

01 May 2025

Gary Schneider
Town of Waterford
1000 Hartford Turnpike
Waterford, CT 06385

**RE: Stormwater Management Report
Waterford Pickleball Courts and Parking
Waterford, Connecticut
Langan Project No.: 140310301**

Dear Mr. Schneider:

This report provides an analysis of the proposed peak runoff discharges and the engineering design for the proposed stormwater management design for the proposed pickleball courts and parking at 51 Daniels Avenue. This report and design of the pickleball courts and parking has been prepared in conjunction with the LEARN Early Childhood School Project. As such, the “existing conditions” this report describes assumes the LEARN school building, site and stormwater improvements have been constructed. Refer to the report titled “Stormwater Management Report” for the LEARN Early Childhood School Project for additional information.

PROJECT DESCRIPTION

Existing Conditions

The project site is located at 51 Daniels Avenue in Waterford, CT; see Figure 1. The existing overall parcel is approximately 19.32 acres. LEARN is acquiring 15.36 acres of the existing parcel to be utilized for a proposed elementary school. The remaining 3.96 acres will be retained by the Town of Waterford. The pickleball courts will be located on the northeastern corner of this revised 3.96 acre parcel. This portion of the site is currently occupied by existing grassy and wooded areas. The parcel is located within the Niantic River subregional drainage basin. The parcel area does not contain any known locations of State and Federal Listed Species and Critical Habitats per the CT Natural Diversity Data Base Areas map of Waterford, CT dated December 2024. To the north, the site is bordered by Daniels Avenue, to the east by wooded areas and residential properties, and to the south and west by the proposed LEARN school. All stormwater from this project site flows overland towards the off-site wetland pool to the west. No permanent site features will be located within the 100-ft upland review area and no direct impacts are proposed.

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Study of New London County, Connecticut map number 09011C0483J with an effective date of August 5, 2013, the proposed development is located within Zone X (Unshaded). Zone X (Unshaded) is considered a Low-Risk Area and described by FEMA as areas outside the 0.2-percent-annual-chance flood. No base flood elevations or base flood depths are shown within these zones; see Figure 2.

According to the USDA Natural Resources Conservation Service Web Soil Survey, the site's soil type varies throughout. The site is mostly classified as either Urban land with a D hydrologic rating and Charlton-Chatfield complex with a B hydrologic rating.

Proposed Project

The proposed project consists of the construction of two pickleball courts with parking and sidewalk access. Additional improvements additional native plantings to provide an enhanced landscape buffer to the vernal pool. A summary of the change in impervious is shown below.

Project Site Impervious Cover [SF]

Existing Conditions	Proposed Conditions	Net Increase
±0	±4,750	±4,750

The site has been designed to maintain existing site hydrology to the maximum extent practicable. Stormwater runoff from the pickleball courts and sidewalk will continue to sheet flow towards the enhanced landscaped area before eventually continuing to discharge to the existing wetland. These impervious areas will be inaccessible to vehicular traffic.

See sheet titled "Site, grading, drainage, & sesc plan" for additional information.

PEAK RUNOFF ANALYSIS (See Appendices A & B)

The stormwater management system is designed to control the rate runoff from the site's watersheds to be equal or less than existing conditions up to, and including, a 100-year design storm event.

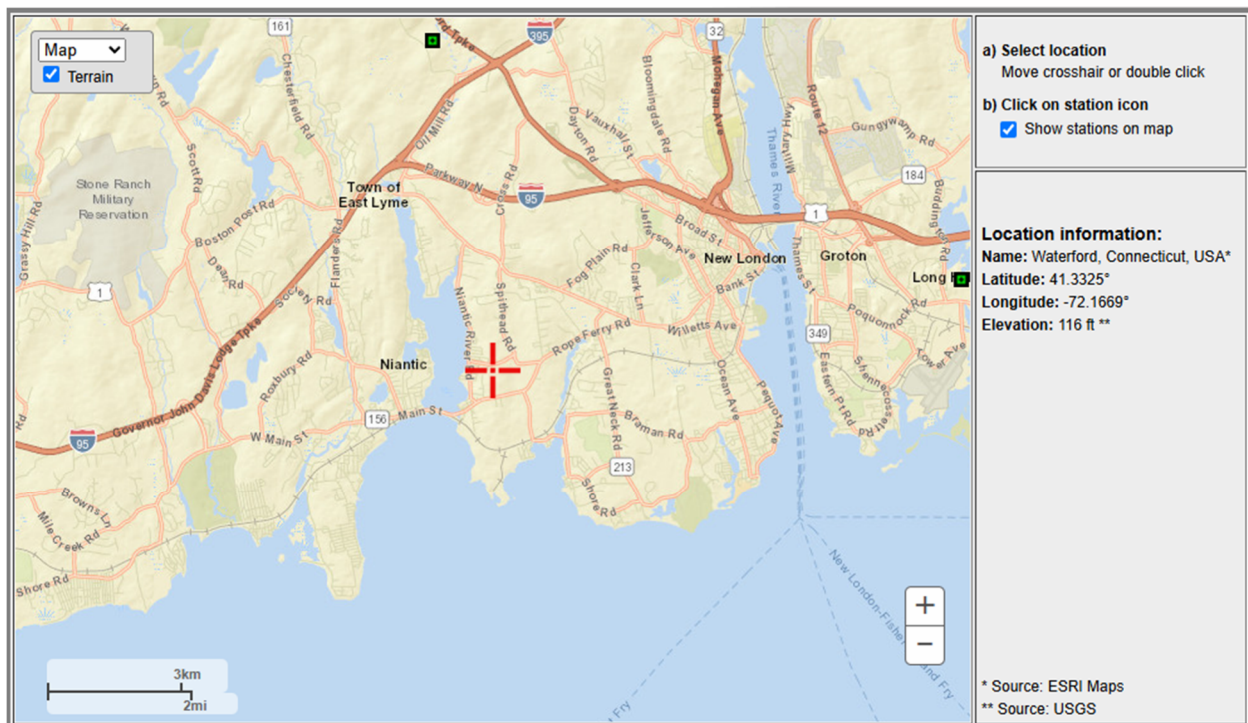
The peak runoff discharges for the existing and proposed conditions were analyzed using Soil Conservation Service (SCS) methodology which outlines procedures for calculating peak rates of runoff resulting from precipitation events as well as procedures for developing runoff hydrographs. The entire site was included in the analysis; see Figures EXWS and PRWS. Values for area, curve number (CN), and a time of concentration were calculated for the existing and proposed conditions.

The curve number is a land sensitive coefficient that dictates the relationship between total rainfall depth and direct storm runoff. The soils within the watershed are divided into hydrologic soil groups (A, B, C, and D). The SCS classification system evaluates the runoff potential of a soil according to its infiltration and transmission rates. "A" soils have the lowest runoff potential, while "D" soils have the greatest runoff potential. Soils within the project area are predominantly "B" and "D" hydrologic rating.

The time of concentration (Tc) is defined as the time for runoff to travel from the hydraulically most distant point in the watershed to a point of interest. Values of time of concentration were determined for existing and proposed conditions based on land cover and slope of the flow path using methods outlined in TR-55.

For this study, a 24-hour NOAA D rainfall distribution was used to determine the peak flow rate to all points of discharge from the site. Precipitation data used for the various storm events is based on the "NOAA Atlas 14 Point Precipitation Frequency Estimates: CT" for the location as shown in Graphic 1. A summary of all rainfall data utilized in the analysis for this site is provided below and a complete compilation of data provided by NOAA for this location is included in Appendix C.

Graphic 1. NOAA Rainfall Data Location Map



NOAA Precipitation Depth per Average Recurrence Interval [in]

Duration	2-Year	10-Year	25-Year	100-Year
24-hour	3.44	5.14	6.21	7.85

Existing Condition (See Appendix A)

The project area's existing drainage conditions were analyzed as a single watershed (See Drawing EXWS).

Existing Watershed 1 is approximately 1.07 acres and consists mostly of grassy and wooded areas. Stormwater runoff from this watershed flows overland to the east and towards the off-site wetland.

Proposed Condition (See Appendix B)

In the proposed condition, the site hydrology has been designed to match existing conditions to the maximum extent possible, and all watershed design points remain the same.

Proposed Watershed 1 is about 1.05 acres and consists mostly of grassy and wooded areas. Stormwater from these areas will continue to flow overland to the east and towards the off-site wetland.

On-site infiltration test was performed on April 16th, 2025, by Langan Engineering. Refer to Appendix D for test locations, results and test pit information.

Site Discharge Peak Flow Comparison for WS-1 (CF)

Storm	Current	Proposed	Delta	% Reduction
2-Year	1.27	1.27	-	-
10-Year	2.69	2.63	-0.06	-2%
25-Year	3.66	3.55	-0.11	-3%
100-Year	5.18	5.00	-0.13	-3%

As can be seen from the tables above, existing site hydrology has been maintained up to and including the 100-year storm.

STORMWATER QUALITY

All-Points Technology has identified an embedded vernal pool within the off-site wetland. The wetland assessment, see report titled “Wetland Assessment – Waterford Pickleball Courts and Parking” prepared by All-Points Technology, dated May 01, 2025, for additional information.

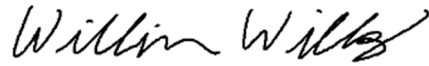
Per the recommendations of the Wetland Assessment, no *structural* water quality improvements are proposed for this project based on two considerations: (1) the proposed pickleball courts will not introduce any pollution sources such as vehicles, sand or salt and (2) the increased environmental benefits of maintaining the 100-foot upland review areas and vernal pool envelope. This design prioritizes avoiding any disturbances within these areas, including the exclusion of stormwater structures, pipes, and detention systems. Instead, the project will implement LID improvements per Section 25.6.5.1 of the Town of Waterford Zoning Regulations. LID techniques such as directing flows to vegetated areas, encouraging sheet flow through vegetated areas, increasing vegetation, restricting ground disturbance, and maintain existing topography and drainage.

Stormwater runoff from the proposed pickleball courts is not expected to contribute pollutant loads, as the area will not support vehicular traffic and as such, no structural stormwater treatment devices are necessary. Additionally, it was recommended to avoid any stormwater basin within close proximity to the vernal pool due to the potential creation of a “decoy vernal pool”. This would pose a significant risk to unsuccessful vernal species breeding.

CONCLUSION

The proposed project has been designed to maintain existing drainage patterns to the greatest extent practicable. Stormwater runoff from the site has mimics existing hydrology with no increase in peak flow rates. This Langan report confirms that the proposed project, as designed, effectively manages the stormwater runoff for the proposed development. Please refer to the Drawings for additional drainage information.

