

DRAINAGE REPORT

Prepared for:

Michael and Marti Mulhern

93 Bagdad Road

Durham, NH 03824

Tax Map 10 Lot 8-6

Prepared on:

9 December, 2020

Revised on:

21 April, 2021



ENGINEERING, P.C.
CIVIL • STRUCTURAL • ENVIRONMENTAL

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- B Drainage Plan
- C Pre-development drainage analysis
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- E Cornell Extreme Precipitation Table
- F Ksat Table for Soils
- G Soils Report
- H Culvert analysis

#

1. Project background

Michael and Marti Mulhern, the owners, have proposed a new residential development on their property in Durham and Madbury, NH. The property is located at 91 Bagdad Road, Durham, NH and identified on Durham Tax Map 10 as Lot 8-6. The subject parcel is 16 acres and the development will impact 4.5 acres.

2. Methodology

The watershed areas have been determined via inspection by our office and a topographical survey. This analysis utilizes HydroCAD modeling software which models the runoff based on the SCS TR-20 method and the time of concentration based on the SCS TR-55 method. This analysis compares the runoff rates for the 1-inch, 2, 10, and 25-year NRCC D Type 24-hour extreme storm events. The rainfall data used in the model is referenced from the Cornell extreme precipitation rainfall table found in Appendix D of this report.

3. Soils

The soils on site consist of fine-grained marine sediments and some well drained glacial till, the Hydrologic Soil Groups determined to be predominantly C and D. The soils on site have been identified by Highland Soil Services in accordance with SSSNNE Standards for a High Intensity Soil Pap and offsite soils in this analysis have been identified in accordance with the NRCS Web Soil Survey. For more detailed information, please see the Appendix E and F.

4. Pre-development conditions

The enclosed Pre-Development portion of the Drainage Plan (Appendix 1) depicts the contributing runoff area of the property. The watershed areas have been determined via inspection by our office as well as a topographical survey. The watershed boundary only encompasses areas that are directly impacted by the development of the site.

The subject parcel is 15.9 acres. The property is mostly undeveloped, except for a walking path and a single-family home that is accessed by a shared driveway off Bagdad Road. The property slopes from Bagdad Road in the south down to the property line in the north. A narrow strip of property also extends to the east to N.H. Route 108. In the center of the property is a wetland that continues to the northern edge of the property.

Two unnamed tributaries run through the wetland in the center of the property and drain the majority of the parcel and discharge into Unnamed Tributary #1 (Unt1) in the northwest corner of the property. Prior to discharging, the two small tributaries combine, approximately at the location where the proposed crossing will be located. Approximately 20 acres drain into the central wetland area (2S)

Approximately 15 acres of the adjacent subdivision (1S), located west of the subject property, drains towards the northwest corner of the subject property. It is routed to a nearby wetland in the existing town right-of-way and routed downhill where it discharges into Unt1.

Multiple small catchment areas drain directly to the north of the property, when they discharge into Unt1 (Subcatchment 3S, 4S, and 5S). Subcatchment 7S (0.2 Acre) drains towards the eastern property line.

Two points of analysis have been selected for this site. The first (POA1) is located at the final discharge point of Unnamed Tributary #1 and the second (POA2) is located at the eastern property line, where subcatchment 6 discharges. The hydrologic analysis of the existing runoff conditions is provided in Appendix B.

5. Post-development conditions

The proposal includes the construction of 15 new residential units (7 single-family and 4 duplexes). A looped private access road will also be constructed to give access to the buildings. The road will start on the existing Gerrish Drive and connect to the cluster of houses. The road will have two wetland crossings.

The location of the POA used in the Pre-Development Analysis has been maintained for the Post-Development Analysis. The hydrologic evaluation of the proposed runoff conditions is provided in the enclosed 17-044 POST HydroCAD output (Appendix C). The subcatchment areas have changed to reflect the proposed grading of the site. The overall outer boundary has been maintained. The cover types are the same as in the Pre-Development.

Subcatchment 1 is the offsite drainage from the existing Gerrish subdivision which drains to the first wetland crossing. Subcatchment 8 is the additional offsite drainage from the existing Gerrish subdivision which drains to the north of the proposed road, meeting up with the drainage from Subcatchment 1 after the wetland crossing.

Subcatchment 2 is the area upgradient of the second wetland crossing. This includes the majority of the property south of the crossing, as well as some offsite area further upgradient. Subcatchments 3, 4 and 5 drain to the north and are relatively unchanged from the pre-development conditions. Subcatchment 6 drains towards the eastern property line. Subcatchment 7, 9 are the areas inside of the new loop. 7S is the catchment for the southern portion of the loop interior and 9S is the northern portion of the loop interior. Subcatchment 10 is the catchment area for the stormwater BMPs. Two points of analysis have been selected for this site. The first (POA1) is located at the final discharge point of Unnamed Tributary #1 and the second (POA2) is located at the eastern property line, where subcatchment 6 discharges. Subcatchment 11 is the proposed road in the R-O-W. The majority of this paved area is routed to a treatment swale before entering the existing wetlands.

The stormwater from the new development is mitigated using multiple BMP's. Due to the poor soils, a gravel wetland was selected as the main method of treating the runoff from this project. There are multiple sediment forebays and detention areas upstream of the gravel wetlands to improve sediment removal and give additional buffering of peak runoff flows during large storms.

6. Comparison of pre- and post-development conditions

The following tables quantify the peak rate of discharge and discharge volume leaving the parcel at POA 1 as shown on the Pre- and Post-Development Drainage Plan. The analysis has been modeled using the extreme rainfall quantities.

Table 1: Summary of peak flow at POA 1

Storm	Pre-Development (cfs)	Post-Development (cfs)	Difference
1-Inch	0.13	0.15	+0.02
2-Year (+15%)	38.75	36.01	-2.74
10-Year (+15%)	82.99	82.17	-0.82
25-Year (+15%)	120.67	120.57	-0.10

Table 2: Summary of discharge volume at POA 1

Storm	Pre-Development (cf)	Post-Development (cf)	Difference
1-Inch	4,846	5,272	+1,197
2-Year (+15%)	225,895	235,307	+9,412
10-Year (+15%)	466,928	481,393	+14,465
25-Year (+15%)	676,521	694,148	+17,627

The following tables quantify the peak rate of discharge and discharge volume leaving the parcel at POA 2 as shown on the Pre- and Post-Development Drainage Plan. The analysis has been modeled using the extreme rainfall quantities.

Table 3: Summary of peak flow at POA 2

Storm	Pre-Development (cfs)	Post-Development (cfs)	Difference
1-Inch	0.00	0.00	0.00
2-Year (+15%)	0.27	0.19	-0.08
10-Year (+15%)	0.75	0.43	-0.32
25-Year (+15%)	1.19	0.64	-0.55

Table 4: Summary of discharge volume at POA 2

Storm	Pre-Development (cf)	Post-Development (cf)	Difference
1-Inch	0	3	+3
2-Year (+15%)	1,006	634	-372
10-Year (+15%)	2,494	1,403	-1,091
25-Year (+15%)	3,887	2,090	-1,797

The peak rate of runoff is reduced or equal to the pre-development conditions during all the design storm events at POA 1 and 2, except a negligible increase at POA1 during the 1” storm event. The reduction in peak rate of discharge is attributed to storage in the detention basin and gravel wetlands which provides peak flow attenuation reduction. There is an increase in the runoff volume due to the limited infiltration capacity of the native soils. The spillway of the gravel wetland system has been designed for the 100-year storm (See Appendix C).

7. Stormwater treatment and pretreatment practices

Stormwater pre-treatment will be provided by sediment forebays. Stormwater treatment will be provided by a gravel wetland system.

8. Groundwater recharge

There are limited opportunities for infiltration due to the presence of fine-grained marine soils and a shallow ledge in many places. Due to this, drip edges will be installed near the proposed houses. The exact location and size of the drip strips will be determined in the field when earthworks are ongoing so that the most suitable areas are selected.

A factor of 0.25, 0.1 and 0.0 is applied to HSG B, C, and D soils, respectively that are replaced by impervious area. The required volume to be infiltrated for this project is as follows;

$$[9660 \text{ sf} \times 0.25 + 166 \text{ sf} \times 0.1] \frac{1'}{12"} = 203 \text{ cf}$$

9. Erosion & Sediment Control

Temporary and permanent practices are used to prevent and minimize erosion and sedimentation on site. The installation of Silt Sox at the perimeter of construction areas will provide sediment retention during the construction phase of the development. Erosion control matting is proposed on all spillways to prevent erosion prior to the establishment of permanent vegetation.

10. Conclusion

The enclosed comparative hydrologic model provides sufficient evidence that the stormwater design will mitigate the typical increase in peak rate of stormwater discharge resulting from the proposed development of the site. Stormwater treatment practices will provide treatment of runoff from proposed paved surfaces. The use of erosion and sediment controls and proper construction practices will minimize the impact of this project to downstream surface waters.

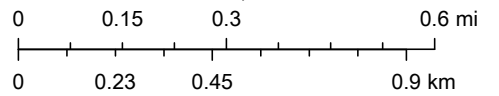
APPENDIX A

The National Map Advanced Viewer



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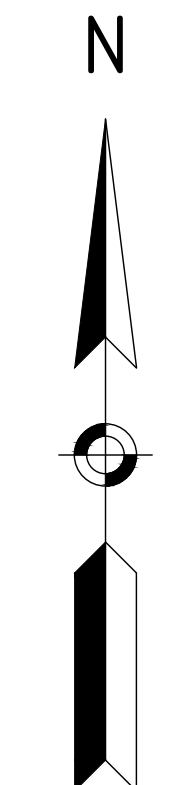
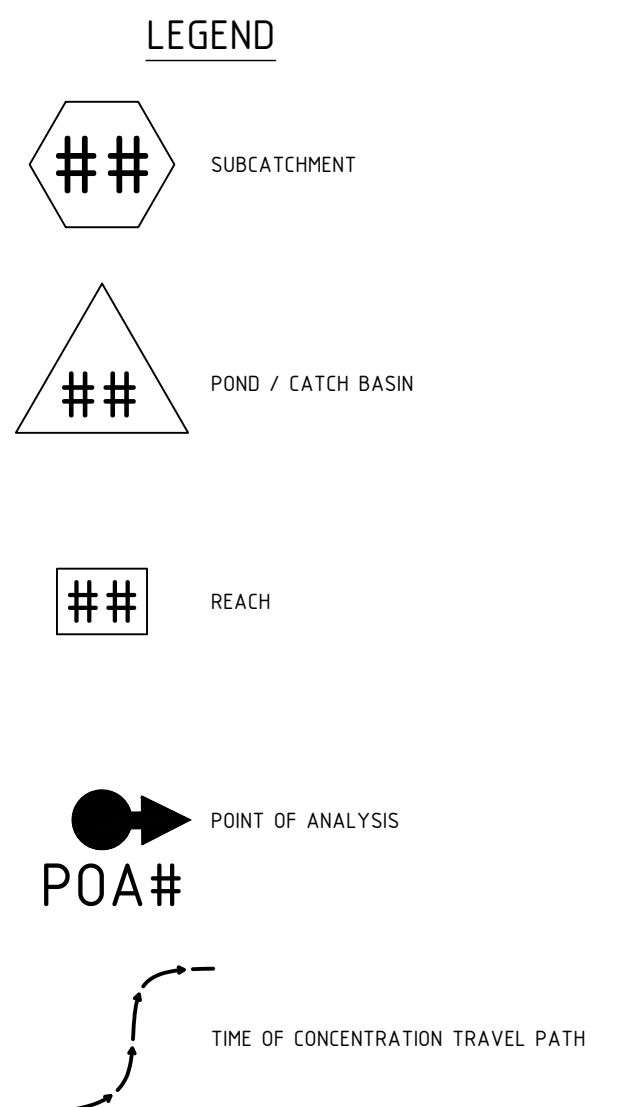
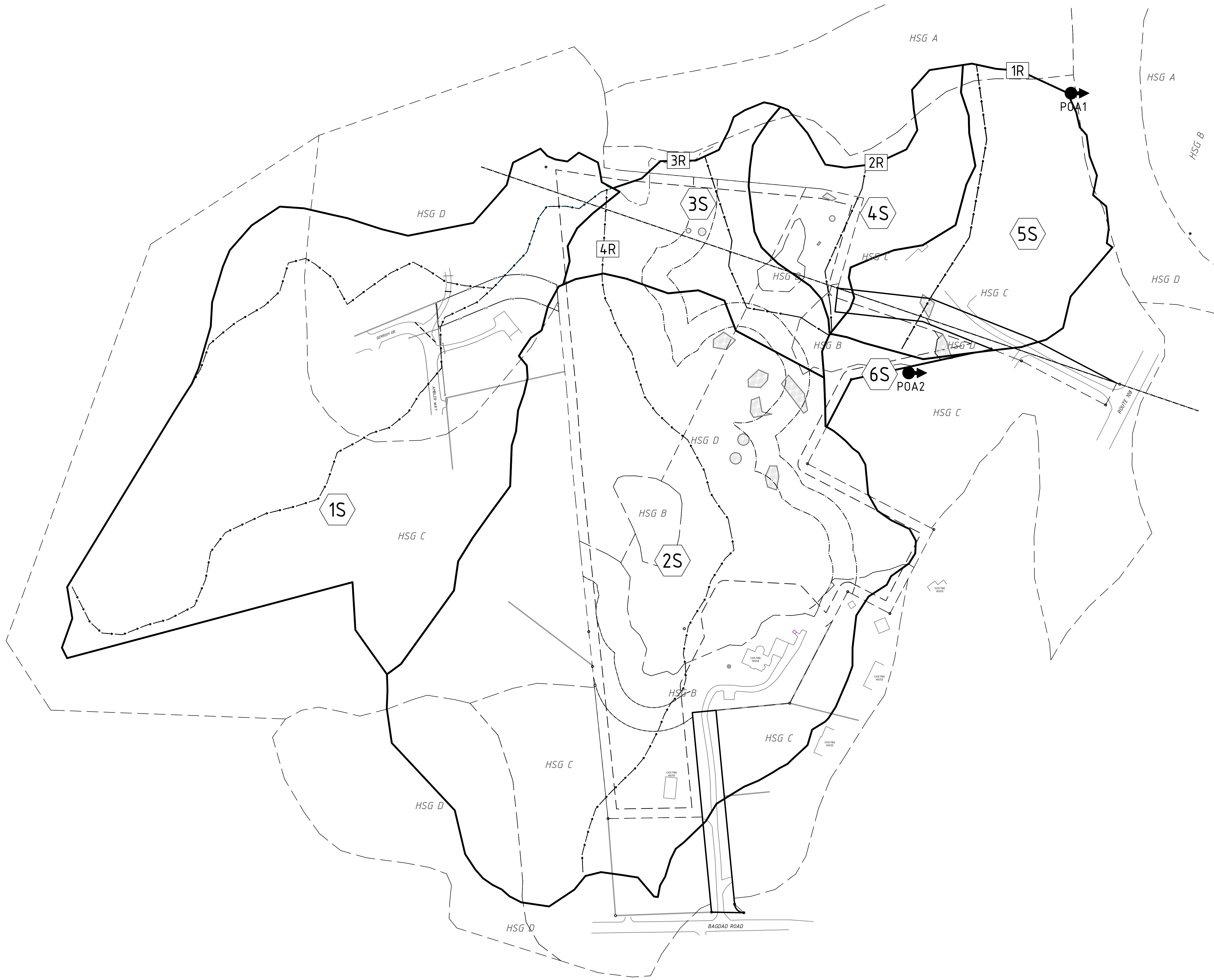
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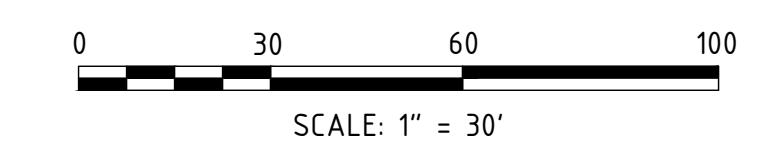
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APPENDIX B



FINAL APPROVAL BY DURHAM PLANNING BOARD.
 CERTIFIED BY MICHAEL BEHRENDT, TOWN PLANNER
 CERTIFIED _____
 DATE _____

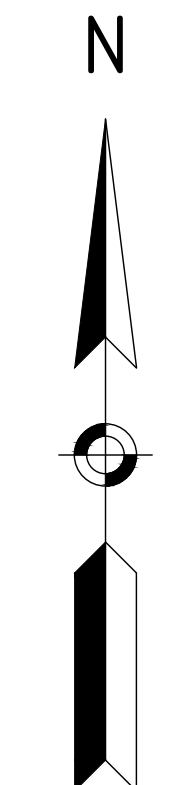


PRE-DEVELOPMENT CONDITIONS PLAN <i>prepared for</i> MULHERN TAX MAP 10, LOT 8-6 93 BAGDAD ROAD, DURHAM, NH 03824		DATE ISSUED: 10/28/20 SCALE: 1"=30' DESIGNED BY: MCS DRAWN BY: MCS APPROVED BY: MJS DWG FILE: 19063 CIVIL_Hydro.dwg	SEAL
<p>MJS ENGINEERING, P.C. CIVIL • STRUCTURAL • ENVIRONMENTAL 5 Railroad St., P.O. Box 359 Newmarket, NH 03857 Phone: (603) 659-4979 Fax: (603) 659-4427 E-mail: mjs@mjse-engineering.com</p>		1 REVISED DRAINAGE DESIGN 0 INITIAL SUBMISSION TO THE DURHAM PLANNING BOARD	NO. NO. NO. DATE INT. DATE INT. DATE INT.
JOB: 19-063		PRE	

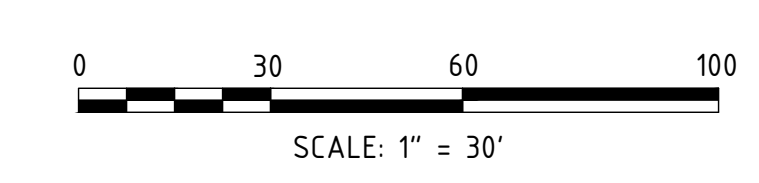


LEGEND

- ## SUBCATCHMENT
- ## POND / CATCH BASIN
- ## REACH
- POA# POINT OF ANALYSIS
- TIME OF CONCENTRATION TRAVEL PATH



FINAL APPROVAL BY DURHAM PLANNING BOARD.
 CERTIFIED BY MICHAEL BEHRENDT, TOWN PLANNER
 CERTIFIED _____
 DATE _____

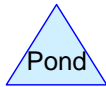
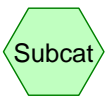
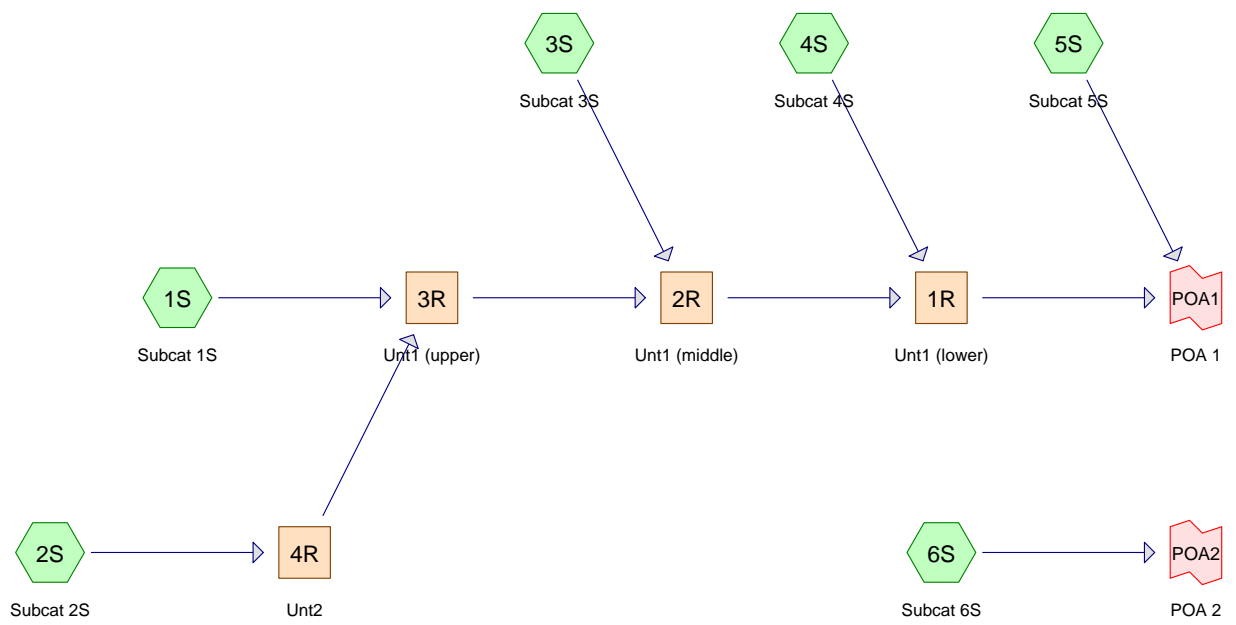


POST-DEVELOPMENT CONDITIONS PLAN <i>prepared for</i> MULHERN TAX MAP 10, LOT 8-6 93 BAGDAD ROAD, DURHAM, NH 03824		DATE ISSUED: 10/28/20 SCALE: 1"=30' DESIGNED BY: MCS DRAWN BY: MCS APPROVED BY: MJS DWG FILE: NH1919063_CIVIL01.dwg	SEAL	NO.	REVISIONS	DATE	INT.
				2	REVISED PER ENGINEERING REVIEW	4/20/21	MCS
				1	REVISED DRAINAGE DESIGN	2/11/21	MCS
				0	INITIAL SUBMISSION TO THE DURHAM PLANNING BOARD	12/9/20	MCS

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JOB: 19-063
POST

APPENDIX C



Routing Diagram for NM19063_Pre01
 Prepared by Horizons Engineering
 HydroCAD® 10.00-25 s/n 08064 © 2019 HydroCAD Software Solutions LLC

NM19063_Pre01

Prepared by Horizons Engineering

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
43,560	61	>75% Grass cover, Good, HSG B (2S)
300,780	74	>75% Grass cover, Good, HSG C (1S, 2S, 4S, 5S)
129,371	80	>75% Grass cover, Good, HSG D (1S, 2S, 5S)
14,033	98	Paved parking, HSG B (2S)
66,622	98	Paved parking, HSG C (1S, 2S, 5S)
31,313	98	Paved parking, HSG D (1S, 2S)
8,625	98	Roofs, HSG B (2S)
34,091	98	Roofs, HSG C (1S, 2S, 4S, 5S)
9,191	98	Roofs, HSG D (1S, 2S)
14,273	30	Woods, Good, HSG A (3S, 4S, 5S)
142,586	55	Woods, Good, HSG B (2S, 3S, 4S, 5S, 6S)
615,100	70	Woods, Good, HSG C (1S, 2S, 3S, 4S, 5S)
640,411	77	Woods, Good, HSG D (1S, 2S, 3S, 4S, 5S, 6S)
2,049,955	74	TOTAL AREA

NM19063_Pre01

Prepared by Horizons Engineering

HydroCAD® 10.00-25 s/n 08064 © 2019 HydroCAD Software Solutions LLC

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
14,273	HSG A	3S, 4S, 5S
208,804	HSG B	2S, 3S, 4S, 5S, 6S
1,016,593	HSG C	1S, 2S, 3S, 4S, 5S
810,286	HSG D	1S, 2S, 3S, 4S, 5S, 6S
0	Other	
2,049,955		TOTAL AREA

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points x 2
 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 1S: Subcat 1S	Runoff Area=665,784 sf 15.75% Impervious Runoff Depth=0.06" Flow Length=1,020' Tc=16.5 min CN=78 Runoff=0.14 cfs 3,237 cf
Subcatchment 2S: Subcat 2S	Runoff Area=910,846 sf 5.15% Impervious Runoff Depth=0.02" Flow Length=1,517' Tc=24.9 min CN=73 Runoff=0.04 cfs 1,299 cf
Subcatchment 3S: Subcat 3S	Runoff Area=129,283 sf 0.00% Impervious Runoff Depth=0.02" Flow Length=450' Tc=13.6 min CN=73 Runoff=0.01 cfs 184 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.958 ac 2.26% Impervious Runoff Depth=0.00" Flow Length=350' Tc=7.1 min CN=70 Runoff=0.00 cfs 49 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.576 ac 4.62% Impervious Runoff Depth=0.00" Flow Length=600' Tc=16.2 min CN=70 Runoff=0.00 cfs 77 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.364 ac 0.00% Impervious Runoff Depth=0.00" Tc=6.0 min CN=64 Runoff=0.00 cfs 0 cf
Reach 1R: Unt1 (lower)	Avg. Flow Depth=0.01' Max Vel=0.92 fps Inflow=0.13 cfs 4,770 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=0.13 cfs 4,770 cf
Reach 2R: Unt1 (middle)	Avg. Flow Depth=0.01' Max Vel=0.91 fps Inflow=0.13 cfs 4,720 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=0.13 cfs 4,720 cf
Reach 3R: Unt1 (upper)	Avg. Flow Depth=0.01' Max Vel=1.03 fps Inflow=0.14 cfs 4,536 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=0.13 cfs 4,536 cf
Reach 4R: Unt2	Avg. Flow Depth=0.04' Max Vel=1.19 fps Inflow=0.04 cfs 1,299 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=0.04 cfs 1,299 cf
Link POA1: POA 1	Inflow=0.13 cfs 4,846 cf Primary=0.13 cfs 4,846 cf
Link POA2: POA 2	Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf
Total Runoff Area = 2,049,955 sf Runoff Volume = 4,846 cf Average Runoff Depth = 0.03"	
92.01% Pervious = 1,886,080 sf 7.99% Impervious = 163,875 sf	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points x 2
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 1S: Subcat 1S Runoff Area=665,784 sf 15.75% Impervious Runoff Depth=1.58"
Flow Length=1,020' Tc=16.5 min CN=78 Runoff=18.55 cfs 87,743 cf

