DRAINAGE REPORT
Stardust LLC
20 Tariffville Road
Simsbury, CT

May 26, 2021

Prepared for:

Stardust, LLC
133 Holcomb Street
Simsbury, Connecticut 06070

&

LADA P.C.
104 West Street
Simsbury, CT 06070

Project No. 2021-011

Prepared by:

J.R. Russo & Associates, LLC
Land Surveyors & Professional Engineers
P.O. Box 938
East Windsor, CT 06088
(860) 623-0569

Table of Contents

I. Introduction

- A. Project Description
- B. Existing Conditions
- C. Soil Investigations

II. System Design

- A. Proposed System
- B. Peak Discharge Attenuation
  - 1. Methodology
  - 2. Pre-Development Hydrology
  - 3. Post-Development Hydrology
- D. Stormwater Treatment
- E. Groundwater Recharge
- F. Pipe Sizing
- G. Pipe Outfall Protection

III. Summary and Conclusions

<u>Appendices</u>

Appendix 1: Rainfall Data
Appendix 2: NRCS Soils Information
Appendix 3: Test Pit Logs & Permeability Test Results
Appendix 4: Drainage Area Maps
Appendix 5: HydroCAD Analysis
Appendix 6: Miscellaneous Calculations

I. INTRODUCTION

A. Project Description

Stardust LLC is proposing a self-storage facility comprised of ten one-story buildings totaling 47,889 square feet at 20 Tariffville Road in Simsbury. The development will result in an increase in impervious area of 2.0 acres. Runoff from the new impervious area will be directed to a new infiltration basin designed to provide treatment and ground water recharge in accordance with the Connecticut Stormwater Quality Manual and Town of Simsbury Stormwater Articles. In addition, runoff from the existing parking lot at the site will be collected and diverted through a new hydrodynamic separator to provide treatment of the stormwater prior to discharge where no treatment was previously provided.

B. Existing Conditions

The subject parcel consists of 10.2 acres at 20 Tariffville Road in Simsbury. The parcel fronts Tariffville Road to the south, St. John's Place to the west, and the Farmington River to the east. The western portion of the site is currently developed with the Old Well Tavern restaurant, a residential structure, and a 148 space parking lot. A second residential building and garage are located on the northern end of the site and accessed by two gravel driveways, one off of the northern corner of the parking lot and a second one that comes off of Tariffville Road. The second driveway runs just west of the top of the bank that leads down into the floodplain of the Farmington River. The central portion of the parcel between the parking lot and the gravel drive at the top of the slope is maintained as lawn. The eastern portion of the parcel is located within the floodplain and consists of a combination of woods and open field. The proposed development area is limited to the undeveloped central portion of the site and the very eastern edge of the existing parking lot.

The project parcel does not contain a formal drainage system. The majority of the runoff from area to the north and east of the restaurant building and parking lot are directed to an existing 15" culvert at the southeast corner of the parking lot which travels under the gravel driveway and discharges at the edge of the floodplain in the southeast corner of the parcel. Runoff from the northern and central portions of the parcel sheet flow easterly toward the Farmington River. The areas to the west and south of the restaurant building sheet flow into the surrounding streets.

C. Soils Investigations

Based on a review of the USDA Soil Survey of Connecticut, the soils in the area to be developed consist of several soils; including Urban Land, Merrimac fine sandy loam, Agawam fine sandy loam, and Enfield silt loam (see Soils Map in Appendix 2). The USDA Soil Survey defines groups of soils into Hydrologic Soil Groups (HSG) according to their runoff-producing characteristics. Soils are assigned to four groups (A, B, C, and D Groups). In group A, are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They typically are deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a hardpan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other nearly impervious material. The classification of the Merrimac fine sandy loam is HSG A and the others are HSG B.

On March 8, 2021, a series of 8 test pits were performed in the area of the proposed development to confirm the existing soil conditions. Test pits were excavated to depths ranging from 76-90 inches. Soils encountered include 10-24 inches of topsoil over sandy loam subsoils to a depth of 24-44 inches, overlying fine to coarse sand and gravel. Soil mottling indicative of the seasonal high water table was encountered in test pits TP4 and TP6 at depths of 80 and 86 inches, respectively. No evidence of the water table was encountered in the other test pits. Test pit logs are provided in Appendix 3.

Soil samples were collected from test pits 1 through 4 at depths ranging from 24 to 36 inches. These samples were submitted to New England Materials Testing Lab, LLC for permeability testing by ASTM D2434. Calculated permeabilities ranged from 0.522 in/hr for the sample collected in TP4 to 12.35 in/hr for the sample collected in TP2. Permeability test results are also provided in Appendix 3.

II. System Design

A. Proposed System

The proposed project will result in the addition of 2 acres of new impervious area at the site. In order to mitigate the increase in runoff resulting from the additional impervious area a new infiltration basin will be constructed along the eastern side of the development to provide retention and treatment prior to discharge. In addition, runoff from the existing parking lot will be collected in a series of new inlets and diverted through a new stormwater treatment unit. Discharge from the infiltration basin and stormwater treatment unit will be conveyed to a new manhole that will discharge to a new riprap outfall to replace the existing culvert outfall at the edge of the floodplain in the southeast corner of the site.

As discussed above, several test pits were completed at the site to verify soil conditions. Test pits TP1, TP2 and TP3 were all located within the limits of the proposed infiltration basin. Samples collected from these test pits at depths consistent with the proposed bottom of the basin were subsequently tested for permeability. The resulting permeabilities were 2.34 in/hr (TP1), 12.35 in/hr (TP2) and 8.5 in/hr (TP3). As a conservative measure, the slowest permeability rate of 2.34 in/hr was used as the basis for the design infiltration rate. This rate was further reduced by 50% to account for potential clogging resulting in a final design infiltration rate for the basin of 1.17 inches/hour.

The infiltration basin has been designed in accordance with the Connecticut Stormwater Quality Manual. Pretreatment will be provided by a level stone spreader at the edge of the pavement and a 25-foot wide vegetated filter strip leading to the basin. The bottom of the basin will be set at elevation 152 which is in excess of the required 3 feet of separation to the seasonal high water table that was encountered in the test pits completed in the vicinity of the basin. The Water Quality Volume (WQV) for the area contributing to the infiltration basin was calculated to be

7,890 cubic feet (see Appendix 6). The proposed basin storage capacity below the outlet is 16,183 cubic feet which exceeds the required WQV (see basin characteristics in Appendix 5). Flows from larger storm events in excess of the storage and infiltration capacity of the basin will discharge via a 15” culvert that will connect to the manhole which ultimately discharges to the edge of the floodplain. Based on the storage volume, bottom area and design infiltration rate, the time to drain the proposed basin was calculated to be 31.7 hours (see Appendix 6), which is less than the required maximum allowable of 72 hours.

B. Peak Discharge Attenuation

1. *Methodology*

Peak runoff flow rates were determined for pre- and post-development conditions using Applied Microcomputer System’s HydroCAD™ Stormwater Modeling System. This computer software employs the SCS Technical Release 55 and 20 (TR-55 & TR-20) methodology. The potential stormwater impacts downstream were evaluated for the 2-yr, 10-yr, 25-yr, and 100-yr; 24-hour storm events. The rainfall for these storm events was taken from NOAA Atlas 14 provided in Appendix 1. Based on the present drainage patterns, all runoff from the proposed development area flows easterly into the Farmington River. As a result, the edge of the floodplain to the Farmington River was selected as the design point.

The analyses area was limited to approximately 7.1 acres which contribute runoff across the development area as shown on the Drainage Area Maps in Appendix 4. Portions of the site to remain unchanged and that do not contribute runoff across the development area (i.e. the areas to the south and west of the restaurant) were excluded from the analyses.

2. Pre-Development Hydrology

The pre-development site was divided into two subcatchments. Subcatchment E1 includes the area that discharges directly to the edge of the design point. Subcatchment E2 includes the remaining portion of the analyses area that drains through the culvert under the gravel driveway at the southeast corner of the site. The pre-development drainage area map is provided in Appendix 4. The pre-development runoff characteristics of the contributing areas are provided on the HydroCAD data sheets in Appendix 5. The calculated peak discharge rates and volumes for the design storms are summarized in Table 1 and 2 below.

3. *Post-Development Hydrology*

The same design point for the pre-development analysis was used for the post development analysis. The post development site was divided into three subcatchments. Subcatchment S1 includes the area that will continue to drain overland directly to the design point (i.e. floodplain). Subcatchment S2 includes the area that will drain to the new catch basins at the southeast corner of the existing parking lot. Subcatchment S3 includes the remainder of the analyses area that will discharge to the infiltration basin. Subcatchment areas are shown on the post development drainage area map in Appendix 4. The post development runoff characteristics of the subcatchments are provided on the HydroCAD data sheets in Appendix 5.

Using the characteristics for the subcatchments and infiltration basin described above, the Post Development peak flow rates and volumes for the site were calculated for the design storms. These are summarized in Tables 1 and 2 below. As shown in Table 1, the post-development peak flows at design point are less than the pre-development peak flows for all design storms. Similarly, Table 2 demonstrates that the proposed stormwater management system will result in a decrease in the overall runoff volume discharged from the site for all of the design storms. In addition, the calculations indicate that all runoff from the new development area intercepted by the infiltration basin will be completely recharged with no discharge from the basin for storms up to and including the 2-year design storm.

TABLE 1 – COMPARISON OF PRE- & POST-DEVELOPMENT DISCHARGE RATES (CFS) TO DESIGN POINT

	2-year	10-year	25-year	100-year
Pre-Development	4.1	9.5	13.6	21.4
Post Development	2.7	7.9	12.8	20.7

TABLE 2 – COMPARISON OF PRE- & POST-DEVELOPMENT DISCHARGE VOLUME (AC-FT) TO DESIGN POINT

	2-year	10-year	25-year	100-year
Pre-Development	0.484	1.198	1.720	2.610
Post Development	0.320	1.004	1.570	2.508

C. *Stormwater Treatment*

As discussed above, runoff from the development area will sheet flow from the edge of the parking lot across a 25-foot wide vegetated filter strip and into the infiltration basin. The filter strip will provide pre-treatment and the infiltration basin is considered by the DEEP as a primary treatment practice for providing water quality renovation prior to discharge.

In addition, runoff from the existing parking lot, which previously was discharged to the floodplain of the Farmington River untreated, will be collected and diverted through a new water quality unit (CDS Model 2015-4-C). This treatment unit was sized by the manufacturer to provide the required Water Quality Flow rate, as well as provide a net annual removal of total suspended solids (TSS) in excess of 80%. Sizing calculations for the unit are provided in Appendix 5.

