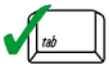
Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

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Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
  - ☐ Credit 1
  - ☐ Credit 2
  - ☐ Credit 3
- ☐ Use of “country drainage” versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☒ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☐ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☐ The ½" or 1" Water Quality Volume or
- ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☒ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☐ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Land Planning Inc.

Cultivate Parking Expansion
1762 Main St., Leicester, MA
Stormwater Management Standards Compliance

Standard 1: No New Untreated Discharges
Supporting Calculations

Riprap Sizing Calculations:

Riprap at detention outlet through retaining wall

100 yr flow per HydroCAD: 3.9 cfs
Pipe diameter = 15”
n=0.012
Depth of flow for 3.9 cfs = 7.05”
Discharge velocity = 6.88 ft/sec

Calculate shear stress on riprap:

$Td=YDS = (62.4\ lb/ft^3)(0.60\ ft)(0.015\ ft/ft) = 0.56\ lb/ft^2$

Calculate riprap size:

$D_{50}=Td/Kv = 0.56\ lb/ft^2/4 = 0.14\ ft = 1.5”$

Use 5”D_{50} riprap at detention discharge

Calculate apron length, depth, and end width:

Class	D_{50} (in)	Apron Length	Apron Depth
1	5	4D	$3.5D_{50}$
2	6	4D	$3.3D_{50}$
3	10	5D	$2.4D_{50}$
4	14	6D	$2.2D_{50}$
5	20	7D	$2.0D_{50}$
6	22	8D	$2.0D_{50}$

HEC 14, Table 10.1

214 Worcester Street, North Grafton, MA 01536 Phone: 508-839-9526 Fax: 508-839-9528
www.landplanninginc.com

Class = 1
D = 1.25 ft
D_{50} = 5 in

Length = 4D = (4)(1.25 ft) = 5 ft
Depth = $3.5D_{50}$ = (3.5)(5 in) = 17.5 in
End width = 3D+(2/3)L = (3)(1.25 ft)+(2/3)(5 ft) = 7.1 ft

Use 5"D_{50} riprap
Apron length = 5 ft minimum, 18 ft proposed
Apron end width = 7 ft minimum, 11 ft proposed
Apron depth = 18 in

Standard 2: Peak Rate Attenuation

The attached drainage analysis demonstrates that the proposed development will not result in an increase in peak discharge rates as compared to the existing site.

Standard 3: Recharge

Calculate required recharge volume:

Hydrologic Soil Type	F (Inches)	New Impervious Area (Acres)	Rv (ft^3)
A	0.60	0	0 ft^3
B	0.35	0	0 ft^3
C	0.25	0.175	159 ft^3
D	0.10	0	0 ft^3
Total Recharge Volume			**159 ft^3**

Calculate required recharge volume:

New impervious area = 0.175 acres
F=0.25 in for soils of hydrologic group C

Rv=(F)(Impervious area)
Rv=(0.25 in)(0.175 acres)(43,560 sf/acre)/12 in/ft = 159 ft^3

Determine recharge volume provided:

Recharge volume provided = Storage volume of infiltration system below outlet
Recharge volume = 168 ft^3 below DMH-1 outlet elev=1002.60

168 ft^3 > 159 ft^3 ∴ Recharge volume is adequate

Calculate infiltration system drawdown time:

Infiltration basin bottom area = (11.25 ft)(23.25 ft) = 262 ft^2
K=0.52 in/hr (sandy loam)

Dt=Rv/((K)(Bottom area))
Dt=168 ft^3/((0.52 in/hr)(1 ft/12 in)(262 ft^2)) = 14.8 hrs

14.8 hrs < 72 hrs ∴ Drawdown time is adequate

Cultivate Infiltration
Prepared by Land Planning, Inc.

Pond 4P: Infiltration - Chamber Wizard Field A

Chamber Model = Cultec R-150XLHD (Cultec Recharger® 150XLHD)
Effective Size= 29.8"W x 18.0"H => 2.65 sf x 10.25'L = 27.2 cf
Overall Size= 33.0"W x 18.5"H x 11.00'L with 0.75' Overlap
Row Length Adjustment= +0.75' x 2.65 sf x 3 rows

33.0" Wide + 6.0" Spacing = 39.0" C-C Row Spacing

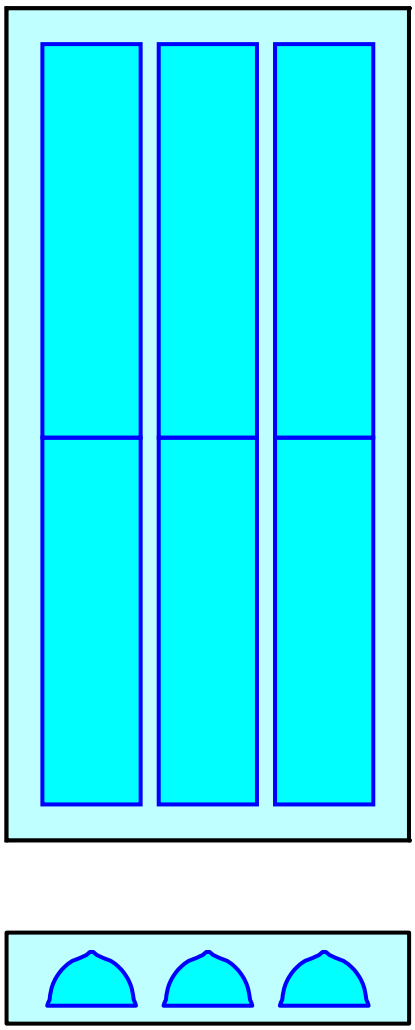
2 Chambers/Row x 10.25' Long +0.75' Row Adjustment = 21.25' Row Length +12.0" End Stone x 2 = 23.25' Base Length
3 Rows x 33.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 11.25' Base Width
6.0" Base + 18.5" Chamber Height + 6.0" Cover = 2.54' Field Height

6 Chambers x 27.2 cf +0.75' Row Adjustment x 2.65 sf x 3 Rows = 168.9 cf Chamber Storage

664.8 cf Field - 168.9 cf Chambers = 495.9 cf Stone x 40.0% Voids = 198.4 cf Stone Storage

Chamber Storage + Stone Storage = 367.2 cf = 0.008 af
Overall Storage Efficiency = 55.2%
Overall System Size = 23.25' x 11.25' x 2.54'

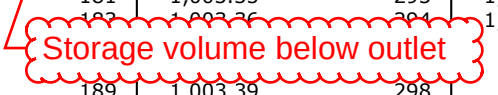
6 Chambers
24.6 cy Field
18.4 cy Stone



Cultivate Infiltration
Prepared by Land Planning, Inc.

Stage-Area-Storage for Pond 4P: Infiltration

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
1,001.50	0	1,002.18	88	1,002.86	216	1,003.54	315
1,001.51	1	1,002.19	90	1,002.87	217	1,003.55	316
1,001.52	2	1,002.20	92	1,002.88	219	1,003.56	317
1,001.53	3	1,002.21	94	1,002.89	221	1,003.57	318
1,001.54	4	1,002.22	96	1,002.90	223	1,003.58	319
1,001.55	5	1,002.23	97	1,002.91	224	1,003.59	320
1,001.56	6	1,002.24	99	1,002.92	226	1,003.60	321
1,001.57	7	1,002.25	101	1,002.93	228	1,003.61	322
1,001.58	8	1,002.26	103	1,002.94	230	1,003.62	323
1,001.59	9	1,002.27	105	1,002.95	231	1,003.63	324
1,001.60	10	1,002.28	107	1,002.96	233	1,003.64	325
1,001.61	12	1,002.29	109	1,002.97	235	1,003.65	326
1,001.62	13	1,002.30	111	1,002.98	237	1,003.66	327
1,001.63	14	1,002.31	113	1,002.99	238	1,003.67	328
1,001.64	15	1,002.32	115	1,003.00	240	1,003.68	329
1,001.65	16	1,002.33	117	1,003.01	242	1,003.69	330
1,001.66	17	1,002.34	119	1,003.02	243	1,003.70	331
1,001.67	18	1,002.35	121	1,003.03	245	1,003.71	333
1,001.68	19	1,002.36	123	1,003.04	247	1,003.72	334
1,001.69	20	1,002.37	125	1,003.05	248	1,003.73	335
1,001.70	21	1,002.38	126	1,003.06	250	1,003.74	336
1,001.71	22	1,002.39	128	1,003.07	252	1,003.75	337
1,001.72	23	1,002.40	130	1,003.08	253	1,003.76	338
1,001.73	24	1,002.41	132	1,003.09	255	1,003.77	339
1,001.74	25	1,002.42	134	1,003.10	256	1,003.78	340
1,001.75	26	1,002.43	136	1,003.11	258	1,003.79	341
1,001.76	27	1,002.44	138	1,003.12	260	1,003.80	342
1,001.77	28	1,002.45	140	1,003.13	261	1,003.81	343
1,001.78	29	1,002.46	142	1,003.14	263	1,003.82	344
1,001.79	30	1,002.47	144	1,003.15	264	1,003.83	345
1,001.80	31	1,002.48	146	1,003.16	266	1,003.84	346
1,001.81	32	1,002.49	147	1,003.17	268	1,003.85	347
1,001.82	33	1,002.50	149	1,003.18	269	1,003.86	348
1,001.83	35	1,002.51	151	1,003.19	271	1,003.87	349
1,001.84	36	1,002.52	153	1,003.20	272	1,003.88	350
1,001.85	37	1,002.53	155	1,003.21	274	1,003.89	351
1,001.86	38	1,002.54	157	1,003.22	275	1,003.90	352
1,001.87	39	1,002.55	159	1,003.23	277	1,003.91	353
1,001.88	40	1,002.56	161	1,003.24	278	1,003.92	355
1,001.89	41	1,002.57	163	1,003.25	280	1,003.93	356
1,001.90	42	1,002.58	164	1,003.26	281	1,003.94	357
1,001.91	43	1,002.59	166	1,003.27	282	1,003.95	358
1,001.92	44	1,002.60	168	1,003.28	284	1,003.96	359
1,001.93	45	1,002.61	170	1,003.29	285	1,003.97	360
1,001.94	46	1,002.62	172	1,003.30	287	1,003.98	361
1,001.95	47	1,002.63	174	1,003.31	288	1,003.99	362
1,001.96	48	1,002.64	176	1,003.32	289	1,004.00	363
1,001.97	49	1,002.65	178	1,003.33	291	1,004.01	364
1,001.98	50	1,002.66	179	1,003.34	292	1,004.02	365
1,001.99	51	1,002.67	181	1,003.35	293	1,004.03	366
1,002.00	52	1,002.68	[illegible]	[illegible]	[illegible]	1,004.04	**367**
1,002.01	54	1,002.69	[illegible]	[illegible]	[illegible]		
1,002.02	56	1,002.70	[illegible]	[illegible]	[illegible]		
1,002.03	58	1,002.71	189	1,003.39	298		
1,002.04	60	1,002.72	190	1,003.40	299		
1,002.05	62	1,002.73	192	1,003.41	300		
1,002.06	64	1,002.74	194	1,003.42	302		
1,002.07	66	1,002.75	196	1,003.43	303		
1,002.08	68	1,002.76	198	1,003.44	304		
1,002.09	70	1,002.77	200	1,003.45	305		
1,002.10	72	1,002.78	201	1,003.46	306		
1,002.11	74	1,002.79	203	1,003.47	307		
1,002.12	76	1,002.80	205	1,003.48	308		
1,002.13	78	1,002.81	207	1,003.49	309		
1,002.14	80	1,002.82	209	1,003.50	311		
1,002.15	82	1,002.83	210	1,003.51	312		
1,002.16	84	1,002.84	212	1,003.52	313		
1,002.17	86	1,002.85	214	1,003.53	314		



Standard 4: Water Quality

Water Quality Treatment Volume:

Calculate required water quality treatment volume:

A_{imp} (New Impervious area) = 0.175 acres
D_{wq} (Water quality depth) = 0.50”

$V_{wq}=(Dwq/12\ in/ft)(A_{imp})$
$V_{wq}=(0.50\ in/12\ in/ft)(0.175\ acres)(43{,}560\ ft^2/ac) = 318\ ft^3$ required

While the required volume applies to the new impervious area only, the treatment system will be sized to include the impervious areas on the adjacent Cultivate site that are tributary to the proposed system. The water quality volume to be treated is:

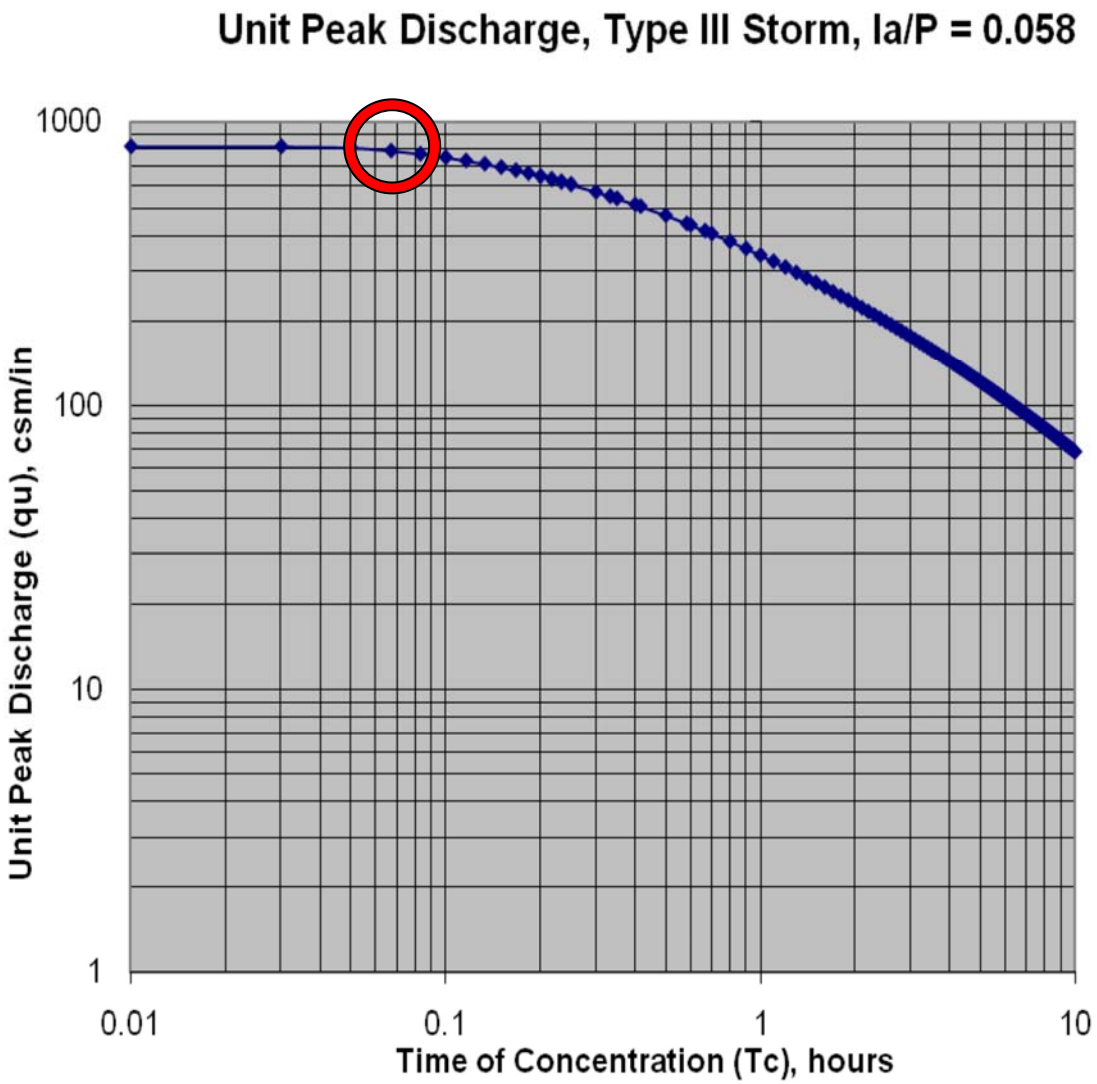
A_{imp} (Total Impervious area) = 0.385 acres
D_{wq} (Water quality depth) = 0.50”

$V_{wq}=(Dwq/12\ in/ft)(A_{imp})$
$V_{wq}=(0.50\ in/12\ in/ft)(0.385\ acres)(43{,}560\ ft^2/ac) = 698\ ft^3$

Determine water quality treatment volume provided:

The stormwater management system will include a StormCeptor STC 450i as the primary means of TSS removal. Therefore, the water quality treatment volume was converted to a discharge rate per the method described within DEP’s “*Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices”.*

Tc from HydroCAD = 4.6 min
qu = see chart below



qu = 775 csm/in @ Tc = 0.077 hours

$Q_{0.5}$ = (qu)(A)(WQV)
$Q_{0.5}$ = (775)(0.385/640)(0.5) = 0.2 cfs

The calculated treatment rate (0.2 cfs), the watershed area (0.63 acres), and percent impervious (61%) values were entered into the online calculator for Stormceptor sizing. The TSS removal rate at the required treatment rate is summarized within the attached report.

TSS Removal Requirements:

Location: **Stormwater Discharge at Retaining Wall**

TSS Removal Calculation Worksheet

B BMP	C TSS Removal Rate	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Stormceptor STC450i	86%	1.00	0.86	0.14

Total TSS Removal = **86%**

Project: **Main Street, Leicester**

Prepared By: MG

Date: 4/4/19

*Equals remaining load from previous BMP € which enters the BMP

Note: Additional treatment can be expected at the infiltration system and the detention system. However, this additional treatment is excluded in demonstrating compliance with Stormwater Management Standard 4

Brief Stormceptor Sizing Report - Cultivate

Project Information & Location			
Project Name	Parking Expansion	**Project Number**	G9370
City	Leicester	**State/ Province**	Massachusetts
Country	United States of America	**Date**	4/4/2019
Designer Information		**EOR Information (optional)**	
Name	Norman Hill	**Name**	
Company	Land Planning, Inc	**Company**	
Phone #	508-839-9526	**Phone #**	
Email	mainoffice@landplanninginc.com	**Email**	

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.

Site Name	Cultivate
Target TSS Removal (%)	80
TSS Removal (%) Provided	86
Recommended Stormceptor Model	STC 450i

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	86
STC 900	91
STC 1200	91
STC 1800	92
STC 2400	94
STC 3600	94
STC 4800	95
STC 6000	96
STC 7200	96
STC 11000	98
STC 13000	98
STC 16000	98
StormceptorMAX	Custom

Sizing Details

Drainage Area	
Total Area (acres)	0.63
Imperviousness %	61.0

Rainfall	
Station Name	WORCESTER WSO AP
State/Province	Massachusetts
Station ID #	9923
Years of Records	58
Latitude	42°16'2"N
Longitude	71°52'34"W

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)	0.20

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

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

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

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

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.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Standard 5: Land Uses with Higher Potential Pollutant Loads

The existing and proposed use of the property is not classified as a Land Use with Higher Potential Pollutant Loads (LUHPPL). This standard is not applicable to this site.

Standard 6: Critical Areas

The project is not located within a Critical Area. This standard is not applicable to the project.

Standard 7: Redevelopment Project

The proposed parking lot at 1762 Main Street will serve the adjacent Cultivate facility located at 1764 Main Street. 1762 Main Street will remain under separate ownership and is not to be combined with the 1764 Main Street property. This project is entirely new construction and does not qualify as redevelopment of the 1764 Main Street property. This standard is not applicable to this site.

Standard 8: Construction Period Pollution Prevention and Erosion Control

See attached report.

Standard 9: Operation and Maintenance Plan

See attached report.

