

# STORM WATER CALCULATIONS

FOR

**No. 113 NORTH AVENUE WEST  
LOT 6, BLOCK 183  
TOWNSHIP OF CRANFORD, UNION COUNTY  
NEW JERSEY**

PREPARED: JUNE 02, 2022

REVISED: MAY 24, 2023



**HARBOR CONSULTANTS  
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A handwritten signature in black ink, consisting of a large, stylized 'V' followed by a horizontal line and a period.

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*Project Number 2021038*

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## **DESCRIPTION OF PROJECT**

## INTRODUCTION

This report prepared by Harbor Consultants, provides storm water management and drainage information related to a proposed site plan within the Township of Cranford, Union County, New Jersey. The subject property is known as Lot 6 in Block 183 as shown on the Tax Map of Township of Cranford. The project is located at No. 113 North Avenue West. The overall property contains about 9,250 s.f. (0.212 acres) and the area of disturbance for this project is 10,044 s.f. (0.23 acres), (less than one acre). Therefore, this application is not considered a major development as defined by the New Jersey Department of Environment Protection. The applicant proposes to construct an addition to an existing 1-1/2 story building turning it into a 3 story building, with an office on the first floor and residential apartment units on the second and third floors with 11 parking spaces in the rear of the building.

## SOILS

According to NRCS/USDA's Soil Survey of Union County, soils in the area are identified as UR Urban Land and hydrologic soil group classified as D.

The runoff coefficients utilized in calculations correspond to table 7.1 Typical Runoff coefficients (c Values) per N.J.A.C. 5:21-7.2 and specified as follows:

- Open Space, Lawn Area (good condition)  $c=0.51$
- Impervious Surfaces  $c=0.99$

The time of concentration used to calculate hydrographs in minutes per minimum. Stormwater runoff peaks have been calculated using Rational Method iterations for the 2, 10- and 100-year storm events. The underground detention system consists of 50 L.F. of 24" Perforated HDPE pipe @ 0% (roof drains to connect to system) surrounded by a stone bed with a proposed storage volume of 374.00 cu.ft.



**PRE & POST DEVELOPMENT CONDITIONS  
& RUNOFF ANALYSIS**

*Project Number 2021038*



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**RATIONAL METHOD**

PROJECT: No. 113 North Avenue West  
Township of Cranford, Union Co, NJ

PROJECT NO. : 2021038

DATE: 5/3/2023

**EXISTING CONDITIONS**

DRAINAGE BASIN AREA = 0.212 Acres

COEFFICIENT OF RUNOFF:

	AREA (Ac.)	C	CA (Ac.)
Grass	0.075	0.51	0.04
Impervious Area	0.137	0.99	0.14
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Total	0.212		0.18
		<b>Weighted C</b>	<b>0.848</b>

TIME OF CONCENTRATION = 10.00 Minutes

RUNOFF:

FREQUENCY	CA (Ac.)	I (in./hr.)	Q (cfs)
2 Yr.	0.18	3.82	0.69
10 Yr.	0.18	5.03	0.91
100 Yr.	0.18	6.47	1.16

RSIS RELEASE RATES:

FREQUENCY	EXISTING	RSIS LIMIT	Q (cfs)
2 Yr.	0.69	0.50	0.34
10 Yr.	0.91	0.75	0.68
100 Yr.	1.16	0.80	0.93



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**RATIONAL METHOD**

PROJECT: No. 113 North Avenue West  
Township of Cranford, Union Co, NJ

PROJECT NO. : 2021038

DATE: 5/3/2023

**PROPOSED CONDITIONS**

DRAINAGE BASIN AREA = 0.212 Acres

COEFFICIENT OF RUNOFF:

	AREA (Ac.)	C	CA (Ac.)
Grass	0.037	0.51	0.02
Impervious Area	0.175	0.99	0.17
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Other			0.00
Total	0.212		0.19
		<b>Weighted C</b>	<b>0.895</b>

TIME OF CONCENTRATION = 10.00 Minutes

RUNOFF:

FREQUENCY	CA (Ac.)	I (in./hr.)	Q (cfs)
2 Yr.	0.19	3.82	0.726
10 Yr.	0.19	5.03	0.956
100 Yr.	0.19	6.47	1.229



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**MODIFIED RATIONAL ANALYSIS**  
PROPOSED CONDITIONS

**PROJECT: No. 113 North Avenue West**  
Township of Cranford, Union Co, NJ

**PROJECT NO. :** 2021038

**DATE:** 5/3/2023

Allowable Release Rate (cfs) = 0.34

**2 YEAR STORM**

Postdevelopment CA = 0.19

**DETENTION SYSTEM**

<b>Time Interval (Min.)</b>	<b>Rainfall Intensity (in./hr.)</b>	<b>Peak Runoff (cfs)</b>	<b>Runoff Volume (cu. ft.)</b>	<b>Release Volume (cu. ft.)</b>	<b>Required Storage (cu. ft.)</b>
5.00	5.50	1.05	313.50	103.14	210.36
6.00	5.30	1.01	362.52	123.77	238.75
7.00	5.20	0.99	414.96	144.40	270.56
8.00	5.00	0.95	456.00	165.02	290.98
9.00	4.80	0.91	492.48	185.65	306.83
10.00	4.50	0.86	513.00	206.28	306.72
15.00	3.70	0.70	632.70	309.42	323.28
20.00	3.20	0.61	729.60	412.56	317.04
30.00	2.60	0.49	889.20	618.84	270.36
40.00	2.10	0.40	957.60	825.12	132.48
50.00	1.80	0.34	1026.00	1031.40	-5.40
60.00	1.60	0.30	1094.40	1237.68	-143.28





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**MODIFIED RATIONAL ANALYSIS**  
PROPOSED CONDITIONS

**PROJECT:** No. 113 North Avenue West  
Township of Cranford, Union Co, NJ

**PROJECT NO. :** 2021038

**DATE:** 5/3/2023

Allowable Release Rate (cfs) = 0.68 **10 YEAR STORM**  
Postdevelopment CA = 0.19 **DETENTION SYSTEM**

