STORMWATER MANAGEMENT REPORT

PROJECT SITE:
SHINGLEMILL APARTMENTS
75-79 POND STREET
ROCKLAND, MASSACHUSETTS 02370

PREPARED FOR:
SHINGLEMILL, LLC
4 FIRST STREET
BRIDGEWATER, MASSACHUSETTS 02324

PREPARED BY:



4 First Street • Bridgewater, Massachusetts 02324

Phone: (508) 697-3191 • Fax: (508) 697-5996 E-mail: <u>DDmitruk@coneco.com</u>

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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. 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 8²
- 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.

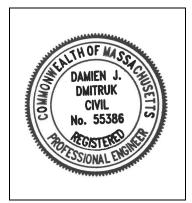
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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 2/14/2022

Checklist

	ject Type: Is the application for new development, redevelopment, or a mix of new and evelopment?
\boxtimes	New development
	Redevelopment
	Mix of New Development and Redevelopment



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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:

\boxtimes	No disturbance to any Wetland Resource Areas
	Site Design Practices (e.g. clustered development, reduced frontage setbacks)
	Reduced Impervious Area (Redevelopment Only)
\boxtimes	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):
Sta	ndard 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
\boxtimes	Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



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Checklist for Stormwater Report

Cł	necklist (continu	req)		
Sta	ndard 2: Peak Rate	e 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.			
	development rates flooding increases of	for the 2-year and 10-year 24-h during the 100-year 24-hour sto	ent peak discharge rates do not exceed pre- our storms. If evaluation shows that off-site rm, calculations are also provided to show that seed pre-development rates for the 100-year 24-	
Sta	ndard 3: Recharge			
\boxtimes	Soil Analysis provid	ed.		
\boxtimes	Required Recharge	Volume calculation provided.		
	Required Recharge	volume reduced through use o	of the LID site Design Credits.	
\boxtimes	Sizing the infiltration	າ, BMPs is based on the followi	ng method: Check the method used.	
	⊠ Static	⊠ Simple Dynamic	☐ Dynamic Field ¹	
	Runoff from all impe	ervious areas at the site discha	rging to the infiltration BMP.	
	are provided showir		lischarging to the infiltration BMP and calculations buting runoff to the infiltration BMPs is sufficient to	
\boxtimes	Recharge BMPs ha	ve been sized to infiltrate the R	equired Recharge Volume.	
		ve been sized to infiltrate the R or the following reason:	equired Recharge Volume <i>only</i> to the maximum	
	☐ Site is comprise	ed solely of C and D soils and/o	r bedrock at the land surface	
	☐ M.G.L. c. 21E s	ites pursuant to 310 CMR 40.0	000	
	☐ Solid Waste La	ndfill pursuant to 310 CMR 19.0	000	
	Project is other practicable.	wise subject to Stormwater Mar	nagement Standards only to the maximum extent	
\boxtimes	Calculations showing	ng that the infiltration BMPs will	drain in 72 hours are provided.	
	Property includes a	M.G.L. c. 21E site or a solid wa	aste 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.



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Checklist for Stormwater Report

Cł	necklist (continued)
Sta	andard 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.
\boxtimes	Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.
Sta	indard 4: Water Quality
The	e 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.

applicable, the 44% TSS removal pretreatment requirement, are provided.

□ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if



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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.



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Checklist for Stormwater Report

Checklist (continued)

	andard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum tent 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.
Sta	andard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control
	Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the owing 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;

the information set forth above has been included in the Stormwater Report.

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing

Inspection Schedule; Maintenance Schedule;

Inspection and Maintenance Log Form.



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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

any stormwater to post-construction BMPs.

\boxtimes	The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
\boxtimes	An Illicit Discharge Compliance Statement is attached;

NO Illicit Discharge Compliance Statement is attached but will be submitted *prior to* the discharge of

INTRODUCTION

Coneco Engineers & Scientists, Incorporated (Coneco) has completed a drainage analysis of the subject property, located at 0 Pond Street in Rockland, Massachusetts, the results of which are contained herein. The purpose of this analysis is to quantitatively understand the impacts of the proposed development of the subject property on the existing hydrologic conditions, and to mitigate any impacts through the implementation of a stormwater management system utilizing best management practices supported by an Operations and Maintenance Plan and a Long-Term Pollution Prevention Plan.

DEVELOPMENT SUMMARY

The proposed development consists of the construction of two residential apartment buildings, ancillary parking areas, pedestrian walkways, landscaping, utilities, and stormwater management system. This project is being filed under the Chapter 40B Comprehensive Permit process and will comply with the Massachusetts Department of Environmental Stormwater Management Standards.

STORMWATER MANAGEMENT SYSTEM OVERVIEW

The proposed stormwater management system consists of a closed drainage system including deep sump hooded catch basins, roof leaders, pipes, drain manholes, proprietary particle separators, underground infiltration chambers, outlet control structures, and rain gardens, all of which will collect stormwater, provide water quality, and mitigate increases in peak runoff flow discharging from the site.

Catch basin structures will include four-foot deep sumps and oil/gas separator hoods. The deep sumps are intended to remove sediment, and the hoods are intended to remove oil and gas from the stormwater prior to release. Stormwater will then travel though a system of pipes and drain manholes. The closed drainage system has been designed to accommodate a 25-year rainfall event.

Using hydrodynamic separation, proprietary particle separators have been designed to provide additional Total Suspended Solids (TSS) removal for downstream infiltration chamber systems.

The infiltration chambers systems with isolation rows have been designed to provide water quality treatment, groundwater recharge, and attenuation of the proposed peak flow rates and volumes to be equal or less than existing condition

The plunge pools have been designed to include flared end inlets, a depressed center, and a level outer rim. The depressed center promotes the removal of any residual sediment, while the level outer rim dissipates the energy of the stormwater by reducing flow velocities and eliminating the point discharges.

METHODOLOGY

Drainage calculations were performed to demonstrate that there will be no increase in the rate of runoff from the subject site under proposed conditions. The rate of runoff is compared at a common point, referred to as the design point, for both the pre and post development conditions (or the existing and proposed condition in the case of a redevelopment project). The hydrologic and hydraulic model created to analyze the pre and post development condition was developed using the Soil Conservation Service (SCS) Technical Release No. 20 (TR 20, SCS unit hydrograph procedures), SCS Technical Release No. 55 (TR 55, Time of Concentration (Tc) and Curve Number (CN)), NOAA Atlas 14 (Atlas-14, rainfall intensity) and the stormwater detention facilities were modeled using the SCS Storage Indication Method.

<u>Time of Concentration (T_c)</u> - Time required for stormwater runoff to travel from the most hydraulically distant point in a drainage area or subcatchment to the design point. The T_c is calculated based upon slope,

distance, surface cover and type of flow. A longer time of concentration will generally result in a smaller rate of runoff.

<u>Curve Number (CN)</u> - Represents the amount of runoff expected from a particular segment of the drainage area. A higher curve number will be less permeable and therefore a larger rate of runoff. The CN is based upon three factors: soil type, soil cover, and cover condition. The soil type is graded A to D; A soil is the post permeable, D is the least. The soil cover (e.g. - vegetated, developed, farmland or impervious) ranges from 30-98, with more permeable soil covers having a lower value. The final factor is the condition of the vegetated soil cover (good, fair or poor), where vegetated cover in good condition is the most permeable and allows the least runoff.

<u>The Hydrologic Soil Group (HSG)</u> for the drainage areas was determined from the Soil Conservation Service Soil Survey of Plymouth, Massachusetts. The soil survey contains maps which depict the extent of the various soil types. A soil type overlay plan is attached as Figure 6.

<u>Design Software</u> - To assist in the analysis, software entitled HydroCAD, Version 10.0 (developed by HydroCAD Software Solutions, L.L.C.) was utilized. The HydroCAD program calculates the runoff based on rainfall events and watershed characteristics, and produces a runoff hydrograph (a runoff rate versus time curve). If applicable, stage-storage-discharge curves for a specific detention facility are calculated.

<u>Peak Attenuation</u> - The peak rate of runoff at the design points was calculated for the existing and proposed conditions for the 2, 10, 25, and 100-year, 24-hour storm events. The peak rate of runoff was compared for each storm event to determine if there was an increase from the pre to post development condition.

Runoff Volume - The total volume of runoff for the entire site was calculated for the existing and proposed conditions for the 2, 10, 25, and 100-year, 24-hour storm events. The volume of runoff was compared for each storm event to determine if there was an increase from the pre to post development condition.

EXISTING CONDITIONS

Coneco delineated the existing and proposed conditions drainage areas from an existing topographic survey. A site visit was conducted to evaluate the existing drainage patterns and watershed areas for the site and surrounding areas. The site is located on the southwest side of Pond Street in Rockland, Massachusetts. The property consists of mostly wetlands which surround an undeveloped upland area. The upland area is mostly wooded but also has some cleared and brush areas. There are access paths that connect the two major upland areas separating the wetland areas. Existing culverts providing a hydraulic connection between the wetlands beneath the upland access paths. Topography generally slopes from the upland area to the surrounding wetlands. The wetlands generally slope from the northeast discharging flows along southwestern edge of the property. Grades range from approximately 0.5 to 8 percent.

The Soil Conservation Service map for the area indicates that the site is made of six soil types. Please refer to Table 1 for a summary of these soils.

<u>Table 1</u>
<u>Existing Soil Classifications</u>

SOIL MAP UNIT	PLYMOUTH COUNTY SOIL SURVEY MAP UNIT NAME AND DESCRIPTION	HYDROLOGIC SOIL GROUP
23A	Tihonet Coarse sand, 0 to 3 percent slopes	A/D
52A	Freetown muck, 0 to 1 percent slopes	B/D
427B	Newfields fine sandy loam, 3 to 8 percent slopes, extremely stony	В
619A	Deerfield-Urban land complex, 0 to 3 percent slopes	А
626B	Merrimac – Urban land complex, 0 to 8 percent slopes	А
655A	Udorthents, wet substratum, 0 to 3 percent slopes	B/D

PROPOSED CONDITIONS

The proposed development consists of the two apartment buildings, a community building, and recreational open space areas. In addition to these new structures, associated access drives, parking areas, walkways, utilities, and drainage systems will be installed throughout the site. These changes increase the overall impervious area found at the site. However, the proposed drainage system has been designed to capture the previously uncontrolled stormwater runoff and direct flows to storage and infiltration facilities, which results in a reduction of the peak rate of runoff. Furthermore, with the addition of the deep sump catch basins with oil/gas hoods, proprietary separators, and infiltration facilities the runoff from the impervious areas will be treated appropriately prior to discharge.

STORMWATER MANAGEMENT STANDARDS REVIEW

As part of this drainage analysis, Coneco has performed an in-depth review of the subject site for conformance with the Massachusetts Department of Environmental Protection's Stormwater Management Standards. The project is not considered a redevelopment project (as defined in Standard 7) and is therefore required to meet all of the Massachusetts Stormwater Management Standards. The following is a summary of our findings relative to our review of each of the standards. Please note that the actual text of each standard is italicized for clarity.

STANDARD 1: No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

The stormwater shall be treated prior to release with deep sump catch basins with hoods, proprietary separators, and infiltration chamber systems. The deep sump will provide an area for sediment to settle out and the hood will provide oil and gas separation. The water quality units will provide further treatment using hydrodynamic separation to further remove pollutants before discharging into an infiltration facility. An isolation row will be installed at the invert row of chambers to further filter stormwater prior to being infiltrated. Outlets of the infiltration facilities have been designed to reduce erosion and eliminate scouring within the wetland areas. A plunge pool shall be installed at each discharge point. The plunge pool will be lined with rip rap and be depressed to form a pool which will enhance sediment removal prior to discharging runoff over a larger area which slows down the velocity and therefore reduces scour.

STANDARD 2: Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

The existing and proposed site conditions were analyzed for the 2, 10, 25, and 100-year 24-hour storm events using the aforementioned methodology (please refer to appendices A and B of this report for HydroCAD output support data). Due to the introduction of stormwater being captured, controlled, attenuated, and infiltrated there is no increase in peak discharge rates or total volume for all storm events analyzed (please refer to Appendix C of this report for Peak Rate of Runoff tables).

CLOSED DRAINAGE SYSTEM CALCULATIONS

Rational Method – Sizing pipes for the 25-year storm

The Rational Method was used to calculate the peak flow through the pipes, and the Manning equation was used to determine the minimum pipe size required to pass the required flow. The closed drainage system calculations determine the rate of runoff, the time of concentration and the rainfall intensity for the drainage subcatchment. The calculations were performed for a 25-year storm event. The following standards were used:

The Rational Formula (Q =CIA) was used to determine the flow to each structure.

Q = Flow cubic feet per second (CFS) C = Runoff coefficients I = Rainfall Intensity (inches per hour) A = Drainage Area (acres)

2. The runoff coefficients used are as follows:

```
Impervious (pavement and roofs) = 0.85
Landscaped = 0.4
```

3. The intensity for each area was determined by the Steel Formula for a 25-year frequency storm. The Steel Formula is:

```
I = k/(t+b)
I = Intensity
k = 230 (25 yr)
t = Time of Concentration
b = 30 (25 yr)
```

- 4. The times of concentration were calculated using a spreadsheet which calculates flow time in the pipe with the Manning equation. A minimum time of concentration of six (6) minutes was utilized.
- 5. The Manning's formula was utilized to calculate the capacity of the individual pipes in the closed drainage system. The Manning's formula is:

```
Q = (Ap) (1.486/n) (s<sup>1/2</sup>) (h<sup>2/3</sup>)
Q = Flow in CFS
Ap = Cross-sectional area of the pipe (square feet)
n = Roughness coefficient
s = slope of the pipe (ft/ft)
h = hydraulic radius = area/wetted perimeter (sf/ft)
```

The closed drainage system as designed is capable of handling the design flow as calculated, as well as maintaining a design velocity of between 2.0 feet per second (fps) and 10.0 fps. Two feet per second is considered "self cleansing velocity", and will prevent the pipes from accumulating sediment. Ten feet per second is considered a safe maximum velocity, to reduce scouring of the pipes

STANDARD 3: Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Standard 3 requires that a certain volume of water be recharged to the site depending on existing soil types and square feet of total impervious area over each soil type. Please refer to Appendix C Stormwater Management Standard 3 - Recharge Volume for a summary of the required recharge.

The on-site infiltration system must be designed with a minimum infiltration capacity of 1,922 cubic feet. The proposed design directs 96.0% of the proposed impervious on site to recharge facilities, resulting in an adjustment factor and increasing the require recharge volume to 2,003 cf. Soils in the proposed area of the infiltration facilities are adequate for infiltration, which was confirmed with onsite soil evaluation. The bottoms of the infiltration facilities have been designed to provide four feet of separation to seasonal high groundwater elevations. Please refer to Appendix F for the test pit soil logs. The infiltration facilities as designed will provide a total static recharge volume of 10,173 cubic feet. Please refer to Appendix C for these calculations as well as 72-hour drawdown calculations.

It should be noted that the proposed Infiltration BMPs do not adversely impact nearby wetland resource areas.

STANDARD 4: Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:

- a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;
- b) Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and
- c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

The proposed stormwater management system will achieve the 80% TSS removal requirement. Please refer to Table 2 for a TSS removal summary.

Please note that a long term pollution prevention plan has been developed as part of the analysis and can be found in Appendix D.

TREATMENT OF SUSPENDED SOLIDS:

Catch basins will be equipped with hoods and four-foot sumps to limit sediment, oils, and grease from being discharged to the drainage system.

The proprietary separators will further reduce total suspended solids (TSS) entering the infiltration facility, by the use of swirling water and baffles to remove floatables and sediments.

The inlet row of the infiltration chambers will be designed as an isolation row. The row of chambers will be wrapped in filter fabric, thus further filtering TSS from the stormwater. The isolation row is used as pretreatment to the infiltration chambers, thus allowing 80% TSS removal for the system.

Please refer to Table 2 – Total Suspended Solids Removal for this information.

Due to the site infiltration rate greater than 2.4 in/hr and the discharges to critical areas, a pretreatment requirement of 44% is necessary to receive the 80% TSS removal rate for the infiltration facilities. This requirement was met by the use of an isolation row.

Runoff from roofs will be considered clean which require no pretreatment. All other proposed impervious areas will be collected in the closed drainage system which is routed through pretreatment devices.

Due to the site conditions and constraints, the entrance access portion of the site and a minor amount of non-traffic impervious will discharge to the wetlands without entering a treatment device. These discharges are being considered as *de minimus*, and calculations have been provided in within Appendix C.

<u>Table 2</u> <u>Total Suspended Solids Removal</u>

Treatment Train 1(Infiltration Chamber A & B)

BMP	TSS Removal Rate	Starting TSS Load	TSS Removed	Remaining TSS Load
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Isolation Row	0.50	0.75	Pretreatment	0.75
Subsurface Structure Infiltration Chambers	0.80	0.75	0.60	0.15
		Total Suspended	d Solids Removed:	85%

Treatment Train 2 (Infiltration Chamber C)

BMP	TSS Removal Rate	Starting TSS Load	TSS Removed	Remaining TSS Load
Isolation Row	0.50	1.00	Pretreatment	1.00
Subsurface Structure (Infiltration Chambers)	0.80	1.00	0.80	0.20
		Total Suspended	Solids Removed:	80%

Treatment Train 3 (Infiltration Chamber D)

BMP	TSS Removal Rate	Starting TSS Load	TSS Removed	Remaining TSS Load
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Proprietary Separator	0.80	0.75	0.60	0.15
Isolation Row	0.50	0.15	Pretreatment	0.15
Subsurface Structure Infiltration Chambers	0.80	0.15	0.12	0.03
		Total Suspended	d Solids Removed:	97%

WATER QUALITY VOLUME

Water Quality Volume(WQV) calculations must be performed per this standard based on the total site impervious area. The equation is as follows:

Water Quality Volume = Total impervious area of post-development project x 1 inch as required by the Stormwater Standards.

Water Quality Volume = 207,424 s.f. impervious area x 1.0 inches/12 inches per foot = 17,286 cubic feet

Each of the infiltration chamber systems have been sized to hold a portion of the water quality volume. See Appendix C for the required water quality volume calculations and the Simple Dynamic method sizing calculations for the infiltration BMPs.

STANDARD 5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The project site is not a land use with higher potential pollutant loads, per the regulation.

STANDARD 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

The project site discharges into an Outstanding Resource Water protection area. Due to these site conditions the proposed discharge is subject to greater stormwater discharge standards. The site is not within or discharge near or to any other critical areas. See Figure 5, Critical Areas.

Due to the project site discharging into an Outstanding Resource Water protection area the use of BMPs are limited to those approved by MassDEP for that protection area. In addition, the Stormwater Standards requires at least 44% TSS pretreatment prior to discharging into an infiltration facility. All infiltration chambers have been designed with an isolation row to accommodate the pretreatment requirement. The primary source of pollution for the site will be the roadway, which is a necessary and integral part of the overall project. The stormwater treatment trains have been designed to meet all DEP stormwater standards.

In addition, the Table 3 compares the existing and the proposed runoff volume from the property to the existing certified vernal pool on site. As shown the proposed runoff to the vernal pool nearly matches that of the existing conditions for a 1-year 24 hour (2.78 inch) storm event. This calculation is being used to indicate that no impact to the MHW elevation within the vernal pool has occurred as a result of the project. HydroCAD calculations for this analysis can be found in Appendix C of this report.

<u>Table 3</u>
<u>VERNAL POOL VOLUME COMPARISON</u>

	EXISTING CONDITIONS VOLUME (cf)	PROPOSED CONDITIONS VOLUME (cf)
2.78" 24-HOUR (1-YEAR)	7,596	7,601

STANDARD 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

The project involves new development of an undeveloped site, and therefore is required to fully meet all the Stormwater Management Standards.

STANDARD 8: A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

A Stormwater Pollution Prevention Plan (SWPPP) will be prepared before the disturbance of any earth commences on the project site. The SWPPP will be prepared by others per EPA NPDES NOI guidelines and submitted under a separate cover.

STANDARD 9: A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.

Please refer to Appendix E for the Operation and Maintenance Plan for the proposed Stormwater Management System.

STANDARD 10: All illicit discharges to the stormwater management system are prohibited.

To our knowledge, no illicit discharges are made to the stormwater management system. An Illicit Discharge Compliance Statement is attached in Appendix G of this report.

CONCLUSION/SUMMARY:

Based on the HydroCAD analysis for the 2, 10, 25, and 100-year storm events, the peak rate of runoff and the total volume have decreased from the existing to the proposed condition. Furthermore, effluent water quality has been enhanced and infiltration has been introduced to previously uncontrolled areas thereby promoting/preserving the natural hydrologic conditions. In addition to these improvements, all 10 of the DEP Stormwater Standards have been met.

LIST OF FIGURES

- FIGURE 1 AERIAL MAP
- FIGURE 2 USGS TOPOGRAPHIC MAP
- FIGURE 3 FLOOD INSURANCE RATE MAP
- FIGURE 4 NATURAL HERITAGE MAP
- FIGURE 5 CRITICAL AREAS
- FIGURE 6 SOIL SURVEY MAP
- FIGURE 7 EXISTING DRAINAGE AREAS
- FIGURE 8 PROPOSED DRAINAGE AREAS



75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370

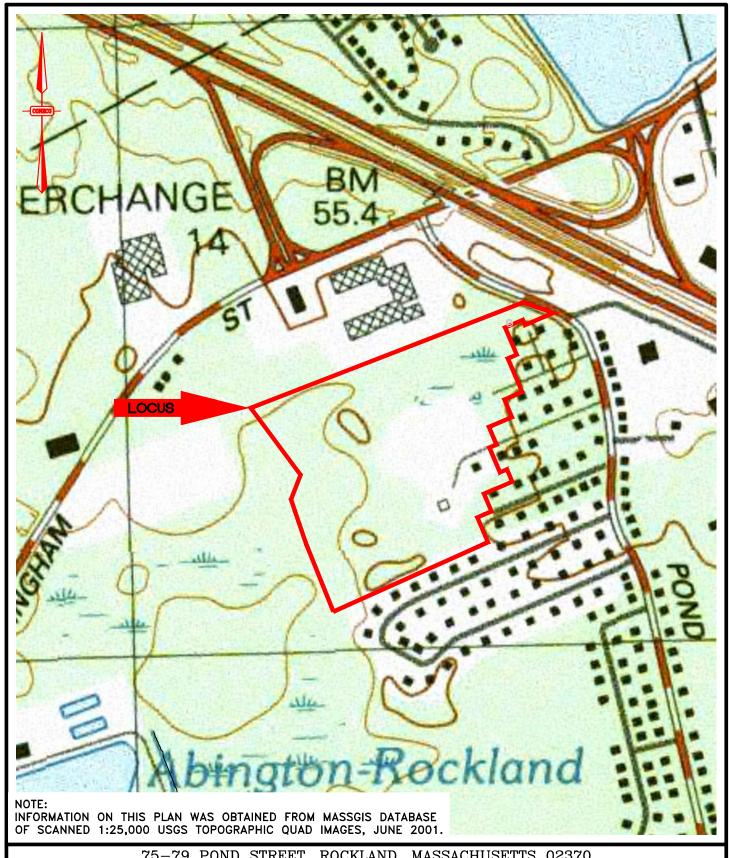


SHINGLEMILL, LLC

REPORT FIGURES

SCALE 1" = 500' DATE 02/14/2022

PROJECT NO 3395.1 FIGURE 1 AERIAL MAP



75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370

ONECO Engineers & Scientists 4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02324 PHONE 508-697-3191 OR 800-548-3355; FAX 508-697-5996 WEBSITE: www.coneco.com SHINGLEMILL, LLC

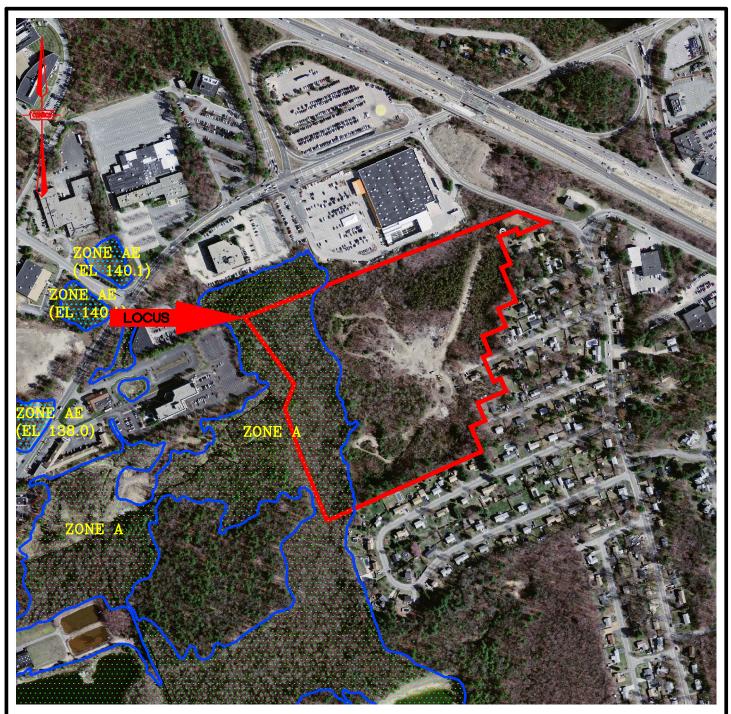
REPORT FIGURES

SCALE 1" = 500'

DATE 02/14/2022

PROJECT NO. 3395.1

FIGURE 2 USGS TOPOGRAPHIC MAP





FLOOD ZONE X, AREAS BETWEEN THE LIMITS OF 100-YEAR AND 500-YEAR FLOODS



FLOOD ZONE AE, AREAS OF 100-YEAR FLOOD, BASE FLOOD ELEVATIONS DETERMINED



FLOODWAY AREAS IN ZONE AE



FLOOD ZONE A, AREAS OF 100-YEAR FLOOD, BASE FLOOD ELEVATIONS NOT DETERMINED

NOTE: FLOOD BOUNDARY INFORMATION ON THIS PLAN WAS DIGITIZED FROM FEMA FLOOD INSURANCE RATE MAP FOR PLYMOUTH COUNTY COMMUNITY MAP NO. 25023C0092K, EFFECTIVE JULY 06, 2021.



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PHONE 508-697-3191 OR 800-548-3355; FAX 508-697-5996
WEBSITE: www.coneco.com

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REPO

REPORT FIGURES

SCALE 1" = 500' DATE 02/14/2022 PROJECT NO 3395.1 FIGURE 3 FLOOD INSURANCE RATE MAP



PRIORITY HABITAT OF RARE SPECIES

CERTIFIED VERNAL POOLS

ESTIMATED HABITATS OF RARE WILDLIFE

POTENTIAL VERNAL POOLS

NOTES

- 1. ESTIMATED HABITATS OF RARE WILDLIFE AND PRIORITY HABITATS OF RARE SPECIES CAME FROM MASSGIS
- DATABASE LAST UPDATED AUGUST 2017.
 2. CERTIFIED VERNAL POOL LOCATIONS WERE TAKEN FROM MASSGIS DATABASE ON OCTOBER 4, 2019. THIS DATA IS UPDATED CONTINUALLY AND SHOWN CONDITIONS MAY VARY FROM THIS DATA.
- 3. POTENTIAL VERNAL POOL LOCATIONS WERE TAKEN FROM MASSGIS DATABASE LAST UPDATED DECEMBER 2000.
- 4. THERE ARE NO ESTIMATED HABITATS OF RARE WILDLIFE OR PRIORITY HABITATS OF RARE SPECIES ON THE PROJECT SITE.

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REPORT FIGURES

SCALE 1" = 500' DATE 02/14/2022 PROJECT NO. 3395.1 FIGURE 4 NATURAL HERITAGE MAP



AREAS OF CRITICAL ENVIRONMENTAL CONCERN



WELLHEAD PROTECTION AREAS



OUTSTANDING RESOURCE WATERS



SURFACE WATER SUPPLY PROTECTION AREAS

NOTES:

- AREAS OF CRITICAL ENVIRONMENTAL CONCERN WERE TAKEN FROM MASSGIS DATABASE, LAST UPDATED APRIL 2009.
- 2. WELLHEAD PROTECTION AREAS WERE TAKEN FROM MASSGIS DATEBASE, LAST UPDATED APRIL 2019.
- 3. OUTSTANDING RESOURCE WATERS WERE TAKEN FROM MASSGIS DATEBASE, LAST UPDATED MARCH 2010.
- 4. SURFACE WATER SUPPLY PROTECTION AREAS WERE TAKEN FROM MASSGIS DATEBASE, LAST UPDATED APRIL 2017 5. THERE ARE NO AREAS OF CRITICAL ENVIRONMENTAL CONCERN OR WELLHEAD PROTECTION AREAS ON THIS

75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370



PROJECT SITE.

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REPORT FIGURES

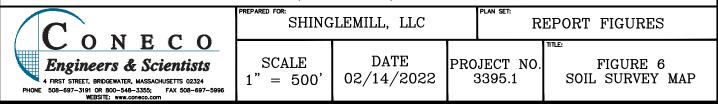
SCALE 1" = 500' DATE 02/14/2022 PROJECT NO. 3395.1

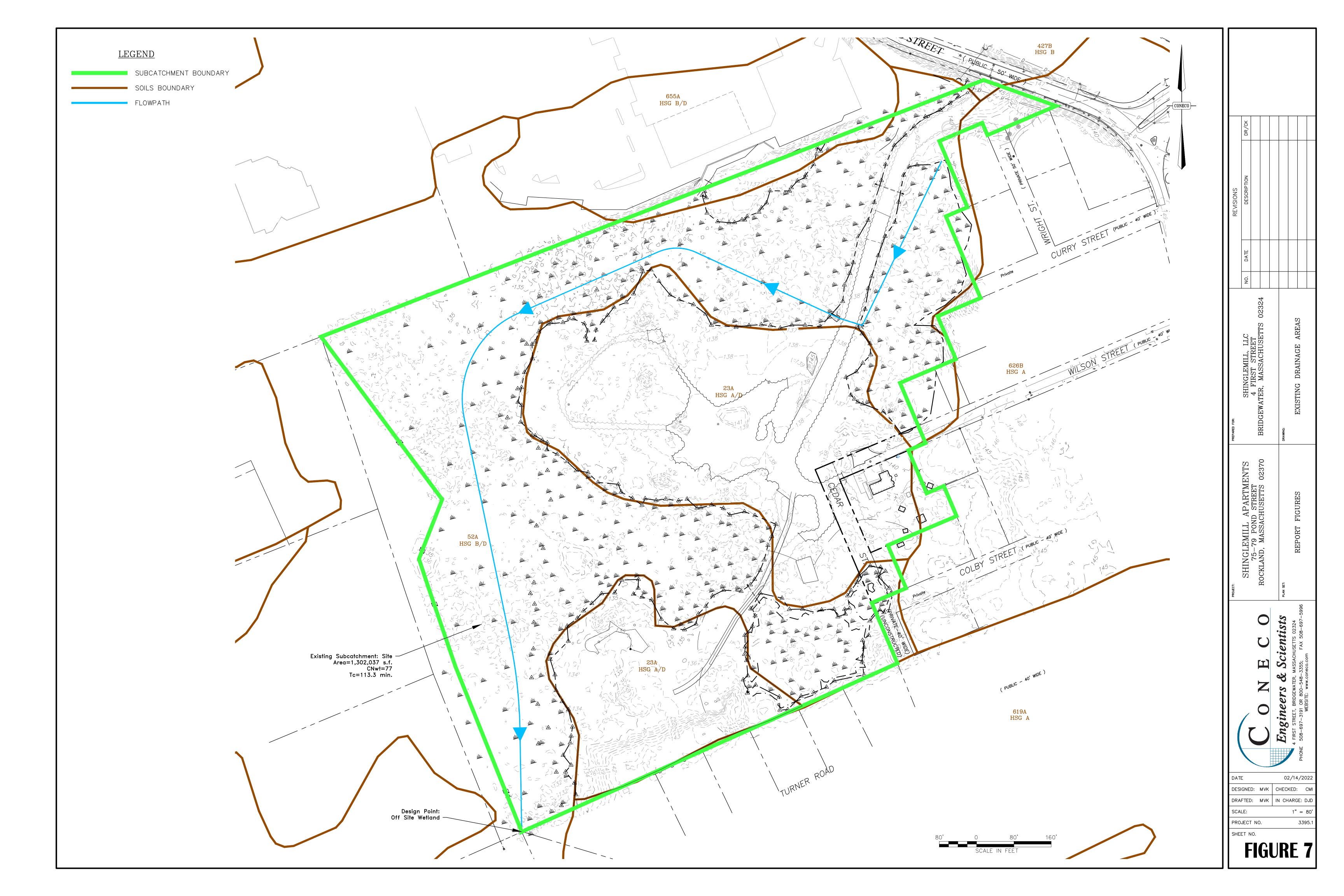
FIGURE 5 CRITICAL AREAS

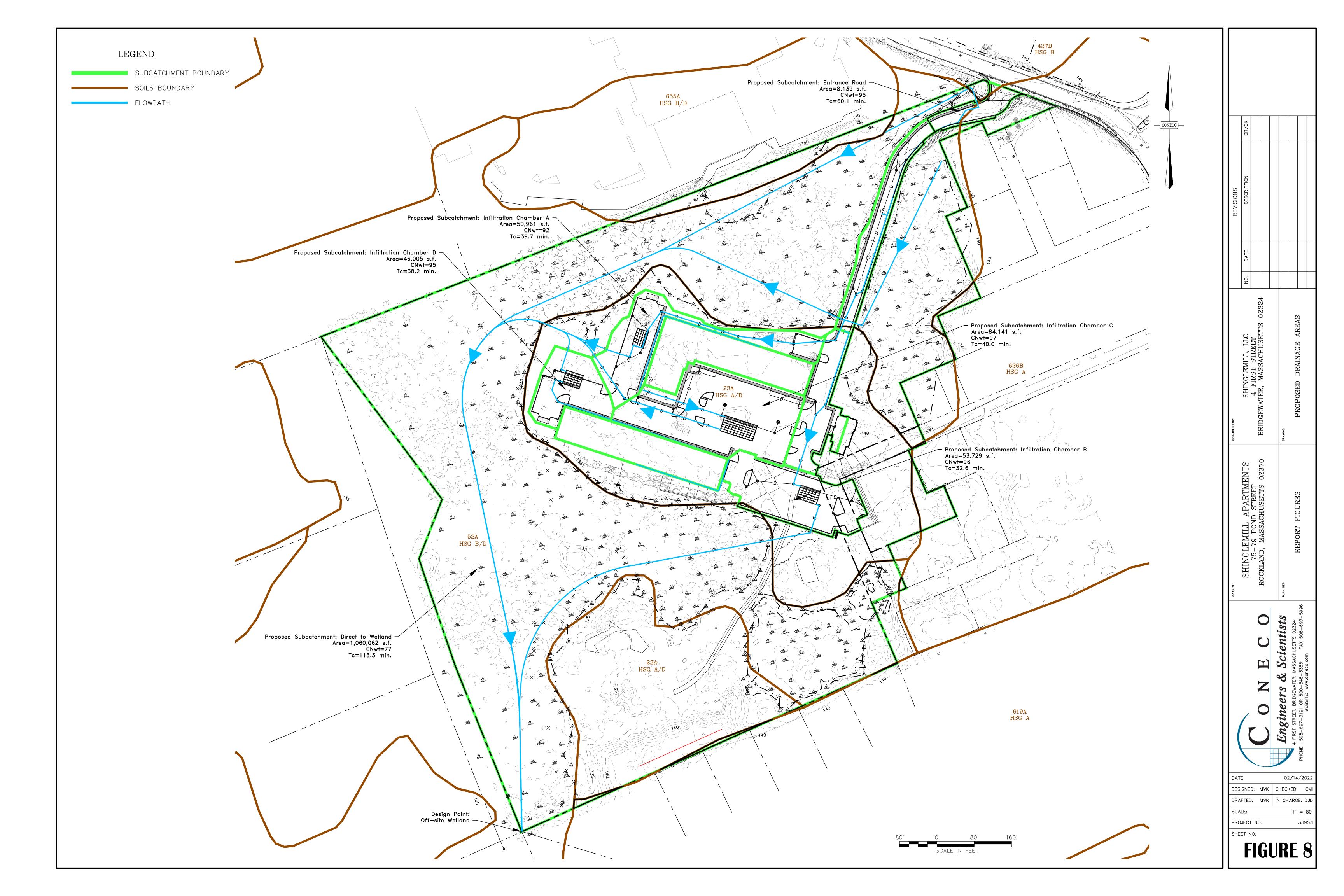


NOTE: INFORMATION ON THIS PLAN WAS OBTAINED FROM THE MASSGIS DATABASE, NRCS SSURGO — CERTIFIED SOILS WHICH WAS LAST UPDATED NOVEMBER 2012.

