JONES & BEACH ENGINEERS INC.

DRAINAGE ANALYSIS

EROSION AND SEDIMENT CONTROL PLAN

35 Madbury Road
Tax Map 106 / Lot 19
Durham, NH 03824

Prepared for:

DWS 35, LLC
288 Calef Highway
Lee, NH 03861

Prepared by:
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Rev. #1 – August 6, 2025
JBE Project No. 25073

1. EXECUTIVE SUMMARY

The purpose of this project is to construct a parking addition and associated driveway on Town of Durham Tax Map 106, Lot 19. The development will include the construction of the parking and driveway area with associated stormwater management practices. Two models were compiled, one for the area in its existing (pre-development) condition, and a second for its proposed (post-development) condition. The analysis was conducted using the USDA SCS TR-20 method within the HydroCAD Stormwater Modeling System environment.

A summary of the existing and proposed conditions peak rates of runoff is as follows:

	EXECUTIVE SUMMARY TABLE – PEAK FLOW							
Analysis Point	1 Inch (cfs)		2 Year (cfs)		10 Year (cfs)		17 Year (cfs)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Analysis Point #1	0.35	0.33	2.94	2.84	5.36	5.23	6.06	5.90
Analysis Point #2	0.03	0.01	0.27	0.06	0.50	0.11	0.57	0.11

A summary of the existing and proposed conditions peak volumes of runoff is as follows:

	EXECUTIVE SUMMARY TABLE – VOLUME							
Analysis Point	1 Inch (cf)		2 Year (cf)		10 Year (cf)		17 Year (cf)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Analysis Point #1	0.039	0.037	0.296	0.291	0.552	0.552	0.628	0.630
Analysis Point #2	0.002	0.001	0.020	0.005	0.037	0.008	0.043	0.010

* A minor increase in the post-construction volume of runoff towards Analysis Point #1 throughout the 17-Year storm event is due to the proposed construction of the driveway and parking area. Infiltration in this location is limited due to a poor infiltration rate and relatively high water table, however, stormwater discharged from the proposed development will be treated and will not negatively impact abutting property owners as the increase is only 0.002 C.F. at the most. Peak discharge is also decreased to this Analysis Point throughout all modeled storm events.

Section 15.5.3(c) in the Durham, NH Site Plan Regulations states "For sites meeting the definition of a redevelopment project and having more than 40% existing impervious surface coverage, stormwater shall be managed for water quality in accordance with the following technique: Implement other LID (Low impact development) techniques onsite to the maximum extent practicable to provide treatment for at least 50% of the entire site area". Since the existing site is already developed and is over the 40% impervious threshold, this project qualifies to meet the aforementioned criteria listed within the regulation. The existing site contains no stormwater management practices and has an impervious area of ±8,339 S.F. requiring treatment under current regulations. The proposed site adds ±684 S.F. of impervious area and the proposed porous asphalt will capture and treat ±5,037 S.F. of the now ±9,023 S.F. needing treatment, providing treatment to over 50% of the required level stated in the regulation. The porous asphalt will also capture and treat ±1,400 S.F. of offsite impervious area, previously left untreated in the pre-construction condition. Therefore, the drainage design intent for this site is to effectively treat stormwater from at least 50% of impervious surfaces of the proposed site. This has been accomplished through the use of porous asphalt to treat runoff from impervious surfaces.

In addition, the potential for increased erosion and sedimentation is handled by way of a riprap outlet protection apron and silt fence. Abutting property owners will suffer minimal impact resultant from this development.

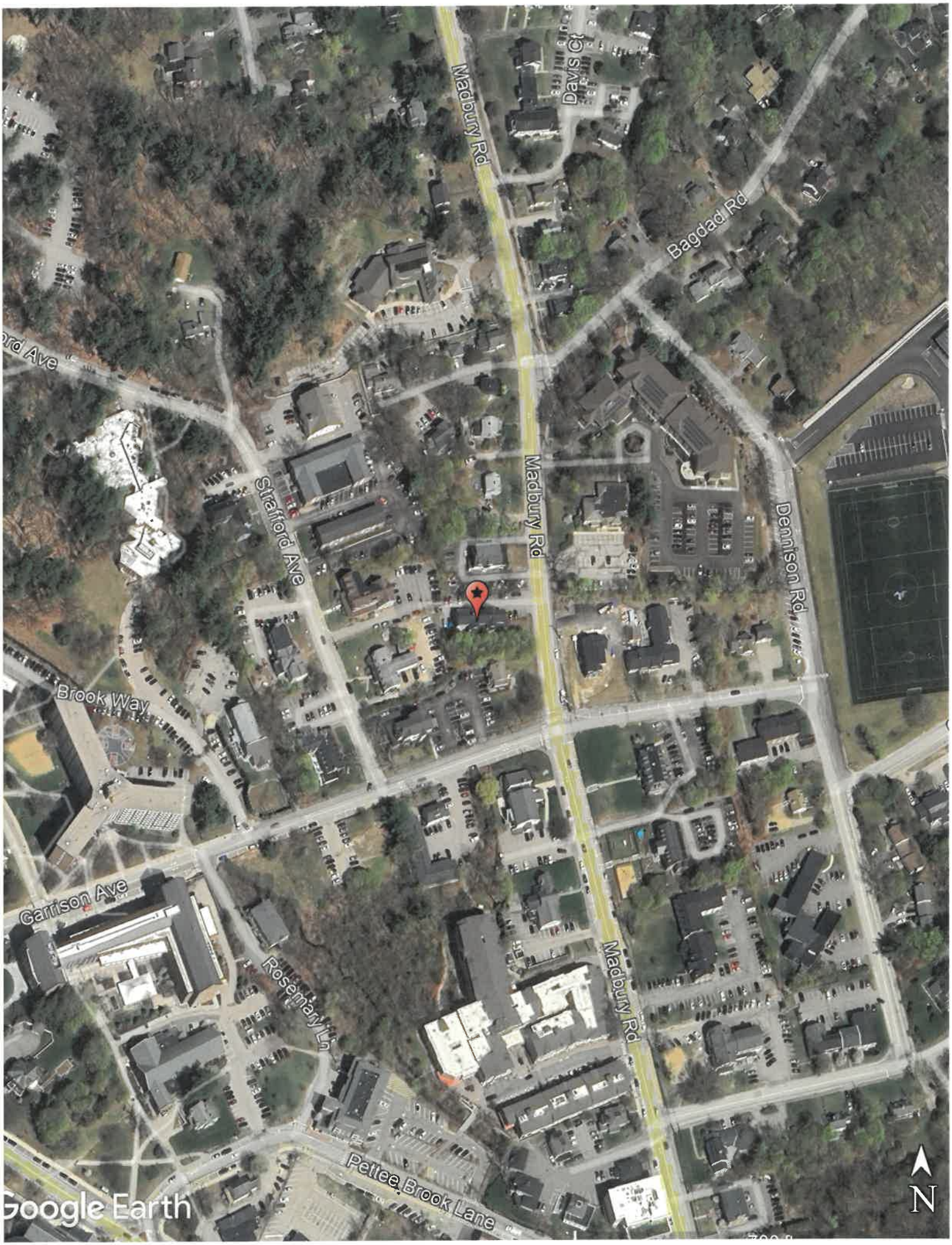
Madbury Rd
Davis Ct
Bagdad Rd
Strafford Ave
Madbury Rd
Dennison Rd
Brook Way
Garrison Ave
Rosemary Ln
Madbury Rd
Pettee Brook Lane
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TABLE OF CONTENTS

2. DRAINAGE ANALYSIS

3.1 INTRODUCTION

The purpose of this project is to construct a parking addition and associated driveway on Town of Durham Tax Map 106, Lot 19. The development will include the construction of the parking and driveway area with associated stormwater management practices.

3.2 METHODOLOGY

The existing and proposed watersheds were modeled utilizing HydroCad stormwater software, version 9.10. The watersheds were analyzed utilizing the SCS TR-20 methodology for hydrograph development and the TR-55 methodology for Time of Concentration (Tc) determination. The Dynamic-Storage-Indicating method for reach and pond routing was utilized. Type III, 24-hour hydrographs were developed for the 1-inch, 2-year, 10-year, and 17-year storm events, corresponding to rainfall events of 1.00", 3.30", 5.29", 5.87" respectively. The 17-Year storm event was determined via interpolation between the published 10-Year and 25-Year rainfall events.

Existing topography and site features were obtained through on-ground topography completed by Jones & Beach Engineers. Existing soil conditions were derived from NRCS Web Soil Survey.

3.3 EXISTING CONDITIONS ANALYSIS

The study area consists of the subject property and upstream contributing area. The study area contains ±1.75 acres including offsite contributing areas. The existing site is currently developed and includes a dwelling utilized by one of the fraternities of the University of New Hampshire as well as a paved driveway and parking area. The surrounding area is mostly developed and contains other dwellings, paved surfaces, woods, and grass cover. The existing site contains a high point that traverses North to South, resulting in the Analysis Points as defined below.

The entirety of the soils for this site are described as Hydrological Soils "D".

Two (2) Analysis Points (AP) were defined for this project.

Analysis Point #1 (AP1) represents the Southwest corner of the subject lot. Runoff that reaches this point flows onto the abutting property. Subcatchment 100 represents the area that flows to this Analysis Point.

Analysis Point #2 (AP2) represents the Southeast corner of the subject. Runoff that reaches this point flows onto Madbury Road, where a network of catch basins is in place to capture and transport stormwater. Subcatchment 101 represents the area the flows to this Analysis Point.

3.4 PROPOSED CONDITIONS ANALYSIS

The proposed site will include the construction of the proposed parking area, driveway, and stormwater management practices.

The addition of the proposed impervious paved areas causes an increase in the curve number (C_n) and a decrease in the time of concentration (T_c), the net result being a potential increase in peak rates of

runoff from the site. To effectively treat the subsequent stormwater runoff to the extent practicable and required under current regulations, the following Best Management Practices (BMP's) have been employed at the Analysis Points as follows:

Subcatchment 200 represents the area of land that flows directly to Analysis Point #1, similarly to Subcatchment 100 in the pre-construction model.

Subcatchment 201 represents the area of land that flows directly to Analysis Point #2, similarly to Subcatchment 101 in the pre-construction model.

Runoff from the southern portion of the roof and the majority of the proposed parking area and driveway, represented by Subcatchment 202, will be captured and treated via porous asphalt (Pond P1) before discharging via culvert and flowing overland (Reach 20R) to Analysis Point #1. Infiltration has also been modeled within the porous asphalt system. The infiltration rate was determined by attaining the lowest published Ksat value for the in-situ soil from the Ksat Values for New Hampshire Soils sponsored by the Society of Soil Scientists of Northern New England. In this case, 0.6 in/hr is the lowest published value and a factor of safety of two was applied in order to arrive at a Ksat value of 0.3 in/hr used in the model.

3.6 CONCLUSION

This proposed site development will have minimal adverse effect on abutting infrastructures or properties by way of stormwater runoff or siltation if properly constructed in accordance with this Drainage Analysis and approved project plan set. Appropriate steps will be taken to control erosion and sedimentation; these will be accomplished through the construction of a drainage system consisting of site grading, porous asphalt, and a riprap outlet protection apron. The use of Best Management Practices developed by the State of New Hampshire have been utilized in the design of this system.

