

## 2. SANITARY SEWER AND STORM DRAIN DESIGN STANDARDS

### 2.1. STANDARDS AND SPECIFICATIONS

Sewer and Storm drain systems shall be planned and constructed in accordance with the regulations contained in Chapter 24 of the City Code of Ordinances.

- 2.1.1. The introduction of non-contaminated water such as rain water, non-contact cooling water, groundwater from foundation drains, sump pumps, surface drains or any other sources of inflow shall not be allow to discharge into as sewer which conveys sanitary waste unless approved by the City Engineer. When no other practical alternatives exist, this condition may be waived by the City Engineer. All Appeals will be considered by the Director of Public Services. (Refer to: Sec. 24-44 of the City Code - Public sewer connection limitations).
- 2.1.2. It is not permissible to backfill any excavation with frozen materials, organic materials or blasted ledge. The maximum size of backfill material shall not exceed 6". (Please refer to Division 2, Street Opening Permits in the City Code).
- 2.1.3. The Department of Public Services shall be responsible for televising all new sewer construction for acceptability as soon as backfilling has been completed and access is available. The permittee will be invoiced for these services. Information on current rates is available through the City of Portland Wastewater Maintenance Division.
- 2.1.4. The information presented below are City of Portland exceptions to the TR-16 or additional required standards
- 2.1.5. Permits to connect to the municipal stormwater and sanitary sewer system are required and may be obtained from the Department of Public Services.

### 2.2. TECHNICAL REFERENCE

The following technical publications are recognized by the City of Portland for use in the design, construction and testing of sanitary and stormwater sewers:

- Technical Report #16 (TR-16): *Guides for the Design of Wastewater Treatment Works*, Prepared by the New England Interstate Water Pollution Control Commission available for review at the Department of Public Services or online at [www.neiwpc.org/tr16guides.asp](http://www.neiwpc.org/tr16guides.asp)
- Maine Department of Transportation (MDOT) Standard Specifications for Highways and Bridges, Current Edition

## 2.3. MANHOLES

- 2.3.1. All manholes shall be designed in conformance with City of Portland standards as illustrated in Figure II-01.
- 2.3.2. When constructing sanitary manhole channels, if the mathematical difference between the invert elevation of the manhole channel and the invert elevation of the sewer pipe connecting to such manhole is two vertical feet (2') or greater, a standard City of Portland drop manhole shall be provided. Such drop manholes shall conform to the engineering specifications illustrated in Figure II-03.
- Drop manholes on stormwater collection systems are permitted.
- 2.3.3. Internal drop connections are prohibited unless site specific constraints warrant an exception. Where exceptional circumstances necessitate a waiver to allow for construction of an internal drop connection, a minimum of two stainless steel pipe anchors shall be used and the manhole diameter shall be five (5) feet minimum. Waiver requests will be evaluated on a case by case basis.
- 2.3.4. Service laterals shall not connect to either stormwater or sanitary manholes.
- 2.3.5. Stormwater and sanitary manholes shall include frames and covers as shown in Figure II-5 or an approved equivalent. Both the frame and riser shall be machined to assure a proper fit.
- 2.3.6. Manhole covers shall be marked "SEWER" or "DRAIN" accordingly.
- 2.3.7. Riser Rings without tabs as shown in Figure II-06 shall be used to adjust manholes to grade with approval of the Wastewater Maintenance Division.
- 2.3.8. All new sanitary manholes shall be vacuum tested before backfilling. Refer to TR-16 for testing standards.
- 2.3.9. All manholes shall have copolymer polypropylene plastic steps with 3/8" grade 60 rebar continuous throughout, spaced at one foot (1') intervals.

## 2.4. Reserved.

## 2.5. PIPES

- 2.5.1. Minimum velocities of surface water drains shall not be less than three (3.0) feet per second.
- 2.5.2. The types of allowable pipe to be used for purposes of sanitary sewers, storm sewers, catch basin drains, or underdrains shall be:

- Reinforced Concrete Pipe (RCP) with a minimum strength of Class III;
- PVC Ring Type Sewer Pipe (SDR 35 or equivalent, minimum PS-46 rating,
- P.V.C. Ring Type Sewer Pipe meeting ASTM F 789 or equal to SDR 35
- Ductile Iron Pipe (DIP).
- ADS N-12 HP triple-wall pipe meeting a minimum PS- 46.
- ADS SaniTite HP meeting a minimum PS-46.

2.5.3. The classes of pipe indicated shall be minimums, however the actual class of pipe used shall be determined by soil weight and compaction loads applied to such pipe in accordance with standard engineering design criteria and subject to the approval of the City Engineer.

2.5.4. Ribbed corrugated polyethylene pipe material, smooth wall interior, is not permitted except for underdrain installation. Underdrain diameter shall be no larger than six (6) inches.

2.5.5. All PVC connections shall be made with Solid PVC Couplings.

## **2.6. BUILDING SEWER LATERALS**

2.6.1. All building sewer laterals shall have a minimum diameter of 4" and a minimum slope of 1/8 inch per foot installed, as shown in Figure II-12.

2.6.2. Typical Pipe Installation: Where a building sewer lateral is to be installed from the sewer main in the street to a property or building to be served, the lateral shall either extend to the building or to the street line of each lot to be served and the pipe shall be capped air-tight.

2.6.3. An accurate record of each building sewer, its location and its depth at the street line shall be kept by the developer's engineer and a true copy of the same shall be provided the City Engineer.

2.6.4. The location of the building sewer at the street line shall be physically marked by the placement of a 2 x 4 wooden stake placed at the end of the lateral end-cap and extending one foot above finished grade.

2.6.5. Each stake shall be painted with a fluorescent paint and marked as storm or sanitary sewer with the depth indicated from grade to end-cap. A ¼" thick by 6" square ferrous metal plate or equivalent shall be placed horizontally one foot below grade over the end of the storm drain.

2.6.6. Construction of building sewers and drains shall conform to Chapter 24 (Sewers) of the City Code.

2.6.7. Building sewers and drains shall be connected to the main sanitary sewer line by the use of wyes, tee/wyes, Inserta-Tees or similar approved methods as determined by the Department of Public Services. A manhole shall be installed at the sewer main to connect building laterals when the building lateral is eight (\*)

inches or larger in diameter. The lateral connections shall be installed from the main toward the lot where possible.

- 2.6.8. Before connecting new pipes into an existing sewer line, the contractor shall obtain a permit from the Department of Public Services.
- 2.6.9. All new laterals connecting to a combined sewer system shall have a Back Water Valve. The valve shall be installed to assure easy access and maintenance. When a Back Water Valve is installed, it is imperative that introduction of rain water, non-contact cooling water, groundwater from foundation drains, sump pumps, surface drains or any other sources of inflow not be allowed on the building side of the valve.
- 2.6.10. All building floor drains shall discharge to the sanitary sewer system.
- 2.6.11. Plugging of Abandoned Sewer Laterals: Prior to abandoning any stormwater or sanitary sewer lateral, the applicant shall acquire a permit from the Department of Public Services. The applicant shall provide a 48 hour notice to the Sewer Maintenance Division stating the date and time the applicant wished to complete the work. The Sewer Maintenance Division will mobilize to the site and allow one hour to assist the applicant to plug the lateral in the following manner. City staff will televise the sewer main in the street to determine the location of the lateral to be plugged.

The applicant shall excavate and expose the lateral at the property line and install an inflatable plug in the lateral to be positioned where the lateral connects to the street sewer, as determined by City staff.

The plug shall be secured by a cable or chain and the lateral fill with pumped grout starting at the plug and filling out to the point of excavation.

## **2.7. CATCH BASINS**

- 2.7.1. All catch basins and catch basin inlets shall be designed and constructed in accordance with Figures II-2 and II-8.
- 2.7.2. Catch basin drain pipes of less than ten inches (10") in diameter are not permitted.
- 2.7.3. All catch basin drains shall be supplied, laid and bedded in a minimum of six inches (6") of crushed stone.
- 2.7.4. All catch basins shall have 4' granite headstone of catch basin inlets conforming to City standards as shown in Figure II-11.
- 2.7.5. No radius catch basin stones shall be permitted.
- 2.7.6. All catch basins shall be constructed with a minimum sump of 3'.

- 2.7.7. Catch basins shall not be located in driveway openings.
- 2.7.8. No storm drain lines, with the exception of field inlets and underdrains, shall be connected into a catch basin structure.
- 2.7.9. Catch basin drains and catch basin inlet drain pipe slopes shall be such that minimum flow velocities shall not be less than 3.0 feet per second.
- 2.7.10. The base material used to support all proposed catch basin drains shall be as shown in Figure II-12.
- 2.7.11. Bee hive casting shall be used on drainage structures located at low points in grassed off road locations.

## 2.8. AGGREGATE SPECIFICATIONS

- 2.8.1. The provisions of Section 703 of the State of Maine Department of Transportation (MDOT) *Standard Specifications for Highways and Bridges* shall apply with the following additions and modifications:

### 703.02 Coarse Aggregate for Concrete:

#### Designated Aggregate Size

Sieve Size	Percent Passing Sieve				
	2 in.	1½ in.	1 in.	¾ in.	½ in.
2 in.	95-100	100	-	-	-
1-1/2 in.	-	95-100	100	-	-
1 in.	50-70	-	90-100	100	-
3/4 in.	-	50-70	-	90-100	100
1/2 in.	15-30	-	25-60	-	90-100
3/8 in.	-	10-30	-	20-55	-
No. 4	0-5	0-5	0-10	0-10	0-15
F.M. (+0.20)	7.45	7.20	6.95	6.70	6.10

- 2.8.1.1. Aggregate used in concrete shall not exceed the following maximum designated sizes:

- 2 inches for mass concrete.
- 1-1/2 inch for piles, pile caps, footings, foundation mats, and walls 8 inches or more thick.
- 3/4 inch for slabs, beams, and girders.
- 1/2 inch for fireproofing on steel columns and beams.
- 1 inch for all other concrete.

- 2.8.2. 703.06 (a) Aggregate Base:

2.8.2.1. Aggregate base - crushed, type "B" shall not contain particles of rock which will not pass the two inch (2") square mesh sieve, and shall conform to the type "B" aggregate, as listed in the subsection of the Standard Specifications.

2.8.2.2. "Crushed" shall be defined as consisting of rock particles with at least 50 per cent of the portion retained on the 1/4 inch square mesh sieve, having a minimum of 2 fracture faces.

2.8.3. 703.06 (b) Aggregate Subbase:

2.8.3.1. Gravel subbase shall not contain particles of rock which will not pass the three inch (3") square mesh sieve, and shall conform to type "D" Aggregate, as listed in this subsection of the Standard Specifications.

2.8.4. 703.18 Common Borrow:

Common borrow shall not contain any particle of bituminous material.

2.8.5. 703.19 Granular Borrow:

Granular borrow shall contain no particles which will not pass a three inch (3") square mesh sieve.

