Drainage Report:
for
32 Alice Street Subdivision

Prepared for:

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July 31, 2018

HUDSON
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TABLE OF CONTENTS

APPENDICES

APPENDIX A: SUPPORTING DATA
APPENDIX B: RAIN GARDEN AND HYDROCAD CALCULATIONS
APPENDIX C: PRODUCT CUT SHEETS

1.0 INTRODUCTION

The 32 Alice Street Subdivision project is located at 32 Alice Street in the City of Beacon, Dutchess County, New York. The project consists of one parcel, Tax ID: 6054-47-320616 (±0.47 acre). The project proposes to subdivide the existing parcel into two lots, with the existing residence to remain as one of the lots, and the remainder being a building lot. The parcel is in the R1-7.5 zoning district.

2.0 METHODOLOGY AND REGULATORY COMPLIANCE

The proposed project will result in 3,067 square feet of additional impervious area and 8,150 square feet of disturbance, and therefore is not subject to the requirements of NYSDEC GP-0-15-002 General Permit for Construction Activities. However, as the site runoff generally flows north and west from the project toward adjacent residential development, certain stormwater management practices are being implemented to limit potential impact to the adjacent parcels. The intent of the stormwater management is to infiltrate all of the new impervious area on lot 2 for runoff generated from the 25-year storm event, and to provide a mechanism that will allow for the rooftop runoff from the existing home on lot 1 to be treated by a rain garden, which will also provide infiltration of the typical smaller storm events. These practices will reduce the rates of runoff that leave the site for the design storm events. This report discusses the design of the proposed stormwater management practices.

Runoff calculations were performed utilizing HydroCAD® version 10.00 published by HydroCAD Software Solutions, LLC. The software utilizes the principles of TR-55 and TR-20 to generate unit hydrographs. Rainfall events are generated utilizing Soil Conservation Service (SCS) Type III, 24-hour rainfall event for Dutchess County, NY. The Type III rainfall depths for the 1-Year, 10-Year, and 25-Year events are 2.61”, 4.71”, and 5.92”, respectively. Rainfall Data can be found within Appendix A of this report.

3.0 SOIL CONDITIONS

A review of the Soil Survey of Dutchess County indicates that there is one type of soil present on the project site and its associated contributing drainage area. Table I below summarizes the characteristics of the soil types present within the drainage area.

Table I: Soil Types

Map Unit	Soil Names	Water Table (ft)	Bedrock	Hydrologic Soil Group
SrB	Stockbridge Urban Land Complex, nearly level	>80”	>80”	C

Source: websoilsurvey.sc.egov.usda.gov

Soil testing in the proposed infiltration area on the northern side of Lots 1 & 2 were conducted on July 24, 2018 (Deep Test Pits on both lots and an Infiltration Test on Lot 2). Two test pits were excavated. Test Pit 1-1 (on lot 1) had 14” of topsoil over 46” of brown sandy-loam. No bedrock, groundwater or mottling was observed; however, there were increasing cobbles found

at the bottom elevation (60" that were more difficult to remove). The test pit was stopped as a result of this less permeable condition in combination with a hydraulic hose leak. Test Pit 2-1 had 11" of topsoil over 73" of medium-grain sand. No bedrock, no groundwater or mottling was observed in Test Pit 2-1. The soil components are relatively uniform throughout the area tested.

One infiltration test was conducted in the stormwater infiltration area on lot 2. The infiltration test (denoted as IT2A) was run three times at a depth of 48" at the bottom, resulting in over 10 inches per hour infiltration rate. As a conservative measure, the design will utilize 5 inches per hour infiltration rate.

All soil testing was observed by representatives of Lanc & Tully, P.C. acting in their capacity as consulting engineer to the City.

Supporting information has been provided in Appendix A.

4.0 PROPOSED STORMWATER MANAGEMENT PRACTICES

4.1 Rain Garden – Lot 1

The existing roof downspouts flow overland toward the west (the location of the proposed residence on lot 2). Therefore, the downspouts are being collected in a system of drain basins and pipes and being re-routed to the north. Since the existing condition permitted some infiltration from overland flow, the new location (being closer to the adjacent developed residential properties) will be treated by means of a rain garden designed in accordance with the January 2015 New York State Stormwater Management Design Manual. Supporting information is provided in Appendix B.

4.2 Infiltration Chambers – Lot 2

The proposed house rooftop runoff will be directed into a yard drain that will discharge into a proposed underground infiltration chamber system. The driveway will also be graded to convey runoff to the yard drain inlet. The contributing drainage area to the system is slightly over 5,000 square feet of mostly impervious area, including some 700+ square feet of runoff from Alice Street that was previously uncontrolled. The infiltration chambers have been designed with a conservative infiltration rate of 5 inches per hour (although soils testing indicated higher potential rates of infiltration). The system has been designed to fully infiltrate the 25-year storm.

Unit hydrograph analysis results for post-development conditions have been included as Appendix B.

5.0 CONCLUSIONS

Implementation of the stormwater management practices as designed and shown on the plans will reduce potential impact to adjacent residential properties. Current areas that were running off the site in its current condition and all new impervious areas will be fully infiltrated.

6.0 EROSION AND SEDIMENT CONTROL

Contractors shall adhere to the temporary and permanent erosion control measures as indicated on the plans. Repairs shall be made as necessary to remain in compliance with the New York State Standards and Specifications for Erosion and Sediment Control, 2016.