Standard 10: Prohibition of Illicit Discharges
Illicit Discharge Compliance Statement

Per the requirements of Standard 10 of the Stormwater Management Standards, the property has been inspected for the presence of illicit discharges. It has been determined that no illicit discharges exist on the property located at 1762 Main Street, Leicester, MA.

The developer, contractor, and property owner shall continue to be responsible for the prevention, detection, and elimination of illicit discharges.

Land Planning, Inc.

Norman G. Hill, P.E.
President

Drainage Analysis

Located at
1762 Main St
Leicester, MA

By
Land Planning, Inc.
214 Worcester St
N. Grafton, MA 01536

April 12, 2019

1.0 INTRODUCTION

Land Planning Inc. has evaluated the hydrologic impacts for the proposed parking lot to be located at 1762 Main Street, Leicester. Included in this report is the proposed method to mitigate any additional runoff from the proposed conditions of this project. The supporting hydrologic calculations are at the end of this report.

2.0 EXISTING CONDITIONS

The project site is a 0.93-acre property located at 1762 Main Street in Leicester, Massachusetts. The site is currently developed for residential use and consists of a single-family home, detached garage, lawn, and woodland. The rear third of the property is bordering vegetated wetland. The site generally slopes downward northeasterly from Main Street to the wetland within the easterly third of the property.

The soils located within the analysis are a Paxton fine sandy loam. Paxton soil is classified as a hydrologic group C soil (see attached NRCS soil report).

3.0 PROPOSED CONDITIONS

The existing house and garage will be razed. The existing well is to be abandoned, and the existing utilities serving the lot will be disconnected. A 24-space parking lot will be constructed with access from the driveway at 1764 Main Street (Cultivate).

A stormwater management system will be constructed to treat stormwater runoff. The system includes a Stormceptor STC 450i inlet to collect the surface runoof, an off-line subsurface chamber infiltration system to recharge groundwater, and a subsurface pipe detention system to attenuate flow rates. The detention outflow will discharge through the retaining wall onto a riprap apron.

4.0 DESIGN CRITERIA AND METHODOLOGY

4.1 Hydrologic Model

Used in the preparation of this hydrologic model were the following:
Soil Conservation Service (SCS) Technical Release 55 (for Times of Concentration and Curve Numbers); USDA Web Soil Survey; Topographic Survey completed by Land Planning, Inc., and HydroCAD software. This report was prepared in accordance with the requirements of Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook.

4.2 Design Storms and Rainfall Depth

The drainage system was analyzed for the 2, 10, 25, and 100-year storms to determine the increase in runoff for the site. The following are the rainfall intensities used for each storm event (NOAA Atlas 14 data attached):

Storm Events	
Storm Event	**24 Hour Rainfall (Inches)**
2 year	3.13
10 year	4.86
100 year	7.61

Table 1

5.0 SUMMARY:

Summary of Peak Flows					
2 Year		**10 Year**		**100 Year**	
Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
1.5 cfs	1.5 cfs	3.3 cfs	3.1 cfs	6.3 cfs	5.9 cfs

6.0 CONCLUSION:

The stormwater management system, as designed, will provide for runoff rates that are at or below predevelopment levels. The proposed stormwater management system meets the objectives and requirements of Stormwater Management Standard 2.

NOAA Atlas 14, Volume 10, Version 2
Location name: Leicester, Massachusetts, USA*
Latitude: 42.2518°, Longitude: -71.9463°
Elevation: 1004.13 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.341** (0.271-0.421)	**0.400** (0.318-0.495)	**0.496** (0.393-0.617)	**0.576** (0.454-0.721)	**0.686** (0.521-0.901)	**0.771** (0.571-1.04)	**0.856** (0.613-1.20)	**0.954** (0.647-1.38)	**1.08** (0.705-1.63)	**1.18** (0.748-1.83)
10-min	**0.483** (0.384-0.597)	**0.566** (0.450-0.701)	**0.703** (0.557-0.874)	**0.816** (0.643-1.02)	**0.972** (0.738-1.28)	**1.09** (0.810-1.47)	**1.21** (0.868-1.70)	**1.35** (0.917-1.96)	**1.54** (0.999-2.31)	**1.68** (1.06-2.59)
15-min	**0.568** (0.452-0.702)	**0.666** (0.530-0.825)	**0.827** (0.655-1.03)	**0.960** (0.756-1.20)	**1.14** (0.868-1.50)	**1.29** (0.952-1.73)	**1.43** (1.02-2.00)	**1.59** (1.08-2.30)	**1.81** (1.18-2.72)	**1.97** (1.25-3.04)
30-min	**0.771** (0.614-0.953)	**0.905** (0.720-1.12)	**1.12** (0.891-1.40)	**1.31** (1.03-1.63)	**1.56** (1.18-2.04)	**1.75** (1.30-2.35)	**1.94** (1.39-2.72)	**2.17** (1.47-3.13)	**2.46** (1.60-3.71)	**2.68** (1.70-4.14)
60-min	**0.974** (0.776-1.21)	**1.14** (0.910-1.42)	**1.42** (1.13-1.77)	**1.65** (1.30-2.07)	**1.97** (1.49-2.58)	**2.21** (1.64-2.97)	**2.46** (1.76-3.44)	**2.74** (1.86-3.96)	**3.11** (2.02-4.69)	**3.40** (2.15-5.24)
2-hr	**1.24** (0.994-1.52)	**1.46** (1.17-1.80)	**1.83** (1.46-2.26)	**2.13** (1.69-2.65)	**2.55** (1.95-3.33)	**2.87** (2.15-3.85)	**3.19** (2.31-4.48)	**3.62** (2.46-5.21)	**4.19** (2.73-6.27)	**4.62** (2.93-7.08)
3-hr	**1.42** (1.14-1.73)	**1.68** (1.35-2.06)	**2.11** (1.69-2.60)	**2.47** (1.96-3.06)	**2.96** (2.28-3.87)	**3.34** (2.51-4.48)	**3.72** (2.71-5.23)	**4.25** (2.90-6.10)	**4.96** (3.24-7.41)	**5.50** (3.50-8.40)
6-hr	**1.76** (1.43-2.14)	**2.11** (1.71-2.57)	**2.69** (2.17-3.28)	**3.16** (2.54-3.89)	**3.82** (2.96-4.97)	**4.33** (3.28-5.79)	**4.83** (3.55-6.78)	**5.58** (3.82-7.96)	**6.57** (4.30-9.75)	**7.32** (4.67-11.1)
12-hr	**2.15** (1.76-2.60)	**2.62** (2.13-3.16)	**3.37** (2.74-4.10)	**4.00** (3.23-4.89)	**4.87** (3.79-6.30)	**5.54** (4.22-7.36)	**6.21** (4.59-8.66)	**7.19** (4.94-10.2)	**8.50** (5.59-12.5)	**9.49** (6.07-14.3)
24-hr	**2.55** (2.10-3.06)	**3.13** (2.57-3.76)	**4.08** (3.33-4.92)	**4.86** (3.95-5.91)	**5.95** (4.66-7.65)	**6.78** (5.20-8.96)	**7.61** (5.66-10.6)	**8.86** (6.11-12.5)	**10.5** (6.92-15.4)	**11.7** (7.53-17.6)
2-day	**2.94** (2.44-3.50)	**3.62** (2.99-4.32)	**4.73** (3.90-5.67)	**5.66** (4.62-6.82)	**6.93** (5.46-8.85)	**7.91** (6.10-10.4)	**8.88** (6.65-12.3)	**10.4** (7.18-14.5)	**12.3** (8.16-18.0)	**13.8** (8.90-20.6)
3-day	**3.21** (2.67-3.81)	**3.95** (3.28-4.69)	**5.15** (4.26-6.15)	**6.15** (5.05-7.39)	**7.53** (5.96-9.59)	**8.59** (6.65-11.2)	**9.65** (7.25-13.3)	**11.3** (7.82-15.7)	**13.4** (8.89-19.5)	**15.0** (9.70-22.3)
4-day	**3.45** (2.87-4.08)	**4.22** (3.52-5.00)	**5.50** (4.56-6.54)	**6.55** (5.39-7.84)	**8.00** (6.35-10.2)	**9.12** (7.08-11.9)	**10.2** (7.71-14.1)	**12.0** (8.31-16.6)	**14.2** (9.44-20.6)	**15.9** (10.3-23.6)
7-day	**4.11** (3.45-4.84)	**4.97** (4.16-5.85)	**6.37** (5.31-7.53)	**7.53** (6.24-8.97)	**9.13** (7.28-11.5)	**10.4** (8.07-13.4)	**11.6** (8.74-15.8)	**13.4** (9.38-18.6)	**15.9** (10.6-22.8)	**17.7** (11.5-26.1)
10-day	**4.78** (4.02-5.60)	**5.68** (4.77-6.66)	**7.15** (5.98-8.42)	**8.37** (6.95-9.93)	**10.1** (8.03-12.6)	**11.3** (8.85-14.6)	**12.6** (9.52-17.0)	**14.5** (10.1-19.9)	**16.9** (11.3-24.3)	**18.8** (12.2-27.5)
20-day	**6.84** (5.80-7.97)	**7.80** (6.60-9.09)	**9.36** (7.89-11.0)	**10.7** (8.91-12.6)	**12.4** (9.98-15.4)	**13.8** (10.8-17.5)	**15.2** (11.4-20.0)	**16.8** (11.9-22.9)	**19.0** (12.7-27.0)	**20.6** (13.4-30.0)
30-day	**8.58** (7.30-9.95)	**9.57** (8.13-11.1)	**11.2** (9.45-13.0)	**12.5** (10.5-14.7)	**14.3** (11.5-17.6)	**15.8** (12.3-19.7)	**17.2** (12.8-22.3)	**18.6** (13.2-25.2)	**20.5** (13.8-28.9)	**21.9** (14.3-31.8)
45-day	**10.7** (9.18-12.4)	**11.8** (10.0-13.6)	**13.4** (11.4-15.6)	**14.8** (12.5-17.3)	**16.7** (13.5-20.3)	**18.2** (14.2-22.6)	**19.6** (14.6-25.2)	**20.8** (14.8-28.1)	**22.5** (15.2-31.6)	**23.7** (15.5-34.2)
60-day	**12.5** (10.8-14.4)	**13.6** (11.6-15.7)	**15.3** (13.0-17.7)	**16.7** (14.1-19.5)	**18.7** (15.1-22.6)	**20.2** (15.8-24.9)	**21.7** (16.2-27.7)	**22.8** (16.2-30.7)	**24.3** (16.4-34.0)	**25.4** (16.6-36.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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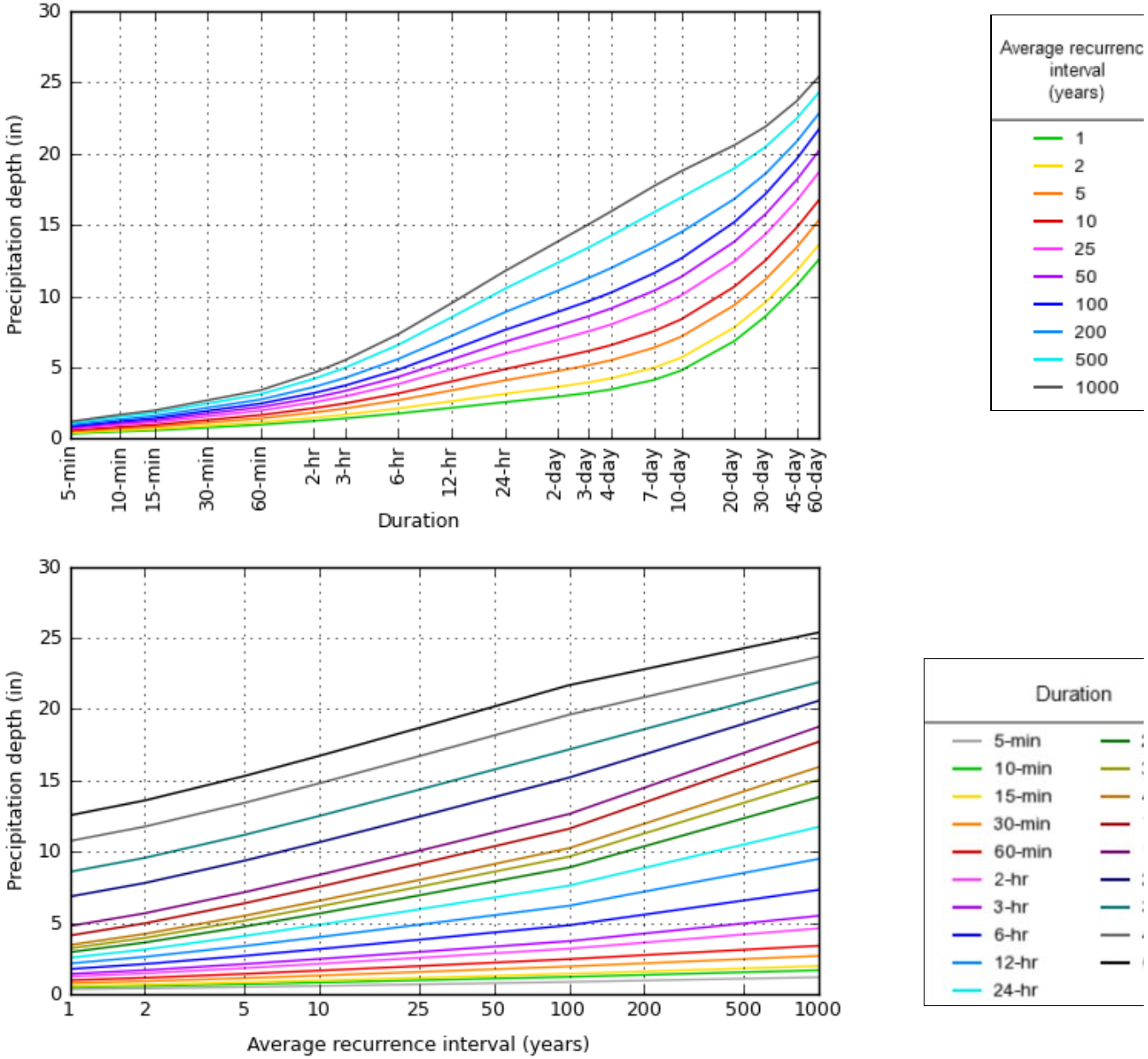
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.2518°, Longitude: -71.9463°



NOAA Atlas 14, Volume 10, Version 2

Created (GMT): Wed Apr 3 13:50:04 2019

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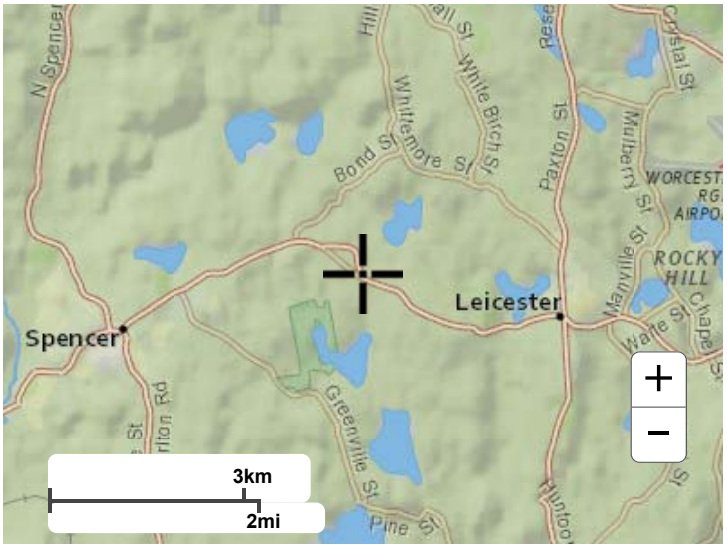
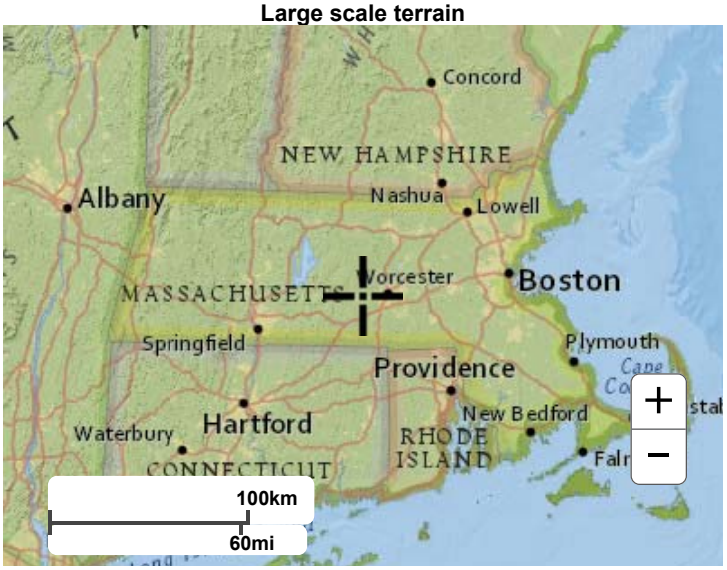
Maps & aerials

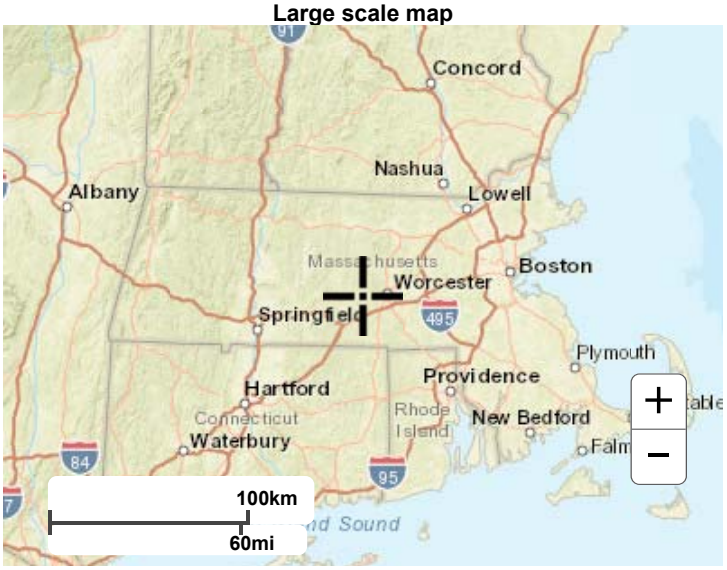
Small scale terrain



Large scale terrain

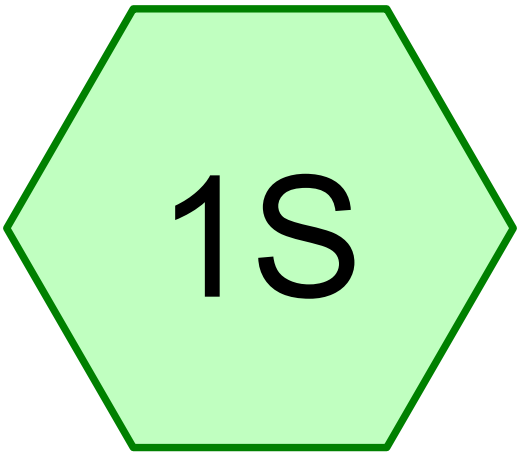


Large scale map



Large scale aerial

Predevelopment Drainage Analysis



Pre

Subcat Reach Pond Link

Routing Diagram for Cultivate Pre
Prepared by Land Planning, Inc., Printed 4/10/2019

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre Runoff Area=45,619 sf 19.98% Impervious Runoff Depth>1.22"
Flow Length=177' Tc=5.3 min CN=78 Runoff=1.5 cfs 0.107 af

Total Runoff Area = 1.047 ac Runoff Volume = 0.107 af Average Runoff Depth = 1.22"
80.02% Pervious = 0.838 ac 19.98% Impervious = 0.209 ac

Cultivate Pre
Prepared by Land Planning, Inc.