2.8.6. 703.20 Gravel Borrow:

Gravel borrow shall not contain particles of rock which will not pass three inch ("3") square mesh sieve.

2.8.7. 703.31 Crushed Stone for Pipe Bedding and Underdrain:

"Crushed Stone" shall be defined as rock of uniform quality and shall consist of clean, angular fragments of quarried rock, free from soft disintegrated pieces or other objectionable matter.

Crushed stone used as a bedding material for pipe and underdrain shall be uniformly graded and shall meet the follow gradations.

Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
¾ inch	100
3/8 inch	20-55
No. 4	0-10

**For pipe sizes 42 inches and larger:**

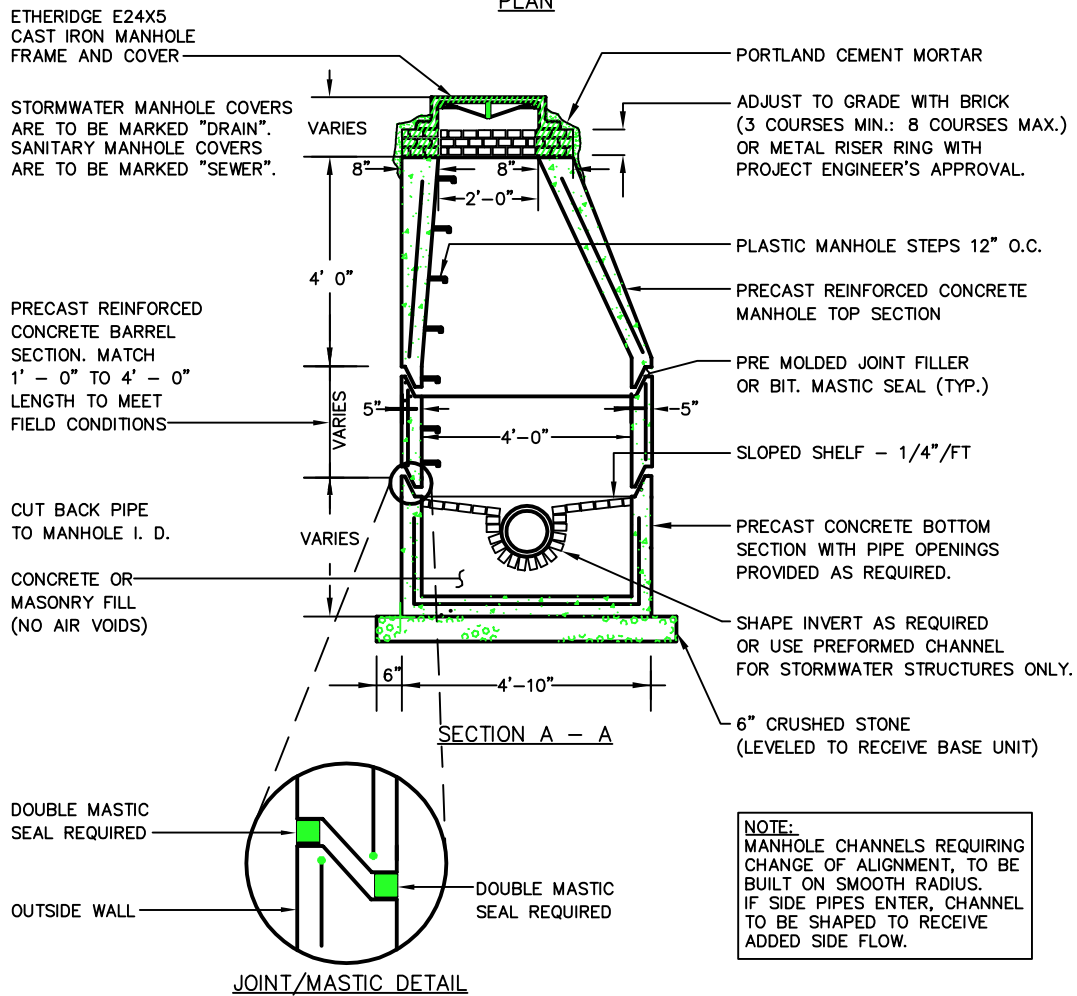
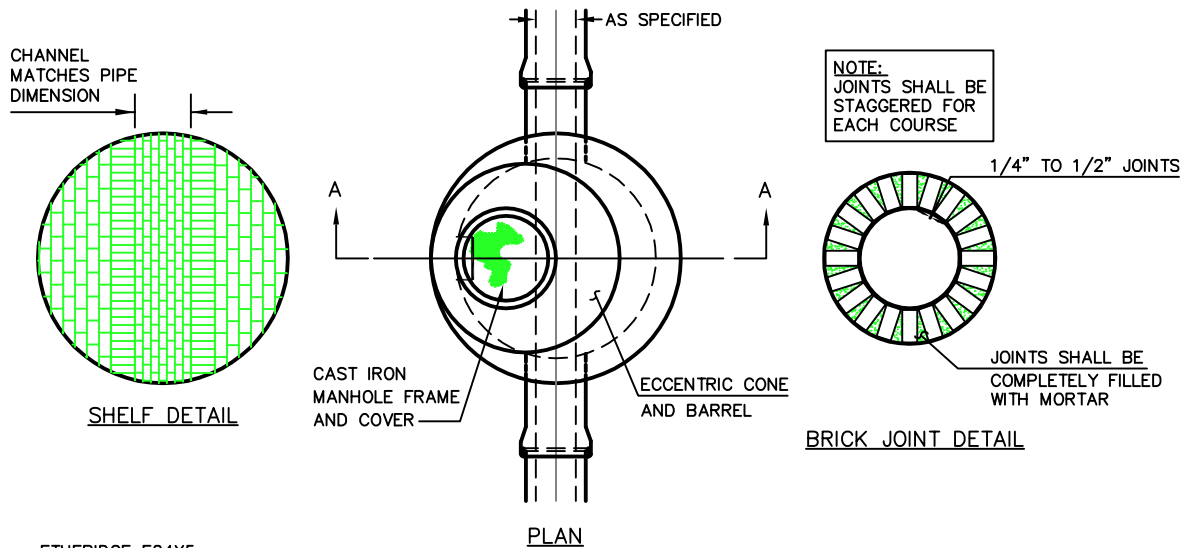
Sieve Designation	Percentage by Weight Passing Square Mesh Sieve
1 ¼ inch	100
3/8 inch	20-55
No. 4	0-10

The stone shall be free from vegetable matter, lumps or balls of clay, and other inappropriate substances.

**2.9. Reserved****2.10. SUBSURFACE WASTEWATER DISPOSAL**

2.10.1. To ensure that adequate provisions have been made for subsurface wastewater disposal, developers are required to locate, design, and install all septic systems in accordance with the latest version of the Maine Subsurface Wastewater Disposal Rules, 144 CMR minimum 241, as described in Chapter 6, Section 6-18(A) of the City Code.

2.10.2. Developers are required to obtain a permit through the City of Portland Inspections Division prior to the installation of any subsurface wastewater disposal system identified on an approved site plan.



**PRECAST CONCRETE MANHOLE**

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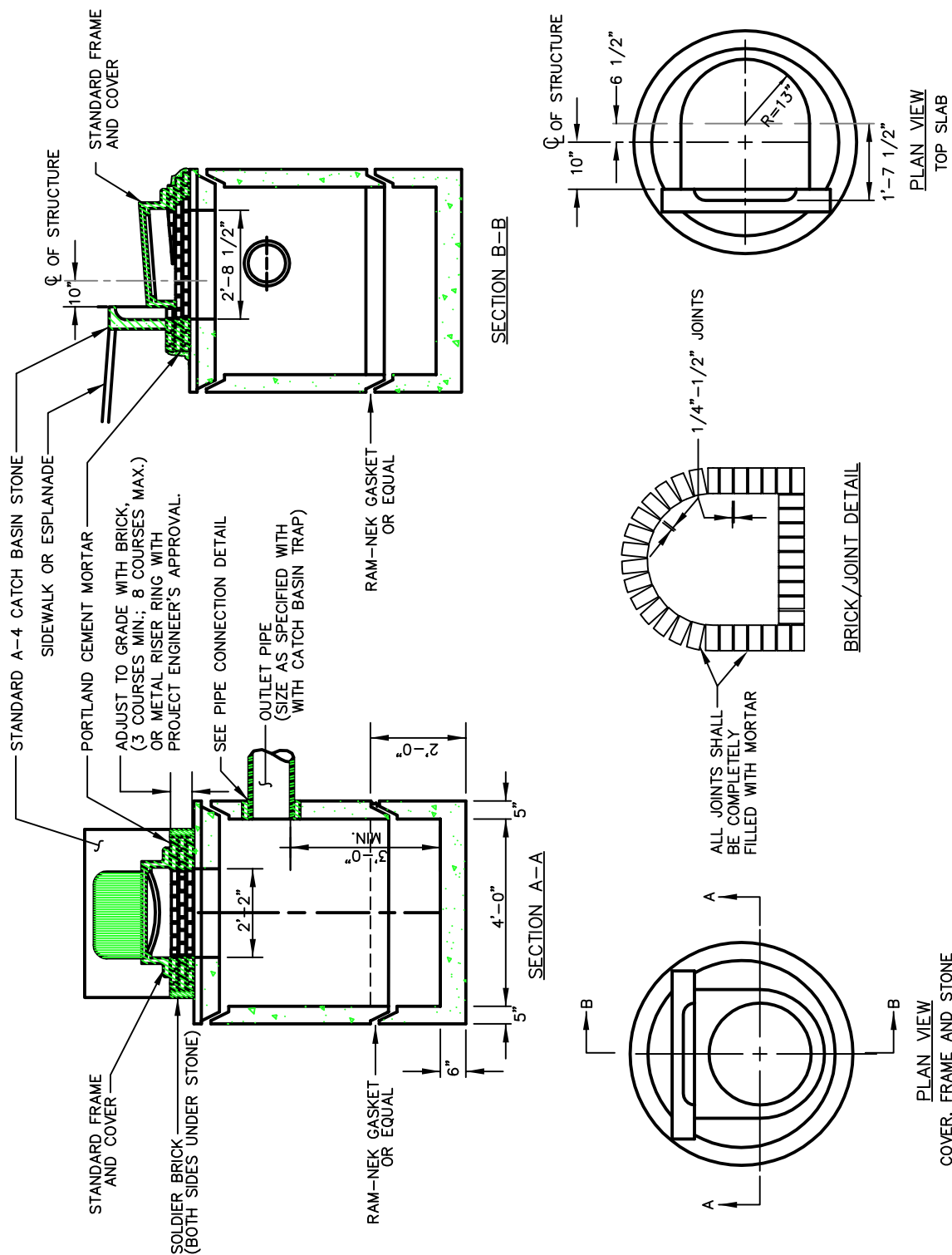
**SANITARY SEWER AND STORM  
 DRAIN DESIGN STANDARDS**  
 SECTION II