Subcatchment 2S: Subcat 2S Runoff Area=910,846 sf 5.15% Impervious Runoff Depth=1.25"
Flow Length=1,517' Tc=24.9 min CN=73 Runoff=15.94 cfs 95,196 cf

Subcatchment 3S: Subcat 3S Runoff Area=129,283 sf 0.00% Impervious Runoff Depth=1.25"
Flow Length=450' Tc=13.6 min CN=73 Runoff=3.02 cfs 13,512 cf

Subcatchment 4S: Subcat 4S Runoff Area=2.958 ac 2.26% Impervious Runoff Depth=1.08"
Flow Length=350' Tc=7.1 min CN=70 Runoff=3.25 cfs 11,561 cf

Subcatchment 5S: Subcat 5S Runoff Area=4.576 ac 4.62% Impervious Runoff Depth=1.08"
Flow Length=600' Tc=16.2 min CN=70 Runoff=3.59 cfs 17,884 cf

Subcatchment 6S: Subcat 6S Runoff Area=0.364 ac 0.00% Impervious Runoff Depth=0.76"
Tc=6.0 min CN=64 Runoff=0.27 cfs 1,006 cf

Reach 1R: Unt1 (lower) Avg. Flow Depth=0.53' Max Vel=5.74 fps Inflow=35.77 cfs 208,011 cf
n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=35.57 cfs 208,011 cf

Reach 2R: Unt1 (middle) Avg. Flow Depth=0.53' Max Vel=5.65 fps Inflow=34.70 cfs 196,450 cf
n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=34.50 cfs 196,450 cf

Reach 3R: Unt1 (upper) Avg. Flow Depth=0.47' Max Vel=5.98 fps Inflow=32.32 cfs 182,938 cf
n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=32.22 cfs 182,938 cf

Reach 4R: Unt2 Avg. Flow Depth=0.60' Max Vel=7.32 fps Inflow=15.94 cfs 95,196 cf
n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=15.92 cfs 95,196 cf

Link POA1: POA 1 Inflow=38.75 cfs 225,895 cf
Primary=38.75 cfs 225,895 cf

Link POA2: POA 2 Inflow=0.27 cfs 1,006 cf
Primary=0.27 cfs 1,006 cf

Total Runoff Area = 2,049,955 sf Runoff Volume = 226,902 cf Average Runoff Depth = 1.33"
92.01% Pervious = 1,886,080 sf 7.99% Impervious = 163,875 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points x 2
 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 1S: Subcat 1S	Runoff Area=665,784 sf 15.75% Impervious Runoff Depth=3.11" Flow Length=1,020' Tc=16.5 min CN=78 Runoff=36.75 cfs 172,346 cf
Subcatchment 2S: Subcat 2S	Runoff Area=910,846 sf 5.15% Impervious Runoff Depth=2.65" Flow Length=1,517' Tc=24.9 min CN=73 Runoff=34.95 cfs 200,883 cf
Subcatchment 3S: Subcat 3S	Runoff Area=129,283 sf 0.00% Impervious Runoff Depth=2.65" Flow Length=450' Tc=13.6 min CN=73 Runoff=6.59 cfs 28,513 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.958 ac 2.26% Impervious Runoff Depth=2.38" Flow Length=350' Tc=7.1 min CN=70 Runoff=7.52 cfs 25,594 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.576 ac 4.62% Impervious Runoff Depth=2.38" Flow Length=600' Tc=16.2 min CN=70 Runoff=8.42 cfs 39,593 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.364 ac 0.00% Impervious Runoff Depth=1.89" Tc=6.0 min CN=64 Runoff=0.75 cfs 2,494 cf
Reach 1R: Unt1 (lower)	Avg. Flow Depth=0.82' Max Vel=7.37 fps Inflow=75.58 cfs 427,335 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=75.33 cfs 427,335 cf
Reach 2R: Unt1 (middle)	Avg. Flow Depth=0.81' Max Vel=7.23 fps Inflow=72.93 cfs 401,742 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=72.66 cfs 401,742 cf
Reach 3R: Unt1 (upper)	Avg. Flow Depth=0.72' Max Vel=7.67 fps Inflow=67.58 cfs 373,229 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=67.48 cfs 373,229 cf
Reach 4R: Unt2	Avg. Flow Depth=0.86' Max Vel=9.27 fps Inflow=34.95 cfs 200,883 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=34.94 cfs 200,883 cf
Link POA1: POA 1	Inflow=82.99 cfs 466,928 cf Primary=82.99 cfs 466,928 cf
Link POA2: POA 2	Inflow=0.75 cfs 2,494 cf Primary=0.75 cfs 2,494 cf
Total Runoff Area = 2,049,955 sf Runoff Volume = 469,422 cf Average Runoff Depth = 2.75"	
92.01% Pervious = 1,886,080 sf 7.99% Impervious = 163,875 sf	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points x 2
 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 1S: Subcat 1S Runoff Area=665,784 sf 15.75% Impervious Runoff Depth=4.40"
 Flow Length=1,020' Tc=16.5 min CN=78 Runoff=51.79 cfs 244,249 cf

Subcatchment 2S: Subcat 2S Runoff Area=910,846 sf 5.15% Impervious Runoff Depth=3.87"
 Flow Length=1,517' Tc=24.9 min CN=73 Runoff=51.25 cfs 293,475 cf

Subcatchment 3S: Subcat 3S Runoff Area=129,283 sf 0.00% Impervious Runoff Depth=3.87"
 Flow Length=450' Tc=13.6 min CN=73 Runoff=9.64 cfs 41,655 cf

Subcatchment 4S: Subcat 4S Runoff Area=2.958 ac 2.26% Impervious Runoff Depth=3.55"
 Flow Length=350' Tc=7.1 min CN=70 Runoff=11.24 cfs 38,140 cf

Subcatchment 5S: Subcat 5S Runoff Area=4.576 ac 4.62% Impervious Runoff Depth=3.55"
 Flow Length=600' Tc=16.2 min CN=70 Runoff=12.65 cfs 59,002 cf

Subcatchment 6S: Subcat 6S Runoff Area=0.364 ac 0.00% Impervious Runoff Depth=2.94"
 Tc=6.0 min CN=64 Runoff=1.19 cfs 3,887 cf

Reach 1R: Unt1 (lower) Avg. Flow Depth=1.01' Max Vel=8.29 fps Inflow=109.32 cfs 617,519 cf
 n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=109.02 cfs 617,519 cf

Reach 2R: Unt1 (middle) Avg. Flow Depth=0.99' Max Vel=8.13 fps Inflow=105.24 cfs 579,379 cf
 n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=104.93 cfs 579,379 cf

Reach 3R: Unt1 (upper) Avg. Flow Depth=0.89' Max Vel=8.64 fps Inflow=97.34 cfs 537,724 cf
 n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=97.23 cfs 537,724 cf

Reach 4R: Unt2 Avg. Flow Depth=1.03' Max Vel=10.39 fps Inflow=51.25 cfs 293,475 cf
 n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=51.22 cfs 293,475 cf

Link POA1: POA 1 Inflow=120.67 cfs 676,521 cf
 Primary=120.67 cfs 676,521 cf

Link POA2: POA 2 Inflow=1.19 cfs 3,887 cf
 Primary=1.19 cfs 3,887 cf

Total Runoff Area = 2,049,955 sf Runoff Volume = 680,407 cf Average Runoff Depth = 3.98"
92.01% Pervious = 1,886,080 sf 7.99% Impervious = 163,875 sf

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points x 2
 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 1S: Subcat 1S	Runoff Area=665,784 sf 15.75% Impervious Runoff Depth=5.65" Flow Length=1,020' Tc=16.5 min CN=78 Runoff=65.96 cfs 313,496 cf
Subcatchment 2S: Subcat 2S	Runoff Area=910,846 sf 5.15% Impervious Runoff Depth=5.06" Flow Length=1,517' Tc=24.9 min CN=73 Runoff=66.89 cfs 383,985 cf
Subcatchment 3S: Subcat 3S	Runoff Area=129,283 sf 0.00% Impervious Runoff Depth=5.06" Flow Length=450' Tc=13.6 min CN=73 Runoff=12.56 cfs 54,502 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.958 ac 2.26% Impervious Runoff Depth=4.71" Flow Length=350' Tc=7.1 min CN=70 Runoff=14.84 cfs 50,530 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.576 ac 4.62% Impervious Runoff Depth=4.71" Flow Length=600' Tc=16.2 min CN=70 Runoff=16.77 cfs 78,168 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.364 ac 0.00% Impervious Runoff Depth=4.01" Tc=6.0 min CN=64 Runoff=1.63 cfs 5,295 cf
Reach 1R: Unt1 (lower)	Avg. Flow Depth=1.17' Max Vel=8.98 fps Inflow=141.53 cfs 802,512 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=141.19 cfs 802,512 cf
Reach 2R: Unt1 (middle)	Avg. Flow Depth=1.15' Max Vel=8.81 fps Inflow=136.07 cfs 751,983 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=135.71 cfs 751,983 cf
Reach 3R: Unt1 (upper)	Avg. Flow Depth=1.03' Max Vel=9.36 fps Inflow=125.71 cfs 697,481 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=125.59 cfs 697,481 cf
Reach 4R: Unt2	Avg. Flow Depth=1.17' Max Vel=11.24 fps Inflow=66.89 cfs 383,985 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=66.87 cfs 383,985 cf
Link POA1: POA 1	Inflow=156.75 cfs 880,680 cf Primary=156.75 cfs 880,680 cf
Link POA2: POA 2	Inflow=1.63 cfs 5,295 cf Primary=1.63 cfs 5,295 cf
Total Runoff Area = 2,049,955 sf Runoff Volume = 885,975 cf Average Runoff Depth = 5.19"	
92.01% Pervious = 1,886,080 sf 7.99% Impervious = 163,875 sf	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points x 2
 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 1S: Subcat 1S	Runoff Area=665,784 sf 15.75% Impervious Runoff Depth=7.18" Flow Length=1,020' Tc=16.5 min CN=78 Runoff=83.02 cfs 398,320 cf
Subcatchment 2S: Subcat 2S	Runoff Area=910,846 sf 5.15% Impervious Runoff Depth=6.53" Flow Length=1,517' Tc=24.9 min CN=73 Runoff=85.93 cfs 496,006 cf
Subcatchment 3S: Subcat 3S	Runoff Area=129,283 sf 0.00% Impervious Runoff Depth=6.53" Flow Length=450' Tc=13.6 min CN=73 Runoff=16.11 cfs 70,402 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.958 ac 2.26% Impervious Runoff Depth=6.14" Flow Length=350' Tc=7.1 min CN=70 Runoff=19.25 cfs 65,973 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.576 ac 4.62% Impervious Runoff Depth=6.14" Flow Length=600' Tc=16.2 min CN=70 Runoff=21.81 cfs 102,060 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.364 ac 0.00% Impervious Runoff Depth=5.36" Tc=6.0 min CN=64 Runoff=2.17 cfs 7,079 cf
Reach 1R: Unt1 (lower)	Avg. Flow Depth=1.33' Max Vel=9.67 fps Inflow=180.59 cfs 1,030,701 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=180.21 cfs 1,030,701 cf
Reach 2R: Unt1 (middle)	Avg. Flow Depth=1.31' Max Vel=9.48 fps Inflow=173.42 cfs 964,727 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=173.01 cfs 964,727 cf
Reach 3R: Unt1 (upper)	Avg. Flow Depth=1.17' Max Vel=10.09 fps Inflow=160.06 cfs 894,325 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=159.93 cfs 894,325 cf
Reach 4R: Unt2	Avg. Flow Depth=1.31' Max Vel=12.11 fps Inflow=85.93 cfs 496,006 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=85.91 cfs 496,006 cf
Link POA1: POA 1	Inflow=200.57 cfs 1,132,760 cf Primary=200.57 cfs 1,132,760 cf
Link POA2: POA 2	Inflow=2.17 cfs 7,079 cf Primary=2.17 cfs 7,079 cf
Total Runoff Area = 2,049,955 sf Runoff Volume = 1,139,839 cf Average Runoff Depth = 6.67"	
92.01% Pervious = 1,886,080 sf 7.99% Impervious = 163,875 sf	

Summary for Subcatchment 1S: Subcat 1S

Runoff = 36.75 cfs @ 12.25 hrs, Volume= 172,346 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (sf)	CN	Description
2,788	74	>75% Grass cover, Good, HSG C
47,568	74	>75% Grass cover, Good, HSG C
30,797	74	>75% Grass cover, Good, HSG C
3,572	74	>75% Grass cover, Good, HSG C
3,945	74	>75% Grass cover, Good, HSG C
0	74	>75% Grass cover, Good, HSG C
13,799	74	>75% Grass cover, Good, HSG C
14,026	74	>75% Grass cover, Good, HSG C
21,562	74	>75% Grass cover, Good, HSG C
19,733	74	>75% Grass cover, Good, HSG C
5,924	74	>75% Grass cover, Good, HSG C
18,644	80	>75% Grass cover, Good, HSG D
25,700	80	>75% Grass cover, Good, HSG D
2,657	80	>75% Grass cover, Good, HSG D
2,744	80	>75% Grass cover, Good, HSG D
13,329	80	>75% Grass cover, Good, HSG D
19,737	80	>75% Grass cover, Good, HSG D
1,481	98	Paved parking, HSG C
2,309	98	Paved parking, HSG C
2,004	98	Paved parking, HSG C
1,307	98	Paved parking, HSG C
1,002	98	Paved parking, HSG C
1,786	98	Paved parking, HSG C
2,439	98	Paved parking, HSG C
915	98	Paved parking, HSG C
87	98	Paved parking, HSG C
436	98	Paved parking, HSG C
2,875	98	Paved parking, HSG C
2,396	98	Paved parking, HSG C
2,178	98	Paved parking, HSG D
2,222	98	Paved parking, HSG D
4,051	98	Paved parking, HSG D
3,398	98	Paved parking, HSG D
3,870	98	Paved parking, HSG D
24,786	98	Paved parking, HSG C
6,665	98	Paved parking, HSG C
11,500	98	Paved parking, HSG D
2,352	98	Paved parking, HSG D
1,655	98	Roofs, HSG C
1,307	98	Roofs, HSG C
2,526	98	Roofs, HSG C
1,220	98	Roofs, HSG C
3,049	98	Roofs, HSG C
1,176	98	Roofs, HSG C
2,047	98	Roofs, HSG C
1,045	98	Roofs, HSG C
2,439	98	Roofs, HSG C
1,830	98	Roofs, HSG C
3,049	98	Roofs, HSG D
174	98	Roofs, HSG D
1,655	98	Roofs, HSG D

44	98	Roofs, HSG D
1,568	98	Roofs, HSG D
566	70	Woods, Good, HSG C
915	70	Woods, Good, HSG C
4,748	70	Woods, Good, HSG C
13,504	70	Woods, Good, HSG C
4,312	70	Woods, Good, HSG C
4,966	70	Woods, Good, HSG C
36,765	70	Woods, Good, HSG C
131,464	70	Woods, Good, HSG C
21,649	77	Woods, Good, HSG D
7,710	77	Woods, Good, HSG D
9,365	77	Woods, Good, HSG D
47,960	77	Woods, Good, HSG D
5,793	77	Woods, Good, HSG D
1,220	77	Woods, Good, HSG D
2,265	77	Woods, Good, HSG D
21,214	77	Woods, Good, HSG D
665,784	78	Weighted Average
560,941		84.25% Pervious Area
104,843		15.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	20	0.0700	0.20		Sheet Flow, A-->B Grass: Short n= 0.150 P2= 3.14"
14.8	1,000	0.0260	1.13		Shallow Concentrated Flow, B-->C Short Grass Pasture Kv= 7.0 fps
16.5	1,020	Total			

Summary for Subcatchment 2S: Subcat 2S

Runoff = 34.95 cfs @ 12.36 hrs, Volume= 200,883 cf, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (sf)	CN	Description
43,560	61	>75% Grass cover, Good, HSG B
91,215	74	>75% Grass cover, Good, HSG C
44,997	80	>75% Grass cover, Good, HSG D
14,033	98	Paved parking, HSG B
7,623	98	Paved parking, HSG C
1,742	98	Paved parking, HSG D
8,625	98	Roofs, HSG B
12,197	98	Roofs, HSG C
2,701	98	Roofs, HSG D
95,484	55	Woods, Good, HSG B
213,008	70	Woods, Good, HSG C
375,661	77	Woods, Good, HSG D
910,846	73	Weighted Average
863,925		94.85% Pervious Area
46,921		5.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0450	0.23		Sheet Flow, A-->B Grass: Short n= 0.150 P2= 3.14"
15.9	800	0.0280	0.84		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
1.8	617	0.0270	5.71	16.38	Trap/Vee/Rect Channel Flow, C-->D Bot.W=2.00' D=0.70' Z= 3.0 '/' Top.W=6.20' n= 0.025
24.9	1,517	Total			

Summary for Subcatchment 3S: Subcat 3S

Runoff = 6.59 cfs @ 12.22 hrs, Volume= 28,513 cf, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (sf)	CN	Description
4,004	30	Woods, Good, HSG A
11,848	55	Woods, Good, HSG B
12,110	70	Woods, Good, HSG C
101,321	77	Woods, Good, HSG D
129,283	73	Weighted Average
129,283		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1200	0.16		Sheet Flow, A-->B Woods: Light underbrush n= 0.400 P2= 3.14"
3.0	350	0.1500	1.94		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
13.6	450	Total			

Summary for Subcatchment 4S: Subcat 4S

Runoff = 7.52 cfs @ 12.14 hrs, Volume= 25,594 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
0.195	74	>75% Grass cover, Good, HSG C
0.067	98	Roofs, HSG C
0.154	30	Woods, Good, HSG A
0.190	55	Woods, Good, HSG B
1.580	70	Woods, Good, HSG C
0.772	77	Woods, Good, HSG D
2.958	70	Weighted Average
2.891		97.74% Pervious Area
0.067		2.26% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	100	0.1000	0.32		Sheet Flow, A-->B Grass: Short n= 0.150 P2= 3.14"
1.9	250	0.2000	2.24		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
7.1	350	Total			

Summary for Subcatchment 5S: Subcat 5S

Runoff = 8.42 cfs @ 12.25 hrs, Volume= 39,593 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
0.858	74	>75% Grass cover, Good, HSG C
0.036	80	>75% Grass cover, Good, HSG D
0.195	98	Paved parking, HSG C
0.016	98	Roofs, HSG C
0.082	30	Woods, Good, HSG A
0.402	55	Woods, Good, HSG B
2.845	70	Woods, Good, HSG C
0.143	77	Woods, Good, HSG D
4.576	70	Weighted Average
4.365		95.38% Pervious Area
0.211		4.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.1000	0.15		Sheet Flow, A-->B Woods: Light underbrush n= 0.400 P2= 3.14"
4.8	500	0.1200	1.73		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
16.2	600	Total			

Summary for Subcatchment 6S: Subcat 6S

Runoff = 0.75 cfs @ 12.14 hrs, Volume= 2,494 cf, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
0.217	55	Woods, Good, HSG B
0.147	77	Woods, Good, HSG D
0.364	64	Weighted Average
0.364		100.00% Pervious Area

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

Summary for Reach 1R: Unt1 (lower)

[62] Hint: Exceeded Reach 2R OUTLET depth by 0.02' @ 12.56 hrs

Inflow Area = 1,834,764 sf, 8.43% Impervious, Inflow Depth = 2.79" for 10-YR+15% (NRCC D) event
 Inflow = 75.58 cfs @ 12.30 hrs, Volume= 427,335 cf
 Outflow = 75.33 cfs @ 12.32 hrs, Volume= 427,335 cf, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2

Max. Velocity= 7.37 fps, Min. Travel Time= 1.3 min

Avg. Velocity = 2.45 fps, Avg. Travel Time= 4.1 min

Peak Storage= 6,092 cf @ 12.32 hrs

Average Depth at Peak Storage= 0.82'

Bank-Full Depth= 3.00' Flow Area= 57.0 sf, Capacity= 858.75 cfs

10.00' x 3.00' deep channel, n= 0.013 Corrugated PE, smooth interior

Side Slope Z-value= 3.0 '/' Top Width= 28.00'

Length= 596.0' Slope= 0.0070 '/'

Inlet Invert= 14.10', Outlet Invert= 9.90'



Summary for Reach 2R: Unt1 (middle)

[62] Hint: Exceeded Reach 3R OUTLET depth by 0.09' @ 12.35 hrs

Inflow Area = 1,705,913 sf, 8.90% Impervious, Inflow Depth = 2.83" for 10-YR+15% (NRCC D) event
 Inflow = 72.93 cfs @ 12.29 hrs, Volume= 401,742 cf
 Outflow = 72.66 cfs @ 12.31 hrs, Volume= 401,742 cf, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 7.23 fps, Min. Travel Time= 1.4 min
 Avg. Velocity = 2.41 fps, Avg. Travel Time= 4.1 min

Peak Storage= 5,967 cf @ 12.31 hrs
 Average Depth at Peak Storage= 0.81'
 Bank-Full Depth= 3.00' Flow Area= 57.0 sf, Capacity= 849.89 cfs

10.00' x 3.00' deep channel, n= 0.013 Corrugated PE, smooth interior
 Side Slope Z-value= 3.0 '/' Top Width= 28.00'
 Length= 594.0' Slope= 0.0069 '/'
 Inlet Invert= 18.20', Outlet Invert= 14.10'



Summary for Reach 3R: Unt1 (upper)

[62] Hint: Exceeded Reach 4R OUTLET depth by 0.02' @ 7.58 hrs

Inflow Area = 1,576,630 sf, 9.63% Impervious, Inflow Depth = 2.84" for 10-YR+15% (NRCC D) event
 Inflow = 67.58 cfs @ 12.29 hrs, Volume= 373,229 cf
 Outflow = 67.48 cfs @ 12.30 hrs, Volume= 373,229 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 7.67 fps, Min. Travel Time= 0.9 min
 Avg. Velocity = 2.59 fps, Avg. Travel Time= 2.8 min

Peak Storage= 3,781 cf @ 12.30 hrs
 Average Depth at Peak Storage= 0.72'
 Bank-Full Depth= 3.00' Flow Area= 57.0 sf, Capacity= 961.66 cfs

10.00' x 3.00' deep channel, n= 0.013 Corrugated PE, smooth interior
 Side Slope Z-value= 3.0 '/' Top Width= 28.00'
 Length= 430.0' Slope= 0.0088 '/'
 Inlet Invert= 22.00', Outlet Invert= 18.20'



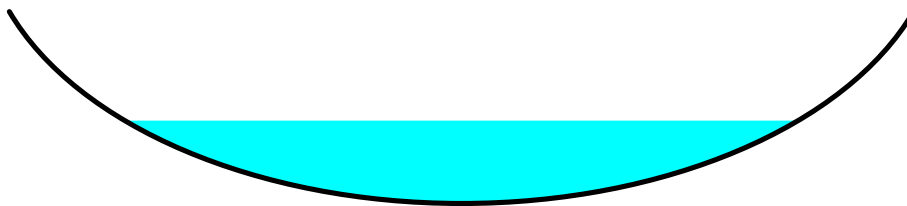
Summary for Reach 4R: Unt2

Inflow Area = 910,846 sf, 5.15% Impervious, Inflow Depth = 2.65" for 10-YR+15% (NRCC D) event
 Inflow = 34.95 cfs @ 12.36 hrs, Volume= 200,883 cf
 Outflow = 34.94 cfs @ 12.37 hrs, Volume= 200,883 cf, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 9.27 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 3.79 fps, Avg. Travel Time= 1.0 min

Peak Storage= 860 cf @ 12.37 hrs
 Average Depth at Peak Storage= 0.86'
 Bank-Full Depth= 2.00' Flow Area= 13.3 sf, Capacity= 209.49 cfs

10.00' x 2.00' deep Parabolic Channel, n= 0.025 Earth, clean & winding
 Length= 228.0' Slope= 0.0539 '/'
 Inlet Invert= 34.30', Outlet Invert= 22.00'



Summary for Link POA1: POA 1

Inflow Area = 2,034,094 sf, 8.06% Impervious, Inflow Depth = 2.75" for 10-YR+15% (NRCC D) event
 Inflow = 82.99 cfs @ 12.31 hrs, Volume= 466,928 cf
 Primary = 82.99 cfs @ 12.31 hrs, Volume= 466,928 cf, Atten= 0%, Lag= 0.0 min

