

Stormwater Management Report

Project: **STRAFFORD EAST**
15 Strafford Road
Strafford, NH 03884

Project Number: **NAV-31**

Applicant/Owner: **Mariner Tower Navigator Properties, LLC**
Address: P.O. Box 1160
Kennebunkport, ME 04046

Designer: **TEP OPCO, LLC.**
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Section 1: Analysis Summary:

Table 1: Peak Discharge Rates

Analysis Point	Design Storm Event											
	1-Inch Storm		2-Year Storm		10-Year Storm		25-Year Storm		50-Year Storm		100-Year Storm	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
Rate, Q (CFS)	1.70	1.69	15.27	14.94	25.27	24.78	31.45	31.11	35.36	35.04	40.85	40.64
		↓ 0.6%		↓ 2.2%		↓ 1.9%		↓ 1.1%		↓ 0.9%		↓ 0.5%

For individual outlet device peak flow rates see storm & sanitary analysis sheets.

Note: The Town of Strafford does not require peak flow reduction rates for the 100-Year storm. The 100-year storm is shown for reference only.

1.1. Proposal & Impacts

The Strafford East project seeks to install a Cellular Communications 160-foot Self-Support Tower with a 75' x75' fenced crushed stone equipment area at the base, a 15' x 75' gravel turn around area serviced by a new 12'x 777' long gravel driveway that will be fronted by Strafford Road (NH 202A).

The project is located on the Southerly portion of an approximately 111 -acre parcel in Strafford, New Hampshire. The property is identified by the Town of Stafford as Tax Assessor's map 11, Lot 83.

The proposed Cellular Site will add approximately 0.39 acres of impervious surface cover. Stormwater controls have been designed to address all Strafford Stormwater Management Requirements. This is not a redevelopment project.

1.2. Stormwater Standards

The analysis and design of the Stormwater Management system has been done in accordance with the State of New Hampshire, December 2008, Clean Water Act Section 319 Nonpoint Source Program grant and a Clean Water Act Section 104(b)(3) grant from the U.S. Environmental Protection Agency through the New Hampshire Department of Environmental Services, Watershed Assistance Section.

A complete evaluation of possible stormwater management measures, including environmentally sensitive site design; Low Impact Development (LID) techniques; structural stormwater Best Management Practices (BMPs); pollution prevention, erosion, and sedimentation control; and proper

operation and maintenance of stormwater BMPs is included in this report. This document includes (8) eight Stormwater design standards to reduce and properly manage stormwater which are summarized and addressed below.

1) Low Impact Development (LID) site planning and design.

Requirement - Low Impact Development (LID) site planning and design strategies must be used to the maximum extent practicable in order to reduce the generation of the stormwater runoff volume. An applicant must document in writing why LID strategies are not appropriate if none are proposed for the management of stormwater.

Compliance - The project infrastructure was placed with Low Impact Development (LID) criteria in mind. Impervious area and ground disturbance are located outside jurisdictional environmental resources and buffer areas. Runoff from impervious surfaces is disconnected and directed to pervious surfaces. Catch basins and unnecessary pipe are not used, promoting “country drainage”.

2) Best Management Practices (BMPs)

Requirement - Best Management Practices (BMPs) as a minimum shall be employed to manage the quantity and quality of stormwater runoff both pre- and post-construction. See the most recent edition of the New Hampshire Stormwater Manual for guidelines.

Compliance – BMPs (Detention Basin & Permeable Geogrid Gravel) was implemented in the stormwater management design to address antidegradation.

3) Water Quality Volume

Requirement - There shall be no negative impact to water quality post-development from pre-development conditions.

Compliance – Stormwater BMPs and controls have been devised to treat runoff and prevent erosion.

4) Total Suspended Solids (TSS) Removal

Requirement - Remove 80 percent of the average annual load of total suspended solids (TSS), floatable, greases, and oils, remove 40 percent of phosphorous and nitrogen and, meet state water quality standards for all other parameters after the site is developed.

Compliance – Pre-treatment is provided and structural stormwater Best Management Practices (BMPs) are sized in accordance with the New Hampshire Stormwater design manual. Source control and pollution prevention practices are identified in the Long-term Pollution Prevention Plan.

5) Peak Discharge Rates

Requirement - Post-development peak runoff rate and volume shall not exceed predevelopment levels for a 50-year storm event.

Compliance – Flow attenuation has been provided such that peak flow discharge rates are no higher after the development than the existing condition for the 1-inch storm, 2, 10, 25 and 50-year storms. See Table 1: Peak Discharge Rates

6) Groundwater Recharge

Requirement - Stormwater management designs shall demonstrate that annual average pre-development groundwater recharge volume (GRV) is maintained post-development, when compared to pre-development conditions.

Compliance – The recharge volume has been determined in accordance with the New Hampshire Stormwater design manual and will be infiltrated to the groundwater.

7) Pre-development conditions

Requirement - For the purposes of calculating pre-development conditions, any site that was wooded in the last five (5) years shall be treated as though the predevelopment conditions are undisturbed woods.

Compliance – This standard is not applicable.

8) Long Term Operation & Maintenance

Requirement - All stormwater management plans shall include an Operation and Maintenance (O&M) Plan for the proposed system (prior to final approval of any permits) to ensure continued proper functioning of the system.

Compliance – The Long-Term O & M plan is included in this submittal. It includes general.

controls for construction and long-term maintenance of the stormwater management system.

Section 2 Project Narrative

2.1. Introduction and methodology

This report is intended to accompany an application to the municipal review agent. Information is presented under two conditions, “Existing” and “Proposed”, so that potential impacts due to the project can be identified, quantified and, if necessary, mitigated.

The objective of the calculations are as follows:

- Delineate hydrologic drainage areas and determine peak flow rates of runoff for the site under both existing and proposed conditions for the 1-Inch, 2, 10, 25 and 50- year design storms.
- Design a stormwater detention system to mitigate proposed increases in peak rates of runoff from existing to proposed conditions for the 1-Inch, 2, 10, 25 and 50- year storm events.
- Implement the New Hampshire Stormwater Manual, volume 1 through volume 3 and Town of Strafford Stormwater Design Standards, 1 through 8 to address both water quality and water quantity.

The final design intent seeks to meet the following interrelated goals:

- Prevent appreciable sediment transport by trapping sediment on site.
- Provide adequate drainage and mitigation measures for new impervious surfaces so that damage does not occur during a 50-year storm.
- Provide a cost-effective engineering solution that addresses

regulatory as well as practical constraints.

2.2. Site Description & Resource Area Delineation

The proposed tower and facility are situated in proximity of a cultivated crop area within a wooded sliver of land situated on an existing farmland. Please see TEP OPCO, LLC Zoning Drawings submittal for additional information.

a) Soil Evaluation

Per the USDA's Natural Resource Conservation Service, the majority of the site and the entirety of the tower pad lies within Paxton fine sandy loam, please refer to Appendix 7.6 NRCS Soils Report for additional details on soils.

The estimated seasonal high groundwater table is at least 46 inches below the existing grade in this area. This is the depth used in the design regarding groundwater offset.

2.3. Project Description

a) Overview

Stormwater is collected by surface runoff (“country drainage”) to a Detention Basin BMP. The BMP is protected by a series of sediment Check dams and a forebay. Peak flow discharge rates are ameliorated by a proposed Detention Basin and the outlet control structure.

Table 2: Surface Covers		
Condition	Impervious (Gravel, Bare soil & Asphalt)	Open (Yard, Woods & Landscape)
Existing	11,958.26 SF	318,302.80 SF
Proposed	17,139.07 SF	301,163.73 SF

2.4. Hydraulic Drainage Areas

The entire locus property is not modeled in this analysis; only the immediate 330,261.06 SF of land around the tower is analyzed.

a) Existing Condition

The analyzed area is a single hydrologic drainage area (subcatchment), based on site survey and proximity to proposed impervious area. The area is mostly wooded, with some grassy areas and farmland. Subcatchment E1, Stormwater follows the ground's slope, moving to the South of Locus property. For a visual of existing conditions, subcatchment and time of concentration, please refer to attached plan in Section 7.7 "Subcatchment Areas: Existing Conditions."

Table 3: Existing Subcatchments				
Subcatchment	Area Sf.	Impervious	Curve Number	Time Of Concentration, Min.
E1	330,261.06	3.62%	86.56	15.93
Total Area	330,261.06	11,958.26 SF		

b) Proposed Condition

The analyzed area is divided into three subcatchments, namely P1, P2 & P3. The areas are mostly Farmland, with some woods, grass areas and gravel surfaces. Subcatchment P1 discharges stormwater run-off to a proposed Detention Basin protected by a sedimentation forebay situated approximately 285 feet south of proposed tower compound. Subcatchment P2 envelopes a smaller area of the proposed development and discharges runoff to an existing tree buffer area inhabiting the southerly portion of locus. Subcatchment P2 discharges stormwater run-off onto a permeable geogrid gravel surface driveway situated on the southeasterly portion of the locus property. For a visual of proposed conditions, subcatchment(s) and times of concentration, please refer to attached plan in Section 7.8 "Subcatchment Areas: Proposed Conditions."

Table 4: Proposed Subcatchments				
Subcatchment	Area S.F.	Impervious	Curve Number	Time of Concentration
P1	49,270.18	22.5%	84.84	16.15
P2	274,325	1.5%	80.97	10.13
P3	6,666.00	28.2%	82.68	9.35
Total Area	330,261.06 SF	17,139.07 SF		

c) Contributing & Impervious Areas

The Contributing Drainage Areas are shown in the attached subcatchment plans.

. 2.5. Analysis Point

The analysis point for existing and proposed conditions is along the southern boundary line of locus property.

2.6. Pipe Sizing

For the purpose of determining pipe sizes to accommodate the site plus any upland tributary (pass-through) flows, the 50-year storm was used. This has a rainfall depth of 5.60 inches. The pipe run is short, and the pipe's characteristics control the basin's outlet flow rate.

See 50 – Year Storm event calculation worksheet for pipe sizing data in shown on the analysis work sheet.

2.7. Hydraulic Analysis Methodology

1. Autodesk® Storm and Sanitary Analysis 2022. The Storm and Sanitary Analysis program was used to generate the runoff hydrographs for the watershed areas, to determine discharge/stage/storage characteristics for the Detention basin & the permeable geogrid gravel driveway, to perform drainage routing and to combine the results of the runoff hydrographs.
2. Storm and Sanitary Analysis combines the most-used capabilities of TR-55¹ and many other techniques and features not provided by other programs.

3. Calculation Settings:

- 3.1. Flow UnitsCFS
- 3.2. Subbasin Hydrograph Method.SCS TR-55
- 3.3. Time of Concentration.....SCS TR-55
- 3.4. Link Routing MethodKinematic Wave
- 3.5 Storage Node Exfiltration.....Constant rate, wetted area.

¹ TR-55 Technical Release 55: Urban Hydrology for Small Watersheds by USDA Soil Conservation Service (now Natural Resources Conservation Service)

Table 5: Local Storm Events	
Storm Event (Year)	NRCS Rainfall (inches)
2	3.00
10	4.30
25	5.10
50	5.60

Source: Rainfall data is interpolated from Technical Paper No. (TP40) Rainfall Frequency +Atlas of the Eastern United States.

The time of concentration, Tc flow paths, for each drainage area was calculated by Civil 3D waterdrop tool to determine the longest (hydrological) path rainfall would travel from the most distant point of the drainage area to the corresponding analysis point. Tc s were calculated via the Storm and Sanitary platform.

Section 3 Stormwater Standards -Supporting Information

Section 3 Stormwater Standards – Supporting Information

For a summary of compliance with Stormwater Standards, please refer to Section 1.2 Stormwater Standards. Below are calculations, methodology and other information supporting each Standard, as necessary.

3.1 Standard 1 Low Impact Development (LID) Site Planning & Design Strategies

Please see section 1.2. on page 7 for all information on this standard

3.2 Standard 2 – Best Management Practice

Please see section 1.2. on page 7 for all information on this standard

3.3 Standard 3 – Water Quality (WQV)

Drainage area = 7.58

Impervious area = 0.39 ac

$I = 0.39/7.58 = 0.05$

$R_v = (0.05 + 0.9(I))$
 $= 0.05 + 0.9(0.05)$
 $= 0.097$

$WQV = (P)(R_v)(A)$
 $= (1 \text{ inch}) \times (0.097) \times 7.58 \text{ ac}$
 $= 0.73 \text{ ac-inch}$
 $= 0.73 \text{ ac-inch} \times 43560 \text{ ft}^2 / 1 \text{ ft} / 12 \text{-inch}$
 $= 2,661.52 \text{ ft}^3$

Detention Basin

Forebay 25% (WQV) $= 363.41 \text{ ft}^3$
Detention Basin (WQV) $= 8,210.42 \text{ ft}^3$
8,857.83 ft³

Permeable Geogrid Gravel

Permeable Gravel: (75% (WQV) $= 979.04$
Total Volume: =9,836.87 ft³

The Structural BMP is structured to capture and treat the required Water Quality Volume.

WQV, provided 9,836.87 CF > WQV, Required (2,661.52 CF) ← **OK**

Where:

P= 1 inch

I = The percent of impervious cover draining to the structure,

R_v = Unitless runoff coefficient, $R_v = 0.05 + 0.9(I)$

in decimal form $0.39 \text{ ac} / 1.71 \text{ ac} = 0.23$

A= Total Site area draining to the structure

3.4 Standard 4 – Total Suspended Solids (TSS) Removal

The runoff volume is captured through a single treatment train.
The details follow:

1. Runoff reaches the BMP via sheet or shallow concentration flow via grassed surfaces. Check dams will trap sediment before entering the main BMP. This treatment train will reduce TSS by 90%.

3.5 Standard 5 – Peak Discharge Rates

Please see table 1 on page 8 for all information on this standard

3.6 Standard 6 – Groundwater Recharge

Proposed Impervious is 0.393 Acres or 17,139.07 SF

Require Recharge Volume is given:

$$GRV = (A_I)(R_d)$$

A_I = Area of impervious surface post development

R_d = Groundwater recharge depth per USDA/NRCS hydrologic soil group

$$GRV = (0.39 \text{ ac}) (0.10 \text{ inch}) = 0.039 \text{ Ac-Inch} \\ = \mathbf{142.83 \text{ Ft}^3}$$

The proposed basin has a peak 50-year storm volume of 6,869.9 CF, per Storm & Sanitary Analysis.

V, provided (6,869.9 CF) >> V, Required (142.83 CF) ← **OK**

Table 6 Recharge Volume										
	F_{HSG "A"}	Area A	F_{HSG "B"}	Area B	F_{HSG "C"}	Area C	F_{HSG "D"}	Area D	Sums	
Impervious	(in.)	SF	(in.)	SF	(in.)	SF	(in.)	SF	AC-Inc	Rev (CF)
Proposed	0.4	0	0.25	0.00	0.1	17,149.01	0	0.00	0.039	142.83

Recharge Volume, Rv = 142.83 CF

3.7 Standard 7 – Pre-development conditions

Please see section 1.2. on page 8 for all information on this standard

3.8 Standard 8 – Long Term Operation & Maintenance

Please see section 1.2. on page 9 for all information on this standard

3.9 Riprap apron Sizing

Apron Length: L_a = $1.8Q/D_o \times 1.5 + 1.5D_o + 7D_o$ (Where $TW < D_o/2$), $Q=1.15$ cfs
 $TW=0.34$ ft

$$= 1.8 (1.15 \text{ cfs}) / (1.5 \times 1.5) + 7(1.5) \\ = 0.2 \text{ ft}$$

Apron Width: W = $3D_o + L_a$
= $3(1.5) + (0.2)$
= 4.7 ft

Apron Width at Outlet: = $3D_o$
= $3(1.5)$
= 4.5 ft

Riprap Diameter D_{50} = $0.02Q^{1.3}/TW \times D_o$
= $0.02(1.15)^{1.3}/0.34 \times 1.5$
= 0.05 ft or 0.56 inches (x 1.5)
= 0.9 inches

3.10 Emergency overflow Sizing

$CLH^{1.5} = Q$ (100-year storm peak flow = 40.84 cfs)

Where: -

C – coefficient: 3.1

L – Bottom Length: 44.00

H – Height of Spillway: 0.45

Try: -

$$3.1 \times 44.00 \times 0.25^{1.5} = 41.17 \text{ cfs}$$

41.17 cfs > provided Q 40.84 cfs ← therefore spillway size is OK

Section 4 Construction Period Pollution Control Plan

1. Contact the regulating municipal agent at least fourteen (14) days prior to start of construction to schedule a pre-construction meeting.
2. Notify “DIGSAFE” at least 3 business days before site activity. Renew every 30 days.
3. Install sediment control perimeter as shown on the plan. This normally consists of silt fence and/or erosion control logs (wattles).
4. Install temporary construction entrance, if shown on plan.
5. Install sedimentation basin, if shown on plan.
6. As needed, cut, stump, clear and grub areas within limit of work.
7. Wood chips generated from clearing activities may be used as a temporary surface stabilization measure in addition to other required controls.
8. Place material stockpiles as far from environmentally sensitive areas as possible.
9. Inactive stockpiles of soil shall be stabilized with erosion control matting or temporary seeding whenever practicable. Surround with silt fence or filter log (“wattle”).
10. When storm inlets are nearby and downgradient, install “silt sacks” around each storm inlet as soon as practicable. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt barrier replaced if torn or damaged. Silt barriers must be easy to remove, replace and/or clean and made of an appropriate material – burlap or woven geotextiles are not appropriate materials.
11. Install Erosion control fabric on all vegetated slopes (greater than 3H:1V).
12. All erosion control measures shall be inspected weekly and after every rainfall event.
13. All erosion control measures shall be maintained, repaired or replaced as required or at the direction of the owner’s engineer, the municipal engineer, or the municipal conservation agent.
14. Sediment accumulation up-gradient of the silt fence greater than 6” in depth, or 40% the height of erosion logs, shall be removed and disposed of in accordance with all applicable regulations. Sediment shall be removed from any sedimentation basin when the sediment depth reaches half the basin’s depth.
15. If soil is tracking off the site via the construction vehicle tires, adjacent roadways shall be kept clean by means of mechanical street sweeping.

16. Dust pollution shall be controlled using water trucks and or approved soil stabilization product.

Section 5 Long-Term Pollution Prevention Plan

In conformance with Standard 4: Water Quality, the following Long-Term Pollution Prevention Plan is offered.

5.1. Project Ownership

Project: Strafford East
 15 Strafford Road, Strafford, NH 03884

Applicant/Owner: Mariner Tower Navigator Properties, LLC
Address: P.O. Box 1160 Kennebunkport, ME 04046
Date: March 2023

5.2. Responsible Party for emergencies:

Owner: Mariner Tower Navigator Properties, LLC
 P.O. Box 1160 Kennebunkport, ME 04046

5.3. Notification Procedures for Change of Responsibility

The Owner of the Stormwater Management System (SMS) for this project is referenced in Section 5 Long-Term Pollution Prevention Plan. The Owner shall be legally responsible for the long-term pollution prevention as well as operation and maintenance of this SMS as outlined in this Operation and Maintenance (O&M) Plan. Should ownership of the SMS change, the Owner will continue to be responsible until the succeeding Owner notifies the Commission or regulating municipal agency that the succeeding owner has assumed such responsibility. Upon subsequent transfers, the responsibility shall continue to be that of transferring Owner until the transferee Owner notifies the regulating municipal agency of its assumption of responsibility.

In the event the SMS will serve multiple lots/owners, such as the subdivision of the existing parcel or creation of lease areas, the Owner(s) shall establish an association or other legally enforceable arrangements under which the association or a single party shall have legal responsibility for the operation and maintenance of the entire SMS. The legal instrument creating such responsibility shall be recorded with the Registry of Deeds and promptly following its recording, a copy thereof shall be furnished to the regulating municipal agency.

5.4. Good Housekeeping Practices

The proposed site improvements have been designed to maintain a high level of water quality treatment for the waters down gradient of the site. Proper use and maintenance of the site for the purpose of reducing downstream impacts include regular street sweeping, and regular inspection and cleaning of the Detention basin, Run-off Diversion Berms, proprietary water quality device, pipe outlet/ditch, and other Best Management Practices in place. Please refer to the following Operation & Maintenance Protocol schedule for further details.

5.5. Storing Materials & Waste Products

All potentially hazardous materials kept on site shall be stored in a neat and orderly fashion in their appropriate containers and under a roof or other secure enclosure. Waste products should be placed in secure receptacles until they are emptied by a licensed solid waste management company.

5.6. Vehicle Washing Controls

Vehicle washing should not occur on site. Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system.

5.7. Inspections and Maintenance BMPs

Regular inspection and maintenance of stormwater infrastructure is essential for long-term protection of the environment and installed BMPs. Please refer to the following Operation & Maintenance Protocol schedule for further details.

5.8. Spill Prevention and Response

Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, herbicides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids outside of the building.

a) Prevention

All potentially hazardous materials kept on site shall be stored in a neat and orderly fashion in their appropriate containers and under a roof or other secure enclosure. Products must be kept in their original containers with the manufacturer's label. All products should be used up before disposing of the container. If excess product remains, it should be disposed of according to the manufacturer's directions in a facility designed to accept the particular class of waste. Never dispose of products directly to the ground or stormwater inlets.

b) Response

Spills should be cleaned up immediately upon discovery. Manufacturer's recommended methods for cleanup shall be followed. The spill area shall be kept well ventilated, and personnel shall wear appropriate protective clothing to prevent injury from contact with a hazardous substance. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.

The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic, and metal trash containers.

Spills of toxic or hazardous material shall be reported, regardless of size, to the NH Department of Environmental Services Waste Management Division, Solid Waste Management Bureau at (603-271-2919).

Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

5.9. Provisions for Maintenance of Landscaped Areas

Lawns, gardens, and other landscaped areas shall be maintained such that surface water flows are not impeded. Special attention is to be paid to the infiltration system intake(s). This is a general guideline towards achieving high quality and well-groomed landscaped areas. Grounds staff / landscape contractor must recognize the shortcomings of a general maintenance plan such as this and modify and/or augment it based on weekly, monthly, and yearly observations.

5.10.Storage and Use of Fertilizers, Herbicides, & Pesticides

All fertilizers, herbicides, and pesticides shall be applied in the minimum amounts recommended by the manufacturer. Storage shall be under a roof or other secure enclosure. The contents of any partially used containers shall be transferred to a sealable plastic container.

a) Fertilizers

Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. Applied fertilizers shall be nitrogen “slow release” and contain no phosphate (such as GreenView Lawn Food, or similar).

b) Herbicides

Applied herbicides shall be eco-friendly or organic (such as FIESTA Turf Weed Killer, or similar). Synthetic chemical controls and pest management applications (when necessary) should be performed only by licensed

applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

c) Pesticides

When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Applied pesticides shall be eco-friendly or organic (such as *AzaGuard Botanical Insecticide/Nematicide*, or similar).

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property, and food. A Pest Management Professional (PMP) will be retained who is licensed with the NH Department of Agriculture, Markets and Food at (603) 271-3551

5.11. Pet Waste Management

Pet waste shall be removed by pet owners within the project area. The pet waste shall be disposed of in accordance with local and state regulations.

5.12. Operation and Management of Septic System

Individual septic systems shall be inspected every 2 to 3 years and pumped according to licensed septage hauler's recommendation.

5.13. Solid Waste Management

Waste products shall be placed in secure receptacles until they are emptied by or transported to a solid waste management company licensed in New Hampshire.

5.14. Snow Disposal and Plowing

Snow cannot be stored in BMPs. Snow will be stockpiled on site within open space areas until the stockpile areas become a hazard to the daily operations of the site. At that point, snow will be disposed of off-site. Snow disposal shall be in accordance with the State of New Hampshire Department of Transportation - Snow Removal general policy.

For more information see:-

<https://www.nh.gov/dot/org/operations/highwaymaintenance/documents/wmsrip.pdf>

In general, snow will be plowed in accordance with standard industry operating procedures.

5.15. Winter Road Salt and/or Sand Use

Snow and ice melt products must be stored in sealed bins under a roof or in a secure container. Sand may be mixed and applied to increase traction. Applied snow melt products shall be eco-friendly (such as Subzero 20 Ice Melt, or similar). Avoid rock salt or products containing urea. Use the minimum amount recommended by the manufacturer and for public safety.

5.16. Street Sweeping

To minimize Total Suspended Solids (TSS) load to the BMPs, where applicable, street sweeping shall be performed. Sweeping early in the spring (before heavy rains occur) and late fall is required and sweeping during dry periods mid-winter is encouraged.

Street sweepings shall be handled according to New Hampshire Department of Environmental Services (NHDES), Regulation RSA 149-M:29, & Disposal of Street Sweepings.

5.17. Illicit Discharge Compliance Statement

Illicit discharges are generally any discharge into a storm system. This is not composed entirely of stormwater. Illicit discharges often include pathogens, nutrients, surfactants, and various toxic pollutants.

No illicit discharges are permitted on site. The Facility Owner is responsible for implementing the Operation and Maintenance Plan and overseeing activities at the facility to prevent illicit discharges to the drainage system from occurring. To achieve this, the owner shall inform staff (particularly maintenance and custodial personnel) that no substance or wash-water can be discharged to the ground, facility managers shall make themselves familiar with the BMPs and stormwater outlets, and an emergency spill kit shall be kept on site.

Should a spill occur, immediate action must be taken to contain the spill, cordon off the area, clean it up immediately and properly dispose of contaminants. The owner shall immediately notify the Conservation Commission, Board of Health, and the local fire department as to the nature and extent of the discharge. ¹²

¹² Additional information on Illicit Discharges can be found under the US EPA's NPDES program:

http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=3.

Section 6 Long-Term Operation & Maintenance Plan

6.1. The following is a description of the Project stormwater management system.

a) Stormwater Collection System

The proposed stormwater collection system utilizes surface flow (“country drainage”) to convey water to the stormwater management system. The majority of the stormwater flows over a proposed gravel driveway and crushed stone surface. All storms flowing over impervious areas will be directed to sediment, stone lined ditches, check dams, and forebay before flowing to the BMP. The BMP has a control structure that meters the outflow via a pipe that directs outflow to a riprap apron Southwest of the infrastructure. An emergency overflow would direct runoff to the Southeast, should the overflow system fail.

Refer to attached plans for locations and system geometry.

b) Proprietary Separator

No proprietary separators are proposed for this project.

c) Proprietary Inlet Filter and Storage

No proprietary filters or storage are proposed for this project.

6.2. Standard Operation & Maintenance Protocol

This section presents the inspection and maintenance procedures associated with the stormwater management system. Inspections and maintenance methods are routine and will require a modest portion of the facility's maintenance budget.

Installation records of the stormwater facilities must be maintained in perpetuity and all maintenance and inspection records must be retained for a minimum three (3) years.

Operation and maintenance of the stormwater system will be provided by the Owner, or their designated representative:

Project: Strafford East NH
 15 Strafford Road, Strafford, NH 03884

Applicant/Owner: Mariner Tower Navigator Properties, LLC
Address: P.O. Box 1160 Kennebunkport, ME 04046

Date: November 2023

6.3. O & M Schedule

The following is a schedule of stormwater components, required maintenance and frequency of necessary actions.

Table 7: O & M Schedule		
Component	Maintenance Required	Frequency
Control Structure	The control structure shall be visually inspected to ensure inlets are clear, internal components are clean and structure is sound.	Quarterly
“ “	Remove sediment from sumps using a vacuum truck or clam shell.	Inspect or clean structure at least four times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the sump of the lowest pipe in the structure. If handling runoff from LUHPPL or discharging runoff near or to a critical area, more frequent cleaning may be necessary.
Sediment Barriers (Silt Fence/ Wattles)	Remove sediment accumulation up- gradient of silt fence greater than 6” in depth or 40% of the height of wattles	Within 24-hours of storm events and every 2 weeks, at a minimum.
Snow Storage	Snow cannot be stored in forebays or the basin. Debris from melted snow piles shall be cleared from the site and properly disposed of at the end of the snow season, and no later than May 15 th	Annually
Component	Maintenance Required	Frequency
Forebays	Inspect for sediment accumulation, erosion or other anomalies.	Inspect sediment forebays monthly and clean them out at least four times per year. Keep the grass height no greater than 6 inches. Set mower blades no lower than 3 to 4 inches.
Infiltration/ Detention Basin	Visual inspection shall be made of the basin’s surface. The infiltration media shall be inspected via the inspection port. If standing water remains 72 hours after last rain event, infiltration interface shall be rehabilitated.	Quarterly for first year. No less than annually thereafter.
Slope Armament and Emergency Overflows	Inspect surface for irregularities. Verify overflow weirs remain at design elevations.	Annually or after an emergency overflow event.

6.4. Operation and Maintenance Log Form

The O & M Log Form

Table 8 O & M Log Form							
Operation & Maintenance Log Form							
Stormwater Management System							
	Type/Location of BMP	Repairs or Other Maintenance Needed? *		Corrective Action Required? *		Date on Which Maintenance or Corrective Action First Identified?	Notes
1.		☐ Yes	☐ No	☐ Yes	☐ No		
2.		☐ Yes	☐ No	☐ Yes	☐ No		
3.		☐ Yes	☐ No	☐ Yes	☐ No		
4.		☐ Yes	☐ No	☐ Yes	☐ No		
5.		☐ Yes	☐ No	☐ Yes	☐ No		
6.		☐ Yes	☐ No	☐ Yes	☐ No		
7.		☐ Yes	☐ No	☐ Yes	☐ No		
8.		☐ Yes	☐ No	☐ Yes	☐ No		
9.		☐ Yes	☐ No	☐ Yes	☐ No		
10.		☐ Yes	☐ No	☐ Yes	☐ No		
* Note: The permit differentiates between conditions requiring repairs and maintenance, and those requiring corrective action. The permit requires maintenance in order to keep controls in effective operating condition and requires repairs if controls are not operating as intended. Corrective actions are triggered only for specific, more serious conditions, which include: 1) A required stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements; 2) You become aware that the stormwater controls you have installed and are maintaining are not effective enough for the discharge to meet applicable water quality standards or applicable requirements; 3) One of the prohibited discharges is occurring or has occurred; or 4) EPA requires corrective actions as a result of a permit violation found during an inspection carried out. If a condition on your site requires a corrective action, you must also fill out a corrective action form.							

6.6. Basin Maintenance Requirements

- Periodic mowing of embankments
- Removal of woody vegetation from embankments
- Removal of debris from outlet structures
- Removal of accumulated sediment
- Inspection and repair of embankments, outlet structures, and appurtenances

6.7. Permeable Gravel Worksheet

The Geogrid permeable Gravel practice worksheet and maintenance requirements follow.



FILTRATION PRACTICE DESIGN CRITERIA (Env-Wq 1508.07)

Type/Node Name:

GEOBLOCK POROUS PAVEMENT - PERMEABLE GRAVEL-P3

Enter the type of filtration practice (e.g., bioretention system) and the node name in the drainage analysis, if applicable.

YES		Check if you reviewed the restrictions on unlined systems outlined in Env-Wq 1508.07(a).	
0.23	ac	A = Area draining to the practice	
0.04	ac	A _I = Impervious area draining to the practice	
0.17	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.20	unitless	R _v = Runoff coefficient = 0.05 + (0.9 x I)	
0.05	ac-in	WQV = 1" x R _v x A	
173	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
43	cf	25% x WQV (check calc for sediment forebay volume)	
130	cf	75% x WQV (check calc for surface sand filter volume)	
FOREBAY		Method of Pretreatment? (not required for clean or roof runoff)	
-	cf	V _{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
Calculate time to drain if system IS NOT underdrained:			
1,778	sf	A _{SA} = Surface area of the practice	
0.20	iph	K _{sat} _{DESIGN} = Design infiltration rate ¹	
		If K _{sat} (prior to factor of safety) is < 0.50 iph, has an underdrain been provided?	
YES	Yes/No	(Use the calculations below)	
5.8	hours	T _{DRAIN} = Drain time = V / (A _{SA} * I _{DESIGN})	≤ 72-hrs
Calculate time to drain if system IS underdrained:			
579.50	ft	E _{WQV} = Elevation of WQV (attach stage-storage table)	
1.21	cfs	Q _{WQV} = Discharge at the E _{WQV} (attach stage-discharge table)	
0.08	hours	T _{DRAIN} = Drain time = 2WQV/Q _{WQV}	≤ 72-hrs
578.77	feet	E _{FC} = Elevation of the bottom of the filter course material ²	
577.77	feet	E _{UD} = Invert elevation of the underdrain (UD), if applicable	
576.43	feet	E _{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
572.76	feet	E _{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
1.00	feet	D _{FC to UD} = Depth to UD from the bottom of the filter course	≥ 1'
6.01	feet	D _{FC to ROCK} = Depth to bedrock from the bottom of the filter course	≥ 1'
2.34	feet	D _{FC to SHWT} = Depth to SHWT from the bottom of the filter course	≥ 1'
579.68	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
581.44	ft	Elevation of the top of the practice	
YES		50 peak elevation ≤ Elevation of the top of the practice	← yes
If a surface sand filter or underground sand filter is proposed:			
YES	ac	Drainage Area check.	< 10 ac
2,395	cf	V = Volume of storage ³ (attach a stage-storage table)	≥ 75%WQV
18.0	inches	D _{FC} = Filter course thickness	18", or 24" if within GPA
Sheet	A-10	Note what sheet in the plan set contains the filter course specification.	
YES	Yes/No	Access grate provided?	← yes

YES	ac	Drainage Area no larger than 5 ac?	← yes
	cf	V = Volume of storage ³ (attach a stage-storage table)	≥ WQV
	inches	D _{FC} = Filter course thickness	18", or 24" if within GPA
Sheet		Note what sheet in the plan set contains the filter course specification	
	:1	Pond side slopes	≥ 3:1
Sheet		Note what sheet in the plan set contains the planting plans and surface cover	
If porous pavement is proposed:			
		Type of pavement proposed (Concrete? Asphalt? Pavers? Etc.)	
	acres	A _{SA} = Surface area of the pervious pavement	
	:1	Ratio of the contributing area to the pervious surface area	≤ 5:1
	inches	D _{FC} = Filter course thickness	12", or 18" if within GPA
Sheet		Note what sheet in the plan set contains the filter course spec.	mod. 304.1 (see spec)

- Designer's Notes:

Maintenance requirements – Permeable Gravel

- Provision of signs is recommended to indicate locations of permeable pavements and the applicability of special maintenance measures.
- No winter sanding of permeable pavements is permitted.
- Minimize application of salt for ice control.
- Never reseal or repave with impermeable materials.
- Inspect annually for pavement deterioration or spalling.
- Monitor periodically to ensure that the pavement surface drains effectively after storms.
- For porous asphalt and concrete, clean periodically (2-4 times per year) using a vacuum sweeper. Power washing may be required prior to vacuum sweeping, to dislodge trapped particles.
- For interlocking paving stones, periodically add joint material to replace lost material.
- For seeded grid systems, periodic reseeding of grass pavers to fill in bare spots.
- Major clogging may necessitate replacement of pavement surface, and possibly filter course and sub-base course.

Section 7 Supplemental Information & Plans

7.6. Locus Map

7.7. Subcatchment Areas: Existing

7.8. Subcatchment Areas: Proposed Conditions

**7.9. Storm & Sanitary Analysis Worksheets:
Existing & Proposed Conditions**

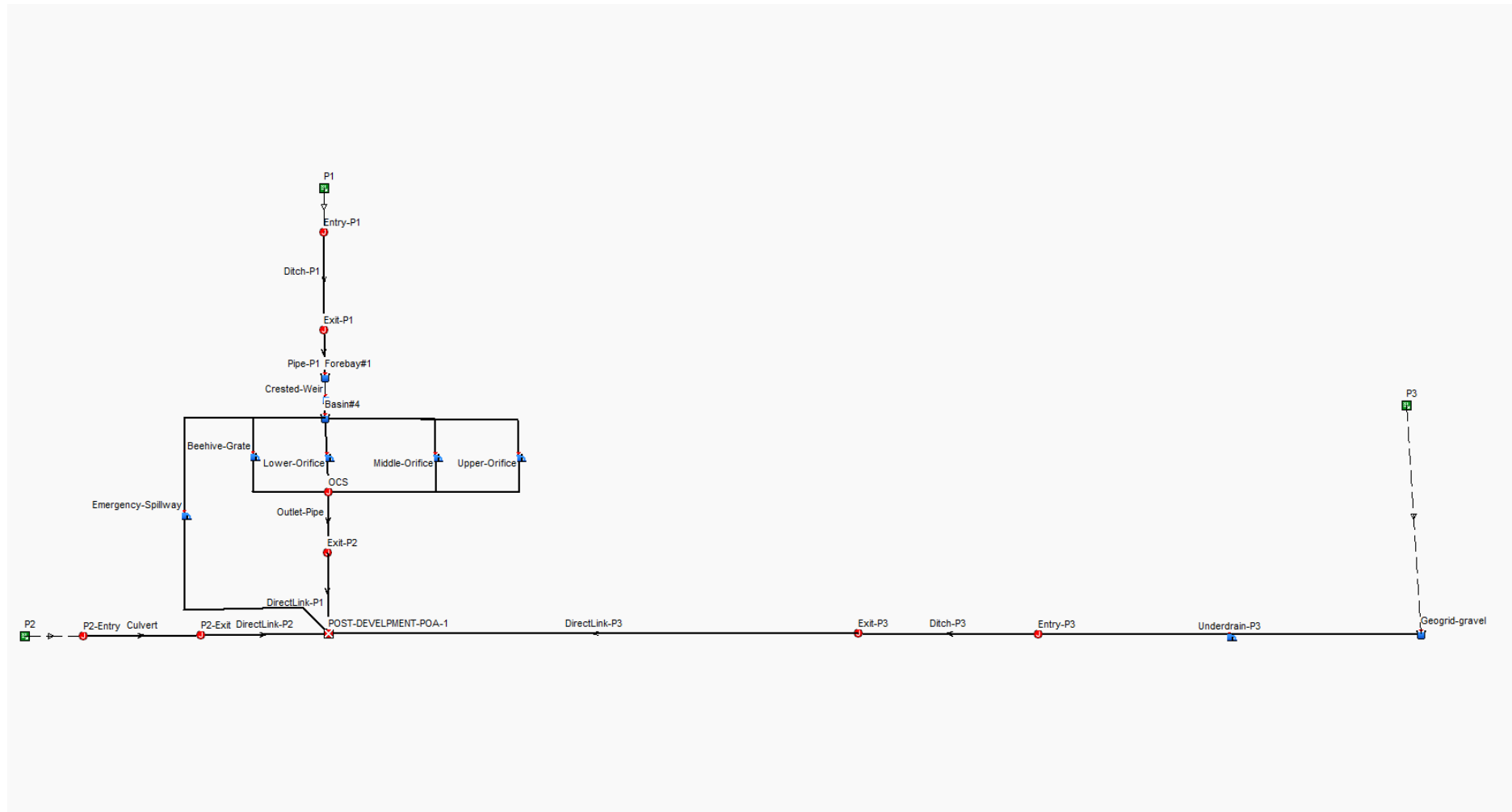
7.10. NRCS Soils Report

7.6. Locus Map



7.6.1. Pre / Post condition nodes & link modeling plan:

Existing & Proposed Conditions nodes & links routing follows.



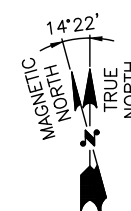
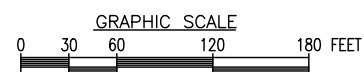
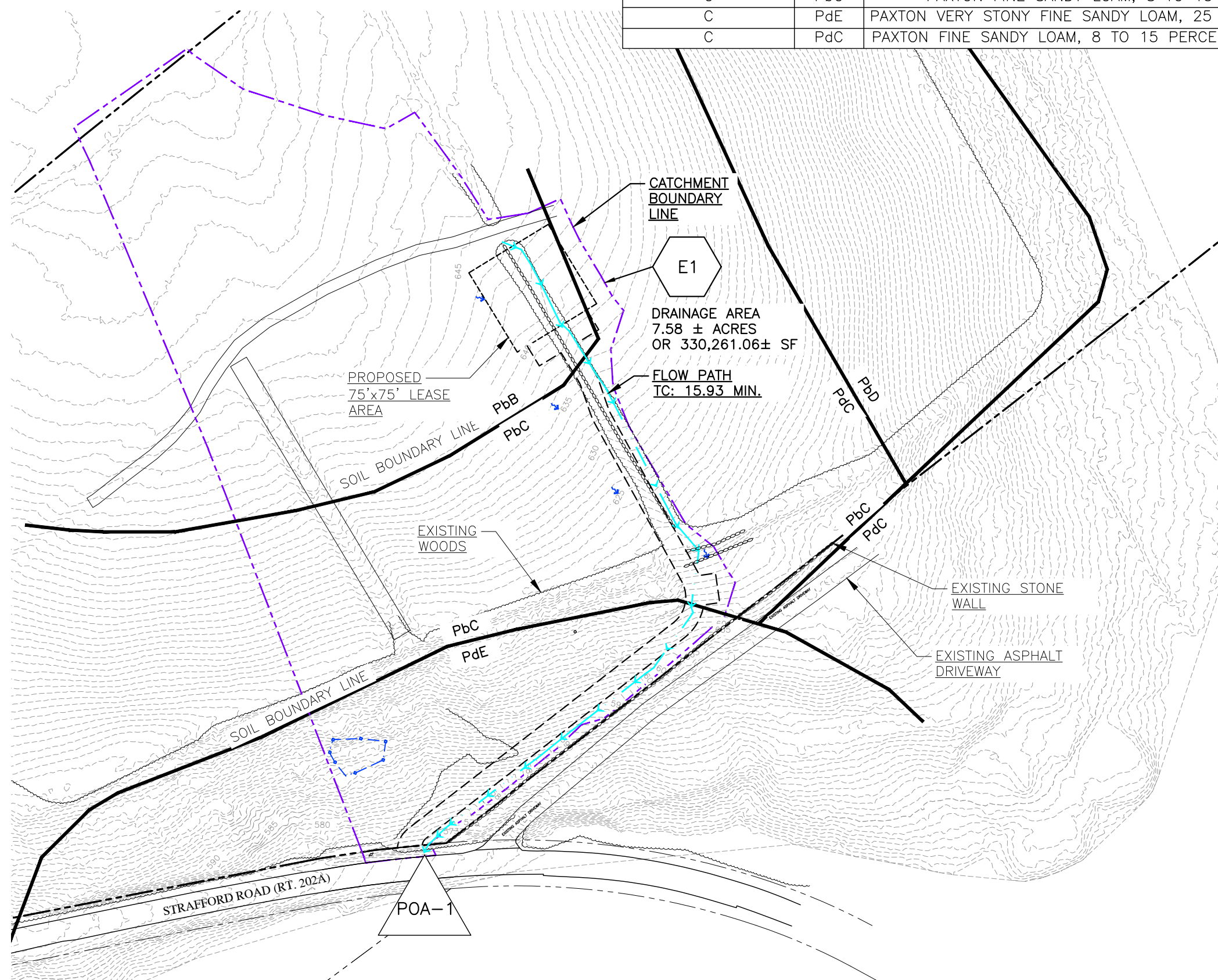
7.7. Subcatchment Areas: Existing Conditions

The sketch of Existing Conditions subcatchments follows.

LEGEND

	PROPERTY LINE – SUBJECT PARCEL
	ABUTTERS PROPERTY LINE
	EXISTING CONTOUR LINE
	EXISTING TREE LINE
	BARBED WIRE FENCE REMAINS
	OVERHEAD WIRE (TRANSMISSION LINE)
	EXISTING CHAIN LINK FENCE
	EXISTING UNDERGROUND SEWER LINE
	DELINEATED WETLAND LINE
	EXISTING BUILDING
	PROPOSED EQUIPMENT CONCRETE PAD
	CATCH BASIN
	CONIFEROUS TREE
	DECIDUOUS TREE
	EXISTING GROUND WELL
	EXISTING SEWER MANHOLE
	STONEWALL
	WELL
	UTILITY POLE
	PROPOSED UTILITY POLE
	PROPOSED LIMIT OF TREE CLEARANCE
	PROPOSED CONTOUR LINE
	PROPOSED CONSTRUCTION SILT SOCK
	LIMIT OF DISTURBANCE
	PROPOSED TOWER
	CATCHMENTS AREA
	POINT OF ANALYSIS
	EXISTING CATCHMENT BOUNDARY LINE
	PROPOSED CATCHMENT BOUNDARY LINE

NRCS SOIL TYPE	HSG	DESCRIPTION
C	PbB	PAXTON FINE SANDY LOAM, 3 TO 8 PERCENT SLOPES
C	PbC	PAXTON FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES
C	PdE	PAXTON VERY STONY FINE SANDY LOAM, 25 TO 60 PERCENT SLOPES
C	PdC	PAXTON FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES, VERY STONY



DRAWING NO.: D-1	SCALE: 1" = 60'
---------------------	--------------------

SITE NAME:
STRAFFORD EAST

SITE ADDRESS:
15 STRAFFORD
ROADSTRAFFORD, NH 03884

2	11/17/23	REVISED CATCHMENT AREAS	SLY
1	07/31/23	REVISED DRIVEWAY & BMP	SLY
0	3/27/23	ISSUED FOR USE	SLY
REV.	DATE	DESCRIPTION	BY



MARINER
TOWER

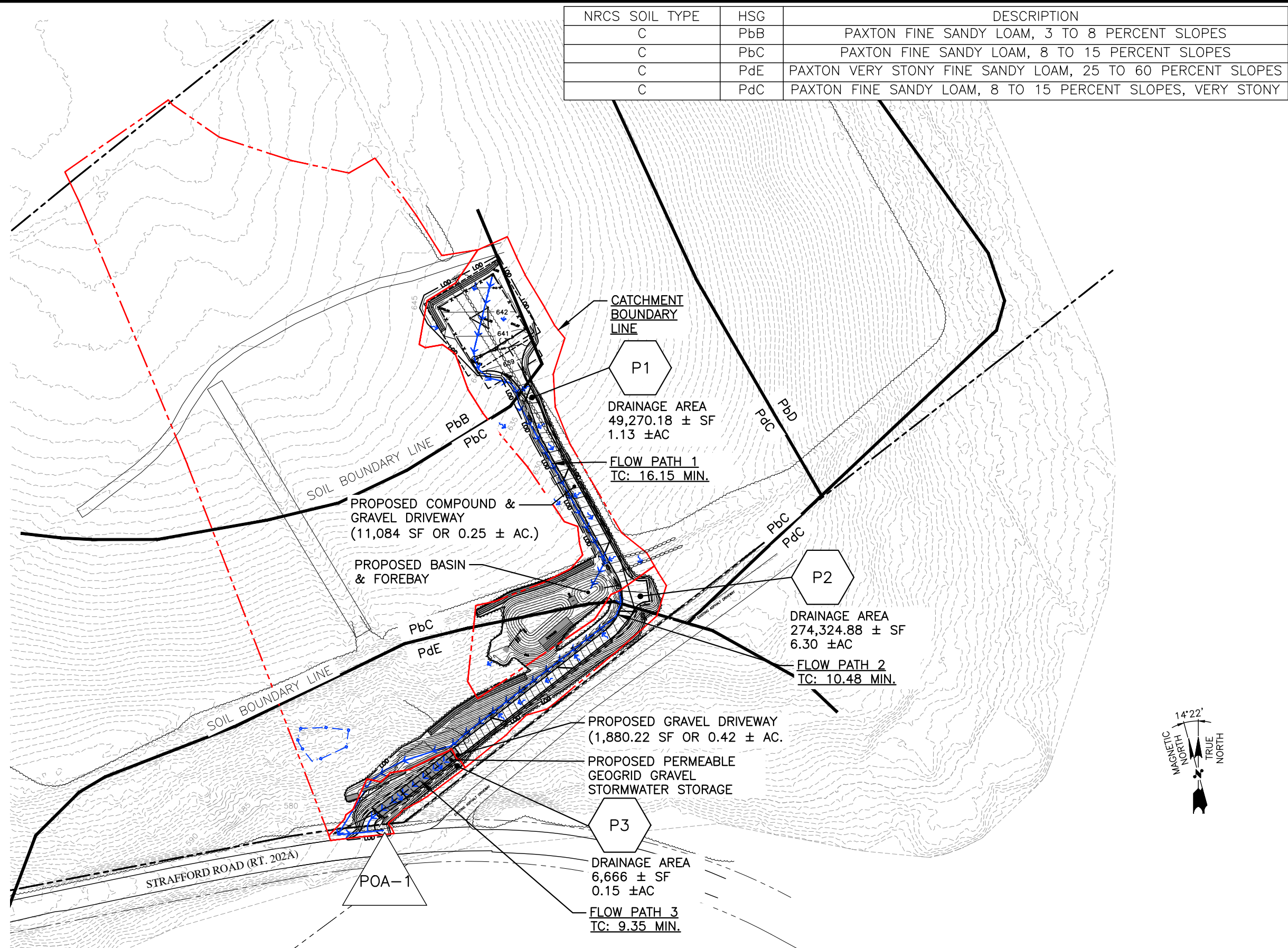
Navigator Properties, LLC
P.O. BOX 1160, KENNEBUNKPORT, ME 04046

7.8. Subcatchment Areas: Proposed Conditions

The sketch of Proposed Conditions subcatchments follows.