<b>Time Interval</b> <b>(Min.)</b>	<b>Rainfall Intensity</b> <b>(in./hr.)</b>	<b>Peak Runoff</b> <b>(cfs)</b>	<b>Runoff Volume</b> <b>(cu. ft.)</b>	<b>Release Volume</b> <b>(cu. ft.)</b>	<b>Required Storage</b> <b>(cu. ft.)</b>
5.00	6.80	1.29	387.60	203.72	183.89
6.00	6.70	1.27	458.28	244.46	213.82
7.00	6.50	1.24	518.70	285.20	233.50
8.00	6.30	1.20	574.56	325.94	248.62
9.00	6.00	1.14	615.60	366.69	248.91
10.00	5.90	1.12	672.60	407.43	265.17
15.00	4.90	0.93	837.90	611.15	226.76
20.00	4.20	0.80	957.60	814.86	142.74
30.00	3.20	0.61	1094.40	1222.29	-127.89
40.00	2.80	0.53	1276.80	1629.72	-352.92
50.00	2.30	0.44	1311.00	2037.15	-726.15
60.00	2.00	0.38	1368.00	2444.58	-1076.58



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**MODIFIED RATIONAL ANALYSIS**  
**PROPOSED CONDITIONS**

**PROJECT: No. 113 North Avenue West**  
Township of Cranford, Union Co, NJ

**PROJECT NO. :** 2021038

**DATE:** 5/3/2023

Allowable Release Rate (cfs) = 0.93 **100 YEAR STORM**

Postdevelopment CA = 0.19 **DETENTION SYSTEM**

<b>Time Interval (Min.)</b>	<b>Rainfall Intensity (in./hr.)</b>	<b>Peak Runoff (cfs)</b>	<b>Runoff Volume (cu. ft.)</b>	<b>Release Volume (cu. ft.)</b>	<b>Required Storage (cu. ft.)</b>
5.00	9.10	1.73	518.70	279.50	239.20
6.00	9.00	1.71	615.60	335.40	280.20
7.00	8.80	1.67	702.24	391.31	310.93
8.00	8.40	1.60	766.08	447.21	318.87
9.00	8.20	1.56	841.32	503.11	338.21
10.00	8.00	1.52	912.00	559.01	352.99
15.00	6.90	1.31	1179.90	838.51	341.39
20.00	5.80	1.10	1322.40	1118.02	204.38
30.00	4.50	0.86	1539.00	1677.02	-138.02
40.00	3.80	0.72	1732.80	2236.03	-503.23
50.00	3.20	0.61	1824.00	2795.04	-971.04
60.00	2.80	0.53	1915.20	3354.05	-1438.85



## **DETENTION DESIGN (DETENTION BASIN)**

*Project Number 2021038*



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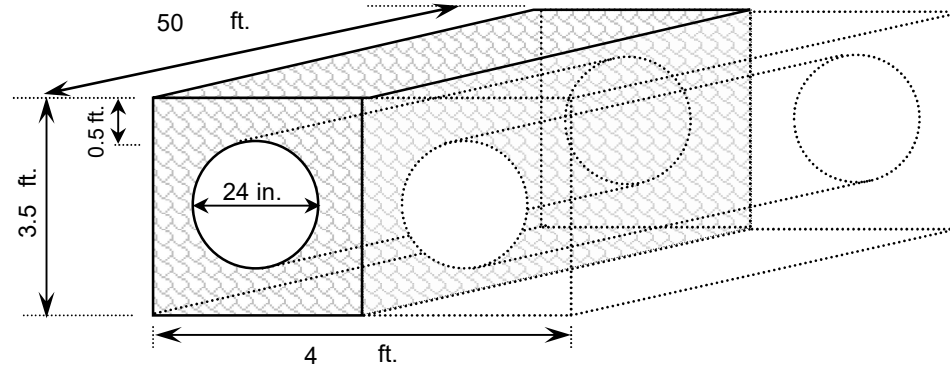
**STORM STORAGE DESIGN**

Project: No. 113 North Avenue West  
Township of Cranford, Union Co, NJ

Project No. 2021038

Date: 5/3/2023

DETENTION DIMENSIONS	
BOTTOM ELEV.	0 Feet
PIPE DIA.	24 Inches
NUMBER PIPES	1
PIPE LENGTH	50 Feet
STONE DIMENSIONS	
WIDTH	4 Feet
DEPTH	3.5 Feet
STONE ABOVE	0.5 Feet
VOIDS	40 %



**PIPE DETENTION SYSTEM DESIGN**

STAGES	STAGE ELEV.	PIPE AREA (SECTION)	STONE AREA (SECTION)	TOTAL AREA (SECTION)	TOTAL VOLUME	ELEVATION
<b>BOT STONE</b>	0.00	0.00 S.F.	0.00 S.F.	0.00 S.F.	0.00 C.F.	0.00 ft
0%	1.00	0.00 S.F.	1.60 S.F.	1.60 S.F.	80.00 C.F.	1.00 ft
25%	1.50	0.61 S.F.	2.16 S.F.	2.77 S.F.	138.50 C.F.	1.50 ft
50%	2.00	1.57 S.F.	2.57 S.F.	4.14 S.F.	207.00 C.F.	2.00 ft
75%	2.50	2.53 S.F.	2.99 S.F.	5.52 S.F.	276.00 C.F.	2.50 ft
100%	3.00	3.14 S.F.	3.54 S.F.	6.68 S.F.	334.00 C.F.	3.00 ft
<b>TOP STONE</b>	3.50	3.14 S.F.	4.34 S.F.	7.48 S.F.	374.00 C.F.	3.50 ft

