RANGER ENGINEERING GROUP, INC.
13 Branch St., Suite 101
Methuen MA 01844
Tel: 978-208-1762
www.rangereng.com

ALTERATION OF TERRAIN APPLICATION

#9 ROUTE 130 WEST, WARNER, NH 03278

ASSESSOR'S MAP 35 LOTS 4-1, 4-2, AND 4-3

JULY 21, 2020

Submitted to:

NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
Alteration of Terrain Bureau
29 Hazen Drive
PO Box 95
Concord, NH 03303-0095

Prepared for:

Comet, LLC
355 Middlesex Avenue
Wilmington, MA 01887

Prepared by:

Ranger Engineering Group, Inc.
13 Branch Street Suite 101
Methuen, MA 01844
Tel : 978-208-1762

STATE OF NEW HAMPSHIRE
BENJAMIN C. OSGOOD, JR
NO. 12053
LICENSED
PROFESSIONAL ENGINEER

7-21-20

Benjamin C. Osgood Jr, PE
Director of Engineering

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

ALTERATION OF TERRAIN PERMIT APPLICATION

Water Division/ Alteration of Terrain Bureau/ Land Resources Management
Check the Status of your Application: www.des.nh.gov/onestop

RSA/ Rule: RSA 485-A:17, Env-Wq 1500

Administrative Use Only	Administrative Use Only	Administrative Use Only	File Number:
			Check No.
			Amount:
			Initials:

1. APPLICANT INFORMATION (INTENDED PERMIT HOLDER)		
Applicant Name: Commet, LLC	Contact Name: Paul Kneeland	
Email: PKneeland@channelbuilding.com	Daytime Telephone: 978-857-1891	
Mailing Address: 355 Middlesex Ave Suite 7		
Town/City: Wilmington	State: MA	Zip Code: 01887

2. APPLICANT'S AGENT INFORMATION If none, check here: ☐		
Business Name: Ranger Engineering Group, Inc.	Contact Name: Benjamin C. Osgood Jr. PE	
Email: bosgood@rangereng.com	Daytime Telephone: 978-435-1324	
Address: 13 Branch Street Suite 101		
Town/City: Methuen	State: MA	Zip Code: 01844

3. PROPERTY OWNER INFORMATION (IF DIFFERENT FROM APPLICANT)		
Applicant Name: Same as owner	Contact Name:	
Email:	Daytime Telephone:	
Mailing Address:		
Town/City:	State:	Zip Code:

4. PROPERTY OWNER'S AGENT INFORMATION If none, check here: ☐		
Business Name:	Contact Name:	
Email:	Daytime Telephone:	
Address:		
Town/City:	State:	Zip Code:

5. CONSULTANT INFORMATION If none, check here: ☐		
Engineering Firm: Ranger Engineering Group Inc.	Contact Name: Benjamin C. Osgood Jr PE	
Email: bosgood @rangereng.com	Daytime Telephone: 978-435-1324	
Address: 13 Branch St Suite 101		
Town/City: Methuen	State: MA	Zip Code: 01844

6. PROJECT TYPE

☐ Excavation Only ☐ Residential ☒ Commercial ☐ Golf Course ☐ School ☐ Municipal
☐ Agricultural ☐ Land Conversion ☐ Other:

7. PROJECT LOCATION INFORMATION

Project Name: Route 103 West Commercial Development

Street/Road Address: 9 Route 103 West

Town/City: Warner | County: Merrimack

Tax Map: 35 | Block: | Lot Number: 4-1 & 4-2 | Unit:

Location Coordinates: 43.287713 -71.83243 ☒ Latitude/Longitude ☐ UTM ☐ State Plane

Post-development, will the proposed project withdraw from or directly discharge to any of the following? If yes, identify the purpose.

1. Stream or Wetland Purpose: Stormwater Outflow	☒ Yes ☐ No	☐ Withdrawal	☒ Discharge
2. Man-made pond created by impounding a stream or wetland Purpose:	☐ Yes ☒ No	☐ Withdrawal	☐ Discharge
3. Unlined pond dug into the water table Purpose:	☐ Yes ☒ No	☐ Withdrawal	☐ Discharge

Post-development, will the proposed project discharge to:

- A surface water impaired for phosphorus and/or nitrogen? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen**
- A Class A surface water or Outstanding Resource Water? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen**
- A lake or pond not covered previously? ☒ No ☐ **Yes - include information to demonstrate that project will not cause net increase in phosphorus in the lake or pond**

Is the project a High Load area? ☐ Yes ☒ No
If yes, specify the type of high load land use or activity: _____

Is the project within a Water Supply Intake Protection Area (WSIPA)? ☐ Yes ☒ No
Is the project within a Groundwater Protection Area (GPA)? ☐ Yes ☒ No
Will the well setbacks identified in Env-Wq 1508.02 be met? ☒ Yes ☐ No

Note: Guidance document titled "*Using NHDES's OneStop WebGIS to Locate Protection Areas*" is available online. For more details on the restrictions in these areas, read Chapter 3.1 in Volume 2 of the NH Stormwater Manual.

Is any part of the property within the 100-year floodplain? ☒ Yes ☐ No
If yes: Cut volume: 0 cubic feet within the 100-year floodplain
Fill volume: 0 cubic feet within the 100-year floodplain

☒ Project **IS** within **¼ mile of a designated river** Name of River: Warner River
☐ Project is **NOT** within ¼ mile of a designated river

☐ Project **IS** within **a Coastal/Great Bay Region community - include info required by Env-Wq 1503.08(l) if applicable**
☒ Project is **NOT** within a Coastal/Great Bay Region community

8. BRIEF PROJECT DESCRIPTION (PLEASE DO NOT REPLY "SEE ATTACHED")

Construction of a 7200 sf retail/resterant building on Lot 1 and 1850 sf drive through donut shop on Lot 2

9. IF APPLICABLE, DESCRIBE ANY WORK STARTED PRIOR TO RECEIVING PERMIT

None

10. ADDITIONAL REQUIRED INFORMATION

A. Date a copy of the application was sent to the municipality as required by Env-Wq 1503.05(e)[1]: 7/21/2020.
(Attach proof of delivery)

B. Date a copy of the application was sent to the local river advisory committee if required by Env-Wq 1503.05(e)[2]: 7/21/2020.
(Attach proof of delivery)

C. Type of plan required: ☐ Land Conversion ☒ Detailed Development ☐ Excavation, Grading & Reclamation ☐ Steep Slope

D. Additional plans required: ☒ Stormwater Drainage & Hydrologic Soil Groups ☐ Source Control ☐ Chloride Management

E. Total area of disturbance: 120575 square feet

F. Additional impervious cover as a result of the project: 62,182 square feet (use the "-" symbol to indicate a net reduction in impervious coverage).
Total final impervious cover: 62,182 square feet

G. Total undisturbed cover: _____ square feet

H. Number of lots proposed: 2 Development of 2 Existing Lots

I. Total length of roadway: 0 linear feet

J. Name(s) of receiving water(s): Warner River

K. Identify all other NHDES permits required for the project, and for each indicate whether an application has been filed and is pending, or if the required approval has been issued provide the permit number, registration date, or approval letter number, as applicable.

Type of Approval	Application Filed?	Status	
		Pending	If Issued:
1. Water Supply Approval	☐ Yes ☐ No ☒ N/A	☐	Permit number:
2. Wetlands Permit	☐ Yes ☐ No ☒ N/A	☐	Permit number:
3. Shoreland Permit	☐ Yes ☐ No ☒ N/A	☐	Permit number:
4. UIC Registration	☐ Yes ☐ No ☒ N/A	☐	Registration date:
5. Large/Small Community Well Approval	☐ Yes ☐ No ☒ N/A	☐	Approval letter date:
6. Large Groundwater Withdrawal Permit	☐ Yes ☐ No ☒ N/A	☐	Permit number:
7. Other:	☐ Yes ☒ No	☐	Permit number:

L. List all species identified by the Natural Heritage Bureau as threatened or endangered or of concern: Wood Turtle

M. Using NHDES's Web GIS OneStop program (www2.des.state.nh.us/gis/onestop/), with the Surface Water Impairment layer turned on, list the impairments identified for each receiving water. If no pollutants are listed, enter "N/A."
N/A

N. Did the applicant/applicant's agent have a pre-application meeting with AOT staff? ☐ Yes ☒ No
If yes, name of staff member:

O. Will blasting of bedrock be required? ☐ Yes ☒ No If yes, estimated quantity of blast rock: _____ cubic yards
If yes, standard blasting BMP notes must be placed on the plans, available at:
http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-10-12.pdf

NOTE: If greater than 5,000 cubic yards of blast rock will be generated, a groundwater monitoring program must be developed and submitted to NHDES. Contact AOT staff for additional detail.

[1] Env-Wq 1503.05(c)(6), requires proof that a completed application form, checklist, plans and specifications, and all other supporting materials have been sent or delivered to the governing body of each municipality in which the project is proposed.

[2] Env-Wq 1503.05(c)(6), requires proof that a completed application form, checklist, plans and specifications, and all other supporting materials have been sent or delivered to the Local River Advisory Committee, if the project is within ¼ mile of a designated river.

11. CHECK ALL APPLICATION ATTACHMENTS THAT APPLY (SUBMIT WITH APPLICATION IN ORDER LISTED)

LOOSE:

- ☐ Signed application form: des.nh.gov/organization/divisions/water/aot/index.htm (with attached proof(s) of delivery)
- ☐ Check for the application fee: des.nh.gov/organization/divisions/water/aot/fees.htm
- ☐ Color copy of a USGS map with the property boundaries outlined (1" = 2,000' scale)
- ☐ If Applicant is not the property owner, proof that the applicant will have a legal right to undertake the project on the property if a permit is issued to the applicant.

BIND IN A REPORT IN THE FOLLOWING ORDER:

- ☐ Copy of the signed application form & application checklist (des.nh.gov/organization/divisions/water/aot/index.htm)
- ☐ Copy of the check
- ☐ Copy of the USGS map with the property boundaries outlined (1" = 2,000' scale)
- ☐ Narrative of the project with a summary table of the peak discharge rate for the off-site discharge points
- ☐ Web GIS printout with the "Surface Water Impairments" layer turned on - http://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx
- ☐ Web GIS printouts with the AOT screening layers turned on - http://www4.des.state.nh.us/onestopdatamapper/onestopmapper.aspx
- ☐ NHB letter using DataCheck Tool – www.nhdfl.org/about-forests-and-lands/bureaus/natural-heritage-bureau/
- ☐ The Web Soil Survey Map with project's watershed outlined – websoilsurvey.nrcs.usda.gov
- ☐ Aerial photograph (1" = 2,000' scale with the site boundaries outlined)
- ☐ Photographs representative of the site
- ☐ Groundwater Recharge Volume calculations (one worksheet for each permit application): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
- ☐ BMP worksheets (one worksheet for each treatment system): des.nh.gov/organization/divisions/water/aot/documents/bmp_worksh.xls
- ☐ Drainage analysis, stamped by a professional engineer (see Application Checklist for details)
- ☐ Riprap apron or other energy dissipation or stability calculations
- ☐ Site Specific Soil Survey report, stamped and with a certification note prepared by the soil scientist that the survey was done in accordance with the Site Specific Soil Mapping standards, *Site-Specific Soil Mapping Standards for NH & VT, SSSNNE Special Publication No. 3*.
- ☐ Infiltration Feasibility Report (example online) [Env-Wq 1503.08(f)(3)]
- ☐ Registration and Notification Form for Storm Water Infiltration to Groundwater (UIC Registration-for underground systems only, including drywells and trenches): (http://des.nh.gov/organization/divisions/water/dwgb/dwspp/gw_discharge)
- ☐ Inspection and maintenance manual with, if applicable, long term maintenance agreements [Env-Wq 1503.08(g)]
- ☐ Source control plan

PLANS:

- ☐ One set of design plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)
- ☐ Pre & post-development color coded soil plans on 11" x 17" (see Application Checklist for details)
- ☐ Pre & post-development drainage area plans on 34 - 36" by 22 - 24" white paper (see Application Checklist for details)

100-YEAR FLOODPLAIN REPORT:

- ☐ All information required in Env-Wq 1503.09, submitted as a separate report.

ADDITIONAL INFORMATION RE: NUTRIENTS, CLIMATE

- ☐ See Checklist for Details

☐ **REVIEW APPLICATION FOR COMPLETENESS & CONFIRM INFORMATION LISTED ON THE APPLICATION IS INCLUDED WITH SUBMITTAL.**

12. REQUIRED SIGNATURES

BCO By initialing here, I acknowledge that I am required by Env-Wq 1503.20(e) to submit a copy of all approved documents to the department in PDF format on a CD within one week after permit approval.

By signing below, I certify that:

- The information contained in or otherwise submitted with this application is true, complete, and not misleading to the best of my knowledge and belief;
- I understand that the submission of false, incomplete, or misleading information constitutes grounds for the department to deny the application, revoke any permit that is granted based on the information, and/or refer the matter to the board of professional engineers established by RSA 310-A:3 if I am a professional engineer; and
- I understand that I am subject to the penalties specified in New Hampshire law for falsification in official matters, currently RSA 641.

☐ **APPLICANT** ☒ **APPLICANT'S AGENT:**

Signature: Benjamin C Osgood Jr Date: 7-21-20

Name (print or type): Benjamin C Osgood Jr Title: SR Engineer

☐ PROPERTY OWNER ☒ PROPERTY OWNER'S AGENT:

Signature: Benjamin C Osgood Jr Date: 7-21-20

Name (print or type): Benjamin C Osgood Jr Title: SR Engineer

ATTACHMENT A:
ALTERATION OF TERRAIN PERMIT APPLICATION CHECKLIST

Check the box to indicate the item has been provided or provide an explanation why the item does not apply.

DESIGN PLANS

- [x] Plans printed on 34 - 36" by 22 - 24" white paper
- [x] PE stamp
- [x] Wetland delineation
- [x] Temporary erosion control measures
- [x] Treatment for all stormwater runoff from impervious surfaces such as roadways (including gravel roadways), parking areas, and non-residential roof runoff. Guidance on treatment BMPs can be found in Volume 2, Chapter 4 of the NH Stormwater Management Manual.
- [x] Pre-existing 2-foot contours
- [x] Proposed 2-foot contours
- [x] Drainage easements protecting the drainage/treatment structures
- [x] Compliance with the Wetlands Bureau, RSA 482- A http://des.nh.gov/organization/divisions/water/wetlands/index.htm. Note that artificial detention in wetlands is not allowed.
- [x] Compliance with the Comprehensive Shoreland Protection Act, RSA 483-B. http://des.nh.gov/organization/divisions/water/wetlands/cspa
- [x] N/A Benches. Benching is needed if you have more than 20 feet change in elevation on a 2:1 slope, 30 feet change in elevation on a 3:1 slope, 40 feet change in elevation on a 4:1 slope.
- [x] N/A Check to see if any proposed ponds need state Dam permits. http://des.nh.gov/organization/divisions/water/dam/documents/damdef.pdf

DETAILS

- [x] Typical roadway x-section
- [x] Detention basin with inverts noted on the outlet structure
- [x] Stone berm level spreader
- [x] Outlet protection – riprap aprons
- [x] A general installation detail for an erosion control blanket
- [x] Silt fences or mulch berm
- [x] Storm drain inlet protection. Note that since hay bales must be embedded 4 inches into the ground, they are not to be used on hard surfaces such as pavement.
- [x] Hay bale barriers
- [x] Stone check dams
- [x] Gravel construction exit
- [x] Temporary sediment trap
- [x] The treatment BMP's proposed
- [x] Any innovative BMP's proposed

CONSTRUCTION SEQUENCE/EROSION CONTROL

☑ Note that the project is to be managed in a manner that meets the requirements and intent of RSA 430:53 and Chapter Agr 3800 relative to invasive species.

☑ Note that perimeter controls shall be installed prior to earth moving operations.

☑ Note that temporary water diversion (swales, basins, etc) must be used as necessary until areas are stabilized.

☑ Note that ponds and swales shall be installed early on in the construction sequence (before rough grading the site).

☑ Note that all ditches and swales shall be stabilized prior to directing runoff to them.

☑ Note that all roadways and parking lots shall be stabilized within 72 hours of achieving finished grade.

☑ Note that all cut and fill slopes shall be seeded/loamed within 72 hours of achieving finished grade

☑ Note that all erosion controls shall be inspected weekly AND after every half-inch of rainfall.

☑ Note the limits on the open area allowed, see Env-Wq 1505.02 for detailed information.

Example note: The smallest practical area shall be disturbed during construction, but in no case shall exceed 5 acres at any one time before disturbed areas are stabilized.

☑ Note the definition of the word "stable"

Example note: An area shall be considered stable if one of the following has occurred:

- Base course gravels have been installed in areas to be paved.
- A minimum of 85 percent vegetated growth has been established.
- A minimum of 3 inches of non-erosive material such stone or riprap has been installed.
- Or, erosion control blankets have been properly installed.

☑ Note the limit of time an area may be exposed
Example note: All areas shall be stabilized within 45 days of initial disturbance.

☑ Provide temporary and permanent seeding specifications. (Reed canary grass is listed in the Green Book; however, this is a problematic species according to the Wetlands Bureau and therefore should not be specified)

☑ Provide winter construction notes that meet or exceed our standards.

Standard Winter Notes:

- All proposed vegetated areas that do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized by seeding and installing erosion control blankets on slopes greater than 3:1, and seeding and placing 3 to 4 tons of mulch per acre, secured with anchored netting, elsewhere. The installation of erosion control blankets or mulch and netting shall not occur over accumulated snow or on frozen ground and shall be completed in advance of thaw or spring melt events.
- All ditches or swales which do not exhibit a minimum of 85 percent vegetative growth by October 15, or which are disturbed after October 15, shall be stabilized temporarily with stone or erosion control blankets appropriate for the design flow conditions.
- After October 15, incomplete road or parking surfaces, where work has stopped for the winter season, shall be protected with a minimum of 3 inches of crushed gravel per NHDOT item 304.3.

☑ Note at the end of the construction sequence that "Lot disturbance, other than that shown on the approved plans, shall not commence until after the roadway has the base course to design elevation and the associated drainage is complete and stable." – This note is applicable to single/duplex family subdivisions, when lot development is not part of the permit.

DRAINAGE ANALYSES

Please double-side 8 ½" × 11" sheets where possible but, **do not** reduce the text such that more than one page fits on one side.

☑ PE stamp

☑ Rainfall amount obtained from the Northeast Regional Climate Center- http://precip.eas.cornell.edu/. Include extreme precipitation table as obtained from the above referenced website.

☑ Drainage analyses, in the following order:

- Pre-development analysis: Drainage diagram.
- Pre-development analysis: Area Listing and Soil Listing.
- Pre-development analysis: Node listing 1-year (if applicable), 2-year, 10-year and 50-year.
- Pre-development analysis: Full summary of the 10-year storm.
- Post-development analysis: Drainage diagram.
- Post-development analysis: Area Listing and Soil Listing.
- Post-development analysis: Node listing for the 2-year, 10-year and 50-year.
- Post-development analysis: Full summary of the 10-year storm.

☑ Review the Area Listing and Soil Listing reports

- Hydrologic soil groups (HSG) match the HSGs on the soil maps provided.
- There is the same or less HSG A soil area after development (check for each HSG).
- There is the same or less "woods" cover in the post-development.
- Undeveloped land was assumed to be in "good" condition.
- The amount of impervious cover in the analyses is correct.

Note: A good check is to subtract the total impervious area used in the pre analysis from the total impervious area used in the post-analysis. For residential projects without demolition occurring, a good check is to take this change in impervious area, subtract out the roadway and divide the remaining by the number of houses/units proposed. Do these numbers make sense?

☑ Check the storage input used to model the ponds.

☑ Check to see if the artificial berms pass the 50-year storm, i.e., make sure the constructed berms on ponds are not overtopped.

☑ Check the outlet structure proposed and make sure it matches that modeled.

☑ Check to see if the total areas in the pre and post analyses are same.

☑ Confirm the correct NRCS storm type was modeled (Coos, Carroll & Grafton counties are Type II, all others Type III).

PRE- AND POST-DEVELOPMENT DRAINAGE AREA PLANS

☑ Plans printed on 34 - 36" by 22 - 24" on white paper.

☑ Submit these plans separate from the soil plans.

☑ A north arrow.

☑ A scale.

☑ Labeled subcatchments, reaches and ponds.

☑ Tc lines.

☑ A clear delineation of the subcatchment boundaries.

☑ Roadway station numbers.

☑ Culverts and other conveyance structures.

PRE AND POST-DEVELOPMENT COLOR-CODED SOIL PLANS

- [x] 11" × 17"sheets suitable, as long as it is readable.
- [x] Submit these plans separate from the drainage area plans.
- [x] A north arrow.
- [x] A scale.
- [x] Name of the soil scientist who performed the survey and date the soil survey took place.
- [x] 2-foot contours (5-foot contours if application is for a gravel pit) as well as other surveyed features.
- [x] Delineation of the soil boundaries and wetland boundaries.
- [x] Delineation of the subcatchment boundaries.
- [x] Soil series symbols (e.g., 26).
- [x] A key or legend which identifies each soil series symbol and its associated soil series name (e.g., 26 = Windsor).
- [x] The hydrologic soil group color coding (A = Green, B = yellow, C= orange, D=red, Water=blue, & Impervious = gray).

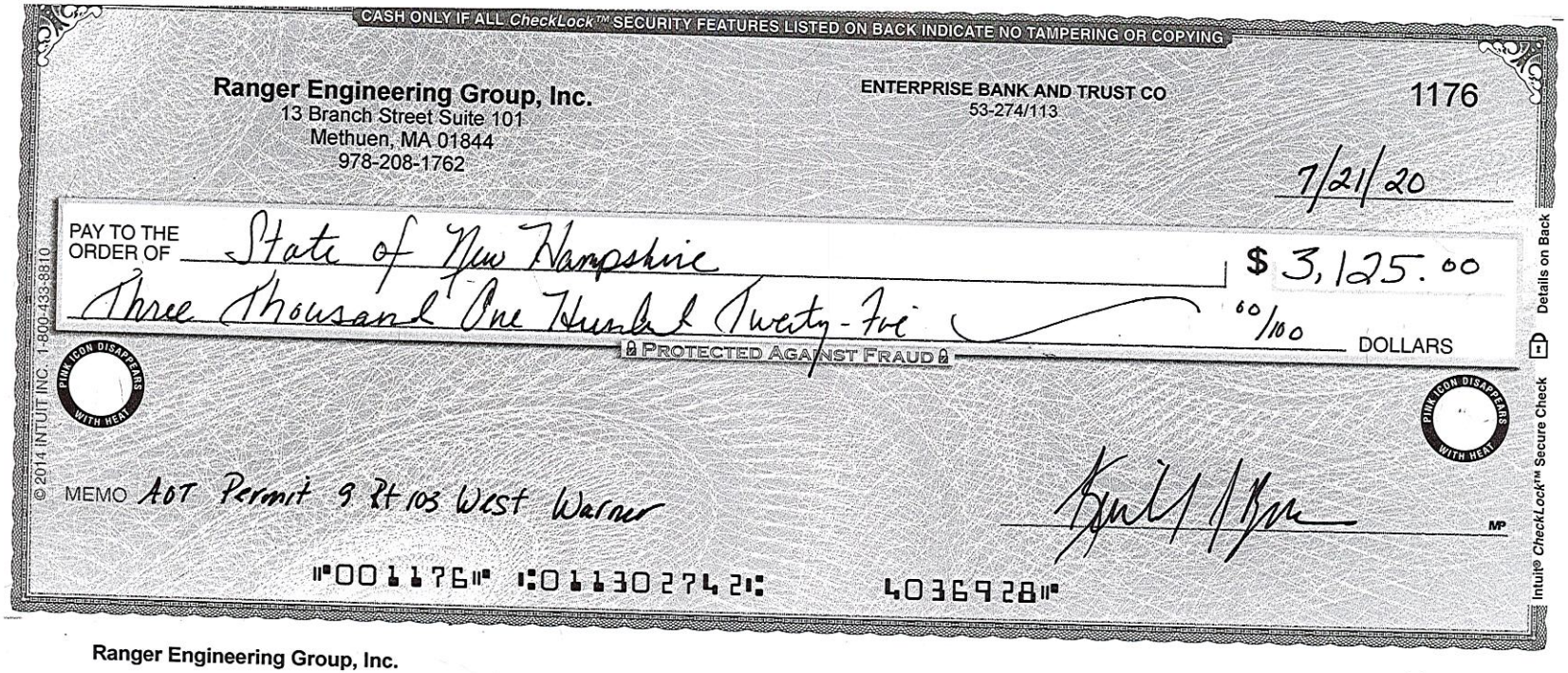
Please note that excavation projects (e.g., gravel pits) have similar requirements to that above, however the following are common exceptions/additions:

- [ ] Drainage report is not needed if site does not have off-site flow.
- [ ] 5 foot contours allowed rather than 2 foot.
- [ ] No PE stamp needed on the plans.
- [ ] Add a note to the plans that the applicant must submit to the Department of Environmental Services a written update of the project and revised plans documenting the project status every five years from the date of the Alteration of Terrain permit.
- [ ] Add reclamation notes.

See NRCS publication titled: *Vegetating New Hampshire Sand and Gravel Pits* for a good resource, it is posted online at: http://des.nh.gov/organization/divisions/water/aot/categories/publications.

ADDITIONAL INFORMATION RE: NUTRIENTS, CLIMATE

- [ ] If project will discharge stormwater to a surface water impaired for phosphorus and/or nitrogen, include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen.
- [ ] If project will discharge stormwater to a Class A surface water or Outstanding Resource Water, include information to demonstrate that project will not cause net increase in phosphorus and/or nitrogen.
- [ ] If project will discharge stormwater to a lake or pond not covered previously, include information to demonstrate that project will not cause net increase in phosphorus in the lake or pond.
- [ ] If project is within a Coastal/Great Bay Region community, include info required by Env-Wq 1503.08(l) if applicable.

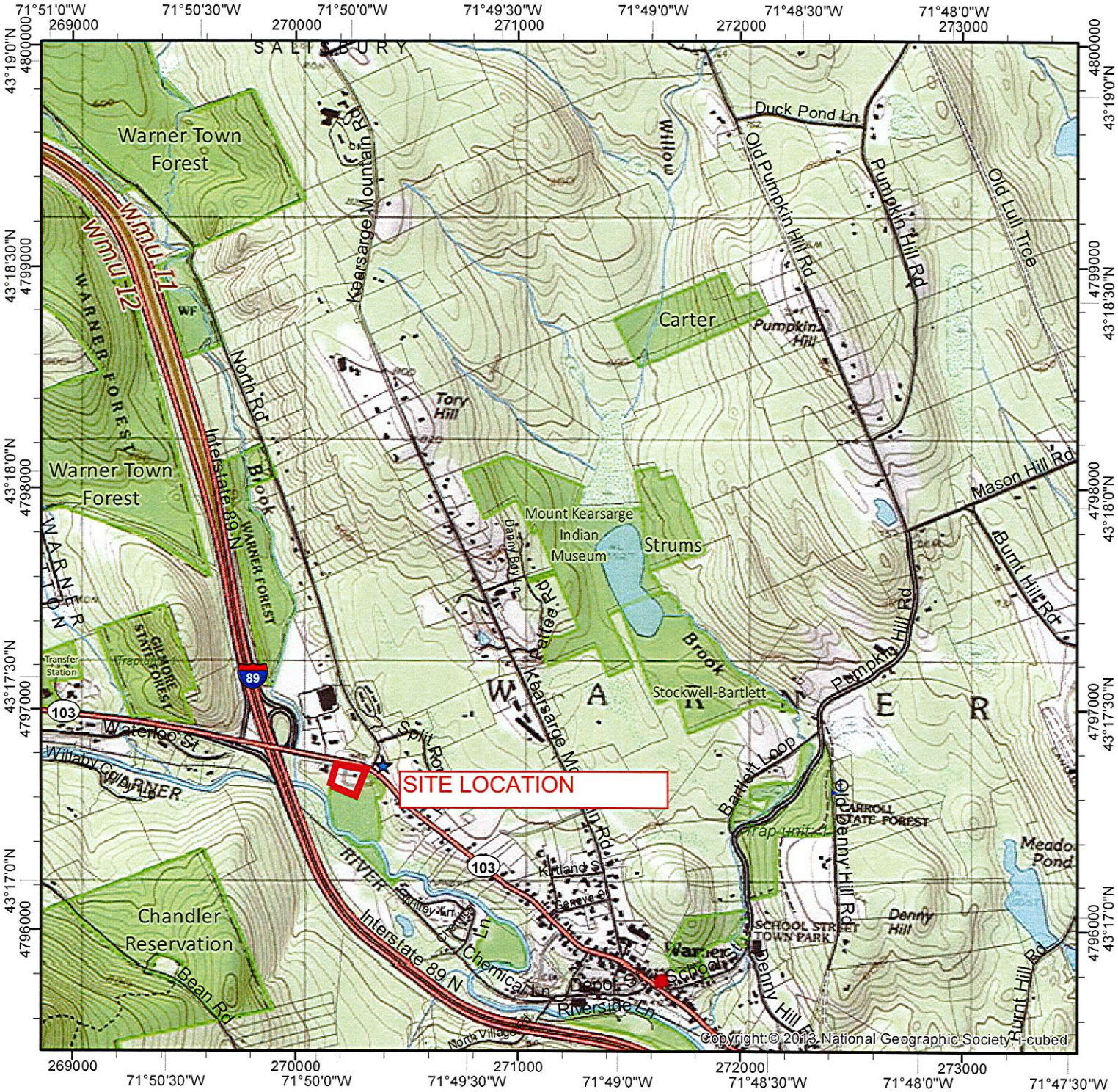


Ranger Engineering Group, Inc.

1176

State of NH Aot Permit

Warner -NH 9 Rt 103 West



MapID: 13408
USGS quad: WARNER 8

- Canoe/Cartop water access
- Boat ramp
- Shorebank access
- Parking area
- Gate
- Route/highway
- Road or Street
- Gravel or Not Maintained
- Trail
- Town boundary
- Wildlife Mgt Unit boundary
- Stream/River
- Lake/Pond
- Wetland
- Conservation
- Parcel boundary (approx.)

Magnetic declination approximately 15° West of north

MN TN

- Forest
- Contour
- Building

Source: USGS and Open Street Map data

Map prepared by NHFG 7/15/2019
(NAD_1983_UTM_Zone_19N meters)
Data from NH GRANIT at Earth Systems Research Center UNH, Open Street Map contributors, and NHFG. NH GRANIT and cooperating agencies make no claim to validity or reliability or to any implied uses of the data. Access and/or activities may be Restricted. Trails and roads may be maintained for management access - not for recreational use. Not all land is open to hunting. NHFG recommends each hunter contact landowners when possible and seek permission.

0 0.4 0.8
Miles

9 Route 103 West, Warner, NH
Assessor's Map 35 Lots 4-1 and 4-2
Project Narrative

INTRODUCTION

In accordance with New Hampshire Alteration of Terrain (AOT) program requirements and the New Hampshire Stormwater Manual, Ranger Engineering Group (Ranger) has prepared a comprehensive Stormwater Management Plan for submittal to the Town of Warner, NH Planning Board and the New Hampshire AOT program on behalf of Comet, LLC in support of an *Application for a Site Plan Review* for the proposed development of a 7200 square foot retail/restaurant building and a drive through Dunkin at 9 Route 103 West, Warner, NH.

The proposed site improvements include construction of buildings, parking areas, pedestrian sidewalk access, landscaped parking islands, grading, utility coordination, and associates site work. Proposed site improvements also include Best Management Practices (BMP) to effectively handle all Stormwater runoff from the site.

The proposed Stormwater Management System (SMS) incorporates structural and non-structural BMPs to provide stormwater peak flow mitigation, quality treatment, infiltration, and conveyance. The SMS includes roof drains, drain manholes, underground piping, deep sump catch basins, a surface sand filter, an underground infiltration system, and a long term Operation and Maintenance Plan.

EXISTING CONDITIONS

The project site consists of two existing lots that front on Rt 103 with a total area of 3.131 ± acres known as 9 Route 103 West (Assessors Map 35 Lots 4-1 and 4-2) in Warner, New Hampshire (see Dwg. CS9201). The site abuts a commercial property developed with a Sunoco gas station on the west, is bordered by the Warner River on the south, and abuts an undeveloped commercially zoned property on the east, which is under the same ownership as the lots being developed.

The site is currently undeveloped consists of filled land that gently slopes from the front to the back. A portion of the back area is wetlands that border on the Warner River. Vegetation consists of a mix of grass and scrub trees. The back portion of the lots are located within a FEMA Flood Zone associated with the Warner River.

The site has one existing gravel access driveway from Route 103.

PROPOSED CONDITIONS

The Applicant proposes to construct a 7,200 square foot retail building on lot 1 and a 1,850 square foot drive through Dunkin on Lot 2. The total number of parking spaces on both lots is 88, 6 of which are handicap spaces. Access will be gained by two driveways, one right turn only entrance on Lot 1, and a larger two way entrance on Lot 2

A closed drainage system will be constructed to collect and convey stormwater runoff to a buried stormwater chamber system which will outlet to the wetland at the rear of the property. Runoff from the back-parking lots will be routed by sheet flow to a shallow depression which is designed as surface sand filter to provide pretreatment. There is an overflow which will handle runoff when the depression fills. The overflow is raised above the ground to prevent the entry of turtles. This flow will then flow into the underground storage system which provides retention for infiltration and peak flow control. Runoff from the front parking lots will be collected in deep sump catch basins with separator hoods which will flow into the chamber system.

The proposed development will be serviced by municipal water, sewer, underground electric, gas, cable TV, and telephone.