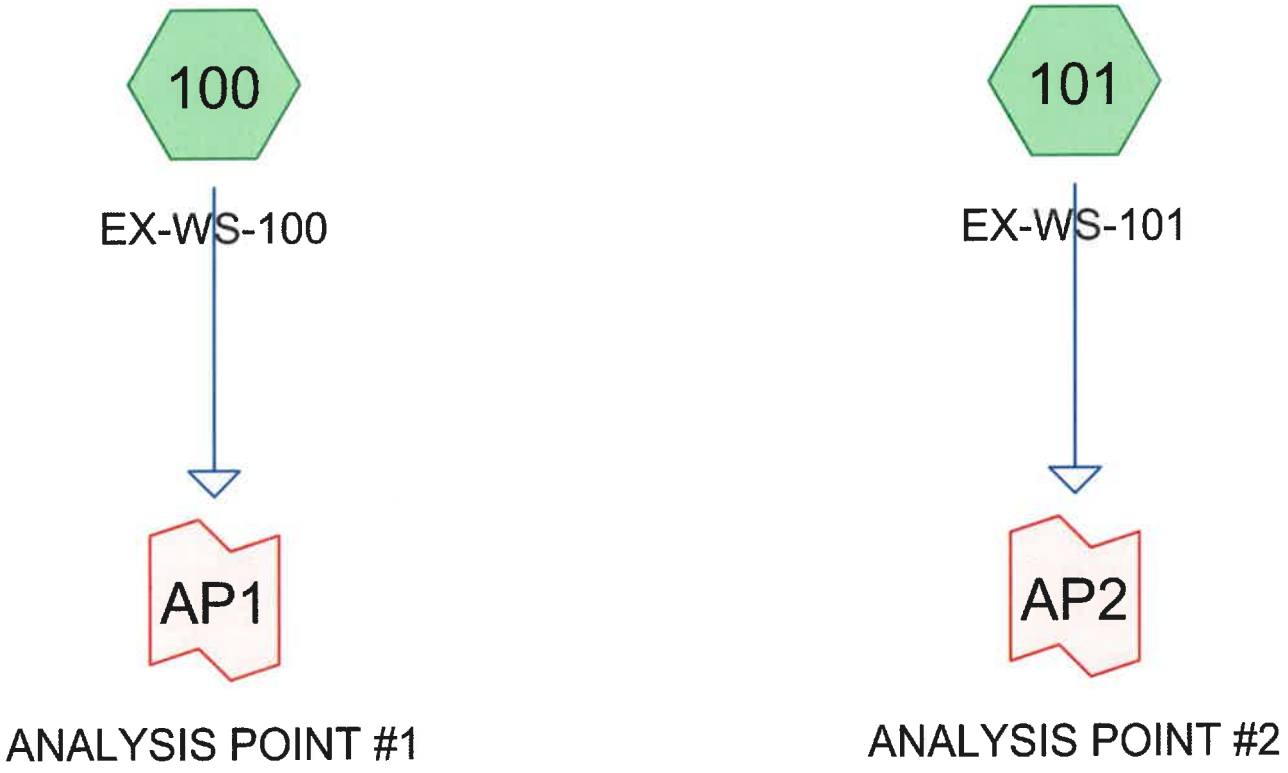
Respectfully Submitted,
JONES & BEACH ENGINEERS, INC.

Nicholas Lorenz
Project Engineer

APPENDIX 3.7
DRAINAGE CALCUALTIONS

PRE-DEVELOPMENT CONDITIONS ANALYSIS

1-Inch 24-Hour Complete Analysis
2-Year 24-Hour Summary Analysis
10-Year 24-Hour Complete Analysis
17-Year 24-Hour Summary Analysis



Subcat Reach Pond Link

Routing Diagram for EXISTING
Prepared by Jones & Beach Engineers Inc, Printed 8/5/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.586	80	>75% Grass cover, Good, HSG D (100, 101)
0.164	98	Gravel, HSG D (100)
0.015	98	Patio/Stairs, HSG D (100)
0.461	98	Pavement, HSG D (100, 101)
0.245	98	Roof, HSG D (100, 101)
0.009	98	Sidewalk, HSG D (100, 101)
0.000	98	Stairs, HSG D (101)
0.274	77	Woods, Good, HSG D (100, 101)
1.754	**89**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.754	HSG D	100, 101
0.000	Other	
1.754		**TOTAL AREA**

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

Subcatchment100: EX-WS-100 Runoff Area=71,445 sf 51.45% Impervious Runoff Depth>0.28"
Flow Length=483' Tc=17.6 min CN=89 Runoff=0.35 cfs 0.039 af

Subcatchment101: EX-WS-101 Runoff Area=4,964 sf 44.56% Impervious Runoff Depth>0.25"
Flow Length=188' Tc=6.0 min CN=88 Runoff=0.03 cfs 0.002 af

Link AP1: ANALYSISPOINT #1 Inflow=0.35 cfs 0.039 af
Primary=0.35 cfs 0.039 af

Link AP2: ANALYSISPOINT #2 Inflow=0.03 cfs 0.002 af
Primary=0.03 cfs 0.002 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.041 af Average Runoff Depth = 0.28"
49.00% Pervious = 0.860 ac 51.00% Impervious = 0.895 ac

Summary for Subcatchment 100: EX-WS-100

Runoff = 0.35 cfs @ 12.27 hrs, Volume= 0.039 af, Depth> 0.28"
Routed to Link AP1 : ANALYSIS POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 INCH Rainfall=1.00"

	Area (sf)	CN	Description
	11,440	77	Woods, Good, HSG D
*	10,379	98	Roof, HSG D
*	267	98	Sidewalk, HSG D
*	640	98	Patio/Stairs, HSG D
*	18,321	98	Pavement, HSG D
*	7,149	98	Gravel, HSG D
	23,249	80	>75% Grass cover, Good, HSG D
	71,445	89	Weighted Average
	34,689		48.55% Pervious Area
	36,756		51.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0082	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.1	2	0.0082	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	23	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	19	0.0465	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0476	1.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	5	0.0476	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	2	0.0476	4.43		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	100	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	17	0.0588	4.92		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	23	0.0435	4.23		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0465	4.38		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	8	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	1.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	3.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	64	0.0143	1.93		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	13	0.0143	0.84		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.6	483	Total			

Summary for Subcatchment 101: EX-WS-101

Runoff = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Depth> 0.25"
Routed to Link AP2 : ANALYSIS POINT #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 INCH Rainfall=1.00"

	Area (sf)	CN	Description
*	310	98	Roof, HSG D
*	1,765	98	Pavement, HSG D
*	133	98	Sidewalk, HSG D
*	4	98	Stairs, HSG D
	482	77	Woods, Good, HSG D
	2,270	80	>75% Grass cover, Good, HSG D
	4,964	88	Weighted Average
	2,752		55.44% Pervious Area
	2,212		44.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	25	0.3333	3.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.9	6	0.0251	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.5	37	0.0251	1.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.6	32	0.0122	0.91		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.1	16	0.0122	2.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	34	0.0122	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	4	0.0309	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	3	0.0309	3.57		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	13	0.0309	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	13	0.0309	0.88		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	5	0.0562	1.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.5	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Link AP1: ANALYSIS POINT #1

Inflow Area = 1.640 ac, 51.45% Impervious, Inflow Depth > 0.28" for 1 INCH event
Inflow = 0.35 cfs @ 12.27 hrs, Volume= 0.039 af
Primary = 0.35 cfs @ 12.27 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link AP2: ANALYSIS POINT #2

Inflow Area = 0.114 ac, 44.56% Impervious, Inflow Depth > 0.25" for 1 INCH event
Inflow = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af
Primary = 0.03 cfs @ 12.10 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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

Subcatchment100: EX-WS-100 Runoff Area=71,445 sf 51.45% Impervious Runoff Depth>2.17"
Flow Length=483' Tc=17.6 min CN=89 Runoff=2.94 cfs 0.296 af

Subcatchment101: EX-WS-101 Runoff Area=4,964 sf 44.56% Impervious Runoff Depth>2.09"
Flow Length=188' Tc=6.0 min CN=88 Runoff=0.27 cfs 0.020 af

Link AP1: ANALYSISPOINT #1 Inflow=2.94 cfs 0.296 af
Primary=2.94 cfs 0.296 af

Link AP2: ANALYSISPOINT #2 Inflow=0.27 cfs 0.020 af
Primary=0.27 cfs 0.020 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.316 af Average Runoff Depth = 2.16"
49.00% Pervious = 0.860 ac 51.00% Impervious = 0.895 ac

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

Subcatchment100: EX-WS-100 Runoff Area=71,445 sf 51.45% Impervious Runoff Depth>4.04"
Flow Length=483' Tc=17.6 min CN=89 Runoff=5.36 cfs 0.552 af

Subcatchment101: EX-WS-101 Runoff Area=4,964 sf 44.56% Impervious Runoff Depth>3.94"
Flow Length=188' Tc=6.0 min CN=88 Runoff=0.50 cfs 0.037 af

Link AP1: ANALYSISPOINT #1 Inflow=5.36 cfs 0.552 af
Primary=5.36 cfs 0.552 af

Link AP2: ANALYSISPOINT #2 Inflow=0.50 cfs 0.037 af
Primary=0.50 cfs 0.037 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.590 af Average Runoff Depth = 4.03"
49.00% Pervious = 0.860 ac 51.00% Impervious = 0.895 ac

Summary for Subcatchment 100: EX-WS-100

Runoff = 5.36 cfs @ 12.24 hrs, Volume= 0.552 af, Depth> 4.04"
Routed to Link AP1 : ANALYSIS POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=5.29"

	Area (sf)	CN	Description
	11,440	77	Woods, Good, HSG D
*	10,379	98	Roof, HSG D
*	267	98	Sidewalk, HSG D
*	640	98	Patio/Stairs, HSG D
*	18,321	98	Pavement, HSG D
*	7,149	98	Gravel, HSG D
	23,249	80	>75% Grass cover, Good, HSG D
	71,445	89	Weighted Average
	34,689		48.55% Pervious Area
	36,756		51.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0082	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.1	2	0.0082	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	23	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	19	0.0465	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0476	1.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	5	0.0476	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	2	0.0476	4.43		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	100	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	17	0.0588	4.92		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	23	0.0435	4.23		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0465	4.38		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	8	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	1.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	3.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	64	0.0143	1.93		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	13	0.0143	0.84		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.6	483	Total			

Summary for Subcatchment 101: EX-WS-101

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 0.037 af, Depth> 3.94"
Routed to Link AP2 : ANALYSIS POINT #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=5.29"

	Area (sf)	CN	Description
*	310	98	Roof, HSG D
*	1,765	98	Pavement, HSG D
*	133	98	Sidewalk, HSG D
*	4	98	Stairs, HSG D
	482	77	Woods, Good, HSG D
	2,270	80	>75% Grass cover, Good, HSG D
	4,964	88	Weighted Average
	2,752		55.44% Pervious Area
	2,212		44.56% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	25	0.3333	3.26		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.9	6	0.0251	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.5	37	0.0251	1.25		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.6	32	0.0122	0.91		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.30"
0.1	16	0.0122	2.24		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.7	34	0.0122	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	4	0.0309	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	3	0.0309	3.57		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.2	13	0.0309	1.23		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.2	13	0.0309	0.88		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	5	0.0562	1.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
3.5	188	Total, Increased to minimum Tc = 6.0 min			

