

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: DDmitruk@coneco.com

FEBRUARY 14, 2022
Revised July 14, 2023

TABLE OF CONTENTS

MASSACHUSETTS DEP CHECKLIST FOR STORMWATER REPORT

INTRODUCTION

STORMWATER MANAGEMENT SYSTEM OVERVIEW

METHODOLOGY

EXISTING CONDITIONS

Table 1 Existing Soil Classifications

PROPOSED CONDITIONS

STORMWATER MANAGEMENT STANDARDS REVIEW

Table 2 Total Suspended Solids Removal

Table 3 Vernal Pool Volume Comparisons

CONCLUSION/SUMMARY

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

APPENDIX A – EXISTING HYDROLOGICAL CONDITIONS

HydroCAD Analysis Printouts for 2-yr, 10-yr, 25-yr, & 100-yr Storm Events

APPENDIX B – PROPOSED HYDROLOGICAL CONDITIONS

HydroCAD Analysis Printouts for 2-yr, 10-yr, 25-yr & 100-yr Storm Events

APPENDIX C – DRAINAGE SYSTEM CALCULATIONS

APPENDIX D – LONG TERM POLLUTION PREVENTION PLAN

APPENDIX E – OPERATION AND MAINTENANCE PLAN AND LOG

APPENDIX F – SOIL LOGS

APPENDIX G – ILLICIT DISCHARGE COMPLIANCE STATEMENT

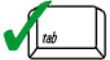
APPENDIX H – STORMCEPTOR SIZING REPORTS AND OWNERS' MANUAL



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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



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.

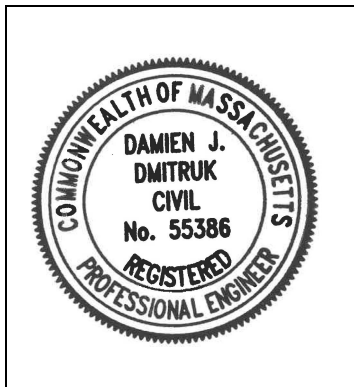
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



7/14/2023

Signature and Date

Checklist

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

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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



Checklist for Stormwater Report

Checklist (continued)

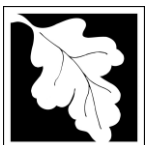
Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☒ Static
 - ☐ Simple Dynamic
 - ☐ Dynamic Field¹
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- ☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☒ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☒ is near or to other critical areas
 - ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☒ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☒ Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
 - ☐ Redevelopment Project
 - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☒ Description and delineation of public safety features;
 - ☐ Estimated operation and maintenance budget; and
 - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☒ An Illicit Discharge Compliance Statement is attached;
- ☐ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

INTRODUCTION

Coneco Engineers & Scientists, Incorporated (Coneco) has completed a drainage analysis of the subject property, located at 75-79 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 with 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, underground piping, drain manholes, proprietary particle separators, a bioretention area (rain garden), underground infiltration chambers, and outlet control structures, which will work in combination to collect, control, and treat runoff discharging from the site.

The site's stormwater flows will travel overland through drainage channels and site grading features until they are captured in one of the underground drainage systems. 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 through a system of pipes and drain manholes. The closed drainage system has been designed to accommodate a 25-year rainfall event.

The site has been equipped with multiple subsurface infiltration chamber systems for the control and treatment of stormwater. Pre-treatment proprietary separators have been provided to facilitate Total Suspended Solids (TSS) removal. Using hydrodynamic separation, the proprietary particle separators provide the required pretreatment TSS removal for the downstream infiltration chamber systems and rain gardens.

The infiltration chamber systems with isolation rows and the rain garden have been designed to provide water quality treatment, groundwater recharge, and attenuation of the proposed peak flow rates and volumes to that of the existing conditions or less. Multistage spillways and weir manholes have been incorporated to facilitate the discharge of stormwater during a high magnitude storm event.

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 point discharges.

From an environmentally sensitive perspective, the aforementioned measures coupled with the introduction of grassed and landscaped areas to previously sparsely vegetated and uncontrolled areas will result in a stormwater design that enhances the introduction of surface water into the ground while preserving the natural hydrologic conditions.

The remainder of this report demonstrates in detail how the proposed site conditions follows the design requirements set forth by Massachusetts Stormwater Standards as well as supplying the necessary calculations for these requirements.

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 conditions 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 (T_c) and Curve Number (CN)), and NOAA Atlas 14 (Atlas-14, rainfall intensity), and the stormwater detention facilities were modeled using the SCS Storage Indication Method.

Time of Concentration (T_c) - 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.

Curve Number (CN) - 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 most 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.

The Hydrologic Soil Group (HSG) 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.

Design Software - 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.

Peak Attenuation - 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 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 a mix of wooded, brush, and cleared bare soil areas. Access paths connect the two major upland areas bisecting the wetland areas. Existing culverts provide 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.

Table 1

Existing Soil Classifications

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	B
619A	Deerfield-Urban land complex, 0 to 3 percent slopes	A
626B	Merrimac – Urban land complex, 0 to 8 percent slopes	A
655A	Udorthents, wet substratum, 0 to 3 percent slopes	B/D

PROPOSED CONDITIONS

The proposed development consists of two apartment buildings and recreational open space areas with associated access drives, parking areas, walkways, utilities, and drainage systems included 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 the bioretention basin and the underground infiltration facilities. This results in a reduction of the peak rate of runoff. Furthermore, due to the deep sump catch basins with oil/gas hoods, proprietary separators, rain garden, and infiltration facilities, the runoff from the impervious areas will undergo the required treatment prior to its 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, a bioretention basin, and/or infiltration chamber systems. The deep sump catch basins with hoods will provide pretreatment. The deep sump will allow sediment to settle out and the hood will withhold oils and gas from continuing through the drainage system. The proprietary separators will provide further pretreatment using hydrodynamic separation to remove pollutants before discharging into a treatment or infiltration facility. Infiltration chambers will provide treatment and the required groundwater recharge. An isolation row will be installed at the inlet row of each chamber facility to further treat stormwater prior to being infiltrated. The bioretention area at the front of the site will provide treatment for stormwater at the entrance of the development. Outlets from the stormwater facilities have been designed to reduce erosion and eliminate scouring within the wetland areas by utilizing a plunge pool at each discharge point. The plunge pools will be lined with riprap and be depressed to form a pool which will enhance sediment removal prior to discharging runoff over a larger area, slowing the velocity and therefore reducing 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 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 and Total Volume 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:

1. 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:

$$Q = (A_p) (1.486/n) (s^{1/2}) (h^{2/3})$$

Q = Flow in CFS

A_p = 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 is intended to handle 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, and 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.

In accordance with the required recharge volume calculations, the on-site infiltration system must be designed with a minimum infiltration capacity of 8,920 cubic feet. The proposed design directs 95.4% of the proposed impervious on site to recharge facilities, requiring the use of an adjustment factor and increasing the required recharge volume to 9,348 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 35,453 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 removing 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 proprietary separators.

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.

Table 2
Total Suspended Solids Removal

Treatment Train 1 (Infiltration Chamber Systems A & B)

<i>BMP</i>	<i>TSS Removal Rate</i>	<i>Starting TSS Load</i>	<i>TSS Removed</i>	<i>Remaining TSS Load</i>
Catch Basin	0.25	1.00	Pretreatment	1.00
Proprietary Separator	0.52	1.00	Pretreatment	1.00
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 2 (Infiltration Chamber System C)

<i>BMP</i>	<i>TSS Removal Rate</i>	<i>Starting TSS Load</i>	<i>TSS Removed</i>	<i>Remaining TSS Load</i>
Proprietary Separator	0.52	1.00	Pretreatment	1.00
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 System D & E - Roof)

<i>BMP</i>	<i>TSS Removal Rate</i>	<i>Starting TSS Load</i>	<i>TSS Removed</i>	<i>Remaining TSS Load</i>
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 4 (Rain Garden)

<i>BMP</i>	<i>TSS Removal Rate</i>	<i>Starting TSS Load</i>	<i>TSS Removed</i>	<i>Remaining TSS Load</i>
Catch Basin	0.25	1.00	Pretreatment	1.00
Proprietary Separator	0.52	1.00	Pretreatment	1.00
Bioretention Area (Rain Garden)	0.90	1.00	0.90	0.10
Total Suspended Solids Removed:				90%

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.

Each of the infiltration chamber systems have been sized to hold its own portion of the water quality volume through the Static Method. See Appendix C for the required water quality volume calculations. Static volume of each BMP was determined by choosing the volume below the lowest invert through the Stage-Storage tables within the HydroCAD model.

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. The site is not within and does not 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 require at least 44% TSS pretreatment prior to discharging into an infiltration facility. The TSS removal treatment trains for infiltration facilities will meet this requirement by the use of deep sump catch basins with gas hoods and propriety separators. All infiltration chambers have been designed with an isolation row as an additional measure on the above pretreatment requirements. The primary source of pollution for the site will be the paved roadways and parking areas, which are a necessary and integral part of the overall project. The stormwater treatment trains have been designed to meet all DEP stormwater standards.

In addition, 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 will occur as a result of the project. HydroCAD calculations for this analysis can be found in Appendix C of this report.

Table 3
VERNAL POOL VOLUME COMPARISON

	EXISTING CONDITIONS VOLUME (cf)	PROPOSED CONDITIONS VOLUME (cf)
2.78" 24-HOUR (1-YEAR)	7,596	7,942

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.

This project is considered new development and is therefore required to fully meet all the Massachusetts 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.

This project will disturb more than one acre of land and will therefore be required to obtain coverage under the NPDES Construction General Permit. A Stormwater Pollution Prevention Plan (SWPPP) will be required before earth-disturbing activities commence 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 conditions. 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

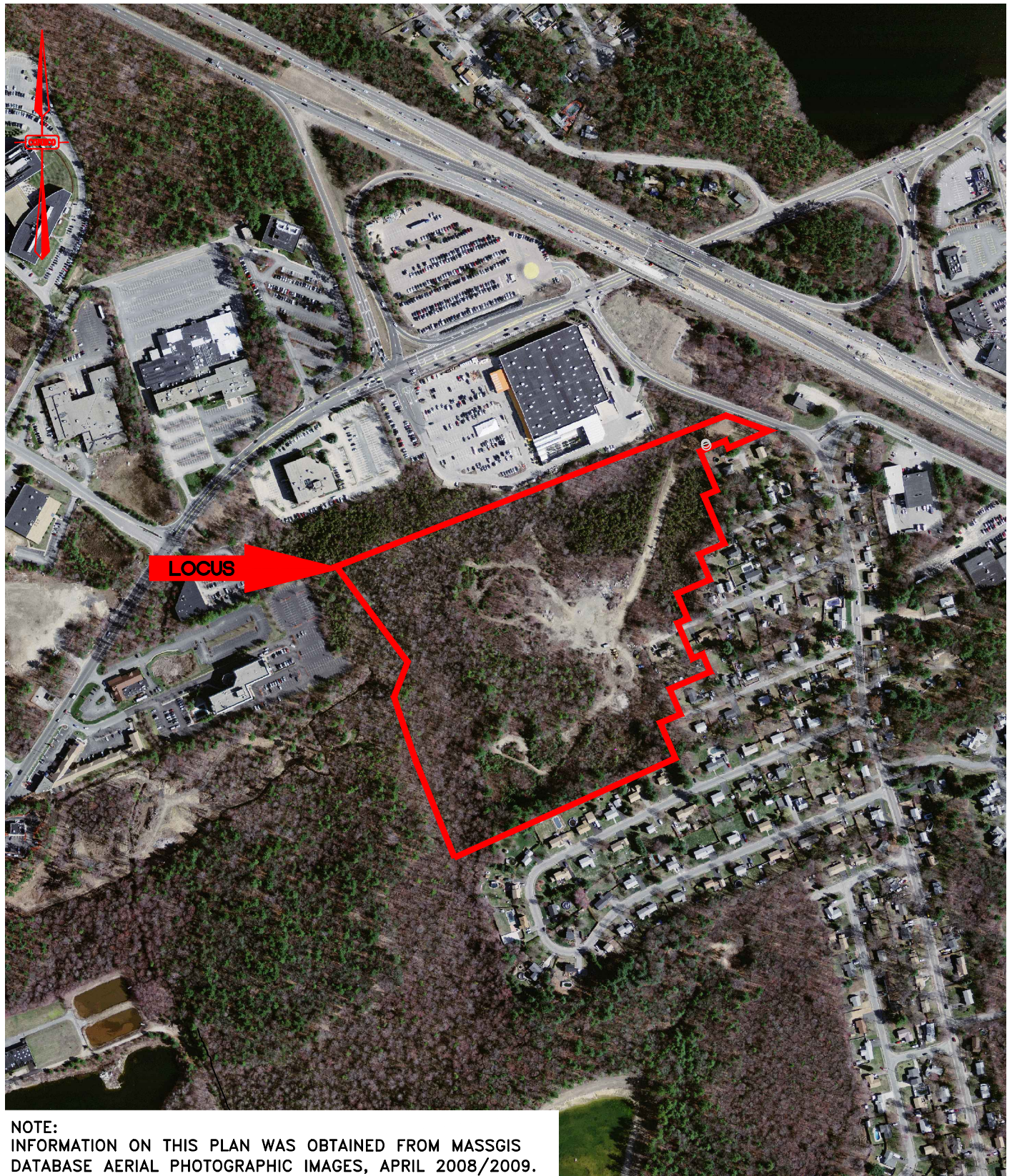
FIGURE 4 - NATURAL HERITAGE MAP

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



PREPARED FOR:

SHINGLEMILL, LLC

PLAN SET:

REPORT FIGURES

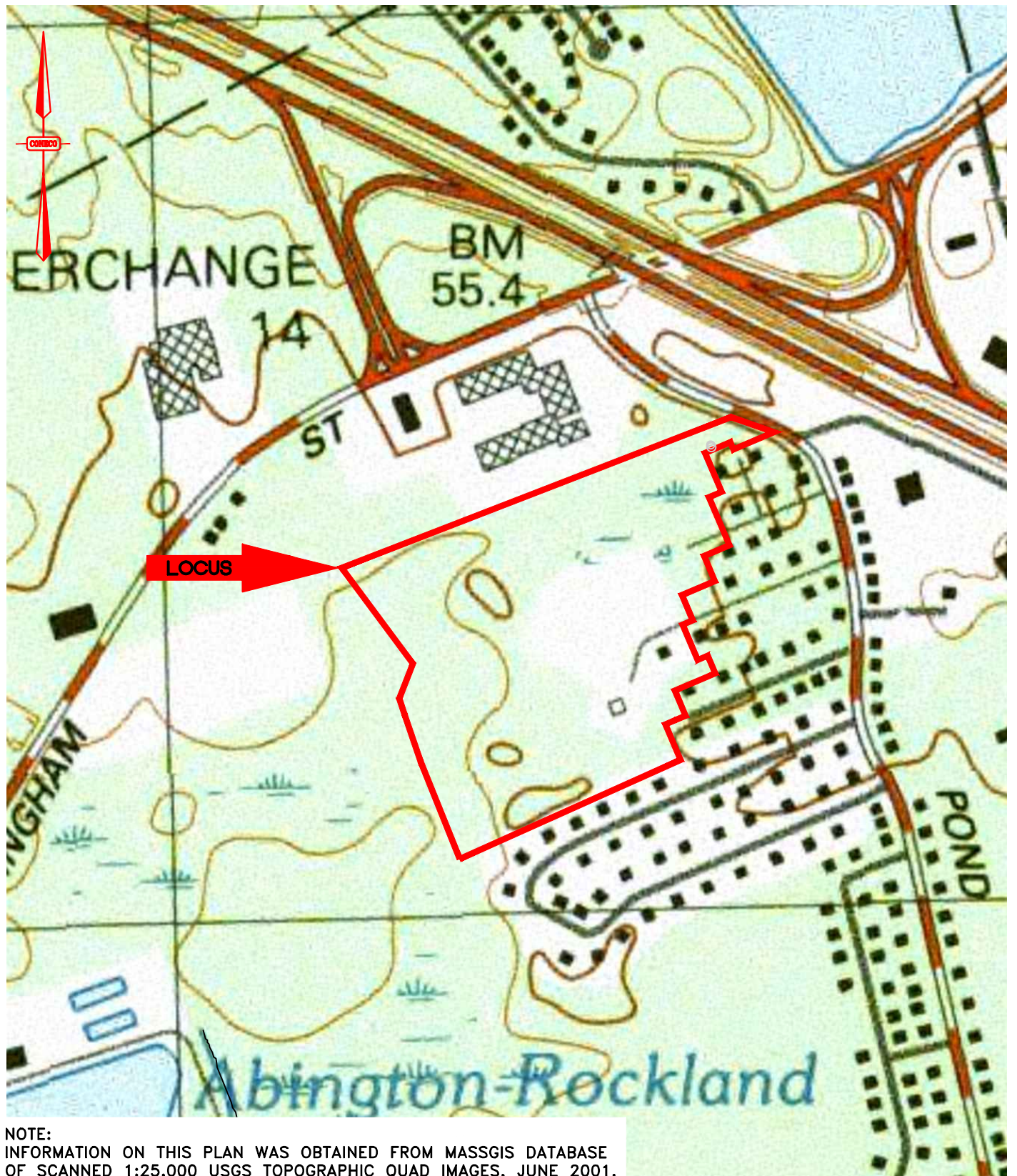
SCALE
1" = 500'

DATE
02/14/2022

PROJECT NO.
3395.1

TITLE:

FIGURE 1
AERIAL MAP



75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370



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

PREPARED FOR:

SHINGLEMILL, LLC

PLAN SET:

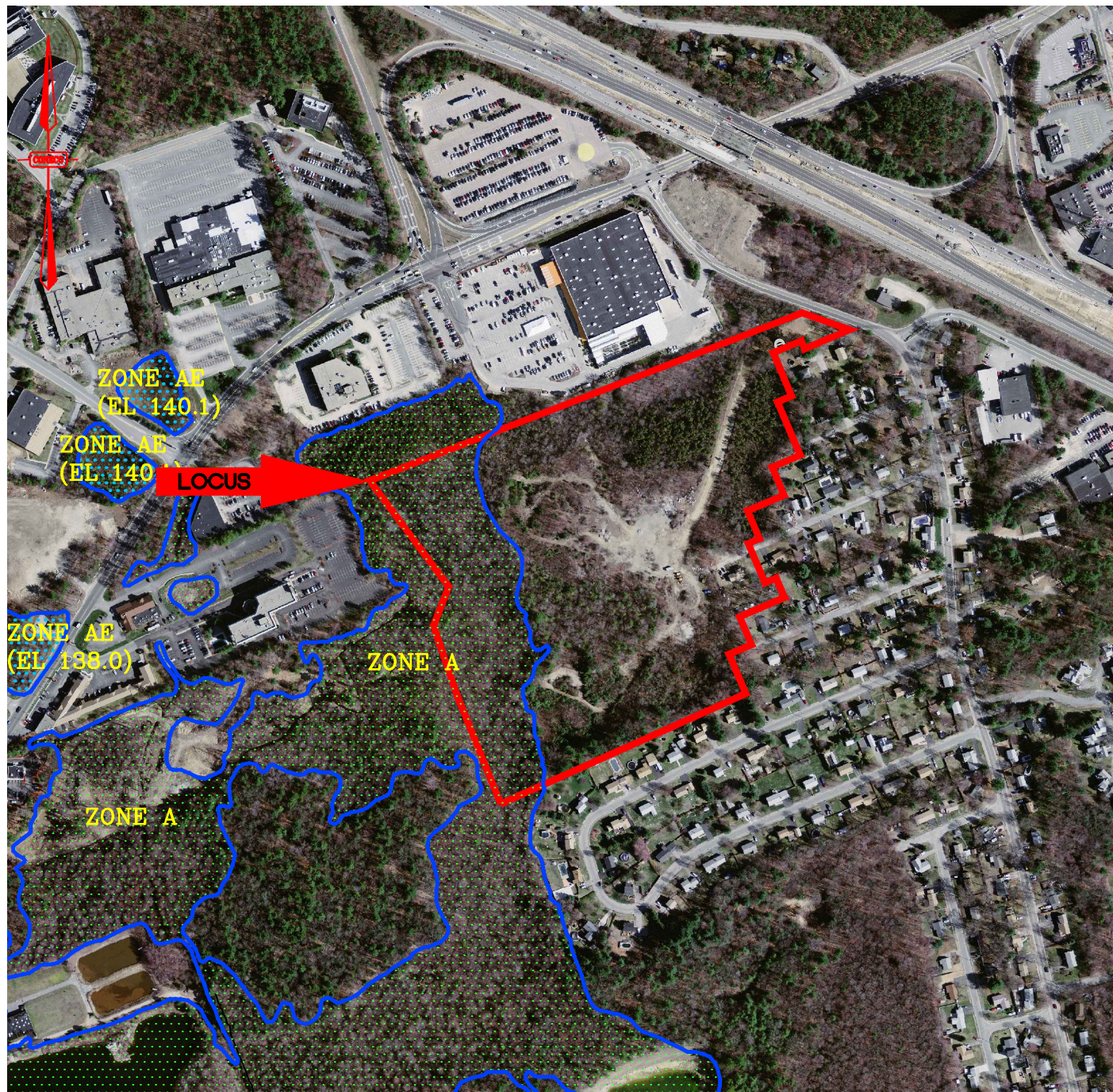
REPORT FIGURES

SCALE
1" = 500'

DATE
02/14/2022

PROJECT NO.
3395.1

TITLE:
FIGURE 2
USGS TOPOGRAPHIC
MAP



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

 FLOODWAY AREAS IN ZONE AE

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

 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.

75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370



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

PREPARED FOR:

SHINGLEMILL, LLC

PLAN SET:

REPORT FIGURES

SCALE
1" = 500'

DATE
02/14/2022

PROJECT NO.
3395.1

TITLE:
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.

75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370



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

PREPARED FOR:

SHINGLEMILL, LLC

PLAN SET:

REPORT FIGURES

SCALE

1" = 500'

DATE

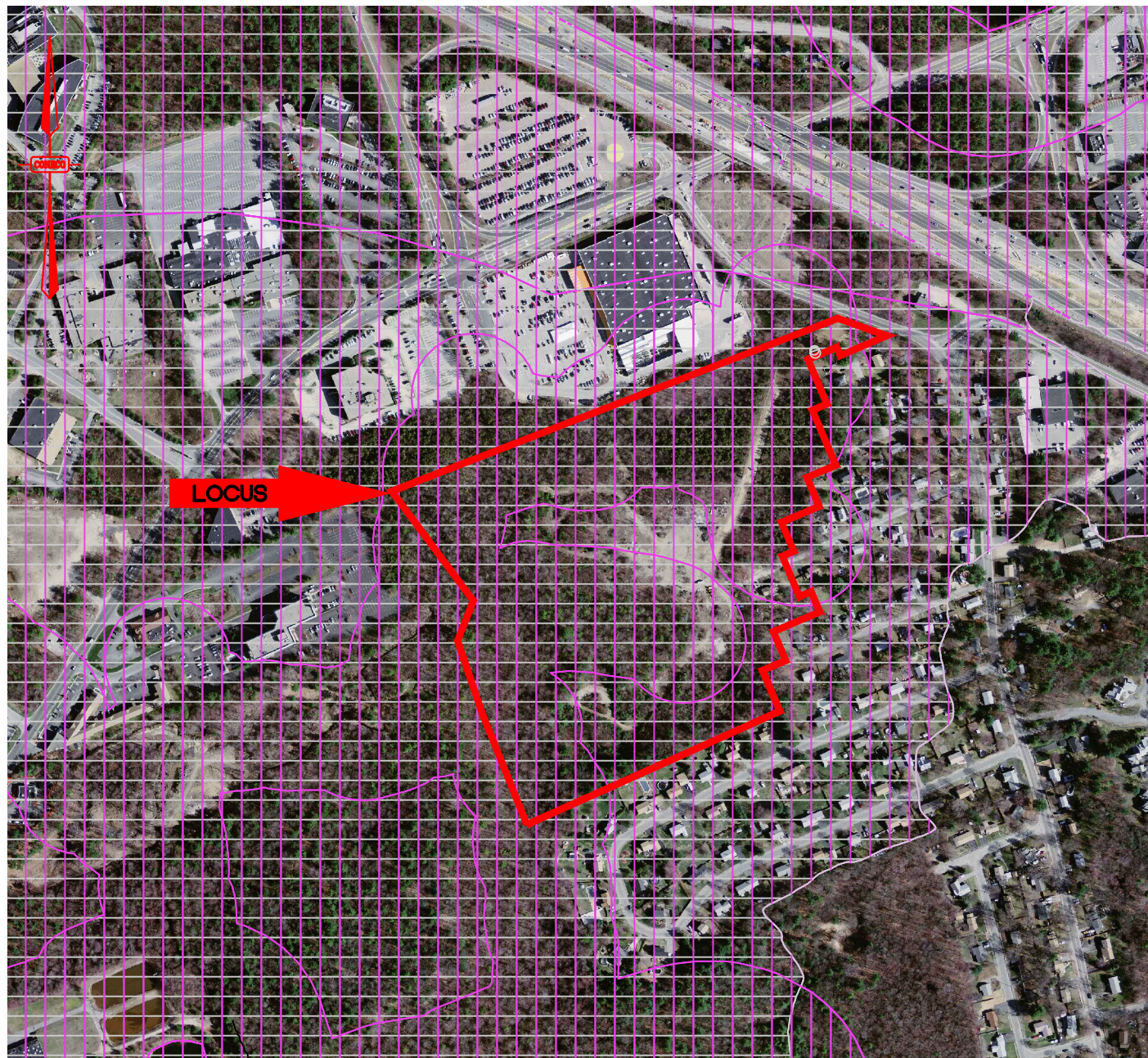
02/14/2022

PROJECT NO.

3395.1

TITLE:

FIGURE 4
NATURAL
HERITAGE MAP



AREAS OF CRITICAL ENVIRONMENTAL CONCERN



WELLHEAD PROTECTION AREAS



OUTSTANDING RESOURCE WATERS



SURFACE WATER SUPPLY PROTECTION AREAS

NOTES:

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

75-79 POND STREET, ROCKLAND, MASSACHUSETTS 02370



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

PREPARED FOR:

SHINGLEMILL, LLC

PLAN SET:

REPORT FIGURES

SCALE
1" = 500'

DATE
02/14/2022

PROJECT NO.
3395.1

TITLE:

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



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

PREPARED FOR:

SHINGLEMILL, LLC

PLAN SET:

REPORT FIGURES

SCALE

1" = 500'

DATE

02/14/2022

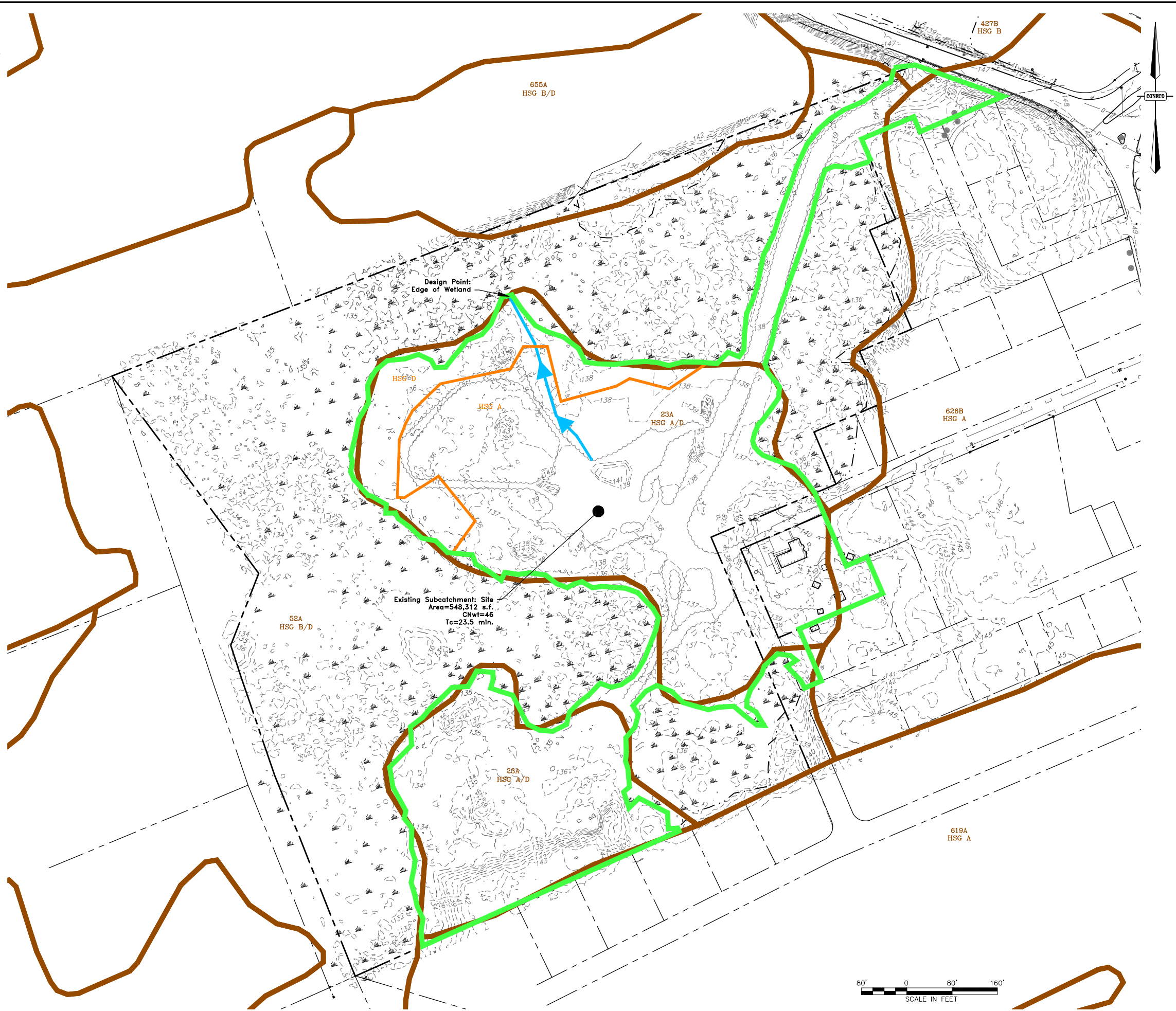
PROJECT NO.

3395.1

TITLE:

FIGURE 6
SOIL SURVEY MAP

- LEGEND
- SUBCATCHMENT BOUNDARY
 - SOILS BOUNDARY
 - SOIL GROUP BREAKLINE
 - FLOWPATH



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

DATE 02/14/2022
DESIGNED: MVK CHECKED: DJD
DRAFTED: MVK IN CHARGE: DJD
SCALE: 1" = 80'
PROJECT NO. 3395.1
SHEET NO.

SHINGLEMILL APARTMENTS
75-79 POND STREET
ROCKLAND, MASSACHUSETTS 02370

REPORT FIGURES

SHINGLEMILL, LLC
4 FIRST STREET
BRIDGEWATER, MASSACHUSETTS 02324

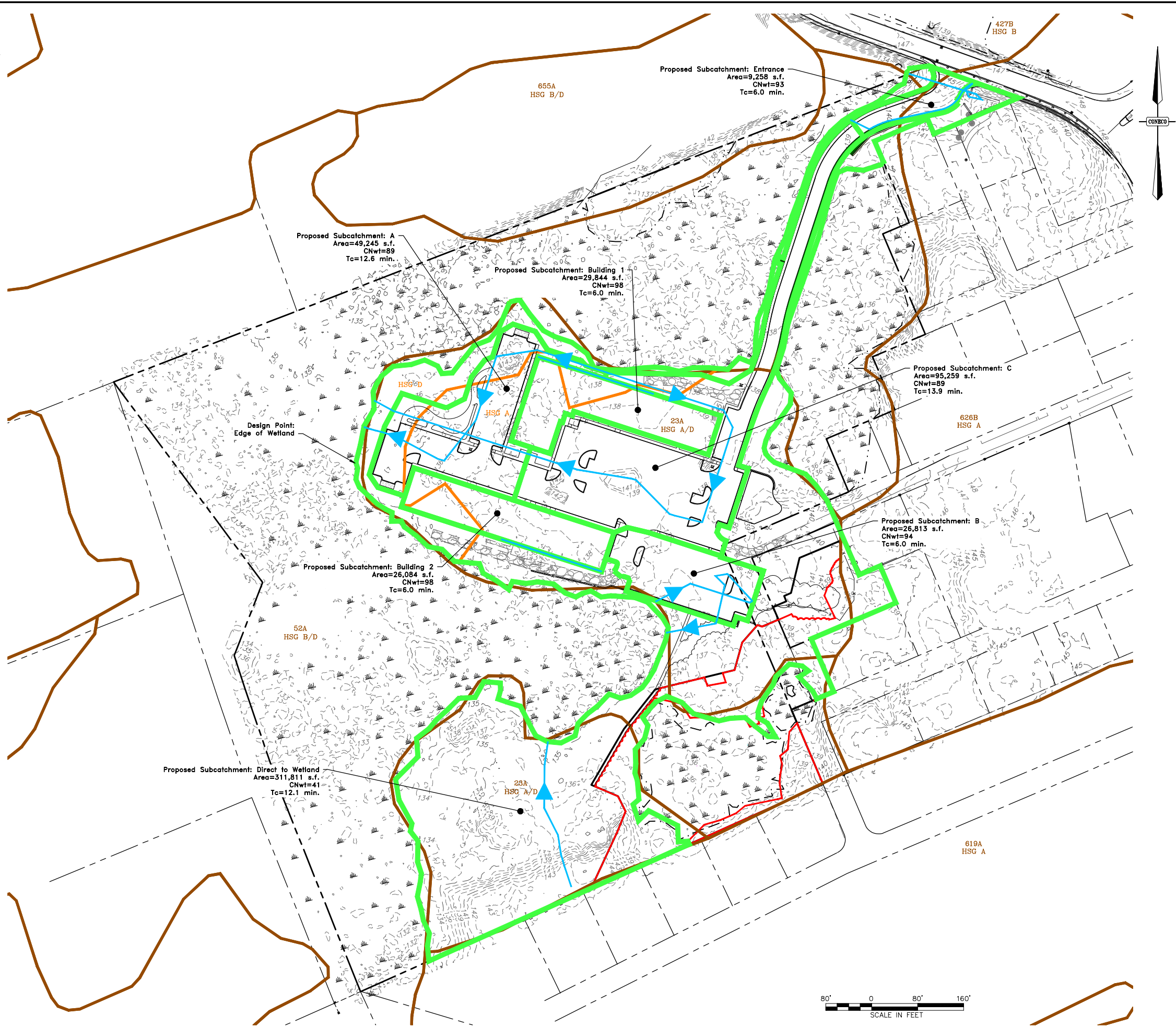
EXISTING DRAINAGE AREAS

REVISIONS	
NO.	DATE
1	7/23/2022
2	4/26/2023
3	7/11/2023

DESCRIPTION	DR/CK
GRADING & DRAINAGE REDESIGN	DJD/MSD
PER REVIEW COMMENTS	BTM/DJD
PER REVIEW COMMENTS	BTM/DJD

FIGURE 7

- LEGEND
- SUBCATCHMENT BOUNDARY
 - SOILS BOUNDARY
 - SOIL GROUP BREAK
 - FLOWPATH



REVISIONS		DESCRIPTION		DATE	
NO.	DATE	DESCRIPTION	DATE	NO.	DATE
1	9/23/2022	GRADING & DRAINAGE REDESIGN	9/23/2022	1	9/23/2022
2	4/26/2023	PER REVIEW COMMENTS	4/26/2023	2	4/26/2023

PROJECT	PREPARED FOR	DRAINAGE
SHINGLEMILL APARTMENTS 75-79 POND STREET ROCKLAND, MASSACHUSETTS 02370	SHINGLEMILL, LLC 4 FIRST STREET BRIDGEWATER, MASSACHUSETTS 02324	PROPOSED DRAINAGE AREAS

DATE	DESIGNED	CHECKED	DRAFTED	SCALE	PROJECT NO.	SHEET NO.
02/14/2022	MVK	DJD	MVK	1" = 80'	3395.1	

FIGURE 8

APPENDIX A

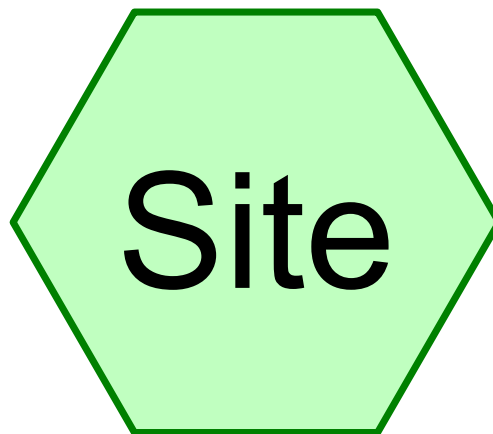
EXISTING HYDROLOGICAL CONDITIONS

2-YEAR STORM EVENT

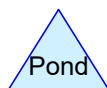
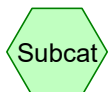
10-YEAR STORM EVENT

25-YEAR STORM EVENT

100-YEAR STORM EVENT



Site



Routing Diagram for 3395.1 - 0 Pond Street - Existing Conditions
Prepared by {enter your company name here}, Printed 7/17/2023
HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

3395.1 - 0 Pond Street - Existing Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 2

Summary for Subcatchment Site: Site

Runoff = 0.11 cfs @ 14.62 hrs, Volume= 3,602 cf, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
326,445	30	Woods, Good, HSG A
9,831	30	Brush, Good, HSG A
1,363	76	Gravel roads, HSG A
76,849	72	Dirt roads, HSG A
13,847	39	>75% Grass cover, Good, HSG A
5,089	98	Paved roads w/curbs & sewers, HSG A
31,739	55	Woods, Good, HSG B
339	48	Brush, Good, HSG B
23,146	82	Dirt roads, HSG B
58,582	77	Woods, Good, HSG D
1,082	73	Brush, Good, HSG D
548,312	46	Weighted Average
543,223		99.07% Pervious Area
5,089		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		Sheet Flow, Wooded AD
					Woods: Light underbrush n= 0.400 P2= 3.35"
9.0	280	0.0107	0.52		Shallow Concentrated Flow, Woodled AD
					Woodland Kv= 5.0 fps
23.5	330	Total			

3395.1 - 0 Pond Street - Existing Conditions

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

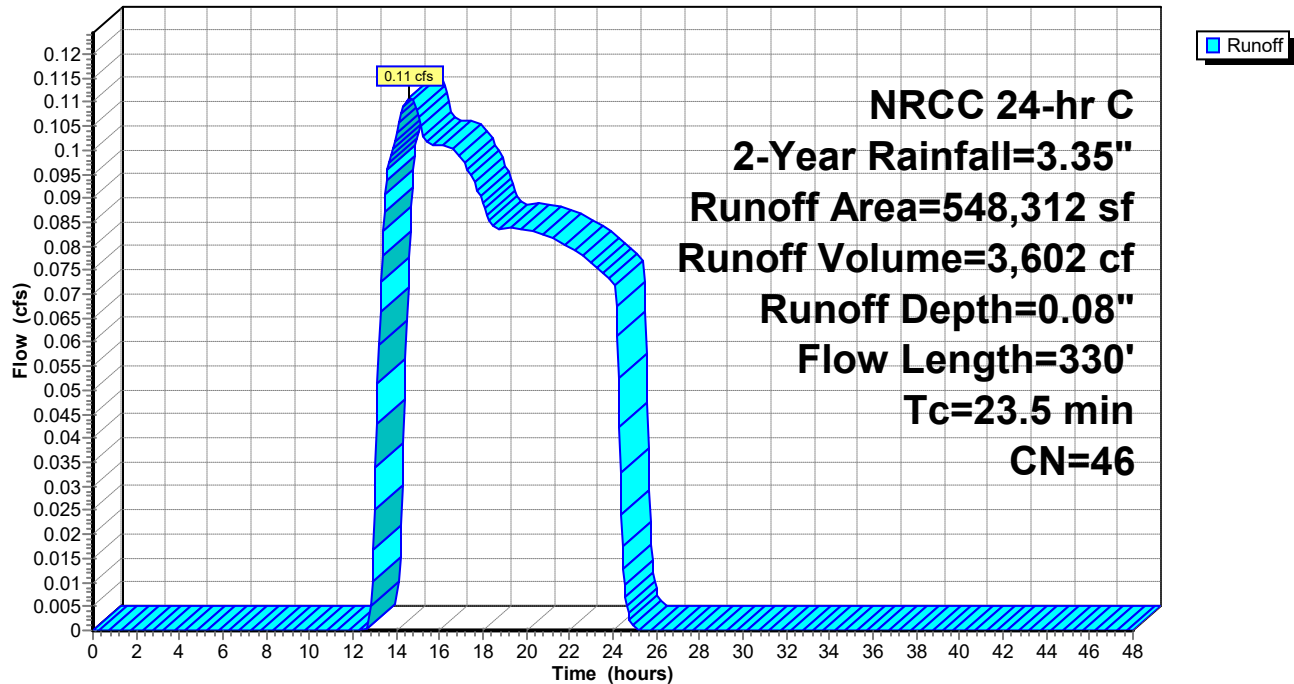
NRCC 24-hr C 2-Year Rainfall=3.35"

Printed 7/17/2023

Page 3

Subcatchment Site: Site

Hydrograph



3395.1 - 0 Pond Street - Existing Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 4

Summary for Subcatchment Site: Site

Runoff = 1.96 cfs @ 12.49 hrs, Volume= 21,574 cf, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
326,445	30	Woods, Good, HSG A
9,831	30	Brush, Good, HSG A
1,363	76	Gravel roads, HSG A
76,849	72	Dirt roads, HSG A
13,847	39	>75% Grass cover, Good, HSG A
5,089	98	Paved roads w/curbs & sewers, HSG A
31,739	55	Woods, Good, HSG B
339	48	Brush, Good, HSG B
23,146	82	Dirt roads, HSG B
58,582	77	Woods, Good, HSG D
1,082	73	Brush, Good, HSG D
548,312	46	Weighted Average
543,223		99.07% Pervious Area
5,089		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		Sheet Flow, Wooded AD
					Woods: Light underbrush n= 0.400 P2= 3.35"
9.0	280	0.0107	0.52		Shallow Concentrated Flow, Woodled AD
					Woodland Kv= 5.0 fps
23.5	330	Total			

3395.1 - 0 Pond Street - Existing Conditions

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

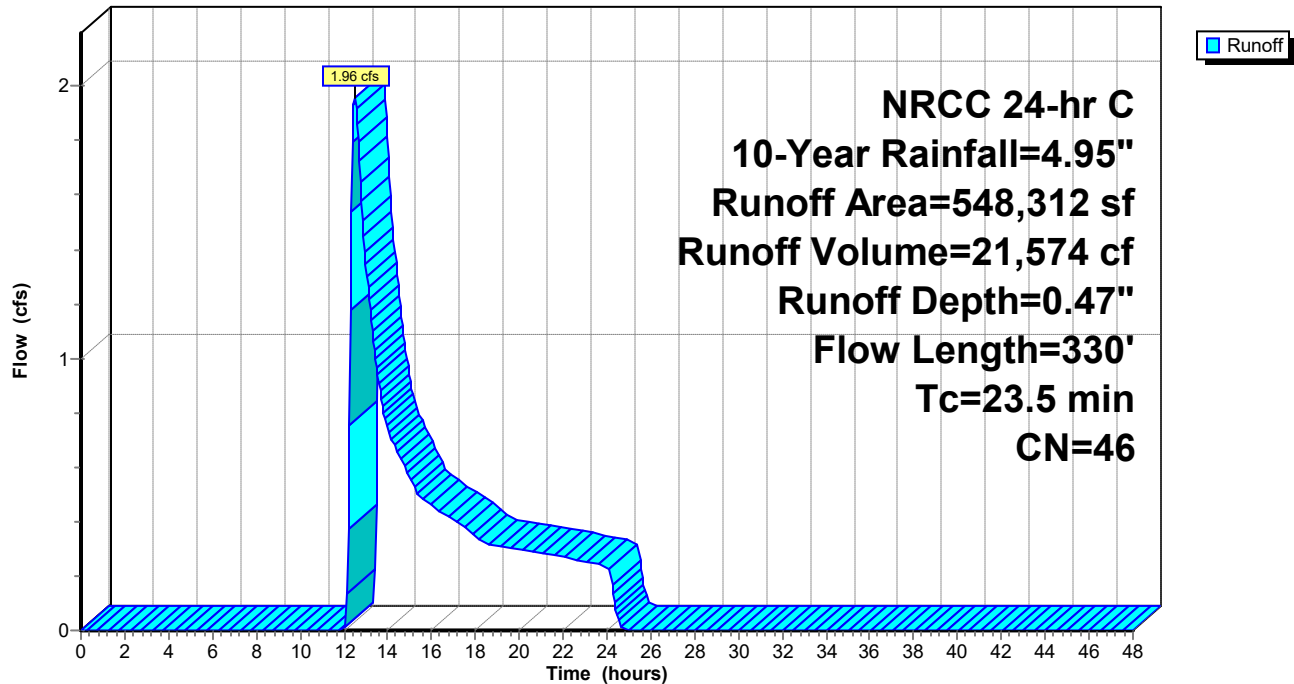
NRCC 24-hr C 10-Year Rainfall=4.95"

Printed 7/17/2023

Page 5

Subcatchment Site: Site

Hydrograph



3395.1 - 0 Pond Street - Existing Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 6

Summary for Subcatchment Site: Site

Runoff = 6.07 cfs @ 12.41 hrs, Volume= 43,291 cf, Depth= 0.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
326,445	30	Woods, Good, HSG A
9,831	30	Brush, Good, HSG A
1,363	76	Gravel roads, HSG A
76,849	72	Dirt roads, HSG A
13,847	39	>75% Grass cover, Good, HSG A
5,089	98	Paved roads w/curbs & sewers, HSG A
31,739	55	Woods, Good, HSG B
339	48	Brush, Good, HSG B
23,146	82	Dirt roads, HSG B
58,582	77	Woods, Good, HSG D
1,082	73	Brush, Good, HSG D
548,312	46	Weighted Average
543,223		99.07% Pervious Area
5,089		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		Sheet Flow, Wooded AD
					Woods: Light underbrush n= 0.400 P2= 3.35"
9.0	280	0.0107	0.52		Shallow Concentrated Flow, Woodled AD
					Woodland Kv= 5.0 fps
23.5	330	Total			

3395.1 - 0 Pond Street - Existing Conditions

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

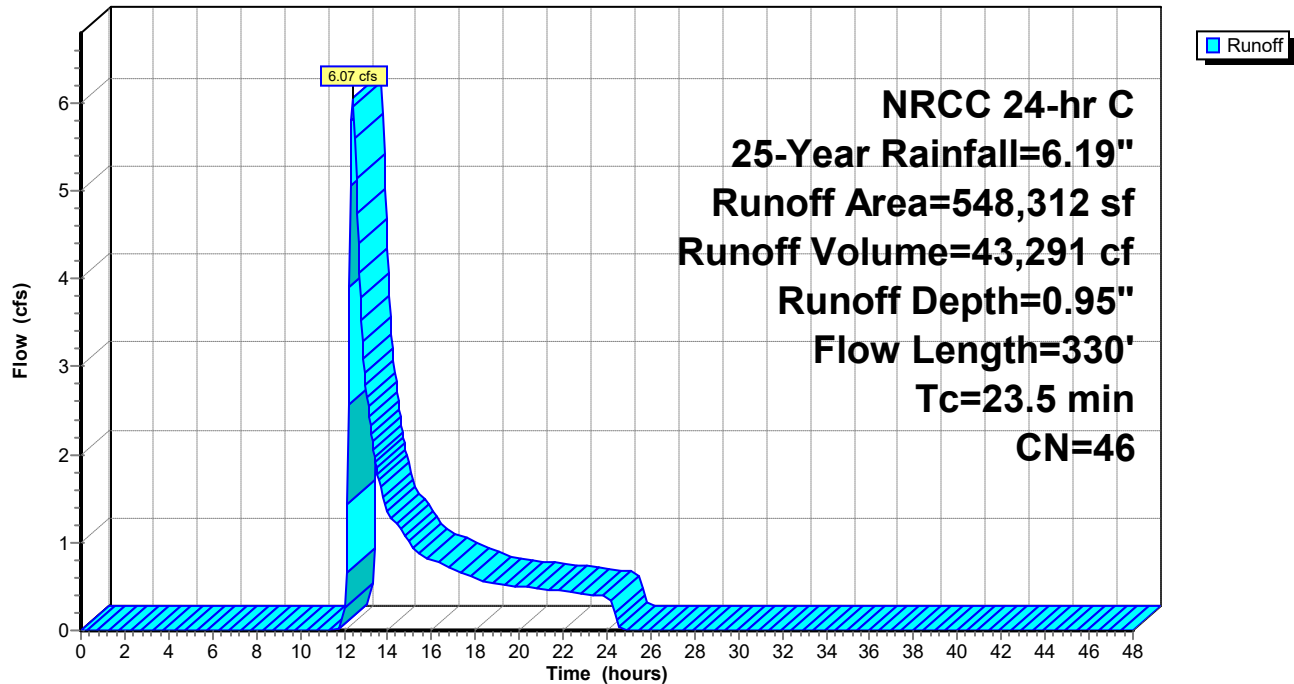
NRCC 24-hr C 25-Year Rainfall=6.19"

Printed 7/17/2023

Page 7

Subcatchment Site: Site

Hydrograph



3395.1 - 0 Pond Street - Existing Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 8

Summary for Subcatchment Site: Site

Runoff = 18.33 cfs @ 12.37 hrs, Volume= 101,382 cf, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.05 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
326,445	30	Woods, Good, HSG A
9,831	30	Brush, Good, HSG A
1,363	76	Gravel roads, HSG A
76,849	72	Dirt roads, HSG A
13,847	39	>75% Grass cover, Good, HSG A
5,089	98	Paved roads w/curbs & sewers, HSG A
31,739	55	Woods, Good, HSG B
339	48	Brush, Good, HSG B
23,146	82	Dirt roads, HSG B
58,582	77	Woods, Good, HSG D
1,082	73	Brush, Good, HSG D
548,312	46	Weighted Average
543,223		99.07% Pervious Area
5,089		0.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	50	0.0125	0.06		Sheet Flow, Wooded AD
					Woods: Light underbrush n= 0.400 P2= 3.35"
9.0	280	0.0107	0.52		Shallow Concentrated Flow, Woodled AD
					Woodland Kv= 5.0 fps
23.5	330	Total			

3395.1 - 0 Pond Street - Existing Conditions

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

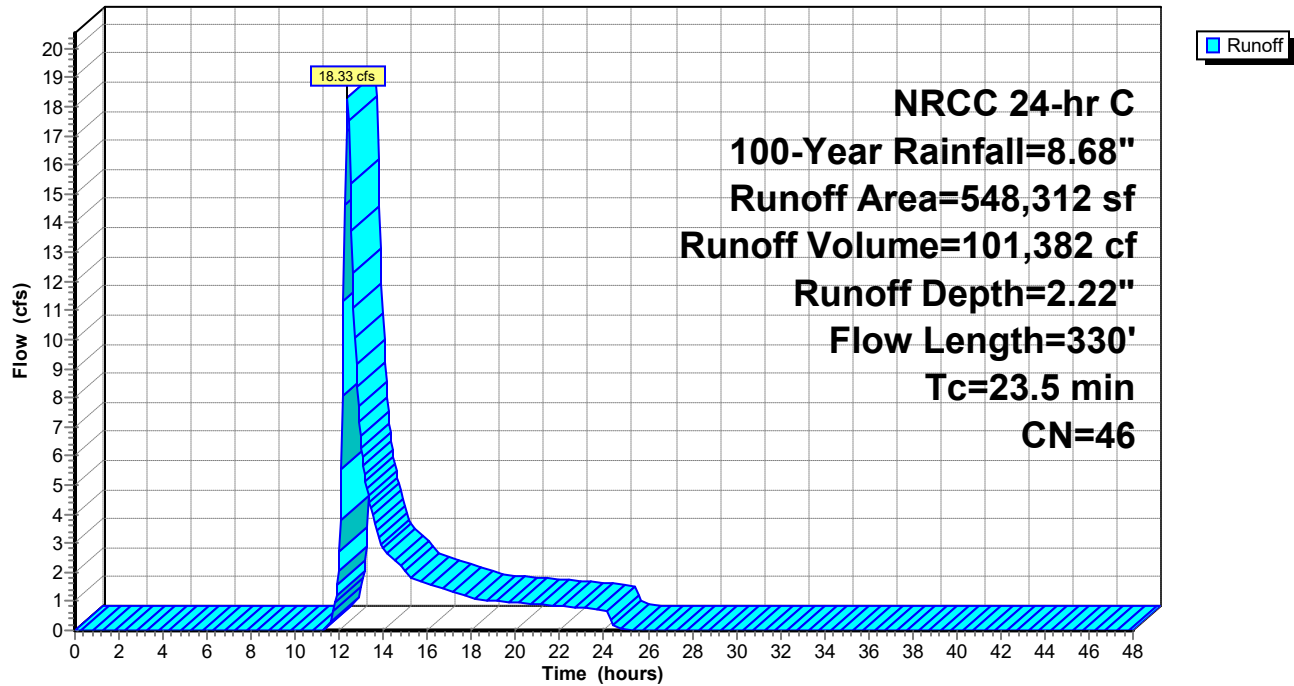
NRCC 24-hr C 100-Year Rainfall=8.68"

Printed 7/17/2023

Page 9

Subcatchment Site: Site

Hydrograph



APPENDIX B

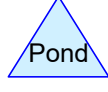
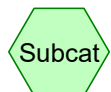
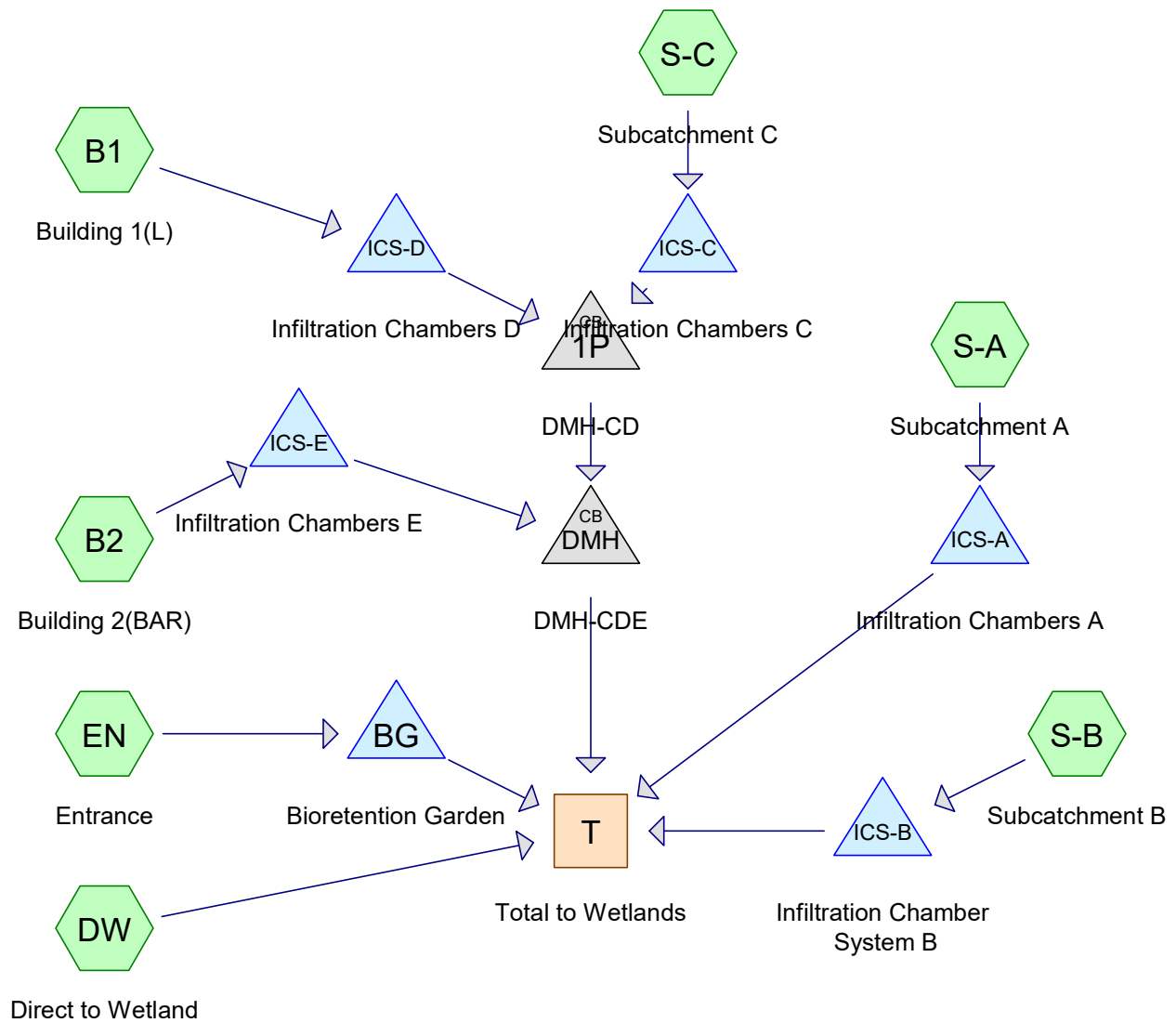
PROPOSED HYDROLOGICAL CONDITIONS

2-YEAR STORM EVENT

10-YEAR STORM EVENT

25-YEAR STORM EVENT

100-YEAR STORM EVENT



Routing Diagram for 3395.1 - 0 Pond Street - Proposed Conditions
 Prepared by {enter your company name here}, Printed 7/17/2023
 HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 2

Summary for Subcatchment B1: Building 1(L)

Runoff = 2.35 cfs @ 12.13 hrs, Volume= 7,752 cf, Depth= 3.12"

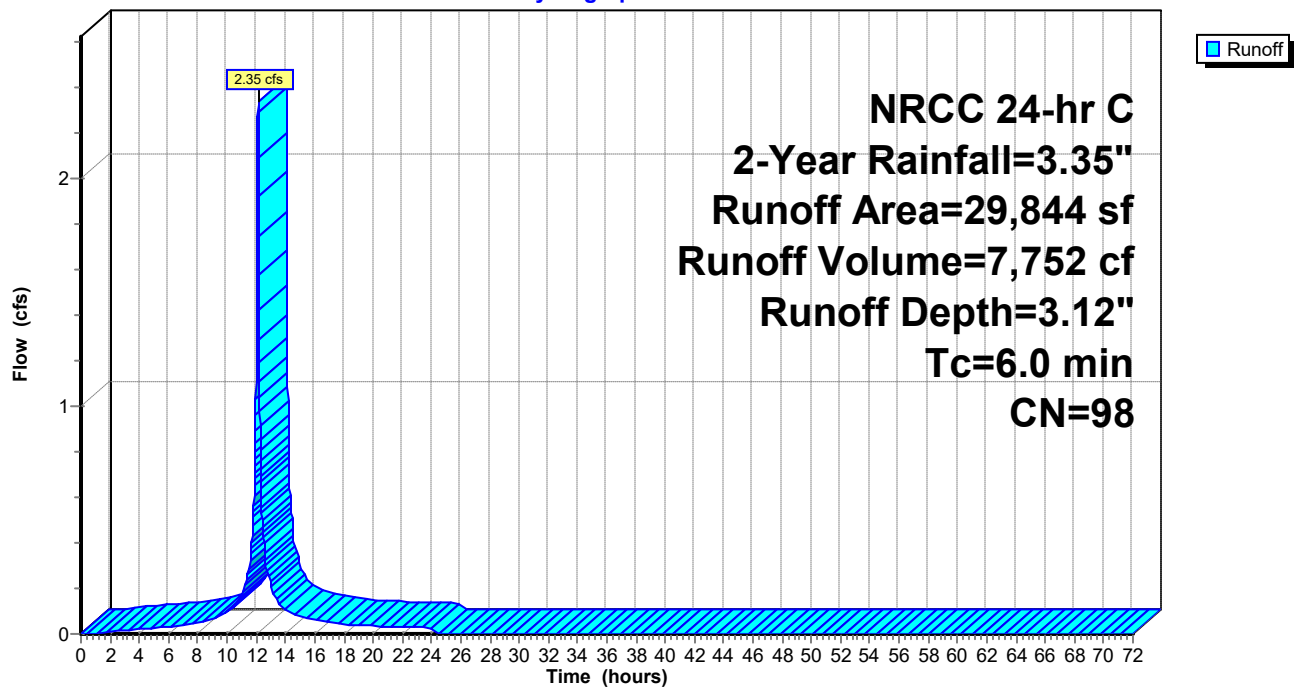
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
29,844	98	Unconnected roofs, HSG A
29,844		100.00% Impervious Area
29,844		100.00% Unconnected

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

Subcatchment B1: Building 1(L)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 3

Summary for Subcatchment B2: Building 2(BAR)

Runoff = 2.05 cfs @ 12.13 hrs, Volume= 6,775 cf, Depth= 3.12"

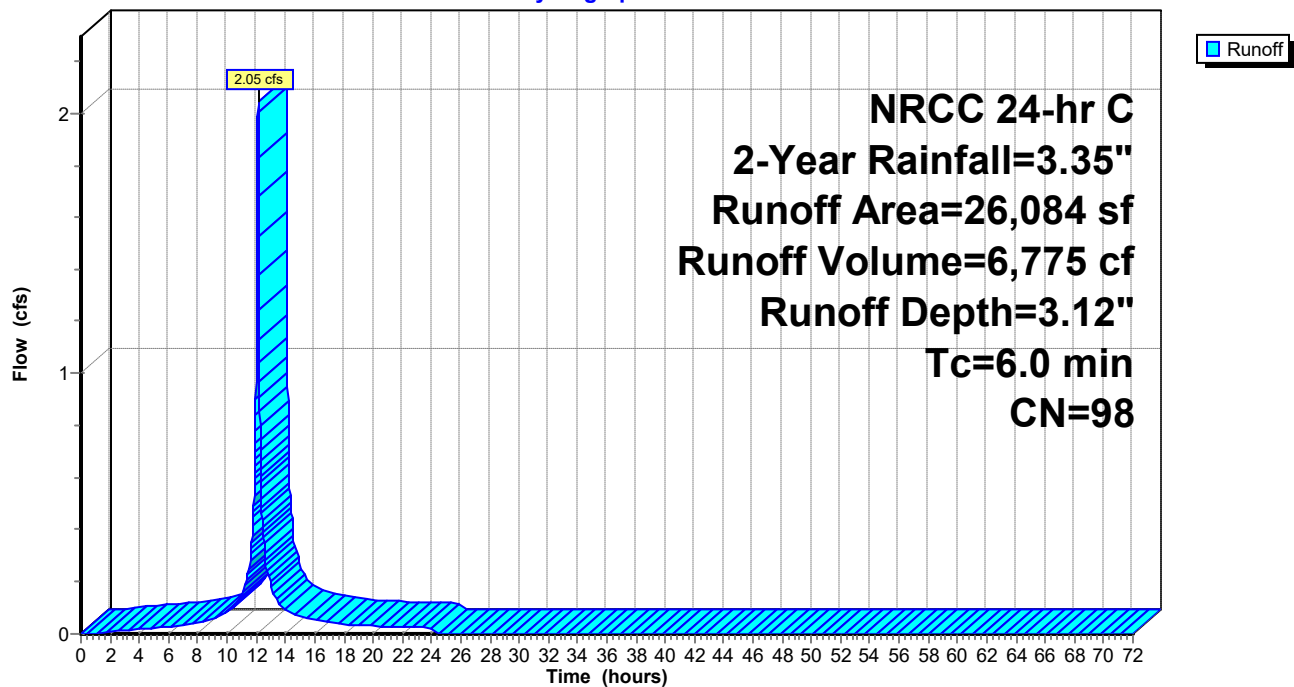
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
26,084	98	Unconnected roofs, HSG A
26,084		100.00% Impervious Area
26,084		100.00% Unconnected

