING & BACKFILL NOT SHOWN FOR CLARITY.

**CONNECTION TO EXISTING VALVE DETAIL**  
NOT TO SCALE



RESTRAINED PIPE LENGTH SCHEDULE					
PIPE DIAMETER	HORIZONTAL & VERTICAL UP BENDS				
	90°	45°	22 1/2°	11 1/4°	CAPS & TEES
6"	18'	8'	4'	2'	41'
8"	24'	10'	5'	3'	54'
10"	28'	12'	6'	3'	65'

\* ADD 40% TO LENGTH IF PIPE IS POLYETHYLENE ENCASED

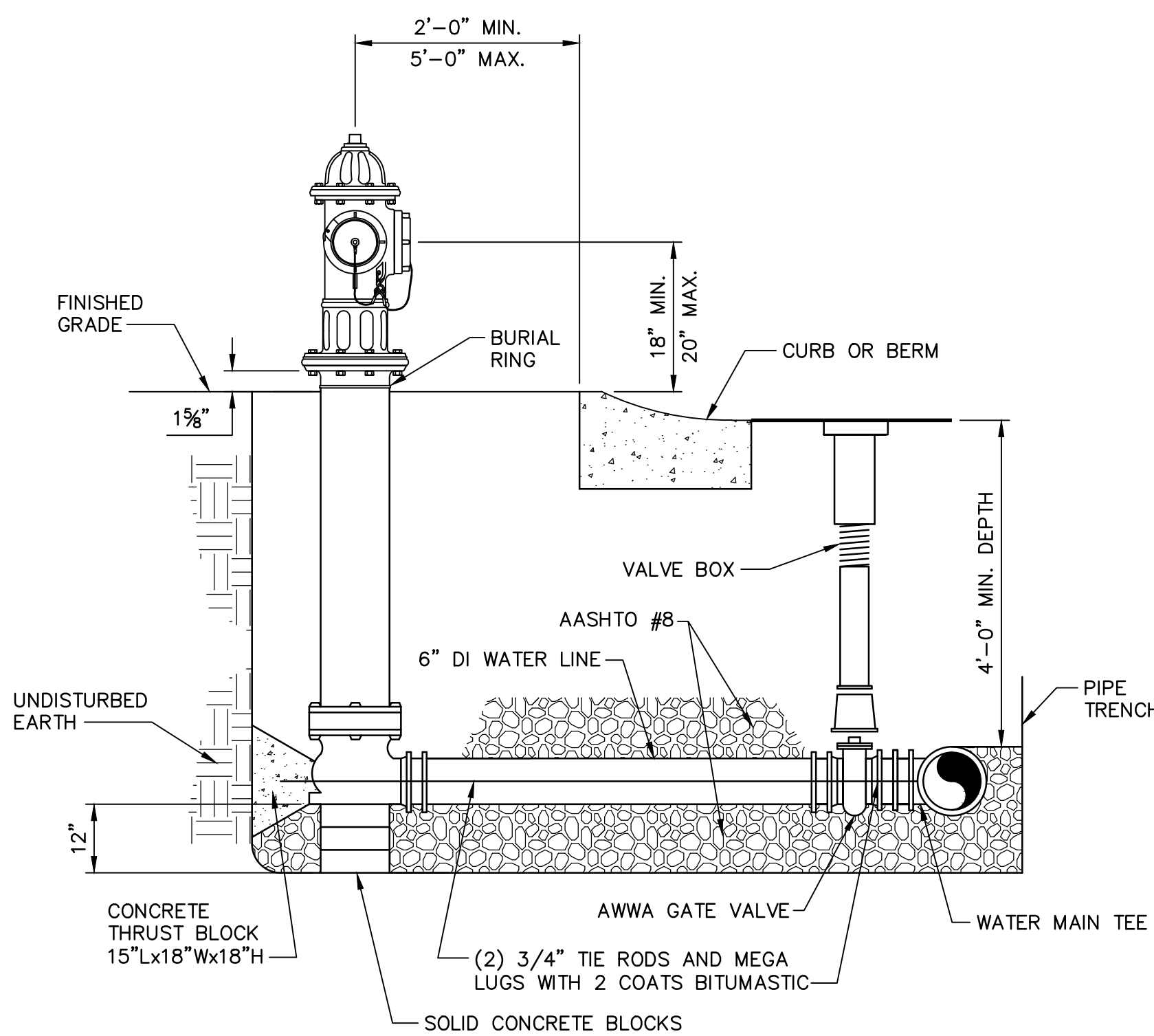
RESTRAINED PIPE LENGTH SCHEDULE			
PIPE DIAMETER	VERTICAL DOWN BENDS		
	45°	22 1/2°	11 1/4°
6"	17'	9'	5'
8"	23'	11'	6'
10"	27'	13'	7'

\* ADD 40% TO LENGTH IF PIPE IS POLYETHYLENE ENCASED

**NOTES:**

- ALL LENGTHS BASED ON 150 PSI MAXIMUM PRESSURE. FOR HIGHER PRESSURES, INCREASE LENGTHS IN PROPORTION TO PRESSURE RATIO.
- PIPE THRUST RESTRAINT SHALL BE IN ACCORDANCE WITH SPECIFICATIONS.

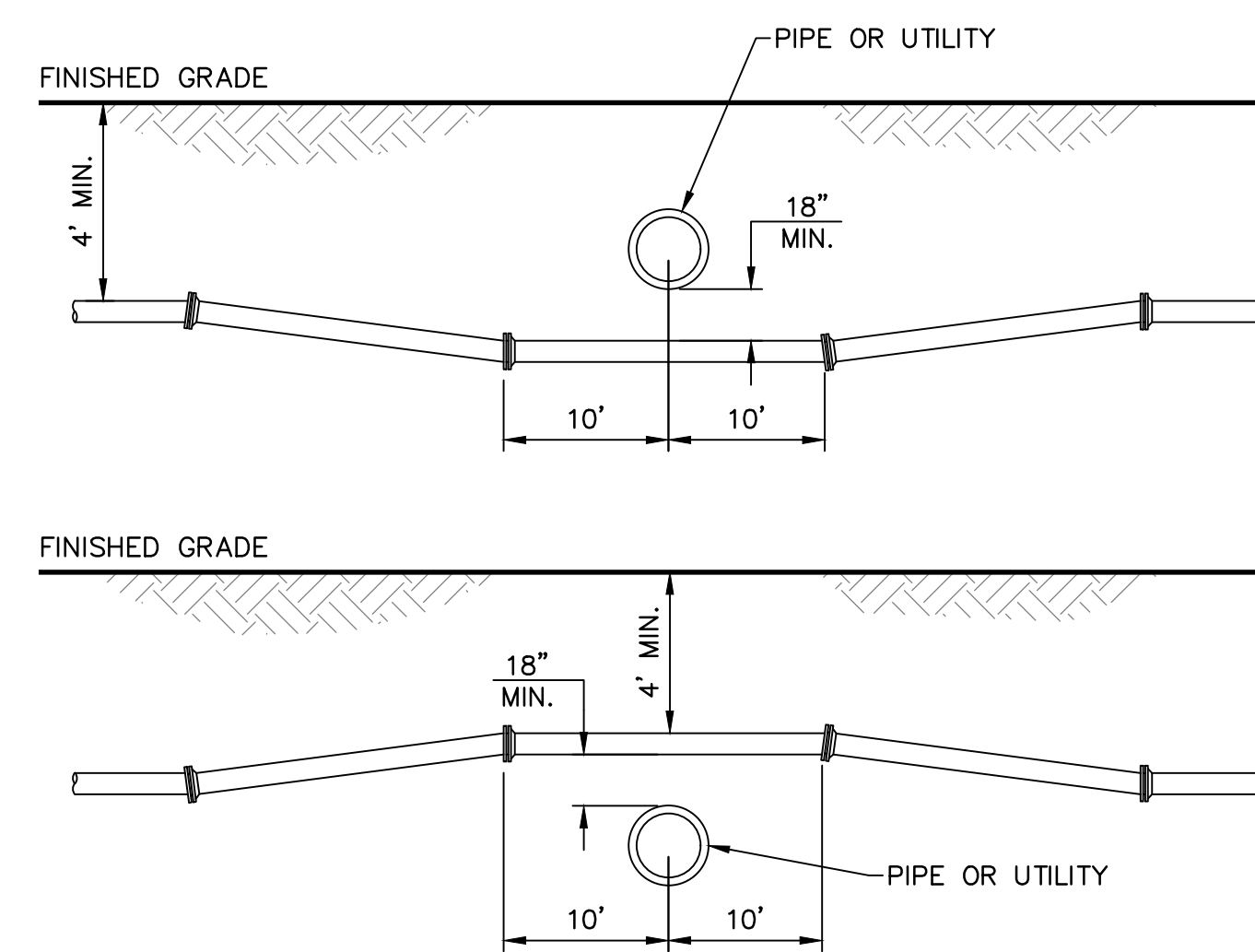
**RESTRAINED PIPE LENGTH SCHEDULE**  
NOT TO SCALE



**NOTES:**

- PLUG HYDRANT DRAINS IN AREAS WHERE GROUNDWATER IS PRESENT. COORDINATE WITH OWNER AND ENGINEER.
- FIRE HYDRANT DRAINS SHALL BE KEPT FREE OF THRUST BLOCK CONCRETE.

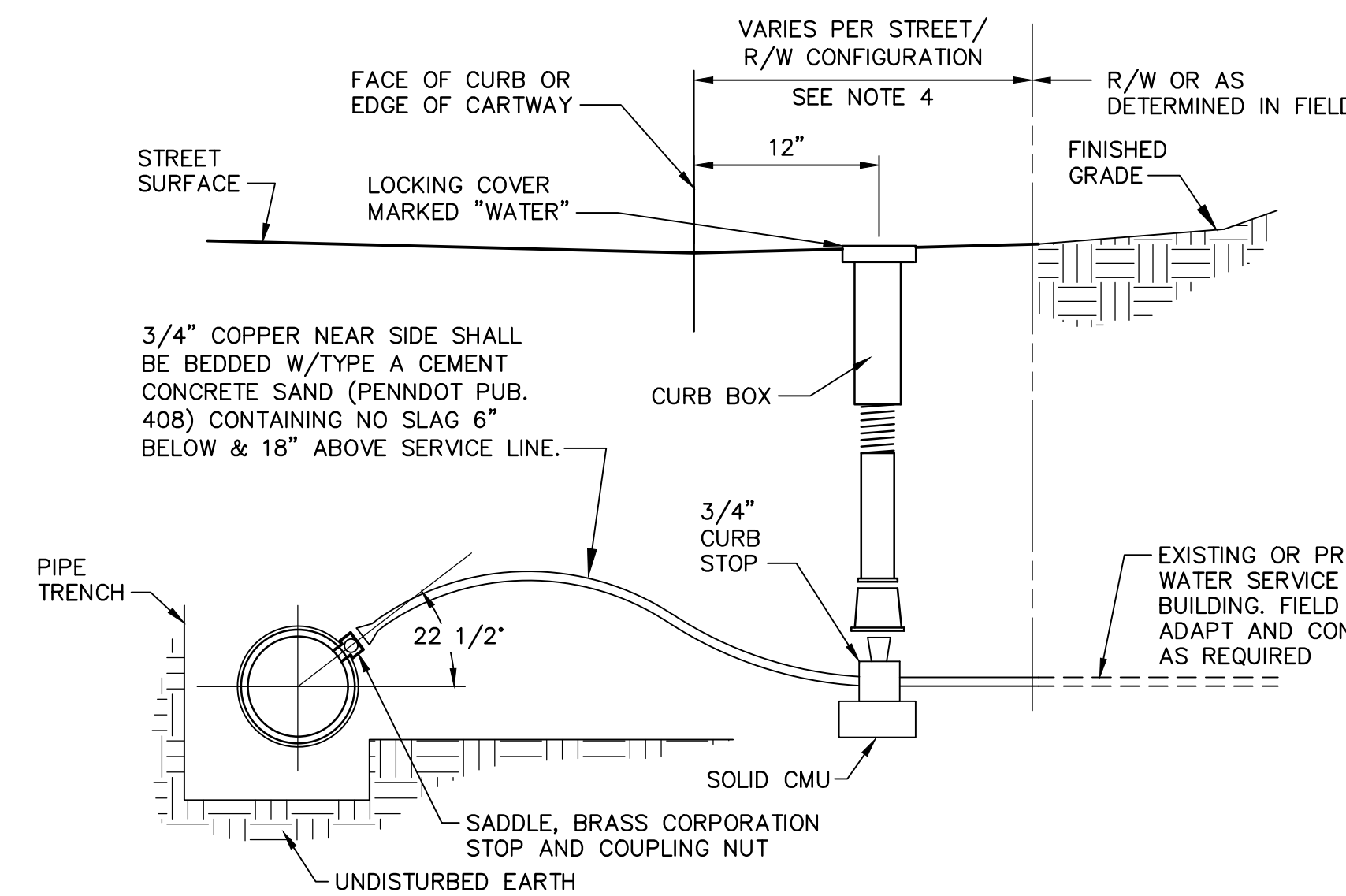
**FIRE HYDRANT SETTING DETAIL**  
NOT TO SCALE



**NOTES:**

- PIPE JOINT DEFLECTIONS TO BE IN ACCORDANCE WITH AWWA STANDARDS, SECTION C600.
- THE CONTRACTOR IS RESPONSIBLE TO DETERMINE THE DISTANCE FROM THE CROSSING TO START THE PIPE JOINT DEFLECTION TO ALLOW FOR PIPING PER THE DETAIL.