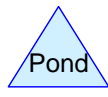
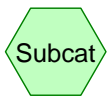
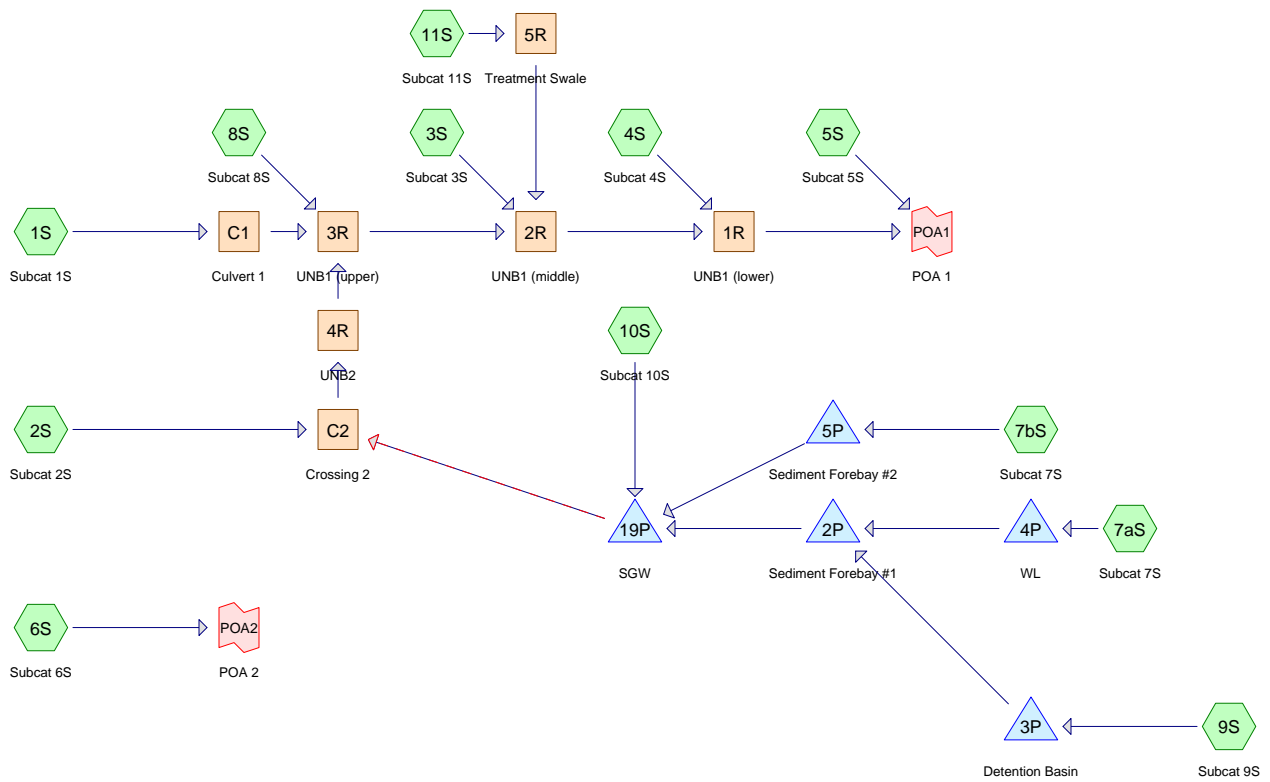
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Link POA2: POA 2

Inflow Area = 15,861 sf, 0.00% Impervious, Inflow Depth = 1.89" for 10-YR+15% (NRCC D) event
Inflow = 0.75 cfs @ 12.14 hrs, Volume= 2,494 cf
Primary = 0.75 cfs @ 12.14 hrs, Volume= 2,494 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

APPENDIX D



Routing Diagram for NM19063_Post01
 Prepared by Horizons Engineering
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NM19063_Post01

Prepared by Horizons Engineering

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
64,137	61	>75% Grass cover, Good, HSG B (2S, 4S, 5S, 6S, 7aS, 9S)
300,405	74	>75% Grass cover, Good, HSG C (1S, 2S, 4S, 5S, 8S)
253,669	80	>75% Grass cover, Good, HSG D (1S, 2S, 3S, 4S, 5S, 6S, 7aS, 7bS, 8S, 9S, 10S, 11S)
19,703	98	Paved parking, HSG B (2S, 4S, 5S, 6S, 7aS, 9S)
66,778	98	Paved parking, HSG C (1S, 2S, 5S, 8S)
59,530	98	Paved parking, HSG D (1S, 2S, 3S, 4S, 7aS, 7bS, 8S, 9S, 10S, 11S)
13,245	98	Roofs, HSG B (2S, 5S, 6S, 7aS, 9S)
34,101	98	Roofs, HSG C (1S, 2S, 4S, 5S, 8S)
20,085	98	Roofs, HSG D (1S, 2S, 7aS, 7bS, 8S, 9S)
14,273	30	Woods, Good, HSG A (3S, 4S, 5S)
111,720	55	Woods, Good, HSG B (2S, 4S, 5S, 6S)
615,310	70	Woods, Good, HSG C (1S, 2S, 3S, 4S, 5S, 7aS, 8S)
477,002	77	Woods, Good, HSG D (1S, 2S, 3S, 4S, 5S, 6S, 7aS, 8S)
2,049,957	75	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
14,273	HSG A	3S, 4S, 5S
208,805	HSG B	2S, 4S, 5S, 6S, 7aS, 9S
1,016,593	HSG C	1S, 2S, 3S, 4S, 5S, 7aS, 8S
810,286	HSG D	1S, 2S, 3S, 4S, 5S, 6S, 7aS, 7bS, 8S, 9S, 10S, 11S
0	Other	
2,049,957		TOTAL AREA

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NRCC 24-hr D 1" (NRCC D) Rainfall=1.00"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
 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 1S: Subcat 1S	Runoff Area=10.720 ac 18.93% Impervious Runoff Depth=0.06" Flow Length=1,506' Tc=18.5 min CN=78 Runoff=0.09 cfs 2,271 cf
Subcatchment 2S: Subcat 2S	Runoff Area=18.899 ac 5.85% Impervious Runoff Depth=0.02" Flow Length=1,517' Tc=25.2 min CN=73 Runoff=0.03 cfs 1,174 cf
Subcatchment 3S: Subcat 3S	Runoff Area=1.859 ac 0.53% Impervious Runoff Depth=0.02" Flow Length=450' Tc=13.6 min CN=74 Runoff=0.00 cfs 157 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.905 ac 2.35% Impervious Runoff Depth=0.00" Flow Length=350' Tc=6.9 min CN=70 Runoff=0.00 cfs 49 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.547 ac 5.37% Impervious Runoff Depth=0.01" Flow Length=600' Tc=16.2 min CN=71 Runoff=0.01 cfs 130 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.162 ac 12.98% Impervious Runoff Depth=0.00" Tc=6.0 min CN=70 Runoff=0.00 cfs 3 cf
Subcatchment 7aS: Subcat 7S	Runoff Area=45,742 sf 20.24% Impervious Runoff Depth=0.11" Tc=10.0 min CN=82 Runoff=0.06 cfs 435 cf
Subcatchment 7bS: Subcat 7S	Runoff Area=20,568 sf 27.20% Impervious Runoff Depth=0.17" Tc=10.0 min CN=85 Runoff=0.06 cfs 298 cf
Subcatchment 8S: Subcat 8S	Runoff Area=193,279 sf 8.93% Impervious Runoff Depth=0.06" Tc=10.0 min CN=78 Runoff=0.04 cfs 940 cf
Subcatchment 9S: Subcat 9S	Runoff Area=61,773 sf 33.66% Impervious Runoff Depth=0.15" Tc=10.0 min CN=84 Runoff=0.14 cfs 782 cf
Subcatchment 10S: Subcat 10S	Runoff Area=16,281 sf 10.26% Impervious Runoff Depth=0.11" Tc=6.0 min CN=82 Runoff=0.03 cfs 155 cf
Subcatchment 11S: Subcat 11S	Runoff Area=0.217 ac 77.49% Impervious Runoff Depth=0.50" Tc=6.0 min CN=94 Runoff=0.12 cfs 398 cf
Reach 1R: UNB1 (lower)	Avg. Flow Depth=0.02' Max Vel=0.92 fps Inflow=0.15 cfs 5,142 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=0.15 cfs 5,142 cf
Reach 2R: UNB1 (middle)	Avg. Flow Depth=0.02' Max Vel=0.91 fps Inflow=0.16 cfs 5,093 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=0.15 cfs 5,093 cf
Reach 3R: UNB1 (upper)	Avg. Flow Depth=0.01' Max Vel=1.03 fps Inflow=0.14 cfs 4,539 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=0.14 cfs 4,539 cf
Reach 4R: UNB2	Avg. Flow Depth=0.03' Max Vel=1.18 fps Inflow=0.04 cfs 1,329 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=0.04 cfs 1,329 cf

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NRCC 24-hr D 1" (NRCC D) Rainfall=1.00"

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Reach 5R: Treatment SwaleAvg. Flow Depth=0.06' Max Vel=0.16 fps Inflow=0.12 cfs 398 cf
n=0.150 L=107.0' S=0.0100 '/' Capacity=9.14 cfs Outflow=0.08 cfs 398 cf**Reach C1: Culvert 1**Avg. Flow Depth=0.02' Max Vel=0.89 fps Inflow=0.09 cfs 2,271 cf
60.0" x 24.0" Box Pipe n=0.013 L=20.0' S=0.0100 '/' Capacity=91.34 cfs Outflow=0.09 cfs 2,271 cf**Reach C2: Crossing 2**Avg. Flow Depth=0.00' Max Vel=1.67 fps Inflow=0.04 cfs 1,329 cf
108.0" x 144.0" Ellipse Pipe w/ 72.0" inside fill n=0.030 L=20.0' S=0.0200 '/' Capacity=416.21 cfs Outflow=0.04 cfs 1,329 cf**Pond 2P: Sediment Forebay #1**Peak Elev=46.60' Storage=322 cf Inflow=0.01 cfs 322 cf
Outflow=0.00 cfs 0 cf**Pond 3P: Detention Basin**Peak Elev=46.60' Storage=460 cf Inflow=0.14 cfs 782 cf
18.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/' Outflow=0.01 cfs 322 cf**Pond 4P: WL**Peak Elev=50.90' Storage=435 cf Inflow=0.06 cfs 435 cf
18.0" Round Culvert n=0.013 L=44.0' S=0.0205 '/' Outflow=0.00 cfs 0 cf**Pond 5P: Sediment Forebay #2**Peak Elev=51.47' Storage=298 cf Inflow=0.06 cfs 298 cf
Outflow=0.00 cfs 0 cf**Pond 19P: SGW**Peak Elev=45.70' Storage=0 cf Inflow=0.03 cfs 155 cf
Primary=0.03 cfs 155 cf Secondary=0.00 cfs 0 cf Outflow=0.03 cfs 155 cf**Link POA1: POA 1**Inflow=0.15 cfs 5,272 cf
Primary=0.15 cfs 5,272 cf**Link POA2: POA 2**Inflow=0.00 cfs 3 cf
Primary=0.00 cfs 3 cf**Total Runoff Area = 2,049,957 sf Runoff Volume = 6,789 cf Average Runoff Depth = 0.04"**
89.59% Pervious = 1,836,516 sf 10.41% Impervious = 213,442 sf

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NRCC 24-hr D 2-YR+15% (NRCC D) Rainfall=3.61"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
 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 1S: Subcat 1S	Runoff Area=10.720 ac 18.93% Impervious Runoff Depth=1.58" Flow Length=1,506' Tc=18.5 min CN=78 Runoff=12.29 cfs 61,540 cf
Subcatchment 2S: Subcat 2S	Runoff Area=18.899 ac 5.85% Impervious Runoff Depth=1.25" Flow Length=1,517' Tc=25.2 min CN=73 Runoff=14.27 cfs 86,040 cf
Subcatchment 3S: Subcat 3S	Runoff Area=1.859 ac 0.53% Impervious Runoff Depth=1.32" Flow Length=450' Tc=13.6 min CN=74 Runoff=2.00 cfs 8,883 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.905 ac 2.35% Impervious Runoff Depth=1.08" Flow Length=350' Tc=6.9 min CN=70 Runoff=3.23 cfs 11,353 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.547 ac 5.37% Impervious Runoff Depth=1.13" Flow Length=600' Tc=16.2 min CN=71 Runoff=3.80 cfs 18,723 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.162 ac 12.98% Impervious Runoff Depth=1.08" Tc=6.0 min CN=70 Runoff=0.19 cfs 634 cf
Subcatchment 7aS: Subcat 7S	Runoff Area=45,742 sf 20.24% Impervious Runoff Depth=1.87" Tc=10.0 min CN=82 Runoff=1.87 cfs 7,143 cf
Subcatchment 7bS: Subcat 7S	Runoff Area=20,568 sf 27.20% Impervious Runoff Depth=2.11" Tc=10.0 min CN=85 Runoff=0.95 cfs 3,621 cf
Subcatchment 8S: Subcat 8S	Runoff Area=193,279 sf 8.93% Impervious Runoff Depth=1.58" Tc=10.0 min CN=78 Runoff=6.64 cfs 25,472 cf
Subcatchment 9S: Subcat 9S	Runoff Area=61,773 sf 33.66% Impervious Runoff Depth=2.03" Tc=10.0 min CN=84 Runoff=2.74 cfs 10,455 cf
Subcatchment 10S: Subcat 10S	Runoff Area=16,281 sf 10.26% Impervious Runoff Depth=1.87" Tc=6.0 min CN=82 Runoff=0.78 cfs 2,542 cf
Subcatchment 11S: Subcat 11S	Runoff Area=0.217 ac 77.49% Impervious Runoff Depth=2.94" Tc=6.0 min CN=94 Runoff=0.66 cfs 2,323 cf
Reach 1R: UNB1 (lower)	Avg. Flow Depth=0.51' Max Vel=5.58 fps Inflow=32.76 cfs 216,585 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=32.63 cfs 216,585 cf
Reach 2R: UNB1 (middle)	Avg. Flow Depth=0.50' Max Vel=5.47 fps Inflow=31.66 cfs 205,232 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=31.53 cfs 205,232 cf
Reach 3R: UNB1 (upper)	Avg. Flow Depth=0.45' Max Vel=5.81 fps Inflow=29.79 cfs 194,025 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=29.73 cfs 194,025 cf
Reach 4R: UNB2	Avg. Flow Depth=0.58' Max Vel=7.19 fps Inflow=14.99 cfs 107,014 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=14.99 cfs 107,014 cf

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NRCC 24-hr D 2-YR+15% (NRCC D) Rainfall=3.61"

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Reach 5R: Treatment SwaleAvg. Flow Depth=0.20' Max Vel=0.32 fps Inflow=0.66 cfs 2,323 cf
n=0.150 L=107.0' S=0.0100 '/' Capacity=9.14 cfs Outflow=0.57 cfs 2,323 cf**Reach C1: Culvert 1**Avg. Flow Depth=0.42' Max Vel=5.81 fps Inflow=12.29 cfs 61,540 cf
60.0" x 24.0" Box Pipe n=0.013 L=20.0' S=0.0100 '/' Capacity=91.34 cfs Outflow=12.29 cfs 61,540 cf**Reach C2: Crossing 2**Avg. Flow Depth=0.44' Max Vel=3.82 fps Inflow=14.99 cfs 107,014 cf
108.0" x 144.0" Ellipse Pipe w/ 72.0" inside fill n=0.030 L=20.0' S=0.0200 '/' Capacity=416.21 cfs Outflow=14.99 cfs 107,014 cf**Pond 2P: Sediment Forebay #1**Peak Elev=47.58' Storage=1,159 cf Inflow=3.68 cfs 15,895 cf
Outflow=3.64 cfs 15,281 cf**Pond 3P: Detention Basin**Peak Elev=47.59' Storage=1,605 cf Inflow=2.74 cfs 10,455 cf
18.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/' Outflow=2.26 cfs 9,592 cf**Pond 4P: WL**Peak Elev=51.84' Storage=1,645 cf Inflow=1.87 cfs 7,143 cf
18.0" Round Culvert n=0.013 L=44.0' S=0.0205 '/' Outflow=1.44 cfs 6,303 cf**Pond 5P: Sediment Forebay #2**Peak Elev=52.10' Storage=808 cf Inflow=0.95 cfs 3,621 cf
Outflow=0.81 cfs 3,150 cf**Pond 19P: SGW**Peak Elev=47.58' Storage=5,343 cf Inflow=4.79 cfs 20,973 cf
Primary=0.76 cfs 20,089 cf Secondary=0.40 cfs 885 cf Outflow=1.16 cfs 20,974 cf**Link POA1: POA 1**Inflow=36.01 cfs 235,307 cf
Primary=36.01 cfs 235,307 cf**Link POA2: POA 2**Inflow=0.19 cfs 634 cf
Primary=0.19 cfs 634 cf**Total Runoff Area = 2,049,957 sf Runoff Volume = 238,728 cf Average Runoff Depth = 1.40"**
89.59% Pervious = 1,836,516 sf 10.41% Impervious = 213,442 sf

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
 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 1S: Subcat 1S	Runoff Area=10.720 ac 18.93% Impervious Runoff Depth=3.11" Flow Length=1,506' Tc=18.5 min CN=78 Runoff=24.39 cfs 120,878 cf
Subcatchment 2S: Subcat 2S	Runoff Area=18.899 ac 5.85% Impervious Runoff Depth=2.65" Flow Length=1,517' Tc=25.2 min CN=73 Runoff=31.41 cfs 181,562 cf
Subcatchment 3S: Subcat 3S	Runoff Area=1.859 ac 0.53% Impervious Runoff Depth=2.74" Flow Length=450' Tc=13.6 min CN=74 Runoff=4.27 cfs 18,465 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.905 ac 2.35% Impervious Runoff Depth=2.38" Flow Length=350' Tc=6.9 min CN=70 Runoff=7.45 cfs 25,133 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.547 ac 5.37% Impervious Runoff Depth=2.47" Flow Length=600' Tc=16.2 min CN=71 Runoff=8.69 cfs 40,771 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.162 ac 12.98% Impervious Runoff Depth=2.38" Tc=6.0 min CN=70 Runoff=0.43 cfs 1,403 cf
Subcatchment 7aS: Subcat 7S	Runoff Area=45,742 sf 20.24% Impervious Runoff Depth=3.49" Tc=10.0 min CN=82 Runoff=3.46 cfs 13,317 cf
Subcatchment 7bS: Subcat 7S	Runoff Area=20,568 sf 27.20% Impervious Runoff Depth=3.80" Tc=10.0 min CN=85 Runoff=1.67 cfs 6,506 cf
Subcatchment 8S: Subcat 8S	Runoff Area=193,279 sf 8.93% Impervious Runoff Depth=3.11" Tc=10.0 min CN=78 Runoff=13.10 cfs 50,033 cf
Subcatchment 9S: Subcat 9S	Runoff Area=61,773 sf 33.66% Impervious Runoff Depth=3.69" Tc=10.0 min CN=84 Runoff=4.90 cfs 19,015 cf
Subcatchment 10S: Subcat 10S	Runoff Area=16,281 sf 10.26% Impervious Runoff Depth=3.49" Tc=6.0 min CN=82 Runoff=1.44 cfs 4,740 cf
Subcatchment 11S: Subcat 11S	Runoff Area=0.217 ac 77.49% Impervious Runoff Depth=4.76" Tc=6.0 min CN=94 Runoff=1.04 cfs 3,759 cf
Reach 1R: UNB1 (lower)	Avg. Flow Depth=0.81' Max Vel=7.34 fps Inflow=74.57 cfs 440,621 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=74.36 cfs 440,621 cf
Reach 2R: UNB1 (middle)	Avg. Flow Depth=0.80' Max Vel=7.21 fps Inflow=72.05 cfs 415,488 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=71.82 cfs 415,488 cf
Reach 3R: UNB1 (upper)	Avg. Flow Depth=0.73' Max Vel=7.70 fps Inflow=68.23 cfs 393,263 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=68.12 cfs 393,263 cf
Reach 4R: UNB2	Avg. Flow Depth=0.90' Max Vel=9.53 fps Inflow=38.33 cfs 222,353 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=38.30 cfs 222,353 cf

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NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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Reach 5R: Treatment SwaleAvg. Flow Depth=0.27' Max Vel=0.39 fps Inflow=1.04 cfs 3,759 cf
n=0.150 L=107.0' S=0.0100 '/' Capacity=9.14 cfs Outflow=0.92 cfs 3,759 cf**Reach C1: Culvert 1**Avg. Flow Depth=0.66' Max Vel=7.40 fps Inflow=24.39 cfs 120,878 cf
60.0" x 24.0" Box Pipe n=0.013 L=20.0' S=0.0100 '/' Capacity=91.34 cfs Outflow=24.38 cfs 120,878 cf**Reach C2: Crossing 2**Avg. Flow Depth=0.79' Max Vel=5.38 fps Inflow=38.33 cfs 222,353 cf
108.0" x 144.0" Ellipse Pipe w/ 72.0" inside fill n=0.030 L=20.0' S=0.0200 '/' Capacity=416.21 cfs Outflow=38.33 cfs 222,353 cf**Pond 2P: Sediment Forebay #1**Peak Elev=48.00' Storage=1,658 cf Inflow=6.25 cfs 30,629 cf
Outflow=5.81 cfs 30,014 cf**Pond 3P: Detention Basin**Peak Elev=48.14' Storage=2,497 cf Inflow=4.90 cfs 19,015 cf
18.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/' Outflow=3.45 cfs 18,152 cf**Pond 4P: WL**Peak Elev=52.08' Storage=2,121 cf Inflow=3.46 cfs 13,317 cf
18.0" Round Culvert n=0.013 L=44.0' S=0.0205 '/' Outflow=2.81 cfs 12,477 cf**Pond 5P: Sediment Forebay #2**Peak Elev=52.25' Storage=953 cf Inflow=1.67 cfs 6,506 cf
Outflow=1.49 cfs 6,035 cf**Pond 19P: SGW**Peak Elev=47.95' Storage=6,901 cf Inflow=7.87 cfs 40,789 cf
Primary=0.82 cfs 28,336 cf Secondary=6.32 cfs 12,454 cf Outflow=7.14 cfs 40,791 cf**Link POA1: POA 1**Inflow=82.17 cfs 481,392 cf
Primary=82.17 cfs 481,392 cf**Link POA2: POA 2**Inflow=0.43 cfs 1,403 cf
Primary=0.43 cfs 1,403 cf**Total Runoff Area = 2,049,957 sf Runoff Volume = 485,581 cf Average Runoff Depth = 2.84"**
89.59% Pervious = 1,836,516 sf 10.41% Impervious = 213,442 sf

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NRCC 24-hr D 25-YR+15% (NRCC D) Rainfall=6.92"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
 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 1S: Subcat 1S	Runoff Area=10.720 ac 18.93% Impervious Runoff Depth=4.40" Flow Length=1,506' Tc=18.5 min CN=78 Runoff=34.39 cfs 171,308 cf
Subcatchment 2S: Subcat 2S	Runoff Area=18.899 ac 5.85% Impervious Runoff Depth=3.87" Flow Length=1,517' Tc=25.2 min CN=73 Runoff=46.11 cfs 265,248 cf
Subcatchment 3S: Subcat 3S	Runoff Area=1.859 ac 0.53% Impervious Runoff Depth=3.97" Flow Length=450' Tc=13.6 min CN=74 Runoff=6.20 cfs 26,807 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.905 ac 2.35% Impervious Runoff Depth=3.55" Flow Length=350' Tc=6.9 min CN=70 Runoff=11.13 cfs 37,454 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.547 ac 5.37% Impervious Runoff Depth=3.66" Flow Length=600' Tc=16.2 min CN=71 Runoff=12.95 cfs 60,348 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.162 ac 12.98% Impervious Runoff Depth=3.55" Tc=6.0 min CN=70 Runoff=0.64 cfs 2,090 cf
Subcatchment 7aS: Subcat 7S	Runoff Area=45,742 sf 20.24% Impervious Runoff Depth=4.84" Tc=10.0 min CN=82 Runoff=4.73 cfs 18,454 cf
Subcatchment 7bS: Subcat 7S	Runoff Area=20,568 sf 27.20% Impervious Runoff Depth=5.18" Tc=10.0 min CN=85 Runoff=2.24 cfs 8,872 cf
Subcatchment 8S: Subcat 8S	Runoff Area=193,279 sf 8.93% Impervious Runoff Depth=4.40" Tc=10.0 min CN=78 Runoff=18.41 cfs 70,906 cf
Subcatchment 9S: Subcat 9S	Runoff Area=61,773 sf 33.66% Impervious Runoff Depth=5.06" Tc=10.0 min CN=84 Runoff=6.62 cfs 26,068 cf
Subcatchment 10S: Subcat 10S	Runoff Area=16,281 sf 10.26% Impervious Runoff Depth=4.84" Tc=6.0 min CN=82 Runoff=1.96 cfs 6,568 cf
Subcatchment 11S: Subcat 11S	Runoff Area=0.217 ac 77.49% Impervious Runoff Depth=6.21" Tc=6.0 min CN=94 Runoff=1.34 cfs 4,901 cf
Reach 1R: UNB1 (lower)	Avg. Flow Depth=1.01' Max Vel=8.28 fps Inflow=108.76 cfs 633,801 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=108.53 cfs 633,801 cf
Reach 2R: UNB1 (middle)	Avg. Flow Depth=0.99' Max Vel=8.12 fps Inflow=104.75 cfs 596,347 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=104.50 cfs 596,347 cf
Reach 3R: UNB1 (upper)	Avg. Flow Depth=0.90' Max Vel=8.69 fps Inflow=99.03 cfs 564,639 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=98.95 cfs 564,639 cf
Reach 4R: UNB2	Avg. Flow Depth=1.08' Max Vel=10.68 fps Inflow=56.32 cfs 322,424 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=56.29 cfs 322,424 cf