Sincerely,
Langan Engineering and Environmental Services, LLC



Bill Willsey, P.E.
Senior Staff Engineer



Kathryn Gagnon, P.E., LEED AP
Senior Project Manager

LIST OF FIGURES

Fig. 1	Location Map
Fig. 2	FEMA Flood Map
Fig. 3	NRCS Soil Map

LIST OF DRAWINGS

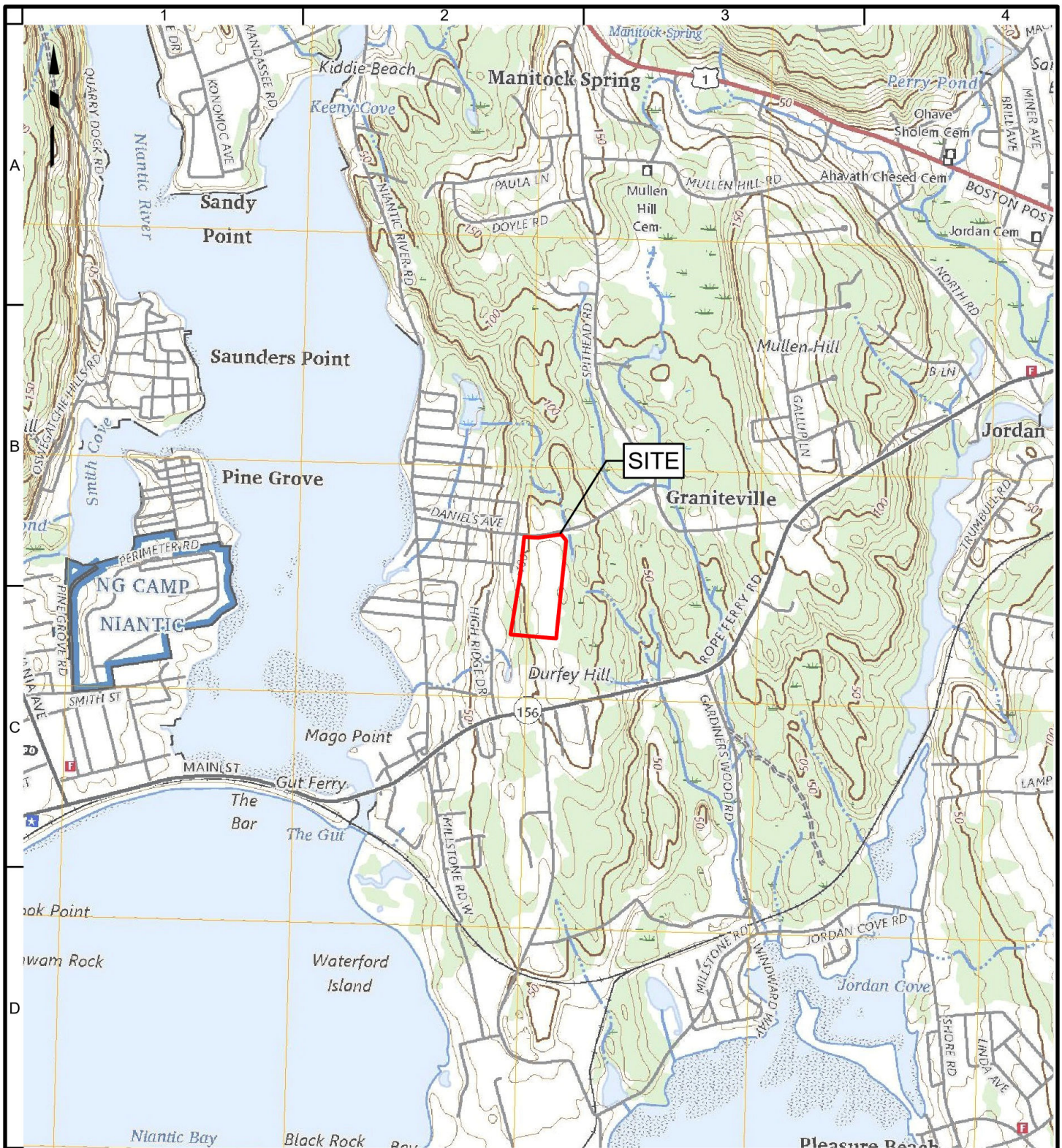
EXWS	Existing Watershed Map
PRWS	Proposed Watershed Map

REFERENCE DRAWINGS

CS101	Site, Grading, Drainage, & SESC Plan
--------------	---

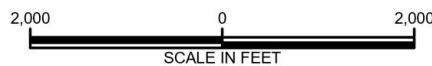
LIST OF APPENDICES

Appendix A	Existing Stormwater Discharge Calculations
Appendix B	Proposed Stormwater Discharge Calculations
Appendix C	NOAA Rainfall Data
Appendix D	Test Pit & Infiltration Logs



Legend

Approximate Site Boundary



NOTES:
1. BASEMAP ADAPTED FROM UNITED STATES GEOLOGICAL SURVEY (USGS) 7.5-MINUTE SERIES TOPOGRAPHICAL MAPS, NIANTIC, CONNECTICUT, QUADRANGLE, DATED 2024.

LANGAN

Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven, CT 06511
T: 203.562.5771 F: 203.789.6142 www.langan.com

Langan Engineering & Environmental Services, Inc.
Langan Engineering, Environmental, Surveying,
Landscape Architecture and Geology, D.P.C.
Langan International LLC

Collectively known as Langan

Project

LEARN SCHOOL

51 DANIELS AVENUE

WATERFORD

CONNECTICUT

Figure Title

SITE LOCATION MAP

Project No.

140310301

Date

3/18/2025

Scale

1"=2,000'

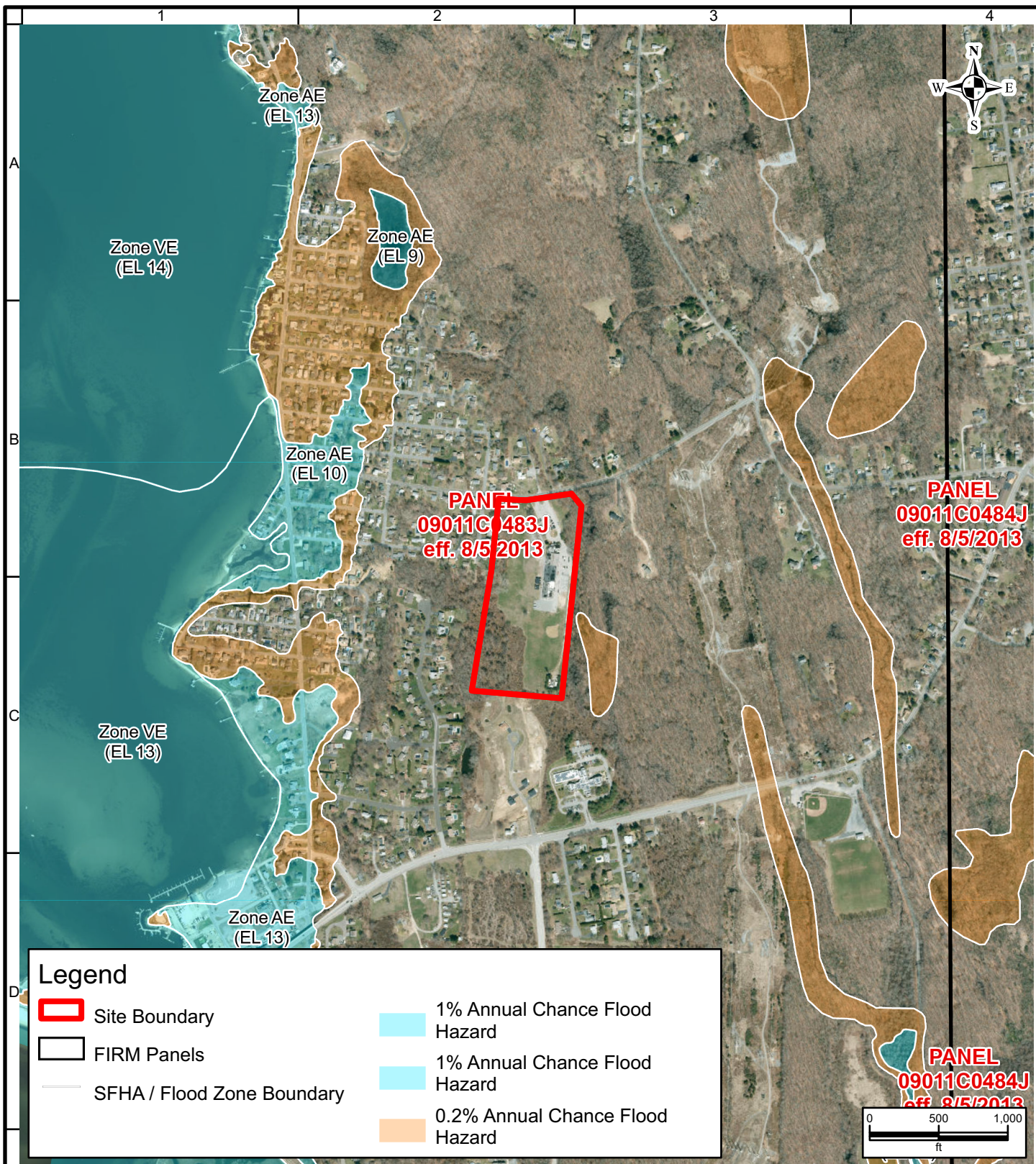
Drawn By

MG

Submission Date

Figure No.

1



Town of Waterford, MassGIS, UConn/CTDEEP, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA, State of Connecticut, Maxar, FEMA, FEMA RiskMap CDS

LANGAN

300 Kimball Drive 4th Floor
Parsippany NJ 07054-2172
T: 973-560-4900 F: 973-560-4901 www.langan.com
Langan Engineering & Environmental Services, LLC.
Langan Engineering, Environmental, Surveying, Landscape
Architecture and Geology, D.P.C.
Langan International
Collectively known as Langan

Project

LEARN

WATERFORD
CONNECTICUT
SOUTHEASTERN

CT

Figure Title

**EFFECTIVE FEMA
FIRM**

Project No.

140310301

Date

3/17/2025

Scale

1:12,000

Drawn By

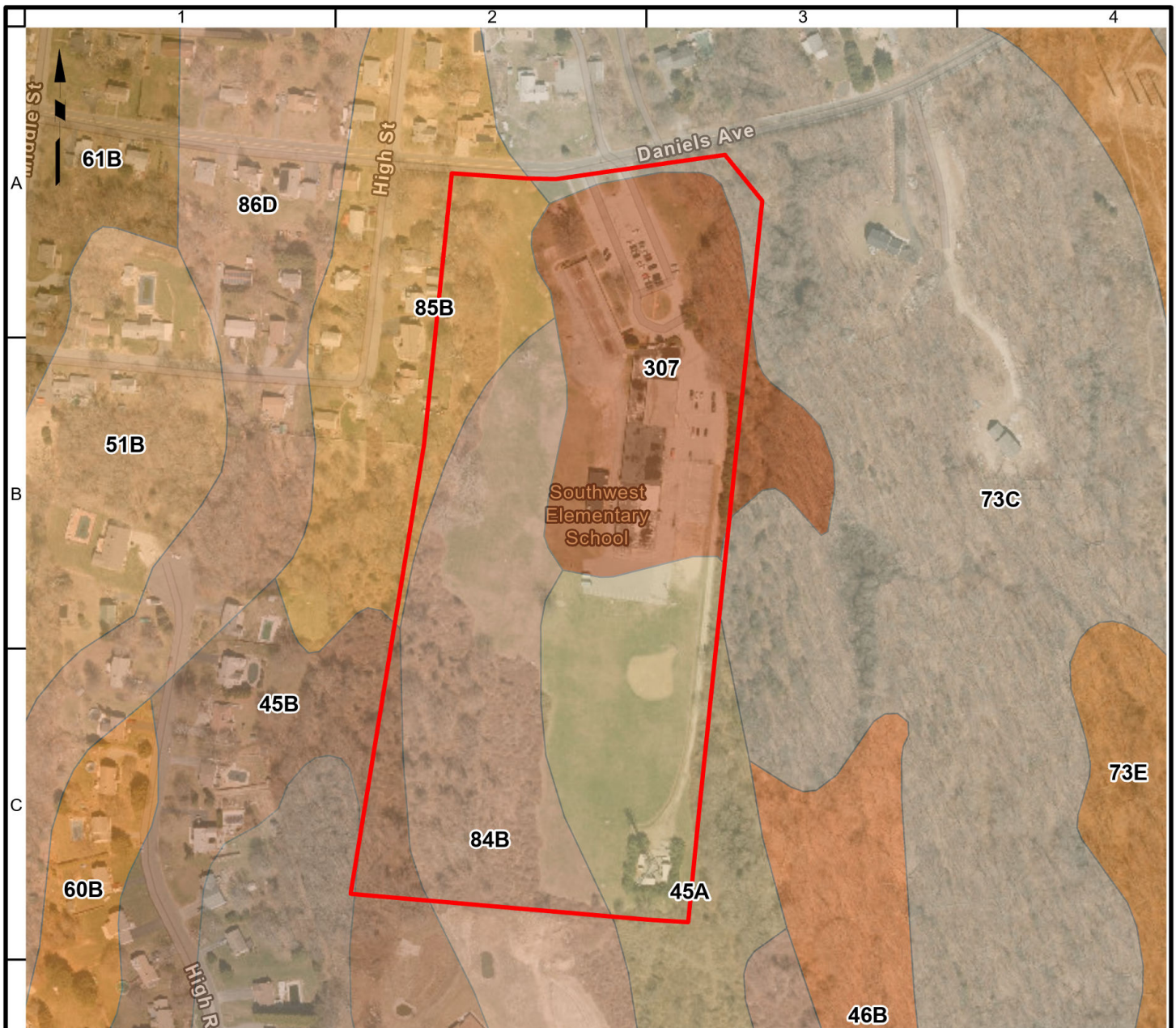
Site Analyzer

Submission Date

3/17/2025

Figure

2



Legend

- | | |
|---|---|
| Approximate Site Boundary | 60B-Canton and Charlton fine sandy loams, 3 to 8 percent slopes |
| 306-Udorthents-Urban land complex | 61B-Canton and Charlton fine sandy loams, 0 to 8 percent slopes, very stony |
| 307-Urban land | 73C-Charlton-Chatfield complex, 0 to 15 percent slopes, very rocky |
| 45A-Woodbridge fine sandy loam, 0 to 3 percent slopes | 73E-Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky |
| 45B-Woodbridge fine sandy loam, 3 to 8 percent slopes | 84B-Paxton and Montauk fine sandy loams, 3 to 8 percent slopes |
| 46B-Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony | 85B-Paxton and Montauk fine sandy loams, 3 to 8 percent slopes, very stony |
| 51B-Sutton fine sandy loam, 0 to 8 percent slopes, very stony | 86D-Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony |



NOTES:

1. SOIL DATA PROVIDED BY THE USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

LANGAN

Long Wharf Maritime Center, 555 Long Wharf Drive
New Haven, CT 06511
T: 203.562.5771 F: 203.789.6142 www.langan.com

Langan Engineering & Environmental Services, Inc.
Langan Engineering, Environmental, Surveying,
Landscape Architecture and Geology, D.P.C.
Langan International LLC

Collectively known as Langan

Project

LEARN SCHOOL

51 DANIELS AVENUE

WATERFORD

CONNECTICUT

Figure Title

NRCS SOILS MAP

Project No.