D. Groundwater Recharge

The infiltration basin was also designed to provide the required groundwater recharge by infiltrating stormwater back into the ground. For the purpose of determining the Groundwater Recharge Volume (GRV), the Hydraulic Soil Group underlying the development area was conservatively assumed to be all HSG A. Using this category, the GRV is calculated as follows:

GRV = (D)(I)/12 where GRV = Groundwater Recharge Volume (acre-ft)
D = depth of runoff to be recharged = 0.6 inches
I = new impervious area = 2.00 acres

GRV = (0.6)(2.00)/12
= 0.100 ac-ft = 4,356 cf

As discussed above, the storage capacity of the infiltration basin below the outlet invert is 16,183 cubic feet, which exceeds the GRV requirement.

E. Pipe Sizing

The piping proposed at the site consists of smooth bore high density polyethylene corrugated plastic pipe (HDPE). The roughness coefficient used for this pipe type is 0.012. The analysis provided in Appendix 5 indicates headwater elevation at each pipe inlet for the design storms and compares it to the flood elevation, which corresponds to the top of frame. The calculations indicate that the piping between the catch basins and the manhole has sufficient capacity to convey the 25-year storm event without surcharging out of the top of the basins. Similarly, the calculations indicate that the pipe from the drain manhole to the outlet is sufficient to convey flows from the 100-year design storm, which is necessary for the infiltration basin outlet to function as designed.

F. Pipe Outfall Protection

Outfall protection for the pipe discharge at the edge of the floodplain will consist of a modified riprap apron. The apron was designed for the 100-year design storm in accordance with the requirements of the Table 8.6.1 of the CT DOT Drainage Manual. Calculations are provided in Appendix 6.

III. SUMMARY AND CONCLUSIONS

The proposed stormwater management system for the new development includes sheet flow from the edge of the pavement across a grass filter strip to an infiltration basin. The discussion above indicates that the basin will recharge in excess of the required WQV and GRV and result in a decrease in both peak discharge rate and volume from the site. In addition, runoff from the existing parking lot, which was previously discharged untreated, will be collected and diverted through a new stormwater treatment unit. In conclusion, the results of this report indicate that the proposed development will result in a positive impact to downstream properties.

Appendix 1:

RAINFALL DATA

NOAA Atlas 14, Volume 10, Version 3
Location name: Simsbury, Connecticut, USA*
Latitude: 41.8949°, Longitude: -72.7808°
Elevation: 149.24 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	0.348 (0.267-0.450)	0.416 (0.319-0.539)	0.528 (0.404-0.686)	0.621 (0.473-0.812)	0.749 (0.553-1.02)	0.845 (0.613-1.18)	0.946 (0.667-1.37)	1.06 (0.710-1.58)	1.22 (0.788-1.88)	1.35 (0.853-2.13)
10-min	0.493 (0.379-0.637)	0.590 (0.453-0.763)	0.749 (0.572-0.973)	0.880 (0.670-1.15)	1.06 (0.784-1.45)	1.20 (0.868-1.68)	1.34 (0.945-1.95)	1.50 (1.01-2.24)	1.73 (1.12-2.67)	1.91 (1.21-3.02)
15-min	0.580 (0.445-0.749)	0.694 (0.532-0.898)	0.880 (0.674-1.14)	1.03 (0.788-1.35)	1.25 (0.922-1.71)	1.41 (1.02-1.97)	1.58 (1.11-2.29)	1.76 (1.18-2.63)	2.03 (1.31-3.14)	2.25 (1.42-3.55)
30-min	0.782 (0.601-1.01)	0.939 (0.721-1.22)	1.20 (0.916-1.55)	1.41 (1.07-1.84)	1.71 (1.26-2.33)	1.93 (1.40-2.70)	2.16 (1.52-3.14)	2.42 (1.62-3.60)	2.78 (1.80-4.30)	3.08 (1.95-4.87)
60-min	0.984 (0.756-1.27)	1.19 (0.910-1.53)	1.51 (1.16-1.97)	1.79 (1.36-2.33)	2.16 (1.60-2.96)	2.45 (1.77-3.42)	2.74 (1.93-3.98)	3.07 (2.06-4.58)	3.53 (2.29-5.47)	3.91 (2.48-6.18)
2-hr	1.27 (0.980-1.63)	1.52 (1.18-1.96)	1.94 (1.49-2.50)	2.28 (1.75-2.96)	2.75 (2.05-3.75)	3.11 (2.27-4.34)	3.48 (2.48-5.07)	3.92 (2.64-5.82)	4.57 (2.97-7.04)	5.12 (3.25-8.05)
3-hr	1.46 (1.13-1.87)	1.75 (1.36-2.25)	2.23 (1.73-2.87)	2.63 (2.02-3.40)	3.18 (2.38-4.33)	3.59 (2.64-5.00)	4.03 (2.89-5.86)	4.55 (3.07-6.74)	5.35 (3.48-8.22)	6.03 (3.84-9.45)
6-hr	1.83 (1.43-2.33)	2.22 (1.73-2.82)	2.86 (2.22-3.65)	3.38 (2.62-4.35)	4.11 (3.09-5.57)	4.64 (3.44-6.46)	5.23 (3.78-7.61)	5.95 (4.03-8.76)	7.07 (4.61-10.8)	8.05 (5.14-12.6)
12-hr	2.24 (1.77-2.83)	2.76 (2.17-3.49)	3.62 (2.83-4.59)	4.32 (3.36-5.51)	5.29 (4.01-7.14)	6.00 (4.48-8.33)	6.79 (4.96-9.88)	7.78 (5.28-11.4)	9.34 (6.11-14.2)	10.7 (6.85-16.6)
24-hr	2.61 (2.07-3.28)	3.28 (2.60-4.12)	4.37 (3.45-5.51)	5.28 (4.14-6.69)	6.52 (4.99-8.78)	7.43 (5.59-10.3)	8.45 (6.23-12.3)	9.76 (6.65-14.2)	11.9 (7.80-18.0)	13.8 (8.84-21.3)
2-day	2.92 (2.33-3.64)	3.73 (2.97-4.65)	5.06 (4.01-6.33)	6.15 (4.85-7.75)	7.66 (5.90-10.3)	8.76 (6.64-12.1)	9.99 (7.46-14.6)	11.7 (7.97-16.9)	14.4 (9.49-21.7)	16.9 (10.9-26.0)
3-day	3.19 (2.55-3.95)	4.08 (3.26-5.06)	5.54 (4.41-6.90)	6.74 (5.34-8.46)	8.41 (6.50-11.3)	9.61 (7.32-13.3)	11.0 (8.23-16.0)	12.8 (8.79-18.6)	16.0 (10.5-24.0)	18.8 (12.1-28.7)
4-day	3.43 (2.76-4.25)	4.39 (3.52-5.43)	5.95 (4.75-7.39)	7.24 (5.75-9.06)	9.02 (6.99-12.0)	10.3 (7.87-14.2)	11.8 (8.83-17.1)	13.8 (9.44-19.9)	17.1 (11.3-25.6)	20.1 (13.0-30.7)
7-day	4.12 (3.32-5.06)	5.20 (4.19-6.40)	6.96 (5.59-8.61)	8.43 (6.73-10.5)	10.4 (8.13-13.9)	11.9 (9.12-16.3)	13.6 (10.2-19.6)	15.8 (10.9-22.7)	19.5 (12.9-29.1)	22.8 (14.8-34.7)
10-day	4.80 (3.89-5.88)	5.94 (4.81-7.29)	7.81 (6.29-9.62)	9.36 (7.50-11.6)	11.5 (8.97-15.2)	13.0 (10.0-17.7)	14.8 (11.1-21.2)	17.1 (11.8-24.5)	20.9 (13.9-31.1)	24.3 (15.8-36.9)
20-day	6.93 (5.65-8.43)	8.12 (6.61-9.90)	10.1 (8.17-12.3)	11.7 (9.43-14.4)	13.9 (10.9-18.1)	15.6 (11.9-20.8)	17.4 (13.0-24.4)	19.7 (13.7-27.9)	23.3 (15.5-34.4)	26.5 (17.2-40.0)
30-day	8.72 (7.14-10.6)	9.94 (8.13-12.1)	11.9 (9.71-14.5)	13.6 (11.0-16.6)	15.8 (12.4-20.4)	17.5 (13.4-23.2)	19.3 (14.4-26.7)	21.5 (15.0-30.4)	24.8 (16.6-36.5)	27.6 (18.0-41.5)
45-day	11.0 (9.02-13.2)	12.2 (10.0-14.8)	14.3 (11.7-17.3)	16.0 (13.0-19.5)	18.3 (14.3-23.3)	20.1 (15.4-26.2)	21.9 (16.2-29.8)	23.9 (16.7-33.6)	26.7 (17.9-39.0)	28.9 (18.9-43.4)
60-day	12.8 (10.6-15.5)	14.1 (11.6-17.0)	16.3 (13.3-19.7)	18.0 (14.7-22.0)	20.5 (16.1-25.9)	22.3 (17.1-29.0)	24.2 (17.8-32.5)	26.0 (18.3-36.5)	28.4 (19.1-41.4)	30.1 (19.7-45.1)

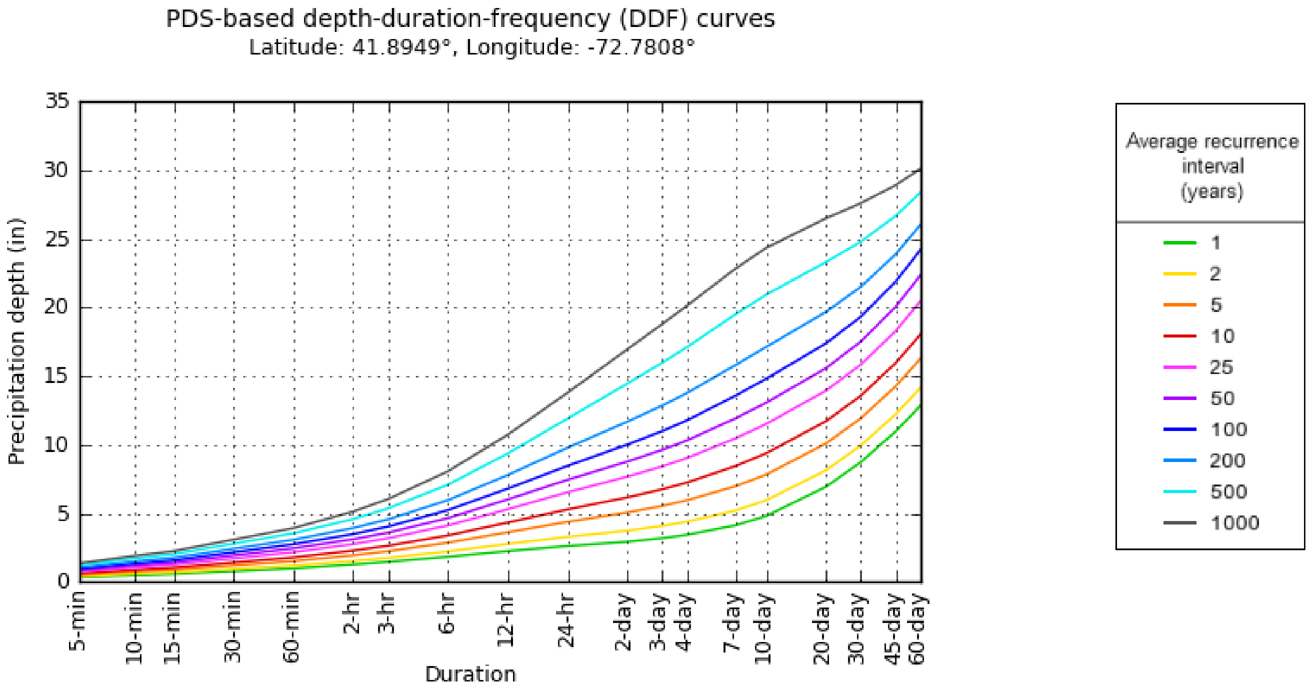
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