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

Subcatchment B2: Building 2(BAR)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 4

Summary for Subcatchment DW: Direct to Wetland

Runoff = 0.02 cfs @ 23.14 hrs, Volume= 389 cf, Depth= 0.01"

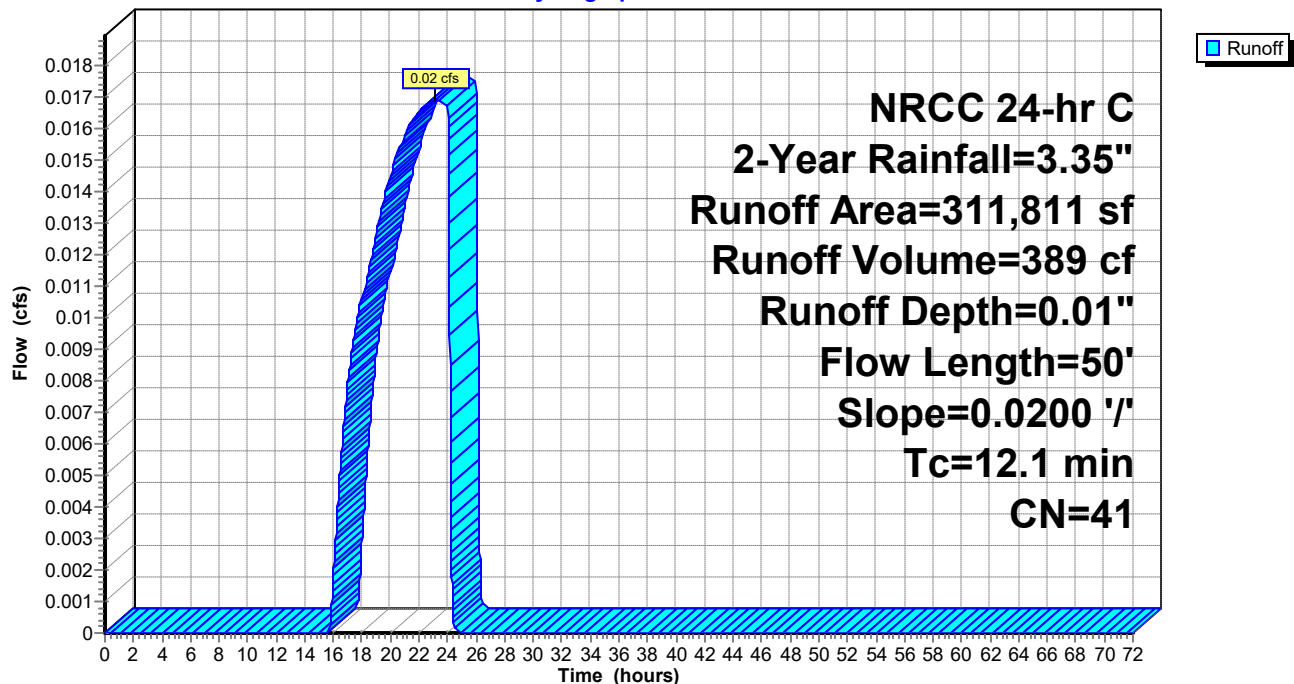
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
196,612	30	Woods, Good, HSG A
36,975	39	>75% Grass cover, Good, HSG A
6,012	76	Gravel roads, HSG A
8,242	72	Dirt roads, HSG A
1,205	98	Paved parking, HSG A
32,491	55	Woods, Good, HSG B
1,342	82	Dirt roads, HSG B
22,867	77	Woods, Good, HSG D
1,051	91	Gravel roads, HSG D
5,014	80	>75% Grass cover, Good, HSG D
311,811	41	Weighted Average
310,606		99.61% Pervious Area
1,205		0.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0200	0.07		Sheet Flow, Wooded - AD
Woods: Light underbrush n= 0.400 P2= 3.35"					

Subcatchment DW: Direct to Wetland

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 5

Summary for Subcatchment EN: Entrance

Runoff = 0.66 cfs @ 12.13 hrs, Volume= 1,998 cf, Depth= 2.59"

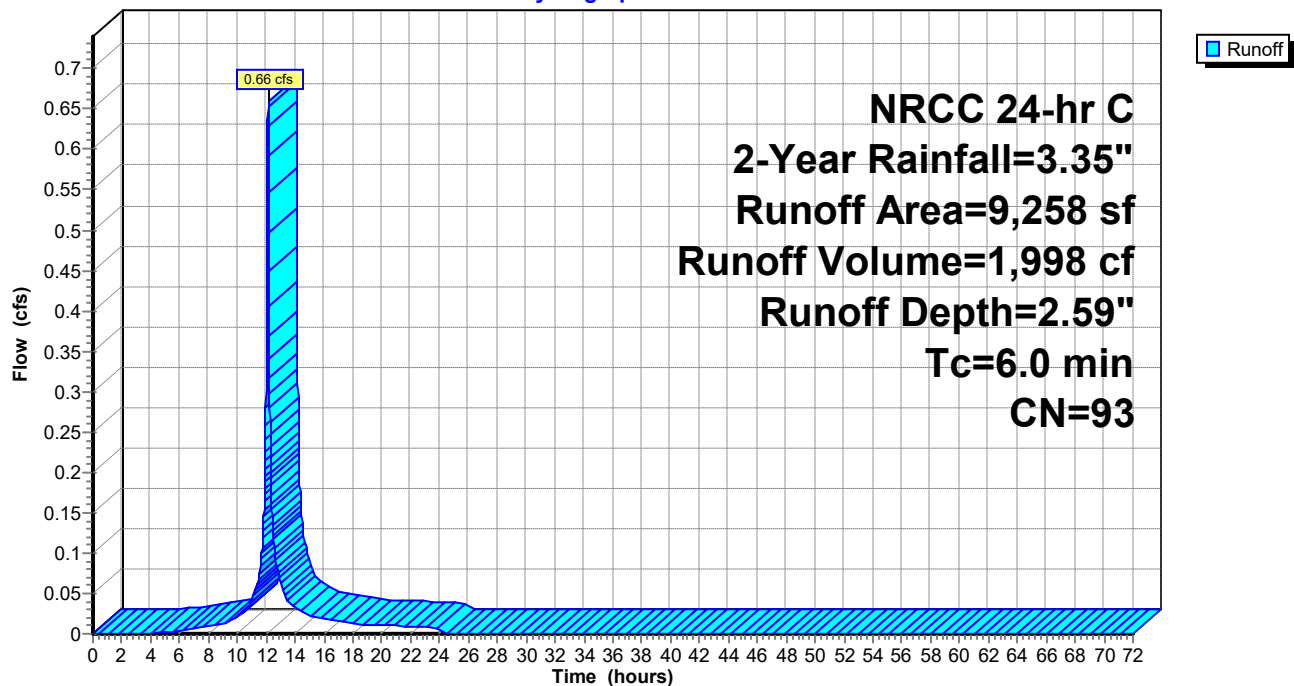
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
372	39	>75% Grass cover, Good, HSG A
4,276	98	Paved parking, HSG A
722	61	>75% Grass cover, Good, HSG B
3,888	98	Paved parking, HSG B
9,258	93	Weighted Average
1,094		11.82% Pervious Area
8,164		88.18% Impervious Area

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

Subcatchment EN: Entrance

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 6

Summary for Subcatchment S-A: Subcatchment A

Runoff = 2.44 cfs @ 12.20 hrs, Volume= 9,106 cf, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
6,400	39	>75% Grass cover, Good, HSG A
26,222	98	Paved parking, HSG A
4,145	80	>75% Grass cover, Good, HSG D
12,478	98	Paved parking, HSG D
49,245	89	Weighted Average
10,545		21.41% Pervious Area
38,700		78.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
1.1	77	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.5	188	0.0100	2.03		Shallow Concentrated Flow, Parking - CD Paved Kv= 20.3 fps
0.4	117	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
12.6	432	Total			

3395.1 - 0 Pond Street - Proposed Conditions

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

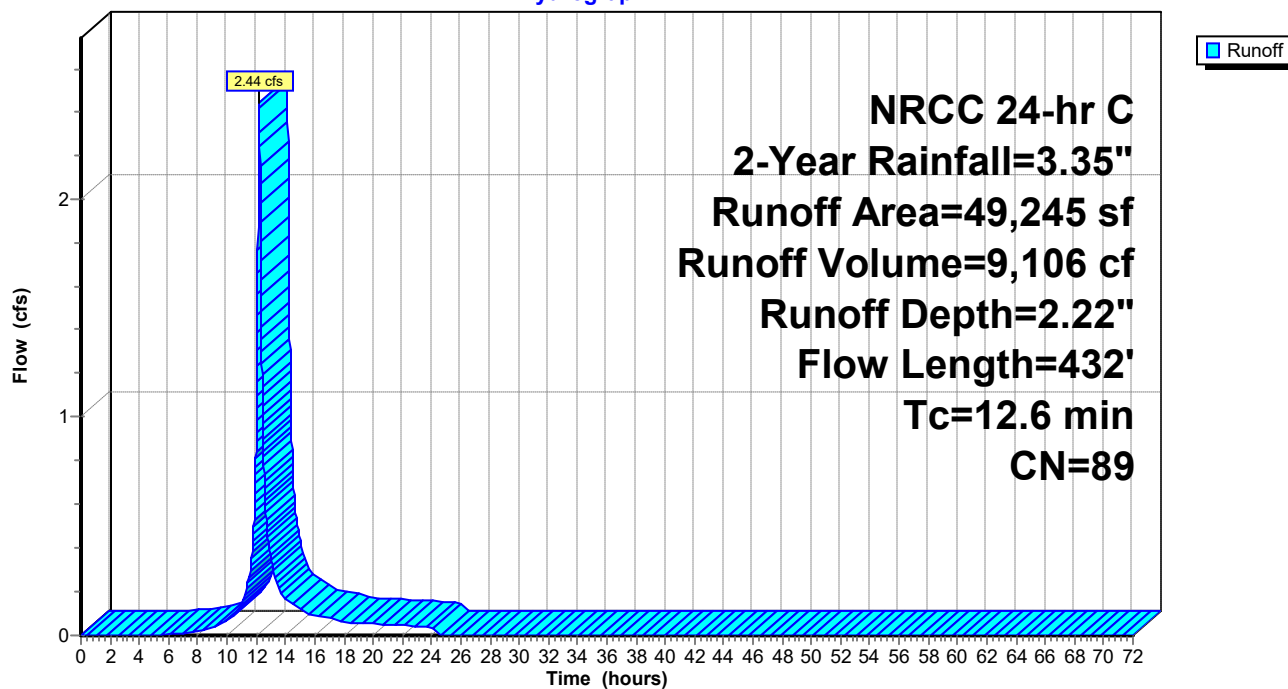
NRCC 24-hr C 2-Year Rainfall=3.35"

Printed 7/17/2023

Page 7

Subcatchment S-A: Subcatchment A

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 8

Summary for Subcatchment S-B: Subcatchment B

Runoff = 1.96 cfs @ 12.13 hrs, Volume= 6,010 cf, Depth= 2.69"

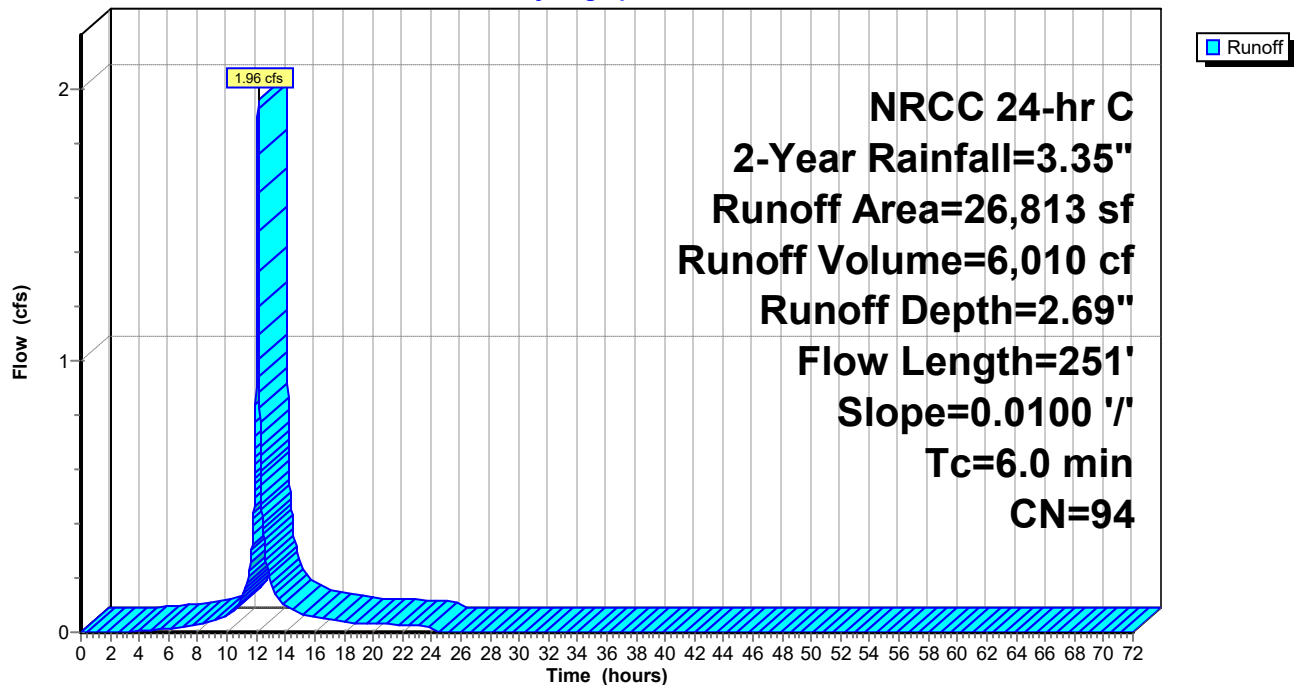
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
1,898	39	>75% Grass cover, Good, HSG A
24,546	98	Paved parking, HSG A
144	61	>75% Grass cover, Good, HSG B
225	98	Paved parking, HSG B
26,813	94	Weighted Average
2,042		7.62% Pervious Area
24,771		92.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.93		Sheet Flow, Parking - AB Smooth surfaces n= 0.011 P2= 3.35"
1.1	132	0.0100	2.03		Shallow Concentrated Flow, Parking - BC Paved Kv= 20.3 fps
0.2	69	0.0100	5.36	4.21	Pipe Channel, Pipe - CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.2	251	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S-B: Subcatchment B

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 9

Summary for Subcatchment S-C: Subcatchment C

Runoff = 4.53 cfs @ 12.22 hrs, Volume= 17,614 cf, Depth= 2.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 2-Year Rainfall=3.35"

Area (sf)	CN	Description
10,950	39	>75% Grass cover, Good, HSG A
1,530	76	Gravel roads, HSG A
61,036	98	Paved parking, HSG A
3,043	61	>75% Grass cover, Good, HSG B
14,735	98	Paved parking, HSG B
1,289	91	Gravel roads, HSG D
2,676	80	>75% Grass cover, Good, HSG D
95,259	89	Weighted Average
19,488		20.46% Pervious Area
75,771		79.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
2.4	165	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.7	207	0.0100	2.03		Shallow Concentrated Flow, Road - CD Paved Kv= 20.3 fps
0.2	59	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
13.9	481	Total			

3395.1 - 0 Pond Street - Proposed Conditions

Prepared by {enter your company name here}

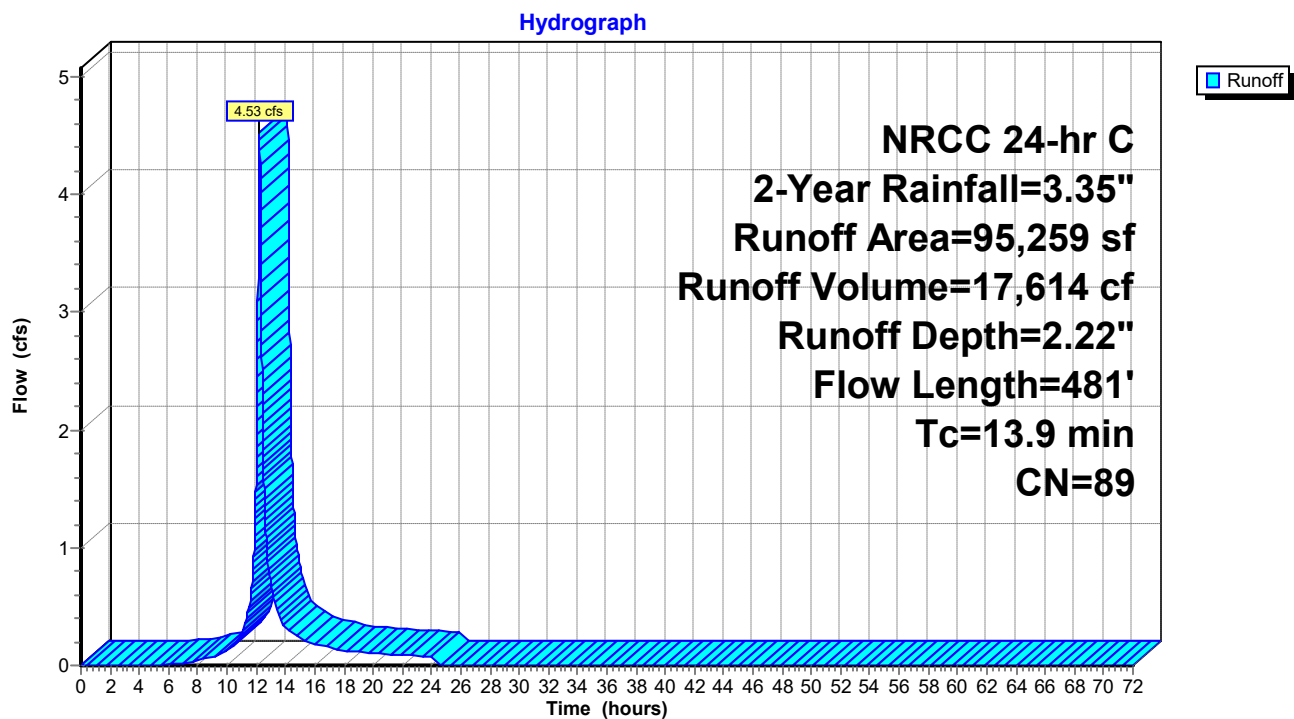
HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

NRCC 24-hr C 2-Year Rainfall=3.35"

Printed 7/17/2023

Page 10

Subcatchment S-C: Subcatchment C



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

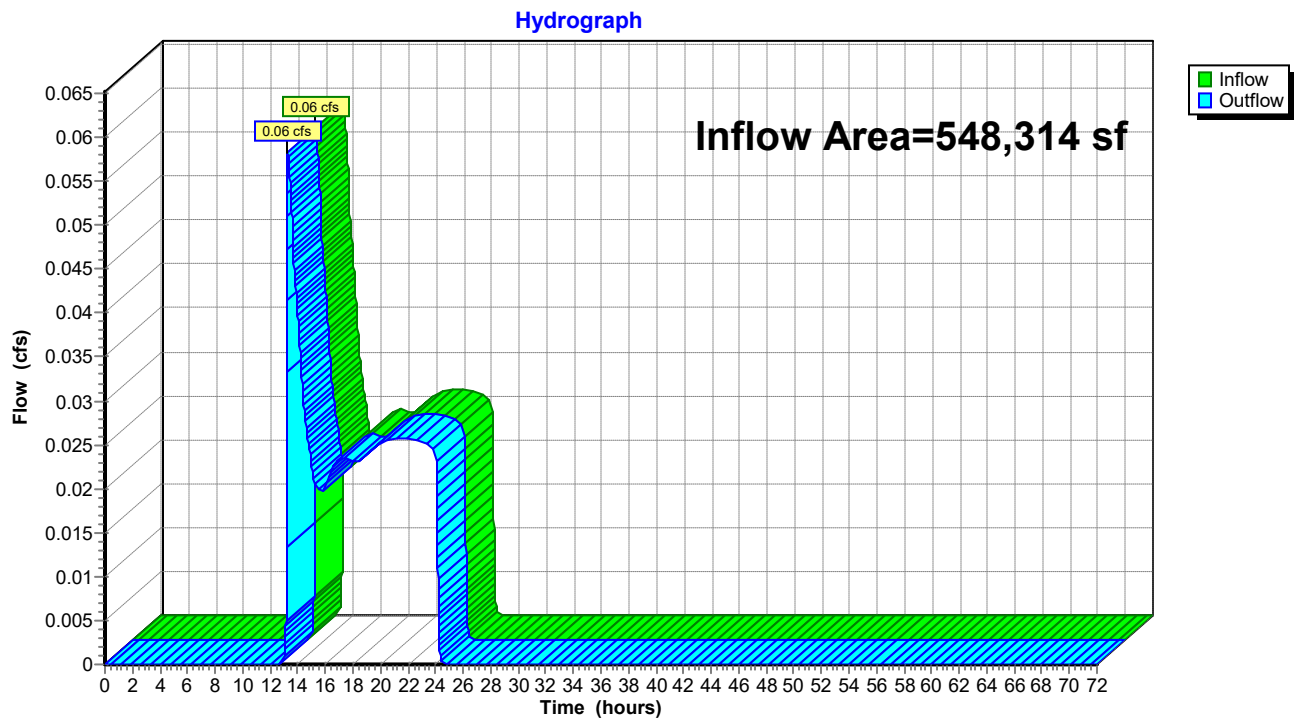
Page 11

Summary for Reach T: Total to Wetlands

Inflow Area = 548,314 sf, 37.30% Impervious, Inflow Depth = 0.02" for 2-Year event
Inflow = 0.06 cfs @ 13.28 hrs, Volume= 1,046 cf
Outflow = 0.06 cfs @ 13.28 hrs, Volume= 1,046 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach T: Total to Wetlands



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 12

Summary for Pond 1P: DMH-CD

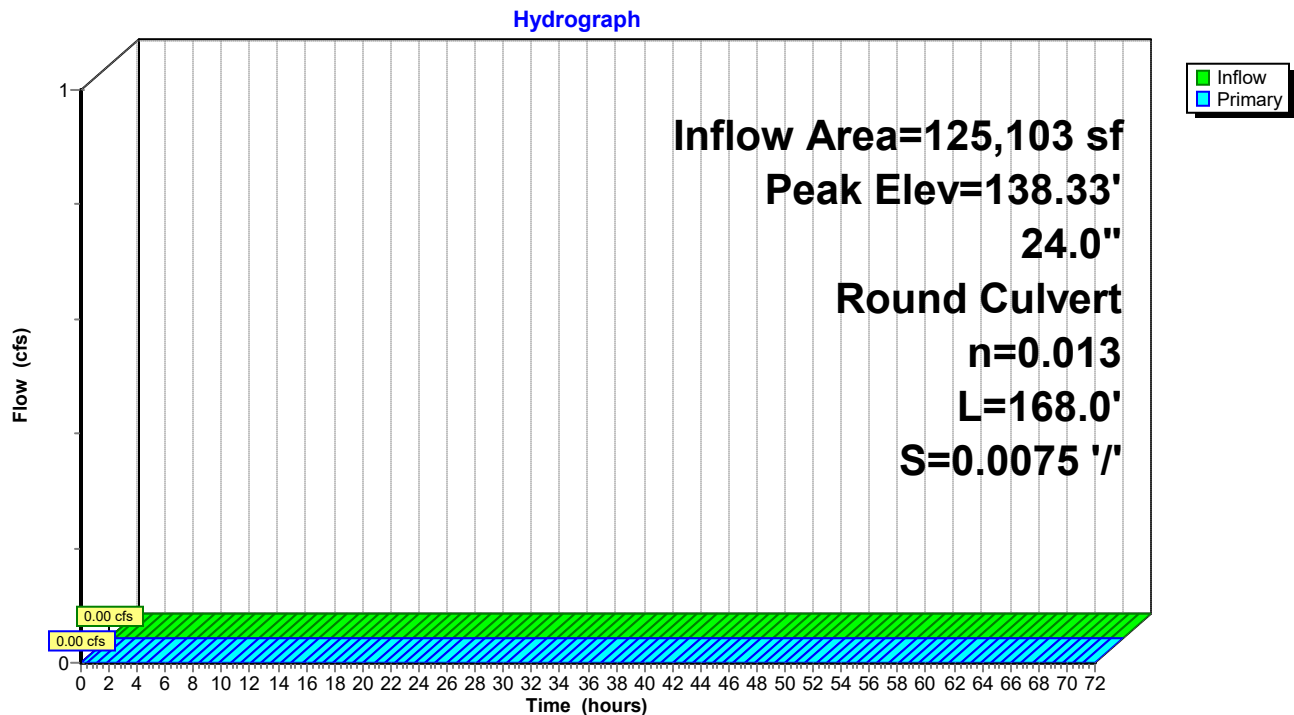
Inflow Area = 125,103 sf, 84.42% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 138.33' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	138.33'	24.0" Round Culvert L= 168.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.33' / 137.07' S= 0.0075 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=138.33' (Free Discharge)
↑1=Culvert (Controls 0.00 cfs)

Pond 1P: DMH-CD



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 13

Stage-Area-Storage for Pond 1P: DMH-CD

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.33	0	139.37	0
138.35	0	139.39	0
138.37	0	139.41	0
138.39	0	139.43	0
138.41	0	139.45	0
138.43	0	139.47	0
138.45	0	139.49	0
138.47	0	139.51	0
138.49	0	139.53	0
138.51	0	139.55	0
138.53	0	139.57	0
138.55	0	139.59	0
138.57	0	139.61	0
138.59	0	139.63	0
138.61	0	139.65	0
138.63	0	139.67	0
138.65	0	139.69	0
138.67	0	139.71	0
138.69	0	139.73	0
138.71	0	139.75	0
138.73	0	139.77	0
138.75	0	139.79	0
138.77	0	139.81	0
138.79	0	139.83	0
138.81	0	139.85	0
138.83	0	139.87	0
138.85	0	139.89	0
138.87	0	139.91	0
138.89	0	139.93	0
138.91	0	139.95	0
138.93	0	139.97	0
138.95	0	139.99	0
138.97	0	140.01	0
138.99	0	140.03	0
139.01	0	140.05	0
139.03	0	140.07	0
139.05	0	140.09	0
139.07	0	140.11	0
139.09	0	140.13	0
139.11	0	140.15	0
139.13	0	140.17	0
139.15	0	140.19	0
139.17	0	140.21	0
139.19	0	140.23	0
139.21	0	140.25	0
139.23	0	140.27	0
139.25	0	140.29	0
139.27	0	140.31	0
139.29	0	140.33	0
139.31	0		
139.33	0		
139.35	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 14

Summary for Pond BG: Bioretention Garden

Inflow Area = 9,258 sf, 88.18% Impervious, Inflow Depth = 2.59" for 2-Year event
 Inflow = 0.66 cfs @ 12.13 hrs, Volume= 1,998 cf
 Outflow = 0.05 cfs @ 13.27 hrs, Volume= 622 cf, Atten= 92%, Lag= 68.3 min
 Primary = 0.05 cfs @ 13.27 hrs, Volume= 622 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.51' @ 13.27 hrs Surf.Area= 983 sf Storage= 1,381 cf

Plug-Flow detention time= 386.5 min calculated for 622 cf (31% of inflow)
 Center-of-Mass det. time= 228.4 min (1,025.2 - 796.8)

Volume	Invert	Avail.Storage	Storage Description
#1	138.50'	2,064 cf	Retention Area (Irregular) Listed below (Recalc) 4,030 cf Overall - 1,966 cf Embedded = 2,064 cf
#2	138.50'	393 cf	BG Media (Irregular) Listed below (Recalc) Inside #1 1,966 cf Overall x 20.0% Voids
		2,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
142.60	983	141.0	4,030	4,030	1,561

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
140.50	983	141.0	1,966	1,966	1,265

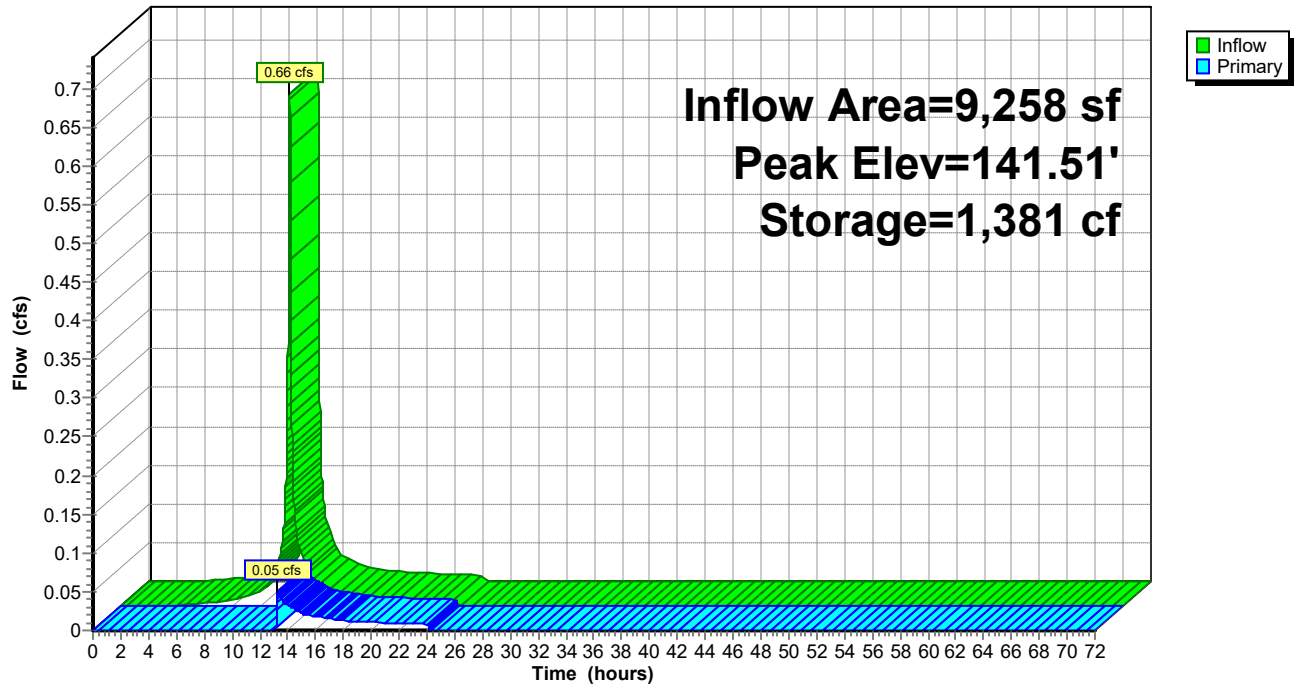
Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	20.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=0.02 cfs @ 13.27 hrs HW=141.51' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.19 fps)

Pond BG: Bioretention Garden

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 16

Stage-Area-Storage for Pond BG: Bioretention Garden

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.50	0	141.10	983
138.55	10	141.15	1,032
138.60	20	141.20	1,081
138.65	29	141.25	1,130
138.70	39	141.30	1,180
138.75	49	141.35	1,229
138.80	59	141.40	1,278
138.85	69	141.45	1,327
138.90	79	141.50	1,376
138.95	88	141.55	1,425
139.00	98	141.60	1,474
139.05	108	141.65	1,524
139.10	118	141.70	1,573
139.15	128	141.75	1,622
139.20	138	141.80	1,671
139.25	147	141.85	1,720
139.30	157	141.90	1,769
139.35	167	141.95	1,819
139.40	177	142.00	1,868
139.45	187	142.05	1,917
139.50	197	142.10	1,966
139.55	206	142.15	2,015
139.60	216	142.20	2,064
139.65	226	142.25	2,113
139.70	236	142.30	2,163
139.75	246	142.35	2,212
139.80	256	142.40	2,261
139.85	265	142.45	2,310
139.90	275	142.50	2,359
139.95	285	142.55	2,408
140.00	295	142.60	2,457
140.05	305		
140.10	315		
140.15	324		
140.20	334		
140.25	344		
140.30	354		
140.35	364		
140.40	374		
140.45	383		
140.50	393		
140.55	442		
140.60	491		
140.65	541		
140.70	590		
140.75	639		
140.80	688		
140.85	737		
140.90	786		
140.95	836		
141.00	885		
141.05	934		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 17

Summary for Pond DMH: DMH-CDE

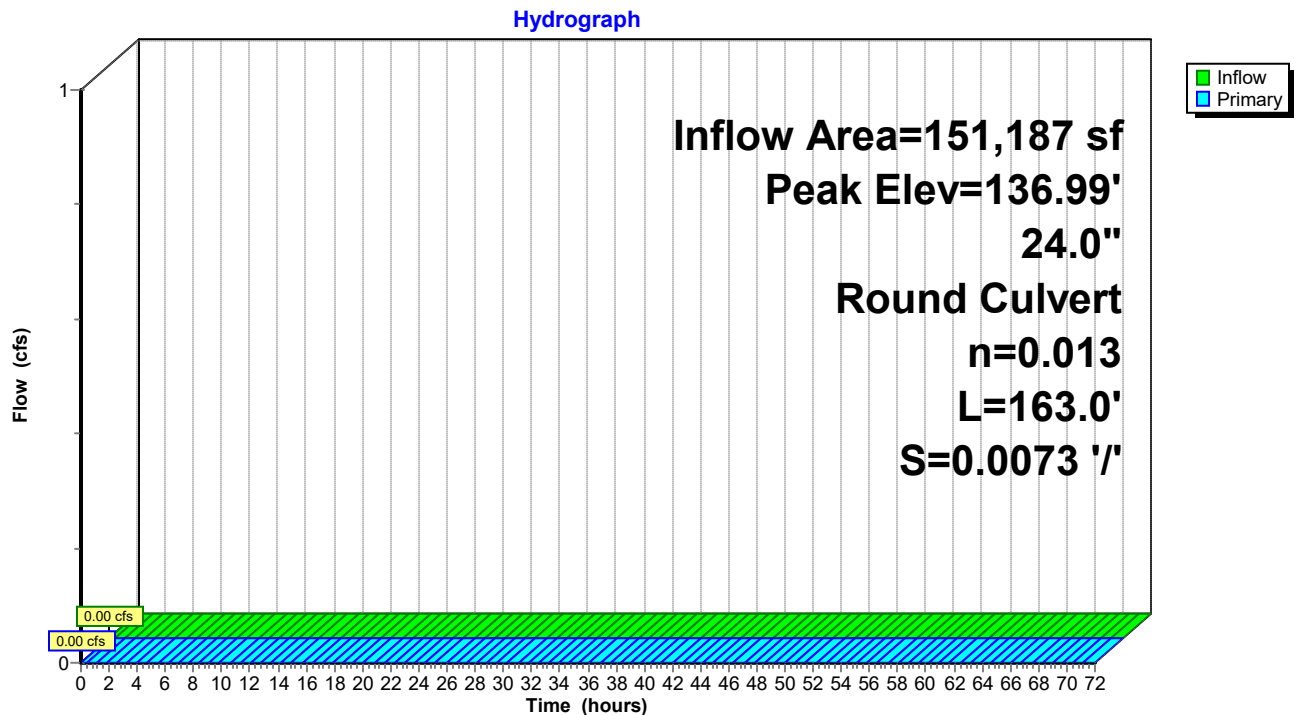
Inflow Area = 151,187 sf, 87.11% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.99' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	136.99'	24.0" Round Culvert L= 163.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.99' / 135.80' S= 0.0073 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=136.99' (Free Discharge)
↑1=Culvert (Controls 0.00 cfs)

Pond DMH: DMH-CDE



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 18

Stage-Area-Storage for Pond DMH: DMH-CDE

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
136.99	0	138.03	0
137.01	0	138.05	0
137.03	0	138.07	0
137.05	0	138.09	0
137.07	0	138.11	0
137.09	0	138.13	0
137.11	0	138.15	0
137.13	0	138.17	0
137.15	0	138.19	0
137.17	0	138.21	0
137.19	0	138.23	0
137.21	0	138.25	0
137.23	0	138.27	0
137.25	0	138.29	0
137.27	0	138.31	0
137.29	0	138.33	0
137.31	0	138.35	0
137.33	0	138.37	0
137.35	0	138.39	0
137.37	0	138.41	0
137.39	0	138.43	0
137.41	0	138.45	0
137.43	0	138.47	0
137.45	0	138.49	0
137.47	0	138.51	0
137.49	0	138.53	0
137.51	0	138.55	0
137.53	0	138.57	0
137.55	0	138.59	0
137.57	0	138.61	0
137.59	0	138.63	0
137.61	0	138.65	0
137.63	0	138.67	0
137.65	0	138.69	0
137.67	0	138.71	0
137.69	0	138.73	0
137.71	0	138.75	0
137.73	0	138.77	0
137.75	0	138.79	0
137.77	0	138.81	0
137.79	0	138.83	0
137.81	0	138.85	0
137.83	0	138.87	0
137.85	0	138.89	0
137.87	0	138.91	0
137.89	0	138.93	0
137.91	0	138.95	0
137.93	0	138.97	0
137.95	0	138.99	0
137.97	0		
137.99	0		
138.01	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 19

Summary for Pond ICS-A: Infiltration Chambers A

Inflow Area = 49,245 sf, 78.59% Impervious, Inflow Depth = 2.22" for 2-Year event
 Inflow = 2.44 cfs @ 12.20 hrs, Volume= 9,106 cf
 Outflow = 0.22 cfs @ 13.56 hrs, Volume= 9,106 cf, Atten= 91%, Lag= 81.3 min
 Discarded = 0.20 cfs @ 11.35 hrs, Volume= 9,071 cf
 Primary = 0.01 cfs @ 13.56 hrs, Volume= 35 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.46' @ 13.56 hrs Surf.Area= 3,663 sf Storage= 3,695 cf

Plug-Flow detention time= 150.8 min calculated for 9,105 cf (100% of inflow)
 Center-of-Mass det. time= 150.8 min (973.9 - 823.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 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= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.30' / 135.40' S= 0.0500 ' S= 0.0500 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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 1	140.40'	7.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 11.35 hrs HW=139.04' (Free Discharge)↑ **4=Exfiltration** (Exfiltration Controls 0.20 cfs)**Primary OutFlow** Max=0.01 cfs @ 13.56 hrs HW=140.46' (Free Discharge)↑ **1=Culvert** (Passes 0.01 cfs of 15.70 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)↑ **3=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.80 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 20

Pond ICS-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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

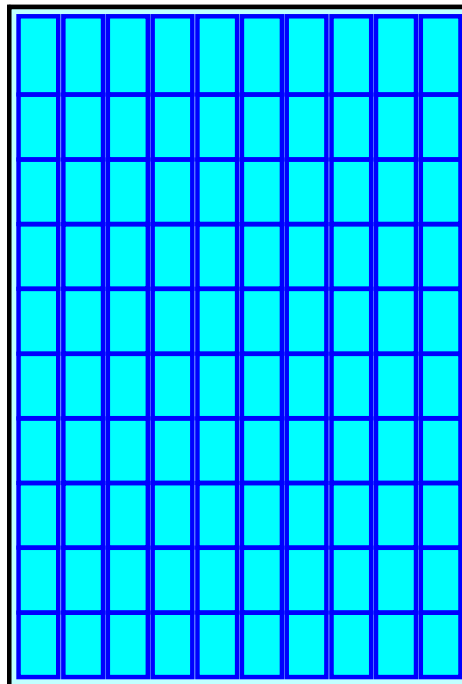
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

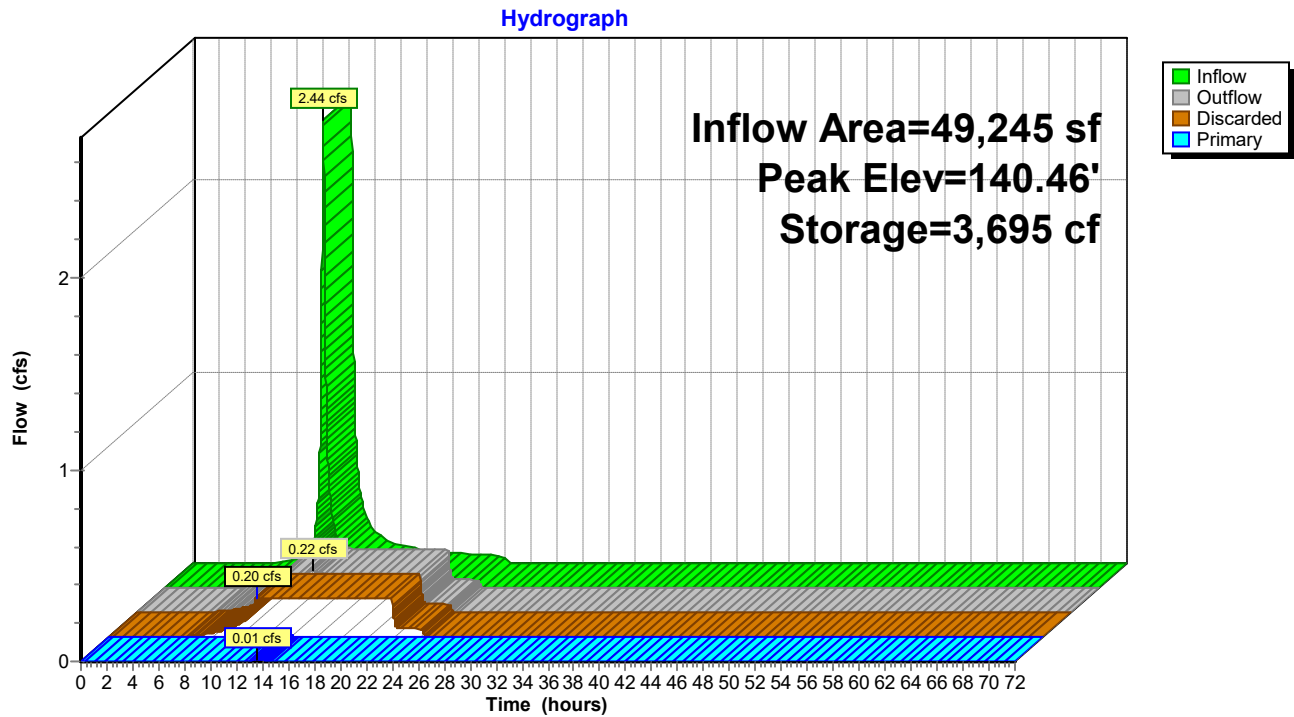
100 Chambers

480.5 cy Field

283.1 cy Stone



Pond ICS-A: Infiltration Chambers A



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 22

Stage-Area-Storage for Pond ICS-A: Infiltration Chambers A

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 23

Summary for Pond ICS-B: Infiltration Chamber System B

Inflow Area = 26,813 sf, 92.38% Impervious, Inflow Depth = 2.69" for 2-Year event
 Inflow = 1.96 cfs @ 12.13 hrs, Volume= 6,010 cf
 Outflow = 0.20 cfs @ 11.52 hrs, Volume= 6,010 cf, Atten= 90%, Lag= 0.0 min
 Discarded = 0.20 cfs @ 11.52 hrs, Volume= 6,010 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 139.87' @ 12.92 hrs Surf.Area= 3,663 sf Storage= 1,895 cf

Plug-Flow detention time= 63.0 min calculated for 6,009 cf (100% of inflow)
 Center-of-Mass det. time= 63.0 min (853.7 - 790.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.78'	18.0" Round Culvert L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.78' / 136.90' S= 0.0472 ' S= 0.0472 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 11.52 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.20 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Controls 0.00 cfs)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 24

Pond ICS-B: Infiltration Chamber System 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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

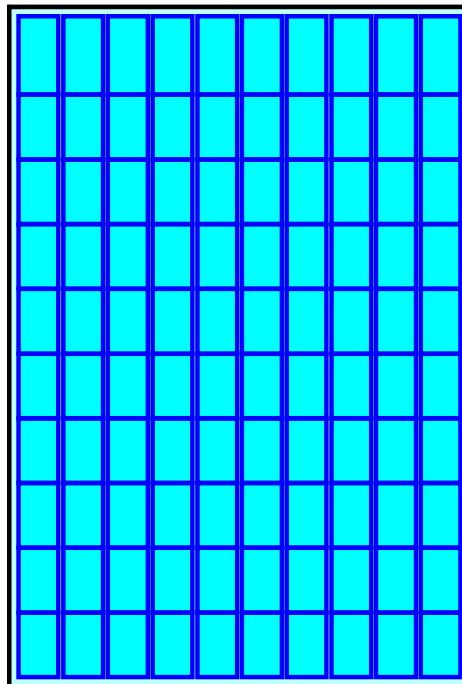
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

100 Chambers

480.5 cy Field

283.1 cy Stone



3395.1 - 0 Pond Street - Proposed Conditions

Prepared by {enter your company name here}

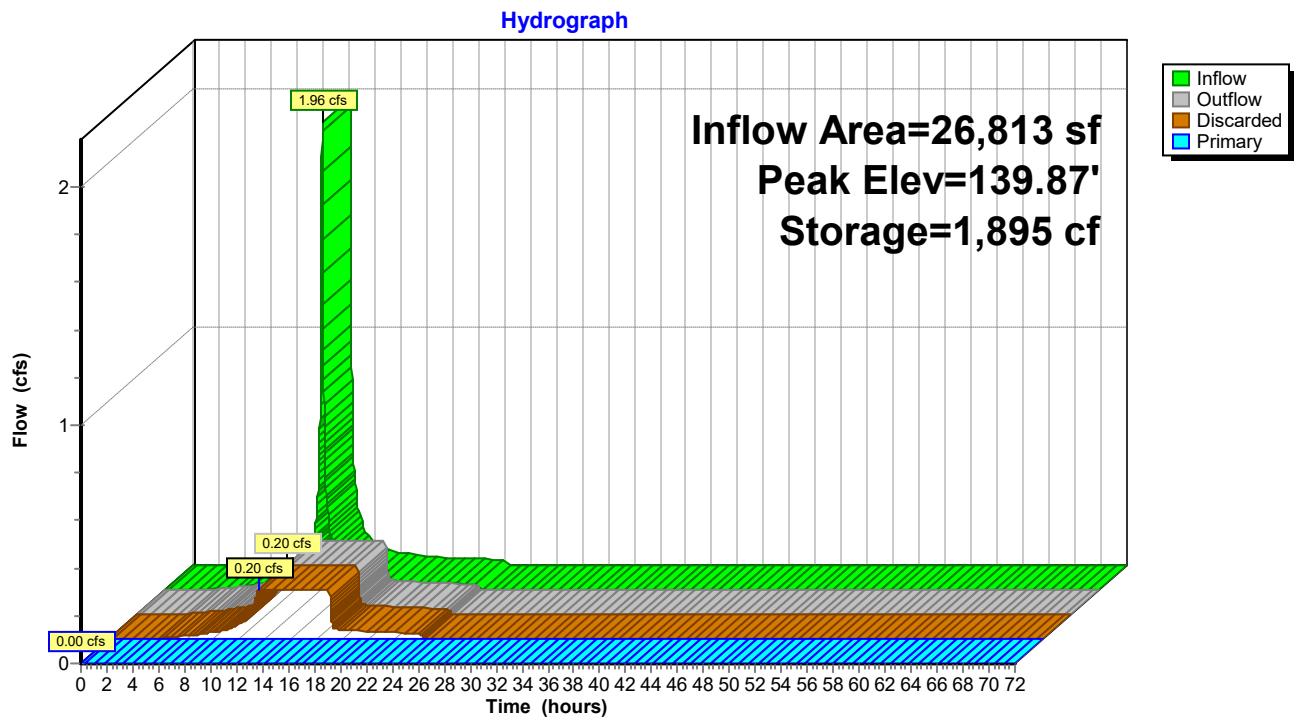
HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

NRCC 24-hr C 2-Year Rainfall=3.35"

Printed 7/17/2023

Page 25

Pond ICS-B: Infiltration Chamber System B



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 26

Stage-Area-Storage for Pond ICS-B: Infiltration Chamber System B

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 27

Summary for Pond ICS-C: Infiltration Chambers C

Inflow Area = 95,259 sf, 79.54% Impervious, Inflow Depth = 2.22" for 2-Year event
 Inflow = 4.53 cfs @ 12.22 hrs, Volume= 17,614 cf
 Outflow = 1.51 cfs @ 12.00 hrs, Volume= 17,614 cf, Atten= 67%, Lag= 0.0 min
 Discarded = 1.51 cfs @ 12.00 hrs, Volume= 17,614 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 139.69' @ 12.53 hrs Surf.Area= 7,902 sf Storage= 2,914 cf

Plug-Flow detention time= 9.8 min calculated for 17,612 cf (100% of inflow)
 Center-of-Mass det. time= 9.8 min (834.1 - 824.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	6,516 cf	98.17'W x 80.50'L x 3.54'H Field A 27,988 cf Overall - 11,698 cf Embedded = 16,290 cf x 40.0% Voids
#2A	139.50'	11,698 cf	Cultec R-330XLHD x 220 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 20 rows
		18,214 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	24.0" Round Culvert L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.42' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	141.50'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.51 cfs @ 12.00 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 1.51 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Controls 0.00 cfs)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 28

Pond ICS-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 20 rows

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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' Base Length

20 Rows x 52.0" Wide + 6.0" Spacing x 19 + 12.0" Side Stone x 2 = 98.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

220 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 20 Rows = 11,698.1 cf Chamber Storage

27,987.7 cf Field - 11,698.1 cf Chambers = 16,289.7 cf Stone x 40.0% Voids = 6,515.9 cf Stone Storage

Chamber Storage + Stone Storage = 18,213.9 cf = 0.418 af

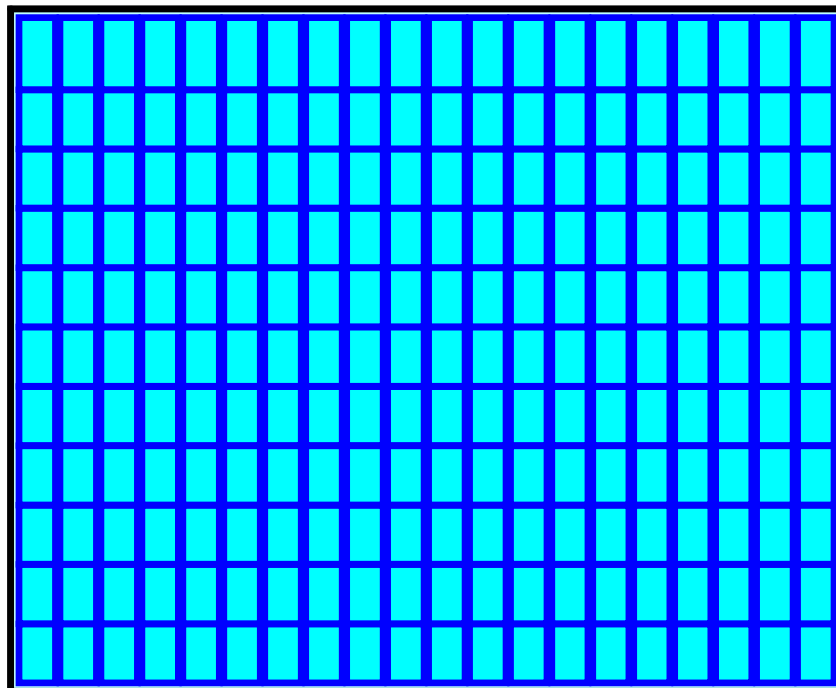
Overall Storage Efficiency = 65.1%

Overall System Size = 80.50' x 98.17' x 3.54'

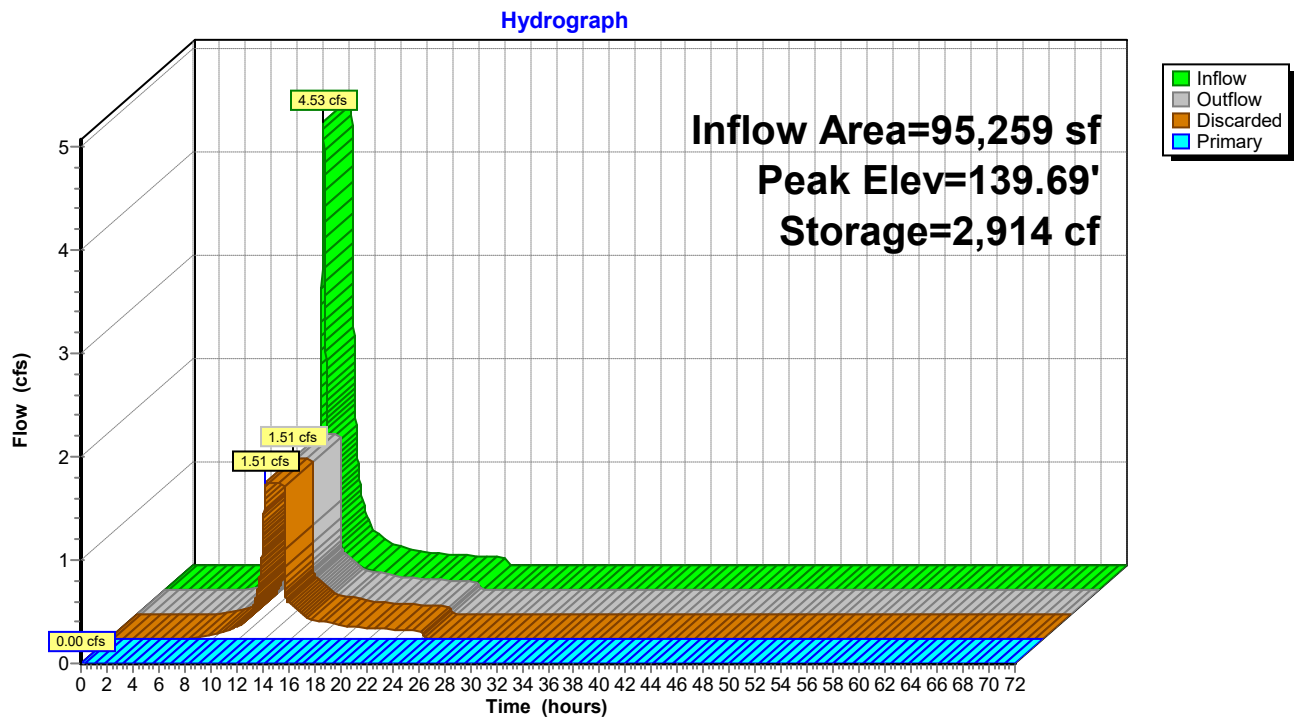
220 Chambers

1,036.6 cy Field

603.3 cy Stone



Pond ICS-C: Infiltration Chambers C



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 30

Stage-Area-Storage for Pond ICS-C: Infiltration Chambers C

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	7,902	0	141.60	7,902	14,866
139.05	7,902	158	141.65	7,902	15,109
139.10	7,902	316	141.70	7,902	15,342
139.15	7,902	474	141.75	7,902	15,565
139.20	7,902	632	141.80	7,902	15,775
139.25	7,902	790	141.85	7,902	15,974
139.30	7,902	948	141.90	7,902	16,161
139.35	7,902	1,106	141.95	7,902	16,337
139.40	7,902	1,264	142.00	7,902	16,502
139.45	7,902	1,422	142.05	7,902	16,660
139.50	7,902	1,580	142.10	7,902	16,818
139.55	7,902	1,926	142.15	7,902	16,976
139.60	7,902	2,270	142.20	7,902	17,134
139.65	7,902	2,613	142.25	7,902	17,292
139.70	7,902	2,956	142.30	7,902	17,450
139.75	7,902	3,297	142.35	7,902	17,608
139.80	7,902	3,639	142.40	7,902	17,766
139.85	7,902	3,980	142.45	7,902	17,924
139.90	7,902	4,320	142.50	7,902	18,082
139.95	7,902	4,661			
140.00	7,902	5,000			
140.05	7,902	5,339			
140.10	7,902	5,677			
140.15	7,902	6,012			
140.20	7,902	6,345			
140.25	7,902	6,676			
140.30	7,902	7,006			
140.35	7,902	7,336			
140.40	7,902	7,665			
140.45	7,902	7,994			
140.50	7,902	8,322			
140.55	7,902	8,649			
140.60	7,902	8,975			
140.65	7,902	9,301			
140.70	7,902	9,625			
140.75	7,902	9,947			
140.80	7,902	10,266			
140.85	7,902	10,582			
140.90	7,902	10,893			
140.95	7,902	11,202			
141.00	7,902	11,508			
141.05	7,902	11,811			
141.10	7,902	12,110			
141.15	7,902	12,406			
141.20	7,902	12,698			
141.25	7,902	12,986			
141.30	7,902	13,271			
141.35	7,902	13,550			
141.40	7,902	13,825			
141.45	7,902	14,095			
141.50	7,902	14,358			
141.55	7,902	14,616			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 31

Summary for Pond ICS-D: Infiltration Chambers D

Inflow Area = 29,844 sf, 100.00% Impervious, Inflow Depth = 3.12" for 2-Year event
 Inflow = 2.35 cfs @ 12.13 hrs, Volume= 7,752 cf
 Outflow = 0.47 cfs @ 11.79 hrs, Volume= 7,752 cf, Atten= 80%, Lag= 0.0 min
 Discarded = 0.47 cfs @ 11.79 hrs, Volume= 7,752 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 139.98' @ 12.41 hrs Surf.Area= 2,455 sf Storage= 1,486 cf

Plug-Flow detention time= 15.1 min calculated for 7,751 cf (100% of inflow)
 Center-of-Mass det. time= 15.1 min (772.5 - 757.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,075 cf	30.50'W x 80.50'L x 3.54'H Field A 8,696 cf Overall - 3,509 cf Embedded = 5,186 cf x 40.0% Voids
#2A	139.50'	3,509 cf	Cultec R-330XLHD x 66 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
		5,584 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	138.44'	12.0" Round Culvert L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.44' / 136.79' S= 0.0485 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.47 cfs @ 11.79 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.47 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Passes 0.00 cfs of 1.15 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 32

Pond ICS-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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' 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" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

66 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,509.4 cf Chamber Storage

8,695.7 cf Field - 3,509.4 cf Chambers = 5,186.3 cf Stone x 40.0% Voids = 2,074.5 cf Stone Storage

Chamber Storage + Stone Storage = 5,583.9 cf = 0.128 af

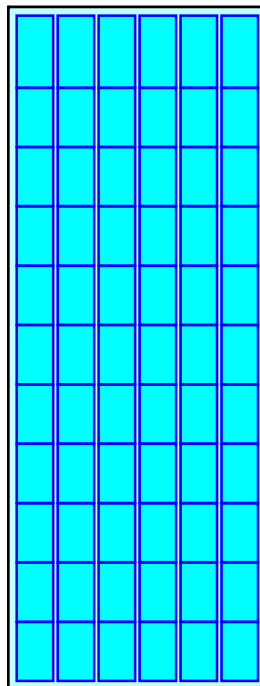
Overall Storage Efficiency = 64.2%

Overall System Size = 80.50' x 30.50' x 3.54'

