

STORMWATER MANAGEMENT REPORT

for

30 Commerce Drive Proposed Mikvah Conversion

30 Commerce Drive
Block 644, Lot 2
Township of Cranford, Union County, NJ

Revised September 29, 2023

Prepared for:

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 10/04/23

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INTRODUCTION

It is proposed to convert an existing single family house at 30 Commerce Drive in Cranford Township, Union County, into a mikvah facility. The subject property is identified as Lot 2 of Block 644 on township tax maps. As part of the conversion, a new parking area on the northerly side of the lot is proposed. This report describes the proposed stormwater management system and addresses compliance with applicable regulations.

EXISTING CONDITIONS

The subject property encompasses 13,000 square feet (0.30 acres) and is currently occupied by a single building and a frame shed in the rear yard. Parking is limited to a 10 foot wide driveway and a single car garage. There are concrete walkways along the south (left) and west (rear) sides of the building and an asphalt basketball court in the rear yard. With the exception of several scattered trees, the majority of the yards consist of lawn.

Roof runoff is collected by gutters along the perimeter of the house and discharges to grade or to the street gutter via downspouts. Several of the downspouts are missing or in disrepair. Two downspouts are directed to underground piping. There are two discharge points in the street curb along the property frontage. It appears the underground piping is connected to these discharge points; however, connectivity is uncertain.

PROPOSED DEVELOPMENT

The proposed building will remain and be converted for the proposed mikvah use. An enclosed, covered patio area will be incorporated to the main building will be used to house the mikvah bath. The remainder of the house will be retrofitted as dressing rooms and a small office. The overall footprint of the building will not change. An existing frame shed in the rear corner of the property will be removed.

A new proposed parking area along the north (right) side of the property with its own curb cut will provide for 5 parking spaces. The existing driveway will be used as a loading area. In order to construct the curb cut, one of the gutter discharge points will be relocated. In addition, new sidewalks will provide pedestrian access from the parking to the ADA ramp and front door and from the loading to the rear of the building. The entire new parking area will be constructed with porous asphalt pavement. The sidewalks on site will be constructed with permeable pavers. The existing driveway will also be replaced with permeable pavers.

It is proposed to construct two interconnected infiltration/retention basins in the front yard on each side of the site new driveway. All Runoff from the proposed parking, a section of the front yard and a portion of the existing roof will be diverted to a proposed storm retention areas located in the front yard. The retention overflow will discharge to the gutter of Commerce Drive through the relocated discharge point.

STORMWATER MANAGEMENT

According to municipal code, a project that results in the creating of more than 1,000 square feet of regulated motor vehicle surface is defined as a major development. Since this project will have a net increase of 2,500 square feet of pavement and sidewalks, the project meets the definition of a major development. As such, it is required to reduce the

peak rates of runoff for the 2, 10, and 100 year storms, to 50%, 75% and 80%, respectively, of existing conditions.

The SCS method was used to calculate existing and proposed peak runoff rates. A minimum Time of Concentration (Tc) of 6 minutes is used for both existing and proposed conditions. Rainfall rates are based on NOAA rainfall data, partial duration series, at the Cranford rainfall station. Rainfall rates from this station are included in the Appendix. Information taken from SSURGO soil data indicates soils in this subject location are typically sandy loams or loams with a Hydraulic Soil Group rating of "C". Pages from the SSURGO Soils report are included in the Appendix of this report. Based on chapter 2 of the USDA TR-55 publication, the following Curve Numbers values have been applied to this project:

Lawn & landscaped areas	CN=74
Roof, pavement & concrete	CN=98
Porous asphalt and permeable pavers	CN=74

For calculation purposes, the project area is defined as the proposed disturbed area. Reductions are only applicable to the project area. Existing roof runoff, which also discharges into the retention system, does not need to be reduced, since this is an existing building and no increase in roof area is proposed.

Calculations included in the Appendix indicate runoff from the existing roof and the proposed project area. Routing through the basins were calculated using the TR-20 method. HydroCAD version 10, by HydroCAD Software Solutions, was used to compute peak runoff rates and basin routings. Under existing conditions, the project area consists of pavement, lawn, and bare earth areas and is 24% impervious. The table below summarizes existing peak rates of runoff and allowable flows from the project. Printouts from HydroCAD are provided in the Appendix.

Existing Site Peak Run-Off Rates						
Storm	24-Hour Rainfall (In)	Project Area Runoff (cfs)	Required Reductions	Reduced Peak Rate (cfs)	Roof Runoff Peak Rate (cfs)*	Total Allowable Peak (cfs)
2-year	3.39	0.32	50%	0.16	0.16	0.32
10-year	5.18	0.63	75%	0.47	0.25	0.72
100-year	8.71	1.26	80%	1.01	0.42	1.43

*Reductions do not apply to runoff from the existing roof.

