

# STORMWATER REPORT

for

## SINGLE-FAMILY HOUSE LOTS

## & STREET IMPROVEMENTS

0 Myrick Avenue  
Worcester, MA 01605

### Prepared for:

Kendall Homes Inc.  
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### Date:

December 18, 2023

### Prepared By:



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*Electronically stamped by  
Michael Andrade, P.E: 12/18/23*

**TABLE OF CONTENTS**

- **Narrative**
  - Site Information
- **Appendix A**      USDA-NRCS Site Soils Map
- **Appendix B**      Long-Term Drainage System Operation & Maintenance Plan

## **NARRATIVE**

### **Project Description**

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Site Location: 0 Myrick Avenue, Worcester, MA 01605

Development Type: Single-Family Houses

Project Summary:

The proposed project consists of the conversion of one vacant wooded lot into four subdivided lots each with a new detached single-family residential building.

### **Existing Site Conditions**

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Location: The project site is located at 0 Myrick Avenue in Worcester, MA (addresses not yet assigned).

Ground Cover: The ground cover in the project area is pervious surfaces (lights woods, brush, and grass).

Slopes: The majority of the site slopes in an easterly/southeasterly direction towards wetlands located east of the property.

Soil Types: Site soil types as mapped by the USDA-NRCS are Paxton fine sandy loam (map unit 306C), Whitman fine sandy load (map unit 73A), and Woodbridge fine sandy loam (map unit 312B). These soils are classified as hydrologic soil groups (HSG) "C" and "D". Refer to Appendix B for more detailed USDA-NRCS soil information; no on-site soil testing has been performed.

## **CALCULATIONS & STORMWATER MANAGEMENT**

The project consists of the subdivision of one lot into four lots each with a detached single-family dwelling. There are no discharges to a critical area and although the project results in a net increase in impervious surfaces, per the MassDEP Stormwater Management Policy, compliance with Stormwater Standards is not required. Additionally, hydrology calculations are not required. Note that Stormwater Management Standards do not apply to housing development projects comprised of detached single-family dwellings on four or fewer lots provided there are no stormwater discharges to a critical area.

### **Drain Outfall Riprap Sizing Calculations**

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There is one drain outfall proposed for this project. It is an 8" diameter pipe originating at the water quality unit located at the end of Myrick Avenue.

$$La = 1.8Q/(Do^{1.5}) + 7Do$$

$$W = 3Do + La$$

$$D_{50} = (0.02/TW) \times (Q/Do)^{1.33}$$

**Single-Family House Lots & Street Improvements**  
**0 Myrick Avenue, Worcester, MA 01605**

**Water Quality Unit**

$$La = (1.8 \times 0.51)/(0.667^{1.5}) + 7(0.667) = 6.4 \text{ ft.}$$

$$W = 3(0.667) + 6.4 = 8.4 \text{ ft.}$$

$$D_{50} = (0.02/0.28) \times (0.51/0.667)^{1.33} = 0.05 \text{ ft.}$$

Proposed riprap apron size = 8.5 ft. wide x 6.5 ft. long using 6" diameter riprap

**Recharge to Groundwater (Sizing Calculations)**

Recharge to groundwater will be provided by the proposed subsurface infiltration systems for each dwelling which will capture runoff from the entire roof area. The sizing calculations are as follows:

$$\text{Roof area (half of roof)} = 925 \text{ ft}^2$$

Based on a custom rainfall event, the volume of runoff generated from half the roof area is 0.005 acre-foot (the 2-year rainfall event also generates a volume of 0.005 acre-foot).

$$\text{Volume} = 0.005 \text{ acre-foot} \times (43,560 \text{ ft}^2 / \text{acre}) = 218 \text{ cubic feet}$$

The proposed subsurface infiltration systems each provide a volume of 220 cubic feet (see HydroCAD calculations following this Narrative). Each dwelling will have two systems.

Based upon an exfiltration rate of 0.27 in./hr. (Rawls rate for hydrologic soil group "C" soils), the drawdown time is calculated as follows:

$$\text{Time}_{\text{drawdown}} = R_v / (K \times \text{Bottom Area}) \quad \text{where,} \quad R_v = \text{recharge BMP storage volume}$$
$$K = \text{Saturated Hydraulic Conductivity (Rawls) Rate}$$

Subsurface Infiltration System

$$\text{Time}_{\text{drawdown}} = 220 \text{ ft}^3 / (0.27 \text{ in./hr.}/12" \times 121 \text{ ft}^2) = 80.8 \text{ hours} > 72 \text{ hours}$$

The system proposes 80.8 hours based on the maximum extent practicable.

**Water Quality Calculations (Sizing Calculations)**

Single-family residential driveways are not considered to generate total suspended solids thus no water quality best management practices are required nor proposed. For the street improvements on Myrick Avenue, water quality treatment is proposed by the installation of a proprietary water quality unit. Runoff from the Myrick Avenue extension will flow towards the new unit for treatment, which will then flow into the existing wetland system off Myrick Avenue. The unit is proposed to be a Stormceptor model manufactured by Contech, which can remove pollutants such as suspended sediments from stormwater and snowmelt runoff. The proposed treatment train of a proprietary drainage structure is anticipated to have a TSS removal rate of 80%.

Proprietary Water Quality Unit (has a TSS removal rate of 0.80) (80%)

Starting TSS Load = 1.00 (100%)

$$\text{TSS Removal} = 1.00 \times 0.80 = 0.20 \text{ (remaining load)}$$

Total TSS Removal = 0.80 (80%)

The size of the proprietary water quality unit is based on the water quality flow rate associated with the water quality volume (see water quality unit information sheet following this Narrative). The site does not discharge to any known or mapped Critical areas thus the required Water Quality Volume was calculated using 0.5 inches of runoff times the amount of impervious area (see attached calculations).

Additionally, a Long-Term Pollution Prevention Plan has been prepared for the site (see Appendix B).

# Myrick\_WQU Sizing

NRCC 24-hr D Custom Rainfall=1.45"

Prepared by Graves Engineering, Inc

Printed 12/11/2023

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## Summary for Subcatchment 1: Drainage Area

Runoff = 0.51 cfs @ 12.14 hrs, Volume= 1,748 cf, Depth> 0.50"  
Routed to nonexistent node 1P

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
NRCC 24-hr D Custom Rainfall=1.45"

Area (sf)	CN	Description
8,220	98	Roofs, HSG C
9,523	98	Paved roads w/curbs & sewers, HSG C
4,484	98	Paved parking, HSG C
19,728	74	>75% Grass cover, Good, HSG C
41,955	87	Weighted Average
19,728		47.02% Pervious Area
22,227		52.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	100		0.28		<b>Direct Entry, Tc</b>

## Detailed Stormceptor Sizing Report – Myrick Avenue

Project Information & Location			
<b>Project Name</b>	Myrick Avenue	<b>Project Number</b>	50159
<b>City</b>	Worcester	<b>State/ Province</b>	Massachusetts
<b>Country</b>	United States of America	<b>Date</b>	12/11/2023
Designer Information		EOR Information (optional)	
<b>Name</b>	Ronald Mendez	<b>Name</b>	
<b>Company</b>	Graves Engineering	<b>Company</b>	
<b>Phone #</b>	508-856-0321	<b>Phone #</b>	
<b>Email</b>	rmendez@gravesengineering.com	<b>Email</b>	

### Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

<b>Site Name</b>	Myrick Avenue
<b>Recommended Stormceptor Model</b>	STC 450i
<b>Target TSS Removal (%)</b>	80.0
<b>TSS Removal (%) Provided</b>	84
<b>PSD</b>	Fine Distribution
<b>Rainfall Station</b>	WORCESTER WSO AP

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	% TSS Removal Provided
STC 450i	84
STC 900	90
STC 1200	90
STC 1800	90
STC 2400	92
STC 3600	93
STC 4800	94
STC 6000	95
STC 7200	96
STC 11000	97
STC 13000	97
STC 16000	98

### Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor’s patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur. Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

### Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM’s precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor’s unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

### Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

### Rainfall Station

<b>State/Province</b>	Massachusetts	<b>Total Number of Rainfall Events</b>	7089
<b>Rainfall Station Name</b>	WORCESTER WSO AP	<b>Total Rainfall (in)</b>	2201.4
<b>Station ID #</b>	9923	<b>Average Annual Rainfall (in)</b>	38.0
<b>Coordinates</b>	42°16'2"N, 71°52'34"W	<b>Total Evaporation (in)</b>	107.2
<b>Elevation (ft)</b>	986	<b>Total Infiltration (in)</b>	1021.2
<b>Years of Rainfall Data</b>	58	<b>Total Rainfall that is Runoff (in)</b>	1073.0

### Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (acres)	0.96
Imperviousness %	53.0

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	0.51

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Design Details	
Stormceptor Inlet Invert Elev (ft)	
Stormceptor Outlet Invert Elev (ft)	715.10
Stormceptor Rim Elev (ft)	719.00
Normal Water Level Elevation (ft)	
Pipe Diameter (in)	8
Pipe Material	PVC - plastic
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	Yes

Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.		
Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

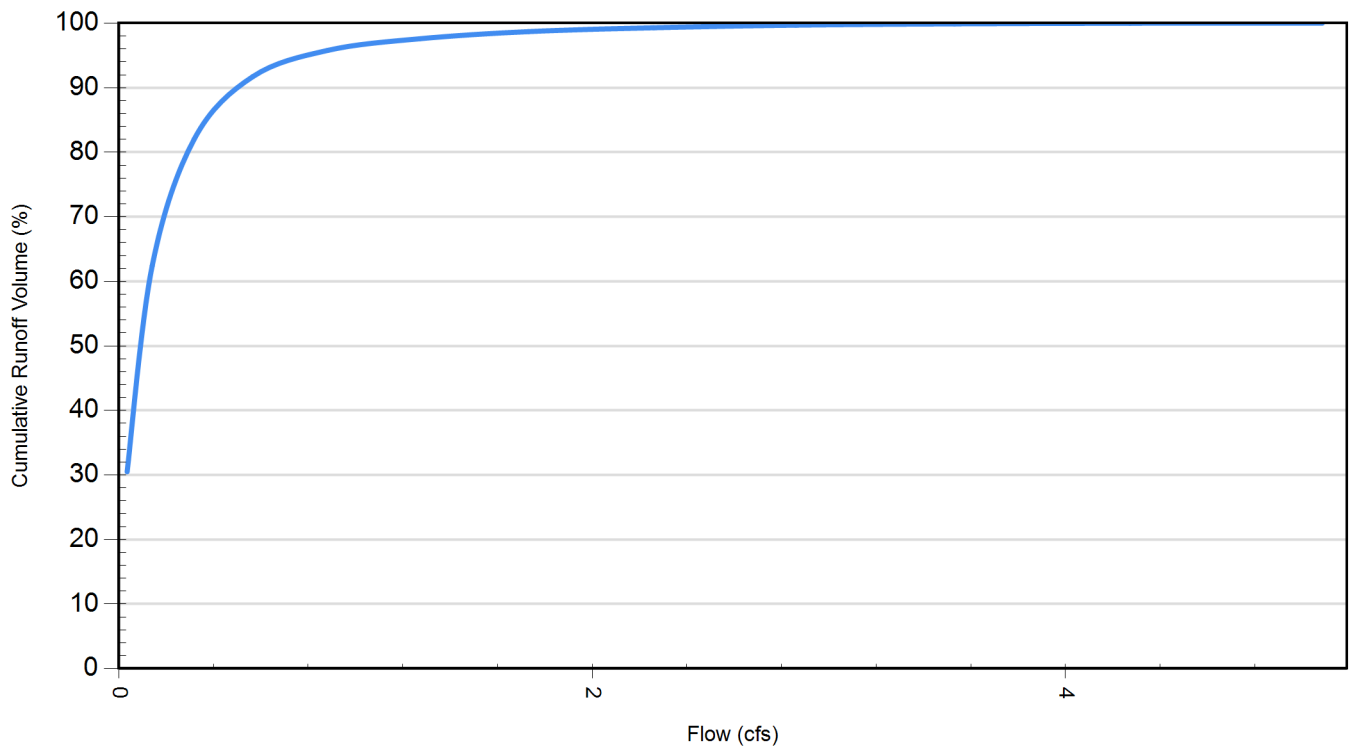


Site Name		Myrick Avenue	
<b>Site Details</b>			
<b>Drainage Area</b>		<b>Infiltration Parameters</b>	
Total Area (acres)	0.96	Horton's equation is used to estimate infiltration	
Imperviousness %	53.0	Max. Infiltration Rate (in/hr)	2.44
<b>Surface Characteristics</b>		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	409.00	Decay Rate (1/sec)	0.00055
Slope %	2	Regeneration Rate (1/sec)	0.01
Impervious Depression Storage (in)	0.02	<b>Evaporation</b>	
Pervious Depression Storage (in)	0.2	Daily Evaporation Rate (in/day)	0.1
Impervious Manning's n	0.015	<b>Dry Weather Flow</b>	
Pervious Manning's n	0.25	Dry Weather Flow (cfs)	0
<b>Maintenance Frequency</b>		<b>Winter Months</b>	
Maintenance Frequency (months) >	12	Winter Infiltration	0
<b>TSS Loading Parameters</b>			
TSS Loading Function			
<b>Buildup/Wash-off Parameters</b>		<b>TSS Availability Parameters</b>	
Target Event Mean Conc. (EMC) mg/L		Availability Constant A	
Exponential Buildup Power		Availability Factor B	
Exponential Washoff Exponent		Availability Exponent C	
		Min. Particle Size Affected by Availability (micron)	

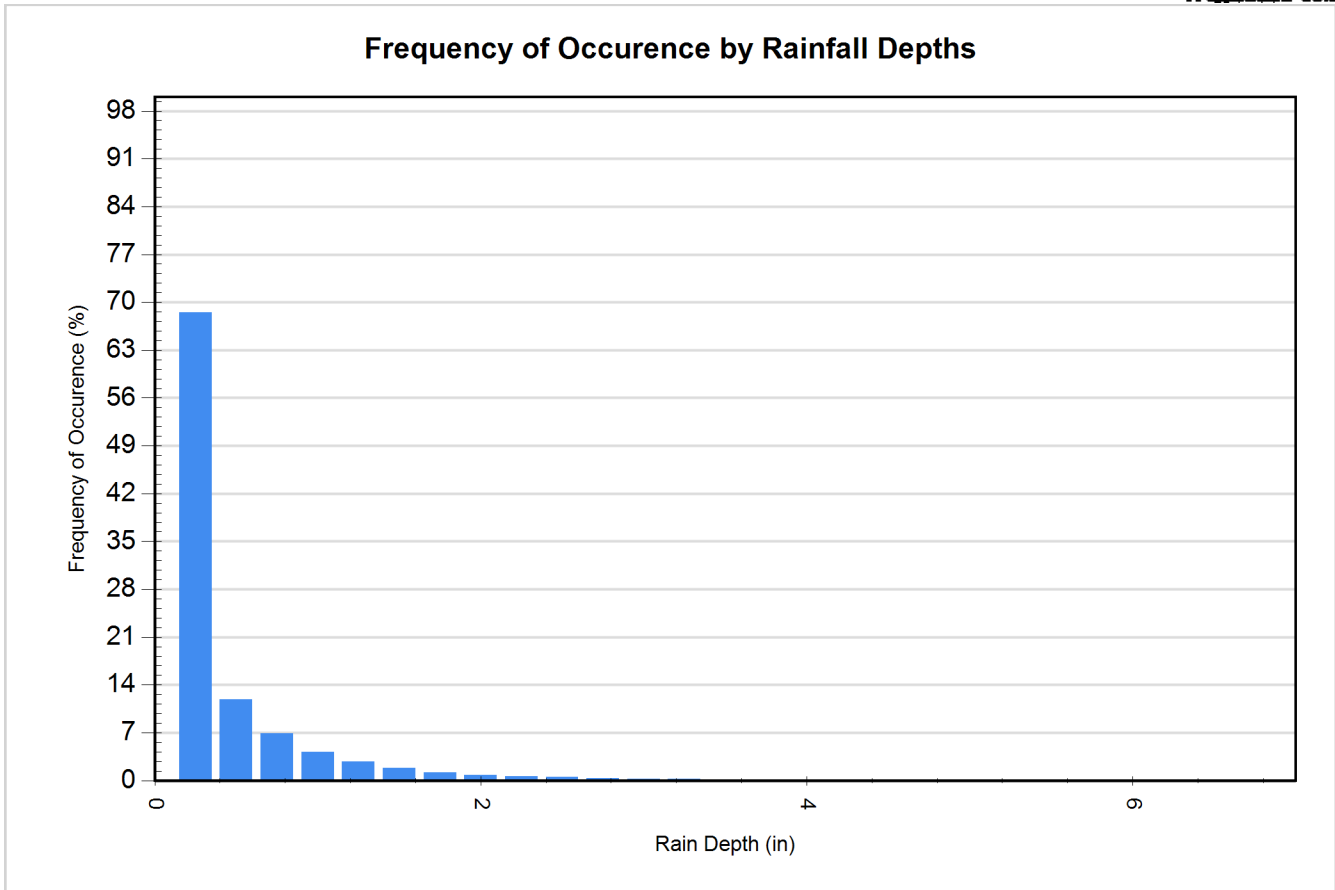
Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	Runoff Volume (ft³)	Volume Over (ft³)	Cumulative Runoff Volume (%)
0.035	1186189	2700870	30.5
0.141	2424596	1462633	62.4
0.318	3186953	699704	82.0
0.565	3561810	324414	91.7
0.883	3721394	164758	95.8
1.271	3793743	92320	97.6
1.730	3834425	51623	98.7
2.260	3859540	26498	99.3
2.860	3873408	12608	99.7
3.531	3880582	5406	99.9
4.273	3884094	1889	100.0
5.085	3885715	266	100.0

### Cumulative Runoff Volume by Runoff Rate

For area: 0.96(ac), imperviousness: 53.0%, rainfall station: WORCESTER WSO AP



Rainfall Event Analysis				
Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	4856	68.5	310	14.1
0.50	841	11.9	306	13.9
0.75	490	6.9	302	13.7
1.00	296	4.2	261	11.8
1.25	199	2.8	224	10.2
1.50	126	1.8	172	7.8
1.75	83	1.2	134	6.1
2.00	54	0.8	100	4.6
2.25	43	0.6	92	4.2
2.50	33	0.5	78	3.6
2.75	22	0.3	58	2.6
3.00	11	0.2	32	1.4
3.25	12	0.2	37	1.7
3.50	5	0.1	17	0.8
3.75	3	0.0	11	0.5
4.00	5	0.1	20	0.9
4.25	2	0.0	8	0.4
4.50	0	0.0	0	0.0
4.75	3	0.0	14	0.6
5.00	3	0.0	15	0.7
5.25	0	0.0	0	0.0
5.50	0	0.0	0	0.0
5.75	0	0.0	0	0.0
6.00	1	0.0	6	0.3
6.25	1	0.0	6	0.3
6.50	0	0.0	0	0.0
6.75	0	0.0	0	0.0



**For Stormceptor Specifications and Drawings Please Visit:**  
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>

# Myrick\_Chamber Sizing

Prepared by Graves Engineering, Inc

HydroCAD® 10.20-3g s/n 00448 © 2023 HydroCAD Software Solutions LLC

NRCC 24-hr D Custom Rainfall=3.09"

Printed 12/18/2023

## Summary for Subcatchment 1: 1/2 Roof Area

Runoff = 0.06 cfs @ 12.13 hrs, Volume= 0.005 af, Depth> 2.85"

Routed to Pond 1P : UG Roof Infiltration

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
NRCC 24-hr D Custom Rainfall=3.09"

Area (sf)	CN	Description
925	98	Roofs, HSG C
925		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	40		0.11		Direct Entry, Tc

Volume = 0.005 acre-foot

1 acre = 43,560 square feet

$0.005 \times 43,560 = 217.8$  cubic feet (minimum)

## Myrick\_Chamber Sizing

Prepared by Graves Engineering, Inc

HydroCAD® 10.20-3g s/n 00448 © 2023 HydroCAD Software Solutions LLC

NRCC 24-hr D Custom Rainfall=3.09"

Printed 12/18/2023

### Pond 1P: UG Roof Infiltration - Chamber Wizard Field A

**Chamber Model = ADS\_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)**

Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf

Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

1 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 8.74' Row Length +12.0" End Stone x 2 = 10.74' Base Length

2 Rows x 51.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 11.00' Base Width

6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

2 Chambers x 45.9 cf = 91.9 cf Chamber Storage

413.4 cf Field - 91.9 cf Chambers = 321.5 cf Stone x 40.0% Voids = 128.6 cf Stone Storage

Chamber Storage + Stone Storage = 220.5 cf = 0.005 af

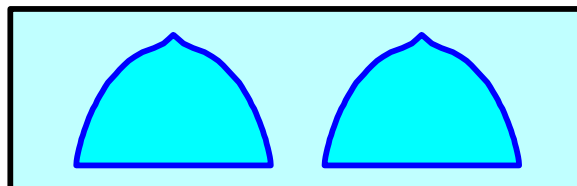
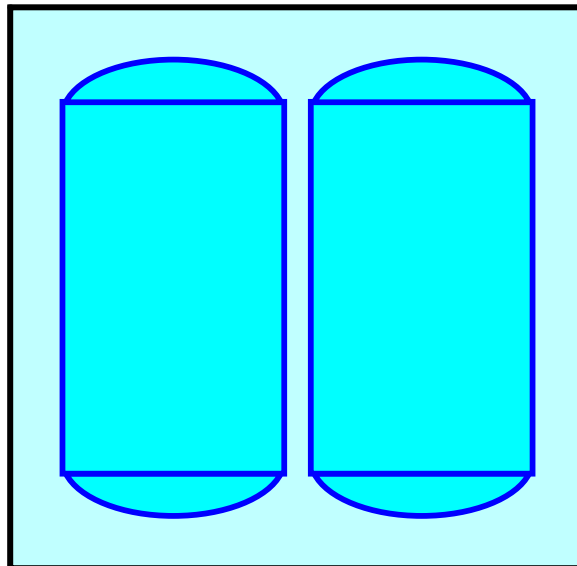
Overall Storage Efficiency = 53.3%

Overall System Size = 10.74' x 11.00' x 3.50'

2 Chambers

15.3 cy Field

11.9 cy Stone



# Myrick\_Chamber Sizing

NRCC 24-hr D Custom Rainfall=3.09"

Prepared by Graves Engineering, Inc

Printed 12/15/2023

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## Summary for Pond 1P: UG Roof Infiltration

Inflow Area = 0.021 ac, 100.00% Impervious, Inflow Depth > 2.85" for Custom event  
Inflow = 0.06 cfs @ 12.13 hrs, Volume= 0.005 af  
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs  
Peak Elev= 3.49' @ 24.00 hrs Surf.Area= 118 sf Storage= 220 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)  
Center-of-Mass det. time= (not calculated: no outflow)

