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STORMWATER MANAGEMENT REPORT

140 HAVERHILL STREET, ANDOVER, MA 01844

ASSESSORS MAP 18 PARCEL 104-A

December 23, 2024

Submitted to:

Town of Andover
36 Bartlet Street
Andover, MA 01810

Prepared for:

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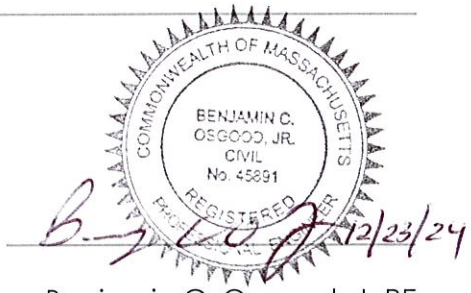

12/23/24

Benjamin C. Osgood, Jr PE
Director of Engineering

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III. INTRODUCTION

In accordance with Massachusetts Stormwater Management Regulations and the Town of Andover Stormwater Management and Erosion Control Regulations, Ranger Engineering Group (Ranger) has prepared a comprehensive Stormwater Management Plan for submittal to the Town of Andover, MA planning board on behalf of Medico 140, LLC (Medico) in support of an Application for a Major Non Residential Site Plan Special Permit with the planning board and Application to Amend the existing Order of Conditions with the conservation commission for the removal of the existing structure and construction of two (2) new structures on one (2) new lots at 140 Haverhill Street, Andover, MA. This project site was approved previously for two (2) buildings on two (2) lots, then revised to one building on one lot, so this submittal is a second modification of an approved project.

IV. EXISTING CONDITIONS

The project site consists of an 7.2 ± acre parcel of land located at 140 Haverhill Street. (Assessors Map 18 Lot 104-A) in Andover, Massachusetts (see Ranger Dwg. CS0201). The site has been previously developed with a 25,000 square foot medical building and associated driveways and parking areas. The parcel is bordered by a similar medical office structure to the north, residential properties across the street to the south and east, and a large wetland area to the west.

Generally, the topography is sloped from the south east corner of the property to the west towards the wetlands. The existing stormwater system is a catch basin and manhole system that routes water from the developed areas of the site to a wetland area within the parking lots and driveway connecting to the adjacent medical building. The outlet of the wetland is a pipe under the driveway which flows north into the adjacent wetland area. Soils on the site are generally dense till on the upper areas of the site and saturated hydric soils on the lower portions of the site.

V. PROPOSED CONDITIONS

The Applicant proposes to divide the site into two new lots. Lot A will have the previously approved 19,600 square foot medical building in approximately the same location as the existing medical building. Lot B will have a new 2-story 17,688 square foot daycare building located on the High Street side of the property.

As was previously approved, the existing stormwater system will be partially modified to accommodate the new parking lot configuration at the front of the new medical building. The remaining portions of the existing closed drainage system will be replaced, but will remain in the same configuration, and will continue to convey stormwater from the existing paved parking areas through deep sump catch basins and eventually into the adjacent wetland areas.

Because the recently approved project was a redevelopment, not all of the stormwater management requirements could be met. The project had about the same amount of impervious area in the post development condition as the pre-development condition, so there was a small decrease in runoff. To control flows, one buried pipe in stone system is being installed to collect and control roof runoff from the new medical building.

In this revised plan, runoff from the proposed new day care facility will be piped through roof drains to a subsurface infiltration and detention structure. The outlet opening will be a horizontal orifice

placed above the volume of runoff required to infiltrate a minimum of ½" of runoff from the impervious roof surface.

The proposed development is serviced by municipal water, sewer, underground electric, gas, and communications systems.

VI. STORMWATER DESIGN

The proposed stormwater system will maintain the same drainage patterns as under the pre-development conditions. Increases to peak rates of flow will be mitigated onsite to minimize or eliminate impacts to downstream areas. Stormwater presently flows off site to the south and east into the surrounding wetland areas.

Closed Drainage Systems

The existing closed drainage system consists of deep sump catch basins with 2' deep sumps, corrugated metal pipe, and reinforced concrete piping. Additional piping and structures will be constructed. New piping will be HDPE and each catch basin will be replaced with 4' deep sump catch basins with hooded outlets.

Stormwater Detention System

One (1) buried pipe detention structure is proposed to mitigate peak runoff rates and volumes from the proposed medical building on Lot A. A second buried chamber detention structure is proposed to capture and infiltrate runoff from the new roof associated with the day care building. The stormwater system is designed to contain and mitigate flow rates from the 2-year, 10-year, 25-year and 100-year storm events. Because the drainage systems from the two lots will comingle, easements will be developed to define inspection and maintenance responsibilities for each of the two properties.

Stormwater Treatment

Two Jellyfish treatment systems manufactured by Contech will be installed in the existing pipe network to treat 100% of the stormwater flow from paved surfaces.

Stormwater Infiltration

Test pits have been performed on site. The water table is high and the buried pipe in stone retention systems serving the medical building will be lined with an impermeable liner to prevent groundwater inflow. Infiltration at this location is not possible due to the high ground water. Runoff from the new roof will be routed to the new open bottom buried chamber system for infiltration.

VII. SITE PARAMETERS

Wetland Resource Areas
The site does contain wetlands resource areas that have been flagged and located on the project plans.

Flood Zone Classification
According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Essex County, Massachusetts, Community Panel 25009C0217F, effective date July 3, 2012, the site and nearby properties are located within Zone X, which is defined as areas outside of the 500-year floodplains (see attached).

Estimated Habitat for Rare Wildlife and Rare Species
According to current *Massachusetts GIS Online Mapping Tool (Oliver),* the site is not designated as an area for estimated habitat for rare wildlife or rare species.

Soil Classification
According to the Soil Survey of Essex County, Massachusetts, prepared by the US Department of Agriculture, Soil Conservation Service, underlying soils located within the site consist primarily of Woodbridge and Wareham (see Soils Map). Woodbridge and Wareham soils, are classified within SCS Hydrologic Soil Group D.

Table 1
Hydrologic Soil Group Ratings

Map Unit Symbol	Map Unit Name	Rating
32A	Wareham Fine Sandy Lom, 3 – 8% slopes	D
311B	Woodbridge	D

The on-site soils consist of series, described by NRCS, as follows:

Wareham: This series consists of very deep, poorly and somewhat poorly drained sandy soils formed in outwash on plains, deltas, and terraces. Slope ranges from 0 to 8 percent. Permeability is rapid throughout High water tables and hydric soils

Woodbridge: The Woodbridge series consists of moderately well drained loamy soils formed in lodgment till and are very deep to bedrock. They are nearly level to moderately steep soils on hills, drumlins, till plains, and ground moraines. Slope ranges from 0 to 25 percent.

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.
Per the soil survey, the general characteristics of the four (4) hydrologic soil groups are 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 clay pan 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.

Subsurface Investigation

Test pits have been performed and are included in the appendix. Ground water was found as close as 28” to the ground surface making the installation of infiltration systems below the existing paved areas impossible.

VIII. DRAINAGE ANALYSIS

Methodology
The comparative hydrologic analysis of pre-development conditions to post-development conditions was performed using the Soil Conservation Service, Technical Release 20 (TR-20). The 2, 10, 25, and 100-year storm events were modeled for a 24-hour, Type III storm using HydroCAD version 8.5. HydroCAD calculations for pre-and post-development conditions are include in the Appendices.

The following rainfall amounts taken from the were utilized for each design storm event.

2-year Frequency Storm:	3.15 inches per 24-hours
10-year Frequency Storm:	5.10 inches per 24-hours
25-year Frequency Storm:	6.15 inches per 24 hours
100-year Frequency Storm:	7.92 inches per 24-hours

Existing Watershed
The existing site has been developed with parking areas and a 25,000 square foot +/- medical building. The existing catchment areas and drainage runoff flow patterns associated with the site are illustrated on the attached Pre-Development Watershed Plan (Dwg. CS9201). The drainage patterns will be maintained under post-development conditions.

For the purposes of the hydrologic analyses, the existing site has been delineated as one (1) existing catchment area which flows to one (1) design point located at the wetlands on the north side of the site.

The following Catchments flow to design point 1 in the pre-development condition

Catchment E1
Catchment EX1 includes areas of the site which direct stormwater runoff primarily toward the wetland area at the north end of the site. The topography within the catchment is moderately sloped (approx. 4%-8%). The catchment has paved parking and driveways, roof area, developed lawn, and wooded areas.

Proposed Watershed
The proposed development will raze the existing building and construct a new 2 story medical office building and a new 2 story day care building. The existing paved parking areas, driveways, and drainage system will be maintained to the greatest extent possible. See attached Post-Development Watershed Plan (Dwg. CS9301)

The following Catchments flow to Design Point 1in the post-development condition

Catchment D1
Catchment D1 includes flow from the parking and lawn areas. Runoff from this catchment flows to the existing drain system and then to the wetlands at Design Point 1.

Catchment D2
Catchment D2 includes flow from the roof of the new building. Runoff from this catchment flows to the proposed buried pipe in stone system and then into the drainage system and eventually to Design Point 1.

Catchment D3
Catchment D3 includes flow from the roof of the new day care building. Runoff from this catchment flows to the proposed buried chamber system and then into the drainage system and eventually to Design Point 1.

IX. SUMMARY OF PEAK DISCHARGE RATES AND VOLUMES

The estimation of flow rates and volumes were calculated utilizing *HydroCad* stormwater modeling software. The methodology is SCS TR-20, Type III, 24-hour rainfalls (2, 10, & 100-year frequency storm events). Supporting calculations are included in the Appendix.

FLOW RATE TABLES

Point of Analysis	**Storm**	**Pre-Development Rate** (CFS)	**Approved Post-Development Rate** (CFS)	**New Post-Development Rate** (CFS)
DP #1 (wetland)	2-year	16.39	15.71	15.63
	10-year	28.70	27.40	27.47
	25-Year	35.25	33.66	33.70
	100-year	46.22	44.09	44.11

X. STORMWATER MANAGEMENT STANDARDS

The project has been designed to meet the *Mass DEP Stormwater Management Standards* outlined in the *Wetlands Protection Act Regulations, 310 CMR 10.05(6)(k)* to the maximum extent practicable for a redevelopment project. The design also complies with the standards of the *Town of Andover Stormwater Management and Erosion Control Regulations* to the maximum extent practicable.

When the property was originally developed in the 1970's and 1980's there were no stormwater management regulations. This redevelopment project involves reusing much of the paved parking areas and complies with the redevelopment standards of the regulation. Conformance with these standards is described below.

STORMWATER MANAGEMENT PRACTICES

Stormwater runoff from the developed site is routed through the existing stormwater system. Treatment will be provided by the addition of two Jellyfish Filters just upstream of the outlets to the design point.

Buried pipe in stone and chamber systems will provide storage for stormwater to maintain peak flows which are lower in the post development condition than in the pre development condition.

CONFORMANCE WITH STANDARDS

Standard 1: No New Untreated Discharges – Met
There will be no new untreated outfalls proposed as part of this project; The existing drainage system will be re-used in the properties re-development and all stormwater will be routed to the existing drainage system outlets which will be fitted with Jellyfish filters to provide treatment.

Standard 2: Peak Rate Attenuation – Met
There will be a slight increase to the impervious area associated with the redevelopment of this site. Pre- and post-development watershed analyses of the drainage systems were performed for the 2, 10, 25 and 100-year storms. A summary of peak discharge rates for the pre and post development conditions is presented in section IX and the full Hydrocad printouts are included in the Appendix to this report. The results of the analysis indicate that post-development peak discharge rates will not increase from the pre-development peak discharge rates for the design point in the analysis.

Standard 3: Recharge Volume– Not Practicable for existing impervious
Due to the high-water table and the extent of existing paved areas it is not practicable to infiltrate the required amount of runoff from the site. Where this is a redevelopment of a property that has existed prior to the implementation of the wetland protection act and the stormwater regulations, it is not practical to infiltrate runoff under the present-day requirements.

The new day care building, which is considered new impervious, will be routed to a subsurface chamber system for infiltration. Because the impervious area for the overall project is about the same in the pre and post conditions and subsurface pipe in stone and chamber systems are being provided, the volume of runoff only increases slightly.

Standard 4: Water Quality – Met
According to Standard 4, the project is subject to an 80% TSS Removal Rate requirement and the one half-inch rule for the water quality volume calculations.

Because the drain system exists it is difficult to add new filter practices. The design proposes installing new deep sump, hooded catch basins to provide pre-treatment, and two Jellyfish Filters will be installed at the outlet of the drain system.

The treatment requirement of 80% TSS removal is met. (see attached Jellyfish Calculations and information.

Standard 5: LUHPPL's – Not applicable

Standard 6: Critical Areas _ Not Applicable

Standard 7: Redevelopment Projects Not Applicable
This project is a redevelopment project, however only the requirement for infiltration is not being met.

Standard 8: Erosion and Sediment Control – Met

Soil and erosion control shall be provided during construction by means of straw bales or waddles, siltation fence, and/or compost filter tubes. Inlet protection will be installed on all drain inlets and a construction entrance will be used in areas where the pavement and building are being removed.

The Stormwater Pollution Prevention Plan (SWPPP) has been completed and included with this report. The Contractor will submit the SWPPP through the NPDES Notice system prior to any land disturbance.

Standard 9: Operation and Maintenance Plan – Met

The operation and maintenance plan for the post-construction BMP's on this project will be the responsibility of the Property Owner. The Operation and Maintenance Plan for the proposed drainage systems can be found in the Appendix.

Standard 10: Illicit Discharges – Met

There are no known or suspected illicit discharges to the proposed stormwater conveyance system.

In summary, this project meets Standards 1, 2, 4, 8, 9, and 10. Standards 5, 6, and 7 are not applicable to the project and meeting standard 3 is not practicable.

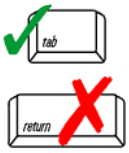
DEP STORMWATER CHECKLIST

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

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.

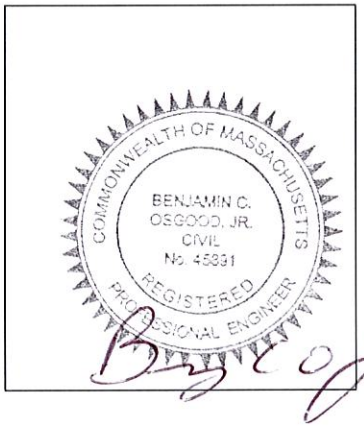
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



12/23/24
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.

TSS REMOVAL CALCULATIONS

INSTRUCTIONS:

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

Non-automated: Mar. 4, 2008

Location: 140 HAVERHILL ST.

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 CATCH BASIN	25%	1.00	.25	0.75
Jelly Fish FILTER	89%	0.75	.66	0.09

Total TSS Removal = 91%

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

Project: 140 HAVERHILL ST
Prepared By: B. OSGOOD
Date: 9/30/21

*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

Mass. Dept. of Environmental Protection

* RESULTS ARE SAME FOR BOTH TREATMENT LOCATIONS

Project: 140 Haverhill Street
Location: Andover, MA
Prepared For: Ranger Engineering

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Compute Q Rate using the following equation:

$$Q = (qu)\ (A)\ (WQV)$$

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
Small Parking Lot	0.13	0.0002098	6.0	0.100	1.00	774.00	0.16
Parking Lot + SW	1.88	0.0029342	6.0	0.100	1.00	774.00	2.27

The WQf sizing calculation selects the minimum size CDS/Cascade/StormCeptor model capable of operating at the computed WQf peak flowrate prior to bypassing. It assumes free discharge of the WQf through the unit and ignores the routing effect of any upstream storm drain piping. As with all hydrodynamic separators, there will be some impact to the Hydraulic Gradient of the corresponding drainage system, and evaluation of this impact should be considered in the design.

CONTECH Stormwater Solutions Inc. Engineer: DRA
Date Prepared: **9/22/2021**

Site Information

Project Name	**140 Haverhill Street**
Project State	**MA**
Project City	**Andover**

Total Drainage Area, Ad	**1.88**	ac
Post Development Impervious Area, Ai	**1.88**	ac
Pervious Area, Ap	**0.00**	ac
% Impervious	**100%**	
Runoff Coefficient, Rc	**0.95**	

Mass Loading Calculations

Mean Annual Rainfall, P	**48.0**	in
Agency Required % Removal	**80%**	
Percent Runoff Capture	**90%**	
Mean Annual Runoff, Vt	**280,073**	ft^3
Event Mean Concentration of Pollutant, EMC	**75**	mg/l
Annual Mass Load, M total	**1311**	lbs

Filter System

Filtration Brand	**Jelly Fish**	
Cartridge Length	**54**	in

Jelly Fish Sizing

Mass to be Captured by System	**1048**	lbs
Water Quality Flow	**2.27**	cfs

Method to Use **FLOW BASED**

Summary			
Flow	Treatment Flow Rate	2.41	cfs
	Required Size	**JFPD0808-12-3**	

CONTECH Stormwater Solutions Inc. Engineer: DRA
Date Prepared: **9/22/2021**

Site Information

Project Name	**140 Haverhill Street**	
Project State	**MA**	
Project City	**Andover**	
Total Drainage Area, Ad	**0.13**	ac
Post Development Impervious Area, Ai	**0.13**	ac
Pervious Area, Ap	**0.00**	ac
% Impervious	**100%**	
Runoff Coefficient, Rc	**0.95**	

Mass Loading Calculations

Mean Annual Rainfall, P	**48.0**	in
Agency Required % Removal	**80%**	
Percent Runoff Capture	**90%**	
Mean Annual Runoff, Vt	**19,367**	ft^3
Event Mean Concentration of Pollutant, EMC	**75**	mg/l
Annual Mass Load, M total	**91**	lbs

Filter System

Filtration Brand	**Jelly Fish**	
Cartridge Length	**54**	in

Jelly Fish Sizing

Mass to be Captured by System	**72**	lbs

Method to Use **FLOW BASED**

Summary			
Flow	Treatment Flow Rate	0.27	cfs
	Required Size	**JF4-1-1**	

XI. POLLUTION PREVENTION PLANS

Construction Period Erosion and Sedimentation Control Plan:

The BMP's associated with the construction phase this project will be owned by the Applicant's Contractor, which will be responsible for inspection, operation and maintenance. A more detailed SWPPP – per NPDES Phase 2 requirements – is to be kept on site, along with inspection logs. All details and plans required are included in the Site Plan set attached herewith.

1. The contractor is to install and maintain drainage facilities as shown on site plan prepared by Ranger Engineering Group, Inc. (Ranger), dated December 18, 2024.

2. Prior to commencement of construction the contractor shall file a notice of intent under the EPA NPDES construction permit.

3. Any dewatering requires coverage under the NPDES construction site dewatering general permit.

4. The contractor must install erosion control measures as shown on the plans and in the details prior to starting any other work on the site. Erosion control must be installed at every inlet structure (existing and proposed) and maintained for the duration of the project.

5. Erosion controls as shown on plans shall be inspected, repaired and/or maintained by the contractor daily and within 12 hours of each storm event.

6. Sediment deposits shall be removed when they reach a depth of 1/4 to 1/2 the height of the silt fence or sediment sock.

7. Sediment shall be contained within the construction site, away from drainage structures. Sediment reaching the public way shall be removed by street sweeping and not by flushing.

8. Stabilize slopes steeper than 3:1 (horizontal to vertical) with seed, secured geotextile fabric, or rock rip-rap as required to prevent erosion during construction.

9. Clean out catch basins, drain manholes and storm drain pipes after completion of construction.

10. Loam and seed all disturbed areas. Permanent seeding shall occur in the spring from late march through may and in late summer or early fall between August and October.

11. Dust shall be controlled at the site with mechanical water spraying as necessary and during extended dry periods.

12. Upon establishment of permanent vegetation over disturbed areas, remove and dispose of hay wattles and stakes.

13. It is the responsibility of the contractor to maintain and supplement the specified sedimentation controls as necessary to prevent sedimentation of off-site areas and/or any regulated resource areas. Failure by the contractor to control erosion, pollution and/or siltation shall be cause for the owner to employ outside assistance or to use his own means to provide the necessary corrective measure. The cost of such assistance plus project engineering costs will be the contractor's responsibility.

14. In addition to those locations shown on this plan and on the grading and drainage plans, erosion controls shall be installed at the following locations: toe of slope of embankment construction, toe of temporary earthwork stockpiles. Stockpile side slopes shall not exceed 2:1.

15. Erosion and sedimentation control shall be installed and maintained in compliance with Massachusetts stormwater policy.

Long-Term Pollution Prevention:

The owner/applicant is to be responsible for maintenance of all drainage structures in the project, including drain pipes. The current owner is expected to remain as property owner and therefore will oversee long term maintenance in the development and will be responsible for compliance with the Plan upon completion of the construction.

Regular maintenance is to include the following:

1. **Pavement Sweeping**
   Pavement surfaces shall be swept a minimum of twice per year, preferably just after snow melt and late in the fall.

2. **Catch Basin Sumps, Drain Manhole and Outlet Control Structures**
   Inspect quarterly for the evidence of structural damage, silt accumulation and improper function. Remove accumulated sediments and debris from catch basin sump when sump is more than 25% full, minimum annually just after snow melt.

3. **Drain Pipes**
   Inspect annually for the evidence of structural damage, silt accumulation and improper function. Clean pipes when sediment occupies more than 20% of pipe diameter.

4. **Buried Detention System - 2**
   Inspect inlet and outlet structures quarterly for damage and silt accumulation. Remove silt buildup and debris.

5. **Jellyfish Treatment Systems - 2**
   Inspect quarterly per the attached Jellyfish System Owners Manual..

6. **Graded Slopes and Rip Rap outlets**
   Inspect every spring for erosion. Repair any erosion by placing rip-rap or loam and seed. Nurtured freshly seeded areas to ensure proper germination and establishment of turf.

Inspections shall be performed by a qualified person with knowledge of stormwater structures and conveyance systems. A report of inspections shall be submitted to the Town of Andover on an annual basis within 30 days of the end of each calendar year.

The requirement and responsibility for the inspection and maintenance of the stormwater system will continue to any subsequent owners of the property.

Inspection Costs

The annual costs of implementing the required inspections and maintenance outlined in the long-term pollution prevention plan are expected to be as follows:

- Quarterly inspections $ 2,000
- Annual roadway sweeping $ 1,500
- Removal of silt from stormwater treatment systems $ 2,000
- Annual mowing of side slopes $ 500
- Annual catch basin cleaning $ 1,500

Public Safety

The stormwater management system is designed as a passive system and when maintained properly it should not pose any threat to public safety.

ANNUAL LONG TERM POLUTION PREVENTION PLAN
MAINTINANCE AND INSPECTION LOG
140 HAVERHILL STREET, ANDOVER, MA

This inspection log shall be maintained on site and completed as required during the calendar year when stormwater system maintenance and inspection is performed. General Maintenance items such as mowing and removal of debris from stormwater systems can be completed by persons employed by the property owner. Inspections of stormwater systems and piping should be performed by a person with knowledge of stormwater systems and is qualified to perform such inspections.

Plan Year _____

Catch Basin Sumps, Drain Manhole and Outlet Control Structures
Inspect quarterly for the evidence of structural damage, silt accumulation and improper function. Remove accumulated sediments and debris from catch basin sump when sump is more than 25% full, minimum annually just after snow melt.
.

INSPECTION DATE	PERFORMED BY	COMMENTS

Drain Pipes
Inspect annually for the evidence of structural damage, silt accumulation and improper function. Clean pipes when sediment occupies more than 20% of pipe diameter.

INSPECTION DATE	PERFORMED BY	COMMENTS

Buried Detention Systems
Inspect quarterly for damage and silt accumulation. Inspect inlet and outlet structures and remove any debris or silt present.