FIGURE:

**PRECAST CONCRETE MANHOLE**

**II-1**

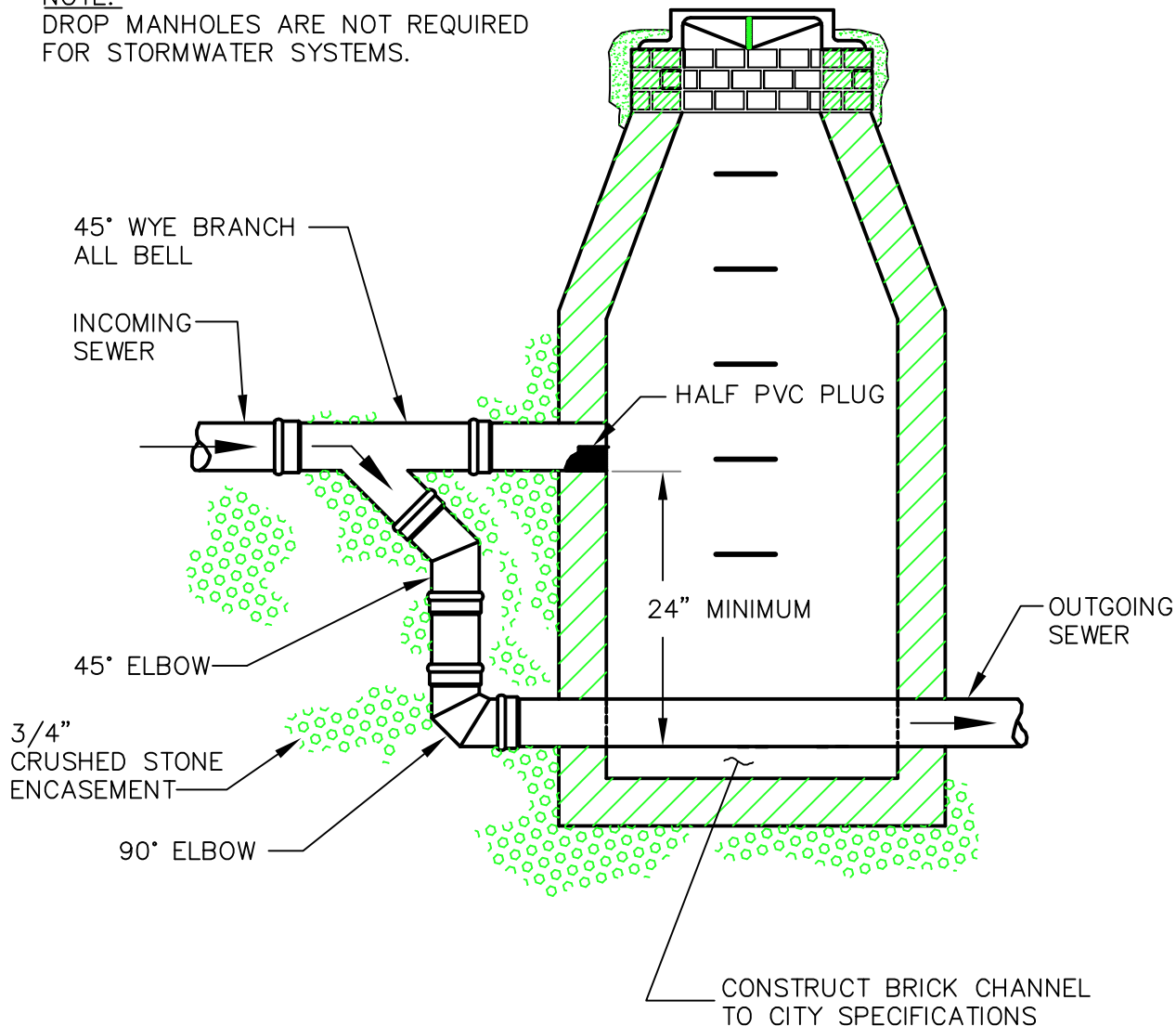




**PRECAST CONCRETE CATCH BASIN - TYPE "E"**  
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<p align="center"><b>PRECAST CONCRETE CATCH BASIN</b></p>			<p align="center"><b>II-2</b></p>

**NOTE:**  
 DROP MANHOLES ARE NOT REQUIRED  
 FOR STORMWATER SYSTEMS.



**TYPICAL OUTSIDE DROP MANHOLE**  
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FIGURE:

**TYPICAL OUTSIDE DROP MANHOLE**

**II-3**

**GENERAL NOTES FOR MANHOLES AND CATCH BASINS**

1. ALL CONCRETE SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 4000 lbs. PER SQ. INCH AT THE END OF 28 DAYS, UNLESS OTHERWISE NOTED.
2. MANHOLES MAY BE CONSTRUCTED OF PRECAST REINFORCED CONCRETE, OR CAST IN PLACE.
3. PRECAST REINFORCED CONE BARREL MANUFACTURED PER ASTM SPEC. C-478.
4. ALL STORM AND SEWER MANHOLE COVERS SHALL BE SOLID AND SHALL HAVE ONE 7/8" DIAMETER DRILLED PICK HOLE LOCATED 8" FROM THE CENTER OF THE COVER.
5. ALL SANITARY MANHOLE COVERS SHALL HAVE "SEWER" CAST INTO THE COVER. ALL STORMWATER/DRAIN MANHOLE COVERS SHALL HAVE "DRAIN" CAST INTO THE COVER.
6. ALL MANHOLE RISERS SHALL BE ETHERIDGE 24" OR APPROVED EQUAL.
7. SEWER BRICK SHALL CONFORM TO ASTM SPEC. DESIGNATE ON C-32-63, GRADE MA AND SA.
8. ALL SANITARY MANHOLES SHALL HAVE A WATERPROOFING COATING APPLIED TO THE EXTERIOR SURFACE.
9. CATCH BASIN FRAMES FOR TYPE A4 CATCH BASIN CURB INLETS SHALL BE ETHERIDGE DR5A OR APPROVED EQUAL.
10. CASTINGS SHALL CONFORM TO ASTM DESIGNATION A48-CLASS 35.
11. EXISTING MANHOLES, CATCH BASINS, FRAMES, AND COVERS SHALL BE SALVAGED BY THE CONTRACTOR, AND SHALL REMAIN THE PROPERTY OF THE CITY OF PORTLAND.
12. ALL CATCH BASIN OUTLETS SHALL BE INSTALLED WITH A CASCO TRAP. SEE FIGURE II-09.

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FIGURE:

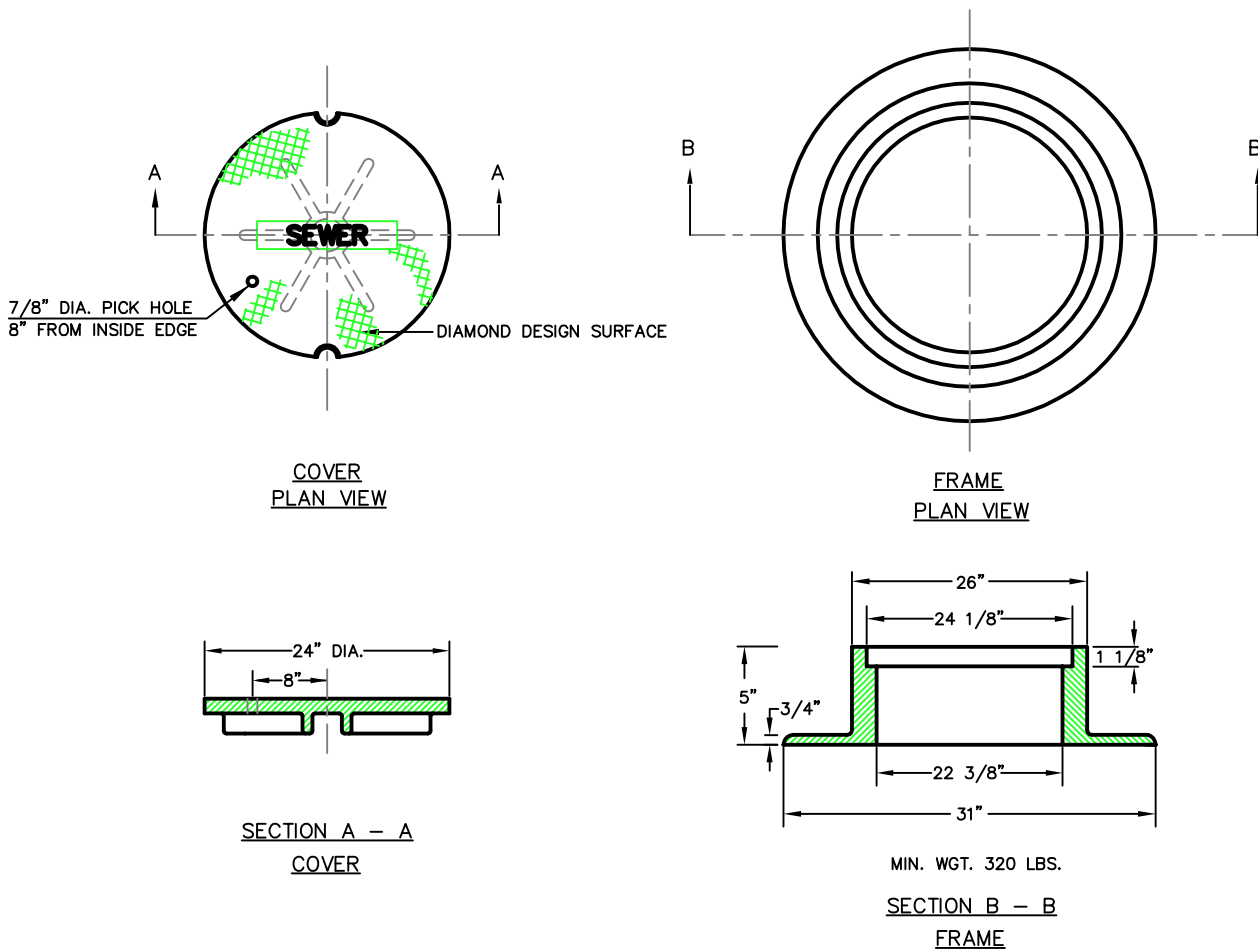
**GENERAL NOTES FOR  
 MANHOLES AND CATCH BASINS**

**II-4**

**NOTE:**

ALL MANHOLE COVERS SHALL BE SOLID AND SHALL HAVE ONE 7/8" DIAMETER DRILLED PICK HOLE, LOCATED 8" FROM THE CENTER OF THE COVER.

ALL SANITARY MANHOLE COVERS SHALL HAVE "SEWER" CAST INTO THE COVER. ALL STORMWATER/DRAIN MANHOLE COVERS SHALL HAVE "DRAIN" CAST INTO THE COVER.