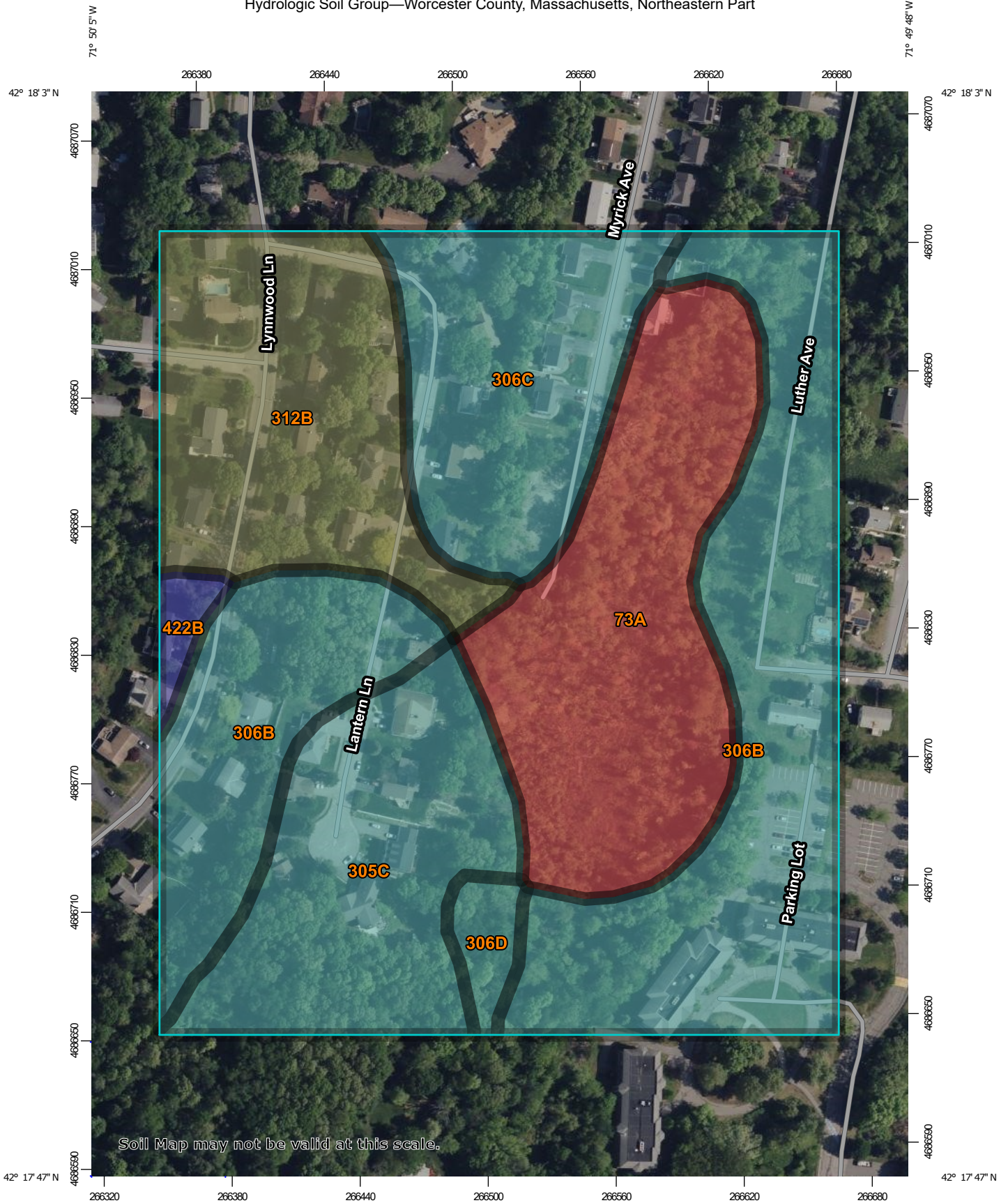
Volume	Invert	Avail.Storage	Storage Description
#1A	0.00'	129 cf	<b>11.00'W x 10.74'L x 3.50'H Field A</b> 413 cf Overall - 92 cf Embedded = 321 cf x 40.0% Voids
#2A	0.50'	92 cf	<b>ADS_StormTech SC-740 +Cap</b> x 2 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 2 Chambers in 2 Rows
		220 cf	Total Available Storage

Storage Group A created with Chamber Wizard

**APPENDIX A**  
**USDA-NRCS SITE SOILS MAP**



Hydrologic Soil Group—Worcester County, Massachusetts, Northeastern Part



Map Scale: 1:2,470 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84



## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines


 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available

### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

**Warning:** Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part  
 Survey Area Data: Version 17, Sep 9, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	5.9	19.8%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	C	4.4	15.0%
306B	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	C	9.8	33.1%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	3.9	13.1%
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	C	0.5	1.6%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	4.8	16.3%
422B	Canton fine sandy loam, 0 to 8 percent slopes, extremely stony	B	0.3	1.1%
<b>Totals for Area of Interest</b>			<b>29.6</b>	<b>100.0%</b>

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher

## **APPENDIX B**

# **LONG-TERM DRAINAGE SYSTEM OPERATION & MAINTENANCE PLAN**

## **LONG-TERM DRAINAGE SYSTEM OPERATION & MAINTENANCE PLAN**

### **System**

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The drainage systems associated with the proposed lots at Myrick Avenue are closed drainage systems consisting of a subsurface infiltration system that collects roof runoff for each dwelling. The drainage system associated with the Myrick Avenue extension consists of a water quality unit (stormwater treatment unit), which will discharge to the adjacent wetland system.

### **Responsible Parties**

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The drainage system located on the house lots will be operated and maintained by the respective property owner, to be determined at this time pending sale of the property. Drainage system maintenance tasks shall include routine cleaning of the overall system and specific duties as listed below.

The water quality unit within Myrick Avenue will be operated and maintained by the City of Worcester's Department of Public Works (DPW). The DPW will designate "qualified personnel" to perform the inspections associated with this plan. This means persons knowledgeable of the layout and overall function of the stormwater system. As necessary, this "qualified personnel" shall employ the services of a registered professional engineer when inspections reveal a failing stormwater system component or when similar attention is needed beyond the knowledge or experience of the inspector.

### **Operation and Maintenance Duties**

---

The following duties shall be considered the minimum required and may be supplemented by additional measures as necessary to maintain the function of the drainage system. This operation and maintenance plan shall serve as a supplement to any and all existing drainage system duties.

#### *Subsurface Infiltration System (Homeowner):*

There is no routine maintenance for a subsurface system therefore an aggressive inspection and maintenance schedule of all upstream BMPs must be maintained to prolong its operational life. Utilizing the observation ports, the system shall be inspected after the first several rain events upon installation. A log shall be kept noting the date and time of the inspection and the level of standing water or sediment (if any) observed within each observation port. The system must be inspected at least every 6 months or after every rainfall event exceeding the 2-year storm frequency (3 inches within 24 hours).

The subsurface system is designed to fully drain after a storm event therefore if standing water is observed within the system beyond 24 hours since the cessation of inflow to the system from a rainstorm, this may indicate a problem and should be noted on the inspection log and further inspected for repairs. Additionally, should the owner notice continued and repeated discharge of stormwater from the overflow, it may also indicate failure of the system. The Owner may need to contact a Registered Professional Engineer to evaluate the system in the event of major problems.

#### *Sweeping (City of Worcester):*

Sweeping of the street should be done at least 2 times annually, namely in the spring and fall. It is imperative that sweeping take place immediately following final winter snowmelt to remove winter sand. All sediments containing hydrocarbons shall be handled properly and disposed of in accordance with local, state, and federal guidelines and regulations.

***Single-Family House Lots & Street Improvements  
0 Myrick Avenue, Worcester, MA 01605***

*Culverts and pipes (City of Worcester):*

All culverts and pipes shall be inspected four times per year and cleaned when drainage impediments are discovered. Flushing of pipes may be required to remove accumulated sediment.

*Riprap Drain Outfall (City of Worcester):*

All riprap drain outfalls shall be inspected four times per year and repaired as necessary. Riprap shall be replaced/repaired as necessary, debris and accumulated sediment removed, and any woody growth removed.

*Water Quality Unit (City of Worcester):*

The unit (Stormceptor) shall be inspected post construction (prior to being put into service) and inspected every 6 months. The unit shall be inspected immediately after any oil, fuel, or chemical spills. All sediments and liquids containing hydrocarbons shall be handled properly and disposed of in accordance with local, state, and federal guidelines. Maintenance is more easily performed with a standard vacuum truck.

**Annual Budget**

---

For the homeowner, an annual budget for the operation and maintenance tasks described above is estimated at \$0.00 (unless services of a “qualified professional” are needed).

For the City of Worcester, an annual budget for the operation and maintenance tasks described above is estimated at \$2,000.00.

**SHEET NOTES**

- ALL JOINTS OF EXISTING & PROPOSED BITUMINOUS PAVEMENT SHALL BE SEALED WITH HOT RUBBERIZED ASPHALT JOINT SEALANT AND SANDED.
- THE PROPOSED BLOCK RETAINING WALL SHOWN IS A DEFERRED DESIGN ITEM AS IT MAY REQUIRE A BUILDING PERMIT AND DESIGN BY A STRUCTURAL ENGINEER. IF SO REQUIRED, A COPY OF THE STAMPED RETAINING WALL DESIGN PLAN(S) SHALL BE PROVIDED TO THE WORCESTER DIVISION OF PLANNING & REGULATORY SERVICES OFFICE PRIOR TO AT THE SAME TIME AS SUBMITTAL OF THE BUILDING PERMIT APPLICATION. RETAINING WALL LOCATIONS, HEIGHTS, AND CONSTRUCTION MATERIALS SHALL REMAIN AS SHOWN ON THESE PLANS. RETAINING WALL DRAINS SHALL DAYLIGHT TO A POSITIVE OUTFALL OR CONNECT TO THE PROPOSED DRAINAGE SYSTEM.
- AN APPROVAL-NOT-REQUIRED (ANR) PLAN WILL BE FILED WITH THE PLANNING BOARD FOR CREATION OF THE FOUR LOTS AS SHOWN ON THESE DRAWINGS.

N/F  
HUR & CHRISTINA  
**ROGAN**  
55578 PG. 333  
BK. 287 PL. 31

N/F  
GARY V. & JENNIFER K.  
**VU**  
BK. 41398 PG. 239  
PL. BK. 777 PL. 98

N/F  
DAVID V. TRAN  
NHUEN T. LE  
BK. 61535 PG. 205  
PL. BK. 287 PL. 31

N/F  
HELEN GANIAS  
BK. 63962 PG. 82  
PL. BK. 287 PL. 31  
PL. BK. 564 PL. 118

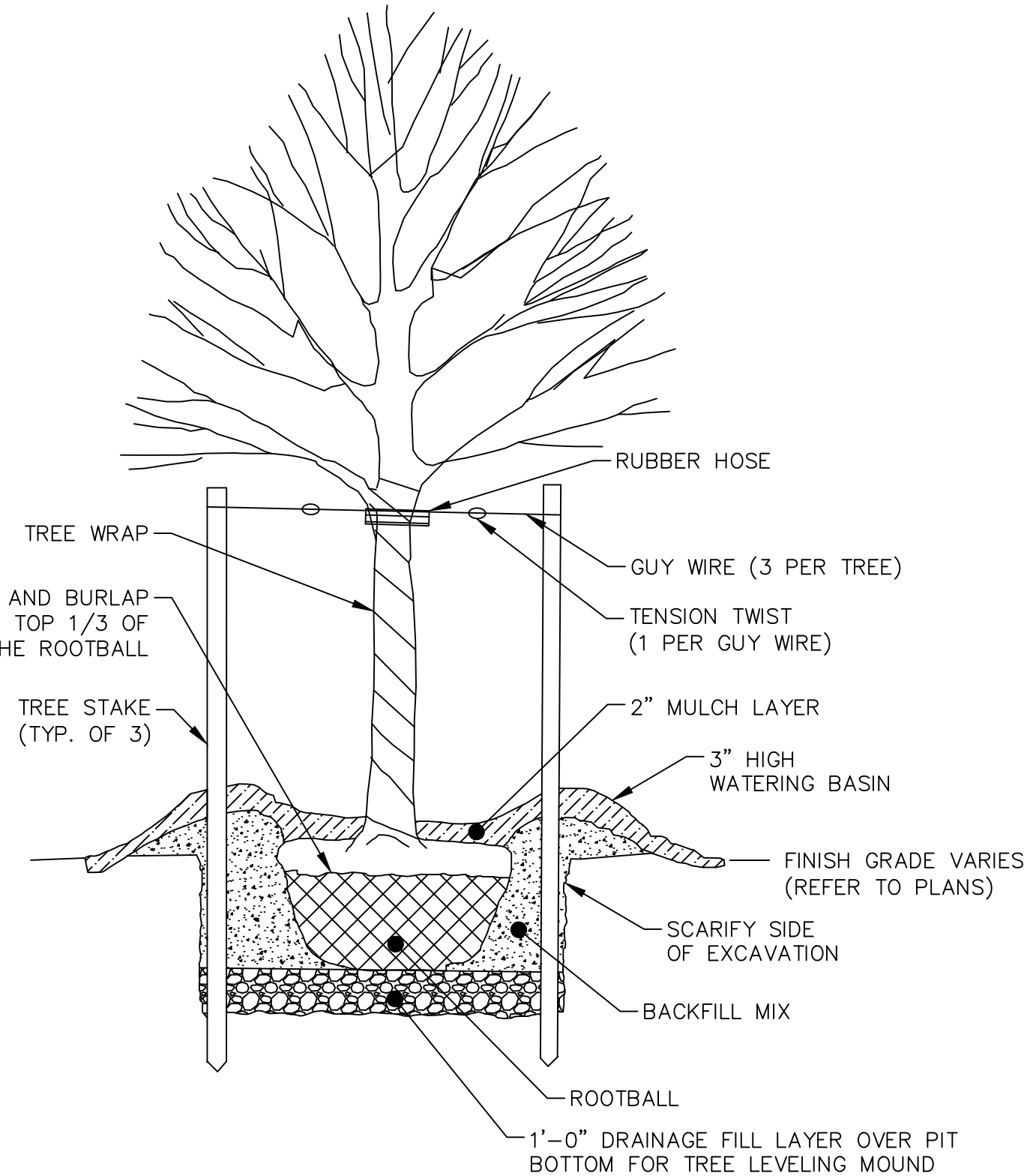
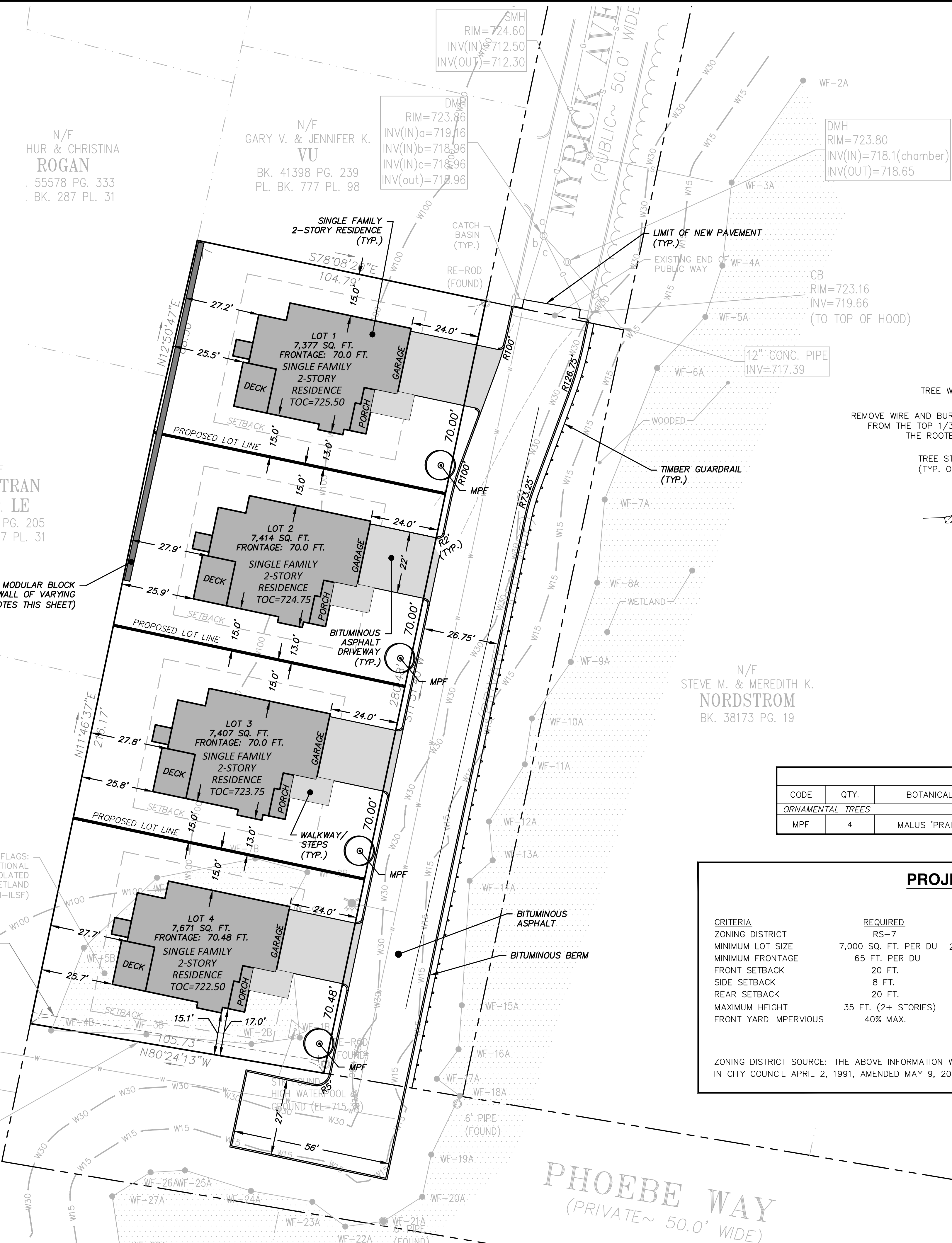
N/F  
STEVE M. & MEREDITH K.  
**NORDSTROM**  
BK. 38173 PG. 19

B-SERIES FLAGS:  
NON-JURISDICTIONAL  
MARSH-SHRUB ISOLATED  
VEGETATED WETLAND  
(NON-ILSF)

LOT LINE AS SHOWN ON  
PL. BK. 495 PL. 77

PHOEBE WAY  
ESTABLISHED BY  
PL. BK. 564 PL. 118

N/F  
DANIEL  
**RIGONAHY**



- TREE PLANTING NTS**
- NOTES:
- SET TREE ROOT CROWN 2" ABOVE FINISH GRADE.
  - DO NOT PLACE SOIL OVER ROOTBALL.

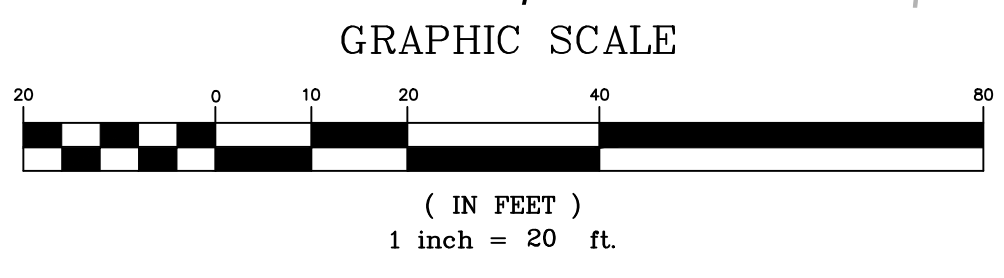
PLANTING LIST					
CODE	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	NOTES
ORNAMENTAL TREES					
MPF	4	MALUS 'PRAIRIE FIRE'	'PRAIRIE FIRE' CRABAPPLE	3'-4' HT.	PLANT WHERE SHOWN

PROJECT ZONING INFORMATION						
CRITERIA	REQUIRED	EXISTING	PROPOSED LOT 1	PROPOSED LOT 2	PROPOSED LOT 3	PROPOSED LOT 4
ZONING DISTRICT	RS-7	SAME	SAME	SAME	SAME	SAME
MINIMUM LOT SIZE	7,000 SQ. FT. PER DU	29,870 SQ. FT.	7,377 SQ. FT.	7,414 SQ. FT.	7,407 SQ. FT.	7,671 SQ. FT.
MINIMUM FRONTAGE	65 FT. PER DU	280.48 FT.	70.0 FT.	70.0 FT.	70.0 FT.	70.48 FT.
FRONT SETBACK	20 FT.	N/A	24.0 FT.	24.0 FT.	24.0 FT.	24.0 FT.
SIDE SETBACK	8 FT.	N/A	13.0 FT.	13.0 FT.	13.0 FT.	15.0 FT.
REAR SETBACK	20 FT.	N/A	25.5 FT.	25.9 FT.	25.8 FT.	25.7 FT.
MAXIMUM HEIGHT	35 FT. (2+ STORIES)	N/A	34 FT.	34 FT.	34 FT.	34 FT.
FRONT YARD IMPERVIOUS	40% MAX.	N/A	33.5%	33.5%	33.5%	32.9%

ZONING DISTRICT SOURCE: THE ABOVE INFORMATION WAS OBTAINED FROM THE CITY OF WORCESTER ZONING ORDINANCE ORDAINED IN CITY COUNCIL APRIL 2, 1991, AMENDED MAY 9, 2023.