For the proposed project runoff to meet the peak rate reduction requirements stated above, a retention system is proposed in the front yard of the property. All new parking areas and some of the front lawn will discharge through the retention system. In addition, more than 60% of the existing roof will be diverted into this retention system. The retention area will allow the first foot of storage to infiltrate. A Yard Basin will project above the bottom of the basin. A low flow orifice in the side of the basin will regulate the 2-year runoff. The top grate will regulate the larger storms. Since there is no storm system in Commerce Drive adjacent to the property, basin discharge will enter the street gutter via a PVC pipes through the curb.

Under proposed conditions, a portion of the existing roof and front yard, including the existing driveway and new front sidewalks, will run off the site undetained, since it is not practical to capture runoff from these areas. The undetained areas will be 30% lawn, 32% permeable pavers walkways and 38% existing roof. The remainder of the project, which will be detained, will consist of 18% existing roof, 38% porous pavement, 2% permeable pavers, 5% concrete and 36% lawn/landscaping. Total project runoff will be the sum of the peak discharge from the retention areas and runoff from the undetained areas. In actuality, the two areas will not necessarily peak simultaneously. The total peak of these two contributing areas is determined by summing the individual hydrographs as computed by HydroCAD.

Discharge from the retention area is computed using the TR-20 Storage-Indication Method. Routing calculations for each design storm are provided in the Appendix. For computational purpose, an infiltration rate of 0.5 in/hr is used. The infiltration volume is negligible and has little impact on the computed peak discharges.

The table below summarizes the proposed runoff from the project and compares them to the allowable peak rates. For all three design storms, the proposed peak runoff rates are less than the allowable discharge rates indicated above.

Proposed Development Runoff Rates		
Storm	Proposed Peak Runoff (cfs)	Allowable Peak (cfs)
2-year	0.14	0.32
10-year	0.50	0.72
100-year	1.22	1.43

Quality Treatment

Water quality treatment is only required where the project entails more than 1/4 acre of new impervious area. The proposed project will increase impervious area by only 2,500 square feet of 0.06 acres. Therefore water quality treatment is not required and no water quality measures are proposed.

Groundwater Recharge

The proposed site is delineated on the State Plan Policy Map as a Metropolitan Planning Area 1 (PA-1). In accordance with the stormwater regulations, projects located in a PA-1 Metropolitan Area are exempt from groundwater recharge requirements. Nevertheless, due to the infiltration design of the retention basin, some groundwater recharge will be provided.

CONCLUSION

The proposed project is a major development under the municipal stormwater rules. Therefore, quantity controls are required to reduce the peak rates of discharge for the 2, 10 and 100 year design storms. The proposed retention system will provide the required peak

flow reductions in compliance with the regulations. The project is exempt from water quality and ground water recharge measures. Therefore, the project meets the requirements of the stormwater ordinance and will not have an adverse impact on adjacent properties or the local storm water drainage system.