75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370







APPENDIX A

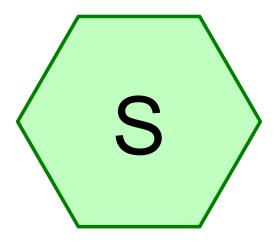
EXISTING HYDROLOGICAL CONDITIONS

2-YEAR STORM EVENT

10-YEAR STORM EVENT

25-YEAR STORM EVENT

100-YEAR STORM EVENT



Site









Printed 2/9/2022 Page 2

Area Listing (selected nodes)

Area	CN	Description
(sq-ft)		(subcatchment-numbers)
6,761	30	Brush, Good, HSG A (S)
1,173	48	Brush, Good, HSG B (S)
32,809	73	Brush, Good, HSG D (S)
74,635	89	Dirt roads, HSG D (S)
1,363	91	Gravel roads, HSG D (S)
192	98	Paved roads w/curbs & sewers, HSG A (S)
5,469	98	Paved roads w/curbs & sewers, HSG D (S)
173	78	Wetland, HSG A (S)
720,013	78	Wetlands, HSG D (S)
14,765	30	Woods, Good, HSG A (S)
501	55	Woods, Good, HSG B (S)
444,183	77	Woods, Good, HSG D (S)
1,302,037	77	TOTAL AREA

Page 3

Summary for Subcatchment S: Site

Runoff = 11.54 cfs @ 13.55 hrs, Volume= 125,297 cf, Depth> 1.15"

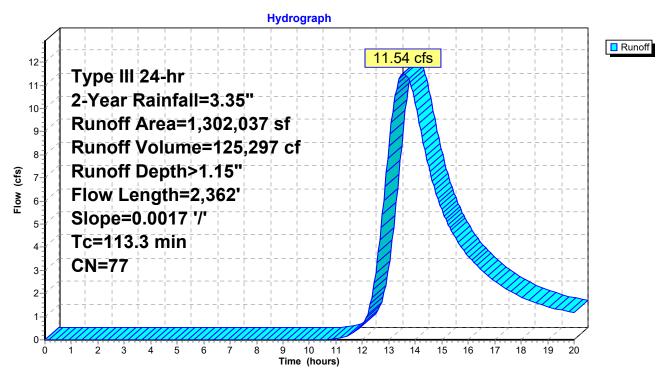
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 2-Year Rainfall=3.35"

	Area (sf)	CN E	escription					
	14,765	30 V	Voods, Go	od, HSG A				
	6,761	30 E	Brush, Goo	d, HSG A				
*	173		Vetland, H					
	192				k sewers, HSG A			
	501			od, HSG B				
	1,173		Brush, Goo					
	444,183	77 Woods, Good, HSG D						
	32,809	73 Brush, Good, HSG D						
	74,635	89 Dirt roads, HSG D 91 Gravel roads, HSG D						
*	1,363							
	720,013 5,469	78 V 98 F	Laguera HSC D					
	-	,						
	1,302,037 77 Weighted Average 1,296,376 99.57% Pervious Area							
1,296,376 5,661			0.43% Impervious Area					
	3,001	U	.40 /0 IIIIpe	i vious Aiec	a			
Tc	Length	Slope	Velocity	Capacity	Description			
(min)	•	(ft/ft)	(ft/sec)	(cfs)				
56.3		0.0017	0.01	, ,	Sheet Flow, Wetlands AB			
00.0			• • • • • • • • • • • • • • • • • • • •		Woods: Dense underbrush n= 0.800 P2= 3.35"			
8.6	341	0.0017	0.66		Shallow Concentrated Flow, Wetlands BC			
					Unpaved Kv= 16.1 fps			
0.2	51	0.0017	3.51	11.02	Pipe Channel, Culvert CD			
					24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'			
					n= 0.011 Concrete pipe, straight & clean			
48.2	1,920	0.0017	0.66		Shallow Concentrated Flow, Wetlands DE			
					Unpaved Kv= 16.1 fps			
113.3	2,362	Total						

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Page 4

Subcatchment S: Site



Page 5

Summary for Subcatchment S: Site

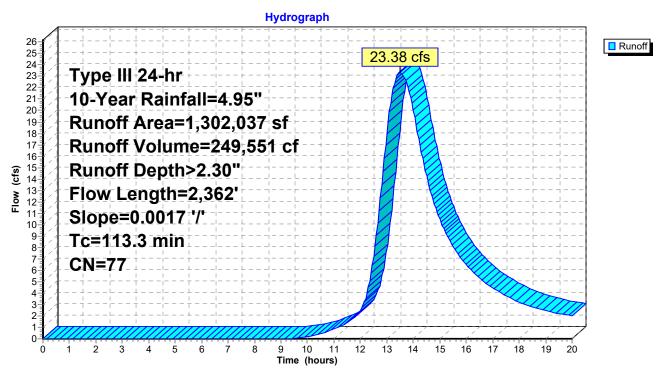
Runoff = 23.38 cfs @ 13.50 hrs, Volume= 249,551 cf, Depth> 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 10-Year Rainfall=4.95"

A	rea (sf)	CN D	escription					
	14,765	30 V	Voods, Go					
	6,761	30 E	Brush, Goo	d, HSG A				
*	173		Vetland, H					
	192				& sewers, HSG A			
	501			od, HSG B				
	1,173		Brush, Goo					
	444,183 77 Woods, Good, HSG D							
32,809 73 Brush, Good, HSG D			,	,				
	74,635 89 Dirt roads, HSG D 1,363 91 Gravel roads, HSG D							
* 7	1,363		ravei road Vetlands, F	•				
/	20,013 5,469		2 aguara HSC D					
4.2			98 Paved roads w/curbs & sewers, HSG D					
1,302,037 77			Weighted Average 99.57% Pervious Area					
1,296,376 5,661		_	0.43% Impervious Area					
	3,001	U	. 4 5 /0 IIIIpe	i vious Aiec	a			
Tc	Length	Slope	Velocity	Capacity	Description			
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	2			
56.3	50	0.0017	0.01	,	Sheet Flow, Wetlands AB			
00.0		0.0011	0.0.		Woods: Dense underbrush n= 0.800 P2= 3.35"			
8.6	341	0.0017	0.66		Shallow Concentrated Flow, Wetlands BC			
					Unpaved Kv= 16.1 fps			
0.2	51	0.0017	3.51	11.02	Pipe Channel, Culvert CD			
					24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'			
					n= 0.011 Concrete pipe, straight & clean			
48.2	1,920	0.0017	0.66		Shallow Concentrated Flow, Wetlands DE			
					Unpaved Kv= 16.1 fps			
113.3	2,362	Total						

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Subcatchment S: Site



Page 7

Summary for Subcatchment S: Site

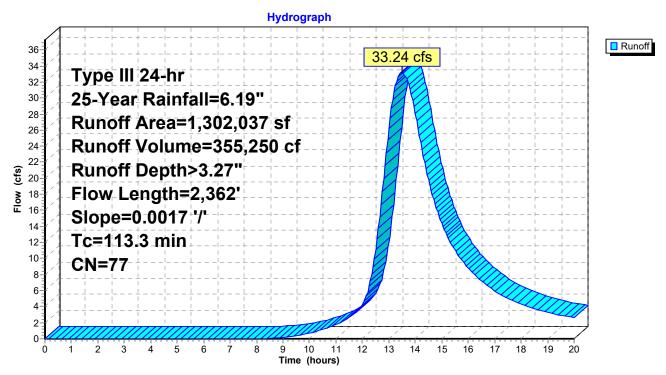
Runoff = 33.24 cfs @ 13.48 hrs, Volume= 355,250 cf, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=6.19"

	Ar	ea (sf)	CN [Description					
		14,765	30 V	Voods, Go	od, HSG A				
		6,761		Brush, Goo	,				
*		173		Vetland, H					
		192				k sewers, HSG A			
		501		Voods, Go					
		1,173		Brush, Goo	•				
		44,183			od, HSG D				
		32,809 73 Brush, Good, HSG D							
		74,635	89 Dirt roads, HSG D 91 Gravel roads, HSG D						
*	7	1,363 20,013		oravei road Vetlands, F					
	1 4	5,469		Convers USC D					
	1 20	02,037	98 Paved roads w/curbs & sewers, HSG D 77 Weighted Average						
	-								
	1,296,376 5,661		_	99.57% Pervious Area 0.43% Impervious Area					
		3,001		7.40 % impe	i vious Aiec	a			
	Тс	Length	Slope	Velocity	Capacity	Description			
	in)	(feet)	(ft/ft)	(ft/sec)	(cfs)	2 - 3 - 3 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1			
	3.3	50	0.0017	0.01		Sheet Flow, Wetlands AB			
				0.0.		Woods: Dense underbrush n= 0.800 P2= 3.35"			
8	3.6	341	0.0017	0.66		Shallow Concentrated Flow, Wetlands BC			
						Unpaved Kv= 16.1 fps			
(0.2	51	0.0017	3.51	11.02	Pipe Channel, Culvert CD			
						24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'			
						n= 0.011 Concrete pipe, straight & clean			
48	3.2	1,920	0.0017	0.66		Shallow Concentrated Flow, Wetlands DE			
						Unpaved Kv= 16.1 fps			
113	3.3	2,362	Total						

Page 8

Subcatchment S: Site



Page 9

Summary for Subcatchment S: Site

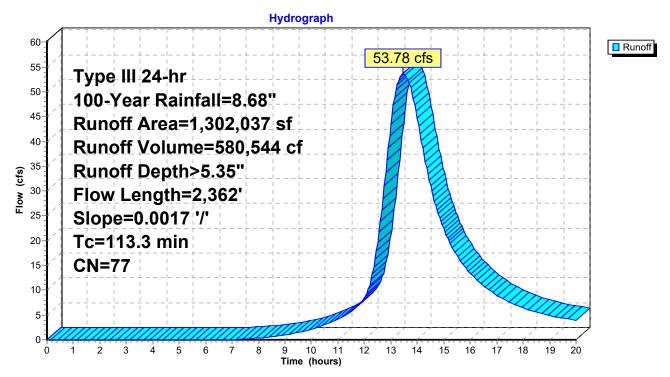
Runoff = 53.78 cfs @ 13.47 hrs, Volume= 580,544 cf, Depth> 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 100-Year Rainfall=8.68"

	Area (sf)	CN E	escription		
	14,765	30 V	Voods, Go	od, HSG A	
	6,761	30 E	Brush, Goo	d, HSG A	
*	173		Vetland, H		
	192				k sewers, HSG A
	501			od, HSG B	
	1,173		Brush, Goo		
4	444,183			od, HSG D	
	32,809		Brush, Goo	,	
	74,635)irt roads, l		
*	1,363		Gravel road	•	
	720,013		Vetlands, F		Laguara UCC D
	5,469				k sewers, HSG D
	302,037		Veighted A	verage vious Area	
۱,4	296,376 5,661			ervious Area	
	3,001	U	.43 /0 IIIIpe	i vious Alea	a
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	2 coonpact
56.3	50	0.0017	0.01	()	Sheet Flow, Wetlands AB
00.0	00	0.0011	0.01		Woods: Dense underbrush n= 0.800 P2= 3.35"
8.6	341	0.0017	0.66		Shallow Concentrated Flow, Wetlands BC
					Unpaved Kv= 16.1 fps
0.2	51	0.0017	3.51	11.02	
					24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'
					n= 0.011 Concrete pipe, straight & clean
48.2	1,920	0.0017	0.66		Shallow Concentrated Flow, Wetlands DE
					Unpaved Kv= 16.1 fps
113.3	2,362	Total			

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Subcatchment S: Site



APPENDIX B

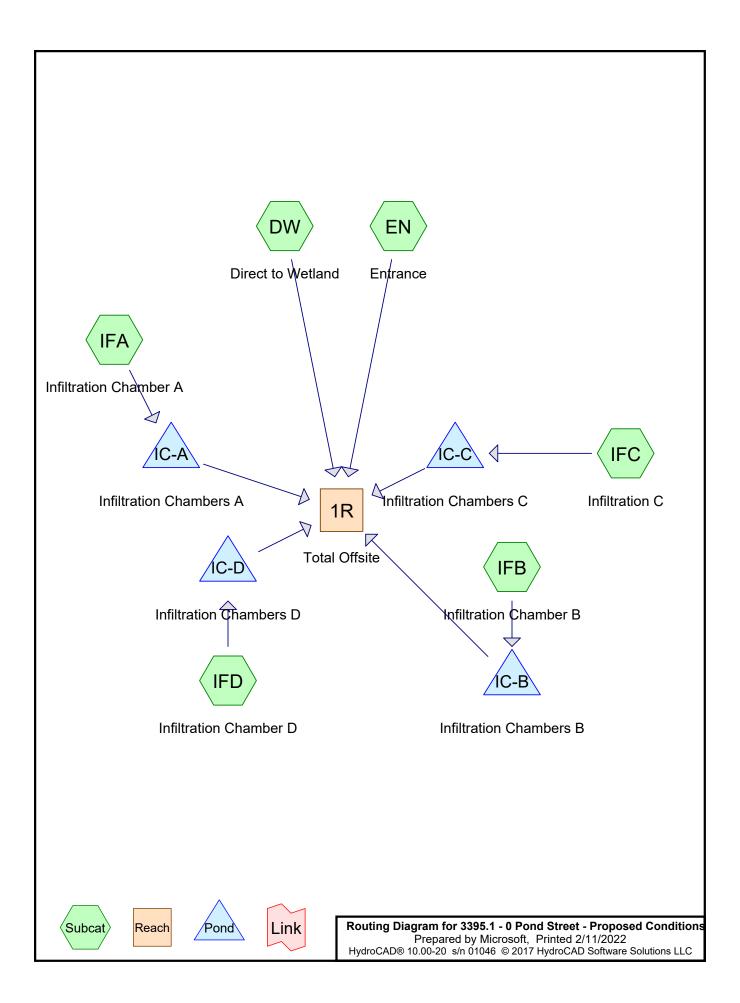
PROPOSED HYDROLOGICAL CONDITIONS

2-YEAR STORM EVENT

10-YEAR STORM EVENT

25-YEAR STORM EVENT

100-YEAR STORM EVENT



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Page 2

Area Listing (selected nodes)

Area	CN	Description
(sq-ft)		(subcatchment-numbers)
1,851	39	>75% Grass cover, Good, HSG A (DW, EN)
512	61	>75% Grass cover, Good, HSG B (DW)
53,201	80	>75% Grass cover, Good, HSG D (DW, EN, IFA, IFB, IFC, IFD)
11,316	89	Dirt roads, HSG D (DW)
8,419	96	Gravel surface, HSG D (DW, IFA)
4,463	98	Paved parking, HSG A (DW, EN)
374	98	Paved parking, HSG B (EN)
202,597	98	Paved parking, HSG D (DW, EN, IFA, IFB, IFC, IFD)
720,013	78	Wetland, HSG D (DW)
15,568	30	Woods, Good, HSG A (DW)
802	55	Woods, Good, HSG B (DW)
282,921	77	Woods, Good, HSG D (DW)
1,302,037	81	TOTAL AREA

Page 3

Summary for Subcatchment DW: Direct to Wetland

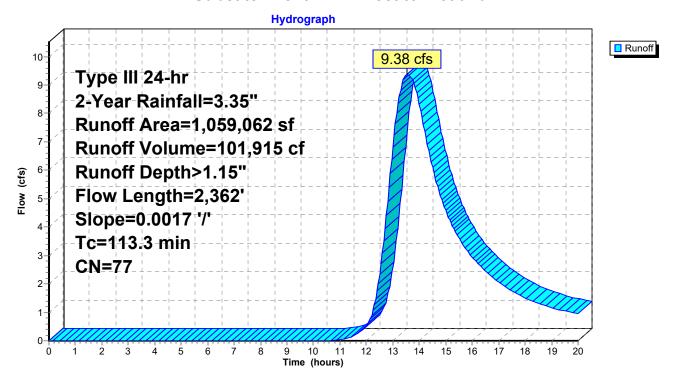
Runoff = 9.38 cfs @ 13.55 hrs, Volume= 101,915 cf, Depth> 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 2-Year Rainfall=3.35"

A	rea (sf)	CN E	Description		
	15,568	30 V	Voods, Go	od, HSG A	
	1,615	39 >	75% Gras	s cover, Go	od, HSG A
	175	98 F	Paved park	ing, HSG A	
	802	55 V	Voods, Go	od, HSG B	
	512				ood, HSG B
2	82,921			od, HSG D	
	11,316		Dirt roads, l		
	7,064			ace, HSG D	
	18,373				od, HSG D
* 7	20,013		Vetland, H		
	703	98 F	Paved park	<u>ing, HSG D</u>	
	59,062		Veighted A		
1,0	58,184			rvious Area	
	878	C).08% Impe	ervious Area	a
_		01		O ::	
Tc	Length	Slope		Capacity	Description
<u>(min)</u>	(feet)	(ft/ft)	(ft/sec)	(cfs)	
56.3	50	0.0017	0.01		Sheet Flow, AB
					Woods: Dense underbrush n= 0.800 P2= 3.35"
8.6	341	0.0017	0.66		Shallow Concentrated Flow, BC
		–			Unpaved Kv= 16.1 fps
0.2	51	0.0017	3.51	11.02	
					24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'
40.0	4 000	0.0047	0.00		n= 0.011
48.2	1,920	0.0017	0.66		Shallow Concentrated Flow, DE
440.0	0.000				Unpaved Kv= 16.1 fps
113.3	2,362	Total			

Page 4

Subcatchment DW: Direct to Wetland



Page 5

Summary for Subcatchment EN: Entrance

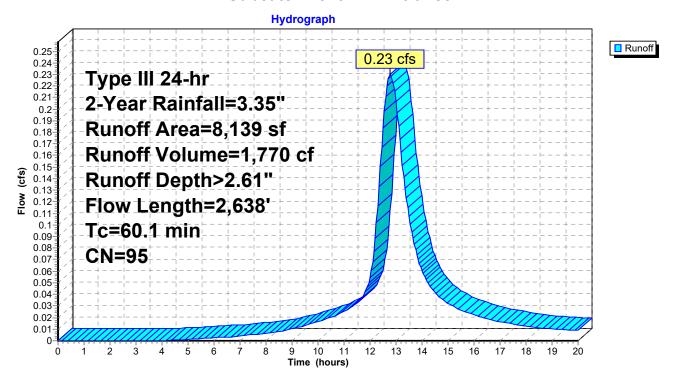
Runoff = 0.23 cfs @ 12.77 hrs, Volume= 1,770 cf, Depth> 2.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 2-Year Rainfall=3.35"

	rea (sf)	CN I	Description		
	236	39 :	>75% Gras	s cover, Go	ood, HSG A
	4,288	98	Paved park	ing, HSG A	
	374	98 I	Paved park	ing, HSG B	
	447	80 :	>75% Gras	s cover, Go	ood, HSG D
	2,794	98	Paved park	ing, HSG D	
	8,139	95	Weighted A	verage	
	683	;	3.39% Perv	ious Area	
	7,456	(91.61% lmp	pervious Are	ea
Tc	Length	Slope		Capacity	Description
<u>(min)</u>	(feet)	(ft/ft)	(ft/sec)	(cfs)	
0.9	50	0.0100	0.93		Sheet Flow, AB
					Smooth surfaces n= 0.011 P2= 3.35"
1.9	227	0.0100	2.03		Shallow Concentrated Flow, BC
					Shallow Concentrated Flow, BC Paved Kv= 20.3 fps
1.9 0.5	227 97	0.0100 0.0050		2.52	Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD
				2.52	Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
0.5	97	0.0050	3.21	2.52	Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
			3.21	2.52	Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Shallow Concentrated Flow, DE
0.5	97	0.0050	3.21	2.52	Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013

Page 6

Subcatchment EN: Entrance



Page 7

Summary for Subcatchment IFA: Infiltration Chamber A

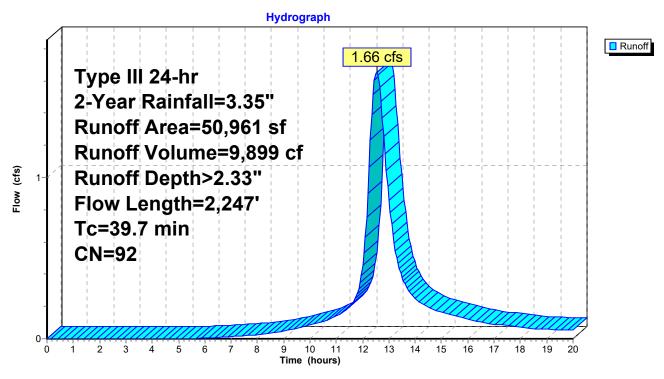
Runoff = 1.66 cfs @ 12.53 hrs, Volume= 9,899 cf, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 2-Year Rainfall=3.35"

A	rea (sf)	CN E	escription		
	1,355	96 Gravel surface, HSG I)
	15,558	80 >	75% Gras	s cover, Go	ood, HSG D
	34,048	98 F	aved park	ing, HSG D	
	50,961	92 V	Veighted A	verage	
	16,913	_	-	vious Area	
	34,048	6	6.81% lmp	pervious Are	ea
т.	ما در می در ا	Clana	\/alaaitu	Canacity	Description
Tc (min)	Length	Slope	Velocity (ft/sec)	Capacity	Description
<u>(min)</u> 0.9	(feet) 50	(ft/ft) 0.0100	0.93	(cfs)	Chest Flow AD
0.9	50	0.0100	0.93		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 3.35"
1.1	133	0.0100	2.03		Shallow Concentrated Flow, BC
1	100	0.0100	2.00		Paved Kv= 20.3 fps
2.9	558	0.0050	3.21	2.52	•
				_	12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013
0.2	73		7.51		Lake or Reservoir, INFILTRATION-DE
					Mean Depth= 1.75'
0.3	66	0.0050	4.20	7.43	· · · · · · · · · · · · · · · · · · ·
					18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
040	4 007	0.0047	0.00		n= 0.013
34.3	1,367	0.0017	0.66		Shallow Concentrated Flow, FG
	0.047	T-4-1			Unpaved Kv= 16.1 fps
39.7	2,247	Total			

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Subcatchment IFA: Infiltration Chamber A



Type III 24-hr 2-Year Rainfall=3.35" Printed 2/11/2022

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Summary for Subcatchment IFB: Infiltration Chamber B

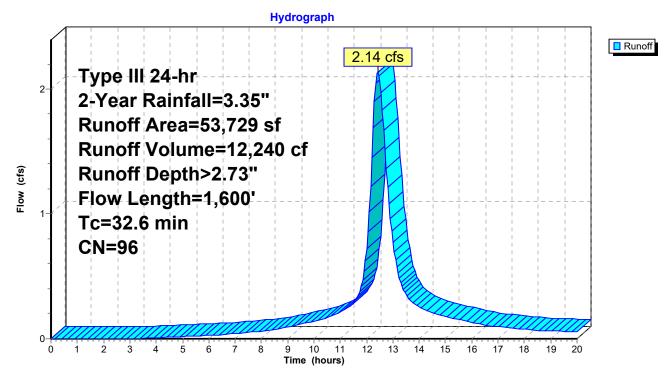
Runoff = 2.14 cfs @ 12.43 hrs, Volume= 12,240 cf, Depth> 2.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 2-Year Rainfall=3.35"

_	А	rea (sf)	CN	Description		
		5,622	80	>75% Gras	s cover, Go	ood, HSG D
_		48,107	98	Paved park	ing, HSG D	
		53,729	96	Weighted A	verage	
		5,622		10.46% Pei	rvious Area	
		48,107		89.54% lmp	pervious Ar	ea
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)		(cfs)	Description
-	0.9	50	0.0100		(013)	Sheet Flow, AB
	0.9	30	0.0100	0.93		Smooth surfaces n= 0.011 P2= 3.35"
	1.0	124	0.0100	2.03		Shallow Concentrated Flow, BC
						Paved Kv= 20.3 fps
	1.0	202	0.0050	3.21	2.52	• • • • • • • • • • • • • • • • • • •
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
						n= 0.013
	2.1	73		0.57		Lake or Reservoir, INFILTRATION-DE
						Mean Depth= 0.01'
	0.3	64	0.0050	4.20	7.43	•
						18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
	07.0	4 007	0.0047	0.00		n= 0.013
	27.3	1,087	0.0017	0.66		Shallow Concentrated Flow, FG
-		4 000	T			Unpaved Kv= 16.1 fps
	32.6	1,600	Total			

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Subcatchment IFB: Infiltration Chamber B



Prepared by Microsoft

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Summary for Subcatchment IFC: Infiltration C

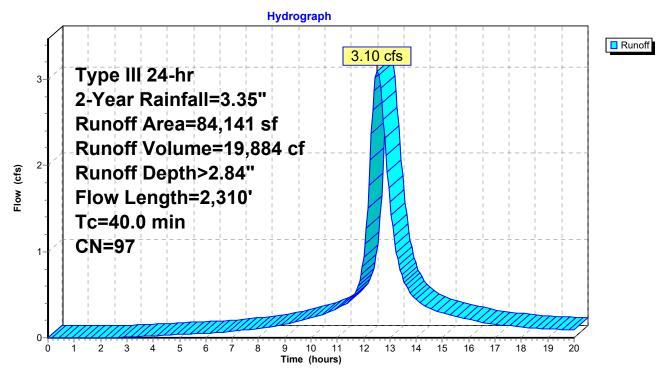
Runoff = 3.10 cfs @ 12.52 hrs, Volume= 19,884 cf, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 2-Year Rainfall=3.35"

	A	rea (sf)	CN [Description		
		5,963	80 >	75% Gras	s cover, Go	ood, HSG D
_		78,178	98 F	Paved park	ing, HSG D	
_		84,141	97 \	Veighted A	verage	
		5,963		7.09% Perv		
		78,178	ç	2.91% Imp	pervious Are	ea
	Тс	Length	Slope		Capacity	Description
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
	1.2	50	0.0050	0.70		Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.9	161	0.0050	1.44		Shallow Concentrated Flow, BC
						Paved Kv= 20.3 fps
	1.5	364	0.0075	3.93	3.09	· · · · · · · · · · · · · · · · · · ·
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	0.4	4.4		7.54		n= 0.013
	0.1	44		7.51		Lake or Reservoir, INFILTRATION-DE
	1.3	336	0.0050	4.20	7.43	Mean Depth= 1.75' Pipe Channel, PIPE-EF
	1.3	330	0.0050	4.20	7.43	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	34.0	1,355	0.0017	0.66		Shallow Concentrated Flow, FG
	54.0	1,000	0.0017	0.00		Unpaved Kv= 16.1 fps
-	40.0	2,310	Total			
		2,010	· Otal			

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Subcatchment IFC: Infiltration C



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Summary for Subcatchment IFD: Infiltration Chamber D

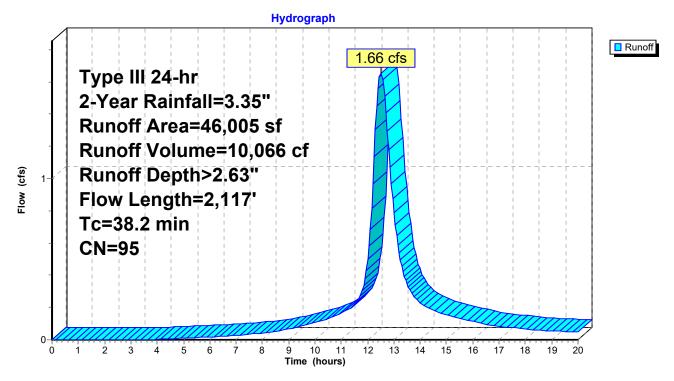
Runoff = 1.66 cfs @ 12.50 hrs, Volume= 10,066 cf, Depth> 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 2-Year Rainfall=3.35"

_	Α	rea (sf)	CN	Description		
		7,238	80	>75% Gras	s cover, Go	ood, HSG D
_		38,767	98	Paved park	ing, HSG D	
		46,005		Weighted A		
		7,238			rvious Area	
		38,767		84.27% lmp	pervious Are	ea
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)	•	(cfs)	1
	1.2	50	0.0050	0.70		Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.5	133	0.0050	1.44		Shallow Concentrated Flow, BC
		50. 4		0.00	0.00	Paved Kv= 20.3 fps
	2.3	531	0.0075	3.93	3.09	
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	0.1	35		7.51		n= 0.013 Lake or Reservoir, INFILTRATION-DE
	0.1	33		7.51		Mean Depth= 1.75'
	0.2	56	0.0050	4.20	7.43	· ·
	0.2		0.0000	0		18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	32.9	1,312	0.0017	0.66		Shallow Concentrated Flow, FG
_						Unpaved Kv= 16.1 fps
	38.2	2,117	Total			

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Subcatchment IFD: Infiltration Chamber D



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Summary for Reach 1R: Total Offsite

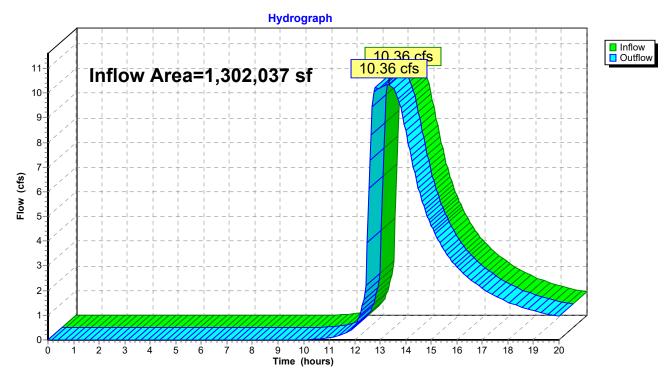
Inflow Area = 1,302,037 sf, 15.93% Impervious, Inflow Depth > 1.06" for 2-Year event

Inflow = 10.36 cfs @ 13.34 hrs, Volume= 115,239 cf

Outflow = 10.36 cfs @ 13.34 hrs, Volume= 115,239 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Reach 1R: Total Offsite



