

STORMWATER MANAGEMENT REPORT

15 GRAND AVENUE

BLOCK 505, LOTS 3 & 4

BOROUGH OF PALISADES PARK, BERGEN COUNTY, NEW JERSEY

BCG# 081197-01-001

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**STORMWATER MANAGEMENT REPORT
15 GRAND AVENUE
Borough of Palisades Park
Bergen County, New Jersey**

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I. INTRODUCTION

This report is prepared to describe and document through engineering calculations and related technical data the stormwater management system designed for a project known as 15 Grand Avenue, proposed upon Lots 3 and 4 of Block 505 in the Borough of Palisades Park, Bergen County, New Jersey. This report accompanies a set of drawings entitled "Preliminary and Final Site Plans for 15 Grand Avenue" which were also prepared by Bowman Consulting Group, Ltd., dated November 15, 2021. The set of Preliminary and Final Site Plans illustrate the existing and proposed conditions upon the subject property, as well as provide details for the stormwater management system described herein. Therefore, this report should be reviewed and considered in conjunction with the above referenced Site Plans.

A. Location and Description of Project Site

The subject property is located at the northwest corner of the intersection of Grand Avenue (State Route 93) and an entrance Ramp to US Highway Route 46. Currently, the tract is developed with a 1-story restaurant/commercial building connected to a 4- to 5-story building, a parking lot, and an area used for the storage of vehicles and equipment of a landscape contractor. The site is almost entirely impervious with the exception of narrow steeply sloped lawn areas along the southern and western property lines.

A manmade ditch leading to an Overpeck Creek tributary exists along the southern and western property lines. The ditch begins at a headwall with a 48" pipe located on the west side of subject property. The ditch, along with a portion of the western side of the property, is located within the tidal flood plain of Overpeck Creek (located approximately 1,000 feet from the site).

The project site is located within State Planning Area No. 1, Metropolitan.

The entire site is located within Urban soil per the *NRCS Soil Survey for Bergen County, New Jersey*. A soil map for the site can be found in Appendix A.

B. Project Description

The project will include the demolition of the single-story portion of the existing building and parking areas and the construction of a 122-unit apartment building. The proposed improvements result in an area of disturbance of approximately 2.5 acres and the project is therefore considered a major development as defined in N.J.A.C. 7:8. The proposed improvements reduce the impervious area from 2.50 acres in the existing condition to 2.35 acres in the proposed condition and decrease the regulated motor vehicle surface from 1.90 acres in the existing condition to 0.65 acres in the proposed condition.

II. COMPLIANCE WITH STORMWATER MANAGEMENT RULES

This section of this report is intended to demonstrate that the design for the project is compliant with all of the regulatory requirements pursuant to the applicable rules. The various considerations relevant to the design of the system are as follows:

- Assuring minimization of erosion and sedimentation
- Maintenance of average annual groundwater recharge volume
- Compliance with applicable Water Quality Management Standards
- Stormwater runoff quantity control
- Providing an effective collection and conveyance system

A. Soil Erosion and Sediment Control Compliance

The project is designed to minimize erosion and sedimentation in accordance with The Standards for Soil Erosion and Sediment Control in New Jersey. A "Soil Erosion and Sediment Control Plan" is included in the set of project plans, specifying numerous practices to achieve this goal. The project's "Soil Erosion and Sediment Control Plan" is subject to review and approval by the Bergen County Soil Conservation District. The District's certification of the plan is required before any construction may commence, which provides further assurance that the project's implementation will minimize erosion and sedimentation. The calculations for the proposed scour hole, designed in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey, are included in Appendix E.

B. Maintenance of Groundwater Recharge

The subject property is previously developed and is within an area delineated on the State Plan Policy Map (SPPM) as the Metropolitan Planning Area (PA1). Therefore, the property is considered "Urban Redevelopment Area", as defined in the NJ Stormwater rules and per N.J.A.C. 7:8-5.4(b)2, is exempt from groundwater recharge requirements.

C. Water Quality Management

Per N.J.A.C. 7:8-5.5(a), stormwater quality standards are applicable when a major development results in an increase of one-quarter acres or more of regulated motor vehicle surface. As described above, the project results in the reduction of motor vehicle surface from 1.90 acres in the existing condition to 0.65 acres in the proposed condition. Therefore, the stormwater runoff quality standards are not applicable.

D. Quantity Control

The project's approach for compliance with the regulatory requirements for "quantity control" are set forth at Subpart 5.6(b)(1) of the Stormwater

Management Regulations (NJAC 7:8). Specifically, as a result of the decrease in impervious coverage, the proposed runoff hydrographs for the two, 10, and 100-year storm events at the point of analysis at the ditch leading to Overpeck Creek do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events.

The hydrologic estimates and modeling conducted for the design of the stormwater management system utilize the "NRCS Methodology". The models use the NOAA Type D, 24-hour rainfall distribution, consistent with the guidance provided in the New Jersey BMP Manual. According to data published by the State Office of the Natural Resources Conservation Service, the 24-hour rainfall depths for Bergen County area are as follows:

- 2-year = 3.34 inches
- 10-year = 5.07 inches
- 100-year = 8.47 inches

The times of concentration for the existing and proposed conditions were calculated using the TR-55 method. The time of concentration was calculated separately for the impervious area and pervious area, each of which are modeled in a separate hydrograph in accordance with the requirements of the NJ BMP Manual.

Per the TR-55 manual, a curve number of 98 is used in the calculations for impervious surfaces. The NRCS Web Soil Survey does not give a Hydrologic Soil Group for the urban soils on site. However, because the project reduces impervious coverage, the post-development hydrographs for the analyzed storms will be less than the pre-development hydrographs regardless of the Hydrologic Soil Group of the onsite soil. Therefore, the soil is assumed to be in Hydrologic Soil Group D and, in accordance with the TR-55 Manual, a curve number of 80 is used for lawn areas.

Table No. 1 below summarizes the existing and proposed peak runoff rates to the onsite ditch. A side-by-side comparison of the existing and proposed hydrographs for each of the analyzed storms is included in Appendix B.

TABLE NO. 1		
SUMMARY OF EXISTING AND PROPOSED PEAK RATES OF RUNOFF		
STORM FREQUENCY (YEARS)	EXISTING PEAK (cfs)	PROPOSED PEAK (cfs)
2	8.80	8.60
10	13.74	13.54
100	23.46	23.29

E. Collection and Conveyance System Design

The project's storm water management system includes a network of storm sewer pipes to convey the stormwater runoff to from the development to the onsite ditch. Stormwater inlets are strategically located to collect runoff from roof drains and the surface of the ground. As required by the RSIS (N.J.A.C. 5:21-7:2) the design of collection and conveyance system is based upon a 25-year storm. Hydraflow Storm Sewer Software is used to demonstrate the adequacy of the system to handle the design flows. **Appendix C** of this report contains the storm sewer design calculations. A corresponding 'Inlet Area Map' is provided as Sheet 3 of 3 in **Appendix F**.