Appendix A

NOAA Rainfall Depths



POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

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	0.335 (0.306-0.367)	0.398 (0.365-0.437)	0.472 (0.430-0.518)	0.524 (0.477-0.576)	0.589 (0.534-0.646)	0.634 (0.572-0.694)	0.679 (0.609-0.744)	0.719 (0.641-0.788)	0.768 (0.679-0.845)	0.805 (0.707-0.888)
10-min	0.534 (0.489-0.587)	0.637 (0.583-0.700)	0.756 (0.689-0.829)	0.838 (0.763-0.921)	0.938 (0.850-1.03)	1.01 (0.911-1.11)	1.08 (0.968-1.18)	1.14 (1.02-1.25)	1.22 (1.07-1.34)	1.27 (1.11-1.40)
15-min	0.668 (0.611-0.734)	0.801 (0.733-0.879)	0.956 (0.871-1.05)	1.06 (0.966-1.16)	1.19 (1.08-1.30)	1.28 (1.15-1.40)	1.36 (1.22-1.49)	1.44 (1.28-1.58)	1.53 (1.35-1.68)	1.59 (1.40-1.76)
30-min	0.916 (0.838-1.01)	1.11 (1.01-1.22)	1.36 (1.24-1.49)	1.54 (1.40-1.69)	1.76 (1.60-1.93)	1.92 (1.74-2.11)	2.09 (1.87-2.29)	2.24 (2.00-2.45)	2.44 (2.15-2.68)	2.58 (2.26-2.84)
60-min	1.14 (1.04-1.25)	1.39 (1.27-1.52)	1.74 (1.59-1.91)	2.00 (1.82-2.20)	2.35 (2.13-2.57)	2.61 (2.35-2.86)	2.88 (2.58-3.15)	3.14 (2.80-3.44)	3.49 (3.09-3.84)	3.76 (3.30-4.15)
2-hr	1.40 (1.27-1.54)	1.70 (1.55-1.88)	2.16 (1.96-2.38)	2.51 (2.27-2.77)	3.00 (2.70-3.31)	3.41 (3.05-3.75)	3.82 (3.39-4.21)	4.26 (3.75-4.69)	4.87 (4.24-5.37)	5.35 (4.62-5.92)
3-hr	1.56 (1.42-1.72)	1.90 (1.73-2.10)	2.41 (2.19-2.66)	2.81 (2.54-3.10)	3.36 (3.03-3.70)	3.81 (3.41-4.20)	4.28 (3.81-4.71)	4.76 (4.20-5.25)	5.44 (4.74-6.01)	5.99 (5.17-6.62)
6-hr	2.00 (1.82-2.22)	2.43 (2.22-2.69)	3.08 (2.80-3.40)	3.61 (3.26-3.97)	4.36 (3.91-4.79)	4.99 (4.44-5.47)	5.66 (4.99-6.20)	6.38 (5.58-6.99)	7.42 (6.40-8.14)	8.28 (7.06-9.09)
12-hr	2.48 (2.26-2.74)	3.01 (2.75-3.33)	3.83 (3.49-4.23)	4.53 (4.10-4.97)	5.54 (4.98-6.07)	6.42 (5.71-7.01)	7.37 (6.48-8.04)	8.42 (7.32-9.19)	9.98 (8.51-10.9)	11.3 (9.49-12.3)
24-hr	2.80 (2.59-3.05)	3.39 (3.14-3.70)	4.36 (4.02-4.75)	5.18 (4.77-5.64)	6.43 (5.86-6.98)	7.51 (6.80-8.15)	8.71 (7.81-9.46)	10.1 (8.91-10.9)	12.1 (10.5-13.2)	13.8 (11.9-15.1)
2-day	3.30 (3.03-3.62)	4.00 (3.67-4.38)	5.11 (4.69-5.59)	6.04 (5.52-6.60)	7.42 (6.74-8.09)	8.59 (7.76-9.36)	9.86 (8.84-10.8)	11.3 (9.98-12.3)	13.3 (11.6-14.7)	15.1 (13.0-16.7)
3-day	3.48 (3.20-3.80)	4.22 (3.88-4.60)	5.36 (4.93-5.86)	6.32 (5.78-6.89)	7.71 (7.02-8.39)	8.88 (8.04-9.67)	10.2 (9.12-11.1)	11.5 (10.2-12.6)	13.5 (11.9-14.9)	15.2 (13.2-16.8)
4-day	3.66 (3.37-3.99)	4.43 (4.08-4.83)	5.62 (5.17-6.12)	6.59 (6.05-7.18)	8.00 (7.31-8.70)	9.18 (8.33-9.98)	10.4 (9.40-11.4)	11.8 (10.5-12.9)	13.8 (12.1-15.1)	15.4 (13.4-17.0)
7-day	4.32 (4.01-4.68)	5.19 (4.81-5.62)	6.45 (5.97-6.98)	7.49 (6.92-8.10)	8.98 (8.25-9.72)	10.2 (9.33-11.1)	11.5 (10.5-12.5)	13.0 (11.6-14.1)	15.0 (13.2-16.4)	16.6 (14.5-18.3)
10-day	4.94 (4.60-5.32)	5.91 (5.50-6.36)	7.23 (6.73-7.79)	8.32 (7.72-8.96)	9.86 (9.10-10.6)	11.1 (10.2-12.0)	12.4 (11.3-13.5)	13.8 (12.5-15.0)	15.8 (14.1-17.3)	17.4 (15.4-19.1)
20-day	6.68 (6.27-7.12)	7.93 (7.44-8.46)	9.46 (8.87-10.1)	10.7 (9.98-11.4)	12.3 (11.5-13.1)	13.6 (12.6-14.5)	14.8 (13.7-15.9)	16.1 (14.8-17.3)	17.9 (16.3-19.3)	19.2 (17.4-20.8)
30-day	8.32 (7.87-8.80)	9.83 (9.29-10.4)	11.5 (10.9-12.1)	12.8 (12.0-13.5)	14.4 (13.6-15.2)	15.7 (14.7-16.6)	16.9 (15.8-17.9)	18.1 (16.8-19.2)	19.6 (18.1-20.9)	20.7 (19.1-22.2)
45-day	10.6 (10.0-11.1)	12.4 (11.8-13.1)	14.4 (13.6-15.1)	15.8 (15.0-16.6)	17.7 (16.7-18.6)	19.0 (17.9-20.1)	20.4 (19.2-21.5)	21.7 (20.3-22.9)	23.3 (21.7-24.7)	24.5 (22.7-26.0)
60-day	12.7 (12.1-13.3)	14.9 (14.2-15.6)	17.0 (16.2-17.8)	18.6 (17.6-19.5)	20.5 (19.5-21.6)	22.0 (20.8-23.1)	23.3 (22.0-24.6)	24.6 (23.2-25.9)	26.1 (24.5-27.6)	27.2 (25.4-28.8)

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.

