Stormwater Report

for

Business Incubator Flex Building

759 Union Street
Franklin, MA

Date: November 12, 2024

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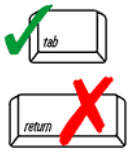
F-4667

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Dale MacKinnon 11/14/2024

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

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NARRATIVE

This report was prepared on behalf of the applicant, Charbel Saghbini. The project development area is 57,801 +/- sf. (1.33 +/-Ac.) owned by PVG One, LLC and being developed by the applicant. The project area is a currently existing vacant, wooded parcel located at the southern end of Union Street. The property is bordered by a vacant and commercial properties to the north, single family residential homes to the east, and interstate route 495 to the southwest. The site is located within the Commercial II zoning district and has frontage along Union Street. Portions of the site lie within the jurisdictional buffer of bordering vegetated wetlands. The site does not lie within a FEMA flood zone or the Franklin water resource district.

PROJECT DESCRIPTION

The Applicant is proposing to construct a 15,080 +/- sf one story business incubator flex building and associated driveways, parking lots, utilities, and grading. Drainage infrastructure associated with the new development will also be constructed. The topography consists of slopes ranging from 0% to 10% grade, with an area of ~50% grades along the Union Street frontage. An existing swale running parallel to the Route 495 has been flagged as a bordering vegetated wetland.

DESCRIPTION OF EXISTING DRAINAGE

The pre-developed site drains principally from south to north, with approximately 1.1 acres of residential woodland draining overland and flowing across the project parcel to the north via an existing wooded channel/swale that runs parallel to Union Street, eventually ponding in an existing depression approximately 330' north of the project parcel, AP-1. Additionally, 0.18 acres of contributing area, consisting entirely of woodland, flows northwest overland to offsite wetlands located on the abutting parcel, AP-2. A third watershed, containing 0.129 acres of land, is comprised of the land which drains directly to the 495 swale associated wetlands, AP-3. These hydrologic areas are shown on the Pre-Development Watershed Plan attached to this report and are denoted as EX-1 through EX-3.

DESCRIPTION OF PROPOSED DRAINAGE FACILITIES

The proposed drainage system to manage stormwater from the proposed development consists of Deep Sump Hooded Catch Basins, Separator Rows, and two Cultec Recharger 300HD chamber systems for detention and infiltration. Stormwater from lawns, driveways, parking lots, and roofs is collected and conveyed by a conventional catch basin and drain manhole system to the chambers for treatment, detention, and infiltration.

In the Post-Development condition, five hydrologic areas were considered. These watershed areas consider the building, driveway, parking, lawns, and drainage facilities proposed to be constructed. These hydrologic areas are shown on the Post-Development Watershed Plan attached to this report and are denoted as PR-1 through PR-5.

PR-1 contains approximately 24,742 square feet of contributing area and includes the land which drains directly to Cultec Infiltration Chamber System #1. Pavement and other impervious areas are captured by a conventional catch basin and manhole system and conveyed to system #1 for treatment, detention, and infiltration. Excess flows are discharged via headwall to analysis point AP-1.

PR-2 contains approximately 958 square feet of contributing area and includes the land which drains directly to AP-2. Runoff from lawn, landscape areas, and woodland flows overland to the northwest to analysis point AP-2.

PR-3 contains approximately 2,657 square feet of contributing area and includes the land which drains directly to AP-3. Runoff from lawn, landscape areas, and woodland flows overland to the southwest to analysis point AP-3.

PR-4 contains approximately 7,057 square feet of contributing area and includes the land which drains directly to AP-1. Runoff from lawn, landscape areas, and woodland flows overland to the north to analysis point AP-1.

PR-5 contains approximately 27,616 square feet of contributing area and includes the land which drains directly to Cultec Detention Chamber System #2. Pavement and other impervious areas are captured by a conventional catch basin and manhole system and conveyed to system #1 for treatment and detention. Stored stormwater is released slowly to Chamber System #1 for additional detention and infiltration prior to discharge to AP-1.

This report documents design compliance with the applicable sections of the Massachusetts Stormwater Management Standards 1-10.

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Stormwater Design Parameter:

The stormwater management system was designed to control the post-development rate of peak rainfall runoff from the site by keeping it below the post-development peak rate of rainfall runoff as stated as the objective in the Massachusetts Stormwater Handbook. The calculations were performed using the HydroCAD hydraulic program, developed by applied Microcomputer System. The HydroCAD software is based upon the Soil Conservation Service, "Technical Release 55 – Urban Hydrology for Small Watersheds" and is generally accepted industry methodology.

The analysis was performed for the 2-year, 10-year, 25-year, and 100-year 24-hour storm events.

The following data was required for input:

- Watershed Area: Areas of each watershed were calculated and expressed in square feet for these calculations.
- SCS Curve Number (Cn): Based on the cover type and hydrologic soil group, a weighted curve number (CN) was determined for each of the existing watersheds utilizing Table 2-2a- *Runoff Curve Numbers For Urban Areas* and *Worksheet 2, Runoff Curve Number and Runoff* from the Soil Conservation Service Technical Release 55 – Urban Hydrology for Small Watersheds.
- Time of Concentration, Tc (Minutes): The time of concentration for each watershed was determined by finding the time necessary for runoff to travel from the hydraulically most distant point in the watershed to the point of analysis. This was calculated by using a minimum time of 6 minutes for runoff to reach the most distant catch basin.
- SCS 24-Hour Storm Type: For the greater New England region, a Type III storm rainfall distribution is recommended for drainage calculations and was used for this project.
- Rainfall Precipitation: Rainfall precipitations used the Atlas-14 Volume 10, Version 3 rainfall estimates for the site, obtained from the NOAA Precipitation Frequency Data Server (PFDS) for the 2, 10, 25, and 100 year storm events and are as follows:

2-year storm event:	3.39 inches
10-year storm event:	5.25 inches
25-year storm event:	6.41 inches
100-year storm event:	8.19 inches

An on-site conventional storm drainage collection system is designed based on the "Rational Method" using Manning's equation to carry a minimum 25-year storm event and underground culverts to carry a minimum 50-year storm event through the site (See Pipe Sizing Attachments). The proposed drainage pipes will be Reinforced Concrete Pipe (RCP), unless otherwise noted on the plans.

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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.

All Paved area runoff from the proposed site will sheet flow across the pavement areas, accumulate into hooded catch basins, connect with drain pipe to one of two Cultec chamber systems equipped with Separator Rows, which discharge to the infiltration chamber system. No new untreated stormwater discharges are proposed.

Standard 2: Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates.

To meet Standard 2, the post-development peak discharge rate must be equal to or less than pre-development rates to prevent storm damage and downstream and offsite flooding from the 2-year and the 10-year 24-hour storm events.

Peak discharge rates were calculated and evaluated at three analysis points. The points of evaluation are shown on the accompanying watershed plans.

In summary of the attached drainage analysis (HydroCAD), the peak discharge rates at the point of evaluation in cubic feet per second (cfs) are as follows;

		Run off		
	Storm Events	Pre-dev. (cfs)[af]	Proposed (cfs)[af]	Change (cfs)[af]
Analysis Point 1 (AP-1)	2-year	(0.92)[0.110]	(0.19)[0.013]	(-0.73)[-0.097]
	10-year	(2.12)[0.242]	(0.47)[0.116]	(-1.65)[-0.126]
	25-year	(2.93)[0.334]	(0.79)[0.232]	(-2.14)[-0.102]
	100-year	(4.22)[0.482]	(3.47)[0.419]	(-0.75)[-0.063]

		Run off		
	Storm Events	Pre-dev. (cfs)[af]	Proposed (cfs)[af]	Change (cfs)[af]
Analysis Point 2 (AP-2)	2-year	(0.16)[0.021]	(0.04)[0.003]	(-0.12)[-0.018]
	10-year	(0.34)[0.043]	(0.08)[0.005]	(-0.26)[-0.038]
	25-year	(0.46)[0.059]	(0.11)[0.007]	(-0.35)[-0.052]
	100-year	(0.65)[0.083]	(0.15)[0.010]	(-0.50)[-0.073]

		Run off		
	Storm Events	Pre-dev. (cfs)[af]	Proposed (cfs)[af]	Change (cfs)[af]
Analysis Point 1 (AP-3)	2-year	(0.18)[0.015]	(0.12)[0.008]	(-0.06)[-0.007]
	10-year	(0.37)[0.031]	(0.24)[0.016]	(-0.13)[-0.015]
	25-year	(0.50)[0.041]	(0.32)[0.021]	(-0.18)[-0.020]
	100-year	(0.71)[0.059]	(0.43)[0.030]	(-0.28)[-0.029]

Standard 3: Loss of annual recharge to ground water shall be eliminated or minimized through the use of 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.

Soil Evaluation

Soil evaluation is broken down into two stages. Stage 1 identifies the underlying soils just beneath the surface that contribute to how much runoff is generated as stormwater falls and moves across the surface. Stage 2 evaluates the soils in direct contact with the proposed infiltration BMPs. The attachments section includes the NRCS Soil Survey used for Stage 1 while the site plan set includes the on-site soil textural analysis in the specific locations that infiltration is proposed. The information from the NRCS Soil Survey is included on the Pre and Post Development Watershed Plans.

Recharge Volume

The required recharge volume is determined by calculating the impervious area proposed over the corresponding soil identified in the NRCS Soil Survey. Soils underlying the site are defined as map units 300B Montauk Fine Sandy Loam (HSG C), and 310B Woodbridge Fine Sandy Loam (HSG C/D), 420C Canton Fine Sandy Loam (HSG B).

Table 2: Required Recharge Volume Calculation

	Recharge	**Impervious**	**Volume**
Hydrologic Group	(in/sqft)	(sqft)	(cf)
A - *sand*	0.60	None	0
B - *loam*	0.35	1,133	33.0 cf
C - *silty loam*	0.25	1,960	40.8 cf
D - *clay*	0.10	42,166	351.3 cf
		Required Recharge Volume Total	**425.1 cf**

Stormwater Basin Sizing

There are three ways of determining the recharge volume provided by a storm water basin (Static, Simple Dynamic and Dynamic Field). The Static Method, used here, includes the volume of water that can be stored beneath the lowest outlet of the basin. This, the most conservative method of determining the recharge volume, doesn't account for any infiltration that takes place while the basin is filling with water and is less dependent on maintenance of the basin since the only way for the water below the lowest invert can leave the basin is though infiltration. The following table summarizes the recharge volume provided by the infiltration chambers. Detailed volume calculations for the basin are included in the attachments.

Table 3: Basin Recharge Volumes

	Recharge Volume
Basin 1 @ 373.10	7,791 cf
Total	7,791 cf

72-hour Drawdown

When using the conservative Static Method to determine infiltration volume provided, the Rawls Rate is used to represent the infiltration rate in place of a hydraulic conductivity rate. The specific rate chosen is based on the textural analysis of the in-site soil performed by a competent soil professional.

A Massachusetts Certified Soil Evaluator performed an evaluation of the soil at the proposed infiltration BMP. The soil textural analysis for the infiltration BMP is listed below with the associated Rawls Rate used in the HydroCAD calculations. Where textural analysis varied within any single BMP, the most restrictive textural evaluation and Rawls Rate were used. Soil logs of the in situ soil evaluation are included within the Site Plan set. A conservative rawl's rate of 1.02 in/hr, consistent with a sandy loam soil, was used to account for the poor soils mapped throughout the site.

Table 4: Rawls Rate

	Most Restrictive Soil Texture	Rawls Rate (in/hour)
Chamber System 1	Loamy Sand	2.41 in/hr (1.02 in/hr used)

Drawdown time for the infiltration chamber systems is modeled by HydroCAD and included in the attachments. The following table summarizes the drawdown time for the basin to show it will drawdown within the 72-hour maximum.

Table 5: Basin Drawdown

	Time for Drawdown
Chamber System 1	48 hours
Chamber System 2	43 hours

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 as determined in accordance with the Massachusetts Stormwater Handbook; and***
- ***c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.***

The Water Quality Volume requiring 80% TSS removal, is calculated as follows:

The required water quality volume is based on 1.0" as the soil recharge rate is 2.41 in/hr, meeting the threshold rate of 2.4 in/hr or greater. The water quality volume equals 1.0 inches of runoff times the increased impervious area of the post-development site.

Existing Site Impervious Area	=	0 sf
Proposed Site Impervious Area	=	45,259 sf
Total Site Impervious Area Increase	=	45.259 sf
Impervious area to be treated	=	**45,259 sf**

Total volume to be treated:
1.0" x 1'/12" x 45,259 sf = 3,772 **cf Water Quality Volume Required**

Provided Water Quality Volume:

Treatment volume (infiltration chamber system # = 7,791 cf @ el. 373.10 Outlet Elevation

See TSS Removal Calculations in Attachment Section.

Separator Row Sizing

The proposed Cultec Separator Rows were sized by calculating an equivalent water quality flow rate in accordance with the MassDEP Wetlands Program "Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices" and Rhode Island Department of Environmental Management's Alternative Stormwater Technology Certification issued April 9, 2024 for the Cultec Separator Row (see supplemental attachments).

Chamber System #1
Water Quality Flow Rate=(qu)(A)(WQV)
Qu = 774 csm/in (6 min Tc, 1.0" WQV)
A = 0.588 Ac = 0.000919 sq. mi.
WQV = 1.0"
Water Quality Flow Rate = 0.71cfs

Chamber System #2
Water Quality Flow Rate=(qu)(A)(WQV)
Qu = 774 csm/in (6 min Tc, 1.0" WQV)
A = 0.451 Ac = 0.000705 sq. mi.
WQV = 1.0"
Water Quality Flow Rate = 0.55cfs

The RIDEM certification specifies a maximum treatment flow rate for the Cultec Recharger 330XLHD of 0.15cfs per chamber in Table 1 (the R-300HD has replaced this chamber for commercial applications and maintains extremely similar dimensions). The separator rows for both chamber systems are designed as an offline pretreatment BMP as required by the manufacturer specifications.

Chamber System #1 Maximum Treatment Flow Rate provided:
0.15 cfs/chamber x 16 chambers = 2.4 cfs

Chamber System #2 Maximum Treatment Flow Rate provided:
0.15 cfs/chamber x 11 chambers = 1.65 cfs

See TSS Removal Calculations in Attachment Section.

MS4 Bylaw Compliance:

Based on the Town of Franklin MS4 stormwater bylaw as specified in § 153-16 (B)(1)(a), new developments require the on-site stormwater management systems to be designed to retain the volume of runoff equivalent to, or greater than, one (1.0) inch multiplied by the total post-construction impervious surface area, and/or remove 90% of the average annual load of Total Suspended Solids (TSS) generated from the total post construction impervious area on site and 60% of the average annual load of Total Phosphorous (TP) generated from the post construction impervious surface area on site..

The total impervious area, including roofs, is 45,259 square feet. The equivalent 1" of runoff from these surfaces is 3,772 cubic feet. The total storage provided below the lowest inverts out are as follows. See Appendix 5 – Stage -Area-Storage calculations.

Basin 1 @ Elev. 373.10 = 7,791 cf Total Storage Volume Required = 3,772 cf

Standard 4: requires the development and implementation of suitable practices for source control and pollution prevention. These measures must be identified in a long-term pollution prevention plan.

The long-term pollution prevention plan is incorporated into the Operation and Maintenance Plan required by Standard 9.

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.

The proposed project is not a use with higher potential pollutant loads.

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.

The subject property discharges stormwater within the Medway Groundwater Protection District. Due to rapid recharge rates present in the infiltration chambers, the Water Quality Volume is calculated using the required 1.0" rule, and 44% TSS removal is achieved prior to discharge to the infiltration chambers. See Standard 4 for computations. The design utilizes stormwater BMPs designated as suitable for critical areas within the Massachusetts Stormwater Handbook. No metal roof is proposed.

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable:

This project is not a redevelopment project and meets all applicable stormwater standards.

Stormwater Report
Business Incubator Flex Building
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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.

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling, and reconstruction.

Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control.
EPA NPDES – Storm Water Pollution Prevention Plan (SWPPP)

A. Names of Persons or Entities Responsible for Plan Compliance

Charbel Saghbini
346 Washington Street
Stoughton, MA 02072
Tel: 617-888-5887
Email:CS@weareexotics.com

B. Construction Period Pollution Prevention Measures

1. Inventory materials to be present on site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.
3. All materials stored on site will be stored in their appropriate containers and if possible under a roof or covered.
4. Follow manufacturer's recommendation for disposal of used containers.
5. Store only enough products on site to do the job.
6. On site equipment, fueling and maintenance measures:
    a. Inspect on-site vehicles and equipment daily for leaks.
    b. Conduct all vehicle and equipment maintenance and refueling outside of 100' wetland buffer, away from storm drains.
    c. Perform major repairs and maintenance off site.
    d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
    e. Collect spent fuels and remove from site, per Local and State regulations.
    f. Maintain a clean construction entrance; install a crushed stone apron where truck traffic is frequent to reduce soil compaction constant sweeping is required and limit tracking of sediment into streets, sweeping street when silt is observed on street.
7. A temporary concrete washout station and equipment wash station shall be located on the site. Areas shall be surrounded with a silt fence and or Filter Mitt to contain materials and provide ease of cleanup.
8. Stock pile materials, and maintain Erosion Control around the materials where it can easily be accessed. Maintain easy access to clean up materials to include brooms, mops, rags gloves, goggles, sand, sawdust, plastic and metal trash containers.
9. Clean up spills.
    a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry cleanup methods (sawdust, cat litter and/or rags and absorbent pads).
    b. Sweep up dry materials immediately. Never wash them away or bury them.

c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil in a certified container and notify a certified hauler for removal.
d. Report significant spills to the Fire Department.

10. It is the responsibility of the site superintendent or employees designated by the Applicant to inspect erosion control and repair as needed, also to inspect all on site vehicles for leaks and check all containers on site that may contain hazardous materials daily.

C. Site Development Plans
1. See Site Plan set "Site Plan Business Incubator Flex Building" dated November 12, 2024, prepared by Guerriere & Halnon, Inc.

D. Construction Erosion and Sedimentation Control Plan;
1. See Site Plan set "Site Plan Business Incubator Flex Building" dated November 12, 2024, prepared by Guerriere & Halnon, Inc.

E. Plans
1. Construction Sequencing Plan
a. A NPDES NOI shall be filed with the EPA.
b. Record Order of Conditions - The site superintendent shall be aware of all the Conditions contained within the Order including inspection schedules.
c. Install DEP File # Sign prior to commencement of work.
d. Prior to any work on the site including tree/brush clearing, the approved limit of clearing as well as the location of the proposed erosion control devices (such as silt fence/straw bales, etc.) must be staked on the ground under the direction of a Massachusetts registered Professional Land Surveyor.
e. Install erosion control barriers at locations depicted on the plans.
f. Erosion control to be inspected by either the design engineer (or agent) or an erosion control monitor appointed by the Town of Franklin.
g. Extra erosion control devices (at least 10% of the linear footage required for the site) shall be stored on the site to be used in case of an emergency (large storm).
h. Perform tree/brush removal.
i. Strip off top and subsoil. Stockpile material to be reused away from any drainage inlet or protected wetland areas, remove excess material from the site. Install and maintain erosion control barrier around stockpile.
j. Rough grade site, maintaining temporary low areas/sediment traps for sediment accumulation and away from the wetlands and prevent sedimentation from migrating from the site.
k. Construct stormwater chamber systems. Install pipes, manholes and catch basins. Stabilize side slopes with loam, seed and mulch.
l. Install underground utilities; protect all open drainage structures with erosion/siltation control devices, and rope off any areas susceptible to heavy vehicle damage.
m. Prepare compacted pavement base.
n. Loam and seed (mulch as required) disturbed areas of site other than immediately adjacent to work area.

o. Upon all catchment structures and mitigation features becoming operational, install pavement up to binder finish grade. Straw bales backed by crushed stone to be provided on down gradient side of catch basins to direct water to temporary basin.
p. Install curbing and catch basin curb inlets.
q. Install final pavement wearing course.
r. Finish grade - loam and seed (mulch as required adjacent to parking lot.
s. Maintain all erosion control devices until site is stabilized and final inspections are performed.

The Contractor shall be responsible to schedule any required inspections of his/her work.

2. Construction Waste Management Plan
   a. Dumpster for trash and bulk waste collection shall be provided separately for construction.
   b. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
   c. Segregate and provide containers for disposal options for waste.
   d. Do not bury waste and debris on site.
   e. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.
   f. The sewer system is only for disposal of human waste.

F. Operation and Maintenance of Erosion and Sedimentation Controls

The operation and maintenance of sedimentation control shall be the responsibility of the contractor. The inspection and maintenance of the storm water component shall be performed as noted below. The contractor shall, at all times have erosion control in place. The contractor, based on future weather reports shall prepare and inspect all erosion control devices; cleaning, repairing and upgrading is a priority so that the devices perform as per design. Inspect the site during rain events. **Don't stay away from the site.** At a minimum, there should be inspection to assure the devices are not clogged or plugged, or that devices have not been destroyed or damaged during the rain event. After a storm event inspection is required to clean and repair any damage components. Immediate repair is required.

G. Inspection and Maintenance Schedules

1. Inspection must be conducted at least once every 7 days and within 24 hours prior to and after the end of a storm event 0.25 inches or greater.
2. Inspection frequency can be reduced to once a month if:
   a. The site is temporarily stabilized.
   b. Runoff is unlikely due to winter conditions, when site is covered with snow or ice.
3. Inspections must be conducted by qualified personnel, "qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls and who possess the skills to assess the conditions and take measures to maintain and ensure proper operation, also to conclude if the erosion control methods selected are effective.
4. For each inspection, the inspection report must include:
   a. The inspection date.
   b. Names, titles of personnel making the inspection.
   c. Weather information for the period since the last inspection.
   d. Weather information at the time of the inspection.
   e. Locations of discharges of sediment from the site, if any.

f. Locations of BMP's that need to be maintained.
g. Locations where additional BMP's may be required.
h. Corrective action required or any changes to the SWPPP that may be necessary.

5. Qualified personnel shall inspect the following in-place work;

Inspection Schedule:

Erosion Control	Weekly
Catch Basins	Weekly
Temporary Sedimentation Traps/Basins	Weekly
Pavement Sweeping	Weekly

Please Note: Special inspections shall also be made after a significant rainfall event.

Maintenance Schedule

Erosion Control Devices Failure	Immediately
Temporary Sedimentation Traps/Basins	As needed
Pavement Sweeping	14 days minimum and prior to any significant rain event.

Please Note: Special maintenance shall also be made after a significant rainfall event.

H. Inspection and Maintenance Log Form.

1. See Construction Phase Inspection and Maintenance Form attached

Stormwater Report
Business Incubator Flex Building
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Standard 9: A Long –Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that storm water management systems function as designed.

The following shall serve as the (O&M) Plan required by Standard 9, as well as the Long-Term Pollution Prevention Plan required by Standard 4.

A. Names of Persons or Entities Responsible for Plan Compliance;

Charbel Saghbini
346 Washington Street
Stoughton, MA 02072
Tel: 617-888-5887
Email: CS@weareexotics.com

It is the intent of the Applicant to have the site completed and released by the various town Departments and Boards.

B. Good housekeeping practices
1. Maintain site, landscaping and vegetation.
2. Sweep and pick up litter on pavements and grounds.
3. Deliveries shall be monitored by owners or representative to ensure that if any spillage occurs, it shall be contained and cleaned up immediately.
4. Maintain pavement and curbing in good repair.

C. Requirements for routine inspections and maintenance of stormwater BMPs
1. Plans: The storm water Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
2. Record Keeping:
   a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location);

3. Descriptions and Designs: The Best Management Practices (BMP) incorporated into the design include the following;
   a. Pavement Sweeping – Stipulated within the Construction Period Pollution Prevention Plan, the Long Term Pollution Prevention Plan, and the Operation and Maintenance Plan. As the amount of TSS removal is discretionary, no credit was taken within the calculations for this BMP.
   b. Deep sump catch basins with hoods installed to promote TSS Removal of solids and control floatable pollutants. This BMP has a design rate of 25% TSS Removal.
   c. Cultec Separator Rows – Subsurface pretreatment device integral with infiltration chambers and function as a subsurface sediment forebay. Separator rows provide 25% TSS removal as pretreatment prior to discharge to the infiltration BMP by capturing the water quality volume and filtering it through a geotextile fabric which surrounds the separator row. Excess runoff is routed to the infiltration chambers via a high invert overflow header.
   d. Infiltration Chambers – subsurface infiltration BMP provides the required groundwater recharge and has a design rate of 80% TSS Removal. Refer to TSS Removal Worksheet included in the Attachments.

e. Spill Containment Kit to contain and clean-up spills that could occur on site.

4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The owner shall also be responsible for the maintenance of the existing stormwater BMPs on the abutting Walgreens property. The cleaning of the components of the stormwater management system shall generally be as follows:
   a. Pavement: The owner shall keep the pavement swept with a mechanical sweeper or hand swept semi-annually at a minimum.
   b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ¼ full.
   c. Cultec Separator Row: Inspect every six months for the first year of service, and then annually thereafter. Clean structure when sediment accumulation reaches a depth of 3 inches. Cleaning is generally done with the combination of a high pressure spray jet and vacuum truck and is the most effective and convenient method. A maintenance log shall be kept for all maintenance activities. Follow the Cultec Separator Row Inspection and Maintenance guide.
   d. Infiltration Chambers: Inspect after 2 years of commission using the inspection port via a CCTV and inspect every year thereafter or as needed depending on rainfall and site conditions. Cleaning with high pressure water through culvert cleaning nozzle when sediment accumulation reaches a depth of 3 inches or more. A maintenance log shall be kept for all maintenance activities.

5. Access Provisions: All of the components of the storm water system will be accessible by the Owner

D. <u>Spill prevention and response plans</u>
1. Train employees and subcontractors in prevention and clean up procedures.
2. All materials stored on site will be stored in their appropriate containers under a roof or in the approved underground storage tanks.
3. No hazardous materials are to be stored outside.
4. Follow manufacturer's recommendation for disposal of used containers.
5. On site equipment, fueling and maintenance measures:
   a. Inspect on-site vehicles and equipment daily for leaks.
   b. Conduct all vehicle and equipment maintenance off Site and refueling in one location, away from storm drains and wetlands. No vehicle washing is allowed on impervious surfaces draining into the stormwater management system, and is recommended for pervious vegetated areas only.
6. Clean up spills.
   a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean-up methods (sawdust, cat litter and/or rags and absorbent pads).
   b. Sweep up dry materials immediately. Never wash them away or bury them.
   c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
   d. Report significant spills to the Fire Department, Conservation Commission and Board of Health.
   e. Floatables shall be promptly and completely removed from catch basins, water quality units, and other drainage structures following a spill.

E. Provisions for maintenance of lawns, gardens, and other landscaped areas
Dispose of clippings away from storm drainage, wetland resource areas, and their buffers.

F. Requirements for storage and use of fertilizers, herbicides, and pesticides
The application of fertilizers, herbicides, or pesticides will be done by professional certified contractor. Only slow release, organic options are permitted for use within wetland jurisdictional buffer areas. Storage these chemicals is not permitted with 100' of the wetland resource area.

G. Provisions for solid waste management
1. Waste Management Plan
   a. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material is recommended.
   b. Do not bury waste and debris on site.
   c. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.
   d. No hazardous waste are to be disposed of in the on-site dumpster, and must be disposed of in accordance with all applicable regulations.

H. Snow disposal and plowing plans
Snow storage areas are designated on the site plan. No snow is to be stored within wetland resources, stormwater management areas, or parking spaces. Snow storage signs are to be provided adjacent to the wetland resource area as shown on the site plan. Excess snow that cannot be stored within the designated snow storage areas is to be removed and disposed of off-site within 72 hours.

I. Winter Road Salt and/or Sand Use and Storage restrictions
No sand, salt, or chemicals for de-icing will be stored outside. No de-icer shall be used without the authorization of the Medway Conservation Commission. Calcium Chloride is proposed for use as the primary de-icing chemical.

J. Pavement sweeping schedules
Sweeping, the act of cleaning pavement can be done by mechanical sweepers, vacuum sweeper or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow and the types of chemicals and spreaders that are being used on site to manage snow. If a liquid de-icer such as calcium chloride is used as a pretreatment to new events the amount of sand is minimized. Sweeping for this site should be done semi-annually at a minimum. Collecting the particulate before it enters the catch basins is cheaper and more environmentally friendly than in a catch basin mixing with oils and greases in the surface water runoff in catch basins.

K. Provisions for prevention of illicit discharges to the stormwater management system
The discharge into the stormwater system is not being violated, see attachment for illicit discharges compliance.

L. Training the staff or personnel involved with implementing Long-Term Pollution Prevention Plan The owner shall develop policies and procedures for containing the illicit spilling of oils, soda, beer, paper, and litter. These wastes provide a degrading of the water quality. The placement of signs and trash barrels with lids around the site would contribute to clean water quality site conditions.

M. List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

Charbel Saghbini
346 Washington Street
Stoughton, MA 02072
Tel: 617-888-5887
Email:CS@weareexotics.com

BMP	Estimated Maintenance Cost
Pavement sweeping	$ 400 per year
Catch basin cleaning	$ 200 per catch basin per cleaning
Separator Row / Infiltration Chambers	$ 500 per cleaning
Spill Containment Kit	$ 750 purchase price

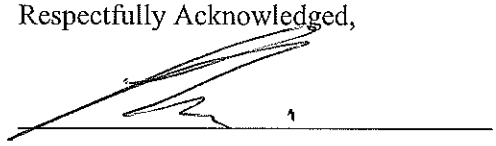
Standard 10: All illicit discharges to the stormwater management system are prohibited.

Standard 10 prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

Illicit Discharge Compliance Statement

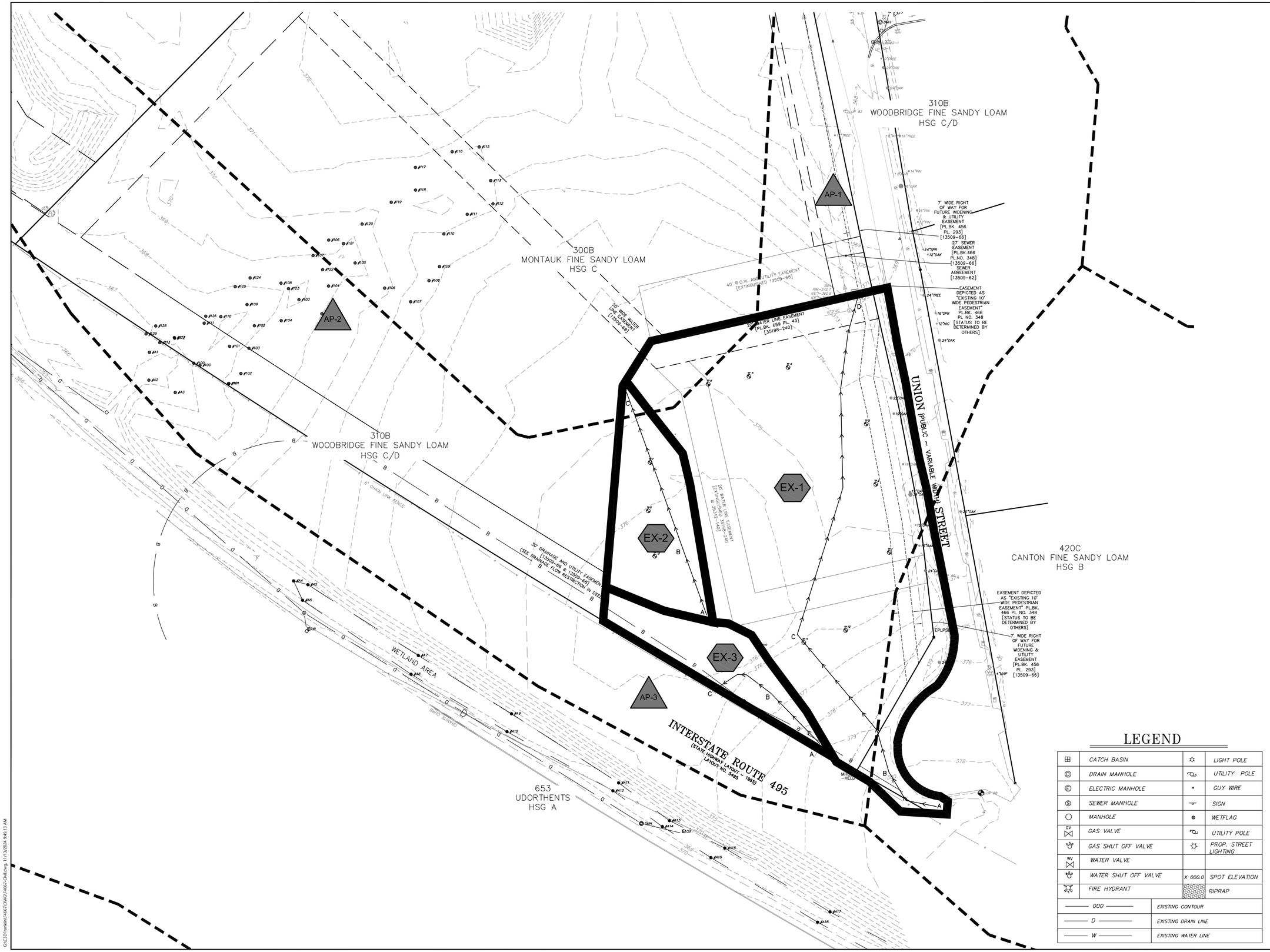
It is the intent of the Applicant, Charbel Saghbini, 346 Washington Street, Stoughton, MA, 02072 to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Owner will also promote a clean Green Environment by mitigating spills onto pavements; oils, soda, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,



WATERSHED PLAN

Pre and Post Development Conditions



LEGEND

⊞	CATCH BASIN	☼	LIGHT POLE
Ⓓ	DRAIN MANHOLE		UTILITY POLE
Ⓔ	ELECTRIC MANHOLE	•	GUY WIRE
Ⓢ	SEWER MANHOLE		SIGN
○	MANHOLE		WETFLAG
GV	GAS VALVE		UTILITY POLE
	GAS SHUT OFF VALVE	☼	PROP. STREET LIGHTING
WV	WATER VALVE		
	WATER SHUT OFF VALVE	X 000.0	SPOT ELEVATION
	FIRE HYDRANT		RIPRAP
000	EXISTING CONTOUR		
D	EXISTING DRAIN LINE		
W	EXISTING WATER LINE		

F4667

APPROVED DATE:

FRANKLIN PLANNING BOARD

BEING A MAJORITY

LEGAL NOTES

UTILITIES ARE PLOTTED AS A COMPILATION OF RECORD DOCUMENTS, MARKINGS AND OTHER OBSERVED EVIDENCE TO THE BEST OF A VIEW OF THE UNDERGROUND UTILITIES AND SHOULD BE CONSIDERED APPROXIMATE. BEFORE DIGGING EXCAVATION, THE EXACT LOCATION OF UNDERGROUND FEATURES CANNOT BE ACCURATELY, COMPLETELY AND RELIABLY DEPICTED. ADDITIONAL UTILITIES, NOT EVIDENCED BY RECORD DOCUMENTS OR OBSERVED PHYSICAL EVIDENCE MAY EXIST. CONTRACTORS (IN ACCORDANCE WITH MASS.G.L. CHAPTER 82 SECTION 40 AS AMENDED) MUST CONTACT ALL UTILITY COMPANIES BEFORE EXCAVATING AND DRILLING AND CALL DIGSAFE AT 1(888)DIG-SAFE{7233}.

CONSTRUCTION ON THIS LAND IS SUBJECT TO ANY EASEMENTS, RIGHTS-OF-WAY, RESTRICTIONS, RESERVATIONS, OR OTHER LIMITATIONS WHICH MAY BE REVEALED BY AN EXAMINATION OF THE TITLE.

OWNER

PVG ONE, LLC
164 WASHINGTON ST
PLAINVILLE, MA. 02762

DEED BOOK 35359 PAGE 485
PLAN No. 293 OF 1998 PLAN Bk. 456
A.M. 314 LOT 13

APPLICANT

CHARBEL SAGHBINI
346 WASHINGTON ST
STOUGHTON, MA 02072

SITE PLAN
BUSINESS INCUBATOR
FLEX BUILDING
759 UNION ST.
FRANKLIN
MASSACHUSETTS

PRE-DEVELOPMENT WATERSHED PLAN

NOVEMBER 12, 2024

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=20'

0 5 10 15 20 25 30 40 50 FEET
0 1 2 3 4 5 10 15 20 METERS

Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING
55 WEST CENTRAL ST. PH. (508) 528-3221
FRANKLIN, MA 02038 FX. (508) 528-7921
www.gandhengineering.com

SHEET 1 OF 2

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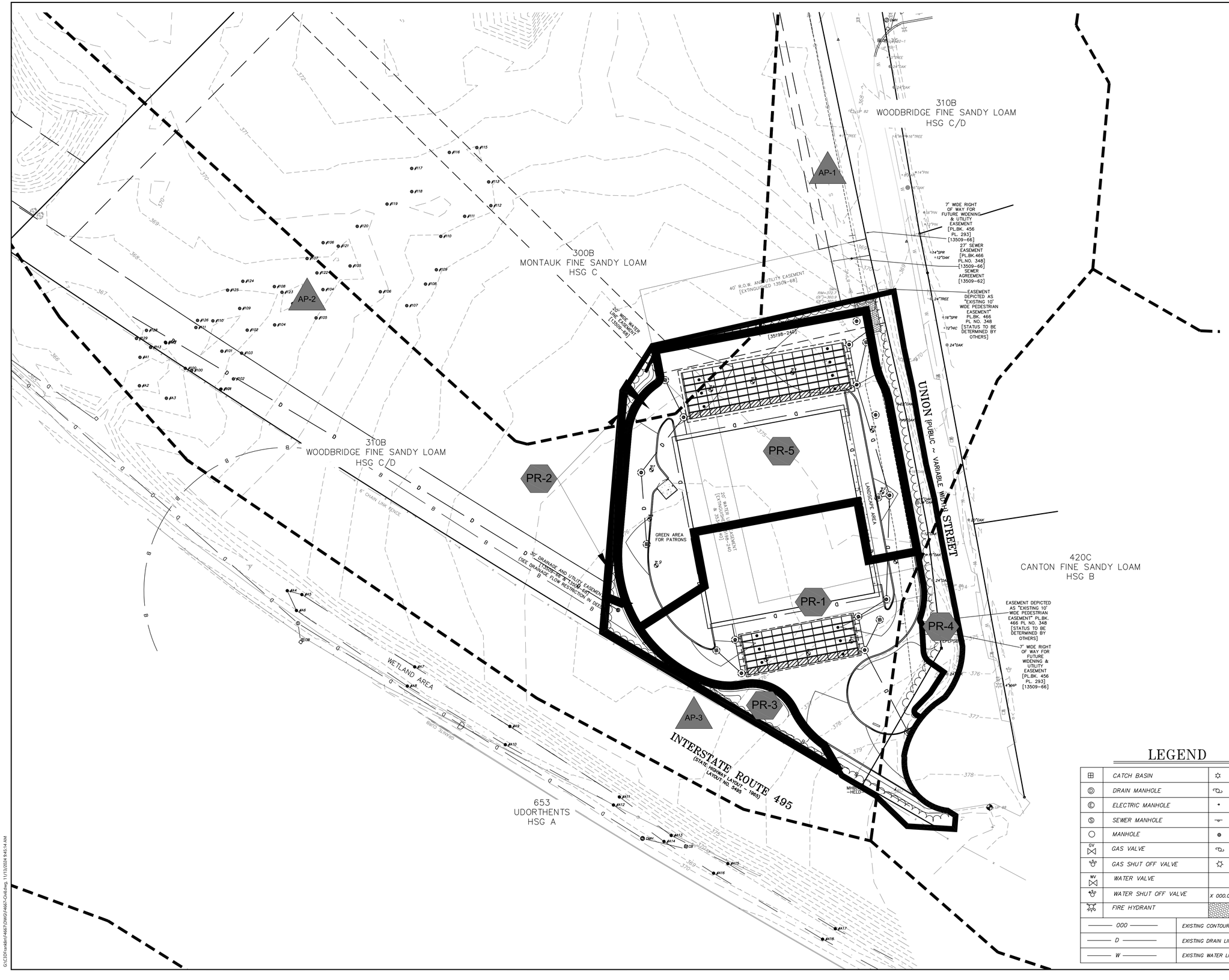

LEGEND

⊞	CATCH BASIN	☼	LIGHT POLE
Ⓓ	DRAIN MANHOLE		UTILITY POLE
Ⓔ	ELECTRIC MANHOLE	*	GUY WIRE
Ⓢ	SEWER MANHOLE		SIGN
○	MANHOLE		WETFLAG
GV	GAS VALVE		UTILITY POLE
	GAS SHUT OFF VALVE	☼	PROP. STREET LIGHTING
WV	WATER VALVE		
	WATER SHUT OFF VALVE	X 000.0	SPOT ELEVATION
	FIRE HYDRANT		RIPRAP
000	EXISTING CONTOUR		
D	EXISTING DRAIN LINE		
W	EXISTING WATER LINE		

F4667

APPROVED DATE:

FRANKLIN PLANNING BOARD

BEING A MAJORITY

LEGAL NOTES

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DEED BOOK 35359 PAGE 485
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346 WASHINGTON ST
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SITE PLAN
BUSINESS INCUBATOR
FLEX BUILDING
759 UNION ST.
FRANKLIN
MASSACHUSETTS

POST DEVELOPMENT WATERSHED PLAN

NOVEMBER 12, 2024

DATE	REVISION DESCRIPTION

GRAPHIC SCALE: 1"=20'

0 5 10 15 20 25 30 40 50 FEET
0 1 2 3 4 5 10 15 20 METERS

Guerriere & Halnon, Inc.
ENGINEERING & LAND SURVEYING
55 WEST CENTRAL ST. PH. (508) 528-3221
FRANKLIN, MA 02038 FX. (508) 528-7921
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SHEET 2 OF 2

JOB NO. F4667

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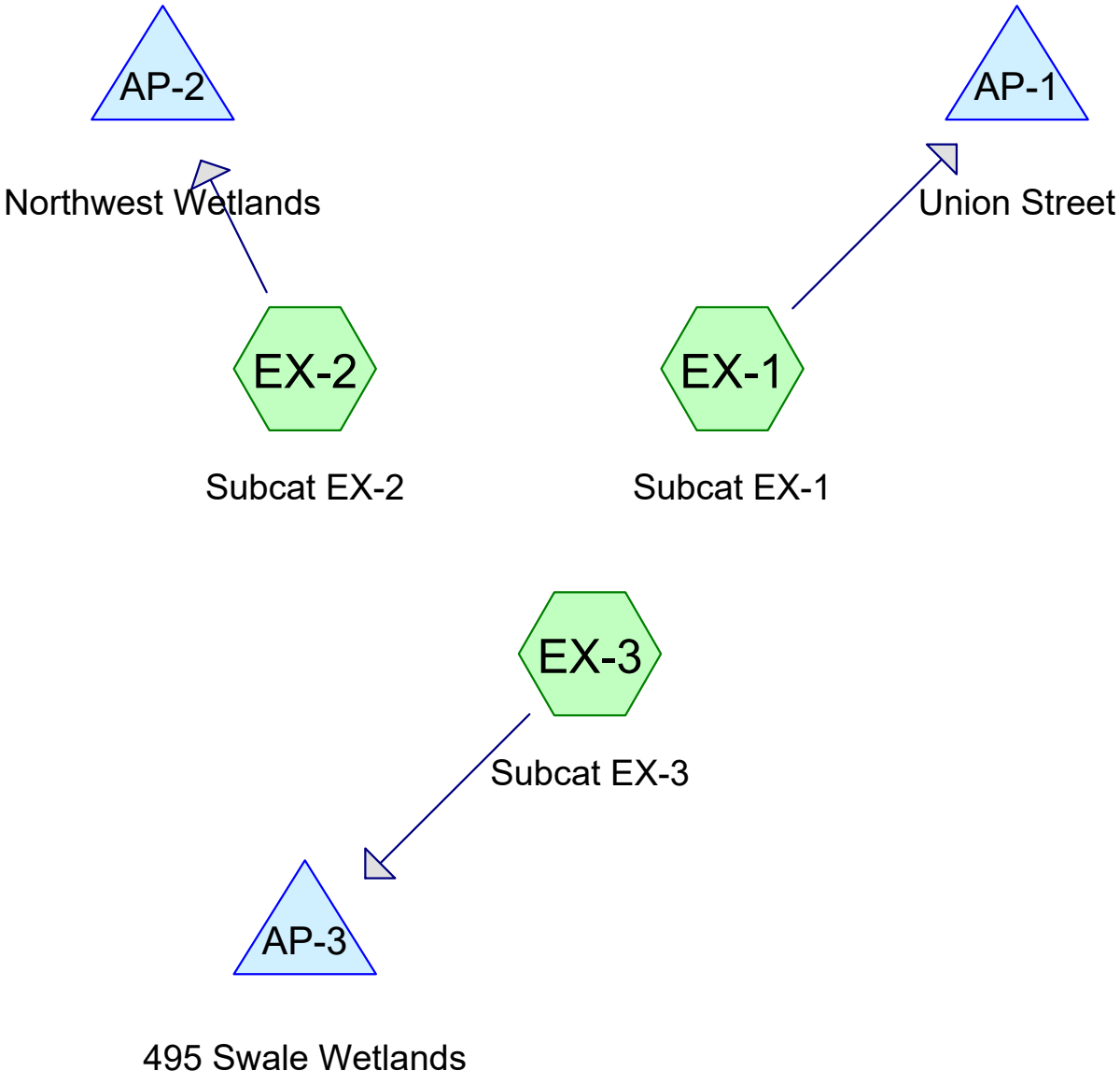
DRAINAGE ANALYSIS

HydroCAD Calculations – Pre-Post Development Conditions

TABLE OF CONTENTS



Subcat Reach Pond Link

Routing Diagram for Existing Conditions
Prepared by Guerriere & Halnon Inc, Printed 11/12/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA10 24-hr	D	Default	24.00	1	3.39	2
2	10-Year	NOAA10 24-hr	D	Default	24.00	1	5.25	2
3	25-Year	NOAA10 24-hr	D	Default	24.00	1	6.41	2
4	100-Year	NOAA10 24-hr	D	Default	24.00	1	8.19	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.141	55	Woods, Good, HSG B (EX-1)
0.074	70	Woods, Good, HSG C (EX-1, EX-2)
1.232	77	Woods, Good, HSG D (EX-1, EX-2, EX-3)
1.447	**75**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.141	HSG B	EX-1
0.074	HSG C	EX-1, EX-2
1.232	HSG D	EX-1, EX-2, EX-3
0.000	Other	
1.447		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.141	0.074	1.232	0.000	1.447	Woods, Good	EX-1, EX-2, EX-3
0.000	**0.141**	**0.074**	**1.232**	**0.000**	**1.447**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=1.134 ac 0.00% Impervious Runoff Depth=1.16"
Flow Length=416' Tc=21.0 min CN=74 Runoff=0.92 cfs 0.110 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=0.184 ac 0.00% Impervious Runoff Depth=1.35"
Flow Length=169' Tc=25.5 min CN=77 Runoff=0.16 cfs 0.021 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=0.129 ac 0.00% Impervious Runoff Depth=1.35"
Flow Length=97' Tc=10.6 min CN=77 Runoff=0.18 cfs 0.015 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.110 af Inflow=0.92 cfs 0.110 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.021 af Inflow=0.16 cfs 0.021 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.015 af Inflow=0.18 cfs 0.015 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.145 af Average Runoff Depth = 1.20"
100.00% Pervious = 1.447 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: Subcat EX-1

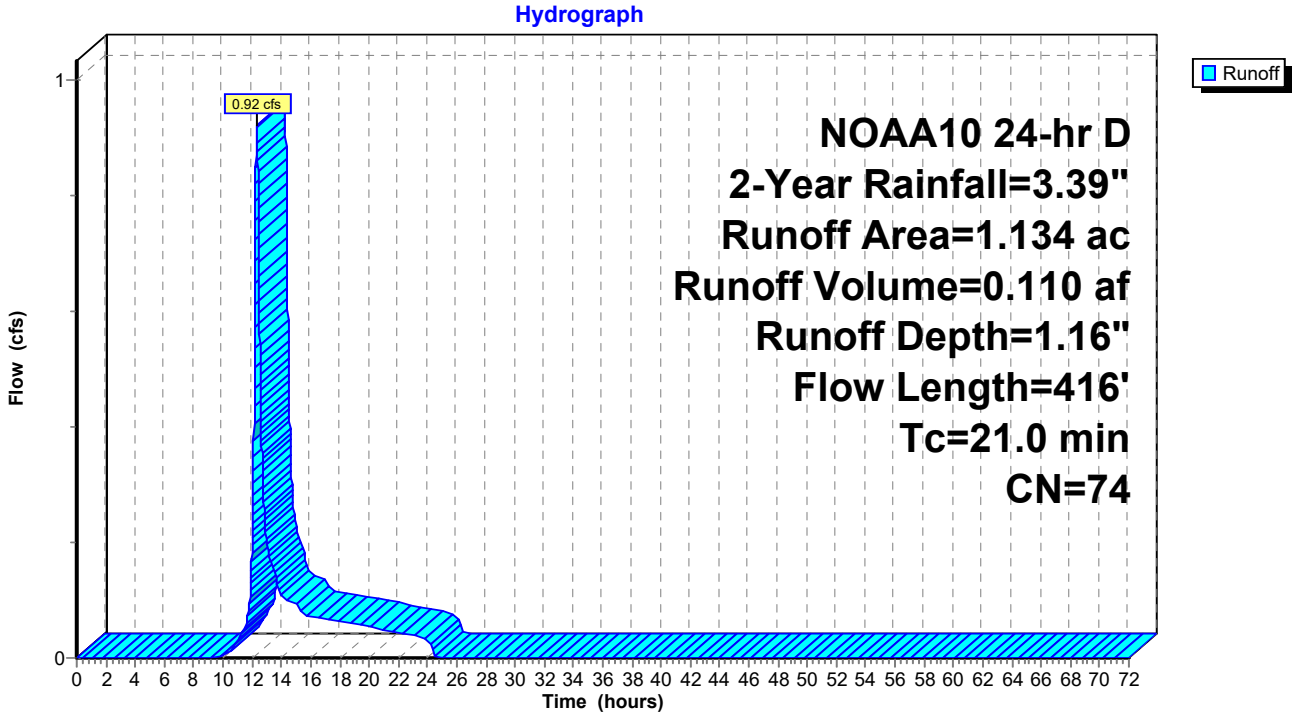
Runoff = 0.92 cfs @ 12.31 hrs, Volume= 0.110 af, Depth= 1.16"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (ac)	CN	Description
0.141	55	Woods, Good, HSG B
0.067	70	Woods, Good, HSG C
0.926	77	Woods, Good, HSG D
1.134	74	Weighted Average
1.134		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
2.2	120	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	246	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	416	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

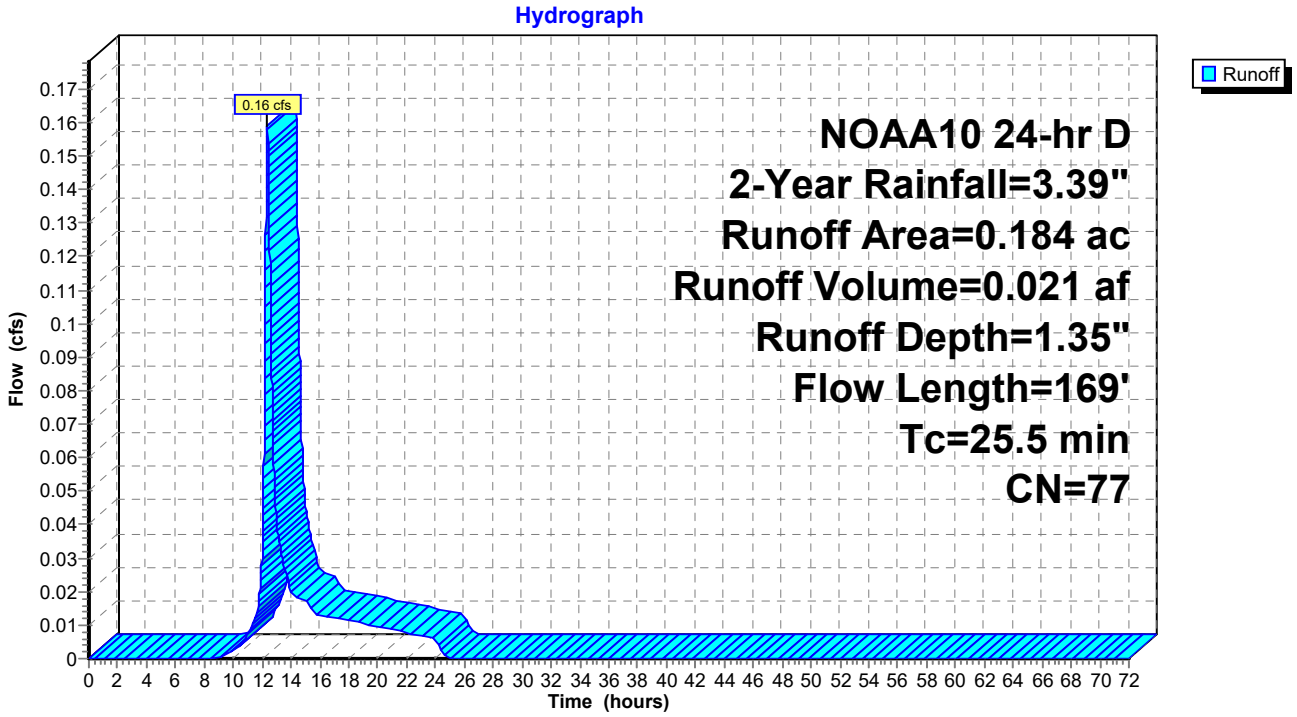
Runoff = 0.16 cfs @ 12.38 hrs, Volume= 0.021 af, Depth= 1.35"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (ac)	CN	Description
0.007	70	Woods, Good, HSG C
0.177	77	Woods, Good, HSG D
0.184	77	Weighted Average
0.184		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	50	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
3.4	119	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.5	169	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

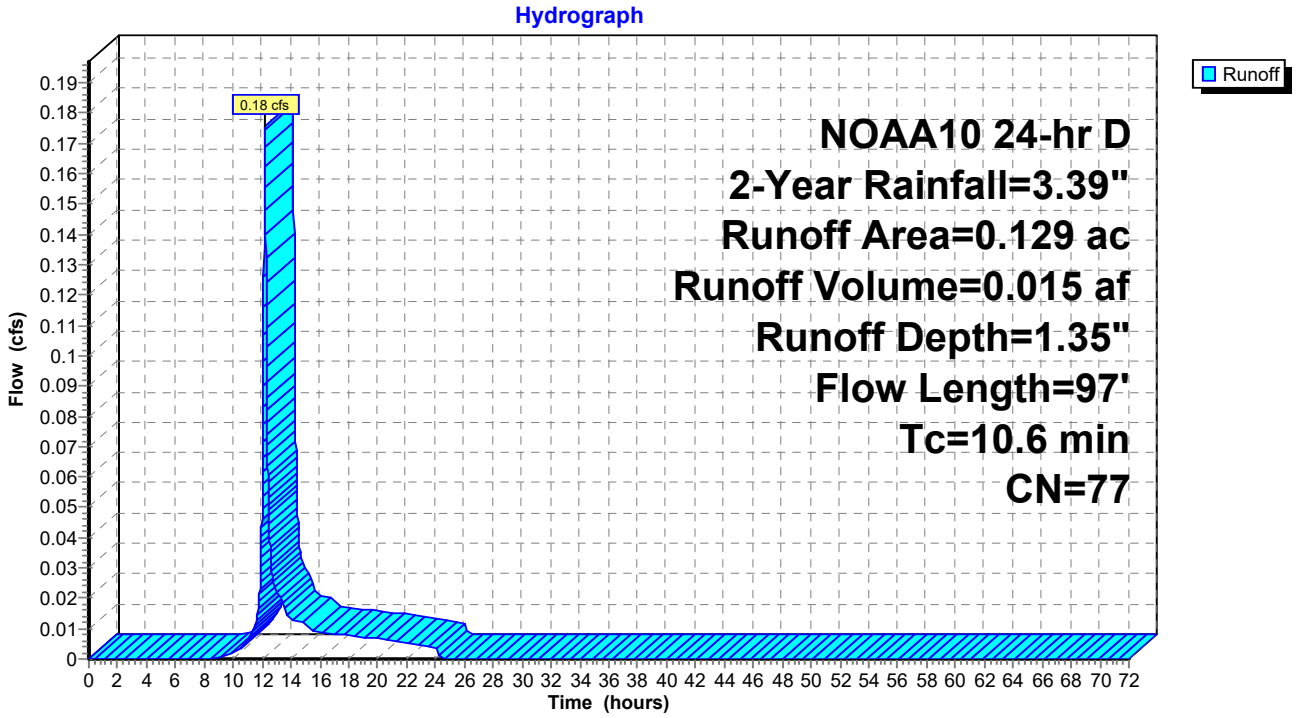
Runoff = 0.18 cfs @ 12.19 hrs, Volume= 0.015 af, Depth= 1.35"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (ac)	CN	Description
0.129	77	Woods, Good, HSG D
0.129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0430	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
1.3	47	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	97	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Pond AP-1: Union Street

Inflow Area = 1.134 ac, 0.00% Impervious, Inflow Depth = 1.16" for 2-Year event
Inflow = 0.92 cfs @ 12.31 hrs, Volume= 0.110 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