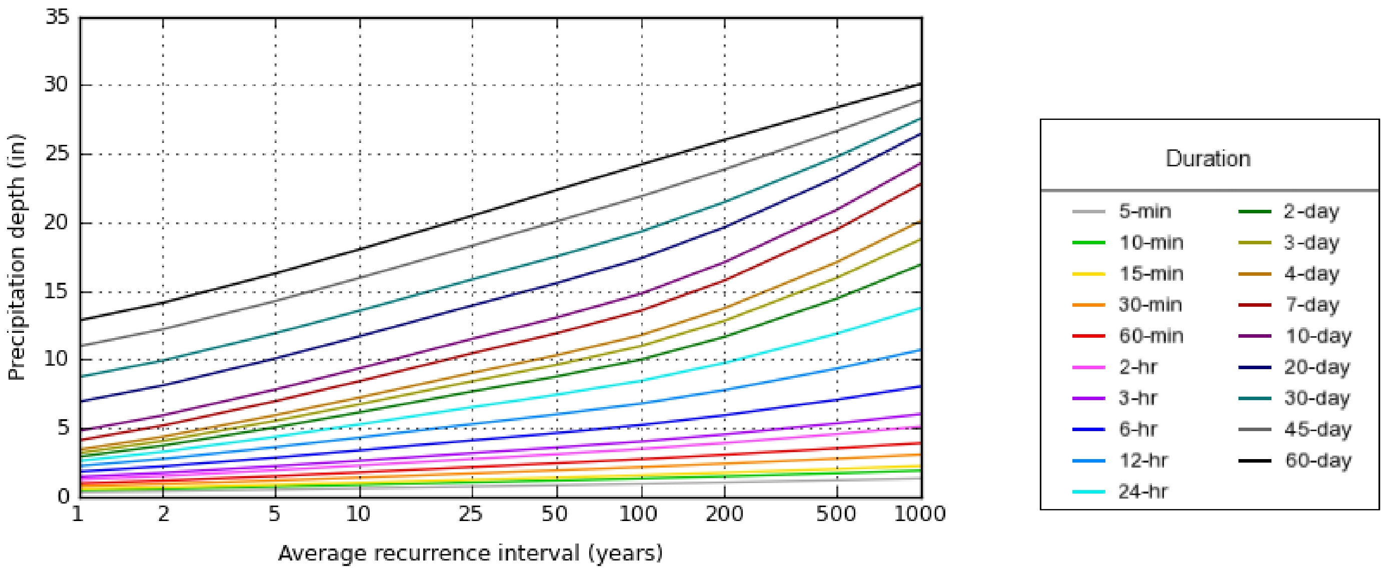
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper 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



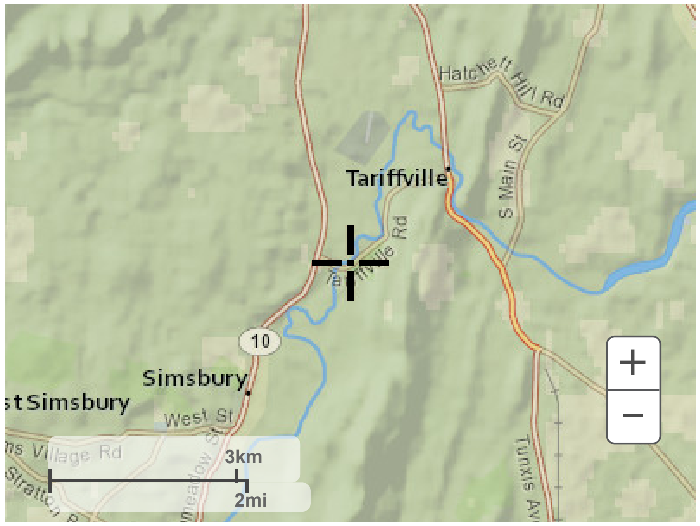


NOAA Atlas 14, Volume 10, Version 3 Created (GMT): Tue Apr 27 13:02:31 2021

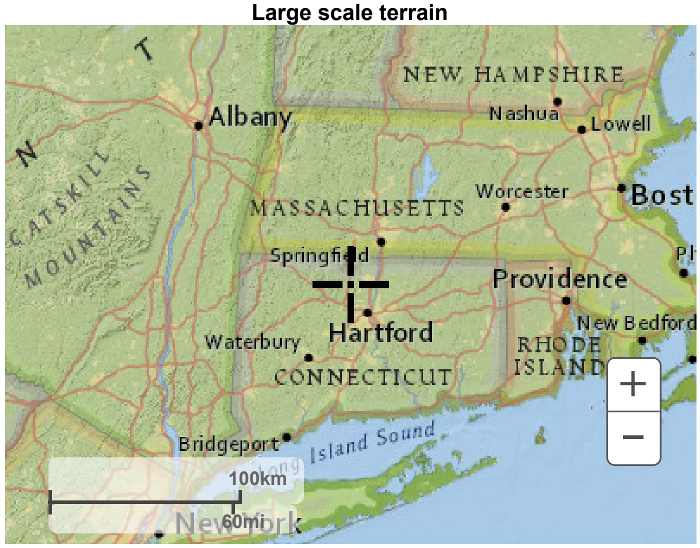
Back to Top

Maps & aerials

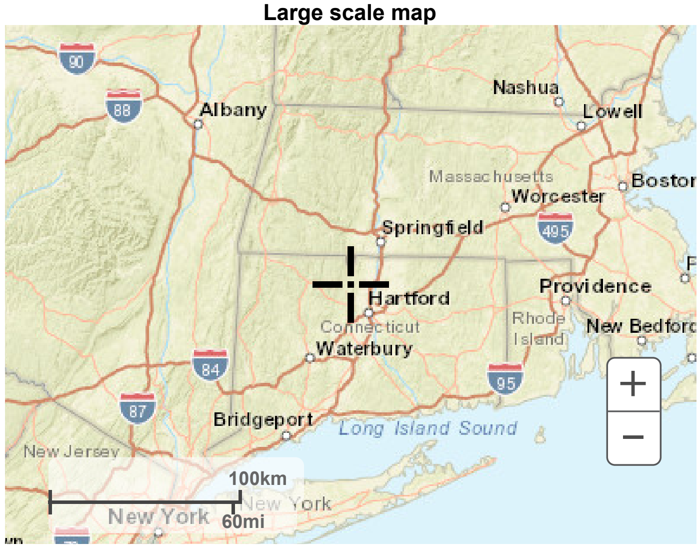
Small scale terrain



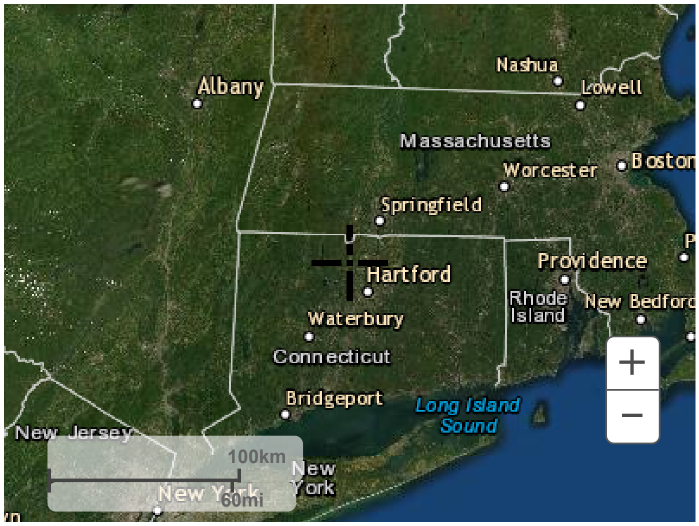
Large scale terrain



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

Disclaimer

Appendix 2:

NRCS SOILS INFORMATION

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for

State of Connecticut

April 27, 2021

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.......... 2
How Soil Surveys Are Made.......... 5
Soil Map.......... 8
Soil Map.......... 9
Legend.......... 10
Map Unit Legend.......... 11
Map Unit Descriptions.......... 11
State of Connecticut.......... 13
29A—Agawam fine sandy loam, 0 to 3 percent slopes.......... 13
34A—Merrimac fine sandy loam, 0 to 3 percent slopes.......... 14
100—Suncook loamy fine sand.......... 16
101—Occum fine sandy loam.......... 18
102—Pootatuck fine sandy loam.......... 19
108—Saco silt loam.......... 21
306—Udorthents-Urban land complex.......... 23
307—Urban land.......... 24
704A—Enfield silt loam, 0 to 3 percent slopes.......... 25
W—Water.......... 27
References.......... 28

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map

Map Scale: 1:2,800 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:12,000.

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: State of Connecticut
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 24, 2019—Oct 24, 2019

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
29A	Agawam fine sandy loam, 0 to 3 percent slopes	3.9	17.4%
34A	Merrimac fine sandy loam, 0 to 3 percent slopes	3.2	14.3%
100	Suncook loamy fine sand	1.1	4.8%
101	Occum fine sandy loam	3.6	16.0%
102	Pootatuck fine sandy loam	0.0	0.2%
108	Saco silt loam	2.4	10.6%
306	Udorthents-Urban land complex	0.2	0.7%
307	Urban land	2.8	12.4%
704A	Enfield silt loam, 0 to 3 percent slopes	2.5	10.9%
W	Water	2.8	12.7%
Totals for Area of Interest		**22.4**	**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.