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PF graphical

Appendix B

SSURGO Soil Data



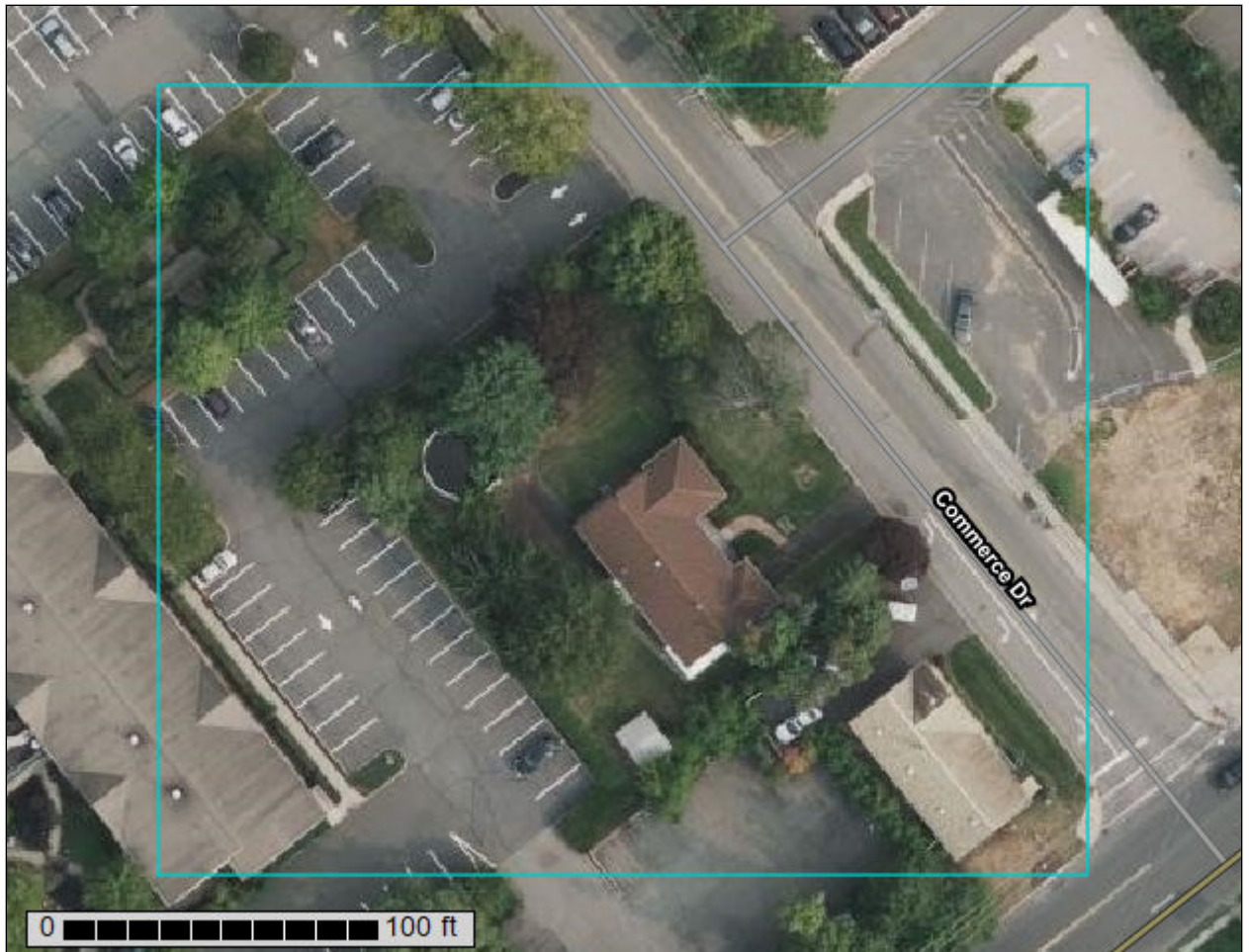
United States
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NRCS

Natural
Resources
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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

