



**STANDARD SPECIFICATIONS
FOR
STORM SEWER CONSTRUCTION**

CITY OF PLYMOUTH, MINNESOTA

MARCH 2023

ENGINEERING DIVISION

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A handwritten signature in black ink, appearing to read 'Chris LaBounty'.

Chris LaBounty, P.E.
Deputy Public Works Director/City Engineer

These specifications are intended for inclusion into the contract documents.
They only address the technical specifications and construction details of the referenced section.

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SECTION 02300
STANDARD DETAIL SPECIFICATIONS
FOR
STORM SEWER CONSTRUCTION

CITY OF PLYMOUTH, MINNESOTA USA

MARCH 2023
INDEX

02301 SCOPE OF WORK

02302 SPECIFICATIONS WHICH APPLY

02303 STORM SEWER MATERIALS

1. [Reinforced Concrete Pipe](#)
2. [Drain Tile & P.E. Yard Drains](#)
3. [Pipe Bedding Materials](#)
4. [Manholes/Catch Basins](#)
5. [Standard Skimmer Structure](#)
6. [Manhole/Catch Basin Castings](#)
7. [Manhole/Catch Basin Adjusting Rings](#)
8. [Flared End Sections/Rip-Rap](#)
9. [Mortar](#)
10. [Channel Post & Markers](#)

02304 STORM SEWER INSTALLATION

1. [Working Hours](#)
2. [Inspections and Handling](#)
3. [Pipe Laying Operations](#)
4. [Connections and Assembly of Joints](#)
5. [Reconstruct Manhole/Catch Basins](#)
6. [Repair Manhole/Catch Basins](#)
7. [Adjust Casting](#)

02305 STORM SEWER TESTING

1. [Compaction](#)
2. [Pipe Class](#)
3. [Televising of Pipes](#)

02306 MEASUREMENT AND PAYMENT

02307 STORM SEWER DETAILS

- ST-1 [Storm Sewer Manhole with Cone Section](#)
- ST-2 [Catch Basin \(Maximum Depth 4.5'\)](#)
- ST-3 [Inlet & Outlet F.E.S with Trash Guard](#)
- ST-4 [Rip-Rap Detail for Flared End Section](#)

2023 STANDARD DETAIL SPECIFICATION FOR STORM SEWER CONSTRUCTION

[Back to Index page](#)

- ST-5 [Catch Basin Casting Installation Detail](#)
- ST-6 [Precast Storm Sewer Catch Basin Manhole](#)
- ST-7 [Block Storm Sewer Catch Basin Manhole](#)
- ST-8 [Storm Sewer Bedding](#)
- ST-9 [Sub drain Details](#)
- ST-10 [Perforated Drain Tile Pipe](#)
- ST-11 [Sump Catch Basin Manhole](#)
- ST-12 [Typical Treatment Pond](#)
- ST-13 [Wetland Mitigation Detail](#)
- ST-14 [Retaining Wall Culvert Casing Detail](#)
- ST-15 [Skimmer Structure](#)
- ST-16 [Typical Rain Garden Detail](#)
- ST-17 [Floatation Silt Curtain Detail](#)
- ST-18 [Silt Fence Detail](#)
- ST-19 [Rock Exit to Construction Site](#)
- ST-20 [Wetland Buffer and Stream Buffer Monument](#)
- ST-21 [PVC Street Drain Tile Cleanouts](#)
- ST-22 [Sample Sand Filter Basin Detail](#)

02301 SCOPE OF WORK

The work to be done under this contract shall include the furnishing of all labor, materials, tools, and equipment to construct complete in place the storm sewer and all appurtenances as show on the drawings, plans, and as specified herein.

The contractor shall excavate all materials encountered; furnish and compact foundations where required; furnish and install all timbering, sheeting and bracing necessary to safely support the work; remove any ground water encountered during excavation operations; protect, repair, relocate, maintain, and restore all sub-surface, surface, and overhead structures directly disturbed, damaged or affected by construction operations; and furnish all backfill and other appurtenant items as necessary.

All off-road storm sewer manholes must be accessible to the city's maintenance vehicles. All manholes outside of the street and not in a maintained area shall be marked with a flange post and a green reflectorized metal maker plate with white "M.H." lettering printed upon the plate. The marker plate shall face the closest access road. The flange post shall be located approximately 2 feet behind the structure when facing the roadway.

All existing drainage features in and around a new project and utilized by the project such as existing pipes and ditches that will remain in service after the project completion shall be in good condition at the completion of the project. If these existing drainage features are not in good condition, they will need to be cleaned or replaced to condition that allows them to function as required to accommodate the new runoff conditions from the project.

02302 SPECIFICATIONS WHICH APPLY

All specifications contained herein, including attached detail drawings, together with the construction plans for the designated project or projects and including current versions of those portions of the following specification, as indicated by paragraph or designation number, shall apply: American Society for Testing Materials ([ASTM](#)); American National Standards Institute ([ANSI](#)); Minnesota Department of Transportation's Standard Specifications for Construction current addition including Special Provisions ([MnDOT](#)), and The City Engineers Association of Minnesota's Standard Specifications for Utility Construction ([CEAM](#)).

02303 STORM SEWER MATERIALS

All storm sewer pipe, fittings, manholes and all appurtenances shall be new materials and shall be of the type, size, strength, and quality as shown on the plans or on the details and as specified herein and/or as indicated in the special provisions.

The contractor may be required to secure and deliver to the city engineer or designee, a written statement from the manufacturer assuring the quality and compliance to the applicable specification of all materials furnished and installed under this improvement project. This shall in no way relieve the contractor of any responsibility as to the quality of materials furnished and installed.

No PVC, corrugated HDPE or corrugated metal pipe (CMP) shall be used for mainline storm sewer within the public right-of-way unless previously approved by the city engineer.

02303.1 REINFORCED CONCRETE PIPE - Storm Sewer Materials

Reinforced concrete pipe (RCP) shall meet the requirements of MnDOT Specification [3236](#) with class as required and shown on the plans; pipe joints shall meet the requirements of ASTM Specification C361, and shall be R-4 type joints.

02303.2 DRAIN TILE - Storm Sewer Materials

Drain tile pipes shall be 6 inches diameter, minimum SDR 35, rigid, Circular holes with two to four rows of holes. Hole diameter = 3/16-inch to 3/8-inch, and minimum area of holes 1.5 in²/linear foot, with protective wrap meeting MnDOT [3733](#) specification. They shall be made from PVC meeting MnDOT [3245.2 \(3\)](#) specification. Solid copper or copper clad steel #10, green coated tracer wire shall be installed along side of the drain tile segments. See Standard Detail Plates [ST-9](#) and [ST-10](#).

A. P.E. Yard Drains

- Shall be Tuf-Tite brand drain sump with a minimum of four connection openings or approved equal.
- A minimum of one outlet connection and three inlet connections are required for yard drains requiring 6-inch connections (as noted on the plans).
- Cover all openings not connected to drain tile with plugs manufactured for that purpose. Provide grate style cover.
- Fittings shall be manufactured specifically for the use required and compatible with other materials used.

02303.3 PIPE BEDDING MATERIALS –Storm Sewer Materials

Pipe bedding material shall be in accordance with Standard Detail Plate [ST-8](#) and [ST-10](#). The contractor shall provide certification of the materials being used and will be required to perform field sampling for gradation test of any bedding materials used as required by the city engineer. Copies of test results shall be submitted to the city in a timely manner. Bedding shall be considered incidental to the pipe installation unless noted otherwise in the contract documents.

02303.4 MANHOLES/CATCH BASINS –Storm Sewer Materials

Manholes, catch basins, and other special access structures shall be constructed at designated locations as required by the plans and in accordance with any standard detail drawings or special design requirements given. Manholes and catch basins shall meet the requirements of A.S.T.M. Specification C-478. Sumps may be required at certain points.

Precast boxes and sections shall be used wherever possible. Block construction of a structure requires prior approval of the city engineer or designee and must be shown on the approved plans. See Standard Detail Plate [ST-2](#).

Barrel and cone/slab height shall be such as to permit placement of at least two and not more than six, 2-inch thick, HDPE adjusting rings immediately below the casting assembly. Manholes/catch basins shall be in accordance with MnDOT Specification [3622](#), and have a minimum diameter of 4 feet. Catch Basins shall be either 4-foot diameter, 27 inches (See MNDOT plate [4003B](#) and [4143E](#)) diameter for use in green areas, or 2-foot by 3-foot precast concrete

structures. See Standard Detail Plates [ST-1](#), [ST-2](#), [ST-6](#), and [ST-7](#). Subgrade drains are required at all low point catch basins and on the uphill side of all in-grade catch basins. See Standard Detail Plate [ST-9](#).

02303.5 STANDARD SKIMMER STRUCTURE –Storm Sewer Materials

Skimmer structures shall be constructed at designated locations as required by the plans and in accordance with any standard detail drawings or special design requirements given. Skimmer structures shall meet the construction requirements of A.S.T.M. Specification C-478 for precast manholes. The minimum inside diameter of the structure shall be 48 inches and the maximum shall not exceed 72 inches. The structures top shall be constructed to match the slope of the pond banks where it is installed. The top of the structure shall be covered with a galvanized metal, circular, 4 feet by 4 feet open grate, hinged split-grate. This grate shall be bolted down to the structure at a minimum of four equally spaced points around its perimeter.

Reinforced concrete pipe (RCP) or ductile iron pipe (DIP) shall be used for the inlet pipe with no apron installed if the pipe will be under water.

Reinforced concrete pipe (RCP) shall be used for the outlet pipe from the skimmer structure. All pipe joints on both the inlets and outlets shall be restrained. See Standard Detail Plate [ST-15](#) for standard skimmer structure details.

02303.6 MANHOLE/CATCH BASIN CASTINGS –Storm Sewer Materials

Manhole castings shall be Neenah R-1642-B or approved equal with machine bearing surfaces, with two concealed pick holes and "Storm Sewer" stamped on the cover. Catch basin castings shall be Neenah R-3067 with type V or VB grates. Other acceptable catch basin castings depending upon the circumstances and subject to city approval are:

Neenah	R-2561-A	Round Beehive Grate & Casting
Neenah	R-2573	Round Concave Grate & Casting
Neenah	R-2577	Round Convex Grate & Casting
Neenah	R-3250-1	Round Curb Inlet Frame, Grate & Curb Box
Neenah	R-3501-TR or TL	Inlet for Roll Type Curb
Neenah	R-4342	Round Low Stool Type w/Conc. Frame per MNDOT STD. Plate # 4143E

02303.7 MANHOLE/CATCH BASIN ADJUSTING RINGS –Storm Sewer Materials

Manhole/catch basin adjusting rings shall be High Density Polyethylene Extruded (HDPE) produced by Ladtech or an approved equal. The rings shall provide a minimum adjustment of 4 inches using 2-inch rings and maximum adjustment of 12 inches with a 4-inch-thick ring used for adjustments of 8 inches or greater. Joints between structure, rings and casting shall be sealed per the standard details with a Butyl caulk and wrapped with non-woven fabric for the catch basin rings. Solid reinforced concrete adjusting rings may be used in special situations only with prior written approval by the city engineer. See Standard Detail Plate [ST-1](#), [ST-2](#), [ST-6](#) and [ST-7](#).

02303.8 FLARED END SECTIONS & POND EOF's/RIPRAP –Storm Sewer Materials

Flared end sections are required on all culverts. They are not allowed on the inlet pipe for a skimmer structure. All flared end sections 24 inches in diameter and larger shall be equipped with trash guards with an opening at the bottom of the trash guard (see Standard Detail Plate [ST-3](#)).

Riprap and or energy dissipaters shall be required for all sizes to prevent erosion. Riprap will also be required at pipe inlets and pond emergency overflows (EOF's). Riprap, per MnDOT specification [3601](#) shall be constructed using granite, 1 inch in diameter or larger and shall be hand placed. Non-woven geotextile fabric conforming to MnDOT specification 3733 shall be required under the riprap. See Standard Detail Plate [ST-4](#). Cable concrete (articulating concrete block mats) can be used instead of riprap.

02303.9 MORTAR –Storm Sewer Materials

Mortar for use in masonry construction shall be an air-entrained mixture of one part masonry cement, Type M, and two parts mortar sand, with sufficient water to produce proper consistency, and with sufficient air-entraining agent added to maintain an air content within the range of 7 to 10 percent. Mortar shall meet the requirements of ASTM C-270.

02303.10 CHANNEL POSTS & MARKERS -Storm Sewer Materials

U-Channel post used for structure marking shall be green, 6 feet in length weighting 3lb/foot and punched full length with 3/8-inch diameter holes, 1 inch on center. Marker signs shall be 0.063-inch-thick aluminum blanks measuring 3 inches wide by 8 inches high with a high intensity green reflectorized background with white 2-inch-high letters. Markers shall be attached to the post with two stainless steel bolts and nuts. Posts and markers shall be considered incidental unless otherwise noted.

02304 STORM SEWER INSTALLATION

02304.1 WORKING HOURS –Storm Sewer Installation

The City engineer or designee shall be notified at least 48 hours prior to commencing any work by calling (763) 509-5500. Contractors are subject to being shut down and or having work rejected if proper notification is not given to the city.

Work shall not commence before 7 a.m. nor extend beyond sunset Monday through Friday. On Saturdays, work hours are from 8 a.m. to 6 p.m. No work is permitted on Sundays or holidays unless authorized by the city. Existing roadways shall not be restricted between 7 a.m. to 9 a.m. and 3 p.m. – 6 p.m. unless approved by the city engineer.

The definition of “work” also includes the starting of equipment and the delivery of materials to the job site.

02304.2 INSPECTION AND HANDLING –Storm Sewer Installation

Proper and adequate implements, tools, and facilities satisfactory to the city engineer or designee, shall be provided and used by the contractor for the safe and convenient prosecution of the work. During the process of unloading, all pipe and accessories shall be inspected by the contractor for damage. The contractor shall notify the city engineer or designee, of all material found to have cracks, flaws, or other defects. The city engineer or designee shall inspect the damaged materials and have the right to reject any materials found to be unsatisfactory. The contractor shall promptly remove all rejected material from the site. All materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fillings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping. All work and materials are subject to tests by the owner at such frequency as may be determined by the city engineer or designee.