Summary for Link AP1: ANALYSIS POINT #1

Inflow Area = 1.640 ac, 51.45% Impervious, Inflow Depth > 4.04" for 10 YEAR event
Inflow = 5.36 cfs @ 12.24 hrs, Volume= 0.552 af
Primary = 5.36 cfs @ 12.24 hrs, Volume= 0.552 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link AP2: ANALYSIS POINT #2

Inflow Area = 0.114 ac, 44.56% Impervious, Inflow Depth > 3.94" for 10 YEAR event
Inflow = 0.50 cfs @ 12.09 hrs, Volume= 0.037 af
Primary = 0.50 cfs @ 12.09 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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

Subcatchment100: EX-WS-100 Runoff Area=71,445 sf 51.45% Impervious Runoff Depth>4.60"
Flow Length=483' Tc=17.6 min CN=89 Runoff=6.06 cfs 0.628 af

Subcatchment101: EX-WS-101 Runoff Area=4,964 sf 44.56% Impervious Runoff Depth>4.50"
Flow Length=188' Tc=6.0 min CN=88 Runoff=0.57 cfs 0.043 af

Link AP1: ANALYSISPOINT #1 Inflow=6.06 cfs 0.628 af
Primary=6.06 cfs 0.628 af

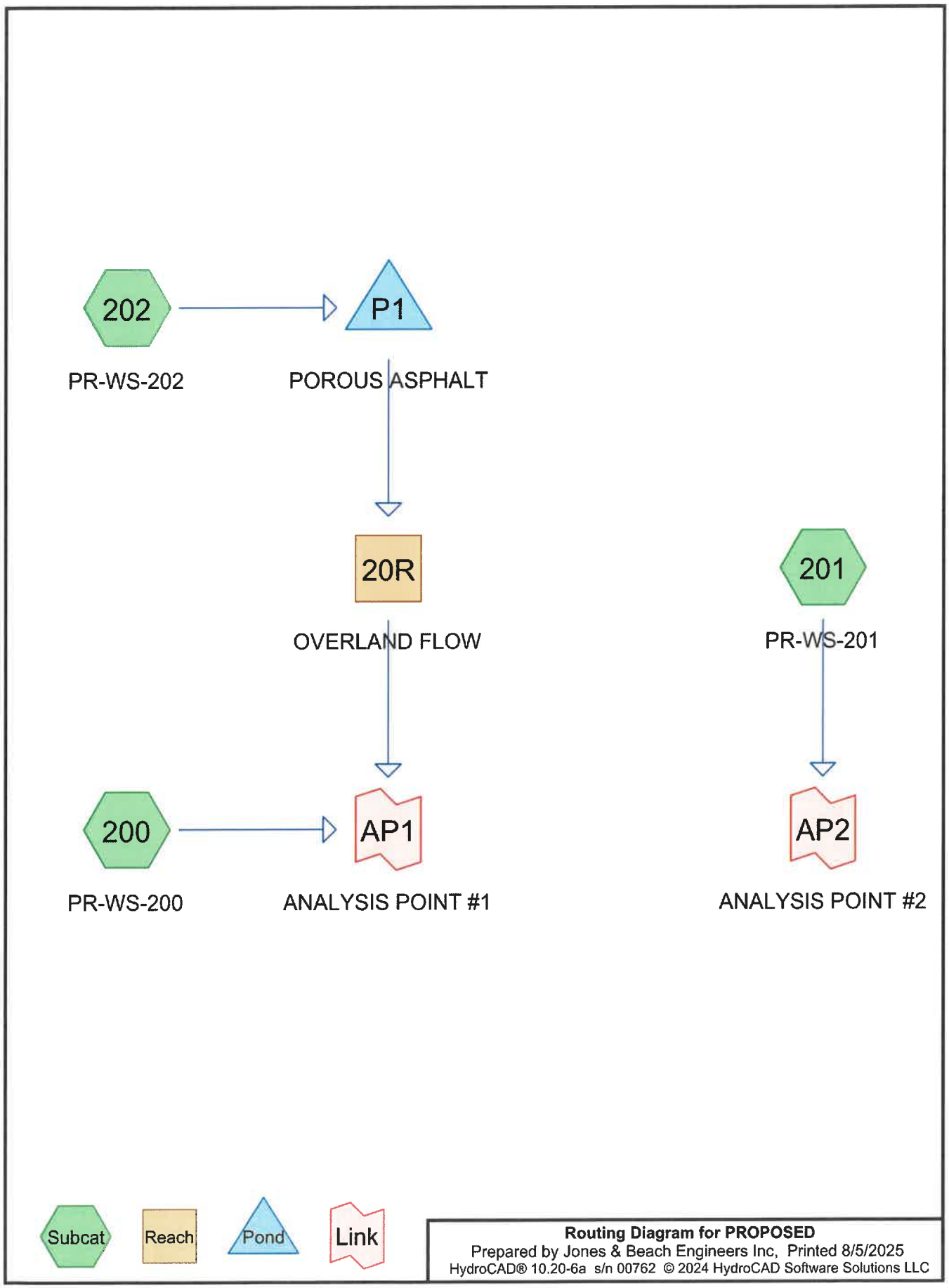
Link AP2: ANALYSISPOINT #2 Inflow=0.57 cfs 0.043 af
Primary=0.57 cfs 0.043 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.671 af Average Runoff Depth = 4.59"
49.00% Pervious = 0.860 ac 51.00% Impervious = 0.895 ac

APPENDIX 3.8
DRAINAGE CALCULATIONS

POST-DEVELOPMENT CONDITIONS ANALYSIS

1-Inch 24-Hour Complete Analysis
2-Year 24-Hour Summary Analysis
10-Year 24-Hour Complete Analysis
17-Year 24-Hour Summary Analysis
100-Year 24-Hour Pond Summary



Routing Diagram for PROPOSED
Prepared by Jones & Beach Engineers Inc, Printed 8/5/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.521	80	>75% Grass cover, Good, HSG D (200, 201, 202)
0.002	98	Concrete, HSG D (202)
0.164	98	Gravel, HSG D (200)
0.015	98	Patio/Stairs, HSG D (200, 202)
0.453	98	Pavement, HSG D (200, 201)
0.098	98	Porous Asphalt, HSG D (202)
0.262	98	Roof, HSG D (200, 202)
0.239	77	Woods, Good, HSG D (200)
1.754	**90**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
1.754	HSG D	200, 201, 202
0.000	Other	
1.754		**TOTAL AREA**

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

Subcatchment200: PR-WS-200 Runoff Area=67,282 sf 53.36% Impervious Runoff Depth>0.28"
Flow Length=483' Tc=17.6 min CN=89 Runoff=0.33 cfs 0.037 af

Subcatchment201: PR-WS-201 Runoff Area=1,090 sf 50.37% Impervious Runoff Depth>0.28"
Tc=6.0 min CN=89 Runoff=0.01 cfs 0.001 af

Subcatchment202: PR-WS-202 Runoff Area=8,013 sf 85.05% Impervious Runoff Depth>0.56"
Tc=6.0 min CN=95 Runoff=0.12 cfs 0.009 af

Reach 20R: OVERLAND FLOW Avg. Flow Depth=0.00' Max Vel=0.00 fps Inflow=0.00 cfs 0.000 af
n=0.030 L=20.3' S=0.0163 '/' Capacity=10.08 cfs Outflow=0.00 cfs 0.000 af

Pond P1: POROUS ASPHALT Peak Elev=70.66' Storage=111 cf Inflow=0.12 cfs 0.009 af
Discarded=0.03 cfs 0.009 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.009 af

Link AP1: ANALYSIS POINT #1 Inflow=0.33 cfs 0.037 af
Primary=0.33 cfs 0.037 af

Link AP2: ANALYSIS POINT #2 Inflow=0.01 cfs 0.001 af
Primary=0.01 cfs 0.001 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.046 af Average Runoff Depth = 0.31"
43.36% Pervious = 0.760 ac 56.64% Impervious = 0.993 ac

Summary for Subcatchment 200: PR-WS-200

Runoff = 0.33 cfs @ 12.27 hrs, Volume= 0.037 af, Depth> 0.28"
Routed to Link AP1 : ANALYSIS POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 INCH Rainfall=1.00"

	Area (sf)	CN	Description
	10,404	77	Woods, Good, HSG D
*	9,221	98	Roof, HSG D
*	354	98	Patio/Stairs, HSG D
*	19,180	98	Pavement, HSG D
*	7,149	98	Gravel, HSG D
	20,974	80	>75% Grass cover, Good, HSG D
	67,282	89	Weighted Average
	31,378		46.64% Pervious Area
	35,904		53.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0082	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.1	2	0.0082	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	23	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	19	0.0465	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0476	1.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	5	0.0476	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	2	0.0476	4.43		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	100	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	17	0.0588	4.92		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	23	0.0435	4.23		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0465	4.38		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	8	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	1.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	3.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	64	0.0143	1.93		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	13	0.0143	0.84		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.6	483	Total			

Summary for Subcatchment 201: PR-WS-201

Runoff = 0.01 cfs @ 12.10 hrs, Volume= 0.001 af, Depth> 0.28"
Routed to Link AP2 : ANALYSIS POINT #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 INCH Rainfall=1.00"

	Area (sf)	CN	Description
*	549	98	Pavement, HSG D
	541	80	>75% Grass cover, Good, HSG D
	1,090	89	Weighted Average
	541		49.63% Pervious Area
	549		50.37% Impervious Area

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

Summary for Subcatchment 202: PR-WS-202

Runoff = 0.12 cfs @ 12.09 hrs, Volume= 0.009 af, Depth> 0.56"
Routed to Pond P1 : POROUS ASPHALT

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 INCH Rainfall=1.00"

	Area (sf)	CN	Description
*	2,178	98	Roof, HSG D
*	286	98	Patio/Stairs, HSG D
	1,198	80	>75% Grass cover, Good, HSG D
*	4,251	98	Porous Asphalt, HSG D
*	100	98	Concrete, HSG D
	8,013	95	Weighted Average
	1,198		14.95% Pervious Area
	6,815		85.05% Impervious Area

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

Summary for Reach 20R: OVERLAND FLOW

Inflow Area = 0.184 ac, 85.05% Impervious, Inflow Depth = 0.00" for 1 INCH event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Link AP1 : ANALYSIS POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.00 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 0.00 fps, Avg. Travel Time= 0.0 min

Peak Storage= 0 cf @ 0.00 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 0.50' Flow Area= 3.3 sf, Capacity= 10.08 cfs

10.00' x 0.50' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 20.3' Slope= 0.0163 '/'
Inlet Invert= 70.70', Outlet Invert= 70.37'