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Summary for Pond IC-A: Infiltration Chambers A

Inflow Area =	50,961 sf, 66.81% Impervious,	Inflow Depth > 2.33" for 2-Year event
Inflow =	1.66 cfs @ 12.53 hrs, Volume=	9,899 cf
Outflow =	1.81 cfs @ 12.57 hrs, Volume=	9,895 cf, Atten= 0%, Lag= 2.6 min
Discarded =	0.19 cfs @ 11.50 hrs, Volume=	6,832 cf
Primary =	1.62 cfs @ 12.57 hrs, Volume=	3,063 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.26' @ 12.55 hrs Surf.Area= 988 sf Storage= 1,862 cf

Plug-Flow detention time= 58.4 min calculated for 9,895 cf (100% of inflow) Center-of-Mass det. time= 58.2 min (850.6 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.55'	856 cf	25.67'W x 38.50'L x 3.54'H Field A
			3,500 cf Overall - 1,360 cf Embedded = 2,140 cf x 40.0% Voids
#2A	139.05'	1,360 cf	Cultec R-330XLHD x 25 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

2,216 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.30'	18.0" Round Culvert
	·		L= 44.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.30' / 136.08' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.15'	18.0" Round Culvert
			L= 19.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.05' / 139.15' S= -0.0053 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Discarded	138.55'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.19 cfs @ 11.50 hrs HW=138.59' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=1.46 cfs @ 12.57 hrs HW=141.25' (Free Discharge)

1=Culvert (Passes 1.46 cfs of 17.45 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 1.46 cfs @ 1.43 fps)

3=Culvert (Passes 1.46 cfs of 4.29 cfs potential flow)

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Pond IC-A: Infiltration Chambers A - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

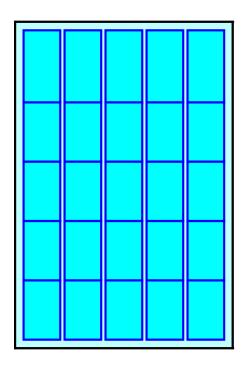
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

25 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,359.8 cf Chamber Storage

3,499.8 cf Field - 1,359.8 cf Chambers = 2,139.9 cf Stone x 40.0% Voids = 856.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,215.8 cf = 0.051 af Overall Storage Efficiency = 63.3% Overall System Size = 38.50' x 25.67' x 3.54'

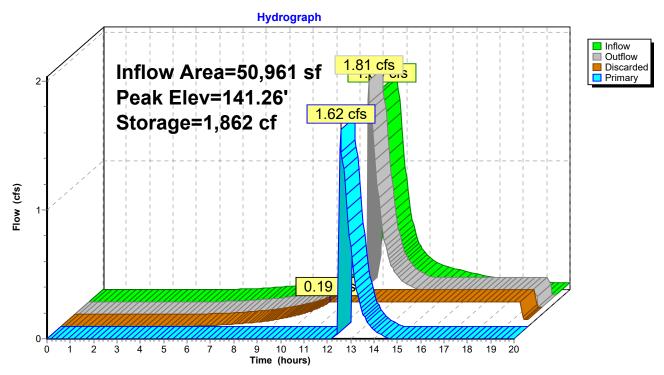
25 Chambers 129.6 cy Field 79.3 cy Stone





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Pond IC-A: Infiltration Chambers A



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Summary for Pond IC-B: Infiltration Chambers B

Inflow Area =	53,729 sf, 89.54% Impervious	, Inflow Depth > 2.73" for 2-Year event
Inflow =	2.14 cfs @ 12.43 hrs, Volume=	12,240 cf
Outflow =	2.05 cfs @ 12.57 hrs, Volume=	12,236 cf, Atten= 4%, Lag= 8.2 min
Discarded =	0.27 cfs @ 11.45 hrs, Volume=	9,408 cf
Primary =	1.79 cfs @ 12.57 hrs, Volume=	2,828 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 140.19' @ 12.57 hrs Surf.Area= 1,388 sf Storage= 2,623 cf

Plug-Flow detention time= 55.7 min calculated for 12,205 cf (100% of inflow) Center-of-Mass det. time= 55.4 min (821.2 - 765.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	137.50'	1,188 cf	30.50'W x 45.50'L x 3.54'H Field A
			4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	138.00'	1,945 cf	Cultec R-330XLHD x 36 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

3,133 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	137.18'	18.0" Round Culvert
	•		L= 55.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 137.18' / 136.90' S= 0.0051 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	139.90'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	138.02'	24.0" Round Culvert
			L= 5.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 138.00' / 138.02' S= -0.0040 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	137.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.27 cfs @ 11.45 hrs HW=137.54' (Free Discharge) 4=Exfiltration (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=1.72 cfs @ 12.57 hrs HW=140.18' (Free Discharge)

1=Culvert (Passes 1.72 cfs of 11.96 cfs potential flow)

-2=Broad-Crested Rectangular Weir (Weir Controls 1.72 cfs @ 1.52 fps)

3=Culvert (Passes 1.72 cfs of 8.05 cfs potential flow)

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Pond IC-B: Infiltration Chambers B - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length

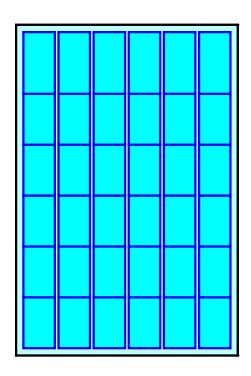
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af Overall Storage Efficiency = 63.7% Overall System Size = 45.50' x 30.50' x 3.54'

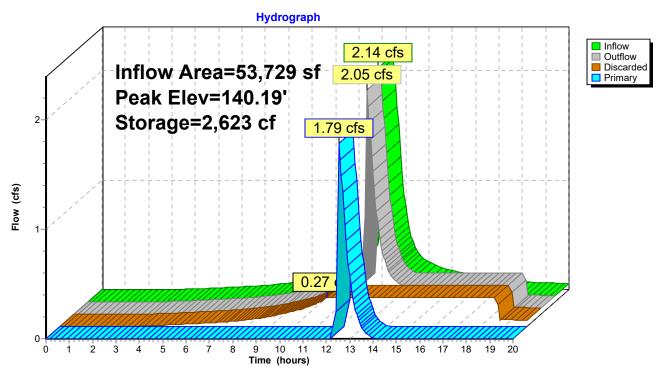
36 Chambers 182.0 cy Field 110.0 cy Stone





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Pond IC-B: Infiltration Chambers B



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Summary for Pond IC-C: Infiltration Chambers C

Inflow Area =	84,141 sf, 92.91% Impervious,	Inflow Depth > 2.84" for 2-Year event
Inflow =	3.10 cfs @ 12.52 hrs, Volume=	19,884 cf
Outflow =	2.42 cfs @ 12.78 hrs, Volume=	19,877 cf, Atten= 22%, Lag= 15.7 min
Discarded =	0.50 cfs @ 11.70 hrs, Volume=	16,448 cf
Primary =	1.93 cfs @ 12.78 hrs, Volume=	3,429 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.65' @ 12.78 hrs Surf.Area= 2,597 sf Storage= 4,746 cf

Plug-Flow detention time= 54.3 min calculated for 19,877 cf (100% of inflow) Center-of-Mass det. time= 54.2 min (818.7 - 764.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	2,187 cf	35.33'W x 73.50'L x 3.54'H Field A
			9,198 cf Overall - 3,729 cf Embedded = 5,468 cf x 40.0% Voids
#2A	139.60'	3,729 cf	Cultec R-330XLHD x 70 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

5,917 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.70'	18.0" Round Culvert L= 110.0' Ke= 0.500
			Inlet / Outlet Invert= 136.70' / 136.15' S= 0.0050 '/' Cc= 0.900
			n= 0.013, Flow Area= 1.77 sf
#2	Device 1	141.35'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	140.25'	24.0" Round Culvert
			L= 215.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.60' / 140.25' S= -0.0030 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.50 cfs @ 11.70 hrs HW=139.14' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=1.91 cfs @ 12.78 hrs HW=141.65' (Free Discharge)

-1=Culvert (Passes 1.91 cfs of 15.14 cfs potential flow)

-2=Broad-Crested Rectangular Weir (Weir Controls 1.91 cfs @ 1.57 fps) **-3=Culvert** (Passes 1.91 cfs of 6.06 cfs potential flow)

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Pond IC-C: Infiltration Chambers C - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

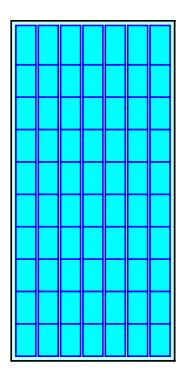
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

70 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 3,729.2 cf Chamber Storage

9,197.7 cf Field - 3,729.2 cf Chambers = 5,468.5 cf Stone x 40.0% Voids = 2,187.4 cf Stone Storage

Chamber Storage + Stone Storage = 5,916.6 cf = 0.136 af Overall Storage Efficiency = 64.3% Overall System Size = 73.50' x 35.33' x 3.54'

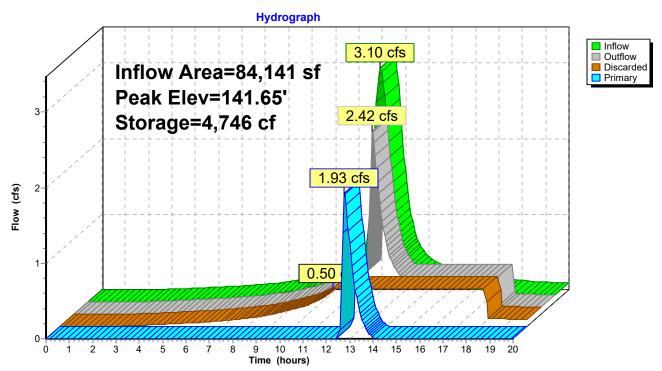
70 Chambers 340.7 cy Field 202.5 cy Stone





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Pond IC-C: Infiltration Chambers C



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Summary for Pond IC-D: Infiltration Chambers D

Inflow Area =	46,005 sf, 84.27% Impervious,	Inflow Depth > 2.63" for 2-Year event
Inflow =	1.66 cfs @ 12.50 hrs, Volume=	10,066 cf
Outflow =	1.59 cfs @ 12.66 hrs, Volume=	10,063 cf, Atten= 4%, Lag= 9.5 min
Discarded =	0.22 cfs @ 11.55 hrs, Volume=	7,829 cf
Primary =	1.37 cfs @ 12.66 hrs, Volume=	2,233 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.24' @ 12.66 hrs Surf.Area= 1,174 sf Storage= 2,247 cf

Plug-Flow detention time= 59.9 min calculated for 10,063 cf (100% of inflow) Center-of-Mass det. time= 59.8 min (836.4 - 776.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.50'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A
			4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	139.00'	1,632 cf	Cultec R-330XLHD x 30 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.040 (T () A ())) O

2,643 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.55'	18.0" Round Culvert
	·		L= 29.0' CMP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.55' / 136.26' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.01'	24.0" Round Culvert
			L= 3.5' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.00' / 139.01' S= -0.0029 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	138.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.22 cfs @ 11.55 hrs HW=138.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=1.31 cfs @ 12.66 hrs HW=141.24' (Free Discharge) 1=Culvert (Passes 1.31 cfs of 16.89 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 1.31 cfs @ 1.38 fps)
3=Culvert (Passes 1.31 cfs of 7.38 cfs potential flow)

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Pond IC-D: Infiltration Chambers D - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

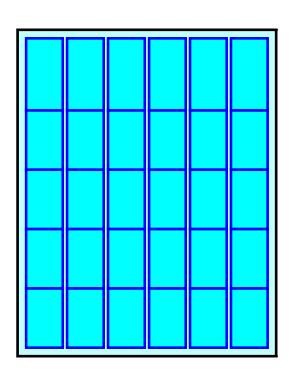
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,631.8 cf Chamber Storage

4,158.8 cf Field - 1,631.8 cf Chambers = 2,527.0 cf Stone x 40.0% Voids = 1,010.8 cf Stone Storage

Chamber Storage + Stone Storage = 2,642.6 cf = 0.061 af Overall Storage Efficiency = 63.5% Overall System Size = 38.50' x 30.50' x 3.54'

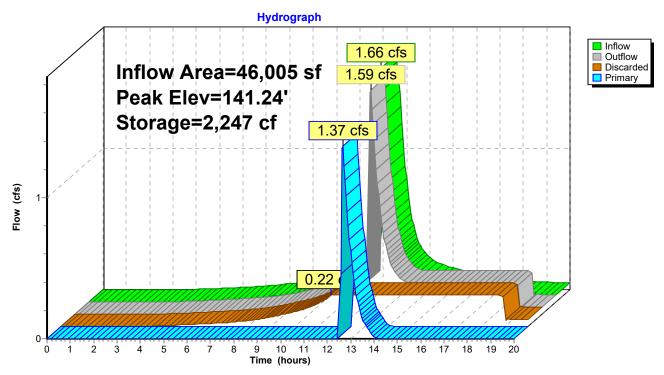
30 Chambers 154.0 cy Field 93.6 cy Stone





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Pond IC-D: Infiltration Chambers D



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Summary for Subcatchment DW: Direct to Wetland

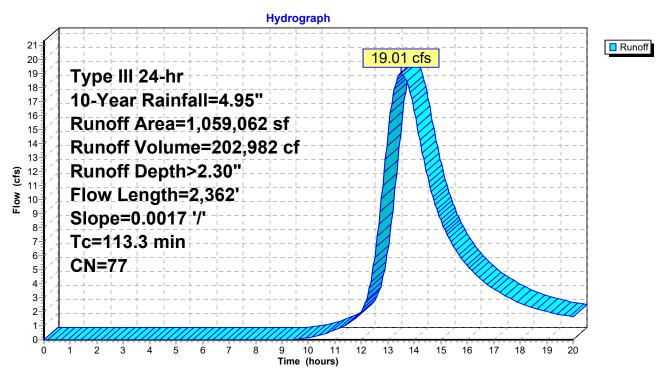
Runoff = 19.01 cfs @ 13.50 hrs, Volume= 202,982 cf, Depth> 2.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 10-Year Rainfall=4.95"

A	rea (sf)	CN E	Description					
	15,568	30 V	Woods, Good, HSG A					
	1,615	39 >	75% Gras	s cover, Go	ood, HSG A			
	175	98 F	Paved park	ing, HSG A				
	802	55 V	Voods, Go	od, HSG B				
	512	61 >	·75% Gras	s cover, Go	ood, HSG B			
2	82,921	77 V	Voods, Go	od, HSG D				
	11,316	89 E	Dirt roads, l	HSG D				
	7,064			ace, HSG D				
	18,373				ood, HSG D			
* 7	20,013		Vetland, H					
	703	98 F	Paved park	ing, HSG D				
1,0	59,062	77 V	Veighted A	verage				
1,0	58,184	9	9.92% Per	rvious Area				
	878	0	0.08% Impervious Area					
Tc	Length	Slope	Velocity		Description			
<u>(min)</u>	(feet)	(ft/ft)	(ft/sec)	(cfs)				
56.3	50	0.0017	0.01		Sheet Flow, AB			
					Woods: Dense underbrush n= 0.800 P2= 3.35"			
8.6	341	0.0017	0.66		Shallow Concentrated Flow, BC			
					Unpaved Kv= 16.1 fps			
0.2	51	0.0017	3.51	11.02				
					24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'			
					n= 0.011			
48.2	1,920	0.0017	0.66		Shallow Concentrated Flow, DE			
					Unpaved Kv= 16.1 fps			
113.3	2,362	Total						

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Subcatchment DW: Direct to Wetland



Type III 24-hr 10-Year Rainfall=4.95" Printed 2/11/2022

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Summary for Subcatchment EN: Entrance

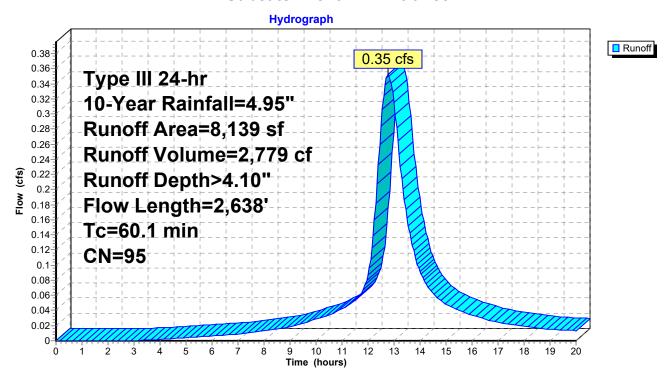
Runoff = 0.35 cfs @ 12.77 hrs, Volume= 2,779 cf, Depth> 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 10-Year Rainfall=4.95"

A	rea (sf)	CN [Description					
	236	39 >	>75% Grass cover, Good, HSG A					
	4,288	98 F	Paved parking, HSG A					
	374	98 F	Paved park	ing, HSG B				
	447	80 >	75% Gras	s cover, Go	ood, HSG D			
	2,794	98 F	Paved park	ing, HSG D				
	8,139	95 \	Veighted A	verage				
	683	3	3.39% Perv	ious Area				
	7,456	9	91.61% lmp	ervious Ar	ea			
Tc	Length	Slope	Velocity		Description			
(min)	(foot)	\tr\tr\	/£1/ \	/ [\				
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
0.9	50	0.0100	0.93	(CfS)	Sheet Flow, AB			
0.9		0.0100	0.93	(cfs)	Smooth surfaces n= 0.011 P2= 3.35"			
		, ,		(CIS)	Smooth surfaces n= 0.011 P2= 3.35" Shallow Concentrated Flow, BC			
0.9	50 227	0.0100	0.93		Smooth surfaces n= 0.011 P2= 3.35" Shallow Concentrated Flow, BC Paved Kv= 20.3 fps			
0.9	50	0.0100	0.93	(cfs) 2.52	Smooth surfaces n= 0.011 P2= 3.35" Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD			
0.9	50 227	0.0100	0.93		Smooth surfaces n= 0.011 P2= 3.35" Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'			
0.9 1.9 0.5	50 227 97	0.0100 0.0100 0.0050	0.93 2.03 3.21		Smooth surfaces n= 0.011 P2= 3.35" Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013			
0.9	50 227	0.0100	0.93		Smooth surfaces n= 0.011 P2= 3.35" Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Shallow Concentrated Flow, DE			
0.9 1.9 0.5	50 227 97	0.0100 0.0100 0.0050	0.93 2.03 3.21		Smooth surfaces n= 0.011 P2= 3.35" Shallow Concentrated Flow, BC Paved Kv= 20.3 fps Pipe Channel, PIPE-CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013			

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Subcatchment EN: Entrance



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Summary for Subcatchment IFA: Infiltration Chamber A

Runoff = 2.63 cfs @ 12.52 hrs, Volume= 16,114 cf, Depth> 3.79"

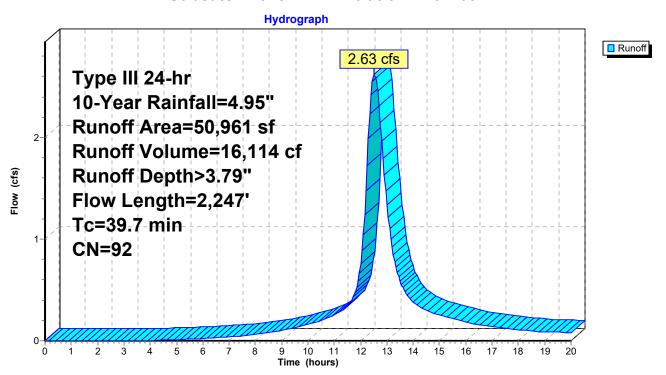
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 10-Year Rainfall=4.95"

	Α	rea (sf)	CN D	escription					
		1,355	355 96 Gravel surface, HSG D						
		15,558	80 >	>75% Grass cover, Good, HSG D					
_		34,048	98 F	aved park	ing, HSG D				
		50,961	92 V	Veighted A	verage				
		16,913	3	3.19% Per	vious Area				
		34,048	6	6.81% Imp	ervious Ar	ea			
	Tc	Length	Slope	Velocity	Capacity	Description			
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
	0.9	50	0.0100	0.93		Sheet Flow, AB			
						Smooth surfaces n= 0.011 P2= 3.35"			
	1.1	133	0.0100	2.03		Shallow Concentrated Flow, BC			
			0.0050	0.04	0.50	Paved Kv= 20.3 fps			
	2.9	558	0.0050	3.21	2.52	· · · · · · · · · · · · · · · · · · ·			
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'			
	0.0	72		7 5 1		n= 0.013			
	0.2	73		7.51		Lake or Reservoir, INFILTRATION-DE Mean Depth= 1.75'			
	0.3	66	0.0050	4.20	7.43	·			
	0.3	00	0.0050	4.20	7.43	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'			
						n= 0.013			
	34.3	1,367	0.0017	0.66		Shallow Concentrated Flow, FG			
	04.0	1,007	0.0017	0.00		Unpaved Kv= 16.1 fps			
-	39.7	2,247	Total						

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Subcatchment IFA: Infiltration Chamber A



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Summary for Subcatchment IFB: Infiltration Chamber B

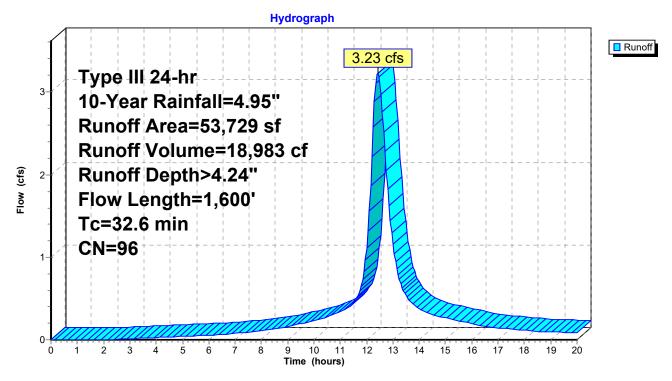
Runoff = 3.23 cfs @ 12.43 hrs, Volume= 18,983 cf, Depth> 4.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 10-Year Rainfall=4.95"

_	Α	rea (sf)	CN [Description		
		5,622	80 >	>75% Grass cover, Good, HSG D		
_		48,107	98 F	Paved park	ing, HSG D	
		53,729		Veighted A		
		5,622			vious Area	
		48,107	8	89.54% Imp	pervious Are	ea
	Тс	Length	Slope	Velocity	Capacity	Description
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
	0.9	50	0.0100	0.93		Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.0	124	0.0100	2.03		Shallow Concentrated Flow, BC
	4.0	000	0.0050	0.04	0.50	Paved Kv= 20.3 fps
	1.0	202	0.0050	3.21	2.52	•
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	2.1	73		0.57		n= 0.013
	۷.۱	73		0.57		Lake or Reservoir, INFILTRATION-DE Mean Depth= 0.01'
	0.3	64	0.0050	4.20	7.43	•
	0.0	0-1	0.0000	7.20	7.40	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	27.3	1,087	0.0017	0.66		Shallow Concentrated Flow, FG
						Unpaved Kv= 16.1 fps
	32.6	1,600	Total			

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Subcatchment IFB: Infiltration Chamber B



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Summary for Subcatchment IFC: Infiltration C

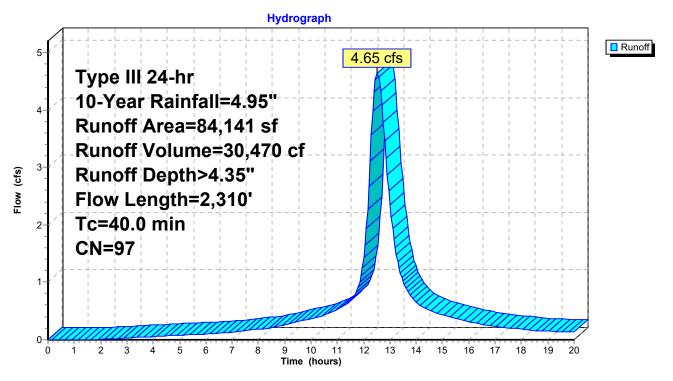
Runoff = 4.65 cfs @ 12.52 hrs, Volume= 30,470 cf, Depth> 4.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 10-Year Rainfall=4.95"

_	Д	rea (sf)	CN	Description		
		5,963	80	30 >75% Grass cover, Good, HSG D		
_		78,178	98	Paved park	ing, HSG D	
		84,141	97	Weighted A	verage	
		5,963		7.09% Perv		
		78,178		92.91% lm	pervious Ar	ea
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)		(cfs)	Description
-	1.2	50	0.0050		(212)	Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.9	161	0.0050	1.44		Shallow Concentrated Flow, BC
						Paved Kv= 20.3 fps
	1.5	364	0.0075	3.93	3.09	•
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	0.4	4.4		7.54		n= 0.013
	0.1	44		7.51		Lake or Reservoir, INFILTRATION-DE
	1.3	336	0.0050	4.20	7.43	Mean Depth= 1.75'
	1.3	330	0.0050	4.20	7.43	Pipe Channel, PIPE-EF 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	34.0	1,355	0.0017	0.66		Shallow Concentrated Flow, FG
	00	1,000	3.0017	0.00		Unpaved Kv= 16.1 fps
-	40.0	2,310	Total			

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Subcatchment IFC: Infiltration C



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Summary for Subcatchment IFD: Infiltration Chamber D

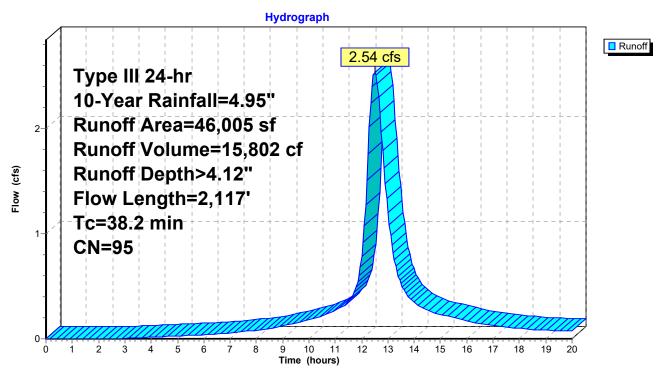
Runoff = 2.54 cfs @ 12.50 hrs, Volume= 15,802 cf, Depth> 4.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 10-Year Rainfall=4.95"

_	Α	rea (sf)	CN	Description		
		7,238	80	>75% Grass cover, Good, HSG D		
_		38,767	98	Paved park	ing, HSG D	
		46,005		Weighted A		
		7,238			rvious Area	
		38,767		84.27% lmp	pervious Are	ea
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)	•	(cfs)	1
	1.2	50	0.0050	0.70		Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.5	133	0.0050	1.44		Shallow Concentrated Flow, BC
		=0.4		0.00	0.00	Paved Kv= 20.3 fps
	2.3	531	0.0075	3.93	3.09	
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	0.1	35		7.51		n= 0.013 Lake or Reservoir, INFILTRATION-DE
	0.1	33		7.51		Mean Depth= 1.75'
	0.2	56	0.0050	4.20	7.43	· ·
	0.2		0.0000	0		18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	32.9	1,312	0.0017	0.66		Shallow Concentrated Flow, FG
_						Unpaved Kv= 16.1 fps
	38.2	2,117	Total			

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Subcatchment IFD: Infiltration Chamber D



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Summary for Reach 1R: Total Offsite

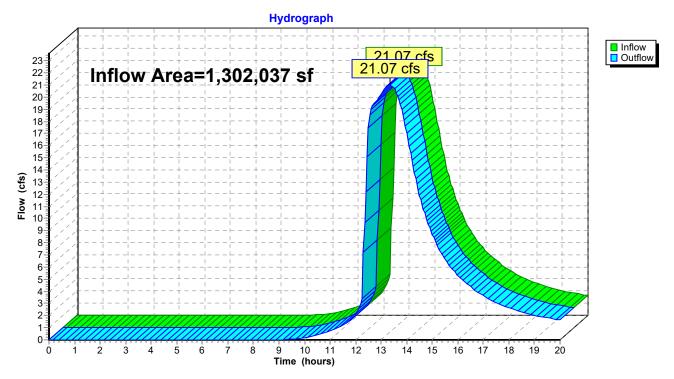
Inflow Area = 1,302,037 sf, 15.93% Impervious, Inflow Depth > 2.18" for 10-Year event

Inflow = 21.07 cfs @ 13.35 hrs, Volume= 236,270 cf

Outflow = 21.07 cfs @ 13.35 hrs, Volume= 236,270 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Reach 1R: Total Offsite



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Summary for Pond IC-A: Infiltration Chambers A

Inflow Area = 50,961 sf, 66.81% Impervious, Inflow Depth > 3.79" for 10-Year event Inflow = 2.63 cfs @ 12.52 hrs, Volume= 16,114 cf

Outflow = 2.63 cfs @ 12.54 hrs, Volume= 15,480 cf, Atten= 0%, Lag= 0.9 min 0.19 cfs @ 10.40 hrs, Volume= 7,911 cf

Primary = 2.44 cfs @ 12.54 hrs, Volume= 7,569 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.35' @ 12.54 hrs Surf.Area= 988 sf Storage= 1,914 cf

Plug-Flow detention time= 45.8 min calculated for 15,441 cf (96% of inflow) Center-of-Mass det. time= 31.3 min (812.2 - 780.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.55'	856 cf	25.67'W x 38.50'L x 3.54'H Field A
			3,500 cf Overall - 1,360 cf Embedded = 2,140 cf x 40.0% Voids
#2A	139.05'	1,360 cf	Cultec R-330XLHD x 25 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
· · · · · · · · · · · · · · · · · · ·	·	0.040 (T () A ())) O

2,216 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.30'	18.0" Round Culvert
	•		L= 44.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.30' / 136.08' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.15'	18.0" Round Culvert
			L= 19.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.05' / 139.15' S= -0.0053 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Discarded	138.55'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.19 cfs @ 10.40 hrs HW=138.59' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=2.43 cfs @ 12.54 hrs HW=141.35' (Free Discharge)

1=Culvert (Passes 2.43 cfs of 17.65 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 2.43 cfs @ 1.72 fps)

3=Culvert (Passes 2.43 cfs of 5.06 cfs potential flow)

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Pond IC-A: Infiltration Chambers A - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

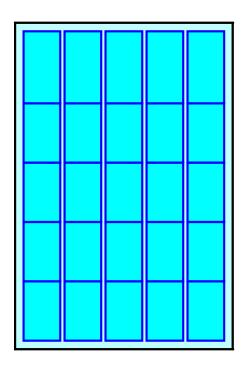
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

25 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,359.8 cf Chamber Storage

3,499.8 cf Field - 1,359.8 cf Chambers = 2,139.9 cf Stone x 40.0% Voids = 856.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,215.8 cf = 0.051 af Overall Storage Efficiency = 63.3% Overall System Size = 38.50' x 25.67' x 3.54'

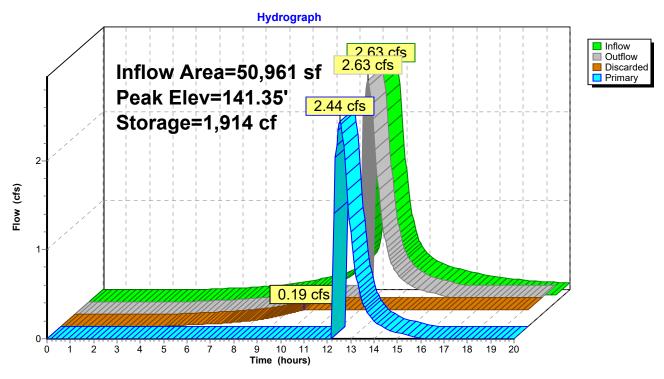
25 Chambers 129.6 cy Field 79.3 cy Stone





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Pond IC-A: Infiltration Chambers A



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Summary for Pond IC-B: Infiltration Chambers B

Inflow Area =	53,729 sf, 89.54% Impervious,	Inflow Depth > 4.24" for 10-Year event
Inflow =	3.23 cfs @ 12.43 hrs, Volume=	18,983 cf
Outflow =	3.23 cfs @ 12.45 hrs, Volume=	18,841 cf, Atten= 0%, Lag= 1.3 min
Discarded =	0.27 cfs @ 10.45 hrs, Volume=	11,658 cf
Primary =	2.97 cfs @ 12.45 hrs, Volume=	7,183 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 140.30' @ 12.45 hrs Surf.Area= 1,388 sf Storage= 2,706 cf

Plug-Flow detention time= 48.7 min calculated for 18,841 cf (99% of inflow) Center-of-Mass det. time= 45.5 min (801.9 - 756.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	137.50'	1,188 cf	30.50'W x 45.50'L x 3.54'H Field A
			4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	138.00'	1,945 cf	Cultec R-330XLHD x 36 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
•		0.400 [T () A ())) O

3,133 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	137.18'	18.0" Round Culvert
	•		L= 55.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 137.18' / 136.90' S= 0.0051 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	139.90'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	138.02'	24.0" Round Culvert
			L= 5.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 138.00' / 138.02' S= -0.0040 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	137.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.27 cfs @ 10.45 hrs HW=137.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=2.96 cfs @ 12.45 hrs HW=140.30' (Free Discharge)

1=Culvert (Passes 2.96 cfs of 12.35 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 2.96 cfs @ 1.85 fps)

3=Culvert (Passes 2.96 cfs of 9.57 cfs potential flow)

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Pond IC-B: Infiltration Chambers B - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length

