

# **Stormwater Management Report**

## **St. George Greek Orthodox Church Cemetery Expansion**

**2508 West Bangs Avenue  
Tax Map Block 1402, Lot 2  
Township of Neptune  
Monmouth County, NJ**

**February 7, 2020**

Prepared by:



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A handwritten signature in blue ink, appearing to read 'J.A. Kennedy', is written over a horizontal line.

**JAMES A. KENNEDY, P.E.**

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## **Introduction**

The applicant proposes the expansion of an existing cemetery located at 2508 West Bangs Road in Neptune Township. The expansion consists of the addition of grave plots, the extension of the onsite circulation roadway, as well as the construction of an enclosed refuse area and topsoil stockpile area. Ancillary improvements, including street trees, grading, and retaining walls are proposed. This stormwater management report is prepared to address the stormwater management requirements of the Township Land Development Ordinance and is prepared in accordance with standard engineering practices. This report contains the comparison and calculation of peak stormwater runoff flow rate at one point of comparison and includes the design of a porous pavement system to intercept and infiltrate runoff generated on-site. This report provides calculations showing no adverse impact from stormwater runoff as a result of this development as proposed.

## **Existing Site Conditions**

The parcel is approximately 5.25 acres in size and is on West Bangs Avenue in the Township of Neptune. The northern portion of the parcel is developed with a cemetery associated with St. George Greek Orthodox Church. The southern half is moderately wooded. Topographic information shown on the survey indicates the site slopes from a high point of about +122 feet in the north-central site area to approximately elevation +96 feet adjacent to Cheswick Court to the south, and elevation +115 feet at West Bangs Avenue to the north. Based upon this topography, all stormwater generated on-site is directed toward either the rear of the site (Cheswick Court) or toward the front (West Bangs Avenue). These points of comparison and associated drainage areas are shown on the enclosed Drainage Area Map. Soil survey mapping performed by the United States Department of Agriculture indicates that this parcel is underlain by Evesboro formation sands. This mapping unit is assigned to a hydrologic soil group (HSG) of A. HSG A soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission and are especially conducive to on-site stormwater infiltration practices.

## Proposed Development

The applicant proposes to expand the existing cemetery toward the south in order to both provide for additional burial plots and accessory storage areas for refuse and soil stockpiling. In order to facilitate the expansion, the existing looped roadway would be continued and expanded to the south. The proposed drainage patterns will remain as under existing conditions. That is, stormwater runoff generated on the southern portion of the site will continue to flow toward Cheswick Court (Drainage Area A). Stormwater runoff generated from the northerly western portion of the site will continue to flow toward West Bangs Avenue. Since no changes to the northern portion of the property are proposed, stormwater runoff to this point will remain unchanged. As such, the stormwater analysis calculations herein are performed at the rear of the property to provide an analysis of the change of runoff directed toward Cheswick Court.

In order to control the peak runoff flow rate of stormwater from the developed site, a permeable pavement system is proposed. Permeable paving is proposed for the expanded looped vehicular circulation roadway through the southern portion of the property. The porous pavement system will not only intercept runoff from precipitation that falls on the surface but is also designed to intercept runoff upstream of the pavement. The permeable pavement system consists of a bituminous asphalt open graded friction course, with a secondary porous pavement section below. Beneath the bituminous asphalt, a stone storage bed is proposed. The stone storage bed is sized to store runoff water for all design storms analyzed based upon the tested permeability rates of the in-situ soils, using a factor of safety of 2.0. Based upon the peak flow rate analysis of the design point and the maintenance of the existing flow paths, there will be an overall decrease in peak flow rates to the Point of Comparison at Cheswick Court. This result is expected as much of stormwater runoff from the developed surfaces is directed toward the permeable pavement system, and is allowed to infiltrate into the soils, instead of being conveyed to the south as surface runoff. The design of the permeable pavement system is contained within the appendix of this report.

## Stormwater Management Methodology

Pursuant to the Township of Neptune Land Development Ordinance, a “Major Development” is classified as one where one acre or more of land is disturbed. Since the project’s limit of disturbance is greater than one acre, this project is classified as a “Major Development”. As such, a permeable pavement system is designed to manage the increase in peak flow rates for the 2-, 10-, and 100-year storm events.

Specifically, the requirements for groundwater recharge (Section 528.3.F.1.b.(1).(b)) are met through the analysis of the minimum groundwater recharge volume comparison of pre vs. post construction runoff volume generated by the 2-year, 24-hour storm. To assess the peak rate of runoff requirements at Section 528.3.F.c.(1), this report takes a point-by-point comparative approach in determining the affect of stormwater runoff as a result of this development. After determining the stormwater runoff drainage areas, parameters and points of concern, the direct calculation of peak stormwater runoff from the drainage area under existing and proposed conditions is calculated.

### **Non-Structural and Structural Stormwater Management Strategies**

In accordance with the Township ordinance, both structural and non-structural design techniques are designed into the project. These strategies include the following:

Non-Structural Stormwater Management Strategies (NJAC 7:8-5.3) utilized in this development:

1. **Protect areas that provide water quality benefits or areas susceptible to erosion**  
To the greatest extent possible, the existing on-site wooded areas along the perimeter of the site are to remain undisturbed.
2. **Minimize impervious surfaces and/or disconnected the flow of runoff over impervious surfaces**  
The stormwater runoff generated from the looped access areas are constructed of porous asphalt pavement. Therefore, no stormwater runoff will be generated within these areas, thus mitigating the impacts of added impervious surface.
3. **Maximize the protection of natural drainage features and vegetation**  
To the greatest extent possible, the existing on-site wooded areas along the perimeter of the site are to remain undisturbed.
4. **Minimize the decrease in the Time of Concentration from Pre- Construction to Post –Construction developments:**

The developed Tc paths are over grassed areas and are lengthened and maximized to the greatest extent practicable.

**5. Minimize Land Disturbance including Clearing and Grading:**

To the greatest extent possible, the existing on-site wooded areas and the perimeter of the site are to remain undisturbed.

**6. Minimize Soil Compaction:**

A note is added to the plan to address this concern.

**7. Provide Low Maintenance Vegetation:**

Addressed on the landscaping plan.

**8. Provide Pollutant Source Controls:**

A note outlining the requirements for fertilizer application, as outlined in the State's Standard for Permanent Vegetative Cover for Soil Stabilization, is included in the Soil Erosion Control Specifications.

Structural Stormwater Management Strategies (NJAC 7:8-5.7)

Structural strategies are incorporated into this project to meet the required Stormwater Quality Standards (NJAC 7:8- 5.5), Groundwater Recharge, and Stormwater Quantity Standards (NJAC 7:8- 5.4).

**Stormwater Quality Standards**

The porous pavement system is designed to provide the required reduction of the Total Suspended Solids (TSS). In accordance with section 9.7 of the New Jersey Stormwater Best Management Practices, the New Jersey Department of Environmental Protection indicates that permeable asphalt systems achieve 80% TSS removal. In order for a permeable asphalt pavement system to achieve an 80% TSS removal rate, certain construction requirement are required. These requirements are also shown on the proposed plans. In addition, a storage bed must be provided under the permeable asphalt paving system. The design of this storage bed is provided within the appendix of this report and is specified on the site plans for this project.

**Groundwater Recharge Requirements**

Calculations included herein show the analysis of the pre vs. post condition groundwater recharge for the 2 year, 24-hour storm event. The calculations indicate that the change in runoff volumes during the required design storm is 987 cubic feet of runoff. Under the

developed conditions, and in consideration of the proposed porous pavement system, approximately 1,511 cubic feet of runoff will be infiltrated. Since the predeveloped groundwater recharge is exceeded by approximately 165%, the groundwater recharge standard of the Township ordinance is met.

### **Runoff Peak Flow Rate**

Under predeveloped conditions, one drainage area is used to determine the rate of stormwater runoff flow from the site towards Cheswick Court (Point A). As described above and shown on the enclosed drainage area map, **Drainage Area A** consists of the on-site area tributary to **Point A**. To quantitatively assess the amount of existing stormwater runoff conveyed to **Point A**, the USDA TR-55 Unit Hydrograph Method is used. The hydrologic parameters are determined as required by standard engineering practice using the worksheets enclosed within the appendix of this report. These procedures are applicable in small watersheds, especially urbanizing watersheds, in the United States. First issued by the Soil Conservation Service (SCS) in January 1975, Technical Release 55 is consistent with the current engineering standard of practice.

Under developed conditions, one drainage area is used similar to the existing conditions of the site. This single developed drainage area is used to determine the peak flow rate of stormwater runoff toward Cheswick Court under the conditions of the expanded cemetery. As under existing conditions, **Drainage Area A** consists of the area tributary to **Point A**. This drainage area and design point is shown on the enclosed Drainage Area Map.

Storm events with return frequencies of 2, 10, and 100 years are included in the peak flow computations shown in the report appendix. The TR-55 methodology is utilized for determining the times of concentration (Tc) with a minimum time of concentration of 10 minutes.

As a result of the proposed re-development of the dry detention basin, the peak stormwater flow rate analysis shows a decrease from pre-developed rates of runoff for the comparison point at Cheswick Court for all design storm events analyzed. These results are illustrated in the tables shown in the conclusion and are consistent with the design of the proposed development. As such, the peak flow rate requirements of the ordinance are met.

## Evaluation of Subsurface Soils

Soil survey mapping performed by the United States Department of Agriculture indicates that this parcel is underlain by Evesboro formation sands. This mapping unit is assigned to a hydrologic soil group (HSG) of A. HSG A soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission and are especially conducive to on-site stormwater infiltration practices. In addition to this generally available soil mapping information, a site-specific soils investigation was undertaken. This soils investigation consisted of the excavation of five test pits to a depth of 10 to 10.5 feet below grade. In addition, fourteen replicate tube samples for laboratory analysis of soil permeability were collected and processed at a soil laboratory. The analysis yielded an average permeability rate of 9 inches per hour. Both the USDA soil survey report and site-specific soils study are included in the appendix of this report.

## Conclusion

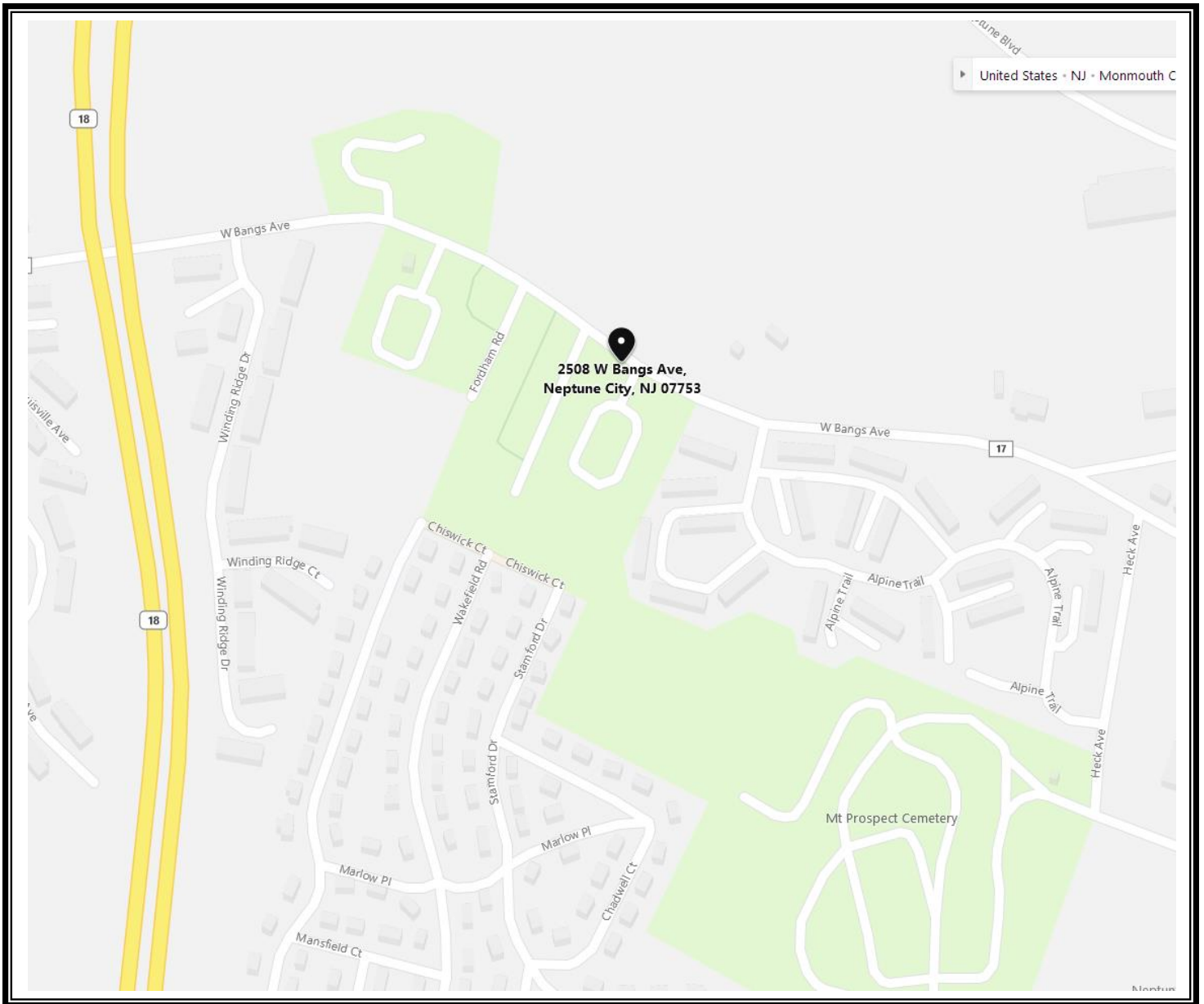
The table below shows the comparison of peak stormwater runoff flow rates for the existing condition and proposed conditions towards Cheswick Court **(Point A)**. This comparative analysis shows a reduction in the peak stormwater runoff flow rates from the developed site directed to the design point for the 2, 10, and 100-year design storm events. In addition, and as detailed above, groundwater recharge and stormwater quality is also achieved as required by the Township Land Development Ordinance. As such, no adverse impacts due to stormwater runoff flow rates are expected as a result of the development of this site as proposed.

Design Storm	Existing (cfs)	Proposed (cfs)	Change in runoff
2 Year	0.04	0.03	-25%
10 Year	0.99	0.76	-23%
100 Year	8.7	7.6	-13%



## Appendices

## **A | Location and Informational Mapping**



## Location Map



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## **B | Soils Information**



United States  
Department of  
Agriculture

**NRCS**

Natural  
Resources  
Conservation  
Service

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

# Custom Soil Resource Report for **Monmouth County, New Jersey**

**St. George Cemetery**



February 10, 2020

# Preface

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

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

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist ([http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2\\_053951](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951)).

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

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

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

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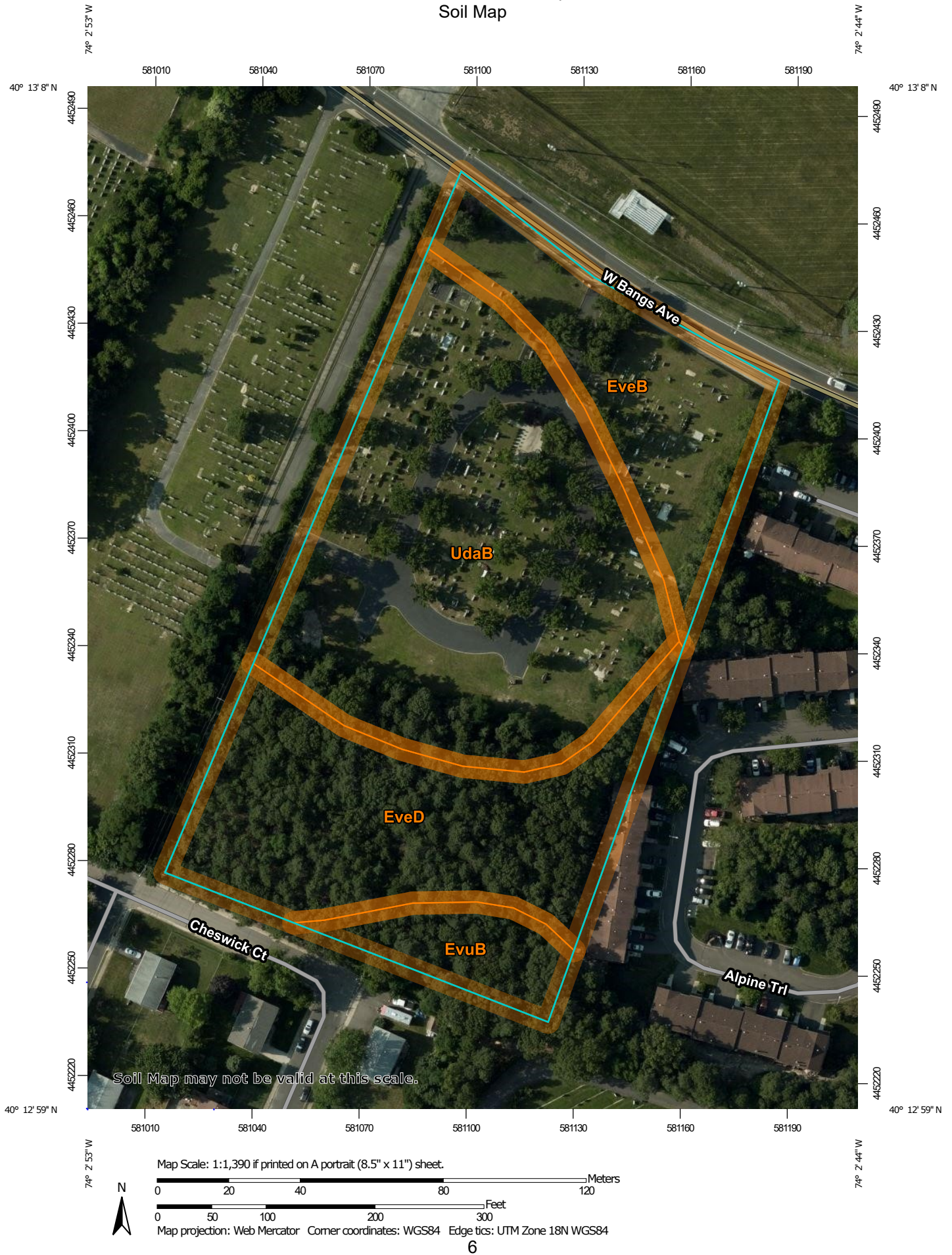


# Soil Map

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

# Custom Soil Resource Report Soil Map



MAP 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: Monmouth County, New Jersey  
Survey Area Data: Version 13, Sep 16, 2019

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

Date(s) aerial images were photographed: Jun 26, 2019—Jun 29, 2019

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

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
EveB	Evesboro sand, 0 to 5 percent slopes	1.0	18.5%
EveD	Evesboro sand, 10 to 15 percent slopes	1.5	27.6%
EvuB	Evesboro-Urban land complex, 0 to 5 percent slopes	0.3	6.1%
UdaB	Udorthents, 0 to 8 percent slopes	2.6	47.8%
<b>Totals for Area of Interest</b>		<b>5.4</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.

## Custom Soil Resource Report

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.



## Monmouth County, New Jersey

### EveB—Evesboro sand, 0 to 5 percent slopes

#### Map Unit Setting

*National map unit symbol:* 4j74  
*Elevation:* 0 to 150 feet  
*Mean annual precipitation:* 28 to 59 inches  
*Mean annual air temperature:* 46 to 79 degrees F  
*Frost-free period:* 161 to 231 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

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

#### Description of Evesboro

##### Setting

*Landform:* Low hills  
*Landform position (three-dimensional):* Interfluve, side slope  
*Down-slope shape:* Convex  
*Across-slope shape:* Linear  
*Parent material:* Sandy eolian deposits and/or sandy fluviomarine deposits

##### Typical profile

*A - 0 to 4 inches:* sand  
*AB - 4 to 17 inches:* sand  
*Bw - 17 to 31 inches:* sand  
*C - 31 to 80 inches:* stratified loamy sand to sand

##### Properties and qualities

*Slope:* 0 to 5 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Excessively drained  
*Runoff class:* Very low  
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (2.00 to 20.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Low (about 4.2 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 7s  
*Hydrologic Soil Group:* A  
*Hydric soil rating:* No

#### Minor Components

##### Atsion

*Percent of map unit:* 5 percent  
*Landform:* Flats  
*Landform position (two-dimensional):* Footslope

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*Landform position (three-dimensional):* Dip, tal  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Hydric soil rating:* Yes

### Lakehurst

*Percent of map unit:* 5 percent  
*Landform:* Flats, depressions  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Linear, concave  
*Hydric soil rating:* No

### Mullica, rarely flooded

*Percent of map unit:* 5 percent  
*Landform:* Flood plains, drainageways, depressions  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Base slope  
*Down-slope shape:* Linear, concave  
*Across-slope shape:* Linear, concave  
*Hydric soil rating:* Yes

### Downer

*Percent of map unit:* 5 percent  
*Landform:* Low hills, knolls  
*Landform position (three-dimensional):* Interfluv  
*Down-slope shape:* Linear  
*Across-slope shape:* Convex  
*Hydric soil rating:* No

## EveD—Evesboro sand, 10 to 15 percent slopes

### Map Unit Setting

*National map unit symbol:* 4j76  
*Elevation:* 10 to 450 feet  
*Mean annual precipitation:* 28 to 59 inches  
*Mean annual air temperature:* 46 to 79 degrees F  
*Frost-free period:* 161 to 231 days  
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Evesboro and similar soils:* 95 percent  
*Minor components:* 5 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Evesboro

#### Setting

*Landform:* Dunes, low hills  
*Landform position (three-dimensional):* Interfluv, side slope

## Custom Soil Resource Report

*Down-slope shape:* Convex

*Across-slope shape:* Convex, linear

*Parent material:* Sandy eolian deposits and/or sandy fluviomarine deposits

### Typical profile

*A - 0 to 5 inches:* sand

*Bw - 5 to 28 inches:* loamy sand

*C - 28 to 60 inches:* stratified loamy sand to sand

### Properties and qualities

*Slope:* 10 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Excessively drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (2.00 to 20.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 4.2 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 7s

*Hydrologic Soil Group:* A

*Hydric soil rating:* No

### Minor Components

#### Downer

*Percent of map unit:* 5 percent

*Landform:* Low hills, knolls

*Landform position (three-dimensional):* Interfluve

*Down-slope shape:* Convex

*Across-slope shape:* Linear

*Hydric soil rating:* No

## EvuB—Evesboro-Urban land complex, 0 to 5 percent slopes

### Map Unit Setting

*National map unit symbol:* 4j78

*Elevation:* 10 to 150 feet

*Mean annual precipitation:* 28 to 59 inches

*Mean annual air temperature:* 46 to 79 degrees F

*Frost-free period:* 161 to 231 days

*Farmland classification:* Not prime farmland

### Map Unit Composition

*Evesboro and similar soils:* 60 percent

*Urban land:* 30 percent

*Minor components:* 10 percent



## Custom Soil Resource Report

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

### Description of Evesboro

#### Setting

*Landform:* Low hills

*Landform position (three-dimensional):* Interfluvial, side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Sandy eolian deposits and/or sandy fluvio-marine deposits

#### Typical profile

*A - 0 to 4 inches:* sand

*AB - 4 to 17 inches:* sand

*Bw - 17 to 31 inches:* sand

*C - 31 to 80 inches:* stratified loamy sand to sand

#### Properties and qualities

*Slope:* 0 to 5 percent

*Depth to restrictive feature:* More than 80 inches

*Natural drainage class:* Excessively drained

*Runoff class:* Very low

*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (2.00 to 20.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water storage in profile:* Low (about 4.2 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 7s

*Hydrologic Soil Group:* A

*Hydric soil rating:* No

### 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

#### Lakehurst

*Percent of map unit:* 5 percent

*Landform:* Flats, depressions

*Landform position (two-dimensional):* Toeslope

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

*Down-slope shape:* Linear, concave

*Across-slope shape:* Linear, concave

*Hydric soil rating:* No

**Downer**

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

**UdaB—Udorthents, 0 to 8 percent slopes**

**Map Unit Setting**

*National map unit symbol:* 1j1jk  
*Elevation:* 400 to 1,500 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**

*Udorthents and similar soils:* 100 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Udorthents**

**Setting**

*Landform:* Low hills  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Fill and/or disturbed original soil material

**Typical profile**

*A - 0 to 12 inches:* loam  
*C - 12 to 72 inches:* loamy sand

**Properties and qualities**

*Slope:* 0 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Well drained  
*Runoff class:* Very low  
*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:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Moderate (about 6.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3w  
*Hydrologic Soil Group:* D

## Custom Soil Resource Report

*Hydric soil rating:* No

# **Soil Information for All Uses**

---

## **Soil Properties and Qualities**

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

## **Soil Qualities and Features**

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

## **Hydrologic Soil Group**

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

## Custom Soil Resource Report

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

# Custom Soil Resource Report Map—Hydrologic Soil Group



MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Water Features**

Streams and Canals

**Transportation**

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

**Background**

Aerial Photography

**Soil Rating Lines**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

**Soil Rating Points**

A

A/D

B

B/D

C

C/D

D

Not rated or not available

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: Monmouth County, New Jersey  
Survey Area Data: Version 13, Sep 16, 2019

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

Date(s) aerial images were photographed: Jun 26, 2019—Jun 29, 2019

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

**Table—Hydrologic Soil Group**

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
EveB	Evesboro sand, 0 to 5 percent slopes	A	1.0	18.5%
EveD	Evesboro sand, 10 to 15 percent slopes	A	1.5	27.6%
EvuB	Evesboro-Urban land complex, 0 to 5 percent slopes	A	0.3	6.1%
UdaB	Udorthents, 0 to 8 percent slopes	D	2.6	47.8%
<b>Totals for Area of Interest</b>			<b>5.4</b>	<b>100.0%</b>

**Rating Options—Hydrologic Soil Group***Aggregation Method: Dominant Condition**Component Percent Cutoff: None Specified**Tie-break Rule: Higher*





Melick-Tully  
& Associates

*A Division of GZA*



## **SOIL LOGS/PERMEABILITY TESTS PROPOSED CEMETERY STORMWATER FACILITIES ST. GEORGE CREEK ORTHODOX CHURCH 2508 West Bangs Avenue Neptune, Monmouth County, New Jersey**

January 21, 2020  
File No. 26.0091995.00

### **PREPARED FOR:**

Kennedy Consulting Engineers, LLC  
211 Maple Avenue  
Red Bank, NJ 07701

### **Melick-Tully & Associates, A Division of GZA**

117 Canal Road | South Bound Brook, NJ 08880  
732-356-3400

GZA has 32 Offices Nationwide

[www.melick-tully.com](http://www.melick-tully.com) [www.gza.com](http://www.gza.com)

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Melick-Tully  
& Associates  
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Christopher P. Tansey P.E., *Associate Principal*  
Todd E. Horowitz, P.E., *Associate Principal*

January 21, 2020  
File No. 26.0091995.00

Kennedy Consulting Engineers, LLC  
211 Maple Avenue  
Red Bank, New Jersey 07701

Attention: Mr. James A. Kennedy, P.E.  
Vice President

**Report**  
**Soil Logs/Permeability Tests**  
**Proposed Cemetery Stormwater Facilities**  
**Neptune, Monmouth County, New Jersey**  
**St. George Greek Orthodox Church**

**Introduction**

This report presents the results of soil logs and permeability testing performed along a proposed loop driveway to be built to service an expansion of the existing St. George Cemetery in Neptune, Monmouth County, New Jersey. The cemetery is located at 2508 West Bangs Avenue. The site is situated between West Bangs Avenue and Cheswick Court. The site is designated as Lot 2, Block 1402 on Neptune Tax Map 41.02. The approximate location of the cemetery is shown on the Site Location Map, Plate 1. This report was prepared in general accordance with our proposal dated October 11, 2019.