III. SUMMARY AND CONCLUSION

This report describes the design of the stormwater management system proposed for the 15 Grand project, as illustrated on the project's Site Plans. Through the proposed redevelopment of the site, the project enhances water quality by reducing regulated motor vehicle surface and reduces the runoff volume and peak flow from the property.

This report also identifies the regulatory requirements pertaining to the storm sewer system's design and, as supported by the engineering calculations and related technical data contained in the appendices of this report, documents the system's compliance with the regulatory requirements.

2-year comparison

10-year comparison

100-year comparison

IV. REFERENCES

The following documents were relied upon during the preparation of the project's stormwater management plan:

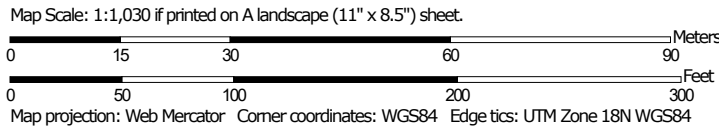
1. New Jersey Stormwater Best Management Practices Manual, New Jersey Department of Environmental Protection; April, 2004 (Revised March, 2020).
2. Residential Site Improvement Standards, New Jersey Administrative Code Title 5, Chapter 21; Adopted January 6, 1997; Revised October 7, 2020
3. Standards for Soil Erosion and Sediment Control in New Jersey, New Jersey State Soil Conservation Committee; January 2014 and revised July 2017.
4. Urban Hydrology for Small Watersheds, United States Department of Agriculture, Soil Conservation Service; June, 1986.

APPENDIX A
USDA SOIL MAP

Soil Map—Bergen County, New Jersey



Soil Map may not be valid at this scale.



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: Bergen County, New Jersey

Survey Area Data: Version 18, Aug 30, 2021

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

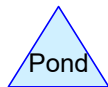
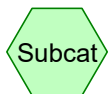
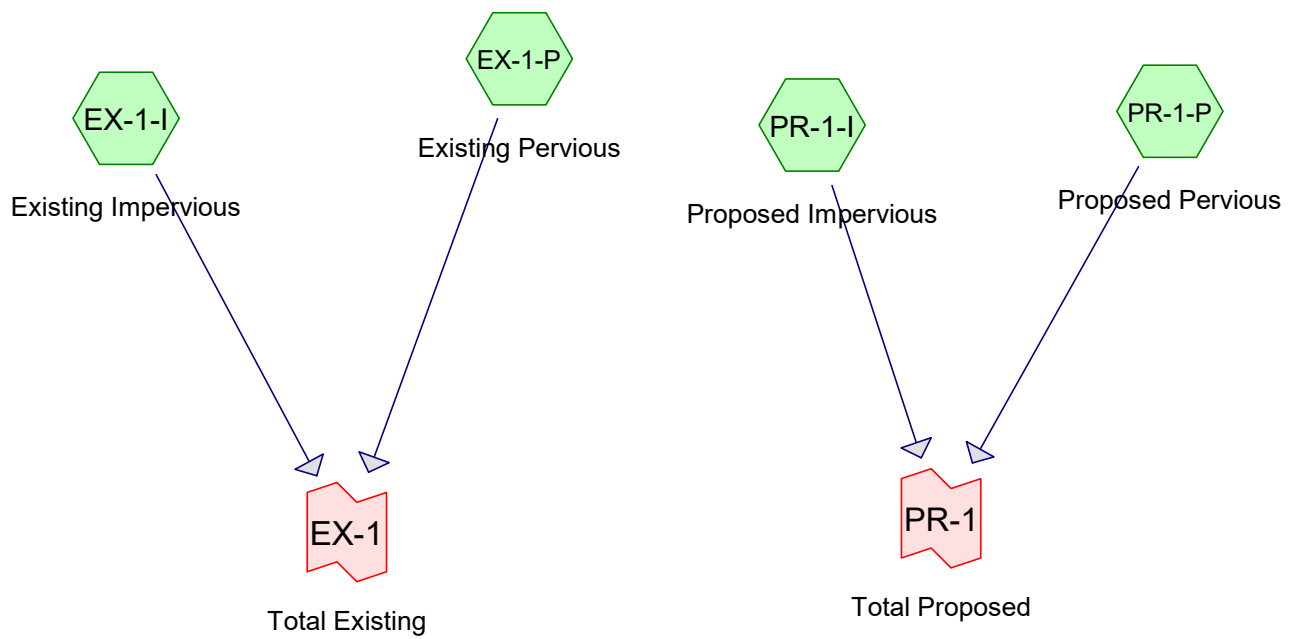
Date(s) aerial images were photographed: May 12, 2020—Nov 4, 2020

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
UR	Urban land	3.0	100.0%
Totals for Area of Interest		3.0	100.0%

APPENDIX B
SCS METHOD CALCULATIONS



Fan Palisade Park

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NOAA 24-hr D 2-Year Rainfall=3.34"

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Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1-I: Existing Runoff Area=108,714 sf 100.00% Impervious Runoff Depth=3.11"
Flow Length=806' Tc=5.3 min CN=98 Runoff=8.09 cfs 0.646 af

Subcatchment EX-1-P: Existing Pervious Runoff Area=17,000 sf 0.00% Impervious Runoff Depth=1.51"
Flow Length=809' Tc=5.3 min CN=80 Runoff=0.71 cfs 0.049 af

Subcatchment PR-1-I: Proposed Runoff Area=102,547 sf 100.00% Impervious Runoff Depth=3.11"
Flow Length=954' Tc=5.3 min CN=98 Runoff=7.63 cfs 0.610 af

Subcatchment PR-1-P: Proposed Pervious Runoff Area=23,167 sf 0.00% Impervious Runoff Depth=1.51"
Flow Length=954' Tc=5.3 min CN=80 Runoff=0.97 cfs 0.067 af

Link EX-1: Total Existing Inflow=8.80 cfs 0.695 af
Primary=8.80 cfs 0.695 af

Link PR-1: Total Proposed Inflow=8.60 cfs 0.676 af
Primary=8.60 cfs 0.676 af

Total Runoff Area = 5.772 ac Runoff Volume = 1.372 af Average Runoff Depth = 2.85"
15.98% Pervious = 0.922 ac 84.02% Impervious = 4.850 ac

Fan Palisade Park

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NOAA 24-hr D 2-Year Rainfall=3.34"

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Summary for Subcatchment EX-1-I: Existing Impervious

Runoff = 8.09 cfs @ 12.12 hrs, Volume= 0.646 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.34"

Area (sf)	CN	Description
108,714	98	Paved parking, HSG D
108,714		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	35	0.2000	0.36		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.7	65	0.0300	1.55		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.50"
1.7	271	0.0180	2.72		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.3	435	0.0080	5.47	87.55	Trap/Vee/Rect Channel Flow, Bot.W=6.00' D=2.00' Z= 1.0 '/' Top.W=10.00' n= 0.030 Stream, clean & straight
5.3	806	Total			

Summary for Subcatchment EX-1-P: Existing Pervious

Runoff = 0.71 cfs @ 12.13 hrs, Volume= 0.049 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.34"