INSPECTION DATE	PERFORMED BY	COMMENTS

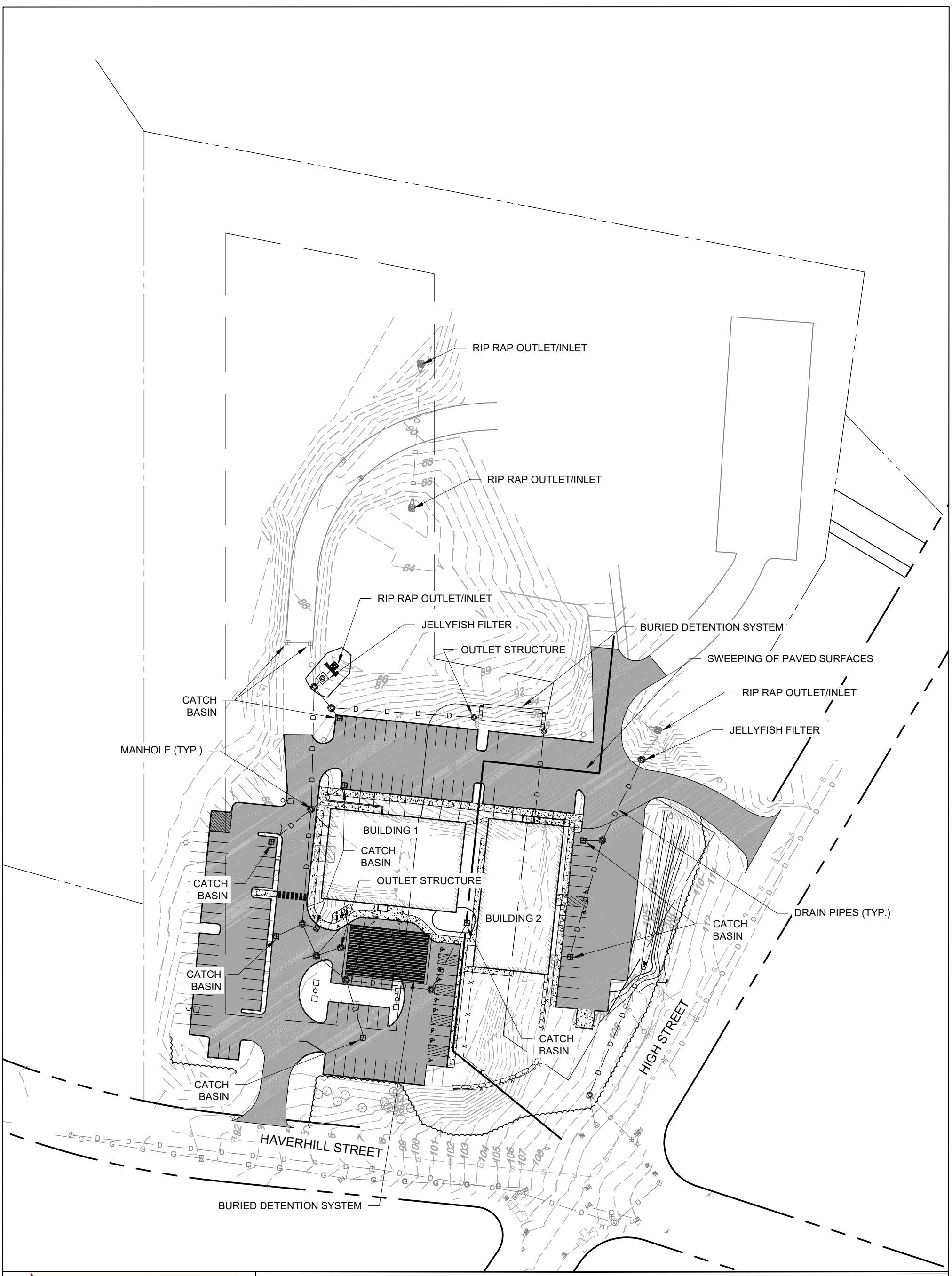
Jellyfish filters
Inspect per the attached owners manual.

INSPECTION DATE	PERFORMED BY	COMMENTS

Graded Slopes and Rip Rap outlets
Inspect every spring for erosion. Repair any erosion by placing rip-rap or loam and seed. Nurtured freshly seeded areas to ensure proper germination and establishment of turf.

INSPECTION DATE	PERFORMED BY	COMMENTS

Corrective actions
In the area below describe any repairs made to the system during the current calendar year. Add additional sheets if necessary.



Ranger Engineering Group, Inc.
13 Red Roof Lane, Suite 203
Salem NH, 03079
Tel: 978-208-1762
rangereng.com

MAINTENANCE INSPECTION LOCATION PLAN

140 HAVERHILL STREET
ANDOVER, MA 01810

PREPARED FOR

MEDICO 140, LLC

SCALE 1" = 80'

DATE: DECEMBER 18, 2024

ILLICIT DISCHARGE COMPLIANCE STATEMENT

SITE ADDRESS: 140 Haverhill Street, Andover, MA

OWNER: Medico, LLC

PLAN REFERENCE: Site Plan 140 Haverhill Street, Assessor's Map 18 Lot 104A, Andover, MA 01810, Date: June 12, 2024 Prepared By Ranger Engineering Group, Inc.

As required by Standard 10 of the Massachusetts Stormwater Standards, I, the undersigned, being the authorized owner/responsible party of the above referenced property do hereby certify that no illicit discharges exist on the site and that the stormwater management system, as shown on the above referenced plan, does not contain or permit any illicit discharges to enter the stormwater management system.

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

Further, I certify that the stormwater management system ass shown on the referenced plan will be maintained in accordance with the conditions of the Long-Term Pollution Prevention Plan.

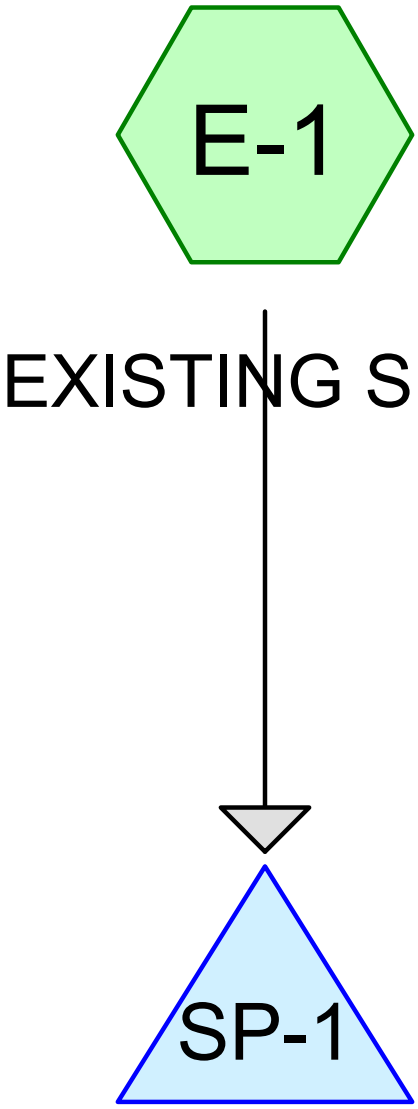
NAME: Paul Kreeland

SIGNED: Paul Kreeland

DATE: 10/11/24

HYDROCAD PRINTOUTS

PRE-DEVELOPMENT DRAINAGE



Subcat Reach Pond Link

Routing Diagram for 140 Haverhill Street, Andover, MA - PRE
Prepared by {enter your company name here}, Printed 12/24/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 YEAR	Type II 24-hr		Default	24.00	1	3.15	2
2	10 YEAR	Type II 24-hr		Default	24.00	1	5.10	2
3	25 YEAR	Type II 24-hr		Default	24.00	1	6.15	2
4	100 YEAR	Type II 24-hr		Default	24.00	1	7.92	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
68,367	89	LAWNS (E-1)
70,000	98	Paved parking, HSG D (E-1)
16,700	98	ROOF HSG D (E-1)
7,100	98	SIDEWALK HSG D (E-1)
26,600	77	WOOD HSGD (E-1)
188,767	**92**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
93,800	HSG D	E-1
94,967	Other	E-1
188,767		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchmen Numbers
0	0	0	0	68,367	68,367	LAWNS	
0	0	0	70,000	0	70,000	Paved parking	
0	0	0	16,700	0	16,700	ROOF	
0	0	0	7,100	0	7,100	SIDEWALK	
0	0	0	0	26,600	26,600	WOOD	
0	**0**	**0**	**93,800**	**94,967**	**188,767**	**TOTAL AREA**	

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: EXISTING SITE Runoff Area=188,767 sf 49.69% Impervious Runoff Depth>2.16"
Tc=6.0 min CN=92 Runoff=16.39 cfs 33,930 cf

Pond SP-1: SUM POND Inflow=16.39 cfs 33,930 cf
Primary=16.39 cfs 33,930 cf

Total Runoff Area = 188,767 sf Runoff Volume = 33,930 cf Average Runoff Depth = 2.16"
50.31% Pervious = 94,967 sf 49.69% Impervious = 93,800 sf

Summary for Subcatchment E-1: EXISTING SITE

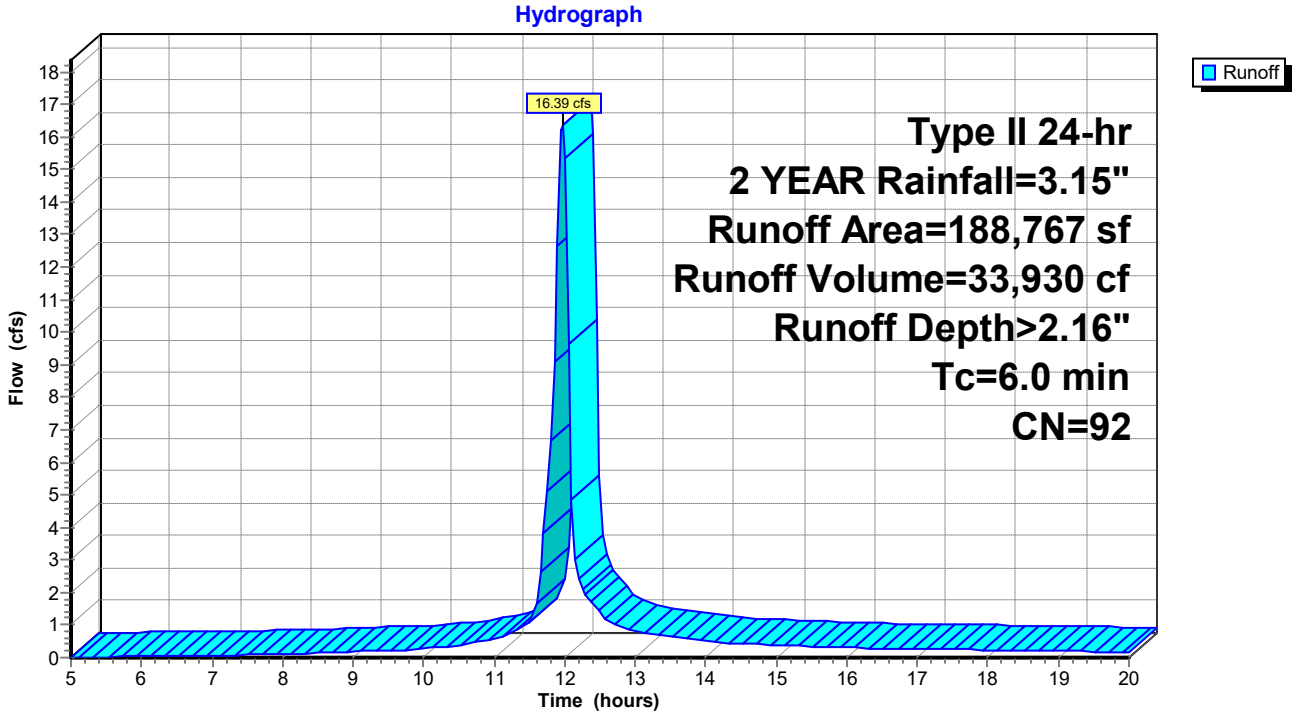
Runoff = 16.39 cfs @ 11.97 hrs, Volume= 33,930 cf, Depth> 2.16"
Routed to Pond SP-1 : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 YEAR Rainfall=3.15"

	Area (sf)	CN	Description
	70,000	98	Paved parking, HSG D
*	7,100	98	SIDEWALK HSG D
*	16,700	98	ROOF HSG D
*	26,600	77	WOOD HSGD
*	68,367	89	LAWNS
	188,767	92	Weighted Average
	94,967		50.31% Pervious Area
	93,800		49.69% Impervious Area

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

Subcatchment E-1: EXISTING SITE

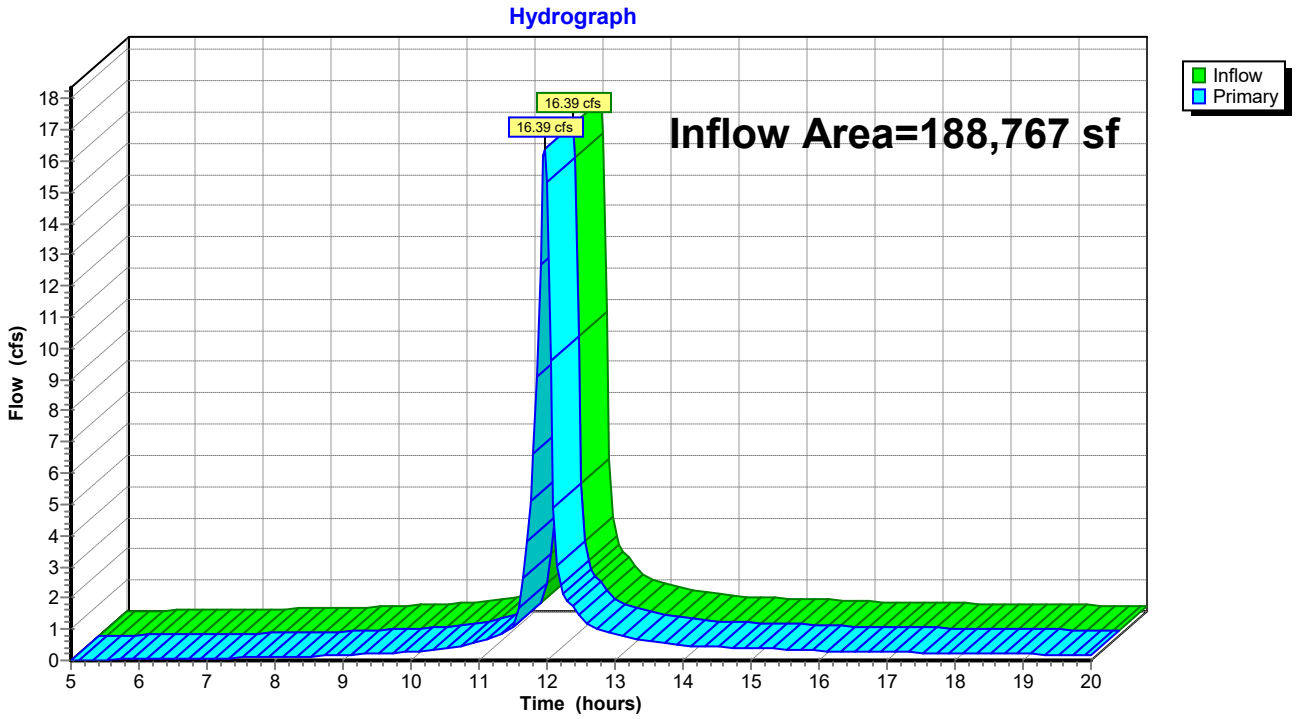


Summary for Pond SP-1: SUM POND

Inflow Area = 188,767 sf, 49.69% Impervious, Inflow Depth > 2.16" for 2 YEAR event
Inflow = 16.39 cfs @ 11.97 hrs, Volume= 33,930 cf
Primary = 16.39 cfs @ 11.97 hrs, Volume= 33,930 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond SP-1: SUM POND



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: EXISTING SITE Runoff Area=188,767 sf 49.69% Impervious Runoff Depth>3.92"
Tc=6.0 min CN=92 Runoff=28.70 cfs 61,737 cf

Pond SP-1: SUM POND Inflow=28.70 cfs 61,737 cf
Primary=28.70 cfs 61,737 cf

Total Runoff Area = 188,767 sf Runoff Volume = 61,737 cf Average Runoff Depth = 3.92"
50.31% Pervious = 94,967 sf 49.69% Impervious = 93,800 sf

Summary for Subcatchment E-1: EXISTING SITE

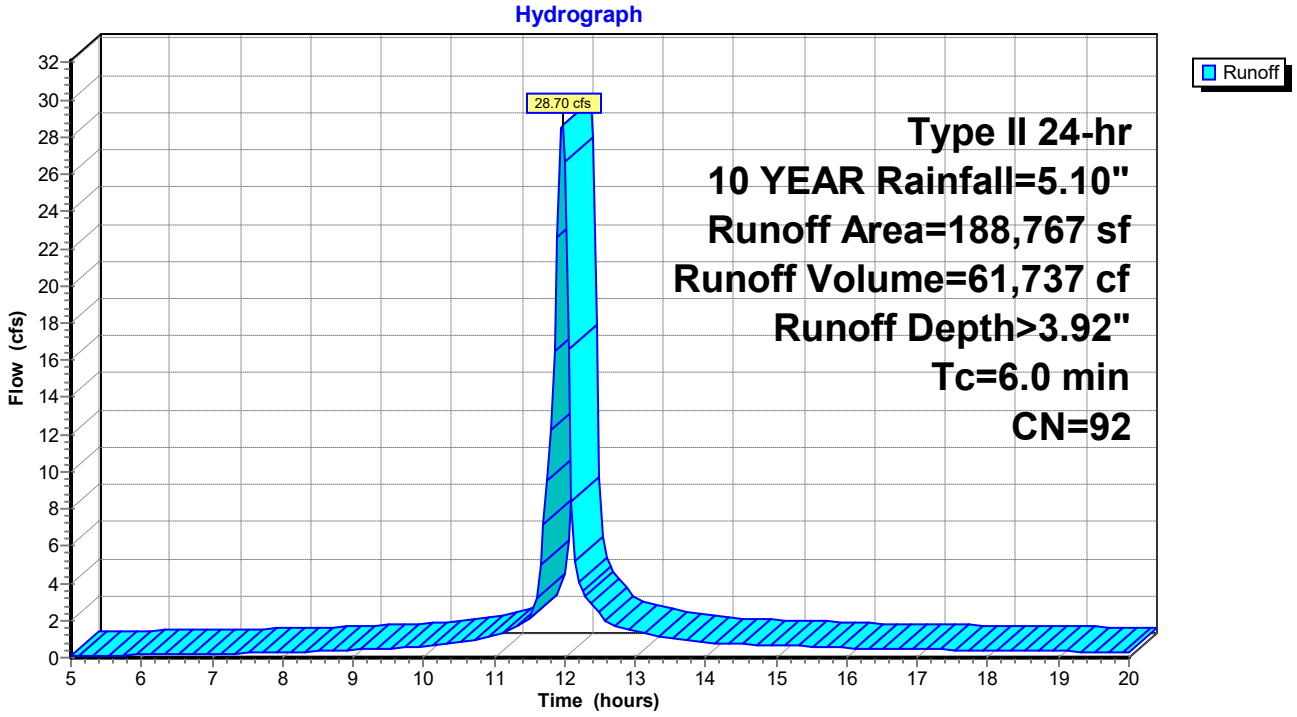
Runoff = 28.70 cfs @ 11.96 hrs, Volume= 61,737 cf, Depth> 3.92"
Routed to Pond SP-1 : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 YEAR Rainfall=5.10"

	Area (sf)	CN	Description
	70,000	98	Paved parking, HSG D
*	7,100	98	SIDEWALK HSG D
*	16,700	98	ROOF HSG D
*	26,600	77	WOOD HSGD
*	68,367	89	LAWNS
	188,767	92	Weighted Average
	94,967		50.31% Pervious Area
	93,800		49.69% Impervious Area

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

Subcatchment E-1: EXISTING SITE

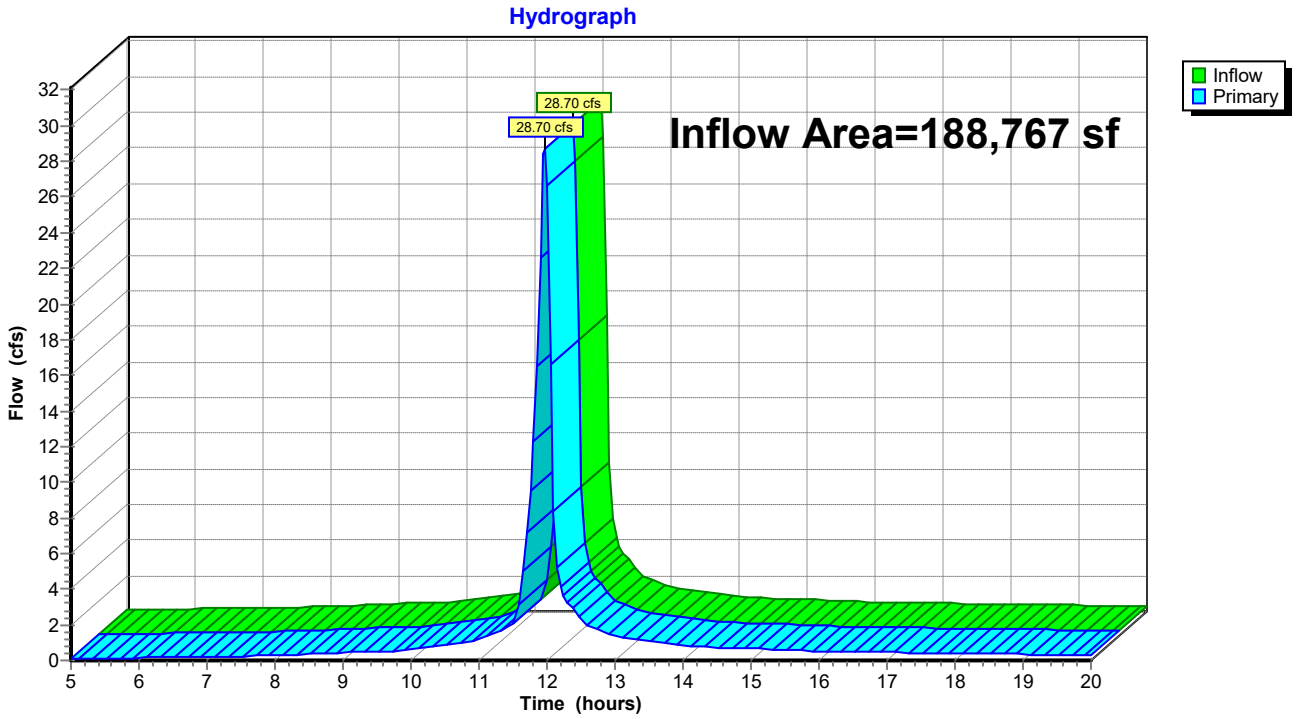


Summary for Pond SP-1: SUM POND

Inflow Area = 188,767 sf, 49.69% Impervious, Inflow Depth > 3.92" for 10 YEAR event
Inflow = 28.70 cfs @ 11.96 hrs, Volume= 61,737 cf
Primary = 28.70 cfs @ 11.96 hrs, Volume= 61,737 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond SP-1: SUM POND



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: EXISTING SITE Runoff Area=188,767 sf 49.69% Impervious Runoff Depth>4.88"
Tc=6.0 min CN=92 Runoff=35.25 cfs 76,817 cf

Pond SP-1: SUM POND Inflow=35.25 cfs 76,817 cf
Primary=35.25 cfs 76,817 cf

Total Runoff Area = 188,767 sf Runoff Volume = 76,817 cf Average Runoff Depth = 4.88"
50.31% Pervious = 94,967 sf 49.69% Impervious = 93,800 sf