State of Connecticut

29A—Agawam fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqw
Elevation: 0 to 1,040 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Agawam

Setting

Landform: Outwash plains, kame terraces, kames, moraines, outwash terraces
Landform position (two-dimensional): Backslope, shoulder, footslope, summit
Landform position (three-dimensional): Side slope, crest, tread, riser, rise, dip
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits derived from gneiss, granite, schist, and/or phyllite

Typical profile

Ap - 0 to 11 inches: fine sandy loam
Bw1 - 11 to 16 inches: fine sandy loam
Bw2 - 16 to 26 inches: fine sandy loam
2C1 - 26 to 39 inches: loamy fine sand
2C2 - 39 to 55 inches: loamy fine sand
2C3 - 55 to 65 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 15 to 35 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: B
Ecological site: F145XY008MA - Dry Outwash

Hydric soil rating: No

Minor Components

Ninigret

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

Windsor

Percent of map unit: 4 percent
Landform: Outwash plains, outwash terraces, deltas, dunes
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Walpole

Percent of map unit: 3 percent
Landform: Outwash plains, depressions, outwash terraces, depressions, deltas
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Hinckley

Percent of map unit: 3 percent
Landform: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

34A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent

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

Description of Merrimac

Setting

Landform: Kames, eskers, moraines, outwash terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Kames, deltas, outwash plains, eskers
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Moraines, outwash plains, outwash terraces, stream terraces, kames, eskers
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Deltas, dunes, outwash plains, outwash terraces
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

100—Suncook loamy fine sand

Map Unit Setting

National map unit symbol: 9ljl
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Suncook

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Sandy alluvium

Typical profile

Ap - 0 to 7 inches: loamy fine sand
C1 - 7 to 15 inches: stratified coarse sand to loamy fine sand
C2 - 15 to 22 inches: stratified coarse sand to loamy fine sand

C3 - 22 to 32 inches: stratified coarse sand to loamy fine sand
C4 - 32 to 42 inches: stratified coarse sand to loamy fine sand
C5 - 42 to 65 inches: stratified gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 99.62 in/hr)
Depth to water table: About 60 to 72 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F144AY006CT - High Floodplain Levee
Hydric soil rating: No

Minor Components

Occum

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

Pootatuck

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

Unnamed, no flooding

Percent of map unit: 4 percent
Hydric soil rating: No

Rippowam

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Saco

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

101—Occum fine sandy loam

Map Unit Setting

National map unit symbol: 9ljm
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Occum

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-loamy alluvium

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: sandy loam
C1 - 28 to 32 inches: stratified very gravelly coarse sand to loamy fine sand
C2 - 32 to 42 inches: stratified very gravelly coarse sand to loamy fine sand
C3 - 42 to 65 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 60 to 72 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F144AY010NH - Sandy High Floodplain
Hydric soil rating: No

Minor Components

Suncook

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

Pootatuck

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

Rippowam

Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Agawam

Percent of map unit: 5 percent
Landform: Outwash plains, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

102—Pootatuck fine sandy loam

Map Unit Setting

National map unit symbol: 9ljn
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Pootatuck

Setting

Landform: Flood plains
Down-slope shape: Linear

Across-slope shape: Concave
Parent material: Coarse-loamy alluvium

Typical profile

Ap - 0 to 4 inches: fine sandy loam
Bw1 - 4 to 16 inches: fine sandy loam
Bw2 - 16 to 21 inches: fine sandy loam
Bw3 - 21 to 29 inches: sandy loam
C1 - 29 to 35 inches: stratified very gravelly coarse sand to loamy fine sand
C2 - 35 to 40 inches: stratified very gravelly coarse sand to loamy fine sand
C3 - 40 to 65 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Available water capacity: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Ecological site: F144AY012CT - Sandy Low Floodplain
Hydric soil rating: No

Minor Components

Suncook

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

Occum

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

Lim

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Rippowam

Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear

Across-slope shape: Concave
Hydric soil rating: Yes

Limerick

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Saco

Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

108—Saco silt loam

Map Unit Setting

National map unit symbol: 9ljv
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Saco

Setting

Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-silty alluvium

Typical profile

A - 0 to 12 inches: silt loam
Cg1 - 12 to 32 inches: silt loam
Cg2 - 32 to 48 inches: silt loam
2Cg3 - 48 to 60 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: FrequentNone
Frequency of ponding: Frequent
Available water capacity: High (about 10.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: B/D
Ecological site: F144AY016MA - Very Wet Low Floodplain
Hydric soil rating: Yes

Minor Components

Lim
Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Limerick
Percent of map unit: 5 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Winooski
Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Rippowam
Percent of map unit: 3 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Hadley
Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Bash
Percent of map unit: 2 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

306—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 9lmg
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 50 percent
Urban land: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Drift

Typical profile

A - 0 to 5 inches: loam
C1 - 5 to 21 inches: gravelly loam
C2 - 21 to 80 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to high (0.00 to 1.98 in/hr)
Depth to water table: About 54 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Unnamed, undisturbed soils

Percent of map unit: 8 percent
Hydric soil rating: No

Udorthents, wet substratum

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

Rock outcrop

Percent of map unit: 2 percent
Hydric soil rating: No

307—Urban land

Map Unit Setting

National map unit symbol: 9lmh
Elevation: 0 to 2,000 feet
Mean annual precipitation: 43 to 56 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 185 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H - 0 to 6 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Unnamed, undisturbed soils

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

Udorthents, wet substratum

Percent of map unit: 10 percent
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

704A—Enfield silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2y07p
Elevation: 0 to 1,200 feet
Mean annual precipitation: 43 to 54 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 140 to 185 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Enfield

Setting

Landform: Outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-silty eolian deposits over sandy and gravelly glaciofluvial deposits derived from granite, schist, and/or gneiss

Typical profile

Ap - 0 to 7 inches: silt loam
Bw1 - 7 to 15 inches: silt loam
Bw2 - 15 to 25 inches: silt loam
2C - 25 to 60 inches: stratified very gravelly coarse sand to loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 16 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Ecological site: F145XY009CT - Well Drained Outwash
Hydric soil rating: No

Minor Components

Haven

Percent of map unit: 5 percent
Landform: Outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Tisbury

Percent of map unit: 5 percent
Landform: Valley trains, outwash terraces, outwash plains, deltas
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Kames, moraines, outwash terraces, outwash plains, kame terraces
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Side slope, crest, tread
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Raypol

Percent of map unit: 2 percent
Landform: Depressions, drainageways
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

W—Water

Map Unit Composition

Water: 100 percent

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

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Appendix 3:

TEST PIT LOGS &
PERMEABILITY TEST RESULTS

Test Pit Logs
20 Tariffville Road, Simsbury, CT
3/28/2021

TP#1 0” – 10” Sandy Loam Topsoil 10” – 38” Brown Loamy Sand 38” – 58” Medium to Coarse Sand & Gravel 58” – 76” Tan Fine Sand No Mottling No Water No Ledge Permeability Sample Depth = 24”-30” Permeability Rate = 2.34 in/hr	TP5 0” – 20” Sandy Loam Topsoil 20” – 40” Red/Brown Sandy Loam 40” – 58” Tan Fine to Coarse Sand 58” – 84” Fine to Coarse Sand & Gravel No Mottling No Water No Ledge Permeability Sample Depth = 24”-36” Permeability Rate = 5.03 in/hr
TP2 0” – 10” Sandy Loam Topsoil 10” – 24” Brown Loamy Sand 24” – 51” Fine to Medium Tan Sand 51” – 70“ Medium to Coarse Sand & Gravel 70” – 84” Tan Fine Sand No Mottling No Water No Ledge Permeability Sample Depth = 30”-36” Permeability Rate = 12.35 in/hr	TP6 0” – 10” Sandy Loam Topsoil 10” – 40” Red/Brown Sandy Loam 40” – 68” Tan Fine to Medium Sand 68” – 96” Fine to Coarse Sand & Gravel Mottles @ 86” Water @ 92” No Ledge
TP3 0” – 10” Sandy Loam Topsoil 10” – 24” Brown Loamy Sand 24” – 58” Fine to Medium Tan Sand 58” – 84” Medium to Coarse Sand & Gravel No Mottling No Water No Ledge Permeability Sample Depth = 24”-30” Permeability Rate = 8.5 in/hr	TP7 0” – 24” Sandy Loam Topsoil 24” – 44” Red/Brown Sandy Loam 44” – 80” Tan Fine to Coarse Sand 80” – 96” Fine to Coarse Sand & Gravel No Mottling No Water No Ledge
TP4 0” – 6” Sand & Gravel Fill 6” – 18” Buried Sandy Loam Topsoil 18” – 40” Red/Brown Sandy Loam 40” – 90” Stratified Sand grading to Fine to Coarse Sand & Gravel Mottles @ 80” Water @ 84” No Ledge Permeability Sample Depth = 24”-30” Permeability Rate = 0.522 in/hr	TP8 0” – 12” Sandy Loam Topsoil 12” – 30” Red/Brown Loamy Sand 38” – 90” Tan Fine to Coarse Sand grading to Coarse Sand & Gravel No Mottling No Water No Ledge

NEW ENGLAND MATERIALS TESTING LAB, LLC.
NEW ENGLAND REGIONAL OFFICE
72 Bissell Street Manchester, CT 06040 • Tel: 860-783-5830 • Fax: 860-783-5832

Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 001

Lab ID: 075-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-1

Technician: Z. A

Date: 06/29/2020

LAB PERMEABILITY TEST

Sample description: Light brown sand and some fines.

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 24" to 30"

Method: Permeability by ASTM D2434 (Constant Head Method)

k = QL/Ath

Where k = coefficient of permeability,

Q = quantity of water discharged,	Q =	1000 cm^3
L = length of sample in centimeters	L =	15.24 cm
A = cross sectional area of specimen,	A =	43.10 cm^2
t = total time for discharge, in seconds	t =	3480 sec
h = difference in head manometers,	h =	61.5 cm

k = 0.00165216 cm/sec.

k = 2.34 inch/hour

Reported To: JR Russo Surveyors Engineers

Submitted By: New England Materials Testing Lab, LLC.

NEW ENGLAND MATERIALS TESTING LAB, LLC.
NEW ENGLAND REGIONAL OFFICE
72 Bissell Street Manchester, CT 06040 • Tel: 860-783-5830 • Fax: 860-783-5832

Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 002

Lab ID: 076-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-2

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Light brown fine sand

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 30" to 36"

Method: Permeability by ASTM D2434 (Constant Head Method)

k = QL/Ath

Where k = coefficient of permeability,

Q = quantity of water discharged,	Q =	1000 cm^3
L = length of sample in centimeters	L =	15.24 cm
A = cross sectional area of specimen,	A =	43.10 cm^2
t = total time for discharge, in seconds	t =	660 sec
h = difference in head manometers,	h =	61.5 cm

k = 0.00871141 cm/sec.

k = 12.35 inch/hour

Reported To: JR Russo Surveyors Engineers

Submitted By: New England Materials Testing Lab, LLC.