Area (sf)	CN	Description
17,000	80	>75% Grass cover, Good, HSG D
17,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	38	0.2000	0.37		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.7	65	0.0300	1.55		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.50"
1.7	271	0.0180	2.72		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.2	435	0.0090	5.80	92.86	Trap/Vee/Rect Channel Flow, Bot.W=6.00' D=2.00' Z= 1.0 '/' Top.W=10.00' n= 0.030 Stream, clean & straight
5.3	809	Total			

Fan Palisade Park

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NOAA 24-hr D 2-Year Rainfall=3.34"

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Summary for Subcatchment PR-1-I: Proposed Impervious

Runoff = 7.63 cfs @ 12.12 hrs, Volume= 0.610 af, Depth= 3.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.34"

Area (sf)	CN	Description
102,547	98	Paved parking, HSG D
102,547		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	27	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.9	170	0.0480	3.29		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.3	68	0.0080	4.06	3.19	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.6	272	0.0200	7.44	9.14	Pipe Channel, 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	79	0.0120	6.51	11.51	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.0	29	0.0290	12.26	38.52	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.8	309	0.0058	6.36	31.24	Pipe Channel, 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
5.3	954	Total			

Summary for Subcatchment PR-1-P: Proposed Pervious

Runoff = 0.97 cfs @ 12.13 hrs, Volume= 0.067 af, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-Year Rainfall=3.34"

Area (sf)	CN	Description
23,167	80	>75% Grass cover, Good, HSG D
23,167		100.00% Pervious Area

Fan Palisade Park

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NOAA 24-hr D 2-Year Rainfall=3.34"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	27	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.9	170	0.0480	3.29		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.3	68	0.0080	4.06	3.19	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.6	272	0.0200	7.44	9.14	Pipe Channel, 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	79	0.0120	6.51	11.51	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.0	29	0.0290	12.26	38.52	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.8	309	0.0058	6.36	31.24	Pipe Channel, 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
5.3	954	Total			

Summary for Link EX-1: Total Existing

Inflow Area = 2.886 ac, 86.48% Impervious, Inflow Depth = 2.89" for 2-Year event
 Inflow = 8.80 cfs @ 12.12 hrs, Volume= 0.695 af
 Primary = 8.80 cfs @ 12.12 hrs, Volume= 0.695 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Link PR-1: Total Proposed

Inflow Area = 2.886 ac, 81.57% Impervious, Inflow Depth = 2.81" for 2-Year event
 Inflow = 8.60 cfs @ 12.12 hrs, Volume= 0.676 af
 Primary = 8.60 cfs @ 12.12 hrs, Volume= 0.676 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Fan Palisade Park

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NOAA 24-hr D 2-Year Rainfall=3.34"

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Primary Comparison

Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)	Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)	Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)
0.00	0.00	0.00	10.40	0.43	0.41	20.80	0.14	0.13
0.20	0.00	0.00	10.60	0.48	0.46	21.00	0.13	0.13
0.40	0.00	0.00	10.80	0.58	0.56	21.20	0.13	0.13
0.60	0.00	0.00	11.00	0.69	0.66	21.40	0.13	0.13
0.80	0.00	0.00	11.20	0.85	0.82	21.60	0.13	0.13
1.00	0.00	0.00	11.40	1.04	1.00	21.80	0.13	0.12
1.20	0.00	0.00	11.60	1.46	1.41	22.00	0.12	0.12
1.40	0.01	0.01	11.80	2.12	2.06	22.20	0.12	0.12
1.60	0.02	0.02	12.00	4.96	4.82	22.40	0.12	0.12
1.80	0.02	0.02	12.20	4.82	4.72	22.60	0.12	0.12
2.00	0.03	0.03	12.40	1.93	1.89	22.80	0.12	0.11
2.20	0.04	0.03	12.60	1.35	1.33	23.00	0.11	0.11
2.40	0.04	0.04	12.80	1.08	1.06	23.20	0.11	0.11
2.60	0.05	0.04	13.00	0.89	0.88	23.40	0.11	0.11
2.80	0.05	0.05	13.20	0.74	0.72	23.60	0.11	0.11
3.00	0.06	0.05	13.40	0.63	0.62	23.80	0.10	0.10
3.20	0.06	0.06	13.60	0.52	0.51	24.00	0.10	0.10
3.40	0.07	0.06	13.80	0.48	0.48	24.20	0.00	0.00
3.60	0.07	0.07	14.00	0.45	0.45	24.40	0.00	0.00
3.80	0.08	0.07	14.20	0.42	0.42	24.60	0.00	0.00
4.00	0.08	0.08	14.40	0.39	0.39	24.80	0.00	0.00
4.20	0.08	0.08	14.60	0.37	0.36	25.00	0.00	0.00
4.40	0.09	0.08	14.80	0.34	0.33			
4.60	0.09	0.09	15.00	0.31	0.30			
4.80	0.10	0.09	15.20	0.28	0.28			
5.00	0.10	0.09	15.40	0.28	0.27			
5.20	0.10	0.10	15.60	0.27	0.26			
5.40	0.11	0.10	15.80	0.26	0.26			
5.60	0.11	0.10	16.00	0.25	0.25			
5.80	0.11	0.11	16.20	0.24	0.24			
6.00	0.12	0.11	16.40	0.24	0.23			
6.20	0.12	0.12	16.60	0.23	0.22			
6.40	0.13	0.12	16.80	0.22	0.22			
6.60	0.14	0.13	17.00	0.21	0.21			
6.80	0.15	0.14	17.20	0.20	0.20			
7.00	0.15	0.15	17.40	0.19	0.19			
7.20	0.16	0.15	17.60	0.19	0.18			
7.40	0.17	0.16	17.80	0.18	0.18			
7.60	0.18	0.17	18.00	0.17	0.17			
7.80	0.19	0.18	18.20	0.16	0.16			
8.00	0.19	0.18	18.40	0.16	0.16			
8.20	0.20	0.19	18.60	0.16	0.16			
8.40	0.21	0.20	18.80	0.16	0.16			
8.60	0.22	0.21	19.00	0.15	0.15			
8.80	0.23	0.21	19.20	0.15	0.15			
9.00	0.24	0.22	19.40	0.15	0.15			
9.20	0.26	0.25	19.60	0.15	0.15			
9.40	0.29	0.27	19.80	0.15	0.15			
9.60	0.32	0.30	20.00	0.14	0.14			
9.80	0.34	0.33	20.20	0.14	0.14			
10.00	0.37	0.35	20.40	0.14	0.14			
10.20	0.40	0.38	20.60	0.14	0.14			

Fan Palisade Park

NOAA 24-hr D 10-Year Rainfall=5.07"

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Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1-I: Existing Runoff Area=108,714 sf 100.00% Impervious Runoff Depth=4.83"
Flow Length=806' Tc=5.3 min CN=98 Runoff=12.35 cfs 1.005 af

Subcatchment EX-1-P: Existing Pervious Runoff Area=17,000 sf 0.00% Impervious Runoff Depth=2.95"
Flow Length=809' Tc=5.3 min CN=80 Runoff=1.39 cfs 0.096 af