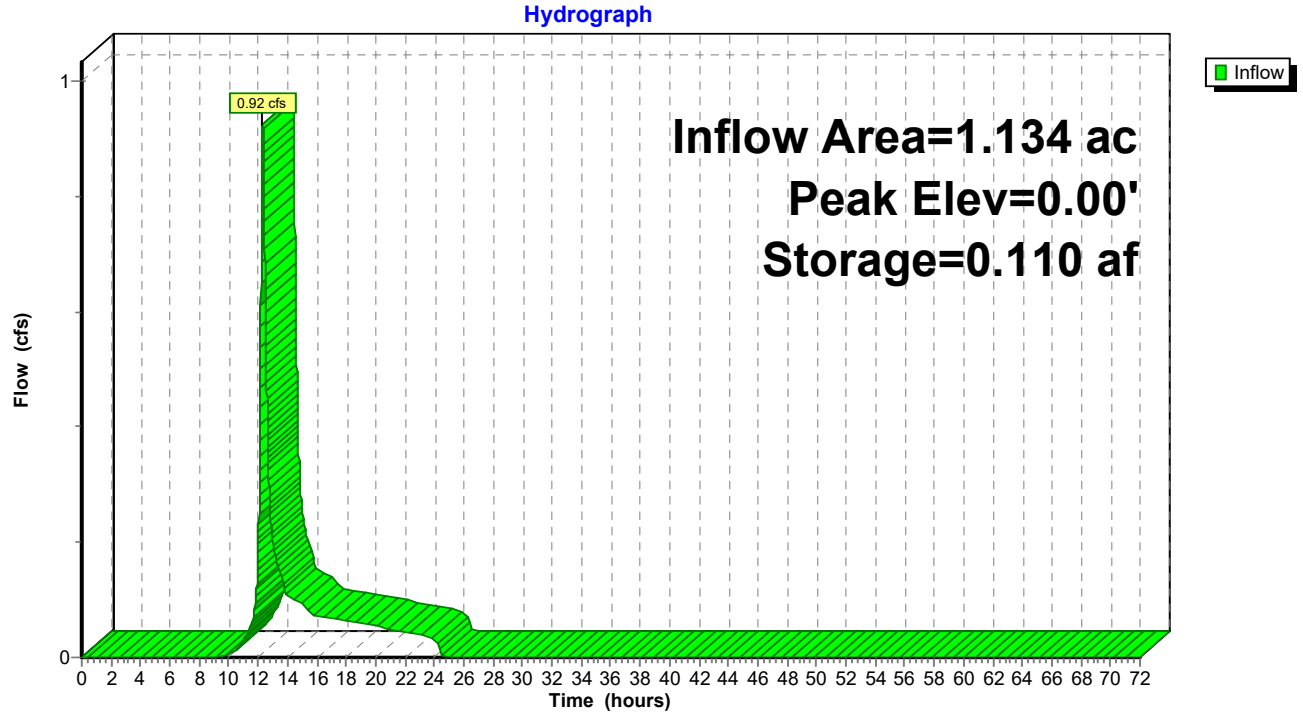
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.21 hrs Surf.Area= 100.000 ac Storage= 0.110 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.184 ac, 0.00% Impervious, Inflow Depth = 1.35" for 2-Year event
Inflow = 0.16 cfs @ 12.38 hrs, Volume= 0.021 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

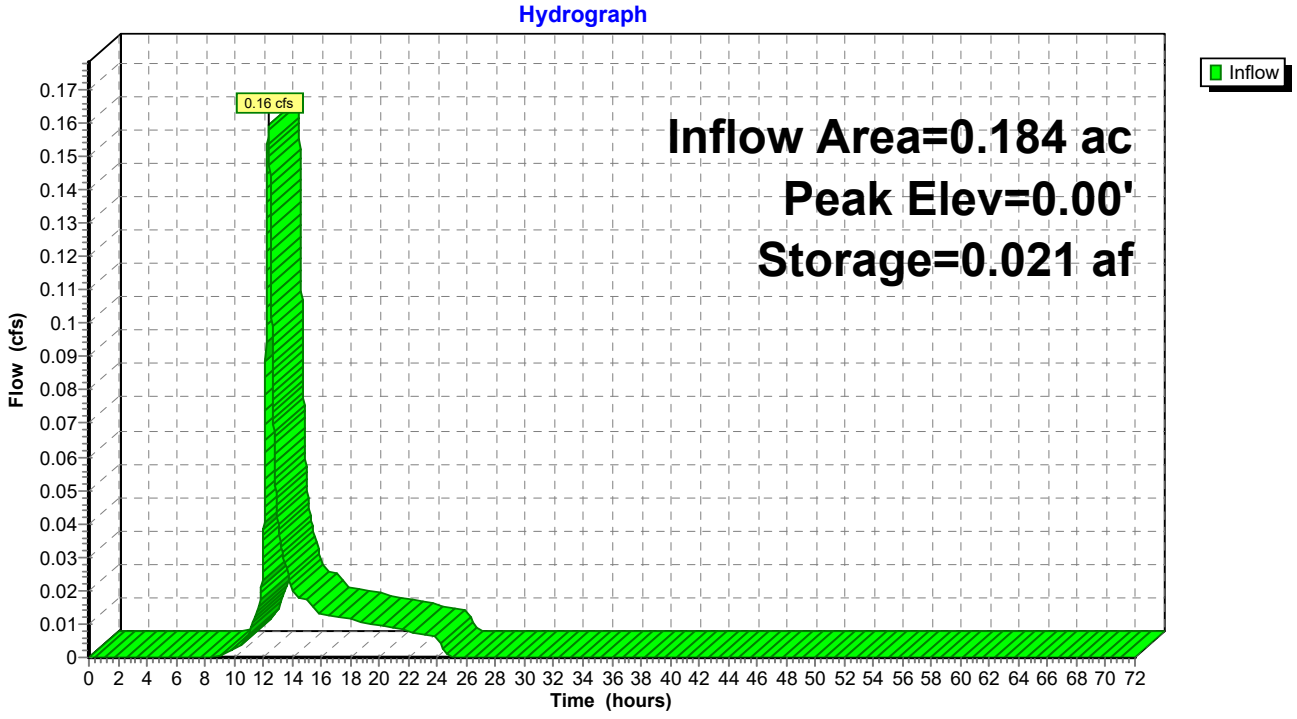
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.45 hrs Surf.Area= 100.000 ac Storage= 0.021 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.129 ac, 0.00% Impervious, Inflow Depth = 1.35" for 2-Year event
Inflow = 0.18 cfs @ 12.19 hrs, Volume= 0.015 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

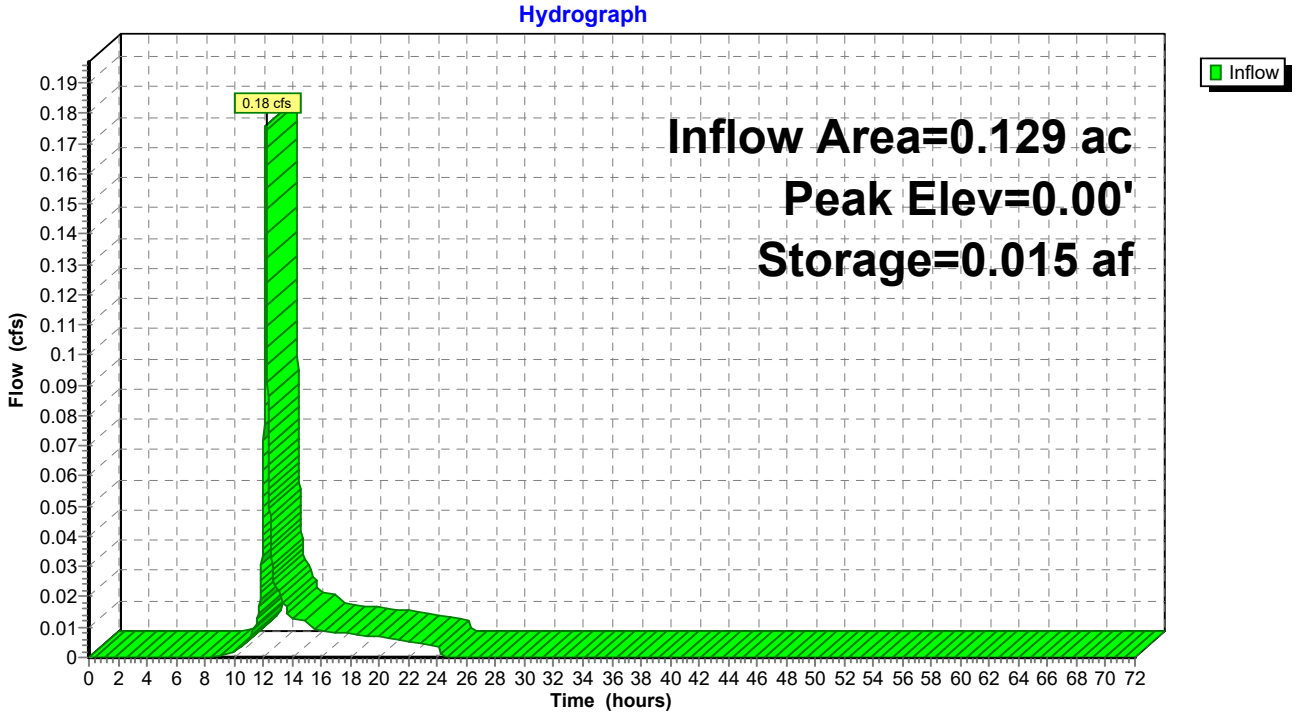
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.60 hrs Surf.Area= 100.000 ac Storage= 0.015 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=1.134 ac 0.00% Impervious Runoff Depth=2.57"
Flow Length=416' Tc=21.0 min CN=74 Runoff=2.12 cfs 0.242 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=0.184 ac 0.00% Impervious Runoff Depth=2.83"
Flow Length=169' Tc=25.5 min CN=77 Runoff=0.34 cfs 0.043 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=0.129 ac 0.00% Impervious Runoff Depth=2.83"
Flow Length=97' Tc=10.6 min CN=77 Runoff=0.37 cfs 0.031 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.242 af Inflow=2.12 cfs 0.242 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.043 af Inflow=0.34 cfs 0.043 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.031 af Inflow=0.37 cfs 0.031 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.316 af Average Runoff Depth = 2.62"
100.00% Pervious = 1.447 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: Subcat EX-1

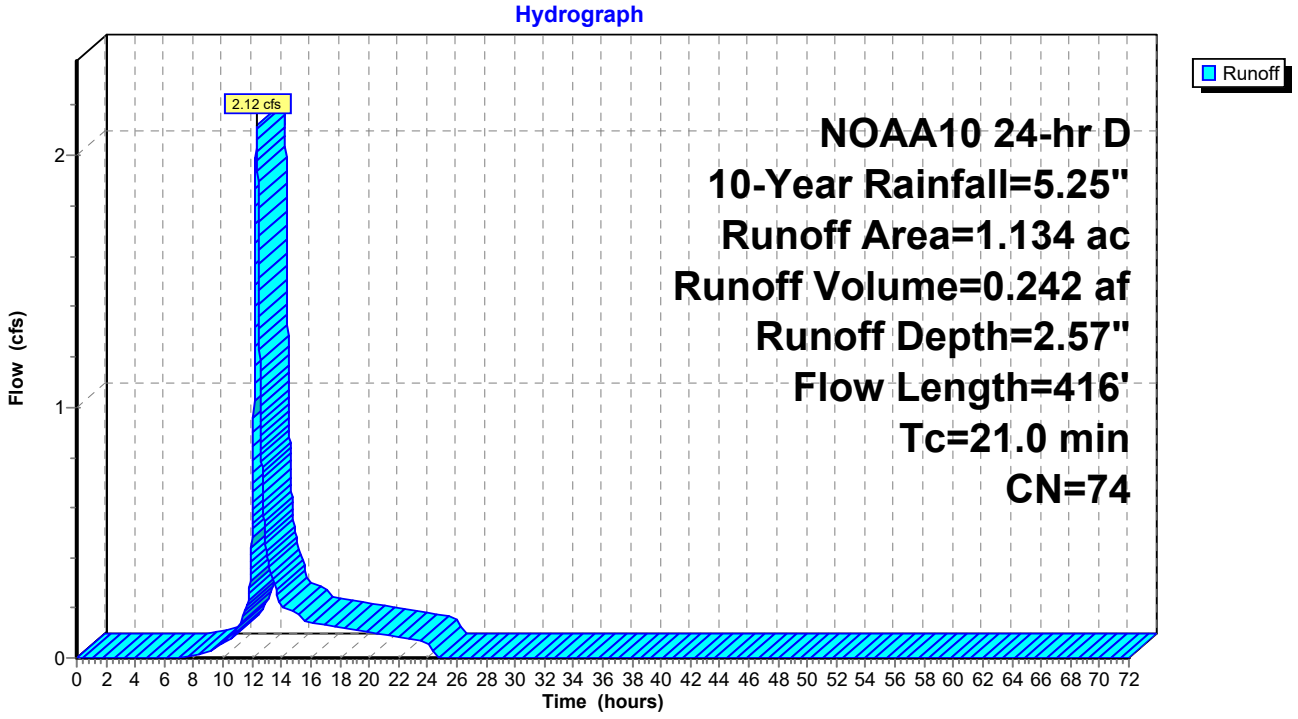
Runoff = 2.12 cfs @ 12.30 hrs, Volume= 0.242 af, Depth= 2.57"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (ac)	CN	Description
0.141	55	Woods, Good, HSG B
0.067	70	Woods, Good, HSG C
0.926	77	Woods, Good, HSG D
1.134	74	Weighted Average
1.134		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
2.2	120	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	246	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	416	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

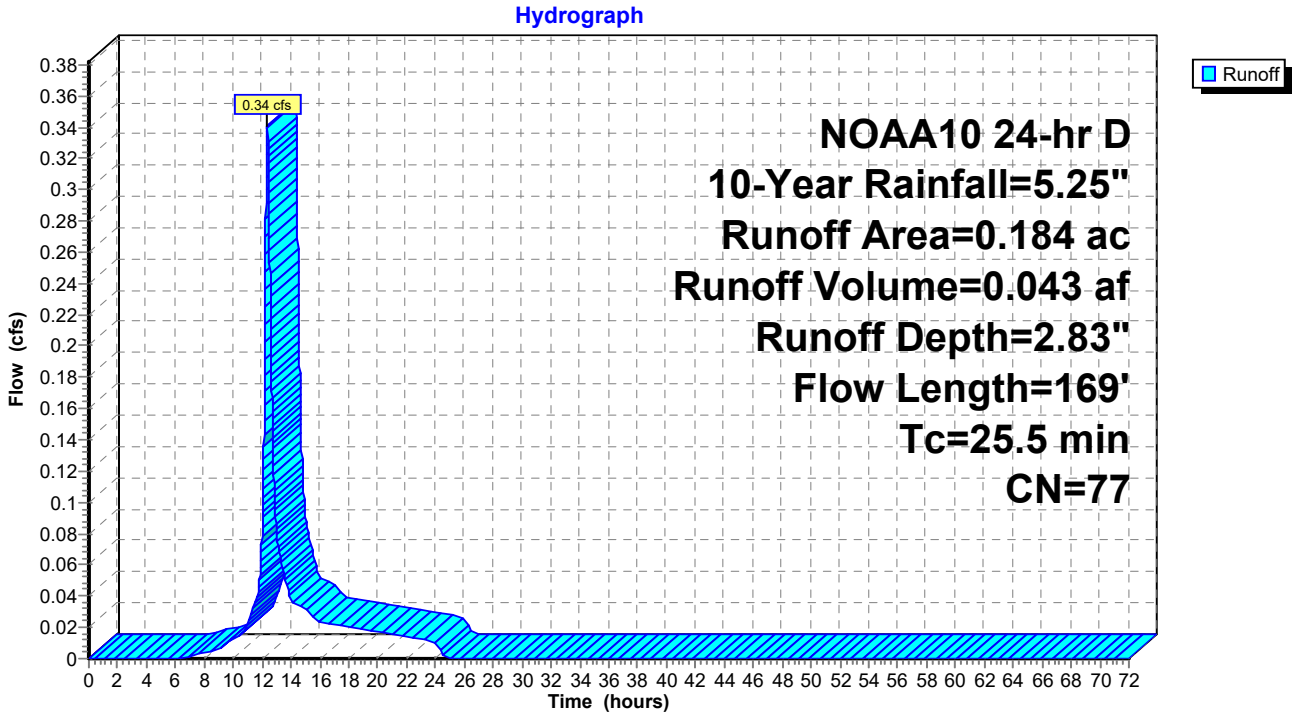
Runoff = 0.34 cfs @ 12.36 hrs, Volume= 0.043 af, Depth= 2.83"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (ac)	CN	Description
0.007	70	Woods, Good, HSG C
0.177	77	Woods, Good, HSG D
0.184	77	Weighted Average
0.184		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	50	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
3.4	119	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.5	169	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

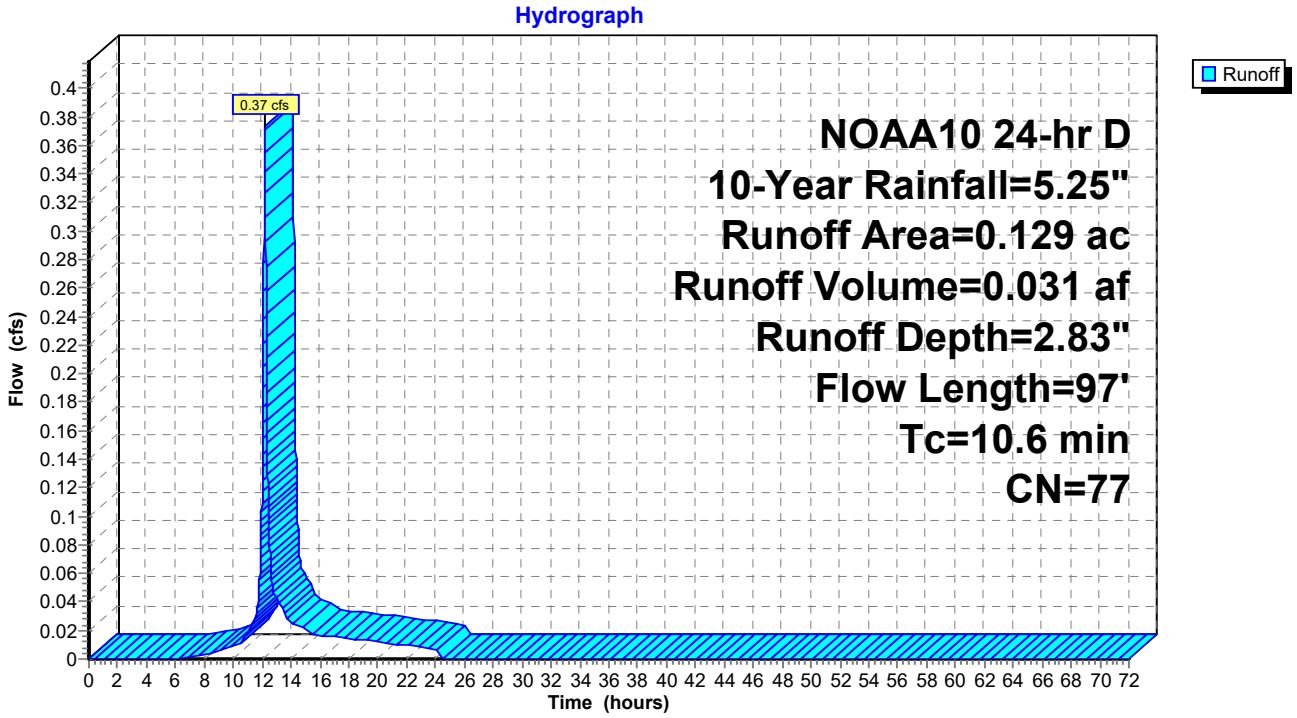
Runoff = 0.37 cfs @ 12.18 hrs, Volume= 0.031 af, Depth= 2.83"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (ac)	CN	Description
0.129	77	Woods, Good, HSG D
0.129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0430	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
1.3	47	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	97	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Pond AP-1: Union Street

Inflow Area = 1.134 ac, 0.00% Impervious, Inflow Depth = 2.57" for 10-Year event
Inflow = 2.12 cfs @ 12.30 hrs, Volume= 0.242 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

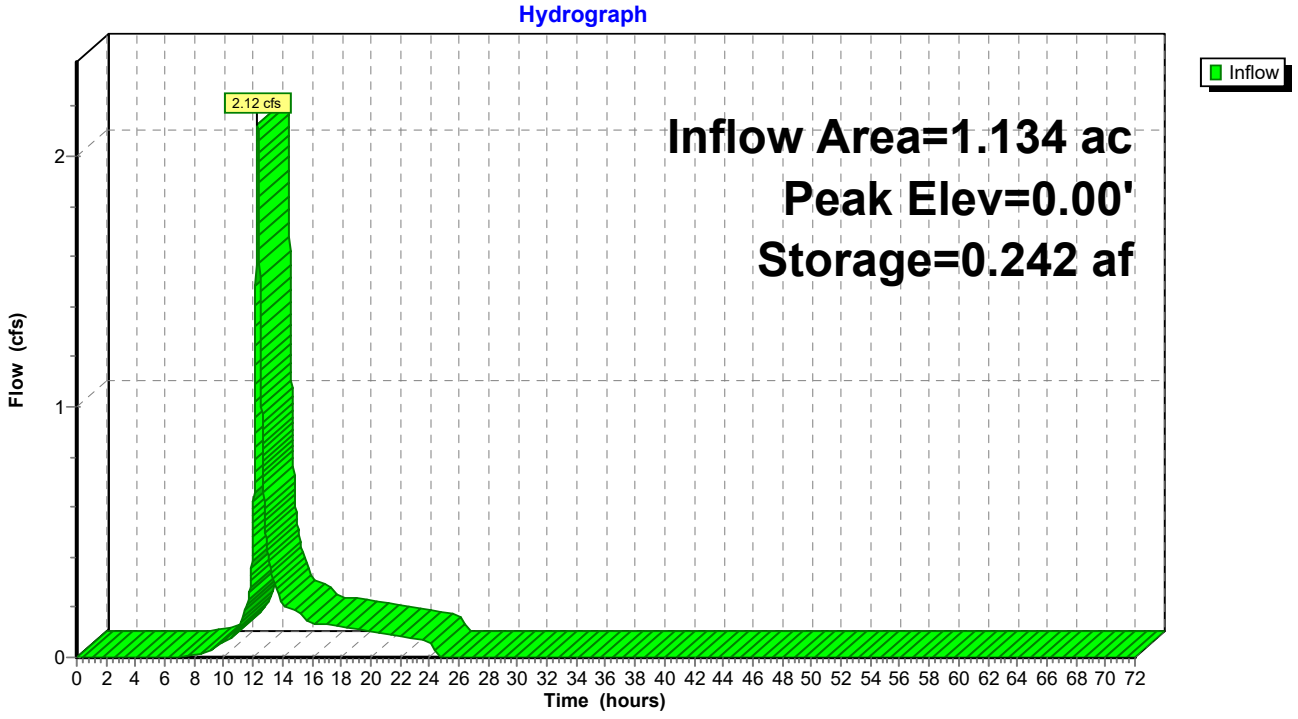
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.21 hrs Surf.Area= 100.000 ac Storage= 0.242 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.184 ac, 0.00% Impervious, Inflow Depth = 2.83" for 10-Year event
Inflow = 0.34 cfs @ 12.36 hrs, Volume= 0.043 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

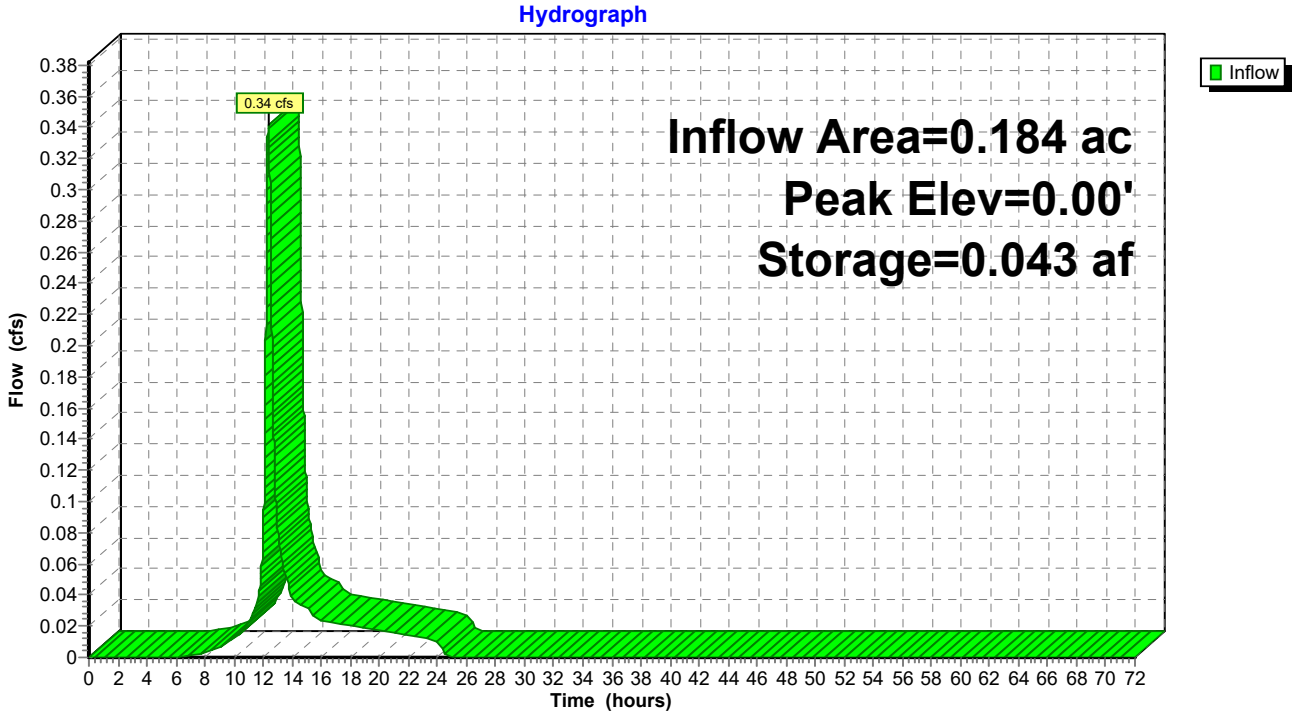
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.45 hrs Surf.Area= 100.000 ac Storage= 0.043 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.129 ac, 0.00% Impervious, Inflow Depth = 2.83" for 10-Year event
Inflow = 0.37 cfs @ 12.18 hrs, Volume= 0.031 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

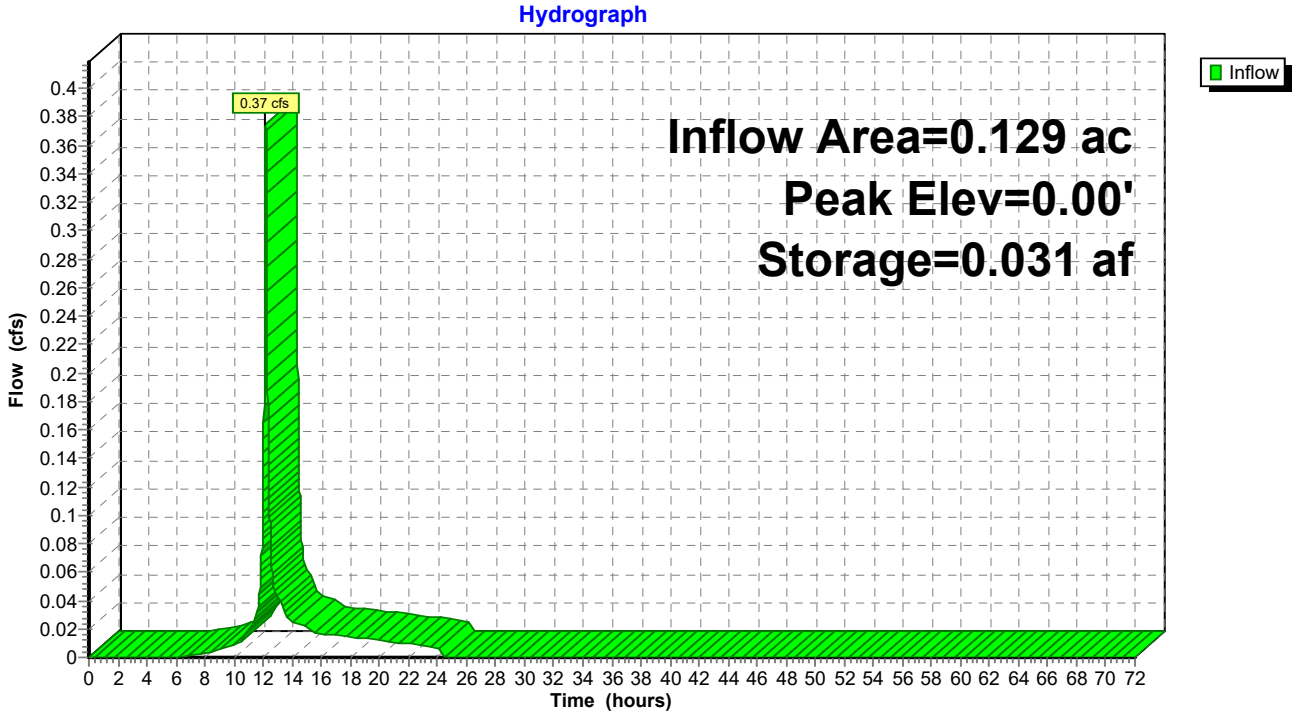
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.60 hrs Surf.Area= 100.000 ac Storage= 0.031 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=1.134 ac 0.00% Impervious Runoff Depth=3.53"
Flow Length=416' Tc=21.0 min CN=74 Runoff=2.93 cfs 0.334 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=0.184 ac 0.00% Impervious Runoff Depth=3.84"
Flow Length=169' Tc=25.5 min CN=77 Runoff=0.46 cfs 0.059 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=0.129 ac 0.00% Impervious Runoff Depth=3.84"
Flow Length=97' Tc=10.6 min CN=77 Runoff=0.50 cfs 0.041 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.334 af Inflow=2.93 cfs 0.334 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.059 af Inflow=0.46 cfs 0.059 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.041 af Inflow=0.50 cfs 0.041 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.434 af Average Runoff Depth = 3.60"
100.00% Pervious = 1.447 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: Subcat EX-1

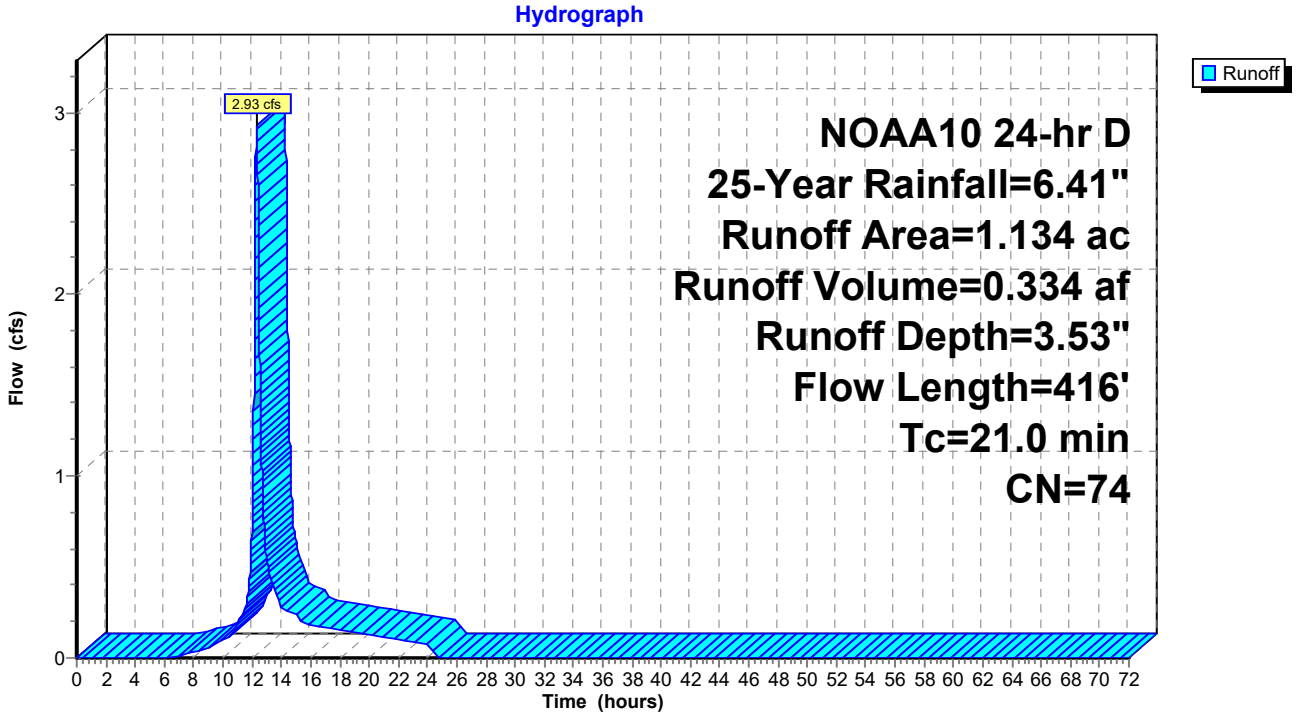
Runoff = 2.93 cfs @ 12.30 hrs, Volume= 0.334 af, Depth= 3.53"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (ac)	CN	Description
0.141	55	Woods, Good, HSG B
0.067	70	Woods, Good, HSG C
0.926	77	Woods, Good, HSG D
1.134	74	Weighted Average
1.134		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
2.2	120	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	246	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	416	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

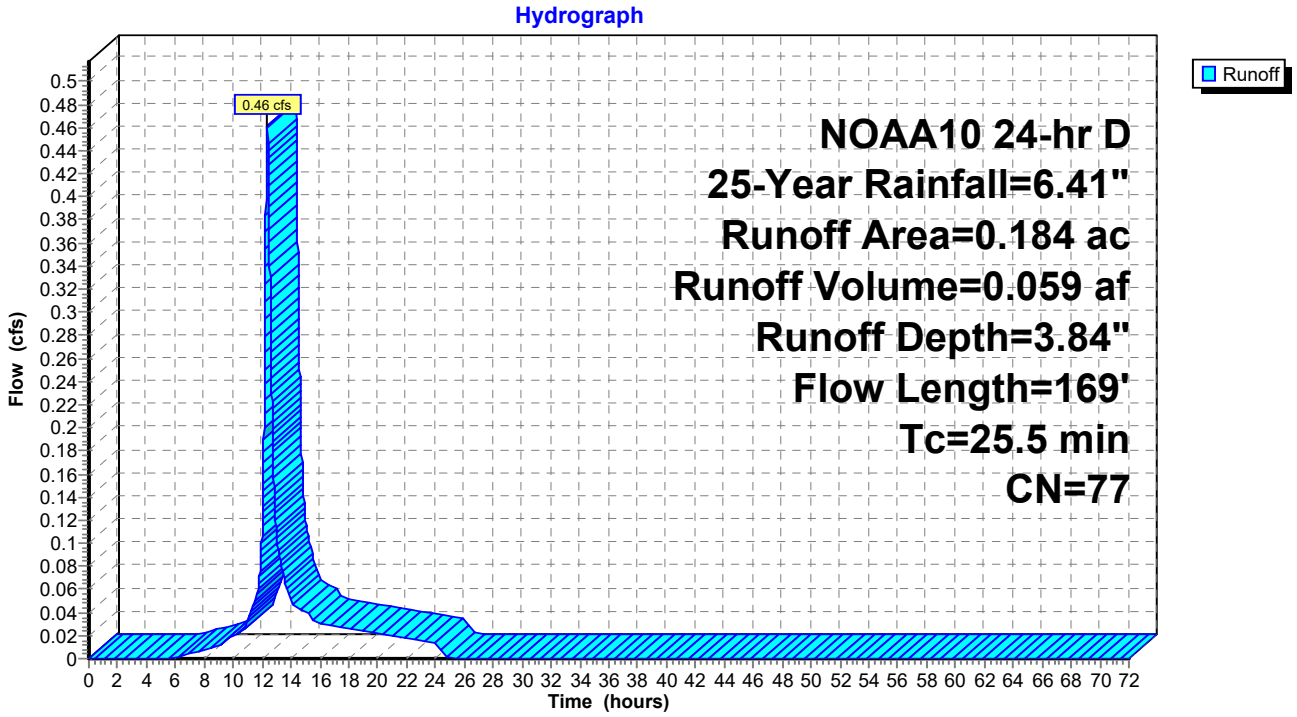
Runoff = 0.46 cfs @ 12.36 hrs, Volume= 0.059 af, Depth= 3.84"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (ac)	CN	Description
0.007	70	Woods, Good, HSG C
0.177	77	Woods, Good, HSG D
0.184	77	Weighted Average
0.184		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	50	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
3.4	119	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.5	169	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

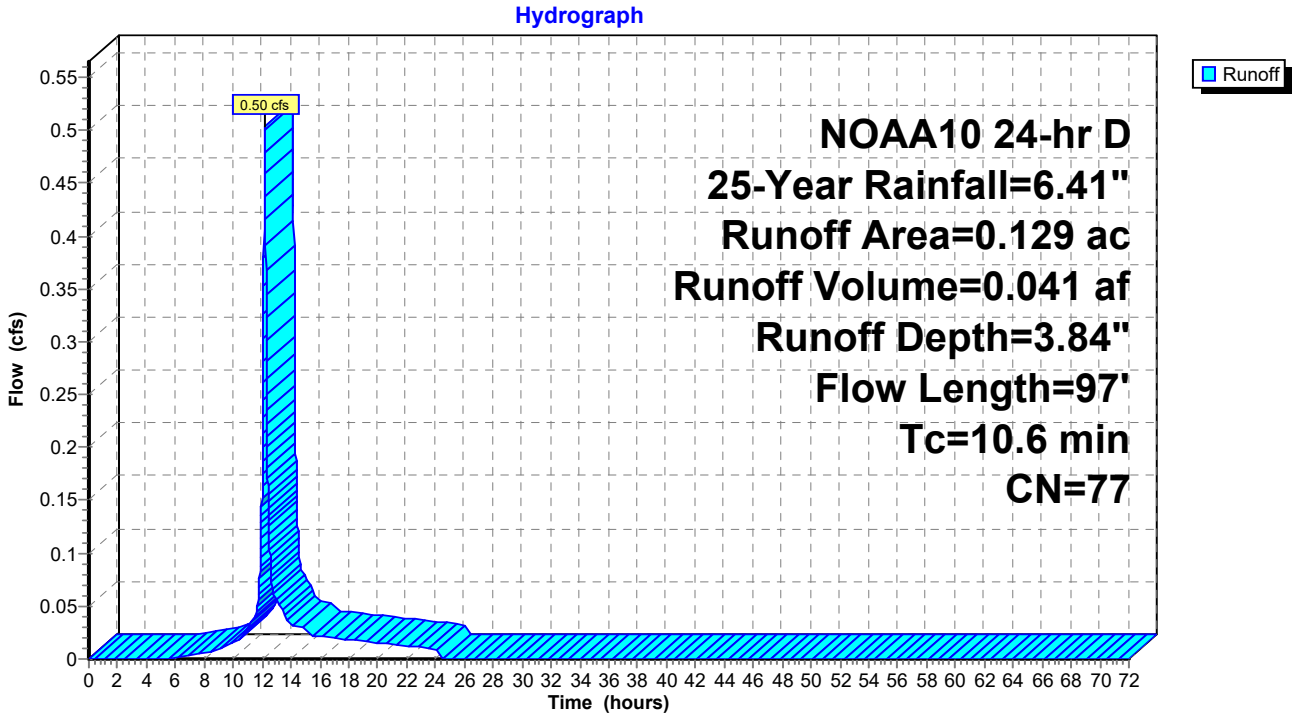
Runoff = 0.50 cfs @ 12.18 hrs, Volume= 0.041 af, Depth= 3.84"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (ac)	CN	Description
0.129	77	Woods, Good, HSG D
0.129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0430	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
1.3	47	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	97	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Pond AP-1: Union Street

Inflow Area = 1.134 ac, 0.00% Impervious, Inflow Depth = 3.53" for 25-Year event
Inflow = 2.93 cfs @ 12.30 hrs, Volume= 0.334 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

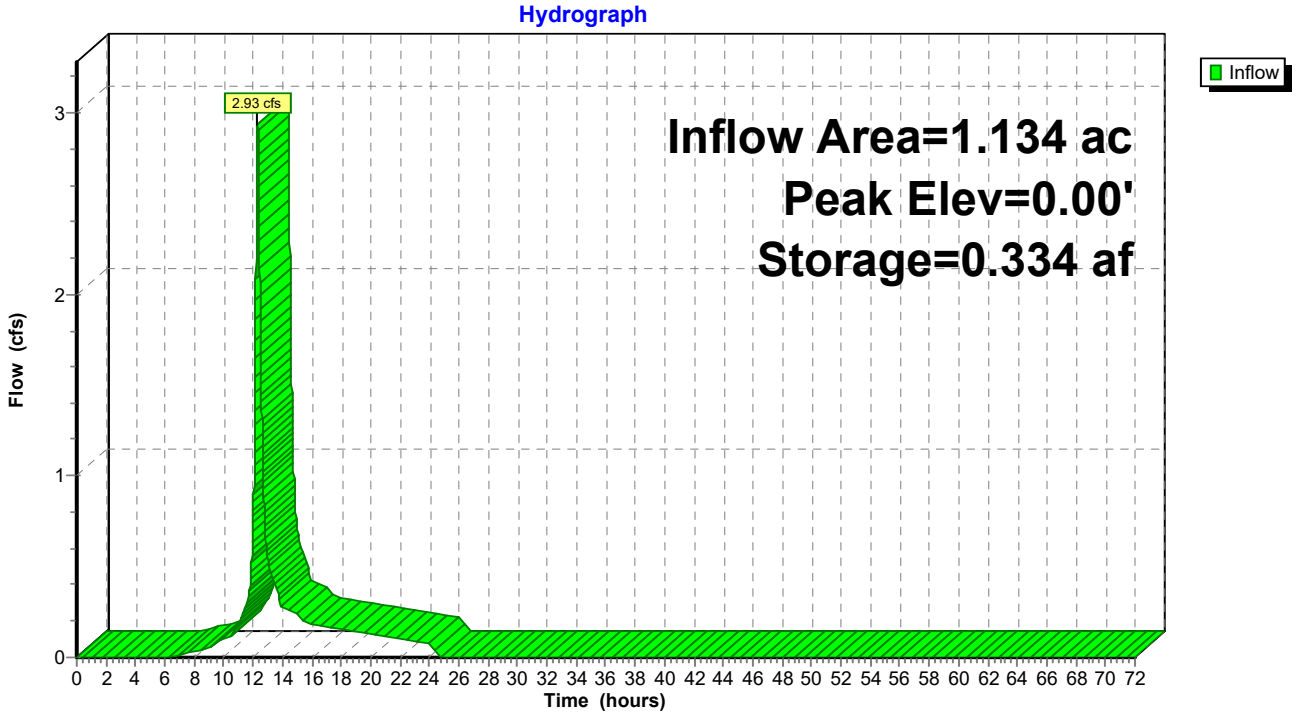
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.21 hrs Surf.Area= 100.000 ac Storage= 0.334 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.184 ac, 0.00% Impervious, Inflow Depth = 3.84" for 25-Year event
Inflow = 0.46 cfs @ 12.36 hrs, Volume= 0.059 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

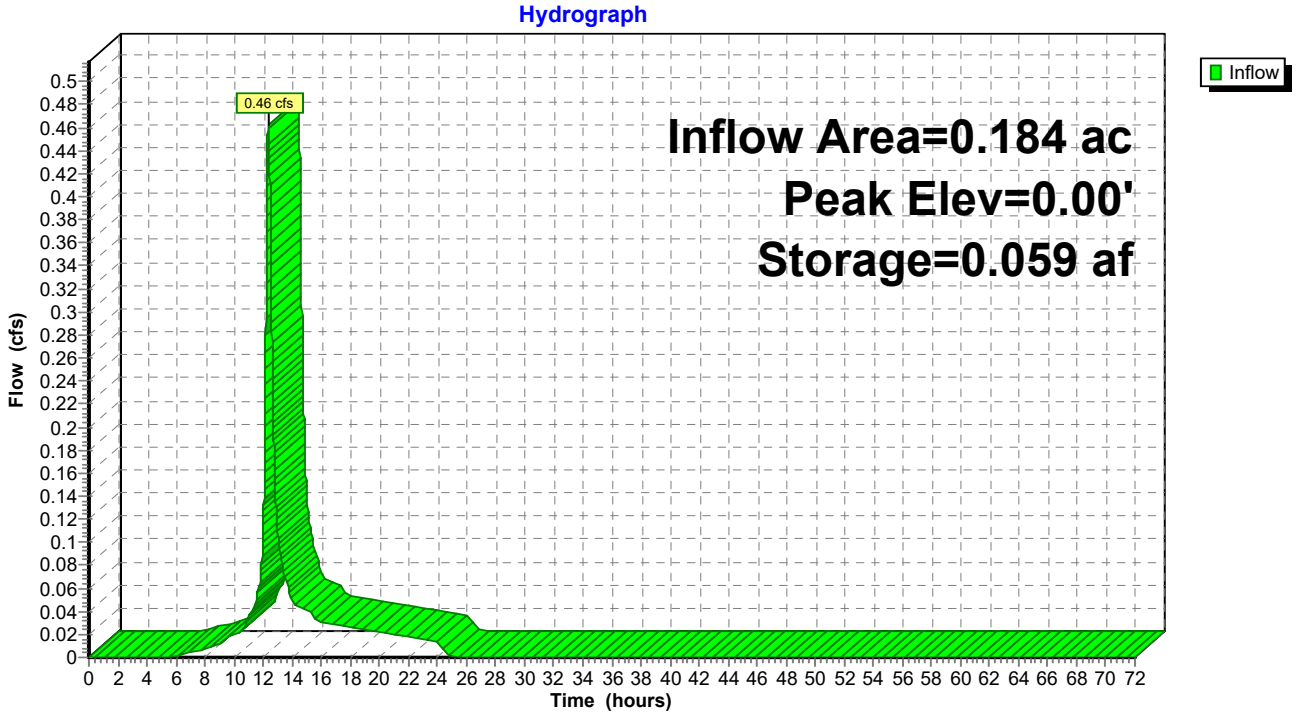
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.45 hrs Surf.Area= 100.000 ac Storage= 0.059 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.129 ac, 0.00% Impervious, Inflow Depth = 3.84" for 25-Year event
Inflow = 0.50 cfs @ 12.18 hrs, Volume= 0.041 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

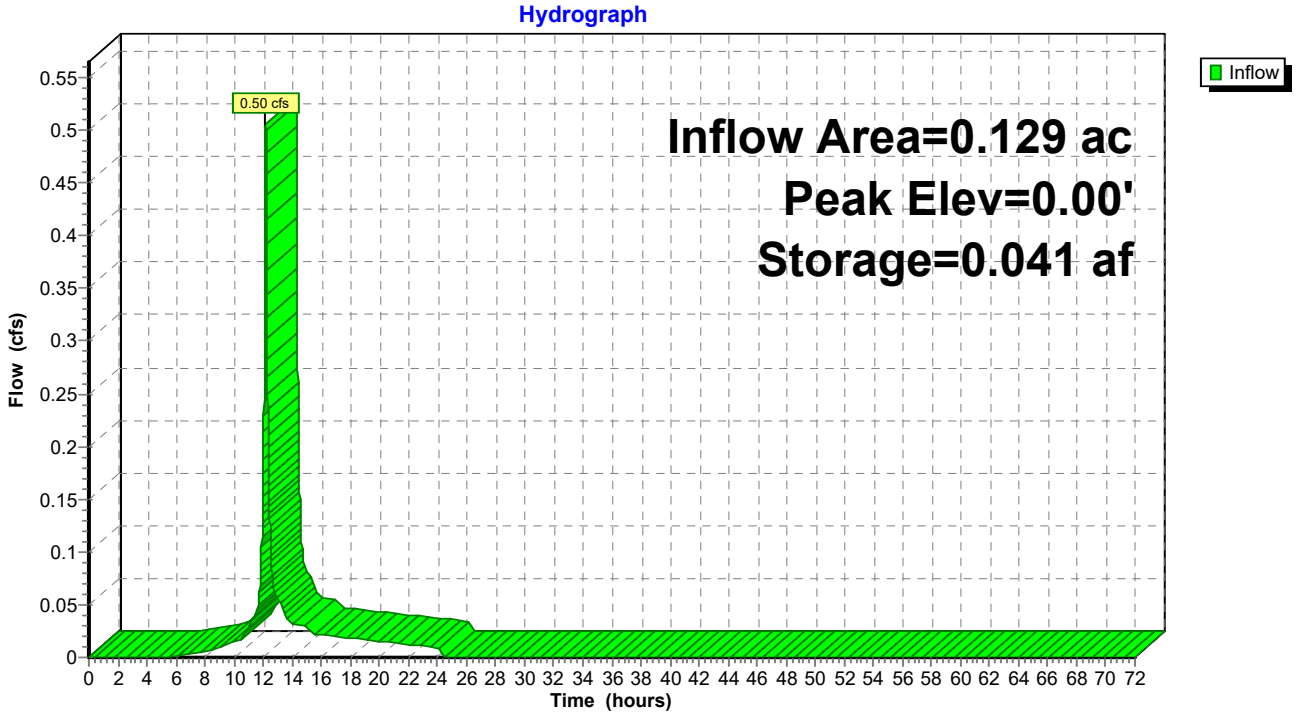
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.60 hrs Surf.Area= 100.000 ac Storage= 0.041 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1 Runoff Area=1.134 ac 0.00% Impervious Runoff Depth=5.10"
Flow Length=416' Tc=21.0 min CN=74 Runoff=4.22 cfs 0.482 af

Subcatchment EX-2: Subcat EX-2 Runoff Area=0.184 ac 0.00% Impervious Runoff Depth=5.45"
Flow Length=169' Tc=25.5 min CN=77 Runoff=0.65 cfs 0.083 af

Subcatchment EX-3: Subcat EX-3 Runoff Area=0.129 ac 0.00% Impervious Runoff Depth=5.45"
Flow Length=97' Tc=10.6 min CN=77 Runoff=0.71 cfs 0.059 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.482 af Inflow=4.22 cfs 0.482 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.083 af Inflow=0.65 cfs 0.083 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.059 af Inflow=0.71 cfs 0.059 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.624 af Average Runoff Depth = 5.17"
100.00% Pervious = 1.447 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment EX-1: Subcat EX-1

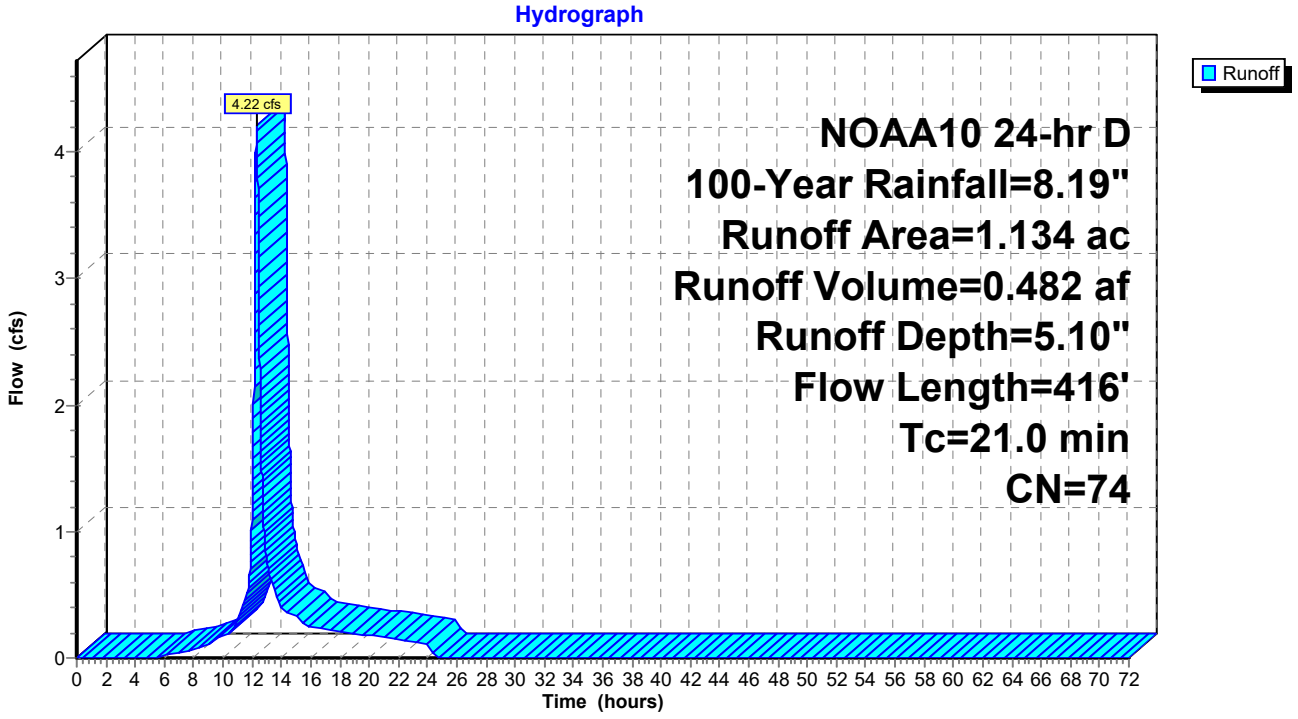
Runoff = 4.22 cfs @ 12.30 hrs, Volume= 0.482 af, Depth= 5.10"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (ac)	CN	Description
0.141	55	Woods, Good, HSG B
0.067	70	Woods, Good, HSG C
0.926	77	Woods, Good, HSG D
1.134	74	Weighted Average
1.134		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	50	0.0200	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
2.2	120	0.0330	0.91		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
6.1	246	0.0180	0.67		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.0	416	Total			

Subcatchment EX-1: Subcat EX-1



Summary for Subcatchment EX-2: Subcat EX-2

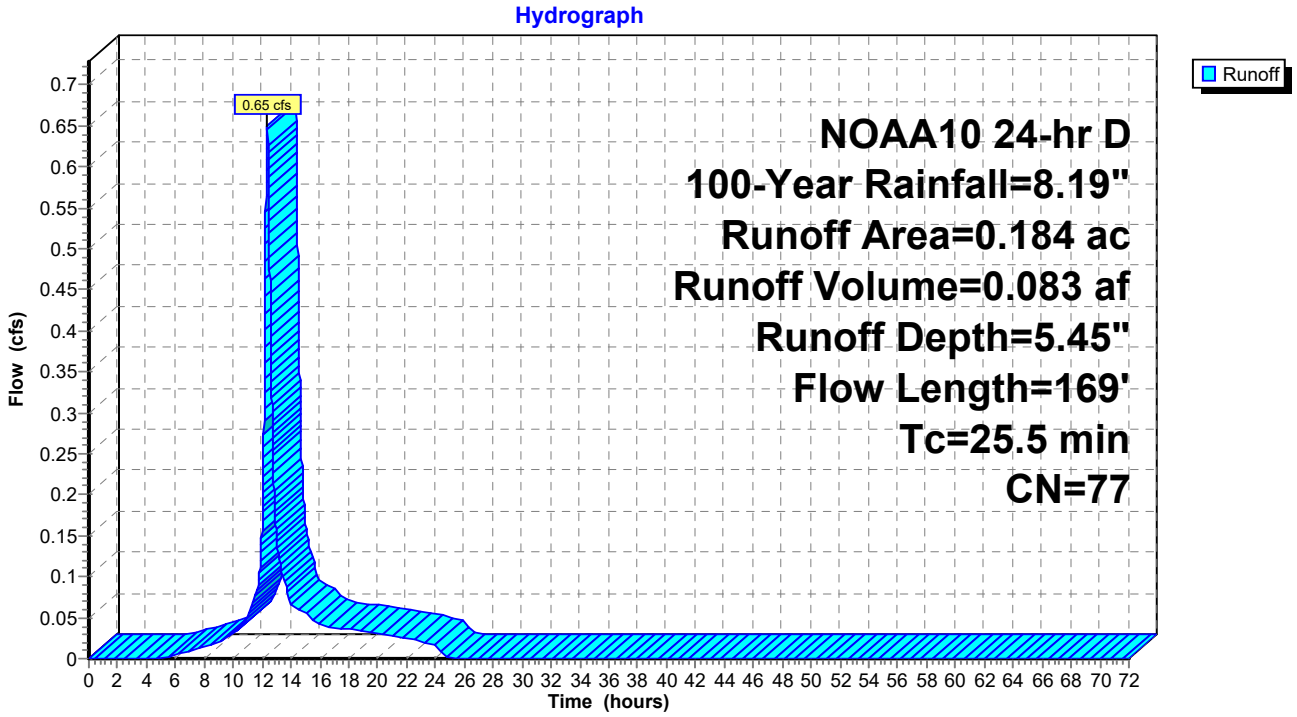
Runoff = 0.65 cfs @ 12.36 hrs, Volume= 0.083 af, Depth= 5.45"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (ac)	CN	Description
0.007	70	Woods, Good, HSG C
0.177	77	Woods, Good, HSG D
0.184	77	Weighted Average
0.184		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.1	50	0.0050	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
3.4	119	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.5	169	Total			

Subcatchment EX-2: Subcat EX-2



Summary for Subcatchment EX-3: Subcat EX-3

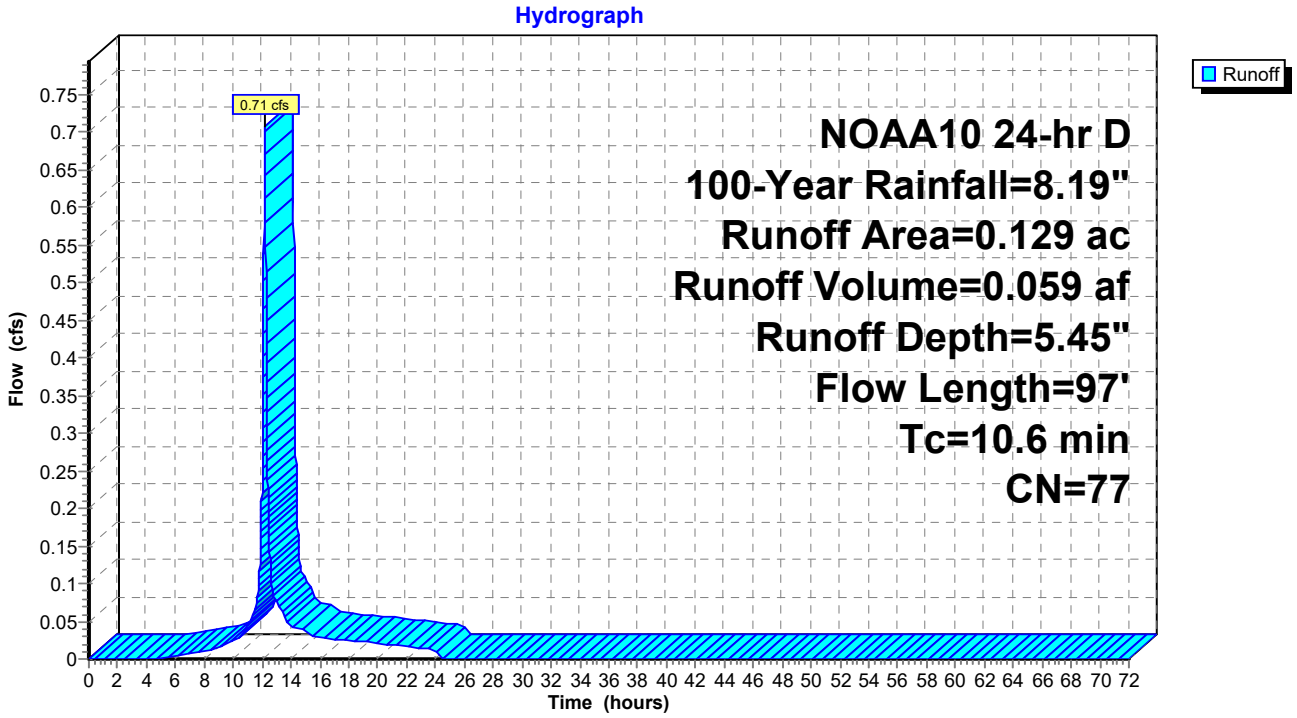
Runoff = 0.71 cfs @ 12.18 hrs, Volume= 0.059 af, Depth= 5.45"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (ac)	CN	Description
0.129	77	Woods, Good, HSG D
0.129		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0430	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.02"
1.3	47	0.0150	0.61		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
10.6	97	Total			