NEW ENGLAND MATERIALS TESTING LAB, LLC.
NEW ENGLAND REGIONAL OFFICE
72 Bissell Street Manchester, CT 06040 • Tel: 860-783-5830 • Fax: 860-783-5832

Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 003

Lab ID: 077-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-3

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Light brown sand, little fines

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 24" to 30"

Method: Permeability by ASTM D2434 (Constant Head Method)

k = QL/Ath

Where k = coefficient of permeability,

Q = quantity of water discharged,	Q =	1000 cm^3
L = length of sample in centimeters	L =	15.24 cm
A = cross sectional area of specimen,	A =	43.10 cm^2
t = total time for discharge, in seconds	t =	960 sec
h = difference in head manometers,	h =	61.5 cm

k = 0.0059891 cm/sec.

k = 8.5 inch/hour

Reported To: JR Russo Surveyors Engineers

Submitted By: New England Materials Testing Lab, LLC.

NEW ENGLAND MATERIALS TESTING LAB, LLC.
NEW ENGLAND REGIONAL OFFICE
72 Bissell Street Manchester, CT 06040 • Tel: 860-783-5830 • Fax: 860-783-5832

Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 004

Lab ID: 078-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-4

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Brown silty clayey sandy material

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 24” to 30”

Method: Permeability by ASTM D2434 (Constant Head Method)

$k = QL/Ath$

Where k = coefficient of permeability,

Q = quantity of water discharged,	Q =	500 cm^3
L = length of sample in centimeters	L =	15.24 cm
A = cross sectional area of specimen,	A =	43.10 cm^2
t = total time for discharge, in seconds	t =	7800 sec
h = difference in head manometers,	h =	61.5 cm

k = 0.00036856 cm/sec.

k = 0.522 inch/hour

Reported To: JR Russo Surveyors Engineers

Submitted By: New England Materials Testing Lab, LLC.

NEW ENGLAND MATERIALS TESTING LAB, LLC.
NEW ENGLAND REGIONAL OFFICE
72 Bissell Street Manchester, CT 06040 • Tel: 860-783-5830 • Fax: 860-783-5832

Client: JR Russo Surveyors Engineers
P. O Box 938
East Windsor, CT. 06088

Report #: 005

Lab ID: 079-21

Project: 22 Tariff Ville Road Simsbury, CT.

Client ID: TP-5

Technician: Z. A

Date: 03/31/2021

LAB PERMEABILITY TEST

Sample description: Gray sand, little bank run gravel, little fines.

Location: Onsite (22 Tariff Ville road Simsbury, CT)

Sample depth: 36" to 42"

Method: Permeability by ASTM D2434 (Constant Head Method)

k = QL/Ath

Where k = coefficient of permeability,

Q = quantity of water discharged,	Q =	1000 cm^3
L = length of sample in centimeters	L =	15.24 cm
A = cross sectional area of specimen,	A =	43.10 cm^2
t = total time for discharge, in seconds	t =	1620 sec
h = difference in head manometers,	h =	61.5 cm

k = 0.00354909 cm/sec.

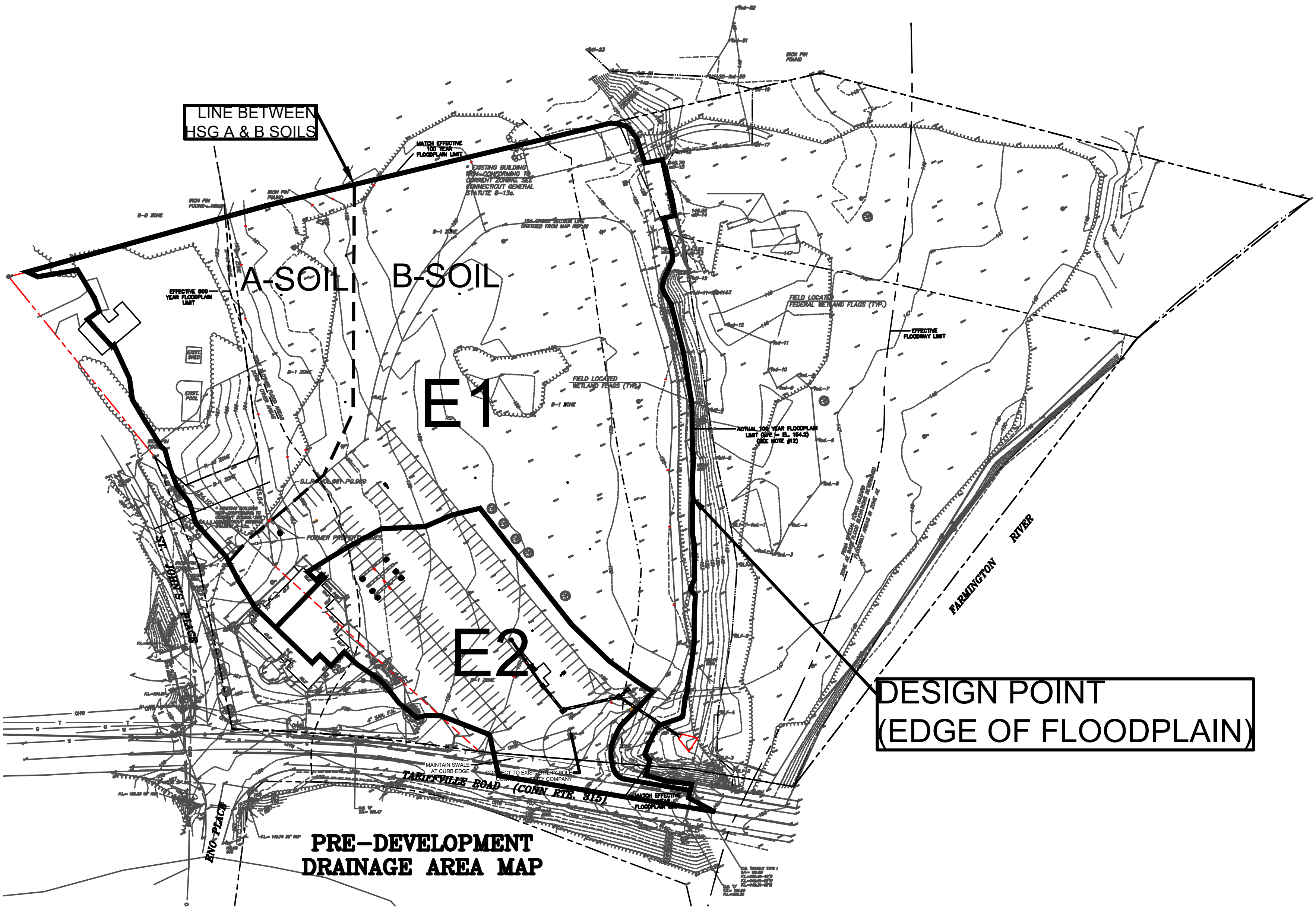
k = 5.03 inch/hour

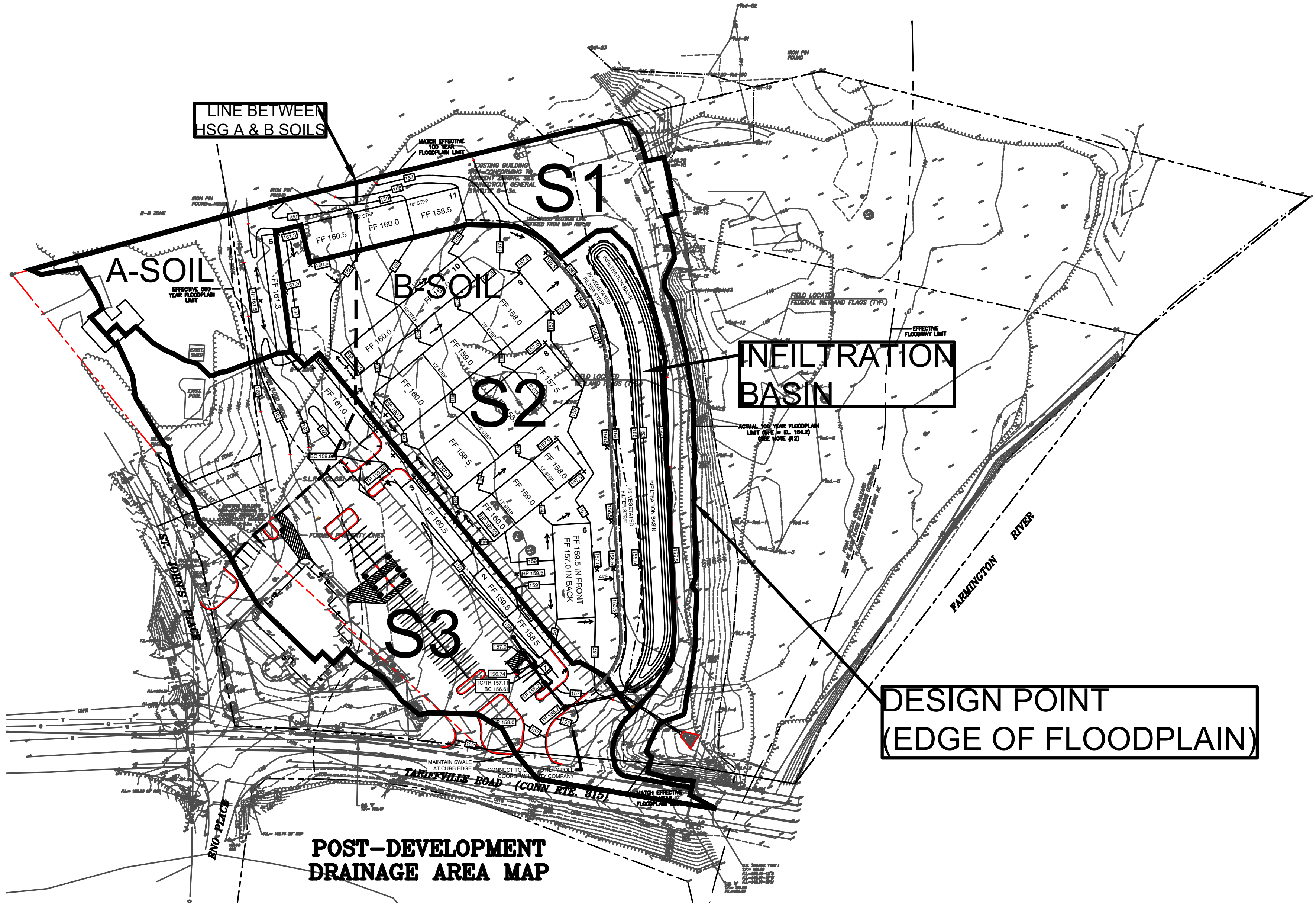
Reported To: JR Russo Surveyors Engineers

Submitted By: New England Materials Testing Lab, LLC.