140310301

Date

3/18/2025

Scale

1"=300'

Drawn By

MG

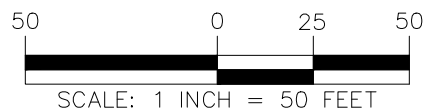
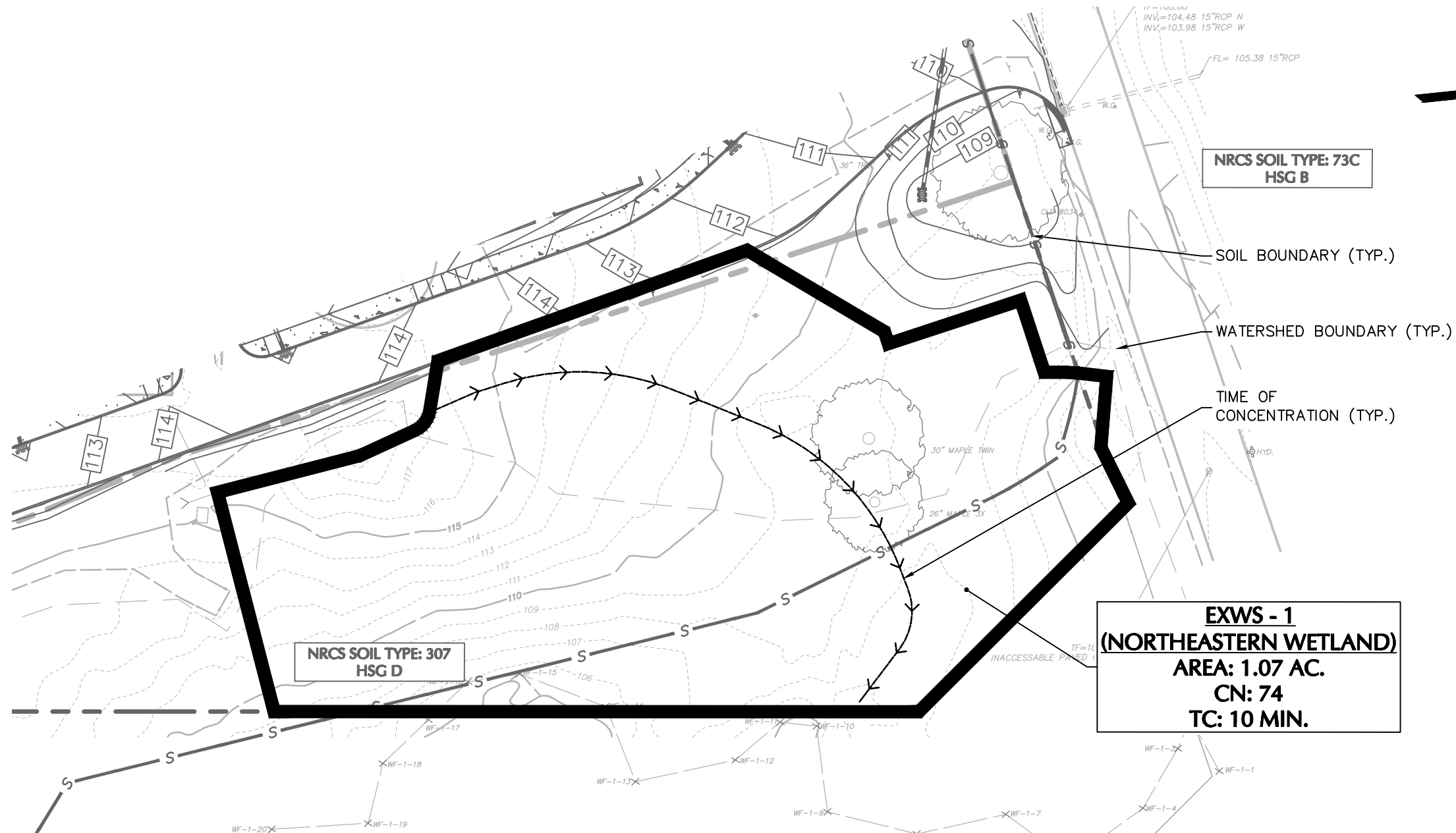
Submission Date

Figure No.

3

GENERAL NOTES

- EXISTING AND TOPOGRAPHIC INFORMATION OBTAINED FROM A PLAN TITLED "LOT LINE MODIFICATION SURVEY" PREPARED BY BENESCH, DATED MARCH 28, 2024.
- THE SITE IS LOCATED WITHIN ZONE X, AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, PER FEMA MAP 09011C0483J FOR NEW LONDON COUNTY, EFFECTIVE DATE AUGUST 5, 2013.
- THE PROPOSED BUILDING FOOTPRINT WAS RECEIVED ELECTRONICALLY FROM NEWMAN ARCHITECTS IN APRIL 2025.



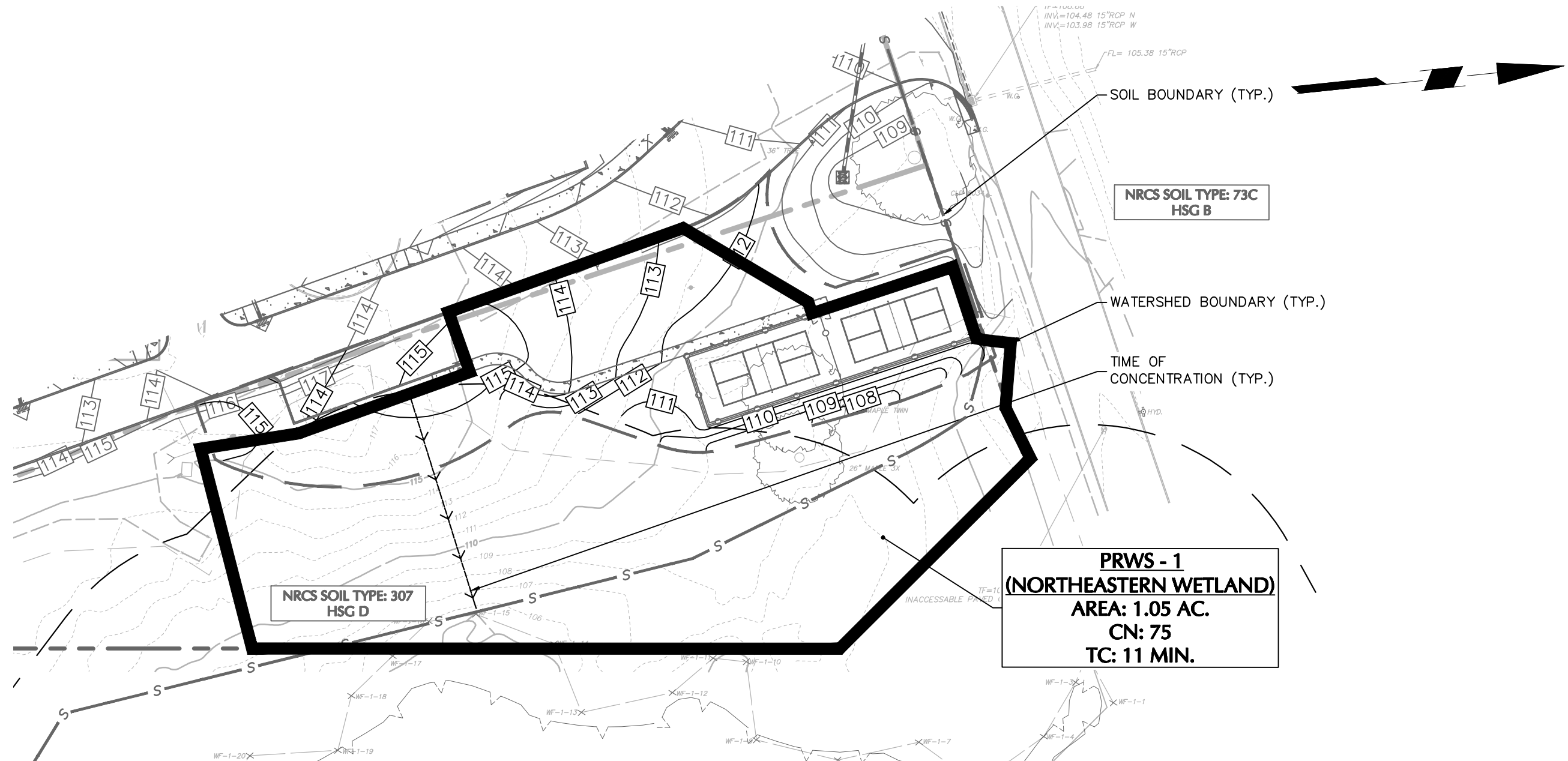
LANGAN
Langan CT, Inc.
555 Long Wharf Drive, 9th Floor
New Haven, CT 06511
T: 203.562.5771 F: 203.789.6142 www.langan.com

Project **WATERFORD PICKLEBALL COURTS AND PARKING**
Drawing Title **EXISTING WATERSHED MAP**
Project No. **140310301**
Date **05/01/2025**
Drawn By **BTW**
Checked By **KEG**

Drawing Title **EXISTING WATERSHED MAP**
Project No. **140310301**
Date **05/01/2025**
Drawn By **BTW**
Checked By **KEG**
Drawing No. **EX-WS**
Sheet **1** of **2**

GENERAL NOTES

- EXISTING AND TOPOGRAPHIC INFORMATION OBTAINED FROM A PLAN TITLED "LOT LINE MODIFICATION SURVEY" PREPARED BY BENESCH, DATED MARCH 28, 2024.
- THE SITE IS LOCATED WITHIN ZONE X, AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, PER FEMA MAP 09011C0483J FOR NEW LONDON COUNTY, EFFECTIVE DATE AUGUST 5, 2013.
- THE PROPOSED BUILDING FOOTPRINT WAS RECEIVED ELECTRONICALLY FROM NEWMAN ARCHITECTS IN APRIL 2025.

**LANGAN**

Langan CT, Inc.
555 Long Wharf Drive, 9th Floor
New Haven, CT 06511

T: 203.562.5771 F: 203.789.6142 www.langan.com

Project: WATERFORD
PICKLEBALL COURTS
AND PARKING

WATERFORD CONNECTICUT

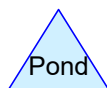
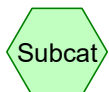
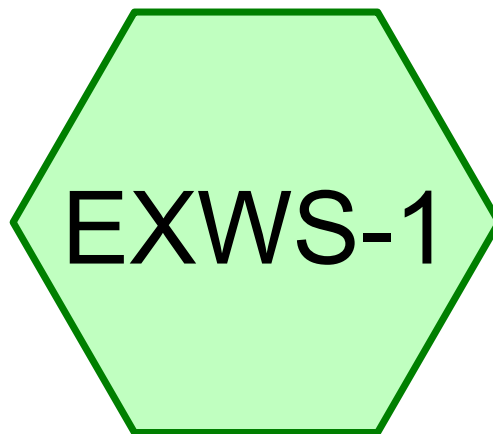
Drawing Title: PROPOSED
WATERSHED
MAP

Project No. 140310301
Date: 05/01/2025
Drawn By: BTW
Checked By: KEG

Drawing No. PR-WS
Sheet 2 of 2

APPENDIX A

Existing Stormwater Discharge Calculations



EX WS_Pickleball

Prepared by Langan Engineering

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Printed 4/28/2025

Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.37	84	50-75% Grass cover, Fair, HSG D (EXWS-1)
0.02	78	Meadow, HSG D (EXWS-1)
0.25	55	Woods, Good, HSG B (EXWS-1)
0.42	77	Woods, Good, HSG D (EXWS-1)
1.07	74	TOTAL AREA

EX WS_Pickleball

NOAA 24-hr D 2-Year Rainfall=3.44"

Prepared by Langan Engineering

Printed 4/28/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 3

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEXWS-1:

Runoff Area=1.07 ac 0.00% Impervious Runoff Depth=1.20"

Flow Length=284' Tc=10 min CN=74 Runoff=1.27 cfs 4,660 CF

Total Runoff Area = 1.07 ac Runoff Volume = 4,660 CF Average Runoff Depth = 1.20"

100.00% Pervious = 1.07 ac 0.00% Impervious = 0.00 ac

EX WS_Pickleball

Prepared by Langan Engineering

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-Year Rainfall=3.44"

Printed 4/28/2025

Page 4

Summary for Subcatchment EXWS-1:

Runoff = 1.27 cfs @ 12.18 hrs, Volume= 4,660 CF, Depth= 1.20"

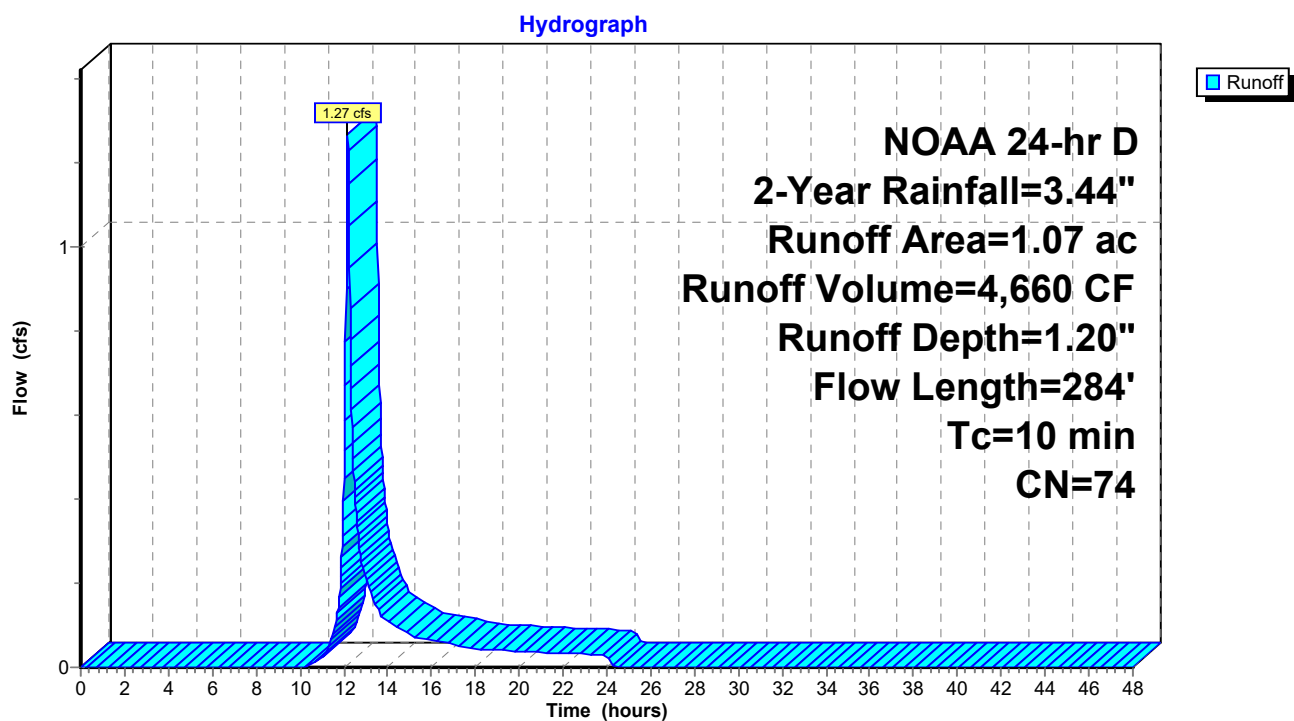
Routed to nonexistent node Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 2-Year Rainfall=3.44"

Area (ac)	CN	Description
* 0.00	98	Impervious
0.00	69	50-75% Grass cover, Fair, HSG B
0.00	79	50-75% Grass cover, Fair, HSG C
0.37	84	50-75% Grass cover, Fair, HSG D
* 0.02	78	Meadow, HSG D
0.25	55	Woods, Good, HSG B
0.00	70	Woods, Good, HSG C
0.42	77	Woods, Good, HSG D
1.07	74	Weighted Average
1.07		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8	150	0.0650	0.31		Sheet Flow, AB
					Grass: Short n= 0.150 P2= 3.44"
0	50	0.0650	1.78		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
1	84	0.0550	1.17		Shallow Concentrated Flow, CD
					Woodland Kv= 5.0 fps
10	284	Total			

Subcatchment EXWS-1:



EX WS_Pickleball

NOAA 24-hr D 10-Year Rainfall=5.14"

Prepared by Langan Engineering

Printed 4/28/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 6

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEXWS-1:

Runoff Area=1.07 ac 0.00% Impervious Runoff Depth=2.48"

Flow Length=284' Tc=10 min CN=74 Runoff=2.69 cfs 9,628 CF

Total Runoff Area = 1.07 ac Runoff Volume = 9,628 CF Average Runoff Depth = 2.48"

100.00% Pervious = 1.07 ac 0.00% Impervious = 0.00 ac

EX WS_Pickleball

Prepared by Langan Engineering

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

NOAA 24-hr D 10-Year Rainfall=5.14"

Printed 4/28/2025

Page 7

Summary for Subcatchment EXWS-1:

Runoff = 2.69 cfs @ 12.17 hrs, Volume= 9,628 CF, Depth= 2.48"

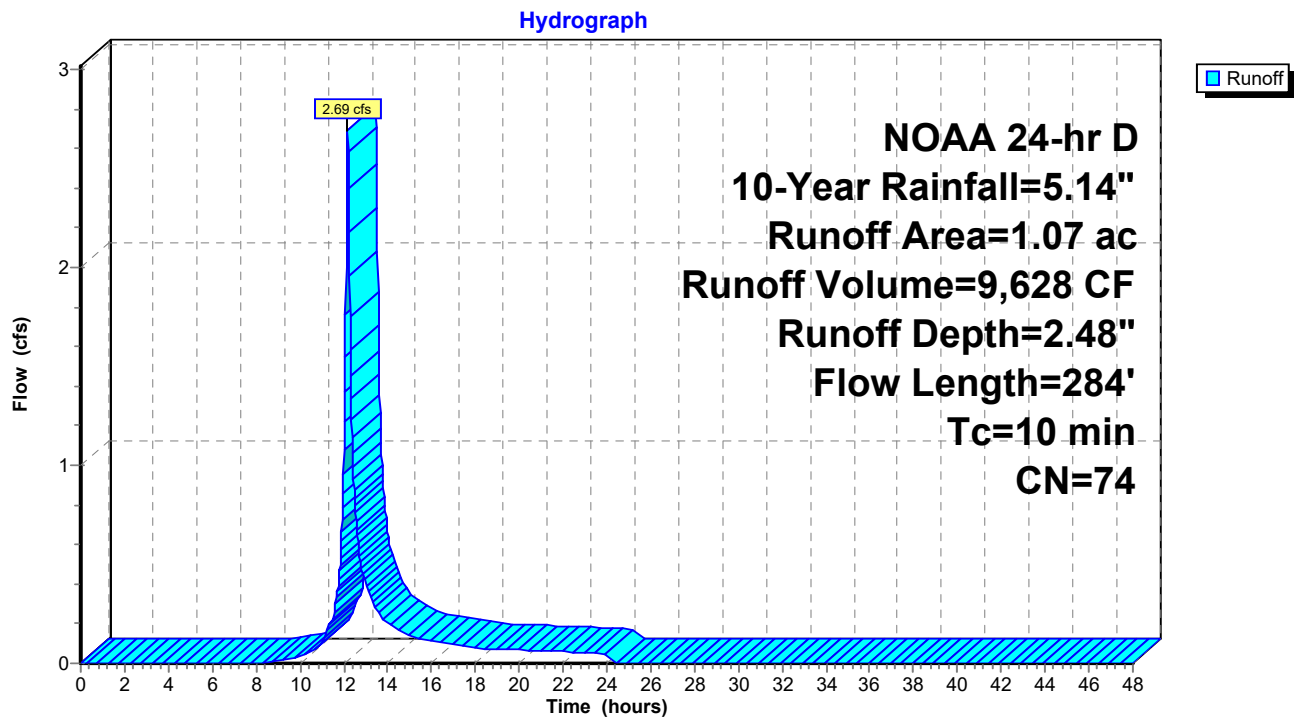
Routed to nonexistent node Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 10-Year Rainfall=5.14"

Area (ac)	CN	Description
* 0.00	98	Impervious
0.00	69	50-75% Grass cover, Fair, HSG B
0.00	79	50-75% Grass cover, Fair, HSG C
0.37	84	50-75% Grass cover, Fair, HSG D
* 0.02	78	Meadow, HSG D
0.25	55	Woods, Good, HSG B
0.00	70	Woods, Good, HSG C
0.42	77	Woods, Good, HSG D
1.07	74	Weighted Average
1.07		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8	150	0.0650	0.31		Sheet Flow, AB
					Grass: Short n= 0.150 P2= 3.44"
0	50	0.0650	1.78		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
1	84	0.0550	1.17		Shallow Concentrated Flow, CD
					Woodland Kv= 5.0 fps
10	284	Total			

Subcatchment EXWS-1:



EX WS_Pickleball

NOAA 24-hr D 25-Year Rainfall=6.21"

Prepared by Langan Engineering

Printed 4/28/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 9

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEXWS-1:

Runoff Area=1.07 ac 0.00% Impervious Runoff Depth=3.36"

Flow Length=284' Tc=10 min CN=74 Runoff=3.66 cfs 13,072 CF

Total Runoff Area = 1.07 ac Runoff Volume = 13,072 CF Average Runoff Depth = 3.36"**100.00% Pervious = 1.07 ac 0.00% Impervious = 0.00 ac**

EX WS_Pickleball

Prepared by Langan Engineering

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

NOAA 24-hr D 25-Year Rainfall=6.21"

Printed 4/28/2025

Page 10

Summary for Subcatchment EXWS-1:

Runoff = 3.66 cfs @ 12.17 hrs, Volume= 13,072 CF, Depth= 3.36"

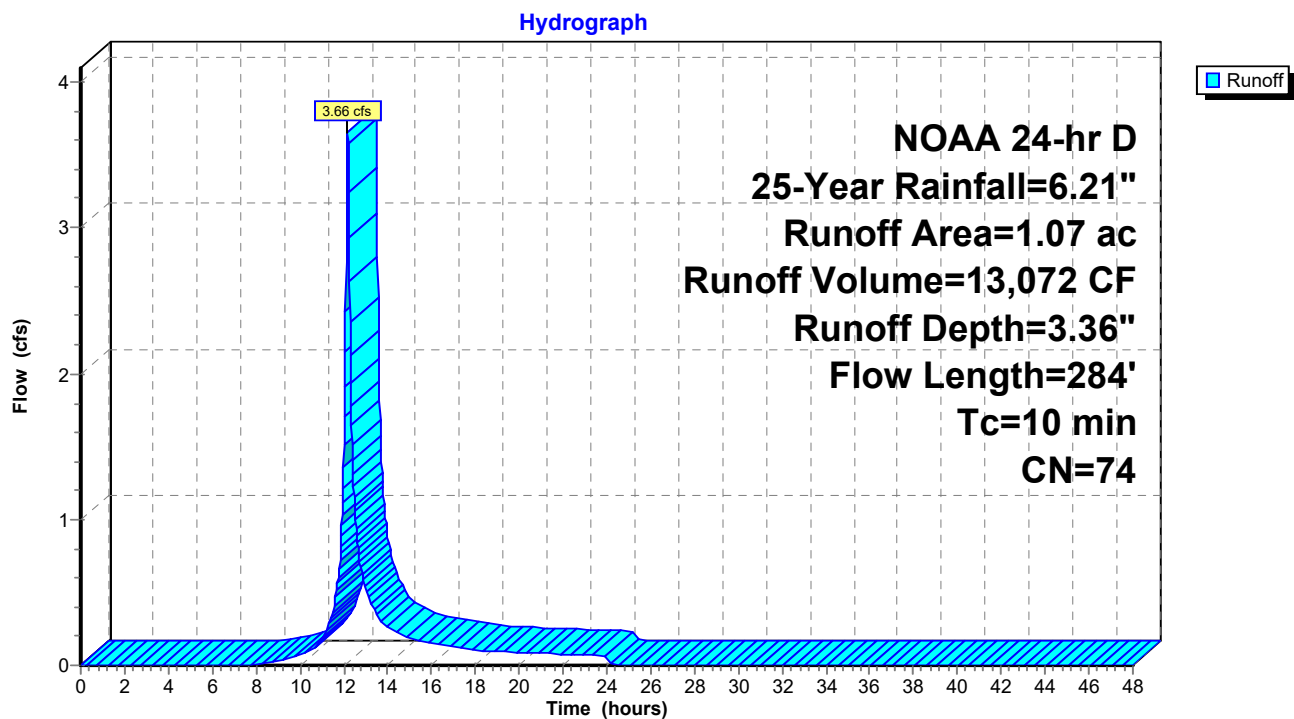
Routed to nonexistent node Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 25-Year Rainfall=6.21"