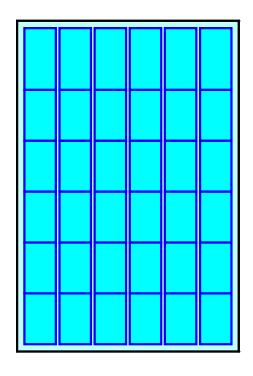
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af Overall Storage Efficiency = 63.7% Overall System Size = 45.50' x 30.50' x 3.54'

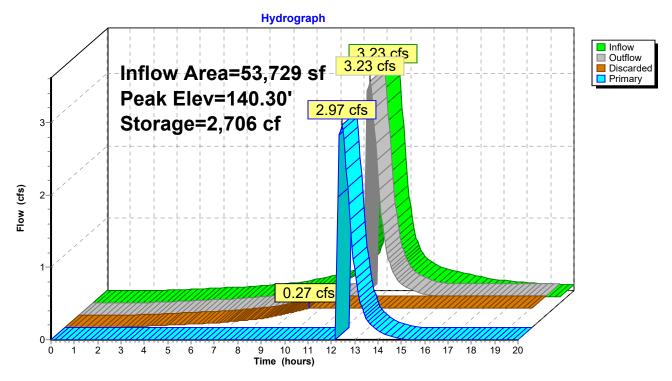
36 Chambers 182.0 cy Field 110.0 cy Stone





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Pond IC-B: Infiltration Chambers B



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Summary for Pond IC-C: Infiltration Chambers C

Inflow Area =	84,141 sf, 92.91% Impervious,	Inflow Depth > 4.35" for 10-Year event
Inflow =	4.65 cfs @ 12.52 hrs, Volume=	30,470 cf
Outflow =	4.63 cfs @ 12.57 hrs, Volume=	30,460 cf, Atten= 0%, Lag= 3.2 min
Discarded =	0.50 cfs @ 10.90 hrs, Volume=	20,672 cf
Primary =	4.14 cfs @ 12.57 hrs, Volume=	9,788 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.84' @ 12.57 hrs Surf.Area= 2,597 sf Storage= 5,036 cf

Plug-Flow detention time= 47.7 min calculated for 30,460 cf (100% of inflow) Center-of-Mass det. time= 47.5 min (803.7 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	2,187 cf	35.33'W x 73.50'L x 3.54'H Field A
			9,198 cf Overall - 3,729 cf Embedded = 5,468 cf x 40.0% Voids
#2A	139.60'	3,729 cf	Cultec R-330XLHD x 70 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
•		5.047. (T () A ())) O

5,917 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.70'	18.0" Round Culvert L= 110.0' Ke= 0.500
	•		Inlet / Outlet Invert= 136.70' / 136.15' S= 0.0050 '/' Cc= 0.900
			n= 0.013, Flow Area= 1.77 sf
#2	Device 1	141.35'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	140.25'	24.0" Round Culvert
			L= 215.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.60' / 140.25' S= -0.0030 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.50 cfs @ 10.90 hrs HW=139.14' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=4.08 cfs @ 12.57 hrs HW=141.84' (Free Discharge)

1=Culvert (Passes 4.08 cfs of 15.49 cfs potential flow)

-2=Broad-Crested Rectangular Weir (Weir Controls 4.08 cfs @ 2.09 fps) **-3=Culvert** (Passes 4.08 cfs of 8.36 cfs potential flow)

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Pond IC-C: Infiltration Chambers C - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

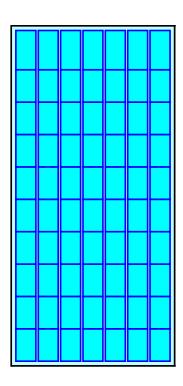
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

70 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 3,729.2 cf Chamber Storage

9,197.7 cf Field - 3,729.2 cf Chambers = 5,468.5 cf Stone x 40.0% Voids = 2,187.4 cf Stone Storage

Chamber Storage + Stone Storage = 5,916.6 cf = 0.136 af Overall Storage Efficiency = 64.3% Overall System Size = 73.50' x 35.33' x 3.54'

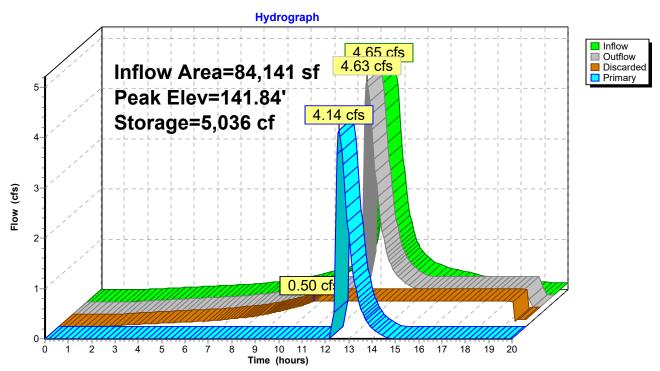
70 Chambers 340.7 cy Field 202.5 cy Stone





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Pond IC-C: Infiltration Chambers C



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Summary for Pond IC-D: Infiltration Chambers D

Inflow Area =	46,005 sf, 84.27% Impervious,	Inflow Depth > 4.12" for 10-Year event
Inflow =	2.54 cfs @ 12.50 hrs, Volume=	15,802 cf
Outflow =	2.54 cfs @ 12.52 hrs, Volume=	15,547 cf, Atten= 0%, Lag= 0.8 min
Discarded =	0.22 cfs @ 10.65 hrs, Volume=	9,579 cf
Primary =	2.32 cfs @ 12.52 hrs, Volume=	5,968 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.34' @ 12.52 hrs Surf.Area= 1,174 sf Storage= 2,306 cf

Plug-Flow detention time= 51.6 min calculated for 15,508 cf (98% of inflow) Center-of-Mass det. time= 44.9 min (811.4 - 766.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.50'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A
			4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	139.00'	1,632 cf	Cultec R-330XLHD x 30 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.040 (T () A ())) O

2,643 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.55'	18.0" Round Culvert
	·		L= 29.0' CMP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.55' / 136.26' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.01'	24.0" Round Culvert
			L= 3.5' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.00' / 139.01' S= -0.0029 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	138.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.22 cfs @ 10.65 hrs HW=138.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=2.30 cfs @ 12.52 hrs HW=141.34' (Free Discharge)

-1=Culvert (Passes 2.30 cfs of 17.11 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 2.30 cfs @ 1.69 fps)

3=Culvert (Passes 2.30 cfs of 8.84 cfs potential flow)

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Pond IC-D: Infiltration Chambers D - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

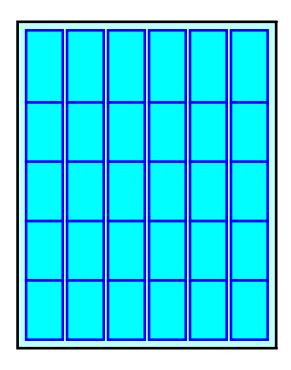
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

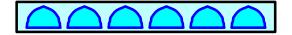
30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,631.8 cf Chamber Storage

4,158.8 cf Field - 1,631.8 cf Chambers = 2,527.0 cf Stone x 40.0% Voids = 1,010.8 cf Stone Storage

Chamber Storage + Stone Storage = 2,642.6 cf = 0.061 af Overall Storage Efficiency = 63.5% Overall System Size = 38.50' x 30.50' x 3.54'

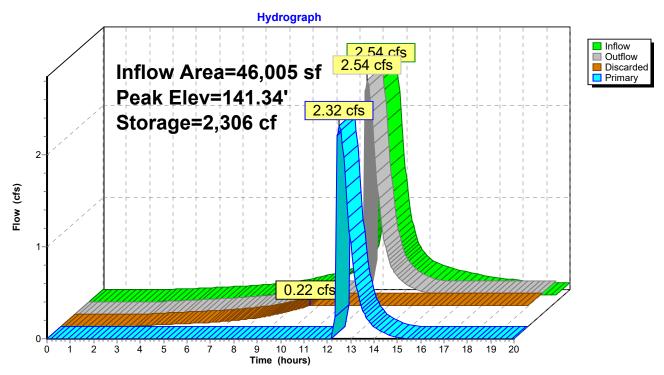
30 Chambers 154.0 cy Field 93.6 cy Stone





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Pond IC-D: Infiltration Chambers D



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Summary for Subcatchment DW: Direct to Wetland

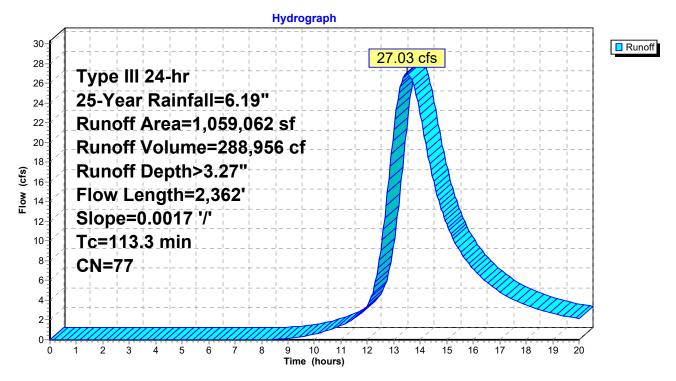
Runoff = 27.03 cfs @ 13.48 hrs, Volume= 288,956 cf, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=6.19"

A	rea (sf)	CN E	Description			
	15,568	30 V	Voods, Go	od, HSG A		
	1,615	39 >	75% Gras	s cover, Go	od, HSG A	
	175	98 F	Paved park	ing, HSG A		
	802	55 V	Voods, Go	od, HSG B		
	512				ood, HSG B	
2	82,921			od, HSG D		
	11,316		Dirt roads, l			
	7,064			ace, HSG D		
	18,373				od, HSG D	
* 7	20,013		Vetland, H			
	703	98 F	Paved park	<u>ing, HSG D</u>		
	59,062		Veighted A			
1,0	58,184		9.92% Pervious Area			
	878	C).08% Impe	ervious Area	a	
_		01				
Tc	Length	Slope		Capacity	Description	
<u>(min)</u>	(feet)	(ft/ft)	(ft/sec)	(cfs)		
56.3	50	0.0017	0.01		Sheet Flow, AB	
					Woods: Dense underbrush n= 0.800 P2= 3.35"	
8.6	341	0.0017	0.66		Shallow Concentrated Flow, BC	
		–			Unpaved Kv= 16.1 fps	
0.2	51	0.0017	3.51	11.02	· · · · · · · · · · · · · · · · · · ·	
					24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'	
40.0	4 000	0.0047	0.00		n= 0.011	
48.2	1,920	0.0017	0.66		Shallow Concentrated Flow, DE	
440.0	0.000				Unpaved Kv= 16.1 fps	
113.3	2,362	Total				

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Subcatchment DW: Direct to Wetland



Type III 24-hr 25-Year Rainfall=6.19" Printed 2/11/2022

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Summary for Subcatchment EN: Entrance

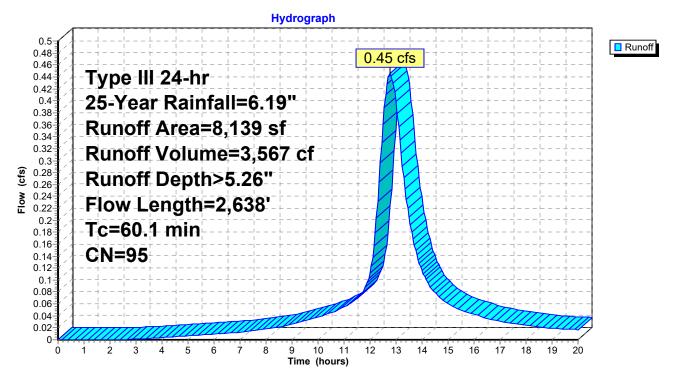
Runoff = 0.45 cfs @ 12.77 hrs, Volume= 3,567 cf, Depth> 5.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=6.19"

A	rea (sf)	CN [Description		
	236	39 >	75% Gras	s cover, Go	ood, HSG A
	4,288			ing, HSG A	
	374	98 F	Paved park	ing, HSG B	
	447	80 >	75% Gras	s cover, Go	ood, HSG D
	2,794	98 F	Paved park	ing, HSG D	
	8,139	95 \	Veighted A	verage	
	683	3	3.39% Perv	ious Area	
	7,456	(91.61% lmp	pervious Are	ea
Тс	Length	Slope		Capacity	Description
<u>(min)</u>	(feet)	(ft/ft)	(ft/sec)	(cfs)	
0.9	50	0.0100	0.93		Sheet Flow, AB
					Smooth surfaces n= 0.011 P2= 3.35"
1.9	227	0.0100	2.03		Shallow Concentrated Flow, BC
					Paved Kv= 20.3 fps
0.5	97	0.0050	3.21	2.52	Pipe Channel, PIPE-CD
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013
56.8	2,264	0.0017	0.66		Shallow Concentrated Flow, DE
					Unpaved Kv= 16.1 fps
60.1	2,638	Total			

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Subcatchment EN: Entrance



3395.1 - 0 Pond Street - Proposed Conditions

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Summary for Subcatchment IFA: Infiltration Chamber A

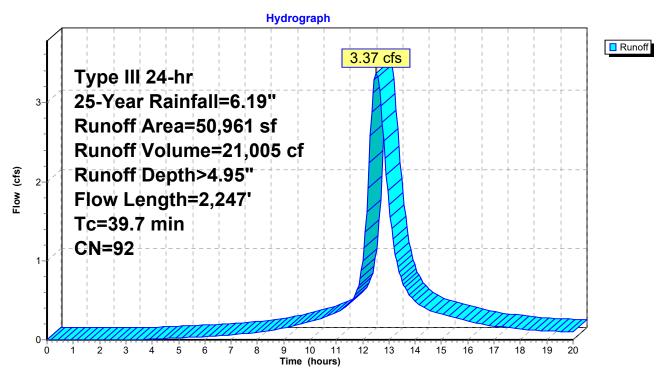
Runoff = 3.37 cfs @ 12.52 hrs, Volume= 21,005 cf, Depth> 4.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=6.19"

A	rea (sf)	CN E	escription		
	1,355	96 G	Gravel surfa	ace, HSG D)
	15,558	80 >	75% Gras	s cover, Go	ood, HSG D
	34,048	98 F	aved park	ing, HSG D	
	50,961	92 V	Veighted A	verage	
	16,913	3	3.19% Per	vious Area	
	34,048	6	6.81% lmp	pervious Are	ea
т.	ما العرب ما	Clana	\/alaaitu	Canacity	Description
Tc (min)	Length	Slope	Velocity (ft/sec)	Capacity	Description
<u>(min)</u> 0.9	(feet) 50	(ft/ft) 0.0100	0.93	(cfs)	Chest Flow AD
0.9	50	0.0100	0.93		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 3.35"
1.1	133	0.0100	2.03		Shallow Concentrated Flow, BC
1	100	0.0100	2.00		Paved Kv= 20.3 fps
2.9	558	0.0050	3.21	2.52	•
				_	12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013
0.2	73		7.51		Lake or Reservoir, INFILTRATION-DE
					Mean Depth= 1.75'
0.3	66	0.0050	4.20	7.43	· · · · · · · · · · · · · · · · · · ·
					18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
040	4 007	0.0047	0.00		n= 0.013
34.3	1,367	0.0017	0.66		Shallow Concentrated Flow, FG
	0.047	T-4-1			Unpaved Kv= 16.1 fps
39.7	2,247	Total			

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Subcatchment IFA: Infiltration Chamber A



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Summary for Subcatchment IFB: Infiltration Chamber B

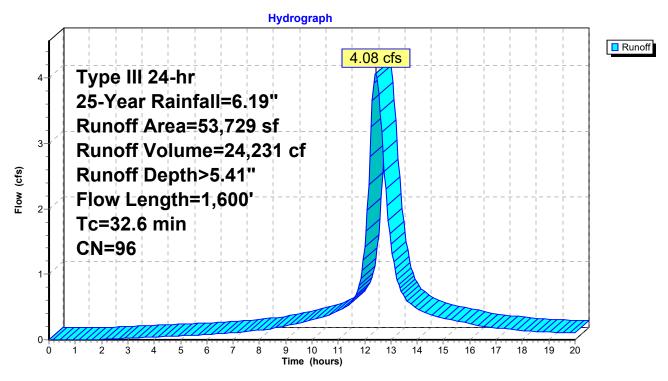
Runoff = 4.08 cfs @ 12.43 hrs, Volume= 24,231 cf, Depth> 5.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=6.19"

_	Α	rea (sf)	CN I	Description		
		5,622	80 >	>75% Gras	s cover, Go	ood, HSG D
_		48,107	98 F	Paved park	ing, HSG D	
		53,729		Neighted A		
		5,622			rvious Area	
		48,107	8	39.54% Imp	pervious Are	ea
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)	•	(cfs)	· · · · · · · · · · · · · · · ·
	0.9	50	0.0100	0.93		Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.0	124	0.0100	2.03		Shallow Concentrated Flow, BC
	4.0	000	0.0050	0.04	0.50	Paved Kv= 20.3 fps
	1.0	202	0.0050	3.21	2.52	
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	2.1	73		0.57		n= 0.013
	۷.۱	73		0.57		Lake or Reservoir, INFILTRATION-DE Mean Depth= 0.01'
	0.3	64	0.0050	4.20	7.43	· ·
	0.0	0-1	0.0000	7.20	7.40	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	27.3	1,087	0.0017	0.66		Shallow Concentrated Flow, FG
_		•				Unpaved Kv= 16.1 fps
_	32.6	1,600	Total			

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Subcatchment IFB: Infiltration Chamber B



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Summary for Subcatchment IFC: Infiltration C

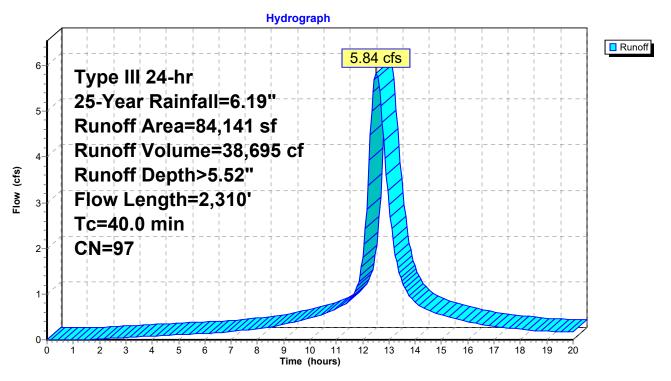
Runoff 5.84 cfs @ 12.52 hrs, Volume= 38,695 cf, Depth> 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=6.19"

	Д	rea (sf)	CN	Description		
		5,963	80	>75% Gras	s cover, Go	ood, HSG D
		78,178	98	Paved park	ing, HSG D	
		84,141		Weighted A		
		5,963		7.09% Perv	ious Area	
		78,178		92.91% lm _l	pervious Ar	ea
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)		(cfs)	·
	1.2	50	0.0050	0.70		Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.9	161	0.0050	1.44		Shallow Concentrated Flow, BC
	4 -	004		0.00		Paved Kv= 20.3 fps
	1.5	364	0.0075	3.93	3.09	1
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	0.1	44		7.51		n= 0.013
	0.1	44		7.51		Lake or Reservoir, INFILTRATION-DE Mean Depth= 1.75'
	1.3	336	0.0050	4.20	7.43	•
	1.0	000	0.0000	7.20	7.40	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	34.0	1,355	0.0017	0.66		Shallow Concentrated Flow, FG
		·				Unpaved Kv= 16.1 fps
-	40.0	2,310	Total			

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Subcatchment IFC: Infiltration C



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Summary for Subcatchment IFD: Infiltration Chamber D

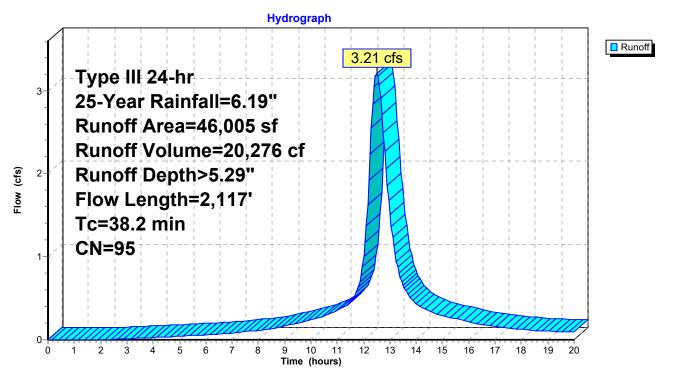
Runoff = 3.21 cfs @ 12.50 hrs, Volume= 20,276 cf, Depth> 5.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 25-Year Rainfall=6.19"

A	rea (sf)	CN E	Description		
	7,238				ood, HSG D
	38,767	98 F	Paved park	<u>ing, HSG D</u>	
	46,005		Veighted A	•	
	7,238			vious Area	
	38,767	8	4.27% Imp	pervious Are	ea
Тс	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
1.2	50	0.0050	0.70		Sheet Flow, AB
					Smooth surfaces n= 0.011 P2= 3.35"
1.5	133	0.0050	1.44		Shallow Concentrated Flow, BC
					Paved Kv= 20.3 fps
2.3	531	0.0075	3.93	3.09	· · · · · · · · · · · · · · · · · · ·
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
0.4	25		7.51		n= 0.013
0.1	35		7.51		Lake or Reservoir, INFILTRATION-DE
0.2	56	0.0050	4.20	7.43	Mean Depth= 1.75' Pipe Channel, PIPE-EF
0.2	30	0.0050	4.20	7.43	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
					n= 0.013
32.9	1,312	0.0017	0.66		Shallow Concentrated Flow, FG
02.0	1,012	0.0017	0.00		Unpaved Kv= 16.1 fps
38.2	2,117	Total			- 1
	_,				

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Subcatchment IFD: Infiltration Chamber D



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Summary for Reach 1R: Total Offsite

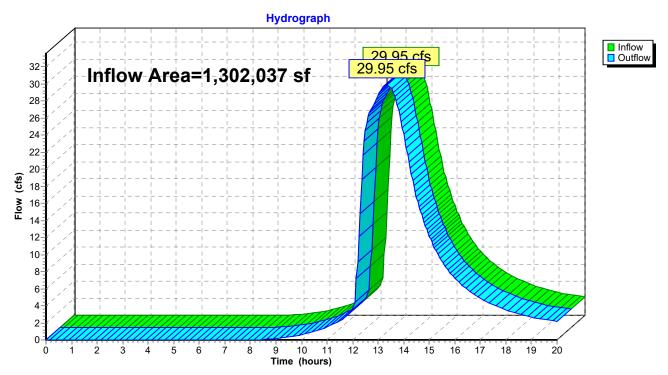
Inflow Area = 1,302,037 sf, 15.93% Impervious, Inflow Depth > 3.13" for 25-Year event

Inflow = 29.95 cfs @ 13.35 hrs, Volume= 339,745 cf

Outflow = 29.95 cfs @ 13.35 hrs, Volume= 339,745 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Reach 1R: Total Offsite



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Summary for Pond IC-A: Infiltration Chambers A

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.42' @ 12.53 hrs Surf.Area= 988 sf Storage= 1,945 cf

Plug-Flow detention time= 38.7 min calculated for 19,984 cf (95% of inflow) Center-of-Mass det. time= 20.8 min (795.6 - 774.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.55'	856 cf	25.67'W x 38.50'L x 3.54'H Field A
			3,500 cf Overall - 1,360 cf Embedded = 2,140 cf x 40.0% Voids
#2A	139.05'	1,360 cf	Cultec R-330XLHD x 25 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
· · · · · · · · · · · · · · · · · · ·	·	0.040 (T () A ())) O

2,216 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.30'	18.0" Round Culvert
	·		L= 44.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.30' / 136.08' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.15'	18.0" Round Culvert
			L= 19.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.05' / 139.15' S= -0.0053 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Discarded	138.55'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.19 cfs @ 9.60 hrs HW=138.59' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=3.17 cfs @ 12.53 hrs HW=141.42' (Free Discharge) 1=Culvert (Passes 3.17 cfs of 17.78 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 3.17 cfs @ 1.90 fps)
3=Culvert (Passes 3.17 cfs of 5.50 cfs potential flow)

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Pond IC-A: Infiltration Chambers A - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

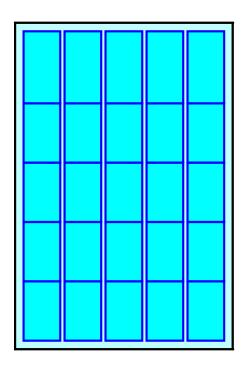
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

25 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,359.8 cf Chamber Storage

3,499.8 cf Field - 1,359.8 cf Chambers = 2,139.9 cf Stone x 40.0% Voids = 856.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,215.8 cf = 0.051 af Overall Storage Efficiency = 63.3% Overall System Size = 38.50' x 25.67' x 3.54'

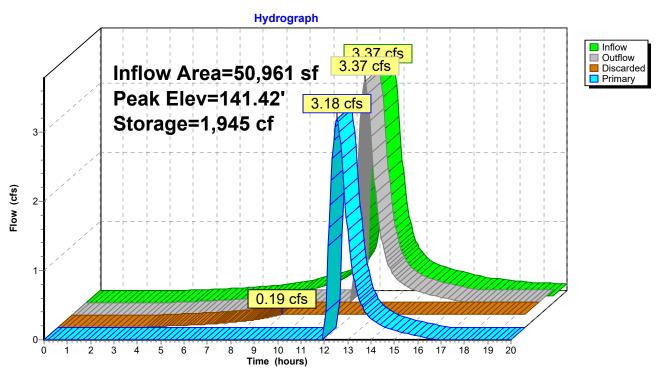
25 Chambers 129.6 cy Field 79.3 cy Stone





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Pond IC-A: Infiltration Chambers A



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Summary for Pond IC-B: Infiltration Chambers B

Inflow Area = 53,729 sf, 89.54% Impervious, Inflow Depth > 5.41" for 25-Year event
Inflow = 4.08 cfs @ 12.43 hrs, Volume= 24,231 cf
Outflow = 4.07 cfs @ 12.44 hrs, Volume= 23,525 cf, Atten= 0%, Lag= 0.9 min
Discarded = 0.27 cfs @ 9.65 hrs, Volume= 12,480 cf
Primary = 3.81 cfs @ 12.44 hrs, Volume= 11,044 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 140.37' @ 12.44 hrs Surf.Area= 1,388 sf Storage= 2,752 cf

Plug-Flow detention time= 43.8 min calculated for 23,466 cf (97% of inflow) Center-of-Mass det. time= 32.0 min (783.6 - 751.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	137.50'	1,188 cf	30.50'W x 45.50'L x 3.54'H Field A
			4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	138.00'	1,945 cf	Cultec R-330XLHD x 36 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
•		0.400 [T () A ())) O

3,133 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	137.18'	18.0" Round Culvert
	•		L= 55.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 137.18' / 136.90' S= 0.0051 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	139.90'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	138.02'	24.0" Round Culvert
			L= 5.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 138.00' / 138.02' S= -0.0040 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	137.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.27 cfs @ 9.65 hrs HW=137.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=3.80 cfs @ 12.44 hrs HW=140.37' (Free Discharge) 1=Culvert (Passes 3.80 cfs of 12.56 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 3.80 cfs @ 2.03 fps)
3=Culvert (Passes 3.80 cfs of 10.34 cfs potential flow)

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Pond IC-B: Infiltration Chambers B - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length

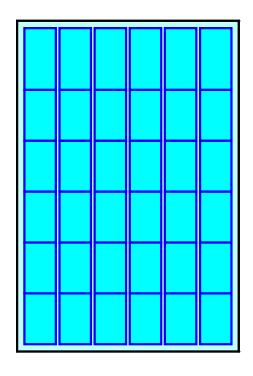
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af Overall Storage Efficiency = 63.7% Overall System Size = 45.50' x 30.50' x 3.54'

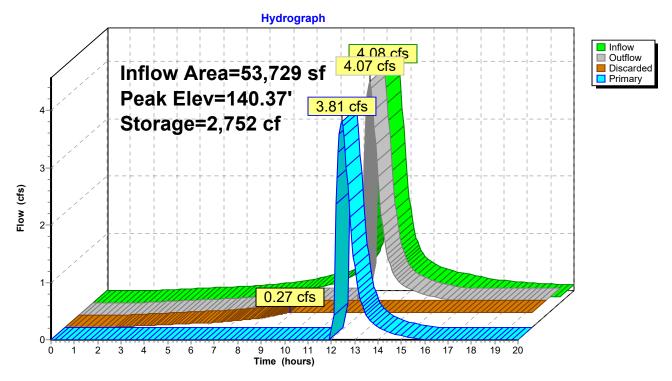
36 Chambers 182.0 cy Field 110.0 cy Stone





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Pond IC-B: Infiltration Chambers B



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Summary for Pond IC-C: Infiltration Chambers C

Inflow Area =	84,141 sf, 92.91% Impervious,	Inflow Depth > 5.52" for 25-Year event
Inflow =	5.84 cfs @ 12.52 hrs, Volume=	38,695 cf
Outflow =	5.82 cfs @ 12.55 hrs, Volume=	38,259 cf, Atten= 0%, Lag= 1.6 min
Discarded =	0.50 cfs @ 10.20 hrs, Volume=	22,842 cf
Primary =	5.32 cfs @ 12.55 hrs, Volume=	15,417 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.92' @ 12.55 hrs Surf.Area= 2,597 sf Storage= 5,148 cf

Plug-Flow detention time= 44.9 min calculated for 38,164 cf (99% of inflow) Center-of-Mass det. time= 40.0 min (791.9 - 751.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	2,187 cf	35.33'W x 73.50'L x 3.54'H Field A
			9,198 cf Overall - 3,729 cf Embedded = 5,468 cf x 40.0% Voids
#2A	139.60'	3,729 cf	Cultec R-330XLHD x 70 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
•		5.047. (T () A ())) O

5,917 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.70'	18.0" Round Culvert L= 110.0' Ke= 0.500
			Inlet / Outlet Invert= 136.70' / 136.15' S= 0.0050 '/' Cc= 0.900
			n= 0.013, Flow Area= 1.77 sf
#2	Device 1	141.35'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	140.25'	24.0" Round Culvert
			L= 215.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.60' / 140.25' S= -0.0030 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.50 cfs @ 10.20 hrs HW=139.14' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=5.32 cfs @ 12.55 hrs HW=141.92' (Free Discharge)

-1=Culvert (Passes 5.32 cfs of 15.64 cfs potential flow)

-2=Broad-Crested Rectangular Weir (Weir Controls 5.32 cfs @ 2.32 fps) **-3=Culvert** (Passes 5.32 cfs of 9.33 cfs potential flow)

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Pond IC-C: Infiltration Chambers C - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

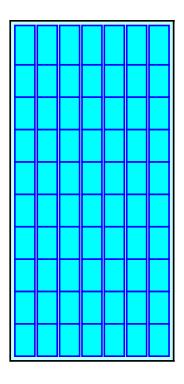
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

70 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 3,729.2 cf Chamber Storage

9,197.7 cf Field - 3,729.2 cf Chambers = 5,468.5 cf Stone x 40.0% Voids = 2,187.4 cf Stone Storage

Chamber Storage + Stone Storage = 5,916.6 cf = 0.136 af Overall Storage Efficiency = 64.3% Overall System Size = 73.50' x 35.33' x 3.54'

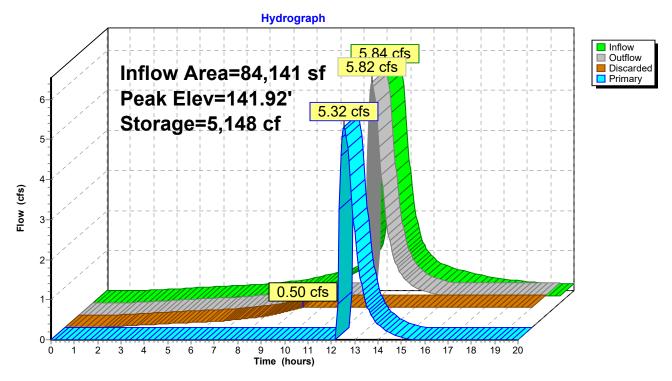
70 Chambers 340.7 cy Field 202.5 cy Stone





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Pond IC-C: Infiltration Chambers C



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Summary for Pond IC-D: Infiltration Chambers D

Inflow Area = 46,005 sf, 84.27% Impervious, Inflow Depth > 5.29" for 25-Year event
Inflow = 3.21 cfs @ 12.50 hrs, Volume= 20,276 cf
Outflow = 3.21 cfs @ 12.51 hrs, Volume= 19,547 cf, Atten= 0%, Lag= 0.8 min
Discarded = 0.22 cfs @ 9.85 hrs, Volume= 10,272 cf
Primary = 2.99 cfs @ 12.51 hrs, Volume= 9,274 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.40' @ 12.51 hrs Surf.Area= 1,174 sf Storage= 2,339 cf

Plug-Flow detention time= 45.2 min calculated for 19,498 cf (96% of inflow) Center-of-Mass det. time= 31.2 min (792.4 - 761.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.50'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A
			4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	139.00'	1,632 cf	Cultec R-330XLHD x 30 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.040 (T () A ())) O