Appendix 4:

DRAINAGE AREA MAPS

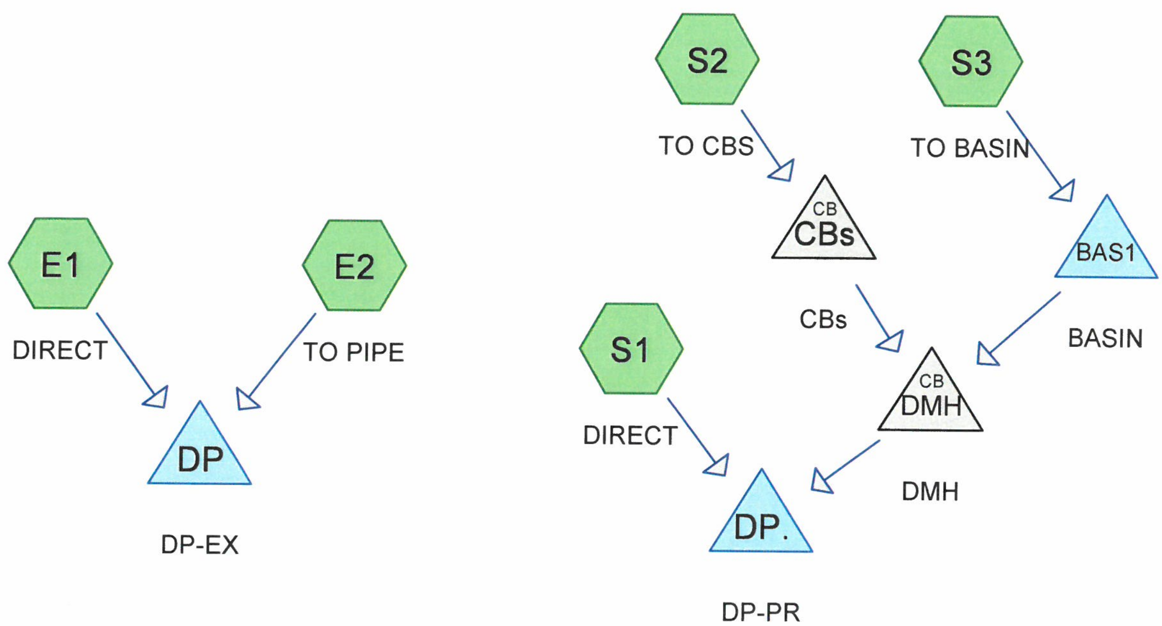

LINE BETWEEN
HSG A & B SOILS
A-SOIL
B-SOIL
E1
E2
DESIGN POINT
(EDGE OF FLOODPLAIN)
TARIFFVILLE ROAD (CONN RTE. 315)
FARMINGTON RIVER
PRE-DEVELOPMENT
DRAINAGE AREA MAP

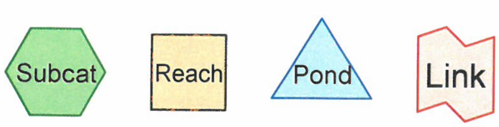


POST-DEVELOPMENT
DRAINAGE AREA MAP

Appendix 5:

HYDROCAD ANALYSES





Routing Diagram for 2021-011 LADA Simsbury
Prepared by {enter your company name here}, Printed 5/26/2021
HydroCAD® 10.00-25 s/n 02386 © 2019 HydroCAD Software Solutions LLC

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment E1: DIRECT Runoff Area=247,375 sf 19.17% Impervious Runoff Depth=2.27"
Flow Length=684' Tc=18.8 min CN=60 Runoff=9.96 cfs 1.074 af

Subcatchment E2: TO PIPE Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=5.47"
Flow Length=389' Tc=4.5 min CN=91 Runoff=9.02 cfs 0.646 af

Subcatchment S1: DIRECT Runoff Area=78,304 sf 37.45% Impervious Runoff Depth=2.83"
Flow Length=635' Tc=20.2 min CN=66 Runoff=3.95 cfs 0.424 af

Subcatchment S2: TO CBS Runoff Area=104,432 sf 55.15% Impervious Runoff Depth=3.63"
Flow Length=602' Tc=22.2 min CN=74 Runoff=6.59 cfs 0.725 af

Subcatchment S3: TO BASIN Runoff Area=124,965 sf 78.62% Impervious Runoff Depth=5.35"
Flow Length=382' Tc=3.8 min CN=90 Runoff=18.47 cfs 1.280 af

Pond BAS1: BASIN Peak Elev=154.88' Storage=27,084 cf Inflow=18.47 cfs 1.280 af
Discarded=0.59 cfs 0.866 af Primary=2.65 cfs 0.421 af Outflow=3.24 cfs 1.287 af

Pond CBs: CBs Peak Elev=154.16' Inflow=6.59 cfs 0.725 af
15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=6.59 cfs 0.725 af

Pond DMH: DMH Peak Elev=152.91' Inflow=8.94 cfs 1.145 af
24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=8.94 cfs 1.145 af

Pond DP: DP-EX Inflow=13.57 cfs 1.720 af
Primary=13.57 cfs 1.720 af

Pond DP.: DP-PR Inflow=12.78 cfs 1.570 af
Primary=12.78 cfs 1.570 af

Summary for Subcatchment E1: DIRECT

Runoff = 9.96 cfs @ 12.27 hrs, Volume= 1.074 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

Area (sf)	CN	Description
120,394	61	>75% Grass cover, Good, HSG B
9,139	55	Woods, Good, HSG B
44,246	98	Paved parking, HSG B
31,283	39	>75% Grass cover, Good, HSG A
39,145	30	Woods, Good, HSG A
3,168	98	Paved parking, HSG A
247,375	60	Weighted Average
199,961		80.83% Pervious Area
47,414		19.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	5	0.0433	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.20"
7.4	135	0.0741	0.30		**Sheet Flow, GR** Grass: Short n= 0.150 P2= 3.20"
2.4	10	0.0455	0.07		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.20"
2.6	135	0.0311	0.88		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
1.6	114	0.0281	1.17		**Shallow Concentrated Flow, GR** Short Grass Pasture Kv= 7.0 fps
3.2	265	0.0045	1.36		**Shallow Concentrated Flow, IM** Paved Kv= 20.3 fps
0.2	20	0.0400	1.40		**Shallow Concentrated Flow, GR** Short Grass Pasture Kv= 7.0 fps
18.8	684	Total			

Summary for Subcatchment E2: TO PIPE

Runoff = 9.02 cfs @ 12.06 hrs, Volume= 0.646 af, Depth= 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

Area (sf)	CN	Description
11,246	61	>75% Grass cover, Good, HSG B
50,561	98	Paved parking, HSG B
61,807	91	Weighted Average
11,246		18.20% Pervious Area
50,561		81.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	10	0.0348	0.13		**Sheet Flow, GR** Grass: Short n= 0.150 P2= 3.20"
1.4	140	0.0296	1.72		**Sheet Flow, IM** Smooth surfaces n= 0.011 P2= 3.20"
1.6	215	0.0122	2.24		**Shallow Concentrated Flow, IM** Paved Kv= 20.3 fps
0.3	24	0.0279	1.17		**Shallow Concentrated Flow, GR** Short Grass Pasture Kv= 7.0 fps
4.5	389	Total			

Summary for Subcatchment S1: DIRECT

Runoff = 3.95 cfs @ 12.28 hrs, Volume= 0.424 af, Depth= 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

Area (sf)	CN	Description
18,730	61	>75% Grass cover, Good, HSG B
4,239	55	Woods, Good, HSG B
23,636	98	Paved parking, HSG B
18,356	39	>75% Grass cover, Good, HSG A
7,653	30	Woods, Good, HSG A
5,690	98	Paved parking, HSG A
78,304	66	Weighted Average
48,978		62.55% Pervious Area
29,326		37.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	5	0.0433	0.06		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.20"
7.4	135	0.0741	0.30		**Sheet Flow, GR** Grass: Short n= 0.150 P2= 3.20"
2.4	10	0.0455	0.07		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.20"
0.8	40	0.0311	0.88		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
8.2	445	0.0169	0.91		**Shallow Concentrated Flow, GR** Short Grass Pasture Kv= 7.0 fps
20.2	635	Total			

Summary for Subcatchment S2: TO CBS

Runoff = 6.59 cfs @ 12.31 hrs, Volume= 0.725 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

Area (sf)	CN	Description
17,448	61	>75% Grass cover, Good, HSG B
54,633	98	Paved parking, HSG B
12,582	39	>75% Grass cover, Good, HSG A
16,809	30	Woods, Good, HSG A
2,960	98	Paved parking, HSG A
104,432	74	Weighted Average
46,839		44.85% Pervious Area
57,593		55.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	121	0.0347	0.22		**Sheet Flow, GR** Grass: Short n= 0.150 P2= 3.20"
5.3	29	0.0552	0.09		**Sheet Flow, WOODS** Woods: Light underbrush n= 0.400 P2= 3.20"
1.3	96	0.0573	1.20		**Shallow Concentrated Flow, WOODS** Woodland Kv= 5.0 fps
2.2	92	0.0100	0.70		**Shallow Concentrated Flow, GR** Short Grass Pasture Kv= 7.0 fps
0.5	74	0.0176	2.69		**Shallow Concentrated Flow, IM** Paved Kv= 20.3 fps
3.7	190	0.0150	0.86		**Shallow Concentrated Flow, GR** Short Grass Pasture Kv= 7.0 fps
22.2	602	Total			

Summary for Subcatchment S3: TO BASIN

Runoff = 18.47 cfs @ 12.05 hrs, Volume= 1.280 af, Depth= 5.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-year Rainfall=6.52"

	Area (sf)	CN	Description
	26,716	61	>75% Grass cover, Good, HSG B
*	88,703	98	Paved parking, HSG B
	9,546	98	Paved parking, HSG A
	124,965	90	Weighted Average
	26,716		21.38% Pervious Area
	98,249		78.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.1	150	0.0118	1.21		**Sheet Flow, IM** Smooth surfaces n= 0.011 P2= 3.20"
1.4	204	0.0134	2.35		**Shallow Concentrated Flow, IM** Paved Kv= 20.3 fps
0.3	28	0.0530	1.61		**Shallow Concentrated Flow, GR** Short Grass Pasture Kv= 7.0 fps
3.8	382	Total			