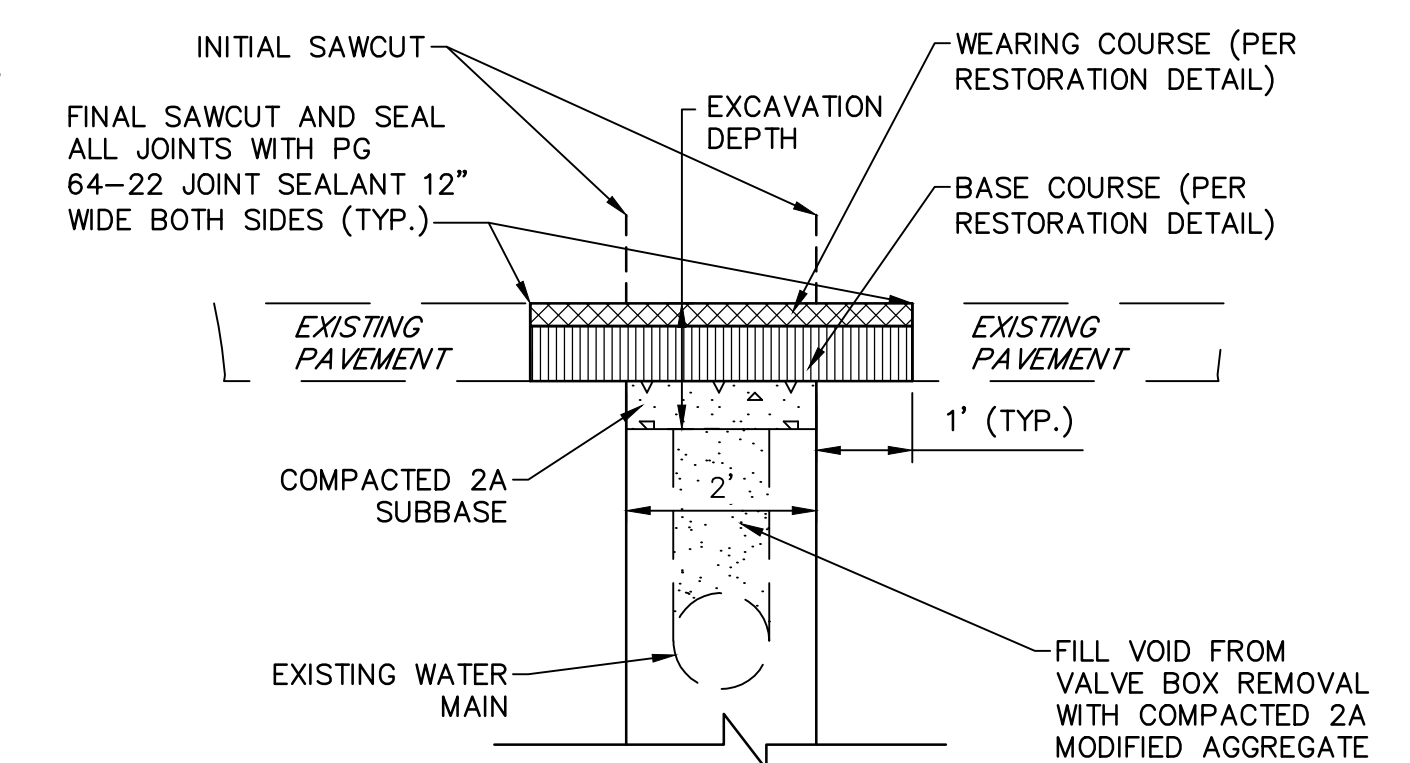
**WATER LINE CROSSING PIPE OR UTILITY USING DEFLECTING JOINTS**  
NOT TO SCALE



**NOTES:**

- FOR SERVICE LINES 2" AND SMALLER.
- FOR 3/4" SERVICE ON NEW DUCTILE IRON WATER MAINS, DELETE THE SADDLE FROM INSTALLATION.
- EXISTING SERVICE BOXES AND RODS TO BE REMOVED AND DISPOSED.
- NEW SERVICE LINE TO EXTEND FROM NEW MAIN TO EXISTING CURB STOP. IF NO CURB BOX EXISTS, SERVICES TO EXTEND TO 1'-0" INSIDE PROPERTY LINE.
- USE 1" DIAMETER SERVICE LINE INSTEAD OF 3/4" WHERE DIRECTED BY OWNER TO MATCH EXISTING SERVICE OR WHERE INDICATED ON WORK ORDER.

**WATER SERVICE LINE INSTALLATION DETAIL**  
NOT TO SCALE



**NOTE:**

- VALVE SHALL BE CLOSED BEFORE VALVE BOX REMOVAL.

**IN-PAVEMENT VALVE BOX REMOVAL RESTORATION DETAIL**  
NOT TO SCALE

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**DIMENSIONS OF CONCRETE BLOCKING FOR VERTICAL BENDS WITH AN UPWARD THRUST**

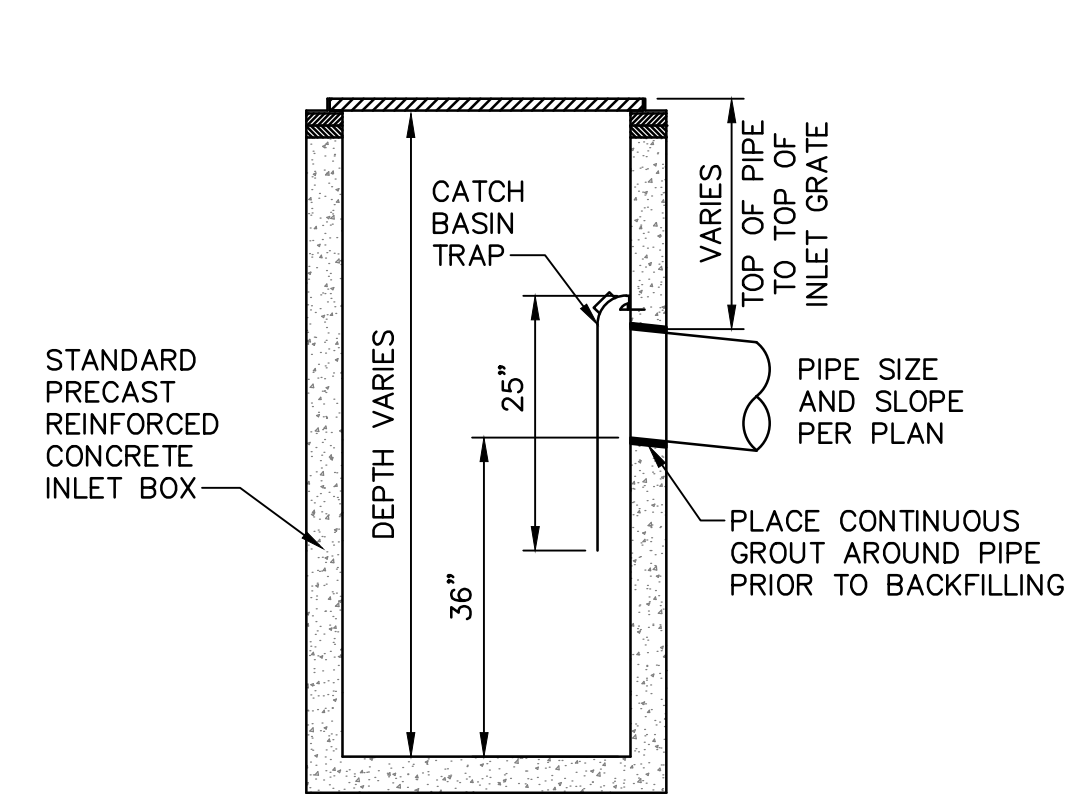
PIPE SIZES	6" AND 8"		
DEGREE BEND OR DEFLECTION	11 1/4'	22 1/2'	45'
LENGTH	3'	4'	6'
WIDTH	3'	3'	3'
DEPTH	2'	3'	4'
SQ. IN. REBAR	0.15	0.28	0.57
MASS CONCRETE CU. YD.	0.66	1.33	2.66

**REINFORCING**

BAR NO.	CROSS SECTION IN <sup>2</sup> PER BAR	VERTICAL IMBEDMENT
5	0.31	15 IN.
6	0.44	19 IN.
7	0.60	26 IN.
8	0.79	35 IN.
9	1.00	44 IN.
10	1.27	56 IN.
11	1.56	68 IN.

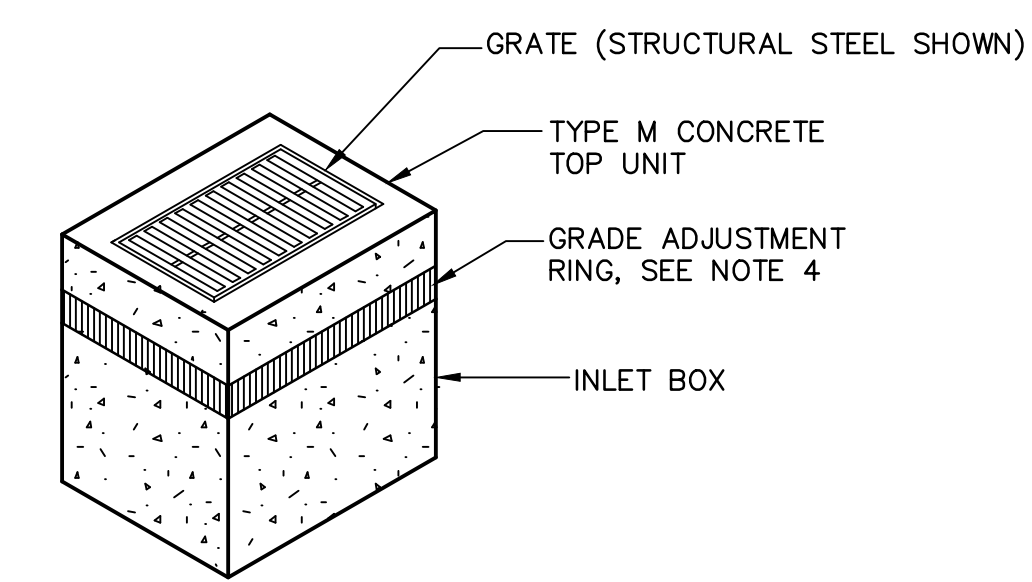
**MINIMUM SQUARE FEET OF BEARING SURFACE REQUIRED FOR HORIZONTAL THRUST BLOCKING AND VERTICAL THRUST DOWNWARD**

PIPE SIZES	6" AND 8"			
	DEGREE BEND OR DEFLECTION			
TYPE OF BEARING MATERIAL & ALLOWABLE LOADS	11 1/4'	22 1/2'	45'	90° PLUGS, TEES & VALVES
	SAND 1 TON/SQ. FT. SOFT CLAY 1 TON/SQ. FT.	1.50	3.00	6.00
SAND & GRAVEL 2 TON/SQ. FT.	1.00	1.50	3.00	6.00
CLAY 3 TON/SQ. FT.	1.00	1.00	2.00	4.00
SOFT ROCK 5 TON/SQ. FT.	1.00	1.00	1.00	2.50
ROCK 20 TON/SQ. FT.	1.00	1.00	1.00	1.00



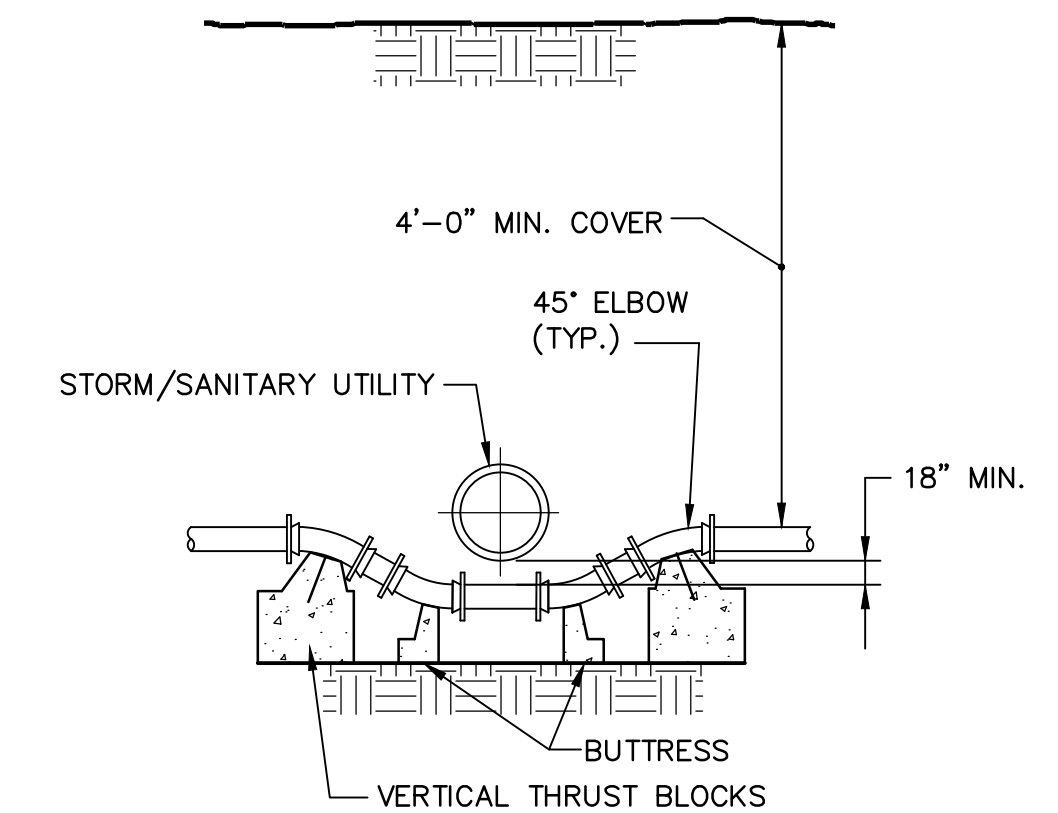
- NOTES:**
- CATCH BASIN TRAP SHALL BE CAST IRON
  - CATCH BASIN TRAP SHALL BE NEENAH MODEL R-3701-15 OR EQUAL.