Subcatchment PR-1-I: Proposed Runoff Area=102,547 sf 100.00% Impervious Runoff Depth=4.83"
Flow Length=954' Tc=5.3 min CN=98 Runoff=11.65 cfs 0.948 af

Subcatchment PR-1-P: Proposed Pervious Runoff Area=23,167 sf 0.00% Impervious Runoff Depth=2.95"
Flow Length=954' Tc=5.3 min CN=80 Runoff=1.89 cfs 0.131 af

Link EX-1: Total Existing Inflow=13.74 cfs 1.101 af
Primary=13.74 cfs 1.101 af

Link PR-1: Total Proposed Inflow=13.54 cfs 1.079 af
Primary=13.54 cfs 1.079 af

Total Runoff Area = 5.772 ac Runoff Volume = 2.180 af Average Runoff Depth = 4.53"
15.98% Pervious = 0.922 ac 84.02% Impervious = 4.850 ac

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NOAA 24-hr D 10-Year Rainfall=5.07"

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Summary for Subcatchment EX-1-I: Existing Impervious

Runoff = 12.35 cfs @ 12.12 hrs, Volume= 1.005 af, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10-Year Rainfall=5.07"

Area (sf)	CN	Description
108,714	98	Paved parking, HSG D
108,714		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	35	0.2000	0.36		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.7	65	0.0300	1.55		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.50"
1.7	271	0.0180	2.72		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.3	435	0.0080	5.47	87.55	Trap/Vee/Rect Channel Flow, Bot.W=6.00' D=2.00' Z= 1.0 '/' Top.W=10.00' n= 0.030 Stream, clean & straight
5.3	806	Total			

Summary for Subcatchment EX-1-P: Existing Pervious

Runoff = 1.39 cfs @ 12.13 hrs, Volume= 0.096 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 10-Year Rainfall=5.07"

Area (sf)	CN	Description
17,000	80	>75% Grass cover, Good, HSG D
17,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	38	0.2000	0.37		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.7	65	0.0300	1.55		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.50"
1.7	271	0.0180	2.72		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.2	435	0.0090	5.80	92.86	Trap/Vee/Rect Channel Flow, Bot.W=6.00' D=2.00' Z= 1.0 '/' Top.W=10.00' n= 0.030 Stream, clean & straight
5.3	809	Total			

Fan Palisade Park

NOAA 24-hr D 10-Year Rainfall=5.07"

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Summary for Subcatchment PR-1-I: Proposed Impervious

Runoff = 11.65 cfs @ 12.12 hrs, Volume= 0.948 af, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.07"

Area (sf)	CN	Description
102,547	98	Paved parking, HSG D
102,547		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	27	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.9	170	0.0480	3.29		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.3	68	0.0080	4.06	3.19	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.6	272	0.0200	7.44	9.14	Pipe Channel, 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	79	0.0120	6.51	11.51	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.0	29	0.0290	12.26	38.52	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.8	309	0.0058	6.36	31.24	Pipe Channel, 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
5.3	954	Total			

Summary for Subcatchment PR-1-P: Proposed Pervious

Runoff = 1.89 cfs @ 12.13 hrs, Volume= 0.131 af, Depth= 2.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-Year Rainfall=5.07"

Area (sf)	CN	Description
23,167	80	>75% Grass cover, Good, HSG D
23,167		100.00% Pervious Area

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NOAA 24-hr D 10-Year Rainfall=5.07"

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	27	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.9	170	0.0480	3.29		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.3	68	0.0080	4.06	3.19	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.6	272	0.0200	7.44	9.14	Pipe Channel, 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	79	0.0120	6.51	11.51	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.0	29	0.0290	12.26	38.52	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.8	309	0.0058	6.36	31.24	Pipe Channel, 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
5.3	954	Total			

Summary for Link EX-1: Total Existing

Inflow Area = 2.886 ac, 86.48% Impervious, Inflow Depth = 4.58" for 10-Year event
 Inflow = 13.74 cfs @ 12.12 hrs, Volume= 1.101 af
 Primary = 13.74 cfs @ 12.12 hrs, Volume= 1.101 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Link PR-1: Total Proposed

Inflow Area = 2.886 ac, 81.57% Impervious, Inflow Depth = 4.49" for 10-Year event
 Inflow = 13.54 cfs @ 12.12 hrs, Volume= 1.079 af
 Primary = 13.54 cfs @ 12.12 hrs, Volume= 1.079 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

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Primary Comparison

Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)	Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)	Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)
0.00	0.00	0.00	10.40	0.69	0.67	20.80	0.21	0.21
0.20	0.00	0.00	10.60	0.78	0.75	21.00	0.21	0.21
0.40	0.00	0.00	10.80	0.93	0.90	21.20	0.20	0.20
0.60	0.00	0.00	11.00	1.09	1.06	21.40	0.20	0.20
0.80	0.00	0.00	11.20	1.36	1.32	21.60	0.20	0.20
1.00	0.02	0.02	11.40	1.65	1.60	21.80	0.19	0.19
1.20	0.03	0.03	11.60	2.31	2.25	22.00	0.19	0.19
1.40	0.04	0.04	11.80	3.35	3.27	22.20	0.19	0.19
1.60	0.06	0.05	12.00	7.77	7.63	22.40	0.18	0.18
1.80	0.07	0.06	12.20	7.50	7.40	22.60	0.18	0.18
2.00	0.08	0.07	12.40	2.99	2.96	22.80	0.18	0.18
2.20	0.09	0.08	12.60	2.09	2.07	23.00	0.17	0.17
2.40	0.10	0.09	12.80	1.67	1.66	23.20	0.17	0.17
2.60	0.10	0.10	13.00	1.38	1.37	23.40	0.17	0.17
2.80	0.11	0.10	13.20	1.14	1.13	23.60	0.17	0.16
3.00	0.12	0.11	13.40	0.97	0.96	23.80	0.16	0.16
3.20	0.13	0.12	13.60	0.81	0.80	24.00	0.16	0.16
3.40	0.13	0.12	13.80	0.75	0.74	24.20	0.00	0.00
3.60	0.14	0.13	14.00	0.70	0.69	24.40	0.00	0.00
3.80	0.14	0.14	14.20	0.66	0.65	24.60	0.00	0.00
4.00	0.15	0.14	14.40	0.61	0.60	24.80	0.00	0.00
4.20	0.15	0.15	14.60	0.56	0.56	25.00	0.00	0.00
4.40	0.16	0.15	14.80	0.52	0.52			
4.60	0.17	0.16	15.00	0.47	0.47			
4.80	0.17	0.16	15.20	0.44	0.44			
5.00	0.17	0.16	15.40	0.43	0.42			
5.20	0.18	0.17	15.60	0.41	0.41			
5.40	0.18	0.17	15.80	0.40	0.40			
5.60	0.19	0.18	16.00	0.39	0.39			
5.80	0.19	0.18	16.20	0.38	0.37			
6.00	0.20	0.19	16.40	0.36	0.36			
6.20	0.21	0.20	16.60	0.35	0.35			
6.40	0.22	0.21	16.80	0.34	0.34			
6.60	0.23	0.22	17.00	0.33	0.32			
6.80	0.24	0.23	17.20	0.31	0.31			
7.00	0.26	0.24	17.40	0.30	0.30			
7.20	0.27	0.25	17.60	0.29	0.28			
7.40	0.28	0.27	17.80	0.27	0.27			
7.60	0.29	0.28	18.00	0.26	0.26			
7.80	0.31	0.29	18.20	0.25	0.25			
8.00	0.32	0.30	18.40	0.25	0.25			
8.20	0.33	0.32	18.60	0.25	0.24			
8.40	0.35	0.33	18.80	0.24	0.24			
8.60	0.36	0.34	19.00	0.24	0.24			
8.80	0.37	0.36	19.20	0.24	0.23			
9.00	0.39	0.37	19.40	0.23	0.23			
9.20	0.42	0.41	19.60	0.23	0.23			
9.40	0.47	0.45	19.80	0.23	0.22			
9.60	0.51	0.49	20.00	0.22	0.22			
9.80	0.56	0.53	20.20	0.22	0.22			
10.00	0.60	0.58	20.40	0.22	0.22			
10.20	0.64	0.62	20.60	0.21	0.21			