Summary for Subcatchment E-1: EXISTING SITE

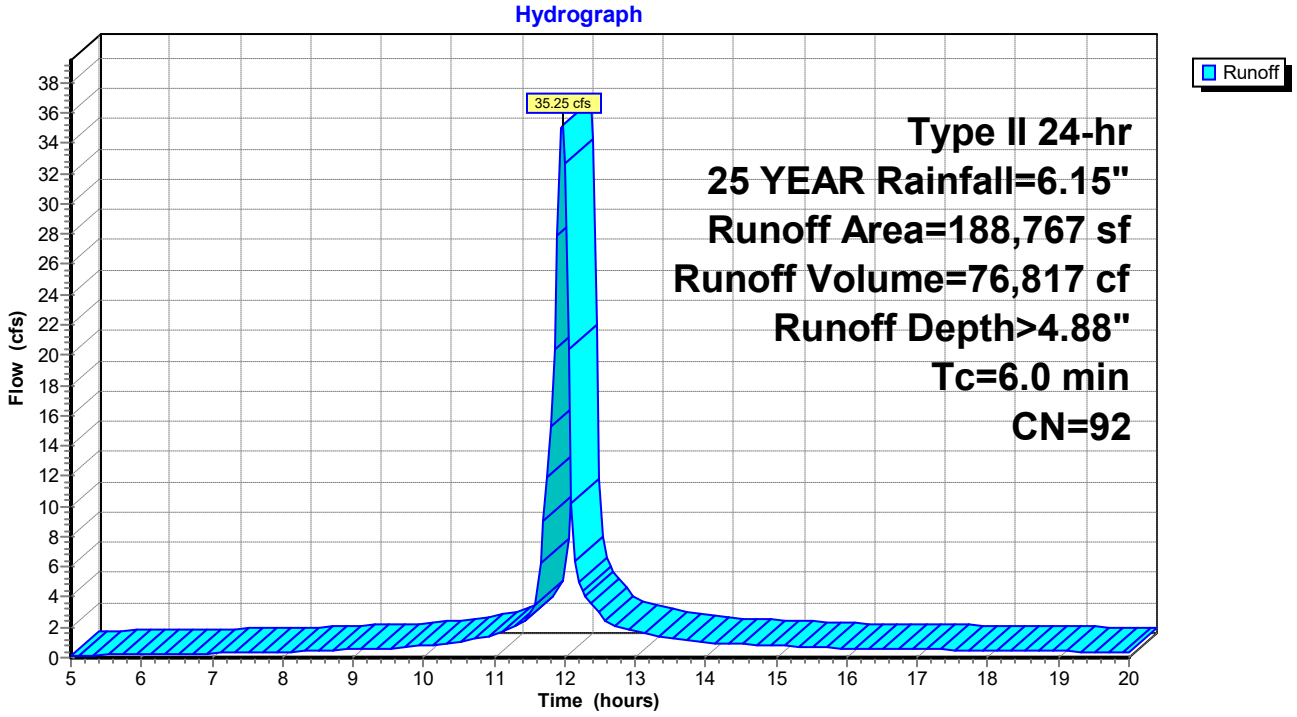
Runoff = 35.25 cfs @ 11.96 hrs, Volume= 76,817 cf, Depth> 4.88"
Routed to Pond SP-1 : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=6.15"

	Area (sf)	CN	Description
	70,000	98	Paved parking, HSG D
*	7,100	98	SIDEWALK HSG D
*	16,700	98	ROOF HSG D
*	26,600	77	WOOD HSGD
*	68,367	89	LAWNS
	188,767	92	Weighted Average
	94,967		50.31% Pervious Area
	93,800		49.69% Impervious Area

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

Subcatchment E-1: EXISTING SITE

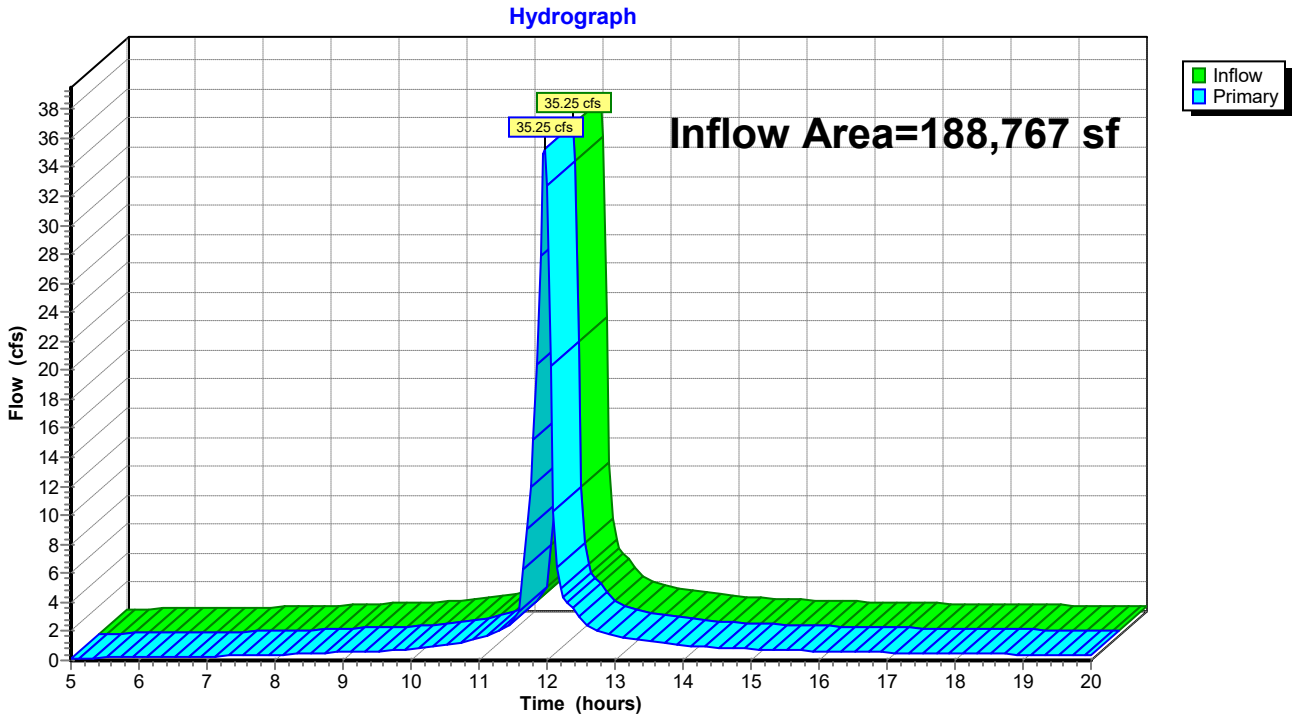


Summary for Pond SP-1: SUM POND

Inflow Area = 188,767 sf, 49.69% Impervious, Inflow Depth > 4.88" for 25 YEAR event
Inflow = 35.25 cfs @ 11.96 hrs, Volume= 76,817 cf
Primary = 35.25 cfs @ 11.96 hrs, Volume= 76,817 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond SP-1: SUM POND



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 E-1: EXISTING SITE Runoff Area=188,767 sf 49.69% Impervious Runoff Depth>6.50"
Tc=6.0 min CN=92 Runoff=46.22 cfs 102,243 cf

Pond SP-1: SUM POND Inflow=46.22 cfs 102,243 cf
Primary=46.22 cfs 102,243 cf

Total Runoff Area = 188,767 sf Runoff Volume = 102,243 cf Average Runoff Depth = 6.50"
50.31% Pervious = 94,967 sf 49.69% Impervious = 93,800 sf

Summary for Subcatchment E-1: EXISTING SITE

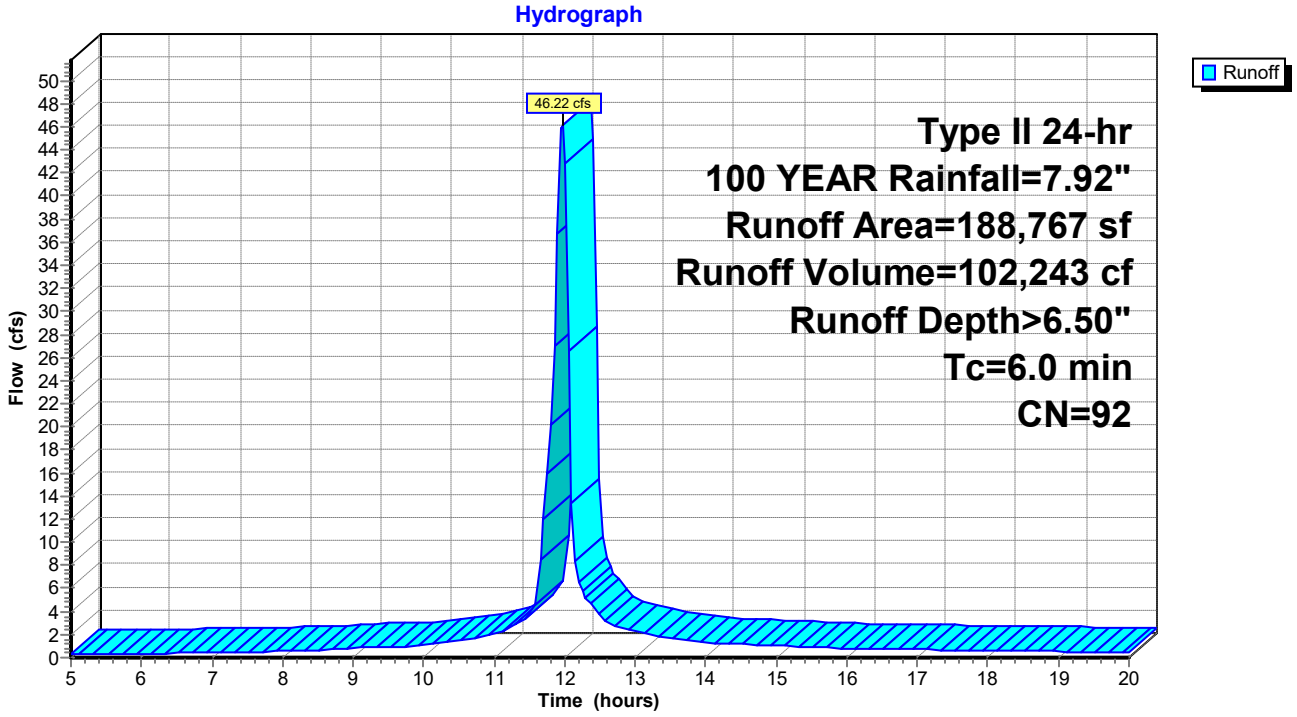
Runoff = 46.22 cfs @ 11.96 hrs, Volume= 102,243 cf, Depth> 6.50"
Routed to Pond SP-1 : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.92"

	Area (sf)	CN	Description
	70,000	98	Paved parking, HSG D
*	7,100	98	SIDEWALK HSG D
*	16,700	98	ROOF HSG D
*	26,600	77	WOOD HSGD
*	68,367	89	LAWNS
	188,767	92	Weighted Average
	94,967		50.31% Pervious Area
	93,800		49.69% Impervious Area

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

Subcatchment E-1: EXISTING SITE

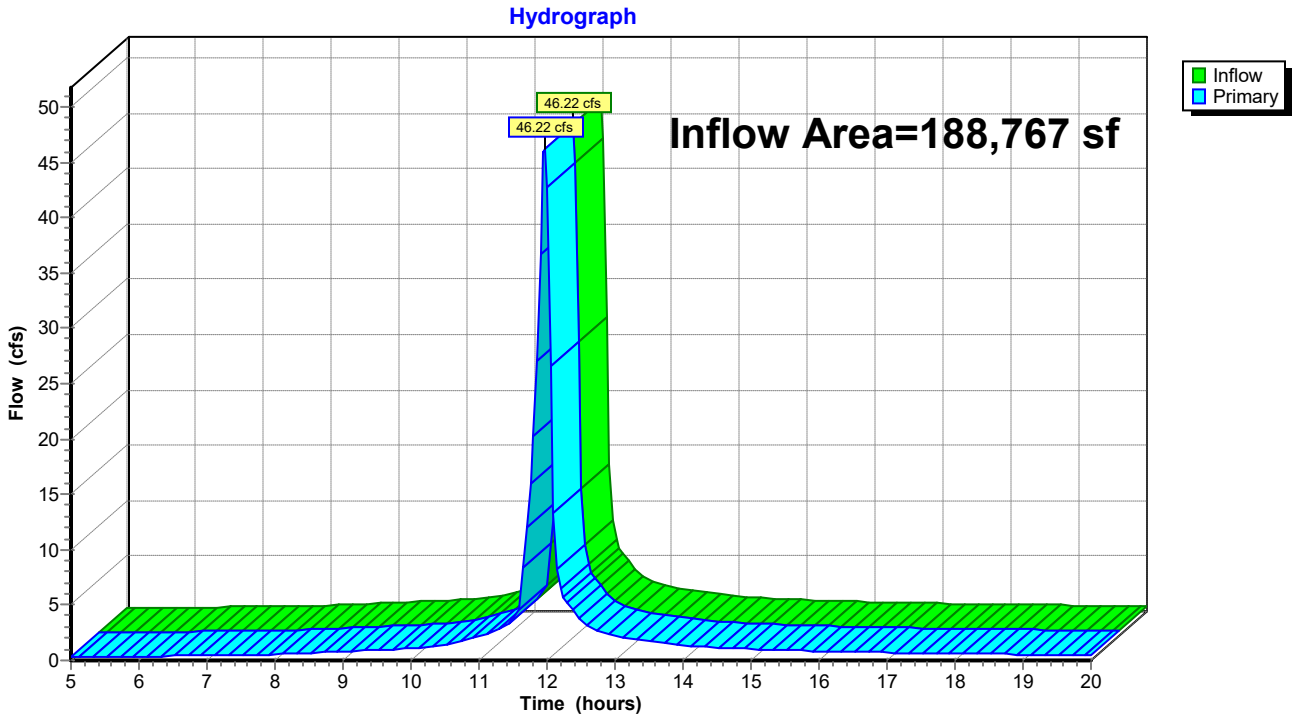


Summary for Pond SP-1: SUM POND

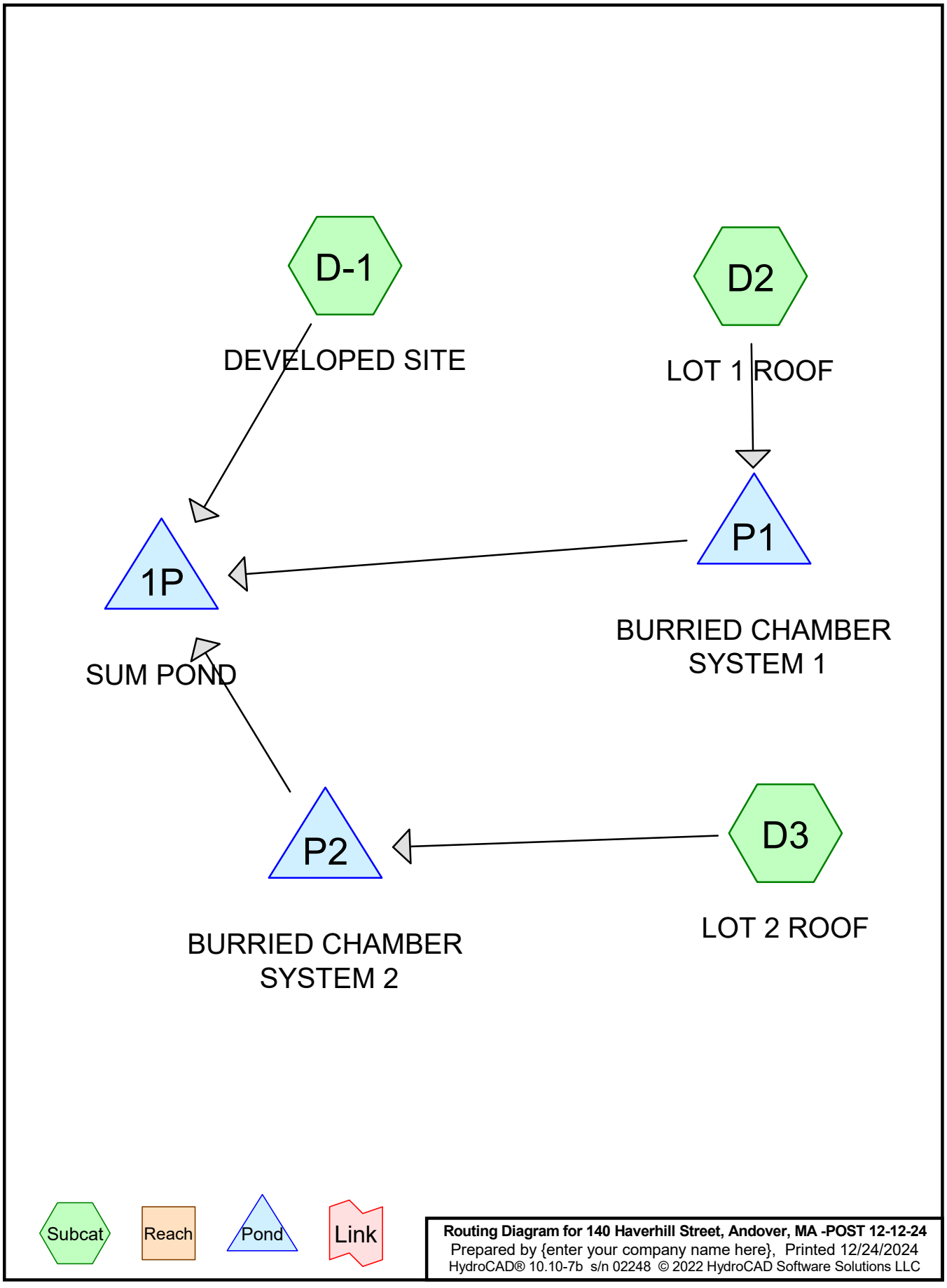
Inflow Area = 188,767 sf, 49.69% Impervious, Inflow Depth > 6.50" for 100 YEAR event
Inflow = 46.22 cfs @ 11.96 hrs, Volume= 102,243 cf
Primary = 46.22 cfs @ 11.96 hrs, Volume= 102,243 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond SP-1: SUM POND



POST-DEVELOPMENT DRAINAGE



Routing Diagram for 140 Haverhill Street, Andover, MA -POST 12-12-24
Prepared by {enter your company name here}, Printed 12/24/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 YEAR	Type II 24-hr		Default	24.00	1	3.15	2
2	10 YEAR	Type II 24-hr		Default	24.00	1	5.10	2
3	25 YEAR	Type II 24-hr		Default	24.00	1	6.15	2
4	100 YEAR	Type II 24-hr		Default	24.00	1	7.92	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
79,367	89	LAWNS (D-1)
75,384	98	Paved parking, HSG D (D-1)
9,600	98	ROOF (D2)
8,844	98	Roofs, HSG D (D3)
4,572	98	SIDEWALK HSG D (D-1)
11,000	77	WOOD HSGD (D-1)
188,767	**93**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
0	HSG C	
88,800	HSG D	D-1, D3
99,967	Other	D-1, D2
188,767		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchmen Numbers
0	0	0	0	79,367	79,367	LAWNS	
0	0	0	75,384	0	75,384	Paved parking	
0	0	0	0	9,600	9,600	ROOF	
0	0	0	8,844	0	8,844	Roofs	
0	0	0	4,572	0	4,572	SIDEWALK	
0	0	0	0	11,000	11,000	WOOD	
0	**0**	**0**	**88,800**	**99,967**	**188,767**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	P1	85.00	84.80	20.0	0.0100	0.013	0.0	12.0	0.0
2	P2	86.00	81.00	50.0	0.1000	0.013	0.0	12.0	0.0

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 D-1: DEVELOPED SITE Runoff Area=170,323 sf 46.94% Impervious Runoff Depth>2.16"
Tc=6.0 min CN=92 Runoff=14.79 cfs 30,615 cf

Subcatchment D2: LOT 1 ROOF Runoff Area=9,600 sf 100.00% Impervious Runoff Depth>2.70"
Tc=6.0 min CN=98 Runoff=0.95 cfs 2,160 cf

Subcatchment D3: LOT 2 ROOF Runoff Area=8,844 sf 100.00% Impervious Runoff Depth>2.70"
Tc=6.0 min CN=98 Runoff=0.88 cfs 1,990 cf

Pond 1P: SUM POND Inflow=15.63 cfs 33,783 cf
Primary=15.63 cfs 33,783 cf

Pond P1: BURRIED CHAMBER SYSTEM 1 Peak Elev=85.65' Storage=953 cf Inflow=0.95 cfs 2,160 cf
Outflow=0.17 cfs 2,059 cf

Pond P2: BURRIED CHAMBER SYSTEM 2 Peak Elev=88.70' Storage=941 cf Inflow=0.88 cfs 1,990 cf
Outflow=0.93 cfs 1,110 cf

Total Runoff Area = 188,767 sf Runoff Volume = 34,764 cf Average Runoff Depth = 2.21"
47.87% Pervious = 90,367 sf 52.13% Impervious = 98,400 sf

Summary for Subcatchment D-1: DEVELOPED SITE

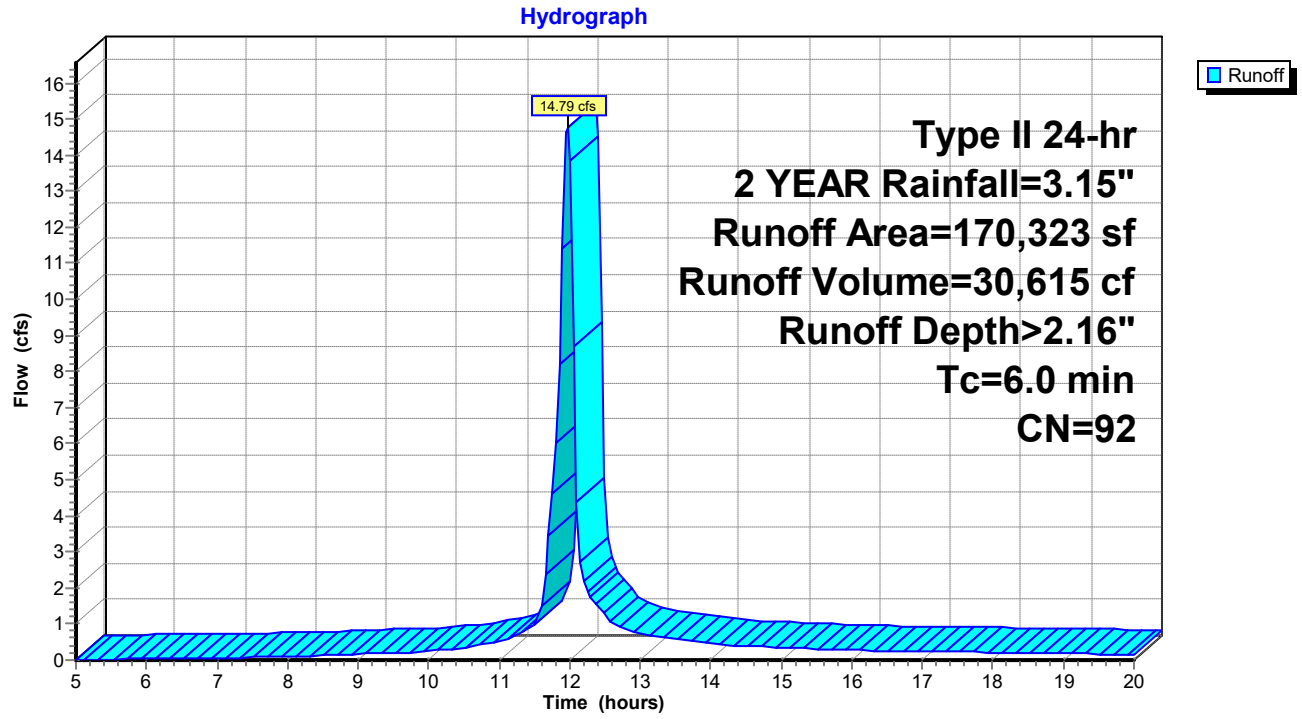
Runoff = 14.79 cfs @ 11.97 hrs, Volume= 30,615 cf, Depth> 2.16"
Routed to Pond 1P : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 YEAR Rainfall=3.15"