LEGEND

	PROPERTY LINE – SUBJECT PARCEL
	ABUTTERS PROPERTY LINE
	EXISTING CONTOUR LINE
	EXISTING TREE LINE
	BARBED WIRE FENCE REMAINS
	OVERHEAD WIRE (TRANSMISSION LINE)
	EXISTING CHAIN LINK FENCE
	EXISTING UNDERGROUND SEWER LINE
	DELINEATED WETLAND LINE
	EXISTING BUILDING
	PROPOSED EQUIPMENT CONCRETE PAD
	CATCH BASIN
	CONIFEROUS TREE
	DECIDUOUS TREE
	EXISTING GROUND WELL
	EXISTING SEWER MANHOLE
	STONEWALL
	WELL
	UTILITY POLE
	PROPOSED UTILITY POLE
	PROPOSED LIMIT OF TREE CLEARANCE
	PROPOSED CONSTRUCTION SILT SOCK
	LIMIT OF DISTURBANCE
	PROPOSED TOWER
	CATCHMENTS AREA
	POINT OF ANALYSIS
	EXISTING CATCHMENT BOUNDARY LINE
	PROPOSED CATCHMENT BOUNDARY LINE



GRAPHIC SCALE



A horizontal scale bar with vertical tick marks at 0, 30, 60, 120, and 180. The numbers are placed above the tick marks. The word "FEET" is at the right end of the bar.

TITLE SHEET:
PROPOSED CONDITIONS
DRAINAGE PLAN

DRAWING NO.: D-2	SCALE: 1" = 60'
---------------------	--------------------

SITE NAME:
STRAFFORD EAST

SITE ADDRESS:
15 STRAFFORD
ROADSTRAFFORD, NH 03884

2	11/17/23	REVISED CATCHMENT AREAS	SLY
1	07/31/23	REVISED DRIVEWAY & BMP	SLY
0	3/27/23	ISSUED FOR USE	SLY
REV.	DATE	DESCRIPTION	BY

TEP
NORTHEAST
TEP OPCO, LLC.
5 BEECHWOOD DRIVE, NORTH ANDOVER, MA 01845
TEL: (978) 557-5553

PREPARED FOR:	
---------------	--



Navigator Properties, LLC
P.O. BOX 1160, KENNEBUNKPORT, ME 04046

7.9. Stormwater and Sanitary Analysis Worksheets: Existing and Proposed Conditions

Stormwater and Sanitary Analysis data output follows.

Project Description

File Name NAV-31 Pre 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 1
Nodes..... 2
 Junctions 1
 Outfalls 1
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 1
 Channels 0
 Pipes 1
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	1-Inch Storm	Cumulative	inches	New Hampshire	Strafford	1.00	1.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	E1	7.58	484.00	86.59	1.00	0.21	1.61	1.71	0 00:15:55

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	Junction	570.00	570.10	570.10	570.10	0.00	0.00	570.00	0.00	0.10	0 00:00	0.00	0.00
2	Pre-Developments	Outfall	570.00					1.70	570.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	Dummy02	Pipe	Dummy01	Pre-Developments	237.22	0.00	570.00	-240.2800	0.000	0.0150	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Subbasin Hydrology

Subbasin : E1

Input Data

Area (ac) 7.58
 Peak Rate Factor 484
 Weighted Curve Number 86.59
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Woods & grass combination, Poor	1.94	C	82
Fallow, crop residue, Good	5.36	C	88
Pasture, grassland, or range, Poor	0.01	C	86
Fallow, crop residue, Good	0.16	C	88
Gravel roads	0.12	C	96
Composite Area & Weighted CN	7.59		86.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3})) * (S_f^{0.5}) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

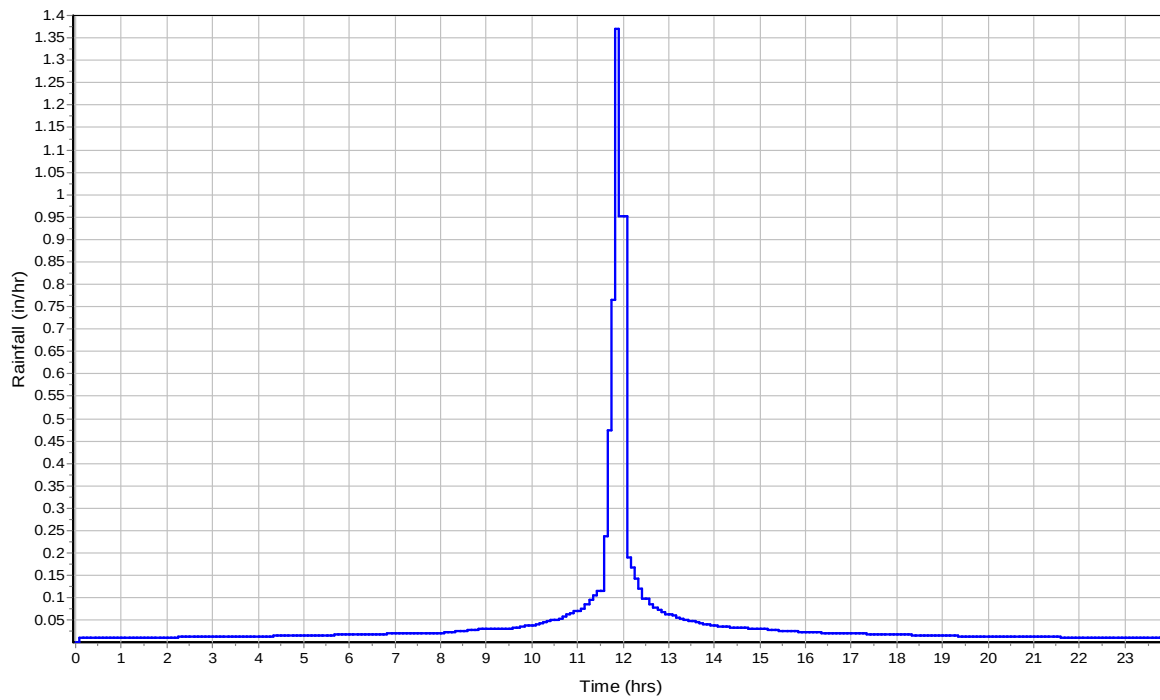
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	4	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.12	0	0
Computed Flow Time (min) :	13.35	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	757.65	0	0
Slope (%) :	9.24	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.9	0	0
Computed Flow Time (min) :	2.58	0	0
Total TOC (min)15.93			

Subbasin Runoff Results

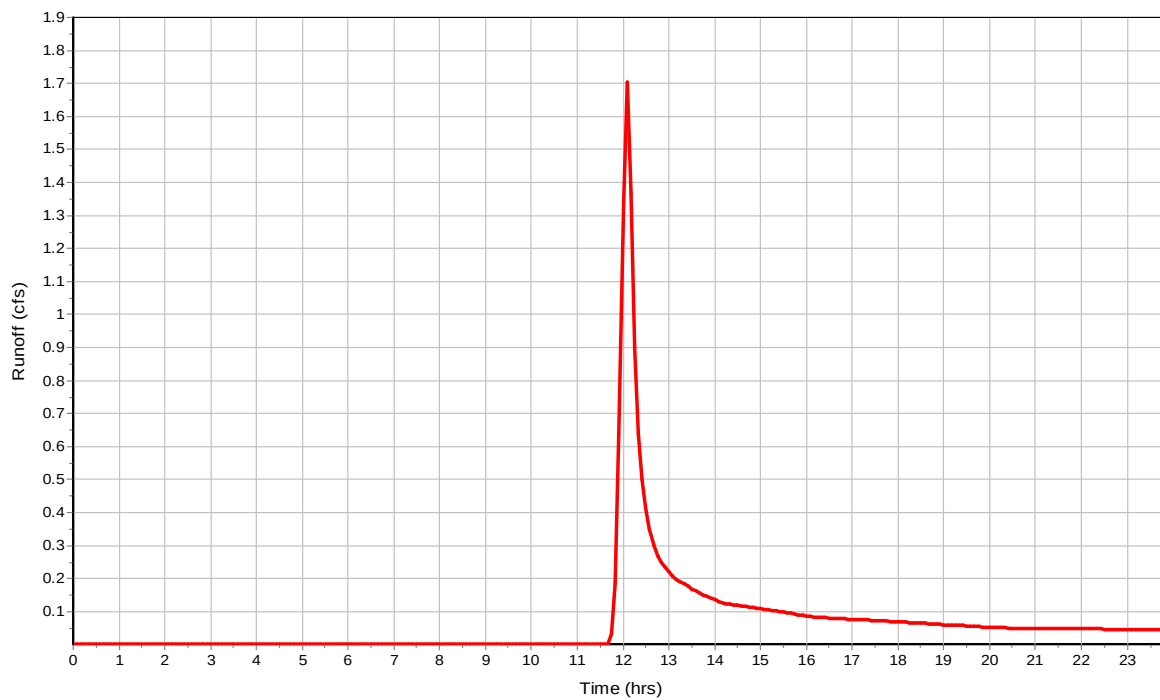
Total Rainfall (in)	1
Total Runoff (in)	0.21
Peak Runoff (cfs)	1.71
Weighted Curve Number	86.59
Time of Concentration (days hh:mm:ss)	0 00:15:56

Subbasin : E1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1 Dummy01	570.00	570.10	0.10	570.10	0.10	570.10	0.00	0.00	0.00

Junction Results

SN	Element	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	ID	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	0.00	0.00	570.00	0.00	0.00	0.10	570.00	0.00	0 00:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	No. of Barrels
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)		
1	Dummy02	237.22	0.00	-570.00	570.00	0.00	-570.00	-240.2800	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 Dummy02	0.00	0 00:00	0.00	0.00	0.00		0.00	0.00	0.00		

Project Description

File Name NAV-31 Pre 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 1
Nodes..... 2
 Junctions 1
 Outfalls 1
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 1
 Channels 0
 Pipes 1
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	2-Year	Cumulative	inches	New Hampshire	Strafford	2.00	3.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	E1	7.58	484.00	86.59	3.00	1.71	12.94	15.71	0 00:15:55

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	Junction	570.00	570.10	570.10	570.10	0.00	0.00	570.00	0.00	0.10	0 00:00	0.00	0.00
2	Pre-Developments	Outfall	570.00					15.27	570.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	Dummy02	Pipe	Dummy01	Pre-Developments	237.22	0.00	570.00	-240.2800	0.000	0.0150	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Subbasin Hydrology

Subbasin : E1

Input Data

Area (ac) 7.58
 Peak Rate Factor 484
 Weighted Curve Number 86.59
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Woods & grass combination, Poor	1.94	C	82
Fallow, crop residue, Good	5.36	C	88
Pasture, grassland, or range, Poor	0.01	C	86
Fallow, crop residue, Good	0.16	C	88
Gravel roads	0.12	C	96
Composite Area & Weighted CN	7.59		86.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3})) * (S_f^{0.5}) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

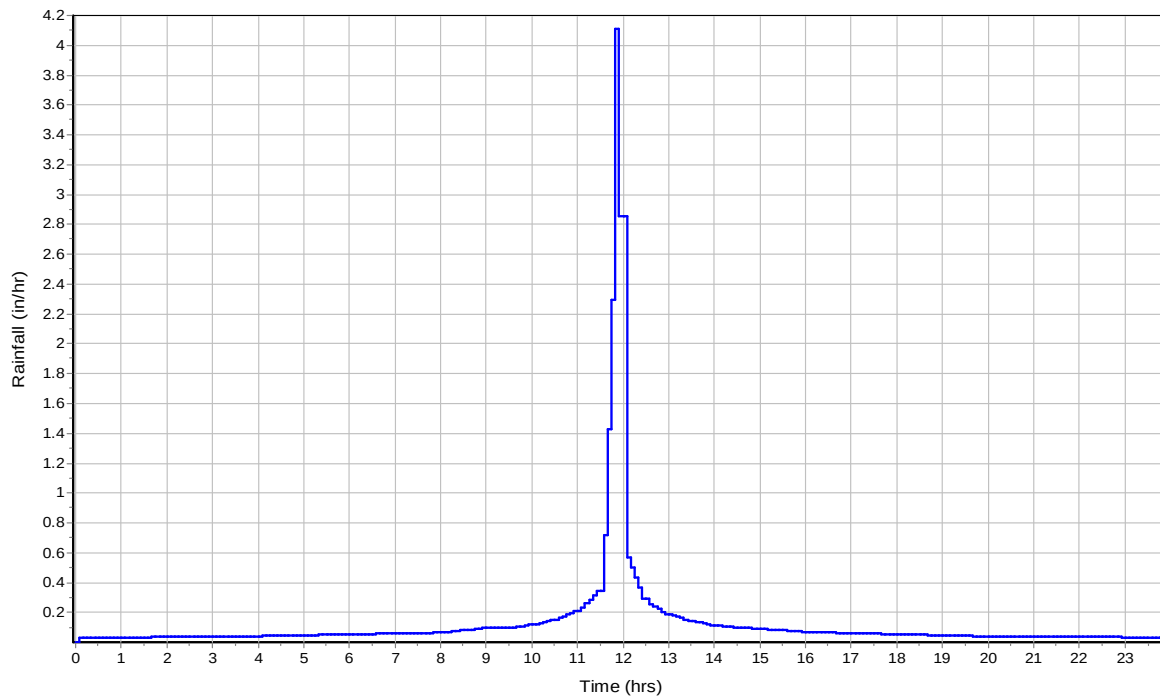
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	4	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.12	0	0
Computed Flow Time (min) :	13.35	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	757.65	0	0
Slope (%) :	9.24	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.9	0	0
Computed Flow Time (min) :	2.58	0	0
Total TOC (min)15.93			

Subbasin Runoff Results

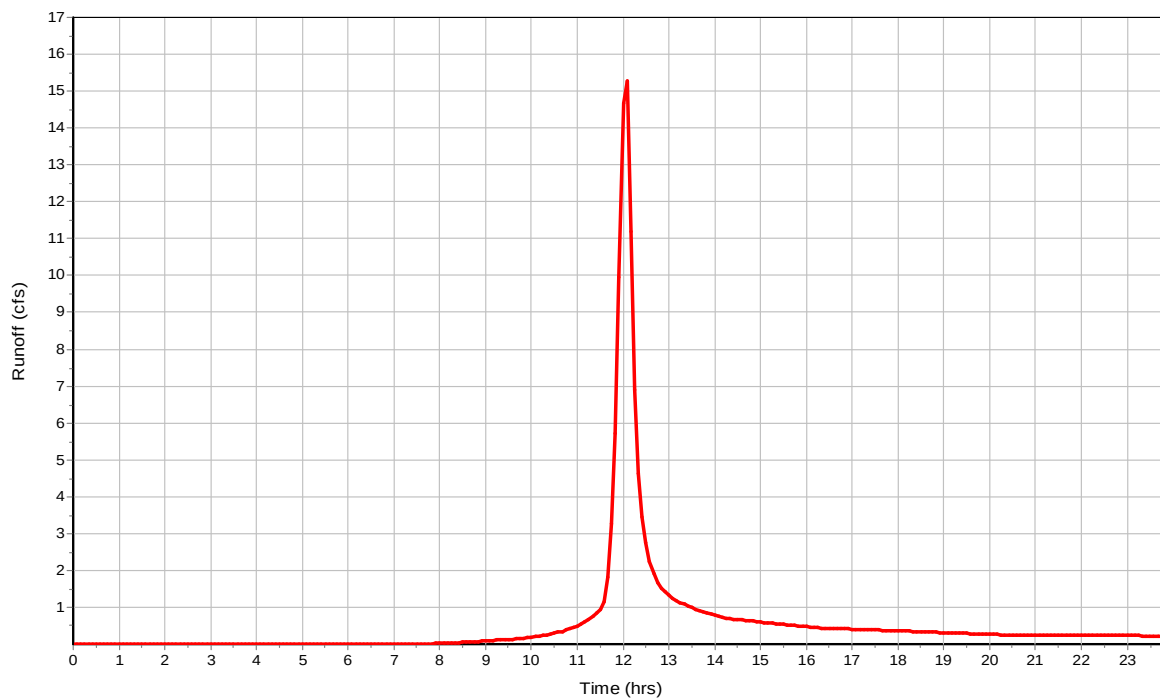
Total Rainfall (in)	3
Total Runoff (in)	1.71
Peak Runoff (cfs)	15.71
Weighted Curve Number	86.59
Time of Concentration (days hh:mm:ss)	0 00:15:56

Subbasin : E1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Dummy01	570.00	570.10	0.10	570.10	0.10	570.10	0.00	0.00	0.00

Junction Results

SN	Element	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	ID	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	0.00	0.00	570.00	0.00	0.00	0.10	570.00	0.00	0 00:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	No. of Barrels
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)		
1	Dummy02	237.22	0.00	-570.00	570.00	0.00	-570.00	-240.28	000 Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Dummy02	0.00	0 00:00	0.00	0.00	0.00		0.00	0.00	0.00		

Project Description

File Name NAV-31 Pre 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	10-Year	Cumulative	inches	New Hampshire	Strafford	10.00	4.30	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	E1	7.58	484.00	86.59	4.30	2.88	21.80	26.15	0 00:15:55

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	Junction	570.00	570.10	570.10	570.10	0.00	0.00	570.00	0.00	0.10	0 00:00	0.00	0.00
2	Pre-Developments	Outfall	570.00					25.27	570.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	Dummy02	Pipe	Dummy01	Pre-Developments	237.22	0.00	570.00	-240.2800	0.000	0.0150	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Subbasin Hydrology

Subbasin : E1

Input Data

Area (ac) 7.58
 Peak Rate Factor 484
 Weighted Curve Number 86.59
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Woods & grass combination, Poor	1.94	C	82
Fallow, crop residue, Good	5.36	C	88
Pasture, grassland, or range, Poor	0.01	C	86
Fallow, crop residue, Good	0.16	C	88
Gravel roads	0.12	C	96
Composite Area & Weighted CN	7.59		86.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

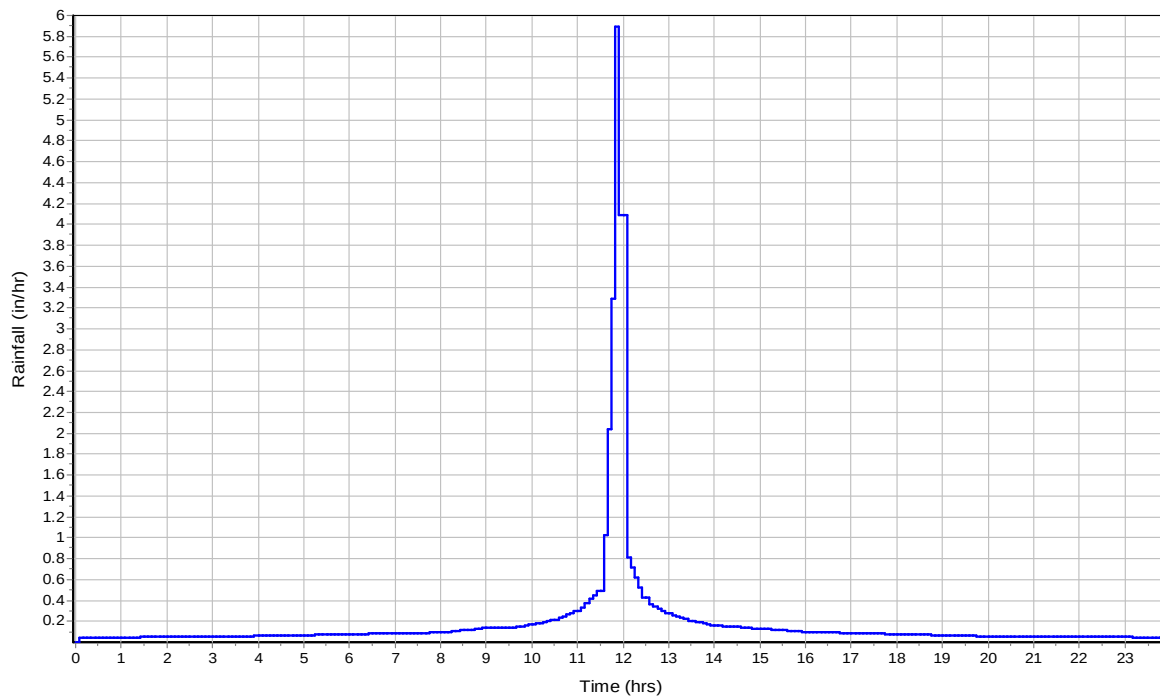
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	4	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.12	0	0
Computed Flow Time (min) :	13.35	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	757.65	0	0
Slope (%) :	9.24	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.9	0	0
Computed Flow Time (min) :	2.58	0	0
Total TOC (min)15.93			

Subbasin Runoff Results

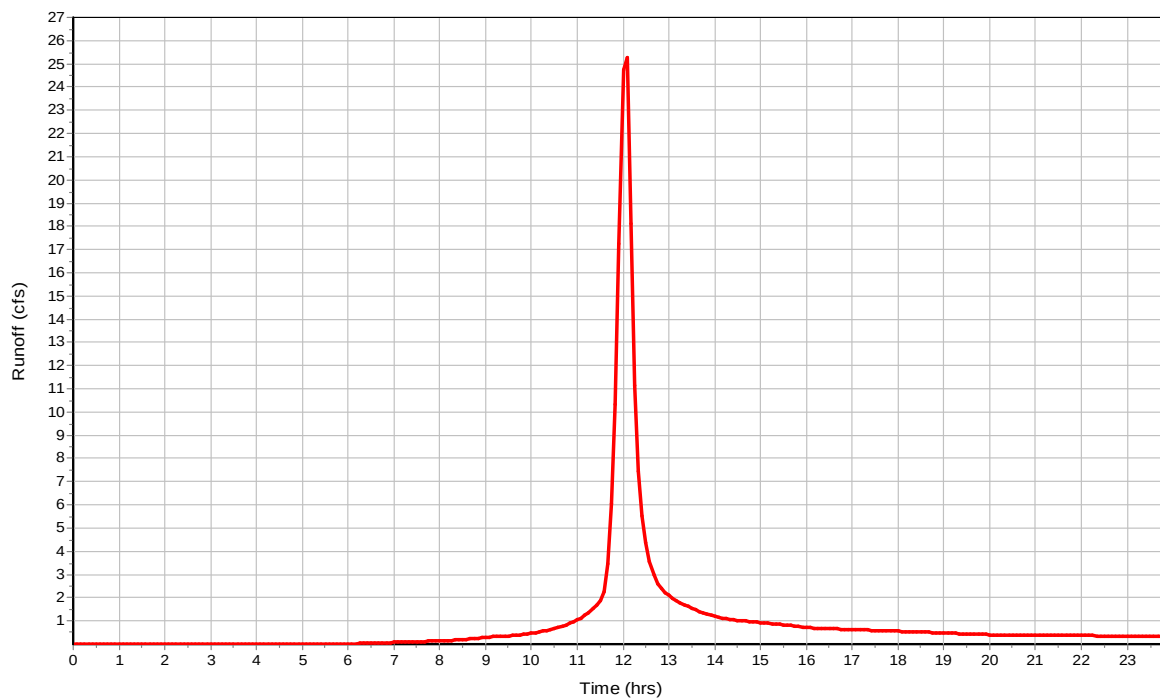
Total Rainfall (in)	4.3
Total Runoff (in)	2.88
Peak Runoff (cfs)	26.15
Weighted Curve Number	86.59
Time of Concentration (days hh:mm:ss)	0 00:15:56

Subbasin : E1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Dummy01	570.00	570.10	0.10	570.10	0.10	570.10	0.00	0.00	0.00

Junction Results

SN	Element	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	ID	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	0.00	0.00	570.00	0.00	0.00	0.10	570.00	0.00	0 00:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	No. of Barrels
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)		
1	Dummy02	237.22	0.00	-570.00	570.00	0.00	-570.00	-240.28	000 Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Dummy02	0.00	0 00:00	0.00	0.00	0.00		0.00	0.00	0.00		

Project Description

File Name NAV-31 Pre 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 1
Nodes..... 2
 Junctions 1
 Outfalls 1
 Flow Diversions 0
 Inlets 0
 Storage Nodes 0
Links..... 1
 Channels 0
 Pipes 1
 Pumps 0
 Orifices 0
 Weirs 0
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	25-year	Cumulative	inches	New Hampshire	Strafford	25.00	5.10	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	E1	7.58	484.00	86.59	5.10	3.62	27.45	32.65	0 00:15:55

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	Junction	570.00	570.10	570.10	570.10	0.00	0.00	570.00	0.00	0.10	0 00:00	0.00	0.00
2	Pre-Developments	Outfall	570.00					31.45	570.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	Dummy02	Pipe	Dummy01	Pre-Developments	237.22	0.00	570.00	-240.2800	0.000	0.0150	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Subbasin Hydrology

Subbasin : E1

Input Data

Area (ac) 7.58
 Peak Rate Factor 484
 Weighted Curve Number 86.59
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Woods & grass combination, Poor	1.94	C	82
Fallow, crop residue, Good	5.36	C	88
Pasture, grassland, or range, Poor	0.01	C	86
Fallow, crop residue, Good	0.16	C	88
Gravel roads	0.12	C	96
Composite Area & Weighted CN	7.59		86.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3})) * (S_f^{0.5}) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

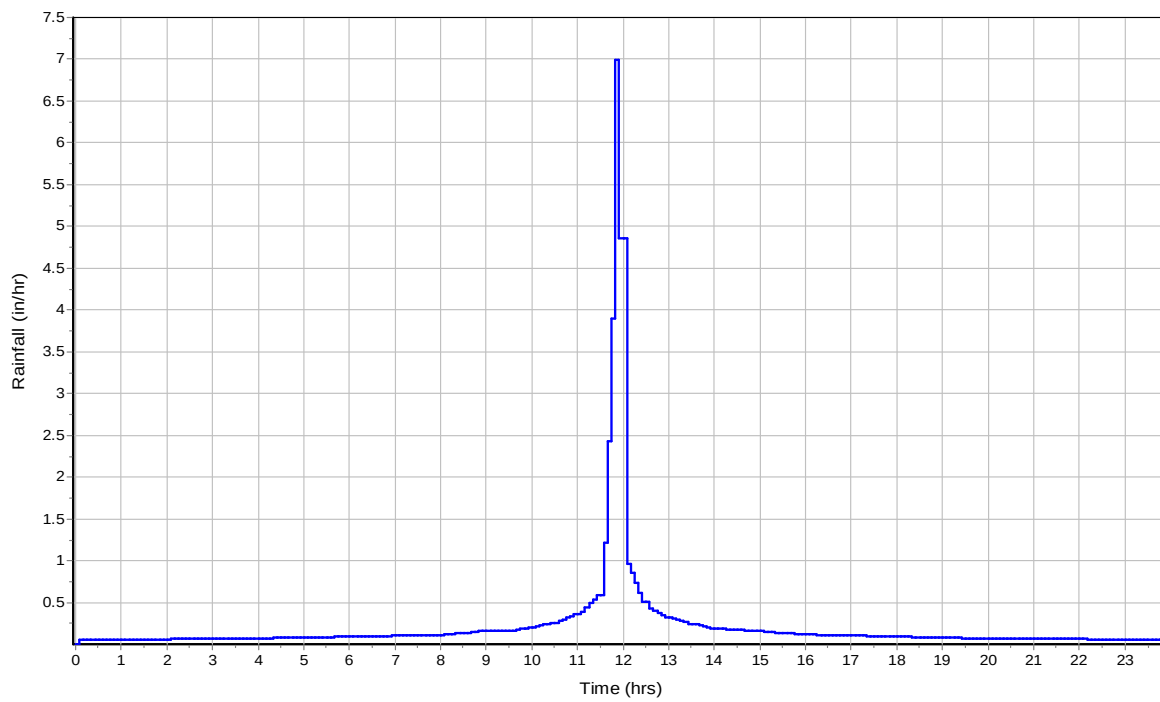
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	4	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.12	0	0
Computed Flow Time (min) :	13.35	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	757.65	0	0
Slope (%) :	9.24	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.9	0	0
Computed Flow Time (min) :	2.58	0	0
Total TOC (min)	15.93		

Subbasin Runoff Results

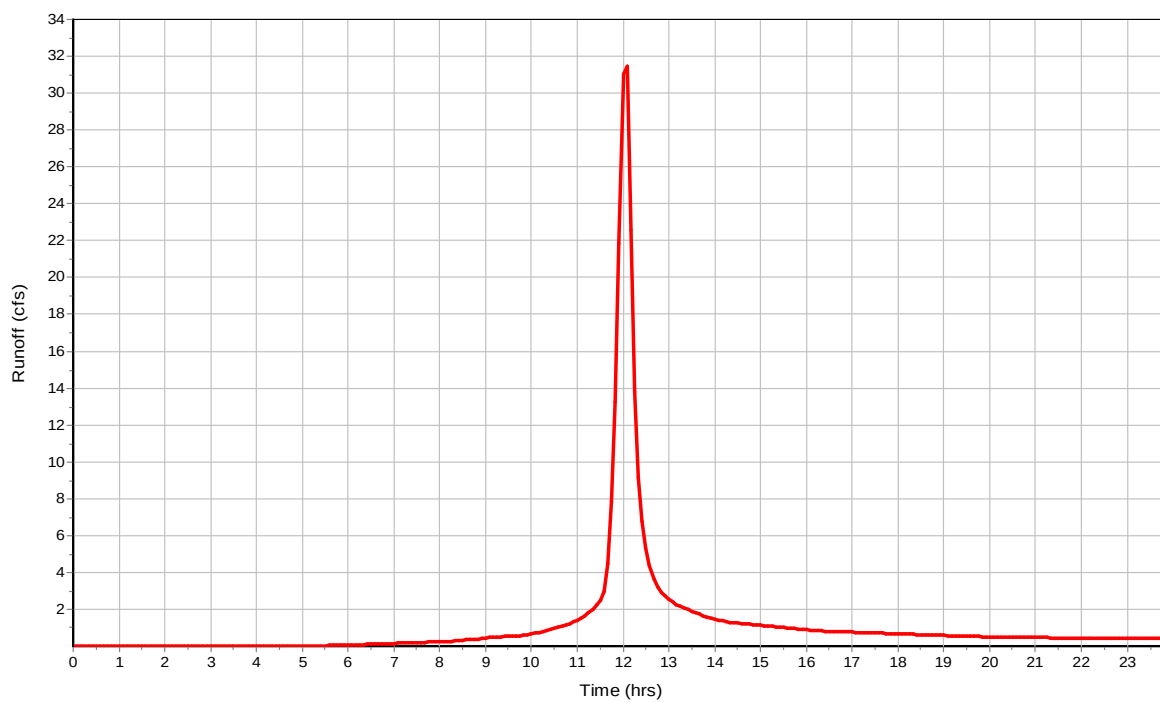
Total Rainfall (in)	5.1
Total Runoff (in)	3.62
Peak Runoff (cfs)	32.65
Weighted Curve Number	86.59
Time of Concentration (days hh:mm:ss)	0 00:15:56

Subbasin : E1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Dummy01	570.00	570.10	0.10	570.10	0.10	570.10	0.00	0.00	0.00

Junction Results

SN	Element	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	ID	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	0.00	0.00	570.00	0.00	0.00	0.10	570.00	0.00	0 00:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	No. of Barrels
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)		
1	Dummy02	237.22	0.00	-570.00	570.00	0.00	-570.00	-240.28	000 Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 Dummy02	0.00	0 00:00	0.00	0.00	0.00		0.00	0.00	0.00		

Project Description

File Name NAV-31 Pre 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	50-Year	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
		(ac)			(in)	(in)	(ac-in)		
1	E1	7.58	484.00	86.59	5.60	4.09	31.02	36.71	0 00:15:55

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	Junction	570.00	570.10	570.10	570.10	0.00	0.00	570.00	0.00	0.10	0 00:00	0.00	0.00
2	Pre-Developments	Outfall	570.00					35.36	570.00					

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	Dummy02	Pipe	Dummy01	Pre-Developments	237.22	0.00	570.00	-240.2800	0.000	0.0150	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Subbasin Hydrology

Subbasin : E1

Input Data

Area (ac) 7.58
 Peak Rate Factor 484
 Weighted Curve Number 86.59
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Woods & grass combination, Poor	1.94	C	82
Fallow, crop residue, Good	5.36	C	88
Pasture, grassland, or range, Poor	0.01	C	86
Fallow, crop residue, Good	0.16	C	88
Gravel roads	0.12	C	96
Composite Area & Weighted CN	7.59		86.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

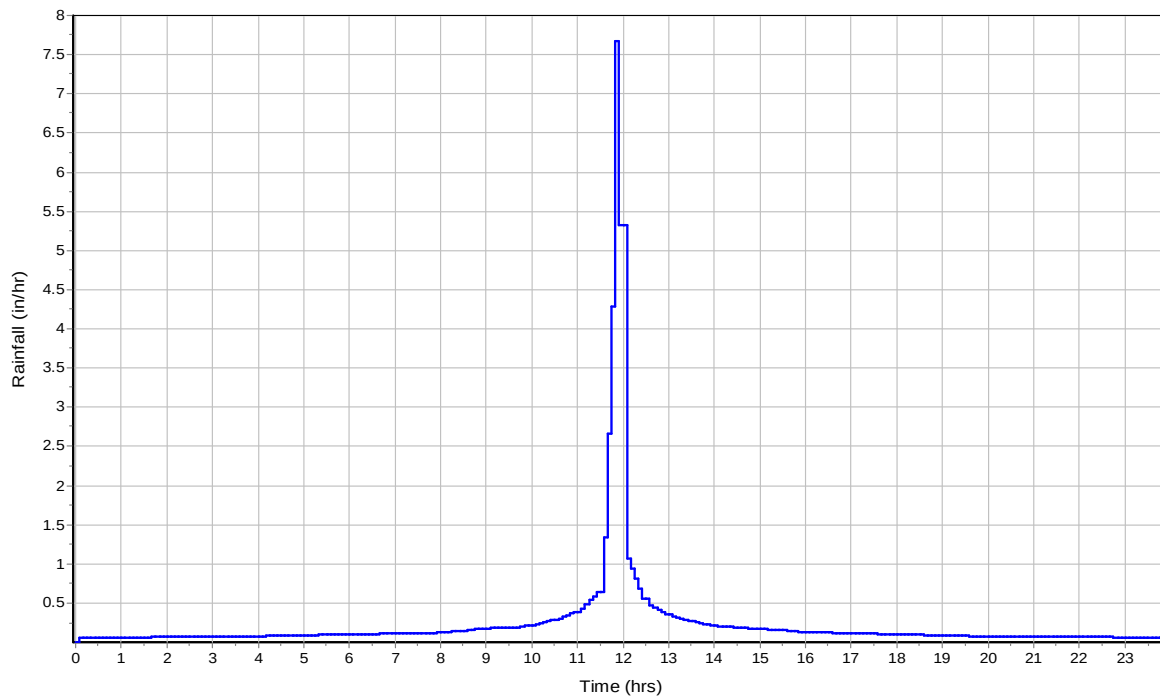
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	4	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.12	0	0
Computed Flow Time (min) :	13.35	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	757.65	0	0
Slope (%) :	9.24	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.9	0	0
Computed Flow Time (min) :	2.58	0	0
Total TOC (min)15.93			

Subbasin Runoff Results

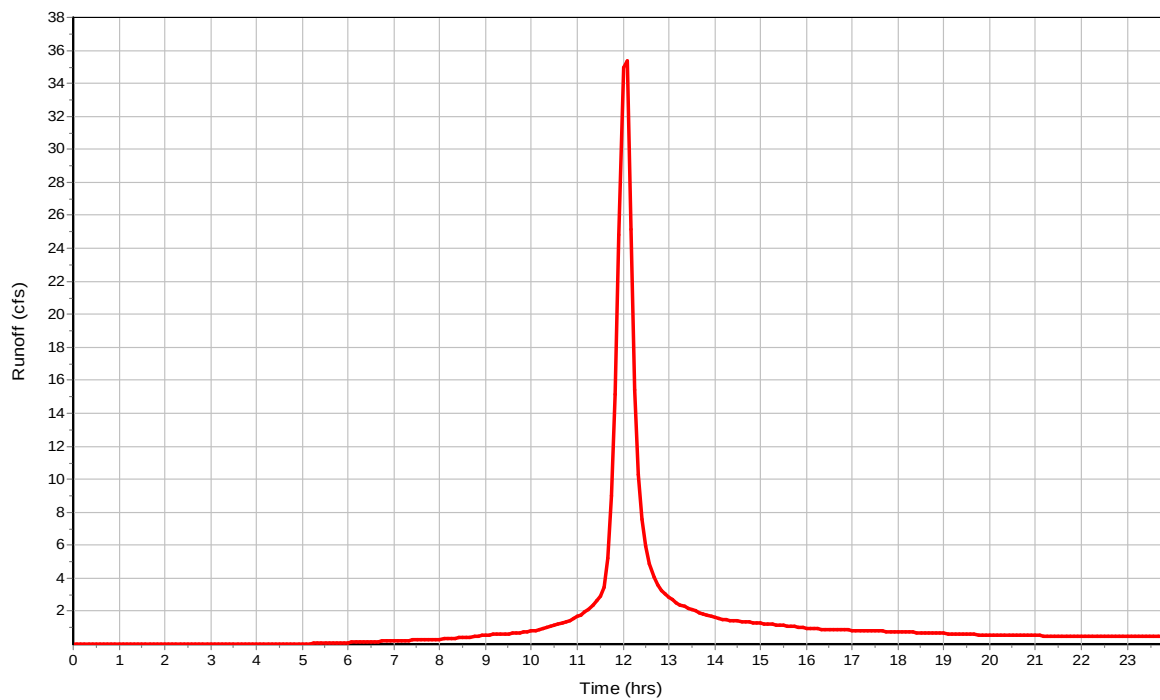
Total Rainfall (in)	5.6
Total Runoff (in)	4.09
Peak Runoff (cfs)	36.71
Weighted Curve Number	86.59
Time of Concentration (days hh:mm:ss)	0 00:15:56

Subbasin : E1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1 Dummy01	570.00	570.10	0.10	570.10	0.10	570.10	0.00	0.00	0.00

Junction Results

SN	Element	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	ID	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	0.00	0.00	570.00	0.00	0.00	0.10	570.00	0.00	0 00:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flap Flow Gate (cfs)	No. of Barrels
1	Dummy02	237.22	0.00	-570.00	570.00	0.00	-570.00	-240.28	00 Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00 No	1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 Dummy02	0.00	0 00:00	0.00	0.00	0.00		0.00	0.00	0.00		

Project Description

File Name NAV-31 Pre 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	1
Nodes.....	2
<i>Junctions</i>	1
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	0
Links.....	1
<i>Channels</i>	0
<i>Pipes</i>	1
<i>Pumps</i>	0
<i>Orifices</i>	0
<i>Weirs</i>	0
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	100-year	Cumulative	inches	New Hampshire	Strafford	100.00	6.30	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate Factor	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
		(ac)			(in)	(in)	(ac-in)		
1	E1	7.58	484.00	86.59	6.30	4.76	36.09	42.37	0 00:15:55

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	Junction	570.00	570.10	570.10	570.10	0.00	0.00	570.00	0.00	0.10	0 00:00	0.00	0.00
2	Pre-Developments	Outfall	570.00					40.84	570.00					

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1	Dummy02	Pipe	Dummy01	Pre-Developments	237.22	0.00	570.00	-240.2800	0.000	0.0150	0.00	0.00	0.00	0.00	0.00	0.00

Subbasin Hydrology

Subbasin : E1

Input Data

Area (ac) 7.58
 Peak Rate Factor 484
 Weighted Curve Number 86.59
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Woods & grass combination, Poor	1.94	C	82
Fallow, crop residue, Good	5.36	C	88
Pasture, grassland, or range, Poor	0.01	C	86
Fallow, crop residue, Good	0.16	C	88
Gravel roads	0.12	C	96
Composite Area & Weighted CN	7.59		86.59

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3})) * (S_f^{0.5}) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

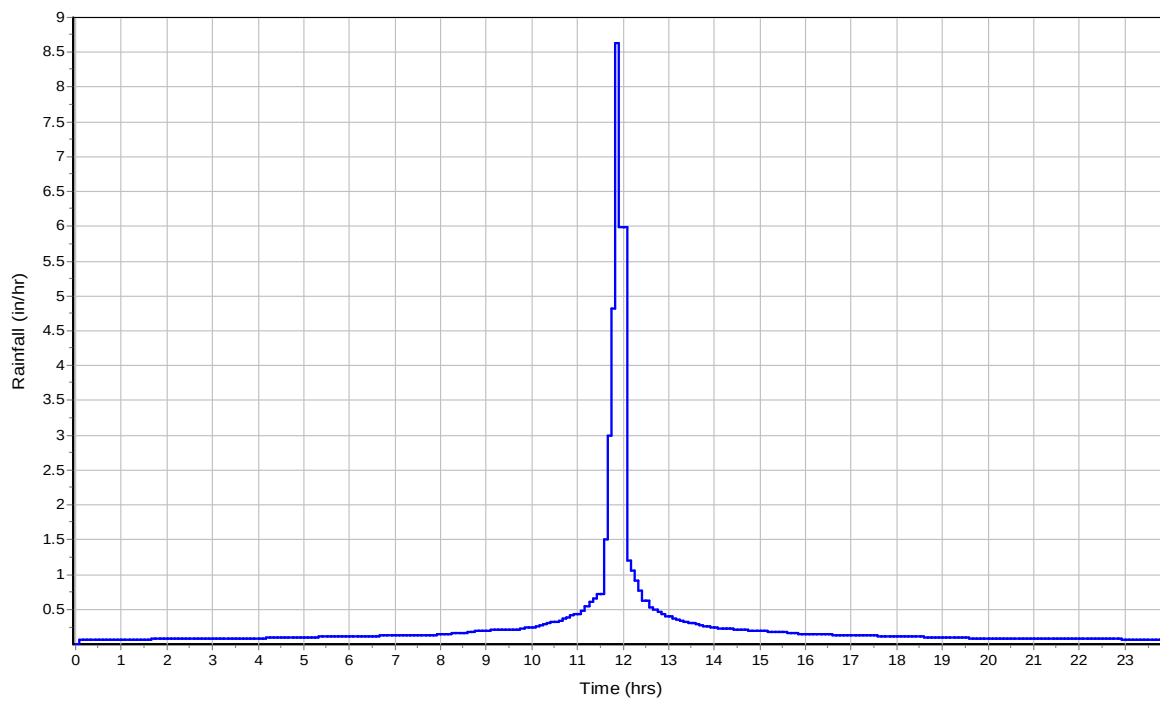
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	4	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.12	0	0
Computed Flow Time (min) :	13.35	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	757.65	0	0
Slope (%) :	9.24	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.9	0	0
Computed Flow Time (min) :	2.58	0	0
Total TOC (min)15.93			

Subbasin Runoff Results

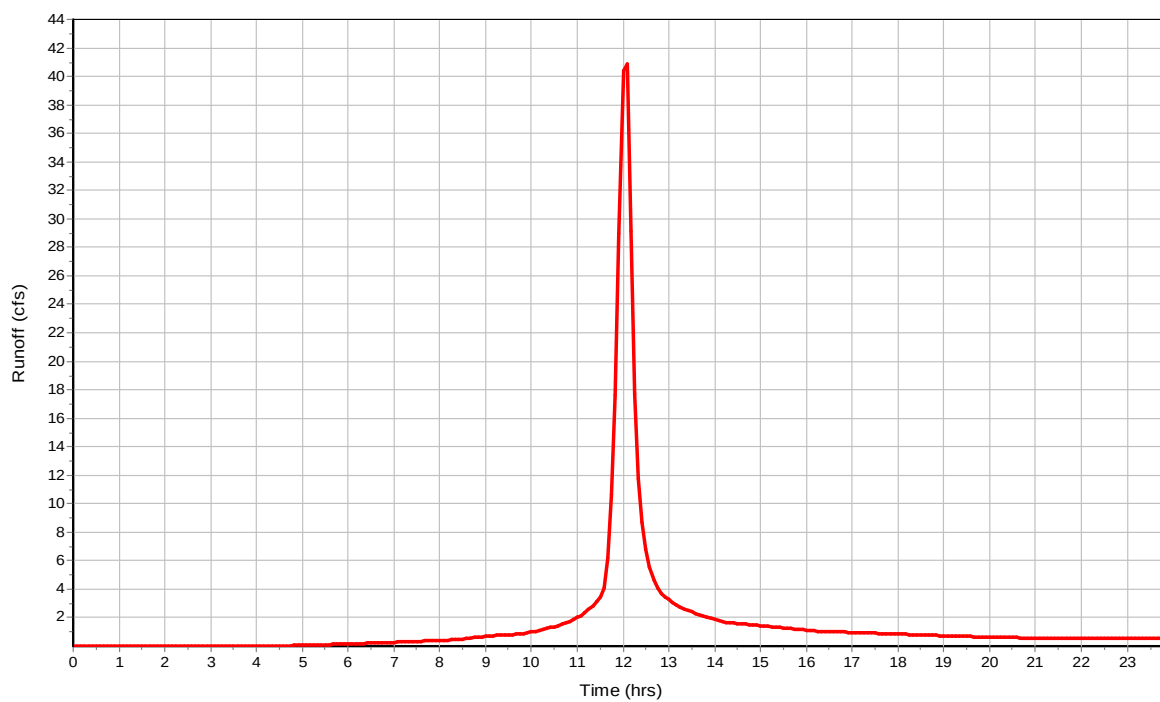
Total Rainfall (in)	6.3
Total Runoff (in)	4.76
Peak Runoff (cfs)	42.37
Weighted Curve Number	86.59
Time of Concentration (days hh:mm:ss)	0 00:15:56

Subbasin : E1

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Dummy01	570.00	570.10	0.10	570.10	0.10	570.10	0.00	0.00	0.00

Junction Results

SN	Element	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
	ID	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Dummy01	0.00	0.00	570.00	0.00	0.00	0.10	570.00	0.00	0 00:00	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	No. of Barrels
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)		
1	Dummy02	237.22	0.00	-570.00	570.00	0.00	-570.00	-240.28	000 Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No	1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Dummy02	0.00	0 00:00	0.00	0.00	0.00		0.00	0.00	0.00		

Project Description

File Name NAV-31 Post 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 3
Nodes..... 12
 Junctions 8
 Outfalls 1
 Flow Diversions 0
 Inlets 0
 Storage Nodes 3
Links..... 15
 Channels 2
 Pipes 6
 Pumps 0
 Orifices 5
 Weirs 2
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	1-Inch Storm	Cumulative	inches	New Hampshire	Strafford	1.00	1.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	P1	1.13	484.00	84.84	6.30	4.57	5.17	6.10	0 00:16:08
2	P2	6.30	484.00	86.93	6.30	4.80	30.21	39.88	0 00:10:28
3	P3	0.15	484.00	82.68	6.30	4.33	0.66	0.92	0 00:09:21