While suspended and before being lowered into laying position, each pipe section and appurtenant unit shall be inspected by the contractor to detect damage or unsound conditions that may need corrective action or be cause for rejection. The contractor shall inform the city engineer or designee, of any defects discovered and the city engineer or designee will prescribe the required corrective actions or order rejection. Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

02304.3 PIPE LAYING OPERATIONS –Storm Sewer Installation

All site grading must be completed, certified by the project engineer and all off-road grading equipment removed from the site before starting any public utility work.

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. All foreign matter or dirt shall be removed from the inside of the pipe and fittings before they are lowered into position in the trench, and they shall be kept clean by approved means during and after laying. The storm sewer materials shall be carefully lowered into laying position by use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate to support the pipe throughout its length.

No pipe material shall be laid in water or when the trench or bedding conditions are frozen or otherwise unsuitable or improper. Maintain existing drainage during construction in developed areas.

When placement or handling precautions prove inadequate, in the city engineer's or designee's opinion, the contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted by tamping around the pipe to a height of at least 12 inches above its top. The contractor shall mechanically compact trenches in accordance with MnDOT specifications [2106](#).

At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipeline shall be closed by watertight plugs or other means approved by the city engineer or designee. If water is present in the trench, the seals shall remain in-place until the trench is pumped completely dry.

When connecting to existing stubs, the contractor shall take every precaution necessary to prevent dirt or debris from entering the existing lines. All necessary work to make the connection shall be done at no additional compensation, except where noted otherwise.

Granular material shall be placed under all storm sewer pipe or structures that are less than 48 inches below finished grade. The granular material shall extend to at least 48 inches below finished grade and taper up to the subgrade elevation at not steeper than a 10% slope.

Catch basin leads or storm sewers which cross the street in areas where soils are highly frost susceptible, shall be backfilled in accordance with the guidelines as are outlined in the MnDOT Road Design Manual Sections 8-6.01.08 and 8-6.01.09. A drain tile pipe shall be placed in the bottom of the aggregate bedding trench, which shall drain into a catch basin structure. A plate for this construction shall be included in the plans. In lieu of the MnDOT method, the city may consider an alternate design. The alternate design shall be reviewed and approved by the city engineer or designee.

See Standard Detail Plates [ST-9](#) and [ST-10](#) for location and construction of drain tile. Holes in structures for drain tile shall be either preformed or core drilled.

All functional storm sewer inlets shall be fitted with an appropriate sediment-trapping device to prevent sediment from entering storm sewer systems during construction. Storm drain inlet protection shall be in accordance with MnDOT [2573.3M](#).

02304.4 CONNECTION AND ASSEMBLY OF JOINTS –Storm Sewer Installation

All pipe and fitting joints shall fit tightly and be fully closed. Spigot ends shall be marked as necessary to indicate the point of complete closure. All joints shall be soil tight, as the minimum requirement, and shall be watertight in all storm sewer pipelines installed within the limits of a paved street or highway traffic lanes. Where specified, the joints in certain assemblies shall be made structurally integral by being completely encased in concrete to form a rigid watertight unit as indicated in the standard drawings.

All joints shall be sealed as follows, subject to such other approved method as the city engineer or designee may authorize as being an acceptable alternative:

a. Concrete pipe and fitting joints - compression type rubber gasket seals conforming to the requirements of ASTM C-443, ASTM C-361 or AASHTO M-198 for circular pipe, or as otherwise approved by the city engineer or a designee, in the case of non-circular pipe sections.

b. Tie the last six (6) joints of both the inlet and outlet of flared end sections as well as all pipes in and out of a skimmer structure. See Standard Detail Plate [ST-3](#). **If the grade of the pipe being laid meets or exceeds 10% then every pipe joint in that segment needs to be tied.**

02304.5 RECONSTRUCT MANHOLES/CATCH BASINS –Storm Sewer Installation

Remove existing manhole or catch basin to the level directed by the engineer. Salvage and reinstall casting to the appropriate finished elevation. Reconstruct manhole or catch basin according to the plan and details. Provide 4-inch HDPE adjusting rings if structure will have 4 or 5 rings, and a 12-inch HDPE adjusting ring if there will be six (6) or more rings. Provide new materials

for any salvaged materials rejected for reinstallation by the engineer. Backfill and patch roadway with aggregate base and bituminous to match existing section.

02304.6 REPAIR MANHOLE/CATCH BASIN –Storm Sewer Installation

Clean and fill all voids in the existing rings and structure and pipe connections with mortar. Restore inverts and benches with mortar.

02304.7 ADJUST CASTING

Adjust castings within 10 days after initial bituminous course placement. Keep excavation of adjustments to a minimum. Replace excavated areas in kind. Replace or install all adjusting rings and set the top of casting to 1/2-inch below and parallel to the proposed roadway surface. Tapered rings shall be used to adjust the casting to match the street grade. If tapered rings do not provide sufficient adjustment, the contractor may use a mortar bed placed between the structure and the first ring to provide additional adjustment with prior approval of the engineer.

Set casting and each ring on inflow and infiltration barrier. Provide 4 inches P.E. adjusting ring if structure will have four or five rings. Use 4 inches of rings minimum and 12 inches maximum rings when setting castings.

02305 STORM SEWER TESTING REQUIREMENTS

To assure quality materials and workmanship, the following tests shall be required unless waived by the city engineer or designee. The city engineer's designee shall be present for all tests of public utilities and shall be notified at least 48 hours in advance of the specific test by calling (763) 509-5500.

All testing to be completed and passed prior to beginning roadway work. Tests shall be in accordance with CEAM standards or what is required within this specification. Individuals qualified to perform and evaluate such tests shall do all testing. The contractor shall pay for all tests required in these guidelines. Copies of the results shall be submitted to the city engineering division.

02305.1 COMPACTION

Mechanically compact all trenches in accordance with MnDOT specification [2106](#).

02305.2 PIPE CLASS

Pipe strength class shall be stamped on the pipe and test results submitted indicating that this pipe meets strength requirements.

02305.3 TELEVISION OF PIPES

The storm sewer system, excluding drain tile lines shall be televised and the video reports along with a written report to be submitted to the city for review. Video reports can be submitted on CD-ROM, DVD, and thumb drive or via the internet cloud services. **All lines must be flushed and cleaned prior to televising.** The video report will be used to view the condition of the storm sewer pipe prior to acceptance. Workmanship and cleanliness of the installation will be checked. If a line requires cleaning or repairs, that segment shall be re-televised afterwards, and the new report will be submitted to the city for review. This shall be repeated at the contractor's expense, until that segment of the sewer line is clean and or repaired. Video reports shall become the property of the city and contain the following:

2023 STANDARD DETAIL SPECIFICATION FOR STORM SEWER CONSTRUCTION

[Back to Index page](#)

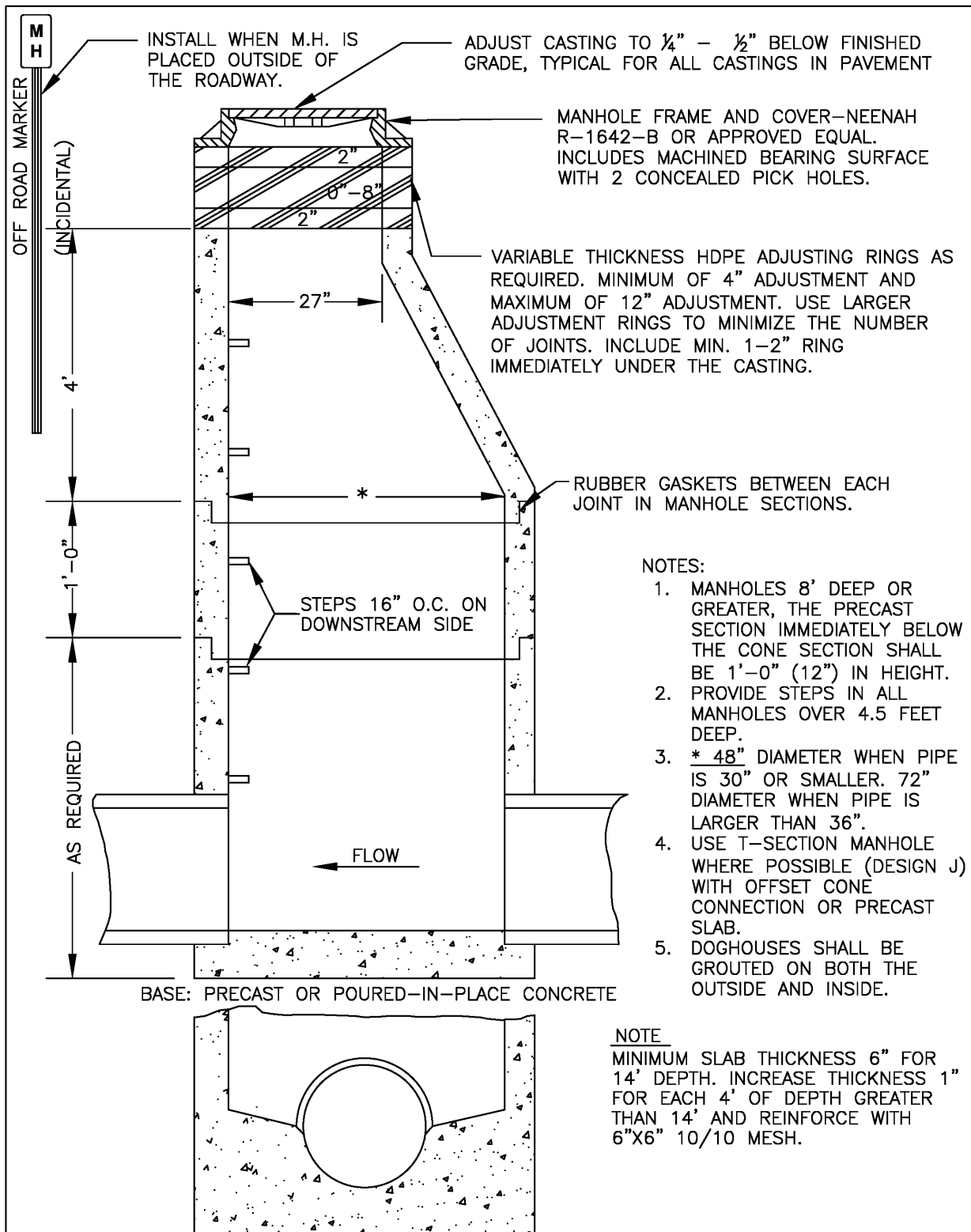
- a. Reference the start and end of each video segment as it begins, by clearly identifying the manhole/catch basin number where the video segment begins and the manhole/catch basin number where the video segment ends.
- b. Footages along the storm sewer line must be shown on the video report and zeroed out at the beginning of each segment starting from the center of the manhole/catch basin.
- c. The video camera shall be guided forward at a moderate to slow pace along the bottom of the pipe.
- d. The camera shall stop at any unusual instances that are viewed while in progress and provide a more detailed and longer view of the specific instance (i.e. – bad joint, dirt in lines, settlement in line, etc.).

02306 MEASUREMENT AND PAYMENT

All items will be measured separately according to design designation as indicated in the pay item name and as may be detailed and defined in the plans, specifications, or special provisions. Pipe will generally be designated by size (inside diameter or span), strength class, kind, or type, and laying condition.

Complete-in-place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate pay items. Linear measurement of piping will include the running length of any special fittings (tees, wyes, elbows, gates, etc.) installed within the line of measure between specified terminal points.

02307 STORM SEWER DETAIL PLATES - ST-1 through ST-22



STANDARD DETAILS
STORM SEWER MANHOLE WITH CONE SECTION
CITY OF PLYMOUTH

PUBLISHED
3-23
CITY PL. NO.
ST-1
REVISED 1-17

The drawing consists of two views of a catch basin. The top view shows a rectangular basin with a Type V grate. Dimensions include a length of 35-1/4", a width of 17-3/4", a grate depth of 6", a curb height of 4", a base width of 31", and a total width of 43". A note indicates the direction of major flow is towards the Type V grate. The side view shows the basin's profile with a depth of 36", a curb height of 24", and a base width of 5". A note specifies a 4'-0" minimum build with casting and rings. A manhole is shown on the side with a 5" diameter. A note indicates that doghouses shall be grouted on both the outside and inside. A note specifies the use of 5" thick 2'x3' precast reinforced concrete. A note indicates that if the structure base is less than 48" below finished grade, granular material should be placed under the structure for a minimum of 48" below finished grade. A note specifies the use of 4 foot diameter catch basin manhole when depth exceeds 4.5 feet. A note indicates that preformed or core drilled holes are required for subdrain connections, grout inside and out around subdrain, and trim drain tile back to wall.

NOTES:

1. EXPANSION MATERIAL TO BE PLACED IN FIRST CURB JOINT, BOTH SIDES OF CATCH BASIN.
2. RECESS CATCH BASINS 1" BELOW GUTTER GRADE LINE.
3. FOR SURMOUNTABLE CURB, PROVIDE FACE OF CURB TRANSITION EXTENDING 10' ON EACH SIDE OF CATCH BASIN TO MATCH CASTING.

VARIABLE THICKNESS HDPE ADJUSTING RINGS AS REQUIRED. MINIMUM OF 4" ADJUSTMENT AND MAXIMUM OF 12" ADJUSTMENT. USE LARGER ADJUSTMENT RINGS TO MINIMIZE THE NUMBER OF JOINTS. INCLUDE MIN. 1-2" RING IMMEDIATELY UNDER THE CASTING. THERE CAN BE NO MORE THAN 3" OF OFFSET IN ANY DIRECTION IN THE ADJUSTING RING PLACEMENT.

APPLY POLYURETHANE SEALANT BETWEEN THE FIRST RING AND THE STRUCTURE AND BETWEEN THE UPPER RING AND THE CASTING. DON'T APPLY SEALANT TO THE MIDDLE JOINTS. WRAP THE OUTSIDE OF THE RINGS WITH A NON-WOVEN GEOTEXTILE FABRIC.

5" THICK 2'x3' PRECAST REINFORCED CONCRETE

IF STRUCTURE BASE IS LESS THAN 48" BELOW FINISHED GRADE, PLACE GRANULAR MATERIAL UNDER STRUCTURE, FOR A MINIMUM OF 48" BELOW FINISHED GRADE.