Area (ac)	CN	Description
* 0.00	98	Impervious
0.00	69	50-75% Grass cover, Fair, HSG B
0.00	79	50-75% Grass cover, Fair, HSG C
0.37	84	50-75% Grass cover, Fair, HSG D
* 0.02	78	Meadow, HSG D
0.25	55	Woods, Good, HSG B
0.00	70	Woods, Good, HSG C
0.42	77	Woods, Good, HSG D
1.07	74	Weighted Average
1.07		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8	150	0.0650	0.31		Sheet Flow, AB
					Grass: Short n= 0.150 P2= 3.44"
0	50	0.0650	1.78		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
1	84	0.0550	1.17		Shallow Concentrated Flow, CD
					Woodland Kv= 5.0 fps
10	284	Total			

Subcatchment EXWS-1:



EX WS_Pickleball

NOAA 24-hr D 100-Year Rainfall=7.85"

Prepared by Langan Engineering

Printed 4/28/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 12

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentEXWS-1:

Runoff Area=1.07 ac 0.00% Impervious Runoff Depth=4.79"

Flow Length=284' Tc=10 min CN=74 Runoff=5.18 cfs 18,629 CF

Total Runoff Area = 1.07 ac Runoff Volume = 18,629 CF Average Runoff Depth = 4.79"**100.00% Pervious = 1.07 ac 0.00% Impervious = 0.00 ac**

EX WS_Pickleball

NOAA 24-hr D 100-Year Rainfall=7.85"

Prepared by Langan Engineering

Printed 4/28/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 13

Summary for Subcatchment EXWS-1:

Runoff = 5.18 cfs @ 12.17 hrs, Volume= 18,629 CF, Depth= 4.79"

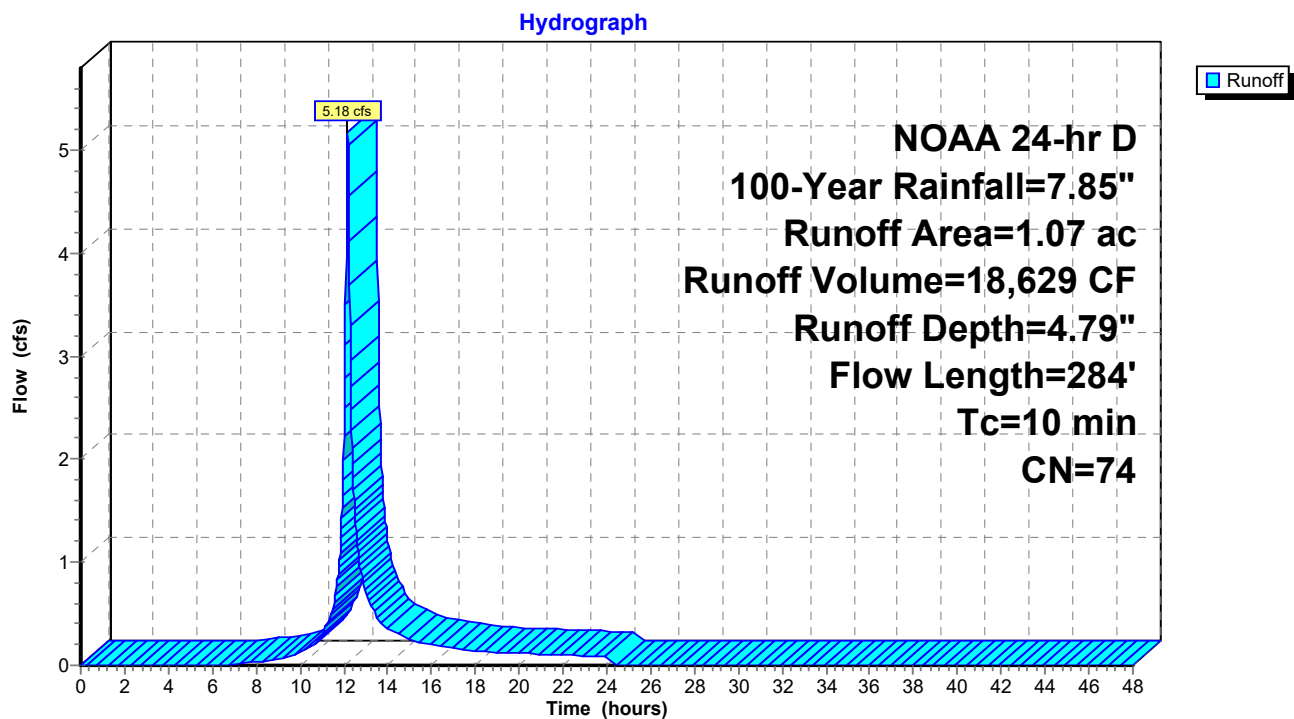
Routed to nonexistent node Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 100-Year Rainfall=7.85"

Area (ac)	CN	Description
* 0.00	98	Impervious
0.00	69	50-75% Grass cover, Fair, HSG B
0.00	79	50-75% Grass cover, Fair, HSG C
0.37	84	50-75% Grass cover, Fair, HSG D
* 0.02	78	Meadow, HSG D
0.25	55	Woods, Good, HSG B
0.00	70	Woods, Good, HSG C
0.42	77	Woods, Good, HSG D
1.07	74	Weighted Average
1.07		100.00% Pervious Area

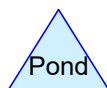
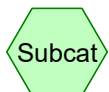
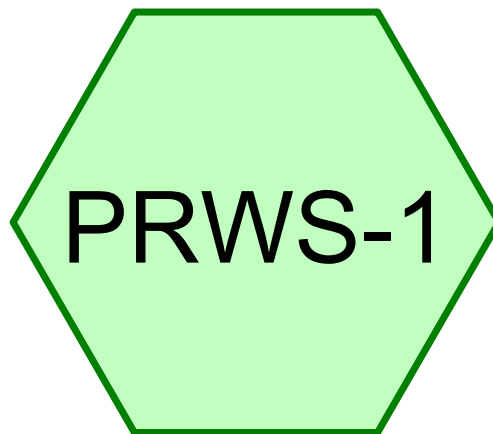
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8	150	0.0650	0.31		Sheet Flow, AB
					Grass: Short n= 0.150 P2= 3.44"
0	50	0.0650	1.78		Shallow Concentrated Flow, BC
					Short Grass Pasture Kv= 7.0 fps
1	84	0.0550	1.17		Shallow Concentrated Flow, CD
					Woodland Kv= 5.0 fps
10	284	Total			

Subcatchment EXWS-1:



APPENDIX B

Proposed Stormwater Discharge Calculations



PR WS_Pickleball

Prepared by Langan Engineering

Printed 4/30/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.06	84	50-75% Grass cover, Fair, HSG D (PRWS-1)
0.11	98	Impervious (PRWS-1)
0.29	78	Meadow, HSG D (PRWS-1)
0.25	55	Woods, Good, HSG B (PRWS-1)
0.35	77	Woods, Good, HSG D (PRWS-1)
1.05	75	TOTAL AREA

PR WS_Pickleball

NOAA 24-hr D 2-Year Rainfall=3.44"

Prepared by Langan Engineering

Printed 4/30/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 3

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPRWS-1:

Runoff Area=45,869 sf 10.35% Impervious Runoff Depth=1.26"

Flow Length=94' Tc=11 min CN=75 Runoff=1.27 cfs 4,814 CF

Total Runoff Area = 1.05 ac Runoff Volume = 4,814 CF Average Runoff Depth = 1.26"

89.65% Pervious = 0.94 ac 10.35% Impervious = 0.11 ac

PR WS_Pickleball

Prepared by Langan Engineering

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

NOAA 24-hr D 2-Year Rainfall=3.44"

Printed 4/30/2025

Page 4

Summary for Subcatchment PRWS-1:

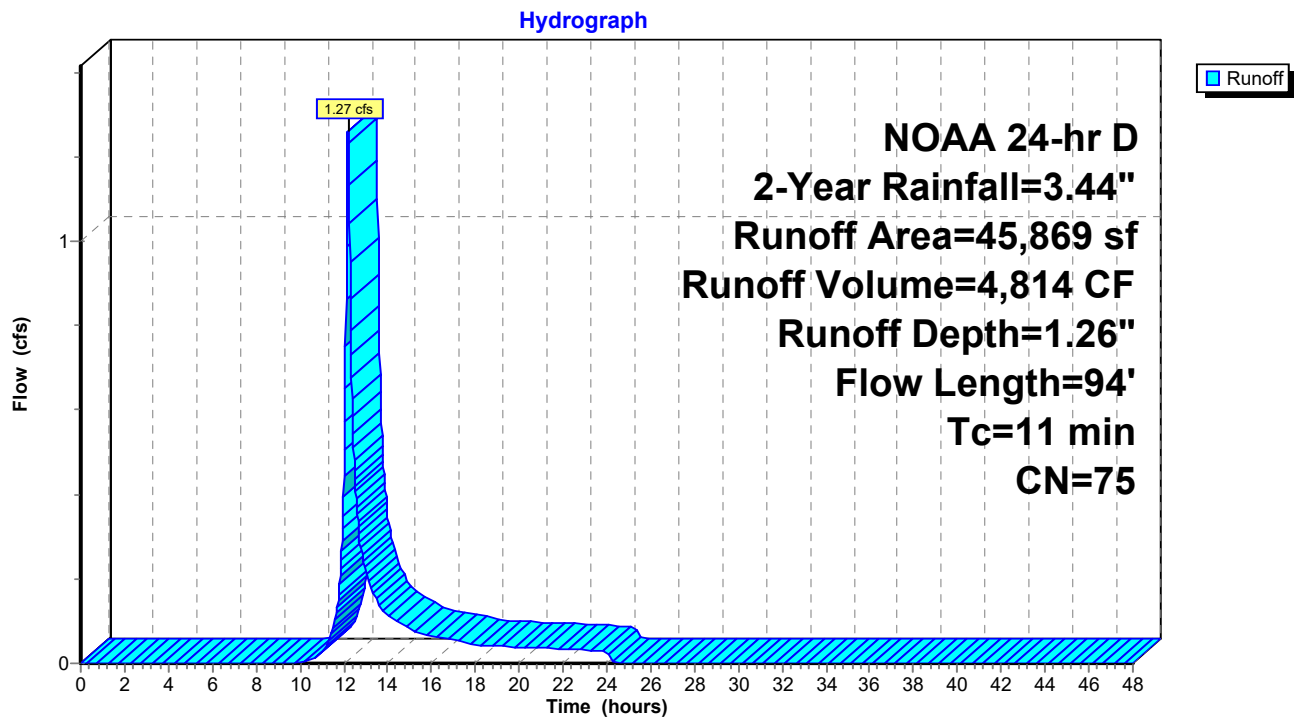
Runoff = 1.27 cfs @ 12.19 hrs, Volume= 4,814 CF, Depth= 1.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 2-Year Rainfall=3.44"

	Area (sf)	CN	Description
*	4,748	98	Impervious
	0	69	50-75% Grass cover, Fair, HSG B
	0	79	50-75% Grass cover, Fair, HSG C
	2,400	84	50-75% Grass cover, Fair, HSG D
	0	80	>75% Grass cover, Good, HSG D
	10,977	55	Woods, Good, HSG B
	0	70	Woods, Good, HSG C
	15,035	77	Woods, Good, HSG D
*	12,709	78	Meadow, HSG D
	45,869	75	Weighted Average
	41,121		89.65% Pervious Area
	4,748		10.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4	32	0.0450	0.13		Sheet Flow, AB
					Grass: Dense n= 0.240 P2= 3.44"
7	62	0.1200	0.15		Sheet Flow, AB
					Woods: Light underbrush n= 0.400 P2= 3.44"
11	94	Total			

Subcatchment PRWS-1:



PR WS_Pickleball

NOAA 24-hr D 10-Year Rainfall=5.14"

Prepared by Langan Engineering

Printed 4/30/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 6

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPRWS-1:

Runoff Area=45,869 sf 10.35% Impervious Runoff Depth=2.56"