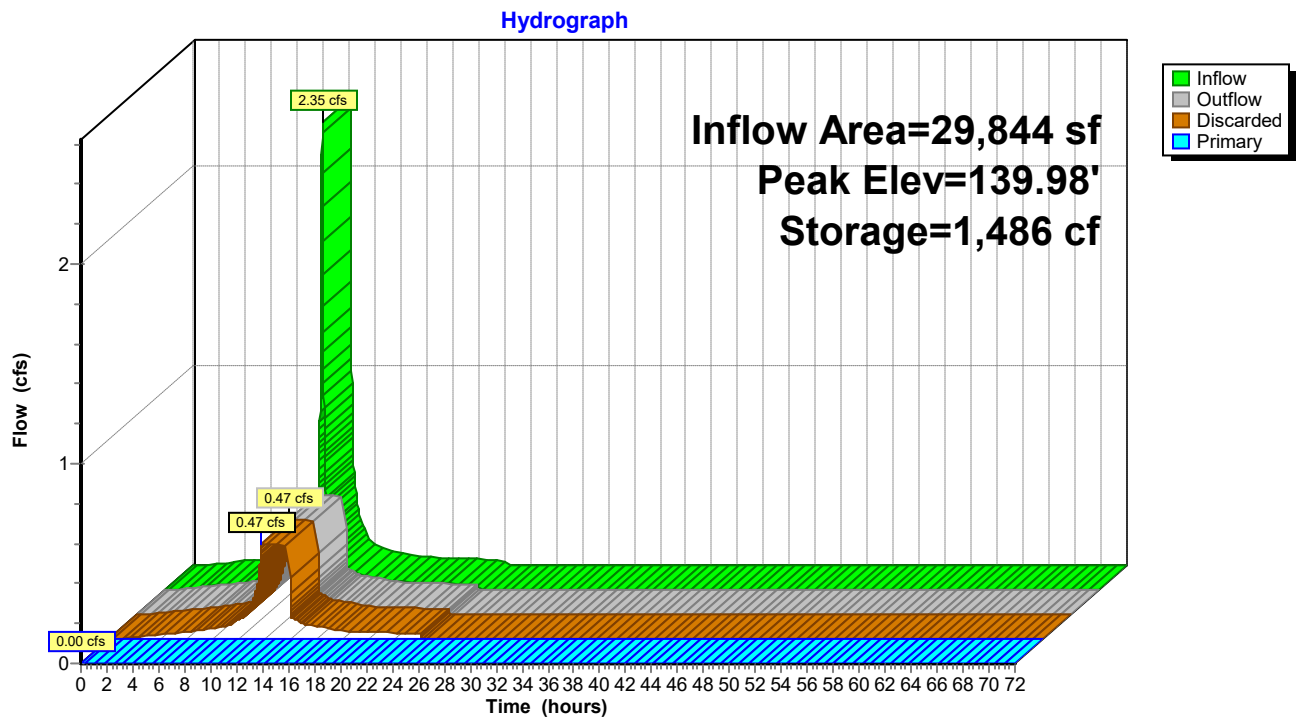
66 Chambers

322.1 cy Field

192.1 cy Stone



Pond ICS-D: Infiltration Chambers D



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 34

Stage-Area-Storage for Pond ICS-D: Infiltration Chambers D

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,455	0	141.60	2,455	4,548
139.05	2,455	49	141.65	2,455	4,622
139.10	2,455	98	141.70	2,455	4,694
139.15	2,455	147	141.75	2,455	4,762
139.20	2,455	196	141.80	2,455	4,827
139.25	2,455	246	141.85	2,455	4,888
139.30	2,455	295	141.90	2,455	4,946
139.35	2,455	344	141.95	2,455	5,001
139.40	2,455	393	142.00	2,455	5,052
139.45	2,455	442	142.05	2,455	5,101
139.50	2,455	491	142.10	2,455	5,150
139.55	2,455	539	142.15	2,455	5,199
139.60	2,455	588	142.20	2,455	5,248
139.65	2,455	637	142.25	2,455	5,297
139.70	2,455	686	142.30	2,455	5,347
139.75	2,455	735	142.35	2,455	5,396
139.80	2,455	784	142.40	2,455	5,445
139.85	2,455	833	142.45	2,455	5,494
139.90	2,455	882	142.50	2,455	5,543
139.95	2,455	931			
140.00	2,455	980			
140.05	2,455	1,029			
140.10	2,455	1,078			
140.15	2,455	1,127			
140.20	2,455	1,176			
140.25	2,455	1,225			
140.30	2,455	1,274			
140.35	2,455	1,323			
140.40	2,455	1,372			
140.45	2,455	1,421			
140.50	2,455	1,470			
140.55	2,455	1,519			
140.60	2,455	1,568			
140.65	2,455	1,617			
140.70	2,455	1,666			
140.75	2,455	1,715			
140.80	2,455	1,764			
140.85	2,455	1,813			
140.90	2,455	1,862			
140.95	2,455	1,911			
141.00	2,455	1,960			
141.05	2,455	2,009			
141.10	2,455	2,058			
141.15	2,455	2,107			
141.20	2,455	2,156			
141.25	2,455	2,205			
141.30	2,455	2,254			
141.35	2,455	2,303			
141.40	2,455	2,352			
141.45	2,455	2,401			
141.50	2,455	2,450			
141.55	2,455	2,499			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 35

Summary for Pond ICS-E: Infiltration Chambers E

Inflow Area = 26,084 sf, 100.00% Impervious, Inflow Depth = 3.12" for 2-Year event
 Inflow = 2.05 cfs @ 12.13 hrs, Volume= 6,775 cf
 Outflow = 0.46 cfs @ 11.83 hrs, Volume= 6,775 cf, Atten= 78%, Lag= 0.0 min
 Discarded = 0.46 cfs @ 11.83 hrs, Volume= 6,775 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 139.85' @ 12.38 hrs Surf.Area= 2,390 sf Storage= 1,200 cf

Plug-Flow detention time= 12.0 min calculated for 6,774 cf (100% of inflow)
 Center-of-Mass det. time= 12.0 min (769.4 - 757.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,015 cf	40.17'W x 59.50'L x 3.54'H Field A 8,464 cf Overall - 3,427 cf Embedded = 5,037 cf x 40.0% Voids
#2A	139.50'	3,427 cf	Cultec R-330XLHD x 64 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 8 rows
		5,442 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	12.0" Round Culvert L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.55' S= 0.0200 ' S= 0.0200 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.46 cfs @ 11.83 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.46 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Controls 0.00 cfs)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 36

Pond ICS-E: Infiltration Chambers E - 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 8 rows

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

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

8 Rows x 52.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 40.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

64 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 8 Rows = 3,427.5 cf Chamber Storage

8,464.3 cf Field - 3,427.5 cf Chambers = 5,036.8 cf Stone x 40.0% Voids = 2,014.7 cf Stone Storage

Chamber Storage + Stone Storage = 5,442.2 cf = 0.125 af

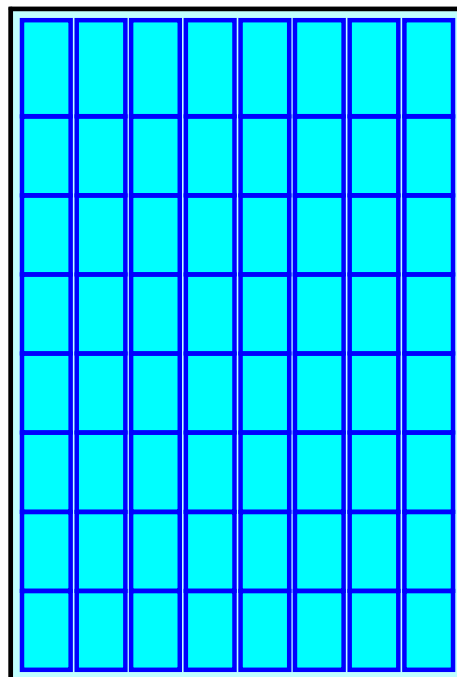
Overall Storage Efficiency = 64.3%

Overall System Size = 59.50' x 40.17' x 3.54'

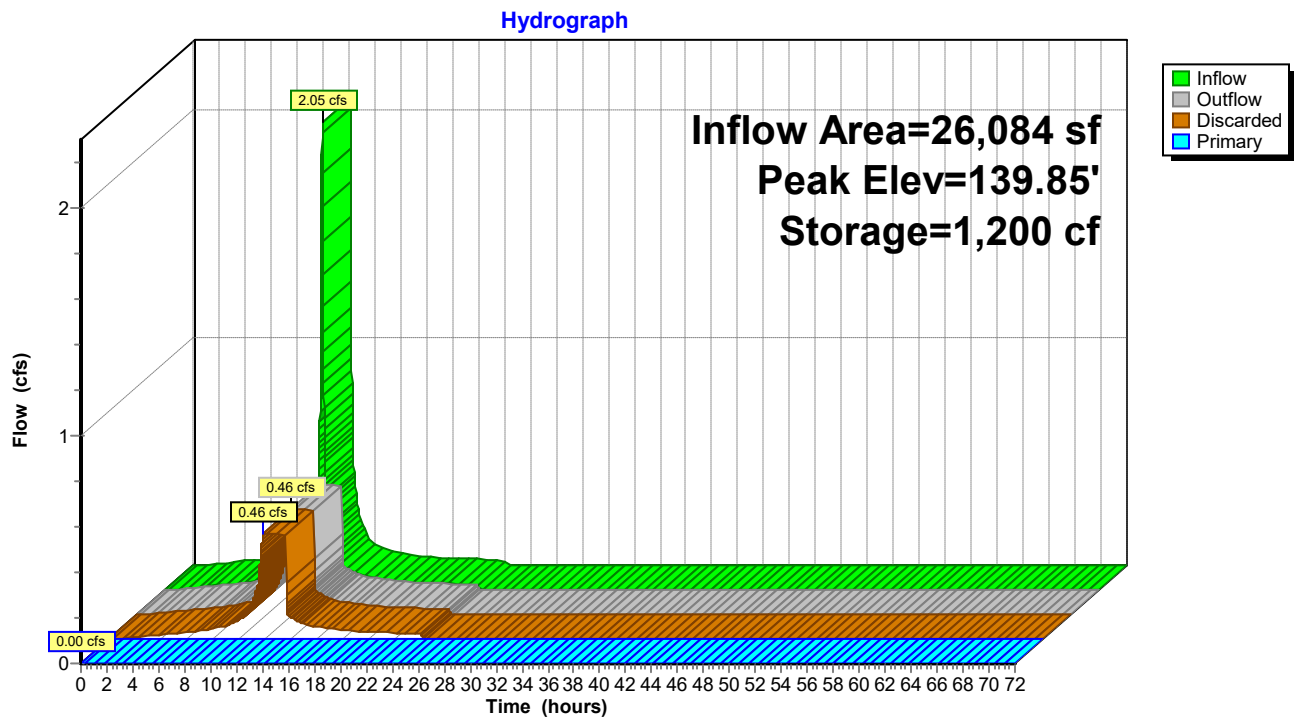
64 Chambers

313.5 cy Field

186.5 cy Stone



Pond ICS-E: Infiltration Chambers E



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 2-Year Rainfall=3.35"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 38

Stage-Area-Storage for Pond ICS-E: Infiltration Chambers E

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,390	0	141.60	2,390	4,433
139.05	2,390	48	141.65	2,390	4,506
139.10	2,390	96	141.70	2,390	4,576
139.15	2,390	143	141.75	2,390	4,642
139.20	2,390	191	141.80	2,390	4,706
139.25	2,390	239	141.85	2,390	4,765
139.30	2,390	287	141.90	2,390	4,821
139.35	2,390	335	141.95	2,390	4,874
139.40	2,390	382	142.00	2,390	4,924
139.45	2,390	430	142.05	2,390	4,972
139.50	2,390	478	142.10	2,390	5,020
139.55	2,390	581	142.15	2,390	5,068
139.60	2,390	683	142.20	2,390	5,116
139.65	2,390	785	142.25	2,390	5,163
139.70	2,390	887	142.30	2,390	5,211
139.75	2,390	988	142.35	2,390	5,259
139.80	2,390	1,090	142.40	2,390	5,307
139.85	2,390	1,191	142.45	2,390	5,355
139.90	2,390	1,293	142.50	2,390	5,402
139.95	2,390	1,394			
140.00	2,390	1,495			
140.05	2,390	1,596			
140.10	2,390	1,696			
140.15	2,390	1,796			
140.20	2,390	1,895			
140.25	2,390	1,993			
140.30	2,390	2,092			
140.35	2,390	2,190			
140.40	2,390	2,288			
140.45	2,390	2,385			
140.50	2,390	2,483			
140.55	2,390	2,580			
140.60	2,390	2,677			
140.65	2,390	2,774			
140.70	2,390	2,871			
140.75	2,390	2,967			
140.80	2,390	3,062			
140.85	2,390	3,155			
140.90	2,390	3,248			
140.95	2,390	3,340			
141.00	2,390	3,431			
141.05	2,390	3,522			
141.10	2,390	3,611			
141.15	2,390	3,699			
141.20	2,390	3,786			
141.25	2,390	3,872			
141.30	2,390	3,957			
141.35	2,390	4,040			
141.40	2,390	4,122			
141.45	2,390	4,203			
141.50	2,390	4,281			
141.55	2,390	4,358			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 39

Summary for Subcatchment B1: Building 1(L)

Runoff = 3.49 cfs @ 12.13 hrs, Volume= 11,722 cf, Depth= 4.71"

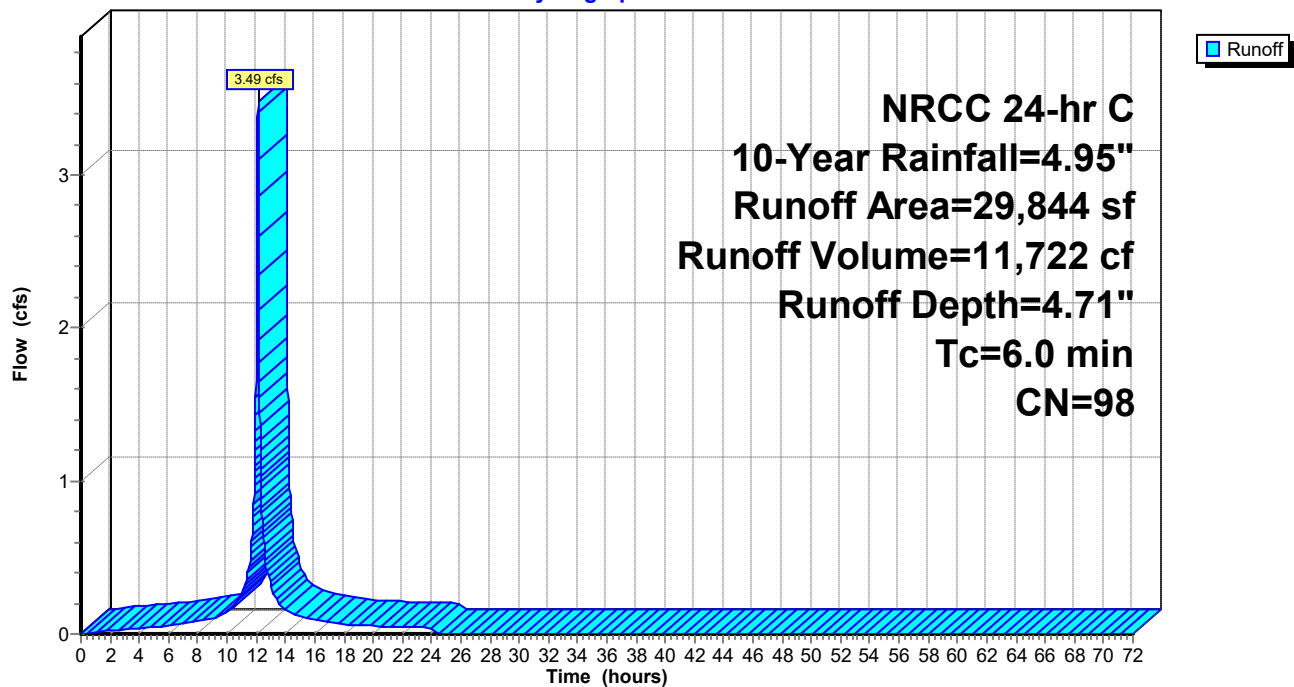
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
29,844	98	Unconnected roofs, HSG A
29,844		100.00% Impervious Area
29,844		100.00% Unconnected

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

Subcatchment B1: Building 1(L)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 40

Summary for Subcatchment B2: Building 2(BAR)

Runoff = 3.05 cfs @ 12.13 hrs, Volume= 10,245 cf, Depth= 4.71"

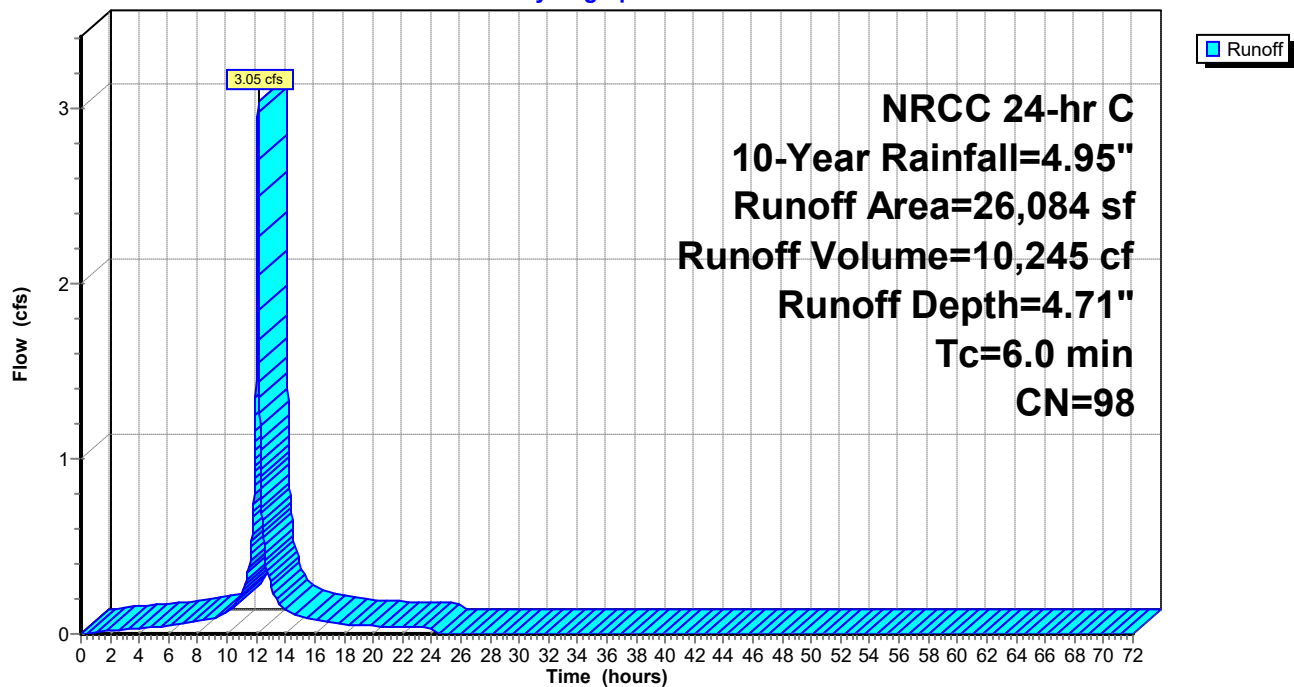
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
26,084	98	Unconnected roofs, HSG A
26,084		100.00% Impervious Area
26,084		100.00% Unconnected

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

Subcatchment B2: Building 2(BAR)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 41

Summary for Subcatchment DW: Direct to Wetland

Runoff = 0.37 cfs @ 12.60 hrs, Volume= 6,776 cf, Depth= 0.26"

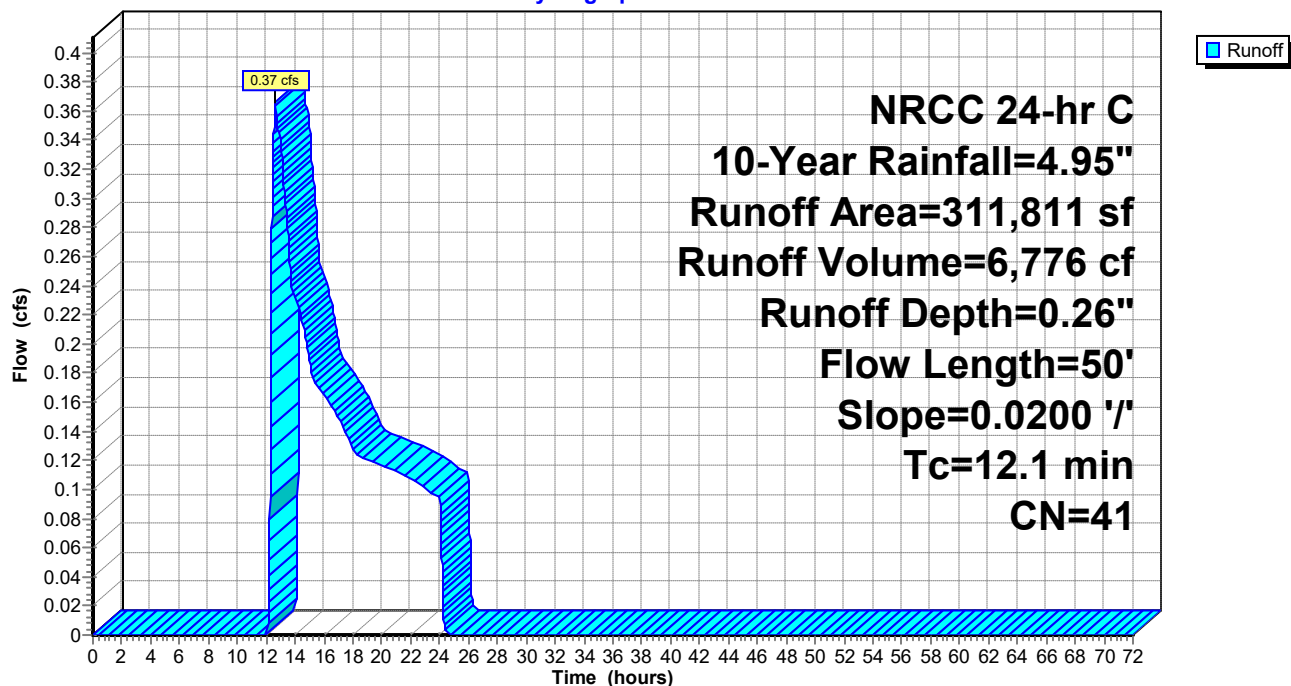
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
196,612	30	Woods, Good, HSG A
36,975	39	>75% Grass cover, Good, HSG A
6,012	76	Gravel roads, HSG A
8,242	72	Dirt roads, HSG A
1,205	98	Paved parking, HSG A
32,491	55	Woods, Good, HSG B
1,342	82	Dirt roads, HSG B
22,867	77	Woods, Good, HSG D
1,051	91	Gravel roads, HSG D
5,014	80	>75% Grass cover, Good, HSG D
311,811	41	Weighted Average
310,606		99.61% Pervious Area
1,205		0.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0200	0.07		Sheet Flow, Wooded - AD
Woods: Light underbrush n= 0.400 P2= 3.35"					

Subcatchment DW: Direct to Wetland

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 42

Summary for Subcatchment EN: Entrance

Runoff = 1.03 cfs @ 12.13 hrs, Volume= 3,201 cf, Depth= 4.15"

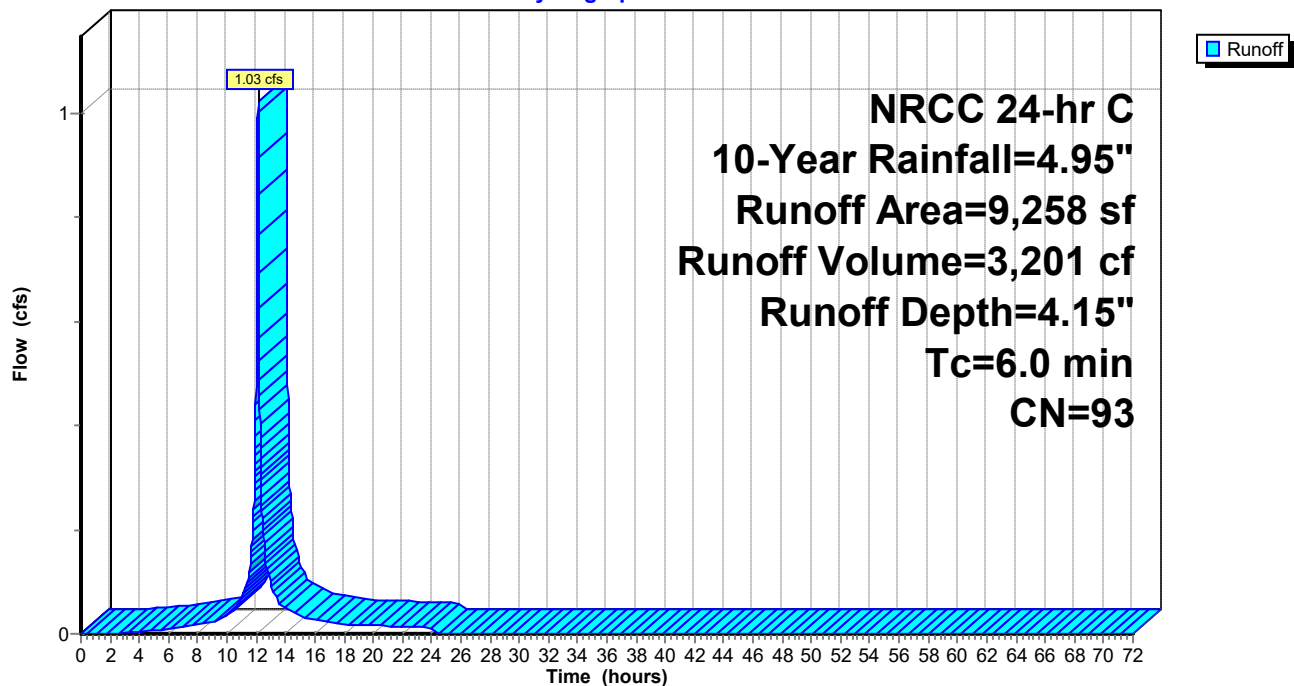
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
372	39	>75% Grass cover, Good, HSG A
4,276	98	Paved parking, HSG A
722	61	>75% Grass cover, Good, HSG B
3,888	98	Paved parking, HSG B
9,258	93	Weighted Average
1,094		11.82% Pervious Area
8,164		88.18% Impervious Area

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

Subcatchment EN: Entrance

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 43

Summary for Subcatchment S-A: Subcatchment A

Runoff = 4.01 cfs @ 12.20 hrs, Volume= 15,283 cf, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
6,400	39	>75% Grass cover, Good, HSG A
26,222	98	Paved parking, HSG A
4,145	80	>75% Grass cover, Good, HSG D
12,478	98	Paved parking, HSG D
49,245	89	Weighted Average
10,545		21.41% Pervious Area
38,700		78.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
1.1	77	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.5	188	0.0100	2.03		Shallow Concentrated Flow, Parking - CD Paved Kv= 20.3 fps
0.4	117	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
12.6	432	Total			

3395.1 - 0 Pond Street - Proposed Conditions

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

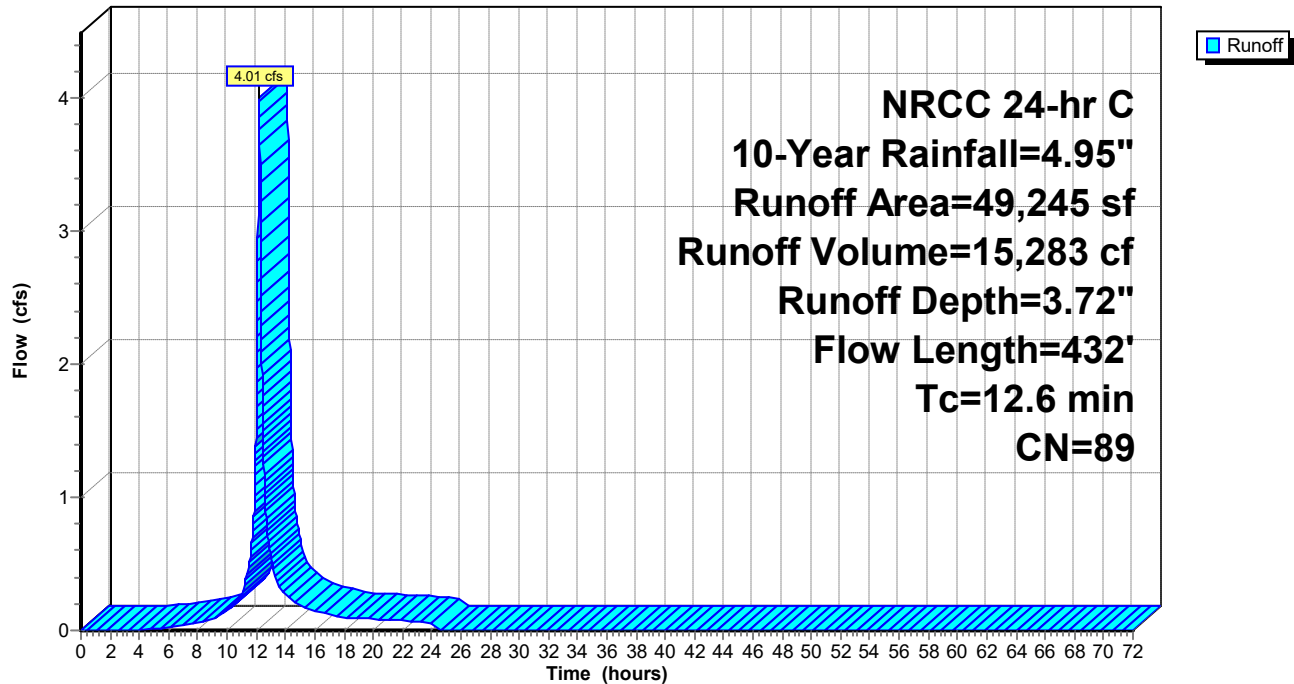
NRCC 24-hr C 10-Year Rainfall=4.95"

Printed 7/17/2023

Page 44

Subcatchment S-A: Subcatchment A

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 45

Summary for Subcatchment S-B: Subcatchment B

Runoff = 3.02 cfs @ 12.13 hrs, Volume= 9,516 cf, Depth= 4.26"

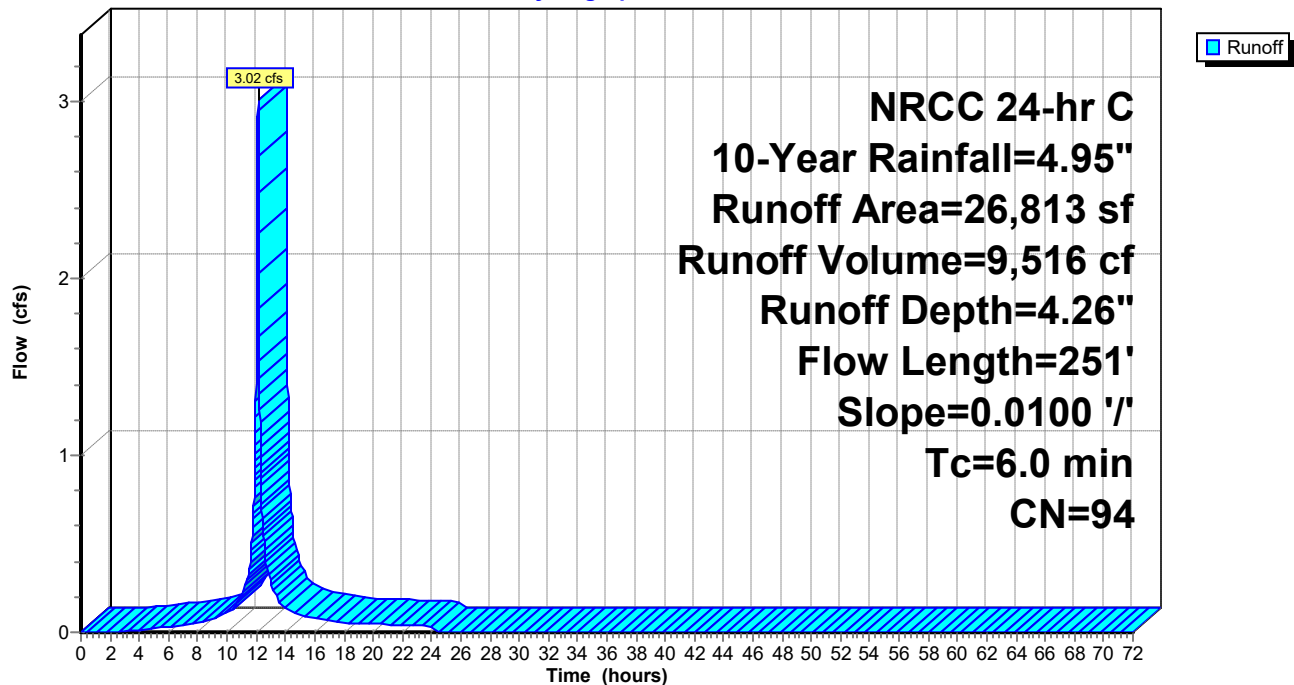
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
1,898	39	>75% Grass cover, Good, HSG A
24,546	98	Paved parking, HSG A
144	61	>75% Grass cover, Good, HSG B
225	98	Paved parking, HSG B
26,813	94	Weighted Average
2,042		7.62% Pervious Area
24,771		92.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.93		Sheet Flow, Parking - AB Smooth surfaces n= 0.011 P2= 3.35"
1.1	132	0.0100	2.03		Shallow Concentrated Flow, Parking - BC Paved Kv= 20.3 fps
0.2	69	0.0100	5.36	4.21	Pipe Channel, Pipe - CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.2	251	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S-B: Subcatchment B

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 46

Summary for Subcatchment S-C: Subcatchment C

Runoff = 7.44 cfs @ 12.22 hrs, Volume= 29,563 cf, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 10-Year Rainfall=4.95"

Area (sf)	CN	Description
10,950	39	>75% Grass cover, Good, HSG A
1,530	76	Gravel roads, HSG A
61,036	98	Paved parking, HSG A
3,043	61	>75% Grass cover, Good, HSG B
14,735	98	Paved parking, HSG B
1,289	91	Gravel roads, HSG D
2,676	80	>75% Grass cover, Good, HSG D
95,259	89	Weighted Average
19,488		20.46% Pervious Area
75,771		79.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
2.4	165	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.7	207	0.0100	2.03		Shallow Concentrated Flow, Road - CD Paved Kv= 20.3 fps
0.2	59	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
13.9	481	Total			

3395.1 - 0 Pond Street - Proposed Conditions

Prepared by {enter your company name here}

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

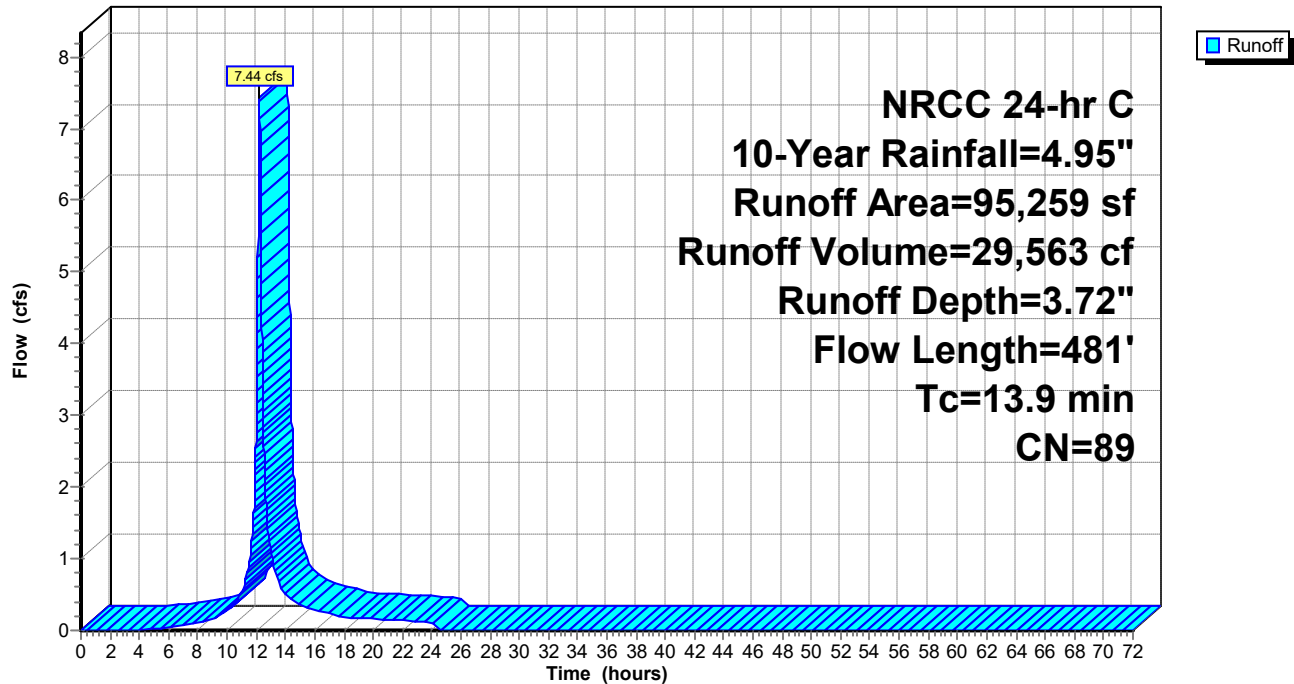
NRCC 24-hr C 10-Year Rainfall=4.95"

Printed 7/17/2023

Page 47

Subcatchment S-C: Subcatchment C

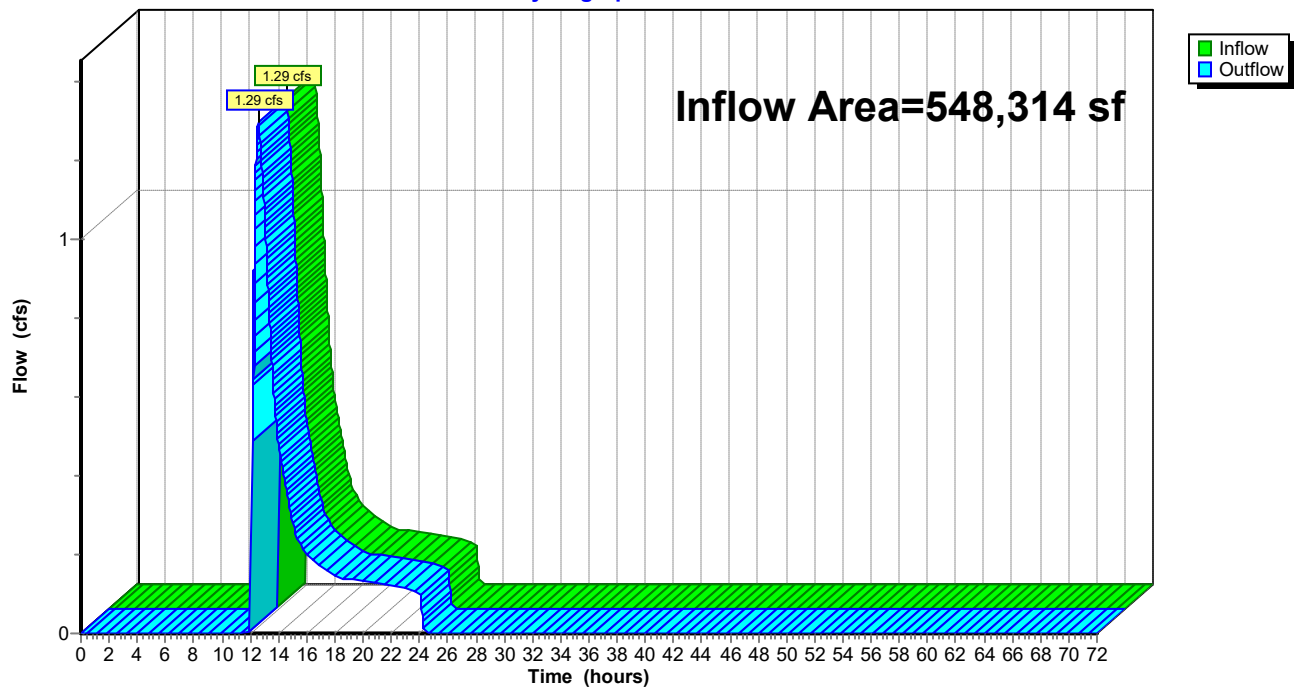
Hydrograph



Summary for Reach T: Total to Wetlands

Inflow Area = 548,314 sf, 37.30% Impervious, Inflow Depth = 0.27" for 10-Year event
Inflow = 1.29 cfs @ 12.57 hrs, Volume= 12,316 cf
Outflow = 1.29 cfs @ 12.57 hrs, Volume= 12,316 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach T: Total to Wetlands**Hydrograph**

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 49

Summary for Pond 1P: DMH-CD

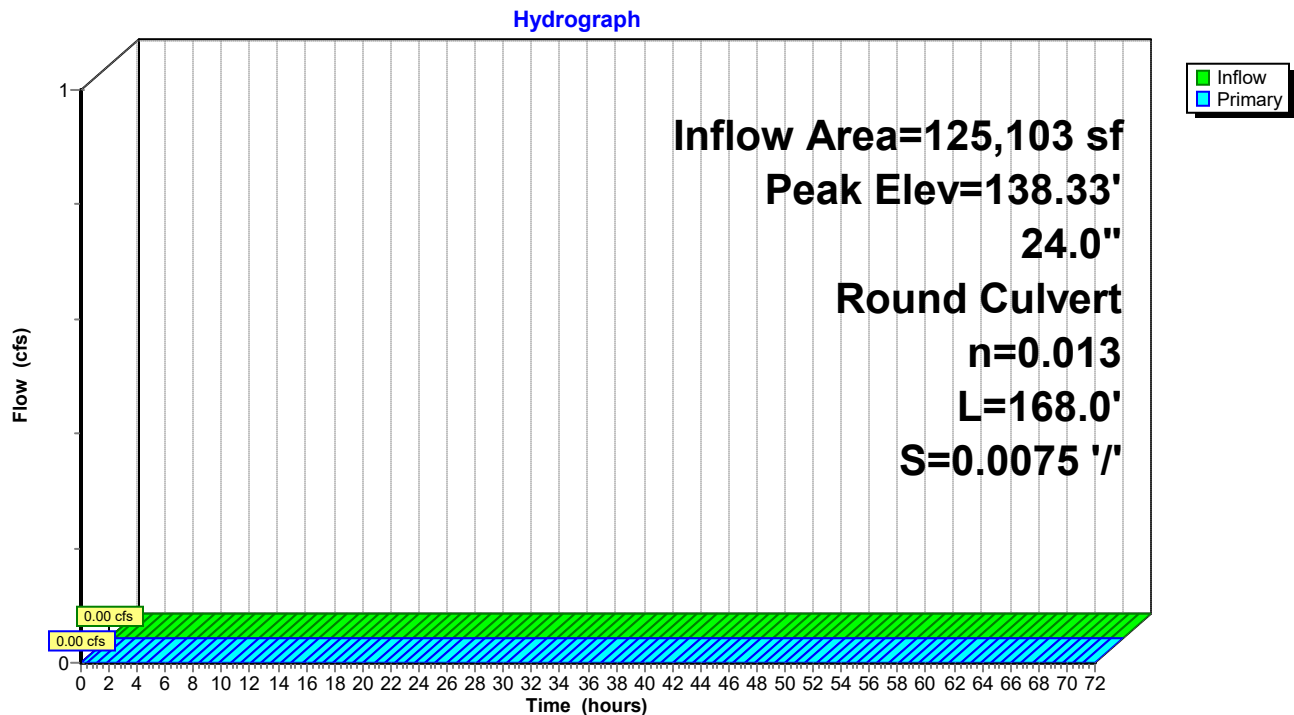
Inflow Area = 125,103 sf, 84.42% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 138.33' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	138.33'	24.0" Round Culvert L= 168.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.33' / 137.07' S= 0.0075 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=138.33' (Free Discharge)
↑1=Culvert (Controls 0.00 cfs)

Pond 1P: DMH-CD



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 50

Stage-Area-Storage for Pond 1P: DMH-CD

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.33	0	139.37	0
138.35	0	139.39	0
138.37	0	139.41	0
138.39	0	139.43	0
138.41	0	139.45	0
138.43	0	139.47	0
138.45	0	139.49	0
138.47	0	139.51	0
138.49	0	139.53	0
138.51	0	139.55	0
138.53	0	139.57	0
138.55	0	139.59	0
138.57	0	139.61	0
138.59	0	139.63	0
138.61	0	139.65	0
138.63	0	139.67	0
138.65	0	139.69	0
138.67	0	139.71	0
138.69	0	139.73	0
138.71	0	139.75	0
138.73	0	139.77	0
138.75	0	139.79	0
138.77	0	139.81	0
138.79	0	139.83	0
138.81	0	139.85	0
138.83	0	139.87	0
138.85	0	139.89	0
138.87	0	139.91	0
138.89	0	139.93	0
138.91	0	139.95	0
138.93	0	139.97	0
138.95	0	139.99	0
138.97	0	140.01	0
138.99	0	140.03	0
139.01	0	140.05	0
139.03	0	140.07	0
139.05	0	140.09	0
139.07	0	140.11	0
139.09	0	140.13	0
139.11	0	140.15	0
139.13	0	140.17	0
139.15	0	140.19	0
139.17	0	140.21	0
139.19	0	140.23	0
139.21	0	140.25	0
139.23	0	140.27	0
139.25	0	140.29	0
139.27	0	140.31	0
139.29	0	140.33	0
139.31	0		
139.33	0		
139.35	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 51

Summary for Pond BG: Bioretention Garden

Inflow Area = 9,258 sf, 88.18% Impervious, Inflow Depth = 4.15" for 10-Year event
 Inflow = 1.03 cfs @ 12.13 hrs, Volume= 3,201 cf
 Outflow = 0.92 cfs @ 12.16 hrs, Volume= 1,825 cf, Atten= 11%, Lag= 1.9 min
 Primary = 0.92 cfs @ 12.16 hrs, Volume= 1,825 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.56' @ 12.16 hrs Surf.Area= 983 sf Storage= 1,440 cf

Plug-Flow detention time= 225.2 min calculated for 1,824 cf (57% of inflow)
 Center-of-Mass det. time= 107.1 min (890.0 - 782.9)

Volume	Invert	Avail.Storage	Storage Description
#1	138.50'	2,064 cf	Retention Area (Irregular) Listed below (Recalc) 4,030 cf Overall - 1,966 cf Embedded = 2,064 cf
#2	138.50'	393 cf	BG Media (Irregular) Listed below (Recalc) Inside #1 1,966 cf Overall x 20.0% Voids
		2,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
142.60	983	141.0	4,030	4,030	1,561

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
140.50	983	141.0	1,966	1,966	1,265

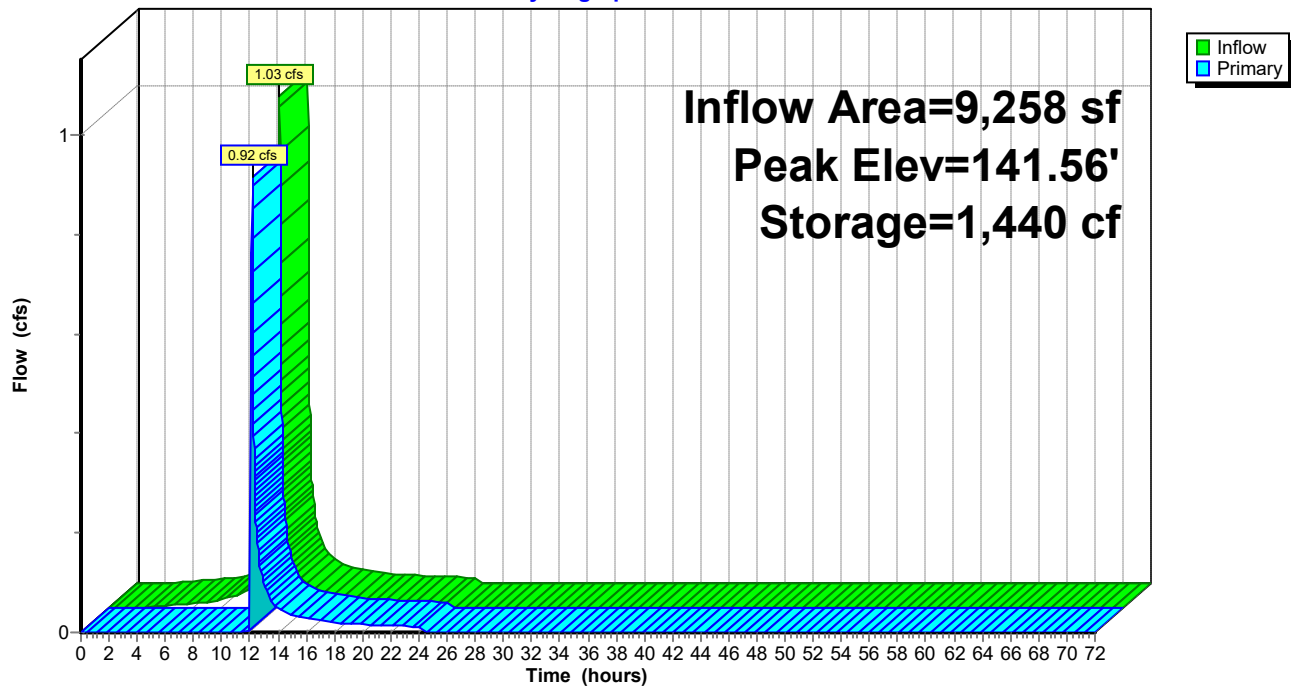
Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	20.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=0.88 cfs @ 12.16 hrs HW=141.56' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 0.88 cfs @ 0.68 fps)

Pond BG: Bioretention Garden

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 53

Stage-Area-Storage for Pond BG: Bioretention Garden

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.50	0	141.10	983
138.55	10	141.15	1,032
138.60	20	141.20	1,081
138.65	29	141.25	1,130
138.70	39	141.30	1,180
138.75	49	141.35	1,229
138.80	59	141.40	1,278
138.85	69	141.45	1,327
138.90	79	141.50	1,376
138.95	88	141.55	1,425
139.00	98	141.60	1,474
139.05	108	141.65	1,524
139.10	118	141.70	1,573
139.15	128	141.75	1,622
139.20	138	141.80	1,671
139.25	147	141.85	1,720
139.30	157	141.90	1,769
139.35	167	141.95	1,819
139.40	177	142.00	1,868
139.45	187	142.05	1,917
139.50	197	142.10	1,966
139.55	206	142.15	2,015
139.60	216	142.20	2,064
139.65	226	142.25	2,113
139.70	236	142.30	2,163
139.75	246	142.35	2,212
139.80	256	142.40	2,261
139.85	265	142.45	2,310
139.90	275	142.50	2,359
139.95	285	142.55	2,408
140.00	295	142.60	2,457
140.05	305		
140.10	315		
140.15	324		
140.20	334		
140.25	344		
140.30	354		
140.35	364		
140.40	374		
140.45	383		
140.50	393		
140.55	442		
140.60	491		
140.65	541		
140.70	590		
140.75	639		
140.80	688		
140.85	737		
140.90	786		
140.95	836		
141.00	885		
141.05	934		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 54

Summary for Pond DMH: DMH-CDE

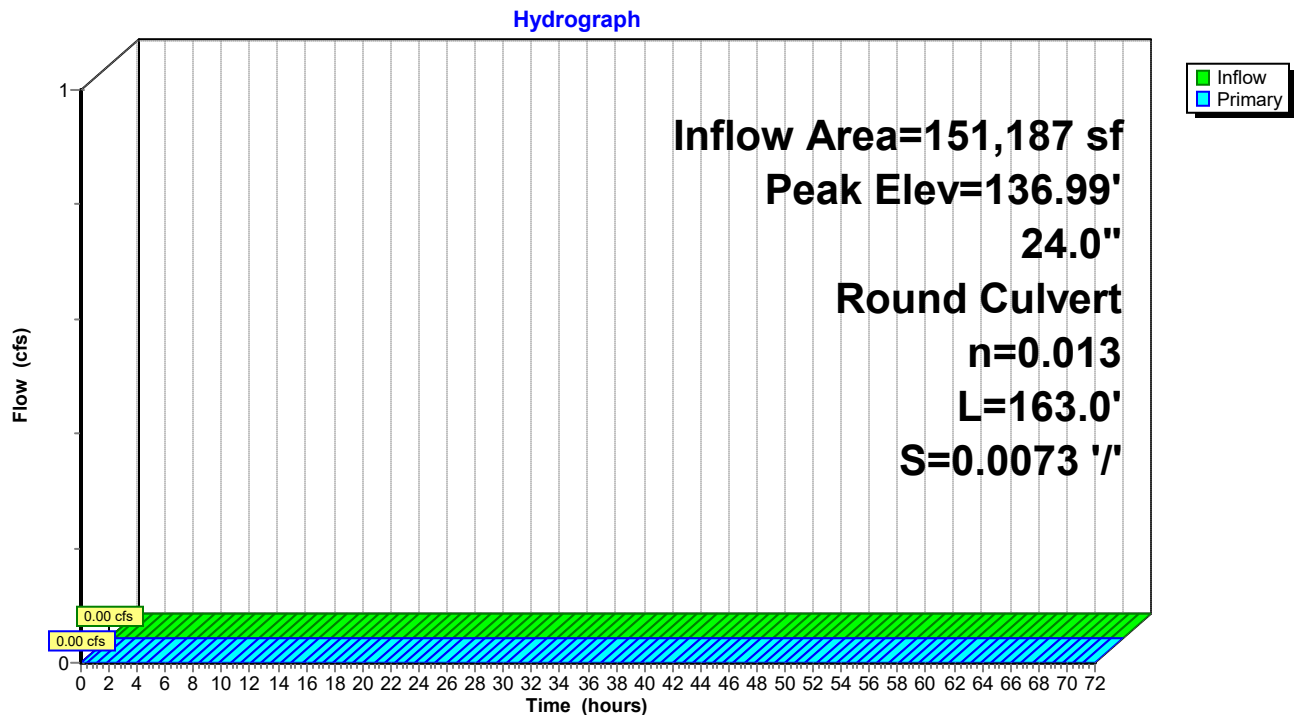
Inflow Area = 151,187 sf, 87.11% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.99' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	136.99'	24.0" Round Culvert L= 163.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.99' / 135.80' S= 0.0073 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=136.99' (Free Discharge)
↑1=Culvert (Controls 0.00 cfs)

Pond DMH: DMH-CDE



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 55

Stage-Area-Storage for Pond DMH: DMH-CDE

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
136.99	0	138.03	0
137.01	0	138.05	0
137.03	0	138.07	0
137.05	0	138.09	0
137.07	0	138.11	0
137.09	0	138.13	0
137.11	0	138.15	0
137.13	0	138.17	0
137.15	0	138.19	0
137.17	0	138.21	0
137.19	0	138.23	0
137.21	0	138.25	0
137.23	0	138.27	0
137.25	0	138.29	0
137.27	0	138.31	0
137.29	0	138.33	0
137.31	0	138.35	0
137.33	0	138.37	0
137.35	0	138.39	0
137.37	0	138.41	0
137.39	0	138.43	0
137.41	0	138.45	0
137.43	0	138.47	0
137.45	0	138.49	0
137.47	0	138.51	0
137.49	0	138.53	0
137.51	0	138.55	0
137.53	0	138.57	0
137.55	0	138.59	0
137.57	0	138.61	0
137.59	0	138.63	0
137.61	0	138.65	0
137.63	0	138.67	0
137.65	0	138.69	0
137.67	0	138.71	0
137.69	0	138.73	0
137.71	0	138.75	0
137.73	0	138.77	0
137.75	0	138.79	0
137.77	0	138.81	0
137.79	0	138.83	0
137.81	0	138.85	0
137.83	0	138.87	0
137.85	0	138.89	0
137.87	0	138.91	0
137.89	0	138.93	0
137.91	0	138.95	0
137.93	0	138.97	0
137.95	0	138.99	0
137.97	0		
137.99	0		
138.01	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 56

Summary for Pond ICS-A: Infiltration Chambers A

Inflow Area = 49,245 sf, 78.59% Impervious, Inflow Depth = 3.72" for 10-Year event
 Inflow = 4.01 cfs @ 12.20 hrs, Volume= 15,283 cf
 Outflow = 0.97 cfs @ 12.61 hrs, Volume= 15,283 cf, Atten= 76%, Lag= 24.8 min
 Discarded = 0.20 cfs @ 10.73 hrs, Volume= 11,567 cf
 Primary = 0.76 cfs @ 12.61 hrs, Volume= 3,715 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.04' @ 12.61 hrs Surf.Area= 3,663 sf Storage= 5,412 cf

Plug-Flow detention time= 138.5 min calculated for 15,281 cf (100% of inflow)
 Center-of-Mass det. time= 138.5 min (945.4 - 806.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 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= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.30' / 135.40' S= 0.0500 ' S= 0.0500 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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 1	140.40'	7.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 10.73 hrs HW=139.04' (Free Discharge)↑ **4=Exfiltration** (Exfiltration Controls 0.20 cfs)**Primary OutFlow** Max=0.76 cfs @ 12.61 hrs HW=141.04' (Free Discharge)↑ **1=Culvert** (Passes 0.76 cfs of 17.00 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)↑ **3=Orifice/Grate** (Orifice Controls 0.76 cfs @ 2.85 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 57

Pond ICS-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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

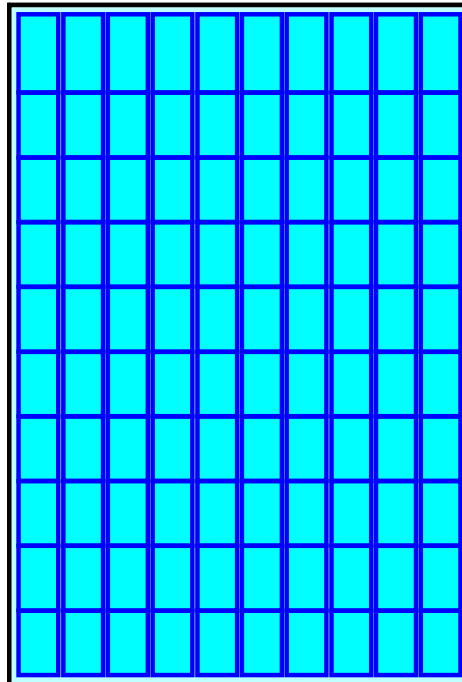
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

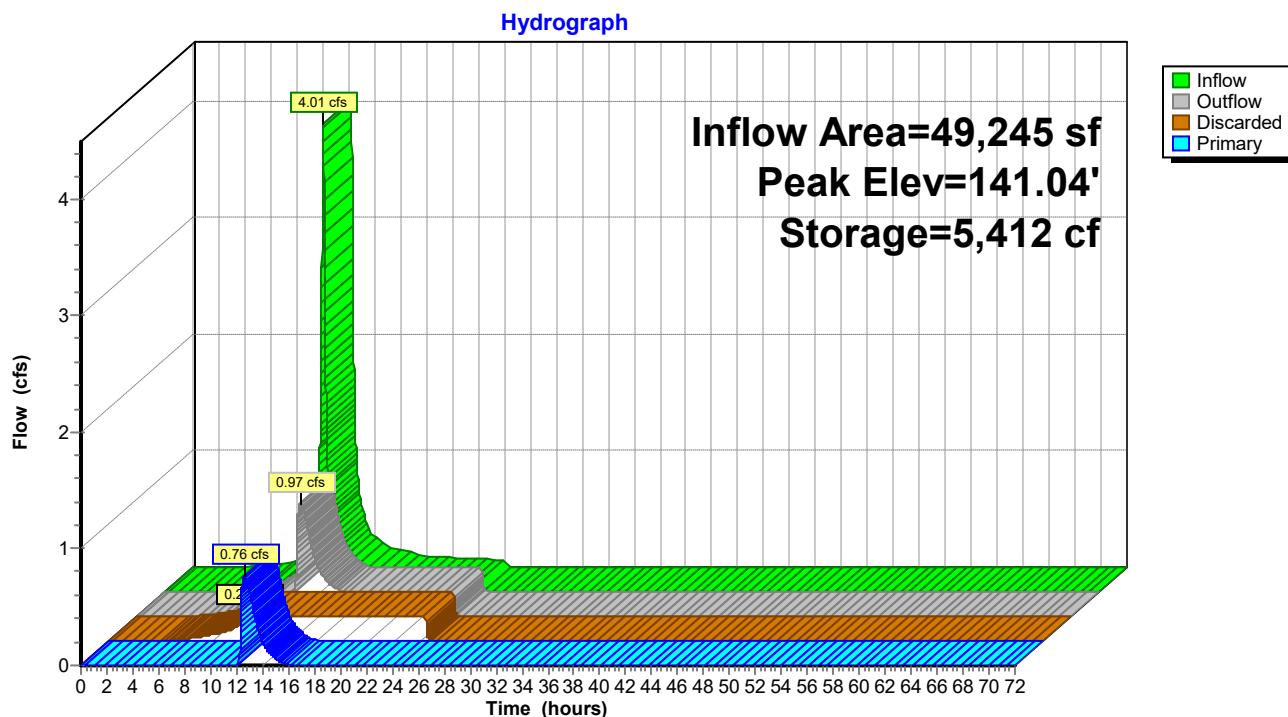
100 Chambers

480.5 cy Field

283.1 cy Stone



Pond ICS-A: Infiltration Chambers A



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 59

Stage-Area-Storage for Pond ICS-A: Infiltration Chambers A

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 60

Summary for Pond ICS-B: Infiltration Chamber System B

Inflow Area = 26,813 sf, 92.38% Impervious, Inflow Depth = 4.26" for 10-Year event
 Inflow = 3.02 cfs @ 12.13 hrs, Volume= 9,516 cf
 Outflow = 0.20 cfs @ 11.04 hrs, Volume= 9,516 cf, Atten= 93%, Lag= 0.0 min
 Discarded = 0.20 cfs @ 11.04 hrs, Volume= 9,516 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.45' @ 13.38 hrs Surf.Area= 3,663 sf Storage= 3,672 cf

Plug-Flow detention time= 136.2 min calculated for 9,514 cf (100% of inflow)
 Center-of-Mass det. time= 136.1 min (913.7 - 777.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.78'	18.0" Round Culvert L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.78' / 136.90' S= 0.0472 ' S= 0.0472 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 11.04 hrs HW=139.04' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)
 ↑ **1=Culvert** (Controls 0.00 cfs)
 ↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 61

Pond ICS-B: Infiltration Chamber System 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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

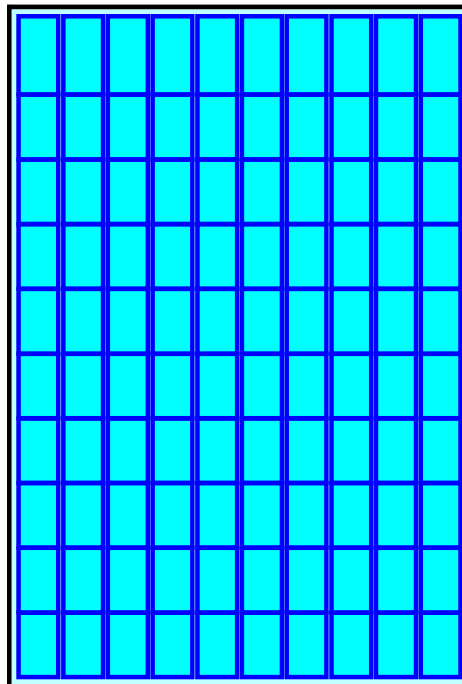
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