STORMWATER DESIGN

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

Closed Drainage Systems

The proposed closed drainage system consists of deep sump catch basins, drain manholes, and HDPE piping. The system conforms to the NH Dot and Town of Warner regulations.

Surface Sand Filter

A surface Sand Filter will be constructed to collect and treat runoff from the back section of the parking lots. The majority of stormwater treatment is provided by infiltrating runoff, however, due to the known presence of endangered turtles in the adjacent Warner River, a system of conveying stormwater to the underground chamber without using catch basin grates at grade was needed in areas close to the wetland. The raised overflow grate will prevent young turtles from entering the system and becoming trapped, while the filter media will allow drainage of the ponding area so water does not pond for long lengths of time.

Stormwater Detention/Infiltration System

A buried chamber system consisting of 4' x 4' x 4' concrete chambers set in stone is proposed to mitigate peak runoff rates and volumes, promote groundwater recharge, and to provide for water quality treatment. The stormwater system is designed to contain and mitigate the 2-year, 10-year, and 100-year storm events.

The system has been sized to provide both water quality treatment and recharge to satisfy the requirements of the NH AOT requirements. Treatment is provided in the buried infiltration basins by infiltrating the required water quality volume after being pretreated through an open sand filter or deep sump catch basins.

SITE PARAMETERS

Wetland Resource Areas
Wetland areas have been delineated on the south portion of the lots. The wetland areas border on the Warner River.

Flood Zone Classification
According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Merrimack County, New Hampshire, Community Panel 33013C287E, effective date April 19, 2010, the site and nearby properties are located within a Zone AE and Zone X. The proposed development portion of the properties is located within Zone X which is above the 100 year flood plain.

Estimated Habitat for Rare Wildlife and Rare Species
A submittal was made to the New Hampshire National Heritage Bureau through the on line data check website which resulted in a determination that this property may be habitat for Wood Turtle. Plans for this project will be submitted to NH Natural Heritage for review and approval.

Soil Classification
According to the Soil Survey of Merrimack County, New Hampshire, prepared by the US Department of Agriculture, Soil Conservation Service, underlying soils located within the site consist primarily of Podunk Fine Sandy Loam and Urban Land(see Soils Map). Soil testing was performed by Benjamin C. Osgood, Jr. and Geotechnical Services Inc. Soil testing results were consistent with the soil mapping for the site.

Table 1
Hydrologic Soil Group Ratings

Map Unit Symbol	Map Unit Name	Rating
104A	Podunk Fine Sandy Loam, 0 – 3% slopes	B
699B	Urban Land 0 – 8% slope	Not Rated

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

Podunk: This series consists of very deep, moderately well drained **soils** formed in recent alluvium on floodplains. Estimated saturated hydraulic conductivity is moderately high or high in the mineral solum and high or very high in the substratum. Slope ranges from 0 to 3 percent.

Urban Land: This map unit consists of nearly level to moderately steep areas where the soils have been altered or obscured by urban fill.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.
Per the soil survey, the general characteristics of the four (4) hydrologic soil groups are as follows:

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

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

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

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

Subsurface Investigation

Test pit investigations were conducted within the site by to determine the presence of the Seasonal High Groundwater (SHGW) elevation, soil classification, and depth to bedrock. The fill soils were found to be consistent with a B soil type (see test pit logs results in the appendix)

One in place conductivity test was performed on site in the original C layer soil which was found at a depth of 8'. This in situ test as well as three constant head permeability tests performed in the lab indicate the soil has a hydraulic conductivity between 4.03 and 68.3 inches per hour.

DRAINAGE ANALYSIS

Methodology

The comparative hydrologic analysis of pre-development conditions to post-development conditions was performed using the Soil Conservation Service, Technical Release 20 (TR-20). The 1, 2, 10, 50 and 100-year storm events were modeled for a 24-hour, Type III storm using HydroCAD version 10.00. HydroCAD calculations for pre-and post-development conditions are include in the Appendices.

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

1-year Frequency Storm:	2.40 inches per 24-hours
2-year Frequency Storm:	2.94 inches per 24-hours
10-year Frequency Storm:	4.56 inches per 24-hours
50-year Frequency Storm:	6.32 inches per 24-hours

Existing Watershed

The existing site is located along route 103 and is undeveloped, however it was filled at some point in the past with the elevation of the developable area being raised several feet. Prior to being filled the land was open farmland. Runoff from the site flows to an adjacent wetland associated with the Warner River which is located at the rear of the site. The existing catchment areas and drainage runoff flow patterns associated with the site are illustrated on the attached Pre-Development Watershed Plan (Dwg. CS9201). The drainage patterns will be maintained under post-development conditions.

For the purposes of the hydrologic analyses, the existing site has been delineated into two (2) existing catchment areas which flow to one (1) design point. The catchment areas which have been modeled flow offsite and are described as follows:

- Design Point #1 (DP1) – Flow to Wetland at rear of site

Catchment EX1
Catchment EX1 includes the entire area of the site which slopes from the road downward to the wetland at the rear of the property. Existing vegetation is a mix of shrub and grass.

Proposed Watershed
The proposed development will include a closed drainage system which will collect and convey stormwater runoff into an underground infiltration/detention structure. For the purposes of the analyses, the proposed site has been divided into ten (10) catchment areas. The proposed catchment areas are shown on the Post-Development Watershed Plan (Dwg. CS9301) and can be described as follows

Catchment P1-A
Catchment P-1A includes flow from the unmaintained grass slope areas on the east side of the development. Runoff from this catchment flows off site towards DP 1, which is the wetlands behind the site.

Catchment P1-B
Catchment P-1B includes unmaintained grass areas which flow to the west side of the site in an existing grass channel to DP-1 at the rear of the site.

Catchment P3-A
Catchment P3-A includes pavement associated with the main driveway which flows to a deep sump catch basin then to the subsurface infiltration/detention structure.

Catchment P3-B
Catchment P3-B includes pavement associated with the west driveway which flow to catch basins then through the subsurface infiltration/detention structure.

Catchment P3-C
Catchment P3-C includes parking lot and landscape areas at the front of the retail building which flow to a deep sump catch basin and then to the subsurface infiltration/detention structure.

Catchment P3-D
Catchment P3-D includes parking lot and landscape areas at the front of the drive through donut shop building which flow to a deep sump catch basin and then to the subsurface infiltration/detention structure.

Catchment P4-A
Catchment P4-A includes parking lot and landscape areas at the rear of the retail building which flow to a surface sand filter and then to the subsurface infiltration/detention structure.

Catchment P4-B
Catchment P4-B includes parking lot and landscape areas at the rear of the drive through donut building which flow to a surface sand filter and then to the subsurface infiltration/detention structure.

Catchment R-1

Catchment R-1 includes the roof area associated with the 7,200 square foot retail building which will flow through a closed drainage system to the subsurface infiltration/detention structure.

Catchment R-2
Catchment R-2 includes the roof area associated with the 1,875 square foot drive through building which will flow through a closed drainage system to the subsurface infiltration/detention structure.

SUMMARY OF PEAK DISCHARGE RATES AND VOLUMES

The estimation of flow rates and volumes were calculated utilizing *HydroCad* stormwater modeling software. The methodology is SCS TR-20, Type II, 24-hour rainfalls (1, 2, 10, 50, & 100-year frequency storm events). Supporting calculations are included in the Appendix.

FLOW RATE TABLES

Point of Analysis	Storm	Pre-Development Rate (CFS)	Post-Development Rate (CFS)
DP #1 (Flow to Wetland)	1-year	0.0	0.0
	2-year	0.3	0.1
	10-year	0.55	0.49
	50-year	2.49	2.44
	100-year	3.71	3.47

AOT STANDARDS AND WATER QUALITY PROTECTION

The project has been designed to meet the requirements the New Hampshire Code of Administrative Rules CHAPTER Env-Wq 1500.

Construction Phase Sediment Control
A detailed sedimentation and erosion control plan has been included as part of the plan set. Erosion and sediment control methods will include the use of perimeter controls consisting of silt fence and mulch waddles which will be installed prior to any work being performed. A construction entrance will be installed to prevent vehicle tracking and all slopes will be stabilized with Loam and seed or erosion control blankets.

Once the site has been graded to sub grade the drainage system will be protected with inlet protection devices. Erosion control devices will be used as needed to prevent sediment laden runoff from traveling off site. The maximum open area allowed is greater than the work area proposed for this project.

Post Construction Water Quality Protection
There will be no new untreated outfalls proposed as part of this project; the stormwater management system is designed to provide the required minimal level of water quality treatment for all new discharges.

Stormwater is pre-treated with deep sump catch basins and a sand filter before it enters a subsurface infiltration chamber where the treatment is accomplished by infiltrating the required water quality volume.

The required water quality volume can be calculated with the following equation.
WQV = (P)(Rv)(A) where P = 1" of rainfall, Rv is a unitless coefficient calculated as 0.5 + 0.9(I), where I is the percent impervious area draining to the site, and A is the total area draining to the treatment practice. Since all of the impervious area drains to one buried treatment structure all of the treatment is accomplished in the one structure.

The water quality volume calculation is as follows.

WQV = 1"/12" x (0.05 + 0.9(0.903)) x 70,006 sf = 5,321 cubic feet.

The subsurface infiltration structure has a volume of 8,697 cubic feet below the lowest outlet which far exceeds the required infiltration volume to provide treatment of the water quality volume..

Peak Rate Attenuation

There will be an increase to the impervious area as a result of this project. The drainage collection and conveyance system has been designed to direct stormwater to detention structures to attenuate increases in peak runoff. Pre- and post-development watershed analyses of the drainage systems were performed for the 1, 2, 10, 50 and 100-year storms. A summary of peak discharge rates for the pre and post development conditions is presented in section IX and the full Hydrocad printouts are included in the Appendix to this report. The results of the analysis indicate that post-development peak discharge rates will not increase from the pre-development peak discharge rates for all design points in the analysis.

Groundwater Recharge Requirement

The groundwater recharge volume requirement is calculated by multiplying the total impervious cover in the proposed development by 0.25". The 0.25" value is determined by the soil classification of hydraulic class B.

The recharge volume for this site can be calculated as 62,182 SF x 0.25" = 1,295 cubic feet.

The subsurface infiltration structure has a volume of 8,697 cubic feet below the lowest outlet which far exceeds the required infiltration value.

72-Hour Drawdown Calculations

The drawdown time for the detention basin is determined with the following equation.

$$\text{Time (drawdown)} = \frac{\text{ReV}}{(\text{K}) \times \text{Area}}$$

Where, ReV = recharge Volume Provided
K = Saturated Hydraulic Conductivity (Rawls Rate for HSG B soils)
Area = Average Surface area of basin bottom

Soil test pits done in the area of the proposed detention basins demonstrate that the fill soils are loamy sand, however they are very compact and in place conductivity testing was

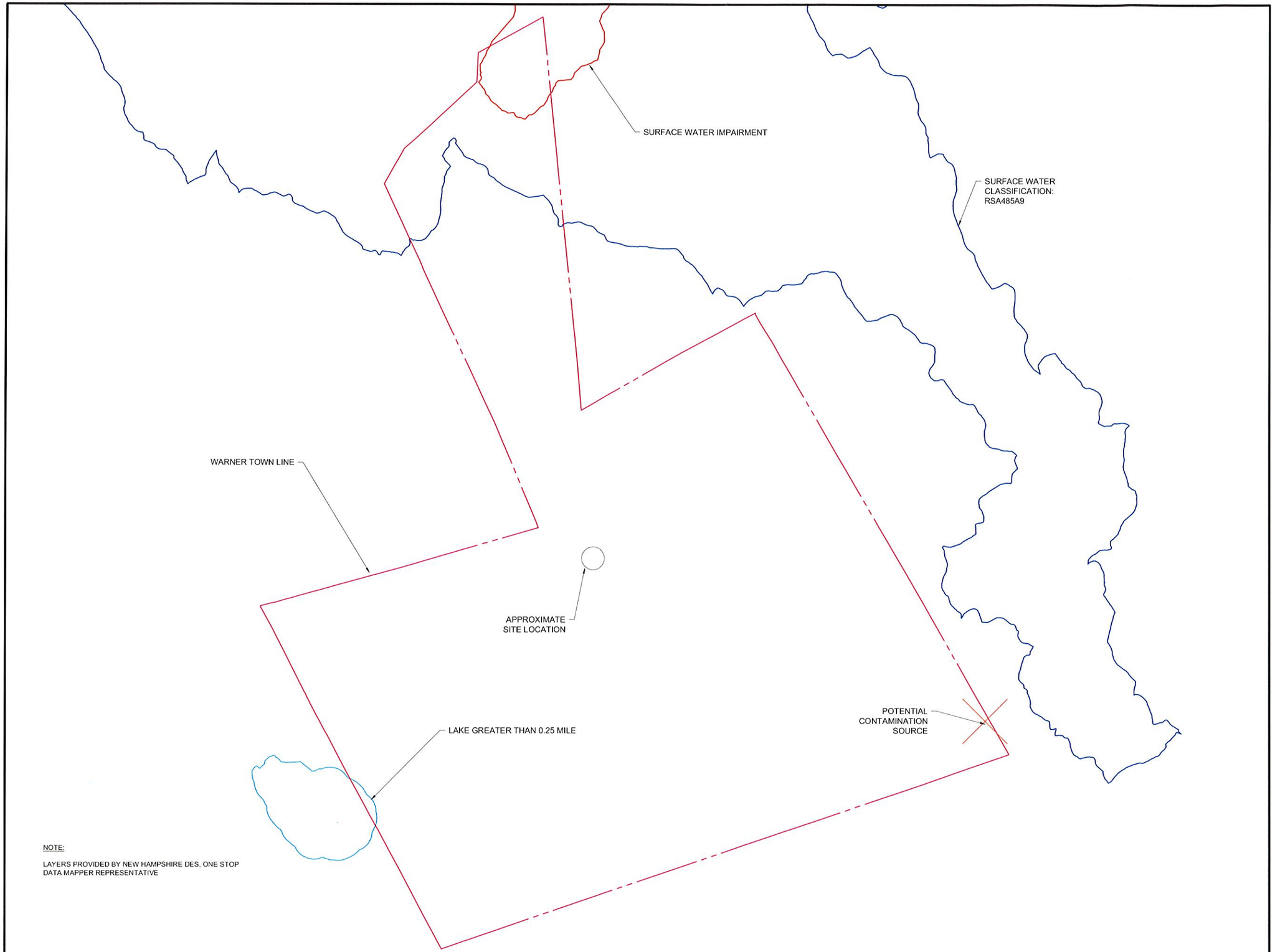
unsuccessful. The project plans specify the removal of fill soils down to the old C layer soils which are fine to medium sand soils. The soil being removed will be replaced with granular fill soils which will be tested I place during construction to verify that they will properly infiltrate runoff. The infiltration rate associated with the fill soils is unknown so a conservative infiltration rate of 0.5 inches per hour has been used in the drawdown calculations below.

Underground Structure 3

$$\text{Time (drawdown)} = \frac{8{,}697 \text{ cf}}{(.5\text{"/hr})/12 \times 6{,}406 \text{ sf}} = 34 \text{ hours}$$

Channel Protection Requirement

Channel protection requirements are met by keeping post development flows to a lesser value than the pre development flow for the 2 year storm combined with a total volume of runoff of 214 cubic feet which is lower than the 0.1 acre feet maximum allowed.



NOTE:

LAYERS PROVIDED BY NEW HAMPSHIRE DES, ONE STOP DATA MAPPER REPRESENTATIVE

RANGER ENGINEERING & DESIGN LLC
13 Branch Street, Suite 101
Methuen, MA 01844
T 978.435.1324

SITE PLAN

9 ROUTE 103 WEST
WARNER, NH

AOT SCREENING LAYERS AND SURFACE WATER IMPAIRMENTS

COMET, LLC
355 MIDDLESEX AVEM SUITE 7
WILMINGTON MA, 01887

NO	DATE	BY
	REVISIONS	

PROJECT	----
DATE	06-15-2020
DRAWING SCALE	1"= 3000'
DRAWN BY	OMR
APPROVED BY	BCO

CS9001

SHEET 1 OF 1

CONFIDENTIAL – NH Dept. of Environmental Services review

Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

To: Kim Brown, Ranger Engineering
13 Branch Street
Suite 101
Methuen, MA 01844

From: Amy Lamb, NH Natural Heritage Bureau
Date: 12/19/2019 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB19-4037 Town: Warner Location: #9 Route 103 West
Description: Construct 3 new buildings on 3 existing lots with associated driveways, parking, utilities, and stormwater controls.
cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: Please contact the NH Fish & Game Department.

Vertebrate species	State[1]	Federal	Notes
Wood Turtle (*Glyptemys insculpta*)	SC	--	Contact the NH Fish & Game Dept (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

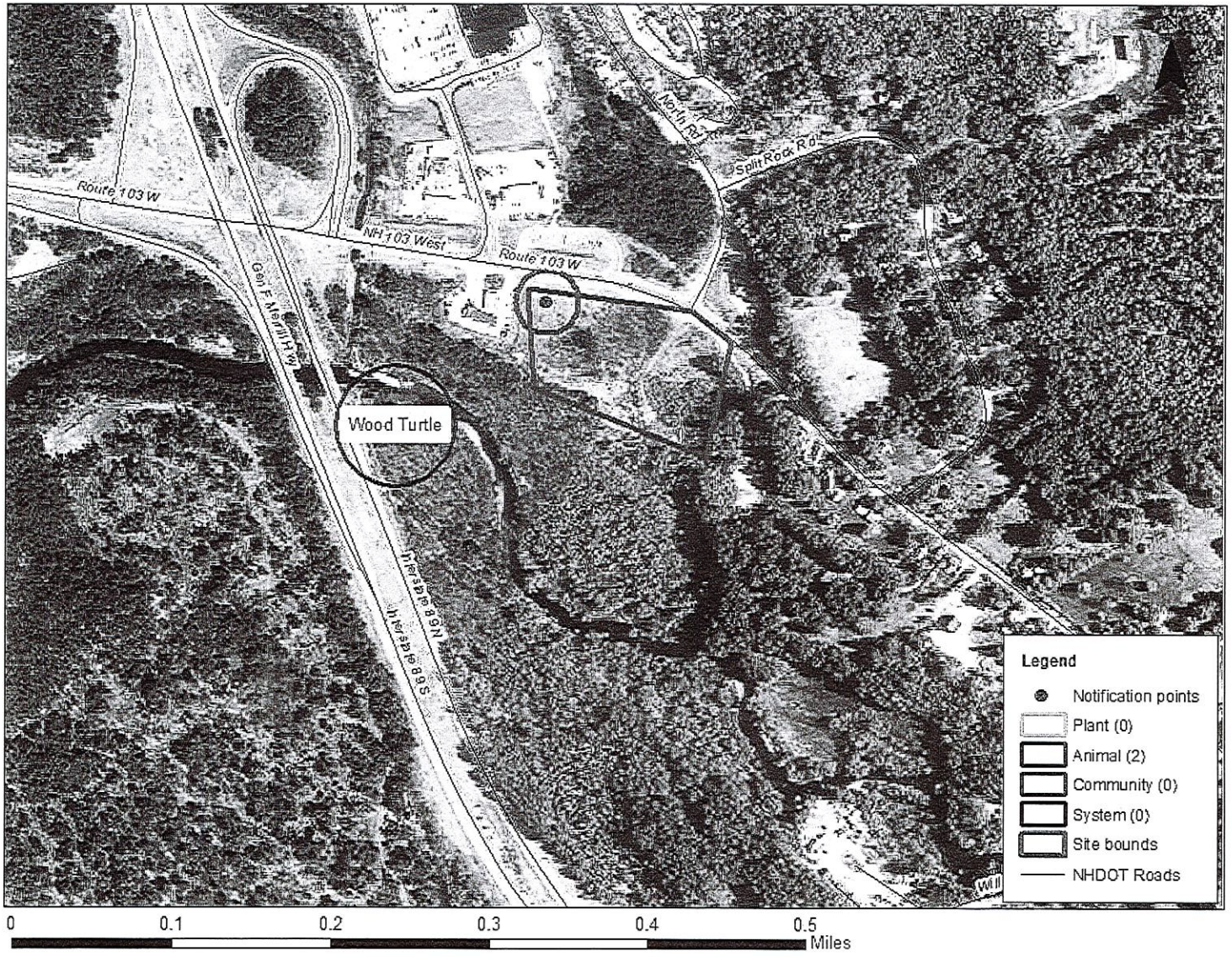
A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

CONFIDENTIAL – NH Dept. of Environmental Services review

NHB19-4037



EOCODE:

Legal Status	Conservation Status
Federal:	Global:
State:	State:

Description at this Location

Conservation Rank:
Comments on Rank:

Detailed Description:
General Area:
General Comments:
Management
Comments:

Location

Survey Site Name:
Managed By:

County:
Town(s):
Size: Elevation:

Precision:

Directions:

Dates documented

First reported: Last reported:

CONFIDENTIAL – NH Dept. of Environmental Services review

EOCODE:

Legal Status	Conservation Status
Federal:	Global:
State:	State:

Description at this Location

Conservation Rank:
Comments on Rank:

Detailed Description:
General Area:
General Comments:
Management
Comments:

Location

Survey Site Name:
Managed By:

County:
Town(s):
Size: Elevation:

Precision:

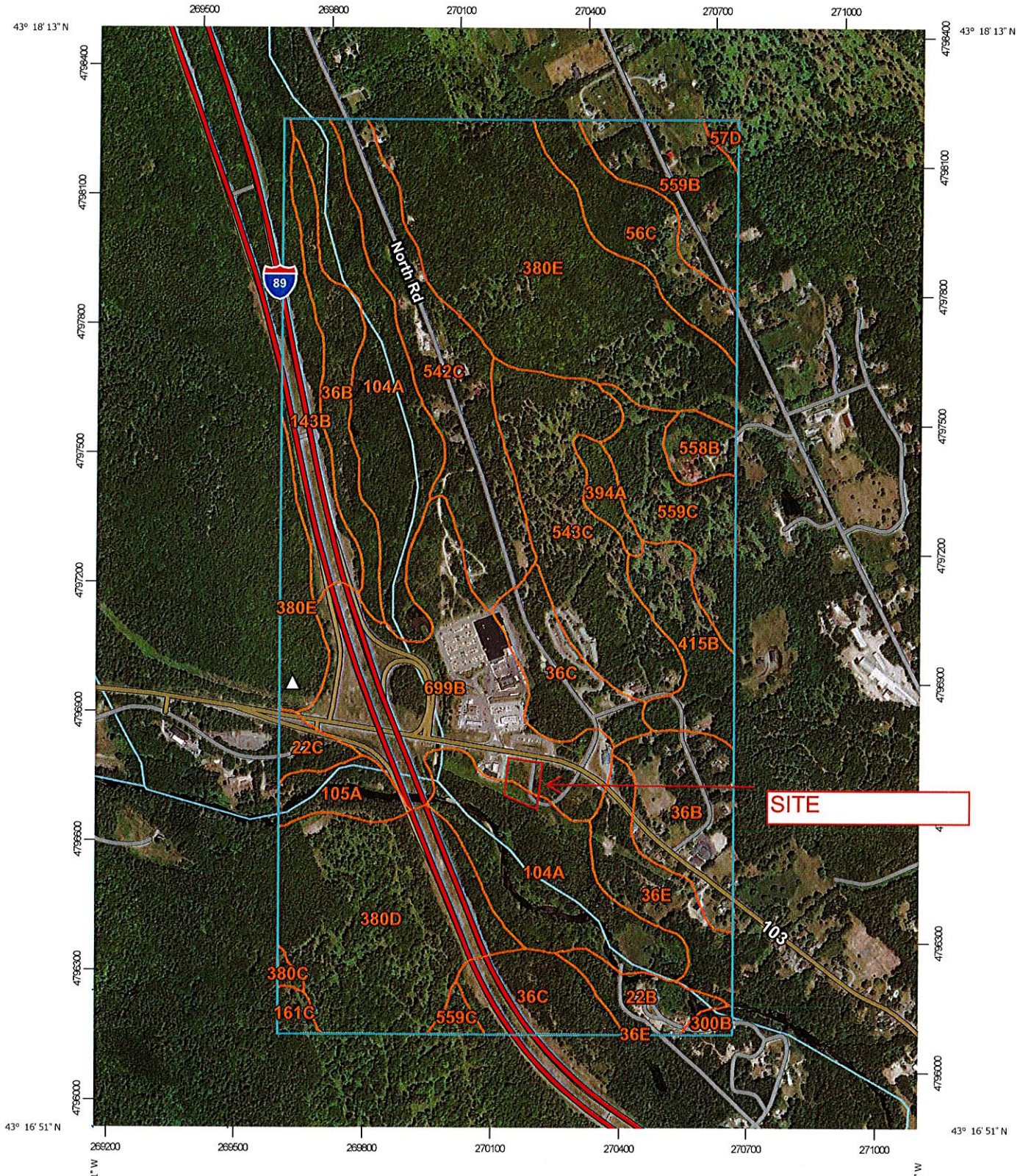
Directions:

Dates documented

First reported: Last reported:

CONFIDENTIAL – NH Dept. of Environmental Services review

Soil Map—Merrimack and Belknap Counties, New Hampshire



Map Scale: 1:12,400 if printed on A portrait (8.5" x 11") sheet.

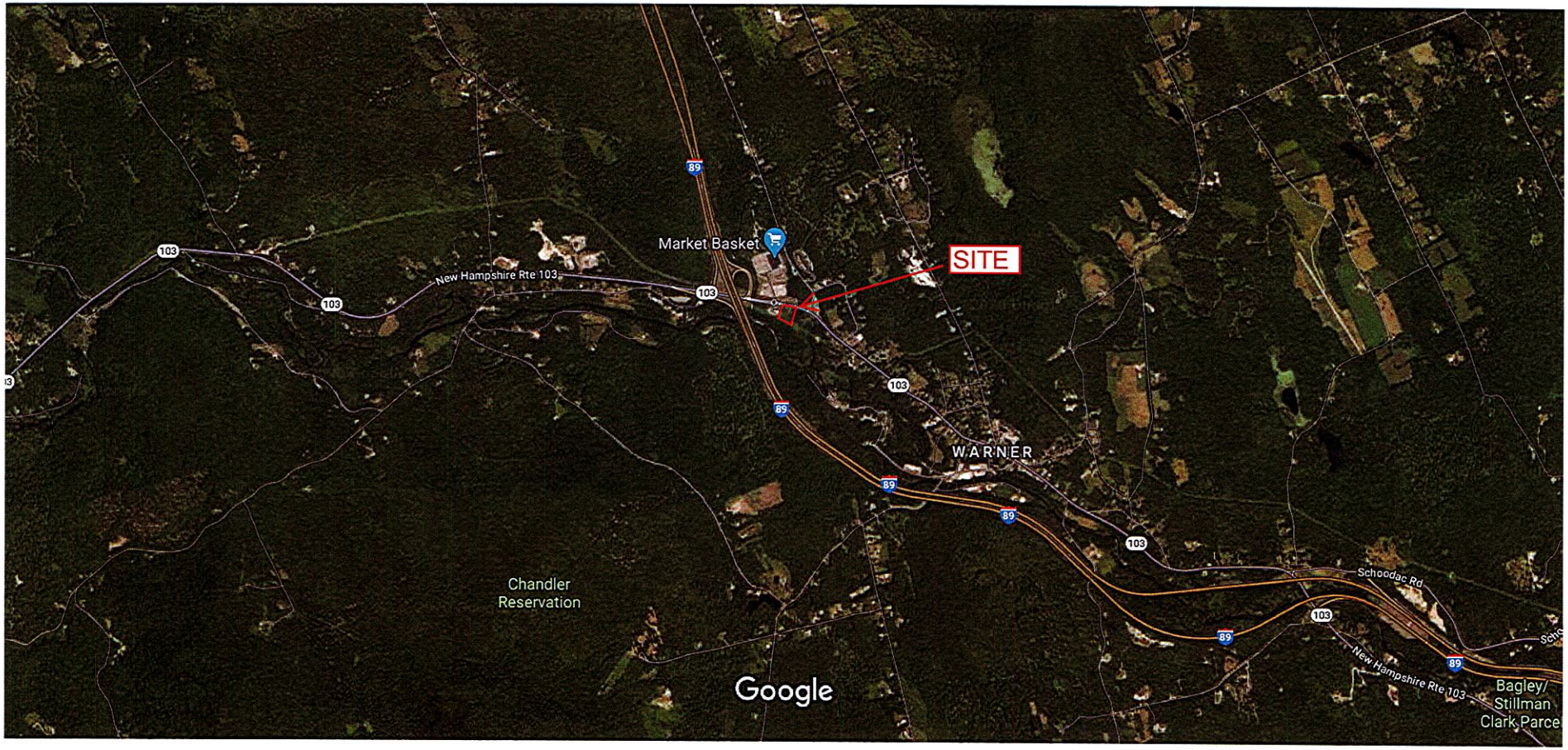
N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

Google Maps



Imagery ©2020 CNES / Airbus, Landsat / Copernicus, Maxar Technologies, USDA Farm Service Agency, Map data ©2020 Google 2000 ft

9 ROUTE 103 WEST, WARNER, NH
SITE PHOTOGRAPHS

Photo 1: Looking onto site (south) from existing gravel drive at front of property.

Photo 2: Looking south east from north east corner on roadway

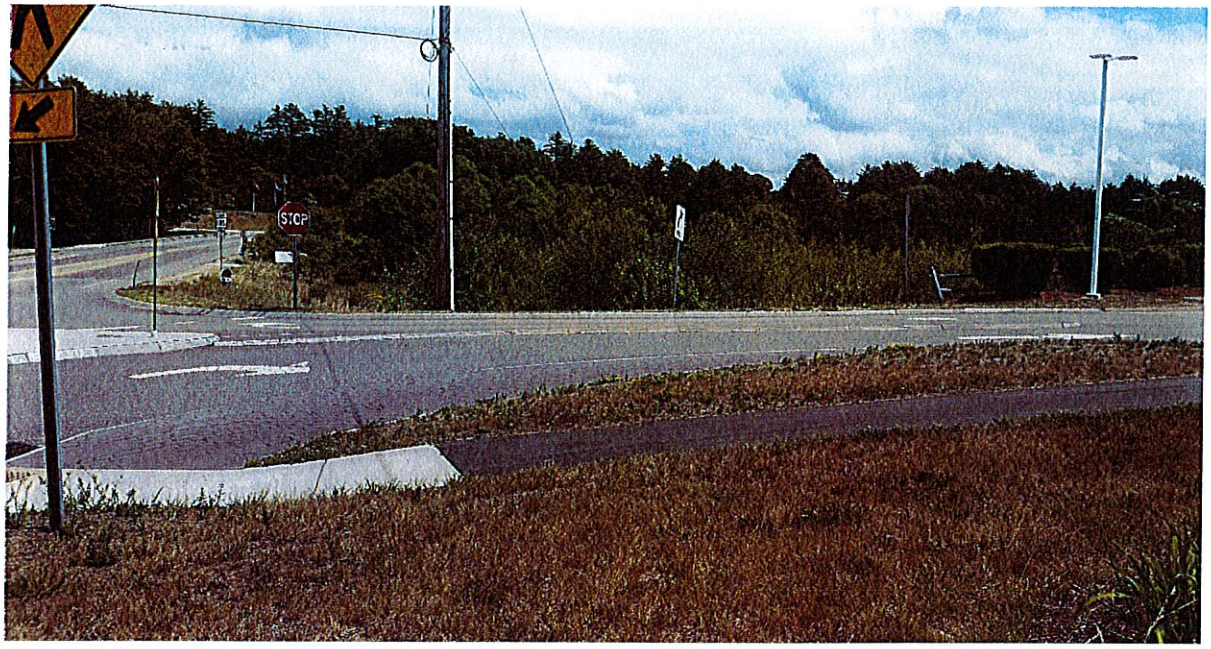


Photo 3: Looking east from across Sunoco Station Driveway
Rt 103 on left side of photo

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

INFILTRATION PRACTICE CRITERIA (Env-Wq 1508.06)

Type/Node Name: **BURRIED CHAMBER SYSTEM - Node # P-2**

Enter the type of infiltration practice (e.g., basin, trench) and the node name in the drainage analysis, if applicable.

yes		Have you reviewed Env-Wq 1508.06(a) to ensure that infiltration is allowed?	← yes
1.62	ac	A = Area draining to the practice	
1.47	ac	A_I = Impervious area draining to the practice	
0.91	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.87	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
1.40	ac-in	WQV= 1" x Rv x A	
5,097	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
1,274	cf	25% x WQV (check calc for sediment forebay volume)	
Designer's Notes:		Method of pretreatment? (not required for clean or roof runoff)	
	cf	V_{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
8,697	cf	V = Volume[1] (attach a stage-storage table)	≥ WQV
6,384	sf	A_{SA} = Surface area of the bottom of the pond	
0.50	iph	$Ksat_{DESIGN}$ = Design infiltration rate[2]	
19.2	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
421.00	feet	E_{BTM} = Elevation of the bottom of the basin	
416.55	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
412.50	feet	E_{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
4.45	feet	D_{SHWT} = Separation from SHWT	≥ *[3]
8.5	feet	D_{ROCK} = Separation from bedrock	≥ *[3]
4.0	ft	D_{amend} = Depth of amended soil, if applicable due high infiltation rate	≥ 24"
4.50	ft	D_T = Depth of trench, if trench proposed	4 - 10 ft
yes	Yes/No	If a trench or underground system is proposed, has observation well been provided?	←yes
		If a trench is proposed, does materialmeet Env-Wq 1508.06(k)(2) requirements.[4]	← yes
	Yes/No	If a basin is proposed, Is the perimeter curvilinear, and basin floor flat?	← yes
	:1	If a basin is proposed, pond side slopes.	≥3:1
423.83	ft	Peak elevation of the 10-year storm event (infiltration can be used in analysis)	
424.63	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
425.50	ft	Elevation of the top of the practice (if a basin, this is the elevation of the berm)	
YES		10 peak elevation ≤ Elevation of the top of the trench?[5]	← yes
YES		If a basin is proposed, 50-year peak elevation ≤ Elevation of berm?	← yes

1. Volume below the lowest invert of the outlet structure and excludes forebay volume
2. $Ksat_{DESIGN}$ includes a factor of safety. See Env-Wq 1504.14 for requirements for determining the infiltr. rate
3. 1' separation if treatment not required; 4' for treatment in GPAs & WSIPAs; & 3' in all other areas.
4. Clean, washed well graded diameter of 1.5 to 3 inches above the in-situ soil.
5. If 50-year peak elevation exceeds top of trench, the overflow must be routed in HydroCAD as secondary discharge.