Summary for Subcatchment 1S: Pre

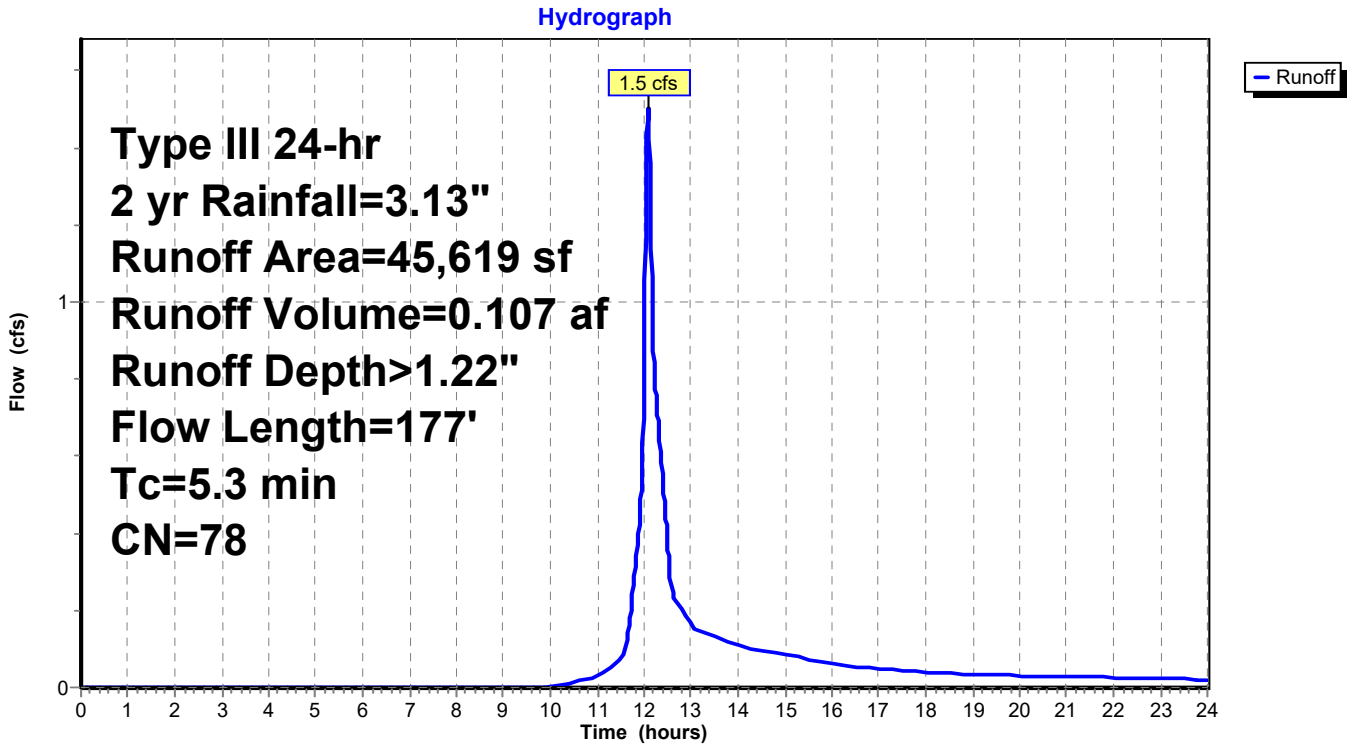
Runoff = 1.5 cfs @ 12.08 hrs, Volume= 0.107 af, Depth> 1.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.13"

Area (sf)	CN	Description
9,116	98	Paved parking, HSG C
2,235	96	Gravel surface, HSG C
17,476	74	>75% Grass cover, Good, HSG C
16,792	70	Woods, Good, HSG C
45,619	78	Weighted Average
36,503		80.02% Pervious Area
9,116		19.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.7	75	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	52	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.3	177	Total			

Subcatchment 1S: Pre



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre Runoff Area=45,619 sf 19.98% Impervious Runoff Depth>2.59"
Flow Length=177' Tc=5.3 min CN=78 Runoff=3.3 cfs 0.226 af

Total Runoff Area = 1.047 ac Runoff Volume = 0.226 af Average Runoff Depth = 2.59"
80.02% Pervious = 0.838 ac 19.98% Impervious = 0.209 ac

Cultivate Pre
Prepared by Land Planning, Inc.

Summary for Subcatchment 1S: Pre

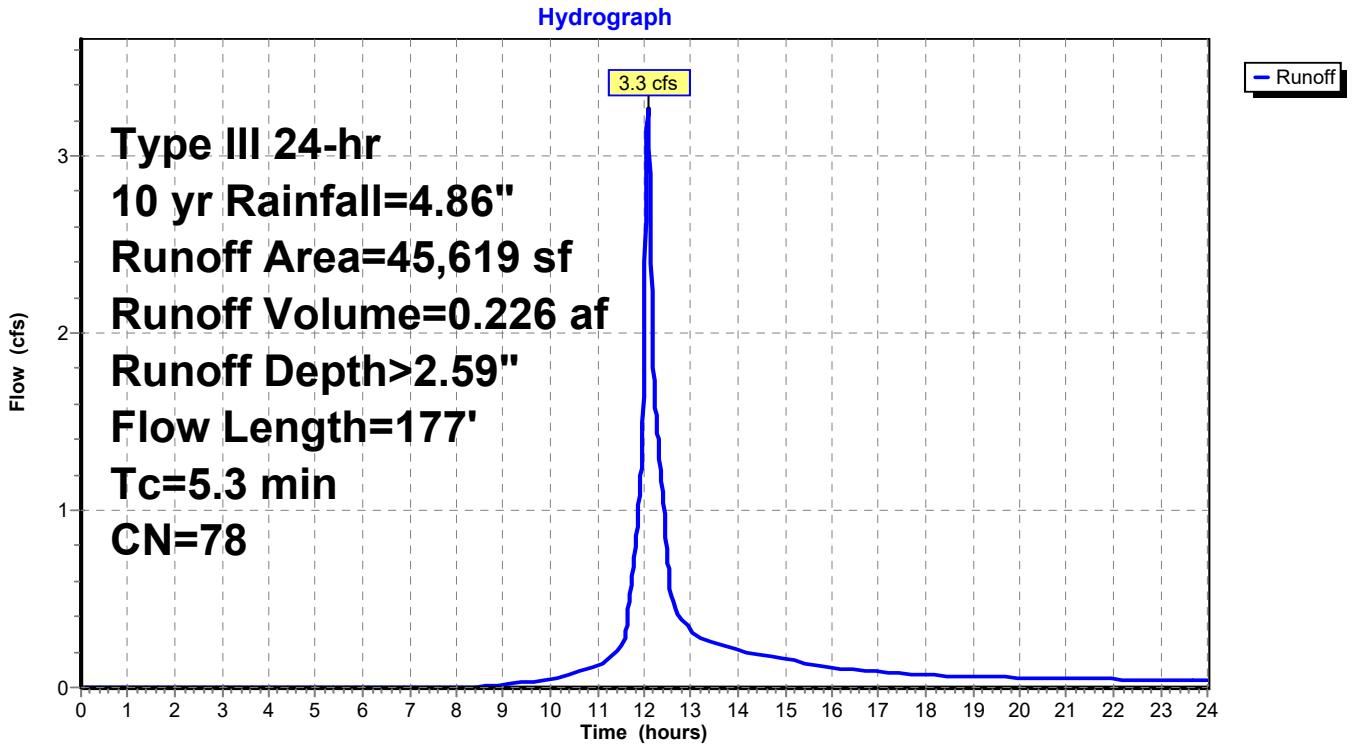
Runoff = 3.3 cfs @ 12.08 hrs, Volume= 0.226 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.86"

Area (sf)	CN	Description
9,116	98	Paved parking, HSG C
2,235	96	Gravel surface, HSG C
17,476	74	>75% Grass cover, Good, HSG C
16,792	70	Woods, Good, HSG C
45,619	78	Weighted Average
36,503		80.02% Pervious Area
9,116		19.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.7	75	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	52	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.3	177	Total			

Subcatchment 1S: Pre



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Pre Runoff Area=45,619 sf 19.98% Impervious Runoff Depth>5.03"
Flow Length=177' Tc=5.3 min CN=78 Runoff=6.3 cfs 0.439 af

Total Runoff Area = 1.047 ac Runoff Volume = 0.439 af Average Runoff Depth = 5.03"
80.02% Pervious = 0.838 ac 19.98% Impervious = 0.209 ac

Cultivate Pre
Prepared by Land Planning, Inc.

Summary for Subcatchment 1S: Pre

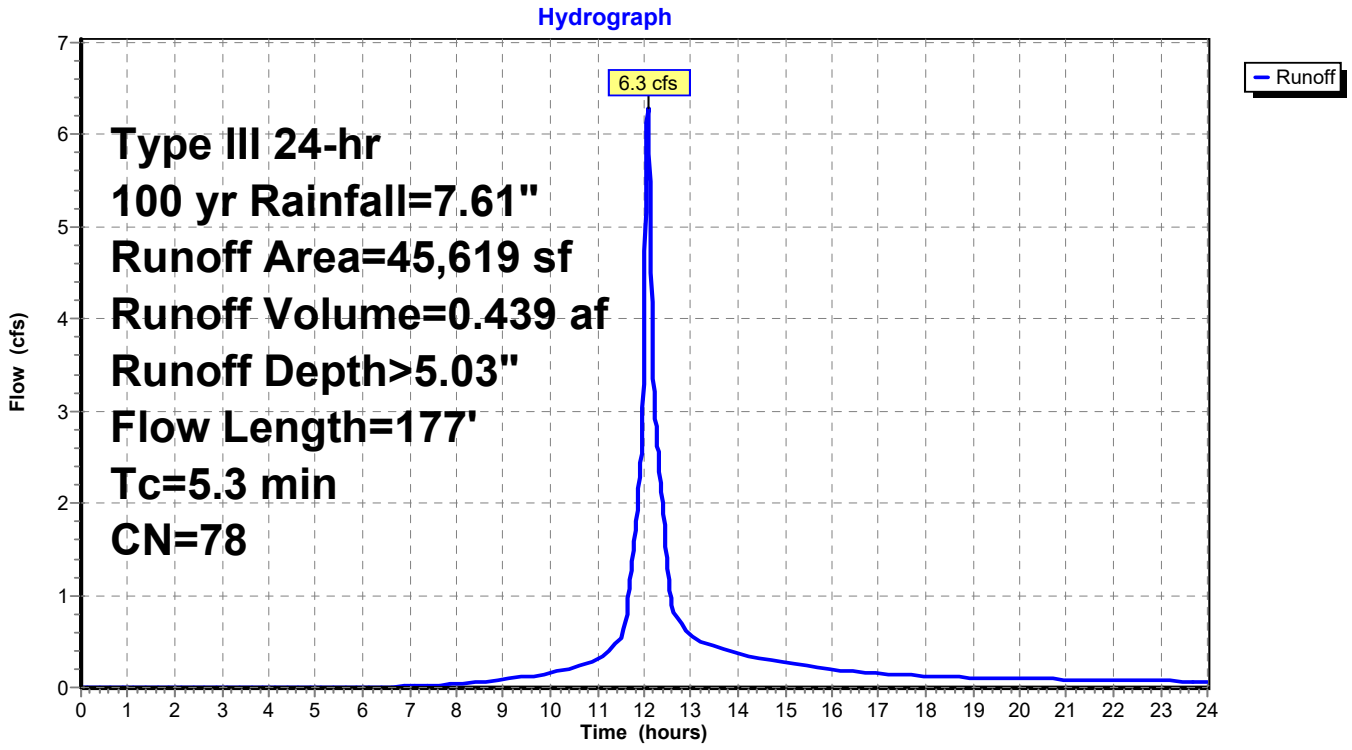
Runoff = 6.3 cfs @ 12.08 hrs, Volume= 0.439 af, Depth> 5.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=7.61"

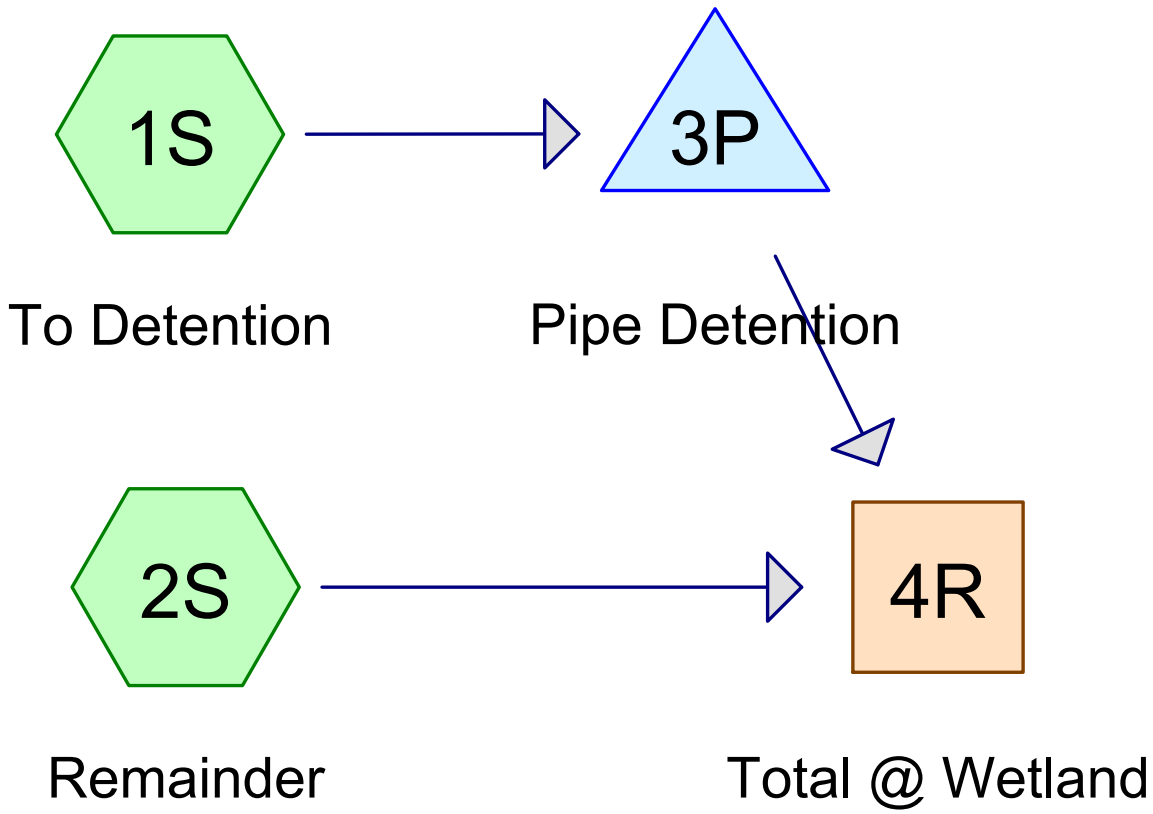
Area (sf)	CN	Description
9,116	98	Paved parking, HSG C
2,235	96	Gravel surface, HSG C
17,476	74	>75% Grass cover, Good, HSG C
16,792	70	Woods, Good, HSG C
45,619	78	Weighted Average
36,503		80.02% Pervious Area
9,116		19.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.9	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.7	75	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	52	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
5.3	177	Total			

Subcatchment 1S: Pre



Postdevelopment Drainage Analysis



Subcat Reach Pond Link

Routing Diagram for Cultivate Post
Prepared by Land Planning, Inc., Printed 4/10/2019

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Detention Runoff Area=27,483 sf 60.95% Impervious Runoff Depth>2.02"
Flow Length=297' Tc=4.6 min CN=89 Runoff=1.6 cfs 4,617 cf

Subcatchment 2S: Remainder Runoff Area=18,136 sf 0.00% Impervious Runoff Depth>0.89"
Flow Length=192' Tc=6.3 min CN=72 Runoff=0.4 cfs 1,338 cf

Reach 4R: Total @ Wetland Inflow=1.5 cfs 5,945 cf
Outflow=1.5 cfs 5,945 cf

Pond 3P: Pipe Detention Peak Elev=999.81' Storage=0.012 af Inflow=1.6 cfs 4,617 cf
Outflow=1.1 cfs 4,607 cf

Total Runoff Area = 45,619 sf Runoff Volume = 5,955 cf Average Runoff Depth = 1.57"
63.28% Pervious = 28,867 sf 36.72% Impervious = 16,752 sf

Cultivate Post
Prepared by Land Planning, Inc.

Summary for Subcatchment 1S: To Detention

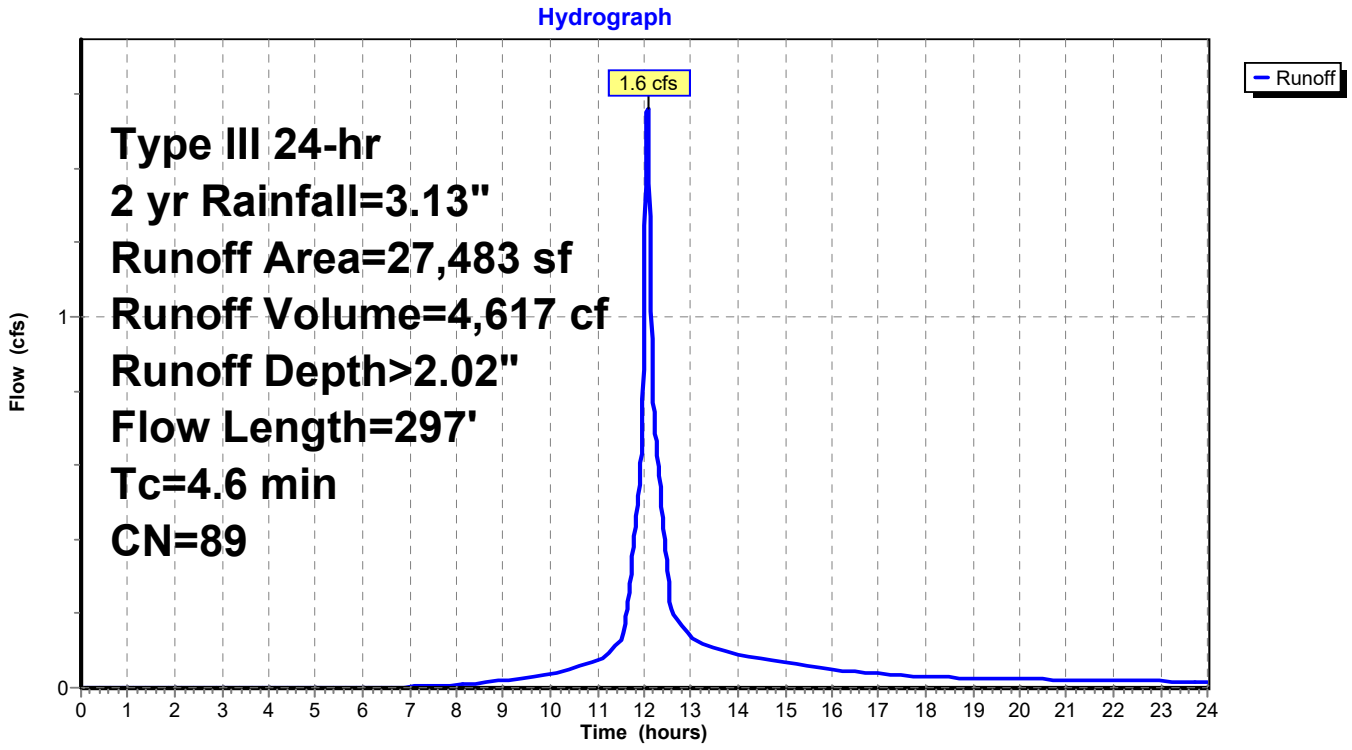
Runoff = 1.6 cfs @ 12.07 hrs, Volume= 4,617 cf, Depth> 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.13"

Area (sf)	CN	Description
16,752	98	Paved parking, HSG C
10,731	74	>75% Grass cover, Good, HSG C
27,483	89	Weighted Average
10,731		39.05% Pervious Area
16,752		60.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.1000	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.7	40	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	207	0.0350	3.80		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.6	297	Total			

Subcatchment 1S: To Detention



Cultivate Post
Prepared by Land Planning, Inc.