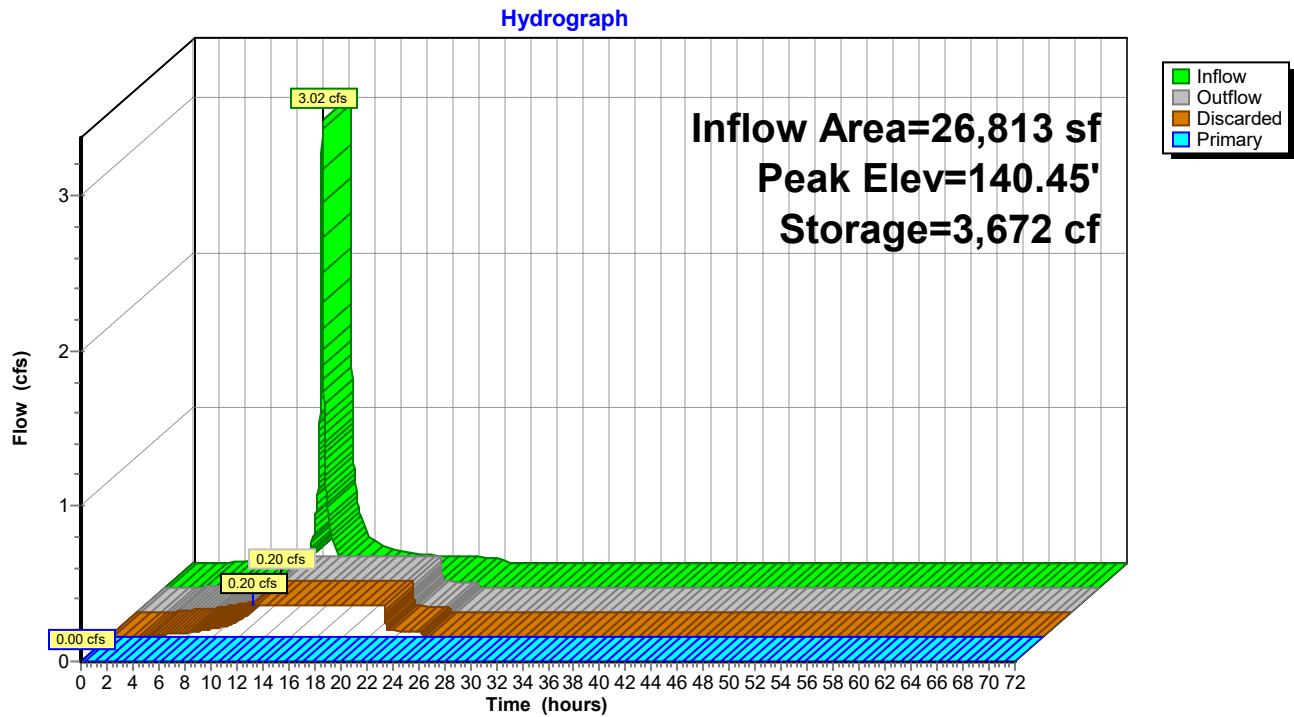
100 Chambers

480.5 cy Field

283.1 cy Stone



Pond ICS-B: Infiltration Chamber System B



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 63

Stage-Area-Storage for Pond ICS-B: Infiltration Chamber System B

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 64

Summary for Pond ICS-C: Infiltration Chambers C

Inflow Area = 95,259 sf, 79.54% Impervious, Inflow Depth = 3.72" for 10-Year event
 Inflow = 7.44 cfs @ 12.22 hrs, Volume= 29,563 cf
 Outflow = 1.51 cfs @ 11.83 hrs, Volume= 29,563 cf, Atten= 80%, Lag= 0.0 min
 Discarded = 1.51 cfs @ 11.83 hrs, Volume= 29,563 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.33' @ 12.73 hrs Surf.Area= 7,902 sf Storage= 7,232 cf

Plug-Flow detention time= 28.0 min calculated for 29,563 cf (100% of inflow)
 Center-of-Mass det. time= 28.0 min (836.1 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	6,516 cf	98.17'W x 80.50'L x 3.54'H Field A 27,988 cf Overall - 11,698 cf Embedded = 16,290 cf x 40.0% Voids
#2A	139.50'	11,698 cf	Cultec R-330XLHD x 220 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 20 rows
		18,214 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	24.0" Round Culvert L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.42' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	141.50'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.51 cfs @ 11.83 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 1.51 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Controls 0.00 cfs)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 65

Pond ICS-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 20 rows

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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' Base Length

20 Rows x 52.0" Wide + 6.0" Spacing x 19 + 12.0" Side Stone x 2 = 98.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

220 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 20 Rows = 11,698.1 cf Chamber Storage

27,987.7 cf Field - 11,698.1 cf Chambers = 16,289.7 cf Stone x 40.0% Voids = 6,515.9 cf Stone Storage

Chamber Storage + Stone Storage = 18,213.9 cf = 0.418 af

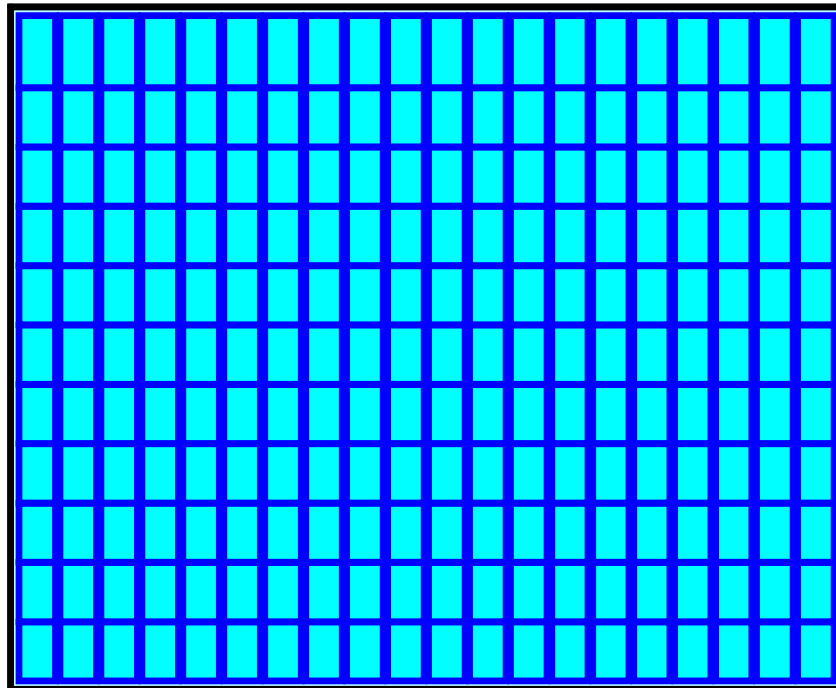
Overall Storage Efficiency = 65.1%

Overall System Size = 80.50' x 98.17' x 3.54'

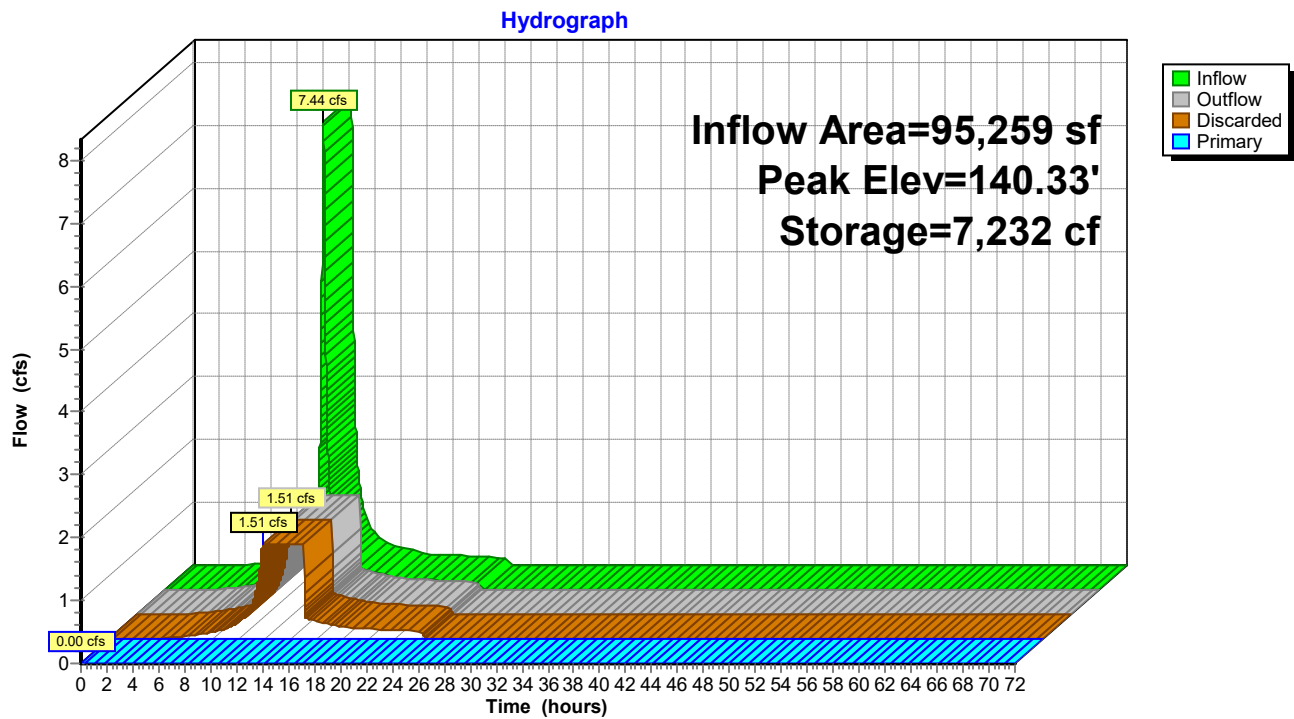
220 Chambers

1,036.6 cy Field

603.3 cy Stone



Pond ICS-C: Infiltration Chambers C



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 67

Stage-Area-Storage for Pond ICS-C: Infiltration Chambers C

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	7,902	0	141.60	7,902	14,866
139.05	7,902	158	141.65	7,902	15,109
139.10	7,902	316	141.70	7,902	15,342
139.15	7,902	474	141.75	7,902	15,565
139.20	7,902	632	141.80	7,902	15,775
139.25	7,902	790	141.85	7,902	15,974
139.30	7,902	948	141.90	7,902	16,161
139.35	7,902	1,106	141.95	7,902	16,337
139.40	7,902	1,264	142.00	7,902	16,502
139.45	7,902	1,422	142.05	7,902	16,660
139.50	7,902	1,580	142.10	7,902	16,818
139.55	7,902	1,926	142.15	7,902	16,976
139.60	7,902	2,270	142.20	7,902	17,134
139.65	7,902	2,613	142.25	7,902	17,292
139.70	7,902	2,956	142.30	7,902	17,450
139.75	7,902	3,297	142.35	7,902	17,608
139.80	7,902	3,639	142.40	7,902	17,766
139.85	7,902	3,980	142.45	7,902	17,924
139.90	7,902	4,320	142.50	7,902	18,082
139.95	7,902	4,661			
140.00	7,902	5,000			
140.05	7,902	5,339			
140.10	7,902	5,677			
140.15	7,902	6,012			
140.20	7,902	6,345			
140.25	7,902	6,676			
140.30	7,902	7,006			
140.35	7,902	7,336			
140.40	7,902	7,665			
140.45	7,902	7,994			
140.50	7,902	8,322			
140.55	7,902	8,649			
140.60	7,902	8,975			
140.65	7,902	9,301			
140.70	7,902	9,625			
140.75	7,902	9,947			
140.80	7,902	10,266			
140.85	7,902	10,582			
140.90	7,902	10,893			
140.95	7,902	11,202			
141.00	7,902	11,508			
141.05	7,902	11,811			
141.10	7,902	12,110			
141.15	7,902	12,406			
141.20	7,902	12,698			
141.25	7,902	12,986			
141.30	7,902	13,271			
141.35	7,902	13,550			
141.40	7,902	13,825			
141.45	7,902	14,095			
141.50	7,902	14,358			
141.55	7,902	14,616			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 68

Summary for Pond ICS-D: Infiltration Chambers D

Inflow Area = 29,844 sf, 100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
 Inflow = 3.49 cfs @ 12.13 hrs, Volume= 11,722 cf
 Outflow = 0.47 cfs @ 11.58 hrs, Volume= 11,722 cf, Atten= 87%, Lag= 0.0 min
 Discarded = 0.47 cfs @ 11.58 hrs, Volume= 11,722 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.68' @ 12.63 hrs Surf.Area= 2,455 sf Storage= 2,901 cf

Plug-Flow detention time= 33.7 min calculated for 11,722 cf (100% of inflow)
 Center-of-Mass det. time= 33.7 min (783.2 - 749.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,075 cf	30.50'W x 80.50'L x 3.54'H Field A 8,696 cf Overall - 3,509 cf Embedded = 5,186 cf x 40.0% Voids
#2A	139.50'	3,509 cf	Cultec R-330XLHD x 66 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
		5,584 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	138.44'	12.0" Round Culvert L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.44' / 136.79' S= 0.0485 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.47 cfs @ 11.58 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.47 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Passes 0.00 cfs of 1.15 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 69

Pond ICS-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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' 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" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

66 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,509.4 cf Chamber Storage

8,695.7 cf Field - 3,509.4 cf Chambers = 5,186.3 cf Stone x 40.0% Voids = 2,074.5 cf Stone Storage

Chamber Storage + Stone Storage = 5,583.9 cf = 0.128 af

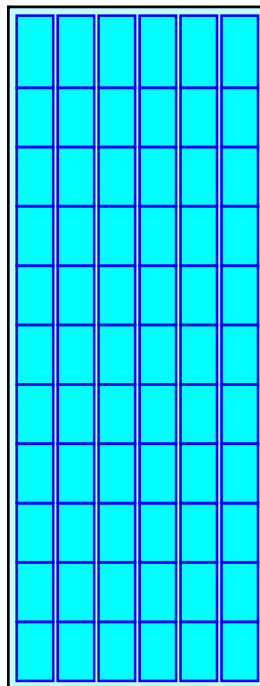
Overall Storage Efficiency = 64.2%

Overall System Size = 80.50' x 30.50' x 3.54'

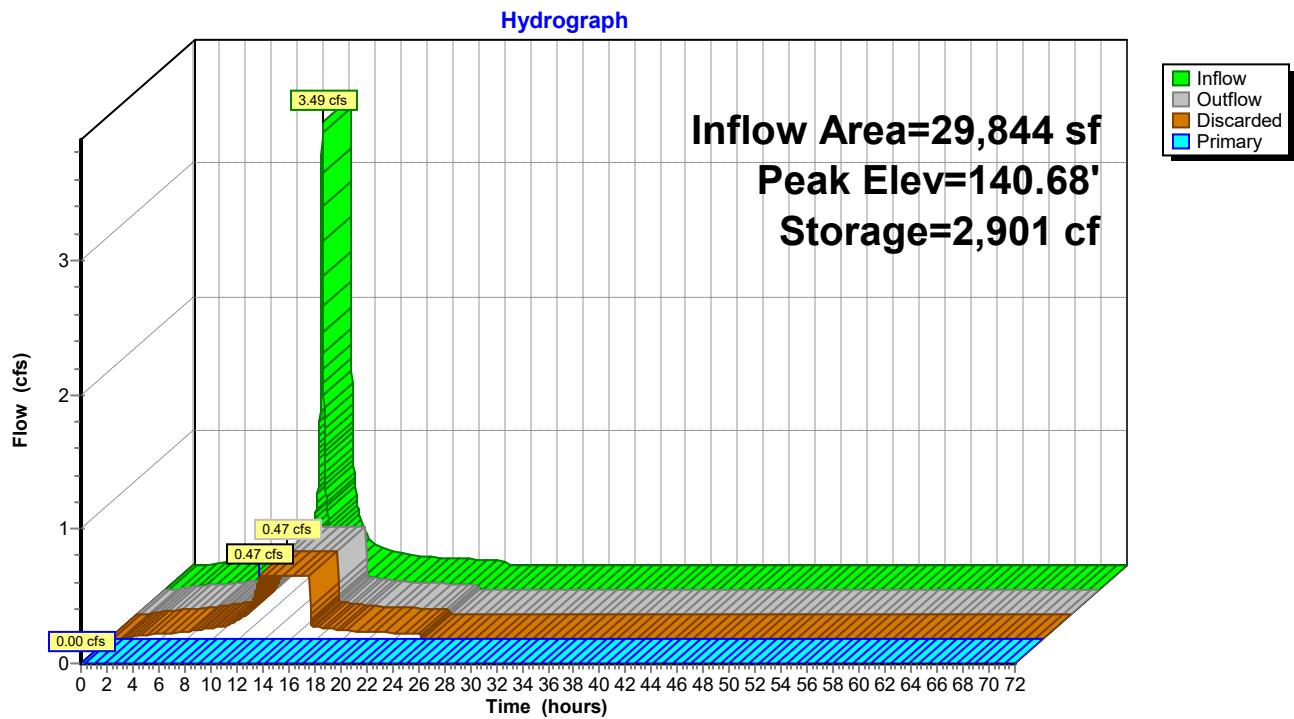
66 Chambers

322.1 cy Field

192.1 cy Stone



Pond ICS-D: Infiltration Chambers D



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 71

Stage-Area-Storage for Pond ICS-D: Infiltration Chambers D

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,455	0	141.60	2,455	4,548
139.05	2,455	49	141.65	2,455	4,622
139.10	2,455	98	141.70	2,455	4,694
139.15	2,455	147	141.75	2,455	4,762
139.20	2,455	196	141.80	2,455	4,827
139.25	2,455	246	141.85	2,455	4,888
139.30	2,455	295	141.90	2,455	4,946
139.35	2,455	344	141.95	2,455	5,001
139.40	2,455	393	142.00	2,455	5,052
139.45	2,455	442	142.05	2,455	5,101
139.50	2,455	491	142.10	2,455	5,150
139.55	2,455	596	142.15	2,455	5,199
139.60	2,455	701	142.20	2,455	5,248
139.65	2,455	806	142.25	2,455	5,297
139.70	2,455	910	142.30	2,455	5,347
139.75	2,455	1,015	142.35	2,455	5,396
139.80	2,455	1,119	142.40	2,455	5,445
139.85	2,455	1,223	142.45	2,455	5,494
139.90	2,455	1,327	142.50	2,455	5,543
139.95	2,455	1,430			
140.00	2,455	1,534			
140.05	2,455	1,637			
140.10	2,455	1,740			
140.15	2,455	1,842			
140.20	2,455	1,944			
140.25	2,455	2,045			
140.30	2,455	2,146			
140.35	2,455	2,246			
140.40	2,455	2,347			
140.45	2,455	2,447			
140.50	2,455	2,547			
140.55	2,455	2,647			
140.60	2,455	2,747			
140.65	2,455	2,846			
140.70	2,455	2,945			
140.75	2,455	3,043			
140.80	2,455	3,141			
140.85	2,455	3,237			
140.90	2,455	3,332			
140.95	2,455	3,427			
141.00	2,455	3,520			
141.05	2,455	3,613			
141.10	2,455	3,704			
141.15	2,455	3,794			
141.20	2,455	3,884			
141.25	2,455	3,972			
141.30	2,455	4,059			
141.35	2,455	4,145			
141.40	2,455	4,229			
141.45	2,455	4,311			
141.50	2,455	4,392			
141.55	2,455	4,471			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 72

Summary for Pond ICS-E: Infiltration Chambers E

Inflow Area = 26,084 sf, 100.00% Impervious, Inflow Depth = 4.71" for 10-Year event
 Inflow = 3.05 cfs @ 12.13 hrs, Volume= 10,245 cf
 Outflow = 0.46 cfs @ 11.62 hrs, Volume= 10,245 cf, Atten= 85%, Lag= 0.0 min
 Discarded = 0.46 cfs @ 11.62 hrs, Volume= 10,245 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.44' @ 12.58 hrs Surf.Area= 2,390 sf Storage= 2,366 cf

Plug-Flow detention time= 27.1 min calculated for 10,245 cf (100% of inflow)
 Center-of-Mass det. time= 27.1 min (776.6 - 749.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,015 cf	40.17'W x 59.50'L x 3.54'H Field A 8,464 cf Overall - 3,427 cf Embedded = 5,037 cf x 40.0% Voids
#2A	139.50'	3,427 cf	Cultec R-330XLHD x 64 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 8 rows
		5,442 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	12.0" Round Culvert L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.55' S= 0.0200 ' S= 0.0200 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.46 cfs @ 11.62 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.46 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Controls 0.00 cfs)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 73

Pond ICS-E: Infiltration Chambers E - 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 8 rows

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

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

8 Rows x 52.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 40.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

64 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 8 Rows = 3,427.5 cf Chamber Storage

8,464.3 cf Field - 3,427.5 cf Chambers = 5,036.8 cf Stone x 40.0% Voids = 2,014.7 cf Stone Storage

Chamber Storage + Stone Storage = 5,442.2 cf = 0.125 af

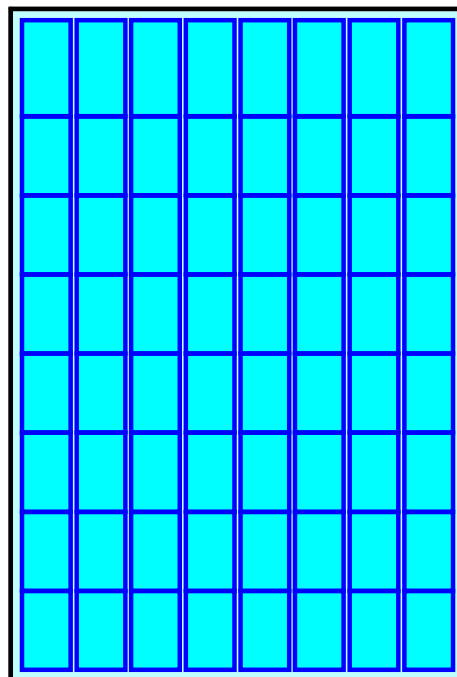
Overall Storage Efficiency = 64.3%

Overall System Size = 59.50' x 40.17' x 3.54'

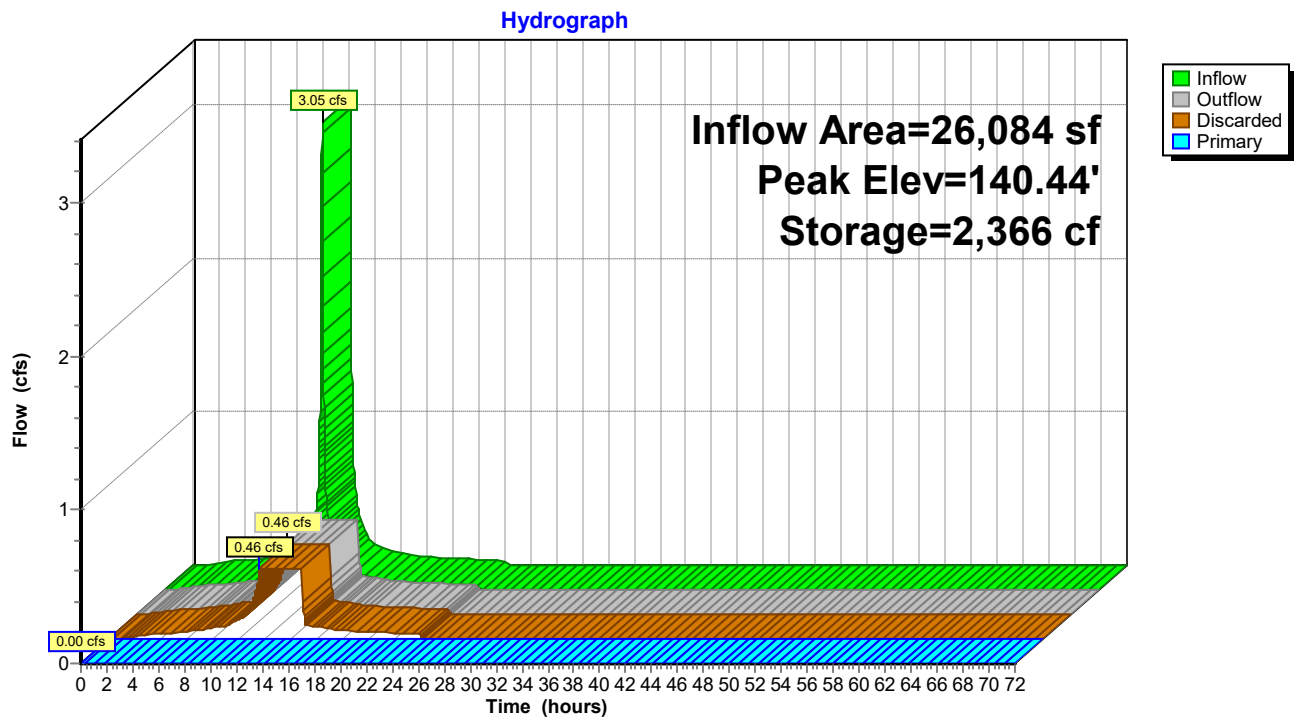
64 Chambers

313.5 cy Field

186.5 cy Stone



Pond ICS-E: Infiltration Chambers E



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 10-Year Rainfall=4.95"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 75

Stage-Area-Storage for Pond ICS-E: Infiltration Chambers E

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,390	0	141.60	2,390	4,433
139.05	2,390	48	141.65	2,390	4,506
139.10	2,390	96	141.70	2,390	4,576
139.15	2,390	143	141.75	2,390	4,642
139.20	2,390	191	141.80	2,390	4,706
139.25	2,390	239	141.85	2,390	4,765
139.30	2,390	287	141.90	2,390	4,821
139.35	2,390	335	141.95	2,390	4,874
139.40	2,390	382	142.00	2,390	4,924
139.45	2,390	430	142.05	2,390	4,972
139.50	2,390	478	142.10	2,390	5,020
139.55	2,390	581	142.15	2,390	5,068
139.60	2,390	683	142.20	2,390	5,116
139.65	2,390	785	142.25	2,390	5,163
139.70	2,390	887	142.30	2,390	5,211
139.75	2,390	988	142.35	2,390	5,259
139.80	2,390	1,090	142.40	2,390	5,307
139.85	2,390	1,191	142.45	2,390	5,355
139.90	2,390	1,293	142.50	2,390	5,402
139.95	2,390	1,394			
140.00	2,390	1,495			
140.05	2,390	1,596			
140.10	2,390	1,696			
140.15	2,390	1,796			
140.20	2,390	1,895			
140.25	2,390	1,993			
140.30	2,390	2,092			
140.35	2,390	2,190			
140.40	2,390	2,288			
140.45	2,390	2,385			
140.50	2,390	2,483			
140.55	2,390	2,580			
140.60	2,390	2,677			
140.65	2,390	2,774			
140.70	2,390	2,871			
140.75	2,390	2,967			
140.80	2,390	3,062			
140.85	2,390	3,155			
140.90	2,390	3,248			
140.95	2,390	3,340			
141.00	2,390	3,431			
141.05	2,390	3,522			
141.10	2,390	3,611			
141.15	2,390	3,699			
141.20	2,390	3,786			
141.25	2,390	3,872			
141.30	2,390	3,957			
141.35	2,390	4,040			
141.40	2,390	4,122			
141.45	2,390	4,203			
141.50	2,390	4,281			
141.55	2,390	4,358			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 76

Summary for Subcatchment B1: Building 1(L)

Runoff = 4.37 cfs @ 12.13 hrs, Volume= 14,802 cf, Depth= 5.95"

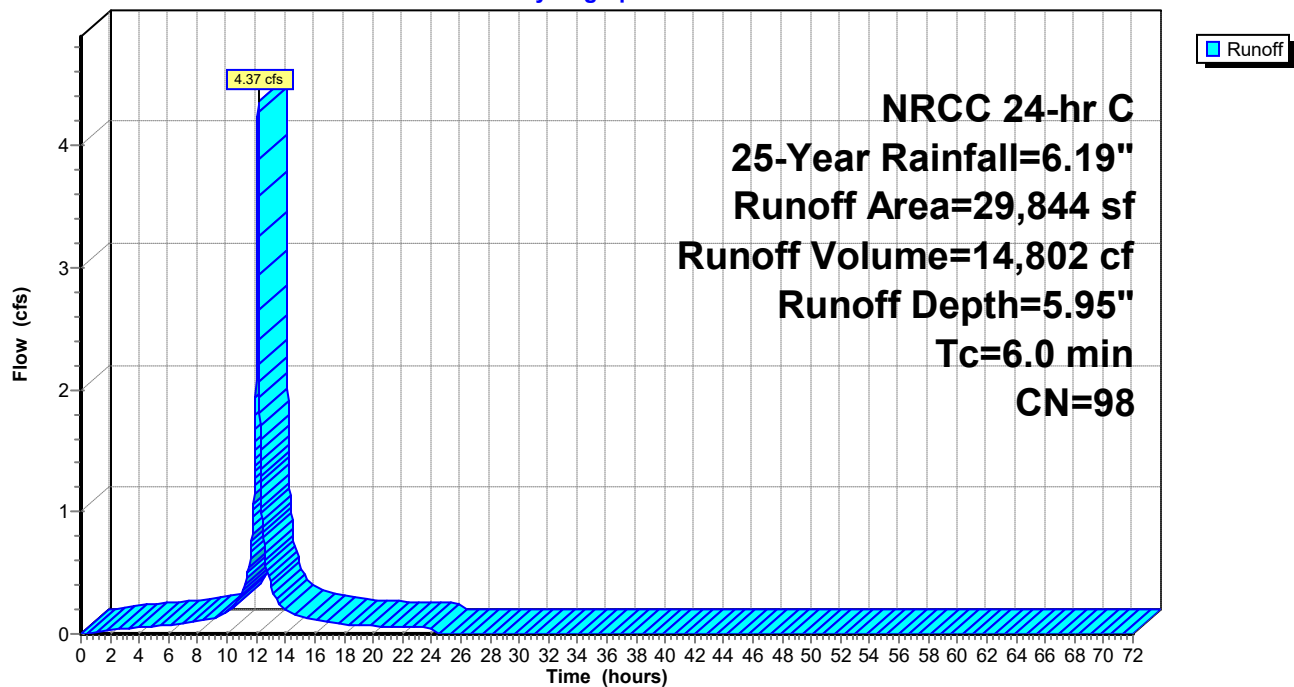
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
29,844	98	Unconnected roofs, HSG A
29,844		100.00% Impervious Area
29,844		100.00% Unconnected

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

Subcatchment B1: Building 1(L)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 77

Summary for Subcatchment B2: Building 2(BAR)

Runoff = 3.82 cfs @ 12.13 hrs, Volume= 12,937 cf, Depth= 5.95"

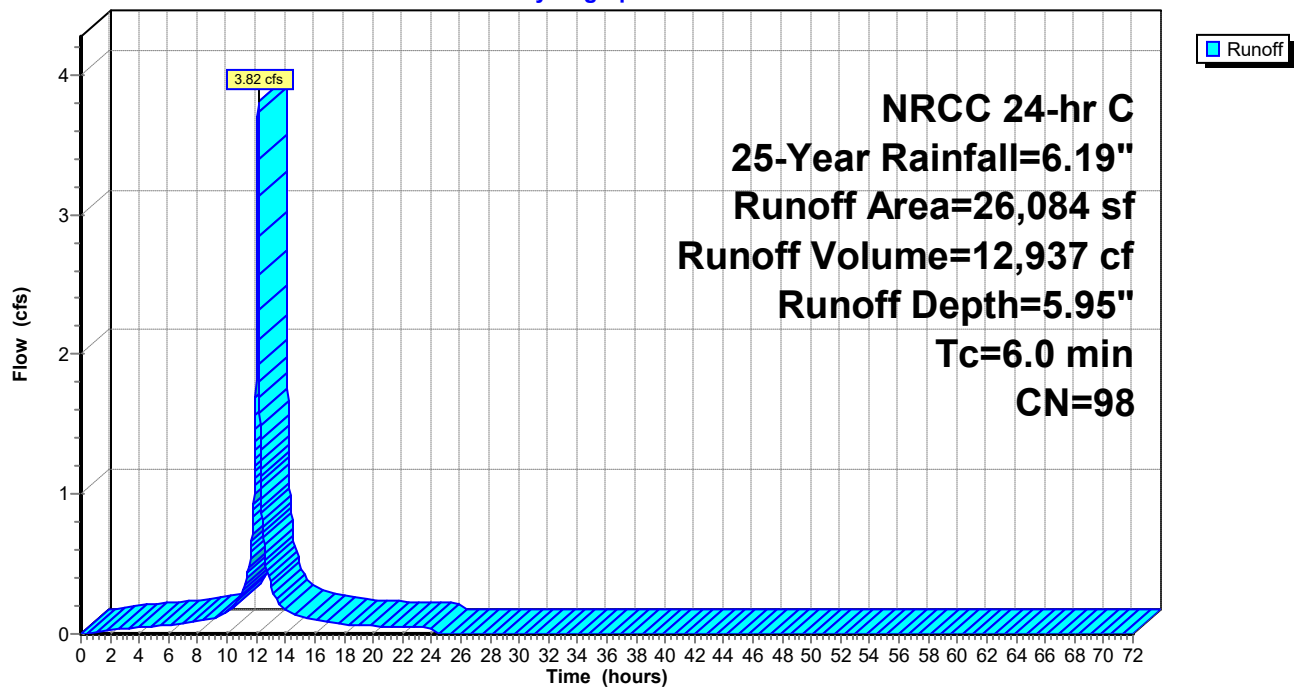
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
26,084	98	Unconnected roofs, HSG A
26,084		100.00% Impervious Area
26,084		100.00% Unconnected

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

Subcatchment B2: Building 2(BAR)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 78

Summary for Subcatchment DW: Direct to Wetland

Runoff = 2.00 cfs @ 12.27 hrs, Volume= 16,101 cf, Depth= 0.62"

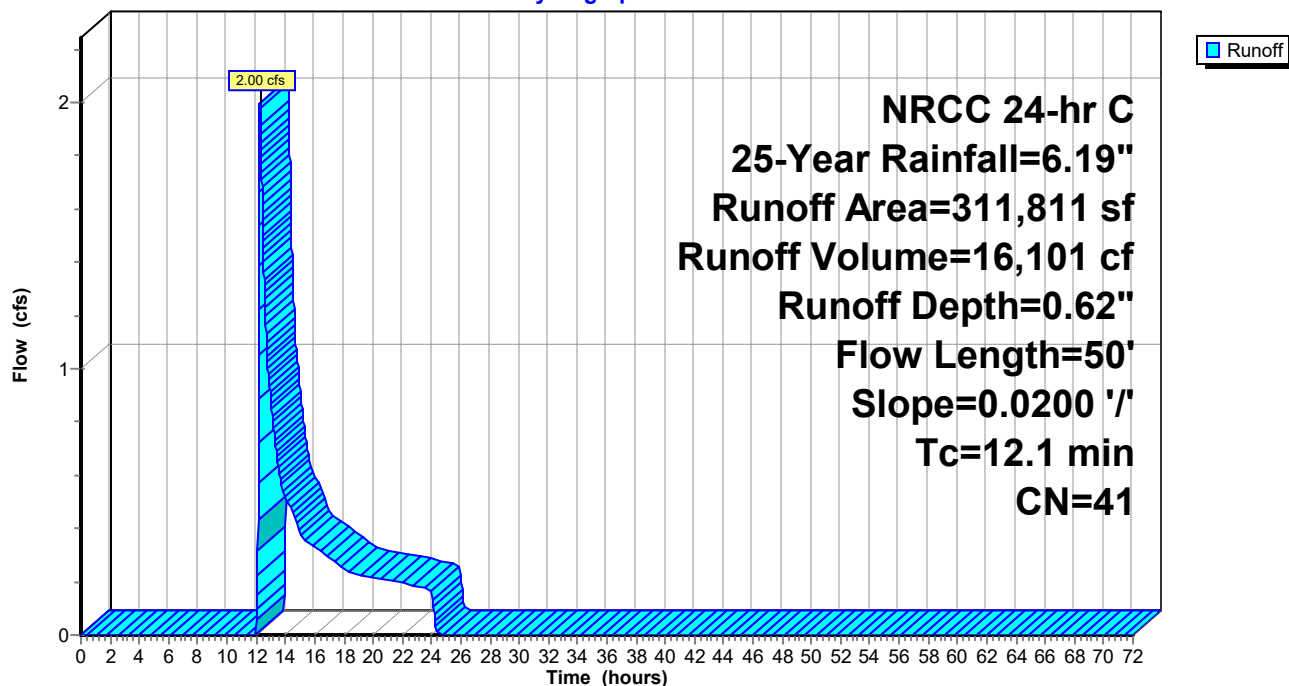
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
196,612	30	Woods, Good, HSG A
36,975	39	>75% Grass cover, Good, HSG A
6,012	76	Gravel roads, HSG A
8,242	72	Dirt roads, HSG A
1,205	98	Paved parking, HSG A
32,491	55	Woods, Good, HSG B
1,342	82	Dirt roads, HSG B
22,867	77	Woods, Good, HSG D
1,051	91	Gravel roads, HSG D
5,014	80	>75% Grass cover, Good, HSG D
311,811	41	Weighted Average
310,606		99.61% Pervious Area
1,205		0.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0200	0.07		Sheet Flow, Wooded - AD
					Woods: Light underbrush n= 0.400 P2= 3.35"

Subcatchment DW: Direct to Wetland

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 79

Summary for Subcatchment EN: Entrance

Runoff = 1.31 cfs @ 12.13 hrs, Volume= 4,143 cf, Depth= 5.37"

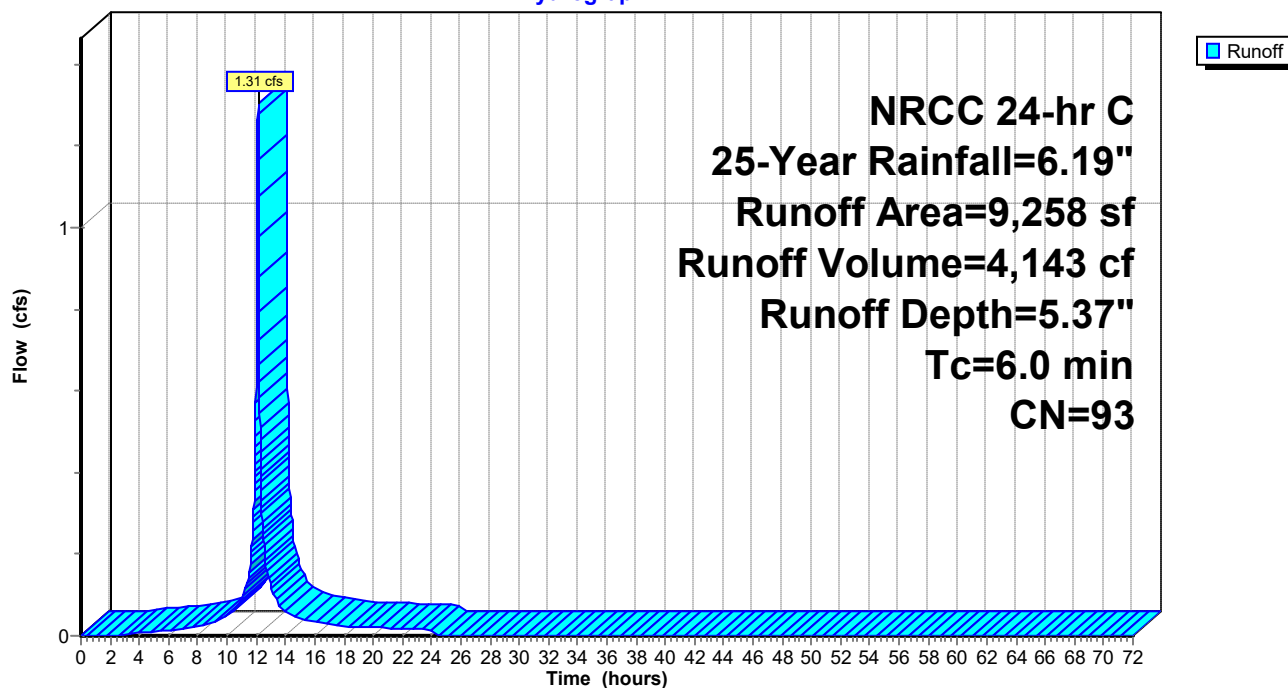
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
372	39	>75% Grass cover, Good, HSG A
4,276	98	Paved parking, HSG A
722	61	>75% Grass cover, Good, HSG B
3,888	98	Paved parking, HSG B
9,258	93	Weighted Average
1,094		11.82% Pervious Area
8,164		88.18% Impervious Area

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

Subcatchment EN: Entrance

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 80

Summary for Subcatchment S-A: Subcatchment A

Runoff = 5.21 cfs @ 12.20 hrs, Volume= 20,189 cf, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
6,400	39	>75% Grass cover, Good, HSG A
26,222	98	Paved parking, HSG A
4,145	80	>75% Grass cover, Good, HSG D
12,478	98	Paved parking, HSG D
49,245	89	Weighted Average
10,545		21.41% Pervious Area
38,700		78.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
1.1	77	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.5	188	0.0100	2.03		Shallow Concentrated Flow, Parking - CD Paved Kv= 20.3 fps
0.4	117	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
12.6	432	Total			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

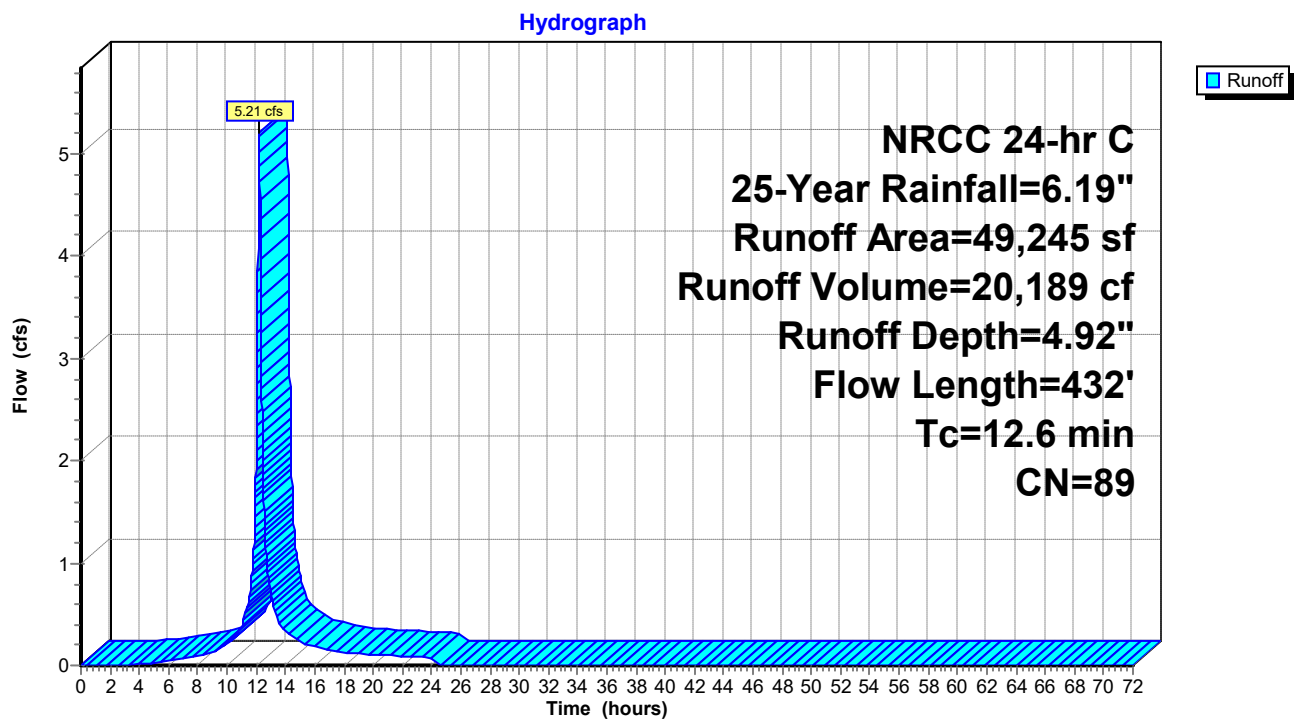
Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 81

Subcatchment S-A: Subcatchment A



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 82

Summary for Subcatchment S-B: Subcatchment B

Runoff = 3.82 cfs @ 12.13 hrs, Volume= 12,255 cf, Depth= 5.48"

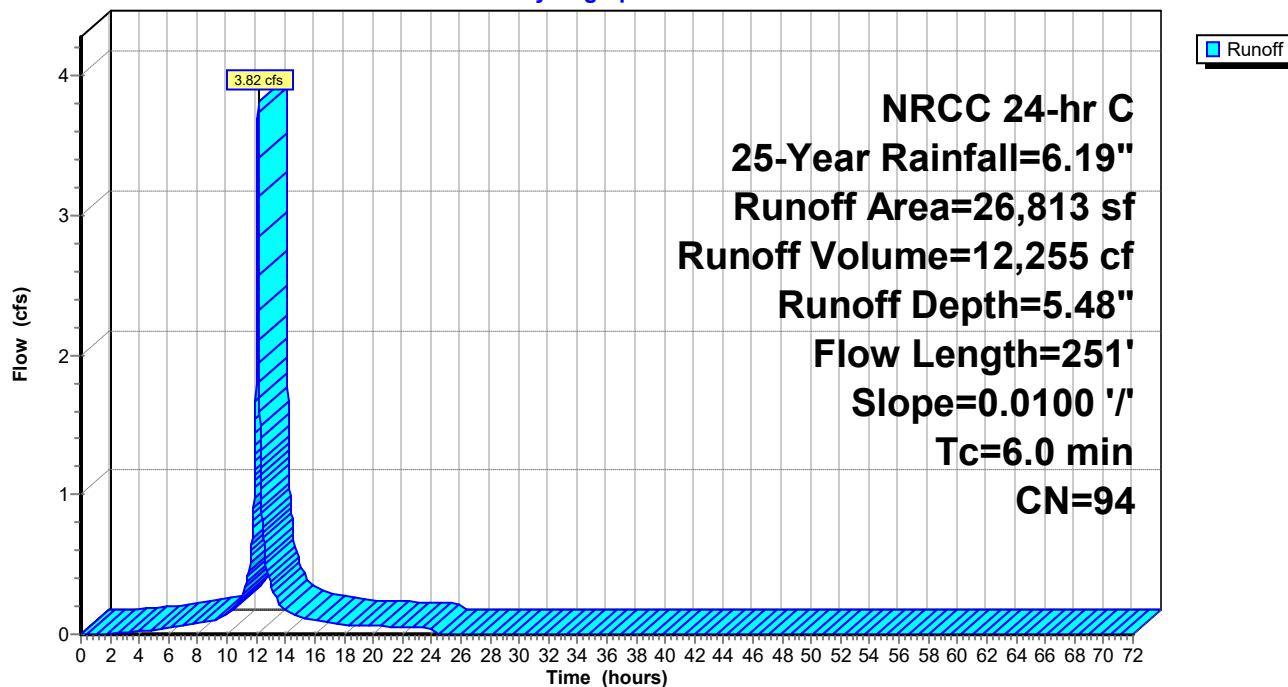
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
1,898	39	>75% Grass cover, Good, HSG A
24,546	98	Paved parking, HSG A
144	61	>75% Grass cover, Good, HSG B
225	98	Paved parking, HSG B
26,813	94	Weighted Average
2,042		7.62% Pervious Area
24,771		92.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.93		Sheet Flow, Parking - AB Smooth surfaces n= 0.011 P2= 3.35"
1.1	132	0.0100	2.03		Shallow Concentrated Flow, Parking - BC Paved Kv= 20.3 fps
0.2	69	0.0100	5.36	4.21	Pipe Channel, Pipe - CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.2	251	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S-B: Subcatchment B

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 83

Summary for Subcatchment S-C: Subcatchment C

Runoff = 9.68 cfs @ 12.22 hrs, Volume= 39,053 cf, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 25-Year Rainfall=6.19"

Area (sf)	CN	Description
10,950	39	>75% Grass cover, Good, HSG A
1,530	76	Gravel roads, HSG A
61,036	98	Paved parking, HSG A
3,043	61	>75% Grass cover, Good, HSG B
14,735	98	Paved parking, HSG B
1,289	91	Gravel roads, HSG D
2,676	80	>75% Grass cover, Good, HSG D
95,259	89	Weighted Average
19,488		20.46% Pervious Area
75,771		79.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
2.4	165	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.7	207	0.0100	2.03		Shallow Concentrated Flow, Road - CD Paved Kv= 20.3 fps
0.2	59	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
13.9	481	Total			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

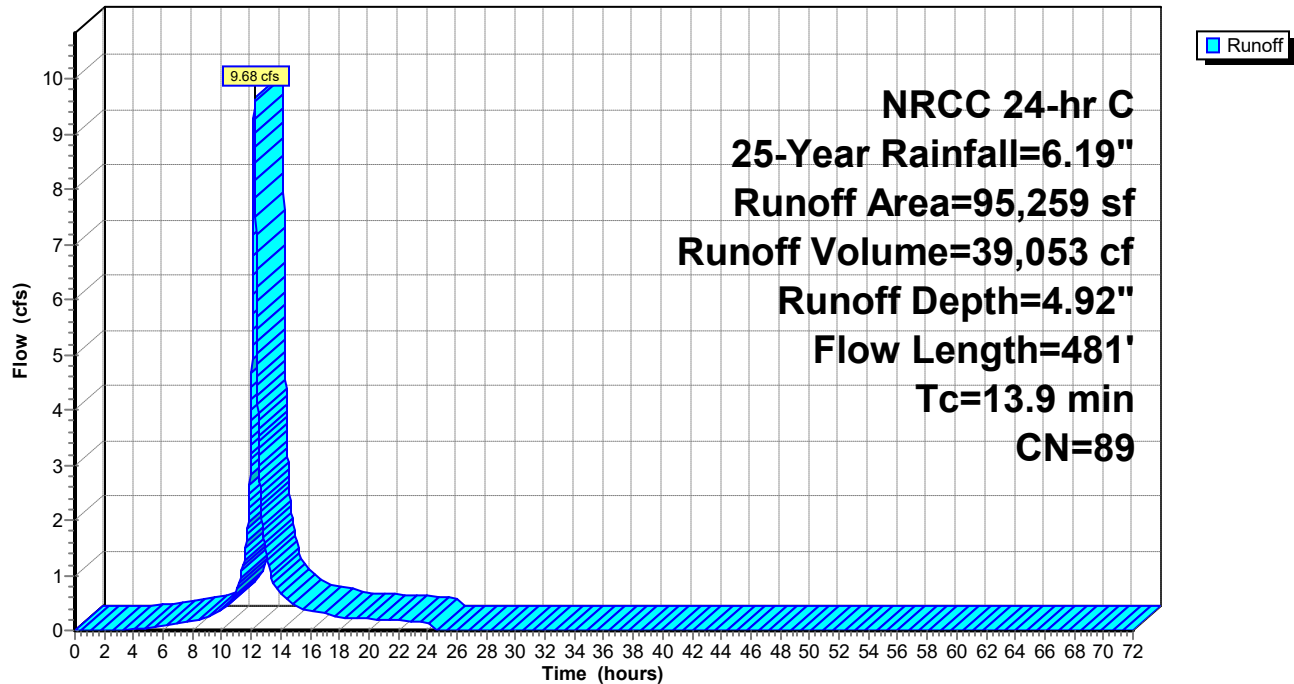
Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 84

Subcatchment S-C: Subcatchment C

Hydrograph



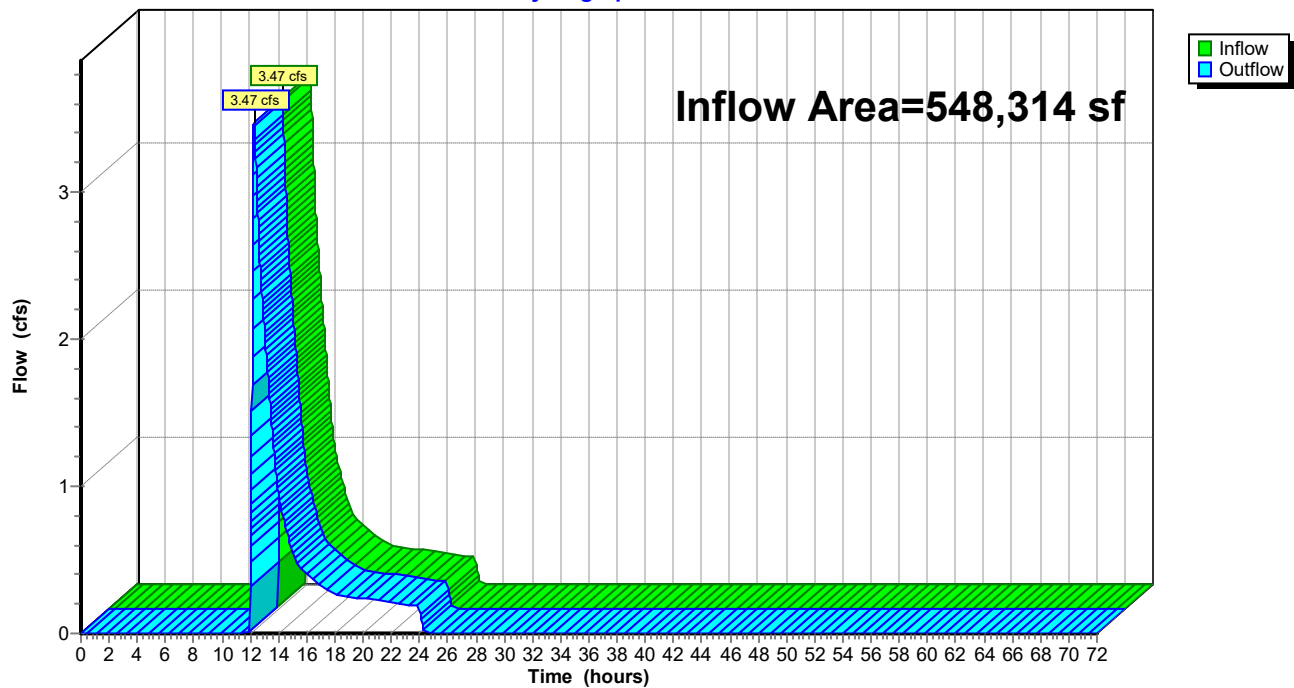
Summary for Reach T: Total to Wetlands

Inflow Area = 548,314 sf, 37.30% Impervious, Inflow Depth = 0.57" for 25-Year event
Inflow = 3.47 cfs @ 12.27 hrs, Volume= 25,986 cf
Outflow = 3.47 cfs @ 12.27 hrs, Volume= 25,986 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach T: Total to Wetlands

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 86

Summary for Pond 1P: DMH-CD

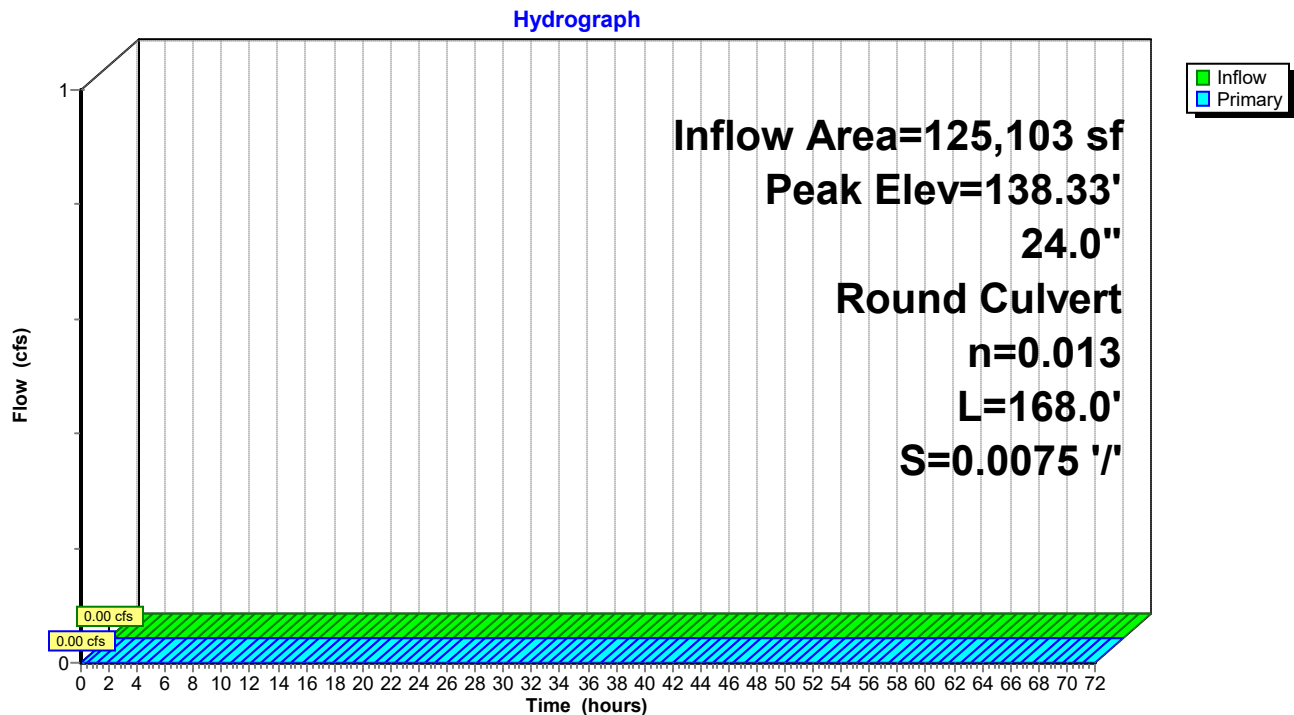
Inflow Area = 125,103 sf, 84.42% Impervious, Inflow Depth = 0.00" for 25-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 138.33' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	138.33'	24.0" Round Culvert L= 168.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.33' / 137.07' S= 0.0075 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=138.33' (Free Discharge)
↑1=Culvert (Controls 0.00 cfs)

Pond 1P: DMH-CD



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 87

Stage-Area-Storage for Pond 1P: DMH-CD

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.33	0	139.37	0
138.35	0	139.39	0
138.37	0	139.41	0
138.39	0	139.43	0
138.41	0	139.45	0
138.43	0	139.47	0
138.45	0	139.49	0
138.47	0	139.51	0
138.49	0	139.53	0
138.51	0	139.55	0
138.53	0	139.57	0
138.55	0	139.59	0
138.57	0	139.61	0
138.59	0	139.63	0
138.61	0	139.65	0
138.63	0	139.67	0
138.65	0	139.69	0
138.67	0	139.71	0
138.69	0	139.73	0
138.71	0	139.75	0
138.73	0	139.77	0
138.75	0	139.79	0
138.77	0	139.81	0
138.79	0	139.83	0
138.81	0	139.85	0
138.83	0	139.87	0
138.85	0	139.89	0
138.87	0	139.91	0
138.89	0	139.93	0
138.91	0	139.95	0
138.93	0	139.97	0
138.95	0	139.99	0
138.97	0	140.01	0
138.99	0	140.03	0
139.01	0	140.05	0
139.03	0	140.07	0
139.05	0	140.09	0
139.07	0	140.11	0
139.09	0	140.13	0
139.11	0	140.15	0
139.13	0	140.17	0
139.15	0	140.19	0
139.17	0	140.21	0
139.19	0	140.23	0
139.21	0	140.25	0
139.23	0	140.27	0
139.25	0	140.29	0
139.27	0	140.31	0
139.29	0	140.33	0
139.31	0		
139.33	0		
139.35	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 88

Summary for Pond BG: Bioretention Garden

Inflow Area = 9,258 sf, 88.18% Impervious, Inflow Depth = 5.37" for 25-Year event
 Inflow = 1.31 cfs @ 12.13 hrs, Volume= 4,143 cf
 Outflow = 1.29 cfs @ 12.14 hrs, Volume= 2,767 cf, Atten= 1%, Lag= 0.6 min
 Primary = 1.29 cfs @ 12.14 hrs, Volume= 2,767 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.58' @ 12.14 hrs Surf.Area= 983 sf Storage= 1,457 cf

Plug-Flow detention time= 192.1 min calculated for 2,767 cf (67% of inflow)
 Center-of-Mass det. time= 86.2 min (861.9 - 775.7)

Volume	Invert	Avail.Storage	Storage Description
#1	138.50'	2,064 cf	Retention Area (Irregular) Listed below (Recalc) 4,030 cf Overall - 1,966 cf Embedded = 2,064 cf
#2	138.50'	393 cf	BG Media (Irregular) Listed below (Recalc) Inside #1 1,966 cf Overall x 20.0% Voids
		2,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
142.60	983	141.0	4,030	4,030	1,561

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
140.50	983	141.0	1,966	1,966	1,265

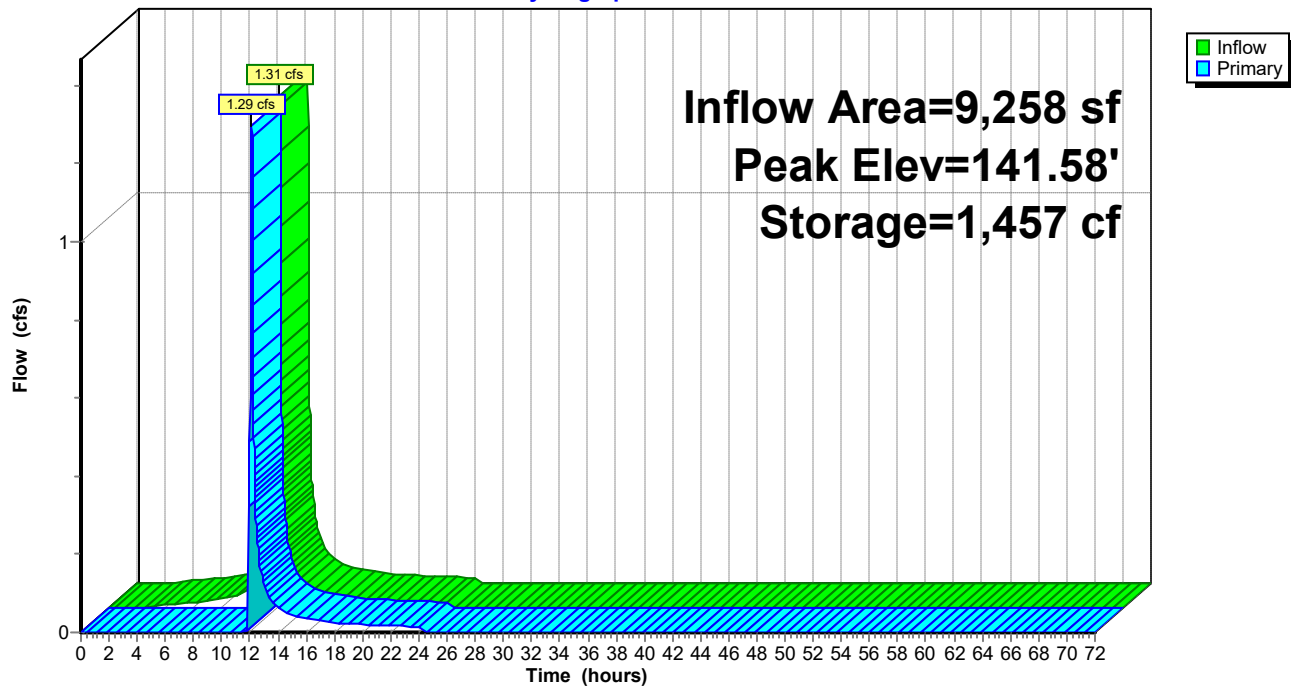
Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	20.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=1.27 cfs @ 12.14 hrs HW=141.58' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 1.27 cfs @ 0.77 fps)