Fan Palisade Park

NOAA 24-hr D 100-Year Rainfall=8.47"

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Time span=0.00-25.00 hrs, dt=0.01 hrs, 2501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EX-1-I: Existing Runoff Area=108,714 sf 100.00% Impervious Runoff Depth=8.23"
Flow Length=806' Tc=5.3 min CN=98 Runoff=20.71 cfs 1.712 af

Subcatchment EX-1-P: Existing Pervious Runoff Area=17,000 sf 0.00% Impervious Runoff Depth=6.07"
Flow Length=809' Tc=5.3 min CN=80 Runoff=2.76 cfs 0.197 af

Subcatchment PR-1-I: Proposed Runoff Area=102,547 sf 100.00% Impervious Runoff Depth=8.23"
Flow Length=954' Tc=5.3 min CN=98 Runoff=19.53 cfs 1.615 af

Subcatchment PR-1-P: Proposed Pervious Runoff Area=23,167 sf 0.00% Impervious Runoff Depth=6.07"
Flow Length=954' Tc=5.3 min CN=80 Runoff=3.76 cfs 0.269 af

Link EX-1: Total Existing Inflow=23.46 cfs 1.909 af
Primary=23.46 cfs 1.909 af

Link PR-1: Total Proposed Inflow=23.29 cfs 1.883 af
Primary=23.29 cfs 1.883 af

Total Runoff Area = 5.772 ac Runoff Volume = 3.792 af Average Runoff Depth = 7.88"
15.98% Pervious = 0.922 ac 84.02% Impervious = 4.850 ac

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NOAA 24-hr D 100-Year Rainfall=8.47"

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Summary for Subcatchment EX-1-I: Existing Impervious

Runoff = 20.71 cfs @ 12.12 hrs, Volume= 1.712 af, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100-Year Rainfall=8.47"

Area (sf)	CN	Description
108,714	98	Paved parking, HSG D
108,714		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	35	0.2000	0.36		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.7	65	0.0300	1.55		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.50"
1.7	271	0.0180	2.72		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.3	435	0.0080	5.47	87.55	Trap/Vee/Rect Channel Flow, Bot.W=6.00' D=2.00' Z= 1.0 '/' Top.W=10.00' n= 0.030 Stream, clean & straight
5.3	806	Total			

Summary for Subcatchment EX-1-P: Existing Pervious

Runoff = 2.76 cfs @ 12.12 hrs, Volume= 0.197 af, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
 NOAA 24-hr D 100-Year Rainfall=8.47"

Area (sf)	CN	Description
17,000	80	>75% Grass cover, Good, HSG D
17,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	38	0.2000	0.37		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.7	65	0.0300	1.55		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.50"
1.7	271	0.0180	2.72		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.2	435	0.0090	5.80	92.86	Trap/Vee/Rect Channel Flow, Bot.W=6.00' D=2.00' Z= 1.0 '/' Top.W=10.00' n= 0.030 Stream, clean & straight
5.3	809	Total			

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Summary for Subcatchment PR-1-I: Proposed Impervious

Runoff = 19.53 cfs @ 12.12 hrs, Volume= 1.615 af, Depth= 8.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.47"

Area (sf)	CN	Description
102,547	98	Paved parking, HSG D
102,547		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	27	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.9	170	0.0480	3.29		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.3	68	0.0080	4.06	3.19	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.6	272	0.0200	7.44	9.14	Pipe Channel, 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	79	0.0120	6.51	11.51	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.0	29	0.0290	12.26	38.52	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.8	309	0.0058	6.36	31.24	Pipe Channel, 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
5.3	954	Total			

Summary for Subcatchment PR-1-P: Proposed Pervious

Runoff = 3.76 cfs @ 12.12 hrs, Volume= 0.269 af, Depth= 6.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-Year Rainfall=8.47"

Area (sf)	CN	Description
23,167	80	>75% Grass cover, Good, HSG D
23,167		100.00% Pervious Area

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Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	27	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.50"
0.9	170	0.0480	3.29		Shallow Concentrated Flow, Grassed Waterway Kv= 15.0 fps
0.3	68	0.0080	4.06	3.19	Pipe Channel, 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.6	272	0.0200	7.44	9.14	Pipe Channel, 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
0.2	79	0.0120	6.51	11.51	Pipe Channel, RCP_Round 18" 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.0	29	0.0290	12.26	38.52	Pipe Channel, 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.8	309	0.0058	6.36	31.24	Pipe Channel, 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013
5.3	954	Total			

Summary for Link EX-1: Total Existing

Inflow Area = 2.886 ac, 86.48% Impervious, Inflow Depth = 7.94" for 100-Year event
 Inflow = 23.46 cfs @ 12.12 hrs, Volume= 1.909 af
 Primary = 23.46 cfs @ 12.12 hrs, Volume= 1.909 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

Summary for Link PR-1: Total Proposed

Inflow Area = 2.886 ac, 81.57% Impervious, Inflow Depth = 7.83" for 100-Year event
 Inflow = 23.29 cfs @ 12.12 hrs, Volume= 1.883 af
 Primary = 23.29 cfs @ 12.12 hrs, Volume= 1.883 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-25.00 hrs, dt= 0.01 hrs

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NOAA 24-hr D 100-Year Rainfall=8.47"