Summary for Subcatchment 2S: Remainder

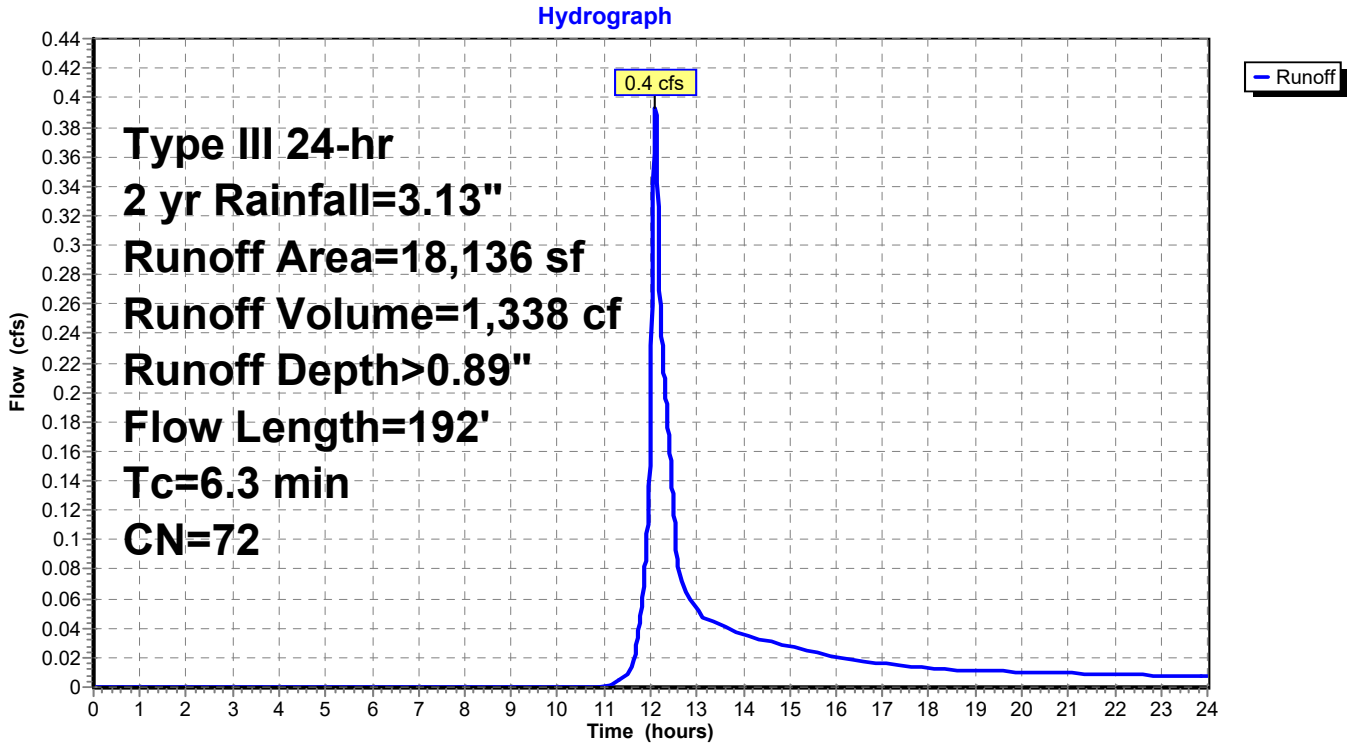
Runoff = 0.4 cfs @ 12.10 hrs, Volume= 1,338 cf, Depth> 0.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.13"

Area (sf)	CN	Description
9,485	74	>75% Grass cover, Good, HSG C
8,651	70	Woods, Good, HSG C
18,136	72	Weighted Average
18,136		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.8	90	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	52	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	192	Total			

Subcatchment 2S: Remainder

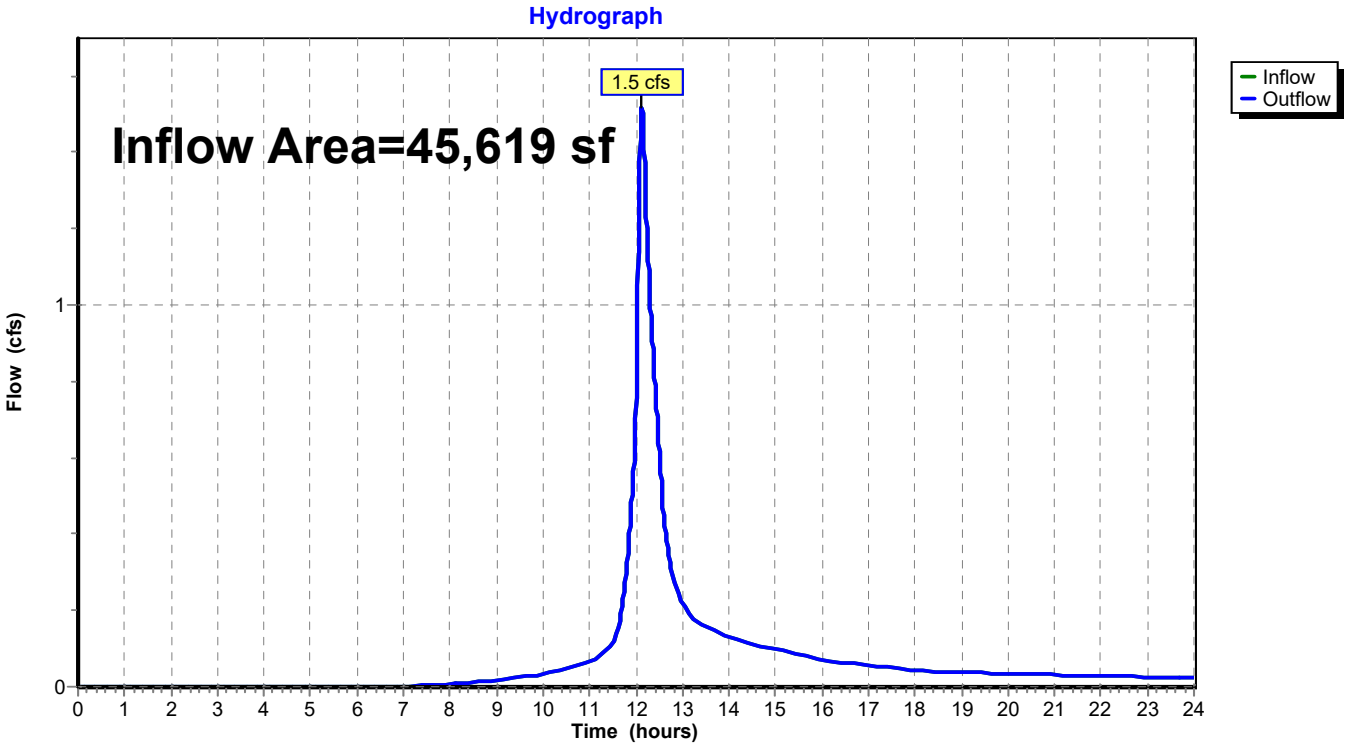


Summary for Reach 4R: Total @ Wetland

Inflow Area = 45,619 sf, 36.72% Impervious, Inflow Depth > 1.56" for 2 yr event
Inflow = 1.5 cfs @ 12.12 hrs, Volume= 5,945 cf
Outflow = 1.5 cfs @ 12.12 hrs, Volume= 5,945 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 4R: Total @ Wetland



Summary for Pond 3P: Pipe Detention

Inflow Area = 27,483 sf, 60.95% Impervious, Inflow Depth > 2.02" for 2 yr event
Inflow = 1.6 cfs @ 12.07 hrs, Volume= 4,617 cf
Outflow = 1.1 cfs @ 12.13 hrs, Volume= 4,607 cf, Atten= 27%, Lag= 4.0 min
Primary = 1.1 cfs @ 12.13 hrs, Volume= 4,607 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 999.81' @ 12.13 hrs Surf.Area= 0.020 ac Storage= 0.012 af

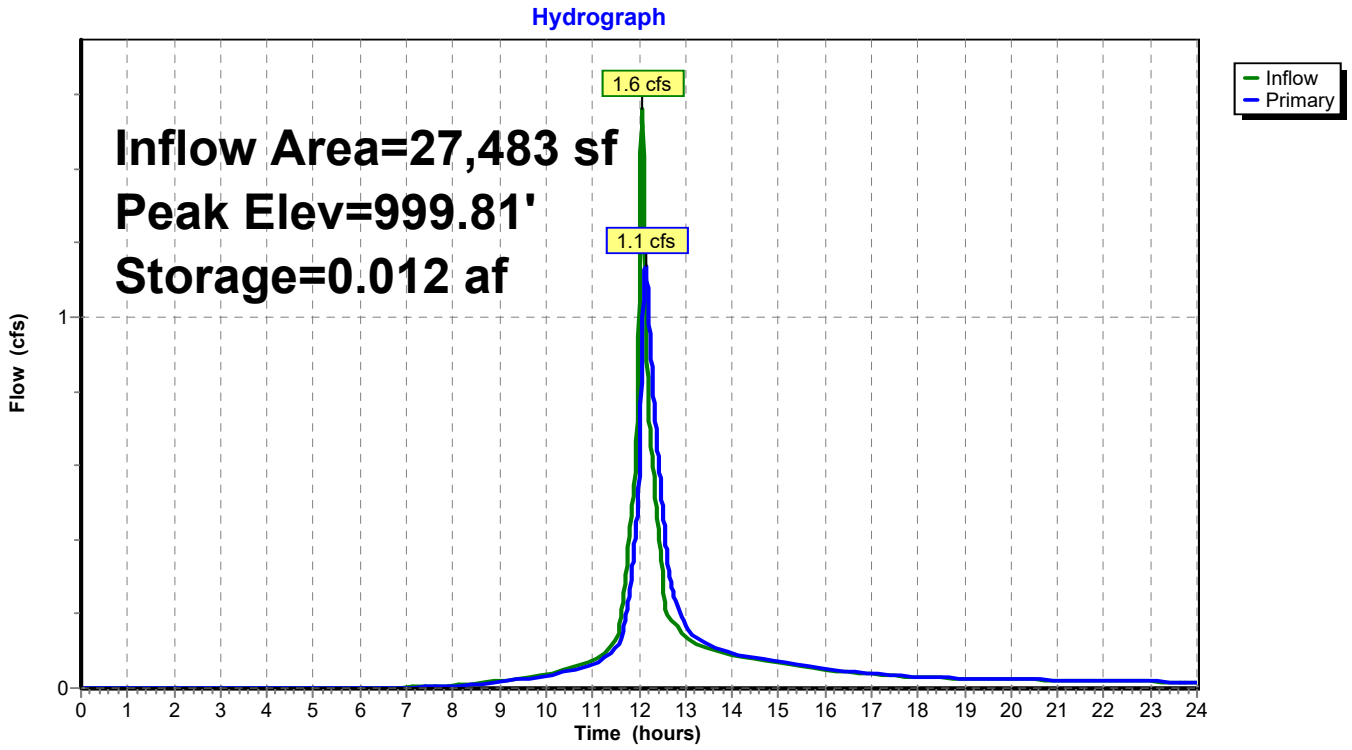
Plug-Flow detention time= 9.6 min calculated for 4,605 cf (100% of inflow)
Center-of-Mass det. time= 8.2 min (818.3 - 810.2)

Volume	Invert	Avail.Storage	Storage Description
#1	999.00'	0.029 af	**24.0" Round Pipe Storage** x 5 L= 80.0'
#2	999.00'	0.002 af	**24.0" Round Headers** x 2 L= 16.0'
#3	999.00'	0.003 af	**4.00'D x 6.00'H Manholes** x 2
		0.035 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Device 3	999.00'	**0.50' long x 0.67' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.77 2.84 2.95 3.12 3.20 3.24 3.28 3.30 3.32 3.31 3.32
#2	Device 3	1,001.00'	**4.00' long x 0.67' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.77 2.84 2.95 3.12 3.20 3.24 3.28 3.30 3.32 3.31 3.32
#3	Primary	998.15'	**15.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 998.15' / 998.00' S= 0.0150 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=1.1 cfs @ 12.13 hrs HW=999.81' (Free Discharge)
└**3=Culvert** (Passes 1.1 cfs of 5.7 cfs potential flow)
  └**1=Broad-Crested Rectangular Weir** (Weir Controls 1.1 cfs @ 2.81 fps)
  └**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 3P: Pipe Detention



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Detention Runoff Area=27,483 sf 60.95% Impervious Runoff Depth>3.64"
Flow Length=297' Tc=4.6 min CN=89 Runoff=2.8 cfs 8,326 cf

Subcatchment 2S: Remainder Runoff Area=18,136 sf 0.00% Impervious Runoff Depth>2.09"
Flow Length=192' Tc=6.3 min CN=72 Runoff=1.0 cfs 3,155 cf

Reach 4R: Total @ Wetland Inflow=3.1 cfs 11,464 cf
Outflow=3.1 cfs 11,464 cf

Pond 3P: Pipe Detention Peak Elev=1,000.19' Storage=0.020 af Inflow=2.8 cfs 8,326 cf
Outflow=2.1 cfs 8,309 cf

Total Runoff Area = 45,619 sf Runoff Volume = 11,481 cf Average Runoff Depth = 3.02"
63.28% Pervious = 28,867 sf 36.72% Impervious = 16,752 sf

Cultivate Post
Prepared by Land Planning, Inc.

Summary for Subcatchment 1S: To Detention

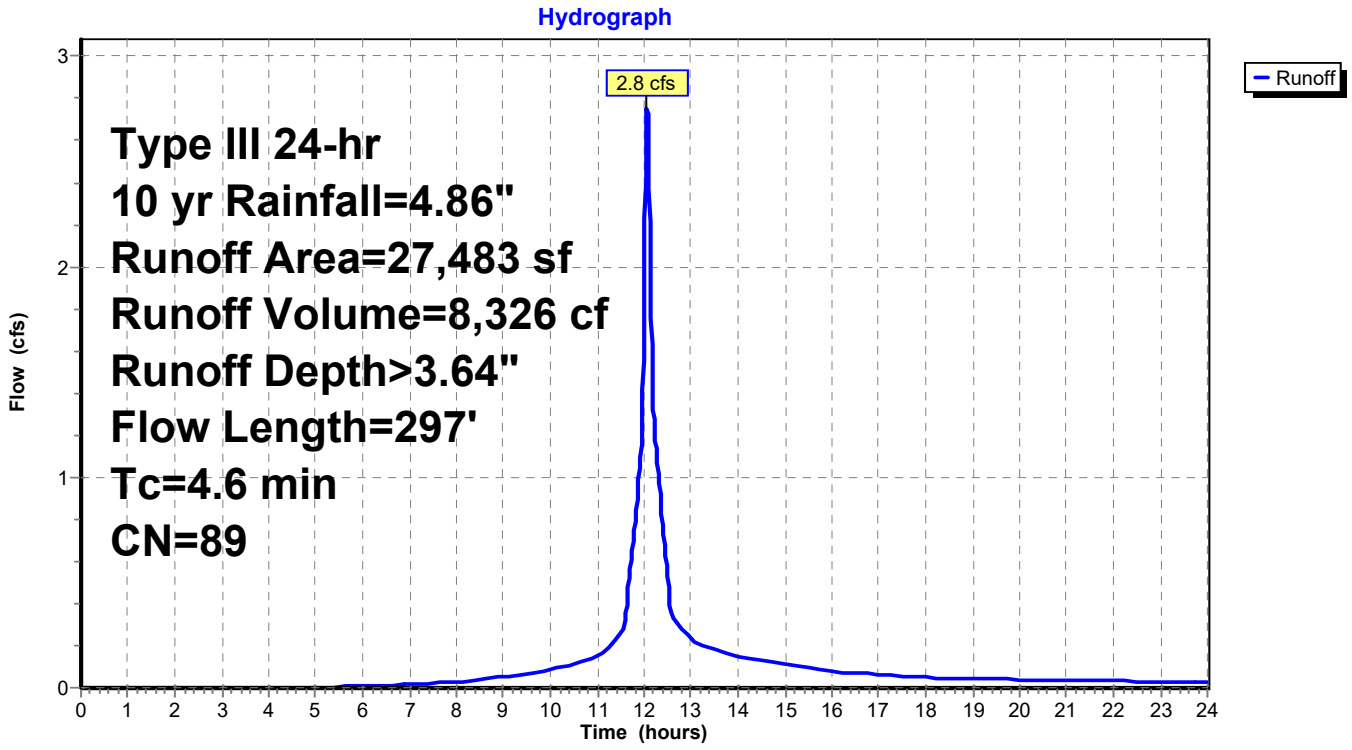
Runoff = 2.8 cfs @ 12.07 hrs, Volume= 8,326 cf, Depth> 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.86"

Area (sf)	CN	Description
16,752	98	Paved parking, HSG C
10,731	74	>75% Grass cover, Good, HSG C
27,483	89	Weighted Average
10,731		39.05% Pervious Area
16,752		60.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.1000	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.7	40	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	207	0.0350	3.80		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.6	297	Total			

Subcatchment 1S: To Detention



Summary for Subcatchment 2S: Remainder

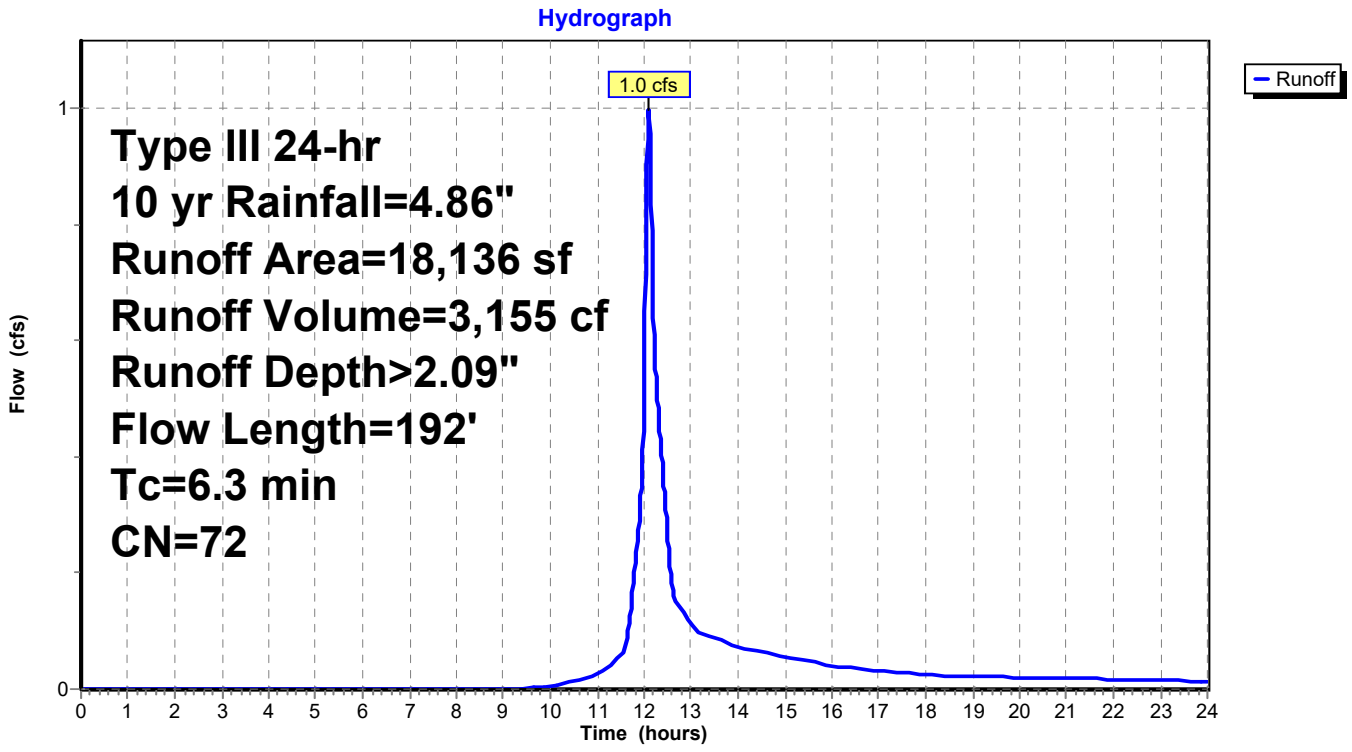
Runoff = 1.0 cfs @ 12.10 hrs, Volume= 3,155 cf, Depth> 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.86"