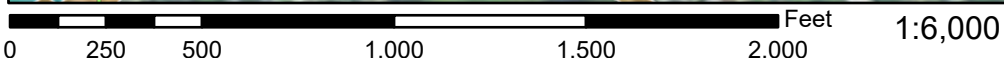
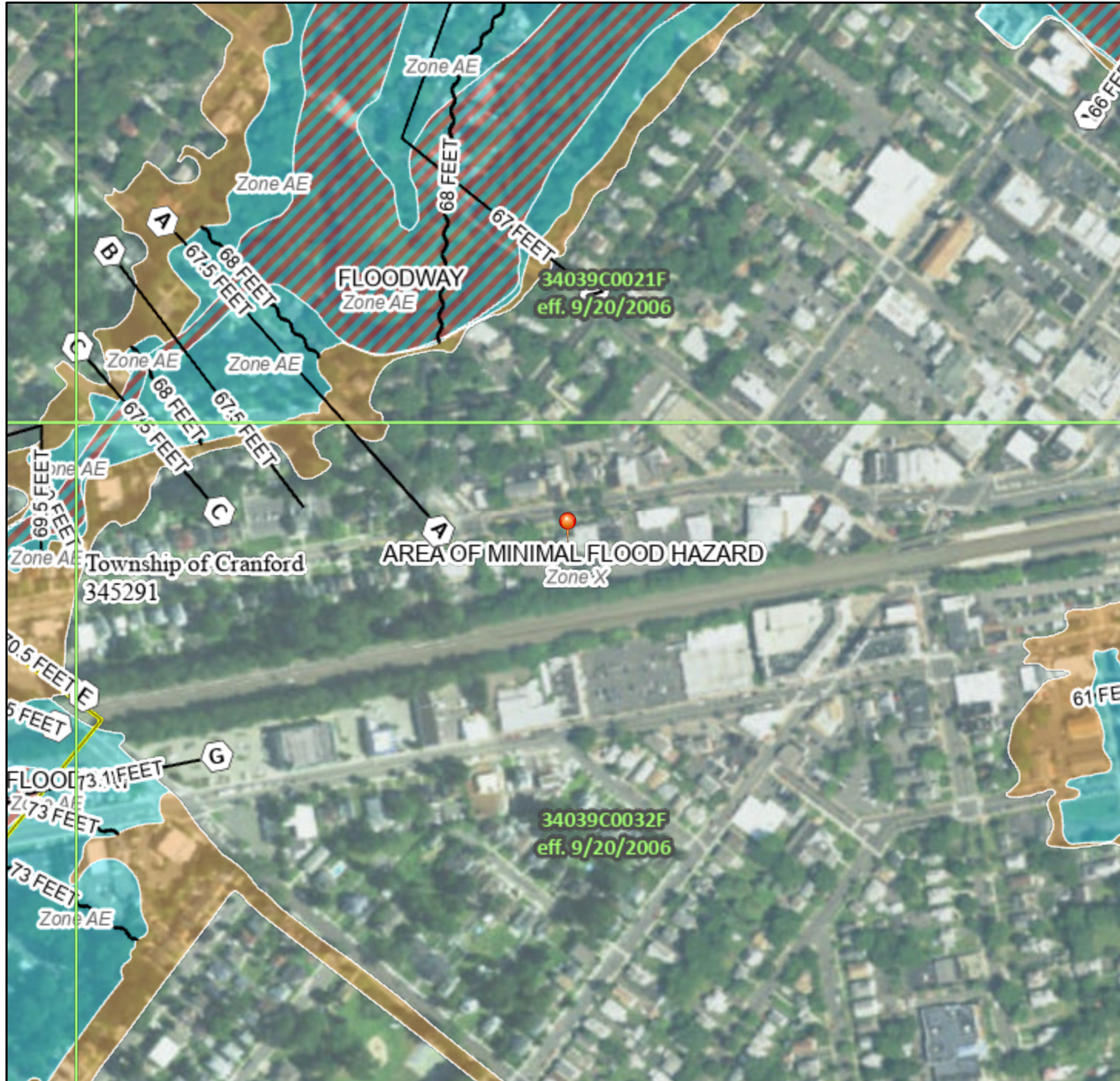


## **MAPS, CHARTS & TABLES**

# National Flood Hazard Layer FIRMMette



74°18'47"W 40°39'33"N



Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
GENERAL STRUCTURES		Area of Undetermined Flood Hazard Zone D
		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

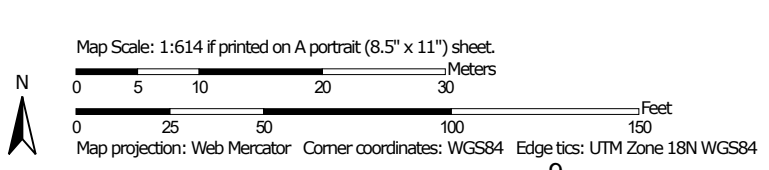
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/4/2021 at 9:20 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



# Custom Soil Resource Report Soil Map



### 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: Union County, New Jersey  
 Survey Area Data: Version 15, Aug 31, 2021

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

Date(s) aerial images were photographed: Sep 14, 2020—Oct 3, 2020

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



## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HatB	Haledon-Urban land-Hasbrouck complex, 0 to 8 percent slopes	0.4	22.0%
UR	Urban land	1.4	78.0%
<b>Totals for Area of Interest</b>		<b>1.8</b>	<b>100.0%</b>

## 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,

## Custom Soil Resource Report

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.

## Union County, New Jersey

### HatB—Haledon-Urban land-Hasbrouck complex, 0 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* b0tt  
*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

*Haledon and similar soils:* 45 percent  
*Urban land:* 25 percent  
*Hasbrouck and similar soils:* 15 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Haledon

##### Setting

*Landform:* Ground moraines  
*Down-slope shape:* Linear  
*Across-slope shape:* Convex  
*Parent material:* Coarse-loamy basal 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 8 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

#### Description of Urban Land

##### Setting

*Landform:* Ground moraines

## Custom Soil Resource Report

*Down-slope shape:* Linear, 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 Hasbrouck

### Setting

*Landform:* Depressions, flood plains

*Landform position (two-dimensional):* Toeslope

*Landform position (three-dimensional):* Base slope

*Down-slope shape:* Concave, linear

*Across-slope shape:* Concave, linear

*Parent material:* Fine-loamy eroded and redeposited glacial material over glacial till

### Typical profile

*Oa - 0 to 2 inches:* highly decomposed plant material

*A - 2 to 12 inches:* silt loam

*Eg - 12 to 18 inches:* sandy loam

*Btg1 - 18 to 26 inches:* loam

*Btg2 - 26 to 32 inches:* clay loam

*Bx - 32 to 54 inches:* loam

*C - 54 to 62 inches:* loam

### Properties and qualities

*Slope:* 0 to 3 percent

*Depth to restrictive feature:* 18 to 36 inches to fragipan

*Drainage class:* Poorly drained

*Runoff class:* Very high

*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)

*Depth to water table:* About 0 to 6 inches

*Frequency of flooding:* Rare

*Frequency of ponding:* None

*Available water supply, 0 to 60 inches:* Moderate (about 6.3 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4w

*Hydrologic Soil Group:* C/D

*Ecological site:* F144AY009CT - Wet Till Depressions

*Hydric soil rating:* Yes

## Minor Components

### Udorthents, haledon substratum

*Percent of map unit:* 10 percent

*Landform:* Ground moraines

*Landform position (three-dimensional):* Tread

## Custom Soil Resource Report

*Down-slope shape:* Linear  
*Across-slope shape:* Convex  
*Hydric soil rating:* No

### **Boonton**

*Percent of map unit:* 5 percent  
*Landform:* Ground moraines  
*Landform position (three-dimensional):* Upper third of mountainflank, center third of mountainflank  
*Down-slope shape:* Convex  
*Across-slope shape:* Linear  
*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**

