# STORM WATER MANAGEMENT REPORT

**SITE LOCATION:**
Beaudry Services, Inc.
1522 Pearl Street
Waukesha, WI

**PREPARED FOR:**
Korb and Associates Architects
648 N Plankinton Ave., Suite. 240
Milwaukee, Wisconsin 53203

**PREPARED BY:**
The Sigma Group, Inc.
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Milwaukee, WI 53233
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**June 12, 2017**

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## 1. INTRODUCTION

This report presents the proposed storm water management plan, including supporting modeling, analyses and plans/figures, for the proposed Beaudry Services, Inc. Development. The project site is bound by Pearl Street to the south, a wetland to the north and commercial property to the east and west and is located in the City of Waukesha, Wisconsin.

This project involves the redevelopment of approximately 2.98 acres of an existing 5.76 acre site. The project involves rough grading of the site, the construction of two new buildings, utilities, associated parking and driveway. The storm water management facility proposed has been designed to accommodate the developments improvements.

## 2. EXISTING CONDITIONS SUMMARY

The existing 2.98 acres site consists mainly of greenspace with and a gravel area that was used for parking semi-trucks. The site generally drains south to north towards an existing wetland.

The existing soils and hydraulic group on the site, according to NRCS soil mapping, include the following: approximately 4.1% Hochheim loam (HmB), 18.2% Houghton Muck (HtA), 11.8% Lamartime Silt Loam (LmB), 40.4% Loamy land (Lu), 5.1% Pella Silt Loam (PH) and 20.4% Water (W). The NRCS soil mapping classifies the majority of the soils as hydraulic group 'D' for HmB and Lu, LmB and Ph group B/D and HtA group 'A/D'. The geotechnical report boring logs identify the soil as Silty Clay Fill or Silty Clay with sand and gravel Fill and Silty Sand with gravel Fill. The native soil below the fill material was identified as Silty Clay. For the purpose of modeling a hydraulic group 'D' was used. Refer to NRCS soil mapping and geotechnical report in Appendix A. Data used to model the site for pre-developed conditions, including surface areas, flow paths, times of concentration, and runoff curve numbers are presented in Figure SW 1.0.

## 3. PROPOSED CONDITIONS SUMMARY

As discussed in the Introduction section, this project involves the redevelopment of a 2.98 acre site. The site will include master grading and construction of infrastructure improvements to accommodate a new commercial building, access drive, associated parking, utilities and the construction of storm water management facilities. The new buildings will have footprints of approximately 9,600 square feet and 7,600 square feet. The anticipated impervious area is approximately 1.89 acres.

The project site will drain to a storm water management facility, located in north portion of the site. The storm water draining to the facility will be collected on-site and conveyed by storm sewer and surface drain sheet flow to a wet detention basin. The storm water draining to the south portion of the site will surface discharge into the public right-or-way and collected in the existing storm sewer.

The total drainage areas draining to the wet detention basin A is 2.33 ac. The wet detention basin will discharge north into the existing wetland located north of the redevelopment. The storm water management facility has been designed to provide peak flow control, volume control and storm water treatment to meet City of Waukesha, and WDNR storm water management requirements for the development site.

Data used to model the site under developed conditions, including surface areas, flow paths, times of concentration, and runoff curve numbers is presented in Figure SW 2.0.

## 4. STORM WATER MANAGEMENT REQUIREMENTS

As a redevelopment project that will disturb more than one acre of land and will create more than ½ acre of additional impervious area, the project will be subject to the following storm water management requirements under WDNR NR 151 and City of Waukesha storm water management regulations.

QUALITY
WDNR NR 151 / City of Waukesha Chapter 32.10(d)(2)(ii)
Reduce to the maximum extent practicable, the total suspended solids load by 40%, based on an average annual rainfall, as compared to no runoff management controls.

QUANTITY
City of Waukesha Chapter 32.10(d)(1)(A)
For redevelopment the calculated post-development peak storm water discharge rate shall not exceed the calculated pre-development discharge rates for the 2-year, 10-year, and 100-year, 24-hour design storms.

## 5. DESCRIPTION OF PROPOSED STORM WATER MANAGEMENT FACILITIES

Storm water treatment and control requirements for the redevelopment will be achieved through the use a wet detention basin.

The wet detention basin is discharged through an outlet control structures which restricts storm water discharge using a 6" orifice at elevation 849.5, a 9" orifice at elevation 850.0, and a weir at elevation 851.25. A 15" diameter outlet storm sewer pipe discharges the storm water from the outlet control structure into the existing wetland at the northern portion of the property. The normal water level of the wet detention basin is 849.5. The high water elevation for the 100-year, 24-hour storm event is 851.49. An emergency spillway is provided at an elevation of 851.50 to allow overflow into the existing storm water basin to the north during heavy rainfall events or in case of blockage of outlet pipes.

## 6. MODELING & CALCULATIONS

The hydraulic calculations and analysis presented in this report were performed using HydroCad Watershed Modeling software which utilizes the methodologies of TR-55 for

a hydrograph based analysis of watershed conditions. Hydrographs were developed using a standard MSE3 unit hydrograph for the various 24-hr storm events. Rainfall depths used in this model area as follows: 2 year = 2.70 in., 10 year = 3.81 in., 100 year = 6.18 in.

WinSLAMM modeling was used to model TSS removal for the storm water management measures.

Based on the NRCS soils data for the site, the majority of the native soils are type D soils (CN = 80), Based on the Geotechnical report the majority of the soils are Silty Clay Fill or Silty Clay with sand and gravel Fill and Silty Sand with gravel Fill. The native soil below the fill material was identified as Silty Clay therefore a type D soil was used in the modeling.

Time of concentration values were calculated based on the standard TR-55 method.

Refer to Figures SW 1.0 and SW 2.0 for data (surface areas, curve numbers, times of concentration, etc.) used to model pre-development and post development conditions.

HydroCad and WinSLAMM modeling backup are presented in Appendices B and C, respectively.

## 7. SUMMARY OF MODELING/CALCULATIONS

A summary of results for can be viewed in the tables below:

| Storm Frequency (yr) | Pre-development Site Conditions | Post-Development Site Conditions |
|---|---|---|
| | Peak Runoff Discharge Rate (cfs) | Peak Runoff Discharge Rate (cfs) |
| **2** | 2.99 | 2.34 |
| **10** | 5.59 | 4.18 |
| **100** | 11.62 | 8.34 |

Water Quality (TSS Reduction) Summary Table:

| Drainage Area (AC) | Pounds of TSS Loading Generated by Exposed Pavement and Roads (lbs) | Pounds of TSS Remaining After Post Control Treatment (lbs) | Removal Rate |
|---|---|---|---|
| **2.84** | **1941** | **629.1** | **67.59%** |

The wet detention basin will remove more than 40% TSS required by WDNR and City

regulations.

## 8. CONSTRUCTION

A construction site WPDES permit will be in place before land disturbing activities begin. Erosion control inspection during construction will be the responsibility of the General Contractor and erosion control inspection reports will be kept on-site during construction.

## 9. MAINTENANCE PLAN

The Owner will be responsible for the regular inspection of the storm water management facilities to ensure that they are functioning properly and the Owner will be required to enter into a storm water maintenance agreement with the City. A draft of the storm water maintenance agreement including a listing of inspection and maintenance activities with frequencies is included in Appendix D.

## 10. CONCLUSION

Based on Sigma's evaluation, the proposed storm water management approach as summarized in this report and presented on the attached plans and attachments, meets City and WDNR storm water management requirements for both flow control and TSS removal.

# Appendix A

## Soils Map & Geotechnical Report

# Hydrologic Soil Group—Milwaukee and Waukesha Counties, Wisconsin
(NRCS Soil Map Hydrologic Soil Group)


88° 12' 22" W
88° 12' 13" W
43° 0' 36" N
43° 0' 25" N
401710
401740
401770
401800
401830
401860
401890
4762630
4762600
4762570
4762540
4762510
4762480
4762450
4762420
4762390
4762360
4762330

Map Scale: 1:914 if printed on B portrait (11" x 17") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 40 80 160 240

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

## 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

**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

**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 1:15,800.

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: Milwaukee and Waukesha Counties, Wisconsin
Survey Area Data: Version 12, Sep 28, 2016

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

Date(s) aerial images were photographed: Sep 7, 2014—Sep 22, 2014

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.

# Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — Milwaukee and Waukesha Counties, Wisconsin (WI602) | | | | |
|---|---|---|---|---|
| **Map unit symbol** | **Map unit name** | **Rating** | **Acres in AOI** | **Percent of AOI** |
| HmB | Hochheim loam, 2 to 6 percent slopes | D | 0.3 | 4.1% |
| HtA | Houghton muck, 0 to 2 percent slopes | A/D | 1.2 | 18.2% |
| LmB | Lamartine silt loam, 0 to 3 percent slopes | B/D | 0.8 | 11.8% |
| Lu | Loamy land | D | 2.7 | 40.4% |
| Ph | Pella silt loam, 0 to 2 percent slopes | B/D | 0.3 | 5.1% |
| W | Water | | 1.4 | 20.4% |
| **Totals for Area of Interest** | | | **6.7** | **100.0%** |

## Description

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.

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.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

**REPORT OF**

**SUBSURFACE EXPLORATION AND**
**GEOTECHNICAL ENGINEERING SERVICES**

**PROPOSED BEAUDRY SERVICES DEVELOPMENT**
**1514 PEARL STREET**
**WAUKESHA, WISCONSIN**

**ECS PROJECT NO. 42:1408**

**FOR**

**BEAUDRY SERVICES, INC**
**WAUKESHA, WISCONSIN**

**MAY 18, 2017**

ECS MIDWEST, LLC
Geotechnical • Construction Materials • Environmental • Facilities

"Setting the Standard for Service"

May 18, 2017

Mr. Joe Beaudry
Beaudry Services, Inc.
1522 Pearl Street
Waukesha, WI 53186
Email: jbeaudry1015@gmail.com

c/o: Korb + Associates Architects
Attn: Mr. Chris Johns
Email: cjohns@kaa-arch.com

ECS Project No. 42:1408

Reference: Subsurface Exploration and Geotechnical Engineering Services
Proposed Beaudry Services Development
1514 Pearl Street
Waukesha, Wisconsin

Dear Mr. Beaudry,

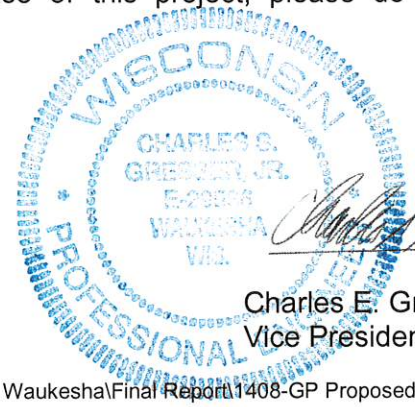
As authorized by your acceptance of our Proposal No. 42:1126-GP (dated April 6, 2017), ECS Midwest, LLC (ECS) has completed the subsurface exploration and geotechnical engineering services for the proposed Beaudry Services Development to be located at 1514 Pearl Street, Waukesha, Wisconsin.

A report, including the results of our subsurface exploration, boring data, laboratory testing, recommendations regarding the geotechnical engineering design and construction aspects for the project and a Boring Location Diagram are enclosed herein. The recommendations presented are intended for use by your office and for use by other professionals involved in the design and construction stages of the project described herein.

We appreciate the opportunity to be of service to Beaudry Services and during the design phase of this project. If you have questions with regard to the information and recommendations contained in this report, or if we may be of further service to you during the planning and/or construction phase of this project, please do not hesitate to contact the undersigned.

Respectfully,

**ECS MIDWEST, LLC**




Jason Peters, E.I.T.
Project Manager

Charles E. Gresser, P.E.
Vice President/Branch Manager

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PROJECT

Subsurface Exploration and
Geotechnical Engineering Services
Proposed Beaudry Services Development
1514 Pearl Street
Waukesha, Wisconsin

CLIENT

Beaudry Services, Inc.
1522 Pearl Street
Waukesha, WI 53186

SUBMITTED BY

ECS Midwest, LLC
3695 North 126th Street, Unit C
Brookfield, Wisconsin 53005

PROJECT NO. 42:1408

DATE May 18, 2017

## EXECUTIVE SUMMARY

The subsurface conditions encountered during our subsurface exploration and ECS' conclusions and recommendations are summarized below. This summary should not be considered apart from the entire text of the report with all the qualifications and considerations mentioned herein. Details of our conclusions and recommendations are discussed in the following sections and in the Appendix of this report.

The project site is located at 1514 Pearl Street in Waukesha, Waukesha County, Wisconsin. Based on aerial photograph review, we understand the site is bound by the existing Beaudry Services facility to the east, existing wetlands and a pond to the north, an existing office/industrial building to the south, and Pearl Street to the south.

Approximately 10 to 14 inches of topsoil was present at the ground surface of Borings B-1, B-2, B-5, B-6 and B-8. Borings B-3, B-4 and B-7 had approximately 4 to 12 inches of gravel present at the ground service. Below the surface materials, Silty CLAY FILL or Silty CLAY with Sand and Gravel FILL soils were encountered to depths ranging from about 6 to 10 feet below existing grade at Borings B-1 through B-3, B-5 and B-7. At Borings B-4, B-6 and B-8, Silty SAND with Gravel FILL and SAND with Gravel FILL were encountered below the surface material from about 3 to 6 feet. The underlying Silty SAND with Gravel FILL at Boring B-2 was encountered to the maximum depth explored, 10 feet. Below the FILL soils in Borings B-1 and B-4 through B-8, native soils consist of Silty CLAY to Clayey SILT to depths ranging from about 3 to at 11 feet. Below depths of 7 to 11 feet at Borings B-3, B-4, B-7 and B-8, the soils consist of PEATY Organic Soil ranging in thicknesses of about 2 to 5 feet. Below the PEAT Organic Soil and Silty CLAY to Clayey SILT trace sand varying layers of Silty CLAY with Sand, SAND with Gravel, Silty SAND with Gravel and Silty Fine SAND extending to at least the maximum depths explored, 25 feet below existing grades.