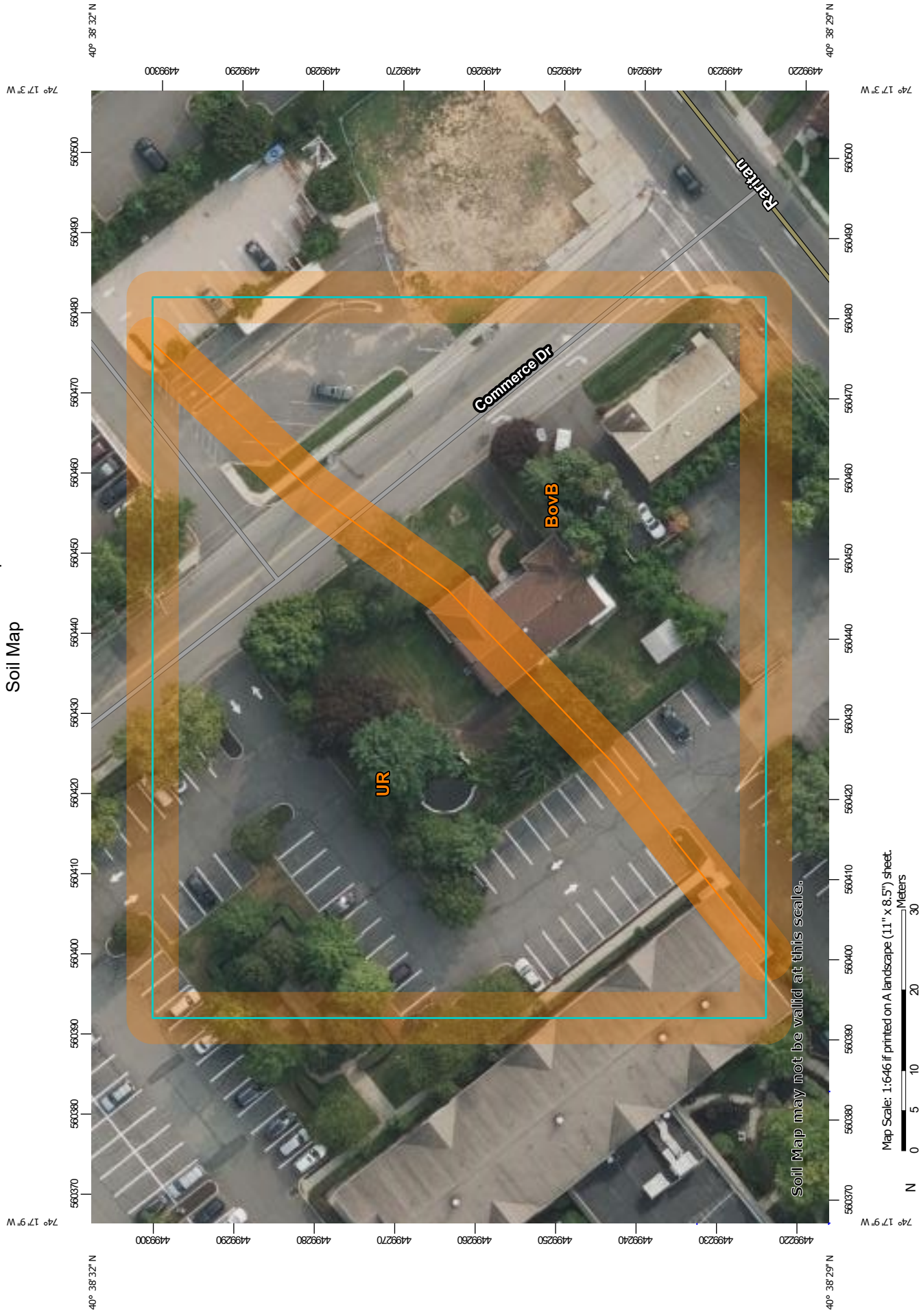
Custom Soil Resource Report for **Union County, New Jersey**



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



Union County, New Jersey

BovB—Boonton-Urban land-Haledon complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 1kgnb
Elevation: 50 to 500 feet
Mean annual precipitation: 30 to 64 inches
Mean annual air temperature: 46 to 79 degrees F
Frost-free period: 131 to 178 days
Farmland classification: Not prime farmland

Map Unit Composition

Boonton, moderately well drained, and similar soils: 50 percent
Urban land: 30 percent
Haledon and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Boonton, Moderately Well Drained

Setting

Landform: Ground moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Coarse-loamy till derived from basalt

Typical profile

Ap - 0 to 8 inches: loam
Bt - 8 to 36 inches: gravelly fine sandy loam
Bx - 36 to 51 inches: loam
C - 51 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Custom Soil Resource Report

Description of Urban Land

Setting

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Typical profile

C - 0 to 60 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Hydric soil rating: Unranked

Description of Haledon

Setting

Landform: Ground moraines

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Upper third of mountainflank, center third of mountainflank

Down-slope shape: Convex

Across-slope shape: Linear

Parent material: Coarse-loamy till derived from basalt

Typical profile

Ap - 0 to 9 inches: loam

Bt - 9 to 28 inches: silt loam

Bx - 28 to 44 inches: sandy loam

C - 44 to 60 inches: gravelly loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: 24 to 36 inches to fragipan