Designer's Notes: Pretreatment provided by deep sump catch basins and surface sand filter for parking lot
Roof drains connect directly to practice.

Stage-Area-Storage for Pond P-2: BURRIED POND

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
421.00	**6,406**	0
421.10	6,406	256
421.20	6,406	513
421.30	6,406	769
421.40	6,406	1,025
421.50	6,406	1,281
421.60	6,406	1,760
421.70	6,406	2,240
421.80	6,406	2,733
421.90	6,406	3,232
422.00	6,406	3,731
422.10	6,406	4,229
422.20	6,406	4,727
422.30	6,406	5,225
422.40	6,406	5,722
422.50	6,406	6,219
422.60	6,406	6,715
422.70	6,406	7,211
422.80	6,406	7,707
422.90	6,406	8,202
423.00	6,406	8,697
423.10	6,406	9,192
423.20	6,406	9,686
423.30	6,406	10,179
423.40	6,406	10,672
423.50	6,406	11,165
423.60	6,406	11,658
423.70	6,406	12,150
423.80	6,406	12,641
423.90	6,406	13,132
424.00	6,406	13,623
424.10	6,406	14,114
424.20	6,406	14,604
424.30	6,406	15,093
424.40	6,406	15,582
424.50	6,406	16,071
424.60	6,406	16,559
424.70	6,406	17,047
424.80	6,406	17,535
424.90	6,406	18,022
425.00	6,406	18,509
425.10	6,406	18,908
425.20	6,406	18,955
425.30	6,406	19,004
425.40	6,406	19,052
425.50	6,406	**19,101**
425.60	6,406	19,101
425.70	6,406	19,101
425.80	6,406	19,101
425.90	6,406	19,101
426.00	6,406	19,101
426.10	6,406	19,101
426.20	6,406	19,101
426.30	6,406	19,101
426.40	6,406	19,101
426.50	6,406	19,101
426.60	6,406	19,101
426.70	6,406	19,101

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

FILTRATION PRACTICE DESIGN CRITERIA
(Env-Wq 1508.07)

Type/Node Name: **SURFACE SAND FILTER NODE # P-1**

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).	
0.58	ac	A = Area draining to the practice	
0.49	ac	A_I = Impervious area draining to the practice	
0.85	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.81	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.47	ac-in	WQV= 1" x Rv x A	
1,706	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
426	cf	25% x WQV (check calc for sediment forebay volume)	
1,279	cf	75% x WQV (check calc for surface sand filter volume)	
		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:			
770	sf	A_{SA} = Surface area of the practice	
1.00	iph	$Ksat_{DESIGN}$ = Design infiltration rate[1]	
		If Ksat (prior to factor of safety) is < 0.50 iph, has an underdrain been provided?	
yes	Yes/No	(Use the calculations below)	
26.6	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
Calculate time to drain if system IS underdrained:			
425.25	ft	E_{WQV} = Elevation of WQV (attach stage-storage table)	
0.20	cfs	Q_{WQV} = Discharge at the E_{WQV} (attach stage-discharge table)	
4.74	hours	T_{DRAIN} = Drain time = 2WQV/Q_{WQV}	≤ 72-hrs
423.75	feet	E_{FC} = Elevation of the bottom of the filter course material[2]	
422.75	feet	E_{UD} = Invert elevation of the underdrain (UD), if applicable	
416.55	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
412.50	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'
11.25	feet	$D_{FC\ to\ ROCK}$ = Depth to bedrock from the bottom of the filter course	≥ 1'
7.20	feet	$D_{FC\ to\ SHWT}$ = Depth to SHWT from the bottom of the filter course	≥ 1'
426.75	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
427.00	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
1,313	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	11 of 16	Note what sheet in the plan set contains the filter course specification.	
yes	Yes/No	Access grate provided?	← yes

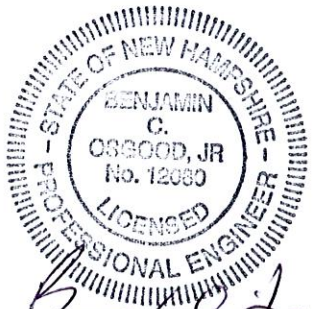
If a bioretention area is proposed:			
YES	ac	Drainage Area no larger than 5 ac?	← yes
	cf	V = Volume of storage[3] (attach a stage-storage table)	≥ WQV
	inches	D_{FC} = Filter course thickness	18", or 24" if within GPA
Sheet		Note what sheet in the plan set contains the filter course specification	
	: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)

1. Rate of the limiting layer (either the filter course or the underlying soil). $Ksat_{design}$ includes factor of safey. See Env-Wq 1504.14 for guidance on determining the infiltration rate.
2. See lines 34, 40 and 48 for required depths of filter media.
3. Volume without depending on infiltration. The volume includes the storage above the filter (but below the invert of the outlet stucture, if any), the filter media voids, and the pretreatment area. The storage above the filter media shall not include the volume above the outlet structure, if any.

Designer's Notes: _____

Stage-Area-Storage for Pond P-1: FILTER

Elevation (feet)	Surface (sq-ft)	Horizontal (sq-ft)	Storage (cubic-feet)
425.25	770	770	0
425.30	792	792	39
425.35	814	814	79
425.40	836	836	120
425.45	859	859	163
425.50	881	881	206
425.55	903	903	251
425.60	925	925	297
425.65	947	947	343
425.70	969	969	391
425.75	991	991	440
425.80	1,013	1,013	490
425.85	1,036	1,036	542
425.90	1,058	1,058	594
425.95	1,080	1,080	647
426.00	1,102	1,102	702
426.05	1,126	1,126	758
426.10	1,150	1,150	815
426.15	1,174	1,174	873
426.20	1,198	1,198	932
426.25	1,222	1,222	993
426.30	1,246	1,246	1,054
426.35	1,270	1,270	1,117
426.40	1,294	1,294	1,181
426.45	1,318	1,318	1,246
426.50	1,342	1,342	1,313
426.55	1,366	1,366	1,381
426.60	1,390	1,390	1,450
426.65	1,413	1,413	1,520
426.70	1,437	1,437	1,591
426.75	1,461	1,461	1,663
426.80	1,485	1,485	1,737
426.85	1,509	1,509	1,812
426.90	1,532	1,532	1,888
426.95	1,556	1,556	1,965
427.00	**1,580**	**1,580**	**2,044**



7-21-20

PREPARED BY
BENJAMIN C OSGOOD,
JR P.E.

NOAA Atlas 14, Volume 10, Version 3
Location name: Warner, New Hampshire, USA*
Latitude: 43.2789°, Longitude: -71.8126°
Elevation: 426.26 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.288 (0.221-0.371)	0.346 (0.265-0.446)	0.440 (0.336-0.569)	0.518 (0.394-0.675)	0.626 (0.462-0.851)	0.707 (0.512-0.982)	0.792 (0.558-1.14)	0.887 (0.595-1.31)	1.02 (0.662-1.57)	1.14 (0.718-1.78)
10-min	0.409 (0.313-0.526)	0.490 (0.375-0.632)	0.623 (0.476-0.805)	0.734 (0.557-0.956)	0.887 (0.654-1.21)	1.00 (0.725-1.39)	1.12 (0.791-1.62)	1.26 (0.842-1.86)	1.45 (0.938-2.22)	1.61 (1.02-2.51)
15-min	0.481 (0.368-0.619)	0.577 (0.442-0.743)	0.734 (0.560-0.949)	0.864 (0.656-1.12)	1.04 (0.769-1.42)	1.18 (0.853-1.64)	1.32 (0.930-1.90)	1.48 (0.990-2.18)	1.71 (1.10-2.61)	1.89 (1.20-2.96)
30-min	0.677 (0.519-0.871)	0.812 (0.622-1.05)	1.03 (0.788-1.34)	1.22 (0.923-1.58)	1.47 (1.08-2.00)	1.66 (1.20-2.30)	1.86 (1.31-2.68)	2.08 (1.39-3.07)	2.40 (1.55-3.67)	2.66 (1.68-4.16)
60-min	0.873 (0.669-1.12)	1.05 (0.802-1.35)	1.33 (1.02-1.72)	1.57 (1.19-2.04)	1.89 (1.40-2.57)	2.14 (1.55-2.97)	2.39 (1.69-3.45)	2.68 (1.80-3.96)	3.09 (2.00-4.74)	3.43 (2.17-5.36)
2-hr	1.09 (0.843-1.40)	1.33 (1.02-1.70)	1.71 (1.31-2.19)	2.02 (1.54-2.61)	2.45 (1.83-3.33)	2.78 (2.03-3.86)	3.12 (2.24-4.54)	3.55 (2.38-5.21)	4.19 (2.72-6.38)	4.74 (3.01-7.36)
3-hr	1.24 (0.964-1.59)	1.52 (1.17-1.94)	1.96 (1.52-2.51)	2.33 (1.79-3.01)	2.84 (2.13-3.86)	3.22 (2.37-4.47)	3.63 (2.62-5.28)	4.14 (2.79-6.07)	4.94 (3.21-7.50)	5.63 (3.58-8.72)
6-hr	1.56 (1.22-1.98)	1.91 (1.49-2.43)	2.49 (1.94-3.17)	2.97 (2.30-3.80)	3.63 (2.74-4.90)	4.12 (3.05-5.70)	4.65 (3.38-6.74)	5.33 (3.60-7.76)	6.39 (4.16-9.64)	7.32 (4.67-11.3)
12-hr	1.96 (1.54-2.46)	2.41 (1.89-3.03)	3.14 (2.46-3.96)	3.74 (2.91-4.76)	4.58 (3.47-6.13)	5.19 (3.86-7.13)	5.87 (4.27-8.42)	6.70 (4.55-9.70)	8.01 (5.24-12.0)	9.14 (5.85-14.0)
24-hr	2.40 (1.90-2.99)	2.94 (2.32-3.68)	3.83 (3.02-4.80)	4.56 (3.57-5.76)	5.58 (4.24-7.41)	6.32 (4.73-8.61)	7.14 (5.21-10.1)	8.13 (5.55-11.7)	9.65 (6.34-14.4)	11.0 (7.03-16.6)
2-day	2.84 (2.27-3.53)	3.47 (2.77-4.31)	4.50 (3.57-5.61)	5.36 (4.22-6.72)	6.53 (5.00-8.61)	7.40 (5.56-9.99)	8.34 (6.11-11.8)	9.48 (6.49-13.5)	11.2 (7.38-16.6)	12.7 (8.15-19.1)
3-day	3.15 (2.52-3.89)	3.82 (3.06-4.73)	4.93 (3.93-6.12)	5.84 (4.63-7.30)	7.10 (5.46-9.32)	8.04 (6.05-10.8)	9.05 (6.63-12.7)	10.3 (7.04-14.6)	12.1 (7.97-17.8)	13.6 (8.77-20.4)
4-day	3.41 (2.74-4.20)	4.11 (3.30-5.08)	5.27 (4.21-6.53)	6.23 (4.95-7.76)	7.55 (5.81-9.87)	8.53 (6.44-11.4)	9.59 (7.04-13.4)	10.8 (7.46-15.4)	12.7 (8.41-18.7)	14.3 (9.23-21.4)
7-day	4.09 (3.30-5.01)	4.86 (3.92-5.96)	6.12 (4.92-7.54)	7.17 (5.73-8.88)	8.61 (6.66-11.2)	9.69 (7.33-12.9)	10.8 (7.96-15.0)	12.2 (8.41-17.1)	14.1 (9.37-20.6)	15.7 (10.2-23.5)
10-day	4.73 (3.83-5.78)	5.54 (4.49-6.77)	6.87 (5.54-8.43)	7.97 (6.39-9.83)	9.48 (7.35-12.2)	10.6 (8.05-14.0)	11.8 (8.68-16.2)	13.2 (9.13-18.5)	15.1 (10.1-22.0)	16.7 (10.8-24.8)
20-day	6.68 (5.45-8.10)	7.55 (6.16-9.17)	8.99 (7.31-11.0)	10.2 (8.22-12.5)	11.8 (9.20-15.1)	13.1 (9.93-17.0)	14.3 (10.5-19.3)	15.7 (10.9-21.8)	17.5 (11.7-25.2)	18.9 (12.3-27.9)
30-day	8.30 (6.81-10.0)	9.23 (7.56-11.2)	10.7 (8.77-13.0)	12.0 (9.73-14.6)	13.7 (10.7-17.4)	15.1 (11.5-19.4)	16.4 (12.0-21.8)	17.7 (12.4-24.5)	19.4 (13.0-27.9)	20.6 (13.4-30.3)
45-day	10.3 (8.51-12.4)	11.3 (9.31-13.6)	12.9 (10.6-15.6)	14.3 (11.6-17.3)	16.1 (12.6-20.3)	17.6 (13.4-22.5)	19.0 (13.9-25.0)	20.2 (14.2-27.9)	21.9 (14.7-31.3)	23.0 (15.0-33.6)
60-day	12.0 (9.94-14.4)	13.1 (10.8-15.7)	14.8 (12.2-17.8)	16.2 (13.2-19.6)	18.2 (14.3-22.8)	19.7 (15.1-25.2)	21.2 (15.5-27.8)	22.5 (15.8-30.9)	24.1 (16.2-34.3)	25.1 (16.4-36.6)

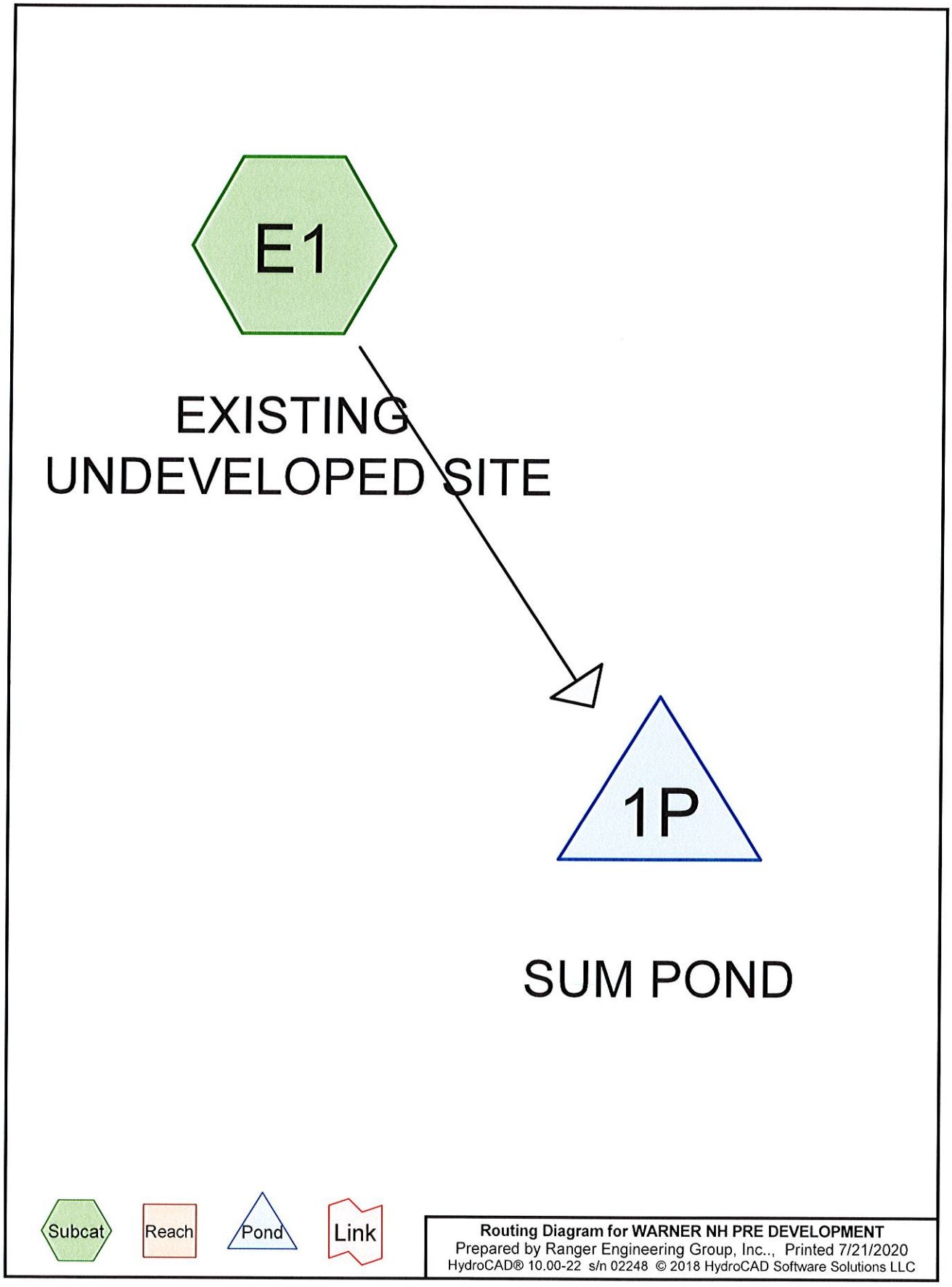
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



Routing Diagram for WARNER NH PRE DEVELOPMENT
Prepared by Ranger Engineering Group, Inc.., Printed 7/21/2020
HydroCAD® 10.00-22 s/n 02248 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
120,540	48	Brush, Good, HSG B (E1)
120,540	**48**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
120,540	HSG B	E1
0	HSG C	
0	HSG D	
0	Other	
120,540		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	120,540	0	0	0	120,540	Brush, Good	E 1
0	**120,540**	**0**	**0**	**0**	**120,540**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXISTING Runoff Area=120,540 sf 0.00% Impervious Runoff Depth>0.00"
Flow Length=310' Tc=9.7 min CN=48 Runoff=0.00 cfs 48 cf

Pond 1P: SUM POND Inflow=0.00 cfs 48 cf
Primary=0.00 cfs 48 cf

Total Runoff Area = 120,540 sf Runoff Volume = 48 cf Average Runoff Depth = 0.00"
100.00% Pervious = 120,540 sf 0.00% Impervious = 0 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXISTING Runoff Area=120,540 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=310' Tc=9.7 min CN=48 Runoff=0.03 cfs 518 cf

Pond 1P: SUM POND Inflow=0.03 cfs 518 cf
Primary=0.03 cfs 518 cf

Total Runoff Area = 120,540 sf Runoff Volume = 518 cf Average Runoff Depth = 0.05"
100.00% Pervious = 120,540 sf 0.00% Impervious = 0 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXISTING Runoff Area=120,540 sf 0.00% Impervious Runoff Depth>0.43"
Flow Length=310' Tc=9.7 min CN=48 Runoff=0.55 cfs 4,334 cf

Pond 1P: SUM POND Inflow=0.55 cfs 4,334 cf
Primary=0.55 cfs 4,334 cf

Total Runoff Area = 120,540 sf Runoff Volume = 4,334 cf Average Runoff Depth = 0.43"
100.00% Pervious = 120,540 sf 0.00% Impervious = 0 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E1: EXISTING Runoff Area=120,540 sf 0.00% Impervious Runoff Depth>1.15"
Flow Length=310' Tc=9.7 min CN=48 Runoff=2.49 cfs 11,530 cf

Pond 1P: SUM POND Inflow=2.49 cfs 11,530 cf
Primary=2.49 cfs 11,530 cf

Total Runoff Area = 120,540 sf Runoff Volume = 11,530 cf Average Runoff Depth = 1.15"
100.00% Pervious = 120,540 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E1: EXISTING UNDEVELOPED SITE

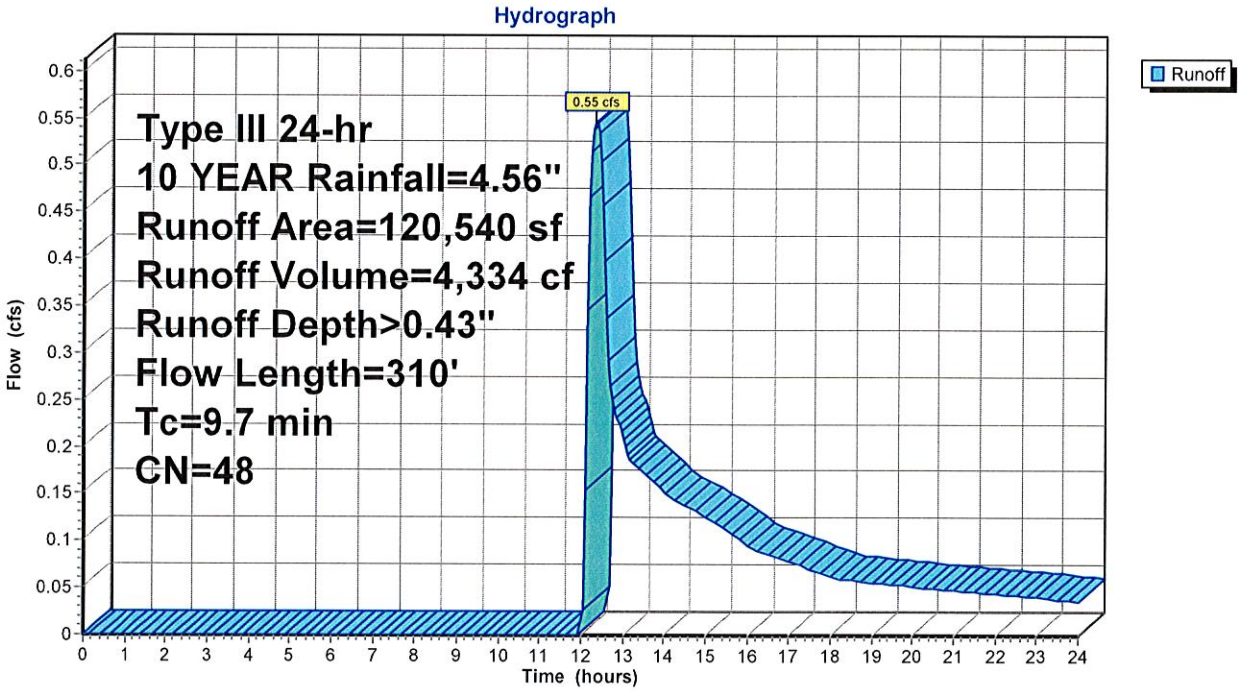
Runoff = 0.55 cfs @ 12.34 hrs, Volume= 4,334 cf, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
120,540	48	Brush, Good, HSG B
120,540		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	60	0.1333	0.20		**Sheet Flow, flow through grass** Grass: Dense n= 0.240 P2= 2.50"
4.7	250	0.0160	0.89		**Shallow Concentrated Flow, flow through grass** Short Grass Pasture Kv= 7.0 fps
9.7	310	Total			

Subcatchment E1: EXISTING UNDEVELOPED SITE



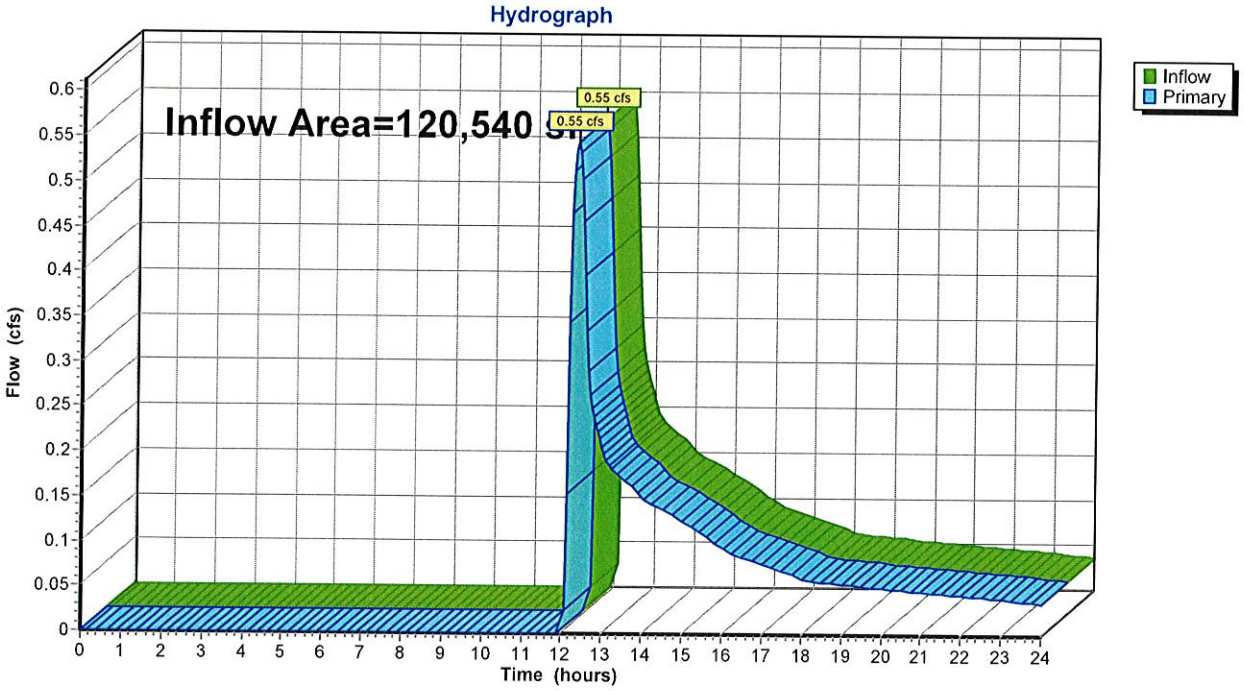
Summary for Pond 1P: SUM POND

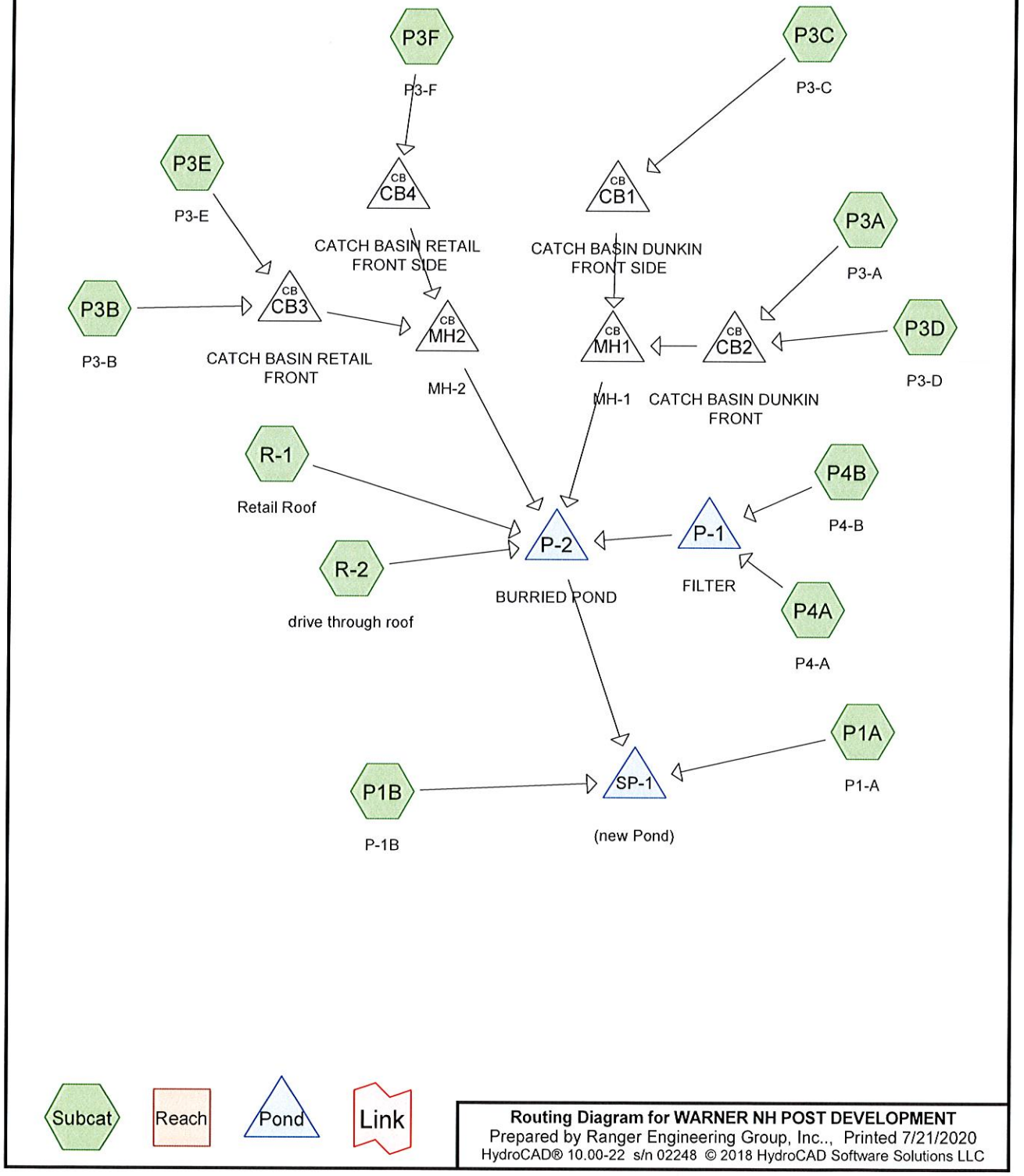
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 120,540 sf, 0.00% Impervious, Inflow Depth > 0.43" for 10 YEAR event
Inflow = 0.55 cfs @ 12.34 hrs, Volume= 4,334 cf
Primary = 0.55 cfs @ 12.34 hrs, Volume= 4,334 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Pond 1P: SUM POND





Routing Diagram for WARNER NH POST DEVELOPMENT
Prepared by Ranger Engineering Group, Inc.., Printed 7/21/2020
HydroCAD® 10.00-22 s/n 02248 © 2018 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
6,408	61	>75% Grass cover, Good, HSG B (P3C, P3D, P3E, P3F, P4A, P4B)
49,819	48	Brush, Good, HSG B (P1A, P1B)
36,601	98	Paved parking, HSG B (P3C, P3D, P3F, P4A, P4B)
14,291	98	Paved roads w/curbs & sewers, HSG B (P3A, P3B, P3E)
9,075	98	Roofs, HSG B (R-1, R-2)
833	98	SIDEWALK (P3E)
2,174	98	Sidewalk, HSG B (P3C, P3D, P3F, P4B)
1,339	98	Water Surface, HSG B (P4B)
120,540	**75**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
119,707	HSG B	P1A, P1B, P3A, P3B, P3C, P3D, P3E, P3F, P4A, P4B, R-1, R-2
0	HSG C	
0	HSG D	
833	Other	P3E
120,540		**TOTAL AREA**

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	P1B	0.00	0.00	70.0	0.0100	0.013	18.0	0.0	0.0
2	CB1	424.83	423.38	113.0	0.0128	0.013	12.0	0.0	0.0
3	CB2	422.50	422.25	10.0	0.0250	0.013	12.0	0.0	0.0
4	CB3	422.50	422.25	10.0	0.0250	0.013	12.0	0.0	0.0
5	CB4	423.55	422.25	130.0	0.0100	0.013	12.0	0.0	0.0
6	MH1	422.25	421.75	10.0	0.0500	0.013	15.0	0.0	0.0
7	MH2	422.00	421.75	10.0	0.0250	0.013	12.0	0.0	0.0
8	P-1	423.00	422.50	20.0	0.0250	0.013	12.0	0.0	0.0
9	P-2	421.00	418.00	103.0	0.0291	0.013	15.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P1A: P1-A Runoff Area=13,322 sf 0.00% Impervious Runoff Depth>0.00"
Flow Length=150' Tc=9.9 min CN=48 Runoff=0.00 cfs 5 cf

Subcatchment P1B: P-1B Runoff Area=36,497 sf 0.00% Impervious Runoff Depth>0.00"
Flow Length=600' Tc=20.0 min CN=48 Runoff=0.00 cfs 14 cf

Subcatchment P3A: P3-A Runoff Area=3,863 sf 100.00% Impervious Runoff Depth>2.17"
Tc=6.0 min CN=98 Runoff=0.20 cfs 699 cf

Subcatchment P3B: P3-B Runoff Area=2,262 sf 100.00% Impervious Runoff Depth>2.17"
Tc=6.0 min CN=98 Runoff=0.12 cfs 409 cf

Subcatchment P3C: P3-C Runoff Area=7,302 sf 98.00% Impervious Runoff Depth>2.06"
Tc=6.0 min CN=97 Runoff=0.37 cfs 1,256 cf

Subcatchment P3D: P3-D Runoff Area=7,218 sf 81.71% Impervious Runoff Depth>1.52"
Tc=6.0 min CN=91 Runoff=0.29 cfs 913 cf

Subcatchment P3E: P3-E Runoff Area=9,512 sf 94.61% Impervious Runoff Depth>1.96"
Tc=6.0 min CN=96 Runoff=0.47 cfs 1,555 cf