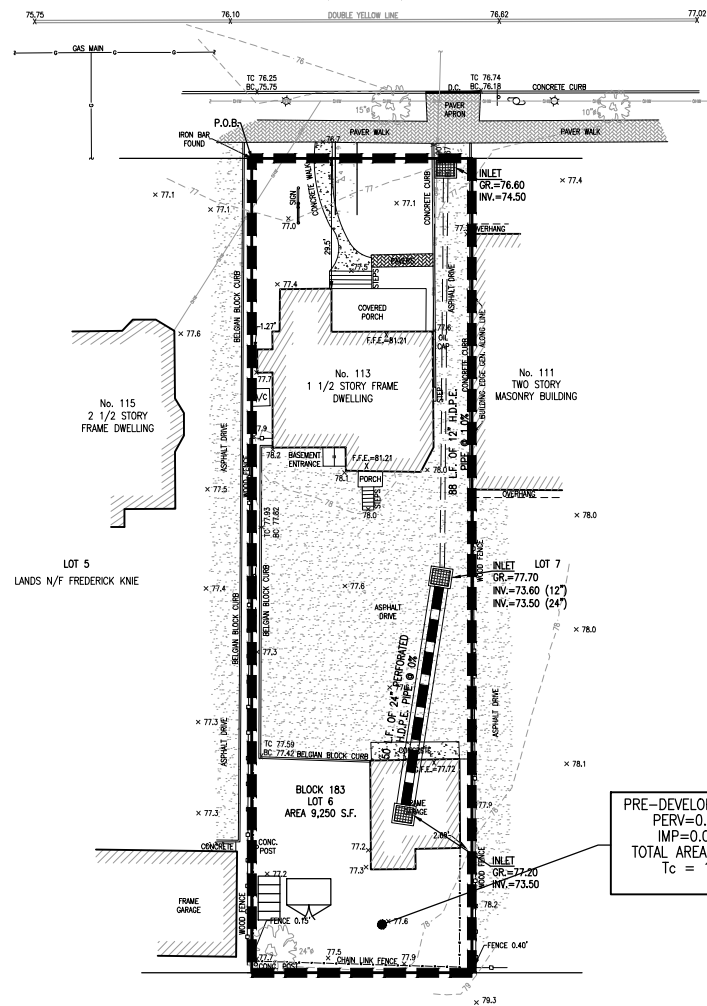
*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 8s  
*Hydric soil rating:* Unranked

### **Minor Components**

#### **Udorthents**

*Percent of map unit:* 5 percent  
*Landform:* Low hills  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Hydric soil rating:* No

NORTH AVENUE WEST  
(66' R.O.W.)

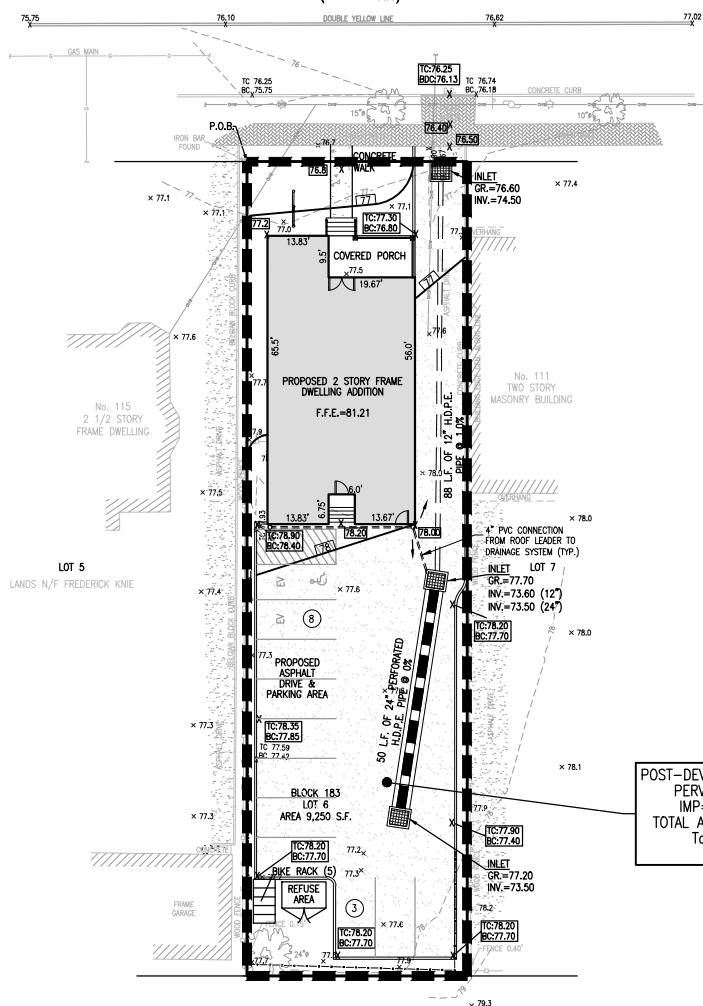


PRE-DEVELOPMENT PD-1  
PERV=0.137 Ac.  
IMP=0.075 Ac.  
TOTAL AREA=0.212 Ac.  
Tc = 10 MIN

CONSOLIDATED RAIL CORPORATION  
(CENTRAL RAILROAD OF NEW JERSEY)

PRE-DEVELOPMENT DRAINAGE MAP  
SCALE: 1"=20'

NORTH AVENUE WEST  
(66' R.O.W.)



POST-DEVELOPMENT PD-1  
PERV=0.177 Ac.  
IMP=0.035 Ac.  
TOTAL AREA=0.212 Ac.  
Tc=10 MIN

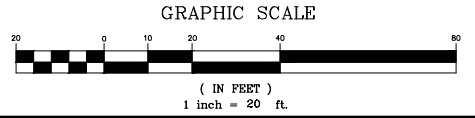
CONSOLIDATED RAIL CORPORATION  
(CENTRAL RAILROAD OF NEW JERSEY)

POST-DEVELOPMENT DRAINAGE MAP  
SCALE: 1"=20'

LEGEND

- STREET SIGN
- CLEANOUT
- SANITARY MANHOLE
- DRAINAGE MANHOLE
- CATCH BASIN
- CATCH BASIN
- SOIL BORING
- GUY WIRE
- UTILITY POLE
- P.K. NAIL FOUND
- CONC. MONUMENT FOUND
- IRON BAR FOUND
- MAILBOX
- STREET TREE
- EXIST. SPOT ELEVATION
- EXISTING CONTOUR LINE
- GAS LINE
- WATER LINE
- WATER VALVE
- GAS VALVE
- WATER VALVE
- FIRE HYDRANT
- LIGHT POST