Pond BG: Bioretention Garden

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 90

Stage-Area-Storage for Pond BG: Bioretention Garden

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.50	0	141.10	983
138.55	10	141.15	1,032
138.60	20	141.20	1,081
138.65	29	141.25	1,130
138.70	39	141.30	1,180
138.75	49	141.35	1,229
138.80	59	141.40	1,278
138.85	69	141.45	1,327
138.90	79	141.50	1,376
138.95	88	141.55	1,425
139.00	98	141.60	1,474
139.05	108	141.65	1,524
139.10	118	141.70	1,573
139.15	128	141.75	1,622
139.20	138	141.80	1,671
139.25	147	141.85	1,720
139.30	157	141.90	1,769
139.35	167	141.95	1,819
139.40	177	142.00	1,868
139.45	187	142.05	1,917
139.50	197	142.10	1,966
139.55	206	142.15	2,015
139.60	216	142.20	2,064
139.65	226	142.25	2,113
139.70	236	142.30	2,163
139.75	246	142.35	2,212
139.80	256	142.40	2,261
139.85	265	142.45	2,310
139.90	275	142.50	2,359
139.95	285	142.55	2,408
140.00	295	142.60	2,457
140.05	305		
140.10	315		
140.15	324		
140.20	334		
140.25	344		
140.30	354		
140.35	364		
140.40	374		
140.45	383		
140.50	393		
140.55	442		
140.60	491		
140.65	541		
140.70	590		
140.75	639		
140.80	688		
140.85	737		
140.90	786		
140.95	836		
141.00	885		
141.05	934		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 91

Summary for Pond DMH: DMH-CDE

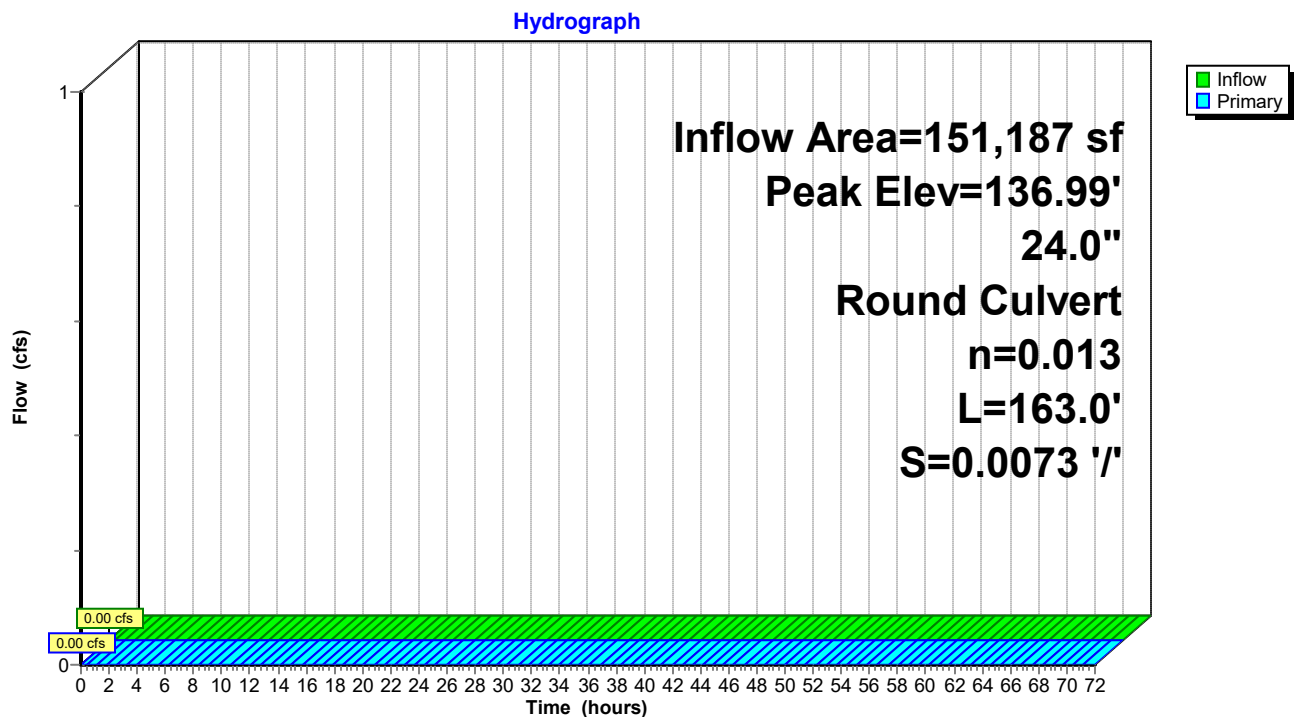
Inflow Area = 151,187 sf, 87.11% Impervious, Inflow Depth = 0.00" for 25-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 136.99' @ 0.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	136.99'	24.0" Round Culvert L= 163.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.99' / 135.80' S= 0.0073 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=136.99' (Free Discharge)
↑1=Culvert (Controls 0.00 cfs)

Pond DMH: DMH-CDE



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 92

Stage-Area-Storage for Pond DMH: DMH-CDE

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
136.99	0	138.03	0
137.01	0	138.05	0
137.03	0	138.07	0
137.05	0	138.09	0
137.07	0	138.11	0
137.09	0	138.13	0
137.11	0	138.15	0
137.13	0	138.17	0
137.15	0	138.19	0
137.17	0	138.21	0
137.19	0	138.23	0
137.21	0	138.25	0
137.23	0	138.27	0
137.25	0	138.29	0
137.27	0	138.31	0
137.29	0	138.33	0
137.31	0	138.35	0
137.33	0	138.37	0
137.35	0	138.39	0
137.37	0	138.41	0
137.39	0	138.43	0
137.41	0	138.45	0
137.43	0	138.47	0
137.45	0	138.49	0
137.47	0	138.51	0
137.49	0	138.53	0
137.51	0	138.55	0
137.53	0	138.57	0
137.55	0	138.59	0
137.57	0	138.61	0
137.59	0	138.63	0
137.61	0	138.65	0
137.63	0	138.67	0
137.65	0	138.69	0
137.67	0	138.71	0
137.69	0	138.73	0
137.71	0	138.75	0
137.73	0	138.77	0
137.75	0	138.79	0
137.77	0	138.81	0
137.79	0	138.83	0
137.81	0	138.85	0
137.83	0	138.87	0
137.85	0	138.89	0
137.87	0	138.91	0
137.89	0	138.93	0
137.91	0	138.95	0
137.93	0	138.97	0
137.95	0	138.99	0
137.97	0		
137.99	0		
138.01	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 93

Summary for Pond ICS-A: Infiltration Chambers A

Inflow Area = 49,245 sf, 78.59% Impervious, Inflow Depth = 4.92" for 25-Year event
 Inflow = 5.21 cfs @ 12.20 hrs, Volume= 20,189 cf
 Outflow = 1.48 cfs @ 12.53 hrs, Volume= 20,189 cf, Atten= 72%, Lag= 20.2 min
 Discarded = 0.20 cfs @ 10.05 hrs, Volume= 13,071 cf
 Primary = 1.27 cfs @ 12.53 hrs, Volume= 7,118 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.67' @ 12.53 hrs Surf.Area= 3,663 sf Storage= 6,992 cf

Plug-Flow detention time= 129.0 min calculated for 20,186 cf (100% of inflow)
 Center-of-Mass det. time= 129.0 min (927.5 - 798.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 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= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.30' / 135.40' S= 0.0500 ' S= 0.0500 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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 1	140.40'	7.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 10.05 hrs HW=139.04' (Free Discharge)↑ **4=Exfiltration** (Exfiltration Controls 0.20 cfs)**Primary OutFlow** Max=1.27 cfs @ 12.53 hrs HW=141.67' (Free Discharge)

↑ **1=Culvert** (Passes 1.27 cfs of 18.29 cfs potential flow)
 ↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
 ↑ **3=Orifice/Grate** (Orifice Controls 1.27 cfs @ 4.76 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 94

Pond ICS-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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

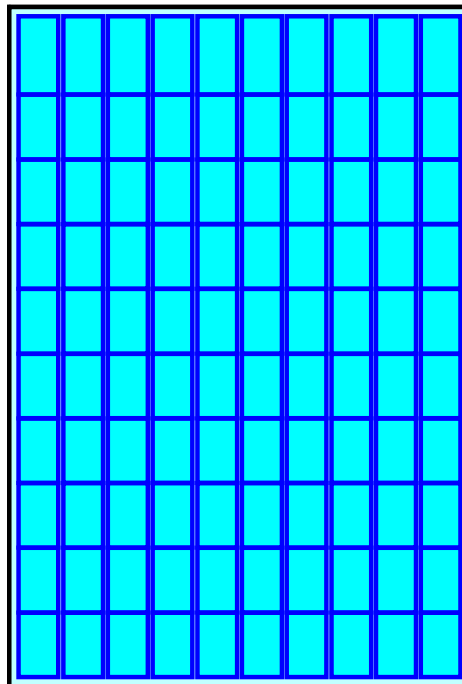
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

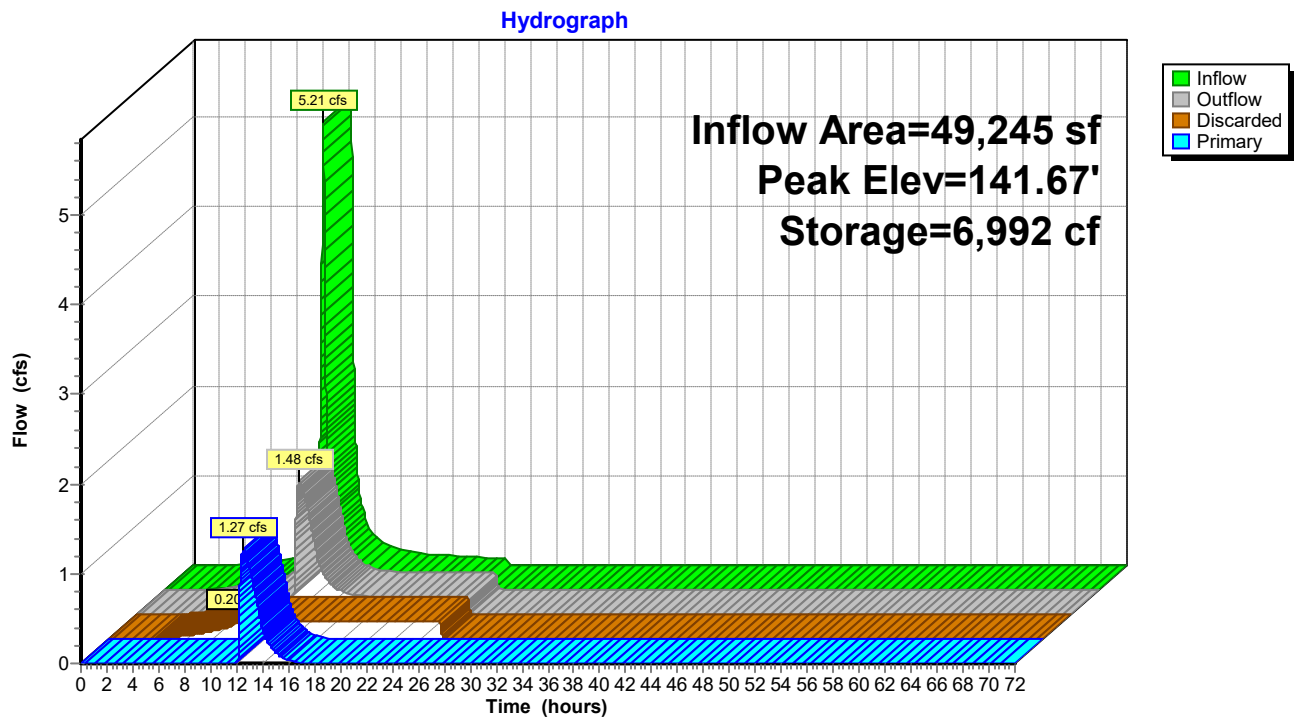
100 Chambers

480.5 cy Field

283.1 cy Stone



Pond ICS-A: Infiltration Chambers A



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 96

Stage-Area-Storage for Pond ICS-A: Infiltration Chambers A

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 97

Summary for Pond ICS-B: Infiltration Chamber System B

Inflow Area = 26,813 sf, 92.38% Impervious, Inflow Depth = 5.48" for 25-Year event
 Inflow = 3.82 cfs @ 12.13 hrs, Volume= 12,255 cf
 Outflow = 0.20 cfs @ 10.73 hrs, Volume= 12,255 cf, Atten= 95%, Lag= 0.0 min
 Discarded = 0.20 cfs @ 10.73 hrs, Volume= 12,255 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.97' @ 13.65 hrs Surf.Area= 3,663 sf Storage= 5,202 cf

Plug-Flow detention time= 206.2 min calculated for 12,254 cf (100% of inflow)
 Center-of-Mass det. time= 206.2 min (977.0 - 770.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.78'	18.0" Round Culvert L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.78' / 136.90' S= 0.0472 ' S= 0.0472 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 10.73 hrs HW=139.04' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)
 ↑ **1=Culvert** (Controls 0.00 cfs)
 ↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 98

Pond ICS-B: Infiltration Chamber System 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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

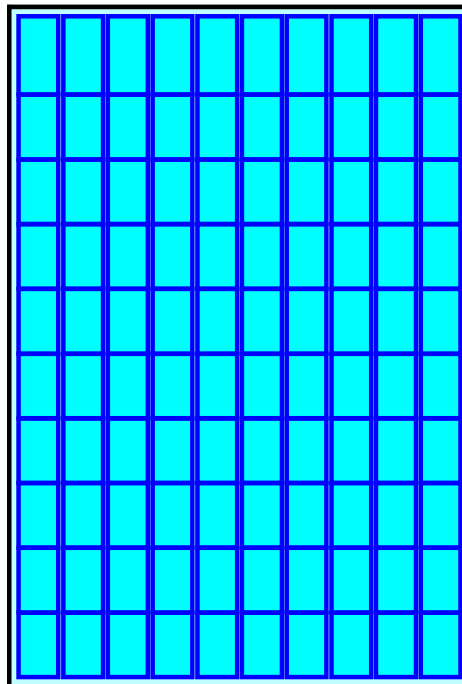
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

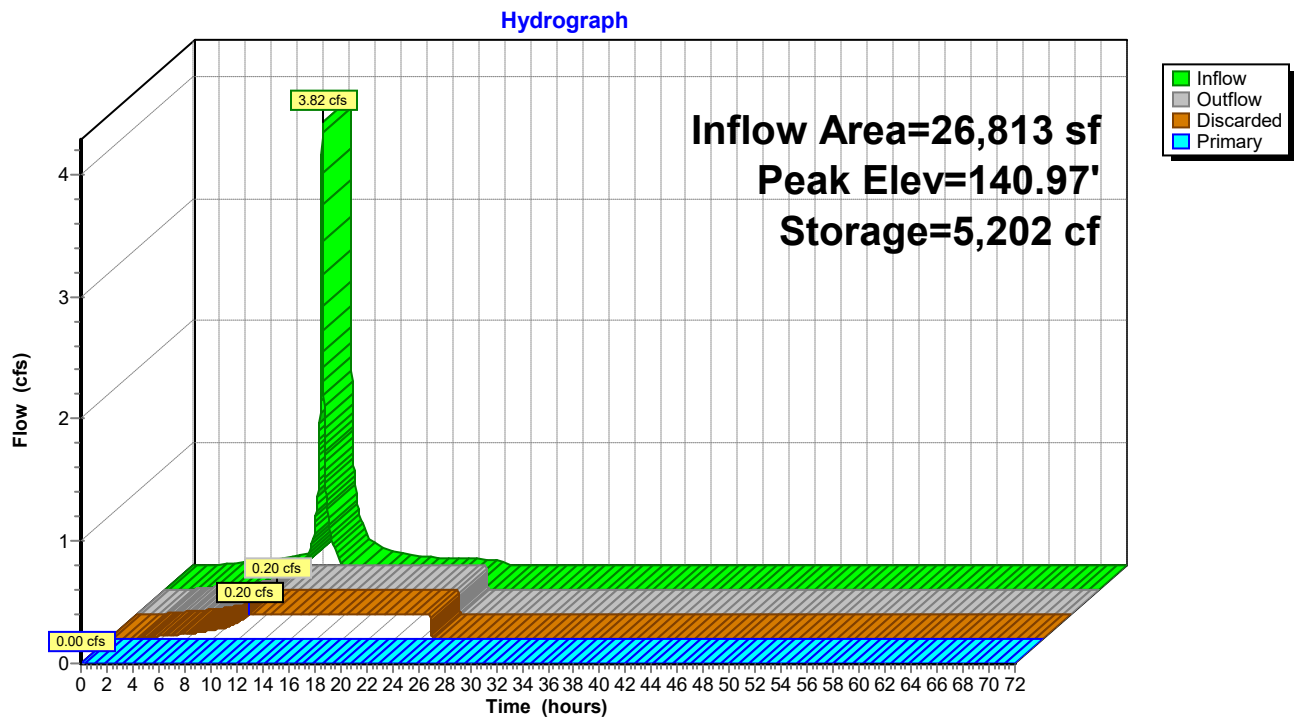
100 Chambers

480.5 cy Field

283.1 cy Stone



Pond ICS-B: Infiltration Chamber System B



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 100

Stage-Area-Storage for Pond ICS-B: Infiltration Chamber System B

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 101

Summary for Pond ICS-C: Infiltration Chambers C

Inflow Area = 95,259 sf, 79.54% Impervious, Inflow Depth = 4.92" for 25-Year event
 Inflow = 9.68 cfs @ 12.22 hrs, Volume= 39,053 cf
 Outflow = 1.51 cfs @ 11.67 hrs, Volume= 39,053 cf, Atten= 84%, Lag= 0.0 min
 Discarded = 1.51 cfs @ 11.67 hrs, Volume= 39,053 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.95' @ 12.92 hrs Surf.Area= 7,902 sf Storage= 11,195 cf

Plug-Flow detention time= 46.9 min calculated for 39,053 cf (100% of inflow)
 Center-of-Mass det. time= 46.9 min (846.6 - 799.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	6,516 cf	98.17'W x 80.50'L x 3.54'H Field A 27,988 cf Overall - 11,698 cf Embedded = 16,290 cf x 40.0% Voids
#2A	139.50'	11,698 cf	Cultec R-330XLHD x 220 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 20 rows
		18,214 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	24.0" Round Culvert L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.42' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	141.50'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.51 cfs @ 11.67 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 1.51 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Controls 0.00 cfs)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 102

Pond ICS-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 20 rows

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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' Base Length

20 Rows x 52.0" Wide + 6.0" Spacing x 19 + 12.0" Side Stone x 2 = 98.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

220 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 20 Rows = 11,698.1 cf Chamber Storage

27,987.7 cf Field - 11,698.1 cf Chambers = 16,289.7 cf Stone x 40.0% Voids = 6,515.9 cf Stone Storage

Chamber Storage + Stone Storage = 18,213.9 cf = 0.418 af

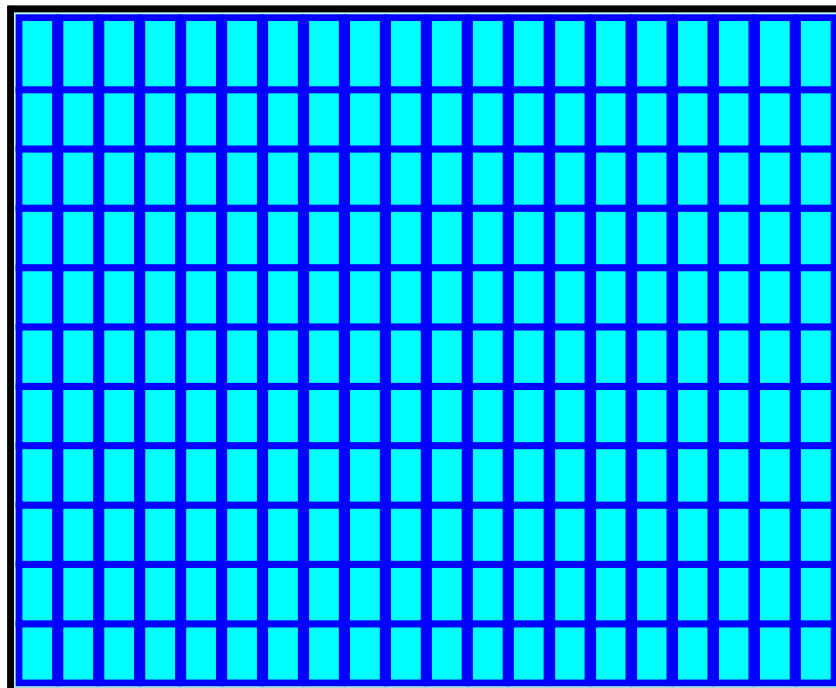
Overall Storage Efficiency = 65.1%

Overall System Size = 80.50' x 98.17' x 3.54'

220 Chambers

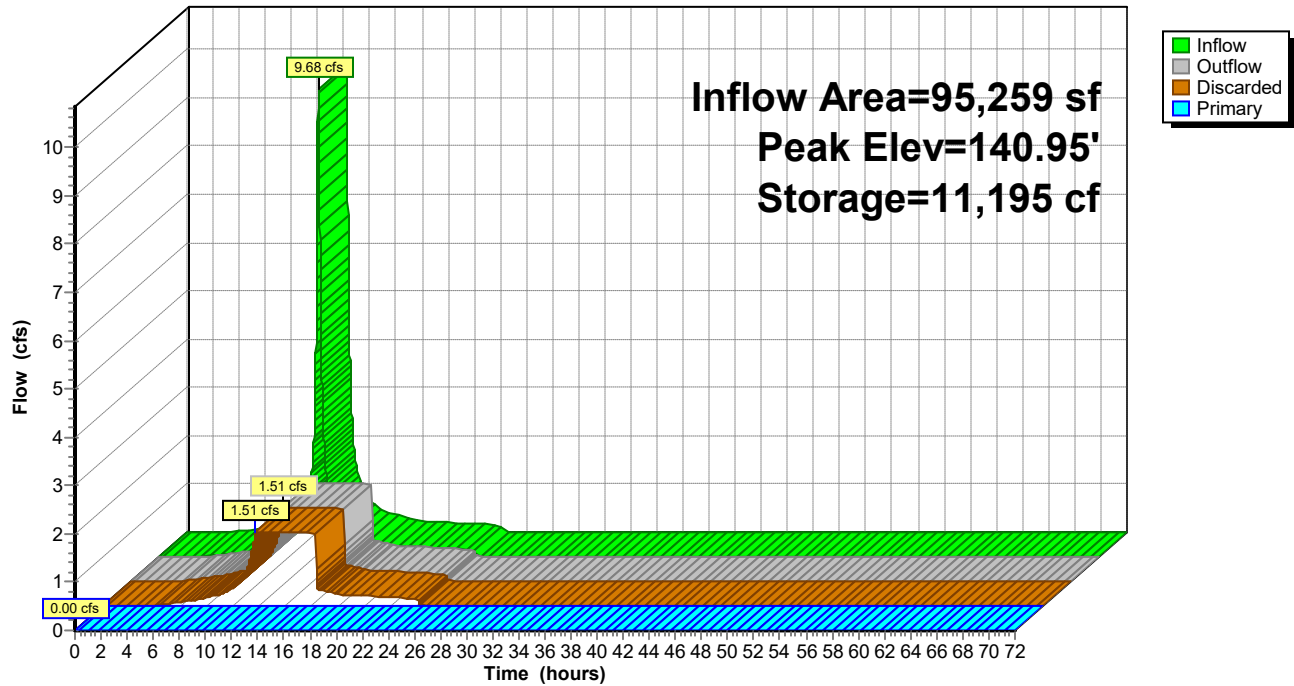
1,036.6 cy Field

603.3 cy Stone



Pond ICS-C: Infiltration Chambers C

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 104

Stage-Area-Storage for Pond ICS-C: Infiltration Chambers C

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	7,902	0	141.60	7,902	14,866
139.05	7,902	158	141.65	7,902	15,109
139.10	7,902	316	141.70	7,902	15,342
139.15	7,902	474	141.75	7,902	15,565
139.20	7,902	632	141.80	7,902	15,775
139.25	7,902	790	141.85	7,902	15,974
139.30	7,902	948	141.90	7,902	16,161
139.35	7,902	1,106	141.95	7,902	16,337
139.40	7,902	1,264	142.00	7,902	16,502
139.45	7,902	1,422	142.05	7,902	16,660
139.50	7,902	1,580	142.10	7,902	16,818
139.55	7,902	1,926	142.15	7,902	16,976
139.60	7,902	2,270	142.20	7,902	17,134
139.65	7,902	2,613	142.25	7,902	17,292
139.70	7,902	2,956	142.30	7,902	17,450
139.75	7,902	3,297	142.35	7,902	17,608
139.80	7,902	3,639	142.40	7,902	17,766
139.85	7,902	3,980	142.45	7,902	17,924
139.90	7,902	4,320	142.50	7,902	18,082
139.95	7,902	4,661			
140.00	7,902	5,000			
140.05	7,902	5,339			
140.10	7,902	5,677			
140.15	7,902	6,012			
140.20	7,902	6,345			
140.25	7,902	6,676			
140.30	7,902	7,006			
140.35	7,902	7,336			
140.40	7,902	7,665			
140.45	7,902	7,994			
140.50	7,902	8,322			
140.55	7,902	8,649			
140.60	7,902	8,975			
140.65	7,902	9,301			
140.70	7,902	9,625			
140.75	7,902	9,947			
140.80	7,902	10,266			
140.85	7,902	10,582			
140.90	7,902	10,893			
140.95	7,902	11,202			
141.00	7,902	11,508			
141.05	7,902	11,811			
141.10	7,902	12,110			
141.15	7,902	12,406			
141.20	7,902	12,698			
141.25	7,902	12,986			
141.30	7,902	13,271			
141.35	7,902	13,550			
141.40	7,902	13,825			
141.45	7,902	14,095			
141.50	7,902	14,358			
141.55	7,902	14,616			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 105

Summary for Pond ICS-D: Infiltration Chambers D

Inflow Area = 29,844 sf, 100.00% Impervious, Inflow Depth = 5.95" for 25-Year event
 Inflow = 4.37 cfs @ 12.13 hrs, Volume= 14,802 cf
 Outflow = 0.47 cfs @ 11.38 hrs, Volume= 14,802 cf, Atten= 89%, Lag= 0.0 min
 Discarded = 0.47 cfs @ 11.38 hrs, Volume= 14,802 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.36' @ 12.85 hrs Surf.Area= 2,455 sf Storage= 4,159 cf

Plug-Flow detention time= 52.2 min calculated for 14,800 cf (100% of inflow)
 Center-of-Mass det. time= 52.2 min (798.0 - 745.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,075 cf	30.50'W x 80.50'L x 3.54'H Field A 8,696 cf Overall - 3,509 cf Embedded = 5,186 cf x 40.0% Voids
#2A	139.50'	3,509 cf	Cultec R-330XLHD x 66 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
		5,584 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	138.44'	12.0" Round Culvert L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.44' / 136.79' S= 0.0485 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.47 cfs @ 11.38 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.47 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Passes 0.00 cfs of 1.15 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 106

Pond ICS-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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' 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" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

66 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,509.4 cf Chamber Storage

8,695.7 cf Field - 3,509.4 cf Chambers = 5,186.3 cf Stone x 40.0% Voids = 2,074.5 cf Stone Storage

Chamber Storage + Stone Storage = 5,583.9 cf = 0.128 af

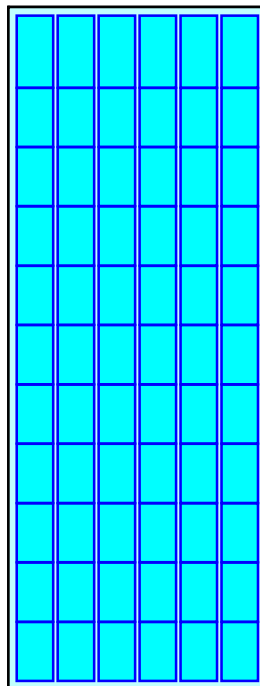
Overall Storage Efficiency = 64.2%

Overall System Size = 80.50' x 30.50' x 3.54'

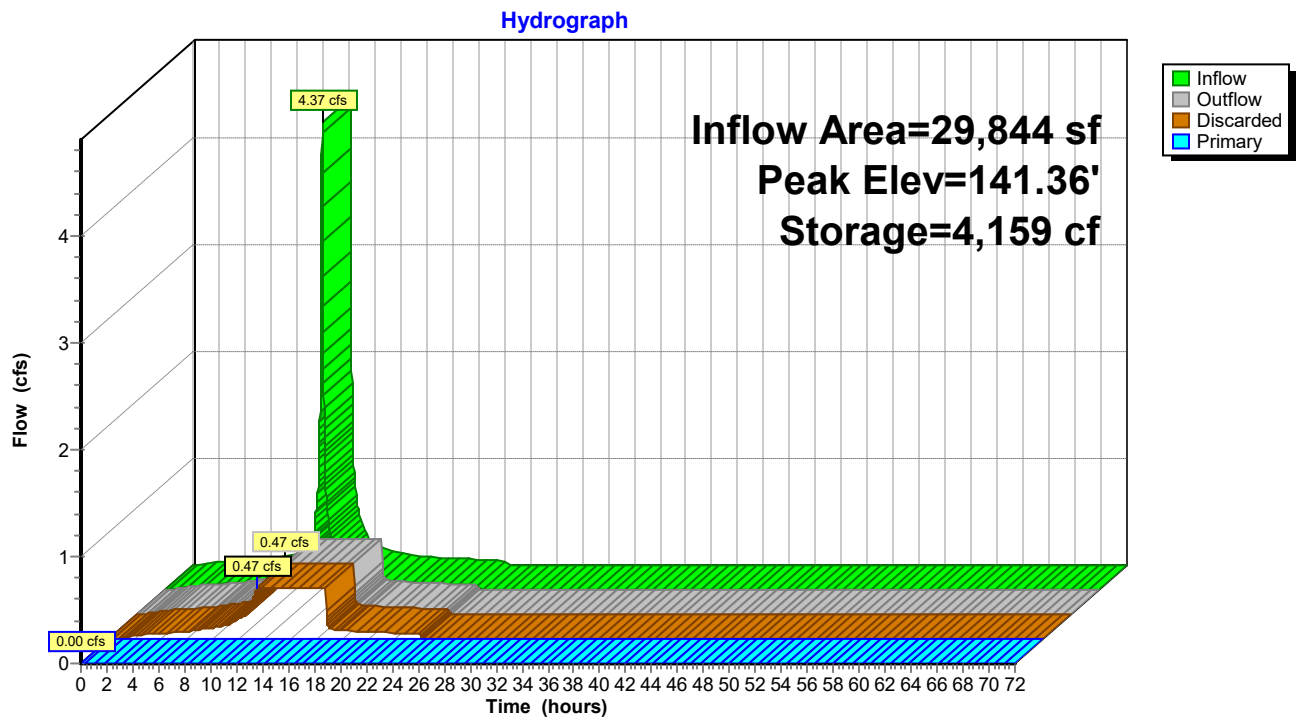
66 Chambers

322.1 cy Field

192.1 cy Stone



Pond ICS-D: Infiltration Chambers D



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 108

Stage-Area-Storage for Pond ICS-D: Infiltration Chambers D

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,455	0	141.60	2,455	4,548
139.05	2,455	49	141.65	2,455	4,622
139.10	2,455	98	141.70	2,455	4,694
139.15	2,455	147	141.75	2,455	4,762
139.20	2,455	196	141.80	2,455	4,827
139.25	2,455	246	141.85	2,455	4,888
139.30	2,455	295	141.90	2,455	4,946
139.35	2,455	344	141.95	2,455	5,001
139.40	2,455	393	142.00	2,455	5,052
139.45	2,455	442	142.05	2,455	5,101
139.50	2,455	491	142.10	2,455	5,150
139.55	2,455	596	142.15	2,455	5,199
139.60	2,455	701	142.20	2,455	5,248
139.65	2,455	806	142.25	2,455	5,297
139.70	2,455	910	142.30	2,455	5,347
139.75	2,455	1,015	142.35	2,455	5,396
139.80	2,455	1,119	142.40	2,455	5,445
139.85	2,455	1,223	142.45	2,455	5,494
139.90	2,455	1,327	142.50	2,455	5,543
139.95	2,455	1,430			
140.00	2,455	1,534			
140.05	2,455	1,637			
140.10	2,455	1,740			
140.15	2,455	1,842			
140.20	2,455	1,944			
140.25	2,455	2,045			
140.30	2,455	2,146			
140.35	2,455	2,246			
140.40	2,455	2,347			
140.45	2,455	2,447			
140.50	2,455	2,547			
140.55	2,455	2,647			
140.60	2,455	2,747			
140.65	2,455	2,846			
140.70	2,455	2,945			
140.75	2,455	3,043			
140.80	2,455	3,141			
140.85	2,455	3,237			
140.90	2,455	3,332			
140.95	2,455	3,427			
141.00	2,455	3,520			
141.05	2,455	3,613			
141.10	2,455	3,704			
141.15	2,455	3,794			
141.20	2,455	3,884			
141.25	2,455	3,972			
141.30	2,455	4,059			
141.35	2,455	4,145			
141.40	2,455	4,229			
141.45	2,455	4,311			
141.50	2,455	4,392			
141.55	2,455	4,471			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 109

Summary for Pond ICS-E: Infiltration Chambers E

Inflow Area = 26,084 sf, 100.00% Impervious, Inflow Depth = 5.95" for 25-Year event
 Inflow = 3.82 cfs @ 12.13 hrs, Volume= 12,937 cf
 Outflow = 0.46 cfs @ 11.50 hrs, Volume= 12,937 cf, Atten= 88%, Lag= 0.0 min
 Discarded = 0.46 cfs @ 11.50 hrs, Volume= 12,937 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.99' @ 12.72 hrs Surf.Area= 2,390 sf Storage= 3,409 cf

Plug-Flow detention time= 42.2 min calculated for 12,935 cf (100% of inflow)
 Center-of-Mass det. time= 42.2 min (788.0 - 745.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,015 cf	40.17'W x 59.50'L x 3.54'H Field A 8,464 cf Overall - 3,427 cf Embedded = 5,037 cf x 40.0% Voids
#2A	139.50'	3,427 cf	Cultec R-330XLHD x 64 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 8 rows
		5,442 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	12.0" Round Culvert L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.55' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.46 cfs @ 11.50 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.46 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=139.00' (Free Discharge)↑ **1=Culvert** (Controls 0.00 cfs)↑ **2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 110

Pond ICS-E: Infiltration Chambers E - 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 8 rows

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

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

8 Rows x 52.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 40.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

64 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 8 Rows = 3,427.5 cf Chamber Storage

8,464.3 cf Field - 3,427.5 cf Chambers = 5,036.8 cf Stone x 40.0% Voids = 2,014.7 cf Stone Storage

Chamber Storage + Stone Storage = 5,442.2 cf = 0.125 af

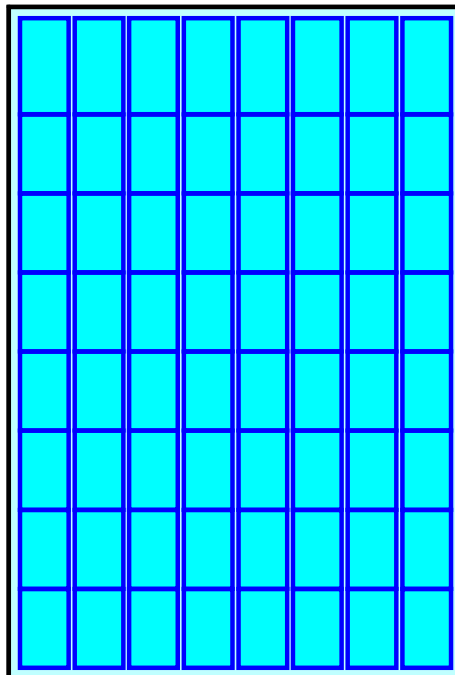
Overall Storage Efficiency = 64.3%

Overall System Size = 59.50' x 40.17' x 3.54'

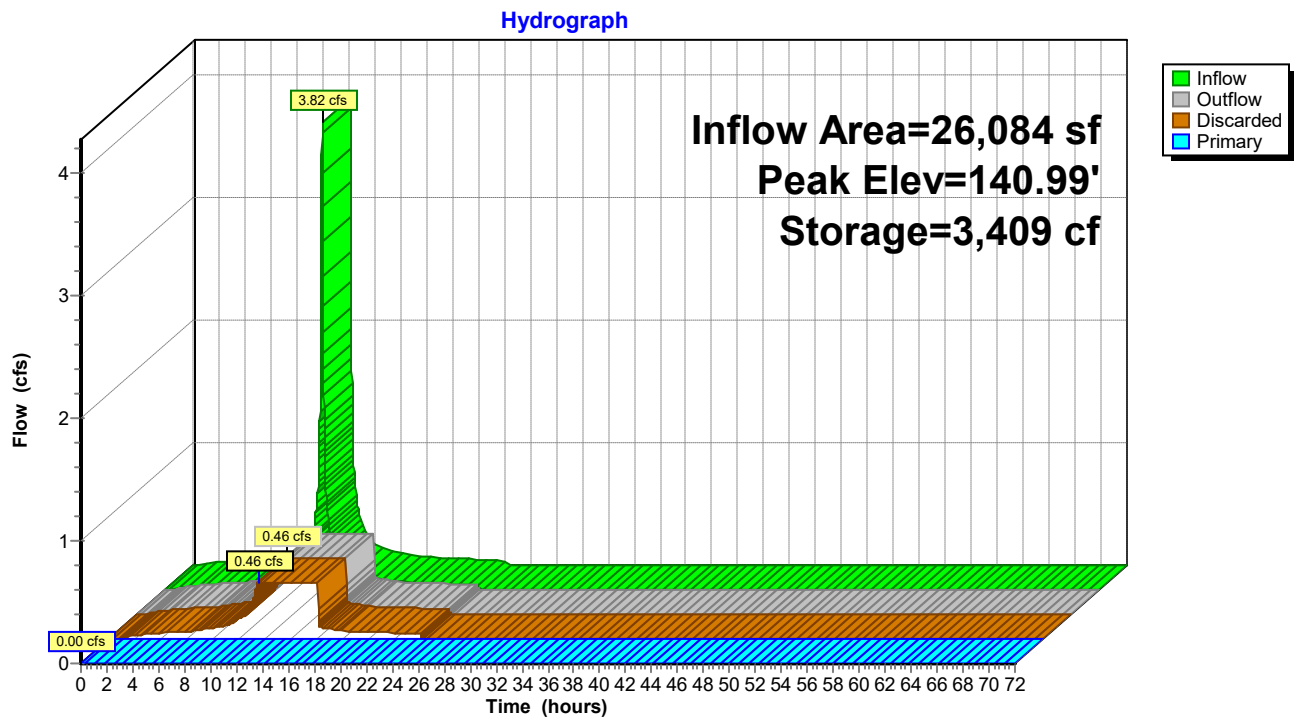
64 Chambers

313.5 cy Field

186.5 cy Stone



Pond ICS-E: Infiltration Chambers E



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 25-Year Rainfall=6.19"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 112

Stage-Area-Storage for Pond ICS-E: Infiltration Chambers E

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,390	0	141.60	2,390	4,433
139.05	2,390	48	141.65	2,390	4,506
139.10	2,390	96	141.70	2,390	4,576
139.15	2,390	143	141.75	2,390	4,642
139.20	2,390	191	141.80	2,390	4,706
139.25	2,390	239	141.85	2,390	4,765
139.30	2,390	287	141.90	2,390	4,821
139.35	2,390	335	141.95	2,390	4,874
139.40	2,390	382	142.00	2,390	4,924
139.45	2,390	430	142.05	2,390	4,972
139.50	2,390	478	142.10	2,390	5,020
139.55	2,390	581	142.15	2,390	5,068
139.60	2,390	683	142.20	2,390	5,116
139.65	2,390	785	142.25	2,390	5,163
139.70	2,390	887	142.30	2,390	5,211
139.75	2,390	988	142.35	2,390	5,259
139.80	2,390	1,090	142.40	2,390	5,307
139.85	2,390	1,191	142.45	2,390	5,355
139.90	2,390	1,293	142.50	2,390	5,402
139.95	2,390	1,394			
140.00	2,390	1,495			
140.05	2,390	1,596			
140.10	2,390	1,696			
140.15	2,390	1,796			
140.20	2,390	1,895			
140.25	2,390	1,993			
140.30	2,390	2,092			
140.35	2,390	2,190			
140.40	2,390	2,288			
140.45	2,390	2,385			
140.50	2,390	2,483			
140.55	2,390	2,580			
140.60	2,390	2,677			
140.65	2,390	2,774			
140.70	2,390	2,871			
140.75	2,390	2,967			
140.80	2,390	3,062			
140.85	2,390	3,155			
140.90	2,390	3,248			
140.95	2,390	3,340			
141.00	2,390	3,431			
141.05	2,390	3,522			
141.10	2,390	3,611			
141.15	2,390	3,699			
141.20	2,390	3,786			
141.25	2,390	3,872			
141.30	2,390	3,957			
141.35	2,390	4,040			
141.40	2,390	4,122			
141.45	2,390	4,203			
141.50	2,390	4,281			
141.55	2,390	4,358			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 113

Summary for Subcatchment B1: Building 1(L)

Runoff = 6.14 cfs @ 12.13 hrs, Volume= 20,990 cf, Depth= 8.44"

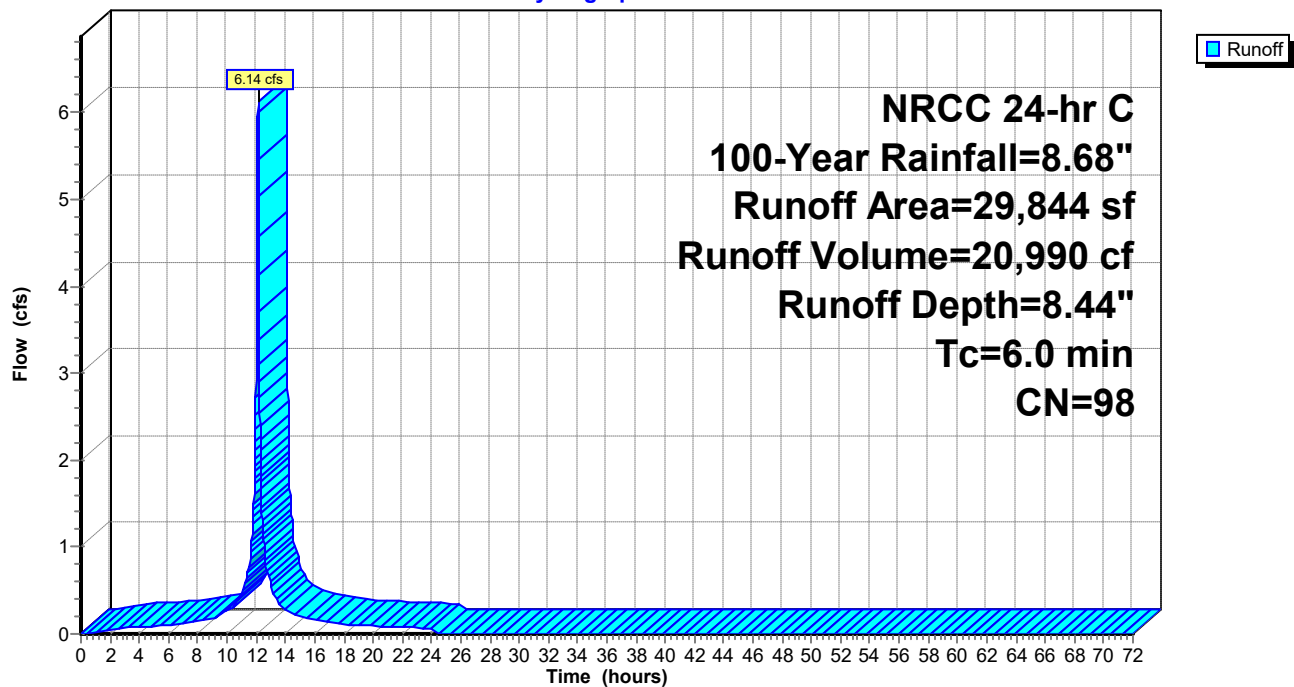
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
29,844	98	Unconnected roofs, HSG A
29,844		100.00% Impervious Area
29,844		100.00% Unconnected

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

Subcatchment B1: Building 1(L)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 114

Summary for Subcatchment B2: Building 2(BAR)

Runoff = 5.36 cfs @ 12.13 hrs, Volume= 18,345 cf, Depth= 8.44"

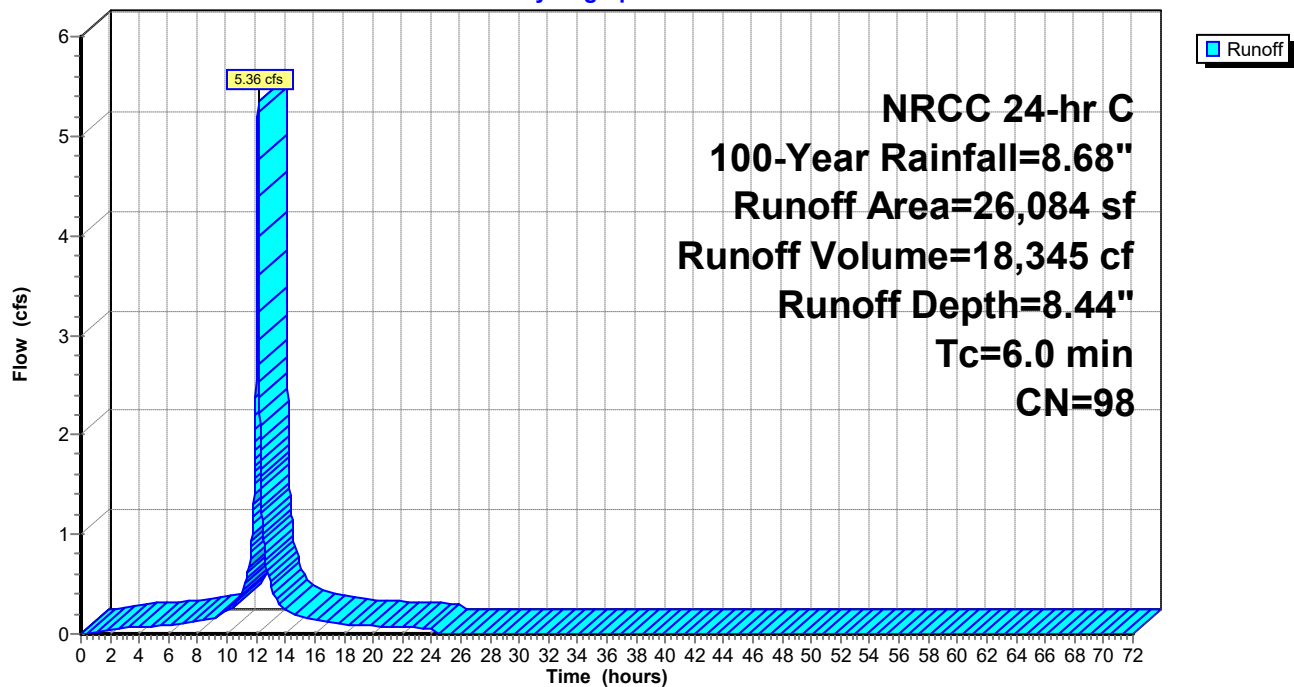
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
26,084	98	Unconnected roofs, HSG A
26,084		100.00% Impervious Area
26,084		100.00% Unconnected

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

Subcatchment B2: Building 2(BAR)

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 115

Summary for Subcatchment DW: Direct to Wetland

Runoff = 9.78 cfs @ 12.22 hrs, Volume= 43,319 cf, Depth= 1.67"

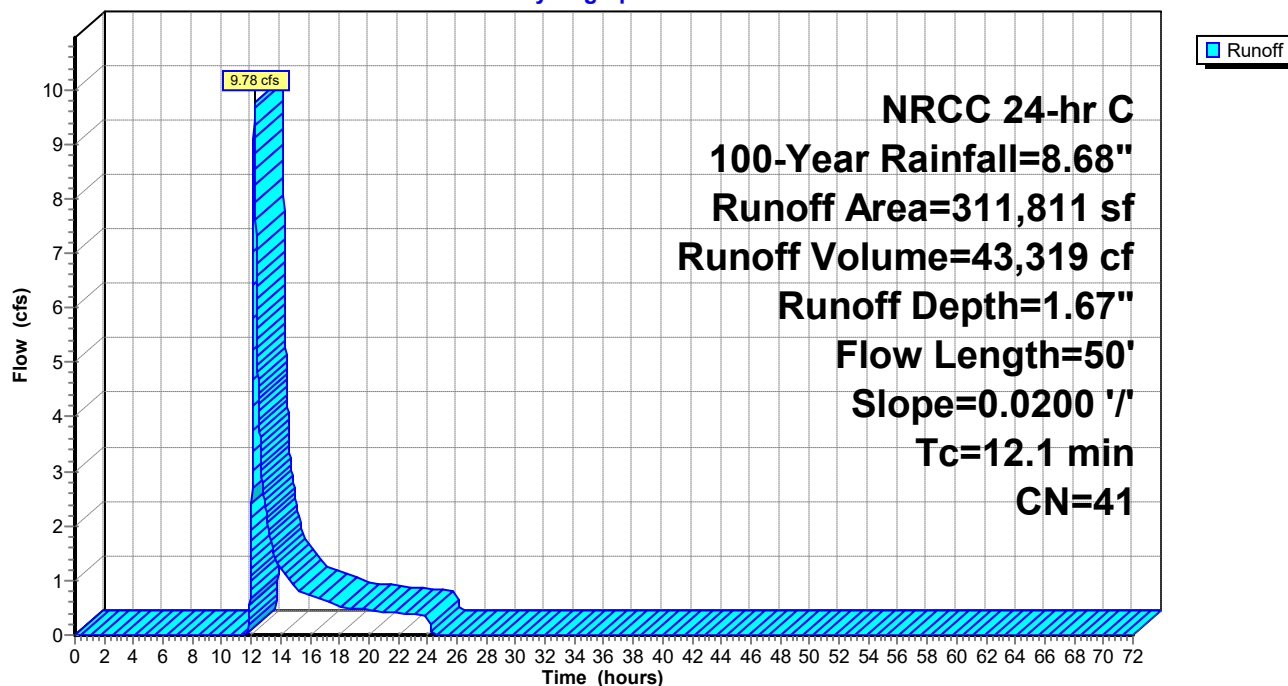
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
196,612	30	Woods, Good, HSG A
36,975	39	>75% Grass cover, Good, HSG A
6,012	76	Gravel roads, HSG A
8,242	72	Dirt roads, HSG A
1,205	98	Paved parking, HSG A
32,491	55	Woods, Good, HSG B
1,342	82	Dirt roads, HSG B
22,867	77	Woods, Good, HSG D
1,051	91	Gravel roads, HSG D
5,014	80	>75% Grass cover, Good, HSG D
311,811	41	Weighted Average
310,606		99.61% Pervious Area
1,205		0.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.1	50	0.0200	0.07		Sheet Flow, Wooded - AD
					Woods: Light underbrush n= 0.400 P2= 3.35"

Subcatchment DW: Direct to Wetland

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 116

Summary for Subcatchment EN: Entrance

Runoff = 1.87 cfs @ 12.13 hrs, Volume= 6,047 cf, Depth= 7.84"

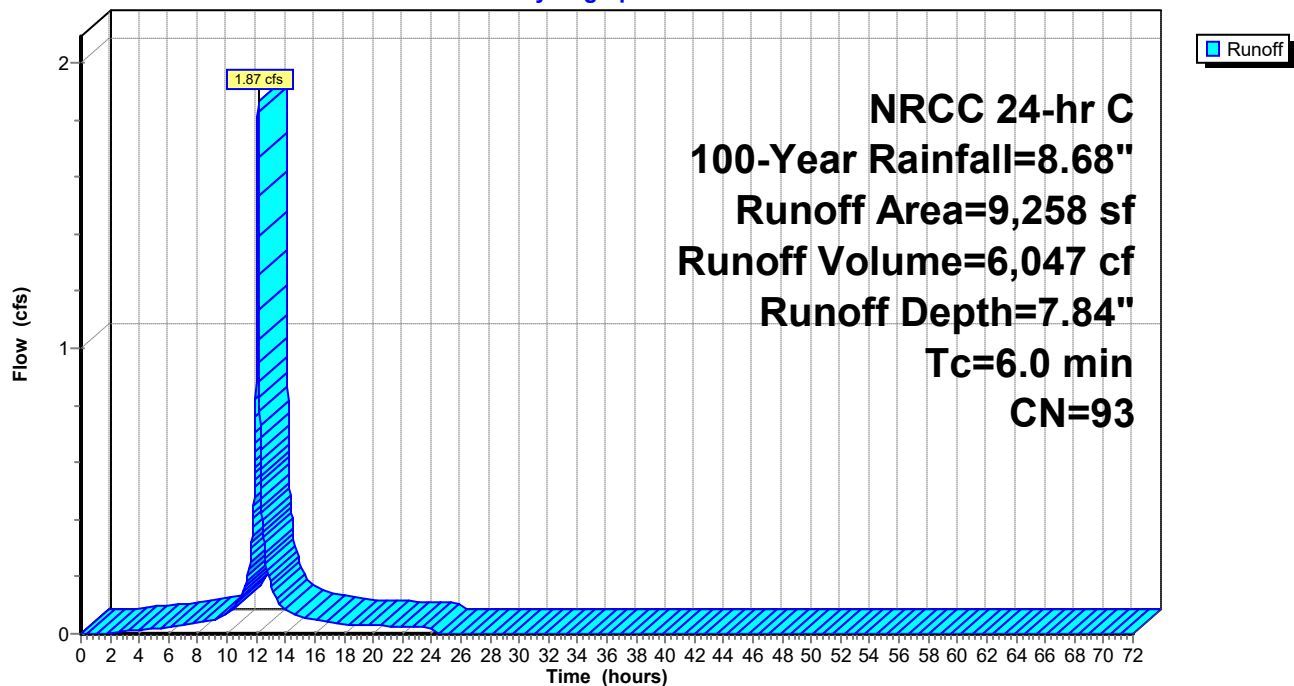
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
372	39	>75% Grass cover, Good, HSG A
4,276	98	Paved parking, HSG A
722	61	>75% Grass cover, Good, HSG B
3,888	98	Paved parking, HSG B
9,258	93	Weighted Average
1,094		11.82% Pervious Area
8,164		88.18% Impervious Area

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

Subcatchment EN: Entrance

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 117

Summary for Subcatchment S-A: Subcatchment A

Runoff = 7.61 cfs @ 12.20 hrs, Volume= 30,182 cf, Depth= 7.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
6,400	39	>75% Grass cover, Good, HSG A
26,222	98	Paved parking, HSG A
4,145	80	>75% Grass cover, Good, HSG D
12,478	98	Paved parking, HSG D
49,245	89	Weighted Average
10,545		21.41% Pervious Area
38,700		78.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
1.1	77	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.5	188	0.0100	2.03		Shallow Concentrated Flow, Parking - CD Paved Kv= 20.3 fps
0.4	117	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
12.6	432	Total			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

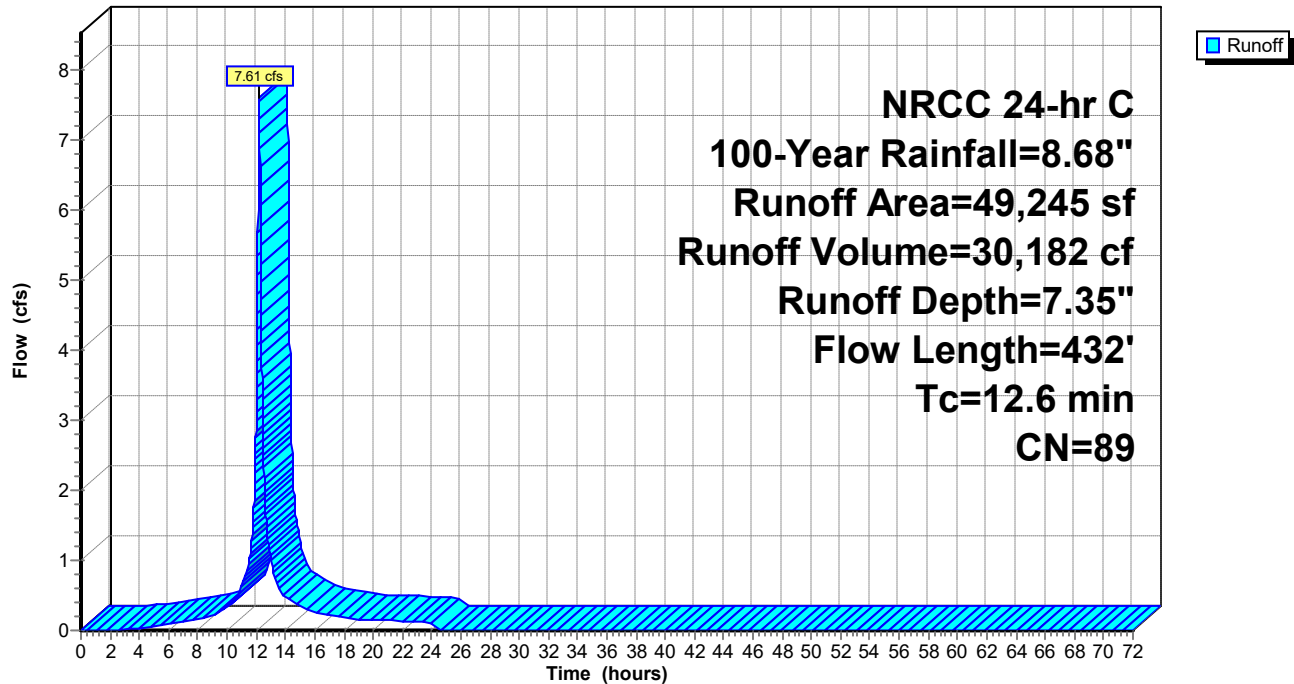
Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 118

Subcatchment S-A: Subcatchment A

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 119

Summary for Subcatchment S-B: Subcatchment B

Runoff = 5.43 cfs @ 12.13 hrs, Volume= 17,782 cf, Depth= 7.96"

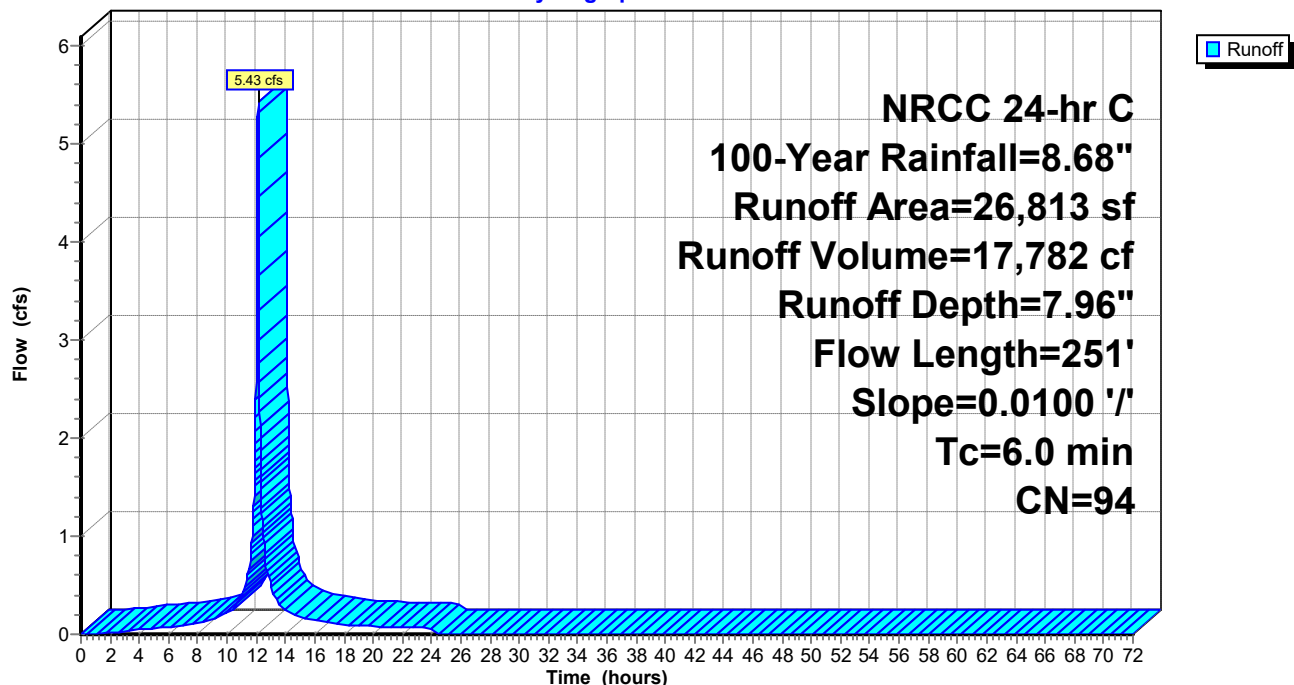
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
1,898	39	>75% Grass cover, Good, HSG A
24,546	98	Paved parking, HSG A
144	61	>75% Grass cover, Good, HSG B
225	98	Paved parking, HSG B
26,813	94	Weighted Average
2,042		7.62% Pervious Area
24,771		92.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	50	0.0100	0.93		Sheet Flow, Parking - AB Smooth surfaces n= 0.011 P2= 3.35"
1.1	132	0.0100	2.03		Shallow Concentrated Flow, Parking - BC Paved Kv= 20.3 fps
0.2	69	0.0100	5.36	4.21	Pipe Channel, Pipe - CD 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
2.2	251	Total, Increased to minimum Tc = 6.0 min			

Subcatchment S-B: Subcatchment B

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 120

Summary for Subcatchment S-C: Subcatchment C

Runoff = 14.13 cfs @ 12.21 hrs, Volume= 58,385 cf, Depth= 7.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NRCC 24-hr C 100-Year Rainfall=8.68"