Subcatchment P3F: P3-F Runoff Area=6,087 sf 91.47% Impervious Runoff Depth>1.87"
Tc=6.0 min CN=95 Runoff=0.29 cfs 946 cf

Subcatchment P4A: P4-A Runoff Area=11,475 sf 91.75% Impervious Runoff Depth>1.87"
Tc=6.0 min CN=95 Runoff=0.54 cfs 1,784 cf

Subcatchment P4B: P4-B Runoff Area=13,927 sf 78.72% Impervious Runoff Depth>1.44"
Tc=6.0 min CN=90 Runoff=0.53 cfs 1,672 cf

Subcatchment R-1: Retail Roof Runoff Area=7,200 sf 100.00% Impervious Runoff Depth>2.17"
Tc=6.0 min CN=98 Runoff=0.37 cfs 1,302 cf

Subcatchment R-2: drive through roof Runoff Area=1,875 sf 100.00% Impervious Runoff Depth>2.17"
Tc=6.0 min CN=98 Runoff=0.10 cfs 339 cf

Pond CB1: CATCH BASIN DUNKIN FRONT SIDE Peak Elev=425.13' Inflow=0.37 cfs 1,256 cf
12.0" Round Culvert n=0.013 L=113.0' S=0.0128 '/' Outflow=0.37 cfs 1,256 cf

Pond CB2: CATCH BASIN DUNKIN FRONT Peak Elev=422.88' Inflow=0.49 cfs 1,612 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=0.49 cfs 1,612 cf

Pond CB3: CATCH BASIN RETAIL FRONT Peak Elev=422.88' Inflow=0.58 cfs 1,964 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=0.58 cfs 1,964 cf

Pond CB4: CATCH BASIN RETAIL FRONT SIDE Peak Elev=423.81' Inflow=0.29 cfs 946 cf
12.0" Round Culvert n=0.013 L=130.0' S=0.0100 '/' Outflow=0.29 cfs 946 cf

Pond MH1: MH-1 Peak Elev=422.69' Inflow=0.86 cfs 2,868 cf
15.0" Round Culvert n=0.013 L=10.0' S=0.0500 '/' Outflow=0.86 cfs 2,868 cf

Pond MH2: MH-2 Peak Elev=422.48' Inflow=0.87 cfs 2,911 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=0.87 cfs 2,911 cf

Pond P-1: FILTER Peak Elev=426.56' Storage=1,396 cf Inflow=1.07 cfs 3,456 cf
Outflow=0.42 cfs 2,472 cf

Pond P-2: BURRIED POND Peak Elev=422.39' Storage=5,690 cf Inflow=2.22 cfs 9,891 cf
Discarded=0.07 cfs 4,528 cf Primary=0.00 cfs 0 cf Outflow=0.07 cfs 4,528 cf

Pond SP-1: (new Pond) Inflow=0.00 cfs 20 cf
Primary=0.00 cfs 20 cf

Total Runoff Area = 120,540 sf Runoff Volume = 10,895 cf Average Runoff Depth = 1.08"
46.65% Pervious = 56,227 sf 53.35% Impervious = 64,313 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P1A: P1-A Runoff Area=13,322 sf 0.00% Impervious Runoff Depth>0.05"
Flow Length=150' Tc=9.9 min CN=48 Runoff=0.00 cfs 57 cf

Subcatchment P1B: P-1B Runoff Area=36,497 sf 0.00% Impervious Runoff Depth>0.05"
Flow Length=600' Tc=20.0 min CN=48 Runoff=0.01 cfs 154 cf

Subcatchment P3A: P3-A Runoff Area=3,863 sf 100.00% Impervious Runoff Depth>2.71"
Tc=6.0 min CN=98 Runoff=0.25 cfs 871 cf

Subcatchment P3B: P3-B Runoff Area=2,262 sf 100.00% Impervious Runoff Depth>2.71"
Tc=6.0 min CN=98 Runoff=0.14 cfs 510 cf

Subcatchment P3C: P3-C Runoff Area=7,302 sf 98.00% Impervious Runoff Depth>2.60"
Tc=6.0 min CN=97 Runoff=0.46 cfs 1,580 cf

Subcatchment P3D: P3-D Runoff Area=7,218 sf 81.71% Impervious Runoff Depth>2.01"
Tc=6.0 min CN=91 Runoff=0.38 cfs 1,211 cf

Subcatchment P3E: P3-E Runoff Area=9,512 sf 94.61% Impervious Runoff Depth>2.49"
Tc=6.0 min CN=96 Runoff=0.58 cfs 1,975 cf

Subcatchment P3F: P3-F Runoff Area=6,087 sf 91.47% Impervious Runoff Depth>2.39"
Tc=6.0 min CN=95 Runoff=0.36 cfs 1,212 cf

Subcatchment P4A: P4-A Runoff Area=11,475 sf 91.75% Impervious Runoff Depth>2.39"
Tc=6.0 min CN=95 Runoff=0.69 cfs 2,285 cf

Subcatchment P4B: P4-B Runoff Area=13,927 sf 78.72% Impervious Runoff Depth>1.93"
Tc=6.0 min CN=90 Runoff=0.70 cfs 2,237 cf

Subcatchment R-1: Retail Roof Runoff Area=7,200 sf 100.00% Impervious Runoff Depth>2.71"
Tc=6.0 min CN=98 Runoff=0.46 cfs 1,624 cf

Subcatchment R-2: drive through roof Runoff Area=1,875 sf 100.00% Impervious Runoff Depth>2.71"
Tc=6.0 min CN=98 Runoff=0.12 cfs 423 cf

Pond CB1: CATCH BASIN DUNKIN FRONT SIDE Peak Elev=425.17' Inflow=0.46 cfs 1,580 cf
12.0" Round Culvert n=0.013 L=113.0' S=0.0128 '/' Outflow=0.46 cfs 1,580 cf

Pond CB2: CATCH BASIN DUNKIN FRONT Peak Elev=422.95' Inflow=0.62 cfs 2,083 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=0.62 cfs 2,083 cf

Pond CB3: CATCH BASIN RETAIL FRONT Peak Elev=422.93' Inflow=0.73 cfs 2,485 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=0.73 cfs 2,485 cf

Pond CB4: CATCH BASIN RETAIL FRONT SIDE Peak Elev=423.85' Inflow=0.36 cfs 1,212 cf
12.0" Round Culvert n=0.013 L=130.0' S=0.0100 '/' Outflow=0.36 cfs 1,212 cf

Pond MH1: MH-1 Peak Elev=422.91' Inflow=1.08 cfs 3,663 cf
15.0" Round Culvert n=0.013 L=10.0' S=0.0500 '/' Outflow=1.08 cfs 3,663 cf

Pond MH2: MH-2 Peak Elev=422.91' Inflow=1.09 cfs 3,697 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=1.09 cfs 3,695 cf

Pond P-1: FILTER Peak Elev=426.62' Storage=1,482 cf Inflow=1.39 cfs 4,522 cf
Outflow=1.15 cfs 3,441 cf

Pond P-2: BURRIED POND Peak Elev=422.91' Storage=8,273 cf Inflow=3.26 cfs 12,846 cf
Discarded=0.07 cfs 4,747 cf Primary=0.00 cfs 0 cf Outflow=0.07 cfs 4,747 cf

Pond SP-1: (new Pond) Inflow=0.01 cfs 211 cf
Primary=0.01 cfs 211 cf

Total Runoff Area = 120,540 sf Runoff Volume = 14,139 cf Average Runoff Depth = 1.41"
46.65% Pervious = 56,227 sf 53.35% Impervious = 64,313 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P1A: P1-A Runoff Area=13,322 sf 0.00% Impervious Runoff Depth>0.43"
Flow Length=150' Tc=9.9 min CN=48 Runoff=0.06 cfs 479 cf

Subcatchment P1B: P-1B Runoff Area=36,497 sf 0.00% Impervious Runoff Depth>0.43"
Flow Length=600' Tc=20.0 min CN=48 Runoff=0.15 cfs 1,306 cf

Subcatchment P3A: P3-A Runoff Area=3,863 sf 100.00% Impervious Runoff Depth>4.32"
Tc=6.0 min CN=98 Runoff=0.39 cfs 1,391 cf

Subcatchment P3B: P3-B Runoff Area=2,262 sf 100.00% Impervious Runoff Depth>4.32"
Tc=6.0 min CN=98 Runoff=0.23 cfs 815 cf

Subcatchment P3C: P3-C Runoff Area=7,302 sf 98.00% Impervious Runoff Depth>4.21"
Tc=6.0 min CN=97 Runoff=0.72 cfs 2,559 cf

Subcatchment P3D: P3-D Runoff Area=7,218 sf 81.71% Impervious Runoff Depth>3.55"
Tc=6.0 min CN=91 Runoff=0.65 cfs 2,137 cf

Subcatchment P3E: P3-E Runoff Area=9,512 sf 94.61% Impervious Runoff Depth>4.09"
Tc=6.0 min CN=96 Runoff=0.93 cfs 3,244 cf

Subcatchment P3F: P3-F Runoff Area=6,087 sf 91.47% Impervious Runoff Depth>3.98"
Tc=6.0 min CN=95 Runoff=0.59 cfs 2,020 cf

Subcatchment P4A: P4-A Runoff Area=11,475 sf 91.75% Impervious Runoff Depth>3.98"
Tc=6.0 min CN=95 Runoff=1.11 cfs 3,807 cf

Subcatchment P4B: P4-B Runoff Area=13,927 sf 78.72% Impervious Runoff Depth>3.45"
Tc=6.0 min CN=90 Runoff=1.23 cfs 4,005 cf

Subcatchment R-1: Retail Roof Runoff Area=7,200 sf 100.00% Impervious Runoff Depth>4.32"
Tc=6.0 min CN=98 Runoff=0.72 cfs 2,593 cf

Subcatchment R-2: drive through roof Runoff Area=1,875 sf 100.00% Impervious Runoff Depth>4.32"
Tc=6.0 min CN=98 Runoff=0.19 cfs 675 cf

Pond CB1: CATCH BASIN DUNKIN FRONT SIDE Peak Elev=425.26' Inflow=0.72 cfs 2,559 cf
12.0" Round Culvert n=0.013 L=113.0' S=0.0128 '/' Outflow=0.72 cfs 2,559 cf

Pond CB2: CATCH BASIN DUNKIN FRONT Peak Elev=423.76' Inflow=1.04 cfs 3,528 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=1.04 cfs 3,528 cf

Pond CB3: CATCH BASIN RETAIL FRONT Peak Elev=423.76' Inflow=1.16 cfs 4,059 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=1.16 cfs 4,059 cf

Pond CB4: CATCH BASIN RETAIL FRONT SIDE Peak Elev=423.94' Inflow=0.59 cfs 2,020 cf
12.0" Round Culvert n=0.013 L=130.0' S=0.0100 '/' Outflow=0.59 cfs 2,020 cf

Pond MH1: MH-1 Peak Elev=423.76' Inflow=1.76 cfs 6,087 cf
15.0" Round Culvert n=0.013 L=10.0' S=0.0500 '/' Outflow=1.76 cfs 6,086 cf

Pond MH2: MH-2 Peak Elev=423.76' Inflow=1.75 cfs 6,078 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=1.75 cfs 6,078 cf

Pond P-1: FILTER Peak Elev=426.69' Storage=1,582 cf Inflow=2.34 cfs 7,812 cf
Outflow=2.26 cfs 6,544 cf

Pond P-2: BURRIED POND Peak Elev=423.75' Storage=12,419 cf Inflow=6.63 cfs 21,976 cf
Discarded=0.07 cfs 5,253 cf Primary=0.32 cfs 7,540 cf Outflow=0.40 cfs 12,794 cf

Pond SP-1: (new Pond) Inflow=0.45 cfs 9,325 cf
Primary=0.45 cfs 9,325 cf

Total Runoff Area = 120,540 sf Runoff Volume = 25,031 cf Average Runoff Depth = 2.49"
46.65% Pervious = 56,227 sf 53.35% Impervious = 64,313 sf

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment P1A: P1-A Runoff Area=13,322 sf 0.00% Impervious Runoff Depth>1.15"
Flow Length=150' Tc=9.9 min CN=48 Runoff=0.27 cfs 1,274 cf

Subcatchment P1B: P-1B Runoff Area=36,497 sf 0.00% Impervious Runoff Depth>1.14"
Flow Length=600' Tc=20.0 min CN=48 Runoff=0.58 cfs 3,478 cf

Subcatchment P3A: P3-A Runoff Area=3,863 sf 100.00% Impervious Runoff Depth>6.08"
Tc=6.0 min CN=98 Runoff=0.54 cfs 1,957 cf

Subcatchment P3B: P3-B Runoff Area=2,262 sf 100.00% Impervious Runoff Depth>6.08"
Tc=6.0 min CN=98 Runoff=0.31 cfs 1,146 cf

Subcatchment P3C: P3-C Runoff Area=7,302 sf 98.00% Impervious Runoff Depth>5.96"
Tc=6.0 min CN=97 Runoff=1.01 cfs 3,627 cf

Subcatchment P3D: P3-D Runoff Area=7,218 sf 81.71% Impervious Runoff Depth>5.27"
Tc=6.0 min CN=91 Runoff=0.94 cfs 3,168 cf

Subcatchment P3E: P3-E Runoff Area=9,512 sf 94.61% Impervious Runoff Depth>5.84"
Tc=6.0 min CN=96 Runoff=1.31 cfs 4,631 cf

Subcatchment P3F: P3-F Runoff Area=6,087 sf 91.47% Impervious Runoff Depth>5.73"
Tc=6.0 min CN=95 Runoff=0.83 cfs 2,904 cf

Subcatchment P4A: P4-A Runoff Area=11,475 sf 91.75% Impervious Runoff Depth>5.73"
Tc=6.0 min CN=95 Runoff=1.56 cfs 5,475 cf

Subcatchment P4B: P4-B Runoff Area=13,927 sf 78.72% Impervious Runoff Depth>5.15"
Tc=6.0 min CN=90 Runoff=1.79 cfs 5,982 cf

Subcatchment R-1: Retail Roof Runoff Area=7,200 sf 100.00% Impervious Runoff Depth>6.08"
Tc=6.0 min CN=98 Runoff=1.00 cfs 3,647 cf

Subcatchment R-2: drive through roof Runoff Area=1,875 sf 100.00% Impervious Runoff Depth>6.08"
Tc=6.0 min CN=98 Runoff=0.26 cfs 950 cf

Pond CB1: CATCH BASIN DUNKIN FRONT SIDE Peak Elev=425.35' Inflow=1.01 cfs 3,627 cf
12.0" Round Culvert n=0.013 L=113.0' S=0.0128 '/' Outflow=1.01 cfs 3,627 cf

Pond CB2: CATCH BASIN DUNKIN FRONT Peak Elev=424.56' Inflow=1.48 cfs 5,125 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=1.48 cfs 5,124 cf

Pond CB3: CATCH BASIN RETAIL FRONT Peak Elev=424.57' Inflow=1.62 cfs 5,777 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=1.62 cfs 5,777 cf

Pond CB4: CATCH BASIN RETAIL FRONT SIDE Peak Elev=424.57' Inflow=0.83 cfs 2,904 cf
12.0" Round Culvert n=0.013 L=130.0' S=0.0100 '/' Outflow=0.83 cfs 2,904 cf

Pond MH1: MH-1 Peak Elev=424.56' Inflow=2.49 cfs 8,751 cf
15.0" Round Culvert n=0.013 L=10.0' S=0.0500 '/' Outflow=2.49 cfs 8,747 cf

Pond MH2: MH-2 Peak Elev=424.57' Inflow=2.45 cfs 8,681 cf
12.0" Round Culvert n=0.013 L=10.0' S=0.0250 '/' Outflow=2.45 cfs 8,681 cf

Pond P-1: FILTER Peak Elev=426.75' Storage=1,661 cf Inflow=3.36 cfs 11,457 cf
Outflow=3.27 cfs 10,143 cf

Pond P-2: BURRIED POND Peak Elev=424.56' Storage=16,350 cf Inflow=9.42 cfs 32,167 cf
Discarded=0.07 cfs 5,620 cf Primary=1.65 cfs 17,091 cf Outflow=1.73 cfs 22,711 cf

Pond SP-1: (new Pond) Inflow=2.32 cfs 21,844 cf
Primary=2.32 cfs 21,844 cf

Total Runoff Area = 120,540 sf Runoff Volume = 38,239 cf Average Runoff Depth = 3.81"
46.65% Pervious = 56,227 sf 53.35% Impervious = 64,313 sf

Summary for Subcatchment P1A: P1-A

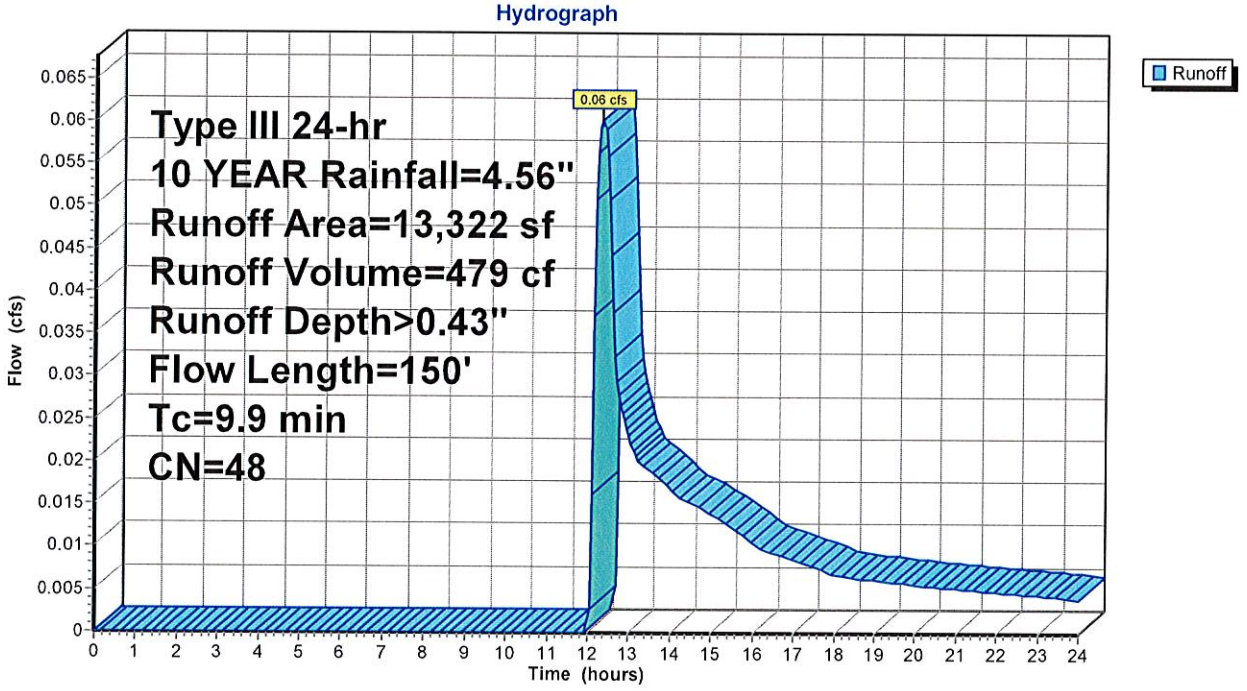
Runoff = 0.06 cfs @ 12.35 hrs, Volume= 479 cf, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
13,322	48	Brush, Good, HSG B
13,322		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0600	0.17		**Sheet Flow, flow through grass** Grass: Dense n= 0.240 P2= 2.94"
0.3	50	0.1200	2.42		**Shallow Concentrated Flow, flow through grass** Short Grass Pasture Kv= 7.0 fps
9.9	150	Total			

Subcatchment P1A: P1-A



Summary for Subcatchment P1B: P-1B

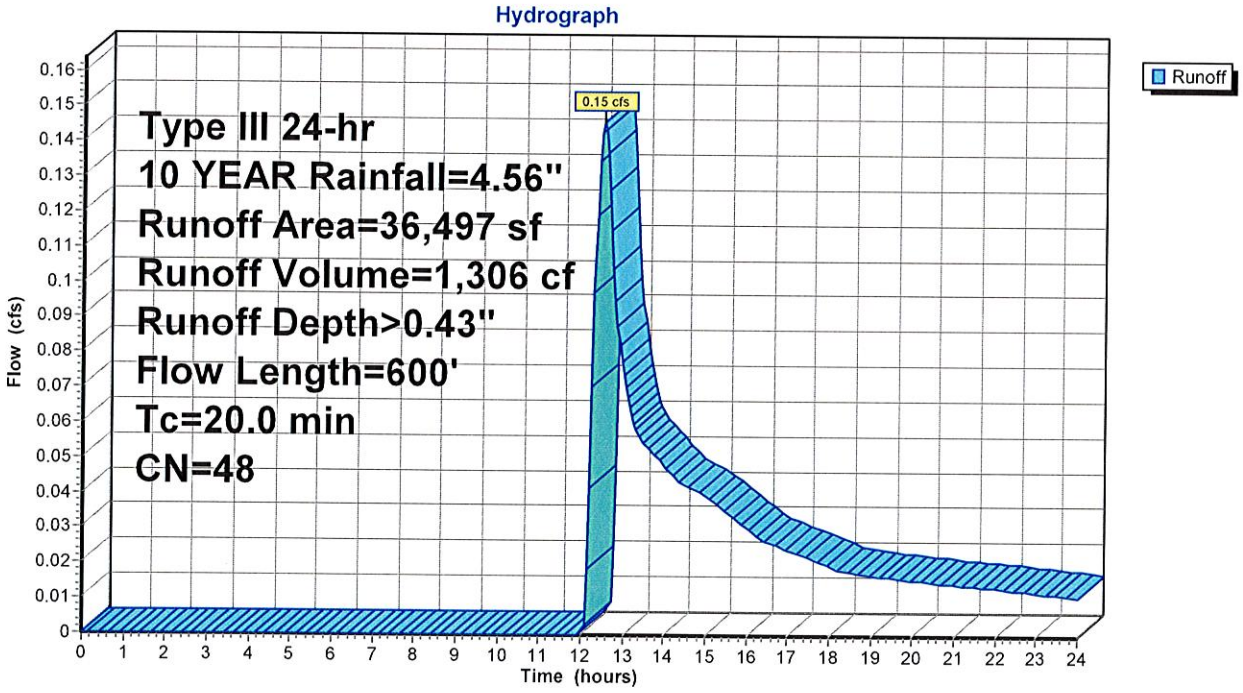
Runoff = 0.15 cfs @ 12.50 hrs, Volume= 1,306 cf, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
36,497	48	Brush, Good, HSG B
36,497		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.6	100	0.0600	0.17		**Sheet Flow, flow over grass** Grass: Dense n= 0.240 P2= 2.94"
0.2	70	0.0100	5.94	10.50	**Pipe Channel, flow through culvert** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
10.2	430	0.0100	0.70		**Shallow Concentrated Flow, flow over grass** Short Grass Pasture Kv= 7.0 fps
20.0	600	Total			

Subcatchment P1B: P-1B



Summary for Subcatchment P3A: P3-A

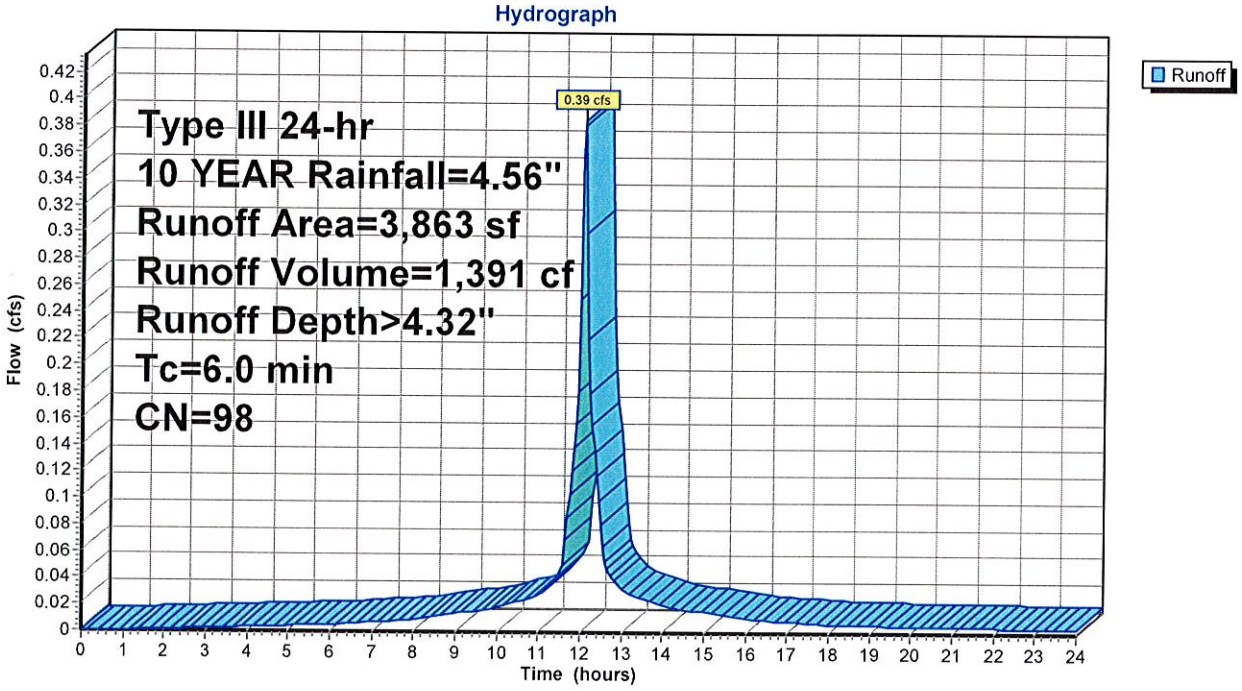
Runoff = 0.39 cfs @ 12.09 hrs, Volume= 1,391 cf, Depth> 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
3,863	98	Paved roads w/curbs & sewers, HSG B
3,863		100.00% Impervious Area

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

Subcatchment P3A: P3-A



Summary for Subcatchment P3B: P3-B

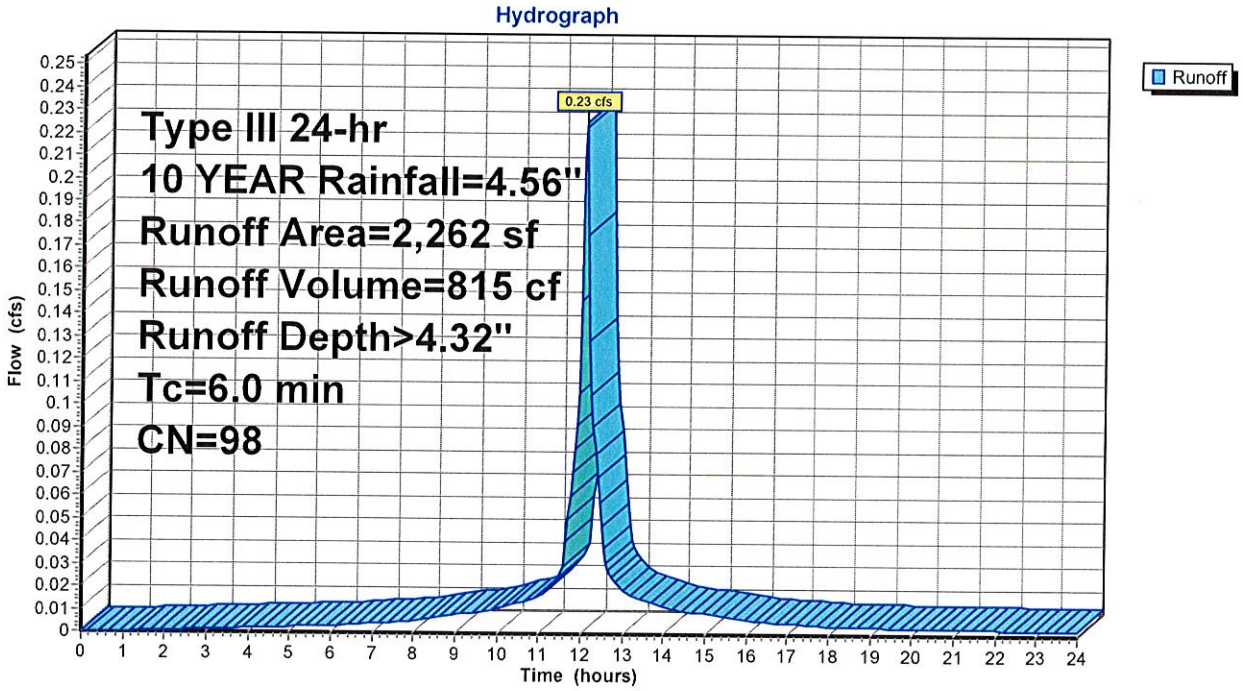
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 815 cf, Depth> 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
2,262	98	Paved roads w/curbs & sewers, HSG B
2,262		100.00% Impervious Area

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

Subcatchment P3B: P3-B



Summary for Subcatchment P3C: P3-C

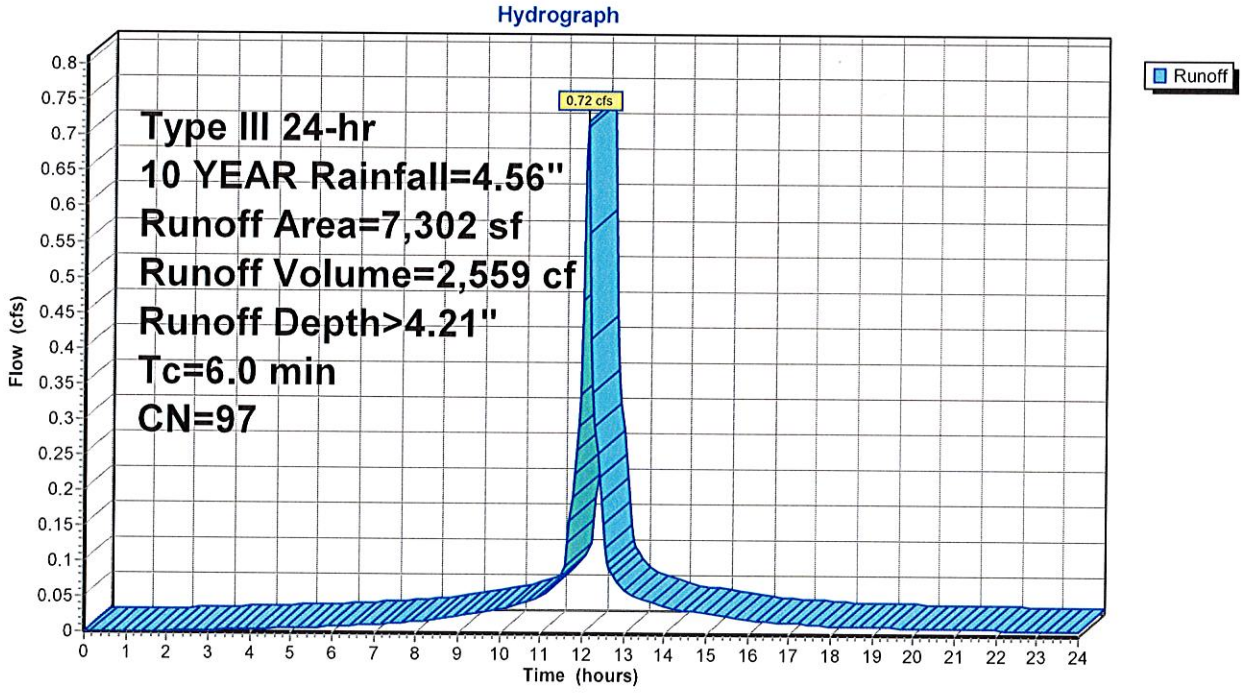
Runoff = 0.72 cfs @ 12.09 hrs, Volume= 2,559 cf, Depth> 4.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

	Area (sf)	CN	Description
	6,756	98	Paved parking, HSG B
*	400	98	Sidewalk, HSG B
	146	61	>75% Grass cover, Good, HSG B
	7,302	97	Weighted Average
	146		2.00% Pervious Area
	7,156		98.00% Impervious Area

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

Subcatchment P3C: P3-C



Summary for Subcatchment P3D: P3-D

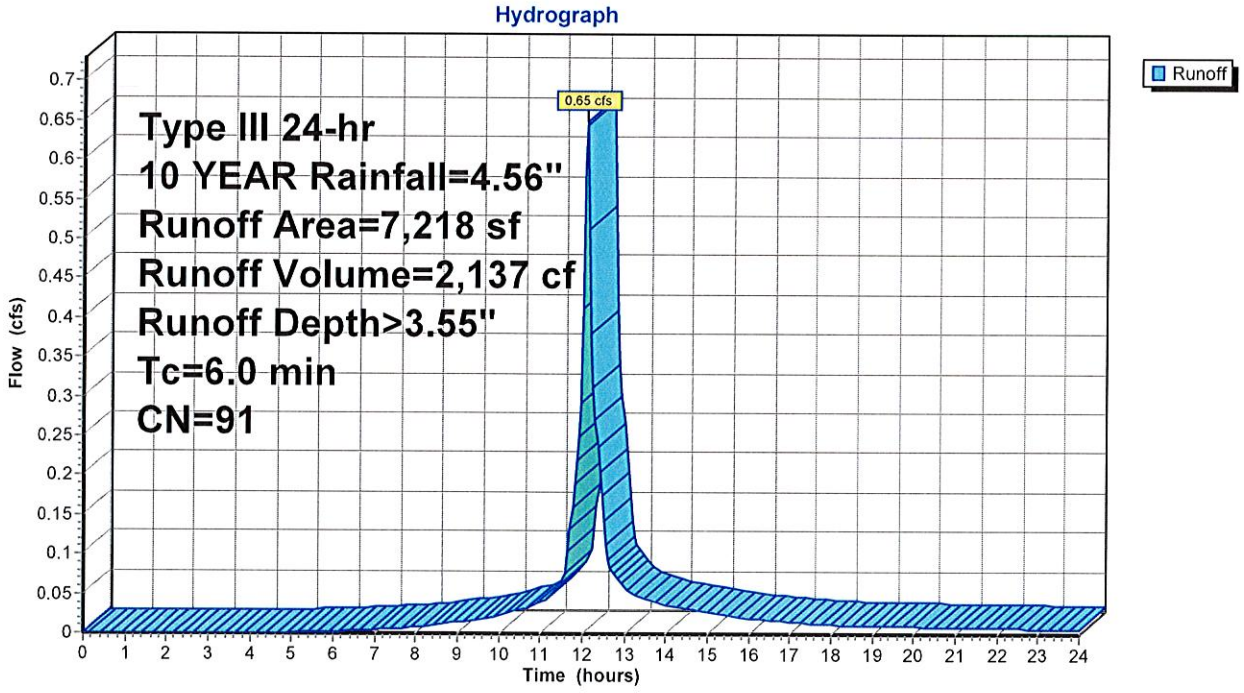
Runoff = 0.65 cfs @ 12.09 hrs, Volume= 2,137 cf, Depth> 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