‡

Summary for Pond P1: POROUS ASPHALT

Inflow Area = 0.184 ac, 85.05% Impervious, Inflow Depth > 0.56" for 1 INCH event
Inflow = 0.12 cfs @ 12.09 hrs, Volume= 0.009 af
Outflow = 0.03 cfs @ 12.48 hrs, Volume= 0.009 af, Atten= 73%, Lag= 23.0 min
Discarded = 0.03 cfs @ 12.48 hrs, Volume= 0.009 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 20R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 70.66' @ 12.48 hrs Surf.Area= 4,251 sf Storage= 111 cf
Flood Elev= 73.50' Surf.Area= 4,251 sf Storage= 2,568 cf

Plug-Flow detention time= 40.4 min calculated for 0.009 af (99% of inflow)
Center-of-Mass det. time= 35.3 min (858.8 - 823.5)

Volume	Invert	Avail.Storage	Storage Description
#1	70.49'	4,687 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	70.75'	7 cf	**4.0" Round Pipe Storage** L= 78.0'
		4,694 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.49	4,251	0.0	0	0
70.50	4,251	15.0	6	6
70.74	4,251	15.0	153	159
70.75	4,251	40.0	17	176
71.41	4,251	40.0	1,122	1,299
71.42	4,251	15.0	6	1,305
71.66	4,251	15.0	153	1,458
71.67	4,251	5.0	2	1,460
72.66	4,251	5.0	210	1,671
72.67	4,251	30.0	13	1,683
73.16	4,251	30.0	625	2,308
73.17	4,251	15.0	6	2,315
73.49	4,251	15.0	204	2,519
73.50	4,251	100.0	43	2,561
74.00	4,251	100.0	2,126	4,687

Device	Routing	Invert	Outlet Devices
#1	Primary	70.75'	**4.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 70.75' / 70.70' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Device 1	70.75'	**4.0" Vert. PERFORATED UNDERDRAIN #1** C= 0.600 Limited to weir flow at low heads
#3	Discarded	70.49'	**0.300 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 68.10' Phase-In= 0.10'

Discarded OutFlow Max=0.03 cfs @ 12.48 hrs HW=70.66' (Free Discharge)
↑└**3=Exfiltration** (Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=70.49' TW=70.70' (Dynamic Tailwater)
↑└**1=Culvert** (Controls 0.00 cfs)
↑└**2=PERFORATED UNDERDRAIN #1**(Controls 0.00 cfs)

Summary for Link AP1: ANALYSIS POINT #1

Inflow Area = 1.729 ac, 56.74% Impervious, Inflow Depth > 0.25" for 1 INCH event
Inflow = 0.33 cfs @ 12.27 hrs, Volume= 0.037 af
Primary = 0.33 cfs @ 12.27 hrs, Volume= 0.037 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link AP2: ANALYSIS POINT #2

Inflow Area = 0.025 ac, 50.37% Impervious, Inflow Depth > 0.28" for 1 INCH event
Inflow = 0.01 cfs @ 12.10 hrs, Volume= 0.001 af
Primary = 0.01 cfs @ 12.10 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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

Subcatchment200: PR-WS-200 Runoff Area=67,282 sf 53.36% Impervious Runoff Depth>2.17"
Flow Length=483' Tc=17.6 min CN=89 Runoff=2.77 cfs 0.279 af

Subcatchment201: PR-WS-201 Runoff Area=1,090 sf 50.37% Impervious Runoff Depth>2.17"
Tc=6.0 min CN=89 Runoff=0.06 cfs 0.005 af

Subcatchment202: PR-WS-202 Runoff Area=8,013 sf 85.05% Impervious Runoff Depth>2.74"
Tc=6.0 min CN=95 Runoff=0.55 cfs 0.042 af

Reach 20R: OVERLAND FLOW Avg. Flow Depth=0.06' Max Vel=0.72 fps Inflow=0.09 cfs 0.012 af
n=0.030 L=20.3' S=0.0163 '/' Capacity=10.08 cfs Outflow=0.09 cfs 0.012 af

Pond P1: POROUS ASPHALT Peak Elev=71.03' Storage=658 cf Inflow=0.55 cfs 0.042 af
Discarded=0.04 cfs 0.030 af Primary=0.09 cfs 0.012 af Outflow=0.13 cfs 0.042 af

Link AP1: ANALYSIS POINT #1 Inflow=2.84 cfs 0.291 af
Primary=2.84 cfs 0.291 af

Link AP2: ANALYSIS POINT #2 Inflow=0.06 cfs 0.005 af
Primary=0.06 cfs 0.005 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.325 af Average Runoff Depth = 2.23"
43.36% Pervious = 0.760 ac 56.64% Impervious = 0.993 ac

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

Subcatchment200: PR-WS-200 Runoff Area=67,282 sf 53.36% Impervious Runoff Depth>4.04"
Flow Length=483' Tc=17.6 min CN=89 Runoff=5.05 cfs 0.520 af

Subcatchment201: PR-WS-201 Runoff Area=1,090 sf 50.37% Impervious Runoff Depth>4.05"
Tc=6.0 min CN=89 Runoff=0.11 cfs 0.008 af

Subcatchment202: PR-WS-202 Runoff Area=8,013 sf 85.05% Impervious Runoff Depth>4.70"
Tc=6.0 min CN=95 Runoff=0.91 cfs 0.072 af

Reach 20R: OVERLAND FLOW Avg. Flow Depth=0.08' Max Vel=0.91 fps Inflow=0.20 cfs 0.032 af
n=0.030 L=20.3' S=0.0163 '/' Capacity=10.08 cfs Outflow=0.20 cfs 0.032 af

Pond P1: POROUS ASPHALT Peak Elev=71.30' Storage=1,119 cf Inflow=0.91 cfs 0.072 af
Discarded=0.04 cfs 0.040 af Primary=0.20 cfs 0.032 af Outflow=0.24 cfs 0.072 af

Link AP1: ANALYSIS POINT #1 Inflow=5.23 cfs 0.552 af
Primary=5.23 cfs 0.552 af

Link AP2: ANALYSIS POINT #2 Inflow=0.11 cfs 0.008 af
Primary=0.11 cfs 0.008 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.600 af Average Runoff Depth = 4.11"
43.36% Pervious = 0.760 ac 56.64% Impervious = 0.993 ac

Summary for Subcatchment 200: PR-WS-200

Runoff = 5.05 cfs @ 12.24 hrs, Volume= 0.520 af, Depth> 4.04"
Routed to Link AP1 : ANALYSIS POINT #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=5.29"

	Area (sf)	CN	Description
	10,404	77	Woods, Good, HSG D
*	9,221	98	Roof, HSG D
*	354	98	Patio/Stairs, HSG D
*	19,180	98	Pavement, HSG D
*	7,149	98	Gravel, HSG D
	20,974	80	>75% Grass cover, Good, HSG D
	67,282	89	Weighted Average
	31,378		46.64% Pervious Area
	35,904		53.36% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0082	0.12		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.30"
0.1	2	0.0082	0.63		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	23	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.3	19	0.0465	1.08		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0571	1.19		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.5	35	0.0476	1.09		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	5	0.0476	1.53		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.0	2	0.0476	4.43		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.6	100	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	17	0.0588	4.92		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	23	0.0435	4.23		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.0	13	0.0465	4.38		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	8	0.0465	1.51		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	1.43		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	12	0.0417	3.29		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.6	64	0.0143	1.93		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	13	0.0143	0.84		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.6	483	Total			

Summary for Subcatchment 201: PR-WS-201

Runoff = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af, Depth> 4.05"
Routed to Link AP2 : ANALYSIS POINT #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=5.29"

	Area (sf)	CN	Description
*	549	98	Pavement, HSG D
	541	80	>75% Grass cover, Good, HSG D
	1,090	89	Weighted Average
	541		49.63% Pervious Area
	549		50.37% Impervious Area

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

Summary for Subcatchment 202: PR-WS-202

Runoff = 0.91 cfs @ 12.09 hrs, Volume= 0.072 af, Depth> 4.70"
Routed to Pond P1 : POROUS ASPHALT

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YEAR Rainfall=5.29"

	Area (sf)	CN	Description
*	2,178	98	Roof, HSG D
*	286	98	Patio/Stairs, HSG D
	1,198	80	>75% Grass cover, Good, HSG D
*	4,251	98	Porous Asphalt, HSG D
*	100	98	Concrete, HSG D
	8,013	95	Weighted Average
	1,198		14.95% Pervious Area
	6,815		85.05% Impervious Area

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

Summary for Reach 20R: OVERLAND FLOW

Inflow Area = 0.184 ac, 85.05% Impervious, Inflow Depth = 2.07" for 10 YEAR event
Inflow = 0.20 cfs @ 12.45 hrs, Volume= 0.032 af
Outflow = 0.20 cfs @ 12.45 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.3 min
Routed to Link AP1 : ANALYSIS POINT #1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.91 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 0.7 min

Peak Storage= 4 cf @ 12.45 hrs
Average Depth at Peak Storage= 0.08' , Surface Width= 4.05'
Bank-Full Depth= 0.50' Flow Area= 3.3 sf, Capacity= 10.08 cfs

10.00' x 0.50' deep Parabolic Channel, n= 0.030 Earth, grassed & winding
Length= 20.3' Slope= 0.0163 '/'
Inlet Invert= 70.70', Outlet Invert= 70.37'

‡

Summary for Pond P1: POROUS ASPHALT

Inflow Area = 0.184 ac, 85.05% Impervious, Inflow Depth > 4.70" for 10 YEAR event
Inflow = 0.91 cfs @ 12.09 hrs, Volume= 0.072 af
Outflow = 0.24 cfs @ 12.45 hrs, Volume= 0.072 af, Atten= 74%, Lag= 21.5 min
Discarded = 0.04 cfs @ 12.45 hrs, Volume= 0.040 af
Primary = 0.20 cfs @ 12.45 hrs, Volume= 0.032 af
Routed to Reach 20R : OVERLAND FLOW

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 71.30' @ 12.45 hrs Surf.Area= 4,251 sf Storage= 1,119 cf
Flood Elev= 73.50' Surf.Area= 4,251 sf Storage= 2,568 cf

Plug-Flow detention time= 80.2 min calculated for 0.072 af (99% of inflow)
Center-of-Mass det. time= 76.1 min (842.4 - 766.3)

Volume	Invert	Avail.Storage	Storage Description
#1	70.49'	4,687 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	70.75'	7 cf	**4.0" Round Pipe Storage** L= 78.0'
		4,694 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
70.49	4,251	0.0	0	0
70.50	4,251	15.0	6	6
70.74	4,251	15.0	153	159
70.75	4,251	40.0	17	176
71.41	4,251	40.0	1,122	1,299
71.42	4,251	15.0	6	1,305
71.66	4,251	15.0	153	1,458
71.67	4,251	5.0	2	1,460
72.66	4,251	5.0	210	1,671
72.67	4,251	30.0	13	1,683
73.16	4,251	30.0	625	2,308
73.17	4,251	15.0	6	2,315
73.49	4,251	15.0	204	2,519
73.50	4,251	100.0	43	2,561
74.00	4,251	100.0	2,126	4,687

Device	Routing	Invert	Outlet Devices
#1	Primary	70.75'	**4.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 70.75' / 70.70' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.09 sf
#2	Device 1	70.75'	**4.0" Vert. PERFORATED UNDERDRAIN #1** C= 0.600 Limited to weir flow at low heads
#3	Discarded	70.49'	**0.300 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 68.10' Phase-In= 0.10'