APPENDIX A

SUPPORTING DATA

Extreme Precipitation Tables

Northeast Regional Climate Center

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

Smoothing	Yes
State	New York
Location	
Longitude	73.956 degrees West
Latitude	41.498 degrees North
Elevation	0 feet
Date/Time	Tue, 31 Jul 2018 06:29:06 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.33	0.50	0.62	0.82	1.02	1.27	**1yr**	0.88	1.20	1.45	1.77	2.16	2.61	2.96	**1yr**	2.31	2.85	3.29	3.96	4.60	**1yr**
2yr	0.39	0.60	0.74	0.98	1.23	1.53	**2yr**	1.06	1.43	1.75	2.15	2.61	3.17	3.58	**2yr**	2.80	3.44	3.94	4.65	5.29	**2yr**
5yr	0.46	0.71	0.89	1.19	1.52	1.92	**5yr**	1.32	1.76	2.20	2.70	3.29	3.97	4.53	**5yr**	3.52	4.35	5.01	5.79	6.55	**5yr**
10yr	0.51	0.80	1.02	1.38	1.79	2.27	**10yr**	1.55	2.07	2.62	3.22	3.91	4.71	5.42	**10yr**	4.17	5.21	6.01	6.85	7.70	**10yr**
25yr	0.60	0.95	1.21	1.67	2.23	2.85	**25yr**	1.92	2.56	3.30	4.06	4.94	5.92	6.87	**25yr**	5.24	6.61	7.66	8.54	9.54	**25yr**
50yr	0.68	1.09	1.39	1.95	2.63	3.39	**50yr**	2.27	3.00	3.93	4.84	5.87	7.04	8.23	**50yr**	6.23	7.92	9.20	10.11	11.22	**50yr**
100yr	0.77	1.24	1.60	2.27	3.10	4.03	**100yr**	2.68	3.53	4.68	5.78	7.00	8.37	9.86	**100yr**	7.40	9.49	11.06	11.96	13.21	**100yr**
200yr	0.87	1.43	1.85	2.65	3.67	4.79	**200yr**	3.17	4.15	5.59	6.90	8.35	9.95	11.83	**200yr**	8.81	11.37	13.31	14.16	15.57	**200yr**
500yr	1.05	1.73	2.26	3.28	4.59	6.03	**500yr**	3.96	5.14	7.04	8.71	10.53	12.53	15.04	**500yr**	11.09	14.46	17.00	17.72	19.35	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.88	1.09	**1yr**	0.76	1.07	1.25	1.60	2.01	2.08	2.35	**1yr**	1.84	2.26	2.59	3.30	4.18	**1yr**
2yr	0.37	0.58	0.71	0.96	1.19	1.42	**2yr**	1.03	1.39	1.61	2.06	2.59	3.08	3.46	**2yr**	2.73	3.33	3.79	4.49	5.15	**2yr**
5yr	0.42	0.65	0.81	1.11	1.41	1.66	**5yr**	1.22	1.62	1.88	2.42	3.01	3.67	4.19	**5yr**	3.25	4.03	4.59	5.32	6.09	**5yr**
10yr	0.47	0.72	0.90	1.25	1.62	1.85	**10yr**	1.40	1.81	2.12	2.71	3.38	4.17	4.84	**10yr**	3.69	4.66	5.29	6.03	6.92	**10yr**
25yr	0.54	0.83	1.03	1.47	1.93	2.14	**25yr**	1.66	2.09	2.46	3.06	3.94	4.89	5.87	**25yr**	4.33	5.64	6.37	7.11	8.20	**25yr**
50yr	0.61	0.92	1.15	1.65	2.22	2.39	**50yr**	1.92	2.33	2.78	3.42	4.44	5.54	6.80	**50yr**	4.91	6.54	7.33	8.05	9.34	**50yr**
100yr	0.68	1.03	1.30	1.87	2.57	2.68	**100yr**	2.22	2.62	3.14	3.81	5.02	6.24	7.88	**100yr**	5.52	7.58	8.44	9.10	10.62	**100yr**
200yr	0.78	1.17	1.48	2.14	2.99	3.00	**200yr**	2.58	2.93	3.55	4.28	5.67	6.98	9.17	**200yr**	6.18	8.82	9.73	10.28	12.11	**200yr**
500yr	0.93	1.38	1.77	2.57	3.66	3.50	**500yr**	3.16	3.42	4.20	4.98	6.70	8.12	11.21	**500yr**	7.18	10.78	11.74	12.06	14.41	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.36	0.56	0.68	0.92	1.13	1.36	**1yr**	0.97	1.33	1.53	1.97	2.43	2.82	3.19	**1yr**	2.49	3.07	3.56	4.25	4.92	**1yr**
2yr	0.40	0.62	0.77	1.04	1.28	1.54	**2yr**	1.10	1.51	1.74	2.25	2.80	3.34	3.71	**2yr**	2.96	3.56	4.09	4.83	5.48	**2yr**
5yr	0.49	0.76	0.94	1.29	1.64	1.95	**5yr**	1.42	1.91	2.26	2.89	3.67	4.26	4.88	**5yr**	3.77	4.70	5.41	6.28	7.01	**5yr**
10yr	0.58	0.89	1.11	1.55	2.00	2.36	**10yr**	1.72	2.31	2.74	3.54	4.49	5.20	6.01	**10yr**	4.60	5.78	6.71	7.69	8.48	**10yr**
25yr	0.72	1.10	1.37	1.95	2.56	3.04	**25yr**	2.21	2.97	3.56	4.74	5.89	6.78	7.92	**25yr**	6.00	7.62	8.92	10.05	10.93	**25yr**
50yr	0.85	1.29	1.61	2.31	3.11	3.69	**50yr**	2.69	3.61	4.34	5.83	7.22	8.31	9.76	**50yr**	7.35	9.39	11.10	12.31	13.24	**50yr**
100yr	1.01	1.52	1.90	2.75	3.77	4.49	**100yr**	3.26	4.39	5.30	7.20	8.85	10.17	12.02	**100yr**	9.00	11.56	13.80	15.11	16.06	**100yr**
200yr	1.19	1.78	2.26	3.27	4.56	5.44	**200yr**	3.94	5.32	6.46	8.86	10.84	12.47	14.81	**200yr**	11.04	14.24	17.17	18.54	19.48	**200yr**
500yr	1.49	2.21	2.85	4.13	5.88	7.03	**500yr**	5.07	6.87	8.40	11.71	14.19	16.37	19.50	**500yr**	14.48	18.75	22.96	24.36	25.14	**500yr**

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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 Dutchess County, New York

32 Alice Street

July 31, 2018

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.

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Contents

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.

Custom Soil Resource Report
Soil Map

Map Scale: 1:527 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

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 1:24,000.

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: Dutchess County, New York
Survey Area Data: Version 14, Oct 8, 2017

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

Date(s) aerial images were photographed: Oct 7, 2013—Feb 26, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
SrB	Stockbridge-Urban land complex, 3 to 8 percent slopes	0.5	100.0%
Totals for Area of Interest		**0.5**	**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.