	Area (sf)	CN	Description
	5,270	98	Paved parking, HSG B
*	628	98	Sidewalk, HSG B
	1,320	61	>75% Grass cover, Good, HSG B
	7,218	91	Weighted Average
	1,320		18.29% Pervious Area
	5,898		81.71% Impervious Area

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

Subcatchment P3D: P3-D



Summary for Subcatchment P3E: P3-E

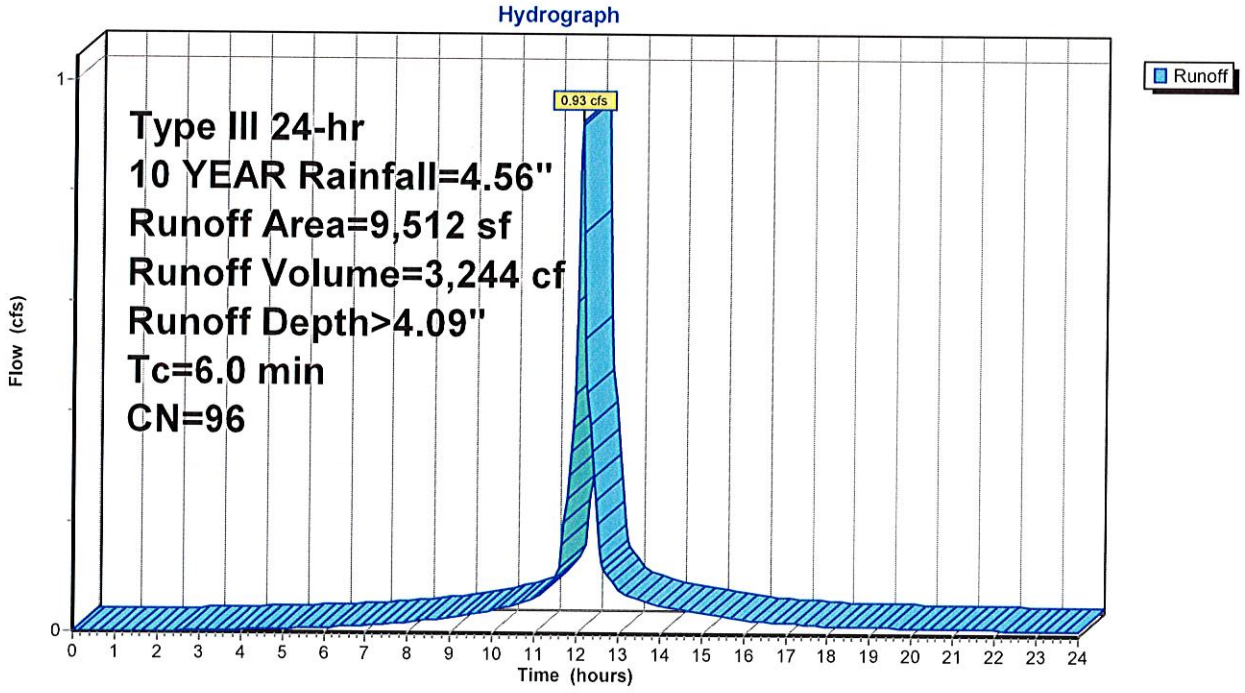
Runoff = 0.93 cfs @ 12.09 hrs, Volume= 3,244 cf, Depth> 4.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

	Area (sf)	CN	Description
	8,166	98	Paved roads w/curbs & sewers, HSG B
*	833	98	SIDEWALK
	513	61	>75% Grass cover, Good, HSG B
	9,512	96	Weighted Average
	513		5.39% Pervious Area
	8,999		94.61% Impervious Area

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

Subcatchment P3E: P3-E



Summary for Subcatchment P3F: P3-F

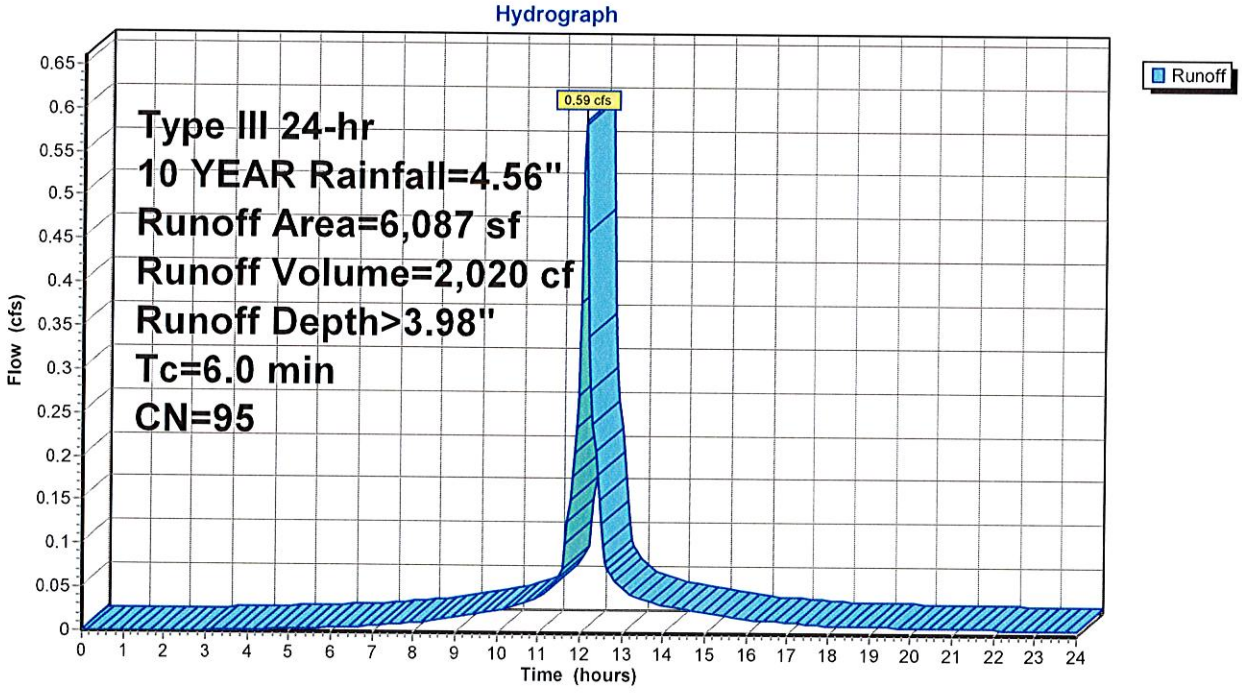
Runoff = 0.59 cfs @ 12.09 hrs, Volume= 2,020 cf, Depth> 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

	Area (sf)	CN	Description
	5,196	98	Paved parking, HSG B
*	372	98	Sidewalk, HSG B
	519	61	>75% Grass cover, Good, HSG B
	6,087	95	Weighted Average
	519		8.53% Pervious Area
	5,568		91.47% Impervious Area

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

Subcatchment P3F: P3-F



Summary for Subcatchment P4A: P4-A

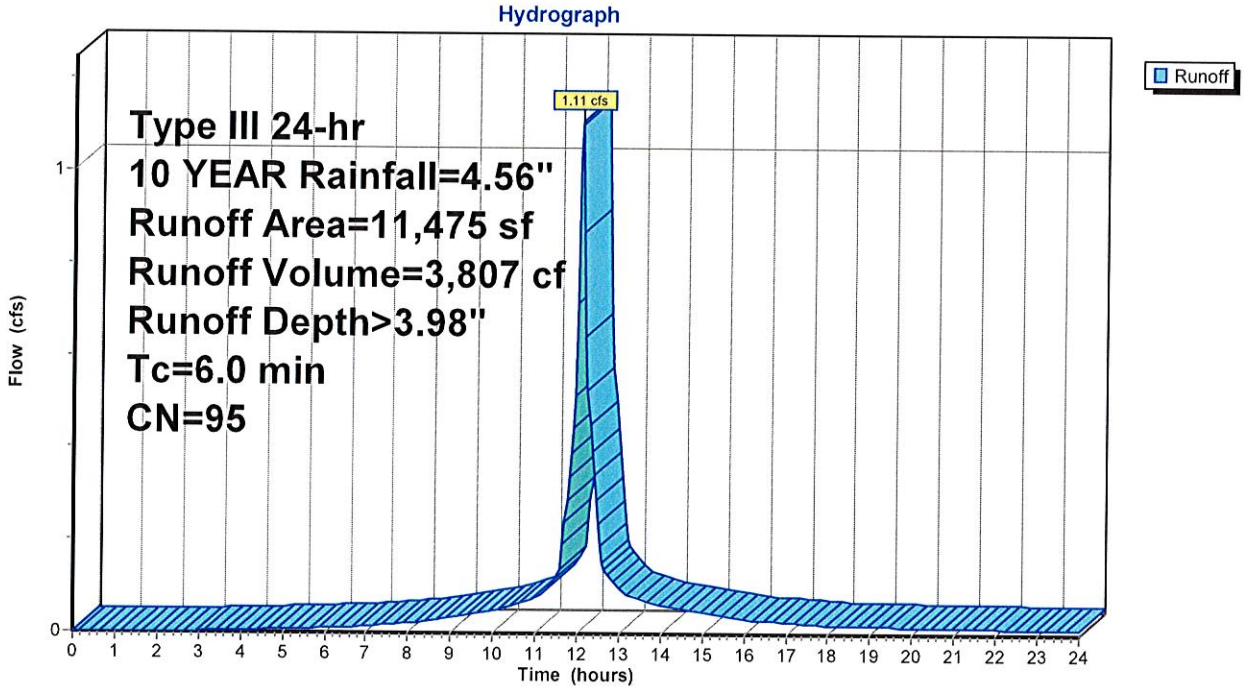
Runoff = 1.11 cfs @ 12.09 hrs, Volume= 3,807 cf, Depth> 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
10,528	98	Paved parking, HSG B
947	61	>75% Grass cover, Good, HSG B
11,475	95	Weighted Average
947		8.25% Pervious Area
10,528		91.75% Impervious Area

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

Subcatchment P4A: P4-A



Summary for Subcatchment P4B: P4-B

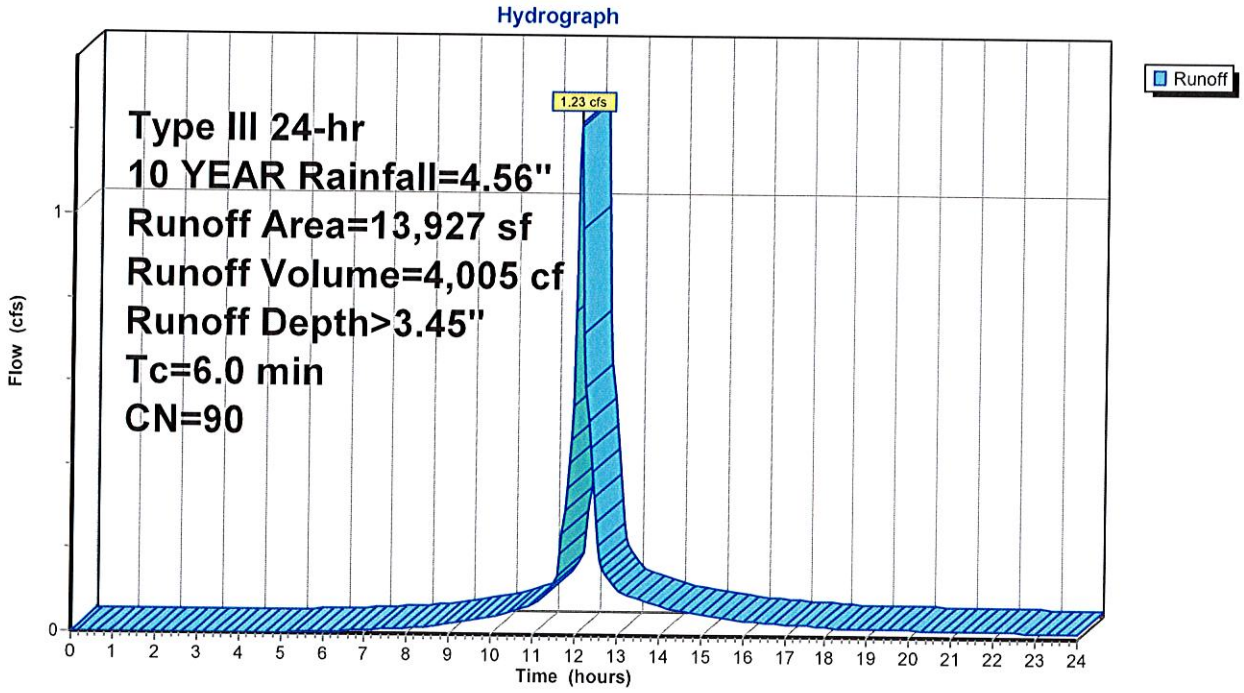
Runoff = 1.23 cfs @ 12.09 hrs, Volume= 4,005 cf, Depth> 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

	Area (sf)	CN	Description
	8,851	98	Paved parking, HSG B
*	774	98	Sidewalk, HSG B
	2,963	61	>75% Grass cover, Good, HSG B
	1,339	98	Water Surface, HSG B
	13,927	90	Weighted Average
	2,963		21.28% Pervious Area
	10,964		78.72% Impervious Area

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

Subcatchment P4B: P4-B



Summary for Subcatchment R-1: Retail Roof

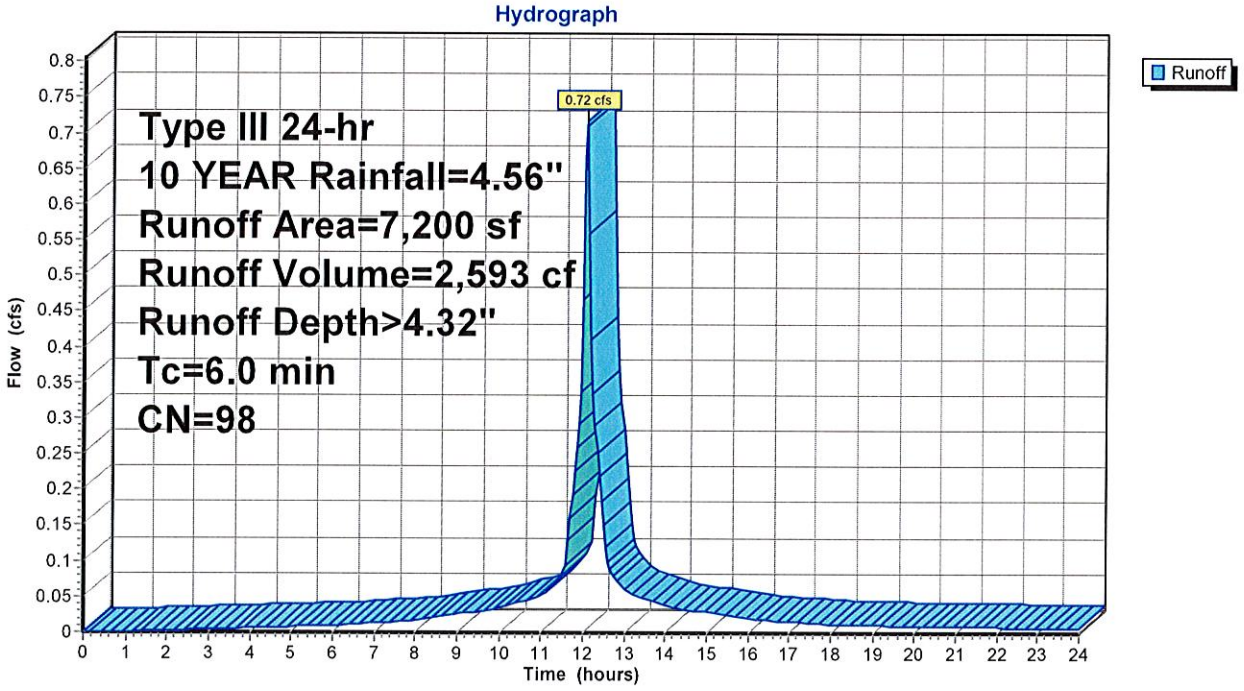
Runoff = 0.72 cfs @ 12.09 hrs, Volume= 2,593 cf, Depth> 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
7,200	98	Roofs, HSG B
7,200		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, flow from roof to storage**

Subcatchment R-1: Retail Roof



Summary for Subcatchment R-2: drive through roof

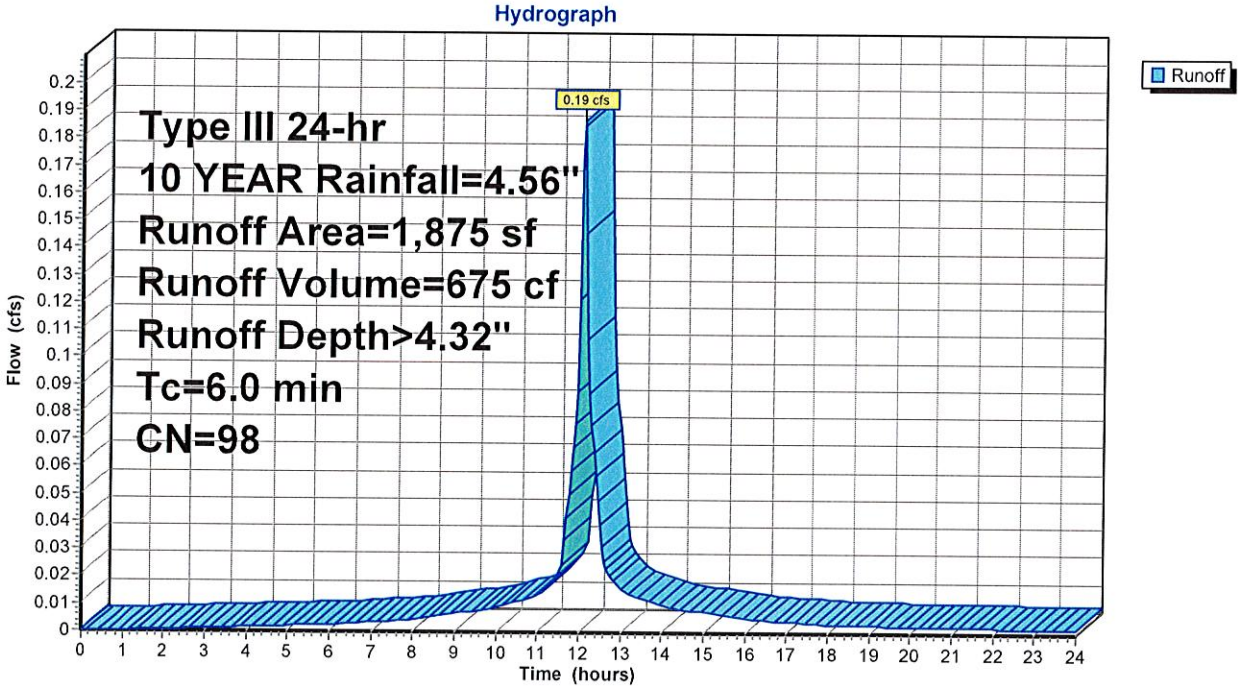
Runoff = 0.19 cfs @ 12.09 hrs, Volume= 675 cf, Depth> 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=4.56"

Area (sf)	CN	Description
1,875	98	Roofs, HSG B
1,875		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, flow from roof to underground storage**

Subcatchment R-2: drive through roof



Summary for Pond CB1: CATCH BASIN DUNKIN FRONT SIDE

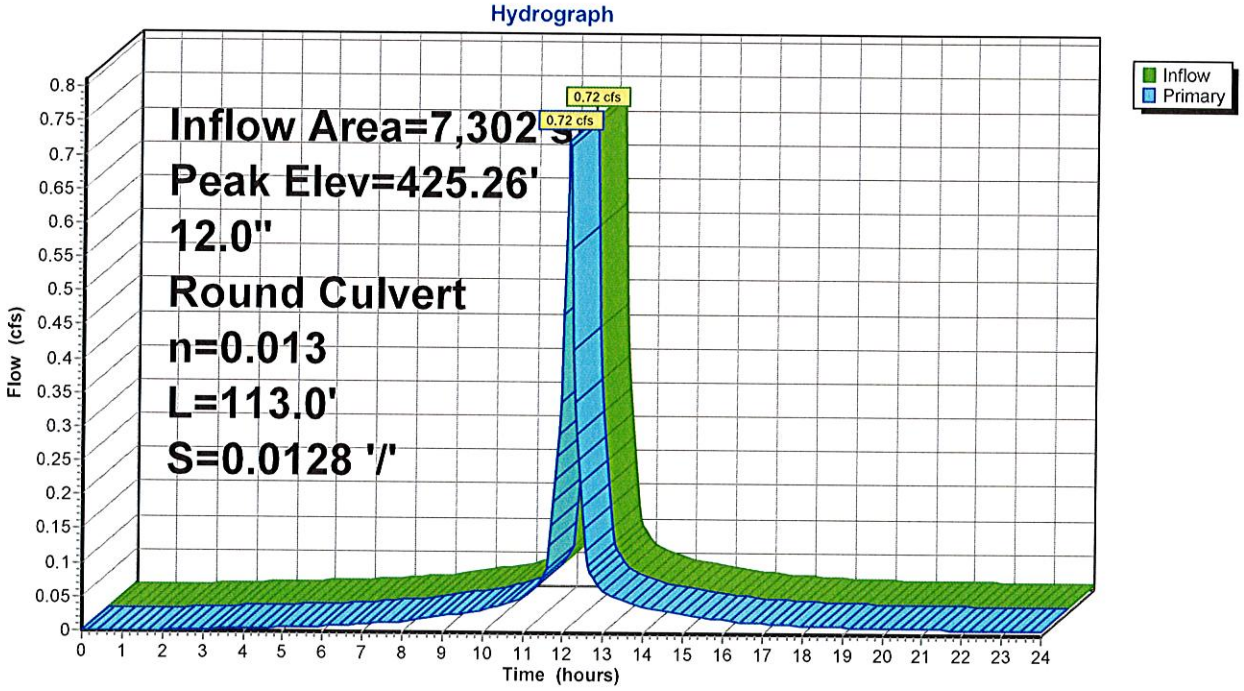
Inflow Area = 7,302 sf, 98.00% Impervious, Inflow Depth > 4.21" for 10 YEAR event
Inflow = 0.72 cfs @ 12.09 hrs, Volume= 2,559 cf
Outflow = 0.72 cfs @ 12.09 hrs, Volume= 2,559 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.72 cfs @ 12.09 hrs, Volume= 2,559 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 425.26' @ 12.09 hrs
Flood Elev= 427.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	424.83'	**12.0" Round Culvert** L= 113.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 424.83' / 423.38' S= 0.0128 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.70 cfs @ 12.09 hrs HW=425.25' TW=422.89' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.70 cfs @ 2.22 fps)

Pond CB1: CATCH BASIN DUNKIN FRONT SIDE



Summary for Pond CB2: CATCH BASIN DUNKIN FRONT

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=59)

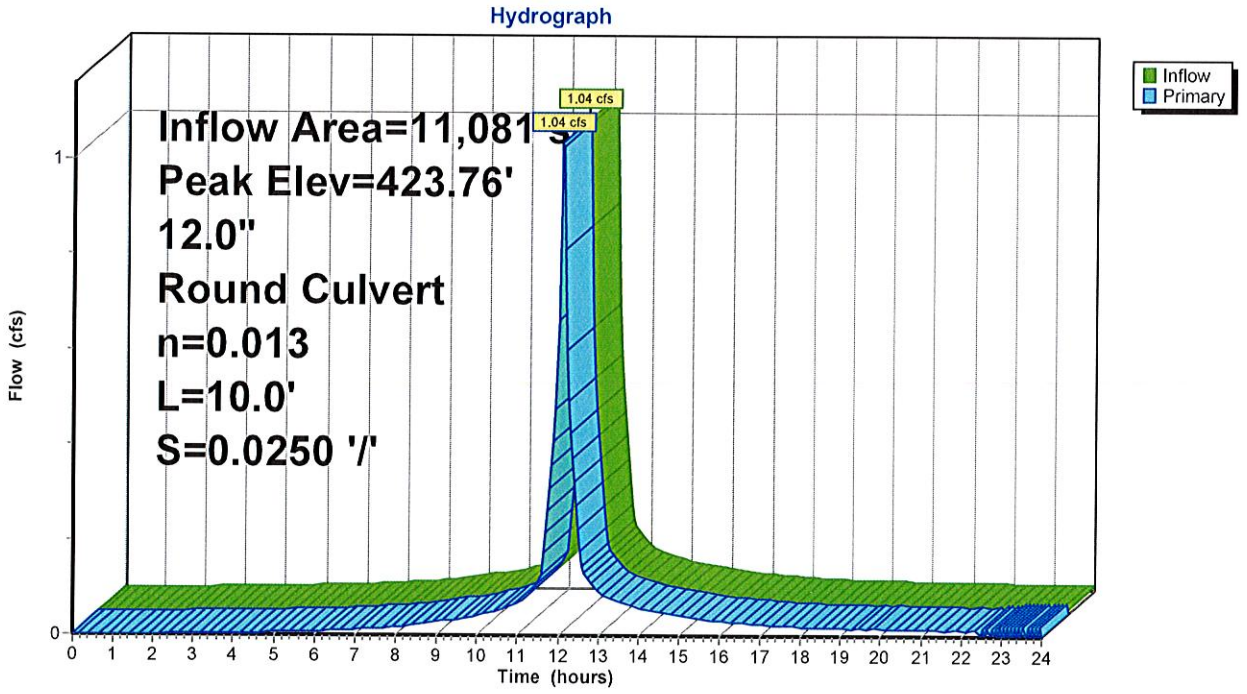
Inflow Area = 11,081 sf, 88.09% Impervious, Inflow Depth > 3.82" for 10 YEAR event
Inflow = 1.04 cfs @ 12.09 hrs, Volume= 3,528 cf
Outflow = 1.04 cfs @ 12.09 hrs, Volume= 3,528 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.04 cfs @ 12.09 hrs, Volume= 3,528 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 423.76' @ 13.98 hrs
Flood Elev= 427.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	422.50'	**12.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 422.50' / 422.25' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.92 cfs @ 12.09 hrs HW=423.10' TW=422.89' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.92 cfs @ 2.69 fps)

Pond CB2: CATCH BASIN DUNKIN FRONT



Summary for Pond CB3: CATCH BASIN RETAIL FRONT

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=48)

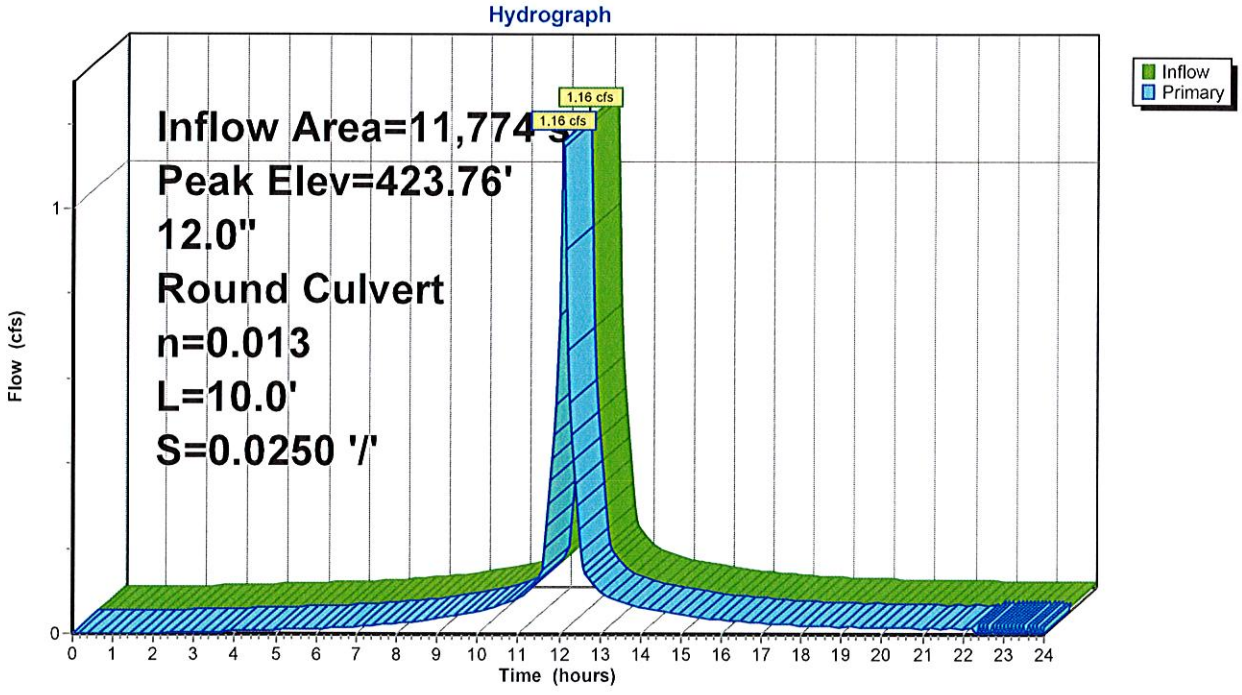
Inflow Area = 11,774 sf, 95.64% Impervious, Inflow Depth > 4.14" for 10 YEAR event
Inflow = 1.16 cfs @ 12.09 hrs, Volume= 4,059 cf
Outflow = 1.16 cfs @ 12.09 hrs, Volume= 4,059 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.16 cfs @ 12.09 hrs, Volume= 4,059 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 423.76' @ 13.98 hrs
Flood Elev= 427.60'

Device	Routing	Invert	Outlet Devices
#1	Primary	422.50'	**12.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 422.50' / 422.25' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.03 cfs @ 12.09 hrs HW=423.06' TW=422.75' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 1.03 cfs @ 3.28 fps)

Pond CB3: CATCH BASIN RETAIL FRONT



Summary for Pond CB4: CATCH BASIN RETAIL FRONT SIDE

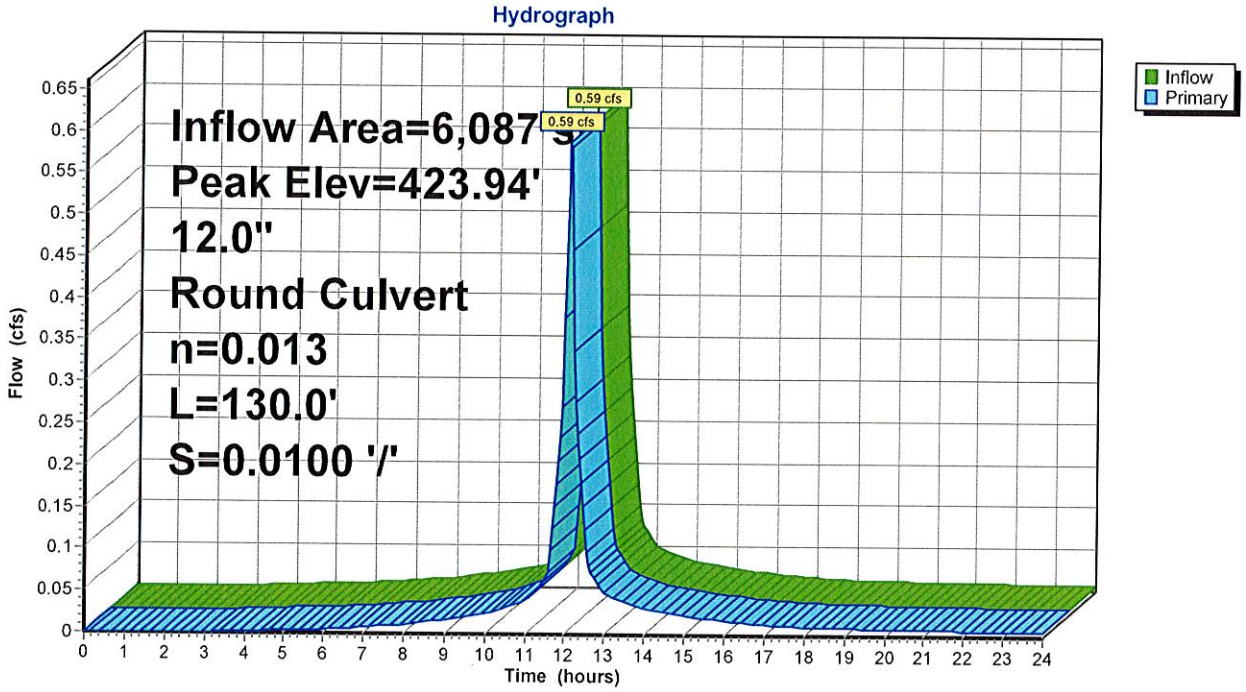
Inflow Area = 6,087 sf, 91.47% Impervious, Inflow Depth > 3.98" for 10 YEAR event
Inflow = 0.59 cfs @ 12.09 hrs, Volume= 2,020 cf
Outflow = 0.59 cfs @ 12.09 hrs, Volume= 2,020 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.59 cfs @ 12.09 hrs, Volume= 2,020 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 423.94' @ 12.09 hrs
Flood Elev= 427.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	423.55'	**12.0" Round Culvert** L= 130.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 423.55' / 422.25' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.56 cfs @ 12.09 hrs HW=423.93' TW=422.75' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.56 cfs @ 2.98 fps)