LANTERN LANE  
(PUBLIC ~ 50.0' WIDE)

PHOEBE WAY  
(PRIVATE ~ 50.0' WIDE)



NO.	DATE	BY	DESCRIPTION
1	12/20/23	ROM	ISSUED FOR PERMITTING

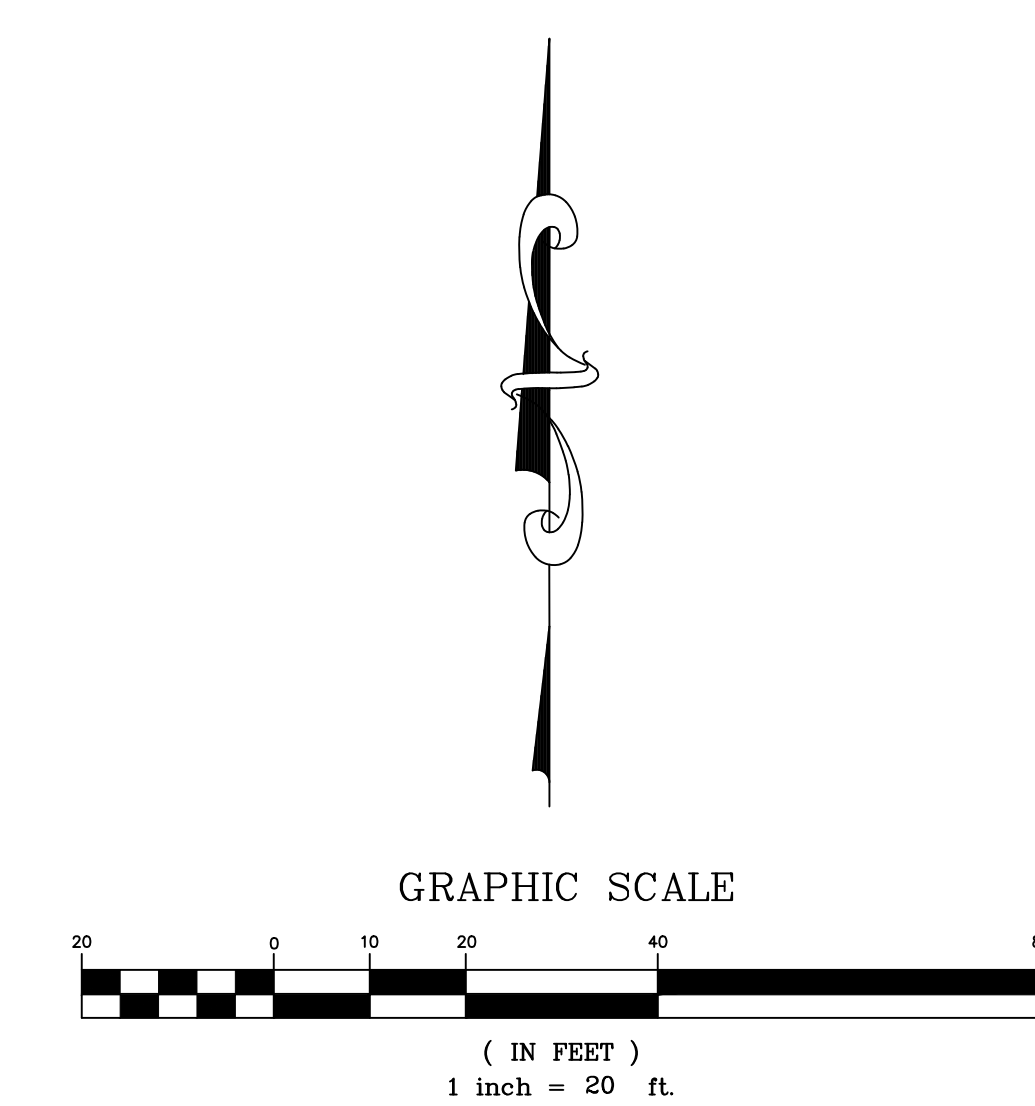
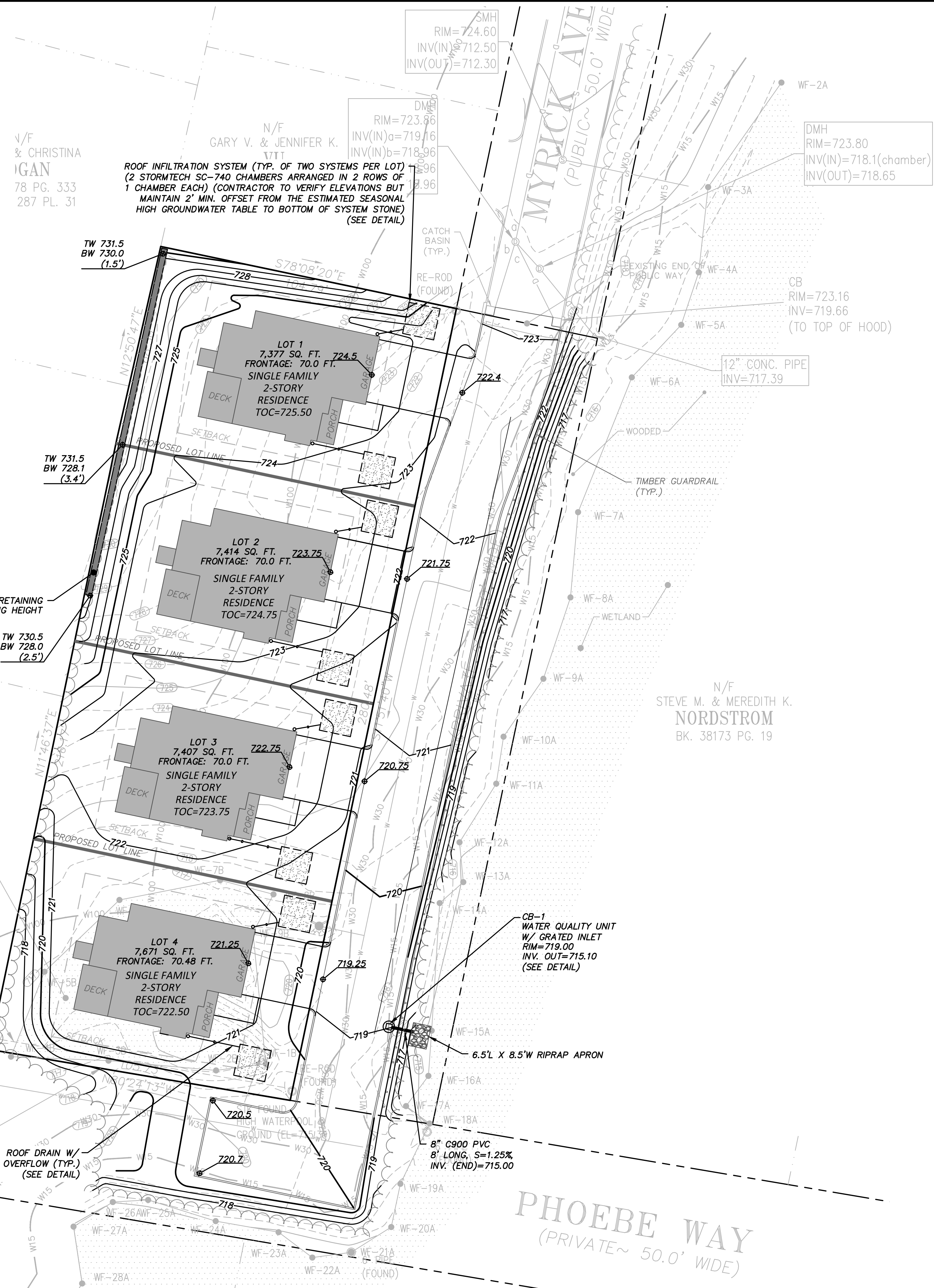
NO.	DATE	BY	DESCRIPTION



**SHEET NOTES**

- PROVIDE POSITIVE DRAINAGE IN ALL FINISH GRADED WORK AREAS INCLUDING AWAY FROM ALL BUILDINGS.
- ADJUST ALL STRUCTURES (MANHOLES, WATER GATE VALVES, SHUTOFFS, ETC.) TO PROPOSED FINISH GRADES WITHIN THE LIMIT OF WORK.
- ALL DISTURBED AREAS OUTSIDE OF PAVEMENT SHALL BE RESTORED WITH 6 INCHES OF LOAM AND SEEDED OR LANDSCAPED.
- ALL FINISHED GRASSED SLOPES EQUAL TO OR GREATER THAN A 3:1 SLOPE SHALL BE STABILIZED WITH AN EROSION CONTROL MATTING SUCH AS SC-150 BY NORTH AMERICAN GREEN, CURLEX II BY AMERICAN EXCELSIOR, OR ENGINEER APPROVED EQUAL. COORDINATE MATTING LOCATIONS WITH THE PLANTINGS AND GROUND COVER MATERIALS.
- PROPOSED GRADES AS SHOWN SHALL BE CARRIED TO ALL PAVEMENT CORNERS HOWEVER GRADE ADJUSTMENTS SHALL BE MADE BY THE CONTRACTOR AS NECESSARY TO PROVIDE POSITIVE DRAINAGE FROM ALL CORNERS.
- SPOT GRADE KEY:  

(E) = EXISTING ELEVATION TO BE MAINTAINED	CB = CATCH BASIN
TC = TOP OF CURB FINISH ELEVATION	HP = HIGH POINT
BC = BOTTOM OF CURB FINISH ELEVATION	LP = LOW POINT
FFE = BUILDING FINISH FLOOR ELEVATION	ME = MATCH EXISTING
TW = TOP OF WALL (FINISH ELEVATION)	VIF = VERIFY IN FIELD
BW = BOTTOM OF WALL (FINISH ELEVATION)	TP = TOP OF PAD
	BP = BOTTOM OF PAD
- SITE SOILS PER USDA-NRCS WEB SOIL SURVEY ARE PAXTON FINE SANDY LOAM (MAP UNIT 306C), WHITMAN FINE SANDY LOAM (MAP UNIT 73A), AND WOODBRIDGE FINE SANDY LOAM (MAP UNIT 312B). NO ON-SITE SOIL TESTING HAS BEEN CONDUCTED.
- ALL NEW PAVEMENT AND CONCRETE SURFACES SHALL BE CONSTRUCTED TO PROPOSED GRADES AS SHOWN AND SHALL BE SMOOTH AND UNIFORM ELIMINATING DEFORMITIES, DEPRESSIONS, PUDDLES, AND TRIP HAZARDS. PROVIDE POSITIVE DRAINAGE ON ALL NEW PAVEMENT AND CONCRETE SURFACES, AWAY FROM BUILDINGS, AND TO EXISTING CATCH BASINS, OUTFALLS OR OTHER COLLECTION POINTS.
- FOUNDATION DRAINS, IF PROPOSED, SHALL EITHER DAYLIGHT TO GRADE OR CONNECT TO THE ROOF INFILTRATION SYSTEMS.
- UTILITY MATERIALS, CONSTRUCTION, AND TESTING SHALL COMPLY WITH THE WORCESTER DEPARTMENT OF PUBLIC WORKS SPECIFICATIONS, LATEST EDITION.



**GRAVES ENGINEERING, Inc.**  
 100 GROVE STREET | WORCESTER MA 01605  
 T 508-856-0321 | F 508-856-0357  
 gravesengineering.com

NO.	DATE	BY	DESCRIPTION
1	12/20/23	ROM	ISSUED FOR PERMITTING

REVISIONS

**GRADING & DRAINAGE PLAN**  
**SINGLE-FAMILY HOUSE LOTS & STREET IMPROVEMENTS**  
 0 MYRICK AVENUE, WORCESTER, MA 01605

PREPARED FOR: KENDALL HOMES INC.  
 P.O. BOX 766, SOUTHBOROUGH, MA 01772

DATE: 12/20/23 SCALE: 1"=20'  
 DES. BY: ROM DRW. BY: ROM CHK. BY: MRA PRJ. NO.: 23127

**SHEET NOTES**

- 1) PRIOR TO WORK, THE CONTRACTOR SHALL VERIFY THE DEPTH OF COVER OVER THE EXISTING UNDERGROUND UTILITIES IN THE AREA OF THE PROPOSED WORK. IF ADEQUATE COVER IS NOT PRESENT TO THE PROPOSED FINISH GRADES, THE CONTRACTOR SHALL CONTACT THE DESIGN ENGINEER IMMEDIATELY BEFORE BEGINNING WORK IN THIS AREA.
- 2) UTILITY MATERIALS, CONSTRUCTION, AND TESTING SHALL COMPLY WITH THE WORCESTER DEPARTMENT OF PUBLIC WORKS SPECIFICATIONS, LATEST EDITION.
- 3) THE CONTRACTOR SHALL COORDINATE THE UTILITY WORK WITH THE PROPOSED BUILDING PLANS.
- 4) ALL UTILITY WORK SHALL BE COORDINATED BY THE CONTRACTOR WITH THE PROPER UTILITY COMPANIES.
- 5) THE CONTRACTOR SHALL VERIFY THE LOCATION AND ELEVATION OF ALL EXISTING WATER AND SEWER SERVICE UTILITIES. IF CONFLICTS ARE FOUND THAT PROHIBIT THE INSTALLATION OF THE UTILITIES AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY BEFORE PROCEEDING WITH THE WORK.
- 6) NEW CATCH BASIN FRAMES AND GRATES SHALL BE CITY STANDARD (MODEL: EJIW 728BZ1 (3-FLANGE), 728BZ (4-FLANGE), OR LEBARON LF288 CAST IRON FRAME & EJIW 7288M OR LEBARON L28SG1 CAST IRON GRATE.
- 7) EXTENSION OF EXISTING ELECTRICAL SERVICE ON MYRICK AVENUE IS NOT SHOWN ON THESE DRAWINGS. THE OWNER/CONTRACTOR SHALL COORDINATE WITH THE APPROPRIATE ELECTRIC UTILITY COMPANY FOR SAID EXTENSION OF SERVICE FOR THESE FOUR LOTS.

N/F  
CHRISTINA  
AN  
PG. 333  
87 PL. 31

N/F  
GARY V. & JENNIFER K.  
VU  
BK. 41398 PG. 239  
PL. BK. 777 PL. 98

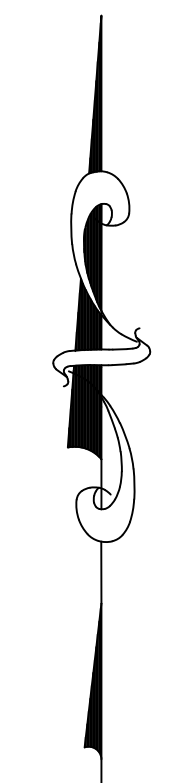
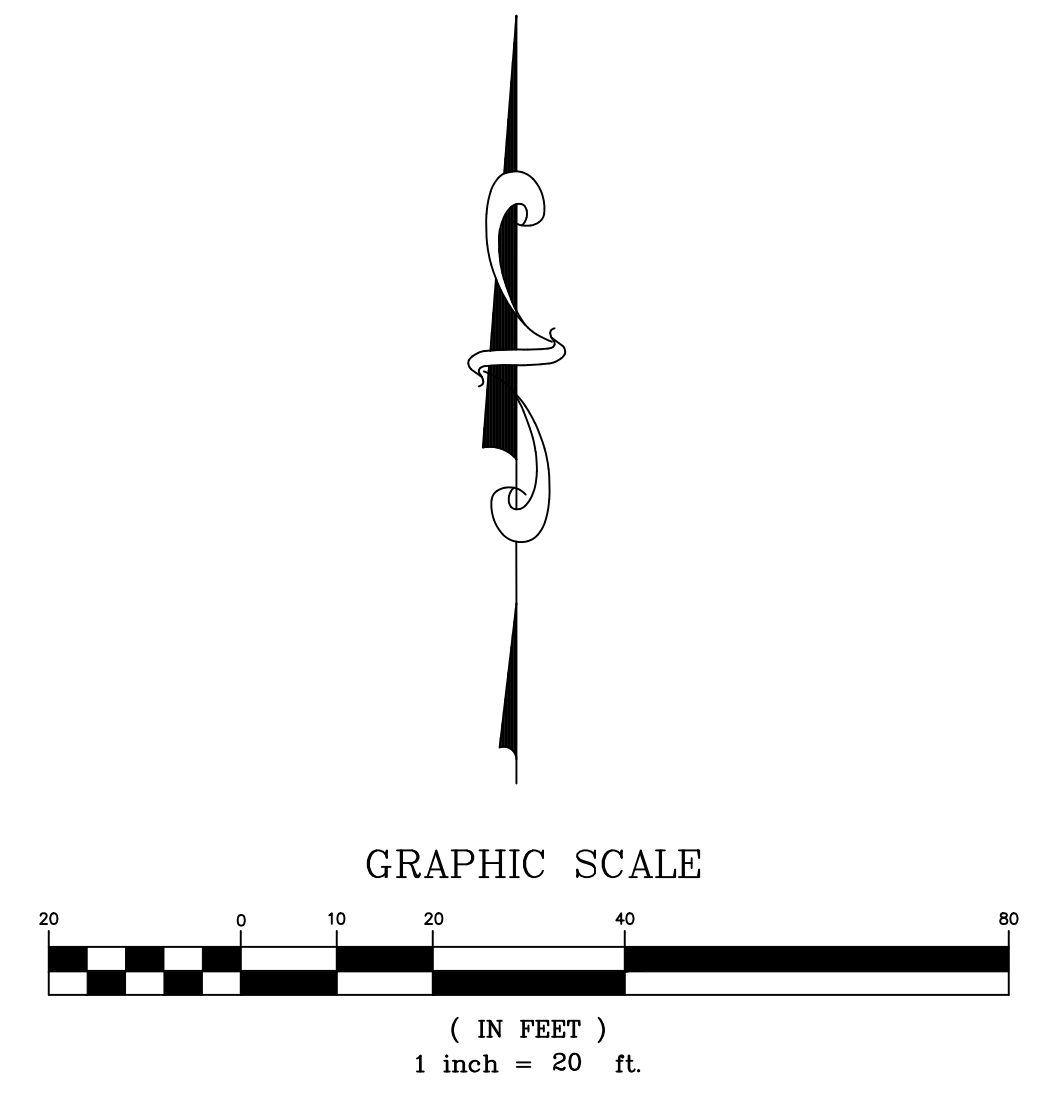
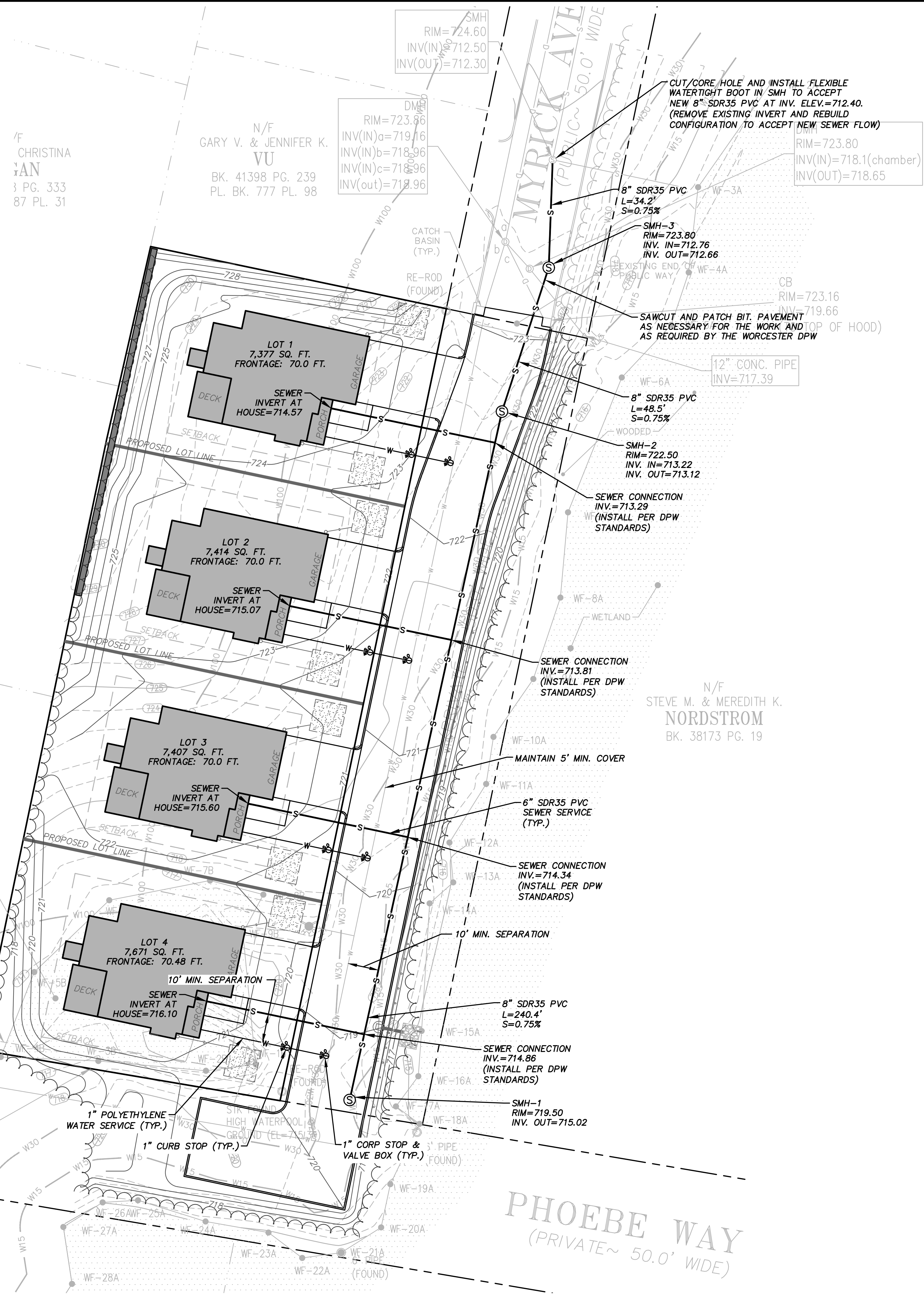
N/F  
HELEN GANIAS  
BK. 63962 PG. 82  
PL. BK. 287 PL. 31  
PL. BK. 564 PL. 118

B-SERIES FLAGS:  
NON-JURISDICTIONAL  
MARSH-SHRUB ISOLATED  
VEGETATED WETLAND  
(NON-ILSF)

LOT LINE AS SHOWN ON  
PL. BK. 495 PL. 77

PHOEBE WAY  
ESTABLISHED BY  
PL. BK. 564 PL. 118

N/F  
DANIEL RIGONAHY



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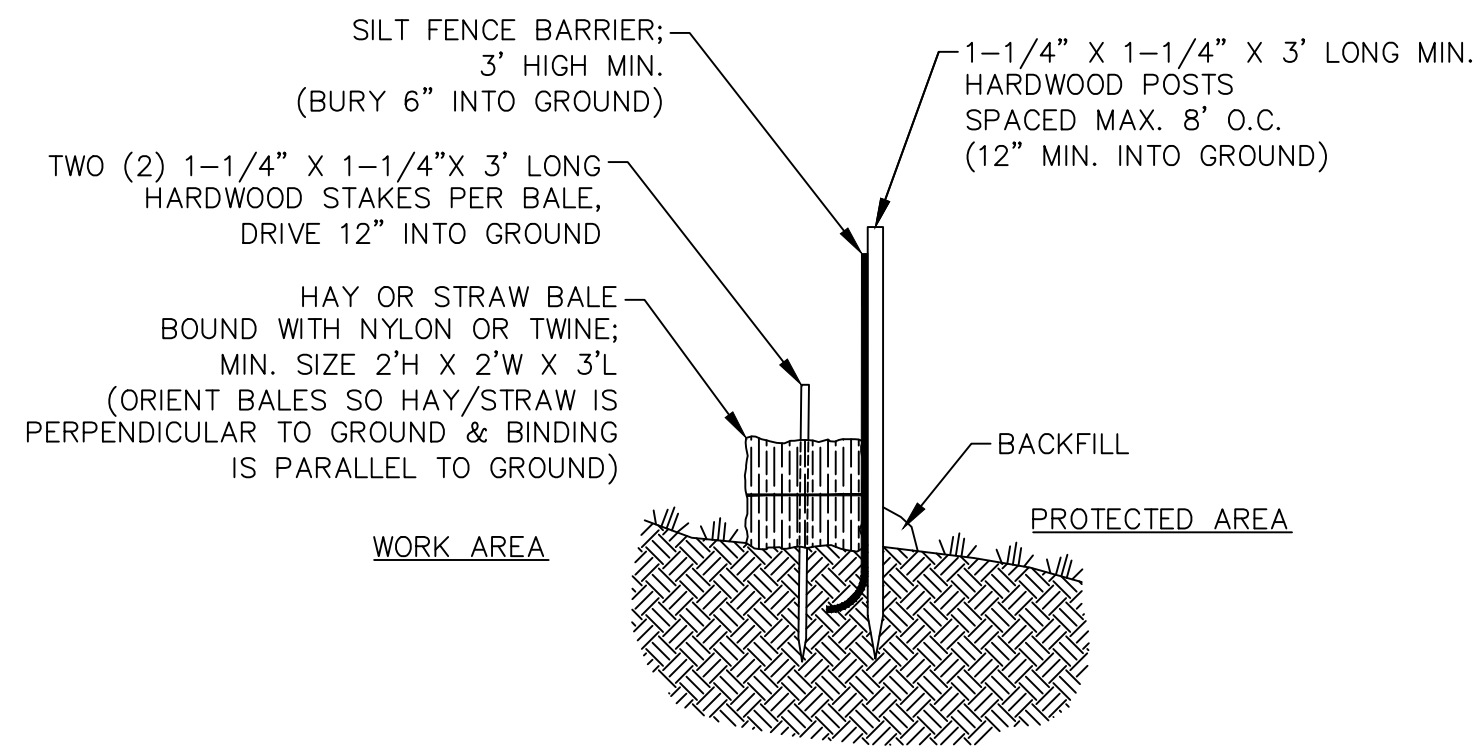
NO.	DATE	BY	DESCRIPTION
1	12/20/23	ROM	ISSUED FOR PERMITTING