**CAST IRON MANHOLE COVER AND FRAME**

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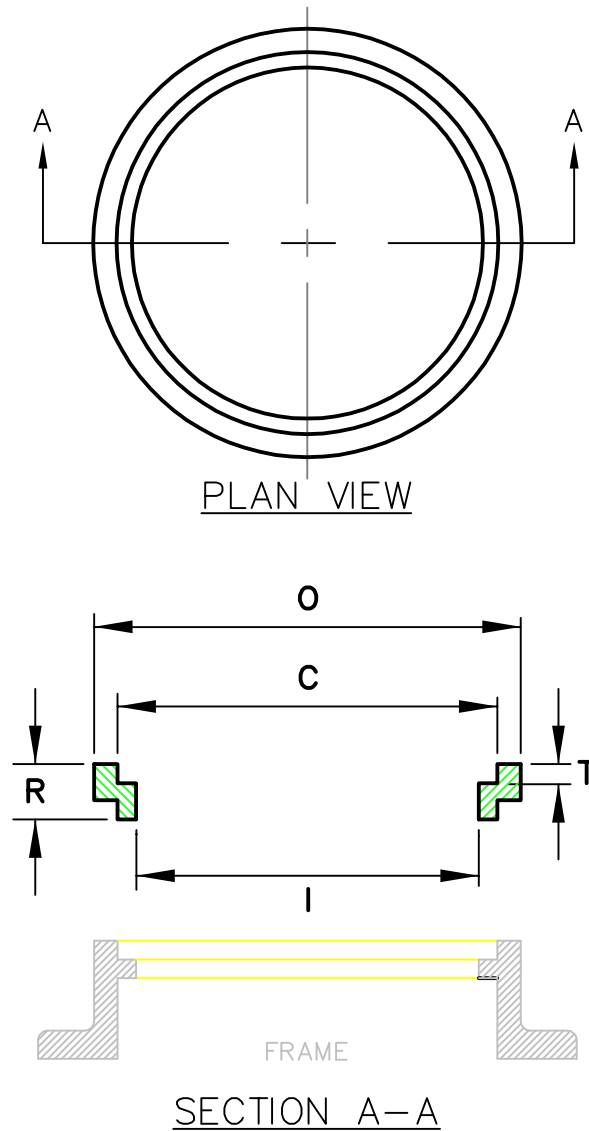
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FIGURE:

**CAST IRON MANHOLE COVER AND FRAME**

**II-5**



SIZE	C	R	T	O	I	Wt.
R241 1/2	24	1 1/2	1 1/8	26 1/4	22 1/2	60
R242	24	2	1 1/8	26 1/4	22 1/2	80
R242 1/2	24	2 1/2	1 1/8	26 1/4	22	100
R243	24	3	1 1/8	26 1/4	22	120

## MANHOLE RISER RING

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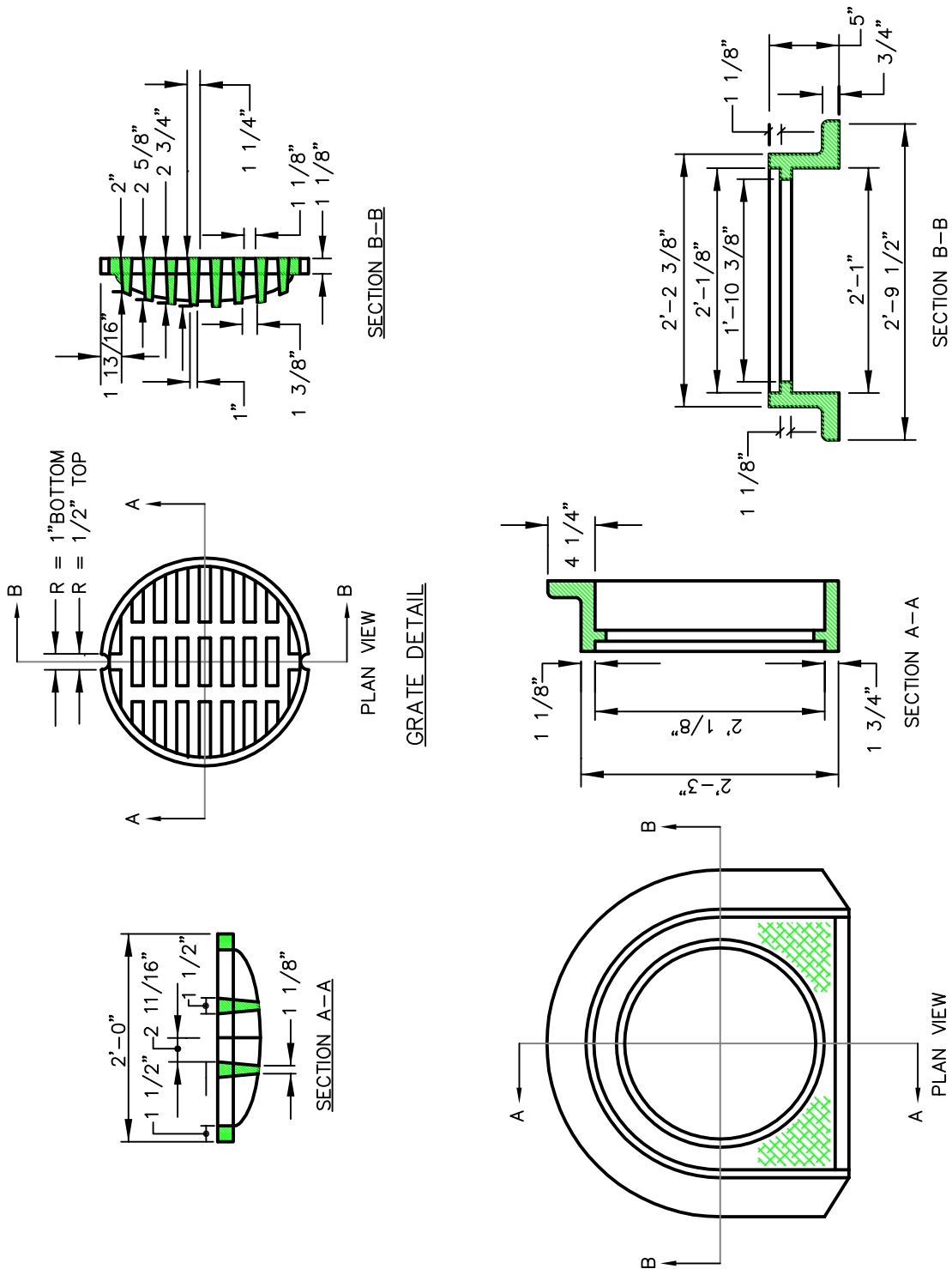
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FIGURE:

**MANHOLE RISER RING**

**II-6**



**CATCH BASIN FRAME & GRATE**

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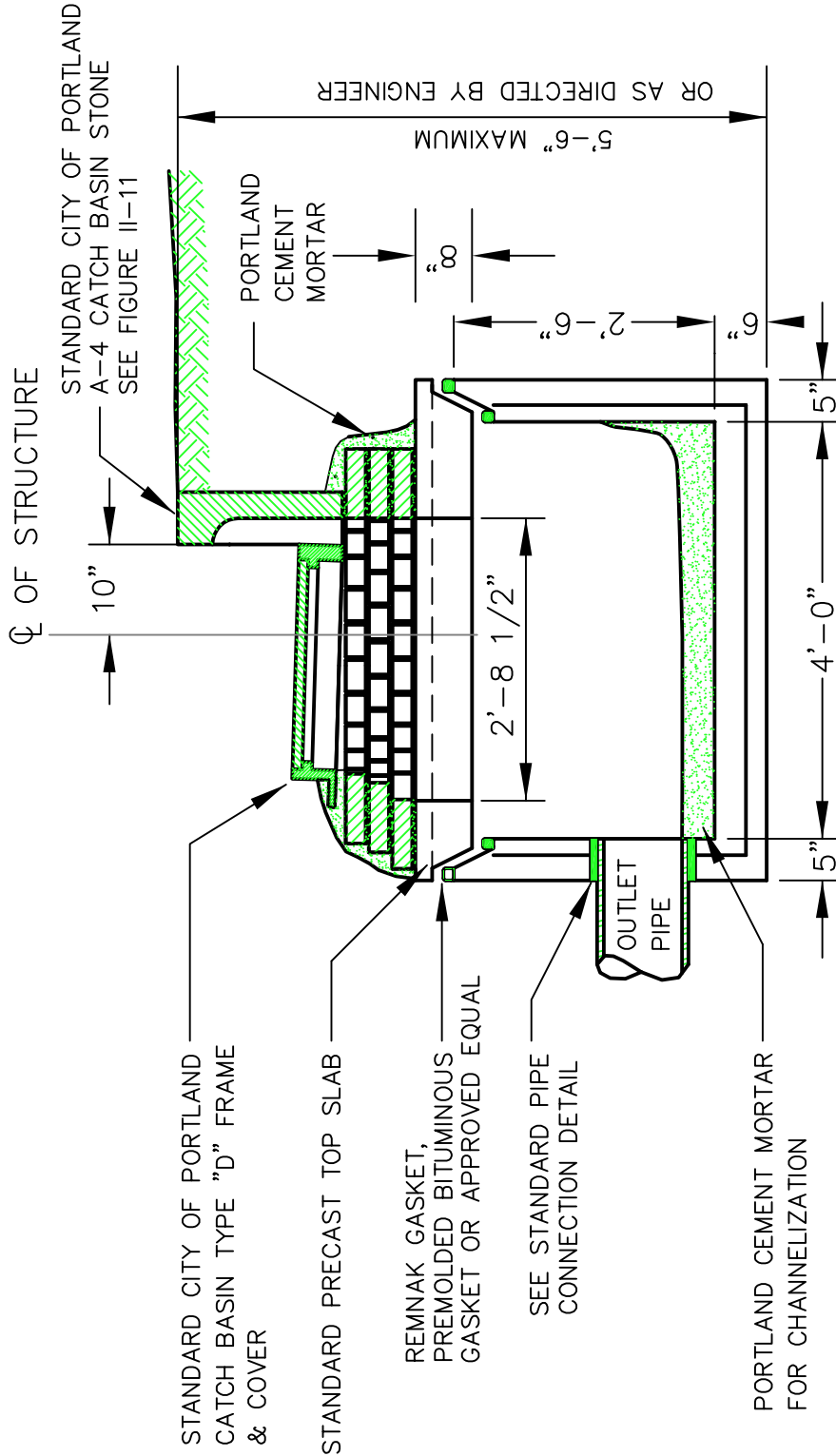
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FIGURE:

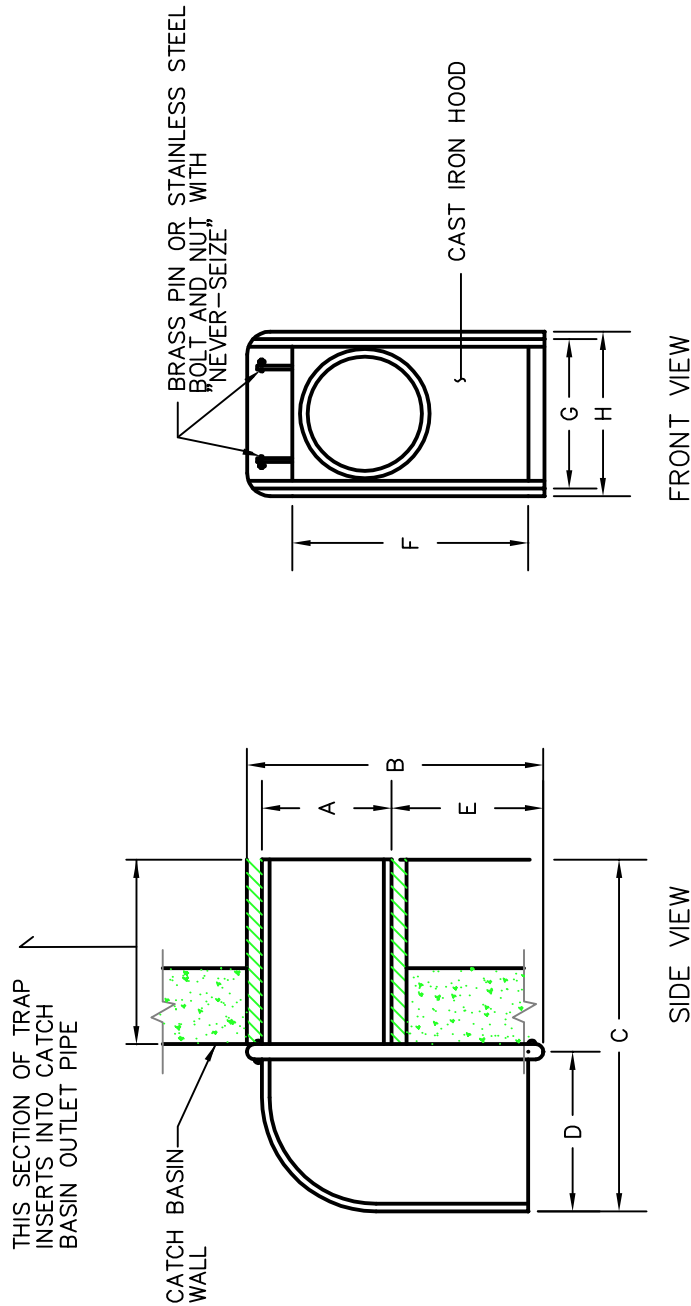
**CATCH BASIN FRAME AND GRATE**

**II-7**



**CATCH BASIN INLET**  
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<b>CATCH BASIN INLET</b>			92



FRONT VIEW

SIDE VIEW

SIZE	A	B	C	D	E	F	G	H
6 in.	5 1/2"	13 3/8"	13 3/4"	5 3/8"	5 7/8"	11 5/8"	6 1/2"	7 1/4"
8 in.	7 1/2"	15"	15 3/8"	5 1/2"	5 3/8"	13 3/4"	8 3/4"	9 3/8"
10 in.	9 1/2"	16"	16 1/4"	6"	4 1/2"	14 1/8"	11 1/2"	12 3/8"
12 in.	11 1/2"	17"	22"	8"	3 1/2"	17"	12 1/2"	13 3/8"

(AS MANUFACTURED BY THE ETHERIDGE FOUNDRY IN PORTLAND, ME.)

NOTE: CONTRACTOR SHALL UTILIZE THE "CASCO TRAP" AS MANUFACTURED BY THE ETHERIDGE FOUNDRY, OR AN APPROVED EQUIVALENT AS SUPPLIED BY THE LEBARON FOUNDRY, MODEL # L, 202 "STANDARD CATCH BASIN TRAP"

**CASCO TRAP**  
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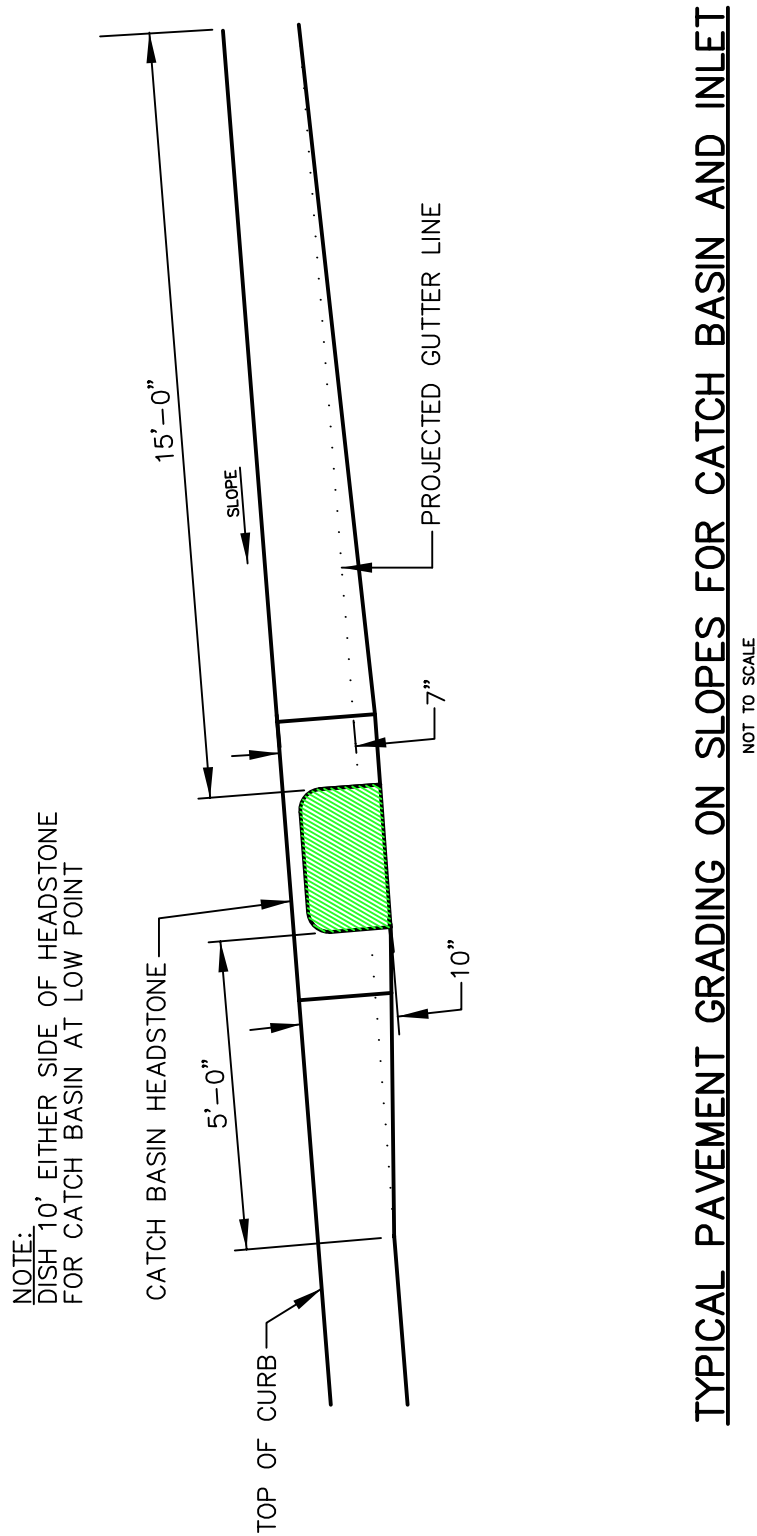
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FIGURE:  
**II-9**

**CASCO TRAP**





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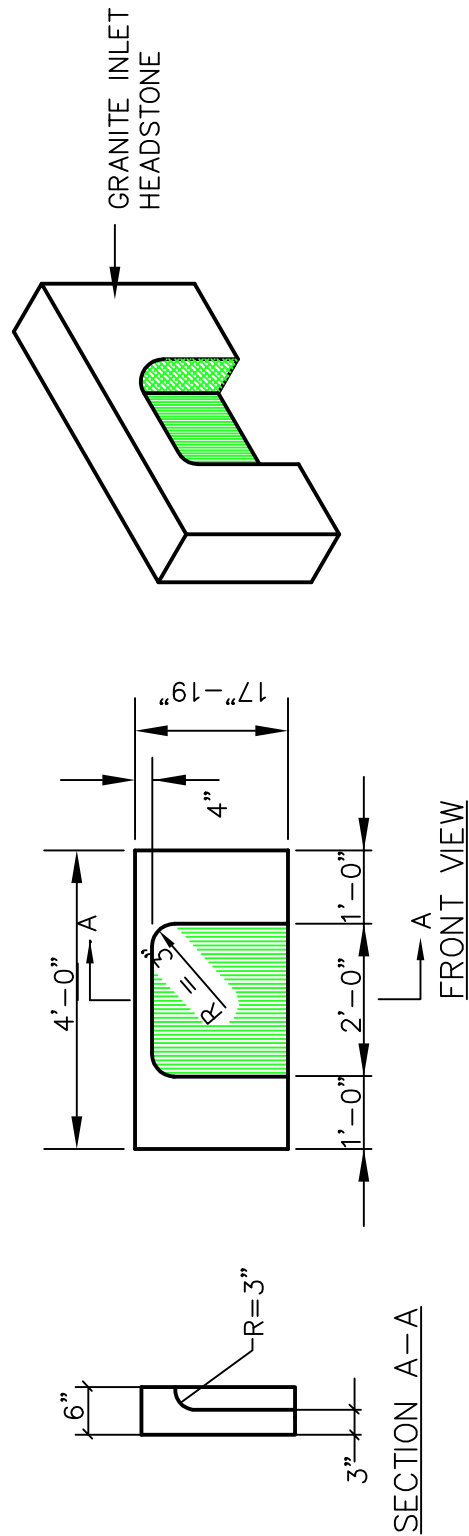
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FIGURE:

TYPICAL PAVEMENT GRADING ON SLOPES  
 FOR CATCH BASIN AND INLET

II-10



**4' GRANITE HEADSTONE FOR CATCH BASIN INLET**  
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FIGURE:

**4' GRANITE HEADSTONE FOR CATCH BASIN INLET**

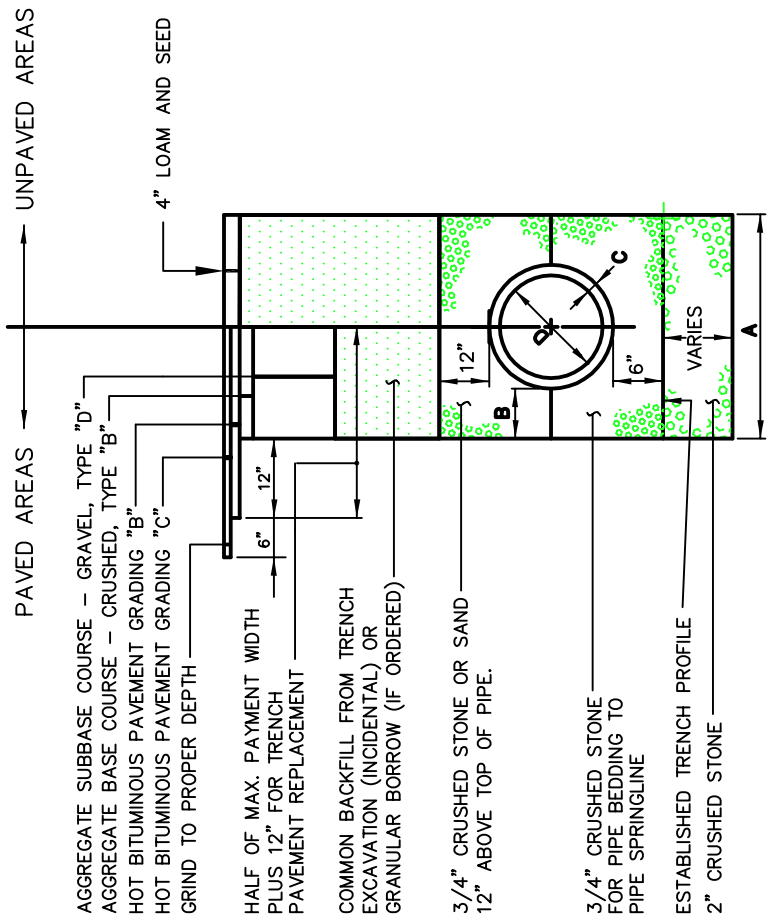
**II-11**

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**TYPICAL PIPE TRENCH INSTALLATION AND NOTES**

FIGURE:  
**II-12**

**NOTES:**  
DEPTH OF BITUMINOUS PAVEMENT AND AGGREGATE COURSES SHALL BE DETERMINED BY STREET CLASSIFICATION.  
ANY ALTERNATE TRENCHING OR PAYMENT METHODS SHALL BE APPROVED IN ADVANCE BY THE CITY OF PORTLAND, DEPARTMENT OF PUBLIC SERVICES..

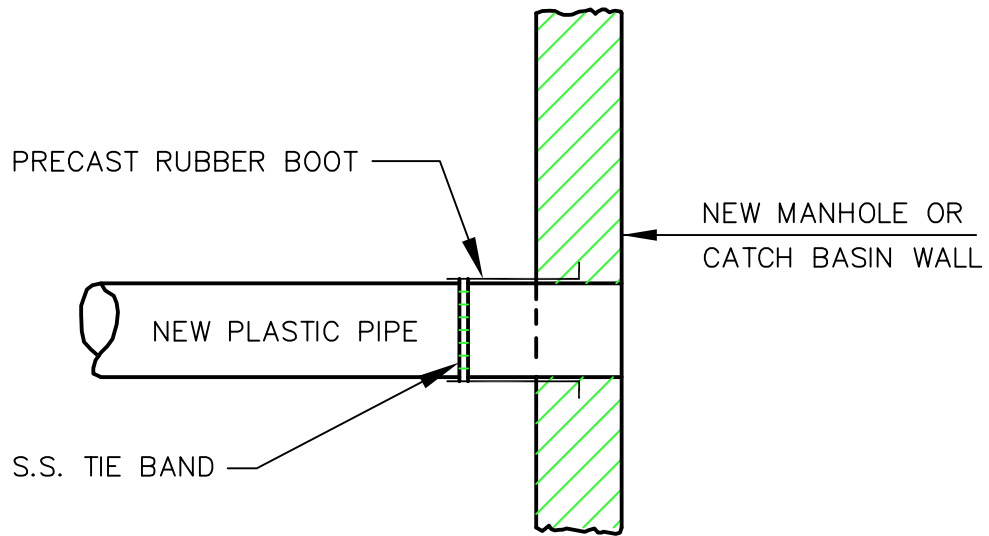


- NOTES:**
1. ALTERNATIVE CONSTRUCTION METHODS OR PAYMENT METHODS SHALL BE APPROVED IN ADVANCE BY THE CITY. IN PAVED AREAS, DEPTHS OF GRAVEL AND HOT MIX ASPHALT PAVEMENT SHALL MATCH THE GREATER OF EXISTING CONDITIONS OR THE REQUIREMENTS FOR THE CORRESPONDING STREET CLASSIFICATION.
  2. DIMENSION **B** SHALL BE SUFFICIENT TO ALLOW CRUSHED STONE BEDDING TO BE PLACED AND COMPACTED UNDER THE HAUNCHES OF THE PIPE; BUT IN ALL CASES DIMENSION **B** SHALL BE AT LEAST 9".
  3. DIMENSION **A** IS THE MAXIMUM WIDTH ALLOWED FOR CALCULATING PAY QUANTITIES UNDER GRANULAR BORROW, CRUSHED STONE, STRUCTURAL EARTH EXCAVATION, AND STRUCTURAL ROCK EXCAVATION. DIMENSION **A** SHALL BE BASED ON PIPE DIAMETER **D**, AS SET FORTH IN THE FOLLOWING TABLE.

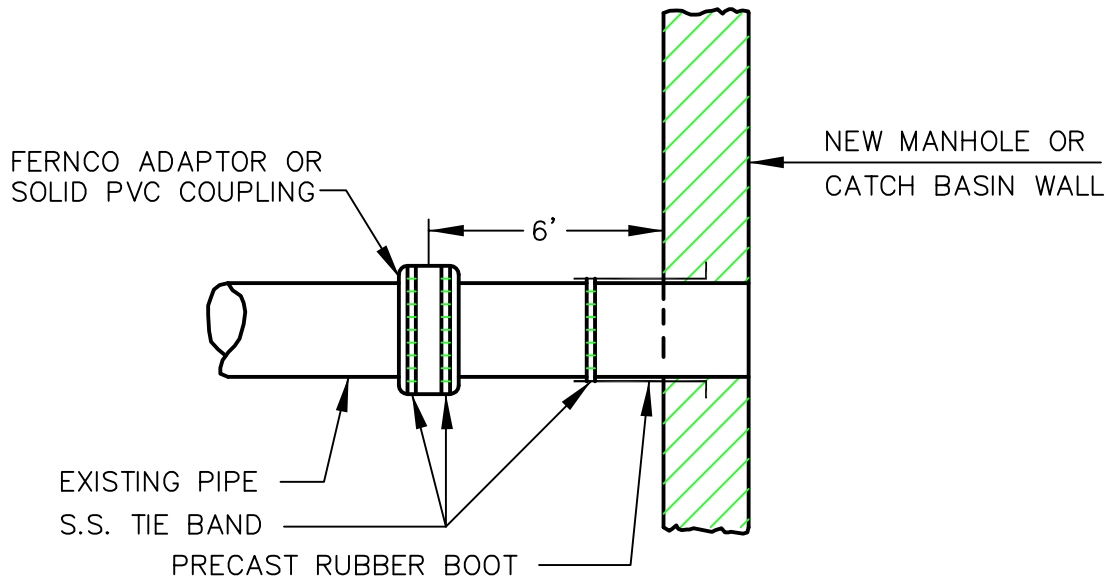
PIPE DIAMETER, <b>D</b> (INCHES)	MAX. TRENCH WIDTH, <b>A</b> (FEET)
4	-
6	-
8	4.0
10	4.0
12	4.0
15	5.0
18	5.0
21	5.0
24	6.0
27	6.0
30	6.0
36	6.0
42	6.0
48	7.0

**TYPICAL PIPE TRENCH INSTALLATION**  
NOT TO SCALE

**TYPICAL PIPE INSTALLATION - NOTES**  
NOT TO SCALE



METHOD 2 - NEW CONSTRUCTION



METHOD 1 - EXISTING PIPE INTO NEW STRUCTURE

## PLASTIC PIPE CONNECTIONS

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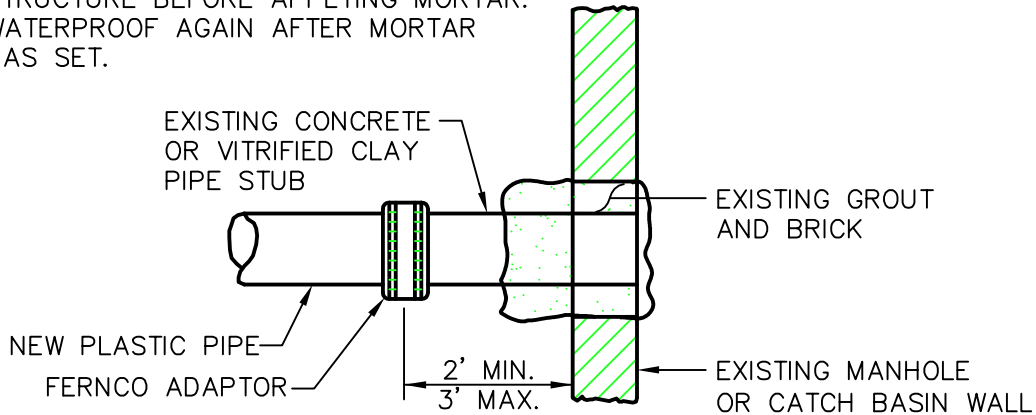
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FIGURE:

**PLASTIC PIPE CONNECTION METHODS 1 & 2**

**II-13**

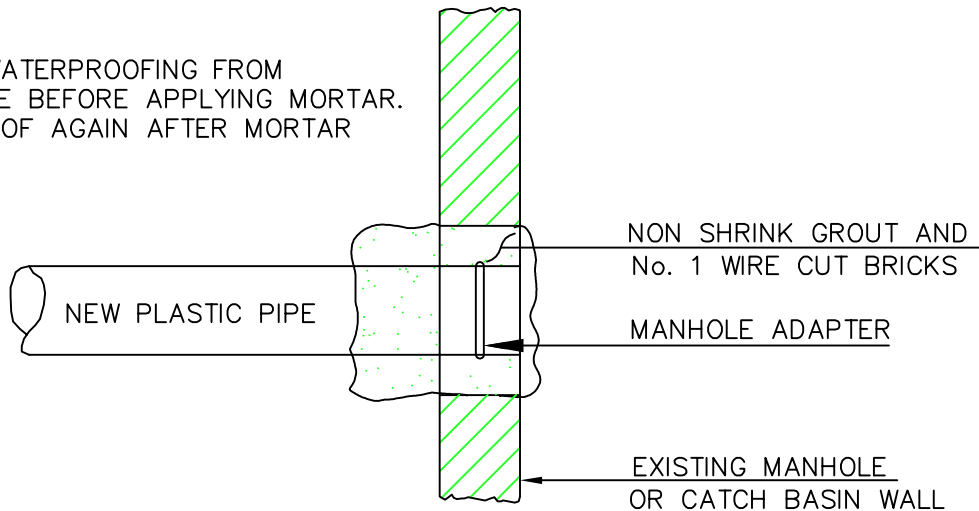
**NOTE:**  
 REMOVE WATERPROOFING FROM  
 STRUCTURE BEFORE APPLYING MORTAR.  
 WATERPROOF AGAIN AFTER MORTAR  
 HAS SET.