**Proposed Construction**

The existing cemetery occupies the northern half of the site and is proposed to be expanded into the wooded southern half of the site. The new expansion will include construction of an extension of loop driveway through the center of the site. Testing

for stormwater facilities to accommodate porous pavement or below-grade infiltration facilities was to include test explorations advanced along the new driveway alignment at the beginning of the loop driveway at the edges of the woods and at intervals along the loop road.

### **Purpose and Scope of Work**

The purpose of our services was to:

- 1) explore the subsurface soil and groundwater conditions at five locations within the expanded loop driveway alignment for the proposed expanded cemetery area;
- 2) collect soil samples of the subsoil layers for permeability testing;
- 3) summarize the nature of the soils encountered in the explorations and the permeability test results as they relate to the NJDEP Stormwater Design Requirements; and
- 4) provide a summary report of the findings for use by KCE in their evaluation and design of the stormwater facilities.

To accomplish these purposes, five test pits were performed at locations along the proposed loop driveway. The test pits were excavated using a John Deere 310SG rubber-tire backhoe and extended to depths of 10 to 10.5 feet below grade. Two test pits (Test Pits 1 and 5) were advanced along the new driveway alignment at the edge of the woods and three tests pits (Test Pits 2 through 4) were advanced within the woods along the loop driveway. The approximate locations of the test pits are shown on the Plot Plan, Plate 2.

All field work was performed under the direct technical observation of a geologist from MTA. Our representative located the explorations in the field, maintained continuous logs of the explorations as the work proceeded and collected selected bulk samples of the encountered materials. In addition,

relatively undisturbed tube samples were obtained from the test pits. Detailed Logs of Test Pits are presented on Plates 3A through 3E. The materials were visually described in general accordance with the USDA Soil Textural Chart described on Plate 4.

Samples of the native subsoils were collected from the test pits for laboratory gradation testing, the results of which are presented on Plate 5. Fourteen replicate tube samples of the subsoils were also subjected to laboratory tube permeameter permeability testing, the results of which are summarized on Plate 6. The results of the field and laboratory testing have provided the basis for our findings.

The following discussion of our findings are subject to the Limitations attached as an Appendix to this report.

### **Site Conditions**

Surface Features: The subject property is an existing cemetery which occupies the northern half of the site. The southern half, where the test pits were advanced, is moderately wooded. Topographic information shown on the plan provided to us indicates the site grades slope from a high point of about Elevation +122 feet in the north-central site area to about Elevation +96 feet adjacent to Cheswick Court to the south, and Elevation +115 feet at West Bangs Avenue to the north. The surface grades in the vicinity of the test pits vary from about Elevation +120 to +112 feet.

Subsurface Conditions: Test Pits 1 and 5 encountered 3 and 2 inches of topsoil, respectively. Test Pits 2 through 4 encountered 1 to 2 inches of leaf litter at the surface. The topsoil in Test Pits 1 and 5 was

underlain by about 2 feet of sandy loam fill which was underlain by 2 to 6 inches of the original topsoil layer.

The surface and fill materials were underlain by stratified sand, loamy sand, and sandy clay loam soils which extended to the bottom of the test pits at depths of 10 to 10.5 feet. A 1.5-foot layer of silty clay was encountered in Test Pit 3 at a depth of 4.5 feet.

Groundwater was not observed to at least 10 feet in the test pits performed at the time of our study, (and deeper than Elevation +103 feet at Test Pit 3, the lowest elevated test pit) which were performed during the traditional high groundwater season, January through April. Few fine faint mottles which may possibly be an indicator of post-temporary or seasonal saturation, were noted at depths of about 3 to 5 feet in the test pits, with the exception of Test Pit 2 where mottling was not present to 10 feet. However, considering the site is elevated above the surrounding properties, the absence of prominent mottling, and that groundwater was not present in the sandy subsoils to more than 10 feet during the wet season, the faint mottles appear most likely to be relic, or possibly representative of natural color variegations rather than areal groundwater.

### **Permeability Test Results**

Tube permeameter permeability tests were performed on tube samples of the sandy and silty subsoils collected at depth from Test Pits 1 through 5. The permeability tests indicate the majority of the tested sand and loamy sand soils exhibited average permeabilities on the order of 1 to greater than 20 inches per hour and was more than 10 inches per hour in most cases. In Test Pits 3 through 5, the upper loamy



January 21, 2020

File No. 26.0091995.00

St. George Greek Orthodox Church - Neptune

Page 5

sand, sandy clay loam, and silty clay soil layers that extended to 6 to 8 feet below grade exhibited lower permeabilities. The results of the permeability tests are summarized on Plate 6.

Please contact us if you have any questions regarding this information.

The following Plates and Appendix are attached and complete this report:

Plate 1 – Site Location Map

Plate 2 – Plot Plan

Plates 3A through 3E – Logs of Test Pits

Plate 4 – USDA Soil Textural Chart

Plate 5 – Gradation Curves

Plate 6 – Summary of Laboratory Permeability Test Results

Appendix – Limitations

Respectfully submitted,

MELICK-TULLY and ASSOCIATES,  
a Division of GZA GeoEnvironmental, Inc.

Cory S. Karinja, P.E.  
Associate Project Manager

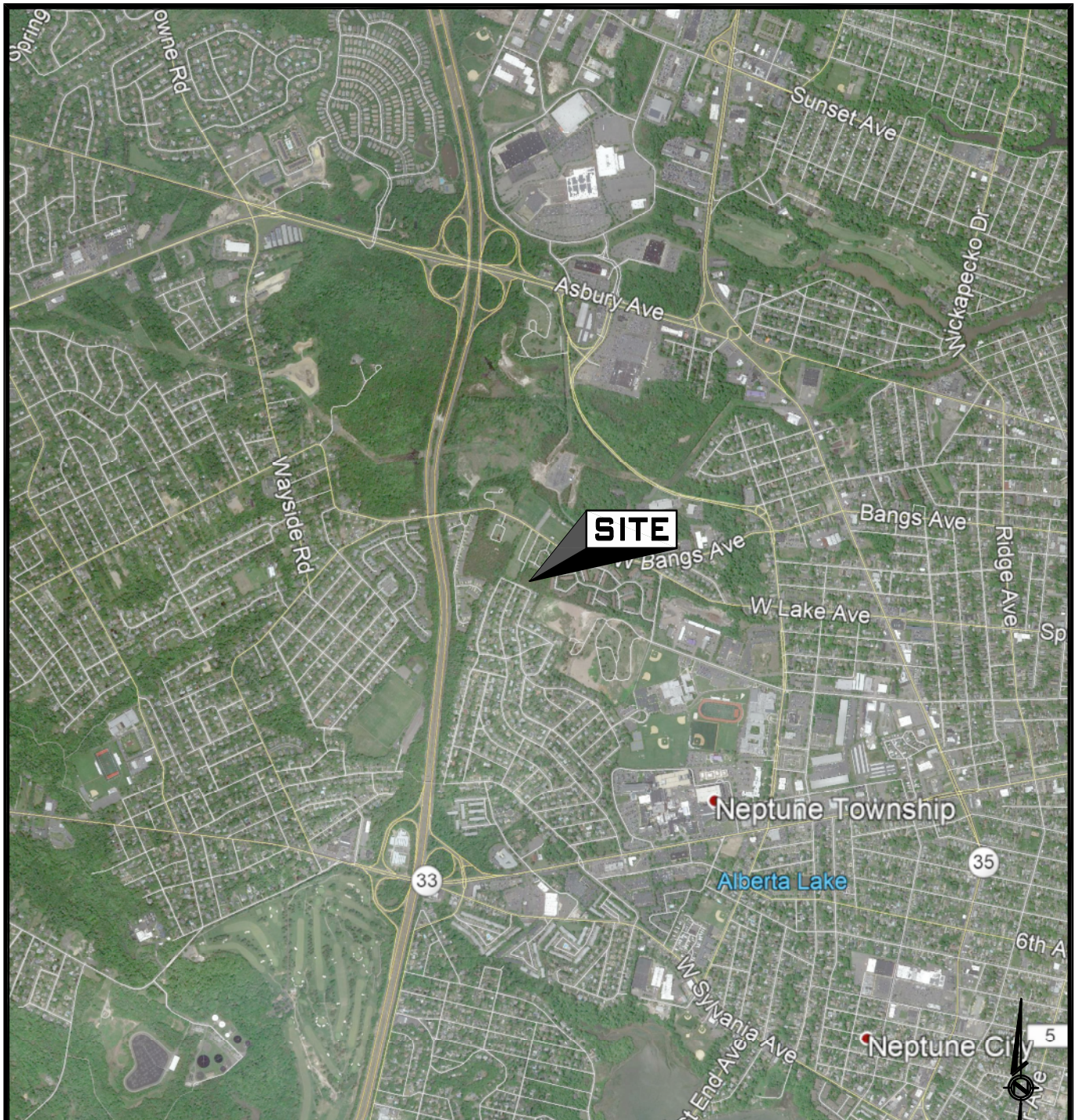
Robert E. Schwankert, P.E.  
Principal

Mark R. Denno, P.E.  
Consultant/Reviewer

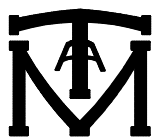
CSK:RES/csk

(1 copy submitted via e-mail)





Aerial Photo courtesy of Google Earth Pro



**MELICK-TULLY AND ASSOCIATES**  
*A Division of GZA*  
 Geotechnical Engineers & Environmental Consultants  
 117 Canal Road  
 South Bound Brook, New Jersey 08880  
 (732) 356-3400

## SITE LOCATION MAP

**PROPOSED CEMETERY STORMWATER FACILITIES  
 NEPTUNE, MONMOUTH COUNTY, NJ  
 ST. GEORGE GREEK ORTHODOX CHURCH**

**JOB NO.**

26.0091995.00

**FILE NO.**

—

**DR. BY**

VJD

**CHK. BY**

CSK

**DATE**

1/7/20

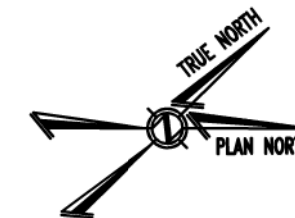
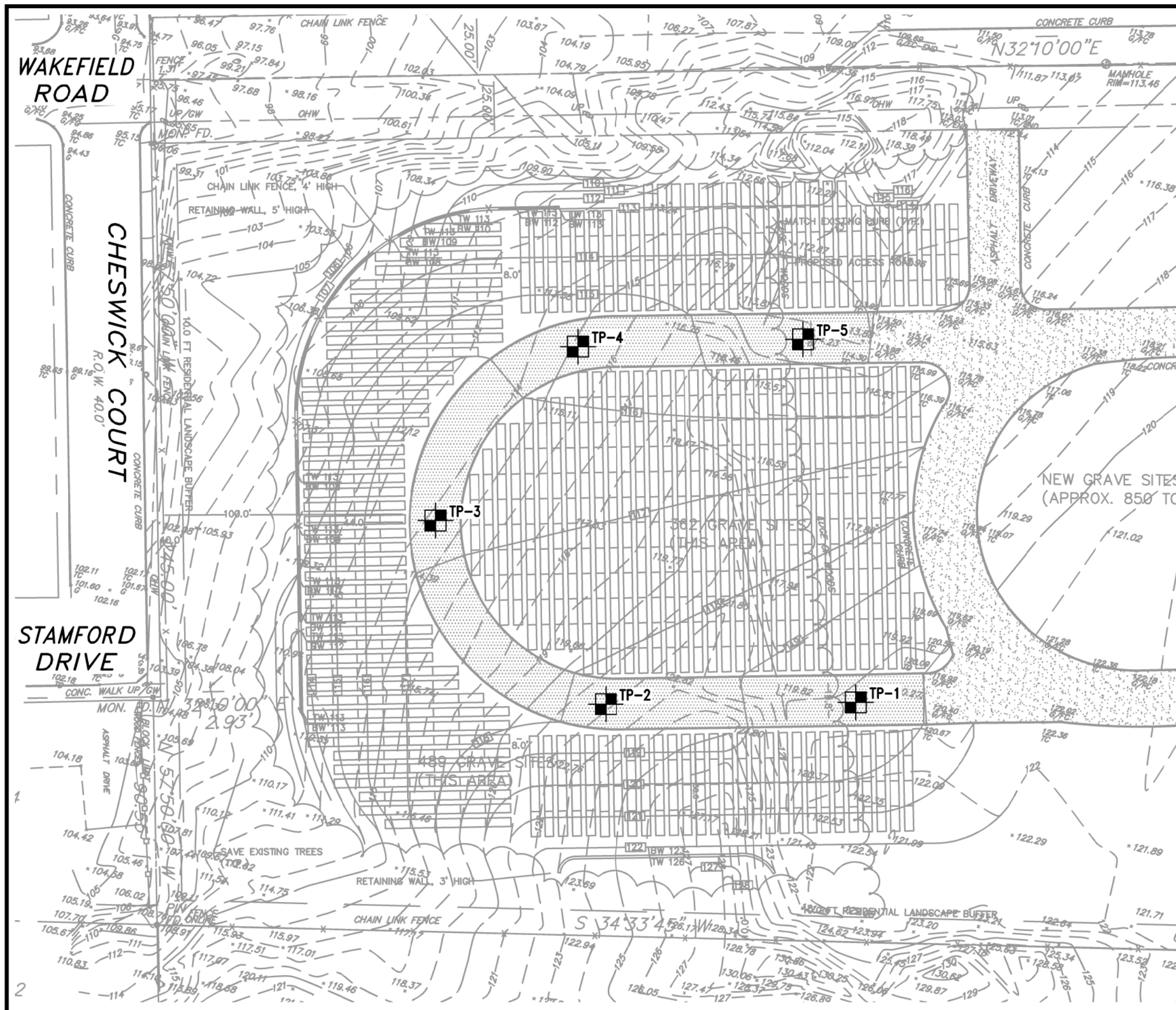
**SCALE**

1"=2,000'

**PLATE**

1





KEY:



TP-1 NUMBER AND APPROXIMATE LOCATION OF TEST PITS PERFORMED FOR THIS STUDY

NOTES:

1. This drawing is part of Melick-Tully and Associates, a Division of GZA, Report No. 26.0091995.00 and should be read together with the report for complete evaluation.
2. General layout was obtained from a drawing prepared by Kennedy Consulting Engineers, entitled "Site Layout Plan" dated 7/29/19, scale 1"=30'.

## PLOT PLAN

PROPOSED CEMETERY STORMWATER FACILITIES  
NEPTUNE, MONMOUTH COUNTY, NJ  
ST. GEORGE GREEK ORTHODOX CHURCH



MELICK-TULLY AND ASSOCIATES  
A Division of GZA  
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117 Canal Road  
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(732) 356-3400

JOB NO.

26.0091995.00

FILE NO.

-

DR. BY  
VJD

CHK. BY  
CSK

DATE  
1/7/20

SCALE  
1"=40'

PLATE  
2



# TEST PIT LOG



**MTA, a Division of GZA**  
**GeoEnvironmental, Inc**  
*Engineers and Scientists*

**St. George Greek Orthodox Church**  
**Neptune, NJ**

**EXPLORATION NO.:** TP-1  
**SHEET:** 1 of 1  
**PROJECT NO:** 26.0091995.00  
**REVIEWED BY:** Cory Karinja

**Logged By:** Glenn Zmigrodski  
**Contractor:**  
**Operator:**

**Test Pit Location:** See Plan

**Final Test Pit Depth (ft.):** 10

**Ground Surface Elev. (ft.):** 120.0

**Date Start - Finish:** 1/2/2020 - 1/2/2020

**Type of Excavator:**

**Groundwater Depth (ft.)**

**Excavator Model:**

**Date**

**Time**

**Water Depth**

**Stab.Time**

1/2/20

NE

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1	1.5	0-0.3		0"-3" Topsoil/Fill - Dark brown (10YR, 3/3) loamy sand, weak fine granular, moist, loose, clear irregular boundary, few fine roots		
			0.3-1.8		3"-22" Fill - Brown (10YR, 4/3) sandy loam, weak fine granular, moist loose, abrupt wavy boundary, few fine roots		
2			1.8-2		22"-24" Topsoil - Dark brown (10YR, 3/3) loamy sand, weak fine granular, moist, loose, abrupt smooth boundary		
3	S2, T1	3.5	2-5		24"-60" Yellow (10YR, 7/6) loamy sand, 5% gravel, weak fine granular, moist, loose, gradual wavy boundary		
4							
5	S3, T2	6	5-8		60"-96" Yellow (10YR, 7/8) loamy sand, 5% gravel, single grain, moist, loose, clear wavy boundary, few fine faint gray (10YR, 6/1) mottles encountered @ 60 inches to 96 inches		
6							
7	S4, T3	9	8-10		96"-120" Yellow (10YR, 8/8) loamy sand, 5% gravel, single grain, moist, loose, few fine faint gray (10YR, 6/1) mottles encountered @ 96 inches to 120 inches		
8							
9							
10					End of exploration at 10 feet.		
11					Groundwater seepage not encountered		
12					Mottling encountered @ 60"		
13					Note: Asphalt layer encountered @ 2', test pit moved 5' south		
14							
15							

**REMARKS**

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

**Plate No.:3A**

# TEST PIT LOG



**MTA, a Division of GZA**  
**GeoEnvironmental, Inc**  
*Engineers and Scientists*

**St. George Greek Orthodox Church**  
**Neptune, NJ**

**EXPLORATION NO.:** TP-2  
**SHEET:** 1 of 1  
**PROJECT NO:** 26.0091995.00  
**REVIEWED BY:** Cory Karinja

**Logged By:** Glenn Zmigrodski/Sean Stevenson  
**Contractor:**  
**Operator:**

**Test Pit Location:** See Plan

**Final Test Pit Depth (ft.):** 10

**Ground Surface Elev. (ft.):** 122.0

**Date Start - Finish:** 1/2/2020 - 1/2/2020

**Type of Excavator:**

**Groundwater Depth (ft.)**

**Excavator Model:**

**Date**

**Time**

**Water Depth**

**Stab.Time**

1/2/20

NE

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1	1.5	0-0.2		0"-2" Leaf litter		
2			0.2-2		2"-24" Light gray (10YR, 7/1) loamy sand, 3% gravel, single grain, moist, loose, abrupt smooth boundary, few fine roots		
3	S2, T1	3.5	2-10		24"-120" Brownish yellow (10YR, 6/6) loamy sand, 10% gravel, single grain, moist, loose		
4							
5	S3, T2	6					
6							
7	S4, T3	9					
8							
9							
10							
11					End of exploration at 10 feet.		
12					Groundwater seepage not encountered		
13					Mottling not encountered		
14							
15							

**REMARKS**

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

**Plate No.:3B**

# TEST PIT LOG



**MTA, a Division of GZA**  
**GeoEnvironmental, Inc**  
*Engineers and Scientists*

**St. George Greek Orthodox Church**  
**Neptune, NJ**

**EXPLORATION NO.:** TP-3  
**SHEET:** 1 of 1  
**PROJECT NO:** 26.0091995.00  
**REVIEWED BY:** Cory Karinja

**Logged By:** Glenn Zmigrodski/Sean Stevenson  
**Contractor:**  
**Operator:**

**Test Pit Location:** See Plan

**Final Test Pit Depth (ft.):** 10

**Ground Surface Elev. (ft.):** 114.0

**Date Start - Finish:** 1/2/2020 - 1/2/2020

**Type of Excavator:**

**Groundwater Depth (ft.)**

**Excavator Model:**

**Date**

**Time**

**Water Depth**

**Stab.Time**

1/2/20

NE

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1	1.5	0-0.1		0"-1" Leaf litter		
2	S2	2.5	0.1-2		1"-24" Light gray (10YR, 7/1) loamy sand, single grain, moist, loose, abrupt wavy boundary, few fine roots		
3	S3, T1	3.5	2-3		24"-36" Brownish yellow (10YR, 6/6) loamy sand, 2% gravel, single grain, moist, loose, clear wavy boundary		
4	S4, T2	6.5	3-6		36"-72" Brownish yellow (10YR, 6/6) sandy clay loam, 3% gravel, moderate medium subangular blocky, moist, firm, gradual wavy boundary, few fine faint gray (10YR, 6/1) mottles encountered @ 36 inches to 72 inches		
5							
6							
7							
8							
9							
10	S5, T3	9	6-10		72"-120" Light gray (10YR, 7/1) loamy sand, 5% gravel, single grain, moist, loose		
11					End of exploration at 10 feet.		
12					Groundwater seepage not encountered		
13					Mottling encountered @ 36"		
14							
15							

**REMARKS**

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

**Plate No.:3C**

# TEST PIT LOG



**MTA, a Division of GZA**  
**GeoEnvironmental, Inc**  
*Engineers and Scientists*

**St. George Greek Orthodox Church**  
**Neptune, NJ**

**EXPLORATION NO.:** TP-4  
**SHEET:** 1 of 1  
**PROJECT NO:** 26.0091995.00  
**REVIEWED BY:** Cory Karinja

**Logged By:** Glenn Zmigrodski  
**Contractor:**  
**Operator:**

**Test Pit Location:** See Plan

**Final Test Pit Depth (ft.):** 10.5

**Ground Surface Elev. (ft.):** 115.0

**Date Start - Finish:** 1/2/2020 - 1/2/2020

**Type of Excavator:**

**Groundwater Depth (ft.)**

**Excavator Model:**

**Date**

**Time**

**Water Depth**

**Stab.Time**

1/2/20

NE

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1	1	0-0.1		0"-1" Leaf litter, dark brown (10YR, 3/3)		
			0.1-1		1"-12" Dark gray (10YR, 3/1) loamy sand, single grain, moist, loose, abrupt wavy boundary, few fine roots		
2			1-4.5		12"-54" Brownish yellow (10YR, 6/6) sandy clay loam, 7% gravel, weak fine subangular blocky, moist, loose, clear wavy boundary		
3							
4	S2, T1	3.5					
5			4.5-6		54"-72" Brownish yellow (10YR, 6/6) silty clay, 3% gravel, moderate medium subangular blocky, moist, firm, clear wavy boundary, few fine faint gray (10YR, 6/1) mottles encountered @ 54 inches to 72 inches		
6	S3, T2	5					
7			6-10.5		72"-126" Light gray (10YR, 7/1) loamy sand, 2% gravel, single grain, moist, loose		
8							
9	S4, T3	8					
10							
11					End of exploration at 10.5 feet.		
12					Groundwater seepage not encountered		
13					Mottling encountered @ 54 inches		
14							
15							

**REMARKS**

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

**Plate No.:3D**

# TEST PIT LOG



**MTA, a Division of GZA**  
**GeoEnvironmental, Inc**  
*Engineers and Scientists*

**St. George Greek Orthodox Church**  
**Neptune, NJ**

**EXPLORATION NO.:** TP-5  
**SHEET:** 1 of 1  
**PROJECT NO:** 26.0091995.00  
**REVIEWED BY:** Cory Karinja

**Logged By:** Glenn Zmigradski  
**Contractor:**  
**Operator:**

**Test Pit Location:** See Plan

**Final Test Pit Depth (ft.):** 10.5

**Ground Surface Elev. (ft.):** 114.23

**Date Start - Finish:** 1/2/2020 - 1/2/2020

**Type of Excavator:**

**Groundwater Depth (ft.)**

**Excavator Model:**

**Date**

**Time**

**Water Depth**

**Stab.Time**

1/2/20

NE

Depth (ft)	Sample No.	Sample Depth (ft.)	Stratum Depth (ft.)	Symbol	Sample Description and Identification	Water Content (%)	Remark
1	S1	1.5	0-0.2		0"-2" Topsoil/Fill - Dark brown (10YR, 3/3) loamy sand, weak fine granular, moist, loose, gradual irregular boundary, few fine roots		
2			0.2-2		2"-24" FILL - Brown (10YR, 4/3) sandy loam, 5% gravel, weak fine granular, moist, loose, abrupt smooth boundary, few fine roots		
3			2-2.5		24"-30" Topsoil - Dark brown (10YR, 3/3) loamy sand, weak fine granular, moist, loose, clear wavy boundary		
4	S2, T1	3.5	2.5-4.2		30"-50" Yellow (10YR, 7/6) loamy sand, 7% gravel, single grain, moist, loose, gradual wavy boundary		
5			4.2-8		50"-96" Brownish yellow (10YR, 6/6) sandy clay loam, 5% gravel, weak fine subangular blocky, moist, loose, clear wavy boundary, few fine faint gray (10YR, 6/1) mottles encountered @ 50 inches to 96 inches		
6	S3, T2	6					
7							
8	S4, T3	9	8-10.5		96"-126" Light gray (10YR, 7/1) loamy sand, 7% gravel, single grain, moist, loose, few fine faint gray (10YR, 6/1) mottles encountered @ 96 inches to 126 inches		
9							
10							
11					End of exploration at 10.5 feet.		
12					Groundwater seepage not encountered		
13					Mottling encountered @ 50"		
14							
15							