Pond CB4: CATCH BASIN RETAIL FRONT SIDE



Summary for Pond MH1: MH-1

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=25)
[80] Warning: Exceeded Pond CB2 by 0.72' @ 19.05 hrs (1.95 cfs 15,009 cf)

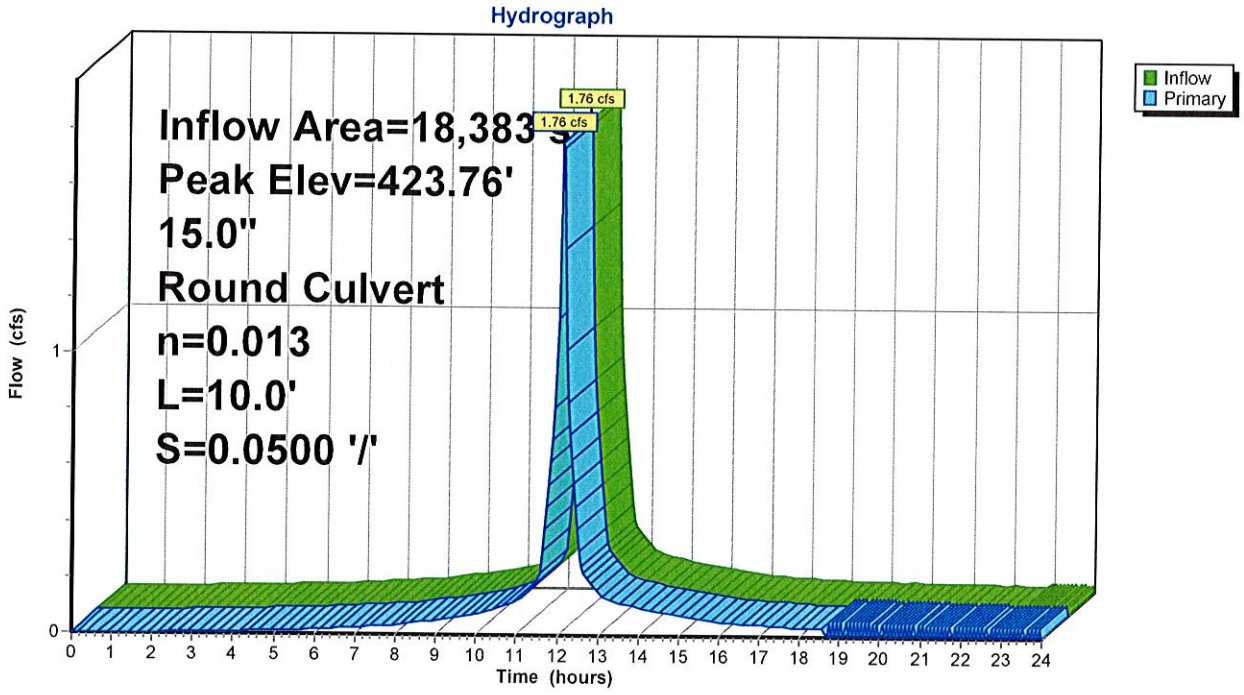
Inflow Area =	18,383 sf,	92.03% Impervious,	Inflow Depth >	3.97"	for 10 YEAR event
Inflow =	1.76 cfs @	12.09 hrs, Volume=	6,087 cf		
Outflow =	1.76 cfs @	12.09 hrs, Volume=	6,086 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.76 cfs @	12.09 hrs, Volume=	6,086 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 423.76' @ 13.94 hrs
Flood Elev= 428.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	422.25'	**15.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 422.25' / 421.75' S= 0.0500 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.49 cfs @ 12.09 hrs HW=422.89' TW=422.56' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.49 cfs @ 3.45 fps)

Pond MH1: MH-1



Summary for Pond MH2: MH-2

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=7)
[80] Warning: Exceeded Pond CB3 by 0.55' @ 22.90 hrs (1.36 cfs 5,875 cf)

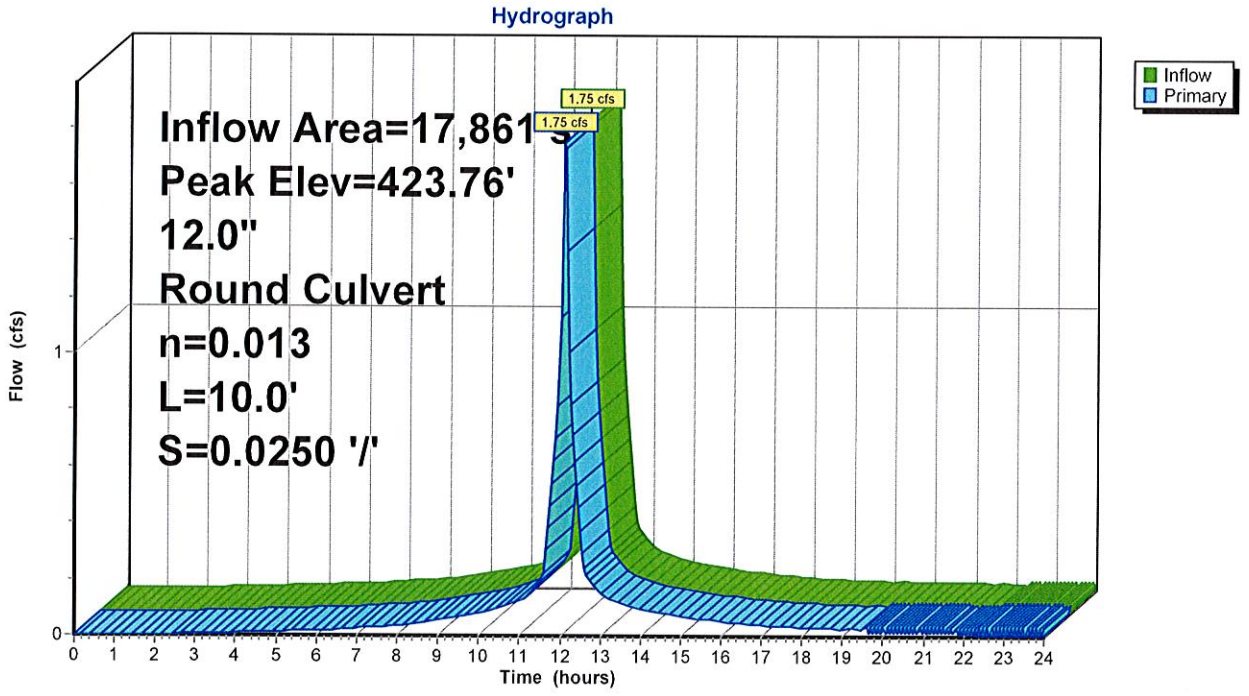
Inflow Area =	17,861 sf,	94.22% Impervious,	Inflow Depth >	4.08"	for 10 YEAR event
Inflow =	1.75 cfs @	12.09 hrs, Volume=	6,078 cf		
Outflow =	1.75 cfs @	12.09 hrs, Volume=	6,078 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.75 cfs @	12.09 hrs, Volume=	6,078 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 423.76' @ 13.93 hrs
Flood Elev= 428.10'

Device	Routing	Invert	Outlet Devices
#1	Primary	422.00'	**12.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 422.00' / 421.75' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.20 cfs @ 12.09 hrs HW=422.75' TW=422.55' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.20 cfs @ 2.65 fps)

Pond MH2: MH-2



Summary for Pond P-1: FILTER

Inflow Area = 25,402 sf, 84.61% Impervious, Inflow Depth > 3.69" for 10 YEAR event
Inflow = 2.34 cfs @ 12.09 hrs, Volume= 7,812 cf
Outflow = 2.26 cfs @ 12.11 hrs, Volume= 6,544 cf, Atten= 3%, Lag= 1.4 min
Primary = 2.26 cfs @ 12.11 hrs, Volume= 6,544 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 426.69' @ 12.11 hrs Surf.Area= 1,434 sf Storage= 1,582 cf

Plug-Flow detention time= 101.7 min calculated for 6,530 cf (84% of inflow)
Center-of-Mass det. time= 35.8 min (817.9 - 782.1)

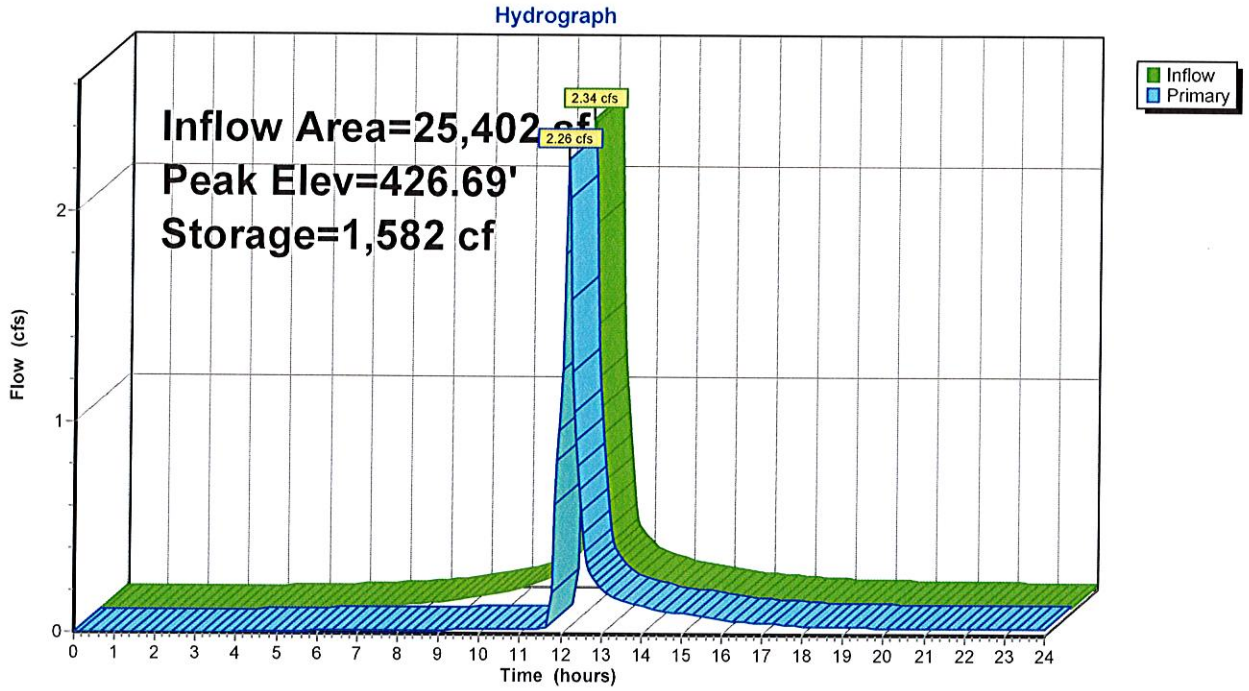
Volume	Invert	Avail.Storage	Storage Description
#1	425.25'	2,044 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
425.25	770	0	0
426.00	1,102	702	702
426.50	1,342	611	1,313
427.00	1,580	731	2,044

Device	Routing	Invert	Outlet Devices
#1	Primary	423.00'	**12.0" Round Culvert** L= 20.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 423.00' / 422.50' S= 0.0250 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	426.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	425.25'	**1.000 in/hr Exfiltration over Horizontal area**

Primary OutFlow Max=2.21 cfs @ 12.11 hrs HW=426.69' TW=422.66' (Dynamic Tailwater)
└─**1=Culvert** (Passes 2.21 cfs of 6.75 cfs potential flow)
  ├─**2=Orifice/Grate** (Weir Controls 2.17 cfs @ 1.43 fps)
  └─**3=Exfiltration** (Exfiltration Controls 0.03 cfs)

Pond P-1: FILTER



Summary for Pond P-2: BURRIED POND

[80] Warning: Exceeded Pond MH1 by 1.04' @ 19.00 hrs (3.78 cfs 29,970 cf)
[80] Warning: Exceeded Pond MH2 by 1.12' @ 22.85 hrs (2.98 cfs 10,518 cf)

Inflow Area =	70,721 sf,	90.94% Impervious,	Inflow Depth >	3.73"	for 10 YEAR event
Inflow =	6.63 cfs @	12.09 hrs, Volume=	21,976 cf		
Outflow =	0.40 cfs @	13.89 hrs, Volume=	12,794 cf,	Atten= 94%,	Lag= 107.6 min
Discarded =	0.07 cfs @	8.35 hrs, Volume=	5,253 cf		
Primary =	0.32 cfs @	13.89 hrs, Volume=	7,540 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 423.75' @ 13.89 hrs Surf.Area= 6,406 sf Storage= 12,419 cf
Flood Elev= 426.75' Surf.Area= 6,406 sf Storage= 19,101 cf

Plug-Flow detention time= 252.3 min calculated for 12,767 cf (58% of inflow)
Center-of-Mass det. time= 141.5 min (920.2 - 778.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	421.00'	2,959 cf	**57.20'W x 112.00'L x 4.50'H Field A** 28,829 cf Overall - 21,431 cf Embedded = 7,398 cf x 40.0% Voids
#2A	421.50'	16,141 cf	**Concrete Galley 4x4x4** x 364 Inside #1 Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf 13 Rows of 28 Chambers
		19,101 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	421.00'	**15.0" Round Culvert** L= 103.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 421.00' / 418.00' S= 0.0291 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	423.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	423.75'	**8.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	424.75'	**4.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Discarded	421.00'	**0.500 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.07 cfs @ 8.35 hrs HW=421.06' (Free Discharge)
└**5=Exfiltration** (Exfiltration Controls 0.07 cfs)

Primary OutFlow Max=0.32 cfs @ 13.89 hrs HW=423.75' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.32 cfs of 8.62 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.32 cfs @ 3.69 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.23 fps)
  └**4=Orifice/Grate** (Controls 0.00 cfs)

Pond P-2: BURRIED POND - Chamber Wizard Field A

Chamber Model = Concrete Galley 4x4x4 (Concrete Galley, UCPI 4x4x4 Galley or equivalent)
Inside= 42.0"W x 43.0"H => 12.67 sf x 3.50'L = 44.3 cf
Outside= 52.8"W x 48.0"H => 14.72 sf x 4.00'L = 58.9 cf

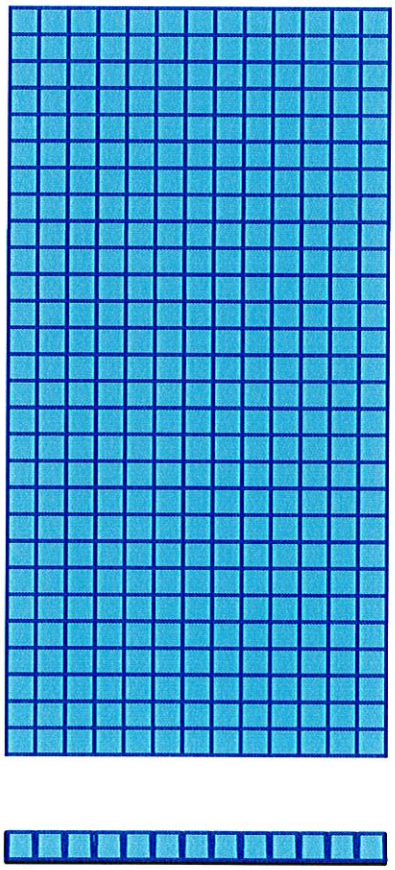
28 Chambers/Row x 4.00' Long = 112.00' Row Length
13 Rows x 52.8" Wide = 57.20' Base Width
6.0" Base + 48.0" Chamber Height = 4.50' Field Height

364 Chambers x 44.3 cf = 16,141.5 cf Chamber Storage
364 Chambers x 58.9 cf = 21,431.0 cf Displacement

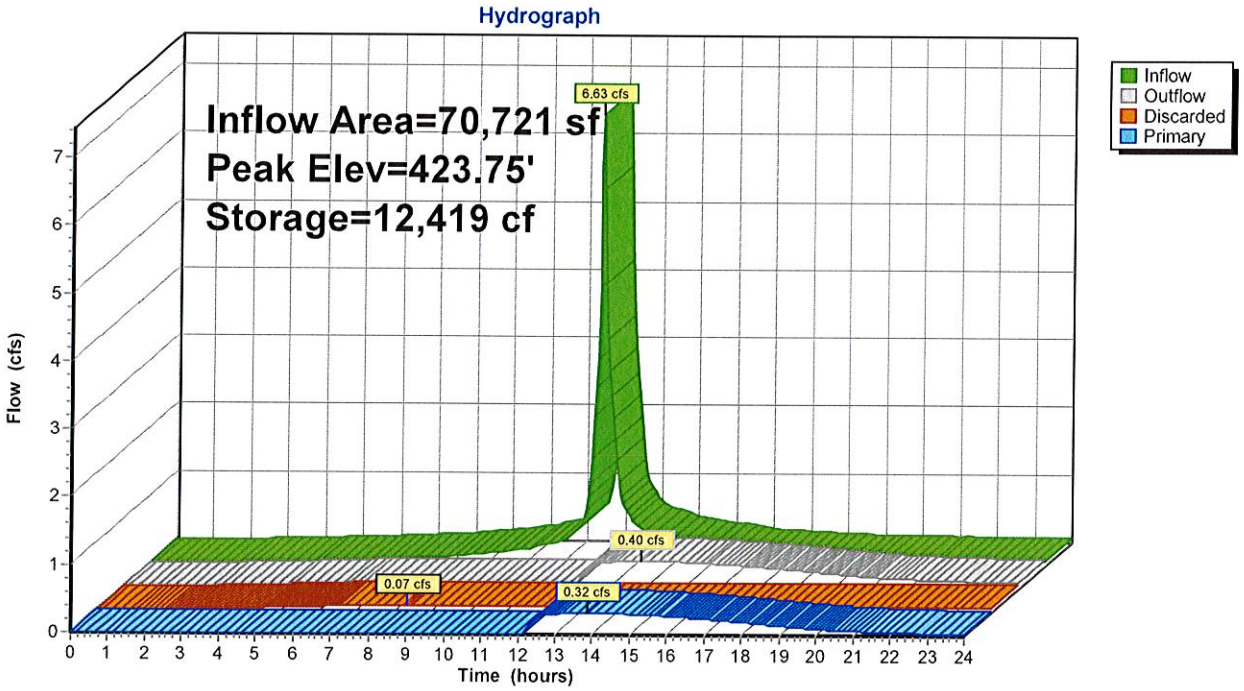
28,828.8 cf Field - 21,431.0 cf Chambers = 7,397.8 cf Stone x 40.0% Voids = 2,959.1 cf Stone Storage

Chamber Storage + Stone Storage = 19,100.6 cf = 0.438 af
Overall Storage Efficiency = 66.3%
Overall System Size = 112.00' x 57.20' x 4.50'

364 Chambers
1,067.7 cy Field
274.0 cy Stone



Pond P-2: BURRIED POND



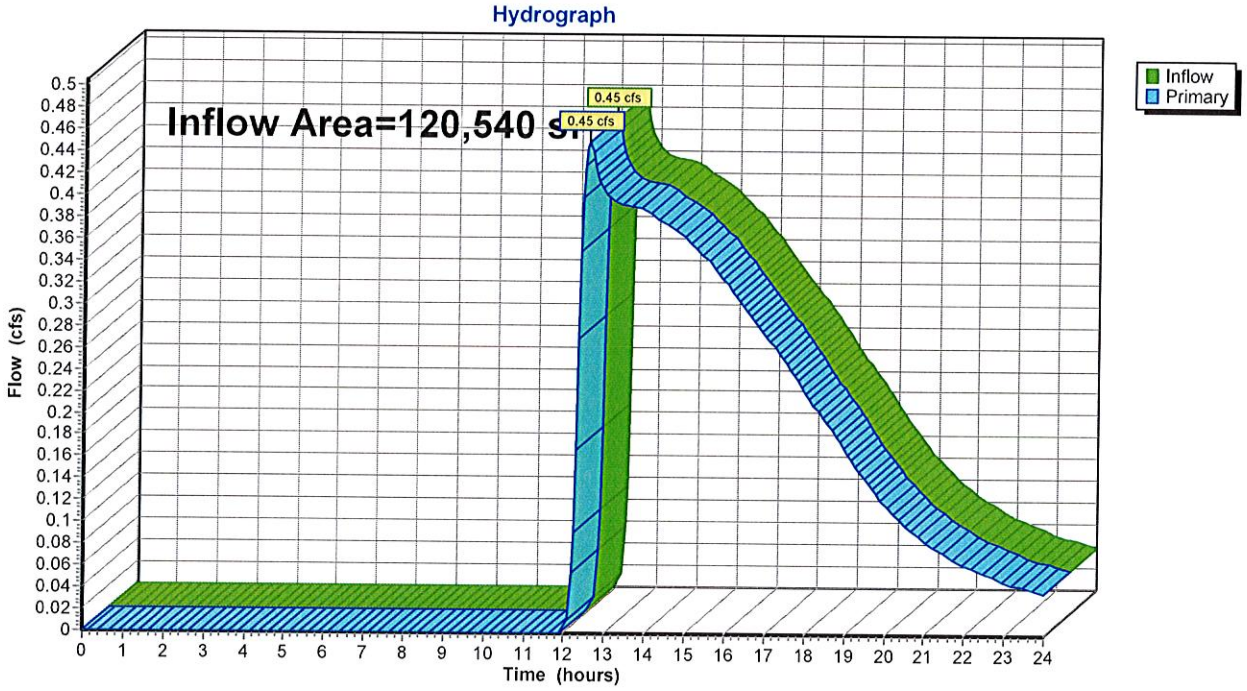
Summary for Pond SP-1: (new Pond)

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area =	120,540 sf,	53.35% Impervious,	Inflow Depth >	0.93"	for 10 YEAR event
Inflow =	0.45 cfs @	12.55 hrs, Volume=	9,325 cf		
Primary =	0.45 cfs @	12.55 hrs, Volume=	9,325 cf,	Atten= 0%,	Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Pond SP-1: (new Pond)



John P. Hayes III CSS, CWS,
7 Limestone Way
North Hampton, NH 03862
603-205-4396
johnphayes@comcast.net

3/25/20

Benjamin Osgood
Ranger Engineering Group Inc.
13 Branch Street Suite 101
Methuen , MA 01844

Job # 19-018

Site Specific Soil Survey 3/23/20
Map 35 Lot 4
Route 103 West Warner, NH

Dear Ben,

This letter report presents the findings of a Site Specific Soil Survey conducted on the referenced property by John P. Hayes III on March 23, 2020. The soil survey was conducted in accordance with the New Hampshire Supplement of the Site-Specific Soil Mapping Standard For New Hampshire and Vermont, Version 5.0, December 2017, Special Publication # 3, published by the Society of Soil Scientist of Northern New England.

The portion of the property that is subject of the soil survey is located on the south side of Route 103, and northeast of Interstate 89, in Warner, NH. The parcel area is 3.13 acres in size. The plans used for these soil maps are a 60 scale plan, where 1 inch equals 60 feet, with two foot contours.

The purpose of the soil survey is to provide the client with soils information for urban and suburban or rural land planning. Soil characteristics on the property were evaluated through test pit information, and observation of numerous test holes and hand auger probes conducted throughout the property. Slope phases were determined with the use of the topography provided on the plan. The Site-specific Soil Map Units identified are taken from the New Hampshire State-Wide Numerical Soils Legend, Issue #10 January 2011, and are briefly described below. Official Series Descriptions (OSD) for each of these soil series are enclosed with this report. The soil map units comply with the Range In Characteristics described in the OSD. Dissimilar inclusions are noted above. Limits of the Site Specific mapping units are highlighted on the plan.

Portions of the soil map with the map unit denominator P, are poorly drained soils. Portions of the soil map,with the map lable 299 and 900, contain disturbed soils that have been excavated and/or regraded, that are loamy in texture, underlain with a layer fine sand. A Disturbed Soil Mapping Unit Supplement for New Hampshire DES AoT Site Specific Soil Maps, is also included. This supplement explains the additional information given about each of the disturbed soil map units that are present on the site.

MAP UNIT #	SOIL TAXANOMIC NAME	DESCRIPTION
104B	**Podunk (Frequently Flooded)**	The Podunk series consists of very deep, moderately well drained soils formed in recent alluvium on floodplains. Estimated saturated hydraulic conductivity is moderately high or high in the mineral solum and high or very high in the substratum. Hydrological Soil Group is B. Slopes range from 3% to 8%.
105A P	**Rumney (Frequently Flooded)**	The Rumney series consists of very deep, poorly drained soils formed in recent alluvium on floodplains. Estimated saturated hydraulic conductivity is moderately high or high in the solum and high or very high in the substratum. Hydrological Soil Group is C. Slopes range from 0% to 3%.
299A (ccadb)	**Udorthents (Smoothed)**	This map unit represents areas that have been cut and filled to create a large level or nearly level area. Soil material making up the map units typically came from the immediate area. The soils are loamy in texture, underlain with a layer fine sand. Hydrological Soil Group is B. Slopes range from 0% to 3 %.
299B (ccadb)	**Udorthents (Smoothed)**	This map unit represents areas that have been cut and filled to create a large level or nearly level area. Soil material making up the map units typically came from the immediate area. The soils are loamy in texture, underlain with a layer fine sand. Hydrological Soil Group is B. Slopes range from 3% to 8 %.
299C (ccadb)	**Udorthents (Smoothed)**	This map unit represents areas that have been cut and filled to create a large level or nearly level area. Soil material making up the map units typically came from the immediate area. The soils are loamy in texture, underlain with a layer fine sand. Hydrological Soil Group is B. Slopes range from 8% to 15 %.
900A P (fcadc)	**Endoaquents (Sandy or Gravelly)**	This map unit represents areas where soil material was excavated down to / near the water table. This map unit is characterized typically by soil textures of: 1) very gravelly (> 35% gravel) sand or very gravelly loamy sand or; 2) sand or loamy sand textures that may have lenses of loamy very fine sand or finer somewhere in the particle-size class control section (25 - 100 cm or 10 - 40"). Saturated hydraulic conductivity (Ksat) is high or very high. Hydrological Drainage class is very poorly drained. Hydrological Soil Group is C. Slopes range from 0% to 3%.

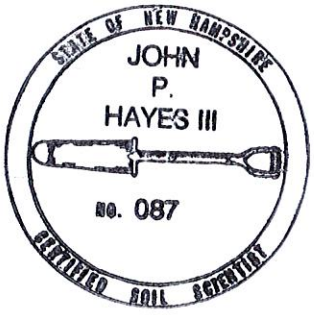
Slope Phases

Alpha Slope Symbol	Range
A	0 – 3%
B	3 – 8%
C	8 – 15%
D	15 – 25%
E	25 – 50%
F	> 50%

I trust that this Soil Survey and report meet your current planning needs. Please do not hesitate to contact me if you have any questions.

Sincerely:

John P. Hayes III



John P. Hayes III CSS, CWS

LOCATION PODUNK ME+MA NH NY VT

Established Series
Rev. JEW-KJL-WDH
02/2012

PODUNK SERIES

The Podunk series consists of very deep, moderately well drained soils formed in recent alluvium on floodplains. Estimated saturated hydraulic conductivity is moderately high or high in the mineral solum and high or very high in the substratum. Slope ranges from 0 to 3 percent. Mean annual temperature is about 43 degrees F, and mean annual precipitation is about 44 inches at the type location.

TAXONOMIC CLASS: Coarse-loamy, mixed, active, frigid Fluvaquentic Dystrudepts

TYPICAL PEDON: Podunk fine sandy loam, on a 1 percent slope in a cultivated field. (Colors are for moist soil unless otherwise stated.)

Ap -- 0 to 10 inches; dark yellowish brown (10YR 3/4) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; many roots; strongly acid; abrupt smooth boundary. (5 to 14 inches thick)

Bw1 -- 10 to 18 inches; light olive brown (2.5Y 5/4) fine sandy loam; weak fine granular structure; friable; many roots; strongly acid; gradual smooth boundary.

Bw2 -- 18 to 30 inches; light olive brown (2.5Y 5/4) fine sandy loam; weak fine granular structure; friable; few roots; common medium distinct light brownish gray (2.5Y 6/2) iron depletions and common medium faint light yellowish brown (2.5Y 6/4) masses of iron accumulation; strongly acid; gradual smooth boundary. (The combined thickness Bw horizon is 11 to 22 inches.)

C -- 30 to 65 inches; olive gray (5Y 5/2) loamy fine sand; single grain; loose; many medium prominent light yellowish brown (2.5Y 6/4) and yellowish brown (10YR 5/4) masses of iron accumulation; and many medium faint pale olive (5Y 6/3) masses of iron accumulation; strongly acid.

TYPE LOCATION: Oxford County, Maine; Town of Fryeburg, 0.6 mile south-southwest of North Fryeburg village and 1.8 miles southwest of Fryeburg Harbor; USGS Fryeburg topographic quadrangle; latitude 44 degrees 06 minutes 46 seconds N. and 70 degrees 58 minutes 22 seconds W., NAD 27.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the coarse-textured substratum ranges from 18 to 40 inches. Depth to bedrock is more than 60 inches. Rock fragments in the solum are less than 15 percent of the volume and range from 0 to 40 percent in the substratum. Reaction ranges from very strongly acid to slightly acid throughout. Some pedons have buried horizons.

The Ap horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. Dry value is 6 or 7. It is sandy loam, fine sandy loam, or loam. It typically has weak or moderate, very fine or fine granular structure but includes subangular blocky in some pedons.

The Bw horizon has hue of 10YR to 5Y, with value and chroma of 2 to 6. It is sandy loam, fine sandy loam, or loam. It has weak or moderate very fine or fine granular or subangular blocky structure. Consistence is very friable or friable.

The C horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 to 6. Texture of individual layers ranges from loamy fine sand through coarse sand in the fine-earth fraction. Included in some pedons are loamy and/or extremely gravelly strata. The thickness and number of subhorizons is variable and corresponds to the thickness and variability of the alluvial deposits. The C horizon is single grain and loose in the sandy part. The loamy part is typically massive and friable or very friable.

COMPETING SERIES: There are currently no other series in the same family.

The Ondawa and Rumney series are similar soils in related families. Ondawa soils do not have redox depletions within 24 inches of the soil surface. Rumney soils have dominant chroma of 2 or less within a depth of 20 inches.

GEOGRAPHIC SETTING: The Podunk soils are on floodplains along the major rivers and streams. The soils formed in recent alluvium derived principally from gneiss, schist, granite, and quartzite. Slope ranges from 0 to 3 percent. Flooding frequency varies from once or twice a year to once in 5 to 10 or more years. Overflow generally occurs during spring runoff and during periods of high rainfall. Climate is humid and cool temperate. Mean annual temperature ranges from 38 to 46 degrees F, and mean annual precipitation ranges from 34 to 50 inches. The frost-free season ranges from 80 to 160 days. Elevation ranges from 10 to 2000 feet above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Adams, Croghan, Ondawa and Rumney soils. Adams and Croghan soils are coarser textured and are on adjacent outwash terraces or plains. Ondawa soils are well drained and Rumney soils are poorly drained and are in a drainage sequence with the Podunk soils on the floodplains.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Moderately well drained. Estimated saturated hydraulic conductivity is moderately high or high in the mineral solum and high or very high in the substratum.

USE AND VEGETATION: Used mainly for growing row crops, hay, or pasture. Wooded areas are in eastern white pine, white birch, yellow birch, gray birch, balsam fir, red spruce, white spruce, hemlock, red maple, elm, and alders.

DISTRIBUTION AND EXTENT: Maine, Massachusetts, New Hampshire, New York and Vermont; MLRAs 142, 143, 144B, 145. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Connecticut Valley, Connecticut, 1903.

REMARKS: 1. The classification is updated to Coarse-loamy, mixed, active, frigid Fluvaquentic Dystrudepts to conform to the Keys to Soil Taxonomy, 8th edition, 1998.

2. Diagnostic horizons and features recognized in this pedon are:
a. Ochric epipedon - the zone from the soil surface to a depth of 10 inches (Ap horizon).
b. Cambic horizon - the zone from 10 to a depth of 30 inches (Bw horizon).
c. Aquic feature - redox features below a depth of 18 inches (Bw2 and C horizons).
d. Fluvaquentic features - content of organic carbon decreases irregularly with depth and redox depletions are within a depth of 24 inches of the soil surface.

ADDITIONAL DATA: The Soil Interpretation Record number for the Podunk series is ME0050.

National Cooperative Soil Survey
U.S.A.

LOCATION RUMNEY ME+CT MA NH NY VT

Established Series
Rev. DEW-KJL-SWF
04/2013

RUMNEY SERIES

The Rumney series consists of very deep, poorly drained soils formed in recent alluvium on floodplains. Estimated saturated hydraulic conductivity is moderately high or high in the solum and high or very high in the substratum. Slope ranges from 0 to 3 percent. Mean annual temperature is about 43 degrees F, and mean annual precipitation is about 44 inches.