2,643 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.55'	18.0" Round Culvert
	·		L= 29.0' CMP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.55' / 136.26' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.01'	24.0" Round Culvert
			L= 3.5' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.00' / 139.01' S= -0.0029 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	138.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.22 cfs @ 9.85 hrs HW=138.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=2.98 cfs @ 12.51 hrs HW=141.40' (Free Discharge)
1=Culvert (Passes 2.98 cfs of 17.23 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 2.98 cfs @ 1.85 fps)
3=Culvert (Passes 2.98 cfs of 9.59 cfs potential flow)

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Pond IC-D: Infiltration Chambers D - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

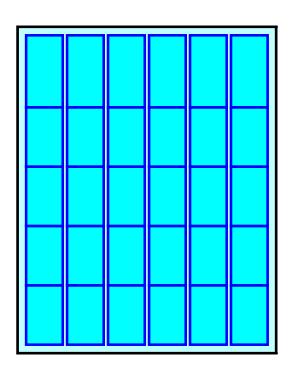
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

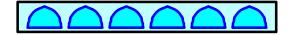
30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,631.8 cf Chamber Storage

4,158.8 cf Field - 1,631.8 cf Chambers = 2,527.0 cf Stone x 40.0% Voids = 1,010.8 cf Stone Storage

Chamber Storage + Stone Storage = 2,642.6 cf = 0.061 af Overall Storage Efficiency = 63.5% Overall System Size = 38.50' x 30.50' x 3.54'

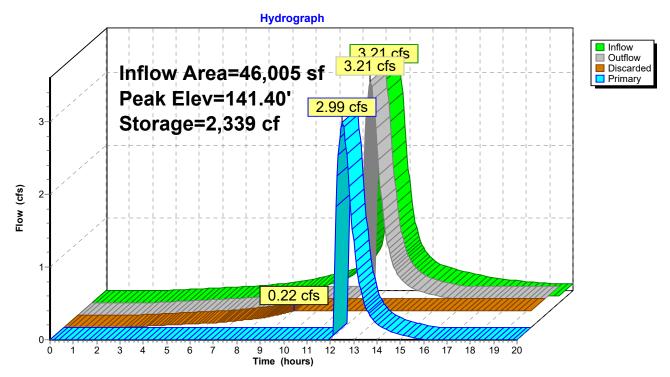
30 Chambers 154.0 cy Field 93.6 cy Stone





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Pond IC-D: Infiltration Chambers D



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Summary for Subcatchment DW: Direct to Wetland

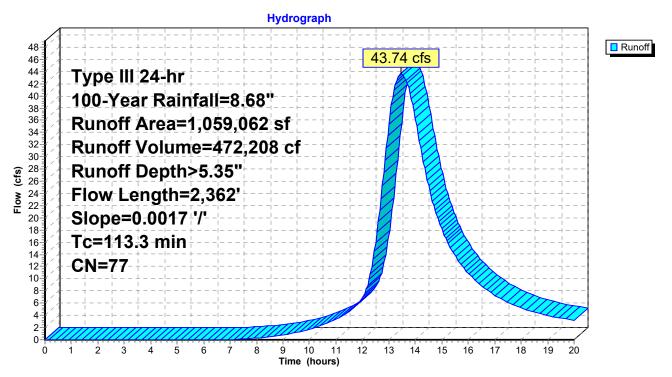
Runoff = 43.74 cfs @ 13.47 hrs, Volume= 472,208 cf, Depth> 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 100-Year Rainfall=8.68"

	Area (sf)	CN [Description					
	15,568	30 \	Woods, Good, HSG A					
	1,615	39 >	>75% Gras	s cover, Go	ood, HSG A			
	175	98 F	Paved park	ing, HSG A				
	802	55 \	Noods, Go	od, HSG B				
	512	61 >	>75% Gras	s cover, Go	ood, HSG B			
	282,921	77 \	Woods, Go	od, HSG D				
	11,316	89 I	Dirt roads, l	HSG D				
	7,064			ace, HSG D				
	18,373			•	ood, HSG D			
*	720,013		Wetland, H					
	703	98 F	Paved park	<u>ing, HSG D</u>				
1	,059,062		Neighted A					
1	,058,184		99.92% Pervious Area					
	878	().08% Impe	ervious Area	a			
_				_				
To	-	Slope	•	Capacity	Description			
(min		(ft/ft)	(ft/sec)	(cfs)				
56.3	3 50	0.0017	0.01		Sheet Flow, AB			
					Woods: Dense underbrush n= 0.800 P2= 3.35"			
8.6	341	0.0017	0.66		Shallow Concentrated Flow, BC			
					Unpaved Kv= 16.1 fps			
0.2	2 51	0.0017	3.51	11.02				
					24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'			
					n= 0.011			
48.2	2 1,920	0.0017	0.66		Shallow Concentrated Flow, DE			
					Unpaved Kv= 16.1 fps			
113.3	3 2,362	Total						

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Subcatchment DW: Direct to Wetland



Type III 24-hr 100-Year Rainfall=8.68" Printed 2/11/2022

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Summary for Subcatchment EN: Entrance

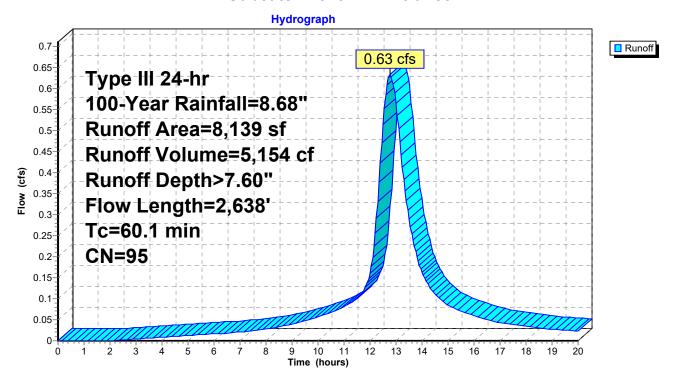
Runoff = 0.63 cfs @ 12.77 hrs, Volume= 5,154 cf, Depth> 7.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 100-Year Rainfall=8.68"

A	rea (sf)	CN [Description				
	236	39 >	>75% Grass cover, Good, HSG A				
	4,288		Paved parking, HSG A				
	374	98 F	Paved park	ing, HSG B			
	447	80 >	75% Gras	s cover, Go	ood, HSG D		
	2,794	98 F	Paved parking, HSG D				
	8,139	95 \	Veighted A	verage			
	683	3	3.39% Perv	ious Area			
	7,456	(91.61% lmp	pervious Are	ea		
Тс	Length	Slope		Capacity	Description		
<u>(min)</u>	(feet)	(ft/ft)	(ft/sec)	(cfs)			
0.9	50	0.0100	0.93		Sheet Flow, AB		
					Smooth surfaces n= 0.011 P2= 3.35"		
1.9	227	0.0100	2.03		Shallow Concentrated Flow, BC		
					Paved Kv= 20.3 fps		
0.5	97	0.0050	3.21	2.52	Pipe Channel, PIPE-CD		
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'		
					n= 0.013		
56.8	2,264	0.0017	0.66		Shallow Concentrated Flow, DE		
					Unpaved Kv= 16.1 fps		
60.1	2,638	Total					

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Subcatchment EN: Entrance



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Summary for Subcatchment IFA: Infiltration Chamber A

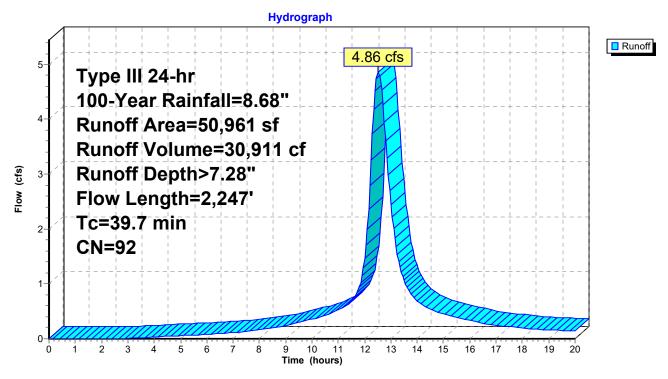
Runoff = 4.86 cfs @ 12.52 hrs, Volume= 30,911 cf, Depth> 7.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 100-Year Rainfall=8.68"

A	rea (sf)	CN E	escription						
	1,355	96 G	96 Gravel surface, HSG D						
	15,558	80 >	75% Gras	s cover, Go	ood, HSG D				
	34,048	98 F	aved park	ing, HSG D					
	50,961	92 V	Veighted A	verage					
	16,913	_	-	vious Area					
	34,048	6	6.81% lmp	pervious Are	ea				
т.	ما در می در ا	Clana	\/alaaitu	Canacity	Description				
Tc (min)	Length	Slope	Velocity (ft/sec)	Capacity	Description				
<u>(min)</u> 0.9	(feet) 50	(ft/ft) 0.0100	0.93	(cfs)	Chast Flour AD				
0.9	50	0.0100	0.93		Sheet Flow, AB Smooth surfaces n= 0.011 P2= 3.35"				
1.1	133	0.0100	2.03		Shallow Concentrated Flow, BC				
1	100	0.0100	2.00		Paved Kv= 20.3 fps				
2.9	558	0.0050	3.21	2.52	•				
				_	12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'				
					n= 0.013				
0.2	73		7.51		Lake or Reservoir, INFILTRATION-DE				
					Mean Depth= 1.75'				
0.3	66	0.0050	4.20	7.43	· · · · · · · · · · · · · · · · · · ·				
					18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'				
040	4 007	0.0047	0.00		n= 0.013				
34.3	1,367	0.0017	0.66		Shallow Concentrated Flow, FG				
	0.047	T-4-1			Unpaved Kv= 16.1 fps				
39.7	2,247	Total							

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Subcatchment IFA: Infiltration Chamber A



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Summary for Subcatchment IFB: Infiltration Chamber B

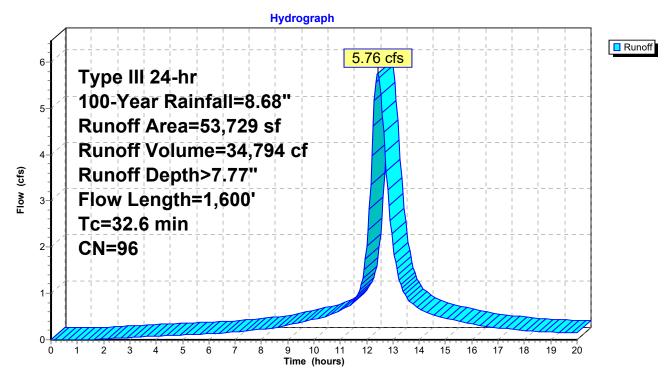
Runoff = 5.76 cfs @ 12.43 hrs, Volume= 34,794 cf, Depth> 7.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 100-Year Rainfall=8.68"

_	Α	rea (sf)	CN I	Description						
		5,622	80 >	>75% Gras	75% Grass cover, Good, HSG D					
_		48,107	98 F	Paved park	aved parking, HSG D					
		53,729		Neighted A						
		5,622			rvious Area					
		48,107	8	39.54% Imp	pervious Are	ea				
	Тс	Length	Slope	Velocity	Capacity	Description				
	(min)	(feet)	(ft/ft)	•	(cfs)	· · · · · · · · · · · · · · · ·				
	0.9	50	0.0100	0.93		Sheet Flow, AB				
						Smooth surfaces n= 0.011 P2= 3.35"				
	1.0	124	0.0100	2.03		Shallow Concentrated Flow, BC				
	4.0	000	0.0050	0.04	0.50	Paved Kv= 20.3 fps				
	1.0	202	0.0050	3.21	2.52					
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'				
	2.1	73		0.57		n= 0.013				
	۷.۱	73		0.57		Lake or Reservoir, INFILTRATION-DE Mean Depth= 0.01'				
	0.3	64	0.0050	4.20	7.43	· ·				
	0.0	0-1	0.0000	7.20	7.40	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'				
						n= 0.013				
	27.3	1,087	0.0017	0.66		Shallow Concentrated Flow, FG				
_		•				Unpaved Kv= 16.1 fps				
_	32.6	1,600	Total							

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Subcatchment IFB: Infiltration Chamber B



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Summary for Subcatchment IFC: Infiltration C

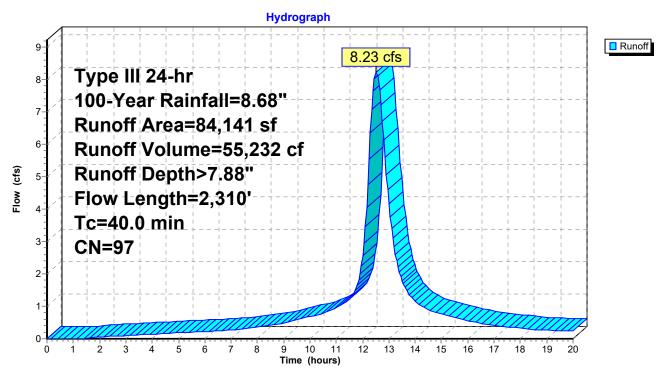
Runoff = 8.23 cfs @ 12.52 hrs, Volume= 55,232 cf, Depth> 7.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 100-Year Rainfall=8.68"

Α	rea (sf)	CN [Description					
	5,963		>75% Grass cover, Good, HSG D					
	78,178	98 F	Paved parking, HSG D					
	84,141	97 \	Neighted A	verage				
	5,963	7	7.09% Perv	ious Area				
	78,178	ę	92.91% lmp	pervious Ar	ea			
т.	1 41.	01	V - 1 24	0	December 1999			
	•	•	,		Description			
				(CIS)				
1.2	50	0.0050	0.70		Sheet Flow, AB			
					Smooth surfaces n= 0.011 P2= 3.35"			
1.9	161	0.0050	1.44		Shallow Concentrated Flow, BC			
4 5	201	0.0075	2.00	2.00	Paved Kv= 20.3 fps			
1.5	364	0.0075	3.93	3.09	1 /			
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'			
0.1	11		7 5 1		n= 0.013			
0.1	44		7.51		Lake or Reservoir, INFILTRATION-DE Mean Depth= 1.75'			
1 2	336	0.0050	4.20	7 /3	Pipe Channel, PIPE-EF			
1.5	330	0.0030	4.20	7.43	18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'			
					n= 0.013			
34.0	1 355	0.0017	0.66		Shallow Concentrated Flow, FG			
04.0	1,000	5.0017	0.00		Unpaved Kv= 16.1 fps			
40.0	2.310	Total			onpared itt ion ipo			
	Tc (min) 1.2 1.9 1.5 0.1 1.3	78,178 84,141 5,963 78,178 Tc Length (min) (feet) 1.2 50 1.9 161 1.5 364 0.1 44 1.3 336 34.0 1,355	5,963 80 78,178 98 F 84,141 97 15,963 78,178 98 Tc Length Slope (min) (feet) (ft/ft) 1.2 50 0.0050 1.9 161 0.0050 1.5 364 0.0075 0.1 44 1.3 336 0.0050 34.0 1,355 0.0017	5,963 80 >75% Gras 78,178 98 Paved park 84,141 97 Weighted A 5,963 7.09% Perv 78,178 92.91% Imp Tc Length (ft/ft) Velocity (ft/sec) 1.2 50 0.0050 0.70 1.9 161 0.0050 1.44 1.5 364 0.0075 3.93 0.1 44 7.51 1.3 336 0.0050 4.20 34.0 1,355 0.0017 0.66	5,963 80 >75% Grass cover, Go 78,178 98 Paved parking, HSG D 84,141 97 Weighted Average 5,963 7.09% Pervious Area 78,178 92.91% Impervious Area 92.91% Impervious Area (min) (feet) (ft/ft) (ft/sec) (cfs) 1.2 50 0.0050 0.70 1.9 161 0.0050 1.44 1.5 364 0.0075 3.93 3.09 0.1 44 7.51 1.3 336 0.0050 4.20 7.43 34.0 1,355 0.0017 0.66			

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Subcatchment IFC: Infiltration C



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Summary for Subcatchment IFD: Infiltration Chamber D

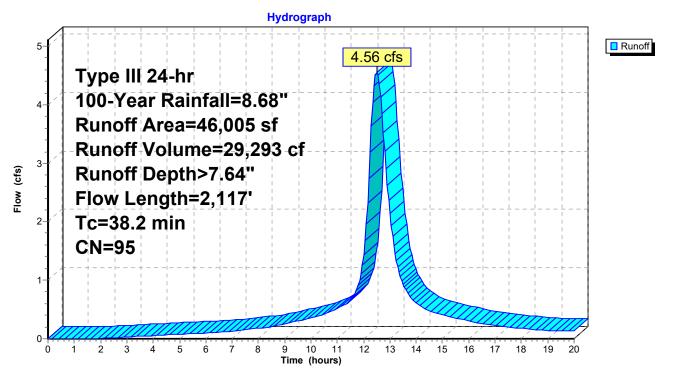
Runoff = 4.56 cfs @ 12.50 hrs, Volume= 29,293 cf, Depth> 7.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 100-Year Rainfall=8.68"

_	Α	rea (sf)	CN	Description		
		7,238	80	>75% Grass cover, Good, HSG D		
_		38,767	98	Paved park	ing, HSG D	
		46,005		Weighted A		
		7,238			rvious Area	
		38,767		84.27% lmp	pervious Are	ea
	Тс	Length	Slope	Velocity	Capacity	Description
	(min)	(feet)	(ft/ft)	•	(cfs)	1
	1.2	50	0.0050	0.70		Sheet Flow, AB
						Smooth surfaces n= 0.011 P2= 3.35"
	1.5	133	0.0050	1.44		Shallow Concentrated Flow, BC
		50. 4		0.00	0.00	Paved Kv= 20.3 fps
	2.3	531	0.0075	3.93	3.09	
						12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
	0.1	35		7.51		n= 0.013 Lake or Reservoir, INFILTRATION-DE
	0.1	33		7.51		Mean Depth= 1.75'
	0.2	56	0.0050	4.20	7.43	· ·
	0.2		0.0000	0		18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
						n= 0.013
	32.9	1,312	0.0017	0.66		Shallow Concentrated Flow, FG
_						Unpaved Kv= 16.1 fps
	38.2	2,117	Total			

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Subcatchment IFD: Infiltration Chamber D



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Summary for Reach 1R: Total Offsite

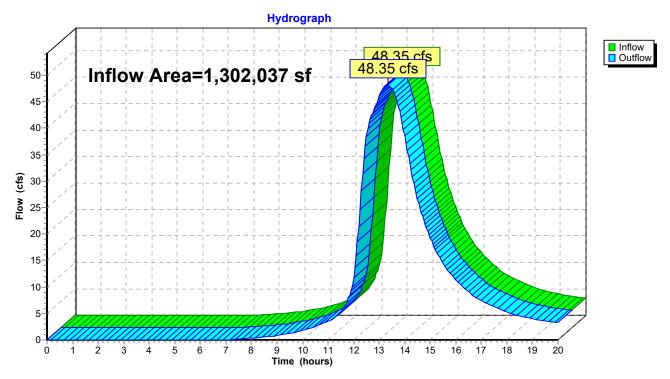
Inflow Area = 1,302,037 sf, 15.93% Impervious, Inflow Depth > 5.17" for 100-Year event

Inflow = 48.35 cfs @ 13.34 hrs, Volume= 561,415 cf

Outflow = 48.35 cfs @ 13.34 hrs, Volume= 561,415 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Reach 1R: Total Offsite



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Summary for Pond IC-A: Infiltration Chambers A

Inflow Area =	50,961 sf, 66.81% Impervious,	Inflow Depth > 7.28" for 100-Year event
Inflow =	4.86 cfs @ 12.52 hrs, Volume=	30,911 cf
Outflow =	4.85 cfs @ 12.53 hrs, Volume=	29,415 cf, Atten= 0%, Lag= 0.5 min
Discarded =	0.19 cfs @ 8.50 hrs, Volume=	9,442 cf
Primary =	4.66 cfs @ 12.53 hrs, Volume=	19,973 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.53' @ 12.53 hrs Surf.Area= 988 sf Storage= 1,994 cf

Plug-Flow detention time= 30.3 min calculated for 29,415 cf (95% of inflow) Center-of-Mass det. time= 12.2 min (778.5 - 766.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.55'	856 cf	25.67'W x 38.50'L x 3.54'H Field A
			3,500 cf Overall - 1,360 cf Embedded = 2,140 cf x 40.0% Voids
#2A	139.05'	1,360 cf	Cultec R-330XLHD x 25 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
-			

2,216 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.30'	18.0" Round Culvert
	·		L= 44.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.30' / 136.08' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.15'	18.0" Round Culvert
			L= 19.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.05' / 139.15' S= -0.0053 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Discarded	138.55'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.19 cfs @ 8.50 hrs HW=138.59' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=4.65 cfs @ 12.53 hrs HW=141.53' (Free Discharge)

1=Culvert (Passes 4.65 cfs of 18.01 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 4.65 cfs @ 2.20 fps)

3=Culvert (Passes 4.65 cfs of 6.19 cfs potential flow)

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Pond IC-A: Infiltration Chambers A - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

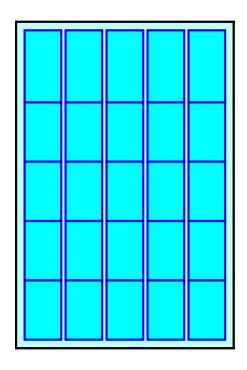
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

25 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,359.8 cf Chamber Storage

3,499.8 cf Field - 1,359.8 cf Chambers = 2,139.9 cf Stone x 40.0% Voids = 856.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,215.8 cf = 0.051 af Overall Storage Efficiency = 63.3% Overall System Size = 38.50' x 25.67' x 3.54'

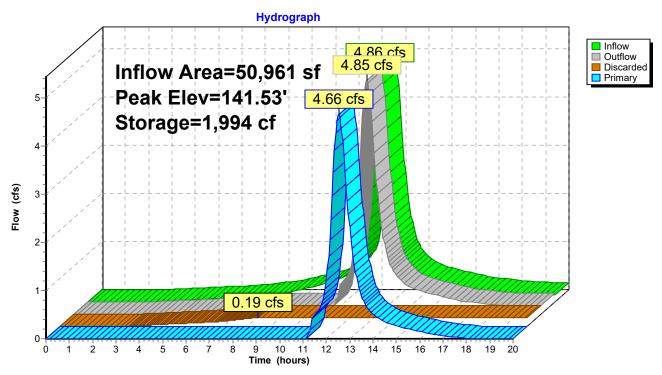
25 Chambers 129.6 cy Field 79.3 cy Stone





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Pond IC-A: Infiltration Chambers A



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Summary for Pond IC-B: Infiltration Chambers B

Inflow Area =	53,729 sf, 89.54% Impervious,	Inflow Depth > 7.77" for 100-Year event
Inflow =	5.76 cfs @ 12.43 hrs, Volume=	34,794 cf
Outflow =	5.76 cfs @ 12.44 hrs, Volume=	33,285 cf, Atten= 0%, Lag= 0.7 min
Discarded =	0.27 cfs @ 8.60 hrs, Volume=	13,786 cf
Primary =	5.49 cfs @ 12.44 hrs, Volume=	19,499 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 140.48' @ 12.44 hrs Surf.Area= 1,388 sf Storage= 2,824 cf

Plug-Flow detention time= 36.1 min calculated for 33,285 cf (96% of inflow) Center-of-Mass det. time= 18.9 min (764.1 - 745.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	137.50'	1,188 cf	30.50'W x 45.50'L x 3.54'H Field A
			4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	138.00'	1,945 cf	Cultec R-330XLHD x 36 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
•		0.400 [T () A ())) O

3,133 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	137.18'	18.0" Round Culvert
	•		L= 55.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 137.18' / 136.90' S= 0.0051 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	139.90'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	138.02'	24.0" Round Culvert
			L= 5.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 138.00' / 138.02' S= -0.0040 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	137.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.27 cfs @ 8.60 hrs HW=137.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=5.47 cfs @ 12.44 hrs HW=140.48' (Free Discharge)
1=Culvert (Passes 5.47 cfs of 12.93 cfs potential flow)
2=Broad-Crested Rectangular Weir (Weir Controls 5.47 cfs @ 2.34 fps)

3=Culvert (Passes 5.47 cfs of 11.56 cfs potential flow)

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Pond IC-B: Infiltration Chambers B - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length

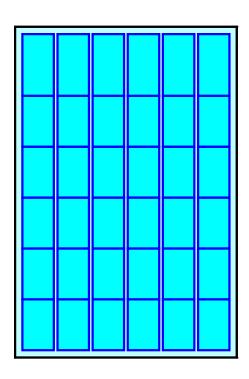
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af Overall Storage Efficiency = 63.7% Overall System Size = 45.50' x 30.50' x 3.54'

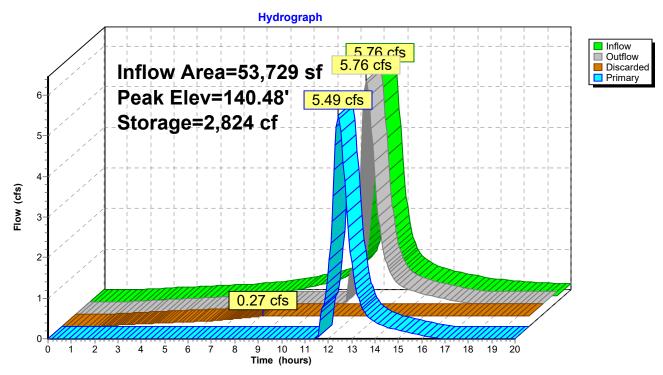
36 Chambers 182.0 cy Field 110.0 cy Stone





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Pond IC-B: Infiltration Chambers B



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Summary for Pond IC-C: Infiltration Chambers C

Inflow Area =	84,141 sf, 92.91% Impervious,	Inflow Depth > 7.88" for 100-Year event
Inflow =	8.23 cfs @ 12.52 hrs, Volume=	55,232 cf
Outflow =	8.21 cfs @ 12.54 hrs, Volume=	53,273 cf, Atten= 0%, Lag= 1.1 min
Discarded =	0.50 cfs @ 9.10 hrs, Volume=	25,218 cf
Primary =	7.71 cfs @ 12.54 hrs, Volume=	28,055 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 142.06' @ 12.54 hrs Surf.Area= 2,597 sf Storage= 5,314 cf

Plug-Flow detention time= 38.4 min calculated for 53,273 cf (96% of inflow) Center-of-Mass det. time= 24.0 min (770.4 - 746.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	2,187 cf	35.33'W x 73.50'L x 3.54'H Field A
			9,198 cf Overall - 3,729 cf Embedded = 5,468 cf x 40.0% Voids
#2A	139.60'	3,729 cf	Cultec R-330XLHD x 70 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
•			

5,917 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.70'	18.0" Round Culvert L= 110.0' Ke= 0.500
	-		Inlet / Outlet Invert= 136.70' / 136.15' S= 0.0050 '/' Cc= 0.900
			n= 0.013, Flow Area= 1.77 sf
#2	Device 1	141.35'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	140.25'	24.0" Round Culvert
			L= 215.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.60' / 140.25' S= -0.0030 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.50 cfs @ 9.10 hrs HW=139.14' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=7.69 cfs @ 12.54 hrs HW=142.06' (Free Discharge)
1=Culvert (Passes 7.69 cfs of 15.90 cfs potential flow)

2=Broad-Crested Rectangular Weir (Weir Controls 7.69 cfs @ 2.70 fps)
3=Culvert (Passes 7.69 cfs of 9.97 cfs potential flow)

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Pond IC-C: Infiltration Chambers C - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

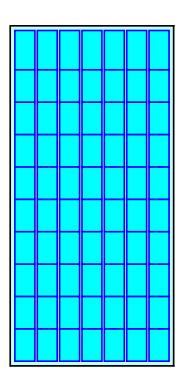
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

70 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 3,729.2 cf Chamber Storage

9,197.7 cf Field - 3,729.2 cf Chambers = 5,468.5 cf Stone x 40.0% Voids = 2,187.4 cf Stone Storage

Chamber Storage + Stone Storage = 5,916.6 cf = 0.136 af Overall Storage Efficiency = 64.3% Overall System Size = 73.50' x 35.33' x 3.54'

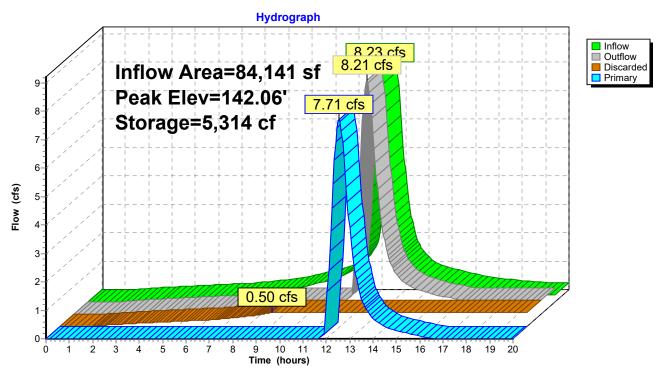
70 Chambers 340.7 cy Field 202.5 cy Stone





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Pond IC-C: Infiltration Chambers C



Prepared by Microsoft HydroCAD® 10.00-20 s/n 01046 © 2017 HydroCAD Software Solutions LLC

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Summary for Pond IC-D: Infiltration Chambers D

Inflow Area =	46,005 sf, 84.27% Impervious,	Inflow Depth > 7.64" for 100-Year event
Inflow =	4.56 cfs @ 12.50 hrs, Volume=	29,293 cf
Outflow =	4.56 cfs @ 12.51 hrs, Volume=	27,896 cf, Atten= 0%, Lag= 0.6 min
Discarded =	0.22 cfs @ 8.80 hrs, Volume=	11,369 cf
Primary =	4.33 cfs @ 12.51 hrs, Volume=	16,527 cf

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Peak Elev= 141.51' @ 12.51 hrs Surf.Area= 1,174 sf Storage= 2,391 cf

Plug-Flow detention time= 36.6 min calculated for 27,896 cf (95% of inflow) Center-of-Mass det. time= 18.2 min (772.3 - 754.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.50'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A
			4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	139.00'	1,632 cf	Cultec R-330XLHD x 30 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.040 (T () A ())) O

2,643 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.55'	18.0" Round Culvert
	·		L= 29.0' CMP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.55' / 136.26' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	ice 1 141.00' 4.0' long x 0.5' breadth Broad-Crested Rectangular Weir	
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.01'	24.0" Round Culvert
			L= 3.5' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.00' / 139.01' S= -0.0029 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	138.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.22 cfs @ 8.80 hrs HW=138.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=4.32 cfs @ 12.51 hrs HW=141.51' (Free Discharge)
1=Culvert (Passes 4.32 cfs of 17.45 cfs potential flow)
2=Broad-Crested Rectangular Weir (Weir Controls 4.32 cfs @ 2.14 fps)
3=Culvert (Passes 4.32 cfs of 10.76 cfs potential flow)

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Pond IC-D: Infiltration Chambers D - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

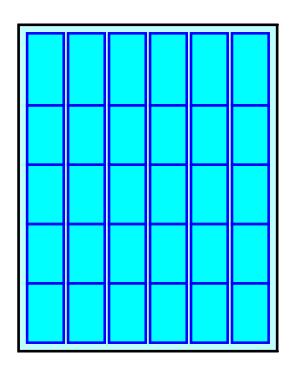
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,631.8 cf Chamber Storage

4,158.8 cf Field - 1,631.8 cf Chambers = 2,527.0 cf Stone x 40.0% Voids = 1,010.8 cf Stone Storage

Chamber Storage + Stone Storage = 2,642.6 cf = 0.061 af Overall Storage Efficiency = 63.5% Overall System Size = 38.50' x 30.50' x 3.54'

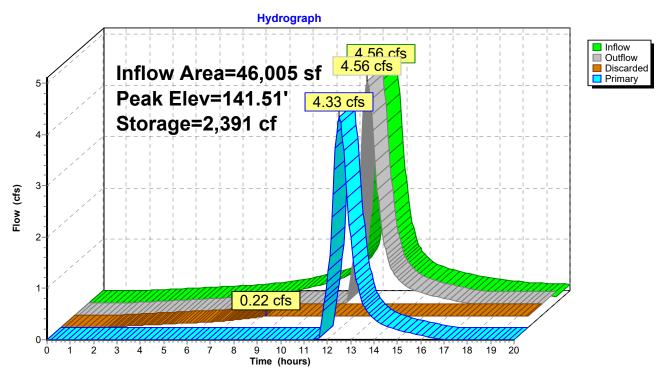
30 Chambers 154.0 cy Field 93.6 cy Stone





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Pond IC-D: Infiltration Chambers D



APPENDIX C

STORMWATER MANAGEMENT STANDARD 2 – PEAK RATE OF RUNOFF

TOTAL VOLUME OF RUNOFF

STORMWATER MANAGEMENT STANDARD 3 – RECHARGE VOLUME DRAWDOWN FOR RECHARGE STRUCTURES

STORMWATER MANAGEMENT STANDARD 4 – WATER QUALITY VOLUME

DE MINIMUS CALCULATIONS

CLOSED DRAINAGE SYSTEM/PIPE SIZING CALCULATIONS
SYMPLE DYNAMIC SIZING

VERNAL POOL CONTRIBUTING VOLUME CALCULATIONS



Project Number: 3395.0 Date: February 14, 2022

Project Name: Shinglemill Calculations by: MVK

Project Address: 0 Pond Street Calculations date: February 14, 2022

Client: Shinglemill, LLC Checked by: DJD

Location: Rockland, Massachusetts Checked Date: February 14, 2022

STORMWATER MANAGEMENT STANDARD 2 - PEAK RATE OF RUNOFF

OFFSITE TO WETLAND

DESIGN STORM (YEAR)	EXISTING PEAK RUNOFF (CFS)	PROPOSEDPEAK RUNOFF (CFS)	REDUCTION IN PEAK RUNOFF
2	11.54	10.36	10.2%
10	23.38	21.07	9.9%
25	33.24	29.95	9.9%
100	53.78	48.35	10.1%

NOTE: PEAK RATES AND VOLUMES SHOWN WERE TAKEN FROM THE EXISTING AND PROPOSED HYDROCAD ANALYSES.