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NRCC 24-hr D 25-YR+15% (NRCC D) Rainfall=6.92"

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Reach 5R: Treatment SwaleAvg. Flow Depth=0.31' Max Vel=0.43 fps Inflow=1.34 cfs 4,901 cf
n=0.150 L=107.0' S=0.0100 '/' Capacity=9.14 cfs Outflow=1.19 cfs 4,901 cf**Reach C1: Culvert 1**Avg. Flow Depth=0.83' Max Vel=8.32 fps Inflow=34.39 cfs 171,308 cf
60.0" x 24.0" Box Pipe n=0.013 L=20.0' S=0.0100 '/' Capacity=91.34 cfs Outflow=34.38 cfs 171,308 cf**Reach C2: Crossing 2**Avg. Flow Depth=1.02' Max Vel=6.16 fps Inflow=56.30 cfs 322,424 cf
108.0" x 144.0" Ellipse Pipe w/ 72.0" inside fill n=0.030 L=20.0' S=0.0200 '/' Capacity=416.21 cfs Outflow=56.32 cfs 322,424 cf**Pond 2P: Sediment Forebay #1**Peak Elev=48.19' Storage=1,911 cf Inflow=8.84 cfs 42,819 cf
Outflow=8.63 cfs 42,205 cf**Pond 3P: Detention Basin**Peak Elev=48.52' Storage=3,223 cf Inflow=6.62 cfs 26,068 cf
18.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/' Outflow=4.96 cfs 25,205 cf**Pond 4P: WL**Peak Elev=52.24' Storage=2,482 cf Inflow=4.73 cfs 18,454 cf
18.0" Round Culvert n=0.013 L=44.0' S=0.0205 '/' Outflow=3.87 cfs 17,614 cf**Pond 5P: Sediment Forebay #2**Peak Elev=52.35' Storage=1,054 cf Inflow=2.24 cfs 8,872 cf
Outflow=2.04 cfs 8,401 cf**Pond 19P: SGW**Peak Elev=48.11' Storage=7,579 cf Inflow=11.47 cfs 57,174 cf
Primary=0.85 cfs 34,246 cf Secondary=10.14 cfs 22,931 cf Outflow=10.99 cfs 57,176 cf**Link POA1: POA 1**Inflow=120.57 cfs 694,149 cf
Primary=120.57 cfs 694,149 cf**Link POA2: POA 2**Inflow=0.64 cfs 2,090 cf
Primary=0.64 cfs 2,090 cf**Total Runoff Area = 2,049,957 sf Runoff Volume = 699,025 cf Average Runoff Depth = 4.09"**
89.59% Pervious = 1,836,516 sf 10.41% Impervious = 213,442 sf

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NRCC 24-hr D 50-YR+15% (NRCC D) Rainfall=8.28"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
 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 1S: Subcat 1S	Runoff Area=10.720 ac 18.93% Impervious Runoff Depth=5.65" Flow Length=1,506' Tc=18.5 min CN=78 Runoff=43.82 cfs 219,876 cf
Subcatchment 2S: Subcat 2S	Runoff Area=18.899 ac 5.85% Impervious Runoff Depth=5.06" Flow Length=1,517' Tc=25.2 min CN=73 Runoff=60.23 cfs 347,053 cf
Subcatchment 3S: Subcat 3S	Runoff Area=1.859 ac 0.53% Impervious Runoff Depth=5.18" Flow Length=450' Tc=13.6 min CN=74 Runoff=8.03 cfs 34,934 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.905 ac 2.35% Impervious Runoff Depth=4.71" Flow Length=350' Tc=6.9 min CN=70 Runoff=14.70 cfs 49,621 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.547 ac 5.37% Impervious Runoff Depth=4.82" Flow Length=600' Tc=16.2 min CN=71 Runoff=17.07 cfs 79,612 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.162 ac 12.98% Impervious Runoff Depth=4.71" Tc=6.0 min CN=70 Runoff=0.85 cfs 2,769 cf
Subcatchment 7aS: Subcat 7S	Runoff Area=45,742 sf 20.24% Impervious Runoff Depth=6.13" Tc=10.0 min CN=82 Runoff=5.92 cfs 23,351 cf
Subcatchment 7bS: Subcat 7S	Runoff Area=20,568 sf 27.20% Impervious Runoff Depth=6.48" Tc=10.0 min CN=85 Runoff=2.77 cfs 11,113 cf
Subcatchment 8S: Subcat 8S	Runoff Area=193,279 sf 8.93% Impervious Runoff Depth=5.65" Tc=10.0 min CN=78 Runoff=23.42 cfs 91,009 cf
Subcatchment 9S: Subcat 9S	Runoff Area=61,773 sf 33.66% Impervious Runoff Depth=6.36" Tc=10.0 min CN=84 Runoff=8.22 cfs 32,762 cf
Subcatchment 10S: Subcat 10S	Runoff Area=16,281 sf 10.26% Impervious Runoff Depth=6.13" Tc=6.0 min CN=82 Runoff=2.45 cfs 8,311 cf
Subcatchment 11S: Subcat 11S	Runoff Area=0.217 ac 77.49% Impervious Runoff Depth=7.56" Tc=6.0 min CN=94 Runoff=1.61 cfs 5,968 cf
Reach 1R: UNB1 (lower)	Avg. Flow Depth=1.16' Max Vel=8.95 fps Inflow=140.16 cfs 821,215 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=139.91 cfs 821,215 cf
Reach 2R: UNB1 (middle)	Avg. Flow Depth=1.14' Max Vel=8.78 fps Inflow=134.78 cfs 771,593 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=134.49 cfs 771,593 cf
Reach 3R: UNB1 (upper)	Avg. Flow Depth=1.03' Max Vel=9.40 fps Inflow=127.37 cfs 730,691 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=127.28 cfs 730,691 cf
Reach 4R: UNB2	Avg. Flow Depth=1.22' Max Vel=11.54 fps Inflow=73.01 cfs 419,806 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=72.98 cfs 419,806 cf

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NRCC 24-hr D 50-YR+15% (NRCC D) Rainfall=8.28"

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Reach 5R: Treatment SwaleAvg. Flow Depth=0.35' Max Vel=0.46 fps Inflow=1.61 cfs 5,968 cf
n=0.150 L=107.0' S=0.0100 '/' Capacity=9.14 cfs Outflow=1.45 cfs 5,968 cf**Reach C1: Culvert 1**Avg. Flow Depth=0.97' Max Vel=9.01 fps Inflow=43.82 cfs 219,876 cf
60.0" x 24.0" Box Pipe n=0.013 L=20.0' S=0.0100 '/' Capacity=91.34 cfs Outflow=43.80 cfs 219,876 cf**Reach C2: Crossing 2**Avg. Flow Depth=1.21' Max Vel=6.73 fps Inflow=72.98 cfs 419,806 cf
108.0" x 144.0" Ellipse Pipe w/ 72.0" inside fill n=0.030 L=20.0' S=0.0200 '/' Capacity=416.21 cfs Outflow=73.01 cfs 419,806 cf**Pond 2P: Sediment Forebay #1**Peak Elev=48.32' Storage=2,091 cf Inflow=10.88 cfs 54,411 cf
Outflow=10.68 cfs 53,796 cf**Pond 3P: Detention Basin**Peak Elev=48.81' Storage=3,860 cf Inflow=8.22 cfs 32,762 cf
18.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/' Outflow=6.04 cfs 31,899 cf**Pond 4P: WL**Peak Elev=52.38' Storage=2,819 cf Inflow=5.92 cfs 23,351 cf
18.0" Round Culvert n=0.013 L=44.0' S=0.0205 '/' Outflow=4.84 cfs 22,512 cf**Pond 5P: Sediment Forebay #2**Peak Elev=52.44' Storage=1,142 cf Inflow=2.77 cfs 11,113 cf
Outflow=2.54 cfs 10,643 cf**Pond 19P: SGW**Peak Elev=48.21' Storage=8,053 cf Inflow=14.20 cfs 72,750 cf
Primary=0.86 cfs 39,179 cf Secondary=12.81 cfs 33,574 cf Outflow=13.68 cfs 72,753 cf**Link POA1: POA 1**Inflow=155.92 cfs 900,827 cf
Primary=155.92 cfs 900,827 cf**Link POA2: POA 2**Inflow=0.85 cfs 2,769 cf
Primary=0.85 cfs 2,769 cf**Total Runoff Area = 2,049,957 sf Runoff Volume = 906,380 cf Average Runoff Depth = 5.31"**
89.59% Pervious = 1,836,516 sf 10.41% Impervious = 213,442 sf

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NRCC 24-hr D 100-YR+15% (NRCC D) Rainfall=9.91"

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Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 2
 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 1S: Subcat 1S	Runoff Area=10.720 ac 18.93% Impervious Runoff Depth=7.18" Flow Length=1,506' Tc=18.5 min CN=78 Runoff=55.16 cfs 279,368 cf
Subcatchment 2S: Subcat 2S	Runoff Area=18.899 ac 5.85% Impervious Runoff Depth=6.53" Flow Length=1,517' Tc=25.2 min CN=73 Runoff=77.40 cfs 448,300 cf
Subcatchment 3S: Subcat 3S	Runoff Area=1.859 ac 0.53% Impervious Runoff Depth=6.66" Flow Length=450' Tc=13.6 min CN=74 Runoff=10.26 cfs 44,972 cf
Subcatchment 4S: Subcat 4S	Runoff Area=2.905 ac 2.35% Impervious Runoff Depth=6.14" Flow Length=350' Tc=6.9 min CN=70 Runoff=19.05 cfs 64,787 cf
Subcatchment 5S: Subcat 5S	Runoff Area=4.547 ac 5.37% Impervious Runoff Depth=6.27" Flow Length=600' Tc=16.2 min CN=71 Runoff=22.10 cfs 103,566 cf
Subcatchment 6S: Subcat 6S	Runoff Area=0.162 ac 12.98% Impervious Runoff Depth=6.14" Tc=6.0 min CN=70 Runoff=1.10 cfs 3,616 cf
Subcatchment 7aS: Subcat 7S	Runoff Area=45,742 sf 20.24% Impervious Runoff Depth=7.69" Tc=10.0 min CN=82 Runoff=7.34 cfs 29,309 cf
Subcatchment 7bS: Subcat 7S	Runoff Area=20,568 sf 27.20% Impervious Runoff Depth=8.07" Tc=10.0 min CN=85 Runoff=3.41 cfs 13,828 cf
Subcatchment 8S: Subcat 8S	Runoff Area=193,279 sf 8.93% Impervious Runoff Depth=7.18" Tc=10.0 min CN=78 Runoff=29.44 cfs 115,633 cf
Subcatchment 9S: Subcat 9S	Runoff Area=61,773 sf 33.66% Impervious Runoff Depth=7.94" Tc=10.0 min CN=84 Runoff=10.13 cfs 40,881 cf
Subcatchment 10S: Subcat 10S	Runoff Area=16,281 sf 10.26% Impervious Runoff Depth=7.69" Tc=6.0 min CN=82 Runoff=3.03 cfs 10,432 cf
Subcatchment 11S: Subcat 11S	Runoff Area=0.217 ac 77.49% Impervious Runoff Depth=9.18" Tc=6.0 min CN=94 Runoff=1.94 cfs 7,249 cf
Reach 1R: UNB1 (lower)	Avg. Flow Depth=1.32' Max Vel=9.63 fps Inflow=177.90 cfs 1,051,975 cf n=0.013 L=596.0' S=0.0070 '/' Capacity=858.75 cfs Outflow=177.62 cfs 1,051,975 cf
Reach 2R: UNB1 (middle)	Avg. Flow Depth=1.30' Max Vel=9.44 fps Inflow=170.84 cfs 987,188 cf n=0.013 L=594.0' S=0.0069 '/' Capacity=849.89 cfs Outflow=170.52 cfs 987,188 cf
Reach 3R: UNB1 (upper)	Avg. Flow Depth=1.18' Max Vel=10.12 fps Inflow=161.39 cfs 934,967 cf n=0.013 L=430.0' S=0.0088 '/' Capacity=961.66 cfs Outflow=161.29 cfs 934,967 cf
Reach 4R: UNB2	Avg. Flow Depth=1.36' Max Vel=12.39 fps Inflow=93.01 cfs 539,966 cf n=0.025 L=228.0' S=0.0539 '/' Capacity=209.49 cfs Outflow=92.98 cfs 539,966 cf

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NRCC 24-hr D 100-YR+15% (NRCC D) Rainfall=9.91"

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Reach 5R: Treatment SwaleAvg. Flow Depth=0.39' Max Vel=0.49 fps Inflow=1.94 cfs 7,249 cf
n=0.150 L=107.0' S=0.0100 '/' Capacity=9.14 cfs Outflow=1.76 cfs 7,249 cf**Reach C1: Culvert 1**Avg. Flow Depth=1.14' Max Vel=9.70 fps Inflow=55.16 cfs 279,368 cf
60.0" x 24.0" Box Pipe n=0.013 L=20.0' S=0.0100 '/' Capacity=91.34 cfs Outflow=55.13 cfs 279,368 cf**Reach C2: Crossing 2**Avg. Flow Depth=1.43' Max Vel=7.31 fps Inflow=92.98 cfs 539,965 cf
108.0" x 144.0" Ellipse Pipe w/ 72.0" inside fill n=0.030 L=20.0' S=0.0200 '/' Capacity=416.21 cfs Outflow=93.01 cfs 539,966 cf**Pond 2P: Sediment Forebay #1**Peak Elev=48.45' Storage=2,283 cf Inflow=13.08 cfs 68,487 cf
Outflow=12.90 cfs 67,873 cf**Pond 3P: Detention Basin**Peak Elev=49.15' Storage=4,669 cf Inflow=10.13 cfs 40,881 cf
18.0" Round Culvert n=0.013 L=50.0' S=0.0100 '/' Outflow=7.15 cfs 40,018 cf**Pond 4P: WL**Peak Elev=52.54' Storage=3,237 cf Inflow=7.34 cfs 29,309 cf
18.0" Round Culvert n=0.013 L=44.0' S=0.0205 '/' Outflow=5.94 cfs 28,469 cf**Pond 5P: Sediment Forebay #2**Peak Elev=52.53' Storage=1,242 cf Inflow=3.41 cfs 13,828 cf
Outflow=3.14 cfs 13,357 cf**Pond 19P: SGW**Peak Elev=48.31' Storage=8,550 cf Inflow=17.18 cfs 91,662 cf
Primary=0.88 cfs 44,236 cf Secondary=15.75 cfs 47,430 cf Outflow=16.63 cfs 91,666 cf**Link POA1: POA 1**Inflow=198.47 cfs 1,155,542 cf
Primary=198.47 cfs 1,155,542 cf**Link POA2: POA 2**Inflow=1.10 cfs 3,616 cf
Primary=1.10 cfs 3,616 cf**Total Runoff Area = 2,049,957 sf Runoff Volume = 1,161,941 cf Average Runoff Depth = 6.80"**
89.59% Pervious = 1,836,516 sf 10.41% Impervious = 213,442 sf

Summary for Subcatchment 1S: Subcat 1S

Runoff = 24.39 cfs @ 12.27 hrs, Volume= 120,878 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
3.343	74	>75% Grass cover, Good, HSG C
1.116	80	>75% Grass cover, Good, HSG D
1.088	98	Paved parking, HSG C
0.515	98	Paved parking, HSG D
0.349	98	Roofs, HSG C
0.078	98	Roofs, HSG D
3.574	70	Woods, Good, HSG C
0.658	77	Woods, Good, HSG D
10.720	78	Weighted Average
8.691		81.07% Pervious Area
2.029		18.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	20	0.0700	0.20		Sheet Flow, A-->B Grass: Short n= 0.150 P2= 3.14"
16.1	1,000	0.0220	1.04		Shallow Concentrated Flow, B-->C Short Grass Pasture Kv= 7.0 fps
0.7	486	0.0494	11.09	44.37	Parabolic Channel, C-->D W=4.00' D=1.50' Area=4.0 sf Perim=5.2' n= 0.025
18.5	1,506	Total			

Summary for Subcatchment 2S: Subcat 2S

Runoff = 31.41 cfs @ 12.35 hrs, Volume= 181,562 cf, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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Area (ac)	CN	Description
1.000	61	>75% Grass cover, Good, HSG B
2.094	74	>75% Grass cover, Good, HSG C
1.285	80	>75% Grass cover, Good, HSG D
0.321	98	Paved parking, HSG B
0.175	98	Paved parking, HSG C
0.046	98	Paved parking, HSG D
0.198	98	Roofs, HSG B
0.280	98	Roofs, HSG C
0.086	98	Roofs, HSG D
2.187	55	Woods, Good, HSG B
4.889	70	Woods, Good, HSG C
6.338	77	Woods, Good, HSG D
18.899	73	Weighted Average
17.793		94.15% Pervious Area
1.106		5.85% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	100	0.0450	0.23		Sheet Flow, A-->B Grass: Short n= 0.150 P2= 3.14"
16.2	800	0.0270	0.82		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
1.8	617	0.0270	5.71	16.38	Trap/Vee/Rect Channel Flow, C-->D Bot.W=2.00' D=0.70' Z= 3.0 '/' Top.W=6.20' n= 0.025
25.2	1,517	Total			

Summary for Subcatchment 3S: Subcat 3S

Runoff = 4.27 cfs @ 12.22 hrs, Volume= 18,465 cf, Depth= 2.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
0.248	80	>75% Grass cover, Good, HSG D
0.010	98	Paved parking, HSG D
0.092	30	Woods, Good, HSG A
0.278	70	Woods, Good, HSG C
1.231	77	Woods, Good, HSG D
1.859	74	Weighted Average
1.849		99.47% Pervious Area
0.010		0.53% Impervious Area

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NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.6	100	0.1200	0.16		Sheet Flow, A-->B Woods: Light underbrush n= 0.400 P2= 3.14"
3.0	350	0.1500	1.94		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
13.6	450	Total			

Summary for Subcatchment 4S: Subcat 4S

Runoff = 7.45 cfs @ 12.14 hrs, Volume= 25,133 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
0.057	61	>75% Grass cover, Good, HSG B
0.195	74	>75% Grass cover, Good, HSG C
0.058	80	>75% Grass cover, Good, HSG D
0.001	98	Paved parking, HSG B
0.000	98	Paved parking, HSG D
0.067	98	Roofs, HSG C
0.154	30	Woods, Good, HSG A
0.086	55	Woods, Good, HSG B
1.580	70	Woods, Good, HSG C
0.707	77	Woods, Good, HSG D
2.905	70	Weighted Average
2.837		97.65% Pervious Area
0.068		2.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.1100	0.33		Sheet Flow, A-->B Grass: Short n= 0.150 P2= 3.14"
1.9	250	0.2000	2.24		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
6.9	350	Total			

Summary for Subcatchment 5S: Subcat 5S

Runoff = 8.69 cfs @ 12.25 hrs, Volume= 40,771 cf, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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Area (ac)	CN	Description
0.085	61	>75% Grass cover, Good, HSG B
0.858	74	>75% Grass cover, Good, HSG C
0.036	80	>75% Grass cover, Good, HSG D
0.007	98	Paved parking, HSG B
0.195	98	Paved parking, HSG C
0.026	98	Roofs, HSG B
0.016	98	Roofs, HSG C
0.082	30	Woods, Good, HSG A
0.254	55	Woods, Good, HSG B
2.845	70	Woods, Good, HSG C
0.143	77	Woods, Good, HSG D
4.547	71	Weighted Average
4.303		94.63% Pervious Area
0.244		5.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.4	100	0.1000	0.15		Sheet Flow, A-->B Woods: Light underbrush n= 0.400 P2= 3.14"
4.8	500	0.1200	1.73		Shallow Concentrated Flow, B-->C Woodland Kv= 5.0 fps
16.2	600	Total			

Summary for Subcatchment 6S: Subcat 6S

Runoff = 0.43 cfs @ 12.13 hrs, Volume= 1,403 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
0.053	61	>75% Grass cover, Good, HSG B
0.021	80	>75% Grass cover, Good, HSG D
0.008	98	Paved parking, HSG B
0.013	98	Roofs, HSG B
0.038	55	Woods, Good, HSG B
0.029	77	Woods, Good, HSG D
0.162	70	Weighted Average
0.141		87.02% Pervious Area
0.021		12.98% Impervious Area

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

Summary for Subcatchment 7aS: Subcat 7S

Runoff = 3.46 cfs @ 12.17 hrs, Volume= 13,317 cf, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (sf)	CN	Description
4,591	61	>75% Grass cover, Good, HSG B
30,722	80	>75% Grass cover, Good, HSG D
1,215	98	Paved parking, HSG B
4,753	98	Paved parking, HSG D
1,132	98	Roofs, HSG B
2,158	98	Roofs, HSG D
67	70	Woods, Good, HSG C
1,104	77	Woods, Good, HSG D
45,742	82	Weighted Average
36,484		79.76% Pervious Area
9,258		20.24% Impervious Area

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

Summary for Subcatchment 7bS: Subcat 7S

Runoff = 1.67 cfs @ 12.17 hrs, Volume= 6,506 cf, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (sf)	CN	Description
14,973	80	>75% Grass cover, Good, HSG D
4,173	98	Paved parking, HSG D
1,422	98	Roofs, HSG D
20,568	85	Weighted Average
14,973		72.80% Pervious Area
5,595		27.20% Impervious Area

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

Summary for Subcatchment 8S: Subcat 8S

Runoff = 13.10 cfs @ 12.17 hrs, Volume= 50,033 cf, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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Area (sf)	CN	Description
17,711	74	>75% Grass cover, Good, HSG C
37,323	80	>75% Grass cover, Good, HSG D
3,275	98	Paved parking, HSG C
7,792	98	Paved parking, HSG D
3,097	98	Roofs, HSG C
3,102	98	Roofs, HSG D
41,730	70	Woods, Good, HSG C
79,249	77	Woods, Good, HSG D
193,279	78	Weighted Average
176,013		91.07% Pervious Area
17,266		8.93% Impervious Area

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

Summary for Subcatchment 9S: Subcat 9S

Runoff = 4.90 cfs @ 12.17 hrs, Volume= 19,015 cf, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (sf)	CN	Description
7,504	61	>75% Grass cover, Good, HSG B
33,476	80	>75% Grass cover, Good, HSG D
3,804	98	Paved parking, HSG B
8,940	98	Paved parking, HSG D
1,773	98	Roofs, HSG B
6,276	98	Roofs, HSG D
61,773	84	Weighted Average
40,980		66.34% Pervious Area
20,793		33.66% Impervious Area

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

Summary for Subcatchment 10S: Subcat 10S

Runoff = 1.44 cfs @ 12.13 hrs, Volume= 4,740 cf, Depth= 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

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Area (sf)	CN	Description
14,610	80	>75% Grass cover, Good, HSG D
1,670	98	Paved parking, HSG D
16,281	82	Weighted Average
14,610		89.74% Pervious Area
1,670		10.26% Impervious Area

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

Summary for Subcatchment 11S: Subcat 11S

Runoff = 1.04 cfs @ 12.13 hrs, Volume= 3,759 cf, Depth= 4.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 10-YR+15% (NRCC D) Rainfall=5.46"

Area (ac)	CN	Description
0.049	80	>75% Grass cover, Good, HSG D
0.169	98	Paved parking, HSG D
0.217	94	Weighted Average
0.049		22.51% Pervious Area
0.169		77.49% Impervious Area

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

Summary for Reach 1R: UNB1 (lower)

[62] Hint: Exceeded Reach 2R OUTLET depth by 0.02' @ 12.55 hrs

Inflow Area = 1,844,828 sf, 10.94% Impervious, Inflow Depth = 2.87" for 10-YR+15% (NRCC D) event
Inflow = 74.57 cfs @ 12.31 hrs, Volume= 440,621 cf
Outflow = 74.36 cfs @ 12.32 hrs, Volume= 440,621 cf, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Max. Velocity= 7.34 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 5.8 min

Peak Storage= 6,039 cf @ 12.32 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 3.00' Flow Area= 57.0 sf, Capacity= 858.75 cfs

10.00' x 3.00' deep channel, n= 0.013 Corrugated PE, smooth interior
Side Slope Z-value= 3.0 '/' Top Width= 28.00'
Length= 596.0' Slope= 0.0070 '/'
Inlet Invert= 14.10', Outlet Invert= 9.90'



Summary for Reach 2R: UNB1 (middle)

[62] Hint: Exceeded Reach 3R OUTLET depth by 0.08' @ 12.39 hrs

Inflow Area = 1,718,293 sf, 11.58% Impervious, Inflow Depth = 2.90" for 10-YR+15% (NRCC D) event
 Inflow = 72.05 cfs @ 12.30 hrs, Volume= 415,488 cf
 Outflow = 71.82 cfs @ 12.31 hrs, Volume= 415,488 cf, Atten= 0%, Lag= 1.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 7.21 fps, Min. Travel Time= 1.4 min
 Avg. Velocity = 1.67 fps, Avg. Travel Time= 5.9 min

Peak Storage= 5,920 cf @ 12.31 hrs
 Average Depth at Peak Storage= 0.80'
 Bank-Full Depth= 3.00' Flow Area= 57.0 sf, Capacity= 849.89 cfs