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	Junction	637.00	638.50	637.00	638.50	0.00	5.89	637.40	0.00	1.10	0 00:00	0.00	0.00
2	Entry-P3	Junction	583.04	584.54	583.04	584.54	0.00	0.51	583.13	0.00	1.41	0 00:00	0.00	0.00
3	Exit-P1	Junction	614.00	615.50	614.00	615.50	0.00	5.87	614.55	0.00	0.95	0 00:00	0.00	0.00
4	Exit-P2	Junction	608.60	610.10	608.60	610.10	0.00	1.86	609.03	0.00	1.07	0 00:00	0.00	0.00
5	Exit-P3	Junction	570.00	571.50	570.00	571.50	0.00	0.51	570.09	0.00	1.41	0 00:00	0.00	0.00
6	OCS	Junction	609.00	613.54	609.00	613.54	0.00	1.86	609.43	0.00	4.11	0 00:00	0.00	0.00
7	P2-Entry	Junction	566.94	569.44	566.94	569.44	0.00	39.53	568.97	0.00	0.47	0 00:00	0.00	0.00
8	P2-Exit	Junction	566.50	569.00	566.50	569.00	0.00	39.49	568.53	0.00	0.47	0 00:00	0.00	0.00
9	POST-DEVELPMENT-POA-1	Outfall	570.00					40.64	570.00					
10	Basin#4	Storage Node	609.00	614.00	609.00		0.00	5.87	613.61				0.00	0.00
11	Forebay#1	Storage Node	611.00	614.00	611.00		0.00	5.87	613.31				0.00	0.00
12	Geogrid-gravel	Storage Node	583.04	584.06	583.04		0.00	0.90	583.57				0.00	0.00

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 Culvert	Pipe	P2-Entry	P2-Exit	35.00	566.94	566.50	1.2600	30.000	0.0150	39.49	39.86	0.99	9.27	2.03	0.81	0.00 Calculated
2 DirectLink-P1	Pipe	Exit-P2	POST-DEVELOPMENT-POA-1	19.95	0.00	0.00	0.0000	0.000	0.0150	1.86	0.00	0.99	0.00	2.03	0.81	0.00 Calculated
3 DirectLink-P2	Pipe	P2-Exit	POST-DEVELOPMENT-POA-1	102.72	0.00	570.00	-554.9100	0.000	0.0150	39.49	0.00	0.99	0.00	2.03	0.81	0.00 Calculated
4 DirectLink-P3	Pipe	Exit-P3	POST-DEVELOPMENT-POA-1	52.90	0.00	0.00	0.0000	0.000	0.0150	0.51	0.00	0.99	0.00	2.03	0.81	0.00 Calculated
5 Outlet-Pipe	Pipe	OCS	Exit-P2	30.00	609.00	608.60	1.3300	18.000	0.0150	1.86	10.51	0.18	4.48	0.42	0.28	0.00 Calculated
6 Pipe-P1	Pipe	Exit-P1	Forebay#1	20.00	614.00	613.00	5.0000	18.000	0.0150	5.87	20.36	0.29	9.96	0.55	0.37	0.00 Calculated
7 Ditch-P1	Channel	Entry-P1	Exit-P1	278.32	637.00	614.00	8.2600	18.000	0.0320	5.87	62.44	0.09	6.13	0.40	0.27	0.00
8 Ditch-P3	Channel	Entry-P3	Exit-P3	163.00	583.04	570.00	8.0000	18.000	0.0320	0.51	61.44	0.01	2.58	0.09	0.06	0.00
9 Beehive-Grate	Orifice	Basin#4	OCS		609.00	609.00		21.250		0.38						
10 Lower-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.67						
11 Middle-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.52						
12 Underdrain-P3	Orifice	Geogrid-gravel	Entry-P3		583.04	583.04		6.000		0.51						
13 Upper-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.29						
14 Crested-Weir	Weir	Forebay#1	Basin#4		611.00	609.00				5.87						
15 Emergency-Spillway	Weir	Basin#4	POST-DEVELOPMENT-POA-1		609.00	570.00				2.42						

Subbasin Hydrology

Subbasin : P1

Input Data

Area (ac) 1.13
 Peak Rate Factor 484
 Weighted Curve Number 84.84
 Rain Gage ID

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Gravel roads	0.25	C	96
> 75% grass cover, Good	0.25	C	74
Fallow, crop residue, Good	0.27	C	88
Woods & grass combination, Poor	0.36	C	82
Composite Area & Weighted CN	1.13		84.84

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

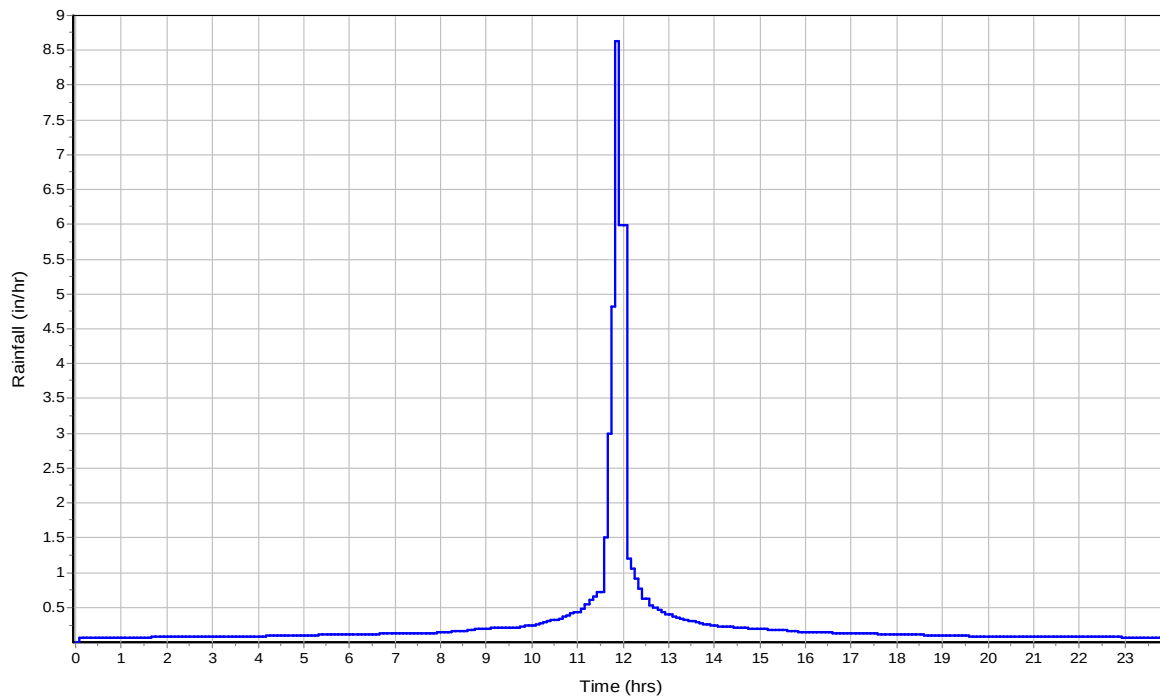
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	3	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.98	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	332.7668	0	0
Slope (%) :	8.71	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.76	0	0
Computed Flow Time (min) :	1.17	0	0
Total TOC (min)	16.15		

Subbasin Runoff Results

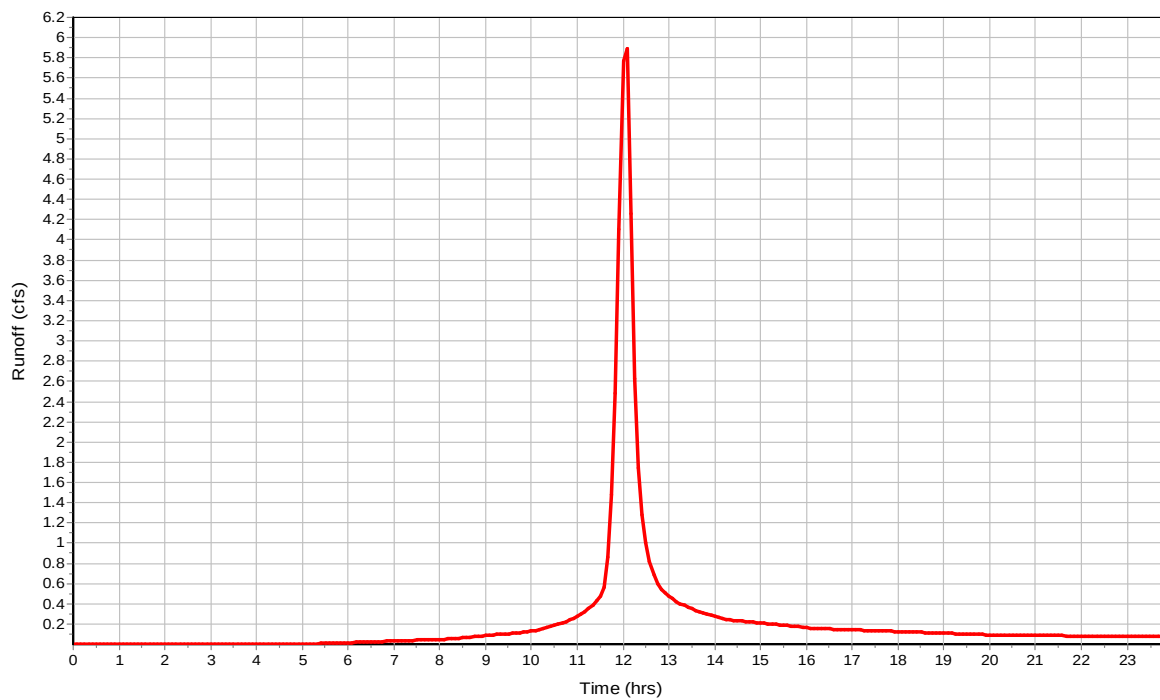
Total Rainfall (in)	6.3
Total Runoff (in)	4.57
Peak Runoff (cfs)	6.1
Weighted Curve Number	84.84
Time of Concentration (days hh:mm:ss)	0 00:16:09

Subbasin : P1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P2**Input Data**

Area (ac) 6.3
 Peak Rate Factor 484
 Weighted Curve Number 86.93
 Rain Gage ID

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.1	C	96
> 75% grass cover, Good	0.22	C	74
Woods & grass combination, Poor	0.97	C	82
Fallow, bare soil	0.16	C	91
Gravel roads	0.12	C	96
Fallow, crop residue, Good	4.73	C	88
Composite Area & Weighted CN	6.3		86.93

Time of Concentration

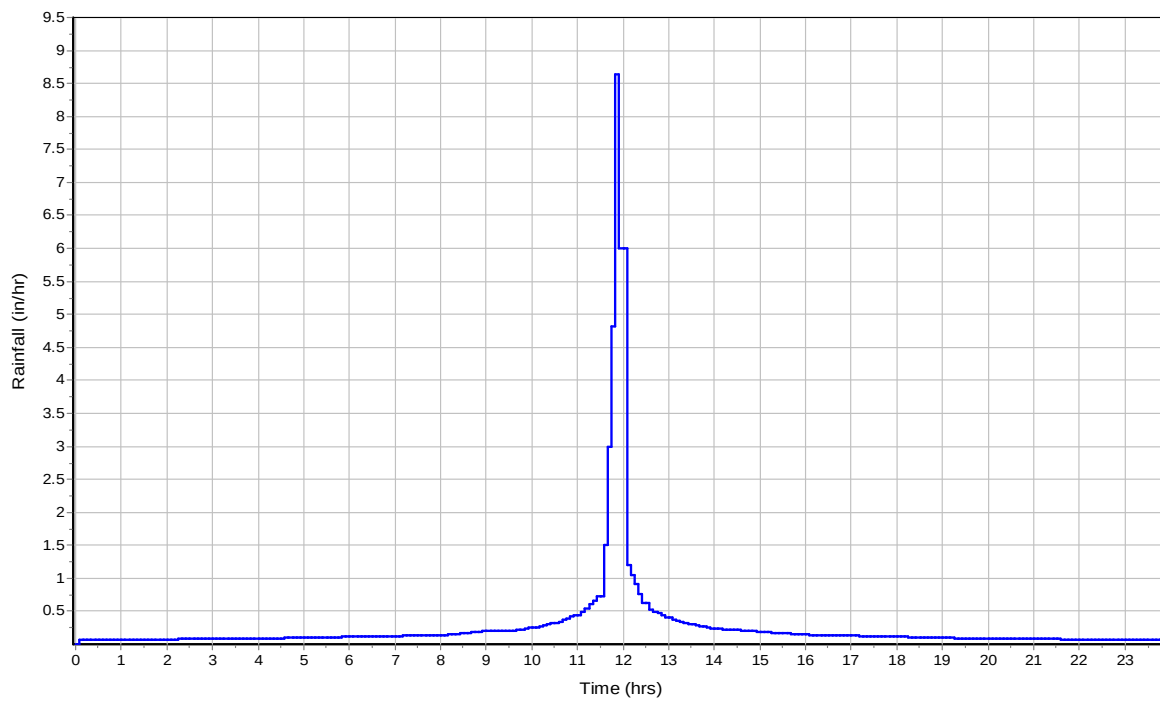
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	359.0728	0	0
Slope (%) :	9.2	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.89	0	0
Computed Flow Time (min) :	1.22	0	0
Total TOC (min)10.48			

Subbasin Runoff Results

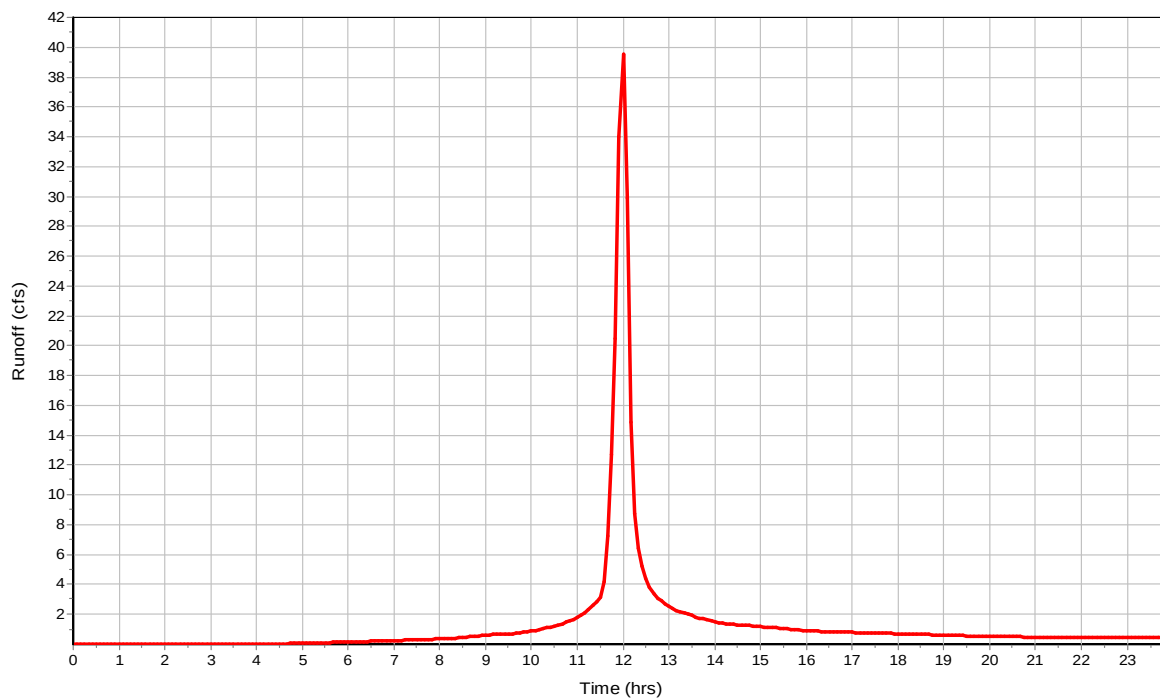
Total Rainfall (in) 6.3
 Total Runoff (in) 4.8
 Peak Runoff (cfs) 39.88
 Weighted Curve Number 86.93
 Time of Concentration (days hh:mm:ss) 0 00:10:29

Subbasin : P2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P3**Input Data**

Area (ac) 0.15
 Peak Rate Factor 484
 Weighted Curve Number 82.68
 Rain Gage ID

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.04	C	96
> 75% grass cover, Good	0.07	C	74
Woods & grass combination, Poor	0.03	C	82
Pasture, grassland, or range, Poor	0.01	C	86
Composite Area & Weighted CN	0.15		82.68

Time of Concentration

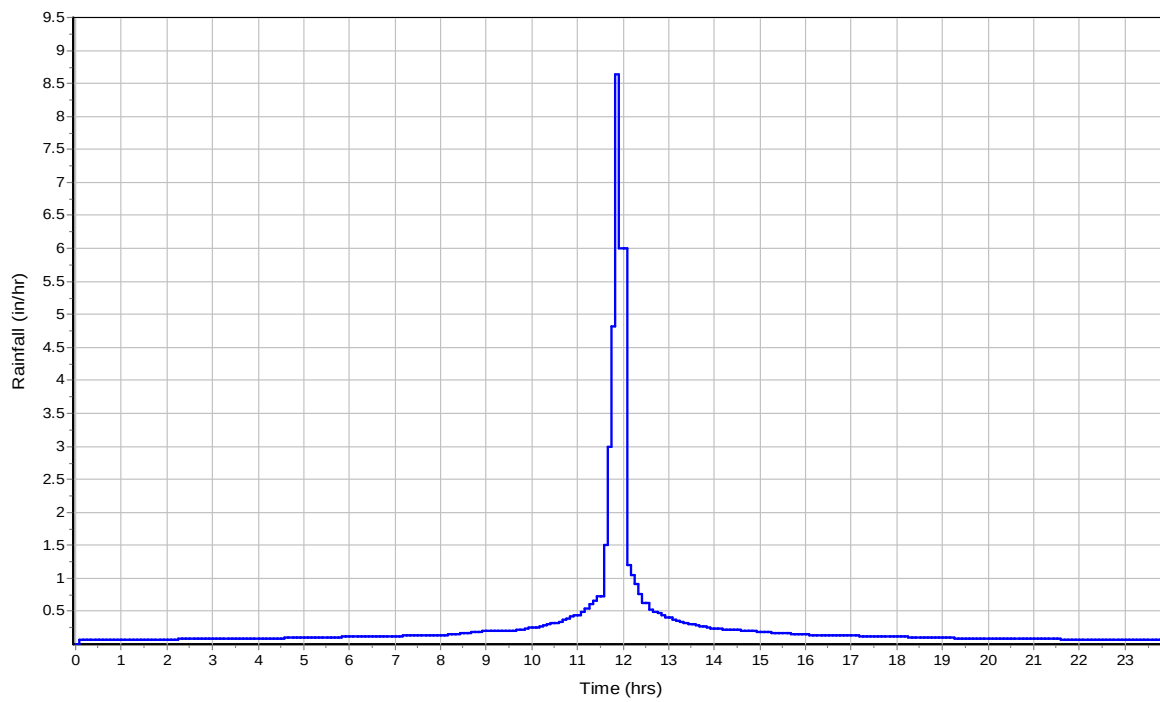
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	26.4558	0	0
Slope (%) :	7.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.45	0	0
Computed Flow Time (min) :	0.1	0	0
Total TOC (min)9.35			

Subbasin Runoff Results

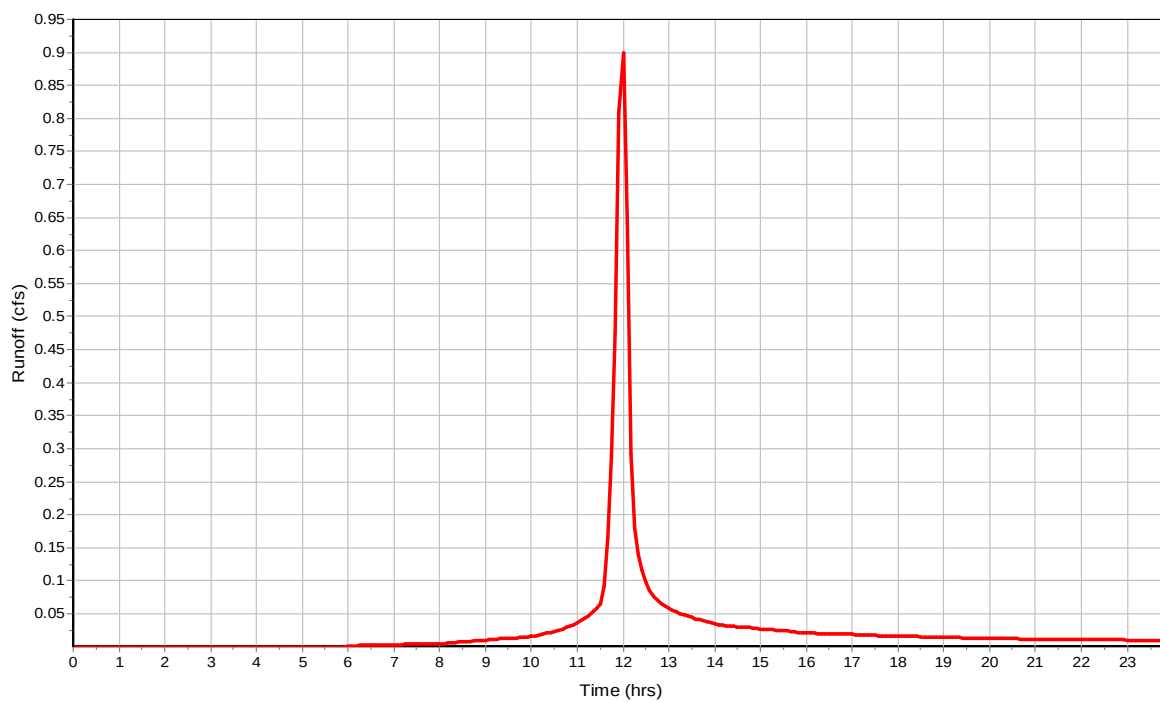
Total Rainfall (in) 6.3
 Total Runoff (in) 4.33
 Peak Runoff (cfs) 0.92
 Weighted Curve Number 82.68
 Time of Concentration (days hh:mm:ss) 0 00:09:21

Subbasin : P3

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1 Entry-P1	637.00	638.50	1.50	637.00	0.00	638.50	0.00	0.00	0.00
2 Entry-P3	583.04	584.54	1.50	583.04	0.00	584.54	0.00	0.00	0.00
3 Exit-P1	614.00	615.50	1.50	614.00	0.00	615.50	0.00	0.00	0.00
4 Exit-P2	608.60	610.10	1.50	608.60	0.00	610.10	0.00	0.00	0.00
5 Exit-P3	570.00	571.50	1.50	570.00	0.00	571.50	0.00	0.00	0.00
6 OCS	609.00	613.54	4.54	609.00	0.00	613.54	0.00	0.00	0.00
7 P2-Entry	566.94	569.44	2.50	566.94	0.00	569.44	0.00	0.00	0.00
8 P2-Exit	566.50	569.00	2.50	566.50	0.00	569.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	5.89	5.89	637.40	0.40	0.00	1.10	637.04	0.04	0 12:10	0 00:00	0.00	0.00
2	Entry-P3	0.51	0.00	583.13	0.09	0.00	1.41	583.05	0.01	0 12:12	0 00:00	0.00	0.00
3	Exit-P1	5.87	0.00	614.55	0.55	0.00	0.95	614.08	0.08	0 12:10	0 00:00	0.00	0.00
4	Exit-P2	1.86	0.00	609.03	0.43	0.00	1.07	608.68	0.08	0 12:16	0 00:00	0.00	0.00
5	Exit-P3	0.51	0.00	570.09	0.09	0.00	1.41	570.01	0.01	0 12:13	0 00:00	0.00	0.00
6	OCS	1.86	0.00	609.43	0.43	0.00	4.11	609.08	0.08	0 12:16	0 00:00	0.00	0.00
7	P2-Entry	39.53	39.53	568.97	2.03	0.00	0.47	567.16	0.22	0 12:05	0 00:00	0.00	0.00
8	P2-Exit	39.49	0.00	568.53	2.03	0.00	0.47	566.72	0.22	0 12:05	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch-P1	278.32	637.00	0.00	614.00	0.00	23.00	8.2600	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch-P3	163.00	583.04	0.00	570.00	0.00	13.04	8.0000	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element	Peak	Time of	Design Flow	Peak Flow/	Peak Flow	Travel	Peak Flow	Peak Flow	Total Time	Froude	Reported
ID	Flow	Peak Flow	Peak Flow	Capacity	Design Flow	Velocity	Time	Depth	Depth/	Surcharged	Number	Condition
		Occurrence			Ratio				Total Depth			
	(cfs)	(days hh:mm)		(cfs)		(ft/sec)	(min)	(ft)	Ratio	(min)		
1	Ditch-P1	5.87	0 12:10	62.44	0.09	6.13	0.76	0.40	0.27	0.00		
2	Ditch-P3	0.51	0 12:13	61.44	0.01	2.58	1.05	0.09	0.06	0.00		

Pipe Input

SN Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Pipe Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1 Culvert	35.00	566.94	0.00	566.50	0.00	0.44	1.2600	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2 DirectLink-P1	19.95	0.00	-608.60	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3 DirectLink-P2	102.72	0.00	-566.50	570.00	0.00	-570.00	-554.9100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
4 DirectLink-P3	52.90	0.00	-570.00	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
5 Outlet-Pipe	30.00	609.00	0.00	608.60	0.00	0.40	1.3300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No
6 Pipe-P1	20.00	614.00	0.00	613.00	2.00	1.00	5.0000	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

1
1
1
1
1
1
1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 Culvert	39.49	0 12:05	39.86	0.99	9.27	0.06	2.03	0.81	0.00		Calculated
2 DirectLink-P1	1.86	0 12:16	0.00	0.99	0.00		2.03	0.81	0.00		Calculated
3 DirectLink-P2	39.49	0 12:05	0.00	0.99	0.00		2.03	0.81	0.00		Calculated
4 DirectLink-P3	0.51	0 12:13	0.00	0.99	0.00		2.03	0.81	0.00		Calculated
5 Outlet-Pipe	1.86	0 12:16	10.51	0.18	4.48	0.11	0.42	0.28	0.00		Calculated
6 Pipe-P1	5.87	0 12:10	20.36	0.29	9.96	0.03	0.55	0.37	0.00		Calculated

Storage Nodes

Storage Node : Basin#4

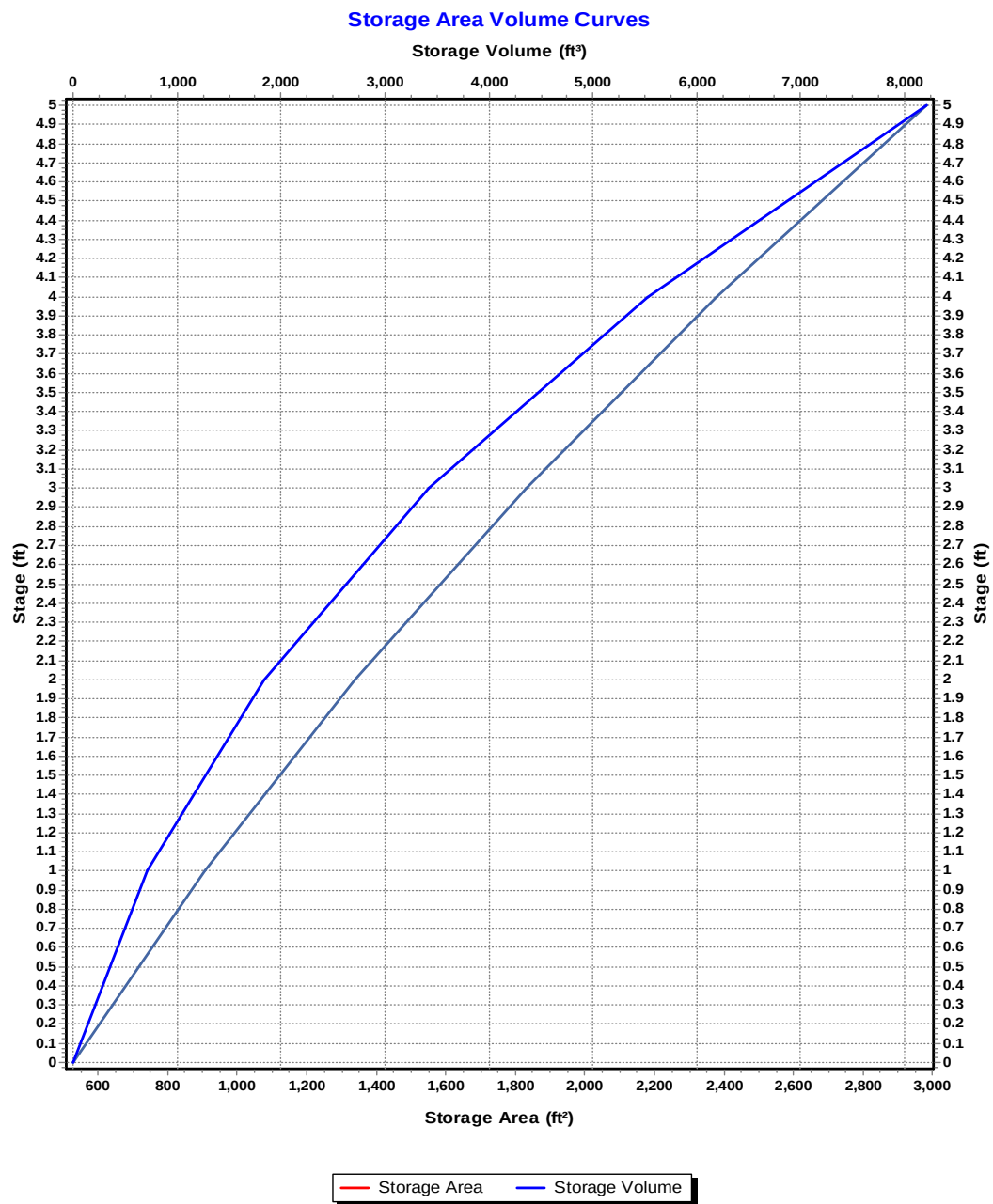
Input Data

Invert Elevation (ft)	609.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	609.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Bassin#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	527.57	0
1	905.52	716.55
2	1340.01	1839.32
3	1831.05	3424.85
4	2378.65	5529.7
5	2982.78	8210.42



Storage Node : Basin#4 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Emergency-Spillway	Trapezoidal	No	613.55	4.55	44.00	0.50	3.33

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Beehive-Grate	Bottom	CIRCULAR	No	21.25			613.54	0.61
2 Lower-Orifice	Side	CIRCULAR	No	4.00			611.00	0.61
3 Middle-Orifice	Side	CIRCULAR	No	4.00			612.00	0.61
4 Upper-Orifice	Side	CIRCULAR	No	4.00			613.00	0.61

Output Summary Results

Peak Inflow (cfs)	5.87
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	4.27
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.61
Max HGL Depth Attained (ft)	4.61
Average HGL Elevation Attained (ft)	610.44
Average HGL Depth Attained (ft)	1.44
Time of Max HGL Occurrence (days hh:mm)	0 12:16
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

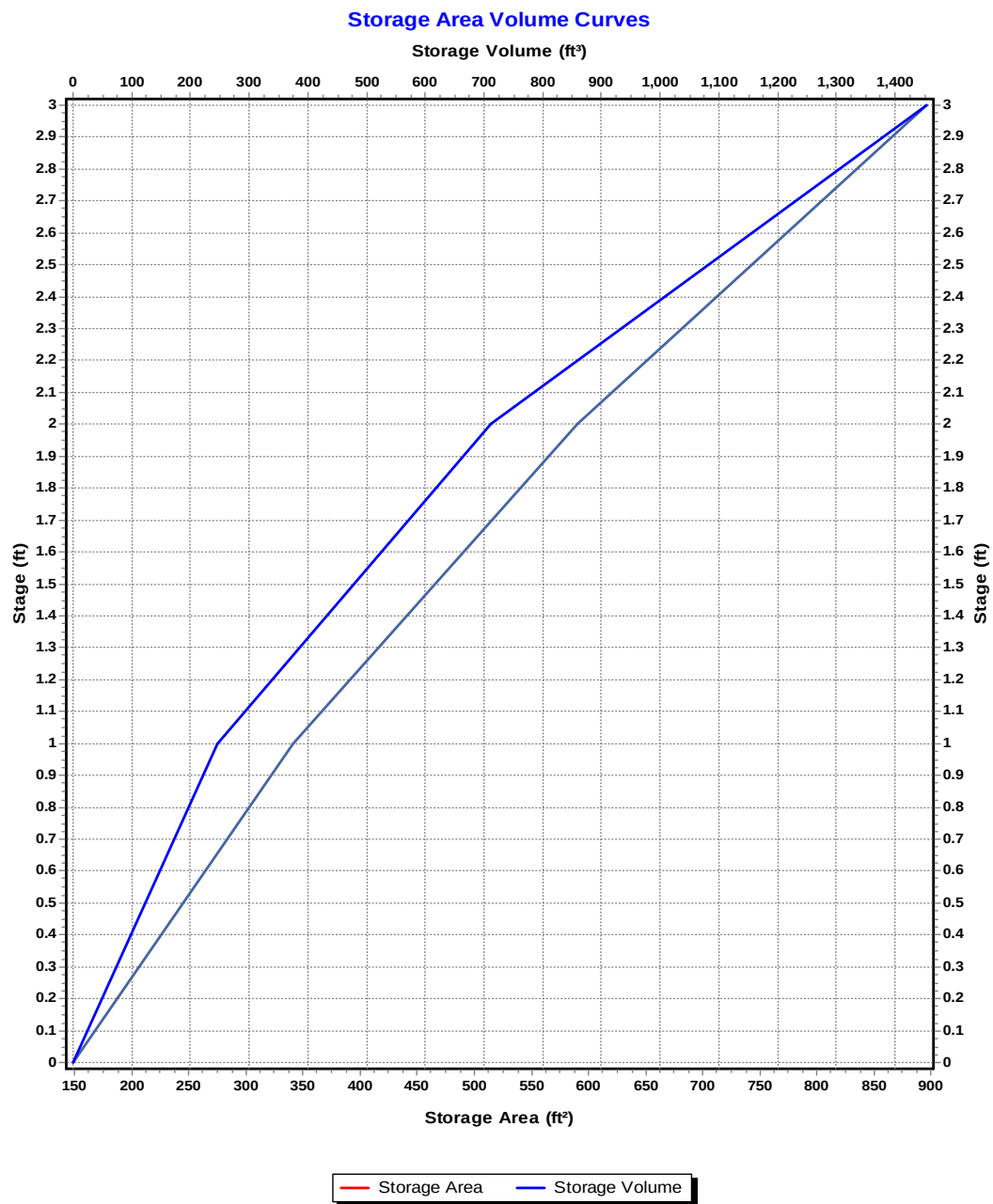
Storage Node : Forebay#1**Input Data**

Invert Elevation (ft)	611.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	3.00
Initial Water Elevation (ft)	611.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Forebay

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	148.47	0
1	341.1	244.79
2	590.29	710.49
3	896.02	1453.65



Storage Node : Forebay#1 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Crested-Weir	Trapezoidal	No	613.00	2.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	5.87
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	5.87
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.31
Max HGL Depth Attained (ft)	2.31
Average HGL Elevation Attained (ft)	612.36
Average HGL Depth Attained (ft)	1.36
Time of Max HGL Occurrence (days hh:mm)	0 12:10
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

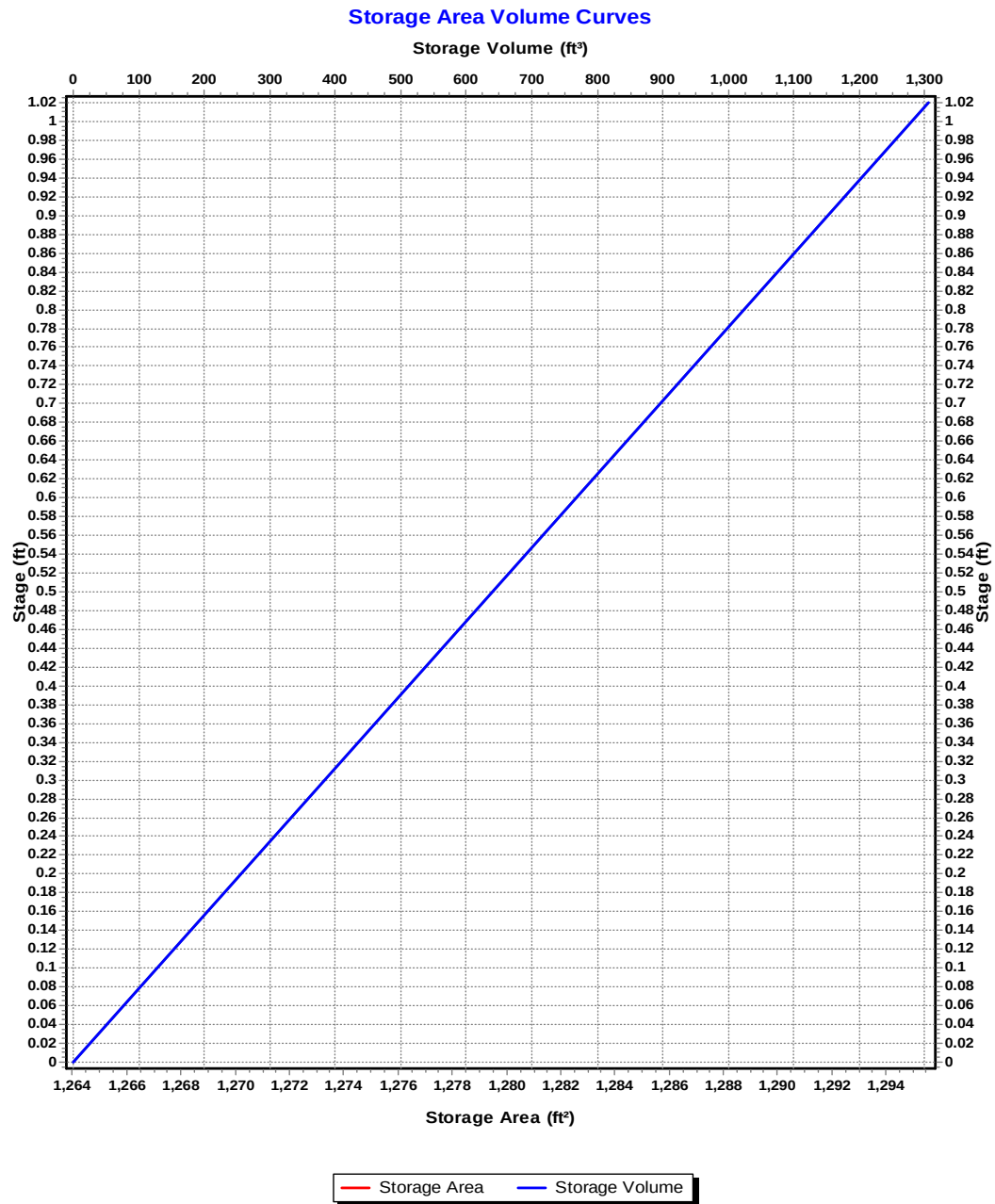
Storage Node : Geogrid-gravel**Input Data**

Invert Elevation (ft)	583.04
Max (Rim) Elevation (ft)	584.06
Max (Rim) Offset (ft)	1.02
Initial Water Elevation (ft)	583.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Permeable Geogrid Gravel#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	1264.03	0
1.02	1295.56	1305.39



Storage Node : Geogrid-gravel (continued)**Outflow Orifices**

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Underdrain-P3	Side	CIRCULAR	No	6.00			583.04	0.61

Output Summary Results

Peak Inflow (cfs)	0.9
Peak Lateral Inflow (cfs)	0.9
Peak Outflow (cfs)	0.51
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	583.57
Max HGL Depth Attained (ft)	0.53
Average HGL Elevation Attained (ft)	583.09
Average HGL Depth Attained (ft)	0.05
Time of Max HGL Occurrence (days hh:mm)	0 12:12
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Project Description

File Name NAV-31 Post 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 3
Nodes..... 12
 Junctions 8
 Outfalls 1
 Flow Diversions 0
 Inlets 0
 Storage Nodes 3
Links..... 15
 Channels 2
 Pipes 6
 Pumps 0
 Orifices 5
 Weirs 2
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	2-Year	Cumulative	inches	New Hampshire	Strafford	2.00	3.00	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	P1	1.13	484.00	84.84	3.00	1.58	1.78	2.16	0 00:16:08
2	P2	6.30	484.00	86.93	3.00	1.73	10.92	14.94	0 00:10:28
3	P3	0.15	484.00	82.68	3.00	1.42	0.22	0.31	0 00:09:21

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	Junction	637.00	638.50	637.00	638.50	0.00	2.11	637.22	0.00	1.28	0 00:00	0.00	0.00
2	Entry-P3	Junction	583.04	584.54	583.04	584.54	0.00	0.13	583.08	0.00	1.46	0 00:00	0.00	0.00
3	Exit-P1	Junction	614.00	615.50	614.00	615.50	0.00	2.10	614.33	0.00	1.17	0 00:00	0.00	0.00
4	Exit-P2	Junction	608.60	610.10	608.60	610.10	0.00	0.27	608.77	0.00	1.33	0 00:00	0.00	0.00
5	Exit-P3	Junction	570.00	571.50	570.00	571.50	0.00	0.13	570.04	0.00	1.46	0 00:00	0.00	0.00
6	OCS	Junction	609.00	613.54	609.00	613.54	0.00	0.27	609.17	0.00	4.37	0 00:00	0.00	0.00
7	P2-Entry	Junction	566.94	569.44	566.94	569.44	0.00	14.91	568.00	0.00	1.44	0 00:00	0.00	0.00
8	P2-Exit	Junction	566.50	569.00	566.50	569.00	0.00	14.87	567.56	0.00	1.44	0 00:00	0.00	0.00
9	POST-DEVELPMENT-POA-1	Outfall	570.00					14.94	570.00					
10	Basin#4	Storage Node	609.00	614.00	609.00		0.00	2.10	611.56				0.00	0.00
11	Forebay#1	Storage Node	611.00	614.00	611.00		0.00	2.10	613.16				0.00	0.00
12	Geogrid-gravel	Storage Node	583.04	584.06	583.04		0.00	0.31	583.24				0.00	0.00

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 Culvert	Pipe	P2-Entry	P2-Exit	35.00	566.94	566.50	1.2600	30.000	0.0150	14.87	39.86	0.37	7.51	1.06	0.42	0.00 Calculated
2 DirectLink-P1	Pipe	Exit-P2	POST-DEVELOPMENT-POA-1	19.95	0.00	0.00	0.0000	0.000	0.0150	0.27	0.00	0.37	0.00	1.06	0.42	0.00 Calculated
3 DirectLink-P2	Pipe	P2-Exit	POST-DEVELOPMENT-POA-1	102.72	0.00	570.00	-554.9100	0.000	0.0150	14.87	0.00	0.37	0.00	1.06	0.42	0.00 Calculated
4 DirectLink-P3	Pipe	Exit-P3	POST-DEVELOPMENT-POA-1	52.90	0.00	0.00	0.0000	0.000	0.0150	0.13	0.00	0.37	0.00	1.06	0.42	0.00 Calculated
5 Outlet-Pipe	Pipe	OCS	Exit-P2	30.00	609.00	608.60	1.3300	18.000	0.0150	0.27	10.51	0.03	2.43	0.17	0.11	0.00 Calculated
6 Pipe-P1	Pipe	Exit-P1	Forebay#1	20.00	614.00	613.00	5.0000	18.000	0.0150	2.10	20.36	0.10	7.44	0.32	0.22	0.00 Calculated
7 Ditch-P1	Channel	Entry-P1	Exit-P1	278.32	637.00	614.00	8.2600	18.000	0.0320	2.10	62.44	0.03	4.37	0.22	0.15	0.00
8 Ditch-P3	Channel	Entry-P3	Exit-P3	163.00	583.04	570.00	8.0000	18.000	0.0320	0.13	61.44	0.00	1.52	0.04	0.03	0.00
9 Beehive-Grate	Orifice	Basin#4	OCS		609.00	609.00		21.250		0.00						
10 Lower-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.27						
11 Middle-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.00						
12 Underdrain-P3	Orifice	Geogrid-gravel	Entry-P3		583.04	583.04		6.000		0.13						
13 Upper-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.00						
14 Crested-Weir	Weir	Forebay#1	Basin#4		611.00	609.00				2.10						
15 Emergency-Spillway	Weir	Basin#4	POST-DEVELOPMENT-POA-1		609.00	570.00				0.00						

Subbasin Hydrology

Subbasin : P1

Input Data

Area (ac) 1.13
 Peak Rate Factor 484
 Weighted Curve Number 84.84
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Gravel roads	0.25	C	96
> 75% grass cover, Good	0.25	C	74
Fallow, crop residue, Good	0.27	C	88
Woods & grass combination, Poor	0.36	C	82
Composite Area & Weighted CN	1.13		84.84

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (S_f^{0.5}) (unpaved surface)
 V = 20.3282 * (S_f^{0.5}) (paved surface)
 V = 15.0 * (S_f^{0.5}) (grassed waterway surface)
 V = 10.0 * (S_f^{0.5}) (nearly bare & untilled surface)
 V = 9.0 * (S_f^{0.5}) (cultivated straight rows surface)
 V = 7.0 * (S_f^{0.5}) (short grass pasture surface)
 V = 5.0 * (S_f^{0.5}) (woodland surface)
 V = 2.5 * (S_f^{0.5}) (forest w/heavy litter surface)
 T_c = (L_f / V) / (3600 sec/hr)

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$$

$$R = A_q / W_p$$

$$T_c = (L_f / V) / (3600 \text{ sec/hr})$$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

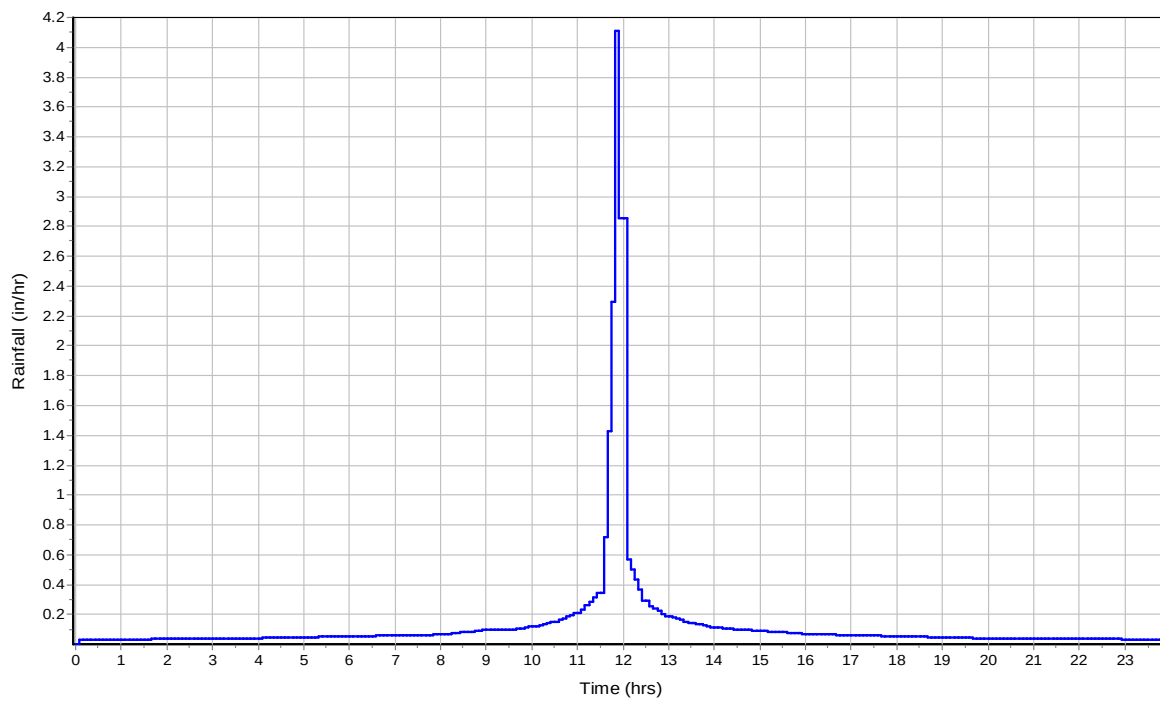
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	3	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.98	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	332.7668	0	0
Slope (%) :	8.71	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.76	0	0
Computed Flow Time (min) :	1.17	0	0
Total TOC (min)	16.15		