Project Name: Shinglemill Calculations by: MVK

Project Address: 0 Pond Street Calculations date: February 14, 2022

Client: Shinglemill, LLC Checked by: DJD

Location: Rockland, Massachusetts Checked Date: February 14, 2022

VOLUME OF RUNOFF

OFFSITE TO WETLAND

DESIGN STORM (YEAR)	EXISTING PEAK RUNOFF (CFS)	PROPOSEDPEAK RUNOFF (CFS)	REDUCTION IN PEAK RUNOFF
2	125,297	115,239	8.0%
10	249,551	236,270	5.3%
25	355,250	339,745	4.4%
100	580,544	561,415	3.3%

NOTE: PEAK RATES AND VOLUMES SHOWN WERE TAKEN FROM THE EXISTING AND PROPOSED HYDROCAD ANALYSES.



Project Name: Shinglemill Calculations by: MVK

Project Address: 0 Pond Street **Calculations date:** February 14, 2022

Client: Shinglemill, LLC Checked by: DJD

Location: Rockland, Massachusetts Checked Date: February 14, 2022

STORMWATER MANAGEMENT STANDARD 3 - RECHARGE VOLUME

]	HYDROLOGIO	C SOIL GROU	P	TOTAL
	A	В	С	D	TOTAL
IMPERVIOUS AREA (S.F.)	4,463	374	0	202,597	207,434
INCHES OF RUNOFF TO BE RECHARGED	0.60	0.35	0.25	0.10	
REQUIRED RECHARGE VOLUME (FT³)	223	11	0	1,688	1,922

CAPTURE AREA ADJUSTMENT - ADJUSTED MINIMUM REQUIRED RECHARGE VOLUME

MINIMUM OF 65% OF IMPERVIOUS AREA MUST BE DIRECTED TO THE RECHARGE BMP; 65 % IS =	134,832	SF	
IMPERVIOUS SITE AREA DRAINING TO BMP =	199,100	SF	96.0% PERCENTAGE OF IMPERVIOUS AREA DIVERTED TO INFILTRATION FACILITY
RATIO OF TOTAL IMPERVIOUS AREA TO IMPERVIOUS AREA DRAINING TO RECHARGE BMP =	1.04		=
ADJUSTED REQUIRED RECHARGE VOLUME=	2,003	CF	= RATIO OF IMPERVIOUS AREA x REQUIRED RECHARGE VOLUME
PROPOSED RECHARGE VOLUME	10,361	CF	TOTAL AVAILABLE STATIC RECHARGE VOLUME



Project Name: Shinglemill Calculations by: MVK

Project Address: 0 Pond Street Calculations date: February 14, 2022

Client: Shinglemill, LLC Checked by: DJD

Location: Rockland, Massachusetts Checked Date: February 14, 2022

DRAWDOWN FOR RECHARGE STRUCTURES

Infiltration Chamber A

A = AREA OF PROPOSED LEACHING STRUCTURE	988	SQ. FT.
$Rv = STORAGE \ VOLUME =$	1,707	CU. FT.
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = VALUE IS BASED ON A HYDRAULIC SOIL GROUP	8.27	INCHES/HOUR
T = ALLOWABLE DRAWDOWN DURING PEAK (USE 2 HRS) =	72	HRS
	URS TO EMPTY THE HOURS, SO DRAWD	
Infiltration Chamber I	<u>3</u>	
A = AREA OF PROPOSED LEACHING STRUCTURE	1,388	SQ. FT.
Rv = STORAGE VOLUME =	2,369	CU. FT.

K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) =

VALUE IS BASED ON A HYDRAULIC SOIL GROUP

8.27 INCHES/HOUR

VALUE IS BASED ON A HYDRAULIC SOIL GROUP

8.27
INCHES/HOC

T = ALLOWABLE DRAWDOWN DURING PEAK (USE 2 HRS) = 72 HRS

DRAWDOWN TIME $T = Rv = K \times A$ = 2.5 HOURS TO EMPTY THE RECHARGE BMP <72 HOURS, SO DRAWDOWN IS OK

Infiltration Chamber C

	A = AREA OF PROPOSED LEACHING STRUCTURE	2,597	SQ. FT.
	Rv = STORAGE VOLUME =	4,210	CU. FT.
K= SATU	JRATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = VALUE IS BASED ON A HYDRAULIC SOIL GROUP	8.27	INCHES/HOUR
T = A	ALLOWABLE DRAWDOWN DURING PEAK (USE 2 HRS) =	72	HRS

DRAWDOWN TIME $T = Rv = K \times A$ = 2.4 HOURS TO EMPTY THE RECHARGE BMP <72 HOURS, SO DRAWDOWN IS OK

Infiltration Chamber D

A = AREA OF PROPOSED LEACHING STRUCTURE	1,174	SQ. FT.
$Rv = STORAGE \ VOLUME =$	2,075	CU. FT.
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = VALUE IS BASED ON A HYDRAULIC SOIL GROUP	8.27	INCHES/HOUR
T = ALLOWABLE DRAWDOWN DURING PEAK (USE 2 HRS) =	72	HRS

DRAWDOWN TIME T= Rv = 2.6 HOURS TO EMPTY THE RECHARGE BMP <72 HOURS, SO DRAWDOWN IS OK



Project Name: Shinglemill Calculations by: MVK

Project Address: 0 Pond Street **Calculations date:** February 14, 2022

Client: Shinglemill, LLC Checked by: DJD

Location: Rockland, Massachusetts Checked Date: February 14, 2022

STORMWATER MANAGEMENT STANDARD 4 - WATER QUALITY VOLUME

SUBCATCHMENT	DEPTH TO TREAT (IN.)	IMPERVIOUS AREA (SF)	WATER VOLUME (CF)
Offsite at Entrance	1	7,456	621
Infiltration Chambers A (IC-A)	1	34,048	2,837
Infiltration Chamber B (IC-B)	1	48,107	4,009
Infiltration Chambers C(IC-C)	1	78,178	6,515
Infiltration Chambers D (IC-D)	1	38,767	3,231
Direct to Wetland	1	878	73
NET WATER QUALITY VOLUME			17,286

Note: The Simple Dynamic Sizing HydroCAD calculations following this page were performed to ensure each BMP can treat the required volume per these calculations. Additional volume was included in IC-C to compensate for the WQV of the Offsite at Entrance & Direct to Wetland subcatchments.



Project Name: Shinglemill Calculations by: MVK

Project Address: 0 Pond Street Calculations date: February 14, 2022

Client: Shinglemill, LLC Checked by: DJD

Location: Rockland, Massachusetts Checked Date: February 14, 2022

STORMWATER MANAGEMENT STANDARD 4 - DE MINIMUS CALCULATIONS

WEIGHTED AVERAGE TSS REMOVAL

SUBCATCHMENT	TSS REMOVAL RATE	IMPERVIOUS AREA (SF)	PRODUCT
Offsite at Entrance	0%	7,456	0
Infiltration Chambers A (IC-A)	85%	34,048	28,941
Infiltration Chamber B (IC-B)	85%	48,107	40,891
Infiltration Chambers C(IC-C)	80%	78,178	62,542
Infiltration Chambers D (IC-D)	97%	38,767	37,604
Direct to Wetland	0%	878	0
	Totals	207,434	169,978
WEIGHTED AVERAGE TSS REMOVAL RATE			81.9%

FLOW RATE CHECK (OFFSITE SOUTHEAST)

Rational Method(CFS) Q=CIA

STEEL Formula for Rainfall Intensity (Inch/hour) I=K/(Tc+b)

STEEL Design Storm 2 year

STEEL Region 3

Time of Concentration (Tc)	6.00
STEEL Constant (K)	106
STEEL Constant (b)	17.0
Steel Rainfall Intensity iph	4.61
Steel Rainfall Intensity fps (I)	0.000107
Impervious Area s.f.(A)	8,334
Runoff Coefficient (C)	0.95
FLOW RATE C.F.S. (Q)	0.84



Project Number: 3395.1 Client: Shinglemill, LLC Project Name: Shinglemill Apartments Project Address: 0 Pond Street Location: Rockland, MA

								ENTF	RAN	CE [DRA	NAGE SY	STEM :	25 YE	AR	STOR	M									
			WATERS	SHED CHA	RACTER	RISTICS										PIPE CHA	ARACTERI	STICS					FL	OW CHARA	CTERISTIC	s
	LOCATION			L	AND USE	=	FLC	OW TIME		FL	ow					R = hyd	draulic rad	ius = area/v	vetted perin	neter						Тс
Description	Cover	Increm.	Total_A	С	CA 1	Total CA	To Inlet	In Pipe	Tc	I	Q	Structure	Invert	Pipe	Size	Length	Area	R	Slope	n	Qf	Vf	Q/Qf	V/Vf	V	L/V
		(ACRE)	(ACRE)				(MIN)	(MIN)	(MIN)	(IPH)	(CFS)				(IN)	(FT)	(SF)	(FT)			(CFS)	(FT/S)			(FT/S)	(MIN)
WS CB-S1	LANDSCAPED	0.007 0.089		0.400								From: CB-S1	Out:	LIDDE	40	40	0.70	0.050	0.005	0.040	0.50	2.04	0.00	0.05	0.40	0.4
	IMPERVIOUS	0.069	0.096	0.850 0.817	0.078		6.00	NONE	6.00	6.39	0.50	To: STC-S1	In:	HDPE	12	13	0.79	0.250	0.005	0.013	2.52	3.21	0.20	0.65	2.10	0.1
WS CB-S2	LANDSCAPED IMPERVIOUS	0.008 0.079		0.400 0.850								From: CB-S2	Out:	HDPE	12	44	0.79	0.250	0.005	0.013	2.52	3.21	0.18	0.64	2.04	0.3
			0.087	0.809	0.071		6.00	NONE	6.00	6.39	0.45	To: STC-S1	In:													
STC-S1	TO FES-S1					0.149	6.00	0.36	6.36	6.33	0.94	From: STC-S1	Out:	HDPE	12	27	0.79	0.250	0.005	0.013	2.52	3.21	0.37	0.79	2.52	0.1
												To: FES-S1	In:	HUPE	12	21	0.79	0.250	0.005	0.013	2.52	3.21	0.37	0.79	2.52	0.1



							1 (O INFILT	IRA	HOI	N CI	HAN	IBER S	SYSIEN	/I A 2	5 YE	AR ST	ORM									
			WATERS	HED CHA	RACTE	RISTICS											PIPE CHA	RACTERIS	TICS					FLC	W CHARA	CTERISTICS	s
	LOCATION			L.	AND US	E	FLO	OW TIME		FLO	ow						R = hyd	raulic radi	us = area/w	etted perim	eter						Тс
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	С	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)		Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-A1	LANDSCAPED IMPERVIOUS	0.013 0.073		0.400 0.850									CB-A1	Out:	HDPE	12	29	0.79	0.250	0.005	0.013	2.52	3.21	0.17	0.63	2.01	0.24
WS CB-A2	LANDSCAPED	0.008	0.085	0.784	0.067		6.00	NONE	6.00	6.39			DMH-A1 CB-A2	In: Out:													
WS CB-AZ	IMPERVIOUS	0.008	0.058	0.400 0.850 0.791	0.046		6.00	NONE	6.00	6.39	0.29		DMH-A1	In:	HDPE	12	27	0.79	0.250	0.005	0.013	2.52	3.21	0.12	0.56	1.80	0.25
DMH-A1	TO DMH-A2					0.113	6.00	0.25	6.25	6.34	0.72	From:	DMH-A1	Out:	UDDE	40	070	0.70	0.050	0.005	0.040	0.50	2.04	0.00	0.70	0.00	4.00
												То:	DMH-A2	In:	HDPE	12	278	0.79	0.250	0.005	0.013	2.52	3.21	0.28	0.73	2.33	1.99
WS CB-A3	LANDSCAPED IMPERVIOUS	0.032 0.133	0.165	0.400 0.850 0.762	0.126		6.00	NONE	6.00	6.39			CB-A3 DMH-A2	Out: In:	HDPE	12	13	0.79	0.250	0.005	0.013	2.52	3.21	0.32	0.75	2.41	0.09
WS CB-A4	LANDSCAPED IMPERVIOUS	0.022 0.103		0.400 0.850									CB-A4	Out:	HDPE	12	13	0.79	0.250	0.005	0.013	2.52	3.21	0.24	0.70	2.23	0.10
DMH-A2	TO DMH-A3		0.125	0.771	0.096	0.335	6.00 6.25	NONE 1.99			2.02		DMH-A2	In: Out:													
												То:	DMH-A3	In:	HDPE	12	104	0.79	0.250	0.005	0.013	2.52	3.21	0.80	0.98	3.15	0.55
DMH-A3	TO DMH-A4					0.335	8.24	0.55	8.79	5.93	1.99	From:	DMH-A3	Out:	HDPE	12	86	0.79	0.25	0.005	0.013	2.52	3.21	0.79	0.98	3.14	0.46
												To:	DMH-A4	In:		12		0.79	0.23	0.003	0.013	2.52	J.21	0.19	0.90		
WS CB-A5	LANDSCAPED IMPERVIOUS	0.125 0.080	0.205	0.400 0.850 0.575	0 118		6.00	NONE	6.00	6 39	0.75		CB-A5 DMH-B3	Out: In:	HDPE	12	17	0.79	0.250	0.010	0.013	3.56	4.54	0.21	0.67	3.03	0.09
DMH-A4	TO DMH-A5		0.200	0.070	0.110	0.453	8.79	0.46					DMH-A4	Out:													
												То:	DMH-A5	ln:	HDPE	15	118	1.23	0.3125	0.005	0.013	4.57	3.72	0.58	0.89	3.33	0.59
DMH-A5	TO DMH-A6					0.453	9.24	0.59	9.83	5.77	2.62		DMH-A5	Out:	HDPE	15	170	1.23	0.3125	0.005	0.013	4.57	3.72	0.57	0.89	3.32	0.85
												То:	DMH-A6	In:													
DMH-A6	TO DMH-A7					0.453	9.83	0.85	10.69	5.65	2.56		DMH-A6	Out:	HDPE	15	46	1.23	0.3125	0.005	0.013	4.57	3.72	0.56	0.89	3.29	0.23
												То:	DMH-A7	In:													



WS CB-A6	LANDSCAPED IMPERVIOUS	0.092 0.167	0.259	0.400 0.850 0.690	0.179		6.00	NONE	6.00	6.39	1.14 To		Out: In:	HDPE	12	41	0.79	0.250	0.020	0.013	5.04	6.42	0.23	0.68	4.37	0.16
DMH-A7	TO ICS-A					0.632	10.69	0.23	10.92	5.62	3.55 Fro	om: DMH-A7 : ICS-A	Out: In:	HDPE	12	2	0.79	0.25	0.01	0.013	3.56	4.54	1.00	1.05	4.75	0.01
WS CB-A7	LANDSCAPED IMPERVIOUS	0.099 0.176	0.275	0.400 0.850 0.687	0.189		6.00	NONE	6.00	6.39	1.21 To	om: CB-A7 : DMH-B3	Out: In:	HDPE	12	56	0.79	0.250	0.010	0.013	3.56	4.54	0.34	0.77	3.47	0.27



							TC) INFILT	RA	TION	CHA	AMBER S	YSTEM	1 B - 2	25 Y	EAR S	TORM									
		1	WATERS	HED CHA	RACTE	RISTICS										PIPE CHA	ARACTERIS	STICS					FLO	OW CHARA	CTERISTIC	s
	LOCATION				AND US			OW TIME		FLC						R = hyd	draulic radi	us = area/v	etted perim	eter						Тс
Description	Cover	Increm. To	otal_A ACRE)	С	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	(IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS CB-B1	LANDSCAPED IMPERVIOUS	0.035 0.222	0.257	0.400 0.850 0.789	0.203		6.00	NONE	6.00	0 6.39		rom: CB-B1	Out:	HDPE	12	25	0.79	0.250	0.010	0.013	3.56	4.54	0.36	0.78	3.54	0.12
WS CB-B2	LANDSCAPED IMPERVIOUS	0.021 0.205	0.201	0.400 0.850	0.200		0.00	HONE	0.00	0.00		rom: CB-B2	Out:	HDPE	12	26	0.79	0.250	0.010	0.013	3.56	4.54	0.33	0.76	3.44	0.13
			0.227	0.807	0.183		6.00	NONE			1.17 To		ln:													
DMH-B1	TO DMH-B2					0.386	6.00	0.13	6.13	3 6.37		rom: DMH-B1 o: DMH-B2	Out: In:	HDPE	12	153	0.79	0.250	0.010	0.013	3.56	4.54	0.69	0.94	4.26	0.60
WS CB-B3	LANDSCAPED IMPERVIOUS	0.007 0.111	0.119	0.400 0.850 0.822	0.098		6.00	NONE	6.00	0 6.39		rom: CB-B3	Out:	HDPE	12	23	0.79	0.250	0.010	0.013	3.56	4.54	0.17	0.63	2.86	0.13
WS CB-B4	LANDSCAPED IMPERVIOUS	0.040 0.122	0.161	0.400 0.850	0.119		6.00			0 6.39	F	rom: CB-B4	Out:	HDPE	12	23	0.79	0.250	0.010	0.013	3.56	4.54	0.21	0.67	3.04	0.13
DMH-B3	TO DMH-B2		0.101	0.739	0.119	0.217	6.13	0.60			1.36 Fi	rom: DMH-B3	Out:	HDPE	12	76	0.79	0.250	0.010	0.013	3.56	4.54	0.38	0.79	3.59	0.35
DMH-B2	TO ICS-B					0.603	6.72	0.35	7.08	3 6.20	3.74 F	rom: DMH-B2 D: ICS-B	Out:	HDPE	12	14	0.79	0.25	0.02	0.013	5.04	6.42	0.74	0.96	6.16	0.04
WS CB-B5	LANDSCAPED IMPERVIOUS	0.031 0.291		0.400 0.850			0.00	110115				rom: CB-B5	Out:	HDPE	12	22	0.79	0.250	0.010	0.013	3.56	4.54	0.47	0.84	3.80	0.10
WS CB-B6	LANDSCAPED IMPERVIOUS	0.015 0.183	0.322	0.807 0.400 0.850	0.259		6.00	NONE	6.00	0 6.39		o: DMH-B4 rom: CB-B6	In: Out:	HDPE	12	22	0.79	0.250	0.010	0.013	3.56	4.54	0.29	0.73	3.31	0.11
DMH-B4	TO ICS-B	3.100	0.198	0.815	0.161	0.421	6.00 7.08	NONE			1.03 To	o: DMH-B4	In: Out:				3.10	5.200	2.010	5.010	5.55	-1104	0.20	5.15	3.3 1	0.11
DIVIN-64	10 103-0					0.421	7.08	0.11	1.18	0.10		on: DMH-B4	In:	HDPE	12	69	0.79	0.25	0.01	0.013	3.56	4.54	0.73	0.96	4.34	0.27

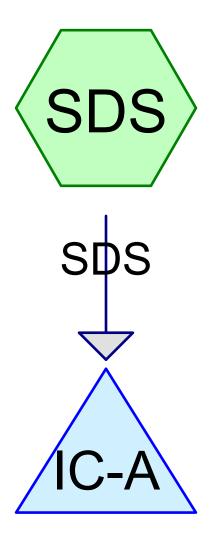


							TC	INFILT	RA1	TION	СН	AMBER S	YSTEM	1 C - 2	25 Y	EAR S	TORM									
			WATERS	HED CH	ARACTE	RISTICS										PIPE CH	ARACTERIS	STICS					FLOW CHARACTERISTICS			
	LOCATION			L	AND US	E	FLO	OW TIME		FLC	W					R = hy	draulic radi	us = area/w	etted perim	eter						Тс
Description	Cover		Total_A (ACRE)	С	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	(IPH)	Q (CFS)	Structure	Invert	Pipe	Size (IN)	Length (FT)	Area (SF)	R (FT)	Slope	n	Qf (CFS)	Vf (FT/S)	Q/Qf	V/Vf	V (FT/S)	L/V (MIN)
WS ROOF DRAIN	LANDSCAPED	0.000		0.400								From: ROOF DRAI	N Out:													
	IMPERVIOUS	0.251	0.251	0.850 0.850	0.214		6.00	NONE	6.00	6.39	1.36	To: DMH-C3	In:	HDPE	12	186	0.79	0.250	0.010	0.013	3.56	4.54	0.38	0.79	3.60	0.86
WS CB-C3	LANDSCAPED IMPERVIOUS	0.030 0.105		0.400 0.850								From: CB-C3	Out:	HDPE	12	22	0.79	0.250	0.010	0.013	3.56	4.54	0.18	0.64	2.89	0.13
			0.135	0.749	0.101		6.00	NONE	6.00	6.39	0.65	To: DMH-C3	ln:													
DMH-C3 TO	D DMH-C4					0.315	6.00	0.86	6.86	6.24	1.96	From: DMH-C3	Out:	HDPE	12	75	0.79	0.250	0.010	0.013	3.56	4.54	0.55	0.88	4.00	0.31
												To: DMH-C4	In:													
WS CB-C4	LANDSCAPED IMPERVIOUS	0.025 0.151		0.400 0.850								From: CB-C4	Out:	HDPE	12	21	0.79	0.250	0.020	0.013	5.04	6.42	0.18	0.63	4.06	0.09
	IIII ERVIGGO	0.101	0.177		0.139		6.00	NONE	6.00	6.39	0.89	To: DMH-C4	In:	1101 2			0.70	0.200	0.020	0.010	0.0-1	0.12	0.10	0.00	1.00	0.00
WS ROOF DRAIN	LANDSCAPED IMPERVIOUS	0.000 0.217		0.400 0.850								From: ROOF DRAI	N Out:	HDPE	8	137	0.35	0.167	0.010	0.013	1.21	3.46	0.97	1.04	3.60	0.63
			0.217	0.850	0.184		6.00	NONE	6.00	6.39	1.18	To: DMH-C4	In:													
DMH-C4 TO	D DMH-C5					0.638	6.86	0.31	7.17	6.19	3.95	From: DMH-C4	Out:	HDPE	15	82	1.23	0.313	0.010	0.013	6.46	5.26	0.61	0.91	4.78	0.29
												To: DMH-C5	ln:	1151 E			1.20	0.010	0.010	0.010	0.10	0.20				0.20
WS DCB-C2	LANDSCAPED IMPERVIOUS	0.060 0.520		0.400 0.850								From: DMH-C5	Out:	HDPE	12	20	0.79	0.250	0.020	0.013	5.04	6.42	0.59	0.90	5.77	0.06
	IIIII ERVIOGO	0.020	0.580	0.803	0.466		6.00	NONE	6.00	6.39	2.98	To: 0.	00 In:	HDI L	12	20	0.70	0.200	0.020	0.010	0.04	0.42	0.00	0.00	0.77	0.00
DMH-C5 TO	D ICS-C					1.104	7.17	0.29	7.46	6.14	6.78	From: ICS-C	Out:	HDPE	18	6	1.77	0.375	0.005	0.013	7.43	4.20	0.91	1.02	4.29	0.02
WS ROOF DRAIN	LANDSCAPED	0.000		0.400								From: ROOF DRAI	N. Out:													
WO ROOF BRAIN	IMPERVIOUS	0.217	0.217	0.850	0.184		6.00	NONE	6.00	6.39			In:	HDPE	8	134	0.35	0.167	0.010	0.013	1.21	3.46	0.97	1.04	3.60	0.62
DMH-C1 TO	D DMH-C2					0.184	6.00	0.62	6.62	6.28	1.16	From: DMH-C1	Out:													
												To: DMH-C2	ln:	HDPE	12	52	0.79	0.250	0.010	0.013	3.56	4.54	0.32	0.76	3.43	0.25
WS DCB-C1	LANDSCAPED	0.020		0.400								From: DCB-C1	Out:													
	IMPERVIOUS	0.334	0.354	0.850 0.825	0.292		6.00	NONE	6.00	6.39	1.87	To: DMH-C2	ln:	HDPE	12	20	0.79	0.250	0.010	0.013	3.56	4.54	0.52	0.87	3.94	0.08
DMH-C2 TO	O ICS-C					0.476	6.62	0.25	6.87	6.24	2.97	From: DMH-C2	Out:													
												To: ICS-C	ln:	HDPE	12	39	0.79	0.250	0.010	0.013	3.56	4.54	0.83	0.99	4.51	0.14



Project Number: 3395.1 Client: Shinglemill, LLC Project Name: Shinglemill Apartments Project Address: 0 Pond Street Location: Rockland, MA

							TO	INFILT	RA	ΓΙΟΝ	1 CH	IAMBER S	YSTEI	M D -	25 Y	EAR S	STORI	Л								
			WATER	SHED CH	ARACTE	ERISTICS										PIPE CH	ARACTER	STICS					FLO	OW CHARA	CTERISTIC	S
	LOCATION				LAND US	SE	FLO	OW TIME		FL	.ow					R = hy	draulic rac	ius = area/	wetted perin	neter						Tc
Description	Cover		Total_A	С	CA	Total CA	To Inlet	In Pipe	Тс		Q	Structure	Invert	Pipe	Size	Length	Area	R	Slope	n	Qf	Vf	Q/Qf	V/Vf	V	L/V
		(ACRE)	(ACRE)				(MIN)	(MIN)	(MIN)) (IPH)	(CFS)				(IN)	(FT)	(SF)	(FT)			(CFS)	(FT/S)			(FT/S)	(MIN)
WS CB-D1	LANDSCAPED IMPERVIOUS	0.137 0.176		0.400 0.850								From: CB-D1	Out:	HDPE	12	16	0.79	0.250	0.010	0.013	3.56	4.54	0.37	0.78	3.55	0.08
	IIVII LITVIOOS	0.170	0.314	0.653			6.00	NONE	6.00	0 6.39	1.31	To: DMH-D1	ln:	IIDI L	12	10	0.79	0.230	0.010	0.013	3.30	4.54	0.57	0.70	3.33	0.00
WS CB-D2	LANDSCAPED	0.029		0.400								From: CB-D2	Out:	LIDDE	40	20	0.70	0.050	0.400	0.040	44.07	44.05	0.00	0.47	0.70	0.05
	IMPERVIOUS	0.115	0.144	0.850 0.758		1	6.00	NONE	6.00	0 6.39	0.70	To: DMH-D1	ln:	HDPE	12	22	0.79	0.250	0.100	0.013	11.27	14.35	0.06	0.47	6.70	0.05
WS ROOF DRA		0.000		0.400								From: ROOF DRA	IN Out:	UDDE	40	540	0.70	0.050	0.040	0.040	2.50	4.54	0.04	4.00	4.00	4.05
	IMPERVIOUS	0.599	0.599	0.850 0.850		1	6.00	NONE	6.00	0 6.39	3.25	To: STC-D1	ln:	HDPE	12	513	0.79	0.250	0.010	0.013	3.56	4.54	0.91	1.02	4.63	1.85
DMH-D1	TO STC-D1					0.823	6.00	1.85	5 7.85	5 6.08	5.00	From: DMH-D1	Out:		40		0.70	0.05		0.040	5.04	0.40	0.00	4.04	0.70	0.04
												To: STC-D1	In:	HDPE	12	6	0.79	0.25	0.020	0.013	5.04	6.42	0.99	1.04	6.70	0.01
STC D4	TO 100 D					0.823	7.05	0.01	1 7.00	6 6 07	, 500	Frame CTC D4	Out:													
STC-D1	TO ICS-D					0.823	7.85	0.01	7.86	6 6.07	5.00	From: STC-D1 To: ICS-D	In:	HDPE	12	6	0.79	0.250	0.020	0.013	5.04	6.42	0.99	1.04	6.70	0.01



Infiltration Chambers A









3395.1 - 0 Pond Street - SDS - (IC-A)

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Area Listing (all nodes)

34,048	98	TOTAL AREA
34,048	98	Unconnected pavement, HSG A (SDS)
(sq-ft)		(subcatchment-numbers)
Area	CN	Description

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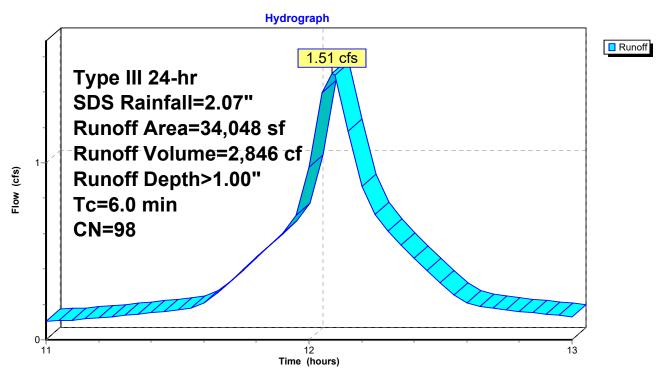
Summary for Subcatchment SDS: SDS

Runoff = 1.51 cfs @ 12.09 hrs, Volume= 2,846 cf, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Type III 24-hr SDS Rainfall=2.07"

A	rea (sf)	CN E	escription									
	34,048	98 L	Unconnected pavement, HSG A									
	34,048	1	00.00% Im	pervious A	rea							
	34,048	1	00.00% Ur	nconnected	l							
Тс	Longth	Slope	Velocity	Capacity	Description							
(min)	Length (feet)	(ft/ft)	(ft/sec)	(cfs)	Description							
6.0	(1001)	(10,10)	(14,000)	(0.0)	Direct Entry,							

Subcatchment SDS: SDS



Page 4

Summary for Pond IC-A: Infiltration Chambers A

Inflow Area = 34,048 sf,100.00% Impervious, Inflow Depth > 1.00" for SDS event
Inflow = 1.51 cfs @ 12.09 hrs, Volume= 2,846 cf
Outflow = 0.19 cfs @ 11.60 hrs, Volume= 1,268 cf, Atten= 87%, Lag= 0.0 min
Discarded = 0.19 cfs @ 11.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Peak Elev= 140.87' @ 12.65 hrs Surf.Area= 988 sf Storage= 1,623 cf

Plug-Flow detention time= 20.0 min calculated for 1,264 cf (44% of inflow) Center-of-Mass det. time= 0.5 min (724.9 - 724.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.55'	856 cf	25.67'W x 38.50'L x 3.54'H Field A
			3,500 cf Overall - 1,360 cf Embedded = 2,140 cf x 40.0% Voids
#2A	139.05'	1,360 cf	Cultec R-330XLHD x 25 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 5 rows
· · · · · · · · · · · · · · · · · · ·	·	0.040 (T () A ())) O

2,216 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.30'	18.0" Round Culvert
	•		L= 44.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.30' / 136.08' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.15'	18.0" Round Culvert
			L= 19.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.05' / 139.15' S= -0.0053 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Discarded	138.55'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.19 cfs @ 11.60 hrs HW=138.59' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 11.00 hrs HW=138.56' (Free Discharge)
1=Culvert (Passes 0.00 cfs of 9.25 cfs potential flow)

-2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
-3=Culvert (Controls 0.00 cfs)

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Pond IC-A: Infiltration Chambers A - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 5 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

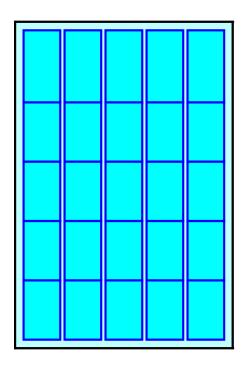
5 Rows x 52.0" Wide + 6.0" Spacing x 4 + 12.0" Side Stone x 2 = 25.67' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

25 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 5 Rows = 1,359.8 cf Chamber Storage

3,499.8 cf Field - 1,359.8 cf Chambers = 2,139.9 cf Stone x 40.0% Voids = 856.0 cf Stone Storage

Chamber Storage + Stone Storage = 2,215.8 cf = 0.051 af Overall Storage Efficiency = 63.3% Overall System Size = 38.50' x 25.67' x 3.54'

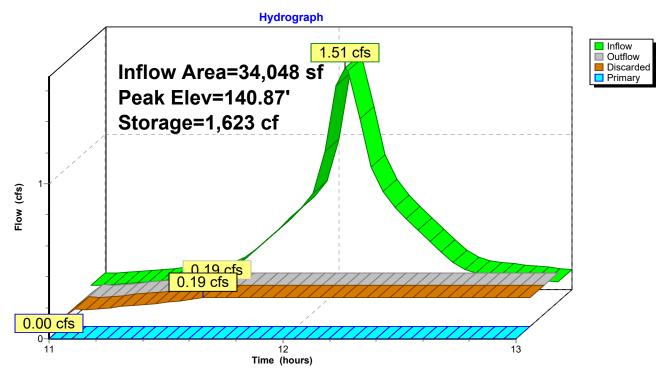
25 Chambers 129.6 cy Field 79.3 cy Stone