Discarded OutFlow Max=0.04 cfs @ 12.45 hrs HW=71.30' (Free Discharge)
↑└**3=Exfiltration** (Controls 0.04 cfs)

Primary OutFlow Max=0.20 cfs @ 12.45 hrs HW=71.30' TW=70.78' (Dynamic Tailwater)
↑└**1=Culvert** (Barrel Controls 0.20 cfs @ 2.30 fps)
↑└**2=PERFORATED UNDERDRAIN #1** (Passes 0.20 cfs of 0.26 cfs potential flow)

Summary for Link AP1: ANALYSIS POINT #1

Inflow Area = 1.729 ac, 56.74% Impervious, Inflow Depth > 3.83" for 10 YEAR event
Inflow = 5.23 cfs @ 12.24 hrs, Volume= 0.552 af
Primary = 5.23 cfs @ 12.24 hrs, Volume= 0.552 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Link AP2: ANALYSIS POINT #2

Inflow Area = 0.025 ac, 50.37% Impervious, Inflow Depth > 4.05" for 10 YEAR event
Inflow = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af
Primary = 0.11 cfs @ 12.09 hrs, Volume= 0.008 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

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

Subcatchment200: PR-WS-200 Runoff Area=67,282 sf 53.36% Impervious Runoff Depth>4.60"
Flow Length=483' Tc=17.6 min CN=89 Runoff=5.71 cfs 0.592 af

Subcatchment201: PR-WS-201 Runoff Area=1,090 sf 50.37% Impervious Runoff Depth>4.61"
Tc=6.0 min CN=89 Runoff=0.13 cfs 0.010 af

Subcatchment202: PR-WS-202 Runoff Area=8,013 sf 85.05% Impervious Runoff Depth>5.28"
Tc=6.0 min CN=95 Runoff=1.01 cfs 0.081 af

Reach 20R: OVERLAND FLOW Avg. Flow Depth=0.09' Max Vel=0.94 fps Inflow=0.23 cfs 0.038 af
n=0.030 L=20.3' S=0.0163 '/' Capacity=10.08 cfs Outflow=0.23 cfs 0.038 af

Pond P1: POROUS ASPHALT Peak Elev=71.38' Storage=1,258 cf Inflow=1.01 cfs 0.081 af
Discarded=0.04 cfs 0.042 af Primary=0.23 cfs 0.038 af Outflow=0.27 cfs 0.080 af

Link AP1: ANALYSIS POINT #1 Inflow=5.92 cfs 0.630 af
Primary=5.92 cfs 0.630 af

Link AP2: ANALYSIS POINT #2 Inflow=0.13 cfs 0.010 af
Primary=0.13 cfs 0.010 af

Total Runoff Area = 1.754 ac Runoff Volume = 0.682 af Average Runoff Depth = 4.67"
43.36% Pervious = 0.760 ac 56.64% Impervious = 0.993 ac

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

Pond P1: POROUS ASPHALT Peak Elev=71.38' Storage=1,258 cf Inflow=1.01 cfs 0.081 af
Discarded=0.04 cfs 0.042 af Primary=0.23 cfs 0.038 af Outflow=0.27 cfs 0.080 af

APPENDIX 4

EXTREME PRECIPITATION TABLE

NOAA Atlas 14, Volume 10, Version 3
Location name: Durham, New Hampshire, USA*
Latitude: 43.1383°, Longitude: -70.9265°
Elevation: 77 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.300 (0.242-0.374)	0.363 (0.293-0.452)	0.466 (0.374-0.583)	0.550 (0.439-0.692)	0.667 (0.512-0.876)	0.755 (0.566-1.01)	0.847 (0.613-1.18)	0.951 (0.647-1.35)	1.10 (0.717-1.62)	1.23 (0.776-1.84)
10-min	0.425 (0.343-0.530)	0.514 (0.415-0.641)	0.659 (0.529-0.824)	0.779 (0.622-0.980)	0.944 (0.726-1.24)	1.07 (0.801-1.43)	1.20 (0.869-1.67)	1.35 (0.917-1.91)	1.56 (1.02-2.29)	1.74 (1.10-2.60)
15-min	0.500 (0.404-0.623)	0.604 (0.488-0.754)	0.774 (0.623-0.969)	0.916 (0.732-1.15)	1.11 (0.854-1.46)	1.26 (0.943-1.69)	1.41 (1.02-1.96)	1.58 (1.08-2.25)	1.84 (1.20-2.70)	2.04 (1.29-3.06)
30-min	0.668 (0.540-0.832)	0.807 (0.651-1.01)	1.04 (0.832-1.30)	1.22 (0.977-1.54)	1.48 (1.14-1.95)	1.68 (1.26-2.26)	1.88 (1.37-2.63)	2.12 (1.44-3.02)	2.48 (1.61-3.64)	2.77 (1.75-4.15)
60-min	0.835 (0.675-1.04)	1.01 (0.815-1.26)	1.30 (1.04-1.62)	1.53 (1.22-1.93)	1.86 (1.43-2.44)	2.10 (1.58-2.83)	2.36 (1.72-3.30)	2.66 (1.81-3.78)	3.12 (2.03-4.58)	3.50 (2.21-5.24)
2-hr	1.12 (0.911-1.39)	1.36 (1.11-1.69)	1.76 (1.42-2.19)	2.09 (1.68-2.62)	2.55 (1.97-3.34)	2.88 (2.18-3.87)	3.25 (2.38-4.54)	3.69 (2.52-5.22)	4.37 (2.85-6.38)	4.94 (3.14-7.36)
3-hr	1.32 (1.08-1.63)	1.62 (1.32-2.00)	2.10 (1.70-2.60)	2.50 (2.01-3.11)	3.05 (2.37-3.98)	3.45 (2.62-4.62)	3.89 (2.87-5.44)	4.43 (3.03-6.24)	5.26 (3.44-7.67)	5.98 (3.80-8.88)
6-hr	1.74 (1.43-2.14)	2.14 (1.75-2.62)	2.78 (2.28-3.43)	3.32 (2.70-4.11)	4.06 (3.18-5.28)	4.61 (3.52-6.13)	5.20 (3.85-7.22)	5.93 (4.07-8.30)	7.06 (4.63-10.2)	8.04 (5.13-11.8)
12-hr	2.22 (1.84-2.70)	2.74 (2.26-3.34)	3.59 (2.95-4.38)	4.29 (3.50-5.27)	5.25 (4.13-6.79)	5.97 (4.59-7.89)	6.74 (5.02-9.31)	7.70 (5.30-10.7)	9.18 (6.04-13.2)	10.5 (6.69-15.3)
24-hr	2.63 (2.19-3.18)	3.30 (2.74-3.99)	4.39 (3.63-5.33)	5.29 (4.34-6.46)	6.53 (5.17-8.40)	7.44 (5.76-9.82)	8.45 (6.35-11.6)	9.72 (6.72-13.4)	11.7 (7.73-16.8)	13.5 (8.65-19.6)
2-day	2.92 (2.44-3.50)	3.74 (3.13-4.49)	5.08 (4.23-6.13)	6.20 (5.12-7.52)	7.74 (6.18-9.93)	8.85 (6.92-11.7)	10.1 (7.68-14.0)	11.8 (8.14-16.2)	14.4 (9.55-20.5)	16.9 (10.8-24.4)
3-day	3.14 (2.64-3.76)	4.02 (3.38-4.82)	5.47 (4.57-6.57)	6.67 (5.53-8.05)	8.32 (6.66-10.6)	9.51 (7.46-12.5)	10.9 (8.29-15.0)	12.6 (8.78-17.3)	15.6 (10.3-22.1)	18.2 (11.7-26.2)
4-day	3.37 (2.84-4.02)	4.29 (3.61-5.12)	5.78 (4.84-6.92)	7.02 (5.83-8.45)	8.72 (7.00-11.1)	9.96 (7.82-13.0)	11.3 (8.67-15.6)	13.2 (9.17-18.0)	16.2 (10.8-22.9)	18.9 (12.2-27.2)
7-day	4.09 (3.47-4.85)	5.05 (4.27-5.99)	6.61 (5.57-7.88)	7.91 (6.61-9.47)	9.69 (7.81-12.3)	11.0 (8.66-14.3)	12.4 (9.51-16.9)	14.3 (10.0-19.5)	17.4 (11.6-24.4)	20.1 (13.0-28.7)
10-day	4.78 (4.06-5.65)	5.77 (4.90-6.83)	7.39 (6.24-8.77)	8.73 (7.32-10.4)	10.6 (8.54-13.3)	11.9 (9.40-15.4)	13.4 (10.2-18.1)	15.3 (10.7-20.7)	18.3 (12.2-25.6)	20.9 (13.6-29.8)
20-day	6.76 (5.78-7.93)	7.86 (6.71-9.23)	9.66 (8.21-11.4)	11.2 (9.41-13.2)	13.2 (10.7-16.3)	14.7 (11.6-18.6)	16.4 (12.4-21.5)	18.2 (12.9-24.4)	21.0 (14.1-29.1)	23.2 (15.1-32.9)
30-day	8.32 (7.14-9.72)	9.51 (8.16-11.1)	11.5 (9.79-13.5)	13.1 (11.1-15.5)	15.3 (12.4-18.8)	17.0 (13.4-21.3)	18.8 (14.1-24.3)	20.6 (14.6-27.5)	23.2 (15.6-32.0)	25.1 (16.4-35.4)
45-day	10.2 (8.78-11.9)	11.5 (9.90-13.4)	13.7 (11.7-16.0)	15.4 (13.1-18.2)	17.9 (14.5-21.8)	19.8 (15.6-24.6)	21.7 (16.3-27.7)	23.5 (16.7-31.2)	25.9 (17.5-35.5)	27.6 (18.0-38.7)
60-day	11.7 (10.1-13.6)	13.1 (11.3-15.3)	15.4 (13.3-18.0)	17.4 (14.8-20.4)	20.0 (16.2-24.2)	22.1 (17.4-27.2)	24.1 (18.0-30.5)	25.9 (18.5-34.2)	28.2 (19.1-38.6)	29.7 (19.4-41.6)