NO.	DATE	BY	DESCRIPTION

**UTILITIES PLAN**  
**SINGLE-FAMILY HOUSE LOTS & STREET IMPROVEMENTS**  
0 MYRICK AVENUE, WORCESTER, MA 01605

PREPARED FOR:  
KENDALL HOMES INC.  
P.O. BOX 766, SOUTHBOROUGH, MA 01772

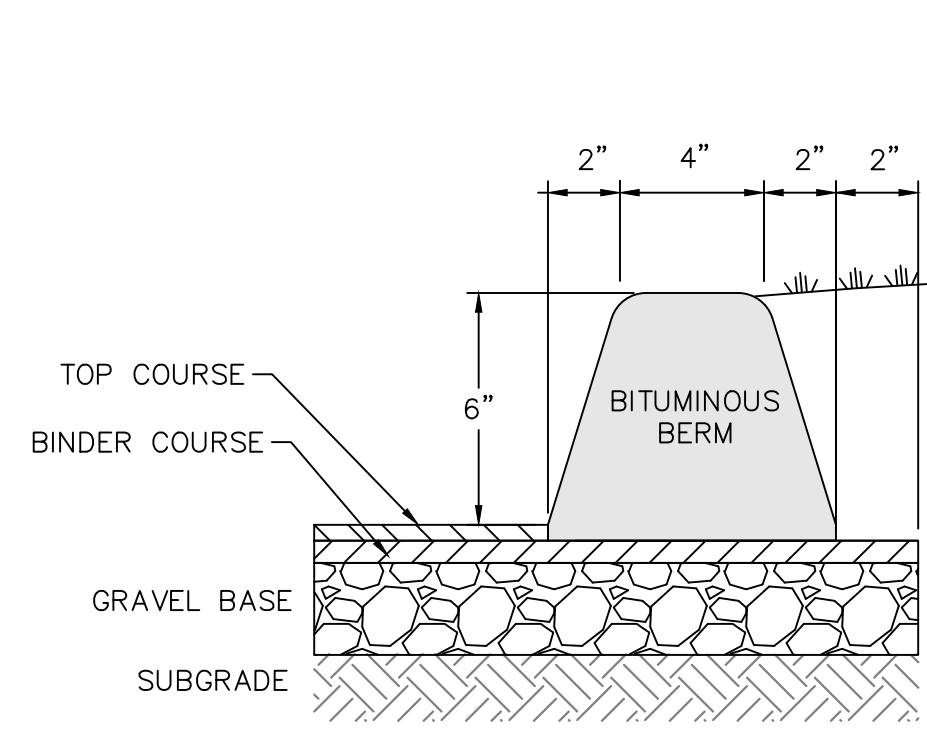
DATE: 12/20/23 SCALE: 1"=20'  
DES. BY: ROM DRW. BY: ROM CHK. BY: MRA PRJ. NO.: 23127



HAY/STRAW BALE & SILT FENCE NTS

NOTE:

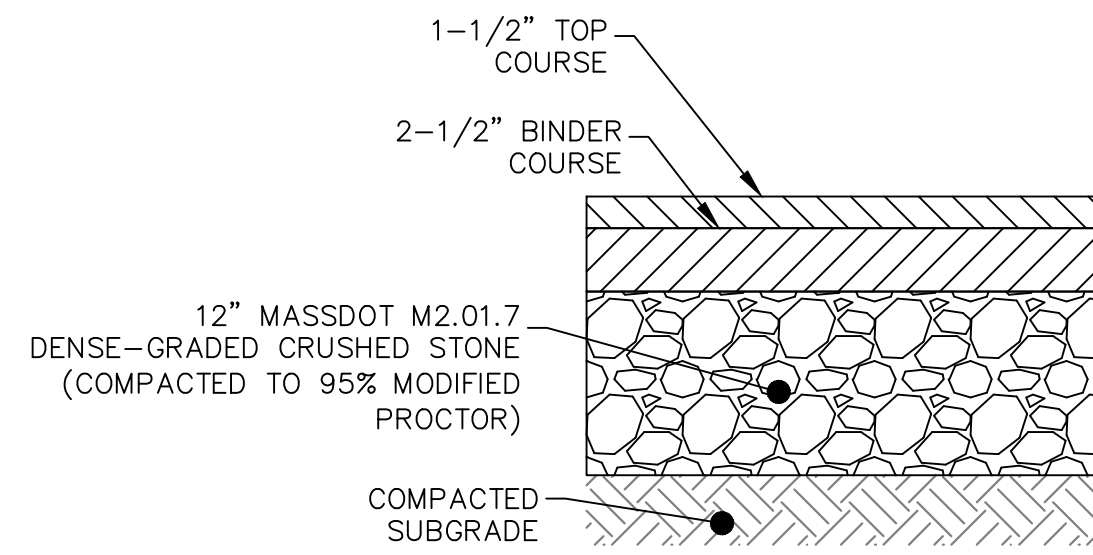
- 1) PROVIDE A 3' TO 6' LEVEL AREA BETWEEN THE HAY/STRAW BALE AND THE TOE OF ANY SLOPE TO PROVIDE AREA FOR SEDIMENT ACCUMULATION.



BITUMINOUS BERM-TYPE 3 NTS

NOTES:

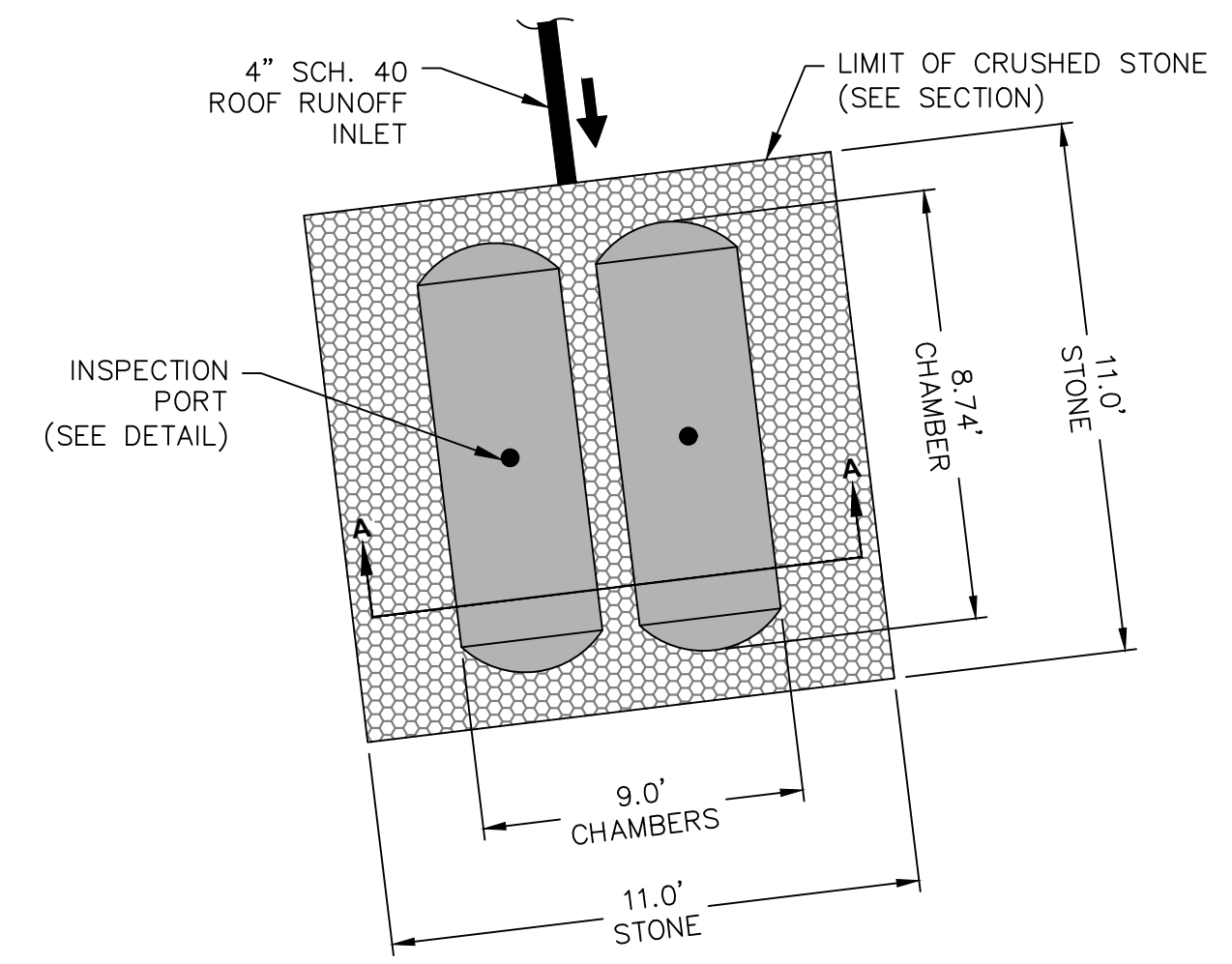
- 1) BERM SHALL BE LAID ON BINDER COURSE AND KEYED INTO TOP COURSE.
- 2) BERM ASPHALT: MASSDOT M3.11.03, TABLE A, "HMA DENSE MIX".



PAVEMENT SECTION-DRIVEWAY NTS

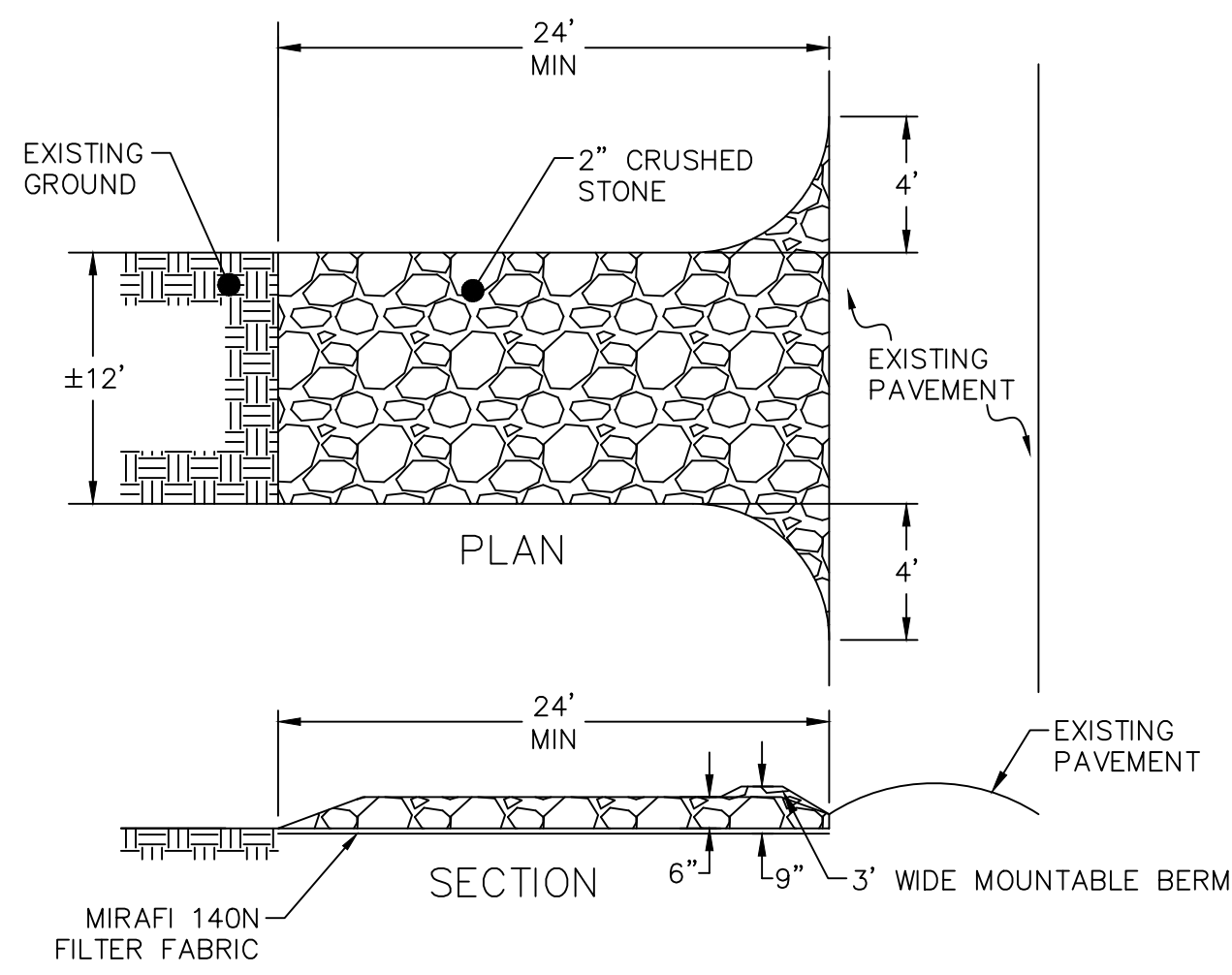
NOTES:

- 1) TAMP ALL ASPHALT EDGES THAT ABUT LAWN, LANDSCAPED AREA, OR OTHER SOFT SURFACE.
- 2) BINDER COURSE: - MASSDOT M3.11.03, TABLE A, "HMA INTERMEDIATE COURSE DENSE BINDER" OR SUPERPAVE INTERMEDIATE COURSE - 19.0MM (MIXTURE DESIGNATION SIC - 19.0).
- 3) TOP COURSE: - MASSDOT M3.11.03, TABLE A, "SURFACE COURSE STANDARD TOP" OR SUPERPAVE SURFACE COURSE - 12.5MM (MIXTURE DESIGNATION SSC - 12.5).

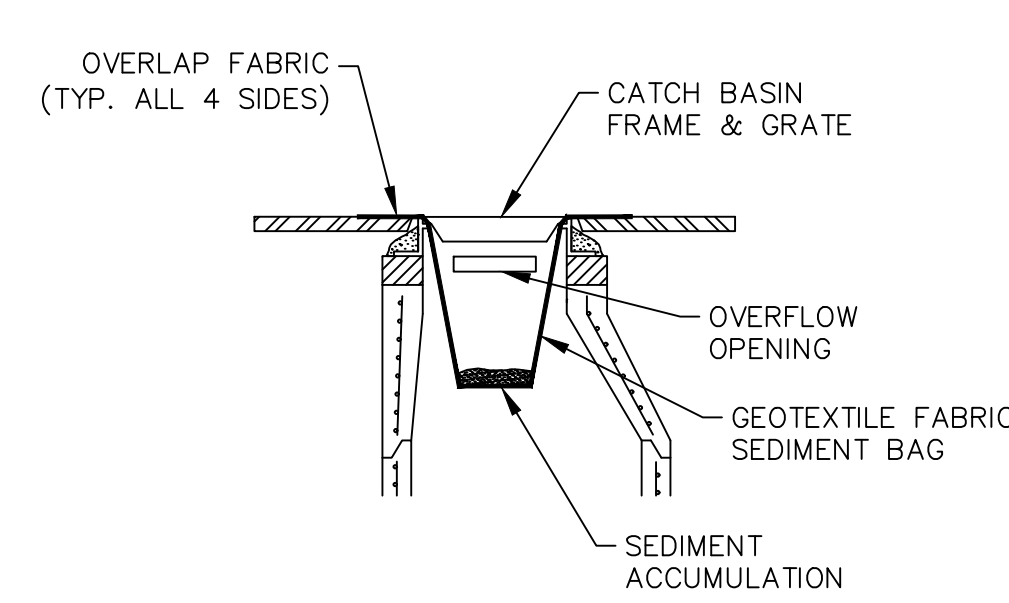


- 2) STORMTECH SC-740 CHAMBERS ARRANGED IN 2 ROWS OF 1 CHAMBERS EACH WITH END CAPS INSTALLED WITH 6" COVER STONE & 6" BASE STONE

SYSTEM LAYOUT



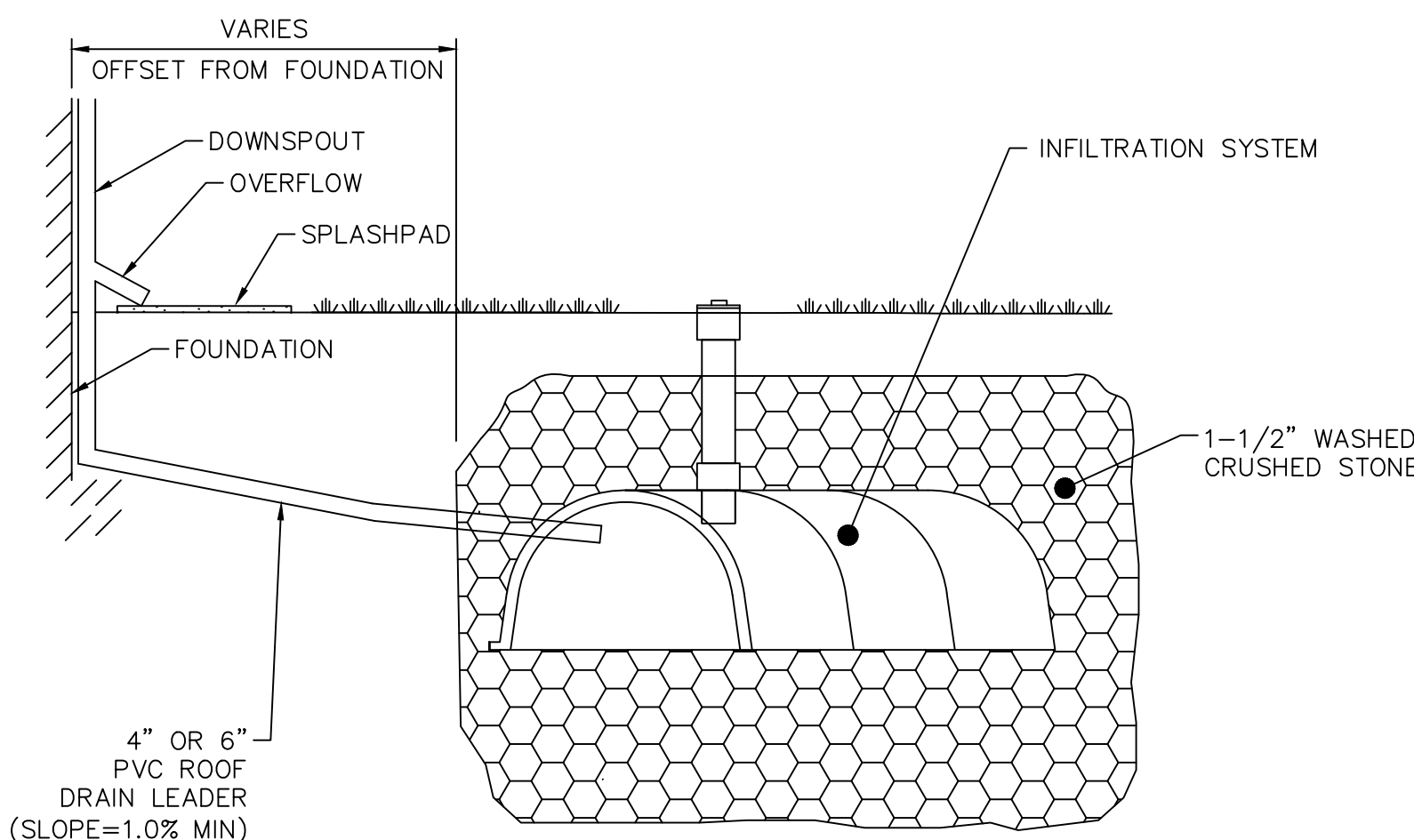
STABILIZED CONSTRUCTION ENTRANCE NTS



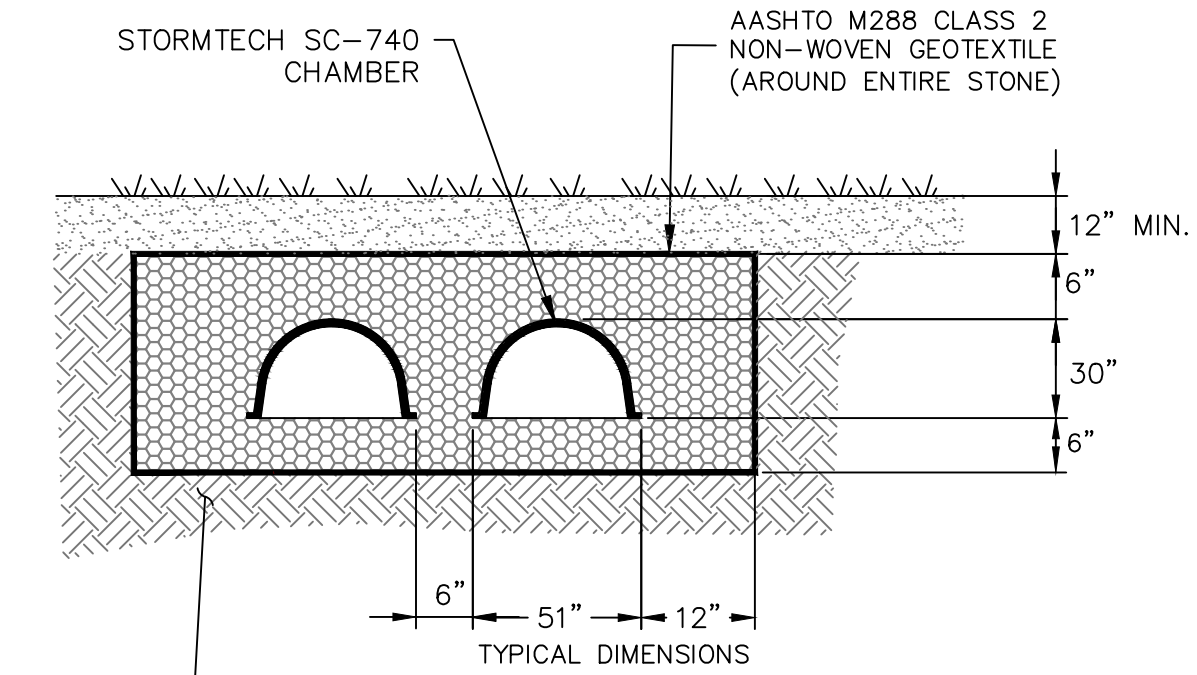
CATCH BASIN SEDIMENT BAG NTS

NOTES:

- 1) SEDIMENT BAG SHALL BE SILTSACK BY ACF ENVIRONMENTAL, OR APPROVED EQUAL.
- 2) OIL ABSORPTION MEDIUM MAY ALSO BE PLACED IN BAG (OPTIONAL).
- 3) INSTALL AND MAINTAIN PER MANUFACTURER'S INSTRUCTIONS.