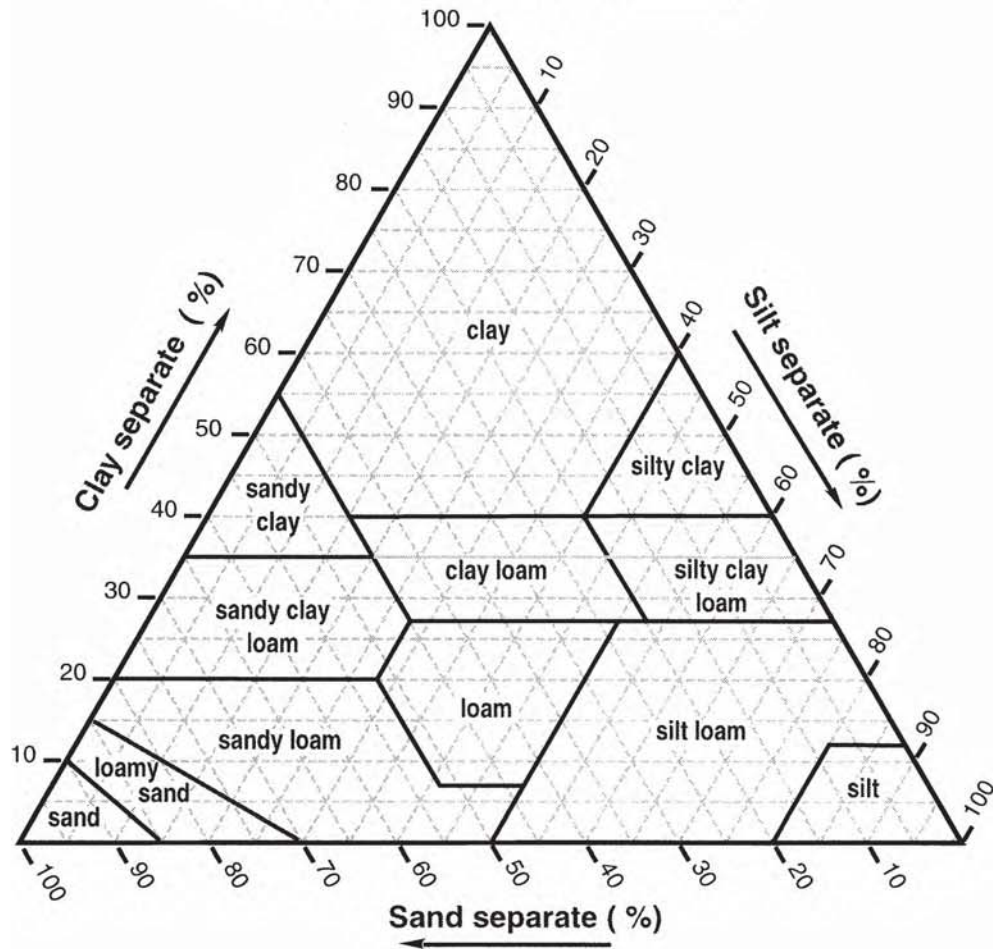
**REMARKS**

See Log Key for exploration of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

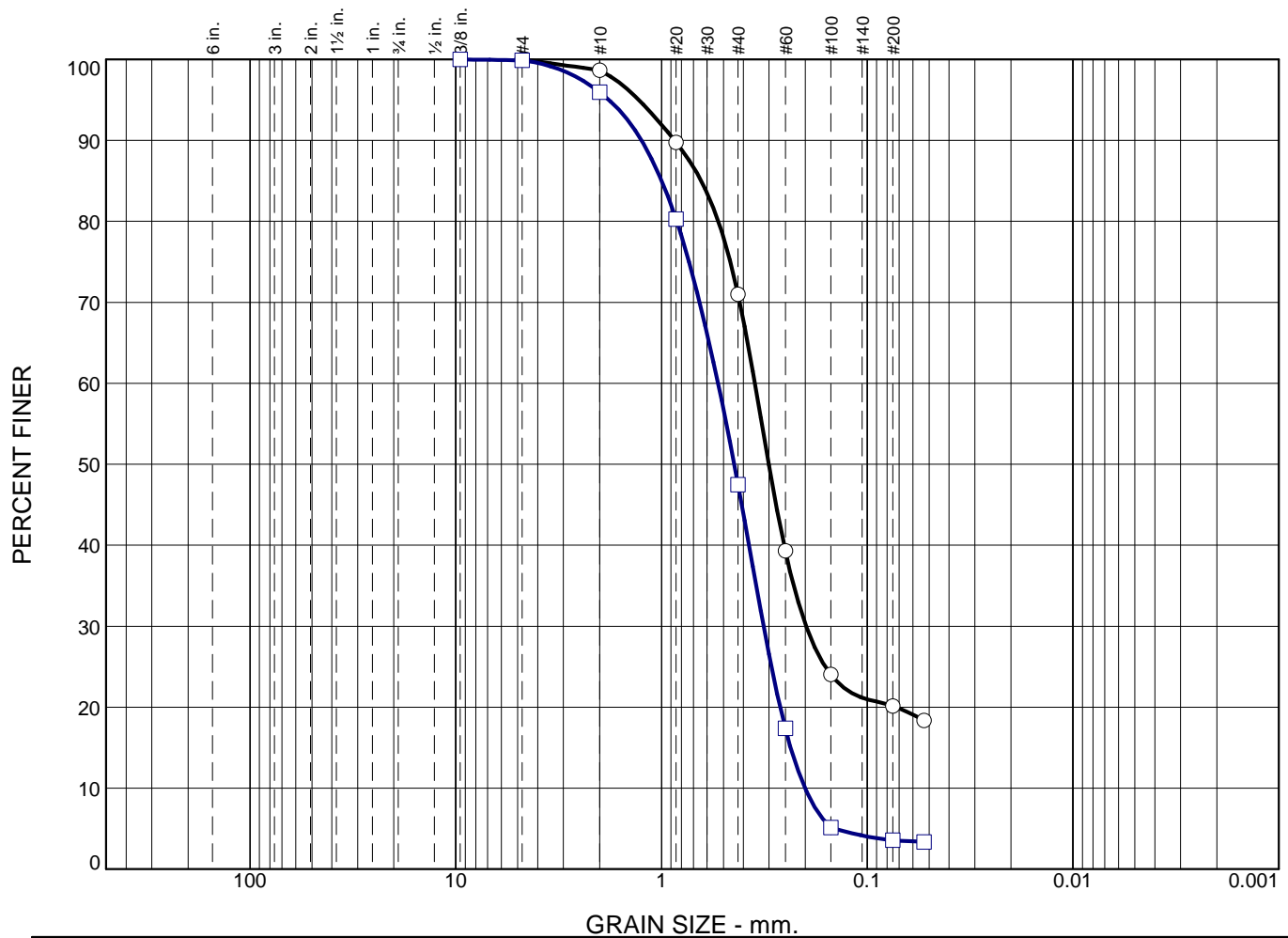
**Plate No.:3E**

# Texture Triangle:

Fine Earth Texture Classes ( — )



# Gradation Curve(s)



	% Cobbles	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.3	27.7	50.8	20.2	
□	0.0	0.0	0.1	3.9	48.5	43.9	3.6	

SOIL DATA					
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-4	S-2	3.5	Fine to medium Sand, some Silt. (MC=11.1%)	SM
□	TP-4	S-4	8	Fine to medium Sand, trace Silt. (MC=4.3%)	SP

**Melick-Tully & Associates**  
a Division of GZA GeoEnvironmental, Inc.  
South Bound Brook, NJ

**Client:** Kennedy Consulting Engineers  
**Project:** Proposed Stormwater Facilities, Neptune City, NJ  
**Project No.:** 26.0091995.00

**Summary of Laboratory Permeability Test Results**  
**Proposed Cemetery Stormwater Facilities**  
**Neptune, New Jersey**  
**St. George Greek Orthodox Church**

Test Pit No.	Depth (feet)	Permeability Rate (inches/hour)		USDA Soil Classification
		A	B	
1	3.5	>20	>20	Loamy Sand
1	6.0	>20	>20	Loamy Sand
1	9.0	10.1	15.5	Loamy Sand
2	3.0	>20	>20	Loamy Sand
2	6.0	>20	>20	Loamy Sand
3	3.5	0.59	0.52	Sandy Clay Loam
3	6.5	1.5	0.23	Loamy Sand
3	9.0	12.7	16.5	Loamy Sand
4	3.5	2.3	2.9	Sandy Clay Loam
4	5.0	<0.06	<0.06	Silty Clay
4	8.0	18.7	>20	Loamy Sand
5	3.5	2.3	1.8	Loamy Sand
5	6.0	<0.06	<0.06	Sandy Clay Loam
5	9.0	12.3	>20	Loamy Sand



## **APPENDIX**

## **APPENDIX**

### **Limitations**

#### **A. Subsurface Information**

Locations: The locations of the explorations were approximately determined by tape measurement from existing site features. Elevations of the explorations were approximately determined by interpolation between contours shown on topographic plans provided to us. The locations and elevations of the explorations should be considered accurate only to the degree implied by the method used.

Interface of Strata: The stratification lines shown on the individual logs of the subsurface explorations represent the approximate boundaries between soil types, and the transitions may be gradual.

Field Logs/Final Logs: A field log was prepared for each exploration by a member of our staff. The field log contains factual information and interpretation of the soil conditions between samples. Our recommendations are based on the final logs as shown in this report and the information contained therein, and not on the field logs. The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and/or tests of the field samples.

Water Levels: Water level readings have been made in the explorations at times and under conditions stated on the individual logs. These data have been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater will occur due to variations in rainfall, temperature, and other factors.

Pollution/Contamination: Unless specifically indicated to the contrary in this report, the scope of our services was limited only to investigation and evaluation of the geotechnical engineering aspects of the site conditions, and did not include any consideration of potential site pollution or contamination resulting from the presence of chemicals, metals, radioactive elements, etc. This report offers no facts or opinions related to potential pollution/contamination of the site.

Environmental Considerations: Unless specifically indicated to the contrary in this report, this report does not address environmental considerations which may affect the site development, e.g., wetlands determinations, flora and fauna, wildlife, etc. The conclusions and recommendations of this report are not intended to supersede any environmental conditions which should be reflected in the site planning.

#### **B. Applicability of Report**

This report has been prepared in accordance with generally accepted soils and foundation engineering practices for the exclusive use of St. George Greek Orthodox Church for specific application to the design of the proposed cemetery stormwater facilities. No other warranty, expressed or implied, is made.

This report may be referred to in the project specifications for general information purposes only, but should not be used as the technical specifications for the work, as it was prepared for design purposes exclusively.

### **C. Reinterpretation of Recommendations**

Change in Location or Nature of Facilities: In the event that any changes in the nature, design or location of the facilities are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

Changed Conditions During Construction: The analyses and recommendations submitted in this report are based in part upon the data obtained from 5 widely-spaced test pit excavations performed for this study. The nature and extent of variations between the explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

Changes in State-of-the-Art: The conclusions and recommendations contained in this report are based upon the applicable standards of our profession at the time this report was prepared.

### **D. Use of Report by Prospective Bidders**

This soil and foundation engineering report was prepared for the project by Melick-Tully and Associates, a Division of GZA GeoEnvironmental Inc. (MTA) for design purposes and may not be sufficient to prepare an accurate bid. Contractors utilizing the information in the report should do so with the express understanding that its scope was developed to address design considerations. Prospective bidders should obtain the owner's permission to perform whatever additional explorations or data gathering they deem necessary to prepare their bid accurately.

### **E. Construction Observation**

We recommend that MTA be retained to provide on-site soils engineering services during the earthwork construction and foundation phases of the work. This is to observe compliance with the design concepts and to allow changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

## **C | Groundwater Recharge Calculations**

ST. GEORGE CEMETERY, LOT 2, BLOCK 1402, NEPTUNE TOWNSHIP, MONMOUTH CO., NJ

SPREADSHEET ANALYSIS OF STORM WATER DRAINAGE CALCULATIONS

SITE SOILS, EvD: EVESBORO SAND, 10-15% SLOPES, HYDROLOGIC SOIL GROUP "A"

RUNOFF CURVE NUMBERS & DESCRIPTIONS	PRE	POST
98 IMPERVIOUS SITE COVERAGE, SQ. FT.	22426	32037
39 >75% GRASS COVER, GOOD CONDITION, SQ. FT.	113413	172801
36 WOODS, FAIR CONDITION, SQ. FT.	93000	24000
WEIGHTED AVERAGE CN:	44	47

SOILS REPORT PERMEABILITY TESTING TEST PIT SUB-SOILS 3-3.5' DEPTHS, IN/HR

TP#1	TP#2	TP#3	TP#4	TP#5	AVERAGE	SF	DESIGN IN/HR
20	20	0.6	2.6	2	9.0	2	4.5

PERVIOUS PAVEMENT HORIZONTAL AREA, SQ. FT.	9600
DESIGN INFILTRATION RATE, IN/HR	4.5
DESIGN INFILTRATION RATE, FPS	0.0001
DESIGN INFILTRATION RATE FOR PERVIOUS PAVEMENT SECTION, CFS	1.0

ENTER DEPTH OF GRAVEL BASE STORAGE SECTION, FT.	1.33
ENTER VOID RATIO	0.4
DESIGN STORAGE VOLUME, AREA X DEPTH X VOID RATIO, CU. FT.	5120

DEPTH OF 100 YEAR-24 HOUR STORM STAGE IN GRAVEL BASE SECTION, FT.	1.27
	OK

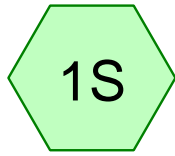
COMPLIANCE DATA

	PRE	POST
2 YEAR HYDROGRAPH RUNOFF VOLUMES, CU. FT.	1025	2012
MIN. REQUIRED FOR GROUNDWATER RECHARGE, POST-PRE, CU. FT.	987	
DESIGN GROUNDWATER RECHARGE PROVIDED 2 YR STORM, CU. FT.	1511	OK

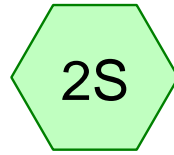
PRE-CONSTRUCTION TO NET POST-CONSTRUCTION PEAK RATES AND VOLUMES

	PRE-CONSTRUCTION		NET POST-CONSTRUCTION	
	228,839 SQ. FT., CN=44		164,473 SQ. FT., CN=44	
	CFS	CU. FT.	CFS	CU. FT.
2 YEAR STORM	0.04	1025	0.03	737 OK
10 YEAR STORM	0.99	8736	0.76	6279 OK
25 YEAR STORM	2.90	17877	2.50	12849 OK
100 YEAR STORM	8.67	40355	7.60	29004 OK

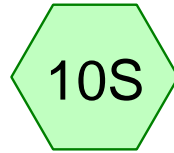
## **D | Hydrograph Analysis Summary**



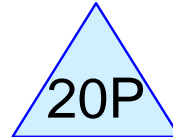
Pre-Construction



Post-Construction



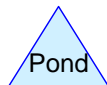
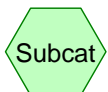
DA#2 TO Pervious  
Pavement Section



Pervious Pavement  
Infiltration



Net Post-Construction



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**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
141,000	36	Woods, Fair, HSG A (1S, 2S, 30S)
459,015	39	> 75% Grass cover, Good, HSG A (1S, 2S, 10S, 30S)
16,022	98	(10S)
32,037	98	14% Lot Coverage (2S)
16,015	98	14% Lot Coverage less pavement (30S)
22,426	98	9.8% Lot Coverage (1S)
<b>686,515</b>		<b>TOTAL AREA</b>



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**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
600,015	HSG A	1S, 2S, 10S, 30S
0	HSG B	
0	HSG C	
0	HSG D	
86,500	Other	1S, 2S, 10S, 30S
<b>686,515</b>		<b>TOTAL AREA</b>

## 20-0121 Hydrocadd

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St. George Cemetery Expansion

Type III 24-hr 2 yr Rainfall=3.40"

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Time span=10.00-26.00 hrs, dt=0.05 hrs, 321 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1S: Pre-Construction

Runoff Area=228,839 sf 9.80% Impervious Runoff Depth=0.05"  
Flow Length=500' Tc=14.0 min CN=44 Runoff=0.04 cfs 1,025 cf

### Subcatchment 2S: Post-Construction

Runoff Area=228,838 sf 14.00% Impervious Runoff Depth=0.11"  
Flow Length=500' Tc=14.0 min CN=47 Runoff=0.08 cfs 2,012 cf

### Subcatchment 10S: DA#2 TO Pervious Pavement

Runoff Area=64,365 sf 24.89% Impervious Runoff Depth=0.28"  
Flow Length=150' Slope=0.0500 '/' Tc=9.4 min CN=54 Runoff=0.17 cfs 1,511 cf

### Subcatchment 30S: Net Post-Construction

Runoff Area=164,473 sf 9.74% Impervious Runoff Depth=0.05"  
Flow Length=290' Tc=7.5 min CN=44 Runoff=0.03 cfs 737 cf

### Pond 20P: Pervious Pavement Infiltration

Peak Elev=0.02' Storage=61 cf Inflow=0.17 cfs 1,511 cf  
Outflow=0.16 cfs 1,511 cf

Total Runoff Area = 686,515 sf Runoff Volume = 5,285 cf Average Runoff Depth = 0.09"  
87.40% Pervious = 600,015 sf 12.60% Impervious = 86,500 sf

## 20-0121 Hydrocadd

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St. George Cemetery Expansion  
Type III 24-hr 2 yr Rainfall=3.40"

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### Summary for Subcatchment 1S: Pre-Construction

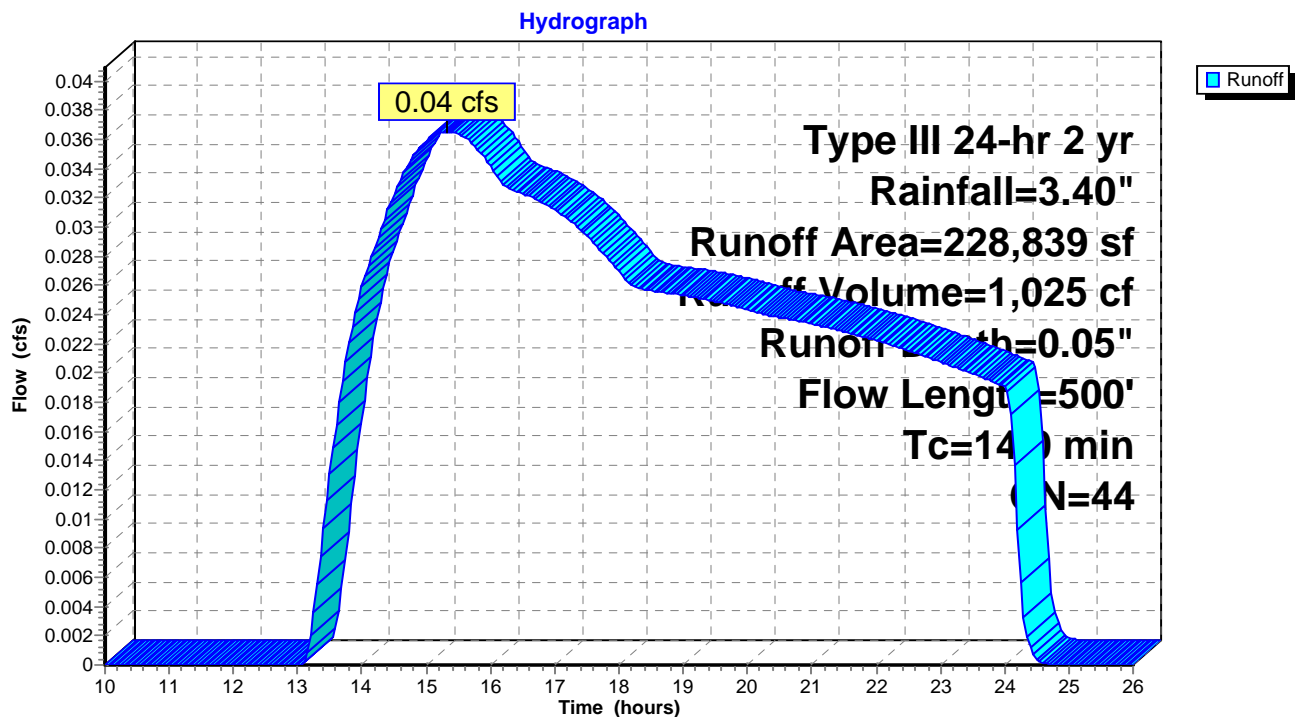
Runoff = 0.04 cfs @ 15.32 hrs, Volume= 1,025 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 2 yr Rainfall=3.40"

	Area (sf)	CN	Description
*	22,426	98	9.8% Lot Coverage
	93,000	36	Woods, Fair, HSG A
	113,413	39	>75% Grass cover, Good, HSG A
	228,839	44	Weighted Average
	206,413		90.20% Pervious Area
	22,426		9.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	150	0.0570	0.28		Sheet Flow, Elev 122.5 to 114
					Grass: Short n= 0.150 P2= 3.20"
5.1	350	0.0520	1.14		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
14.0	500	Total			

### Subcatchment 1S: Pre-Construction



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### Hydrograph for Subcatchment 1S: Pre-Construction

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.64	0.00	0.00	23.00	3.37	0.05	0.02
10.25	0.69	0.00	0.00	23.25	3.38	0.05	0.02
10.50	0.74	0.00	0.00	23.50	3.39	0.05	0.02
10.75	0.79	0.00	0.00	23.75	3.39	0.05	0.02
11.00	0.85	0.00	0.00	24.00	<b>3.40</b>	<b>0.05</b>	0.02
11.25	0.92	0.00	0.00	24.25	3.40	0.05	0.01
11.50	1.01	0.00	0.00	24.50	3.40	0.05	0.00
11.75	1.21	0.00	0.00	24.75	3.40	0.05	0.00
12.00	1.70	0.00	0.00	25.00	3.40	0.05	0.00
12.25	2.19	0.00	0.00	25.25	3.40	0.05	0.00
12.50	2.39	0.00	0.00	25.50	3.40	0.05	0.00
12.75	2.48	0.00	0.00	25.75	3.40	0.05	0.00
13.00	2.55	0.00	0.00	26.00	3.40	0.05	0.00
13.25	2.61	0.00	0.00				
13.50	2.66	0.00	0.01				
13.75	2.71	0.00	0.02				
14.00	2.76	0.00	0.03				
14.25	2.80	0.00	0.03				
14.50	2.84	0.01	0.03				
14.75	2.87	0.01	0.03				
15.00	2.90	0.01	0.04				
15.25	2.94	0.01	<b>0.04</b>				
15.50	2.96	0.01	<b>0.04</b>				
15.75	2.99	0.01	0.04				
16.00	3.01	0.02	0.03				
16.25	3.03	0.02	0.03				
16.50	3.05	0.02	0.03				
16.75	3.07	0.02	0.03				
17.00	3.09	0.02	0.03				
17.25	3.11	0.02	0.03				
17.50	3.13	0.03	0.03				
17.75	3.14	0.03	0.03				
18.00	3.16	0.03	0.03				
18.25	3.17	0.03	0.03				
18.50	3.18	0.03	0.03				
18.75	3.19	0.03	0.03				
19.00	3.21	0.03	0.03				
19.25	3.22	0.03	0.03				
19.50	3.23	0.04	0.02				
19.75	3.24	0.04	0.02				
20.00	3.25	0.04	0.02				
20.25	3.26	0.04	0.02				
20.50	3.28	0.04	0.02				
20.75	3.29	0.04	0.02				
21.00	3.30	0.04	0.02				
21.25	3.31	0.04	0.02				
21.50	3.32	0.04	0.02				
21.75	3.33	0.05	0.02				
22.00	3.33	0.05	0.02				
22.25	3.34	0.05	0.02				
22.50	3.35	0.05	0.02				
22.75	3.36	0.05	0.02				

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St. George Cemetery Expansion

Type III 24-hr 2 yr Rainfall=3.40"

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### Summary for Subcatchment 2S: Post-Construction

Runoff = 0.08 cfs @ 13.87 hrs, Volume= 2,012 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs

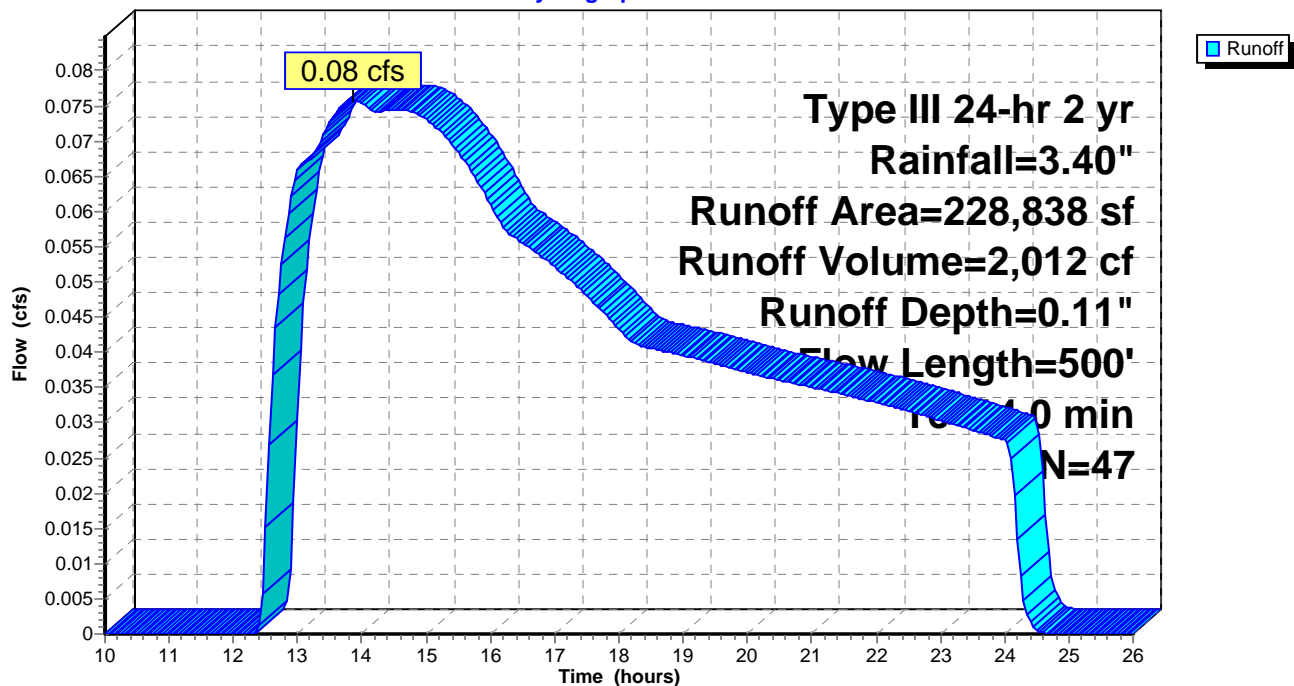
Type III 24-hr 2 yr Rainfall=3.40"

	Area (sf)	CN	Description
*	32,037	98	14% Lot Coverage
	24,000	36	Woods, Fair, HSG A
	172,801	39	>75% Grass cover, Good, HSG A
	228,838	47	Weighted Average
	196,801		86.00% Pervious Area
	32,037		14.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	150	0.0570	0.28		Sheet Flow, Elev 122.5 to 114
					Grass: Short n= 0.150 P2= 3.20"
5.1	350	0.0520	1.14		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
14.0	500	Total			

### Subcatchment 2S: Post-Construction

Hydrograph



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### Hydrograph for Subcatchment 2S: Post-Construction

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.64	0.00	0.00	23.00	3.37	0.10	0.03
10.25	0.69	0.00	0.00	23.25	3.38	0.10	0.03
10.50	0.74	0.00	0.00	23.50	3.39	0.10	0.03
10.75	0.79	0.00	0.00	23.75	3.39	0.10	0.03
11.00	0.85	0.00	0.00	24.00	<b>3.40</b>	<b>0.11</b>	0.03
11.25	0.92	0.00	0.00	24.25	3.40	0.11	0.01
11.50	1.01	0.00	0.00	24.50	3.40	0.11	0.00
11.75	1.21	0.00	0.00	24.75	3.40	0.11	0.00
12.00	1.70	0.00	0.00	25.00	3.40	0.11	0.00
12.25	2.19	0.00	0.00	25.25	3.40	0.11	0.00
12.50	2.39	0.00	0.02	25.50	3.40	0.11	0.00
12.75	2.48	0.00	0.05	25.75	3.40	0.11	0.00
13.00	2.55	0.01	0.07	26.00	3.40	0.11	0.00
13.25	2.61	0.01	0.07				
13.50	2.66	0.01	0.07				
13.75	2.71	0.02	<b>0.08</b>				
14.00	2.76	0.02	<b>0.08</b>				
14.25	2.80	0.02	0.07				
14.50	2.84	0.03	0.07				
14.75	2.87	0.03	0.07				
15.00	2.90	0.04	0.07				
15.25	2.94	0.04	0.07				
15.50	2.96	0.04	0.07				
15.75	2.99	0.04	0.07				
16.00	3.01	0.05	0.06				
16.25	3.03	0.05	0.06				
16.50	3.05	0.05	0.06				
16.75	3.07	0.06	0.05				
17.00	3.09	0.06	0.05				
17.25	3.11	0.06	0.05				
17.50	3.13	0.06	0.05				
17.75	3.14	0.06	0.05				
18.00	3.16	0.07	0.04				
18.25	3.17	0.07	0.04				
18.50	3.18	0.07	0.04				
18.75	3.19	0.07	0.04				
19.00	3.21	0.07	0.04				
19.25	3.22	0.08	0.04				
19.50	3.23	0.08	0.04				
19.75	3.24	0.08	0.04				
20.00	3.25	0.08	0.04				
20.25	3.26	0.08	0.04				
20.50	3.28	0.08	0.04				
20.75	3.29	0.09	0.04				
21.00	3.30	0.09	0.04				
21.25	3.31	0.09	0.03				
21.50	3.32	0.09	0.03				
21.75	3.33	0.09	0.03				
22.00	3.33	0.09	0.03				
22.25	3.34	0.10	0.03				
22.50	3.35	0.10	0.03				
22.75	3.36	0.10	0.03				

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St. George Cemetery Expansion

Type III 24-hr 2 yr Rainfall=3.40"

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### Summary for Subcatchment 10S: DA#2 TO Pervious Pavement Section

Runoff = 0.17 cfs @ 12.37 hrs, Volume= 1,511 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs

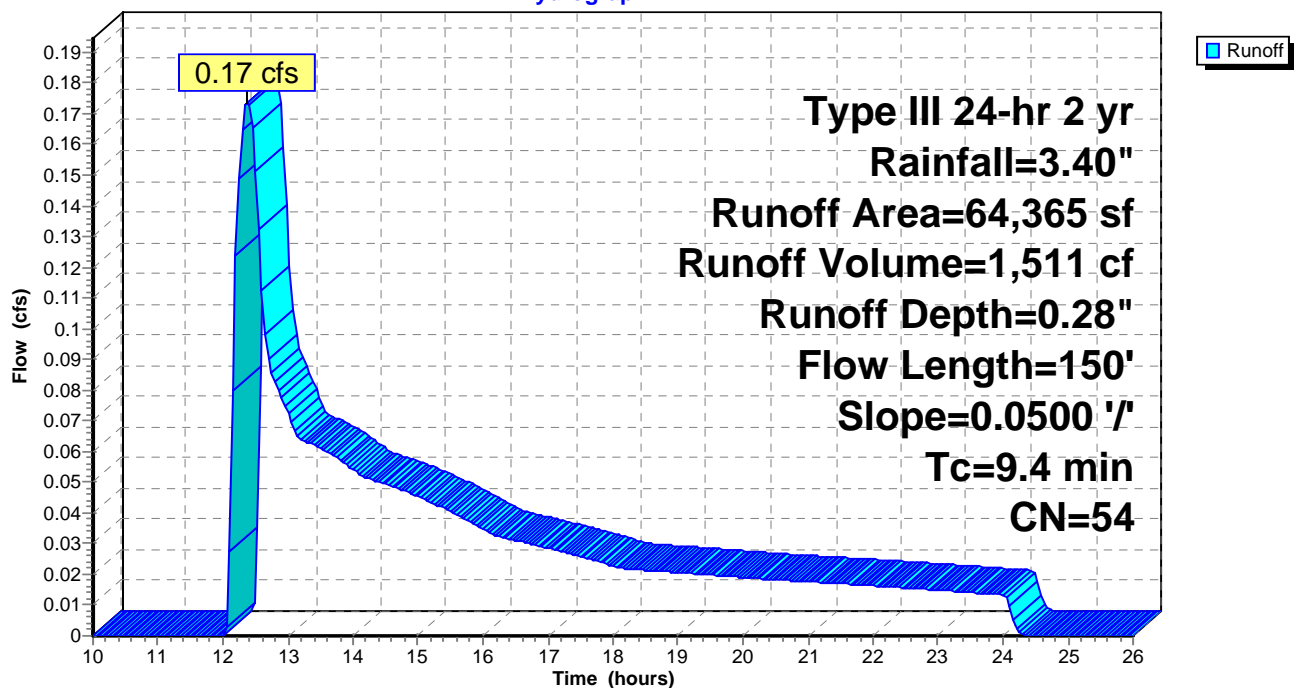
Type III 24-hr 2 yr Rainfall=3.40"

	Area (sf)	CN	Description
*	16,022	98	
	48,343	39	>75% Grass cover, Good, HSG A
	64,365	54	Weighted Average
	48,343		75.11% Pervious Area
	16,022		24.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	150	0.0500	0.27		Sheet Flow, ELEV. 122.5 TO 115 Grass: Short n= 0.150 P2= 3.20"

### Subcatchment 10S: DA#2 TO Pervious Pavement Section

Hydrograph



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St. George Cemetery Expansion  
Type III 24-hr 2 yr Rainfall=3.40"

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**Hydrograph for Subcatchment 10S: DA#2 TO Pervious Pavement Section**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.64	0.00	0.00	23.00	3.37	0.27	0.01
10.25	0.69	0.00	0.00	23.25	3.38	0.27	0.01
10.50	0.74	0.00	0.00	23.50	3.39	0.28	0.01
10.75	0.79	0.00	0.00	23.75	3.39	0.28	0.01
11.00	0.85	0.00	0.00	24.00	<b>3.40</b>	<b>0.28</b>	0.01
11.25	0.92	0.00	0.00	24.25	3.40	0.28	0.00
11.50	1.01	0.00	0.00	24.50	3.40	0.28	0.00
11.75	1.21	0.00	0.00	24.75	3.40	0.28	0.00
12.00	1.70	0.00	0.00	25.00	3.40	0.28	0.00
12.25	2.19	0.03	<b>0.15</b>	25.25	3.40	0.28	0.00
12.50	2.39	0.05	<b>0.15</b>	25.50	3.40	0.28	0.00
12.75	2.48	0.06	0.09	25.75	3.40	0.28	0.00
13.00	2.55	0.08	0.07	26.00	3.40	0.28	0.00
13.25	2.61	0.09	0.06				
13.50	2.66	0.10	0.06				
13.75	2.71	0.11	0.06				
14.00	2.76	0.12	0.05				
14.25	2.80	0.12	0.05				
14.50	2.84	0.13	0.05				
14.75	2.87	0.14	0.05				
15.00	2.90	0.15	0.05				
15.25	2.94	0.16	0.04				
15.50	2.96	0.16	0.04				
15.75	2.99	0.17	0.04				
16.00	3.01	0.17	0.03				
16.25	3.03	0.18	0.03				
16.50	3.05	0.18	0.03				
16.75	3.07	0.19	0.03				
17.00	3.09	0.19	0.03				
17.25	3.11	0.20	0.03				
17.50	3.13	0.20	0.03				
17.75	3.14	0.21	0.02				
18.00	3.16	0.21	0.02				
18.25	3.17	0.21	0.02				
18.50	3.18	0.22	0.02				
18.75	3.19	0.22	0.02				
19.00	3.21	0.23	0.02				
19.25	3.22	0.23	0.02				
19.50	3.23	0.23	0.02				
19.75	3.24	0.24	0.02				
20.00	3.25	0.24	0.02				
20.25	3.26	0.24	0.02				
20.50	3.28	0.24	0.02				
20.75	3.29	0.25	0.02				
21.00	3.30	0.25	0.02				
21.25	3.31	0.25	0.02				
21.50	3.32	0.26	0.02				
21.75	3.33	0.26	0.02				
22.00	3.33	0.26	0.02				
22.25	3.34	0.26	0.02				
22.50	3.35	0.27	0.02				
22.75	3.36	0.27	0.02				



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St. George Cemetery Expansion

Type III 24-hr 2 yr Rainfall=3.40"

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### Summary for Subcatchment 30S: Net Post-Construction

Runoff = 0.03 cfs @ 15.22 hrs, Volume= 737 cf, Depth= 0.05"

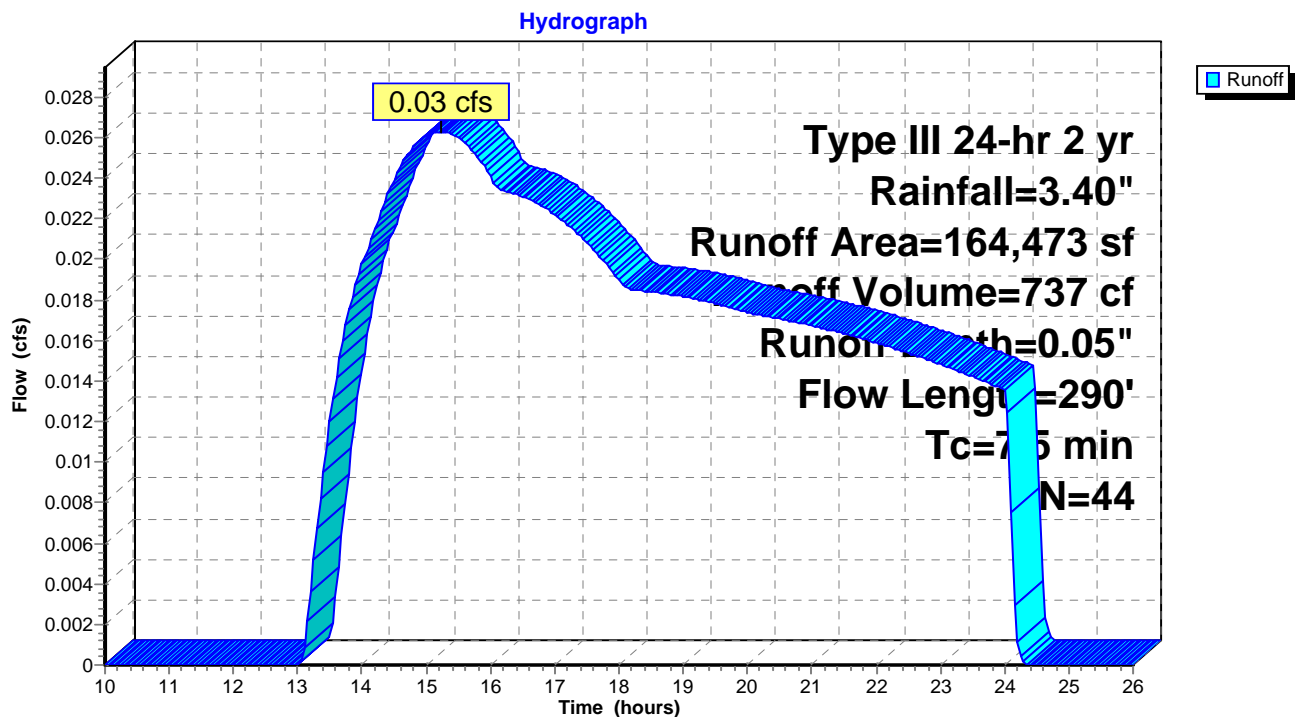
Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 yr Rainfall=3.40"

	Area (sf)	CN	Description
*	16,015	98	14% Lot Coverage less pavement
	24,000	36	Woods, Fair, HSG A
	124,458	39	>75% Grass cover, Good, HSG A
	164,473	44	Weighted Average
	148,458		90.26% Pervious Area
	16,015		9.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	66	0.0530	0.23		Sheet Flow, Elev 116 to 112.5
					Grass: Short n= 0.150 P2= 3.20"
2.7	224	0.0750	1.37		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
7.5	290	Total			

### Subcatchment 30S: Net Post-Construction



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St. George Cemetery Expansion  
Type III 24-hr 2 yr Rainfall=3.40"

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**Hydrograph for Subcatchment 30S: Net Post-Construction**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.64	0.00	0.00	23.00	3.37	0.05	0.01
10.25	0.69	0.00	0.00	23.25	3.38	0.05	0.01
10.50	0.74	0.00	0.00	23.50	3.39	0.05	0.01
10.75	0.79	0.00	0.00	23.75	3.39	0.05	0.01
11.00	0.85	0.00	0.00	24.00	<b>3.40</b>	<b>0.05</b>	0.01
11.25	0.92	0.00	0.00	24.25	3.40	0.05	0.00
11.50	1.01	0.00	0.00	24.50	3.40	0.05	0.00
11.75	1.21	0.00	0.00	24.75	3.40	0.05	0.00
12.00	1.70	0.00	0.00	25.00	3.40	0.05	0.00
12.25	2.19	0.00	0.00	25.25	3.40	0.05	0.00
12.50	2.39	0.00	0.00	25.50	3.40	0.05	0.00
12.75	2.48	0.00	0.00	25.75	3.40	0.05	0.00
13.00	2.55	0.00	0.00	26.00	3.40	0.05	0.00
13.25	2.61	0.00	0.01				
13.50	2.66	0.00	0.01				
13.75	2.71	0.00	0.02				
14.00	2.76	0.00	0.02				
14.25	2.80	0.00	0.02				
14.50	2.84	0.01	0.02				
14.75	2.87	0.01	0.03				
15.00	2.90	0.01	<b>0.03</b>				
15.25	2.94	0.01	<b>0.03</b>				
15.50	2.96	0.01	0.03				
15.75	2.99	0.01	0.03				
16.00	3.01	0.02	0.02				
16.25	3.03	0.02	0.02				
16.50	3.05	0.02	0.02				
16.75	3.07	0.02	0.02				
17.00	3.09	0.02	0.02				
17.25	3.11	0.02	0.02				
17.50	3.13	0.03	0.02				
17.75	3.14	0.03	0.02				
18.00	3.16	0.03	0.02				
18.25	3.17	0.03	0.02				
18.50	3.18	0.03	0.02				
18.75	3.19	0.03	0.02				
19.00	3.21	0.03	0.02				
19.25	3.22	0.03	0.02				
19.50	3.23	0.04	0.02				
19.75	3.24	0.04	0.02				
20.00	3.25	0.04	0.02				
20.25	3.26	0.04	0.02				
20.50	3.28	0.04	0.02				
20.75	3.29	0.04	0.02				
21.00	3.30	0.04	0.02				
21.25	3.31	0.04	0.02				
21.50	3.32	0.04	0.02				
21.75	3.33	0.05	0.02				
22.00	3.33	0.05	0.02				
22.25	3.34	0.05	0.02				
22.50	3.35	0.05	0.02				
22.75	3.36	0.05	0.02				

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St. George Cemetery Expansion  
Type III 24-hr 2 yr Rainfall=3.40"

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### Summary for Pond 20P: Pervious Pavement Infiltration

Inflow Area = 64,365 sf, 24.89% Impervious, Inflow Depth = 0.28" for 2 yr event  
Inflow = 0.17 cfs @ 12.37 hrs, Volume= 1,511 cf  
Outflow = 0.16 cfs @ 12.48 hrs, Volume= 1,511 cf, Atten= 9%, Lag= 6.4 min  
Primary = 0.16 cfs @ 12.48 hrs, Volume= 1,511 cf

Routing by Stor-Ind method, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs

Peak Elev= 0.02' @ 12.48 hrs Surf.Area= 0 sf Storage= 61 cf

Plug-Flow detention time= 6.4 min calculated for 1,506 cf (100% of inflow)

Center-of-Mass det. time= 6.4 min ( 960.8 - 954.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	5,120 cf	<b>Custom Stage Data</b> Listed below

Elevation (feet)	Cum.Store (cubic-feet)
0.00	0
1.33	5,120

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	<b>9600 sq. ft. INFILTRATION</b> Elev. (feet) 0.00 0.10 1.00 Disch. (cfs) 0.000 1.000 1.000

**Primary OutFlow** Max=0.16 cfs @ 12.48 hrs HW=0.02' (Free Discharge)

↑1=9600 sq. ft. INFILTRATION (Custom Controls 0.16 cfs)

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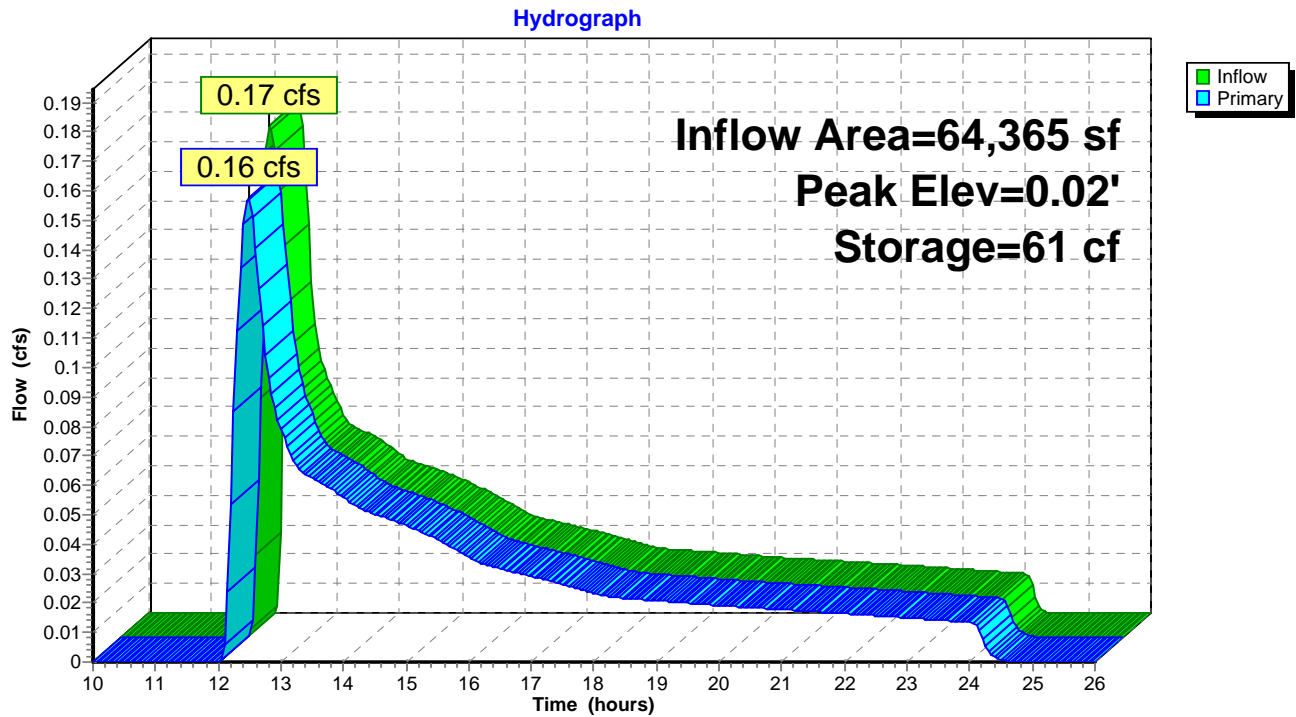
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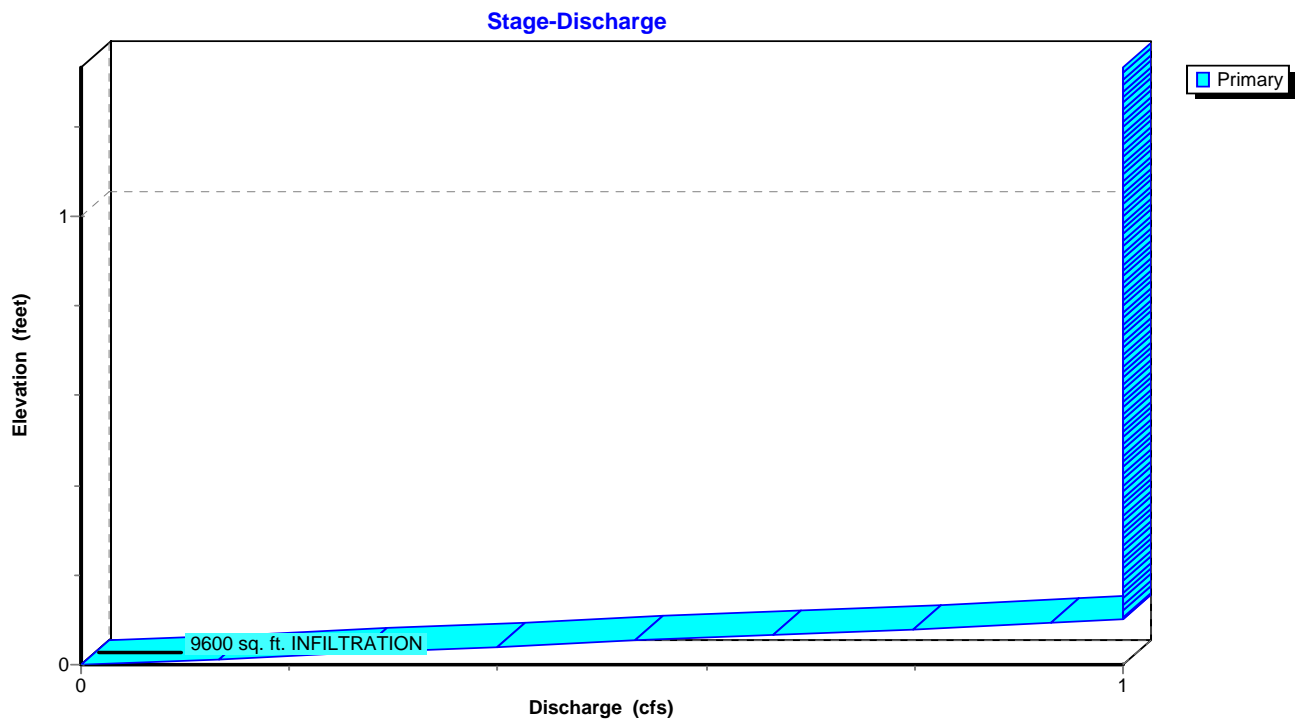
St. George Cemetery Expansion  
Type III 24-hr 2 yr Rainfall=3.40"