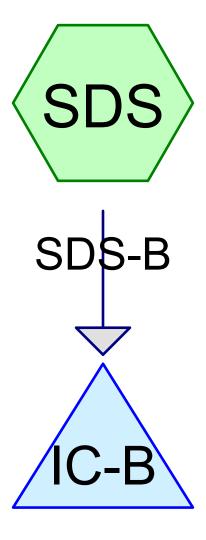




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Pond IC-A: Infiltration Chambers A





Infiltration Chambers B









3395.1 - 0 Pond Street - SDS - (IC-B)

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Area Listing (all nodes)

48,107 48.107	98 98	Unconnected pavement, HSG A (SDS) TOTAL AREA
(sq-ft)		(subcatchment-numbers)
Area	CN	Description

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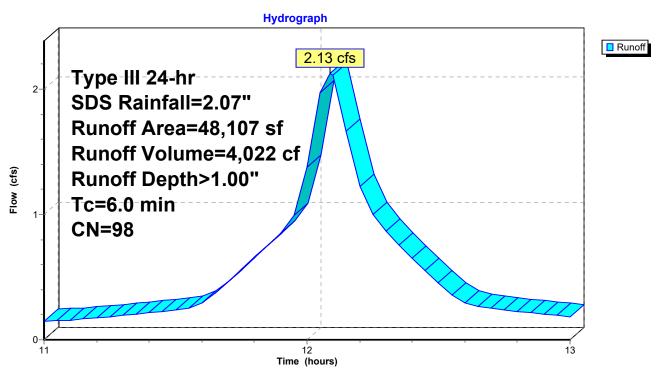
Summary for Subcatchment SDS: SDS-B

Runoff = 2.13 cfs @ 12.09 hrs, Volume= 4,022 cf, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Type III 24-hr SDS Rainfall=2.07"

A	rea (sf)	CN E	escription									
	48,107	98 L	Unconnected pavement, HSG A									
	48,107	1	00.00% Im	pervious A	rea							
	48,107	1	00.00% Ur	nconnected	l							
Тс	Length	Slope	Velocity	Capacity	Description							
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	Description							
6.0					Direct Entry,							

Subcatchment SDS: SDS-B



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Summary for Pond IC-B: Infiltration Chambers B

Inflow Area = 48,107 sf,100.00% Impervious, Inflow Depth > 1.00" for SDS event
Inflow = 2.13 cfs @ 12.09 hrs, Volume= 4,022 cf
Outflow = 0.27 cfs @ 11.60 hrs, Volume= 1,784 cf, Atten= 88%, Lag= 0.0 min
Discarded = 0.00 cfs @ 11.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Peak Elev= 139.83' @ 12.66 hrs Surf.Area= 1,388 sf Storage= 2,299 cf

Plug-Flow detention time= 20.0 min calculated for 1,778 cf (44% of inflow) Center-of-Mass det. time= 0.4 min (724.8 - 724.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	137.50'	1,188 cf	30.50'W x 45.50'L x 3.54'H Field A
			4,915 cf Overall - 1,945 cf Embedded = 2,970 cf x 40.0% Voids
#2A	138.00'	1,945 cf	Cultec R-330XLHD x 36 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
•		0.400 [T () A ())) O

3,133 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	137.18'	18.0" Round Culvert
	•		L= 55.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 137.18' / 136.90' S= 0.0051 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	139.90'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	138.02'	24.0" Round Culvert
			L= 5.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 138.00' / 138.02' S= -0.0040 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	137.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.27 cfs @ 11.60 hrs HW=137.54' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.27 cfs)

Primary OutFlow Max=0.00 cfs @ 11.00 hrs HW=137.51' (Free Discharge)

1=Culvert (Passes 0.00 cfs of 0.42 cfs potential flow)

-2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
-3=Culvert (Controls 0.00 cfs)

Page 5

Pond IC-B: Infiltration Chambers B - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

6 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 43.50' Row Length +12.0" End Stone x 2 = 45.50' Base Length

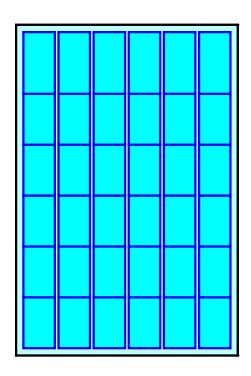
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

36 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,944.7 cf Chamber Storage

4,914.9 cf Field - 1,944.7 cf Chambers = 2,970.2 cf Stone x 40.0% Voids = 1,188.1 cf Stone Storage

Chamber Storage + Stone Storage = 3,132.8 cf = 0.072 af Overall Storage Efficiency = 63.7% Overall System Size = 45.50' x 30.50' x 3.54'

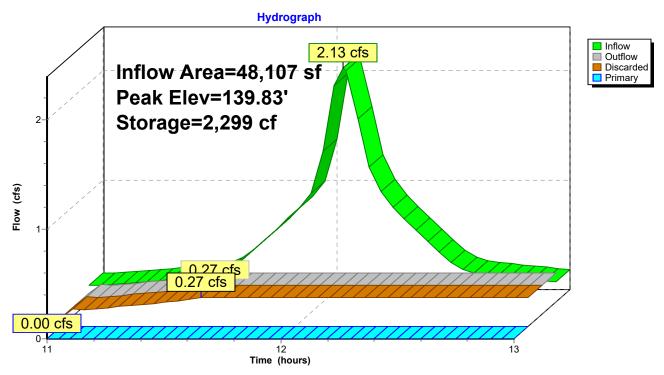
36 Chambers 182.0 cy Field 110.0 cy Stone

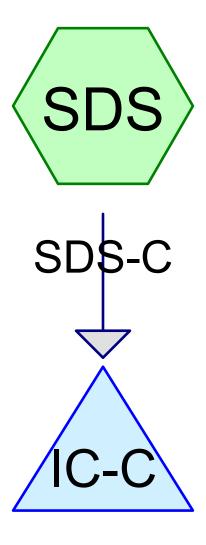




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Pond IC-B: Infiltration Chambers B





Infiltration Chambers C









3395.1 - 0 Pond Street - SDS - (IC-C)

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Area Listing (all nodes)

_			Description
(S	q-ft)		(subcatchment-numbers)
78,	178	98	Unconnected pavement, HSG A (SDS)
78.	178	98	TOTAL AREA

Page 3

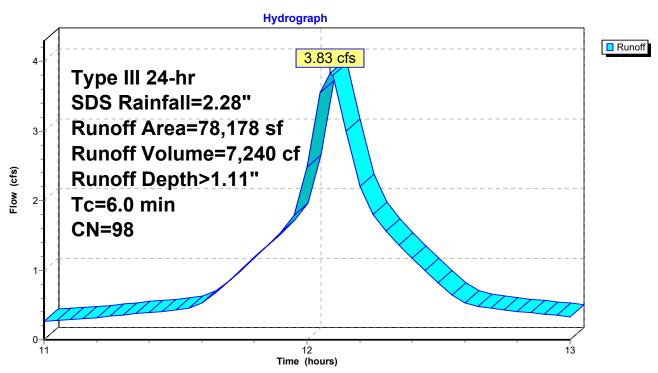
Summary for Subcatchment SDS: SDS-C

Runoff = 3.83 cfs @ 12.09 hrs, Volume= 7,240 cf, Depth> 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Type III 24-hr SDS Rainfall=2.28"

_	Α	rea (sf)	CN I	CN Description					
		78,178	98 l	98 Unconnected pavement, HSG A					
		78,178	8 100.00% Impervious Area						
		78,178	100.00% Unconnected						
	Тс	Longth	Slope	Velocity	Capacity	Description			
	(min)	Length (feet)	(ft/ft)	(ft/sec)	(cfs)	Description			
-	6.0	(,	(12,11)	(14000)	(0.0)	Direct Entry.			

Subcatchment SDS: SDS-C



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Summary for Pond IC-C: Infiltration Chambers C

Routing by Stor-Ind method, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Peak Elev= 141.27' @ 12.63 hrs Surf.Area= 2,597 sf Storage= 4,064 cf

Plug-Flow detention time= 19.8 min calculated for 3,304 cf (46% of inflow) Center-of-Mass det. time= 0.8 min (725.1 - 724.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	2,187 cf	35.33'W x 73.50'L x 3.54'H Field A
			9,198 cf Overall - 3,729 cf Embedded = 5,468 cf x 40.0% Voids
#2A	139.60'	3,729 cf	Cultec R-330XLHD x 70 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 7 rows
•			

5,917 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.70'	18.0" Round Culvert L= 116.0' Ke= 0.500
	-		Inlet / Outlet Invert= 136.70' / 136.12' S= 0.0050 '/' Cc= 0.900
			n= 0.013, Flow Area= 1.77 sf
#2	Device 1	141.35'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	140.25'	24.0" Round Culvert
			L= 215.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.60' / 140.25' S= -0.0030 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.50 cfs @ 11.60 hrs HW=139.14' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.50 cfs)

Primary OutFlow Max=0.00 cfs @ 11.00 hrs HW=139.11' (Free Discharge)

1=Culvert (Passes 0.00 cfs of 9.10 cfs potential flow)

2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

1—3=Culvert (Controls 0.00 cfs)

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Pond IC-C: Infiltration Chambers C - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 7 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length

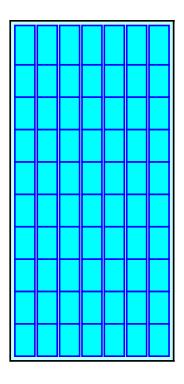
7 Rows x 52.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 35.33' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

70 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 7 Rows = 3,729.2 cf Chamber Storage

9,197.7 cf Field - 3,729.2 cf Chambers = 5,468.5 cf Stone x 40.0% Voids = 2,187.4 cf Stone Storage

Chamber Storage + Stone Storage = 5,916.6 cf = 0.136 af Overall Storage Efficiency = 64.3% Overall System Size = 73.50' x 35.33' x 3.54'

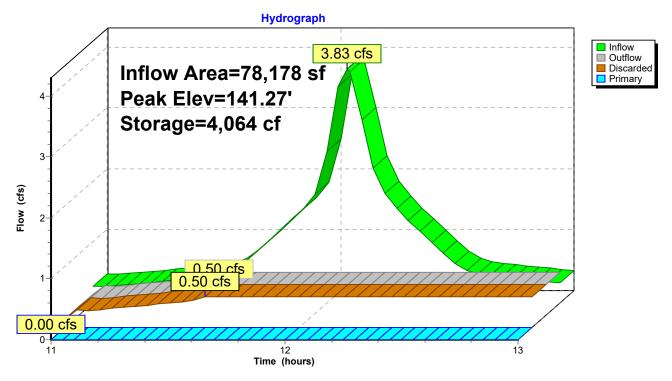
70 Chambers 340.7 cy Field 202.5 cy Stone

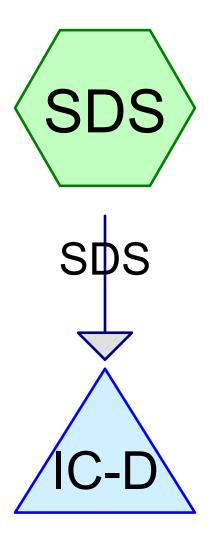




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Pond IC-C: Infiltration Chambers C





Infiltration Chambers D









3395.1 - 0 Pond Street - SDS - (IC-D)

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
38,767	98	Unconnected pavement, HSG A (SDS)
38,767	98	TOTAL AREA

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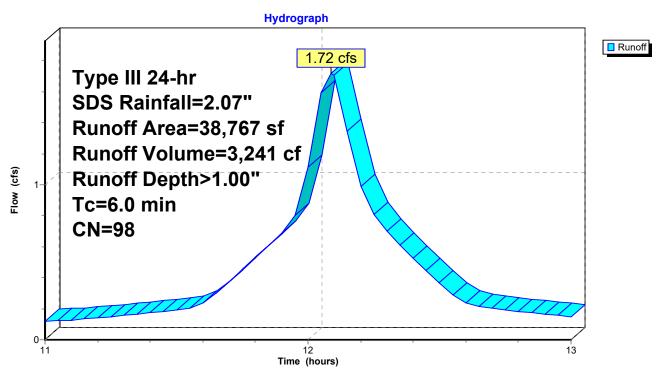
Summary for Subcatchment SDS: SDS

Runoff = 1.72 cfs @ 12.09 hrs, Volume= 3,241 cf, Depth> 1.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Type III 24-hr SDS Rainfall=2.07"

	Α	rea (sf)	CN I	Description					
		38,767	98 I	98 Unconnected pavement, HSG A					
		38,767	100.00% Impervious Area						
		38,767	100.00% Unconnected						
	Тс	Length	Slope	Velocity	Capacity	Description			
	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	Description			
-	6.0	,	•	,	,	Direct Entry.			

Subcatchment SDS: SDS



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Summary for Pond IC-D: Infiltration Chambers D

Inflow Area = 38,767 sf,100.00% Impervious, Inflow Depth > 1.00" for SDS event
Inflow = 1.72 cfs @ 12.09 hrs, Volume= 3,241 cf
Outflow = 0.22 cfs @ 11.65 hrs, Volume= 1,493 cf, Atten= 87%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.05 hrs, Volume= 1,493 cf
Primary = 0.00 cfs @ 11.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 11.00-13.00 hrs, dt= 0.05 hrs Peak Elev= 140.67' @ 12.63 hrs Surf.Area= 1,174 sf Storage= 1,812 cf

Plug-Flow detention time= 19.8 min calculated for 1,488 cf (46% of inflow) Center-of-Mass det. time= 0.9 min (725.3 - 724.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	138.50'	1,011 cf	30.50'W x 38.50'L x 3.54'H Field A
			4,159 cf Overall - 1,632 cf Embedded = 2,527 cf x 40.0% Voids
#2A	139.00'	1,632 cf	Cultec R-330XLHD x 30 Inside #1
			Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
			Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
			Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
		0.040 (T () A ())) O

2,643 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	136.55'	18.0" Round Culvert
	·		L= 29.0' CMP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 136.55' / 136.26' S= 0.0100 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	141.00'	4.0' long x 0.5' breadth Broad-Crested Rectangular Weir
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Device 2	139.01'	24.0" Round Culvert
			L= 3.5' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 139.00' / 139.01' S= -0.0029 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#4	Discarded	138.50'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.22 cfs @ 11.65 hrs HW=138.55' (Free Discharge) **4=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 11.00 hrs HW=138.51' (Free Discharge)
1=Culvert (Passes 0.00 cfs of 8.88 cfs potential flow)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

1—3=Culvert (Controls 0.00 cfs)

Page 5

Pond IC-D: Infiltration Chambers D - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 36.50' Row Length +12.0" End Stone x 2 = 38.50' Base Length

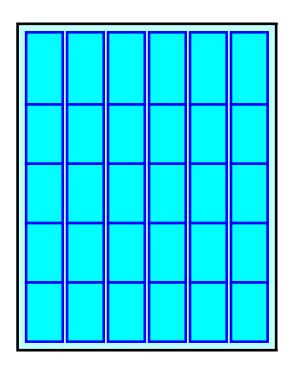
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width 6.0" Base + 30.5" Chamber Height + 6.0" Cover = 3.54' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 1,631.8 cf Chamber Storage

4,158.8 cf Field - 1,631.8 cf Chambers = 2,527.0 cf Stone x 40.0% Voids = 1,010.8 cf Stone Storage

Chamber Storage + Stone Storage = 2,642.6 cf = 0.061 af Overall Storage Efficiency = 63.5% Overall System Size = 38.50' x 30.50' x 3.54'

30 Chambers 154.0 cy Field 93.6 cy Stone

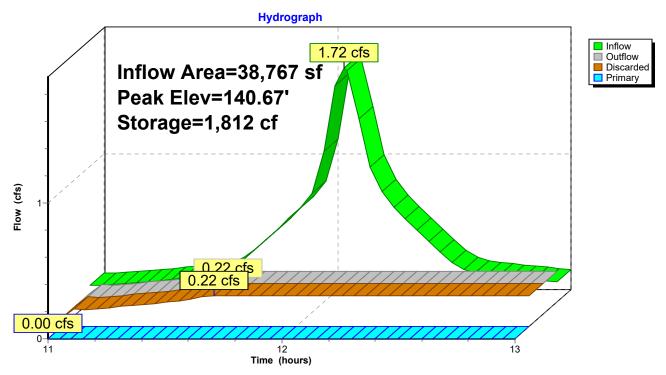


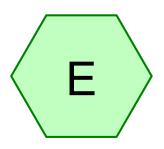


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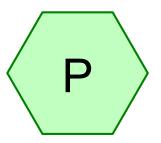
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Pond IC-D: Infiltration Chambers D





Existing



Proposed









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Area Listing (all nodes)

Area	CN	Description
(sq-ft)		(subcatchment-numbers)
1,996	80	>75% Grass cover, Good, HSG D (P)
242	30	Brush, Good, HSG A (E, P)
14,201	73	Brush, Good, HSG D (E, P)
3,166	89	Dirt roads, HSG D (E, P)
1,392	98	Unconnected pavement, HSG D (E, P)
192	98	Unconnected roofs, HSG A (E)
101,630	78	Wetlands, HSG D (E, P)
13,316	30	Woods, Good, HSG A (E, P)
108,736	77	Woods, Good, HSG D (E, P)
244,871	75	TOTAL AREA

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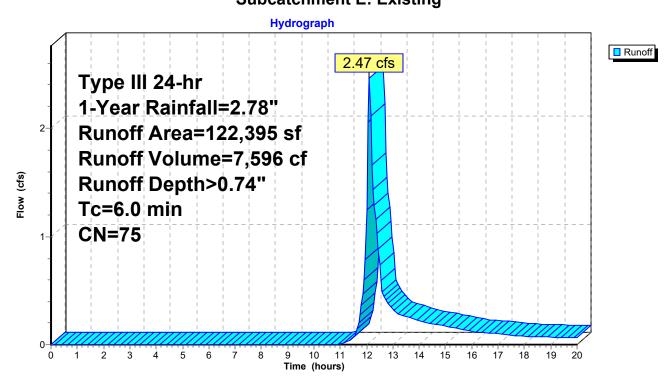
Summary for Subcatchment E: Existing

Runoff = 2.47 cfs @ 12.10 hrs, Volume= 7,596 cf, Depth> 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 1-Year Rainfall=2.78"

	Area (sf)	CN	Description						
	6,562	30	Woods, Good	Woods, Good, HSG A					
	121	30	Brush, Good,	HSG A					
	192	98	Unconnected	roofs, HS	SG A				
	54,519	77	Woods, Good	I, HSG D					
	7,301	73	Brush, Good,	HSG D					
	1,583	89	Dirt roads, HS	SG D					
*	50,815	78	Wetlands, HS	G D					
	1,302	98	Unconnected pavement, HSG D						
	122,395	75	Weighted Ave	erage					
	120,901		98.78% Pervi						
	1,494		1.22% Imperv	ious Area	a				
	1,494			100.00% Unconnected					
	Tc Length	Slop	e Velocity (Capacity	Description				
<u>(m</u>	nin) (feet)	(ft/	ft) (ft/sec)	(cfs)					
	6.0				Direct Entry, Direct				

Subcatchment E: Existing



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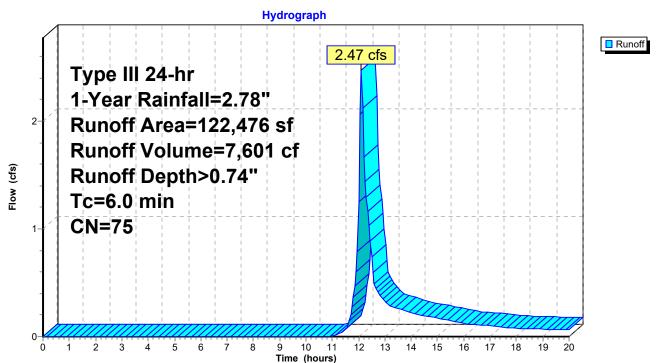
Summary for Subcatchment P: Proposed

Runoff = 2.47 cfs @ 12.10 hrs, Volume= 7,601 cf, Depth> 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs Type III 24-hr 1-Year Rainfall=2.78"

	Area (sf)	CN	Description						
	6,754	30	Woods, Go	od, HSG A					
	121	30	Brush, Goo	d, HSG A					
	54,217	77	Woods, Go	od, HSG D					
	6,900	73	Brush, Goo	d, HSG D					
	1,583	89	Dirt roads, I	HSG D					
	1,996	80	>75% Gras	s cover, Go	ood, HSG D				
*	50,815	78	Wetlands, F	ISG D					
*	90	98	Unconnected pavement, HSG D						
	122,476	75	Weighted A	verage					
	122,386		99.93% Per		1				
	90		0.07% Impe	rvious Are	a				
	90			100.00% Unconnected					
	Tc Length	n Slop	oe Velocity	Capacity	Description				
	(min) (feet			(cfs)	·				
	6.0				Direct Entry, Direct				

Subcatchment P: Proposed



APPENDIX D
LONG TERM POLLUTION PREVENTION PLAN – REQUIRED BY STANDARDS 4-6

LONG TERM POLLUTION PREVENTION PLAN

To keep the Stormwater Management System (SMS) functioning properly and to ensure that the stormwater Total Suspended Solids (TSS) are reduced, a long-term pollution prevention is required. Shinglemill, LLC, the owner/operator of the facility, is responsible for the adherence to this long-term plan. The following is a guideline of the specific requirements of the plan to maintain the long term viability of the stormwater management system.

The Stormwater Pollution Prevention Plan for the site addresses many of the items in the Long-Term Pollution Prevention Plan.

Good Housekeeping Practices

Employees shall be instructed in the importance of not spilling fluids and chemicals such as oil, antifreeze, etc. onto the bare ground. All areas exposed to the weather shall be kept clean

Provisions for Storing Materials and Waste Products Inside or Under Cover

Liquid waste products shall be captured when draining from vehicles, and stored in sealed containers under cover until they are disposed of. Waste products shall be disposed of in a legal manner, at a state licensed recycling center or landfill.

Requirements for routine inspections and maintenance of stormwater BMPs;

BMPs shall be inspected on a monthly basis. BMPs shall be maintained per the Operations and Maintenance Plan.

Spill prevention and response plans;

<u>First responders</u>	Phone Numbers
Rockland Fire Department	911 if emergency or (781) 878-2123
Rockland Police Department	911 if emergency or (781) 871-3890
 Mass Department of Environmental Protection 	
Emergency Response	1-888-304-1133

Requirements for storage and use of fertilizers, herbicides, and pesticides;

Fertilizers shall not be used within 25 feet of the wetland resource areas. Excess fertilizers shall be swept up from all impervious surfaces and not allowed to run into the drainage system.

All fertilizer, herbicides, and pesticides shall be stored at least 100 feet away from the wetland line. If stored on site, these materials should be kept in a wrapped or sealed container, and kept under cover out of the rain and snow.

Provisions for solid waste management;

Solid waste shall be collected at a minimum of once per week and disposed of in an appropriate dumpster or garbage truck. Waste shall be disposed of in a legal manner, at a state licensed recycling center or landfill.

Winter Road Salt and/or Sand Use and Storage restrictions

Road salt shall not be used on this site.

Street sweeping schedules;

Street Sweeping shall be performed on paved surfaces no less than once per year, preferably in the spring months.

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:

Oil booms shall be kept on site in a readily accessible area in the event of an oil spill. If an oil spill occurs, the booms shall be placed and secured at the overflow spillway and in front of the entrance to the Stormceptors.

Routine Inspections and Maintenance of SMS BMP's

Routine inspections and maintenance shall be performed in accordance with the Operations and Maintenance Plan

APPENDIX E

OPERATION AND MAINTENANCE PLAN - REQUIRED BY STANDARD 9

OPERATION AND MAINTENANCE PLAN

To keep the Stormwater Management System (SMS) functioning properly and to ensure that the Total Suspended Solids (TSS) are reduced, periodic maintenance is required. The owner/operator of the facility is responsible for the periodic maintenance requirements of the SMS. Shinglemill, LLC is the owner and will be the party responsible for the maintenance of the SMS. The following is a guideline of the specific maintenance schedules and tasks required to keep the SMS functioning properly.

- Deep Sump Catch Basins
 - General Maintenance
 - Remove any accumulated leaves from the grates during the fall and spring.
 - Quarterly Maintenance
 - Inspect sumps for accumulated sediment. If sediment has reached a depth of eighteen inches (18"), remove via clamshell bucket or vacuum truck.
 - Annual Maintenance
 - Inspect hood to ensure that it is properly secured.
 - Remove accumulated sediment via clamshell bucket or vacuum truck.
- Proprietary Separators
 - o General Maintenance
 - All operation and maintenance to follow Proprietary Separator Manufacturer's guideline.
 - Sediment to be removed once it reaches approximately 15% of unit storage capacity. Approximate Depths for Stormceptors on site:
 - Stormceptor 450i 9"
 - Stormceptor 900 8"
 - Units to be cleaned immediately after an oil, fuel, or chemical spill.
 - Quarterly Maintenance
 - Inspect structure for accumulated sediment and oil. Remove sediment if sediment has reached maximum depth. If oil is present, pump off oil layer.
 - Annual Maintenance
 - Inspect structure for accumulated sediment and oil. Remove sediment if sediment has reached maximum depth. If oil is present, pump off oil layer.
- Infiltration Chambers
 - General Maintenance
 - Inspect subsurface infiltration facilities twice a year.
 - Remove any debris that may clog the system via vacuum truck.
- Plunge Pools/Splash Pads
 - General Maintenance
 - During the fall and the spring remove any accumulated leaves or large debris.
 - Annual Maintenance
 - Check for signs of erosion and repair as needed.
 - Remove any branches, trash or other large debris that could interfere with the proper operation of the inlet or outlet of the basin. Remove any accumulated sediment, by the use of hand tools (shovels, rakes, wheelbarrows, etc.) when it exceeds three-inches (3") but not less than annually.

SHINGLEMILL, LLC SHINGLEMILL 0 POND STREET, ROCKLAND, MASSACHUSETTS STORMWATER MANAGEMENT SYSTEM OPERATION & MAINTENANCE LOG DATE TIME MAINTENANCE ACTIVITY MAINTENANCE PERFORMED, OBSERVATIONS

APPENDIX F

SOIL LOGS

	Job No.:	3395.1		Soi	l Evaluator:		mitruk	
	Client:				Witness:			
Site	e Location:	0 Pond St., Rockland, N	MA		Excavator:	Iaria Broth	ners - Vinny	
	Land Use:	Vacant lot			Date:	October 2	, 2019	
Parer	nt Material:				Weather:	Cloudy, 75	0	
		r Resource Conditions:		Above:		X		
	water	Resource Conditions.	1 VOIIIIai.	TIBOVC.	_ Delow.		•	
ГР #	3							
Depth	Horizon	Texture	Color	Comments	Infiltrat	ion Test	Groun	dwater
0-24	Fill			Change in redox color at 11"	Depth		Mottling	4"
24-40	Ab	Loam	5Y 2.5/1		0-15 Min.		Mottling	4
40-58	C1	Sand	2.5Y 5/1	5% Gravel, 5% Cob./Stones	15-30 Min.		Weeping	
58-90	C2	Coarse Sand	2.5Y 5/1	10% Gravel, 10% Cob./Stones	30-45 Min.		weeping	
					45-60 Min.		Standing	40"
					60-75 Min.		Standing	40
					Rate	•	"/hr	
ГР #	4							
Depth	Horizon	Texture	Color	Comments	Infiltrati	ion Test	Groun	dwater
0-24	Fill				Depth		Mottling	31"
24-30	Ab	Coarse Sand	10YR 4/1		0-15 Min.		Wotting	<i>J</i> 1
30-35	Bw	Coarse Sand	10YR 5/6		15-30 Min.		Weeping	
35-79	С	Coarse Sand	10YR 4/4	10% Gravel, 10% Cob./Stones	30-45 Min.		weeping	
					45-60 Min.		Standing	40"
					60-75 Min.		6	
ГР #	5				Rate		"/hr	
Depth	Horizon	Texture	Color	Comments	Infiltrat	ion Test	Groun	dwater
0-2	О				Depth		3.61"	6 11
2-4	Α	Loamy Sand	10YR 4/3	10% Gravel, 10% Cob./Stones	0-15 Min.		Mottling	6"
4-13	Bw	Sand	2.5Y 5/4	10% Gravel, 10% Cob./Stones, heavier mottling at 26"	15-30 Min.		Weeping	25"
13-72	С	Sand	2.5Y 6/3	10% Gravel, 10% Cob./Stones	30-45 Min.			
					45-60 Min.		Standing	36"
					60-75 Min.		Stariding	30
ГР #	6				Rate		"/hr	
Depth	Horizon	Texture	Color	Comments	Infiltrat	ion Test	Groun	dwater
0-15	Fill				Depth		Mottling	10"
15-23	Ab	Loamy Sand	10YR 2/1	10% Gravel, 10% Cob./Stones	0-15 Min.		mouning	10
23-29	Bw	Sand	10YR 5/6	10% Gravel, 10% Cob./Stones	15-30 Min.]	
29-105	С	Sand	2.5Y 5/1	10% Gravel, 10% Cob./Stones, Heavier mottling at 55"	30-45 Min.		Weeping	28"
					45-60 Min.		Standing	48"
					60-75 Min.		Januing	10
					Rate		"/hr	

TP#	7						
Depth	Horizon	Texture	Color	Comments	Infiltration Test	Groun	dwater
0-113	Fill			60" to organic fill, roots at 86"	Depth	Mottling	
113-123	Ab	Loamy Sand	10YR 2/1		0-15 Min.	Wiottillig	
123-131	Cg	Sand	5GY 5/2	10% Gravel, 5% Cob./Stones	15-30 Min.	Weeping	54'
					30-45 Min.	weeping	34
					45-60 Min.	Standing	123
					60-75 Min.	Standing	123
ГР #	8				Rate	"/hr	
Depth	Horizon	Texture	Color	Comments	Infiltration Test	Groun	dwater
0-3	A	Sand	10YR 3/1	30% Gravel	Donth	+ -	
	t	Sand	10YR 3/1 10YR 4/4	20% Gravel, 30% Cob./Stones	Depth 0-15 Min.	Mottling	47'
3-6 6-95	Bw C1	Coarse Sand	2.5Y 5/4	20% Gravel, 30% Cob./Stones	0-15 Min. 15-30 Min.	+ +	
0-93	CI	Coarse Sand	2.31 3/4	2070 Graver, 5070 COD./ Stories	<u> </u>	Weeping	
					30-45 Min.		
					45-60 Min.	Standing	59'
					60-75 Min.	Ü	
ГР #	10				Rate	"/hr	
Depth	Horizon	Texture	Color	Comments	Infiltration Test	Groun	dwatei
0-31	Fill			20% Gravel, 30% Cob./Stones	Depth	3.612	451
31-100	C1	Sand	2.5Y 5/2	10% Gravel, 10% Cob./Stones	0-15 Min.	- Mottling	45'
			,		15-30 Min.		
					30-45 Min.	Weeping	
					45-60 Min.		
					60-75 Min.	Standing	59'
					Rate	"/hr	
TP #	12			T	_	,	
Depth	Horizon	Texture	Color	Comments	Infiltration Test	Groun	dwate
0-27	Fill				Depth	Mottling	42'
27-29	Ab	Loamy Sand			0-15 Min.	111Ottillig	74
29-42	Bw	Loamy Sand	10YR 5/6	10% Gravel, 10% Cob./Stones	15-30 Min.	Weeping	84'
42-56	С	Sand	10YR 4/2	10% Gravel, 10% Cob./Stones	30-45 Min.	weeping	- 04
56-100	2C	Coarse Sand	10YR 6/1	10% Gravel, 10% Cob./Stones	45-60 Min.	C+3*	90'
					60-75 Min.	- Standing	90
TP #	13				Rate	"/hr	
Depth	Horizon	Texture	Color	Comments	Infiltration Test	Groun	dwater
0-10	Fill				Depth	+ 1	
10-17	Ab	Fine Sand	10YR 2/1	Heavy organic	0-15 Min.	Mottling	28'
17-31	Bw	Sand	10YR 5/8	, ,	15-30 Min.		
31-76	C1	Coarse Sand	2.5Y 4/4		30-45 Min.	Weeping	48'
76-92	C2	Coarse Sand	2.5Y 5/1	10% Gravel, 30% Cob./Stones,	45-60 Min.	0. "	48'
7/6-92	C2	Coarse Sand	2.5Y 5/1	10% Small Boulders	45-60 Min.	Standing	4

Rate "/hr

60-75 Min.