Summary for Pond BAS1: BASIN

Inflow Area = 2.869 ac, 78.62% Impervious, Inflow Depth = 5.35" for 25-year event
Inflow = 18.47 cfs @ 12.05 hrs, Volume= 1.280 af
Outflow = 3.24 cfs @ 12.50 hrs, Volume= 1.287 af, Atten= 82%, Lag= 26.4 min
Discarded = 0.59 cfs @ 12.50 hrs, Volume= 0.866 af
Primary = 2.65 cfs @ 12.50 hrs, Volume= 0.421 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 154.88' @ 12.50 hrs Surf.Area= 13,648 sf Storage= 27,084 cf
Flood Elev= 155.50' Surf.Area= 15,508 sf Storage= 36,056 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 327.9 min (1,108.0 - 780.0)

Volume	Invert	Avail.Storage	Storage Description
#1	152.00'	44,794 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
152.00	5,233	0	0
153.00	8,064	6,649	6,649
154.00	11,004	9,534	16,183
155.00	13,993	12,499	28,681
155.50	15,508	7,375	36,056
156.00	19,442	8,738	44,794

Device	Routing	Invert	Outlet Devices
#1	Discarded	152.00'	**1.170 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 149.00'
#2	Primary	154.00'	**15.0" Round Culvert** L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 154.00' / 153.80' S= 0.0200 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#3	Primary	155.50'	**40.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.59 cfs @ 12.50 hrs HW=154.88' (Free Discharge)
└─**1=Exfiltration** (Controls 0.59 cfs)

Primary OutFlow Max=2.65 cfs @ 12.50 hrs HW=154.88' TW=152.79' (Dynamic Tailwater)
├─**2=Culvert** (Barrel Controls 2.65 cfs @ 4.01 fps)
└─**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond CBs: CBs

Inflow Area = 2.397 ac, 55.15% Impervious, Inflow Depth = 3.63" for 25-year event
Inflow = 6.59 cfs @ 12.31 hrs, Volume= 0.725 af
Outflow = 6.59 cfs @ 12.32 hrs, Volume= 0.725 af, Atten= 0%, Lag= 0.6 min
Primary = 6.59 cfs @ 12.32 hrs, Volume= 0.725 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 154.16' @ 12.32 hrs
Flood Elev= 156.20'

Device	Routing	Invert	Outlet Devices
#1	Primary	152.00'	**15.0" Round Culvert** L= 60.0' Ke= 0.500 Inlet / Outlet Invert= 152.00' / 151.70' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=6.59 cfs @ 12.32 hrs HW=154.15' TW=152.90' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 6.59 cfs @ 5.37 fps)

Summary for Pond DMH: DMH

Inflow Area =	5.266 ac, 67.94% Impervious, Inflow Depth = 2.61"	for 25-year event	
Inflow =	8.94 cfs @ 12.34 hrs, Volume=	1.145 af	
Outflow =	8.94 cfs @ 12.35 hrs, Volume=	1.145 af,	Atten= 0%, Lag= 0.6 min
Primary =	8.94 cfs @ 12.35 hrs, Volume=	1.145 af	

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 152.91' @ 12.35 hrs
Flood Elev= 157.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	151.35'	**24.0" Round Culvert** L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 151.35' / 151.00' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=8.94 cfs @ 12.35 hrs HW=152.91' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 8.94 cfs @ 4.70 fps)

Summary for Pond DP: DP-EX

Inflow Area =	7.098 ac, 31.69% Impervious, Inflow Depth = 2.91"	for 25-year event	
Inflow =	13.57 cfs @ 12.09 hrs, Volume=	1.720 af	
Primary =	13.57 cfs @ 12.10 hrs, Volume=	1.720 af,	Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond DP.: DP-PR

Inflow Area =	7.064 ac, 60.18% Impervious, Inflow Depth = 2.67"	for 25-year event	
Inflow =	12.78 cfs @ 12.33 hrs, Volume=	1.570 af	
Primary =	12.78 cfs @ 12.34 hrs, Volume=	1.570 af,	Atten= 0%, Lag= 0.6 min

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment E1: DIRECT Runoff Area=247,375 sf 19.17% Impervious Runoff Depth=0.44"
Flow Length=684' Tc=18.8 min CN=60 Runoff=1.29 cfs 0.208 af

Subcatchment E2: TO PIPE Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=2.33"
Flow Length=389' Tc=4.5 min CN=91 Runoff=4.02 cfs 0.276 af

Subcatchment S1: DIRECT Runoff Area=78,304 sf 37.45% Impervious Runoff Depth=0.68"
Flow Length=635' Tc=20.2 min CN=66 Runoff=0.79 cfs 0.102 af

Subcatchment S2: TO CBS Runoff Area=104,432 sf 55.15% Impervious Runoff Depth=1.09"
Flow Length=602' Tc=22.2 min CN=74 Runoff=1.87 cfs 0.218 af

Subcatchment S3: TO BASIN Runoff Area=124,965 sf 78.62% Impervious Runoff Depth=2.24"
Flow Length=382' Tc=3.8 min CN=90 Runoff=8.07 cfs 0.536 af

Pond BAS1: BASIN Peak Elev=153.67' Storage=12,674 cf Inflow=8.07 cfs 0.536 af
Discarded=0.38 cfs 0.546 af Primary=0.00 cfs 0.000 af Outflow=0.38 cfs 0.546 af

Pond CBs: CBs Peak Elev=152.77' Inflow=1.87 cfs 0.218 af
15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=1.87 cfs 0.218 af

Pond DMH: DMH Peak Elev=151.99' Inflow=1.87 cfs 0.218 af
24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=1.87 cfs 0.218 af

Pond DP: DP-EX Inflow=4.12 cfs 0.484 af
Primary=4.12 cfs 0.484 af

Pond DP.: DP-PR Inflow=2.66 cfs 0.320 af
Primary=2.66 cfs 0.320 af

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment E1: DIRECT Runoff Area=247,375 sf 19.17% Impervious Runoff Depth=1.47"
Flow Length=684' Tc=18.8 min CN=60 Runoff=6.11 cfs 0.695 af

Subcatchment E2: TO PIPE Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=4.25"
Flow Length=389' Tc=4.5 min CN=91 Runoff=7.12 cfs 0.503 af

Subcatchment S1: DIRECT Runoff Area=78,304 sf 37.45% Impervious Runoff Depth=1.92"
Flow Length=635' Tc=20.2 min CN=66 Runoff=2.61 cfs 0.288 af

Subcatchment S2: TO CBS Runoff Area=104,432 sf 55.15% Impervious Runoff Depth=2.59"
Flow Length=602' Tc=22.2 min CN=74 Runoff=4.68 cfs 0.517 af

Subcatchment S3: TO BASIN Runoff Area=124,965 sf 78.62% Impervious Runoff Depth=4.15"
Flow Length=382' Tc=3.8 min CN=90 Runoff=14.51 cfs 0.991 af

Pond BAS1: BASIN Peak Elev=154.50' Storage=22,059 cf Inflow=14.51 cfs 0.991 af
Discarded=0.52 cfs 0.801 af Primary=1.05 cfs 0.199 af Outflow=1.57 cfs 1.000 af

Pond CBs: CBs Peak Elev=153.43' Inflow=4.68 cfs 0.517 af
15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=4.68 cfs 0.517 af

Pond DMH: DMH Peak Elev=152.49' Inflow=5.34 cfs 0.716 af
24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=5.34 cfs 0.716 af

Pond DP: DP-EX Inflow=9.54 cfs 1.198 af
Primary=9.54 cfs 1.198 af

Pond DP.: DP-PR Inflow=7.87 cfs 1.004 af
Primary=7.87 cfs 1.004 af

Time span=1.00-72.00 hrs, dt=0.01 hrs, 7101 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Sim-Route method - Pond routing by Sim-Route method

Subcatchment E1: DIRECT Runoff Area=247,375 sf 19.17% Impervious Runoff Depth=3.67"
Flow Length=684' Tc=18.8 min CN=60 Runoff=16.68 cfs 1.739 af

Subcatchment E2: TO PIPE Runoff Area=61,807 sf 81.80% Impervious Runoff Depth=7.37"
Flow Length=389' Tc=4.5 min CN=91 Runoff=11.95 cfs 0.871 af

Subcatchment S1: DIRECT Runoff Area=78,304 sf 37.45% Impervious Runoff Depth=4.38"
Flow Length=635' Tc=20.2 min CN=66 Runoff=6.19 cfs 0.656 af

Subcatchment S2: TO CBS Runoff Area=104,432 sf 55.15% Impervious Runoff Depth=5.33"
Flow Length=602' Tc=22.2 min CN=74 Runoff=9.66 cfs 1.065 af

Subcatchment S3: TO BASIN Runoff Area=124,965 sf 78.62% Impervious Runoff Depth=7.25"
Flow Length=382' Tc=3.8 min CN=90 Runoff=24.57 cfs 1.733 af

Pond BAS1: BASIN Peak Elev=155.41' Storage=34,656 cf Inflow=24.57 cfs 1.733 af
Discarded=0.69 cfs 0.951 af Primary=5.13 cfs 0.788 af Outflow=5.82 cfs 1.738 af

Pond CBs: CBs Peak Elev=156.21' Inflow=9.66 cfs 1.065 af
15.0" Round Culvert n=0.012 L=60.0' S=0.0050 '/' Outflow=9.66 cfs 1.065 af

Pond DMH: DMH Peak Elev=153.55' Inflow=14.68 cfs 1.852 af
24.0" Round Culvert n=0.012 L=70.0' S=0.0050 '/' Outflow=14.68 cfs 1.852 af

Pond DP: DP-EX Inflow=21.35 cfs 2.610 af
Primary=21.35 cfs 2.610 af

Pond DP.: DP-PR Inflow=20.72 cfs 2.508 af
Primary=20.72 cfs 2.508 af

Appendix 6:

MISCELLANEOUS CALCULATIONS

INFILTRATION BASIN SIZING

① Water Quality Volume (WQV):

$WQV = (1")(R)(A)/12$ and $R = 0.05 + 0.009(I)$

where WQV = water quality volume (ac-ft)
R = runoff coefficient
A = contributing Area (acres) = 2.869 ac
I = percent impervious Coverage = 78.62%

$R = 0.05 + 0.009(78.62)$
$= 0.758$

$WQV = (1")(0.758)(2.869\ ac)/12$
$= 0.181$ ac-ft
$= 7,890$ cf

② Time to Drain

Design infiltration rate = 1.17 in/hr = 0.0976 ft/hr
Storage capacity below outlet = 16,183 cf
Basin Bottom Area (Elev. 152) = 5,233 SF

$$\text{Drawdown Time} = \frac{\text{Volume}}{(\text{Area})(\text{Rate})}$$

$$= \frac{16,183\ CF}{(5,233\ SF)(0.0976\ ft/hr)}$$

$= 31.7$ hrs

Max. Drawdown Time = 72 hrs

Project: Stardust Self Storage
Location: Simsbury, CT
Prepared For: JR Russo

Purpose: To calculate the first flush runoff flow rate (WQF) over a given site area. In this situation the WQV to be analyzed is the runoff produced by the first 1" of rainfall.