Area (sf)	CN	Description
9,485	74	>75% Grass cover, Good, HSG C
8,651	70	Woods, Good, HSG C
18,136	72	Weighted Average
18,136		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.8	90	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	52	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	192	Total			

Subcatchment 2S: Remainder

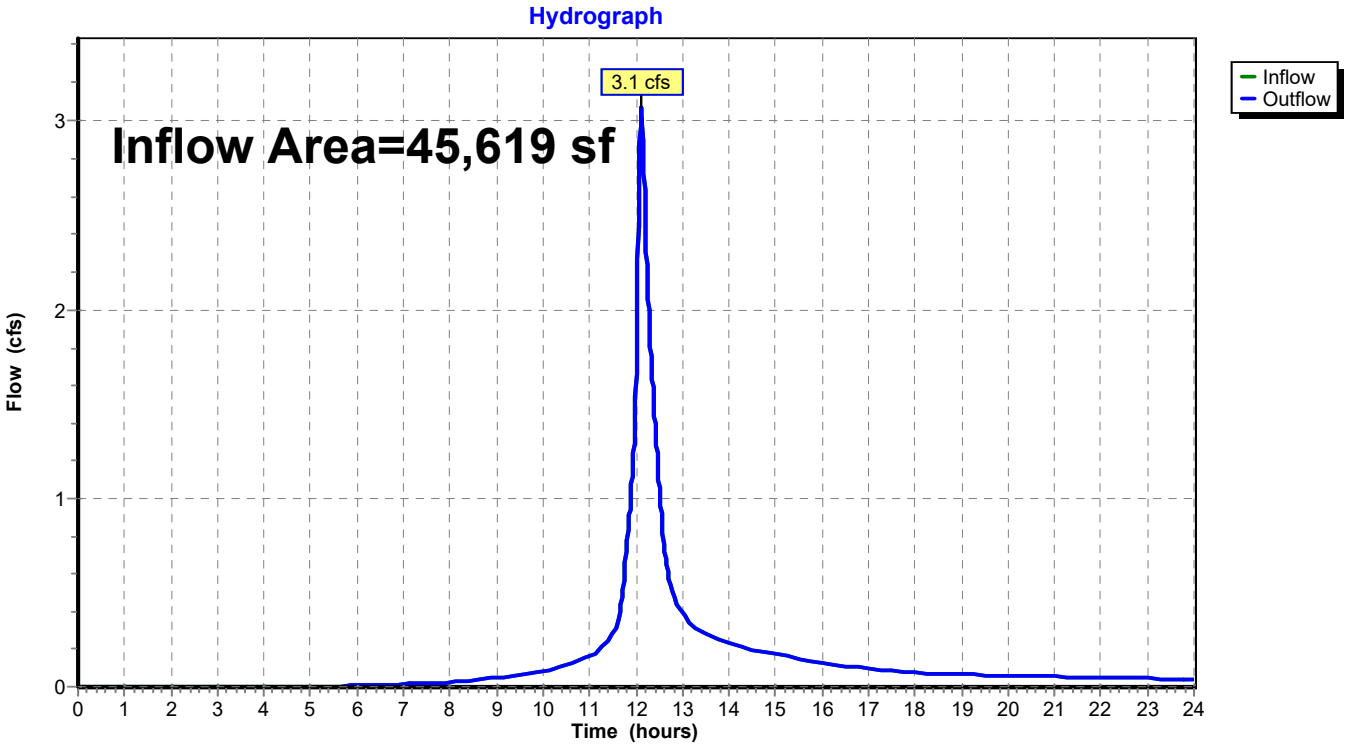


Summary for Reach 4R: Total @ Wetland

Inflow Area = 45,619 sf, 36.72% Impervious, Inflow Depth > 3.02" for 10 yr event
Inflow = 3.1 cfs @ 12.11 hrs, Volume= 11,464 cf
Outflow = 3.1 cfs @ 12.11 hrs, Volume= 11,464 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 4R: Total @ Wetland



Summary for Pond 3P: Pipe Detention

Inflow Area = 27,483 sf, 60.95% Impervious, Inflow Depth > 3.64" for 10 yr event
Inflow = 2.8 cfs @ 12.07 hrs, Volume= 8,326 cf
Outflow = 2.1 cfs @ 12.13 hrs, Volume= 8,309 cf, Atten= 23%, Lag= 3.6 min
Primary = 2.1 cfs @ 12.13 hrs, Volume= 8,309 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,000.19' @ 12.13 hrs Surf.Area= 0.020 ac Storage= 0.020 af

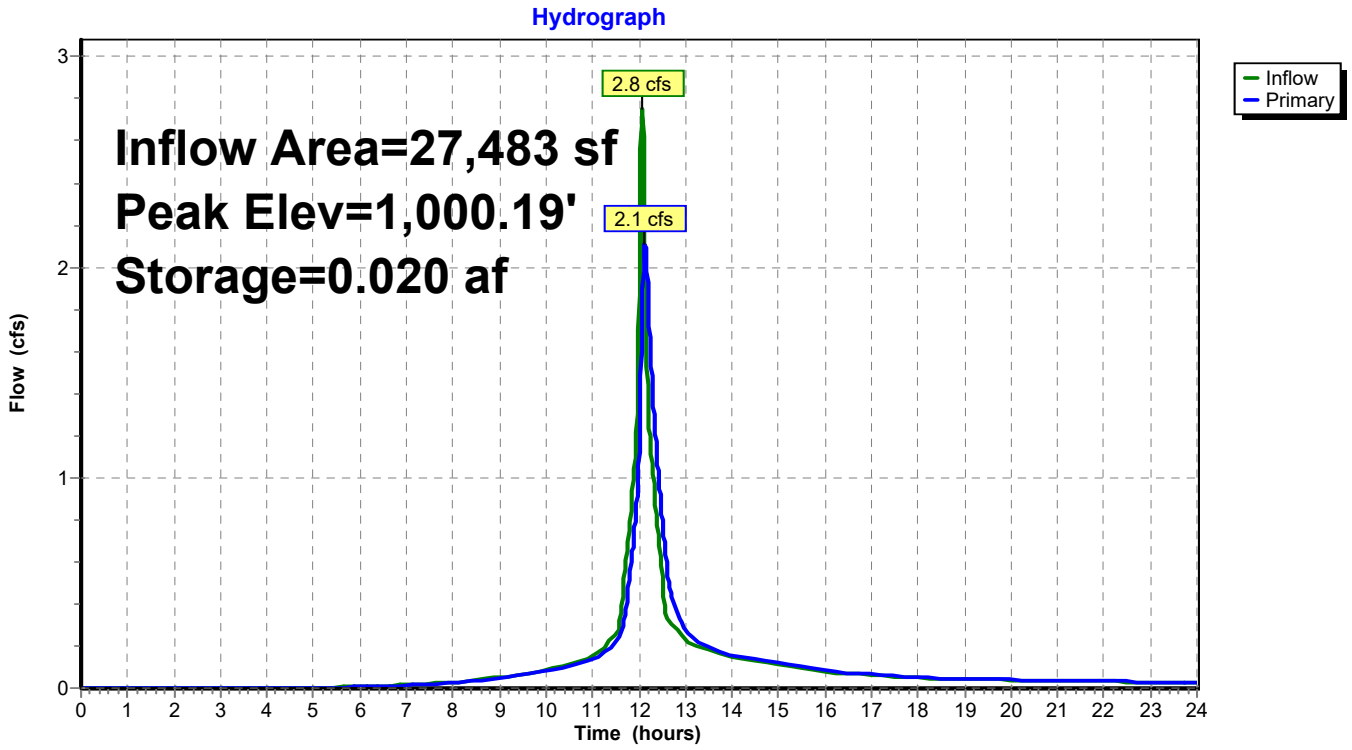
Plug-Flow detention time= 9.1 min calculated for 8,306 cf (100% of inflow)
Center-of-Mass det. time= 7.8 min (801.4 - 793.6)

Volume	Invert	Avail.Storage	Storage Description
#1	999.00'	0.029 af	**24.0" Round Pipe Storage** x 5 L= 80.0'
#2	999.00'	0.002 af	**24.0" Round Headers** x 2 L= 16.0'
#3	999.00'	0.003 af	**4.00'D x 6.00'H Manholes** x 2
		0.035 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Device 3	999.00'	**0.50' long x 0.67' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.77 2.84 2.95 3.12 3.20 3.24 3.28 3.30 3.32 3.31 3.32
#2	Device 3	1,001.00'	**4.00' long x 0.67' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.77 2.84 2.95 3.12 3.20 3.24 3.28 3.30 3.32 3.31 3.32
#3	Primary	998.15'	**15.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 998.15' / 998.00' S= 0.0150 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=2.1 cfs @ 12.13 hrs HW=1,000.19' (Free Discharge)
└**3=Culvert** (Passes 2.1 cfs of 7.0 cfs potential flow)
  └**1=Broad-Crested Rectangular Weir** (Weir Controls 2.1 cfs @ 3.54 fps)
  └**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 3P: Pipe Detention



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: To Detention Runoff Area=27,483 sf 60.95% Impervious Runoff Depth>6.30"
Flow Length=297' Tc=4.6 min CN=89 Runoff=4.6 cfs 14,429 cf

Subcatchment 2S: Remainder Runoff Area=18,136 sf 0.00% Impervious Runoff Depth>4.35"
Flow Length=192' Tc=6.3 min CN=72 Runoff=2.1 cfs 6,572 cf

Reach 4R: Total @ Wetland Inflow=5.9 cfs 20,975 cf
Outflow=5.9 cfs 20,975 cf

Pond 3P: Pipe Detention Peak Elev=1,000.76' Storage=0.030 af Inflow=4.6 cfs 14,429 cf
Outflow=3.9 cfs 14,403 cf

Total Runoff Area = 45,619 sf Runoff Volume = 21,002 cf Average Runoff Depth = 5.52"
63.28% Pervious = 28,867 sf 36.72% Impervious = 16,752 sf

Cultivate Post
Prepared by Land Planning, Inc.

Summary for Subcatchment 1S: To Detention

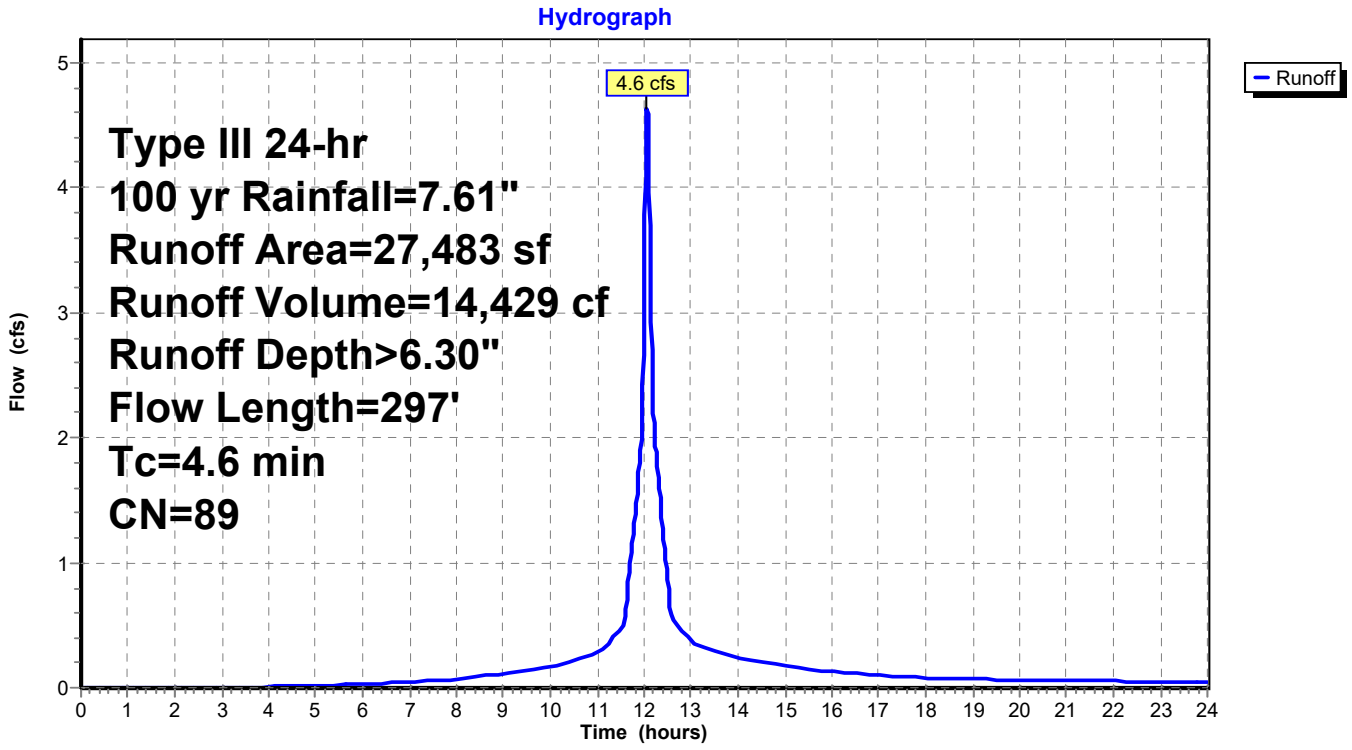
Runoff = 4.6 cfs @ 12.07 hrs, Volume= 14,429 cf, Depth> 6.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=7.61"

Area (sf)	CN	Description
16,752	98	Paved parking, HSG C
10,731	74	>75% Grass cover, Good, HSG C
27,483	89	Weighted Average
10,731		39.05% Pervious Area
16,752		60.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	50	0.1000	0.28		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.7	40	0.0200	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.9	207	0.0350	3.80		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.6	297	Total			

Subcatchment 1S: To Detention



Summary for Subcatchment 2S: Remainder

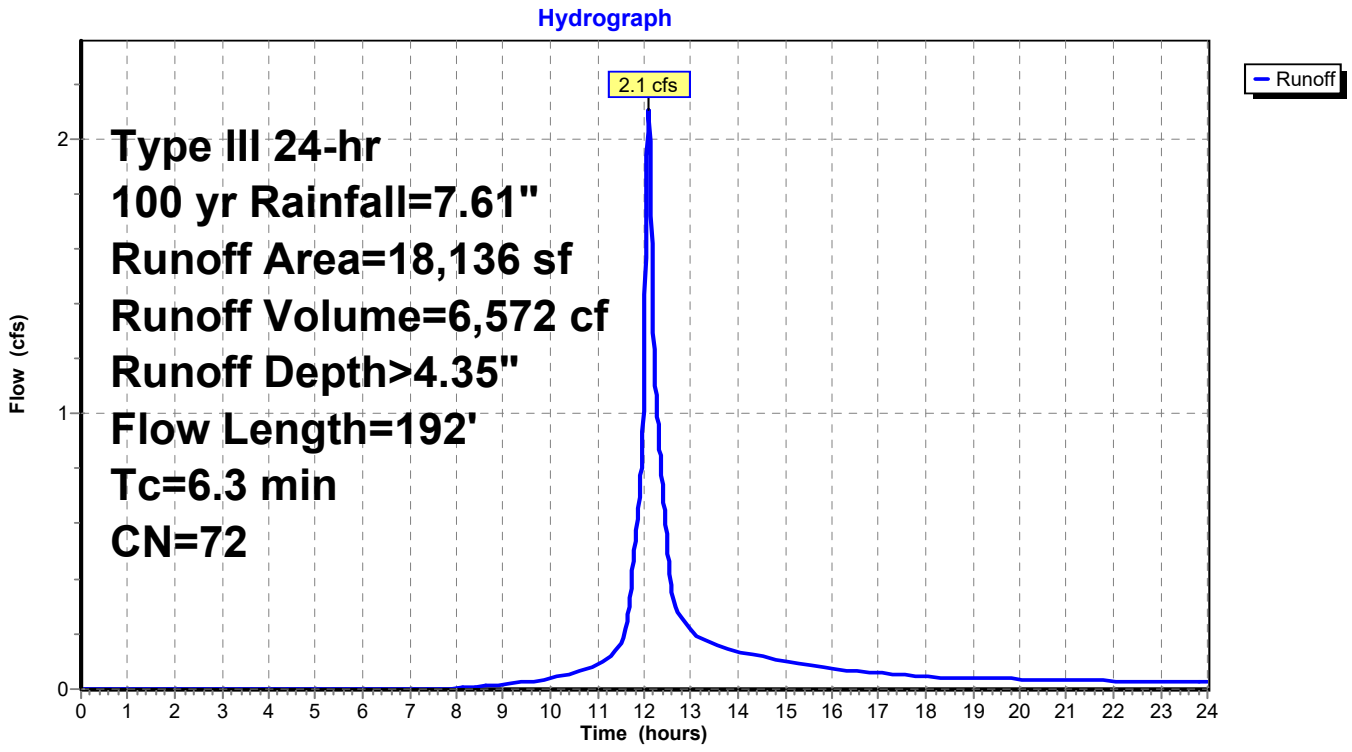
Runoff = 2.1 cfs @ 12.09 hrs, Volume= 6,572 cf, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=7.61"

Area (sf)	CN	Description
9,485	74	>75% Grass cover, Good, HSG C
8,651	70	Woods, Good, HSG C
18,136	72	Weighted Average
18,136		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	50	0.0300	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.13"
0.8	90	0.0700	1.85		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.7	52	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.3	192	Total			