Area (sf)	CN	Description
10,950	39	>75% Grass cover, Good, HSG A
1,530	76	Gravel roads, HSG A
61,036	98	Paved parking, HSG A
3,043	61	>75% Grass cover, Good, HSG B
14,735	98	Paved parking, HSG B
1,289	91	Gravel roads, HSG D
2,676	80	>75% Grass cover, Good, HSG D
95,259	89	Weighted Average
19,488		20.46% Pervious Area
75,771		79.54% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	50	0.0050	0.09		Sheet Flow, Grass - AB Grass: Short n= 0.150 P2= 3.35"
2.4	165	0.0050	1.14		Shallow Concentrated Flow, Grass - BC Unpaved Kv= 16.1 fps
1.7	207	0.0100	2.03		Shallow Concentrated Flow, Road - CD Paved Kv= 20.3 fps
0.2	59	0.0100	5.36	4.21	Pipe Channel, Pipe - DE 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
13.9	481	Total			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

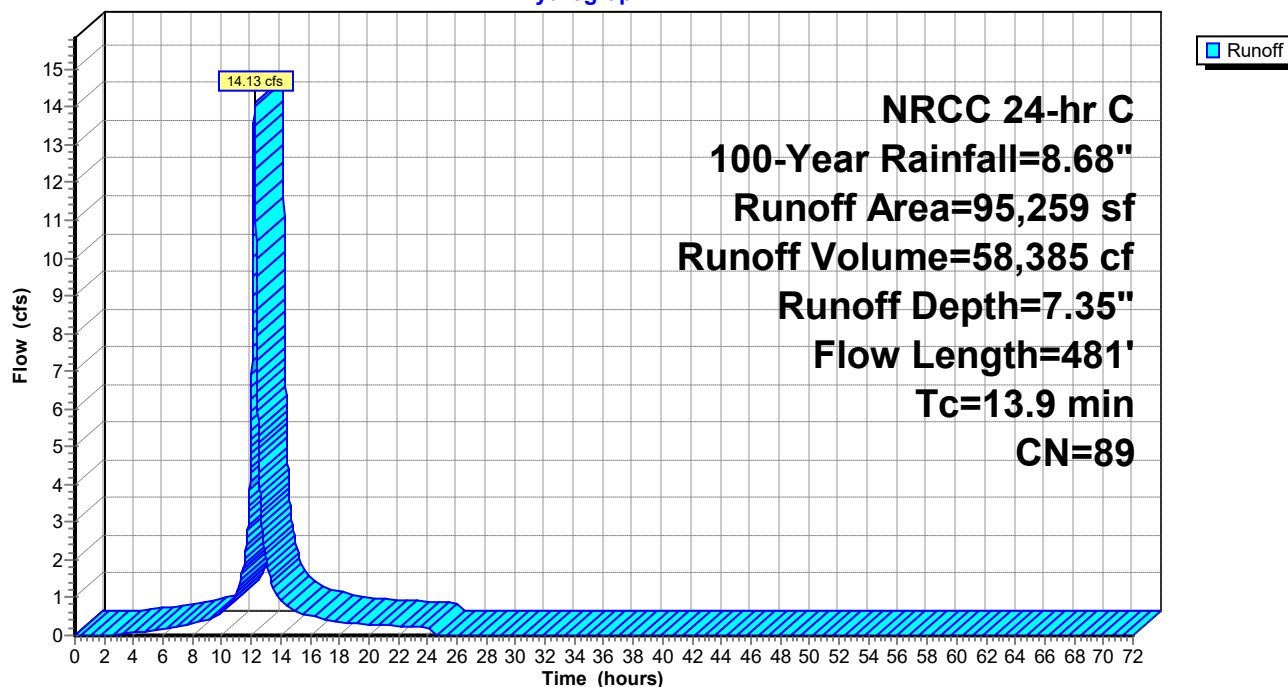
Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 121

Subcatchment S-C: Subcatchment C

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 122

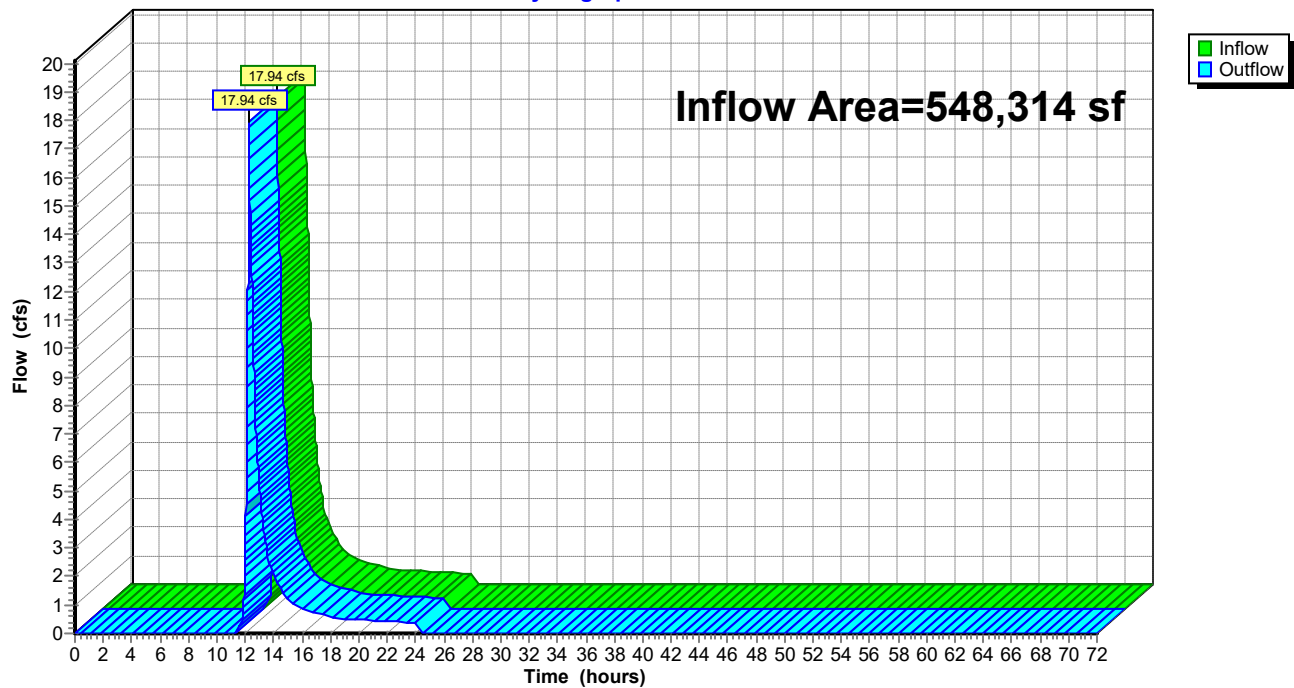
Summary for Reach T: Total to Wetlands

Inflow Area = 548,314 sf, 37.30% Impervious, Inflow Depth = 1.58" for 100-Year event
Inflow = 17.94 cfs @ 12.25 hrs, Volume= 72,379 cf
Outflow = 17.94 cfs @ 12.25 hrs, Volume= 72,379 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Reach T: Total to Wetlands

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 123

Summary for Pond 1P: DMH-CD

Inflow Area = 125,103 sf, 84.42% Impervious, Inflow Depth = 0.75" for 100-Year event
Inflow = 4.15 cfs @ 12.49 hrs, Volume= 7,774 cf
Outflow = 4.15 cfs @ 12.49 hrs, Volume= 7,774 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.15 cfs @ 12.49 hrs, Volume= 7,774 cf

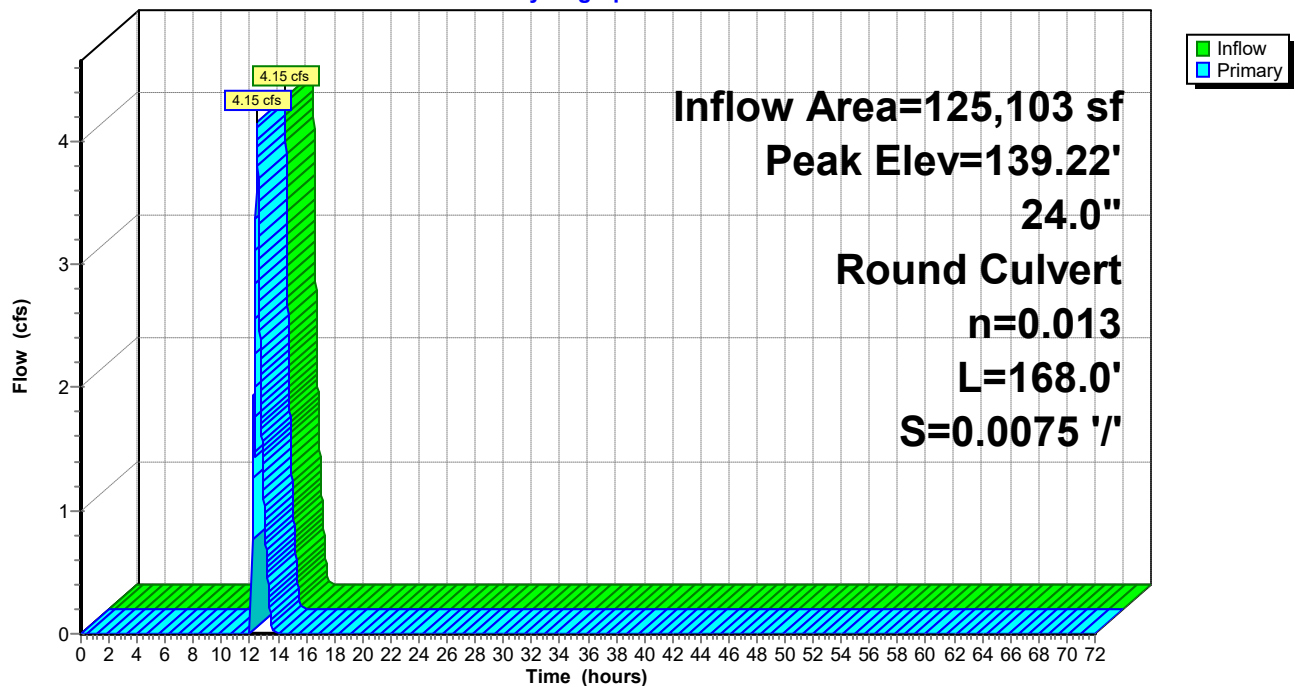
Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 139.22' @ 12.49 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	138.33'	24.0" Round Culvert L= 168.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.33' / 137.07' S= 0.0075 '/ Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=4.15 cfs @ 12.49 hrs HW=139.22' (Free Discharge)
↑1=Culvert (Barrel Controls 4.15 cfs @ 4.55 fps)

Pond 1P: DMH-CD

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 124

Stage-Area-Storage for Pond 1P: DMH-CD

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.33	0	139.37	0
138.35	0	139.39	0
138.37	0	139.41	0
138.39	0	139.43	0
138.41	0	139.45	0
138.43	0	139.47	0
138.45	0	139.49	0
138.47	0	139.51	0
138.49	0	139.53	0
138.51	0	139.55	0
138.53	0	139.57	0
138.55	0	139.59	0
138.57	0	139.61	0
138.59	0	139.63	0
138.61	0	139.65	0
138.63	0	139.67	0
138.65	0	139.69	0
138.67	0	139.71	0
138.69	0	139.73	0
138.71	0	139.75	0
138.73	0	139.77	0
138.75	0	139.79	0
138.77	0	139.81	0
138.79	0	139.83	0
138.81	0	139.85	0
138.83	0	139.87	0
138.85	0	139.89	0
138.87	0	139.91	0
138.89	0	139.93	0
138.91	0	139.95	0
138.93	0	139.97	0
138.95	0	139.99	0
138.97	0	140.01	0
138.99	0	140.03	0
139.01	0	140.05	0
139.03	0	140.07	0
139.05	0	140.09	0
139.07	0	140.11	0
139.09	0	140.13	0
139.11	0	140.15	0
139.13	0	140.17	0
139.15	0	140.19	0
139.17	0	140.21	0
139.19	0	140.23	0
139.21	0	140.25	0
139.23	0	140.27	0
139.25	0	140.29	0
139.27	0	140.31	0
139.29	0	140.33	0
139.31	0		
139.33	0		
139.35	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 125

Summary for Pond BG: Bioretention Garden

Inflow Area = 9,258 sf, 88.18% Impervious, Inflow Depth = 7.84" for 100-Year event
 Inflow = 1.87 cfs @ 12.13 hrs, Volume= 6,047 cf
 Outflow = 1.85 cfs @ 12.14 hrs, Volume= 4,671 cf, Atten= 1%, Lag= 0.6 min
 Primary = 1.85 cfs @ 12.14 hrs, Volume= 4,671 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.60' @ 12.14 hrs Surf.Area= 983 sf Storage= 1,479 cf

Plug-Flow detention time= 159.7 min calculated for 4,671 cf (77% of inflow)
 Center-of-Mass det. time= 70.5 min (836.5 - 766.0)

Volume	Invert	Avail.Storage	Storage Description
#1	138.50'	2,064 cf	Retention Area (Irregular) Listed below (Recalc) 4,030 cf Overall - 1,966 cf Embedded = 2,064 cf
#2	138.50'	393 cf	BG Media (Irregular) Listed below (Recalc) Inside #1 1,966 cf Overall x 20.0% Voids
		2,457 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
142.60	983	141.0	4,030	4,030	1,561

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
138.50	983	141.0	0	0	983
140.50	983	141.0	1,966	1,966	1,265

Device	Routing	Invert	Outlet Devices
#1	Primary	141.50'	20.0' long x 1.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Primary OutFlow Max=1.82 cfs @ 12.14 hrs HW=141.60' (Free Discharge)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 1.82 cfs @ 0.87 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

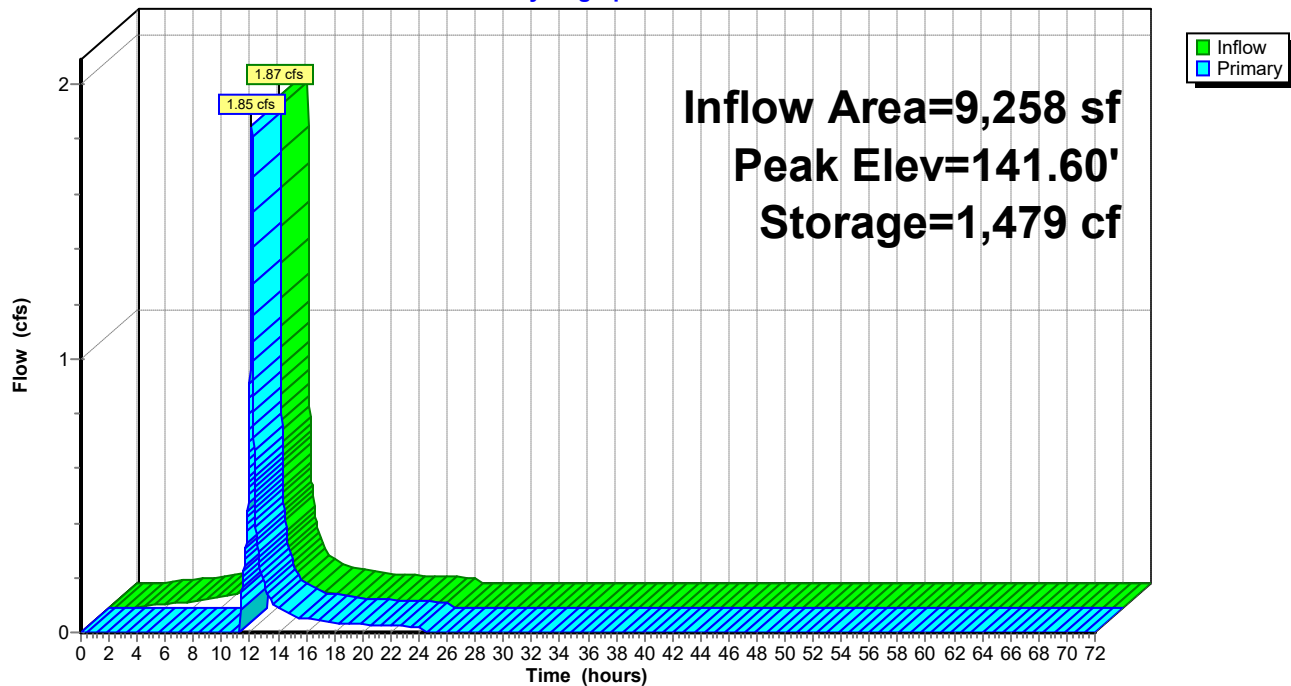
Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 126

Pond BG: Bioretention Garden

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 127

Stage-Area-Storage for Pond BG: Bioretention Garden

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
138.50	0	141.10	983
138.55	10	141.15	1,032
138.60	20	141.20	1,081
138.65	29	141.25	1,130
138.70	39	141.30	1,180
138.75	49	141.35	1,229
138.80	59	141.40	1,278
138.85	69	141.45	1,327
138.90	79	141.50	1,376
138.95	88	141.55	1,425
139.00	98	141.60	1,474
139.05	108	141.65	1,524
139.10	118	141.70	1,573
139.15	128	141.75	1,622
139.20	138	141.80	1,671
139.25	147	141.85	1,720
139.30	157	141.90	1,769
139.35	167	141.95	1,819
139.40	177	142.00	1,868
139.45	187	142.05	1,917
139.50	197	142.10	1,966
139.55	206	142.15	2,015
139.60	216	142.20	2,064
139.65	226	142.25	2,113
139.70	236	142.30	2,163
139.75	246	142.35	2,212
139.80	256	142.40	2,261
139.85	265	142.45	2,310
139.90	275	142.50	2,359
139.95	285	142.55	2,408
140.00	295	142.60	2,457
140.05	305		
140.10	315		
140.15	324		
140.20	334		
140.25	344		
140.30	354		
140.35	364		
140.40	374		
140.45	383		
140.50	393		
140.55	442		
140.60	491		
140.65	541		
140.70	590		
140.75	639		
140.80	688		
140.85	737		
140.90	786		
140.95	836		
141.00	885		
141.05	934		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 128

Summary for Pond DMH: DMH-CDE

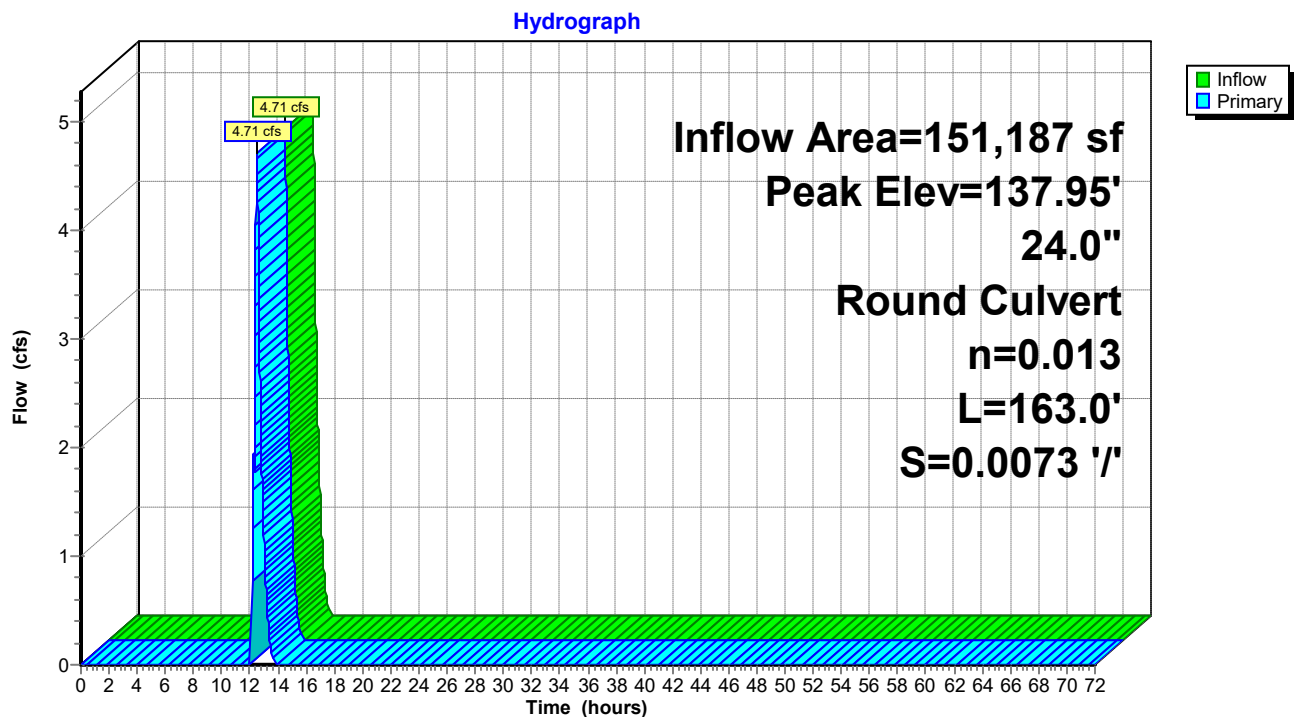
Inflow Area = 151,187 sf, 87.11% Impervious, Inflow Depth = 0.69" for 100-Year event
Inflow = 4.71 cfs @ 12.48 hrs, Volume= 8,684 cf
Outflow = 4.71 cfs @ 12.48 hrs, Volume= 8,684 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.71 cfs @ 12.48 hrs, Volume= 8,684 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 137.95' @ 12.48 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	136.99'	24.0" Round Culvert L= 163.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.99' / 135.80' S= 0.0073 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=4.70 cfs @ 12.48 hrs HW=137.95' (Free Discharge)
↑1=Culvert (Barrel Controls 4.70 cfs @ 4.64 fps)

Pond DMH: DMH-CDE



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 129

Stage-Area-Storage for Pond DMH: DMH-CDE

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
136.99	0	138.03	0
137.01	0	138.05	0
137.03	0	138.07	0
137.05	0	138.09	0
137.07	0	138.11	0
137.09	0	138.13	0
137.11	0	138.15	0
137.13	0	138.17	0
137.15	0	138.19	0
137.17	0	138.21	0
137.19	0	138.23	0
137.21	0	138.25	0
137.23	0	138.27	0
137.25	0	138.29	0
137.27	0	138.31	0
137.29	0	138.33	0
137.31	0	138.35	0
137.33	0	138.37	0
137.35	0	138.39	0
137.37	0	138.41	0
137.39	0	138.43	0
137.41	0	138.45	0
137.43	0	138.47	0
137.45	0	138.49	0
137.47	0	138.51	0
137.49	0	138.53	0
137.51	0	138.55	0
137.53	0	138.57	0
137.55	0	138.59	0
137.57	0	138.61	0
137.59	0	138.63	0
137.61	0	138.65	0
137.63	0	138.67	0
137.65	0	138.69	0
137.67	0	138.71	0
137.69	0	138.73	0
137.71	0	138.75	0
137.73	0	138.77	0
137.75	0	138.79	0
137.77	0	138.81	0
137.79	0	138.83	0
137.81	0	138.85	0
137.83	0	138.87	0
137.85	0	138.89	0
137.87	0	138.91	0
137.89	0	138.93	0
137.91	0	138.95	0
137.93	0	138.97	0
137.95	0	138.99	0
137.97	0		
137.99	0		
138.01	0		

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 130

Summary for Pond ICS-A: Infiltration Chambers A

Inflow Area = 49,245 sf, 78.59% Impervious, Inflow Depth = 7.35" for 100-Year event
 Inflow = 7.61 cfs @ 12.20 hrs, Volume= 30,182 cf
 Outflow = 6.29 cfs @ 12.27 hrs, Volume= 30,182 cf, Atten= 17%, Lag= 4.5 min
 Discarded = 0.20 cfs @ 8.93 hrs, Volume= 15,489 cf
 Primary = 6.09 cfs @ 12.27 hrs, Volume= 14,693 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.51' @ 12.27 hrs Surf.Area= 3,663 sf Storage= 8,336 cf

Plug-Flow detention time= 112.9 min calculated for 30,178 cf (100% of inflow)
 Center-of-Mass det. time= 112.9 min (899.7 - 786.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 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= 18.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 136.30' / 135.40' S= 0.0500 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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 1	140.40'	7.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#4	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 8.93 hrs HW=139.04' (Free Discharge)↑ **4=Exfiltration** (Exfiltration Controls 0.20 cfs)**Primary OutFlow** Max=6.08 cfs @ 12.27 hrs HW=142.51' (Free Discharge)↑ **1=Culvert** (Passes 6.08 cfs of 19.88 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 4.35 cfs @ 2.14 fps)↑ **3=Orifice/Grate** (Orifice Controls 1.73 cfs @ 6.49 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 131

Pond ICS-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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

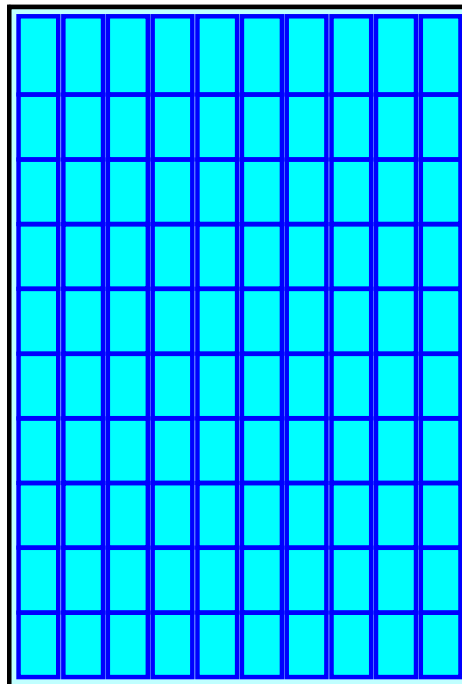
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

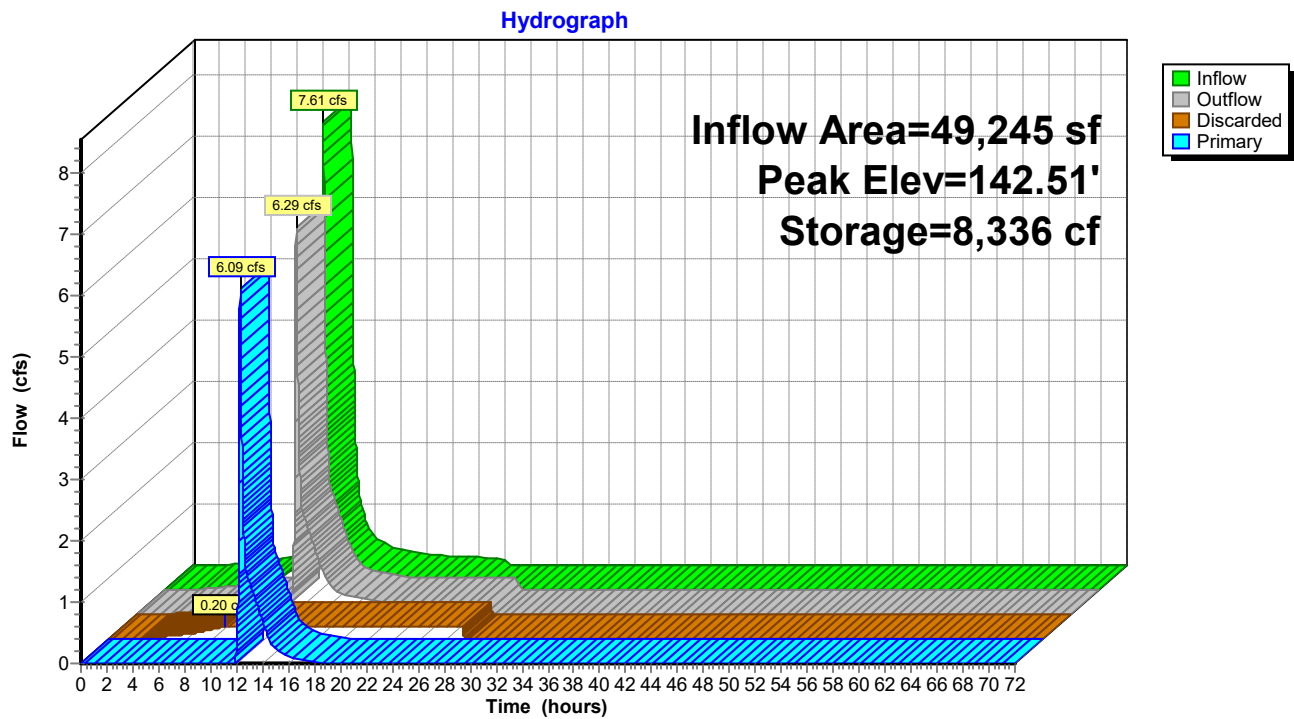
100 Chambers

480.5 cy Field

283.1 cy Stone



Pond ICS-A: Infiltration Chambers A



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 133

Stage-Area-Storage for Pond ICS-A: Infiltration Chambers A

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 134

Summary for Pond ICS-B: Infiltration Chamber System B

Inflow Area = 26,813 sf, 92.38% Impervious, Inflow Depth = 7.96" for 100-Year event
 Inflow = 5.43 cfs @ 12.13 hrs, Volume= 17,782 cf
 Outflow = 0.56 cfs @ 12.90 hrs, Volume= 17,782 cf, Atten= 90%, Lag= 46.2 min
 Discarded = 0.20 cfs @ 9.85 hrs, Volume= 16,770 cf
 Primary = 0.35 cfs @ 12.90 hrs, Volume= 1,012 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.10' @ 12.90 hrs Surf.Area= 3,663 sf Storage= 7,737 cf

Plug-Flow detention time= 301.5 min calculated for 17,780 cf (100% of inflow)
 Center-of-Mass det. time= 301.5 min (1,063.3 - 761.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	3,058 cf	49.83'W x 73.50'L x 3.54'H Field A 12,972 cf Overall - 5,327 cf Embedded = 7,645 cf x 40.0% Voids
#2A	139.50'	5,327 cf	Cultec R-330XLHD x 100 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 10 rows
		8,385 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.78'	18.0" Round Culvert L= 61.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.78' / 136.90' S= 0.0472 ' S= 0.0472 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	142.00'	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	Discarded	139.00'	2.410 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.20 cfs @ 9.85 hrs HW=139.04' (Free Discharge)
 ↑ **3=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.35 cfs @ 12.90 hrs HW=142.10' (Free Discharge)
 ↑ **1=Culvert** (Passes 0.35 cfs of 10.66 cfs potential flow)
 ↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 0.35 cfs @ 0.88 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 135

Pond ICS-B: Infiltration Chamber System 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 10 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

10 Rows x 52.0" Wide + 6.0" Spacing x 9 + 12.0" Side Stone x 2 = 49.83' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

100 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 10 Rows = 5,327.5 cf Chamber Storage

12,972.2 cf Field - 5,327.5 cf Chambers = 7,644.8 cf Stone x 40.0% Voids = 3,057.9 cf Stone Storage

Chamber Storage + Stone Storage = 8,385.4 cf = 0.193 af

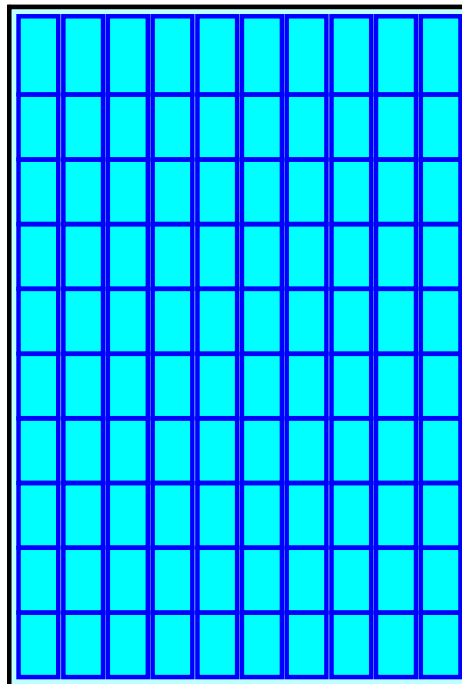
Overall Storage Efficiency = 64.6%

Overall System Size = 73.50' x 49.83' x 3.54'

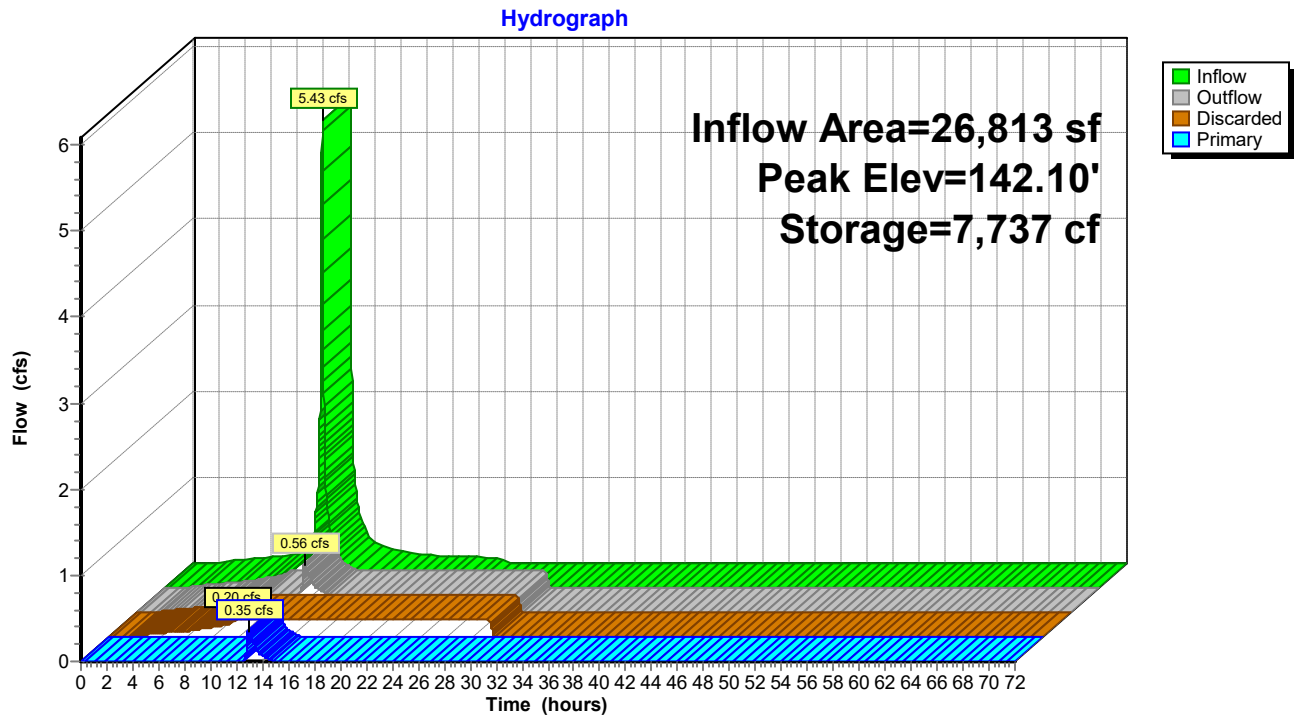
100 Chambers

480.5 cy Field

283.1 cy Stone



Pond ICS-B: Infiltration Chamber System B



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 137

Stage-Area-Storage for Pond ICS-B: Infiltration Chamber System B

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	3,663	0	141.60	3,663	6,837
139.05	3,663	73	141.65	3,663	6,948
139.10	3,663	147	141.70	3,663	7,056
139.15	3,663	220	141.75	3,663	7,159
139.20	3,663	293	141.80	3,663	7,256
139.25	3,663	366	141.85	3,663	7,347
139.30	3,663	440	141.90	3,663	7,434
139.35	3,663	513	141.95	3,663	7,515
139.40	3,663	586	142.00	3,663	7,592
139.45	3,663	659	142.05	3,663	7,665
139.50	3,663	733	142.10	3,663	7,738
139.55	3,663	891	142.15	3,663	7,812
139.60	3,663	1,049	142.20	3,663	7,885
139.65	3,663	1,207	142.25	3,663	7,958
139.70	3,663	1,364	142.30	3,663	8,031
139.75	3,663	1,521	142.35	3,663	8,105
139.80	3,663	1,678	142.40	3,663	8,178
139.85	3,663	1,834	142.45	3,663	8,251
139.90	3,663	1,991	142.50	3,663	8,324
139.95	3,663	2,147			
140.00	3,663	2,303			
140.05	3,663	2,458			
140.10	3,663	2,613			
140.15	3,663	2,767			
140.20	3,663	2,920			
140.25	3,663	3,072			
140.30	3,663	3,224			
140.35	3,663	3,375			
140.40	3,663	3,527			
140.45	3,663	3,677			
140.50	3,663	3,828			
140.55	3,663	3,978			
140.60	3,663	4,128			
140.65	3,663	4,278			
140.70	3,663	4,427			
140.75	3,663	4,575			
140.80	3,663	4,721			
140.85	3,663	4,866			
140.90	3,663	5,010			
140.95	3,663	5,151			
141.00	3,663	5,292			
141.05	3,663	5,431			
141.10	3,663	5,569			
141.15	3,663	5,705			
141.20	3,663	5,839			
141.25	3,663	5,972			
141.30	3,663	6,102			
141.35	3,663	6,231			
141.40	3,663	6,357			
141.45	3,663	6,481			
141.50	3,663	6,603			
141.55	3,663	6,721			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 138

Summary for Pond ICS-C: Infiltration Chambers C

Inflow Area = 95,259 sf, 79.54% Impervious, Inflow Depth = 7.35" for 100-Year event
 Inflow = 14.13 cfs @ 12.21 hrs, Volume= 58,385 cf
 Outflow = 4.98 cfs @ 12.50 hrs, Volume= 58,385 cf, Atten= 65%, Lag= 17.1 min
 Discarded = 1.51 cfs @ 11.30 hrs, Volume= 52,632 cf
 Primary = 3.47 cfs @ 12.50 hrs, Volume= 5,752 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.94' @ 12.50 hrs Surf.Area= 7,902 sf Storage= 16,307 cf

Plug-Flow detention time= 60.2 min calculated for 58,376 cf (100% of inflow)
 Center-of-Mass det. time= 60.2 min (848.2 - 788.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	6,516 cf	98.17'W x 80.50'L x 3.54'H Field A 27,988 cf Overall - 11,698 cf Embedded = 16,290 cf x 40.0% Voids
#2A	139.50'	11,698 cf	Cultec R-330XLHD x 220 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 20 rows
		18,214 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	24.0" Round Culvert L= 95.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.42' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	141.50'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.51 cfs @ 11.30 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 1.51 cfs)**Primary OutFlow** Max=3.46 cfs @ 12.50 hrs HW=141.94' (Free Discharge)↑ **1=Culvert** (Passes 3.46 cfs of 18.96 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 3.46 cfs @ 1.96 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 139

Pond ICS-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 20 rows

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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' Base Length

20 Rows x 52.0" Wide + 6.0" Spacing x 19 + 12.0" Side Stone x 2 = 98.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

220 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 20 Rows = 11,698.1 cf Chamber Storage

27,987.7 cf Field - 11,698.1 cf Chambers = 16,289.7 cf Stone x 40.0% Voids = 6,515.9 cf Stone Storage

Chamber Storage + Stone Storage = 18,213.9 cf = 0.418 af

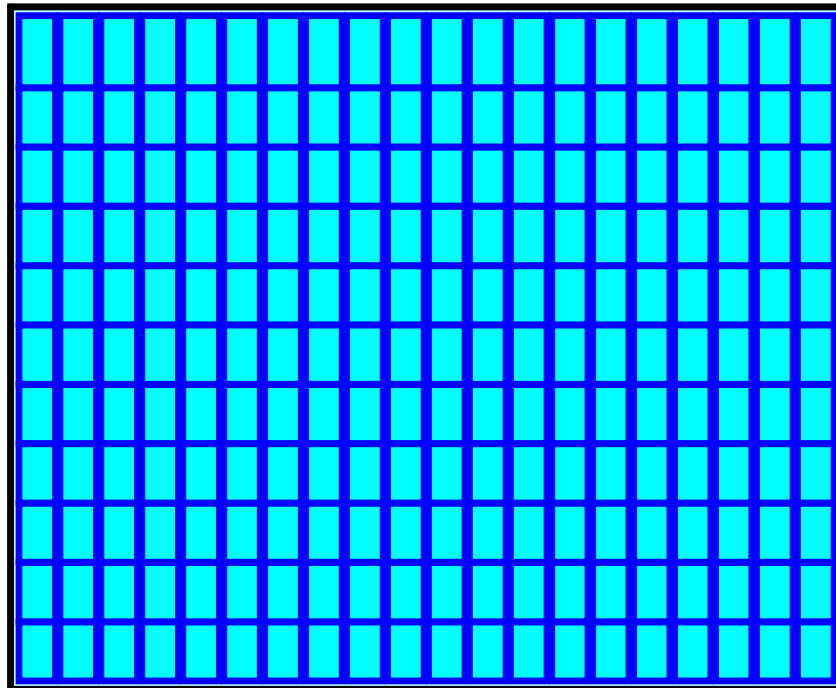
Overall Storage Efficiency = 65.1%

Overall System Size = 80.50' x 98.17' x 3.54'

220 Chambers

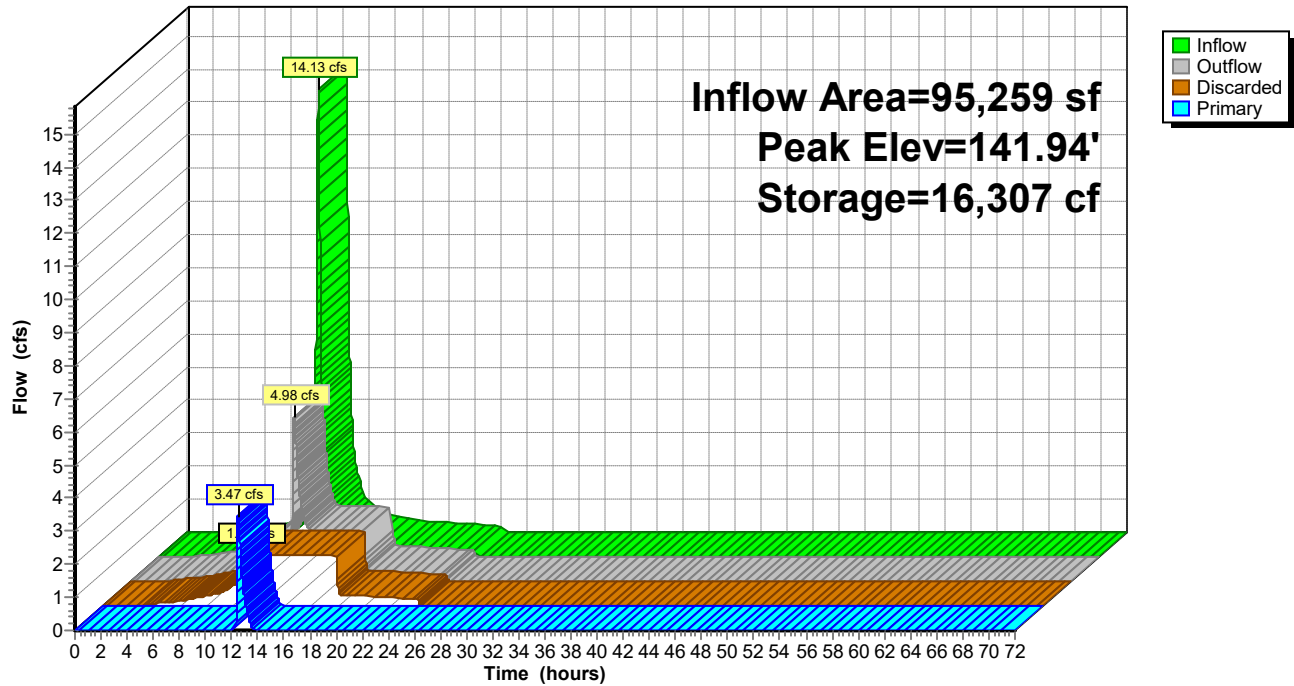
1,036.6 cy Field

603.3 cy Stone



Pond ICS-C: Infiltration Chambers C

Hydrograph



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 141

Stage-Area-Storage for Pond ICS-C: Infiltration Chambers C

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	7,902	0	141.60	7,902	14,866
139.05	7,902	158	141.65	7,902	15,109
139.10	7,902	316	141.70	7,902	15,342
139.15	7,902	474	141.75	7,902	15,565
139.20	7,902	632	141.80	7,902	15,775
139.25	7,902	790	141.85	7,902	15,974
139.30	7,902	948	141.90	7,902	16,161
139.35	7,902	1,106	141.95	7,902	16,337
139.40	7,902	1,264	142.00	7,902	16,502
139.45	7,902	1,422	142.05	7,902	16,660
139.50	7,902	1,580	142.10	7,902	16,818
139.55	7,902	1,926	142.15	7,902	16,976
139.60	7,902	2,270	142.20	7,902	17,134
139.65	7,902	2,613	142.25	7,902	17,292
139.70	7,902	2,956	142.30	7,902	17,450
139.75	7,902	3,297	142.35	7,902	17,608
139.80	7,902	3,639	142.40	7,902	17,766
139.85	7,902	3,980	142.45	7,902	17,924
139.90	7,902	4,320	142.50	7,902	18,082
139.95	7,902	4,661			
140.00	7,902	5,000			
140.05	7,902	5,339			
140.10	7,902	5,677			
140.15	7,902	6,012			
140.20	7,902	6,345			
140.25	7,902	6,676			
140.30	7,902	7,006			
140.35	7,902	7,336			
140.40	7,902	7,665			
140.45	7,902	7,994			
140.50	7,902	8,322			
140.55	7,902	8,649			
140.60	7,902	8,975			
140.65	7,902	9,301			
140.70	7,902	9,625			
140.75	7,902	9,947			
140.80	7,902	10,266			
140.85	7,902	10,582			
140.90	7,902	10,893			
140.95	7,902	11,202			
141.00	7,902	11,508			
141.05	7,902	11,811			
141.10	7,902	12,110			
141.15	7,902	12,406			
141.20	7,902	12,698			
141.25	7,902	12,986			
141.30	7,902	13,271			
141.35	7,902	13,550			
141.40	7,902	13,825			
141.45	7,902	14,095			
141.50	7,902	14,358			
141.55	7,902	14,616			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 142

Summary for Pond ICS-D: Infiltration Chambers D

Inflow Area = 29,844 sf, 100.00% Impervious, Inflow Depth = 8.44" for 100-Year event
 Inflow = 6.14 cfs @ 12.13 hrs, Volume= 20,990 cf
 Outflow = 2.42 cfs @ 12.26 hrs, Volume= 20,990 cf, Atten= 61%, Lag= 7.8 min
 Discarded = 0.47 cfs @ 11.02 hrs, Volume= 18,968 cf
 Primary = 1.95 cfs @ 12.26 hrs, Volume= 2,021 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.31' @ 12.26 hrs Surf.Area= 2,455 sf Storage= 5,353 cf

Plug-Flow detention time= 61.7 min calculated for 20,987 cf (100% of inflow)
 Center-of-Mass det. time= 61.7 min (802.7 - 741.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,075 cf	30.50'W x 80.50'L x 3.54'H Field A 8,696 cf Overall - 3,509 cf Embedded = 5,186 cf x 40.0% Voids
#2A	139.50'	3,509 cf	Cultec R-330XLHD x 66 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
		5,584 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	138.44'	12.0" Round Culvert L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 138.44' / 136.79' S= 0.0485 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.47 cfs @ 11.02 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.47 cfs)**Primary OutFlow** Max=1.95 cfs @ 12.26 hrs HW=142.31' (Free Discharge)↑ **1=Culvert** (Passes 1.95 cfs of 6.94 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 1.95 cfs @ 1.59 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 143

Pond ICS-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

11 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 78.50' Row Length +12.0" End Stone x 2 = 80.50' 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" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

66 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,509.4 cf Chamber Storage

8,695.7 cf Field - 3,509.4 cf Chambers = 5,186.3 cf Stone x 40.0% Voids = 2,074.5 cf Stone Storage

Chamber Storage + Stone Storage = 5,583.9 cf = 0.128 af

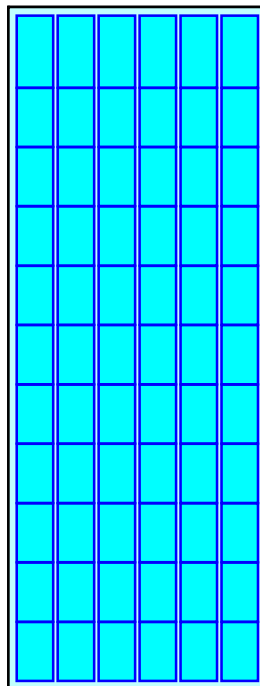
Overall Storage Efficiency = 64.2%

Overall System Size = 80.50' x 30.50' x 3.54'

66 Chambers

322.1 cy Field

192.1 cy Stone



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

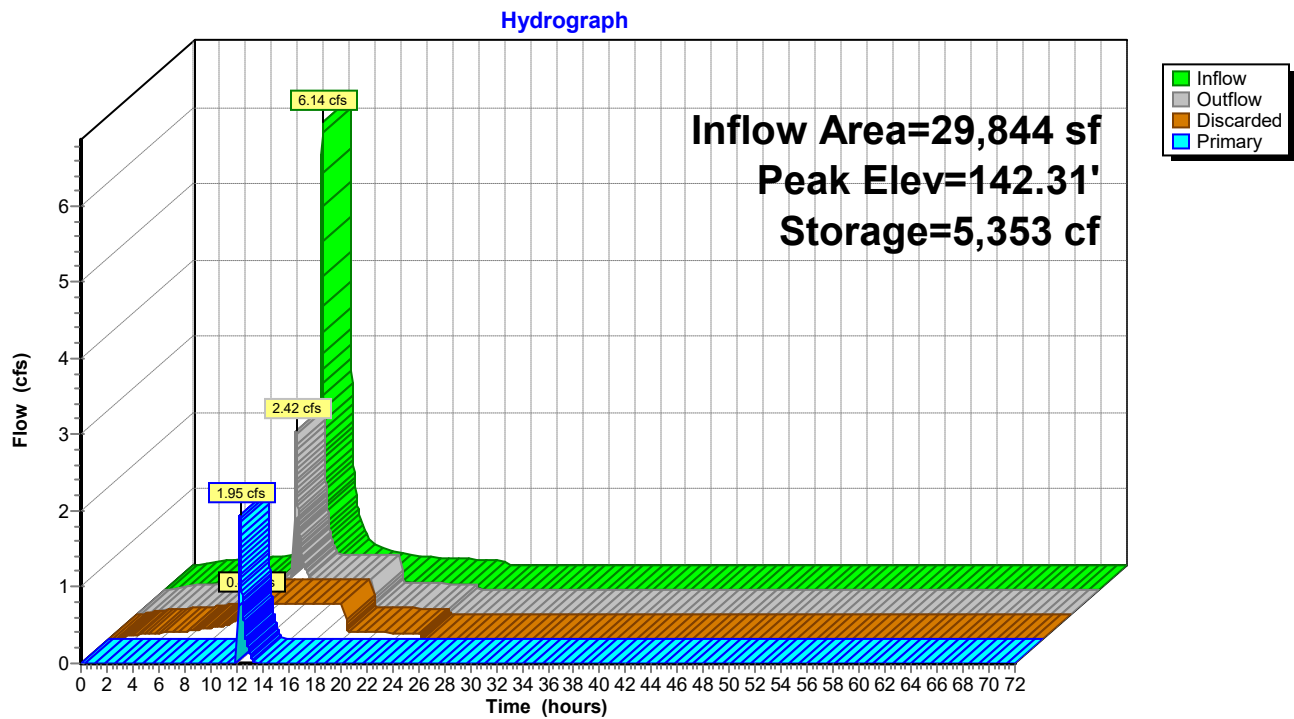
Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 144

Pond ICS-D: Infiltration Chambers D



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 145

Stage-Area-Storage for Pond ICS-D: Infiltration Chambers D

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,455	0	141.60	2,455	4,548
139.05	2,455	49	141.65	2,455	4,622
139.10	2,455	98	141.70	2,455	4,694
139.15	2,455	147	141.75	2,455	4,762
139.20	2,455	196	141.80	2,455	4,827
139.25	2,455	246	141.85	2,455	4,888
139.30	2,455	295	141.90	2,455	4,946
139.35	2,455	344	141.95	2,455	5,001
139.40	2,455	393	142.00	2,455	5,052
139.45	2,455	442	142.05	2,455	5,101
139.50	2,455	491	142.10	2,455	5,150
139.55	2,455	539	142.15	2,455	5,199
139.60	2,455	588	142.20	2,455	5,248
139.65	2,455	637	142.25	2,455	5,297
139.70	2,455	686	142.30	2,455	5,347
139.75	2,455	735	142.35	2,455	5,396
139.80	2,455	784	142.40	2,455	5,445
139.85	2,455	833	142.45	2,455	5,494
139.90	2,455	882	142.50	2,455	5,543
139.95	2,455	931			
140.00	2,455	980			
140.05	2,455	1,029			
140.10	2,455	1,078			
140.15	2,455	1,127			
140.20	2,455	1,176			
140.25	2,455	1,225			
140.30	2,455	1,274			
140.35	2,455	1,323			
140.40	2,455	1,372			
140.45	2,455	1,421			
140.50	2,455	1,470			
140.55	2,455	1,519			
140.60	2,455	1,568			
140.65	2,455	1,617			
140.70	2,455	1,666			
140.75	2,455	1,715			
140.80	2,455	1,764			
140.85	2,455	1,813			
140.90	2,455	1,862			
140.95	2,455	1,911			
141.00	2,455	1,960			
141.05	2,455	2,009			
141.10	2,455	2,058			
141.15	2,455	2,107			
141.20	2,455	2,156			
141.25	2,455	2,205			
141.30	2,455	2,254			
141.35	2,455	2,303			
141.40	2,455	2,352			
141.45	2,455	2,401			
141.50	2,455	2,450			
141.55	2,455	2,499			

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 146

Summary for Pond ICS-E: Infiltration Chambers E

Inflow Area = 26,084 sf, 100.00% Impervious, Inflow Depth = 8.44" for 100-Year event
 Inflow = 5.36 cfs @ 12.13 hrs, Volume= 18,345 cf
 Outflow = 1.21 cfs @ 12.38 hrs, Volume= 18,345 cf, Atten= 77%, Lag= 15.2 min
 Discarded = 0.46 cfs @ 11.13 hrs, Volume= 17,435 cf
 Primary = 0.75 cfs @ 12.38 hrs, Volume= 910 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.16' @ 12.38 hrs Surf.Area= 2,390 sf Storage= 5,082 cf

Plug-Flow detention time= 64.1 min calculated for 18,343 cf (100% of inflow)
 Center-of-Mass det. time= 64.1 min (805.1 - 741.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.00'	2,015 cf	40.17'W x 59.50'L x 3.54'H Field A 8,464 cf Overall - 3,427 cf Embedded = 5,037 cf x 40.0% Voids
#2A	139.50'	3,427 cf	Cultec R-330XLHD x 64 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 8 rows
		5,442 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	139.37'	12.0" Round Culvert L= 41.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 139.37' / 138.55' S= 0.0200 ' S= 0.0200 ' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	142.00'	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	Discarded	139.00'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=0.46 cfs @ 11.13 hrs HW=139.04' (Free Discharge)↑ **3=Exfiltration** (Exfiltration Controls 0.46 cfs)**Primary OutFlow** Max=0.75 cfs @ 12.38 hrs HW=142.16' (Free Discharge)↑ **1=Culvert** (Passes 0.75 cfs of 5.73 cfs potential flow)↑ **2=Broad-Crested Rectangular Weir** (Weir Controls 0.75 cfs @ 1.14 fps)

3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 147

Pond ICS-E: Infiltration Chambers E - 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 8 rows

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

8 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 57.50' Row Length +12.0" End Stone x 2 = 59.50' Base Length

8 Rows x 52.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 40.17' Base Width

6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

64 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 8 Rows = 3,427.5 cf Chamber Storage

8,464.3 cf Field - 3,427.5 cf Chambers = 5,036.8 cf Stone x 40.0% Voids = 2,014.7 cf Stone Storage

Chamber Storage + Stone Storage = 5,442.2 cf = 0.125 af

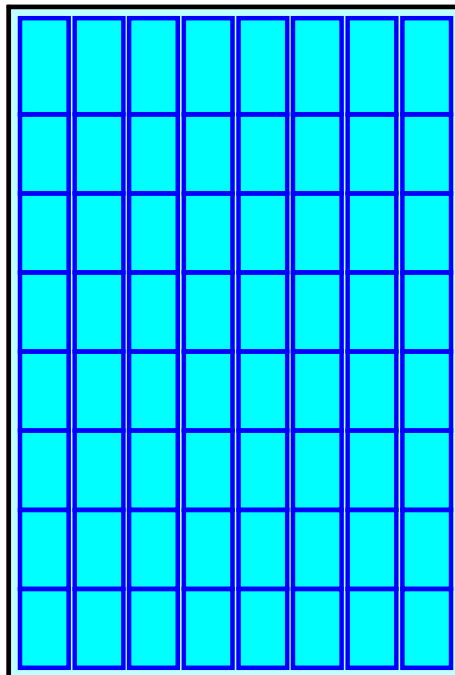
Overall Storage Efficiency = 64.3%

Overall System Size = 59.50' x 40.17' x 3.54'

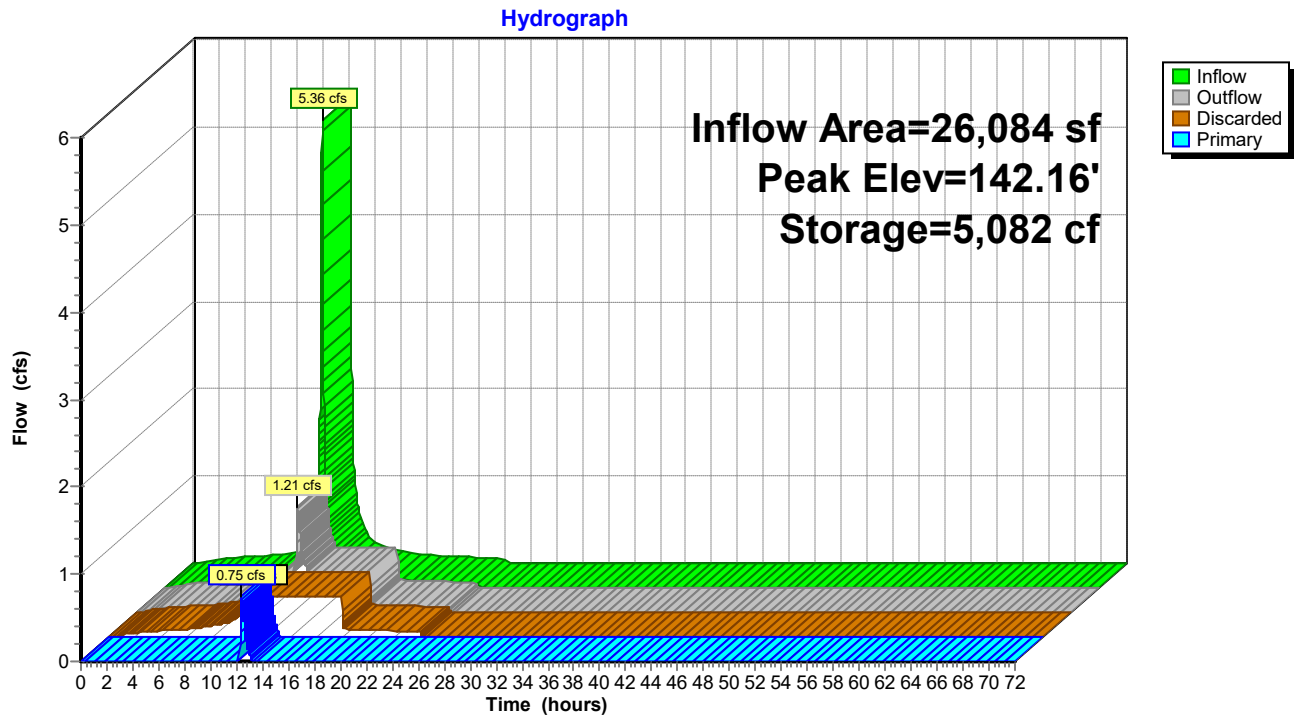
64 Chambers

313.5 cy Field

186.5 cy Stone



Pond ICS-E: Infiltration Chambers E



3395.1 - 0 Pond Street - Proposed Conditions

NRCC 24-hr C 100-Year Rainfall=8.68"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 149

Stage-Area-Storage for Pond ICS-E: Infiltration Chambers E

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
139.00	2,390	0	141.60	2,390	4,433
139.05	2,390	48	141.65	2,390	4,506
139.10	2,390	96	141.70	2,390	4,576
139.15	2,390	143	141.75	2,390	4,642
139.20	2,390	191	141.80	2,390	4,706
139.25	2,390	239	141.85	2,390	4,765
139.30	2,390	287	141.90	2,390	4,821
139.35	2,390	335	141.95	2,390	4,874
139.40	2,390	382	142.00	2,390	4,924
139.45	2,390	430	142.05	2,390	4,972
139.50	2,390	478	142.10	2,390	5,020
139.55	2,390	581	142.15	2,390	5,068
139.60	2,390	683	142.20	2,390	5,116
139.65	2,390	785	142.25	2,390	5,163
139.70	2,390	887	142.30	2,390	5,211
139.75	2,390	988	142.35	2,390	5,259
139.80	2,390	1,090	142.40	2,390	5,307
139.85	2,390	1,191	142.45	2,390	5,355
139.90	2,390	1,293	142.50	2,390	5,402
139.95	2,390	1,394			
140.00	2,390	1,495			
140.05	2,390	1,596			
140.10	2,390	1,696			
140.15	2,390	1,796			
140.20	2,390	1,895			
140.25	2,390	1,993			
140.30	2,390	2,092			
140.35	2,390	2,190			
140.40	2,390	2,288			
140.45	2,390	2,385			
140.50	2,390	2,483			
140.55	2,390	2,580			
140.60	2,390	2,677			
140.65	2,390	2,774			
140.70	2,390	2,871			
140.75	2,390	2,967			
140.80	2,390	3,062			
140.85	2,390	3,155			
140.90	2,390	3,248			
140.95	2,390	3,340			
141.00	2,390	3,431			
141.05	2,390	3,522			
141.10	2,390	3,611			
141.15	2,390	3,699			
141.20	2,390	3,786			
141.25	2,390	3,872			
141.30	2,390	3,957			
141.35	2,390	4,040			
141.40	2,390	4,122			
141.45	2,390	4,203			
141.50	2,390	4,281			
141.55	2,390	4,358			

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

CLOSED DRAINAGE SYSTEM/PIPE SIZING CALCULATIONS

VERNAL POOL CONTRIBUTING VOLUME CALCULATIONS



Project Number:	3395.0	Date:	July 14, 2023
Project Name:	Shinglemill	Calculations by:	BTM
Project Address:	75-79 Pond Street	Calculations date:	July 14, 2023
Client:	Shinglemill, LLC	Checked by:	DJD
Location:	Rockland, Massachusetts	Checked Date:	July 14, 2023

STORMWATER MANAGEMENT STANDARD 2 - PEAK RATE OF RUNOFF

OFFSITE TO WETLAND

DESIGN STORM (YEAR)	EXISTING PEAK RUNOFF (CFS)	PROPOSED PEAK RUNOFF (CFS)	REDUCTION IN PEAK RUNOFF
2	0.11	0.06	45.5%
10	1.96	1.29	34.2%
25	6.07	3.47	42.8%
100	18.33	17.94	2.1%

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



Project Number:	3395.0	Date:	July 14, 2023
Project Name:	Shinglemill	Calculations by:	BTM
Project Address:	0 Pond Street	Calculations date:	July 14, 2023
Client:	Shinglemill, LLC	Checked by:	DJD
Location:	Rockland, Massachusetts	Checked Date:	July 14, 2023

VOLUME OF RUNOFF

OFFSITE TO WETLAND

DESIGN STORM (YEAR)	EXISTING RUNOFF (CF)	PROPOSED RUNOFF (CF)	REDUCTION IN PEAK RUNOFF
2	3,602	1,046	71.0%
10	21,574	12,316	42.9%
25	43,291	25,986	40.0%
100	101,382	72,379	28.6%

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



Project Number: 3395
Project Name: Shinglemill
Project Address: 75-79 Pond Street
Client: Shinglemill, LLC
Location: Rockland, Massachusetts

Date: July 14, 2023
Calculations by: BTM
Calculations date: July 14, 2023
Checked by: DJD
Checked Date: July 14, 2023

STORMWATER MANAGEMENT STANDARD 3 - RECHARGE VOLUME

	HYDROLOGIC SOIL GROUP				TOTAL
	A	B	C	D	
IMPERVIOUS AREA (S.F.)	163,744	18,848	0	21,945	204,537
INCHES OF RUNOFF TO BE RECHARGED	0.60	0.35	0.25	0.10	
REQUIRED RECHARGE VOLUME (FT³)	8,187	550	0	183	8,920

CAPTURE AREA ADJUSTMENT - ADJUSTED MINIMUM REQUIRED RECHARGE VOLUME

MINIMUM OF 65% OF IMPERVIOUS AREA MUST BE DIRECTED TO THE RECHARGE BMP; 65 % IS =	132,949	SF		
IMPERVIOUS SITE AREA DRAINING TO BMP =	195,168	SF	95.4%	PERCENTAGE OF IMPERVIOUS AREA DIVERTED TO INFILTRATION FACILITY
RATIO OF TOTAL IMPERVIOUS AREA TO IMPERVIOUS AREA DRAINING TO RECHARGE BMP =	1.05		= $\frac{\text{TOTAL IMPERVIOUS AREA}}{\text{IMPERVIOUS AREA DRAINING TO THE RECHARGE AREA}}$	
ADJUSTED REQUIRED RECHARGE VOLUME=	9,348	CF	= RATIO OF IMPERVIOUS AREA x REQUIRED RECHARGE VOLUME	
PROPOSED RECHARGE VOLUME	35,453	CF	TOTAL AVAILABLE STATIC RECHARGE VOLUME	



Project Number: 3395
Project Name: Shinglemill
Project Address: 75-79 Pond Street
Client: Shinglemill, LLC
Location: Rockland, Massachusetts

Date: July 14, 2023
Calculations by: BTM
Calculations date: July 14, 2023
Checked by: DJD
Checked Date: July 14, 2023

DRAWDOWN FOR RECHARGE STRUCTURES

Infiltration Chamber A

A = AREA OF PROPOSED LEACHING STRUCTURE 3,663 SQ. FT.
Rv = STORAGE VOLUME = 3,527 CU. FT.
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = 2.41 INCHES/HOUR

DRAWDOWN TIME $T = \frac{Rv}{K \times A} =$ 4.8 HOURS TO EMPTY THE RECHARGE BMP
<72 HOURS, SO DRAWDOWN IS OK

Infiltration Chamber B

A = AREA OF PROPOSED LEACHING STRUCTURE 3,663 SQ. FT.
Rv = STORAGE VOLUME = 7,592 CU. FT.
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = 2.41 INCHES/HOUR

DRAWDOWN TIME $T = \frac{Rv}{K \times A} =$ 10.3 HOURS TO EMPTY THE RECHARGE BMP
<72 HOURS, SO DRAWDOWN IS OK

Infiltration Chamber C

A = AREA OF PROPOSED LEACHING STRUCTURE 7,902 SQ. FT.
Rv = STORAGE VOLUME = 14,358 CU. FT.
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = 8.27 INCHES/HOUR

DRAWDOWN TIME $T = \frac{Rv}{K \times A} =$ 2.6 HOURS TO EMPTY THE RECHARGE BMP
<72 HOURS, SO DRAWDOWN IS OK

Infiltration Chamber D

A = AREA OF PROPOSED LEACHING STRUCTURE 2,455 SQ. FT.
Rv = STORAGE VOLUME = 5,052 CU. FT.
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = 8.27 INCHES/HOUR

DRAWDOWN TIME $T = \frac{Rv}{K \times A} =$ 3.0 HOURS TO EMPTY THE RECHARGE BMP
<72 HOURS, SO DRAWDOWN IS OK

Infiltration Chamber E

A = AREA OF PROPOSED LEACHING STRUCTURE 2,390 SQ. FT.
Rv = STORAGE VOLUME = 4,924 CU. FT.
K= SATURATED HYDRAULIC CONDUCTIVITY (RAWLS RATE) = 8.27 INCHES/HOUR

DRAWDOWN TIME $T = \frac{Rv}{K \times A} =$ 3.0 HOURS TO EMPTY THE RECHARGE BMP
<72 HOURS, SO DRAWDOWN IS OK



Project Number:	3395	Date:	July 14, 2023
Project Name:	Shinglemill	Calculations by:	BTM
Project Address:	75-79 Pond Street	Calculations date:	July 14, 2023
Client:	Shinglemill, LLC	Checked by:	DJD
Location:	Rockland, Massachusetts	Checked Date:	July 14, 2023

STORMWATER MANAGEMENT STANDARD 4 - WATER QUALITY VOLUME

SUBCATCHMENT	DEPTH TO TREAT (IN.)	IMPERVIOUS AREA (SF)	WATER VOLUME (CF)
Entrance Bioretention Garden	1	8,164	680
Infiltration Chambers A (IC-A)	1	38,700	3,225
Infiltration Chamber B (IC-B)	1	24,771	2,064
Infiltration Chambers C(IC-C)	1	75,771	6,314
Infiltration Chamber D(IC-D)	1	29,842	2,487
Infiltration Chamber E(IC-E)	1	26,084	2,174
Direct to Wetland(Existing)	1	1,205	100
NET WATER QUALITY VOLUME			17,045

Note: All BMPs are able to contain a volume greater than their associated WQV by the static method for sizing. Static volume of each BMP was determined by choosing the volume below the lowest invert through the Stage-Storage tables within the HydroCAD model.