Dutchess County, New York

SrB—Stockbridge-Urban land complex, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9rj2
Mean annual precipitation: 41 to 47 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 115 to 195 days
Farmland classification: Not prime farmland

Map Unit Composition

Stockbridge and similar soils: 40 percent
Urban land: 35 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stockbridge

Setting

Landform: Hills, till plains, drumlinoid ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Calcareous loamy till

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 23 inches: silt loam
H3 - 23 to 80 inches: silt loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Available water storage in profile: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Galway

Percent of map unit: 5 percent
Hydric soil rating: No

Georgia

Percent of map unit: 5 percent
Hydric soil rating: No

Bernardston

Percent of map unit: 5 percent
Hydric soil rating: No

Udorthents

Percent of map unit: 5 percent
Hydric soil rating: No

Massena

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

Sun

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

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D E E P T E S T R E S U L T S

Date: 07/24/2018

Name of property: 32 Alice Street Subdivision City of Beacon

TAX GRID #

6	0	5	4	-	4	7	-	3	2	0	6	1	6

Owner of property: Brent & Alison Spodek Engineer: Hudson Land Design

Person directing test: Daniel G. Koehler P.E.; conducted by Adam Gasparre

HOLE #	LOT #	TOTAL DEPTH	ROCK DEPTH	WATER DEPTH	MOTTLING DEPTH	SOIL DESCRIPTION
1-1	1	60”	60”	None Observed	None Observed	0-14” Topsoil; 14”-60” Brown sandy Loam with Cobbles, Bedrock possible @ 60”
2-1	2	84”	None Observed	None Observed	None Observed	0-11” Topsoil; 11”-84” Medium grained sand with some Cobbles

General remarks (terrain; weather; springs, streams, etc.)

Sun and Clouds, Light intermittent showers, 74 degrees F.

INFILTRATION TEST DATA

Name: 32 Alice Street Subdivision City of Beacon Date: 7/24/2018

By: Adam Gasparre

Lot No.	Test Hole No.	Test Hole Depth	Soil Type	Soaked	TEST RUNS					
					*	1	2	3	4	5
2	2A	48"	Medium Grained sand with some Cobbles	Yes	Finish	12:44	1:46	2:47		
					Start	11:44	12:46	1:47		
					Depth (in)	10.50"	10.50"	10.25"		
					Finish					
					Start					
					Depth (in)					
					Finish					
					Start					
					Depth (in)					
					Finish					
					Start					
					Depth (in)					
					Finish					
					Start					
					Depth (in)					
					Finish					
					Start					
					Depth (in)					

I, Daniel G. Koehler, the undersigned, certify that these percolation tests were done by myself or under my direction according to the standard procedure. The data and results presented are true and correct.

Dated: 07/24/2018 Signature: _____

STATE OF NEW YORK
DANIEL G. KOEHLER
LICENSED PROFESSIONAL ENGINEER
082716

License No. (P.E.) 082716

APPENDIX B

RAIN GARDEN AND HYDROCAD CALCULATIONS

Job:	32 Alice Street Subdivision		
Job No.:	2018:014		
Description:	Rain Garden Design		
Prep. By:	DGK	Date:	7/31/2018
Check By:	MAB	Date:	7/31/2018

174 Main Street
Beacon NY 12508

Stormwater Quality:

Stormwater Quality will be accomplished by treating the runoff volume generated by the 90% rainfall of the average annual stormwater runoff volume (January 2015 NYS Stormwater Design Manual).

Volume Generated By 90 % Rule (Per Ch. 4 of the NYS Stormwater Management Design Manual):

WQv = [P x Rv x A] / 12

WQv = Water quality volume (in acre-feet)
Rv = 0.05+0.009(I) = Minimum Rv = 0.2
I = Impervious Cover (Percentage)
P = 90 % Rainfall Event Number
A = Site area in acres

Water Quality Volume For The Development Conveyed to Treatment Practice

Area	Total Area (acres)	Impervious Area (acres)	Impervious Cover (%)	Rv	P	WQv (ac-ft)	WQv (cf)	Method of Treatment
Lot 1 Rooftop (1)	0.025	0.025	100	0.95	1.15	0.0023	98	Rain Garden

(1) Based on entire rooftop of existing house for future potential connection of all roof downspouts

Job:	32 Alice Street Subdivision		
Job No.:	2018:014		
Description:	Rain Garden Design		
Prep. By:	DGK	Date:	7/31/2018
Check By:	MAB	Date:	7/31/2018

HUDSON LAND DESIGN
174 Main Street
Beacon NY 12508

Rain Garden Design

Step 1 - Calculate Water Quality Volume

Water quality volume (WQ_V)= 98 cubic feet (see Sheet 1)

Step 2 - Solve for drainage layer & soil media storage volume (per Ch. 9 of the NYS Stormwater Management Design Manual)

		Provided:
V_{SM}=	Volume of the soil media (cf) = $(A_{RG})(D_{SM})(P_{SM})$	
V_{DL}=	Volume of the drainage layer (cf) = $(A_{RG})(D_{DL})(P_{DL})$	
where A_{RG} =	Rain garden surface area (sf)	108 square feet
D_{SM} =	Depth of the soil media, typically 1.0 to 1.5 feet (ft)	1.00 ft
D_{DL} =	Depth of the drainage layer, typically 0.05 to 1.0 feet (ft)	0.75 ft
P_{SM} =	Porosity of the soil media (≥20%)	20%
P_{DL} =	Porsity of the drainage layer (≥40%)	40%
D_P =	Depth of ponding above surface, maximum 0.5 feet (ft)	0.50 ft

$WQ_V \leq V_{SM} + V_{DL} + (D_P \times A_{RG})$

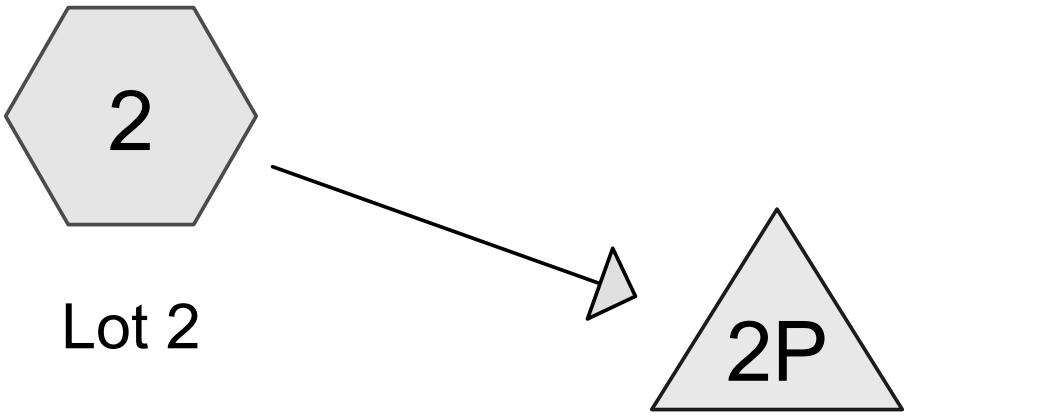
V_{SM}= 22 cubic feet

V_{DL}= 32 cubic feet

W_{QV}= 108 cubic feet

Water Quality Volume:	Provided:		Required:	
	108 cubic feet	>	**98 cubic feet**	meets min. requirement

General Notes:
1) Rain gardens shall be located downgradient and a minimum of 10 feet from basement foundations
2) Rain gardens shall not be located in areas with steep slopes. However, design modifications can be implemented on moderate slopes.
3) In compacted soils and clay, additional excavation is necessary, along with gravel bed, and, under some circumstances, an underdrain system.
4) Rain gardens shall not be located any closer than 50 feet to wells or sewage disposal systems.