**INLET BOX CATCH BASIN TRAP DETAIL**  
NOT TO SCALE

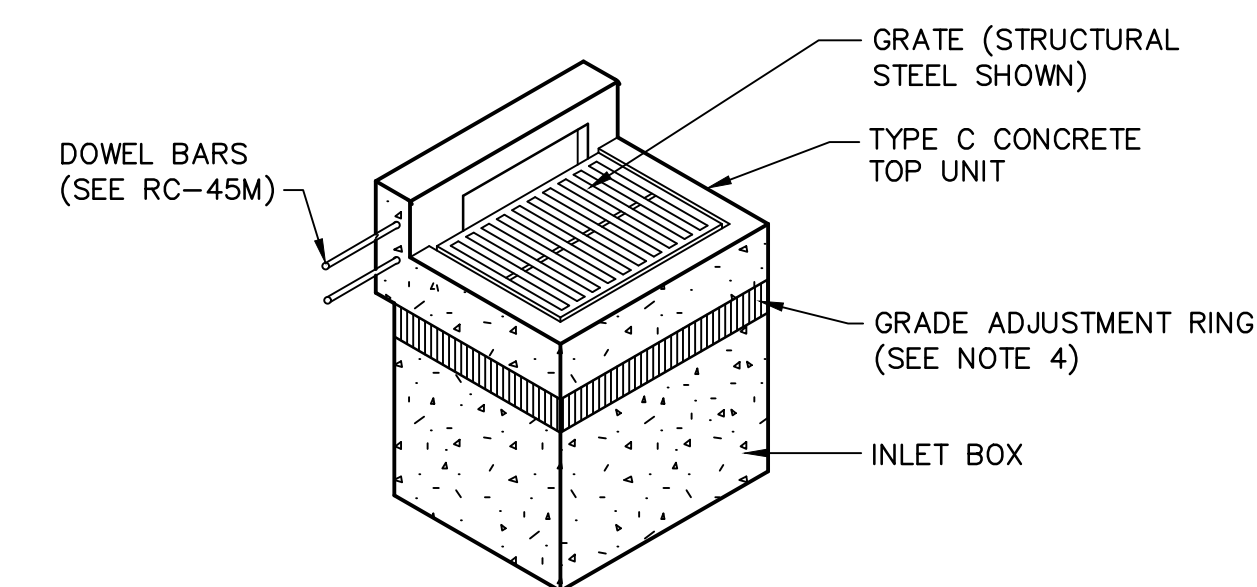


- NOTES:**
- ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH PENNDOT PUBLICATION 408, SECTION 605 AND STANDARDS FOR ROADWAY CONSTRUCTION, RC-34. CONTRACTOR SHALL VERIFY INLET BOX SIZING BASED ON PIPE SIZES AND ALIGNMENT PRIOR TO ORDERING PRECAST STRUCTURES.
  - ALL DRAINAGE STRUCTURES SHALL BE PROVIDED WITH CATCH BASIN TRAPS AND SUMPS.
  - NO PIPES SHALL ENTER INLET BOX AT CORNER.
  - PROVIDE GRADE ADJUSTMENT RINGS WHEN REQUIRED. SEE RC-45M FOR DETAILS.

**TYPE M INLET DETAIL**  
NOT TO SCALE

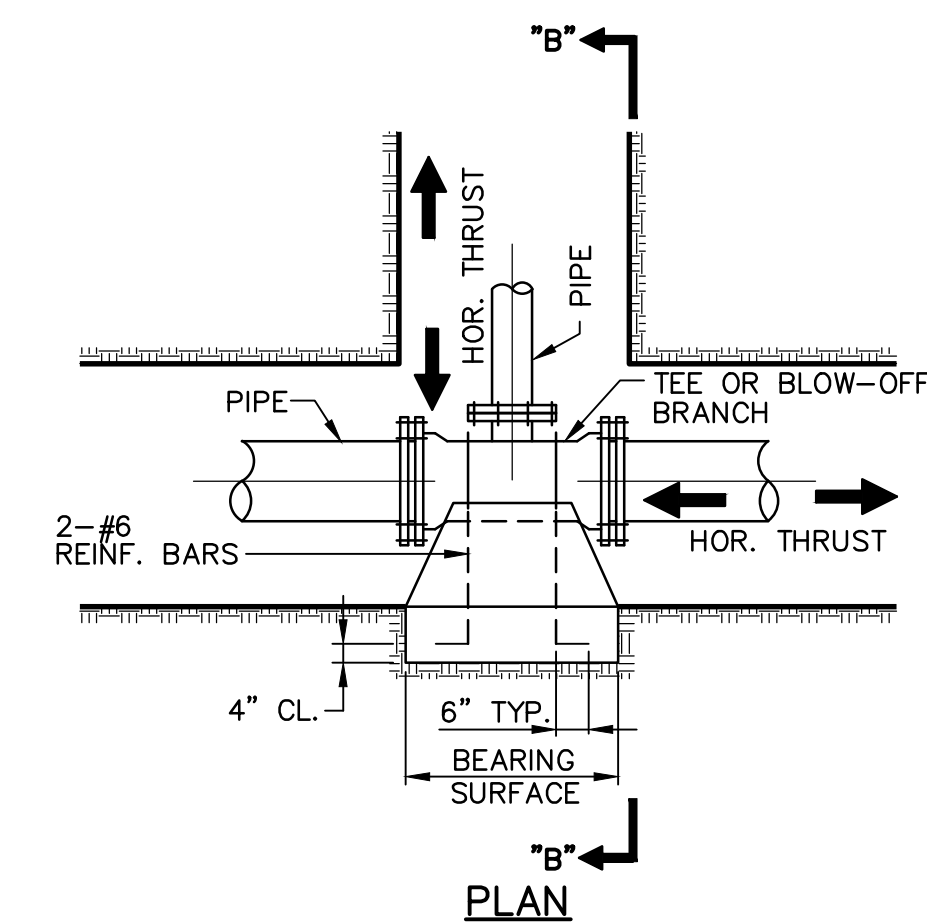
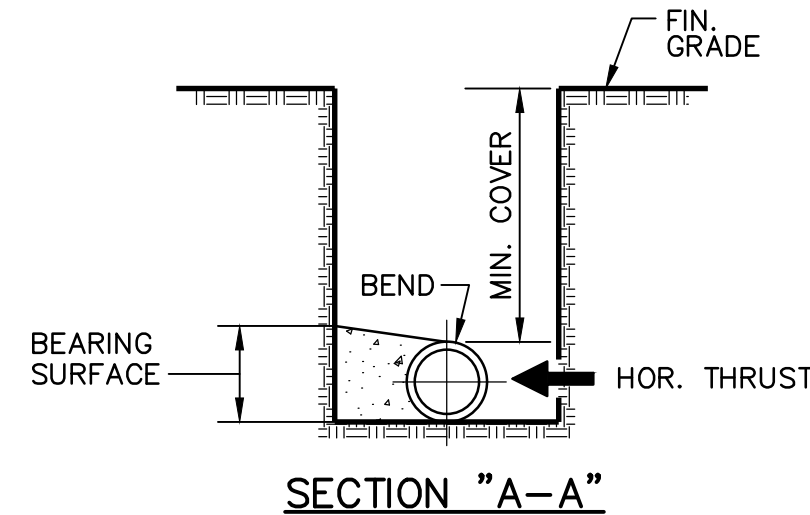
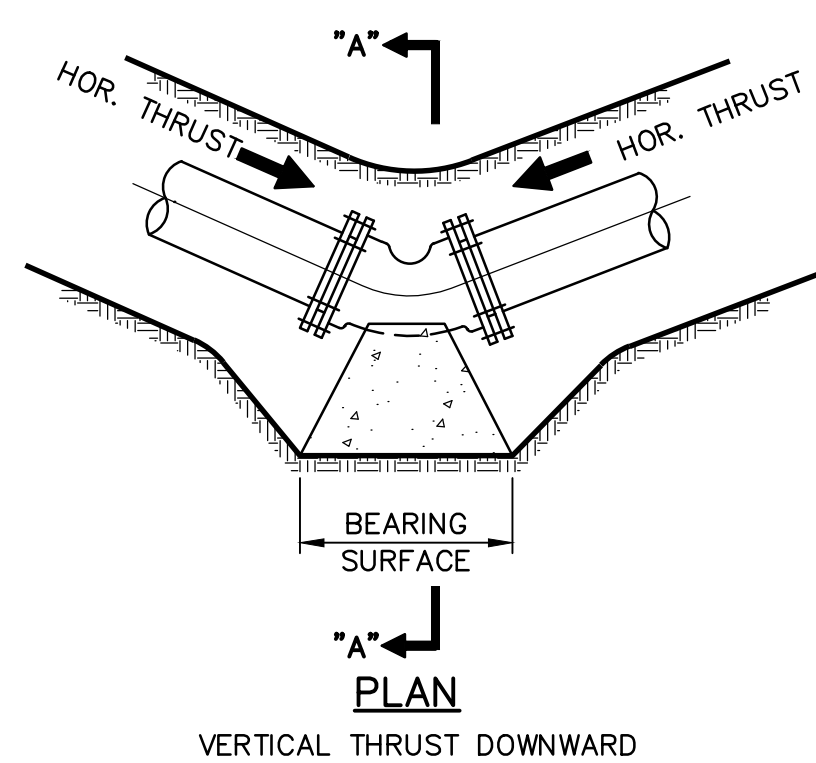


**WATER MAIN CROSSING UNDER UTILITIES DETAIL**  
NOT TO SCALE

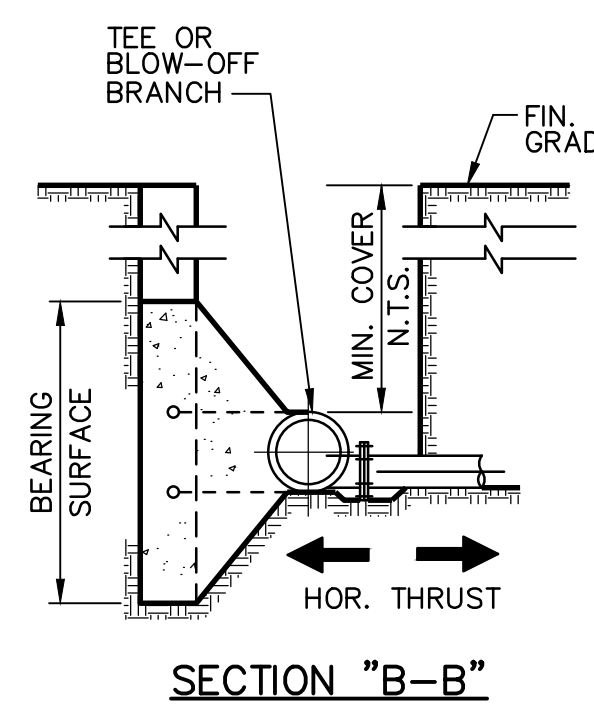


- NOTES:**
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  - ALL DRAINAGE STRUCTURES SHALL BE PROVIDED WITH CATCH BASIN TRAPS AND SUMPS.
  - NO PIPES SHALL ENTER INLET BOX AT CORNER.
  - PROVIDE GRADE ADJUSTMENT RINGS WHEN REQUIRED. (SEE RC-45M FOR DETAILS)