Subcatchment EX-3: Subcat EX-3



Summary for Pond AP-1: Union Street

Inflow Area = 1.134 ac, 0.00% Impervious, Inflow Depth = 5.10" for 100-Year event
Inflow = 4.22 cfs @ 12.30 hrs, Volume= 0.482 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

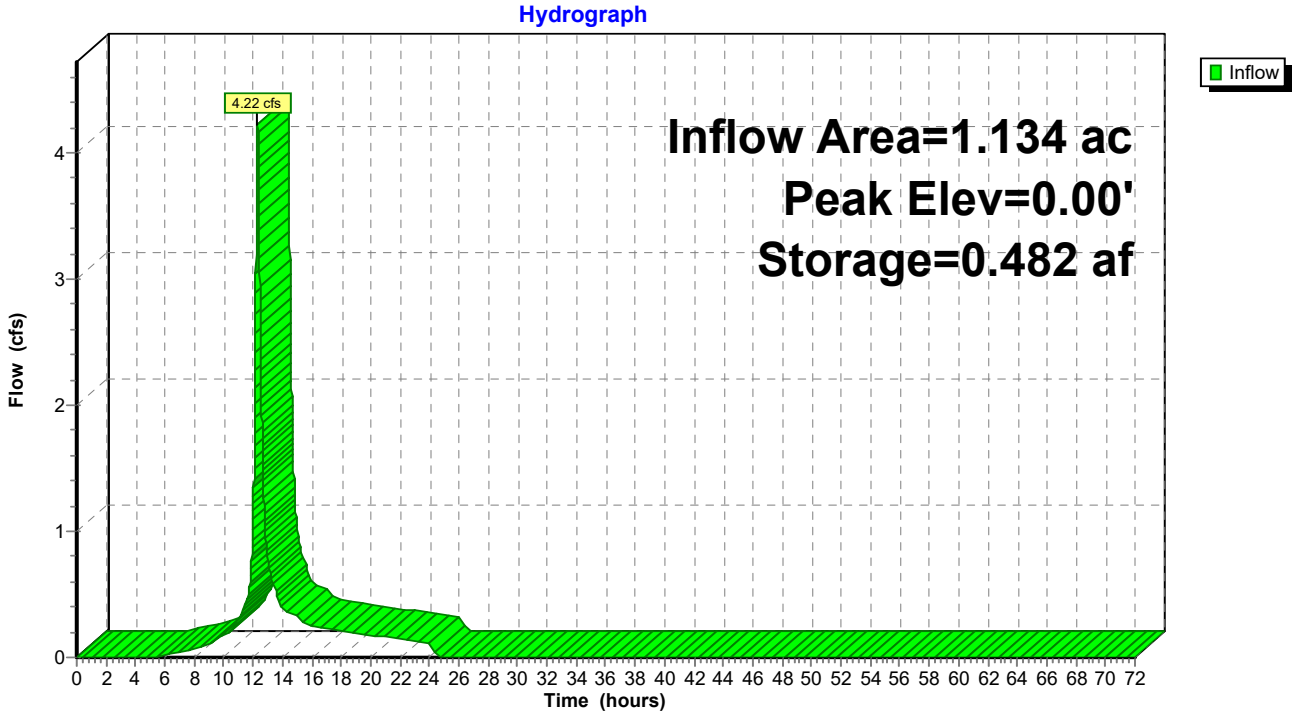
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.21 hrs Surf.Area= 100.000 ac Storage= 0.482 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.184 ac, 0.00% Impervious, Inflow Depth = 5.45" for 100-Year event
Inflow = 0.65 cfs @ 12.36 hrs, Volume= 0.083 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

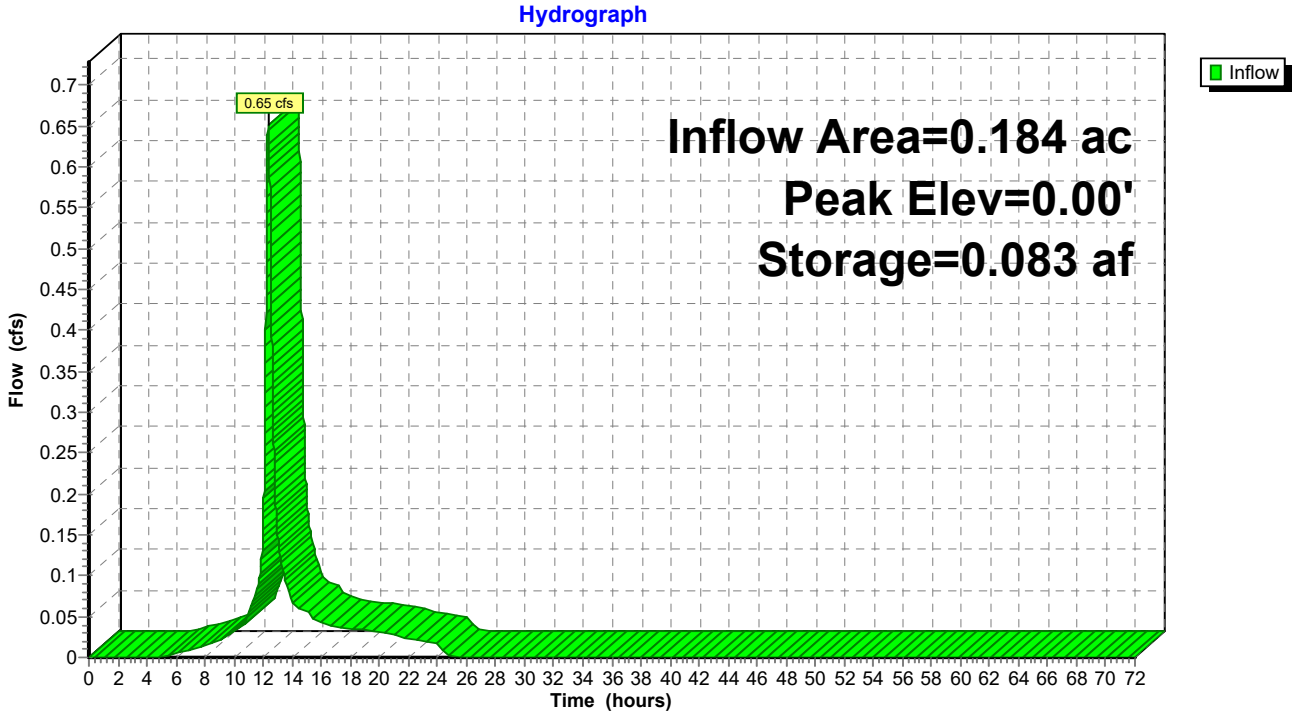
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 25.45 hrs Surf.Area= 100.000 ac Storage= 0.083 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.129 ac, 0.00% Impervious, Inflow Depth = 5.45" for 100-Year event
Inflow = 0.71 cfs @ 12.18 hrs, Volume= 0.059 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

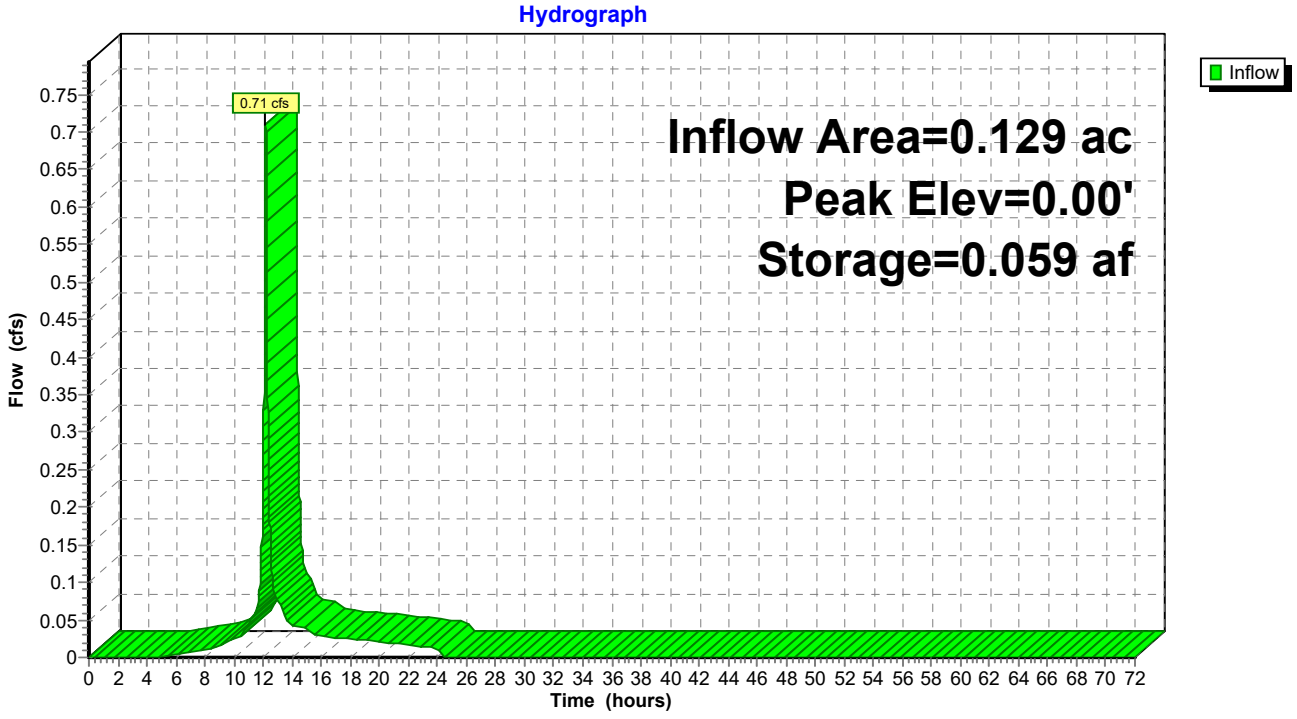
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.60 hrs Surf.Area= 100.000 ac Storage= 0.059 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Events for Subcatchment EX-1: Subcat EX-1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	0.92	0.110	1.16
10-Year	5.25	2.12	0.242	2.57
25-Year	6.41	2.93	0.334	3.53
100-Year	**8.19**	**4.22**	**0.482**	**5.10**

Events for Subcatchment EX-2: Subcat EX-2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	0.16	0.021	1.35
10-Year	5.25	0.34	0.043	2.83
25-Year	6.41	0.46	0.059	3.84
100-Year	**8.19**	**0.65**	**0.083**	**5.45**

Events for Subcatchment EX-3: Subcat EX-3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	0.18	0.015	1.35
10-Year	5.25	0.37	0.031	2.83
25-Year	6.41	0.50	0.041	3.84
100-Year	**8.19**	**0.71**	**0.059**	**5.45**

Events for Pond AP-1: Union Street

Event	Inflow (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.92	0.00	0.110
10-Year	2.12	0.00	0.242
25-Year	2.93	0.00	0.334
100-Year	**4.22**	**0.00**	**0.482**

Events for Pond AP-2: Northwest Wetlands

Event	Inflow (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.16	0.00	0.021
10-Year	0.34	0.00	0.043
25-Year	0.46	0.00	0.059
100-Year	**0.65**	**0.00**	**0.083**

Events for Pond AP-3: 495 Swale Wetlands

Event	Inflow (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.18	0.00	0.015
10-Year	0.37	0.00	0.031
25-Year	0.50	0.00	0.041
100-Year	**0.71**	**0.00**	**0.059**

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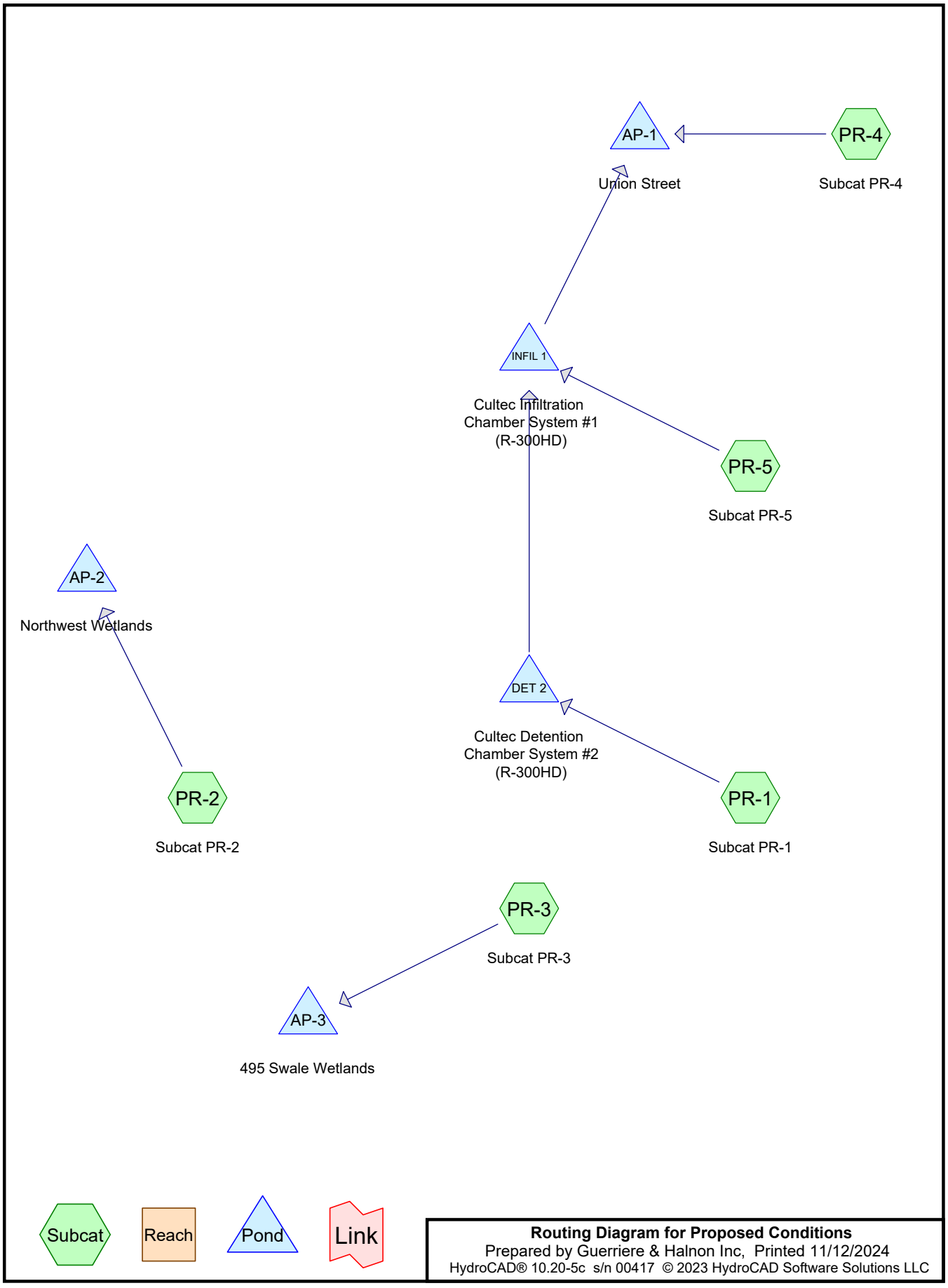


Routing Diagram for Proposed Conditions
Prepared by Guerriere & Halnon Inc, Printed 11/12/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA10 24-hr	D	Default	24.00	1	3.39	2
2	10-Year	NOAA10 24-hr	D	Default	24.00	1	5.25	2
3	25-Year	NOAA10 24-hr	D	Default	24.00	1	6.41	2
4	100-Year	NOAA10 24-hr	D	Default	24.00	1	8.19	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.059	61	>75% Grass cover, Good, HSG B (PR-1, PR-4)
0.022	74	>75% Grass cover, Good, HSG C (PR-2, PR-4, PR-5)
0.203	80	>75% Grass cover, Good, HSG D (PR-1, PR-2, PR-3, PR-4, PR-5)
0.026	98	Paved parking, HSG B (PR-1)
0.045	98	Paved parking, HSG C (PR-5)
0.622	98	Paved parking, HSG D (PR-1, PR-5)
0.346	98	Roofs, HSG D (PR-1, PR-5)
0.057	55	Woods, Good, HSG B (PR-1, PR-4)
0.006	70	Woods, Good, HSG C (PR-2, PR-4)
0.062	77	Woods, Good, HSG D (PR-1, PR-2, PR-3, PR-4)
1.447	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.141	HSG B	PR-1, PR-4
0.074	HSG C	PR-2, PR-4, PR-5
1.232	HSG D	PR-1, PR-2, PR-3, PR-4, PR-5
0.000	Other	
1.447		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.059	0.022	0.203	0.000	0.284	>75% Grass cover, Good	PR-1, PR-2, PR-3, PR-4, PR-5
0.000	0.026	0.045	0.622	0.000	0.693	Paved parking	PR-1, PR-5
0.000	0.000	0.000	0.346	0.000	0.346	Roofs	PR-1, PR-5
0.000	0.057	0.006	0.062	0.000	0.125	Woods, Good	PR-1, PR-2, PR-3, PR-4
0.000	**0.141**	**0.074**	**1.232**	**0.000**	**1.447**	**TOTAL AREA**	

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=0.568 ac 79.29% Impervious Runoff Depth=2.53"
Tc=6.0 min CN=92 Runoff=1.72 cfs 0.120 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.022 ac 0.00% Impervious Runoff Depth=1.41"
Tc=6.0 min CN=78 Runoff=0.04 cfs 0.003 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=0.062 ac 0.00% Impervious Runoff Depth=1.55"
Tc=6.0 min CN=80 Runoff=0.12 cfs 0.008 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.162 ac 0.00% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=71 Runoff=0.19 cfs 0.013 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=27,602 sf 92.84% Impervious Runoff Depth=3.05"
Tc=6.0 min CN=97 Runoff=2.14 cfs 0.161 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.013 af Inflow=0.19 cfs 0.013 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.003 af Inflow=0.04 cfs 0.003 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.008 af Inflow=0.12 cfs 0.008 af
Outflow=0.00 cfs 0.000 af

Pond DET 2: Cultec Detention Chamber Peak Elev=373.43' Storage=2,143 cf Inflow=1.72 cfs 0.120 af
Outflow=0.33 cfs 0.107 af

Pond INFIL 1: Cultec Infiltration Chamber Peak Elev=372.30' Storage=5,600 cf Inflow=2.41 cfs 0.268 af
Discarded=0.10 cfs 0.268 af Primary=0.00 cfs 0.000 af Outflow=0.10 cfs 0.268 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.305 af Average Runoff Depth = 2.53"
28.22% Pervious = 0.408 ac 71.78% Impervious = 1.039 ac

Summary for Subcatchment PR-1: Subcat PR-1

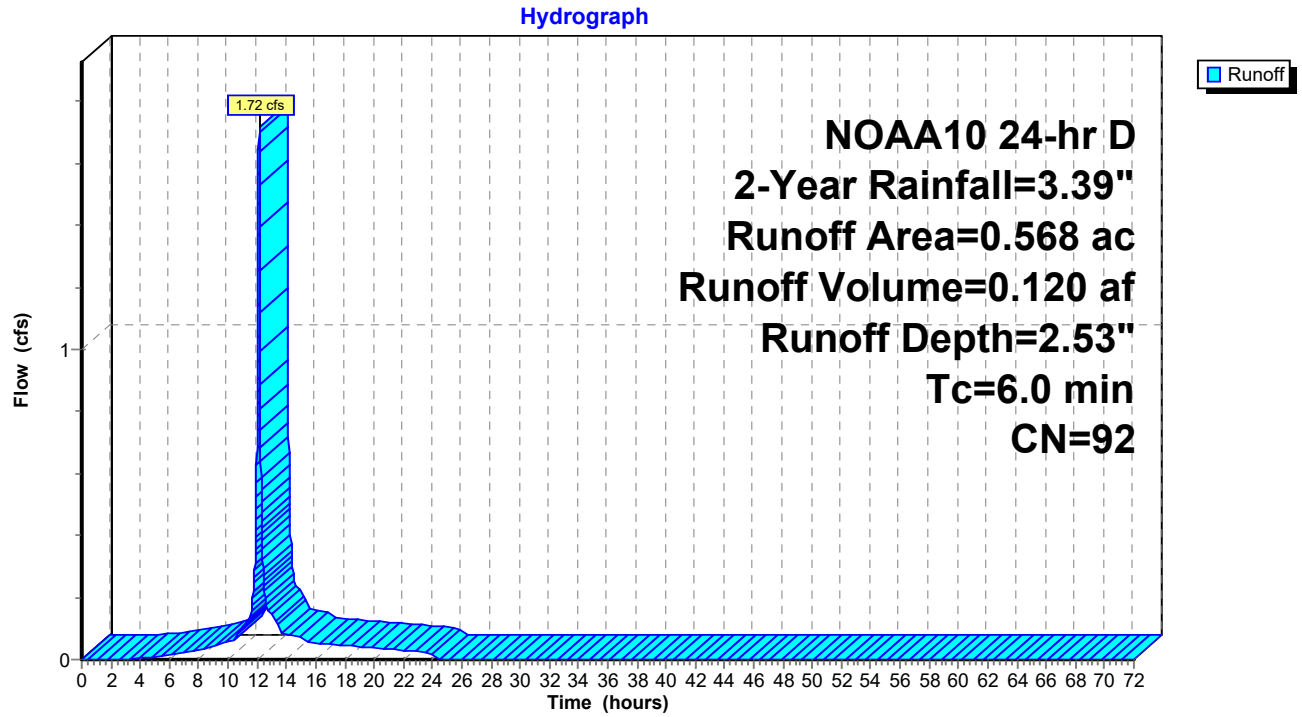
Runoff = 1.72 cfs @ 12.13 hrs, Volume= 0.120 af, Depth= 2.53"
Routed to Pond DET 2 : Cultec Detention Chamber System #2 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (ac)	CN	Description
0.046	61	>75% Grass cover, Good, HSG B
0.053	80	>75% Grass cover, Good, HSG D
0.026	98	Paved parking, HSG B
0.252	98	Paved parking, HSG D
0.173	98	Roofs, HSG D
0.016	55	Woods, Good, HSG B
0.003	77	Woods, Good, HSG D
0.568	92	Weighted Average
0.118		20.71% Pervious Area
0.450		79.29% Impervious Area

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

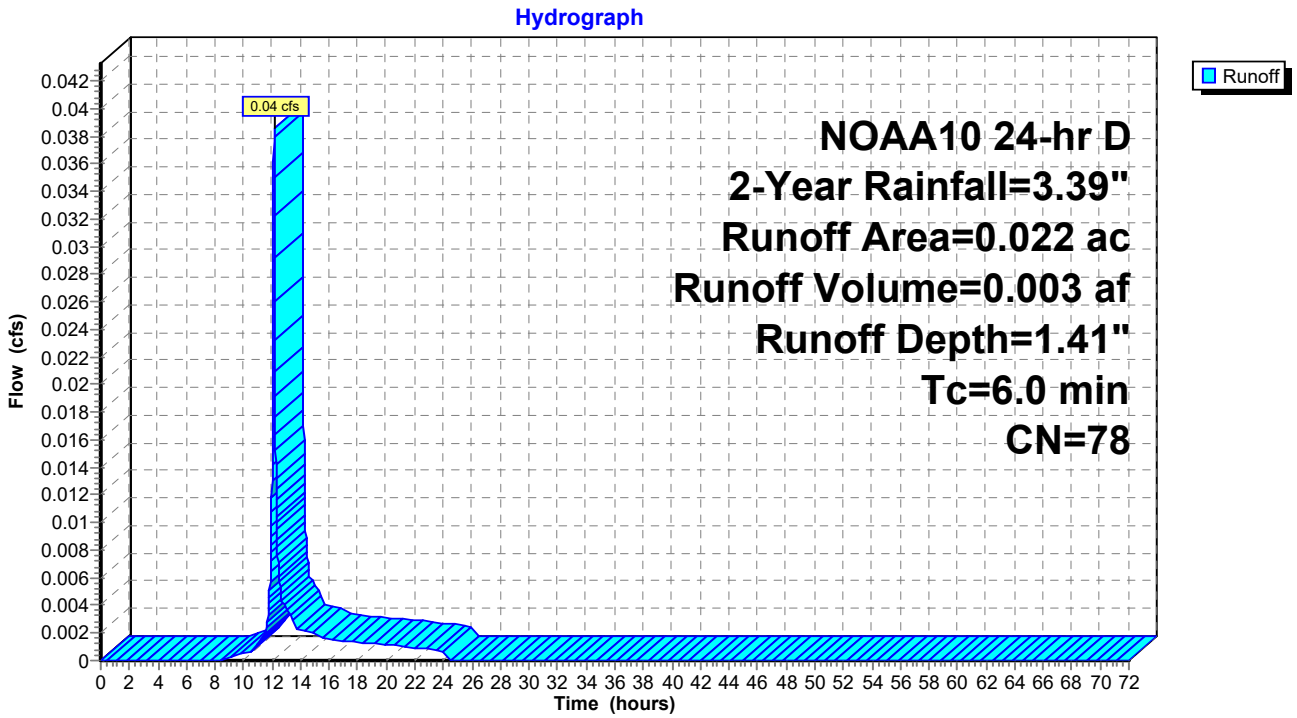
Runoff = 0.04 cfs @ 12.13 hrs, Volume= 0.003 af, Depth= 1.41"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (ac)	CN	Description
0.003	74	>75% Grass cover, Good, HSG C
0.012	80	>75% Grass cover, Good, HSG D
0.001	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.022	78	Weighted Average
0.022		100.00% Pervious Area

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

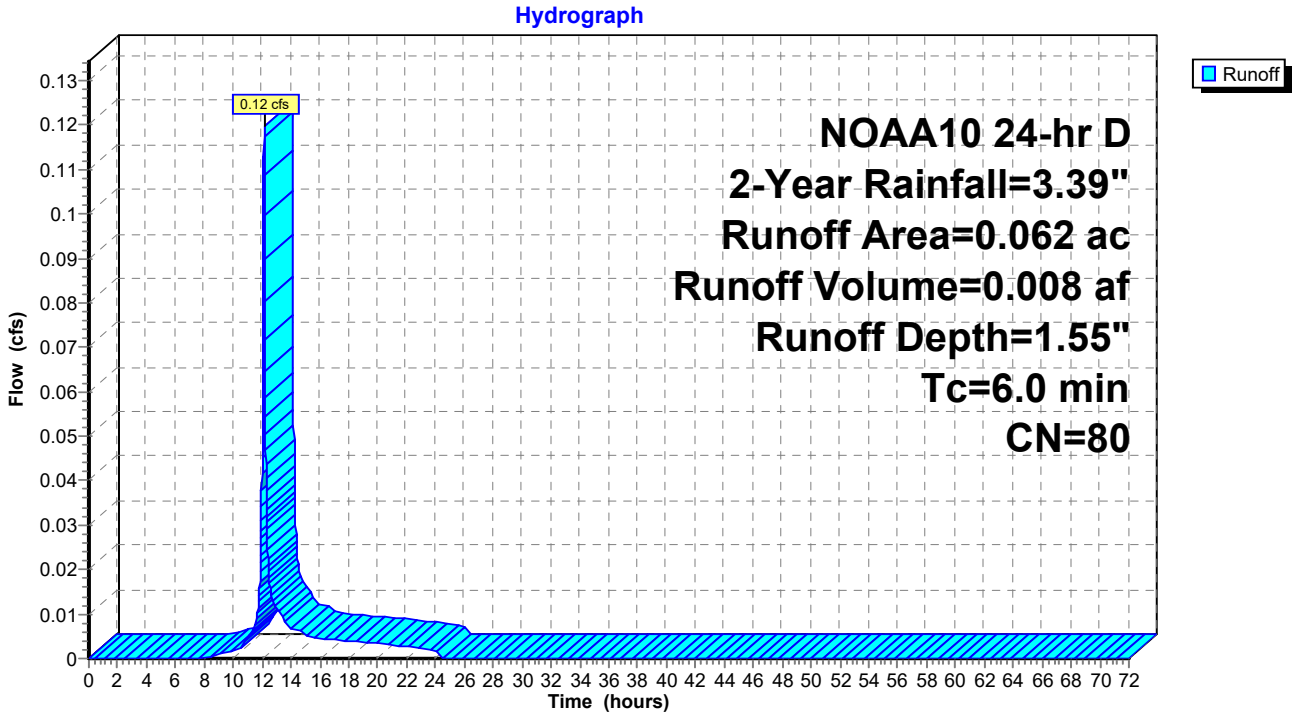
Runoff = 0.12 cfs @ 12.13 hrs, Volume= 0.008 af, Depth= 1.55"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (ac)	CN	Description
0.053	80	>75% Grass cover, Good, HSG D
0.008	77	Woods, Good, HSG D
0.062	80	Weighted Average
0.062		100.00% Pervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

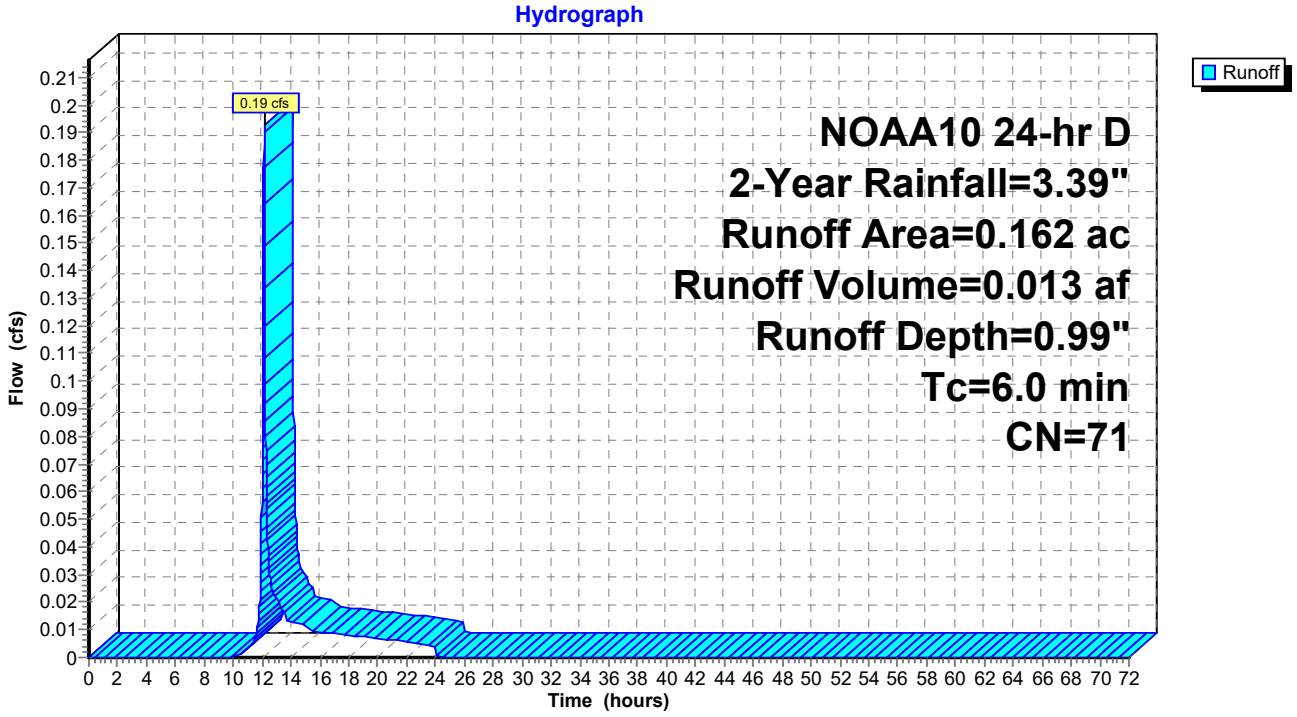
Runoff = 0.19 cfs @ 12.14 hrs, Volume= 0.013 af, Depth= 0.99"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (ac)	CN	Description
0.013	61	>75% Grass cover, Good, HSG B
0.013	74	>75% Grass cover, Good, HSG C
0.045	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.005	70	Woods, Good, HSG C
0.045	77	Woods, Good, HSG D
0.162	71	Weighted Average
0.162		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

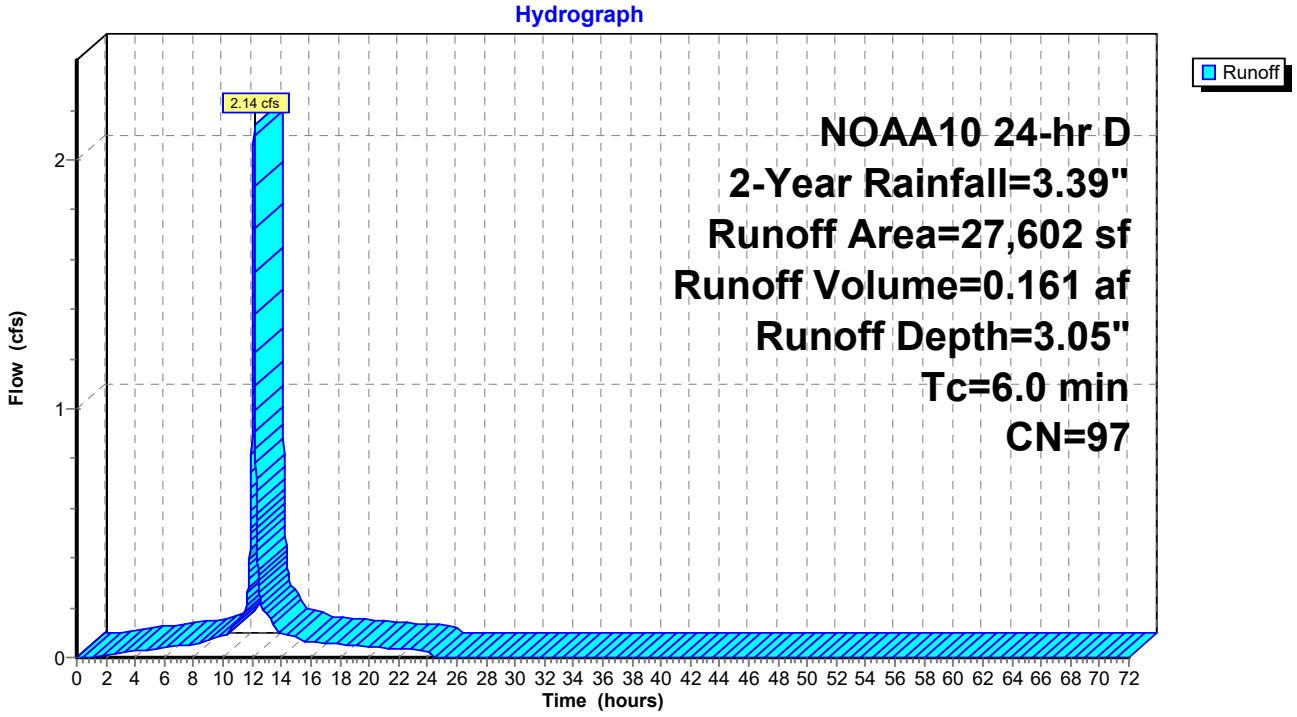
Runoff = 2.14 cfs @ 12.13 hrs, Volume= 0.161 af, Depth= 3.05"
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 2-Year Rainfall=3.39"

Area (sf)	CN	Description
255	74	>75% Grass cover, Good, HSG C
1,721	80	>75% Grass cover, Good, HSG D
1,974	98	Paved parking, HSG C
16,113	98	Paved parking, HSG D
7,539	98	Roofs, HSG D
27,602	97	Weighted Average
1,976		7.16% Pervious Area
25,626		92.84% Impervious Area

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

Subcatchment PR-5: Subcat PR-5



Summary for Pond AP-1: Union Street

Inflow Area = 1.363 ac, 76.19% Impervious, Inflow Depth = 0.12" for 2-Year event
Inflow = 0.19 cfs @ 12.14 hrs, Volume= 0.013 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

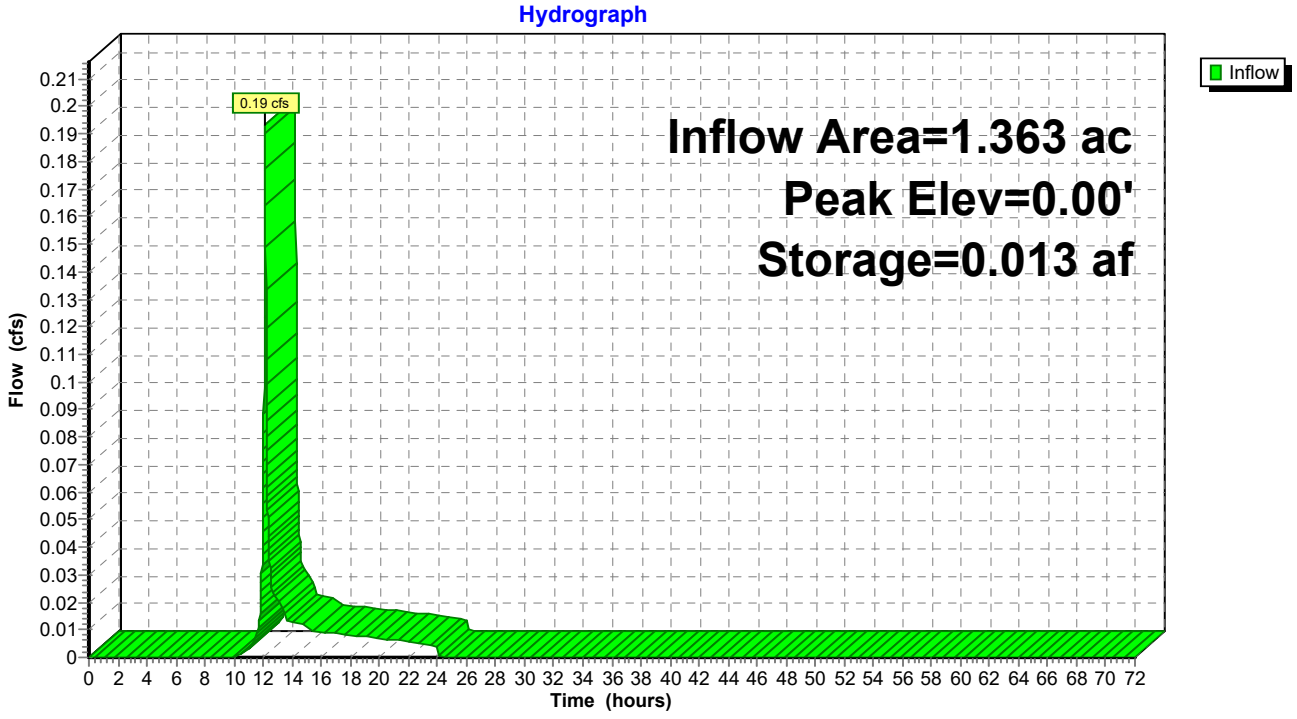
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.013 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.022 ac, 0.00% Impervious, Inflow Depth = 1.41" for 2-Year event
Inflow = 0.04 cfs @ 12.13 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

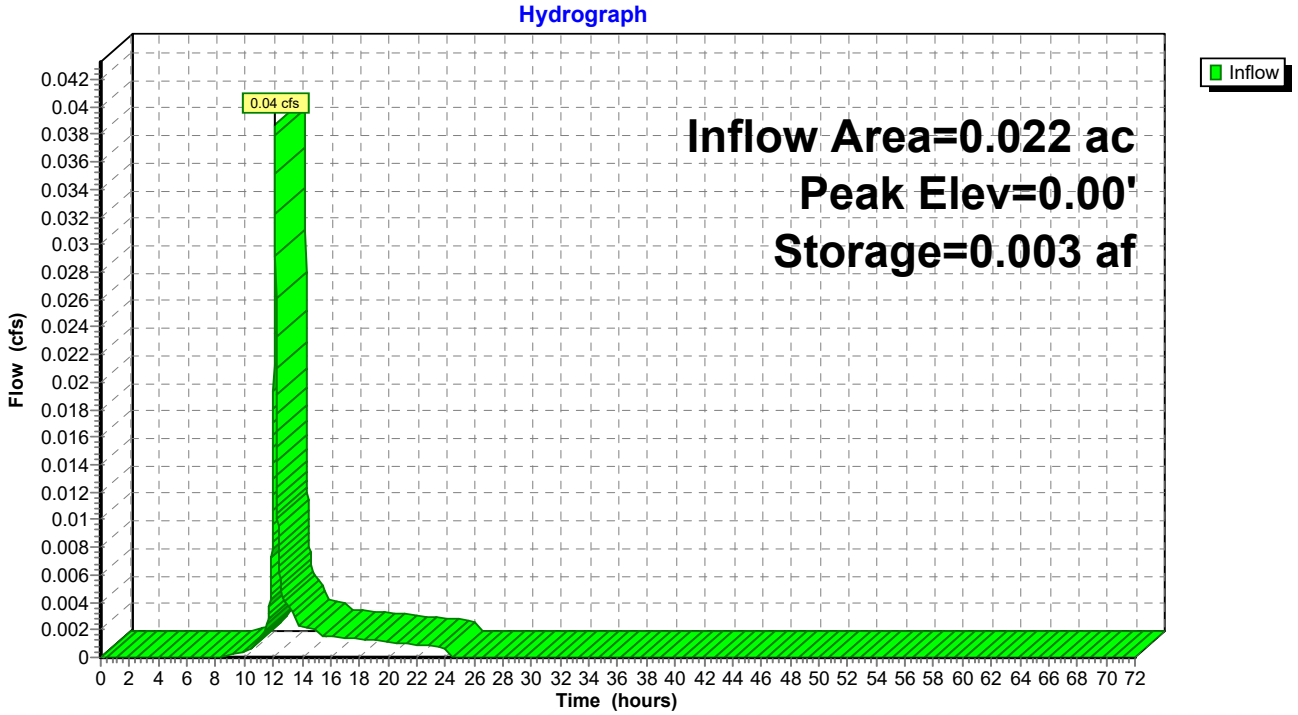
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.003 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.062 ac, 0.00% Impervious, Inflow Depth = 1.55" for 2-Year event
Inflow = 0.12 cfs @ 12.13 hrs, Volume= 0.008 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

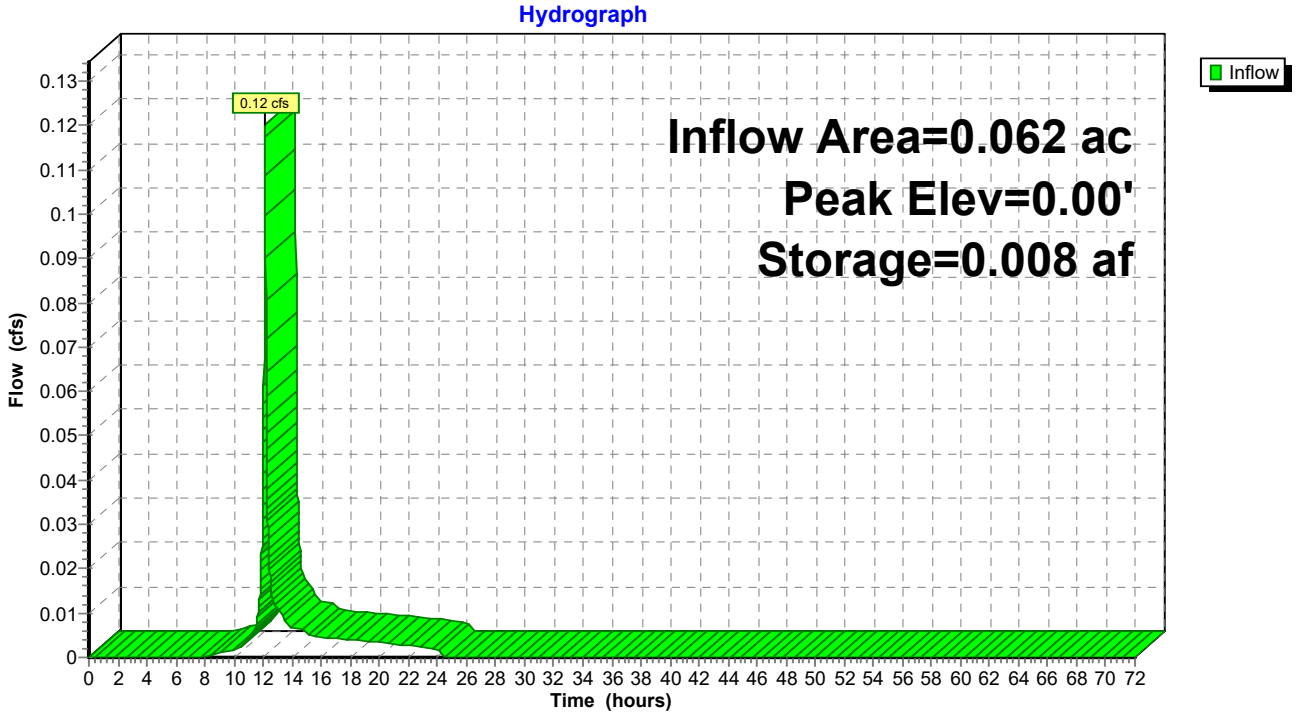
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.008 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Summary for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)

Inflow Area = 0.568 ac, 79.29% Impervious, Inflow Depth = 2.53" for 2-Year event
Inflow = 1.72 cfs @ 12.13 hrs, Volume= 0.120 af
Outflow = 0.33 cfs @ 12.37 hrs, Volume= 0.107 af, Atten= 81%, Lag= 14.5 min
Primary = 0.33 cfs @ 12.37 hrs, Volume= 0.107 af
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.43' @ 12.37 hrs Surf.Area= 2,673 sf Storage= 2,143 cf

Plug-Flow detention time= 190.2 min calculated for 0.107 af (90% of inflow)
Center-of-Mass det. time= 135.1 min (947.2 - 812.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	372.16'	2,508 cf	**32.00'W x 83.52'L x 3.50'H Field A** 9,354 cf Overall - 3,084 cf Embedded = 6,270 cf x 40.0% Voids
#2A	372.66'	3,084 cf	**Cultec R-300HD** x 66 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 66 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
		5,592 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	372.66'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	375.25'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.33 cfs @ 12.37 hrs HW=373.43' TW=371.44' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.33 cfs @ 3.73 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond DET 2: Cultec Detention Chamber System #2 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

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

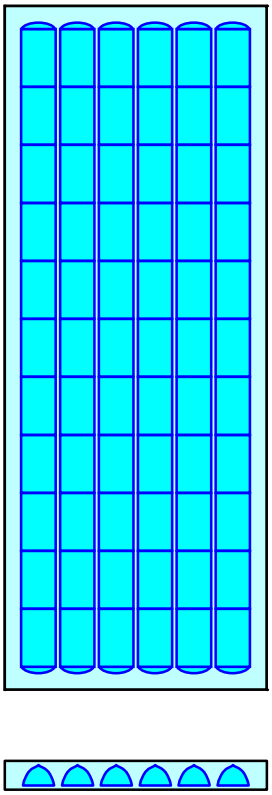
11 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 79.52' Row Length +24.0" End Stone x 2 = 83.52' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 24.0" Side Stone x 2 = 32.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

66 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 3,083.8 cf Chamber Storage

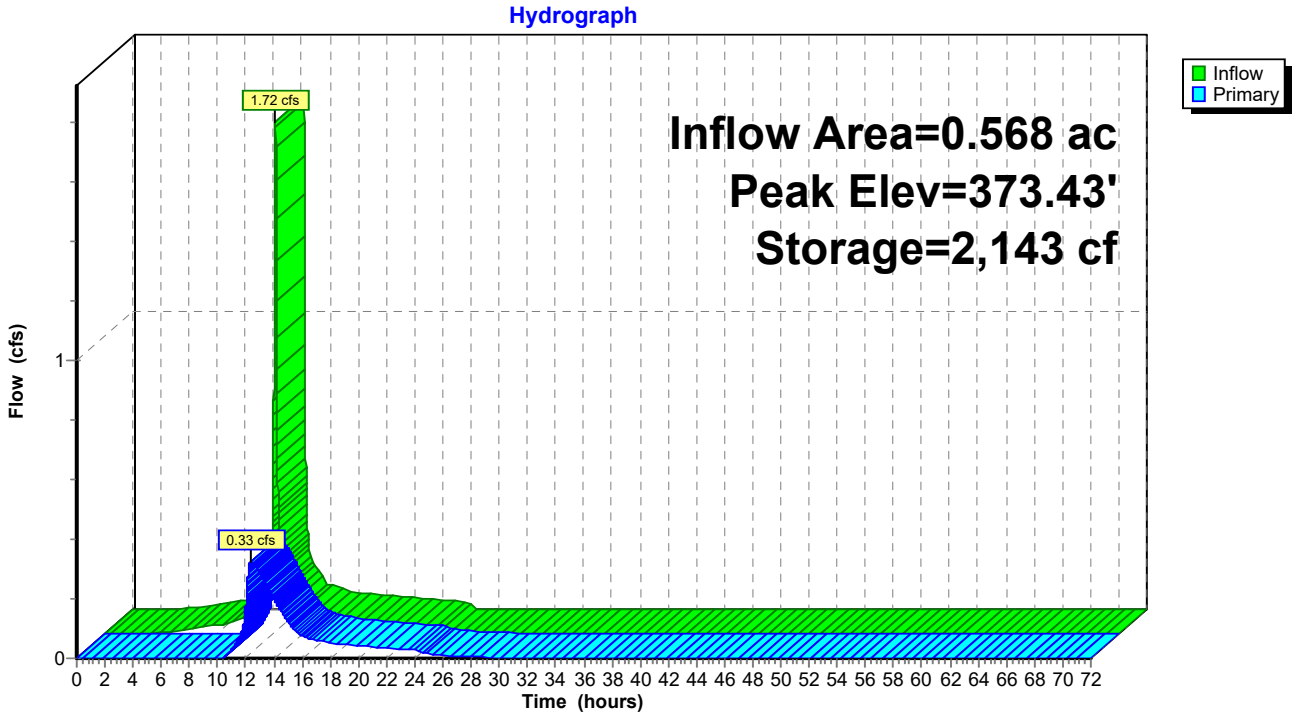
9,353.9 cf Field - 3,083.8 cf Chambers = 6,270.0 cf Stone x 40.0% Voids = 2,508.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,591.8 cf = 0.128 af
Overall Storage Efficiency = 59.8%
Overall System Size = 83.52' x 32.00' x 3.50'

66 Chambers
346.4 cy Field
232.2 cy Stone



Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)



Summary for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)

Inflow Area = 1.202 ac, 86.44% Impervious, Inflow Depth = 2.68" for 2-Year event
Inflow = 2.41 cfs @ 12.13 hrs, Volume= 0.268 af
Outflow = 0.10 cfs @ 10.91 hrs, Volume= 0.268 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.10 cfs @ 10.91 hrs, Volume= 0.268 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond AP-1 : Union Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 372.30' @ 18.34 hrs Surf.Area= 4,371 sf Storage= 5,600 cf

Plug-Flow detention time= 508.1 min calculated for 0.268 af (100% of inflow)
Center-of-Mass det. time= 508.1 min (1,349.6 - 841.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	370.40'	4,033 cf	**36.75'W x 118.93'L x 3.50'H Field A** 15,298 cf Overall - 5,216 cf Embedded = 10,082 cf x 40.0% Voids
#2A	370.90'	5,216 cf	**Cultec R-300HD** x 112 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 112 Chambers in 7 Rows Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf
		9,249 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	370.40'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	373.10'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.10 cfs @ 10.91 hrs HW=370.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=370.40' TW=0.00' (Dynamic Tailwater)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf

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

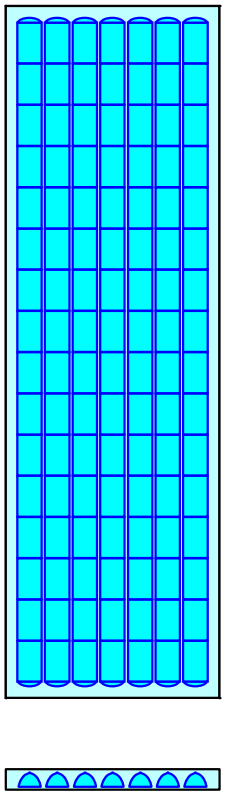
16 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 114.93' Row Length +24.0" End Stone x 2 = 118.93' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 24.0" Side Stone x 2 = 36.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

112 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 7 Rows = 5,216.3 cf Chamber Storage

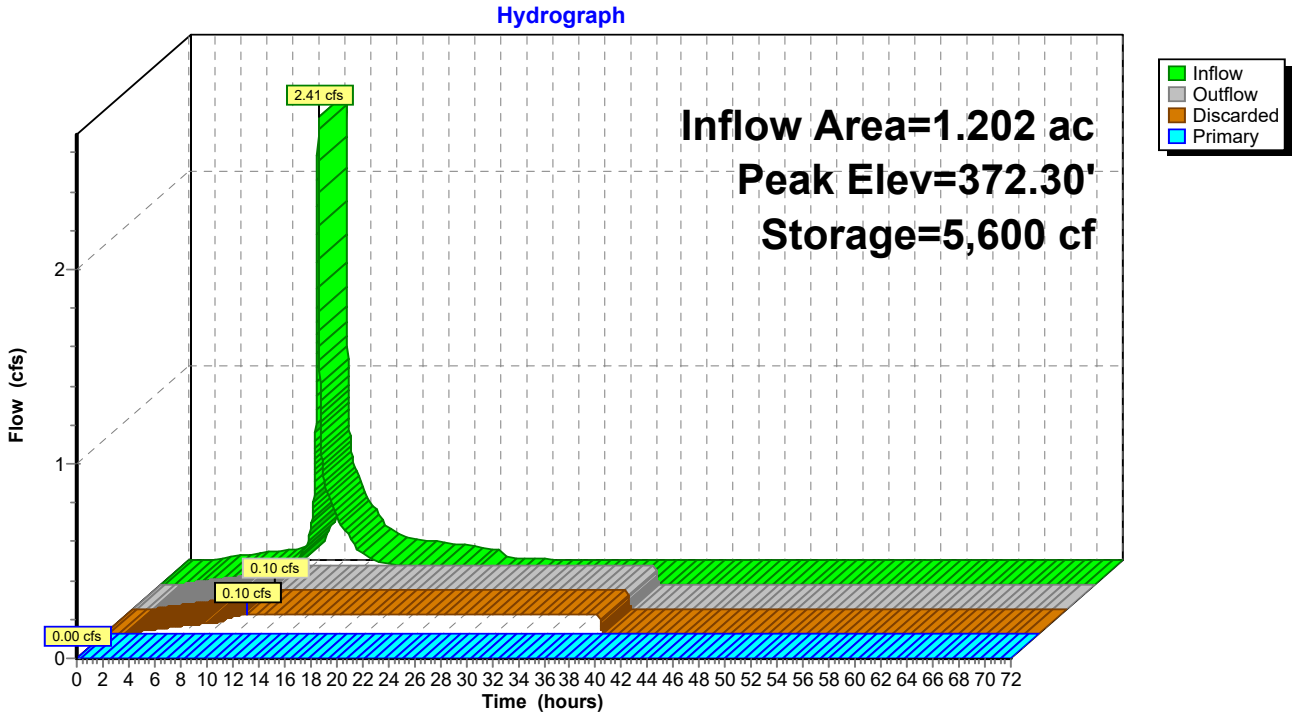
15,297.8 cf Field - 5,216.3 cf Chambers = 10,081.5 cf Stone x 40.0% Voids = 4,032.6 cf Stone Storage

Chamber Storage + Stone Storage = 9,248.9 cf = 0.212 af
Overall Storage Efficiency = 60.5%
Overall System Size = 118.93' x 36.75' x 3.50'

112 Chambers
566.6 cy Field
373.4 cy Stone



Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=0.568 ac 79.29% Impervious Runoff Depth=4.33"
Tc=6.0 min CN=92 Runoff=2.85 cfs 0.205 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.022 ac 0.00% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=78 Runoff=0.08 cfs 0.005 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=0.062 ac 0.00% Impervious Runoff Depth=3.11"
Tc=6.0 min CN=80 Runoff=0.24 cfs 0.016 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.162 ac 0.00% Impervious Runoff Depth=2.31"
Tc=6.0 min CN=71 Runoff=0.47 cfs 0.031 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=27,602 sf 92.84% Impervious Runoff Depth=4.90"
Tc=6.0 min CN=97 Runoff=3.36 cfs 0.259 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.116 af Inflow=0.47 cfs 0.116 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.005 af Inflow=0.08 cfs 0.005 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.016 af Inflow=0.24 cfs 0.016 af
Outflow=0.00 cfs 0.000 af

Pond DET 2: Cultec Detention Chamber Peak Elev=374.03' Storage=3,323 cf Inflow=2.85 cfs 0.205 af
Outflow=0.46 cfs 0.193 af

Pond INFIL 1: Cultec Infiltration Chamber Peak Elev=373.20' Storage=8,012 cf Inflow=3.74 cfs 0.451 af
Discarded=0.10 cfs 0.366 af Primary=0.35 cfs 0.085 af Outflow=0.45 cfs 0.451 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.516 af Average Runoff Depth = 4.28"
28.22% Pervious = 0.408 ac 71.78% Impervious = 1.039 ac