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

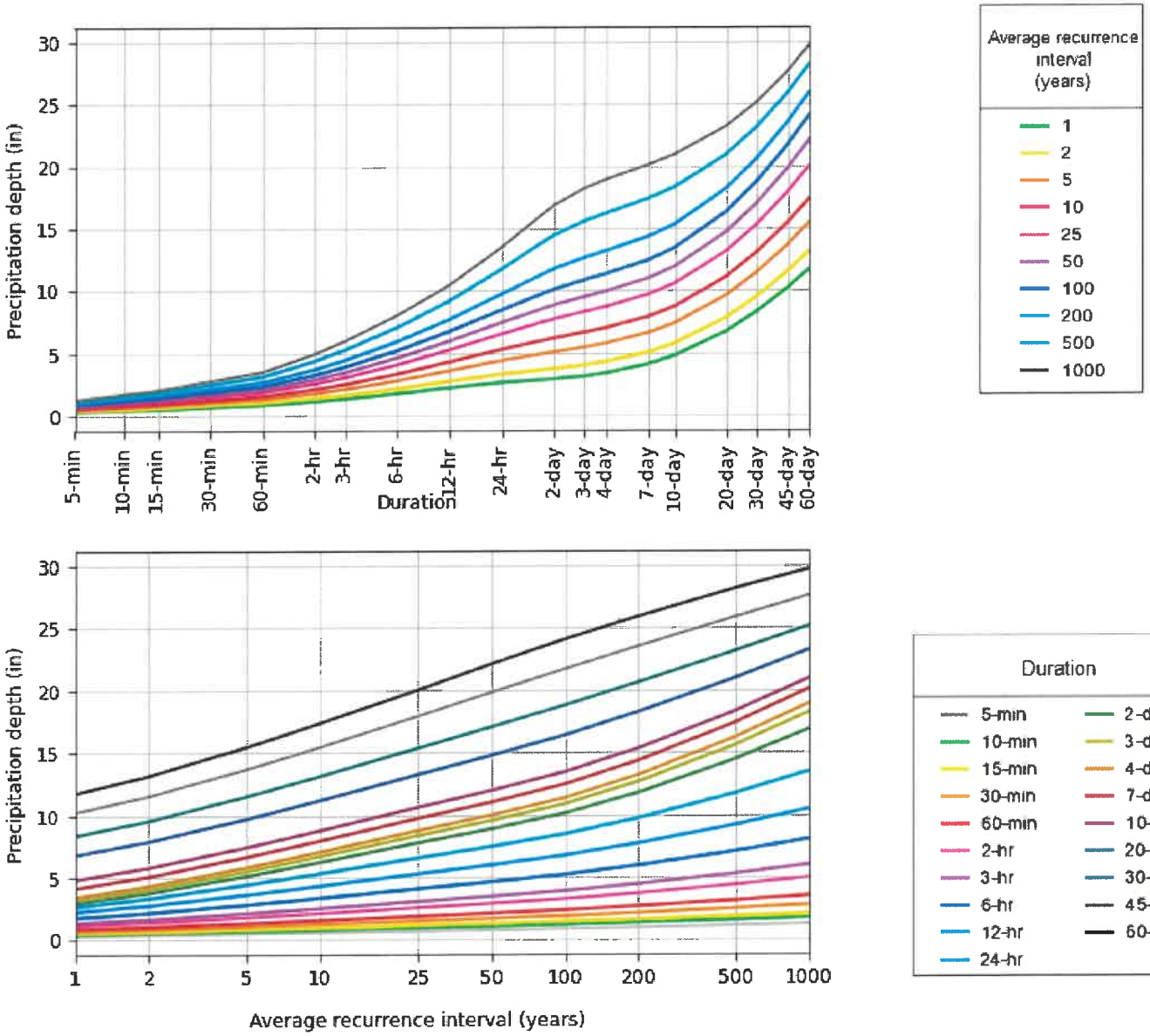
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 43.1383°, Longitude: -70.9265°



NOAA Atlas 14, Volume 10, Version 3

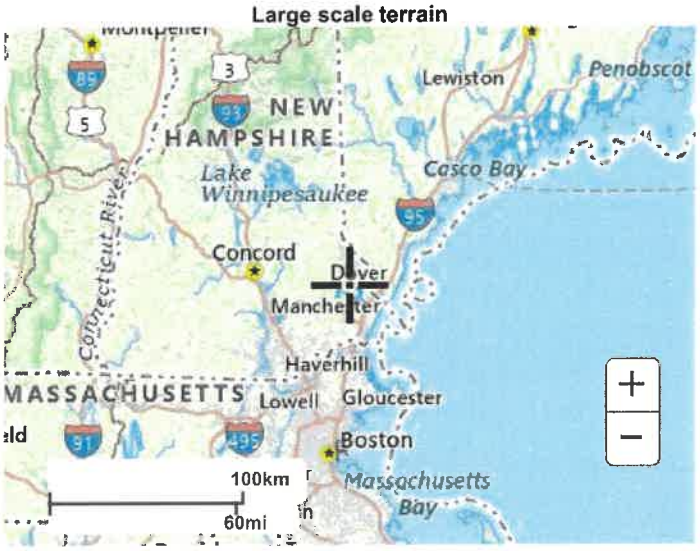
Created (GMT): Wed Jun 25 15:48:17 2025

Back to Top

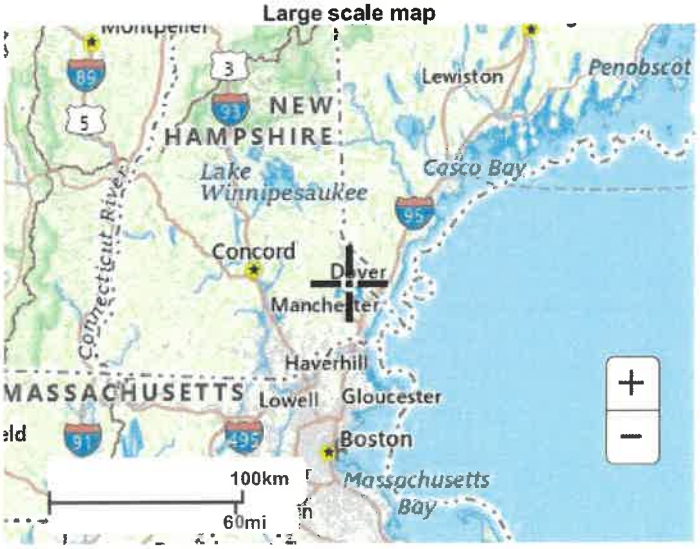
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

Back to Top

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

APPENDIX 5

WEB SOIL SURVEY

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,570 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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 25, Sep 3, 2024

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

Date(s) aerial images were photographed: Jun 19, 2020—Sep 20, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BzB	Buxton silt loam, 3 to 8 percent slopes	0.6	2.3%
HcB	Hollis-Charlton fine sandy loams, 3 to 8 percent slopes	18.8	71.1%
HdC	Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes	7.0	26.6%
Totals for Area of Interest		**26.4**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

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

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

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

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

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

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

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

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

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

APPENDIX 6

TEST PIT LOG

TEST PITS
FOR
35 MADBURY ROAD
DURHAM, NEW HAMPSHIRE
JUNE 19, 2025
JBE Project No. 25073

Performed by: Anthony Jones, Jones & Beach Engineers, Inc., SSD #1900

Test Pit #1

0"- 14"	10YR 5/6	yellowish brown sand granular, very friable many roots
14" – 36"	10YR 4/4	dark yellowish brown fine sandy loam single grain, very friable common roots
36" – 42"	2.5Y 5/2	grayish brown Loamy fine sand platey, very friable

SHWT = 36"
Roots: 36"
No H_2O observed
No Refusal observed

Test Pit #2

0"- 16"	10YR 5/6	yellowish brown fine sandy loam granular, friable many roots
16" – 40"	10YR 4/4	dark yellowish brown fine sandy loam granular, friable common roots
40" – 48"	2.5Y 5/3	light olive brown Loamy fine sand platey, very friable common roots

SHWT = 40"
Roots: 40"
No H_2O observed
No Refusal observed

APPENDIX 7

BMP WORKSHEETS

FILTRATION PRACTICE DESIGN CRITERIA
(Env-Wq 1508.08)

Type/Node Name: **POROUS ASPHALT (POND P1)**

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

		Check if you reviewed the restrictions on unlined systems outlined in Env-Wq 1508.08(a).	
0.18	ac	A = Area draining to the practice	
0.16	ac	A_I = Impervious area draining to the practice	
0.89	decimal	I = Percent impervious area draining to the practice, in decimal form	
0.85	unitless	Rv = Runoff coefficient = 0.05 + (0.9 x I)	
0.15	ac-in	WQV= 1" x Rv x A	
555	cf	WQV conversion (ac-in x 43,560 sf/ac x 1ft/12")	
139	cf	25% x WQV (check calc for sediment forebay volume)	
417	cf	75% x WQV (check calc for surface sand filter volume)	
N/A		Method of Pretreatment? (not required for clean or roof runoff)	
	cf	V_{SED} = Sediment forebay volume, if used for pretreatment	≥ 25%WQV
Calculate time to drain if system IS NOT underdrained:			
	sf	A_{SA} = Surface area of the practice	
	iph	$Ksat_{DESIGN}$ = Design infiltration rate[1]	
		If Ksat (prior to factor of safety) is < 0.50 iph, has an underdrain been provided?	
	Yes/No	(Use the calculations below)	
-	hours	T_{DRAIN} = Drain time = V / (A_{SA} * I_{DESIGN})	≤ 72-hrs
Calculate time to drain if system IS underdrained:			
72.93	ft	E_{WQV} = Elevation of WQV (attach stage-storage table)	
0.47	cfs	Q_{WQV} = Discharge at the E_{WQV} (attach stage-discharge table)	
0.66	hours	T_{DRAIN} = Drain time = 2WQV/Q_{WQV}	≤ 72-hrs
71.67	feet	E_{FC} = Elevation of the bottom of the filter course material[2]	
70.75	feet	E_{UD} = Invert elevation of the underdrain (UD), if applicable	
68.10	feet	E_{SHWT} = Elevation of SHWT (if none found, enter the lowest elevation of the test pit)	
68.10	feet	E_{ROCK} = Elevation of bedrock (if none found, enter the lowest elevation of the test pit)	
0.92	feet	$D_{FC\ to\ UD}$ = Depth to UD from the bottom of the filter course	≥ 1'
3.57	feet	$D_{FC\ to\ ROCK}$ = Depth to bedrock from the bottom of the filter course	≥ 1'
3.57	feet	$D_{FC\ to\ SHWT}$ = Depth to SHWT from the bottom of the filter course	≥ 1'
72.17	ft	Peak elevation of the 50-year storm event (infiltration can be used in analysis)	
73.50	ft	Elevation of the top of the practice	
YES		50 peak elevation ≤ Elevation of the top of the practice	← yes
If a surface sand filter or underground sand filter is proposed:			
YES	ac	Drainage Area check.	< 10 ac
	cf	V = Volume of storage[3] (attach a stage-storage table)	≥ 75%WQV
	inches	D_{FC} = Filter course thickness	18", or 24" if within GPA
Sheet		Note what sheet in the plan set contains the filter course specification.	
	Yes/No	Access grate provided?	← yes

If a bioretention area is proposed:			
YES	ac	Drainage Area no larger than 5 ac?	← yes
	cf	V = Volume of storage[3] (attach a stage-storage table)	≥ WQV
	inches	D_{FC} = Filter course thickness	18", or 24" if within GPA
Sheet		Note what sheet in the plan set contains the filter course specification	
	:1	Pond side slopes	≥ 3:1
Sheet		Note what sheet in the plan set contains the planting plans and surface cover	
If porous pavement is proposed:			
ASPHALT		Type of pavement proposed (Concrete? Asphalt? Pavers? Etc.)	
0.1	acres	A_{SA} = Surface area of the pervious pavement	
2.3	:1	Ratio of the contributing area to the pervious surface area	≤ 5:1
12.0	inches	D_{FC} = Filter course thickness	12", or 18" if within GPA mod. 304.1 (see spec)
Sheet	D1	Note what sheet in the plan set contains the filter course spec.	