The Silty CLAY FILL and Silty CLAY with Sand and Gravel FILL soils exhibited unconfined compressive strength (Qp) values generally ranging from about ½ to 2½ tons per square foot (tsf), which are indicative of firm to very stiff consistencies, and moisture contents of about 14.6 to 27.8 percent. The PEATY Organic Soils exhibited moisture contents of 43 to 108 percent. The native Silty CLAY with Sand and Gravel soils exhibited unconfined compressive strength (Qp) values generally ranging from about ½ to 2½ tsf, which are indicative of firm to very stiff consistencies, and moisture contents of about 8 to 24 percent. SPT N-Values in the more granular Silty SAND to Sandy SILT, SAND with Gravel, and Sandy SILT with Clay were observed to vary from 5 to 36 bpf and 50 blows for 3 to 5 inches of penetration, which are indicative of medium dense to very dense relative densities. The higher N-values may not be indicative of the actual soil strength due to the presence of possible cobbles and/or boulders.

Groundwater was encountered at the boring locations during or upon completion of drilling at depths ranging from approximately 3 to 9 feet below existing site grades. Based on the results of this exploration, we estimate the long-term groundwater level at the time of the exploration is at approximately 13 below existing grades.

The design finished floor elevation has estimated an elevation of EL 855 and the subsurface conditions encountered at the boring locations, variable strength existing FILL soils and an area of highly organic soils are present within the planned building area to depths ranging from about 9 feet to 14 feet (to EL. +841 feet to EL. +846 feet) below existing grades. The depths of suitable bearing Silty CLAY native soils corresponds to about 16 to 23 feet below the anticipated foundation bearing grades (ranging from about EL. +832 feet to EL. +839 feet). Complete removal and replacement of the existing FILL and underlying highly organic soils, and replacement with engineered fill, would allow for the use of a conventional spread footing foundation system. However, as summarized above, this would require extensive removal below the water table and we do not anticipate this option would be feasible. Considering the encountered conditions, and the anticipated building loads, we are providing the following two (2) alternatives to support the proposed building: (1) A shallow foundation system bearing driven piles; or, (2) A shallow foundation system bearing on helical piers.

More detailed recommendations with regard to foundations, subgrade preparation and earthwork operations, fill placement, foundation recommendations, slab, below-grade wall design, underslab drainage, storm water management considerations and construction dewatering, are included herein and must be fully reviewed and understood so that the intent of the recommendations are properly utilized during design and construction of the proposed development. We recommend that ECS be retained during construction of the proposed development to monitor all earthwork/subgrade preparation to verify that the exposed subgrade materials and the soil bearing pressures will be suitable for the proposed structure.

Report Prepared By:

Jason Peters, E.I.T.
Project Manager

Report Reviewed By:

Charles E. Gresser, P.E.
Branch Manager/Vice President

# PROJECT OVERVIEW

## Introduction

This report presents the results of our subsurface exploration and geotechnical engineering analysis performed for the proposed Beaudry Services to be located at 1514 Pearl Street in Waukesha, Wisconsin. A Site Location Diagram, included in the Appendix of this report, shows the approximate location of the project site. This study was conducted in general accordance with ECS Proposal 42:1126-GP (dated April 6, 2017), and authorized by you on April 24, 2017. In preparing this report, we have utilized information from our current subsurface exploration.

## Project Location and Existing Site Conditions

The subject property is located at 1514 Pearl Street in Waukesha, Wisconsin. Based on aerial photograph review, we understand the site is bound by the existing Beaudry Services facility to the east, existing wetlands and a pond to the north, an existing office/industrial building to the south and Pearl Street to the south. The subject site is currently vacant, grass and gravel covered. The site is currently being used as a storage area for semi-trailers. Based on review of topographic information included on the Waukesha County GIS site grades currently slope from the northwesterly corner of the site (approximately EL. 855) down to the southeast (to about EL. 850 at the southeastern and southwestern corners of the site).

Based on review of historical aerial photographs, in 1941 and 1950, the site appears to have consisted of a wooded area with possible wetland areas (similar in appearance to the existing northern portion of the site). Starting in 1963 through about 1995, the site appears to have been filled, starting at Pearl Street and extending to the north. From about the year 2000 to the present time, the site appears to have been similar to the current conditions. Based on review of topographic information included on the Waukesha County GIS Mapping website, existing site grades range from about EL. 855 in the central portion of the site sloping down in all direction to about EL. 850 around the perimeter of the proposed development area.

## Proposed Construction

ECS understands the proposed construction will consist of two (2) separate buildings that will include a 9,600 square foot (SF) structure in the southeast portion of the site, and a storage building in the southwest portion of the site along Pearl Street. The development will also include a primary parking lot between the two buildings, concrete aprons, and a compacted gravel parking lot for semi-trailers. We understand the structures will consist of one-story buildings that will not contain basements or other below-grade areas. Building details and structural loads were not provided with the RFP; however, we understand the buildings will have rigid frames and will be designed for the storage and light service of concrete pump trucks. The storage building will be unheated. Based on similar projects, we assume the building will be supported by column and wall footings, and structural loads will be in the range of 40 to 100 kips and 2 to 4 klf, respectively, depending on the proposed structural systems.

Based on an email from Chris Johns with Korb + Associates dated 5/16/17, we understand that the proposed finished floor elevation (FFE) will be EL. 855. Based on the planned grades, we

anticipate that about 1 to 5 feet of fill will be necessary to establish the approximate floor slab subgrade elevation.

If our understanding of the proposed construction and site grades is inaccurate, or if the design changes, please notify ECS immediately so that we can review the proposed scope of work to verify it is applicable for the proposed construction.

## Purpose of Exploration and Scope of Work

The purpose of this exploration was to explore the subsurface conditions at the site and to develop engineering recommendations to guide the geotechnical design and construction aspects of the project. We accomplished these purposes by performing the following scope of services:

1. Drilling eight (8) SPT (standard penetration test) soil borings at the project site using an all-terrain vehicle (ATV) mounted auger drill rig;

2. Performing laboratory tests on selected representative soil samples from the borings to evaluate pertinent engineering properties;

3. Analyzing the field and laboratory data from this exploration to develop appropriate engineering recommendations; and,

4. Preparing this geotechnical report of our findings and recommendations.

The conclusions and recommendations contained in this report are based on eight (8) soil borings (designated as borings B-1 through B-8) conducted at the project site under ECS' direction. The soil borings were drilled by ECS subcontracted driller (Professional Testing Service) to depths of 10 to 25 feet below existing site grades. Borings B-3, B-4, B-7 and B-8 were drilled to 25 feet within or near the planned 9,600 SF building footprint, Borings B-5 and B-6 were drilled to 25 feet within or near the planned storage building, and Borings B-1 and B-2 were drilled to 10 feet within the planed parking area, as planned. However, Borings B-4 and B-7 had an added sample collected at 11 to 12½ to aid in the thickness of the peat layer. The soil borings included split-spoon soil sampling, standard penetration tests (SPT) and groundwater level observations in the boreholes. The results of the completed soil borings along with a Boring Location Diagram are included in the Appendix of this report.

The soil borings were located in the field by an ECS representative. The approximate boring locations are shown on the Boring Location Diagram included in the Appendix. The ground elevations noted on the borings logs were estimated from the referenced *Site Plan* and are indicated on each of the boring logs. The ground surface elevations are considered to be accurate to within one contour interval (1± foot).

## EXPLORATION PROCEDURES

### Subsurface Exploration Procedures

The soil borings were located and staked in the field by an ECS representative. The ECS subcontracted driller contacted Digger's Hotline, to clear and mark underground utilities in the vicinity of the project site prior to drilling operations.

The soil borings were performed with an all-terrain vehicle (ATV) mounted rotary-type auger drill rig, which utilized continuous flight augers to advance the boreholes. Representative soil samples were obtained at 2½-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter, to the termination depth of the borings, by means of conventional split-barrel sampling procedures. An exception was at Borings B-4 and B-7, in the planned proposed building area, where an additional sample at 11 to 12½ feet were collected. In these borings, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval, after an initial setting of 6 inches, is termed the Standard Penetration Test (SPT) or N-value and is indicated for each sample on the boring logs. The SPT value can be used as a qualitative indication of the in-place relative density of cohesionless soils. In a less reliable way, it also indicates the consistency of cohesive soils.

The drill rig utilized an automatic trip hammer to drive the sampler. Consideration of the effect of the automatic hammer's efficiency was included in the interpretation of subsurface information for the analyses prepared for this report.

The drill crew maintained a field log of the soils encountered in the borings. After recovery, each geotechnical soil sample was removed from the sampler and visually classified. Representative portions of each soil sample were then sealed in jars and delivered to our laboratory in Brookfield, Wisconsin, for further visual classification and laboratory testing. After completion of the drilling operations, the boreholes were backfilled with auger cuttings to the existing ground surface.

### Laboratory Testing Program

Representative soil samples were selected and tested in our laboratory to check field classifications and to determine pertinent engineering properties. The laboratory testing program included visual classifications, unconfined compressive strength testing of cohesive soil samples utilizing a calibrated pocket penetrometer and moisture content determinations of cohesive soil samples.

Each soil sample was classified on the basis of texture and plasticity in accordance with the Visual-Manual Classification of Soils (ASTM D 2488-09). The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. A brief explanation of the Visual-Manual Classification of Soils is included in the Appendix of this report. The various soil types were grouped into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs and profiles are approximate; in situ, the transitions may be gradual.

Moisture content determination was performed in general accordance with ASTM D 2216. The unconfined compressive strength (Qp) of relatively cohesive clay soil samples was estimated with the use of a calibrated hand penetrometer. In the hand penetrometer test, the unconfined compressive strength of a soil sample is estimated to a maximum of 4½ tons per square foot (tsf) by measuring the resistance of a soil sample to penetration of a small, calibrated spring-loaded cylinder.

The soil samples will be retained in our laboratory for a period of 60 days, after which, they will be discarded unless other instructions are received as to their disposal.

## EXPLORATION RESULTS

### Soil Conditions

Eight (8) soil borings (Borings B-1 through B-8) were conducted at the project site, under ECS' direction, to depths ranging from approximately 10 feet to 25 feet below existing site grades. The subsurface conditions encountered at the boring locations performed at the site can be summarized as follows.

Approximately 10 to 14 inches of topsoil was present at the ground surface of Borings B-1, B-2, B-5, B-6 and B-8. Borings B-3, B-4 and B-7 had approximately 4 to 12 inches of gravel present at the ground service. Below the surface materials, Silty CLAY FILL or Silty CLAY with Sand and Gravel FILL soils were encountered to depths ranging from about 6 to 10 feet below existing grade at Borings B-1 through B-3, B-5, and B-7. At Borings B-4, B-6, and B-8, Silty SAND with Gravel FILL and SAND with Gravel FILL were encountered below the surface material from about 3 to 6 feet. The underlying Silty SAND with Gravel FILL at Boring B-2 was encountered to the maximum depth explored, 10 feet. Below the FILL soils in Borings B-1 and B-4 through B-8, native soils consist of Silty CLAY to Clayey SILT to depths ranging from about 3 to at 11 feet. Below depths of 7 to 11 feet at Borings B-3, B-4, B-7 and B-8, the soils consist of PEATY Organic Soil ranging in thicknesses of about 2 to 5 feet. Below the PEATY Organic Soil and Silty CLAY to Clayey SILT, trace sand, varying layers of Silty CLAY with Sand, SAND with Gravel, Silty SAND with Gravel and Silty Fine SAND extended to at least the maximum depths explored, 25 feet below existing grades.

The Silty CLAY FILL and Silty CLAY with Sand and Gravel FILL soils exhibited unconfined compressive strength (Qp) values generally ranging from about ½ to 2½ tons per square foot (tsf), which are indicative of firm to very stiff consistencies, and moisture contents of about 14.6 to 27.8 percent. The PEATY Organic Soils exhibited moisture contents of 43 to 108 percent.

The native Silty CLAY with Sand and Gravel soils exhibited unconfined compressive strength (Qp) values generally ranging from about ½ to 2½ tsf, which are indicative of firm to very stiff consistencies, and moisture contents of about 8 to 24 percent. PT N-Values in the more granular Silty SAND to Sandy SILT, SAND with Gravel, and Sandy SILT with Clay were observed to vary from 5 to 36 bpf and 50 blows for 3 to 5 inches of penetration, which are indicative of medium dense to very dense relative densities. In several borings, the clayey SILT below the peat was soft, as evidenced by blow counts in the range of 3 to 5. The higher N-values may not be indicative of the actual soil strength due to the presence of possible cobbles and/or boulders.

It should be noted that bid quantity estimation by "averaging" thickness/depths and strata changes from boring logs may not be representative of the actual thickness/depths and strata changes during earthwork construction. Too many variations exist for such "averaging" to be valid, particularly in the thickness of surficial material and fill soil, soil types and condition, depth, and groundwater conditions. Additional scope of professional services may be required to obtain subsurface information needed for earthwork bid preparation. This additional scope could include test pit exploration program to better understand the extents (vertical and horizontal) of the materials/soils of concern such as unsuitable existing Fill soils. Even with this additional information, contingencies should always be carried in construction budgets to cover

variations in subsurface conditions. Soil borings cannot present the same full-scale view that is obtained during complete site grading, excavation or other aspects of earthwork construction.

## Groundwater Observations

Observations for groundwater were made during sampling and upon completion of the drilling operations at the boring locations. In auger drilling operations, water is not introduced into the boreholes, and the groundwater position can often be obtained by observing water flowing into or out of the boreholes. Furthermore, visual observation of the soil samples retrieved during the auger drilling exploration can often be used in evaluating the groundwater conditions.

Groundwater was encountered at the boring locations during or upon completion of drilling at depths ranging from approximately 3 to 9 feet below existing site grades. These levels could be perched water or the seasonal water table. Glacial till soils in the Midwest frequently oxidize from gray to brown above the level at which the soil remains saturated. The long-term groundwater level is often interpreted to be near this zone of color change. Based on the results of this exploration, we estimate the long-term groundwater level at the time of the exploration was located approximately 13 feet below the existing grades.

The highest groundwater observations are normally encountered in late winter and early spring. The current groundwater observations may not be at the seasonal maximum water table. It should be noted that the groundwater level can vary based on precipitation, evaporation, surface run-off and other factors not immediately apparent at the time of this exploration. Surface water runoff will be a factor during general construction, and steps should be taken during construction to control surface water runoff and to remove water that may accumulate in the proposed excavations as well as floor slab areas.

## ANALYSIS AND RECOMMENDATIONS

### Overview

The conclusions and recommendations presented in this report should be incorporated in the geotechnical engineering design and construction aspects of the project to reduce possible soil and/or foundation related problems.