Subbasin Runoff Results

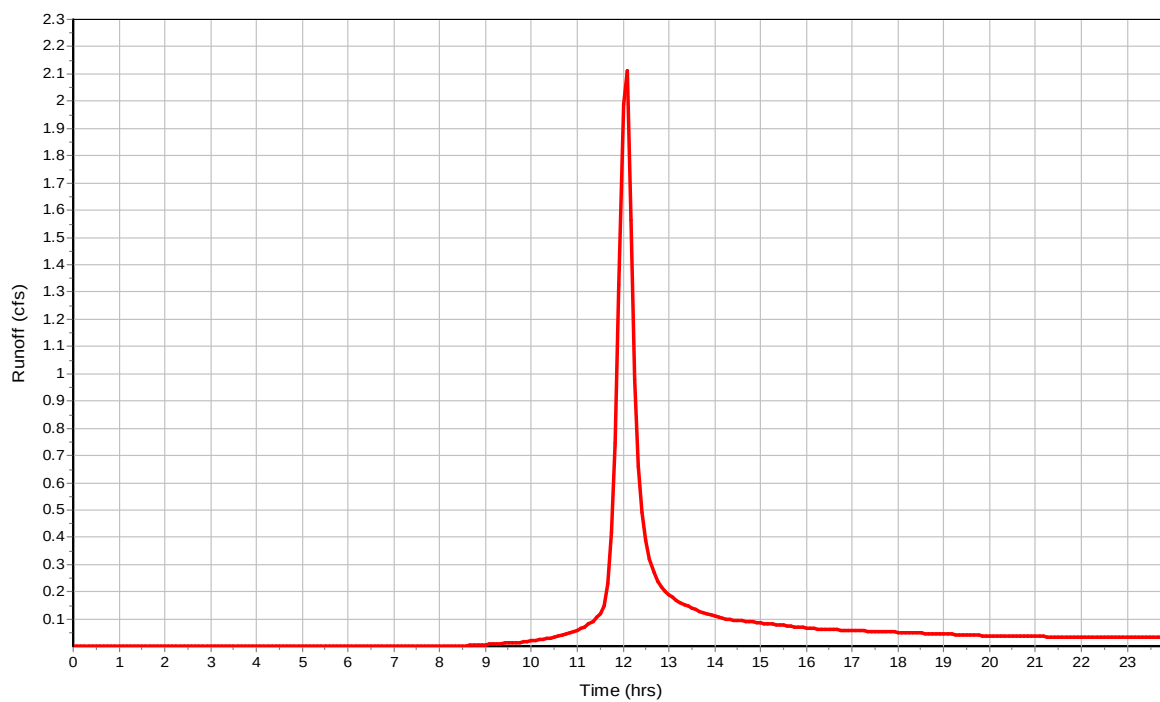
Total Rainfall (in)	3
Total Runoff (in)	1.58
Peak Runoff (cfs)	2.16
Weighted Curve Number	84.84
Time of Concentration (days hh:mm:ss)	0 00:16:09

Subbasin : P1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P2**Input Data**

Area (ac) 6.3
 Peak Rate Factor 484
 Weighted Curve Number 86.93
 Rain Gage ID

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.1	C	96
> 75% grass cover, Good	0.22	C	74
Woods & grass combination, Poor	0.97	C	82
Fallow, bare soil	0.16	C	91
Gravel roads	0.12	C	96
Fallow, crop residue, Good	4.73	C	88
Composite Area & Weighted CN	6.3		86.93

Time of Concentration

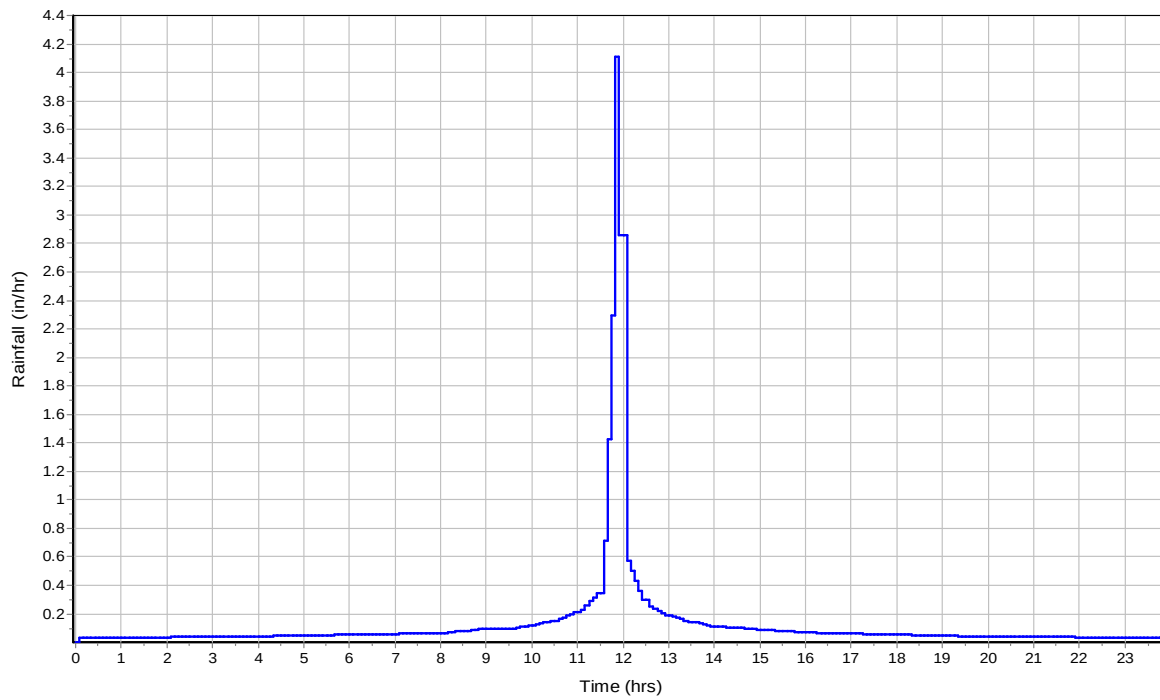
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	359.0728	0	0
Slope (%) :	9.2	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.89	0	0
Computed Flow Time (min) :	1.22	0	0
Total TOC (min)10.48			

Subbasin Runoff Results

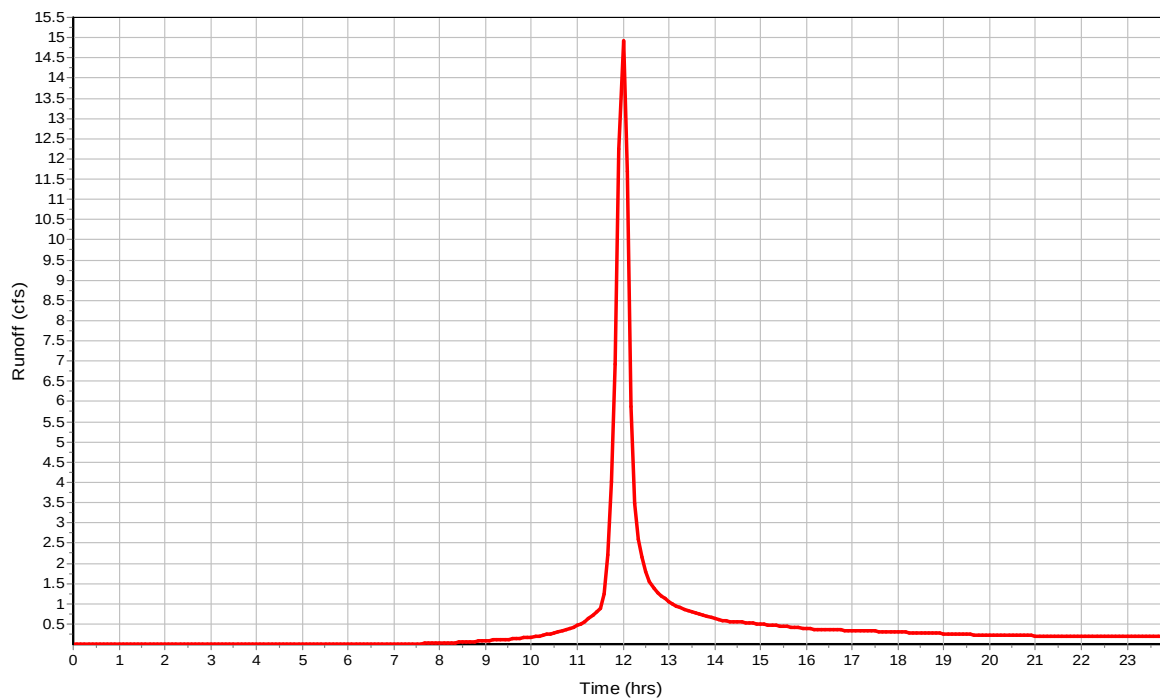
Total Rainfall (in) 3
 Total Runoff (in) 1.73
 Peak Runoff (cfs) 14.94
 Weighted Curve Number 86.93
 Time of Concentration (days hh:mm:ss) 0 00:10:29

Subbasin : P2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P3**Input Data**

Area (ac) 0.15
 Peak Rate Factor 484
 Weighted Curve Number 82.68
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Gravel roads	0.04	C	96
> 75% grass cover, Good	0.07	C	74
Woods & grass combination, Poor	0.03	C	82
Pasture, grassland, or range, Poor	0.01	C	86
Composite Area & Weighted CN	0.15		82.68

Time of Concentration

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0

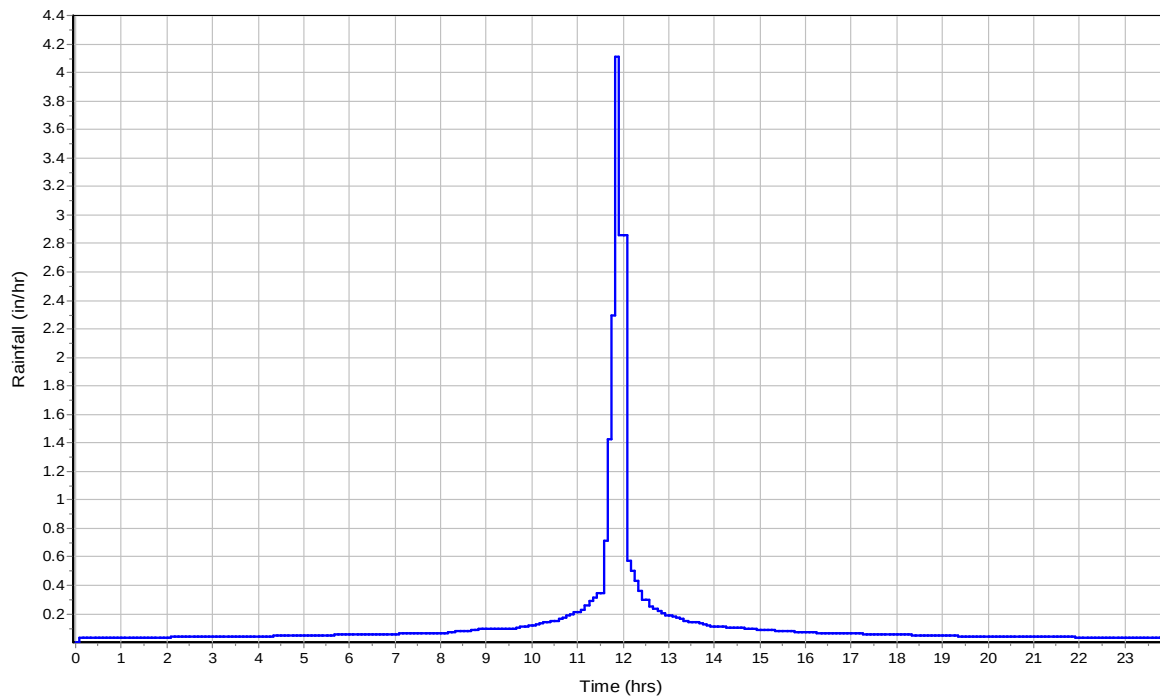
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	26.4558	0	0
Slope (%) :	7.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.45	0	0
Computed Flow Time (min) :	0.1	0	0
Total TOC (min)9.35			

Subbasin Runoff Results

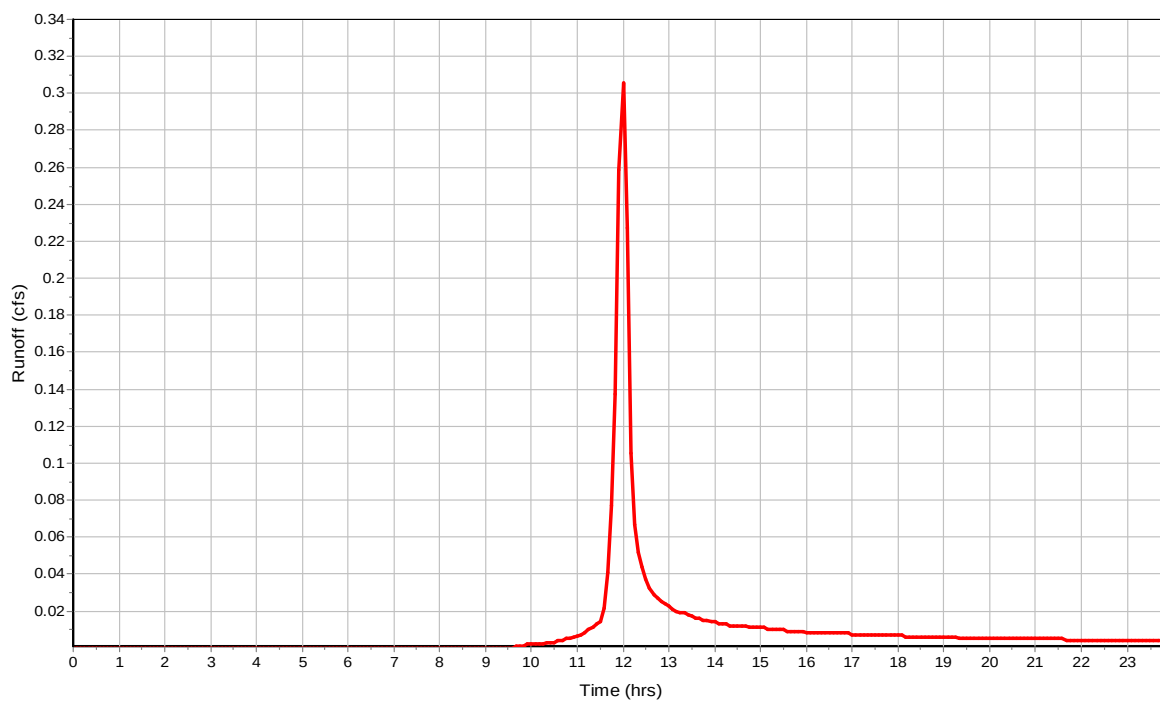
Total Rainfall (in) 3
 Total Runoff (in) 1.42
 Peak Runoff (cfs) 0.31
 Weighted Curve Number 82.68
 Time of Concentration (days hh:mm:ss) 0 00:09:21

Subbasin : P3

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(in)
1 Entry-P1	637.00	638.50	1.50	637.00	0.00	638.50	0.00	0.00	0.00
2 Entry-P3	583.04	584.54	1.50	583.04	0.00	584.54	0.00	0.00	0.00
3 Exit-P1	614.00	615.50	1.50	614.00	0.00	615.50	0.00	0.00	0.00
4 Exit-P2	608.60	610.10	1.50	608.60	0.00	610.10	0.00	0.00	0.00
5 Exit-P3	570.00	571.50	1.50	570.00	0.00	571.50	0.00	0.00	0.00
6 OCS	609.00	613.54	4.54	609.00	0.00	613.54	0.00	0.00	0.00
7 P2-Entry	566.94	569.44	2.50	566.94	0.00	569.44	0.00	0.00	0.00
8 P2-Exit	566.50	569.00	2.50	566.50	0.00	569.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	2.11	2.11	637.22	0.22	0.00	1.28	637.02	0.02	0 12:10	0 00:00	0.00	0.00
2	Entry-P3	0.13	0.00	583.08	0.04	0.00	1.46	583.05	0.01	0 12:14	0 00:00	0.00	0.00
3	Exit-P1	2.10	0.00	614.33	0.33	0.00	1.17	614.04	0.04	0 12:10	0 00:00	0.00	0.00
4	Exit-P2	0.27	0.00	608.77	0.17	0.00	1.33	608.64	0.04	0 12:48	0 00:00	0.00	0.00
5	Exit-P3	0.13	0.00	570.04	0.04	0.00	1.46	570.01	0.01	0 12:15	0 00:00	0.00	0.00
6	OCS	0.27	0.00	609.17	0.17	0.00	4.37	609.05	0.05	0 12:48	0 00:00	0.00	0.00
7	P2-Entry	14.91	14.91	568.00	1.06	0.00	1.44	567.06	0.12	0 12:05	0 00:00	0.00	0.00
8	P2-Exit	14.87	0.00	567.56	1.06	0.00	1.44	566.62	0.12	0 12:05	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Shape	Height (ft)	Width (ft)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flap Flow Gate (cfs)
1	Ditch-P1	278.32	637.00	0.00	614.00	0.00	23.00	8.2600	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00 No
2	Ditch-P3	163.00	583.04	0.00	570.00	0.00	13.04	8.0000	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00 No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch-P1	2.10	0 12:10	62.44	0.03	4.37	1.06	0.22	0.15	0.00		
2	Ditch-P3	0.13	0 12:15	61.44	0.00	1.52	1.79	0.04	0.03	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	Culvert	35.00	566.94	0.00	566.50	0.00	0.44	1.2600	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	DirectLink-P1	19.95	0.00	-608.60	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	DirectLink-P2	102.72	0.00	-566.50	570.00	0.00	-570.00	-554.9100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
4	DirectLink-P3	52.90	0.00	-570.00	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
5	Outlet-Pipe	30.00	609.00	0.00	608.60	0.00	0.40	1.3300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No
6	Pipe-P1	20.00	614.00	0.00	613.00	2.00	1.00	5.0000	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

1
1
1
1
1
1
1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 Culvert	14.87	0 12:05	39.86	0.37	7.51	0.08	1.06	0.42	0.00		Calculated
2 DirectLink-P1	0.27	0 12:48	0.00	0.37	0.00		1.06	0.42	0.00		Calculated
3 DirectLink-P2	14.87	0 12:05	0.00	0.37	0.00		1.06	0.42	0.00		Calculated
4 DirectLink-P3	0.13	0 12:15	0.00	0.37	0.00		1.06	0.42	0.00		Calculated
5 Outlet-Pipe	0.27	0 12:48	10.51	0.03	2.43	0.21	0.17	0.11	0.00		Calculated
6 Pipe-P1	2.10	0 12:10	20.36	0.10	7.44	0.04	0.32	0.22	0.00		Calculated

Storage Nodes

Storage Node : Basin#4

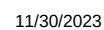
Input Data

Invert Elevation (ft)	609.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	609.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Basin#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	527.57	0
1	905.52	716.55
2	1340.01	1839.32
3	1831.05	3424.85
4	2378.65	5529.7
5	2982.78	8210.42



Storage Node : Basin#4 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Emergency-Spillway	Trapezoidal	No	613.55	4.55	44.00	0.50	3.33

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Beehive-Grate	Bottom	CIRCULAR	No	21.25			613.54	0.61
2 Lower-Orifice	Side	CIRCULAR	No	4.00			611.00	0.61
3 Middle-Orifice	Side	CIRCULAR	No	4.00			612.00	0.61
4 Upper-Orifice	Side	CIRCULAR	No	4.00			613.00	0.61

Output Summary Results

Peak Inflow (cfs)	2.1
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	0.27
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	611.56
Max HGL Depth Attained (ft)	2.56
Average HGL Elevation Attained (ft)	610.09
Average HGL Depth Attained (ft)	1.09
Time of Max HGL Occurrence (days hh:mm)	0 12:48
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Forebay#1

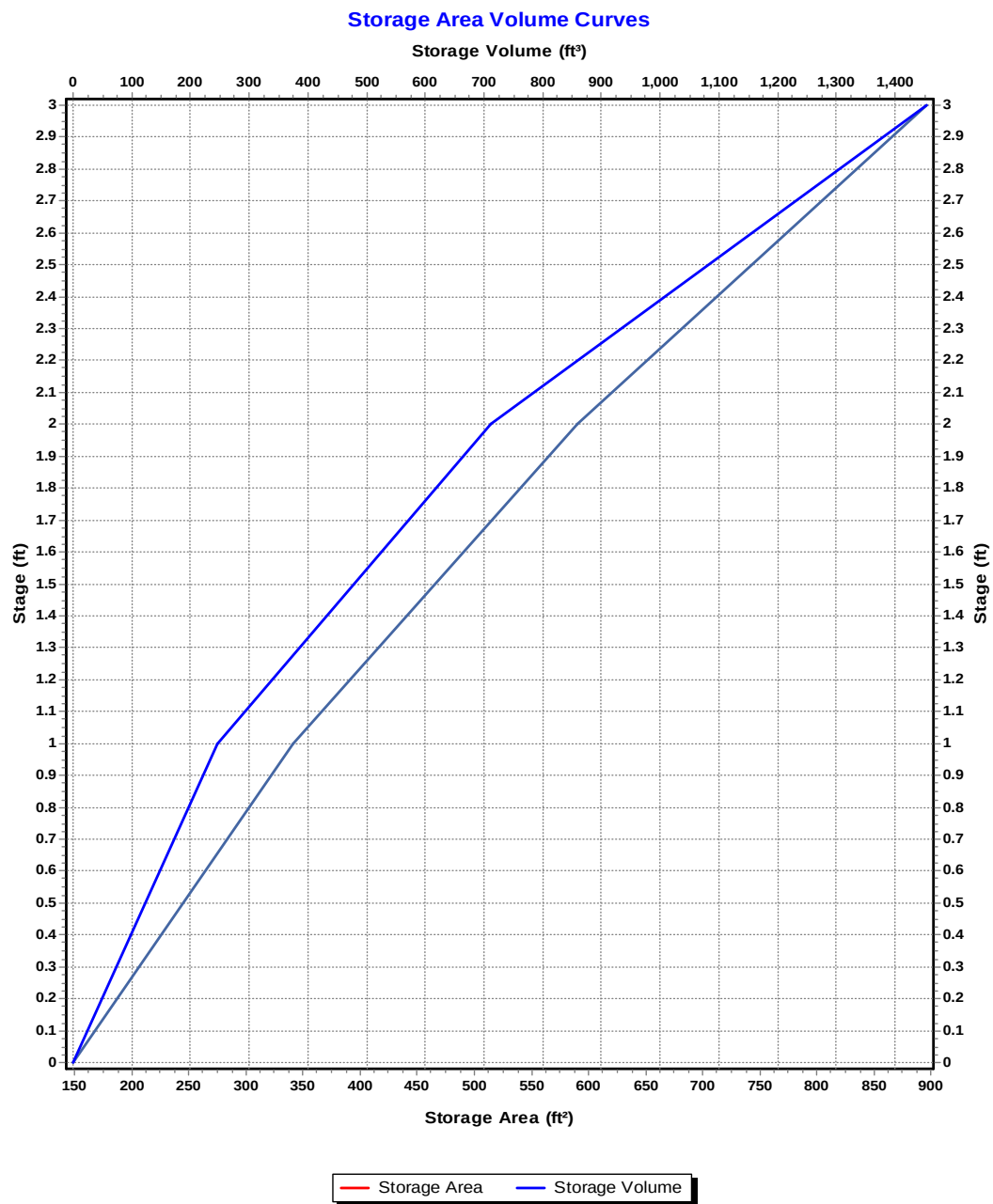
Input Data

Invert Elevation (ft)	611.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	3.00
Initial Water Elevation (ft)	611.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Forebay

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	148.47	0
1	341.1	244.79
2	590.29	710.49
3	896.02	1453.65



Storage Node : Forebay#1 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Crested-Weir	Trapezoidal	No	613.00	2.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	2.1
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	2.1
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.16
Max HGL Depth Attained (ft)	2.16
Average HGL Elevation Attained (ft)	612.08
Average HGL Depth Attained (ft)	1.08
Time of Max HGL Occurrence (days hh:mm)	0 12:11
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Geogrid-gravel

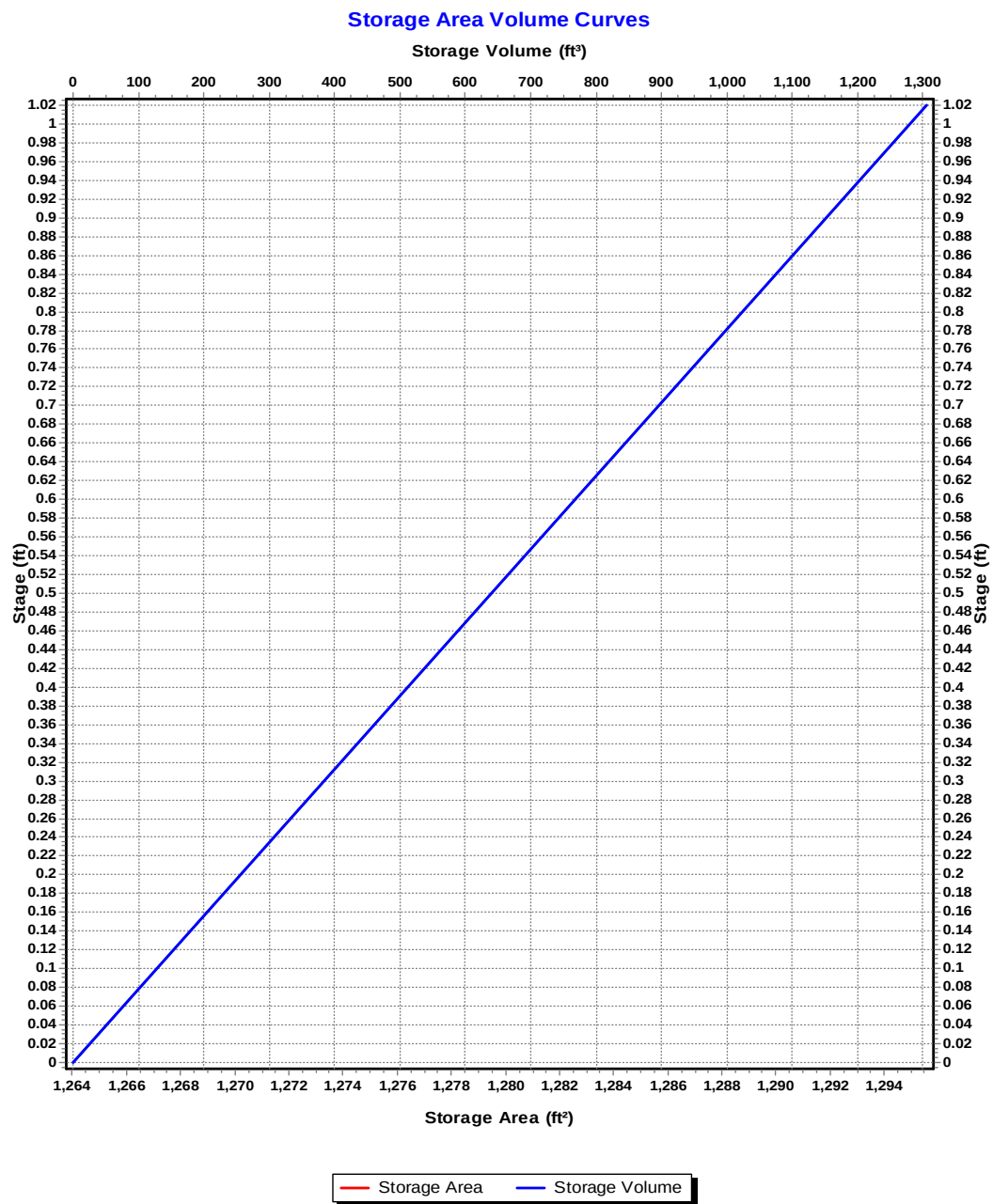
Input Data

Invert Elevation (ft)	583.04
Max (Rim) Elevation (ft)	584.06
Max (Rim) Offset (ft)	1.02
Initial Water Elevation (ft)	583.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Permeable Geogrid Gravel#4

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	1264.03	0
1.02	1295.56	1305.39



Storage Node : Geogrid-gravel (continued)**Outflow Orifices**

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Underdrain-P3	Side	CIRCULAR	No	6.00			583.04	0.61

Output Summary Results

Peak Inflow (cfs)	0.31
Peak Lateral Inflow (cfs)	0.31
Peak Outflow (cfs)	0.13
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	583.24
Max HGL Depth Attained (ft)	0.2
Average HGL Elevation Attained (ft)	583.06
Average HGL Depth Attained (ft)	0.02
Time of Max HGL Occurrence (days hh:mm)	0 12:14
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Project Description

File Name NAV-31 Post 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	3
Nodes.....	12
<i>Junctions</i>	8
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	3
Links.....	15
<i>Channels</i>	2
<i>Pipes</i>	6
<i>Pumps</i>	0
<i>Orifices</i>	5
<i>Weirs</i>	2
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	10-Year	Cumulative	inches	New Hampshire	Strafford	10.00	4.30	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	P1	1.13	484.00	84.84	4.30	2.71	3.07	3.69	0 00:16:08
2	P2	6.30	484.00	86.93	4.30	2.91	18.31	24.71	0 00:10:28
3	P3	0.15	484.00	82.68	4.30	2.52	0.39	0.54	0 00:09:21

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft ²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	Junction	637.00	638.50	637.00	638.50	0.00	3.58	637.30	0.00	1.20	0 00:00	0.00	0.00
2	Entry-P3	Junction	583.04	584.54	583.04	584.54	0.00	0.27	583.10	0.00	1.44	0 00:00	0.00	0.00
3	Exit-P1	Junction	614.00	615.50	614.00	615.50	0.00	3.57	614.43	0.00	1.07	0 00:00	0.00	0.00
4	Exit-P2	Junction	608.60	610.10	608.60	610.10	0.00	0.82	608.88	0.00	1.22	0 00:00	0.00	0.00
5	Exit-P3	Junction	570.00	571.50	570.00	571.50	0.00	0.27	570.06	0.00	1.44	0 00:00	0.00	0.00
6	OCS	Junction	609.00	613.54	609.00	613.54	0.00	0.82	609.28	0.00	4.26	0 00:00	0.00	0.00
7	P2-Entry	Junction	566.94	569.44	566.94	569.44	0.00	24.59	568.36	0.00	1.08	0 00:00	0.00	0.00
8	P2-Exit	Junction	566.50	569.00	566.50	569.00	0.00	24.55	567.92	0.00	1.08	0 00:00	0.00	0.00
9	POST-DEVELPMENT-POA-1	Outfall	570.00					24.78	570.00					
10	Basin#4	Storage Node	609.00	614.00	609.00		0.00	3.57	612.64				0.00	0.00
11	Forebay#1	Storage Node	611.00	614.00	611.00		0.00	3.57	613.22				0.00	0.00
12	Geogrid-gravel	Storage Node	583.04	584.06	583.04		0.00	0.54	583.38				0.00	0.00

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 Culvert	Pipe	P2-Entry	P2-Exit	35.00	566.94	566.50	1.2600	30.000	0.0150	24.55	39.86	0.62	8.53	1.42	0.57	0.00 Calculated
2 DirectLink-P1	Pipe	Exit-P2	POST-DEVELOPMENT-POA-1	19.95	0.00	0.00	0.0000	0.000	0.0150	0.82	0.00	0.62	0.00	1.42	0.57	0.00 Calculated
3 DirectLink-P2	Pipe	P2-Exit	POST-DEVELOPMENT-POA-1	102.72	0.00	570.00	-554.9100	0.000	0.0150	24.55	0.00	0.62	0.00	1.42	0.57	0.00 Calculated
4 DirectLink-P3	Pipe	Exit-P3	POST-DEVELOPMENT-POA-1	52.90	0.00	0.00	0.0000	0.000	0.0150	0.27	0.00	0.62	0.00	1.42	0.57	0.00 Calculated
5 Outlet-Pipe	Pipe	OCS	Exit-P2	30.00	609.00	608.60	1.3300	18.000	0.0150	0.82	10.51	0.08	3.54	0.28	0.19	0.00 Calculated
6 Pipe-P1	Pipe	Exit-P1	Forebay#1	20.00	614.00	613.00	5.0000	18.000	0.0150	3.57	20.36	0.18	8.65	0.43	0.28	0.00 Calculated
7 Ditch-P1	Channel	Entry-P1	Exit-P1	278.32	637.00	614.00	8.2600	18.000	0.0320	3.57	62.44	0.06	5.22	0.30	0.20	0.00
8 Ditch-P3	Channel	Entry-P3	Exit-P3	163.00	583.04	570.00	8.0000	18.000	0.0320	0.27	61.44	0.00	2.03	0.06	0.04	0.00
9 Beehive-Grate	Orifice	Basin#4	OCS		609.00	609.00		21.250		0.00						
10 Lower-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.52						
11 Middle-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.30						
12 Underdrain-P3	Orifice	Geogrid-gravel	Entry-P3		583.04	583.04		6.000		0.27						
13 Upper-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.00						
14 Crested-Weir	Weir	Forebay#1	Basin#4		611.00	609.00				3.57						
15 Emergency-Spillway	Weir	Basin#4	POST-DEVELOPMENT-POA-1		609.00	570.00				0.00						

Subbasin Hydrology

Subbasin : P1

Input Data

Area (ac) 1.13
 Peak Rate Factor 484
 Weighted Curve Number 84.84
 Rain Gage ID

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Gravel roads	0.25	C	96
> 75% grass cover, Good	0.25	C	74
Fallow, crop residue, Good	0.27	C	88
Woods & grass combination, Poor	0.36	C	82
Composite Area & Weighted CN	1.13		84.84

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$$

$$R = A_q / W_p$$

$$T_c = (L_f / V) / (3600 \text{ sec/hr})$$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

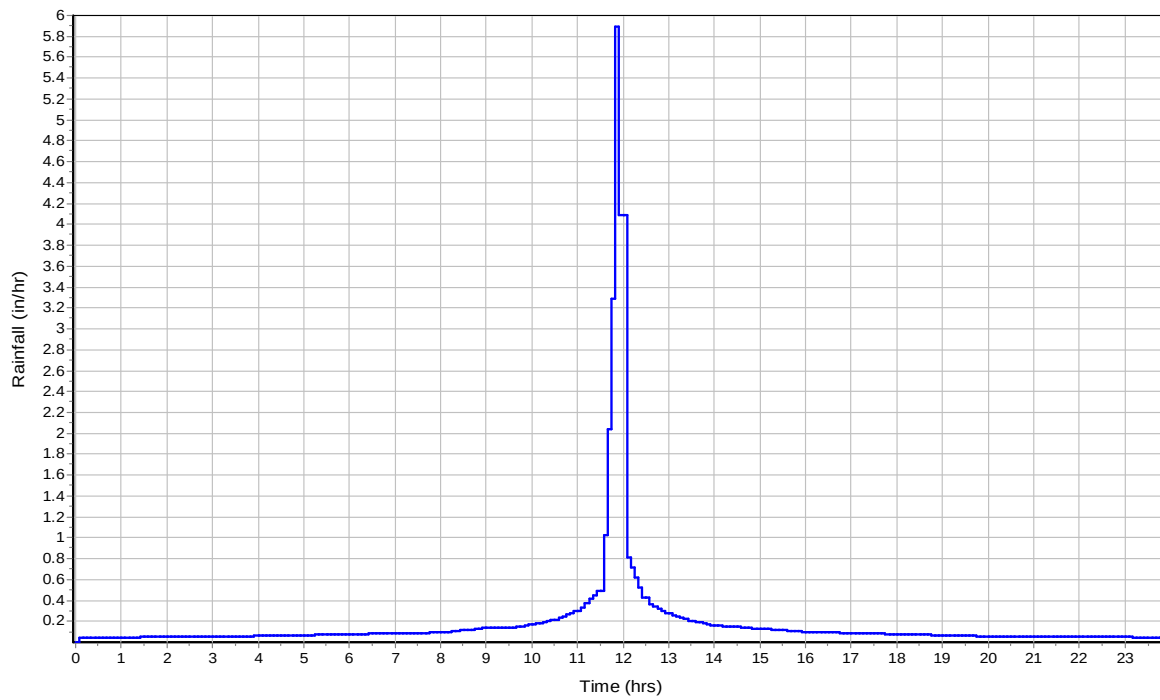
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	3	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.98	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	332.7668	0	0
Slope (%) :	8.71	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.76	0	0
Computed Flow Time (min) :	1.17	0	0
Total TOC (min)	16.15		

Subbasin Runoff Results

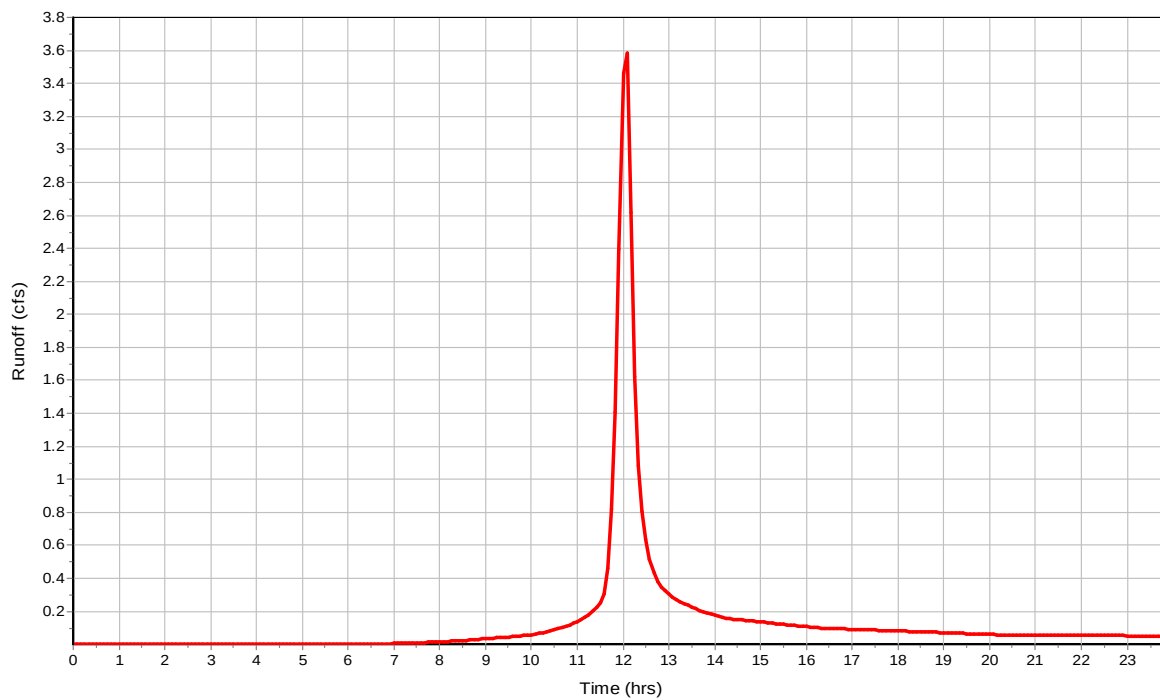
Total Rainfall (in)	4.3
Total Runoff (in)	2.71
Peak Runoff (cfs)	3.69
Weighted Curve Number	84.84
Time of Concentration (days hh:mm:ss)	0 00:16:09

Subbasin : P1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P2**Input Data**

Area (ac) 6.3
 Peak Rate Factor 484
 Weighted Curve Number 86.93
 Rain Gage ID

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.1	C	96
> 75% grass cover, Good	0.22	C	74
Woods & grass combination, Poor	0.97	C	82
Fallow, bare soil	0.16	C	91
Gravel roads	0.12	C	96
Fallow, crop residue, Good	4.73	C	88
Composite Area & Weighted CN	6.3		86.93

Time of Concentration

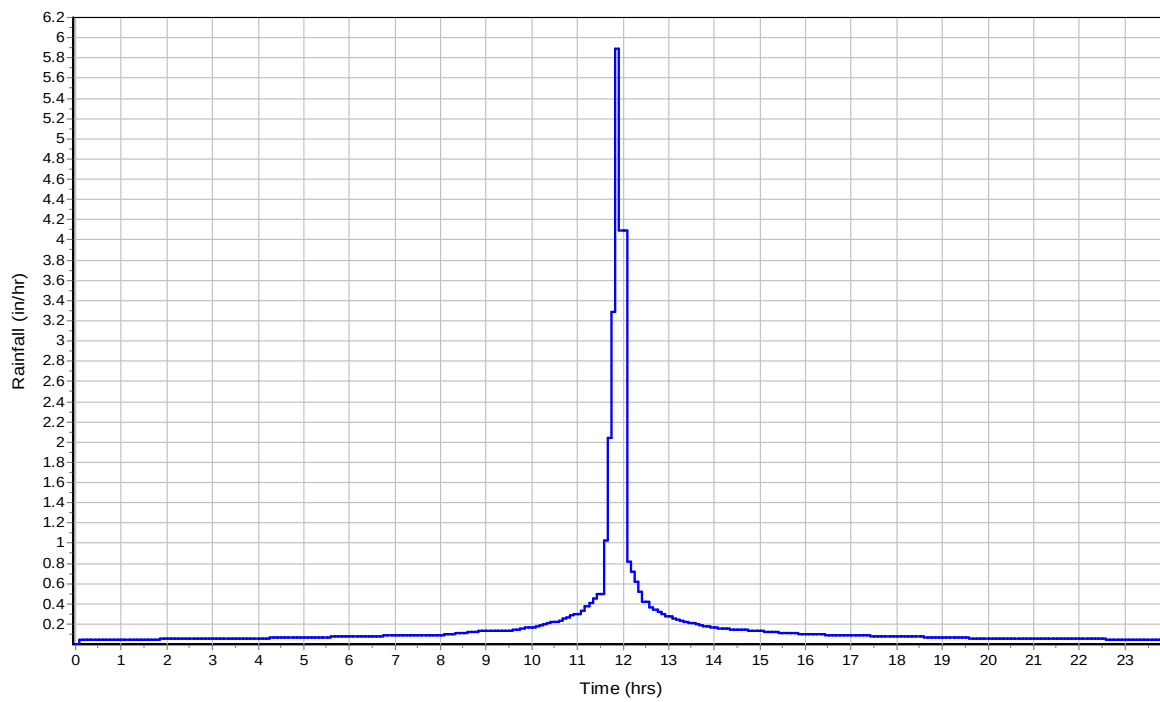
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	359.0728	0	0
Slope (%) :	9.2	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.89	0	0
Computed Flow Time (min) :	1.22	0	0
Total TOC (min)10.48			

Subbasin Runoff Results

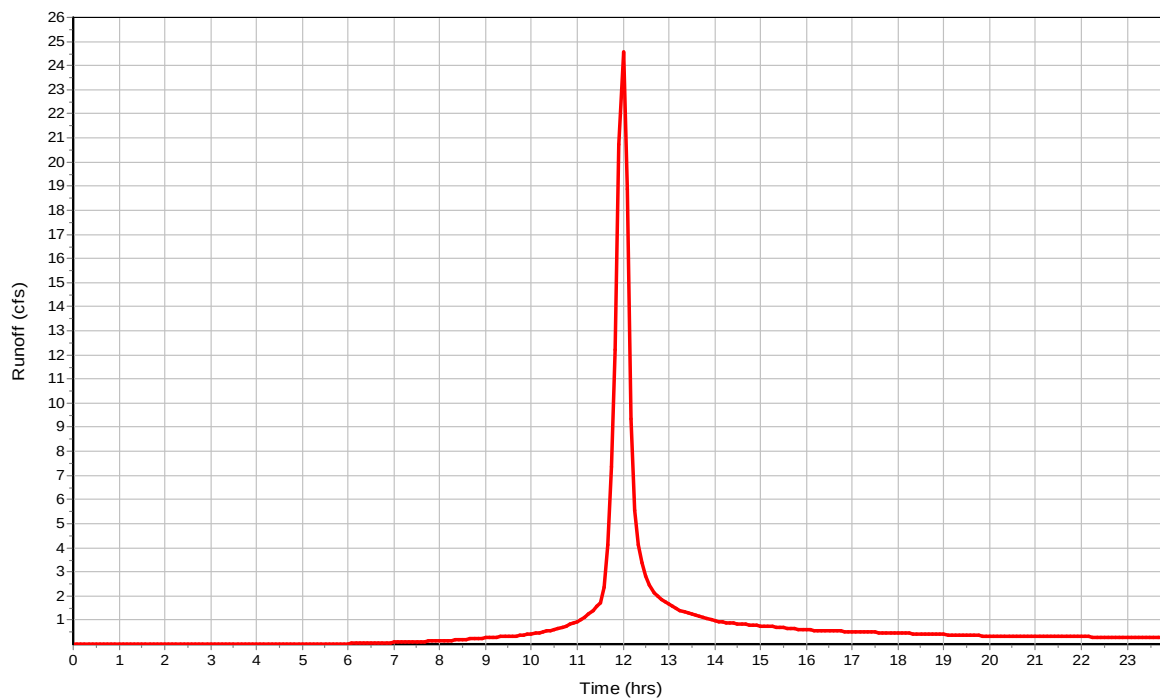
Total Rainfall (in) 4.3
 Total Runoff (in) 2.91
 Peak Runoff (cfs) 24.71
 Weighted Curve Number 86.93
 Time of Concentration (days hh:mm:ss) 0 00:10:29

Subbasin : P2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P3**Input Data**

Area (ac) 0.15
 Peak Rate Factor 484
 Weighted Curve Number 82.68
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Gravel roads	0.04	C	96
> 75% grass cover, Good	0.07	C	74
Woods & grass combination, Poor	0.03	C	82
Pasture, grassland, or range, Poor	0.01	C	86
Composite Area & Weighted CN	0.15		82.68

Time of Concentration

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0

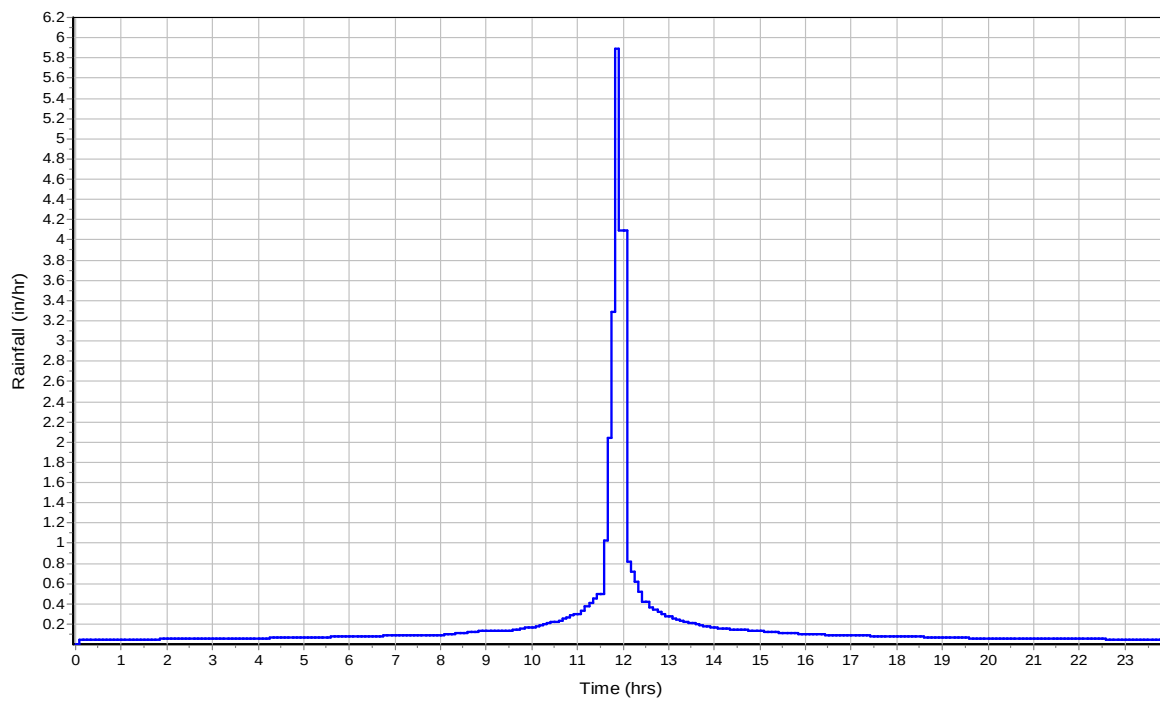
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	26.4558	0	0
Slope (%) :	7.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.45	0	0
Computed Flow Time (min) :	0.1	0	0
Total TOC (min)9.35			