Summary for Subcatchment PR-1: Subcat PR-1

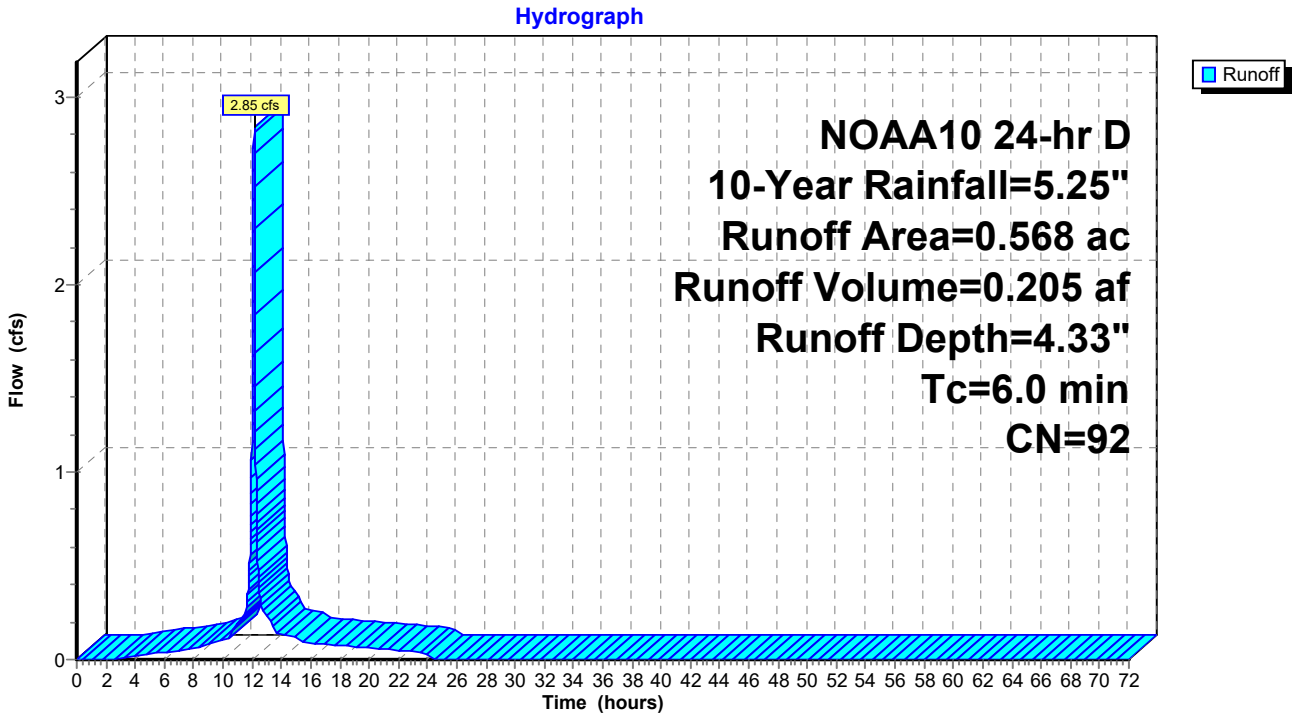
Runoff = 2.85 cfs @ 12.13 hrs, Volume= 0.205 af, Depth= 4.33"
Routed to Pond DET 2 : Cultec Detention Chamber System #2 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (ac)	CN	Description
0.046	61	>75% Grass cover, Good, HSG B
0.053	80	>75% Grass cover, Good, HSG D
0.026	98	Paved parking, HSG B
0.252	98	Paved parking, HSG D
0.173	98	Roofs, HSG D
0.016	55	Woods, Good, HSG B
0.003	77	Woods, Good, HSG D
0.568	92	Weighted Average
0.118		20.71% Pervious Area
0.450		79.29% Impervious Area

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

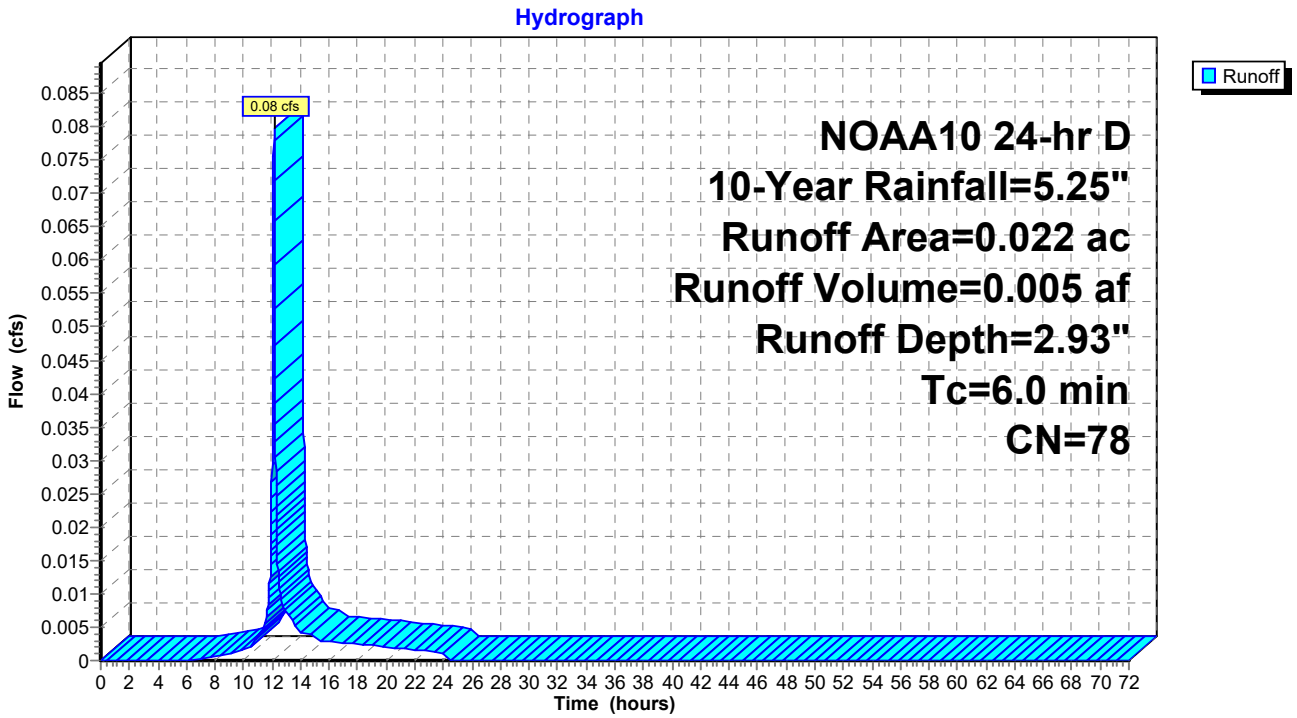
Runoff = 0.08 cfs @ 12.13 hrs, Volume= 0.005 af, Depth= 2.93"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (ac)	CN	Description
0.003	74	>75% Grass cover, Good, HSG C
0.012	80	>75% Grass cover, Good, HSG D
0.001	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.022	78	Weighted Average
0.022		100.00% Pervious Area

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

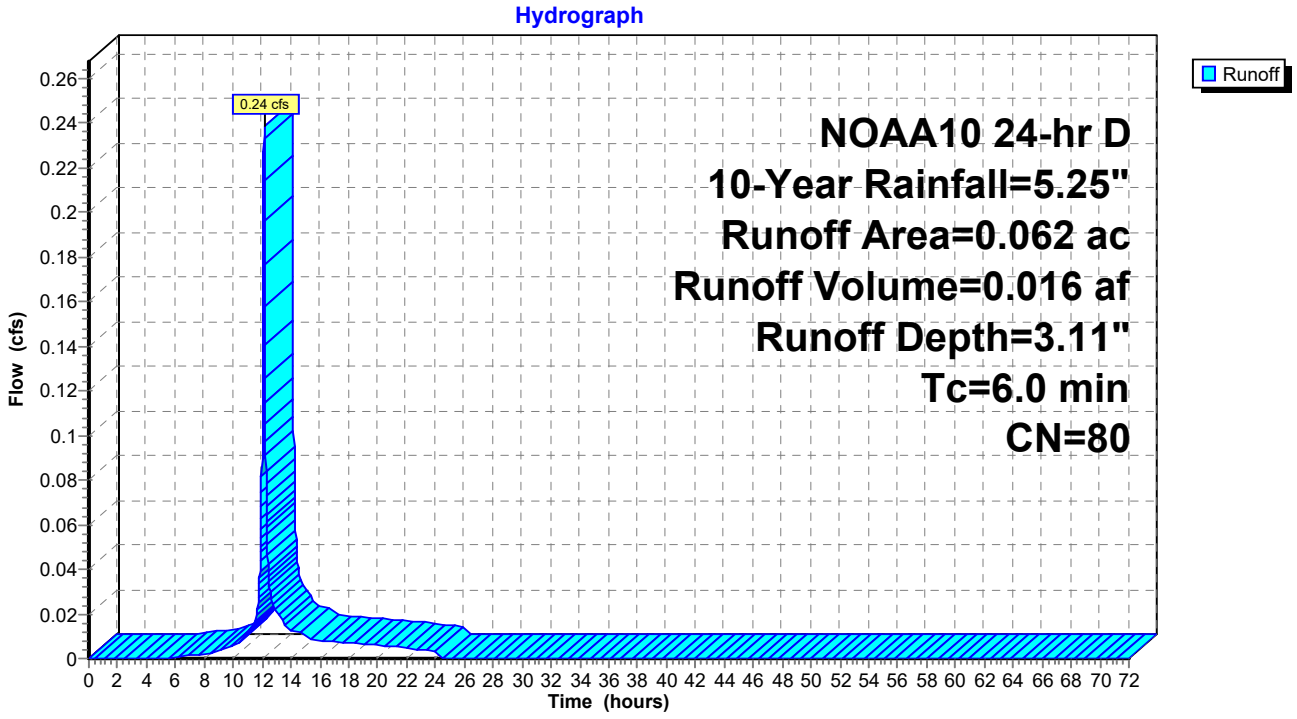
Runoff = 0.24 cfs @ 12.13 hrs, Volume= 0.016 af, Depth= 3.11"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (ac)	CN	Description
0.053	80	>75% Grass cover, Good, HSG D
0.008	77	Woods, Good, HSG D
0.062	80	Weighted Average
0.062		100.00% Pervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

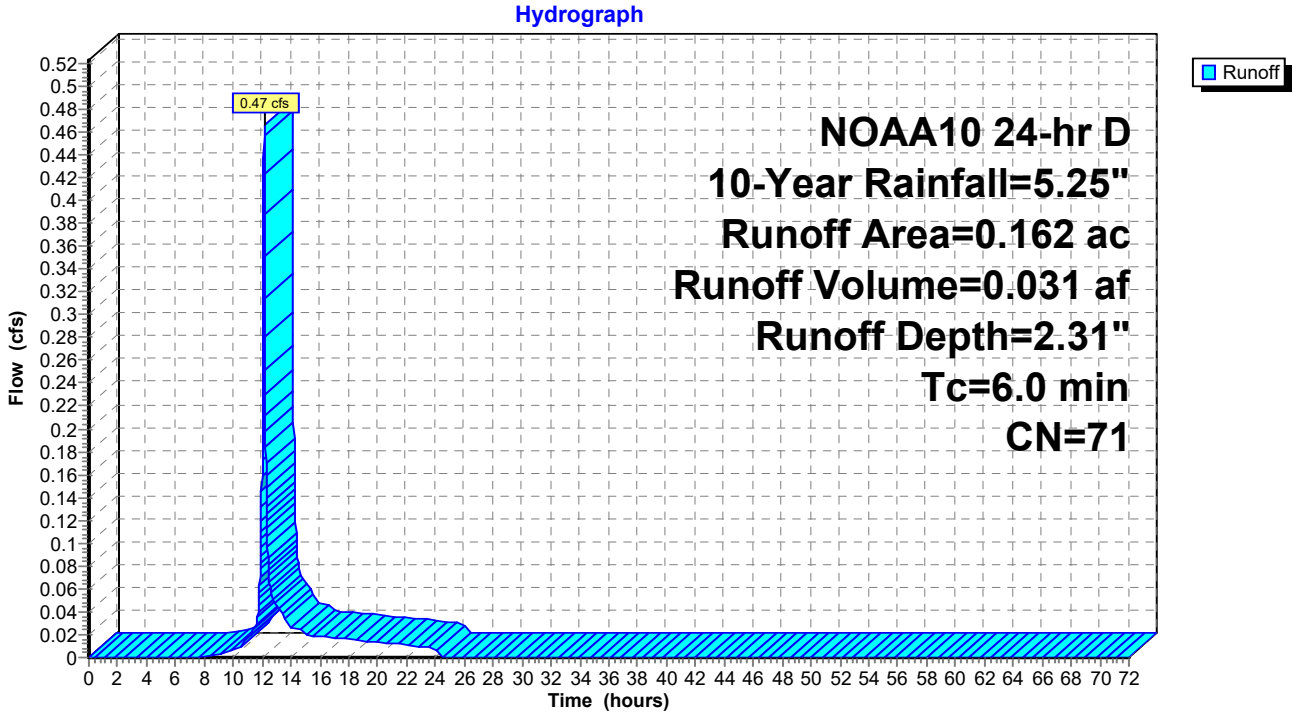
Runoff = 0.47 cfs @ 12.13 hrs, Volume= 0.031 af, Depth= 2.31"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (ac)	CN	Description
0.013	61	>75% Grass cover, Good, HSG B
0.013	74	>75% Grass cover, Good, HSG C
0.045	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.005	70	Woods, Good, HSG C
0.045	77	Woods, Good, HSG D
0.162	71	Weighted Average
0.162		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

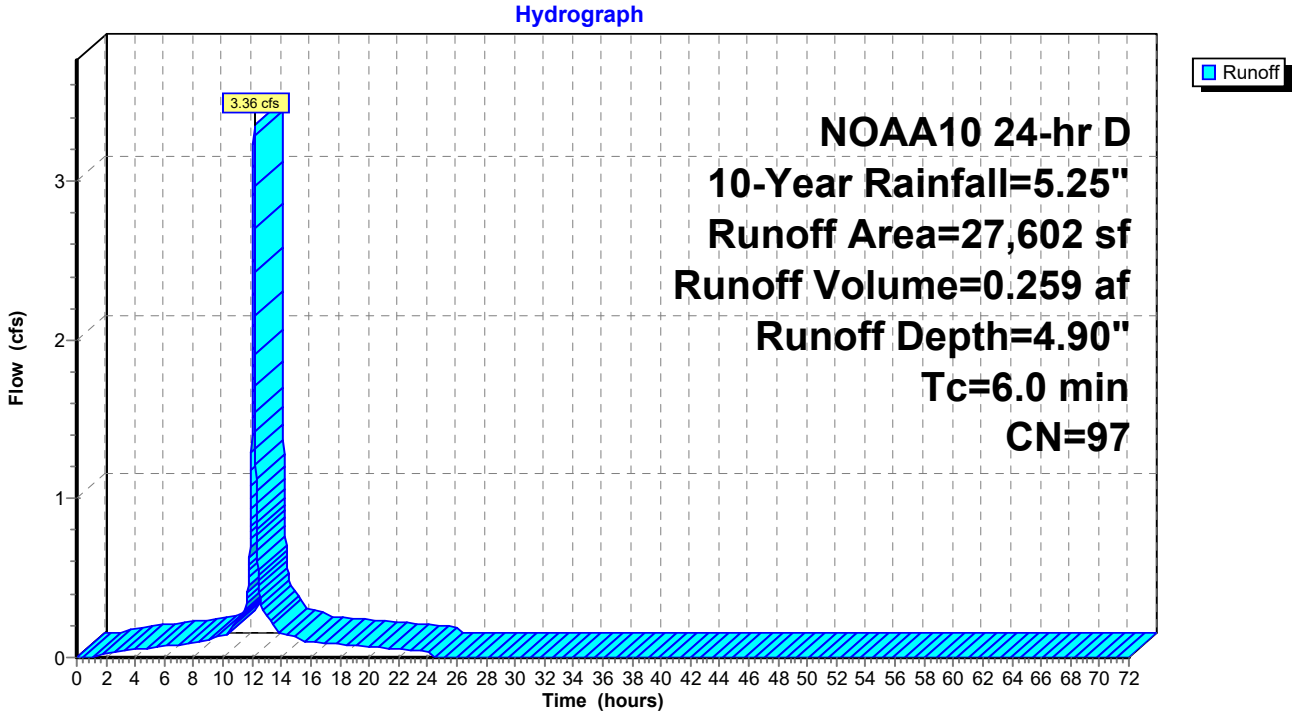
Runoff = 3.36 cfs @ 12.13 hrs, Volume= 0.259 af, Depth= 4.90"
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 10-Year Rainfall=5.25"

Area (sf)	CN	Description
255	74	>75% Grass cover, Good, HSG C
1,721	80	>75% Grass cover, Good, HSG D
1,974	98	Paved parking, HSG C
16,113	98	Paved parking, HSG D
7,539	98	Roofs, HSG D
27,602	97	Weighted Average
1,976		7.16% Pervious Area
25,626		92.84% Impervious Area

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

Subcatchment PR-5: Subcat PR-5



Summary for Pond AP-1: Union Street

Inflow Area = 1.363 ac, 76.19% Impervious, Inflow Depth = 1.02" for 10-Year event
Inflow = 0.47 cfs @ 12.13 hrs, Volume= 0.116 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

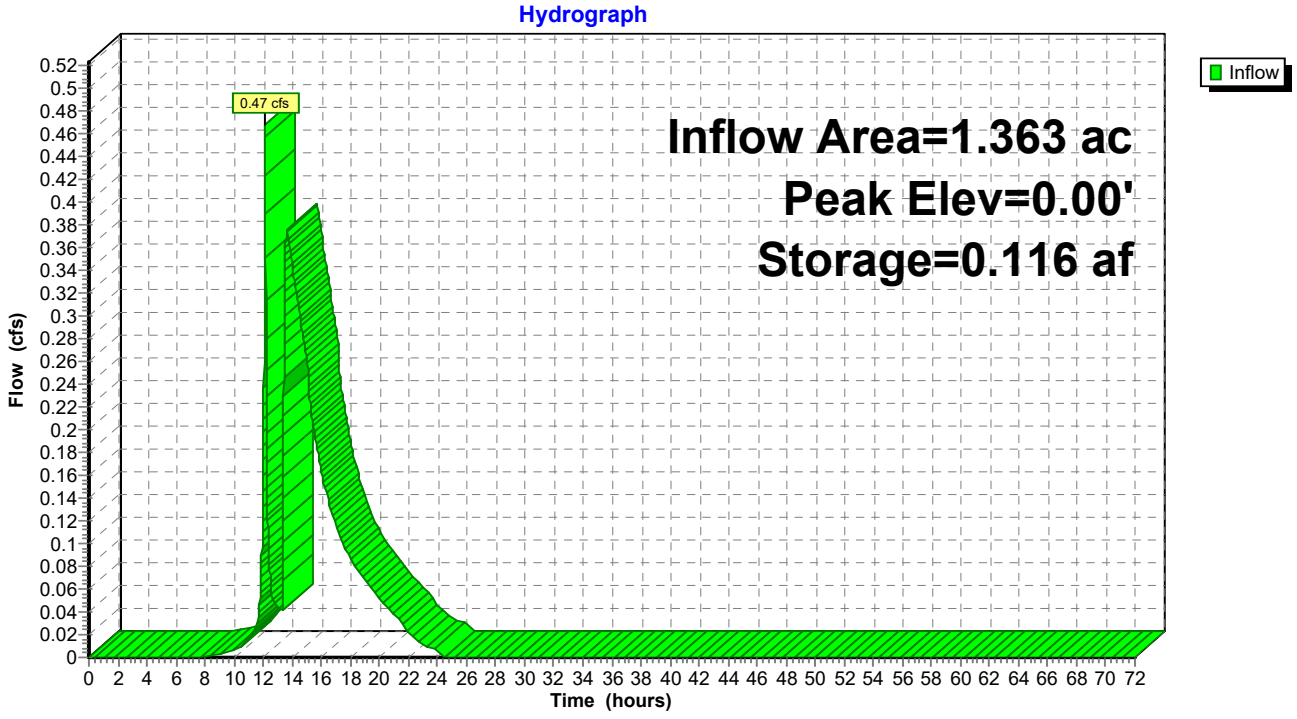
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.116 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.022 ac, 0.00% Impervious, Inflow Depth = 2.93" for 10-Year event
Inflow = 0.08 cfs @ 12.13 hrs, Volume= 0.005 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

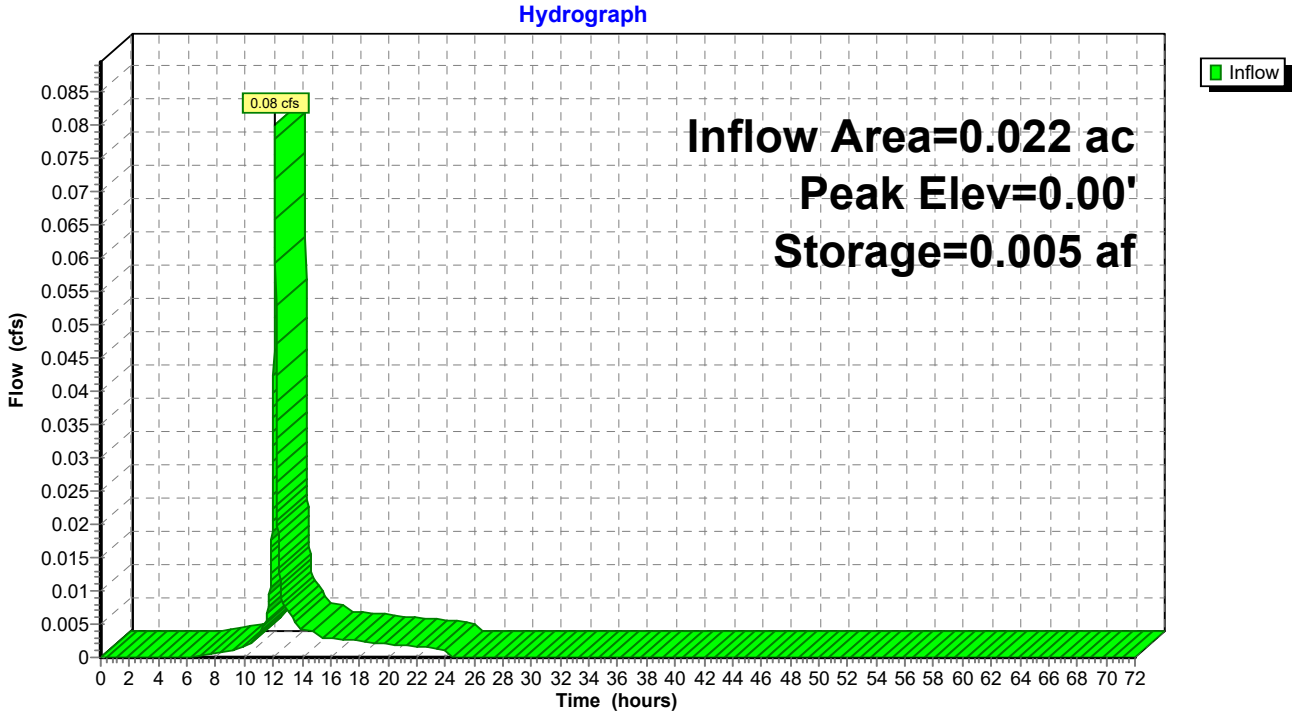
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.005 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.062 ac, 0.00% Impervious, Inflow Depth = 3.11" for 10-Year event
Inflow = 0.24 cfs @ 12.13 hrs, Volume= 0.016 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

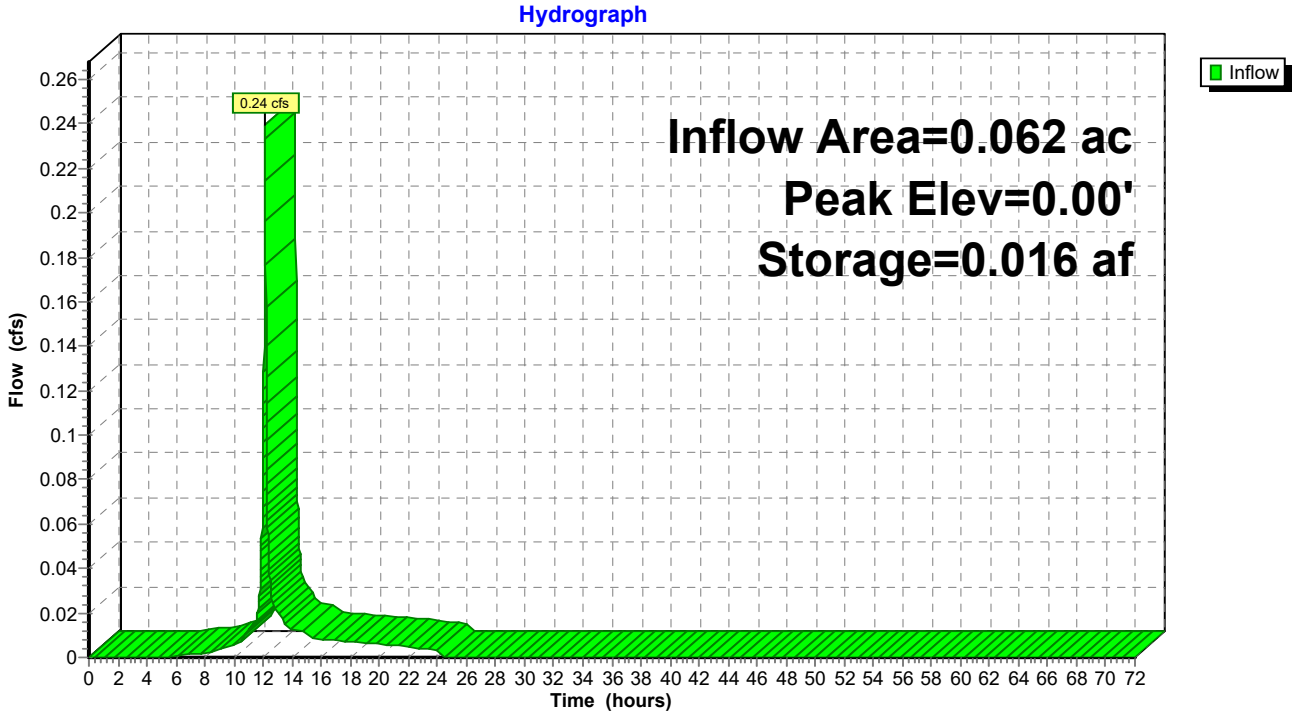
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.016 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Summary for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)

Inflow Area = 0.568 ac, 79.29% Impervious, Inflow Depth = 4.33" for 10-Year event
Inflow = 2.85 cfs @ 12.13 hrs, Volume= 0.205 af
Outflow = 0.46 cfs @ 12.40 hrs, Volume= 0.193 af, Atten= 84%, Lag= 16.4 min
Primary = 0.46 cfs @ 12.40 hrs, Volume= 0.193 af
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 374.03' @ 12.40 hrs Surf.Area= 2,673 sf Storage= 3,323 cf

Plug-Flow detention time= 217.0 min calculated for 0.193 af (94% of inflow)
Center-of-Mass det. time= 181.5 min (974.0 - 792.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	372.16'	2,508 cf	**32.00'W x 83.52'L x 3.50'H Field A** 9,354 cf Overall - 3,084 cf Embedded = 6,270 cf x 40.0% Voids
#2A	372.66'	3,084 cf	**Cultec R-300HD** x 66 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 66 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
		5,592 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	372.66'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	375.25'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.46 cfs @ 12.40 hrs HW=374.03' TW=372.35' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.46 cfs @ 5.29 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond DET 2: Cultec Detention Chamber System #2 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

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

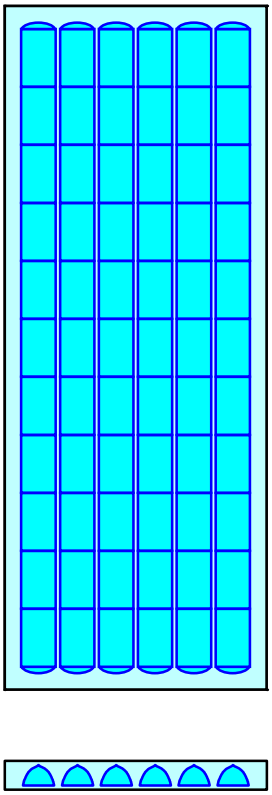
11 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 79.52' Row Length +24.0" End Stone x 2 = 83.52' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 24.0" Side Stone x 2 = 32.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

66 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 3,083.8 cf Chamber Storage

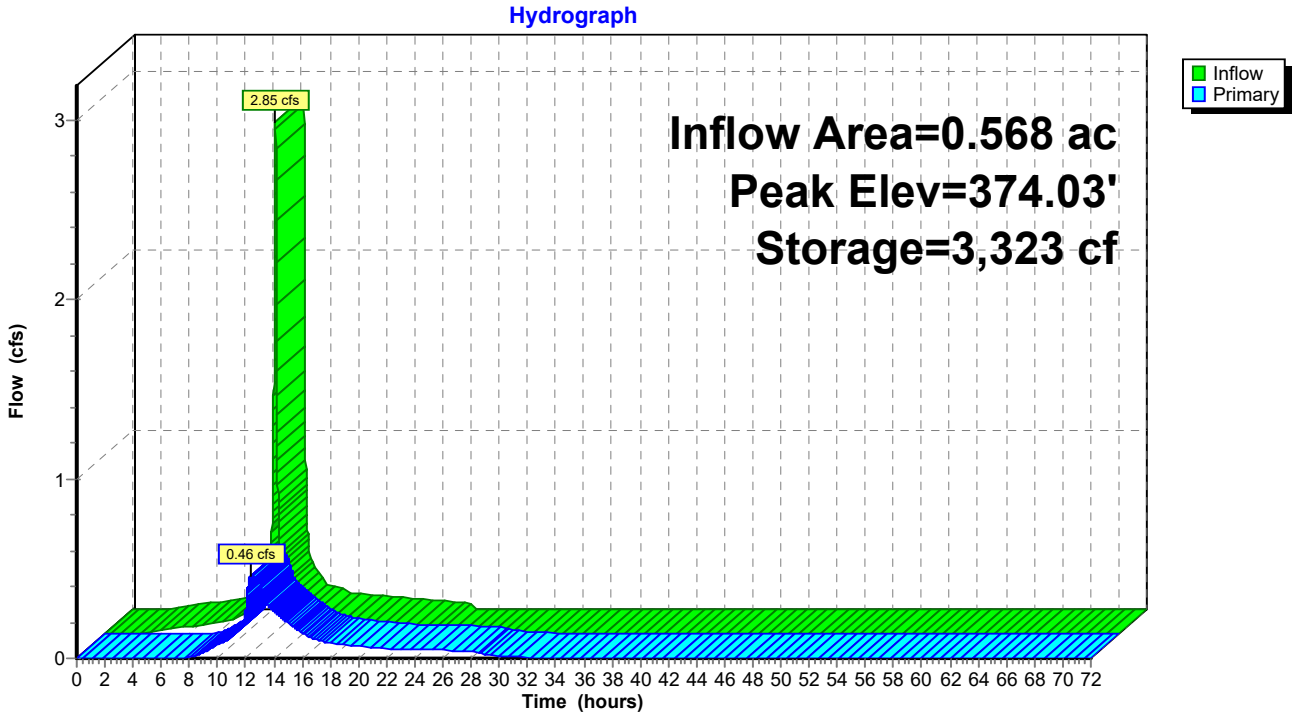
9,353.9 cf Field - 3,083.8 cf Chambers = 6,270.0 cf Stone x 40.0% Voids = 2,508.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,591.8 cf = 0.128 af
Overall Storage Efficiency = 59.8%
Overall System Size = 83.52' x 32.00' x 3.50'

66 Chambers
346.4 cy Field
232.2 cy Stone



Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)



Summary for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)

Inflow Area = 1.202 ac, 86.44% Impervious, Inflow Depth = 4.51" for 10-Year event
Inflow = 3.74 cfs @ 12.13 hrs, Volume= 0.451 af
Outflow = 0.45 cfs @ 13.64 hrs, Volume= 0.451 af, Atten= 88%, Lag= 90.3 min
Discarded = 0.10 cfs @ 9.05 hrs, Volume= 0.366 af
Primary = 0.35 cfs @ 13.64 hrs, Volume= 0.085 af
Routed to Pond AP-1 : Union Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.20' @ 13.64 hrs Surf.Area= 4,371 sf Storage= 8,012 cf

Plug-Flow detention time= 590.1 min calculated for 0.451 af (100% of inflow)
Center-of-Mass det. time= 590.0 min (1,440.6 - 850.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	370.40'	4,033 cf	**36.75'W x 118.93'L x 3.50'H Field A** 15,298 cf Overall - 5,216 cf Embedded = 10,082 cf x 40.0% Voids
#2A	370.90'	5,216 cf	**Cultec R-300HD** x 112 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 112 Chambers in 7 Rows Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf
		9,249 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	370.40'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	373.10'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.10 cfs @ 9.05 hrs HW=370.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.35 cfs @ 13.64 hrs HW=373.20' TW=0.00' (Dynamic Tailwater)
↑**2=Orifice/Grate** (Weir Controls 0.35 cfs @ 1.06 fps)

Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf

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

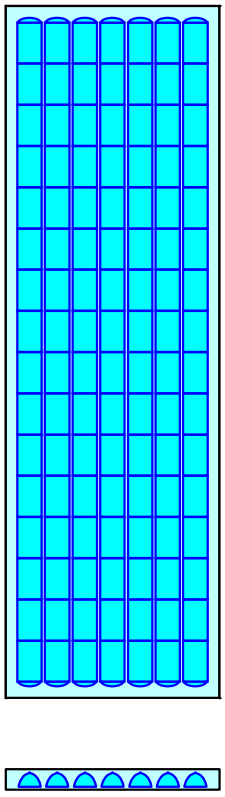
16 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 114.93' Row Length +24.0" End Stone x 2 = 118.93' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 24.0" Side Stone x 2 = 36.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

112 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 7 Rows = 5,216.3 cf Chamber Storage

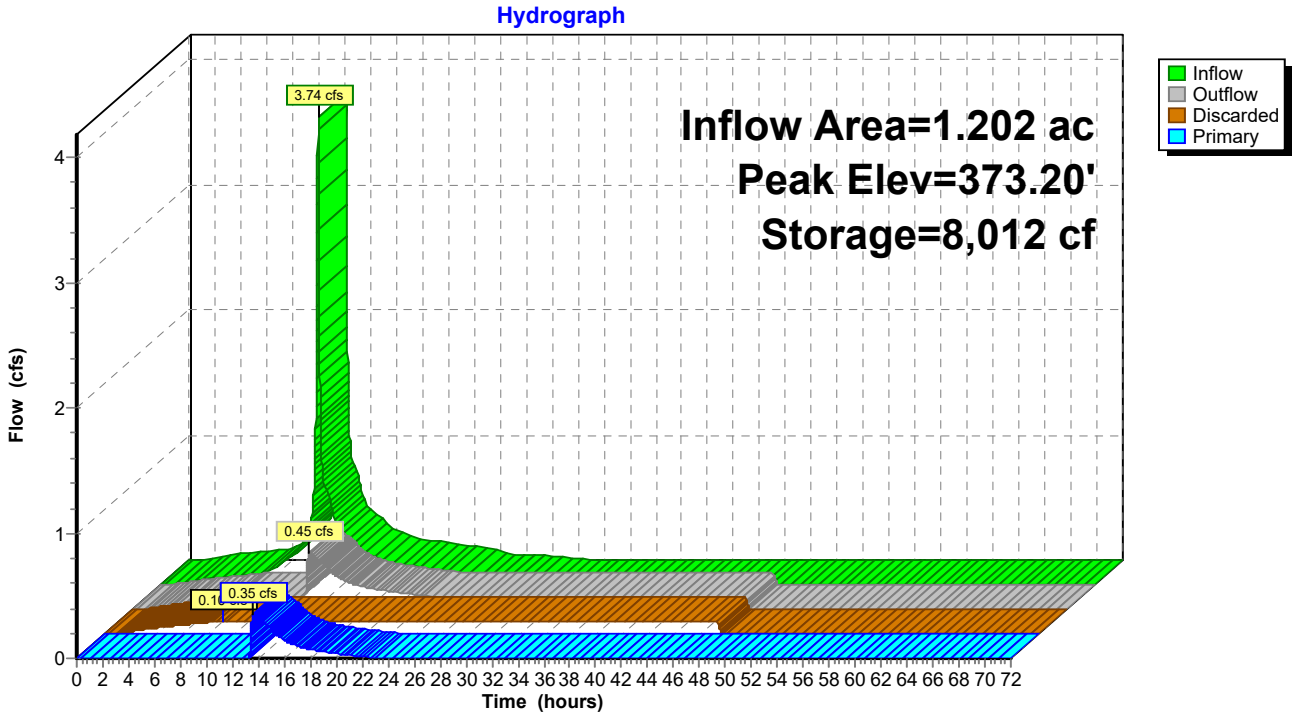
15,297.8 cf Field - 5,216.3 cf Chambers = 10,081.5 cf Stone x 40.0% Voids = 4,032.6 cf Stone Storage

Chamber Storage + Stone Storage = 9,248.9 cf = 0.212 af
Overall Storage Efficiency = 60.5%
Overall System Size = 118.93' x 36.75' x 3.50'

112 Chambers
566.6 cy Field
373.4 cy Stone



Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=0.568 ac 79.29% Impervious Runoff Depth=5.47"
Tc=6.0 min CN=92 Runoff=3.55 cfs 0.259 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.022 ac 0.00% Impervious Runoff Depth=3.94"
Tc=6.0 min CN=78 Runoff=0.11 cfs 0.007 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=0.062 ac 0.00% Impervious Runoff Depth=4.15"
Tc=6.0 min CN=80 Runoff=0.32 cfs 0.021 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.162 ac 0.00% Impervious Runoff Depth=3.23"
Tc=6.0 min CN=71 Runoff=0.65 cfs 0.044 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=27,602 sf 92.84% Impervious Runoff Depth=6.05"
Tc=6.0 min CN=97 Runoff=4.12 cfs 0.320 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.232 af Inflow=0.79 cfs 0.232 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.007 af Inflow=0.11 cfs 0.007 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.021 af Inflow=0.32 cfs 0.021 af
Outflow=0.00 cfs 0.000 af

Pond DET 2: Cultec Detention Chamber Peak Elev=374.46' Storage=4,091 cf Inflow=3.55 cfs 0.259 af
Outflow=0.53 cfs 0.247 af

Pond INFIL 1: Cultec Infiltration Chamber Peak Elev=373.27' Storage=8,138 cf Inflow=4.55 cfs 0.566 af
Discarded=0.10 cfs 0.377 af Primary=0.72 cfs 0.189 af Outflow=0.82 cfs 0.566 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.651 af Average Runoff Depth = 5.40"
28.22% Pervious = 0.408 ac 71.78% Impervious = 1.039 ac

Summary for Subcatchment PR-1: Subcat PR-1

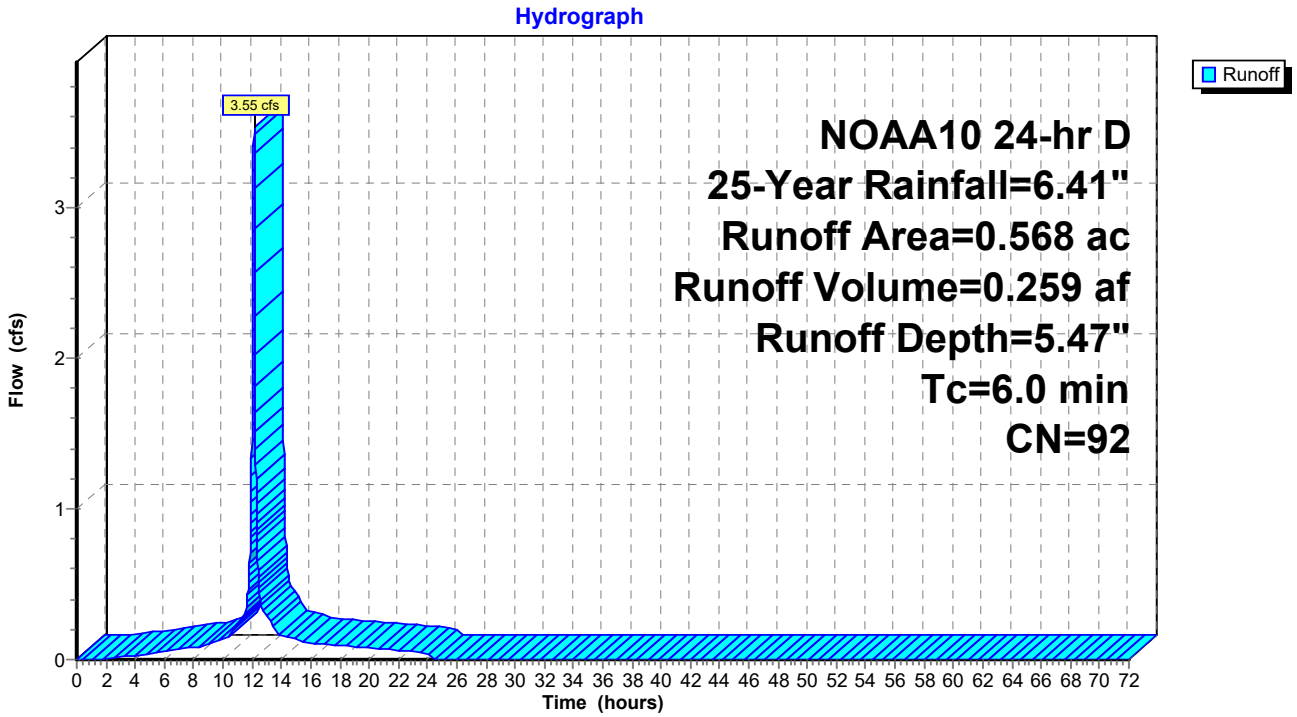
Runoff = 3.55 cfs @ 12.13 hrs, Volume= 0.259 af, Depth= 5.47"
Routed to Pond DET 2 : Cultec Detention Chamber System #2 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (ac)	CN	Description
0.046	61	>75% Grass cover, Good, HSG B
0.053	80	>75% Grass cover, Good, HSG D
0.026	98	Paved parking, HSG B
0.252	98	Paved parking, HSG D
0.173	98	Roofs, HSG D
0.016	55	Woods, Good, HSG B
0.003	77	Woods, Good, HSG D
0.568	92	Weighted Average
0.118		20.71% Pervious Area
0.450		79.29% Impervious Area

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

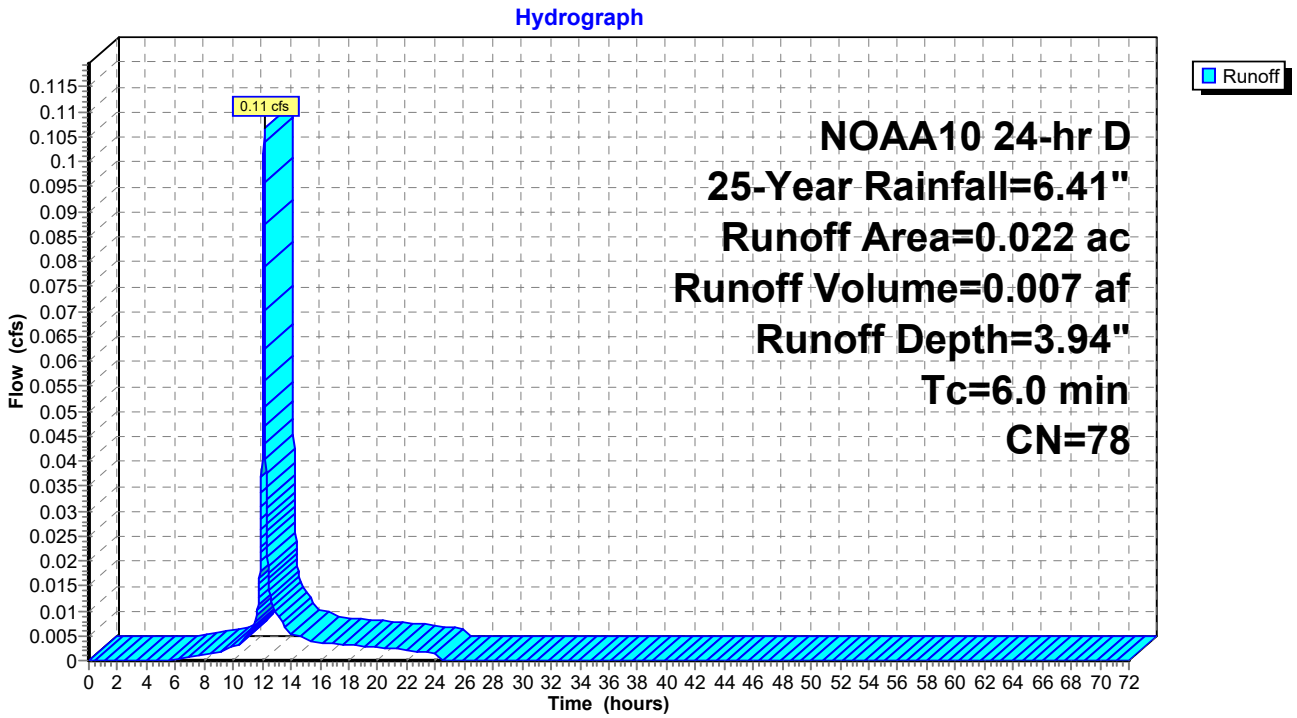
Runoff = 0.11 cfs @ 12.13 hrs, Volume= 0.007 af, Depth= 3.94"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (ac)	CN	Description
0.003	74	>75% Grass cover, Good, HSG C
0.012	80	>75% Grass cover, Good, HSG D
0.001	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.022	78	Weighted Average
0.022		100.00% Pervious Area

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

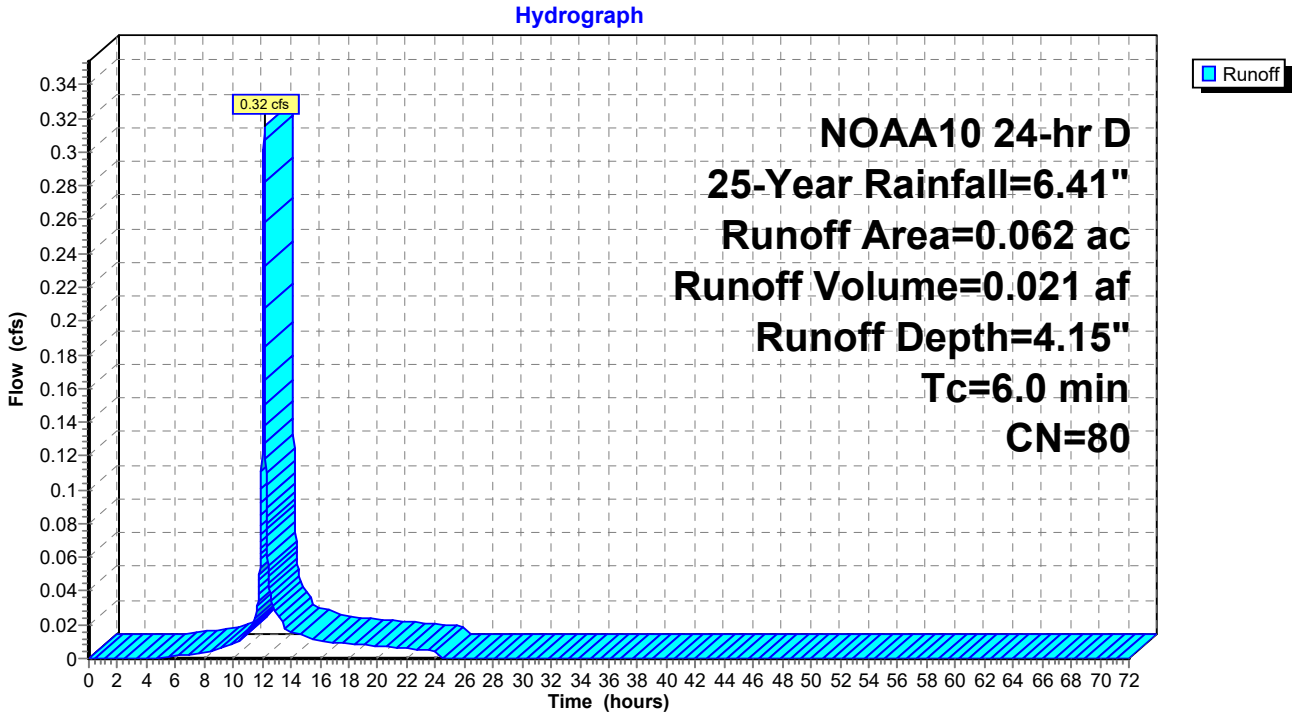
Runoff = 0.32 cfs @ 12.13 hrs, Volume= 0.021 af, Depth= 4.15"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (ac)	CN	Description
0.053	80	>75% Grass cover, Good, HSG D
0.008	77	Woods, Good, HSG D
0.062	80	Weighted Average
0.062		100.00% Pervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

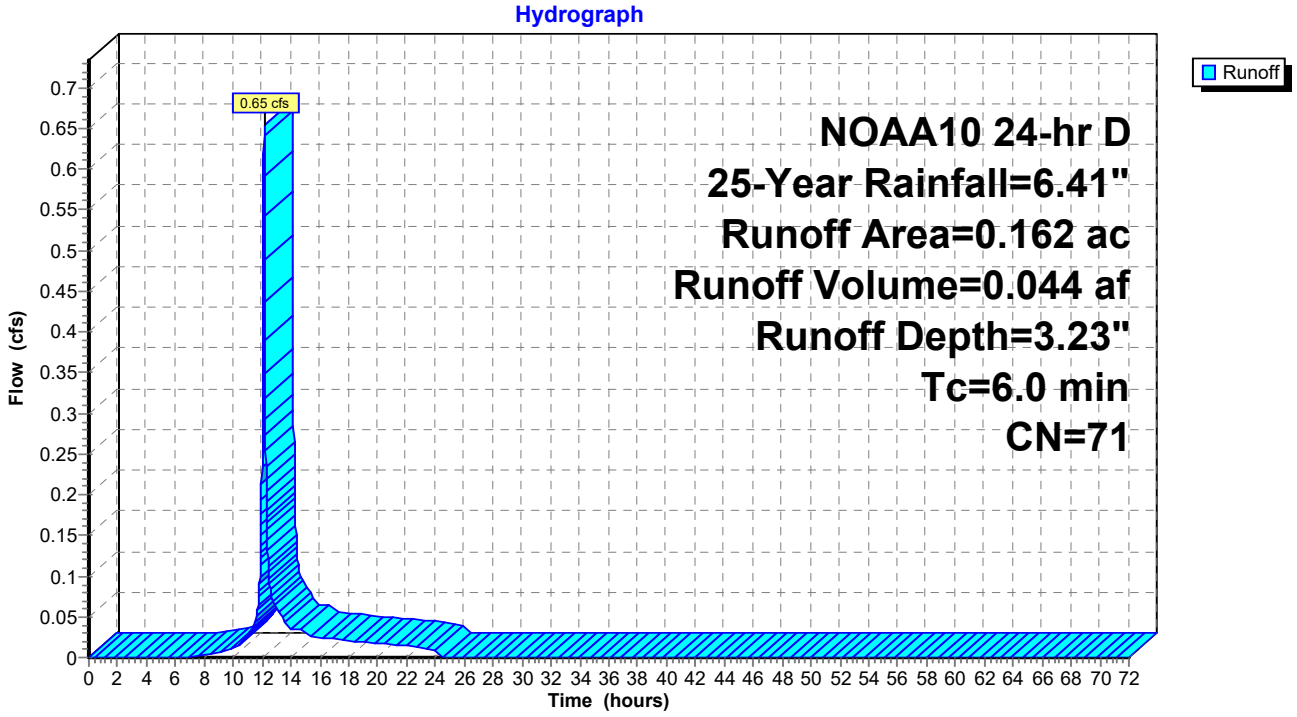
Runoff = 0.65 cfs @ 12.13 hrs, Volume= 0.044 af, Depth= 3.23"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (ac)	CN	Description
0.013	61	>75% Grass cover, Good, HSG B
0.013	74	>75% Grass cover, Good, HSG C
0.045	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.005	70	Woods, Good, HSG C
0.045	77	Woods, Good, HSG D
0.162	71	Weighted Average
0.162		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

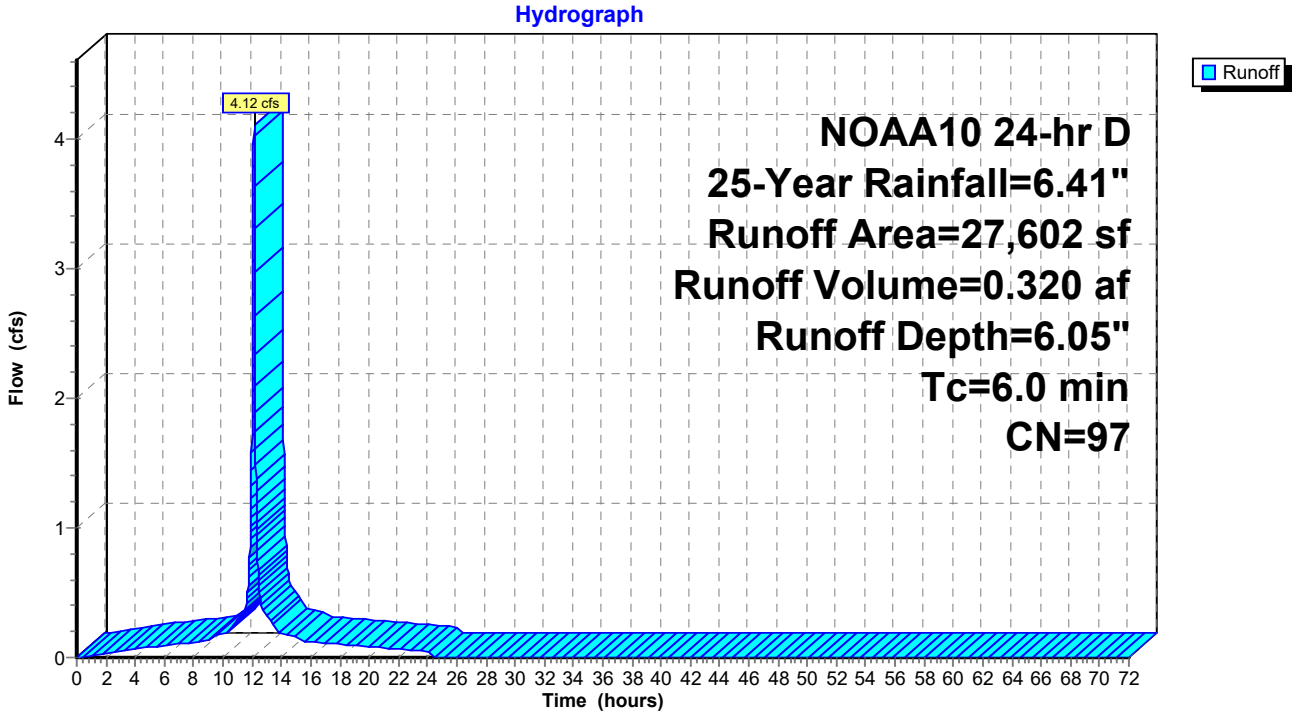
Runoff = 4.12 cfs @ 12.13 hrs, Volume= 0.320 af, Depth= 6.05"
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 25-Year Rainfall=6.41"

Area (sf)	CN	Description
255	74	>75% Grass cover, Good, HSG C
1,721	80	>75% Grass cover, Good, HSG D
1,974	98	Paved parking, HSG C
16,113	98	Paved parking, HSG D
7,539	98	Roofs, HSG D
27,602	97	Weighted Average
1,976		7.16% Pervious Area
25,626		92.84% Impervious Area

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

Subcatchment PR-5: Subcat PR-5



Summary for Pond AP-1: Union Street

Inflow Area = 1.363 ac, 76.19% Impervious, Inflow Depth = 2.04" for 25-Year event
Inflow = 0.79 cfs @ 12.71 hrs, Volume= 0.232 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

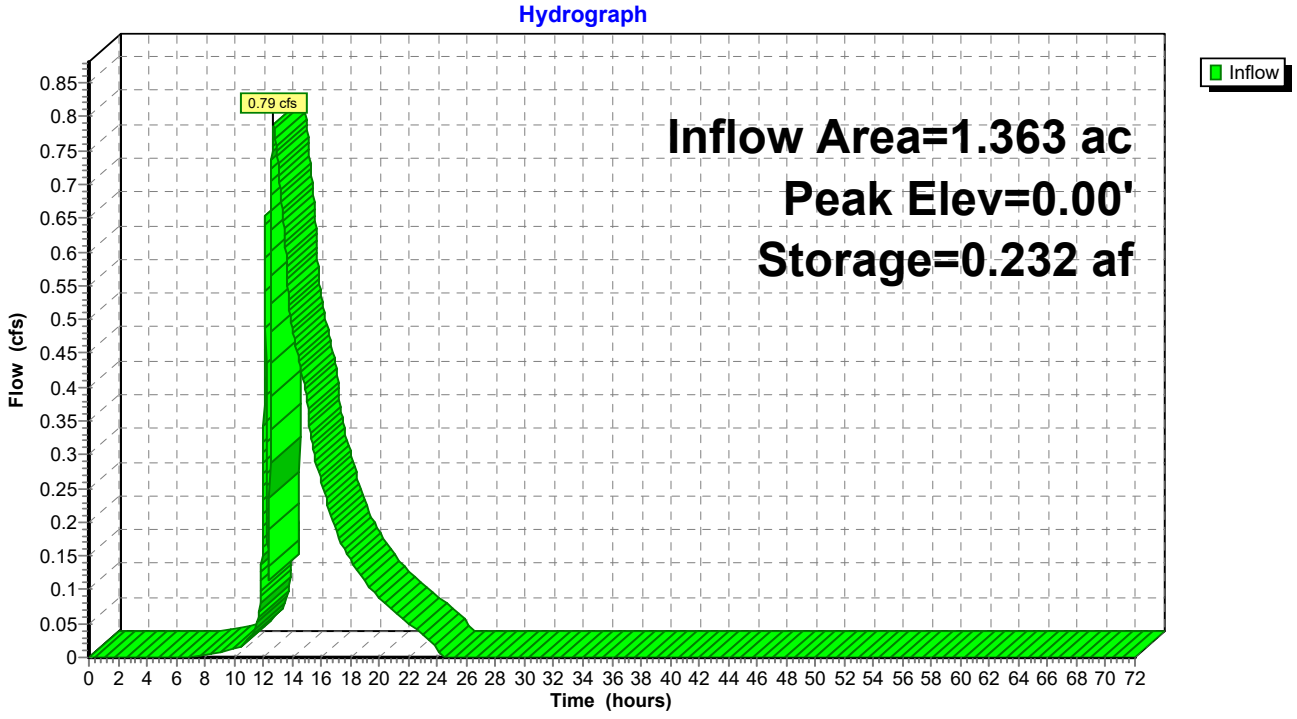
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.232 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.022 ac, 0.00% Impervious, Inflow Depth = 3.94" for 25-Year event
Inflow = 0.11 cfs @ 12.13 hrs, Volume= 0.007 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