Drainage class: Somewhat poorly drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)

Depth to water table: About 6 to 18 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3w

Hydrologic Soil Group: C

Ecological site: F144AY037MA - Moist Dense Till Uplands

Hydric soil rating: No

UR—Urban land

Map Unit Setting

National map unit symbol: b0vf

Elevation: 0 to 170 feet

Mean annual precipitation: 30 to 64 inches

Mean annual air temperature: 46 to 79 degrees F

Frost-free period: 131 to 178 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 95 percent

Minor components: 5 percent

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

Description of Urban Land

Setting

Parent material: Surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 5 percent

Landform: Low hills

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BovB	Boonton-Urban land-Haledon complex, 0 to 8 percent slopes	C	0.8	45.4%
UR	Urban land		0.9	54.6%
Totals for Area of Interest			1.7	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C

Weighted Curve Numbers and Allowable Peak Runoff Rates

WEIGHTED CURVE NUMBERS & ALLOWABLE PEAK RUNOFF RATES

Project: 30 Commerce Dr Mikvah, Cranford, NJ
 Proj. No. PN23107

09/29/23

<u>Area Description</u>	<u>Area (SF)</u>	
Project Limits*	10,220	SF
less Existing House Area	-2,260	SF
Net Project Area	7,960	SF

*Project Limits is Area of Disturbance

EXISTING CONDITIONS

<u>Area Description</u>	<u>Area (SF)</u>	<u>CN</u>	
Paved Area	1,770	98	
Shed Area	180	98	
Lawn/Dirt Area	6,010	74	
Net Project Area	7,960	80	Weighted

Allowable Flow from Net Project Area:

<u>Storm</u>	<u>Rainfall</u>	<u>Area</u>	<u>CN</u>	<u>Q*</u>	<u>Reduction %</u>	<u>Allow. Q</u>
2-YR	3.39	7,960	80	0.32	50%	0.16
10-YR	5.18	7,960	80	0.63	75%	0.47
100-YR	8.71	7,960	80	1.26	80%	1.01

* From HydroCAD output

Allowable Flow from Existing House (Not in Project Area):

<u>Storm</u>	<u>Rainfall</u>	<u>Area</u>	<u>CN</u>	<u>Q*</u>	<u>Reduction %</u>	<u>Allow. Q*</u>
2-YR	3.39	2,260	98	0.16	100%	0.16
10-YR	5.18	2,260	98	0.25	100%	0.25
100-YR	8.71	2,260	98	0.42	100%	0.42

* From HydroCAD output - Reductions not required for areas outside Project Area

Total Allowable from Project Area & Existing House

<u>Storm</u>	<u>Proj. Area</u>	<u>Exist. House</u>	<u>Total</u>
2-YR	0.16	0.16	0.32
10-YR	0.47	0.25	0.72
100-YR	1.01	0.42	1.43

PROPOSED CONDITIONS

Undetained Areas:

<u>Area Description</u>	<u>Area (SF)</u>	<u>CN</u>	
Paved/Concrete Areas	160	98	
Lawn/Dirt Area	850	74	
Permeable Pavers	910	74	
Roof south portion	900	98	
Total Area	2,820	83	Weighted

Detained Areas:

<u>Area Description</u>	<u>Area (SF)</u>	<u>CN</u>	
Concrete Areas	390	98	
Porous Asphalt	2,830	74	
Lawn/planter	2,680	74	
Permeable Pavers	140	74	
Roof north portion	1,360	98	
Total Area (SF)	7,400	78	Weighted

Appendix D

Existing Conditions Calculations:

2-Year Storm

10-Year Storm

100-Year Storm

CE23104-2023-10-02-C Existing Cond

Prepared by Chisvette Engineering

HydroCAD® 10.00-22 s/n 09089 © 2018 HydroCAD Software Solutions LLC

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.052	98	Roofs, HSG C (EX-2)
0.183	80	Weighted (EX-1)
0.235	84	TOTAL AREA

Summary for Subcatchment EX-1: Net Project Area

Runoff = 0.32 cfs @ 12.13 hrs, Volume= 0.021 af, Depth> 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-yr Rainfall=3.39"

Area (sf)	CN	Description
* 7,960	80	Weighted
7,960		100.00% Pervious Area

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

Summary for Subcatchment EX-2: Existing House

Runoff = 0.16 cfs @ 12.13 hrs, Volume= 0.012 af, Depth> 2.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-yr Rainfall=3.39"

Area (sf)	CN	Description
2,260	98	Roofs, HSG C
2,260		100.00% Impervious Area

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

Summary for Subcatchment EX-1: Net Project Area

Runoff = 0.63 cfs @ 12.13 hrs, Volume= 0.043 af, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-yr Rainfall=5.18"