Subcat Reach Pond Link

Routing Diagram for POST DEV_32 Alice

Prepared by Hudson Land Design Professional Engineering, P.C., Printed 7/31/2018

Summary for Subcatchment 2: Lot 2

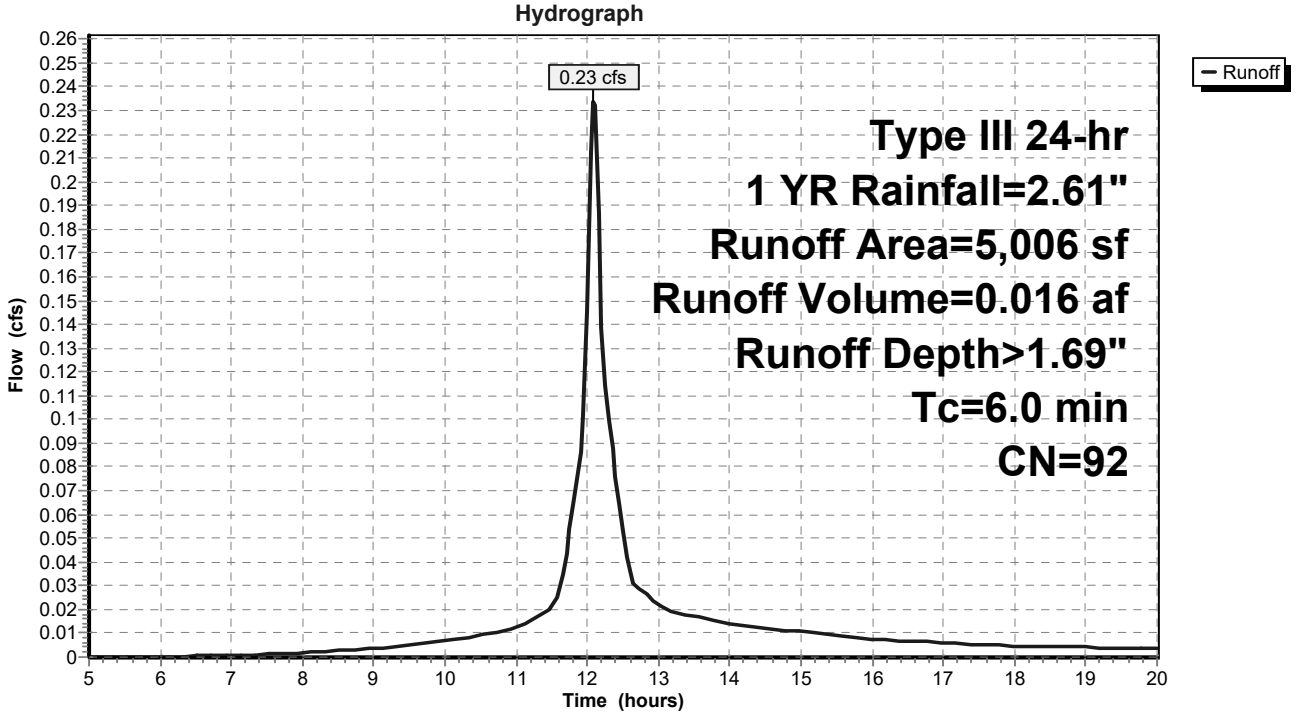
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 0.016 af, Depth> 1.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 1 YR Rainfall=2.61"

Area (sf)	CN	Description
3,782	98	Paved parking, HSG C
1,224	74	>75% Grass cover, Good, HSG C
5,006	92	Weighted Average
1,224		24.45% Pervious Area
3,782		75.55% Impervious Area

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

Subcatchment 2: Lot 2



Summary for Pond 2P: SC-310 Chambers

Inflow Area = 0.115 ac, 75.55% Impervious, Inflow Depth > 1.69" for 1 YR event
Inflow = 0.23 cfs @ 12.09 hrs, Volume= 0.016 af
Outflow = 0.05 cfs @ 12.51 hrs, Volume= 0.016 af, Atten= 78%, Lag= 24.9 min
Discarded = 0.05 cfs @ 12.51 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 213.80' @ 12.51 hrs Surf.Area= 0.010 ac Storage= 0.004 af

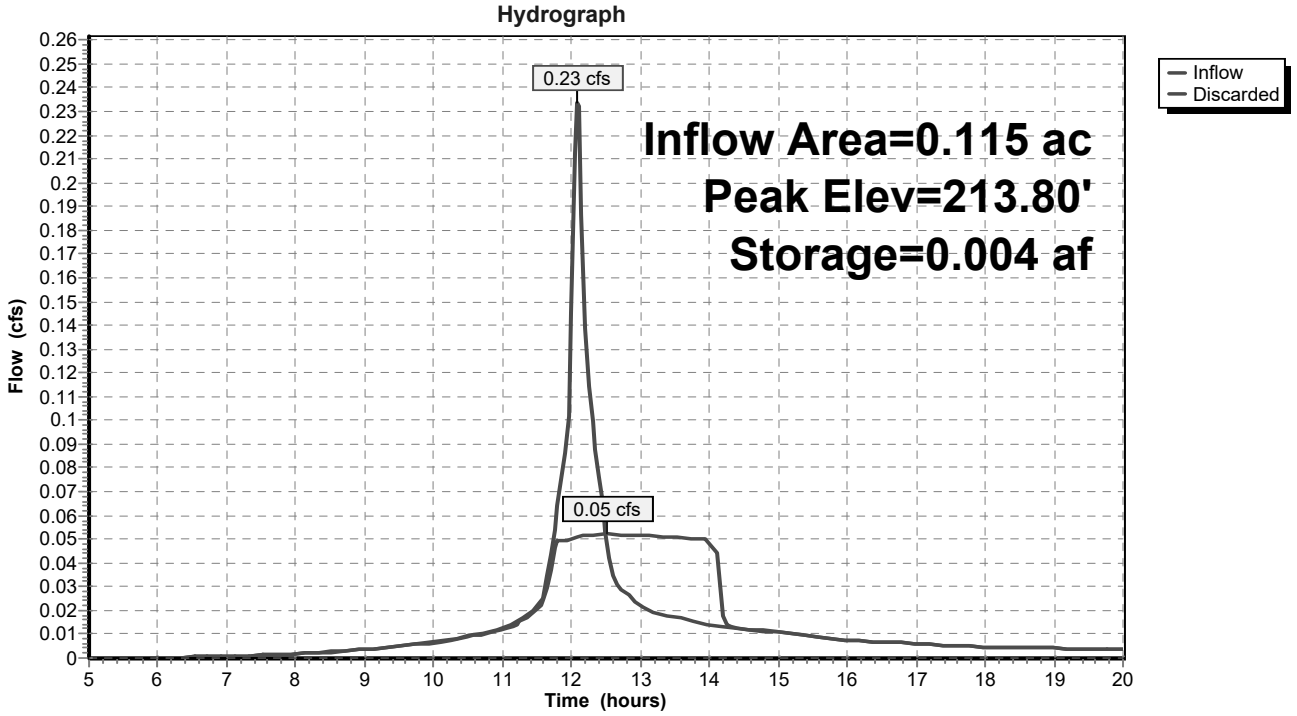
Plug-Flow detention time= 21.6 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 21.2 min (794.5 - 773.2)