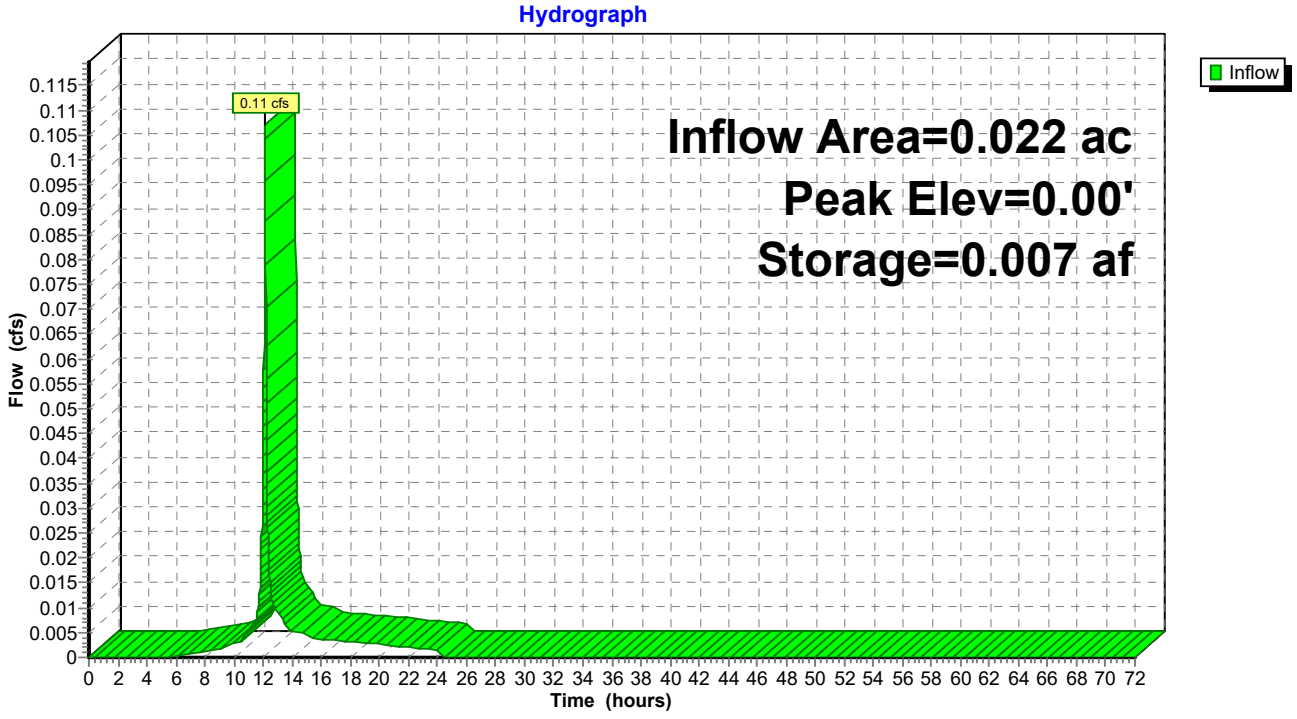
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.007 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.062 ac, 0.00% Impervious, Inflow Depth = 4.15" for 25-Year event
Inflow = 0.32 cfs @ 12.13 hrs, Volume= 0.021 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

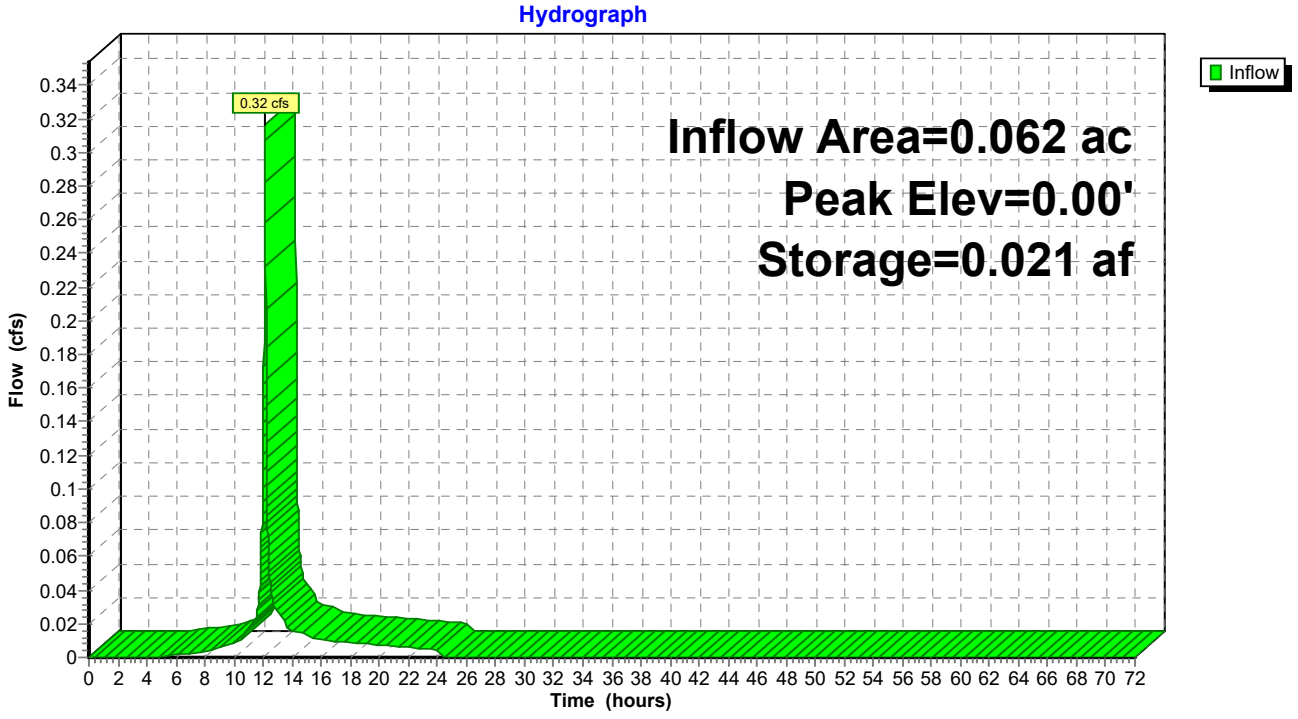
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.021 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Summary for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)

Inflow Area = 0.568 ac, 79.29% Impervious, Inflow Depth = 5.47" for 25-Year event
Inflow = 3.55 cfs @ 12.13 hrs, Volume= 0.259 af
Outflow = 0.53 cfs @ 12.28 hrs, Volume= 0.247 af, Atten= 85%, Lag= 9.0 min
Primary = 0.53 cfs @ 12.28 hrs, Volume= 0.247 af
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 374.46' @ 12.47 hrs Surf.Area= 2,673 sf Storage= 4,091 cf

Plug-Flow detention time= 196.6 min calculated for 0.247 af (95% of inflow)
Center-of-Mass det. time= 167.9 min (952.6 - 784.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	372.16'	2,508 cf	**32.00'W x 83.52'L x 3.50'H Field A** 9,354 cf Overall - 3,084 cf Embedded = 6,270 cf x 40.0% Voids
#2A	372.66'	3,084 cf	**Cultec R-300HD** x 66 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 66 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
		5,592 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	372.66'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	375.25'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.52 cfs @ 12.28 hrs HW=374.39' TW=372.85' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.52 cfs @ 5.98 fps)
2=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)

Pond DET 2: Cultec Detention Chamber System #2 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

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

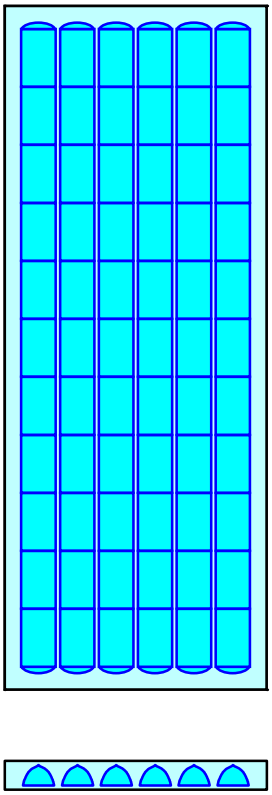
11 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 79.52' Row Length +24.0" End Stone x 2 = 83.52' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 24.0" Side Stone x 2 = 32.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

66 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 3,083.8 cf Chamber Storage

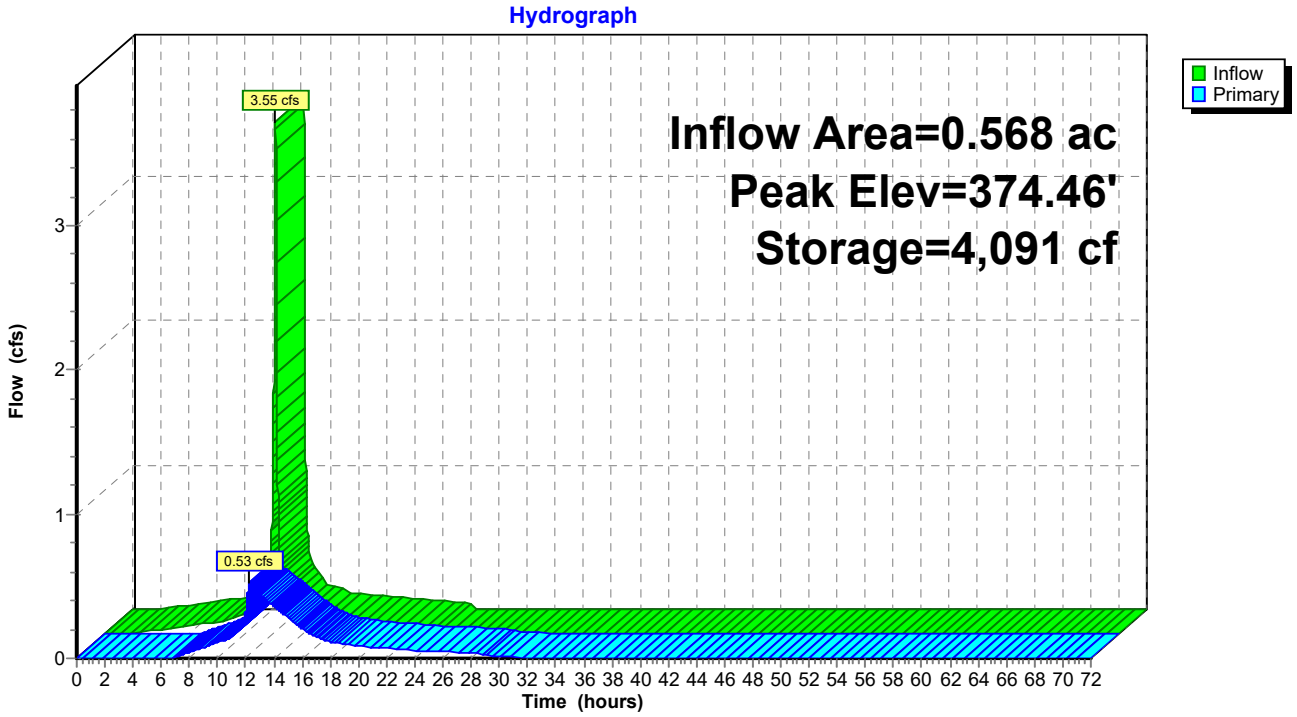
9,353.9 cf Field - 3,083.8 cf Chambers = 6,270.0 cf Stone x 40.0% Voids = 2,508.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,591.8 cf = 0.128 af
Overall Storage Efficiency = 59.8%
Overall System Size = 83.52' x 32.00' x 3.50'

66 Chambers
346.4 cy Field
232.2 cy Stone



Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)



Summary for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)

Inflow Area = 1.202 ac, 86.44% Impervious, Inflow Depth = 5.65" for 25-Year event
Inflow = 4.55 cfs @ 12.13 hrs, Volume= 0.566 af
Outflow = 0.82 cfs @ 12.72 hrs, Volume= 0.566 af, Atten= 82%, Lag= 35.2 min
Discarded = 0.10 cfs @ 7.65 hrs, Volume= 0.377 af
Primary = 0.72 cfs @ 12.72 hrs, Volume= 0.189 af
Routed to Pond AP-1 : Union Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.27' @ 12.72 hrs Surf.Area= 4,371 sf Storage= 8,138 cf

Plug-Flow detention time= 486.5 min calculated for 0.566 af (100% of inflow)
Center-of-Mass det. time= 486.4 min (1,326.9 - 840.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	370.40'	4,033 cf	**36.75'W x 118.93'L x 3.50'H Field A** 15,298 cf Overall - 5,216 cf Embedded = 10,082 cf x 40.0% Voids
#2A	370.90'	5,216 cf	**Cultec R-300HD** x 112 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 112 Chambers in 7 Rows Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf
		9,249 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	370.40'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	373.10'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.10 cfs @ 7.65 hrs HW=370.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.72 cfs @ 12.72 hrs HW=373.27' TW=0.00' (Dynamic Tailwater)
↑**2=Orifice/Grate** (Weir Controls 0.72 cfs @ 1.35 fps)

Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf

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

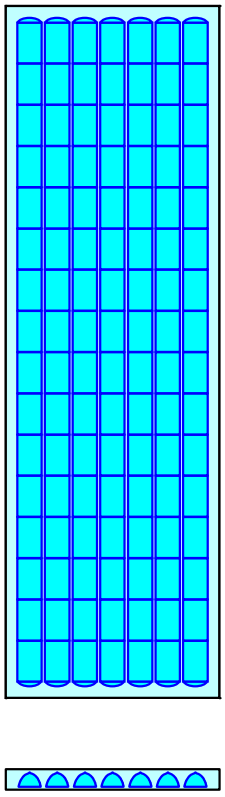
16 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 114.93' Row Length +24.0" End Stone x 2 = 118.93' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 24.0" Side Stone x 2 = 36.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

112 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 7 Rows = 5,216.3 cf Chamber Storage

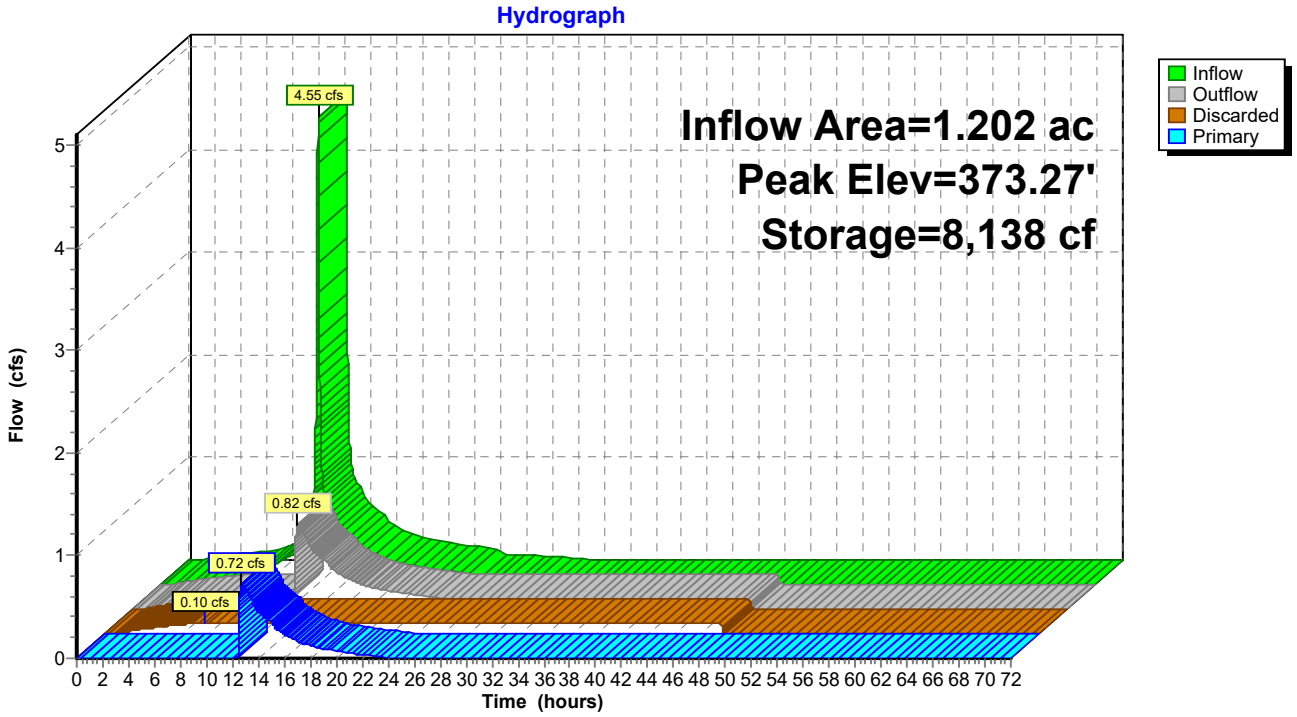
15,297.8 cf Field - 5,216.3 cf Chambers = 10,081.5 cf Stone x 40.0% Voids = 4,032.6 cf Stone Storage

Chamber Storage + Stone Storage = 9,248.9 cf = 0.212 af
Overall Storage Efficiency = 60.5%
Overall System Size = 118.93' x 36.75' x 3.50'

112 Chambers
566.6 cy Field
373.4 cy Stone



Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)



Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=0.568 ac 79.29% Impervious Runoff Depth=7.23"
Tc=6.0 min CN=92 Runoff=4.61 cfs 0.342 af

Subcatchment PR-2: Subcat PR-2 Runoff Area=0.022 ac 0.00% Impervious Runoff Depth=5.57"
Tc=6.0 min CN=78 Runoff=0.15 cfs 0.010 af

Subcatchment PR-3: Subcat PR-3 Runoff Area=0.062 ac 0.00% Impervious Runoff Depth=5.80"
Tc=6.0 min CN=80 Runoff=0.43 cfs 0.030 af

Subcatchment PR-4: Subcat PR-4 Runoff Area=0.162 ac 0.00% Impervious Runoff Depth=4.74"
Tc=6.0 min CN=71 Runoff=0.96 cfs 0.064 af

Subcatchment PR-5: Subcat PR-5 Runoff Area=27,602 sf 92.84% Impervious Runoff Depth=7.83"
Tc=6.0 min CN=97 Runoff=5.28 cfs 0.413 af

Pond AP-1: Union Street Peak Elev=0.00' Storage=0.419 af Inflow=3.47 cfs 0.419 af
Outflow=0.00 cfs 0.000 af

Pond AP-2: Northwest Wetlands Peak Elev=0.00' Storage=0.010 af Inflow=0.15 cfs 0.010 af
Outflow=0.00 cfs 0.000 af

Pond AP-3: 495 Swale Wetlands Peak Elev=0.00' Storage=0.030 af Inflow=0.43 cfs 0.030 af
Outflow=0.00 cfs 0.000 af

Pond DET 2: Cultec Detention Chamber Peak Elev=375.33' Storage=5,241 cf Inflow=4.61 cfs 0.342 af
Outflow=0.95 cfs 0.330 af

Pond INFIL 1: Cultec Infiltration Chamber Peak Elev=373.68' Storage=8,864 cf Inflow=5.72 cfs 0.743 af
Discarded=0.10 cfs 0.388 af Primary=2.88 cfs 0.355 af Outflow=2.98 cfs 0.743 af

Total Runoff Area = 1.447 ac Runoff Volume = 0.860 af Average Runoff Depth = 7.13"
28.22% Pervious = 0.408 ac 71.78% Impervious = 1.039 ac

Summary for Subcatchment PR-1: Subcat PR-1

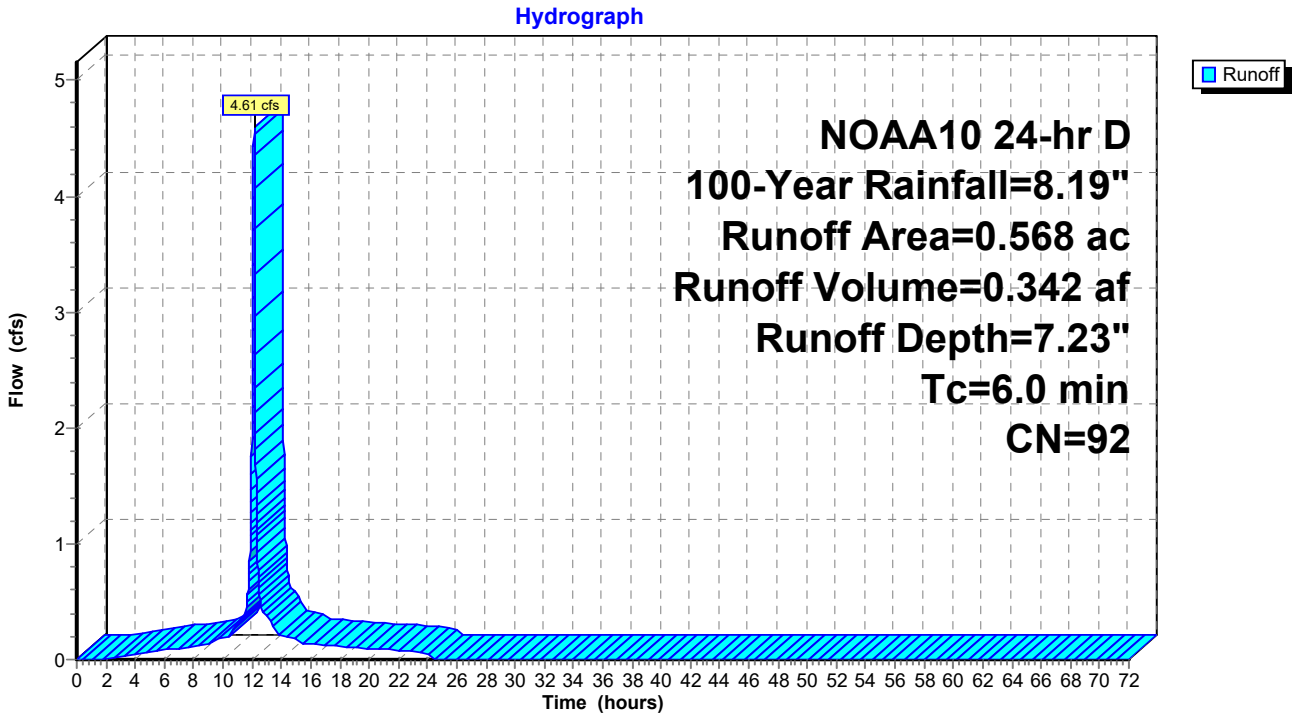
Runoff = 4.61 cfs @ 12.13 hrs, Volume= 0.342 af, Depth= 7.23"
Routed to Pond DET 2 : Cultec Detention Chamber System #2 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (ac)	CN	Description
0.046	61	>75% Grass cover, Good, HSG B
0.053	80	>75% Grass cover, Good, HSG D
0.026	98	Paved parking, HSG B
0.252	98	Paved parking, HSG D
0.173	98	Roofs, HSG D
0.016	55	Woods, Good, HSG B
0.003	77	Woods, Good, HSG D
0.568	92	Weighted Average
0.118		20.71% Pervious Area
0.450		79.29% Impervious Area

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

Subcatchment PR-1: Subcat PR-1



Summary for Subcatchment PR-2: Subcat PR-2

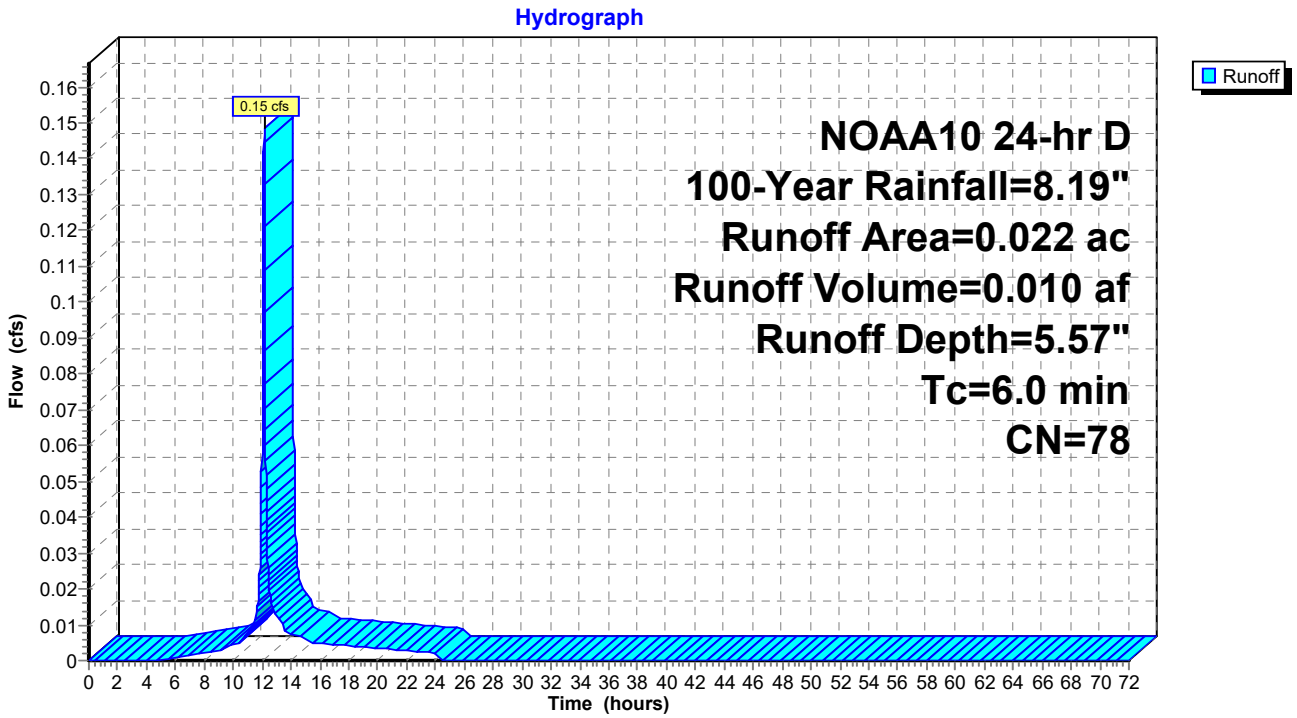
Runoff = 0.15 cfs @ 12.13 hrs, Volume= 0.010 af, Depth= 5.57"
Routed to Pond AP-2 : Northwest Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (ac)	CN	Description
0.003	74	>75% Grass cover, Good, HSG C
0.012	80	>75% Grass cover, Good, HSG D
0.001	70	Woods, Good, HSG C
0.006	77	Woods, Good, HSG D
0.022	78	Weighted Average
0.022		100.00% Pervious Area

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

Subcatchment PR-2: Subcat PR-2



Summary for Subcatchment PR-3: Subcat PR-3

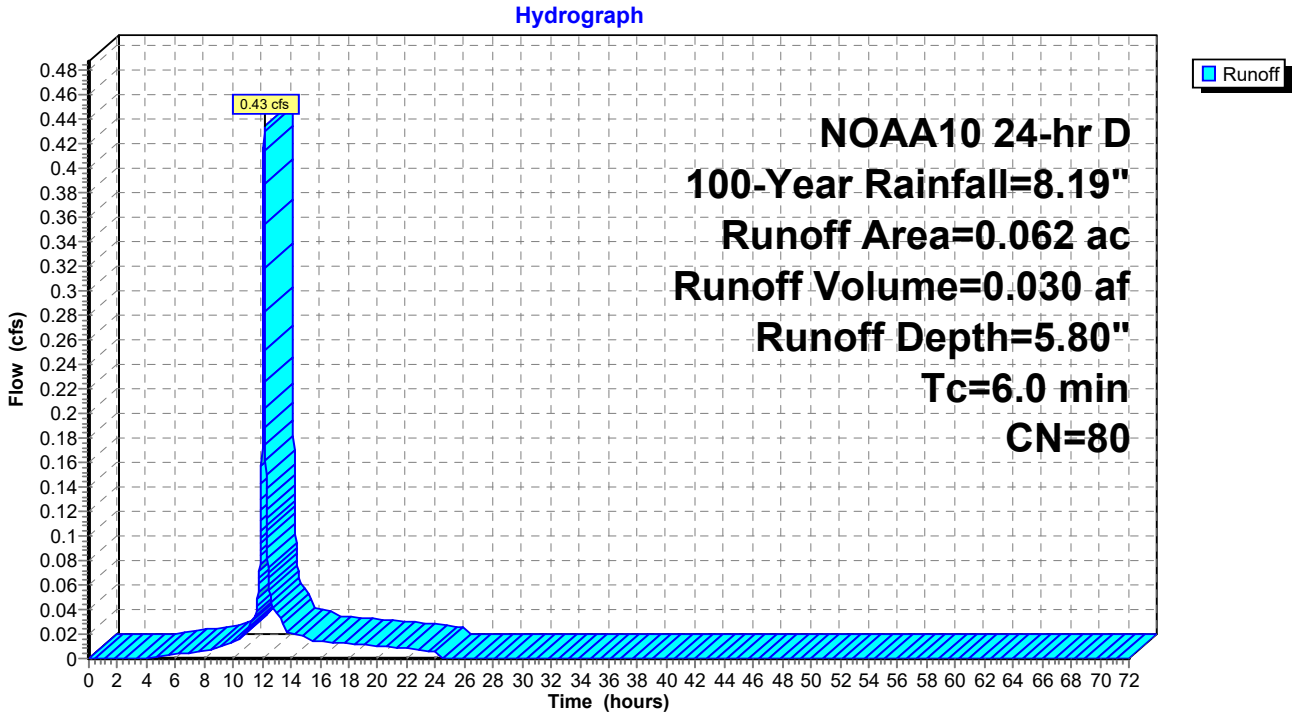
Runoff = 0.43 cfs @ 12.13 hrs, Volume= 0.030 af, Depth= 5.80"
Routed to Pond AP-3 : 495 Swale Wetlands

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (ac)	CN	Description
0.053	80	>75% Grass cover, Good, HSG D
0.008	77	Woods, Good, HSG D
0.062	80	Weighted Average
0.062		100.00% Pervious Area

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

Subcatchment PR-3: Subcat PR-3



Summary for Subcatchment PR-4: Subcat PR-4

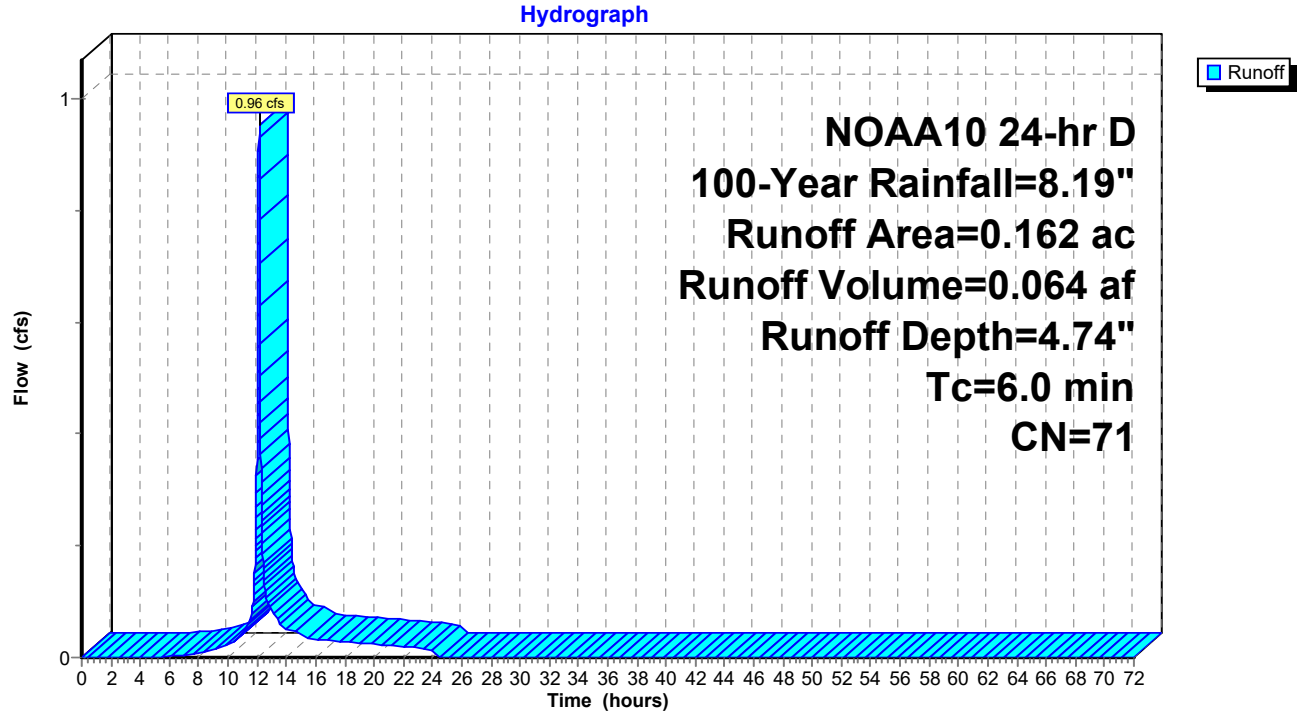
Runoff = 0.96 cfs @ 12.13 hrs, Volume= 0.064 af, Depth= 4.74"
Routed to Pond AP-1 : Union Street

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (ac)	CN	Description
0.013	61	>75% Grass cover, Good, HSG B
0.013	74	>75% Grass cover, Good, HSG C
0.045	80	>75% Grass cover, Good, HSG D
0.040	55	Woods, Good, HSG B
0.005	70	Woods, Good, HSG C
0.045	77	Woods, Good, HSG D
0.162	71	Weighted Average
0.162		100.00% Pervious Area

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

Subcatchment PR-4: Subcat PR-4



Summary for Subcatchment PR-5: Subcat PR-5

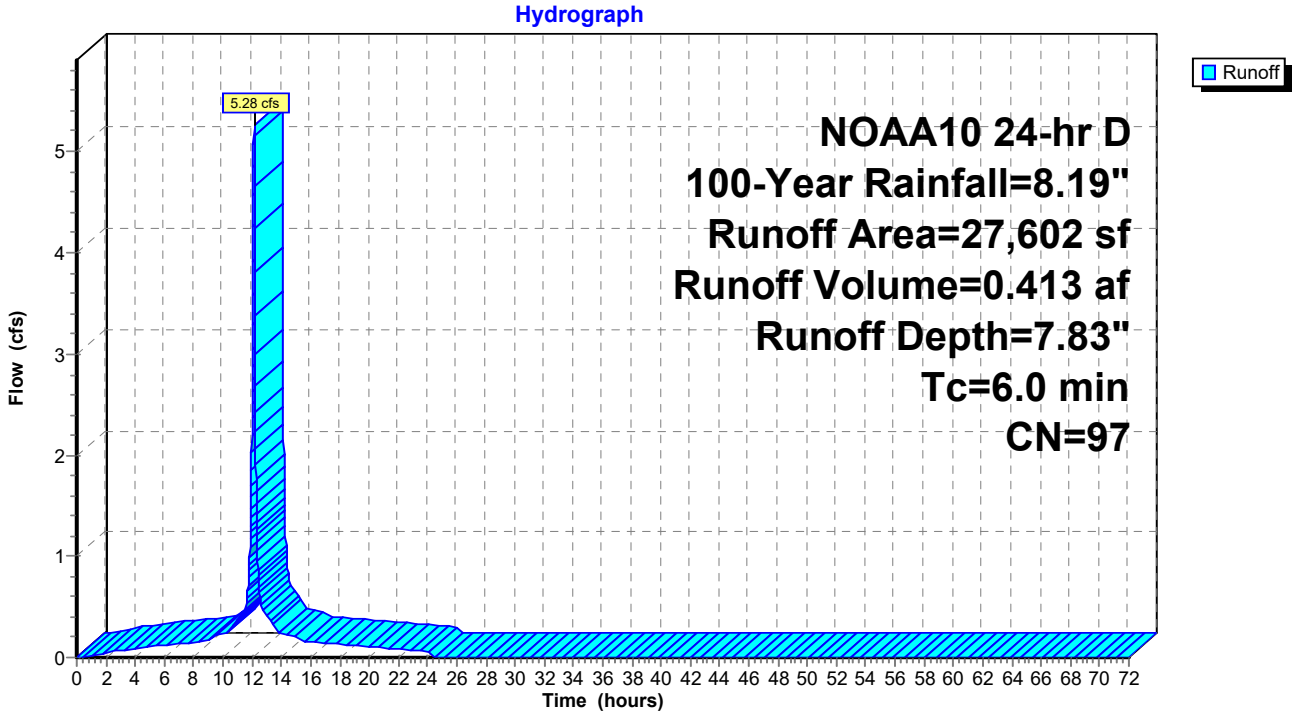
Runoff = 5.28 cfs @ 12.13 hrs, Volume= 0.413 af, Depth= 7.83"
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
NOAA10 24-hr D 100-Year Rainfall=8.19"

Area (sf)	CN	Description
255	74	>75% Grass cover, Good, HSG C
1,721	80	>75% Grass cover, Good, HSG D
1,974	98	Paved parking, HSG C
16,113	98	Paved parking, HSG D
7,539	98	Roofs, HSG D
27,602	97	Weighted Average
1,976		7.16% Pervious Area
25,626		92.84% Impervious Area

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

Subcatchment PR-5: Subcat PR-5



Summary for Pond AP-1: Union Street

Inflow Area = 1.363 ac, 76.19% Impervious, Inflow Depth = 3.69" for 100-Year event
Inflow = 3.47 cfs @ 12.18 hrs, Volume= 0.419 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

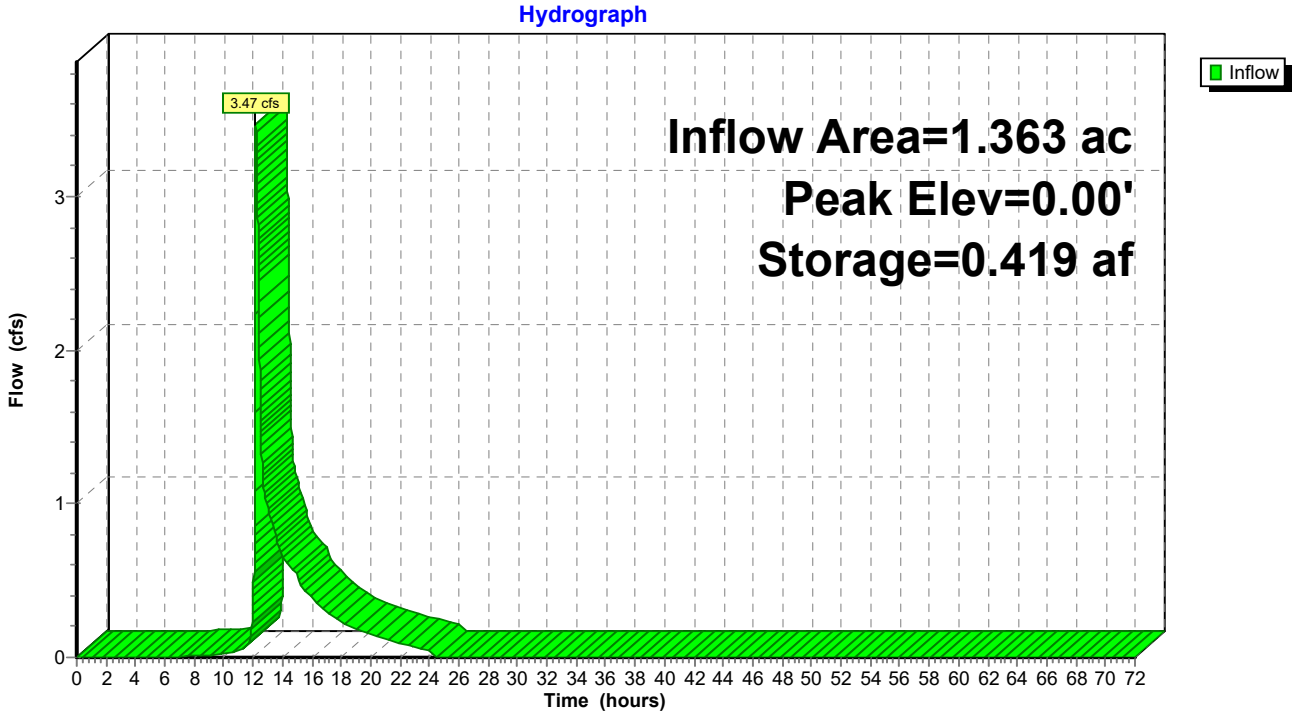
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.419 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-1: Union Street



Summary for Pond AP-2: Northwest Wetlands

Inflow Area = 0.022 ac, 0.00% Impervious, Inflow Depth = 5.57" for 100-Year event
Inflow = 0.15 cfs @ 12.13 hrs, Volume= 0.010 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

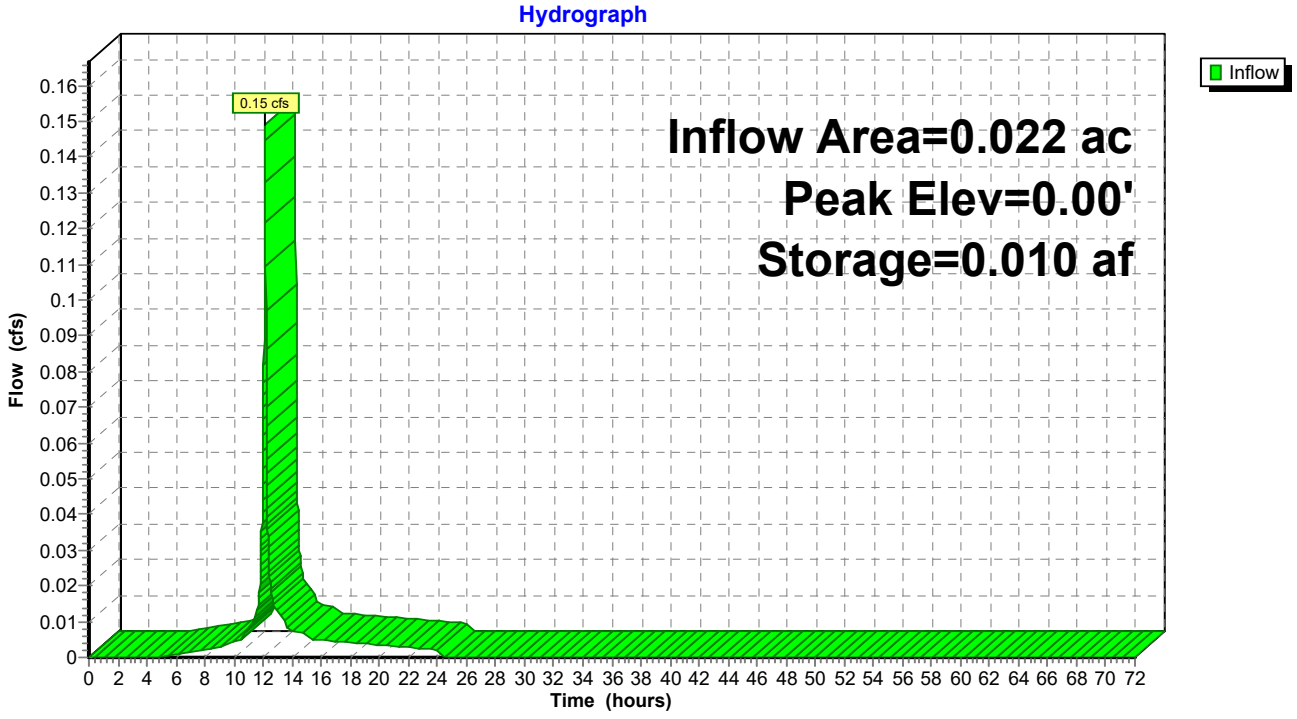
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.010 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-2: Northwest Wetlands



Summary for Pond AP-3: 495 Swale Wetlands

Inflow Area = 0.062 ac, 0.00% Impervious, Inflow Depth = 5.80" for 100-Year event
Inflow = 0.43 cfs @ 12.13 hrs, Volume= 0.030 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

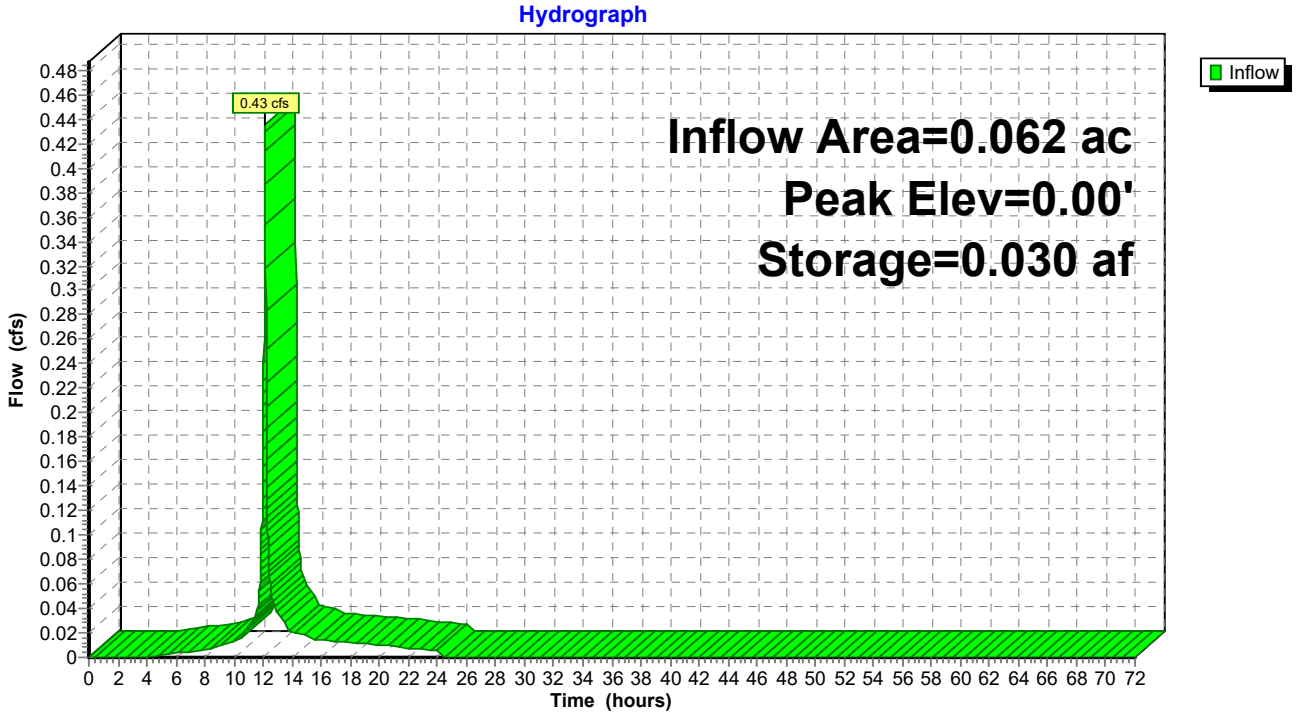
Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 0.00' @ 24.34 hrs Surf.Area= 100.000 ac Storage= 0.030 af

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

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	10,000.000 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
0.00	100.000	0.000	0.000
100.00	100.000	10,000.000	10,000.000

Pond AP-3: 495 Swale Wetlands



Summary for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)

Inflow Area = 0.568 ac, 79.29% Impervious, Inflow Depth = 7.23" for 100-Year event
Inflow = 4.61 cfs @ 12.13 hrs, Volume= 0.342 af
Outflow = 0.95 cfs @ 12.35 hrs, Volume= 0.330 af, Atten= 79%, Lag= 13.4 min
Primary = 0.95 cfs @ 12.35 hrs, Volume= 0.330 af
Routed to Pond INFIL 1 : Cultec Infiltration Chamber System #1 (R-300HD)

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 375.33' @ 12.35 hrs Surf.Area= 2,673 sf Storage= 5,241 cf

Plug-Flow detention time= 174.6 min calculated for 0.330 af (96% of inflow)
Center-of-Mass det. time= 152.2 min (928.1 - 775.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	372.16'	2,508 cf	**32.00'W x 83.52'L x 3.50'H Field A** 9,354 cf Overall - 3,084 cf Embedded = 6,270 cf x 40.0% Voids
#2A	372.66'	3,084 cf	**Cultec R-300HD** x 66 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 66 Chambers in 6 Rows Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf
		5,592 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	372.66'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Primary	375.25'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.95 cfs @ 12.35 hrs HW=375.33' TW=373.53' (Dynamic Tailwater)
1=Orifice/Grate (Orifice Controls 0.56 cfs @ 6.47 fps)
2=Sharp-Crested Rectangular Weir (Weir Controls 0.38 cfs @ 0.94 fps)

Pond DET 2: Cultec Detention Chamber System #2 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 6 rows = 31.9 cf

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

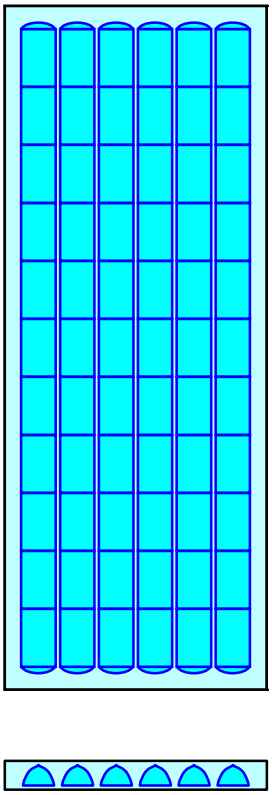
11 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 79.52' Row Length +24.0" End Stone x 2 = 83.52' Base Length
6 Rows x 51.0" Wide + 6.0" Spacing x 5 + 24.0" Side Stone x 2 = 32.00' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

66 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 6 Rows = 3,083.8 cf Chamber Storage

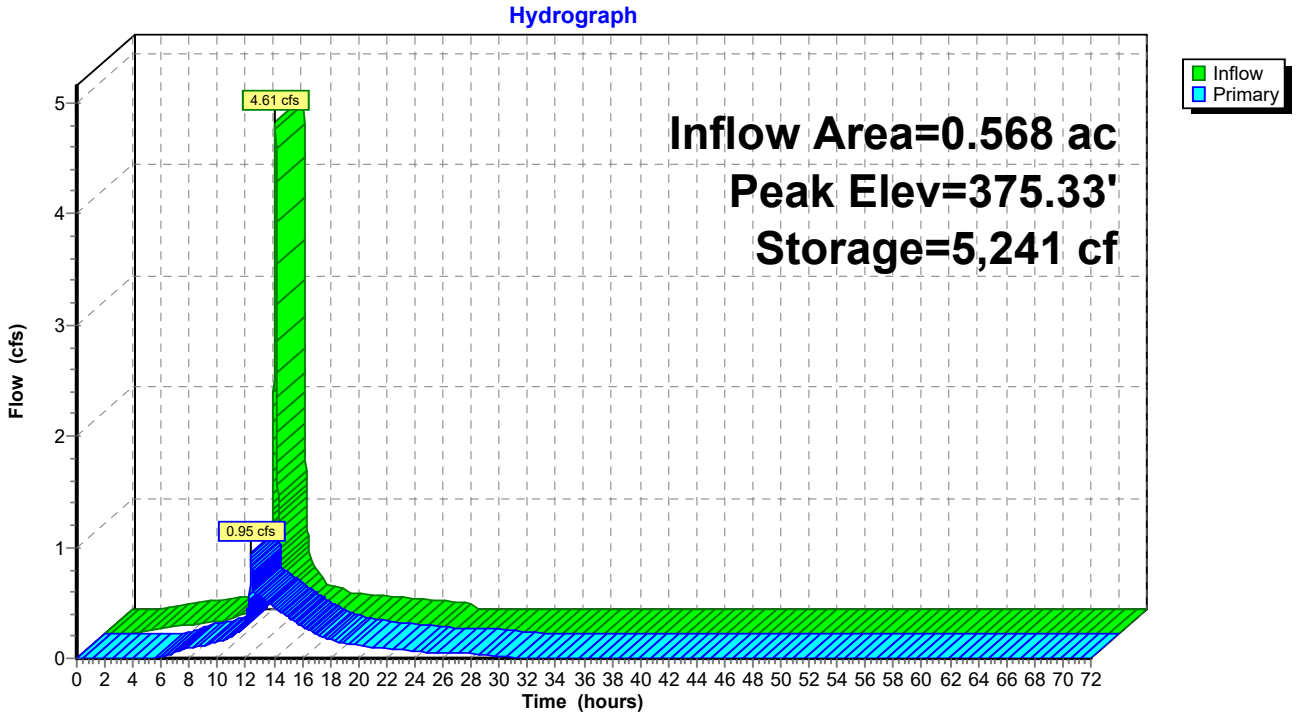
9,353.9 cf Field - 3,083.8 cf Chambers = 6,270.0 cf Stone x 40.0% Voids = 2,508.0 cf Stone Storage

Chamber Storage + Stone Storage = 5,591.8 cf = 0.128 af
Overall Storage Efficiency = 59.8%
Overall System Size = 83.52' x 32.00' x 3.50'

66 Chambers
346.4 cy Field
232.2 cy Stone



Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)



Summary for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)

Inflow Area = 1.202 ac, 86.44% Impervious, Inflow Depth = 7.42" for 100-Year event
Inflow = 5.72 cfs @ 12.13 hrs, Volume= 0.743 af
Outflow = 2.98 cfs @ 12.22 hrs, Volume= 0.743 af, Atten= 48%, Lag= 5.3 min
Discarded = 0.10 cfs @ 5.99 hrs, Volume= 0.388 af
Primary = 2.88 cfs @ 12.22 hrs, Volume= 0.355 af
Routed to Pond AP-1 : Union Street

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 373.68' @ 12.22 hrs Surf.Area= 4,371 sf Storage= 8,864 cf

Plug-Flow detention time= 386.1 min calculated for 0.743 af (100% of inflow)
Center-of-Mass det. time= 386.0 min (1,214.6 - 828.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	370.40'	4,033 cf	**36.75'W x 118.93'L x 3.50'H Field A** 15,298 cf Overall - 5,216 cf Embedded = 10,082 cf x 40.0% Voids
#2A	370.90'	5,216 cf	**Cultec R-300HD** x 112 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 112 Chambers in 7 Rows Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf
		9,249 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	370.40'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	373.10'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.10 cfs @ 5.99 hrs HW=370.44' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=2.88 cfs @ 12.22 hrs HW=373.68' TW=0.00' (Dynamic Tailwater)
↑**2=Orifice/Grate** (Orifice Controls 2.88 cfs @ 3.67 fps)

Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD) - Chamber Wizard Field A

Chamber Model = Cultec R-300HD (Cultec Recharger® 300HD)
Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf
Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap
Cap Storage= 2.7 cf x 2 x 7 rows = 37.2 cf

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

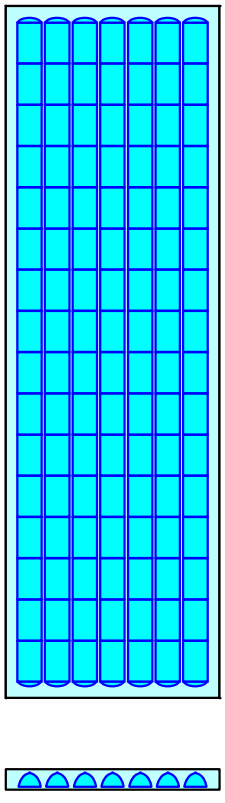
16 Chambers/Row x 7.08' Long +0.80' Cap Length x 2 = 114.93' Row Length +24.0" End Stone x 2 = 118.93' Base Length
7 Rows x 51.0" Wide + 6.0" Spacing x 6 + 24.0" Side Stone x 2 = 36.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

112 Chambers x 46.2 cf + 2.7 cf Cap Volume x 2 x 7 Rows = 5,216.3 cf Chamber Storage

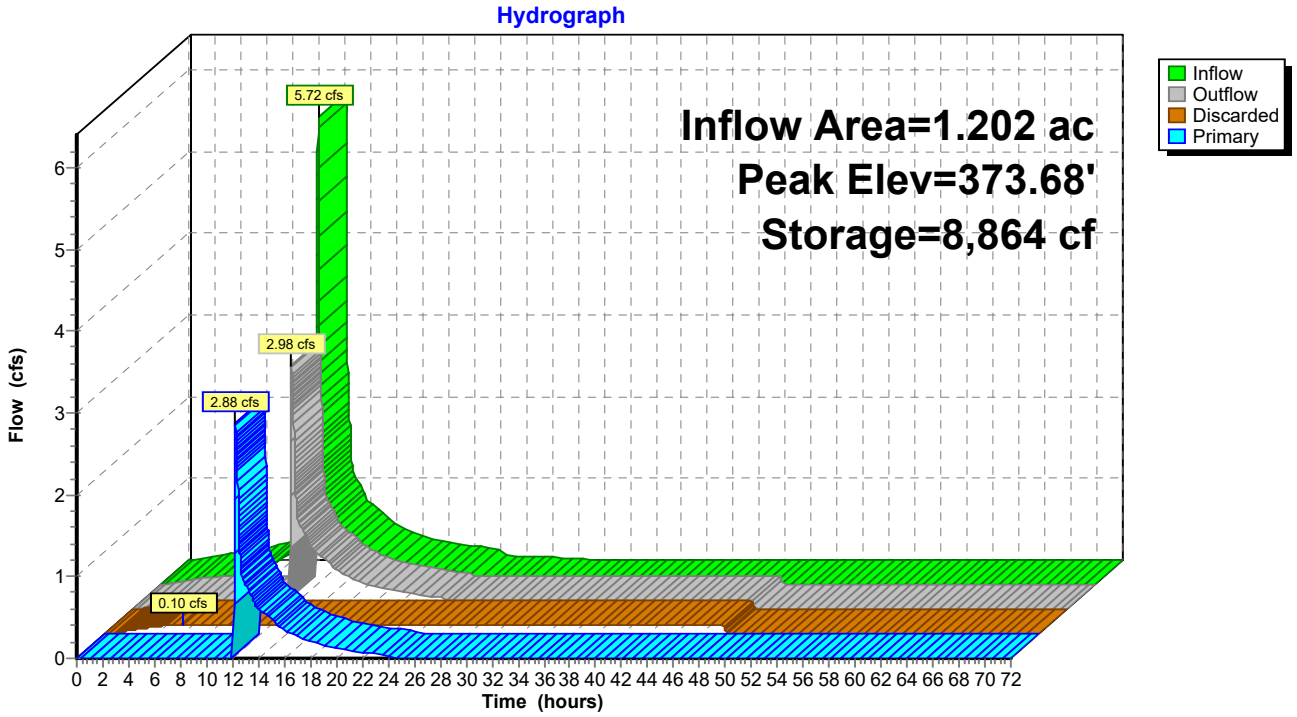
15,297.8 cf Field - 5,216.3 cf Chambers = 10,081.5 cf Stone x 40.0% Voids = 4,032.6 cf Stone Storage

Chamber Storage + Stone Storage = 9,248.9 cf = 0.212 af
Overall Storage Efficiency = 60.5%
Overall System Size = 118.93' x 36.75' x 3.50'

112 Chambers
566.6 cy Field
373.4 cy Stone



Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)



Events for Subcatchment PR-1: Subcat PR-1

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	1.72	0.120	2.53
10-Year	5.25	2.85	0.205	4.33
25-Year	6.41	3.55	0.259	5.47
100-Year	**8.19**	**4.61**	**0.342**	**7.23**

Events for Subcatchment PR-2: Subcat PR-2

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	0.04	0.003	1.41
10-Year	5.25	0.08	0.005	2.93
25-Year	6.41	0.11	0.007	3.94
100-Year	**8.19**	**0.15**	**0.010**	**5.57**

Events for Subcatchment PR-3: Subcat PR-3

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	0.12	0.008	1.55
10-Year	5.25	0.24	0.016	3.11
25-Year	6.41	0.32	0.021	4.15
100-Year	**8.19**	**0.43**	**0.030**	**5.80**