Reference: United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	A (acres)	A (miles^2)	Runoff Coefficient	Percent Imp. (%)*	t_c (min)	t_c (hr)
WQU	2.40	0.00375	0.63	55.15	22.0	0.367

* Assumes runoff coefficient of 0.3 for pervious areas and 0.9 for impervious areas.

Procedure: The Water Quality Flow (WQF) is calculated using the Water Quality Volume (WQV). This WQV, converted to watershed inches, is substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Graphical Peak Discharge Method.

1. Compute WQV in watershed inches using the following equation:

$$\mathbf{WQV = P * R}$$

where: WQV = water quality volume (watershed inches)
P = design precipitation (inches) = (1" for water quality storm)
R = volumetric runoff coefficient = 0.05 + 0.009(I)
I = percent impervious cover

Structure Name	Percent Imp. (%)	R	P (in)	WQV (in)	WQV (ac-ft)
WQU	55.15	0.546	1.0	0.546	0.1093

2. Compute the NRCS Runoff Curve Number (CN) using the following equation, or graphically using Figure 2-1 from TR-55 (USDA, 1986):

$$\mathbf{CN = 1000 / [10+5P+10Q-10(Q^2+1.25QP)^{1/2}]}$$

where: CN = Runoff Curve Number
P = design precipitation (inches) = (1" for water quality storm)
Q = runoff depth (watershed inches)

Structure Name	Q (in)	CN
WQU	0.546	94.73

3. Using computed CN, read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55; compute I_a/P, interpolating when appropriate.

Structure Name	I_a (in)	I_a/P
WQU	0.111	0.111

4. Compute the time of concentration (t_c) in hours and the drainage area in square miles.

Structure Name	t_c (hr)	A (miles^2)
WQU	0.367	0.00375

5. Read the unit peak discharge (q_u) from Exhibit 4-III in Chapter 4 of TR-55 for appropriate t_c for type III rainfall distribution.

Structure Name	t_c (hr)	I_a/P	q_u (csm/in)
WQU	0.367	0.111351144	475

6. Substituting WQV (watershed inches) for runoff depth (Q), compute the water quality flow (WQF) from the following equation:

$$\mathbf{WQF = (q_u)*(A)*(Q)}$$

where: WQF = water quality flow (cfs)
q_u = unit peak discharge (cfs/mi^2/inch)
A = drainage area (mi^2)
Q = runoff depth (watershed inches)

Structure Name	q_u (csm/in)	A (miles^2)	Q (in)	WQF (cfs)
WQU	475	0.00375	0.546	0.97

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

STARDUST SELF STORAGE
SIMSBURY, CT

Area	2.40 ac	Unit Site Designation	WQU
Weighted C	0.63	Rainfall Station #	34
t_c	22 min		
CDS Model	2015-4	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.7%	9.7%	0.03	0.03	9.7
0.04	9.7%	19.4%	0.06	0.06	9.6
0.06	9.8%	29.2%	0.09	0.09	9.6
0.08	7.7%	36.9%	0.12	0.12	7.5
0.10	8.0%	44.9%	0.15	0.15	7.7
0.12	5.4%	50.3%	0.18	0.18	5.2
0.14	4.7%	55.0%	0.21	0.21	4.4
0.16	5.5%	60.5%	0.24	0.24	5.1
0.18	3.5%	63.9%	0.27	0.27	3.2
0.20	4.1%	68.0%	0.30	0.30	3.7
0.25	6.5%	74.5%	0.38	0.38	5.8
0.30	5.5%	80.0%	0.45	0.45	4.7
0.35	4.0%	84.0%	0.53	0.53	3.4
0.40	2.0%	86.0%	0.61	0.61	1.6
0.45	2.1%	88.1%	0.68	0.68	1.7
0.50	2.0%	90.2%	0.76	0.76	1.5
0.75	5.1%	95.3%	1.14	1.14	3.2
1.00	2.5%	97.8%	1.51	1.40	1.2
1.50	1.8%	99.5%	2.27	1.40	0.6
2.00	0.5%	100.0%	3.03	1.40	0.1
					89.5

Removal Efficiency Adjustment[2] = 6.5%

Predicted % Annual Rainfall Treated = 92.4%

Predicted Net Annual Load Removal Efficiency = 83.1%

1 - Based on 10 years of hourly precipitation data from NCDC station 806, Bridgeport WSO ARPT, Fairfield County, CT

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

J.R. RUSSO & ASSOCIATES, LLC
Professional Engineers & Surveyors
SERVING CONNECTICUT & MASSACHUSETTS
1 Shoham Rd. • East Windsor, CT 06088
CONN (860) 623-0569 • MASS (413) 785-1158
www.jrrusso.com

JOB 2021-011 Stardust
SHEET NO. 1 OF 1
CALCULATED BY TAC DATE 5/26/21
CHECKED BY DATE
SCALE

OUTFALL SIZING

Design Storm = 100-YR

Peak Discharge = 14.68 cfs

Exit Velocity = 5.29 fps

Pipe Size = 24"

Riprap Size: use modified riprap per Table 8.5 (attached)

Apron Length: = 16' per Table 8-6.1 (attached)

Apron Width @ pipe (W_1) = 3 x Dia = 3 x 2' = 6'

Apron Width @ end (W_2) = (3 x Dia) + (0.7 L)
= (3 x 2') + (0.7(16')
= 17.2'

Summary for Pond DMH: DMH

Inflow Area = 5.266 ac, 67.94% Impervious, Inflow Depth = 4.22" for 100-year event
Inflow = 14.68 cfs @ 12.32 hrs, Volume= 1.852 af
Outflow = 14.68 cfs @ 12.33 hrs, Volume= 1.852 af, Atten= 0%, Lag= 0.6 min
Primary = 14.68 cfs @ 12.33 hrs, Volume= 1.852 af

Routing by Sim-Route method, Time Span= 1.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 153.55' @ 12.33 hrs
Flood Elev= 157.50'

Device	Routing	Invert	Outlet Devices
#1	Primary	151.35'	**24.0" Round Culvert** L= 70.0' Ke= 0.500 Inlet / Outlet Invert= 151.35' / 151.00' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf

Primary OutFlow Max=14.68 cfs @ 12.33 hrs HW=153.55' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 14.68 cfs @ 5.29 fps)

8.7.3 Design Criteria

The design of riprap outlet protection applies to the immediate area or reach downstream of the pipe outlet and does not apply to continuous rock linings of channels or streams. For pipe outlets at the top of exit slopes or on slopes greater than 10%, the designer should assure that suitable safeguards are provided beyond the limits of the localized outlet protection to counter the highly erosive velocities caused by the reconcentration of flow beyond the initial riprap apron. Outlet protection shall be designed according to the following criteria:

- Riprap outlet protection shall be used at all outlets not flowing over exposed rock or into deep watercourses and ponds.
- In situations not covered by the above noted criteria and where the exit velocity is ≤ 4.27 mps (14 fps), a riprap apron shall also be used. For Type A and B riprap aprons, the type of riprap specified is dependent on the outlet velocity (see Section 8.6.6) and can be determined from Table 8.5. For Type C aprons, the type of riprap specified is determined by the procedures in HEC-15 and HEC-11 depending on the design discharge. See Chapter 7, Channels.
- The type of riprap apron and dimensions are determined by the guidelines outlined in Sections 8.7.2 and 8.7.5, respectively.
- When the outlet velocity is > 4.27 mps (14 fps), the designer should first investigate methods to reduce the outlet velocity. This may be accomplished by any one or combination of the following: increasing the pipe roughness, increasing the pipe size and/or decreasing the culvert slope. When this is not possible or economical, a number of outlet protection or energy dissipation design options are available. These are presented in detail in HEC-14. In most instances, however, a preformed scour hole design should be used, as it generally can provide the necessary degree of protection at an economical cost. The design of a preformed scour hole is presented in Section 8.7.6.

The design criteria of this section should be applicable to most outlet situations. However, recognizing that design and site conditions can vary significantly depending on the project or location on a particular project, it is the responsibility of the designer to ensure that the criteria is suitable to the site or to provide an alternate design which will adequately protect the outlet area from scour and erosion. These situations should be documented in the drainage design report.

Table 8.5 Allowable Outlet Velocities for Type A and B Riprap Aprons

Outlet Velocity - mps (fps)	Riprap Specification
0-2.44 (0-8)	Modified
2.44-3.05 (8-10)	Intermediate
3.05-4.27 (10-14)	Standard

8.7.4 Tailwater Depth

The depth of tailwater immediately at the pipe outlet is required for the design of outlet protection and must be determined for the design flow rate. Manning's equation may be used to determine tailwater depth. See Sections 8.3.5 and 8.3.6 for additional information on how to determine the tailwater depth.

OUTLET PROTECTION - OUTLET VELOCITY ≤ 14 feet/sec

DISCHARGE (cfs)	OUTLET PIPE DIAMETER OR SPAN (in)									
	12	15	18	24	30	36	42	48	54	60
0-5	***10***	***10***		USE						
6	12	11								
7		13	***12***							
8		14	13	***12***		MINIMUM				
9			14	13						
10			15	13						
11			16	14				LENGTH		
12				14						
14				16	***14***					
16				17	15	***14***			OUTLINED	
18				18	16	15				
20					17	15	***14***			
22		USE			18	16	15			
24						17	15	***14***		
26						17	16	15		
28						18	16	15		
30						19	17	16		
35						20	18	17	***16***	
40			PREFORMED				20	18	17	***16***
45							21	19	18	16
50							22	20	18	17
55								21	19	18
60								22	20	19
65								24	21	20
70					SCOUR			25	22	20
75								26	23	21
80									24	22
90									26	24
100									28	25
110										27
125							HOLE			29
130										30

Table 8-6.1 - Length - L_a (feet)
Type A Riprap Apron

Notes: 1. Bold face outlined boxes indicate minimum L_a to be used for a given pipe diameter or span.
2. Rounding and interpolating are acceptable.