ELEVATIONS SHOWN ARE BASED  
ON NAVD 88



REV.	DATE	DESCRIPTION	CHK'D.	APP'VD
1	05/24/2023	REVISED AS DRC MEETING		

**Harbor Consultants Inc.**  
Engineers & Surveyors  
320 NORTH AVENUE EAST  
CRANFORD, N.J. 07016  
Phone (908) 276-2715 Fax (908) 709-1738  
Email: info@hcicg.net

1 OF 1

*[Signature]*  
**VICTOR E. VINEGRA**  
PROFESSIONAL ENGINEER & LAND SURVEYOR  
NEW JERSEY LICENSE No. 34460

PRE & POST DEVELOPMENT DRAINAGE MAP  
No. 113 NORTH AVENUE WEST  
LOT 6, BLOCK 183  
TOWNSHIP OF CRANFORD UNION COUNTY NEW JERSEY

SCALE: 1"=20' DATE: 06/02/2022 DESIGNED BY: V.E.V. DRAWN BY: S.P. WORK FILE: 2021038\_Pre&Post Drain. CERTIFICATE OF AUTHORIZATION No. 24GA27962100 PROJECT No. 2021038

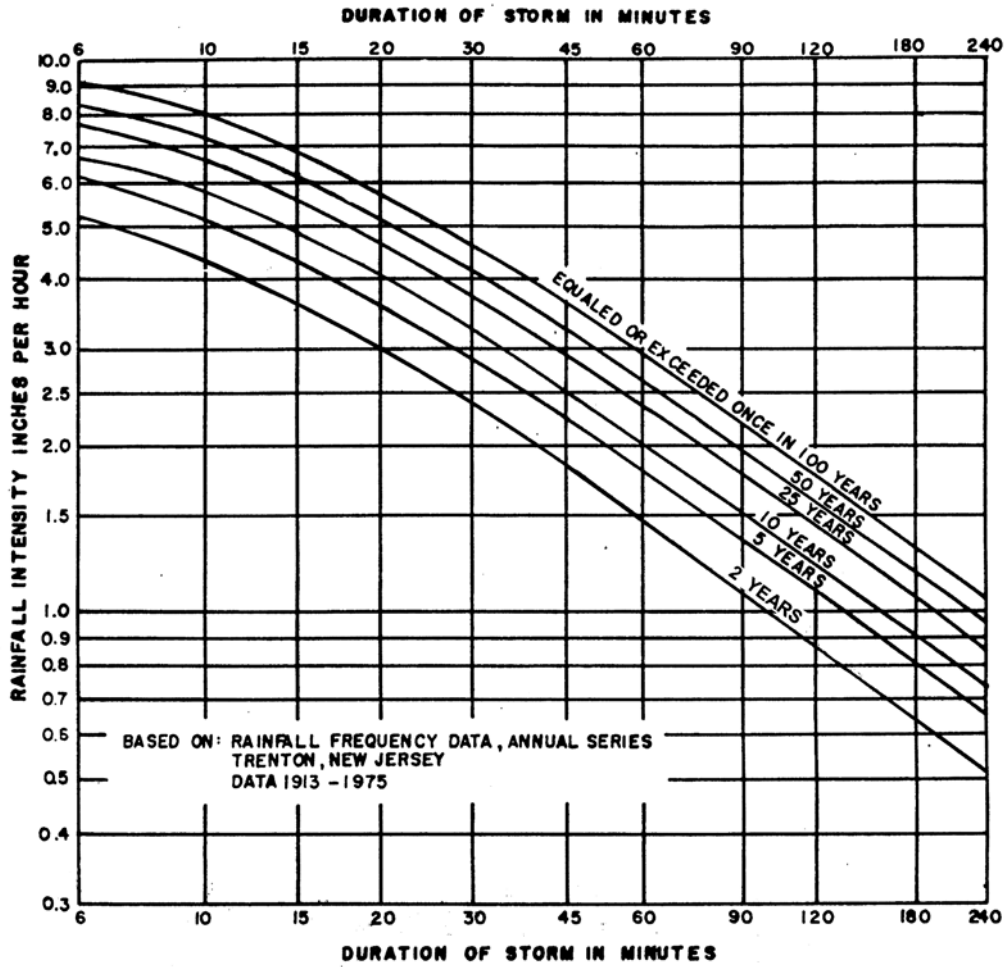
T:\2021038 - 113 North Avenue West, Cranford\Civil\Drainage\2021038\_Per-Post Drainage Map.dwg, 6/7/2023 3:43:21 PM, DWG To PDF.pc3

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or other approved methods may be employed.

<b>TABLE 7.1 TYPICAL RUNOFF COEFFICIENTS (C VALUES) FOR 100-YEAR FREQUENCY STORM</b>				
<b>LAND-USE DESCRIPTION</b>	<b>HYDROLOGIC SOIL GROUP</b>			
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
Cultivated land: without conservation treatment	0.49	0.67	0.81	0.88
with conservation treatment	0.27	0.43	0.61	0.67
Pasture or range land: poor condition	0.38	0.63	0.78	0.84
good condition	NA	0.25	0.51	0.65
Meadow: good condition	NA	NA	0.44	0.61
Wood or forest land: thin stand, poor cover, no mulch	NA	NA	0.59	0.79
good cover	NA	NA	0.45	0.59
Open spaces, lawns, parks, golf courses, cemeteries: good condition, grass cover on 75% or more of area	NA	0.25	0.51	0.65
fair condition, grass cover on 50-75% of area	NA	0.45	0.63	0.74
Commercial and business areas (85% impervious)	0.84	0.90	0.93	0.96
Industrial districts (72% impervious)	0.67	0.81	0.88	0.92
Residential:				
<u>Average lot size</u> <u>Average impervious</u>				
1/8 acre                65%	0.59	0.76	0.86	0.90
1/4 acre                38%	0.25	0.55	0.70	0.80
1/3 acre                30%	NA	0.49	0.67	0.78
1/2 acre                25%	NA	0.45	0.65	0.76
1 acre                  20%	NA	0.41	0.63	0.74
Paved parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Streets and roads:				
paved with curbs and storm sewers	0.99	0.99	0.99	0.99
gravel	0.57	0.76	0.84	0.88
dirt	0.49	0.69	0.80	0.84
NOTE:	NA denotes information is not available; design engineers should rely on another authoritative source.			
SOURCE:	<i>Technical Manual for Land Use Regulation Program</i> , Department of Environmental Protection, Bureaus of Inland and Coastal Regulations, Stream Encroachment Permits (Trenton, New Jersey, revised September 1995), p. 12.			