The following sections present specific recommendations with regard to the design of the proposed church building. These include recommendations with regard to subgrade preparation, earthwork, fill placement, new building foundations, floor slabs, pavements, below grade wall recommendations, storm water considerations and construction dewatering. Discussion of the factors affecting the building foundations for the proposed construction, as well as additional recommendations regarding the geotechnical engineering design and construction aspects at the project site are included below. We recommend that ECS review the final design and specifications to check that the earthwork and foundation recommendations presented in this report have been properly interpreted and implemented in the design and specifications.

### Subgrade Preparation and Earthwork Operations

Subgrade preparation for the building pads and parking lot/driveway pavement areas should consist of complete removal of vegetation, topsoil/root mat and other deleterious organic or refuse material. Topsoil/root mat ranged in thickness from about 10 to 14 inches at the borings; however, deeper removal depths may be necessary in unexplored areas of the site. The topsoil can be stockpiled at the subject property for potential reuse in landscaping and other non-structural applications. The topsoil materials may be stockpiled onsite for potential reuse in landscaping and other non-structural applications. Once the surficial materials have been removed, the limits of the building footprints should be excavated to the design subgrade elevations. We recommend the earthwork clearing be extended a minimum of 10 feet beyond the limits of new structure and 5 feet beyond pavements, where possible.

ECS does not recommend the pavement or slab subgrades remain exposed to the elements or construction traffic for a prolonged period of time as the subgrade may be disturbed and/or softened. If the pavement/slab is not planned to be constructed within a few days after exposing the final design subgrade, consideration should be given to leaving the subgrade approximately 1 foot above the final design subgrade to help prevent softening of the design subgrade soils (if feasible).

Based on our observations at the boring locations and the variable soil profile at the project site, we anticipate the soils at the slab or gravel parking subgrade elevation will typically consist of Silty Clay FILL or Silty Sand Fill. We typically recommend the fill and underlying organic soils be removed and replaced with properly engineered fill. However, considering the depth of the existing FILL, Possible FILL and Probable FILL soils encountered at the boring locations, the PEAT encountered at boring B-3, B-4, B7 and B-8 (ranging between about 8 to 13 feet), and soft soils below the peat, we are aware that complete removal and replacement of the existing FILL, Possible FILL, Probable FILL, PEAT, and soft soils encountered at the boring locations may not be feasible from a cost perspective.

Subgrade Preparation – Floor Slab

Based on the results of the subsurface exploration indicating the presence of highly compressible Organic PEAT at depths ranging from 8 feet to 13 feet below existing site grades at borings B-3, B-4 B-7 and B-8, the presence of soft Clayey SILT, within the limits of the slab-on-grade/foundation, the presence of variable FILL, Possible FILL and Probable FILL soils throughout the proposed building area, and considering the site fill soil, we anticipate substantial differential settlement of the floor slab subgrade soils could occur. As such, we recommend constructing structural slabs supported by a deep foundation system, such as helical piers or driven piles. Utilization of properly designed structural slabs should limit the risks associated with settlement of the subgrade, as the slab will be designed to span between foundation elements. The thickness and reinforcing steel for the structural slab should be designed by the structural engineer.

As an alternate to the floor slabs being designed as structural slabs, the floor slabs could be designed as conventional slabs-on-grade provided the following site preparation option is performed:

Complete Removal and Replacement (**Slabs**) – We recommend removing and replacing the undocumented fill and underlying organic materials and replacing them with new compacted engineered fill following the recommendations in the **Fill Placement** section of this report. Based on the conditions encountered at the building boring locations, this would require removal of approximately 6 to 13 feet of materials below existing site grades at some locations. Following removal, the exposed subgrade should be proofrolled and densified to the extent practical prior to placing the new engineered fill. This option results in low risk of slab distress.

Site Preparation – Pavement Areas

ECS understands the parking/ drive areas will be aggregate base material with no asphalt/concrete. We are providing two (2) options for site preparation and support of the **gravel parking** based on the anticipated cost and the level of risk the owner/project team are willing to accept.

1. Partial Removal and Replacement– To minimize the depth of undercuts, but also with some risk of pavement movement and long term maintenance issues, the project team could consider stabilizing the upper 18 inches of the pavement subgrades by removing the existing undocumented FILL material to a depth of 18 inches below the final subgrade elevations and replacing it with two 9-inch lifts of crushed aggregate base on top of 1 layer of triaxial geogrid (Tensar TX 140 or equivalent) (geogrid in pavement areas only). The geogrid should be installed in accordance with the manufacturer's recommendations on top of the exposed subgrade and beneath the first lift of crushed aggregate fill. The aggregate backfill should be densified with a smooth drum roller. This option would reduce the volume of required undercuts, but could result in premature deterioration/cracking of the pavement (moderate to high risk). The exposed subgrade should be proofrolled and densified to the extent practical prior to the placement of geogrid and new engineered fill.

2. Proofroll/Replace– Once the subgrade has been exposed and prior to raising the site with engineered fill where required, the subgrade could be proofrolled using a loaded dump truck having an axle weight of at least 10 tons. The intent of the proofroll is to aid in identifying localized soft, loose or unsuitable material which may be required to be removed. If soft or yielding soils are observed during the proofroll of the subgrade, the soft soils should be undercut up to a maximum of 2 feet and replaced with compacted engineered fill to the design subgrade. This option will only identify near surface soils that are unsuitable for the aggregate base support and deeper pockets of unsuitable fill may not be fully identified, which could lead to premature settlement and/or rutting. This option poses a high risk, specifically due to the possible presence of high organic content and compressible PEAT and fill materials. To help limit the volume of soil removed (as a result unstable conditions revealed by the proofrolling), we recommend that soft or yielding soils be evaluated in approximately 6-inch intervals. That is to say, if soft or yielding soils are identified, the contractor should remove 6 inches of material in the subject area and then proofroll/evaluate the undercut subgrade. This will potentially limit the need to remove 2 feet of soil at all locations where soft or yielding soils are identified at the design subgrade.

General Site Preparation Considerations

Exposure to the environment may weaken the subgrade soils if the excavations remain open for too long a period. If the subgrade soils are softened by surface water intrusion or exposure, the softened soils must be removed from the subgrade excavation bottom immediately prior to placement of concrete and/or engineered fill.

Excavations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. This document states that the contractor is solely responsible for the design and construction of stable, temporary excavations. The excavations should not only be in accordance with current OSHA excavation and trench safety standards but also with applicable local, state, and federal regulations. The contractor should shore, slope or bench the excavation sides when appropriate.

If problems are encountered during the earthwork operations, or if site conditions deviate from those encountered during our subsurface exploration, ECS should be notified immediately. We recommend that the project geotechnical engineer or his representative should be on site to monitor stripping and site preparation operations and observe that unsuitable soils have been satisfactorily removed and observe the proofrolling of the subgrades.

Proofrolling

We recommend the stripped subgrades should be proofrolled prior to placement of base materials or new fill to reach final grades. Proofrolling using a loaded dump truck, having an axle weight of at least 10 tons, can be used to aid in identifying localized soft or unsuitable material which should be removed. If soft or yielding soils are observed during the proofroll, the soft or yielding soils should be undercut and replaced with compacted and engineered fill to the design subgrade in accordance with the **Fill Placement and Compaction** section of this report. To help limit the volume of soil removed as a result of the manual testing, we recommend that soft or yielding soils be evaluated in approximately 6-inch intervals. That is to say, if soft or

yielding soils are identified, the contractor should remove 6 inches of material in the subject area and then evaluate the undercut subgrade.

General

At the time of construction, we recommend ECS should be on site to provide additional guidelines and recommendations in regard to the suitability and compaction of suitable on-site material/soils. Steps should be taken by the contractor to control surface water runoff and to remove water from precipitation that may accumulate in the basement subgrade areas. When wet and subjected to construction traffic, softening and disturbance of the exposed subgrade may occur. Construction traffic should be limited when the subgrade is soft and wet. During final preparation of the subgrade, a smooth drum roller is often used to provide a flat surface and provide for better drainage to reduce the negative impact of rain events. When water is encountered, we recommend providing trenches and sumps and/or crowning or sloping the subgrade to provide positive drainage off the subgrades.

Excavations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. This document states that the contractor is solely responsible for the design and construction of stable, temporary excavations. The excavations should not only be in accordance with current OSHA excavation and trench safety standards but also with applicable local, state, and federal regulations. The contractor should shore, slope or bench the excavation sides when appropriate. In no case should excavations extend below the level of adjacent structures, utilities or pavements, unless underpinning or other adequate support is provided. Site safety is the sole responsibility of the contractor, who shall also be responsible for the means, methods and sequencing of construction operations.

If problems are encountered during the earthwork operations, or if site conditions deviate from those encountered during our subsurface exploration, ECS should be notified immediately. We recommend that the project geotechnical engineer or his representative should be on site to monitor stripping and site preparation operations and observe that unsuitable soils have been satisfactorily removed and observe the proofrolling of the subgrades.

## Fill Placement and Compaction

All fills should consist of an approved material, free of organic matter and debris, particles greater than 3-inches and have a Liquid Limit and Plasticity Index less than 40 and 15, respectively. Unacceptable fill materials include topsoil and organic materials (OH, OL), high plasticity silts and clays (CH, MH), and low-plasticity silts (ML). We do not recommend the use of Pea Gravel as engineered fill beneath structure, pavement and utility trench areas. Pea Gravel has round/smooth characteristics, no fines and does not interlock when compacted, which makes that material more susceptible to future movement and instability resulting in excessive and variable settlement of the slabs, foundations, pavements and utilities. From our experience on previous projects, some contractors used and placed Pea Gravel and other open-graded gravel fill materials with minimal or without compaction, which resulted in unacceptable foundation, slab, pavement and utility settlement.

The Silty CLAY, Silty SAND with Clay and SAND with Gravel anticipated to be removed during the basement and foundation excavations appear to be suitable for reuse as engineered fill

provided they are free of organics and moisture conditioned to within the acceptable range of moisture contents. However, the Sandy SILT soils are considered to be frost susceptible and may heave, leading to premature slab and pavement distress, if placed above the frost depth. In addition, the Silty soils are extremely moisture and disturbance sensitive, difficult to work with and the soils may become disturbed and/or softened. Therefore, the Sandy SILT soils, if encountered, are not recommended to be used as engineered fill in structural areas. Rather, they could be used as general fill in non-structural areas of the site. The deeper soils on the site may also contain cobbles and/or boulders; therefore, some sorting of oversized materials (greater than 3 inches in size) is anticipated to be necessary to reuse the soils as engineered fill. The onsite soils may require moisture content adjustments, such as the application of discing or other drying techniques or spraying of water to the soils prior to their use as compacted fill (termed manipulation). The planning of earthwork operations should recognize and account for increased costs associated with manipulation of the onsite materials considered for reuse as compacted fill. **In addition, if construction occurs in late fall to early spring, drying the onsite cohesive soils may not be possible and the contractor should budget for offsite fill, if required.**

New engineered fill materials should be placed in lifts not exceeding 8-inches in loose thickness and moisture conditioned to within ±2 percentage points of the optimum moisture content. Soil bridging lifts should not be used, since intolerable settlement of overlying structures will likely occur. Controlled fill soils should be compacted to a minimum of 95 percent of the maximum dry density obtained in accordance with ASTM D 1557, Modified Proctor method. The zone of the engineered fill placed below the foundations should extend 1 foot beyond the outside edges of the footings and from that point, outward laterally 1 foot for every 2 feet of fill thickness below the footing.

The expanded footprint of the proposed building pad and fill areas should be well defined, including the limits of the fill zones at the time of fill placement. We recommend the building pad subgrade preparation should extend at least 10 feet beyond the outside edges of the building footprints, if practical. Grade control should be maintained throughout the fill placement operations. All fill operations should be observed on a full-time basis by a qualified soil technician to determine that the specified compaction requirements are being met. A minimum of one compaction test per 2,500 square foot area should be tested in each lift placed with a minimum of three tests. Within trench or other localized excavations, one test for each 50 linear feet of each lift of fill should be performed with a minimum of three tests per lift. The elevation and location of the tests should be clearly identified at the time of fill placement.

Compaction equipment suitable to the soil type used as fill should be used to compact the fill material. Theoretically, any equipment type can be used as long as the required density is achieved; however, the standard of practice typically dictates that a vibratory roller be utilized for compaction of granular soils and a sheepsfoot roller be utilized for compaction of cohesive soils. In addition, a steel drum roller is typically most efficient for compacting and sealing the surface soils. Lighter hand operated compaction equipment should be used adjacent to below-grade walls. All areas receiving fill should be graded to facilitate positive drainage from building pad areas of free water associated with precipitation and surface runoff.

It should be noted that prior to the commencement of fill operations and/or utilization of off-site borrow materials, the Geotechnical Engineer of Record should be provided with representative samples to determine the material's suitability for use in a controlled compacted fill and to

develop moisture-density relationships. In order to expedite the earthwork operations, if off-site borrow materials are required, it is recommended they consist of suitable fill materials in accordance with the recommendations previously outlined in this section. We do not recommend importing frost susceptible soil, (i.e., silt soils) for use as engineered fill within 4 feet of the exterior finish grades.

Fill materials should not be placed on frozen soils or frost-heaved soils and/or soils that have been recently subjected to precipitation. Frozen soils should be removed prior to continuation of fill operations. Borrow fill materials, if required, should not contain frozen materials at the time of placement. Frost-heaved soils should be removed prior to placement of controlled, compacted fill, granular subbase materials, and foundation or slab concrete.

Underground Utility Trench Excavation and Limited Excavation Areas

Based on our experience, fill soils placed in utility trench excavation or immediate areas around underground utility structures/manholes and underground pipes and excavation areas adjacent to foundations are typically not compacted/densified adequately due to space constraints and lack of compaction effort. A jumping jack, walk-behind vibratory plate or similar equipment should be used in structure/manhole/pipe areas or space-constrained areas that are not feasible with a heavy-duty pneumatic tire or smooth drum roller to compact the granular backfill materials. A larger, sloped excavation may be necessary to allow for compaction equipment in the immediate areas of the utility structures/manholes and to properly compact the backfill materials. In areas where small hand compaction equipment is used, we recommend backfill material should be placed in lifts not exceeding 6 inches loose thickness and compacted to at least 95 percent of the maximum dry density obtained in accordance with Modified Proctor method ASTM D 1557.