METHOD 4 – NEW PIPE TO EXISTING STRUCTURE STUB

**NOTE:** EXISTING MANHOLE OR CATCH BASIN SHALL BE CORE DRILLED FOR PIPE INSTALLATION. IF PIPE DIAMETER IS SO LARGE THAT CORE DRILLING IS PROHIBITED, THE CONTRACTOR MAY SAW CUT THE STRUCTURE TO CREATE PIPE OPENING. THE NEW OPENING MUST THEN BE SEALED AND WATERTIGHT BOTH INSIDE AND OUTSIDE THE STRUCTURE.

**NOTE:**  
 REMOVE WATERPROOFING FROM  
 STRUCTURE BEFORE APPLYING MORTAR.  
 WATERPROOF AGAIN AFTER MORTAR  
 HAS SET.



METHOD 3 – NEW PIPE INTO EXISTING STRUCTURE

**PLASTIC PIPE CONNECTIONS**

NOT TO SCALE

DATE:  
 AUGUST 2009  
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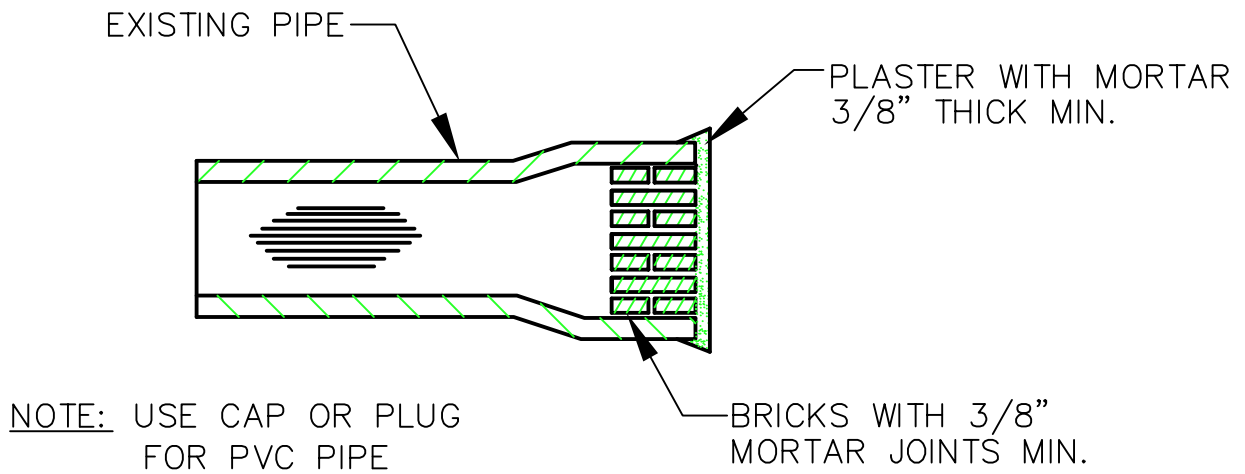
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**SANITARY SEWER AND STORM  
 DRAIN DESIGN STANDARDS**  
 SECTION II

FIGURE:

**PLASTIC PIPE CONNECTION METHODS 3 & 4**

**II-14**



## MASONRY PLUG

NOT TO SCALE

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DRAIN DESIGN STANDARDS**  
SECTION II

FIGURE:

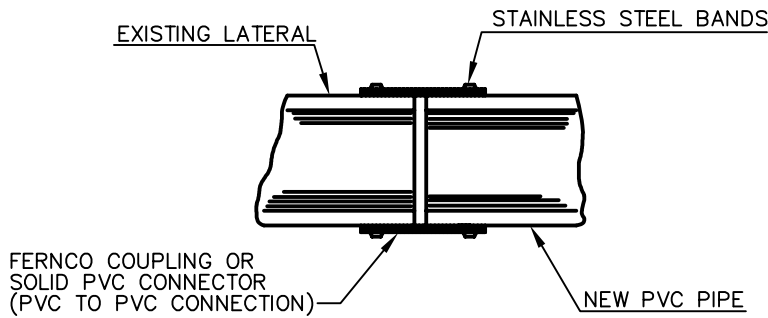
**MASONRY PLUG**

**II-15**

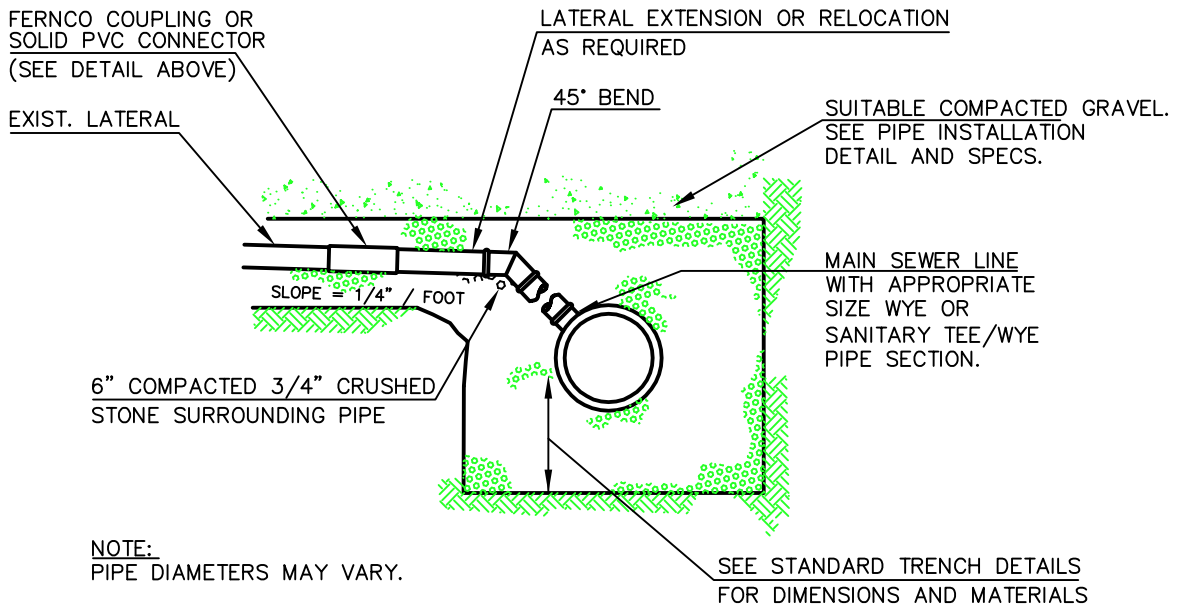
**NOTE:**

LOCATIONS AND ELEVATIONS OF STUBS SHOWN ON THE PLANS ARE TO BE CONSIDERED AS APPROXIMATE AND MAY BE ADJUSTED AS DIRECTED TO SUIT FIELD CONDITIONS.

HOUSE CONNECTIONS AND CATCH BASINS CONNECTIONS TO THE MAIN LINE OF THE SEWER, SHALL CONSIST OF AN APPROPRIATE "Y" BRANCH CONNECTION AS SHOWN ON THE PLANS, OR AS DIRECTED. ACTUAL "Y" LOCATIONS FOR HOUSE CONNECTIONS AND CATCH BASIN CONNECTIONS SHALL BE DETERMINED DURING CONSTRUCTION. THE CONTRACTOR SHALL KEEP A COMPLETE RECORD OF "Y" LOCATIONS WHICH SHALL BE GIVEN TO THE CITY OF PORTLAND UPON COMPLETION OF THE CONTRACT. ALL PVC TO PVC COUPLING SHALL BE "SOLID PVC COUPLINGS".



**FERNCO COUPLING FOR REPAIR OR REPLACEMENT**



**NOTE:**  
 PIPE DIAMETERS MAY VARY.

**SECTION**

**TYPICAL EXISTING LATERAL CONNECTION**

NOT TO SCALE

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**SANITARY SEWER AND STORM  
 DRAIN DESIGN STANDARDS**  
 SECTION II

FIGURE:

**TYPICAL EXISTING LATERAL CONNECTION**

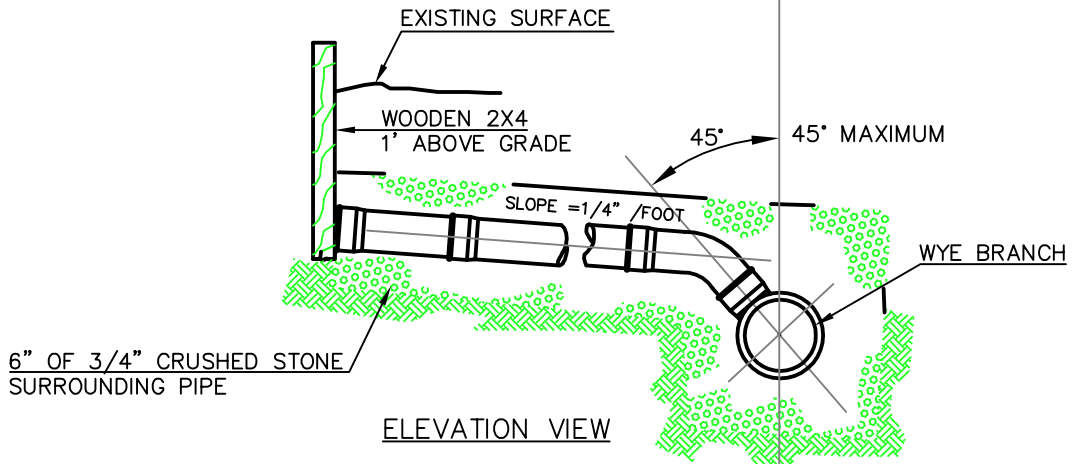
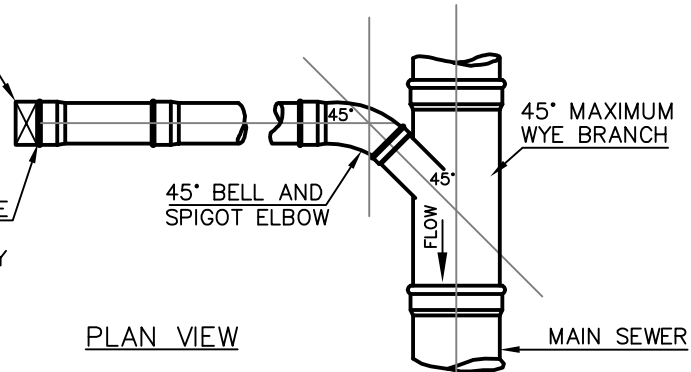
**II-16**

**NOTE:**  
 LOCATION / WARNING TAPE SHALL BE  
 INSTALLED OVER CENTERLINE OF PIPE AT A  
 MAXIMUM OF 24 INCHES BELOW FINISH GRADE.