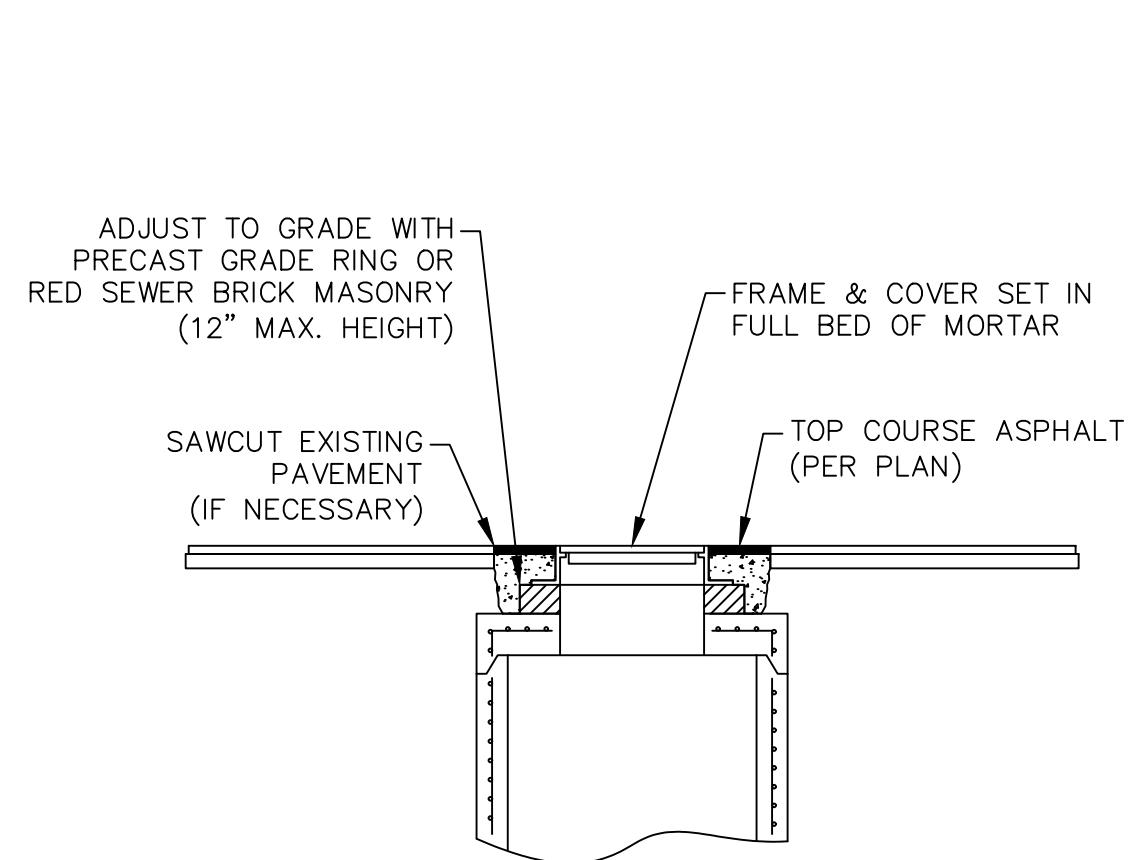


ROOF DRAIN OVERFLOW NTS

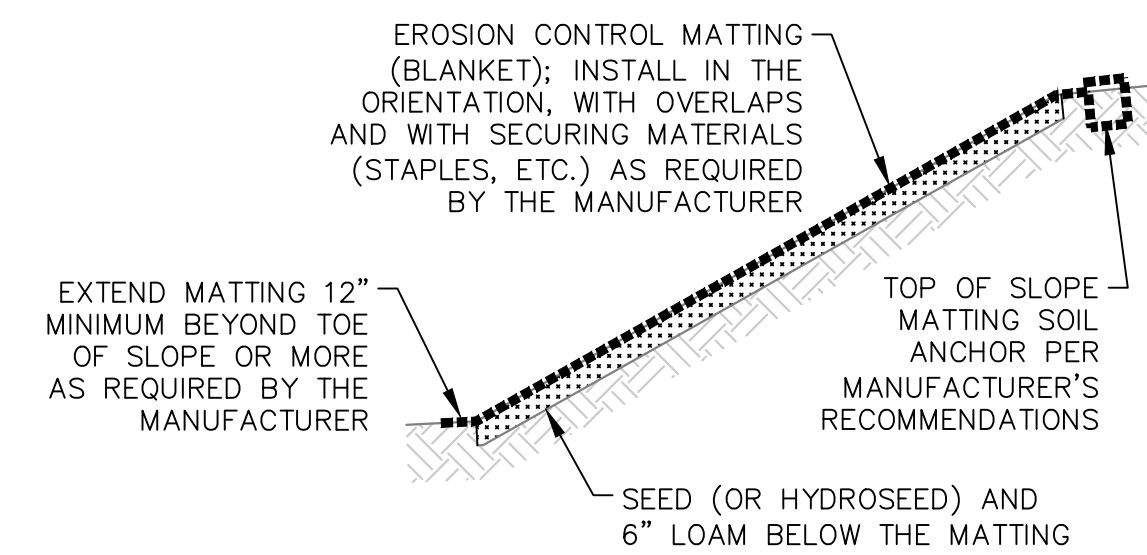


SECTION A-A NTS

- COMPACTED NATIVE SUBGRADE OR WHERE FILL IS NEEDED USE GRANULAR WELL GRADED SOIL/AGGREGATE MIXTURES, <35% FINES, COMPACT IN 6" LIFTS TO 95% PROCTOR DENSITY. SEE MANUFACTURER'S INSTRUCTIONS FOR ACCEPTABLE FILL MATERIALS.



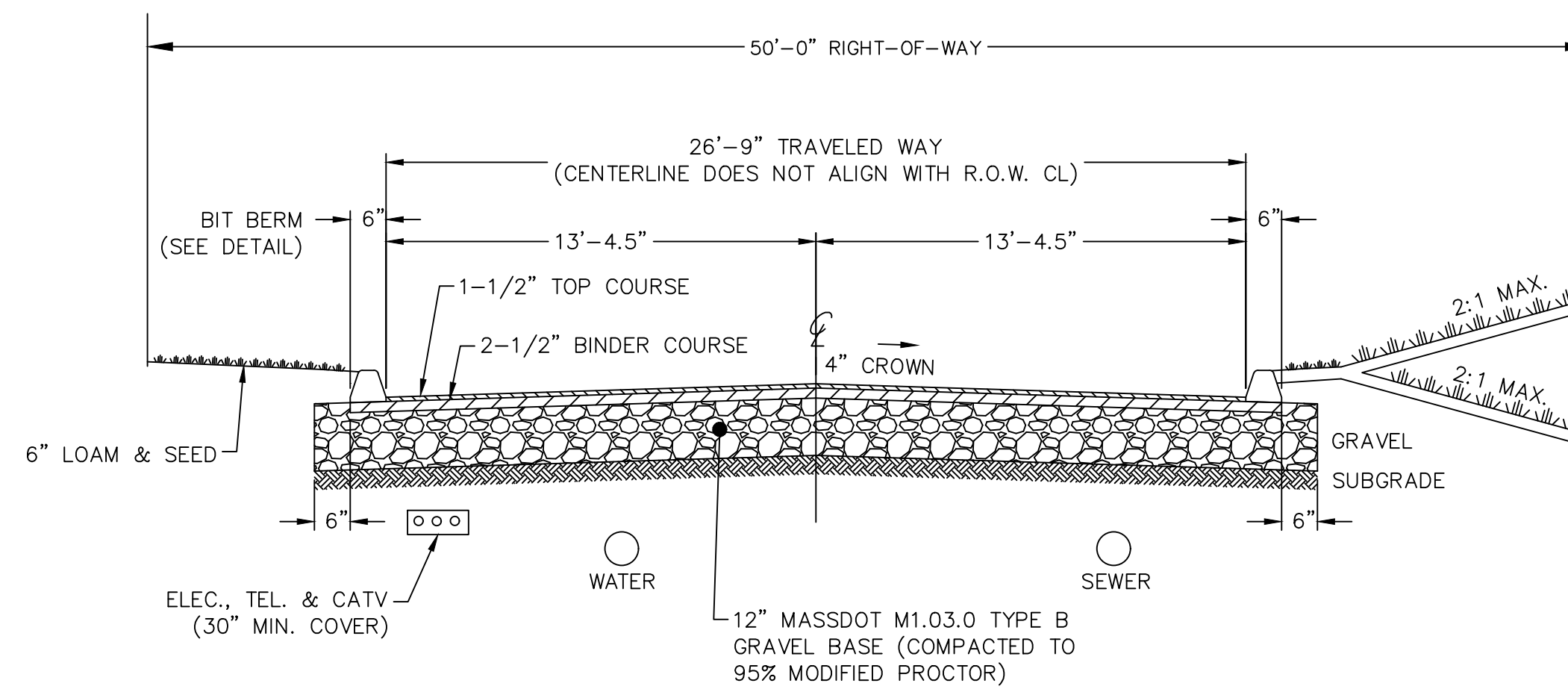
STRUCTURE ADJUSTMENT NTS



EROSION CONTROL BLANKET SLOPE STABILIZATION NTS

NOTES:

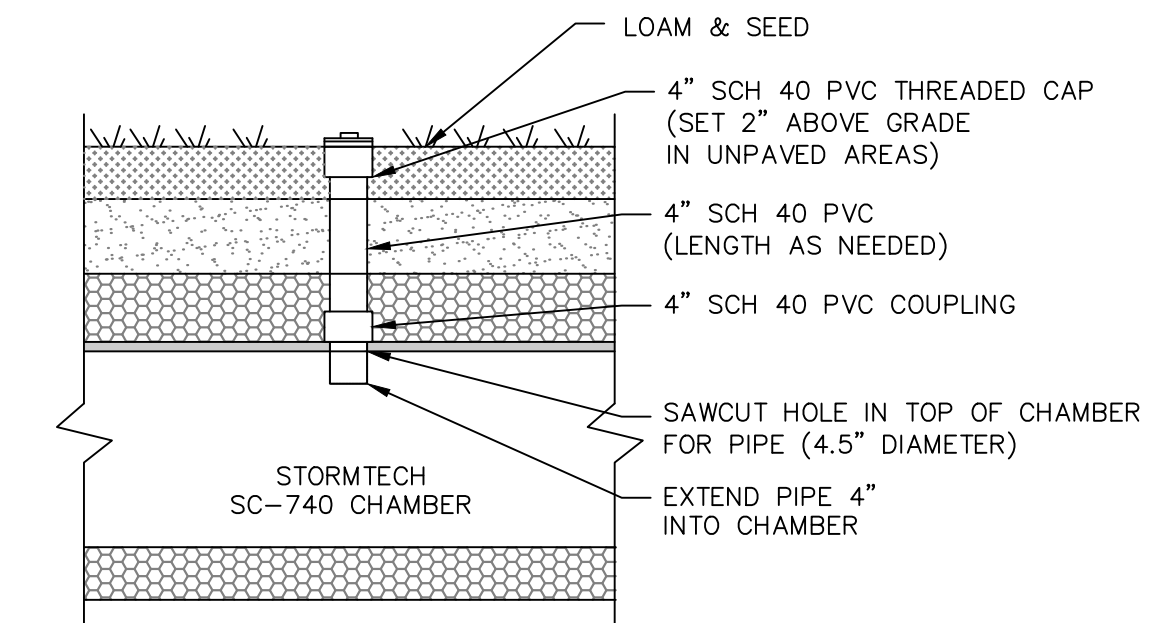
- 1) EROSION CONTROL MATTING (BLANKETS) SHALL BE INSTALLED ON ALL FINISHED SLOPES SHOWN EQUAL TO OR EXCEEDING A 3:1 SLOPE (33.5%).
- 2) INSTALLATION SHALL STRICTLY FOLLOW THE MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS.
- 3) UNLESS OTHERWISE SPECIFIED ON THE DRAWINGS FOR A PARTICULAR LOCATION AND APPLICATION, ACCEPTABLE EROSION CONTROL BLANKETS FOR GENERAL SLOPE STABILIZATION ARE: SC150 BY NORTH AMERICAN GREEN, CURLEX II BY AMERICAN EXCELSIOR COMPANY, OR LANDLOK C2 BY PROPEX (OR ENGINEER APPROVED EQUAL).



TYPICAL ROADWAY CROSS SECTION NTS

NOTES:

- 1) TAMP ALL ASPHALT EDGES THAT ABUT LAWN, LANDSCAPED AREA, OR OTHER SOFT SURFACE.
- 2) BINDER COURSE: - MASSDOT M3.11.03, TABLE A, "HMA INTERMEDIATE COURSE DENSE BINDER" OR SUPERPAVE INTERMEDIATE COURSE - 12.5MM, LEVEL 2 (MIXTURE DESIGNATION SIC - 12.5).
- 3) TOP COURSE: - MASSDOT M3.11.03, TABLE A, "SURFACE COURSE STANDARD TOP" OR SUPERPAVE SURFACE COURSE - 9.5MM, LEVEL 2 (MIXTURE DESIGNATION SSC - 9.5).



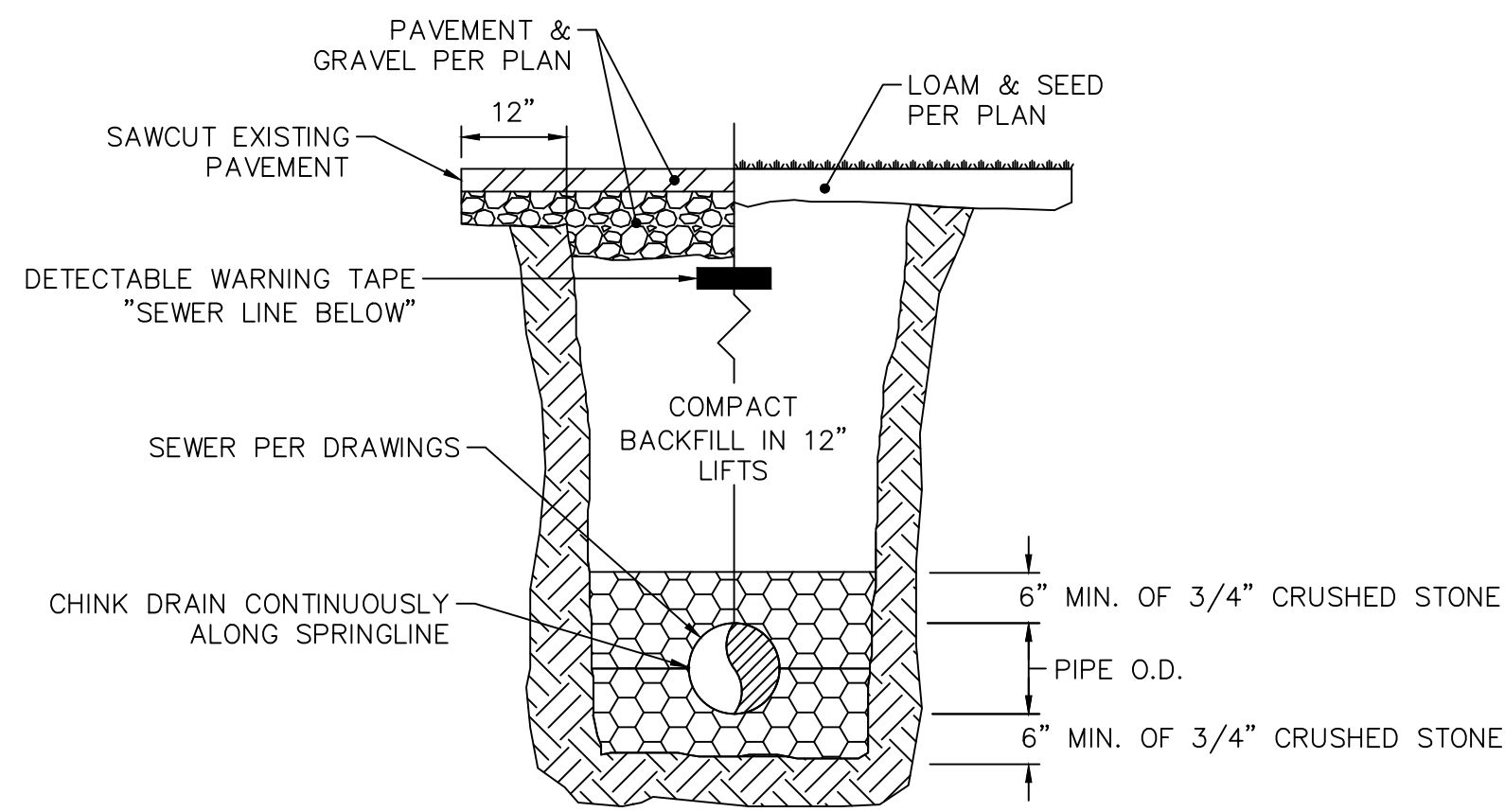
INSPECTION PORT NTS

SUBSURFACE ROOF INFILTRATION SYSTEM NTS

NOTE:

- 1) ONSITE SOIL TESTING SHALL BE CONDUCTED PRIOR TO CONSTRUCTION AND WITNESSED BY THE ENGINEER.

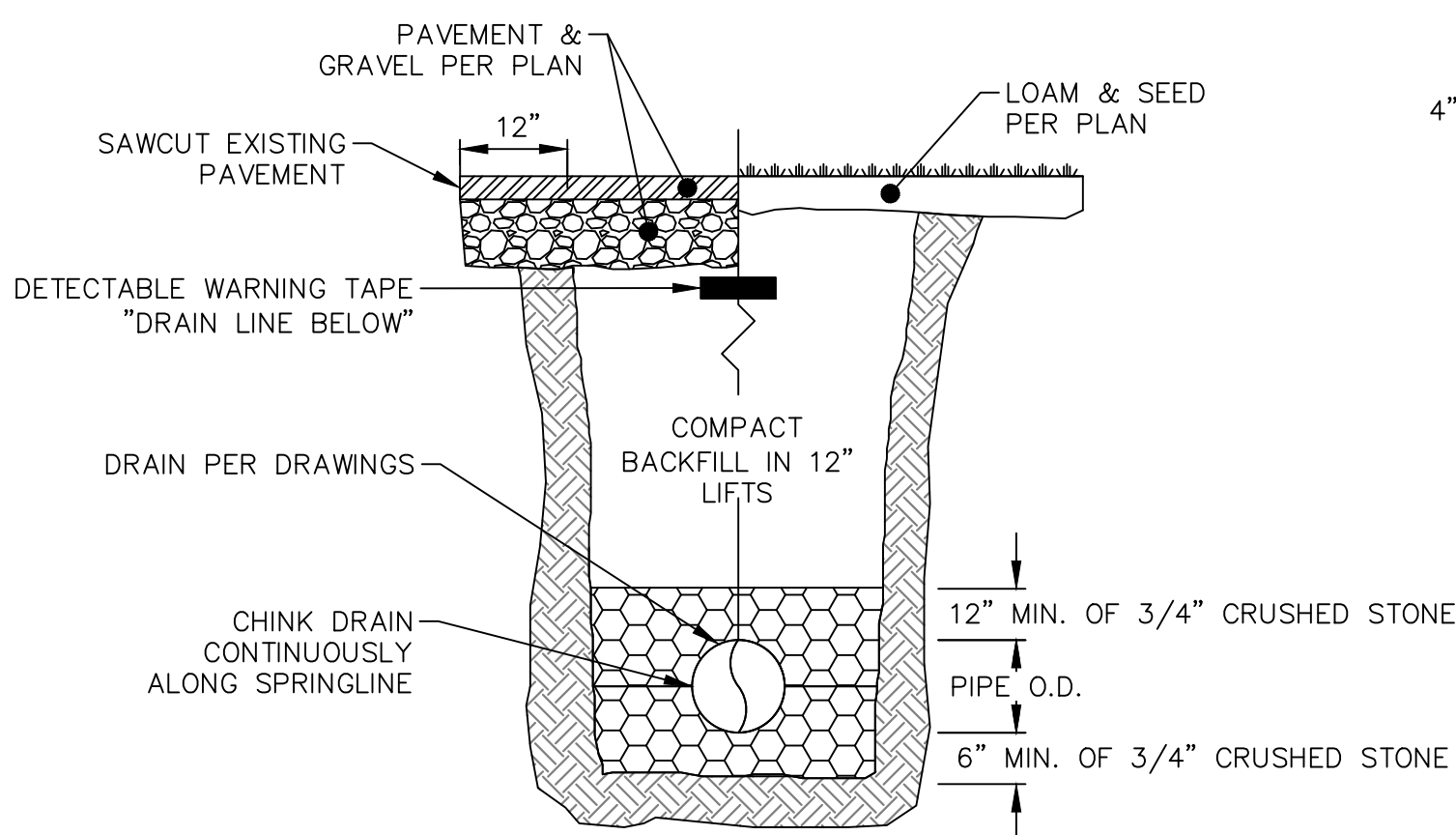
NO.	DATE	BY	DESCRIPTION	REVISIONS
1	12/20/23	ROM	ISSUED FOR PERMITTING	



SEWER TRENCH SECTION NTS

NOTE:

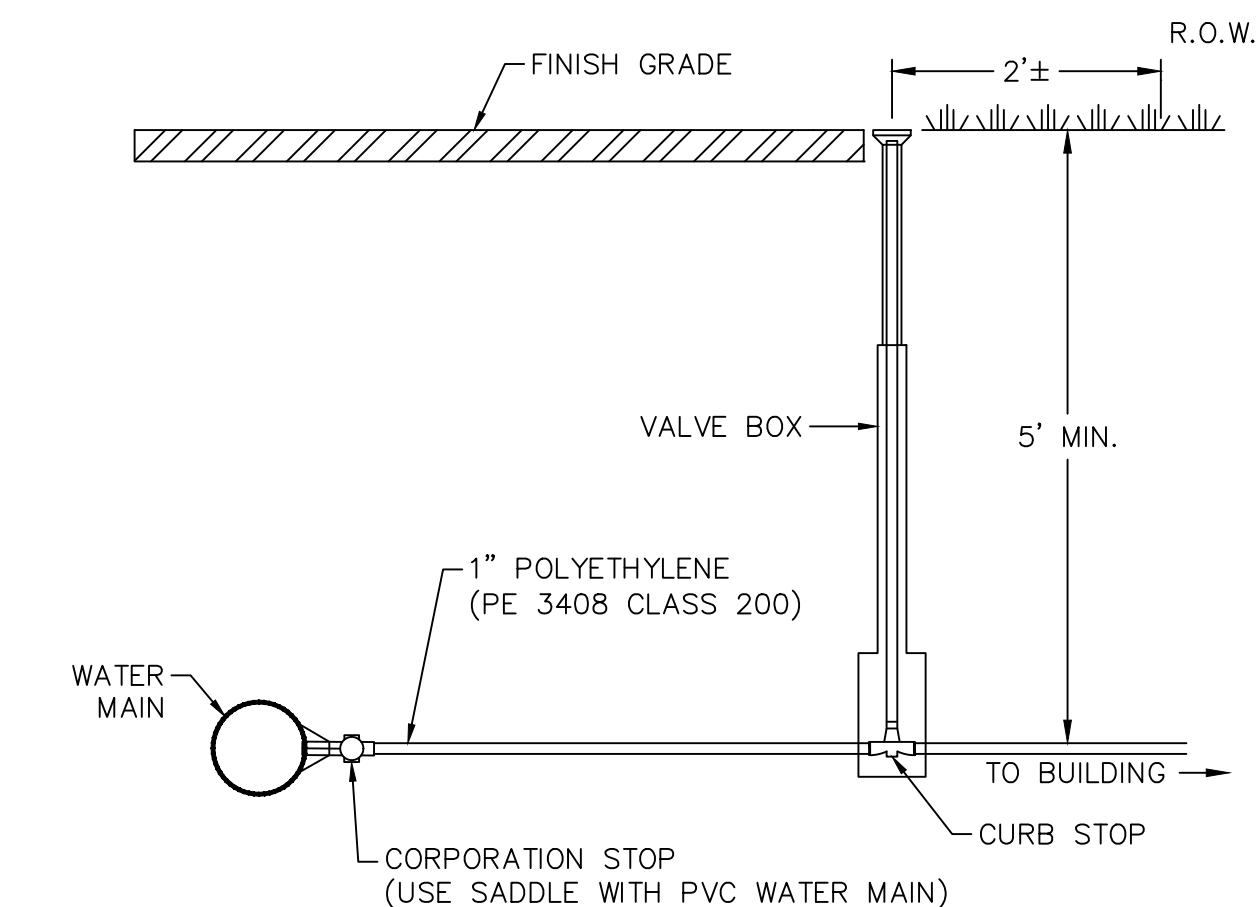
- 1) BACKFILL SHALL BE AN AASHTO CLASS III SOIL; EITHER TRENCH SPOILS OR AN IMPORTED SAND AND GRAVEL WITH FINES AND COMPACTED TO 90% OF THE PROCTOR DENSITY.