TAXONOMIC CLASS: Coarse-loamy, mixed, active, nonacid, frigid Fluvaquentic Endoaquepts

TYPICAL PEDON: Rumney fine sandy loam, on a 1 percent slope in a wooded area. (Colors are for moist soil unless otherwise stated.)

Ap -- 0 to 9 inches; very dark grayish brown (10YR 3/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many very fine and fine and common medium and coarse roots; few fine distinct dark grayish brown (2.5Y 4/2) iron depletions; very strongly acid; clear smooth boundary. (3 to 10 inches thick.)

Bg1 -- 9 to 20 inches; dark grayish brown (2.5Y 4/2) fine sandy loam; weak fine granular structure; very friable; many very fine and fine, and common medium roots; common fine prominent dark yellowish brown (10YR 4/4) masses of iron accumulation and common fine faint grayish brown (2.5Y 5/2) iron depletions; strongly acid; clear wavy boundary.

Bg2 -- 20 to 30 inches; grayish brown (2.5Y 5/2) sandy loam; weak fine granular structure; friable; common very fine, fine and medium roots; many medium prominent strong brown (7.5YR 4/6) masses of iron accumulation and common medium faint olive gray (5Y 5/2) iron depletions; moderately acid; clear wavy boundary. (The combined thickness of the Bg horizon is 14 to 30 inches.)

Cg -- 30 to 65 inches; olive gray (5Y 4/2) loamy sand; single grain; loose; common medium faint olive gray (5Y 5/2) and few fine faint gray (5Y 6/1) iron depletions; moderately acid.

TYPE LOCATION: Oxford County, Maine; Town of Fryeburg; 0.4 mile south-southeast of the junction of the Saco River and US Route 302, and 1.0 mile east of the north end of Lovewell Pond; USGS Fryeburg, ME topographic quadrangle; Latitude 44 degrees, 01 minute 23, seconds N. and Longitude 70 degrees, 55 minutes, 10 seconds W., NAD 1927.

RANGE IN CHARACTERISTICS: Thickness of the solum and depth to the coarse textured substratum ranges from 20 to 40 inches. Depth to bedrock is more than 60 inches. Gravel content ranges from 0 to 15 percent by volume in the solum and from 0 to 50 percent in the substratum. Reaction ranges from very strongly acid to neutral throughout, but some subhorizon within 40 inches of the mineral soil surface is moderately acid to neutral. Some pedons are slightly alkaline below 40 inches. Some pedons have buried horizons.

The Ap, or A horizon where present, has hue of 10YR or 2.5Y, value of 2 to 4, and chroma of 1 to 3. Dry value is 6 or more. It is sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam. It has weak or moderate, fine or medium granular structure and is very friable or friable. A horizons can have blocky structure.

The B horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 to 4. At least one subhorizon within 20 inches of the mineral soil surface has hue of 10YR or 2.5Y, with value of 3 to 5, and chroma of 2. It has common or many, fine to coarse, faint to prominent redoximorphic features. It is sandy loam, fine sandy loam, or loam. Some pedons have thin subhorizons of very fine sandy loam in the upper part of the B horizon. It has weak or moderate, very fine to coarse subangular blocky or very fine to medium granular structure, and is very friable or friable.

Some pedons may have a Bw horizon.

The C horizon has hue of 7.5YR to 5Y, value of 3 to 6, and chroma of 1 to 4. The texture of individual layers ranges from loamy fine sand to coarse sand in the fine-earth fraction. Included in some pedons are loamy and/or extremely gravelly strata. The thickness and number of subhorizons is variable and corresponds to the thickness and variability of the alluvial deposits. The C horizon is single grain and loose in the sandy part. The loamy part is typically massive and very friable or friable.

COMPETING SERIES: There are currently no other series in the same family.

Similar soils in related families include the Charles, Medomak, and Podunk series. Charles soils are finer textured. Medomak soils are very poorly drained and have an umbric epipedon. Podunk soils are moderately well drained and have a chroma of 3 or more within a depth of 20 inches.

GEOGRAPHIC SETTING: Rumney soils are on the floodplains of rivers and streams. Slope ranges from 0 to 3 percent. The soils formed in recent alluvium derived principally from gneiss, schist, granite, and quartzite. Flooding generally occurs once or twice annually, but may occur less often than once in 2 years in some places. Overflow generally occurs during spring runoff and during periods of high rainfall. The climate is humid and cool temperate. Mean annual precipitation ranges from 34 to 50 inches, and mean annual temperature ranges from 38 to 46 degrees F. The frost-free season ranges from 80 to 160 days. Elevation ranges from 10 to 2000 feet above mean sea level.

GEOGRAPHICALLY ASSOCIATED SOILS: Ondawa soils are well drained and Podunk soils are moderately well drained soils in a drainage sequence with Rumney soils. Sunday soils are associated in slightly higher positions on the flood plain. Adams, Allagash, and Colton soils are on adjacent outwash plains, deltas, and terraces.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY: Poorly drained. The potential for surface runoff is very high, high, or negligible. Estimated saturated hydraulic conductivity is moderately high or high in the solum and high or very high in the substratum.

USE AND VEGETATION: Cleared areas are used mainly for hay and pasture. The remaining areas are mostly forested. Common tree species are willow, elm, eastern white pine, tamarack, red spruce, black spruce, red maple, and gray birch.

DISTRIBUTION AND EXTENT: Maine, northern Connecticut, Massachusetts, New Hampshire, Vermont, and eastern and northern New York; MLRA 101*, 141, 142, 143 144A, 144B, 145*, and 146. The series is of moderate extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Amherst, Massachusetts.

SERIES ESTABLISHED: Coos County, New Hampshire, 1938.

REMARKS: *MLRA 101, 144A, and 145 are areas with mesic soil temperature regimes. Rumney soils have a frigid temperature regime and will not be mapped in MLRA 101, 144A, and 145 when these areas are updated. Some pedons have been described with an AC horizon sequence.

Diagnostic horizons and features recognized in this pedon include:
a. Ochric epipedon - the zone from 0 to 9 inches (Ap horizon).
b. Cambic horizon - the zone from 9 to 30 inches (Bg horizon).
c. Fluvaquentic feature - the content of organic carbon decreases irregularly with depth.
d. Aquic conditions - redox features throughout the mineral soil.

ADDITIONAL DATA: The Soil Interpretation Record number for the Rumney series is ME0014.

National Cooperative Soil Survey
U.S.A.

Disturbed Soil Mapping Unit Supplement
for New Hampshire
DES AoT Site Specific Soil Maps

Introduction

The NRCS NH State-Wide Legend, as amended, contains a number of distinct map units used for identifying areas of soils altered or disturbed by human influence. However, in preparing the required Site Specific Soils Maps for compliance with NH Department of Environmental Services Alteration of Terrain (AoT) rules, additional information is often needed and desired. This supplement provides a means to supply the user a more detailed soil mapping unit description to meet this need.

Purpose

To provide soil scientists with additional soil mapping tools for disturbed sites and miscellaneous areas to enhance site specific soil maps and interpretations to reflect new requirements under the revised NH Alteration of Terrain regulations. This supplement is intended to allow the creation of soil maps with mapping units that can be expanded beyond those of the NRCS NH State-Wide Numerical Legend and the standards of the National Cooperative Soil Survey for disturbed units in order to provide specific information useful in preparation of site specific soils maps and reports to comply with NHDES Env-Wq 1500-Alteration of Terrain.

Note that the disturbed soil supplement has been created by SSSNNE and is not a product of the NRCS or the National Cooperative Soil Survey. Additionally, the supplemental legend can only be used in conjunction with the Site Specific Soil Mapping standards and cannot be used to create a stand-alone soils map.

For the purposes of this supplement, the definition of disturbed land, including excavate and fill, is as defined by RSA 485-A: 6, VIII; RSA 485-A: 17, and NHDES Env-Wq 1500.

Map Notation

Notation on the Site Specific Soil Map completed to comply with the NH AoT rules should include the following disclaimer:

Site-Specific Soil Map

1. This detailed Site-Specific Soil Map conforms to the standards of SSSNNE Publication No. 3, as amended, "Site-Specific Soil Mapping Standards for NH and VT".

2. This map has been prepared to comply with soil mapping requirements of RSA 485 A: 17and NHDES Env-Wq 1500, Alteration of Terrain.

3. See accompanying narrative report for methodology, map symbol legend, and interpretations.

Map Symbol Denominators for Disturbed Unit Supplements

The map symbols for Site-Specific Soil Mapping of disturbed soils in New Hampshire is a two part symbol with parts separated by a forward slash (/).

The first part consists of the USDA-NRCS Disturbed Map Unit symbol from the NH State-Wide Numerical Soil Legend. The map symbol is composed of 1 to 3 digits followed by a capital letter designating slope.

The second part consists of symbols of the SSSNNE NH Disturbed Soil Supplement to the Site Specific Soil Survey Standards, as detailed below. The disturbed map symbol is composed of 5 lower case letters.

Thus a Site Specific map symbol for a map prepared for an AoT application would be formatted as follows:

400A/aaaaa

These SSSNNE NH Disturbed Soil Supplemental symbols can only be used in conjunction with the USDA-NRCS Disturbed Map Unit symbols for the NH Statewide Numerical Soil Legend.

Supplemental Symbols

The five components of the Disturbed Soil Mapping Unit Supplement are as follows:

Symbol 1: Drainage Class
a-Excessively Drained
b-Somewhat Excessively Drained
c-Well Drained
d-Moderately Well Drained
e-Somewhat Poorly Drained
f-Poorly Drained
g-Very Poorly Drained
h-Not Determined

Symbol 2: Parent Material (of naturally formed soil only, if present)
a-No natural soil within 60"
b-Glaciofluvial Deposits (outwash/terraces of sand or sand and gravel)
c-Glacial Till Material (active ice)
d-Glaciolacustrine very fine sand and silt deposits (glacial lakes)
e-Loamy/sandy over Silt/Clay deposits
f-Marine Silt and Clay deposits (ocean waters)
g-Alluvial Deposits (floodplains)
h-Organic Materials-Fresh water Bogs, etc
i- Organic Materials-Tidal Marsh

Symbol 3: Restrictive/Impervious Layers
a-None
b-Bouldery surface with more than 15% of the surface covered with boulders
c-Mineral restrictive layer(s) are present in the soil profile less than 40 inches below the soil surface such as hard pan, platy structure or clayey texture with consistence of at least firm (i.e. more than 20 newtons). For other examples of soil characteristics that qualify for restrictive layers, see "Soil Manual for Site evaluations in NH" 2nd Ed., (page 3-17, figure 3-14)
d-Bedrock in the soil profile; 0-20 inches
e-Bedrock in the soil profile; 20-60 inches
f-Areas where depth to bedrock is so variable that a single soil type cannot be applied, will be mapped as a complex of soil types
g-Subject to Flooding
h-Man-made impervious surface including pavement, concrete, or built-up surfaces (i.e. buildings) with no morphological restrictive layer within control section

Symbol 4: Estimated Ksat* (most limiting layer excluding symbol 3h above).
a- High.
b-Moderate
c-Low
d-Not determined
*See "Guidelines for Ksat Class Placement" in Chapter 3 of the Soil Survey Manual, USDA

Symbol 5: Hydrologic Soil Group*
a-Group A
b-Group B
c-Group C
d-Group D
e-Not determined

*excluding man-made surface impervious/restrictive layers

Disturbed Map Units (continued)

II. Filled land

100 Udorthents, wet substratum

This map unit represents areas that have been filled and leveled over what were originally hydric soils.

199 Dumps, bark chips, and organic material

This map unit consists of man-made deposits of bark, wood chips, sawdust, paper mill sludge, cinders, waste paper, ashes, and other similar refuse from the operation of paper mills and sawmills.

200 Udorthents, refuse substratum

This map unit represents alternating layers of soil and refuse such as in sanitary landfills. Closed landfills typically have 2 feet of loamy material capping the area.

299 Udorthents, smoothed

This map unit represents areas that have been cut and filled to create a large level or nearly level area. Soil material making up the map units typically came from the immediate area. School athletic fields are an example (unless they were created on hydric soils – see Map Unit 100).

III. Bottom Land

7 Fluvaquents

This map unit represents areas of various kinds of soil materials on the bottom lands of streams and rivers. The soil material ranges in texture from silt loam to sand and gravel within the particle-size class control section (25 - 100 cm or 10 - 40 inches). Drainage class is poorly or very poorly drained. The Hydrologic Soil Group (HSG) is D.

Disturbed Map Units

This edition of the New Hampshire State-Wide Numerical Soil Legend contains eleven distinct map units used for identifying areas of soils altered or disturbed by human influence and the addition of one naturally formed map unit. These map units were designed for the Order 2 and Order 3 levels of mapping intensity, but can be used in Order 1 mapping if appropriate.

The definition of disturbed map units is intentionally brief and vague. Classification at the Great Group level allows for a wide range in soil properties and behavioral characteristics. The variability in soil properties typically requires on-site investigations before any interpretation can be developed. The map unit descriptions are intended to provide guidance in differentiating map units. The author of the soil map is expected to provide additional information to reflect the nature of the disturbed areas within the survey area.

I. Excavated land

300 Udipsamments

This map unit is characterized by soil textures of loamy fine sand to sand and gravel throughout the entire particle-size class control section (25 - 100 cm or 10 - 40 inches). Saturated hydraulic conductivity (K_{sat}) is high or very high. Drainage class ranges from excessively drained to well drained. The Hydrologic Soil Group (HSG) is A. Typical sand pit.

350 Udipsamments, wet substratum

This map unit is characterized by soil textures of loamy fine sand to sand and gravel throughout the entire particle-size class control section (25 - 100 cm or 10 - 40 inches). Saturated hydraulic conductivity (K_{sat}) is high or very high. Drainage class ranges from moderately well drained to somewhat poorly drained.

400 Udorthents, sandy or gravelly

This map unit typically includes the following concepts: 1) very gravelly (> 35%) sand or very gravelly loamy sand; Or 2) sand or loamy sand textures that may have lenses of loamy very fine sand or finer somewhere in the particle-size class control section (25 - 100 cm or 10 - 40"). Saturated hydraulic conductivity (K_{sat}) is high or very high. Drainage class ranges from excessively drained to somewhat poorly drained. Typical gravel pit.

Disturbed Map Units (continued)

500 Udorthents, loamy

This map unit is characterized typically by soil textures that are sandy loam, loam, or silt loam within the particle size control section (25 – 100cm or 10 – 40"). Saturated hydraulic conductivity (K_{sat}) is low through high. Drainage class ranges from well drained to somewhat poorly drained. These areas typically represent excavated glacial till or perhaps areas where sand and gravel was excavated down to the loamy underlying material.

550 Udorthents, Bedrock substratum

This map unit is characterized by soil textures of sandy loam, loam, or silt loam within the particle-size class control section (25 - 100 cm or 10 - 40 inches). These areas typically represent excavated soil materials where the range in depth to bedrock is 10 - 60 inches (25 - 152 cm). Saturated hydraulic conductivity (K_{sat}) is low through high. Drainage class ranges from somewhat excessively drained to somewhat poorly drained.

600 Endoaquents, loamy

This map unit represents areas where soil material was excavated down to, or near the water table. Soil material is typically sandy loam, loam or silt loam within the particle-size class control section (25 - 100 cm or 10 - 40 inches). Saturated hydraulic conductivity (K_{sat}) is low through high. Drainage class is poorly or very poorly drained. The Hydrologic Soil Group (HSG) is D.

900 Endoaquents, sandy or gravelly

This map unit represents areas where soil material was excavated down to / near the water table. This map unit is characterized typically by soil textures of: 1) very gravelly (> 35% gravel) sand or very gravelly loamy sand or; 2) sand or loamy sand textures that may have lenses of loamy very fine sand or finer somewhere in the particle-size class control section (25 - 100 cm or 10 - 40"). Saturated hydraulic conductivity (K_{sat}) is high or very high. Drainage class is poorly or very poorly drained. The Hydrologic Soil Group (HSG) is D. Typical gravel pit dug down to or close to the water table.

INFILTRATION FEASIBILITY REPORT
Warner NH Retail Development
9 Rt. 103 West
July 17, 2020

TABLE OF CONTENTS

The project proposes one subsurface detention/infiltration system consisting of 4' x 4' x 4' concrete chambers set in rows which will be located between the two proposed buildings.

1. ***Location of Practice***
   The subsurface infiltration system is located in the center of the site between the two proposed buildings.

2. **Existing topography at the location of the practice.**

   The existing topography at the location of the proposed practice is flat. The area was previously filled and is covered with scrub shrubs and grass.

3. **Test pit locations**

   The area of the proposed infiltration practice is 6,000 square feet and 4 test pits were excavated within the location of the practice. These pits are identified as TP 5, TP 11, TP 12, and TP 13.

4. **Seasonal High Water table (SHWT) and bedrock elevations**

   The following data was collected on December 27, 2019:

   TP # 5: Existing Surface Elevation of TP 5 = 423.0'
   SHWT = 416.0'
   BEDROCK = not found
   Deepest Elevation of TP 5 = 415.0'

   The following data was collected on June 26, 2020:

   TP # 11: Existing Surface Elevation of TP 11 = 423.0'
   SHWT = 415.5'
   BEDROCK = not found
   Deepest Elevation of TP 11 = 413.0'

   TP # 12: Existing Surface Elevation of TP 12 = 422.5'
   SHWT = 414.5'
   BEDROCK = not found
   Deepest Elevation of TP 11 = 412.5'

   TP # 13: Existing Surface Elevation of TP 13 = 423.0'
   SHWT = 415.5'
   BEDROCK = not found
   Deepest Elevation of TP 11 = 415.5'

5. Profile Descriptions

TP # 5 :

0-75"	Fill	
75" – 96"	C layer	Gravely Sand 7.5Y 3/3

Redox @ 75"
No Refusal
No Weeping or Ponding

TP # 11:

0-38"	Fill layer 1	
38"–42"	Fill layer 2	
42"–44"	Buried pavement	
44"-5"	Fill – gravely sand	
50"-72"	Fill – Medium gray sand	
72"-90"	Buried A and B	
90"-120"	C layer	Course Sand 2.5y4/4

Redox @ 90"
Ponding @ 115"
No Refusal

TP # 12:

0-30"	Fill layer 1	
30"-80"	Fill Layer 2	
80"-96"	Buried A and B	
96"-120"	C layer	Gravely Sand 10yr 2/2

Redox @ 96"
No Ponding
No Refusal

TP # 13:

0"-84" Fill		
84"-90"	Buried A and B	
90"-120"	C Layer	Course Sand 2.5y4/4

Redox @ 90"
No Ponding
No Refusal

Conductivity testing performed at 90'

6. Soil Plan in the proposed practice

The plan below shows the location of the proposed buried infiltration/ detention area as being located within a soil area identified as 299A Udorthents (smooth) which is an area that has been filled.

7. Summary of Data used to determine infiltration rate

Soil testing revels the presence of fill to a depth of approximately 8 feet within the proposed area of infiltration. An in-place Guelph Permeameter Test was attempted on 2 occasions at the bottom elevation of the proposed infiltration practice. On both occasions the test was aborted due to saturated soils due to recent rain events.

On June 26, 2020 additional test pits were performed in the area of the infiltration practice in 3 locations. Soil samples of the buried C layer was taken at each test location and an in-place Guelph Permeameter Test was performed in TP 13 in the buried C layer material.

The test pits show that the fill material was placed over the old A and B layers and in one instance over an old paved driveway which was probably part of the previous homestead which occupied the premises.

Based upon the test pit data the design includes the removal of the fill, old A and B layers to expose the original C horizon which consists of sand and gravel. This engineer surmises that the original soil classification of the location was probably Rumney based upon the rapid infiltration rates obtained in the field and lab testing that was performed.

Field permeability tests indicate the permeability of the soil to be 10.9 inches per hour. Lab tests resulted with permeabilities of between 4.3 and 68.02 In/Hr.

To insure that the infiltration area works as designed the existing fill material will be removed and replaced with imported sand fill. This imported fill will require testing to verify that its permeability is at least as fast as the rate used in the hydraulic calculations. Because the permeability of fill can be variable and depends upon where it is purchased and how it is placed, the most conservative value of 0.5 inches per hour has been used in the drainage design. In all likelihood the permeability of the soil placed during construction will be higher, but the result of having more infiltration will be a benefit to the groundwater system in the area.

Attachments:

GSI Field Report dated 4/30/2020
GSI Field Report dated 5/22/20
GSI Field Testing Report dated June 26, 2020
GSI Lab Testing Report dated July 6, 2020

GEOTECHNICAL SERVICES INC.

Geotechnical Engineering · Environmental Studies · Materials Testing · Construction Monitoring

GSI FIELD REPORT

PROJECT: Route 103 Commercial Development	**PROJECT NO.:** 220115
LOCATION: Warner, NH	**WEATHER:** Rain 50
INSPECTION DATE: 4/30/2020	**CONTRACTOR:** Ranger Engineering Group
CLIENT: Channel Building Co.	**SITE CONTRACTOR:** GSI
SITE CONTACT: Ben Osgood	**FIELD REPRESENTATIVE:** Charles Wetherbee
EQUIPMENT OPERATING: N/A	

DESCRIPTION OF TODAY'S WORK: A GSI Representative arrived onsite to perform Guelph Permeameter Tests in various locations. Upon arrival, the test spots were submerged in water and completely saturated, not allowing testing to be done. GSI will return at a later date to perform the tests once the test areas have less water.

APPLICABLE SPECIFICATIONS:

REPORT PREPARED BY: Charles Wetherbee

55 North Stark Highway Weare NH · 603/529/7766 · FAX 603/529/7080

30 Newbury Street, Boston, MA · 617/861/2617

GSI GEOTECHNICAL SERVICES INC.

Geotechnical Engineering · Environmental Studies · Materials Testing · Construction Monitoring

GSI FIELD REPORT

PROJECT: Route 103 Commercial Development	**PROJECT NO.:** 220115
LOCATION: Warner, NH	**WEATHER:** Sunny 80
INSPECTION DATE: 5/22/2020	**CONTRACTOR:** Ranger Engineering Group
CLIENT: Channel Building Co.	**SITE CONTRACTOR:** GSI
SITE CONTACT: Ben Osgood	**FIELD REPRESENTATIVE:** Charles Wetherbee
EQUIPMENT OPERATING: N/A	

DESCRIPTION OF TODAY'S WORK:

A GSI representative arrived onsite to perform Guelph Permeameter testing in various locations as previously attempted on April 30, 2020. Tests were attempted in the different locations as previously identified, but the flow of water was exceptionally low and a reading was not able to taken after several minutes. A soil sample was taken and will be transported to GSI's test laboratory to determine the gradation of the soil.

APPLICABLE SPECIFICATIONS:

REPORT PREPARED BY: Charles Wetherbee

55 North Stark Highway Weare NH · 603/529/7766 · FAX 603/529/7080

30 Newbury Street, Boston, MA · 617/861/2617

GSI GEOTECHNICAL SERVICES INC.
Geotechnical Engineering Environmental Studies Materials Testing Construction Monitoring

June 26, 2020

Mr. Jeff Hernon
Channel Building Company, Inc
355 Middlesex Avenue, Suite 7
Wilmington, MA 01887-2163

RE: Guelph Permeameter Testing
Route 103 Development
New Hampshire Route 103
Warner, New Hampshire **GSI Project No. 220115**

Dear Mr. Hernon,

Geotechnical Services, Inc. (GSI) submits this letter report in connection with the June 26, 2020 site visit by GSI to conduct Guelph Permeameter testing at the project site located in Warner, New Hampshire.

GUELPH PERMEAMETER TEST

To evaluate the potential in-situ permeability of the existing soils in the area of the proposed infiltration basins, the Guelph Permeameter test was employed in accordance with the NHDES Stormwater Manual Volume Two. The Guelph Permeameter is a constant head permeameter that utilizes a siphon principle to measure in-situ hydraulic conductivity. The purpose of this investigation was to evaluate the saturated hydraulic conductivity or K_{fs} of the infiltrating soils.

SOIL CONDITIONS AND GUELPH PERMEAMETER TESTING

Three test pits (TP-11, TP-12, TP-13) were excavated on site, with a Guelph Test performed on the third one (TP-13). The encountered soil at this location consisted mainly of gray/tan coarse to fine sand, some gravel, and trace silt. The Guelph permeameter method involves measuring the steady-state rate of water recharge into unsaturated soil from a 2" cylindrical hole, in which a constant head of water is maintained. Calculations can then be made to determine the saturated hydraulic conductivity.

The Guelph permeameter test procedure was conducted at this location within the prepared section of soil. The test consisted of one test at 10cm and one at 5cm to determine a statistical average for the rate of hydraulic conductivity based on differing head heights. Guelph permeameter testing was performed at a depth of approximately eight feet below existing surface. A summary of the average field test results is provided in the table below.

Location	Soil Classification	Ksat (in./hr.)	Meets Specification
TP-13	Gray/Tan C-F Sand, Some Gravel, Little Silt	**10.9**	**N/A**

The results of the testing were reported to the representative from Chanel Building Co. prior to leaving the site. Guelph permeameter field test results are attached. GSI appreciates the opportunity to be of service to you on this project. We trust that this letter report will be responsive to your needs at this time. If you have any questions or comments regarding this letter report, please feel free to call.

Very truly yours,

GEOTECHNICAL SERVICES, INC.

Alfred Osborne
Staff Engineer

Harry Wetherbee, P.E.
Principal Engineer

Attachments:
Guelph Permeameter Test Results

Guelph Permeameter Worksheet

Project: Route 103 Development
Project #: 220115
Location: Warner, NH
Engineer: Charles Wetherbee
Soil Conditions: Tan/Gray C-F Sand Some Gravel, Little Silt

Test Date: 6/26/2020
Location: Warner, NH
Depth: 8ft
Reservoir: N/A
Reservoir Constant (X): 35.41

Well Head Height = 5cm

Reading Number	Time (m)	Time Interval (m)	Water Level (cm)	W Level Change (cm)	Rate of Water Level Change (cm/min)
1	0.00	0.00	3.6	-	-
2	0.50	0.50	6.4	2.8	5.60
3	1.00	0.50	8.7	2.3	4.60
4	1.50	0.50	11.0	2.3	4.60
5	2.00	0.50	13.5	2.5	5.00
6	2.50	0.50	15.8	2.3	4.60
7	3.00	0.50	18.4	2.6	5.20
8					
9					
10					

Rate of Water Level Change/60 = R1
R1 = 0.080 cm/sec

Well Head Height = 10cm

Reading Number	Time (m)	Time Interval (m)	Water Level (cm)	W Level Change (cm)	Rate of Water Level Change (cm/min)
1	0.00	0.00	28.0	-	-
2	0.25	0.25	31.2	3.2	12.80
3	0.50	0.25	33.6	2.4	9.60
4	0.75	0.25	36.4	2.8	11.20
5	1.00	0.25	38.8	2.4	9.60
6	1.25	0.25	40.8	2.0	8.00
7	1.50	0.25	43.6	2.8	11.20
8	1.75	0.25	45.8	2.2	8.80
9	2.00	0.25	47.8	2.0	8.00
10	2.25	0.25	50.2	2.4	9.60

Rate of Water Level Change/60 = R2
R2 = 0.158 cm/sec

Field Saturated Conductivity:

Ksat (cm/sec) = (.0041*X*R_2) - (.0054*X*R_1)= 7.69E-03 cm/sec

Ksat (in/hr) = (5.811*X*R_2) - (7.654*X* R_1) = 10.9 in/hour

G S I GEOTECHNICAL SERVICES, INC.

Geotechnical Engineering · Environmental Studies · Material Testing · Construction Monitoring

CONSTANT HEAD PERMEABILITY TEST DATA SUMMARY

Project: Route 103 Development
Project No.: 220115 **Tested By:** K.Maser **Date tested:** 7/2/2020
Sample No.: L-239-20 **Sampled By:** C.Wetherbee **Date Sampled:** 6/26/2020
Elevation: N/A **Plotted By:** A.Osborne **Date Plotted:** 7/6/2020
Location: TP-11 **Checked By:** H. Wetherbee
Source: On-Site
Soil Description: coarse to fine SAND, little Gravel, trace Silt
REMARKS:

SAMPLE DIAMETER:	6.37 cm	**SAMPLE LENGTH:**	6.75 cm
SAMPLE AREA:	31.9 cm^2	**VOLUME:**	215.3 cm^3
MASS OF SOIL:	414.93 gm	**ORIG. MOISTURE:**	4.3 %
DRY DENSITY:	115.2 pcf	**AREA STANDPIPE:**	1.77 cm^2
MAX. DRY DENSITY:	124.9 pcf		

Percent of Max. Dry Density: 92%

TEST No.	Q (cm^3)	TIME (s)	HEAD (cm)	TEMP. (C)
1	17	60.00	18	20
2	16	60.00	18	20
3	16	60.00	18	20
4	17	60.00	18	20
5	14	60.00	18	20
6	13	60.00	18	20
AVERAGE	15.5	60.00	18.0	20.0

CORRECTION FACTOR = $\alpha = \eta_T / \eta_{20} =$ 1

COEFFICIENT OF PERMEABILITY = $K_T = \frac{Q\,L}{A\,h\,t} =$ 3.04E-03 cm/s

CORRECTED COEFFICIENT = $K_{20} = \alpha\, K_T =$ 3.04E-03 cm/s

K_{sat} (in/hr) = 4.30 in./hr.

G S I GEOTECHNICAL SERVICES, INC.

Geotechnical Engineering · Environmental Studies · Material Testing · Construction Monitoring

CONSTANT HEAD PERMEABILITY TEST DATA SUMMARY

Project:	Route 103 Development				
Project No.:	220115	**Tested By:**	K.Maser	**Date tested:**	7/2/2020
Sample No.:	L-240-20	**Sampled By:**	C.Wetherbee	**Date Sampled:**	6/26/2020
Elevation:	N/A	**Plotted By:**	A.Osborne	**Date Plotted:**	7/6/2020
Location:	TP-12	**Checked By:**	H. Wetherbee		
Source:	On-Site				
Soil Description:	Gravel, some coarse to medium SAND, trace Silt				
REMARKS:					

SAMPLE DIAMETER:	6.37 cm	**SAMPLE LENGTH:**	6.75 cm
SAMPLE AREA:	31.9 cm^2	**VOLUME:**	215.3 cm^3
MASS OF SOIL:	417.46 gm	**ORIG. MOISTURE:**	1.0 %
DRY DENSITY:	119.8 pcf	**AREA STANDPIPE:**	1.77 cm^2
MAX. DRY DENSITY:	131.7 pcf		

Percent of Max. Dry Density: **91%**

TEST No.	Q (cm^3)	TIME (s)	HEAD (cm)	TEMP. (C)
1	47	30.00	17	20
2	50	30.00	17	20
3	48	30.00	17	20
4	48	30.00	17	20
5	47	30.00	17	20
6	48	30.00	17	20
AVERAGE	48.0	30.00	17.0	20.0

CORRECTION FACTOR = $\alpha = \eta_T / \eta_{20}$ = 1

COEFFICIENT OF PERMEABILITY = $K_T = \frac{Q\,L}{A\,h\,t}$ = 1.99E-02 cm/s

CORRECTED COEFFICIENT = $K_{20} = \alpha\, K_T$ = 1.99E-02 cm/s

K_{sat} (in/hr) = 28.23 in./hr.

G S I GEOTECHNICAL SERVICES, INC.