	Area (sf)	CN	Description
	75,384	98	Paved parking, HSG D
*	4,572	98	SIDEWALK HSG D
*	11,000	77	WOOD HSGD
*	79,367	89	LAWNS
	170,323	92	Weighted Average
	90,367		53.06% Pervious Area
	79,956		46.94% Impervious Area

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

Subcatchment D-1: DEVELOPED SITE



Summary for Subcatchment D2: LOT 1 ROOF

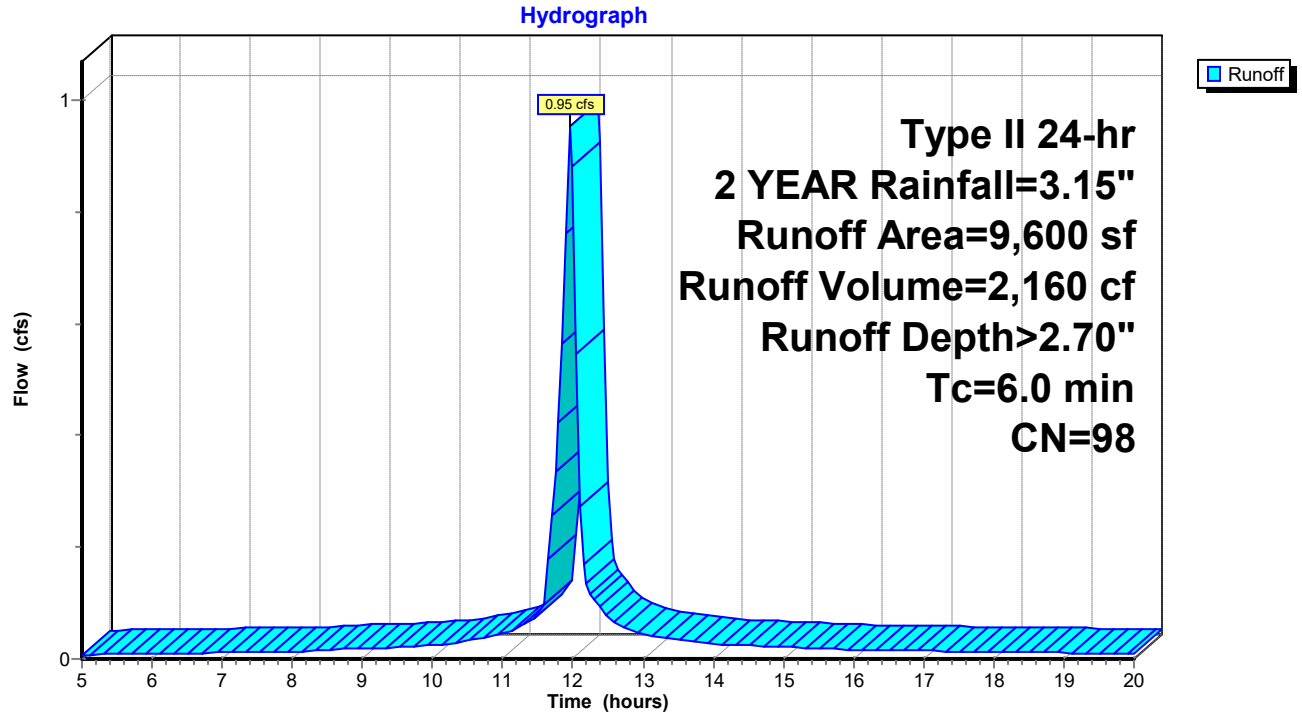
Runoff = 0.95 cfs @ 11.96 hrs, Volume= 2,160 cf, Depth> 2.70"
Routed to Pond P1 : BURRIED CHAMBER SYSTEM 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 YEAR Rainfall=3.15"

	Area (sf)	CN	Description
*	9,600	98	ROOF
	9,600		100.00% Impervious Area

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

Subcatchment D2: LOT 1 ROOF



Summary for Subcatchment D3: LOT 2 ROOF

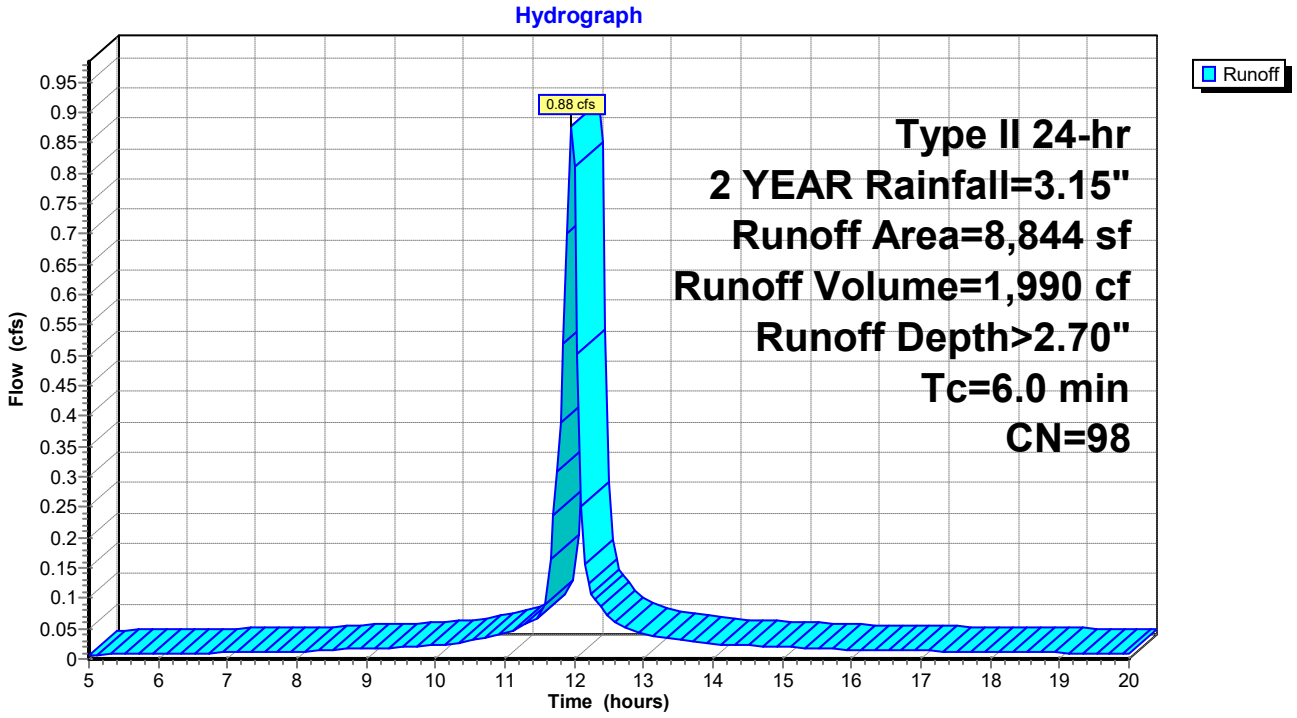
Runoff = 0.88 cfs @ 11.96 hrs, Volume= 1,990 cf, Depth> 2.70"
Routed to Pond P2 : BURRIED CHAMBER SYSTEM 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2 YEAR Rainfall=3.15"

Area (sf)	CN	Description
8,844	98	Roofs, HSG D
8,844		100.00% Impervious Area

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

Subcatchment D3: LOT 2 ROOF

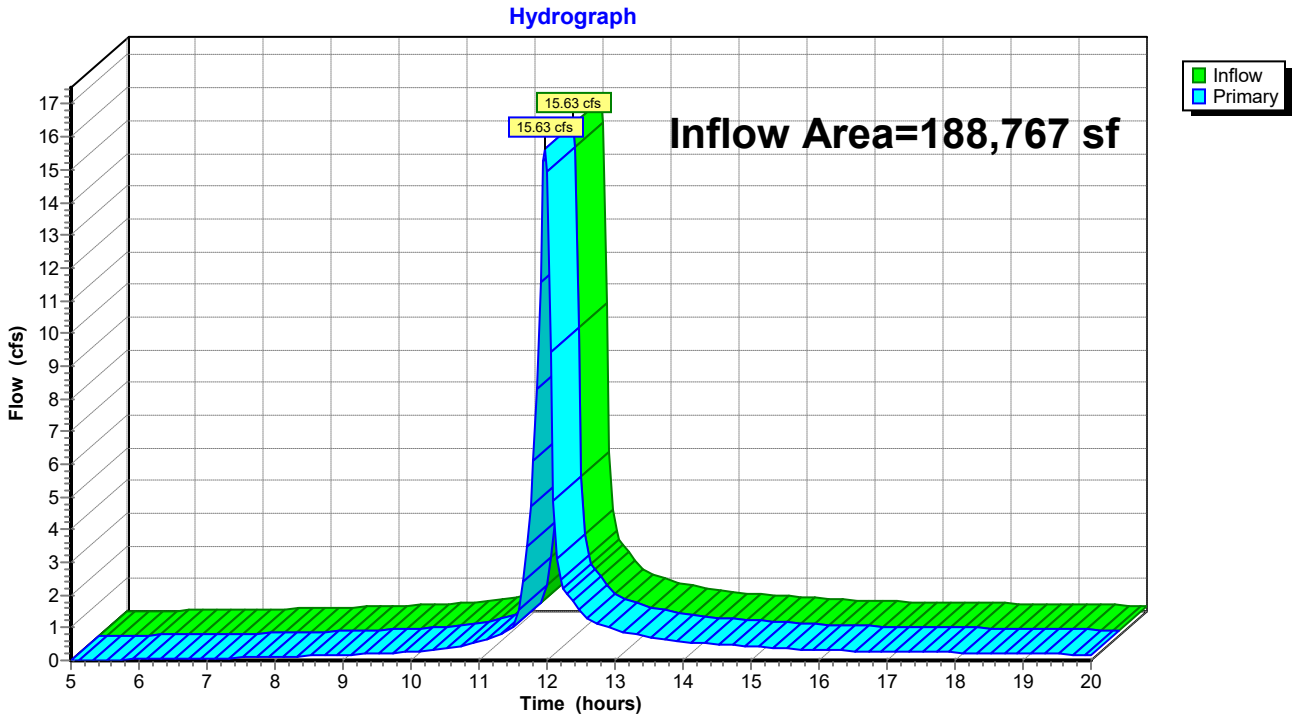


Summary for Pond 1P: SUM POND

Inflow Area = 188,767 sf, 52.13% Impervious, Inflow Depth > 2.15" for 2 YEAR event
Inflow = 15.63 cfs @ 11.97 hrs, Volume= 33,783 cf
Primary = 15.63 cfs @ 11.97 hrs, Volume= 33,783 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond 1P: SUM POND



Summary for Pond P1: BURRIED CHAMBER SYSTEM 1

Inflow Area = 9,600 sf,100.00% Impervious, Inflow Depth > 2.70" for 2 YEAR event
Inflow = 0.95 cfs @ 11.96 hrs, Volume= 2,160 cf
Outflow = 0.17 cfs @ 12.16 hrs, Volume= 2,059 cf, Atten= 82%, Lag= 11.9 min
Primary = 0.17 cfs @ 12.16 hrs, Volume= 2,059 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 85.65' @ 12.16 hrs Surf.Area= 3,375 sf Storage= 953 cf
Flood Elev= 87.50' Surf.Area= 3,375 sf Storage= 4,406 cf

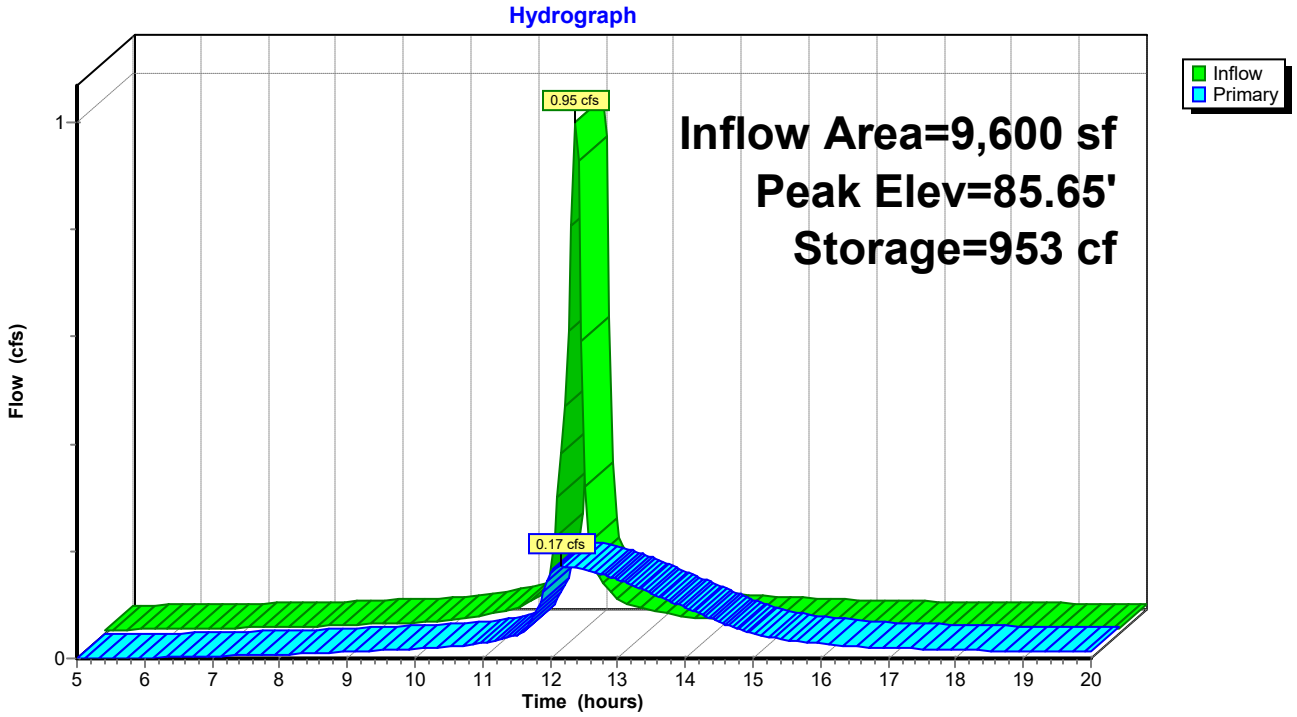
Plug-Flow detention time= 87.1 min calculated for 2,058 cf (95% of inflow)
Center-of-Mass det. time= 67.8 min (801.1 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	3,025 cf	**45.00'W x 75.00'L x 2.75'H Prismatoid** 9,281 cf Overall - 1,718 cf Embedded = 7,563 cf x 40.0% Voids
#2	85.50'	1,718 cf	**15.0" Round Pipe Storage** x 20 Inside #1 L= 70.0'
		4,743 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	85.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.25'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.17 cfs @ 12.16 hrs HW=85.65' TW=0.00' (Dynamic Tailwater)
1=Culvert (Passes 0.17 cfs of 1.26 cfs potential flow)
2=Orifice/Grate (Orifice Controls 0.17 cfs @ 3.50 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond P1: BURRIED CHAMBER SYSTEM 1



Summary for Pond P2: BURRIED CHAMBER SYSTEM 2

Inflow Area = 8,844 sf,100.00% Impervious, Inflow Depth > 2.70" for 2 YEAR event
Inflow = 0.88 cfs @ 11.96 hrs, Volume= 1,990 cf
Outflow = 0.93 cfs @ 12.00 hrs, Volume= 1,110 cf, Atten= 0%, Lag= 2.4 min
Primary = 0.93 cfs @ 12.00 hrs, Volume= 1,110 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 88.70' @ 12.00 hrs Surf.Area= 787 sf Storage= 941 cf
Flood Elev= 89.00' Surf.Area= 787 sf Storage= 1,034 cf

Plug-Flow detention time= 158.7 min calculated for 1,105 cf (56% of inflow)
Center-of-Mass det. time= 78.9 min (812.3 - 733.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	86.50'	622 cf	**14.83'W x 53.04'L x 2.50'H Field A** 1,967 cf Overall - 413 cf Embedded = 1,554 cf x 40.0% Voids
#2A	87.00'	413 cf	**ADS_StormTech SC-310 +Cap** x 28 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 28 Chambers in 4 Rows
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.00' / 81.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	88.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.92 cfs @ 12.00 hrs HW=88.70' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 0.92 cfs of 5.61 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 0.92 cfs @ 1.46 fps)

Pond P2: BURRIED CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

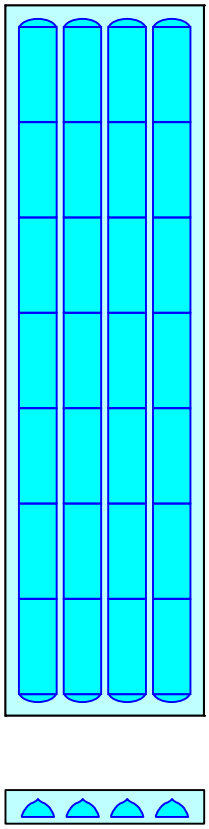
7 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 51.04' Row Length +12.0" End Stone x 2 = 53.04' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 8.0" Stone Cover = 2.50' Field Height

28 Chambers x 14.7 cf = 412.8 cf Chamber Storage

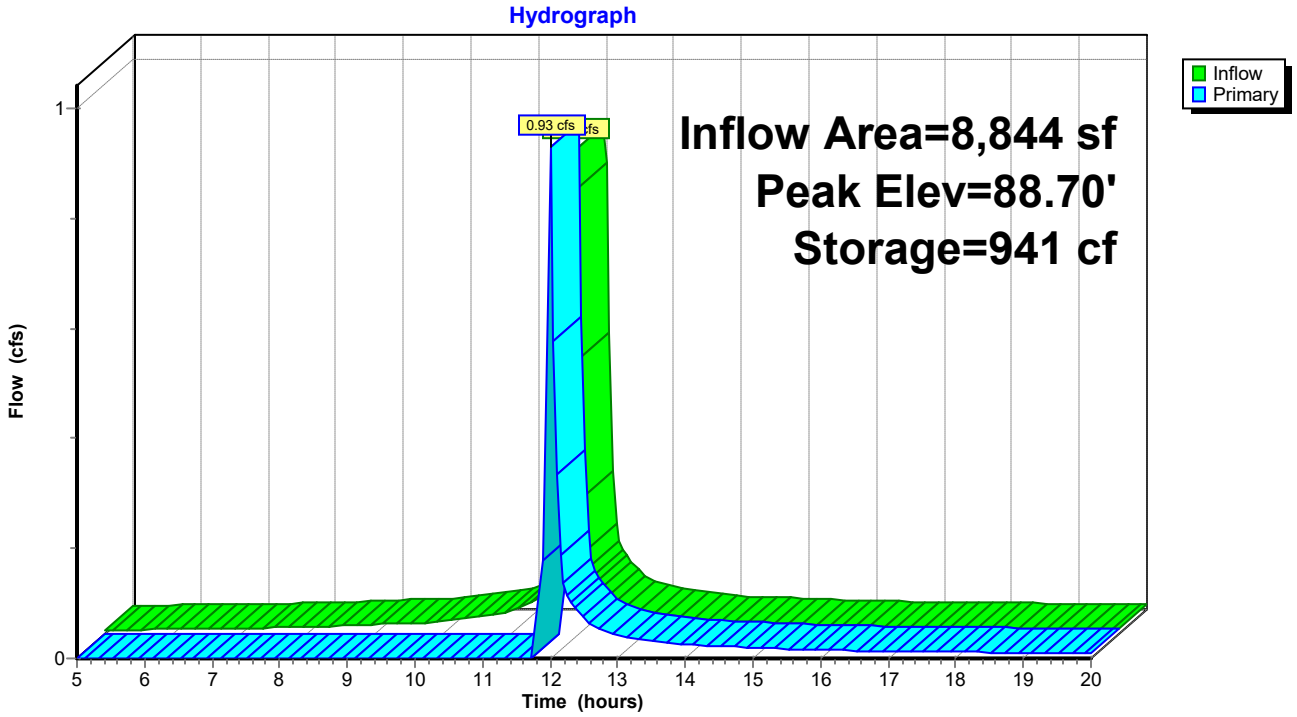
1,966.9 cf Field - 412.8 cf Chambers = 1,554.1 cf Stone x 40.0% Voids = 621.7 cf Stone Storage

Chamber Storage + Stone Storage = 1,034.4 cf = 0.024 af
Overall Storage Efficiency = 52.6%
Overall System Size = 53.04' x 14.83' x 2.50'

28 Chambers
72.8 cy Field
57.6 cy Stone



Pond P2: BURRIED CHAMBER SYSTEM 2



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 D-1: DEVELOPED SITE Runoff Area=170,323 sf 46.94% Impervious Runoff Depth>3.92"
Tc=6.0 min CN=92 Runoff=25.89 cfs 55,705 cf

Subcatchment D2: LOT 1 ROOF Runoff Area=9,600 sf 100.00% Impervious Runoff Depth>4.46"
Tc=6.0 min CN=98 Runoff=1.56 cfs 3,568 cf

Subcatchment D3: LOT 2 ROOF Runoff Area=8,844 sf 100.00% Impervious Runoff Depth>4.46"
Tc=6.0 min CN=98 Runoff=1.43 cfs 3,287 cf

Pond 1P: SUM POND Inflow=27.47 cfs 61,549 cf
Primary=27.47 cfs 61,549 cf

Pond P1: BURRIED CHAMBER SYSTEM 1 Peak Elev=85.94' Storage=1,593 cf Inflow=1.56 cfs 3,568 cf
Outflow=0.21 cfs 3,438 cf

Pond P2: BURRIED CHAMBER SYSTEM 2 Peak Elev=88.77' Storage=961 cf Inflow=1.43 cfs 3,287 cf
Outflow=1.42 cfs 2,406 cf

Total Runoff Area = 188,767 sf Runoff Volume = 62,559 cf Average Runoff Depth = 3.98"
47.87% Pervious = 90,367 sf 52.13% Impervious = 98,400 sf

Summary for Subcatchment D-1: DEVELOPED SITE

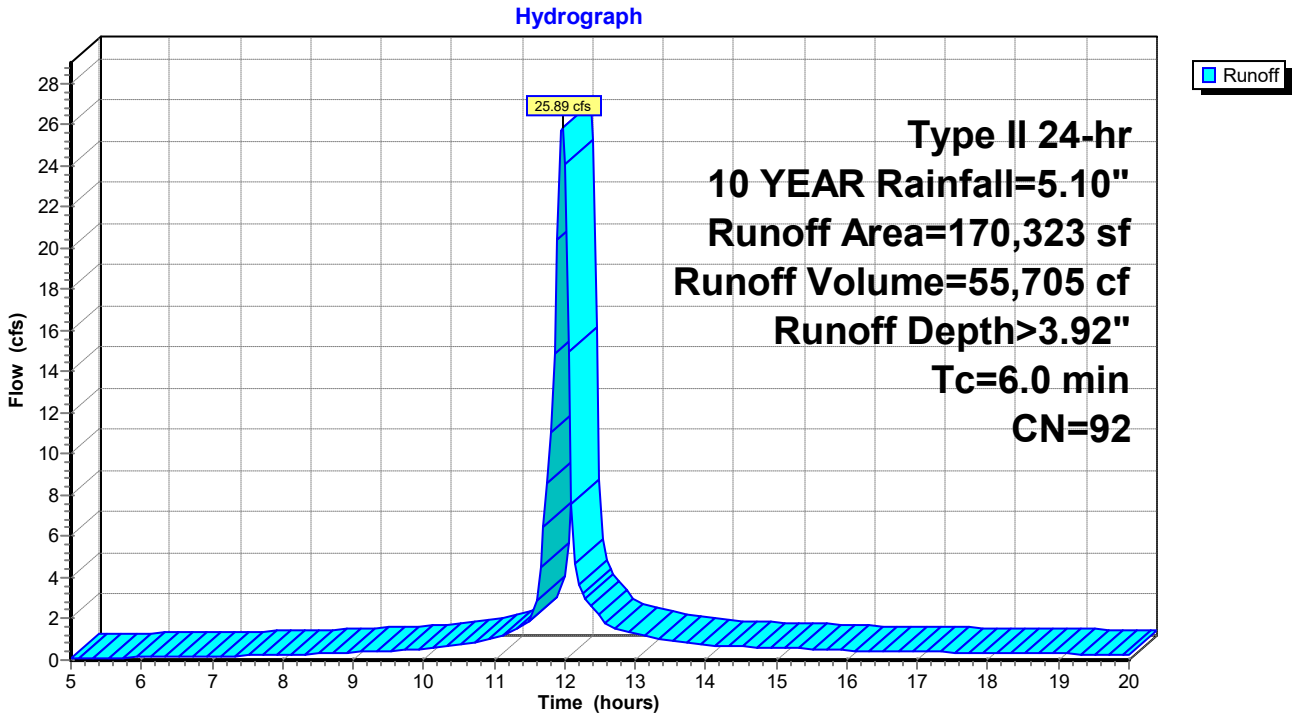
Runoff = 25.89 cfs @ 11.96 hrs, Volume= 55,705 cf, Depth> 3.92"
Routed to Pond 1P : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 YEAR Rainfall=5.10"