FIGURE 7.2 RAINFALL INTENSITY CURVES



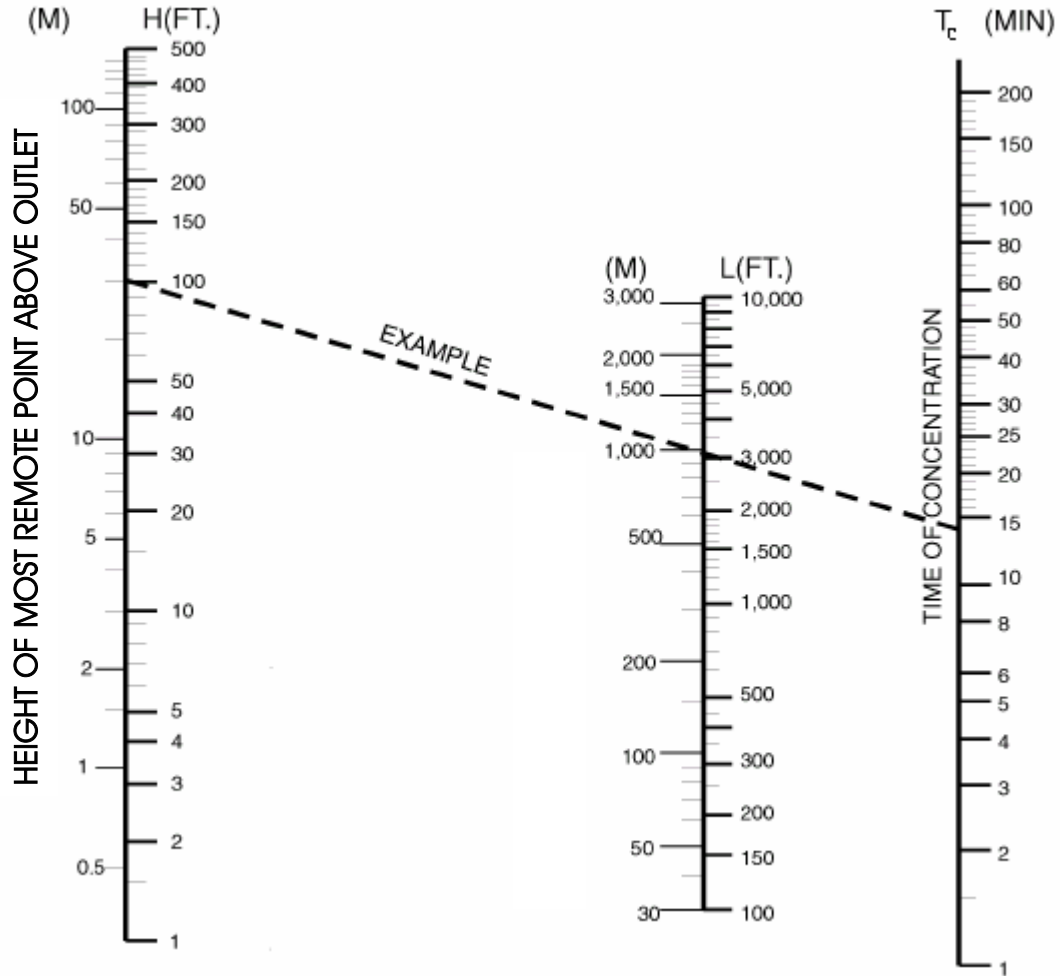
Note: Adapted from Figure 2.1-2 in the NJDEP *Technical Manual for Stream Encroachment Permits*.



Figure 7.1

TIME OF CONCENTRATION

**Example**  
 Height = 100 ft.  
 Length = 3000 ft.  
 Time of Concentration = 14



**Notes:**

Use Nomograph T<sub>c</sub> for natural basins with well-defined channels, for overland or bare earth, and for mowed grass roadside channels.

For overland flow, grassed surfaces, multiply T<sub>c</sub> by 2.

For overland flow, concrete or asphalt surfaces, multiply T<sub>c</sub> by 0.4.

For concrete channels, multiply T<sub>c</sub> by 0.2 overland flow.

Based on a study by P.Z. Kirpich, *Civil Engineering*, Vol.10, No.6, June 1940, p. 362.



**NOAA Atlas 14, Volume 2, Version 3**  
**Location name: Cranford, New Jersey, USA\***  
**Latitude: 40.6554°, Longitude: -74.3079°**  
**Elevation: 77.66 ft\*\***