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	0.014 af	**18.20'W x 23.30'L x 4.00'H Prismatoid** 0.039 af Overall - 0.005 af Embedded = 0.034 af x 40.0% Voids
#2	213.50'	0.005 af	**ADS_StormTech SC-310** x 15 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		0.019 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	**5.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 200.00'

Discarded OutFlow Max=0.05 cfs @ 12.51 hrs HW=213.80' (Free Discharge)
↑**1=Exfiltration** (Controls 0.05 cfs)

Pond 2P: SC-310 Chambers



Summary for Subcatchment 2: Lot 2

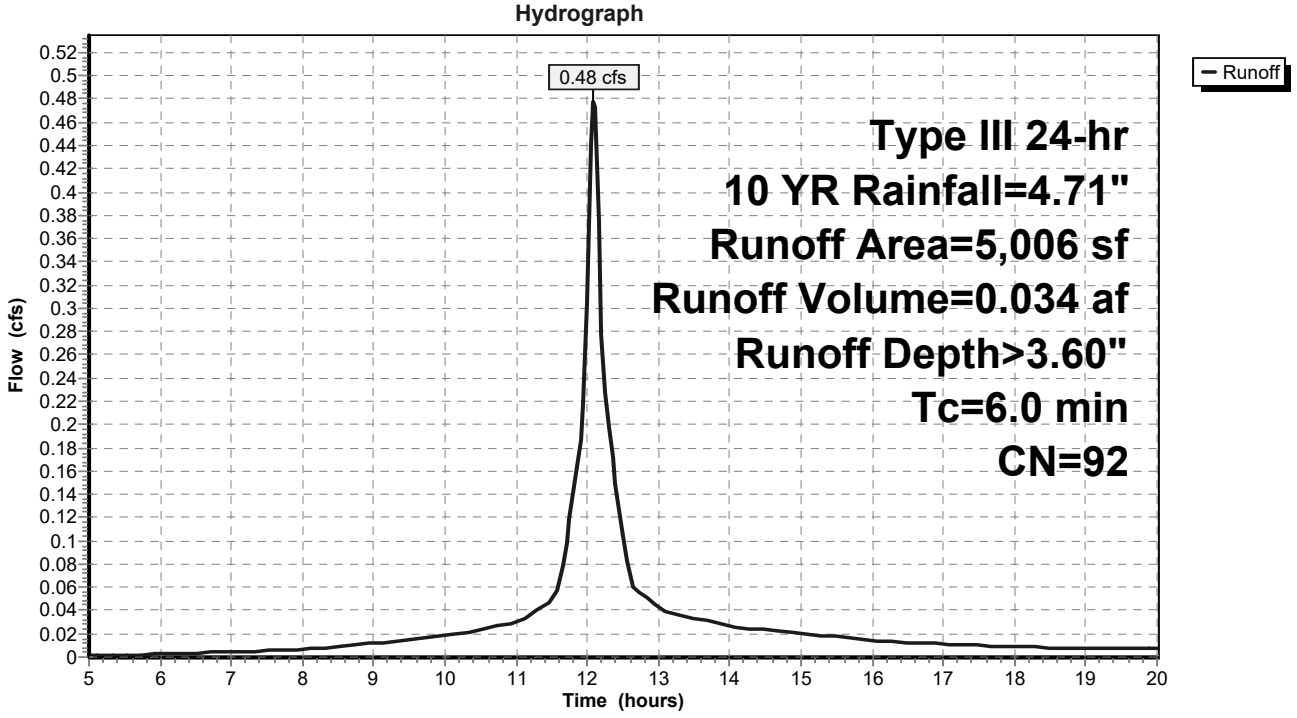
Runoff = 0.48 cfs @ 12.09 hrs, Volume= 0.034 af, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 YR Rainfall=4.71"

Area (sf)	CN	Description
3,782	98	Paved parking, HSG C
1,224	74	>75% Grass cover, Good, HSG C
5,006	92	Weighted Average
1,224		24.45% Pervious Area
3,782		75.55% Impervious Area

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

Subcatchment 2: Lot 2



Summary for Pond 2P: SC-310 Chambers

Inflow Area = 0.115 ac, 75.55% Impervious, Inflow Depth > 3.60" for 10 YR event
Inflow = 0.48 cfs @ 12.09 hrs, Volume= 0.034 af
Outflow = 0.06 cfs @ 12.69 hrs, Volume= 0.034 af, Atten= 88%, Lag= 36.2 min
Discarded = 0.06 cfs @ 12.69 hrs, Volume= 0.034 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 215.37' @ 12.69 hrs Surf.Area= 0.010 ac Storage= 0.012 af