10.00' x 3.00' deep channel, n= 0.013 Corrugated PE, smooth interior
 Side Slope Z-value= 3.0 '/' Top Width= 28.00'
 Length= 594.0' Slope= 0.0069 '/'
 Inlet Invert= 18.20', Outlet Invert= 14.10'



Summary for Reach 3R: UNB1 (upper)

[61] Hint: Exceeded Reach 4R outlet invert by 0.73' @ 12.31 hrs

Inflow Area = 1,627,842 sf, 11.74% Impervious, Inflow Depth = 2.90" for 10-YR+15% (NRCC D) event
 Inflow = 68.23 cfs @ 12.30 hrs, Volume= 393,263 cf
 Outflow = 68.12 cfs @ 12.31 hrs, Volume= 393,263 cf, Atten= 0%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 7.70 fps, Min. Travel Time= 0.9 min
 Avg. Velocity = 1.90 fps, Avg. Travel Time= 3.8 min

Peak Storage= 3,805 cf @ 12.31 hrs
 Average Depth at Peak Storage= 0.73'
 Bank-Full Depth= 3.00' Flow Area= 57.0 sf, Capacity= 961.66 cfs

10.00' x 3.00' deep channel, n= 0.013 Corrugated PE, smooth interior
 Side Slope Z-value= 3.0 '/' Top Width= 28.00'
 Length= 430.0' Slope= 0.0088 '/'
 Inlet Invert= 22.00', Outlet Invert= 18.20'



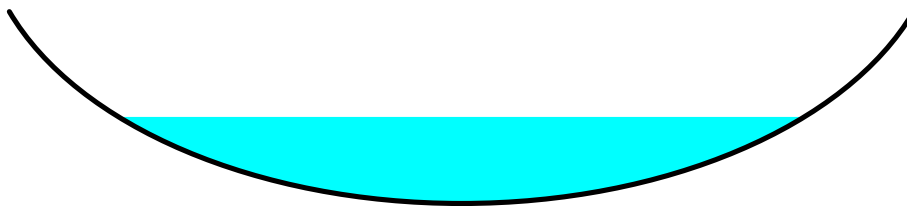
Summary for Reach 4R: UNB2

Inflow Area = 967,604 sf, 8.84% Impervious, Inflow Depth = 2.76" for 10-YR+15% (NRCC D) event
 Inflow = 38.33 cfs @ 12.35 hrs, Volume= 222,353 cf
 Outflow = 38.30 cfs @ 12.35 hrs, Volume= 222,353 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 9.53 fps, Min. Travel Time= 0.4 min
 Avg. Velocity = 2.23 fps, Avg. Travel Time= 1.7 min

Peak Storage= 917 cf @ 12.35 hrs
 Average Depth at Peak Storage= 0.90'
 Bank-Full Depth= 2.00' Flow Area= 13.3 sf, Capacity= 209.49 cfs

10.00' x 2.00' deep Parabolic Channel, n= 0.025 Earth, clean & winding
 Length= 228.0' Slope= 0.0539 '/'
 Inlet Invert= 34.30', Outlet Invert= 22.00'



Summary for Reach 5R: Treatment Swale

Inflow Area = 9,473 sf, 77.49% Impervious, Inflow Depth = 4.76" for 10-YR+15% (NRCC D) event
 Inflow = 1.04 cfs @ 12.13 hrs, Volume= 3,759 cf
 Outflow = 0.92 cfs @ 12.16 hrs, Volume= 3,759 cf, Atten= 12%, Lag= 2.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 0.39 fps, Min. Travel Time= 4.6 min
 Avg. Velocity = 0.10 fps, Avg. Travel Time= 18.4 min

Peak Storage= 253 cf @ 12.16 hrs
 Average Depth at Peak Storage= 0.27'
 Bank-Full Depth= 1.00' Flow Area= 11.0 sf, Capacity= 9.14 cfs

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8.00' x 1.00' deep channel, n= 0.150
Side Slope Z-value= 3.0 '/ Top Width= 14.00'
Length= 107.0' Slope= 0.0100 '/
Inlet Invert= 44.40', Outlet Invert= 43.33'



Summary for Reach C1: Culvert 1

[52] Hint: Inlet/Outlet conditions not evaluated

[65] Warning: Inlet elevation not specified

Inflow Area = 466,959 sf, 18.93% Impervious, Inflow Depth = 3.11" for 10-YR+15% (NRCC D) event
Inflow = 24.39 cfs @ 12.27 hrs, Volume= 120,878 cf
Outflow = 24.38 cfs @ 12.27 hrs, Volume= 120,878 cf, Atten= 0%, Lag= 0.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Max. Velocity= 7.40 fps, Min. Travel Time= 0.0 min

Avg. Velocity = 2.37 fps, Avg. Travel Time= 0.1 min

Peak Storage= 66 cf @ 12.27 hrs

Average Depth at Peak Storage= 0.66'

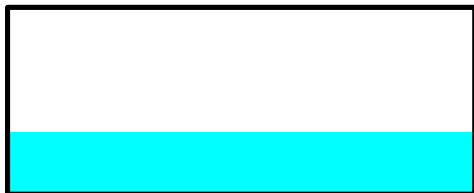
Bank-Full Depth= 2.00' Flow Area= 10.0 sf, Capacity= 91.34 cfs

60.0" W x 24.0" H Box Pipe

n= 0.013

Length= 20.0' Slope= 0.0100 '/

Inlet Invert= 0.00', Outlet Invert= -0.20'



Summary for Reach C2: Crossing 2

[52] Hint: Inlet/Outlet conditions not evaluated

[65] Warning: Inlet elevation not specified

Inflow Area = 967,604 sf, 8.84% Impervious, Inflow Depth = 2.76" for 10-YR+15% (NRCC D) event
Inflow = 38.33 cfs @ 12.35 hrs, Volume= 222,353 cf
Outflow = 38.33 cfs @ 12.35 hrs, Volume= 222,353 cf, Atten= 0%, Lag= 0.0 min

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Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Max. Velocity= 5.38 fps, Min. Travel Time= 0.1 min

Avg. Velocity = 1.89 fps, Avg. Travel Time= 0.2 min

Peak Storage= 143 cf @ 12.35 hrs

Average Depth at Peak Storage= 6.79' above invert (0.79' above fill)

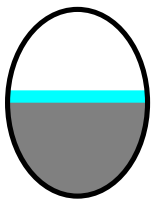
Bank-Full Depth= 12.00' above invert (6.00' above fill) Flow Area= 42.4 sf, Capacity= 416.21 cfs

108.0" W x 144.0" H Ellipse Pipe w/ 72.0" inside fill

n= 0.030 Earth, grassed & winding

Length= 20.0' Slope= 0.0200 '/'

Inlet Invert= 0.00', Outlet Invert= -0.40'



Summary for Pond 2P: Sediment Forebay #1

Inflow Area = 107,515 sf, 27.95% Impervious, Inflow Depth = 3.42" for 10-YR+15% (NRCC D) event

Inflow = 6.25 cfs @ 12.23 hrs, Volume= 30,629 cf

Outflow = 5.81 cfs @ 12.26 hrs, Volume= 30,014 cf, Atten= 7%, Lag= 1.8 min

Primary = 5.81 cfs @ 12.26 hrs, Volume= 30,014 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2

Peak Elev= 48.00' @ 12.30 hrs Surf.Area= 1,299 sf Storage= 1,658 cf

Plug-Flow detention time= 24.7 min calculated for 30,014 cf (98% of inflow)

Center-of-Mass det. time= 12.5 min (877.3 - 864.8)

Volume	Invert	Avail.Storage	Storage Description
#1	46.00'	3,156 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
46.00	437	86.0	0	0	437
48.00	1,300	159.0	1,660	1,660	1,881
49.00	1,699	174.0	1,495	3,156	2,312

Device	Routing	Invert	Outlet Devices
#1	Primary	47.00'	6.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=5.87 cfs @ 12.26 hrs HW=47.98' TW=47.93' (Dynamic Tailwater)

↑1=**Broad-Crested Rectangular Weir** (Weir Controls 5.87 cfs @ 0.99 fps)

Summary for Pond 3P: Detention Basin

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=5)

Inflow Area = 61,773 sf, 33.66% Impervious, Inflow Depth = 3.69" for 10-YR+15% (NRCC D) event
 Inflow = 4.90 cfs @ 12.17 hrs, Volume= 19,015 cf
 Outflow = 3.45 cfs @ 12.22 hrs, Volume= 18,152 cf, Atten= 30%, Lag= 3.1 min
 Primary = 3.45 cfs @ 12.22 hrs, Volume= 18,152 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 48.14' @ 12.27 hrs Surf.Area= 1,788 sf Storage= 2,497 cf

Plug-Flow detention time= 56.9 min calculated for 18,152 cf (95% of inflow)
 Center-of-Mass det. time= 30.5 min (858.7 - 828.2)

Volume	Invert	Avail.Storage	Storage Description			
#1	46.00'	7,117 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
46.00	641	100.0	0	0	641	
50.00	3,253	214.0	7,117	7,117	3,558	

Device	Routing	Invert	Outlet Devices			
#1	Primary	46.50'	18.0" Round Culvert L= 50.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 46.50' / 46.00' S= 0.0100 '/ Cc= 0.900 n= 0.013, Flow Area= 1.77 sf			

Primary OutFlow Max=3.39 cfs @ 12.22 hrs HW=48.11' TW=47.94' (Dynamic Tailwater)

↑ **1=Culvert** (Outlet Controls 3.39 cfs @ 2.22 fps)

Summary for Pond 4P: WL

Inflow Area = 45,742 sf, 20.24% Impervious, Inflow Depth = 3.49" for 10-YR+15% (NRCC D) event
 Inflow = 3.46 cfs @ 12.17 hrs, Volume= 13,317 cf
 Outflow = 2.81 cfs @ 12.24 hrs, Volume= 12,477 cf, Atten= 19%, Lag= 3.8 min
 Primary = 2.81 cfs @ 12.24 hrs, Volume= 12,477 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 52.08' @ 12.24 hrs Surf.Area= 2,129 sf Storage= 2,121 cf

Plug-Flow detention time= 73.4 min calculated for 12,475 cf (94% of inflow)
 Center-of-Mass det. time= 38.3 min (873.8 - 835.5)

Volume	Invert	Avail.Storage	Storage Description			
#1	50.00'	4,635 cf	Custom Stage Data (Irregular) Listed below (Recalc)			

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Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
50.00	223	74.0	0	0	223
52.00	2,030	185.0	1,951	1,951	2,525
53.00	3,398	227.0	2,685	4,635	3,918

Device	Routing	Invert	Outlet Devices
#1	Primary	51.30'	18.0" Round Culvert L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 51.30' / 50.40' S= 0.0205 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=2.80 cfs @ 12.24 hrs HW=52.08' TW=47.96' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.80 cfs @ 3.01 fps)

Summary for Pond 5P: Sediment Forebay #2

Inflow Area = 20,568 sf, 27.20% Impervious, Inflow Depth = 3.80" for 10-YR+15% (NRCC D) event
 Inflow = 1.67 cfs @ 12.17 hrs, Volume= 6,506 cf
 Outflow = 1.49 cfs @ 12.22 hrs, Volume= 6,035 cf, Atten= 10%, Lag= 2.6 min
 Primary = 1.49 cfs @ 12.22 hrs, Volume= 6,035 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 52.25' @ 12.22 hrs Surf.Area= 973 sf Storage= 953 cf

Plug-Flow detention time= 80.9 min calculated for 6,035 cf (93% of inflow)
 Center-of-Mass det. time= 40.5 min (864.9 - 824.4)

Volume	Invert	Avail.Storage	Storage Description
#1	51.00'	3,256 cf	Custom Stage Data (Irregular) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
51.00	565	97.4	0	0	565
52.00	885	116.2	719	719	902
54.00	1,695	153.9	2,537	3,256	1,756

Device	Routing	Invert	Outlet Devices
#1	Primary	48.80'	12.0" Round Culvert L= 53.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.80' / 46.80' S= 0.0377 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	51.70'	18.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=1.49 cfs @ 12.22 hrs HW=52.25' TW=47.87' (Dynamic Tailwater)
1=Culvert (Passes 1.49 cfs of 6.50 cfs potential flow)
2=Orifice/Grate (Orifice Controls 1.49 cfs @ 2.53 fps)

Summary for Pond 19P: SGW

[44] Hint: Outlet device #3 is below defined storage

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=25)

Inflow Area = 144,364 sf, 25.85% Impervious, Inflow Depth = 3.39" for 10-YR+15% (NRCC D) event
 Inflow = 7.87 cfs @ 12.24 hrs, Volume= 40,789 cf
 Outflow = 7.14 cfs @ 12.31 hrs, Volume= 40,791 cf, Atten= 9%, Lag= 4.2 min
 Primary = 0.82 cfs @ 12.31 hrs, Volume= 28,336 cf
 Secondary = 6.32 cfs @ 12.31 hrs, Volume= 12,454 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 47.95' @ 12.31 hrs Surf.Area= 7,648 sf Storage= 6,901 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 61.3 min (931.5 - 870.2)

Volume	Invert	Avail.Storage	Storage Description
#1	45.70'	1,911 cf	Cell #1 (Irregular) Listed below (Recalc)
#2	45.70'	2,064 cf	Cell #2 (Irregular) Listed below (Recalc)
#3	47.20'	8,095 cf	+46.8 (Irregular) Listed below (Recalc)
		12,070 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
45.70	1,003	123.2	0	0	1,003
46.80	1,401	142.1	1,316	1,316	1,428
47.20	1,576	149.6	595	1,911	1,611

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
45.70	1,089	130.8	0	0	1,089
46.80	1,510	149.7	1,423	1,423	1,538
47.20	1,694	157.2	640	2,064	1,731

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
47.20	3,404	310.3	0	0	3,404
48.00	4,441	354.0	3,129	3,129	5,729
49.00	5,511	370.0	4,966	8,095	6,720

Device	Routing	Invert	Outlet Devices
#1	Secondary	47.50'	8.0' long x 4.0' breadth Emergency spillway Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32
#2	Primary	45.30'	6.0" Round Control device outlet (to outfall) L= 44.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 45.30' / 44.80' S= 0.0114 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.20 sf

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#3	Device 2	45.00'	4.0" Vert. 4" Ø oriface	C= 0.600
#4	Device 2	47.20'	24.0" Horiz. 24" Ø high flow by-pass	C= 0.600

Limited to weir flow at low heads

Primary OutFlow Max=0.82 cfs @ 12.31 hrs HW=47.95' TW=6.78' (Dynamic Tailwater)

↳ **2=Control device outlet (to outfall)** (Barrel Controls 0.82 cfs @ 4.19 fps)

↳ **3=4" Ø oriface** (Passes < 0.68 cfs potential flow)

↳ **4=24" Ø high flow by-pass** (Passes < 13.14 cfs potential flow)

Secondary OutFlow Max=6.32 cfs @ 12.31 hrs HW=47.95' TW=6.78' (Dynamic Tailwater)

↳ **1=Emergency spillway** (Weir Controls 6.32 cfs @ 1.74 fps)

Summary for Link POA1: POA 1

Inflow Area =	2,042,895 sf, 10.40% Impervious,	Inflow Depth =	2.83"	for 10-YR+15% (NRCC D) event
Inflow =	82.17 cfs @ 12.31 hrs,	Volume=	481,392 cf	
Primary =	82.17 cfs @ 12.31 hrs,	Volume=	481,392 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link POA2: POA 2

Inflow Area =	7,062 sf, 12.98% Impervious,	Inflow Depth =	2.38"	for 10-YR+15% (NRCC D) event
Inflow =	0.43 cfs @ 12.13 hrs,	Volume=	1,403 cf	
Primary =	0.43 cfs @ 12.13 hrs,	Volume=	1,403 cf,	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

APPENDIX E

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	New Hampshire
Location	
Longitude	70.909 degrees West
Latitude	43.149 degrees North
Elevation	0 feet
Date/Time	Tue, 17 Dec 2019 11:01:15 -0500

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.40	0.50	0.65	0.81	1.03	1yr	0.70	0.98	1.20	1.55	2.00	2.61	2.85	1yr	2.31	2.74	3.14	3.86	4.44	1yr
2yr	0.32	0.49	0.61	0.81	1.01	1.29	2yr	0.88	1.17	1.50	1.91	2.44	3.14	3.48	2yr	2.78	3.35	3.84	4.57	5.21	2yr
5yr	0.37	0.57	0.72	0.96	1.23	1.58	5yr	1.06	1.44	1.85	2.38	3.07	3.97	4.46	5yr	3.52	4.29	4.90	5.79	6.55	5yr
10yr	0.40	0.63	0.80	1.09	1.42	1.84	10yr	1.22	1.69	2.18	2.82	3.66	4.75	5.38	10yr	4.20	5.18	5.90	6.92	7.79	10yr
25yr	0.46	0.74	0.94	1.29	1.72	2.26	25yr	1.48	2.09	2.69	3.52	4.61	6.02	6.91	25yr	5.32	6.65	7.53	8.76	9.81	25yr
50yr	0.51	0.83	1.06	1.48	1.99	2.66	50yr	1.72	2.46	3.17	4.18	5.50	7.20	8.35	50yr	6.37	8.03	9.07	10.48	11.68	50yr
100yr	0.58	0.93	1.20	1.70	2.31	3.11	100yr	1.99	2.89	3.74	4.95	6.54	8.62	10.10	100yr	7.63	9.71	10.92	12.54	13.92	100yr
200yr	0.64	1.04	1.35	1.94	2.69	3.66	200yr	2.32	3.40	4.41	5.89	7.81	10.32	12.21	200yr	9.13	11.74	13.15	15.02	16.59	200yr
500yr	0.75	1.24	1.61	2.34	3.28	4.52	500yr	2.83	4.21	5.48	7.37	9.85	13.11	15.70	500yr	11.60	15.10	16.83	19.06	20.94	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.60	0.74	0.90	1yr	0.64	0.88	0.91	1.26	1.57	2.04	2.50	1yr	1.80	2.40	2.92	3.29	4.02	1yr
2yr	0.31	0.49	0.60	0.81	1.00	1.18	2yr	0.86	1.16	1.37	1.83	2.36	3.04	3.39	2yr	2.69	3.26	3.74	4.46	5.05	2yr
5yr	0.35	0.54	0.67	0.92	1.16	1.40	5yr	1.01	1.37	1.61	2.15	2.78	3.72	4.13	5yr	3.29	3.97	4.59	5.42	6.13	5yr
10yr	0.38	0.59	0.73	1.02	1.32	1.60	10yr	1.14	1.56	1.82	2.45	3.13	4.28	4.80	10yr	3.79	4.62	5.33	6.28	7.05	10yr
25yr	0.44	0.67	0.83	1.18	1.55	1.91	25yr	1.34	1.87	2.11	2.85	3.66	5.01	5.84	25yr	4.44	5.61	6.51	7.63	8.51	25yr
50yr	0.48	0.73	0.91	1.31	1.77	2.19	50yr	1.52	2.14	2.36	3.21	4.12	5.74	6.76	50yr	5.08	6.50	7.59	8.84	9.80	50yr
100yr	0.54	0.81	1.02	1.47	2.02	2.51	100yr	1.74	2.45	2.64	3.59	4.60	6.57	7.82	100yr	5.81	7.52	8.84	10.25	11.25	100yr
200yr	0.60	0.90	1.14	1.65	2.30	2.87	200yr	1.99	2.80	2.94	4.02	5.14	7.51	9.05	200yr	6.65	8.71	10.31	11.88	12.95	200yr
500yr	0.70	1.04	1.34	1.94	2.76	3.45	500yr	2.38	3.37	3.41	4.66	5.98	8.93	10.98	500yr	7.90	10.55	12.63	14.46	15.54	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.87	1.08	1yr	0.75	1.05	1.24	1.74	2.22	2.84	3.04	1yr	2.52	2.92	3.38	4.18	4.78	1yr
2yr	0.33	0.51	0.62	0.84	1.04	1.25	2yr	0.90	1.22	1.48	1.95	2.51	3.26	3.58	2yr	2.89	3.45	3.95	4.71	5.40	2yr
5yr	0.39	0.60	0.75	1.03	1.31	1.58	5yr	1.13	1.55	1.85	2.50	3.20	4.23	4.78	5yr	3.74	4.60	5.23	6.17	6.94	5yr
10yr	0.46	0.70	0.87	1.21	1.57	1.92	10yr	1.35	1.88	2.23	3.05	3.85	5.21	5.96	10yr	4.61	5.73	6.51	7.57	8.46	10yr
25yr	0.55	0.84	1.05	1.49	1.97	2.47	25yr	1.70	2.42	2.87	3.96	4.94	7.04	7.98	25yr	6.23	7.68	8.65	9.95	11.02	25yr
50yr	0.64	0.97	1.21	1.74	2.34	2.99	50yr	2.02	2.92	3.48	4.83	5.99	8.71	9.98	50yr	7.71	9.59	10.75	12.23	13.48	50yr
100yr	0.74	1.12	1.40	2.03	2.78	3.61	100yr	2.40	3.53	4.23	5.91	7.28	10.77	12.47	100yr	9.53	11.99	13.33	15.05	16.49	100yr
200yr	0.86	1.29	1.64	2.37	3.31	4.38	200yr	2.85	4.28	5.14	7.24	8.83	13.37	15.61	200yr	11.83	15.01	16.55	18.51	20.21	200yr
500yr	1.05	1.56	2.01	2.91	4.14	5.62	500yr	3.58	5.49	6.63	9.47	11.42	17.82	20.99	500yr	15.77	20.18	22.03	24.37	26.46	500yr



APPENDIX F

Soil Series	legend number	Ksat low - B in/hr	Ksat high - B in/hr	Ksat low - C in/hr	Ksat high - C in/hr	Hyd. Grp.	Group	Land Form	Temp.	Soil Textures	Spodosol ?	Other
Occum	1	0.6	2.0	6.00	20.0	B	2	Flood Plain (Bottom Land)	mesic	loamy	no	loamy over loamy sand
Suncook	2	6.0	20.0	6.00	20.0	A	1	Flood Plain (Bottomland)	mesic	sandy	no	occasionally flooded
Lim	3	0.6	2.0	6.00	20.0	C	5	Flood Plain (Bottom Land)	mesic	loamy	no	
Pootatuck	4	0.6	6.0	6.00	20.0	B	3	Flood Plain (Bottom Land)	mesic	loamy	no	single grain in C
Rippowam	5	0.6	6.0	6.00	20.0	C	5	Flood Plain (Bottom Land)	mesic	loamy	no	
Saco	6	0.6	2.0	6.00	20.0	D	6	Flood Plain (Bottom Land)	mesic	silty	no	strata
Hadley	8	0.6	2.0	0.60	6.0	B	2	Flood Plain (Bottom Land)	mesic	silty	no	strata of fine sand
Winooski	9	0.6	6.0	0.60	6.0	B		Flood Plain (Bottom Land)	mesic	silty over loamy	no	
Merrimac	10	2.0	20.0	6.00	20.0	A	1	Outwash and Stream Terraces	mesic	gravely sand	no	loamy cap
Gloucester	11	6.0	20.0	6.00	20.0	A	1	Sandy Till	mesic	sandy-skeletal	no	loamy cap
Hinckley	12	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	mesic	sandy-skeletal	no	
Sheepscot	14	6.0	20.0	6.00	20.0	B	3	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	gravely coarse sand
Searsport	15	6.0	20.0	6.00	20.0	D	6	Outwash and Stream Terraces	frigid	sandy	no	organic over sand
Saugatuck	16	0.06	0.2	6.00	20.0	C	5	Outwash and Stream Terraces	mesic	sandy	yes	ortstein
Colton, gravelly	21	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	gravely surface
Colton	22	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	
Masardis	23	6.0	20.0	6.00	20.0	A	1	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	slate, loamy cap
Agawam	24	6.0	20.0	20.00	100.0	B	2	Outwash and Stream Terraces	mesic	loamy over sandy	no	loamy over sand/gravel
Windsor	26	6.0	20.0	6.00	20.0	A	1	Outwash and Stream Terraces	mesic	sandy	no	
Groveton	27	0.6	2.0	0.60	6.0	B	2	Outwash and Stream Terraces	frigid	loamy	yes	loamy over sandy
Madawaska	28	0.6	2.0	6.00	20.0	B	3	Outwash and Stream Terraces	frigid	loamy over sandy	yes	sandy or sandy-skeletal
Woodbridge	29	0.6	2.0	0.00	0.6	C	3	Firm, platy, loamy till	mesic	loamy	no	sandy loam in Cd
Unadilla	30	0.6	2.0	2.00	20.0	B	2	Terraces and glacial lake plains	mesic	silty	no	silty over gravelly
Hartland	31	0.6	2.0	0.20	2.0	B	2	Terraces and glacial lake plains	mesic	silty	no	very fine sandy loam
Boxford	32	0.1	0.2	0.00	0.2	C	3	Silt and Clay Deposits	mesic	fine	no	silty clay loam
Scitico	33	0.0	0.2	0.00	0.2	C	5	Silt and Clay Deposits	mesic	fine	no	
Wareham	34	6.0	20.0	6.00	20.0	C	5	Outwash and Stream Terraces	mesic	sandy	no	
Champlain	35	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	gravely sand	no	
Adams	36	6.0	20.0	20.00	99.0	A	1	Outwash and Stream Terraces	frigid	sandy	yes	
Melrose	37	2.0	6.0	0.00	0.2	C	3	Sandy/loamy over silt/clay	frigid	loamy over clayey	no	silty clay loam in C
Eldridge	38	6.0	20.0	0.06	0.6	C	3	Sandy/loamy over silt/clay	mesic	sandy over loamy	no	
Millis	39					C	3	Firm, platy, sandy till	frigid	loamy	yes	loamy sand in Cd
Canton	42	2.0	6.0	6.00	20.0	B	2	Loose till, sandy textures	mesic	loamy over sandy	no	loamy over loamy sand
Montauk	44	0.6	6.0	0.06	0.6	C	3	Firm, platy, sandy till	mesic	loamy	no	loamy sand in Cd
Henniker	46	0.6	2.0	0.06	0.6	C	3	Firm, platy, sandy till	frigid	loamy	no	loamy sand in Cd
Madawaska, aquatic	48	0.6	2.0	6.00	20.0	B	3	Outwash and Stream Terraces	frigid	loamy over sandy	yes	sandy or sandy-skeletal
Whitman	49	0.0	0.2	0.00	0.2	D	6	Firm, platy, loamy till	mesic	loamy	no	mucky loam
Hermon	55	2.0	20.0	6.00	20.0	A	1	Sandy Till	frigid	sandy-skeletal	yes	loamy cap
Becket	56	0.6	2.0	0.06	0.6	C	3	Firm, platy, sandy till	frigid	loamy	yes	gravely sandy loam in Cd
Waumbeck	58	2.0	20.0	6.00	20.0	B	3	Loose till, sandy textures	frigid	sandy-skeletal	yes	very cobbly loamy sand
Charlton	62	0.6	6.0	0.60	6.0	B	2	Loose till, loamy textures	mesic	loamy	no	fine sandy loam
Paxton	66	0.6	2.0	0.00	0.2	C	3	Firm, platy, loamy till	mesic	loamy	no	
Sutton	68	0.6	6.0	0.60	6.0	B	3	Loose till, loamy textures	mesic	loamy	no	
Berkshire	72	0.6	6.0	0.60	6.0	B	2	Loose till, loamy textures	frigid	loamy	yes	fine sandy loam
Marlow	76	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	yes	fine sandy loam in Cd
Peru	78	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	yes	
Thorndike	84	0.6	2.0	0.60	2.0	C/D	4	Friable till, silty, schist & phyllite	frigid	loamy-skeletal	yes	less than 20 in. deep
Hollis	86	0.6	6.0	0.60	6.0	C/D	4	Loose till, bedrock	mesic	loamy	no	less than 20 in. deep
Winnecook	88	0.6	2.0	0.60	2.0	C	4	Friable till, silty, schist & phyllite	frigid	loamy-skeletal	yes	20 to 40 in. deep
Chatfield	89	0.6	6.0	0.60	6.0	B	4	Loose till, bedrock	mesic	loamy	no	20 to 40 in. deep
Hogback	91	2.0	6.0	2.00	6.0	C	4	Loose till, bedrock	frigid	loamy	yes	less than 20 in. deep
Lyman	92	2.0	6.0	2.00	6.0	A/D	4	Loose till, bedrock	frigid	loamy	yes	less than 20 in. deep
Woodstock	93	2.0	6.0	2.00	6.0	C/D	4	Loose till, bedrock	frigid	loamy	no	less than 20 in. deep
Rawsonville	98	0.6	6.0	0.60	6.0	C	4	Loose till, bedrock	frigid	loamy	yes	20 to 40 in. deep
Tunbridge	99	0.6	6.0	0.60	6.0	C	4	Loose till, bedrock	frigid	loamy	yes	20 to 40 in. deep