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

Calculations by: BTM
Calculations Date: 07/14/2023
Checked By: DJD
Checked Date: 07/14/2023

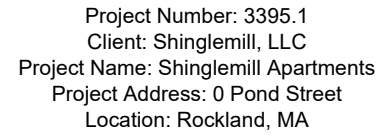
ENTRANCE DRAINAGE SYSTEM - 25 YEAR STORM																										
WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS R = hydraulic radius = area/wetted perimeter										FLOW CHARACTERISTICS				
LOCATION				LAND USE			FLOW TIME			FLOW												Q/Qf				V/Vf
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	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)	Tc L/V (MIN)
WS CB-E1	LANDSCAPED	0.025		0.400								From: CB-E1	Out:													
	IMPERVIOUS	0.187		0.850								To: WQU-E1	In:	HDPE	12	12	0.79	0.250	0.020	0.013	5.04	6.42	0.21	0.67	4.30	0.05
			0.213	0.797	0.169		6.00	NONE	6.00	6.39	1.08															
	WQU-E1 TO FES-E1					0.169	6.00	0.05	6.05	6.38	1.08	From: STC-S1	Out:													
												To: FES-S1	In:	HDPE	12	16	0.79	0.250	0.020	0.013	5.04	6.42	0.21	0.67	4.30	0.06



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

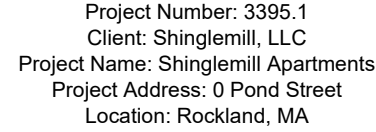
Calculations by: BTM
Calculations Date: 07/14/2023
Checked By: DJD
Checked Date: 07/14/2023

TO INFILTRATION CHAMBER SYSTEM A - 25 YEAR STORM																										
WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS										FLOW CHARACTERISTICS				
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	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)	Tc L/V (MIN)
WS DCB-A1	LANDSCAPED IMPERVIOUS	0.131 0.383	0.515	0.400 0.850 0.735	CA	0.378	6.00	NONE	6.00	6.39	2.42	From: DCB-A1	Out:	HDPE	12	86	0.79	0.250	0.010	0.013	3.56	4.54	0.68	0.94	4.24	0.34
												To: WQU-A1	In:													
WS CB-A2	LANDSCAPED IMPERVIOUS	0.024 0.097	0.121	0.400 0.850 0.761	CA	0.092	6.00	NONE	6.00	6.39	0.59	From: CB-A2	Out:	HDPE	12	67	0.79	0.250	0.010	0.013	3.56	4.54	0.16	0.62	2.82	0.40
												To: WQU-A1	In:													
WQU-A1 TO DMH-A1			0.635			0.470	6.00	0.40	6.40	6.32	2.97	From: WQU-A1	Out:	HDPE	12	9	0.79	0.250	0.020	0.013	5.04	6.42	0.59	0.90	5.76	0.03
												To: DMH-A1	In:													
DMH-A1 TO ICS-A						0.470	6.40	0.03	6.42	6.31	2.97	From: DMH-A1	Out:	HDPE	18	5	1.77	0.375	0.020	0.013	14.86	8.41	0.20	0.66	5.52	0.02
												To: ICS-A	In:													
WS DCB-A3	LANDSCAPED IMPERVIOUS	0.116 0.379	0.495	0.400 0.850 0.744	CA	0.369	6.00	NONE	6.00	6.39	2.36	From: DCB-A3	Out:	HDPE	12	8	0.79	0.250	0.020	0.013	5.04	6.42	0.47	0.84	5.39	0.02
												To: WQU-A2	In:													
WQU-A2 TO ICS-A						0.839	6.42	0.02	6.45	6.31	5.29	From: WQU-A2	Out:	HDPE	12	5	0.79	0.250	0.040	0.013	7.13	9.07	0.74	0.96	8.71	0.01
												To: ICS-A	In:													



Calculations by: BTM
Calculations Date: 07/14/2023
Checked By: DJD
Checked Date: 07/14/2023

Watershed Characteristics												PIPE CHARACTERISTICS R = hydraulic radius = area/wetted perimeter										FLOW CHARACTERISTICS														
LOCATION				LAND USE			FLOW TIME			FLOW												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)	Tc L/V (MIN)
Description	Cover	Increment. (ACRE)	Total_A (ACRE)	C	CA	Total CA	To Inlet (MIN)	In Pipe (MIN)	Tc (MIN)	I (IPH)	Q (CFS)																									
WS CB-B1	LANDSCAPED IMPERVIOUS	0.010 0.089		0.400 0.850								From: CB-B1	Out:																							
			0.100	0.804	0.080		6.00	NONE	6.00	6.39	0.51	To: DMH-B1	In:	HDPE	12	23	0.79	0.250	0.010	0.013	3.56	4.54	0.14	0.60	2.71	0.14										
WS CB-B2	LANDSCAPED IMPERVIOUS	0.007 0.111		0.400 0.850								From: CB-B2	Out:																							
			0.119	0.822	0.097		6.00	NONE	6.00	6.39	0.62	To: DMH-B1	In:	HDPE	12	23	0.79	0.250	0.010	0.013	3.56	4.54	0.17	0.63	2.86	0.13										
DMH-B1	TO WQU-B1					0.178	6.00	0.14	6.14	6.36	1.13	From: DMH-B1	Out:																							
												To: WQU-B1	In:	HDPE	12	51	0.79	0.250	0.010	0.013	3.56	4.54	0.32	0.75	3.40	0.25										
WQU-B1	TO ICS-B					0.178	6.14	0.25	6.39	6.32	1.12	From: WQU-B1	Out:																							
												To: ICS-B	In:	HDPE	12	5	0.79	0.25	0.010	0.013	3.56	4.54	0.31	0.75	3.40	0.02										
WS CB-B3	LANDSCAPED IMPERVIOUS	0.008 0.178		0.400 0.850								From: CB-B3	Out:																							
			0.186	0.832	0.154		6.00	NONE	6.00	6.39	0.99	To: WQU-B2	In:	HDPE	12	51	0.79	0.250	0.010	0.013	3.56	4.54	0.28	0.72	3.27	0.26										
WS CB-B4	LANDSCAPED IMPERVIOUS	0.030 0.289		0.400 0.850								From: CB-B4	Out:																							
			0.319	0.808	0.257		6.00	NONE	6.00	6.39	1.64	To: WQU-B2	In:	HDPE	12	62	0.79	0.250	0.010	0.013	3.56	4.54	0.46	0.84	3.80	0.27										
WQU-B2	TO ICS-B					0.412	6.39	0.27	6.66	6.27	2.58	From: WQU-B2	Out:																							
												To: ICS-B	In:	HDPE	12	5	0.79	0.250	0.010	0.013	3.56	4.54	0.73	0.95	4.33	0.02										



Calculations by: BTM
Calculations Date: 07/14/2023
Checked By: DJD
Checked Date: 07/14/2023

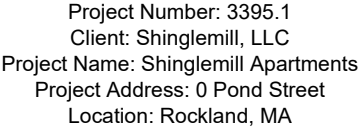
TO INFILTRATION CHAMBER SYSTEM C - 25 YEAR STORM																										
Watershed Characteristics												PIPE CHARACTERISTICS R = hydraulic radius = area/wetted perimeter										FLOW CHARACTERISTICS				
LOCATION				LAND USE			FLOW TIME			FLOW																
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	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)	Tc L/V (MIN)
WS CB-C1	LANDSCAPED IMPERVIOUS	0.011	0.061	0.400	0.047		6.00	NONE	6.00	6.39	0.30	From: CB-C1	Out:	HDPE	12	28	0.79	0.250	0.010	0.013	3.56	4.54	0.08	0.51	2.32	0.20
		To: WQU-C1		In:																						
WS DCB-C2	LANDSCAPED IMPERVIOUS	0.014	0.269	0.400	0.223		6.00	NONE	6.00	6.39	1.42	From: DCB-C2	Out:	HDPE	12	20	0.79	0.250	0.005	0.013	2.52	3.21	0.56	0.89	2.85	0.12
		To: WQU-C1		In:																						
WS DCB-C3	LANDSCAPED IMPERVIOUS	0.048	0.362	0.400	0.286		6.00	NONE	6.00	6.39	1.83	From: DCB-C3	Out:	HDPE	12	70	0.79	0.250	0.005	0.013	2.52	3.21	0.73	0.95	3.06	0.38
		To: WQU-C1		In:																						
WQU-C1 TO ICS-C						0.556	6.00	0.38	6.38	6.32	3.52	From: WQU-C1	Out:	HDPE	18	5	1.77	0.375	0.010	0.013	10.50	5.94	0.33	0.76	4.53	0.02
						To: ICS-C	In:																			
WS DCB-C4	LANDSCAPED IMPERVIOUS	0.280	0.723	0.400	0.488		6.00	NONE	6.00	6.39	3.12	From: DCB-C4	Out:	HDPE	12	42	0.79	0.250	0.010	0.013	3.56	4.54	0.88	1.01	4.57	0.15
		To: WQU-C2		In:																						
WS DCB-C5	LANDSCAPED IMPERVIOUS	0.006	0.134	0.400	0.111		6.00	NONE	6.00	6.39	0.71	From: DCB-C5	Out:	HDPE	12	35	0.79	0.250	0.010	0.013	3.56	4.54	0.20	0.66	2.98	0.20
		To: WQU-C2		In:																						
WQU-C2 TO ICS-C						0.599	6.00	0.20	6.20	6.35	3.81	From: ICS-C	Out:	HDPE	18	5	1.77	0.375	0.010	0.013	10.50	5.94	0.36	0.78	4.64	0.02
						To: ICS-C	In:																			
WS DCB-C6	LANDSCAPED IMPERVIOUS	0.035	0.333	0.400	0.268		6.00	NONE	6.00	6.39	1.71	From: DCB-C6	Out:	HDPE	12	25	0.79	0.250	0.010	0.013	3.56	4.54	0.48	0.85	3.84	0.11
		To: WQU-C3		In:																						
WS DCB-C7	LANDSCAPED IMPERVIOUS	0.038	0.307	0.400	0.244		6.00	NONE	6.00	6.39	1.56	From: DCB-C7	Out:	HDPE	12	28	0.79	0.250	0.010	0.013	3.56	4.54	0.44	0.82	3.74	0.12
		To: WQU-C3		In:																						
WQU-C3 TO ICS-C						0.512	6.00	0.12	6.12	6.37	3.26	From: WQU-C3	Out:	HDPE	18	5	1.77	0.375	0.010	0.013	10.50	5.94	0.31	0.75	4.43	0.02
						To: ICS-C	In:																			



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

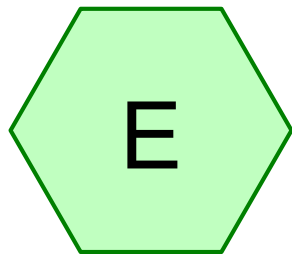
Calculations by: BTM
Calculations Date: 07/14/2023
Checked By: DJD
Checked Date: 07/14/2023

TO INFILTRATION CHAMBER SYSTEM D - 25 YEAR STORM																										
WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS										FLOW CHARACTERISTICS				
LOCATION				LAND USE			FLOW TIME			FLOW		R = hydraulic radius = area/wetted perimeter														
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	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)	Tc L/V (MIN)
WS ROOF DRAIN	LANDSCAPED	0.000		0.400								From: ROOF DRAIN	Out:													
	IMPERVIOUS	0.343		0.850										HDPE	12	99	0.79	0.250	0.010	0.013	3.56	4.54	0.52	0.87	3.93	0.42
			0.343	0.850	0.291		6.00	NONE	6.00	6.39	1.86	To: DMH-D1	In:													
DMH-D1	TO ICS-D					0.291	6.00	0.42	6.42	6.32	1.84	From: DMH-D1	Out:													
												To: ICS-D	In:	HDPE	12	5	0.79	0.25	0.010	0.013	3.56	4.54	0.52	0.86	3.92	0.02
WS ROOF DRAIN	LANDSCAPED	0.000		0.400								From: ROOF DRAIN	Out:													
	IMPERVIOUS	0.343		0.850										HDPE	12	245	0.79	0.250	0.010	0.013	3.56	4.54	0.52	0.87	3.93	1.04
			0.343	0.850	0.291		6.00	NONE	6.00	6.39	1.86	To: DMH-D2	In:													
DMH-D2	TO ICS-D					0.291	6.00	1.04	7.04	6.21	1.81	From: DMH-D2	Out:													
												To: ICS-D	In:	HDPE	12	5	0.79	0.25	0.010	0.013	3.56	4.54	0.51	0.86	3.90	0.02

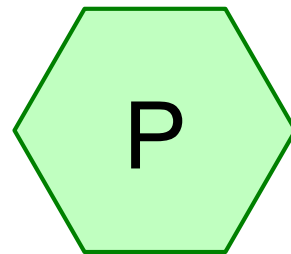


Calculations by: BTM
Calculations Date: 07/14/2023
Checked By: DJD
Checked Date: 07/14/2023

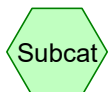
TO INFILTRATION CHAMBER SYSTEM E - 25 YEAR STORM																											
WATERSHED CHARACTERISTICS												PIPE CHARACTERISTICS R = hydraulic radius = area/wetted perimeter										FLOW CHARACTERISTICS					
LOCATION				LAND USE			FLOW TIME			FLOW												Qf = discharge = area x velocity					Q/Qf
Description	Cover	Increm. (ACRE)	Total_A (ACRE)	C	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)	Tc L/V (MIN)	
WS	ROOF DRAIN	LANDSCAPED	0.000	0.400								From: ROOF DRAIN	Out:														
		IMPERVIOUS	0.312	0.850																							
			0.312	0.850	0.265		6.00	NONE	6.00	6.39	1.69	To:	DMH-E2	In:	HDPE	12	262	0.79	0.250	0.010	0.013	3.56	4.54	0.48	0.84	3.83	1.14
	DMH-E2	TO ICS-E			0.265		6.00	1.14	7.14	6.19	1.64	From: DMH-E2	Out:														
												To:	ICS-E	In:	HDPE	12	12	0.79	0.25	0.010	0.013	3.56	4.54	0.46	0.84	3.79	0.05
WS	ROOF DRAIN	LANDSCAPED	0.000	0.400								From: ROOF DRAIN	Out:														
		IMPERVIOUS	0.287	0.850																							
			0.287	0.850	0.244		6.00	NONE	6.00	6.39	1.56	To:	DMH-E1	In:	HDPE	12	198	0.79	0.250	0.010	0.013	3.56	4.54	0.44	0.82	3.74	0.88
	DMH-E1	TO ICS-E			0.244		6.00	0.88	6.88	6.24	1.52	From: DMH-E1	Out:														
												To:	ICS-E	In:	HDPE	12	5	0.79	0.25	0.010	0.013	3.56	4.54	0.43	0.82	3.71	0.02



Existing



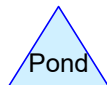
Proposed



Subcat



Reach



Pond



Link

Routing Diagram for 3395.1 - 0 Pond Street - Vernal Pool
Prepared by {enter your company name here}, Printed 7/17/2023
HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

3395.1 - 0 Pond Street - Vernal Pool

Type III 24-hr 1-Year Rainfall=2.78"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 2

Summary for Subcatchment E: Existing

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

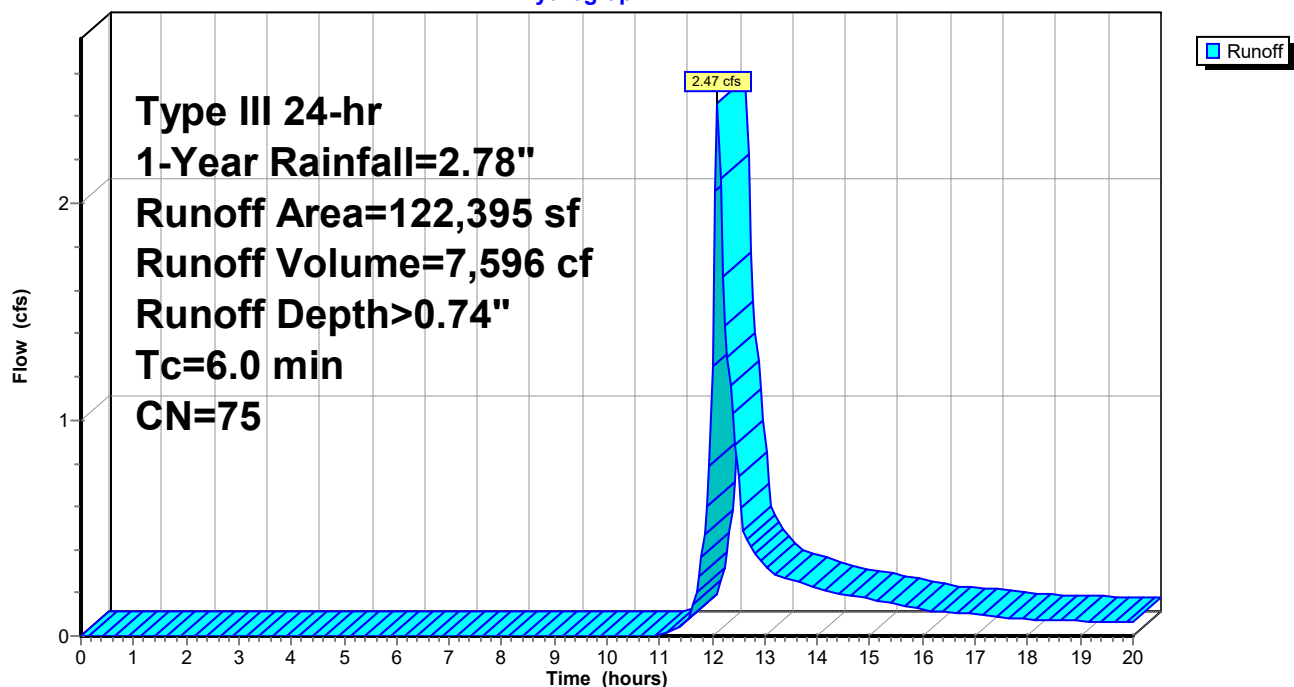
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.78"

Area (sf)	CN	Description
6,562	30	Woods, Good, HSG A
121	30	Brush, Good, HSG A
192	98	Unconnected roofs, HSG A
54,519	77	Woods, Good, HSG D
7,301	73	Brush, Good, HSG D
1,583	89	Dirt roads, HSG D
* 50,815	78	Wetlands, HSG D
1,302	98	Unconnected pavement, HSG D
122,395	75	Weighted Average
120,901		98.78% Pervious Area
1,494		1.22% Impervious Area
1,494		100.00% Unconnected

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

Subcatchment E: Existing

Hydrograph



3395.1 - 0 Pond Street - Vernal Pool

Type III 24-hr 1-Year Rainfall=2.78"

Prepared by {enter your company name here}

Printed 7/17/2023

HydroCAD® 10.10-5a s/n 03074 © 2020 HydroCAD Software Solutions LLC

Page 3

Summary for Subcatchment P: Proposed

Runoff = 2.58 cfs @ 12.10 hrs, Volume= 7,942 cf, Depth> 0.74"

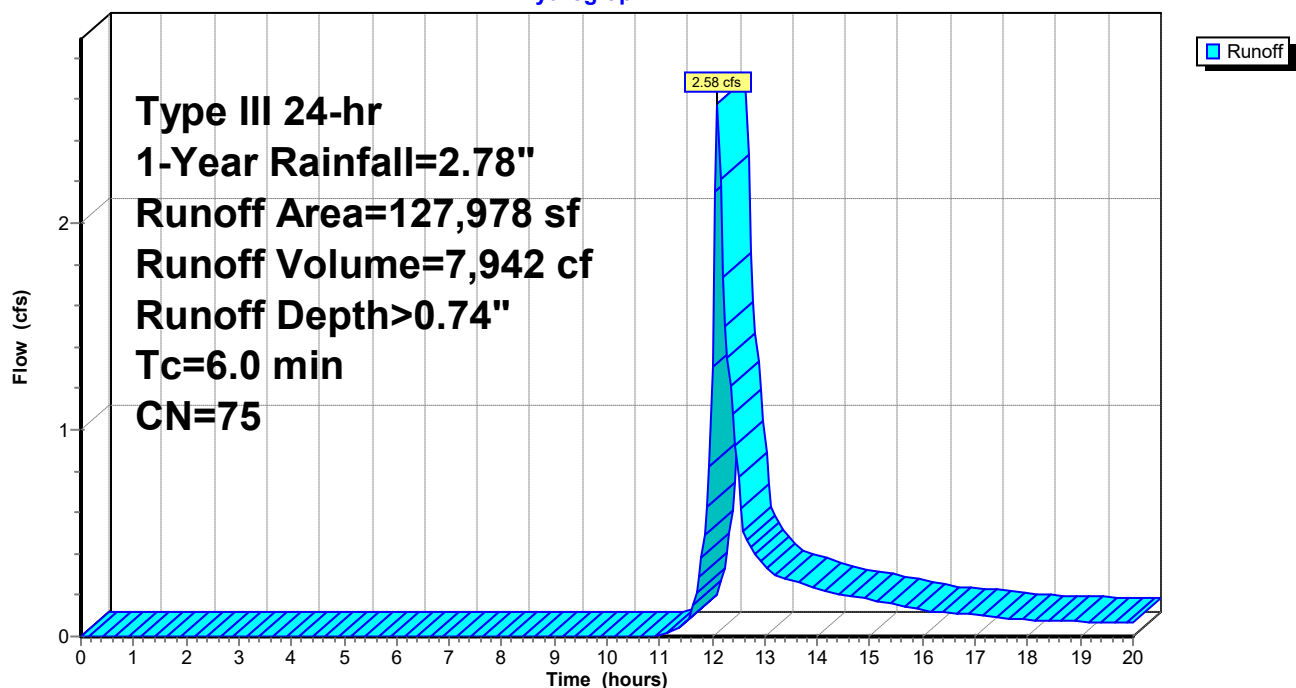
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-Year Rainfall=2.78"

Area (sf)	CN	Description
6,754	30	Woods, Good, HSG A
121	30	Brush, Good, HSG A
54,217	77	Woods, Good, HSG D
6,900	73	Brush, Good, HSG D
1,583	89	Dirt roads, HSG D
1,996	80	>75% Grass cover, Good, HSG D
* 50,815	78	Wetlands, HSG D
* 90	98	Unconnected pavement, HSG D
5,502	80	>75% Grass cover, Good, HSG D
127,978	75	Weighted Average
127,888		99.93% Pervious Area
90		0.07% Impervious Area
90		100.00% Unconnected

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

Subcatchment P: Proposed

Hydrograph



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 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.

Motor Vehicle controls

Repair, maintenance, and washing of motor vehicles is prohibited from being performed on the property.

Pet waste management provisions

Should pets be allowed in the subdivisions, the property management organization shall submit a Pet Waste Disposal Plan, including at a minimum, the requirement to post signs at various locations throughout the common open space land requiring all pet waste be bagged and properly disposed and all dogs shall be leashed in accordance with town bylaws. The property management organization should also include on its signs that cats pose a risk to wildlife and should not be let outside.

Requirements for routine inspections and maintenance of stormwater BMPs

BMPs shall be inspected and maintained per the Operations and Maintenance Plan.

Spill prevention and response plans

First responders

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

All fertilizer, herbicides, and pesticides shall not be used within 25 feet of direct drainage to a wetland resource area. Excess materials 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 in a wrapped or sealed container and kept under cover out of the rain and snow.

Only organic fertilizers shall be used on site. Fertilizers with urea and chicken manure shall not be used on site.

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.

Snow disposal and plowing plans relative to Resource Areas

Where possible snow shall be placed onto grassed and landscaped areas adjacent to the area it was removed from. Snow shall not be stored within 25 feet of direct drainage to wetland area, or within 25 feet of a drain structure which discharges directly to the wetlands. No snow collected from outside of the Zone A shall be transported and stored within the Zone A. During snow events in which excessive snow cannot be stored within open landscaped areas, snow shall be stored in the designated "Overburden Snow Stockpile Area" at the end of the southeastern parking area outside the Zone A and 100' Wetland Buffer Zone as indicated on the Site Plans. During extreme snow events, in which snow cannot be stored on site, snow will be trucked off and disposed of in a legal manner.

Winter Road Deicing and/or Sand Use and Storage restrictions

Road salt (Sodium chloride) shall not be used on this site. Calcium chloride is acceptable for use per manufacturer's recommendations. 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.

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 in front of the entrance to the drainage inlets (catch basins) and along the outer edge of the plunge pool outlets. Oil booms should remain in place until the system has been cleaned and inspected. Oil booms should be inspected once a year. All used and damaged booms should be replaced immediately. Refer to manufacturer's instructions on the lifespan of the oil booms.

Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan

Training shall be conducted during the hiring of all new site employees and site maintenance contractors. Training shall be performed by the owner of the property or a qualified representative. Training records shall be kept on file.

APPENDIX E

OPERATION AND MAINTENANCE PLAN - REQUIRED BY STANDARD 9

OPERATION AND MAINTENANCE PLAN

SHINGLMILL

75-79 Pond Street, Rockland, Massachusetts

OWNER NAME: Shinglemill, LLC

ADDRESS: 4 First Street, Bridgewater, MA 02324

TEL. NUMBER: (508) 962-6291

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 debris 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 and dispose of removed materials per local, state, and federal regulations.
 - Annual Maintenance
 - Inspect hood to ensure that it is properly secured.
 - Remove accumulated sediment via clamshell bucket or vacuum truck and dispose of removed materials per local, state, and federal regulations.
- Proprietary Separators
 - 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.
 - 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.
- Infiltration Chambers
 - General Maintenance
 - Inspect subsurface infiltration facilities twice a year.
 - Remove any debris that may clog the system via vacuum truck.

- Rain Garden
 - General Maintenance
 - Inspect and remove trash monthly.
 - Mow grasses when between 3" to 6", 2 to 12 times annually
 - Annual Maintenance
 - Inspect and repair voids within the mulched areas
 - Apply fertilizers as recommended by the manufacturer for each plant species within the garden
 - Remove and prune dead vegetation as necessary. Replant vegetation of similar species that was removed during maintenance activities.
- 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.
- Snow Removal
 - General Maintenance
 - During any snow event, remove any accumulated snow from all parking areas, sidewalks, and travel ways including the emergency vehicle accesses.
 - Snow shall be placed onto grassed and landscaped areas adjacent to the area it was removed from.
 - Snow shall not be stored within 25 feet of direct drainage to wetland area, or within 25 feet of a drain structure which discharges directly to the wetlands.
 - No snow collected from outside of the Zone A shall be transported and stored within the Zone A.
 - Excessive Snow Storage
 - During snow events in which excessive snow cannot be stored within open landscaped areas, snow shall be stored in the designated "Overburden Snow Stockpile Area" at the end of the southeastern parking area outside the Zone A and 100' Wetland Buffer Zone as indicated on the Site Plans.
 - During extreme snow events, in which snow cannot be stored on site, snow will be trucked off and disposed of in a legal manor.

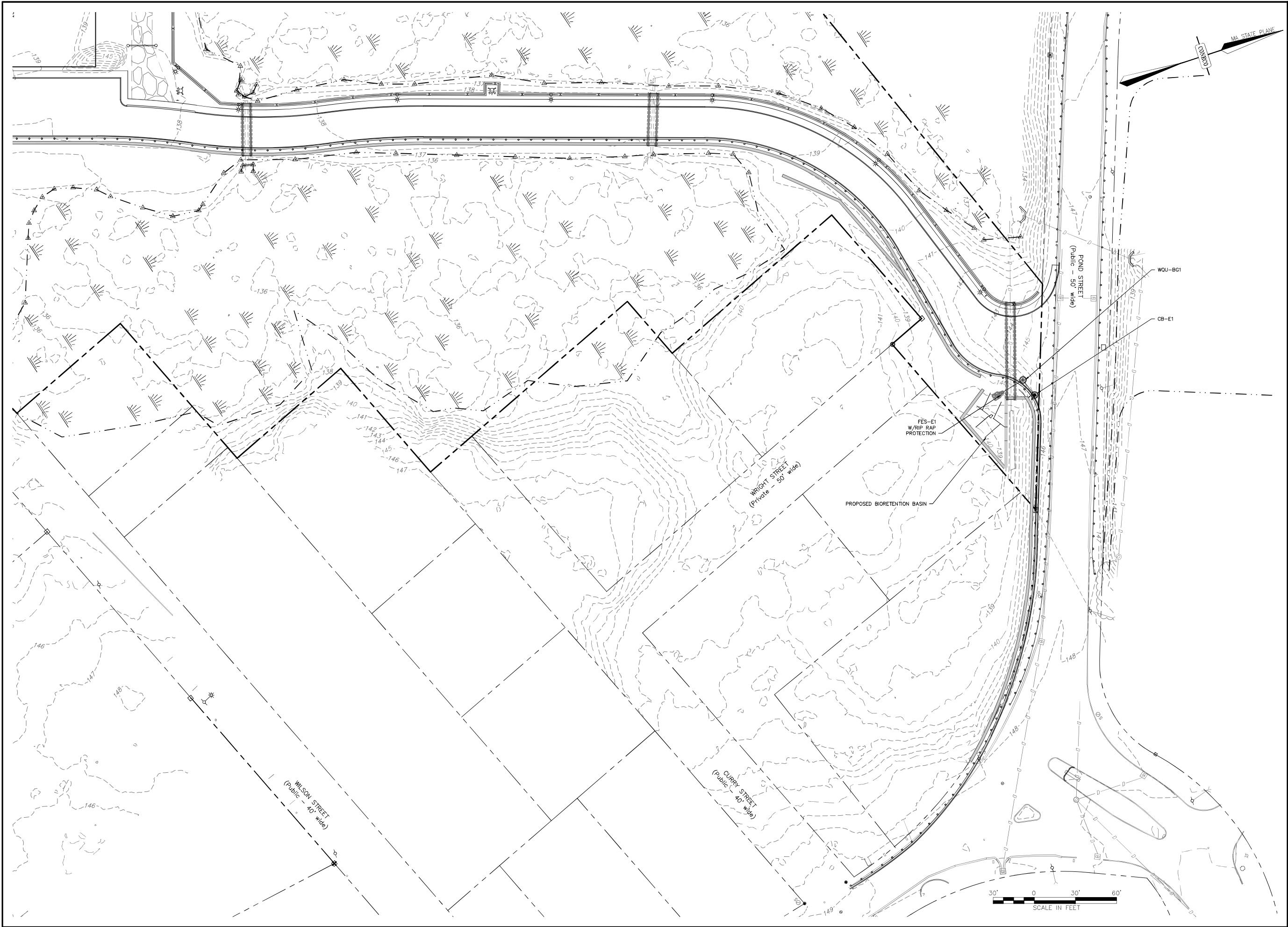
SHINGLEMILL, LLC

SHINGLEMILL	
-------------	--

0 POND STREET, ROCKLAND, MASSACHUSETTS
--

STORMWATER MANAGEMENT SYSTEM OPERATION & MAINTENANCE LOG

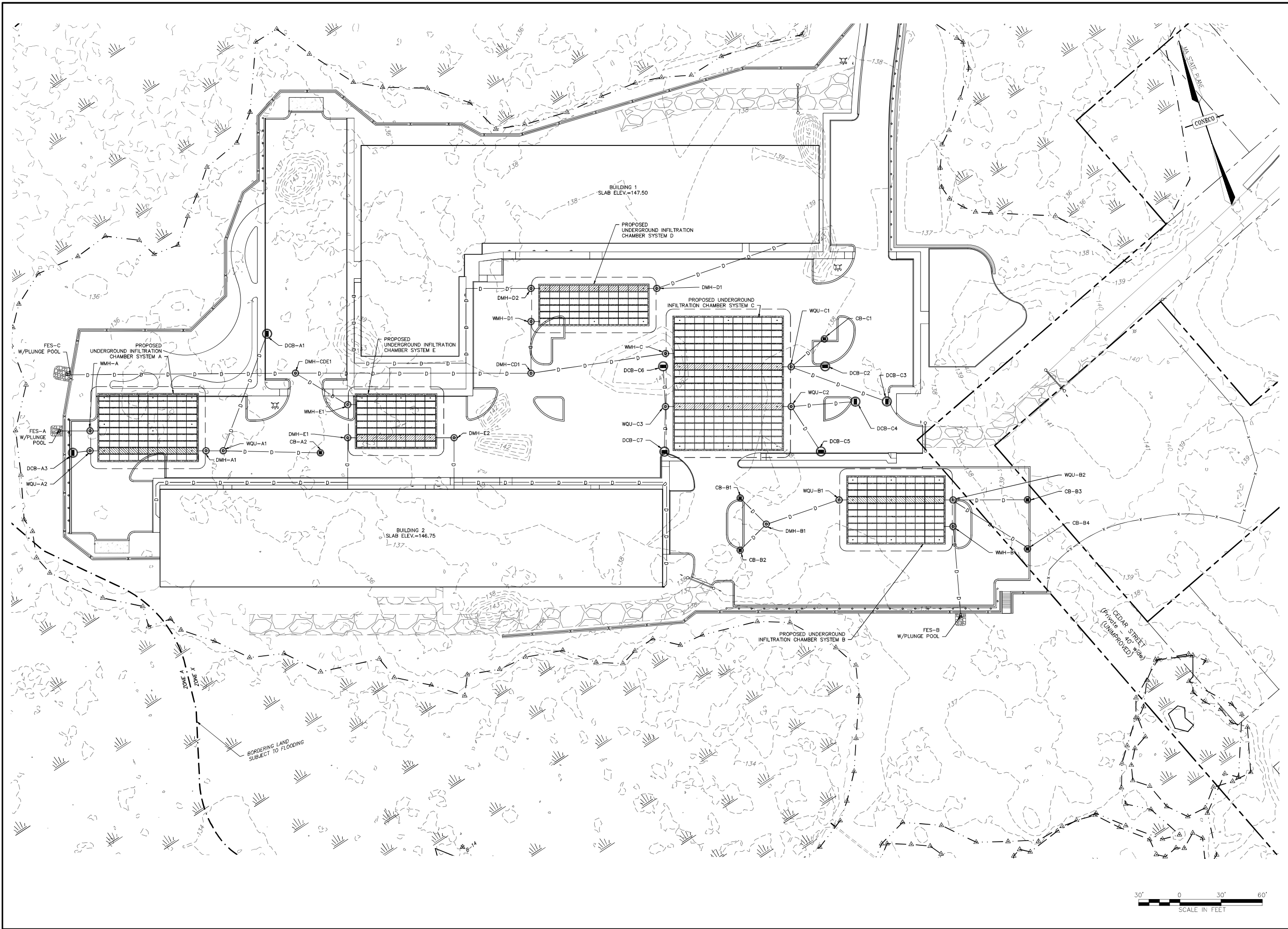
[illegible]



CONECO <i>Engineers & Scientists</i>		SHINGLEMILL APARTMENTS 75-79 POND STREET ROCKLAND, MASSACHUSETTS 02370		SHINGLEMILL, LLC 4 FIRST STREET BRIDGEWATER, MASSACHUSETTS 02324	
4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02324 PHONE 508-697-3191 OR 800-348-3555 FAX 508-697-5996 WEBSITE: www.coneco.com		COMPREHENSIVE PERMIT PLANS		OPERATION AND MAINTENANCE PLAN SHEET 1 OF 2	
DATE: 02/14/2022		DESIGNED: MVK		CHECKED: DJD	
DRAFTED: MVK		IN CHARGE: DJD		SCALE: 1" = 30'	
PROJECT NO. 3395.1		SHEET NO.		1	
OF 32					

REVISIONS	
NO.	DATE
1	9/23/2022
2	4/26/2023
3	7/14/2023

DESCRIPTION	DR/CK
GRADING & DRAINAGE REDESIGN	DJD/MSD
PER REVIEW COMMENTS	DJD/MSD
PER REVIEW COMMENTS	DJD/BTM



 4 FIRST STREET, BRIDGEWATER, MASSACHUSETTS 02224 PHONE 508-697-3191 OR 800-548-3355 FAX 508-697-5996 WEBSITE: www.coneco.com		PROJECT: SHINGLEMILL APARTMENTS 75-79 POND STREET ROCKLAND, MASSACHUSETTS 02370		PREPARED FOR: SHINGLEMILL, LLC 4 FIRST STREET BRIDGEWATER, MASSACHUSETTS 02324	
DATE 02/14/2022					
DESIGNED: MVK	CHECKED: DJD				
DRAFTED: MVK	IN CHARGE: DJD				
SCALE: 1" = 30'					
PROJECT NO. 3395.1					
SHEET NO.					
		</			

APPENDIX F

SOIL LOGS

Job No.: 3395.1

Soil Evaluator: Damien Dmitruk

Client: _____

Witness: _____

Site Location: 0 Pond St., Rockland, MA

Excavator: Iaria Brothers - Vinny

Land Use: Vacant lot

Date: October 2, 2019

Parent Material: _____

Weather: Cloudy, 75°

Water Resource Conditions: Normal: _____ Above: _____ Below: X

TP # 3

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-24	Fill			Change in redox color at 11"	Depth		Mottling	4"
24-40	Ab	Loam	5Y 2.5/1		0-15 Min.			
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.			
					45-60 Min.		Standing	40"
					60-75 Min.			
Rate					"/hr			

TP # 4

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-24	Fill				Depth		Mottling	31"
24-30	Ab	Coarse Sand	10YR 4/1		0-15 Min.			
30-35	Bw	Coarse Sand	10YR 5/6		15-30 Min.		Weeping	
35-79	C	Coarse Sand	10YR 4/4	10% Gravel, 10% Cob./Stones	30-45 Min.			
					45-60 Min.		Standing	40"
					60-75 Min.			
Rate					"/hr			

TP # 5

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-2	O				Depth		Mottling	6"
2-4	A	Loamy Sand	10YR 4/3	10% Gravel, 10% Cob./Stones	0-15 Min.			
4-13	Bw	Sand	2.5Y 5/4	10% Gravel, 10% Cob./Stones, heavier mottling at 26"	15-30 Min.		Weeping	25"
13-72	C	Sand	2.5Y 6/3	10% Gravel, 10% Cob./Stones	30-45 Min.			
					45-60 Min.		Standing	36"
					60-75 Min.			
Rate					"/hr			

TP # 6

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-15	Fill				Depth		Mottling	10"
15-23	Ab	Loamy Sand	10YR 2/1	10% Gravel, 10% Cob./Stones	0-15 Min.			
23-29	Bw	Sand	10YR 5/6	10% Gravel, 10% Cob./Stones	15-30 Min.		Weeping	28"
29-105	C	Sand	2.5Y 5/1	10% Gravel, 10% Cob./Stones, Heavier mottling at 55"	30-45 Min.			
					45-60 Min.		Standing	48"
					60-75 Min.			
Rate					"/hr			

TP # 7

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-113	Fill			60" to organic fill, roots at 86"	Depth		Mottling	
113-123	Ab	Loamy Sand	10YR 2/1		0-15 Min.			
123-131	Cg	Sand	5GY 5/2	10% Gravel, 5% Cob./Stones	15-30 Min.		Weeping	54"
					30-45 Min.			
					45-60 Min.		Standing	123"
					60-75 Min.			
Rate					"/hr			

TP # 8

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-3	A	Sand	10YR 3/1	30% Gravel	Depth		Mottling	47"
3-6	Bw	Sand	10YR 4/4	20% Gravel, 30% Cob./Stones	0-15 Min.			
6-95	C1	Coarse Sand	2.5Y 5/4	20% Gravel, 30% Cob./Stones	15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	59"
					60-75 Min.			
Rate					"/hr			

TP # 10

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-31	Fill			20% Gravel, 30% Cob./Stones	Depth		Mottling	45"
31-100	C1	Sand	2.5Y 5/2	10% Gravel, 10% Cob./Stones	0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	59"
					60-75 Min.			
Rate					"/hr			

TP # 12

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-27	Fill				Depth		Mottling	42"
27-29	Ab	Loamy Sand			0-15 Min.			
29-42	Bw	Loamy Sand	10YR 5/6	10% Gravel, 10% Cob./Stones	15-30 Min.		Weeping	84"
42-56	C	Sand	10YR 4/2	10% Gravel, 10% Cob./Stones	30-45 Min.			
56-100	2C	Coarse Sand	10YR 6/1	10% Gravel, 10% Cob./Stones	45-60 Min.		Standing	90"
					60-75 Min.			
Rate					"/hr			

TP # 13

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-10	Fill				Depth		Mottling	28"
10-17	Ab	Fine Sand	10YR 2/1	Heavy organic	0-15 Min.			
17-31	Bw	Sand	10YR 5/8		15-30 Min.		Weeping	48"
31-76	C1	Coarse Sand	2.5Y 4/4		30-45 Min.			
76-92	C2	Coarse Sand	2.5Y 5/1	10% Gravel, 30% Cob./Stones, 10% Small Boulders	45-60 Min.		Standing	48"
					60-75 Min.			
Rate					"/hr			

TP # 14

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

Job No.: 3395.1

Soil Evaluator: Damien Dmitruk

Client: _____

Witness: _____

Site Location: 0 Pond St., Rockland, MA

Excavator: Iaria Brothers - Vinny

Land Use: Vacant lot

Date: October 3, 2019

Parent Material: _____

Weather: Cloudy, 55°

Water Resource Conditions: Normal: _____ Above: _____ Below: X

TP # 1

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-100	Fill			Scrap, fill until water surface 75", sand @ bottom of pit	Depth		Mottling	
					0-15 Min.		Weeping	
					15-30 Min.			
					30-45 Min.			
					45-60 Min.		Standing	44"
					60-75 Min.			
Rate						"/hr		

TP # 2

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-70	Fill				Depth		Mottling	18"
70-97	C	Sand		10% Gravel, 10% Cob./Stone	0-15 Min.			
					15-30 Min.		Weeping	
					30-45 Min.			
					45-60 Min.		Standing	45"
					60-75 Min.			
Rate						"/hr		

TP # 9

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-22	Fill				Depth		Mottling	27"
22-60	C1	Sand		Denser mottling @32"	0-15 Min.			
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.			
					45-60 Min.		Standing	44"
					60-75 Min.			
Rate						"/hr		

TP # 11

Depth	Horizon	Texture	Color	Comments	Infiltration Test		Groundwater	
0-18	Fill				Depth		Mottling	36"
18-33	C1	Coarse Sand	10YR 6/6	10% Gravel, 10% Cob./Stone	0-15 Min.			
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.			
					45-60 Min.		Standing	53"
					60-75 Min.			
Rate						"/hr		

TP # 15

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

Rate "/hr

Job No.: 3395.1

Client: Shinglemill LLC

Site Location: 75-79 Pond Street, Rockland, MA

Land Use: Partially Disturbed Vacant Lot

Parent Material: Gravelly Glaciofluvial Deposits

Water Resource Conditions: Normal: _____

Soil Evaluator: Damien Dmitruk

Witness: Henry Nover

Excavator: Tony Iaria

Date: February 1, 2023

Weather: Sunny 28° F

Above: _____ Below: _____

TP # 1

Depth	Horizon	Texture	Color	Comments	Groundwater	
0-4	A	Loamy Sand	10YR 3/2		Mottling	4"
4-13	B	Loamy Sand	10YR 4/6			
13-60	C	Loamy Sand	5Y 4/2		Weeping	
					Standing	5"

TP # 2

Depth	Horizon	Texture	Color	Comments	Groundwater	
0-2	A	Loamy Sand	10YR 3/2		Mottling	30"
2-10	B	Medium Sand	5Y 4/2	Redox 7.5YA 4/6		
10-74	C	Sand	2.5Y 4/3	Strong redox at 30", 20% Gravel	Weeping	
					Standing	10"

TP # 3

Depth	Horizon	Texture	Color	Comments	Groundwater	
0-4	A	Loamy Sand	10YR 3/2		Mottling	40"
4-18	B	Loamy Sand	10YR 4/6			
18-84	C	Coarse Sand	2.5Y 4/3		Weeping	
					Standing	41"

TP # 4

Depth	Horizon	Texture	Color	Comments	Groundwater	
0-80	Fill				Mottling	
90-100	Ab	Loamy Sand	10YR 3/2			
100-110	C	Loamy Sand	5Y 5/1		Weeping	
					Standing	30"

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

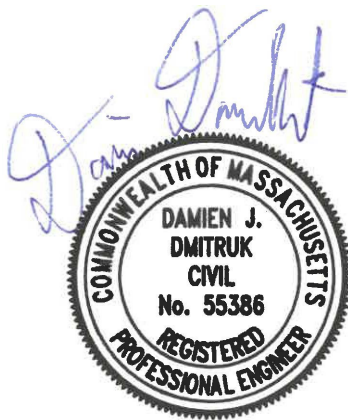
ADDRESS: 4 First Street
Bridgewater, MA 02324

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.



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 – WQU-A1

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	WQU-A1
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	86
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	79
STC 900	86
STC 1200	86
STC 1800	86
STC 2400	89
STC 3600	90
STC 4800	92
STC 6000	92
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)	198.4
Elevation (ft)	630	Total Infiltration (in)	599.2
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2052.1

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.

Drainage Area	
Total Area (acres)	1.13
Imperviousness %	78.6

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)	

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

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

Design 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)	Yes
Grate Inlet (Y/N)	No

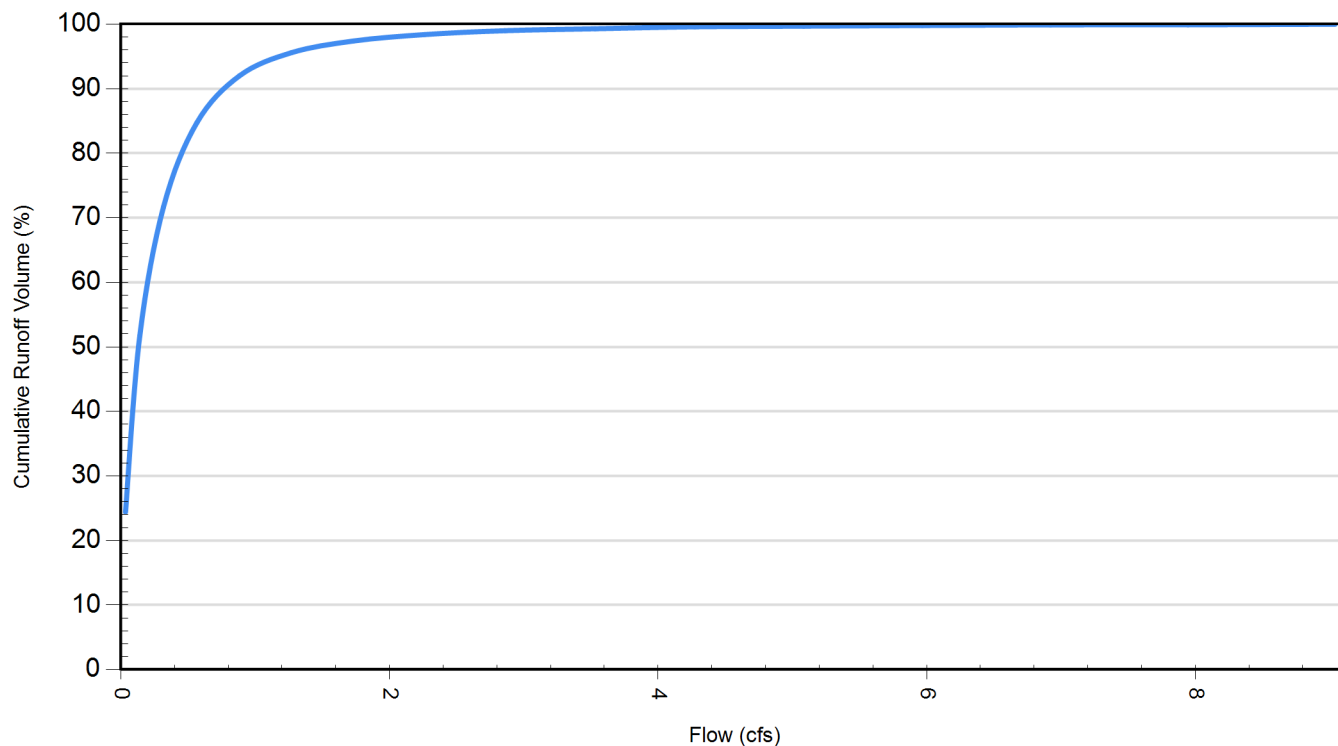
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-A1	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	1.13	Horton's equation is used to estimate infiltration	
Imperviousness %	78.6	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	444.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	2121831	6583186	24.4
0.141	4495430	4208170	51.7
0.318	6243062	2461136	71.7
0.565	7371554	1330744	84.7
0.883	8002870	699608	92.0
1.271	8316572	385522	95.6
1.730	8475365	226735	97.4
2.260	8561014	141001	98.4
2.860	8611474	90538	99.0
3.531	8643156	58832	99.3
4.273	8663827	38172	99.6
5.085	8678047	23951	99.7
5.968	8686466	15539	99.8
6.922	8692444	9558	99.9
7.946	8696403	5601	99.9
9.041	8698418	3585	100.0

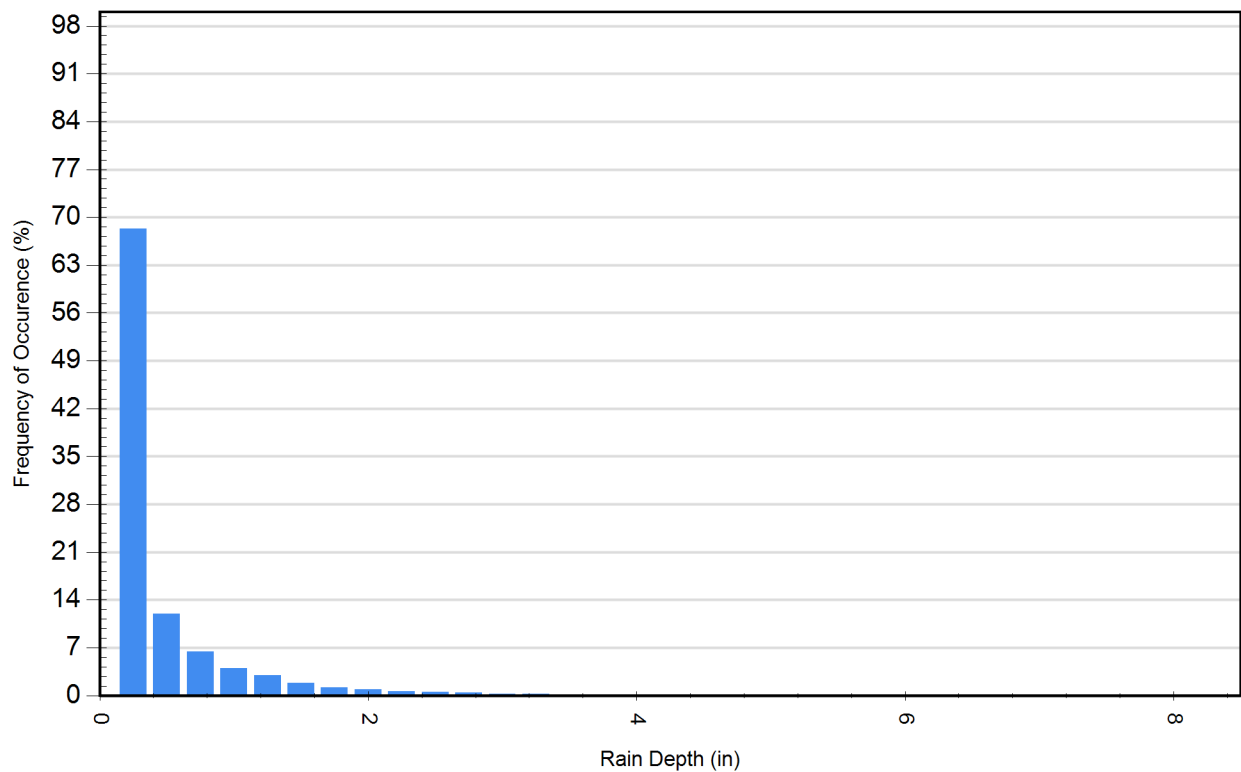
Cumulative Runoff Volume by Runoff Rate

For area: 1.13(ac), imperviousness: 78.6%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Detailed Stormceptor Sizing Report – WQU-A2

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@coneeco.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	WQU-A2
Recommended Stormceptor Model	STC 450i
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	86
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	86
STC 900	91
STC 1200	91
STC 1800	91
STC 2400	94
STC 3600	94
STC 4800	95
STC 6000	96
STC 7200	96
STC 11000	98
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)	191.3
Elevation (ft)	630	Total Infiltration (in)	657.0
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2001.4

Notes

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

Drainage Area		Up Stream Storage	
Total Area (acres)	0.50	Storage (ac-ft)	Discharge (cfs)
Imperviousness %	76.5	0.000	0.000
Water Quality Objective		Up Stream Flow Diversion	
TSS Removal (%)	80.0	Max. Flow to Stormceptor (cfs)	
Runoff Volume Capture (%)		Design Details	
Oil Spill Capture Volume (Gal)		Stormceptor Inlet Invert Elev (ft)	
Peak Conveyed Flow Rate (CFS)		Stormceptor Outlet Invert Elev (ft)	
Water Quality Flow Rate (CFS)		Stormceptor Rim Elev (ft)	
		Normal Water Level Elevation (ft)	
		Pipe Diameter (in)	
		Pipe Material	
		Multiple Inlets (Y/N)	No
		Grate Inlet (Y/N)	No

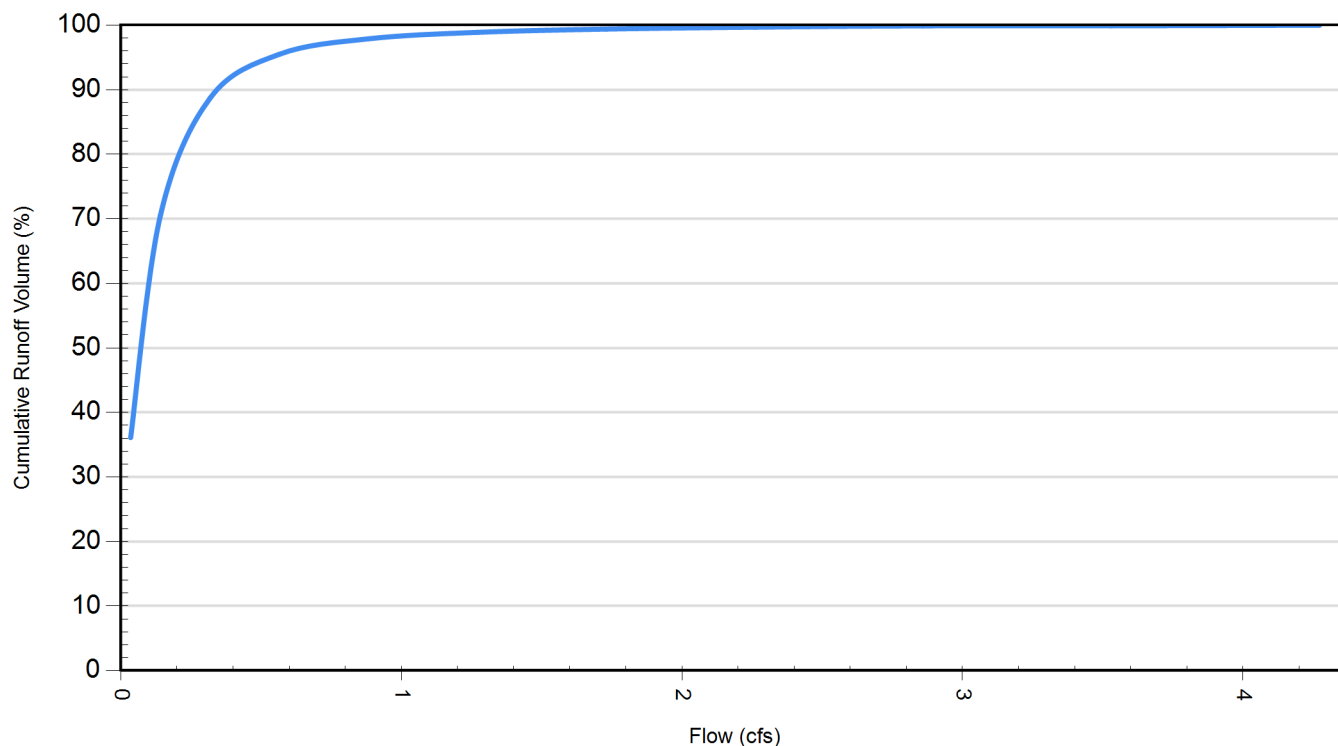
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-A2	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.50	Horton's equation is used to estimate infiltration	
Imperviousness %	76.5	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	295.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	1364055	2414150	36.1
0.141	2660771	1116816	70.5
0.318	3349594	427447	88.7
0.565	3607566	169061	95.5
0.883	3698372	78196	97.9
1.271	3736431	40094	98.9
1.730	3755559	20960	99.4
2.260	3765923	10587	99.7
2.860	3771146	5363	99.9
3.531	3774050	2458	99.9
4.273	3775177	1332	100.0