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Primary Comparison

Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)	Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)	Time (hours)	Link EX-1 (cfs)	Link PR-1 (cfs)
0.00	0.00	0.00	10.40	1.21	1.18	20.80	0.35	0.35
0.20	0.00	0.00	10.60	1.36	1.33	21.00	0.35	0.35
0.40	0.00	0.00	10.80	1.63	1.60	21.20	0.34	0.34
0.60	0.02	0.02	11.00	1.91	1.87	21.40	0.34	0.34
0.80	0.06	0.05	11.20	2.36	2.32	21.60	0.33	0.33
1.00	0.09	0.08	11.40	2.85	2.81	21.80	0.33	0.33
1.20	0.11	0.11	11.60	3.99	3.93	22.00	0.32	0.32
1.40	0.14	0.13	11.80	5.77	5.70	22.20	0.32	0.32
1.60	0.15	0.15	12.00	13.34	13.21	22.40	0.31	0.31
1.80	0.17	0.16	12.20	12.79	12.71	22.60	0.31	0.31
2.00	0.19	0.18	12.40	5.09	5.06	22.80	0.30	0.30
2.20	0.20	0.19	12.60	3.55	3.54	23.00	0.29	0.29
2.40	0.21	0.20	12.80	2.84	2.83	23.20	0.29	0.29
2.60	0.22	0.21	13.00	2.35	2.34	23.40	0.28	0.28
2.80	0.23	0.22	13.20	1.93	1.92	23.60	0.28	0.28
3.00	0.24	0.23	13.40	1.65	1.64	23.80	0.27	0.27
3.20	0.25	0.24	13.60	1.37	1.36	24.00	0.27	0.27
3.40	0.26	0.25	13.80	1.26	1.26	24.20	0.00	0.00
3.60	0.27	0.26	14.00	1.19	1.18	24.40	0.00	0.00
3.80	0.28	0.26	14.20	1.11	1.10	24.60	0.00	0.00
4.00	0.29	0.27	14.40	1.03	1.03	24.80	0.00	0.00
4.20	0.29	0.28	14.60	0.96	0.95	25.00	0.00	0.00
4.40	0.30	0.29	14.80	0.88	0.88			
4.60	0.31	0.29	15.00	0.80	0.80			
4.80	0.32	0.30	15.20	0.74	0.74			
5.00	0.32	0.31	15.40	0.72	0.72			
5.20	0.33	0.31	15.60	0.70	0.70			
5.40	0.34	0.32	15.80	0.68	0.68			
5.60	0.35	0.33	16.00	0.66	0.66			
5.80	0.35	0.34	16.20	0.64	0.63			
6.00	0.36	0.34	16.40	0.62	0.61			
6.20	0.38	0.36	16.60	0.59	0.59			
6.40	0.40	0.38	16.80	0.57	0.57			
6.60	0.42	0.40	17.00	0.55	0.55			
6.80	0.44	0.43	17.20	0.53	0.53			
7.00	0.47	0.45	17.40	0.51	0.50			
7.20	0.49	0.47	17.60	0.48	0.48			
7.40	0.51	0.49	17.80	0.46	0.46			
7.60	0.53	0.51	18.00	0.44	0.44			
7.80	0.55	0.53	18.20	0.43	0.42			
8.00	0.58	0.56	18.40	0.42	0.42			
8.20	0.60	0.58	18.60	0.42	0.41			
8.40	0.62	0.60	18.80	0.41	0.41			
8.60	0.64	0.62	19.00	0.40	0.40			
8.80	0.67	0.65	19.20	0.40	0.40			
9.00	0.69	0.67	19.40	0.39	0.39			
9.20	0.75	0.73	19.60	0.39	0.39			
9.40	0.83	0.81	19.80	0.38	0.38			
9.60	0.90	0.88	20.00	0.38	0.38			
9.80	0.98	0.96	20.20	0.37	0.37			
10.00	1.06	1.03	20.40	0.37	0.37			
10.20	1.13	1.10	20.60	0.36	0.36			

APPENDIX C
CONVEYANCE SYSTEM CALCULATIONS



NOAA Atlas 14, Volume 2, Version 3
Location name: Palisades Park, New Jersey, USA*
Latitude: 40.8443°, Longitude: -74.0051°
Elevation: 12.53 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