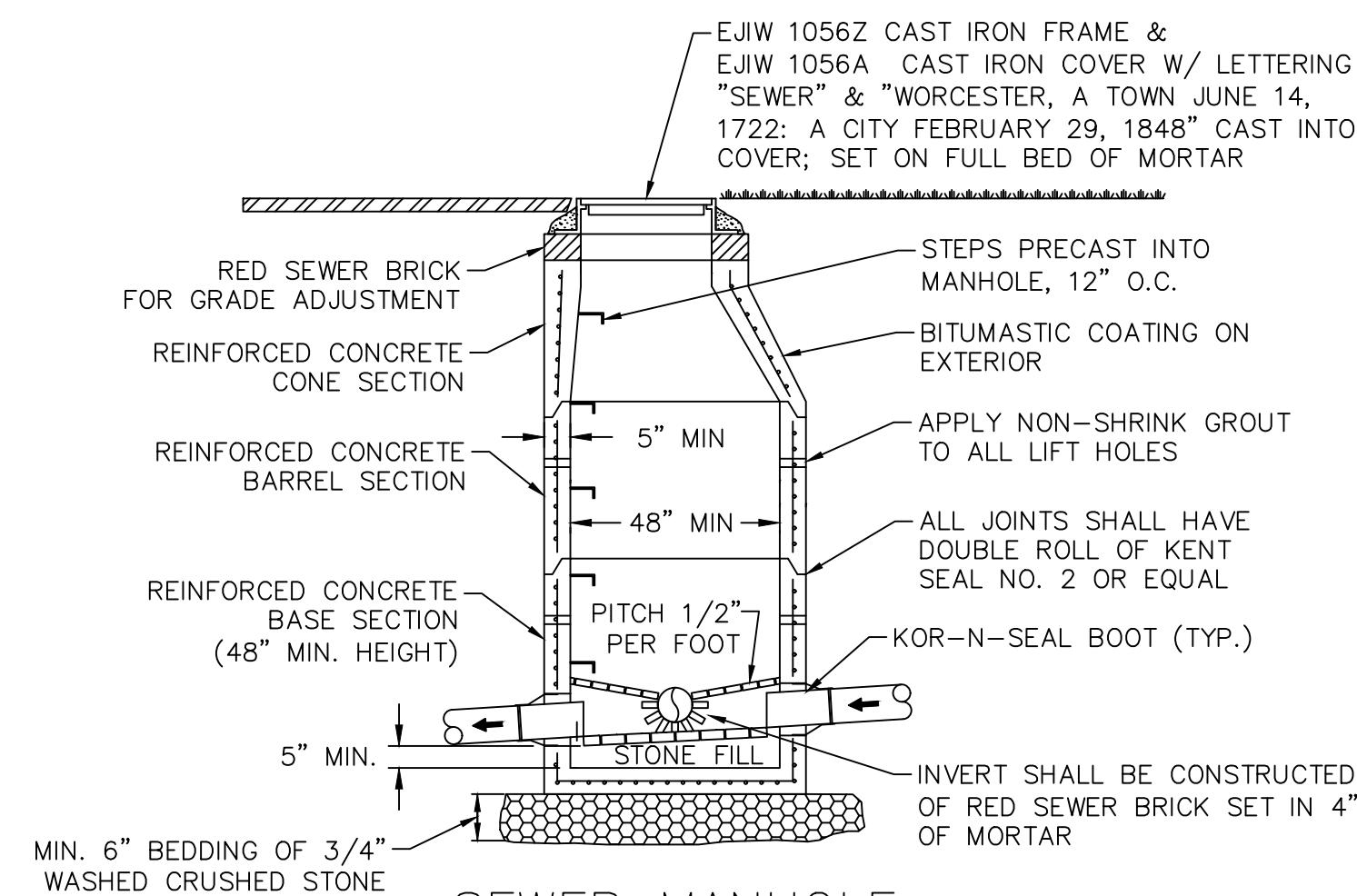
HDPE/PVC DRAIN TRENCH SECTION NTS

NOTES:

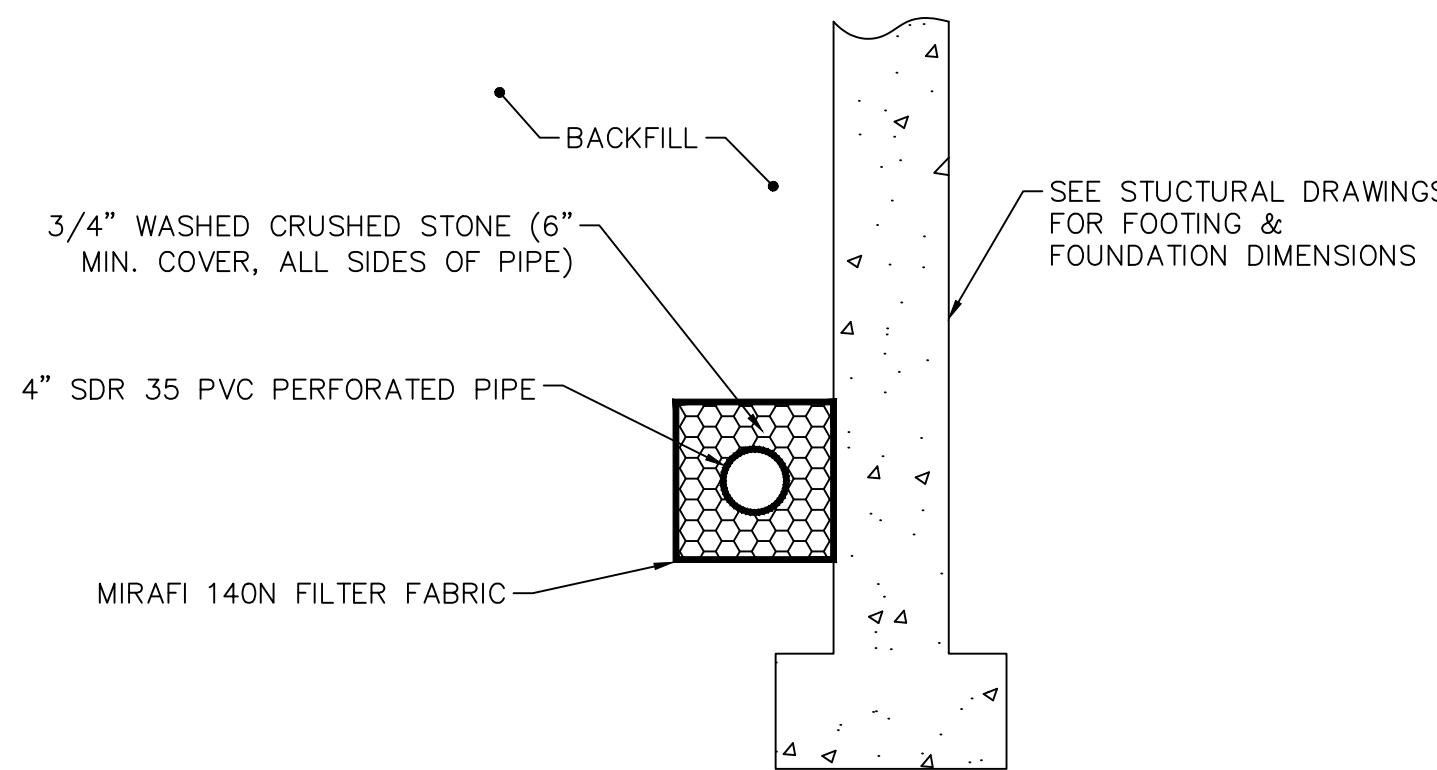
- 1) BACKFILL SHALL BE AN AASHTO CLASS III SOIL; EITHER TRENCH SPOILS OR AN IMPORTED SAND AND GRAVEL WITH FINES AND COMPACTED TO 90% OF THE PROCTOR DENSITY.
- 2) BACKFILL OF HDPE PIPE SHALL CONFORM TO ASTM D2321 AND/OR MANUFACTURER'S SPECIFICATIONS.



WATER SERVICE NTS



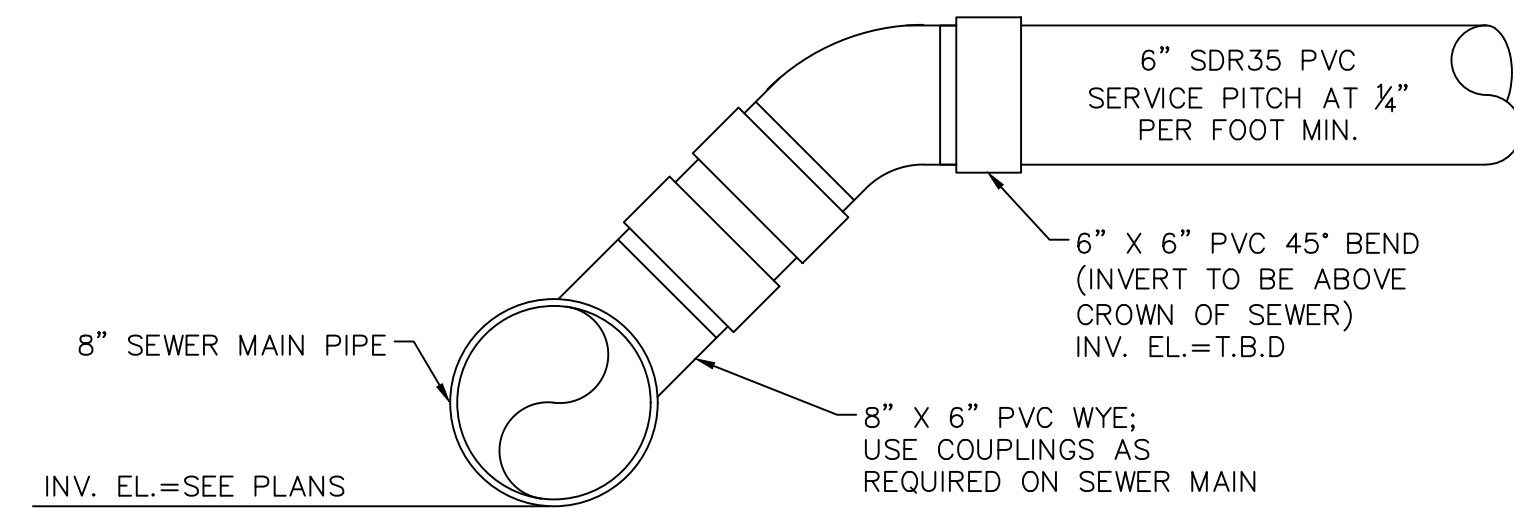
SEWER MANHOLE NTS



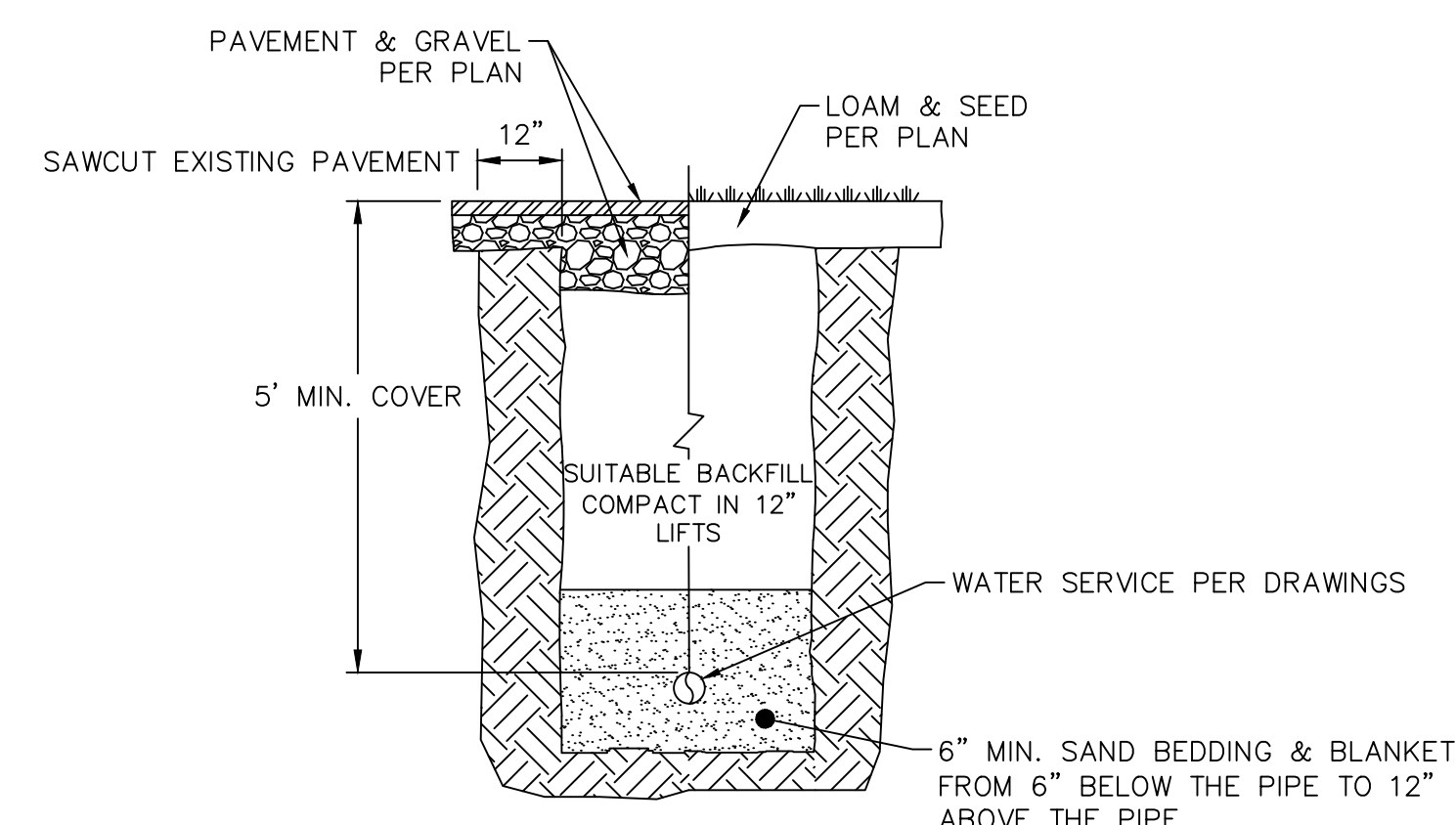
PERIMETER DRAIN DETAIL NTS

NOTE:

- 1) PERIMETER DRAIN ELEVATION VARIES.



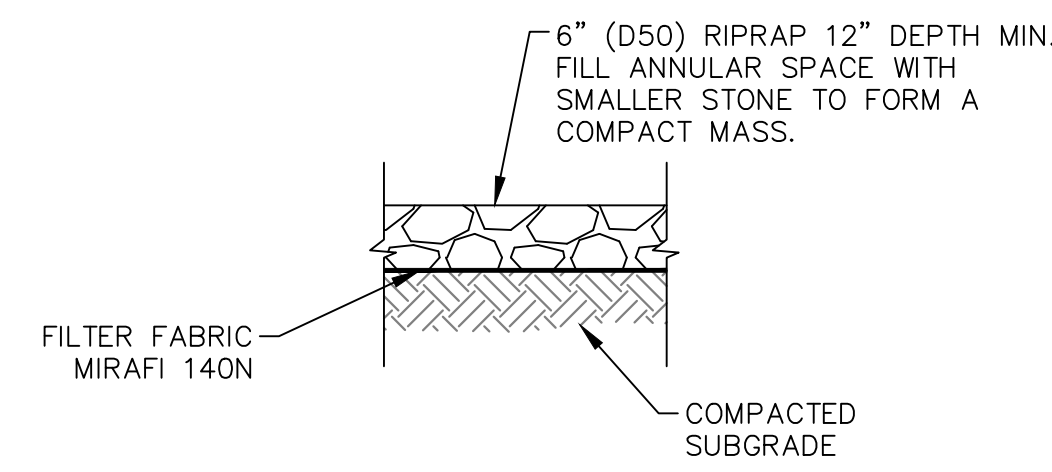
SEWER SERVICE CONNECTION DETAIL NTS



WATER SERVICE TRENCH SECTION NTS

NOTE:

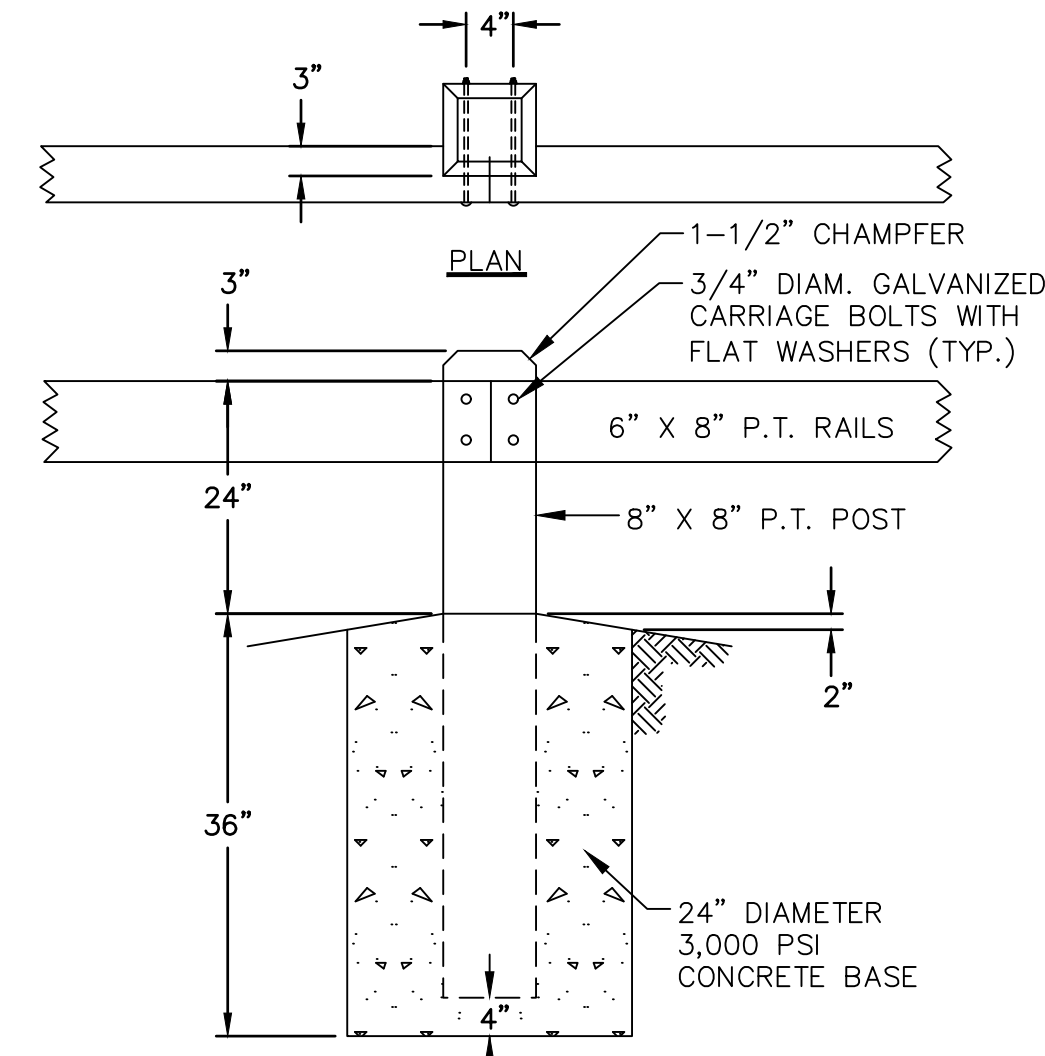
- 1) SUITABLE BACKFILL SHALL BE AN AASHTO CLASS III SOIL; EITHER TRENCH SPOILS OR AN IMPORTED SAND AND GRAVEL WITH FINES AND COMPACTED TO 90% OF THE PROCTOR DENSITY.



RIPRAP APRON SECTION NTS

NOTE:

- 1) THIS DETAIL APPLIES TO ALL SPECIFIED RIPRAP APPLICATIONS.

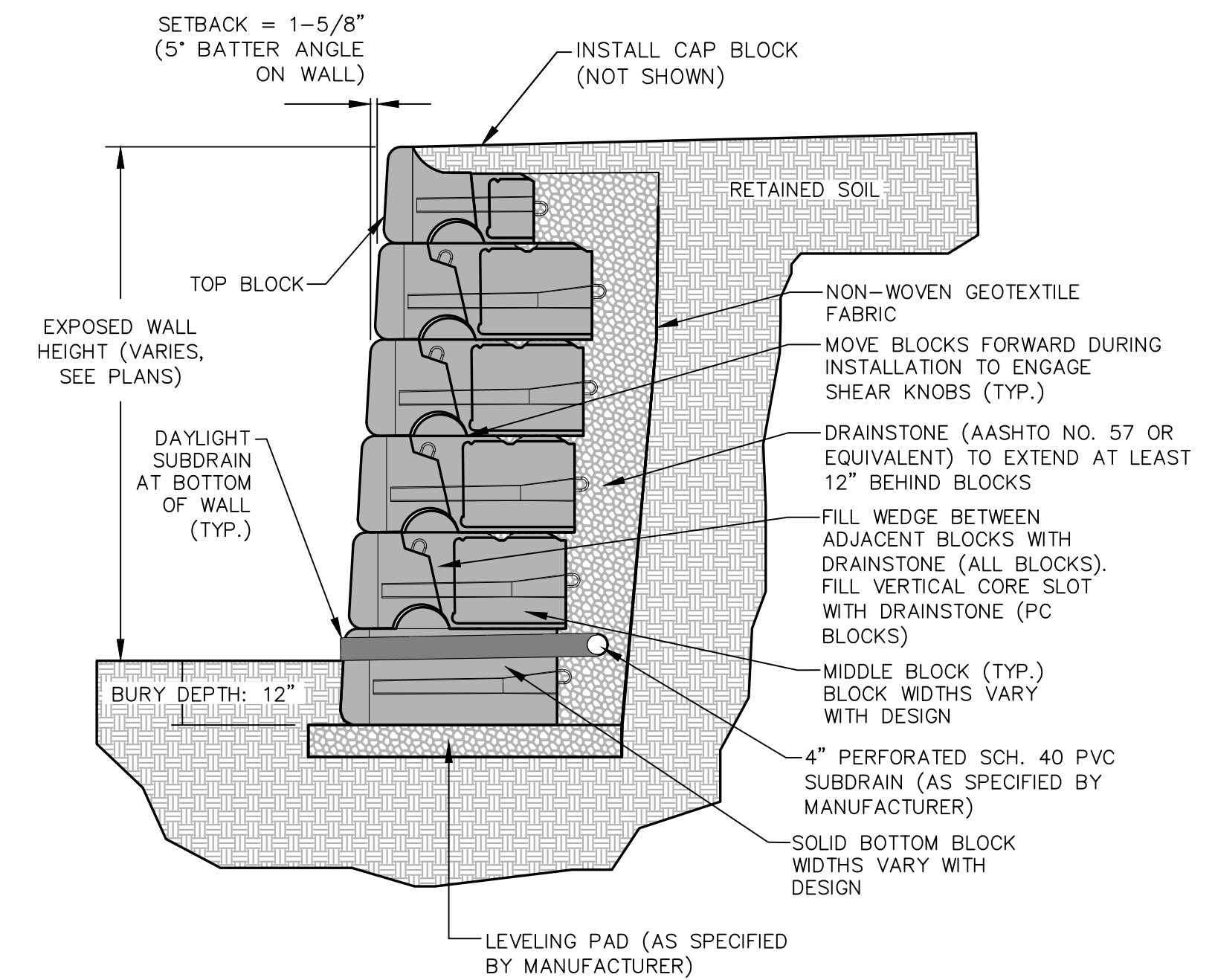


ELEVATION

WOOD GUARDRAIL NTS

NOTE:

- 1) POST SPACING SHALL BE 8'-0" ON CENTER.