Subbasin Runoff Results

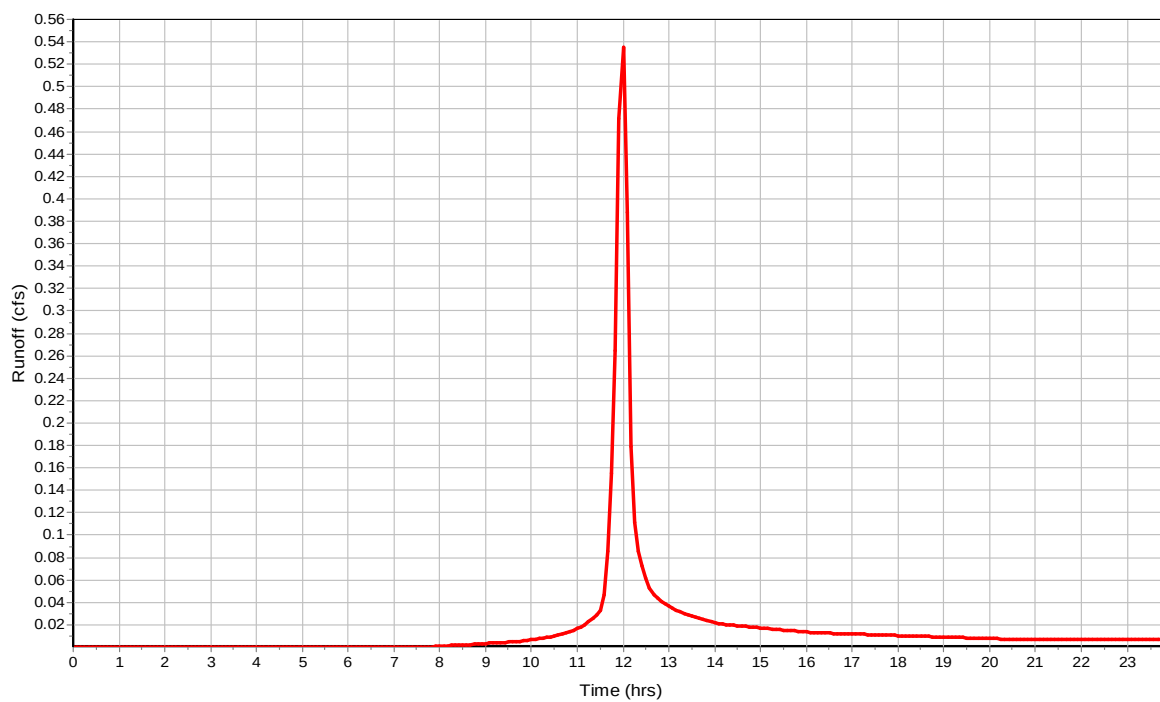
Total Rainfall (in) 4.3
 Total Runoff (in) 2.52
 Peak Runoff (cfs) 0.54
 Weighted Curve Number 82.68
 Time of Concentration (days hh:mm:ss) 0 00:09:21

Subbasin : P3

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN	Element ID	Invert Elevation	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1	Entry-P1	637.00	638.50	1.50	637.00	0.00	638.50	0.00	0.00	0.00
2	Entry-P3	583.04	584.54	1.50	583.04	0.00	584.54	0.00	0.00	0.00
3	Exit-P1	614.00	615.50	1.50	614.00	0.00	615.50	0.00	0.00	0.00
4	Exit-P2	608.60	610.10	1.50	608.60	0.00	610.10	0.00	0.00	0.00
5	Exit-P3	570.00	571.50	1.50	570.00	0.00	571.50	0.00	0.00	0.00
6	OCS	609.00	613.54	4.54	609.00	0.00	613.54	0.00	0.00	0.00
7	P2-Entry	566.94	569.44	2.50	566.94	0.00	569.44	0.00	0.00	0.00
8	P2-Exit	566.50	569.00	2.50	566.50	0.00	569.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	3.58	3.58	637.30	0.30	0.00	1.20	637.03	0.03	0 12:10	0 00:00	0.00	0.00
2	Entry-P3	0.27	0.00	583.10	0.06	0.00	1.44	583.05	0.01	0 12:13	0 00:00	0.00	0.00
3	Exit-P1	3.57	0.00	614.43	0.43	0.00	1.07	614.06	0.06	0 12:10	0 00:00	0.00	0.00
4	Exit-P2	0.82	0.00	608.88	0.28	0.00	1.22	608.66	0.06	0 12:32	0 00:00	0.00	0.00
5	Exit-P3	0.27	0.00	570.06	0.06	0.00	1.44	570.01	0.01	0 12:14	0 00:00	0.00	0.00
6	OCS	0.82	0.00	609.28	0.28	0.00	4.26	609.06	0.06	0 12:32	0 00:00	0.00	0.00
7	P2-Entry	24.59	24.59	568.36	1.42	0.00	1.08	567.11	0.17	0 12:05	0 00:00	0.00	0.00
8	P2-Exit	24.55	0.00	567.92	1.42	0.00	1.08	566.66	0.16	0 12:05	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch-P1	278.32	637.00	0.00	614.00	0.00	23.00	8.2600	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch-P3	163.00	583.04	0.00	570.00	0.00	13.04	8.0000	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch-P1	3.57	0 12:10	62.44	0.06	5.22	0.89	0.30	0.20	0.00		
2	Ditch-P3	0.27	0 12:14	61.44	0.00	2.03	1.34	0.06	0.04	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Pipe Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	Culvert	35.00	566.94	0.00	566.50	0.00	0.44	1.2600	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	DirectLink-P1	19.95	0.00	-608.60	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	DirectLink-P2	102.72	0.00	-566.50	570.00	0.00	-570.00	-554.9100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
4	DirectLink-P3	52.90	0.00	-570.00	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
5	Outlet-Pipe	30.00	609.00	0.00	608.60	0.00	0.40	1.3300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No
6	Pipe-P1	20.00	614.00	0.00	613.00	2.00	1.00	5.0000	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

1
1
1
1
1
1
1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Culvert	24.55	0 12:05	39.86	0.62	8.53	0.07	1.42	0.57	0.00		Calculated
2	DirectLink-P1	0.82	0 12:32	0.00	0.62	0.00		1.42	0.57	0.00		Calculated
3	DirectLink-P2	24.55	0 12:05	0.00	0.62	0.00		1.42	0.57	0.00		Calculated
4	DirectLink-P3	0.27	0 12:14	0.00	0.62	0.00		1.42	0.57	0.00		Calculated
5	Outlet-Pipe	0.82	0 12:32	10.51	0.08	3.54	0.14	0.28	0.19	0.00		Calculated
6	Pipe-P1	3.57	0 12:10	20.36	0.18	8.65	0.04	0.43	0.28	0.00		Calculated

Storage Nodes

Storage Node : Basin#4

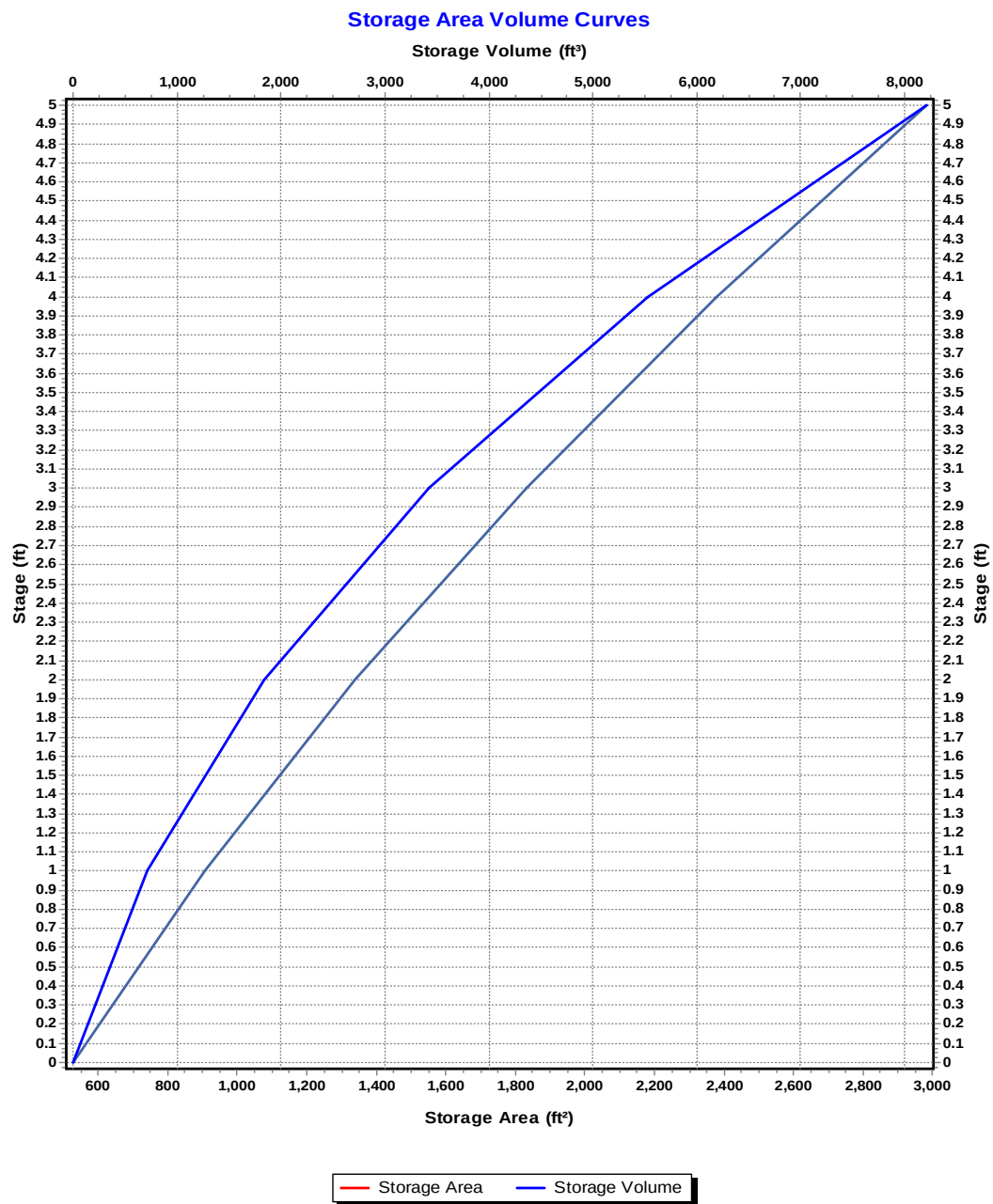
Input Data

Invert Elevation (ft)	609.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	609.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Bassin#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	527.57	0
1	905.52	716.55
2	1340.01	1839.32
3	1831.05	3424.85
4	2378.65	5529.7
5	2982.78	8210.42



Storage Node : Basin#4 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Emergency-Spillway	Trapezoidal	No	613.55	4.55	44.00	0.50	3.33

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Beehive-Grate	Bottom	CIRCULAR	No	21.25			613.54	0.61
2 Lower-Orifice	Side	CIRCULAR	No	4.00			611.00	0.61
3 Middle-Orifice	Side	CIRCULAR	No	4.00			612.00	0.61
4 Upper-Orifice	Side	CIRCULAR	No	4.00			613.00	0.61

Output Summary Results

Peak Inflow (cfs)	3.57
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	0.82
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	612.64
Max HGL Depth Attained (ft)	3.64
Average HGL Elevation Attained (ft)	610.23
Average HGL Depth Attained (ft)	1.23
Time of Max HGL Occurrence (days hh:mm)	0 12:32
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

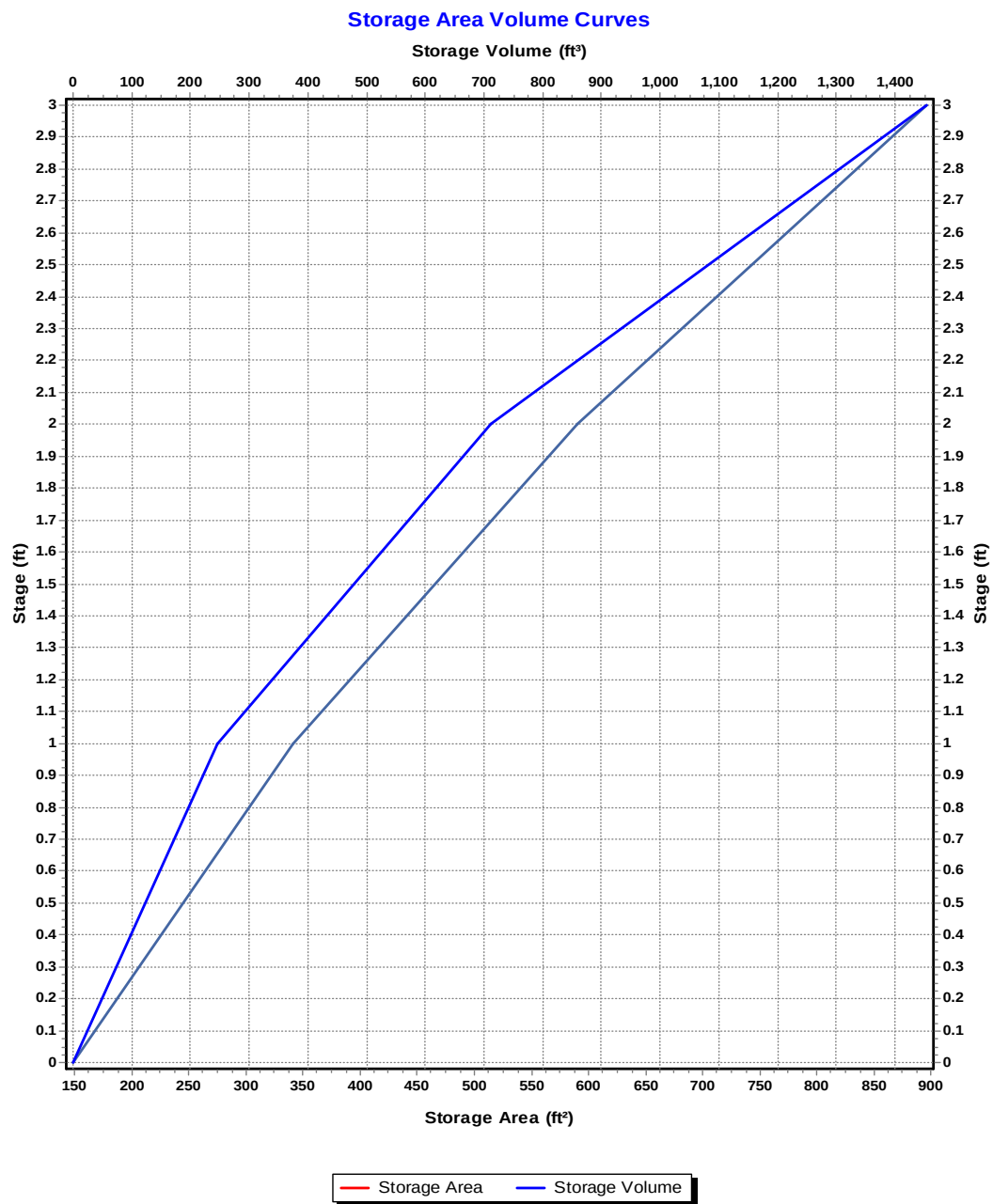
Storage Node : Forebay#1**Input Data**

Invert Elevation (ft)	611.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	3.00
Initial Water Elevation (ft)	611.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Forebay

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	148.47	0
1	341.1	244.79
2	590.29	710.49
3	896.02	1453.65



Storage Node : Forebay#1 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Crested-Weir	Trapezoidal	No	613.00	2.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	3.57
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	3.57
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.22
Max HGL Depth Attained (ft)	2.22
Average HGL Elevation Attained (ft)	612.2
Average HGL Depth Attained (ft)	1.2
Time of Max HGL Occurrence (days hh:mm)	0 12:10
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

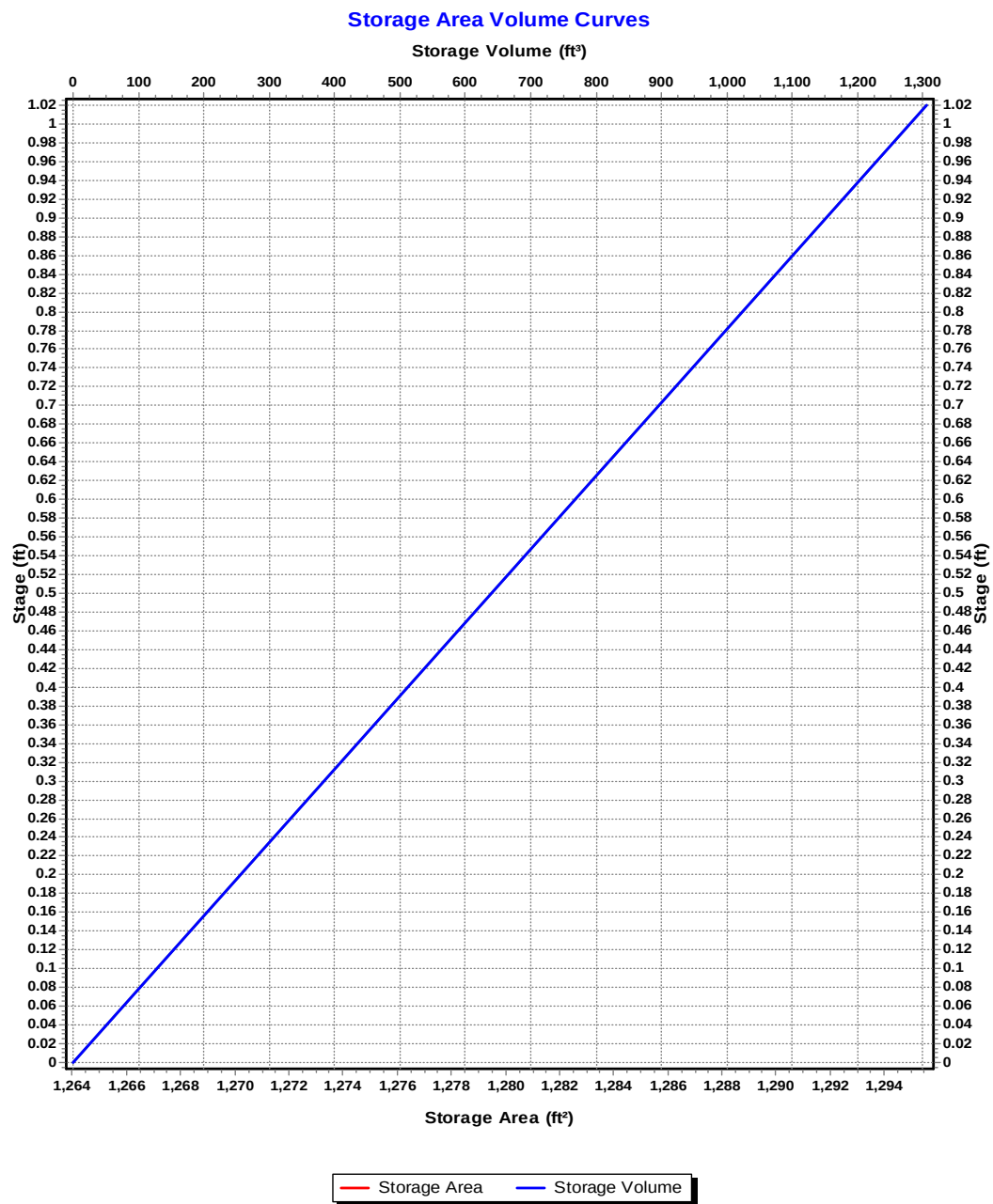
Storage Node : Geogrid-gravel**Input Data**

Invert Elevation (ft)	583.04
Max (Rim) Elevation (ft)	584.06
Max (Rim) Offset (ft)	1.02
Initial Water Elevation (ft)	583.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Permeable Geogrid Gravel#4

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	1264.03	0
1.02	1295.56	1305.39



Storage Node : Geogrid-gravel (continued)**Outflow Orifices**

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Underdrain-P3	Side	CIRCULAR	No	6.00			583.04	0.61

Output Summary Results

Peak Inflow (cfs)	0.54
Peak Lateral Inflow (cfs)	0.54
Peak Outflow (cfs)	0.27
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	583.38
Max HGL Depth Attained (ft)	0.34
Average HGL Elevation Attained (ft)	583.08
Average HGL Depth Attained (ft)	0.04
Time of Max HGL Occurrence (days hh:mm)	0 12:13
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Project Description

File Name NAV-31 Post 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 3
Nodes..... 12
 Junctions 8
 Outfalls 1
 Flow Diversions 0
 Inlets 0
 Storage Nodes 3
Links..... 15
 Channels 2
 Pipes 6
 Pumps 0
 Orifices 5
 Weirs 2
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	25-year	Cumulative	inches	New Hampshire	Strafford	25.00	5.10	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	P1	1.13	484.00	84.84	5.10	3.45	3.90	4.65	0 00:16:08
2	P2	6.30	484.00	86.93	5.10	3.65	23.01	30.77	0 00:10:28
3	P3	0.15	484.00	82.68	5.10	3.23	0.49	0.69	0 00:09:21

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	Junction	637.00	638.50	637.00	638.50	0.00	4.50	637.34	0.00	1.16	0 00:00	0.00	0.00
2	Entry-P3	Junction	583.04	584.54	583.04	584.54	0.00	0.37	583.12	0.00	1.42	0 00:00	0.00	0.00
3	Exit-P1	Junction	614.00	615.50	614.00	615.50	0.00	4.48	614.48	0.00	1.02	0 00:00	0.00	0.00
4	Exit-P2	Junction	608.60	610.10	608.60	610.10	0.00	1.15	608.94	0.00	1.16	0 00:00	0.00	0.00
5	Exit-P3	Junction	570.00	571.50	570.00	571.50	0.00	0.37	570.08	0.00	1.42	0 00:00	0.00	0.00
6	OCS	Junction	609.00	613.54	609.00	613.54	0.00	1.15	609.34	0.00	4.20	0 00:00	0.00	0.00
7	P2-Entry	Junction	566.94	569.44	566.94	569.44	0.00	30.55	568.58	0.00	0.86	0 00:00	0.00	0.00
8	P2-Exit	Junction	566.50	569.00	566.50	569.00	0.00	30.51	568.14	0.00	0.86	0 00:00	0.00	0.00
9	POST-DEVELPMENT-POA-1	Outfall	570.00					31.11	570.00					
10	Basin#4	Storage Node	609.00	614.00	609.00		0.00	4.49	613.22				0.00	0.00
11	Forebay#1	Storage Node	611.00	614.00	611.00		0.00	4.48	613.26				0.00	0.00
12	Geogrid-gravel	Storage Node	583.04	584.06	583.04		0.00	0.68	583.46				0.00	0.00

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 Culvert	Pipe	P2-Entry	P2-Exit	35.00	566.94	566.50	1.2600	30.000	0.0150	30.51	39.86	0.77	8.94	1.64	0.66	0.00 Calculated
2 DirectLink-P1	Pipe	Exit-P2	POST-DEVELOPMENT-POA-1	19.95	0.00	0.00	0.0000	0.000	0.0150	1.15	0.00	0.77	0.00	1.64	0.66	0.00 Calculated
3 DirectLink-P2	Pipe	P2-Exit	POST-DEVELOPMENT-POA-1	102.72	0.00	570.00	-554.9100	0.000	0.0150	30.51	0.00	0.77	0.00	1.64	0.66	0.00 Calculated
4 DirectLink-P3	Pipe	Exit-P3	POST-DEVELOPMENT-POA-1	52.90	0.00	0.00	0.0000	0.000	0.0150	0.37	0.00	0.77	0.00	1.64	0.66	0.00 Calculated
5 Outlet-Pipe	Pipe	OCS	Exit-P2	30.00	609.00	608.60	1.3300	18.000	0.0150	1.15	10.51	0.11	3.91	0.34	0.22	0.00 Calculated
6 Pipe-P1	Pipe	Exit-P1	Forebay#1	20.00	614.00	613.00	5.0000	18.000	0.0150	4.48	20.36	0.22	9.24	0.48	0.32	0.00 Calculated
7 Ditch-P1	Channel	Entry-P1	Exit-P1	278.32	637.00	614.00	8.2600	18.000	0.0320	4.48	62.44	0.07	5.63	0.34	0.23	0.00
8 Ditch-P3	Channel	Entry-P3	Exit-P3	163.00	583.04	570.00	8.0000	18.000	0.0320	0.37	61.44	0.01	2.28	0.08	0.05	0.00
9 Beehive-Grate	Orifice	Basin#4	OCS		609.00	609.00		21.250		0.00						
10 Lower-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.62						
11 Middle-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.44						
12 Underdrain-P3	Orifice	Geogrid-gravel	Entry-P3		583.04	583.04		6.000		0.37						
13 Upper-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.10						
14 Crested-Weir	Weir	Forebay#1	Basin#4		611.00	609.00				4.49						
15 Emergency-Spillway	Weir	Basin#4	POST-DEVELOPMENT-POA-1		609.00	570.00				0.00						

Subbasin Hydrology

Subbasin : P1

Input Data

Area (ac) 1.13
 Peak Rate Factor 484
 Weighted Curve Number 84.84
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Gravel roads	0.25	C	96
> 75% grass cover, Good	0.25	C	74
Fallow, crop residue, Good	0.27	C	88
Woods & grass combination, Poor	0.36	C	82
Composite Area & Weighted CN	1.13		84.84

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$$

$$R = A_q / W_p$$

$$T_c = (L_f / V) / (3600 \text{ sec/hr})$$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

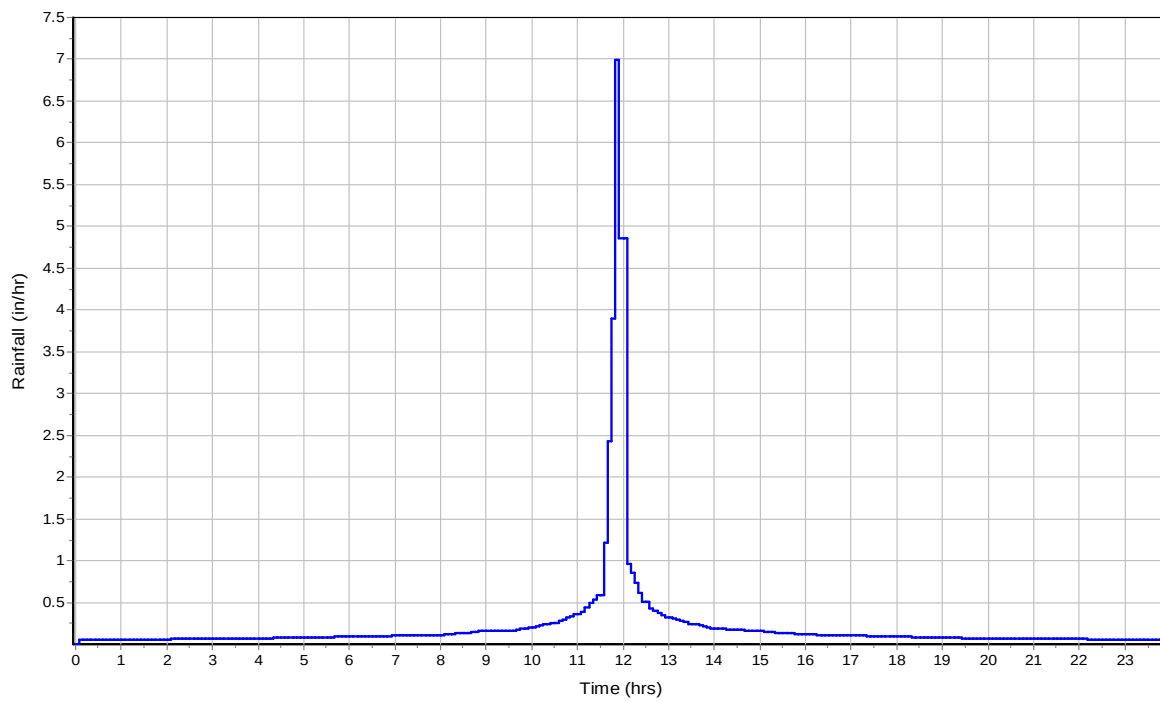
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	3	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.98	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	332.7668	0	0
Slope (%) :	8.71	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.76	0	0
Computed Flow Time (min) :	1.17	0	0
Total TOC (min)	16.15		

Subbasin Runoff Results

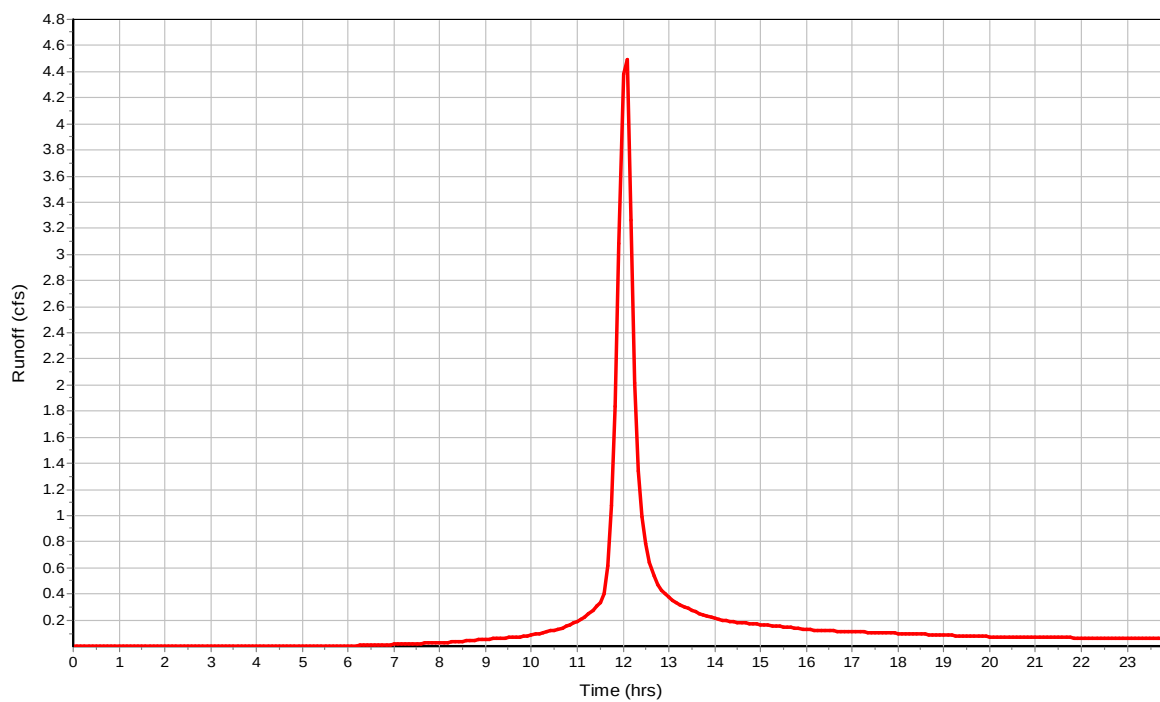
Total Rainfall (in)	5.1
Total Runoff (in)	3.45
Peak Runoff (cfs)	4.65
Weighted Curve Number	84.84
Time of Concentration (days hh:mm:ss)	0 00:16:09

Subbasin : P1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P2**Input Data**

Area (ac) 6.3
 Peak Rate Factor 484
 Weighted Curve Number 86.93
 Rain Gage ID

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.1	C	96
> 75% grass cover, Good	0.22	C	74
Woods & grass combination, Poor	0.97	C	82
Fallow, bare soil	0.16	C	91
Gravel roads	0.12	C	96
Fallow, crop residue, Good	4.73	C	88
Composite Area & Weighted CN	6.3		86.93

Time of Concentration

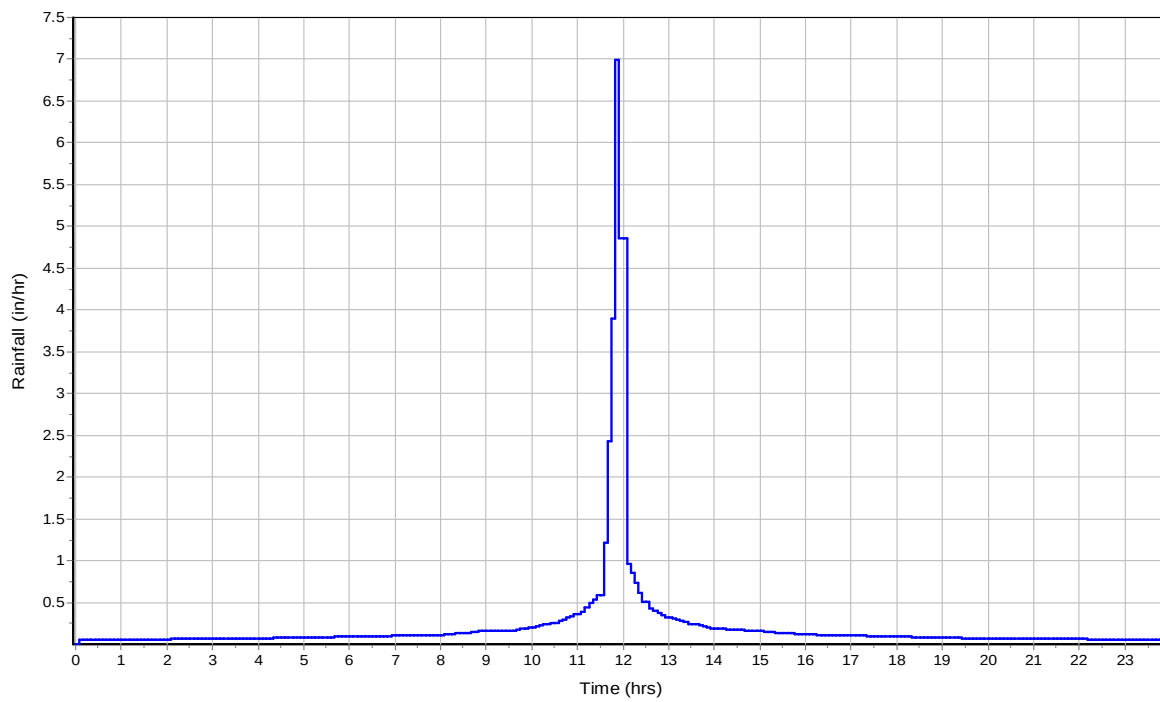
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	359.0728	0	0
Slope (%) :	9.2	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.89	0	0
Computed Flow Time (min) :	1.22	0	0
Total TOC (min)10.48			

Subbasin Runoff Results

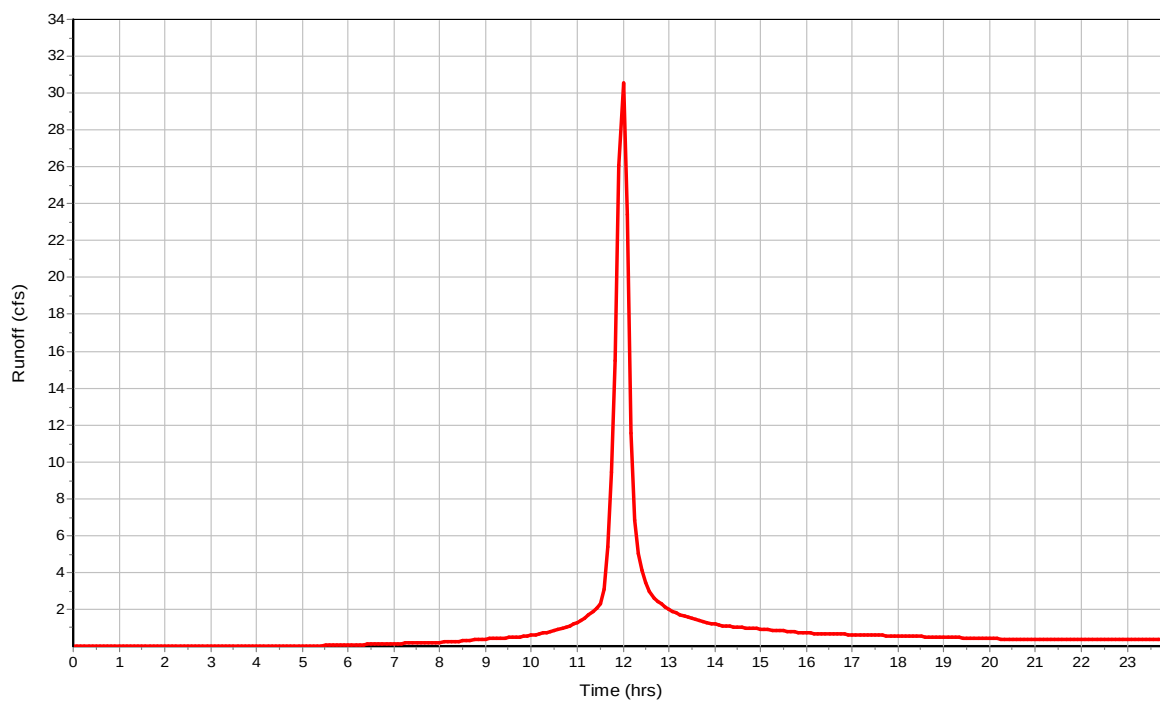
Total Rainfall (in) 5.1
 Total Runoff (in) 3.65
 Peak Runoff (cfs) 30.77
 Weighted Curve Number 86.93
 Time of Concentration (days hh:mm:ss) 0 00:10:29

Subbasin : P2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P3**Input Data**

Area (ac) 0.15
 Peak Rate Factor 484
 Weighted Curve Number 82.68
 Rain Gage ID

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.04	C	96
> 75% grass cover, Good	0.07	C	74
Woods & grass combination, Poor	0.03	C	82
Pasture, grassland, or range, Poor	0.01	C	86
Composite Area & Weighted CN	0.15		82.68

Time of Concentration

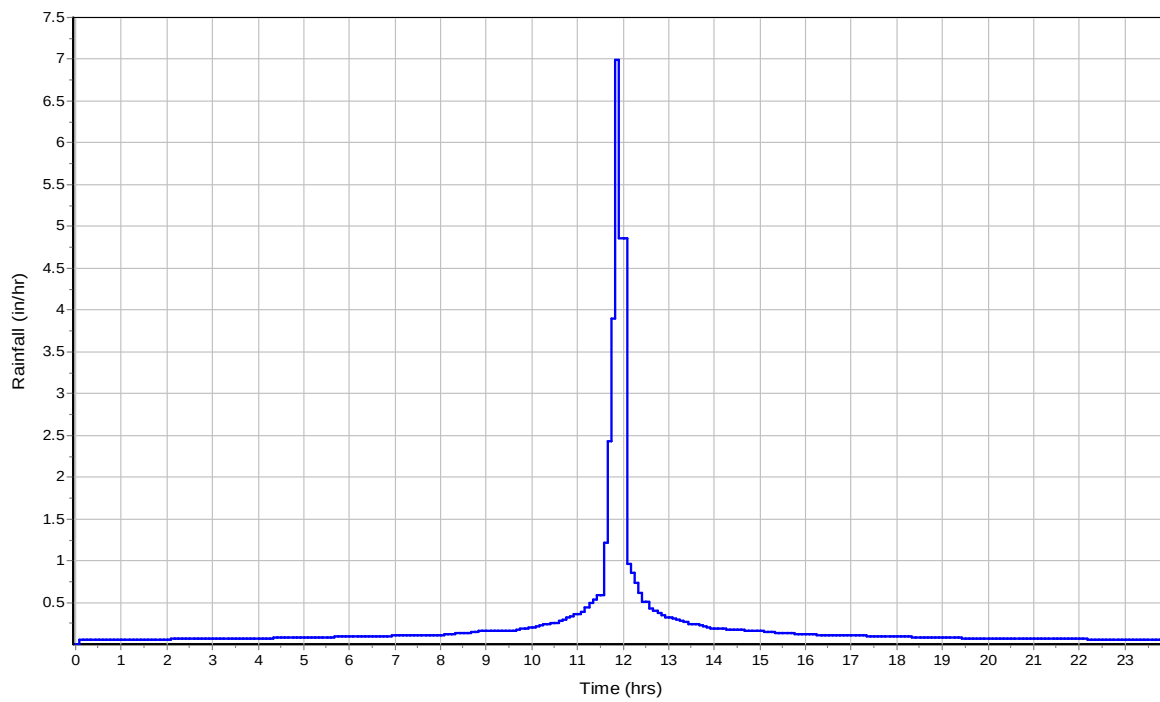
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	26.4558	0	0
Slope (%) :	7.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.45	0	0
Computed Flow Time (min) :	0.1	0	0
Total TOC (min)9.35			

Subbasin Runoff Results

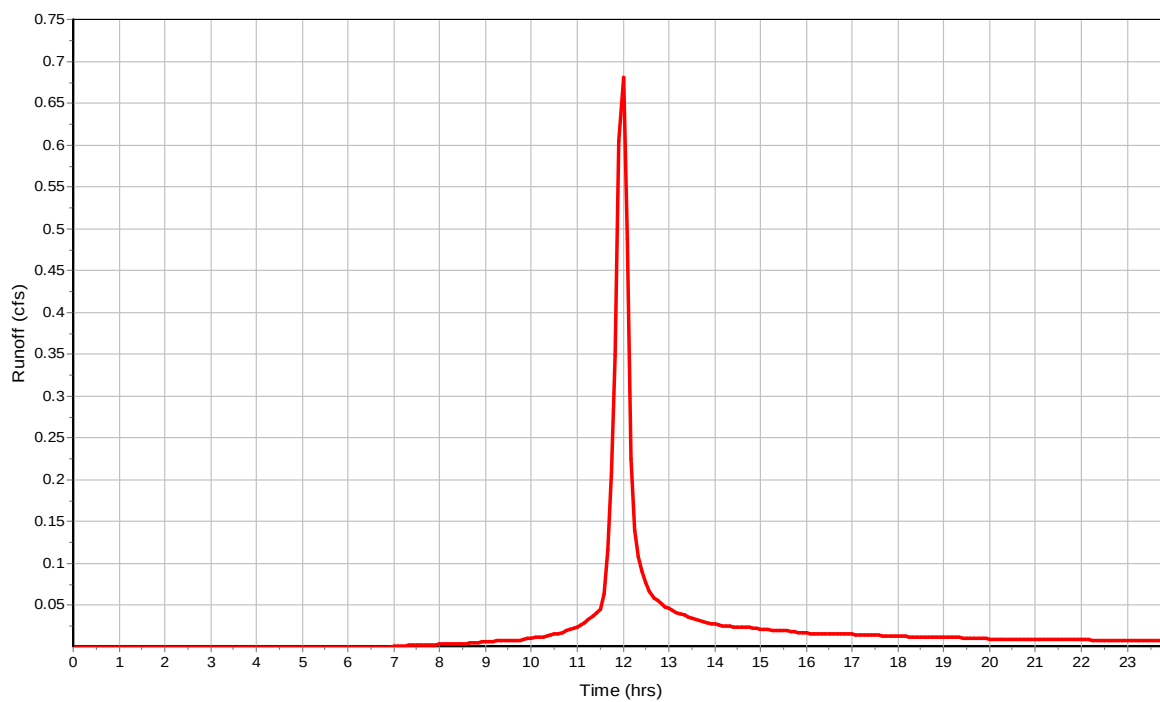
Total Rainfall (in) 5.1
 Total Runoff (in) 3.23
 Peak Runoff (cfs) 0.69
 Weighted Curve Number 82.68
 Time of Concentration (days hh:mm:ss) 0 00:09:21

Subbasin : P3

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1 Entry-P1	637.00	638.50	1.50	637.00	0.00	638.50	0.00	0.00	0.00
2 Entry-P3	583.04	584.54	1.50	583.04	0.00	584.54	0.00	0.00	0.00
3 Exit-P1	614.00	615.50	1.50	614.00	0.00	615.50	0.00	0.00	0.00
4 Exit-P2	608.60	610.10	1.50	608.60	0.00	610.10	0.00	0.00	0.00
5 Exit-P3	570.00	571.50	1.50	570.00	0.00	571.50	0.00	0.00	0.00
6 OCS	609.00	613.54	4.54	609.00	0.00	613.54	0.00	0.00	0.00
7 P2-Entry	566.94	569.44	2.50	566.94	0.00	569.44	0.00	0.00	0.00
8 P2-Exit	566.50	569.00	2.50	566.50	0.00	569.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	4.50	4.50	637.34	0.34	0.00	1.16	637.03	0.03	0 12:10	0 00:00	0.00	0.00
2	Entry-P3	0.37	0.00	583.12	0.08	0.00	1.42	583.05	0.01	0 12:12	0 00:00	0.00	0.00
3	Exit-P1	4.48	0.00	614.48	0.48	0.00	1.02	614.06	0.06	0 12:10	0 00:00	0.00	0.00
4	Exit-P2	1.15	0.00	608.94	0.34	0.00	1.16	608.67	0.07	0 12:29	0 00:00	0.00	0.00
5	Exit-P3	0.37	0.00	570.08	0.08	0.00	1.42	570.01	0.01	0 12:13	0 00:00	0.00	0.00
6	OCS	1.15	0.00	609.34	0.34	0.00	4.20	609.07	0.07	0 12:29	0 00:00	0.00	0.00
7	P2-Entry	30.55	30.55	568.58	1.64	0.00	0.86	567.13	0.19	0 12:05	0 00:00	0.00	0.00
8	P2-Exit	30.51	0.00	568.14	1.64	0.00	0.86	566.69	0.19	0 12:05	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Elevation	Offset	Outlet Invert	Outlet Invert Elevation	Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch-P1	278.32	637.00	0.00		614.00	0.00		23.00	8.2600	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch-P3	163.00	583.04	0.00		570.00	0.00		13.04	8.0000	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch-P1	4.48	0 12:10	62.44	0.07	5.63	0.82	0.34	0.23	0.00		
2	Ditch-P3	0.37	0 12:13	61.44	0.01	2.28	1.19	0.08	0.05	0.00		

Pipe Input

SN Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Pipe Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1 Culvert	35.00	566.94	0.00	566.50	0.00	0.44	1.2600	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2 DirectLink-P1	19.95	0.00	-608.60	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3 DirectLink-P2	102.72	0.00	-566.50	570.00	0.00	-570.00	-554.9100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
4 DirectLink-P3	52.90	0.00	-570.00	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
5 Outlet-Pipe	30.00	609.00	0.00	608.60	0.00	0.40	1.3300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No
6 Pipe-P1	20.00	614.00	0.00	613.00	2.00	1.00	5.0000	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