Flow Length=94' Tc=11 min CN=75 Runoff=2.63 cfs 9,798 CF

Total Runoff Area = 1.05 ac Runoff Volume = 9,798 CF Average Runoff Depth = 2.56"

89.65% Pervious = 0.94 ac 10.35% Impervious = 0.11 ac

PR WS_Pickleball

NOAA 24-hr D 10-Year Rainfall=5.14"

Prepared by Langan Engineering

Printed 4/30/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 7

Summary for Subcatchment PRWS-1:

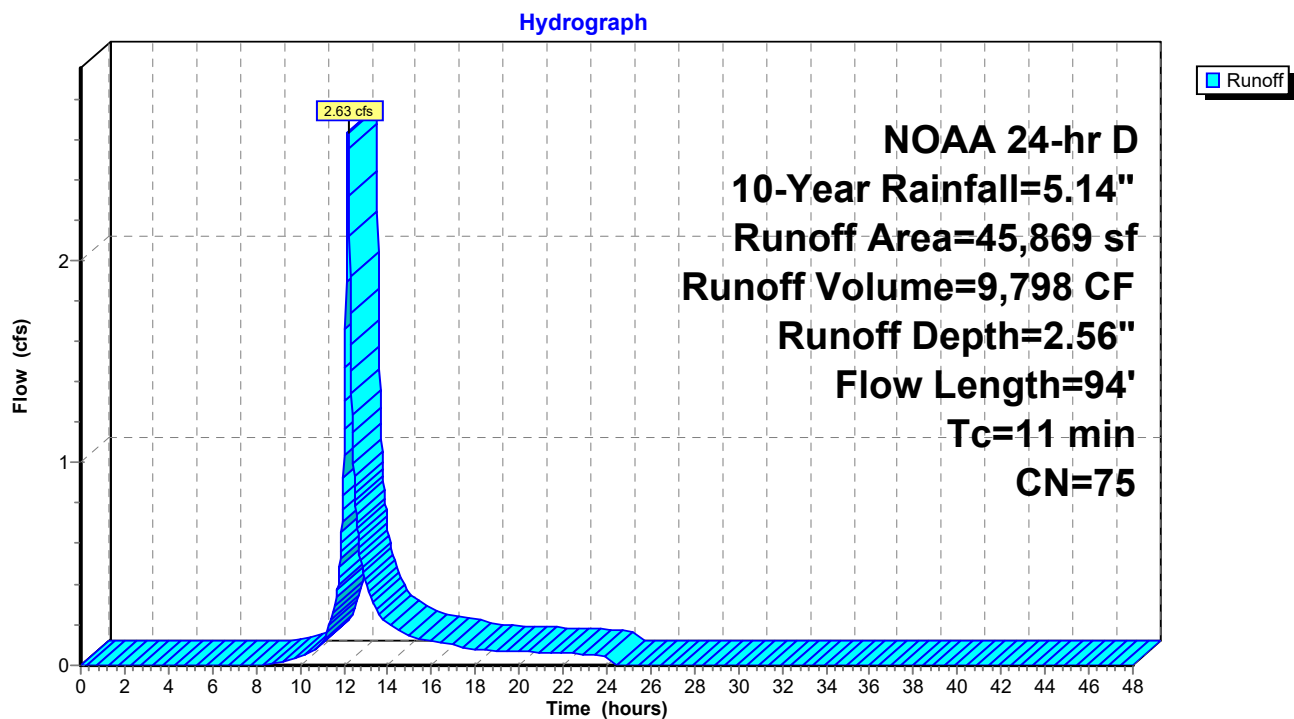
Runoff = 2.63 cfs @ 12.19 hrs, Volume= 9,798 CF, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 10-Year Rainfall=5.14"

	Area (sf)	CN	Description
*	4,748	98	Impervious
	0	69	50-75% Grass cover, Fair, HSG B
	0	79	50-75% Grass cover, Fair, HSG C
	2,400	84	50-75% Grass cover, Fair, HSG D
	0	80	>75% Grass cover, Good, HSG D
	10,977	55	Woods, Good, HSG B
	0	70	Woods, Good, HSG C
	15,035	77	Woods, Good, HSG D
*	12,709	78	Meadow, HSG D
	45,869	75	Weighted Average
	41,121		89.65% Pervious Area
	4,748		10.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4	32	0.0450	0.13		Sheet Flow, AB
					Grass: Dense n= 0.240 P2= 3.44"
7	62	0.1200	0.15		Sheet Flow, AB
					Woods: Light underbrush n= 0.400 P2= 3.44"
11	94	Total			

Subcatchment PRWS-1:



PR WS_Pickleball

NOAA 24-hr D 25-Year Rainfall=6.21"

Prepared by Langan Engineering

Printed 4/30/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 9

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPRWS-1:

Runoff Area=45,869 sf 10.35% Impervious Runoff Depth=3.46"
Flow Length=94' Tc=11 min CN=75 Runoff=3.55 cfs 13,232 CF

Total Runoff Area = 1.05 ac Runoff Volume = 13,232 CF Average Runoff Depth = 3.46"
89.65% Pervious = 0.94 ac 10.35% Impervious = 0.11 ac

PR WS_Pickleball

NOAA 24-hr D 25-Year Rainfall=6.21"

Prepared by Langan Engineering

Printed 4/30/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 10

Summary for Subcatchment PRWS-1:

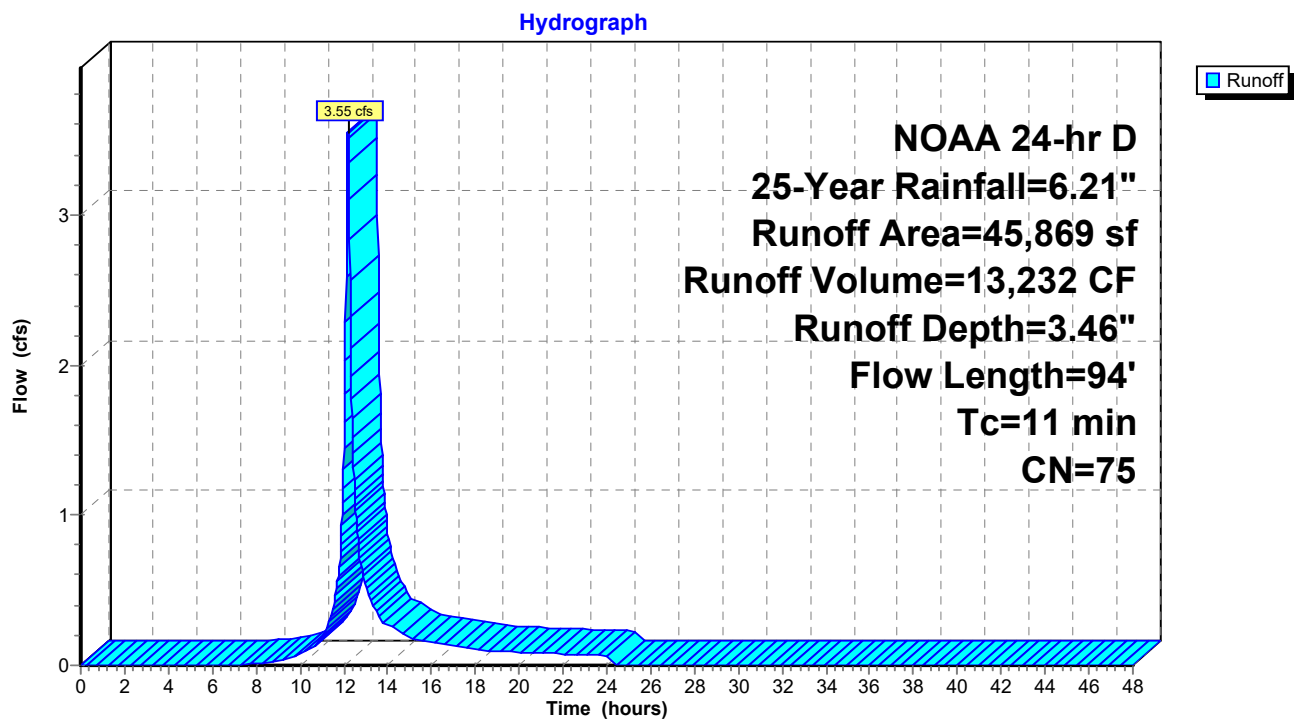
Runoff = 3.55 cfs @ 12.18 hrs, Volume= 13,232 CF, Depth= 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 25-Year Rainfall=6.21"

	Area (sf)	CN	Description
*	4,748	98	Impervious
	0	69	50-75% Grass cover, Fair, HSG B
	0	79	50-75% Grass cover, Fair, HSG C
	2,400	84	50-75% Grass cover, Fair, HSG D
	0	80	>75% Grass cover, Good, HSG D
	10,977	55	Woods, Good, HSG B
	0	70	Woods, Good, HSG C
	15,035	77	Woods, Good, HSG D
*	12,709	78	Meadow, HSG D
	45,869	75	Weighted Average
	41,121		89.65% Pervious Area
	4,748		10.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4	32	0.0450	0.13		Sheet Flow, AB
					Grass: Dense n= 0.240 P2= 3.44"
7	62	0.1200	0.15		Sheet Flow, AB
					Woods: Light underbrush n= 0.400 P2= 3.44"
11	94	Total			

Subcatchment PRWS-1:



PR WS_Pickleball

NOAA 24-hr D 100-Year Rainfall=7.85"

Prepared by Langan Engineering

Printed 4/30/2025

HydroCAD® 10.20-6a s/n 08223 © 2024 HydroCAD Software Solutions LLC

Page 12

Time span=0.00-48.00 hrs, dt=0.02 hrs, 2401 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentPRWS-1:

Runoff Area=45,869 sf 10.35% Impervious Runoff Depth=4.91"
Flow Length=94' Tc=11 min CN=75 Runoff=5.00 cfs 18,755 CF

Total Runoff Area = 1.05 ac Runoff Volume = 18,755 CF Average Runoff Depth = 4.91"
89.65% Pervious = 0.94 ac 10.35% Impervious = 0.11 ac

Summary for Subcatchment PRWS-1:

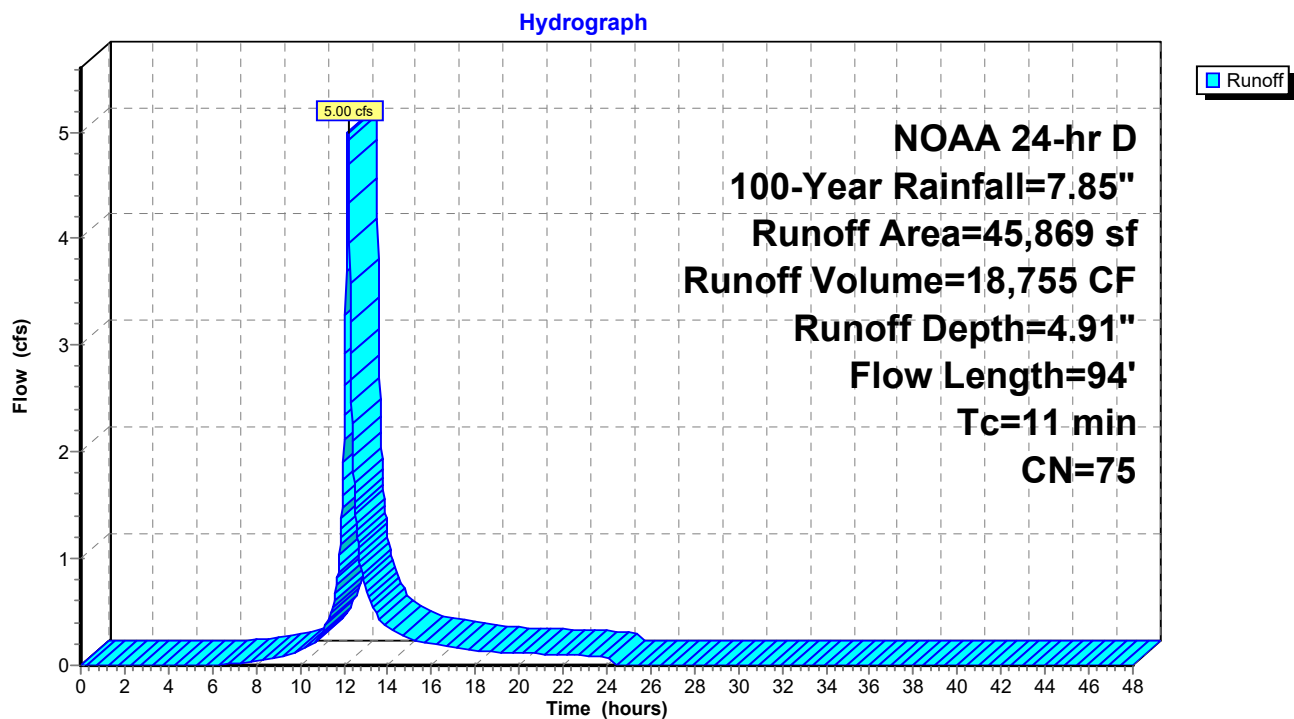
Runoff = 5.00 cfs @ 12.18 hrs, Volume= 18,755 CF, Depth= 4.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.02 hrs
NOAA 24-hr D 100-Year Rainfall=7.85"