## Foundation Recommendations

The design finished floor elevation has not been provided to ECS at this time, therefore utilizing an elevation of EL 855 and the subsurface conditions encountered at the boring locations, variable strength existing FILL soils and an area of highly organic soils are present within the planned building area to depths ranging from about 9 feet to 14 feet (to EL. +841 feet to EL. +846 feet) below existing grades. The depths of suitable bearing Silty CLAY native soils corresponds to about 16 to 23 feet below the anticipated foundation bearing grades (ranging from about EL. +832 feet to EL. +839 feet). Complete removal and replacement of the existing FILL and underlying highly organic soils and replacement with engineered fill which would allow for the use of a conventional spread footing foundation system. However, as summarized above, this would require extensive removal and we do not anticipate this option would be feasible. Considering the encountered conditions, and the anticipated building loads, we are providing the following two (2) alternatives to support the proposed building:

1) **Foundation system through the peat and/or soft soils bearing on stone columns**: Shallow spread footing foundations supported at shallow depth within suitable improved existing fill/lower strength native soils and may be utilized for the support of proposed building. In this regard, the existing soils may be improved/reinforced with rammed aggregate piers or vibro-replacement aggregate piers (“stone columns”). Because of the presence of PEAT soils in boring B-4, B-5, B-

7 and B-8, we recommend the project team reach out to specialty contractor's for recommendations to improve the existing soils, including the encountered organic Peat/Clay soil layers. ECS can provide contact information for Rammed Aggregate Pier specialty contractors upon request.

Foundations bearing on geopier/stone column improved ground typically could be designed for a net allowable bearing pressure in the range of 3,000 pounds per square foot (psf). However, the final bearing pressure recommendations in the ground improved areas will be provided by the rammed aggregate pier contractor based on the subsurface conditions and the final loads of the proposed structure.

ECS recommends the width of continuous wall foundations be at least 18 inches wide and equal (although ideally larger) than the width of the aggregate pier elements and column foundations at least 30 inches square, regardless of calculated dimensions. In addition, exterior footings should be placed at a depth of at least 3½ feet to provide adequate frost cover protection.

**2)** **Shallow foundation system bearing on deep helical piers**: As an alternate to rammed aggregate pier foundations, the proposed building could be supported on helical pier foundations. Helical piers should extend below the fill soil materials and underlying low strength organic natural soils, where encountered, into competent natural Silty Clay soils. The helical pier foundation manufacturers/installers will interpret the subsurface information and provide appropriate foundations based upon proprietary design criteria. The number size and depth of the helical pier design will depend on the final structural loading and column spacing, as well as the subsurface soil profile. In addition, the use of helical piers for foundation support would require the building floor slabs to be designed a structural slabs. ECS can provide contact information for Helical Pier specialty contractors upon request.

**3)** **Driven Pile Foundations:** Based on the subsurface conditions encountered at the project site, particularly the peat down to about 13 feet and soft soils to about 15 to 18, consideration should be given to supporting the proposed building on driven piles bearing on natural very firm soil below the existing FILL/peat/soft soils. We anticipate the soil capacity should control and should be used in the design. Settlement of the pile foundations is expected to be within tolerable limits for the proposed building.

We recommend that the installation of the pile foundations be monitored by an ECS Geotechnical Engineer or his qualified representative. During the installation of driven piles, ECS should observe the condition and length of the piles prior to driving, monitor any pre-excavation, monitor the pile driving resistance, and verify the final pile alignment and tip depth.

If piles are utilized, the proposed building should be designed to be supported on pile caps and grade beams. The pile cap and grade beam dimensions and reinforcement should be designed by the Structural Engineer of Record. The grade beams should extend a minimum of 4 feet below final site grades for frost considerations.

To provide lateral stability to the pile foundation system, we recommend a minimum of 3 piles be used for isolated columns and a minimum of 2 rows of piles along exterior

and interior load bearing walls. We recommend a minimum center-to-center spacing of piles should be at least three times the diagonal dimension of the steel pile.

The project documents should clearly specify driving criteria to verify adequate bearing yet reduce the potential for driving damage. The foundation contractor should be prepared to remove and/or break up obstructions, if encountered. It may be desirable to “pothole” or pre-excavate the pile/column locations to remove obstructions prior to pile driving, to reduce the potential for costly pile driving delays due to obstruction removal.

The pile driving operation will densify the FILL soils which could result in movements and settlements of adjacent structures, especially those structures supported on shallow foundation systems. The densification of the granular soils from pile driving operation may also result in movements/settlements of the adjacent pavements, walls, roads and utilities. We recommend appropriate monitoring of surrounding development prior to and during pile installation be implemented. Adjacent structures should be well documented and photographed before pile installation begins (i.e., preconstruction survey) and a vibration survey and analysis should be made by competent personnel prior to and during pile driving.

Prior to start of construction, we recommend the foundation contractor should submit pile driving procedures for review by the design team. The procedures should address the handling obstructions. **The project team should be aware that relocation of steel piles may be necessary if an obstruction that cannot be penetrated is encountered.**

General Foundation Considerations

To help reduce the potential for foundation bearing failure and excessive settlement due to local shear or "punching" action, we recommend that continuous footings have a minimum width of 18 inches and that isolated column footings have a minimum lateral dimension of 30 inches, regardless of the calculated dimensions. In addition, footings should be placed at a depth to provide adequate frost cover protection. For this region, we recommend the exterior footings and footings beneath unheated areas be placed at a minimum depth of 4 feet below finished grade. Interior footings in heated areas can be placed at 1 to 2 feet below grade provided that suitable soils are encountered and that the foundations will not be subjected to freezing weather either during or after construction.

Settlement of the structures and slabs designed in accordance with our recommendations presented in this report is expected to be within tolerable limits for the proposed buildings. The expected maximum settlement is expected to be in the range of 1 inch or less. Maximum differential settlement between adjacent columns is expected to be in the range of ½ inch. These settlement values are based on our engineering experience with the soil and the anticipated structural loading, and are to guide the structural engineer with his design.

## Floor Slab Design

If helical pier, driven pile, or drilled pier deep foundations are utilized for building support, we recommend the floor slabs be designed as structural slabs. The structural slabs should be designed by the structural engineer of record based on the anticipated slab loading. If Rammed Aggregate Piers or Geopier's Armorpact system are utilized for improvement of site soils for foundation support, consideration could be given to designing the slabs as a slabs-on-grade bearing on soils improved with interstitial Rammed Aggregate Piers or Armorpact piers.

For the design and construction of the slab-on-grade for the proposed building, if Rammed Aggregate Piers or Armorpact piers are utilized, the recommendations provided in the section entitled **Subgrade Preparation and Earthwork Operations** should be followed. The building floor slab thickness can be determined utilizing an assumed modulus of subgrade reaction of 125 pounds per cubic inch (pci). We recommend the slabs be designed with a minimum thickness of 5 inches.

We recommend consideration be given to the floor slabs being underlain by a minimum of 6 inches of granular material in the slab on grade areas. The granular materials should have a maximum aggregate size of 1½ inches and no more than 2 percent soil passing the No. 200 sieve. This granular layer will facilitate the fine grading of the subgrade and help prevent the rise of water through the floor slabs. Prior to placing the granular material, the floor subgrades should be free of standing water, mud, and frozen soil. Before the placement of concrete, a vapor barrier may be placed on top of the granular material to provide additional moisture protection. Slab reinforcement should be designed by the structural engineer. The use of a blotter or cushion layer above the vapor retarder can also be considered for project specific reasons. Please refer to ACI 302.1R04 *Guide for Concrete Floor and Slab Construction* and ASTM E 1643 *Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs* for additional guidance on this issue.

We recommend that the floor slabs be isolated from the foundations so differential settlement of the structure will not induce shear stresses on the floor slabs. For maximum effectiveness, temperature and shrinkage reinforcements in slabs on ground should be positioned in the upper third of the slab thickness. The Wire Reinforcement Institute recommends the mesh reinforcement be placed 2 inches below the slab surface or upper one-third of slab thickness, whichever is closer to the surface. Adequate construction joints, contraction joints and isolation joints should also be provided in the slab to reduce the impacts of cracking and shrinkage. Please refer to ACI 302.1R04 *Guide for Concrete Floor and Slab Construction* for additional information regarding concrete slab joint design.

If problems are encountered during the slab subgrade preparation, or if site conditions deviate from those encountered during our subsurface exploration, ECS should be notified immediately. We recommend that the project geotechnical engineer or his representative should be on site to monitor subgrade preparation and observe that unsuitable soils have been satisfactorily removed and the subgrade soils are suitable to support the slab.

## Under slab Methane Considerations

Due to the proximity of the peat and water level, we recommend a below slab moisture/methane system be installed prior to the placement of the interior slab on grade. An open graded layer of aggregate should be placed for the gas to move freely under the slab. The gas/vapor retarder membrane should be installed on top of the open graded material with all openings, penetrations, and joints sealed within the enclosed building. A venting system may be required to draw the vapor up through the building to the outside air. The owner should seek out a contractor for design considerations.

## Below-Grade Walls

### Lateral Earth Pressures

Permanent below-grade walls, such as the foundation walls, should be designed to withstand lateral earth pressures and surcharge loads. The lateral earth pressures exerted on the walls will be a function of the stiffness and the rotation of the walls. The rotation of the wall controls the degree to which the internal strength of the soil is mobilized. If rotation or deflection of the walls will be less than that required to mobilize the active earth pressure condition due to stiffness, bracing or other mechanism the “at-rest” earth pressure condition should be evaluated. For the at-rest earth pressure condition, below grade walls can be designed for a linearly increasing lateral earth pressure of 65 psf per vertical foot of wall. The at-rest earth pressure of 65 psf per vertical foot of wall assumes that the below-grade walls will be in a drained condition (i.e., no hydrostatic forces on the back of the wall). In the event that the walls remain undrained, a linearly increasing lateral earth pressure of 65 psf per vertical foot of wall should be utilized above the long-term groundwater level and 100 psf per vertical foot of wall should be utilized below the long-term groundwater level. A long-term groundwater level of approximately 14 feet below existing site grades (about EL. +731 feet) is recommended for design. The wall design should also account for surcharge loads within a 45 degree slope from the base of the wall. For the at-rest earth pressure condition, a lateral earth pressure coefficient of 0.45 should be applied to surcharge loads.

The “active” earth pressure condition, such as for retaining walls not associated with structures, which results in the minimum applied earth pressure, results when the rotation of the wall about its base and away from the retained soil is approximately 0.001 times the height of the wall or greater. This is typically the case with cantilever-type walls. If the active earth pressure condition develops, we recommend below-grade walls be designed for a linearly increasing lateral earth pressure of 40 psf per vertical foot of wall above the long-term groundwater level and 85 psf/ft below the long-term groundwater level. These active lateral earth pressures assume that granular materials are used for wall backfill. The wall design should also account for surcharge loads within a 45 degree slope from the base of the wall. For the active earth pressure condition, a lateral earth pressure coefficient of 0.33 should be applied to surcharge loads.

To develop “passive earth” pressures, the footings should be located at depths greater than the depth of frost penetration (4 feet below lowest adjacent finished grade). Passive resistance within the zone of seasonal volume change (i.e., approximately 4 feet from the final ground surface) should be neglected. For footings and walls located below the frost penetration of 4

feet (if any) and if the passive condition develops, a passive lateral earth pressure of 360 psf per vertical foot of wall can be used to design below grade walls for granular backfill. As stated, the upper 4 feet of soil should be neglected when determining the passive resistance of the soil.

Below-Grade Wall Backfill

The space between the outside of the walls and the excavation should be backfilled with a granular fill extending to a level of approximately 2 feet below the final outside grade. The remaining 2 feet should consist of a clayey material to minimize the amount of surface water infiltration into the granular material, and thus, reduce the excess water to be handled by the drainage system. Asphaltic concrete or Portland cement concrete can also be used to cover the ground surface and minimize the surface water infiltration. The ground surface adjacent to the below-grade walls should be kept properly graded to prevent ponding of water adjacent to the below-grade walls.

Special attention should be employed during placement of new fill against below-grade walls. Based on our experience, fill soils placed against below-grade walls and immediate areas along Below-grade walls are often not compacted/densified adequately due to space constraints and lack of compaction effort. Inadequate placement and compaction of new fill will result on at-grade slab/pavement subgrade settlement and distress. A jumping jack, walk-behind vibratory plate or similar equipment should be used in manhole areas or other limited areas that are not feasible with a heavy-duty pneumatic tire or smooth drum roller. To achieve a desirable balance between minimizing excessive pressures against the below grade walls and reducing the settlement of the wall backfill, we recommend that the wall granular backfill be compacted to at least 90 percent of the maximum dry density obtained in accordance with ASTM Specification D 1557, Modified Proctor Method. Thinner lifts of 4 to 6 inches can be effective in improving compaction performance. Where the fill materials will be supporting sidewalks or pavements, the upper 2 feet should be compacted to 95% of the maximum dry density referenced above.

Backfill materials should consist of inorganic materials, free of debris, be free draining, and containing no frost susceptible soil. The fill placed adjacent to the below grade walls should not be overcompacted. Heavy earthwork equipment should maintain a minimum horizontal distance away from the below-grade walls of 1 foot per foot of vertical wall height. Lighter compaction equipment should be used close to the below grade walls. Where light (e.g., hand) compaction equipment is employed, the maximum lift thickness should be reduced to 6 inches.

Suitable man-made drainage materials may be used in lieu of the granular backfill, adjacent to the below-grade walls. Examples of suitable materials include Enka Mat, Mira Drain, or geotec Drains. If the excavation support system is used as a back form for wall construction, the geosynthetic drainage media can be placed directly against the support system prior to placing reinforcing steel. These materials should be covered with a filter fabric having an apparent opening size (AOS) consistent with the size of the soil to be retained (or with cast-in-place concrete). The material should be placed in accordance with the manufacturer's recommendations and connected to a perimeter drainage system, which in turn should be properly drained.

## Pavement Design

For new pavement construction, we recommend the pavement subgrade be prepared in accordance with the **Subgrade Preparation and Earthwork Operations** section of this report. Once the subgrade has been properly prepared, we recommend the minimum pavement sections detailed in Table 1 for the proposed development. The recommended pavement sections were developed based on the anticipated traffic loads, assuming a California Bearing Ratio (CBR) of 3 for the predominant Silty CLAY FILL and Possible FILL subgrade soils encountered in the proposed parking lot areas (Borings B-4 and B-5) and our local experience. All pavement materials and construction should be in accordance with the Guidelines for AASHTO Pavement Design and current WisDOT Standard Specifications for Highway and Structure Construction.