Soil Series	legend number	Ksat low - B in/hr	Ksat high - B in/hr	Ksat low - C in/hr	Ksat high - C in/hr	Hyd. Grp.	Group	Land Form	Temp.	Soil Textures	Spodosol ?	Other
Ondawa	101	0.6	6.0	6.00	20.0	B	2	Flood Plain (Bottom Land)	frigid	loamy	no	loamy over loamy sand
Sunday	102	6.0	20.0	6.00	20.0	A	1	Flood Plain (Bottomland)	frigid	sandy	no	occasionally flooded
Winooski	103	0.6	6.0	0.60	6.0	B	3	Flood Plain (Bottom Land)	mesic	silty	no	very fine sandy loam
Podunk	104	0.6	6.0	6.00	20.0	B	3	Flood Plain (Bottom Land)	frigid	loamy	no	loamy to coarse sand in C
Rumney	105	0.6	6.0	6.00	20.0	C	5	Flood Plain (Bottom Land)	frigid	loamy	no	
Hadley	108	0.6	2.0	0.60	6.0	B	2	Flood Plain (Bottom Land)	mesic	silty	no	strata of fine sand, occ flooded
Limerick	109	0.6	2.0	0.60	2.0	C	5	Flood Plain (Bottom Land)	mesic	silty	no	
Scarboro	115	6.0	20.0	6.00	20.0	D	6	Outwash and Stream Terraces	mesic	sandy	no	organic over sand, non stony
Finch	116					C	3	Outwash and Stream Terraces	frigid	sandy	yes	cemented (ortstein)
Sudbury	118	2.0	6.0	2.00	20.0	B	3	Outwash and Stream Terraces	mesic	sandy	no	loam over gravelly sand
Telos	123	0.6	2.0	0.02	0.2	C	3	Firm, platy, silty till, schist & phyllite	frigid	loamy	yes	channery silt loam in Cd
Chesuncook	126	0.6	2.0	0.02	0.2	C	3	Firm, platy, silty till, schist & phyllite	frigid	loamy	yes	channery silt loam in Cd
Allagash	127	0.6	2.0	6.00	20.0	B	2	Outwash and Stream Terraces	frigid	loamy over sandy	yes	loamy over sandy
Elliottsville	128	0.6	2.0	0.60	2.0	B	4	Friable till, silty, schist & phyllite	frigid	loamy	yes	20 to 40 in. deep
Hitchcock	130	0.6	2.0	0.06	0.6	B	3	Terraces and glacial lake plains	mesic	silty	no	silt loam to silt in C
Burnham	131	0.2	6.0	0.02	0.2	D	6	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	organic over silt
Dartmouth	132	0.6	2.0	0.06	0.6	B	3	Terraces and glacial lake plains	mesic	silty	no	thin strata silty clay loam
Monson	133	0.6	2.0	0.60	2.0	D	4	Friable till, silty, schist & phyllite	frigid	loamy	yes	less than 20 in. deep
Maybid	134	0.0	0.2	0.00	0.2	D	6	Silt and Clay Deposits	mesic	fine	no	silt over clay
Shapleigh	136					C/D	4	Sandy Till	mesic	sandy	yes	less than 20 in. deep
Monadnock	142	0.6	2.0	2.00	6.0	B	2	Loose till, sandy textures	frigid	loamy over sandy, sandy-skeletal	yes	gravelly loamy sand in C
Acton	146	2.0	20.0	2.00	20.0	B	3	Loose till, sandy textures	mesic	sandy-skeletal	no	cobbly loamy sand
Vassalboro	150					D	6	Organic Materials - Freshwater	frigid	peat	no	deep organic
Success	154	2.0	6.0	6.00	20.0	A	1	Sandy Till	frigid	sandy-skeletal	yes	cemented
Canterbury	166	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	no	loam in Cd
Sunapee	168	0.6	2.0	0.60	6.0	B	3	Loose till, loamy textures	frigid	loamy	yes	
Waskish	195					D	6	Organic Materials - Freshwater	frigid	peat	no	deep organic
Ondawa	201	0.6	6.0	6.00	20.0	B	2	Flood Plain (Bottom Land)	frigid	loamy	no	occ flood, loamy over l. sand
Sunday	202	6.0	20.0	6.00	20.0	A	1	Flood Plain (Bottomland)	frigid	sandy	no	frequently flooded
Fryeburg	208	0.6	2.0	2.00	6.0	B	2	Flood Plain (Bottom Land)	frigid	silty	no	very fine sandy loam
Charles	209	0.6	100.0	0.60	100.0	C	5	Flood Plain (Bottom Land)	frigid	silty	no	
Warwick	210	2.0	6.0	20.00	100.0	A	1	Outwash and Stream Terraces	mesic	loamy-skeletal	no	loamy over slate gravel
Naumburg	214	6.0	20.0	6.00	20.0	C	5	Outwash and Stream Terraces	frigid	sandy	yes	
Boscawen	220	6.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	frigid	sandy-skeletal	no	loamy cap
Bemis	224	0.6	0.2	0.00	0.2	C	5	Firm, platy, loamy till	cryic	loamy	no	
Bice	226	0.6	6.0	0.60	6.0	B	2	Loose till, loamy textures	frigid	loamy	no	sandy loam
Lanesboro	228	0.6	2.0	0.06	0.2	C	3	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	channery silt loam in Cd
Poocham	230	0.6	2.0	0.20	2.0	B	3	Terraces and glacial lake plains	mesic	silty	no	silt loam in C
Buxton	232	0.1	0.6	0.00	0.2	C	3	Silt and Clay Deposits	frigid	fine	no	silty clay
Scantic	233	0.0	0.2	0.00	0.2	D	5	Silt and Clay Deposits	frigid	fine	no	
Biddeford	234	0.0	0.2	0.00	0.2	D	6	Silt and Clay Deposits	frigid	fine	no	organic over clay
Buckland	237	0.6	2.0	0.06	0.2	C	3	Firm, platy, loamy till	frigid	loamy	no	loam in Cd
Elmridge	238	2.0	6.0	0.00	0.2	C	3	Sandy/loamy over silt/clay	mesic	loamy over clayey	no	
Brayton	240	0.6	2.0	0.06	0.6	C	5	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	
Lyme	246	0.6	6.0	0.60	6.0	C	5	Loose till, sandy textures	frigid	loamy	no	
Millsite	251	0.6	6.0	0.60	6.0	C	4	Loose till, bedrock	frigid	loamy	no	20 to 40 in. deep
Macomber	252	0.6	2.0	0.60	2.0	C	4	Friable till, silty, schist & phyllite	frigid	loamy-skeletal	yes	20 to 40 in. deep
Lombard	259	0.6	6.0	2.00	20.0	C/D	2	Weathered bedrock, phyllite	frigid	loamy	no	very channery
Sunapee var	269	0.6	2.0	0.60	6.0	B	3	Loose till, loamy textures	frigid	loamy	yes	frigid dystrodept
Chatfield Var.	289	0.6	6.0	0.60	6.0	B	3	Loose till, bedrock	mesic	loamy	no	mwd to swpd
Greenwood	295					A/D	6	Organic Materials - Freshwater	frigid	hemic	no	deep organic
Catden	296					A/D	6	Organic Materials - Freshwater	mesic	sapric	no	deep organic
Lovewell	307	0.6	2.0	0.60	2.0	B	3	Flood Plain (Bottom Land)	frigid	silty	no	very fine sandy loam
Quonset	310	2.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	mesic	sandy-skeletal	no	shale
Deerfield	313	6.0	20.0	20.00	100.0	B	3	Outwash and Stream Terraces	mesic	sandy	no	single grain in C

Soil Series	legend number	Ksat low - B in/hr	Ksat high - B in/hr	Ksat low - C in/hr	Ksat high - C in/hr	Hyd. Grp.	Group	Land Form	Temp.	Soil Textures	Spodosol ?	Other
Pipestone	314					B	5	Outwash and Stream Terraces	mesic	sandy	yes	
Mashpee	315	6.0	20.0	6.00	20.0	B	5	Outwash and Stream Terraces	mesic	sandy	yes	
Bernardston	330	0.6	2.0	0.06	0.2	C	3	Firm, platy, silty till, schist & phyllite	mesic	loamy	no	channery silt loam in Cd
Roundabout	333	0.2	2.0	0.06	0.6	C	5	Terraces and glacial lake plains	frigid	silty	no	silt loam in the C
Pittstown	334	0.6	2.0	0.06	0.2	C	3	Firm, platy, silty till, schist & phyllite	mesic	loamy	no	channery silt loam in Cd
Elmwood	338	2.0	6.0	0.00	0.2	C	3	Sandy/loamy over silt/clay	frigid	loamy over clayey	no	
Stissing	340	0.6	2.0	0.06	0.2	C	5	Firm, platy, silty till, schist & phyllite	mesic	loamy	no	
Cardigan	357	0.6	2.0	0.60	2.0	B	4	Friable till, silty, schist & phyllite	mesic	loamy	no	20 to 40 in. deep
Kearsarge	359	0.6	2.0	0.60	2.0	B	4	Friable till, silty, schist & phyllite	mesic	loamy	no	less than 20 in. deep
Dutchess	366	0.6	2.0	0.60	2.0	B	2	Friable till, silty, schist & phyllite	mesic	loamy	no	very channery
Dixfield	378	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	yes	fine sandy loam in Cd
Timakwa	393			6.00	100.0	D	6	Organic Materials - Freshwater	mesic	sandy or sandy-skeletal	no	organic over sand
Chocorua	395			6.00	20.0	D	6	Organic Materials - Freshwater	frigid	sandy or sandy-skeletal	no	organic over sand
Ipswich	397					D	6	Tidal Flat	mesic	hemic/sapric	no	deep organic
Suncook	402	6.0	20.0	6.00	20.0	A	1	Flood Plain (Bottomland)	mesic	sandy	no	frequent flooding
Metallak	404	6.0	100.0	6.00	100.0	B	3	Flood Plain (Bottom Land)	frigid	loamy over sandy	no	sandy or sandy-skeletal
Medomak	406	0.6	2.0	0.60	2.0	D	6	Flood Plain (Bottom Land)	frigid	silty	no	organic over silt
Haven	410	0.6	2.0	20.00	100.0	B	2	Outwash and Stream Terraces	mesic	loamy over sandy	no	loamy over sand/gravel
Duane	413	6.0	20.0	6.00	20.0	B	3	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	cemented (ortstein)
Moosilauke	414	6.0	20.0	6.00	20.0	C	5	Loose till, sandy textures	frigid	sandy	no	
Grange	433	0.6	2.0	0.60	2.0	C	5	Outwash and Stream Terraces	frigid	co. loamy over sandy (skeletal)	no	
Swanton	438	2.0	6.0	0.00	0.2	C	5	Sandy/loamy over silt/clay	frigid	co. loamy over clayey	no	
Shaker	439	2.0	6.0	0.00	0.2	C	5	Sandy/loamy over silt/clay	mesic	co. loamy over clayey	no	
Chichester	442	0.6	2.0	2.00	6.0	B	3	Loose till, sandy textures	frigid	loamy over sandy	no	loamy over loamy sand
Newfields	444	0.6	2.0	0.60	2.0	B	3	Loose till, sandy textures	mesic	loamy over sandy	no	sandy or sandy-skeletal
Scituate	448	0.6	2.0	0.06	0.2	C	3	Firm, platy, sandy till	mesic	loamy	no	loamy sand in Cd
Metacomet	458	0.6	2.0	0.06	0.6	C	3	Firm, platy, sandy till	frigid	loamy	no	loamy sand in Cd
Pennichuck	460	0.6	2.0	0.60	2.0	B	4	Friable till, silty, schist & phyllite	mesic	loamy-skeletal	no	20 to 40 in. deep
Gilmanton	478	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	no	fine sandy loam in Cd
Ossipee	495			0.20	2.0	D	6	Organic Materials - Freshwater	frigid	loamy	no	organic over loam
Natchaug	496			0.20	2.0	D	6	Organic Materials - Freshwater	mesic	loamy	no	organic over loam
Pawcatuck	497			20.00	100.0	D	6	Tidal Flat	mesic	sandy or sandy-skeletal	no	organic over sand
Abenaki	501	0.6	2.0	6.00	99.0	B	2	Outwash and Stream Terraces	frigid	loamy over sandy-skeletal	no	loamy over gravelly
Cohas	505	0.6	2.0	0.60	100.0	C	5	Flood Plain (Bottom Land)	frigid	co. loamy over sandy (skeletal)	no	
Hoosic	510	2.0	20.0	20.00	100.0	A	1	Outwash and Stream Terraces	mesic	sandy-skeletal	no	slate, loamy cap
Ninigret	513	0.6	6.0	6.00	20.0	B	3	Outwash and Stream Terraces	mesic	loamy over sandy	no	sandy or sandy-skeletal
Leicester	514	0.6	6.0	0.60	20.0	C	5	Loose till, loamy textures	mesic	loamy	no	
Au Gres	516					B	5	Outwash and Stream Terraces	frigid	sandy	yes	single grain, loose
Machias	520	2.0	6.0	6.00	20.0	B	3	Outwash and Stream Terraces	frigid	sandy or sandy-skeletal	yes	strata sand/gravel in C
Stetson	523	0.6	6.0	6.00	20.0	B	2	Outwash and Stream Terraces	frigid	sandy-skeletal	yes	loamy over gravelly
Caesar	526	20.0	100.0	20.00	100.0	A	1	Outwash and Stream Terraces	mesic	coarse sand	no	
Scio	531	0.6	2.0	0.60	2.0	B	3	Terraces and glacial lake plains	mesic	silty	no	gravelly sand in 2C
Belgrade	532	0.6	2.0	0.06	2.0	B	3	Terraces and glacial lake plains	mesic	silty	no	strata of fine sand
Raynham	533	0.2	2.0	0.06	0.2	C	5	Terraces and glacial lake plains	mesic	silty	no	
Binghamville	534	0.2	2.0	0.06	0.2	D	5	Terraces and glacial lake plains	mesic	silty	no	
Suffield	536	0.6	2.0	0.00	0.2	C	3	Sandy/loamy over silt/clay	mesic	silty over clayey	no	deep to clay C
Squamscott	538	6.0	20.0	0.06	0.6	C	5	Sandy/loamy over silt/clay	mesic	sandy over loamy	yes	
Raypol	540	0.6	2.0	6.00	100.0	D	5	Outwash and Stream Terraces	mesic	co. loamy over sandy (skeletal)	no	
Walpole	546	2.0	6.0	6.00	20.0	C	5	Outwash and Stream Terraces	mesic	sandy	no	
Peacham	549	0.6	2.0	0.00	0.2	D	6	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	organic over loam
Skerry	558	0.6	2.0	0.06	0.6	C	3	Firm, platy, sandy till	frigid	loamy	yes	loamy sand in Cd
Plaisted	563	0.6	2.0	0.06	0.6	C	3	Firm, platy, silty till, schist & phyllite	frigid	loamy	yes	channery silt loam in Cd
Howland	566	0.6	2.0	0.06	0.2	C	3	Firm, platy, silty till, schist & phyllite	frigid	loamy	yes	silt loam, platy in Cd
Monarda	569	0.2	2.0	0.02	0.2	D	5	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	
Bangor	572	0.6	2.0	0.60	2.0	B	2	Friable till, silty, schist & phyllite	frigid	loamy	yes	silt loam

Soil Series	legend number	Ksat low - B in/hr	Ksat high - B in/hr	Ksat low - C in/hr	Ksat high - C in/hr	Hyd. Grp.	Group	Land Form	Temp.	Soil Textures	Spodosol ?	Other
Dixmont	578	0.6	2.0	0.60	2.0	C	3	Friable till, silty, schist & phyllite	frigid	loamy	yes	silt loam, platy in C
Cabot	589	0.6	2.0	0.06	0.2	D	5	Firm, platy, silty till, schist & phyllite	frigid	loamy	no	
Westbrook	597			0.00	2.0	D	6	Tidal Flat	mesic	loamy	no	organic over loam
Mundal	610	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	yes	gravely sandy loam in Cd
Croghan	613	20.0	100.0	20.00	100.0	B	3	Outwash and Stream Terraces	frigid	sandy	yes	single grain in C
Kinsman	614	6.0	20.0	6.00	20.0	C	5	Outwash and Stream Terraces	frigid	sandy	yes	
Salmon	630	0.6	2.0	0.60	2.0	B	2	Terraces and glacial lake plains	frigid	silty	yes	very fine sandy loam
Nicholville	632	0.6	2.0	0.60	2.0	C	3	Terraces and glacial lake plains	frigid	silty	yes	very fine sandy loam
Pemi	633	0.6	2.0	0.06	0.6	C	5	Terraces and glacial lake plains	frigid	silty	no	
Pillsbury	646	0.6	2.0	0.06	0.2	C	5	Firm, platy, loamy till	frigid	silty	no	
Ridgebury	656	0.6	6.0	0.00	0.2	C	5	Firm, platy, loamy till	mesic	loamy	no	
Canaan	663	2.0	20.0	2.00	20.0	C	4	Weathered Bedrock Till	frigid	loamy-skeletal	yes	less than 20 in. deep
Redstone	665	2.0	6.0	6.00	20.0	A	1	Weathered Bedrock Till	frigid	fragmental	yes	loamy cap
Sisk	667	0.6	2.0	0.00	0.6	C	3	Firm, platy, loamy till	cryic	loamy	yes	sandy loam in Cd
Surplus	669	0.6	2.0	0.00	0.6	C	3	Firm, platy, loamy till	cryic	loamy	yes	mwd, sandy loam in Cd
Glebe	671	2.0	6.0	2.00	6.0	C	4	Loose till, bedrock	cryic	loamy	yes	20 to 40 in. deep
Saddleback	673	0.6	2.0	0.60	2.0	C/D	4	Loose till, bedrock	cryic	loamy	yes	less than 20 in. deep
Ricker	674	2.0	6.0	2.00	6.0	A	4	Organic over bedrock (up to 4" of mineral)	cryic	fibric to hemic	no	well drained, less than 20 in. deep
Houghtonville	795	0.6	6.0	0.60	6.0	B	2	Loose till, loamy textures	frigid	loamy	yes	cobbly fine sandy loam
Matunuck	797			20.00	100.0	D	6	Tidal Flat	mesic	sandy	no	organic over sand
Meadowsedge	894					D	6	Organic Materials - Freshwater	frigid	peat	no	deep organic
Bucksport	895					D	6	Organic Materials - Freshwater	frigid	sapric	no	deep organic
Colonel	927	0.6	2.0	0.06	0.6	C	3	Firm, platy, loamy till	frigid	loamy	yes	loam in Cd
Pondicherry	992			6.00	20.0	D	6	Organic Materials - Freshwater	frigid	sandy or sandy-skeletal	no	organic over sand
Wonsqueak	995			0.20	2.0	D	6	Organic Materials - Freshwater	frigid	loamy	no	organic over loam
Glover	NA	0.6	2.0	0.60	2	D	4	Friable till, silty, schist & phyllite	frigid	loamy	no	less than 20 in. deep



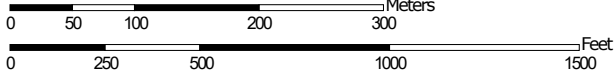
no longer recognized
organic materials

Custom Soil Resource Report Soil Map



Soil Map may not be valid at this scale.

Map Scale: 1:6,070 if printed on A landscape (11" x 8.5") sheet.



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

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)


Soils


 Soil Map Unit Polygons


 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit


 Clay Spot


 Closed Depression

 Gravel Pit

 Gravelly Spot


 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water


 Perennial Water

 Rock Outcrop


 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole

 Slide or Slip


 Sodic Spot


 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals


Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Strafford County, New Hampshire
 Survey Area Data: Version 19, Sep 16, 2019

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

Date(s) aerial images were photographed: Dec 31, 2009—Sep 9, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BzB	Buxton silt loam, 3 to 8 percent slopes	53.3	32.7%
EaA	Elmwood fine sandy loam, 0 to 3 percent slopes	0.7	0.5%
GsB	Gloucester very stony fine sandy loam, 3 to 8 percent slopes	3.6	2.2%
GsD	Gloucester very stony fine sandy loam, 15 to 25 percent slopes	3.0	1.9%
HcB	Hollis-Charlton fine sandy loams, 3 to 8 percent slopes	2.3	1.4%
HdB	Hollis-Charlton very rocky fine sandy loams, 3 to 8 percent slopes	20.9	12.8%
HdC	Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes	33.4	20.5%
LrA	Leicester-Ridgebury fine sandy loams, 0 to 3 percent slopes, very stony	3.5	2.2%
MI	Mixed alluvial land, wet	3.6	2.2%
ScA	Scantic silt loam, 0 to 3 percent slopes	12.6	7.7%
ScB	Scantic silt loam, 3 to 8 percent slopes	5.8	3.6%
SfC	Suffield silt loam, 8 to 15 percent slopes	8.5	5.2%
SwA	Swanton fine sandy loam, 0 to 3 percent slopes	1.8	1.1%
WfB	Windsor loamy fine sand, clay subsoil variant, 0 to 8 percent slopes	2.7	1.7%
WfC	Windsor loamy fine sand, clay subsoil variant, 8 to 15 percent slopes	7.4	4.5%
Totals for Area of Interest		163.2	100.0%

Map Unit Descriptions

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

SOIL REPORT

May 14, 2018

Mulhern
93 Bagdad Rd., Durham NH

Location: In Durham NH - 93 Bagdad Rd; Map 10 Lot 8-6: +/-14 acres
In Madbury NH - 121 Route 108; Map 9 Lot 32: +/-2 acres

The property is nearly bounded on the north by the Durham/Madbury town line and a small unnamed stream, on the east by backyards of properties on Route 108, on the south by a 500-foot long right-of-way to Bagdad Road, and on the east by backyards of properties on Ambler Way.