1
1
1
1
1
1
1

Pipe Results

SN Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
	(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1 Culvert	30.51	0 12:05	39.86	0.77	8.94	0.07	1.64	0.66	0.00		Calculated
2 DirectLink-P1	1.15	0 12:29	0.00	0.77	0.00		1.64	0.66	0.00		Calculated
3 DirectLink-P2	30.51	0 12:05	0.00	0.77	0.00		1.64	0.66	0.00		Calculated
4 DirectLink-P3	0.37	0 12:13	0.00	0.77	0.00		1.64	0.66	0.00		Calculated
5 Outlet-Pipe	1.15	0 12:29	10.51	0.11	3.91	0.13	0.34	0.22	0.00		Calculated
6 Pipe-P1	4.48	0 12:10	20.36	0.22	9.24	0.04	0.48	0.32	0.00		Calculated

Storage Nodes

Storage Node : Basin#4

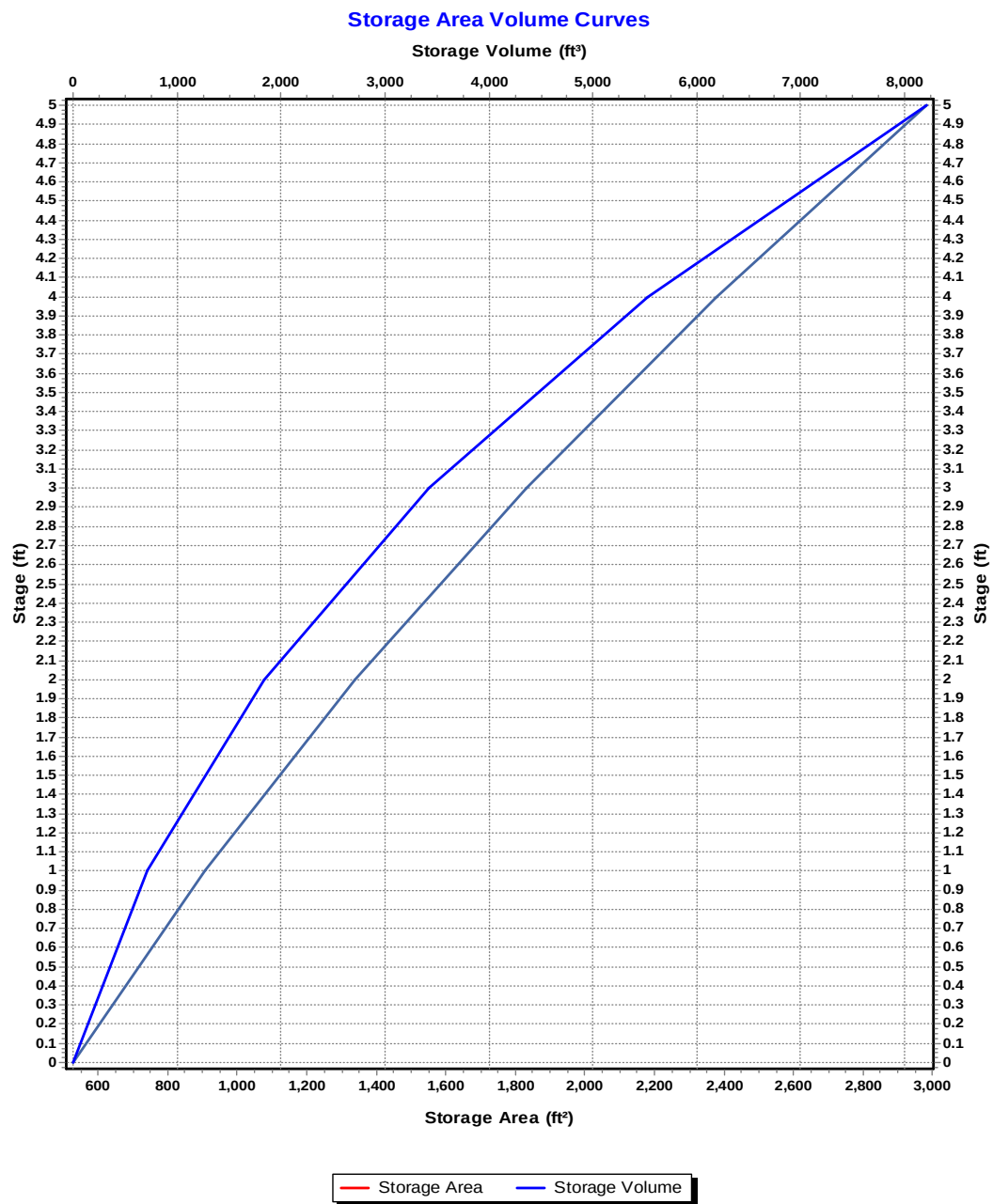
Input Data

Invert Elevation (ft)	609.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	609.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Basin#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	527.57	0
1	905.52	716.55
2	1340.01	1839.32
3	1831.05	3424.85
4	2378.65	5529.7
5	2982.78	8210.42



Storage Node : Basin#4 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Emergency-Spillway	Trapezoidal	No	613.55	4.55	44.00	0.50	3.33

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Beehive-Grate	Bottom	CIRCULAR	No	21.25			613.54	0.61
2 Lower-Orifice	Side	CIRCULAR	No	4.00			611.00	0.61
3 Middle-Orifice	Side	CIRCULAR	No	4.00			612.00	0.61
4 Upper-Orifice	Side	CIRCULAR	No	4.00			613.00	0.61

Output Summary Results

Peak Inflow (cfs)	4.49
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	1.15
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.22
Max HGL Depth Attained (ft)	4.22
Average HGL Elevation Attained (ft)	610.32
Average HGL Depth Attained (ft)	1.32
Time of Max HGL Occurrence (days hh:mm)	0 12:29
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Forebay#1

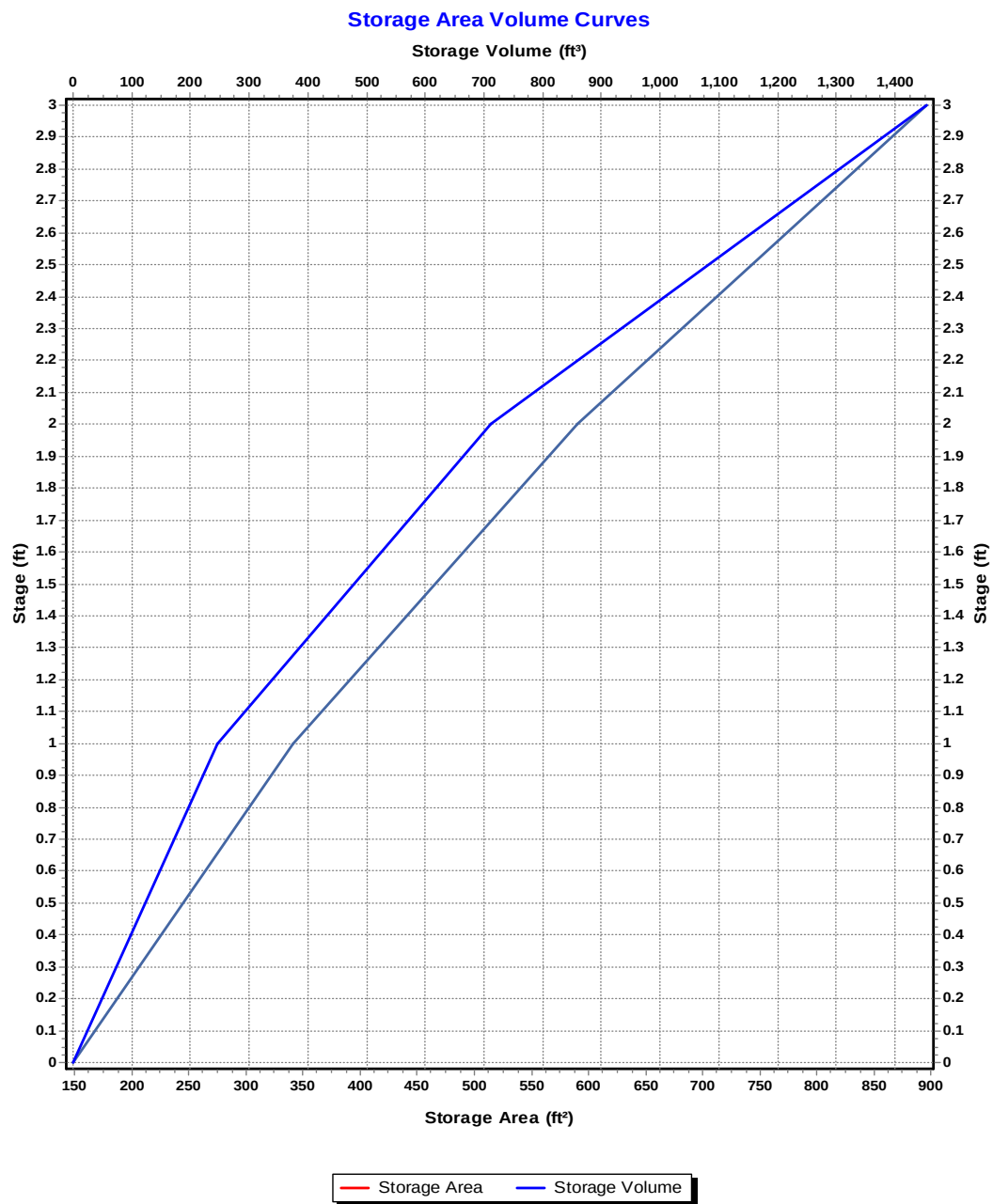
Input Data

Invert Elevation (ft)	611.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	3.00
Initial Water Elevation (ft)	611.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Forebay

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	148.47	0
1	341.1	244.79
2	590.29	710.49
3	896.02	1453.65



Storage Node : Forebay#1 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Crested-Weir	Trapezoidal	No	613.00	2.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	4.48
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	4.49
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.26
Max HGL Depth Attained (ft)	2.26
Average HGL Elevation Attained (ft)	612.27
Average HGL Depth Attained (ft)	1.27
Time of Max HGL Occurrence (days hh:mm)	0 12:10
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Geogrid-gravel

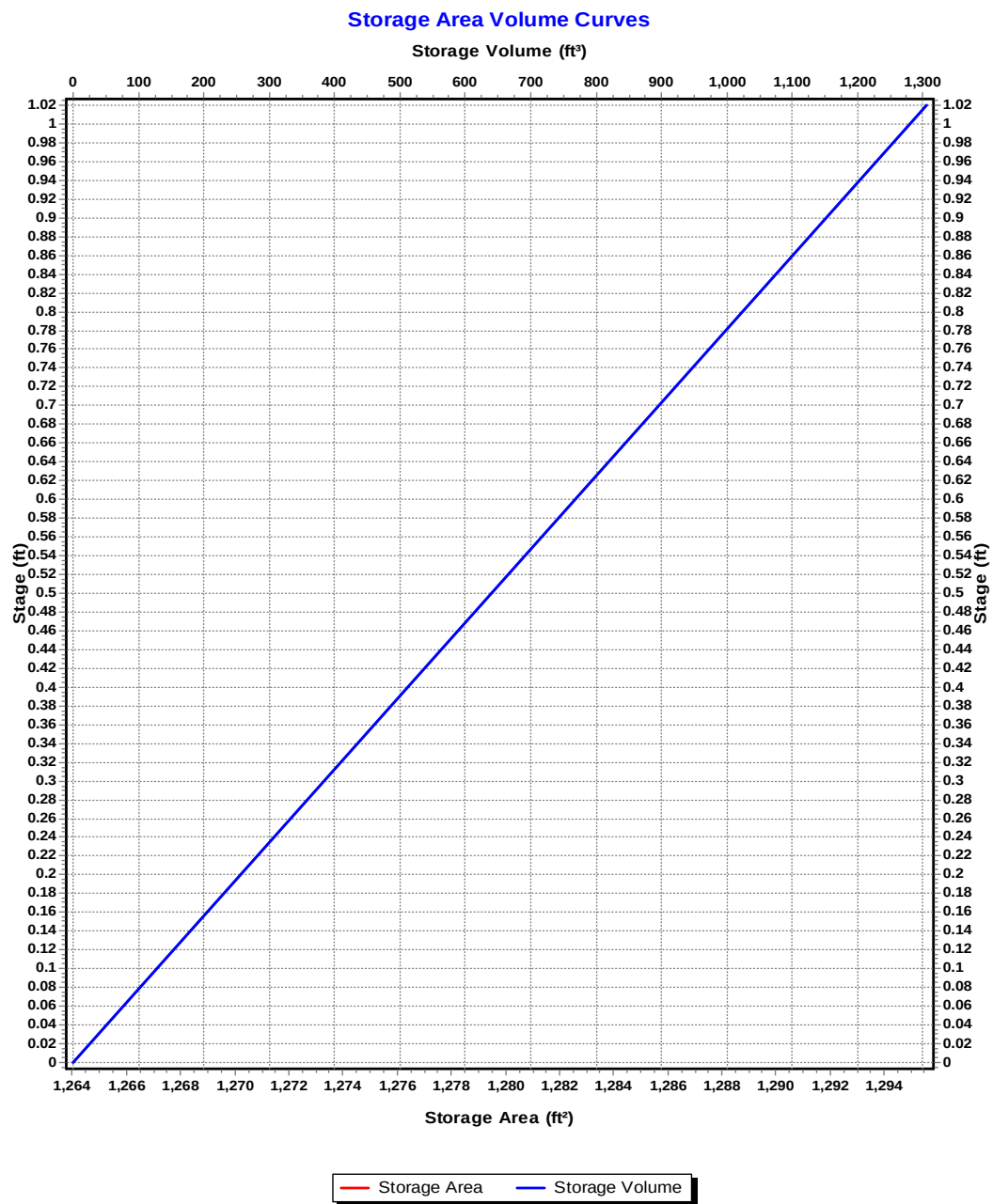
Input Data

Invert Elevation (ft)	583.04
Max (Rim) Elevation (ft)	584.06
Max (Rim) Offset (ft)	1.02
Initial Water Elevation (ft)	583.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Permeable Geogrid Gravel#4

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	1264.03	0
1.02	1295.56	1305.39



Storage Node : Geogrid-gravel (continued)**Outflow Orifices**

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Underdrain-P3	Side	CIRCULAR	No	6.00			583.04	0.61

Output Summary Results

Peak Inflow (cfs)	0.68
Peak Lateral Inflow (cfs)	0.68
Peak Outflow (cfs)	0.37
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	583.46
Max HGL Depth Attained (ft)	0.42
Average HGL Elevation Attained (ft)	583.08
Average HGL Depth Attained (ft)	0.04
Time of Max HGL Occurrence (days hh:mm)	0 12:12
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Project Description

File Name NAV-31 Post 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	0:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins.....	3
Nodes.....	12
<i>Junctions</i>	8
<i>Outfalls</i>	1
<i>Flow Diversions</i>	0
<i>Inlets</i>	0
<i>Storage Nodes</i>	3
Links.....	15
<i>Channels</i>	2
<i>Pipes</i>	6
<i>Pumps</i>	0
<i>Orifices</i>	5
<i>Weirs</i>	2
<i>Outlets</i>	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	50-Year	Cumulative	inches					User Defined

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted Curve Number	Total Rainfall	Total Runoff	Total Runoff Volume	Peak Runoff	Time of Concentration
		(ac)	Factor		(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	P1	1.13	484.00	84.84	5.60	3.91	4.42	5.25	0 00:16:08
2	P2	6.30	484.00	86.93	5.60	4.13	26.00	34.56	0 00:10:28
3	P3	0.15	484.00	82.68	5.60	3.69	0.56	0.79	0 00:09:21

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	Junction	637.00	638.50	637.00	638.50	0.00	5.08	637.37	0.00	1.13	0 00:00	0.00	0.00
2	Entry-P3	Junction	583.04	584.54	583.04	584.54	0.00	0.43	583.13	0.00	1.41	0 00:00	0.00	0.00
3	Exit-P1	Junction	614.00	615.50	614.00	615.50	0.00	5.07	614.51	0.00	0.99	0 00:00	0.00	0.00
4	Exit-P2	Junction	608.60	610.10	608.60	610.10	0.00	1.42	608.97	0.00	1.13	0 00:00	0.00	0.00
5	Exit-P3	Junction	570.00	571.50	570.00	571.50	0.00	0.43	570.09	0.00	1.41	0 00:00	0.00	0.00
6	OCS	Junction	609.00	613.54	609.00	613.54	0.00	1.42	609.37	0.00	4.17	0 00:00	0.00	0.00
7	P2-Entry	Junction	566.94	569.44	566.94	569.44	0.00	34.32	568.73	0.00	0.71	0 00:00	0.00	0.00
8	P2-Exit	Junction	566.50	569.00	566.50	569.00	0.00	34.27	568.29	0.00	0.71	0 00:00	0.00	0.00
9	POST-DEVELPMENT-POA-1	Outfall	570.00					35.04	570.00					
10	Basin#4	Storage Node	609.00	614.00	609.00		0.00	5.07	613.53				0.00	0.00
11	Forebay#1	Storage Node	611.00	614.00	611.00		0.00	5.07	613.28				0.00	0.00
12	Geogrid-gravel	Storage Node	583.04	584.06	583.04		0.00	0.77	583.50				0.00	0.00

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 Culvert	Pipe	P2-Entry	P2-Exit	35.00	566.94	566.50	1.2600	30.000	0.0150	34.27	39.86	0.86	9.12	1.79	0.72	0.00 Calculated
2 DirectLink-P1	Pipe	Exit-P2	POST-DEVELOPMENT-POA-1	19.95	0.00	0.00	0.0000	0.000	0.0150	1.42	0.00	0.86	0.00	1.79	0.72	0.00 Calculated
3 DirectLink-P2	Pipe	P2-Exit	POST-DEVELOPMENT-POA-1	102.72	0.00	570.00	-554.9100	0.000	0.0150	34.27	0.00	0.86	0.00	1.79	0.72	0.00 Calculated
4 DirectLink-P3	Pipe	Exit-P3	POST-DEVELOPMENT-POA-1	52.90	0.00	0.00	0.0000	0.000	0.0150	0.43	0.00	0.86	0.00	1.79	0.72	0.00 Calculated
5 Outlet-Pipe	Pipe	OCS	Exit-P2	30.00	609.00	608.60	1.3300	18.000	0.0150	1.42	10.51	0.14	4.16	0.37	0.25	0.00 Calculated
6 Pipe-P1	Pipe	Exit-P1	Forebay#1	20.00	614.00	613.00	5.0000	18.000	0.0150	5.07	20.36	0.25	9.56	0.51	0.34	0.00 Calculated
7 Ditch-P1	Channel	Entry-P1	Exit-P1	278.32	637.00	614.00	8.2600	18.000	0.0320	5.07	62.44	0.08	5.85	0.37	0.25	0.00
8 Ditch-P3	Channel	Entry-P3	Exit-P3	163.00	583.04	570.00	8.0000	18.000	0.0320	0.43	61.44	0.01	2.43	0.08	0.06	0.00
9 Beehive-Grate	Orifice	Basin#4	OCS		609.00	609.00		21.250		0.00						
10 Lower-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.66						
11 Middle-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.50						
12 Underdrain-P3	Orifice	Geogrid-gravel	Entry-P3		583.04	583.04		6.000		0.43						
13 Upper-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.26						
14 Crested-Weir	Weir	Forebay#1	Basin#4		611.00	609.00				5.07						
15 Emergency-Spillway	Weir	Basin#4	POST-DEVELOPMENT-POA-1		609.00	570.00				0.00						

Subbasin Hydrology

Subbasin : P1

Input Data

Area (ac) 1.13
 Peak Rate Factor 484
 Weighted Curve Number 84.84
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Gravel roads	0.25	C	96
> 75% grass cover, Good	0.25	C	74
Fallow, crop residue, Good	0.27	C	88
Woods & grass combination, Poor	0.36	C	82
Composite Area & Weighted CN	1.13		84.84

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$
 $R = A_q / W_p$
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

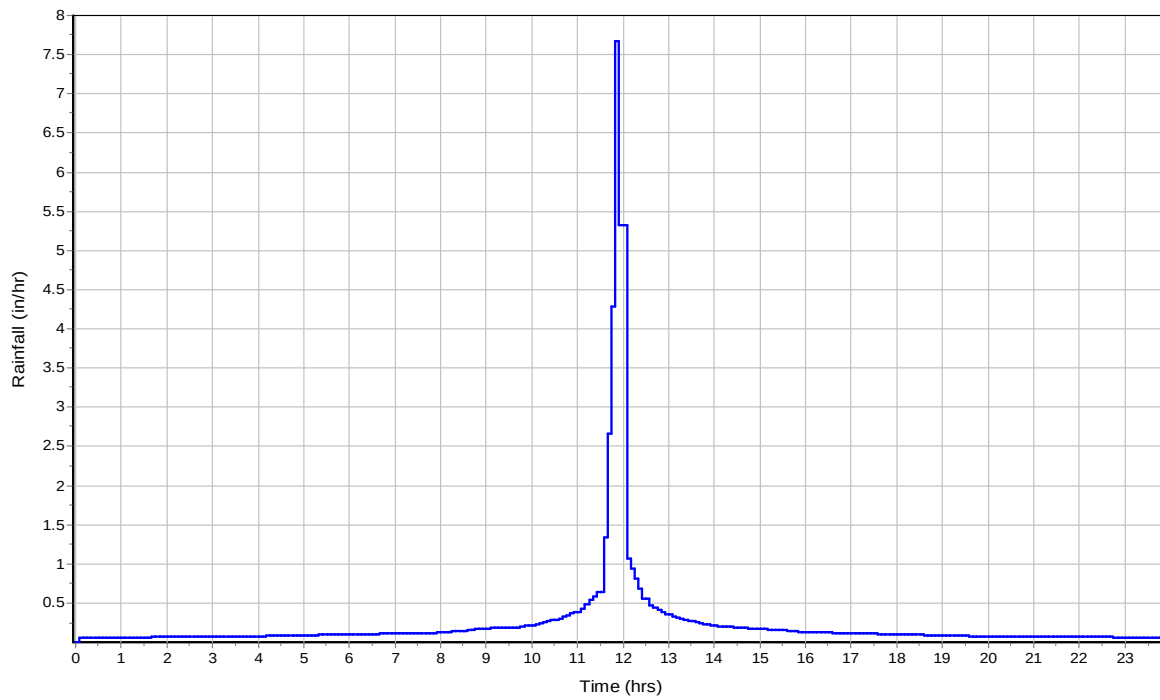
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	3	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.98	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	332.7668	0	0
Slope (%) :	8.71	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.76	0	0
Computed Flow Time (min) :	1.17	0	0
Total TOC (min)	16.15		

Subbasin Runoff Results

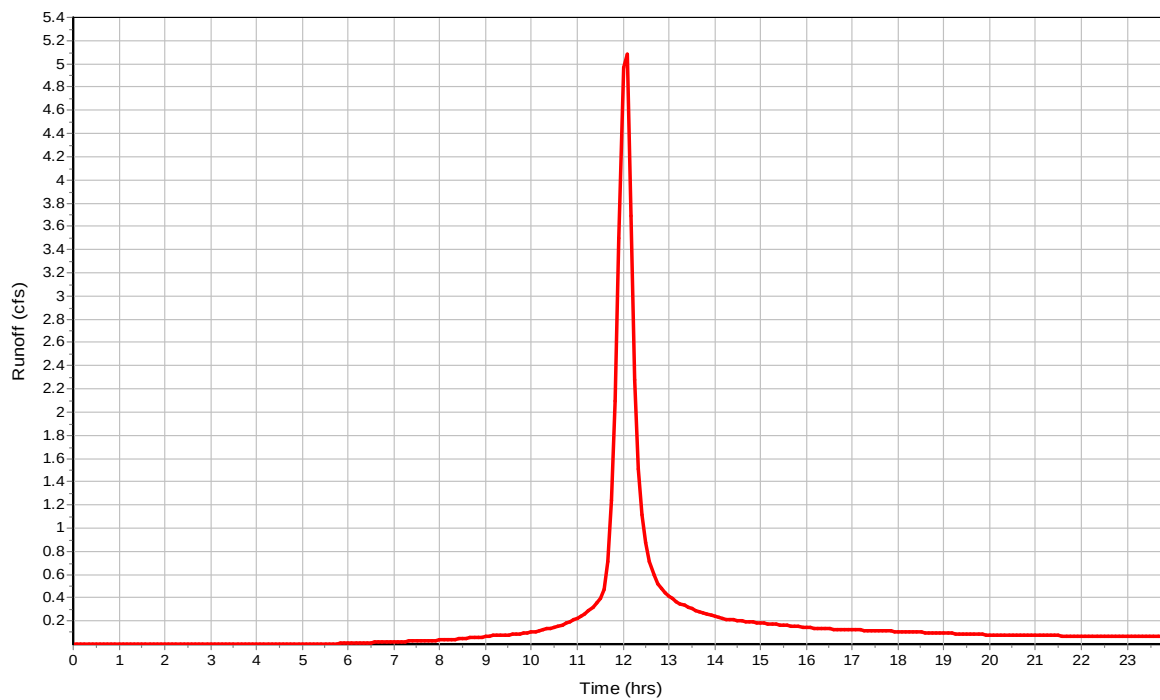
Total Rainfall (in)	5.6
Total Runoff (in)	3.91
Peak Runoff (cfs)	5.25
Weighted Curve Number	84.84
Time of Concentration (days hh:mm:ss)	0 00:16:09

Subbasin : P1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P2**Input Data**

Area (ac) 6.3
 Peak Rate Factor 484
 Weighted Curve Number 86.93
 Rain Gage ID

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Gravel roads	0.1	C	96
> 75% grass cover, Good	0.22	C	74
Woods & grass combination, Poor	0.97	C	82
Fallow, bare soil	0.16	C	91
Gravel roads	0.12	C	96
Fallow, crop residue, Good	4.73	C	88
Composite Area & Weighted CN	6.3		86.93

Time of Concentration

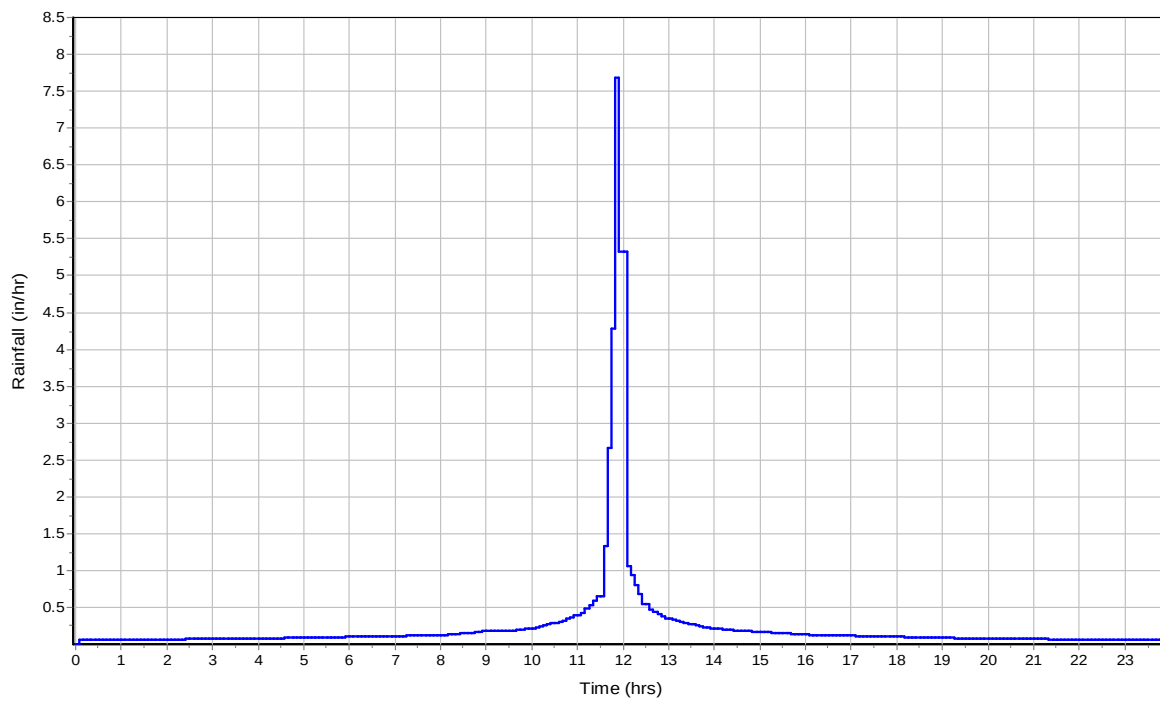
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	359.0728	0	0
Slope (%) :	9.2	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.89	0	0
Computed Flow Time (min) :	1.22	0	0
Total TOC (min)10.48			

Subbasin Runoff Results

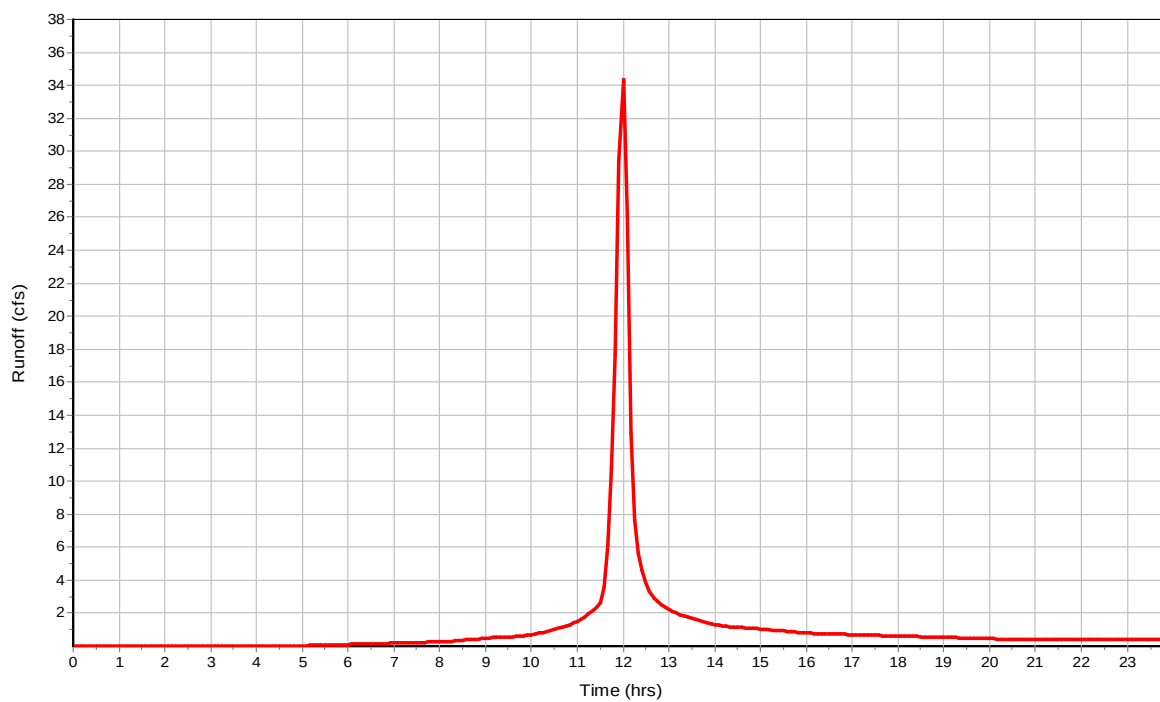
Total Rainfall (in) 5.6
 Total Runoff (in) 4.13
 Peak Runoff (cfs) 34.56
 Weighted Curve Number 86.93
 Time of Concentration (days hh:mm:ss) 0 00:10:29

Subbasin : P2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P3**Input Data**

Area (ac) 0.15
 Peak Rate Factor 484
 Weighted Curve Number 82.68
 Rain Gage ID

Composite Curve Number

32 Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Gravel roads	0.04	C	96
> 75% grass cover, Good	0.07	C	74
Woods & grass combination, Poor	0.03	C	82
Pasture, grassland, or range, Poor	0.01	C	86
Composite Area & Weighted CN	0.15		82.68

Time of Concentration

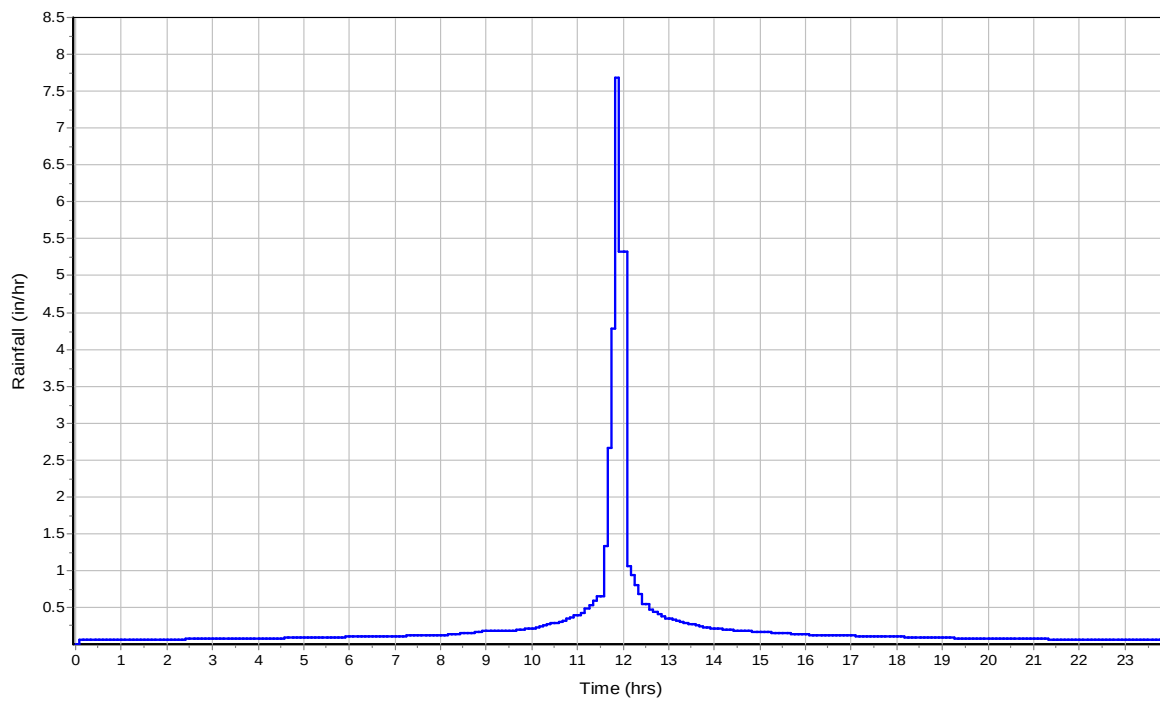
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	26.4558	0	0
Slope (%) :	7.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.45	0	0
Computed Flow Time (min) :	0.1	0	0
Total TOC (min)9.35			

Subbasin Runoff Results

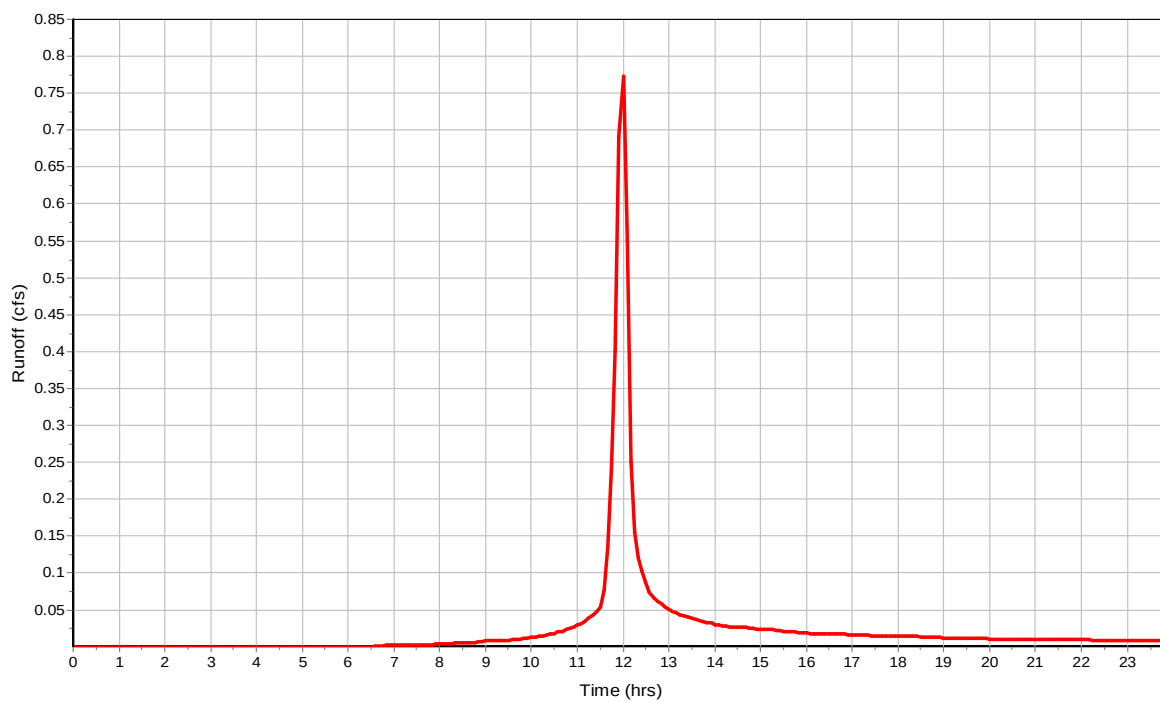
Total Rainfall (in) 5.6
 Total Runoff (in) 3.69
 Peak Runoff (cfs) 0.79
 Weighted Curve Number 82.68
 Time of Concentration (days hh:mm:ss) 0 00:09:21

Subbasin : P3

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (in)
1 Entry-P1	637.00	638.50	1.50	637.00	0.00	638.50	0.00	0.00	0.00
2 Entry-P3	583.04	584.54	1.50	583.04	0.00	584.54	0.00	0.00	0.00
3 Exit-P1	614.00	615.50	1.50	614.00	0.00	615.50	0.00	0.00	0.00
4 Exit-P2	608.60	610.10	1.50	608.60	0.00	610.10	0.00	0.00	0.00
5 Exit-P3	570.00	571.50	1.50	570.00	0.00	571.50	0.00	0.00	0.00
6 OCS	609.00	613.54	4.54	609.00	0.00	613.54	0.00	0.00	0.00
7 P2-Entry	566.94	569.44	2.50	566.94	0.00	569.44	0.00	0.00	0.00
8 P2-Exit	566.50	569.00	2.50	566.50	0.00	569.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	5.08	5.08	637.37	0.37	0.00	1.13	637.04	0.04	0 12:10	0 00:00	0.00	0.00
2	Entry-P3	0.43	0.00	583.13	0.09	0.00	1.41	583.05	0.01	0 12:12	0 00:00	0.00	0.00
3	Exit-P1	5.07	0.00	614.51	0.51	0.00	0.99	614.07	0.07	0 12:10	0 00:00	0.00	0.00
4	Exit-P2	1.42	0.00	608.97	0.37	0.00	1.13	608.68	0.08	0 12:28	0 00:00	0.00	0.00
5	Exit-P3	0.43	0.00	570.09	0.09	0.00	1.41	570.01	0.01	0 12:13	0 00:00	0.00	0.00
6	OCS	1.42	0.00	609.37	0.37	0.00	4.17	609.08	0.08	0 12:28	0 00:00	0.00	0.00
7	P2-Entry	34.32	34.32	568.73	1.79	0.00	0.71	567.14	0.20	0 12:05	0 00:00	0.00	0.00
8	P2-Exit	34.27	0.00	568.29	1.79	0.00	0.71	566.70	0.20	0 12:05	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert	Inlet Invert Elevation	Offset	Outlet Invert	Outlet Invert Elevation	Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch-P1	278.32	637.00	0.00		614.00	0.00		23.00	8.2600	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch-P3	163.00	583.04	0.00		570.00	0.00		13.04	8.0000	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch-P1	5.07	0 12:10	62.44	0.08	5.85	0.79	0.37	0.25	0.00		
2	Ditch-P3	0.43	0 12:13	61.44	0.01	2.43	1.12	0.08	0.06	0.00		

Pipe Input

SN Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Pipe Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1 Culvert	35.00	566.94	0.00	566.50	0.00	0.44	1.2600	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2 DirectLink-P1	19.95	0.00	-608.60	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3 DirectLink-P2	102.72	0.00	-566.50	570.00	0.00	-570.00	-554.9100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
4 DirectLink-P3	52.90	0.00	-570.00	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
5 Outlet-Pipe	30.00	609.00	0.00	608.60	0.00	0.40	1.3300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No
6 Pipe-P1	20.00	614.00	0.00	613.00	2.00	1.00	5.0000	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

1
1
1
1
1
1
1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Culvert	34.27	0 12:05	39.86	0.86	9.12	0.06	1.79	0.72	0.00		Calculated
2	DirectLink-P1	1.42	0 12:28	0.00	0.86	0.00		1.79	0.72	0.00		Calculated
3	DirectLink-P2	34.27	0 12:05	0.00	0.86	0.00		1.79	0.72	0.00		Calculated
4	DirectLink-P3	0.43	0 12:13	0.00	0.86	0.00		1.79	0.72	0.00		Calculated
5	Outlet-Pipe	1.42	0 12:28	10.51	0.14	4.16	0.12	0.37	0.25	0.00		Calculated
6	Pipe-P1	5.07	0 12:10	20.36	0.25	9.56	0.03	0.51	0.34	0.00		Calculated

Storage Nodes

Storage Node : Basin#4

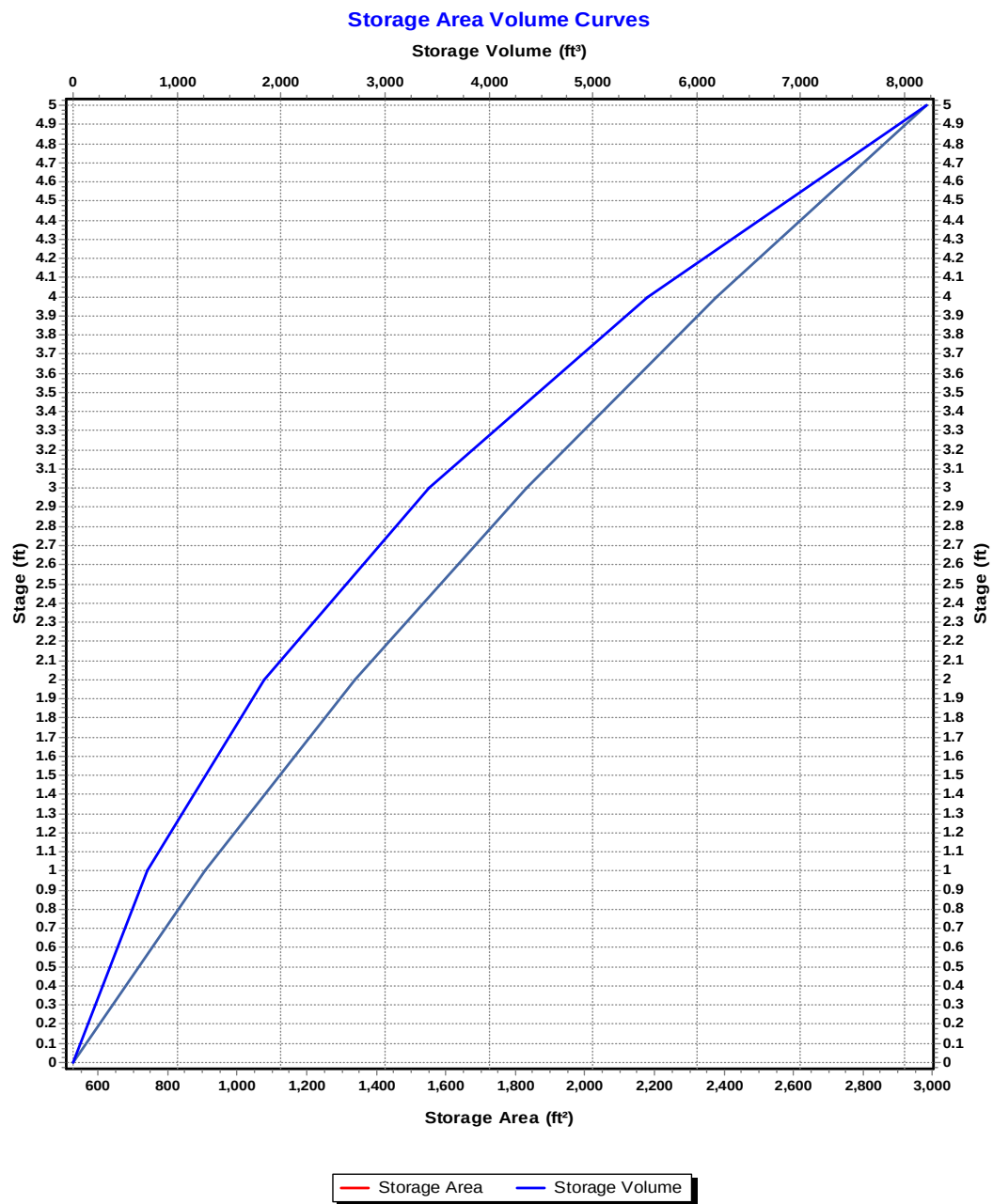
Input Data

Invert Elevation (ft)	609.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	609.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Bassin#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	527.57	0
1	905.52	716.55
2	1340.01	1839.32
3	1831.05	3424.85
4	2378.65	5529.7
5	2982.78	8210.42



Storage Node : Basin#4 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Emergency-Spillway	Trapezoidal	No	613.55	4.55	44.00	0.50	3.33

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Beehive-Grate	Bottom	CIRCULAR	No	21.25			613.54	0.61
2 Lower-Orifice	Side	CIRCULAR	No	4.00			611.00	0.61
3 Middle-Orifice	Side	CIRCULAR	No	4.00			612.00	0.61
4 Upper-Orifice	Side	CIRCULAR	No	4.00			613.00	0.61

Output Summary Results

Peak Inflow (cfs)	5.07
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	1.42
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.53
Max HGL Depth Attained (ft)	4.53
Average HGL Elevation Attained (ft)	610.38
Average HGL Depth Attained (ft)	1.38
Time of Max HGL Occurrence (days hh:mm)	0 12:28
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Forebay#1

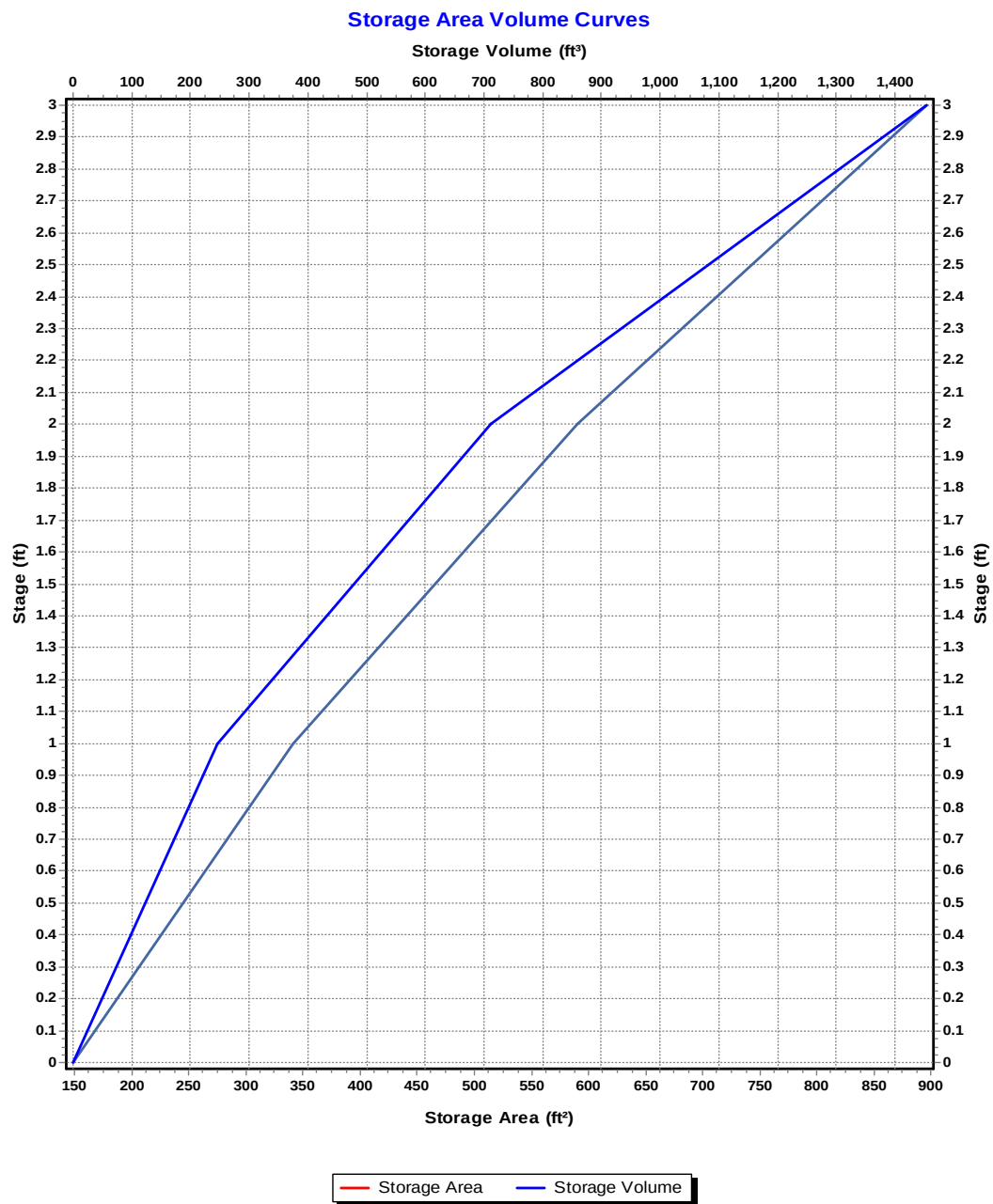
Input Data

Invert Elevation (ft)	611.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	3.00
Initial Water Elevation (ft)	611.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Forebay