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

Designer's Notes:

Stage-Area-Storage for Pond P1: POROUS ASPHALT

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
70.49	4,251	0
70.54	4,251	32
70.59	4,251	64
70.64	4,251	96
70.69	4,251	128
70.74	4,251	159
70.79	4,275	245
70.84	4,284	332
70.89	**4,288**	418
70.94	**4,288**	505
70.99	4,284	592
71.04	4,276	678
71.09	4,251	764
71.14	4,251	849
71.19	4,251	934
71.24	4,251	1,019
71.29	4,251	1,104
71.34	4,251	1,189
71.39	4,251	1,274
71.44	4,251	1,327
71.49	4,251	1,359
71.54	4,251	1,391
71.59	4,251	1,423
71.64	4,251	1,455
71.69	4,251	1,474
71.74	4,251	1,485
71.79	4,251	1,495
71.84	4,251	1,506
71.89	4,251	1,517
71.94	4,251	1,527
71.99	4,251	1,538
72.04	4,251	1,549
72.09	4,251	1,559
72.14	4,251	1,570
72.19	4,251	1,580
72.24	4,251	1,591
72.29	4,251	1,602
72.34	4,251	1,612
72.39	4,251	1,623
72.44	4,251	1,634
72.49	4,251	1,644
72.54	4,251	1,655
72.59	4,251	1,665
72.64	4,251	1,676
72.69	4,251	1,719
72.74	4,251	1,782
72.79	4,251	1,846
72.84	4,251	1,910
72.89	4,251	1,974
72.94	4,251	2,037
72.99	4,251	2,101
73.04	4,251	2,165
73.09	4,251	2,229
73.14	4,251	2,292
73.19	4,251	2,337
73.24	4,251	2,369
73.29	4,251	2,401
73.34	4,251	2,433
73.39	4,251	2,465
73.44	4,251	2,497
73.49	4,251	2,528
73.54	4,251	2,741
73.59	4,251	2,954
73.64	4,251	3,166
73.69	4,251	3,379
73.74	4,251	3,591
73.79	4,251	3,804
73.84	4,251	4,016
73.89	4,251	4,229
73.94	4,251	4,441
73.99	4,251	**4,654**

WQV REQUIRED = 555 C.F.

BOTTOM OF FILTER COURSE = 71.67

STORAGE @ 71.67 = 1,470 C.F.

1,470 C.F. + 555 C.F. = 2,025 C.F.

WQV ELEVATION = 72.93

Stage-Discharge for Pond P1: POROUS ASPHALT

Elevation (feet)	Discharge (cfs)	Discarded (cfs)	Primary (cfs)
70.49	0.00	0.00	0.00
70.54	0.02	0.02	0.00
70.59	0.03	0.03	0.00
70.64	0.03	0.03	0.00
70.69	0.03	0.03	0.00
70.74	0.03	0.03	0.00
70.79	0.04	0.03	0.00
70.84	0.05	0.03	0.01
70.89	0.06	0.03	0.03
70.94	0.08	0.04	0.05
70.99	0.11	0.04	0.07
71.04	0.13	0.04	0.10
71.09	0.16	0.04	0.12
71.14	0.18	0.04	0.15
71.19	0.20	0.04	0.16
71.24	0.22	0.04	0.18
71.29	0.24	0.04	0.20
71.34	0.26	0.04	0.21
71.39	0.27	0.04	0.23
71.44	0.28	0.04	0.24
71.49	0.29	0.04	0.25
71.54	0.30	0.04	0.26
71.59	0.32	0.04	0.27
71.64	0.33	0.04	0.28
71.69	0.34	0.04	0.29
71.74	0.35	0.05	0.30
71.79	0.36	0.05	0.31
71.84	0.37	0.05	0.32
71.89	0.37	0.05	0.33
71.94	0.38	0.05	0.34
71.99	0.39	0.05	0.34
72.04	0.40	0.05	0.35
72.09	0.41	0.05	0.36
72.14	0.42	0.05	0.37
72.19	0.43	0.05	0.37
72.24	0.43	0.05	0.38
72.29	0.44	0.05	0.39
72.34	0.45	0.05	0.40
72.39	0.46	0.05	0.40
72.44	0.46	0.05	0.41
72.49	0.47	0.05	0.42
72.54	0.48	0.06	0.42
72.59	0.48	0.06	0.43
72.64	0.49	0.06	0.44
72.69	0.50	0.06	0.44
72.74	0.51	0.06	0.45
72.79	0.51	0.06	0.45
72.84	0.52	0.06	0.46
72.89	0.53	0.06	0.47
72.94	0.53	0.06	0.47
72.99	0.54	0.06	0.48
73.04	0.54	0.06	0.48
73.09	0.55	0.06	0.49
73.14	0.56	0.06	0.49
73.19	0.56	0.06	0.50
73.24	0.57	0.06	0.51
73.29	0.58	0.06	0.51
73.34	0.58	0.07	0.52
73.39	0.59	0.07	0.52
73.44	0.59	0.07	0.53
73.49	0.60	0.07	0.53
73.54	0.60	0.07	0.54
73.59	0.61	0.07	0.54
73.64	0.62	0.07	0.55
73.69	0.62	0.07	0.55
73.74	0.63	0.07	0.56
73.79	0.63	0.07	0.56
73.84	0.64	0.07	0.57
73.89	0.64	0.07	0.57
73.94	0.65	0.07	0.58
73.99	**0.65**	**0.07**	**0.58**

WQV ELEVATION = 72.93

DISHCHARGE @ 72.93
= 0.47 C.F.S.

APPENDIX 8

RIP RAP CALCULATIONS

RIP RAP CALCULATIONS

35 Madbury Road
Durham, NH

Jones & Beach Engineers, Inc.
P.O. Box 219
Stratham, NH 03885
6-Aug-25

Rip Rap equations were obtained from the *Stormwater Management and Erosion Control Handbook for Urban and Developing Areas in New Hampshire.*
Aprons are sized for the 25-Year storm event.

TAILWATER < HALF THE D_o

$L_a = (1.8 \times Q) / D_0^{3/2} + (7 \times D_o)$
$W = L_a + (3 \times D_o)$ or defined channel width
$d_{50} = (0.02 \times Q^{4/3}) / (T_w \times D_0)$

Culvert or Catch Basin (Sta. No.)	Tailwater (Feet) T_w	Discharge (C.F.S.) Q	Diameter of Pipe D_o	Length of Rip Rap L_a (feet)	Width of Rip Rap W (feet)	d_{50}-Median Stone Rip Rap d50 (feet)

TAILWATER > HALF THE D_o

$L_a = (3.0 \times Q) / D_0^{3/2} + (7 \times D_o)$
$W = (0.4 \times L_a) + (3 \times D_o)$ or defined channel width
$d_{50} = (0.02 \times Q^{4/3}) / (T_w \times D_0)$

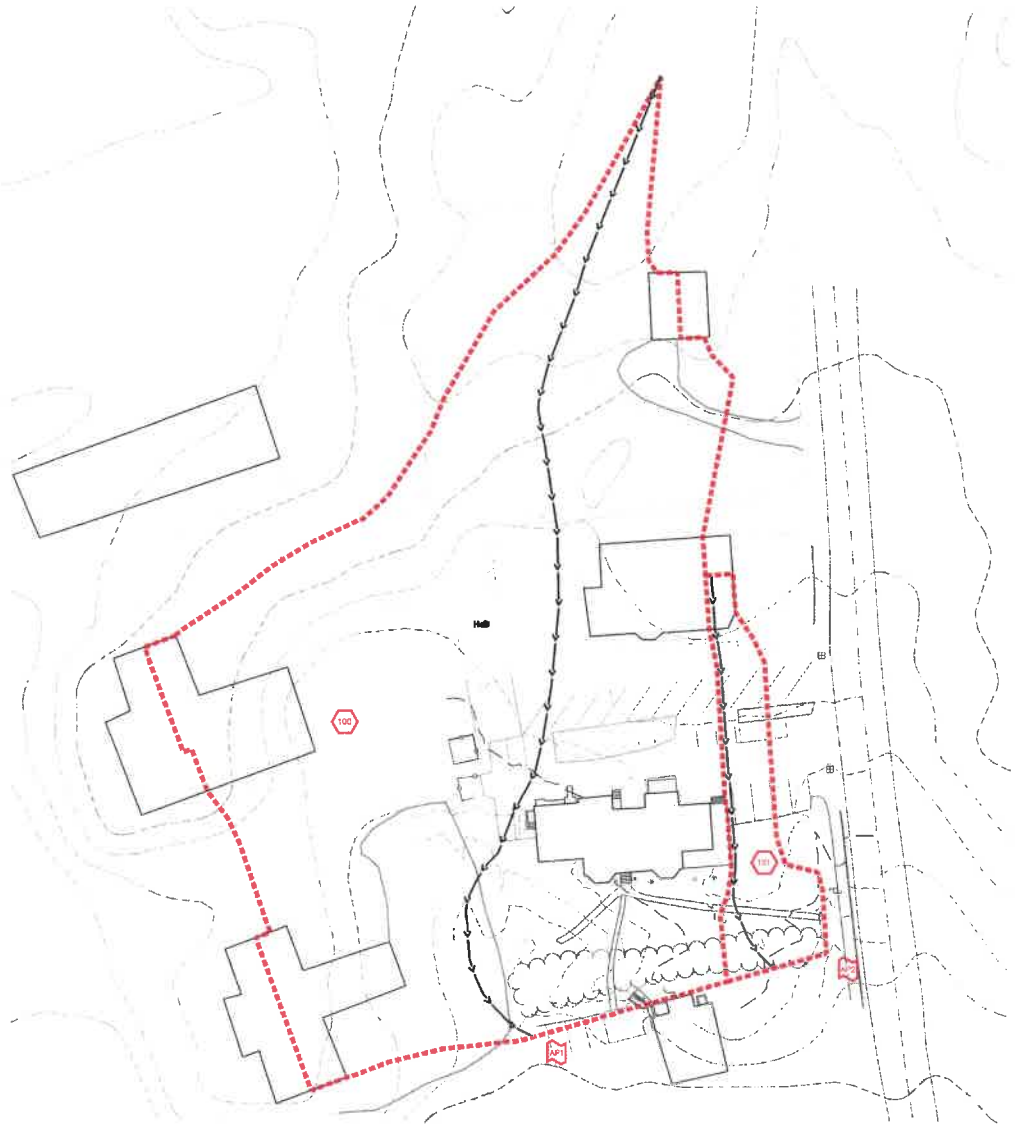
Culvert or Catch Basin (Sta. No.)	Tailwater (Feet) T_w	Discharge (C.F.S.) Q	Diameter of Pipe D_o	Length of Rip Rap L_a (feet)	Width of Rip Rap W (feet)	d_{50}-Median Stone Rip Rap d50 (feet)
4" HDPE	0.33	0.29	0.33	6.9	4	0.04