Landscape: A few knolls on the eastern half of the lot slope to the north and west to a wetland parallel to the westerly property line. A stream cuts across the NW corner in Madbury

Wetlands: A large wetland parallels the westerly property line and varies in width from about 25' in the NW corner just south of the stream to nearly 150' at its widest point. The wetland is classified as Palustrine Forested (PFO).

Wetlands were identified in accordance with the 1987 US Army Corps of Engineers Wetland Delineation Manual and the 2012 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region, Version 2.0. Hydric soils were identified by Field Indicators for Identifying Hydric Soils in New England, version 4, May 2017. A routine determination, as described in the manual, was followed. The wetland boundary was flagged in pink and numbered for future location by Trittech Engineering, Dover NH

Soils: Soils consist of moderately well drained glacial till on a few knolls at the highest elevations but dominated by moderately well drained silty marine sediments over most of the remainder of the property. Poorly drained silty to clayey marine sediments occupy the wetlands with a narrow band of somewhat poorly drained soil around the perimeter. Several bedrock outcrops were observed and located, but they drop off quickly leaving few areas of soils with bedrock at depths less than 40"

Purpose: The high intensity soil map was prepared for a proposed residential subdivision with city water and on-site subsurface wastewater disposal.

Methodology: The soil map was prepared in accordance with the Standards for a High Intensity Soil Map, New Hampshire, December 2017 by the Society of Soil Scientists of Northern New England and standards established by the National Cooperative Soil Survey. The soil survey was prepared by Michael Mariano, NH Certified Soil Scientist #076.

A plan provided by Trittech Engineering, Dover NH at 1" = 100' with 2' contours was used as a base map. Existing monumentation, survey transects, and topographic features were used as control. Pits were dug by an excavator to classify soils at the series level. Pits were located by Trittech Engineering.

Soil boundaries were observed throughout their length and their placement corresponds to changes in soil properties or landform. Boundary line placement is accurate within 20 feet. The

Highland Soil Services
75 Prospect St., Somersworth NH 03878

692-4457

identification of soils is based on the connotative legend used for high intensity soil maps in NH (see attachment).

Map unit purity:

- Map units contain 75 percent or more of pedons that fit within the range of the taxon that provides the name for the map unit, or are in similar taxa.
- No one dissimilar soil is greater than the named taxa
- Individual dissimilar inclusions are less than 2,000 square feet in area. Dissimilar inclusions may total no more than 25% per map unit delineation in the aggregate, if not continuous.

Drainage Classes: (slope designation and high intensity classifier not included. Soil series name added for those familiar with that nomenclature)

Very Poorly Drained: There are no very poorly drained soils mapped on this property. Small areas less than 2,000 square feet that may be present are treated as inclusions in poorly drained mapping units.

Poorly Drained: Poorly drained soils occupy the areas delineated as wetlands. In these soils, water is removed so slowly that the soil is wet at shallow depths periodically during the growing season or remains wet for long periods. The occurrence of free water is shallow or very shallow and common or persistent.

553 These soils are found in the wetlands and adjacent to the stream in the NW corner (Scitico)

Somewhat Poorly Drained: Water is removed slowly enough to keep the soil wet for significant periods of time, but not the entire year. A seasonal high water table ranges from 7-15 inches in depth from October to May, but may recede to over 30 inches in depth during the summer. These soils may be classified as hydric soils in depressions. Subsurface wastewater disposal is not permitted in somewhat poorly drained soil in Durham.

453 These soils occupy narrow bands at the toe slopes just above poorly drained soils. (Boxford somewhat poorly drained)

Moderately Well Drained: Water is removed from the soil somewhat slowly. There is a seasonal high water table at 15-40 inches from November through May. The 353 soils contain a hardpan in the subsoil. There are few limitations that can't be overcome. In Durham, subsurface wastewater disposal is permitted only in areas where the depth to the hardpan or to the water table is greater than 24".

353 These are the dominant soils on the landscape and occupy most of the land between the poorly drained wetlands and the glacial till on the highest knolls. Mapping units include small areas with similar soils that are somewhat poorly drained. (Boxford)

321 These soils occupy the few knolls on the property. Subsurface wastewater disposal is permitted where the depth to the seasonal water table is greater than 24". (Sutton)

324 This is a soil shallow to bedrock. The only area large enough to be separated into a mapping unit is a flat table between outcrops at the center east of the property. (Hollis)

Well Drained: Water is removed from the soil readily but not rapidly and the soil does not have a water table at less than 40 inches of the surface throughout the year. Subsurface wastewater disposal is allowed, but individual test pits at each disposal area are required

221 This soil is limited to the top of the small knoll near the center of the property above elevation 66. (Charlton)

Excessively Drained: There are no excessively drained soils on the property

Soil Map Legend

See attachment.

This map product is within the technical standards of the National Cooperative Soil Survey and produced in accordance with the Society of Soil Scientists of Northern New England Publication *Standards for a High Intensity Soil Map, New Hampshire*. It was produced by a professional soil scientist, and is not a product of the USDA Natural Resources Conservation Service. There is a map that accompanies this report.

KEY TO SOIL TYPES

This key is used in determining soil types that are utilized in high intensity soil surveys. The soil types are defined as soils having the same soil characteristics of drainage class, parent material, restrictive features, and slope; and are designated by a five-part symbol, the parts being A, B, C, D and E.

SYMBOL: A Drainage Class

- 1- Excessively drained
- 2- Well drained
- 3- Moderately well drained
- 4- Somewhat poorly drained
- 5- Poorly drained
- 6- Very poorly drained
- 7- Not determinable (to be used only with Symbol B-6)

SYMBOL: B Parent Material

- 1- Glaciofluvial Deposits (outwash/terraces of sand or sand and gravel).
- 2- Glacial Till Material (active ice)
Marine or Glaciolacustrine Deposits (3, 4 or 5)
- 3- Very fine sand and silt deposits (glacial lakes)
- 4- Loamy/sandy over silt/clay deposits
- 5- Silt and clay deposits (ocean waters)
- 6- Excavated, Regraded or Human Transported Material (see Connotative Soil Legend)
- 7- Alluvial Deposits (flood plains)
- 8- Organic Materials - Fresh Water Wetlands
- 9- Organic Materials - Tidal Wetlands

SYMBOL: C Restrictive Features (if more than one applies, list the most restrictive)

- 1- None
- 2- Bouldery, with more than 15% of the surface covered with boulders (larger than 24 inches in diameter).
- 3- Mineral restrictive layer(s) are present in the soil profile less than 40 inches below the soil surface - such as "hard pan", densic material, 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 layer, see Soil Manual for Site Evaluations in New Hampshire, 2nd Ed., page 3-17, figure 3-14.
(continued)
- 4- Bedrock present in the soil profile 0-20 inches below the mineral soil

surface (Bedrock is either a lithic or paralithic contact - See *User Note: Soil Taxonomy*. Paralithic references bedrock that can be removed by an excavator, backhoe or by hand shovel with difficulty. Bedrock fractures are spaced more than 4 inches.

- 5- Subject to flooding.
- 6- Does not meet fill standards (see addendum - Standards for Human Transported Material) (only to be used with Symbol B-6).
- 7- Bedrock present in the soil profile 20 to 40 inches below the mineral soil surface. (Bedrock is either lithic or paralithic contact; see *Soil Taxonomy*).
- 8- 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 and will have a symbol C of 8.

SYMBOL: D Slope Class

- B- 0% to 8%
- C- 8% to 15%
- D- 15% to 25%
- E- 25% to 35%
- F- 35%+

SYMBOL: E -High Intensity Soil Map Identifier - H. (see addendum)

Boxford Silt Loam
3 to >25 Percent Slopes

High Intensity Map Symbol: 353, moderately well drained
453, somewhat poorly drained

Setting

Parent Material: Silty marine sediments
Landform: Convex plains, broad drainageways
Position on Landscape: Uplands at lower elevations or in drainageways
Slope Range: 3 to >25 percent

Composition and Soil Characteristics

Drainage Class: Moderately well drained; seasonal high water table at 15 to 40 inches. OR..somewhat poorly drained with seasonal high water table at 7-15"
Hydrologic Group: C/D
Surface Runoff: Rapid
Permeability: Slow. Very slow in subsoil
Depth to Bedrock: > 40 inches
Hydric conditions: Possible in somewhat poorly drained areas

Inclusions within Mapping Unit

Similar: Scitico silt loam – poorly drained
Contrasting: None

Use and Management

With improvements and engineering practices, this soil is fairly well suited to development. Slow permeability and a seasonal high water table are the limiting factors. Position on the landscape allows engineering practices to overcome the limitations. Subsurface wastewater disposal is permitted. See Test Pit 6 for a typical description.

Charlton Fine Sandy Loam
3-8 Percent Slopes

High Intensity Map Symbol: 221, well drained

Setting

Parent Material: Glacial till
Landform: Glaciated uplands
Position on Landscape: Ridgetops and upper side slopes
Slope Range: 3 to 8 percent

Composition and Soil Characteristics

Drainage Class: Well drained; seasonal high water table at >40 inches.
Hydrologic Group: A
Surface Runoff: Slow
Permeability: Rapid
Depth to Bedrock: > 40 inches
Hydric conditions: No

Inclusions within Mapping Unit

Similar: Sutton – moderately well drained
Contrasting: None

Use and Management

This soil is well suited to development. There are few limitations. See test pit 5 for a typical description

Hollis Fine Sandy Loam
0 - 8 Percent Slopes

High Intensity Map Symbol: 324, moderately well drained

Setting

Parent Material: Glacial till
Landform: Glaciated uplands
Position on Landscape: bedrock controlled ridges
Slope Range: 0 to 8 percent

Composition and Soil Characteristics

Drainage Class: Moderately well drained; usually no seasonal water table above bedrock
Hydrologic Group: D
Surface Runoff: Moderate
Permeability: Moderate
Depth to Bedrock: 0 to 20 inches
Hydric conditions: No

Inclusions within Mapping Unit

Similar: Tunbridge - > 20" to bedrock
Contrasting: Boxford - silty marine sediments
Sutton - Bedrock at >40"

Use and Management

This soil is poorly to most development. Depth to bedrock is the limiting factor. See test pit 17 for a typical description

Scitico Silt Loam
0-8 Percent Slopes

High Intensity Map Symbol: 553, poorly drained

Setting

Parent Material: Silty marine sediments
Landform: Lowlands
Position on Landscape: Depressions, drainageways, wetlands
Slope Range: 0 to 8 percent

Composition and Soil Characteristics

Drainage Class: Poorly drained; seasonal high water table at 0 to 7 inches.
Hydrologic Group: D
Surface Runoff: Slow
Permeability: Slow. Very slow in subsoil
Depth to Bedrock: > 40 inches
Hydric conditions: Yes

Inclusions within Mapping Unit

Similar: Boxford - somewhat poorly drained
Contrasting: None

Use and Management

This soil is poorly suited to development. Areas mapped as Scitico are classified as wetlands and permitting is required for any activity in those wetlands. Wetness is the limiting factor with a water table at or near the surface during most months of the year. Subsurface wastewater disposal is not permitted. See test pit 3 for a typical description

Sutton Fine Sandy Loam
3 - >25 Percent Slopes

High Intensity Map Symbol: 321, moderately well drained

Setting

Parent Material: Glacial till
Landform: Glaciated uplands
Position on Landscape: Ridgetops and upper side slopes
Slope Range: 3 to >25 percent

Composition and Soil Characteristics

Drainage Class: Moderately well drained; seasonal high water table at 15 to 40 inches
Hydrologic Group: B
Surface Runoff: Moderate
Permeability: Moderate
Depth to Bedrock: > 40 inches
Hydric conditions: No

Inclusions within Mapping Unit

Similar: Charlton – well drained
Contrasting: Boxford – silty marine sediments
Tunbridge – Bedrock at <40”

Use and Management

This soil is well suited to development. A seasonal high water table is present during seasonally wet periods. See test pit 12 for a typical description.

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 1

- 00 – 06” Dark brown (10YR4/3) sandy loam; weak fine granular structure; moist, friable.
- 06 – 13” Strong brown (7.5Y5/8) sandy loam; weak medium granular structure; moist, friable.
- 13 – 24” Yellowish brown (10YR5/6) loamy sand; moderate medium granular structure; moist, friable
- 24 – 48” Olive brown (2.5Y5/3) loamy sand; moderate medium granular structure; moist, friable.

Series: Charlton
Estimated seasonal high water table: None to 48”
Observed water: none
Restrictive layer: None
Soil Hydrologic Group: A

Test Pit 2

- 00 – 04” Dark brown (10YR4/3) sandy loam; weak fine granular structure; moist, friable.
- 04 – 16” Yellowish brown (10YR5/6) sandy loam; weak medium granular structure; moist, friable.
- 16 – 37” Light olive brown (2.5Y5/4) loamy sand; moderate medium granular structure; moist, friable
- 37 – 54” Olive brown (2.5Y5/3) loamy sand; few redox features in 10YR6/1 and 10YR5/6; moderate medium granular structure; moist, friable.

Series: Sutton
Estimated seasonal high water table 37”
Observed water: None
Restrictive layer: none
Soil Hydrologic Group: A

Test Pit Descriptions

Durham NH

Mulhern – Bagdad Rd

May 12, 2018

Test pits described on 02-15-18 & 04-09-18

Test Pit 3

- 00 – 06” Dark brownish gray (10YR4/2) very fine sandy loam; weak fine granular structure; moist, friable.
- 06 – 20” Light olive brown (2.5Y5/4) silt loam; many redox features in 10YR6/1 and 7.5YR5/8; massive structure; moist, friable.
- 20” + Olive gray (2.5Y5/2) silty clay loam; many redox features in 10YR6/1 and 10YR4/4; strong medium subangular blocky structure; moist, friable.

Series: Scitico

Estimated seasonal high water table: 0”

Observed water: 12”

Restrictive layer: 20”

Soil Hydrologic Group: D

Test Pit 4

- 00 – 06” Dark brown (10YR4/3) fine sandy loam; weak fine granular structure; moist, friable.
- 06 – 17” Light olive brown (2.5Y5/4) fine sandy loam; weak fine granular structure; moist, friable.
- 17 – 32” Light olive brown (2.5Y5/4) loamy sand; few fine redox features in 10YR6/1 and 7.5YR5/8; weak medium granular structure; moist, friable.
- 32 – 48” Yellowish brown (10YR5/6) sandy loam; many medium redox features in 10YR6/1 and 7.5YR5/8; moderate medium granular structure; moist, friable.

Series: Sutton

Estimated seasonal high water table: 17”

Observed water: none

Restrictive layer: none

Soil Hydrologic Group: D

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 5

- 00 – 05” Dark brown (10YR4/3) fine sandy loam; weak fine granular structure; moist, friable.
05 – 15” Strong brown (7.5Y5/8) sandy loam; weak medium granular structure; moist, friable.
15 – 34” Yellowish brown (10YR5/6) sandy loam; moderate medium granular structure; moist, friable
34 – 50” Light olive brown (2.5Y5/6) loamy sand; moderate medium granular structure; moist, friable.

Series: Charlton
Estimated seasonal high water table: None to 50”
Observed water: none
Restrictive layer: None
Soil Hydrologic Group: A

Test Pit 6

- 00 – 05” Dark brown (10YR4/4) very fine sandy loam; weak fine granular structure; moist, friable.
05 – 11” Dark brown (10YR4/4) very fine sandy loam; massive structure; moist, friable.
11 – 18” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
18 – 25” Light olive brown (2.5Y5/4) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); strong medium subangular blocky structure; moist, firm.
25 – 50” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); strong medium subangular blocky structure; moist, firm.

Series: Boxford
Estimated seasonal high water table: 18”
Observed water: none
Restrictive layer: 18”
Soil Hydrologic Group: D

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 7

- 00 – 06” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
- 06 – 21” Light olive brown (2.5Y5/6) silt loam; massive structure; moist, friable.
- 21 – 33” Light olive brown (2.5Y5/6) very fine sandy loam; few redox features in 10YR6/1 and 10YR5/6); massive structure; moist, friable.
- 33 – 48” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); strong medium subangular blocky structure; moist, firm.

Series: Boxford
Estimated seasonal high water table: 21”
Observed water: none
Restrictive layer: 21”
Soil Hydrologic Group: D

Test Pit 8

- 00 – 05” Dark brown (10YR4/3) fine sandy loam; weak fine granular structure; moist, friable.
- 05 – 15” Yellowish brown (10YR5/6) fine sandy loam; weak fine granular structure; moist, friable.
- 15 – 26” Light olive brown (2.5Y5/4) fine sandy loam; moderate medium granular structure; moist, friable.
- 26 – 45” Light olive brown (2.5Y5/4) fine sandy loam; common fine and medium redox features in 10YR6/1 and 10YR5/6); moderate medium granular structure; moist, friable.
- @45” Bedrock

Series: Sutton
Estimated seasonal high water table: 26”
Observed water: none
Restrictive layer: none
Bedrock at 45”
Soil Hydrologic Group: C

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 9

- 00 – 05” Dark brownish gray (10YR4/2) silt loam; weak fine granular structure; wet, slightly sticky, slightly plastic
- 05 – 09” Olive gray (2.5Y5/2) silt loam; massive structure; wet, slightly sticky, slightly plastic
- 09 – 18” Light olive brown (2.5Y5/4) silt loam; many redox features in 10YR6/1 and 10YR4/4; strong medium subangular blocky structure; moist, friable.
- 18 – 36” Olive gray (2.5Y5/2) silty clay loam; strong medium subangular blocky structure; moist, very firm

Series: Scitico

Estimated seasonal high water table: 0”

Observed water: 14”

Restrictive layer: 18”

Soil Hydrologic Group: D

Test Pit 10

- 00 – 04” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
- 04 – 08” Strong brown (7.5YR5/8) silt loam; massive structure; moist, friable.
- 08 – 17” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
- 17 – 24” Light olive brown (2.5Y5/4) silt loam; common fine and medium redox features in 10YR6/1 and 10YR5/6; massive structure; moist, friable.
- 24 – 42” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); strong medium subangular blocky structure; moist, firm.

Series: Boxford

Estimated seasonal high water table: 17”

Observed water: none

Restrictive layer: 24”

Soil Hydrologic Group: D

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 11

- 00 – 06” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
- 06 – 11” Yellowish brown (10YR5/6) silt loam; massive structure; moist, friable.
- 11 – 20” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
- 20 – 48” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); strong medium subangular blocky structure; moist, firm.

Series: Boxford
Estimated seasonal high water table: 20”
Observed water: none
Restrictive layer: 20”
Soil Hydrologic Group: D

Test Pit 12

- 00 – 06” Dark brown (10YR4/3) fine sandy loam; weak fine granular structure; moist, friable.
- 06 – 15” Strong brown (7.5YR5/6) fine sandy loam; weak fine granular structure; moist, friable.
- 15 – 32” Light olive brown (2.5Y5/4) sandy loam; moderate medium granular structure; moist, friable.
- 32 – 60” Light olive brown (2.5Y5/4) loamy sand; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); moderate medium granular structure; moist, friable.
- @50” Bedrock

Series: Sutton
Estimated seasonal high water table: 32”
Observed water: none
Restrictive layer: none
Bedrock at 50”
Soil Hydrologic Group: B

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 13

00 – 06” Dark brown (10YR4/3) fine sandy loam; weak fine granular structure; moist, friable.
06 – 12” Strong brown (7.5YR5/8) fine sandy loam; weak fine granular structure; moist, friable.
12 – 30” Light olive brown (2.5Y5/4) sandy loam; moderate medium granular structure; moist, friable.
30 – 38” Light olive brown (2.5Y5/4) loamy sand; moderate medium granular structure; moist, friable.
@38” Refusal - boulder

Series: Sutton (depth not reached for Charlton classification)
Estimated seasonal high water table: none
Observed water: none
Restrictive layer: none
Refusla at 38”
Soil Hydrologic Group: C

Test Pit 14

00 – 04” Dark brown (10YR4/4) fine sandy loam; weak fine granular structure; moist, friable.
04 – 12” Yellowish brown (10YR5/6) fine sandy loam; weak fine granular structure; moist, friable.
12 – 18” Light olive brown (2.5Y5/4) very fine sandy loam; massive structure; moist, friable.
18 – 42” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); strong medium subangular blocky structure; moist, firm.

Series: Boxford
Estimated seasonal high water table: 18”
Observed water: none
Restrictive layer: 18”
Soil Hydrologic Group: D

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 15

- 00 – 06” Dark brown (10YR4/4) fine sandy loam; weak fine granular structure; moist, friable.
06 – 16” Yellowish brown (10YR5/6) silt loam; weak fine granular structure; moist, friable.
16 – 21” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
21 – 42” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8); strong medium subangular blocky structure; moist, firm.

Series: Boxford
Estimated seasonal high water table: 18”
Observed water: none
Restrictive layer: 18”
Soil Hydrologic Group: D

Test Pit 16

- 00 – 09” Dark brown (10YR4/3) sandy loam; weak fine granular structure; moist, friable.
09 – 15” Yellowish brown (10YR5/6) fine sandy loam; weak fine granular structure; moist, friable.
15 – 36” Light olive brown (2.5Y5/4) sandy loam; moderate medium granular structure; moist, friable.
36 – 42” Light olive brown (2.5Y5/4) sandy loam; common fine and medium redox features in 10YR6/1 and 10YR5/6); moderate medium granular structure; moist, friable.
@42” Refusal – small machine; assumed boulders

Series: Sutton
Estimated seasonal high water table: 36”
Observed water: none
Restrictive layer: none
Refusal at 42”
Soil Hydrologic Group: C

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 17

00 – 06” Dark Brown (10YR4/3) fine sandy loam; weak fine granular structure; moist, friable

At 6” Bedrock

Series: Hollis
Estimated seasonal high water table: none
Observed water: none
Restrictive layer: none
Bedrock at 6”
Soil Hydrologic Group: D

Test Pit 18

- 00 – 03” Dark brown (10YR4/4) very fine sandy loam; weak fine granular structure; moist, friable.
- 03 – 12” Light olive brown (2.5Y5/6) very fine sandy loam; massive structure; moist, friable.
- 12 – 18” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
- 18 – 32” Light olive brown (2.5Y5/4) silty clay loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8; strong medium subangular blocky structure; moist, firm.
- 32 – 50” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 7.5YR5/8; strong medium subangular blocky structure; moist, very firm.

Series: Boxford
Estimated seasonal high water table: 18”
Observed water: none
Restrictive layer: 18”
Soil Hydrologic Group: D

Test Pit 19

There is no test pit 19; number skipped in field

Test Pit Descriptions

Durham NH

Mulhern – Bagdad Rd

May 12, 2018

Test pits described on 02-15-18 & 04-09-18

Test Pit 20

- 00 – 06” Dark brown (10YR4/4) very fine sandy loam; weak fine granular structure; moist, friable.
- 06 – 11” Light olive brown (2.5Y5/6) very fine sandy loam; massive structure; moist, friable.
- 11 – 26” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
- 26 – 35” Light olive brown (2.5Y5/4) silt loam; few fine redox features in 10YR6/1; moderate medium subangular blocky structure; moist, friable.
- 35 – 54” Light olive brown (2.5Y5/6) silty clay loam; common fine and medium redox features in 7.5YR5/8; strong medium subangular blocky structure; moist, very firm.

Series: Boxford

Estimated seasonal high water table: 26”

Observed water: none

Restrictive layer: 35”

Soil Hydrologic Group: C

Test Pit 21

- 00 – 04” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
- 04 – 16” Olive brown (2.5Y5/3) silt loam; massive structure; moist, friable.
- 16 – 22” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
- 22 – 32” Light olive brown (2.5Y5/4) silt loam; few fine redox features in 10YR6/1 and 7.5YR5/8; moderate medium subangular blocky structure; moist, friable.
- 32 – 50” Light olive brown (2.5Y5/6) silty clay loam; common fine and medium redox features in 7.5YR5/8; strong medium subangular blocky structure; moist, very firm.

Series: Boxford

Estimated seasonal high water table: 22”

Observed water: none

Restrictive layer: 32”

Soil Hydrologic Group: D

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 22

- 00 – 07” Dark brown (10YR4/3) sandy loam; weak fine granular structure; moist, friable.
07 – 19” Yellowish brown (10YR5/6) fine sandy loam; weak fine granular structure; moist, friable.
19 – 24” Yellowish brown (10YR5/6) sandy loam; moderate medium granular structure; moist, friable.
24 – 32” Light olive brown (2.5Y5/4) sandy loam; moderate medium granular structure; moist, friable.
32 – 50” Light olive brown (2.5Y5/4) loamy sand; strong medium platy structure; moist, firm.

Series: Scituate
Estimated seasonal high water table: 32”
Observed water: none
Restrictive layer: 32”
Soil Hydrologic Group: C

Test Pit 23

- 00 – 06” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
06 – 12” Yellowish brown (10YR5/6) silt loam; massive structure; moist, friable.
12 – 17” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
17 – 42” Olive gray (2.5Y5/2) silty clay loam; common fine and medium redox features in 7.5YR5/8; strong medium subangular blocky structure; moist, very firm.

Series: Boxford
Estimated seasonal high water table: 17”
Observed water: none
Restrictive layer: 17”
Soil Hydrologic Group: D

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 24

- 00 – 03” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
- 03 – 17” Yellowish brown (10YR5/6) silt loam; massive structure; moist, friable.
- 17 – 30” Light olive brown (2.5Y5/4) silt loam; few redox features in 10YR6/1; strong medium subangular blocky structure; moist, very firm
- 30 – 42” Light olive brown (2.5Y5/4) silt loam; many fine and medium redox features in 7.5YR5/8 and 10YR6/1; strong medium subangular blocky structure; moist, very firm.