Events for Subcatchment PR-4: Subcat PR-4

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	0.19	0.013	0.99
10-Year	5.25	0.47	0.031	2.31
25-Year	6.41	0.65	0.044	3.23
100-Year	**8.19**	**0.96**	**0.064**	**4.74**

Events for Subcatchment PR-5: Subcat PR-5

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	3.39	2.14	0.161	3.05
10-Year	5.25	3.36	0.259	4.90
25-Year	6.41	4.12	0.320	6.05
100-Year	**8.19**	**5.28**	**0.413**	**7.83**

Events for Pond AP-1: Union Street

Event	Inflow (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.19	0.00	0.013
10-Year	0.47	0.00	0.116
25-Year	0.79	0.00	0.232
100-Year	**3.47**	**0.00**	**0.419**

Events for Pond AP-2: Northwest Wetlands

Event	Inflow (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.04	0.00	0.003
10-Year	0.08	0.00	0.005
25-Year	0.11	0.00	0.007
100-Year	**0.15**	**0.00**	**0.010**

Events for Pond AP-3: 495 Swale Wetlands

Event	Inflow (cfs)	Elevation (feet)	Storage (acre-feet)
2-Year	0.12	0.00	0.008
10-Year	0.24	0.00	0.016
25-Year	0.32	0.00	0.021
100-Year	**0.43**	**0.00**	**0.030**

Events for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	1.72	0.33	373.43	2,143
10-Year	2.85	0.46	374.03	3,323
25-Year	3.55	0.53	374.46	4,091
100-Year	**4.61**	**0.95**	**375.33**	**5,241**

Events for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)

Event	Inflow (cfs)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	2.41	0.10	**0.10**	0.00	372.30	5,600
10-Year	3.74	0.45	0.10	0.35	373.20	8,012
25-Year	4.55	0.82	0.10	0.72	373.27	8,138
100-Year	**5.72**	**2.98**	0.10	**2.88**	**373.68**	**8,864**

DRAINAGE ANALYSIS

Storm Drain Calculations – Rational Method and Catchment Area Calculation

Land Use Coefficients "C"

Pave	0.90
Gravel	0.80
Wetland	0.72
Grass	0.30
Woods	0.25
Roof	0.90

Area	Land Use Area Impervious (acres)	Gravel (acres)	Wetland (acres)	Pervious (acres)	Woods (acres)	Roof (acres)	Total (acres)	Weighted "C"
CB 1	0.036			0.023	0.019	0.000	0.078	0.56
CB 2	0.127			0.007	0.000	0.000	0.134	0.87
CB 3	0.114			0.068	0.000	0.000	0.182	0.68
CB 4	0.108			0.005	0.000	0.000	0.113	0.87
CB 5	0.048			0.020	0.000	0.000	0.068	0.72
CB 6	0.124			0.007	0.000	0.000	0.131	0.87
CB 7	0.136			0.013	0.000	0.000	0.149	0.85
ROOF NORTH	0.000			0.000	0.000	0.173	0.173	0.90
ROOF SOUTH	0.000			0.000	0.000	0.173	0.173	0.90
SUBTOTAL	0.693	0.000	0.000	0.143	0.019	0.346	1.201	
OVERALL TOTALS	0.693			0.143	0.019	0.346	1.201	

Drainage Area	Upper Structure	Lower Structure	Sum of CA's (sf)	Time of Concentration (Tc) (min)	Rainfall Intensity (I) (in/hr)	Actual Peak Flow Rate (Q) (cfs)	Pipe Diameter (in)	Slope (ft/ft)	Roughness Coefficient (n)	Design Flow Full (Q) (cfs)	Velocity Flow Full (V) (fps)	Actual Velocity (V) (fps)	Length of Pipe (L)* (ft)	Time in pipe (min)	Total Fall (ft)	Invert Elevation Elev. Upper End	Invert Elevation Elev. Lower End	Rim Elev Elev. Upper End	Rim Elev Elev. Lower End	Destination
	CB 1	DMH 1	0.04	6.00	8.02	0.35	12	0.008	0.013	3.13	3.99	0.45	64.6	0.27	0.50	374.50	374.00	279.60	277.70	
	CB 2	DMH 2	0.12	6.00	8.02	0.93	12	0.010	0.013	3.59	4.57	1.19	23.6	0.09	0.24	373.80	373.56			SUBSURFACE CHAMBER SYSTEM #2
	CB 3	DMH 1	0.12	6.00	8.02	0.99	12	0.010	0.013	3.59	4.57	1.26	23.6	0.09	0.24	373.80	373.56		275.70	
	CB 4	DMH 7	0.10	6.00	8.02	0.79	12	0.010	0.013	3.56	4.53	1.01	50.1	0.18	0.50	373.70	373.20	274.80	276.50	
	CB 5	DMH 5	0.05	6.00	8.02	0.39	12	0.010	0.013	3.56	4.54	0.50	8.0	0.03	0.08	373.70	373.62	274.80	276.50	
	CB 6	DMH 8	0.11	6.00	8.02	0.91	12	0.010	0.013	3.57	4.54	1.16	29.0	0.11	0.29	373.50	373.21	277.60	277.60	SUBSURFACE CHAMBER SYSTEM #1
	CB 7	DMH 6	0.13	6.00	8.02	1.01	12	0.010	0.013	3.54	4.51	1.29	30.4	0.11	0.30	373.20	372.90	275.32	275.45	
	ROOF NORTH	DMH 8	0.16	6.00	8.02	1.25	12	0.008	0.013	3.27	4.17	1.59	185.1	0.74	1.56	374.17	372.61	274.20	274.35	
	ROOF SOUTH	DMH 10	0.16	6.00	8.02	1.25	12	0.006	0.013	2.67	3.40	1.59	168.7	0.83	0.95	374.75	373.80	273.75	274.60	SUBSURFACE CHAMBER SYSTEM #2
	DMH 1	SOUTH CHAMBERS	0.17	6.00	8.02	1.34	12	0.067	0.013	9.20	11.71	1.71	1.5	0.00	0.10	372.76	372.66	377.30		
	DMH 2	SOUTH CHAMBERS	0.12	6.00	8.02	0.93	12	0.067	0.013	9.20	11.71	1.19	1.5	0.00	0.10	372.76	372.66	377.30		SUBSURFACE CHAMBER SYSTEM #2
	DMH 10	SOUTH CHAMBERS	0.16	6.00	8.02	1.25	12	0.067	0.013	9.20	11.71	1.59	1.5	0.00	0.10	372.76	372.66	377.05		
*	SOUTH CHAMBERS	DMH 3	0.07	6.00	8.02	0.53	12	0.007	0.013	2.91	3.70	0.67	1.5	0.01	0.01	372.67	372.66		377.00	
	DMH 3	DMH 4	0.07	6.00	8.02	0.53	12	0.005	0.013	2.47	3.14	0.67	23.0	0.12	0.11	372.00	371.89	377.00	377.40	
	DMH 4	DMH 5	0.07	6.00	8.02	0.53	12	0.005	0.013	2.61	3.33	0.67	72.6	0.36	0.39	371.79	371.40	377.40	376.80	
	DMH 5	DMH 6	0.12	6.00	8.02	0.92	12	0.005	0.013	2.51	3.20	1.18	80.5	0.42	0.40	371.30	370.90	376.80	377.00	SUBSURFACE CHAMBER SYSTEM #1
	DMH 6	NORTH CHAMBERS	0.24	6.00	8.02	1.94	12	0.000	0.013			2.47	4.0		0.00	370.90	370.90	377.00		
	DMH 7	DMH 8	0.10	6.00	8.02	0.79	12	0.010	0.013	3.58	4.55	1.01	48.6	0.18	0.49	373.10	372.61	377.60	377.00	
	DMH 8	NORTH CHAMBERS	0.21	6.00	8.02	1.70	12	0.025	0.013	5.63	7.17	2.17	4.0	0.01	0.10	371.00	370.90	377.00		
	NORTH CHAMBERS	HEADWALL #1	0.45	6.00	8.02	3.64	12	0.025	0.013	5.68	7.23	4.63	19.7	0.05	0.50	373.00	372.50	376.50		

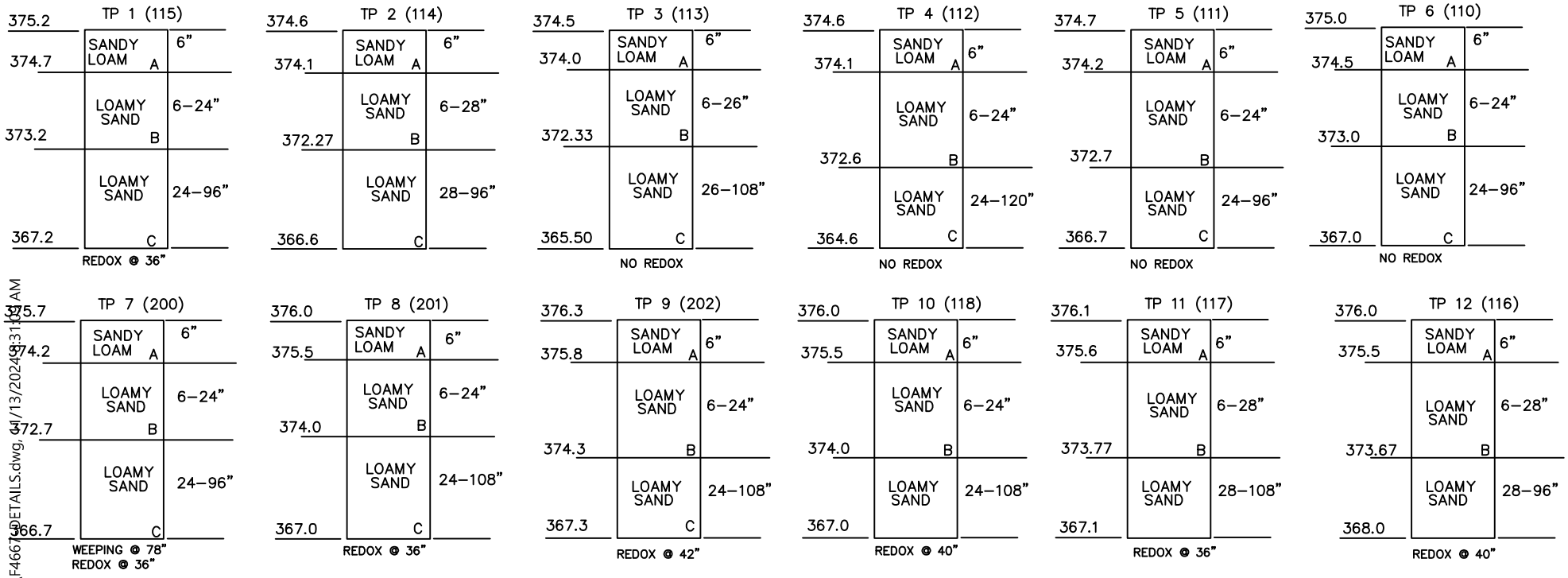
Pipe lengths were taken from center of structures

* 25 Year basin outflow from HydroCAD used to approximate design flow

USDA WEB SOIL SURVEY

TESTING INFORMATION

TESTING DATE: JUNE 20, 2024 SOIL EVALUATOR: BRIAN HASSETT



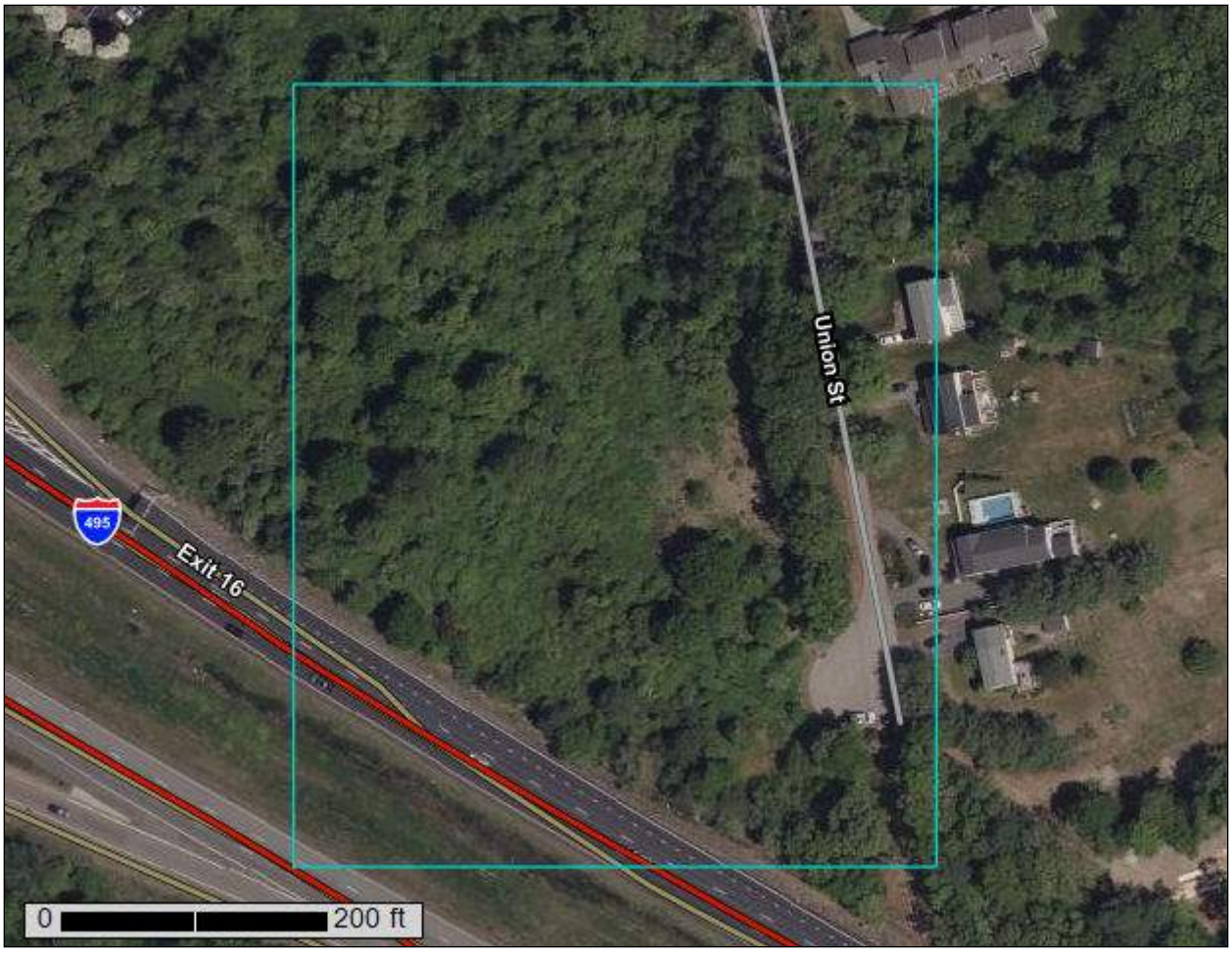
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Norfolk and Suffolk Counties, Massachusetts



November 11, 2024

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

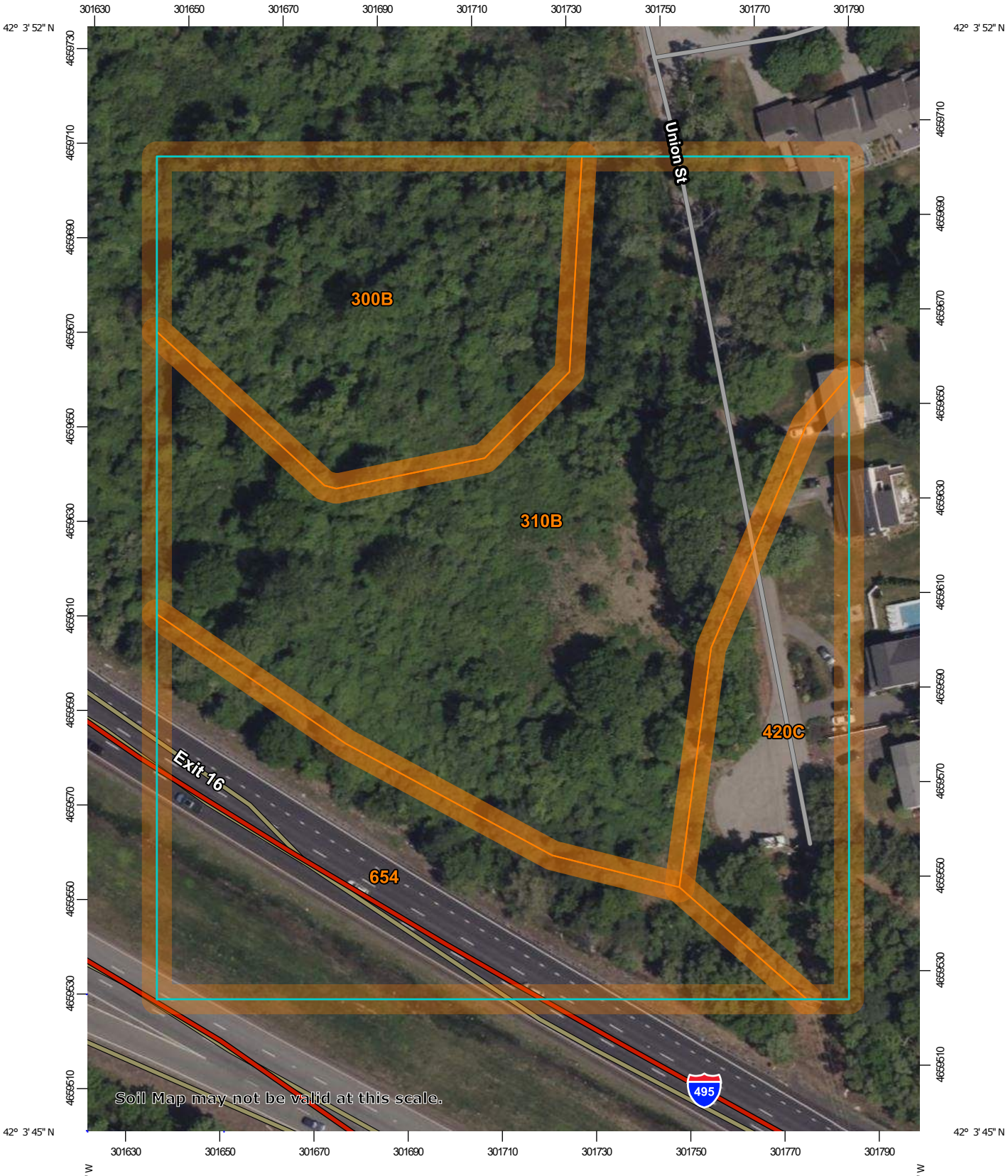
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,140 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
300B	Montauk fine sandy loam, 3 to 8 percent slopes	1.3	20.0%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	3.0	46.6%
420C	Canton fine sandy loam, 8 to 15 percent slopes	0.8	12.0%
654	Udorthents, loamy	1.4	21.5%
Totals for Area of Interest		**6.5**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

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

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

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

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

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

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

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

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

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

Norfolk and Suffolk Counties, Massachusetts

300B—Montauk fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyrh
Elevation: 0 to 1,030 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Montauk

Setting

Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 26 inches: fine sandy loam
Bw2 - 26 to 34 inches: sandy loam
2Cd - 34 to 72 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 1.42 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 6 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Canton

Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 4 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2ql
Elevation: 0 to 1,470 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, fine sandy loam, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope

Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 8 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420C—Canton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w817
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Canton

Setting

Landform: Hills, moraines, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Montauk

Percent of map unit: 6 percent
Landform: Moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Scituate

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Newfields

Percent of map unit: 4 percent
Landform: Ground moraines, hills, moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

654—Udorthents, loamy

Map Unit Setting

National map unit symbol: vkyb
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents

Setting

Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Excavated and filled coarse-loamy human transported material

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Udorthents,sandy

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Udorthents,wet substr.

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Urban land

Percent of map unit: 4 percent
Hydric soil rating: Unranked

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

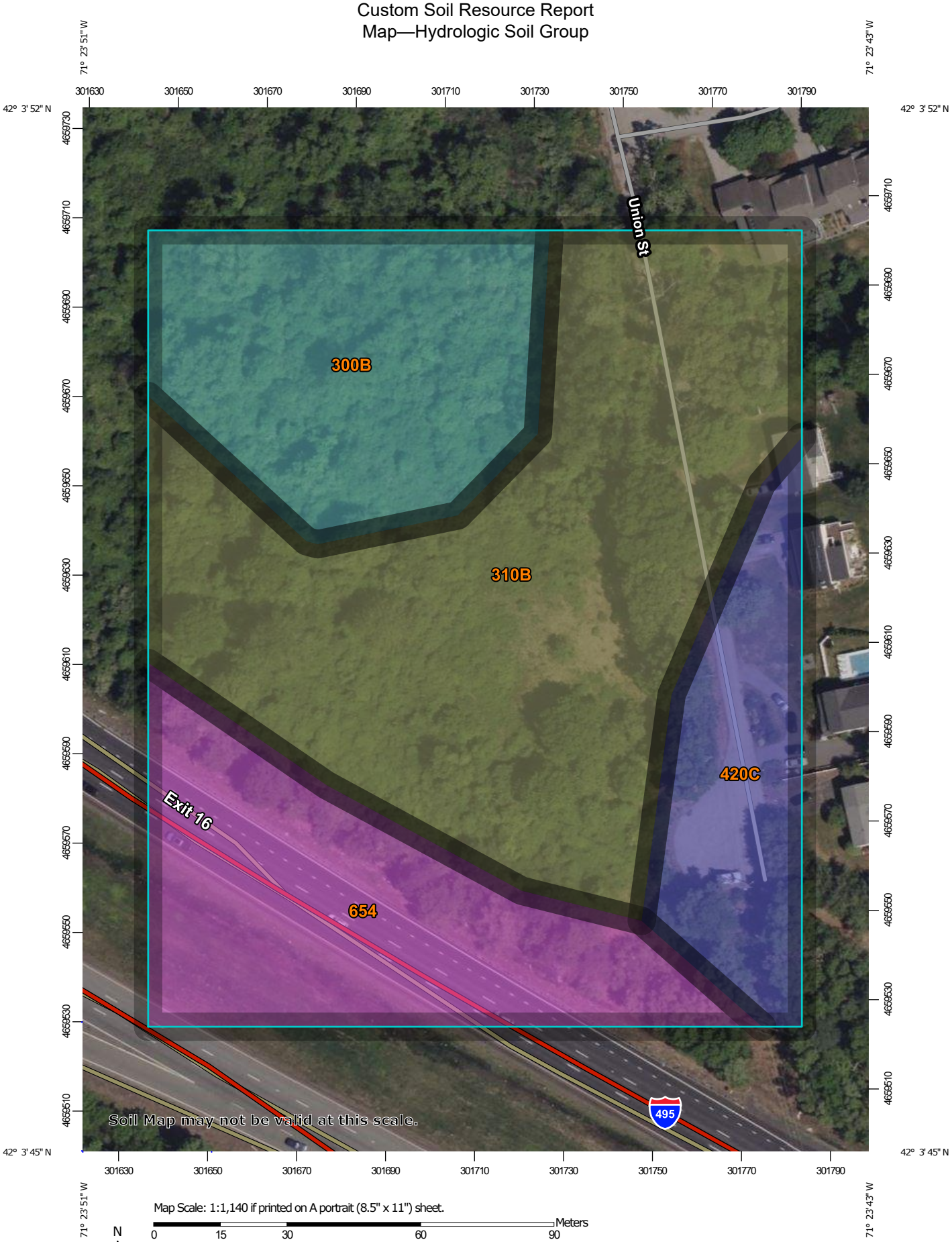
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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

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

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

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



Map Scale: 1:1,140 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 20, Aug 27, 2024

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

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

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
300B	Montauk fine sandy loam, 3 to 8 percent slopes	C	1.3	20.0%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	3.0	46.6%
420C	Canton fine sandy loam, 8 to 15 percent slopes	B	0.8	12.0%
654	Udorthents, loamy	A	1.4	21.5%
Totals for Area of Interest			**6.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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TSS REMOVAL CALCULATIONS

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 759 Union Street - Subsurface Chamber System #1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Cultec Separator Row	0.25	0.75	0.19	0.56

Pretreatment

Total TSS Removal = 44.0%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: F-4667

Prepared By: Michael Hassett

Date: 11/12/2024

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 759 Union Street - Subsurface Chamber System #1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Subsurface Infiltration Chamber System #1	0.80	0.75	0.60	0.15

Total TSS Removal = 85.0%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: F-4667

Prepared By: Michael Hassett

Date: 11/12/2024

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 759 Union Street - Subsurface Chamber System #2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Cultec Separator Row	0.25	0.75	0.19	0.56

Pretreatment

Total TSS Removal = 44%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: F-4667

Prepared By: Michael Hassett

Date: 11/12/2024

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 759 Union Street - Subsurface Chamber System #2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	0.25	1.00	0.25	0.75
Subsurface Detention Chamber System #2	0.50	0.75	0.375	0.375
Subsurface Infiltration Chamber System #1	0.80	0.375	0.30	0.075

Total TSS Removal = 92.5%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: F-4667

Prepared By: Michael Hassett

Date: 11/12/2024

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

DRAWDOWN CALCULATIONS (100-YR)

Hydrograph for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
0.00	0.00	0	370.40	0.00	0.00	0.00
1.00	0.01	2	370.40	0.01	0.01	0.00
2.00	0.05	8	370.40	0.05	0.05	0.00
3.00	0.07	12	370.41	0.07	0.07	0.00
4.00	0.09	15	370.41	0.09	0.09	0.00
5.00	0.11	19	370.41	0.10	**0.10**	0.00
6.00	0.13	63	370.44	0.10	**0.10**	0.00
7.00	0.19	268	370.55	0.10	0.10	0.00
8.00	0.24	675	370.79	0.10	0.10	0.00
9.00	0.27	1,227	371.00	0.10	0.10	0.00
10.00	0.38	2,101	371.25	0.10	0.10	0.00
11.00	0.58	3,343	371.61	0.10	0.10	0.00
12.00	**2.90**	**6,387**	**372.57**	**0.10**	0.10	**0.00**
13.00	**0.97**	**8,187**	**373.30**	**0.99**	0.10	**0.89**
14.00	0.70	8,102	373.25	0.71	0.10	0.60
15.00	0.59	8,065	373.23	0.60	0.10	0.49
16.00	0.44	8,013	373.21	0.45	0.10	0.35
17.00	0.36	7,978	373.19	0.37	0.10	0.27
18.00	0.30	7,949	373.17	0.31	0.10	0.21
19.00	0.26	7,925	373.16	0.26	0.10	0.16
20.00	0.22	7,906	373.15	0.23	0.10	0.13
21.00	0.20	7,890	373.15	0.20	0.10	0.10
22.00	0.17	7,874	373.14	0.18	0.10	0.08
23.00	0.15	7,857	373.13	0.16	0.10	0.05
24.00	0.13	7,838	373.12	0.14	0.10	0.03
25.00	0.05	7,667	373.05	0.10	0.10	0.00
26.00	0.05	7,468	372.96	0.10	0.10	0.00
27.00	0.04	7,260	372.88	0.10	0.10	0.00
28.00	0.04	7,037	372.80	0.10	0.10	0.00
29.00	0.03	6,792	372.71	0.10	0.10	0.00
30.00	0.01	6,495	372.60	0.10	0.10	0.00
31.00	0.01	6,163	372.49	0.10	0.10	0.00
32.00	0.01	5,816	372.37	0.10	0.10	0.00
33.00	0.00	5,461	372.26	0.10	0.10	0.00
34.00	0.00	5,102	372.14	0.10	0.10	0.00
35.00	0.00	4,739	372.03	0.10	0.10	0.00
36.00	0.00	4,375	371.92	0.10	0.10	0.00
37.00	0.00	4,009	371.81	0.10	0.10	0.00
38.00	0.00	3,642	371.70	0.10	0.10	0.00
39.00	0.00	3,274	371.59	0.10	0.10	0.00
40.00	0.00	2,906	371.48	0.10	0.10	0.00
41.00	0.00	2,537	371.37	0.10	0.10	0.00
42.00	0.00	2,168	371.27	0.10	0.10	0.00
43.00	0.00	1,799	371.16	0.10	0.10	0.00
44.00	0.00	1,429	371.06	0.10	0.10	0.00
45.00	0.00	1,059	370.95	0.10	0.10	0.00
46.00	0.00	689	370.79	0.10	0.10	0.00
47.00	0.00	319	370.58	0.10	0.10	0.00
48.00	0.00	0	370.40	0.00	0.00	0.00
49.00	0.00	0	370.40	0.00	0.00	0.00
50.00	0.00	0	370.40	0.00	0.00	0.00
51.00	0.00	0	370.40	0.00	0.00	0.00

Hydrograph for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Outflow (cfs)	Discarded (cfs)	Primary (cfs)
52.00	0.00	0	370.40	0.00	0.00	0.00
53.00	0.00	0	370.40	0.00	0.00	0.00
54.00	0.00	0	370.40	0.00	0.00	0.00
55.00	0.00	0	370.40	0.00	0.00	0.00
56.00	0.00	0	370.40	0.00	0.00	0.00
57.00	0.00	0	370.40	0.00	0.00	0.00
58.00	0.00	0	370.40	0.00	0.00	0.00
59.00	0.00	0	370.40	0.00	0.00	0.00
60.00	0.00	0	370.40	0.00	0.00	0.00
61.00	0.00	0	370.40	0.00	0.00	0.00
62.00	0.00	0	370.40	0.00	0.00	0.00
63.00	0.00	0	370.40	0.00	0.00	0.00
64.00	0.00	0	370.40	0.00	0.00	0.00
65.00	0.00	0	370.40	0.00	0.00	0.00
66.00	0.00	0	370.40	0.00	0.00	0.00
67.00	0.00	0	370.40	0.00	0.00	0.00
68.00	0.00	0	370.40	0.00	0.00	0.00
69.00	0.00	0	370.40	0.00	0.00	0.00
70.00	0.00	0	370.40	0.00	0.00	0.00
71.00	0.00	0	370.40	0.00	0.00	0.00
72.00	0.00	0	370.40	0.00	0.00	0.00

Hydrograph for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	372.16	0.00
1.00	0.00	0	372.16	0.00
2.00	0.01	5	372.16	0.00
3.00	0.03	69	372.22	0.00
4.00	0.05	205	372.35	0.00
5.00	0.07	408	372.54	0.00
6.00	0.08	667	372.72	0.01
7.00	0.10	876	372.82	0.06
8.00	0.11	985	372.87	0.09
9.00	0.13	1,047	372.90	0.11
10.00	0.19	1,175	372.96	0.15
11.00	0.32	1,376	373.06	0.20
12.00	**2.18**	**2,569**	**373.64**	**0.38**
13.00	**0.37**	**4,920**	**375.04**	**0.55**
14.00	0.21	4,074	374.46	0.46
15.00	0.19	3,296	374.02	0.37
16.00	0.14	2,636	373.67	0.29
17.00	0.13	2,208	373.46	0.22
18.00	0.12	1,956	373.34	0.17
19.00	0.11	1,816	373.27	0.14
20.00	0.10	1,735	373.23	0.12
21.00	0.09	1,681	373.20	0.10
22.00	0.08	1,638	373.18	0.09
23.00	0.07	1,601	373.16	0.08
24.00	0.06	1,565	373.15	0.07
25.00	0.00	1,385	373.06	0.05
26.00	0.00	1,212	372.98	0.05
27.00	0.00	1,050	372.90	0.04
28.00	0.00	901	372.83	0.04
29.00	0.00	774	372.77	0.03
30.00	0.00	700	372.74	0.01
31.00	0.00	660	372.72	0.01
32.00	0.00	635	372.71	0.01
33.00	0.00	619	372.70	0.00
34.00	0.00	607	372.69	0.00
35.00	0.00	598	372.69	0.00
36.00	0.00	590	372.69	0.00
37.00	0.00	585	372.68	0.00
38.00	0.00	580	372.68	0.00
39.00	0.00	576	372.68	0.00
40.00	0.00	573	372.68	0.00
41.00	0.00	570	372.68	0.00
42.00	0.00	568	372.68	0.00
43.00	0.00	566	372.67	0.00
44.00	0.00	564	372.67	0.00
45.00	0.00	562	372.67	0.00
46.00	0.00	561	372.67	0.00
47.00	0.00	559	372.67	0.00
48.00	0.00	558	372.67	0.00
49.00	0.00	557	372.67	0.00
50.00	0.00	556	372.67	0.00
51.00	0.00	555	372.67	0.00

Hydrograph for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.00	554	372.67	0.00
53.00	0.00	554	372.67	0.00
54.00	0.00	553	372.67	0.00
55.00	0.00	552	372.67	0.00
56.00	0.00	552	372.67	0.00
57.00	0.00	551	372.67	0.00
58.00	0.00	551	372.67	0.00
59.00	0.00	550	372.67	0.00
60.00	0.00	550	372.67	0.00
61.00	0.00	549	372.67	0.00
62.00	0.00	549	372.67	0.00
63.00	0.00	548	372.67	0.00
64.00	0.00	548	372.67	0.00
65.00	0.00	548	372.67	0.00
66.00	0.00	547	372.67	0.00
67.00	0.00	547	372.67	0.00
68.00	0.00	547	372.67	0.00
69.00	0.00	546	372.67	0.00
70.00	0.00	546	372.67	0.00
71.00	0.00	546	372.67	0.00
72.00	0.00	545	372.67	0.00

SUPPLEMENT ATTACHMENTS

Stage-Area-Storage for Pond INFIL 1: Cultec Infiltration Chamber System #1 (R-300HD)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
370.40	**4,371**	0
370.45	4,371	87
370.50	4,371	175
370.55	4,371	262
370.60	4,371	350
370.65	4,371	437
370.70	4,371	524
370.75	4,371	612
370.80	4,371	699
370.85	4,371	787
370.90	4,371	874
370.95	4,371	1,053
371.00	4,371	1,231
371.05	4,371	1,408
371.10	4,371	1,585
371.15	4,371	1,761
371.20	4,371	1,937
371.25	4,371	2,113
371.30	4,371	2,287
371.35	4,371	2,461
371.40	4,371	2,634
371.45	4,371	2,807
371.50	4,371	2,978
371.55	4,371	3,149
371.60	4,371	3,319
371.65	4,371	3,488
371.70	4,371	3,657
371.75	4,371	3,824
371.80	4,371	3,991
371.85	4,371	4,156
371.90	4,371	4,320
371.95	4,371	4,484
372.00	4,371	4,646
372.05	4,371	4,807
372.10	4,371	4,967
372.15	4,371	5,125
372.20	4,371	5,283
372.25	4,371	5,438
372.30	4,371	5,593
372.35	4,371	5,746
372.40	4,371	5,897
372.45	4,371	6,047
372.50	4,371	6,195
372.55	4,371	6,342
372.60	4,371	6,486
372.65	4,371	6,628
372.70	4,371	6,768
372.75	4,371	6,906
372.80	4,371	7,041
372.85	4,371	7,174
372.90	4,371	7,305
372.95	4,371	7,432
373.00	4,371	7,556
373.05	4,371	7,675
373.10	4,371	7,791
373.15	4,371	7,899
373.20	4,371	8,002
373.25	4,371	8,100
373.30	4,371	8,194
373.35	4,371	8,286
373.40	4,371	8,375
373.45	4,371	8,462
373.50	4,371	8,550
373.55	4,371	8,637
373.60	4,371	8,724
373.65	4,371	8,812
373.70	4,371	8,899
373.75	4,371	8,987
373.80	4,371	9,074
373.85	4,371	9,161
373.90	4,371	**9,249**

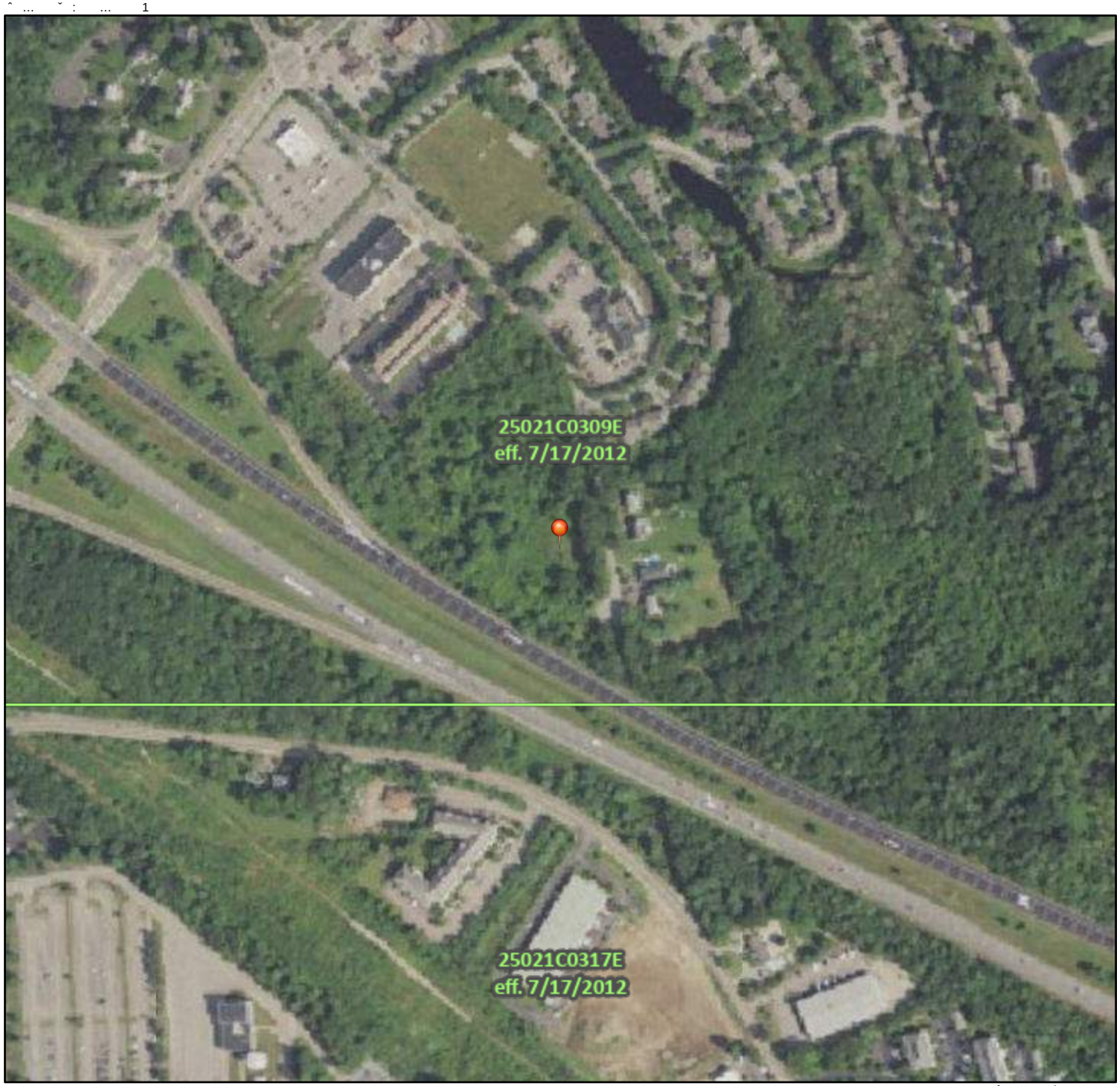
Hydrograph for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	372.16	0.00
1.00	0.00	0	372.16	0.00
2.00	0.01	5	372.16	0.00
3.00	0.03	69	372.22	0.00
4.00	0.05	205	372.35	0.00
5.00	0.07	408	372.54	0.00
6.00	0.08	667	372.72	0.01
7.00	0.10	876	372.82	0.06
8.00	0.11	985	372.87	0.09
9.00	0.13	1,047	372.90	0.11
10.00	0.19	1,175	372.96	0.15
11.00	0.32	1,376	373.06	0.20
12.00	**2.18**	**2,569**	**373.64**	**0.38**
13.00	**0.37**	**4,920**	**375.04**	**0.55**
14.00	0.21	4,074	374.46	0.46
15.00	0.19	3,296	374.02	0.37
16.00	0.14	2,636	373.67	0.29
17.00	0.13	2,208	373.46	0.22
18.00	0.12	1,956	373.34	0.17
19.00	0.11	1,816	373.27	0.14
20.00	0.10	1,735	373.23	0.12
21.00	0.09	1,681	373.20	0.10
22.00	0.08	1,638	373.18	0.09
23.00	0.07	1,601	373.16	0.08
24.00	0.06	1,565	373.15	0.07
25.00	0.00	1,385	373.06	0.05
26.00	0.00	1,212	372.98	0.05
27.00	0.00	1,050	372.90	0.04
28.00	0.00	901	372.83	0.04
29.00	0.00	774	372.77	0.03
30.00	0.00	700	372.74	0.01
31.00	0.00	660	372.72	0.01
32.00	0.00	635	372.71	0.01
33.00	0.00	619	372.70	0.00
34.00	0.00	607	372.69	0.00
35.00	0.00	598	372.69	0.00
36.00	0.00	590	372.69	0.00
37.00	0.00	585	372.68	0.00
38.00	0.00	580	372.68	0.00
39.00	0.00	576	372.68	0.00
40.00	0.00	573	372.68	0.00
41.00	0.00	570	372.68	0.00
42.00	0.00	568	372.68	0.00
43.00	0.00	566	372.67	0.00
44.00	0.00	564	372.67	0.00
45.00	0.00	562	372.67	0.00
46.00	0.00	561	372.67	0.00
47.00	0.00	559	372.67	0.00
48.00	0.00	558	372.67	0.00
49.00	0.00	557	372.67	0.00
50.00	0.00	556	372.67	0.00
51.00	0.00	555	372.67	0.00

Hydrograph for Pond DET 2: Cultec Detention Chamber System #2 (R-300HD) (continued)

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
52.00	0.00	554	372.67	0.00
53.00	0.00	554	372.67	0.00
54.00	0.00	553	372.67	0.00
55.00	0.00	552	372.67	0.00
56.00	0.00	552	372.67	0.00
57.00	0.00	551	372.67	0.00
58.00	0.00	551	372.67	0.00
59.00	0.00	550	372.67	0.00
60.00	0.00	550	372.67	0.00
61.00	0.00	549	372.67	0.00
62.00	0.00	549	372.67	0.00
63.00	0.00	548	372.67	0.00
64.00	0.00	548	372.67	0.00
65.00	0.00	548	372.67	0.00
66.00	0.00	547	372.67	0.00
67.00	0.00	547	372.67	0.00
68.00	0.00	547	372.67	0.00
69.00	0.00	546	372.67	0.00
70.00	0.00	546	372.67	0.00
71.00	0.00	546	372.67	0.00
72.00	0.00	545	372.67	0.00

1DWLRQDO)ORRG +D]DUG / FEMA) /HJHQG



)HHW

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63(&,$/)/22' +$=$5' $5($6

:LWKRXW %DVH)ORRG (O
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5HJXODWRU\ )ORRGZD\

$QQXDO &KDQFH)ORR
RI DQQXDO FKDQFH IO
GHSWK OHVV WKDQ RQH
DUHDV RI OHVV WKDQ RQ
)XWXUH &RQGLWLRQV
&KDQFH)ORRG +D]DUG
$UHD ZLWK 5HGXFHG)OR
/HYHH 6HH 1RWHV
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&KDQQHO &RQYH\DQFH
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&URVV 6HFWLRQV ZLWK
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&RDVWDO 7UDQVHFW
%DVH)ORRG (OHYDWLRQ
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-XULVGLFWLRQ %RXQGDU
&RDVWDO 7UDQVHFW %DV
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+\GURJUDSKLF)HDWXUH

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1R 'LJLWDO 'DWD $YDLOD
0$3 3$1(/6
8QPDSSHG

7KH SLQ GLVSOD\HG RQ WKH
SRLQW VHOHFWHG E\ WKH XV
DQ DXWKRULWDWLYH SURSHU

7KLV PDS FRPSOLHV ZLWK)(0$ V VWDQ
GLJLWDO IORRG PDSV LI LW LV QRW YR
7KH EDVHPDS VKRZQ FRPSOLHV ZLWK)(
DFFXUDF\ VWDQGDUGV

7KH IORRG KD]DUG LQIRUPDWLRQ LV GH
DXWKRULWDWLYH 1)+/ ZHE VHUYLFHV S
ZDV H[SRUWHG RQ DW ,QG GHV QRW
UHIOHFW FKDQJHV RU DPHQGPHQWV VX
WLPH 7KH 1)+/ DQG HIIHFWLYH LQIRUP
EHFRPH VXSHUVHGHG E\ QHZ GDWD RY

7KLV PDS LPDJH LV YRLG LI WKH RQH R
HOHPHQWV GR QRW DSSHDU EDVHPDS
OHJHQG VFDOH EDU PDS FUHDWLRQ G
),50 SDQHO QXPEHU DQG),50 HIIHFWLY
XQPDSSHG DQG XQPRGHUQL]HG DUHDV
UHJXODWRU\ SXUSRVHV

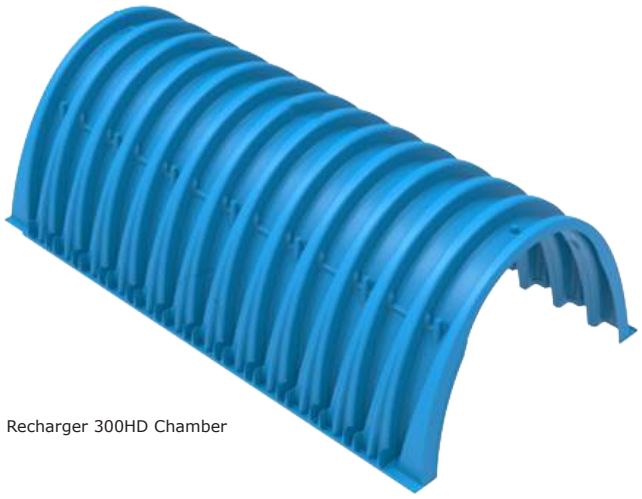
%DVHPDS ,PDJHU\ 6RXUFH¸ 86*6 1DWLRQDO 0DS

Post Construction Inspection Report
759 Union Street
Franklin, Massachusetts

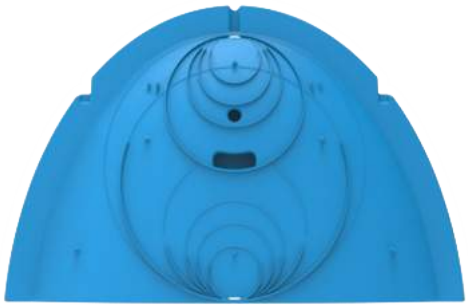
INSPECTION DATE:						
Person Inspecting		Weather				Other Personnel Present
Item	**N/A***	**sat.****	**NMR*****	**CAM****	**MCA***	**Comments:**
Pavement Swept						
Catch Basins						
CB #1						
CB #2						
CB #3						
CB #4						
CB #5						
CB #6						
CB #7						
Cultec Infiltration Chamber System #1 (R-300HD)						
Separator Row						
Inspection Port						
Cultec Detention Chamber System #2 (R-300HD)						
Separator Row						
Inspection Port						
Weir Manhole Outlet						
Headwall #1						
Rip-rap Outfall						
NMR* normal maintenance requested						
N/A* not applicable at the time of inspection						
CAM* corrective action - minor						
SAT* satisfactory conditions as compliant						
MCA* Major corrective action						

CULTEC RECHARGER® 300HD STORMWATER CHAMBER

The Recharger® 300HD is a 30" (762 mm) tall, high capacity chamber. Typically when using this model, fewer chambers are required resulting in less labor and a smaller installation area. The Recharger® 300HD has the side portal internal manifold feature. HVLV® FC-24 Feed Connectors are inserted into the side portals to create the internal manifold.



Recharger 300HD Chamber



Recharger 300HD End Cap

Recharger 300HD Chamber	
Size (L x W x H)	7.54' x 51" x 30"
	2.29 m x 1295 mm x 762 mm
Installed Length	7.08'
	2.16 m
Length Adjustment per Row - with two end caps installed	0.89'
	0.27 m
Length Adjustment per Row - when not using end caps	0.46'
	0.14 m
Chamber Storage	6.53 ft^3/ft
	0.61 m^3/m
	46.27 ft^3/unit
	1.31 m^3/unit
Min. Installed Storage	10.57 ft^3/ft
	0.98 m^3/m
	74.44 ft^3/unit
	2.12 m^3/unit
Min. Area Required	33.65 ft^2
	3.13 m^2
Chamber Weight	80.4 lbs
	36.47 kg
Shipping	25 chambers/skid
	12 skids/48' flatbed
Min. Center-to-Center Spacing	4.75'
	1.45 m
Max. Allowable Cover	12'
	3.66 m
Max. Allowable O.D. in Side Portal	10" HDPE, 12" PVC
	250 mm HDPE, 300 mm PVC
Compatible Feed Connector	HVLV FC-24 Feed Connector

Calculations are based on installed chamber length.
All above values are nominal.
Includes 6" (152 mm) stone above crown of chamber and typical stone surround at 4.75' (1.45 m) center-to-center spacing and stone foundation depth as listed in table.
Stone void calculated at 40%.

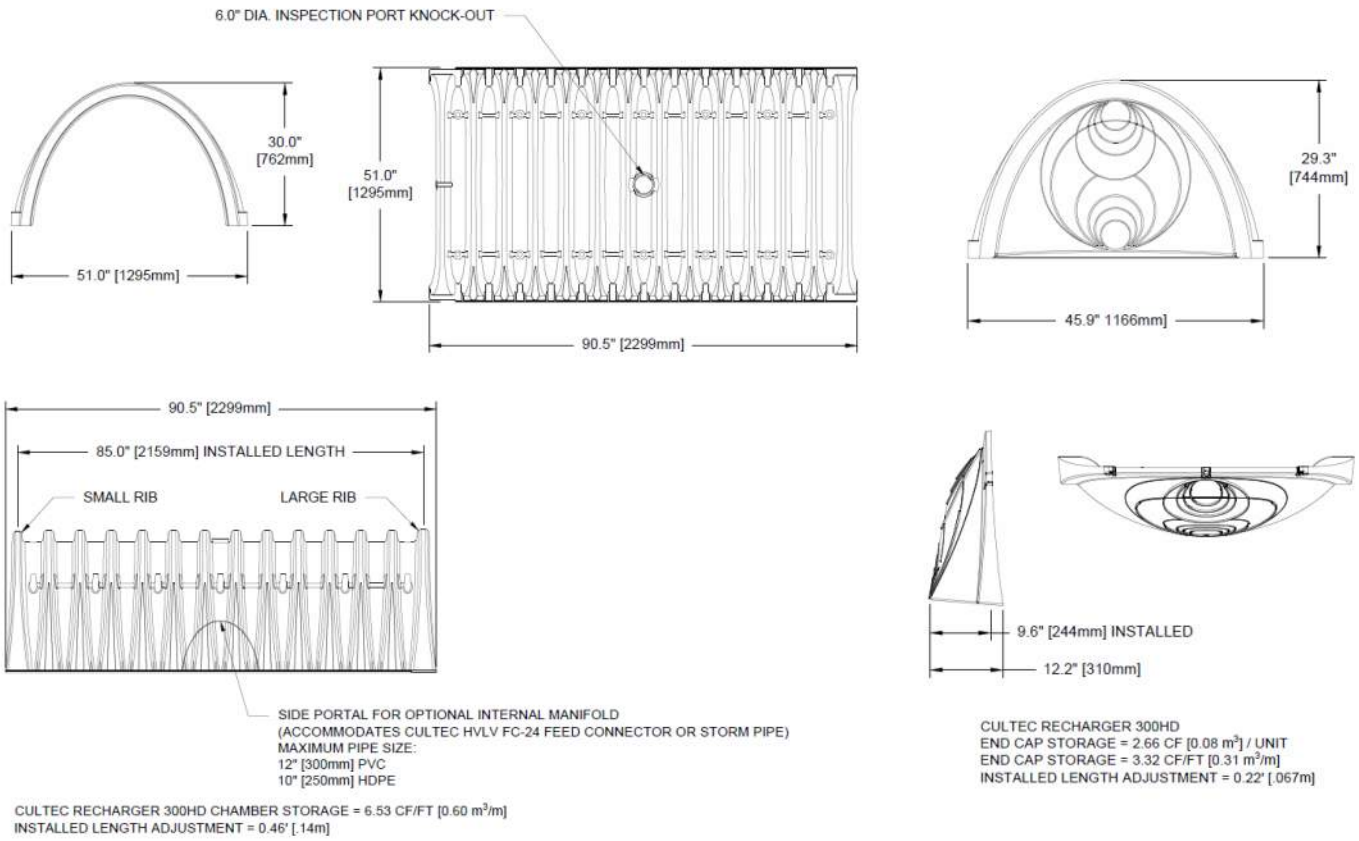
	Stone Foundation Depth		
	6"	12"	18"
	152 mm	305 mm	457 mm
Chamber and Stone Storage Per Chamber	74.84 ft^3	101.94 ft^3	107.26 ft^3
	2.12 m^3	2.89 m^3	3.04 m^3
Min. Effective Depth	3.5'	6.00'	6.5'
	1.07 m	1.83 m	1.98 m
Stone Required Per Chamber	71.44 ft^3	88.25 ft^3	105.07 ft^3
	2.12 m^3	2.50 m^3	2.98 m^3

Recharger 300HD End Cap	
Size (L x W x H)	12.2" x 45.9" x 29.3"
	310 mm x 1166 mm x 744 mm
Installed Length	9.6"
	244 mm
End Cap Storage	3.32 ft^3/ft
	0.31 m^3/m
	2.565 ft^3/unit
	0.08 m^3/unit
Min. Installed Storage	16.95 ft^3/ft
	1.57 m^3/m
	13.56 ft^3/unit
	0.38 m^3/unit
End Cap Weight	13.7 lbs
	6.21 kg
Shipping	60 end caps/skid
	922 lbs/skid
	11 skids/48' flatbed
Max. Inlet Opening in End Cap	24" HDPE, 24" PVC
	600 mm HDPE, 600 mm PVC

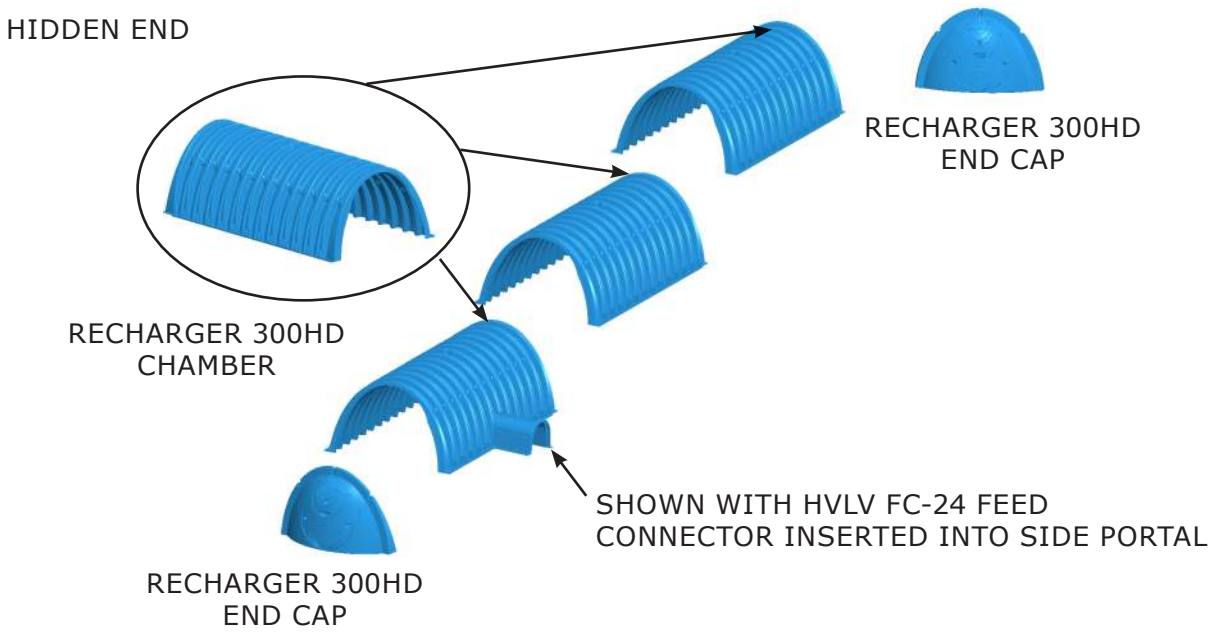
Calculations are based on installed chamber length.
All above values are nominal.
Min. installed storage includes 6" (152 mm) stone base, 6" (152 mm) stone above crown of chamber and typical stone surround at 4.75' (1.25 m) center-to-center spacing.

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.