\* source: ESRI Maps  
 \*\* source: USGS

**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**

<b>PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)<sup>1</sup></b>										
<b>Duration</b>	<b>Average recurrence interval (years)</b>									
	<b>1</b>	<b>2</b>	<b>5</b>	<b>10</b>	<b>25</b>	<b>50</b>	<b>100</b>	<b>200</b>	<b>500</b>	<b>1000</b>
<b>5-min</b>	<b>4.02</b> (3.67-4.40)	<b>4.78</b> (4.38-5.24)	<b>5.66</b> (5.16-6.22)	<b>6.29</b> (5.72-6.90)	<b>7.07</b> (6.41-7.74)	<b>7.61</b> (6.86-8.33)	<b>8.14</b> (7.31-8.92)	<b>8.62</b> (7.69-9.46)	<b>9.22</b> (8.15-10.1)	<b>9.65</b> (8.47-10.6)
<b>10-min</b>	<b>3.20</b> (2.93-3.52)	<b>3.82</b> (3.50-4.20)	<b>4.54</b> (4.13-4.97)	<b>5.03</b> (4.58-5.52)	<b>5.63</b> (5.10-6.17)	<b>6.05</b> (5.47-6.64)	<b>6.47</b> (5.81-7.09)	<b>6.83</b> (6.10-7.49)	<b>7.29</b> (6.44-8.02)	<b>7.60</b> (6.67-8.38)
<b>15-min</b>	<b>2.67</b> (2.44-2.94)	<b>3.20</b> (2.93-3.52)	<b>3.82</b> (3.48-4.20)	<b>4.24</b> (3.86-4.66)	<b>4.76</b> (4.31-5.21)	<b>5.11</b> (4.61-5.60)	<b>5.45</b> (4.89-5.97)	<b>5.74</b> (5.12-6.30)	<b>6.12</b> (5.40-6.72)	<b>6.36</b> (5.58-7.01)
<b>30-min</b>	<b>1.83</b> (1.68-2.01)	<b>2.21</b> (2.03-2.43)	<b>2.72</b> (2.48-2.98)	<b>3.07</b> (2.80-3.37)	<b>3.52</b> (3.19-3.86)	<b>3.85</b> (3.47-4.22)	<b>4.17</b> (3.75-4.57)	<b>4.47</b> (3.99-4.91)	<b>4.87</b> (4.30-5.35)	<b>5.15</b> (4.52-5.68)
<b>60-min</b>	<b>1.14</b> (1.05-1.25)	<b>1.39</b> (1.27-1.52)	<b>1.74</b> (1.59-1.91)	<b>2.00</b> (1.82-2.20)	<b>2.35</b> (2.13-2.57)	<b>2.61</b> (2.35-2.86)	<b>2.87</b> (2.58-3.15)	<b>3.14</b> (2.80-3.44)	<b>3.49</b> (3.09-3.84)	<b>3.76</b> (3.30-4.14)
<b>2-hr</b>	<b>0.698</b> (0.634-0.770)	<b>0.850</b> (0.774-0.939)	<b>1.08</b> (0.980-1.19)	<b>1.26</b> (1.14-1.39)	<b>1.50</b> (1.35-1.66)	<b>1.70</b> (1.52-1.88)	<b>1.91</b> (1.70-2.10)	<b>2.13</b> (1.88-2.35)	<b>2.43</b> (2.12-2.69)	<b>2.68</b> (2.31-2.96)
<b>3-hr</b>	<b>0.518</b> (0.473-0.574)	<b>0.632</b> (0.576-0.699)	<b>0.802</b> (0.729-0.887)	<b>0.935</b> (0.848-1.03)	<b>1.12</b> (1.01-1.23)	<b>1.27</b> (1.14-1.40)	<b>1.42</b> (1.27-1.57)	<b>1.59</b> (1.40-1.75)	<b>1.81</b> (1.58-2.00)	<b>1.99</b> (1.72-2.20)
<b>6-hr</b>	<b>0.335</b> (0.305-0.370)	<b>0.407</b> (0.370-0.449)	<b>0.515</b> (0.467-0.567)	<b>0.603</b> (0.545-0.663)	<b>0.729</b> (0.653-0.800)	<b>0.834</b> (0.743-0.914)	<b>0.946</b> (0.835-1.04)	<b>1.07</b> (0.933-1.17)	<b>1.24</b> (1.07-1.36)	<b>1.38</b> (1.18-1.52)
<b>12-hr</b>	<b>0.206</b> (0.188-0.228)	<b>0.250</b> (0.228-0.277)	<b>0.319</b> (0.290-0.352)	<b>0.376</b> (0.341-0.414)	<b>0.461</b> (0.414-0.505)	<b>0.534</b> (0.475-0.583)	<b>0.613</b> (0.539-0.669)	<b>0.701</b> (0.609-0.764)	<b>0.830</b> (0.708-0.905)	<b>0.941</b> (0.790-1.03)
<b>24-hr</b>	<b>0.117</b> (0.108-0.127)	<b>0.142</b> (0.131-0.154)	<b>0.182</b> (0.168-0.198)	<b>0.216</b> (0.199-0.235)	<b>0.268</b> (0.245-0.291)	<b>0.313</b> (0.284-0.340)	<b>0.364</b> (0.326-0.395)	<b>0.420</b> (0.372-0.457)	<b>0.504</b> (0.439-0.550)	<b>0.577</b> (0.495-0.632)
<b>2-day</b>	<b>0.069</b> (0.063-0.075)	<b>0.083</b> (0.077-0.091)	<b>0.107</b> (0.098-0.117)	<b>0.126</b> (0.115-0.138)	<b>0.155</b> (0.141-0.169)	<b>0.179</b> (0.162-0.195)	<b>0.206</b> (0.184-0.225)	<b>0.235</b> (0.208-0.257)	<b>0.278</b> (0.243-0.306)	<b>0.315</b> (0.271-0.348)
<b>3-day</b>	<b>0.048</b> (0.045-0.053)	<b>0.059</b> (0.054-0.064)	<b>0.075</b> (0.069-0.081)	<b>0.088</b> (0.081-0.096)	<b>0.107</b> (0.098-0.117)	<b>0.124</b> (0.112-0.134)	<b>0.141</b> (0.127-0.154)	<b>0.160</b> (0.143-0.175)	<b>0.188</b> (0.165-0.207)	<b>0.212</b> (0.183-0.234)
<b>4-day</b>	<b>0.038</b> (0.035-0.042)	<b>0.046</b> (0.043-0.050)	<b>0.059</b> (0.054-0.064)	<b>0.069</b> (0.063-0.075)	<b>0.083</b> (0.076-0.091)	<b>0.096</b> (0.087-0.104)	<b>0.109</b> (0.098-0.118)	<b>0.123</b> (0.110-0.134)	<b>0.143</b> (0.126-0.157)	<b>0.161</b> (0.139-0.177)
<b>7-day</b>	<b>0.026</b> (0.024-0.028)	<b>0.031</b> (0.029-0.033)	<b>0.038</b> (0.036-0.042)	<b>0.045</b> (0.041-0.048)	<b>0.054</b> (0.049-0.058)	<b>0.061</b> (0.056-0.066)	<b>0.069</b> (0.062-0.075)	<b>0.077</b> (0.069-0.084)	<b>0.089</b> (0.079-0.098)	<b>0.099</b> (0.087-0.109)
<b>10-day</b>	<b>0.021</b> (0.019-0.022)	<b>0.025</b> (0.023-0.027)	<b>0.030</b> (0.028-0.033)	<b>0.035</b> (0.032-0.037)	<b>0.041</b> (0.038-0.044)	<b>0.046</b> (0.043-0.050)	<b>0.052</b> (0.047-0.056)	<b>0.058</b> (0.052-0.063)	<b>0.066</b> (0.059-0.072)	<b>0.073</b> (0.064-0.080)
<b>20-day</b>	<b>0.014</b> (0.013-0.015)	<b>0.017</b> (0.016-0.018)	<b>0.020</b> (0.019-0.021)	<b>0.022</b> (0.021-0.024)	<b>0.026</b> (0.024-0.027)	<b>0.028</b> (0.026-0.030)	<b>0.031</b> (0.029-0.033)	<b>0.034</b> (0.031-0.036)	<b>0.037</b> (0.034-0.040)	<b>0.040</b> (0.036-0.044)
<b>30-day</b>	<b>0.012</b> (0.011-0.012)	<b>0.014</b> (0.013-0.014)	<b>0.016</b> (0.015-0.017)	<b>0.018</b> (0.017-0.019)	<b>0.020</b> (0.019-0.021)	<b>0.022</b> (0.020-0.023)	<b>0.023</b> (0.022-0.025)	<b>0.025</b> (0.023-0.027)	<b>0.027</b> (0.025-0.029)	<b>0.029</b> (0.027-0.031)
<b>45-day</b>	<b>0.010</b> (0.009-0.010)	<b>0.012</b> (0.011-0.012)	<b>0.013</b> (0.013-0.014)	<b>0.015</b> (0.014-0.015)	<b>0.016</b> (0.015-0.017)	<b>0.018</b> (0.017-0.019)	<b>0.019</b> (0.018-0.020)	<b>0.020</b> (0.019-0.021)	<b>0.022</b> (0.020-0.023)	<b>0.023</b> (0.021-0.024)
<b>60-day</b>	<b>0.009</b> (0.008-0.009)	<b>0.010</b> (0.010-0.011)	<b>0.012</b> (0.011-0.012)	<b>0.013</b> (0.012-0.014)	<b>0.014</b> (0.014-0.015)	<b>0.015</b> (0.014-0.016)	<b>0.016</b> (0.015-0.017)	<b>0.017</b> (0.016-0.018)	<b>0.018</b> (0.017-0.019)	<b>0.019</b> (0.018-0.020)