**Table 1: New Pavement Section Recommendations**

| Pavement Material | Compacted Material Thicknesses (Inches) | | | |
|---|---|---|---|---|
| | Flexible Pavement (Light-Duty) | Flexible Pavement (Heavy Duty) | Rigid Pavement (Light-Duty) | Rigid Pavement (Heavy Duty) |
| Portland Cement Concrete | -- | -- | 5 | 6 |
| Bituminous Surface Course | 1½ | 1½ | -- | -- |
| Bituminous Base Course | 2¼ | 3 | -- | -- |
| Dense Graded Aggregate Base Course | 5 | 9 | 3 | 5 |
| Drainage Base (1 inch stone) | 3 | 3 | 3 | 3 |
| Total Pavement Section Thickness | 11¾ | 16½ | 11 | 14 |

The new pavement sections specified in the table above are general pavement recommendations based on the anticipated usage at the project site and were not developed based on specific traffic patterns/loading and resiliency factors, as those parameters were not provided by the design team. The table above provides “Light-Duty” and “Heavy Duty” flexible and rigid pavement recommendations. The “Light-Duty” pavement section assumes that typical traffic loading will be limited to standard automobiles and does not account for more heavily loaded vehicles (i.e., multiple axle trucks). We recommend the “Light-Duty” pavements be used for parking stalls/lanes. The “Heavy-Duty” pavement section is recommended for pavements to be subjected with frequent traffic such as drive-lanes, entrance/exit drive areas, delivery areas and loading dock aprons and 25 trucks or less per day.

It should also be noted that the pavement sections specified in the table above were developed for the assumed in-service traffic conditions only and do not provide an allowance for construction traffic conditions or traffic conditions in excess of typical residential/collector street traffic. Therefore, if pavements will be constructed early during site development to accommodate construction traffic, consideration should be given to the construction of designated haul roads, where thickened pavement sections can be provided to accommodate

the construction traffic, as well as the future in-service traffic. ECS can provide additional design assistance with pavement sections for haul roads upon request.

Large, front loading trash dumpsters frequently impose concentrated front-wheel loads on pavements during loading. This type of loading typically results in rutting of the pavement and ultimately pavement failures. Therefore, we recommend the pavement in trash pickup areas consist of the heavy duty rigid pavement section in Table 1. It should be noted that the pavement should be comprised of air-entrained Portland cement concrete with a minimum compressive strength of 4,000 psi and a minimum flexural strength of 650 psi.

Adequate construction joints, contraction joints and isolation joints should be provided in the areas of rigid pavement to reduce the impacts of cracking and shrinkage. Please refer to ACI 330R-92 *Guide for Design of Concrete Parking Lots*. The Guide recommends an appropriate spacing strategy for the anticipated loads and pavement thickness. It has been our experience that joint spacing closer to the minimum values results in a pavement with less cracking and better long term performance.

We recommend the dense graded aggregate base course should be compacted to at least 95 percent of the maximum dry density obtained in accordance with ASTM D1557, Modified Proctor Method. During bituminous pavement construction, the wearing and leveling course should be compacted to a minimum of 93 percent of the theoretical density value. Prior to placing the granular material, the pavement subgrade soil should be properly compacted, observed to be stable during a final proofroll and free of standing water, mud, and frozen soil.

An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should minimize the possibility of the subgrade materials becoming saturated over a long period of time. We recommend pavement subgrades should be crowned, or sloped, a minimum of 1 to 2 percent to promote subsurface water flow across the lean clay subgrades and to prevent ponding. Crowning or sloping the subgrade should minimize the potential for water to accumulate and the aggregate base course.

## **Pavement Drainage**

The area of the proposed parking lot is underlain by Silty CLAY FILL and Silty Sand soils and underlying native Silty CLAY soils which are relatively impermeable. Because of the Silty CLAY subgrade soils, we have recommended that a drainage base course (1-inch clean stone) be incorporated into the pavement section as summarized in Table 1 above. We also recommend that “stub” or “finger” drains be provided around catch basins and in other low-lying areas of the parking lot/drive lanes to minimize the accumulation of water above and within the subgrade soils and granular base. As an alternative to the use of stub or finger drains, manhole and storm sewer inlets can be perforated, at the top of subgrade elevation, with 1 inch diameter holes and with manholes wrapped with a non-woven geotextile. The holes could be placed 90 degree intervals around the perimeter of the manhole backfilled with free draining granular materials.

An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should minimize the possibility of the subgrade materials beneath the pavement becoming saturated over a long period of time. Infiltration and subterranean water are the two sources of water that should be considered in pavement design. Infiltration is surface water that enters the pavement through the joints, pores, cracks in the pavement and through shoulders and adjacent areas pavements as a result of precipitation. Subterranean water is a source of water from a high water table on the site. We anticipate the long-term water table greater than 13 feet below existing grade. However, we consider the site to be susceptible to shallower perched water conditions especially within existing FILL soils and/or in more permeable soils (i.e. Sand, Gravel) underlain by less permeable Silty CLAY soils. Therefore, we consider surface water infiltration to be the most important source of water to be considered for pavement design for this project.

The final pavement surface should be shaped or crowned to properly direct surface water to suitable on or off-site stormwater drainage infrastructure. In addition, the clayey pavement subgrade should be properly sloped to avoid dips or pockets where water could be trapped. Dips in the clay subgrade could result in “bathtub” effect, trapping water and potentially softening the subgrade. If the Owner chooses to implement the recommended minimum pavement sections for the parking areas and drive lanes, the difference in depth between the two proposed pavement sections could create a “bathtub” effect. Good drainage should help minimize the possibility of the subgrade materials becoming saturated over a long period of time. We would be pleased to be of further assistance to you in the design of the project pavements by providing additional services during construction of the project.

## Pavement Maintenance

The pavements should be reviewed for distress and cracks twice a year, once in the spring and once in the fall. Regular maintenance and occasional repairs should be implemented to keep pavements in a serviceable condition. In addition, to minimize water infiltration to the pavement section and within the base course layer resulting in softening of the subgrade and deterioration of the pavement, we recommend the timely sealing of joints and cracks in the existing bituminous pavement using a hot-poured emulsified asphalt crack sealant.

Sound maintenance programs should help maintain and enhance the performance of pavements and attain the design service life. A preventative maintenance program should be implemented early in the pavement life to be effective. The “standard in the industry” supported by research indicates that preventative maintenance should begin within 2 to 5 years of the placement of pavement. Failure to perform preventative maintenance will reduce the service life of the pavement and increase the costs for both corrective maintenance and full pavement rehabilitation.

## PROJECT CONSTRUCTION RECOMMENDATIONS

### General Construction Considerations

We recommend that the subgrade preparation, installation of the foundations, and construction of slabs-on-grade and pavement be monitored by an ECS geotechnical engineer or his/her authorized representative. Methods of verification and identification such as proofrolling, hand auger probes with in-situ DCP or Army Corps of Engineers static cone penetrometer testing will be necessary to further evaluate the subgrade soils and identify unsuitable soils. The contractor should be prepared to over-excavate slab-on-grade and pavement subgrades at isolated locations (as necessary). We recommend that excavations of new foundations be monitored on a full-time basis by an ECS geotechnical engineer or his representative to verify that the soil bearing pressure and the subgrade materials will be suitable for the proposed structure and are consistent with the boring log information obtained during this geotechnical exploration. We would be pleased to provide these services.

All unsuitable materials should be removed and legally disposed off site and replaced with environmentally clean, inorganic fill and free of debris or harmful matter. Unsuitable materials removed from the project site should be disposed of in accordance with all applicable Federal, State, and Local regulations.

The contractor should avoid stockpiling excavated materials immediately adjacent to the top of the excavation. We recommend that stockpile materials be kept back from the excavation a minimum distance equal to the excavation depth to avoid surcharging the excavation walls. If this is impractical due to space constraints, the excavation walls should be retained with bracing designed for the anticipated surcharge loading.

Excavations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, "Excavations" and its appendices, as well as other applicable codes. This document states that the contractor is solely responsible for the design and construction of stable, temporary excavations. The excavations should not only be in accordance with current OSHA excavation and trench safety standards but also with applicable local, state, and federal regulations. The contractor should shore, slope or bench the excavation sides when appropriate. Site safety is the sole responsibility of the contractor, who shall also be responsible for the means, methods and sequencing of construction operations.

### Construction Dewatering

Based on the groundwater conditions encountered at the project site, we anticipate that significant dewatering efforts will be required during construction of the proposed development. It should be noted that surface runoff may introduce water into the project site and the general contractor should be prepared to remove any accumulated water prior to the placement of fill and concrete. We anticipate that the removal of any accumulated water can be achieved utilizing drainage trenches and a sump and pump system. We recommend the contractor be prepared in case that perched water becomes an issue.

## Closing

This report has been prepared to aid in the evaluation of this property and to assist the architect and/or engineer in the design of the development described herein. The scope is limited to the specific project and locations described herein and our description of the project represents our understanding of the significant aspects relative to soil and foundation characteristics. In the event that any change in the nature or location of the proposed construction outlined in this report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified or approved in writing by the geotechnical engineer. It is recommended that all construction operations dealing with earthwork and foundations be reviewed by an experienced geotechnical engineer to provide information on which to base a decision as to whether the design requirements are fulfilled in the actual construction. If you wish, we would welcome the opportunity to provide field construction services for you during construction.

The analysis and recommendations submitted in this report are based upon the data obtained from the soil borings and tests performed at the locations as indicated on the Boring Location Diagram and other information referenced in this report. This report does not reflect variations, which may occur between the borings. In the performance of the subsurface exploration, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in soil conditions exist on most sites between boring locations and also such situations as groundwater levels vary from time to time. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, after performing on-site observations during the construction period and noting characteristics and variations, a reevaluation of the recommendations for this report will be necessary.

In addition to geotechnical engineering services, ECS Midwest, LLC has the in-house capability to perform multiple additional services as this project moves forward. These services include the following:

- Environmental Consulting;
- Geophysical Testing (ReMi and PHSA)
- Project Drawing and Specification Review; and,
- Construction Material Testing / Special Inspections

We would be pleased to provide these services for you. If you have questions with regard to this information or need further assistance during the design and construction of the project please feel free to contact us.