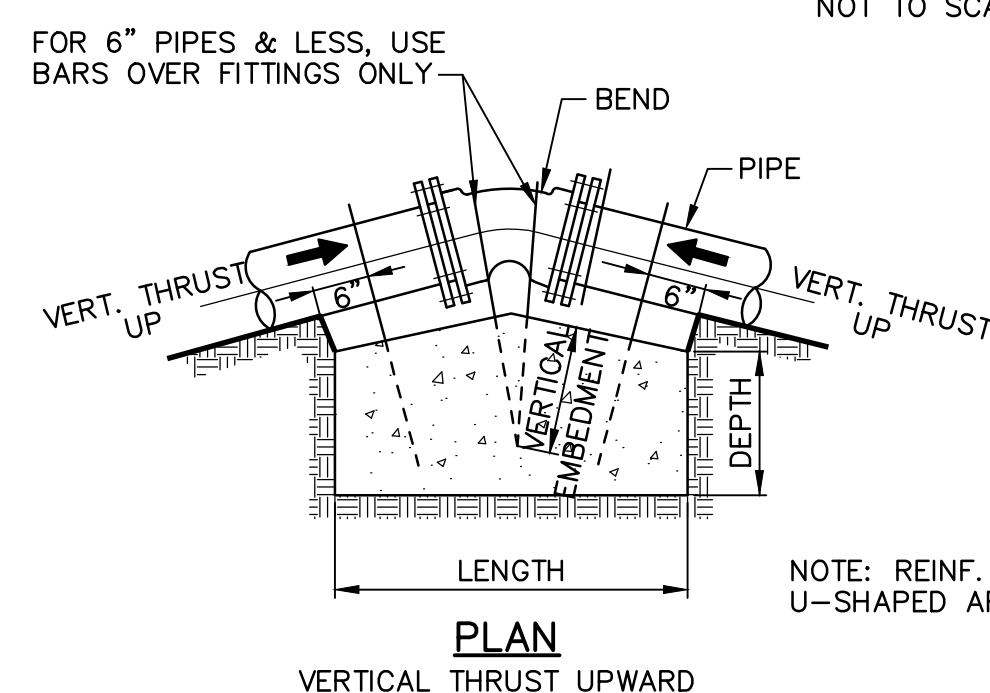
**TYPE C INLET DETAIL**  
NOT TO SCALE



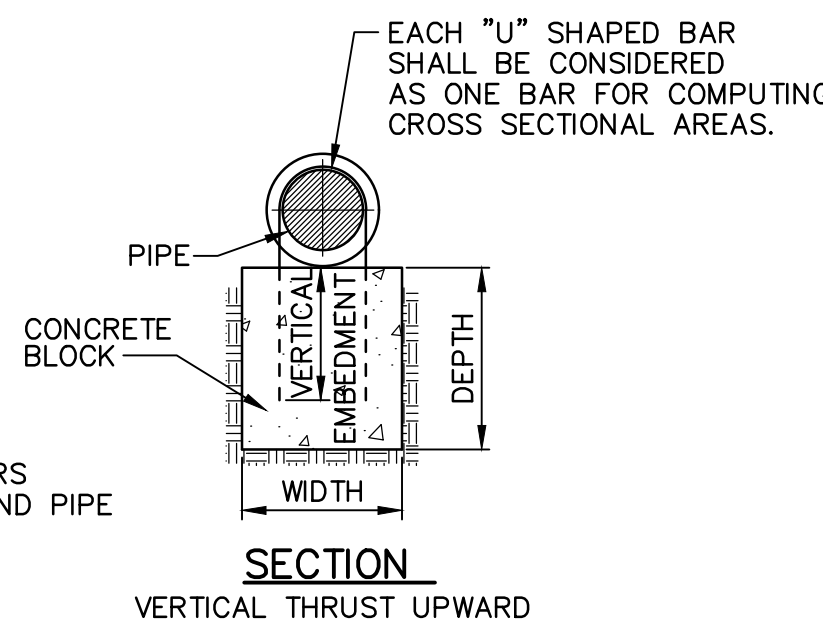
**THRUST BLOCKING**  
NOT TO SCALE



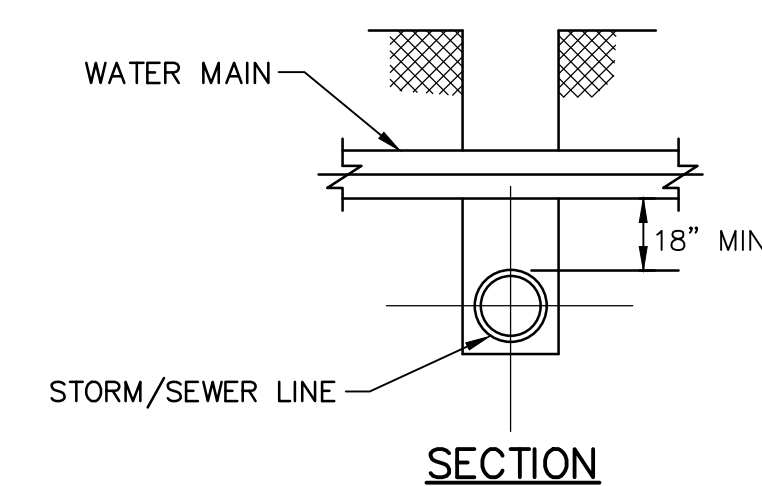
**SECTION "B-B"**



**THRUST BLOCKING**  
NOT TO SCALE



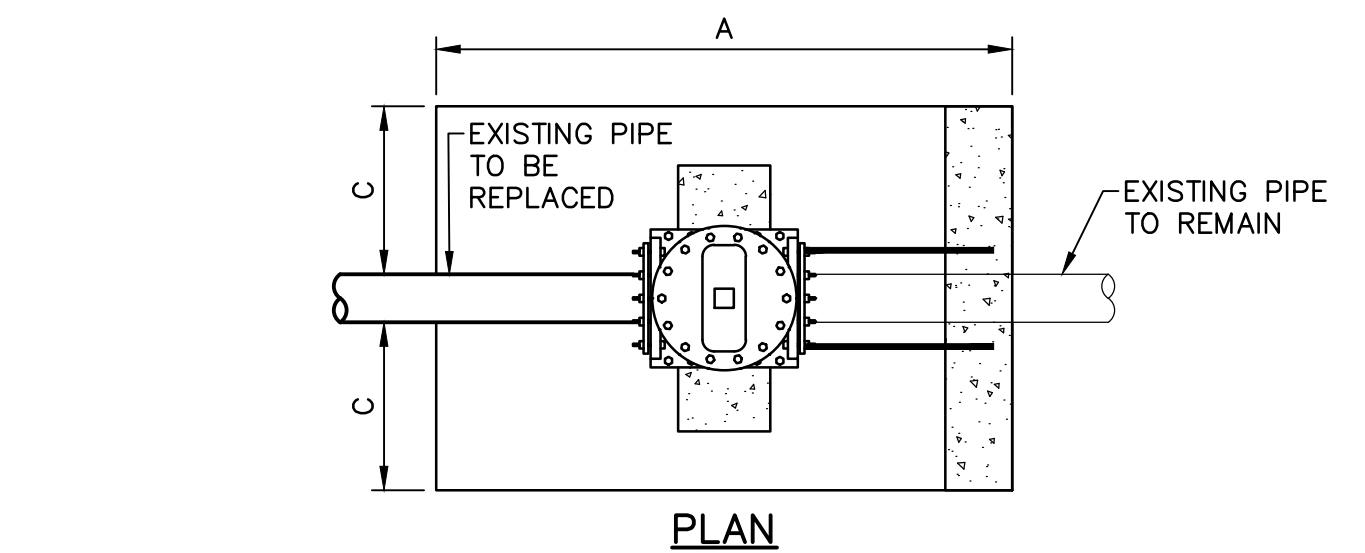
**SECTION**



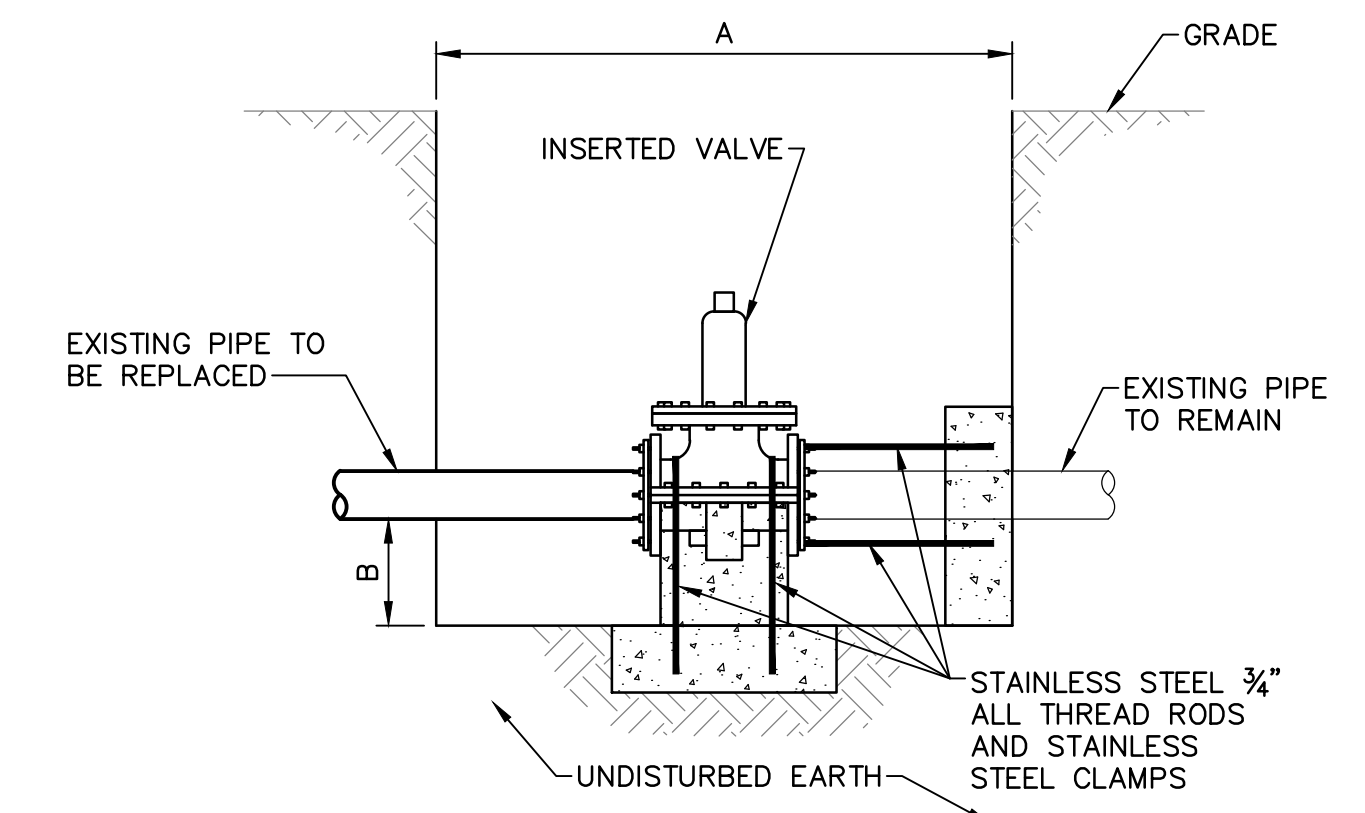
**SECTION**

- NOTES:**
- IF JOINT ON WATER MAIN IS WITHIN LIMITS OF SEWER TRENCH. INSTALL MECHANICAL BELL JOINT CLAMP.
  - IF CLEARANCE IS LESS THAN 18" CONCRETE ENCASE SEWER PIPE 10 FT. EACH SIDE OF WATER MAIN. TO BE PAID AT UNIT PRICE BID PER CUBIC YARD OF MISC. CONCRETE.
  - IN NO CASE SHALL THE SEWER PIPE CONTACT ANY WATER MAIN, SERVICE LINE OR APPURTENANCE.

**WATER MAIN CLEARANCE**  
NOT TO SCALE



**PLAN**



**ELEVATION**

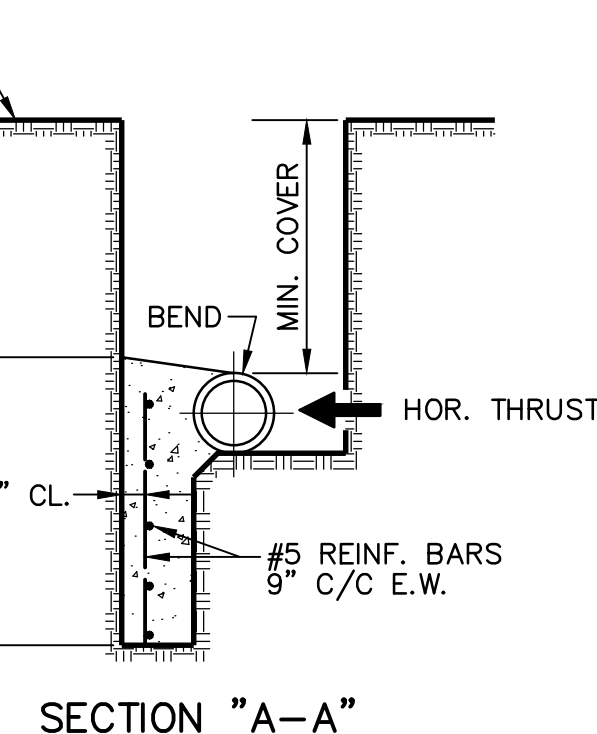
PIPE DIA.	A	B	C
4"-8"	6'	18"	3'
10"-12"	8'	24"	4'

- NOTES:**
- VALVE BOX, BEDDING & BACKFILL NOT SHOWN FOR CLARITY.
  - INSTALL IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

**INSERTED VALVE DETAIL**  
NOT TO SCALE

- NOTES:**
- ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 P.S.I. AT THE END OF 28 DAYS.
  - ALL REINFORCING STEEL SHALL BE DEFORMED BARS.
  - NO COUPLINGS OR JOINTS SHALL BE COVERED WITH CONCRETE.

**THRUST BLOCKING**  
NOT TO SCALE



**SECTION "A-A"**



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CAPITAL REGION WATER  
3003 NORTH FRONT STREET  
HARRISBURG, PA 17110

(717) 525-7677

**STANDARD DETAIL DRAWINGS**

CITY OF HARRISBURG DAUPHIN COUNTY PENNSYLVANIA

PROJ. MGR. - EAE  
DESIGN - CJK  
CADD - RSF  
CHECKED -  
SCALE - AS NOTED  
DATE - OCT. 2021

DRAWING NO.  
**DT-4**  
SHEET NO.  
4 OF 4  
PROJECT 4379.0494

NO.	REVISION	DATE	BY



**CAPITAL REGION™**

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**WATER**

**SECTION 33 31 00 – UTILITY SEWER PIPING AND ACCESSORIES**

**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Sewer pipe, sewer laterals, fittings, and related appurtenances.

1.2 SUBMITTALS

- A. Submit under provisions of Section 01 33 00.
- B. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cut, or other data as required to provide a complete description of piping, fittings and other appurtenances specified herein.
- C. Certificates:
  - 1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
  - 2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.3 QUALITY ASSURANCE

- A. Design Criteria:
  - 1. Use only one type and class of pipe in any continuous line of sewer between structures, unless otherwise indicated on the Contract Drawings.
  - 2. Use pipe and fittings designed to withstand imposed trench loadings and conditions at the various locations.
- B. Source Quality Control:
  - 1. Perform hydrostatic and leakage shop tests on all pipe and fittings in accordance with applicable AWWA Standards.
  - 2. Shop Tests: Each pipe manufacturer must have facilities to perform listed tests. The Engineer reserves the right to require the manufacturer to perform such additional number of tests as the Engineer may deem necessary to establish the quality of the material offered for use.
  - 3. Laboratory Tests: The Engineer reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish without compensation, labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory. The Contractor will pay for these laboratory tests.

#### 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle piping and related products in accordance with Specifications, manufacturer's recommendations, and as supplemented herein.
- B. Pipe and related materials to be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances drop or skid such material against other products already on ground.
- C. Handle pipe and related materials at all times with care to avoid damage. Interior kept free from dirt and foreign matter. All pipe and appurtenances carefully lowered or raised into place, with suitable equipment in manner that will prevent damage to material. Do not drop or dump pipe or accessories under any circumstances.
- D. Thoroughly inspect pipe, pipe linings, fittings, valves, and all related materials for defects prior to being unloaded and again prior to being installed. Repair or replace any defective, damaged, or unsound material, as determined by Engineer, at no additional cost to Owner.
- E. All lumps, blisters, and excess coating removed from ends of each pipe. Joints brushed and wiped clean, dry, and free from oil and grease before pipe is installed.

#### 1.5 SITE CONDITIONS

- A. Environmental Requirements:
  - 1. Keep trenches dewatered until initial bedding has been placed, pipe joints have been made, and initial bedding and concrete cradle and encasement, if any, have cured.
  - 2. Under no circumstances lay pipe in water or on bedding containing frost.
  - 3. Do not lay pipe when weather conditions are unsuitable, as determined by the Engineer, for pipe laying work.

### **PART 2 – PRODUCTS**

#### 2.1 GENERAL

- A. All specials and every length of pipe shall be marked with the manufacturer's name or trademark, size, class, and the date of manufacture. Special care in handling shall be exercised during delivery, distribution, and storage of pipe to avoid damage and unnecessary stresses. Damaged pipe will be rejected and shall be replaced at the Contractor's expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.
- B. Testing of pipe before installation shall be as described in the corresponding ASTM or AWWA Specifications and in the applicable standard specifications listed in the following sections. Testing after the pipe is installed shall be as specified in Paragraph 3.04.

- C. The Drawings indicate work affecting existing piping and appurtenances. The Contractor shall excavate test pits as required of all connections and crossings which may affect the Contractor's work prior to ordering pipe and fittings to determine sufficient information for ordering materials. The Contractor shall take whatever measurements that are required to complete the work as shown or specified.