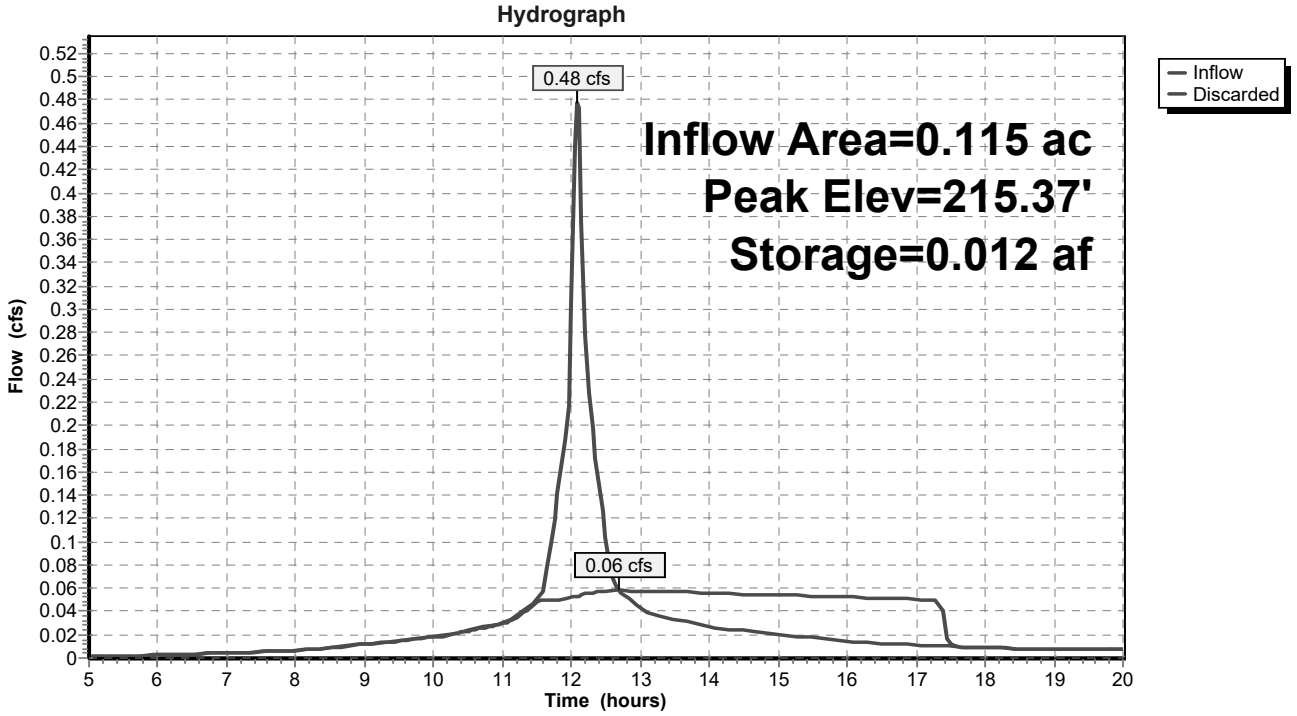
Plug-Flow detention time= 71.9 min calculated for 0.034 af (100% of inflow)
Center-of-Mass det. time= 71.3 min (827.4 - 756.0)

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	0.014 af	**18.20'W x 23.30'L x 4.00'H Prismatoid** 0.039 af Overall - 0.005 af Embedded = 0.034 af x 40.0% Voids
#2	213.50'	0.005 af	**ADS_StormTech SC-310** x 15 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		0.019 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	**5.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 200.00'

Discarded OutFlow Max=0.06 cfs @ 12.69 hrs HW=215.37' (Free Discharge)
↑**1=Exfiltration** (Controls 0.06 cfs)

Pond 2P: SC-310 Chambers



Summary for Subcatchment 2: Lot 2

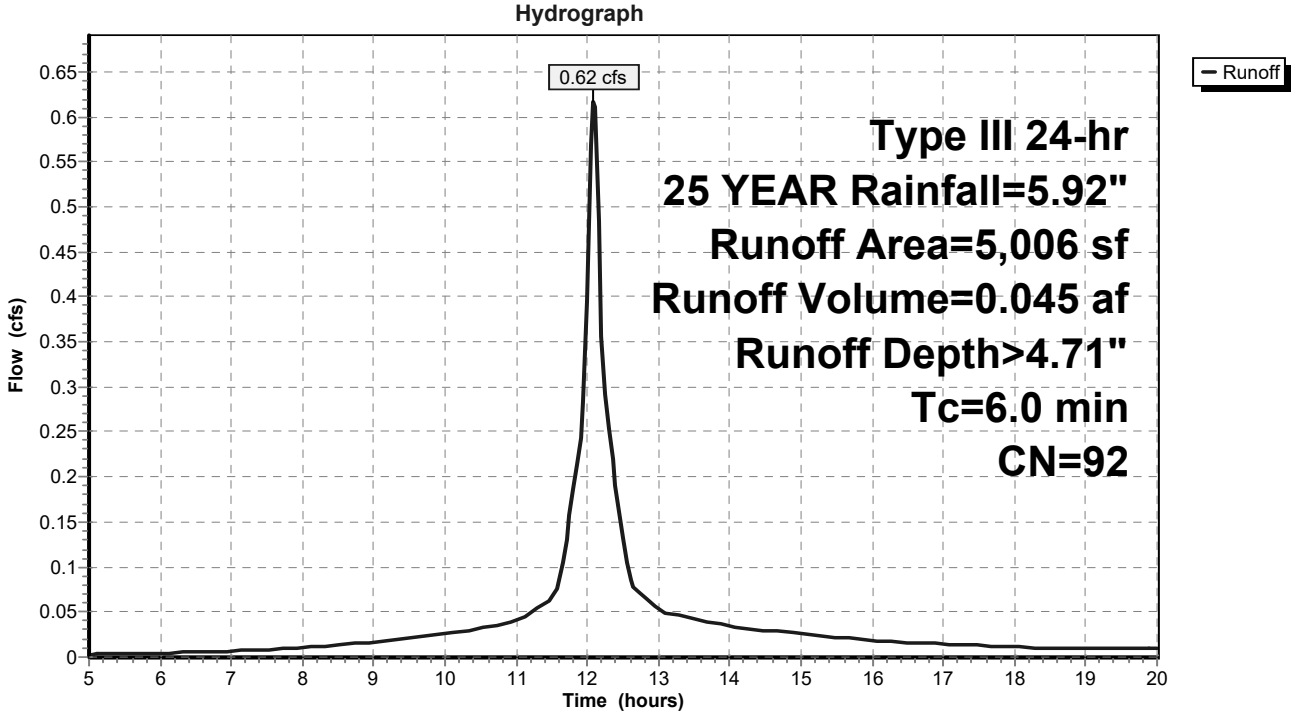
Runoff = 0.62 cfs @ 12.09 hrs, Volume= 0.045 af, Depth> 4.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 YEAR Rainfall=5.92"