EXTEND WOODEN 2X4  
 TO 1' ABOVE GRADE TO  
 DELINEATE END OF STUB.  
 MARK 2X4 WITH THE DEPTH  
 FROM GRADE TO PLUG.

FOR FUTURE CONNECTION, TERMINATE  
 AND PLUG LATERAL AT STREETLINE.  
 PLUG TO BE IDENTIFIED AS SANITARY  
 OR STORM.

PLAN VIEW



ELEVATION VIEW

**TYPICAL HOUSE LATERAL TEE/WYE CONNECTION**  
 NOT TO SCALE

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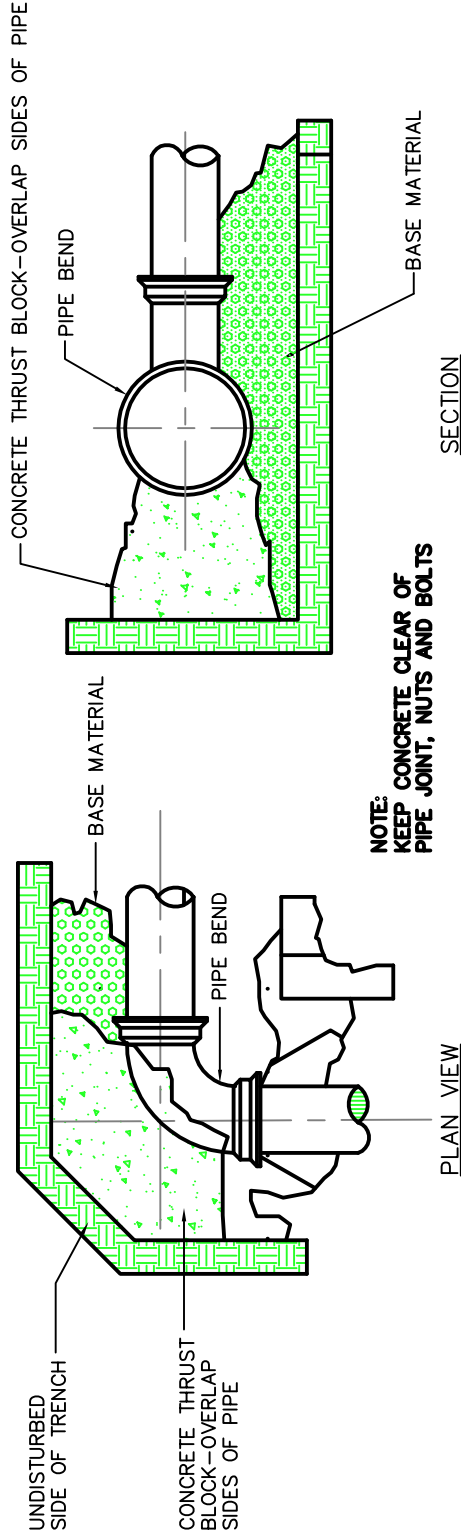
**SANITARY SEWER AND STORM  
 DRAIN DESIGN STANDARDS**  
 SECTION II

FIGURE:

**TYPICAL HOUSE LATERAL TEE/WYE CONNECTION**

**II-17**





THRUST/RETAINER SCHEDULE	
1/4 BEND (90°)	USE POURED-IN-PLACE THRUST BLOCK w/RETAINERS
1/8 BEND (45°)	THRUST BLOCK w/RETAINERS
1/16 BEND (22 1/2°)	THRUST BLOCK
1/32 BEND (11 1/4°)	THRUST BLOCK

**FORCE MAIN - CONCRETE THRUST BLOCK PLACEMENT**  
**ON VERTICAL & HORIZONTAL BENDS**  
NOT TO SCALE

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**SANITARY SEWER AND STORM  
 DRAIN DESIGN STANDARDS**  
 SECTION II

FIGURE:

**FORCE MAIN  
 CONCRETE THRUST BLOCK PLACEMENT**

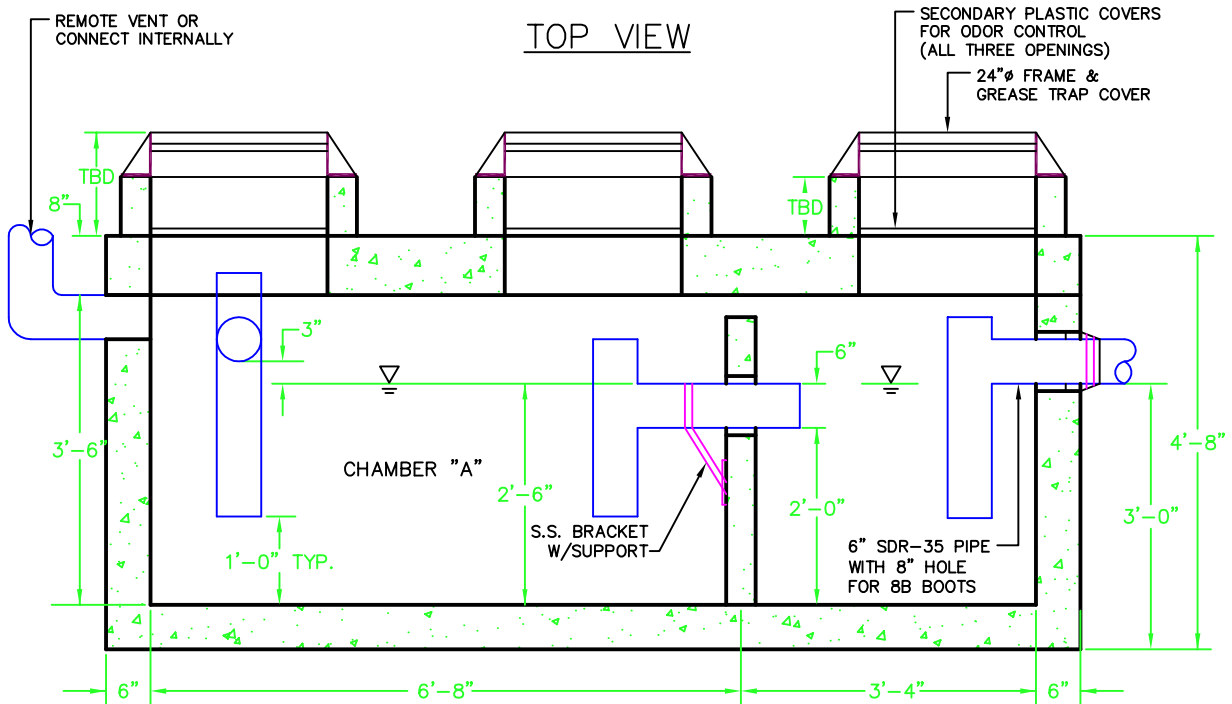
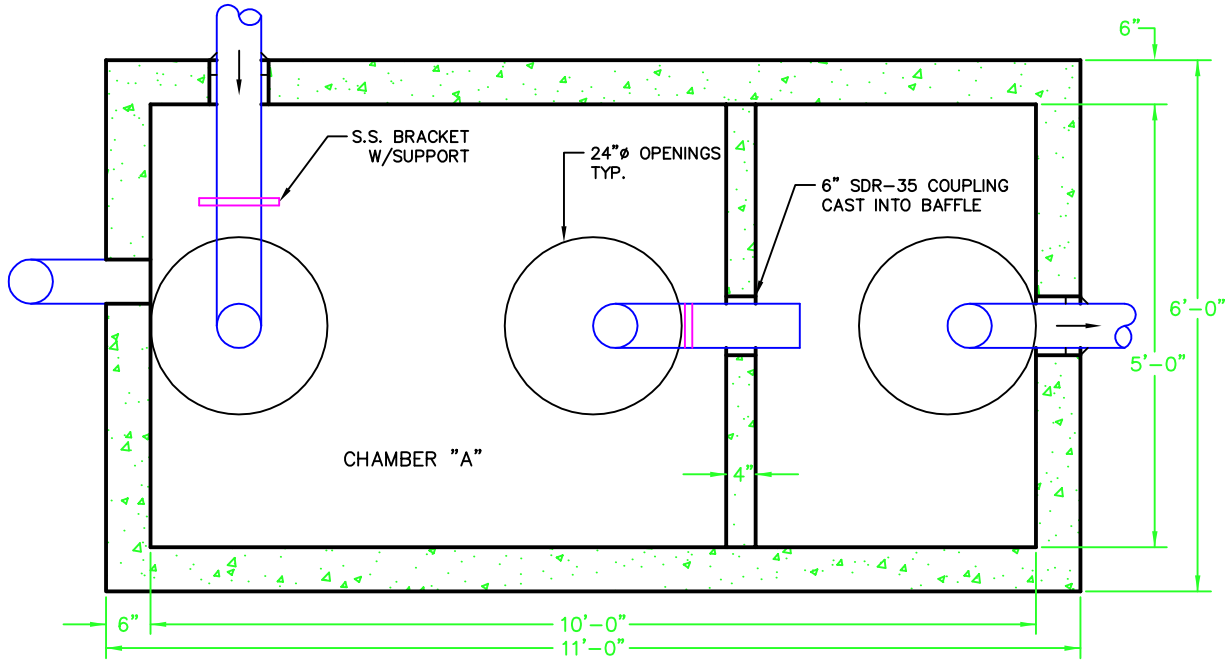
**II-18**

**DESIGN NOTES:**

1. CONCRETE 5000 PSI AT 28 DAYS.
2. H-20 LOADING
3. JOINTS SEALED WITH BUTYL RUBBER JOINT SEALANT (ASSHTO M-19)
4. ALL TEES/BAFFLES PROVIDED BY PRECAST.

THIS STRUCTURE MUST DISCHARGE TO A CITY OF PORTLAND STANDARD MANHOLE WITH CHANNEL (CONTROL/SAMPLING MANHOLE).

FORMULA FOR SIZING THE TRAP: CHAMBER "A" (2/3 OF TANK VOLUME) MUST BE EQUIVALENT TO THE AVERAGE DAILY PROCESS FLOW FROM THE FACILITY WITH NO SANITARY OR OTHER EXTRANEIOUS WASTES FLOWING THROUGH IT.



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 SECTION II

FIGURE:

**EXTERNAL GREASE TRAP DESIGN**

**II-19**