	Area (sf)	CN	Description
	75,384	98	Paved parking, HSG D
*	4,572	98	SIDEWALK HSG D
*	11,000	77	WOOD HSGD
*	79,367	89	LAWNS
	170,323	92	Weighted Average
	90,367		53.06% Pervious Area
	79,956		46.94% Impervious Area

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

Subcatchment D-1: DEVELOPED SITE



Summary for Subcatchment D2: LOT 1 ROOF

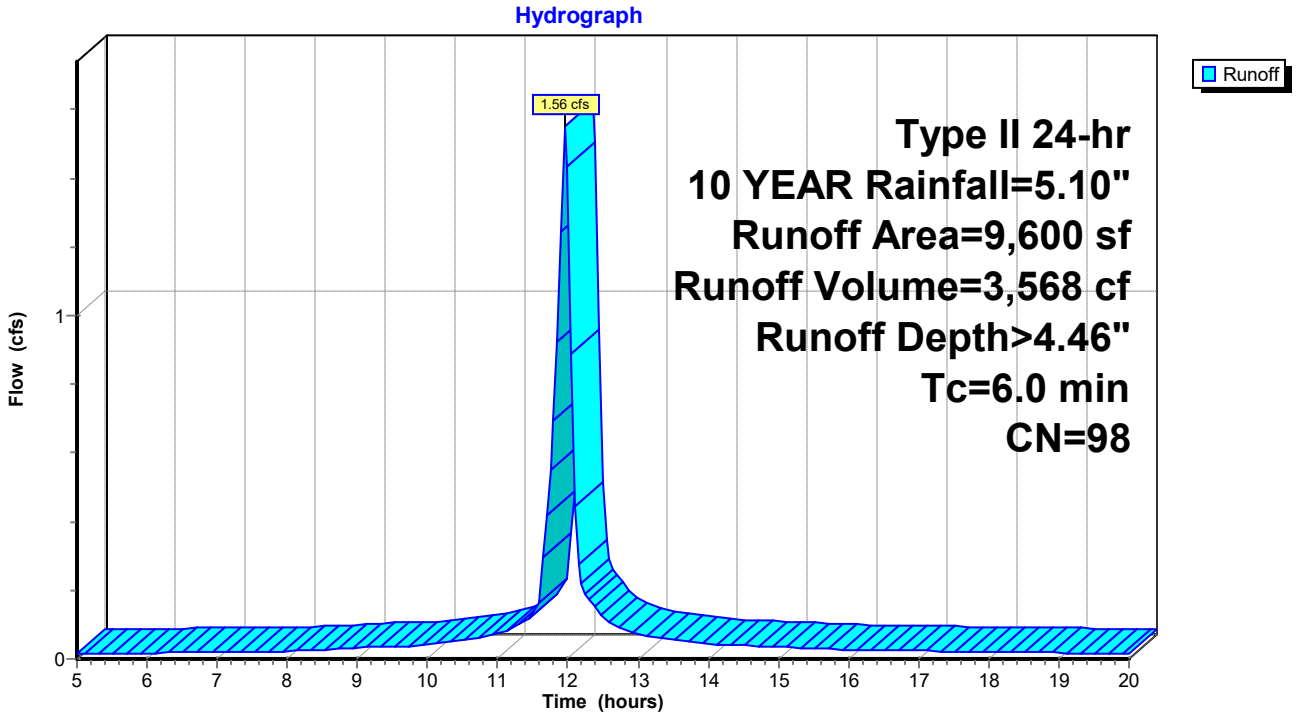
Runoff = 1.56 cfs @ 11.96 hrs, Volume= 3,568 cf, Depth> 4.46"
Routed to Pond P1 : BURRIED CHAMBER SYSTEM 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 YEAR Rainfall=5.10"

	Area (sf)	CN	Description
*	9,600	98	ROOF
	9,600		100.00% Impervious Area

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

Subcatchment D2: LOT 1 ROOF



Summary for Subcatchment D3: LOT 2 ROOF

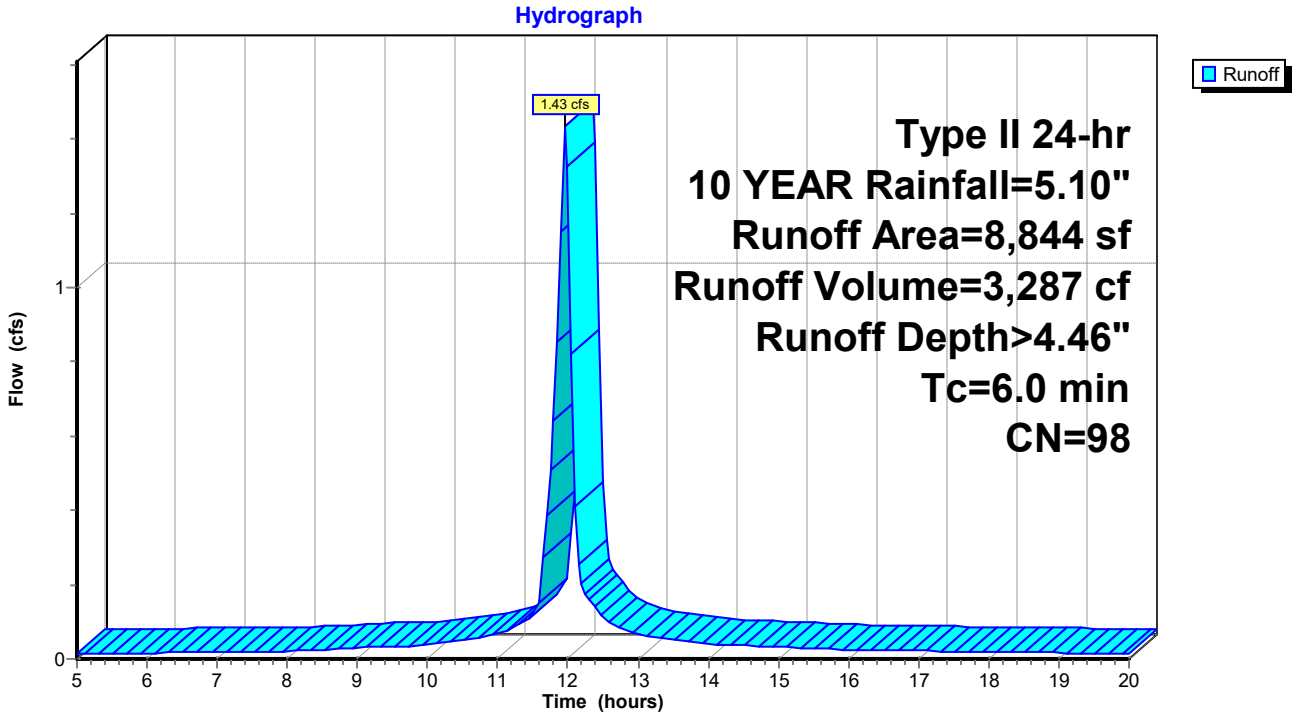
Runoff = 1.43 cfs @ 11.96 hrs, Volume= 3,287 cf, Depth> 4.46"
Routed to Pond P2 : BURRIED CHAMBER SYSTEM 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10 YEAR Rainfall=5.10"

Area (sf)	CN	Description
8,844	98	Roofs, HSG D
8,844		100.00% Impervious Area

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

Subcatchment D3: LOT 2 ROOF

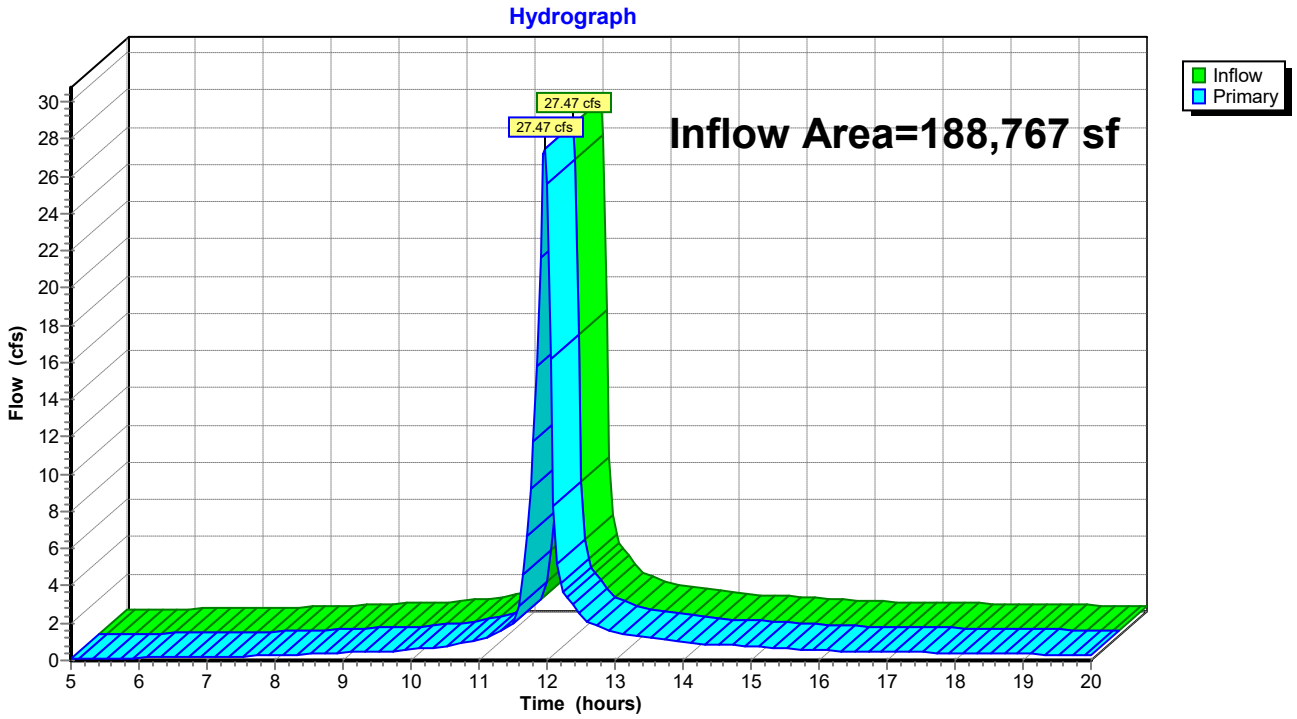


Summary for Pond 1P: SUM POND

Inflow Area = 188,767 sf, 52.13% Impervious, Inflow Depth > 3.91" for 10 YEAR event
Inflow = 27.47 cfs @ 11.96 hrs, Volume= 61,549 cf
Primary = 27.47 cfs @ 11.96 hrs, Volume= 61,549 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond 1P: SUM POND



Summary for Pond P1: BURRIED CHAMBER SYSTEM 1

Inflow Area = 9,600 sf,100.00% Impervious, Inflow Depth > 4.46" for 10 YEAR event
Inflow = 1.56 cfs @ 11.96 hrs, Volume= 3,568 cf
Outflow = 0.21 cfs @ 12.21 hrs, Volume= 3,438 cf, Atten= 86%, Lag= 15.2 min
Primary = 0.21 cfs @ 12.21 hrs, Volume= 3,438 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 85.94' @ 12.21 hrs Surf.Area= 3,375 sf Storage= 1,593 cf
Flood Elev= 87.50' Surf.Area= 3,375 sf Storage= 4,406 cf

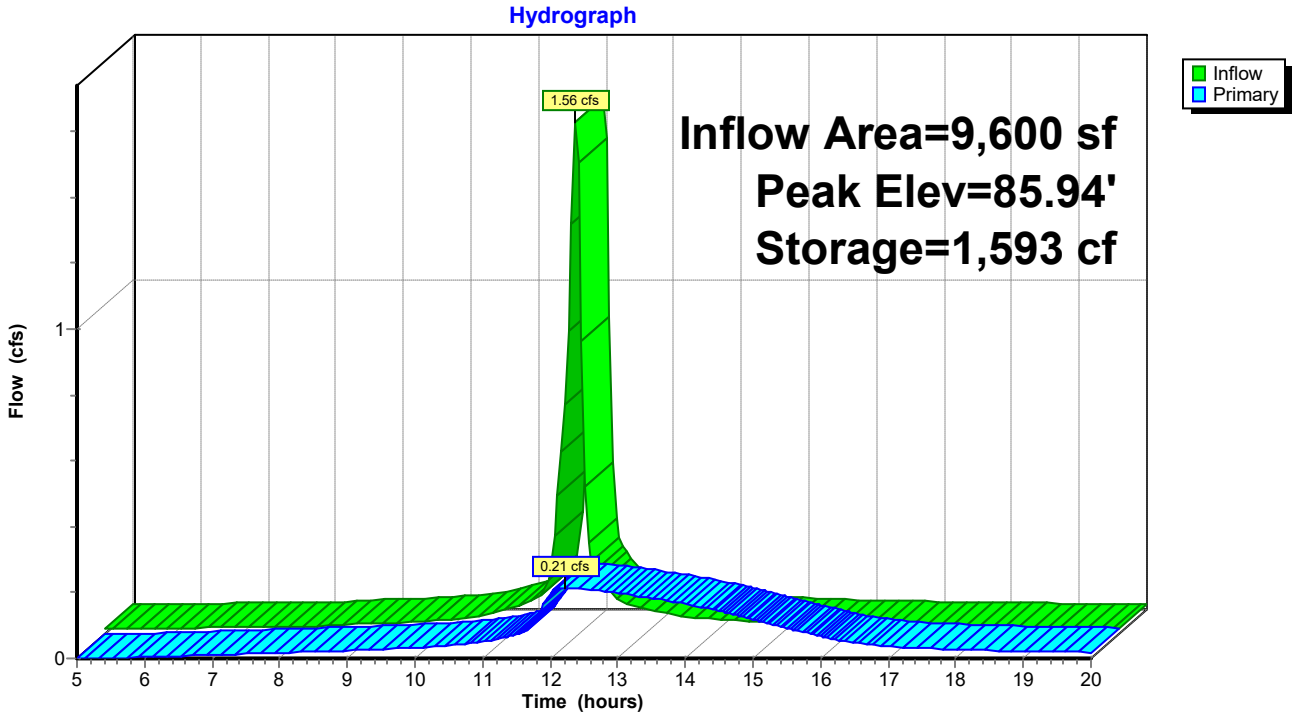
Plug-Flow detention time= 93.8 min calculated for 3,426 cf (96% of inflow)
Center-of-Mass det. time= 78.3 min (808.3 - 730.0)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	3,025 cf	**45.00'W x 75.00'L x 2.75'H Prismatoid** 9,281 cf Overall - 1,718 cf Embedded = 7,563 cf x 40.0% Voids
#2	85.50'	1,718 cf	**15.0" Round Pipe Storage** x 20 Inside #1 L= 70.0'
		4,743 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	85.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.25'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.21 cfs @ 12.21 hrs HW=85.94' TW=0.00' (Dynamic Tailwater)
1=Culvert (Passes 0.21 cfs of 2.21 cfs potential flow)
2=Orifice/Grate (Orifice Controls 0.21 cfs @ 4.35 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Pond P1: BURRIED CHAMBER SYSTEM 1



Summary for Pond P2: BURRIED CHAMBER SYSTEM 2

Inflow Area = 8,844 sf,100.00% Impervious, Inflow Depth > 4.46" for 10 YEAR event
Inflow = 1.43 cfs @ 11.96 hrs, Volume= 3,287 cf
Outflow = 1.42 cfs @ 11.98 hrs, Volume= 2,406 cf, Atten= 1%, Lag= 0.9 min
Primary = 1.42 cfs @ 11.98 hrs, Volume= 2,406 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 88.77' @ 11.98 hrs Surf.Area= 787 sf Storage= 961 cf
Flood Elev= 89.00' Surf.Area= 787 sf Storage= 1,034 cf

Plug-Flow detention time= 119.9 min calculated for 2,405 cf (73% of inflow)
Center-of-Mass det. time= 56.7 min (786.7 - 730.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	86.50'	622 cf	**14.83'W x 53.04'L x 2.50'H Field A** 1,967 cf Overall - 413 cf Embedded = 1,554 cf x 40.0% Voids
#2A	87.00'	413 cf	**ADS_StormTech SC-310 +Cap** x 28 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 28 Chambers in 4 Rows
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.00' / 81.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	88.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.37 cfs @ 11.98 hrs HW=88.76' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Passes 1.37 cfs of 5.69 cfs potential flow)
↑—**2=Orifice/Grate** (Weir Controls 1.37 cfs @ 1.67 fps)

Pond P2: BURRIED CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

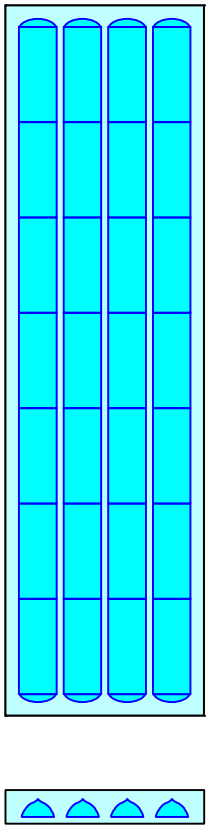
7 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 51.04' Row Length +12.0" End Stone x 2 = 53.04' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 8.0" Stone Cover = 2.50' Field Height

28 Chambers x 14.7 cf = 412.8 cf Chamber Storage

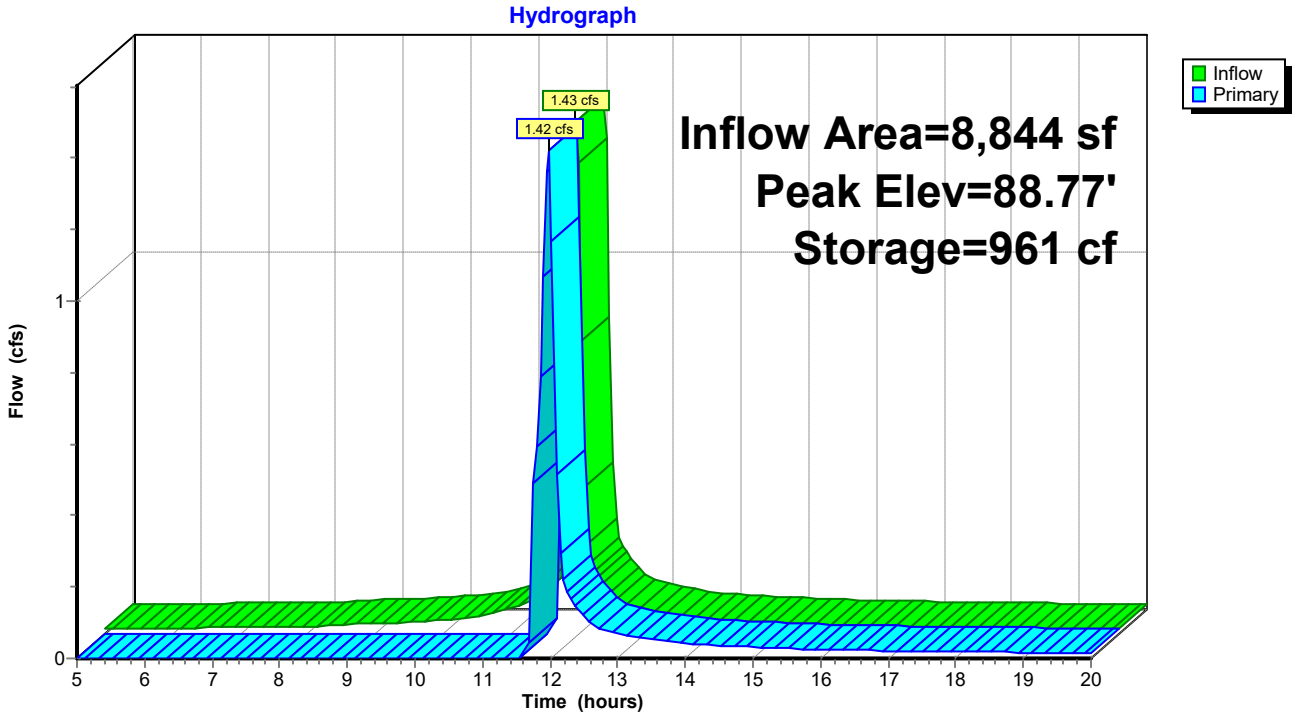
1,966.9 cf Field - 412.8 cf Chambers = 1,554.1 cf Stone x 40.0% Voids = 621.7 cf Stone Storage

Chamber Storage + Stone Storage = 1,034.4 cf = 0.024 af
Overall Storage Efficiency = 52.6%
Overall System Size = 53.04' x 14.83' x 2.50'

28 Chambers
72.8 cy Field
57.6 cy Stone



Pond P2: BURRIED CHAMBER SYSTEM 2



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 D-1: DEVELOPED SITE Runoff Area=170,323 sf 46.94% Impervious Runoff Depth>4.88"
Tc=6.0 min CN=92 Runoff=31.81 cfs 69,311 cf

Subcatchment D2: LOT 1 ROOF Runoff Area=9,600 sf 100.00% Impervious Runoff Depth>5.40"
Tc=6.0 min CN=98 Runoff=1.88 cfs 4,322 cf

Subcatchment D3: LOT 2 ROOF Runoff Area=8,844 sf 100.00% Impervious Runoff Depth>5.40"
Tc=6.0 min CN=98 Runoff=1.73 cfs 3,982 cf

Pond 1P: SUM POND Inflow=33.70 cfs 76,591 cf
Primary=33.70 cfs 76,591 cf

Pond P1: BURRIED CHAMBER SYSTEM 1 Peak Elev=86.09' Storage=1,950 cf Inflow=1.88 cfs 4,322 cf
Outflow=0.23 cfs 4,179 cf

Pond P2: BURRIED CHAMBER SYSTEM 2 Peak Elev=88.80' Storage=973 cf Inflow=1.73 cfs 3,982 cf
Outflow=1.72 cfs 3,101 cf

Total Runoff Area = 188,767 sf Runoff Volume = 77,616 cf Average Runoff Depth = 4.93"
47.87% Pervious = 90,367 sf 52.13% Impervious = 98,400 sf