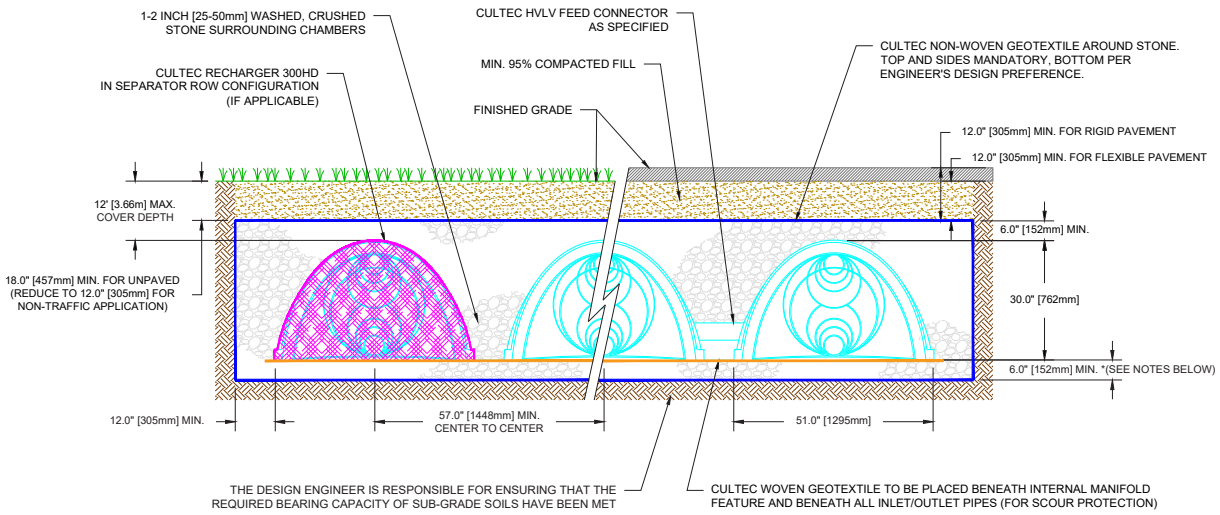
Three View Drawing



Typical Interlock Installation



Typical Cross Section for Traffic Application

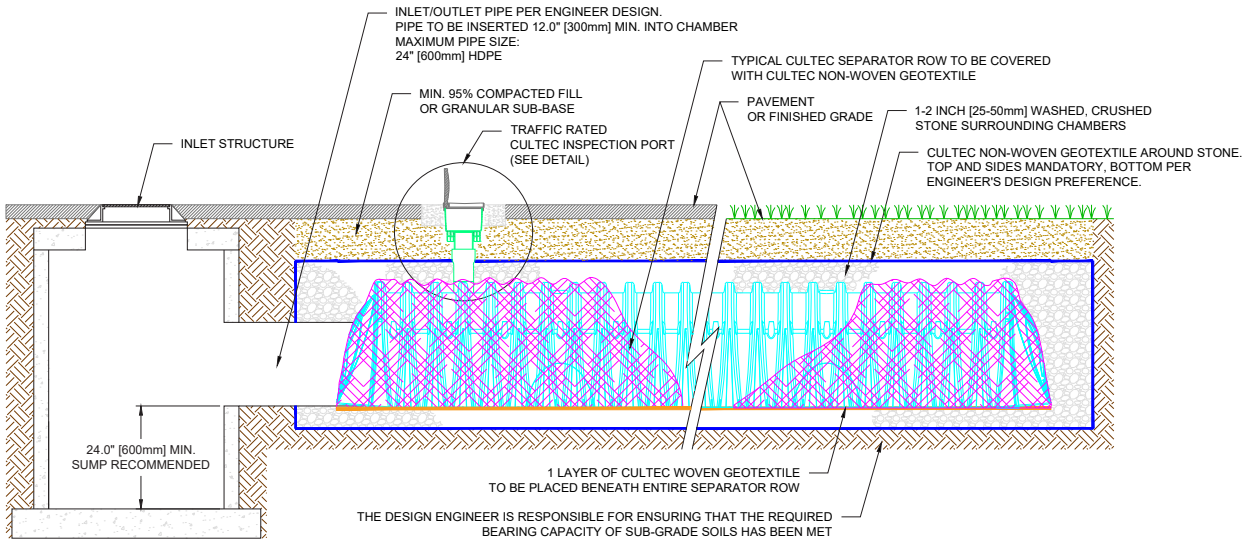


NOTES:

*FOR COVER DEPTHS FROM 18.0" - 8.0' (457mm - 2.44m). INCREASE DEPTH OF BEDDING STONE TO 9.0" (229mm) MIN. FOR COVER DEPTHS GREATER THAN 8.0' (2.44m)
**UTILIZE HVLV FC-24 FEED CONNECTOR FOR 6" (152mm) ROW SPACING. UTILIZE HVLV FC-48 FEED CONNECTOR FOR ROW SPACING GREATER THAN 6" (152mm)

1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F2418
   3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

Typical Profile View for Traffic Application



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   3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

Recharger® 300HD Bare Chamber Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft^3/ft	m^3/m	ft^3	m^3	ft^3	m^3
30	762	0.0082	0.0008	0.06	0.002	46.268	1.310
29	737	0.0235	0.0022	0.17	0.005	46.210	1.309
28	711	0.0405	0.0038	0.29	0.008	46.044	1.304
27	686	0.0863	0.0080	0.61	0.017	45.757	1.296
26	660	0.1144	0.0106	0.81	0.023	45.146	1.279
25	635	0.1354	0.0126	0.96	0.027	44.336	1.256
24	610	0.1529	0.0142	1.08	0.031	43.377	1.228
23	584	0.1677	0.0156	1.19	0.034	42.294	1.198
22	559	0.1799	0.0167	1.27	0.036	41.106	1.164
21	533	0.1926	0.0179	1.36	0.039	39.832	1.128
20	508	0.2053	0.0191	1.45	0.041	38.468	1.089
19	483	0.2156	0.0200	1.53	0.043	37.013	1.048
18	457	0.2246	0.0209	1.59	0.045	35.486	1.005
17	432	0.2332	0.0217	1.65	0.047	33.895	0.960
16	406	0.2413	0.0224	1.71	0.048	32.244	0.913
15	381	0.2488	0.0231	1.76	0.050	30.535	0.865
14	356	0.2560	0.0238	1.81	0.051	28.772	0.815
13	330	0.2626	0.0244	1.86	0.053	26.959	0.763
12	305	0.2689	0.0250	1.90	0.054	25.099	0.711
11	279	0.2748	0.0255	1.95	0.055	23.195	0.657
10	254	0.2803	0.0260	1.99	0.056	21.248	0.602
9	229	0.2854	0.0265	2.02	0.057	19.263	0.546
8	203	0.2903	0.0270	2.06	0.058	17.241	0.488
7	178	0.2948	0.0274	2.09	0.059	15.185	0.430
6	152	0.2991	0.0278	2.12	0.060	13.097	0.371
5	127	0.3030	0.0282	2.15	0.061	10.978	0.311
4	102	0.3067	0.0285	2.17	0.062	8.831	0.250
3	76	0.3101	0.0288	2.20	0.062	6.659	0.189
2	51	0.3133	0.0291	2.22	0.063	4.462	0.126
1	25	0.3166	0.0294	2.24	0.064	2.243	0.064
Total		**6.532**	**0.607**	**46.27**	**1.310**	**46.268**	**1.310**

Calculations are based on installed chamber length of 7.08' (2.16 m).

Recharger® 300HD Bare End Cap Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft^3/ft	m^3/m	ft^3	m^3	ft^3	m^3
30	762	0.0000	0.0000	0.0000	0.000	2.655	0.075
29	737	0.0000	0.0000	0.0000	0.000	2.655	0.075
28	711	0.0050	0.0005	0.0040	0.000	2.655	0.075
27	686	0.0075	0.0007	0.0060	0.000	2.651	0.075
26	660	0.0138	0.0013	0.0110	0.000	2.645	0.075
25	635	0.0237	0.0022	0.0190	0.001	2.634	0.075
24	610	0.0350	0.0033	0.0280	0.001	2.615	0.074
23	584	0.0463	0.0043	0.0370	0.001	2.587	0.073
22	559	0.0537	0.0050	0.0430	0.001	2.550	0.072
21	533	0.0688	0.0064	0.0550	0.002	2.507	0.071
20	508	0.0800	0.0074	0.0640	0.002	2.452	0.069
19	483	0.0900	0.0084	0.0720	0.002	2.388	0.068
18	457	0.1000	0.0093	0.0800	0.002	2.316	0.066
17	432	0.1113	0.0103	0.0890	0.003	2.236	0.063
16	406	0.1113	0.0103	0.0890	0.003	2.147	0.061
15	381	0.1250	0.0116	0.1000	0.003	2.058	0.058
14	356	0.1300	0.0121	0.1040	0.003	1.958	0.055
13	330	0.1425	0.0132	0.1140	0.003	1.854	0.053
12	305	0.1513	0.0141	0.1210	0.003	1.740	0.049
11	279	0.1425	0.0132	0.1140	0.003	1.619	0.046
10	254	0.1675	0.0156	0.1340	0.004	1.505	0.043
9	229	0.1738	0.0161	0.1390	0.004	1.371	0.039
8	203	0.1813	0.0168	0.1450	0.004	1.232	0.035
7	178	0.1888	0.0175	0.1510	0.004	1.087	0.031
6	152	0.1850	0.0172	0.1480	0.004	0.936	0.027
5	127	0.2013	0.0187	0.1610	0.005	0.788	0.022
4	102	0.2075	0.0193	0.1660	0.005	0.627	0.018
3	76	0.2125	0.0197	0.1700	0.005	0.461	0.013
2	51	0.2188	0.0203	0.1750	0.005	0.291	0.008
1	25	0.1450	0.0135	0.1160	0.003	0.116	0.003
Total		**3.3188**	**0.308**	**2.655**	**0.075**	**2.655**	**0.075**

Calculations are based on installed chamber length of 9.6" (244 mm).

CULTEC Recharger® 300HD Specifications

GENERAL

CULTEC Recharger® 300HD chambers are designed for underground stormwater management. The chambers may be used for retention, recharging, detention, or controlling the flow of on-site stormwater runoff.

CHAMBER PARAMETERS

1. The chambers shall be manufactured in the U.S.A. by CULTEC of Brookfield, CT (cultec.com, 203-775-4416).
2. The chambers shall be designed and tested in accordance with ASTM F2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers". The load configuration shall include:
    a. Instantaneous AASHTO Design Truck live load at minimum cover
    b. Maximum permanent (50-year) cover load
    c. 1-week parked AASHTO design truck load
3. The chambers shall meet the requirements of ASTM F2418 "Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers".
4. The installed chamber system shall provide resistance to the loads and load factors as defined in the AASHTO LRFD Bridge Design Specifications Section 12.12, when installed according to CULTEC's recommended installation instructions. The structural design of the chambers shall include the following:
    a. The Creep Modulus shall be 50-year as specified in ASTM F2418
    b. The minimum safety factor for live loads shall be 1.75
    c. The minimum safety factor for dead loads shall be 1.95
5. The installed chamber system shall be structurally designed to provide resistance to live loads as defined by the AASHTO H-20/HL-93 specification when installed according to CULTEC's recommended installation instructions.
6. The chamber shall be structural foam injection molded of blue virgin impact-modified polypropylene.
7. The chamber shall be arched in shape.
8. The chamber shall be open-bottomed.
9. The chamber shall be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings.
10. The nominal chamber dimensions of the CULTEC Recharger® 300HD shall be 30 inches (762 mm) tall, 51 inches (1295 mm) wide and 90.5 inches (2299 mm) long. The installed length of a joined Recharger 300HD shall be 7.08 feet (2.159 m).
11. Multiple chambers may be connected to form different length rows. Each row shall begin and end with a separately formed CULTEC Recharger® 300HD End Cap. Maximum inlet opening on the end cap is 24 inches (600 mm) HDPE.
12. The chamber shall have two side portals to accept CULTEC HVLV™ FC-24 Feed Connectors to create an internal manifold. Maximum allowable pipe size in the side portal is 10 inches (250 mm) HDPE and 12 inches (300 mm) PVC.
13. The nominal chamber dimensions of the CULTEC HVLV™ FC-24 Feed Connector shall be 12 inches (305 mm) tall, 16 inches (406 mm) wide and 24.2 inches (615 mm) long.
14. The nominal storage volume of the Recharger 300HD chamber shall be 6.53 ft^3 / ft (0.607 m^3 / m) - without stone. The nominal storage volume of a joined Recharger 300HD shall be 46.27 ft^3 / unit (1.310 m^3 / unit) - without stone.
15. The Recharger 300HD chamber shall have 14 corrugations.
16. The chamber shall be capable of accepting a 6 inch (150 mm) inspection port opening at the top center of each chamber, centered on the corrugation crest.
17. The chamber shall be manufactured in a facility employing CULTEC's Quality Control and Assurance Procedures.
18. Maximum allowable cover over the top of the chamber shall be 12.0 feet (3.66 m).
19. The installed chamber system shall be structurally designed to provide resistance to live loads as defined by the AASHTO H-20/HL-93 specification when installed according to CULTEC's recommended installation instructions.

END CAP PARAMETERS

1. The CULTEC Recharger® 300HD End Cap (referred to as 'end cap') shall be manufactured in the U.S.A. by CULTEC of Brookfield, CT (cultec.com, 203-775-4416).
2. The end cap shall be injection molded of blue virgin impact-modified polyethylene copolymers.
3. The end cap shall be arched in shape.
4. The end cap shall be joined at the beginning and end of each row of chambers using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings.
5. The nominal dimensions of the end cap shall be 29.3 inches (744 mm) tall, 45.9 inches (1166 mm) wide and 12.2 inches (310 mm) long. When joined with a Recharger 300HD Chamber, the installed length of the end cap shall be 9.6 inches (244 mm).
6. The nominal storage volume of the end cap shall be 3.32 ft^3 / ft (0.31 m^3 / m) - without stone. The nominal storage volume of an interlocked end cap shall be 2.66 ft^3 / unit (0.08 m^3 / unit) - without stone.
7. Maximum inlet opening on the end cap is 24 inches (600 mm) HDPE.
8. The end cap shall provide resistance to the loads and load factors as defined in the AASHTO LRFD Bridge Design Specifications Section 12.12.

SEPARATOR ROW™ SPECIFICATIONS

GENERAL

1. CULTEC'S SEPARATOR ROW IS USED AS AN INEXPENSIVE MEANS OF REMOVING TOTAL SUSPENDED SOLIDS FROM THE CHAMBER SYSTEM, AS WELL AS PROVIDING EASIER ACCESS FOR INSPECTION AND MAINTENANCE.

2. THE SEPARATOR ROW PERFORMANCE SHALL BE TESTED AND VERIFIED TO THE PROTOCOLS AND PROCEDURES AS DEFINED BY ENVIRONMENTAL TECHNOLOGY VERIFICATION (ETV) CANADA TO ACHIEVE 80% TSS REMOVAL.

INSTALLATION INSTRUCTIONS

A SEPARATOR ROW IS INSTALLED ON A 1-2 INCH [25-51 mm] WASHED, CRUSHED STONE BASE. TYPICALLY, THE CULTEC CHAMBER MODEL USED FOR THE SEPARATOR ROW IS THE SAME CHAMBER USED THROUGHOUT THE ENTIRE CHAMBER BED.

STORMWATER IS DISTRIBUTED TO THE SEPARATOR ROW BY A PRIMARY FEED SYSTEM THAT DIVERTS FLOW TO THE SEPARATOR ROW AND A SECONDARY BYPASS FEED SYSTEM THAT DIVERTS THE FLOW OF CLEAN WATER TO THE OTHER PARTS OF THE UNDERGROUND STORMWATER MANAGEMENT SYSTEM. THE DISTRIBUTION SYSTEM MAY BE BY PIPES SET AT A LOWER ELEVATION THAT PERMIT THE FIRST FLUSH TO THE SEPARATOR ROW VERSUS OTHER PARTS OF THE UNDERGROUND STORMWATER SYSTEM. THIS INITIAL FLOW MAY BE MANAGED BY A BAFFLE OR WEIR. THE SIZING OF THE PIPE(S) THAT PROVIDE STORM WATER TO THE SEPARATOR ROW IS TO BE DETERMINED BY THE DESIGN ENGINEER AND IS BASED UPON THE REQUIREMENT TO ACCOMMODATE THE DESIGN FLOW AND SERVICE CONVENIENCE.

THE CHAMBERS UTILIZED IN THE SEPARATOR ROW ARE TO BE COMPLETELY WRAPPED WITH CULTEC NON-WOVEN GEOTEXTILE. THIS CREATES A PASS-THROUGH FILTER ARRANGEMENT TO SEPARATE TOTAL SUSPENDED SOLIDS IN THE TRANSFER OF STORM WATER TO OTHER CHAMBERS THROUGHOUT THE UNDERGROUND STORMWATER MANAGEMENT SYSTEM.

ONCE WRAPPED, THE SEPARATOR ROW IS TO THEN PLACED ENTIRELY OVER 1 LAYER OF CULTEC AFAB-HPF WOVEN GEOTEXTILE. THIS CULTEC AFAB-HPF WOVEN GEOTEXTILE PROVIDES A DURABLE SURFACE WITHIN THE ROW FOR MAINTENANCE PROCEDURES AS WELL AS TO PREVENT ANY SCOURING OF THE STONE BASE DURING HIGH PRESSURE JETTING.

THE RECOMMENDED INSTALLATION OF SEPARATOR ROW CHAMBERS, IN REGARD TO STONE SEPARATION AND STONE ABOVE THE UNIT, ALONG WITH OTHER MINIMUM COVER, MATERIALS AND METHOD SPECIFICATIONS DETAILED FOR THE PROPER INSTALLATION, IS THE SAME AS CULTEC'S REQUIREMENT DETAILED IN THE COMPANY'S INSTALLATION GUIDELINES WITH THE EXCEPTION OF THE PLACEMENT OF THE REQUIRED FILTERING FABRICS. PLEASE REFER TO CULTEC'S CURRENT INSTALLATION INSTRUCTIONS FOR STORMWATER CHAMBERS AS A GUIDE.

MAINTENANCE PROCEDURES

CULTEC RECOMMENDS INSPECTIONS OF THE SEPARATOR ROW TO BE PERFORMED EVERY SIX MONTHS FOR THE FIRST YEAR. THE FREQUENCY OF INSPECTION CAN THEN BE ADJUSTED BASED UPON PREVIOUS OBSERVATION OF SEDIMENT DEPOSITION.

WHILE CLEANING IS POSSIBLE FROM A SINGLE MANHOLE IN SHORTER LINES, A CLEAN-OUT OPTION FROM EITHER END OF A LINE IS PREFERABLE, PARTICULARLY FOR LONGER RUNS. CLEANING INVOLVES FLUSHING SEDIMENT FROM THE BASE FABRIC OF THE SEPARATOR ROW.

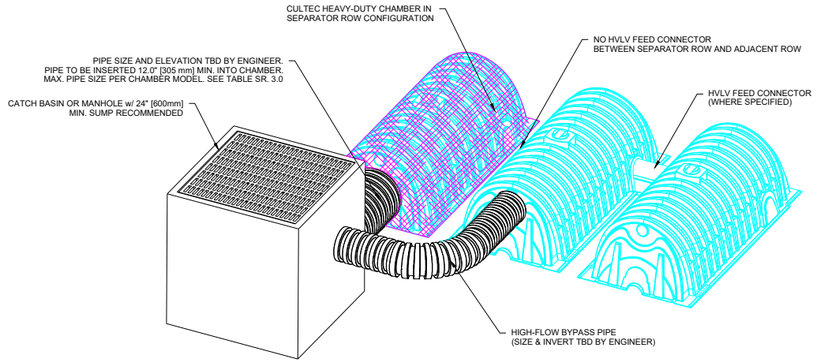
ACCESS WILL BE PROVIDED VIA A MANHOLE(S) LOCATED AT THE END(S) OF THE ROW FOR CLEAN OUT.

MAINTENANCE OF THE SEPARATOR ROW IS TO BE ACCOMPLISHED WITH A JETVAC PROCESS.

THE JETVAC IS TO BE SENT DOWN THE ENTIRE LENGTH OF THE SEPARATOR ROW. AS THE HIGH PRESSURE WATER NOZZLE IS RETRIEVED, THE CAPTURED SEDIMENTS ARE PUSHED BACK INTO THE MANHOLE FOR VACUUMING.

SR 1.0

GENERAL NOTES



SR 2.0

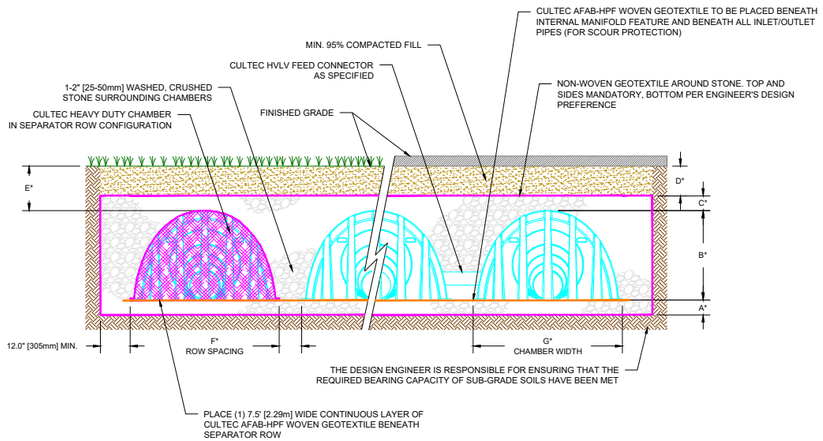
TYPICAL SEPARATOR ROW CONFIGURATION INLET CONNECTION

CULTEC CHAMBER MODEL							
	DESCRIPTION	CONTACTOR 100HD	RECHARGER 150XLHD	RECHARGER 280HD	RECHARGER 300HD	RECHARGER 360HD	RECHARGER 902HD
A[1]	MIN. DEPTH OF STONE BASE	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	9" 229 mm
B	CHAMBER HEIGHT	12.5" 318 mm	18.5" 470 mm	26.5" 673 mm	30.0" 762 mm	36.0" 914 mm	48" 1219 mm
C[1]	MIN. DEPTH OF STONE REQUIRED ABOVE UNITS FOR TRAFFIC APPLICATIONS	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	12" 305 mm
D	MIN. DEPTH REQUIRED OF 95% COMPACTED FILL FOR PAVED TRAFFIC	8" 203 mm	8" 203 mm	8" 203 mm	10" 254 mm	10" 254 mm	12" 305 mm
E	MAX. DEPTH OF COVER ALLOWED ABOVE CROWN OF CHAMBER	12' 3.65 m	12' 3.65 m	12' 3.65 m	12' 3.65 m	12' 3.65 m	8.3' 2.53 m
F	MIN. ROW SPACING	4" 102 mm	6" 152 mm	5" 127 mm	6" 152 mm	6" 152 mm	9" 229mm
G	CHAMBER WIDTH	36" 914 mm	33" 838 mm	47" 1194 mm	51" 1295 mm	60" 1525 mm	78" 1981 mm
	MAX. PIPE SIZE TO CHAMBER ENDWALL/ENDCAP (CORRUGATED HDPE)	10" 250 mm	12" 300 mm	18" 450 mm	24" 600 mm	24" 600 mm	30" 750 mm

NOTE[1]: STONE ABOVE AND BELOW UNITS MAY VARY PER SYSTEM.
SEE SYSTEM LAYOUT FOR STONE REQUIREMENTS

SR 3.0

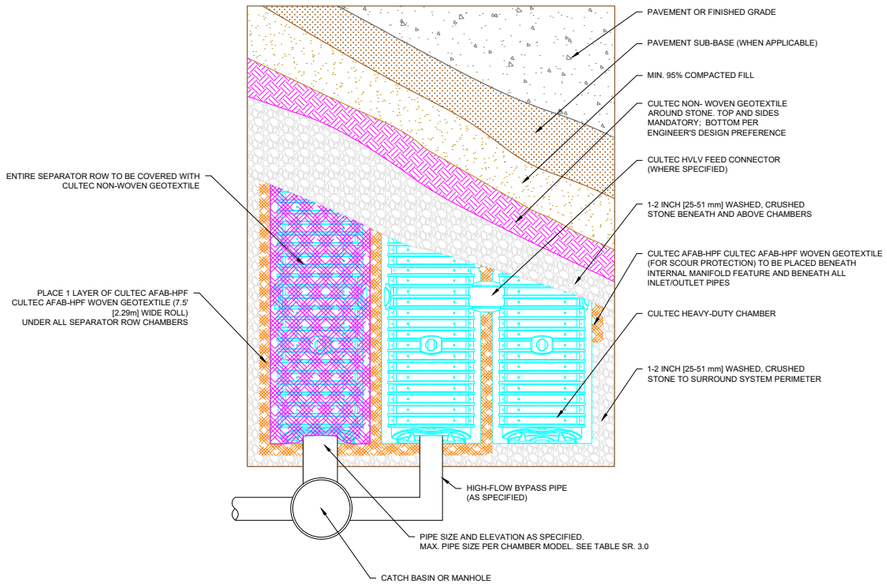
CROSS SECTION TABLE REFERENCE



* SEE SR 3.0 - CROSS SECTION TABLE REFERENCE

SR 4.0

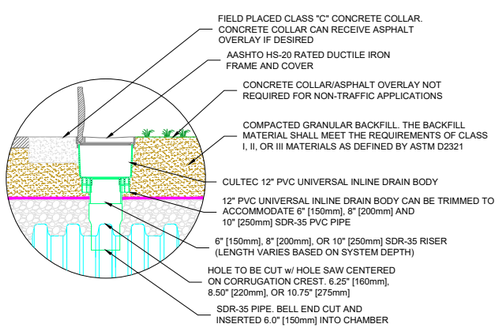
TYPICAL SEPARATOR ROW CONFIGURATION PLAN VIEW



* SEE SR 3.0 - CROSS SECTION TABLE REFERENCE

SR 5.0

CULTEC INSPECTION PORT - ZOOM DETAIL

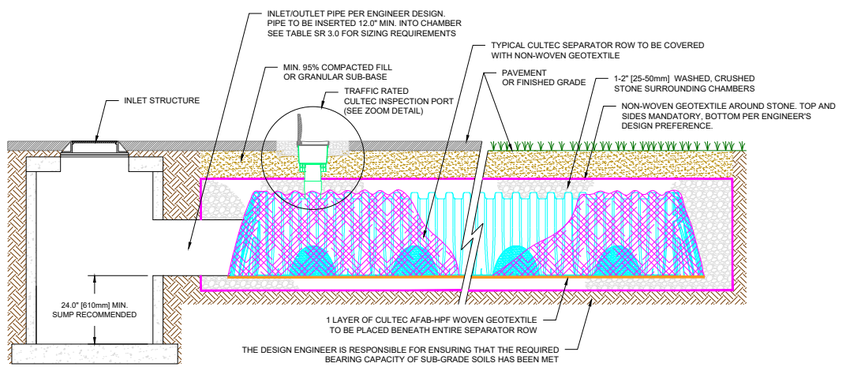


SR 6.0

TYPICAL SEPARATOR ROW CONFIGURATION CROSS SECTION

SR 7.0

TYPICAL SEPARATOR ROW CONFIGURATION CROSS SECTION WITH INSPECTION PORT DETAIL



CULTEC STORMWATER CHAMBER

PROJECT NO: N/A	DESIGNED BY: TECH	SCALE: N.T.S	
DATE: 10/2024	CHECKED BY: DFG	SHEET NO: 1 OF 1	

CULTEC SEPARATOR ROW DETAILS

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Subsurface Stormwater Management Systems
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Brookfield, CT 06804
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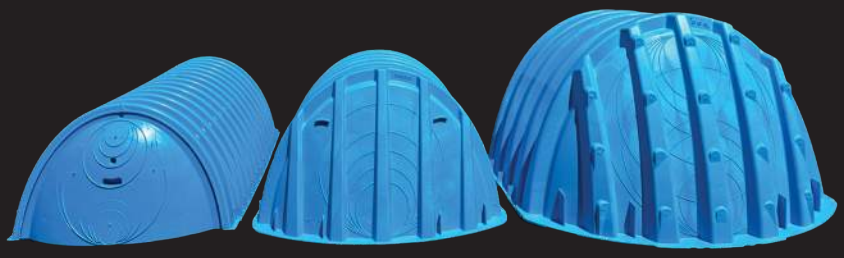
PH: 1(800) 4-CULTEC
CT-tech@cultec.com
www.cultec.com

RECHARGER® 300HD, 360HD, & 902HD

STORMWATER MANAGEMENT SOLUTIONS

INSTALLATION INSTRUCTIONS



RETENTION • DETENTION • INFILTRATION • WATER QUALITY

CULTEC®

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More information at https://cultec.com/legal/

CULTEC reserves the right to make design and/or specification changes at any time without notice at CULTEC's sole discretion.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at 1-(800)428-5832, (203)775-4416 ext. 202, or e-mail us at CT-CustomerService@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail CT-Tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT009 08-24
August 2024
You are using version CLT009 08-24 of our CULTEC Installation Instructions for Recharger® 300HD, 360HD, and 902HD Stormwater Systems.

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

Required Materials and Equipment

- Proper geotechnical soil evaluation by a qualified engineer or soil scientist to determine suitability of structural installation
- OSHA compliance
- CULTEC warning tape, or equivalent
- Assurances from local utilities that no underground gas, electrical or other potentially dangerous pipelines or conduits are already buried at the site
- Acceptable 1– 2 inch washed, crushed stone as shown in Table 3, page 18. Cleanliness of stone to be verified by engineer.
- Acceptable fill material
- CULTEC No. 410™ non-woven geotextile or equivalent
- CULTEC AFAB-HPF woven geotextile or equivalent, as required
- All CULTEC chambers and accessories as specified in the engineer's plans including CULTEC No. 410™ non-woven geotextile, CULTEC StormFilter® and CULTEC AFAB-HPF woven geotextile, where applicable. Check CULTEC chambers for damage prior to installation. Do not use damaged CULTEC chambers. Contact your supplier immediately to report damage or packing list discrepancies.
- Reciprocating saw or router
- Stone bucket
- Stone conveyor and/or tracked excavator
- Transit or laser level measuring device
- Compaction equipment

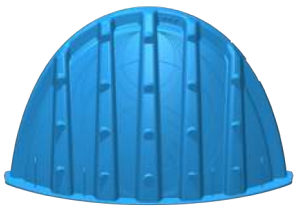
Requirements for CULTEC Chamber System Installations

- CULTEC systems must be designed and installed in accordance with CULTEC's minimum requirements. Failure to do so will void the limited warranty. To request a copy and submit the CULTEC limited warranty, call CULTEC at 203-775-4416 or visit www.cultec.com.
- Installing contractors are expected to comprehend and use the most current installation instructions prior to beginning a system installation. If there is any question as to whether these are the most current instructions, contact CULTEC at (203)775-4416 or visit www.cultec.com.
- Contact CULTEC at least thirty days prior to system installation to arrange a pre-construction meeting.
- All CULTEC system designs must be certified by a registered professional engineer.
- Use these installation instructions as a guideline only. Actual design may vary. Refer to approved construction drawings for job-specific details. Be sure to follow the engineer's drawings as your primary guide.
- System cover/backfill requirements will vary based on installation type.
- Any discrepancies with the system sub-grade soil's bearing capacity must be reported to the design engineer.
- Non-woven geotextile must be used as specified in the engineer's drawings.
- Erosion and sediment-control measures must meet local codes and the design engineer's specifications throughout the entire site construction process.
- Responsibility for preventing vehicles that exceed CULTEC's requirements from traveling across or parking over the chamber system lies solely with the contractor throughout the entire site construction process. The placement of warning tape, temporary fencing, and/or appropriately located signs is highly recommended. Imprinted warning tape is available from CULTEC. For Acceptable Vehicle Load information, refer to Table 1 on page 16.

Chamber Specification Information

	Recharger 300HD Chamber	Recharger 360HD Chamber	Recharger 902HD Chamber
Size (L x W x H)	7.54′ x 51″ x 30″	4.17′ x 60″ x 36″	4.25' x 78" x 48"
Installed Length	7.08′	3.67′	3.67'
Length Adjustment per Row with two end caps installed	0.89′	2.50′	1.03'
when not using end caps	0.46′	0.50′	0.58'
Chamber Storage	6.53 ft^3/ft	10.00 ft^3/ft	17.31 ft^3/ft
	46.27 ft^3/unit	36.66 ft^3/unit	63.47 ft^3/unit
Minimum Installed Storage	10.57 ft^3/ft	15.20 ft^3/ft	27.06 ft^3/ft
	74.44 ft^3/unit	55.73 ft^3/unit	99.28 ft^3/unit
Minimum Area Required	33.65 ft^2	21.08 ft^2	26.58 ft^2
Minimum Center-to-Center Spacing	4.75′	5.75′	7.25'
Minimum Spacing Between Chambers	6″	9″	9″
Minimum Cover Requirements	18″ (Paved)	18″ (Paved)	24″ (Paved)
	24″ (Unpaved)	24″ (Unpaved)	30″ (Unpaved)
Maximum Allowable Cover	12′	12′	8.3'
Maximum Allowable O.D. in Side Portal	10″ HDPE, 12″ PVC	10″ HDPE, 12″ PVC	10″ HDPE, 12″ PVC
Compatible Feed Connector	HVLV FC-24 Feed Connector	HVLV FC-48 Feed Connector	HVLV FC-48 Feed Connector
			

End Cap Specification Information

	Recharger 300HD End Cap	Recharger 360HD End Cap	Recharger 902HD End Cap
Size (L x W x H)	12.2″ x 45.9″ x 29.3″	18″ x 60″ x 36.5″	28.0″ x 78.0″ x 48.5″
Installed Length	9.6″	15″	24"
End Cap Storage	3.32 ft^3/ft	5.17 ft^3/ft	9.01 ft^3/ft
	2.66 ft^3/unit (interlocked)	6.46 ft^3/unit (interlocked)	18.02 ft^3/unit (interlocked)
Minimum Installed Storage	16.95 ft^3/ft	12.40 ft^3/ft	22.08 ft^3/ft
	13.56 ft^3/unit	15.50 ft^3/unit	44.16 ft^3/unit
Maximum Inlet Opening in End Cap	24″ HDPE, 24″ PVC	24″ HDPE, 30″ PVC	30" HDPE, 36″ PVC
			

All dimensions are nominal. Actual dimensions may vary on-site due to shipping and temperature.

CULTEC HVLV Feed Connector Specification Information

	HVLV FC-24 Feed Connector	HVLV® FC-48 Feed Connector
Length	24.2”	49"
Installed Length (exposed)	6”	9" min.
Width	16”	16"
Height	12”	12"
Chamber Storage Capacity	0.91 ft^3/ft	0.91 ft^3/ft
Pipe Comparison	Greater flow capacity than 12” pipe	Greater flow capacity than 12" pipe
Compatible Models	Recharger 300HD	Recharger 360HD, Recharger 902HD

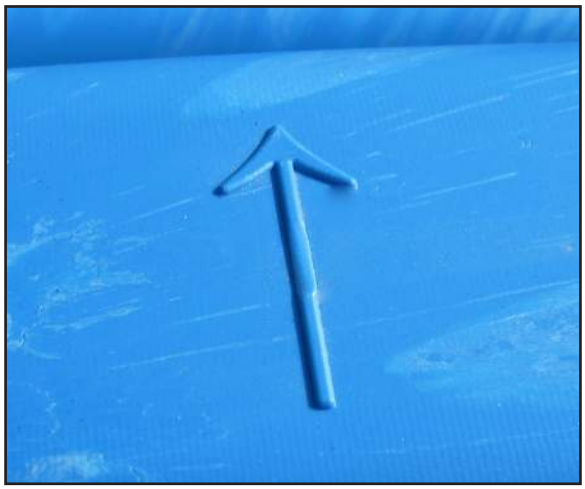
Site Preparation and Excavation

- Excavate and level the area per engineer’s drawings. Refer to plan view and cross-section details and excavate bed to accommodate chambers and manifold system. Be sure to allow for a minimum 12 inch stone border around the perimeter of the system and unforeseen overages in your excavation calculations.
- Remove any standing water and maintain positive drainage of the site throughout the installation. Dewatering procedures must be used, if necessary.
- Prepare the sub-grade soil for the chamber bed as specified by the engineer’s drawings.
- Place CULTEC No. 410™ non-woven geotextile (or equivalent) on the excavated bed bottom and perimeter sidewalls as specified by the engineer’s drawings. CULTEC No. 410™ non-woven geotextile is required on the sides and over the top of the system. It is also recommended on the system bottom. Overlap the geotextile by at least 24 inches where the fabric edges meet.

- Disperse a level base of 1 to 2 inch diameter washed, crushed stone over the entire area of the bed bottom. Refer to the engineer’s drawings for sub-grade soil preparation and required stone foundation thickness.
- Compact the stone base to achieve a flat, level unyielding surface. For vibratory roller use, refer to Table 1 on page 16 for recommended guidelines.

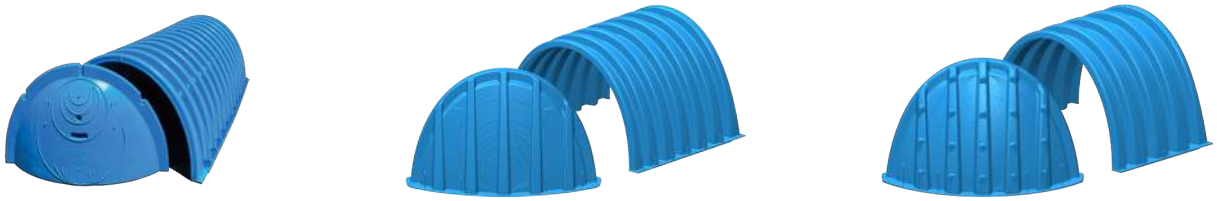
Chamber Information for Recharger® Models 300HD, 360HD, & 902HD

Directional arrows located on the top of the chamber point towards the Small Rib End.



CULTEC Recharger® 300HD, 360HD, & 902HD Chambers

The Recharger models 300HD, 360HD, & 902HD chambers come in only one model type which is fully open on both ends. The chamber requires the coordinating End Cap (*sold separately*) to cap rows of chambers or to create single stand alone units. One rib is dimensionally smaller to be able to interlock with additional units. A directional arrow points towards the small rib end. Typically, the build of the row begins with the large rib end facing you.



Shown: Recharger 300HD, 360HD, & Recharger 902HD Chambers with End Caps.

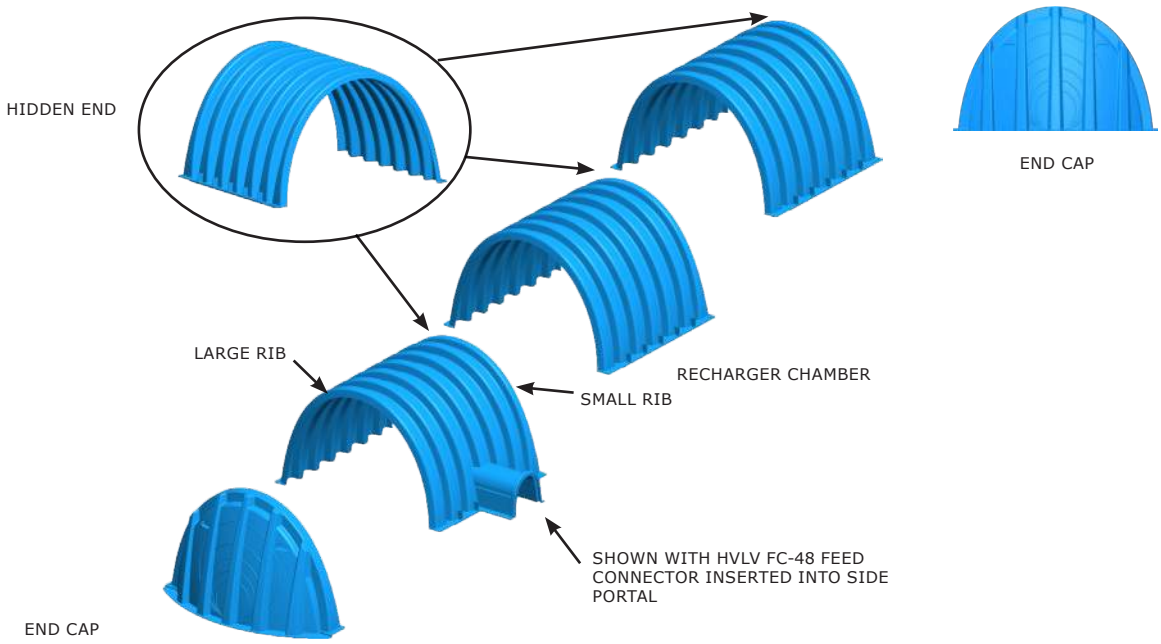
CULTEC Recharger® 300HD, 360HD, & 902HD End Caps

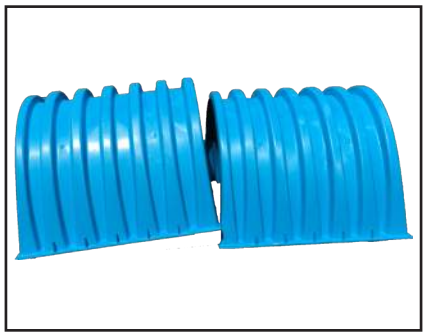
The End Cap is used in conjunction with the chamber to cap rows of chambers or to create single stand alone units.

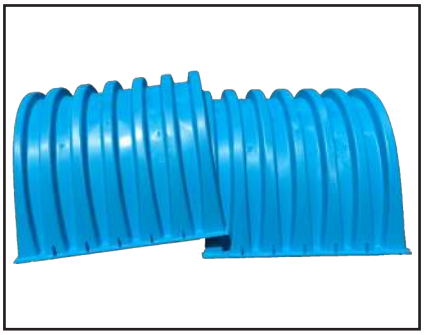
Shown: Recharger 300HD End Cap, 360HD End Cap & Recharger 902HD End Cap

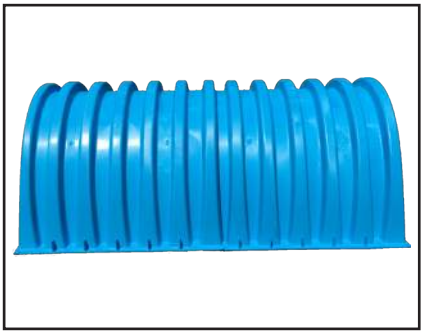
Typical Installation Method

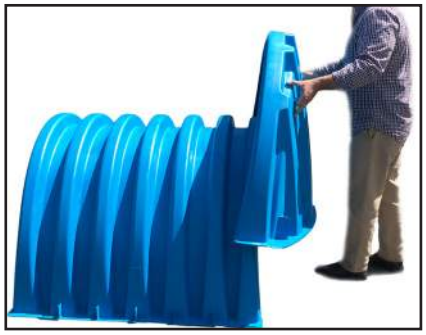
Interlock Recharger chambers using the overlapping rib connection.
Cap the ends of the lines using the Recharger End Cap.











Chamber Preparation and Installation

CULTEC Recharger® 300HD, 360HD, & 902HD chambers have the distinctive features of being fully open on both ends and utilize an overlapping rib connection. CULTEC chamber ribs are dimensionally sized with a large rib and a smaller rib to allow for an easy interlocking rib connection. The chambers require a separate end cap to cap off lines.

- Identify and group the chambers and end caps to ensure proper quantity and usage.
- Trim all side portals, end caps and inspection ports prior to installation for easier handling during trimming.
- Place one Recharger chamber for each row of units to be installed. Directional arrows point towards the small rib end of the chamber.
- If using the side portal internal manifold feature, trim the side portal(s) according to guidelines located on the sidewall of the chamber, as required. Insert one end of the HVLV Feed Connector into the trimmed portal to create the internal manifold. Refer to Installation of Manifold section on page 9.
- Place the next Recharger chamber so the directional arrow located in the center of the unit points downstream towards the end of the line. Overlap the large rib over the small rib of the preceding chamber's end wall, interlocking the chambers together. When placing chambers take care to maintain separation requirements, measuring from the base of the chamber.
- To ease backfilling requirements, only install as many chambers as the stone-laying bucket or conveyor can reach.
- Place stone taking care not to drop stone over the last rib to be overlapped.
- Continue chamber and stone placement to extend the length of the row.
- Use the Recharger End Caps to cap off chamber rows. To install the end cap, lift the end cap above the chamber and slide down the chamber rib.
- Prior to the placement of the next line of chambers, check and correct the level and alignment of the chamber units, where needed.

Installation of Manifold

Utilize the side portals located on the chamber as an internal manifold in locations where indicated on the engineer's drawings. HVLV® Feed Connectors are inserted into the portals to promote flow. An additional external manifold is not required unless specified by the engineer's design.

- CULTEC AFAB-HPF woven geotextile is to be placed under all chambers utilizing the internal manifold feature and under all chambers accepting inlet/outlet pipe connections per engineer's drawings. If inserting a pipe 18" diameter or larger into the CULTEC chamber, the use of CULTEC AFAB-HPF woven geotextile is recommended to prevent washout of the bedding stone.

- Most installations are designed with the internal manifold located at the ends of the chamber bed. However, the side portal internal manifold feature allows for the manifold to be located at any point within the chamber run. Refer to system design for manifold location(s).

- Using a reciprocating saw or router, trim the sidewall portals of the units that are to receive the HVLV Feed Connectors. Feed connectors may be placed on any chamber requiring a manifold, as indicated by the engineer's drawings.

- Place the HVLV Feed Connector into the side portal of the chambers per engineer's drawings. Maintain the required minimum separation between chamber rows.

- Check for correct center-to-center spacing of chamber runs according to engineer's drawings before proceeding to next row.

- Insert inflow/outflow pipe(s) into end cap or side portal as detailed on engineer's drawings. Maximum inlet sizes for the end caps are:
  - Recharger 300HD: 24" HDPE, 24" PVC
  - Recharger 360HD: 24" HDPE, 30" PVC
  - Recharger 902HD: 30" HDPE, 36" PVC

- Maximum pipe sizes for the side portals are: 10" HDPE, 12" PVC. There is no need to feed every row if utilizing the internal manifold feature.

If the manifold installation detail does not include CULTEC's side portal internal manifold, proceed according to the engineer's drawings for pipe manifold installation.

How to Trim CULTEC Chamber to Accommodate Pipe on End Cap

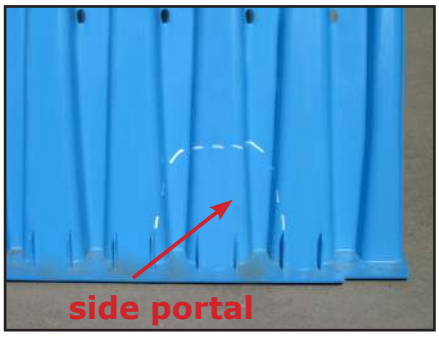
When using a conventional pipe manifold or inlet / outlet pipes, the contractor is required to trim the CULTEC Recharger End Cap on-site. Here are some quick steps to ensure a successful outcome:

- Lay out chambers according to engineered plans.
- Directional arrows located at the top of the chamber point towards the small rib end.
- Install end caps on the chambers as detailed on the engineer's drawing.
- Locate the proper diameter pipe outline on the end cap to accommodate the designed pipe size and invert elevation.
- Drill a hole on the chamber end wall large enough to accommodate a saw blade.
- Following the etched outline, use a reciprocating saw to trim out the opening to accommodate the pipe. Trimming should be within 1/4" tolerance of pipe O.D. to prevent stone intrusion.
- Insert the pipe or fitting a minimum of 8" into the chamber. This is not required to be a watertight connection. Maximum inlet pipe sizes:
  - Recharger 300HD: 24" HDPE, 24" PVC
  - Recharger 360HD: 24" HDPE, 30" PVC
  - Recharger 902HD: 30" HDPE, 36" PVC
- Backfill as noted in the installation instructions and engineering details.

Trimming may only be performed on end caps or within side portal areas.
Pipe may not be inserted into the sidewall of the chamber unless it is within the side portal trim lines.

How to Trim Side Portal to Accommodate HVLV Feed Connector for Internal Manifold

When using the side portal internal manifold feature, the contractor is required to trim the side portal of the CULTEC Recharger chamber on site.



- Following the guides on the side portal, use a reciprocating saw to trim out the opening to accommodate the HVLV Feed Connector. Trimming should be within 1/4” tolerance of HVLV Feed Connector to prevent soil intrusion.

Trimming may only be performed on the side portal area. Side entry in any other location is unacceptable.

- Insert the HVLV Feed Connector a minimum of 8” into the sidewall of the chamber. This is not required to be a watertight connection.

- Maintain proper minimum separation between chamber rows.

How to Trim Side Portal to Accommodate Pipe for Side Entry

When using the side portal feature as an inlet /outlet location, the contractor is required to trim the side portal of the CULTEC Chamber on site.

- Line up the pipe on the chamber side portal to the designated pipe elevation as detailed on the engineer's drawing. The side portal may accommodate 10" HDPE or 12" PVC pipe.
- Using a grease pen, outline the pipe on the side portal of the CULTEC chamber. See Fig. 1 for acceptable trim area. Do not cut outside the side portal area guides.
- Drill a hole on the chamber side portal large enough to accommodate a saw blade.
- Following the grease pen outline, use a reciprocating saw to trim out the opening to accommodate the pipe. Trimming should be within 1/4" tolerance of pipe O.D. to prevent soil intrusion.
- Insert the pipe or fitting a minimum of 8" into the chamber. This is not required to be a watertight connection.

Fig. 1 - Acceptable Trim Area

Trimming may only be performed on the side portal area. Side entry in any other location is unacceptable.

Embedment Stone Backfill

Backfill using washed, crushed stone. To maintain row separation distance and prevent chamber displacement, slowly distribute stone on top of the center of the chamber crown so that stone trickles down and builds between chamber rows as required. Stone column differential should not exceed 12” between adjacent chamber rows or between chamber rows and perimeter.

Place the stone carefully over the centerline of the chamber crown. Embedment stone must only be placed by an excavator or telescoping conveyor boom. Placement of embedment stone with a bulldozer is not an acceptable method of installation and may cause damage to the chambers. Any chambers damaged using an unacceptable method of backfill are not covered under the CULTEC limited warranty.

Excavator-Placed Stone

Typically the most common method, excavator-placed stone is limited by the reach of the arm. To accommodate this issue with larger beds, it is common to prepare a bed by joining just a few chamber units at a time, then placing the stone and fabric before installing the next few units.

The excavator is usually operated within the excavation area. The excavator may work at grade level over recently placed chambers, provided coverage between the chambers and the excavator tracks meets the minimum requirements.

Telescoping Conveyor Boom Placement

With booms as much as 120-140 feet long, telescoping aggregate conveyors can greatly aid the process of stone placement.

With both stone-placement methods, ladling the stone carefully over the chambers’ centers will secure them in place. Evenly distributing the stones will help prevent chamber movement and maintain row separation.

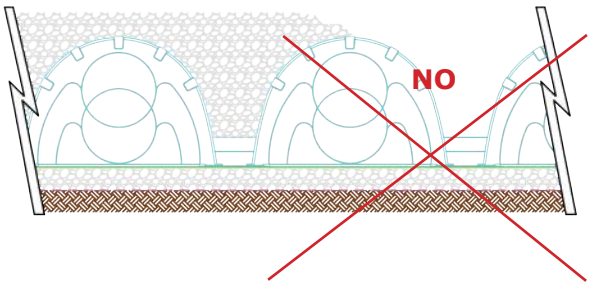
Once secured, stone may be placed to surround the chambers and fill the perimeter areas. Be sure to adhere to manufacturer recommendations and engineer’s drawings for system cover/backfill requirements.

Do not allow equipment to drive over the chambers unless the minimum cover is in place. Use a warning tape (available from CULTEC) to restrict access.

Repeat steps until all of the last chamber units are in place. Be certain to use the Recharger End Caps to end the line of chambers as specified by the drawings.

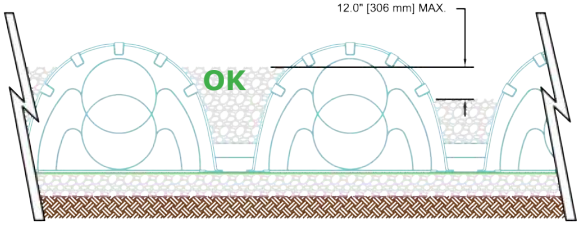
If a manifold system is designed on the back end of the chamber bed, follow manifold installation instructions as described previously.

Stone column height differential should never exceed 12 inches with adjacent chambers or between chamber rows and perimeter. Minimum depth of cover of properly compacted material must be met before allowing vehicles to drive over the bed. Avoid using large rocks and/or organic matter as backfill material. Refer to "Acceptable Fill Materials" or contact the design engineer for approved fill types.



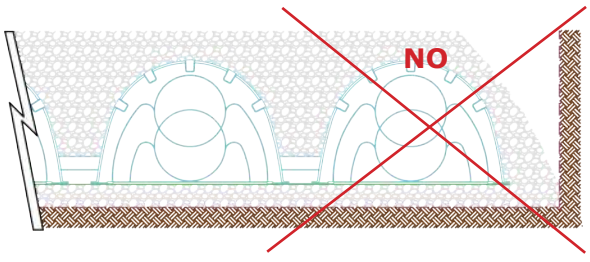
NOTE: CHAMBERS MUST BE BACKFILLED EVENLY.

UNEVEN BACKFILL - INCORRECT INSTALLATION



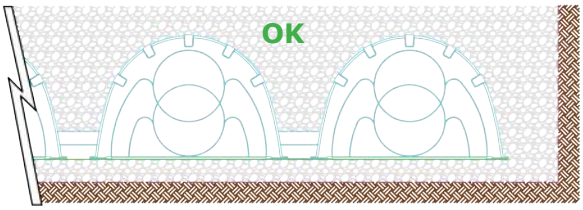
NOTE: STONE HEIGHT IN BETWEEN ROWS AND PERIMETER SHOULD NOT DIFFER BY MORE THAN 12" (300 MM)

EVEN BACKFILL - CORRECT INSTALLATION



NOTE: WHEN FILLING IN PERIMETER, STONE MUST BE FILLED IN EVENLY WITH CHAMBER ROWS.

PERIMETER NOT FULLY BACKFILLED
INCORRECT INSTALLATION



NOTE: PERIMETER STONE MUST BE FULLY BACKFILLED WITH STONE AND EXTEND TO THE EXCAVATION WALL.

PERIMETER FULLY BACKFILLED
CORRECT INSTALLATION

Placement of Top Fabric Layer & System Backfill Process

- Place the stone over the entire bed area as described in previous section.

- Cover the entire installation area with CULTEC No. 410 non-woven geotextile starting from the perimeter and laying it on top of the stone. The geotextile must overlap at least 24 inches at the edges.

- Fill the first 12 inches with enough material (See 3 in Fig. 1, page 18) to meet the requirements as shown in Table 3, page 18. Backfill over the top of the geotextile (See 3 in Fig. 1, page 18) in lifts that do not exceed 6 inches, and disperse the fill with a vehicle that meets the maximum wheel loads or ground pressure limits as specified on specified in Table 1 on page 16.

- Compact each lift of backfill as specified in the engineer's drawings. CULTEC specifies compacting to a minimum of 95% of the standard proctor density using compaction equipment Refer to Table 1, page 16 for acceptable equipment.

- Backfill over the chamber bed (See 4 in Fig. 1, page 18) in 12-inch maximum lifts until the specified grade is achieved. For pavement sub-base or special fill requirements, see engineer's drawings.

NOTE:
Excavation alongside already installed chamber rows backfilled with stone is not acceptable.
No chambers may be added or subtracted from previously installed systems.

Table 1: Maximum Allowable Construction Loads

Material Location (See Fig. 1, p. 18)	Cumulative Cover Depth over Chambers (in)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads		Maximum Allowable Compaction Loads	
		Max Axle Load for Trucks (lbs)	Max Axle Load for Loaders (lbs)	Track Shoe Width (in)	Max Ground Pressure (psi)	Maximum Centrifugal Force (lbs)	Max Gross Vehicle Weight (lbs)
4 Final Fill Material	36 Compacted	32,000	16,000	12	23.8	38,000	16,000
				18	16.3		
				24	12.8		
				30	10.6		
				36	9.1		
	30 Compacted	32,000	16,000	12	20.5	24,000	12,000
				18	14.3		
				24	11.4		
				30	9.5		
				36	8.3		
3 Initial Fill Material	24 Compacted	32,000	16,000	12	17.2	20,000	12,000
				18	12.3		
				24	9.9		
				30	8.4		
				36	7.4		
	24 Loose/Dumped	300HD: 32,000 360HD: 32,000 902HD: 24,000	300HD: 16,000 360HD: 16,000 902HD: 12,000	12	15.6	20,000	12,000
				18	11.3		
				24	9.2		
				30	7.9		
				36	7.0		
	18 Compacted	300HD: 32,000 360HD: 32,000 902HD: 24,000	300HD: 16,000 360HD: 16,000 902HD: 12,000	12	14.0	300HD: 20,000 360HD: 20,000 902HD: NOT ALLOWED	300HD: 12,000 360HD: 12,000 902HD: 5,000
				18	10.3		
				24	8.5		
				30	7.4		
				36	6.6		
	18 Loose/Dumped	300HD: 16,000 360HD: 16,000 902HD: NOT ALLOWED	NOT ALLOWED	12	12.6	NOT ALLOWED	300HD: 12,000 360HD: 12,000 902HD: NOT ALLOWED
				18	9.3		
				24	7.7		
				30	6.7		
				36	6.0		
2 Embedment Stone	12	NOT ALLOWED	NOT ALLOWED	12	10.7	NOT ALLOWED	NOT ALLOWED
				18	8.3		
				24	7.0		
				30	6.3		
				36	5.8		
	6	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED FOR RECHARGER 902HD. 6" FILL DEPTH TRACK LOAD DATA APPLIES TO RECHARGER 360HD ONLY		NOT ALLOWED	NOT ALLOWED
				12	7.4		
				18	6.3		
				24	5.6		
				30	5.3		
				36	5.0		

The use of wheeled equipment without proper cover is strictly prohibited.
For Tracked Vehicles: Ground pressure is vehicle operating weight divided by total truck contact area for both tracks. Turning should be kept to a minimum.
No wheeled vehicles are allowed prior to compacted fill placement

Table 2: Placement Methods and Descriptions

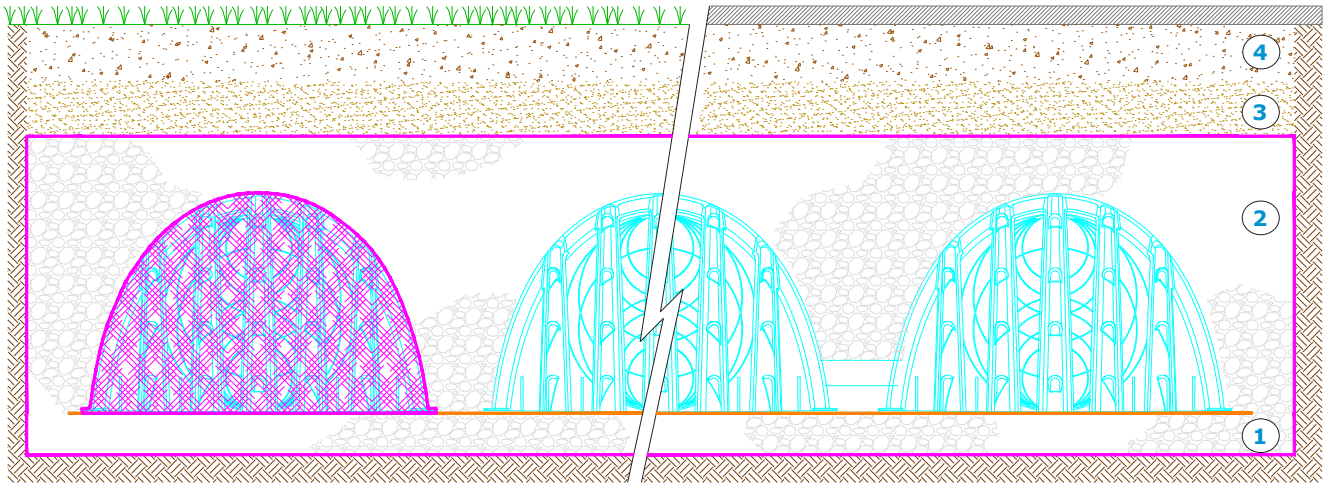
Material Location See Fig. 1, p.18	Placement Method/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Compaction Restrictions
	See Table 1, p. 16 for Maximum Construction Loads			
4 Final Fill Material	A variety of placement methods may be used. All construction loads shall not exceed the maximum values listed in Table 1.	902HD: 36" minimum cover for dump truck and wheel loader travel 300HD, 360HD: 24" minimum cover for dump truck and wheel loader travel	Dozers shall push parallel to rows only.	902HD: Roller travel shall be parallel to rows only until 36" of cover is reached 300HD, 360HD: Roller travel shall be parallel to rows only until 24" of cover is reached
3 Initial Fill Material	Excavator positioned off of bed or on foundation stone. Small LGP track dozer, track skid steer loaders may be used. Must maintain 12" minimum fill below tracks at all times.	902HD: Asphalt can be dumped into paver machine when total cumulative fill depth over chambers reaches 24" 300HD, 360HD: Asphalt can be dumped into paver machine when total cumulative fill depth over chambers reaches 18"	Equipment direction of travel shall be parallel to rows at all times. Equipment shall not be permitted to turn direction over chambers.	Roller travel shall be parallel to rows only. 902HD: Dynamic roller mode shall be used only when total cumulative fill depth over chambers reaches 24" 300HD, 360HD: Dynamic roller mode shall be used only when total cumulative fill depth over chambers reaches 18"
2 Embedment Stone	No equipment shall be permitted to contact the chambers. Stone conveyor positioned off of bed or on foundation stone. Excavator positioned off of bed or on foundation stone. Stone column height differential between chamber rows shall never exceed 12". Stone to be placed at the crown of the chamber. No stone shall be pushed over chambers.	No wheel loads allowed. No wheel loaders permitted to dump stone directly onto chambers.	No tracked equipment is allowed on chambers until 12" of embedment stone is in place.	No rollers allowed.
1 Foundation	A variety of placement methods may be used including but not limited to excavator placement, stone conveyor placement or dozer placement. Plate compact or roll to achieve a flat, unyielding surface. Contractor is responsible for any conditions or requirements relating to subgrade bearing capacity, dewatering or protection of subgrade infiltrative capacity.			