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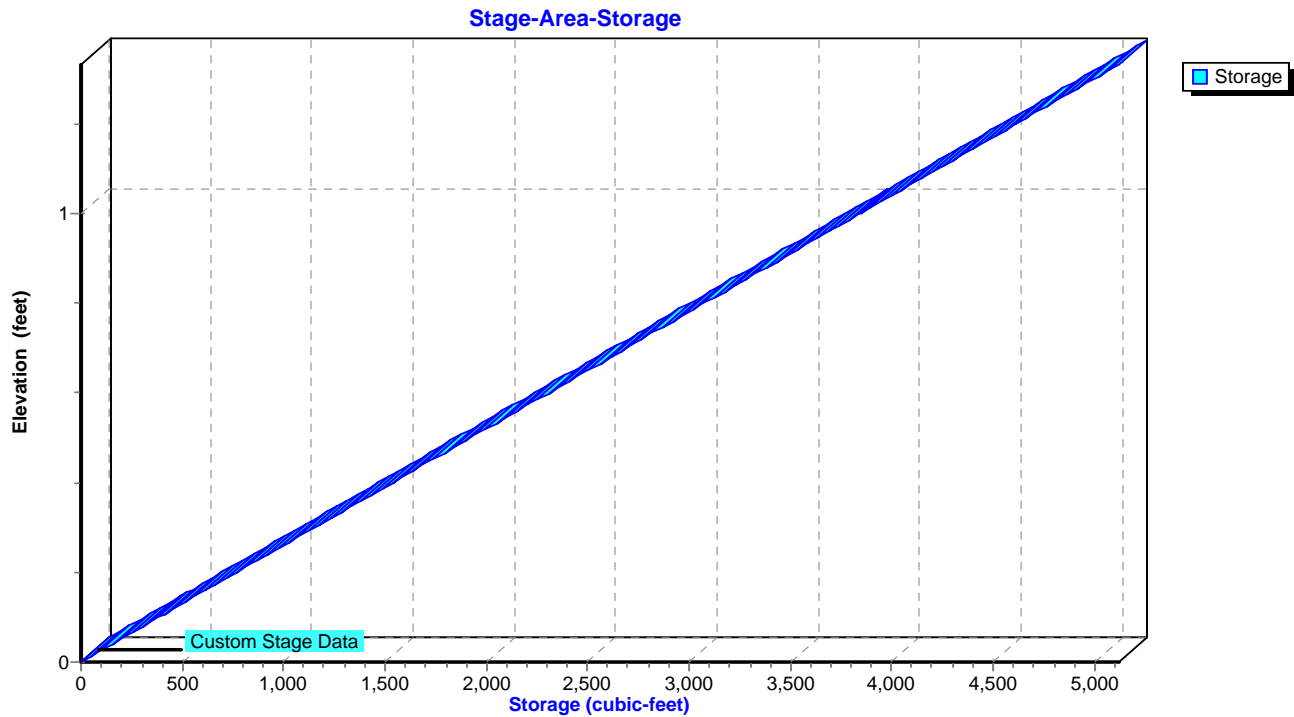
### Pond 20P: Pervious Pavement Infiltration



### Pond 20P: Pervious Pavement Infiltration



### Pond 20P: Pervious Pavement Infiltration



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### Hydrograph for Pond 20P: Pervious Pavement Infiltration

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
10.00	0.00	0	0.00	0.00
10.50	0.00	0	0.00	0.00
11.00	0.00	0	0.00	0.00
11.50	0.00	0	0.00	0.00
12.00	<b>0.00</b>	0	0.00	0.00
12.50	<b>0.15</b>	<b>60</b>	<b>0.02</b>	<b>0.16</b>
13.00	0.07	30	0.01	0.08
13.50	0.06	24	0.01	0.06
14.00	0.05	21	0.01	0.06
14.50	0.05	19	0.01	0.05
15.00	0.05	18	0.00	0.05
15.50	0.04	16	0.00	0.04
16.00	0.03	14	0.00	0.04
16.50	0.03	12	0.00	0.03
17.00	0.03	11	0.00	0.03
17.50	0.03	10	0.00	0.03
18.00	0.02	9	0.00	0.02
18.50	0.02	8	0.00	0.02
19.00	0.02	8	0.00	0.02
19.50	0.02	8	0.00	0.02
20.00	0.02	7	0.00	0.02
20.50	0.02	7	0.00	0.02
21.00	0.02	7	0.00	0.02
21.50	0.02	7	0.00	0.02
22.00	0.02	6	0.00	0.02
22.50	0.02	6	0.00	0.02
23.00	0.01	6	0.00	0.02
23.50	0.01	5	0.00	0.01
24.00	0.01	5	0.00	0.01
24.50	0.00	0	0.00	0.00
25.00	0.00	0	0.00	0.00
25.50	0.00	0	0.00	0.00
26.00	0.00	0	0.00	0.00

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Type III 24-hr 2 yr Rainfall=3.40"

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**Stage-Discharge for Pond 20P: Pervious Pavement Infiltration**

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.52	1.00	1.04	1.00
0.01	0.10	0.53	1.00	1.05	1.00
0.02	0.20	0.54	1.00	1.06	1.00
0.03	0.30	0.55	1.00	1.07	1.00
0.04	0.40	0.56	1.00	1.08	1.00
0.05	0.50	0.57	1.00	1.09	1.00
0.06	0.60	0.58	1.00	1.10	1.00
0.07	0.70	0.59	1.00	1.11	1.00
0.08	0.80	0.60	1.00	1.12	1.00
0.09	0.90	0.61	1.00	1.13	1.00
0.10	1.00	0.62	1.00	1.14	1.00
0.11	1.00	0.63	1.00	1.15	1.00
0.12	1.00	0.64	1.00	1.16	1.00
0.13	1.00	0.65	1.00	1.17	1.00
0.14	1.00	0.66	1.00	1.18	1.00
0.15	1.00	0.67	1.00	1.19	1.00
0.16	1.00	0.68	1.00	1.20	1.00
0.17	1.00	0.69	1.00	1.21	1.00
0.18	1.00	0.70	1.00	1.22	1.00
0.19	1.00	0.71	1.00	1.23	1.00
0.20	1.00	0.72	1.00	1.24	1.00
0.21	1.00	0.73	1.00	1.25	1.00
0.22	1.00	0.74	1.00	1.26	1.00
0.23	1.00	0.75	1.00	1.27	1.00
0.24	1.00	0.76	1.00	1.28	1.00
0.25	1.00	0.77	1.00	1.29	1.00
0.26	1.00	0.78	1.00	1.30	1.00
0.27	1.00	0.79	1.00	1.31	1.00
0.28	1.00	0.80	1.00	1.32	1.00
0.29	1.00	0.81	1.00	1.33	1.00
0.30	1.00	0.82	1.00		
0.31	1.00	0.83	1.00		
0.32	1.00	0.84	1.00		
0.33	1.00	0.85	1.00		
0.34	1.00	0.86	1.00		
0.35	1.00	0.87	1.00		
0.36	1.00	0.88	1.00		
0.37	1.00	0.89	1.00		
0.38	1.00	0.90	1.00		
0.39	1.00	0.91	1.00		
0.40	1.00	0.92	1.00		
0.41	1.00	0.93	1.00		
0.42	1.00	0.94	1.00		
0.43	1.00	0.95	1.00		
0.44	1.00	0.96	1.00		
0.45	1.00	0.97	1.00		
0.46	1.00	0.98	1.00		
0.47	1.00	0.99	1.00		
0.48	1.00	1.00	1.00		
0.49	1.00	1.01	1.00		
0.50	1.00	1.02	1.00		
0.51	1.00	1.03	1.00		

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St. George Cemetery Expansion  
Type III 24-hr 2 yr Rainfall=3.40"

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**Stage-Area-Storage for Pond 20P: Pervious Pavement Infiltration**

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
0.00	0	0.52	2,002	1.04	4,004
0.01	38	0.53	2,040	1.05	4,042
0.02	77	0.54	2,079	1.06	4,081
0.03	115	0.55	2,117	1.07	4,119
0.04	154	0.56	2,156	1.08	4,158
0.05	192	0.57	2,194	1.09	4,196
0.06	231	0.58	2,233	1.10	4,235
0.07	269	0.59	2,271	1.11	4,273
0.08	308	0.60	2,310	1.12	4,312
0.09	346	0.61	2,348	1.13	4,350
0.10	385	0.62	2,387	1.14	4,389
0.11	423	0.63	2,425	1.15	4,427
0.12	462	0.64	2,464	1.16	4,466
0.13	500	0.65	2,502	1.17	4,504
0.14	539	0.66	2,541	1.18	4,543
0.15	577	0.67	2,579	1.19	4,581
0.16	616	0.68	2,618	1.20	4,620
0.17	654	0.69	2,656	1.21	4,658
0.18	693	0.70	2,695	1.22	4,697
0.19	731	0.71	2,733	1.23	4,735
0.20	770	0.72	2,772	1.24	4,774
0.21	808	0.73	2,810	1.25	4,812
0.22	847	0.74	2,849	1.26	4,851
0.23	885	0.75	2,887	1.27	4,889
0.24	924	0.76	2,926	1.28	4,928
0.25	962	0.77	2,964	1.29	4,966
0.26	1,001	0.78	3,003	1.30	5,005
0.27	1,039	0.79	3,041	1.31	5,043
0.28	1,078	0.80	3,080	1.32	5,082
0.29	1,116	0.81	3,118	1.33	5,120
0.30	1,155	0.82	3,157		
0.31	1,193	0.83	3,195		
0.32	1,232	0.84	3,234		
0.33	1,270	0.85	3,272		
0.34	1,309	0.86	3,311		
0.35	1,347	0.87	3,349		
0.36	1,386	0.88	3,388		
0.37	1,424	0.89	3,426		
0.38	1,463	0.90	3,465		
0.39	1,501	0.91	3,503		
0.40	1,540	0.92	3,542		
0.41	1,578	0.93	3,580		
0.42	1,617	0.94	3,619		
0.43	1,655	0.95	3,657		
0.44	1,694	0.96	3,696		
0.45	1,732	0.97	3,734		
0.46	1,771	0.98	3,773		
0.47	1,809	0.99	3,811		
0.48	1,848	1.00	3,850		
0.49	1,886	1.01	3,888		
0.50	1,925	1.02	3,927		
0.51	1,963	1.03	3,965		



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Type III 24-hr 10 yr Rainfall=5.20"

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Time span=10.00-26.00 hrs, dt=0.05 hrs, 321 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1S: Pre-Construction

Runoff Area=228,839 sf 9.80% Impervious Runoff Depth=0.46"  
Flow Length=500' Tc=14.0 min CN=44 Runoff=0.99 cfs 8,736 cf

### Subcatchment 2S: Post-Construction

Runoff Area=228,838 sf 14.00% Impervious Runoff Depth=0.61"  
Flow Length=500' Tc=14.0 min CN=47 Runoff=1.61 cfs 11,627 cf

### Subcatchment 10S: DA#2 TO Pervious Pavement

Runoff Area=64,365 sf 24.89% Impervious Runoff Depth=1.02"  
Flow Length=150' Slope=0.0500 '/' Tc=9.4 min CN=54 Runoff=1.23 cfs 5,457 cf

### Subcatchment 30S: Net Post-Construction

Runoff Area=164,473 sf 9.74% Impervious Runoff Depth=0.46"  
Flow Length=290' Tc=7.5 min CN=44 Runoff=0.76 cfs 6,279 cf

### Pond 20P: Pervious Pavement Infiltration

Peak Elev=0.10' Storage=377 cf Inflow=1.23 cfs 5,457 cf  
Outflow=0.98 cfs 5,457 cf

Total Runoff Area = 686,515 sf Runoff Volume = 32,100 cf Average Runoff Depth = 0.56"  
87.40% Pervious = 600,015 sf 12.60% Impervious = 86,500 sf

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Type III 24-hr 10 yr Rainfall=5.20"

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### Summary for Subcatchment 1S: Pre-Construction

Runoff = 0.99 cfs @ 12.43 hrs, Volume= 8,736 cf, Depth= 0.46"

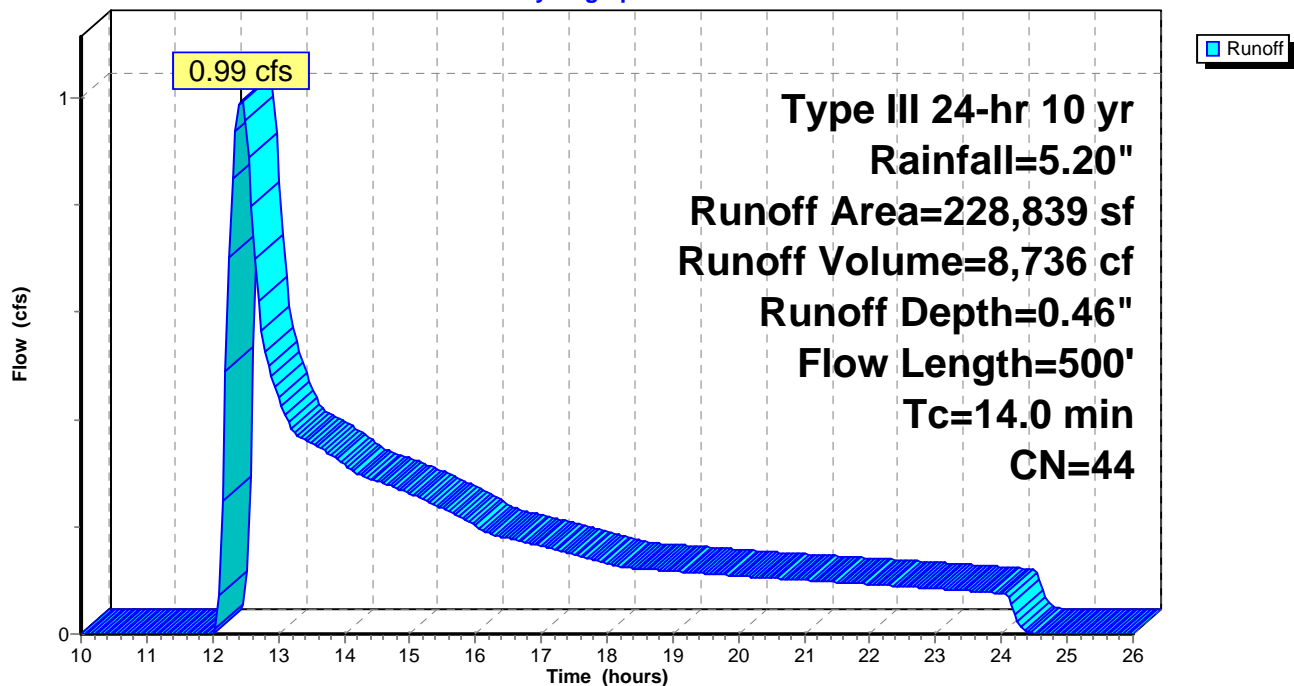
Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr Rainfall=5.20"

	Area (sf)	CN	Description
*	22,426	98	9.8% Lot Coverage
	93,000	36	Woods, Fair, HSG A
	113,413	39	>75% Grass cover, Good, HSG A
	228,839	44	Weighted Average
	206,413		90.20% Pervious Area
	22,426		9.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	150	0.0570	0.28		Sheet Flow, Elev 122.5 to 114
					Grass: Short n= 0.150 P2= 3.20"
5.1	350	0.0520	1.14		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
14.0	500	Total			

### Subcatchment 1S: Pre-Construction

Hydrograph



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Type III 24-hr 10 yr Rainfall=5.20"

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**Hydrograph for Subcatchment 1S: Pre-Construction**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.98	0.00	0.00	23.00	5.15	0.44	0.08
10.25	1.05	0.00	0.00	23.25	5.17	0.45	0.08
10.50	1.13	0.00	0.00	23.50	5.18	0.45	0.08
10.75	1.21	0.00	0.00	23.75	5.19	0.45	0.08
11.00	1.30	0.00	0.00	24.00	<b>5.20</b>	<b>0.46</b>	0.08
11.25	1.41	0.00	0.00	24.25	5.20	0.46	0.02
11.50	1.55	0.00	0.00	24.50	5.20	0.46	0.00
11.75	1.85	0.00	0.00	24.75	5.20	0.46	0.00
12.00	2.60	0.00	0.00	25.00	5.20	0.46	0.00
12.25	3.35	0.05	<b>0.70</b>	25.25	5.20	0.46	0.00
12.50	3.65	0.09	<b>0.96</b>	25.50	5.20	0.46	0.00
12.75	3.79	0.11	0.57	25.75	5.20	0.46	0.00
13.00	3.90	0.13	0.44	26.00	5.20	0.46	0.00
13.25	3.99	0.15	0.38				
13.50	4.07	0.16	0.36				
13.75	4.15	0.18	0.34				
14.00	4.22	0.19	0.32				
14.25	4.28	0.21	0.30				
14.50	4.34	0.22	0.29				
14.75	4.39	0.23	0.27				
15.00	4.44	0.25	0.26				
15.25	4.49	0.26	0.25				
15.50	4.53	0.27	0.23				
15.75	4.57	0.28	0.22				
16.00	4.61	0.29	0.20				
16.25	4.64	0.30	0.19				
16.50	4.67	0.30	0.18				
16.75	4.70	0.31	0.17				
17.00	4.73	0.32	0.16				
17.25	4.76	0.33	0.16				
17.50	4.78	0.33	0.15				
17.75	4.80	0.34	0.14				
18.00	4.83	0.35	0.13				
18.25	4.85	0.35	0.12				
18.50	4.87	0.36	0.12				
18.75	4.89	0.36	0.12				
19.00	4.90	0.37	0.12				
19.25	4.92	0.37	0.11				
19.50	4.94	0.38	0.11				
19.75	4.96	0.38	0.11				
20.00	4.98	0.39	0.11				
20.25	4.99	0.39	0.11				
20.50	5.01	0.40	0.10				
20.75	5.03	0.40	0.10				
21.00	5.04	0.41	0.10				
21.25	5.06	0.41	0.10				
21.50	5.07	0.42	0.10				
21.75	5.09	0.42	0.09				
22.00	5.10	0.43	0.09				
22.25	5.11	0.43	0.09				
22.50	5.13	0.44	0.09				
22.75	5.14	0.44	0.09				

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Type III 24-hr 10 yr Rainfall=5.20"

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### Summary for Subcatchment 2S: Post-Construction

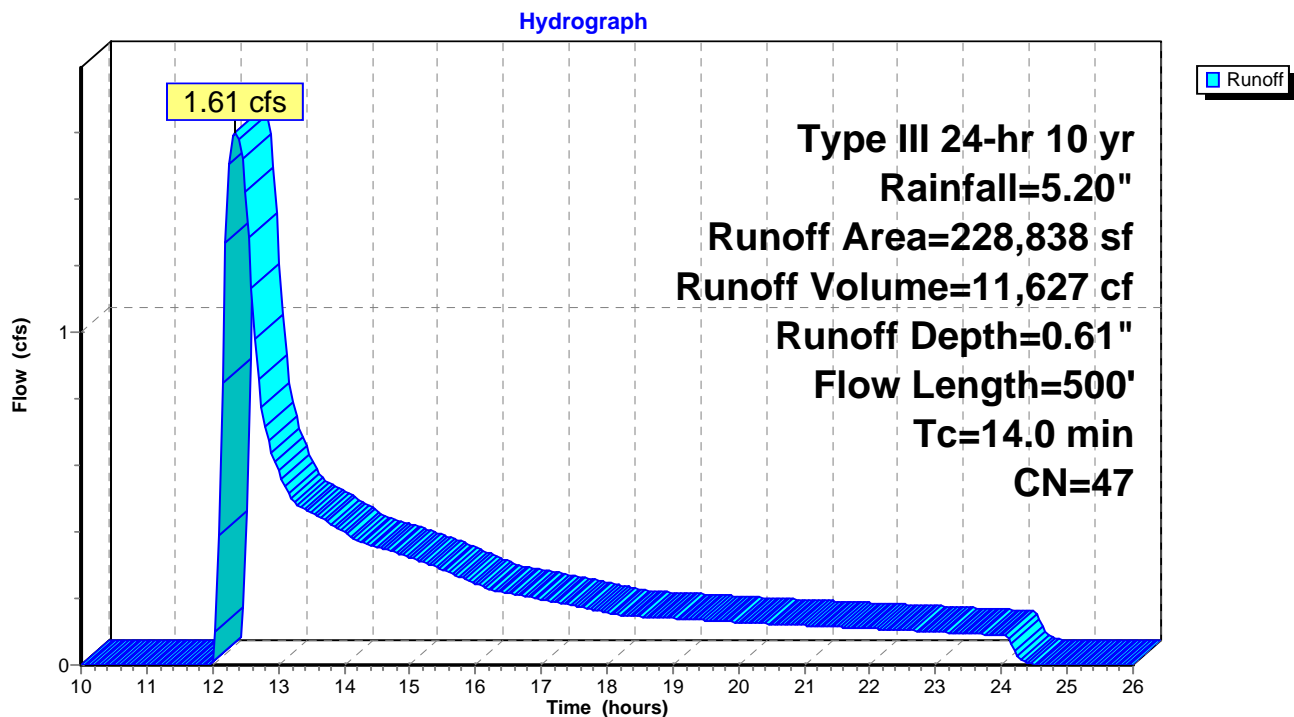
Runoff = 1.61 cfs @ 12.34 hrs, Volume= 11,627 cf, Depth= 0.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr Rainfall=5.20"

	Area (sf)	CN	Description
*	32,037	98	14% Lot Coverage
	24,000	36	Woods, Fair, HSG A
	172,801	39	>75% Grass cover, Good, HSG A
	228,838	47	Weighted Average
	196,801		86.00% Pervious Area
	32,037		14.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	150	0.0570	0.28		Sheet Flow, Elev 122.5 to 114
					Grass: Short n= 0.150 P2= 3.20"
5.1	350	0.0520	1.14		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
14.0	500	Total			

### Subcatchment 2S: Post-Construction



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Type III 24-hr 10 yr Rainfall=5.20"

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**Hydrograph for Subcatchment 2S: Post-Construction**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.98	0.00	0.00	23.00	5.15	0.59	0.10
10.25	1.05	0.00	0.00	23.25	5.17	0.60	0.10
10.50	1.13	0.00	0.00	23.50	5.18	0.60	0.09
10.75	1.21	0.00	0.00	23.75	5.19	0.61	0.09
11.00	1.30	0.00	0.00	24.00	<b>5.20</b>	<b>0.61</b>	0.09
11.25	1.41	0.00	0.00	24.25	5.20	0.61	0.03
11.50	1.55	0.00	0.00	24.50	5.20	0.61	0.00
11.75	1.85	0.00	0.00	24.75	5.20	0.61	0.00
12.00	2.60	0.01	0.01	25.00	5.20	0.61	0.00
12.25	3.35	0.10	<b>1.51</b>	25.25	5.20	0.61	0.00
12.50	3.65	0.15	<b>1.42</b>	25.50	5.20	0.61	0.00
12.75	3.79	0.18	0.77	25.75	5.20	0.61	0.00
13.00	3.90	0.21	0.59	26.00	5.20	0.61	0.00
13.25	3.99	0.23	0.49				
13.50	4.07	0.25	0.46				
13.75	4.15	0.27	0.43				
14.00	4.22	0.29	0.40				
14.25	4.28	0.31	0.37				
14.50	4.34	0.32	0.36				
14.75	4.39	0.34	0.34				
15.00	4.44	0.36	0.32				
15.25	4.49	0.37	0.31				
15.50	4.53	0.38	0.29				
15.75	4.57	0.39	0.27				
16.00	4.61	0.41	0.24				
16.25	4.64	0.42	0.23				
16.50	4.67	0.43	0.22				
16.75	4.70	0.44	0.21				
17.00	4.73	0.45	0.20				
17.25	4.76	0.45	0.19				
17.50	4.78	0.46	0.18				
17.75	4.80	0.47	0.17				
18.00	4.83	0.48	0.16				
18.25	4.85	0.48	0.15				
18.50	4.87	0.49	0.15				
18.75	4.89	0.50	0.14				
19.00	4.90	0.50	0.14				
19.25	4.92	0.51	0.14				
19.50	4.94	0.52	0.13				
19.75	4.96	0.52	0.13				
20.00	4.98	0.53	0.13				
20.25	4.99	0.53	0.13				
20.50	5.01	0.54	0.12				
20.75	5.03	0.55	0.12				
21.00	5.04	0.55	0.12				
21.25	5.06	0.56	0.12				
21.50	5.07	0.56	0.11				
21.75	5.09	0.57	0.11				
22.00	5.10	0.57	0.11				
22.25	5.11	0.58	0.11				
22.50	5.13	0.58	0.10				
22.75	5.14	0.59	0.10				

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Type III 24-hr 10 yr Rainfall=5.20"

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### Summary for Subcatchment 10S: DA#2 TO Pervious Pavement Section

Runoff = 1.23 cfs @ 12.16 hrs, Volume= 5,457 cf, Depth= 1.02"

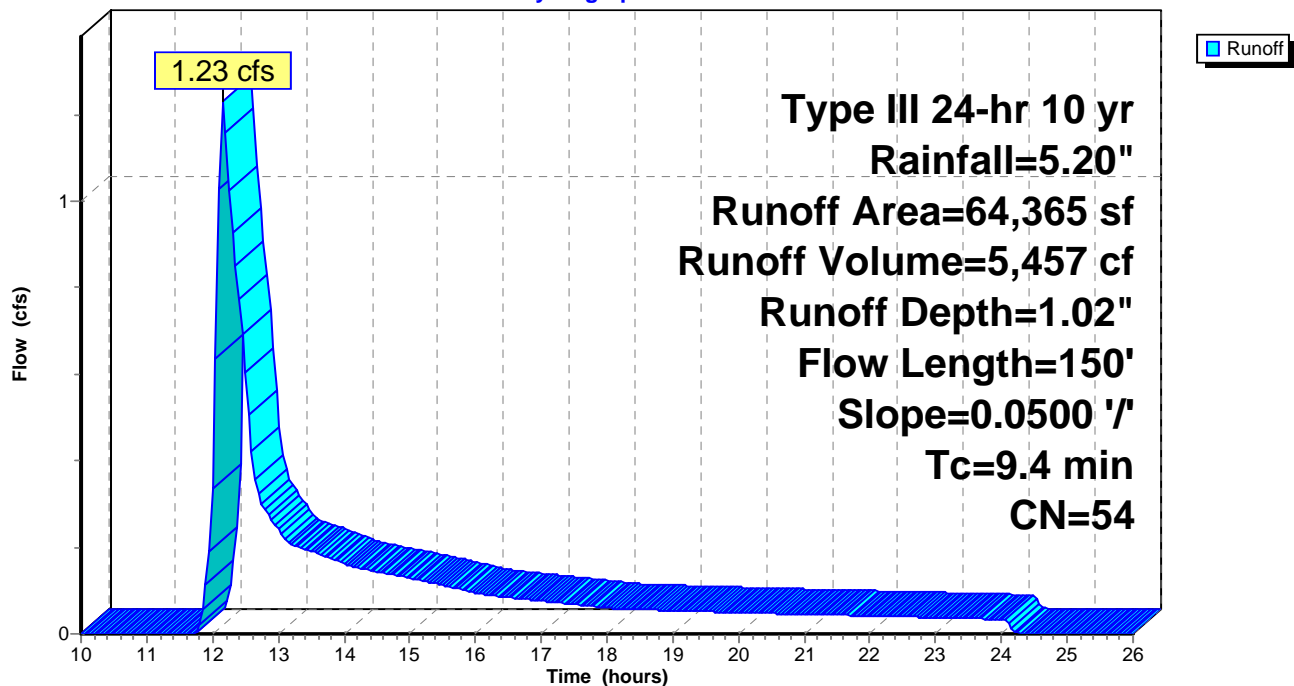
Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr Rainfall=5.20"