TYPICAL GRAVITY-TYPE PRECAST CONCRETE MODULAR BLOCK RETAINING WALL SECTION NTS

NOTES:

- 1) BLOCK TEXTURE (FINISH) SHALL BE SIMILAR TO "LIMESTONE" BY REDI-ROCK INTERNATIONAL, LLC. AND BASED ON CONTRACTOR-SELECTED WALL MANUFACTURER.
- 2) BLOCK COLOR SHALL BE GRAY.
- 3) CONTRACTOR IS RESPONSIBLE FOR WALL MANUFACTURER'S COST OF PREPARING STRUCTURAL ENGINEERING DRAWINGS.
- 4) DESIGN SUBJECT TO CHANGE BASED ON STRUCTURAL ENGINEER-PREPARED DRAWINGS AND OWNER MATERIAL SELECTIONS.

**STORMCEPTOR DESIGN NOTES**

THE STANDARD STC450I CONFIGURATION WITH ROUND, SOLID FRAME AND COVER, AND INLET PIPE IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRADED INLET ONLY (NO INLET PIPE)
GRADED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES

SITE SPECIFIC DATA REQUIREMENTS			
STRUCTURE ID			
WATER QUALITY FLOW RATE (GAL/HR)			
PEAK FLOW RATE (GAL/HR)			
RETURN PERIOD OF PEAK FLOW (yrs)			
RIM ELEVATION			
PIPE DATA:			
INLET PIPE 1	INVERT	MATERIAL	DIAMETER
INLET PIPE 2			
OUTLET PIPE			
NOTES/SPECIAL REQUIREMENTS:			

**GENERAL NOTES**

- 1) CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- 2) FOR SITE SPECIFIC DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHT, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE: [www.conteches.com](http://www.conteches.com)
- 3) STORMCEPTOR WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF PROJECT.
- 4) STORMCEPTOR STRUCTURE SHALL MEET AASHTO HEAVY LOAD RATING, ASSURING EARTH COVER OF 2' - 2 1/2' AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CONTRACTOR SHALL MEET AASHTO M809 AND BE CAST WITH THE CONTECH LOGO.
- 5) STORMCEPTOR STRUCTURE SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C493 AND AASHTO LOAD FACTOR DESIGN METHOD.
- 6) ALTERNATE UNITS ARE SHOWN IN MILLIMETERS (mm).

**INSTALLATION NOTES**

- A) ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- B) CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STORMCEPTOR MANHOLE STRUCTURE.
- C) CONTRACTOR TO INSTALL JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLE STRUCTURE.
- D) CONTRACTOR TO PROVIDE, INSTALL, AND GROUT INLET AND OUTLET PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN. ALL PIPE CENTERLINES TO MATCH PIPE OPENING CENTERLINES.
- E) CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

**FRAME AND COVER (MAY VARY) NOT TO SCALE**

**FRAME AND GRATE (MAY VARY) NOT TO SCALE**

**SECTION A-A**

**Stormceptor®**

**CONTECH ENGINEERED SOLUTIONS LLC**

STC450I STORMCEPTOR STANDARD DETAIL

CB-1 - WATER QUALITY UNIT NTS

NO.	DATE	BY	DESCRIPTION	REVISIONS
1	12/20/23	ROM	ISSUED FOR PERMITTING	



# STORMTECH SC-740 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

## STORMTECH SC-740 CHAMBER (not to scale)

### Nominal Chamber Specifications

**Size (L x W x H)**  
85.4" x 51" x 30"  
2,170 mm x 1,295 mm x 762 mm

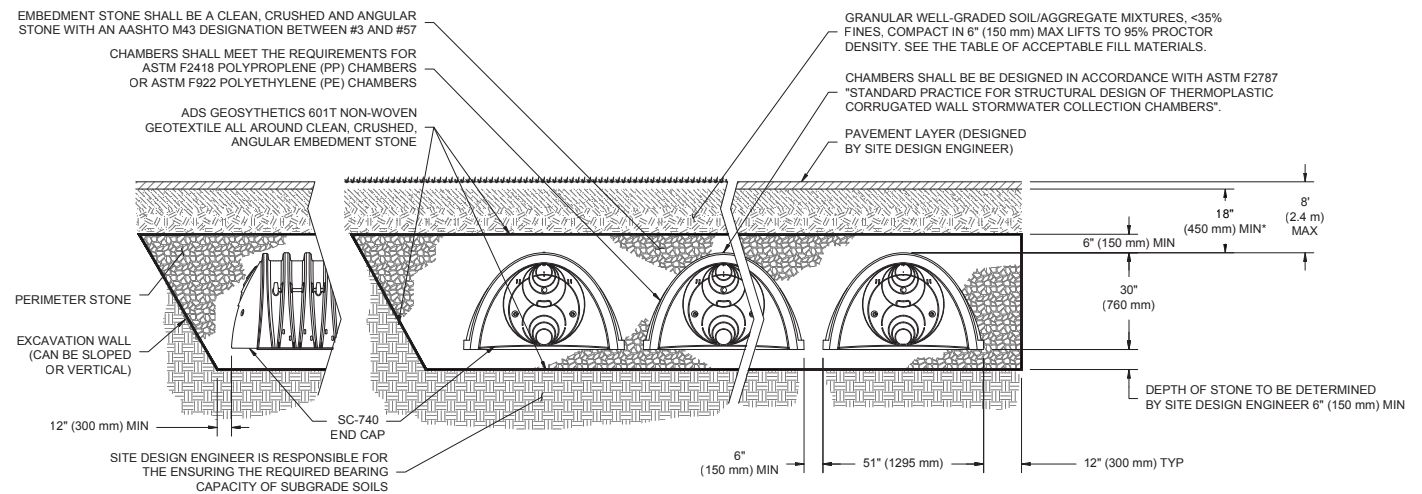
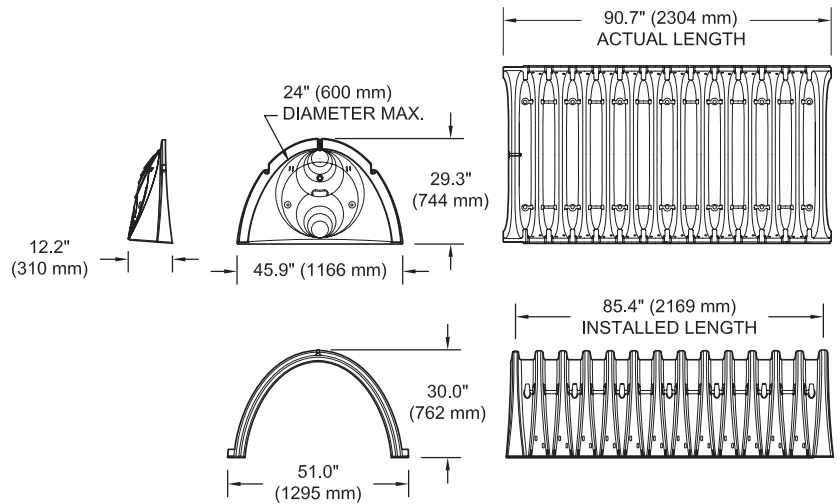
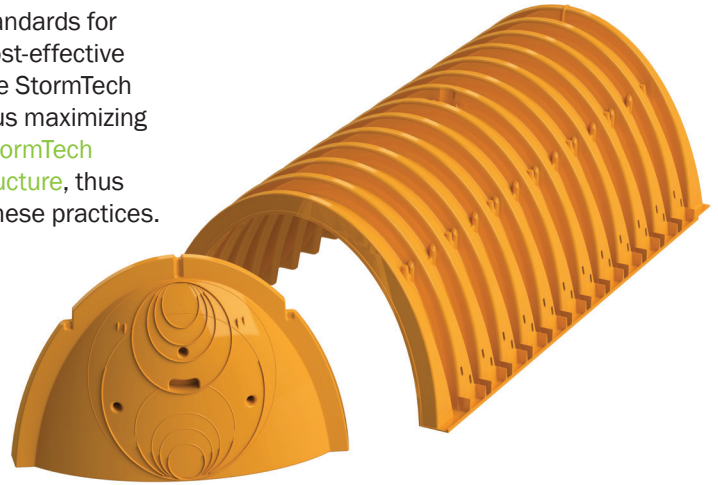
**Chamber Storage**  
45.9 ft<sup>3</sup> (1.30 m<sup>3</sup>)

**Min. Installed Storage\***  
74.9 ft<sup>3</sup> (2.12 m<sup>3</sup>)

**Weight**  
74.0 lbs (33.6 kg)

**Shipping**  
30 chambers/pallet  
60 end caps/pallet  
12 pallets/truck

\*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.



\*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

## SC-740 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft <sup>3</sup> (m <sup>3</sup> )	Total System Cumulative Storage ft <sup>3</sup> (m <sup>3</sup> )
42 (1067)	45.90 (1.300)	74.90 (2.121)
41 (1041)	45.90 (1.300)	73.77 (2.089)
40 (1016)	45.90 (1.300)	72.64 (2.057)
39 (991)	45.90 (1.300)	71.52 (2.025)
38 (965)	45.90 (1.300)	70.39 (1.993)
37 (940)	45.90 (1.300)	69.26 (1.961)
36 (914)	45.90 (1.300)	68.14 (1.929)
35 (889)	45.85 (1.298)	66.98 (1.897)
34 (864)	45.69 (1.294)	65.75 (1.862)
33 (838)	45.41 (1.286)	64.46 (1.825)
32 (813)	44.81 (1.269)	62.97 (1.783)
31 (787)	44.01 (1.246)	61.36 (1.737)
30 (762)	43.06 (1.219)	59.66 (1.689)
29 (737)	41.98 (1.189)	57.89 (1.639)
28 (711)	40.80 (1.155)	56.05 (1.587)
27 (686)	39.54 (1.120)	54.17 (1.534)
26 (660)	38.18 (1.081)	52.23 (1.479)
25 (635)	36.74 (1.040)	50.23 (1.422)
24 (610)	35.22 (0.977)	48.19 (1.365)
23 (584)	33.64 (0.953)	46.11 (1.306)
22 (559)	31.99 (0.906)	44.00 (1.246)
21 (533)	30.29 (0.858)	4.185 (1.185)
20 (508)	28.54 (0.808)	39.67 (1.123)
19 (483)	26.74 (0.757)	37.47 (1.061)
18 (457)	24.89 (0.705)	35.23 (0.997)
17 (432)	23.00 (0.651)	32.96 (0.939)
16 (406)	21.06 (0.596)	30.68 (0.869)
15 (381)	19.09 (0.541)	28.36 (0.803)
14 (356)	17.08 (0.484)	26.03 (0.737)
13 (330)	15.04 (0.426)	23.68 (0.670)
12 (305)	12.97 (0.367)	21.31 (0.608)
11 (279)	10.87 (0.309)	18.92 (0.535)
10 (254)	8.74 (0.247)	16.51 (0.468)
9 (229)	6.58 (0.186)	14.09 (0.399)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	0 (0)	6.76 (0.191)
5 (127)	0 (0)	5.63 (0.160)
4 (102)	0 (0)	4.51 (0.128)
3 (76)	0 (0)	3.38 (0.096)
2 (51)	0 (0)	2.25 (0.064)
1 (25)	0 (0)	1.13 (0.032)

Note: Add 1.13 ft<sup>3</sup> (0.032 m<sup>3</sup>) of storage for each additional inch (25 mm) of stone foundation.

## STORAGE VOLUME PER CHAMBER FT<sup>3</sup> (M<sup>3</sup>)

	Bare Chamber Storage ft <sup>3</sup> (m <sup>3</sup> )	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

## AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds <sup>3</sup> )	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m <sup>3</sup> )	150 mm	300 mm	450 mm
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

## VOLUME EXCAVATION PER CHAMBER YD<sup>3</sup> (M<sup>3</sup>)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.



Working on a project?  
Visit us at [www.stormtech.com](http://www.stormtech.com)  
and utilize the StormTech Design Tool

For more information on the StormTech SC-740 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™

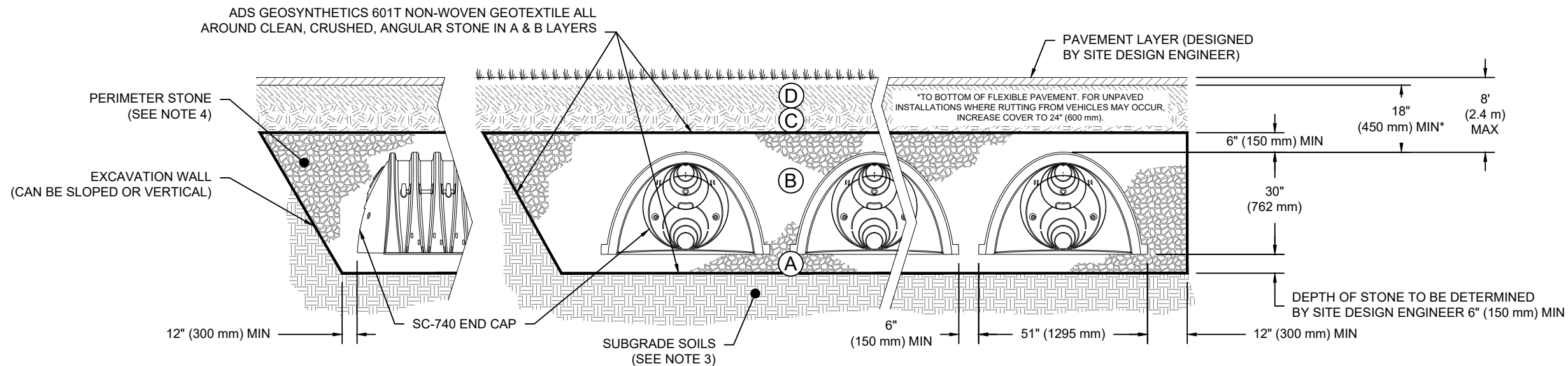
Advanced Drainage Systems, Inc.  
4640 Trueman Blvd., Hilliard, OH 43026  
1-800-821-6710 [www.ads-pipe.com](http://www.ads-pipe.com)

## ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	<b>FINAL FILL:</b> FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	<b>INITIAL FILL:</b> FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE.  MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145 <sup>1</sup> A-1, A-2-4, A-3  OR AASHTO M43 <sup>1</sup> 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	<b>EMBEDMENT STONE:</b> FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43 <sup>1</sup> 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	<b>FOUNDATION STONE:</b> FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43 <sup>1</sup> 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. <sup>2,3</sup>

**PLEASE NOTE:**

- THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
- STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
- WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
- ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



**NOTES:**

- CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
- PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
- REQUIREMENTS FOR HANDLING AND INSTALLATION:
  - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
  - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
  - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-740

STANDARD CROSS SECTION

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PROJECT #: \_\_\_\_\_

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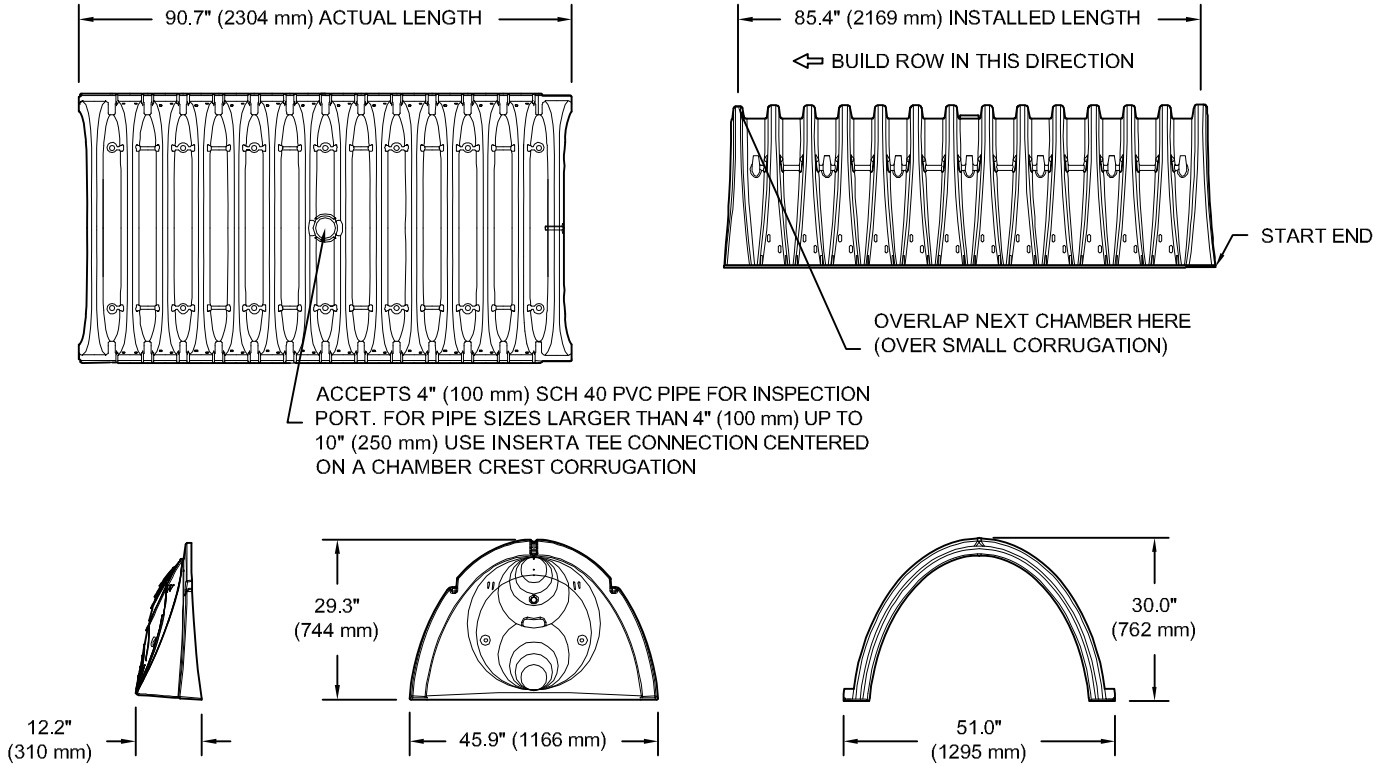
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# SC-740 TECHNICAL SPECIFICATION

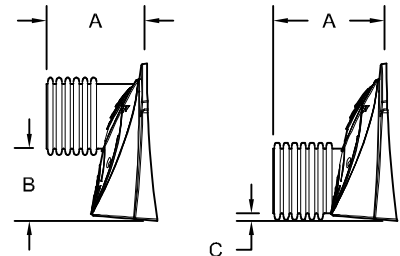
NTS



## NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m <sup>3</sup> )
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m <sup>3</sup> )
WEIGHT	75.0 lbs.	(33.6 kg)

\*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



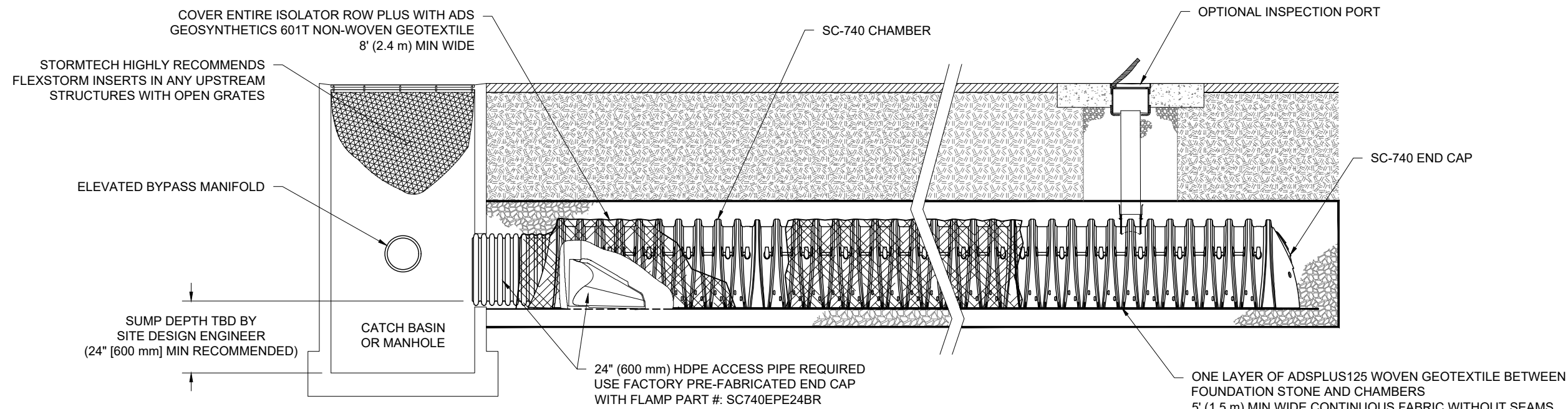
STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"  
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	—
SC740EPE06B / SC740EPE06BPC			—	0.5" (13 mm)
SC740EPE08T / SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	—
SC740EPE08B / SC740EPE08BPC			—	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	—
SC740EPE10B / SC740EPE10BPC			—	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	—
SC740EPE12B / SC740EPE12BPC			—	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	—
SC740EPE15B / SC740EPE15BPC			—	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	—
SC740EPE18B / SC740EPE18BPC			—	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	—	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

\* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL



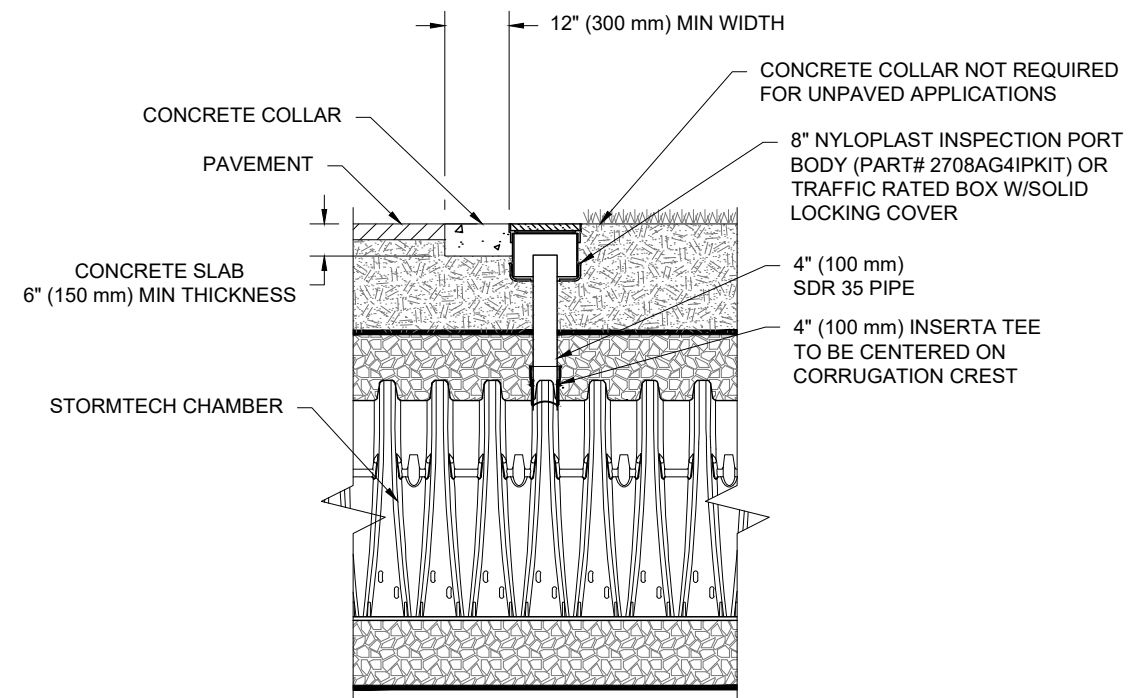
**SC-740 ISOLATOR ROW PLUS DETAIL**  
NTS

**INSPECTION & MAINTENANCE**

- STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
    - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
    - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
    - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
    - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
    - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
  - B. ALL ISOLATOR PLUS ROWS
    - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
    - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
      - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
      - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
    - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
  - B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
  - C. VACUUM STRUCTURE SUMP AS REQUIRED
- STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.
- STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

**NOTES**

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:  
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION CREST.