Table 3: Acceptable Fill Materials

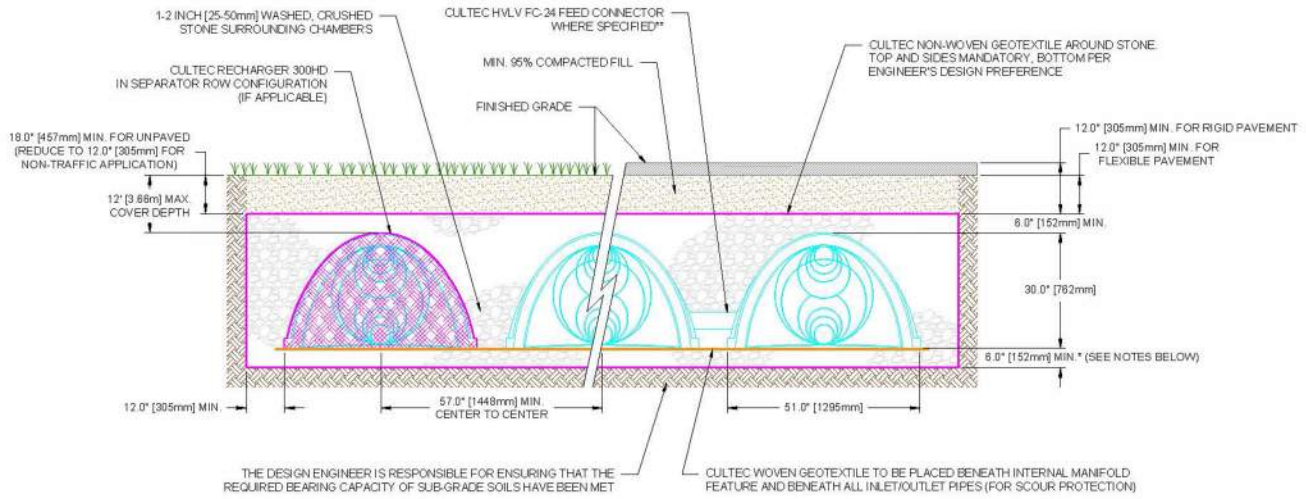
Material Location		Description	AASHTO M43 Classification	Compaction/ Density Requirement
4	Fill Material for Layer 4 starts from the top of Layer 3 to the bottom of pavement or unpaved finished grade above. Refer to cross section, page 19 for proper minimum fill requirements.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	Per engineer's drawings	Prepare per engineer's drawing. Paved installations may have strict material and preparation requirements.
3	Fill Material for Layer 3 starts from top of embedment stone (Layer 2) to minimum required depth above top of chamber. Refer to cross section, page 19 for proper minimum fill requirements.	Granular well-graded soil/aggregate mixtures, <35% fines	3, 4, 5, 6, 7, 8, 9, 10, 56, 57, 67, 68, 78, 89, 467	Compact in 6" lifts to a minimum 95% Standard Proctor density. Refer to Table 1 for acceptable gross vehicle weights.
2	Embedment Stone surrounding chambers and to a minimum elevation above chamber crown. 300HD: 6" min. required 360HD: 6" min. required 902HD: 12" min. required.	Washed, crushed stone with the majority of particles between 1" - 2"	Recharger 300HD: 3, 4, 467, 57 Recharger 360HD: 3, 4, 467, 57 Recharger 902HD: 3, 4	No compaction required.
1	Foundation Stone below chambers per engineer's drawing 300HD: 6" min. required 360HD: 6" min. required 902HD: 9" min. required.	Washed, crushed stone with the majority of particles between 1" - 2"	Recharger 300HD: 3, 4, 467, 57 Recharger 360HD: 3, 4, 467, 57 Recharger 902HD: 3, 4	Plate compact or roll to achieve a flat, unyielding surface.

The listed AASHTO classifications are for gradations. The stone must be washed, crushed and angular. See Table 5, page 20.
For example, the stone must be specified as washed, crushed No. 4 stone. Fill materials shall be free of debris, trash, frozen lumps and other deleterious matter.
Contact CULTEC for gradation requirements for specific projects that do not fall within the above specifications.

Fig. 1. Fill Material Locations - refer to Tables 1-3



Recharger 300HD Typical Cross Section for Traffic Applications

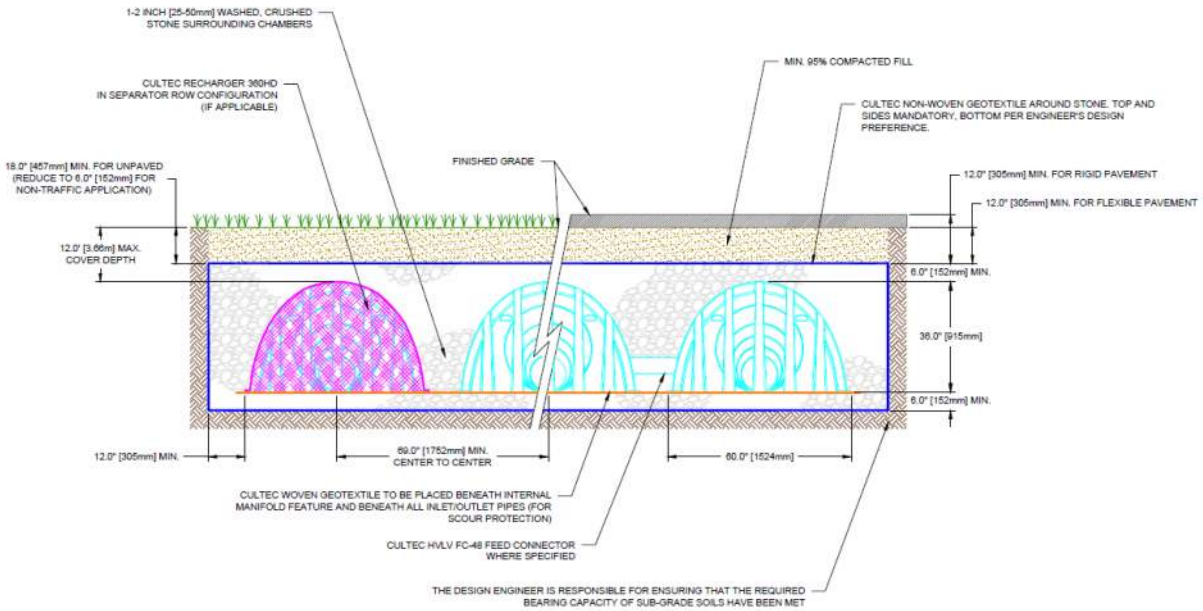


NOTES:

*FOR COVER DEPTHS FROM 18.0" - 8.0' (457mm - 2.44m), INCREASE DEPTH OF BEDDING STONE TO 9.0" (229mm) MIN. FOR COVER DEPTHS GREATER THAN 8.0' (2.44m)
**UTILIZE HVLV FC-24 FEED CONNECTOR FOR 6" (152mm) ROW SPACING. UTILIZE HVLV FC-48 FEED CONNECTOR FOR ROW SPACING GREATER THAN 6" (152mm)

1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F2418
   3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

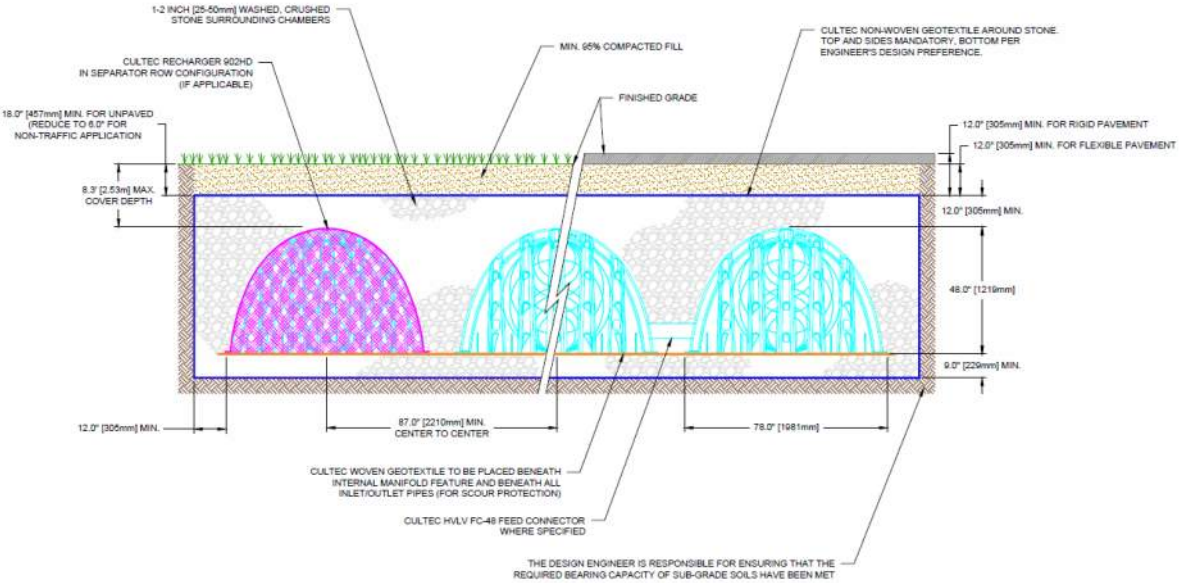
Recharger 360HD Typical Cross Section for Traffic Applications



NOTES:

1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F3430-20 "STANDARD SPECIFICATION FOR CELLULAR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F3430
   3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
   3.c. THE MINIMUM SAFETY FACTOR FOR DEAD LOADS SHALL BE 1.95

Recharger 902HD Typical Cross Section for Traffic Applications



NOTES:
1. THE CHAMBERS SHALL BE DESIGNED AND TESTED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS." THE LOAD CONFIGURATION SHALL INCLUDE:
   1.a. INSTANTANEOUS AASHTO DESIGN TRUCK LIVE LOAD AT MINIMUM COVER
   1.b. MAXIMUM PERMANENT (50-YEAR) COVER LOAD
   1.c. 1-WEEK PARKED AASHTO DESIGN TRUCK LOAD
2. THE CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F3430-20 "STANDARD SPECIFICATION FOR CELLULAR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS"
3. THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE RESISTANCE TO THE LOADS AND LOAD FACTORS AS DEFINED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12, WHEN INSTALLED ACCORDING TO CULTEC'S RECOMMENDED INSTALLATION INSTRUCTIONS. THE STRUCTURAL DESIGN OF THE CHAMBERS SHALL INCLUDE THE FOLLOWING:
   3.a. THE CREEP MODULUS SHALL BE 50-YEAR AS SPECIFIED IN ASTM F3430
   3.b. THE MINIMUM SAFETY FACTOR FOR LIVE LOADS SHALL BE 1.75
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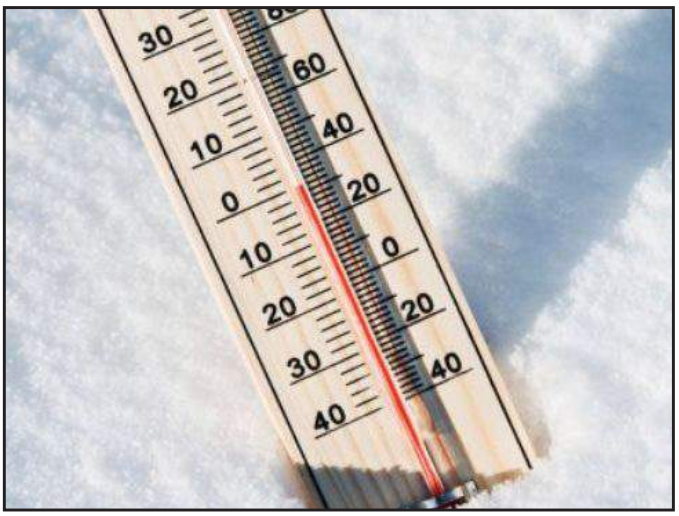
Special Handling Instructions for Polypropylene, Chambers in Colder Temperatures



CULTEC chambers are manufactured of impact-modified polypropylene, which is inherently resistant to corrosion and chemical breakdown and cold weather impact. Additional UV inhibitors and antioxidants increase the chambers' resistance to sunlight degradation. However, CULTEC recommends that, when installed in cold temperatures below 32° F, the installer take special care when removing the chambers from the stacks, not allowing the chambers to fall from height. Avoid using machinery to handle the chambers. When possible, CULTEC recommends that the stone backfill be placed in temperatures above 32° F to minimize depressions or deflections.

Table 3: CULTEC No. 410™ Non-Woven Geotextile Specification Information

Properties	ASTM Test Method	Test Results
Appearance		Black
Weight - Typical	D 5261	4.5 oz/sy
Tensile Strength	D 4632	120 lbs
Elongation @ Break	D 4632	50%
Mullen Burst*	D 3786*	225 psi
Puncture Strength*	D 4833*	65 lbs
CBR Puncture	D 6241	340 lbs
Trapezoid Tear	D 4533	50 lbs
AOS	D 4751	70 US Sieve
Permittivity	D 4491	1.70 Sec^{-1}
Water Flow Rate	D 4491	135 gal/min/sf
UV Resistance @ 500 Hours	D 4355	70%

** Historical averages (current values not available): Mullen Burst Strength ASTM D3786 is no longer recognized by ASTM D-35 on Geosynthetics as an acceptable test method. Puncture Strength ASTM D4833 is not recognized by AASHTO M288 and has been replaced with CBR Puncture ASTM D6241.*
Substitutions must meet or exceed these minimums. Non-woven geotextile placement is mandatory over top and sides of system. Coverage of system bottom is recommended. However, follow engineer's design preference.

Table 4: CULTEC AFAB-HPF Woven Geotextile Specification Information

Properties	ASTM Test Method	Test Results
Appearance		Black
Tensile Strength	D 4632	320 lbs
Elongation @ Break	D 4632	15%
Wide Width Tensile	D 4595	52 kN/m
Wide Width Elongation	D 4595	15%
CBR Puncture	D 6241	1,500 lbs
Trapezoidal Tear	D 4533	120 lbs
Apparent Opening Size	D 4751	30 US Sieve
Permittivity	D 4491	0.2 Sec^{-1}
Water Flow Rate	D 4491	22 g/min/sf
UV Resistance @ 500 Hours	D 4355	70%

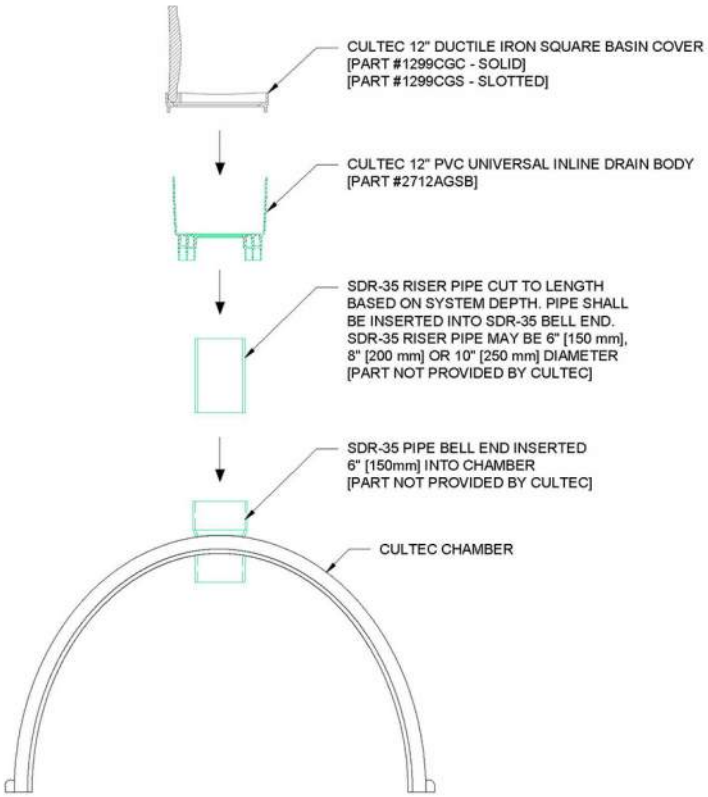
Substitutions must meet or exceed these minimums. To be used as scour protection and in conjunction with CULTEC Separator Row (if specified).

Table 5: Criteria for acceptable 1 - 2 inch washed, crushed, angular stone

Washed Crushed Stone	Description	Criteria
Acceptable	Angular	Stones have sharp edges and relatively plane sides with unpolished surfaces
	Subangular	Stones are similar to angular description but may have slightly rounded edges
Unacceptable	Subrounded	Stones have nearly plane sides but have well-rounded corners and edges
	Rounded	Stones have smoothly curved sides and no edges

See Item 1 and Item 2 of Table 3 on page 18 for additional stone requirements.

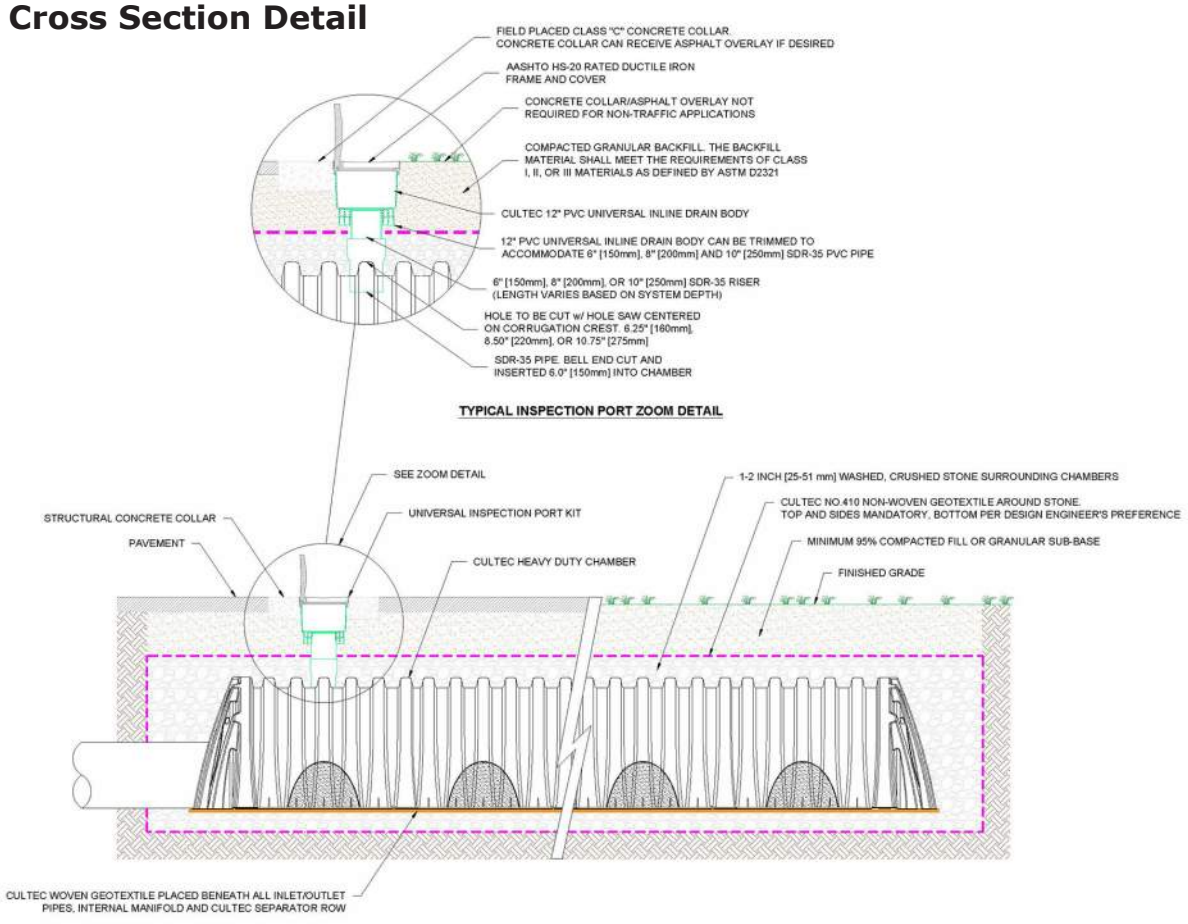
Inspection Port Detail for Paved Traffic Applications



Trim inspection port knock-out with reciprocating saw or hole-saw.

Corrugated pipe is not suitable for inspection port.

Typical Cross Section Detail



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Feb 2022

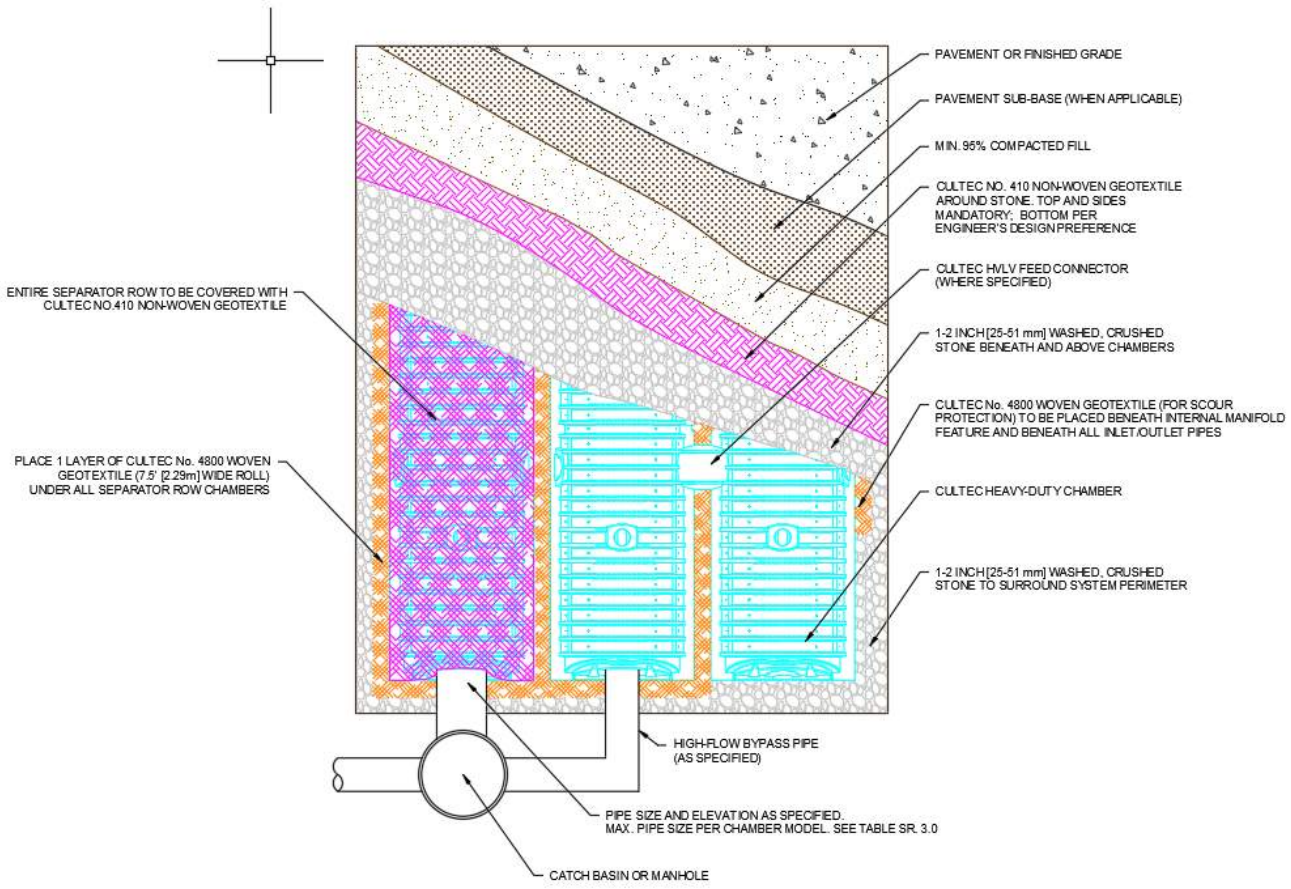
Introduction

CULTEC's Separator™ Row is an inexpensive means of removing Total Suspended Solids from the CULTEC chamber system, as well as providing easier access for inspection and maintenance. The Separator Row is designed to capture the First Flush of a rain event and is typically included as part of the "Treatment Train" for water quality.

The CULTEC Separator Row is a row of CULTEC Contactor or Recharger Chambers that are surrounded on all sides by filter fabric. One layer of CULTEC No. 4800™ Woven Geotextile are placed between the clean foundation stone and the chamber feet. The chambers are then completely wrapped with CULTEC No. 410™ non-woven geotextile. This configuration is designed to trap any sediment and/or debris that may pass through the upstream water-quality structures and into the chamber system.

A manhole is typically located adjacent to the separator row for ease of inspection and maintenance. This manhole is placed upstream of the system and can include a high-flow bypass pipe to pass peak-flows onto adjacent rows of chambers. The upstream manhole is designed with a sump to trap heavier sediment and allow for proper cleaning of the Separator Row. A JetVac process with a high pressure water nozzle is introduced down the Separator Row via the access manhole to clean all sediment and debris from the Separator Row. Captured pollutants are flushed into the sumped access manhole for vacuuming, and the process is repeated until the Separator Row is completely free of sediment and debris.

The Separator Row performance has been tested and verified to the protocols and procedures as defined by Environmental Technology Verification (ETV) Canada to achieve 80% TSS removal.



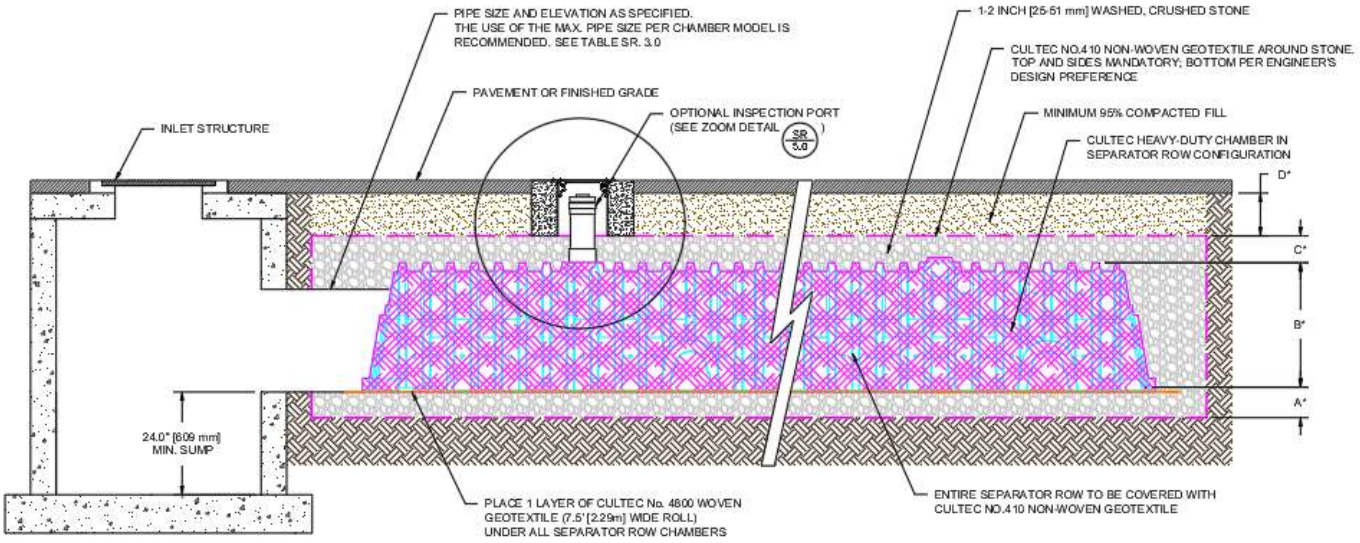
Design

There is no single design to achieve a high level of water quality. The CULTEC Separator Row should be designed as part of an overall best management practices water quality system. Pre-treatment devices such as sump catch basins, inlet baffles and proprietary oil-grit separators and filter systems can all be incorporated upstream of the CULTEC Separator Row. Sumped access/diversion manholes should be installed directly upstream of the Separator Row.

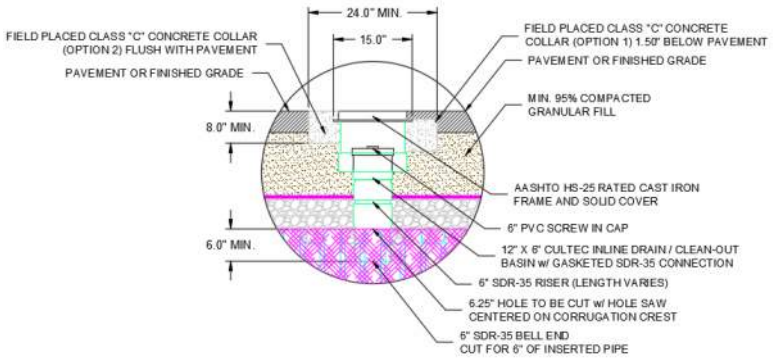
The following is a list of recommended design practices to ensure proper maintenance for the life of the system:

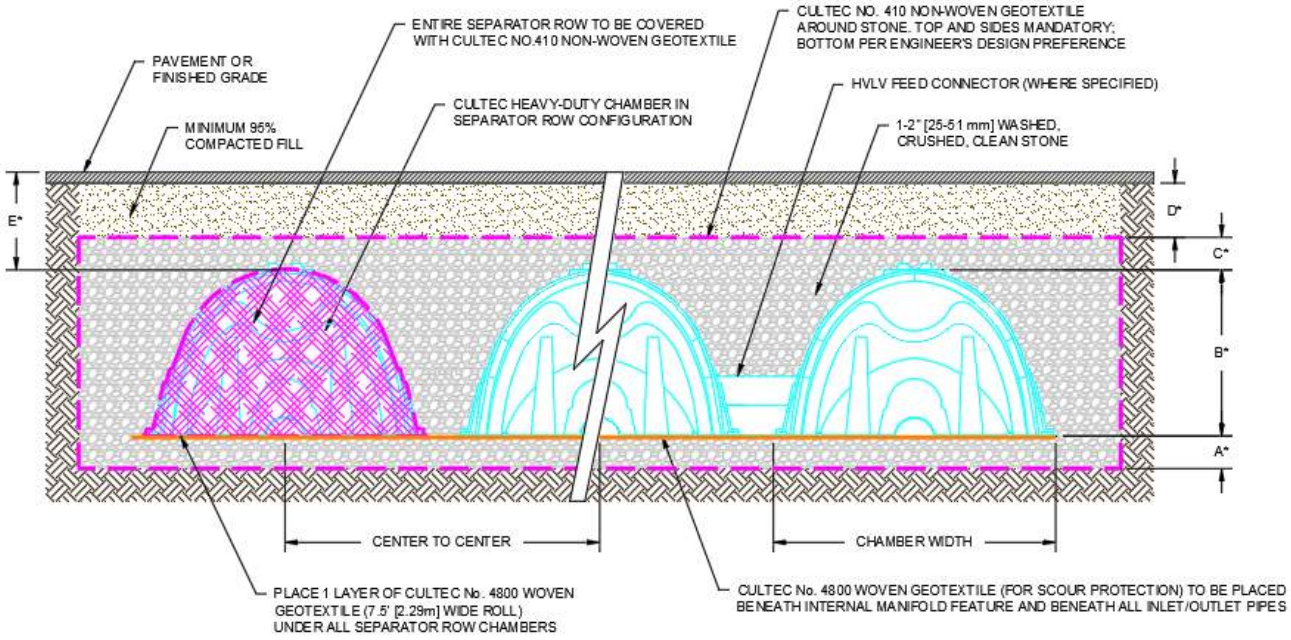
- Install sumped access/diversion manholes, including a minimum 24” (600 mm) sump, directly upstream of the Separator Row.
- Include a high-flow bypass pipe to divert peak flows that exceed the capacity of the Separator Row to adjacent rows.
- Connect the access manhole to the Separator Row with the largest diameter pipe allowable based on the CULTEC chamber model used.
- Maintain a minimum distance between the access manhole and the Separator Row to promote efficient maintenance.
- Include at least one inspection port per Separator Row for periodic inspection.

Note: Typical JetVac maintenance reels have a maximum of 400 feet (121.9 m) of available hose. Consider this when designing the length of the CULTEC Separator Rows.



*SEE SR 3.0 - CROSS SECTION TABLE REFERENCE





*SEE SR 3.0 - CROSS SECTION TABLE REFERENCE

Table SR 3.0

	Description	Contactor 100HD	Recharger 150XLHD	Recharger 280HD	Recharger 330XLHD	Recharger 360HD	Recharger 902HD
A	Min. depth of stone base	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	9″ 229 m
B	Chamber height	12.5″ 318 mm	18.5″ 470 mm	26.5″ 673 mm	30.5″ 775 mm	36″ 914 mm	48″ 1219 mm
C	Min. depth of stone required above units for traffic applications	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	12″ 305 mm
D	Min. depth required of 95% compacted fill for paved traffic application	8″ 203 mm	8″ 203 mm	8″ 203 mm	10″ 254 mm	12″ 305 mm	12″ 305 mm
E	Max. depth of cover allowed above crown of chamber	12′ 3.65 m	12′ 3.65 m	12′ 3.65 m	12′ 3.65 m	12′ 3.65 m	8.5′ 2.59 m
	Max. allowable pipe size into chamber end wall/end cap	10″ 250 mm	12″ 300 mm	18″ 450 mm	24″ 600 mm	24″ 600 mm	24″ 600 mm

Inspection and Maintenance

CULTEC recommends inspection of the Separator Row to be performed every six months for the first year of service. Future inspection frequency can be adjusted based upon previous inspection observations. However annual inspections are recommended. Inspection of the Separator Row can be achieved via an inspection port riser installed during construction. This inspection port riser will connect the top of the Separator Row chambers to finished grade with a removable lid. Alternatively the Separator Row may be inspected via the manhole(s) located at the end(s) of the Separator Row. However this method of inspection requires confined space entry. If entry into the manhole is required, all local and OSHA rules for confined space entries must be strictly followed.

To inspect:

- Remove the inspection port lid from the floor box frame.
- Remove the riser pipe cap.
- With a flashlight and stadia rod, measure the depth of sediment.
- Record results in a maintenance log.
- When depth of sediment exceeds 3” (76 mm), use the JetVac procedure described below.

The JetVac process utilizes a high pressure water nozzle controlled from the surface. The high pressure nozzle is introduced down the Separator Row via the access manhole(s). The high pressure water cleans all sediment and debris from the Separator Row as the nozzle is retrieved. Captured pollutants are flushed into the sumped access manhole for vacuuming. This process is repeated until the Separator Row is completely free of sediment and debris. A small diameter culvert cleaning nozzle is recommended for this procedure.

High pressure water nozzle

Cleaning Separator Row and pipes with high pressure water nozzle

SEPARATOR ROW: Separator Row prior to cleaning

ADJACENT ROW: When the Separator Row is working properly, the adjacent rows will not show signs of sediment.

Inspection and Maintenance Record

Date	Mode of Access	Frequency	Depth of Sediment	Actions	Expenses	Inspector	Notes
Ex.	Inspection Port	Semi-annually	2”	Measure sediment depth with stadia rod. Visually inspect	$100	DPG	Depth of Sediment was measured via Northeast Inspection Port Adjacent to MH-1. Sediment depth was found to be 2”. No further action required at this time.
Ex.	Access Manhole	Annually					

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RETENTION • DETENTION • INFILTRATION • WATER QUALITY

Rhode Island Department of Environmental Management

Office of Water Resources – Stormwater Technology Review Committee

235 Promenade St. Providence, RI 02908 Ph: 401-222-4700

Alternative Stormwater Technology Certification

Vendor Contact:
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Technology Name:
Separator™ Row

Approval Type:
Pretreatment/Retrofits

Certification Dates:
Issued: April 9, 2024
Expires: April 9, 2029

CERTIFICATION:

The Rhode Island Stormwater Technology Review Committee which consists of members from the Department of Environmental Management (DEM), Department of Transportation (DOT) and the Coastal Resources Management Council (CRMC) have reviewed the **Separator™ Row** application for certification of its Technology Approval and accepted use for Stormwater Treatment in the State of Rhode Island.

In accordance with Stormwater Rule 250-RICR-150-10-8.9B, **Cultec** has petitioned the permitting agencies to certify the **Separator™ Row** as an acceptable structural stormwater control described in Stormwater Rule 250-RICR-150-10-8.31. They have submitted monitoring results and supporting information developed in accordance with the provisions of the Technology Assessment Protocol (TAP) for Innovative and Emerging Technologies as described in in Stormwater Rule 250-RICR-150-10 Sections 8.39 and 8.40.

The **Separator™ Row** is granted reciprocity in Rhode Island as a proprietary stormwater treatment technology, given that it has been issued an Environmental Technology Verification (ETV) in accordance with International Organization for Standardization (ISO) 14034:2016 – Laboratory Testing of Oil-Grit Separators (June 2014). The laboratory study was conducted at Good Harbour Laboratories in Mississauga, Ontario, Canada with third-party verification provided by Globe Performance Solutions. The ISO is not a member of the Technology Acceptance Reciprocity Protocol (TARP) and the ETV is not equivalent to an approval from the Washington Department of Ecology Technology Assessment Protocol (TAPE). However, the TAPE program takes data from ETV studies into consideration when evaluating the effectiveness of emerging stormwater treatment technologies. Furthermore, the Massachusetts Department of Environmental Protection (DEP) allows the **Separator™ Row** to be utilized to meet TSS removal requirements. Additionally, the RIDEM has historically allowed the use of this device for the purpose of pre-treatment. This Environmental Technology Verification recognizes the **Separator™ Row** as a stormwater treatment technology which provides at least 25% removal of total suspended solids when operating at the maximum treatment flow rate for each device specified in the attached ***Table 1: Separator™ Row Sizing Table.*** The State of Massachusetts is a member of the Technology Acceptance Reciprocity Partnership (TARP). As per Stormwater Rule 250-RICR-150-10-8.39, both TAPE and TARP approved devices are allowed reciprocity consideration in Rhode Island.

The **Separator™ Row** is a pre-treatment or retrofit device that captures TSS from stormwater runoff as described in Stormwater Rule 250-RICR-150-10-8.31. It is an open-bottom thermoplastic molded arch whose sides are wrapped in non-woven geotextile filter fabric and bottom lined with a woven geotextile filter fabric. The device is designed to remove trash and sediment from stormwater. This product was developed by **Cultec.** The **Separator™ Row** is approved for off-line use only.

The manufacturer has demonstrated that this product meets the minimum water quality standards for pretreatment as described in Stormwater Rule 250-RICR-150-10-8.31. The **Separator™ Row** is approved for at

least **25%** removal of total suspended solids (TSS) when designed using flow rates specified in the attached ***Table 1: Separator™ Row Sizing Table*** which is based on a maximum loading rate of 2.1 gallons per minute per square foot of bottom chamber area. The **Separator™ Row** is NOT recognized for removal of Pathogens, Total Phosphorus or Nitrogen. This device may be used as pretreatment or retrofit device provided that the design, installation, and maintenance are conducted in accordance with the following terms and conditions:

I. GENERAL CERTIFICATION REQUIREMENTS

1. The system must adhere to the manufacturer's specification for the **Separator™ Row** located in the general notes section of the Cultec **Separator™ Row** detail sheet that is located on the last page of this certification letter. The detail sheet containing the **Separator™ Row** specifications can also be found at: https://cultec.com/Asset/separator-row-stormwater-details.pdf

2. The system must be installed in accordance with the manufacturer's installation manual for the **Separator™ Row**, which can be found at: https://cultec.com/Asset/CLT058-stormwater-installation-instructions-c4-330xlhd.pdf and https://cultec.com/Asset/CLT009-recharger-360hd-902hd-installation-instructions-stormwater-imperial.pdf

3. The **Separator™ Row** is **certified as a pretreatment** device in accordance with Stormwater Rule 250-RICR-150-10-8.31, provided the device treats the flow of the first inch of runoff from the capture area, unless waived by the state permitting agency. The system's design must utilize flow rates, impervious catchment sizes, and maximum sediment capacities listed in the attached ***Table 1: Separator™ Row Sizing Table.***

4. The system must be designed to meet the following requirements:

    a. The device must be attached to an upstream flow-splitter diversion manhole with either a weir or an elevated bypass manifold designed to ensure that the first inch of runoff is routed to the device prior to bypass. The weir or elevated bypass manifold's invert must be located at least 9" above the bottom invert of the **Separator™ Row** chamber elevation.

    b. If the upstream flow-splitter diversion manhole is designed with a weir, then the manhole must be at least 30" wide. The manhole must be at least 48" wide if its rim is more than 4' above the invert of the device.

    c. The upstream flow-splitter diversion manhole must also provide a 2' sump.

    d. Each individual row of **Separator™ Row** chambers must be directly connected to a maintenance access manhole.

    e. The inlet pipe connecting the diversion manhole to the device must be the maximum allowable diameter per chamber as specified on the vendor's construction details.

    f. The inlet must be the only pipe connected to the **Separator™ Row**. No outlet pipes shall be directly connected to the pre-treatment chambers.

    g. Each device must provide an inspection port at the point located furthest from the inlet.

    h. The maximum distance between maintenance access manholes connected to each individual row of **Separator™ Row** chambers shall not exceed 200' to ensure that the JetVac hose is sufficiently long.

5. This device is **certified as a retrofit device** in accordance with Stormwater Rule 250-RICR-150-10-8.6A. Retrofits are allowed flexibility with regards to the eleven minimum standards described in Sections 8.6 through 8.17 of Stormwater Rule 250-RICR-150-10, but in general they are considered

effective if they capture at least 50% of the catchment and meet the target water quality treatment of at least the first 0.5 inches of the water quality volume.

6. The approved devices shall be located such that they are accessible for maintenance and/or emergency removal of oil or chemical spills.

7. The device cannot be used in series with another Hydrodynamic separator to achieve enhanced removal rates for TSS.

II. MAINTENANCE REQUIREMENTS

1. Standard permitting conditions for inclusion of this technology will, at a minimum include the following:

    a. Each individual owner must ensure that any and all of their proprietary stormwater treatment devices are maintained in accordance with the manufacturer's specifications, which are provided in the **Cultec Separator™ Row** Operation & Maintenance Manual: https://cultec.com/Asset/CLT043-cultec-separator-row-o-m.pdf

    b. Each individual owner must ensure that any and all of their proprietary stormwater pre-treatment devices are maintained in accordance with the requirements stated in Stormwater Rule 250-RICR-150-10-8.31-C, which requires the device to be inspected a minimum of 2 times per year. Additionally, the device must be cleaned out with a JetVac when either pollutant removal capacity is reduced by 50% or more, or when average sediment depth is 3" or greater.

    c. All material removed from the unit must be properly disposed of and is the responsibility of the owner.

    d. The applicant must include a copy of the **Separator™ Row** Inspection and Maintenance Guide in their project specific long-term operation and maintenance plan.

2. The applicant must provide evidence of a maintenance contract which extends for a minimum of two years. The contracted maintenance provider must receive training by **Cultec** on how to properly maintain **Separator™ Row** devices. This requirement excludes maintenance providers recognized by the RIDEM to be qualified in maintenance of **Separator™ Row** devices.

III. REPORTING REQUIREMENTS

1. Upon request from the owner of any **Separator™ Row** system installed in the State of Rhode Island, the vendor shall provide the owner with a recommended maintenance schedule after the first year of the device's operation. If a recommended maintenance schedule is requested by the owner after the first year of the device's operation, then the owner is responsible for notifying the vendor of any additional pollutant loading sites where contributing drainage areas may be subject to further development (i.e., strip malls).

2. The Vendor shall immediately notify the RIDEM Office of Water Resources if and when any changes are made to the model name or number of any **Separator™ Row** device for all models applicable to this certification.

3. The Vendor shall immediately notify the RIDEM Office of Water Resources if and when any revisions are made to the design, installation operation and maintenance manuals for all models applicable to this certification. Revisions deemed by the RIDEM to be substantial, may require re-application to the Alternative Stormwater Technology Program.

4. The Vendor shall notify the RIDEM at least thirty (30) days following any proposed transfer of ownership of the Component technology. Notification shall include the name and address of the new owner and a written agreement between the existing and new owner specifying a date for transfer of ownership, responsibility, and liability for the Component. All provisions of this Certification shall be applicable to any new owners.

IV. RIGHTS OF THE RIDEM AND CRMC

1. The RIDEM may suspend, modify, or revoke this approval for cause, including but not limited to non-compliance with any of the conditions or provisions of this approval, misrepresentation, or failure to fully disclose all relevant data, or receipt of new information indicating that the use of the **Separator™ Row** system is contrary to the public interest, public health, or the environment.

2. This approval does not represent an endorsement of the **Separator™ Row** system by the RIDEM, RIDOT or CRMC. This letter of approval may be reproduced only in its entirety.

3. The **Separator™ Row** General Specification and **Separator™ Row** Operation and Maintenance Manual referenced herein are approved upon the date of approval of this Certification.

4. The RIDEM reserves the right to suspend or revoke this Certification if updated design, installation, and O&M manuals are not provided to the RIDEM within thirty (30) days of RIDEM request or one hundred and eighty (180) days prior to the expiration date of this Certification. All revisions must be reviewed and approved by the RIDEM prior to re-certification.

Eric A. Beck, P.E. Date
Administrator of Groundwater and Freshwater Wetlands Protection

SEE ATTACHMENTS ON NEXT PAGE:

Table 1: Separator™ Row Sizing Table

Model #	Chamber Dimensions (H x W x L)	Chamber Bottom Surface Area (ft^2)	Maximum Treatment Flow Rate per Chamber (cfs)	Approximate Maximum Impervious Treatment Area (acres)
Contactor® 100HD	12.5” x 36” x 8’	22.5	0.11	0.095
Recharger® 150XLHD	18.5” x 33” x 11’	24.0	0.11	0.105
Recharger® 180HD	20.5” x 36” x 7.33’	19.0	0.09	0.083
Recharger® 280HD	26.5” x 47” x 8’	27.4	0.13	0.114
Recharger® 330XLHD	30.5” x 52” x 8.5’	31.3	0.15	0.130
Recharger® 360HD	36” x 60” x 4.17’	18.4	0.09	0.077
Recharger® 902HD	48” x 78” x 4.25’	23.9	0.11	0.102

TYPICAL STANDARD DETAIL FOR SEPARATOR™ ROW - ON NEXT PAGE

SEPARATOR ROW™ SPECIFICATIONS

GENERAL

1. CULTEC'S SEPARATOR ROW IS USED AS AN INEXPENSIVE MEANS OF REMOVING TOTAL SUSPENDED SOLIDS FROM THE CHAMBER SYSTEM, AS WELL AS PROVIDING EASIER ACCESS FOR INSPECTION AND MAINTENANCE.

2. THE SEPARATOR ROW PERFORMANCE SHALL BE TESTED AND VERIFIED TO THE PROTOCOLS AND PROCEDURES AS DEFINED BY ENVIRONMENTAL TECHNOLOGY VERIFICATION (ETV) CANADA TO ACHIEVE 80% TSS REMOVAL.

INSTALLATION INSTRUCTIONS

A SEPARATOR ROW IS INSTALLED ON A 1-2 INCH [25-51 mm] WASHED, CRUSHED STONE BASE. TYPICALLY, THE CULTEC CHAMBER MODEL USED FOR THE SEPARATOR ROW IS THE SAME CHAMBER USED THROUGHOUT THE ENTIRE CHAMBER BED.

STORMWATER IS DISTRIBUTED TO THE SEPARATOR ROW BY A PRIMARY FEED SYSTEM THAT DIVERTS FLOW TO THE SEPARATOR ROW AND A SECONDARY BYPASS FEED SYSTEM THAT DIVERTS THE FLOW OF CLEAN WATER TO THE OTHER PARTS OF THE UNDERGROUND STORMWATER MANAGEMENT SYSTEM. THE DISTRIBUTION SYSTEM MAY BE BY PIPES SET AT A LOWER ELEVATION THAT PERMIT THE FIRST FLUSH TO THE SEPARATOR ROW VERSUS OTHER PARTS OF THE UNDERGROUND STORMWATER SYSTEM. THIS INITIAL FLOW MAY BE MANAGED BY A BAFFLE OR WEIR. THE SIZING OF THE PIPE(S) THAT PROVIDE STORM WATER TO THE SEPARATOR ROW IS TO BE DETERMINED BY THE DESIGN ENGINEER AND IS BASED UPON THE REQUIREMENT TO ACCOMMODATE THE DESIGN FLOW AND SERVICE CONVENIENCE.

THE CHAMBERS UTILIZED IN THE SEPARATOR ROW ARE TO BE COMPLETELY WRAPPED WITH CULTEC NO. 410 NON-WOVEN GEOTEXTILE. THIS CREATES A PASS-THROUGH FILTER ARRANGEMENT TO SEPARATE TOTAL SUSPENDED SOLIDS IN THE TRANSFER OF STORM WATER TO OTHER CHAMBERS THROUGHOUT THE UNDERGROUND STORMWATER MANAGEMENT SYSTEM.

ONCE WRAPPED, THE SEPARATOR ROW IS TO THEN PLACED ENTIRELY OVER 1 LAYER OF CULTEC No. 4800 WOVEN GEOTEXTILE. THIS WOVEN GEOTEXTILE PROVIDES A DURABLE SURFACE WITHIN THE ROW FOR MAINTENANCE PROCEDURES AS WELL AS TO PREVENT ANY SCOURING OF THE STONE BASE DURING HIGH PRESSURE JETTING.

THE RECOMMENDED INSTALLATION OF SEPARATOR ROW CHAMBERS, IN REGARD TO STONE SEPARATION AND STONE ABOVE THE UNIT, ALONG WITH OTHER MINIMUM BURIAL MATERIALS AND METHOD SPECIFICATIONS DETAILED FOR THE PROPER INSTALLATION, IS THE SAME AS CULTEC'S REQUIREMENT DETAILED IN THE COMPANY'S INSTALLATION GUIDELINES WITH THE EXCEPTION OF THE PLACEMENT OF THE REQUIRED FILTERING FABRICS. PLEASE REFER TO CULTEC'S CURRENT INSTALLATION INSTRUCTIONS FOR STORMWATER CHAMBERS AS A GUIDE.

MAINTENANCE PROCEDURES

CULTEC RECOMMENDS INSPECTIONS OF THE SEPARATOR ROW TO BE PERFORMED EVERY SIX MONTHS FOR THE FIRST YEAR. THE FREQUENCY OF INSPECTION CAN THEN BE ADJUSTED BASED UPON PREVIOUS OBSERVATION OF SEDIMENT DEPOSITION.

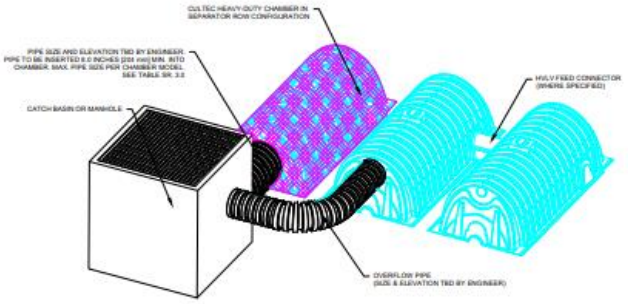
WHILE CLEANING IS POSSIBLE FROM A SINGLE MANHOLE IN SHORTER LINES, A CLEAN-OUT OPTION FROM EITHER END OF A LINE IS PREFERABLE, PARTICULARLY FOR LONGER RUNS. CLEANING INVOLVES FLUSHING SEDIMENT FROM THE BASE FABRIC OF THE SEPARATOR ROW.

ACCESS WILL BE PROVIDED VIA A MANHOLE(S) LOCATED AT THE END(S) OF THE ROW FOR CLEAN OUT.

MAINTENANCE OF THE SEPARATOR ROW IS TO BE ACCOMPLISHED WITH A JETVAC PROCESS.

THE JETVAC IS TO BE SENT DOWN THE ENTIRE LENGTH OF THE SEPARATOR ROW. AS THE HIGH PRESSURE WATER NOZZLE IS RETRIEVED, THE CAPTURED SEDIMENTS ARE FLUSHED BACK INTO THE MANHOLE FOR VACUUMING.

GENERAL NOTES

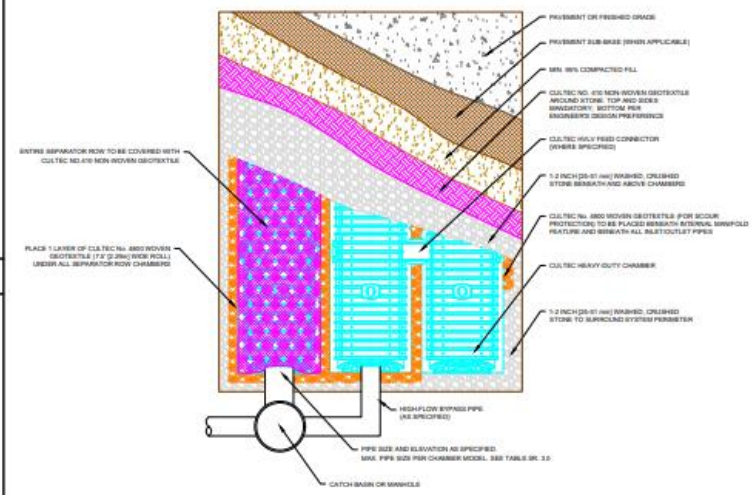


TYPICAL SEPARATOR ROW CONFIGURATION INLET CONNECTION

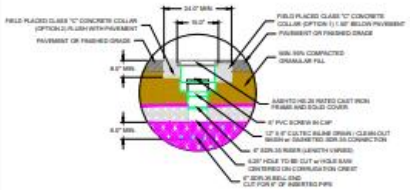
	CULTEC CHAMBER MODEL					
	DESCRIPTION	CONTACTOR 100HD	RECHARGER 150XLHD	RECHARGER 280HD	RECHARGER 330XLHD	RECHARGER 902HD
A'	MIN. DEPTH OF STONE BASE	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	9" 229 mm
B	CHAMBER HEIGHT	12.5" 318 mm	18.5" 470 mm	26.5" 673 mm	30.5" 775 mm	48" 1219 mm
C'	MIN. DEPTH OF STONE REQUIRED ABOVE UNITS FOR TRAFFIC APPLICATIONS	6" 152 mm	6" 152 mm	6" 152 mm	6" 152 mm	12" 305 mm
D	MIN. DEPTH REQUIRED OF 95% COMPACTED FILL FOR PAVED TRAFFIC	8" 203 mm	8" 203 mm	8" 203 mm	10" 254 mm	12" 305 mm
E	MAX. DEPTH OF COVER ALLOWED ABOVE CROWN OF CHAMBER	12' 3.65 m	12' 3.65 m	12' 3.65 m	12' 3.65 m	8.3' 2.53 m
	MAX. PIPE SIZE TO CHAMBER END/WALL/ENDCAP	10" 250 mm	12" 300 mm	18" 450 mm	24" 600 mm	24" 600 mm

NOTE[1]: STONE ABOVE AND BELOW UNITS MAY VARY PER SYSTEM. SEE SYSTEM LAYOUT FOR STONE REQUIREMENTS

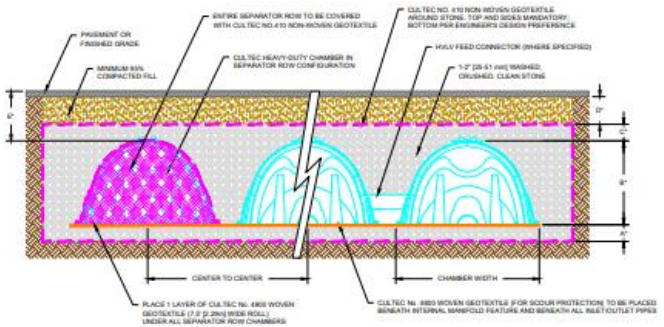
CROSS SECTION TABLE REFERENCE



TYPICAL SEPARATOR ROW CONFIGURATION PLAN VIEW

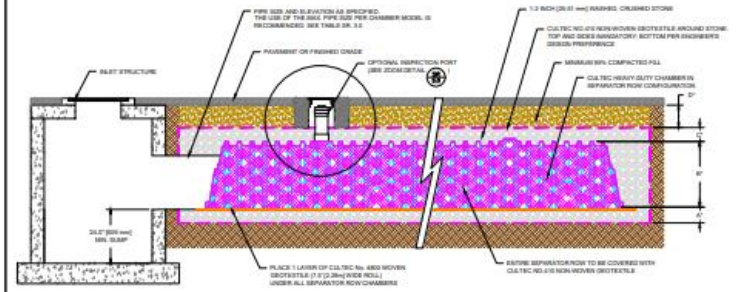


TYPICAL INSPECTION PORT - ZOOM DETAIL



* SEE SR 3.0 - CROSS SECTION TABLE REFERENCE

TYPICAL SEPARATOR ROW CONFIGURATION CROSS SECTION



* SEE SR 3.0 - CROSS SECTION TABLE REFERENCE

TYPICAL SEPARATOR ROW CONFIGURATION CROSS SECTION WITH INSPECTION PORT DETAIL

CULTEC

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SEPARATOR ROW
DETAIL SHEET
TRAFFIC APPLICATION

SEPARATOR ROW DETAIL SHEET

PROJECT NO: -	DATE: 08/2018
DESIGNED BY: CULTEC, INC	CHECKED BY: TECH
SCALE: N.T.S.	SHEET NO: -