	Area (sf)	CN	Description
*	16,022	98	
	48,343	39	>75% Grass cover, Good, HSG A
	64,365	54	Weighted Average
	48,343		75.11% Pervious Area
	16,022		24.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	150	0.0500	0.27		Sheet Flow, ELEV. 122.5 TO 115 Grass: Short n= 0.150 P2= 3.20"

### Subcatchment 10S: DA#2 TO Pervious Pavement Section

Hydrograph



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Type III 24-hr 10 yr Rainfall=5.20"

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**Hydrograph for Subcatchment 10S: DA#2 TO Pervious Pavement Section**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.98	0.00	0.00	23.00	5.15	0.99	0.04
10.25	1.05	0.00	0.00	23.25	5.17	1.00	0.04
10.50	1.13	0.00	0.00	23.50	5.18	1.01	0.04
10.75	1.21	0.00	0.00	23.75	5.19	1.01	0.03
11.00	1.30	0.00	0.00	24.00	<b>5.20</b>	<b>1.02</b>	0.03
11.25	1.41	0.00	0.00	24.25	5.20	1.02	0.00
11.50	1.55	0.00	0.00	24.50	5.20	1.02	0.00
11.75	1.85	0.00	0.00	24.75	5.20	1.02	0.00
12.00	2.60	0.09	<b>0.33</b>	25.00	5.20	1.02	0.00
12.25	3.35	0.27	<b>1.03</b>	25.25	5.20	1.02	0.00
12.50	3.65	0.36	0.60	25.50	5.20	1.02	0.00
12.75	3.79	0.41	0.30	25.75	5.20	1.02	0.00
13.00	3.90	0.45	0.24	26.00	5.20	1.02	0.00
13.25	3.99	0.48	0.20				
13.50	4.07	0.52	0.19				
13.75	4.15	0.55	0.18				
14.00	4.22	0.57	0.16				
14.25	4.28	0.60	0.15				
14.50	4.34	0.62	0.14				
14.75	4.39	0.64	0.14				
15.00	4.44	0.67	0.13				
15.25	4.49	0.69	0.12				
15.50	4.53	0.71	0.11				
15.75	4.57	0.72	0.10				
16.00	4.61	0.74	0.09				
16.25	4.64	0.75	0.09				
16.50	4.67	0.77	0.08				
16.75	4.70	0.78	0.08				
17.00	4.73	0.79	0.08				
17.25	4.76	0.81	0.07				
17.50	4.78	0.82	0.07				
17.75	4.80	0.83	0.06				
18.00	4.83	0.84	0.06				
18.25	4.85	0.85	0.06				
18.50	4.87	0.86	0.06				
18.75	4.89	0.87	0.05				
19.00	4.90	0.87	0.05				
19.25	4.92	0.88	0.05				
19.50	4.94	0.89	0.05				
19.75	4.96	0.90	0.05				
20.00	4.98	0.91	0.05				
20.25	4.99	0.92	0.05				
20.50	5.01	0.92	0.05				
20.75	5.03	0.93	0.05				
21.00	5.04	0.94	0.05				
21.25	5.06	0.95	0.04				
21.50	5.07	0.95	0.04				
21.75	5.09	0.96	0.04				
22.00	5.10	0.97	0.04				
22.25	5.11	0.97	0.04				
22.50	5.13	0.98	0.04				
22.75	5.14	0.99	0.04				

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Type III 24-hr 10 yr Rainfall=5.20"

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### Summary for Subcatchment 30S: Net Post-Construction

Runoff = 0.76 cfs @ 12.33 hrs, Volume= 6,279 cf, Depth= 0.46"

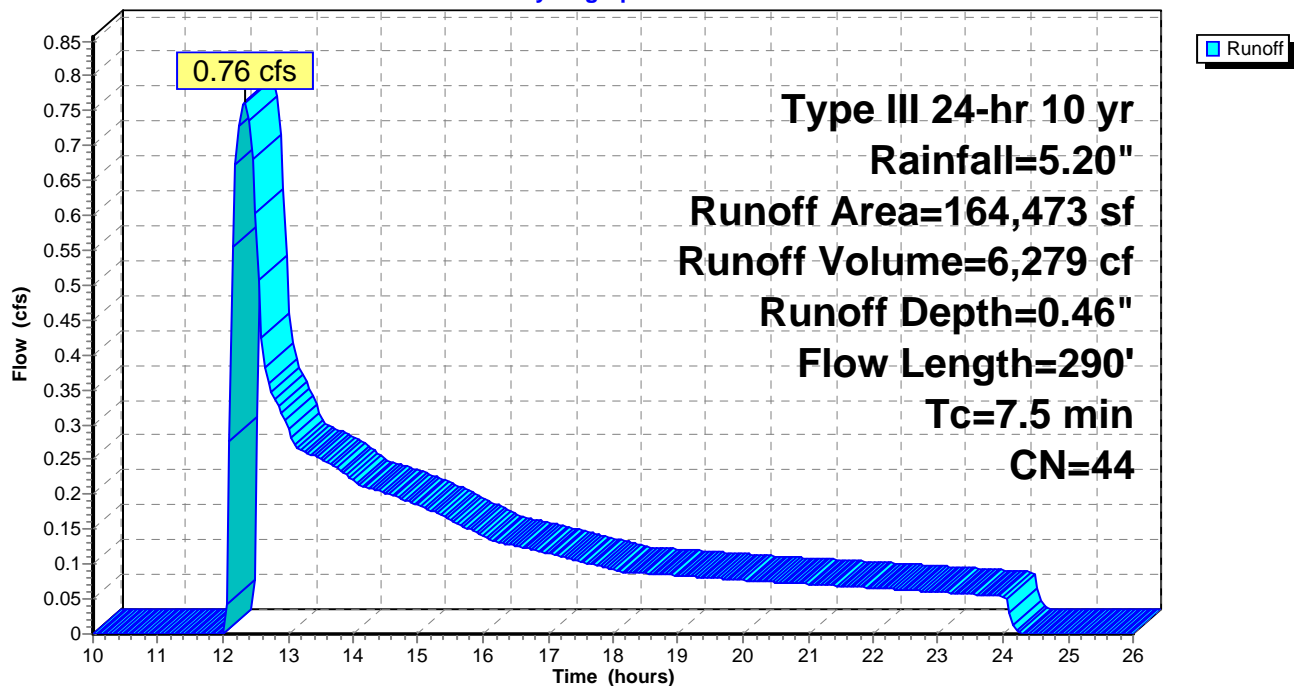
Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 10 yr Rainfall=5.20"

	Area (sf)	CN	Description
*	16,015	98	14% Lot Coverage less pavement
	24,000	36	Woods, Fair, HSG A
	124,458	39	>75% Grass cover, Good, HSG A
	164,473	44	Weighted Average
	148,458		90.26% Pervious Area
	16,015		9.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	66	0.0530	0.23		Sheet Flow, Elev 116 to 112.5
					Grass: Short n= 0.150 P2= 3.20"
2.7	224	0.0750	1.37		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
7.5	290	Total			

### Subcatchment 30S: Net Post-Construction

Hydrograph





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Type III 24-hr 10 yr Rainfall=5.20"

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**Hydrograph for Subcatchment 30S: Net Post-Construction**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	0.98	0.00	0.00	23.00	5.15	0.44	0.06
10.25	1.05	0.00	0.00	23.25	5.17	0.45	0.06
10.50	1.13	0.00	0.00	23.50	5.18	0.45	0.06
10.75	1.21	0.00	0.00	23.75	5.19	0.45	0.06
11.00	1.30	0.00	0.00	24.00	<b>5.20</b>	<b>0.46</b>	0.05
11.25	1.41	0.00	0.00	24.25	5.20	0.46	0.00
11.50	1.55	0.00	0.00	24.50	5.20	0.46	0.00
11.75	1.85	0.00	0.00	24.75	5.20	0.46	0.00
12.00	2.60	0.00	0.00	25.00	5.20	0.46	0.00
12.25	3.35	0.05	<b>0.73</b>	25.25	5.20	0.46	0.00
12.50	3.65	0.09	<b>0.60</b>	25.50	5.20	0.46	0.00
12.75	3.79	0.11	0.35	25.75	5.20	0.46	0.00
13.00	3.90	0.13	0.29	26.00	5.20	0.46	0.00
13.25	3.99	0.15	0.26				
13.50	4.07	0.16	0.25				
13.75	4.15	0.18	0.24				
14.00	4.22	0.19	0.22				
14.25	4.28	0.21	0.21				
14.50	4.34	0.22	0.20				
14.75	4.39	0.23	0.19				
15.00	4.44	0.25	0.18				
15.25	4.49	0.26	0.17				
15.50	4.53	0.27	0.16				
15.75	4.57	0.28	0.15				
16.00	4.61	0.29	0.14				
16.25	4.64	0.30	0.13				
16.50	4.67	0.30	0.13				
16.75	4.70	0.31	0.12				
17.00	4.73	0.32	0.12				
17.25	4.76	0.33	0.11				
17.50	4.78	0.33	0.10				
17.75	4.80	0.34	0.10				
18.00	4.83	0.35	0.09				
18.25	4.85	0.35	0.09				
18.50	4.87	0.36	0.09				
18.75	4.89	0.36	0.09				
19.00	4.90	0.37	0.08				
19.25	4.92	0.37	0.08				
19.50	4.94	0.38	0.08				
19.75	4.96	0.38	0.08				
20.00	4.98	0.39	0.08				
20.25	4.99	0.39	0.08				
20.50	5.01	0.40	0.07				
20.75	5.03	0.40	0.07				
21.00	5.04	0.41	0.07				
21.25	5.06	0.41	0.07				
21.50	5.07	0.42	0.07				
21.75	5.09	0.42	0.07				
22.00	5.10	0.43	0.07				
22.25	5.11	0.43	0.06				
22.50	5.13	0.44	0.06				
22.75	5.14	0.44	0.06				

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Type III 24-hr 10 yr Rainfall=5.20"

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### Summary for Pond 20P: Pervious Pavement Infiltration

Inflow Area = 64,365 sf, 24.89% Impervious, Inflow Depth = 1.02" for 10 yr event  
Inflow = 1.23 cfs @ 12.16 hrs, Volume= 5,457 cf  
Outflow = 0.98 cfs @ 12.28 hrs, Volume= 5,457 cf, Atten= 21%, Lag= 6.8 min  
Primary = 0.98 cfs @ 12.28 hrs, Volume= 5,457 cf

Routing by Stor-Ind method, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs

Peak Elev= 0.10' @ 12.28 hrs Surf.Area= 0 sf Storage= 377 cf

Plug-Flow detention time= 6.4 min calculated for 5,440 cf (100% of inflow)

Center-of-Mass det. time= 6.4 min ( 902.3 - 895.9 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	5,120 cf	<b>Custom Stage Data</b> Listed below

Elevation (feet)	Cum.Store (cubic-feet)
0.00	0
1.33	5,120

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	<b>9600 sq. ft. INFILTRATION</b> Elev. (feet) 0.00 0.10 1.00 Disch. (cfs) 0.000 1.000 1.000

**Primary OutFlow** Max=0.98 cfs @ 12.28 hrs HW=0.10' (Free Discharge)

↑1=9600 sq. ft. INFILTRATION (Custom Controls 0.98 cfs)

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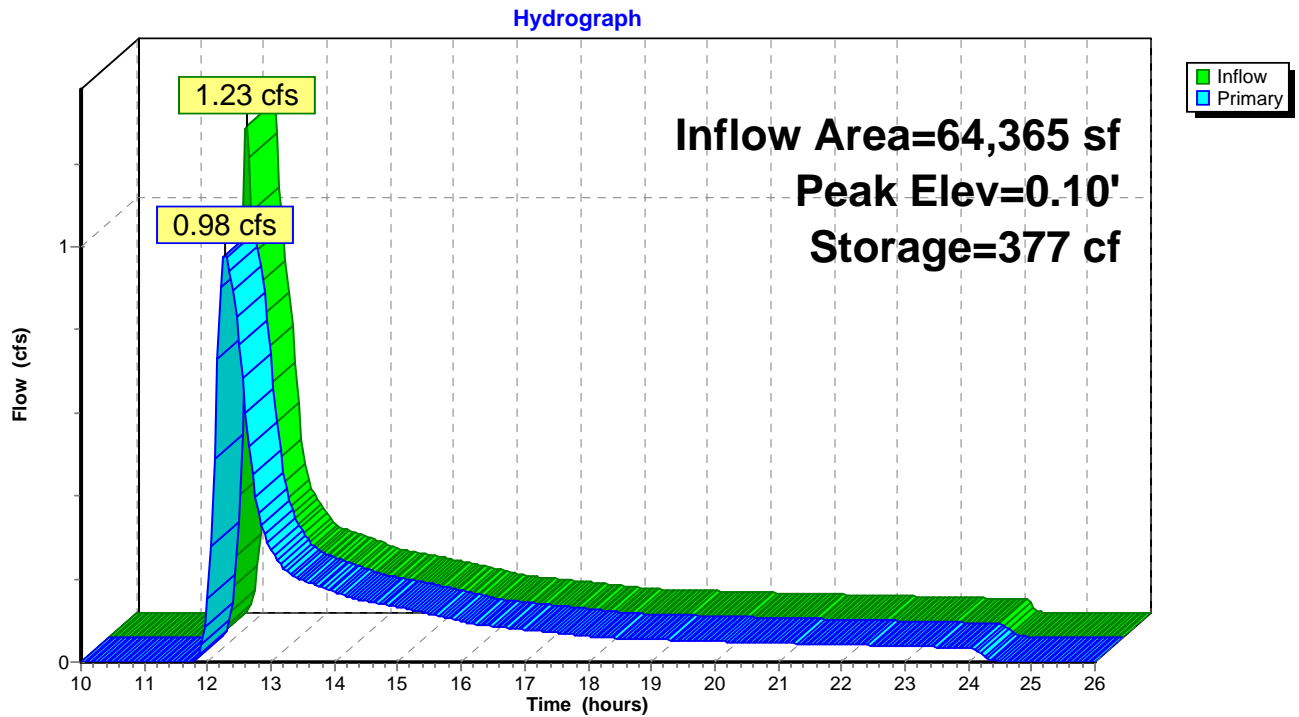
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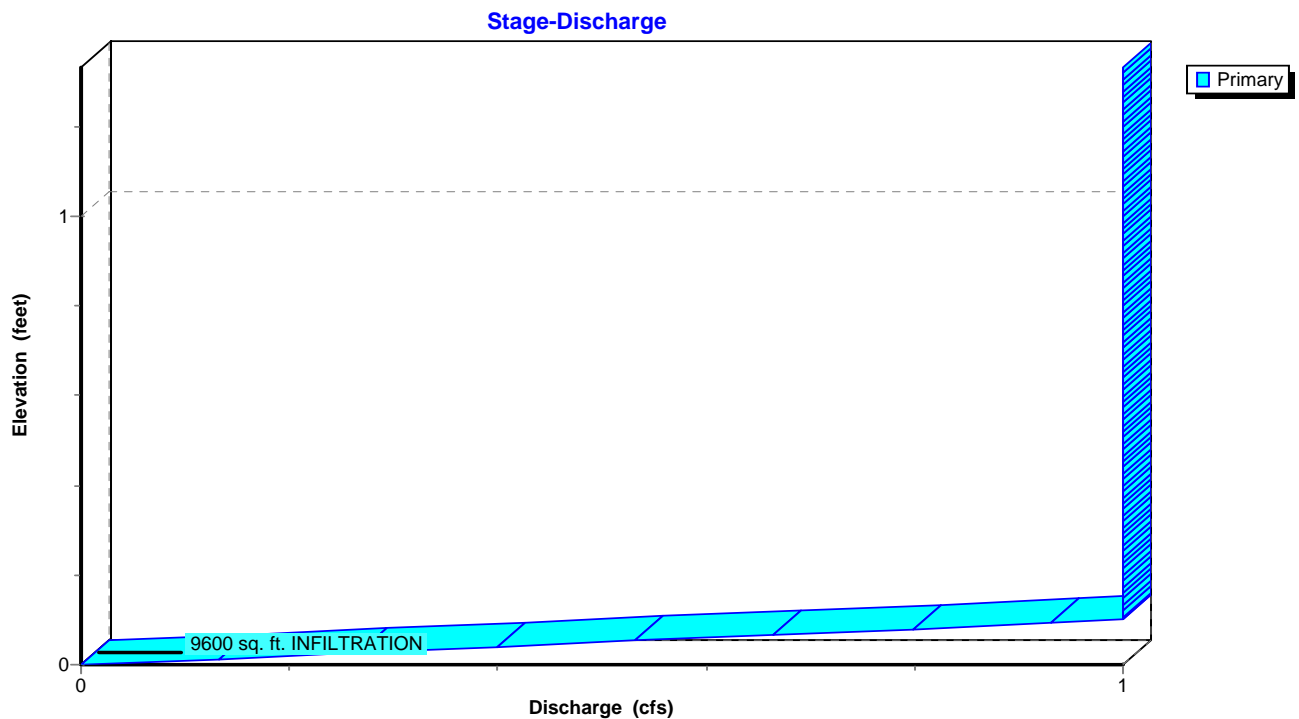
St. George Cemetery Expansion  
Type III 24-hr 10 yr Rainfall=5.20"

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### Pond 20P: Pervious Pavement Infiltration



### Pond 20P: Pervious Pavement Infiltration



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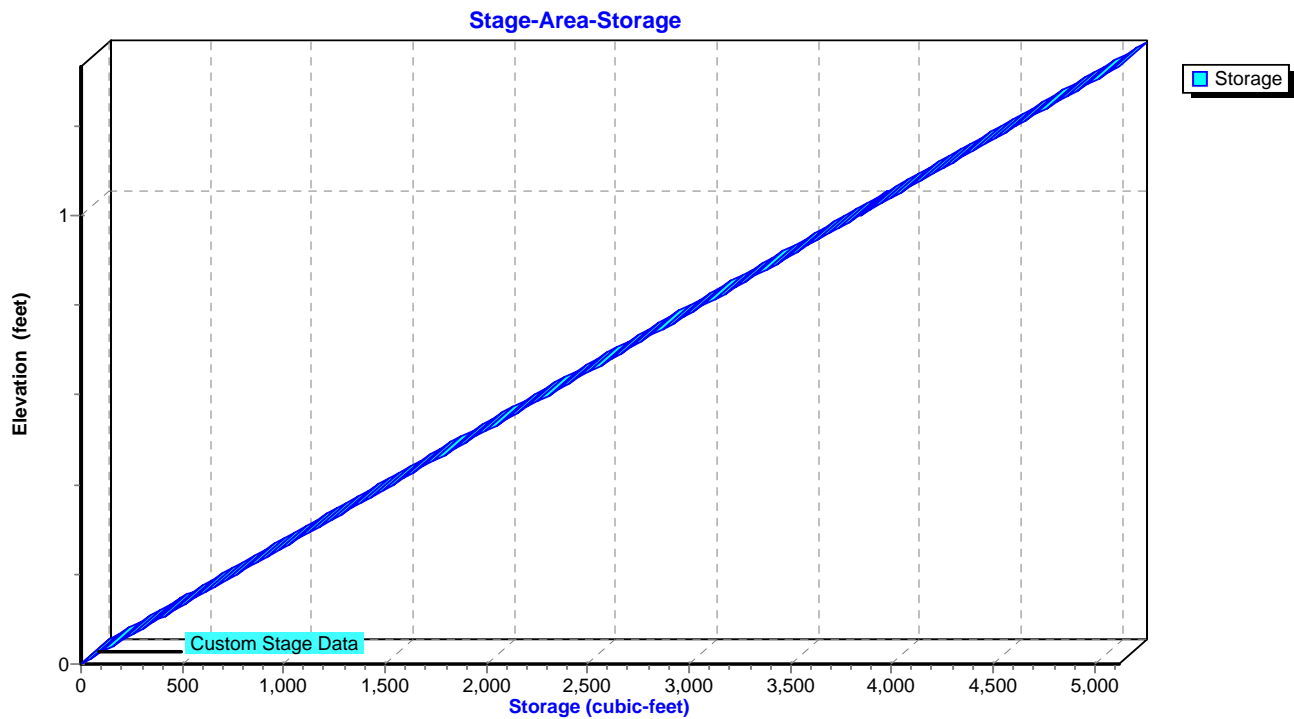
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Type III 24-hr 10 yr Rainfall=5.20"

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### Pond 20P: Pervious Pavement Infiltration



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### Hydrograph for Pond 20P: Pervious Pavement Infiltration

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
10.00	0.00	0	0.00	0.00
10.50	0.00	0	0.00	0.00
11.00	0.00	0	0.00	0.00
11.50	0.00	0	0.00	0.00
12.00	<b>0.33</b>	<b>58</b>	<b>0.02</b>	<b>0.15</b>
12.50	<b>0.60</b>	<b>294</b>	<b>0.08</b>	<b>0.76</b>
13.00	0.24	105	0.03	0.27
13.50	0.19	76	0.02	0.20
14.00	0.16	65	0.02	0.17
14.50	0.14	57	0.01	0.15
15.00	0.13	51	0.01	0.13
15.50	0.11	45	0.01	0.12
16.00	0.09	38	0.01	0.10
16.50	0.08	33	0.01	0.09
17.00	0.08	30	0.01	0.08
17.50	0.07	27	0.01	0.07
18.00	0.06	24	0.01	0.06
18.50	0.06	22	0.01	0.06
19.00	0.05	21	0.01	0.05
19.50	0.05	20	0.01	0.05
20.00	0.05	19	0.00	0.05
20.50	0.05	18	0.00	0.05
21.00	0.05	17	0.00	0.05
21.50	0.04	17	0.00	0.04
22.00	0.04	16	0.00	0.04
22.50	0.04	15	0.00	0.04
23.00	0.04	15	0.00	0.04
23.50	0.04	14	0.00	0.04
24.00	0.03	13	0.00	0.03
24.50	0.00	1	0.00	0.00
25.00	0.00	0	0.00	0.00
25.50	0.00	0	0.00	0.00
26.00	0.00	0	0.00	0.00

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St. George Cemetery Expansion  
Type III 24-hr 10 yr Rainfall=5.20"

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**Stage-Discharge for Pond 20P: Pervious Pavement Infiltration**

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.52	1.00	1.04	1.00
0.01	0.10	0.53	1.00	1.05	1.00
0.02	0.20	0.54	1.00	1.06	1.00
0.03	0.30	0.55	1.00	1.07	1.00
0.04	0.40	0.56	1.00	1.08	1.00
0.05	0.50	0.57	1.00	1.09	1.00
0.06	0.60	0.58	1.00	1.10	1.00
0.07	0.70	0.59	1.00	1.11	1.00
0.08	0.80	0.60	1.00	1.12	1.00
0.09	0.90	0.61	1.00	1.13	1.00
0.10	1.00	0.62	1.00	1.14	1.00
0.11	1.00	0.63	1.00	1.15	1.00
0.12	1.00	0.64	1.00	1.16	1.00
0.13	1.00	0.65	1.00	1.17	1.00
0.14	1.00	0.66	1.00	1.18	1.00
0.15	1.00	0.67	1.00	1.19	1.00
0.16	1.00	0.68	1.00	1.20	1.00
0.17	1.00	0.69	1.00	1.21	1.00
0.18	1.00	0.70	1.00	1.22	1.00
0.19	1.00	0.71	1.00	1.23	1.00
0.20	1.00	0.72	1.00	1.24	1.00
0.21	1.00	0.73	1.00	1.25	1.00
0.22	1.00	0.74	1.00	1.26	1.00
0.23	1.00	0.75	1.00	1.27	1.00
0.24	1.00	0.76	1.00	1.28	1.00
0.25	1.00	0.77	1.00	1.29	1.00
0.26	1.00	0.78	1.00	1.30	1.00
0.27	1.00	0.79	1.00	1.31	1.00
0.28	1.00	0.80	1.00	1.32	1.00
0.29	1.00	0.81	1.00	1.33	1.00
0.30	1.00	0.82	1.00		
0.31	1.00	0.83	1.00		
0.32	1.00	0.84	1.00		
0.33	1.00	0.85	1.00		
0.34	1.00	0.86	1.00		
0.35	1.00	0.87	1.00		
0.36	1.00	0.88	1.00		
0.37	1.00	0.89	1.00		
0.38	1.00	0.90	1.00		
0.39	1.00	0.91	1.00		
0.40	1.00	0.92	1.00		
0.41	1.00	0.93	1.00		
0.42	1.00	0.94	1.00		
0.43	1.00	0.95	1.00		
0.44	1.00	0.96	1.00		
0.45	1.00	0.97	1.00		
0.46	1.00	0.98	1.00		
0.47	1.00	0.99	1.00		
0.48	1.00	1.00	1.00		
0.49	1.00	1.01	1.00		
0.50	1.00	1.02	1.00		
0.51	1.00	1.03	1.00		