NOTE:

USE 4 FOOT DIAMETER CATCH BASIN MANHOLE WHEN DEPTH EXCEEDS 4.5 FEET. SEE PLATE NO. ST-1 OR ST-6.

PREFORMED OR CORE DRILLED HOLES REQUIRED FOR SUBDRAIN CONNECTIONS. GROUT INSIDE AND OUT AROUND SUBDRAIN. TRIM DRAIN TILE BACK TO WALL.

DOGHOUSES SHALL BE GROUTED ON BOTH THE OUTSIDE AND INSIDE.



PUBLISHED
3-23

CITY PL. NO.
ST-2
REVISED 1-21

RIP-RAP REQUIRED FOR ALL APRONS: SEE STD. PLATE ST-4

PLACE GRANITE RIP-RAP AROUND SIDES AND OVER THE TOP OF THE F.E.S.

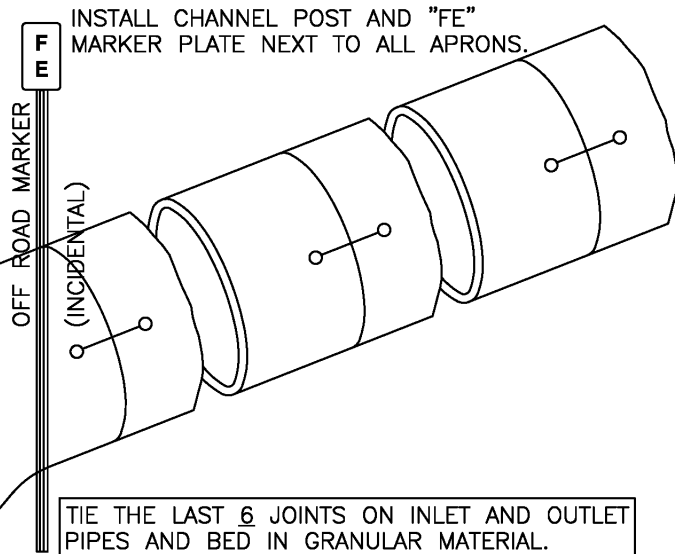
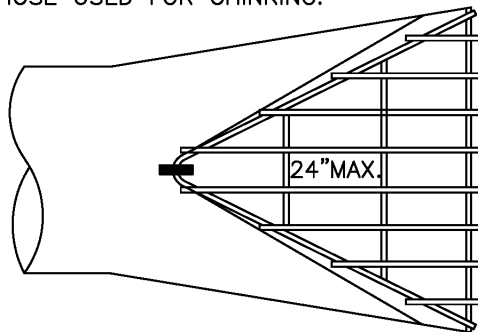
DON'T PLACE RIP-RAP HIGHER THAN THE INVERT OF THE F.E.S.

SEE STD. PL. ST-4 FOR RIPRAP DETAIL

PLACE NONWOVEN GEOTEXTILE FABRIC UNDER RIP-RAP AND EXTENDING 1' UNDER FES

HAND PLACED GRANITE RIPRAP

INDIVIDUAL STONES SHALL NOT WEIGH LESS THAN 50 POUNDS EACH EXCEPT THOSE USED FOR CHINKING.



TIE THE LAST 6 JOINTS ON INLET AND OUTLET PIPES AND BED IN GRANULAR MATERIAL.

USE 2 TIE BOLT FASTENERS PER JOINT INSTALLED AT 60 DEG FROM TOP OR BOTTOM OF PIPE.

USE 5/8" TIE FOR PIPE SIZES 12" TO 27".

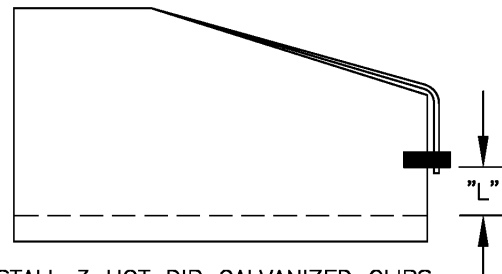
USE 3/4" TIE FOR PIPE SIZES 30" TO 66".

USE 1" TIE FOR PIPE SIZES OVER 72".

NUTS AND WASHERS ARE NOT REQUIRED ON PIPE SIZE LESS THAN 24".

TRASH GUARDS WILL BE REQUIRED ON ALL 24" OR LARGER APRONS UNLESS APPROVED BY THE CITY ENGINEER.

SIZE OF PIPE	BARS	BOLTS	MIN. "L"
21" TO 42"	1"	3/4"	6"
48" TO 72"	1-1/4"	1"	12"



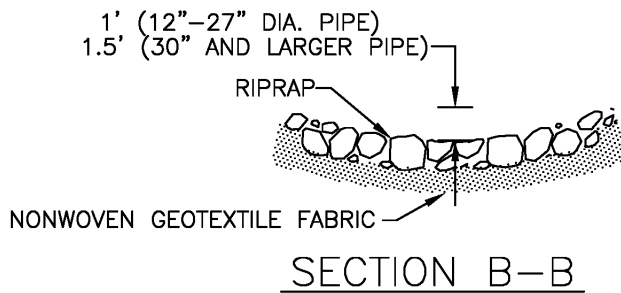
INSTALL 3 HOT DIP GALVANIZED CLIPS TO FASTEN TRASH GUARD TO F.E.S.



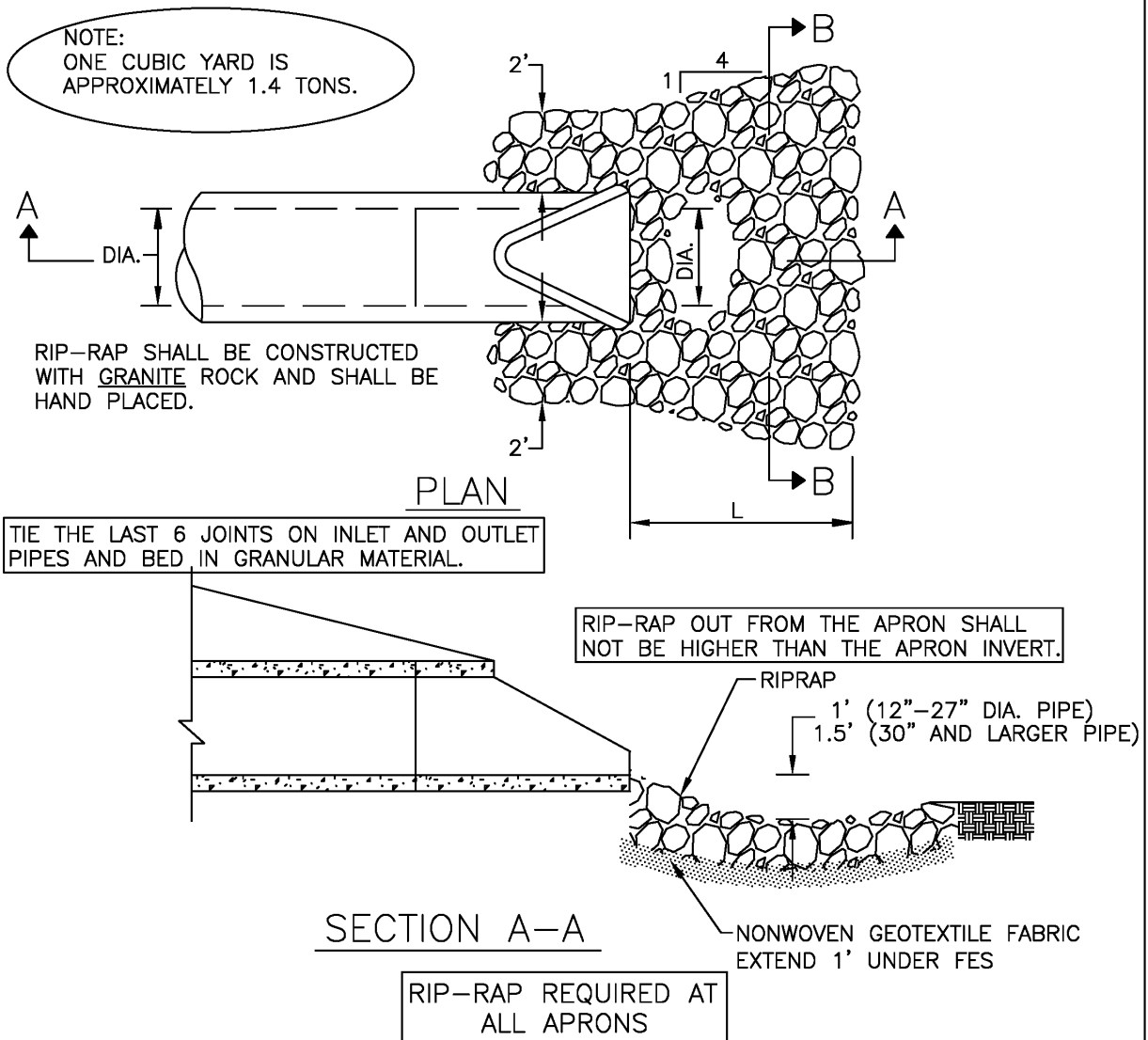
STANDARD DETAILS
INLET & OUTLET F.E.S. WITH TRASH GUARD
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-3
REVISED 1-17



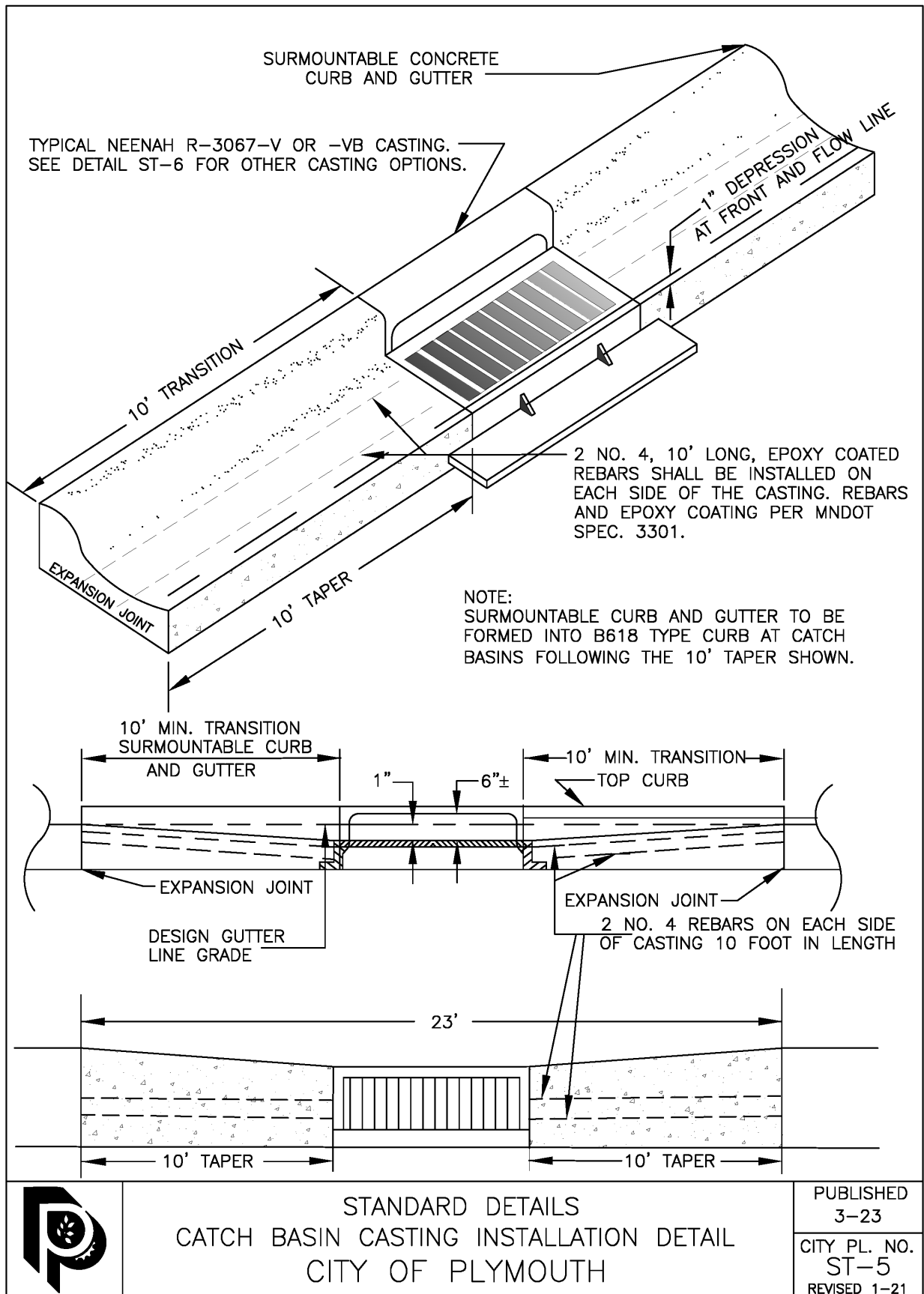
MINIMUM RIPRAP REQUIRED			
DIA. OF PIPE (IN.)	L (FT.)	QUANTITY (C.Y.)	CLASS
12	8	5	III
15	8	5	III
18	10	6	III
24	12	8	III
30	14	12	III
36	16	14	III
42	18	22	IV
48	20	26	IV
>48	22-28	30-40	IV