## 2.2 GRAVITY SEWER PIPE AND FITTINGS

- A. PVC (Gravity Sewer SDR 35, PS 46 and SDR 26, PS 115) Pipe and Fittings:
1. Polyvinyl chloride (PVC) pipe, used for gravity sewer construction, as indicated on the Contract Drawings, shall meet, or exceed the requirements of ASTM D 3034 for 4-inch through 15-inch pipe and ASTM F679 for 18-inch through 48-inch pipe. The PVC sewer pipe shall have a minimum standard dimension ratio (SDR) of 35 and the minimum pipe stiffness, as tested in accordance with ASTM D 2412, shall be 46 psi when measured under 5 percent deflection at 73 degrees Fahrenheit. Pipe shall be manufactured with integral wall bell and spigot joints in standard lengths not exceeding 20 feet. PVC sewer installed greater than 14-feet in depth shall be SDR 26, unless otherwise called out.
  2. All polyvinyl chloride (PVC) pipe and fittings shall utilize elastomeric O-ring gasketed joints assembled in accordance with the manufacturer's SDRsquare inches and conform to ASTM F477 specifications. Provide elastomeric gaskets that have been tested as suitable for continuous contact with domestic sewage.
  3. Polyvinyl chloride repair couplings, tees, pipe stoppers, and other fittings shall be manufactured in accordance with the same specifications and shall have the same thickness, depth of socket, and annular space as the pipe. PVC sewer fittings shall conform to ASTM D3034 specifications with a minimum wall thickness of SDR 35. PVC material shall have a cell classification of 12454-B or C as defined in ASTM D1784.
  4. PVC wye fittings or three-piece lateral connection shall be used for connection to PVC pipe:
    - a. Three-piece lateral connections shall consist of a PVC hub, rubber sleeve, and stainless-steel band. Three-piece lateral connections shall be compression fit into the cored wall of a PVC pipe and requires no special tools.
    - b. Wye Fittings:
      - i. Wye fittings shall conform to the requirements in the section. Make connections to sewer using fittings of same material and joint configuration as the sewer at the planned point of branch connection.
      - ii. Use commercially manufactured wye fittings and one-eighth bends.
      - iii. Set wye branches at proper vertical angles as required to bring service connections to the proper depth.
      - iv. Fitting locations shall be determined in the field by the Engineer.
- A. Ductile Iron Pipe and Fittings:



1. Ductile iron pipe, for sewer construction, shall be centrifugally cast with push-on joints, not less than 12 feet nor more than 20 feet in length. Ductile iron sewer pipe shall be Thickness Class 52 and meet the requirements of ANSI A21.51, ANSI 21.50, and AWWA C151.
2. Fittings and specials for ductile iron pipe shall be made of cast iron in accordance with ANSI A21.10 and rated for 350-psi working pressure.
3. Buried Joints: Use rubber-gasketed joints for pipe and fittings installed underground. Push-on: Per ANSI/AWWA C111/A21.11 requirements.
4. Pipe and Fittings Coating: Factory coat outside with bituminous material, minimum 1 mil dry thickness. Bituminous material and finished coat shall conform to seal coat requirement of ANSI A21.4 and AWWA C151.
5. Condition of Ductile Iron Pipe Prior to Surface Preparation:
  - a. All ductile pipe and fittings shall be delivered to the application facility without asphalt, cement lining, or any other lining on the interior surface. Because removal of old linings may not be possible, the intent of this Section is that the entire interior of the ductile iron pipe and fittings shall not have been lined with any substance prior to the application of the specified lining material and no coating shall have been applied to the first six inches of the exterior of the spigot ends.
6. Lining Material:
  - a. Interior surfaces of ductile iron pipes and fittings shall be lined with Protecto 401™ Ceramic Epoxy, Tnemec Permashield 431, per manufacturer's recommendations.
  - b. Exterior coating shall be bitumastic.
  - c. Application:
    - i. Surface Preparation: Abrasive Blast Cleaning per NAPF 500-03-04 shall be performed on all Ductile Iron pipe and fittings prior to lining.
    - ii. Dry Film Thickness (DFT): Linings on all Ductile Iron pipe and fittings shall have a minimum DFT of 40 mils and shall be tested per NACE SSPC PA-2 Film Thickness Rating.
    - iii. Testing for Pinholes: All linings shall be tested for pinholes using high voltage discontinuity testing per ASTM 5162.
    - iv. It is the Contractor's responsibility to make minor field repairs to any linings that are damaged during installation.
    - v. Owner reserves the right to accept or reject any lined pipe or fittings that does not meet the requirements listed above.
  - d. Handling:
    - i. Lined pipe and fittings must be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying. The pipe shall not be dropped or unloaded by rolling.
    - ii. Care should be taken not to let the pipe strike sharp objects while swinging or being off loaded. Ductile iron pipe should never be placed on grade by use of hydraulic pressure from an excavator bucket or by banging with heavy hammers.

### 2.3 PIPELINE DETECTION AND MARKING

- A. Pipeline detection tape:
1. Detection tape shall consist of a minimum 5.0 mil overall thickness with a solid aluminum core or backing capable of being detected.
  2. Detection tape shall be minimum 2-inches wide, green in color, imprinted with the words "Caution-Sewer Line Below", and capable of being detected with inductive methods.
  3. Tape shall be installed two (2) feet above the sewer main and laterals.

### 2.4 SHIELDED FLEXIBLE TYPE PIPE COUPLINGS

- A. Shielded flexible type pipe transition couplings shall be provided where PVC and non-PVC, such as VCP, pipe is to be connected. Flexible type pipe coupling shall be constructed of an elastomeric compound meeting the requirements of ASTM C1173 and D5926. Coupling shall be provided with two (2) stainless steel take up clamps.
- B. Coupling shall be provided with a 316 stainless steel clamp band. Six inch and larger couplings shall have two nut and bolt take-up points per band. Coupling shall have a .012" thick, 300 Series stainless steel shear ring. Length manufactured shall be according to manufacturer based on coupling diameter. Width manufactured according to coupling width. Clamps shall be welded on to the shear ring in place.

### 2.5 DISSIMILAR PIPE COUPLING

- A. Dissimilar pipe coupling shall be used where dissimilar sewer pipes, such as existing brick pipe to new PVC pipe, are to be interconnected.
- B. Dissimilar pipe couplings shall consist of:
1. Rubberized mastic laminated to strong reinforcing mesh designed for long term structural integrity.
  2. High strength steel straps incorporated inside the coupler to compress the specially formulated mastic to permanently bond to the pipe surface.
  3. Dissimilar pipe couplers shall conform to ASTM C877, Type II Plastic Film and Mesh Reinforcement Mastic Band.
  4. Tie straps shall be steel with a minimum width of 5/8" and conform to ASTM D3953.

### 2.6 FLEXIBLE PVC CAPS

- A. Flexible PVC caps shall be provided where existing pipes are to be abandoned. Flexible type pipe coupling shall be constructed of an elastomeric compound. Caps shall be provided with one (1) stainless steel take up clamp.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Carefully examine each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.
- B. Remove rejected pipe from the Project.

### 3.2 PREPARATION

- A. Clean piping interior and mating surfaces of bell, spigot, and gasket before laying. Maintain clean until completed work is accepted.
- B. Perform trenching for sewer pipe and place pipe bedding as specified in Section 31 23 33.
- C. Dig bell holes sufficiently large to permit proper joint making and to ensure pipe is firmly bedded full length of its barrel.

### 3.3 Pre-Inspection

- A. Prior to any excavation work, contractor shall conduct a CCTV inspection of the existing pipes at all locations where excavation activities are planned. Detailed lateral location logs shall be kept by the contractor during construction. CCTV inspection shall be conducted in accordance with Section 33 01 31.
- B. If pre-inspection CCTV cannot be completed due to deterioration of the existing sewer pipe, contractor shall complete dye testing of all buildings (floor drains, sanitary sewer facilities, roof drains, etc.) and storm inlets within the vicinity of the excavation activities to confirm location of all active storm and sanitary sewer connections during excavation activities to ensure all are reconnection to the sewer system.

### 3.4 LAYING PIPE

- A. General Requirements for Open Cut Pipe Installation:
  - 1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade unless shown otherwise on the drawings or directed by the Engineer.
  - 2. Contractor's attention is called to the fact that a portion of the construction involved in this project is being conducted at minimum allowable grade. The Contractor shall use care in setting lasers or the other means that he plans to utilize for construction of the sewers. If not constructed at the required grade, the Engineer shall have the option of directing the Contractor to relay the pipe to the required grade at no additional cost to the Owner.
  - 3. Exercise care to ensure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipeline.
  - 4. Center spigot end in bell or socket end of previously laid pipe, shove tight and secure.

5. No wedging or blocking permitted in laying pipe unless by written order of Engineer.
  6. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place.
  7. Walking or working on completed pipeline, except as necessary in tamping and backfilling, not permitted until trench is backfilled one foot deep over top of pipes.
  8. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.
  9. Take up and replace with new, such in-place pipe sections found to be defective. Replace at Contractor's expense.
  10. Take necessary precautions to prevent newly laid pipe from floating as a result of water accumulation in the trench, or the collapse of the pipeline from any cause. Restore or replace pipe as necessary at Contractor's expense.
  11. Bed pipe using materials specified in Section 31 23 33.
  12. At the close of each day's work, and at such other times when pipe is not being laid, protect open end of pipe with a close-fitting stopper.
  13. Cut pipe using only equipment specifically designed for that purpose such as an abrasive wheel, rotary wheel cutter, a guillotine pipe saw or a milling wheel saw. The use of chisels or hand saws will not be permitted. Grind smooth cut ends and rough edges. Bevel slightly, cut end for push-on connections.
  14. Where cutting of pipe is necessary, minimum laying length shall be five (5) feet, unless stated otherwise on the Contract Drawings.
- B. Specific Requirements:
1. Install plastic pipe and fittings and assemble joints according to ASTM D2321 for Class 1 bedding material.
  2. Refer to Section 31 23 33 for backfilling requirements.
  3. Pipeline detectable tape shall be installed continuously along all gravity sewer lines. The tape shall be installed directly above each pipeline and two (2) feet from the ground surface.
- C. Joints:
1. Make pipe and fittings joints according to pipe manufacturer's specifications and to specifications previously specified for pipe.
  2. Make joints watertight. Immediately repair detected leaks and defects. Methods of repair subject to Engineer's approval.
- D. Alignment and Grade:
1. Lay and maintain all pipe at the required lines and grades as shown on the Drawings. Place fittings and valves at the required locations with joints centered, spigots forced home, and all valve stems plumb. Do not deviate from the required line and grade, except with the approval of the Engineer.
  2. Deflect pipe joints where indicated on the drawings. Deflections shall not exceed pipe manufacturer's recommended maximum allowable deflection.

3. Do not change grade or alignment without Engineer's approval.
4. Where PVC pipe is shown to be installed between storm inlets and sewer manholes or pipes, contractor shall install proposed PVC with a consistent slope and straight alignment, to the greatest extent possible. Where existing utilities prevent a constant slope and straight alignment, install fittings to follow existing alignment of sewer pipe, as approved by Engineer prior to installation.

### 3.5 FIELD QUALITY CONTROL

- A. General Requirements: Conduct tests specified herein so that each pipeline installed in the Project is tested to the Engineer's satisfaction:
  1. Provide tools, materials (including water), apparatus and instruments necessary for pipeline testing.
  2. Conduct tests in the presence of and to the satisfaction of the Engineer.
- B. Cleaning Prior to Tests: Before tests are conducted, clean piping including sewers, branches, and service connections until free of dirt or silt or construction debris.
- C. Alignment: After the gravity mains have been laid and backfilled, a light will be flashed between manholes or manhole locations to determine whether the alignment of the sewer is true and whether any pipe has been displaced, broken or otherwise damaged subsequent to laying. This test will again be conducted before final acceptance of the sewer:
  1. Horizontal Alignment: Each section (manhole to manhole) of sewer shall show no less than a three-quarter (3/4) light circle throughout its length and any and all defects shall be corrected by the Contractor, to the satisfaction of the Engineer, before the work shall proceed and before acceptance of and/or payment shall be made.
  2. Vertical Alignment: No vertical displacement or misalignment will be accepted. The Contractor, to the satisfaction of the Engineer, shall correct all defects before the work shall proceed and before acceptance of and/or payment shall be made.
- D. Initial Section Test: To demonstrate acceptability of install pipe materials and workmanship, construct, and air test one sewer section from manhole to manhole using the pipe provided in the Contract. Pretesting such section prior to actual Initial Section Test not permitted:
  1. Conduct Initial Section Test in same manner as Line Acceptance Test specified in a following paragraph.
  2. Conduct said Initial Section Test for each size and type pipe material used in the Project prior to continued installation of same pipe.
  3. Provide pipe manufacturer's representation during laying, backfilling, and testing of Initial Sections Tests.
  4. Failure of an Initial Section Test will be sufficient cause for the Engineer to reject manufacturer and supplier of pipe regardless of cause of failure.
  5. Sewer sections successfully tested as Initial Section Test will be retested under Line Acceptance Test.



6. Include costs for above stated tests in unit or lump sum price or prices bid for the Work as no separate payment will be allowed for Initial Section Test.
- E. Line Acceptance Test for Gravity Lines: (Leakage tests):
1. After a section of sewer is constructed between two new adjacent manholes, backfilled and successfully cleaned and passes an alignment test, perform a low-pressure air Line Acceptance Test in accordance with ASTM F 1417 and the following:
    - a. Seal and brace sewer piping at upstream and downstream manholes and at all laterals. Test plug seal before actual use by testing plugs outside the trench in one length of pipe pressurized to maximum anticipated testing pressure. Plugs shall hold without bracing and show no movement. After plug is placed in pipe and sealed, brace or protect as insurance against blow out. Protect workers from potential plug blow out.
    - b. Introduce low pressure air slowly into sealed sewer section until the internal air pressure is four psig greater than the average ground water pressure acting on the pipe, but in no case higher than 10 psig.
    - c. To determine the internal air pressure for the test, add 3.5 psig to the height in feet of the ground water above the invert of the pipe divided by 2.3. However, the test pressure should not exceed 10 psig.  
  
For example, if ground water height is 6.9':  $3.5 + (6.9/2.3) = 6.5$  psig
    - d. Allow no less than 3 minutes for air temperature and pressure to stabilize. Add air only to maintain required test pressure.
    - e. After the stabilization period, adjust the test pressure to the required test pressure, and disconnect the air supply. Then measure the time that is required to achieve a 1.0 psig pressure drop.
    - f. The line passes if the time required for a 1-psig pressure drop exceeds the value listed in Table 1 included at the end of this Section. Interpolate values for intermediate distances from those shown. If the time for 1 psig pressure loss is less than that reported in the table, then the line fails and shall be repaired prior to re-test.
    - g. For conditions not reflected in the Table, utilize the following equation:

$$T=0.085 * (D^k) / Q$$

Where: T=shortest time, in seconds, allowed for the air pressure to drop 1.0 psig.

$K=0.000419D*L$ , but not less than 1.0.

$Q=0.0015$  cubic feet/minute/square feet of internal surface.

D=nominal pipe diameter in inches.

L=Length of pipe being tested in feet.