Subcatchment 2S: Remainder

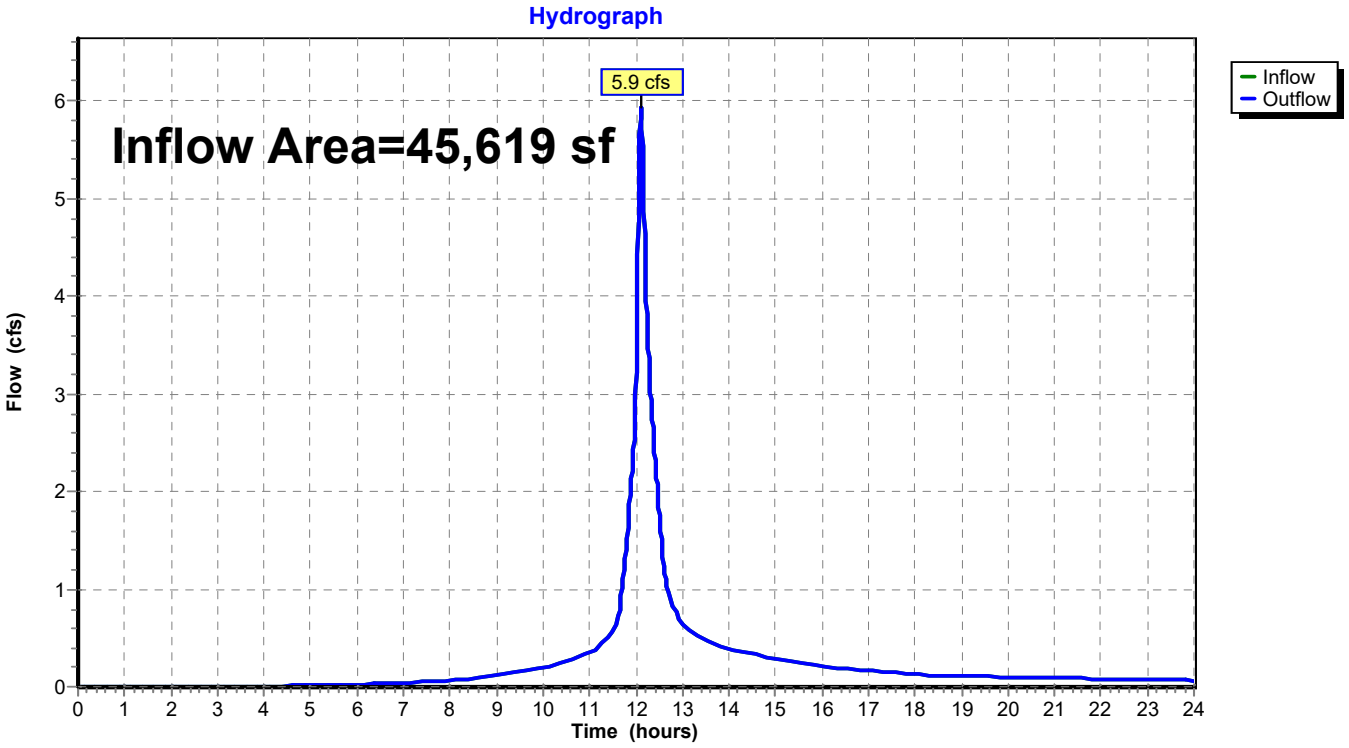


Summary for Reach 4R: Total @ Wetland

Inflow Area = 45,619 sf, 36.72% Impervious, Inflow Depth > 5.52" for 100 yr event
Inflow = 5.9 cfs @ 12.11 hrs, Volume= 20,975 cf
Outflow = 5.9 cfs @ 12.11 hrs, Volume= 20,975 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 4R: Total @ Wetland



Summary for Pond 3P: Pipe Detention

Inflow Area = 27,483 sf, 60.95% Impervious, Inflow Depth > 6.30" for 100 yr event
Inflow = 4.6 cfs @ 12.07 hrs, Volume= 14,429 cf
Outflow = 3.9 cfs @ 12.11 hrs, Volume= 14,403 cf, Atten= 16%, Lag= 2.9 min
Primary = 3.9 cfs @ 12.11 hrs, Volume= 14,403 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 1,000.76' @ 12.11 hrs Surf.Area= 0.013 ac Storage= 0.030 af

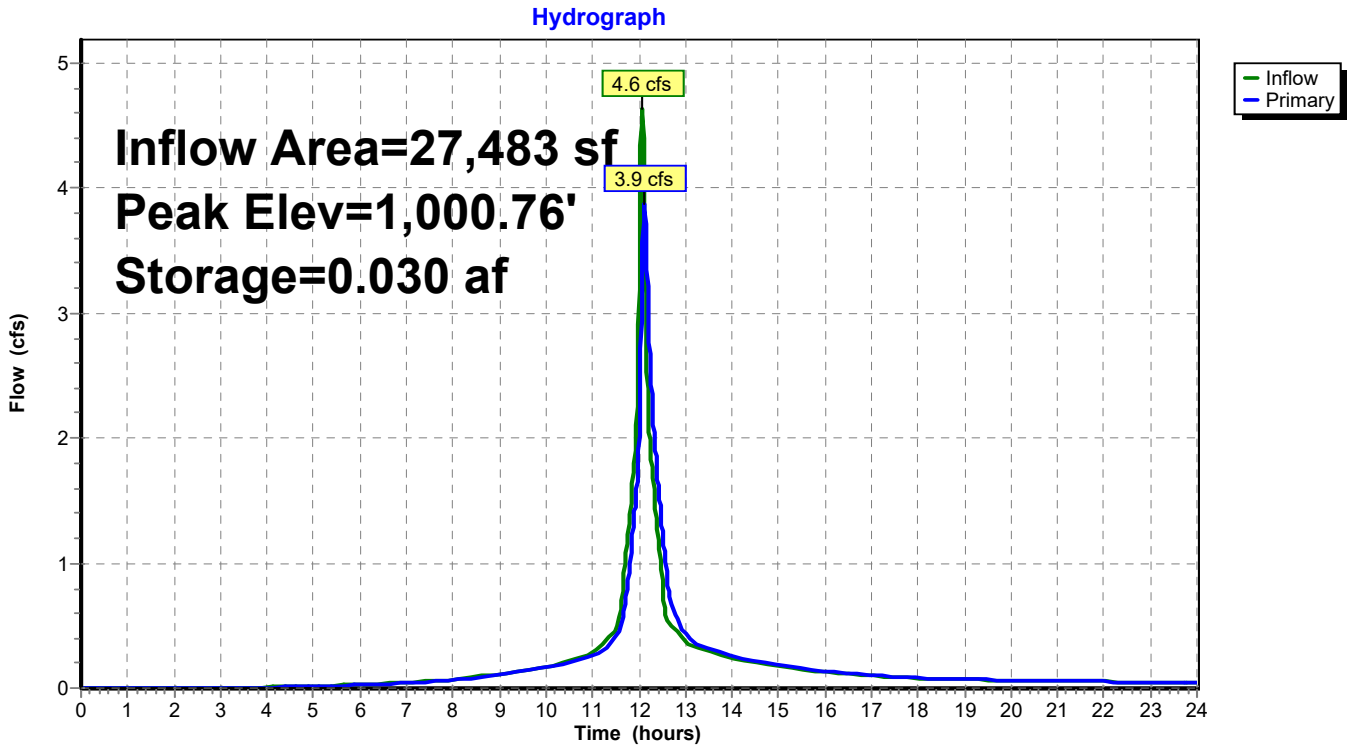
Plug-Flow detention time= 8.5 min calculated for 14,403 cf (100% of inflow)
Center-of-Mass det. time= 7.3 min (786.2 - 778.8)

Volume	Invert	Avail.Storage	Storage Description
#1	999.00'	0.029 af	**24.0" Round Pipe Storage** x 5 L= 80.0'
#2	999.00'	0.002 af	**24.0" Round Headers** x 2 L= 16.0'
#3	999.00'	0.003 af	**4.00'D x 6.00'H Manholes** x 2
		0.035 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Device 3	999.00'	**0.50' long x 0.67' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.77 2.84 2.95 3.12 3.20 3.24 3.28 3.30 3.32 3.31 3.32
#2	Device 3	1,001.00'	**4.00' long x 0.67' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 Coef. (English) 2.77 2.84 2.95 3.12 3.20 3.24 3.28 3.30 3.32 3.31 3.32
#3	Primary	998.15'	**15.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 998.15' / 998.00' S= 0.0150 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=3.9 cfs @ 12.11 hrs HW=1,000.76' (Free Discharge)
└**3=Culvert** (Passes 3.9 cfs of 8.3 cfs potential flow)
  ├**1=Broad-Crested Rectangular Weir** (Weir Controls 3.9 cfs @ 4.40 fps)
  └**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Pond 3P: Pipe Detention



Pipe Sizing

Storm Drain System Design Calculations

Project: **1762 Main St** City/Town: **Leicester** Design Frequency: **100 Years** Date: **April 12, 2019**

Pipe Material: **HDPE** Manning's n: **0.012**

Pipe No.	Pipe Location		Discharge						Pipe Data					Invert Elevation		Top of MH Elevation	
	From	To	Drainage Area	Coefficient	Tc or Pipe Flow Time (min)	Total Tc (min)	Rainfall Intensity (in/hr)	Design Discharge (cfs)	Length (ft)	Slope (ft/ft)	Diameter (in)	Full Flow Capacity (cfs)	Full Flow Velocity (ft/sec)	Upper	Lower	Upper	Lower
P1	STC 450	DMH-1						4.6	32	0.0156	12	4.82	6.14	1002.50	1002.00	1005.50	1002.00
P2	DMH-1	Infiltration						N/A	4	FLAT	6	N/A	N/A	1002.00	1002.00	1006.50	N/A
P3	DMH-1	DMH-2						4.6	16	0.1000	12	12.21	15.54	1002.60	1001.00	1006.50	1006.82
P4	DMH-3	HW						4.6	10	0.0150	15	8.57	6.98	998.15	998.00	1005.84	N/A

Note: Desing Discharge data from HydroCAD, rational method not used

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Worcester County, Massachusetts, Southern Part

March 18, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,450 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:25,000.

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, Southern Part
Survey Area Data: Version 11, Sep 11, 2018

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

Date(s) aerial images were photographed: Apr 14, 2011—Aug 27, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
71A	Ridgebury fine sandy loam, 0 to 3 percent slopes, extremely stony	0.0	0.2%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	7.9	96.7%
305C	Paxton fine sandy loam, 8 to 15 percent slopes	0.3	3.1%
Totals for Area of Interest		**8.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Worcester County, Massachusetts, Southern Part

71A—Ridgebury fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69b
Elevation: 0 to 1,480 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Ridgebury, extremely stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ridgebury, Extremely Stony

Setting

Landform: Ground moraines, depressions, drumlins, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Percent of area covered with surface fragments: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Natural drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony
Percent of map unit: 7 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Crest, base slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony
Percent of map unit: 7 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony
Percent of map unit: 1 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Crest
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Hydric soil rating: No

305B—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2t2qp
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Paxton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Linear, convex
Across-slope shape: Convex

Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 6 percent
Landform: Hills, ground moraines, depressions, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

305C—Paxton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w66y
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Paxton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 6 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Footslope, summit, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 2 percent
Landform: Ground moraines, depressions, drainageways, drumlins, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

Storm Water
Pollution Prevention Plan
For:

1762 Main St
Leicester, MA

Site Owner/Operator
Topnotch Realty Corp.
208 Pine Street
Leicester, MA 01524

Prepared by:
Land Planning, Inc.
214 Worcester St
N. Grafton, MA 01536

April 12, 2019

1.0 Site Evaluation, Assessment, and Planning

1.1 Project Information

The construction site is located at 1762 Main Street, Leicester, on the northeast corner of Main Street and Route 9.

1.2 Contact Information / Responsible Parties

Project Manager or Site Supervisor

Name:_____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____

SWPPP Contact

Name:_____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____

SWPPP prepared by

Norman G. Hill, P.E.

Land Planning, Inc.

214 Worcester Street

N. Grafton, MA 01536

508-839-9526

Property Owner

Topnotch Realty Corp.

208 Pine Street

Leicester, MA 01524

Phone: _____

1.3 Nature and Sequence of Construction Activity

The development proposal is to raze the existing house and garage and construct a parking lot for the adjacent business at 1764 Main Street. Soil disturbing activities will include: building demolition, utility disconnection, clearing and grubbing, grading, and construction of stormwater system and parking lot.

1.4 Soils, Slopes, Vegetation, Drainage Patterns

The soils on site are classified as Paxton fine sandy loam by the NRCS. Paxton soil belongs to hydrologic soil group C.

The site slopes moderately downward from west to east. Preconstruction runoff flows to a bordering vegetated wetland that occupies the easterly third of the property. No point discharges of stormwater are currently present on the property.

Postconstruction runoff flows will be treated for suspended solids removal and runoff rate control prior to being discharged toward the existing wetland.

1.5 Construction Site Estimates

The following are estimates of the construction site:

Size of property	40,408 ft²
Construction site area to be disturbed	19,500 ft²
Percentage of preconstruction impervious area	4.7%
Percentage of postconstruction impervious area	22.3%

1.6 Receiving Waters

Stormwater runoff from the site enters a vegetated wetland bordering on a tributary to Shaw Brook.

1.7 Site Features and Sensitive Areas to be Protected

Natural features to be protected include the delineated bordering vegetated wetland located at the east end of the property. Additionally, the Town of Leicester requires a 25-foot-wide no-disturbance zone adjacent to the wetland boundary. No disturbance of these areas shall be permitted.

1.8 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff include:

- Clearing and grubbing operations
- Grading and excavation operations
- Vehicle tracking
- Topsoil stripping and stockpiling
- Landscaping operations

Potential pollutants and sources, other than sediment, to stormwater runoff:

- Combined Staging Area – fueling activities, equipment maintenance, sanitary facilities, waste storage
- Materials Storage Area – general building materials, solvents, adhesives, paving materials, paints, aggregates, and trash.
- Construction Activity – building demolition, paving, concrete pouring,

- Concrete Washout Area

See table below for potential construction site pollutants:

TRADE NAME MATERIAL	CHEMICAL/PHYSICAL DESCRIPTION	STORM WATER POLLUTANTS
Pesticides	Various colored to colorless liquid, powder, grains, or pellets	Chlorinated hydrocarbons, organophosphates, carbamates, arsenic
Fertilizer	Liquid or solid grains	Nitrogen, Phosphorous
Plaster	White granules or powder	Calcium sulphate, calcium carbonate, sulfuric acid
Cleaning solvents	Colorless, blue, or yellow-green liquid	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates
Asphalt	Black solid	Oil, petroleum distillates
Concrete	White solid	Limestone, sand
Glue, adhesives	White or yellow liquid	Polymers, epoxies
Paints	Various colored liquid	Metal oxides, stoddard solvent, talc, calcium carbonate, arsenic
Curing compounds	Creamy white liquid	Naphtha
Waste water from construction equipment washing	Water	Soil, oil and grease, solids
Wood preservatives	Clear amber or dark brown liquid	Stoddard solvent, petroleum distillates, arsenic, copper, chromium
Hydraulic oil/fluids	Brown oily petroleum hydrocarbon	Mineral oil
Gasoline	Colorless, pale brown or pink petroleum hydrocarbon	Benzene, ethyl benzene, toluene, xylene, MTBE
Diesel fuel	Clear, blue-green to yellow liquid	Petroleum distillate, oil and grease, naphthalene, xylenes
Kerosene	Pale yellow liquid petroleum hydrocarbon	Coal oil, petroleum distillates
Antifreeze/coolant	Clear green/yellow liquid	Ethylene glycol, propylene glycol, heavy metals (copper, zinc, lead)
Sanitary toilets	Various colored liquid	Bacteria, parasites, and viruses

2.0 Erosion and Sedimentation Control BMPs

- **Minimize disturbed area and protect natural features and soil**

  Topsoil to be stripped from the construction area will be stockpiled as identified on the Sedimentation & Erosion Control Plan. The stockpile shall be surrounded by sediment barriers at its base.

- **Phase Construction Activity**

  The proposed site is too small for phased disturbance areas to be practical. To minimize erosion construction activities should be limited to the spring, summer, and fall seasons.

- **Control stormwater flowing onto and through the project**

  The runoff entering the site from the Cultivate facility should be directed easterly across the construction entrance toward the existing swale along the 1764/1762 Main Street properties.

- **Stabilize soils**

  Temporary Stabilization

  Hydromulching will provide immediate protection to exposed soils where construction will cease for more than 14 days and over the winter months. Straw mulch and wood fiber will be mixed with a tackifier (amount specified per manufacturer's instructions) and applied uniformly by machine with an application rate of 90–100 pounds (2–3 bales) per 1,000 square feet or 2 tons (100–200 bales) per acre. If the tackifier does not appear effective in anchoring the mulch to the disturbed soil, crimping equipment will be used to provide additional binding to the soil. The mulch will cover 75 to 90 percent of the ground surface. In areas, where hydromulching is inaccessible, straw mulch will be applied by hand with an application rate of 90–100 pounds (2–3 bales) per 1,000 square feet.

  Permanent Stabilization

  Permanent stabilization will be done immediately after the final design grades are achieved but no later than 14 days after construction ceases. Native species of plants will be used to establish vegetative cover on exposed soils. Permanent stabilization will be completed in accordance with the final stabilization procedures.

- **Protect slopes**

  The project does not include slopes exceeding 3:1.

- **Protect storm drain inlets**

  The inlet grate at the Stormceptor unit shall be projected with a catch basin filter bag. The filter bag shall be maintained until final stabilization of all upgradient areas has been completed.

- **Establish perimeter controls and sediment barriers**

  Sediment barriers consisting of straw wattles and silt fence will be installed at the perimeter of the site as indicated on the Sedimentation & Erosion Control Plan. See the detail provided on the Sedimentation & Erosion Control Plan for specifications and installation requirements of the sediment barrier.

- **Establish stabilized construction exits**

  An anti-tracking pads consisting of washed stone will be installed at the exit to Cultivate's driveway, as identified on the Sedimentation & Erosion Control Plan, to prevent the off-site transport of sediment by construction vehicles. The anti-tracking pads will be at least 50 feet long, a minimum of 25 feet wide, flared at the end closest to the pavement.

3.0 Good Housekeeping BMPs

3.1 Material Handling and Waste Management

- **Waste Materials**

  All waste materials will be collected and disposed of into metal trash dumpsters. Dumpsters will have a secure watertight lid, be placed away from stormwater conveyances and drains, and meet all federal, state, and municipal regulations. Only trash and construction debris from the site will be deposited in the dumpster. No construction materials will be buried on-site.

- **Hazardous Waste Materials**

  All hazardous waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids will be stored in structurally sound and sealed shipping containers, within the hazardous materials storage area. Hazardous waste materials will be stored in appropriate and clearly marked containers and segregated from other non-waste materials. Secondary containment will be provided for all waste materials in the hazardous materials
  storage area and will consist of commercially available spill pallets. Additionally, all hazardous waste materials will be disposed of in accordance with federal, state, and municipal regulations. Hazardous waste materials will not be disposed of into the on-site dumpsters.

- **Sanitary Waste**

  Temporary sanitary facilities (portable toilets) will be provided at the site throughout the construction phase. The toilets will be in the staging area. The portable toilets will be located away from a concentrated flow paths and traffic flow and will have collection pans underneath as secondary containment.

3.2 Equipment/Vehicle Fueling and Maintenance Practices

- **Fueling and Maintenance**

  Several types of vehicles and equipment will be used on-site throughout the
  project, including graders, scrapers, excavators, loaders, paving equipment, rollers, trucks and
  trailers, backhoes, and forklifts. All major equipment maintenance will be performed off-site. Vehicle fueling and minor maintenance will be performed within the existing Cultivate driveway on the south side of the existing building. Absorbent, spill-cleanup materials and spill kits will be available on-site.

3.6 Spill Prevention and Control

- **Spill Prevention and Control Procedures**

  I. Employee Training: All employees will be trained via monthly tailgate sessions.
  II. Vehicle Maintenance: Vehicles and equipment will be maintained off-site. All vehicles and equipment including subcontractor vehicles will be checked for leaking oil and fluids. Vehicles leaking fluids will not be allowed on-site.
  III. Hazardous Material Storage: Hazardous materials will be stored in accordance with Section 3 and federal and municipal regulations.
  IV. Spill Kits: Spill kits will be within the materials storage area and concrete washout areas.
  V. Spills: All spills will be cleaned up immediately upon discovery. Spent absorbent materials and rags will be hauled off-site immediately after the spill is cleaned up for proper disposal. Spills large enough to discharge to surface water will be reported to the National Response Center at 1-800-424-8802 and MassDEP Emergency Response Line at 1-888-304-1133.
  VI. Material safety data sheets, a material inventory, and emergency contact information will be maintained at the on-site project trailer.