## APPENDIX

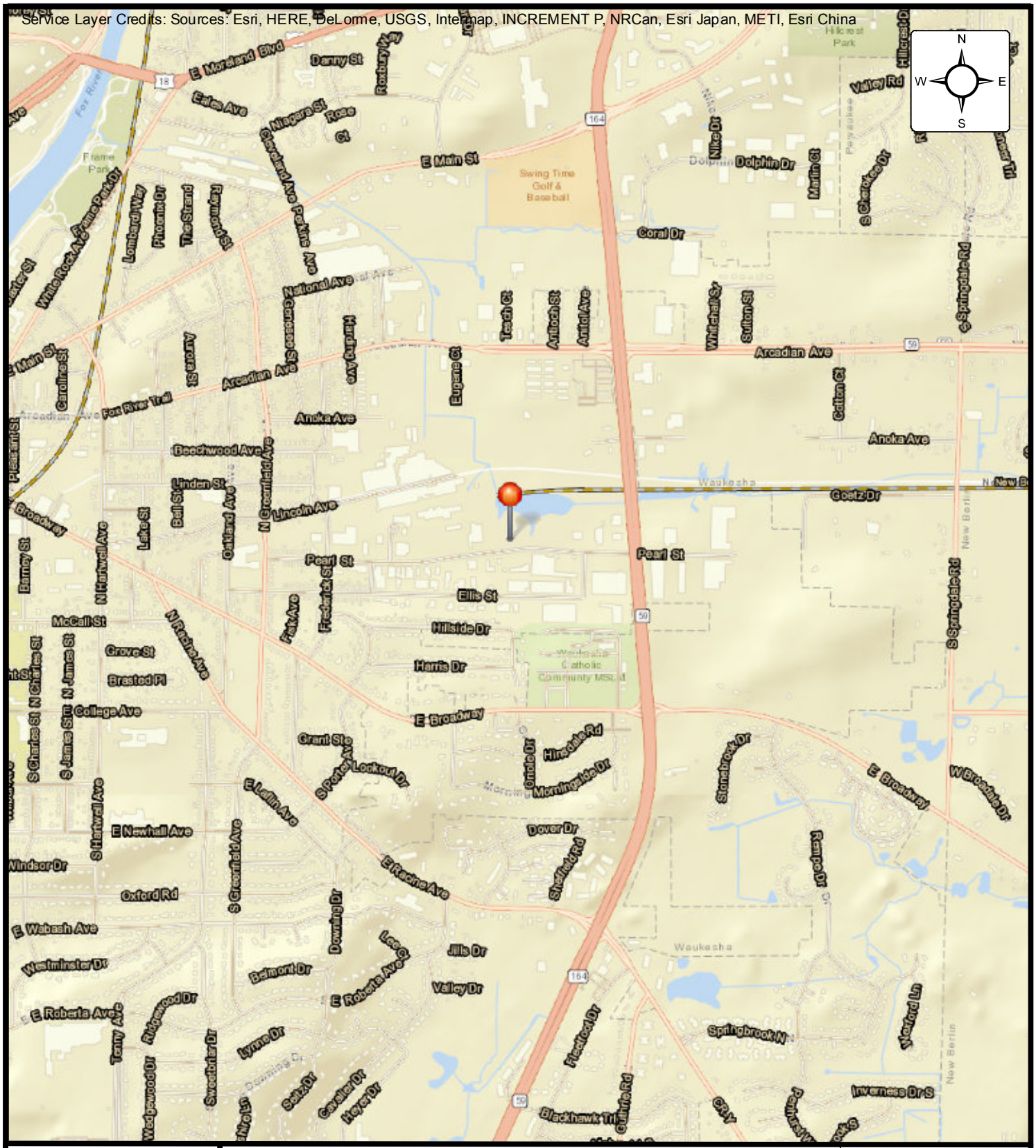
Site Location Map

Boring Location Diagram

Boring Logs

WDNR Soil Evaluation Storm Form

Reference Notes for Boring Logs

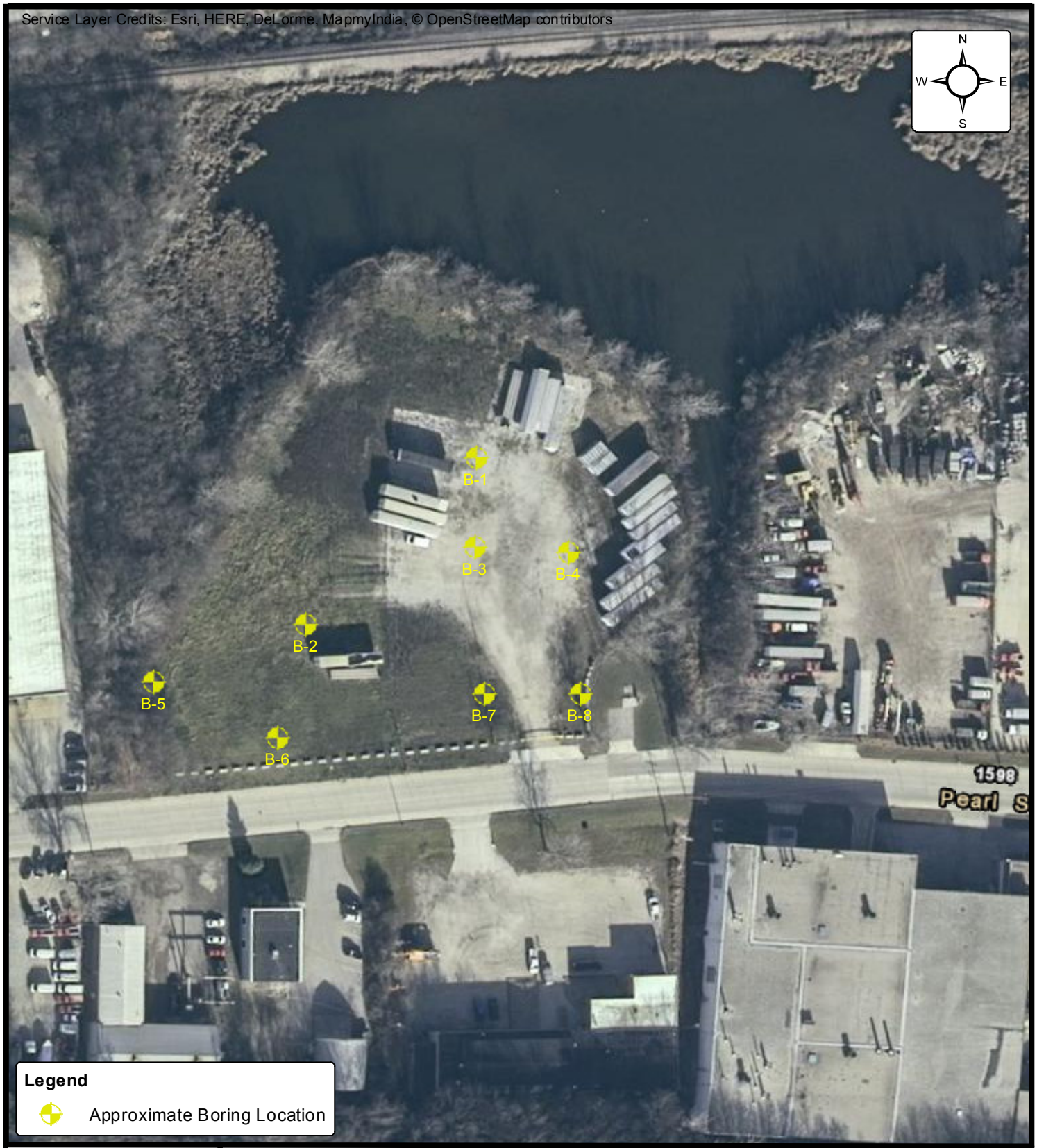



# SITE LOCATION DIAGRAM

# BEAUDRY SERVICES

**KORB + ASSOCIATES ARCHITECTS**
**WAUKESHA WI**

| | |
|---|---|
| ENGINEER | JFP |
| SCALE | NTS |
| PROJECT NO. | 42:1408 |
| SHEET | 1 OF 1 |
| DATE | 4/28/2017 |




# BORING LOCATION DIAGRAM

## BEAUDRY SERVICES

**KORB + ASSOCIATES ARCHITECTS**
**WAUKESHA WI**

| | |
|---|---|
| ENGINEER | JFP |
| SCALE | NTS |
| PROJECT NO. | 42:1408 |
| SHEET | 1 OF 1 |
| DATE | 4/28/2017 |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-1 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION: 1514 Pearl Street, Waukesha, Waukesha County, WI

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

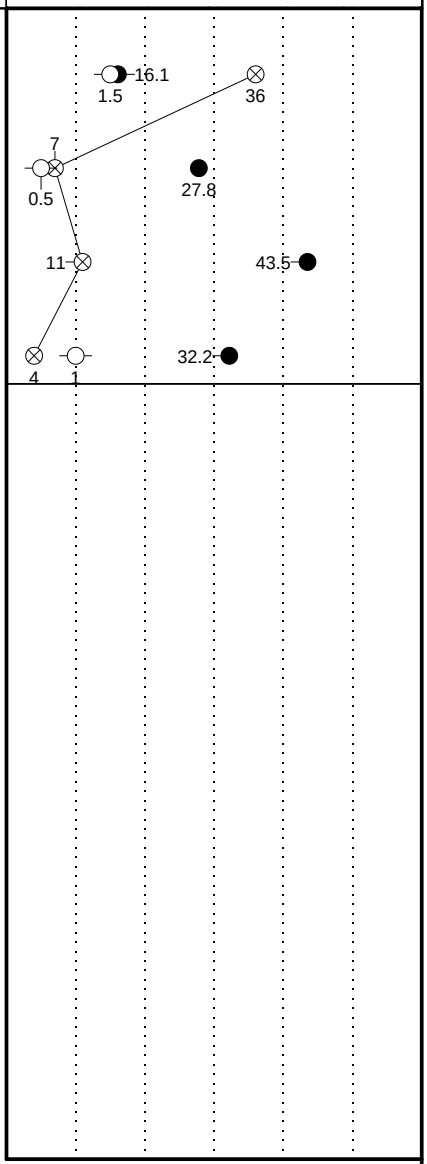
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 852 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Depth [10"] | | | |
| | S-1 | SS | 18 | 8 | (CL/ML FILL) SILTY CLAY with gravel, gray, moist, stiff | | 850 | 7<br>22<br>14 |
| | S-2 | SS | 18 | 16 | (CL/ML FILL) SILTY CLAY, trace gravel, trace PEAT, dark gray, moist, firm | ▼ | | 3<br>3<br>4 |
| 5 | S-3 | SS | 18 | 10 | | | 845 | 6<br>6<br>5 |
| | S-4 | SS | 18 | 16 | (ML/CL) CLAYEY SILT, trace sand, gray, moist, stiff | | | 1<br>1<br>3 |
| 10 | | | | | END OF BORING @ 10' | | 840 | |
| 15 | | | | | | | 835 | |
| 20 | | | | | | | 830 | |
| 25 | | | | | | | 825 | |
| 30 | | | | | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL 5 WS ☐ WD ☒ | BORING STARTED 05/01/17 | CAVE IN DEPTH |
| WL(SHW) WL(ACR) 3 | BORING COMPLETED 05/01/17 | HAMMER TYPE Auto |
| WL | RIG ATV FOREMAN Mike | DRILLING METHOD HSA |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-2 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION

1514 Pearl Street, Waukesha, Waukesha County, WI

| NORTHING | EASTING | STATION |
|---|---|---|
| | | |

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

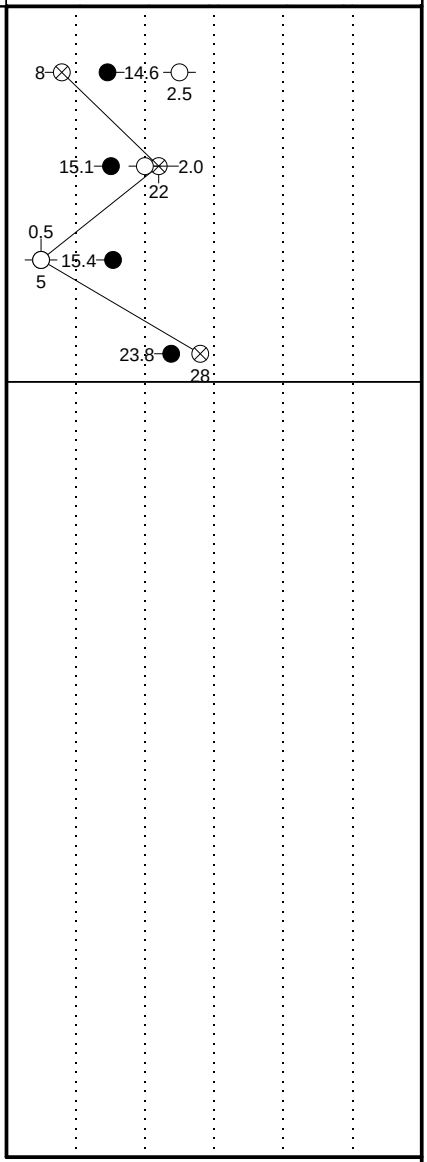
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING ▶ LOSS OF CIRCULATION

SURFACE ELEVATION 855 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Depth [12"] | | 855 | |
| | S-1 | SS | 18 | 14 | (CL/ML FILL) SILTY CLAY, trace sand, dark brown, moist, very stiff | | | 2 4 4 |
| | S-2 | SS | 18 | 14 | (CL/ML FILL) SILTY CLAY, trace sand and gravel, dark brown, moist, very stiff | | | 3 9 13 |
| 5 | | | | | | | 850 | |
| | S-3 | SS | 18 | 12 | | ▼ | | 2 2 3 |
| | S-4 | SS | 18 | 10 | (SM FILL) SILTY SAND WITH GRAVEL, contains asphalt and concrete, dark gray, wet, medium dense | | | 4 9 19 |
| 10 | | | | | END OF BORING @ 10' | | 845 | |
| 15 | | | | | | | 840 | |
| 20 | | | | | | | 835 | |
| 25 | | | | | | | 830 | |
| 30 | | | | | | | 825 | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL 7 WS ☐ WD ☒ | BORING STARTED 05/02/17 | CAVE IN DEPTH |
| WL(SHW) WL(ACR) 7 | BORING COMPLETED 05/02/17 | HAMMER TYPE Auto |
| WL | RIG ATV FOREMAN Mike | DRILLING METHOD HSA |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-3 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION: 1514 Pearl Street, Waukesha, Waukesha County, WI

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC%

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

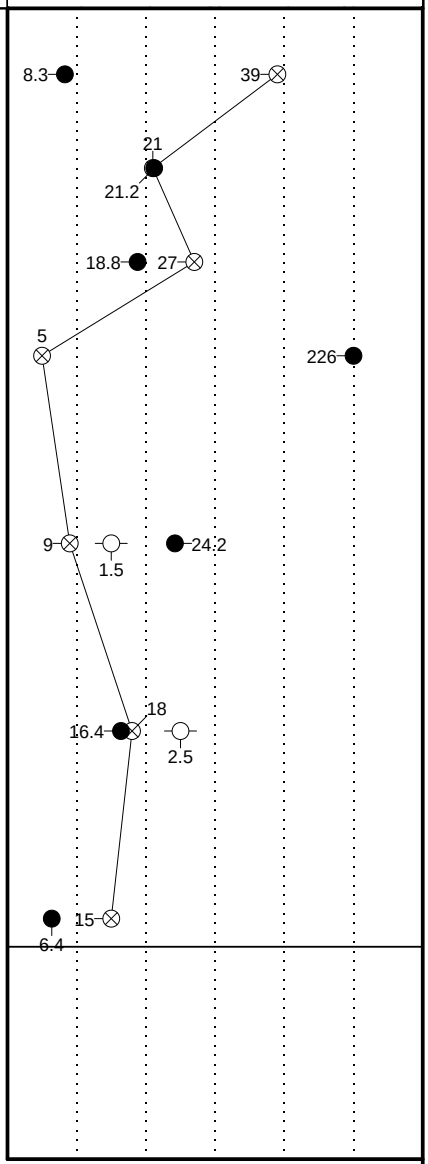
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 853 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Gravel Depth [12"] | | | |
| | S-1 | SS | 18 | 10 | (SP FILL) SAND WITH GRAVEL, trace clay, dark brown, moist, medium dense | | | 14 17 22 |
| | | | | | | | 850 | |
| | S-2 | SS | 18 | 6 | (SM FILL) SILTY SAND WITH GRAVEL, contains brick, dark gray, moist, medium dense | | | 3 7 14 |
| 5 | | | | | | | | |
| | S-3 | SS | 18 | 10 | | | | 22 14 13 |
| | | | | | | | 845 | |
| | S-4 | SS | 18 | 12 | (PT) PEATY ORGANIC SOIL, black, moist, very soft | | | 2 2 3 |
| 10 | | | | | | | | |
| | | | | | | | 840 | |
| | S-5 | SS | 18 | 12 | (ML/CL) CLAYEY SILT, trace sand, gray, moist, loose to medium dense | | | 4 4 5 |
| 15 | | | | | | | | |
| | | | | | | | 835 | |
| | S-6 | SS | 18 | 12 | | | | 7 8 10 |
| 20 | | | | | | | | |
| | | | | | (ML/CL) CLAYEY SILT, grayish brown, wet, medium dense | | 830 | |
| | S-7 | SS | 18 | 12 | | | | 5 5 10 |
| 25 | | | | | END OF BORING @ 25' | | | |
| | | | | | | | 825 | |
| 30 | | | | | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL 4 WS ☐ WD ☒ | BORING STARTED 05/01/17 | CAVE IN DEPTH 9 |
| WL(SHW) WL(ACR) 5 | BORING COMPLETED 05/01/17 | HAMMER TYPE Auto |
| WL | RIG Truck FOREMAN Mike | DRILLING METHOD HSA |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-4 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION: 1514 Pearl Street, Waukesha, Waukesha County, WI