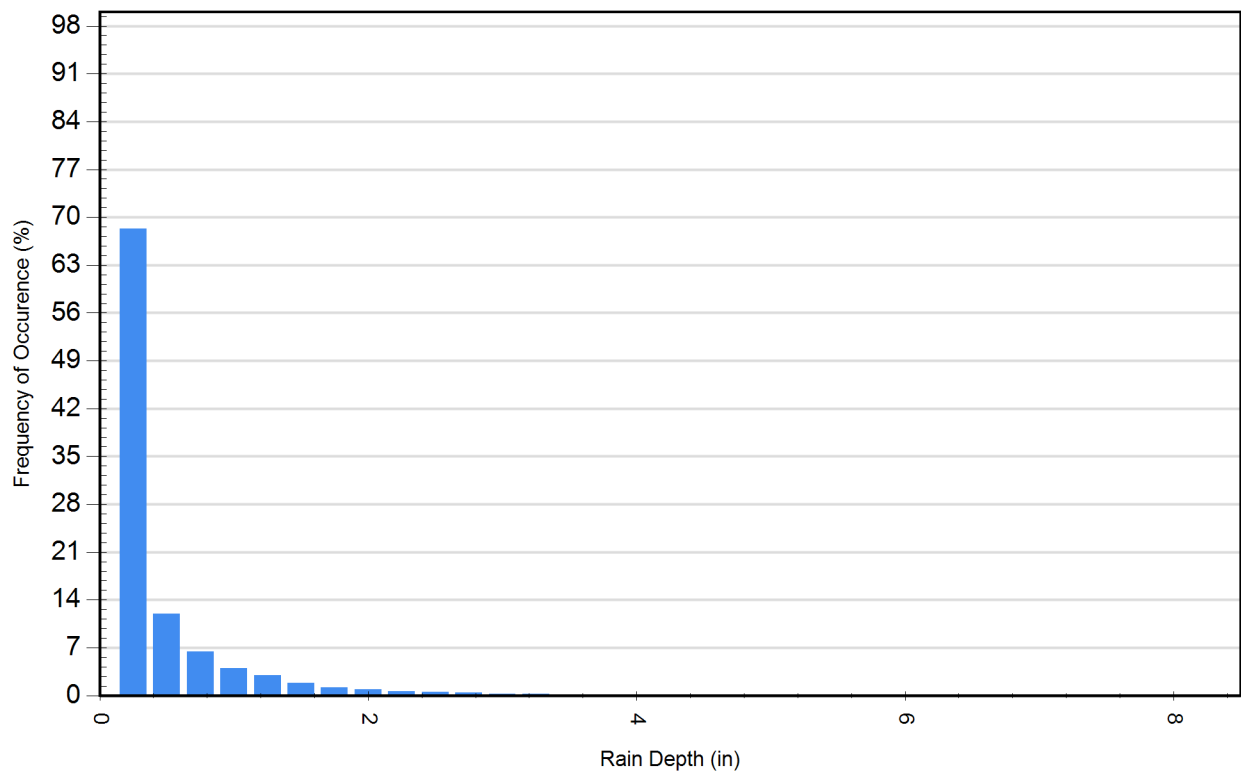
Cumulative Runoff Volume by Runoff Rate

For area: 0.50(ac), imperviousness: 76.5%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Detailed Stormceptor Sizing Report – WQU-B1

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	WQU-B1
Recommended Stormceptor Model	STC 450i
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	90
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	90
STC 900	94
STC 1200	94
STC 1800	94
STC 2400	96
STC 3600	96
STC 4800	97
STC 6000	97
STC 7200	98
STC 11000	99
STC 13000	99
STC 16000	99

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)	220.5
Elevation (ft)	630	Total Infiltration (in)	226.0
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2403.2

Notes

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

Drainage Area		Up Stream Storage	
Total Area (acres)	0.22	Storage (ac-ft)	Discharge (cfs)
Imperviousness %	91.9	0.000	0.000
Water Quality Objective		Up Stream Flow Diversion	
TSS Removal (%)	80.0	Max. Flow to Stormceptor (cfs)	
Runoff Volume Capture (%)		Design Details	
Oil Spill Capture Volume (Gal)		Stormceptor Inlet Invert Elev (ft)	
Peak Conveyed Flow Rate (CFS)		Stormceptor Outlet Invert Elev (ft)	
Water Quality Flow Rate (CFS)		Stormceptor Rim Elev (ft)	
		Normal Water Level Elevation (ft)	
		Pipe Diameter (in)	12
		Pipe Material	HDPE - plastic
		Multiple Inlets (Y/N)	Yes
		Grate Inlet (Y/N)	No

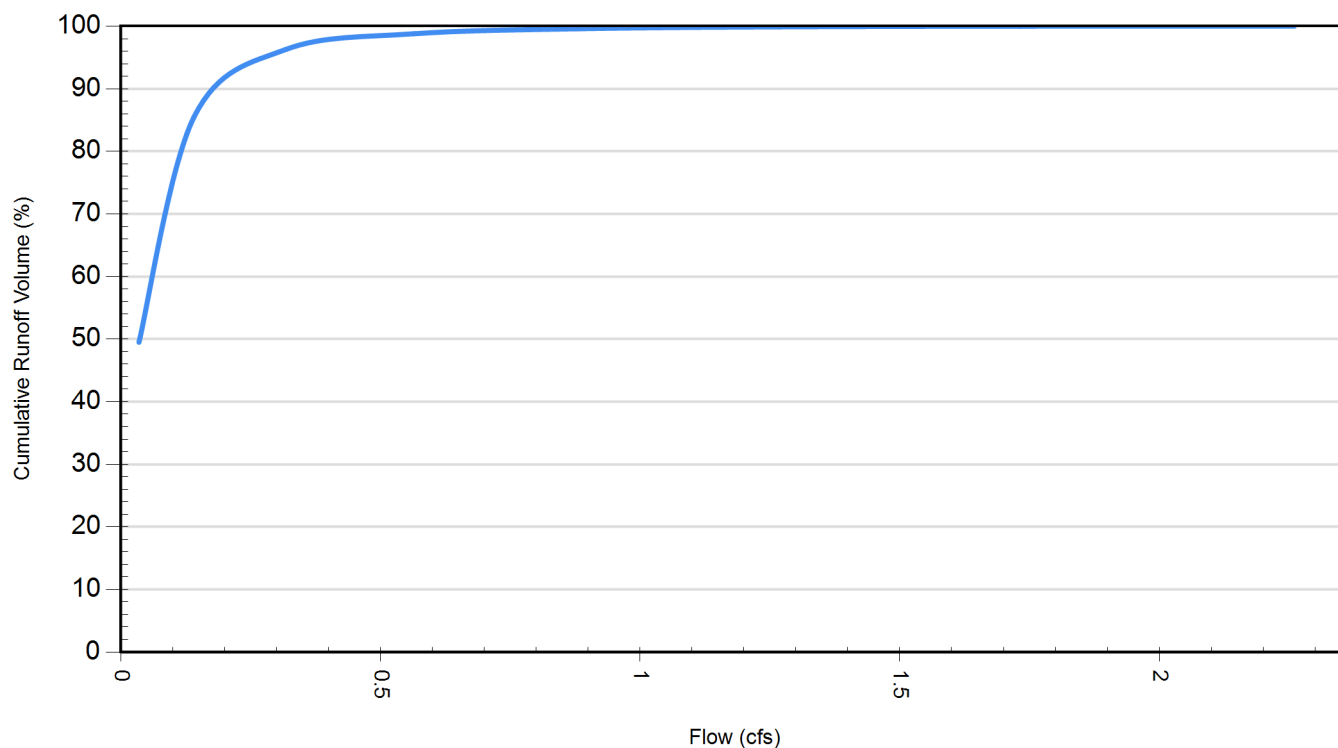
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-B1	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.22	Horton's equation is used to estimate infiltration	
Imperviousness %	91.9	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	196.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	985712	1007142	49.5
0.141	1703873	288827	85.5
0.318	1918379	74295	96.3
0.565	1969013	23648	98.8
0.883	1984182	8477	99.6
1.271	1989829	2831	99.9
1.730	1991792	868	100.0
2.260	1992332	328	100.0

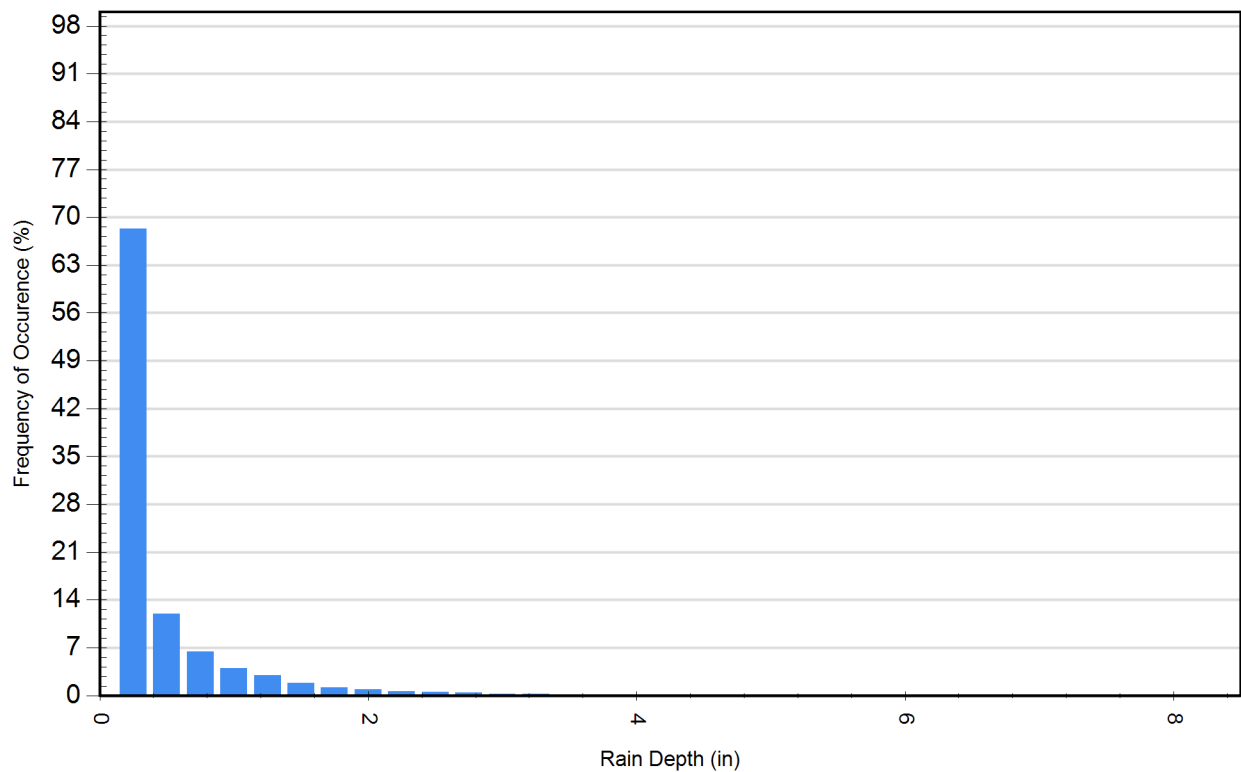
Cumulative Runoff Volume by Runoff Rate

For area: 0.22(ac), imperviousness: 91.9%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Detailed Stormceptor Sizing Report – WQU-B2

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@coneeco.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	WQU-B2
Recommended Stormceptor Model	STC 450i
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	85
STC 900	91
STC 1200	91
STC 1800	91
STC 2400	93
STC 3600	93
STC 4800	95
STC 6000	95
STC 7200	96
STC 11000	97
STC 13000	97
STC 16000	98

Stormceptor

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

Design Methodology

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

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

Hydrology Analysis

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

Rainfall Station

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)	233.5
Elevation (ft)	630	Total Infiltration (in)	206.5
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2409.7

Notes

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

Drainage Area		Up Stream Storage	
Total Area (acres)	0.50	Storage (ac-ft)	Discharge (cfs)
Imperviousness %	92.6	0.000	0.000
Water Quality Objective		Up Stream Flow Diversion	
TSS Removal (%)	80.0	Max. Flow to Stormceptor (cfs)	
Runoff Volume Capture (%)		Design Details	
Oil Spill Capture Volume (Gal)		Stormceptor Inlet Invert Elev (ft)	
Peak Conveyed Flow Rate (CFS)		Stormceptor Outlet Invert Elev (ft)	
Water Quality Flow Rate (CFS)		Stormceptor Rim Elev (ft)	
		Normal Water Level Elevation (ft)	
		Pipe Diameter (in)	12
		Pipe Material	HDPE - plastic
		Multiple Inlets (Y/N)	Yes
		Grate Inlet (Y/N)	No

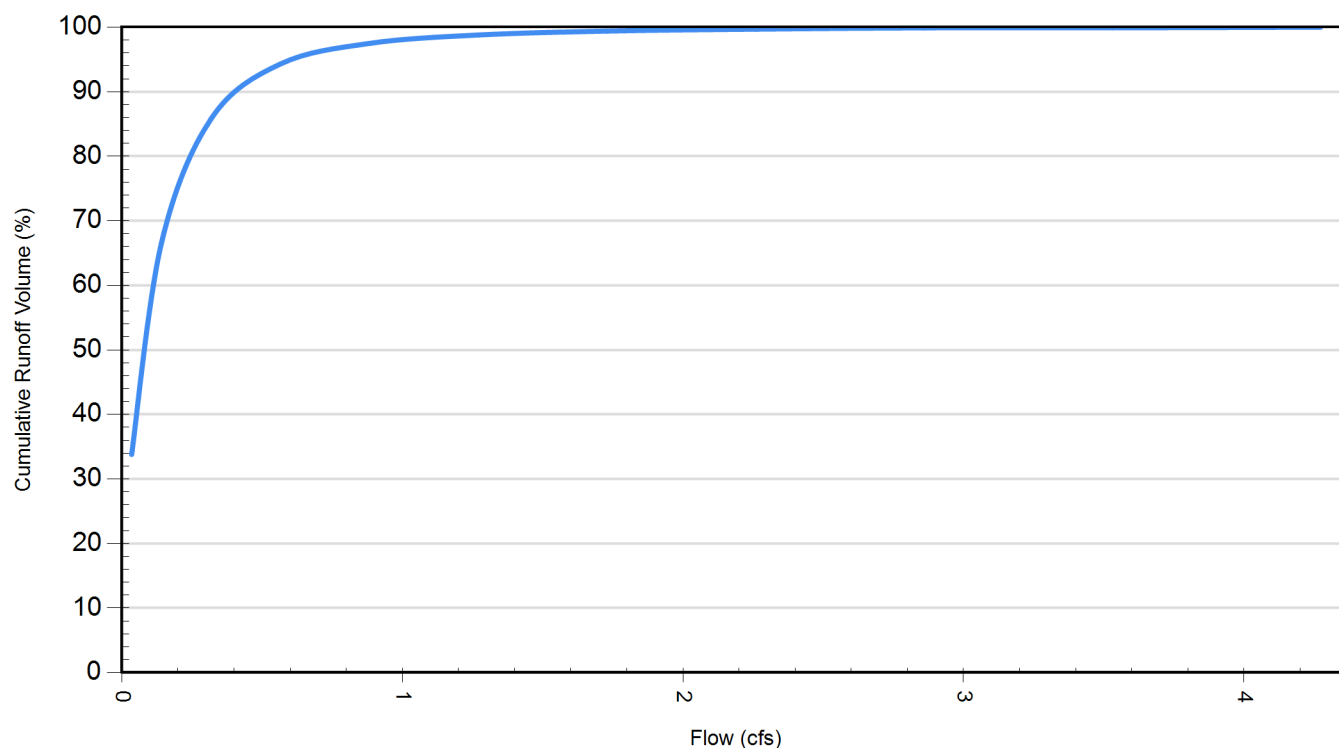
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-B2	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.50	Horton's equation is used to estimate infiltration	
Imperviousness %	92.6	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	295.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	1534037	3007123	33.8
0.141	3021278	1519677	66.5
0.318	3898151	643051	85.8
0.565	4282643	258174	94.3
0.883	4427194	113640	97.5
1.271	4486134	54659	98.8
1.730	4513369	27435	99.4
2.260	4527101	13690	99.7
2.860	4534112	6680	99.9
3.531	4537678	3113	99.9
4.273	4539259	1532	100.0

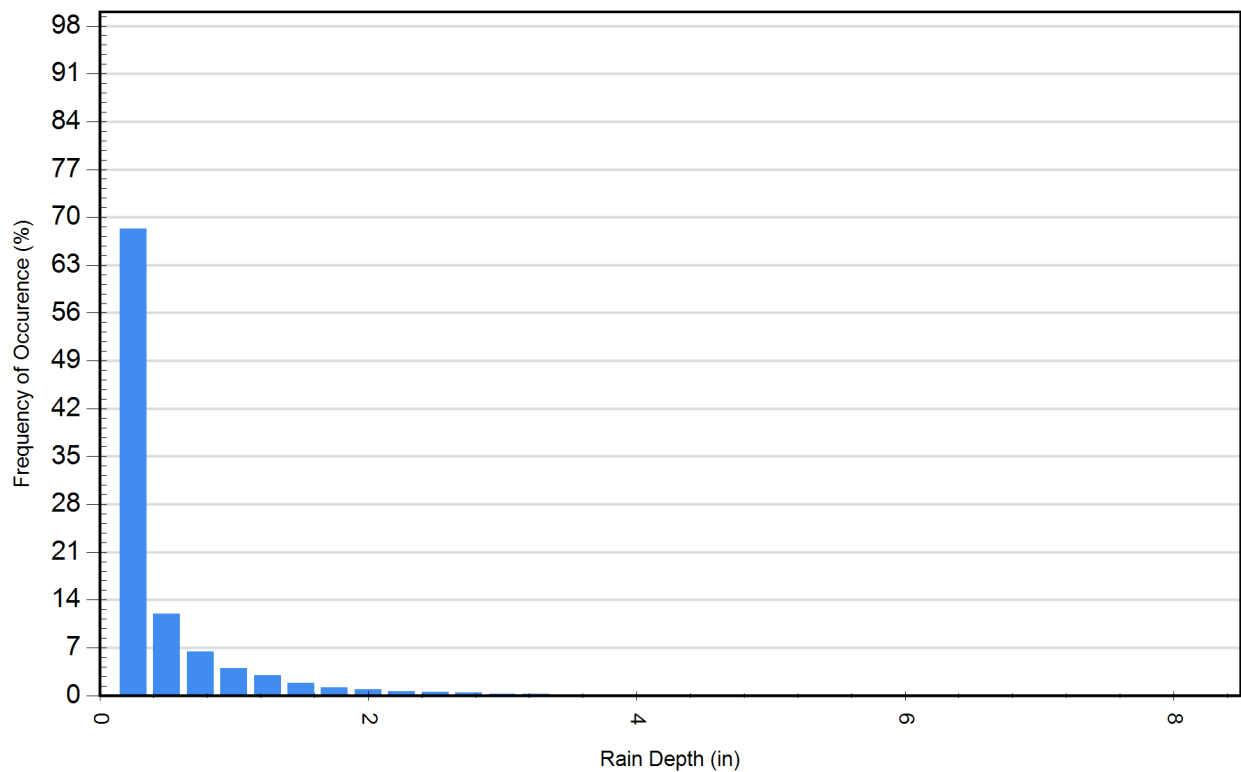
Cumulative Runoff Volume by Runoff Rate

For area: 0.50(ac), imperviousness: 92.6%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Detailed Stormceptor Sizing Report – WQU-BG1

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	WQU-BG1
Recommended Stormceptor Model	STC 450i
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	91
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	91
STC 900	95
STC 1200	95
STC 1800	95
STC 2400	96
STC 3600	97
STC 4800	97
STC 6000	98
STC 7200	98
STC 11000	99
STC 13000	99
STC 16000	99

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)	211.0
Elevation (ft)	630	Total Infiltration (in)	329.2
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2309.5

Notes

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

Drainage Area	
Total Area (acres)	0.21
Imperviousness %	88.2

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)	

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

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

Design Details	
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

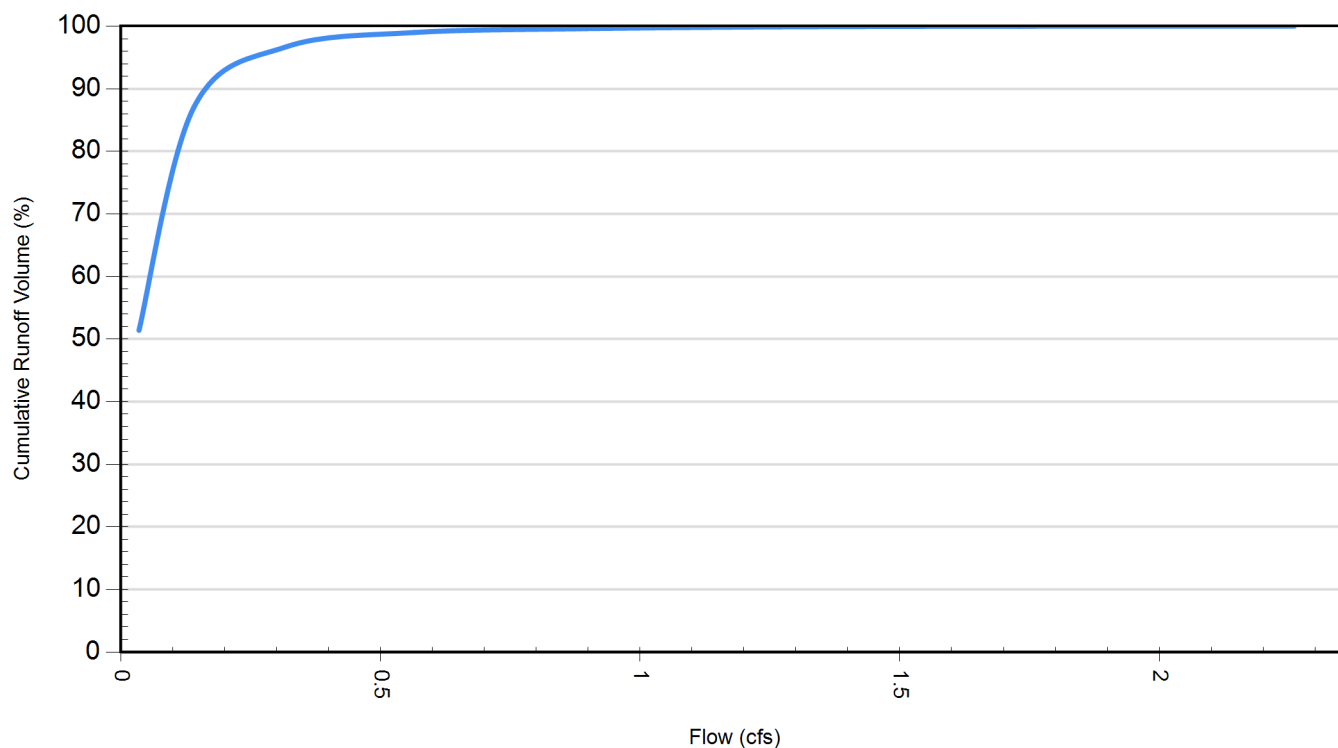
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-BG1	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.21	Horton's equation is used to estimate infiltration	
Imperviousness %	88.2	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	191.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	940389	888070	51.4
0.141	1591784	236260	87.1
0.318	1768270	59657	96.7
0.565	1808727	19182	99.0
0.883	1821127	6777	99.6
1.271	1825674	2227	99.9
1.730	1827219	683	100.0
2.260	1827695	206	100.0

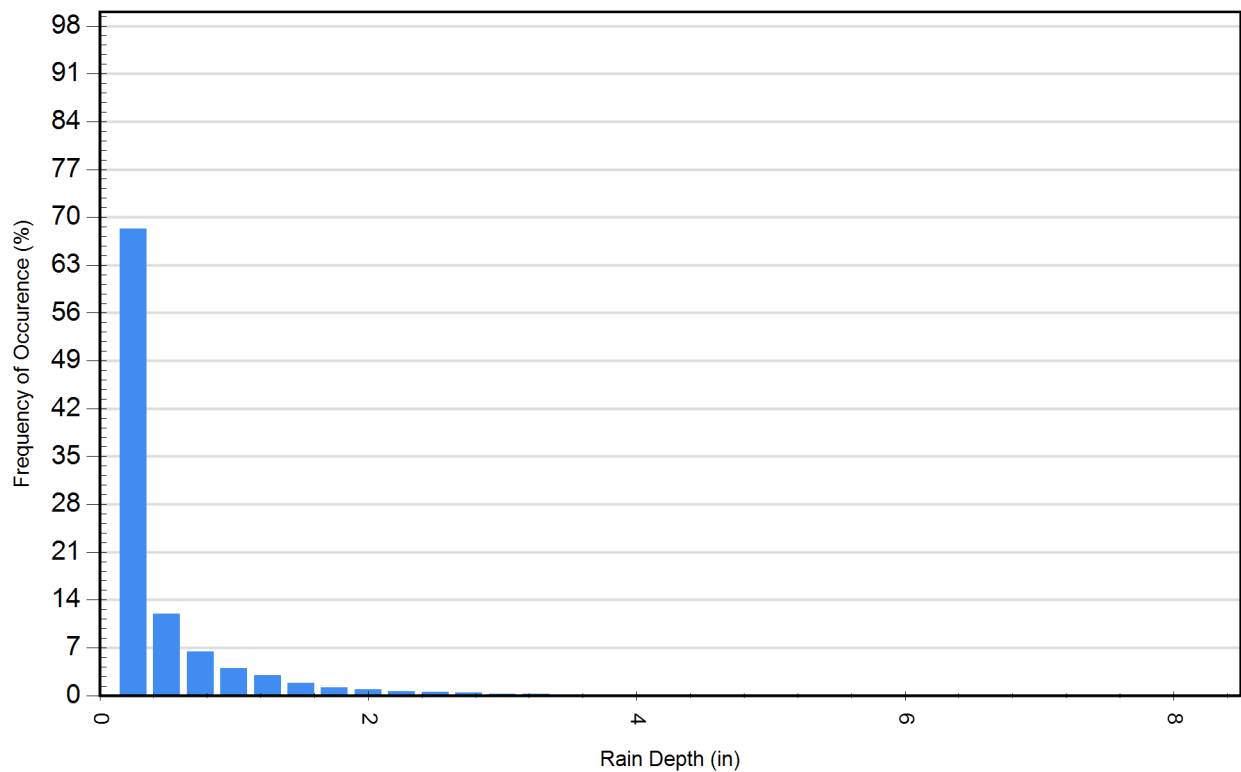
Cumulative Runoff Volume by Runoff Rate

For area: 0.21(ac), imperviousness: 88.2%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Detailed Stormceptor Sizing Report – WQU-C1

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@coneeco.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	WQU-C1
Recommended Stormceptor Model	STC 450i
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	83
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	83
STC 900	89
STC 1200	89
STC 1800	89
STC 2400	91
STC 3600	92
STC 4800	94
STC 6000	94
STC 7200	95
STC 11000	96
STC 13000	97
STC 16000	97

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)	226.5
Elevation (ft)	630	Total Infiltration (in)	307.3
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2315.9

Notes

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

Drainage Area		Up Stream Storage	
Total Area (acres)	0.69	Storage (ac-ft)	Discharge (cfs)
Imperviousness %	89.0	0.000	0.000
Water Quality Objective		Up Stream Flow Diversion	
TSS Removal (%)	80.0	Max. Flow to Stormceptor (cfs)	
Runoff Volume Capture (%)		Design Details	
Oil Spill Capture Volume (Gal)		Stormceptor Inlet Invert Elev (ft)	
Peak Conveyed Flow Rate (CFS)		Stormceptor Outlet Invert Elev (ft)	
Water Quality Flow Rate (CFS)		Stormceptor Rim Elev (ft)	
		Normal Water Level Elevation (ft)	
		Pipe Diameter (in)	
		Pipe Material	
		Multiple Inlets (Y/N)	No
		Grate Inlet (Y/N)	No

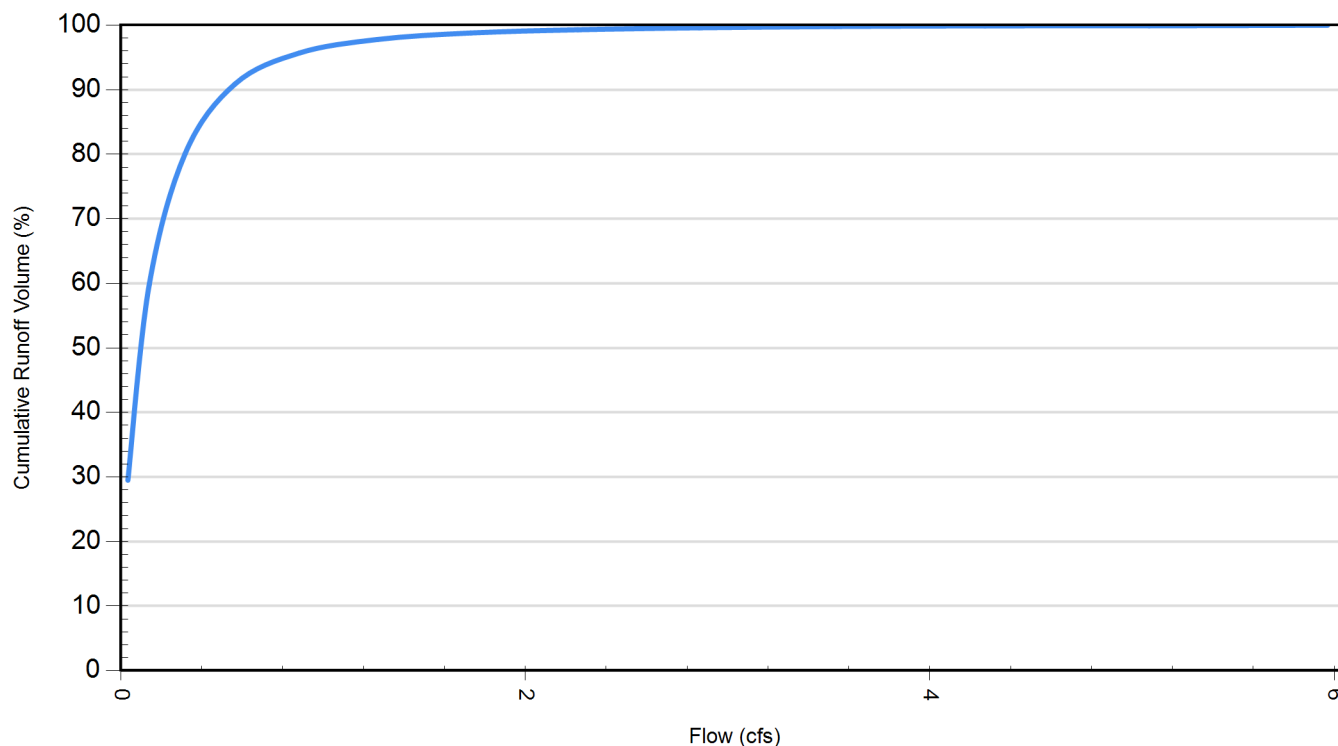
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-C1	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.69	Horton's equation is used to estimate infiltration	
Imperviousness %	89.0	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	347.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	1775399	4242012	29.5
0.141	3604066	2411228	59.9
0.318	4819546	1195358	80.1
0.565	5468547	545858	90.9
0.883	5757011	257474	95.7
1.271	5882895	131508	97.8
1.730	5942623	71787	98.8
2.260	5974075	40318	99.3
2.860	5991480	22916	99.6
3.531	6001939	12451	99.8
4.273	6007623	6771	99.9
5.085	6010998	3389	99.9
5.968	6012392	1996	100.0

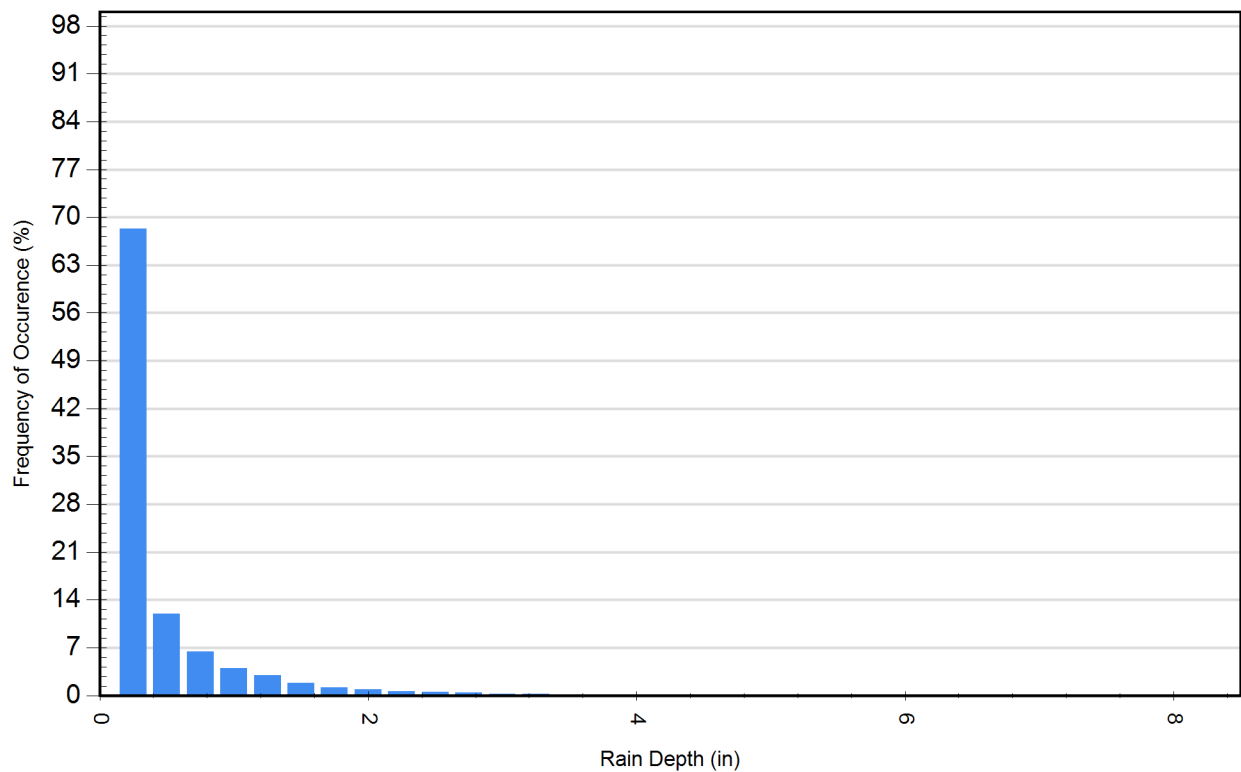
Cumulative Runoff Volume by Runoff Rate

For area: 0.69(ac), imperviousness: 89.0%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Detailed Stormceptor Sizing Report – WQU-C2

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	WQU-C2
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	84
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	79
STC 900	84
STC 1200	84
STC 1800	85
STC 2400	87
STC 3600	88
STC 4800	90
STC 6000	90
STC 7200	92
STC 11000	94
STC 13000	94
STC 16000	95

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)	167.5
Elevation (ft)	630	Total Infiltration (in)	924.8
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	1757.4

Notes

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

Drainage Area		Up Stream Storage	
Total Area (acres)	0.86	Storage (ac-ft)	Discharge (cfs)
Imperviousness %	67.0	0.000	0.000
Water Quality Objective		Up Stream Flow Diversion	
TSS Removal (%)	80.0	Max. Flow to Stormceptor (cfs)	
Runoff Volume Capture (%)		Design Details	
Oil Spill Capture Volume (Gal)		Stormceptor Inlet Invert Elev (ft)	
Peak Conveyed Flow Rate (CFS)		Stormceptor Outlet Invert Elev (ft)	
Water Quality Flow Rate (CFS)		Stormceptor Rim Elev (ft)	
		Normal Water Level Elevation (ft)	
		Pipe Diameter (in)	
		Pipe Material	
		Multiple Inlets (Y/N)	No
		Grate Inlet (Y/N)	No

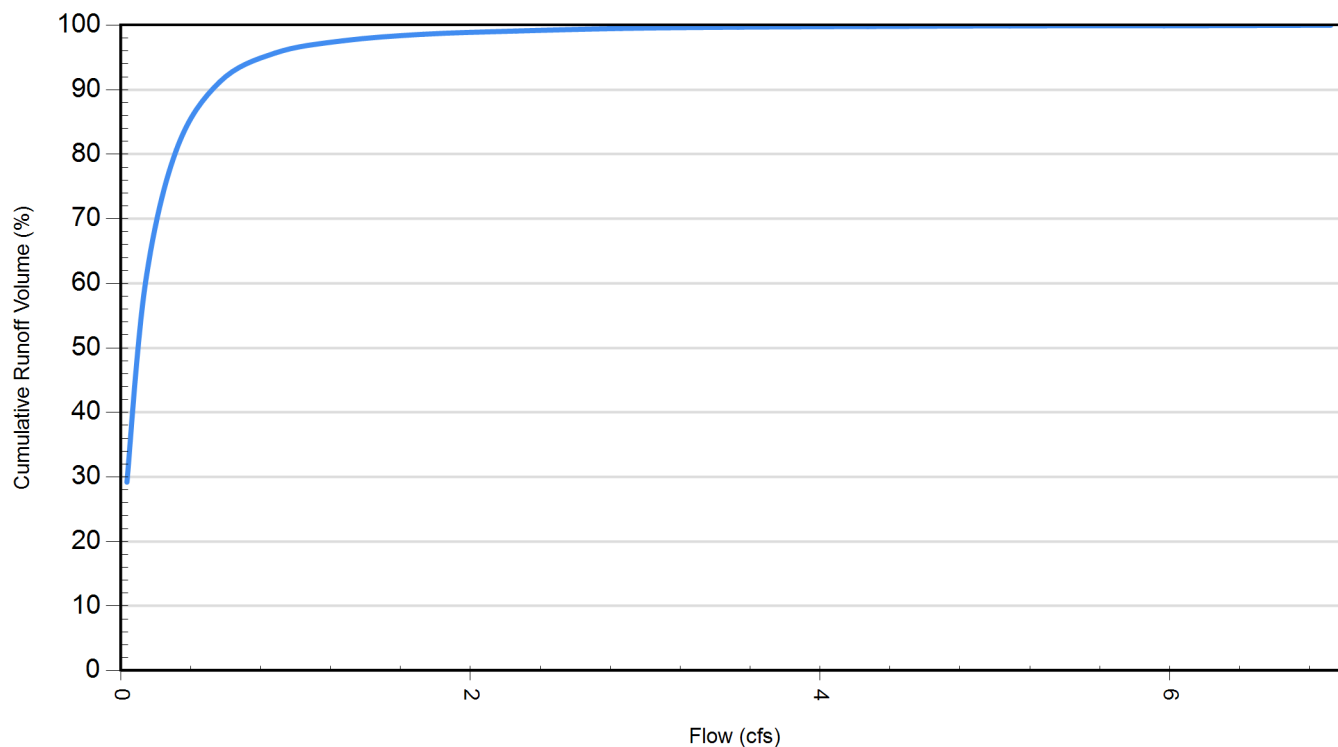
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-C2	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.86	Horton's equation is used to estimate infiltration	
Imperviousness %	67.0	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	387.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	1663084	4031283	29.2
0.141	3422083	2271759	60.1
0.318	4594744	1099551	80.7
0.565	5193102	500021	91.2
0.883	5447154	245853	95.7
1.271	5557278	135550	97.6
1.730	5611518	81293	98.6
2.260	5642556	50201	99.1
2.860	5661781	30966	99.5
3.531	5673895	18835	99.7
4.273	5681184	11550	99.8
5.085	5686030	6703	99.9
5.968	5689022	3712	99.9
6.922	5690436	2298	100.0

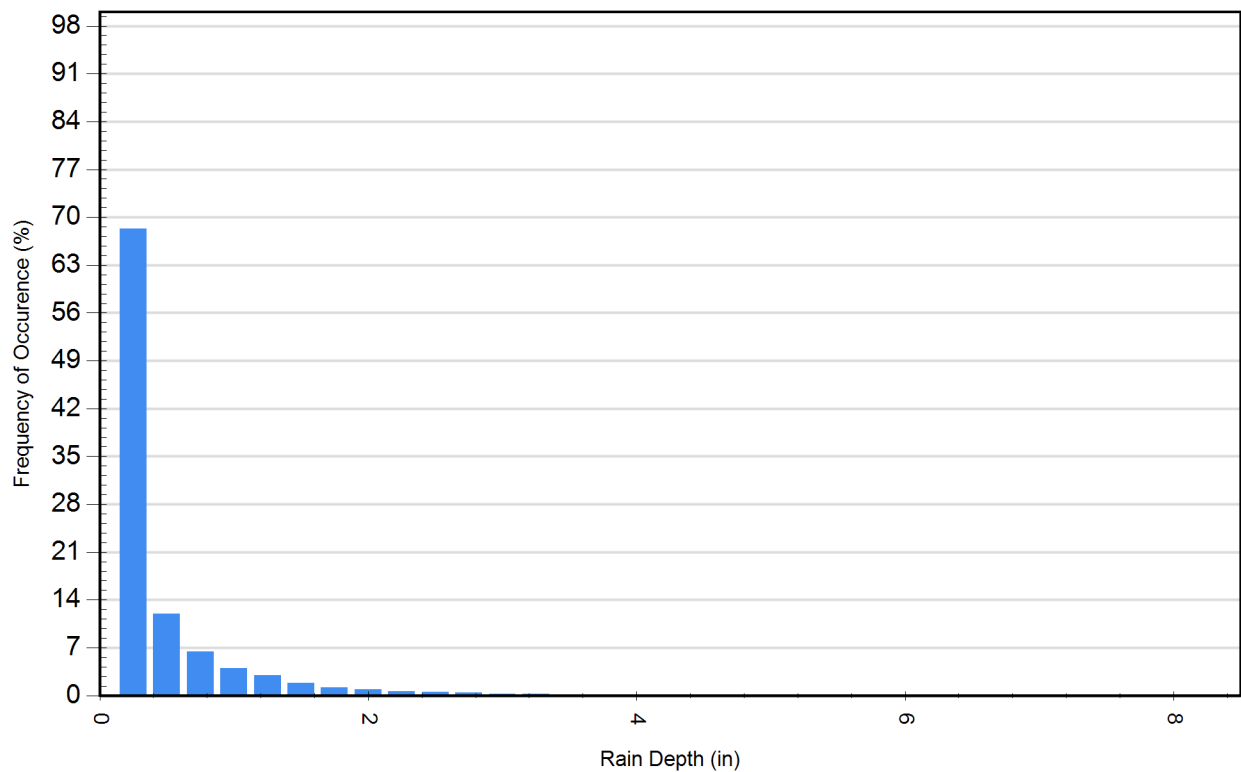
Cumulative Runoff Volume by Runoff Rate

For area: 0.86(ac), imperviousness: 67.0%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Detailed Stormceptor Sizing Report – WQU-C3

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	WQU-C3
Recommended Stormceptor Model	STC 900
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	84
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	79
STC 900	84
STC 1200	85
STC 1800	85
STC 2400	87
STC 3600	88
STC 4800	90
STC 6000	90
STC 7200	92
STC 11000	94
STC 13000	94
STC 16000	95

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)	223.8
Elevation (ft)	630	Total Infiltration (in)	307.4
Years of Rainfall Data	58	Total Rainfall that is Runoff (in)	2318.5

Notes

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

Drainage Area		Up Stream Storage	
Total Area (acres)	0.64	Storage (ac-ft)	Discharge (cfs)
Imperviousness %	89.0	0.000	0.000
Water Quality Objective		Up Stream Flow Diversion	
TSS Removal (%)	80.0	Max. Flow to Stormceptor (cfs)	
Runoff Volume Capture (%)		Design Details	
Oil Spill Capture Volume (Gal)		Stormceptor Inlet Invert Elev (ft)	
Peak Conveyed Flow Rate (CFS)		Stormceptor Outlet Invert Elev (ft)	
Water Quality Flow Rate (CFS)		Stormceptor Rim Elev (ft)	
		Normal Water Level Elevation (ft)	
		Pipe Diameter (in)	
		Pipe Material	
		Multiple Inlets (Y/N)	No
		Grate Inlet (Y/N)	No

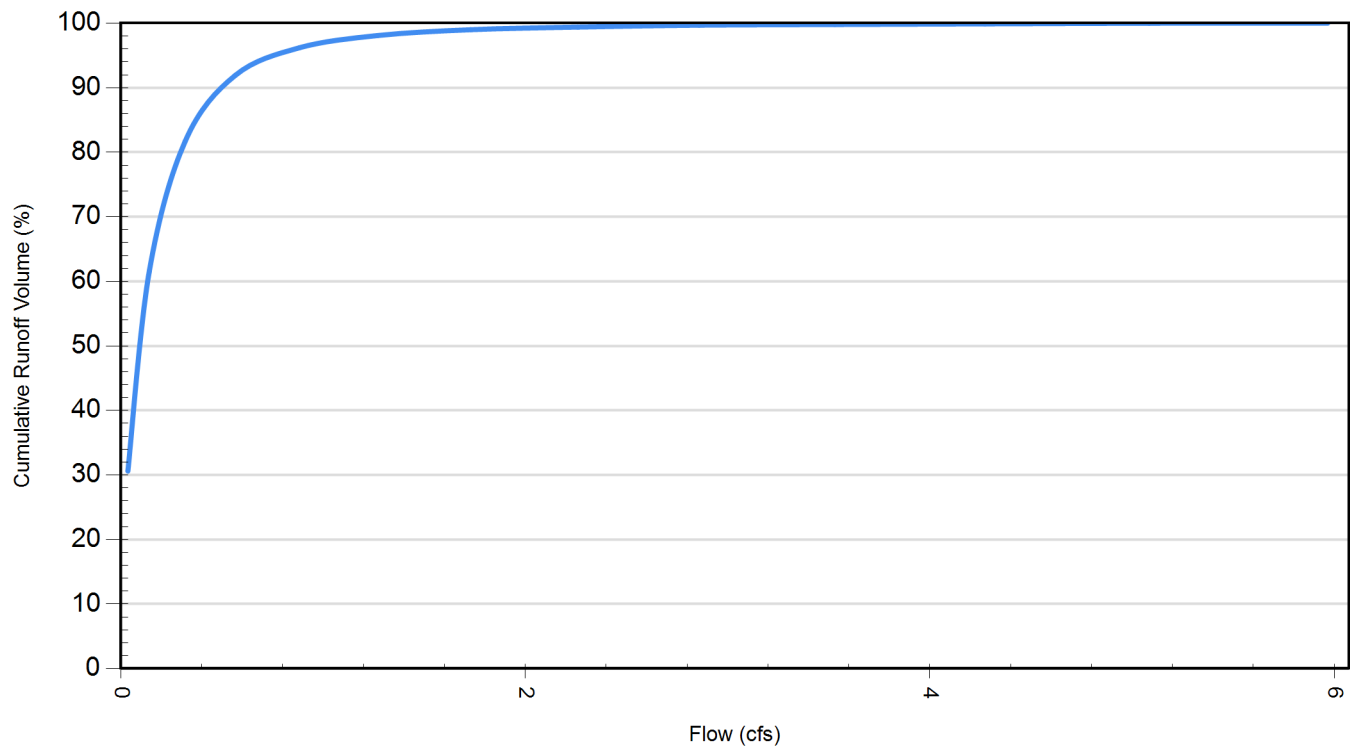
Particle Size Distribution (PSD)		
Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor 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		WQU-C3	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (acres)	0.64	Horton's equation is used to estimate infiltration	
Imperviousness %	89.0	Max. Infiltration Rate (in/hr)	2.44
Surface Characteristics		Min. Infiltration Rate (in/hr)	0.4
Width (ft)	334.00	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 Parameters			
TSS Loading Function			
Buildup/Wash-off Parameters		TSS Availability Parameters	
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	1705878	3878489	30.6
0.141	3439012	2144505	61.6
0.318	4561498	1022029	81.7
0.565	5131417	451069	91.9
0.883	5372473	209883	96.2
1.271	5476166	105996	98.1
1.730	5525081	57040	99.0
2.260	5550501	31564	99.4
2.860	5564942	17098	99.7
3.531	5572819	9202	99.8
4.273	5577254	4760	99.9
5.085	5579641	2370	100.0
5.968	5580547	1463	100.0

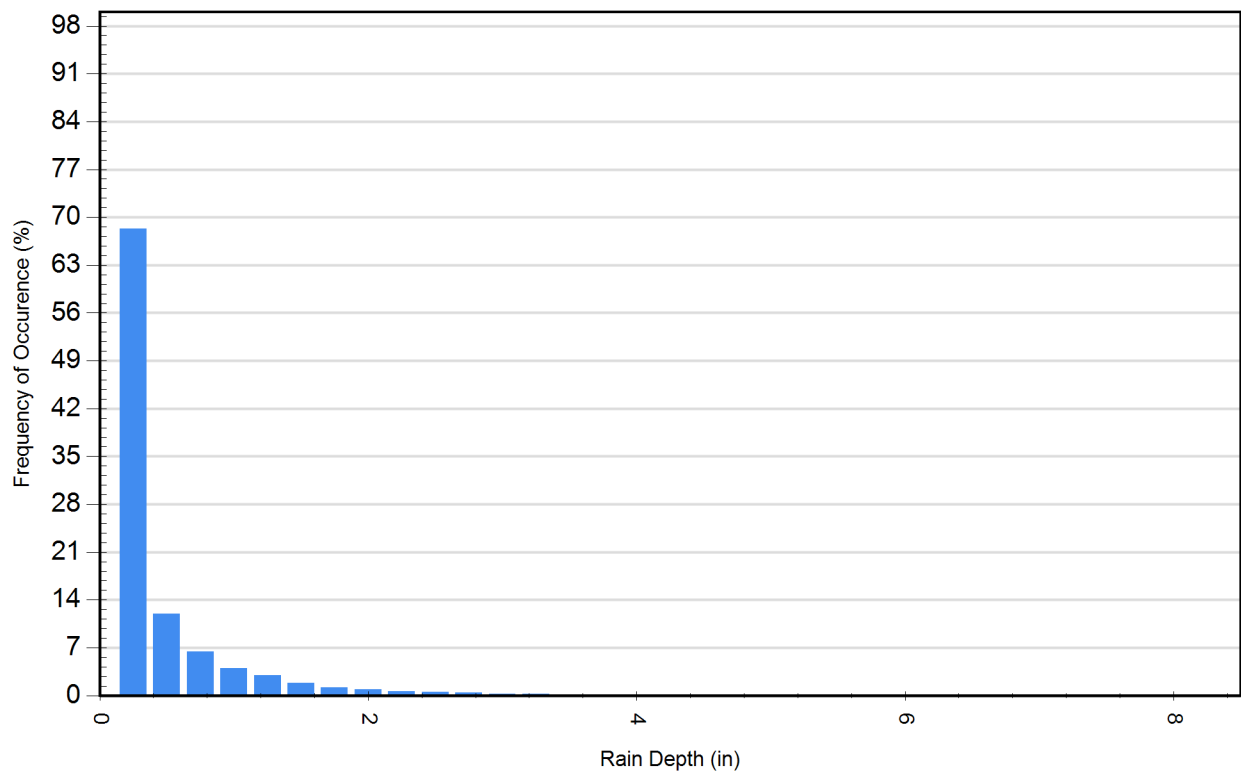
Cumulative Runoff Volume by Runoff Rate

For area: 0.64(ac), imperviousness: 89.0%, rainfall station: BLUE HILL



Rainfall Event Analysis				
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

Frequency of Occurrence by Rainfall Depths



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

Stormceptor[®] STC
Owner's Manual



Table of Contents

TITLE	SECTION
Stormceptor Overview	1
Stormceptor Operation and Components	2
Stormceptor Identification	3
Stormceptor Inspection and Maintenance	4
<i>Recommended Stormceptor Inspection Procedure</i>	
<i>Recommended Stormceptor Maintenance Procedure</i>	
Contact Information	5

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

Figure 1.

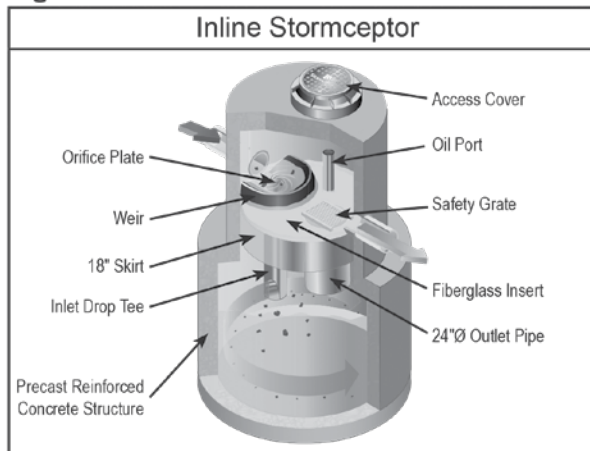
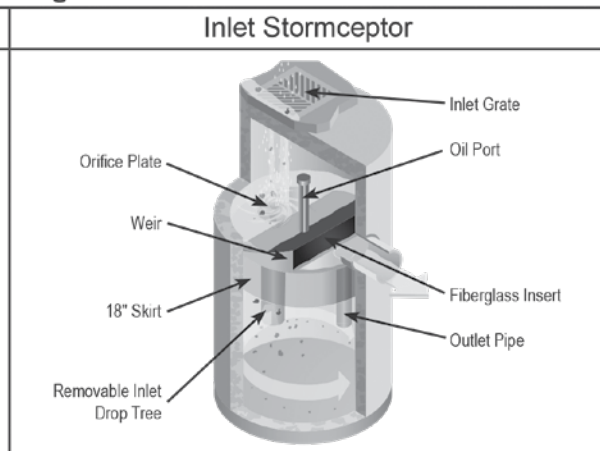


Figure 2.



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

Notes:

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.

*Consist of two chamber structures in series.

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:

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

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

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.

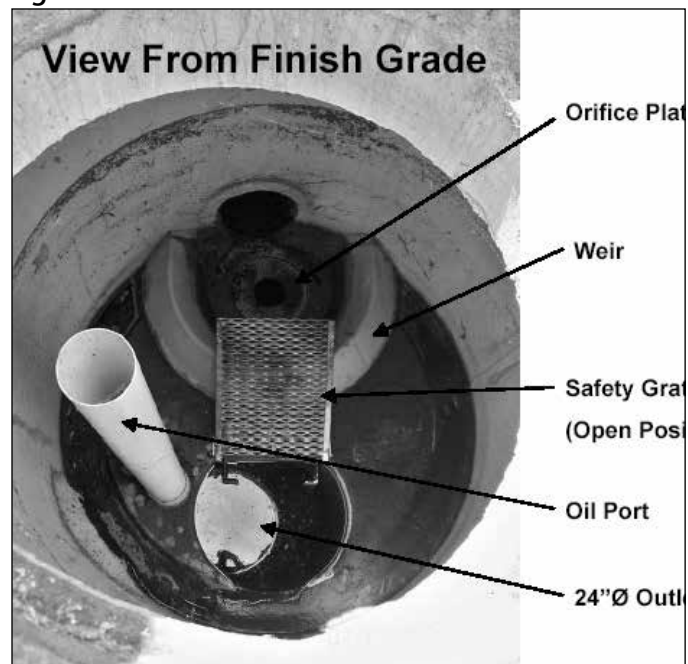
Figure 3.



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 ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, 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.

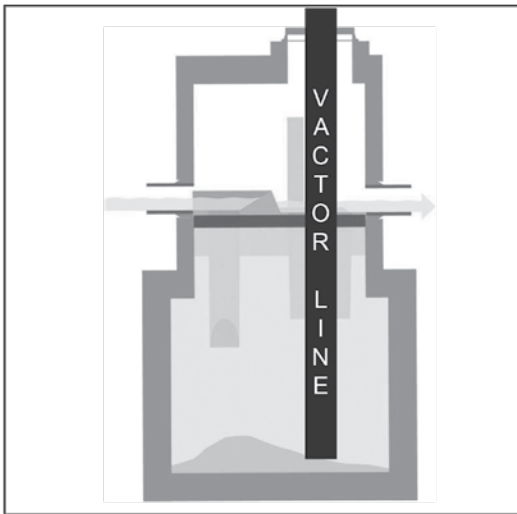
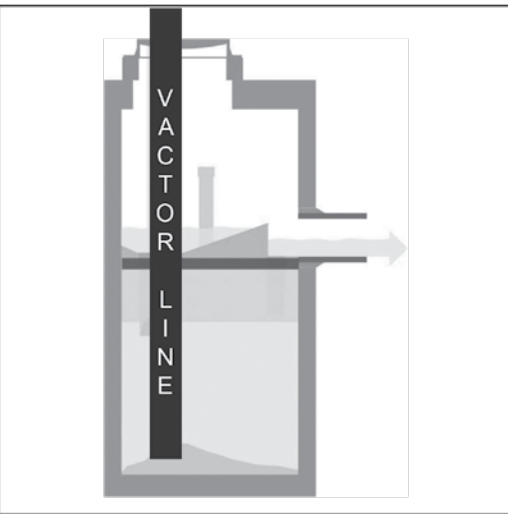


Figure 6.



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

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:

1. The values above are for typical standard units.

* Per structure.

Replacement parts

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

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.

©2019 Contech Engineered Solutions LLC, a QUIKRETE Company

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

NOTHING IN THIS CATALOG SHOULD BE CONSTRUED AS A WARRANTY. APPLICATIONS SUGGESTED HEREIN ARE DESCRIBED ONLY TO HELP READERS MAKE THEIR OWN EVALUATIONS AND DECISIONS, AND ARE NEITHER GUARANTEES NOR WARRANTIES OF SUITABILITY FOR ANY APPLICATION. CONTECH MAKES NO WARRANTY WHATSOEVER, EXPRESS OR IMPLIED, RELATED TO THE APPLICATIONS, MATERIALS, COATINGS, OR PRODUCTS DISCUSSED HEREIN. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE ARE DISCLAIMED BY CONTECH. SEE CONTECH'S CONDITIONS OF SALE (AVAILABLE AT WWW.CONTECHES.COM/COS) FOR MORE INFORMATION.

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.

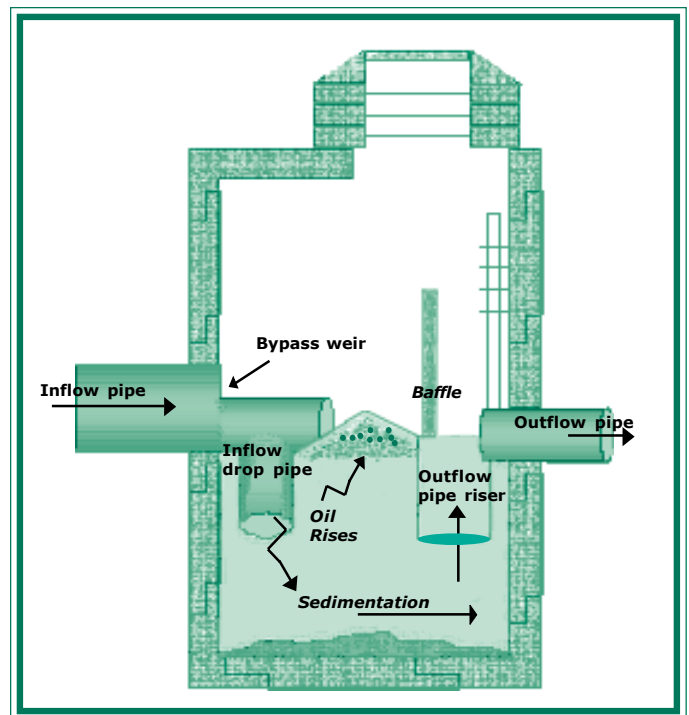


Figure 1. Stormceptor operation during average flow conditions.

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.



**MASSACHUSETTS
STRATEGIC ENVIROTECHNOLOGY PARTNERSHIP**

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 Model Number	Maximum Impervious Area (acres)	
	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.
- ✦ It 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 pre-treatment 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.

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

averaging \$300 to \$500. The expected life of a system has been estimated to be 50 to 100 years.

Sediment Depths Indicating Required Maintenance	
Model Number	Sediment Depth (feet)
STC 900	0.5
STC 1200	0.75
STC 1800	1
STC 2400	1
STC 3600	1.25
STC 4800	1
STC 6000	1.5
STC 7200	1.25

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

References

- Winkler, E.S. 1998. "Technology Assessment, Stormceptor." University of Massachusetts, Amherst, MA.
STEP Web site: www.STEPSITE.org/
- Massachusetts Department of Environmental Protection and Office of Coastal Zone Management. 1997. "Stormwater Management Handbooks, Volumes One and Two." Boston, MA. *Handbooks Web site:* www.state.ma.us/dep/brp/stormwtr/stormpub.htm.
- 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

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.