Area (sf)	CN	Description
* 7,960	80	Weighted
7,960		100.00% Pervious Area

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

Summary for Subcatchment EX-2: Existing House

Runoff = 0.25 cfs @ 12.13 hrs, Volume= 0.019 af, Depth> 4.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-yr Rainfall=5.18"

Area (sf)	CN	Description
2,260	98	Roofs, HSG C
2,260		100.00% Impervious Area

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

Summary for Subcatchment EX-1: Net Project Area

Runoff = 1.26 cfs @ 12.13 hrs, Volume= 0.089 af, Depth> 5.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-yr Rainfall=8.71"

Area (sf)	CN	Description
* 7,960	80	Weighted
7,960		100.00% Pervious Area

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

Summary for Subcatchment EX-2: Existing House

Runoff = 0.42 cfs @ 12.13 hrs, Volume= 0.033 af, Depth> 7.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-yr Rainfall=8.71"

Area (sf)	CN	Description
2,260	98	Roofs, HSG C
2,260		100.00% Impervious Area

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

Appendix E

Proposed Conditions Calculations:

2-Year Storm

10-Year Storm

100-Year Storm

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.065	83	Weighted (PR-1)
0.170	78	Weighted (PR-2)
0.235	79	TOTAL AREA

Summary for Subcatchment PR-1: Undetained Area

Runoff = 0.13 cfs @ 12.13 hrs, Volume= 0.010 af, Depth> 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-yr Rainfall=3.39"

Area (sf)	CN	Description
* 2,820	83	Weighted
2,820		100.00% Pervious Area

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

Summary for Subcatchment PR-2: Detained Areas

Runoff = 0.27 cfs @ 12.13 hrs, Volume= 0.020 af, Depth> 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 2-yr Rainfall=3.39"

Area (sf)	CN	Description
* 7,400	78	Weighted
7,400		100.00% Pervious Area

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

Summary for Pond BA-1: Infiltration Basin

Inflow Area = 0.170 ac, 0.00% Impervious, Inflow Depth > 1.41" for 2-yr event
 Inflow = 0.27 cfs @ 12.13 hrs, Volume= 0.020 af
 Outflow = 0.10 cfs @ 12.32 hrs, Volume= 0.015 af, Atten= 63%, Lag= 11.3 min
 Discarded = 0.00 cfs @ 12.32 hrs, Volume= 0.004 af
 Primary = 0.10 cfs @ 12.32 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 64.77' @ 12.32 hrs Surf.Area= 364 sf Storage= 283 cf

Plug-Flow detention time= 158.0 min calculated for 0.015 af (75% of inflow)
 Center-of-Mass det. time= 61.2 min (918.0 - 856.8)

Volume	Invert	Avail.Storage	Storage Description
#1	63.50'	598 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	64.00'	318 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		915 cf	Total Available Storage

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NOAA 24-hr D 2-yr Rainfall=3.39"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.50	100	0	0
64.00	150	63	63
65.00	260	205	268
66.00	400	330	598

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.00	60	0	0
65.00	150	105	105
66.00	275	213	318

Device	Routing	Invert	Outlet Devices
#1	Primary	64.55'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	65.55'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Discarded	63.50'	0.500 in/hr Exfiltration over Horizontal area Conductivity to Groundwater Elevation = 55.00'

Discarded OutFlow Max=0.00 cfs @ 12.32 hrs HW=64.77' (Free Discharge)
 ↳ **3=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.10 cfs @ 12.32 hrs HW=64.77' (Free Discharge)
 ↳ **1=Orifice/Grate** (Orifice Controls 0.10 cfs @ 1.58 fps)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link PR-Tot: Total Proposed

Inflow Area = 0.235 ac, 0.00% Impervious, Inflow Depth > 1.04" for 2-yr event
 Inflow = 0.15 cfs @ 12.25 hrs, Volume= 0.020 af
 Primary = 0.15 cfs @ 12.25 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PR-1: Undetained Area

Runoff = 0.24 cfs @ 12.13 hrs, Volume= 0.018 af, Depth> 3.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-yr Rainfall=5.18"

Area (sf)	CN	Description
* 2,820	83	Weighted
2,820		100.00% Pervious Area

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

Summary for Subcatchment PR-2: Detained Areas

Runoff = 0.55 cfs @ 12.13 hrs, Volume= 0.041 af, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 10-yr Rainfall=5.18"

Area (sf)	CN	Description
* 7,400	78	Weighted
7,400		100.00% Pervious Area

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

Summary for Pond BA-1: Infiltration Basin

Inflow Area = 0.170 ac, 0.00% Impervious, Inflow Depth > 2.86" for 10-yr event
 Inflow = 0.55 cfs @ 12.13 hrs, Volume= 0.041 af
 Outflow = 0.30 cfs @ 12.24 hrs, Volume= 0.035 af, Atten= 46%, Lag= 6.5 min
 Discarded = 0.01 cfs @ 12.24 hrs, Volume= 0.005 af
 Primary = 0.29 cfs @ 12.24 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 65.20' @ 12.24 hrs Surf.Area= 463 sf Storage= 459 cf