Summary for Subcatchment D-1: DEVELOPED SITE

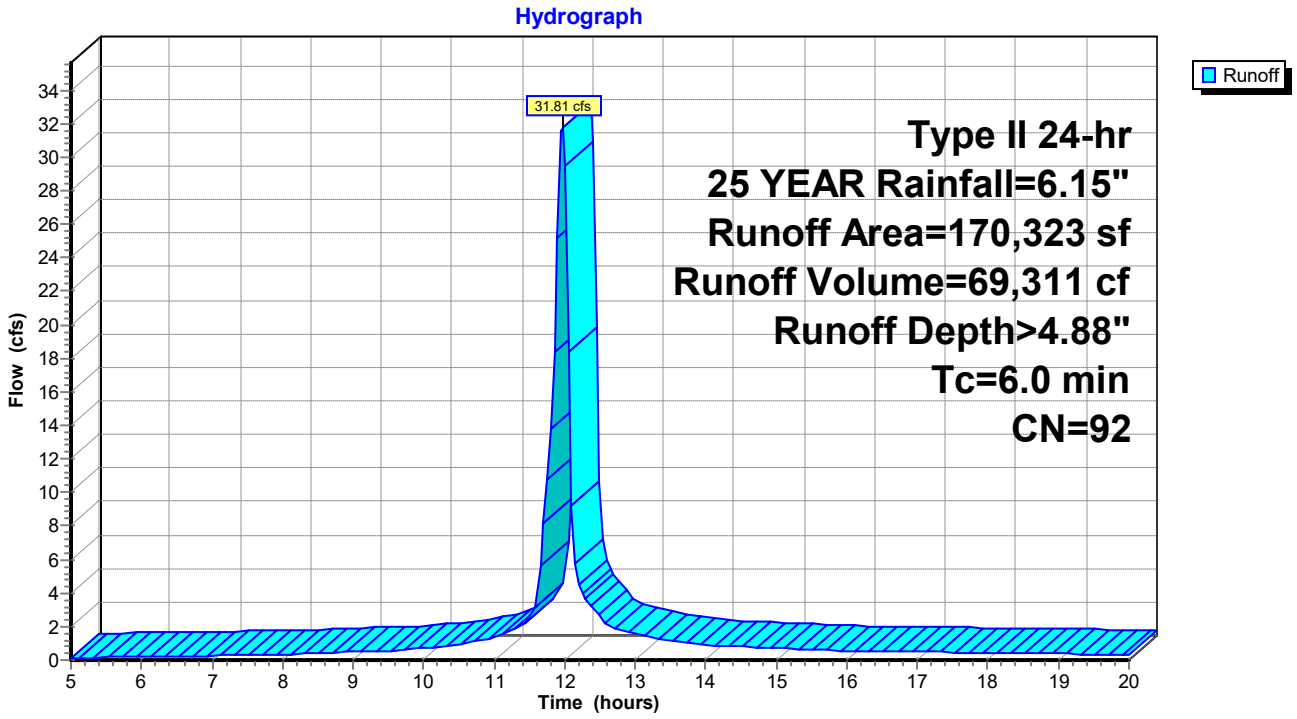
Runoff = 31.81 cfs @ 11.96 hrs, Volume= 69,311 cf, Depth> 4.88"
Routed to Pond 1P : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=6.15"

	Area (sf)	CN	Description
	75,384	98	Paved parking, HSG D
*	4,572	98	SIDEWALK HSG D
*	11,000	77	WOOD HSGD
*	79,367	89	LAWNS
	170,323	92	Weighted Average
	90,367		53.06% Pervious Area
	79,956		46.94% Impervious Area

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

Subcatchment D-1: DEVELOPED SITE



Summary for Subcatchment D2: LOT 1 ROOF

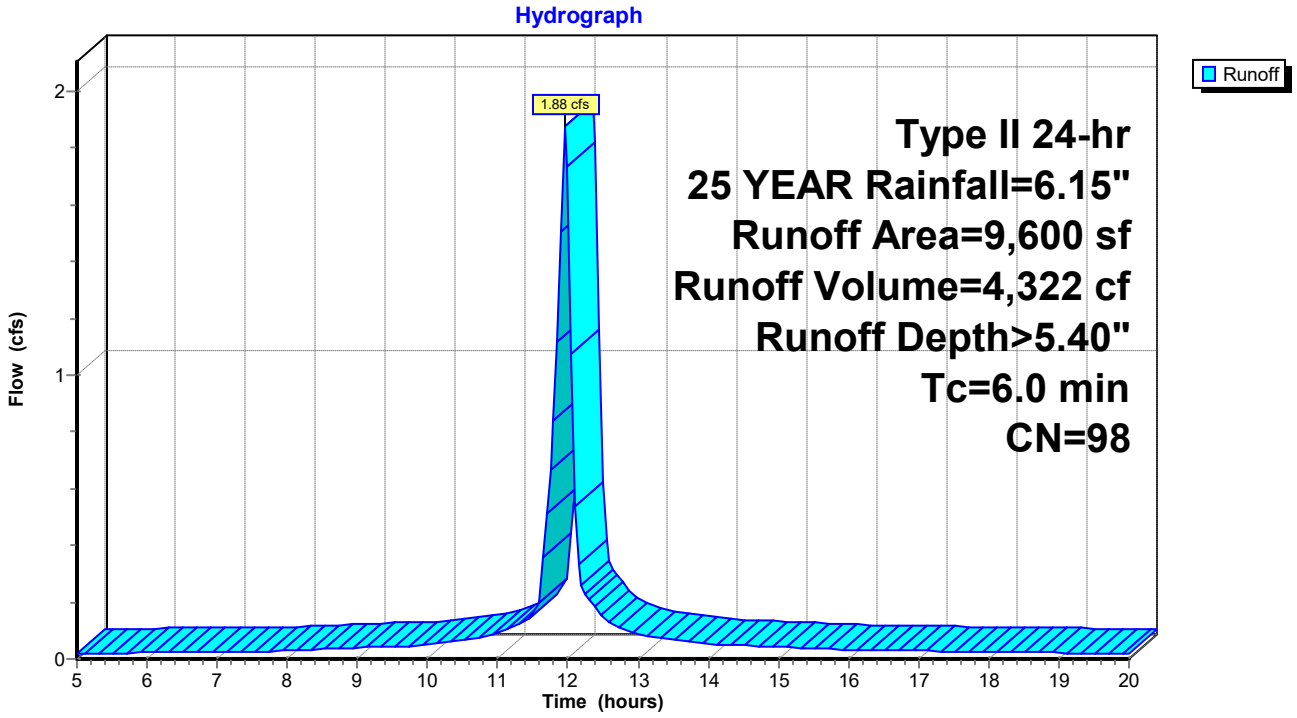
Runoff = 1.88 cfs @ 11.96 hrs, Volume= 4,322 cf, Depth> 5.40"
Routed to Pond P1 : BURRIED CHAMBER SYSTEM 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=6.15"

	Area (sf)	CN	Description
*	9,600	98	ROOF
	9,600		100.00% Impervious Area

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

Subcatchment D2: LOT 1 ROOF



Summary for Subcatchment D3: LOT 2 ROOF

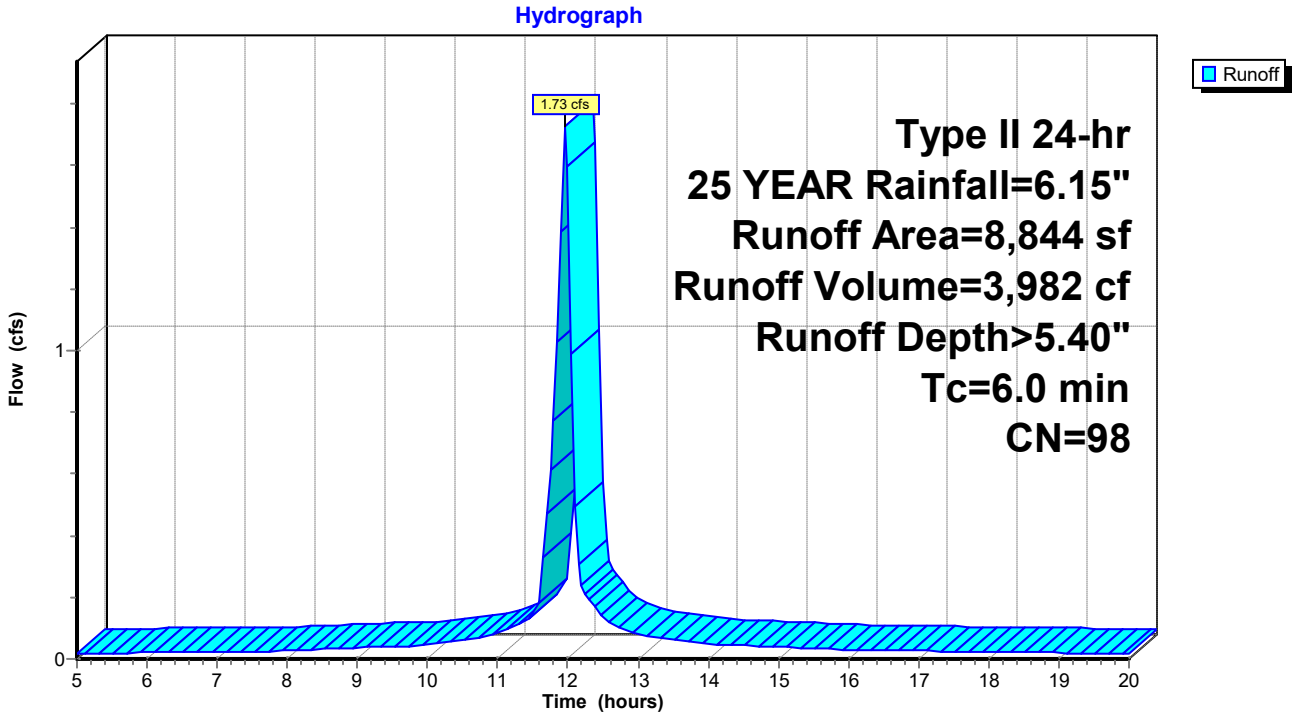
Runoff = 1.73 cfs @ 11.96 hrs, Volume= 3,982 cf, Depth> 5.40"
Routed to Pond P2 : BURRIED CHAMBER SYSTEM 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 25 YEAR Rainfall=6.15"

Area (sf)	CN	Description
8,844	98	Roofs, HSG D
8,844		100.00% Impervious Area

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

Subcatchment D3: LOT 2 ROOF

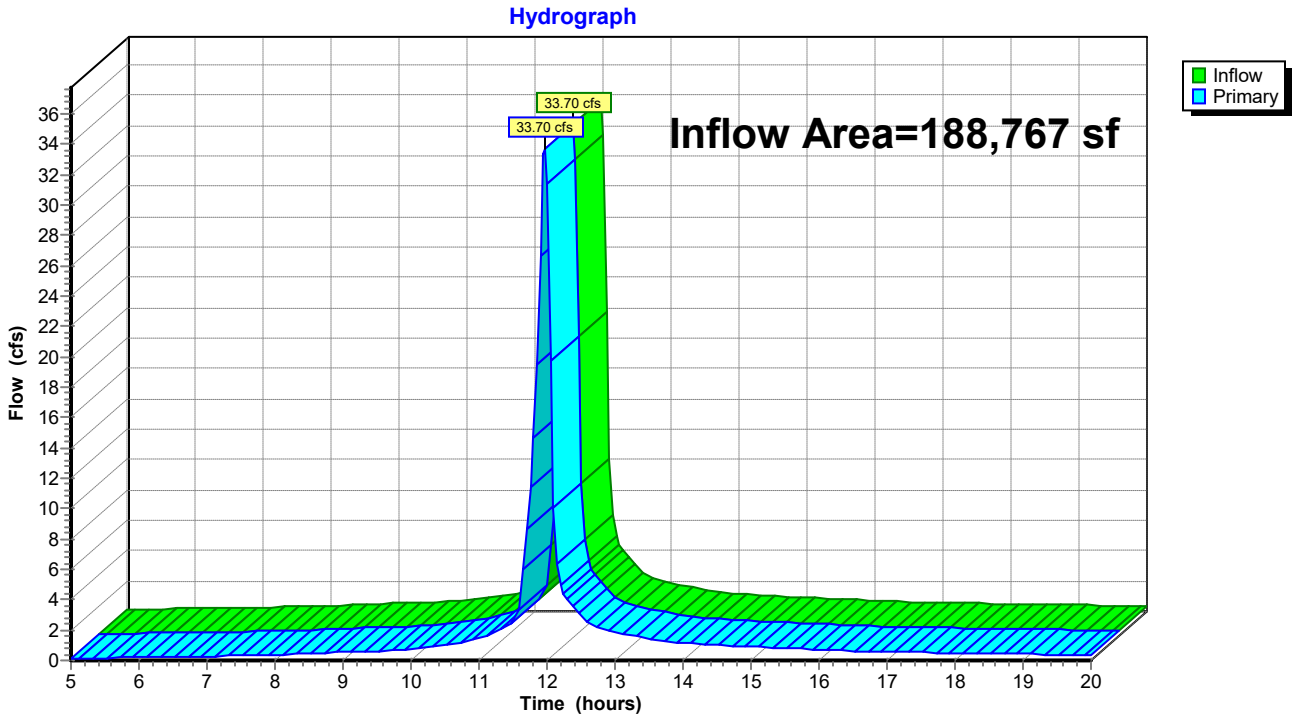


Summary for Pond 1P: SUM POND

Inflow Area = 188,767 sf, 52.13% Impervious, Inflow Depth > 4.87" for 25 YEAR event
Inflow = 33.70 cfs @ 11.96 hrs, Volume= 76,591 cf
Primary = 33.70 cfs @ 11.96 hrs, Volume= 76,591 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond 1P: SUM POND



Summary for Pond P1: BURRIED CHAMBER SYSTEM 1

Inflow Area = 9,600 sf,100.00% Impervious, Inflow Depth > 5.40" for 25 YEAR event
Inflow = 1.88 cfs @ 11.96 hrs, Volume= 4,322 cf
Outflow = 0.23 cfs @ 12.25 hrs, Volume= 4,179 cf, Atten= 88%, Lag= 17.4 min
Primary = 0.23 cfs @ 12.25 hrs, Volume= 4,179 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 86.09' @ 12.25 hrs Surf.Area= 3,375 sf Storage= 1,950 cf
Flood Elev= 87.50' Surf.Area= 3,375 sf Storage= 4,406 cf

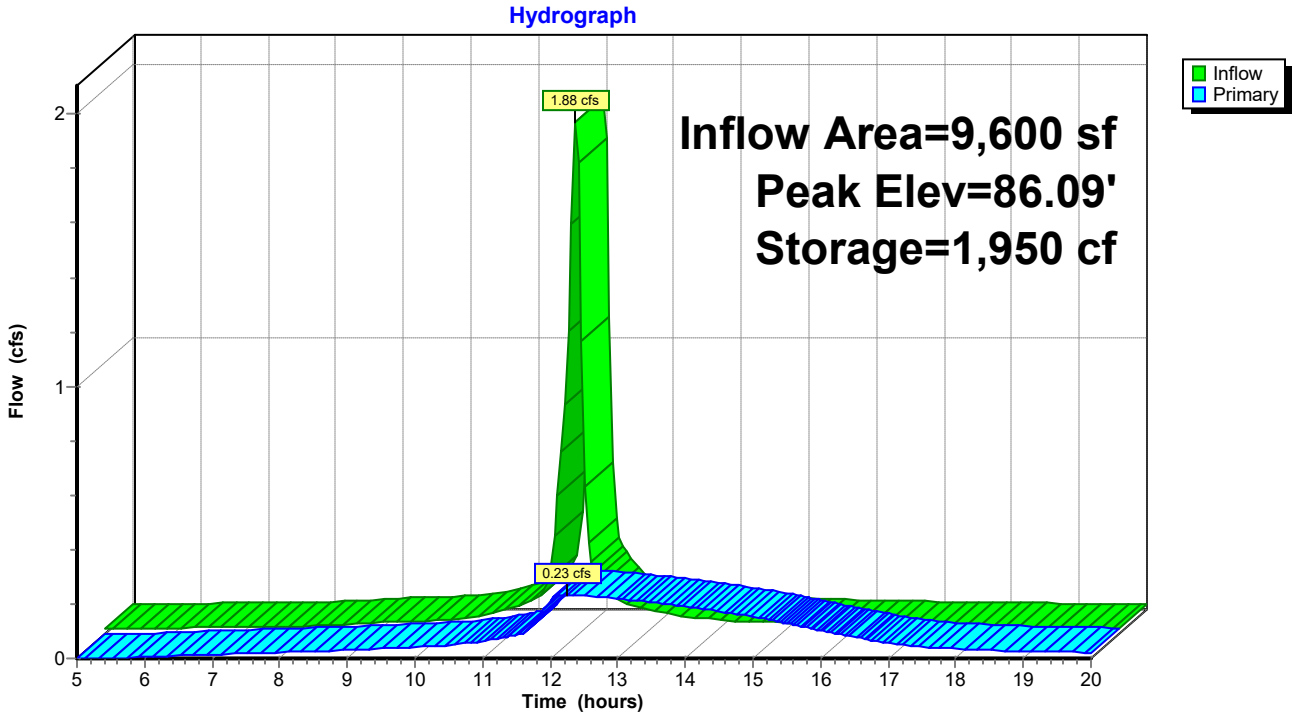
Plug-Flow detention time= 99.8 min calculated for 4,178 cf (97% of inflow)
Center-of-Mass det. time= 85.3 min (814.4 - 729.1)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	3,025 cf	**45.00'W x 75.00'L x 2.75'H Prismatoid** 9,281 cf Overall - 1,718 cf Embedded = 7,563 cf x 40.0% Voids
#2	85.50'	1,718 cf	**15.0" Round Pipe Storage** x 20 Inside #1 L= 70.0'
		4,743 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	85.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.25'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.23 cfs @ 12.25 hrs HW=86.09' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.23 cfs of 2.69 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.23 cfs @ 4.73 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P1: BURRIED CHAMBER SYSTEM 1



Summary for Pond P2: BURRIED CHAMBER SYSTEM 2

Inflow Area = 8,844 sf,100.00% Impervious, Inflow Depth > 5.40" for 25 YEAR event
Inflow = 1.73 cfs @ 11.96 hrs, Volume= 3,982 cf
Outflow = 1.72 cfs @ 11.98 hrs, Volume= 3,101 cf, Atten= 1%, Lag= 0.8 min
Primary = 1.72 cfs @ 11.98 hrs, Volume= 3,101 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 88.80' @ 11.98 hrs Surf.Area= 787 sf Storage= 973 cf
Flood Elev= 89.00' Surf.Area= 787 sf Storage= 1,034 cf

Plug-Flow detention time= 108.5 min calculated for 3,089 cf (78% of inflow)
Center-of-Mass det. time= 51.7 min (780.9 - 729.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	86.50'	622 cf	**14.83'W x 53.04'L x 2.50'H Field A** 1,967 cf Overall - 413 cf Embedded = 1,554 cf x 40.0% Voids
#2A	87.00'	413 cf	**ADS_StormTech SC-310 +Cap** x 28 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 28 Chambers in 4 Rows
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.00' / 81.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	88.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.66 cfs @ 11.98 hrs HW=88.80' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 1.66 cfs of 5.73 cfs potential flow)
↑**2=Orifice/Grate** (Weir Controls 1.66 cfs @ 1.78 fps)

Pond P2: BURRIED CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

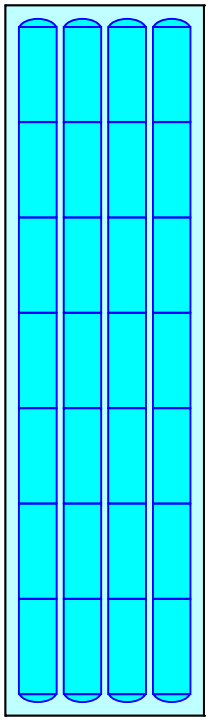
7 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 51.04' Row Length +12.0" End Stone x 2 = 53.04' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 8.0" Stone Cover = 2.50' Field Height

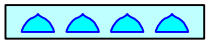
28 Chambers x 14.7 cf = 412.8 cf Chamber Storage

1,966.9 cf Field - 412.8 cf Chambers = 1,554.1 cf Stone x 40.0% Voids = 621.7 cf Stone Storage

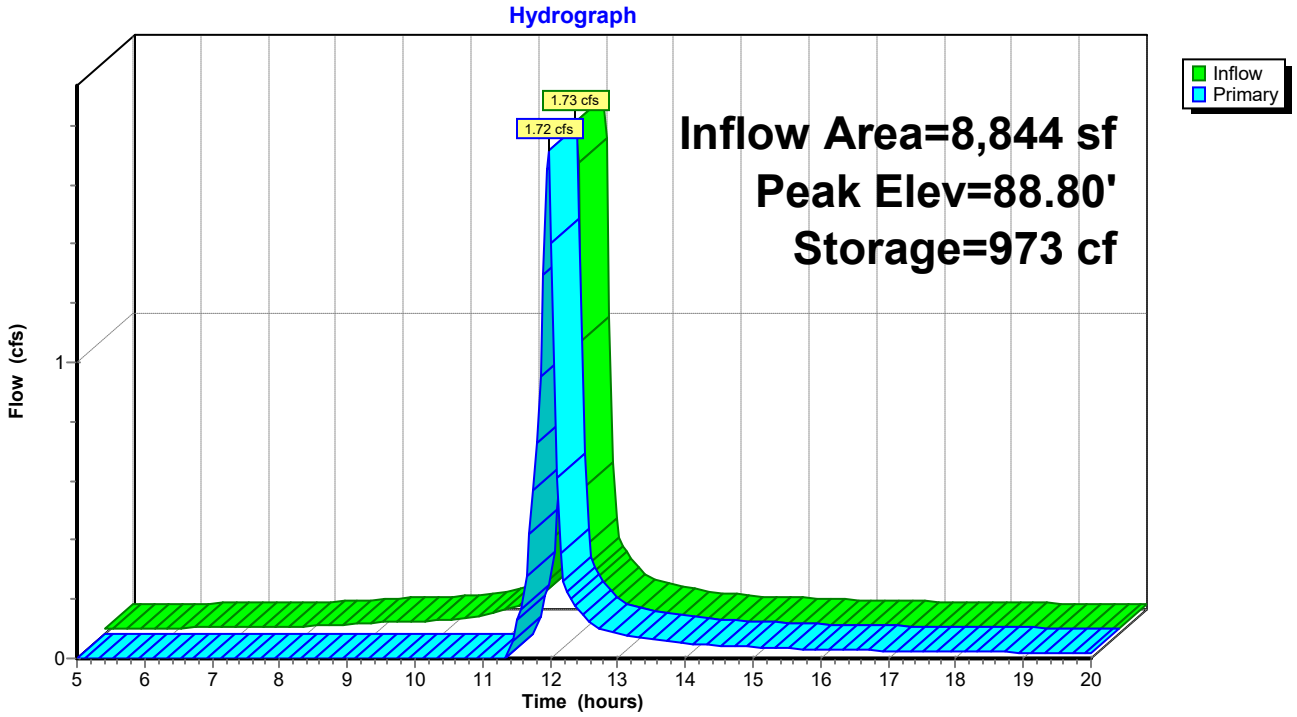
Chamber Storage + Stone Storage = 1,034.4 cf = 0.024 af
Overall Storage Efficiency = 52.6%
Overall System Size = 53.04' x 14.83' x 2.50'

28 Chambers
72.8 cy Field
57.6 cy Stone





Pond P2: BURRIED CHAMBER SYSTEM 2



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 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 D-1: DEVELOPED SITE Runoff Area=170,323 sf 46.94% Impervious Runoff Depth>6.50"
Tc=6.0 min CN=92 Runoff=41.70 cfs 92,253 cf

Subcatchment D2: LOT 1 ROOF Runoff Area=9,600 sf 100.00% Impervious Runoff Depth>6.99"
Tc=6.0 min CN=98 Runoff=2.42 cfs 5,592 cf

Subcatchment D3: LOT 2 ROOF Runoff Area=8,844 sf 100.00% Impervious Runoff Depth>6.99"
Tc=6.0 min CN=98 Runoff=2.23 cfs 5,151 cf

Pond 1P: SUM POND Inflow=44.11 cfs 101,946 cf
Primary=44.11 cfs 101,946 cf

Pond P1: BURRIED CHAMBER SYSTEM 1 Peak Elev=86.35' Storage=2,575 cf Inflow=2.42 cfs 5,592 cf
Outflow=0.26 cfs 5,424 cf