2. After laterals are installed, re-test line in accordance with the above procedure if line is initially tested before the installation of laterals.
  3. Where lines are live and carry flow, perform Joint Acceptance Test by testing one joint at a time as described in paragraph 3.04.F, below.
- F. Joint Acceptance Test for Gravity Lines (Leakage Tests):
1. Joint Testing Equipment Control Test: A two-part control test shall be performed to insure the accuracy, integrity, and performance capabilities of the testing equipment; testing as follows:
    - a. Demonstration Test: Prior to starting the air testing work, perform a demonstration test in the presence of the Engineer using a test cylinder, furnished by the Contractor, constructed so that a leak can be simulated. The demonstration test shall use the procedures specified in this Section:
      - 1) The purpose of the demonstration test is to establish that the air testing system is capable of meeting the specified test criteria.
      - 2) If this test cannot be performed successfully, the Contractor shall repair or otherwise modify his equipment and repeat the test until the results are satisfactory to the Engineer.
      - 3) The Engineer may require that this test be repeated at any time during the joint testing work when, in the Engineer's opinion, the testing results are suspect.
    - b. Readiness Test: Prior to commencing joint testing in each section of sewer main piping, perform a readiness test in the presence of the Engineer. Position the air testing packer on a section of sound sewer pipe between pipe joints and perform a test as specified:
      - 1) The purpose of the test is to check that the piping is properly cleaned for air testing and the air testing equipment system is operating in accordance with the requirements of the Specifications.
      - 2) If this test cannot be performed successfully, the Contractor shall remove the air testing packer from the sewer section and repair or otherwise modify his equipment and repeat the test until the results are satisfactory to the Engineer.
  2. Air Testing Equipment: Provide a complete air testing system specifically designed and constructed for internal air pressure tightness integrity testing of sewer piping joints. The equipment shall be constructed in such a way as to provide means for introducing air, under pressure, into the void area created by the expanded ends of the joint-testing packer and a means for continuously measuring the actual static pressure of the air within the void area only. The system shall include, but not be limited to, the following items and features:
    - a. Closed Circuit Television System per requirements of Section 33 01 31.

- b. Packer: Open end, cylindrical casing of a size less than the pipe diameter, remote controlled for forward and backward movement within the sewer mains:
    - 1) Air-inflatable sleeves (or diaphragms) mounted at each end of the casing exterior with the ends of sleeves fastened to the casing. Devices that have sleeves which may require extreme pressures to “seat” against the inside periphery of the sewer main pipe are not permitted.
    - 2) Regulate expansion of air-inflatable sleeves by precise pressure gauges and controls. Under no conditions will hydraulically or mechanically expanded devices be allowed.
    - 3) Pass conduits leading from the surface through one end of the packer casing adapted to supply air, under pressure, to the space at the center of the casing.
  - c. Compressed Air System: compressed air system shall include compressed air source, piping, valves, and pressure gauges to control the rate of air flow to the packer sleeves and test section:
    - 1) To prevent loading the test section with the full pressure of the compressor, the test equipment shall be provided with an approved pressure regulating device.
  - d. Test Monitoring Equipment: Provide test monitoring equipment to transmit the value of the void air pressure to a remote test pressure monitoring gauge or readout:
    - 1) Test pressure monitoring gauge or readout shall be located to allow for simultaneous and continuous observation of the television monitor and test monitoring equipment by the Engineer.
3. Use internal televising to observe each joint and fault and to accurately position air testing equipment in sewer piping. Televising conducted in conjunction with air testing will be considered a part of the work of air testing.
  4. The air testing packer end elements shall be expanded so as to isolate the joint from the remainder of the line and create a void area between the packer end elements and the pipe joint. The ends of the testing device shall be expanded against the pipe with sufficient inflation pressure to contain the air within the void without leakage past the expanded ends.
  5. Contractor shall then introduce pressurized air into the isolated void created by testing device. Pressure shall be applied until it is determined that the pressure cannot be built in the void, or four (4) psi as recorded by the void pressure monitor. When either of these conditions is reached, Contractor shall shut off the air supply.
  6. If the required pressure cannot be developed, joint shall have failed the test. If the required test pressure in the void was increased to four (4) psi, rate of decay of this pressure shall not exceed one (1) psi in 15 seconds. The joint being tested will also have failed if the pressure drops more than one (1) psi in 15 seconds. The line shall then be repaired prior to the retest.
  7. Test Records:

- a. During joint acceptance testing, records shall be kept which include identification of the sewer section tested, test pressure used, location (footage) of each joint tested, a statement indicating test results (passed or failed) for each joint tested, test pressure achieved and maintained for each joint passing air test, weekly equipment pressure test results, sewer section barrel test results, and air temperature at time of testing joints.
- G. Construction Testing – Lateral Connections:
1. To determine if a lateral connection passes the air test, the packer and sealing bladder shall be inflated to isolate the area around the connection and the first joint of the lateral pipe.
  2. Contractor shall then introduce an air pressure of four (4) psi into the isolated void and shut off the air supply. Contractor shall then measure and record the length of time for the pressure to drop from 4 psi to 3 psi.
  3. The joint test for the lateral would consider to be passed if the time delay for the pressure drop exceeds 15 seconds.
- H. Time for Making Test:
1. Engineer shall be present during the operating of valves required to fill mains for leakage test.
  2. Contractor shall advise Engineer of any test at least 48 hours in advance. No testing will be authorized unless ambient air temperature is 35° F or higher.
  3. All tests shall be witnessed by Engineer.
  4. Contractor shall furnish laboratory calibrated test gauges and measuring devices for the leakage test.
- I. Gravity Sewer Deflection Test:
1. Test all PVC gravity sewer main installed not less than 30 days following backfill.
  2. Mandrel shall be cylindrical in shape, 95 percent of nominal pipe diameter and a minimum of 10 inches long for 4" – 15" pipe and 24 inches long for 18" – 48" pipe. Mandrel diameter achieved with no less than 8" arms evenly spaced at each end and in the middle of the mandrel.
  3. Pull mandrel through pipe section manually. Powered pulling devices are not permitted.
  4. Pipe fails test if mandrel cannot be pulled through pipe. Note location of failure, excavate, replace pipe section that failed, and re-test.
- J. CCTV Inspection:
1. Complete CCTV inspection after installation and all other testing is completed, but prior to the removal of bypass equipment/reinstatement of flow. CCTV inspection shall conform to Section 33 01 31.
  2. CCTV inspection is not required for the inspection spot repairs on sewer mains that are to be lined. The pre-lining CCTV inspection of these pipes shall be conducted by the Contractor in accordance with Section 33 01 31, and Section 33 01 34.

3. Any visual defects identified in the gravity sewer main will be considered a failure. Following identification of failure location(s), excavate, replace pipe section where visual defect was located, and coordinate re-inspection with Owner.
  
- K. Acceptance: Observation of successful testing of this Section by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Owner. Only upon final inspection by the Owner or Engineer, and upon written acceptance for same, will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the manholes and sewers will commence:
  1. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor's expense prior to acceptance.

### 3.6 PROTECTION

- A. Section 01 73 00 - Execution Requirements: Requirements for protecting finished Work.
- B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
- C. Cap open ends of piping during periods of Work stoppage.



TABLE 1

**MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP  
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015**

1 Pipe Diameter (in.)	2 Minimum Time (min: sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	SPECIFICATION TIME FOR LENGTH (L) SHOWN (MIN:SEC)								
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.	
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470 L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	
36	34:00	66	30.768 L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	

**END OF SECTION**

**SECTION 33 39 00 – UTILITY SEWER STRUCTURES****PART 1 – GENERAL****1.1 SECTION INCLUDES**

- A. Sewer manholes and related appurtenances.
- B. Storm sewer inlets and related appurtenances.

**1.2 REFERENCE STANDARDS**

- A. ASTM International:
  - 1. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
  - 2. ASTM C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
  - 3. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
  - 4. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
  - 5. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

**1.3 SUBMITTALS**

- A. Shop Drawings and Product Data:
  - 1. Submit under provisions of Section 01 33 00.
  - 2. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable. Include, at a minimum:
    - a. Indicate structure locations and elevations.
    - b. Indicate sizes and elevations of piping penetrations.
  - 3. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.
  - 4. Contractor shall conduct a manned entry field investigation of each existing manhole that is to be replaced to confirm existing pipe sizes, inverts, and angle of connections prior to submitting shop drawings.
- B. Certificates:
  - 1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
  - 2. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products as specified in source quality control.
  - 3. Certificate of construction compliance with ASTM C478 from the precast reinforced concrete structure manufacturer.
  - 4. Manufacturer sworn certification that sanitary sewer manholes were constructed using Type II Portland cement or approved equivalent. No payment for sanitary

- sewer manholes will be approved until such certificate has been submitted.
5. Certificate of material compliance with ASTM A48, Class 30 tensile strength from the manhole frame and cover manufacturer. Furnish certification that tensile test bars were from same pour as castings.
  6. Manufacturer certification that manhole frame and cover meet or exceeds AASHTO HS-20 highway loading requirements.
- C. Submit certification that all products supplied under this Section comply with the Pennsylvania Steel Products Procurement Act.

#### 1.4 QUALITY ASSURANCE

- A. Initial Sewer Manholes: Construct first sanitary sewer manholes in the Project to demonstrate the following and serve as the minimum acceptable conditions of construction throughout the Project. No additional compensation allowed for initial manhole requirement.
1. Demonstrate manhole base construction methods.
  2. Demonstrate manhole component sealing in the case of precast reinforced concrete manholes.
  3. Demonstrate manhole step alignment.
  4. Demonstrate pipe opening sealing.
  5. Demonstrate method of adjustment of manhole frame and cover to grade and manhole frame and cover attachment.
- B. Shop Inspection:
1. All materials furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.
  2. Installation of precast concrete structures within the PennDOT right-of-way cannot commence until a minimum of 75% of the 28-day concrete compressive strength is achieved and documented through shop testing. Shop test results shall be submitted to Engineer.
- C. Field Inspection:
1. All materials furnished shall be tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Engineer.
- D. Source Quality Control:
1. Precast concrete unit manufacturer shall be listed in PennDOT Bulletin 15.
  2. Precast concrete supplier plant shall be registered and certified under either the Prestressed Concrete Institute (PCI) or the National Precast Concrete Association (NPCA) plant certification program.
  3. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete structures.
  4. Structural steel grate manufacturer/supplier shall be PennDOT Bulletin 15 approved.

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## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Transport and handle precast reinforced concrete structure components and other Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects. Through-wall lifting holes and cast-in lifting cables not permitted in manhole component construction.
- B. Store precast reinforced concrete structure components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise such care in storage of other specified Products as recommended by the respective manufacturers.

## 1.6 PROJECT CONDITIONS

- A. Environmental Requirements:
  - 1. In no instance set or construct manhole on subgrade containing frost.
  - 2. To improve workability of Preformed Plastic Sealing Compound during cold weather, store such at temperature above 70° F or artificially warm compound in a manner satisfactory to the Engineer.

## PART 2 – PRODUCTS

### 2.1 BASIC MATERIALS

- A. Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:
  - 1. Concrete: Composition and compressive strength conforming to ASTM C478 except increase compressive strength to 4500 psi (at 28 days) in precast bases:
    - a. Portland cement shall be of the type identified in Paragraph 2.01.B.1.
  - 2. Casting and Curing: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C302.
  - 3. Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Contract Drawings. Materials as specified in Paragraph 2.01.E.
  - 4. Manhole Seals: Manhole component joints factory formed for self-centering concrete-to-concrete bearing utilizing sealing compound materials as specified in Paragraph 2.02.
  - 5. Manhole Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C 478, are as indicated on Contract Drawings.
- B. Cast-In-Place Concrete Products: Formwork, Reinforcement, and Cast-In-Place Concrete conforming to requirements of Division 3 – Concrete:
  - 1. Portland Cement: Composition and compressive strength conforming to ASTM C478 except use ASTM C150, Type I or Type III with Xypex Concentrate Admix C-2000 (for sulfate resistance), or ASTM C 150 Type II cement or Type I with portland blast-furnace slag cement or portland-pozzolan cement conforming to ASTM C595,

except that the pozzolan constituents of the Type IP portland-pozzolan cement shall be fly ash and shall not exceed 25% by weight.

- C. Waterproofed Mortar:
1. Manufacturers:
    - a. Medusa Cement Company; Medusa Waterproofing Paste or Powder.
    - b. Grace Construction Materials; Hydratite.
    - c. Chem-Master Corporation; Hydrolox.
    - d. Or equal.
  2. Material composition meeting ASTM C270, Type M with waterproofing admixture included.
- D. Epoxy Bonding Compound:
1. Manufacturers:
    - a. A. C. Horn EPOXTITE BINDER.
    - b. Sika Chemical SIKADUR-HI-MOD.
    - c. Euclid Chemical Company 452 EPOXY SYSTEM.
    - d. Or equal.
  2. Provide a high-modulus, low viscosity, moisture insensitive epoxy adhesive having the following characteristics:
    - a. Mix Ratio: 100 percent solids, two components; mixed one part by volume component B to two parts by volume component A.
    - b. Ultimate Compressive Strength: 13,000 psi after cure at 73°F and 50 percent relative humidity determined in accordance with ASTM D695.
- E. Manhole Steps: Design as indicated on Contract Drawings:
1. Manufacturers:
    - a. MA Industries, Inc.; Type PS-2-B.
    - b. American Step Company, Inc.
    - c. Or equal.
  2. Reinforced Plastic Step: Composed of a 1/2-inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in Grade 49108, ASTM D2146 polypropylene copolymer compound, Type II.
  3. Manhole step dimensions shall meet requirements of OSHA standard 1910.27 for fixed ladders.
- F. Manhole Frame and Cover:
1. Manufacturer & Model:
    - a. East Jordan Iron Works, Frame – 1045-Z; Cover 1040-A.
    - b. Neenah Foundry Company.
    - c. Or Equal.
  2. General:
    - a. Castings for manhole frames and covers shall be heavy duty cast iron.
    - b. Ferrous Castings shall be of uniform quality, free of blow holes, shrinkage distortion, or other defects.
    - c. Metal shall conform to ASTM A-48 Class 35 for gray iron. Designed for AASHTO highway loading class HS-20.