STANDARD DETAILS
RIPRAP DETAIL FOR FLARED END SECTIONS
CITY OF PLYMOUTH

PUBLISHED
3-23

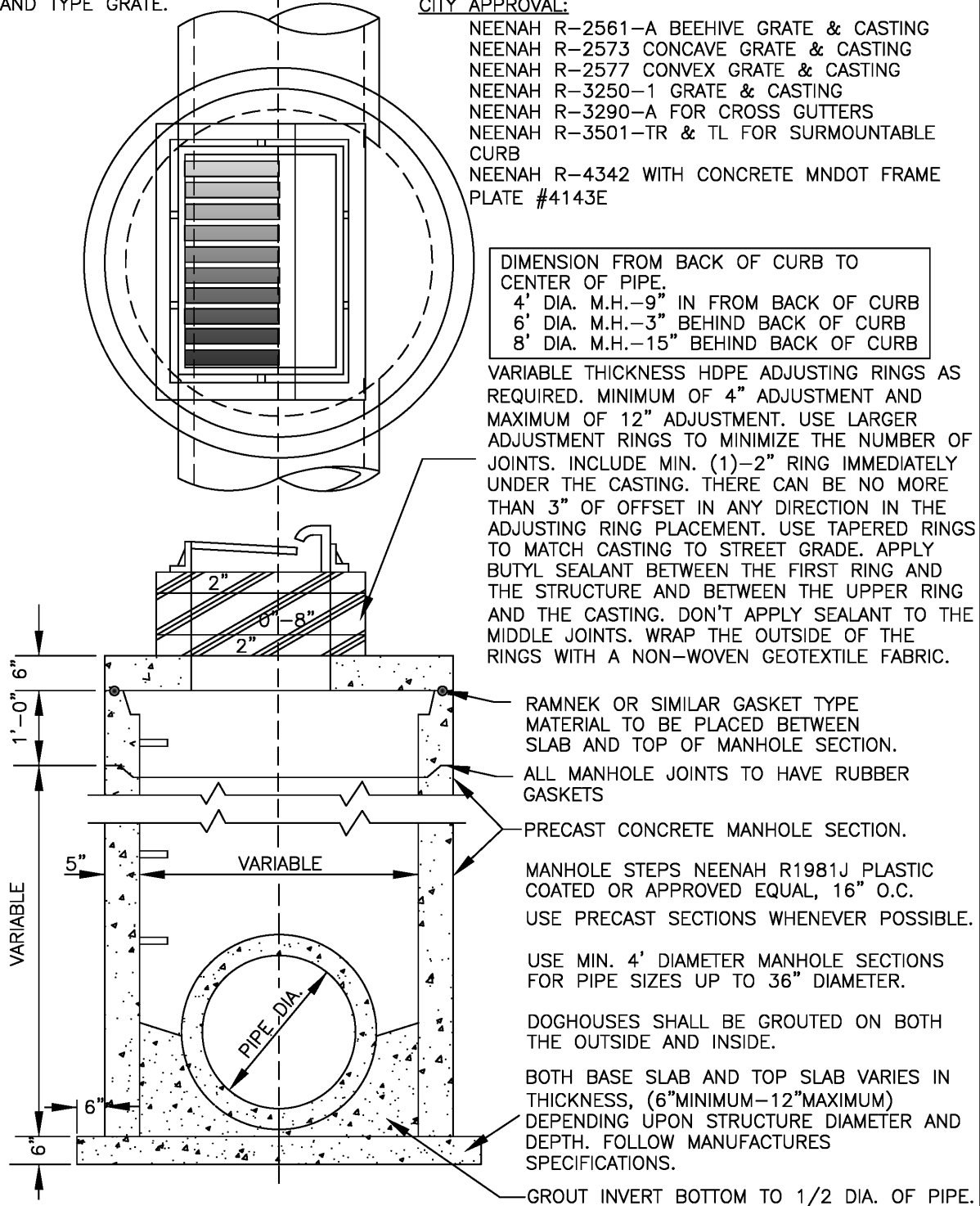
CITY PL. NO.
ST-4
REVISED 1-17



NOTE: 24"X36" SLAB OPENING FOR NEENAH R-3067-V OR -VB CASTING AND TYPE GRATE.

OTHER POTENTIALLY ACCEPTABLE CATCH BASIN CASTINGS DEPENDING UPON CIRCUMSTANCES AND SUBJECT TO CITY APPROVAL:

NEENAH R-2561-A BEEHIVE GRATE & CASTING
 NEENAH R-2573 CONCAVE GRATE & CASTING
 NEENAH R-2577 CONVEX GRATE & CASTING
 NEENAH R-3250-1 GRATE & CASTING
 NEENAH R-3290-A FOR CROSS GUTTERS
 NEENAH R-3501-TR & TL FOR SURMOUNTABLE CURB
 NEENAH R-4342 WITH CONCRETE MNDOT FRAME PLATE #4143E



STANDARD DETAILS
 PRECAST STORM SEWER CATCH BASIN MANHOLE
 WITH REINFORCED CONCRETE TOP SLAB
 CITY OF PLYMOUTH

PUBLISHED
 3-23

CITY PL. NO.
 ST-6
 REVISED 1-21

NOTE: 24"X36" SLAB OPENING FOR NEENAH R-3067-V OR -VB CASTING AND GRATE.

OTHER POTENTIALLY ACCEPTABLE CATCH BASIN CASTINGS DEPENDING UPON CIRCUMSTANCES AND SUBJECT TO CITY APPROVAL:

NEENAH R-2561-A BEEHIVE GRATE & CASTING
NEENAH R-2573 CONCAVE GRATE & CASTING
NEENAH R-2577 CONVEX GRATE & CASTING
NEENAH R-3250-1 GRATE & CASTING
NEENAH R-3290-A FOR CROSS GUTTERS
NEENAH R-3501-TR & TL FOR SURMOUNTABLE CURB
NEENAH R-4342 WITH CONCRETE MNDOT FRAME PLATE #4143E

DIMENSION FROM BACK OF CURB TO CENTER OF PIPE.
4' DIA. M.H.-9" IN FROM BACK OF CURB
6' DIA. M.H.-3" BEHIND BACK OF CURB
8' DIA. M.H.-15" BEHIND BACK OF CURB

VARIABLE THICKNESS HDPE ADJUSTING RINGS AS REQUIRED. MINIMUM OF 4" ADJUSTMENT AND MAXIMUM OF 12" ADJUSTMENT. USE LARGER ADJUSTMENT RINGS TO MINIMIZE THE NUMBER OF JOINTS. INCLUDE MIN. 1-2" RING IMMEDIATELY UNDER THE CASTING. THERE CAN BE NO MORE THAN 3" OF OFFSET IN ANY DIRECTION IN THE ADJUSTING RING PLACEMENT. USE TAPERED RINGS TO MATCH CASTING TO STREET GRADE. APPLY BUTYL SEALANT BETWEEN THE FIRST RING AND THE STRUCTURE AND BETWEEN THE UPPER RING AND THE CASTING. DON'T APPLY SEALANT TO THE MIDDLE JOINTS. WRAP THE OUTSIDE OF THE RINGS WITH A NON-WOVEN GEOTEXTILE FABRIC.

RAMNEK OR SIMILAR GASKET TYPE MATERIAL TO BE PLACED BETWEEN SLAB AND TOP OF MANHOLE SECTION.

ALL MANHOLE JOINTS TO HAVE RUBBER GASKETS.

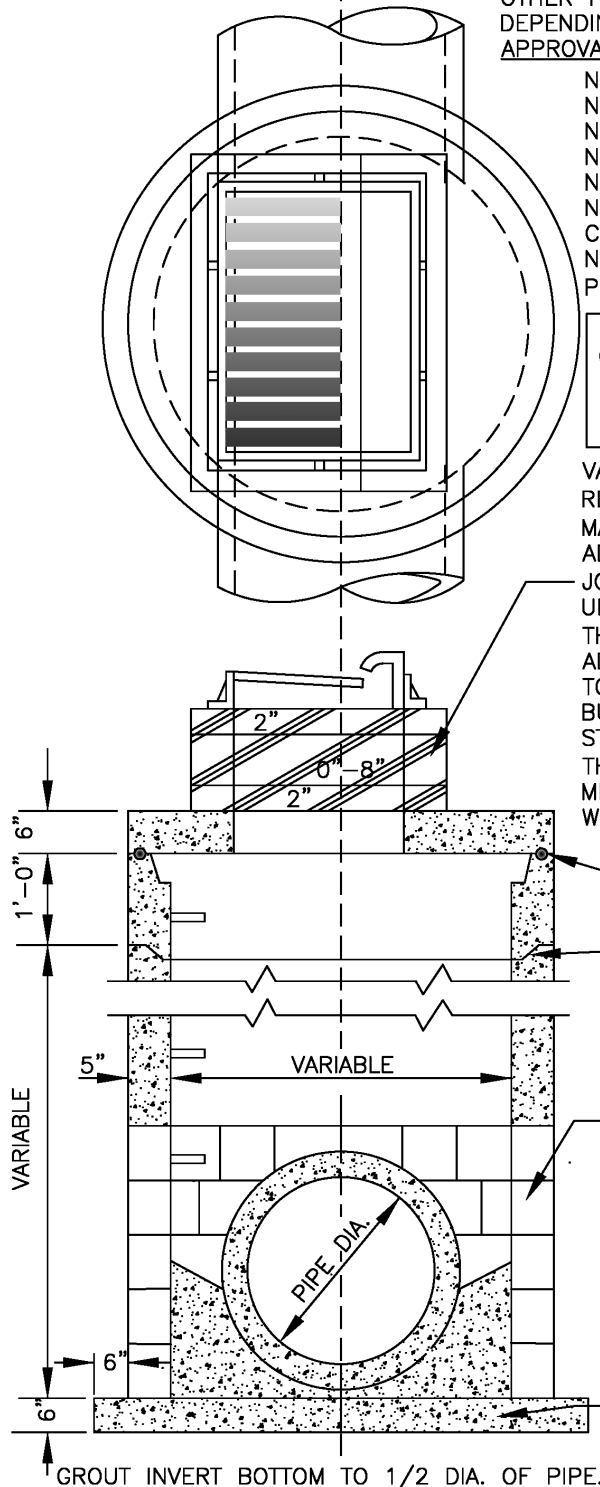
MANHOLE STEPS NEENAH R1981J PLASTIC COATED OR APPROVED EQUAL, 16" O.C.

USE PRECAST SECTIONS WHENEVER POSSIBLE WITH APPROVAL: 8" PRECAST CONCRETE BLOCK TO TOP OF THE PIPE, WITH PRECAST MANHOLE SECTION ABOVE TOP OF PIPE, PLASTER INTERIOR, EXTERIOR AND ALL GAPS IN CONCRETE BLOCK WITH FLEX SEAL OR APPROVED EQUAL.

USE MIN. 4' DIAMETER MANHOLE SECTIONS FOR PIPE SIZES UP TO 36" DIAMETER.

DOGHOUSES SHALL BE GROUTED ON BOTH THE OUTSIDE AND INSIDE.

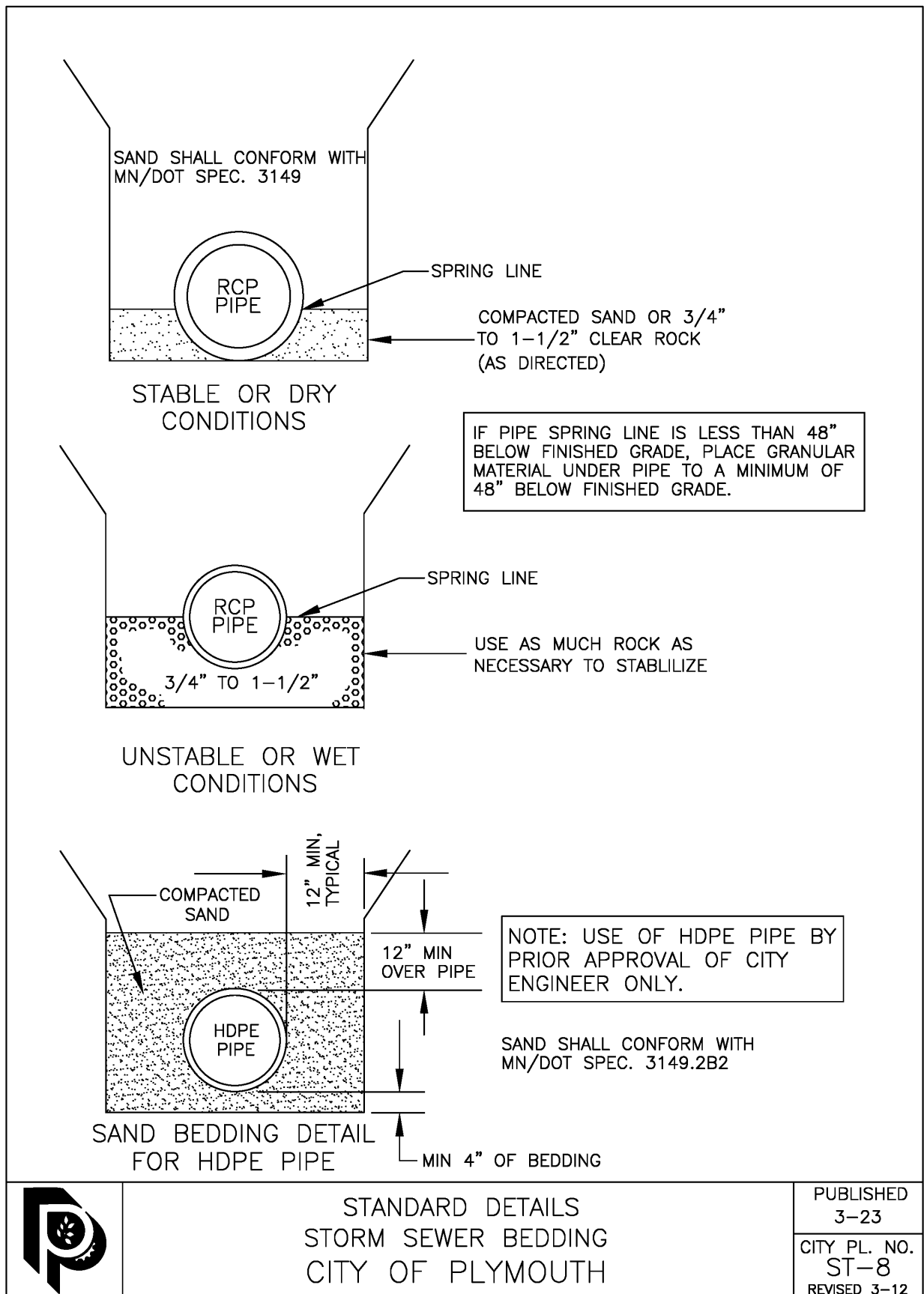
BOTH BASE SLAB AND TOP SLAB VARIES IN THICKNESS, (6" MINIMUM-12" MAXIMUM) DEPENDING UPON STRUCTURE DIAMETER AND DEPTH. FOLLOW MANUFACTURES SPECIFICATIONS.