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	148.47	0
1	341.1	244.79
2	590.29	710.49
3	896.02	1453.65



Storage Node : Forebay#1 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Crested-Weir	Trapezoidal	No	613.00	2.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	5.07
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	5.07
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.28
Max HGL Depth Attained (ft)	2.28
Average HGL Elevation Attained (ft)	612.31
Average HGL Depth Attained (ft)	1.31
Time of Max HGL Occurrence (days hh:mm)	0 12:10
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Storage Node : Geogrid-gravel

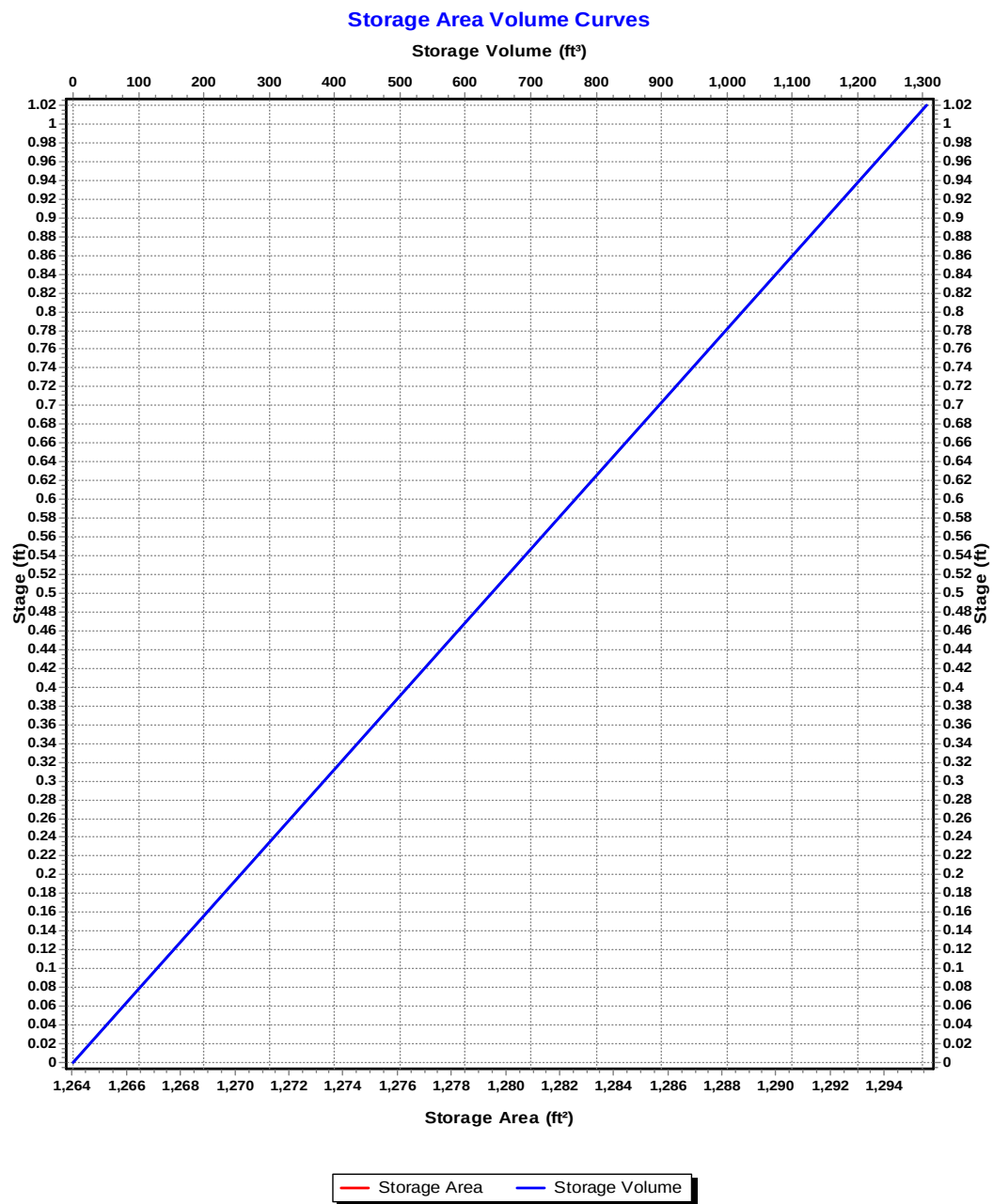
Input Data

Invert Elevation (ft)	583.04
Max (Rim) Elevation (ft)	584.06
Max (Rim) Offset (ft)	1.02
Initial Water Elevation (ft)	583.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Permeable Geogrid Gravel#4

Stage	Storage Area	Storage Volume
(ft)	(ft²)	(ft³)
0	1264.03	0
1.02	1295.56	1305.39



Storage Node : Geogrid-gravel (continued)**Outflow Orifices**

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Underdrain-P3	Side	CIRCULAR	No	6.00			583.04	0.61

Output Summary Results

Peak Inflow (cfs)	0.77
Peak Lateral Inflow (cfs)	0.77
Peak Outflow (cfs)	0.43
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	583.5
Max HGL Depth Attained (ft)	0.46
Average HGL Elevation Attained (ft)	583.09
Average HGL Depth Attained (ft)	0.05
Time of Max HGL Occurrence (days hh:mm)	0 12:12
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

Project Description

File Name NAV-31 Post 113023.SPF

Project Options

Flow Units CFS
Elevation Type Elevation
Hydrology Method SCS TR-55
Time of Concentration (TOC) Method SCS TR-55
Link Routing Method Kinematic Wave
Enable Overflow Ponding at Nodes YES
Skip Steady State Analysis Time Periods ... YES

Analysis Options

Start Analysis On 00:00:00 0:00:00
End Analysis On 00:00:00 0:00:00
Start Reporting On 00:00:00 0:00:00
Antecedent Dry Days 0 days
Runoff (Dry Weather) Time Step 0 01:00:00 days hh:mm:ss
Runoff (Wet Weather) Time Step 0 00:05:00 days hh:mm:ss
Reporting Time Step 0 00:05:00 days hh:mm:ss
Routing Time Step 30 seconds

Number of Elements

Qty
Rain Gages 1
Subbasins..... 3
Nodes..... 12
 Junctions 8
 Outfalls 1
 Flow Diversions 0
 Inlets 0
 Storage Nodes 3
Links..... 15
 Channels 2
 Pipes 6
 Pumps 0
 Orifices 5
 Weirs 2
 Outlets 0
Pollutants 0
Land Uses 0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
49		Time Series	100-year	Cumulative	inches	New Hampshire	Strafford	100.00	6.30	SCS Type II 24-hr

Subbasin Summary

SN	Subbasin ID	Area	Peak Rate	Weighted	Total	Total	Total	Peak	Time of
			Factor	Curve	Rainfall	Runoff	Runoff	Runoff	Concentration
		(ac)		Number	(in)	(in)	(ac-in)	(cfs)	(days hh:mm:ss)
1	P1	1.13	484.00	84.84	6.30	4.57	5.17	6.10	0 00:16:08
2	P2	6.30	484.00	86.93	6.30	4.80	30.21	39.88	0 00:10:28
3	P3	0.15	484.00	82.68	6.30	4.33	0.66	0.92	0 00:09:21

Node Summary

SN	Element ID	Element Type	Invert Elevation	Ground/Rim (Max) Elevation	Initial Water Elevation	Surcharge Elevation	Ponded Area	Peak Inflow	Max HGL Elevation Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
			(ft)	(ft)	(ft)	(ft)	(ft²)	(cfs)	(ft)	(ft)	(ft)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	Junction	637.00	638.50	637.00	638.50	0.00	5.89	637.40	0.00	1.10	0 00:00	0.00	0.00
2	Entry-P3	Junction	583.04	584.54	583.04	584.54	0.00	0.51	583.13	0.00	1.41	0 00:00	0.00	0.00
3	Exit-P1	Junction	614.00	615.50	614.00	615.50	0.00	5.87	614.55	0.00	0.95	0 00:00	0.00	0.00
4	Exit-P2	Junction	608.60	610.10	608.60	610.10	0.00	1.86	609.03	0.00	1.07	0 00:00	0.00	0.00
5	Exit-P3	Junction	570.00	571.50	570.00	571.50	0.00	0.51	570.09	0.00	1.41	0 00:00	0.00	0.00
6	OCS	Junction	609.00	613.54	609.00	613.54	0.00	1.86	609.43	0.00	4.11	0 00:00	0.00	0.00
7	P2-Entry	Junction	566.94	569.44	566.94	569.44	0.00	39.53	568.97	0.00	0.47	0 00:00	0.00	0.00
8	P2-Exit	Junction	566.50	569.00	566.50	569.00	0.00	39.49	568.53	0.00	0.47	0 00:00	0.00	0.00
9	POST-DEVELPMENT-POA-1	Outfall	570.00					40.64	570.00					
10	Basin#4	Storage Node	609.00	614.00	609.00		0.00	5.87	613.61				0.00	0.00
11	Forebay#1	Storage Node	611.00	614.00	611.00		0.00	5.87	613.31				0.00	0.00
12	Geogrid-gravel	Storage Node	583.04	584.06	583.04		0.00	0.90	583.57				0.00	0.00

Link Summary

SN Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Reported Surcharged Condition
				(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)
1 Culvert	Pipe	P2-Entry	P2-Exit	35.00	566.94	566.50	1.2600	30.000	0.0150	39.49	39.86	0.99	9.27	2.03	0.81	0.00 Calculated
2 DirectLink-P1	Pipe	Exit-P2	POST-DEVELOPMENT-POA-1	19.95	0.00	0.00	0.0000	0.000	0.0150	1.86	0.00	0.99	0.00	2.03	0.81	0.00 Calculated
3 DirectLink-P2	Pipe	P2-Exit	POST-DEVELOPMENT-POA-1	102.72	0.00	570.00	-554.9100	0.000	0.0150	39.49	0.00	0.99	0.00	2.03	0.81	0.00 Calculated
4 DirectLink-P3	Pipe	Exit-P3	POST-DEVELOPMENT-POA-1	52.90	0.00	0.00	0.0000	0.000	0.0150	0.51	0.00	0.99	0.00	2.03	0.81	0.00 Calculated
5 Outlet-Pipe	Pipe	OCS	Exit-P2	30.00	609.00	608.60	1.3300	18.000	0.0150	1.86	10.51	0.18	4.48	0.42	0.28	0.00 Calculated
6 Pipe-P1	Pipe	Exit-P1	Forebay#1	20.00	614.00	613.00	5.0000	18.000	0.0150	5.87	20.36	0.29	9.96	0.55	0.37	0.00 Calculated
7 Ditch-P1	Channel	Entry-P1	Exit-P1	278.32	637.00	614.00	8.2600	18.000	0.0320	5.87	62.44	0.09	6.13	0.40	0.27	0.00
8 Ditch-P3	Channel	Entry-P3	Exit-P3	163.00	583.04	570.00	8.0000	18.000	0.0320	0.51	61.44	0.01	2.58	0.09	0.06	0.00
9 Beehive-Grate	Orifice	Basin#4	OCS		609.00	609.00		21.250		0.38						
10 Lower-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.67						
11 Middle-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.52						
12 Underdrain-P3	Orifice	Geogrid-gravel	Entry-P3		583.04	583.04		6.000		0.51						
13 Upper-Orifice	Orifice	Basin#4	OCS		609.00	609.00		4.000		0.29						
14 Crested-Weir	Weir	Forebay#1	Basin#4		611.00	609.00				5.87						
15 Emergency-Spillway	Weir	Basin#4	POST-DEVELOPMENT-POA-1		609.00	570.00				2.42						

Subbasin Hydrology

Subbasin : P1

Input Data

Area (ac) 1.13
 Peak Rate Factor 484
 Weighted Curve Number 84.84
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Gravel roads	0.25	C	96
> 75% grass cover, Good	0.25	C	74
Fallow, crop residue, Good	0.27	C	88
Woods & grass combination, Poor	0.36	C	82
Composite Area & Weighted CN	1.13		84.84

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

$$T_c = (0.007 * ((n * L_f)^{0.8})) / ((P^{0.5}) * (S_f^{0.4}))$$

Where :

T_c = Time of Concentration (hr)
 n = Manning's roughness
 L_f = Flow Length (ft)
 P = 2 yr, 24 hr Rainfall (inches)
 S_f = Slope (ft/ft)

Shallow Concentrated Flow Equation :

$V = 16.1345 * (S_f^{0.5})$ (unpaved surface)
 $V = 20.3282 * (S_f^{0.5})$ (paved surface)
 $V = 15.0 * (S_f^{0.5})$ (grassed waterway surface)
 $V = 10.0 * (S_f^{0.5})$ (nearly bare & untilled surface)
 $V = 9.0 * (S_f^{0.5})$ (cultivated straight rows surface)
 $V = 7.0 * (S_f^{0.5})$ (short grass pasture surface)
 $V = 5.0 * (S_f^{0.5})$ (woodland surface)
 $V = 2.5 * (S_f^{0.5})$ (forest w/heavy litter surface)
 $T_c = (L_f / V) / (3600 \text{ sec/hr})$

Where:

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)

Channel Flow Equation :

$$V = (1.49 * (R^{2/3}) * (S_f^{0.5})) / n$$

$$R = A_q / W_p$$

$$T_c = (L_f / V) / (3600 \text{ sec/hr})$$

Where :

T_c = Time of Concentration (hr)
 L_f = Flow Length (ft)
 R = Hydraulic Radius (ft)
 A_q = Flow Area (ft²)
 W_p = Wetted Perimeter (ft)
 V = Velocity (ft/sec)
 S_f = Slope (ft/ft)
 n = Manning's roughness

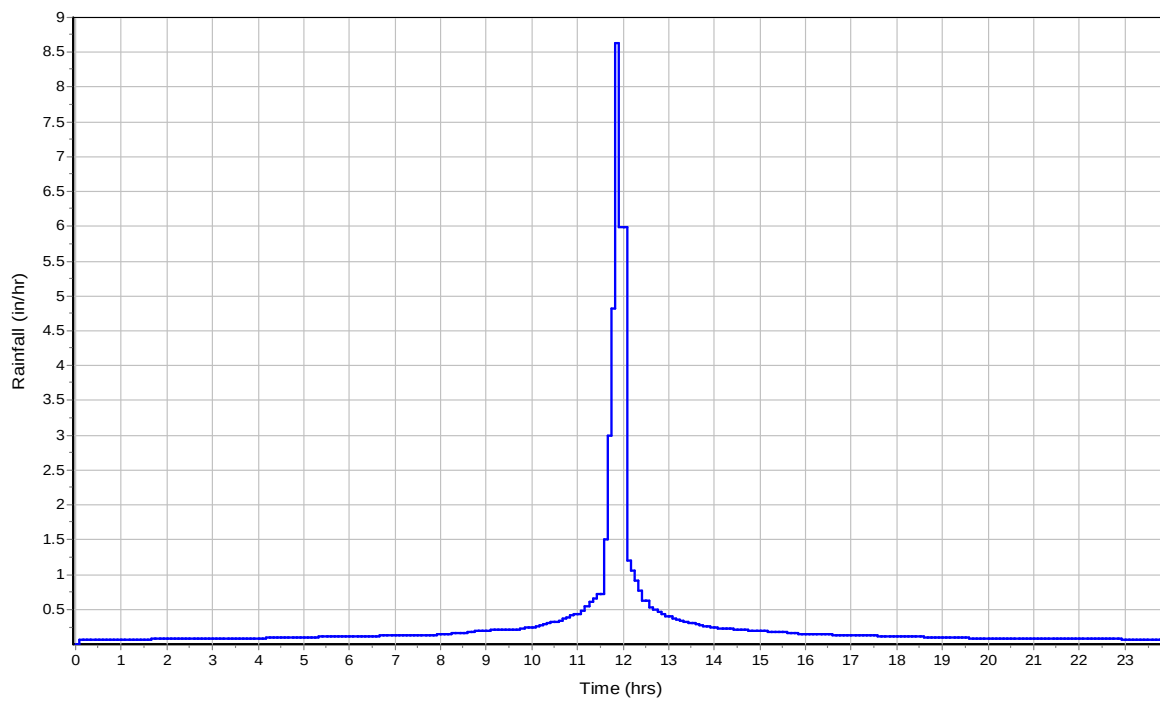
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	3	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.11	0	0
Computed Flow Time (min) :	14.98	0	0
	Subarea A	Subarea B	Subarea C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	332.7668	0	0
Slope (%) :	8.71	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.76	0	0
Computed Flow Time (min) :	1.17	0	0
Total TOC (min)	16.15		

Subbasin Runoff Results

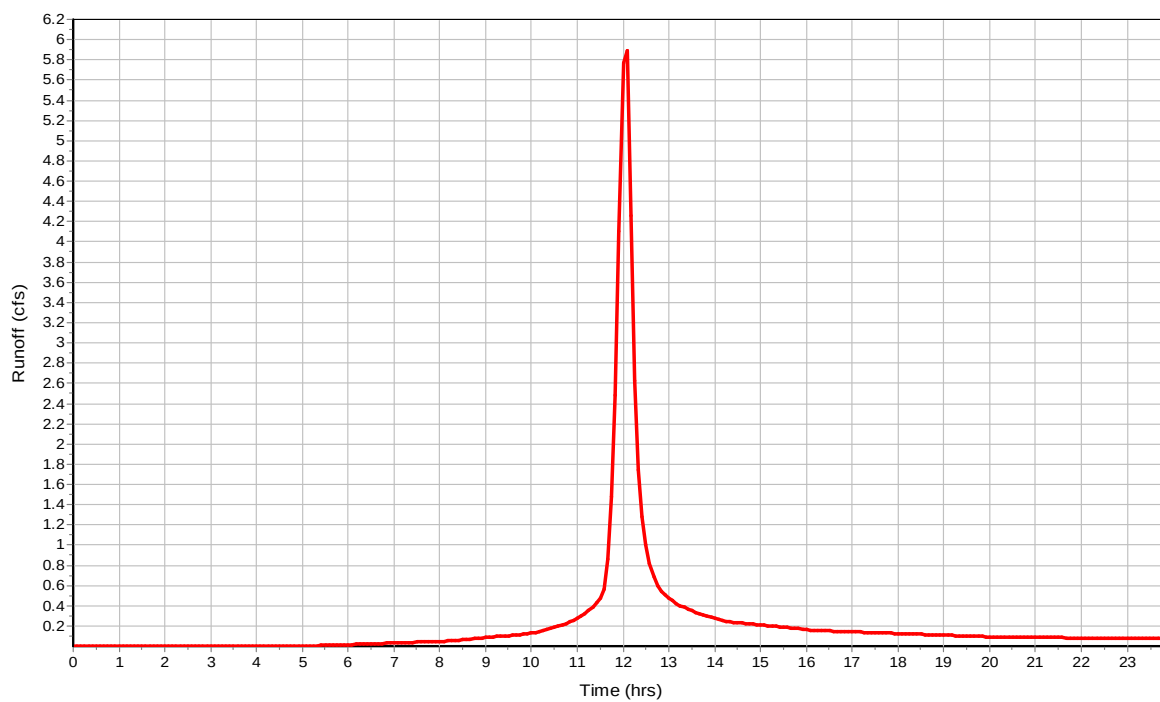
Total Rainfall (in)	6.3
Total Runoff (in)	4.57
Peak Runoff (cfs)	6.1
Weighted Curve Number	84.84
Time of Concentration (days hh:mm:ss)	0 00:16:09

Subbasin : P1

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P2**Input Data**

Area (ac) 6.3
 Peak Rate Factor 484
 Weighted Curve Number 86.93
 Rain Gage ID

Composite Curve Number

32	Area (acres)	Soil Group	Curve Number
Soil/Surface Description			
Gravel roads	0.1	C	96
> 75% grass cover, Good	0.22	C	74
Woods & grass combination, Poor	0.97	C	82
Fallow, bare soil	0.16	C	91
Gravel roads	0.12	C	96
Fallow, crop residue, Good	4.73	C	88
Composite Area & Weighted CN	6.3		86.93

Time of Concentration

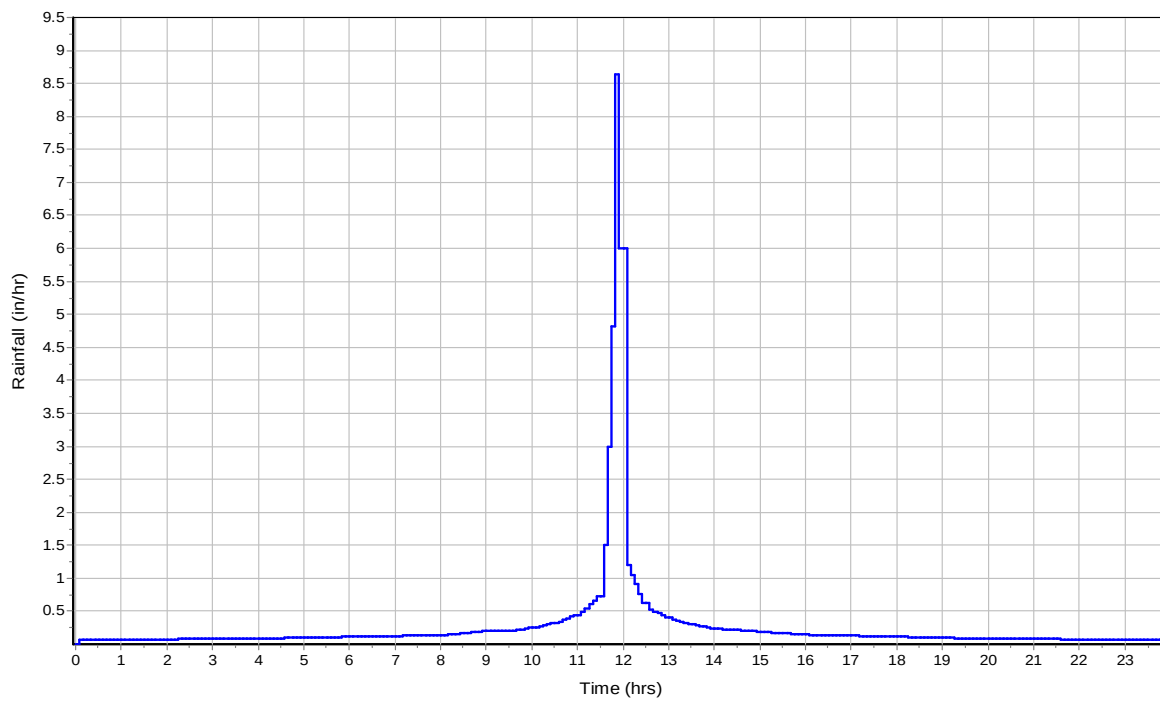
	Subarea A	Subarea B	Subarea C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0
Shallow Concentrated Flow Computations			
Flow Length (ft) :	359.0728	0	0
Slope (%) :	9.2	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.89	0	0
Computed Flow Time (min) :	1.22	0	0
Total TOC (min)10.48			

Subbasin Runoff Results

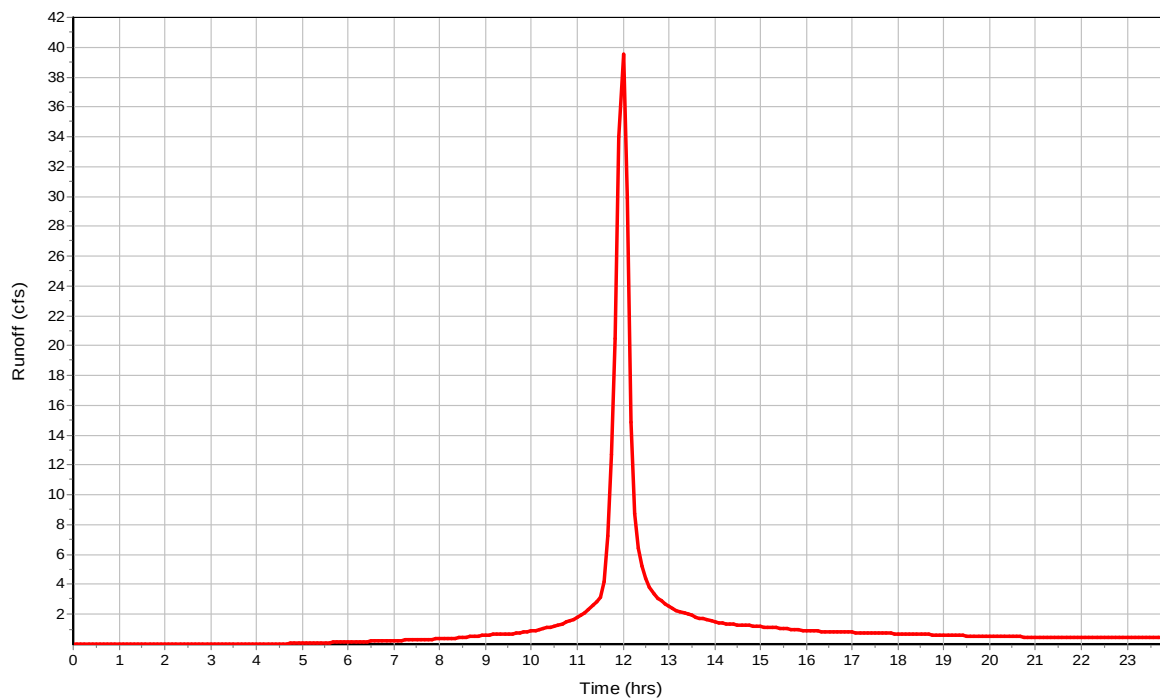
Total Rainfall (in) 6.3
 Total Runoff (in) 4.8
 Peak Runoff (cfs) 39.88
 Weighted Curve Number 86.93
 Time of Concentration (days hh:mm:ss) 0 00:10:29

Subbasin : P2

Rainfall Intensity Graph



Runoff Hydrograph



Subbasin : P3**Input Data**

Area (ac) 0.15
 Peak Rate Factor 484
 Weighted Curve Number 82.68
 Rain Gage ID

Composite Curve Number

32	Area	Soil	Curve
Soil/Surface Description	(acres)	Group	Number
Gravel roads	0.04	C	96
> 75% grass cover, Good	0.07	C	74
Woods & grass combination, Poor	0.03	C	82
Pasture, grassland, or range, Poor	0.01	C	86
Composite Area & Weighted CN	0.15		82.68

Time of Concentration

	Subarea	Subarea	Subarea
	A	B	C
Sheet Flow Computations			
Manning's Roughness :	0.3	0	0
Flow Length (ft) :	100	0	0
Slope (%) :	10	0	0
2 yr, 24 hr Rainfall (in) :	3	0	0
Velocity (ft/sec) :	0.18	0	0
Computed Flow Time (min) :	9.26	0	0

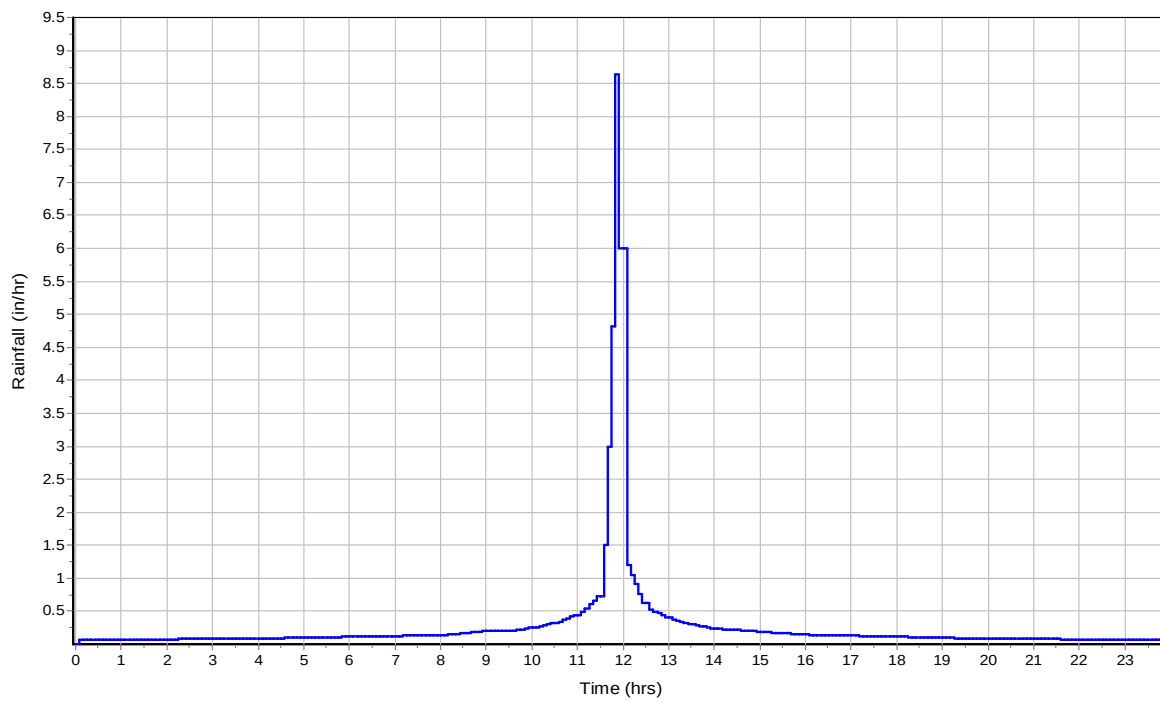
	Subarea	Subarea	Subarea
	A	B	C
Shallow Concentrated Flow Computations			
Flow Length (ft) :	26.4558	0	0
Slope (%) :	7.6	0	0
Surface Type :	Unpaved	Unpaved	Unpaved
Velocity (ft/sec) :	4.45	0	0
Computed Flow Time (min) :	0.1	0	0
Total TOC (min)9.35			

Subbasin Runoff Results

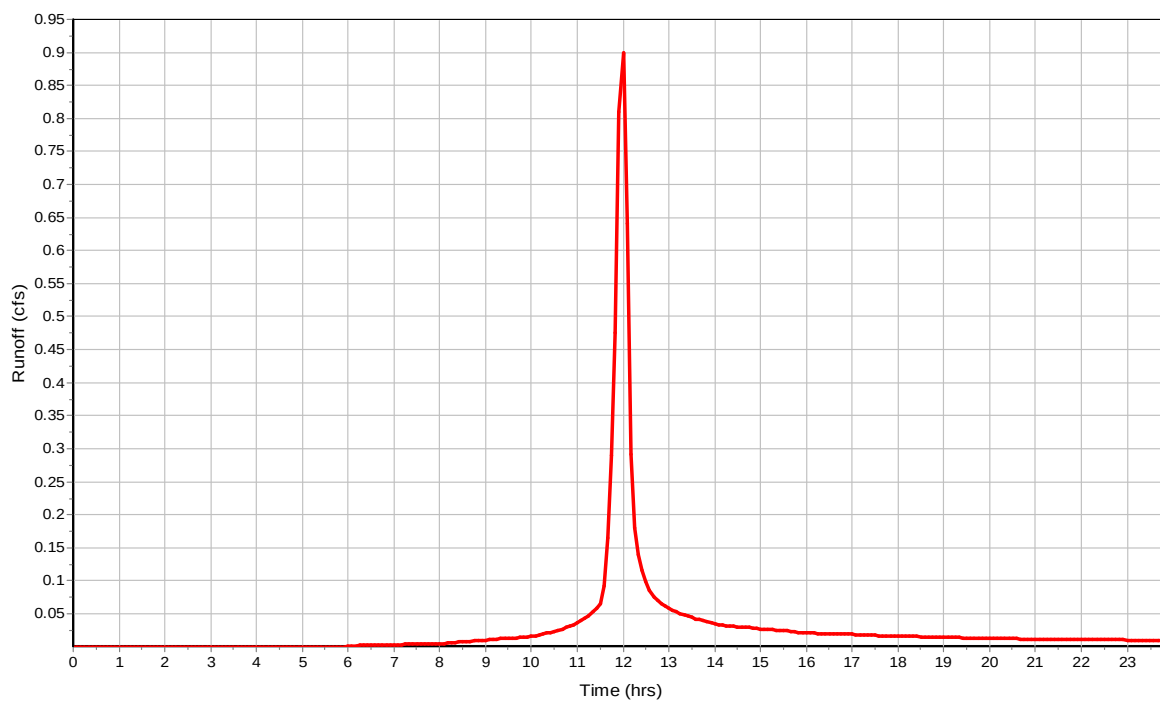
Total Rainfall (in) 6.3
 Total Runoff (in) 4.33
 Peak Runoff (cfs) 0.92
 Weighted Curve Number 82.68
 Time of Concentration (days hh:mm:ss) 0 00:09:21

Subbasin : P3

Rainfall Intensity Graph



Runoff Hydrograph



Junction Input

SN Element ID	Invert Elevation	Ground/Rim (Max) Elevation	Ground/Rim (Max) Offset	Initial Water Elevation	Initial Water Depth	Surcharge Elevation	Surcharge Depth	Ponded Area	Minimum Pipe Cover
	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft²)	(in)
1 Entry-P1	637.00	638.50	1.50	637.00	0.00	638.50	0.00	0.00	0.00
2 Entry-P3	583.04	584.54	1.50	583.04	0.00	584.54	0.00	0.00	0.00
3 Exit-P1	614.00	615.50	1.50	614.00	0.00	615.50	0.00	0.00	0.00
4 Exit-P2	608.60	610.10	1.50	608.60	0.00	610.10	0.00	0.00	0.00
5 Exit-P3	570.00	571.50	1.50	570.00	0.00	571.50	0.00	0.00	0.00
6 OCS	609.00	613.54	4.54	609.00	0.00	613.54	0.00	0.00	0.00
7 P2-Entry	566.94	569.44	2.50	566.94	0.00	569.44	0.00	0.00	0.00
8 P2-Exit	566.50	569.00	2.50	566.50	0.00	569.00	0.00	0.00	0.00

Junction Results

SN	Element ID	Peak Inflow	Peak Lateral Inflow	Max HGL Elevation Attained	Max HGL Depth Attained	Max Surcharge Depth Attained	Min Freeboard Attained	Average HGL Elevation Attained	Average HGL Depth Attained	Time of Max HGL Occurrence	Time of Peak Flooding Occurrence	Total Flooded Volume	Total Time Flooded
		(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(days hh:mm)	(days hh:mm)	(ac-in)	(min)
1	Entry-P1	5.89	5.89	637.40	0.40	0.00	1.10	637.04	0.04	0 12:10	0 00:00	0.00	0.00
2	Entry-P3	0.51	0.00	583.13	0.09	0.00	1.41	583.05	0.01	0 12:12	0 00:00	0.00	0.00
3	Exit-P1	5.87	0.00	614.55	0.55	0.00	0.95	614.08	0.08	0 12:10	0 00:00	0.00	0.00
4	Exit-P2	1.86	0.00	609.03	0.43	0.00	1.07	608.68	0.08	0 12:16	0 00:00	0.00	0.00
5	Exit-P3	0.51	0.00	570.09	0.09	0.00	1.41	570.01	0.01	0 12:13	0 00:00	0.00	0.00
6	OCS	1.86	0.00	609.43	0.43	0.00	4.11	609.08	0.08	0 12:16	0 00:00	0.00	0.00
7	P2-Entry	39.53	39.53	568.97	2.03	0.00	0.47	567.16	0.22	0 12:05	0 00:00	0.00	0.00
8	P2-Exit	39.49	0.00	568.53	2.03	0.00	0.47	566.72	0.22	0 12:05	0 00:00	0.00	0.00

Channel Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Shape	Height	Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)					(cfs)	
1	Ditch-P1	278.32	637.00	0.00	614.00	0.00	23.00	8.2600	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No
2	Ditch-P3	163.00	583.04	0.00	570.00	0.00	13.04	8.0000	Trapezoidal	1.500	5.000	0.0320	0.5000	0.5000	0.0000	0.00	No

Channel Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Ditch-P1	5.87	0 12:10	62.44	0.09	6.13	0.76	0.40	0.27	0.00		
2	Ditch-P3	0.51	0 12:13	61.44	0.01	2.58	1.05	0.09	0.06	0.00		

Pipe Input

SN	Element ID	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Pipe Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate
		(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(in)	(in)					(cfs)	
1	Culvert	35.00	566.94	0.00	566.50	0.00	0.44	1.2600	CIRCULAR	30.000	30.000	0.0150	0.5000	0.5000	0.0000	0.00	No
2	DirectLink-P1	19.95	0.00	-608.60	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
3	DirectLink-P2	102.72	0.00	-566.50	570.00	0.00	-570.00	-554.9100	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
4	DirectLink-P3	52.90	0.00	-570.00	0.00	-570.00	0.00	0.0000	Dummy	0.000	0.000	0.0150	0.5000	0.5000	0.0000	0.00	No
5	Outlet-Pipe	30.00	609.00	0.00	608.60	0.00	0.40	1.3300	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No
6	Pipe-P1	20.00	614.00	0.00	613.00	2.00	1.00	5.0000	CIRCULAR	18.000	18.000	0.0150	0.5000	0.5000	0.0000	0.00	No

No. of
Barrels

1
1
1
1
1
1
1

Pipe Results

SN	Element ID	Peak Flow	Time of Peak Flow Occurrence	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Travel Time	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Froude Number	Reported Condition
		(cfs)	(days hh:mm)	(cfs)		(ft/sec)	(min)	(ft)		(min)		
1	Culvert	39.49	0 12:05	39.86	0.99	9.27	0.06	2.03	0.81	0.00		Calculated
2	DirectLink-P1	1.86	0 12:16	0.00	0.99	0.00		2.03	0.81	0.00		Calculated
3	DirectLink-P2	39.49	0 12:05	0.00	0.99	0.00		2.03	0.81	0.00		Calculated
4	DirectLink-P3	0.51	0 12:13	0.00	0.99	0.00		2.03	0.81	0.00		Calculated
5	Outlet-Pipe	1.86	0 12:16	10.51	0.18	4.48	0.11	0.42	0.28	0.00		Calculated
6	Pipe-P1	5.87	0 12:10	20.36	0.29	9.96	0.03	0.55	0.37	0.00		Calculated

Storage Nodes

Storage Node : Basin#4

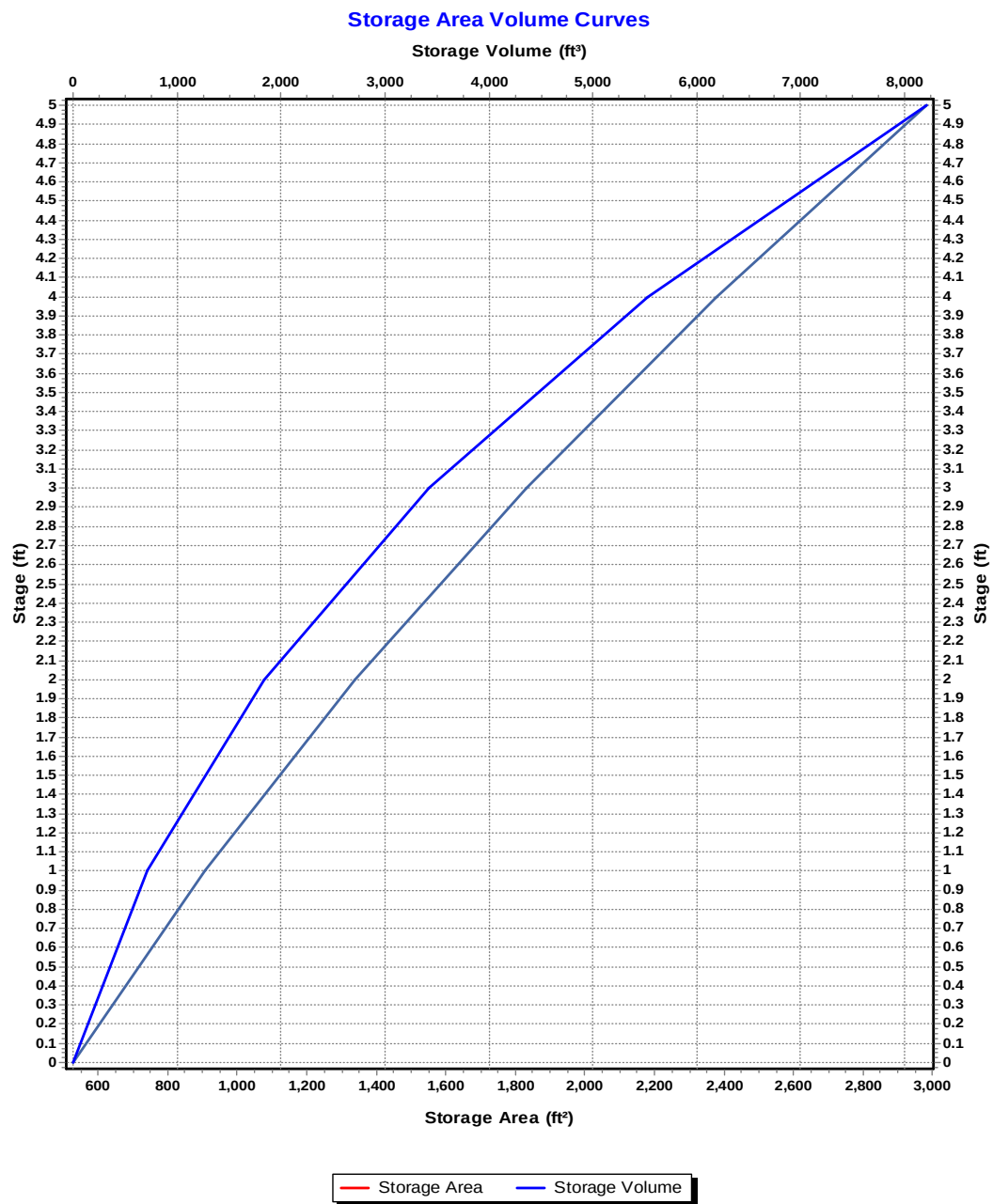
Input Data

Invert Elevation (ft)	609.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	5.00
Initial Water Elevation (ft)	609.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Bassin#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	527.57	0
1	905.52	716.55
2	1340.01	1839.32
3	1831.05	3424.85
4	2378.65	5529.7
5	2982.78	8210.42



Storage Node : Basin#4 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Emergency-Spillway	Trapezoidal	No	613.55	4.55	44.00	0.50	3.33

Outflow Orifices

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Beehive-Grate	Bottom	CIRCULAR	No	21.25			613.54	0.61
2 Lower-Orifice	Side	CIRCULAR	No	4.00			611.00	0.61
3 Middle-Orifice	Side	CIRCULAR	No	4.00			612.00	0.61
4 Upper-Orifice	Side	CIRCULAR	No	4.00			613.00	0.61

Output Summary Results

Peak Inflow (cfs)	5.87
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	4.27
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.61
Max HGL Depth Attained (ft)	4.61
Average HGL Elevation Attained (ft)	610.44
Average HGL Depth Attained (ft)	1.44
Time of Max HGL Occurrence (days hh:mm)	0 12:16
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

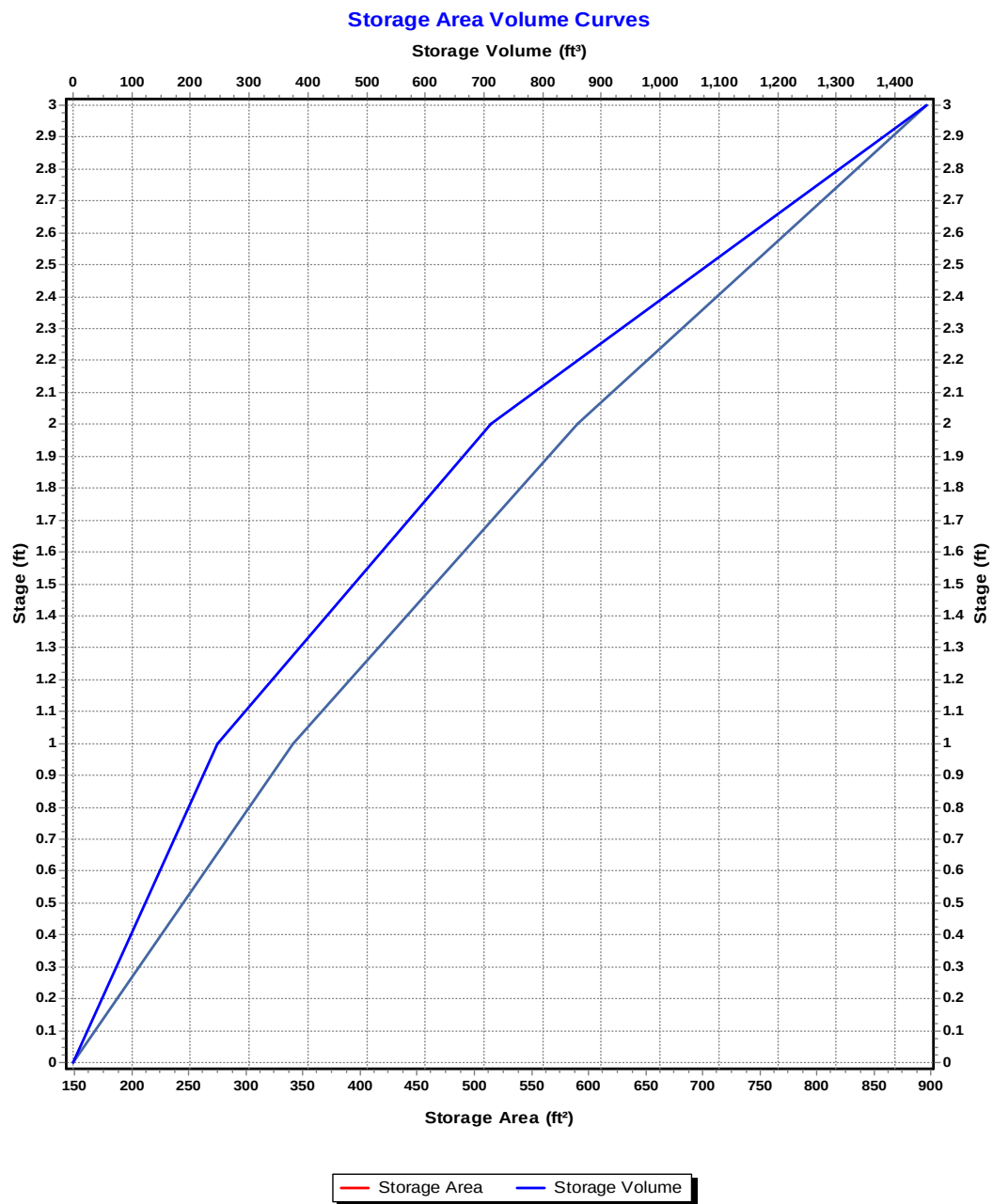
Storage Node : Forebay#1**Input Data**

Invert Elevation (ft)	611.00
Max (Rim) Elevation (ft)	614.00
Max (Rim) Offset (ft)	3.00
Initial Water Elevation (ft)	611.00
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Forebay

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	148.47	0
1	341.1	244.79
2	590.29	710.49
3	896.02	1453.65



Storage Node : Forebay#1 (continued)**Outflow Weirs**

SN Element ID	Weir Type	Flap Gate	Crest Elevation (ft)	Crest Offset (ft)	Length (ft)	Weir Total Height (ft)	Discharge Coefficient
1 Crested-Weir	Trapezoidal	No	613.00	2.00	10.00	1.00	3.33

Output Summary Results

Peak Inflow (cfs)	5.87
Peak Lateral Inflow (cfs)	0
Peak Outflow (cfs)	5.87
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	613.31
Max HGL Depth Attained (ft)	2.31
Average HGL Elevation Attained (ft)	612.36
Average HGL Depth Attained (ft)	1.36
Time of Max HGL Occurrence (days hh:mm)	0 12:10
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

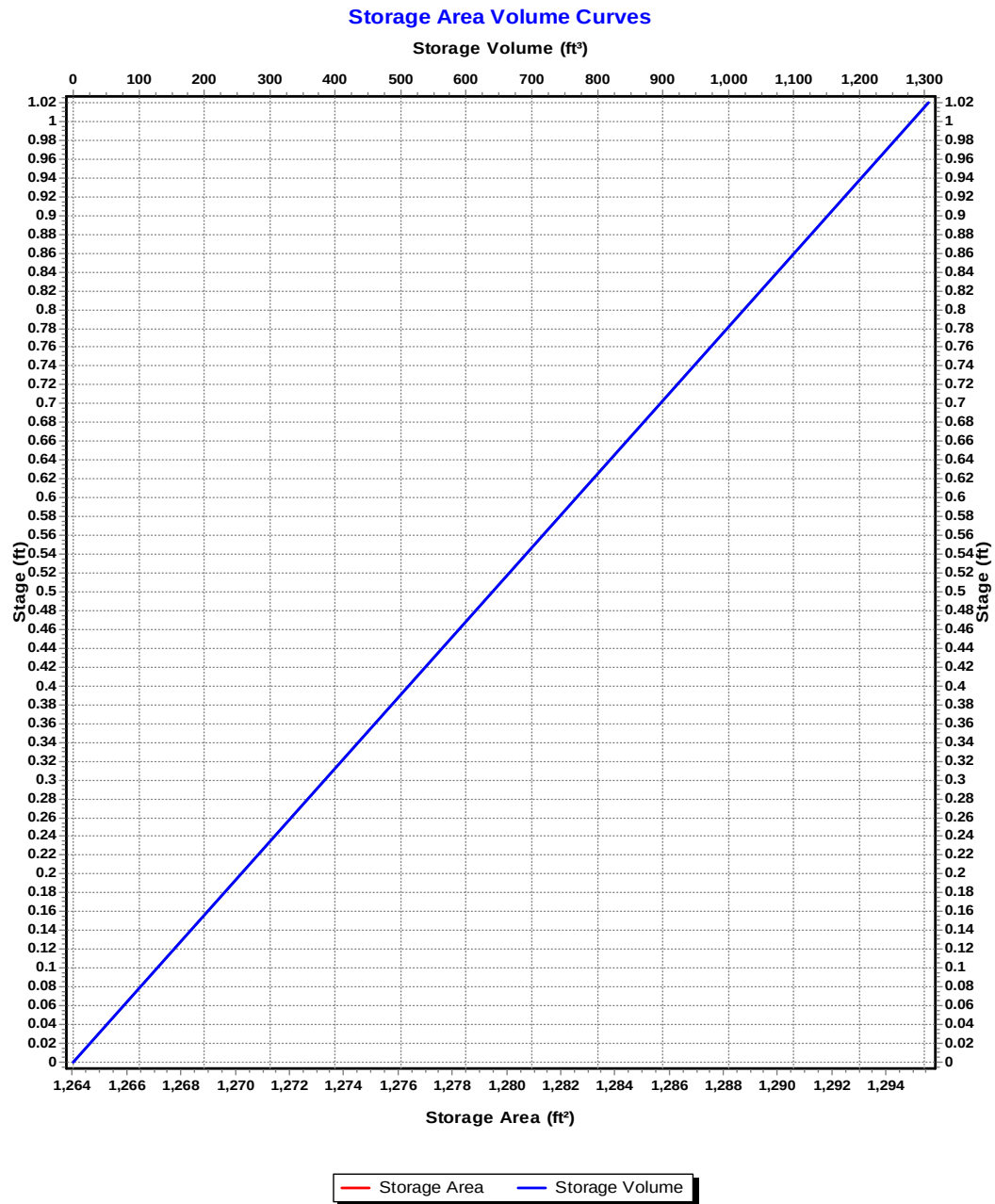
Storage Node : Geogrid-gravel**Input Data**

Invert Elevation (ft)	583.04
Max (Rim) Elevation (ft)	584.06
Max (Rim) Offset (ft)	1.02
Initial Water Elevation (ft)	583.04
Initial Water Depth (ft)	0.00
Ponded Area (ft²)	0.00
Evaporation Loss	0.00

Storage Area Volume Curves

Storage Curve : Permeable Geogrid Gravel#4

Stage (ft)	Storage Area (ft²)	Storage Volume (ft³)
0	1264.03	0
1.02	1295.56	1305.39



Storage Node : Geogrid-gravel (continued)**Outflow Orifices**

SN Element ID	Orifice Type	Orifice Shape	Flap Gate	Circular Orifice Diameter (in)	Rectangular Orifice Height (in)	Rectangular Orifice Width (in)	Orifice Invert Elevation (ft)	Orifice Coefficient
1 Underdrain-P3	Side	CIRCULAR	No	6.00			583.04	0.61

Output Summary Results

Peak Inflow (cfs)	0.9
Peak Lateral Inflow (cfs)	0.9
Peak Outflow (cfs)	0.51
Peak Exfiltration Flow Rate (cfm)	0
Max HGL Elevation Attained (ft)	583.57
Max HGL Depth Attained (ft)	0.53
Average HGL Elevation Attained (ft)	583.09
Average HGL Depth Attained (ft)	0.05
Time of Max HGL Occurrence (days hh:mm)	0 12:12
Total Exfiltration Volume (1000-ft³)	0
Total Flooded Volume (ac-in)	0
Total Time Flooded (min)	0
Total Retention Time (sec)	0

7.10. Stormwater Management Site Evaluation report

The following is the Stormwater Management Site Evaluation Report for the project.