Area (sf)	CN	Description
3,782	98	Paved parking, HSG C
1,224	74	>75% Grass cover, Good, HSG C
5,006	92	Weighted Average
1,224		24.45% Pervious Area
3,782		75.55% Impervious Area

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

Subcatchment 2: Lot 2



Summary for Pond 2P: SC-310 Chambers

Inflow Area = 0.115 ac, 75.55% Impervious, Inflow Depth > 4.71" for 25 YEAR event
Inflow = 0.62 cfs @ 12.09 hrs, Volume= 0.045 af
Outflow = 0.06 cfs @ 12.86 hrs, Volume= 0.045 af, Atten= 90%, Lag= 46.2 min
Discarded = 0.06 cfs @ 12.86 hrs, Volume= 0.045 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 216.69' @ 12.86 hrs Surf.Area= 0.010 ac Storage= 0.017 af

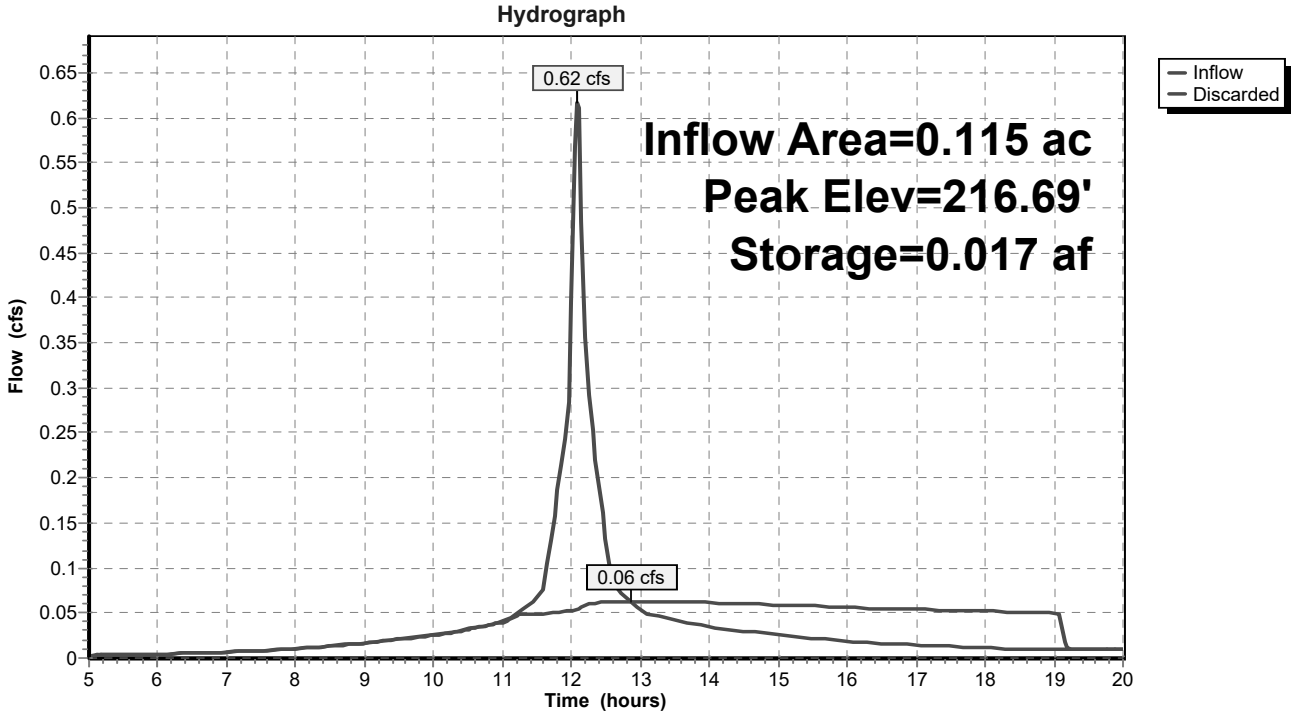
Plug-Flow detention time= 101.2 min calculated for 0.045 af (100% of inflow)
Center-of-Mass det. time= 100.8 min (851.8 - 750.9)

Volume	Invert	Avail.Storage	Storage Description
#1	213.00'	0.014 af	**18.20'W x 23.30'L x 4.00'H Prismatoid** 0.039 af Overall - 0.005 af Embedded = 0.034 af x 40.0% Voids
#2	213.50'	0.005 af	**ADS_StormTech SC-310** x 15 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 5 rows
		0.019 af	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	213.00'	**5.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 200.00'

Discarded OutFlow Max=0.06 cfs @ 12.86 hrs HW=216.69' (Free Discharge)
↑**1=Exfiltration** (Controls 0.06 cfs)

Pond 2P: SC-310 Chambers

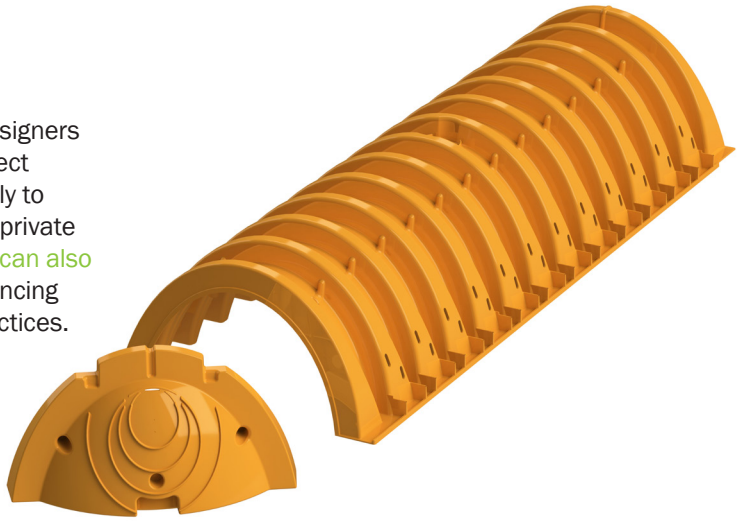


APPENDIX C

PRODUCT CUT SHEETS

SC-310 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



STORMTECH SC-310 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
85.4" x 34.0" x 16.0"
2,170 mm x 864 mm x 406 mm