STANDARD DETAILS
BLOCK STORM SEWER CATCH BASIN MANHOLE
WITH REINFORCED CONCRETE TOP SLAB
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-7
REVISED 1-21



MORTAR JOINT INSIDE AND OUTSIDE STRUCTURE,
WHERE DRAIN PIPE COMES INTO MANHOLE
OR CATCH BASIN.

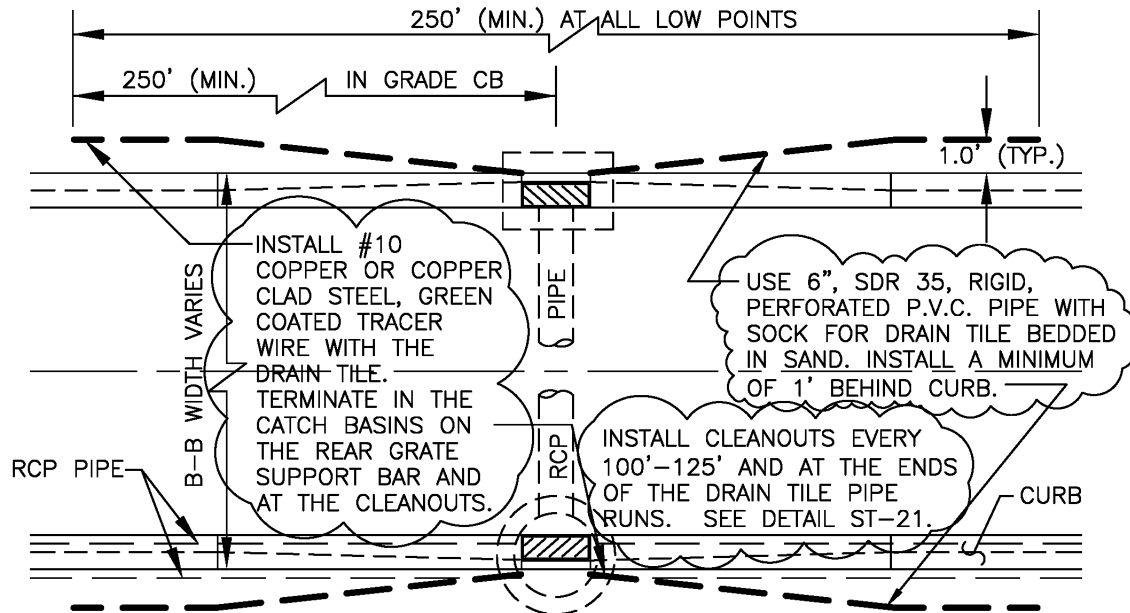
SUBDRAIN

TRIM EXCESS PIPE
CLOSE TO INSIDE WALL
OF STRUCTURE

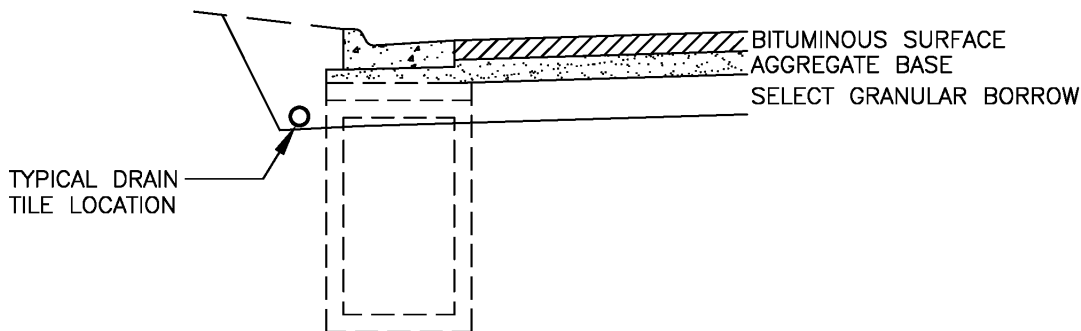
MANHOLE OR CATCH
BASIN WALL

PREFORMED HOLES REQUIRED ON NEW
STRUCTURES FOR SUBDRAIN CONNECTIONS.
CORE DRILL SUBDRAIN HOLES FOR ANY
ADDITIONAL CONNECTIONS TO NEW OR
EXISTING STRUCTURES.

CONNECTION



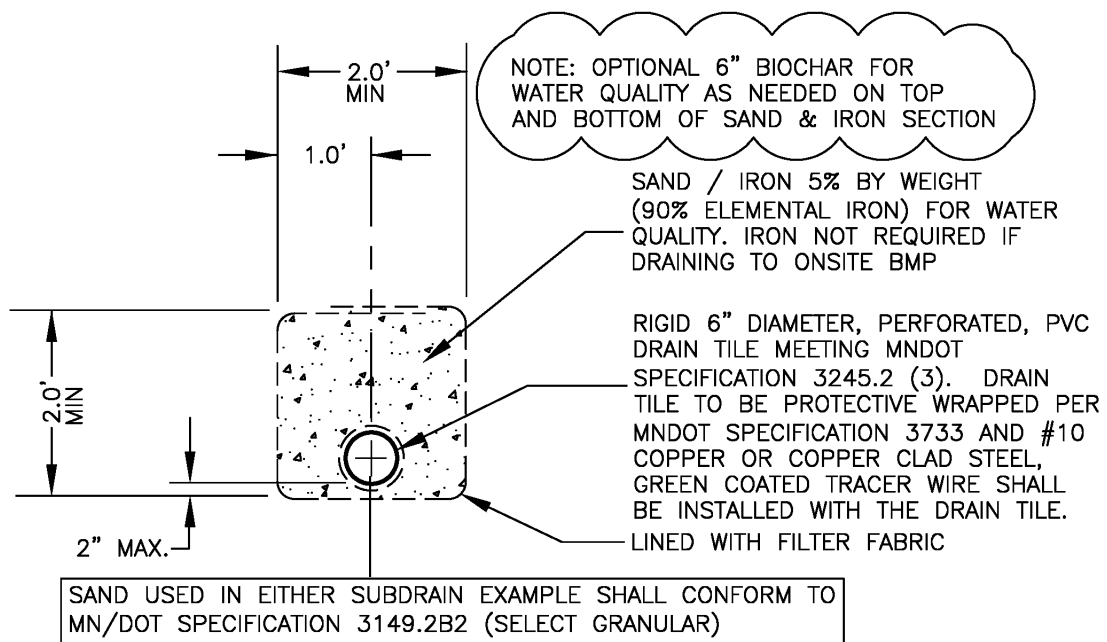
6" RIGID PERFORATED DRAINTILE IS REQUIRED AT ALL LOW POINT CATCH BASINS AND ON THE UPHILL SIDE OF ALL IN-GRADE CATCH BASINS. BENDS MAYBE USED UP TO 22 ½ DEGREES WITH THE RIDGID DRAIN TILE. FLEXIBLE 6" DRAIN TILE CAN BE USED IN CUL-DE-SACS.



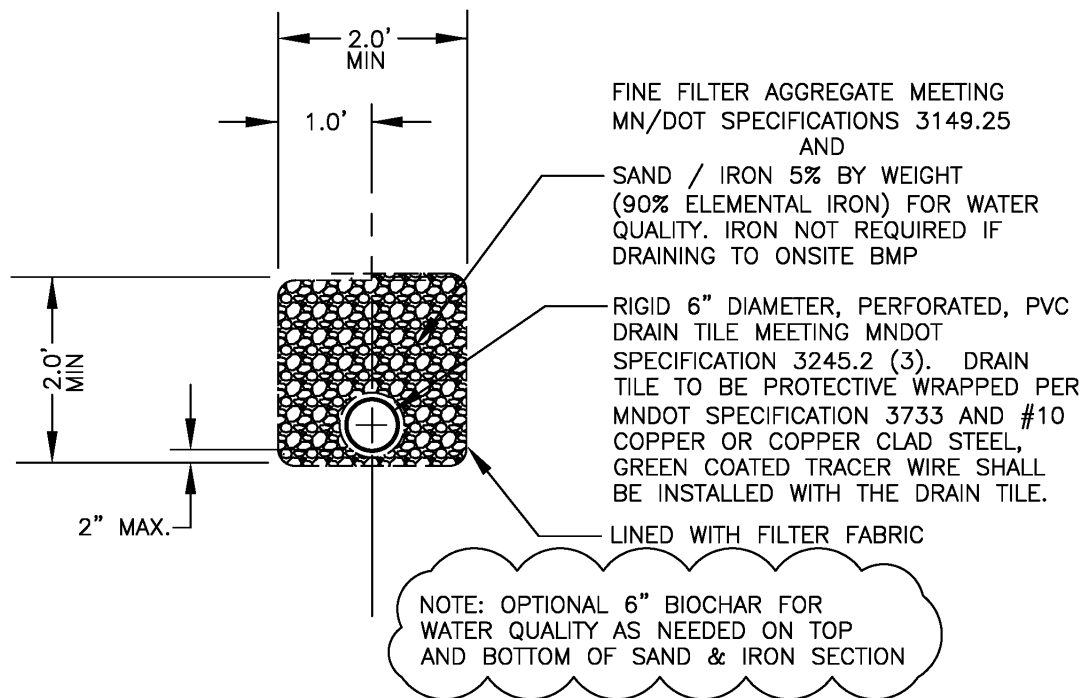
STANDARD DETAILS
SUBDRAIN DETAILS
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-9
REVISED 1-22



ALTERNATIVE SUBDRAIN INSTALLATIONS
FOR USE IN GREEN AREAS
IF APPROVED BY THE CITY ENGINEER



STANDARD DETAILS
 PERFORATED DRAIN TILE PIPE
 CITY OF PLYMOUTH

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 3-23

CITY PL. NO.
 ST-10
 REVISED 1-22

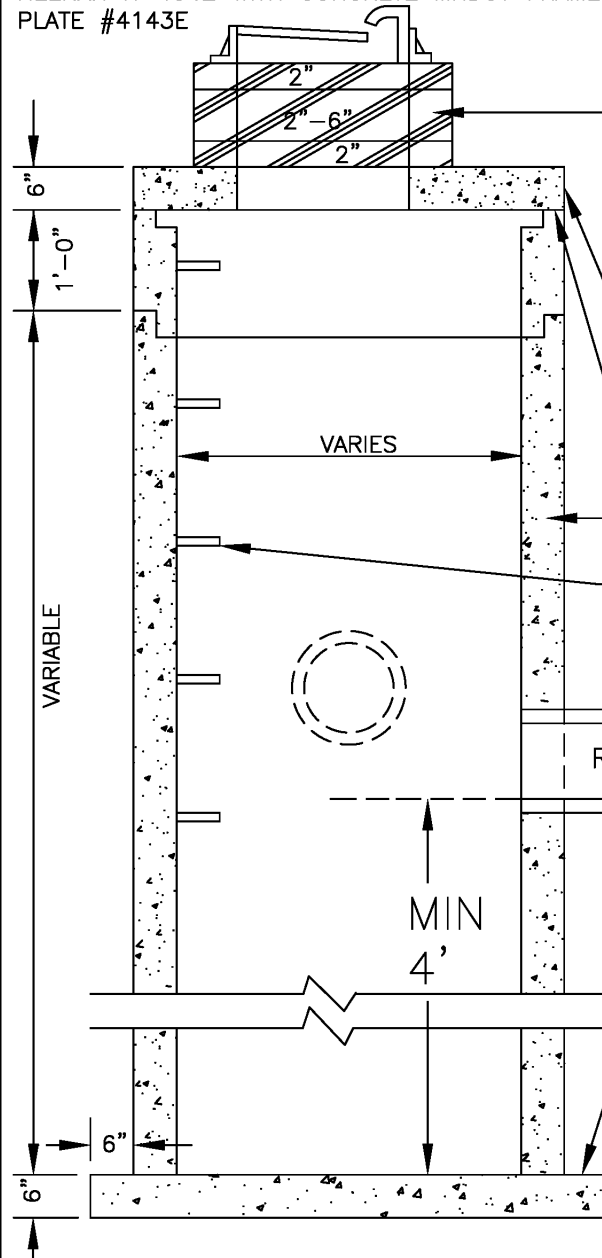
NEENAH R-2561-A BEEHIVE GRATE & CASTING
NEENAH R-2573 CONCAVE GRATE & CASTING
NEENAH R-2577 CONVEX GRATE & CASTING
NEENAH R-3250-1 GRATE & CASTING
NEENAH R-3290-A FOR CROSS GUTTERS
NEENAH R-3501-TR & TL FOR SURMOUNTABLE
CURB
NEENAH R-4342 WITH CONCRETE MNDOT FRAME
PLATE #4143E

—MANHOLE STEPS NEENAH R-1981-J PLASTIC
COATED OR APPROVED EQUAL, 16" ON
CENTER

FLOW

CONSTRUCT SUMP MANHOLE,
INTERNAL SKIMMER AND ENERGY
DISSIPATER PER MANUFACTURERS
SPECIFICATIONS BASED UPON SITE
SPECIFIC DESIGN CONSIDERATIONS.

- BOTH BASE SLAB AND TOP SLAB VARIES IN THICKNESS, (6"MINIMUM-12"MAXIMUM) DEPENDING UPON STRUCTURE DIAMETER AND DEPTH. FOLLOW MANUFACTURES SPECIFICATIONS.