October 9th, 2023

Andrey Tsikanovsky / Project Executive
TEP Northeast
45 Beechwood Drive
North Andover, Massachusetts 01845
(978) 557-5553 x225
atsikanovsky@tepgroup.net

**RE: Stormwater Management Site Evaluation
Proposed Telecommunication Tower
15 Strafford Road
Strafford, New Hampshire 03884
Project Number: 23212001**

Dear Mr. Tsikanovsky,

Solli Engineering, LLC (Solli) has been contracted by you (the client) to perform a Stormwater Management Site Evaluation at the Project Site (Site) located at the above-referenced property. On September 29th, 2023, Solli performed an on-site Stormwater Management Site Evaluation which included the excavation of three (3) test pits, and the observation and evaluation of the soils within each pit. Solli compiled the data gathered in this Evaluation Report.

PROJECT DESCRIPTION

Site Location

The Site is in the Town of Strafford, Strafford County, along the northern corridor of Mile High Road. The area of interest is located on a parcel (MBLU: 11/18), 15 Strafford Road, consisting of approximately 1.3± acres of land, currently owned by Michael A Barry Jr. The Site is bound by farmland to the north, residential properties to the east, Mile High Road to the south and farmland to the west. It is Solli's understanding that the project proposes to develop a portion of the property for the construction of a telecommunication tower, associated gravel road, drainage swales, and stormwater management basin.

Existing Site Conditions

The area evaluated is heavily wooded and is located on the boundary of existing agricultural fields on the parcel of 15 Strafford Road. Several stone walls traverse the parcel roughly delineating the parcel boundaries. The existing topography of Site is steep, with elevations ranging from approximately 643' to 570' sloping southeasterly towards Strafford Road.

According to soil survey mapping, obtained from the Natural Resource Conservation Service (NRCS), the surface soils on the Site are Paxton fine sandy loams with varying slopes. Paxton soils have a parent material of basal lodgement till derived from granite and gneiss and/or basal lodgement till derived from schist. Expected depths of restrictive features vary from 18" to more than 80" within Paxton soils on the Site. Expected depths to the water table vary from 18" to 24" within Paxton soils on the Site. Paxton fine sandy loams have a hydraulic soil rating of C with an estimated infiltration rate between 0.17 inches / hour and 0.27 inches / hour (1982 Rawls Rates). For more information regarding the surface soil conditions of the Site, refer to Figure 2 – Soil Survey Map enclosed.

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Monroe, CT 06468
Office: (203) 880-5455

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Norwood, MA 02062
Office: (781) 352-8491

www.SolliEngineering.com

FIELD INVESTIGATION

Test Pits

Solli managed the excavation of three (3) test pits, identified as TP-101, TP-102, and TP-103, to depths of 10 to 12 feet below ground surface (bgs), at the locations shown on the Test Pit Location Plan (Figure 1) enclosed. The test pits encountered 6" to 14" of topsoil above a subsoil horizon of sandy loam to depths of 27" to 38" bgs. The subsoil consisted of brownish sandy loam throughout all three (3) test pits. Beneath the subsoil, the sandy loam parent material was encountered. Weeping, groundwater or redoximorphic features were observed in all three (3) of the test pits varying in elevation from 27" to 80" bgs. Bedrock or restrictive features were not observed during the excavations. Upon completion, the three (3) test pits were backfilled with the excavated soil.

All three (3) of the test pits were excavated under the supervision of a Solli engineer, who performed the soil evaluations classifying the soil horizons, depths, textures, colors, structures, consistencies, and composition of the soils. No infiltration tests were performed. The test pits were performed in approximate locations utilizing normal taping procedures off landmarks identified.

CLOSING

Solli greatly appreciates the opportunity to assist you with this project. Please let us know if you have any questions or comments regarding this report.

Respectfully,
Solli Engineering, LLC


Sam T. Malafronte
Asst. Project Manager

Solli Engineering, LLC

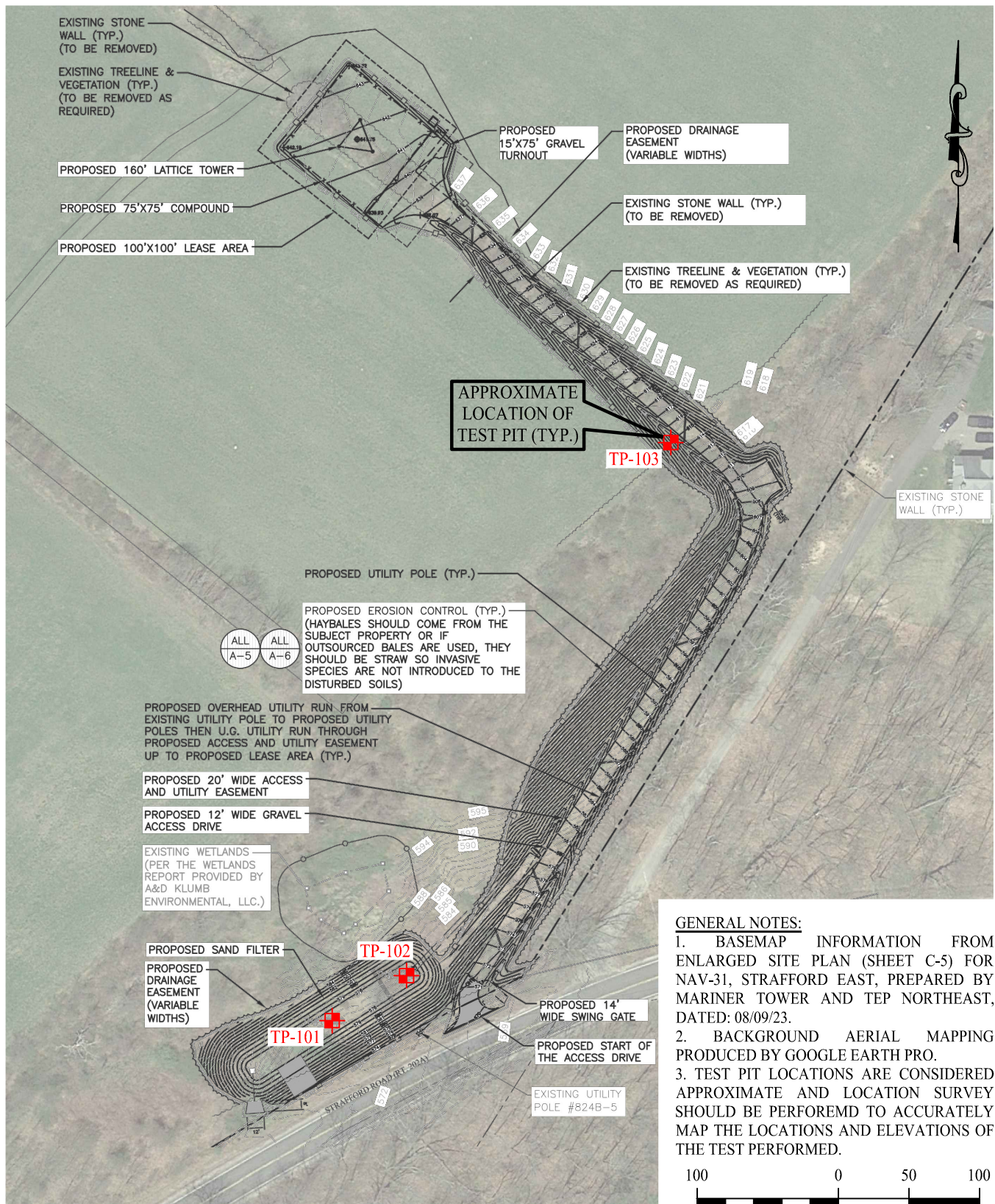

Casey J. Burch
Sr. Project Manager

Solli Engineering, LLC


Kevin Solli, P.E.
Principal / Owner

Enclosures:

- Figures
 - Figure 1 – Test Pit Location Plan
 - Figure 2 – Soil Survey Map
- Test Pit Logs
 - TP-101
 - TP-102
 - TP-103



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TEST PIT LOCATION PLAN

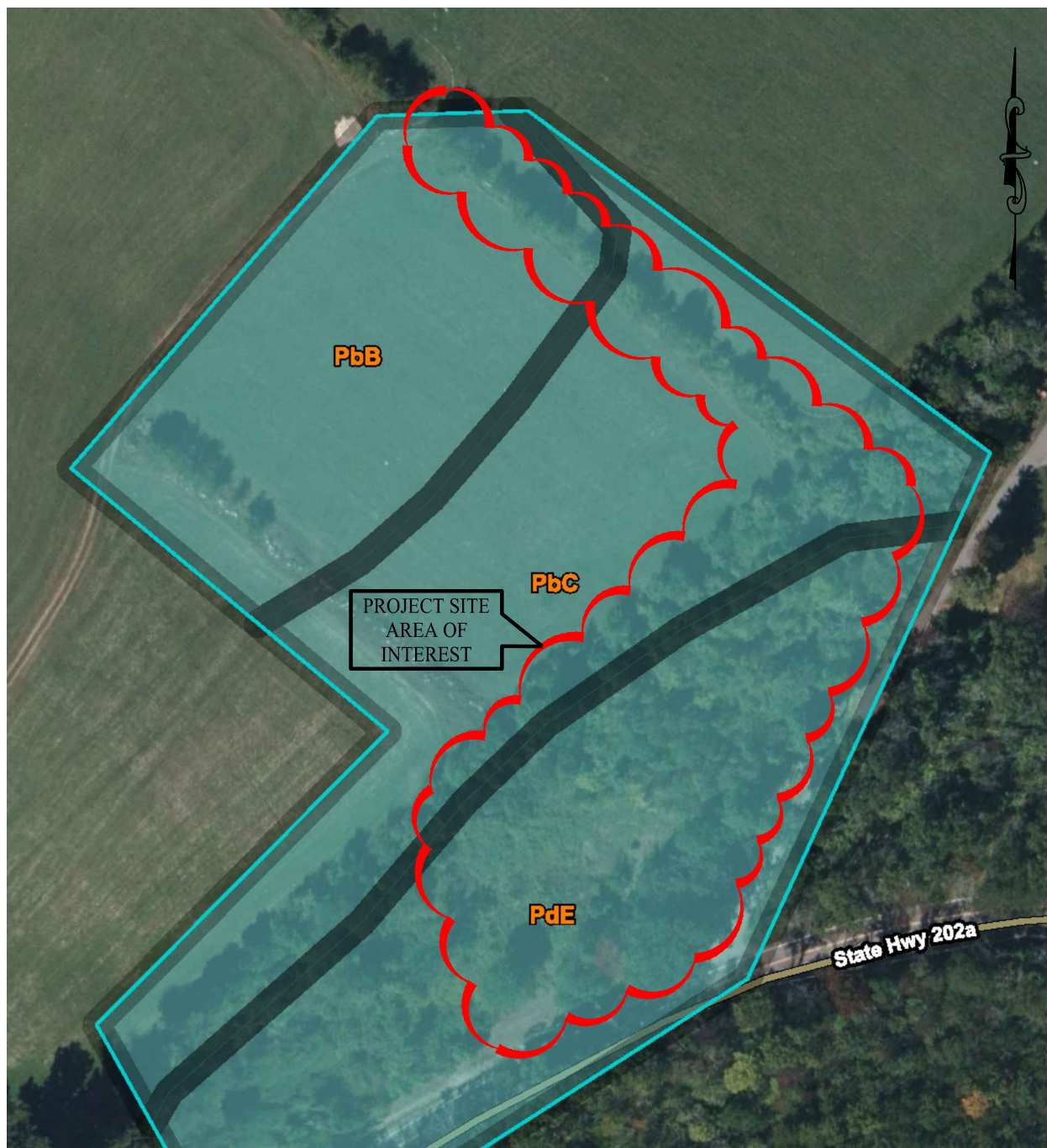
15 STRAFFORD ROAD
STRAFFORD, NEW HAMPSHIRE

Project #: 23212001

Plan Date: 10/06/23

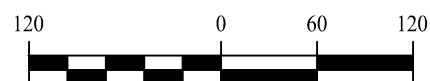
Scale: 1" = 100'

Figure: 1



Map unit symbol	Map unit name	Rating
PbB	Paxton fine sandy loam, 3 to 8 percent slopes	C
PbC	Paxton fine sandy loam, 8 to 15 percent slopes	C
PdE	Paxton very stony fine sandy loam, 25 to 60 percent slopes	C

NOTE: BASE MAP RESOURCES TAKEN FROM THE NATURAL RESOURCES CONSERVATION SERVICE, URL: <https://websoilsurvey.sc.egov.usda.gov>



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SOIL SURVEY MAP

15 STRAFFORD ROAD
STRAFFORD, NEW HAMPSHIRE

Project #: 23212001

Plan Date: 10/06/23

Scale: 1" = 120'

Figure: 2

TEST PIT DATA

(PERFORMED BY CASEY J. BURCH WITH SOLLI ENGINEERING, LLC ON 09/29/23)

TP #101

0" - 14" A HORIZON LAYER - SANDY LOAM, MASSIVE SS, FRIABLE (10 YR 3/3)
14" - 27" B HORIZON LAYER - SANDY LOAM, MASSIVE SS, VERY FRIABLE (10 YR 4/4)
27" - 38" B₂ HORIZON LAYER - SANDY LOAM, MASSIVE SS, FRIABLE (10 YR 5/2)
38" - 46" C HORIZON LAYER - LOAMY SAND, MASSIVE SS, FRIABLE (10 YR 5/4)
46" - 142"+ 2C HORIZON LAYER - VERY GRAVELLY SANDY LOAM (SATURATED - 50% GRAVEL),
MASSIVE SS, FRIABLE (10 YR 5/1)

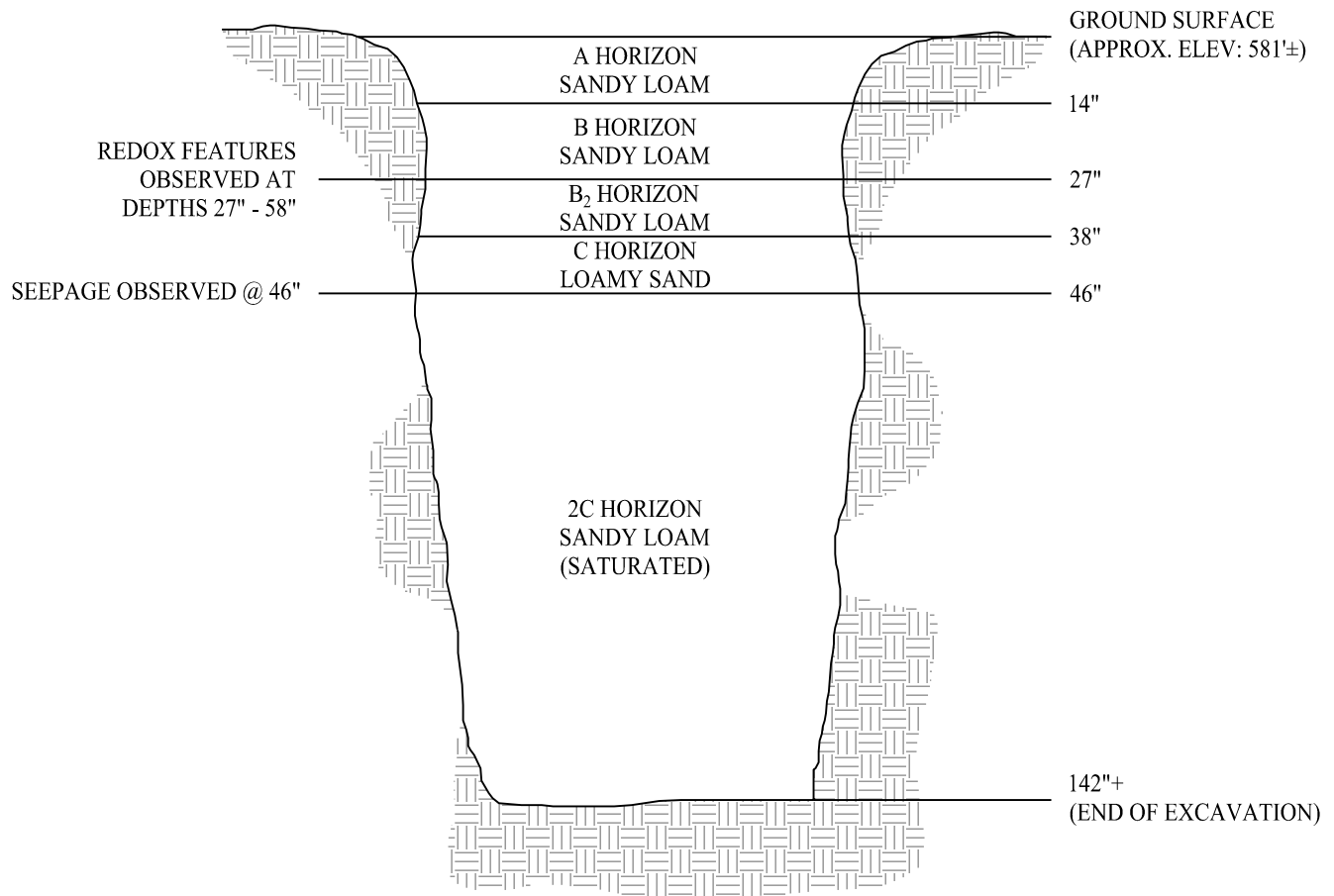
END OF EXPLORATION

*WATER SEEPING @ 46"

*REDOXIMORPHIC FEATURES @ 27" - 58"

*ROOTS @ 18"

*NO LEDGE



TP-101



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TEST PIT LOG

15 STRAFFORD ROAD
STRAFFORD, NEW HAMPSHIRE

Project #: 23212001

Plan Date: 10/06/23

Scale: NTS

Test pit: 101

TEST PIT DATA

(PERFORMED BY CASEY J. BURCH WITH SOLLI ENGINEERING, LLC ON 09/29/23)

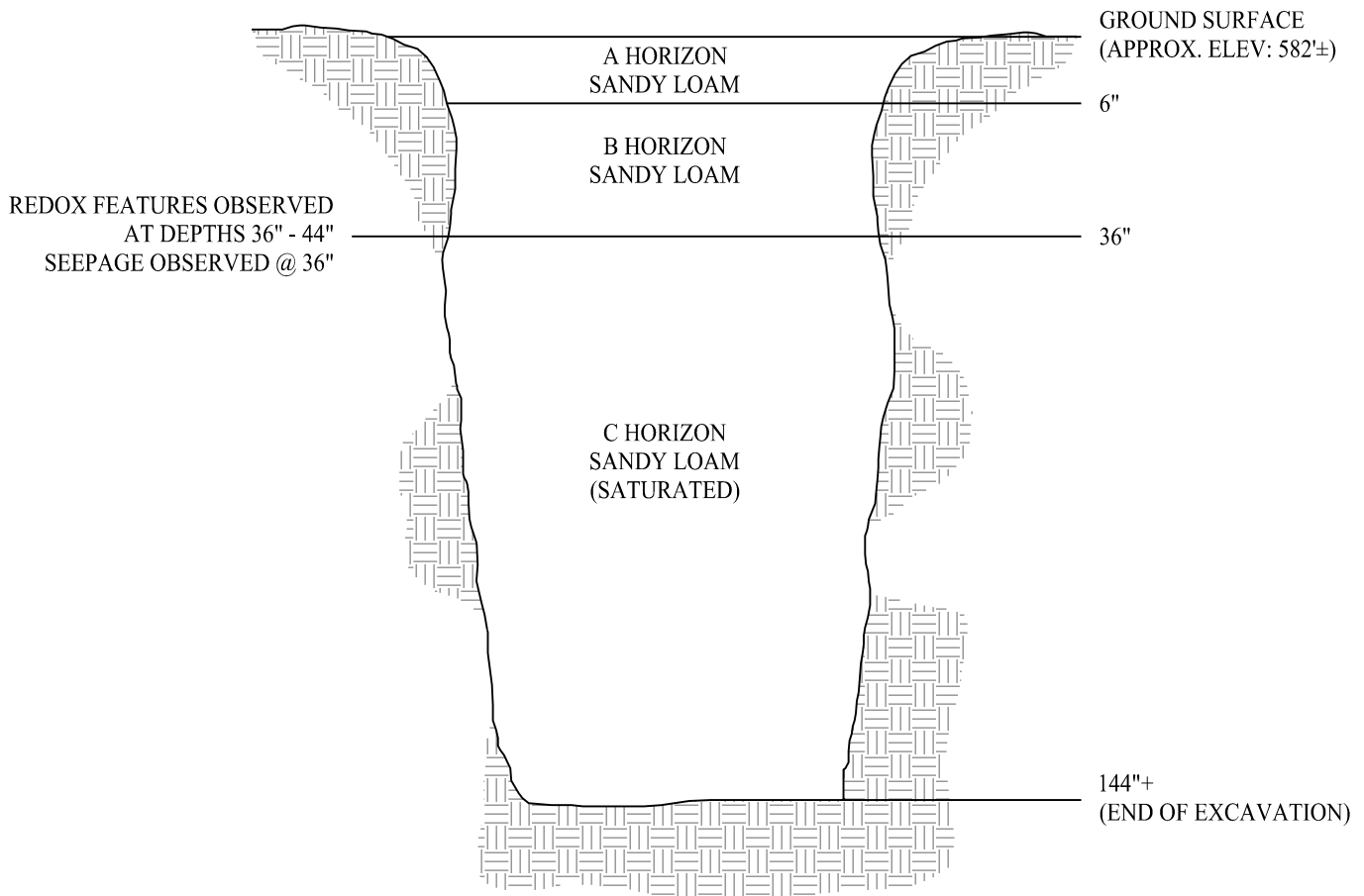
TP #102

0" - 6" A HORIZON LAYER - SANDY LOAM, MASSIVE SS, FRIABLE (10 YR 3/3)
6" - 36" B HORIZON LAYER - SANDY LOAM (10% GRAVEL), MASSIVE SS, FRIABLE (10 YR 5/4)
36" - 144"+ C HORIZON LAYER - SANDY LOAM (SATURATED), MASSIVE SS, FRIABLE (10 YR 5/4)
END OF EXPLORATION

*WATER SEEPING @ 36"

*REDOXIMORPHIC FEATURES @ 36" - 44"

*NO LEDGE



TP-102



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TEST PIT LOG

15 STRAFFORD ROAD
STRAFFORD, NEW HAMPSHIRE

Project #:	23212001
Plan Date:	10/06/23
Scale:	NTS
Test pit:	102

TEST PIT DATA

(PERFORMED BY CASEY J. BURCH WITH SOLLI ENGINEERING, LLC ON 09/29/23)

TP #103

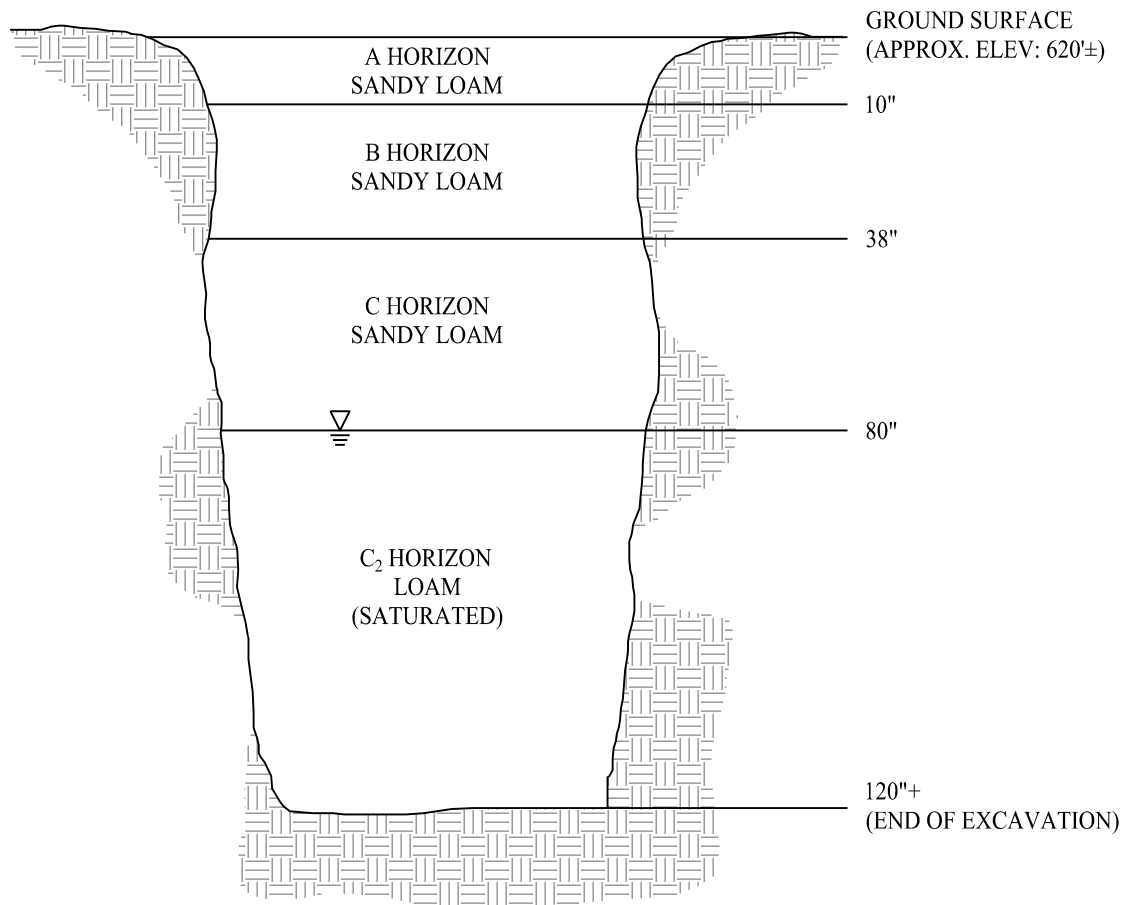
0" - 10" A HORIZON LAYER - SANDY LOAM, MASSIVE SS, FRIABLE (10 YR 3/2)
10" - 38" B HORIZON LAYER - SANDY LOAM, MASSIVE SS, FRIABLE (10 YR 5/4)
38" - 80" C HORIZON LAYER - SANDY LOAM, MASSIVE SS, FRIABLE (10 YR 5/2)
80" - 120"+ C₂ HORIZON LAYER - LOAM (SATURATED), MASSIVE SS, FRIABLE (10 YR 6/1)
END OF EXPLORATION

*WATER @ 80"

*NO REDOXIMORPHIC FEATURES

*ROOTS @ 10"

*NO LEDGE



TP-103



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TEST PIT LOG

15 STRAFFORD ROAD
STRAFFORD, NEW HAMPSHIRE

Project #: 23212001

Plan Date: 10/06/23

Scale: NTS

Test pit: 103

7.11. NRCS Soils Report

The following is the NRCS Custom Soil Resource Report for the project.



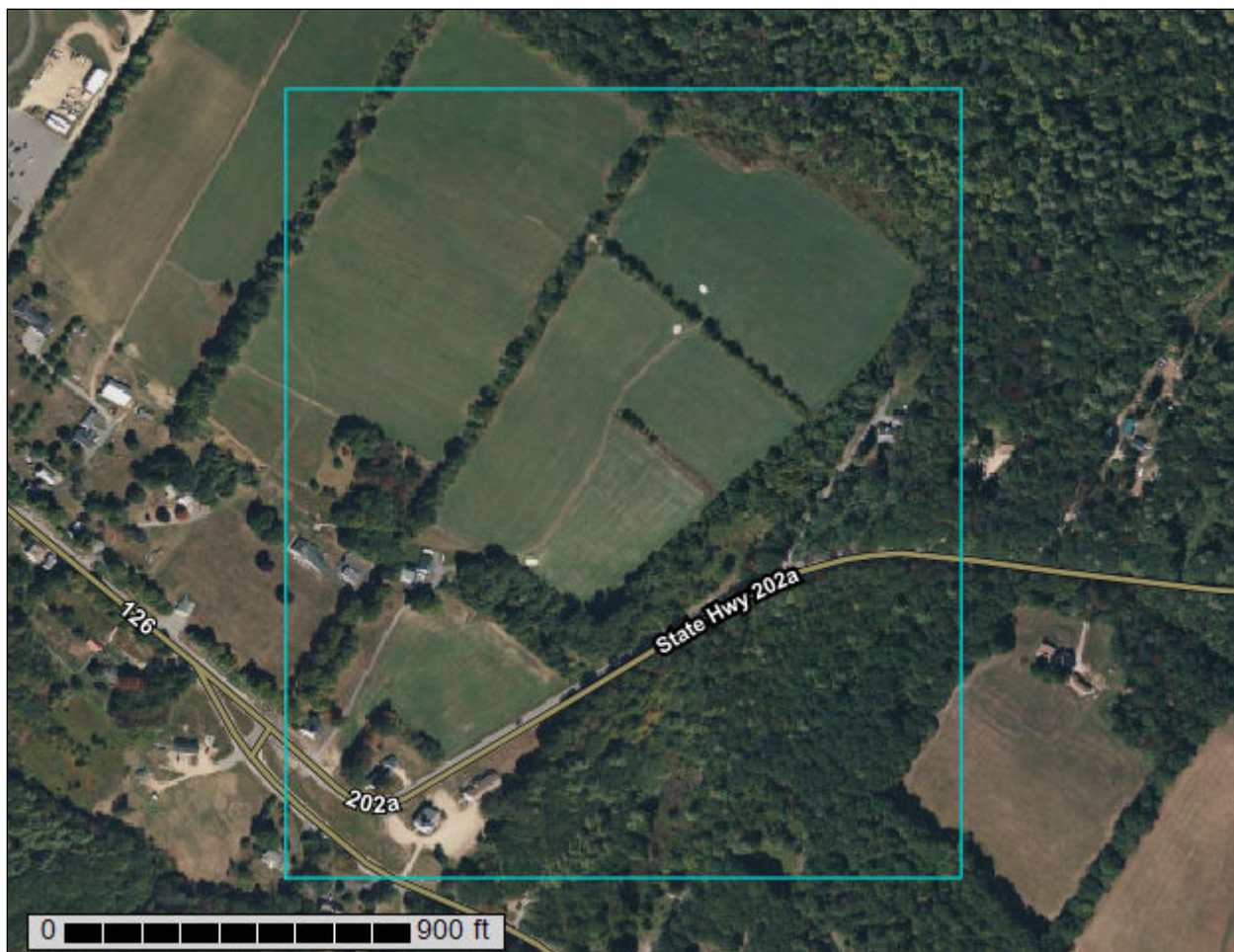
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for **Strafford County, New Hampshire**



March 12, 2023

Preface

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

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

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

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

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

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

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PbC—Paxton fine sandy loam, 8 to 15 percent slopes.....	21
PbD—Paxton fine sandy loam, 15 to 25 percent slopes.....	22
PdB—Paxton fine sandy loam, 0 to 8 percent slopes, very stony.....	24
PdC—Paxton fine sandy loam, 8 to 15 percent slopes, very stony.....	25
PdD—Paxton fine sandy loam, 15 to 25 percent slopes, very stony.....	27
PdE—Paxton very stony fine sandy loam, 25 to 60 percent slopes.....	28
RIB—Ridgebury fine sandy loam, 3 to 8 percent slopes, very stony.....	30
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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

Custom Soil Resource Report

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

Soil Map

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

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

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 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Strafford County, New Hampshire
Survey Area Data: Version 23, Sep 9, 2022

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

Date(s) aerial images were photographed: Data not available.

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
HdC	Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes	2.8	3.4%
HdD	Hollis-Charlton very rocky fine sandy loams, 15 to 25 percent slopes	1.5	1.8%
Mp	Freetown and Swansea mucky peats, 0 to 2 percent slopes	4.4	5.3%
PbB	Paxton fine sandy loam, 3 to 8 percent slopes	37.0	44.6%
PbC	Paxton fine sandy loam, 8 to 15 percent slopes	13.4	16.1%
PbD	Paxton fine sandy loam, 15 to 25 percent slopes	6.3	7.6%
PdB	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	1.2	1.4%
PdC	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	3.5	4.2%
PdD	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	3.7	4.4%
PdE	Paxton very stony fine sandy loam, 25 to 60 percent slopes	9.1	11.0%
RIB	Ridgebury fine sandy loam, 3 to 8 percent slopes, very stony	0.2	0.2%
WgB	Woodbridge fine sandy loam, 3 to 8 percent slopes	0.0	0.0%
Totals for Area of Interest		83.1	100.0%

Map Unit Descriptions

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

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

up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Strafford County, New Hampshire

HdC—Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9d7n

Elevation: 0 to 1,200 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 120 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 40 percent

Charlton and similar soils: 30 percent

Minor components: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Parent material: Till

Typical profile

H1 - 0 to 14 inches: very stony fine sandy loam

H2 - 14 to 18 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: 10 to 20 inches to lithic bedrock

Drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Description of Charlton

Setting

Parent material: Till

Typical profile

H1 - 0 to 13 inches: very stony fine sandy loam

H2 - 13 to 36 inches: fine sandy loam

Custom Soil Resource Report

H3 - 36 to 40 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent

Hydric soil rating: No

Not named

Percent of map unit: 10 percent

Hydric soil rating: No

Woodbridge

Percent of map unit: 5 percent

Hydric soil rating: No

Sutton

Percent of map unit: 5 percent

Hydric soil rating: No

HdD—Hollis-Charlton very rocky fine sandy loams, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9d7p

Elevation: 0 to 1,280 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 120 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 40 percent

Charlton and similar soils: 30 percent

Minor components: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Parent material: Till

Typical profile

H1 - 0 to 14 inches: very stony fine sandy loam

H2 - 14 to 18 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: 10 to 20 inches to lithic bedrock

Drainage class: Well drained

Runoff class: Very high

*Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 6.00 in/hr)*

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Description of Charlton

Setting

Parent material: Till

Typical profile

H1 - 0 to 13 inches: very stony fine sandy loam

H2 - 13 to 36 inches: fine sandy loam

H3 - 36 to 40 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 25 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Medium

*Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00
in/hr)*

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Not named

Percent of map unit: 20 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 10 percent
Hydric soil rating: No

Mp—Freetown and Swansea mucky peats, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2w68w
Elevation: 10 to 940 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Freetown and similar soils: 50 percent
Swansea and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Freetown

Setting

Landform: Marshes, kettles, depressions, swamps, bogs
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Moderately decomposed organic material

Typical profile

Oe1 - 0 to 2 inches: mucky peat
Oe2 - 2 to 79 inches: mucky peat

Properties and qualities

Slope: 0 to 2 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained

Custom Soil Resource Report

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Available water supply, 0 to 60 inches: Very high (about 20.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydrologic Soil Group: B/D

Ecological site: F144AY043MA - Acidic Organic Wetlands

Hydric soil rating: Yes

Description of Swansea

Setting

Landform: Swamps, marshes, depressions, bogs, kettles

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Moderately decomposed organic material over sandy and gravelly glaciofluvial deposits

Typical profile

Oe1 - 0 to 12 inches: mucky peat

Oe2 - 12 to 25 inches: mucky peat

Cg - 25 to 79 inches: sand

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Very poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high
(0.14 to 14.17 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Available water supply, 0 to 60 inches: High (about 11.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8

Hydrologic Soil Group: B/D

Ecological site: F144AY043MA - Acidic Organic Wetlands

Hydric soil rating: Yes

Minor Components

Natchaug

Percent of map unit: 10 percent

Landform: Depressions, depressions, depressions

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Scarboro

Percent of map unit: 4 percent
Landform: Outwash deltas, outwash terraces, drainageways, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 4 percent
Landform: Hills, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Maybid

Percent of map unit: 2 percent
Landform: Marine terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

PbB—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Paxton

Setting

Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex

Custom Soil Resource Report

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

Typical profile

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

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

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

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

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

Charlton

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

PbC—Paxton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w66y

Elevation: 0 to 1,320 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Paxton and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex, linear

Across-slope shape: Convex

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

Typical profile

Ap - 0 to 8 inches: fine sandy loam

Bw1 - 8 to 15 inches: fine sandy loam

Bw2 - 15 to 26 inches: fine sandy loam

Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: 20 to 39 inches to densic material

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: About 18 to 37 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Custom Soil Resource Report

Hydric soil rating: No

Minor Components

Charlton

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

Woodbridge

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

Ridgebury

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

PbD—Paxton fine sandy loam, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 2w67j
Elevation: 0 to 1,450 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Paxton

Setting

Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Backslope

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Landform position (three-dimensional): Side slope

Down-slope shape: Convex, linear

Across-slope shape: Convex

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

Typical profile

Ap - 0 to 8 inches: fine sandy loam

Bw1 - 8 to 15 inches: fine sandy loam

Bw2 - 15 to 26 inches: fine sandy loam

Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 25 percent

Depth to restrictive feature: 20 to 39 inches to densic material

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: About 18 to 37 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Hydric soil rating: No

Minor Components

Charlton

Percent of map unit: 8 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Woodbridge

Percent of map unit: 6 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Ridgebury

Percent of map unit: 1 percent

Landform: Hills, ground moraines, drumlins, drainageways, depressions

Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Head slope, base slope

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Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

PdB—Paxton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w673
Elevation: 0 to 1,340 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of local importance

Map Unit Composition

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

Description of Paxton, Very Stony

Setting

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

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 8 percent
Landform: Hills, ground moraines, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury, very stony

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

Charlton, very stony

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

PdC—Paxton fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w677
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Paxton, Very Stony

Setting

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex, linear

Across-slope shape: Linear, convex

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

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material

A - 2 to 10 inches: fine sandy loam

Bw1 - 10 to 17 inches: fine sandy loam

Bw2 - 17 to 28 inches: fine sandy loam

Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: 20 to 43 inches to densic material

Drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: About 18 to 37 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 8 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope, footslope

Landform position (three-dimensional): Side slope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Charlton, very stony

Percent of map unit: 5 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

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Across-slope shape: Convex

Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 2 percent

Landform: Hills, ground moraines, drumlins, drainageways, depressions

Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Head slope, base slope

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

PdD—Paxton fine sandy loam, 15 to 25 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w67h

Elevation: 0 to 1,400 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Paxton, very stony, and similar soils: 90 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton, Very Stony

Setting

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex, linear

Across-slope shape: Linear, convex

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

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material

A - 2 to 10 inches: fine sandy loam

Bw1 - 10 to 17 inches: fine sandy loam

Bw2 - 17 to 28 inches: fine sandy loam

Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 25 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: 20 to 43 inches to densic material

Drainage class: Well drained

Runoff class: High

Custom Soil Resource Report

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: About 18 to 37 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 5 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Charlton, very stony

Percent of map unit: 4 percent

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 1 percent

Landform: Hills, ground moraines, drumlins, drainageways, depressions

Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Head slope, base slope

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

PdE—Paxton very stony fine sandy loam, 25 to 60 percent slopes

Map Unit Setting

National map unit symbol: 9d8h

Elevation: 150 to 1,100 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Custom Soil Resource Report

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Paxton and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Parent material: Basal lodgement till derived from granite and gneiss and/or basal lodgement till derived from schist

Typical profile

H1 - 0 to 11 inches: very stony fine sandy loam

H2 - 11 to 22 inches: fine sandy loam

H3 - 22 to 41 inches: fine sandy loam

Properties and qualities

Slope: 25 to 60 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)

Depth to water table: About 24 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: C

Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Hydric soil rating: No

Minor Components

Not named

Percent of map unit: 12 percent

Hydric soil rating: No

Hollis

Percent of map unit: 3 percent

Hydric soil rating: No

RIB—Ridgebury fine sandy loam, 3 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2xffx
Elevation: 40 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Ridgebury, Very Stony

Setting

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

Typical profile

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

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w

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Hydrologic Soil Group: D

Ecological site: F144AY009CT - Wet Till Depressions

Hydric soil rating: Yes

Minor Components

Woodbridge, very stony

Percent of map unit: 7 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex

Across-slope shape: Linear

Hydric soil rating: No

Whitman, very stony

Percent of map unit: 4 percent

Landform: Hills, ground moraines, drumlins, drainageways, depressions

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Walpole

Percent of map unit: 2 percent

Landform: Outwash terraces, drainageways, depressions

Landform position (three-dimensional): Tread

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Scituate, very stony

Percent of map unit: 2 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

WgB—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2ql

Elevation: 0 to 1,470 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, fine sandy loam, and similar soils: 82 percent

Minor components: 18 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Summit, backslope, footslope

Landform position (three-dimensional): Side slope

Down-slope shape: Concave

Across-slope shape: Linear

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

Typical profile

Ap - 0 to 7 inches: fine sandy loam

Bw1 - 7 to 18 inches: fine sandy loam

Bw2 - 18 to 30 inches: fine sandy loam

Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 20 to 39 inches to densic material

Drainage class: Moderately well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: About 18 to 30 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: C/D

Ecological site: F144AY037MA - Moist Dense Till Uplands

Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent

Landform: Hills, ground moraines, drumlins

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest

Down-slope shape: Convex, linear

Across-slope shape: Convex

Hydric soil rating: No

Ridgebury

Percent of map unit: 8 percent

Landform: Hills, ground moraines, drainageways, depressions

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Landform position (two-dimensional): Toeslope, backslope, footslope

Landform position (three-dimensional): Base slope, head slope, dip

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

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