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

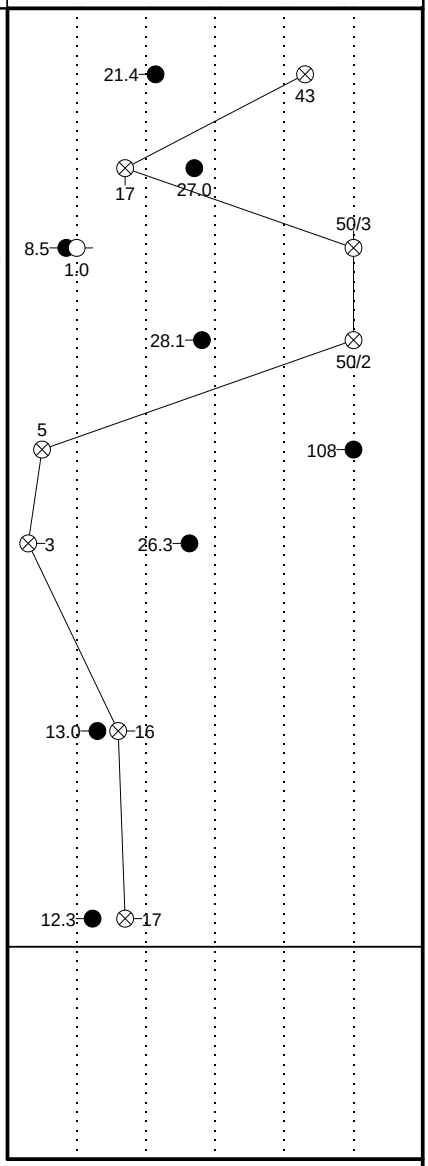
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 852 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Gravel Depth [12"] | | | |
| | S-1 | SS | 18 | 4 | (SM FILL) SILTY FINE SAND WITH GRAVEL, dark brown, moist to wet, medium dense | | 850 | 17 18 25 |
| | S-2 | SS | 18 | 2 | | | | 15 10 7 |
| 5 | S-3 | SS | 9 | 6 | (CL/ML) SILTY CLAY WITH SAND AND GRAVEL ,brown, moist, stiff | | 845 | 17 50/3 |
| | S-4 | SS | 8 | 0 | | | | 22 50/2 |
| 10 | S-5 | SS | 18 | 2 | (PT) PEATY ORGANIC SOIL, black, moist, very soft | | 840 | 3 2 3 |
| | S-6 | SS | 18 | 14 | (ML/CL) CLAYEY SILT, trace sand, gray, moist, medium dense | | 835 | 1 1 2 |
| 15 | S-7 | SS | 18 | 12 | | | 830 | 6 9 7 |
| 20 | S-8 | SS | 18 | 14 | (SM) SILTY SAND, trace gravel, gray, wet, medium dense | | 825 | 5 10 7 |
| 25 | | | | | END OF BORING @ 25' | | | |
| 30 | | | | | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL 4 WS ☐ WD ☒ | BORING STARTED 05/01/17 | CAVE IN DEPTH @ 4' |
| WL(SHW) WL(ACR) 4 | BORING COMPLETED 05/01/17 | HAMMER TYPE Auto |
| WL | RIG Truck FOREMAN Mike | DRILLING METHOD HSA |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-5 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION: 1514 Pearl Street, Waukesha, Waukesha County, WI

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC%

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

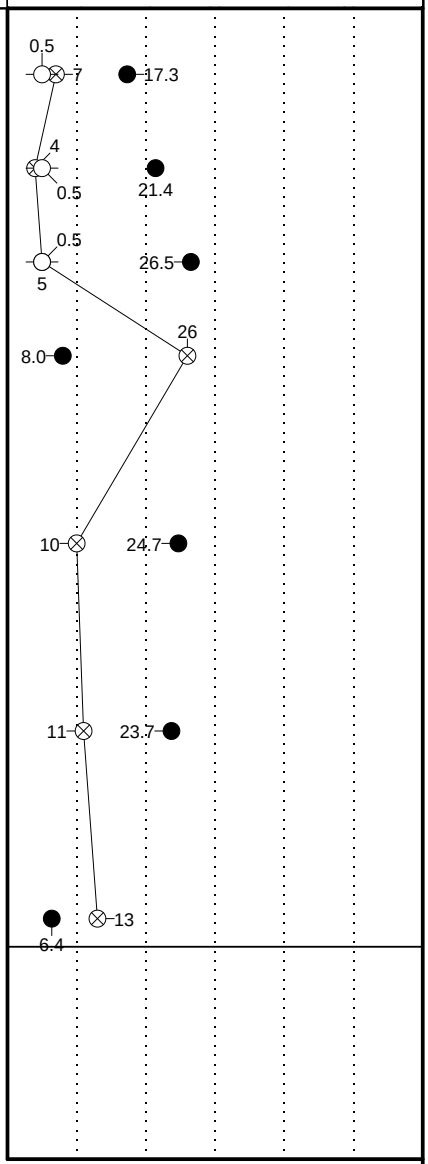
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 853.4 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Depth [14"] | | |
| | S-1 | SS | 18 | 8 | (CL/ML FILL) SILTY CLAY WITH SAND AND GRAVEL, brown, moist, firm | | 2 4 3 |
| | S-2 | SS | 18 | 8 | | 850 | 2 2 2 |
| 5 | S-3 | SS | 18 | 14 | (ML/CL) CLAYEY SILT, trace sand, brown to gray, moist, loose | | 1 2 3 |
| | S-4 | SS | 18 | 8 | (SM) SILTY SAND WITH GRAVEL, brown, moist, medium dense | 845 | 10 16 10 |
| 10 | | | | | | | |
| | | | | | (SM) SILTY FINE SAND WITH GRAVEL, brown, wet, medium dense | 840 | 5 4 6 |
| | S-5 | SS | 18 | 14 | | | |
| 15 | | | | | | | |
| | | | | | | 835 | 3 5 6 |
| | S-6 | SS | 18 | 10 | | | |
| 20 | | | | | | | |
| | | | | | | 830 | 5 6 7 |
| | S-7 | SS | 18 | 12 | (SM) SILTY FINE SAND WITH GRAVEL, gray, wet, medium dense | | |
| 25 | | | | | END OF BORING @ 25' | | |
| | | | | | | 825 | |
| 30 | | | | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL 7 WS ☐ WD ☒ | BORING STARTED 05/02/17 | CAVE IN DEPTH @ 10' |
| WL(SHW) WL(ACR) 7 | BORING COMPLETED 05/02/17 | HAMMER TYPE Auto |
| WL | RIG ATV FOREMAN Mike | DRILLING METHOD HSA |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-6 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION: 1514 Pearl Street, Waukesha, Waukesha County, WI

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC%

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

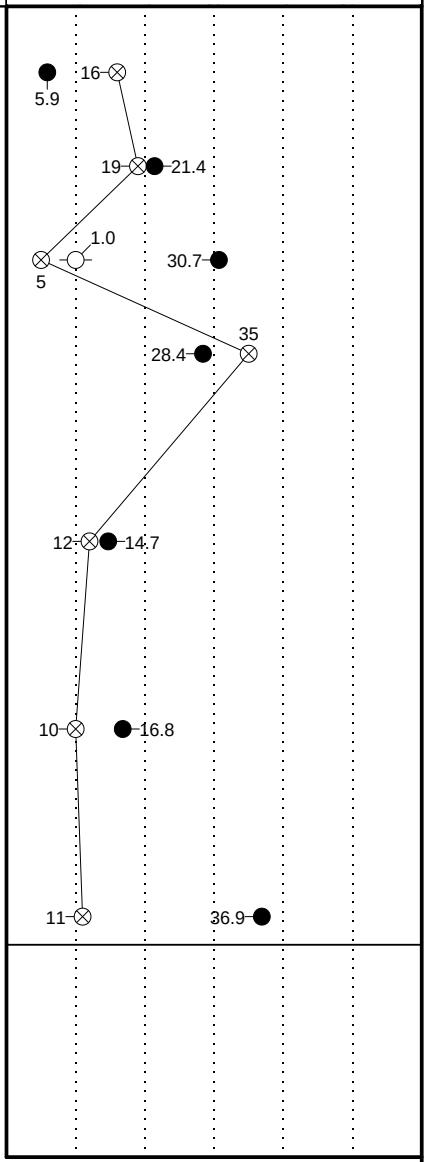
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 853 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Depth [14"] | | | |
| | S-1 | SS | 18 | 18 | (SM FILL) SILTY SAND WITH GRAVEL, trace clay, brown, moist, medium dense | | | 5 9 7 |
| | | | | | | | 850 | |
| | S-2 | SS | 18 | 6 | (CL/ML) SILTY CLAY WITH SAND AND GRAVEL , brown, moist, very stiff | | | 12 13 6 |
| 5 | | | | | (ML/CL) CLAYEY SILT, brown/ gray mottled, moist, loose | | | |
| | S-3 | SS | 18 | 12 | | | | 1 2 3 |
| | | | | | (SM) SILTY SAND WITH GRAVEL, gray/lt brown mottled, moist, dense | | 845 | |
| | S-4 | SS | 18 | 6 | | | | 6 16 19 |
| 10 | | | | | | | | |
| | | | | | | | 840 | |
| | S-5 | SS | 18 | 12 | (SM) SILTY FINE SAND WITH GRAVEL, brown, moist to wet, medium dense | | | 8 8 4 |
| 15 | | | | | | | | |
| | | | | | | | 835 | |
| | S-6 | SS | 18 | 12 | | | | 5 5 5 |
| 20 | | | | | | | | |
| | | | | | | | 830 | |
| | S-7 | SS | 18 | 14 | (SM) SILTY SAND WITH GRAVEL, gray, wet, dense | | | 4 6 5 |
| 25 | | | | | END OF BORING @ 25' | | | |
| | | | | | | | 825 | |
| 30 | | | | | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL 9 WS ☐ WD ☒ | BORING STARTED 05/02/17 | CAVE IN DEPTH @ 7' |
| WL(SHW) WL(ACR) 5 | BORING COMPLETED 05/02/17 | HAMMER TYPE Auto |
| WL | RIG ATV FOREMAN Mike | DRILLING METHOD HSA |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-7 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION: 1514 Pearl Street, Waukesha, Waukesha County, WI

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC%

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

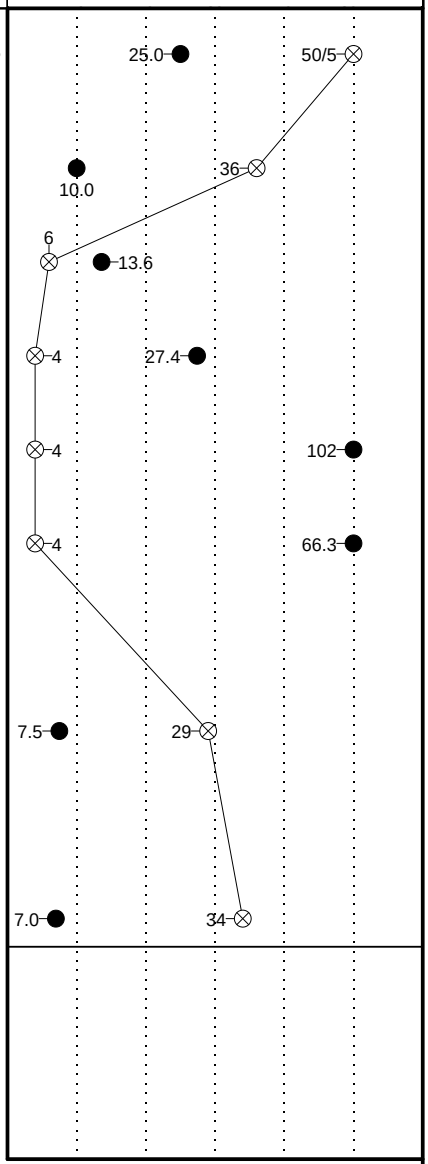
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 852 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Gravel Depth [4"] | | | |
| | S-1 | SS | 5 | 2 | (CL/ML FILL) SILTY CLAY WITH SAND AND GRAVEL, brown, moist, stiff | | 850 | 50/5 |
| | S-2 | SS | 18 | 10 | | | | 16 17 19 |
| 5 | S-3 | SS | 18 | 12 | (CL/ML) SILTY CLAY, trace sand and gravel, dark brown, moist, firm | | 845 | 1 2 4 |
| | S-4 | SS | 18 | 10 | | | | 1 2 2 |
| 10 | S-5 | SS | 18 | 10 | (PT) PEATY ORGANIC SOIL, black, moist, very soft | | 840 | 3 2 2 |
| | S-6 | SS | 18 | 12 | (ML/CL) CLAYEY SILT, trace sand, trace peat, gray, moist, very loose | | | 1 2 2 |
| 15 | | | | | (SM) SILTY FINE SAND WITH GRAVEL, brown to gray, wet, medium dense | | 835 | |
| | S-7 | SS | 18 | 10 | | | | 11 12 17 |
| 20 | | | | | | | 830 | |
| | S-8 | SS | 18 | 10 | | | | 11 15 19 |
| 25 | | | | | END OF BORING @ 25' | | 825 | |
| 30 | | | | | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL WS ☐ WD ☒ | BORING STARTED 05/01/17 | CAVE IN DEPTH |
| WL(SHW) WL(ACR) 9 | BORING COMPLETED 05/01/17 | HAMMER TYPE Auto |
| WL | RIG Truck FOREMAN Mike | DRILLING METHOD HSA |

| CLIENT | Job #: | BORING # | SHEET |
|---|---|---|---|
| Beaudry Services, Inc | 42:1408 | B-8 | 1 OF 1 |

| PROJECT NAME | ARCHITECT-ENGINEER |
|---|---|
| Beaudry Services | Korb + Associates Architects |