STANDARD DETAILS
SUMP CATCH BASIN MANHOLE
CITY OF PLYMOUTH

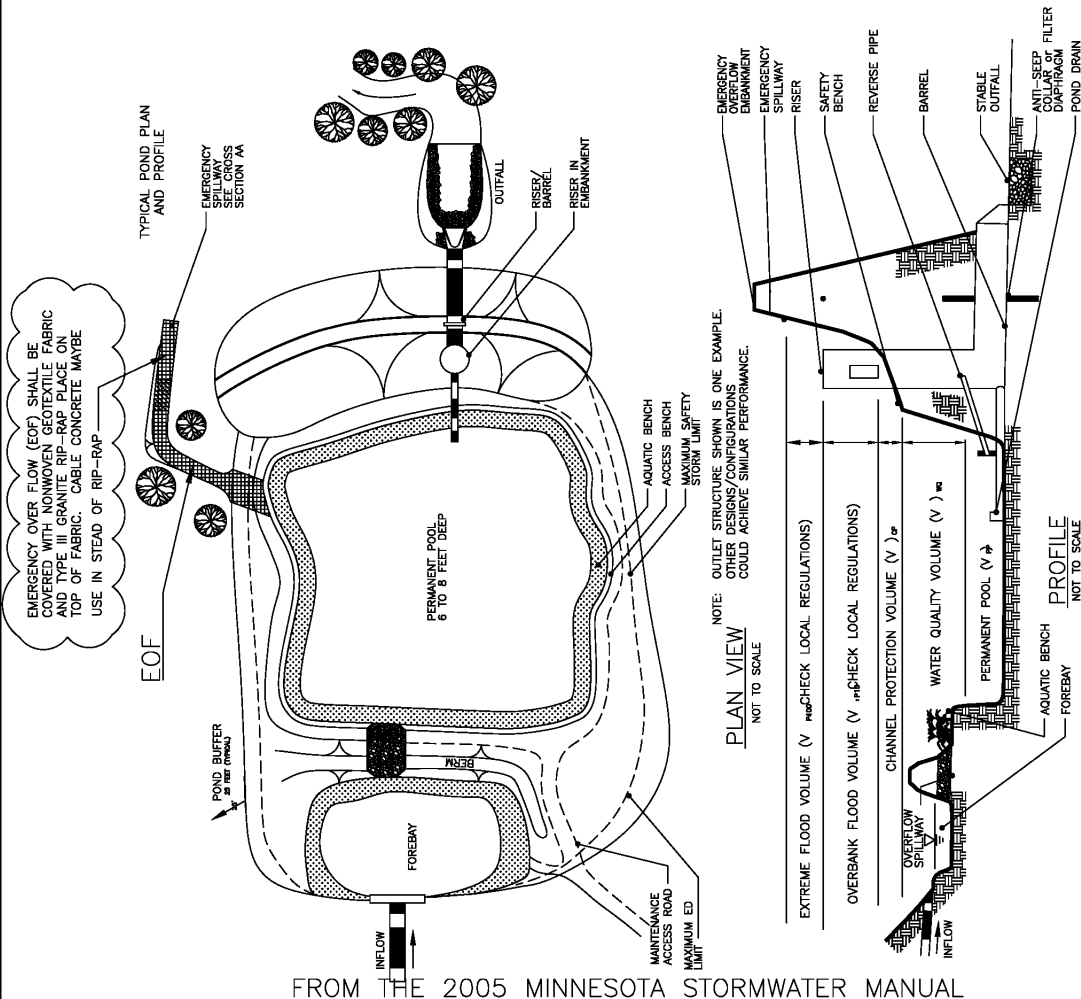
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3-23

CITY PL. NO.
ST-11
REVISED 1-21



STANDARD DETAILS
TYPICAL TREATMENT POND
CITY OF PLYMOUTH

PUBLISHED
3-23
CITY PL. NO.
ST-12
REVISED 1-18



CONSTRUCTION STANDARDS AND SPECIFICATIONS
(ADAPTED FROM STORMWATER MANAGER'S RESOURCE CENTER, WWW.STORMWATERCENTER.NET
SITE PREPARATION
<http://www.stormwatercenter.net2> WITH SOME ADDITIONS)

1. TEMPORARY EROSION CONTROL MEASURES IN ACCORDANCE WITH MNDOT GENERAL CONDITIONS 2573 SHALL BE INSTALLED PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
2. AREAS DESIGNATED FOR BORROW AREAS, EMBANKMENT, AND STRUCTURAL WORKS SHALL BE CLEARED, GRUBBED AND STRIPPED OF TOPSOIL. VEGETATION AND OTHER MATERIAL SHALL BE CLEARED FROM POND AREA.
4. TOPSOIL SHALL BE STOCKPILED FOR FUTURE USE AS SPECIFIED.

EMBANKMENT

1. FILL MATERIAL SHALL BE TAKEN FROM APPROVED BORROW AREAS AND SHALL BE FREE OF ROOTS, STUMPS, WOOD, RUBBISH, STONES GREATER THAN 6", FROZEN MATERIAL, AND OTHER OBJECTIONABLE MATERIALS.
2. FILL MATERIAL FOR CENTER OF EMBANKMENT SHALL CONFORM TO UNIFIED SOIL CLASSIFICATION GC, SC, CH, OR CL AND MUST HAVE AT LEAST 30% PASSING THE #200 SIEVE. CONSIDERATION MAY BE GIVEN TO THE USE OF OTHER MATERIALS IN THE EMBANKMENT IF DESIGNED BY A GEOTECHNICAL ENGINEER.
3. MATERIALS USED IN THE OUTER SHELL OF THE EMBANKMENT MUST HAVE THE CAPABILITY TO SUPPORT VEGETATION OF THE QUALITY REQUIRED TO PREVENT EROSION OF THE EMBANKMENT.
4. BEFORE FILL IS TO BE PLACED, SHALL BE SORTED PRIOR TO PLACEMENT OF FILL MATERIALS SHALL BE PLACED IN MAXIMUM 8 INCH THICK (BEFORE COMPACTION) LAYERS WHICH ARE TO BE CONTINUOUS OVER THE ENTIRE LENGTH OF THE FILL. THE MOST PERMEABLE BORROW MATERIAL SHALL BE PLACED IN THE DOWNSTREAM PORTIONS OF THE EMBANKMENT. THE PRINCIPAL SPILLWAY MUST BE INSTALLED CONCURRENTLY WITH FILL PLACEMENT AND NOT EXCAVATED INTO THE EMBANKMENT.
5. WHEN REQUIRED BY THE REVIEWING AGENCY THE MINIMUM REQUIRED DENSITY SHALL NOT BE LESS THAN 95% OF MAXIMUM DRY DENSITY WITH A MOISTURE CONTENT WITHIN 2% OF THE OPTIMUM. EACH LAYER OF FILL SHALL BE COMPACTED AS NECESSARY TO OBTAIN THAT DENSITY, AND IS TO BE CERTIFIED BY THE ENGINEER AT THE TIME OF CONSTRUCTION. ALL COMPACTION IS TO BE DETERMINED BY AGS10 METHOD T-99 (STANDARD PROCTOR).
6. THE EMBANKMENT SHALL BE PARALLEL TO THE CENTERLINE OF THE EMBANKMENT. THE TOP WIDTH OF THE CORE SHALL BE A MINIMUM OF FOUR FEET. THE HEIGHT SHALL EXTEND UP TO AT LEAST THE 10 YEAR WATER ELEVATION OR AS SHOWN ON THE PLANS. THE SIDE SLOPES SHALL BE 1 TO 1 OR FLATTER. THE CORE SHALL BE COMPACTED WITH CONSTRUCTION EQUIPMENT, ROLLERS, OR HAND TAMPERS TO ASSURE MAXIMUM DENSITY AND MINIMUM PERMEABILITY. IN ADDITION, THE CORE SHALL BE PLACED CONCURRENTLY WITH THE OUTER SHELL OF THE EMBANKMENT.

STRUCTURE BACKFILL

1. BACKFILL ADJACENT TO PIPES OR STRUCTURES SHALL BE OF THE TYPE AND QUALITY SPECIFIED FOR THE STRUCTURE. BACKFILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT TO EXCEED FOUR INCHES IN THICKNESS AND COMPACTED BY HAND TAMPERS OR OTHER MANUALLY DIRECTED COMPACTION EQUIPMENT. THE MATERIAL NEEDS TO FILL COMPLETELY ALL SPACES UNDER AND ADJACENT TO THE PIPE.
2. AT NO TIME DURING THE BACKFILLING OPERATION SHALL DRIVEN EQUIPMENT BE ALLOWED TO OPERATE CLOSER THAN FOUR FEET, MEASURED HORIZONTALLY, TO ANY PART OF A STRUCTURE. UNDER NO CIRCUMSTANCES SHALL EQUIPMENT BE DRIVEN OVER ANY PART OF A CONCRETE STRUCTURE OR PIPE, UNLESS THERE IS A COMPACTED FILL OF 24" OR GREATER OVER THE STRUCTURE OR PIPE.

CARE OF WATER DURING CONSTRUCTION

1. CARE OF WORK AREAS: EXPOSED SURFACES SHALL BE CARRIED OUT IN AREAS FREE FROM WATER. TEMPORARY DRAINAGE STRUCTURES, DRAINAGE CHANNELS, AND STREAM DIVERSIONS NECESSARY TO PROTECT THE AREAS TO BE OCCUPIED BY THE PERMANENT WORKS SHALL BE INSTALLED, AS WELL AS PUMPING AND OTHER EQUIPMENT REQUIRED FOR REMOVAL OF WATER FROM VARIOUS PARTS OF THE WORK.
2. AFTER HAVING SERVED THEIR PURPOSE, ALL TEMPORARY PROTECTIVE WORKS SHALL BE REMOVED OR LEVELED AND GRADED TO THE EXTENT REQUIRED TO PREVENT OBSTRUCTION OF THE FLOW OF WATER TO THE SPILLWAY OR OUTLET WORKS.
3. STREAM DIVERSIONS SHALL BE MAINTAINED UNTIL THE FULL FLOW CAN BE PASSED THROUGH THE PERMANENT WORKS.

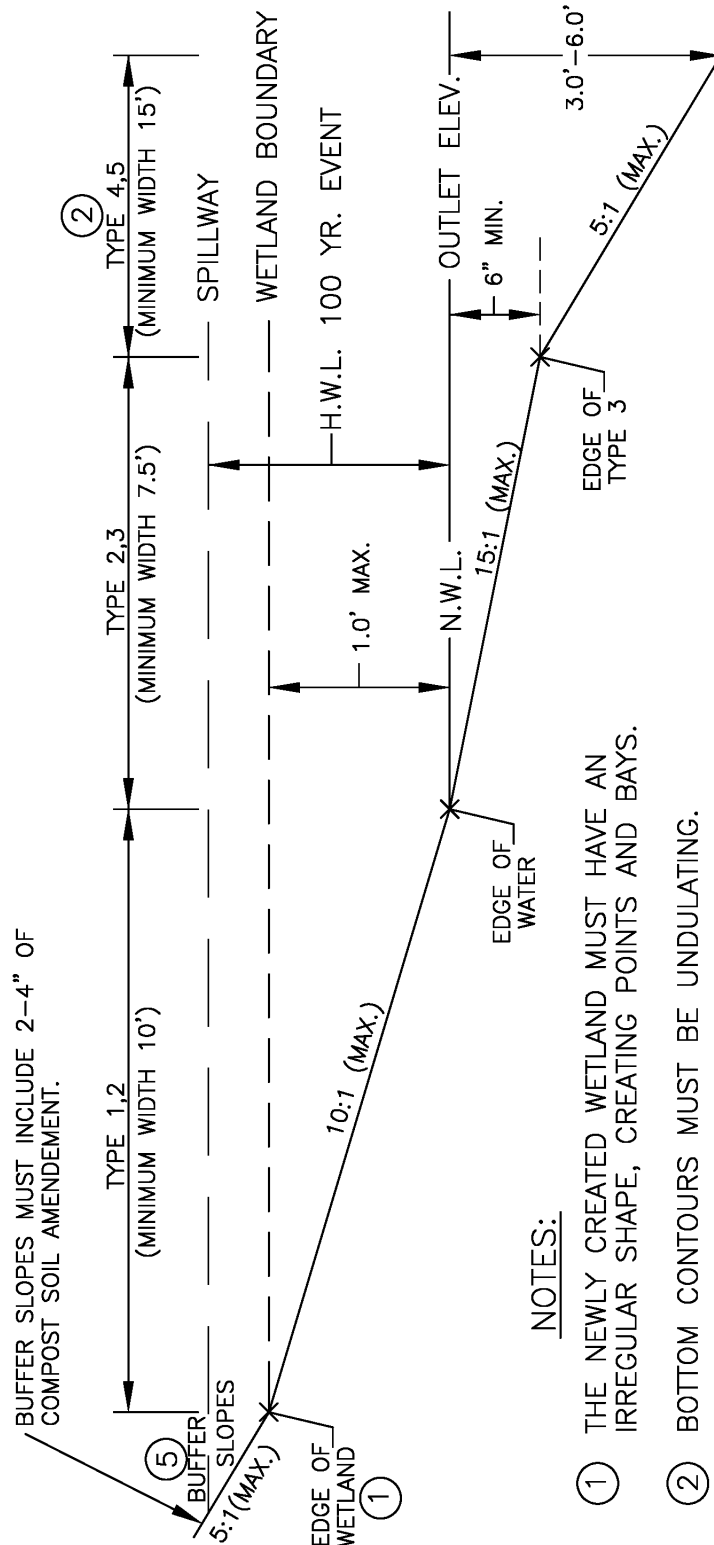
STABILIZATION AND EROSION CONTROL

1. ALL EXPOSED SURFACES OF THE EMBANKMENT, SPILLWAY, SPOIL AND BORROW AREAS AND BERMS SHALL BE STABILIZED BY SEEDING, LIMING, FERTILIZING AND MULCHING IN ACCORDANCE WITH LOCAL NATURAL RESOURCES CONSERVATION SERVICE STANDARDS AND SPECIFICATIONS. A 4-INCH LAYER OF TOPSOIL SHALL BE PLACED ON THESE AREAS TO SUPPORT STABILIZING VEGETATION.
2. FILTER FABRIC PLACED BENEATH THE RIP-RAP SHALL MEET STATE OR LOCAL DEPARTMENT OF TRANSPORTATION REQUIREMENTS FOR A CLASS "C" FILTER FABRIC.