TP # 14

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Infiltration Test Gro		Grour	roundwater	
0-36	Fill				Depth		Mottling	40"			
36-41	Ab	Sandy Loam	10YR 2/1		0-15 Min.		Motting	40			
41-50	Bw	Loamy Sand	10YR 5/6		15-30 Min.		Weeping				
50-117	С	Medium Sand	2.5Y 4/4	20% Gravel, 5% Cob./Stones	30-45 Min.		weeping				
					45-60 Min.		Standing	56"			
					60-75 Min.		Standing	50			

Rate "/hr

	Job No.:	3395.1		Se	oil Evaluator:	Damien D	mitruk		
	Client:				Witness:				
Sit	e Location:	0 Pond St., Rockland, M			Excavator:	Iaria Broth	ners - Vinny	r	
		¥7. 1			Date:	October 3,	, 2019		
Pare	nt Material:	-				Cloudy, 55			
		r Resource Conditions:		Above:		X			
	w atc.	r Resource Conditions.	rvoimai.	nbove.	_ Delow.	A	-		
TP#	1								
Depth	Horizon	Texture	Color	Comments	Infiltrati	ion Test	Groun	ndwater	
0-100	Fill			Scrap, fill until water surface 75", sand @ bottom of pit	Depth		Mottling		
					0-15 Min.				
					15-30 Min.		Weeping		
	<u> </u>				30-45 Min.		weeping		
					45-60 Min.		Standing	44"	
					60-75 Min.		Standing	77	
					Rate		"/hr		
TP#	2								
Depth	Horizon	Texture	Color	Comments	Infiltrati	Infiltration Test		Groundwater	
0-70	Fill				Depth		Mottling	18"	
70-97	С	Sand	<u> </u>	10% Gravel, 10% Cob./Stone	0-15 Min.	<u> </u>	1.10ttaling		
			 		15-30 Min.		Weeping		
			 		30-45 Min.				
	-		 	 	45-60 Min.		Standing	45"	
					60-75 Min.				
TP#	9				Rate		"/hr		
Depth	Horizon	Texture	Color	Comments	Infiltrati	ion Test	Groun	ndwater	
0-22	Fill				Depth		Mottling	27"	
22-60	C1	Sand		Denser mottling @32"	0-15 Min.		Motung	21	
60-63	C2	Sand		10% Gravel, 10% Stone, Black	15-30 Min.		Weeping		
63-90	C3	Sand	5YR 4/6	10% Gravel, 10% Cob./Stone	30-45 Min.		weeping		
			<u> </u>		45-60 Min.	<u> </u>	Standing	44"	
					60-75 Min.		8		
					Rate		"/hr		
TP#	11								
Depth	Horizon	Texture	Color	Comments	Infiltrati	ion Test	Groun	ndwater	
0-18	Fill				Depth		Mottling	36"	
18-33	C1	Coarse Sand	10YR 6/6	10% Gravel, 10% Cob./Stone	0-15 Min.		Motting	30	
33-67	C2	Fine Sand	2.5Y 6/2	10% Gravel, 10% Cob./Stone	15-30 Min.		Weeping		
67-90	C3	Coarse Sand	5Y 5/3	10% Gravel, 10% Cob./Stone	30-45 Min.		,, cep.ii.g		
					45-60 Min.		Standing	53"	
i	1		i		60-75 Min	Standing			

Rate

TP # 15

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Infiltration Test Groun	
0-54	Fill	Coarse Loamy Sand			Depth		Mottling	21"
54-69	Ab	Silt loam	10YR 2/1		0-15 Min.		Motunig	21
69-99	C1	Coarse Sand	5Y 4/2	20% Gravel, 20% Cob./Stone	15-30 Min.		Weeping	48"
					30-45 Min.		weeping	40
					45-60 Min.		Standing	87"
					60-75 Min.		Standing	0/

Rate "/hr

APPENDIX G
ILLICIT DISCHARGE COMPLIANCE STATEMENT- REQUIRED BY STANDARD 10

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER NAME: Shinglemill, LLC

ADDRESS: 4 First Street

Bridgewater, MA 02324

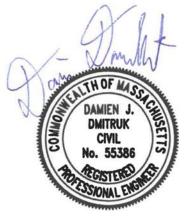
TEL. NUMBER: (508) 697-3191

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.



Damien J. Dmitruk, P.E. Civil Engineer

APPENDIX H

STORMCEPTOR SIZING REPORTS RINKER STORMCEPTOR OWNER'S MANUAL STEP - STORMCEPTOR FACT SHEET





Detailed Stormceptor Sizing Report – STC-S1

Project Information & Location									
Project Name	Shinglemill Apartments	Project Number	3395.1						
City	Rockland	State/ Province	Massachusetts						
Country	United States of America	Date	4/7/2020						
Designer Information		EOR Information (optional)							
Name	Coneco Coneco	Name							
Company	Coneco Engineers & Scientists	Company							
Phone #	508-697-3191	Phone #							
Email	Stormceptor@coneco.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	STC-S1
Recommended Stormceptor Model	STC 450i
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	87
PSD	Fine Distribution
Rainfall Station	BLUE HILL

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	87	
STC 900	91	
STC 1200	91	
STC 1800	92	
STC 2400	93	
STC 3600	94	
STC 4800	95	
STC 6000	96	
STC 7200	96	
STC 11000	97	
STC 13000	98	
STC 16000	98	





Stormceptor

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

Design Methodology

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

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

Hydrology Analysis

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

Rainfall Station			
State/Province	Massachusetts	Total Number of Rainfall Events	8652
Rainfall Station Name	BLUE HILL	Total Rainfall (in)	2849.7
Station ID #	0736	Average Annual Rainfall (in)	49.1
Coordinates	42°12'44"N, 71°6'53"W	Total Evaporation (in)	220.6
Elevation (ft)	630	Total Infiltration (in)	251.0
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2378.1

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.





Discharge (cfs)

Drainage Area		
Total Area (acres)	0.18	
Imperviousness %	91.0	
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)		

0.000	0.	.000
Up Stream Flow Diversion		
Max. Flow to Stormce	ptor (cfs)	
Desi		
Stormceptor Inlet Invert Elev (ft)		
Stormceptor Outlet Invert Elev (ft)		
Stormceptor Rim Elev (ft)		
Normal Water Level Elevation (ft)		
Pipe Diameter (in)		
Pipe Material		HDPE - plastic
Multiple Inlets (Y/N)		No
Grate Inlet (Y/N)		No

Up Stream Storage

Storage (ac-ft)

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution			
Particle Diameter (microns)	Distribution %	Specific Gravity	
20.0	20.0	1.30	
60.0	20.0	1.80	
150.0	20.0	2.20	
400.0	20.0	2.65	
2000.0	20.0	2.65	



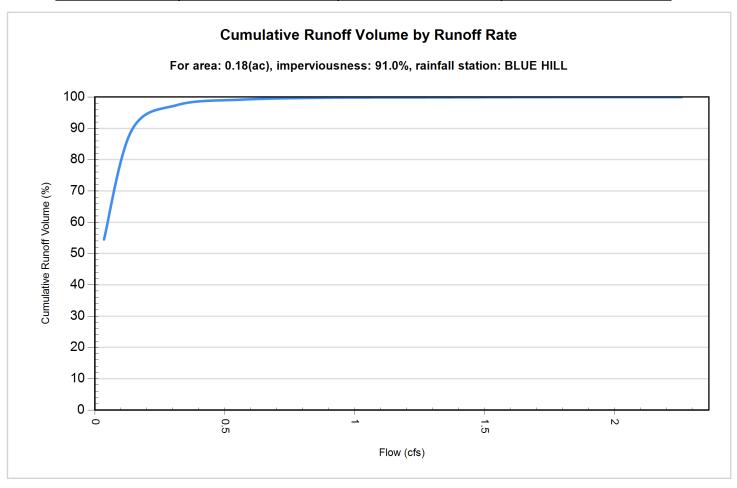


Site Name		STC-S1	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.18	Horton's equation is used to estimate	infiltration
Imperviousness %	91.0	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics	5	Min. Infiltration Rate (in/hr)	0.4
Width (ft)	177.00	Decay Rate (1/sec)	0.00055
Slope %	2	Regeneration Rate (1/sec)	0.01
Impervious Depression Storage (in)	0.02	Evaporation	
Pervious Depression Storage (in)	0.2	Daily Evaporation Rate (in/day)	0.1
Impervious Manning's n	0.015	Dry Weather Flow	
Pervious Manning's n	0.25	Dry Weather Flow (cfs)	0
Maintenance Frequency		Winter Months	
Maintenance Frequency (months) >	12	Winter Infiltration	0
	TSS Loading	y Parameters	
TSS Loading Function			
Buildup/Wash-off Parame	eters	TSS Availability Paramete	ers
Target Event Mean Conc. (EMC) mg/L		Availability Constant A	
Exponential Buildup Power		Availability Factor B	
Exponential Washoff Exponent		Availability Exponent C	
		Min. Particle Size Affected by Availability (micron)	





Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	Runoff Volume (ft³)	Volume Over (ft³)	Cumulative Runoff Volume (%)
0.035	881001	734837	54.5
0.141	1442769	172785	89.3
0.318	1574811	40691	97.5
0.565	1603241	12254	99.2
0.883	1611714	3779	99.8
1.271	1614392	1098	99.9
1.730	1615119	372	100.0
2.260	1615491	0	100.0



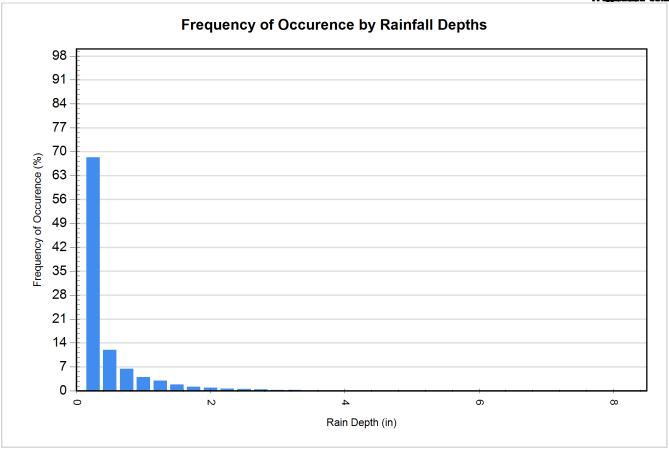




Rainfall Event Analysis				A appendix Per Con
Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	5908	68.3	386	13.6
0.50	1039	12.0	381	13.4
0.75	555	6.4	344	12.1
1.00	349	4.0	301	10.6
1.25	262	3.0	292	10.3
1.50	154	1.8	211	7.4
1.75	104	1.2	168	5.9
2.00	75	0.9	140	4.9
2.25	48	0.6	102	3.6
2.50	43	0.5	102	3.6
2.75	33	0.4	87	3.0
3.00	17	0.2	49	1.7
3.25	18	0.2	56	2.0
3.50	8	0.1	27	0.9
3.75	7	0.1	25	0.9
4.00	4	0.0	15	0.5
4.25	1	0.0	4	0.1
4.50	4	0.0	18	0.6
4.75	3	0.0	14	0.5
5.00	1	0.0	5	0.2
5.25	1	0.0	5	0.2
5.50	4	0.0	21	0.7
5.75	2	0.0	11	0.4
6.00	4	0.0	23	0.8
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	1	0.0	7	0.2
7.00	1	0.0	7	0.2
7.25	2	0.0	14	0.5
7.50	0	0.0	0	0.0
7.75	1	0.0	8	0.3
8.00	1	0.0	8	0.3
8.25	0	0.0	0	0.0
8.25	2	0.0	17	0.6







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





Detailed Stormceptor Sizing Report – STC-D1

Project Information & Location			
Project Name	Shinglemill Apartments	Project Number 3395.1	
City	Rockland	State/ Province	Massachusetts
Country	United States of America	a Date 4/7/2020	
Designer Information		EOR Information (optional)	
Name	Coneco Coneco	Name	
Company	Coneco Engineers & Scientists	Company	
Phone #	508-697-3191	Phone #	
Email	Stormceptor@coneco.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	STC-D1
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	85
PSD	Fine Distribution
Rainfall Station	BLUE HILL

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	78	
STC 900	85	
STC 1200	85	
STC 1800	85	
STC 2400	88	
STC 3600	89	
STC 4800	91	
STC 6000	91	
STC 7200	93	
STC 11000	95	
STC 13000	95	
STC 16000	96	





Stormceptor

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

Design Methodology

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

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

Hydrology Analysis

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

Rainfall Station			
State/Province	Massachusetts	Total Number of Rainfall Events	8652
Rainfall Station Name	BLUE HILL	Total Rainfall (in)	2849.7
Station ID #	0736	Average Annual Rainfall (in)	49.1
Coordinates	42°12'44"N, 71°6'53"W	Total Evaporation (in)	230.7
Elevation (ft)	630	Total Infiltration (in)	307.4
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2311.6

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.





Discharge (cfs)

Drainage Area		
Total Area (acres)	1.09	
Imperviousness %	89.0	
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)		

0.000 0.000		.000	
Up Stream	Up Stream Flow Diversion		
Max. Flow to Stormce	ptor (cfs)		
Desi	gn Details		
Stormceptor Inlet Invert Elev (ft)			
Stormceptor Outlet Invert Elev (ft)			
Stormceptor Rim Elev (ft)			
Normal Water Level Elevation (ft)			
Pipe Diameter (in)		12	
Pipe Material		HDPE - plastic	
Multiple Inlets (Y/N)		No	
Grate Inlet (Y/I	N)	No	

Up Stream Storage

Storage (ac-ft)

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65



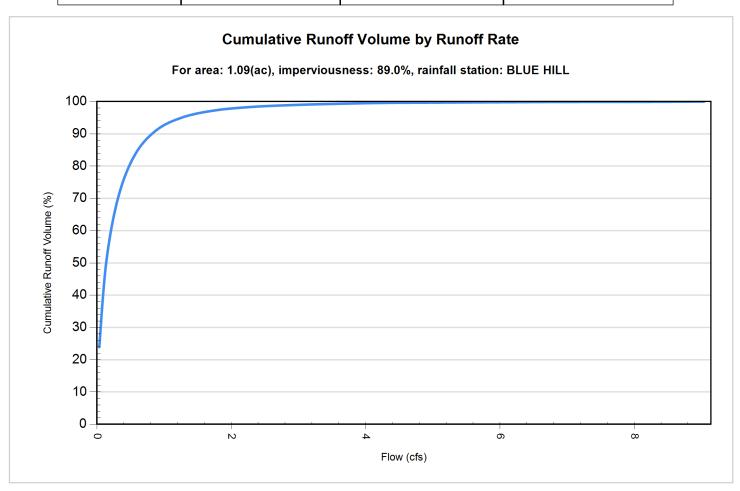


Site Name		STC-D1		
Site Details				
Drainage Area		Infiltration Parameters	Infiltration Parameters	
Total Area (acres)	1.09	Horton's equation is used to estimate infiltration		
Imperviousness %	89.0	Max. Infiltration Rate (in/hr)	2.44	
Surface Characteristics	5	Min. Infiltration Rate (in/hr)	0.4	
Width (ft)	436.00	Decay Rate (1/sec)	0.00055	
Slope %	2	Regeneration Rate (1/sec)	0.01	
Impervious Depression Storage (in)	0.02	Evaporation		
Pervious Depression Storage (in)	0.2	Daily Evaporation Rate (in/day)	0.1	
Impervious Manning's n	0.015	Dry Weather Flow		
Pervious Manning's n	0.25	Dry Weather Flow (cfs)	0	
Maintenance Frequency		Winter Months		
Maintenance Frequency (months) >	12	Winter Infiltration	0	
	TSS Loading	g Parameters		
TSS Loading Function				
Buildup/Wash-off Parame	eters	TSS Availability Paramete	ers	
Target Event Mean Conc. (EMC) mg/L		Availability Constant A		
Exponential Buildup Power		Availability Factor B		
Exponential Washoff Exponent		Availability Exponent C		
		Min. Particle Size Affected by Availability (micron)		





Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (cfs)	Runoff Volume (ft³)	Volume Over (ft³)	Cumulative Runoff Volume (%)
0.035	2260787	7204660	23.9
0.141	4787934	4678145	50.6
0.318	6659058	2807468	70.4
0.565	7898003	1566220	83.5
0.883	8623277	841188	91.1
1.271	9003010	460890	95.1
1.730	9197598	266348	97.2
2.260	9302821	161019	98.3
2.860	9363108	100740	98.9
3.531	9399897	63932	99.3
4.273	9422883	40949	99.6
5.085	9438694	25126	99.7
5.968	9448033	15788	99.8
6.922	9454150	9667	99.9
7.946	9458264	5555	99.9
9.041	9460340	3479	100.0



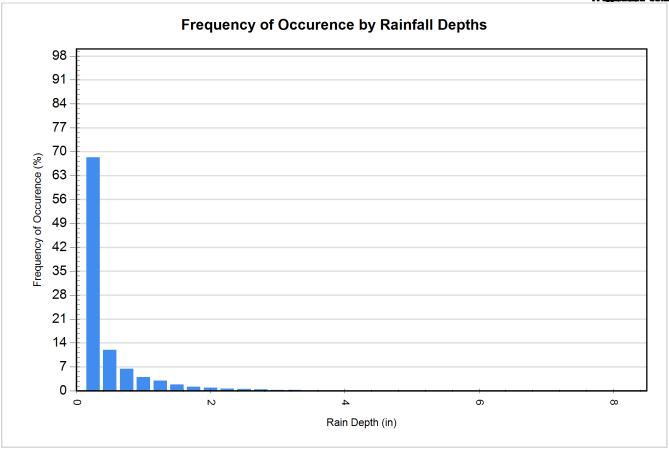




Rainfall Event Analysis			A appendix Per Con	
Rainfall Depth (in)	No. of Events	Percentage of Total Events (%)	Total Volume (in)	Percentage of Annual Volume (%)
0.25	5908	68.3	386	13.6
0.50	1039	12.0	381	13.4
0.75	555	6.4	344	12.1
1.00	349	4.0	301	10.6
1.25	262	3.0	292	10.3
1.50	154	1.8	211	7.4
1.75	104	1.2	168	5.9
2.00	75	0.9	140	4.9
2.25	48	0.6	102	3.6
2.50	43	0.5	102	3.6
2.75	33	0.4	87	3.0
3.00	17	0.2	49	1.7
3.25	18	0.2	56	2.0
3.50	8	0.1	27	0.9
3.75	7	0.1	25	0.9
4.00	4	0.0	15	0.5
4.25	1	0.0	4	0.1
4.50	4	0.0	18	0.6
4.75	3	0.0	14	0.5
5.00	1	0.0	5	0.2
5.25	1	0.0	5	0.2
5.50	4	0.0	21	0.7
5.75	2	0.0	11	0.4
6.00	4	0.0	23	0.8
6.25	0	0.0	0	0.0
6.50	0	0.0	0	0.0
6.75	1	0.0	7	0.2
7.00	1	0.0	7	0.2
7.25	2	0.0	14	0.5
7.50	0	0.0	0	0.0
7.75	1	0.0	8	0.3
8.00	1	0.0	8	0.3
8.25	0	0.0	0	0.0
8.25	2	0.0	17	0.6







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



Stormceptor® STC Owner's Manual

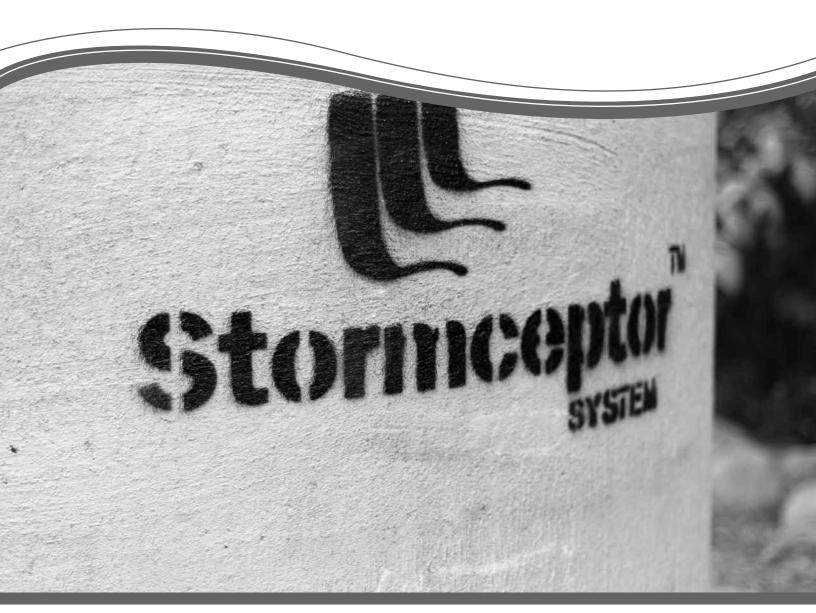




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For patent information, go to www.ContechES.com/ip.

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)
- 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 Contech at 1-800-338-1122.

2 – Stormceptor Operation and Components

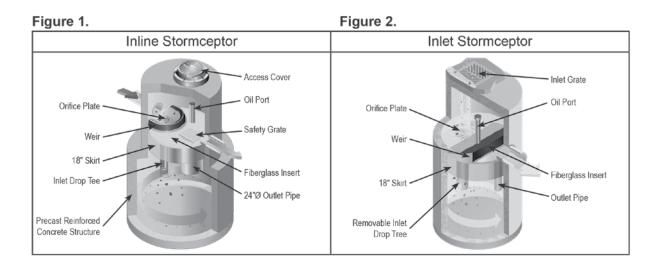
Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology. Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. 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.

- 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 and MAX) 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 Contech Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS and OSR Stormceptor models 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 1. 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	

Λ	١.	+-	

^{1.} Depth Below Pipe Inlet Invert to the Inside Top 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.

Table 2. Storage	Table 2. Storage Capacities		
STC Model	Hydrocarbon Storage Capacity (gal)	Sediment Capacity (ft³)	
450	86	46	
900	251	89	
1200	251	127	
1800	251	207	
2400	840	205	
3600	840	373	
4800	909	543	
6000	909	687	
7200	1059	839	
11000*	2797	1089	
13000*	2797	1374	
16000*	3055	1677	

Notes

4 – Stormceptor Inspection and 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 3). 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

^{*}Consist of two chamber structures in series.

^{1.} Hydrocarbon and Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

^{*}Consist of two chamber structures in series

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 or 6-inch diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

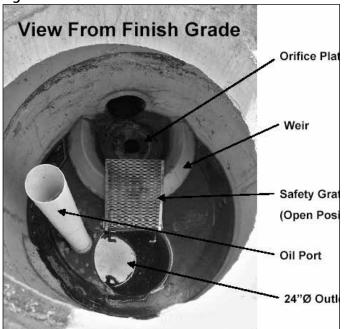
Figure 3.



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 ³/₄-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, hoist and safety harness for specially trained personnel if confined space entry is required

Figure 4.

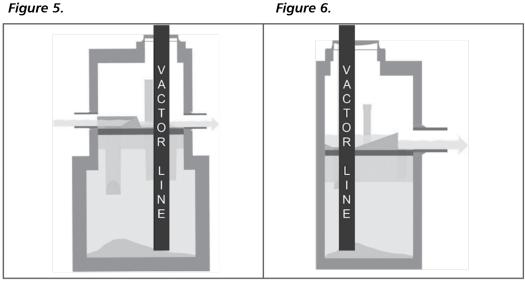


Recommended Stormceptor Maintenance Procedure

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). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local 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 diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch outlet riser pipe (See Fig. 5).
 - For 4-ft diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch drop tee hole (See Fig. 6).

Figure 5.



- 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.

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 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 3. Recommended Sediment Depths Indicating Maintenance		
STC Model	Maintenance Sediment Depth (in)	
450	8	
900	8	
1200	10	
1800	15	
2400	12	
3600	17	
4800	15	
6000	18	
7200	15	
11000*	17	
13000*	20	
16000*	17	

Notes:

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 Contech Representative or call 800-338-1122.

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.

^{1.} The values above are for typical standard units.

^{*} Per structure.

Stormceptor Inspection and Maintenance Log
Stormceptor Model No:
Allowable Sediment Depth:
Serial Number:
Installation Date:
Location Description of Unit:
Other Comments:

5 – Contact Information

Questions regarding the Stormceptor can be addressed by contacting your local Contech representative or by calling 800-338-1122.



SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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Stormwater Technology: Stormceptor

(Hydro Conduit, formerly CSR New England Pipe)

Revised February 2003

The Stormceptor Fact Sheet is one in a series of fact sheets for stormwater technologies and related performance evaluations, which are undertaken by the Massachusetts STrategic Envirotechnology Partnership (STEP).

The STEP evaluation entitled, *Technology Assessment, Stormceptor CSR New England Pipe*, January 1998 is the information source for this fact sheet. When a more thorough understanding of a system is required, the full *Technology Assessment* should be reviewed. Copies are available for downloading from the STEP Web site (www.STEPSITE.org/) or by contacting the STEP Program (Phone: 617/626/1197, FAX: 617/626/1180, email: linda.benevides@state.ma.us). This fact sheet is subject to future updates as additional performance information becomes available.

Description/Definition

Stormceptor is a prefabricated, underground unit that separates oils, grease, and sediment from stormwater runoff when installed with an existing or new pipe conveyance system. The unit is divided into two chambers—a treatment and a flow bypass chamber. During typical storm events, runoff is directed by the inflow weir through a drop pipe into the lower treatment chamber where sediment, oil, and grease are separated from the flow by gravity. The bypass chamber is designed to convey excess stormwater, which overtops the inflow weir, through the system without treatment.

Equipment and Sizing

The on-line Stormceptor units are available in eight sizes ranging from six and twelve feet in diameter with capacities of 900 to 7200 gallons. Since issuing the STEP assessment in 1998, the manufacturer has expanded the Stormceptor product line to include a storm drain inlet (STC 450i) and three units (Models STC 11000, STC 13000, and STC16000). These systems are not included in the STEP evaluation. Users and decision-makers may require additional field test results and new data for these new systems in order to accept performance ratings, particularly if they are higher than those reported in the STEP technology assessment and this fact sheet.

Stormceptor units are available in either precast concrete or fiberglass for special applications. Concrete units are pre-engineered for HS-20 min. traffic loading at the surface. Fiberglass units can be used in areas where there is a potential for oil and chemical spills.

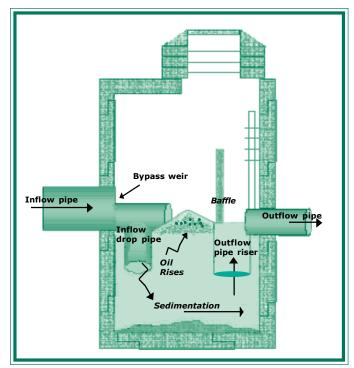


Figure 1. Stormceptor operation during average flow conditions.

Performance/Effectiveness

The system is designed to provide separation of sediment, oil, and grease from stormwater by routing runoff into a low-turbulence environment where solids settle and oils float out of solution. The system sizing is based on the drainage area, historical rainfall data, and the solids removal efficiency required. It is recommended that the system be used in combination with other stormwater controls to conform with the Massachusetts Stormwater Management Policy and standards.



An Imperial Model STC 2000 (equivalent to the Model STC 2400) in Edmonton, Canada treats flow from a 9.8 acre commercial parking lot. This system was monitored during four storm events in 1996 and shown to have an average total suspended solids (TSS) removal efficiency of 52 percent. In designing a system to achieve a comparable removal efficiency, the relationship between system size and impervious drainage area should be considered, as detailed in Table 1 and the Technology Assessment Report.

A Model STC 1200 in Westwood, Massachusetts treats flow from 0.65 acres consisting of a paved truck loading area at a manufacturing facility. The unit was monitored for six storm events in 1997, but only four events had measurable TSS influent concentrations. Of these four events, the average TSS removal efficiency was calculated to be 77 percent, which is less than the 80 percent removal targeted by the manufacturer.

Based on these field monitoring results, and when the unit sizing follows the guidance in Table 1, removal efficiencies between 52 percent and 77 percent may be achieved where installations have similar rainfall and land use characteristics as those reviewed for the STEP evaluation. It is recommended that additional field research and new data be evaluated to validate performance ratings higher than those verified by STEP.

Specific performance claims for oil and grease were not evaluated by STEP. However, total petroleum hydrocarbons (TPH) were analyzed during the Westwood study. Results indicated that the unit was effective in capturing oils.

Stormceptor	Maximum Impervious Area (acres)	
Model Number	77% TSS removal	52% TSS removal
STC 900	0.45	0.9
STC 1200	0.7	1.45
STC 1800	1.25	2.55
STC 2400	1.65	3.35
STC 3600	2.6	5.3
STC 4800	3.6	7.25
STC 6000	4.6	9.25
STC 7200	5.55	11.25

Table 1: Sizing for TSS removal (adapted from the manufacturer's sizing in the 1998 STEP Report) Use the table to determine a TSS removal rate. Use the new Rinker method for sizing Stormceptor units. The sizing method has been changed since publication of the STEP Report.

Note: To achieve 52% and 77% TSS removal rates on some sites, it may be necessary to use lower maximum impervious areas than those in Table 1.

Technology Status

The Stormceptor system provides greater solids separation and higher TSS removal efficiencies than oil and grit separators. Stormceptor systems are among the category of hydrodynamic separators, which are flow-through devices with the capacity to settle or separate grit, oil, sediment, or other pollutants from stormwater. According to the U.S. Environmental Protection Agency, "Hydrodynamic separators are most effective where the materials to be removed from runoff are heavy particulates - which can be settled - or floatables - which can be captured, rather than solids with poor settleability or dissolved pollutants."

The field studies evaluated for the STEP assessment predate the Stormwater Best Management Practice Demonstration Tier II Protocol (2001), which is applicable in Massachusetts and other states in the Technology Acceptance Reciprocity Partnership (TARP), to ensure quality controlled studies that can be shared among participating states. Therefore, interstate reciprocity is not available to the manufacturer, based on performance claims that were evaluated by STEP in 1998. If the TARP Protocol requirements are fulfilled in the future, the manufacturer could pursue reciprocal verification for Stormceptor systems in participating TARP states. More information on the TARP Protocol is available on the following Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp.

Applications/Advantages

- Stormceptor systems identified in Table 1 should be used in combination with other BMPs to remove 80 percent of the average annual load of TSS (DEP Stormwater Policy Standard 4). Systems may be well suited for pretreatment in a mixed component system designed for stormwater recharge.
- Performance data show that Stormceptor may provide TSS removal rates in the range of 52 percent to 77 percent when sized according to Table 1. Higher TSS removal rates were achieved during low flow, low intensity storms with less than one third of an inch of runoff. Also, by reducing the impervious drainage area, relative to the system size, the STEP Technology Assessment Report indicated that higher removal efficiencies may be achievable. However, STEP recommends collection of additional data "representing a varied set of operating conditions over a realistic maintenance cycle to verify TSS removal rates greater than 80 percent."
- The Stormceptor system is suitable for new and retrofit applications. For retrofit applications, it should not

take the place of a catch basin for the systems that have been verified. Also, for retrofit applications, it should be installed in lateral lines and not main trunk lines.

- The system is particularly well suited in constricted areas and where space is limited.
- t also is suitable for use in areas of high potential pollutant loads (DEP Stormwater Policy Standard 5), where it may be used effectively in capturing and containing oil and chemical spills. *Web site*: www.state.ma.us/dep/ brp/stormwtr/stormpub.htm.

Considerations/Limitations

- Systems are not expected to provide significant nutrient (nitrogen and phosphorus) or fecal coliform removal.
- The systems are not recommended for use in critical areas, such as public drinking water supplies, certified vernal pools, public swimming beaches, shellfish growing areas, cold water fisheries, and some Areas of Critical Environmental Concern (ACECs), except as a pretreatment device for BMPs that have been approved by DEP for use in critical areas. The structural BMPs approved for use in critical areas are described in Standard 6 of the Stormwater Management Policy, www.state.ma.us/dep/brp/stormwtr/stormpub.htm.
- There is a limited set of useful data for predicting the relationship between treatment efficiency and loading rates. Removal efficiencies have not been demonstrated for all unit sizes.
- Further research is needed to determine how much TSS bypasses the treatment chamber during certain, higher velocity storm events which recur less frequently.
- Systems require regular maintenance to minimize the potential for washout of the accumulated sediments.

STC 1200 0.75 STC 1800 1 STC 2400 1 STC 3600 1.25 STC 4800 1 STC 6000 1.5

been estimated to be 50 to 100 years.

Model Number

STC 900

STC 7200

Table 2: The Stormceptor clean out is based on 15 percent of the sediment storage volume in the

averaging \$300 to \$500. The expected life of a system has

Sediment Depths Indicating Required Maintenance

Sediment Depth (feet)

0.5

1.25

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United States Environmental Protection Agency. "Storm Water Technology Fact Sheet Hydrodynamic Separators." EPA 832-F-99-017.

Stormceptor Web sites: www.rinkermaterials.com/stormceptor

TARP Web site: www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp

Reliability/Maintenance

All BMPs require scheduled, routine maintenance to ensure that they operate as efficiently as possible. Although maintenance requirements are site specific, a general relationship between cleaning needs and depths of sediment has been established by the manufacturer. Inspection of the Stormceptor interior should be done after major storm events, particularly in the first year of operation. It is recommended that material in the treatment chamber be pumped out by a vacuum truck semiannually, or when the sediment and pollutant loads reach about 15 percent of the total storage. If the unit is used for spill containment, it should be pumped after the event is contained. Typical cleaning costs were estimated by the manufacturer in 1998 to be \$250, with disposal costs

STEP Verification vs. Regulatory Approval

STEP assistance to developers of innovative technologies and STEP verification of stormwater treatment systems is not required to receive necessary approvals from conservation commissions or the Department of Environmental Protection (DEP). However, if a system has received verification, a conservation commission shall presume that the technology will function as proposed, provided the conditions are similar to those in which performance was verified. STEP reports are not technology approvals, and do not constitute an endorsement or recommendation for use. Questions on regulatory issues should be referred to the DEP regional offices.