	Area (sf)	CN	Description
*	4,748	98	Impervious
	0	69	50-75% Grass cover, Fair, HSG B
	0	79	50-75% Grass cover, Fair, HSG C
	2,400	84	50-75% Grass cover, Fair, HSG D
	0	80	>75% Grass cover, Good, HSG D
	10,977	55	Woods, Good, HSG B
	0	70	Woods, Good, HSG C
	15,035	77	Woods, Good, HSG D
*	12,709	78	Meadow, HSG D
	45,869	75	Weighted Average
	41,121		89.65% Pervious Area
	4,748		10.35% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4	32	0.0450	0.13		Sheet Flow, AB
					Grass: Dense n= 0.240 P2= 3.44"
7	62	0.1200	0.15		Sheet Flow, AB
					Woods: Light underbrush n= 0.400 P2= 3.44"
11	94	Total			

Subcatchment PRWS-1:



APPENDIX C

NOAA Rainfall Data



NOAA Atlas 14, Volume 10, Version 3
Location name: Town of Waterford, Connecticut,
USA*

Latitude: 41.3325°, Longitude: -72.1669°

Elevation: 116 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 & aerals](#)

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	0.336 (0.259-0.427)	0.402 (0.310-0.511)	0.510 (0.392-0.651)	0.600 (0.458-0.768)	0.723 (0.537-0.960)	0.816 (0.594-1.10)	0.914 (0.648-1.27)	1.03 (0.689-1.44)	1.19 (0.770-1.72)	1.33 (0.840-1.95)
10-min	0.475 (0.367-0.605)	0.569 (0.438-0.725)	0.723 (0.555-0.921)	0.850 (0.649-1.09)	1.02 (0.760-1.36)	1.16 (0.841-1.56)	1.30 (0.918-1.80)	1.45 (0.977-2.05)	1.69 (1.09-2.44)	1.88 (1.19-2.76)
15-min	0.559 (0.431-0.711)	0.670 (0.516-0.852)	0.851 (0.654-1.09)	1.00 (0.764-1.28)	1.21 (0.894-1.60)	1.36 (0.989-1.84)	1.52 (1.08-2.12)	1.71 (1.15-2.40)	1.98 (1.28-2.86)	2.21 (1.40-3.24)
30-min	0.791 (0.610-1.01)	0.946 (0.729-1.20)	1.20 (0.922-1.53)	1.41 (1.08-1.81)	1.70 (1.26-2.26)	1.92 (1.40-2.59)	2.15 (1.52-2.99)	2.41 (1.62-3.39)	2.79 (1.81-4.03)	3.11 (1.97-4.56)
60-min	1.02 (0.789-1.30)	1.22 (0.942-1.56)	1.55 (1.19-1.98)	1.82 (1.39-2.33)	2.20 (1.63-2.91)	2.48 (1.80-3.34)	2.77 (1.96-3.85)	3.11 (2.09-4.37)	3.60 (2.33-5.20)	4.01 (2.54-5.88)
2-hr	1.34 (1.04-1.69)	1.60 (1.25-2.02)	2.04 (1.58-2.58)	2.39 (1.85-3.04)	2.89 (2.16-3.80)	3.26 (2.39-4.36)	3.65 (2.61-5.03)	4.10 (2.77-5.71)	4.76 (3.10-6.82)	5.32 (3.38-7.73)
3-hr	1.56 (1.22-1.95)	1.86 (1.46-2.34)	2.36 (1.84-2.97)	2.78 (2.15-3.51)	3.35 (2.52-4.38)	3.77 (2.78-5.02)	4.23 (3.04-5.80)	4.76 (3.22-6.59)	5.53 (3.61-7.87)	6.19 (3.94-8.93)
6-hr	1.98 (1.56-2.46)	2.36 (1.87-2.94)	2.99 (2.36-3.73)	3.51 (2.75-4.40)	4.23 (3.21-5.48)	4.77 (3.55-6.28)	5.34 (3.86-7.26)	6.00 (4.09-8.23)	6.98 (4.58-9.83)	7.80 (5.00-11.1)
12-hr	2.45 (1.96-3.02)	2.92 (2.33-3.60)	3.69 (2.94-4.56)	4.33 (3.42-5.37)	5.21 (3.99-6.69)	5.87 (4.40-7.66)	6.57 (4.79-8.84)	7.38 (5.06-10.0)	8.57 (5.65-12.0)	9.57 (6.16-13.5)
24-hr	2.87 (2.32-3.50)	3.44 (2.77-4.19)	4.37 (3.51-5.34)	5.14 (4.11-6.31)	6.21 (4.80-7.90)	7.00 (5.30-9.06)	7.85 (5.78-10.5)	8.85 (6.11-11.9)	10.3 (6.85-14.3)	11.6 (7.50-16.2)
2-day	3.20 (2.61-3.86)	3.87 (3.16-4.68)	4.98 (4.04-6.03)	5.89 (4.76-7.17)	7.16 (5.59-9.04)	8.09 (6.19-10.4)	9.10 (6.77-12.1)	10.3 (7.17-13.8)	12.2 (8.13-16.7)	13.8 (8.97-19.1)
3-day	3.46 (2.84-4.15)	4.18 (3.43-5.03)	5.37 (4.39-6.47)	6.36 (5.16-7.68)	7.71 (6.06-9.69)	8.72 (6.70-11.1)	9.80 (7.33-13.0)	11.1 (7.76-14.7)	13.1 (8.78-17.9)	14.9 (9.69-20.5)
4-day	3.71 (3.06-4.43)	4.47 (3.68-5.34)	5.70 (4.68-6.84)	6.73 (5.49-8.11)	8.15 (6.42-10.2)	9.19 (7.10-11.7)	10.3 (7.74-13.6)	11.7 (8.18-15.4)	13.8 (9.23-18.6)	15.6 (10.2-21.4)
7-day	4.42 (3.67-5.24)	5.23 (4.34-6.21)	6.56 (5.43-7.81)	7.67 (6.30-9.16)	9.19 (7.29-11.4)	10.3 (8.01-13.0)	11.5 (8.67-15.0)	13.0 (9.12-17.0)	15.1 (10.2-20.3)	16.9 (11.1-23.1)
10-day	5.11 (4.27-6.03)	5.96 (4.98-7.04)	7.35 (6.11-8.70)	8.50 (7.02-10.1)	10.1 (8.03-12.4)	11.3 (8.77-14.1)	12.5 (9.42-16.1)	14.0 (9.87-18.2)	16.1 (10.9-21.5)	17.9 (11.7-24.2)
20-day	7.25 (6.13-8.47)	8.16 (6.89-9.54)	9.65 (8.11-11.3)	10.9 (9.09-12.8)	12.6 (10.1-15.2)	13.9 (10.9-17.0)	15.2 (11.4-19.1)	16.6 (11.8-21.3)	18.5 (12.6-24.4)	20.0 (13.2-26.8)
30-day	9.03 (7.68-10.5)	9.99 (8.49-11.6)	11.5 (9.77-13.5)	12.8 (10.8-15.0)	14.6 (11.8-17.5)	16.0 (12.6-19.5)	17.4 (13.1-21.6)	18.7 (13.4-23.9)	20.5 (14.0-26.8)	21.8 (14.4-29.0)
45-day	11.2 (9.63-13.0)	12.3 (10.5-14.2)	13.9 (11.9-16.1)	15.3 (12.9-17.8)	17.2 (13.9-20.4)	18.7 (14.7-22.5)	20.1 (15.1-24.7)	21.4 (15.4-27.1)	23.0 (15.8-29.9)	24.1 (16.0-31.9)
60-day	13.1 (11.3-15.1)	14.2 (12.2-16.3)	15.9 (13.6-18.4)	17.4 (14.7-20.1)	19.4 (15.7-22.9)	21.0 (16.5-25.1)	22.4 (16.9-27.3)	23.7 (17.1-29.9)	25.2 (17.4-32.7)	26.2 (17.5-34.5)

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



NOAA Atlas 14, Volume 10, Version 3
Location name: Town of Waterford, Connecticut,
USA*

Latitude: 41.3325°, Longitude: -72.1669°

Elevation: 116 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 & aerals](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.03 (3.11-5.12)	4.82 (3.72-6.13)	6.12 (4.70-7.81)	7.20 (5.50-9.22)	8.68 (6.44-11.5)	9.79 (7.13-13.2)	11.0 (7.78-15.3)	12.3 (8.27-17.3)	14.3 (9.24-20.6)	15.9 (10.1-23.4)
10-min	2.85 (2.20-3.63)	3.41 (2.63-4.35)	4.34 (3.33-5.53)	5.10 (3.89-6.53)	6.15 (4.56-8.16)	6.94 (5.05-9.36)	7.77 (5.51-10.8)	8.72 (5.86-12.3)	10.1 (6.55-14.6)	11.3 (7.14-16.5)
15-min	2.24 (1.72-2.84)	2.68 (2.06-3.41)	3.40 (2.62-4.34)	4.00 (3.06-5.12)	4.82 (3.58-6.40)	5.44 (3.96-7.34)	6.09 (4.32-8.48)	6.84 (4.59-9.62)	7.94 (5.14-11.5)	8.85 (5.60-13.0)
30-min	1.58 (1.22-2.01)	1.89 (1.46-2.41)	2.40 (1.84-3.06)	2.82 (2.16-3.62)	3.40 (2.52-4.51)	3.84 (2.79-5.18)	4.29 (3.04-5.97)	4.82 (3.24-6.78)	5.59 (3.62-8.07)	6.22 (3.94-9.13)
60-min	1.02 (0.789-1.30)	1.22 (0.942-1.56)	1.55 (1.19-1.98)	1.82 (1.39-2.33)	2.20 (1.63-2.91)	2.48 (1.80-3.34)	2.77 (1.96-3.85)	3.11 (2.09-4.37)	3.60 (2.33-5.20)	4.01 (2.54-5.88)
2-hr	0.670 (0.522-0.845)	0.802 (0.624-1.01)	1.02 (0.789-1.29)	1.20 (0.923-1.52)	1.44 (1.08-1.90)	1.63 (1.20-2.18)	1.82 (1.30-2.52)	2.05 (1.38-2.86)	2.38 (1.55-3.41)	2.66 (1.69-3.86)
3-hr	0.518 (0.405-0.649)	0.620 (0.485-0.777)	0.786 (0.613-0.989)	0.924 (0.716-1.17)	1.11 (0.838-1.46)	1.26 (0.927-1.67)	1.41 (1.01-1.93)	1.58 (1.07-2.19)	1.84 (1.20-2.62)	2.06 (1.31-2.97)
6-hr	0.330 (0.261-0.410)	0.394 (0.311-0.490)	0.499 (0.393-0.622)	0.586 (0.459-0.733)	0.706 (0.536-0.915)	0.796 (0.592-1.05)	0.891 (0.644-1.21)	1.00 (0.683-1.37)	1.16 (0.764-1.64)	1.30 (0.834-1.86)
12-hr	0.203 (0.162-0.250)	0.242 (0.193-0.298)	0.306 (0.243-0.378)	0.359 (0.284-0.445)	0.432 (0.331-0.555)	0.487 (0.365-0.635)	0.545 (0.397-0.733)	0.612 (0.420-0.831)	0.711 (0.469-0.991)	0.793 (0.511-1.12)
24-hr	0.119 (0.096-0.145)	0.143 (0.115-0.174)	0.182 (0.146-0.222)	0.214 (0.171-0.263)	0.258 (0.199-0.329)	0.291 (0.220-0.377)	0.327 (0.240-0.437)	0.368 (0.254-0.496)	0.430 (0.285-0.594)	0.483 (0.312-0.677)
2-day	0.066 (0.054-0.080)	0.080 (0.065-0.097)	0.103 (0.084-0.125)	0.122 (0.099-0.149)	0.149 (0.116-0.188)	0.168 (0.128-0.216)	0.189 (0.141-0.252)	0.215 (0.149-0.286)	0.254 (0.169-0.347)	0.287 (0.186-0.398)
3-day	0.048 (0.039-0.057)	0.058 (0.047-0.069)	0.074 (0.060-0.089)	0.088 (0.071-0.106)	0.107 (0.084-0.134)	0.121 (0.093-0.154)	0.136 (0.101-0.180)	0.154 (0.107-0.204)	0.182 (0.122-0.248)	0.206 (0.134-0.284)
4-day	0.038 (0.031-0.046)	0.046 (0.038-0.055)	0.059 (0.048-0.071)	0.070 (0.057-0.084)	0.084 (0.066-0.106)	0.095 (0.073-0.121)	0.107 (0.080-0.141)	0.121 (0.085-0.160)	0.143 (0.096-0.194)	0.162 (0.105-0.222)
7-day	0.026 (0.021-0.031)	0.031 (0.025-0.036)	0.039 (0.032-0.046)	0.045 (0.037-0.054)	0.054 (0.043-0.067)	0.061 (0.047-0.077)	0.068 (0.051-0.089)	0.077 (0.054-0.100)	0.089 (0.060-0.120)	0.100 (0.066-0.137)
10-day	0.021 (0.017-0.025)	0.024 (0.020-0.029)	0.030 (0.025-0.036)	0.035 (0.029-0.042)	0.042 (0.033-0.051)	0.046 (0.036-0.058)	0.052 (0.039-0.067)	0.058 (0.041-0.075)	0.067 (0.045-0.089)	0.074 (0.048-0.100)
20-day	0.015 (0.012-0.017)	0.016 (0.014-0.019)	0.020 (0.016-0.023)	0.022 (0.018-0.026)	0.026 (0.021-0.031)	0.028 (0.022-0.035)	0.031 (0.023-0.039)	0.034 (0.024-0.044)	0.038 (0.026-0.050)	0.041 (0.027-0.055)
30-day	0.012 (0.010-0.014)	0.013 (0.011-0.016)	0.016 (0.013-0.018)	0.017 (0.014-0.020)	0.020 (0.016-0.024)	0.022 (0.017-0.027)	0.024 (0.018-0.029)	0.025 (0.018-0.033)	0.028 (0.019-0.037)	0.030 (0.020-0.040)
45-day	0.010 (0.008-0.012)	0.011 (0.009-0.013)	0.012 (0.010-0.014)	0.014 (0.011-0.016)	0.015 (0.012-0.018)	0.017 (0.013-0.020)	0.018 (0.014-0.022)	0.019 (0.014-0.025)	0.021 (0.014-0.027)	0.022 (0.014-0.029)
60-day	0.009 (0.007-0.010)	0.009 (0.008-0.011)	0.011 (0.009-0.012)	0.012 (0.010-0.013)	0.013 (0.010-0.015)	0.014 (0.011-0.017)	0.015 (0.011-0.018)	0.016 (0.011-0.020)	0.017 (0.012-0.022)	0.018 (0.012-0.023)