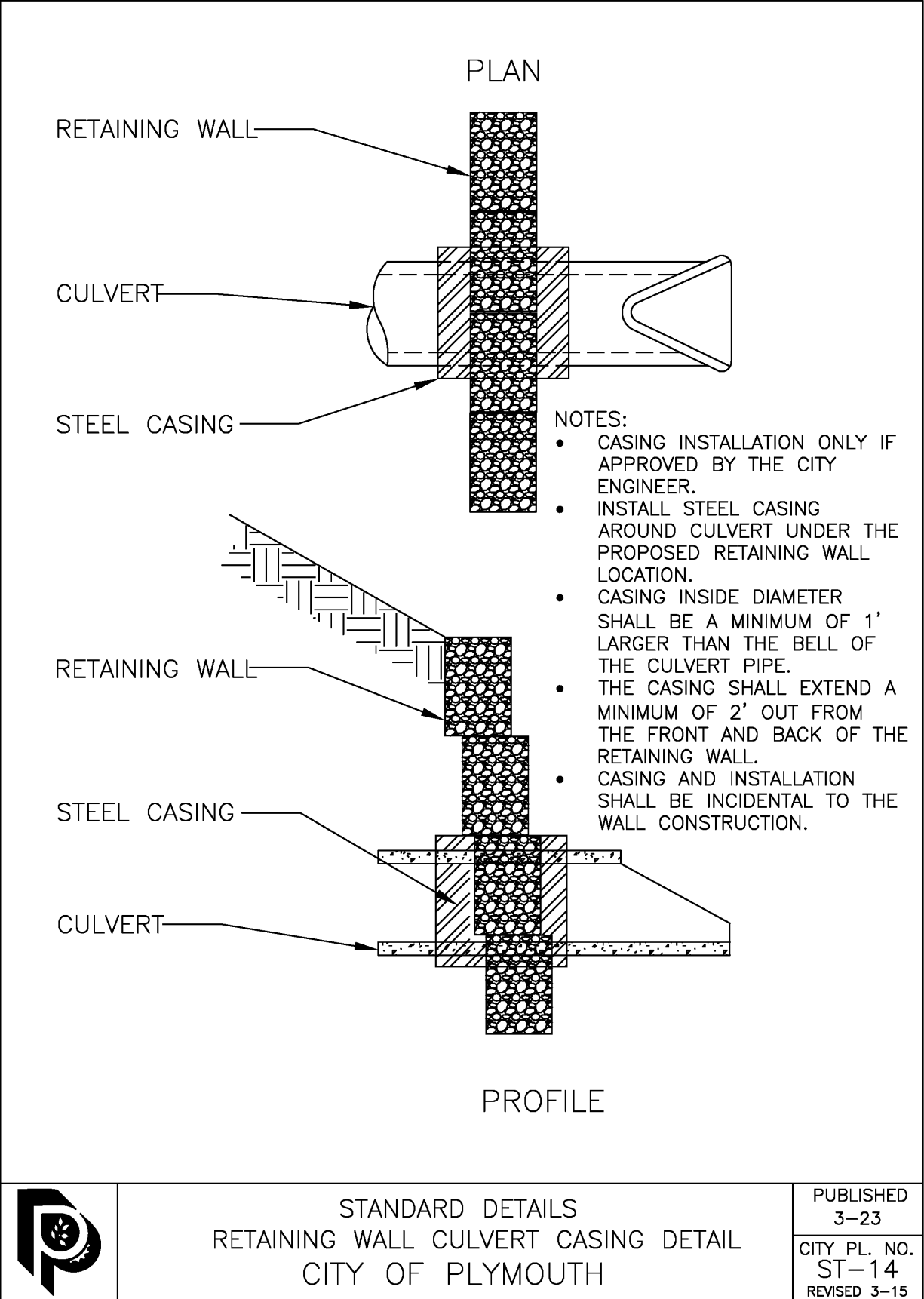
STANDARD DETAILS
WETLAND MITIGATION DETAIL
CITY OF PLYMOUTH

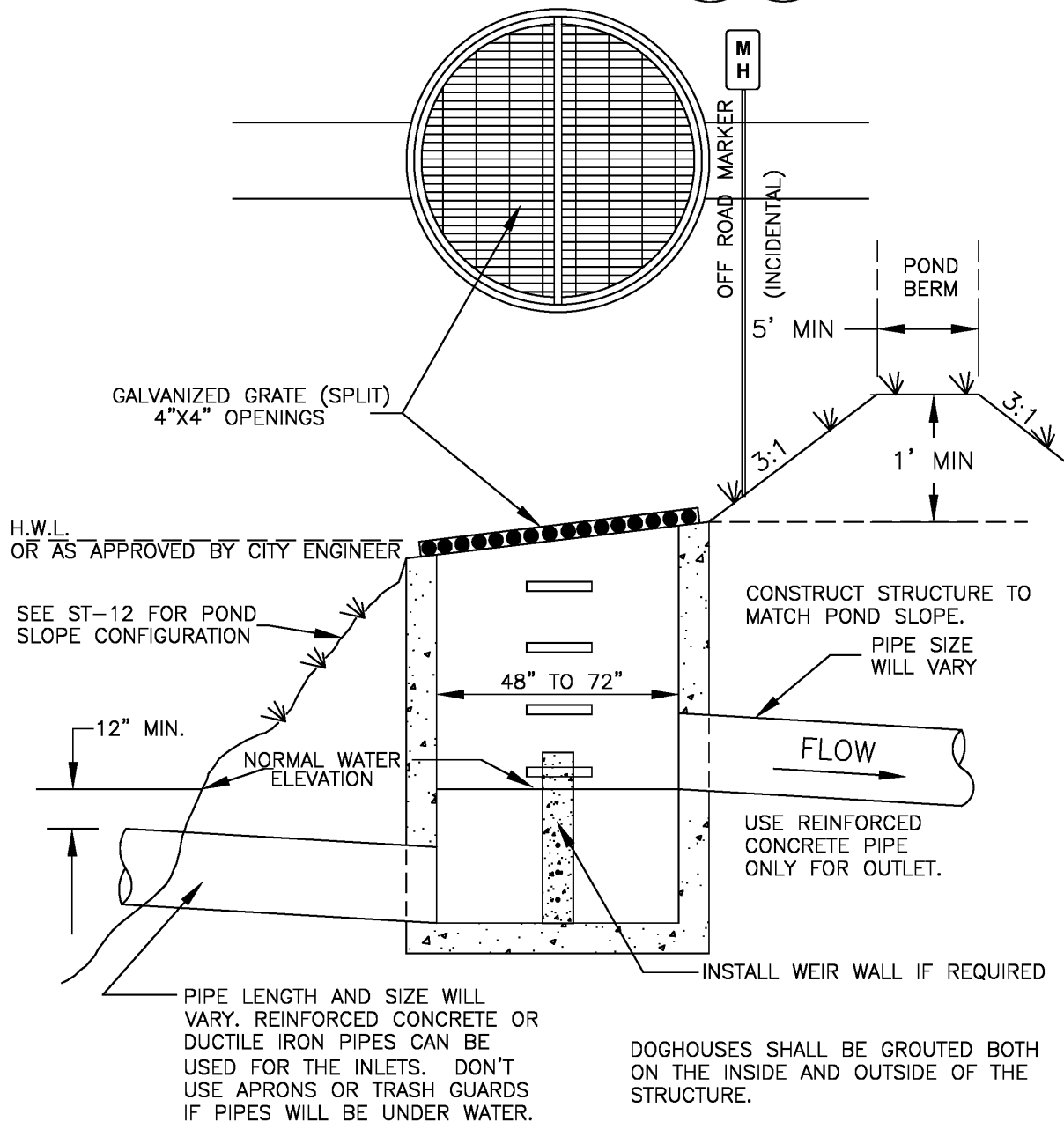
PUBLISHED
3-23
CITY PL. NO.
ST-13
REVISED 3-12



NOTES:

- 1 THE NEWLY CREATED WETLAND MUST HAVE AN IRREGULAR SHAPE, CREATING POINTS AND BAYS.
- 2 BOTTOM CONTOURS MUST BE UNDULATING.
- 3 RE-VEGETATE WITH BWSR MIX #W8.
- 4 WETLAND BUFFER ZONE WITH MAXIMUM 5:1 SLOPE IS REQUIRED.
- 5 2"-4" SOIL AMENDMENT REQUIRED. SOIL AMENDMENT SHALL BE APPLIED TO VOLUME REQUIREMENTS.

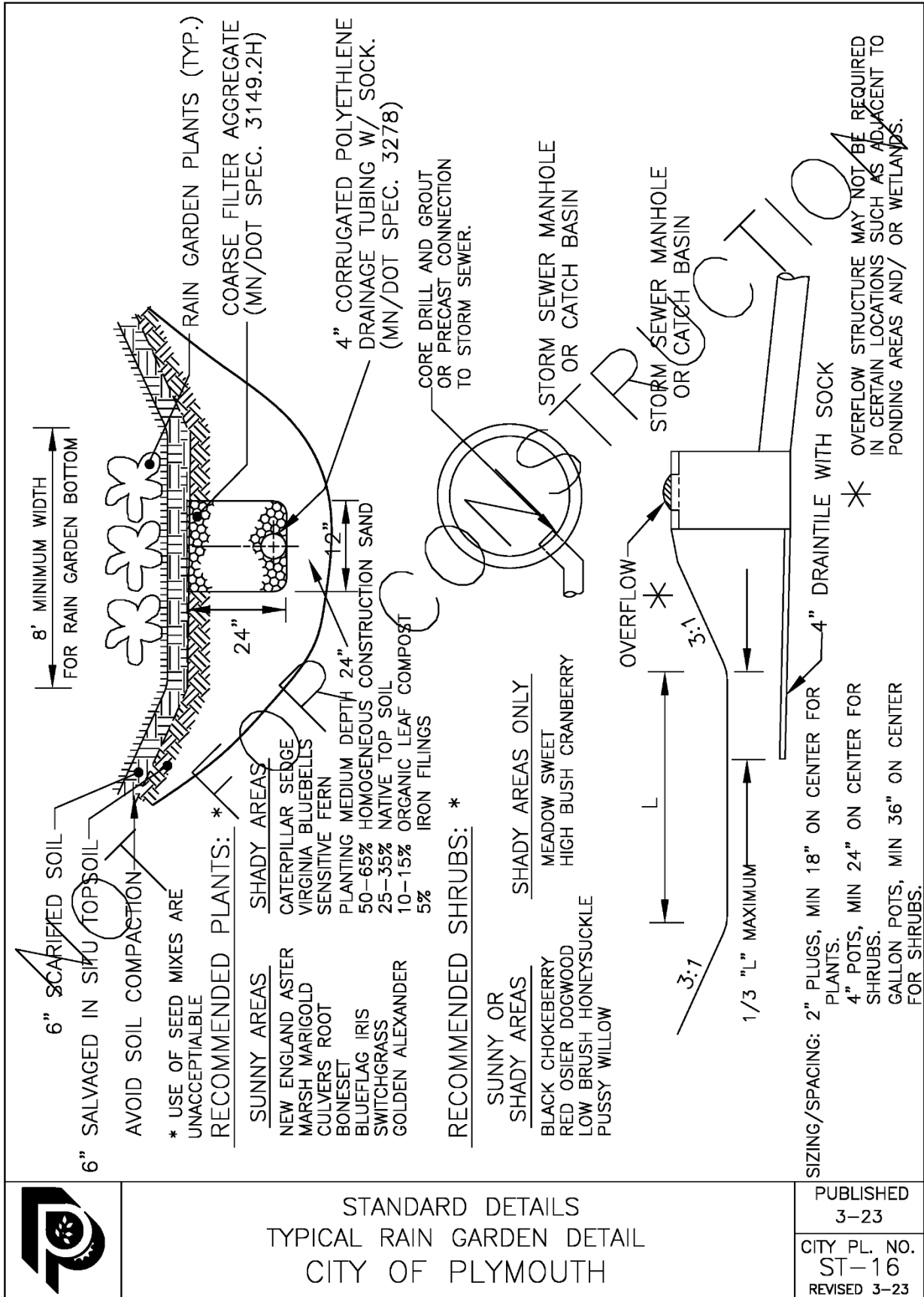


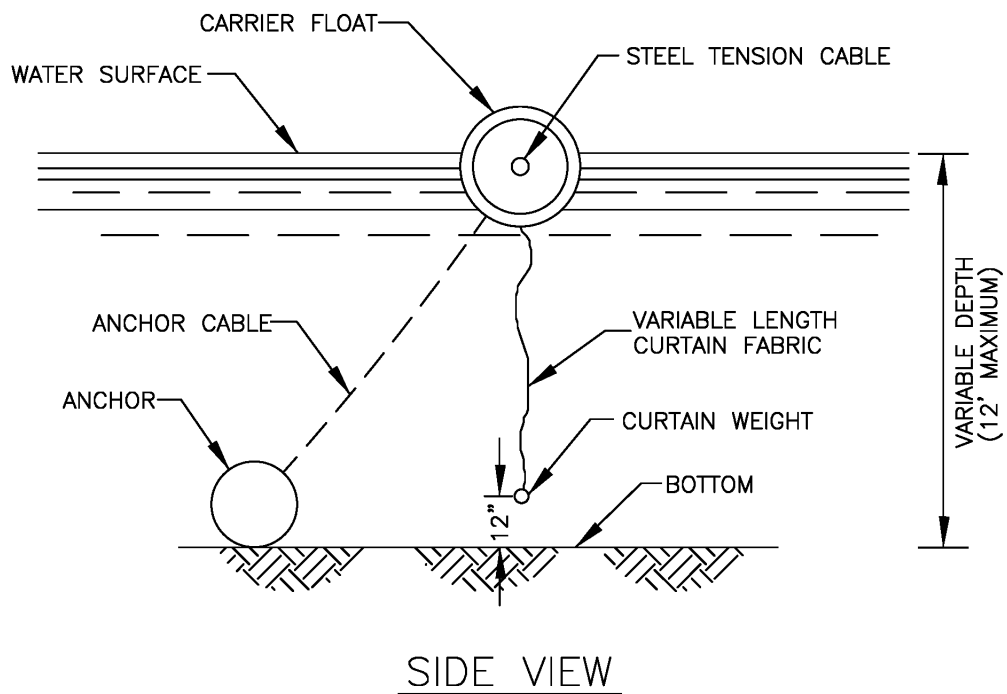
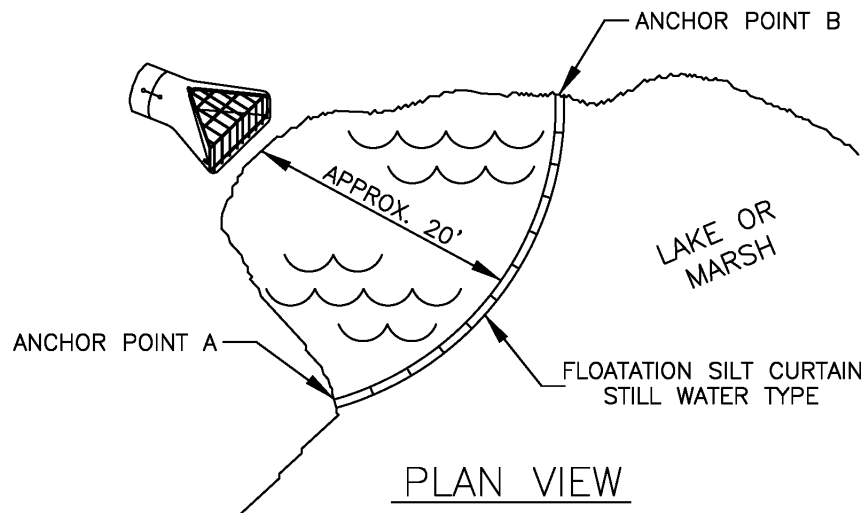