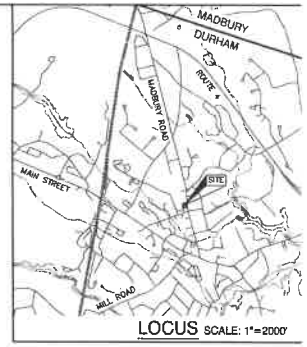
Table 7-24 -- Recommended Rip Rap Gradation Ranges				
d_{50} Size =	0.25	Feet	3	Inches
% of Weight Smaller		Size of Stone (Inches)		
Than the Given d_{50} Size		From		To
100%		5		6
85%		4		5
50%		3		5
15%		1		2

Table 7-24 -- Recommended Rip Rap Gradation Ranges				
d_{50} Size =	0.5	Feet	6	Inches
% of Weight Smaller		Size of Stone (Inches)		
Than the Given d_{50} Size		From		To
100%		9		12
85%		8		11
50%		6		9
15%		2		3

APPENDIX 10

WATERSHED PLANS





LOCUS SCALE: 1"=2000'

LEGEND

SUBCATCHMENT BOUNDARY	
SUBCATCHMENT	X
REACH	X
POND	X
TC PATH	

SOIL LEGEND

SYMBOL	NAME	HSG
HcB	HOLLIS–CHARLTON FINE SANDY LOAMS	D

GRAPHIC SCALE

(IN FEET)
1 inch = 80 feet

PROJECT PARC
TOWN OF DURHAM
TAX MAP 105, LOT

APPLICANT/OW
DWS 35, LLC
288 CALEF HIGH
LEE, NH 0386

TOTAL LOT AR
±18,060 SQ. F
±0.42 ACRES

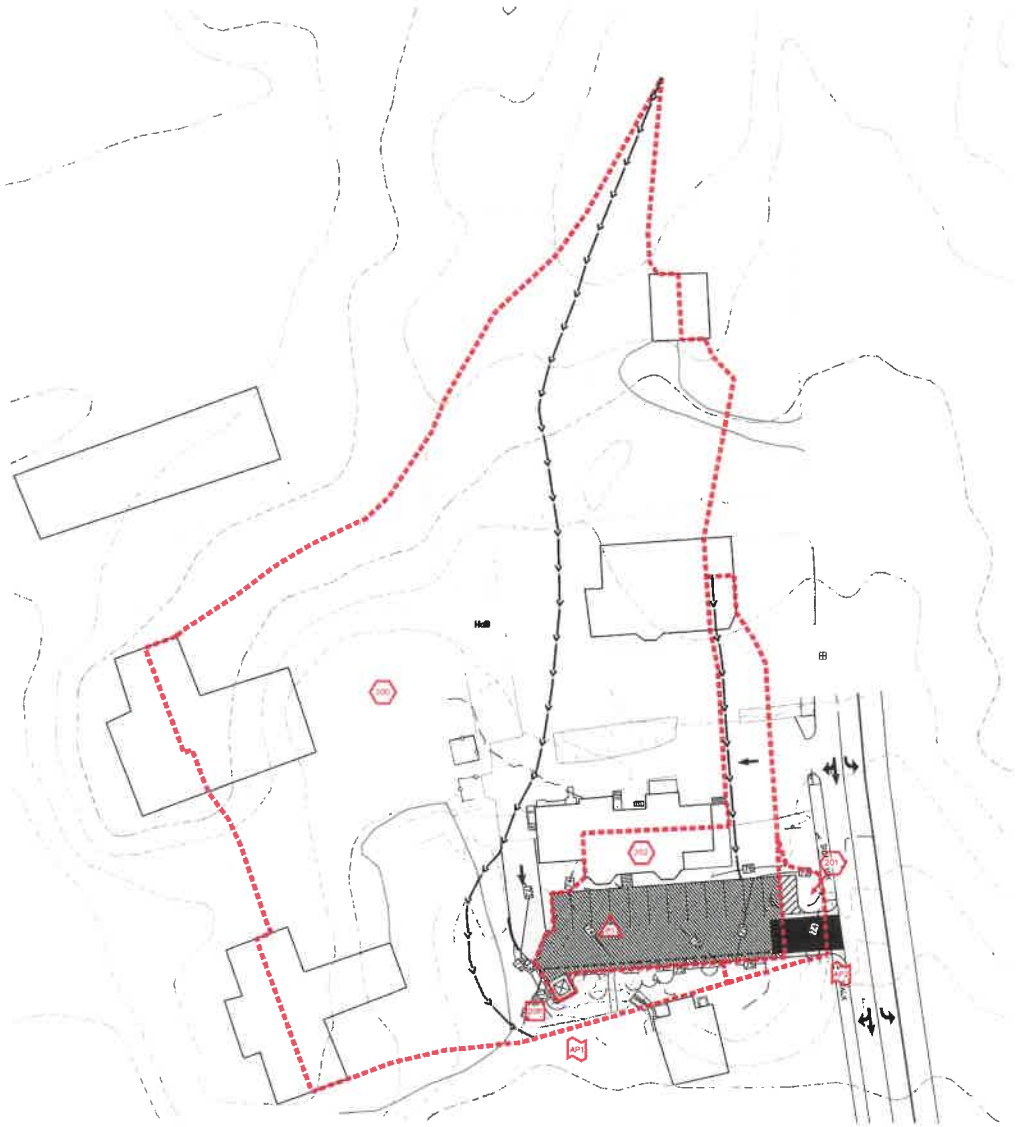
Design: NJL	Draft: NJL	Date: 06/26/2025
Checked: PSL	Scale: AS SHOWN	Project No.: 25073
Drawing Name: 25073-WATERSHED.dwg		

REV.	DATE	REVISION	BY
1	08/06/25	REVISED PER SITE MODIFICATION	NJL
0	07/02/25	ISSUED FOR REVIEW	NJL

Designed and Produced in NH
J/B Jones & Beach Engineers, Inc.
85 Portsmouth Ave. Civil Engineering Services 603-772-4746
PO Box 219
Stratham, NH 03885
E-MAIL: JBE@JONESANDBEACH.COM

Plan Name:	EXISTING WATERSHED PLAN
Project:	35 MADBURY ROAD DURHAM, NH
Owner of Record:	DWS 35, LLC 288 CALEF HIGHWAY, LEE, NH 03861

DRAWI
W
SHEET
JBE PROJEC



APPROX

LEGEND

- SUBCATCHMENT BOUNDARY
- SUBCATCHMENT
- REACH
- POND
- TC PATH

GRAPHIC SCALE

(IN FEET)
1 inch = 50 feet

PROJECT PAR
TOWN OF DURHA
TAX MAP 106, LO

APPLICANT/OW
DWS 35, LLC
288 CALEF HIGH
LEE, NH 0386

TOTAL LOT A
±16,090 SQ. F
±0.42 ACRES

Design: NJL	Draft: NJL	Date: 08/26/2025	
Checked: PSL	Scale: AS SHOWN	Project No.: 25073	
Drawing Name: 25073-WATERSHED.dwg			

REV.	DATE	REVISION	BY
1	08/26/25	REVISED PER SITE MODIFICATION	NJL
0	07/02/25	ISSUED FOR REVIEW	NJL

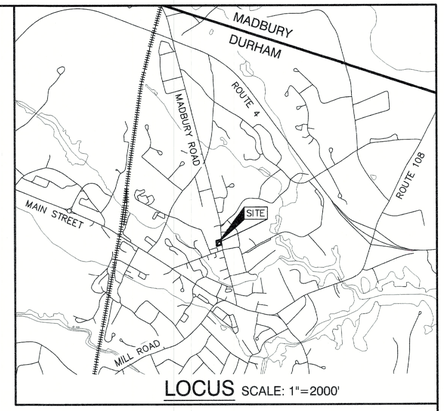
Designed and Produced in NH
Jones & Beach Engineers, Inc.
85 Portsmouth Ave.
PO Box 219
Stratham, NH 03885
Civil Engineering Services
603-772-4746
E-MAIL: JBE@JONESANDBEACH.COM

Plan Name:	PROPOSED WATERSHED PLAN
Project:	35 MADBURY ROAD DURHAM, NH
Owner of Record:	DWS 35, LLC 288 CALEF HIGHWAY, LEE, NH 03861

DRAWI

W

SHEET
JBE PROJEC



LOCUS SCALE: 1"=2000'

LEGEND

SUBCATCHMENT BOUNDARY

SUBCATCHMENT X

REACH X

POND X

TC PATH

SOIL LEGEND

SYMBOL	NAME	HSG
HcB	HOLLIS–CHARLTON FINE SANDY LOAMS	D

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 feet

PROJECT PARCEL
TOWN OF DURHAM, NH
TAX MAP 106, LOT 19

APPLICANT/OWNER
DWS 35, LLC
288 CALEF HIGHWAY
LEE, NH 03861

TOTAL LOT AREA
±18,060 SQ. FT.
±0.42 ACRES

Design: NJL	Draft: NJL	Date: 06/25/2025
Checked: PSL	Scale: AS SHOWN	Project No.: 25073
Drawing Name: 25073-WATERSHED.dwg		

STATE OF NEW HAMPSHIRE – PAIGE S. LIBBEY No.16670 – LICENSED PROFESSIONAL ENGINEER

REV.	DATE	REVISION	BY
1	08/06/25	REVISED PER SITE MODIFICATION	NJL
0	07/02/25	ISSUED FOR REVIEW	NJL

Designed and Produced in NH
Jones & Beach Engineers, Inc.
Civil Engineering Services
85 Portsmouth Ave.
PO Box 219
Stratham, NH 03885
603-772-4746
E-MAIL: JBE@JONESANDBEACH.COM

Plan Name:	EXISTING WATERSHED PLAN
Project:	35 MADBURY ROAD DURHAM, NH
Owner of Record:	DWS 35, LLC 288 CALEF HIGHWAY, LEE, NH 03861

DRAWING No.
W1
SHEET 1 OF 2
JBE PROJECT NO. 25073

LEGEND

SUBCATCHMENT BOUNDARY

SUBCATCHMENT X

REACH X

POND X

TC PATH

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 feet

PROJECT PARCEL
TOWN OF DURHAM, NH
TAX MAP 106, LOT 19

APPLICANT/OWNER
DWS 35, LLC
288 CALEF HIGHWAY
LEE, NH 03861

TOTAL LOT AREA
±18,060 SQ. FT.
±0.42 ACRES

Design: NJL	Draft: NJL	Date: 06/25/2025
Checked: PSL	Scale: AS SHOWN	Project No.: 25073
Drawing Name: 25073-WATERSHED.dwg		

STATE OF NEW HAMPSHIRE – PAIGE S. LIBBEY No.16670 – LICENSED PROFESSIONAL ENGINEER

REV.	DATE	REVISION	BY
1	08/06/25	REVISED PER SITE MODIFICATION	NJL
0	07/02/25	ISSUED FOR REVIEW	NJL

Designed and Produced in NH
Jones & Beach Engineers, Inc.
85 Portsmouth Ave.
PO Box 219
Stratham, NH 03885
Civil Engineering Services
603-772-4746
E-MAIL: JBE@JONESANDBEACH.COM

Plan Name:	PROPOSED WATERSHED PLAN
Project:	35 MADBURY ROAD DURHAM, NH
Owner of Record:	DWS 35, LLC 288 CALEF HIGHWAY, LEE, NH 03861

DRAWING No.
W2
SHEET 2 OF 2
JBE PROJECT NO. 25073