- d. All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Frames and covers shall have continuously machined bearing surfaces to prevent rocking.
  - e. As-cast dimensions may vary one half the maximum shrinkage characteristic of the metal or + 1/16 inch.
  - f. Watertight frame and covers lid should have 4 depressed bolt holes for stainless steel hex bolt and washer equally spaced on bolt circle (see details for dimensions).
  - g. All castings shall be cleaned by means of sand blast and neatly finished.
  - h. Manhole Casting Schedule:
    - 1) Standard frame and cover (Self Sealing):
      - a) The word "SEWER", or "STORM" as appropriate, shall be cast in the cover. Lettering shall be a minimum of 2-inches high.
      - b) Two concealed pick holes shall be provided.
      - c) Provide machined dovetail groove centered in lip seat of cover for ¼-inch diameter continuous loop polyisoprene or neoprene rubber gasket (40 durometer).
      - d) Drill four 1-inch diameter holes in frame flange equally spaced.
      - e) Cover casting shall be black asphaltic coated.
- G. Preformed Plastic Sealing Compound:
- 1. Manufacturers:
    - a. K. T. Snyder Company, Inc.; RAM-NEK.
    - b. ConSeal CS 102/202.
    - c. Hamilton Kent Manufacturing Company; KENT-SEAL NO. 2.
    - d. Or equal.
  - 2. Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound and shipped protected in a removable two-piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
- H. Waterstop Gasket:
- 1. Ring: Ring style waterstop gasket composed of elastomeric polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co., Press-Seal Gasket Corporation, or equal.
  - 2. Strip: Flexible strip style bentonite style waterstop.
- I. Waterstop Paste: Hydrophylic paste type waterstop.
- J. Grout – Refer to Section 03 60 00 "Grouting".
- K. Manhole Adapter (for cored holes):
- 1. A watertight flexible pipe-to-manhole connector.
  - 2. The connector shall provide a flexible watertight seal of the pipe to the manhole. The connector shall consist of a rubber gasket, an internal expansion sleeve, and

one or more external compression take-up clamps. Materials for the connection shall be natural or synthetic rubber and Series 300 non-magnetic stainless steel. Connector shall meet the requirements of ASTM C 923.

- L. Manhole Adapter (for cast-in-place): Provide manhole adapters for use on pipe entering manhole base where manhole base is of cast-in-place construction:
  - 1. Gasket type waterstop composed of SBR with stainless steel hardware as manufactured A-Lok, Fernco, or equal.
- M. Sanded Manhole Adaptor:
  - 1. Shall be capable of passing a 10 PSI pressure test and withstands 20 in. Hg vacuum test.
  - 2. PVC Manhole Adaptor with silica-impregnated surface.
  - 3. Gasket shall maintain enough flexibility to adjust for pipe deflection long after installation.

## 2.2 PRECAST REINFORCED CONCRETE SEWER MANHOLE COMPONENTS

- A. Precast Concrete Components: Design, materials, and construction as specified previously.
- B. Precast Concrete Channels: Concrete used for channels inside precast manhole bases shall be of a 3500 psi Mix Design with a 5/8" diameter maximum allowable aggregate size:
  - 1. Consistency: The mixed concrete shall be of uniform consistency. The maximum allowable slump shall be 1-inch.
  - 2. Cement: As specified previously.
- C. Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe provided:
  - 1. Resilient Gasket Type Pipe Opening Seals:
    - a. Manufacturers:
      - 1) A-LOK Products Corporation; A-LOK X-Cel Connectors.
      - 2) Hamilton Kent; Tylox Dual Seal II Series.
      - 3) Or equal.
    - b. Cast integrally with manhole component conforming to requirements specified in ASTM C923.
  - 2. Expandable Sleeve Type: ASTM C923, consisting of a power sleeve, gasket and two (2) take up clamps. Power sleeve is mechanically expanded to compress gasket against receptacle hole in manhole wall. Install at precast plant:
    - a. Power Sleeve: Type 304 stainless steel, 85,000 psi yield strength.
    - b. Gasket: Compound Polyisoprene suitable for use with raw sewage.
    - c. Take Up Clamps: Type 304 stainless steel with stainless steel screw.
- D. Precast Top Sections: Designs as required by Contract Drawings, of materials and construction as specified previously except additional and differing requirements as follows:
  - 1. Hold Down Bolt Inserts: Factory cast in top section no less than four 3/4-inch threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3-inches depth. Both insert types designed for an

- ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.
2. Eccentric Cone Tops: Manufactured to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections and as shown in the Contract Drawings.
- E. Gasket for Sealing Precast Concrete Manhole Joints:
1. Manhole section joint gasket materials specified herein shall be used in accordance with the Detail Drawings. Only one method of joint sealing and gasketing will be permitted for all manholes:
    - a. Preformed Plastic Gaskets for Manhole Joints:
      - 1) Flexible plastic gasket-type sealant for manhole joints shall be butyl rubber (plastic) sealant shall meet the requirements of Federal Specification SS-S-210A (3.4 Adhesion & Hydrostatic Pressure) and shall conform with the applicable requirements specified in Section 5.7 of ASTM C361.
      - 2) The sealing compound shall not leak at the joints (while being tested at 10 psi) for a period of 24 hours. Requirements for sag and flow resistance (vertical and overhead 1"-wide joints) shall be such that no sagging is detected (while being tested at 135 degrees F) for a period of 5 days. Requirements for chemical resistance shall be such that no visible deterioration of the sealing compound occurs (when immersed separately in a solution of acid, alkalis and saturated hydrogen sulfide) for a period of 30 days.
      - 3) The sealing compound shall be supplied in extruded rope form of suitable cross-section. The size of the sealing compound shall be in accordance with the manufacturer's recommendations and sufficient to obtain squeeze-out of the material around the entire interior and exterior circumference when the joint is completed. The sealing compound shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to facilitate application of the sealing compound. The sealing compound contained within the joint shall be the sole element utilized in sealing the joint from internal and external hydrostatic pressure. Joint surfaces shall be primed, sealing compound applied, and joint made in strict conformance with the written specifications of the sealing compound manufacturer.
    - b. Rubber O-Ring Gaskets for Manhole Joints:
      - 1) For joints sealed with rubber gaskets, the joint design and rubber gaskets shall conform with the applicable requirements specified in ASTM C443 and in Section 5.7 and Section 4.10 respectively of ASTM C361. A rectangular groove shall be provided in the tongue end of each manhole section to receive the rubber gasket and to contain the deformed gasket on all four sides when the joint is completed.

F. Grade Rings:

1. General: Grade adjustment for a manhole shall not exceed twelve (12) inches.
2. Rubber Grade Rings:
  - a. Rubber grade rings (rubber adjustment riser) for leveling units shall comply with the following:

PHYSICAL PROPERTIES	TEST RESULTS	TEST METHOD
Density	±1.098 g/cm <sup>3</sup>	ASTM C 642 - 90
Durometer Hardness		Based on ASTM D 2240
- Molded surface	75A±10 points	
- Interior surface	73A±10 points	
Tensile Strength	1.6 MPa (232 psi) (not less than 1 MPa)	ASTM D 412 - 87
Compression Deformation	under 1 MPa (145 psi)	Based on ASTM D 575
- Initial deformation	6±4%	
- Final deformation	6±4%	
Compression Set	0.4% (no more than 4%) under 1 MPa (145 psi)	Based on ASTM D 395
Freeze and Thaw When Exposed to Deicing Chemicals	no loss after 50 cycles	ASTM C 672 - 91
Coefficient of Thermal Expansion	1.08 x 10 <sup>-4</sup> mm/mm/ °C (6 x 10 <sup>-5</sup> in/in/°F)	ASTM C 531 - 85
Weathering (70 hours at 70° C)		ASTM D 573 - 88
- Hardness retained	100%±5%	
- Compressive strength retained	100%±5%	
- Tensile strength retained	100%±5%	
- Elongation retained	100%±5%	

- b. Rubber grade rings shall only be used in paved areas.
- c. Tapered rubber grade rings shall be used to accommodate sloped paved

surfaces.

- G. Coatings:
  - 1. Exterior: Apply two (2) coats of coal tar epoxy to outer surface of entire manhole.

## 2.3 INTERIOR DROP CONNECTION

- A. Drop Bowl: Hand fabricated from marine grade fiberglass, unsaturated polyester resin, and ISO gel coat. Bowl size shall be determined by incoming pipe size.
- B. Drop Pipe and Fittings: Drop pipe and fittings shall be SDR 35 PVC. Drop pipe and fitting size shall be as indicated on the Drawings.
- C. Clamping Brackets: Clamping brackets shall be 11-gauge 304 stainless steel. Clamping bracket size shall be determined by drop pipe size.
- D. Fasteners: Fasteners shall be stainless steel.

## 2.4 REMOVABLE STORM INLET CATCH BASIN TRAP/HOOD

- A. Shall be manufactured from Class 35B Gray Iron or Ductile Iron.
- B. Shall conform to ASTM A48/A48M-03.
- C. Shall be of proper size to cover entire pipe connection with storm inlet box catch basin wall and maintain an airtight connection to prevent gases from leaving the sewer system.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Inspect precast reinforced concrete structure components in accordance with requirements of ASTM C 478 and PennDOT Publication 408 and PennDOT Publication 72 regarding repairable defects and defects subject to rejection by the Engineer.
- B. All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Engineer. All defective materials furnished by the Contractor shall be promptly removed from the site.

### 3.2 PREPARATION

- A. Keep pipe and precast structure interiors cleared of debris as construction progresses.
- B. Earthwork: Perform earthwork as previously specified in Section 31 23 33.

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### 3.3 MANHOLE INSTALLATION

- A. Precast Concrete Bases: Install manhole and chamber bases on an 8-inch-deep compacted layer of 2A coarse aggregate:
1. When using prefabricated pipe opening seals (i.e., A-LOK, Tylox, etc.) for connecting pipes into manholes, and such seals create an annular space on interior and exterior of manhole wall pipe openings after pipe connection is made, fill such annular spaces with preformed plastic sealing compound:
    - a. Tightly caulk sealing compound into annular spaces in a manner to completely fill the spaces and render the installation watertight.
    - b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.
  2. For other pipe connections into manholes: Install manhole adapter and grout all pipe entries flush to interior walls for watertight connection. Refer to Section 03 60 00.
- B. Length of Pipe Connections into Manholes:
1. Use pipes no longer than 5-feet in length when connecting into manholes through resilient gasket type pipe opening seals, unless otherwise directed by Engineer.
  2. For all other pipe connections into manholes, use pipes of such length that a pipe joint is provided at the outside edge of manhole base or wall as applicable. Also use pipes no longer than 6 feet in length for first pipe joined thereto.
- C. Concrete Channel Fill: Field pour concrete channel fill for each manhole base:
1. Form inverts directly in concrete channel fill.
  2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
  3. Make changes in size and grade gradually.
  4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
  5. Make slopes gradual outside the invert channels.
- D. Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser, and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps:
1. Install sealing compound in accordance with manufacturer's recommendations and join sections also in accordance with written instructions of manhole component manufacturer:
    - a. Prime joint surfaces if required by preformed sealing compound manufacturer.
    - b. If sealing compound is installed in advance of section joining leave exposed half of two-piece protective wrapper in place until just prior to section joining.
    - c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
    - d. To improve workability of "Preformed Plastic Sealing Compound" during

- cold weather, store such at temperature above 70°F or artificially warm compound in a manner satisfactory to the Engineer.
- e. During warm weather stiffen "Preformed Plastic Sealing Compound" by placing under cold water or by other means as recommended by the compound manufacturer.
  - f. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
  - g. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.
  - h. Remove all interior excessive plastic sealing compound after all manhole sections have been set.
- E. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and airtight. Sealing of lifting recesses with grout is not permitted.
- F. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using precast grade rings or rubber adjustment riser. Grade elevation adjustments shall not be permitted to exceed twelve (12) inches. Frame and Covers installed within paved areas shall be set at 1/8" below final pavement elevation. Frame and Covers installed in all other areas shall be set within 1/8" of final grade elevations, with exception of manholes with rim elevations identified above final grade elevations:
1. Joints between precast concrete grade rings for leveling units shall be sealed with two continuous rings along the inner and outer diameter of grade rings with preformed plastic sealing compound. Sealing compound shall be 1/2 inch thick and trowelled or trimmed smooth on the inside of the manhole.
  2. Joints between rubber grade rings for leveling units shall be made with Sikaflex compound.
  3. The joint between the bottom of the frame and the top of grade ring leveling units, or the top manhole section as applicable, shall be made with preformed plastic sealing compound.
  4. Frames for all manholes shall be bolted to the manhole as shown on the Detail Drawings. Studs, nuts, and washers shall be of stainless steel. Bolts shall have a sufficient number of proper sized threads for proper connection.
  5. Bolt frames to top manhole section.
  6. Secure covers to frame as shown on the Detail Drawings.
- G. Base and Alignment:
1. Install manholes supported at proper grade and alignment on compacted crushed-stone bedding support system as indicated on Drawings.
  2. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour as indicated on Drawings.
  3. Form and place manhole or structure cylinders plumb and level, to correct dimensions and elevations.
- H. Connections to Existing Structure:
1. Cut required opening by core drilling; prevent cracking and spalling. Make

openings of sufficient size to accommodate pipe and expandable sleeve manhole adapter. Install expandable sleeve manhole adapter and tighten against structure and pipe. Grout pipe entry flush to interior wall and make connection watertight. Do not permit ground water, surface water or debris to enter the existing facilities. Maintain all existing flow during construction.

2. For sewer manholes, form a new flow channel in the existing manhole base to properly conduct all flows through the existing manhole.
  3. Visually inspect existing manhole after making connection to assure water tightness of manhole.
- I. Connections to Existing Sewers: Where new manholes are constructed on existing sewers, the Contractor shall have the option to use cast-in-place manhole bases or precast bases, both as specified previously:
1. Replace broken or damaged pipe with new pipe, whether existing or resulting from this work. New pipe material shall match existing. Use solid sleeve coupling.
  2. Connect new pipe to new manhole bases or new in-line structures as specified previously.
  3. If precast manhole bases are used, replace existing sewer pipe with new to first joint outside the manhole, unless otherwise directed by Engineer.
  4. Maintain flow in existing sewer both during construction operations and until concrete is cured both in the case of cast-in-place work and formed inverts.
  5. Cut with a saw piping to be removed. Chipping or breaking pipe with a hammer not permitted.