4.0 Inspections

4.1 Inspection Schedule and Procedures

- Inspections of the site will be performed once every 7 days and within 24 hours of the end of a storm event of one-half inch or greater. The inspections will verify that all BMPs required in Sections 2 and 3 are implemented, maintained, and effectively minimizing erosion and preventing stormwater contamination from construction materials. For detailed inspection procedures, see Sections 2 and 3.

- A maintenance inspection report will be made after each inspection. A copy of the report form to be completed by the SWPPP Coordinator is provided Section 8. Completed forms will be maintained on-site throughout construction. Following construction, the completed forms will be retained at the site operators' office for a minimum of 1 year.

5.0 Recordkeeping and Training

5.1 Recordkeeping

- Records will be retained for a minimum period of at least 3 years after the Certificate of Compliance is issued.

5.2 Log of Changes to the SWPPP

No.	Description of Amendment	Date of Amendment	Amendment Prepared by

5.3 Training

- **General stormwater and BMP awareness training**

  The SWPPP Coordinator will conduct informal training for all staff, including subcontractors, on the site. The training will be conducted primarily via tailgate sessions and will focus on avoiding damage to stormwater BMPs and preventing illicit discharges. The tailgate sessions will be conducted monthly and will address the following topics: Erosion Control BMPs, Sediment Control BMPs, Non-Stormwater BMPs, Waste Management and Materials Storage BMPs, and Emergency Procedures specific to the construction site.

- **Detailed training for staff with specific stormwater responsibilities**

  The SWPPP Coordinator will provide formal training to all staff and subcontractors with specific stormwater responsibilities, such as installing and maintaining BMPs. The formal training will cover all design and construction specifications for installing the BMPs and proper procedures for maintaining each BMP. Formal training will occur before any BMPs are installed on the site.

6.0 Final Stabilization

6.1 Permanent Seeding

- **Seedbed Preparation**

a. In areas where disturbance results in subsoil or fill material being the final grade surface, topsoil will be spread over the finished area at minimum depth of 4 inches.

b. The seedbed will be free of large clods, rocks, woody debris and other objectionable materials.

c. Fertilizer and lime will be applied to the seedbed according to the manufacturer's recommendations or soil tests.

d. The top layer of soil will be loosened to a depth of 3–5 inches by raking, tilling, disking or other suitable means.

- **Grass Selection/Application**

a. Lawns will be stabilized with a mixture of Kentucky Blue Grass and Creeping Red Fescue at an application rate of 100 pounds per acre or 2.3 pounds per 1,000 square feet.

b. Seed will be applied uniformly by hydroseeding or broadcasting. Where broadcasting is used, the seed will be covered with .25 inch of soil or less.

- **Mulching**

a. Hydromulch will be applied immediately following seeding at an application rate of 90–100 pounds (2–3 bales) per 1,000 square feet.

7.0 SWPPP Coordinator and Duties

The construction site SWPPP Coordinator for the facility is:

Name: _____ Title: _____

Company: _____ Phone:_____.

The SWPPP Coordinator's duties include the following:

- Implement the SWPPP plan;
- Oversee maintenance practices identified as BMPs in the SWPPP;
- Implement and oversee employee training;
- Conduct or provide for inspection and monitoring activities;
- Identify other potential pollutant sources and make sure they are added to the SWPPP;
- Identify any deficiencies in the SWPPP and make sure they are corrected and
- Ensure that any changes in construction plans are addressed in the SWPPP.

8.0 Forms and Logs

Initial Inspection of Erosion and Sediment Control

DEP File Number: _____ Date:_____

Contractor/Representative:_____

Evaluated by SWPPP Coordinator:_____

A. Project Overview

- How Many Acres Total Does the Project Disturb? _____
- Project Start Date:_____ Project End Date:_____
- Phase I start date?_____

B. Paperwork

• *Does the project have a Order of Conditions?	Yes	No	N/A
• *Is the SWPPP Notebook onsite?	Yes	No	N/A

C. Site Preparation

• *Has the contractor installed temporary construction entrance(s) and are the vehicles using it?	Yes	No	N/A
• *Is there a place for concrete wash-out, is it clearly marked and do concrete trucks appear to be using it?	Yes	No	N/A
• *Is the site largely free of construction trash? (cups, lunch sacks, material packaging, etc.)	Yes	No	N/A
• *Have perimeter sediment controls been installed?	Yes	No	N/A
• *Have pre-construction controls been installed per the plan been installed?	Yes	No	N/A
• *Have easily recognizable indications of the construction limits been installed? (fencing, staking, physical barriers)	Yes	No	N/A

* Must be “yes” or N/A in order for inspection to be “satisfactory”.

Note: The local Conservation Commission must inspect and approve of the initial erosion and sediment controls, as installed, prior to the start of construction.

Erosion and Sediment Control Inspection Report Form

Project Name and Location

Weather:	**Pollution Control Measures (BMP) Checklist:**
Rain in last 24 hrs (inches):	____ Inlet Barrier (ie: filter bags) ____ Sediment Barriers (ie: wattles/silt fence) ____ Erosion Blankets, Hydromulch / Seed ____ Stabilized Construction Entrance ____ Diversion Berms ____ Seed / Sod Areas ____ Sediment Basins & Discharge ____ Borrow Areas ____ General Site Condition (trash, etc)
Owner / Permittee:	
A. Current Construction / Active Areas:	

B. Problem Areas / Special Observations(*Note problem areas ONLY below*):

BMP	Location	Observations, Effectiveness, & Corrective Actions Ordered

C. Listing of Areas where construction operations have permanently or temporarily stopped; stabilization measures initiated.

D. Have items noted on last inspection been corrected? Yes No (if No, Explain:)

Note: Inspection comments above indicate deficiencies only. Deficiencies must be corrected within 7 days, unless otherwise noted. All other BMP's on site are considered to be in good working condition.

Inspection Date **SWPPP Coordinator Signature**

BMP INSPECTION CHECKLIST

General notes about Inspections:
1) Site inspected weekly
2) Within 24 hours of the end of a storm with rain >0.5”
3) Deficiencies corrected within 7 calendar days of inspection

Key elements to look at during inspection
1) Proper installation
2) Operation
3) Maintenance

Inlet Barriers (ie:sand bags, filter bags, straw wattles)
- √ Is the structure deteriorating
- √ Is sediment >1/2 the height of structure?
- √ Evidence of water/sediment getting **around or under** barrier?
- √ Are there other structures that require inlet barriers?

Sediment Barriers (ie: silt fence/straw wattles)
- √ Are they trenched in or falling down?
- √ Evidence of sediment/water getting **around** or **under** barrier?
- √ Is sediment more than 1/3 height of structure?
- √ Are there areas where more sediment barriers are required or need extended?

Stabilized Construction Entrance
- √ Is gravel clean or getting filled with mud?
- √ Evidence of sediment being tracked off site onto public streets?

Final or temporary Stabilization area
- √ Mulches/Grasses-are areas thinning or have been disturbed? Re-application req’d?
- √ Straw Blankets-are they deteriorating and need replaced?

Borrow Areas
- √ When on site or offsite borrow areas, which include contractor furnished, are to be excavated below ground elevations, an earth berm must be constructed around the borrow area to prevent runoff from entering excavation area

Sediment Basin
- √ Note the basin depth. Is the basin more than ½ full of sediment from original design?
- √ Condition of basin side slopes
- √ Evidence of overtopping embankment
- √ Condition of outfall

General Site Conditions
- √ Trash barrels-any evidence of trash lying around site
- √ Location of porta potties
- √ Leaking vehicles
- √ Concrete Washouts Designated

Quality Assurance Field Review – Erosion and Sediment Control

DEP File Number: _____ Contractor/Representative:_____

Date:_____ Evaluated by SWPPP Coordinator:_____

A. Project Status: *(brief description of the current phase of construction; major items of work in progress; and general observations of effectiveness and maintenance of site controls, and stormwater discharge at outfalls).*

B. Deficiencies Noted *(List any specific deficiencies found during the review).*

C. Have weekly and rainfall-required inspections been conducted since the last compliance evaluation? Were noted deficiencies corrected within 7 days?

Notice to Contractor: All deficiencies must be corrected within 7 days unless otherwise noted. A record of corrected deficiencies must be maintained.

Final Inspection of Erosion and Sediment Control

DEP File Number: _____ Date:_____

Contractor/Representative:_____

Evaluated by SWPPP Coordinator:_____

Project Overview

- How Many Acres Total Does the Project Disturb? _____
- Project Start Date_____ Project End Date _____

Paperwork

- Is the SWPPP Notebook onsite? Yes No N/A

Final Site Preparation*

- Has the concrete wash-out area been cleaned? Yes No N/A
- Is the site free of construction trash? (cups, lunch sacks, material packaging, wood debris, etc.) Yes No N/A
- Have perimeter sediment controls been taken down? Yes No N/A
- Have indications of the construction limits been taken down? (fencing, staking, physical barriers) Yes No N/A
- Has all the dirt on the site been covered? Yes No N/A
- Have appropriate grasses/sod/trees been planted? Yes No N/A
- Have the plants accepted? Yes No N/A
- Have gutters and streets been cleaned of soil/trash? Yes No N/A
- Have all erosion controls been removed? Yes No N/A

* Must be “yes” or N/A in order for inspection to be “satisfactory”.

Stormwater Management
Operation & Maintenance Plan

1762 Main St
Leicester, MA

Prepared by:
Land Planning, Inc.
214 Worcester St
N. Grafton, MA 01536

April 10, 2019

Operation & Maintenance Plan

Property Owner

Topnotch Realty Corp.
208 Pine Street
Leicester, MA 01524

Site Operator

Topnotch Realty Corp.
208 Pine Street
Leicester, MA 01524

Facility Location

1762 Main Street
Leicester, MA 01524

This Operation & Maintenance Plan is transferable to future property owners and operators. The above information shall be updated as required should a change in ownership or operation occur.

Structural Controls

The stormwater management system has been designed to protect water quality through removal of sediment and pollutants. The permanent BMPs used to capture sediment and pollutants are described as follows:

Stormceptor STC 450i

A Stormceptor inlet unit is provided to intercept runoff from the parking lot. Proper maintenance of this unit is critical as it provides the majority of sediment removal and all oil containment functions of the system. A copy of the manufacturers operation and maintenance manual is attached to this report.

Stormceptor STC 450i	
Activity	**Frequency**
Inspect unit	Four times per year
Clean unit	See attached manufacturers operation and maintenance manual

Subsurface Infiltration System

A subsurface infiltration system consisting of Cultec Recharger 150XLHD chambers within a field of washed stone is provided to recharge groundwater. Stormwater flow into the system is regulated by a 6" PVC pipe located within DMH-1. The system is provided with access ports at the ground surface to provide for inspection and maintenance. A copy of the manufacturers operation and maintenance plan is attached to this report.

Subsurface Infiltration System	
Activity	**Frequency**
Check inlet for clogging (within DMH-1)	Two times per year
Other maintenance	See attached manufacturers operation and maintenance manual

Subsurface Pipe Detention System

A detention system using sealed HDPE pipe for storage is provided to attenuate runoff rates. Stormwater enters the system at DMH-2. System outflow is regulated by weir located within DMH-3. Cleanout ports, flush with the pavement surface, are located at the end of each row of storage pipes.

DMH-3 has a shallow sump between the storage pipe and the outlet weir to allow monitoring of sediment accumulation within the detention system.

Subsurface Pipe Detention System	
Activity	**Frequency**
Check inlet (DMH-2) and outlet (DMH-3) for clogging	Two times per year
Check for sediment accumulation in sump of DMH-3	Two times per year
Sediment removal	See attached manufacturers operation and maintenance manual

Riprap

Stormwater is discharged from DMH-3, through the retaining wall, to a riprap apron. The riprap serves to spread out and dissipate energy from the discharge.

Riprap	
Activity	**Frequency**
Inspect pipe outlet and riprap apron. Remove trash and debris.	Two times per year

Non-Structural Controls and Housekeeping

Snow Removal

Snow shall be moved to the designated storage area located at the south end of the parking lot. Snow shall not be plowed into or over the retaining wall or landscape areas.

Deicing Chemicals

Application of deicing chemicals shall be done sparingly as needed to ensure the safety of the vehicles and pedestrians. Exterior storage of deicing materials on this property is forbidden.

Fertilizers, Pesticides, Herbicides

Organic, slow-release fertilizers should be used within the landscaped areas and maintained lawn areas. Use of pesticides and herbicides is discouraged. Outside storage of fertilizers, pesticides, and herbicides is forbidden.

Landscape Maintenance

Leaves, trimmings, and grass clippings shall be properly disposed of. If these materials are to be composted on-site, it shall be done outside of any wetland resource area or buffer zone.

Street Sweeping

The parking lot and driveways shall be swept as necessary with a minimum frequency of twice per year. The first sweeping shall take place in early spring after the snow has melted. The second sweeping should be done in autumn.

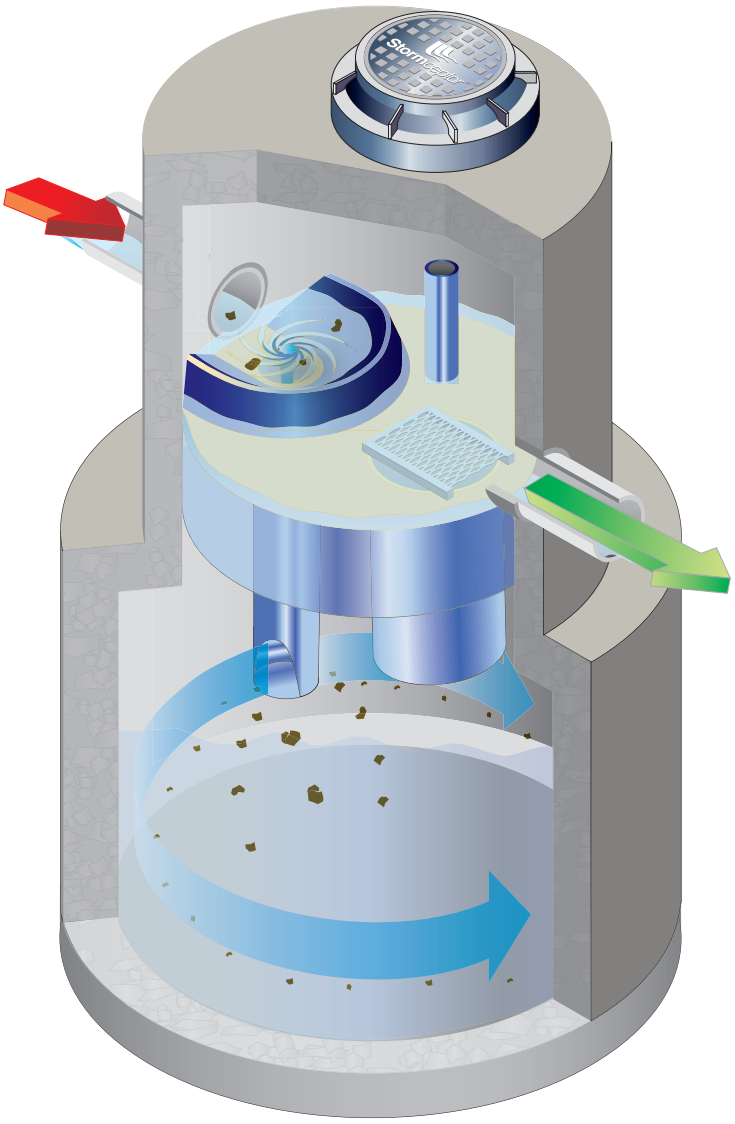
Maintenance and Inspection Log

Inspections for year _____

BMP	Action	Date	Comment	By
Stormceptor STC 450i	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Clean			
	Clean			
Subsurface Infiltration System	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Other			
	Other			
Subsurface Pipe Detention System	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Clean			
	Clean			
Riprap	Inspect			
	Inspect			
	Inspect			
	Inspect			
	Clean			
	Clean			

Stormceptor®

Owner's Manual



Stormceptor is protected by one or more of the following patents:

Canadian Patent No. 2,137,942
Canadian Patent No. 2,175,277
Canadian Patent No. 2,180,305
Canadian Patent No. 2,180,338
Canadian Patent No. 2,206,338
Canadian Patent No. 2,327,768
U.S. Patent No. 5,753,115
U.S. Patent No. 5,849,181
U.S. Patent No. 6,068,765
U.S. Patent No. 6,371,690
U.S. Patent No. 7,582,216
U.S. Patent No. 7,666,303
Australia Patent No. 693.164
Australia Patent No. 707,133
Australia Patent No. 729,096
Australia Patent No. 779,401
Australia Patent No. 2008,279,378
Australia Patent No. 2008,288,900
Indonesia Patent No. 0007058
Japan Patent No. 3581233
Japan Patent No. 9-11476
Korean Patent No. 0519212
Malaysia Patent No. 118987
New Zealand Patent No. 314,646
New Zealand Patent No. 583,008
New Zealand Patent No. 583,583
South African Patent No. 2010/00682
South African Patent No. 2010/01796
Other Patents Pending

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1 – Stormceptor Overview

2 – Stormceptor Operation & Components

3 – Stormceptor Identification

4 – Stormceptor Inspection & Maintenance
    Recommended Stormceptor Inspection Procedure
    Recommended Stormceptor Maintenance Procedure

5 – Contact Information (Stormceptor Licensees)

Congratulations!

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a “Hydrodynamic Separator (HDS)” or an “Oil Grit Separator (OGS)”, engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- “STORMCEPTOR” is *clearly* marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- STF (Fiberglass)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site’s tailwater conditions)
- Series Unit (combines treatment in two systems)

Please Maintain Your Stormceptor

To ensure long-term environmental protection through continued performance as originally designed for your site, **Stormceptor must be maintained**, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call your local Stormceptor Licensee or Imbrium® Systems.

2 – Stormceptor Operation & Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology.

Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

Figure 1.

Inline Stormceptor

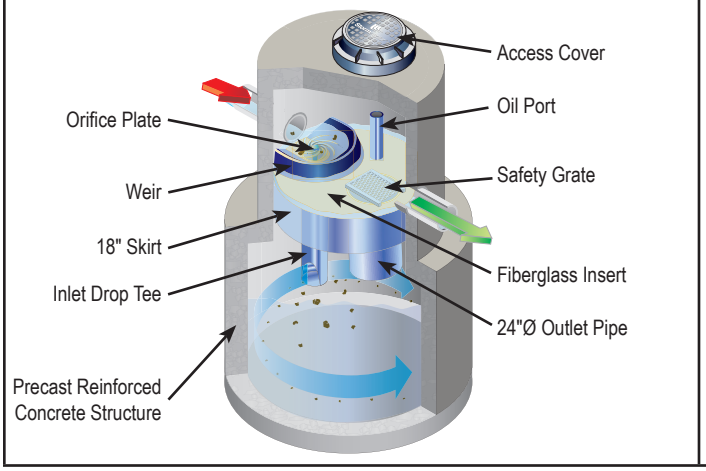
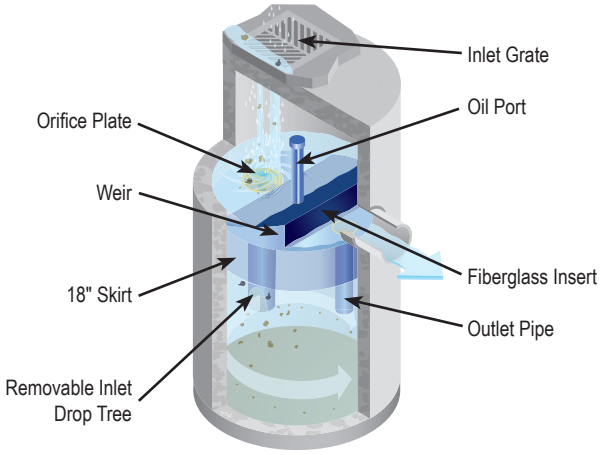


Figure 2.