STANDARD DETAILS
SKIMMER STRUCTURE
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-15
REVISED 3-23





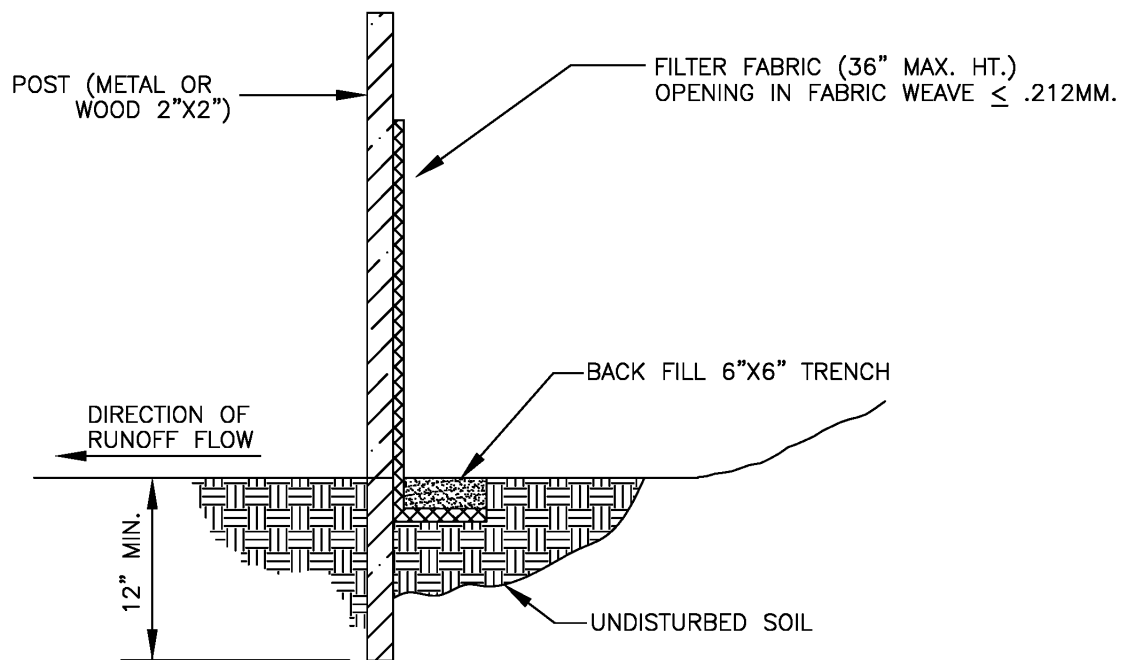
STANDARD DETAILS
FLOATATION SILT CURTAIN DETAIL
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-17
REVISED 3-16

NOTES:

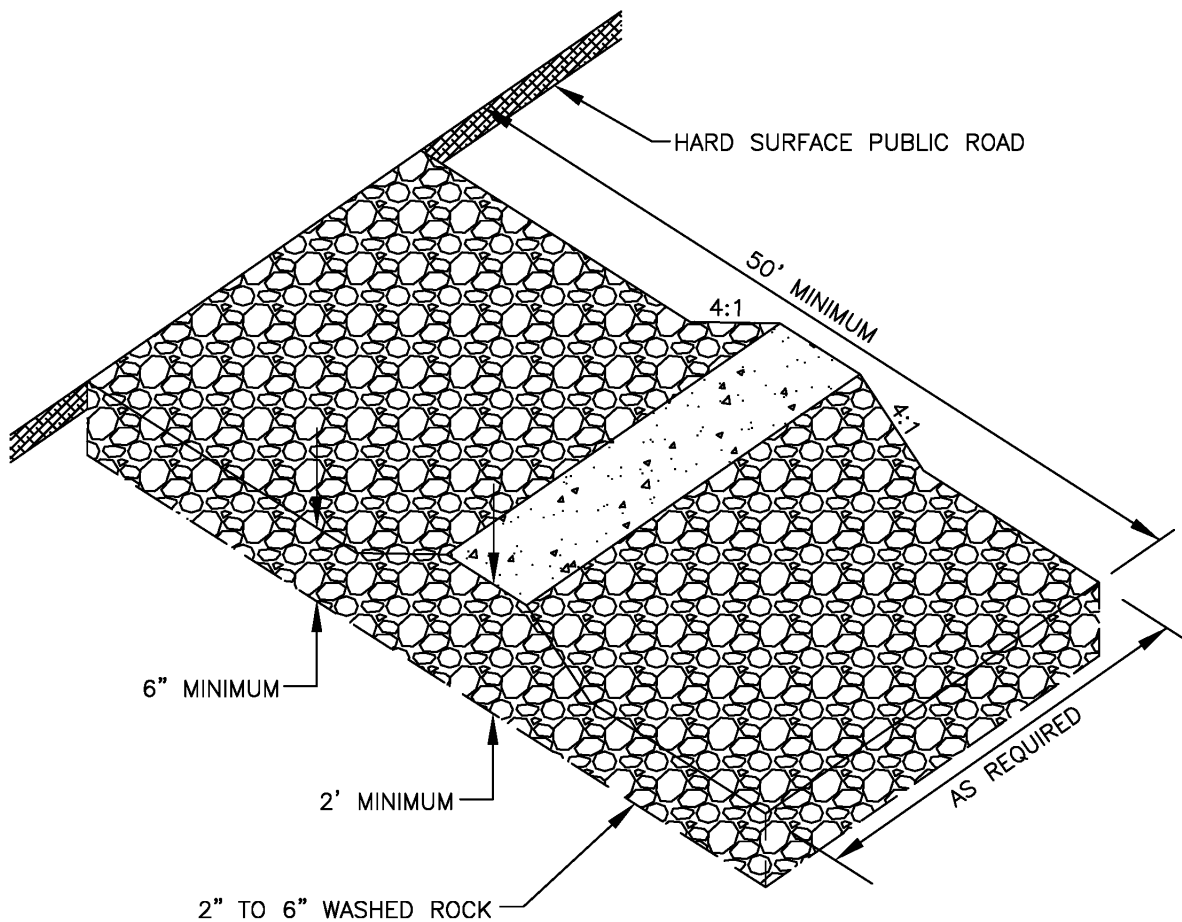
1. DIG A 6"x6" TRENCH ALONG THE INTENDED FENCE LINE.
2. DRIVE ALL POSTS INTO THE GROUND AT THE DOWNHILL SIDE OF THE TRENCH.
3. LAY OUT SILT FENCE ON THE UPHILL SIDE ALONG THE FENCE LINE, AND BACK FILL.
4. WOOD POSTS MAY BE SPACED UP TO 5 FEET APART. STEEL POSTS MAY BE SPACED UP TO 6 FEET APART
5. REMOVE SILT FENCE AFTER TURF IS ESTABLISHED.



STANDARD DETAILS
SILT FENCE DETAIL
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-18
REVISED 1-20



NOTES:

ROCK SHOULD BE 2" TO 6" IN SIZE SUCH AS WASHED ROCK OR CRUSHED CONCRETE

A GEOTEXTILE FABRIC MAY BE USED UNDER THE ROCK TO PREVENT MIGRATION OF THE UNDERLYING SOIL INTO THE STONE.



STANDARD DETAILS
ROCK EXIT TO CONSTRUCTION SITE
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-19
REVISED 1-20



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SPECIFICATIONS:

MONUMENT

CONSISTS OF A POST AND A WETLAND BUFFER OR
STREAM BUFFER SIGN

WETLAND BUFFER & STREAM BUFFER SIGNS

PURCHASED FROM THE CITY OF PLYMOUTH,
COMMUNITY DEVELOPMENT DEPT.

MOUNTED FLUSH WITH THE TOP OF THE POSTS

FASTENED WITH NON-REMOVABLE SCREWS OR RIVETS



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POST MATERIALS

4" X 4" SQUARE

TREATED WOOD OR OTHER CITY APPROVED MATERIAL

POST INSTALLATION

INSTALL POST PLUMB TO A HEIGHT OF FOUR FEET ABOVE
GRADE.

SET AT LEAST 42 INCHES IN THE GROUND

INSTALLED AT EACH LOT LINE WHERE IT CROSSES A
WETLAND BUFFER OR STREAM BUFFER, WITH
A MAXIMUM SPACING OF 100 FEET BETWEEN SIGNS
PER CITY CODE 21670.07

(IF NO BUFFER IS REQUIRED, THE MONUMENT SHALL BE
AT THE EDGE OF THE WETLAND)

PLACE ADDITIONAL POSTS AS NECESSARY
TO FOLLOW BUFFER CONTOUR LINE



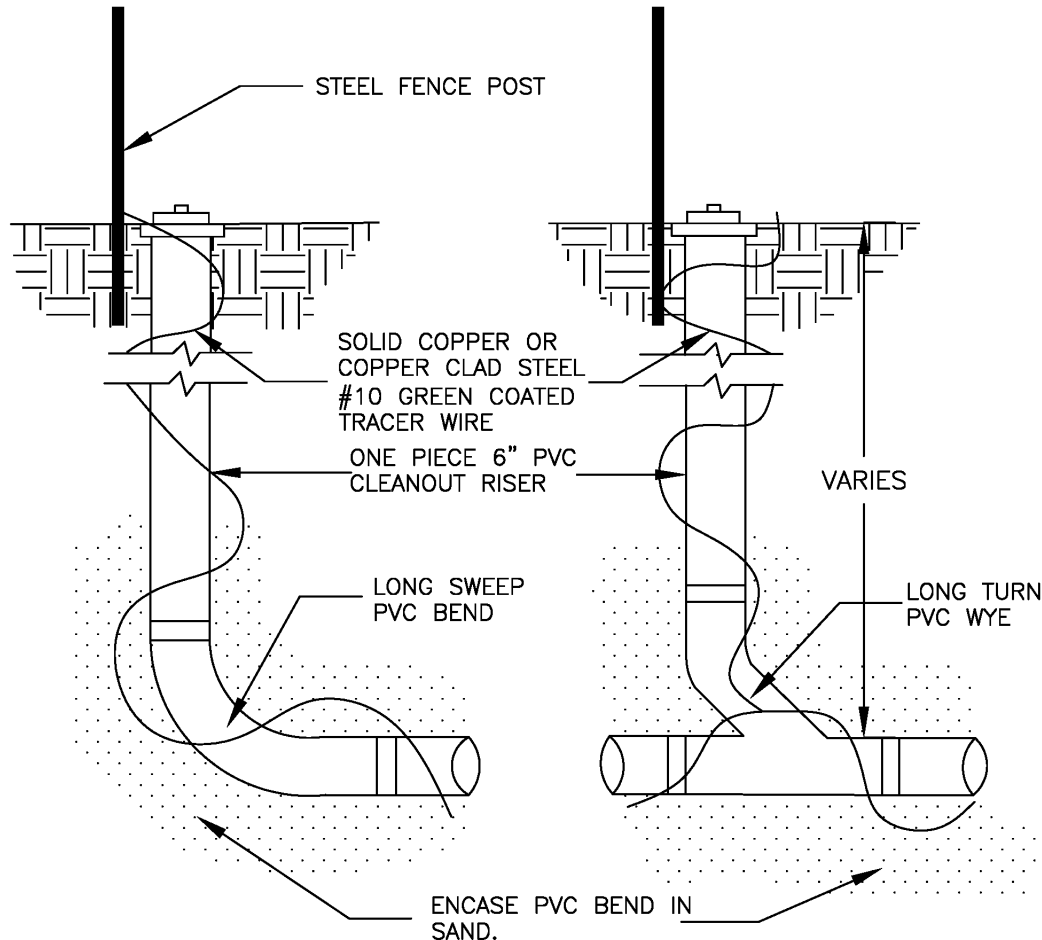
STANDARD DETAILS
WETLAND BUFFER & STREAM BUFFER MONUMENT
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-20
REVISED 1-21

NOTE:

- 6" HUB WITH THREADED PVC CAP, DO NOT GLUE
- COVER WITH FORD METER BOX A-1 CASTING OR APPROVED EQUAL. SET COVER FLUSH WITH FINISHED GRADE AND PLACE TEMPORARY STEEL FENCE POST NEXT TO EACH CLEAN OUT
- TERMINATE #10 GREEN COATED TRACER WIRE UNDER THE METER BOX CASTING AND INSIDE THE CATCH BASINS ON THE REAR GRATE SUPPORT
- INSTALL STEEL FENCE POST BEHIND EACH CLEANOUT
- ENCLOSE LONG SWEEP BEND OR WYE IN AGGREGATE MATERIAL AS SHOWN
- BENDS SHALL NOT BE GREATER THAN $22\frac{1}{2}$ DEGREES
- FLEXIBLE 6" DRAIN TILE MAY BE USED IN CUL-DE-SACS



END OF
LINE
CLEANOUT

IN LINE
CLEANOUT

INSTALL CLEANOUTS EVERY 100' TO 125'. CONNECT STREET DRAINTILE CB TO CB WHERE PRACTICAL.



STANDARD DETAILS
PVC STREET DRAIN TILE CLEANOUTS
CITY OF PLYMOUTH

PUBLISHED
3-23

CITY PL. NO.
ST-21
REVISED 1-22



CITY PL. NO.
ST-22
REVISED 3-23