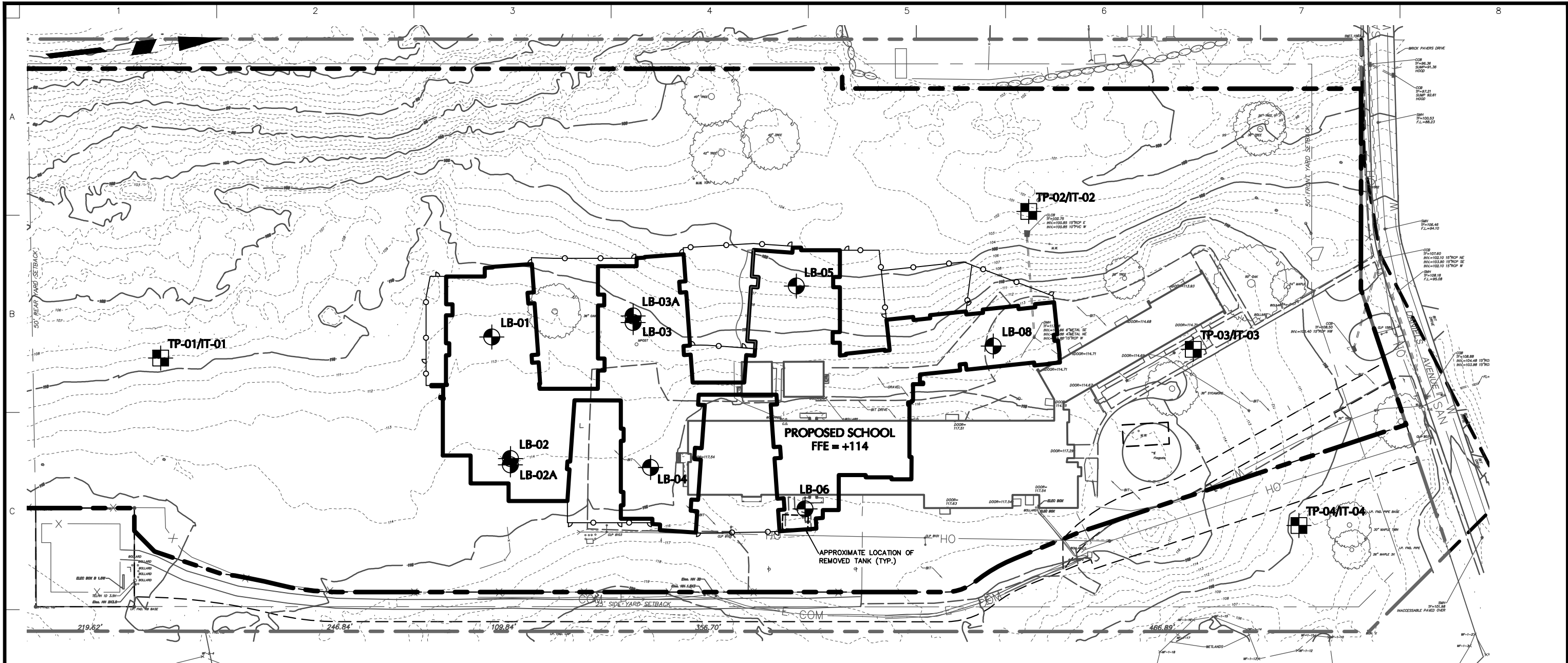
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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

APPENDIX D

Test Pit & Infiltration Logs



GENERAL NOTES

- BORING LOCATIONS ARE APPROXIMATE.
- SURVEY BACKGROUND FROM A PLAN TITLED "LOT LINE MODIFICATION SURVEY", PREPARED BY BENESCH DATED 28 MARCH 2024.
- SITE PLAN IS TAKEN FROM A PLAN TITLED "OVERALL SITE PLAN" PREPARED BY LANGAN, DATED 20 MARCH 2025.
- ELEVATIONS SHOWN ARE IN REFERENCE TO THE NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88).
- BORINGS LB-01, LB-02, LB-02A, LB-03, LB-03A, LB-04, LB-05, LB-06, AND LB-08 WERE PERFORMED BY GENERAL BORINGS, INC. BETWEEN 13 AND 14 MARCH 2025, UNDER THE FULL TIME OBSERVATION OF A LANGAN FIELD ENGINEER.

LEGEND



LB-01

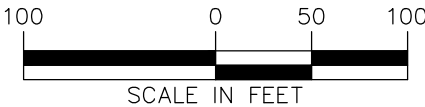
LANGAN BORING LOCATIONS



PROPOSED BUILDING FOOTPRINT



PROPERTY LINE



SCALE IN FEET

LANGAN

Langan CT, Inc.
555 Long Wharf Drive, 9th Floor
New Haven, CT 06511
T: 203.562.5771 F: 203.789.6142 www.langan.com

Project

LEARN

51 DANIELS AVE
WATERFORD, CT 06385
CONNECTICUT

Drawing Title

**EXPLORATION
LOCATION
PLAN**

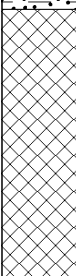
Project No.

140310301
Date
4/21/2025
Drawn By
OAC
Checked By
TSD

Drawing No.

5
Sheet **0** of **1**

Project		LEARN - Newman Architects		Project No.		140310301		Date		4/16/2025			
Location				51 Daniel's Ave, Waterford, Connecticut									
Excavation Company				Polster Industries, LLC				Elevation and Datum		Approx. el. + 109.0 (NAVD 88)			
Excavation Equipment				Kubota KX080-4 Mini Excavator				Depth		10.0 ft			
								Water Level - First		10.0 ▽			
								Water Level - Completion		N/A ▼			
Excavation Foreman				Ben Ignace				Field Engineer				Shawn OConnor	

SYMBOL	Elev. (ft)	DESCRIPTION	Depth Scale	SAMPLE		REMARKS
				Number	Type	
	+109.0		0			
	+108.0	Brown Silty fine SAND, trace fine gravel, trace root (moist) [TOPSOIL]	1			
		Brown medium to fine SAND, trace boulder, trace fine gravel, trace silt, trace brick, trace metal (moist) [FILL]	2			G-1 from 2ft to 2.5ft
	+104.0		3			
	+104.0	Dark brown SILT, trace medium to fine sand, trace root (moist) [BURIED TOPSOIL]	4			
	+103.0	Grayish brown fine to coarse SAND, trace coarse to fine gravel, trace silt (moist) [TILL]	5			Infiltration test performed at about 6ft below grade. G-2 from 5.5ft to 6ft
			6			Perched groundwater flowing in from test pit sidewall at 7ft; G-3 from 6.5ft to 7ft
			7			Mottling observed from 6ft to 10ft
			8			
			9			G-4 from 8.5ft to 9ft
			10			G-5 from 9.5ft to 10ft
	+99.0	End of Test Pit at 10.0ft.	11			Groundwater pooling at 10ft. Bottom of test pit at 10ft. Test pit backfilled to grade in lifts of the excavated material and tamped with the excavator bucket.
			12			
			13			
			14			
			15			
			16			
			17			
			18			
			19			
			20			

LANGAN

INFILTRATION TESTS							
IT-04 in TP-04 Basin 5A							
PROJECT LEARN				PROJECT NO. 140310301			
LOCATION Waterford, CT				DATE 16 April 2025			
INSPECTOR Shawn O'Connor				WEATHER Partly Sunny, 45-52°F			
PRESOAK	TIME	DEPTH OF HOLE (INCH)		ELEVATION AND DATUM			
	Start	10:23	24	Surface Elevation	Approx.	109	(NAVD88)
	End	11:40	24	Top of Hole Elevation	Approx.	105	(NAVD88)
				Bottom of Hole Elevation	Approx.	103	(NAVD88)
METHOD OF INFILTRATION TEST							
TP-04 was advanced to a depth of about 10 feet below existing grades. The test pit benched to the side of the pit about 4 feet below grade. A 24-inch deep and about 6-inch diameter hole was dug by hand with a post hole digger. A 25-inch long pipe with a 4-inch diameter was inserted into the hole. The hole was presoaked for about 1 hour with 24-inches of water. At the end of the presoak, about 16-inches of water had infiltrated. For each infiltration test, the hole was filled with water to a predetermined depth. Then, after every 15 minutes, the depth to water was measured to calculate the total drop of water over that time period. The tables below outline the calculations for determining the average rate in which the water dissipated.							
	TIME (MIN)	DEPTH TO WATER (IN)	DROP (IN)	RATE (IN/MIN)	RATE (IN/HOUR)	SOIL CONDITIONS	
TEST 1 @ 11:56	0	1	-	-		Grayish brown fine to coarse SAND, trace coarse to fine gravel, trace silt [TILL]	
	15	10.5	9.5	0.63	38		
	30	13.5	3	0.20	12		
	45	15.5	2	0.13	8		
	60	16.5	1	0.07	4		
	Average Rate:				15.5		
	TIME (MIN)	WATER LEVEL (IN)	DROP (IN)	RATE (IN/MIN)	RATE (IN/HOUR)	SOIL CONDITIONS	
TEST 2 @ 1:05	0	1	-	-		Grayish brown fine to coarse SAND, trace coarse to fine gravel, trace silt [TILL]	
	15	9.5	8.5	0.57	34.0		
	30	12.5	3	0.20	12.0		
	45	14.5	2	0.13	8.0		
	60	16	1.5	0.10	6.0		
	Average Rate:				15.0		
	TIME (MIN)	WATER LEVEL (IN)	DROP (IN)	RATE (IN/MIN)	RATE (IN/HOUR)	SOIL CONDITIONS	
TEST 3 @ 2:06	0	1	-	-		Grayish brown fine to coarse SAND, trace coarse to fine gravel, trace silt [TILL]	
	15	9	8	0.53	32.0		
	30	12.5	3.5	0.23	14.0		
	-	-	-	-	-		
	-	-	-	-	-		
	Average Rate:				23.0		
				Average Rate:	17.8	inches/hour	