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.04 (3.68-4.44)	4.84 (4.40-5.32)	5.76 (5.24-6.32)	6.46 (5.86-7.08)	7.32 (6.60-8.03)	7.97 (7.15-8.76)	8.60 (7.67-9.47)	9.23 (8.16-10.2)	10.0 (8.75-11.1)	10.6 (9.19-11.9)
10-min	3.20 (2.92-3.51)	3.83 (3.49-4.21)	4.55 (4.14-5.00)	5.08 (4.60-5.57)	5.74 (5.18-6.31)	6.22 (5.59-6.84)	6.70 (5.97-7.37)	7.13 (6.31-7.88)	7.70 (6.72-8.56)	8.10 (7.00-9.06)
15-min	2.64 (2.41-2.90)	3.17 (2.89-3.49)	3.79 (3.45-4.17)	4.24 (3.85-4.66)	4.80 (4.34-5.28)	5.20 (4.67-5.72)	5.61 (5.00-6.17)	5.98 (5.28-6.60)	6.45 (5.62-7.17)	6.78 (5.85-7.58)
30-min	1.79 (1.63-1.96)	2.17 (1.97-2.38)	2.66 (2.42-2.92)	3.02 (2.74-3.32)	3.49 (3.15-3.83)	3.84 (3.45-4.22)	4.19 (3.74-4.61)	4.53 (4.01-5.00)	4.99 (4.35-5.54)	5.32 (4.59-5.95)
60-min	1.11 (1.01-1.21)	1.35 (1.23-1.48)	1.69 (1.54-1.86)	1.95 (1.77-2.14)	2.30 (2.08-2.53)	2.57 (2.31-2.83)	2.86 (2.55-3.14)	3.14 (2.78-3.47)	3.53 (3.08-3.92)	3.82 (3.30-4.28)
2-hr	0.684 (0.620-0.756)	0.830 (0.754-0.918)	1.05 (0.949-1.16)	1.22 (1.10-1.34)	1.45 (1.30-1.60)	1.64 (1.47-1.81)	1.83 (1.63-2.03)	2.04 (1.79-2.26)	2.32 (2.01-2.58)	2.54 (2.18-2.85)
3-hr	0.508 (0.462-0.560)	0.616 (0.561-0.681)	0.777 (0.707-0.860)	0.905 (0.820-1.00)	1.08 (0.975-1.20)	1.23 (1.10-1.36)	1.38 (1.22-1.52)	1.54 (1.35-1.70)	1.76 (1.52-1.96)	1.94 (1.65-2.16)
6-hr	0.330 (0.301-0.362)	0.399 (0.365-0.439)	0.500 (0.457-0.549)	0.582 (0.529-0.638)	0.696 (0.629-0.763)	0.790 (0.710-0.866)	0.888 (0.790-0.975)	0.991 (0.874-1.09)	1.14 (0.988-1.26)	1.25 (1.08-1.40)
12-hr	0.201 (0.183-0.223)	0.244 (0.222-0.269)	0.307 (0.279-0.339)	0.358 (0.324-0.395)	0.432 (0.388-0.475)	0.494 (0.441-0.544)	0.560 (0.494-0.617)	0.631 (0.551-0.697)	0.733 (0.629-0.812)	0.817 (0.691-0.908)
24-hr	0.114 (0.105-0.125)	0.138 (0.127-0.151)	0.176 (0.162-0.192)	0.208 (0.191-0.227)	0.255 (0.232-0.278)	0.296 (0.267-0.322)	0.340 (0.304-0.370)	0.389 (0.345-0.424)	0.462 (0.402-0.505)	0.524 (0.450-0.574)
2-day	0.067 (0.061-0.074)	0.081 (0.074-0.089)	0.103 (0.094-0.113)	0.122 (0.110-0.134)	0.149 (0.135-0.164)	0.173 (0.155-0.190)	0.199 (0.177-0.220)	0.228 (0.200-0.252)	0.271 (0.233-0.301)	0.307 (0.260-0.343)
3-day	0.047 (0.043-0.051)	0.057 (0.052-0.062)	0.072 (0.066-0.079)	0.085 (0.078-0.093)	0.104 (0.094-0.113)	0.120 (0.108-0.131)	0.138 (0.123-0.151)	0.157 (0.139-0.173)	0.186 (0.162-0.205)	0.210 (0.180-0.233)
4-day	0.037 (0.034-0.040)	0.045 (0.041-0.048)	0.057 (0.052-0.061)	0.067 (0.061-0.072)	0.081 (0.074-0.088)	0.094 (0.085-0.102)	0.107 (0.097-0.116)	0.122 (0.109-0.133)	0.144 (0.126-0.157)	0.162 (0.140-0.178)
7-day	0.025 (0.023-0.027)	0.030 (0.028-0.032)	0.037 (0.034-0.040)	0.043 (0.040-0.047)	0.052 (0.048-0.056)	0.059 (0.054-0.064)	0.067 (0.061-0.073)	0.076 (0.068-0.082)	0.088 (0.078-0.096)	0.098 (0.086-0.107)
10-day	0.020 (0.018-0.021)	0.024 (0.022-0.025)	0.029 (0.027-0.031)	0.034 (0.031-0.036)	0.040 (0.037-0.043)	0.045 (0.042-0.049)	0.051 (0.047-0.055)	0.057 (0.052-0.061)	0.066 (0.059-0.071)	0.073 (0.064-0.079)
20-day	0.013 (0.013-0.014)	0.016 (0.015-0.017)	0.019 (0.018-0.020)	0.021 (0.020-0.023)	0.025 (0.023-0.026)	0.027 (0.025-0.029)	0.030 (0.028-0.032)	0.033 (0.030-0.035)	0.036 (0.033-0.039)	0.039 (0.035-0.042)
30-day	0.011 (0.010-0.012)	0.013 (0.012-0.014)	0.015 (0.014-0.016)	0.017 (0.016-0.018)	0.019 (0.018-0.021)	0.021 (0.020-0.022)	0.023 (0.021-0.024)	0.024 (0.023-0.026)	0.027 (0.025-0.028)	0.028 (0.026-0.030)
45-day	0.009 (0.009-0.010)	0.011 (0.010-0.012)	0.013 (0.012-0.014)	0.014 (0.013-0.015)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.020 (0.018-0.021)	0.021 (0.020-0.022)	0.022 (0.021-0.024)
60-day	0.008 (0.008-0.009)	0.010 (0.009-0.010)	0.011 (0.011-0.012)	0.012 (0.012-0.013)	0.014 (0.013-0.015)	0.015 (0.014-0.016)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.018 (0.017-0.020)

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

Storm Sewer Tabulation

Station		Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line		Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	132.549	0.00	4.41	0.00	0.00	4.12	10.0	10.0	5.9	24.19	32.26	5.31	30	0.62	1.20	2.02	3.70	4.04	4.49	7.80	A8 to A9
2	1	30.048	0.36	4.41	0.94	0.34	4.12	10.0	10.0	5.9	24.19	31.74	4.93	30	0.60	2.12	2.30	4.80	4.90	7.80	7.23	A7 to A8
3	2	145.691	1.69	4.05	0.91	1.54	3.78	10.0	10.0	5.9	22.20	30.39	4.52	30	0.55	2.40	3.20	5.47	5.89	7.23	6.83	A6 to A7
4	3	29.221	1.33	2.36	0.99	1.32	2.24	10.0	10.0	5.9	13.16	38.35	5.12	24	2.87	3.79	4.63	6.05	5.94	6.83	8.30	A5 to A6
5	4	78.855	0.30	1.03	0.93	0.28	0.92	10.0	10.0	5.9	5.42	11.34	3.20	18	1.17	4.73	5.65	6.78	6.95	8.30	8.19	A4 to A5
6	5	74.806	0.34	0.73	0.97	0.33	0.64	10.0	10.0	5.9	3.78	7.00	3.87	15	1.18	5.90	6.78	7.21	7.57	8.19	9.49	A12 to A4
7	6	93.425	0.00	0.39	0.00	0.00	0.31	10.0	10.0	5.9	1.85	7.76	3.16	15	1.45	6.88	8.23	7.57	8.77	9.49	17.03	A11 to A12
8	7	34.732	0.03	0.39	0.99	0.03	0.31	10.0	10.0	5.9	1.85	14.58	5.88	15	5.10	13.39	15.16	13.69	15.70	17.03	19.30	A2 to A11
9	8	68.592	0.22	0.36	0.88	0.19	0.28	10.0	10.0	5.9	1.67	8.72	4.50	15	1.82	15.54	16.79	15.91	17.30	19.30	18.80	A10 to A2
10	9	68.290	0.14	0.14	0.65	0.09	0.09	10.0	10.0	5.9	0.53	3.14	1.99	12	0.78	16.79	17.32	17.30	17.62	18.80	19.90	A1 to A10

Project File: New.stm

Number of lines: 10

Run Date: 11/18/2021

NOTES: Intensity = 52.62 / (Inlet time + 9.50) ^ 0.74; Return period = Yrs. 25 ; Pipe travel time suppressed. ; c = cir e = ellip b = box

APPENDIX D
SCOUR HOLE CALCULATIONS

Scour Hole Calculations

Project: 15 Grand Avenue
 Location: HW A9

Computed By: JS
 Checked By: ELK
 Date: 11/15/2021

Scour Hole Design

Criteria: N.J. Soil Erosion and Sediment Control Standards

INPUT

Q = 24.19 cfs
 Pipe size, D(o) = 30 in
 Width of outlet, W_o = 30 in
 Tw = Scour Hole Depth = 1.50 ft
 Depth of scour hole, Y = 1.50 ft

OUTPUT

Bottom length = 3 x D_o
 = 7.50 ft

Use bottom length = 7.5 ft

Bottom width = 2 x W_o
 = 5.00 ft

Use bottom width = 5.0 ft

Total length = bottom length + 2 (3 x depth)

Total length = 16.5 ft

Total width = bottom width + 2 (3 x depth)