Pond P2: BURRIED CHAMBER SYSTEM 2 Peak Elev=88.86' Storage=990 cf Inflow=2.23 cfs 5,151 cf
Outflow=2.20 cfs 4,269 cf

Total Runoff Area = 188,767 sf Runoff Volume = 102,996 cf Average Runoff Depth = 6.55"
47.87% Pervious = 90,367 sf 52.13% Impervious = 98,400 sf

Summary for Subcatchment D-1: DEVELOPED SITE

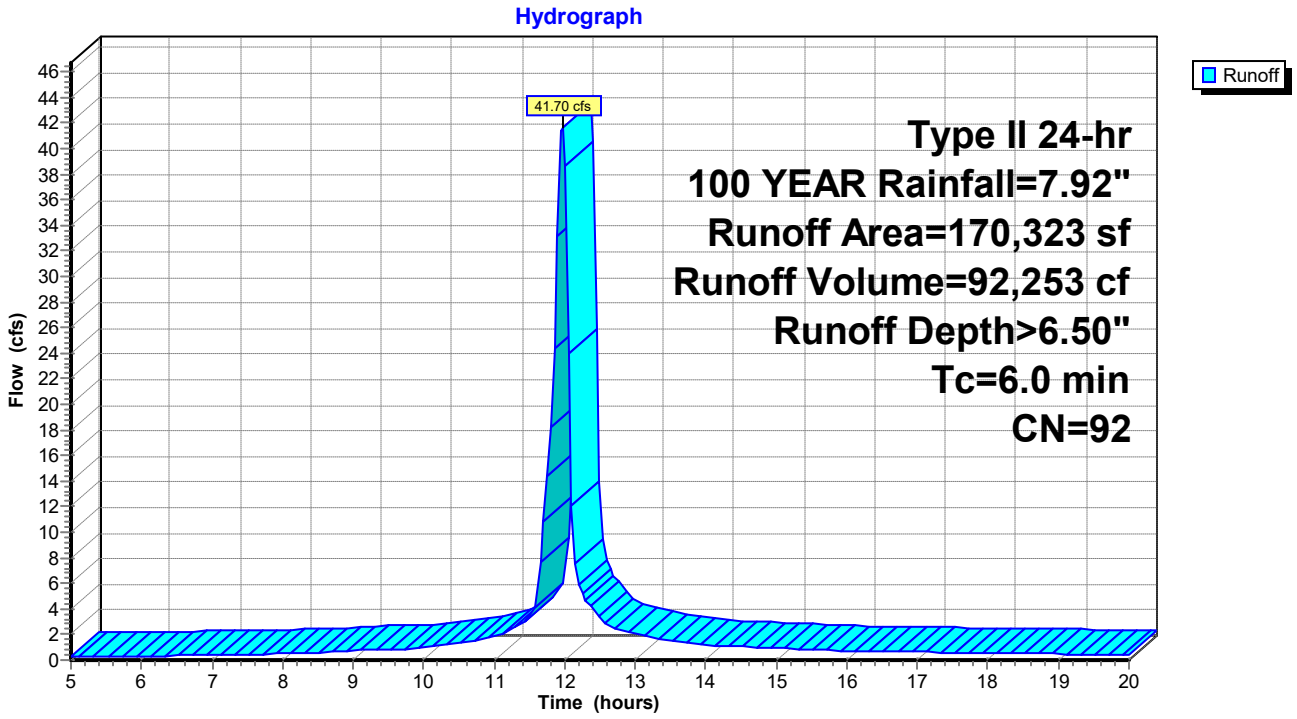
Runoff = 41.70 cfs @ 11.96 hrs, Volume= 92,253 cf, Depth> 6.50"
Routed to Pond 1P : SUM POND

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.92"

	Area (sf)	CN	Description
	75,384	98	Paved parking, HSG D
*	4,572	98	SIDEWALK HSG D
*	11,000	77	WOOD HSGD
*	79,367	89	LAWNS
	170,323	92	Weighted Average
	90,367		53.06% Pervious Area
	79,956		46.94% Impervious Area

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

Subcatchment D-1: DEVELOPED SITE



Summary for Subcatchment D2: LOT 1 ROOF

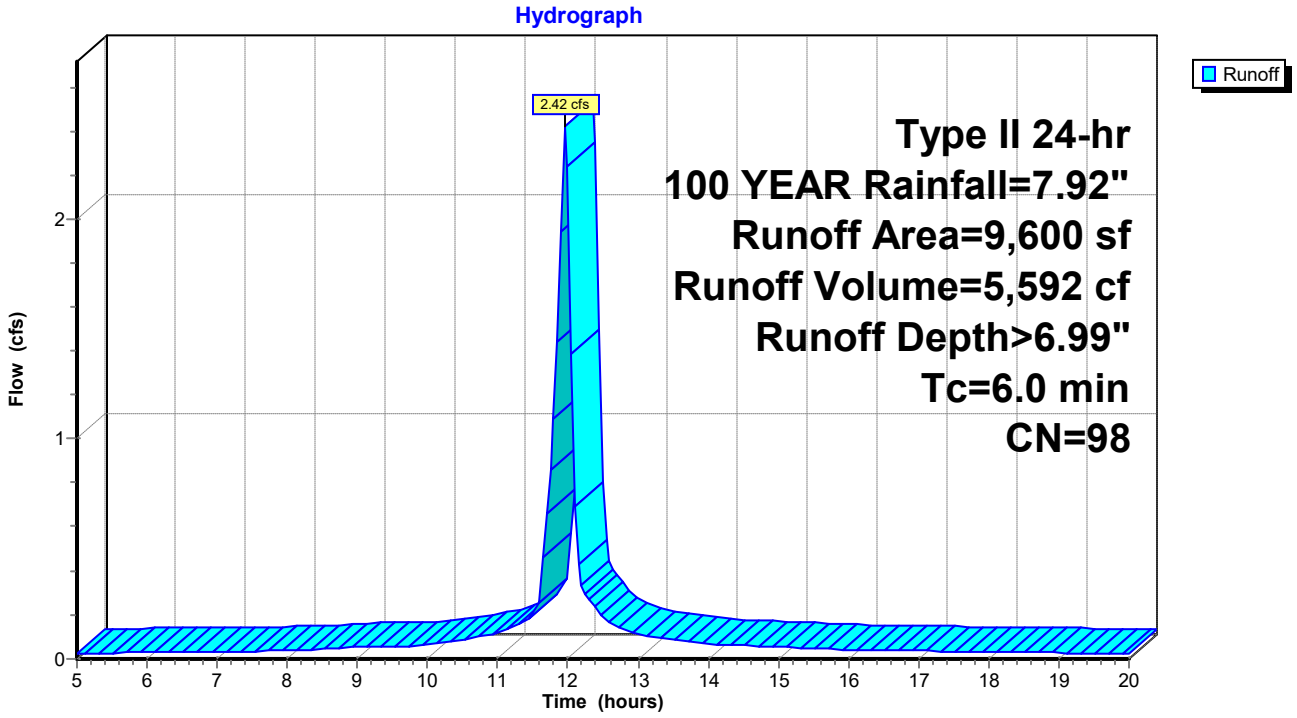
Runoff = 2.42 cfs @ 11.96 hrs, Volume= 5,592 cf, Depth> 6.99"
Routed to Pond P1 : BURRIED CHAMBER SYSTEM 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.92"

	Area (sf)	CN	Description
*	9,600	98	ROOF
	9,600		100.00% Impervious Area

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

Subcatchment D2: LOT 1 ROOF



Summary for Subcatchment D3: LOT 2 ROOF

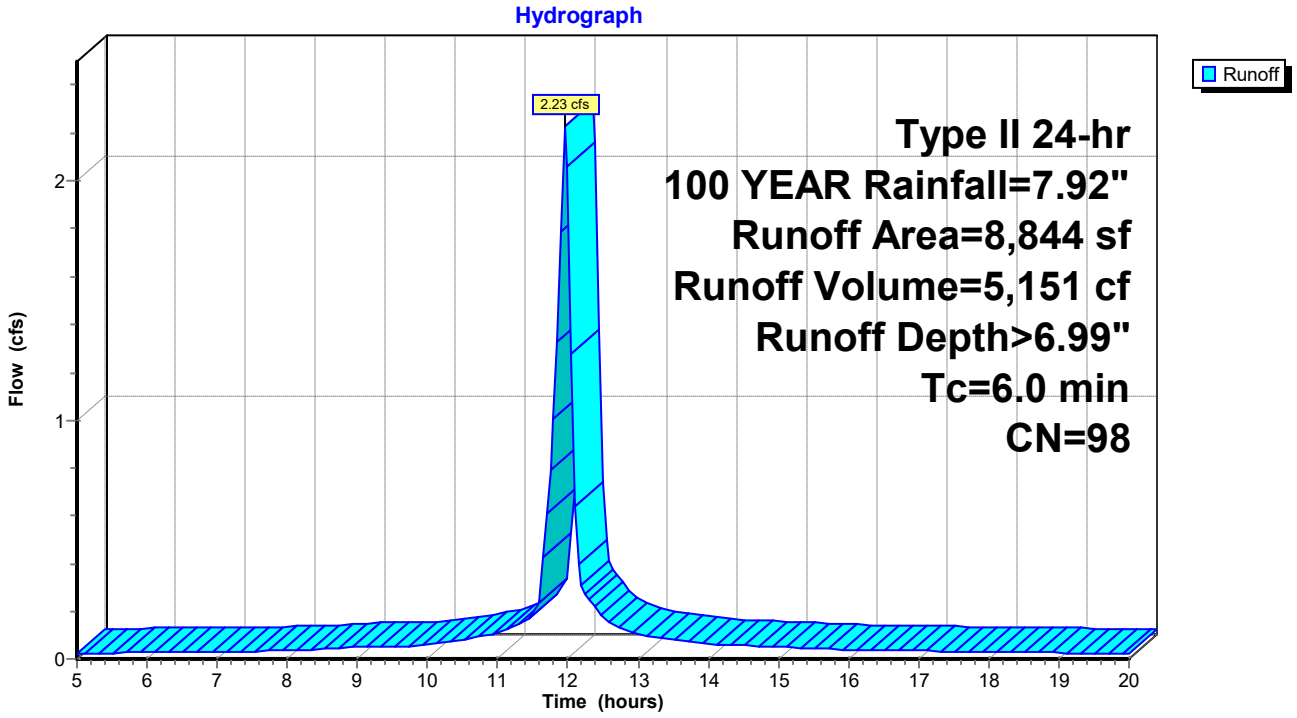
Runoff = 2.23 cfs @ 11.96 hrs, Volume= 5,151 cf, Depth> 6.99"
Routed to Pond P2 : BURRIED CHAMBER SYSTEM 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 100 YEAR Rainfall=7.92"

Area (sf)	CN	Description
8,844	98	Roofs, HSG D
8,844		100.00% Impervious Area

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

Subcatchment D3: LOT 2 ROOF

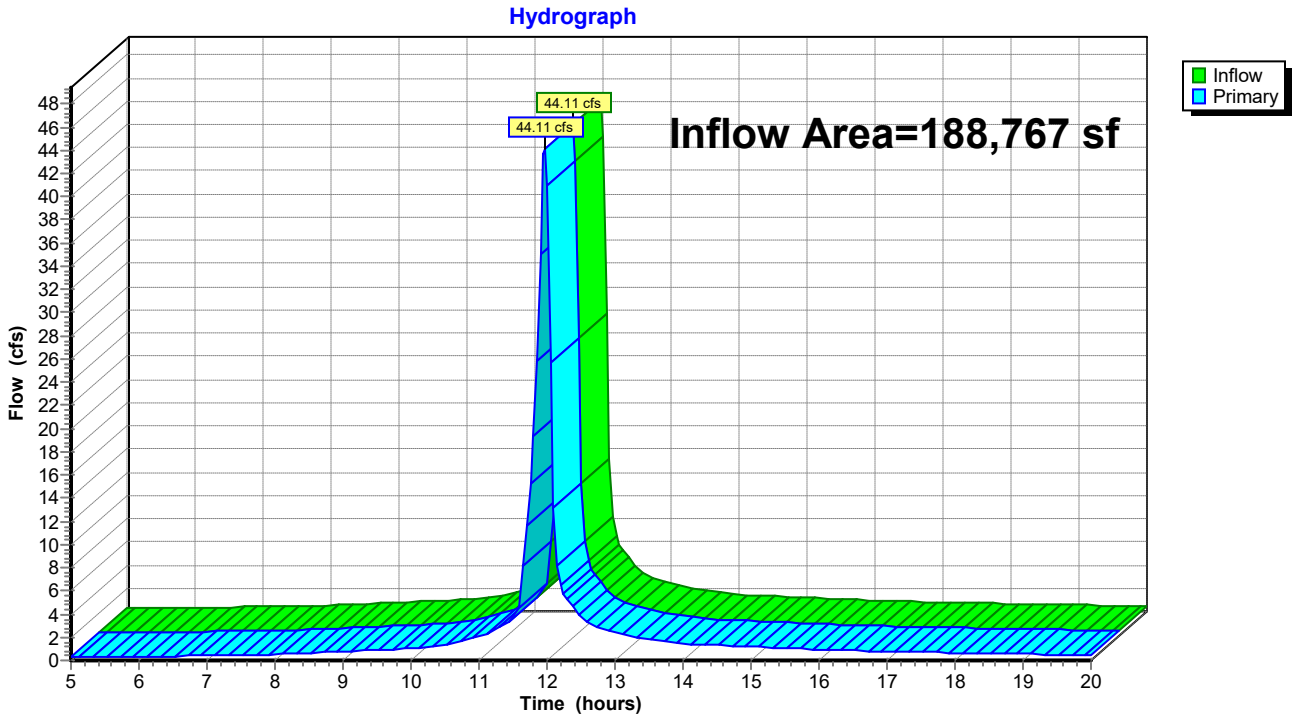


Summary for Pond 1P: SUM POND

Inflow Area = 188,767 sf, 52.13% Impervious, Inflow Depth > 6.48" for 100 YEAR event
Inflow = 44.11 cfs @ 11.96 hrs, Volume= 101,946 cf
Primary = 44.11 cfs @ 11.96 hrs, Volume= 101,946 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Pond 1P: SUM POND



Summary for Pond P1: BURRIED CHAMBER SYSTEM 1

Inflow Area = 9,600 sf,100.00% Impervious, Inflow Depth > 6.99" for 100 YEAR event
Inflow = 2.42 cfs @ 11.96 hrs, Volume= 5,592 cf
Outflow = 0.26 cfs @ 12.32 hrs, Volume= 5,424 cf, Atten= 89%, Lag= 21.6 min
Primary = 0.26 cfs @ 12.32 hrs, Volume= 5,424 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 86.35' @ 12.32 hrs Surf.Area= 3,375 sf Storage= 2,575 cf
Flood Elev= 87.50' Surf.Area= 3,375 sf Storage= 4,406 cf

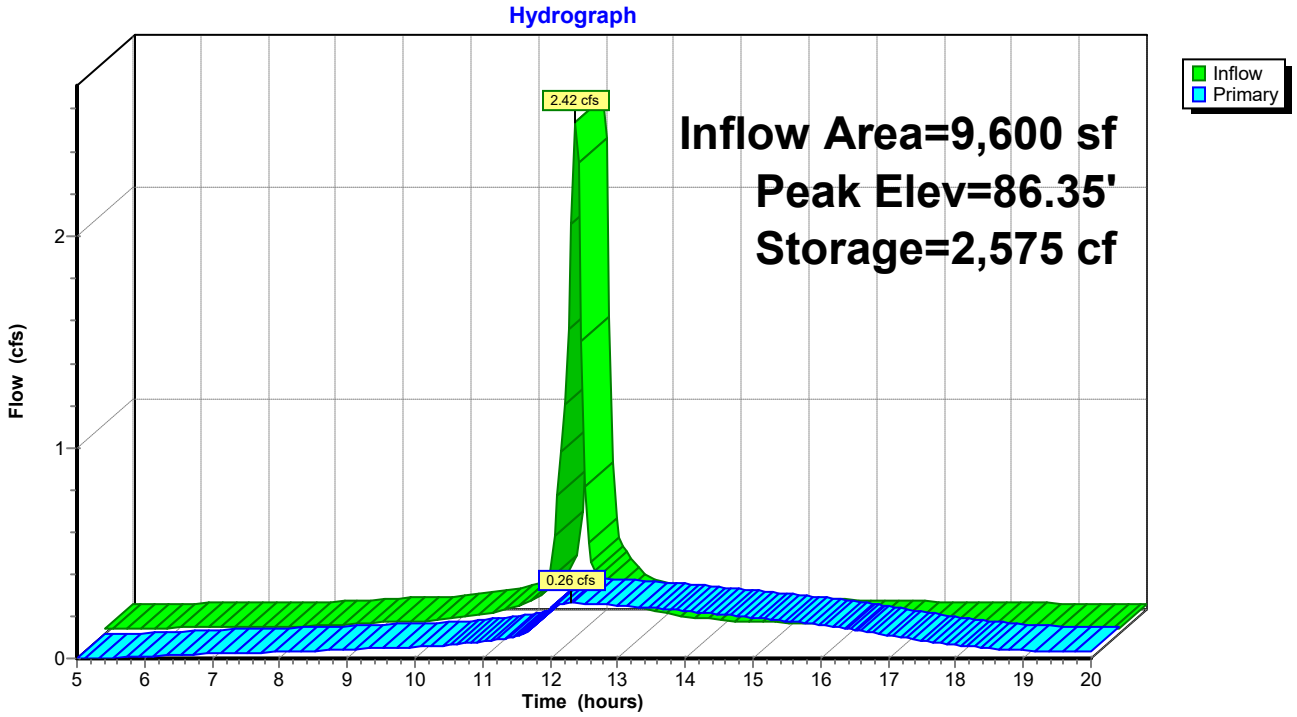
Plug-Flow detention time= 111.0 min calculated for 5,421 cf (97% of inflow)
Center-of-Mass det. time= 97.6 min (825.9 - 728.2)

Volume	Invert	Avail.Storage	Storage Description
#1	85.00'	3,025 cf	**45.00'W x 75.00'L x 2.75'H Prismatoid** 9,281 cf Overall - 1,718 cf Embedded = 7,563 cf x 40.0% Voids
#2	85.50'	1,718 cf	**15.0" Round Pipe Storage** x 20 Inside #1 L= 70.0'
		4,743 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Primary	85.00'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 85.00' / 84.80' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	85.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	87.25'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.26 cfs @ 12.32 hrs HW=86.35' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.26 cfs of 3.21 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.26 cfs @ 5.33 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Pond P1: BURRIED CHAMBER SYSTEM 1



Summary for Pond P2: BURRIED CHAMBER SYSTEM 2

Inflow Area = 8,844 sf,100.00% Impervious, Inflow Depth > 6.99" for 100 YEAR event
Inflow = 2.23 cfs @ 11.96 hrs, Volume= 5,151 cf
Outflow = 2.20 cfs @ 11.97 hrs, Volume= 4,269 cf, Atten= 2%, Lag= 0.8 min
Primary = 2.20 cfs @ 11.97 hrs, Volume= 4,269 cf
Routed to Pond 1P : SUM POND

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 88.86' @ 11.97 hrs Surf.Area= 787 sf Storage= 990 cf
Flood Elev= 89.00' Surf.Area= 787 sf Storage= 1,034 cf

Plug-Flow detention time= 96.1 min calculated for 4,267 cf (83% of inflow)
Center-of-Mass det. time= 45.5 min (773.7 - 728.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	86.50'	622 cf	**14.83'W x 53.04'L x 2.50'H Field A** 1,967 cf Overall - 413 cf Embedded = 1,554 cf x 40.0% Voids
#2A	87.00'	413 cf	**ADS_StormTech SC-310 +Cap** x 28 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap 28 Chambers in 4 Rows
		1,034 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**12.0" Round Culvert** L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 86.00' / 81.00' S= 0.1000 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	88.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.14 cfs @ 11.97 hrs HW=88.85' TW=0.00' (Dynamic Tailwater)
↑**1=Culvert** (Passes 2.14 cfs of 5.80 cfs potential flow)
↑**2=Orifice/Grate** (Weir Controls 2.14 cfs @ 1.94 fps)

Pond P2: BURRIED CHAMBER SYSTEM 2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-310 +Cap (ADS StormTech® SC-310 with cap length)
Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf
Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap

34.0" Wide + 6.0" Spacing = 40.0" C-C Row Spacing

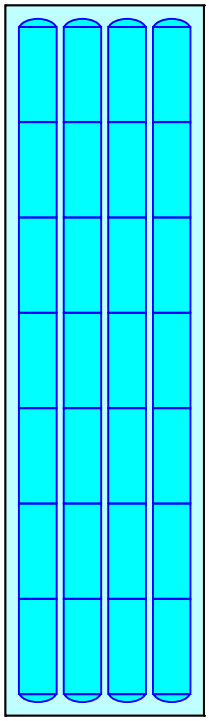
7 Chambers/Row x 7.12' Long +0.60' Cap Length x 2 = 51.04' Row Length +12.0" End Stone x 2 = 53.04' Base Length
4 Rows x 34.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 14.83' Base Width
6.0" Stone Base + 16.0" Chamber Height + 8.0" Stone Cover = 2.50' Field Height

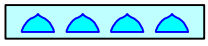
28 Chambers x 14.7 cf = 412.8 cf Chamber Storage

1,966.9 cf Field - 412.8 cf Chambers = 1,554.1 cf Stone x 40.0% Voids = 621.7 cf Stone Storage

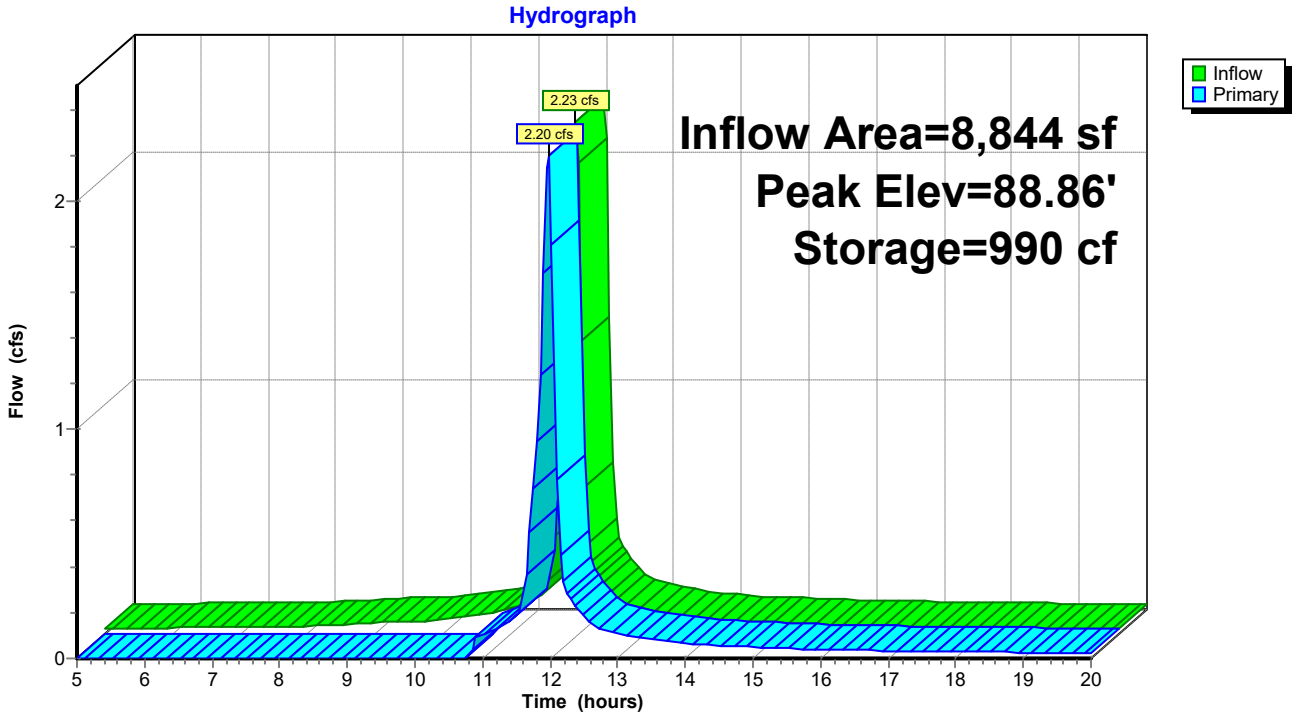
Chamber Storage + Stone Storage = 1,034.4 cf = 0.024 af
Overall Storage Efficiency = 52.6%
Overall System Size = 53.04' x 14.83' x 2.50'