Series: Boxford
Estimated seasonal high water table: 17”
Observed water: none
Restrictive layer: 17”
Soil Hydrologic Group: D

Test Pit 25

- 00 – 05” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
- 05 – 20” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
- 20 – 42” Olive gray (2.5Y5/2) silty clay loam; few fine and medium redox depletions in 10YR6/1; strong medium subangular blocky structure; moist, firm.

Series: Boxford
Estimated seasonal high water table: 20”
Observed water: none
Restrictive layer: 20”
Soil Hydrologic Group: D

Test Pit Descriptions

Durham NH
Mulhern – Bagdad Rd
May 12, 2018
Test pits described on 02-15-18 & 04-09-18

Test Pit 26

- 00 – 05” Dark brown (10YR4/4) silt loam; weak fine granular structure; moist, friable.
- 02 – 17” Light olive brown (2.5Y5/4) silt loam; massive structure; moist, friable.
- 17 – 42” Olive gray (2.5Y5/2) silty clay loam; few fine and medium redox depletions in 10YR6/1; strong medium subangular blocky structure; moist, firm.

Series: Boxford
Estimated seasonal high water table: 20”
Observed water: none
Restrictive layer: 20”
Soil Hydrologic Group: D

Test Pit 27

- 00 – 07” Dark brown (10YR4/3) fine sandy loam; weak fine granular structure; moist, friable.
- 07 – 15” Yellowish brown (10YR5/6) fine sandy loam; weak medium granular structure; moist, friable.
- 15 – 25” Light olive brown (2.5Y5/4) fine sandy loam; few redox features in 10YR6/1; moderate medium granular structure; moist, friable
- 25 – 32” Light olive brown (2.5Y5/4) fine sandy loam; few fine and medium redox features in 7.5YR5/8 and 10YR6/1; moderate medium granular structure; moist, friable.
- 32 – 48” Light olive brown (2.5Y5/4) silt loam; common fine and medium redox features in 10YR6/1 and 7.5YR5/8; strong medium subangular blocky structure; moist, firm

Series: Boxford
Estimated seasonal high water table: 25”
Observed water: none
Restrictive layer: 32”
Soil Hydrologic Group: D

APPENDIX G



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Culvert design

The design of the proposed culvert for the wetland crossing in the town right of way was analyzed using HydroCAD (version 10.00-25) and HY-8 (version 7.50). HydroCAD was used to model the hydrology of the contributing area at the proposed crossing. HY-8 was used for steady-state analysis of the culvert using the 100-yr rainfall event peak flows (plus an additional 15%). HydroCAD was used for a transient analysis of the culvert and to account for the storage due to ponding on the upgradient side of the proposed road.

Hydrologic Conditions

The proposed crossing is located on a wetland area downgradient of an existing subdivision on Gerrish Drive and Ambler Way. The wetland area contains a small stream that discharges into a tributary of Gerrish Brook in the north. Approximately 11 acres of the existing subdivision discharge to this wetland. An existing 12" corrugated metal pipe (CMP) culvert that is partially crushed is installed in Ambler Way. Due to the condition of the existing CMP culvert, Ambler Way impounds water on the westerly side during large storm events which helps to reduce the peak flows down gradient.

In order to access the proposed subdivision, a road has been proposed in the existing town right of way coming off Gerrish Road. The proposed road will cross the wetland area and the stream that carries the stormwater runoff from the existing subdivision. This analysis ignores the restriction of flow due to the existing 12" CMP culvert for the runoff of the subdivision on Gerrish Drive and Ambler Way. This was done conservatively to ensure the culvert on the proposed road will not be undersized if changes are made to the upstream drainage.

Design storm	100-yr (+15%)
Rainfall depth	9.91 inches
Rainfall distribution	NRCC D
Event duration	24 hours
Peak flow	55.17 cfs

Table 1: design criteria for proposed crossing

The culvert has been analyzed to ensure that both the proposed road will not be overtopped during large storm events and that any water impounded by the proposed road will not adversely impact the neighboring properties. The design flow for the culvert was estimated by a 100-year rainfall event with an additional 15% runoff volume using the NRCS curve number method.



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Hydraulic analysis

HY-8 results

HY-8 is a software program that aids in the design of culverts. The software is only capable of steady-state analysis and is unable to account for the storage upstream of the culvert. This will give a conservative result compared to a transient analysis. The results of the HY-8 model predict that the inlet of the culvert will be submerged during a 100-yr (+15%) storm event.

Storm event	100-yr (+15%)
Total discharge	55.20 cfs
Headwater elevation	43.76 ft
Road elevation	44.99 ft
Freeboard	1.23 ft

Table 2: Summary of HY-8 results

As shown in Table 2, the proposed culvert will have adequate capacity to discharge the flow of a 100-yr storm with greater than 1 foot of freeboard assuming steady-state conditions.

HydroCAD results

The culvert was also analyzed using HydroCAD. The model included the transient flow and the ponding area in front of the proposed culvert. A secondary analysis was done to check the impact of a potential blockage.

Storm event	100-yr (+15%)
Total discharge	55.20 cfs
Headwater elevation	43.40 ft
Road elevation	44.99 ft
Freeboard	1.59 ft

Table 3: Summary of HydroCAD results

As shown in Table 3, the proposed culvert will have adequate capacity to discharge the flow of a 100-yr storm with greater than 1 foot of freeboard assuming transient conditions.

Discussion

Both the steady-state and transient analyses indicate that the proposed culvert is adequately sized to discharge a 100-year (+15%) rainfall event with acceptable freeboard.

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 24.41 cfs

Design Flow: 55.5 cfs

Maximum Flow: 55.5 cfs

Table 1 - Summary of Culvert Flows at Crossing: Road Sta 1+50

Headwater Elevation (ft)	Total Discharge (cfs)	Precast box culvert Discharge (cfs)	Roadway Discharge (cfs)	Iterations
42.50	24.41	24.41	0.00	1
42.62	27.52	27.52	0.00	1
42.75	30.63	30.63	0.00	1
42.87	33.74	33.74	0.00	1
42.99	36.85	36.85	0.00	1
43.11	39.95	39.95	0.00	1
43.23	43.06	43.06	0.00	1
43.36	46.17	46.17	0.00	1
43.49	49.28	49.28	0.00	1
43.62	52.39	52.39	0.00	1
43.76	55.50	55.50	0.00	1
44.99	78.24	78.24	0.00	Overtopping

Rating Curve Plot for Crossing: Road Sta 1+50

Total Rating Curve

Crossing: Road Sta 1+50

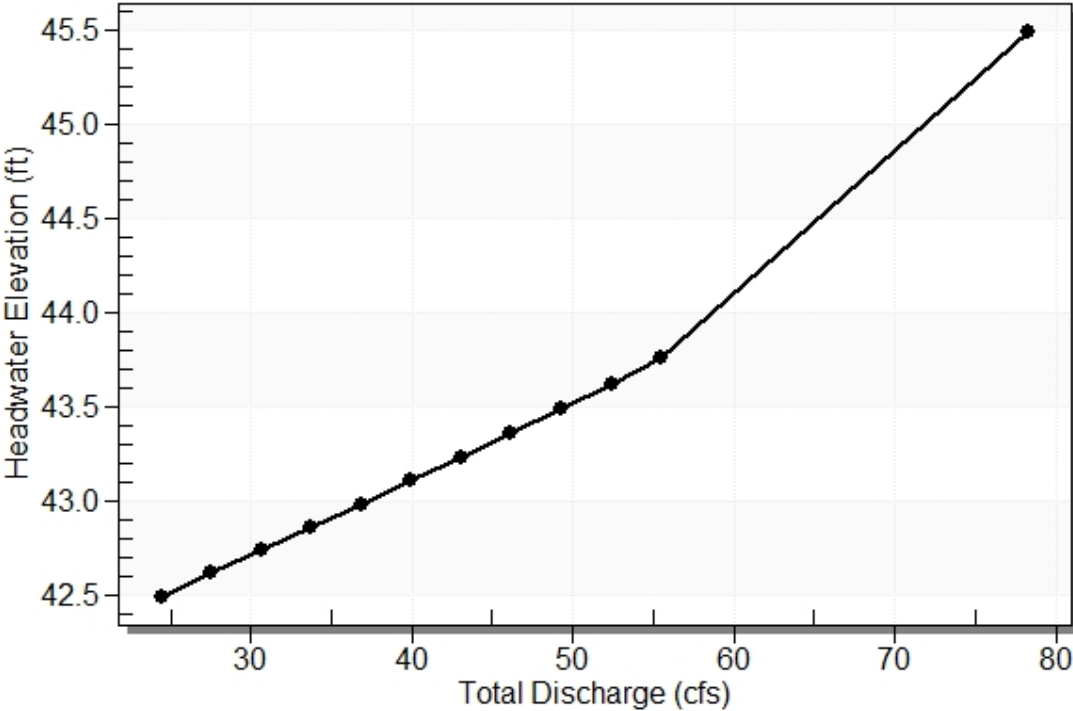


Table 2 - Culvert Summary Table: Precast box culvert

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
24.41	24.41	42.50	1.497	0.0*	1-S2n	0.405	0.905	0.459	1.443	10.639	2.750
27.52	27.52	42.62	1.623	0.013	1-S2n	0.437	0.980	0.507	1.500	10.850	2.787
30.63	30.63	42.75	1.745	0.116	1-S2n	0.468	1.052	0.547	1.552	11.199	2.823
33.74	33.74	42.87	1.866	0.221	1-S2n	0.498	1.122	0.589	1.601	11.449	2.858
36.85	36.85	42.99	1.986	0.329	1-S2n	0.527	1.190	0.630	1.646	11.689	2.892
39.95	39.95	43.11	2.107	0.439	5-S2n	0.556	1.256	0.670	1.689	11.919	2.925
43.06	43.06	43.23	2.230	0.552	5-S2n	0.583	1.321	0.711	1.730	12.119	2.957
46.17	46.17	43.36	2.356	0.669	5-S2n	0.611	1.384	0.750	1.769	12.307	2.988
49.28	49.28	43.49	2.486	0.790	5-S2n	0.637	1.445	0.789	1.806	12.498	3.018
52.39	52.39	43.62	2.620	0.914	5-S2n	0.663	1.505	0.829	1.841	12.646	3.047
55.50	55.50	43.76	2.760	1.043	5-S2n	0.689	1.564	0.864	1.875	12.841	3.075

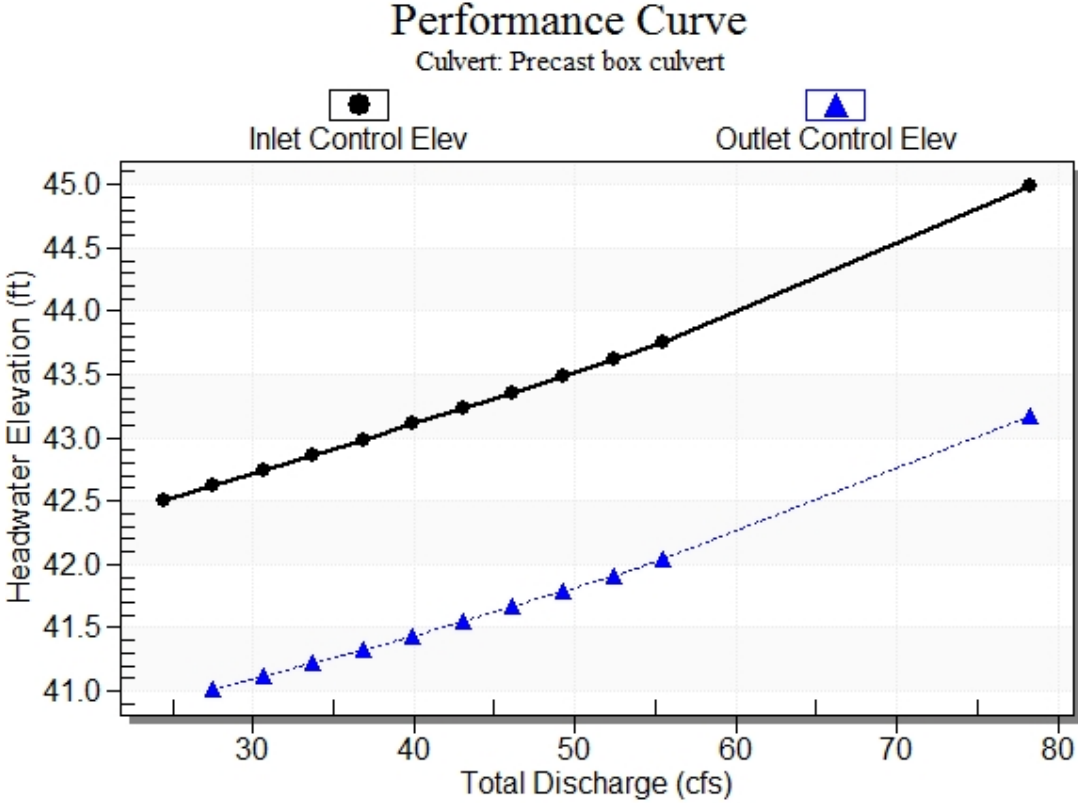
* Full Flow Headwater elevation is below inlet invert.

Straight Culvert

Inlet Elevation (invert): 41.00 ft, Outlet Elevation (invert): 39.30 ft

Culvert Length: 48.03 ft, Culvert Slope: 0.0354

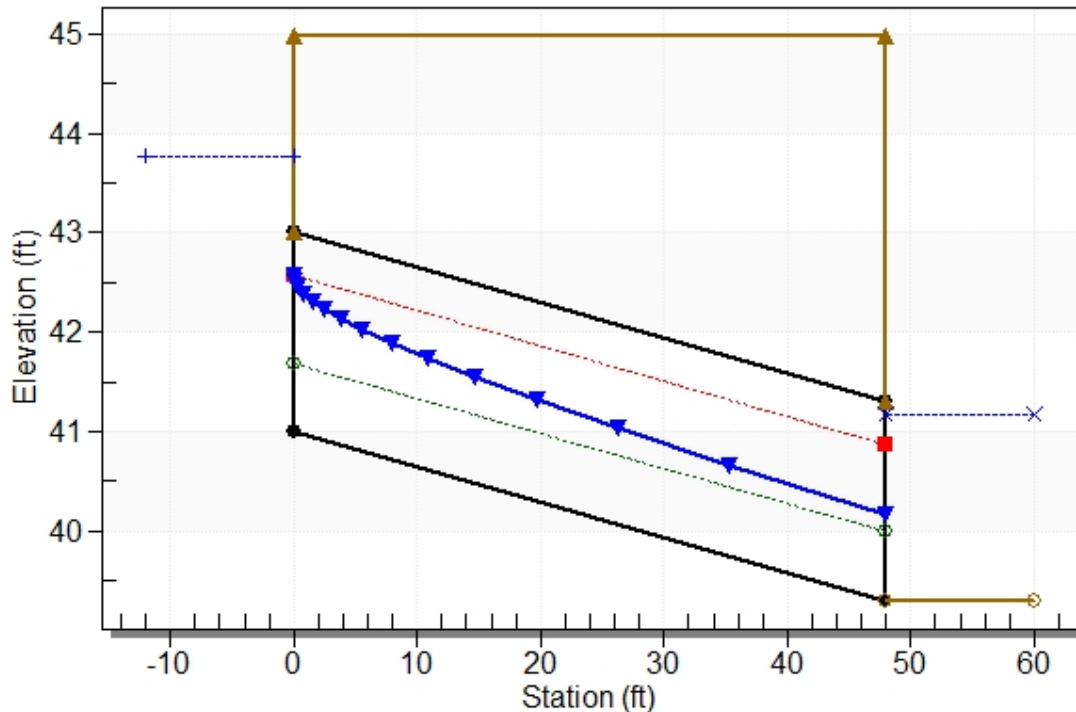
Culvert Performance Curve Plot: Precast box culvert



Water Surface Profile Plot for Culvert: Precast box culvert

Crossing - Road Sta 1+50, Design Discharge - 55.5 cfs

Culvert - Precast box culvert, Culvert Discharge - 55.5 cfs



Site Data - Precast box culvert

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 41.00 ft

Outlet Station: 48.00 ft

Outlet Elevation: 39.30 ft

Number of Barrels: 1

Culvert Data Summary - Precast box culvert

Barrel Shape: Concrete Box

Barrel Span: 5.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge (90°) Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: Road Sta 1+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
24.41	40.74	1.44	2.75	0.45	0.67
27.52	40.80	1.50	2.79	0.47	0.67
30.63	40.85	1.55	2.82	0.48	0.66
33.74	40.90	1.60	2.86	0.50	0.66
36.85	40.95	1.65	2.89	0.51	0.65
39.95	40.99	1.69	2.92	0.53	0.65
43.06	41.03	1.73	2.96	0.54	0.65
46.17	41.07	1.77	2.99	0.55	0.65
49.28	41.11	1.81	3.02	0.56	0.64
52.39	41.14	1.84	3.05	0.57	0.64
55.50	41.18	1.88	3.08	0.59	0.64

Tailwater Channel Data - Road Sta 1+50

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0050

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	42.00	0.0330
2	19.00	40.00	0.0250
3	20.00	39.30	0.0250
4	21.00	39.30	0.0250
5	22.00	40.00	0.0330
6	41.00	42.00	0.0330

Roadway Data for Crossing: Road Sta 1+50

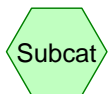
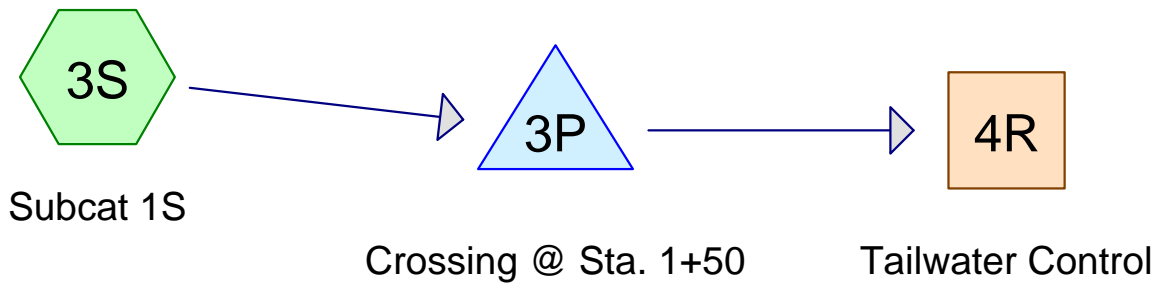
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 44.99 ft

Roadway Surface: Paved

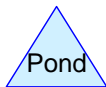
Roadway Top Width: 48.00 ft



Subcat



Reach



Pond



Link

Routing Diagram for 19063 Post-Culvert#1Pond
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19063 Post-Culvert#1Pond

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.343	74	>75% Grass cover, Good, HSG C (3S)
1.116	80	>75% Grass cover, Good, HSG D (3S)
1.088	98	Paved parking, HSG C (3S)
0.515	98	Paved parking, HSG D (3S)
0.349	98	Roofs, HSG C (3S)
0.078	98	Roofs, HSG D (3S)
3.574	70	Woods, Good, HSG C (3S)
0.658	77	Woods, Good, HSG D (3S)
10.721	78	TOTAL AREA

19063 Post-Culvert#1Pond

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Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
8.354	HSG C	3S
2.367	HSG D	3S
0.000	Other	
10.721		TOTAL AREA

19063 Post-Culvert#1Pond

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Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	3.343	1.116	0.000	4.459	>75% Grass cover, Good	3S
0.000	0.000	1.088	0.515	0.000	1.603	Paved parking	3S
0.000	0.000	0.349	0.078	0.000	0.427	Roofs	3S
0.000	0.000	3.574	0.658	0.000	4.232	Woods, Good	3S
0.000	0.000	8.354	2.367	0.000	10.721	TOTAL AREA	

19063 Post-Culvert#1Pond

NRCC 24-hr D 100-YR+15% (NRCC D) Rainfall=9.91"

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Summary for Subcatchment 3S: Subcat 1S

Runoff = 55.47 cfs @ 12.26 hrs, Volume= 6.414 af, Depth= 7.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs
NRCC 24-hr D 100-YR+15% (NRCC D) Rainfall=9.91"

Area (ac)	CN	Description
3.343	74	>75% Grass cover, Good, HSG C
1.116	80	>75% Grass cover, Good, HSG D
1.088	98	Paved parking, HSG C
0.515	98	Paved parking, HSG D
0.349	98	Roofs, HSG C
0.078	98	Roofs, HSG D
3.574	70	Woods, Good, HSG C
0.658	77	Woods, Good, HSG D
10.721	78	Weighted Average
8.691		81.07% Pervious Area
2.030		18.93% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	20	0.0700	0.22		Sheet Flow, A-->B Grass: Short n= 0.150 P2= 3.61"
16.1	1,000	0.0220	1.04		Shallow Concentrated Flow, B-->C Short Grass Pasture Kv= 7.0 fps
0.7	486	0.0494	11.09	44.37	Parabolic Channel, C-->D W=4.00' D=1.50' Area=4.0 sf Perim=5.2' n= 0.025
18.3	1,506	Total			

Summary for Reach 4R: Tailwater Control

Inflow Area = 10.721 ac, 18.93% Impervious, Inflow Depth = 7.18" for 100-YR+15% (NRCC D) event
 Inflow = 55.39 cfs @ 12.27 hrs, Volume= 6.414 af
 Outflow = 55.36 cfs @ 12.27 hrs, Volume= 6.414 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs / 2
 Max. Velocity= 2.49 fps, Min. Travel Time= 0.3 min
 Avg. Velocity = 1.59 fps, Avg. Travel Time= 0.5 min

Peak Storage= 1,113 cf @ 12.27 hrs
 Average Depth at Peak Storage= 2.03'
 Bank-Full Depth= 2.70' Flow Area= 45.4 sf, Capacity= 133.52 cfs

Custom cross-section, Length= 50.0' Slope= 0.0030 '/'
 Flow calculated by Manning's Subdivision method
 Inlet Invert= 39.20', Outlet Invert= 39.05'

19063 Post-Culvert#1Pond

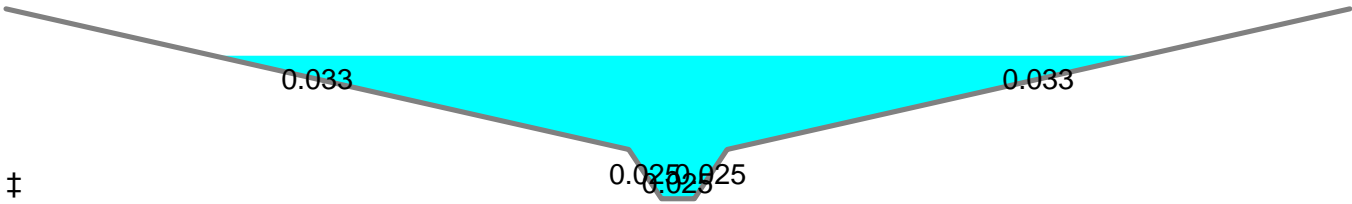
NRCC 24-hr D 100-YR+15% (NRCC D) Rainfall=9.91"

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Offset (feet)	Elevation (feet)	Chan.Depth (feet)	n	Description
0.00	42.00	0.00		
19.00	40.00	2.00	0.033	
20.00	39.30	2.70	0.025	
21.00	39.30	2.70	0.025	
22.00	40.00	2.00	0.025	
41.00	42.00	0.00	0.033	

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	1.0	0	0.00
0.70	1.4	3.4	70	2.51
2.70	45.4	41.7	2,270	133.52

Summary for Pond 3P: Crossing @ Sta. 1+50

Inflow Area = 10.721 ac, 18.93% Impervious, Inflow Depth = 7.18" for 100-YR+15% (NRCC D) event
 Inflow = 55.47 cfs @ 12.26 hrs, Volume= 6.414 af
 Outflow = 55.39 cfs @ 12.27 hrs, Volume= 6.414 af, Atten= 0%, Lag= 0.4 min
 Primary = 55.39 cfs @ 12.27 hrs, Volume= 6.414 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-26.00 hrs, dt= 0.01 hrs / 2
 Peak Elev= 43.40' @ 12.27 hrs Surf.Area= 415 sf Storage= 75 cf

Plug-Flow detention time= 0.0 min calculated for 6.412 af (100% of inflow)
 Center-of-Mass det. time= 0.0 min (826.0 - 826.0)

Volume #1	Invert	Avail.Storage	Storage Description			
	41.00'	10,671 cf	Custom Stage Data (Irregular) Listed below (Recalc)			
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)	
41.00	1	1.0	0	0	1	
43.00	10	1.0	9	9	3	
44.00	2,136	283.0	764	773	6,378	
46.00	8,459	488.0	9,897	10,671	18,979	

Device	Routing	Invert	Outlet Devices
#1	Primary	41.00'	60.0" W x 24.0" H Box Culvert L= 48.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 41.00' / 39.30' S= 0.0354 ' / Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 10.00 sf

19063 Post-Culvert#1Pond

NRCC 24-hr D 100-YR+15% (NRCC D) Rainfall=9.91"

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Primary OutFlow Max=55.39 cfs @ 12.27 hrs HW=43.40' TW=41.23' (Dynamic Tailwater)

↑**1=Culvert** (Inlet Controls 55.39 cfs @ 5.54 fps)