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**Stage-Area-Storage for Pond 20P: Pervious Pavement Infiltration**

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
0.00	0	0.52	2,002	1.04	4,004
0.01	38	0.53	2,040	1.05	4,042
0.02	77	0.54	2,079	1.06	4,081
0.03	115	0.55	2,117	1.07	4,119
0.04	154	0.56	2,156	1.08	4,158
0.05	192	0.57	2,194	1.09	4,196
0.06	231	0.58	2,233	1.10	4,235
0.07	269	0.59	2,271	1.11	4,273
0.08	308	0.60	2,310	1.12	4,312
0.09	346	0.61	2,348	1.13	4,350
0.10	385	0.62	2,387	1.14	4,389
0.11	423	0.63	2,425	1.15	4,427
0.12	462	0.64	2,464	1.16	4,466
0.13	500	0.65	2,502	1.17	4,504
0.14	539	0.66	2,541	1.18	4,543
0.15	577	0.67	2,579	1.19	4,581
0.16	616	0.68	2,618	1.20	4,620
0.17	654	0.69	2,656	1.21	4,658
0.18	693	0.70	2,695	1.22	4,697
0.19	731	0.71	2,733	1.23	4,735
0.20	770	0.72	2,772	1.24	4,774
0.21	808	0.73	2,810	1.25	4,812
0.22	847	0.74	2,849	1.26	4,851
0.23	885	0.75	2,887	1.27	4,889
0.24	924	0.76	2,926	1.28	4,928
0.25	962	0.77	2,964	1.29	4,966
0.26	1,001	0.78	3,003	1.30	5,005
0.27	1,039	0.79	3,041	1.31	5,043
0.28	1,078	0.80	3,080	1.32	5,082
0.29	1,116	0.81	3,118	1.33	5,120
0.30	1,155	0.82	3,157		
0.31	1,193	0.83	3,195		
0.32	1,232	0.84	3,234		
0.33	1,270	0.85	3,272		
0.34	1,309	0.86	3,311		
0.35	1,347	0.87	3,349		
0.36	1,386	0.88	3,388		
0.37	1,424	0.89	3,426		
0.38	1,463	0.90	3,465		
0.39	1,501	0.91	3,503		
0.40	1,540	0.92	3,542		
0.41	1,578	0.93	3,580		
0.42	1,617	0.94	3,619		
0.43	1,655	0.95	3,657		
0.44	1,694	0.96	3,696		
0.45	1,732	0.97	3,734		
0.46	1,771	0.98	3,773		
0.47	1,809	0.99	3,811		
0.48	1,848	1.00	3,850		
0.49	1,886	1.01	3,888		
0.50	1,925	1.02	3,927		
0.51	1,963	1.03	3,965		

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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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Time span=10.00-26.00 hrs, dt=0.05 hrs, 321 points

Runoff by SCS TR-20 method, UH=SCS

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

### Subcatchment 1S: Pre-Construction

Runoff Area=228,839 sf 9.80% Impervious Runoff Depth=2.12"  
Flow Length=500' Tc=14.0 min CN=44 Runoff=8.67 cfs 40,355 cf

### Subcatchment 2S: Post-Construction

Runoff Area=228,838 sf 14.00% Impervious Runoff Depth=2.46"  
Flow Length=500' Tc=14.0 min CN=47 Runoff=10.61 cfs 46,981 cf

### Subcatchment 10S: DA#2 TO Pervious Pavement

Runoff Area=64,365 sf 24.89% Impervious Runoff Depth=3.30"  
Flow Length=150' Slope=0.0500 1' Tc=9.4 min CN=54 Runoff=4.85 cfs 17,676 cf

### Subcatchment 30S: Net Post-Construction

Runoff Area=164,473 sf 9.74% Impervious Runoff Depth=2.12"  
Flow Length=290' Tc=7.5 min CN=44 Runoff=7.60 cfs 29,004 cf

### Pond 20P: Pervious Pavement Infiltration

Peak Elev=1.27' Storage=4,890 cf Inflow=4.85 cfs 17,676 cf  
Outflow=1.00 cfs 17,676 cf

Total Runoff Area = 686,515 sf Runoff Volume = 134,017 cf Average Runoff Depth = 2.34"  
87.40% Pervious = 600,015 sf 12.60% Impervious = 86,500 sf



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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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### Summary for Subcatchment 1S: Pre-Construction

Runoff = 8.67 cfs @ 12.22 hrs, Volume= 40,355 cf, Depth= 2.12"

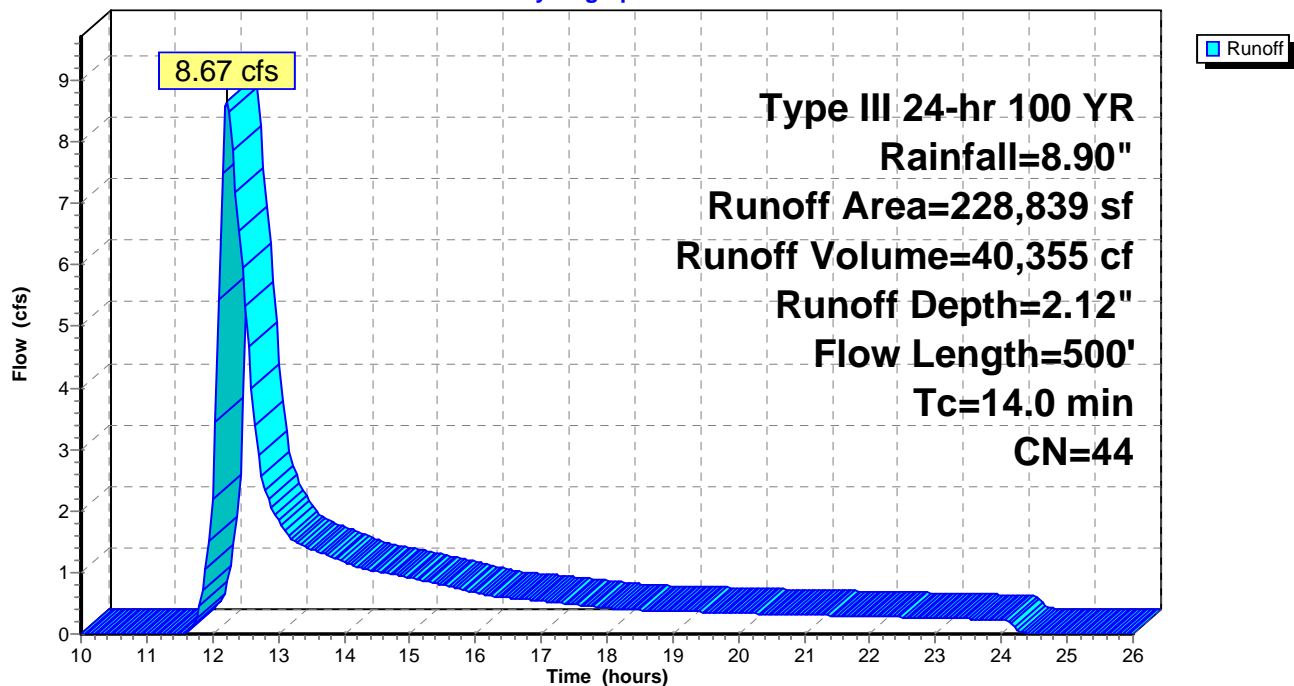
Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100 YR Rainfall=8.90"

	Area (sf)	CN	Description
*	22,426	98	9.8% Lot Coverage
	93,000	36	Woods, Fair, HSG A
	113,413	39	>75% Grass cover, Good, HSG A
	228,839	44	Weighted Average
	206,413		90.20% Pervious Area
	22,426		9.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	150	0.0570	0.28		Sheet Flow, Elev 122.5 to 114
					Grass: Short n= 0.150 P2= 3.20"
5.1	350	0.0520	1.14		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
14.0	500	Total			

### Subcatchment 1S: Pre-Construction

Hydrograph



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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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**Hydrograph for Subcatchment 1S: Pre-Construction**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	1.68	0.00	0.00	23.00	8.82	2.07	0.26
10.25	1.80	0.00	0.00	23.25	8.84	2.08	0.25
10.50	1.93	0.00	0.00	23.50	8.86	2.09	0.24
10.75	2.07	0.00	0.00	23.75	8.88	2.11	0.24
11.00	2.23	0.00	0.00	24.00	<b>8.90</b>	<b>2.12</b>	0.23
11.25	2.41	0.00	0.00	24.25	8.90	2.12	0.07
11.50	2.65	0.00	0.00	24.50	8.90	2.12	0.00
11.75	3.16	0.03	0.27	24.75	8.90	2.12	0.00
12.00	4.45	0.25	<b>2.20</b>	25.00	8.90	2.12	0.00
12.25	5.74	0.64	<b>8.49</b>	25.25	8.90	2.12	0.00
12.50	6.25	0.83	5.33	25.50	8.90	2.12	0.00
12.75	6.49	0.93	2.58	25.75	8.90	2.12	0.00
13.00	6.67	1.01	1.85	26.00	8.90	2.12	0.00
13.25	6.83	1.08	1.50				
13.50	6.97	1.14	1.38				
13.75	7.10	1.20	1.28				
14.00	7.22	1.25	1.17				
14.25	7.32	1.30	1.07				
14.50	7.42	1.35	1.02				
14.75	7.52	1.40	0.97				
15.00	7.60	1.44	0.91				
15.25	7.68	1.48	0.85				
15.50	7.76	1.51	0.80				
15.75	7.82	1.55	0.73				
16.00	7.89	1.58	0.67				
16.25	7.94	1.61	0.62				
16.50	8.00	1.63	0.59				
16.75	8.05	1.66	0.56				
17.00	8.09	1.68	0.53				
17.25	8.14	1.71	0.51				
17.50	8.18	1.73	0.48				
17.75	8.22	1.75	0.45				
18.00	8.26	1.77	0.42				
18.25	8.29	1.79	0.40				
18.50	8.33	1.81	0.39				
18.75	8.36	1.82	0.38				
19.00	8.39	1.84	0.37				
19.25	8.43	1.86	0.36				
19.50	8.46	1.88	0.35				
19.75	8.49	1.89	0.34				
20.00	8.52	1.91	0.34				
20.25	8.55	1.92	0.33				
20.50	8.57	1.94	0.32				
20.75	8.60	1.95	0.32				
21.00	8.63	1.97	0.31				
21.25	8.65	1.98	0.30				
21.50	8.68	1.99	0.30				
21.75	8.70	2.01	0.29				
22.00	8.73	2.02	0.28				
22.25	8.75	2.03	0.28				
22.50	8.78	2.05	0.27				
22.75	8.80	2.06	0.26				

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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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### Summary for Subcatchment 2S: Post-Construction

Runoff = 10.61 cfs @ 12.22 hrs, Volume= 46,981 cf, Depth= 2.46"

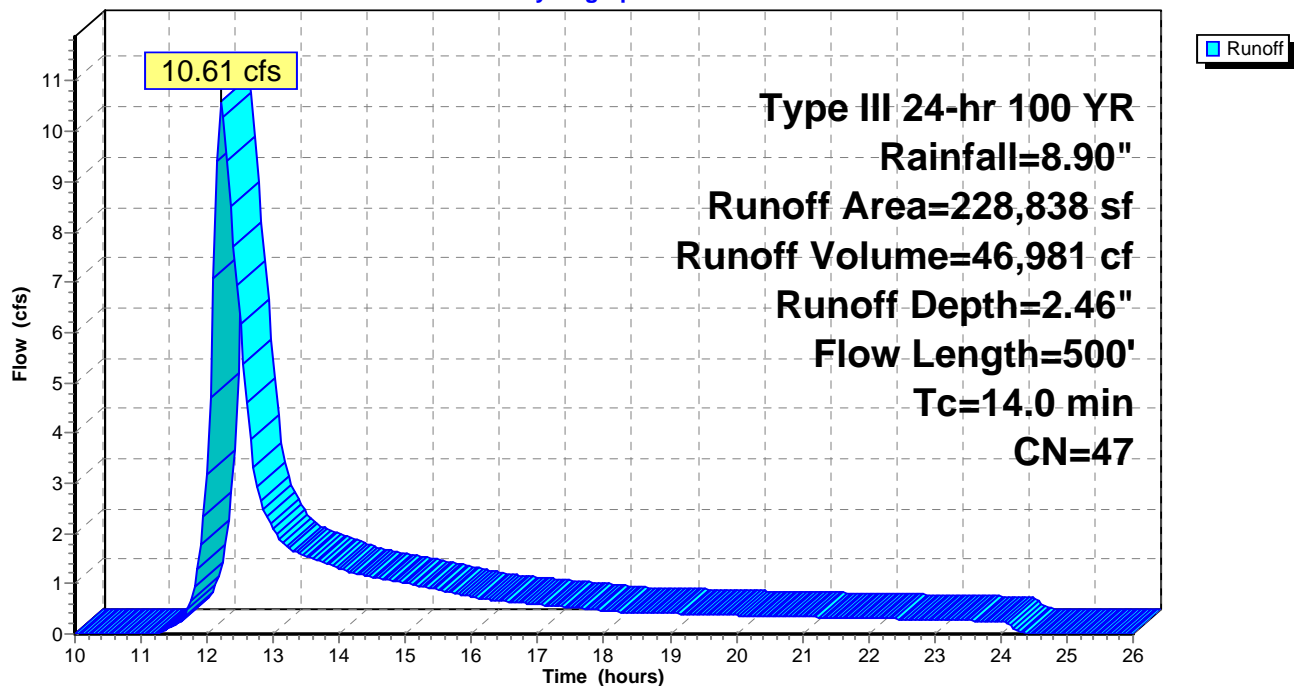
Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100 YR Rainfall=8.90"

	Area (sf)	CN	Description
*	32,037	98	14% Lot Coverage
	24,000	36	Woods, Fair, HSG A
	172,801	39	>75% Grass cover, Good, HSG A
	228,838	47	Weighted Average
	196,801		86.00% Pervious Area
	32,037		14.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	150	0.0570	0.28		Sheet Flow, Elev 122.5 to 114
					Grass: Short n= 0.150 P2= 3.20"
5.1	350	0.0520	1.14		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
14.0	500	Total			

### Subcatchment 2S: Post-Construction

Hydrograph



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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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**Hydrograph for Subcatchment 2S: Post-Construction**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	1.68	0.00	0.00	23.00	8.82	2.42	0.28
10.25	1.80	0.00	0.00	23.25	8.84	2.43	0.27
10.50	1.93	0.00	0.00	23.50	8.86	2.44	0.26
10.75	2.07	0.00	0.00	23.75	8.88	2.45	0.26
11.00	2.23	0.00	0.00	24.00	<b>8.90</b>	<b>2.46</b>	0.25
11.25	2.41	0.00	0.02	24.25	8.90	2.46	0.07
11.50	2.65	0.01	0.16	24.50	8.90	2.46	0.01
11.75	3.16	0.07	0.67	24.75	8.90	2.46	0.00
12.00	4.45	0.36	<b>3.17</b>	25.00	8.90	2.46	0.00
12.25	5.74	0.82	<b>10.29</b>	25.25	8.90	2.46	0.00
12.50	6.25	1.04	6.17	25.50	8.90	2.46	0.00
12.75	6.49	1.15	2.93	25.75	8.90	2.46	0.00
13.00	6.67	1.24	2.09	26.00	8.90	2.46	0.00
13.25	6.83	1.32	1.69				
13.50	6.97	1.39	1.55				
13.75	7.10	1.46	1.43				
14.00	7.22	1.52	1.31				
14.25	7.32	1.57	1.20				
14.50	7.42	1.62	1.13				
14.75	7.52	1.67	1.07				
15.00	7.60	1.72	1.01				
15.25	7.68	1.76	0.95				
15.50	7.76	1.80	0.88				
15.75	7.82	1.84	0.81				
16.00	7.89	1.87	0.74				
16.25	7.94	1.91	0.68				
16.50	8.00	1.94	0.65				
16.75	8.05	1.96	0.62				
17.00	8.09	1.99	0.59				
17.25	8.14	2.02	0.56				
17.50	8.18	2.04	0.52				
17.75	8.22	2.06	0.49				
18.00	8.26	2.09	0.46				
18.25	8.29	2.11	0.43				
18.50	8.33	2.13	0.42				
18.75	8.36	2.15	0.41				
19.00	8.39	2.16	0.40				
19.25	8.43	2.18	0.40				
19.50	8.46	2.20	0.39				
19.75	8.49	2.22	0.38				
20.00	8.52	2.24	0.37				
20.25	8.55	2.25	0.36				
20.50	8.57	2.27	0.35				
20.75	8.60	2.29	0.34				
21.00	8.63	2.30	0.34				
21.25	8.65	2.32	0.33				
21.50	8.68	2.33	0.32				
21.75	8.70	2.35	0.32				
22.00	8.73	2.36	0.31				
22.25	8.75	2.37	0.30				
22.50	8.78	2.39	0.29				
22.75	8.80	2.40	0.29				

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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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### Summary for Subcatchment 10S: DA#2 TO Pervious Pavement Section

Runoff = 4.85 cfs @ 12.14 hrs, Volume= 17,676 cf, Depth= 3.30"

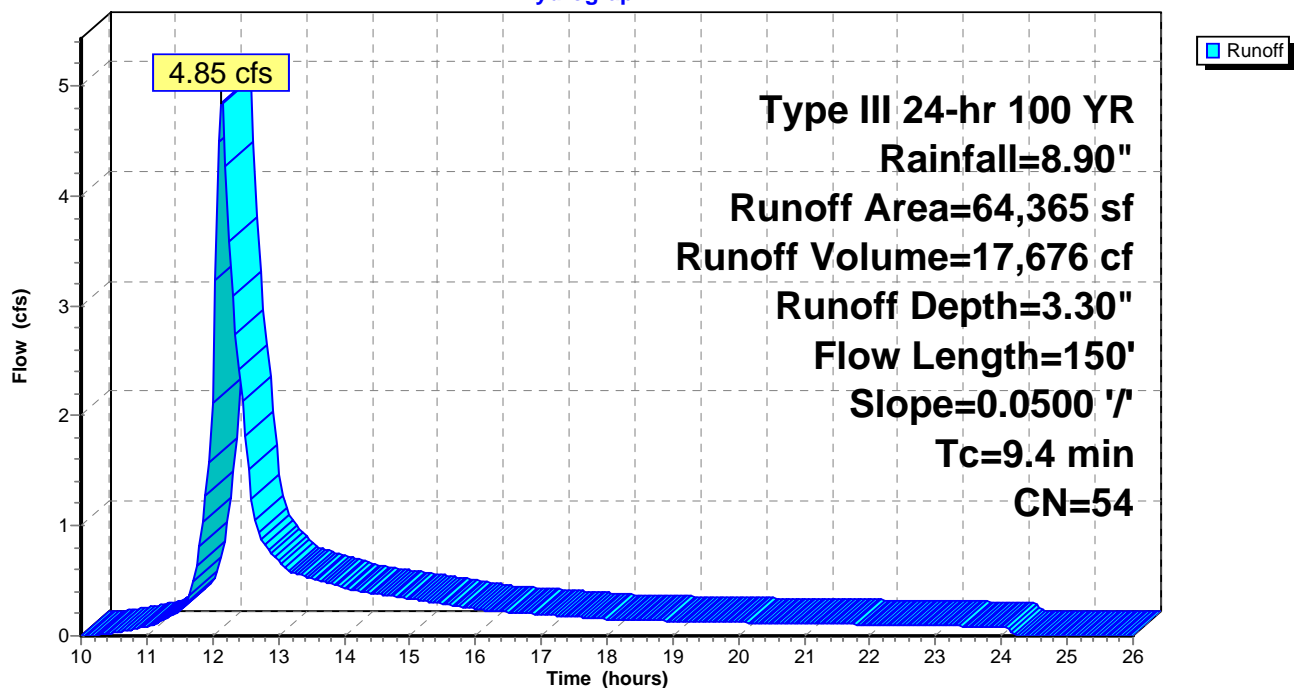
Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100 YR Rainfall=8.90"

	Area (sf)	CN	Description
*	16,022	98	
	48,343	39	>75% Grass cover, Good, HSG A
	64,365	54	Weighted Average
	48,343		75.11% Pervious Area
	16,022		24.89% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.4	150	0.0500	0.27		Sheet Flow, ELEV. 122.5 TO 115 Grass: Short n= 0.150 P2= 3.20"

### Subcatchment 10S: DA#2 TO Pervious Pavement Section

Hydrograph



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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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**Hydrograph for Subcatchment 10S: DA#2 TO Pervious Pavement Section**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	1.68	0.00	0.00	23.00	8.82	3.24	0.09
10.25	1.80	0.00	0.00	23.25	8.84	3.25	0.09
10.50	1.93	0.01	0.03	23.50	8.86	3.27	0.09
10.75	2.07	0.02	0.05	23.75	8.88	3.28	0.08
11.00	2.23	0.03	0.09	24.00	<b>8.90</b>	<b>3.30</b>	0.08
11.25	2.41	0.05	0.14	24.25	8.90	3.30	0.01
11.50	2.65	0.10	0.23	24.50	8.90	3.30	0.00
11.75	3.16	0.21	0.64	24.75	8.90	3.30	0.00
12.00	4.45	0.67	<b>2.12</b>	25.00	8.90	3.30	0.00
12.25	5.74	1.30	<b>3.58</b>	25.25	8.90	3.30	0.00
12.50	6.25	1.58	1.82	25.50	8.90	3.30	0.00
12.75	6.49	1.72	0.87	25.75	8.90	3.30	0.00
13.00	6.67	1.83	0.68	26.00	8.90	3.30	0.00
13.25	6.83	1.93	0.57				
13.50	6.97	2.01	0.52				
13.75	7.10	2.09	0.48				
14.00	7.22	2.17	0.44				
14.25	7.32	2.23	0.40				
14.50	7.42	2.30	0.38				
14.75	7.52	2.36	0.36				
15.00	7.60	2.41	0.34				
15.25	7.68	2.47	0.31				
15.50	7.76	2.51	0.29				
15.75	7.82	2.56	0.27				
16.00	7.89	2.60	0.24				
16.25	7.94	2.64	0.23				
16.50	8.00	2.67	0.21				
16.75	8.05	2.71	0.20				
17.00	8.09	2.74	0.19				
17.25	8.14	2.77	0.18				
17.50	8.18	2.80	0.17				
17.75	8.22	2.83	0.16				
18.00	8.26	2.85	0.15				
18.25	8.29	2.87	0.14				
18.50	8.33	2.90	0.14				
18.75	8.36	2.92	0.14				
19.00	8.39	2.94	0.13				
19.25	8.43	2.97	0.13				
19.50	8.46	2.99	0.13				
19.75	8.49	3.01	0.12				
20.00	8.52	3.03	0.12				
20.25	8.55	3.05	0.12				
20.50	8.57	3.07	0.12				
20.75	8.60	3.09	0.11				
21.00	8.63	3.10	0.11				
21.25	8.65	3.12	0.11				
21.50	8.68	3.14	0.11				
21.75	8.70	3.16	0.10				
22.00	8.73	3.17	0.10				
22.25	8.75	3.19	0.10				
22.50	8.78	3.21	0.10				
22.75	8.80	3.22	0.09				

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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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### Summary for Subcatchment 30S: Net Post-Construction

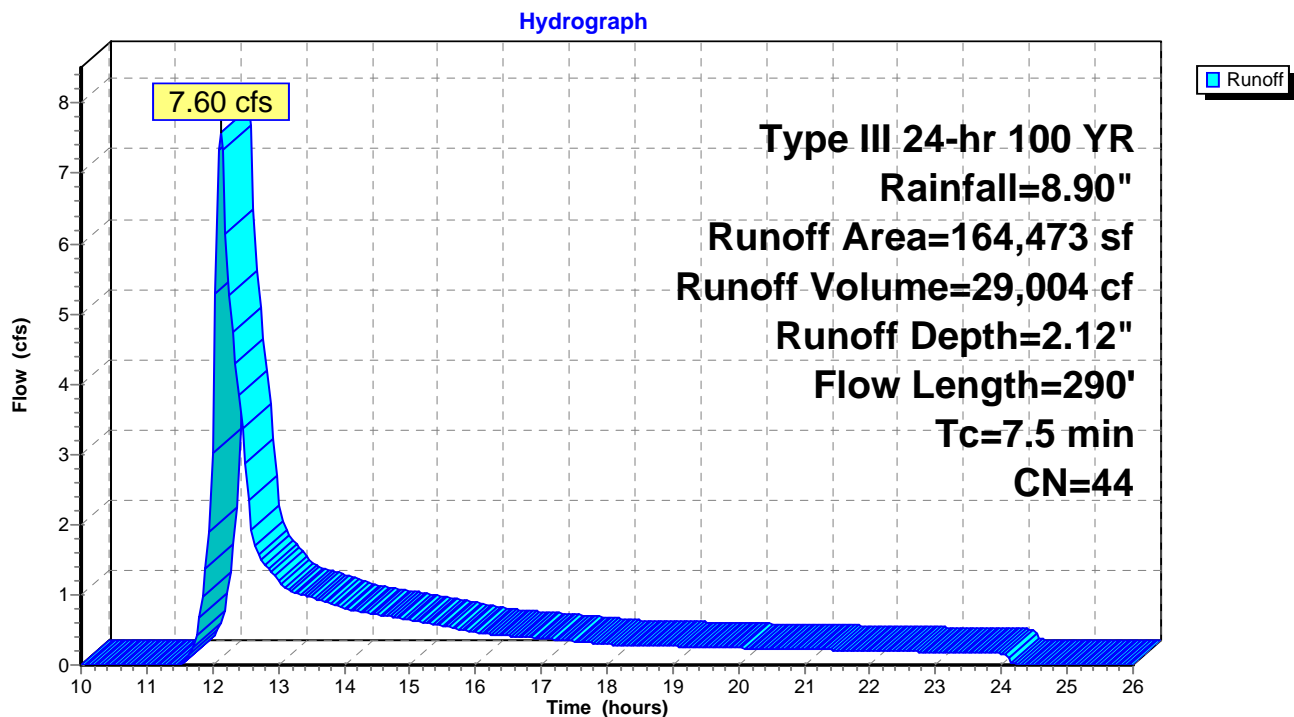
Runoff = 7.60 cfs @ 12.12 hrs, Volume= 29,004 cf, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs  
Type III 24-hr 100 YR Rainfall=8.90"