Inlet Stormceptor



- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS, MAX and STF) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/ approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using **Table 1**.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Stormceptor Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS & OSR Stormceptor models in both USA and Canada/International (excluding South East Asia and Australia) are provided in **Tables 1 and 2**. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1A. (US) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

EOS Model	Insert to Base (in.)
4-175	60
9-365	55
12-590	71
18-1000	105
24-1400	94
36-1700	134
48-2000	128
60-2500	150
72-3400	134
110-5000*	128
130-6000*	150
160-7800*	134

OSR Model	Insert to Base (in.)
65	60
140	55
250	94
390	128
560	134
780*	128
1125*	134

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 1B. (CA & Int'l) Stormceptor Dimensions – Insert to Base of Structure

STC Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
1500	2.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
11000*	4.0
14000*	3.7

EOS Model	Insert to Base (m)
300	1.5
750	1.5
1000	1.8
2000	2.8
3000	3.7
4000	3.4
5000	4.0
6000	3.7
9000*	3.4
10000*	4.0
14000*	3.7

OSR Model	Insert to Base (m)
300	1.7
750	1.6
2000	2.6
4000	3.6
6000	3.7
9000*	3.6
14000*	3.7

Typical STF m (in.)
1.5 (60)
1.5 (61)
1.8 (73)
2.9 (115)
2.3 (89)
3.2 (127)
2.9 (113)
3.5 (138)
3.3 (128)

Notes:

1. *Depth Below Pipe Inlet Invert to the Bottom of Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2A. (US) Storage Capacities

STC Model	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3	**EOS Model**	Hydrocarbon Storage Capacity gal	**OSR Model**	Hydrocarbon Storage Capacity gal	Sediment Capacity ft^3
450	86	46	**4-175**	175	**065**	115	46
900	251	89	**9-365**	365	**140**	233	58
1200	251	127	**12-590**	591			
1800	251	207	**18-1000**	1198			
2400	840	205	**24-1400**	1457	**250**	792	156
3600	840	373	**36-1700**	1773			
4800	909	543	**48-2000**	2005	**390**	1233	465
6000	909	687	**60-2500**	2514			
7200	1059	839	**72-3400**	3418	**560**	1384	690
11000*	2797	1089	**110-5000***	5023	**780***	2430	930
13000*	2797	1374	**130-6000***	6041			
16000*	3055	1677	**160-7800***	7850	**1125***	2689	1378

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

Table 2B. (CA & Int'l) Storage Capacities

STC Model	Hydrocarbon Storage Capacity L	Sediment Capacity L	EOS Model	Hydrocarbon Storage Capacity L	OSR Model	Hydrocarbon Storage Capacity L	Sediment Capacity L
300	300	1450	**300**	662	**300**	300	1500
750	915	3000	**750**	1380	**750**	900	3000
1000	915	3800	**1000**	2235			
1500	915	6205					
2000	2890	7700	**2000**	5515	**2000**	2790	7700
3000	2890	11965	**3000**	6710			
4000	3360	16490	**4000**	7585	**4000**	4700	22200
5000	3360	20940	**5000**	9515			
6000	3930	26945	**6000**	12940	**6000**	5200	26900
9000*	10555	32980	**9000***	19010	**9000***	9300	33000
11000*	10555	37415	**10000***	22865			
14000*	11700	53890	**14000***	29715	**14000***	10500	53900

Notes:

1. *Hydrocarbon & Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.*

**Consist of two chamber structures in series.*

4 – Stormceptor Inspection & Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see **Table 2**). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.

- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in **Table 2**, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins. For typical inspection and maintenance activities, no specific supplemental training is required for the Stormceptor. Information provided within this Manual (provided to the site owner) contains sufficient guidance to maintain the system properly.

In unusual circumstances, such as if a damaged component needs replacement or some other condition requires manned entry into the vessel, confined space entry procedures must be followed. Only professional maintenance service providers trained in these procedures should enter the vessel. Service provider companies typically have personnel who are trained and certified in confined space entry procedures according to local, state, and federal standards.

What equipment is typically required for inspection?

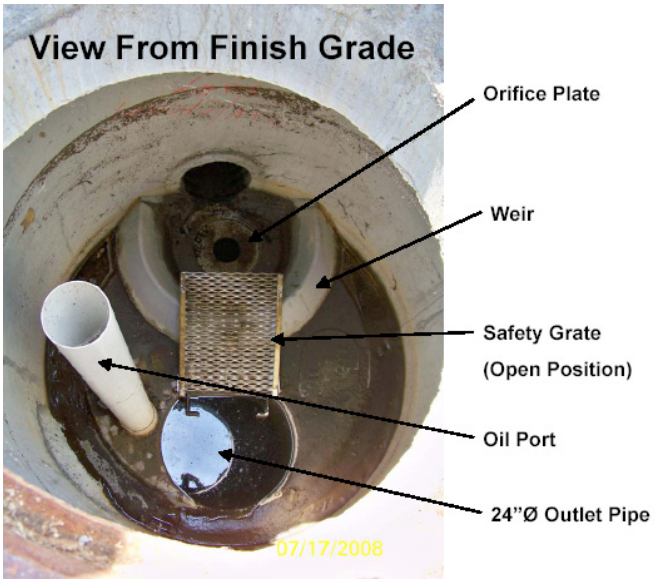
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Recommended Stormceptor Inspection Procedure:

- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch (100 mm) or 6-inch (150 mm) diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch (610 mm) diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

Figure 3.

Figure 4.



What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, and safety harness for specially trained personnel if confined space entry is required

Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck.

No entry into the unit is required for maintenance. ***DO NOT ENTER THE STORMCEPTOR CHAMBER*** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146 or Canada Occupational Safety and Health Regulations – SOR/86-304). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local, provincial, and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
    - For 6-ft (1800 mm) diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch (610 mm) outlet riser pipe.
    - For 4-ft (1200 mm) diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch (305 mm) drop tee hole.

Figure 5.

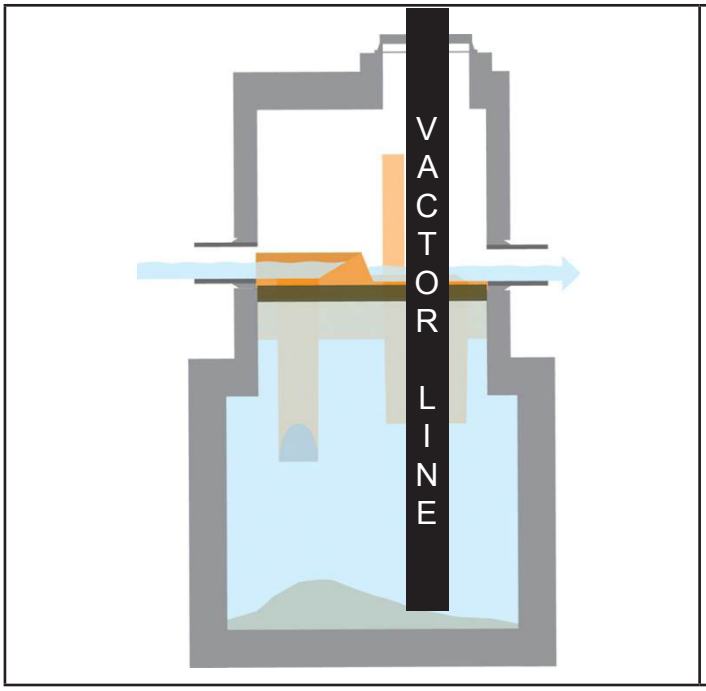
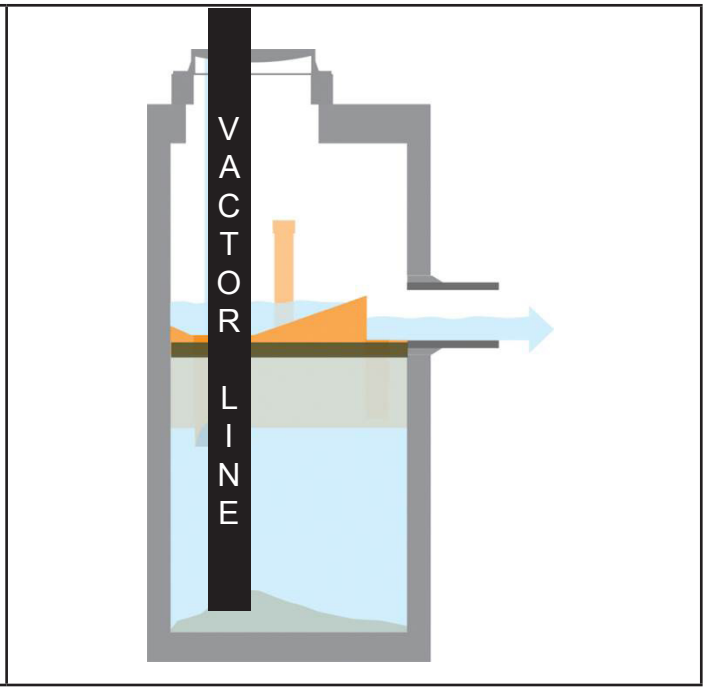


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

Figure 7.

Figure 8.

A maintenance worker stationed at the above ground surface uses a vacuum hose to evacuate water, sediment, and debris from the system.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

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 hydrocarbon rainbow or sheen can be seen at

very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean that 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 or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?
The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?
Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in **Table 3** based on the unit size.

Table 3A. (US) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (in)	EOS Model	Maintenance Sediment depth (in)	Oil Storage Depth (in)	OSR Model	Maintenance Sediment depth (in)
450	8	**4-175**	9	24	**065**	8
900	8	**9-365**	9	24	**140**	8
1200	10	**12-590**	11	39		
1800	15					
2400	12	**24-1400**	14	68	**250**	12
3600	17	**36-1700**	19	79		
4800	15	**48-2000**	16	68	**390**	17
6000	18	**60-2500**	20	79		
7200	15	**72-3400**	17	79	**560**	17
11000*	17	**110-5000***	16	68	**780***	17
13000*	20	**130-6000***	20	79		
16000*	17	**160-7800***	17	79	**1125***	17

Note:

1. *The values above are for typical standard units.*

**Per structure.*

Table 3B. (CA & Int'l) Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment depth (mm)	EOS Model	Maintenance Sediment depth (mm)	Oil Storage Depth (mm)	OSR Model	Maintenance Sediment depth (mm)
300	225	**300**	225	610	**300**	200
750	230	**750**	230	610	**750**	200
1000	275	**1000**	275	990		
1500	400					
2000	350	**2000**	350	1727	**2000**	300
3000	475	**3000**	475	2006		
4000	400	**4000**	400	1727	**4000**	375
5000	500	**5000**	500	2006		
6000	425	**6000**	425	2006	**6000**	375
9000*	400	**9000***	400	1727	**9000***	425
11000*	500	**10000***	500	2006		
14000*	425	**14000***	425	2006	**14000***	425

Note:

1. *The values above are for typical standard units.*

   **Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Stormceptor Representative, or Imbrium Systems.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

Contact Information

Questions regarding the Stormceptor can be addressed by contacting your area Stormceptor Licensee, Imbrium Systems, or visit our website at www.stormceptor.com.

Stormceptor Licensees:

CANADA

Lafarge Canada Inc.
www.lafargepipe.com

403-292-9502 / 1-888-422-4022	Calgary, AB
780-468-5910	Edmonton, AB
204-958-6348	Winnipeg, MB, NW. ON, SK

Langley Concrete Group
www.langleyconcretegroup.com

604-502-5236	BC

Hanson Pipe & Precast Inc.
www.hansonpipeandprecast.com

519-622-7574 / 1-888-888-3222	ON

Lécuyer et Fils Ltée.
www.lecuyerbeton.com

450-454-3928 / 1-800-561-0970	QC

Strescon Limited
www.strescon.com

902-494-7400	NS, NF
506-633-8877	NB, PE

UNITED STATES

Rinker Materials
www.rinkerstormceptor.com
1-800-909-7763

AUSTRALIA & SOUTHEAST ASIA, including New Zealand & Japan

Humes Water Solutions
www.humes.com.au
+61 7 3364 2894

Imbrium Systems Inc. & Imbrium Systems LLC

Canada	1-416-960-9900 / 1-800-565-4801
United States	1-301-279-8827 / 1-888-279-8826
International	+1-416-960-9900 / +1-301-279-8827
Email	info@imbriumsystems.com

www.imbriumsystems.com
www.stormceptor.com

Contactor® & Recharger®
Stormwater Chambers The Chamber With The Stripe®

Operation and Maintenance Guidelines

CULTEC™

Operation & Maintenance

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access

This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris as required.

B. Major Maintenance
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

Major Maintenance *(continued)*

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.
	45 to 50 years after commissioning	• Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

CULTEC™
Chamber of Choice™

CULTEC, Inc.
878 Federal Road • P.O. Box 280 • Brookfield, CT 06804
Phone: 203-775-4416 • Toll Free: 800-4-CULTEC • Fax: 203-775-1462
Web: www.cultec.com • E-mail: custservice@cultec.com

TECHNICAL NOTE

Retention/Detention System Maintenance

TN 6.01
February 2007

This document is provided for informational purposes only and is meant only to be a guide. Individuals using this information should make their own decisions as to suitability of this guideline for their individual projects and adjust accordingly.

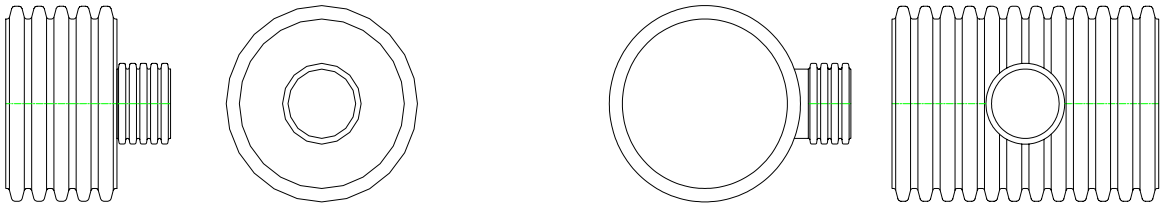
Introduction

A retention/detention system is comprised of a series of pipes and fittings that form an underground storage area, which retains or detains storm water runoff from a given area. As sediment and debris settle out of the detained stormwater, build up occurs that requires the system to be regularly inspected and cleaned in order for the system to perform as originally designed. The following provides the available fittings and guidelines for inspection and maintenance of an HDPE underground storage system.

System Accessories and Fittings

Concentric Reducers

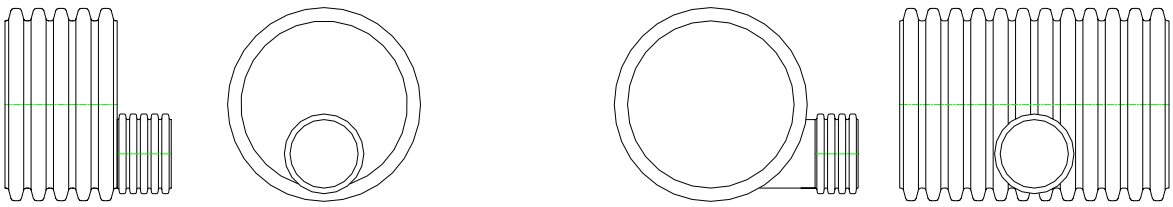
Concentric Reducers are fittings that transition between two pipes, either in line with one another or at perpendicular angles. The centerlines of the two pipes are at the same elevation. When a concentric reducer is used to connect the manifold pipe to the lateral pipes, most debris will be trapped in the manifold pipe.



SIDE VIEW SECTION VIEW SIDE VIEW SECTION VIEW

Eccentric Reducers

Eccentric Reducers are fittings that transition between two pipes, either in line with one another or at perpendicular angles. The inverts of the two pipes are at the same elevations. When an eccentric reducer is used to connect the manifold pipe to the lateral pipes, most debris will follow the flow of the storm water into the lateral pipes.



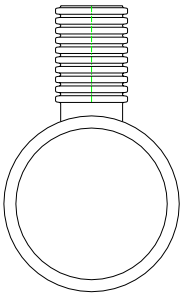
SIDE VIEW SECTION VIEW SIDE VIEW SECTION VIEW

Riser

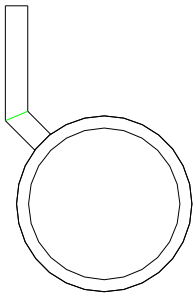
Each retention/detention system typically has risers strategically placed for maintenance and inspection of the system. These risers are typically 24” in diameter or larger and are placed on the manifold fittings.

Cleanouts

Cleanout ports are usually 4-, 6-, or 8-in diameter pipe and are placed on the manifold fittings. They are used for entrance of a pipe from a vacuum truck or a water-jetting device.



RISER
CROSS-SECTION VIEW



CLEANOUT
CROSS-SECTION VIEW

For a complete listing of available fittings and components please refer to the *ADS Fittings Manual*.

Maintenance Overview of a Retention/Detention System

Maintaining a clean and obstruction-free retention/detention system helps to ensure the system performs the intended function of the primary design. Build up of debris may obstruct flow through the laterals in a retention system or block the entranceway of the outlet pipe in a detention system. This may result in ineffective operation or complete failure of the system . Additionally, surrounding areas may potentially run the risk of damage due to flooding or other similar issues.

Inspection/Maintenance Frequency

All retention/detention systems must be cleaned and maintained. Underground systems may be maintained more cost effectively if these simple guidelines are followed. Inspection should be performed at a minimum of once per year. Cleaning should be done at the discretion of individuals responsible to maintain proper storage and flow. While maintenance can generally be performed year round, it should be scheduled during a relatively dry season.

Pre-Inspection

A post-installation inspection should be performed to allow the owner to measure the invert prior to accumulation of sediment. This survey will allow the monitoring of sediment build-up without requiring access to the retention/detention system.

The following is the recommended procedure for pre-inspections:

1) Locate the riser section or cleanouts of the retention/detention system. The riser will typically be 24” in diameter or larger and the cleanouts are usually 4”, 6” or 8” in diameter.
2) Remove the lid of the riser or clean outs.
3) Insert a measuring device into the opening and make note to a point of reference on the stick or string. (This is done so that sediment build up can be determined in the future without having to enter the system.)

Inspection/Maintenance

A retention/detention system should be inspected at a minimum of one time a year or after major rain events if necessary.

The following is the recommended procedure to inspect system in service:

1) Locate the riser section of the retention/detention system. The riser will typically be 24” in diameter or larger.
2) Remove the lid from the riser.
3) Measure the sediment buildup at each riser and cleanout location. Only certified confined space entry personnel having appropriate equipment should be permitted to enter the retention/detention System.
4) Inspect each manifold, all laterals, and outlet pipes for sediment build up, obstructions, or other problems. Obstructions should be removed at this time.
5) If measured sediment build up is between 5% - 20% of the pipe diameter, cleaning should be considered; if sediment build up exceeds 20%, cleaning should be performed at the earliest opportunity. A thorough cleaning of the system (manifolds and laterals) shall be performed by either manual methods or by a vacuum truck.