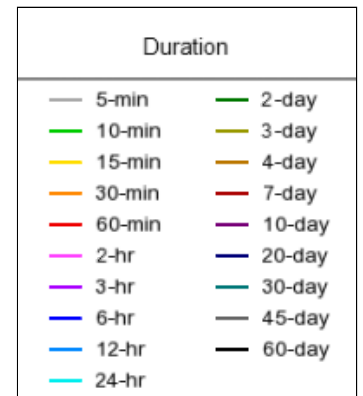
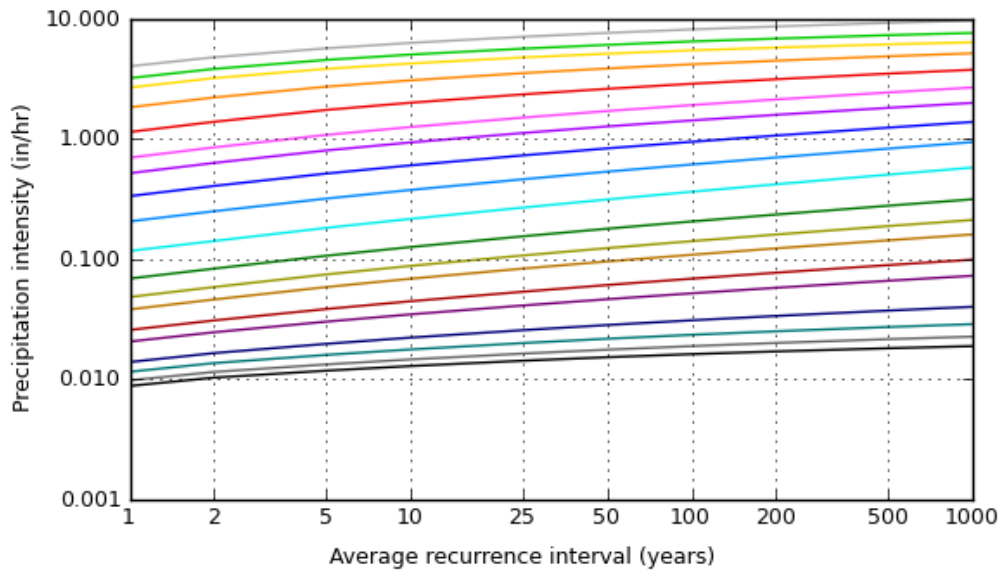
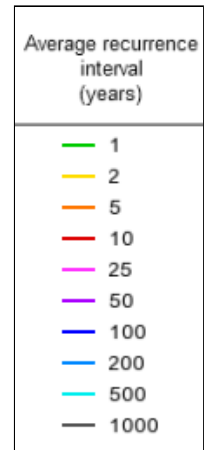
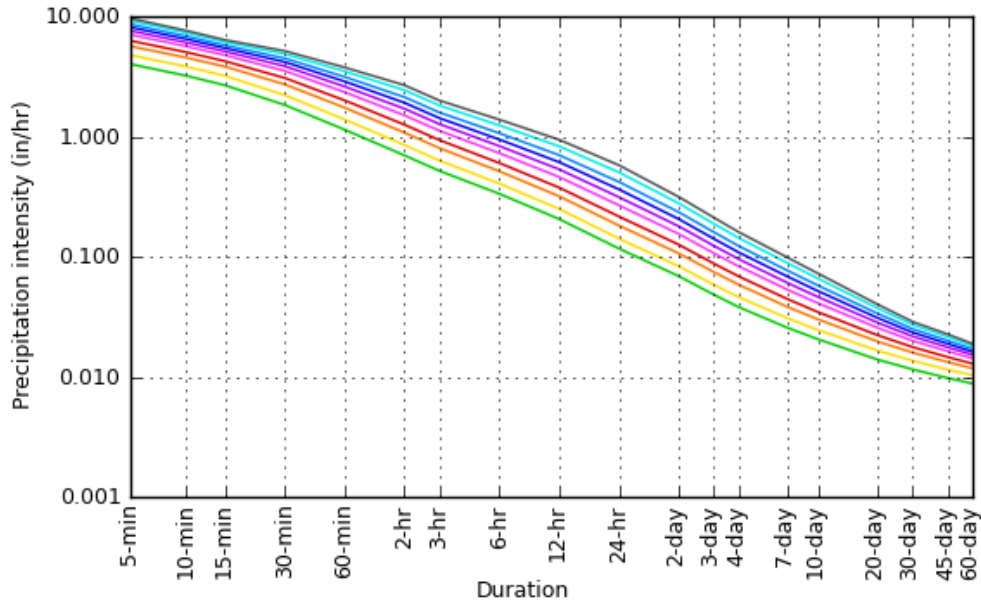
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration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

PDS-based intensity-duration-frequency (IDF) curves

Latitude: 40.6554°, Longitude: -74.3079°



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**Maps & aerials**

**Small scale terrain**



Large scale terrain



Large scale map



Large scale aerial



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