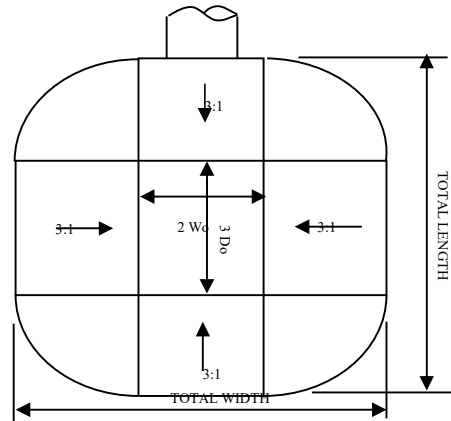
Total width = 14.0 ft

Since $Y = 1/2 D_o$, $d(50) = (0.0125/Tw)(Q/D_o)^{4/3}$
 = 1.4 in

Use d(50) = 6 in

Th = 2*d(50) w/filter fabric

Th = 12 in w/filter fabric

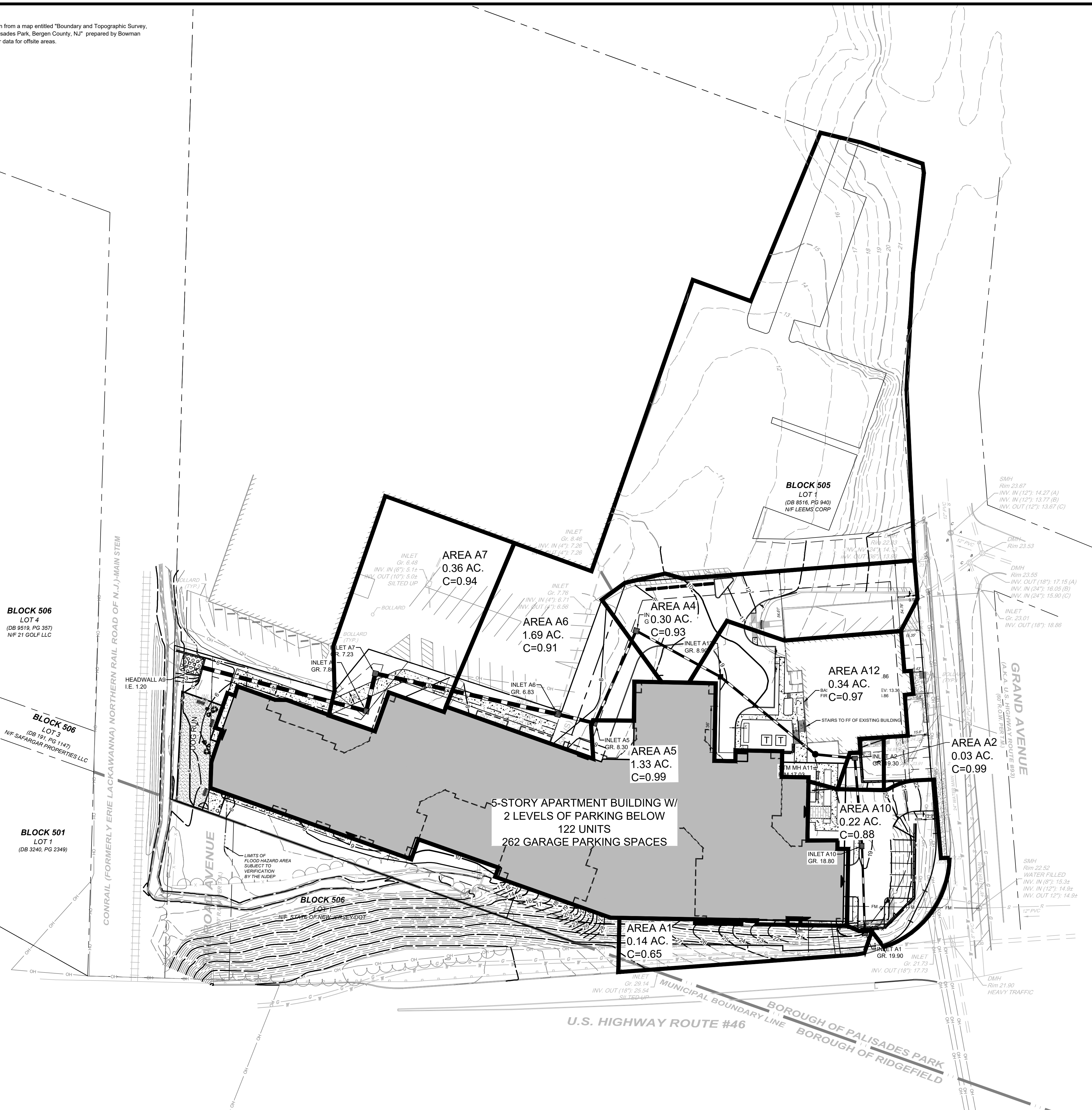


Stone Volume

9 cy

APPENDIX E
DRAINAGE AREA MAPS

NOTES
1. Existing Topographic Information shown hereon taken from a map entitled "Boundary and Topographic Survey, Grand Avenue, Block 505, Lots 3 & 4, Borough of Palisades Park, Bergen County, NJ" prepared by Bowman dated 09/09/2021 and supplemented with NOAA Lidar data for offsite areas.



BLOCK 506
LOT 4
(DB 9519, PG 357)
NF 21 GOLF LLC

BLOCK 506
LOT 3
(DB 191, PG 1147)
NF SAFARGAR PROPERTIES LLC

BLOCK 501
LOT 1
(DB 3240, PG 2349)

BLOCK 505
LOT 1
(DB 8516, PG 940)
NF LEEMS CORP

AREA A7
0.36 AC.
C=0.94

AREA A6
1.69 AC.
C=0.91

AREA A4
0.30 AC.
C=0.93

AREA A12
0.34 AC.
C=0.97

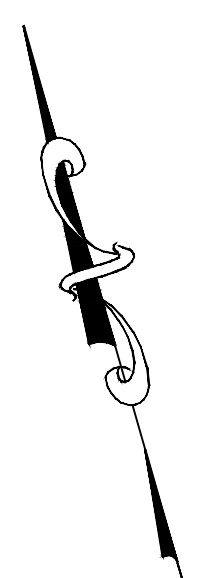
AREA A2
0.03 AC.
C=0.99

AREA A5
1.33 AC.
C=0.99

AREA A10
0.22 AC.
C=0.88

AREA A1
0.14 AC.
C=0.65

5-STORY APARTMENT BUILDING W/
2 LEVELS OF PARKING BELOW
122 UNITS
262 GARAGE PARKING SPACES



6					
5					
4					
3					
2					
1					

PROJ: 081197-01-001
DATE: 10/05/2021
CHKD: [Signature]
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NJ Certificate of Authorization
No. 24GA0222600
ERIC L. KELLER, N.J. Professional Engineer, Lic. 24GE03205400

STORMWATER CALCULATION PLANS
15 GRAND AVENUE
INLET AREA PLAN
BLOCK 505, LOTS 3 & 4
BOROUGH OF PALISADES PARK, BERGEN COUNTY, NEW JERSEY

SHEET No.
3
OF
3

THESE PLANS
ARE NOT TO BE
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