Geotechnical Engineering · Environmental Studies · Material Testing · Construction Monitoring

CONSTANT HEAD PERMEABILITY TEST DATA SUMMARY

Project:	Route 103 Development				
Project No.:	220115	**Tested By:**	K.Maser	**Date tested:**	7/2/2020
Sample No.:	L-241-20	**Sampled By:**	C.Wetherbee	**Date Sampled:**	6/26/2020
Elevation:	N/A	**Plotted By:**	A.Osborne	**Date Plotted:**	7/6/2020
Location:	TP-13	**Checked By:**	H. Wetherbee		
Source:	On-Site				
Soil Description:	Gravel and coarse to medium SAND, trace Silt				
REMARKS:					

SAMPLE DIAMETER:	6.37 cm	**SAMPLE LENGTH:**	6.75 cm
SAMPLE AREA:	31.9 cm^2	**VOLUME:**	215.3 cm^3
MASS OF SOIL:	410.24 gm	**ORIG. MOISTURE:**	2.3 %
DRY DENSITY:	116.2 pcf	**AREA STANDPIPE:**	1.77 cm^2
MAX. DRY DENSITY:	129.1 pcf		

Percent of Max. Dry Density: 90%

TEST No.	Q (cm^3)	TIME (s)	HEAD (cm)	TEMP. (C)
1	120	30.00	17	20
2	122	30.00	17	20
3	122	30.00	17	20
4	114	30.00	17	20
5	112	30.00	17	20
6	104	30.00	17	20
AVERAGE	115.7	30.00	17.0	20.0

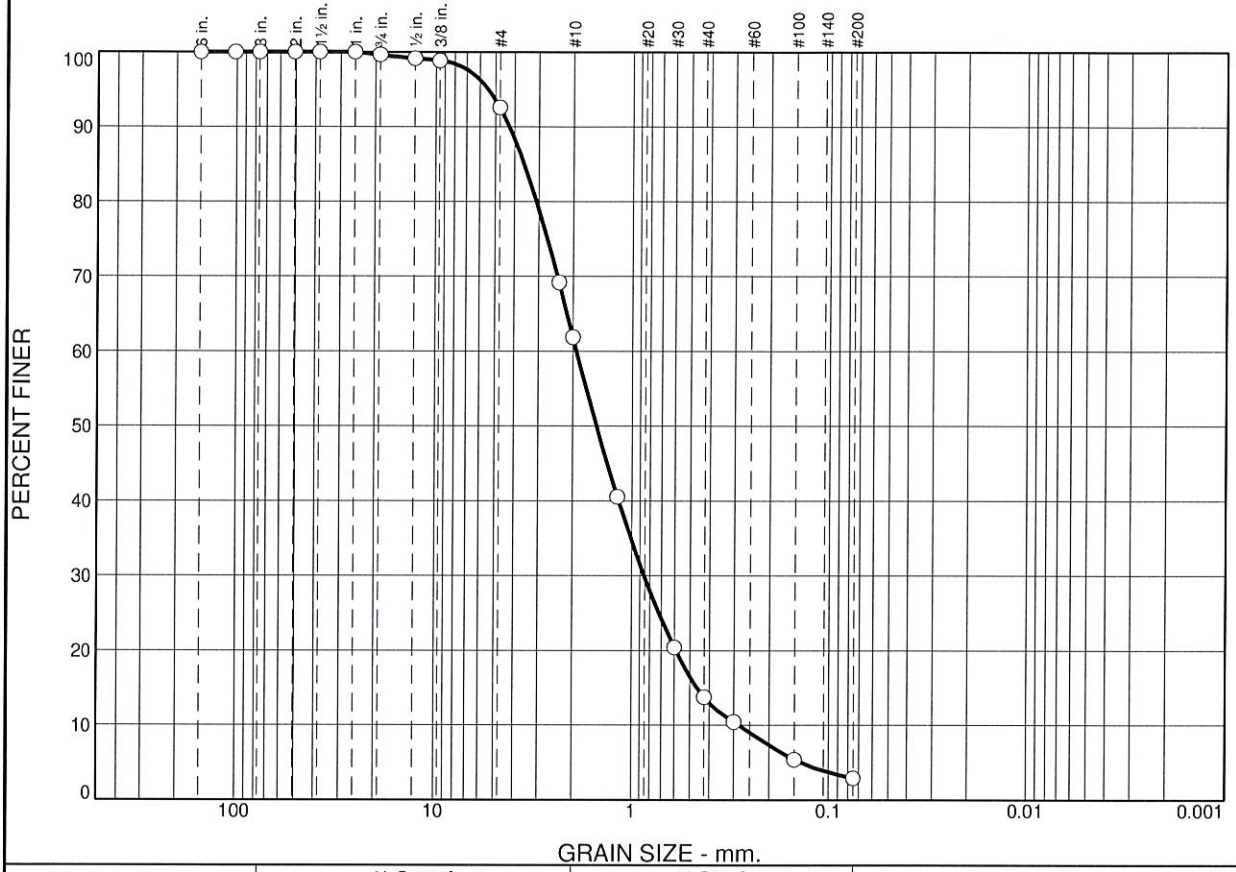
CORRECTION FACTOR = $\alpha = \eta_T / \eta_{20}$ = 1

COEFFICIENT OF PERMEABILITY = $K_T = \frac{Q\,L}{A\,h\,t}$ = 4.80E-02 cm/s

CORRECTED COEFFICIENT = $K_{20} = \alpha\, K_T$ = 4.80E-02 cm/s

K_{sat} (in/hr) = 68.02 in./hr.

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	1.2	36.9	41.5	11.4	6.1	2.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
4"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
0.75"	99.6		
0.5"	99.1		
0.375"	98.8		
#4	92.6		
#8	69.2		
#10	61.9		
#16	40.5		
#30	20.4		
#40	13.7		
#50	10.4		
#100	5.4		
#200	2.9		

* (no specification provided)

Material Description

coarse to fine SAND, little fine Gravel, trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 3.5675 D_{60}= 1.9171 D_{50}= 1.5116
D_{30}= 0.8582 D_{15}= 0.4610 D_{10}= 0.2845
C_u= 6.74 C_c= 1.35

Classification

USCS= SW AASHTO=

Remarks

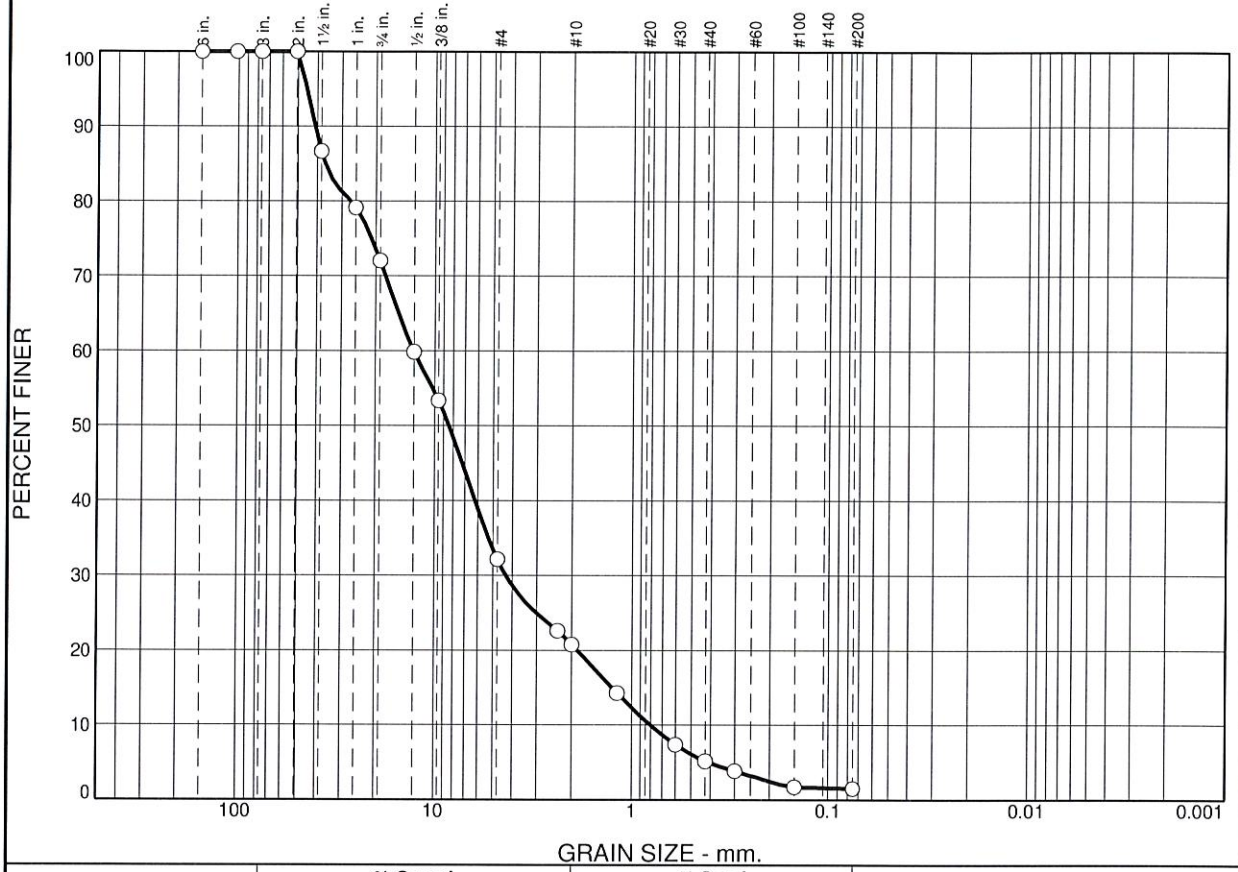
Sample No.: L-239-20 **Source of Sample:** On-Site Materials **Date:** 7/2/2020
Location: TP-11 **Elev./Depth:**

GEOTECHNICAL SERVICES, INC.

Weare, New Hampshire

Client: Channel Building Co.
Project: Route 103 Commercial Development
Warner, New Hampshire
Project No: 220115 **Figure**

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	20.9	25.8	32.6	13.3	4.2	1.7	1.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
4"	100.0		
3"	100.0		
2"	100.0		
1.5"	86.7		
1"	79.1		
0.75"	72.0		
0.5"	59.8		
0.375"	53.3		
#4	32.1		
#8	22.6		
#10	20.7		
#16	14.3		
#30	7.4		
#40	5.2		
#50	3.8		
#100	1.7		
#200	1.5		

* (no specification provided)

Material Description

coarse to fine GRAVEL some, coarse to med Sand, trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 36.3677 D_{60}= 12.7848 D_{50}= 8.4469
D_{30}= 4.3100 D_{15}= 1.2536 D_{10}= 0.8037
C_u= 15.91 C_c= 1.81

Classification

USCS= GW AASHTO=

Remarks

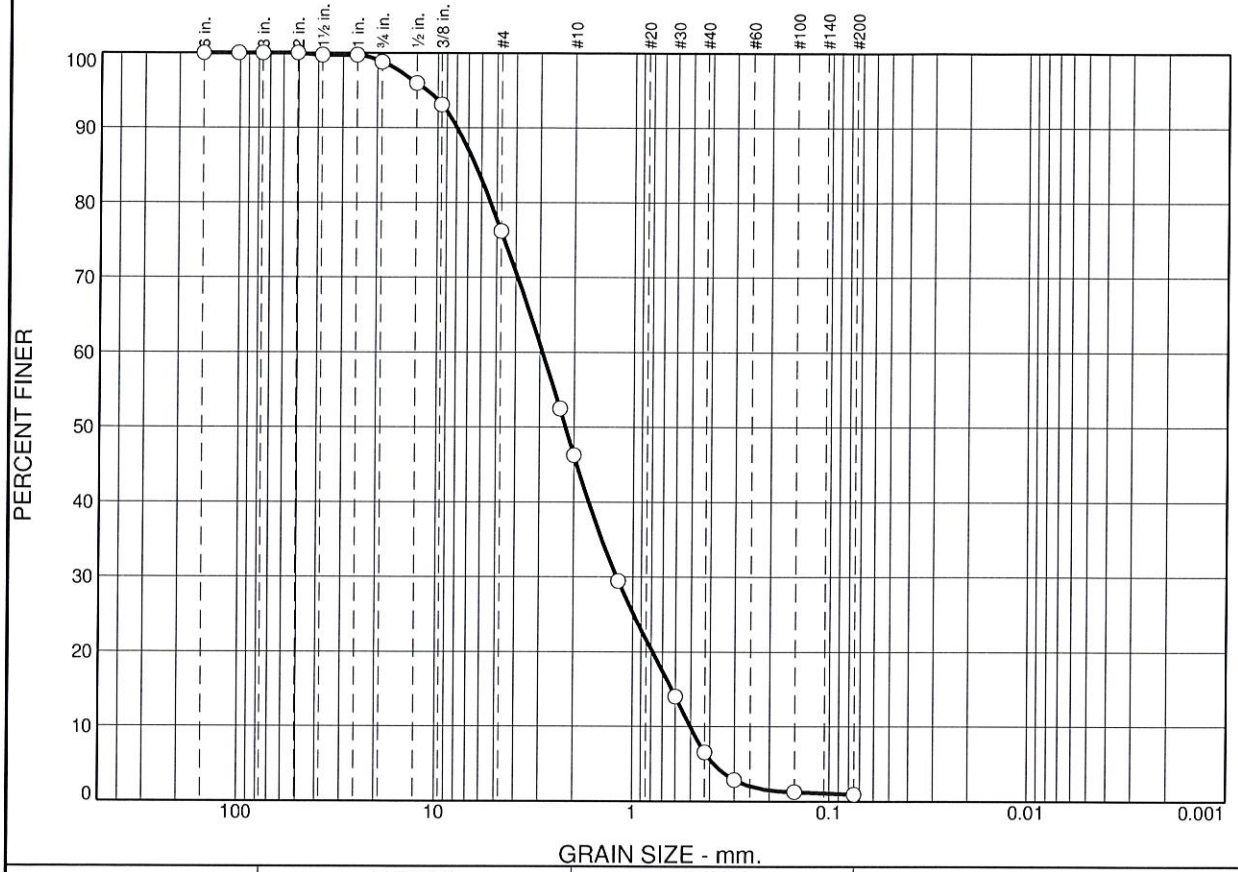
Sample No.: L-240-20 **Source of Sample:** On-Site Materials **Date:** 7/3/2020
Location: TP-12 **Elev./Depth:**

GEOTECHNICAL SERVICES, INC.

Weare, New Hampshire

Client: Channel Building Co.
Project: Route 103 Commercial Development
Warner, New Hampshire
Project No: 220115 **Figure**

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.3	6.6	46.8	32.3	12.0	1.1	0.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
4"	100.0		
3"	100.0		
2"	100.0		
1.5"	99.7		
1"	99.7		
0.75"	98.8		
0.5"	96.0		
0.375"	93.1		
#4	76.2		
#8	52.5		
#10	46.3		
#16	29.5		
#30	14.0		
#40	6.6		
#50	2.9		
#100	1.3		
#200	0.9		

* (no specification provided)

Material Description

med to fine GRAVEL and, coarse to med Sand, trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 6.4432 D_{60}= 2.9023 D_{50}= 2.2097
D_{30}= 1.2041 D_{15}= 0.6272 D_{10}= 0.5045
C_u= 5.75 C_c= 0.99

Classification

USCS= SP AASHTO=

Remarks

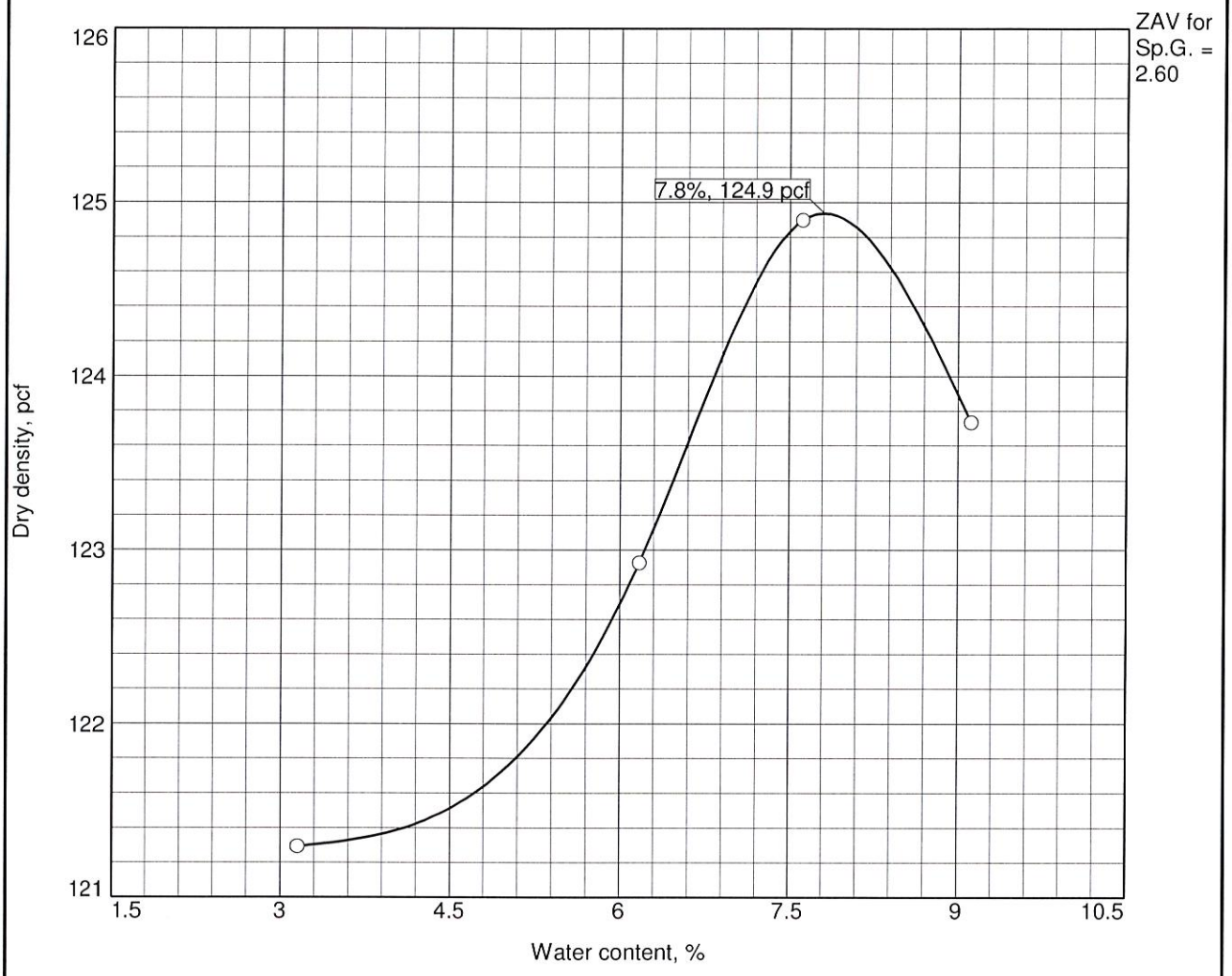
Sample No.: L-241-20 **Source of Sample:** On-Site Materials **Date:** 7/3/2020
Location: TP-13 **Elev./Depth:**

GEOTECHNICAL SERVICES, INC.

Weare, New Hampshire

Client: Channel Building Co.
Project: Route 103 Commercial Development
Warner, New Hampshire
Project No: 220115 **Figure**

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
	SW			2.60				2.9

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 124.9 pcf Optimum moisture = 7.8 %	coarse to fine SAND, little fine Gravel, trace Silt

Project No. 220115 **Client:** Channel Building Co.
Project: Route 103 Commercial Development
Warner, New Hampshire **Date:** 7/1/2020
○ **Location:** TP-11 **Sample Number:** L-239-20

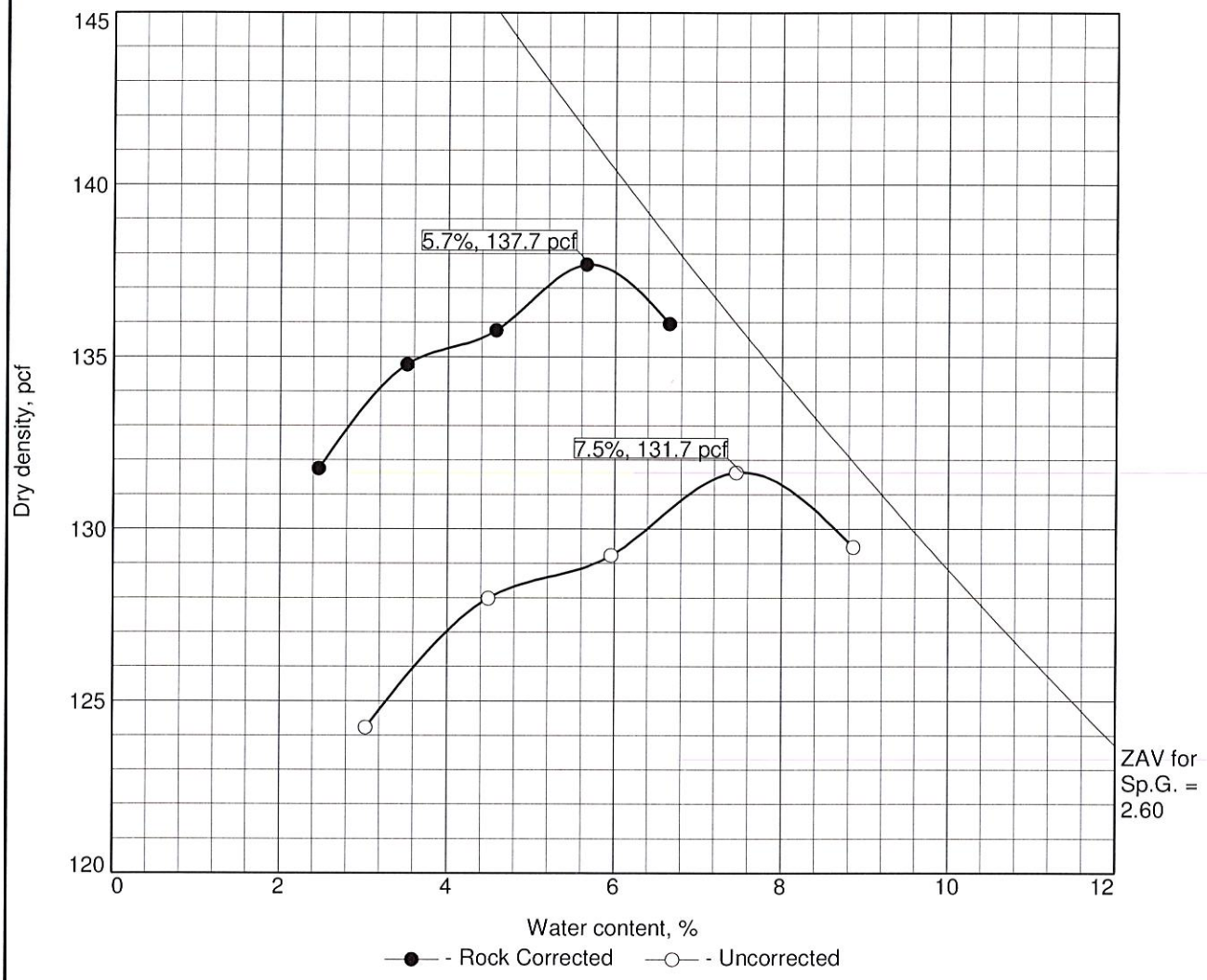
GEOTECHNICAL SERVICES, INC.
Weare, New Hampshire

Remarks:

Figure

Tested By: C.Burbank **Checked By:** A.Osborne

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method C Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
	GW			2.60			28	1.5

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 137.7 pcf	131.7 pcf	coarse to fine GRAVEL some, coarse to med Sand, trace Silt
Optimum moisture = 5.7 %	7.5 %	

Project No. 220115 **Client:** Channel Building Co.
Project: Route 103 Commercial Development
Warner, New Hampshire **Date:** 7/2/2020
○ **Location:** TP-12 **Sample Number:** L-240-20

GEOTECHNICAL SERVICES, INC.

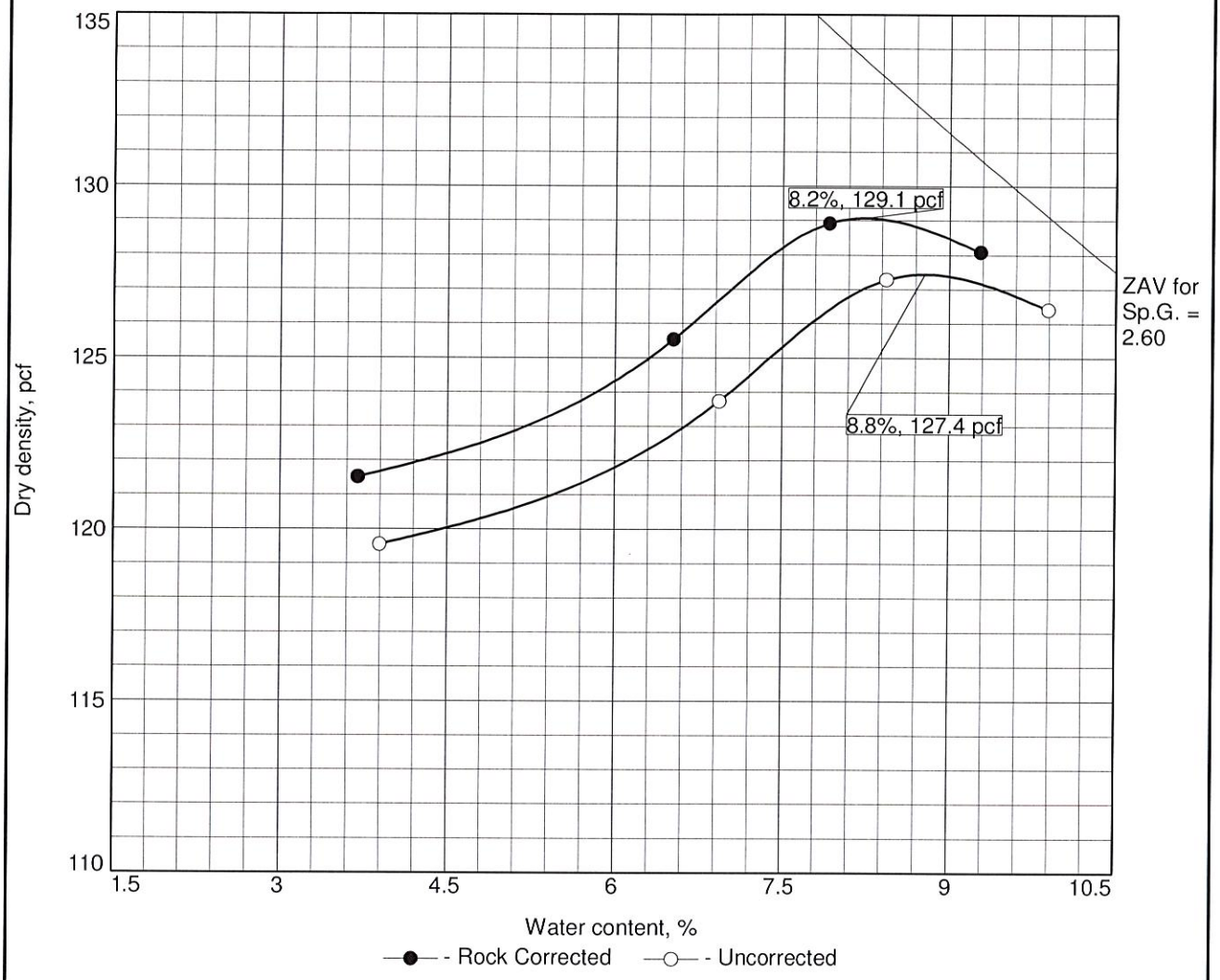
Weare, New Hampshire

Remarks:

Figure

Tested By: C.Burbank **Checked By:** A.Osborne

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
	SP			2.60			6.9	0.9

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 129.1 pcf	127.4 pcf	med to fine GRAVEL and, coarse to med Sand, trace Silt
Optimum moisture = 8.2 %	8.8 %	

Project No. 220115 **Client:** Channel Building Co.
Project: Route 103 Commercial Development
Warner, New Hampshire **Date:** 7/2/2020
○ **Location:** TP-13 **Sample Number:** L-241-20

GEOTECHNICAL SERVICES, INC.

Weare, New Hampshire

Remarks:

Figure

Tested By: C.Burbank **Checked By:** A.Osborne

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

REGISTRATION AND NOTIFICATION FORM FOR STORMWATER INFILTRATION TO GROUNDWATER (5H1)

Groundwater Discharge Program

RSA/Rule: RSA 485-A:6, VII; 485:3, X; Env-Wq 402

Applicant Information

Name: Commet LLC	Daytime Phone: 978-857-1891	
Mailing Address: 355 Middlesex Ave Suite 7		
City: Wilmington	State: MA	ZIP: 01887
Contact Person Name: Paul Kneeland	Email:	
Contact Person Phone Number: 978-857-1891	Fax Number:	

Facility Information

Name: Warner New Hampshire Retial Site		
Address: 9 Route 103 West		
City: Warner	State: NH	ZIP: 03278
Property Tax Map: 35	Lot Number: 4	
Latitude & Longitude of discharge point(s): 43.287713 -71.832438		

Facility Owner Information (complete only if different than applicant)

Owner Name: Same as applicant	Daytime Phone:	
Mailing Address:		
City/Town:	State:	ZIP:
Contact Person Name:	Email:	
Contact Person Phone Number:	Fax Number:	

Property Owner (complete only if different then Applicant)

Name: Same as Applicant	Daytime Phone:	
Mailing Address:		
City:	State:	ZIP:
Contact Person Name:	Email:	
Contact Person Phone Number:	Fax Number:	

Facility Operator's Information (complete only if different than applicant)

Facility Operator Name: Same as Applicant	Daytime Phone:	
Mailing Address:		
City:	State:	ZIP:

Complete this form if you are using a drywell or other subsurface infiltration structures to recharge stormwater to the ground or groundwater. If a completed Underground Injection Control (UIC) registration form was submitted to the Alteration of Terrain Bureau for this project, then one is not required to be sent directly to the Drinking Water and Groundwater Bureau (DWGB).

REGISTRATION AND NOTIFICATION FORM FOR STORMWATER INFILTRATION TO GROUNDWATER (attach additional sheets, as necessary, for responses to questions below)

Please provide a complete description of the facility including historic uses, any former contamination and/or ongoing remedial action at the site.
The property is currently undeveloped land which was previously used as farm land. The site has been raised with clean fill and no known contamination exists on site.

Please provide information concerning the location of the infiltration activity, include Locus map (i.e. USGS map).
The infiltration system will be located at the center of the site between the two proposed buildings. The system is designed as a burried chamber system.

Please describe the pretreatment system, if any, and capacity of the system.
Pretreatment will be provided by deep sump catch basins for approximately half of the site and a sand filter for the other half.

Please describe the materials and products used for the subsurface infiltration structure (i.e., pipe and stone leachfield, plastic chamber units, concrete drywell, etc.).
The subgrade infiltration system will be constructed with 4' x 4' x 4' concrete chambers set on a bed of crushed stone.

Please describe the disposal method and location. Include a site plan showing: the infiltration structure, any other on-site infiltration structures, dimensions, depth to groundwater (if known), adjacent septic system(s), and drinking water source(s).
There is only one infiltration system proposed for the site. (see plans attached)

Please provide information concerning methods and schedule for periodic inspection and/or maintenance.
Inspections will be conducted on a quarterly basis by a person experienced with drain system inspections. (see attached Long Term Maintenance Plan)

Applicant/Owner Certification Statement and Signature

By signing this application, the signer certifies that the information contained in or otherwise submitted with this application is true, complete and not misleading to the best of the signer's knowledge and belief.

By signing this application, the signer understands that submission of false, incomplete or misleading information is grounds for:

- **Denying the application;**
- **Revoking any application that is granted based on the information; and**
- **If the signer is acting as or on behalf of a listed engineer as defined in Env-C 502.10, debarring the listed engineer from the roster.**

By signing the application, the signer and applicant agree to comply with all applicable rules and conditions of this permit and to not discharge to the holding tank(s) until written permission from the department has been received.

Signature of Facility Owner or Contact **Date**

STORMWATER POLLUTION PREVENTION PLANS AND SYSTEM MAINTENANCE
9 ROUTE 103 WARNER, NH

Construction Period Erosion and Sedimentation Control Plan:

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

1. The contractor is to install and maintain drainage facilities as shown on site plan prepared by Ranger Engineering Group. (Ranger), dated May 6, 2020, revised to June 10, 2020.

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

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

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

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

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

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

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

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

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

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

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

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

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

15. Erosion and sedimentation control shall be in compliance with New Hampshire Stormwater Manual

Long-Term Pollution Prevention:

The owner/applicant is to be responsible for maintenance of all drainage structures in the project, including drain pipes. The future owner is expected to be Comet, LLC which is the current property owner. Comet will place a deed restriction on the property outlining the requirements for stormwater system maintenance at the development.

Regular maintenance is to include the following:

1. Inspection of all drainage facilities (pipes and infiltration basins) every three months. During these inspections, the inspector (a person qualified in drainage system inspections) shall look for evidence of the following: structural damage, silt accumulation (near inlet inverts on pipes), and improper function. A report on the system shall be delivered to the Property Owner, with a copy delivered to the Town Engineer.

2. The sand filter shall be inspected to verify proper filtration and condition of filter surface. Existing trash and debris shall be removed and the surface media replaced as required to maintain infiltration.

3. After inspection, if any of the above conditions exist, the inspector shall notify the Owner who shall immediately arrange for all necessary repairs and sediment removal.

4. All graded slopes shall be inspected every spring for erosion. Upon discovery of any failure (ie. erosion, sloughing, rutting), loam and seed shall be put in place and nurtured.

5. Catch basins and sediment forebays shall be cleaned annually or when sediment has accumulated to within 6" of the inlet or outlet inverts.

6. Grassed channel slopes shall be mowed at least monthly to maintain grass cover. Trash and debris shall be removed monthly.

7. Roadway surfaces shall be swept clean at least once per year, preferably in the spring just after snow melt.

STORMWATER MANAGEMENT SYSTEM
Post-Development Inspection & Maintenance Log

BMP/System Component	Maintenance Required & Frequency	Date of Inspection	Inspection Inspector	Cleaning/Repair Needed (list items/comments)	Date of Cleaning/ Repair	Cleaning/ Repair Performed by
Pavement Sweeping	• Swept clean as required (i.e. visual noticeable build-up). A minimum of once per year, preferably just after snow melt.					
Catch Basin Sumps/Drain Manholes/ Outlet Control Structure	• Inspect and clean annually for the evidence of structural damage, silt accumulation and improper function. • Remove accumulated sediments and debris from sump when sump is more than 25% full, minimum annually just after snow melt.					
Drain Pipes	• Inspect annually for the evidence of structural damage, silt accumulation and improper function.					

BMP/System Component	Maintenance Required & Frequency	Date of Inspection	Inspection Inspector	Cleaning/Repair Needed (list items/comments)	Date of Cleaning/ Repair	Cleaning/ Repair Performed by
	• Clean pipes when sediment occupies more than 20% of pipe diameter.					
Grassed Channels	• Inspect after every major storm during first three months of operation and annually thereafter for the evidence of structural damage, silt accumulation and improper function. • Mow the side slopes, remove trash and debris, grass clippings and accumulated organic dead `matter every six months.					
Buried Detention Structure	• Inspect quarterly for silt accumulation or structural damage.					

BMP/System Component	Maintenance Required & Frequency	Date of Inspection	Inspection Inspector	Cleaning/Repair Needed (list items/comments)	Date of Cleaning/ Repair	Cleaning/ Repair Performed by
Sand Filter	• Inspect Monthly for trash and debris • Clean silt accumulations annually or when silt is closer than 6" to outlet invert.					
Graded Slopes/ Rip-Rap	• Inspect every spring for erosion. Repair any erosion by placing rip-rap/ loam and seed in place and nurtured					