### 3.4 INLET INSTALLATION

- A. Precast Concrete Bases: Install bases on a 12-inch-deep compacted layer of 2A coarse aggregate:
1. Grout all pipe entries flush to interior walls for watertight connection.
- B. Construct inlets as shown on PennDOT Publication 72 RC-45M and RC-46M and in accordance with the Inlet Box Catch Basin Trap Detail.
- C. Inlets that are not a PennDOT approved product shall be designed by manufacturer for H-20 loadings and be approved by Engineer prior to manufacturing.
- D. Length of Pipe Connections into Inlets:
1. Use pipes of such length that a pipe joint is provided at the outside edge of inlet base or wall as applicable. Also use pipes no longer than 6 feet in length for first pipe joined thereto, unless otherwise approved.
- E. Lifting Recess Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into recesses in such manner to render them completely water and airtight. Sealing of lifting recesses with grout is not permitted.

### 3.5 INSTALLATION OF INTERIOR DROP CONNECTION (SANITARY/COMBINED SEWER ONLY)



- A. Install interior drop connection as stated in Manufacturer's recommendations and as shown on the Construction Detail.
- B. Form new flow channel to allow for proper flow of sanitary sewer.

### 3.6 FIELD QUALITY CONTROL

- A. General: Test each manhole constructed in the Project as specified herein:
  - 1. Conduct tests in presence of and to complete satisfaction of the Engineer.
  - 2. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.
  - 3. Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.
  - 4. Prior to testing manholes, thoroughly clean such and seal openings, both to complete satisfaction of the Engineer. Seal openings using properly sized plugs.
  - 5. Perform manhole testing with frames installed. The joint between the manhole and the manhole frame shall be included in the test.
  - 6. The tests of the manholes for acceptance shall be conducted after the backfilling has been completed.
- B. Sewer manholes must pass a vacuum test in accordance with the requirements identified in this Section.
- C. The Engineer shall conduct visual inspection of the storm sewer structures.
- D. Vacuum Testing of Standard and Doghouse Sewer Manholes:
  - 1. Vacuum Testing Equipment:
    - a. Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum.
    - b. Provide an extra vacuum gauge of known accuracy to frequently check test equipment and apparatus.
    - c. Vacuum testing equipment and associated testing apparatus subject to Engineer's approval.
    - d. Provide seal plate with vacuum piping connections for inserting in manhole frame.
  - 2. Vacuum Test Procedure:
    - a. Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.
    - b. Draw a vacuum of ten (10) inches of Hg and close the valves.
    - c. Consider manhole acceptable when vacuum does not drop below nine inches of mercury for the following manhole sizes and times:
      - 1) Four-foot diameter – 60 seconds.
      - 2) Five-foot diameter – 75 seconds.
      - 3) Six-foot diameter – 90 seconds.
      - 4) Eight-foot diameter – 120 seconds.
      - \* Add five (5) seconds to square manholes using equivalent manhole size. Example: 5'x5' square manhole shall be tested for 80

seconds.

- E. Repair and Retest: Determine source or sources of leaks in manholes failing acceptable limits:
1. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.
  2. Materials and methods used to make manhole repairs must meet with Engineer's approval prior to use.
  3. Make repairs, replacements, and retests at no additional expense to Owner.

**END OF SECTION**



**CAPITAL REGION™**

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**WATER**

**SECTION 33 14 13 - PUBLIC WATER UTILITY DISTRIBUTION PIPING****PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Pipe and fittings for public line, including potable water line.
  2. Tapping sleeves and valves.
  3. Line stops.
  4. Valves and fire hydrants.
  5. Underground pipe markers.
  6. Bedding and cover materials.
- B. Related Requirements:
1. Section 03 20 00 - Concrete Reinforcing: Reinforcing steel and required supports for cradles and encasements.
  2. Section 03 30 00 - Cast-in-Place Concrete: Concrete for cradles and encasements.
  3. Section 33 13 00 - Disinfection of Water Utility Distribution: Disinfection of water mains and appurtenances.
  4. Section 33 05 53 - Identification and Signage for Utilities: Pipe markers.
  5. Section 33 14 17 - Site Water Service Utility Laterals: Water main service connections.
  6. Section 33 14 19 - Valves and Hydrants for Water Utility Service: Fire hydrants, valves, and valve boxes for fire hydrant and water main installations.

**1.2 REFERENCE STANDARDS**

- A. American Society of Mechanical Engineers:
1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- B. ASTM International:
1. ASTM A36 - Standard Specification for Carbon Structural Steel.
  2. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
- C. American Water Works Association:
1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
  2. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
  3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
  5. AWWA C153 - Ductile-Iron Compact Fittings.
  6. AWWA C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied.
  7. AWWA C213 - Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
  8. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.

9. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

### 1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.

C. Shop Drawings: Indicate piping layout, including piping specialties.

### 1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

### 1.5 QUALITY ASSURANCE

A. Valves: Mark valve body with manufacturer's name and pressure rating.

B. Design Criteria:

1. Use only one type and class of pipe in any continuous line of waterline, unless otherwise indicated on the Drawings.

2. Use pipe and fittings designed to withstand imposed trench loadings and conditions at the various locations.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 61 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver and store valves in shipping containers with manufacturer's labeling in place and inspect for damage.

C. Block individual and stockpiled pipe lengths to prevent moving.

D. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.

E. Exercise each manual valve operator through at least two full open and close cycles at least once every two months, or more frequently if required by manufacturer.

- F. Thoroughly inspect pipe, pipe linings, fittings, valves, and all related materials for defects prior to being unloaded and again prior to being installed. Repair or replace any defective, damaged, or unsound material, as determined by Engineer, at no additional cost to Owner. Remove defective products and materials from site at Contractor's expense.
- G. Store all valves with rubber seats out of sunlight with discs or plugs opened slightly off seat (3 to 5 degrees).

## 1.7 EXISTING CONDITIONS

- A. Field Measurements:
  - 1. Verify field measurements prior to fabrication.
  - 2. Indicate field measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All piping, fittings, and appurtenances shall be NSF 61 approved/certified.

### 2.2 WATER PIPING

- A. Ductile-Iron Pipe:
  - 1. Comply with AWWA C151.
  - 2. Bituminous Outside Coating: Comply with AWWA C151.
  - 3. Pipe Mortar Lining:
    - a. Comply with AWWA C104.
    - b. Double thickness.
  - 4. Pipe Class:
    - a. Comply with AWWA C151.
    - b. Class 52.
  - 5. Fittings:
    - a. Material: Ductile iron, AWWA C110.
    - b. Compact Fittings: Comply with AWWA C153.
    - c. Coating and Lining:
      - 1) Bituminous Coating: Comply with AWWA C110.
      - 2) Cement Mortar Lining: Comply with AWWA C104, double thickness.
  - 6. Joints:
    - a. Mechanical and Push-on Joints: Comply with AWWA C111.
    - b. Restrained Joints: Boltless, push-on type, joint restraint independent of joint seal.

### 2.3 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves:
  - 1. Manufacturers:
    - a. Mueller Co.
    - b. Romac Industries, Inc.; Model SST or SSTIII.

- c. Or approved equal.
- 2. Description:
  - a. Complies with AWWA C223.
  - b. Material: Stainless Steel.
  - c. Type: Dual compression.
  - d. Gasket: EPDM or Nitrile, full circumference.
  - e. Fasteners: Integrated threaded fasteners or triangular side-bars and drop in bolts.
  - f. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 200, and MSS SP-60.

B. Tapping Valves:

- 1. Manufacturers:
  - a. American Flow Control.
  - b. Mueller Co.
  - c. Or approved equal.
- 2. Description:
  - a. Comply with AWWA C515.
  - b. Type: Resilient wedge with non-rising stem.
  - c. Inlet Flanges: Comply with ASME B16.1, Class 200, and MSS SP-60.
  - d. Mechanical Joint Outlets: Comply with AWWA C111.
  - e. Operation:
    - 1) Square operating nut.
    - 2) Opening Direction: Left.
- 3. Mark manufacturer's name and pressure rating on valve body.

2.4 TEMPORARY LINE STOPS

A. Option A:

- 1. Manufacturers:
  - a. JCM Industries.
  - b. Or approved equal.
- 2. Description:
  - a. Pressure Rating: 250 psi.
  - b. Body: 304 Stainless Steel or Epoxy Coated Carbon Steel.
  - c. Blind Flange and Flange: ANSI Class 150.
  - d. Completion Plug: Push and Pin Style.
  - e. Gasket: Nitrile or EPDM.

B. Option B:

- 1. Manufacturers:
  - a. EZ Valve.
  - b. Or approved equal.
- 2. Description:
  - a. Comply with AWWA C509.
  - b. Pressure Rating: 250 psi.
  - c. Body: Ductile Iron.

## 2.5 COUPLINGS

- A. Manufacturer:
  - 1. Romac.
  - 2. Smith-Blair.
  - 3. Or approved equal.
  
- B. Description:
  - 1. Body: ASTM A36 Steel.
  - 2. Restraint Gland: Ductile iron meeting ASTM A536.
  - 3. Gasket: Nitrile or EPDM.
  - 4. Bolts and nuts: Type 304 or 316 stainless steel.
  - 5. Finish: Fusion bonded epoxy coating.
  - 6. Transition couplings must be restrained.

## 2.6 VALVES AND FIRE HYDRANTS

- A. Valves and Hydrants: As specified in Section 33 14 19 - Valves and Hydrants for Water Utility Service: Fire hydrants, valves, and valve boxes for fire hydrant and water main installations.

## 2.7 UNDERGROUND PIPE MARKERS

- A. Plastic Ribbon Tape:
  - 1. Refer to 33 05 53 – Identification for Utilities Piping and Equipment.

## 2.8 VALVE BOXES

- A. Manufacturers:
  - 1. Tyler Utilities.
  - 2. Bingham & Taylor.
  - 3. Ford.
  - 4. Or approved equal.
  
- B. Description:
  - 1. 12-inch Diameter Valves and Smaller:
    - a. Material: Cast iron.
    - b. Coating: Tar or asphaltic compound; interior and exterior.
    - c. Type: Two piece; screw.
  - 2. Lid Inscription: WATER.

## 2.9 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete:
  - 1. As specified in Section 03 30 00 - Cast-in-Place Concrete.
  - 2. Type: reinforced, air entrained.
  - 3. Compressive Strength: 4,000psi at 28 days.
  - 4. Finish: Rough troweled.



- B. Concrete Reinforcement: As specified in Section 03 20 00 - Concrete Reinforcing.

#### 2.10 ACCESSORIES

- A. Concrete for Thrust Restraints: As specified in Section 03 30 00 - Cast-in-Place Concrete.
- B. Steel Rods, Bolt, Lugs, and Brackets:
  - 1. Comply with ASTM A36 or ASTM A307.
  - 2. Grade A carbon steel.

### **PART 3 - EXECUTION**

#### 3.1 EXAMINATION

- A. Section 01 73 00 - Execution Requirements: Requirements for installation examination.
- B. Verify that existing utility water main size, location, and invert are as indicated on Drawings.

#### 3.2 PREPARATION

- A. Section 01 73 00 - Execution Requirements: Requirements for installation preparation.
- B. Pipe Cutting:
  - 1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
  - 2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
  - 3. Grind edges smooth with beveled end for push-on connections.
- C. Remove scale and dirt on inside and outside before assembly.

#### 3.3 INSTALLATION

- A. Bedding:
  - 1. Excavation:
    - a. Excavate pipe trench as specified in Section 31 23 33 – Trenching and Backfilling for Utilities for Work of this Section.
    - b. Hand trim excavation for accurate placement of pipe to elevations as indicated on Drawings.
  - 2. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
  - 3. Provide sheeting and shoring as specified in Section 31 23 33 – Trenching and Backfilling for Utilities.
- B. Piping:
  - 1. Install pipe according to AWWA C600.
  - 2. Handle and assemble pipe according to manufacturer instructions and as indicated on Drawings.

3. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
  4. Maintain 10 feet horizontal separation of water main from sewer piping, unless otherwise shown on the Drawings.
  5. Install ductile-iron piping and fittings according to AWWA C600.
  6. Route pipe in straight line; re-lay pipe that is out of alignment or grade.
  7. High Points:
    - a. Install pipe with no high points.
    - b. If unforeseen field conditions arise that necessitate high points, install air release valves or blow-off assembly as directed by Engineer.
  8. Bearing:
    - a. Install pipe to have bearing along entire length of pipe.
    - b. Excavate bell holes to permit proper joint installation.
    - c. Do not lay pipe in wet or frozen trench.
  9. Prevent foreign material from entering pipe during placement.
  10. Install pipe to allow for expansion and contraction without stressing pipe or joints.
  11. Close pipe openings with watertight plugs during Work stoppages.
  12. Install access fittings to permit disinfection of water system performed under Section 33 13 00 - Disinfection of Water Utility Distribution.
  13. Cover:
    - a. Establish elevations of buried piping with not less than 4 feet of cover.
    - b. Measure depth of cover from final surface grade to top of pipe barrel.
  14. Pipe Markers:
    - a. Install plastic ribbon tape continuous buried 24 inches below finish grade, above piping.
    - b. Coordinate with trench Work as specified in Section 31 23 33 – Trenching and Backfilling for Utilities.
- C. Valves and Hydrants:
1. Install valves and hydrants as specified in Section 33 14 19 - Valves and Hydrants for Water Utility Service: Fire hydrants, valves, and valve boxes for fire hydrant and water main installations.
- D. Tapping Sleeves and Valves:
1. As indicated on Drawings and according to manufacturer instructions.
- E. Thrust Restraints:
1. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks or restrained joints.
  2. Pour concrete thrust blocks against undisturbed earth.
  3. Locate thrust blocks at each elbow or change of pipe direction to resist resultant force and to ensure that pipe and fitting joints will be accessible for repair.
  4. Provide thrust restraint bearing on subsoil in accordance with details on Drawings.
  5. Install tie rods, clamps, setscrew retainer glands, or restrained joints.
  6. Protect metal-restrained joint components against corrosion by applying a bituminous coating or encasing metal area using concrete mortar.

- 7. Do not encase pipe and fitting joints to flanges.
- 8. Install thrust blocks, tie rods, and joint restraint at dead ends of water main.
  
- F. Service Connections:
  - 1. As specified in Section 33 14 17 – Site Water Service Utility Laterals.
  
- G. Backfilling: Backfill around sides and to top of pipe as specified in Section 31 23 33 – Trenching and Backfilling for Utilities.
  
- H. Hydrostatic Testing for Water Piping System:
  - 1. As specified in Section 33 05 05.31 – Hydrostatic Testing.
  
- I. Disinfection of Potable Water Piping System:
  - 1. As specified in Section 33 13 00 - Disinfection of Water Utility Distribution.

**END OF SECTION**