	Area (sf)	CN	Description
*	16,015	98	14% Lot Coverage less pavement
	24,000	36	Woods, Fair, HSG A
	124,458	39	>75% Grass cover, Good, HSG A
	164,473	44	Weighted Average
	148,458		90.26% Pervious Area
	16,015		9.74% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.8	66	0.0530	0.23		Sheet Flow, Elev 116 to 112.5
					Grass: Short n= 0.150 P2= 3.20"
2.7	224	0.0750	1.37		Shallow Concentrated Flow, To Cheswick Court
					Woodland Kv= 5.0 fps
7.5	290	Total			

### Subcatchment 30S: Net Post-Construction



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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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**Hydrograph for Subcatchment 30S: Net Post-Construction**

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
10.00	1.68	0.00	0.00	23.00	8.82	2.07	0.18
10.25	1.80	0.00	0.00	23.25	8.84	2.08	0.18
10.50	1.93	0.00	0.00	23.50	8.86	2.09	0.17
10.75	2.07	0.00	0.00	23.75	8.88	2.11	0.17
11.00	2.23	0.00	0.00	24.00	<b>8.90</b>	<b>2.12</b>	0.16
11.25	2.41	0.00	0.00	24.25	8.90	2.12	0.00
11.50	2.65	0.00	0.01	24.50	8.90	2.12	0.00
11.75	3.16	0.03	0.43	24.75	8.90	2.12	0.00
12.00	4.45	0.25	<b>3.02</b>	25.00	8.90	2.12	0.00
12.25	5.74	0.64	<b>5.27</b>	25.25	8.90	2.12	0.00
12.50	6.25	0.83	2.87	25.50	8.90	2.12	0.00
12.75	6.49	0.93	1.49	25.75	8.90	2.12	0.00
13.00	6.67	1.01	1.20	26.00	8.90	2.12	0.00
13.25	6.83	1.08	1.03				
13.50	6.97	1.14	0.96				
13.75	7.10	1.20	0.89				
14.00	7.22	1.25	0.81				
14.25	7.32	1.30	0.75				
14.50	7.42	1.35	0.72				
14.75	7.52	1.40	0.68				
15.00	7.60	1.44	0.64				
15.25	7.68	1.48	0.60				
15.50	7.76	1.51	0.55				
15.75	7.82	1.55	0.51				
16.00	7.89	1.58	0.47				
16.25	7.94	1.61	0.43				
16.50	8.00	1.63	0.41				
16.75	8.05	1.66	0.40				
17.00	8.09	1.68	0.38				
17.25	8.14	1.71	0.36				
17.50	8.18	1.73	0.34				
17.75	8.22	1.75	0.31				
18.00	8.26	1.77	0.29				
18.25	8.29	1.79	0.28				
18.50	8.33	1.81	0.28				
18.75	8.36	1.82	0.27				
19.00	8.39	1.84	0.26				
19.25	8.43	1.86	0.26				
19.50	8.46	1.88	0.25				
19.75	8.49	1.89	0.25				
20.00	8.52	1.91	0.24				
20.25	8.55	1.92	0.23				
20.50	8.57	1.94	0.23				
20.75	8.60	1.95	0.22				
21.00	8.63	1.97	0.22				
21.25	8.65	1.98	0.22				
21.50	8.68	1.99	0.21				
21.75	8.70	2.01	0.21				
22.00	8.73	2.02	0.20				
22.25	8.75	2.03	0.20				
22.50	8.78	2.05	0.19				
22.75	8.80	2.06	0.19				



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St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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**Summary for Pond 20P: Pervious Pavement Infiltration**

Inflow Area = 64,365 sf, 24.89% Impervious, Inflow Depth = 3.30" for 100 YR event  
 Inflow = 4.85 cfs @ 12.14 hrs, Volume= 17,676 cf  
 Outflow = 1.00 cfs @ 11.95 hrs, Volume= 17,676 cf, Atten= 79%, Lag= 0.0 min  
 Primary = 1.00 cfs @ 11.95 hrs, Volume= 17,676 cf

Routing by Stor-Ind method, Time Span= 10.00-26.00 hrs, dt= 0.05 hrs

Peak Elev= 1.27' @ 12.67 hrs Surf.Area= 0 sf Storage= 4,890 cf

Plug-Flow detention time= 35.4 min calculated for 17,621 cf (100% of inflow)

Center-of-Mass det. time= 35.3 min ( 892.2 - 857.0 )

Volume	Invert	Avail.Storage	Storage Description
#1	0.00'	5,120 cf	<b>Custom Stage Data</b> Listed below

Elevation (feet)	Cum.Store (cubic-feet)
0.00	0
1.33	5,120

Device	Routing	Invert	Outlet Devices
#1	Primary	0.00'	<b>9600 sq. ft. INFILTRATION</b> Elev. (feet) 0.00 0.10 1.00 Disch. (cfs) 0.000 1.000 1.000

**Primary OutFlow** Max=1.00 cfs @ 11.95 hrs HW=0.11' (Free Discharge)

↑1=9600 sq. ft. INFILTRATION (Custom Controls 1.00 cfs)

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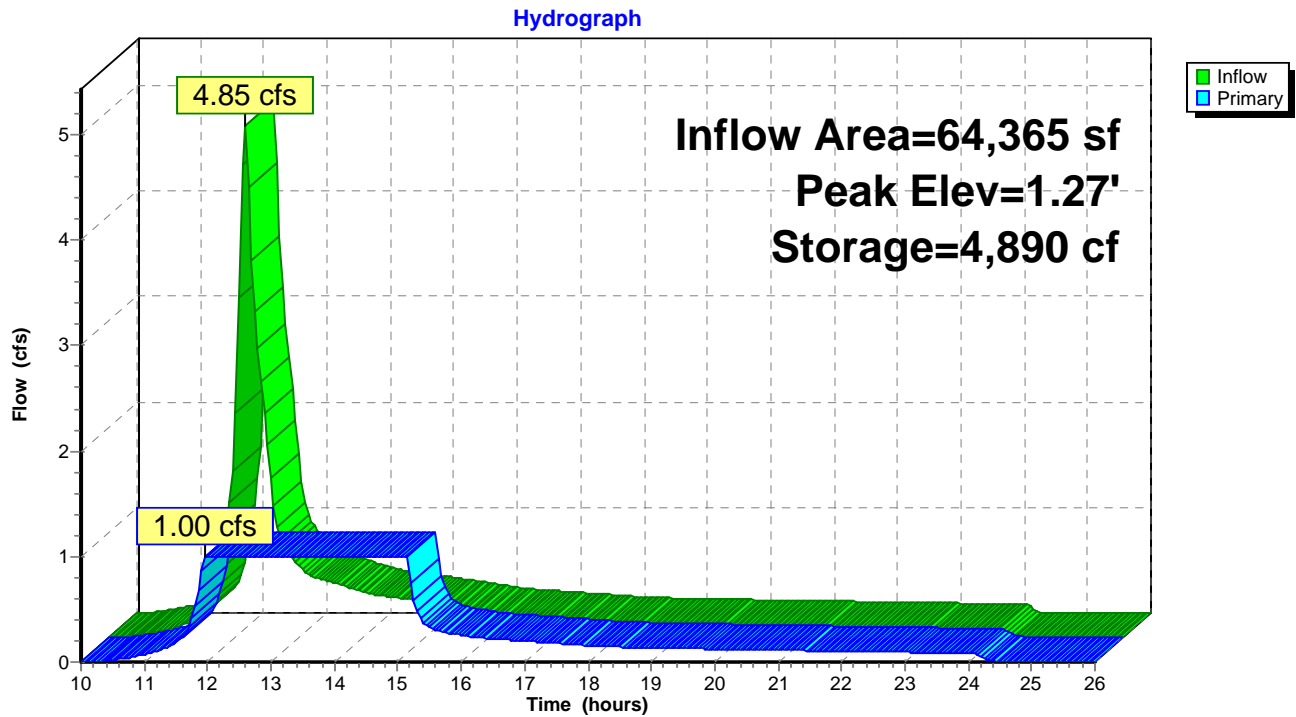
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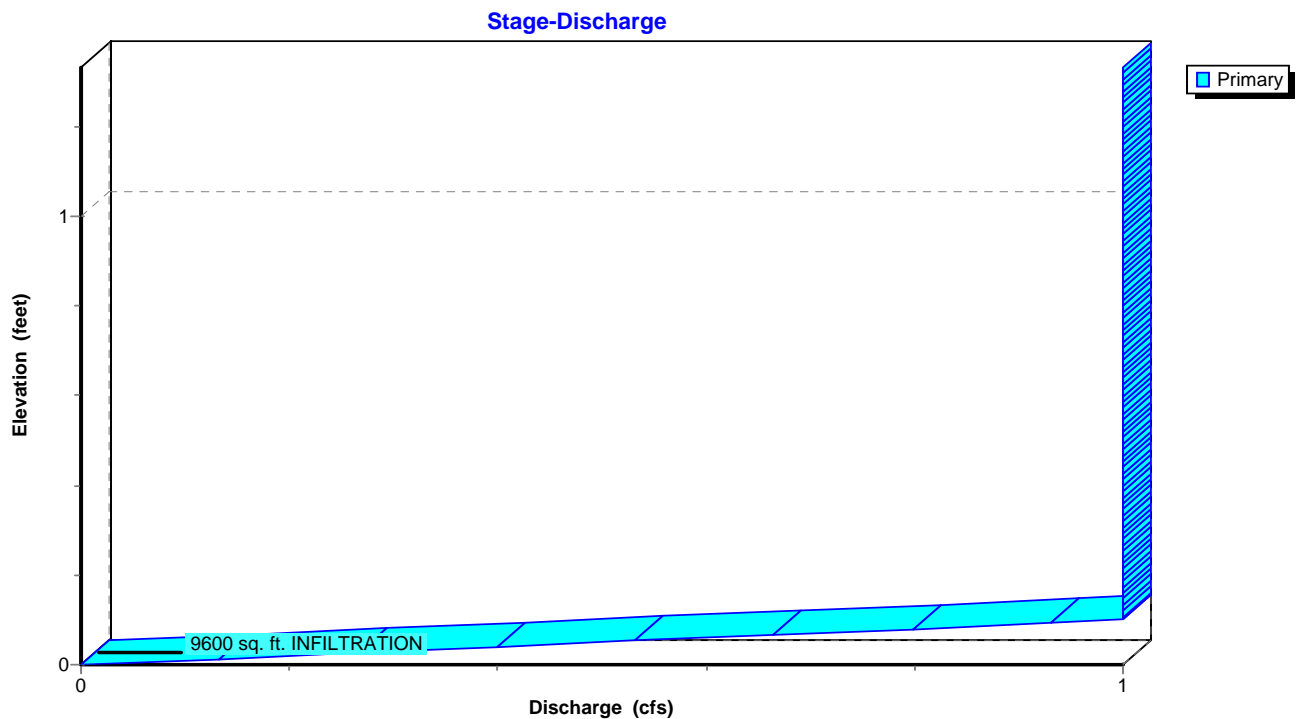
St. George Cemetery Expansion  
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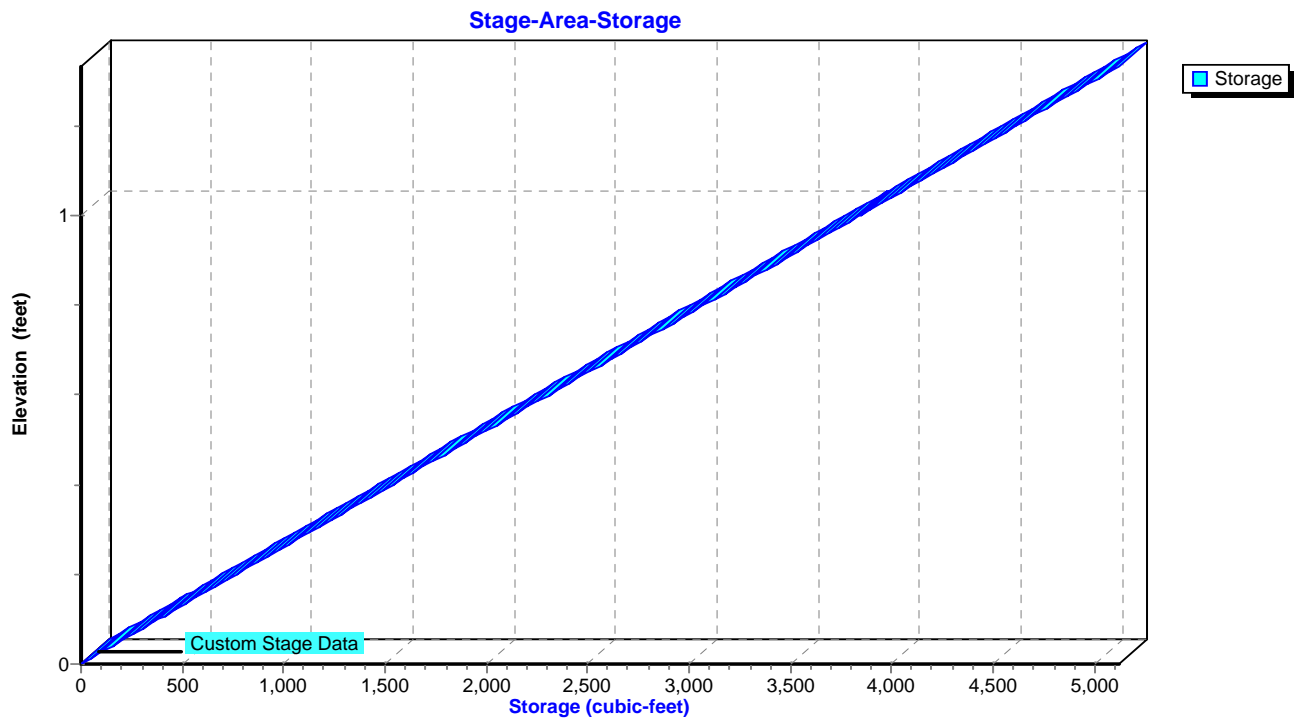
### Pond 20P: Pervious Pavement Infiltration



### Pond 20P: Pervious Pavement Infiltration



### Pond 20P: Pervious Pavement Infiltration



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### Hydrograph for Pond 20P: Pervious Pavement Infiltration

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
10.00	0.00	0	0.00	0.00
10.50	0.03	7	0.00	0.02
11.00	0.09	28	0.01	0.07
11.50	0.23	74	0.02	<b>0.19</b>
12.00	<b>2.12</b>	573	0.15	<b>1.00</b>
12.50	<b>1.82</b>	<b>4,673</b>	<b>1.21</b>	1.00
13.00	0.68	<b>4,661</b>	<b>1.21</b>	1.00
13.50	0.52	3,904	1.01	1.00
14.00	0.44	2,971	0.77	1.00
14.50	0.38	1,899	0.49	1.00
15.00	0.34	745	0.19	1.00
15.50	0.29	125	0.03	0.32
16.00	0.24	98	0.03	0.25
16.50	0.21	84	0.02	0.22
17.00	0.19	76	0.02	0.20
17.50	0.17	68	0.02	0.18
18.00	0.15	60	0.02	0.16
18.50	0.14	54	0.01	0.14
19.00	0.13	52	0.01	0.14
19.50	0.13	50	0.01	0.13
20.00	0.12	47	0.01	0.12
20.50	0.12	45	0.01	0.12
21.00	0.11	43	0.01	0.11
21.50	0.11	41	0.01	0.11
22.00	0.10	39	0.01	0.10
22.50	0.10	37	0.01	0.10
23.00	0.09	36	0.01	0.09
23.50	0.09	34	0.01	0.09
24.00	0.08	32	0.01	0.08
24.50	0.00	1	0.00	0.00
25.00	0.00	0	0.00	0.00
25.50	0.00	0	0.00	0.00
26.00	0.00	0	0.00	0.00

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Type III 24-hr 100 YR Rainfall=8.90"

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**Stage-Discharge for Pond 20P: Pervious Pavement Infiltration**

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
0.00	0.00	0.52	1.00	1.04	1.00
0.01	0.10	0.53	1.00	1.05	1.00
0.02	0.20	0.54	1.00	1.06	1.00
0.03	0.30	0.55	1.00	1.07	1.00
0.04	0.40	0.56	1.00	1.08	1.00
0.05	0.50	0.57	1.00	1.09	1.00
0.06	0.60	0.58	1.00	1.10	1.00
0.07	0.70	0.59	1.00	1.11	1.00
0.08	0.80	0.60	1.00	1.12	1.00
0.09	0.90	0.61	1.00	1.13	1.00
0.10	1.00	0.62	1.00	1.14	1.00
0.11	1.00	0.63	1.00	1.15	1.00
0.12	1.00	0.64	1.00	1.16	1.00
0.13	1.00	0.65	1.00	1.17	1.00
0.14	1.00	0.66	1.00	1.18	1.00
0.15	1.00	0.67	1.00	1.19	1.00
0.16	1.00	0.68	1.00	1.20	1.00
0.17	1.00	0.69	1.00	1.21	1.00
0.18	1.00	0.70	1.00	1.22	1.00
0.19	1.00	0.71	1.00	1.23	1.00
0.20	1.00	0.72	1.00	1.24	1.00
0.21	1.00	0.73	1.00	1.25	1.00
0.22	1.00	0.74	1.00	1.26	1.00
0.23	1.00	0.75	1.00	1.27	1.00
0.24	1.00	0.76	1.00	1.28	1.00
0.25	1.00	0.77	1.00	1.29	1.00
0.26	1.00	0.78	1.00	1.30	1.00
0.27	1.00	0.79	1.00	1.31	1.00
0.28	1.00	0.80	1.00	1.32	1.00
0.29	1.00	0.81	1.00	1.33	1.00
0.30	1.00	0.82	1.00		
0.31	1.00	0.83	1.00		
0.32	1.00	0.84	1.00		
0.33	1.00	0.85	1.00		
0.34	1.00	0.86	1.00		
0.35	1.00	0.87	1.00		
0.36	1.00	0.88	1.00		
0.37	1.00	0.89	1.00		
0.38	1.00	0.90	1.00		
0.39	1.00	0.91	1.00		
0.40	1.00	0.92	1.00		
0.41	1.00	0.93	1.00		
0.42	1.00	0.94	1.00		
0.43	1.00	0.95	1.00		
0.44	1.00	0.96	1.00		
0.45	1.00	0.97	1.00		
0.46	1.00	0.98	1.00		
0.47	1.00	0.99	1.00		
0.48	1.00	1.00	1.00		
0.49	1.00	1.01	1.00		
0.50	1.00	1.02	1.00		
0.51	1.00	1.03	1.00		

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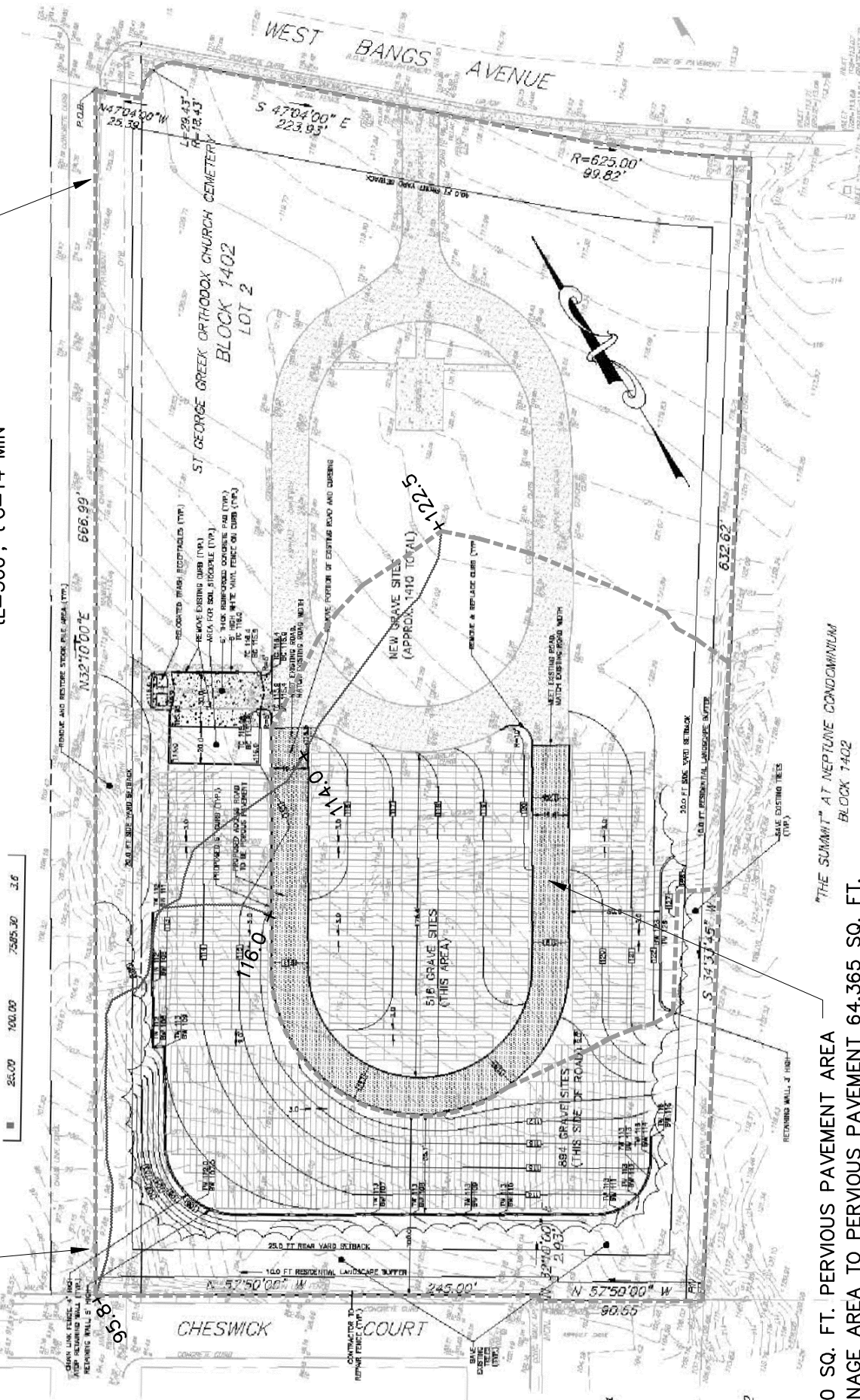
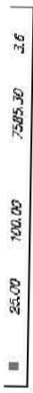
St. George Cemetery Expansion  
Type III 24-hr 100 YR Rainfall=8.90"

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**Stage-Area-Storage for Pond 20P: Pervious Pavement Infiltration**

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
0.00	0	0.52	2,002	1.04	4,004
0.01	38	0.53	2,040	1.05	4,042
0.02	77	0.54	2,079	1.06	4,081
0.03	115	0.55	2,117	1.07	4,119
0.04	154	0.56	2,156	1.08	4,158
0.05	192	0.57	2,194	1.09	4,196
0.06	231	0.58	2,233	1.10	4,235
0.07	269	0.59	2,271	1.11	4,273
0.08	308	0.60	2,310	1.12	4,312
0.09	346	0.61	2,348	1.13	4,350
0.10	385	0.62	2,387	1.14	4,389
0.11	423	0.63	2,425	1.15	4,427
0.12	462	0.64	2,464	1.16	4,466
0.13	500	0.65	2,502	1.17	4,504
0.14	539	0.66	2,541	1.18	4,543
0.15	577	0.67	2,579	1.19	4,581
0.16	616	0.68	2,618	1.20	4,620
0.17	654	0.69	2,656	1.21	4,658
0.18	693	0.70	2,695	1.22	4,697
0.19	731	0.71	2,733	1.23	4,735
0.20	770	0.72	2,772	1.24	4,774
0.21	808	0.73	2,810	1.25	4,812
0.22	847	0.74	2,849	1.26	4,851
0.23	885	0.75	2,887	1.27	4,889
0.24	924	0.76	2,926	1.28	4,928
0.25	962	0.77	2,964	1.29	4,966
0.26	1,001	0.78	3,003	1.30	5,005
0.27	1,039	0.79	3,041	1.31	5,043
0.28	1,078	0.80	3,080	1.32	5,082
0.29	1,116	0.81	3,118	1.33	5,120
0.30	1,155	0.82	3,157		
0.31	1,193	0.83	3,195		
0.32	1,232	0.84	3,234		
0.33	1,270	0.85	3,272		
0.34	1,309	0.86	3,311		
0.35	1,347	0.87	3,349		
0.36	1,386	0.88	3,388		
0.37	1,424	0.89	3,426		
0.38	1,463	0.90	3,465		
0.39	1,501	0.91	3,503		
0.40	1,540	0.92	3,542		
0.41	1,578	0.93	3,580		
0.42	1,617	0.94	3,619		
0.43	1,655	0.95	3,657		
0.44	1,694	0.96	3,696		
0.45	1,732	0.97	3,734		
0.46	1,771	0.98	3,773		
0.47	1,809	0.99	3,811		
0.48	1,848	1.00	3,850		
0.49	1,886	1.01	3,888		
0.50	1,925	1.02	3,927		
0.51	1,963	1.03	3,965		

## E | Drainage Area Map

$t_L=290', t'_C=7.5 \text{ MIN.}$  $t_L=500', t'_C=14 \text{ MIN}$ 

"THE SUMMIT" AT NEPTUNE CONDOMINIUM  
BLOCK 1402

BLOCK 1402

 $t_L=150'$ ,  $t'C=9.4$  MIN.

DRAINAGE AREA MAP SCALE 1 INCH = 80 FEET.