28 Chambers
72.8 cy Field
57.6 cy Stone





Pond P2: BURRIED CHAMBER SYSTEM 2



PRECIPITATION FREQUENCY TABLE

NOAA Atlas 14, Volume 10, Version 3
Location name: Andover, Massachusetts, USA*
Latitude: 42.6749°, Longitude: -71.1359°
Elevation: 71.22 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.310** (0.244-0.383)	**0.370** (0.291-0.457)	**0.468** (0.367-0.580)	**0.549** (0.428-0.685)	**0.661** (0.497-0.861)	**0.746** (0.549-0.992)	**0.834** (0.595-1.15)	**0.932** (0.630-1.32)	**1.07** (0.695-1.57)	**1.19** (0.750-1.77)
10-min	**0.439** (0.346-0.542)	**0.524** (0.412-0.648)	**0.663** (0.519-0.822)	**0.778** (0.606-0.970)	**0.937** (0.705-1.22)	**1.06** (0.778-1.41)	**1.18** (0.843-1.63)	**1.32** (0.891-1.87)	**1.52** (0.984-2.22)	**1.68** (1.06-2.51)
15-min	**0.517** (0.407-0.638)	**0.617** (0.485-0.762)	**0.780** (0.611-0.967)	**0.916** (0.713-1.14)	**1.10** (0.829-1.44)	**1.24** (0.914-1.65)	**1.39** (0.991-1.92)	**1.55** (1.05-2.19)	**1.79** (1.16-2.62)	**1.98** (1.25-2.95)
30-min	**0.711** (0.560-0.878)	**0.849** (0.667-1.05)	**1.07** (0.841-1.33)	**1.26** (0.982-1.57)	**1.52** (1.14-1.98)	**1.71** (1.26-2.28)	**1.92** (1.37-2.64)	**2.14** (1.45-3.03)	**2.46** (1.60-3.61)	**2.73** (1.72-4.07)
60-min	**0.906** (0.713-1.12)	**1.08** (0.850-1.34)	**1.37** (1.07-1.70)	**1.61** (1.25-2.00)	**1.94** (1.46-2.52)	**2.18** (1.61-2.90)	**2.44** (1.74-3.37)	**2.73** (1.84-3.86)	**3.14** (2.04-4.60)	**3.48** (2.20-5.20)
2-hr	**1.16** (0.924-1.43)	**1.40** (1.11-1.72)	**1.78** (1.41-2.20)	**2.10** (1.65-2.60)	**2.54** (1.93-3.30)	**2.87** (2.14-3.82)	**3.22** (2.33-4.46)	**3.64** (2.47-5.12)	**4.28** (2.78-6.22)	**4.81** (3.06-7.15)
3-hr	**1.34** (1.07-1.64)	**1.62** (1.29-1.98)	**2.08** (1.65-2.55)	**2.46** (1.94-3.03)	**2.98** (2.28-3.86)	**3.36** (2.52-4.46)	**3.78** (2.75-5.24)	**4.29** (2.92-6.01)	**5.08** (3.31-7.37)	**5.76** (3.66-8.52)
6-hr	**1.71** (1.38-2.08)	**2.08** (1.67-2.53)	**2.68** (2.15-3.27)	**3.18** (2.53-3.90)	**3.87** (2.98-4.99)	**4.38** (3.31-5.79)	**4.93** (3.62-6.81)	**5.62** (3.84-7.82)	**6.70** (4.38-9.65)	**7.63** (4.87-11.2)
12-hr	**2.15** (1.75-2.59)	**2.63** (2.13-3.17)	**3.42** (2.76-4.13)	**4.07** (3.26-4.95)	**4.96** (3.85-6.36)	**5.62** (4.27-7.38)	**6.34** (4.69-8.70)	**7.24** (4.96-10.0)	**8.63** (5.66-12.4)	**9.83** (6.29-14.4)
24-hr	**2.54** (2.08-3.03)	**3.15** (2.58-3.78)	**4.16** (3.39-5.00)	**5.00** (4.04-6.04)	**6.15** (4.81-7.84)	**6.99** (5.36-9.14)	**7.92** (5.91-10.8)	**9.09** (6.26-12.5)	**10.9** (7.21-15.6)	**12.6** (8.06-18.2)
2-day	**2.83** (2.34-3.37)	**3.59** (2.97-4.28)	**4.84** (3.98-5.78)	**5.87** (4.79-7.05)	**7.29** (5.76-9.27)	**8.32** (6.45-10.9)	**9.48** (7.15-13.0)	**11.0** (7.59-15.0)	**13.4** (8.87-19.0)	**15.6** (10.0-22.5)
3-day	**3.11** (2.58-3.68)	**3.92** (3.26-4.65)	**5.26** (4.35-6.25)	**6.36** (5.22-7.61)	**7.89** (6.26-9.99)	**8.99** (7.00-11.7)	**10.2** (7.76-14.0)	**11.9** (8.22-16.1)	**14.5** (9.61-20.4)	**16.9** (10.9-24.2)
4-day	**3.38** (2.82-3.99)	**4.22** (3.51-4.98)	**5.59** (4.64-6.63)	**6.73** (5.55-8.03)	**8.30** (6.61-10.5)	**9.44** (7.37-12.2)	**10.7** (8.14-14.6)	**12.4** (8.61-16.8)	**15.1** (10.0-21.3)	**17.6** (11.4-25.2)
7-day	**4.12** (3.46-4.84)	**4.99** (4.19-5.86)	**6.41** (5.35-7.55)	**7.58** (6.29-8.99)	**9.20** (7.38-11.5)	**10.4** (8.14-13.4)	**11.7** (8.92-15.8)	**13.4** (9.37-18.1)	**16.2** (10.8-22.7)	**18.8** (12.1-26.7)
10-day	**4.79** (4.04-5.60)	**5.68** (4.79-6.65)	**7.13** (5.99-8.38)	**8.34** (6.95-9.86)	**10.0** (8.04-12.4)	**11.2** (8.81-14.3)	**12.6** (9.57-16.8)	**14.3** (10.0-19.2)	**17.1** (11.4-23.7)	**19.5** (12.7-27.6)
20-day	**6.68** (5.69-7.76)	**7.66** (6.52-8.91)	**9.27** (7.85-10.8)	**10.6** (8.91-12.4)	**12.4** (10.0-15.2)	**13.8** (10.8-17.3)	**15.3** (11.5-19.9)	**16.9** (11.9-22.5)	**19.4** (13.0-26.8)	**21.5** (14.0-30.2)
30-day	**8.26** (7.08-9.56)	**9.32** (7.98-10.8)	**11.1** (9.42-12.8)	**12.5** (10.6-14.6)	**14.5** (11.7-17.6)	**16.0** (12.6-19.8)	**17.5** (13.2-22.5)	**19.2** (13.6-25.4)	**21.4** (14.4-29.4)	**23.2** (15.1-32.5)
45-day	**10.3** (8.86-11.8)	**11.4** (9.84-13.2)	**13.3** (11.4-15.4)	**14.9** (12.6-17.3)	**17.0** (13.8-20.5)	**18.7** (14.7-22.9)	**20.3** (15.3-25.7)	**21.9** (15.6-28.9)	**24.0** (16.2-32.7)	**25.5** (16.7-35.6)
60-day	**12.0** (10.4-13.8)	**13.2** (11.4-15.2)	**15.2** (13.1-17.6)	**16.9** (14.4-19.6)	**19.1** (15.6-23.0)	**20.9** (16.5-25.6)	**22.6** (17.0-28.5)	**24.2** (17.3-31.8)	**26.2** (17.8-35.7)	**27.6** (18.1-38.4)

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

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

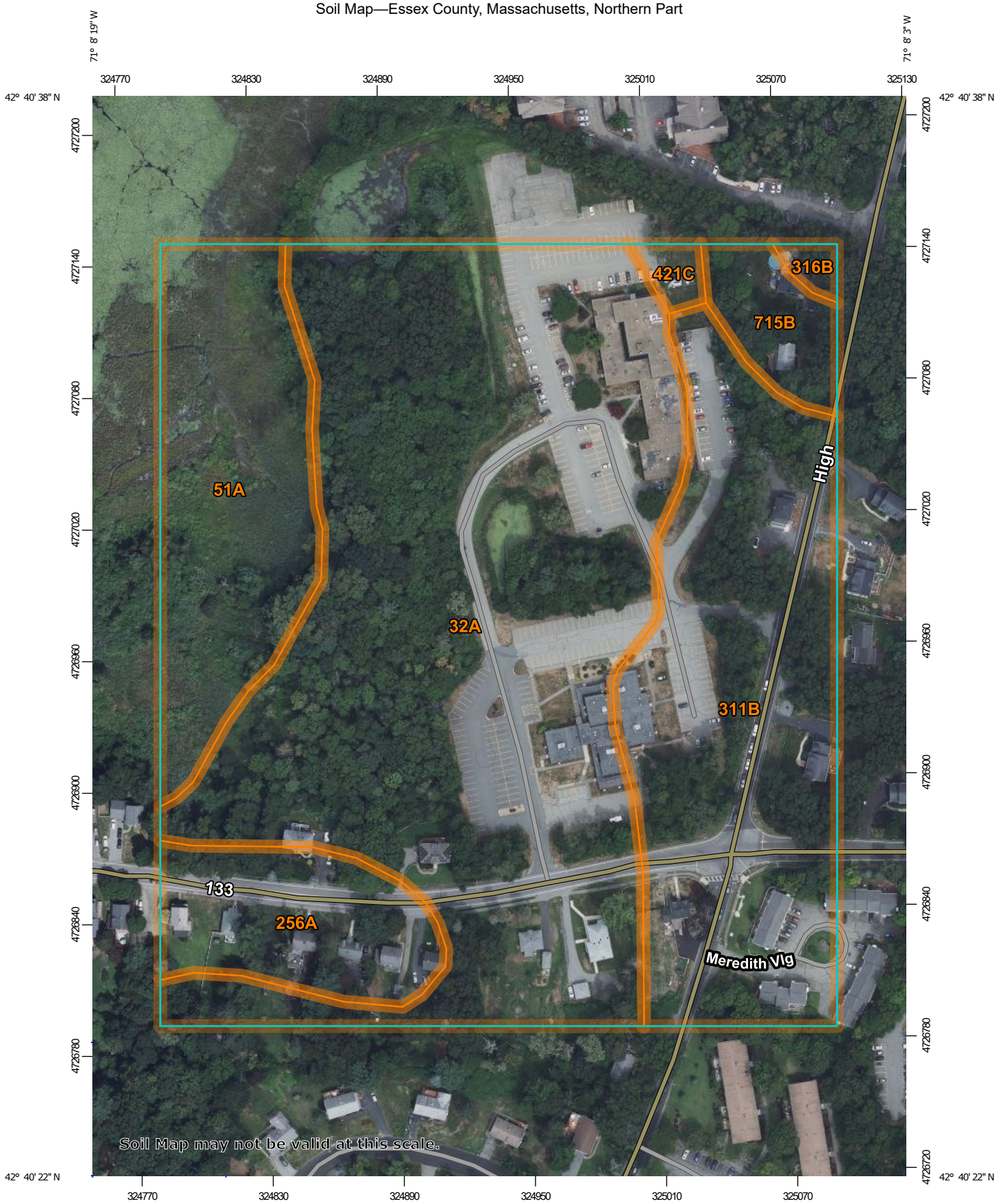
MAPS

USGS LOCUS
SCS SOILS
FEMA
CS 9201 PRE-DEVELOPMENT DRAINAGE
CS 9301 POST DEVELOPMENT DRAINAGE

Source: Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs; USGS Topographic Quadrangle Images

USGS MAP
140 HAVERHILL ST., ANDOVER, MA
MAP 18 LOT 104

Soil Map—Essex County, Massachusetts, Northern Part



Map Scale: 1:2,400 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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 1:15,800.

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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 16, Jun 9, 2020

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

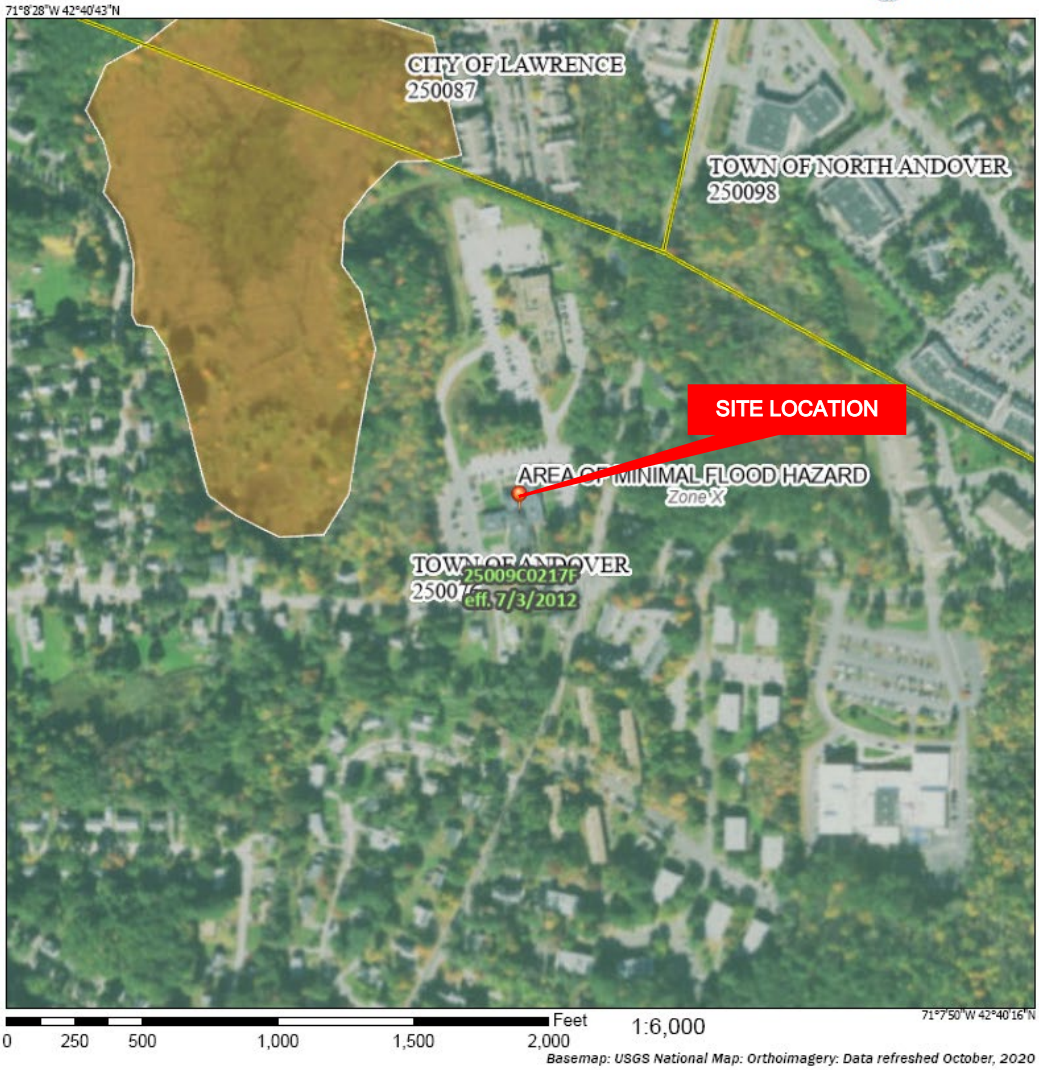
Date(s) aerial images were photographed: Aug 13, 2020—Sep 15, 2020

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
32A	Wareham loamy sand, 0 to 3 percent slopes	14.4	52.4%
51A	Swansea muck, 0 to 1 percent slopes	3.6	13.2%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	1.9	6.9%
311B	Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony	6.4	23.5%
316B	Scituate fine sandy loam, 3 to 8 percent slopes, very stony	0.1	0.5%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	0.2	0.7%
715B	Ridgebury and Leicester fine sandy loams, 3 to 8 percent slopes, extremely stony	0.8	2.9%
Totals for Area of Interest		**27.4**	**100.0%**

National Flood Hazard Layer FIRMette



FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone D

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

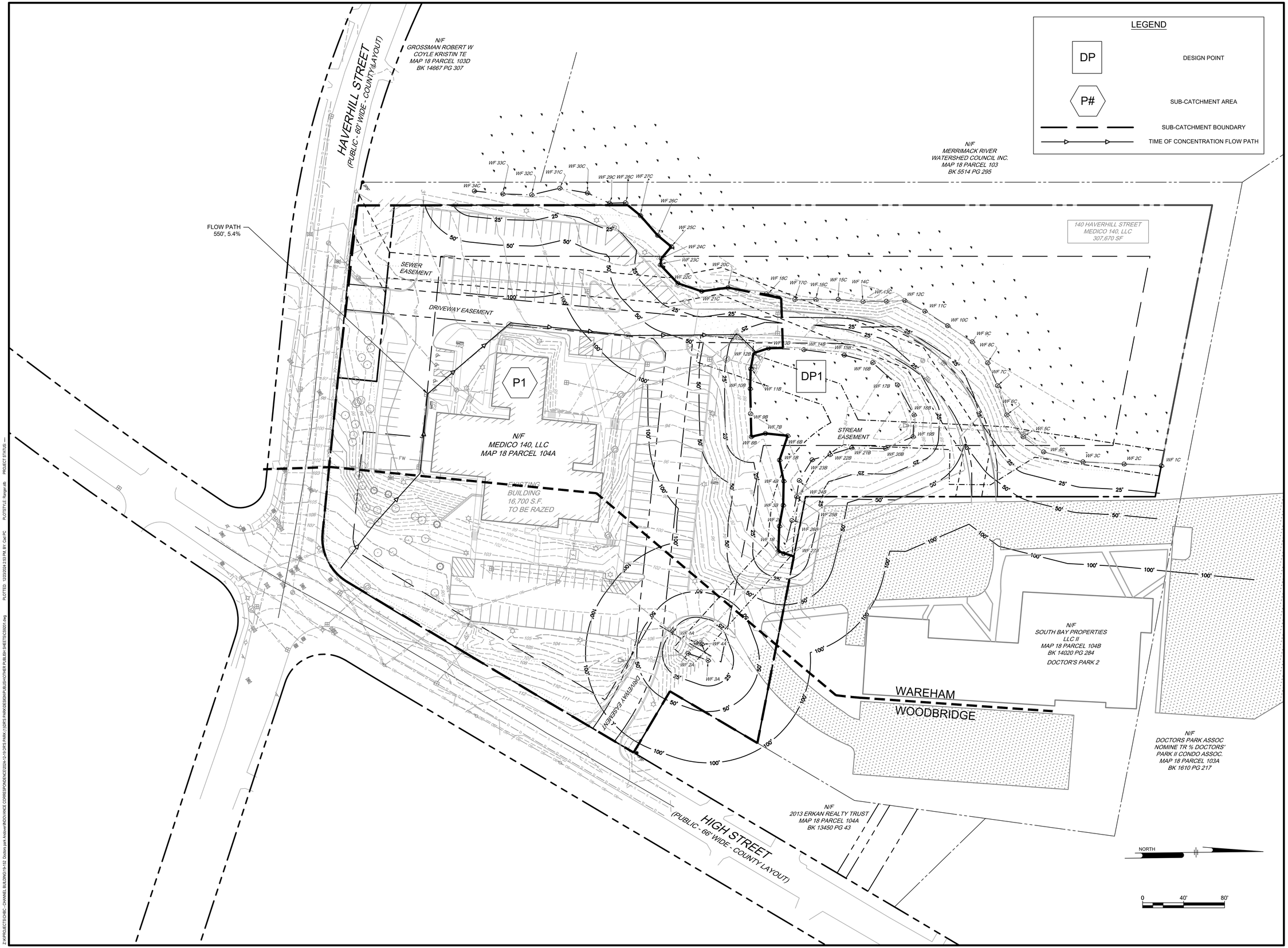
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/13/2021 at 12:20 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Source: Official Website of the Department of Homeland Security FEMA

FEMA MAP
140 HAVERHILL ST., ANDOVER, MA
MAP18 LOT 104



Ranger Engineering Group, Inc.
130 Main Street, Suite 202
Salem NH, 03079
Tel: 978-208-1762
rangereng.com

SITE PLAN
140 HAVERHILL STREET
ANDOVER MA, 01810

PRE-DEVELOPMENT
DRAINAGE PLAN
MEDICO 140, LLC
355 MIDDLESEX AVE. SUITE 7
WILMINGTON, MA 01887

NO.	DATE	REVISIONS	BY

PROJECT	19-152
DATE	DECEMBER 18, 2024
DRAWING SCALE	1"= 40'
DRAWN BY	OMR
APPROVED BY	BCO

CS9201

SHEET OF 19

TABLE OF IMPERVIOUS AREAS		
	EXISTING	PROPOSED
PAVEMENT	70,000 S.F.	70,761 S.F.
SIDEWALK	7,100 S.F.	4,573 S.F.
BUILDING	16,700 S.F.	19,200 S.F.
WOODLAND	26,600 S.F.	90,041 S.F.
GRASS	68,367 S.F.	4192 S.F.
TOTAL	188,767 S.F.	188,767 S.F.

TOTAL DISTURBED AREA = 111,300 S.F

FLOW PATH
550', 5.4%

D1

P-1

D2

DP1

PROPOSED BUILDING 1
2 STORY, 19,200 S.F.
FFE = 90.0

5,000 S.F.
PLAYGROUND

PROPOSED BUILDING 2
2 STORY, 17,688 S.F.
NEW BUILDING FINISH FLOOR = 104.0
GROUND LEVEL FLOOR = 90.00

18" RCP
INV = 81.93'

18" RCP
INV =81.06'

P-2

24" RCP
INV = 87.6'

D3

CB
RIM=111.02'
INV OUT (12"RCP)=108.27'

CB
RIM=112.61'
INV OUT (12"RCP)=109.86'

CB
RIM=112.57'
INV IN & OUT (12'CMP)=109.07'
INV TO HEADWALL = 109.00

CONC HEADWALL
TOP OF WALL = 109.85'
INV OUT = 108.05'

24" CMP
INV = 102.2'

24" CMP
INV = 99.5'

FES
INV = 95.75'

12" RCP
INV = 98.8'

WAREHAM
WOODBRIDGE

LEGEND

P-2	POND
DP	DESIGN POINT
SP	SUB-CATCHMENT AREA
	SUB-CATCHMENT BOUNDARY
	TIME OF CONCENTRATION FLOW PATH

NORTH

0 40' 80'

Ranger Engineering Group, Inc.
130 Main Street, Suite 202
Salem NH, 03079
Tel: 978-208-1762
rangereng.com

SITE PLAN

140 HAVERHILL STREET
ANDOVER MA, 01810

POST DEVELOPMENT DRAINAGE PLAN

MEDICO 140, LLC
355 MIDDLESEX AVE, SUITE 7
WILMINGTON, MA 01887

NO.	DATE	REVISIONS	BY

PROJECT	19-152
DATE	DECEMBER 18, 2024
DRAWING SCALE	1"= 40'
DRAWN BY	OMR
APPROVED BY	BCO

CS9301

SHEET 1 OF 19