Plug-Flow detention time= 95.1 min calculated for 0.035 af (87% of inflow)
 Center-of-Mass det. time= 35.1 min (869.3 - 834.3)

Volume	Invert	Avail.Storage	Storage Description
#1	63.50'	598 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	64.00'	318 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		915 cf	Total Available Storage

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NOAA 24-hr D 10-yr Rainfall=5.18"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.50	100	0	0
64.00	150	63	63
65.00	260	205	268
66.00	400	330	598

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.00	60	0	0
65.00	150	105	105
66.00	275	213	318

Device	Routing	Invert	Outlet Devices
#1	Primary	64.55'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	65.55'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Discarded	63.50'	0.500 in/hr Exfiltration over Horizontal area Conductivity to Groundwater Elevation = 55.00'

Discarded OutFlow Max=0.01 cfs @ 12.24 hrs HW=65.20' (Free Discharge)↑**3=Exfiltration** (Controls 0.01 cfs)**Primary OutFlow** Max=0.29 cfs @ 12.24 hrs HW=65.20' (Free Discharge)↑**1=Orifice/Grate** (Orifice Controls 0.29 cfs @ 3.34 fps)↑**2=Orifice/Grate** (Controls 0.00 cfs)**Summary for Link PR-Tot: Total Proposed**

Inflow Area = 0.235 ac, 0.00% Impervious, Inflow Depth > 2.48" for 10-yr event
 Inflow = 0.50 cfs @ 12.15 hrs, Volume= 0.049 af
 Primary = 0.50 cfs @ 12.15 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PR-1: Undetained Area

Runoff = 0.47 cfs @ 12.13 hrs, Volume= 0.036 af, Depth> 6.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-yr Rainfall=8.71"

Area (sf)	CN	Description
* 2,820	83	Weighted
2,820		100.00% Pervious Area

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

Summary for Subcatchment PR-2: Detained Areas

Runoff = 1.14 cfs @ 12.13 hrs, Volume= 0.086 af, Depth> 6.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 NOAA 24-hr D 100-yr Rainfall=8.71"

Area (sf)	CN	Description
* 7,400	78	Weighted
7,400		100.00% Pervious Area

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

Summary for Pond BA-1: Infiltration Basin

Inflow Area = 0.170 ac, 0.00% Impervious, Inflow Depth > 6.04" for 100-yr event
 Inflow = 1.14 cfs @ 12.13 hrs, Volume= 0.086 af
 Outflow = 0.89 cfs @ 12.20 hrs, Volume= 0.080 af, Atten= 22%, Lag= 4.1 min
 Discarded = 0.01 cfs @ 12.20 hrs, Volume= 0.006 af
 Primary = 0.88 cfs @ 12.20 hrs, Volume= 0.074 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
 Peak Elev= 65.71' @ 12.20 hrs Surf.Area= 599 sf Storage= 733 cf

Plug-Flow detention time= 61.1 min calculated for 0.080 af (94% of inflow)
 Center-of-Mass det. time= 27.2 min (837.9 - 810.7)

Volume	Invert	Avail.Storage	Storage Description
#1	63.50'	598 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	64.00'	318 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		915 cf	Total Available Storage

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NOAA 24-hr D 100-yr Rainfall=8.71"

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Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.50	100	0	0
64.00	150	63	63
65.00	260	205	268
66.00	400	330	598

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
64.00	60	0	0
65.00	150	105	105
66.00	275	213	318

Device	Routing	Invert	Outlet Devices
#1	Primary	64.55'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	65.55'	8.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Discarded	63.50'	0.500 in/hr Exfiltration over Horizontal area Conductivity to Groundwater Elevation = 55.00'

Discarded OutFlow Max=0.01 cfs @ 12.20 hrs HW=65.71' (Free Discharge)

↑**3=Exfiltration** (Controls 0.01 cfs)

Primary OutFlow Max=0.87 cfs @ 12.20 hrs HW=65.71' (Free Discharge)

↑**1=Orifice/Grate** (Orifice Controls 0.42 cfs @ 4.81 fps)

↑**2=Orifice/Grate** (Weir Controls 0.45 cfs @ 1.32 fps)

Summary for Link PR-Tot: Total Proposed

Inflow Area = 0.235 ac, 0.00% Impervious, Inflow Depth > 5.64" for 100-yr event
 Inflow = 1.22 cfs @ 12.18 hrs, Volume= 0.110 af
 Primary = 1.22 cfs @ 12.18 hrs, Volume= 0.110 af, Atten= 0%, Lag= 0.0 min

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