**4" PVC INSPECTION PORT DETAIL**  
**(SC SERIES CHAMBER)**  
NTS

<b>SC-740</b>	<b>ISOLATOR ROW PLUS DETAILS</b>	DATE: 08/26/20	DRAWN: ALI	CHECKED: ALI
		PROJECT #: ----		
		DATE		DESCRIPTION
		DRWN		CHKD
		DATE		DESCRIPTION

**StormTech**  
Advancing Stormwater Management

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ADVANCED DRAINAGE SYSTEMS, INC.

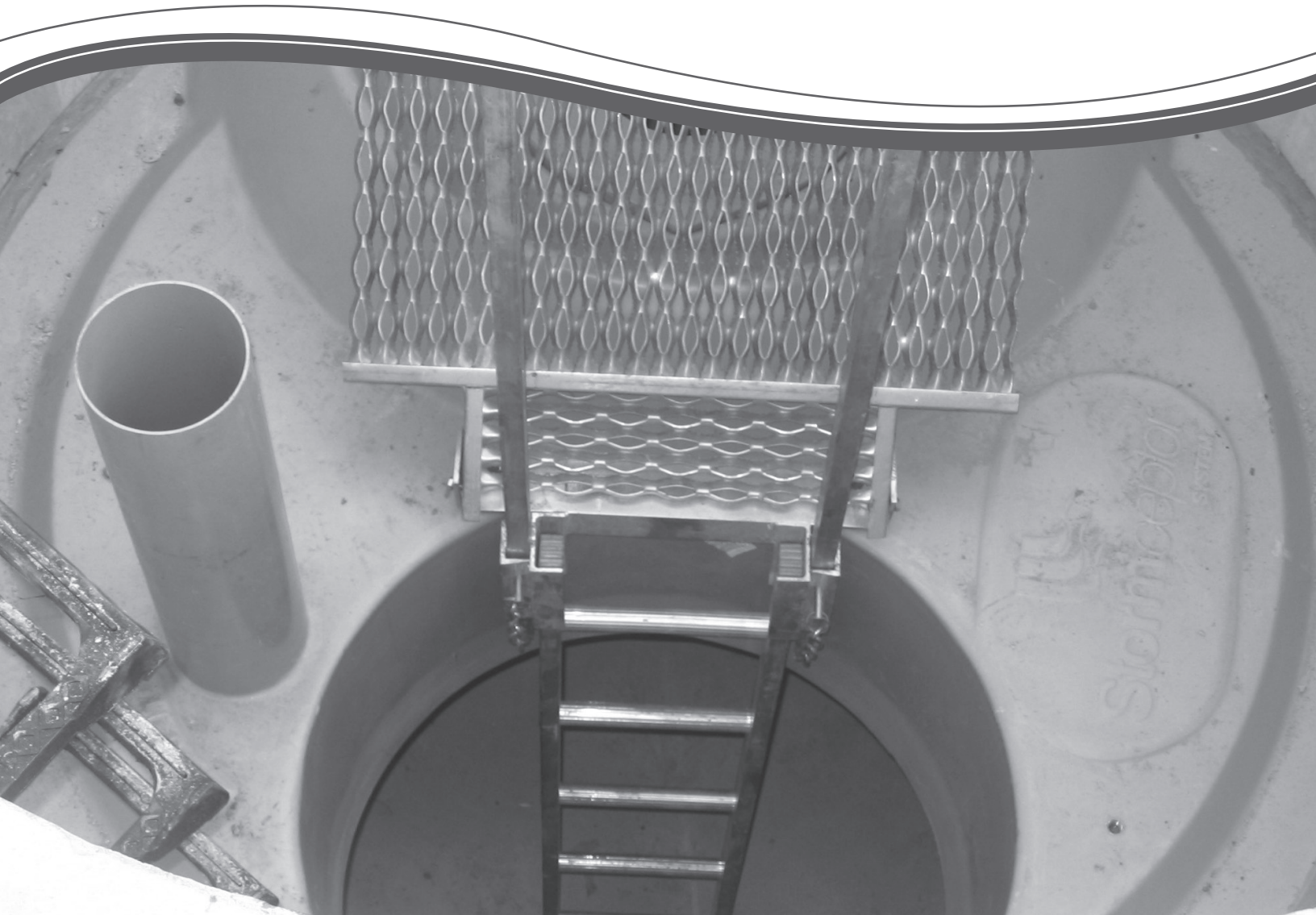
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1 SHEET

**1 OF 1**

**Stormceptor<sup>®</sup> STC**  
**Operation and Maintenance Guide**



## Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

### Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.

### Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
  - Top of grade elevation
  - Stormceptor inlet and outlet pipe diameters and invert elevations
  - Standing water elevation
  - Stormceptor head loss,  $K = 1.3$  (for submerged condition,  $K = 4$ )



## OPERATION AND MAINTENANCE GUIDE

### Table of Content

1. About Stormceptor .....	4
2. Stormceptor Design Overview .....	4
3. Key Operation Features .....	6
4. Stormceptor Product Line.....	7
5. Sizing the Stormceptor System.....	10
6. Spill Controls.....	12
7. Stormceptor Options.....	14
8. Comparing Technologies .....	17
9. Testing.....	18
10. Installation .....	18
11. Stormceptor Construction Sequence.....	18
12. Maintenance .....	19

# 1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

## 1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

# 2. Stormceptor Design Overview

## 2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

## 2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

## 2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

## 3. Key Operation Features

### 3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

### 3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{sc} = \frac{H}{\theta_H} = \frac{Q}{A_s}$$

Where:

$v_{sc}$  = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

$\theta_H$  = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft<sup>3</sup>/s (m<sup>3</sup>/s)

$A_s$  = surface area, ft<sup>2</sup> (m<sup>2</sup>)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

### 3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.



## 4. Stormceptor Product Line

### 4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

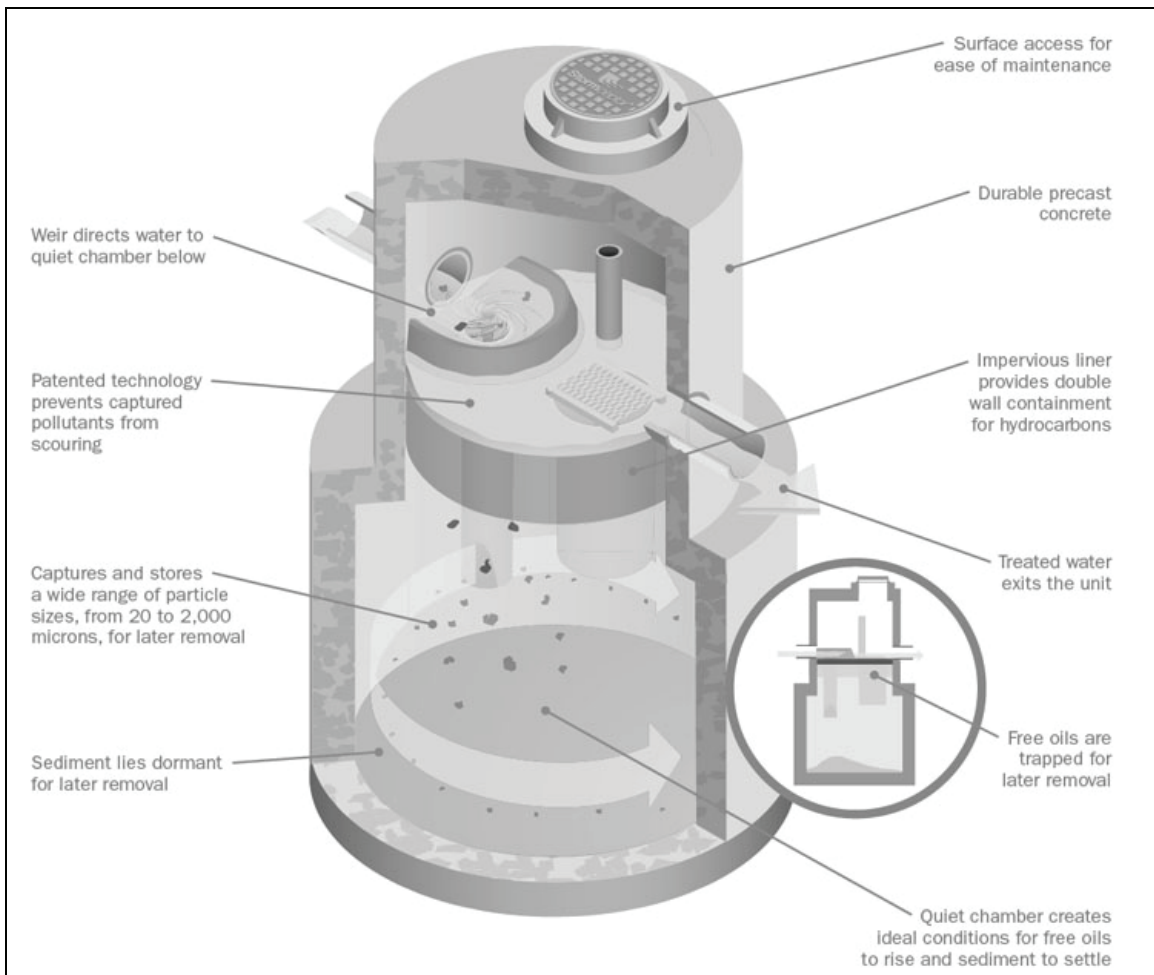
**Table 1. Stormceptor Models**

Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft <sup>3</sup> (L)
STC 450i	470 (1,780)	86 (330)	46 (1,302)
STC 900	952 (3,600)	251 (950)	89 (2,520)
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

### 4.2. Inline Stormceptor

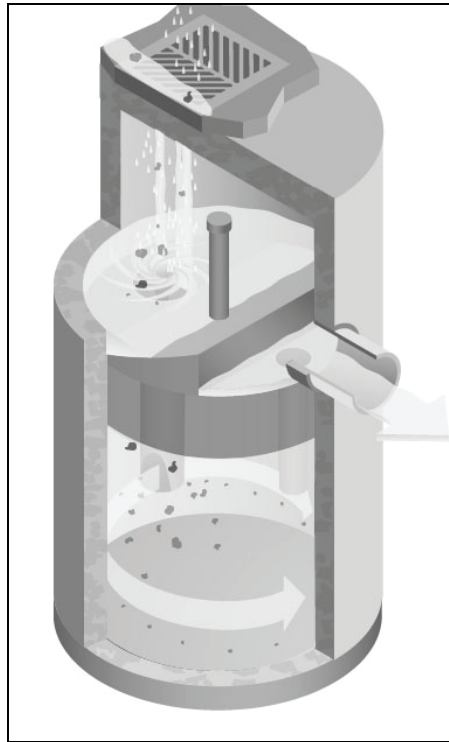
The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.



**Figure 1. Inline Stormceptor**

## Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.



**Figure 2. Inlet Stormceptor**

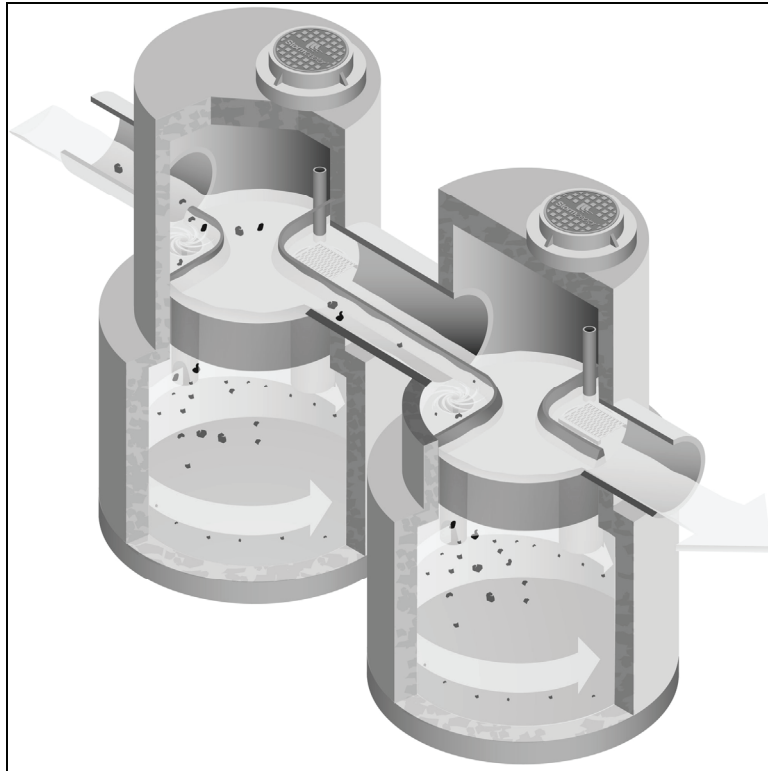
#### **4.3. Inlet Stormceptor**

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

#### **4.4. Series Stormceptor**

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.



**Figure 3. Series System**

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

## 5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

### STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

### STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

### STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

## STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

**Table 2. Fine Distribution**

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

## STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

## STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

## STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

## 5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
  - » The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
  - » The distribution of TSS with the hydrology is properly and accurately considered in the sizing
  - » Particle size distribution is properly considered in the sizing
  - » The sizing can be optimized for TSS removal
  - » The cost benefit of alternate TSS removal criteria can be easily assessed
  - » The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit [www.imbriumsystems.com](http://www.imbriumsystems.com) to download a free copy of the program.

## 5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

### Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

### Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

## 6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

### 6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

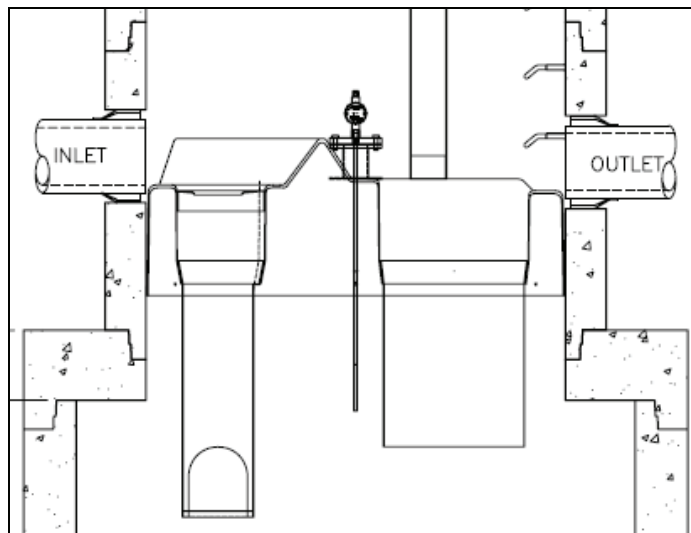


Figure 4. Oil level alarm

### 6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

## 7. Stormceptor Options

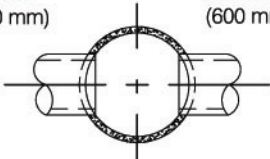
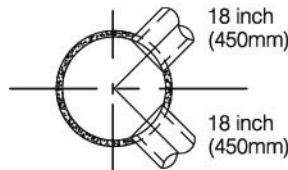
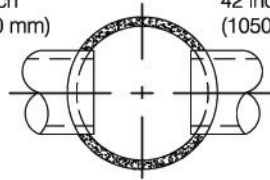
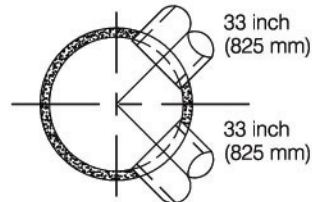
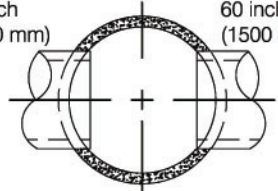
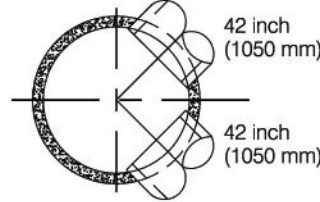
The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

### 7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

### 7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

Upper Chamber Diameter	Maximum Pipe Diameters for Straight Through and 90° Bends (Based on Concrete Pipe)	
Inlet Stormceptor	24 inch (600 mm)  24 inch (600 mm)	 18 inch (450mm) 18 inch (450mm)
Inline Stormceptor	42 inch (1050 mm)  42 inch (1050 mm)	 33 inch (825 mm) 33 inch (825 mm)
Inline Stormceptor or Series Stormceptor	60 inch (1500 mm)  60 inch (1500 mm)	 42 inch (1050 mm) 42 inch (1050 mm)

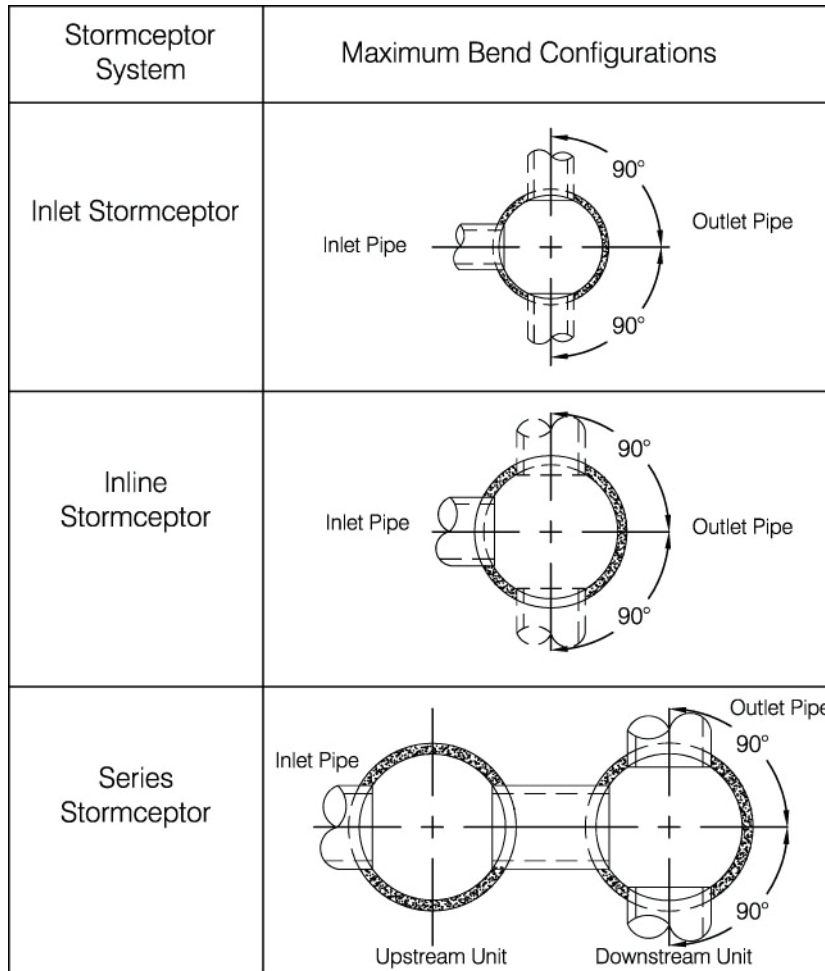
**Figure 5. Maximum pipe diameters for straight through and bend applications**

\*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

### 7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.





**Figure 6. Maximum bend angles**

#### 7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

#### 7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

**Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts**

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

#### 7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

#### 7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

## 7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life-cycle maintenance cost.

## 7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss =  $k \cdot 1.3v^2/2g$ ).

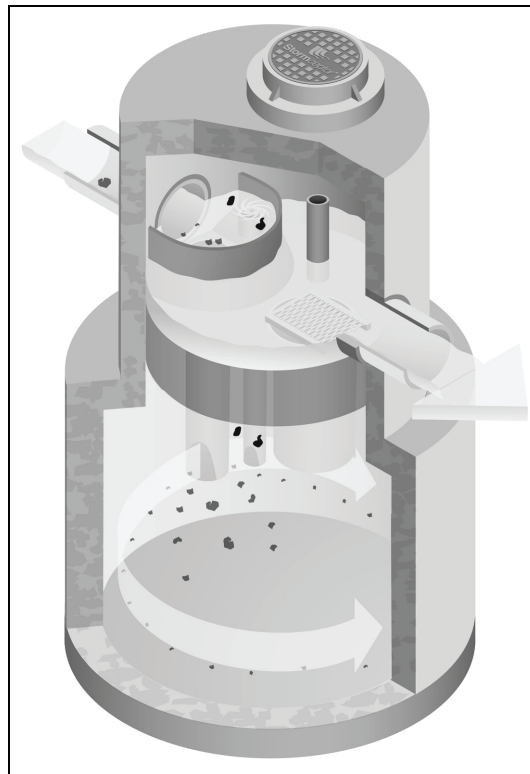
However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

## 7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation



**Figure 7. Submerged Stormceptor**

## 8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between “approved alternatives”. The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

### 8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

### 8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system’s performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product’s performance claims.

### 8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

### 8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system’s design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

## 9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

## 10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

### 10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

### 10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

## 11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate)
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

## 12. Maintenance

### 12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

### 12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

**Table 4. Sediment Depths Indicating Required Servicing\***

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

### 12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

### 12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

### 12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

### 12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.



## SUPPORT

Drawings and specifications are available at [www.ContechES.com](http://www.ContechES.com).

Site-specific design support is available from our engineers.

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