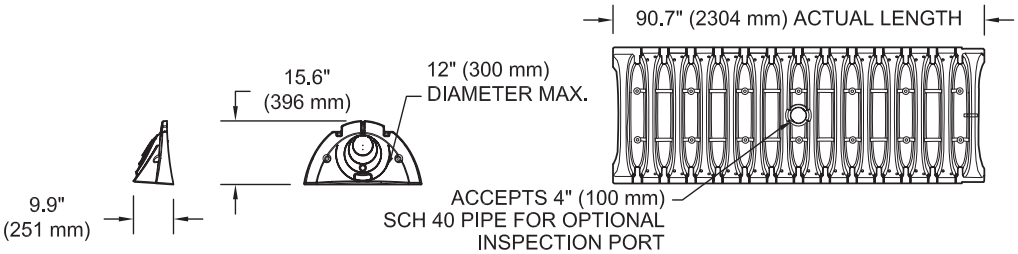
Chamber Storage
14.7 ft³ (0.42 m³)

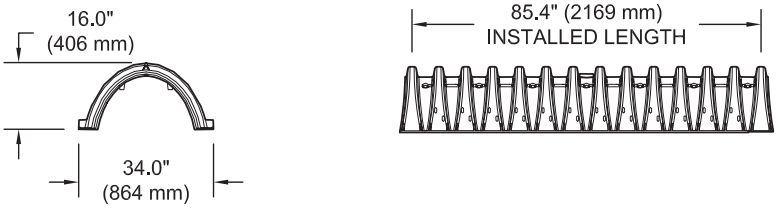
Min. Installed Storage*
31.0 ft³ (0.88 m³)

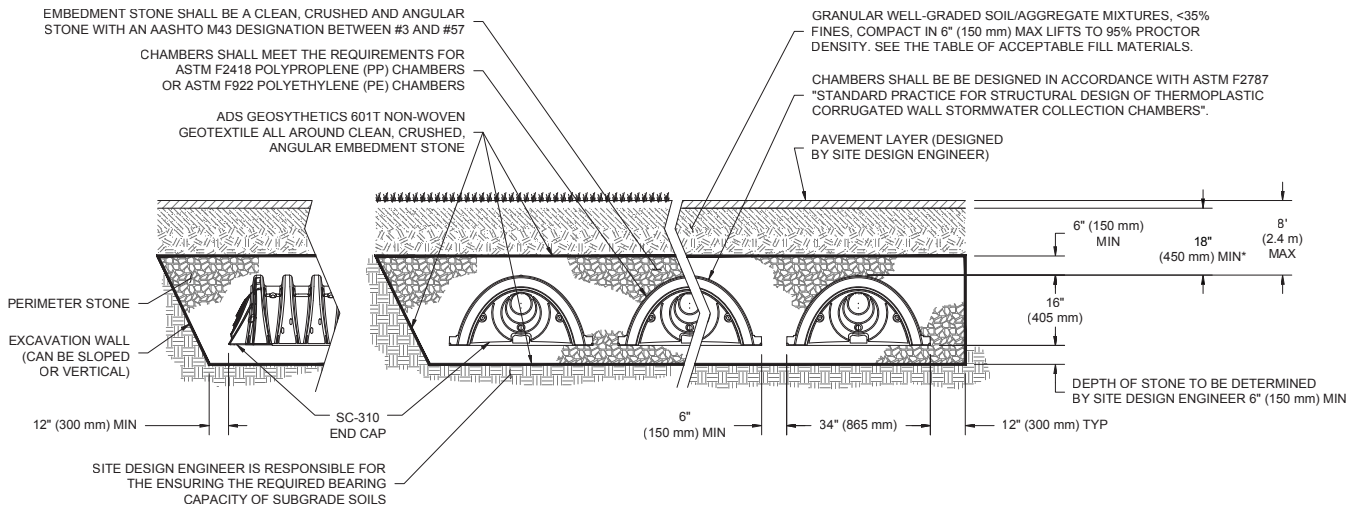
Weight
37.0 lbs (16.8 kg)

Shipping
41 chambers/pallet
108 end caps/pallet
18 pallets/truck

*Assumes 6" (150 mm) stone above and below chambers and 40% stone porosity.







*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

SC-310 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)	14.70 (0.416)	31.00 (0.878)
27 (686)	14.70 (0.416)	30.21 (0.855)
26 (680)	Stone 14.70 (0.416)	29.42 (0.833)
25 (610)	Cover 14.70 (0.416)	28.63 (0.811)
24 (609)	14.70 (0.416)	27.84 (0.788)
23 (584)	14.70 (0.416)	27.05 (0.766)
22 (559)	14.70 (0.416)	26.26 (0.748)
21 (533)	14.64 (0.415)	25.43 (0.720)
20 (508)	14.49 (0.410)	24.54 (0.695)
19 (483)	14.22 (0.403)	23.58 (0.668)
18 (457)	13.68 (0.387)	22.47 (0.636)
17 (432)	12.99 (0.368)	21.25 (0.602)
16 (406)	12.17 (0.345)	19.97 (0.566)
15 (381)	11.25 (0.319)	18.62 (0.528)
14 (356)	10.23 (0.290)	17.22 (0.488)
13 (330)	9.15 (0.260)	15.78 (0.447)
12 (305)	7.99 (0.227)	14.29 (0.425)
11 (279)	6.78 (0.192)	12.77 (0.362)
10 (254)	5.51 (0.156)	11.22 (0.318)
9 (229)	4.19 (0.119)	9.64 (0.278)
8 (203)	2.83 (0.081)	8.03 (0.227)
7 (178)	1.43 (0.041)	6.40 (0.181)
6 (152)	0	4.74 (0.134)
5 (127)	0	3.95 (0.112)
4(102)	Stone Foundation 0	3.16 (0.090)
3 (76)	0	2.37 (0.067)
2 (51)	0	1.58 (0.046)
1 (25)	0	0.79 (0.022)

Note: Add 0.79 ft³ (0.022 m³) of storage for each additional inch. (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
StormTech SC-310	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)

Note: Assumes 6" (150 mm) of stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

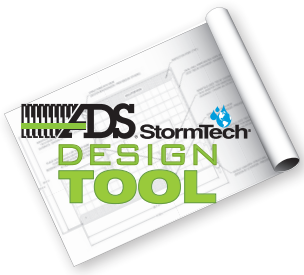
ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	18"
StormTech SC-310	2.1 (1.5 yd³)	2.7 (1.9 yd³)	3.4 (2.4 yd³)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
StormTech SC-310	1830 (1.1 m³)	2490 (1.5 m³)	2990 (1.8 m³)

Note: Assumes 6" (150 mm) of stone above, and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6" (150 mm)	12" (300 mm)	18" (450 mm)
StormTech SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as the depth of the cover increases.



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