SITE LOCATION: 1514 Pearl Street, Waukesha, Waukesha County, WI

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT$^2$

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

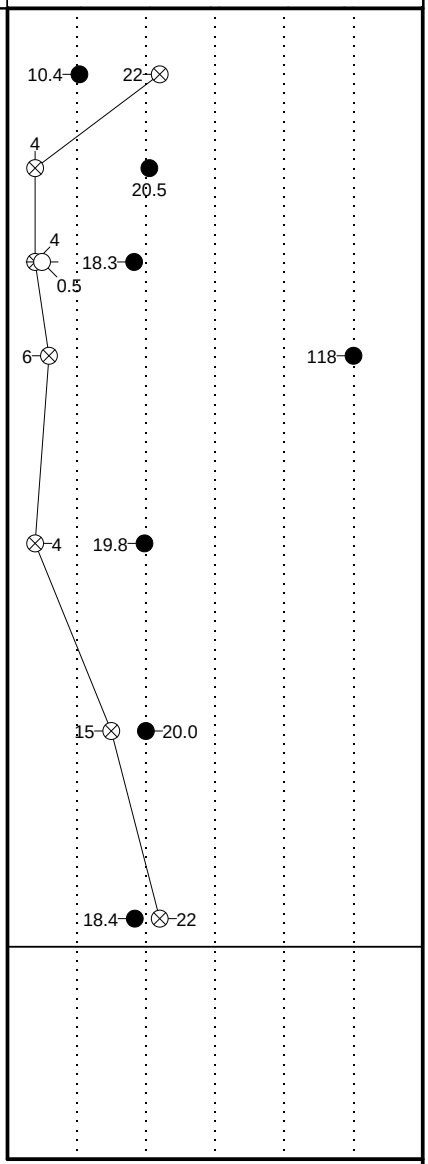
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 852 +/-

| DEPTH (FT) | SAMPLE NO. | SAMPLE TYPE | SAMPLE DIST. (IN) | RECOVERY (IN) | DESCRIPTION OF MATERIAL | WATER LEVELS | ELEVATION (FT) | BLOWS/6" |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Topsoil Depth [14"] | | | |
| | S-1 | SS | 18 | 4 | (SP FILL) SAND WITH GRAVEL, trace clay, dark brown, wet, very loose to medium dense | | 850 | 8 10 12 |
| | S-2 | SS | 18 | 4 | | | | 7 2 2 |
| 5 | | | | | | | | |
| | S-3 | SS | 18 | 4 | (CL/ML) SILTY CLAY WITH GRAVEL, gray, moist, firm | | 845 | 1 2 2 |
| | S-4 | SS | 18 | 4 | (PT) PEATY ORGANIC SOIL, black, moist, very soft | | | 2 2 4 |
| 10 | | | | | | | 840 | |
| | S-5 | SS | 18 | 4 | (ML/CL) CLAYEY SILT, trace sand, dark brown, moist, loose | | | 1 2 2 |
| 15 | | | | | | | 835 | |
| | S-6 | SS | 18 | 10 | | | | 6 7 8 |
| 20 | | | | | (SM) SILTY MEDIUM SAND, trace gravel, brown, wet, medium dense | | 830 | |
| | S-7 | SS | 18 | 10 | | | | 2 11 11 |
| 25 | | | | | END OF BORING @ 25' | | 825 | |
| 30 | | | | | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

| | | |
|---|---|---|
| WL 5 WS ☐ WD ☒ | BORING STARTED 05/01/17 | CAVE IN DEPTH @ 7' |
| WL(SHW) WL(ACR) 3 | BORING COMPLETED 05/01/17 | HAMMER TYPE Auto |
| WL | RIG Truck FOREMAN Mike | DRILLING METHOD HSA |

# REFERENCE NOTES FOR BORING LOGS

| MATERIAL[1,2] | |
|---|---|
| | **ASPHALT** |
| | **CONCRETE** |
| | **GRAVEL** |
| | **TOPSOIL** |
| | **VOID** |
| | **BRICK** |
| | **AGGREGATE BASE COURSE** |
| | **FILL[3] MAN-PLACED SOILS** |
| **GW** | **WELL-GRADED GRAVEL** gravel-sand mixtures, little or no fines |
| **GP** | **POORLY-GRADED GRAVEL** gravel-sand mixtures, little or no fines |
| **GM** | **SILTY GRAVEL** gravel-sand-silt mixtures |
| **GC** | **CLAYEY GRAVEL** gravel-sand-clay mixtures |
| **SW** | **WELL-GRADED SAND** gravelly sand, little or no fines |
| **SP** | **POORLY-GRADED SAND** gravelly sand, little or no fines |
| **SM** | **SILTY SAND** sand-silt mixtures |
| **SC** | **CLAYEY SAND** sand-clay mixtures |
| **ML** | **SILT** non-plastic to medium plasticity |
| **MH** | **ELASTIC SILT** high plasticity |
| **CL** | **LEAN CLAY** low to medium plasticity |
| **CH** | **FAT CLAY** high plasticity |
| **OL** | **ORGANIC SILT or CLAY** non-plastic to low plasticity |
| **OH** | **ORGANIC SILT or CLAY** high plasticity |
| **PT** | **PEAT** highly organic soils |

| DRILLING SAMPLING SYMBOLS & ABBREVIATIONS | | | |
|---|---|---|---|
| SS | Split Spoon Sampler | PM | Pressuremeter Test |
| ST | Shelby Tube Sampler | RD | Rock Bit Drilling |
| WS | Wash Sample | RC | Rock Core, NX, BX, AX |
| BS | Bulk Sample of Cuttings | REC | Rock Sample Recovery % |
| PA | Power Auger (no sample) | RQD | Rock Quality Designation % |
| HSA | Hollow Stem Auger | | |

| PARTICLE SIZE IDENTIFICATION | | |
|---|---|---|
| **DESIGNATION** | | **PARTICLE SIZES** |
| Boulders | | 12 inches (300 mm) or larger |
| Cobbles | | 3 inches to 12 inches (75 mm to 300 mm) |
| Gravel: | Coarse | ¾ inch to 3 inches (19 mm to 75 mm) |
| | Fine | 4.75 mm to 19 mm (No. 4 sieve to ¾ inch) |
| Sand: | Coarse | 2.00 mm to 4.75 mm (No. 10 to No. 4 sieve) |
| | Medium | 0.425 mm to 2.00 mm (No. 40 to No. 10 sieve) |
| | Fine | 0.074 mm to 0.425 mm (No. 200 to No. 40 sieve) |
| Silt & Clay ("Fines") | | <0.074 mm (smaller than a No. 200 sieve) |

| COHESIVE SILTS & CLAYS | | |
|---|---|---|
| **UNCONFINED COMPRESSIVE STRENGTH, $Q_P$[4]** | **SPT[5] (BPF)** | **CONSISTENCY[7] (COHESIVE)** |
| <0.25 | <3 | Very Soft |
| 0.25 - <0.50 | 3 - 4 | Soft |
| 0.50 - <1.00 | 5 - 8 | Firm |
| 1.00 - <2.00 | 9 - 15 | Stiff |
| 2.00 - <4.00 | 16 - 30 | Very Stiff |
| 4.00 - 8.00 | 31 - 50 | Hard |
| >8.00 | >50 | Very Hard |

| GRAVELS, SANDS & NON-COHESIVE SILTS | |
|---|---|
| **SPT[5]** | **DENSITY** |
| <5 | Very Loose |
| 5 - 10 | Loose |
| 11 - 30 | Medium Dense |
| 31 - 50 | Dense |
| >50 | Very Dense |

| RELATIVE AMOUNT[7] | COARSE GRAINED (%)[8] | FINE GRAINED (%)[8] |
|---|---|---|
| Trace | ≤5 | ≤5 |
| Dual Symbol *(ex: SW-SM)* | 10 | 10 |
| With | 15 - 20 | 15 - 25 |
| Adjective *(ex: "Silty")* | ≥25 | ≥30 |

| WATER LEVELS[6] | | |
|---|---|---|
| | WL | Water Level (WS)(WD) |
| | | (WS) While Sampling |
| | | (WD) While Drilling |
| | SHW | Seasonal High WT |
| | ACR | After Casing Removal |
| | SWT | Stabilized Water Table |
| | DCI | Dry Cave-In |
| | WCI | Wet Cave-In |

*[1] Classifications and symbols per ASTM D 2488-09 (Visual-Manual Procedure) unless noted otherwise.*

*[2] To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.*

*[3] Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-**FILL**)].*

*[4] Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).*

*[5] Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf).*

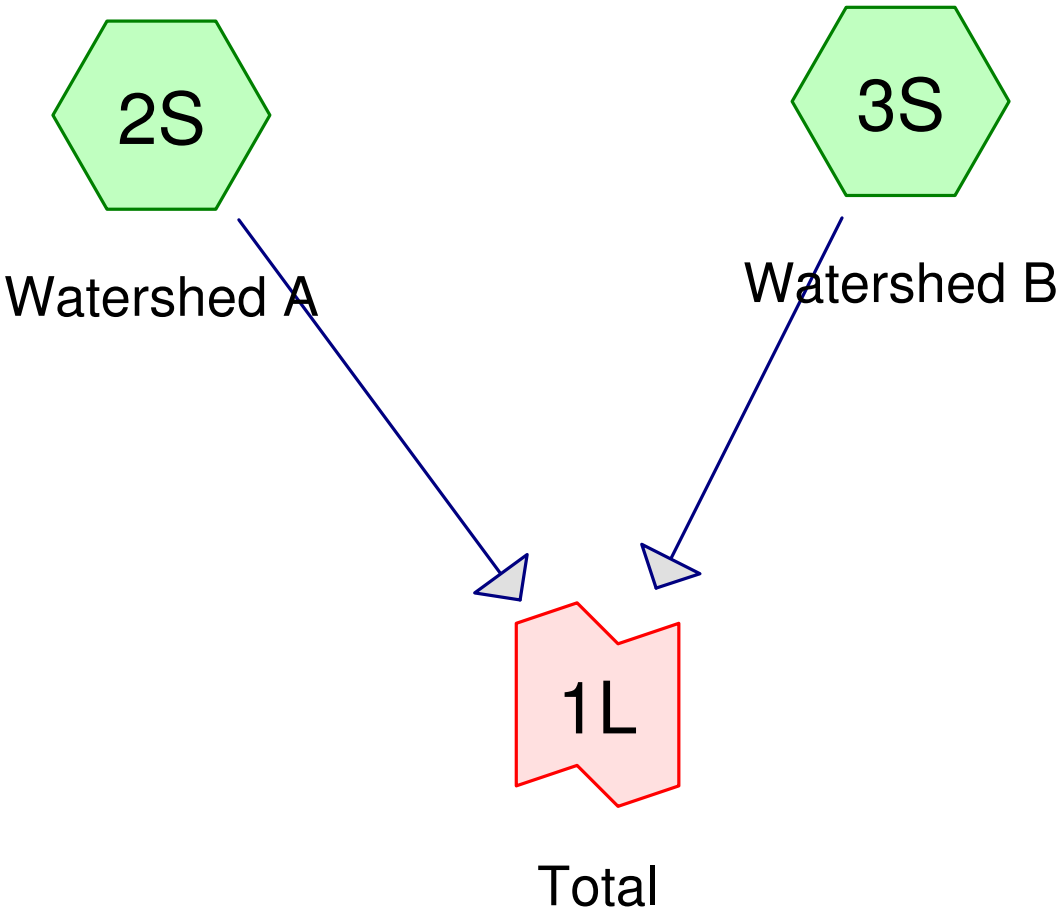
*[6] The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.*

*[7] Minor deviation from ASTM D 2488-09 Note 16.*

*[8] Percentages are estimated to the nearest 5% per ASTM D 2488-09.*

# Appendix B

# Storm Water Quantity (HydroCAD) Modeling




Subcat Reach Pond Link

**Routing Diagram for 16923 Existing**
Prepared by {enter your company name here}, Printed 6/9/2017

## Summary for Subcatchment 2S: Watershed A

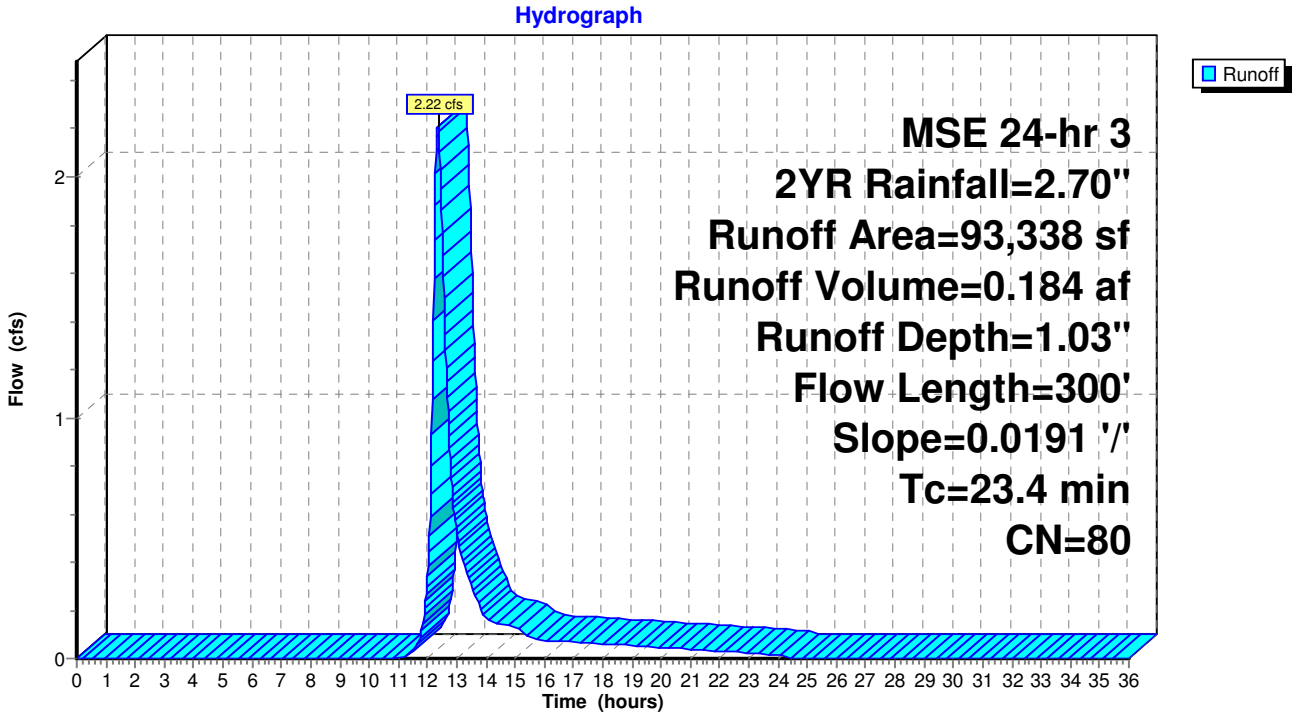
Runoff = 2.22 cfs @ 12.35 hrs, Volume= 0.184 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 2YR Rainfall=2.70"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 90,409 | 80 | Greenspace |
| * | 2,929 | 89 | Gravel |
| | 93,338 | 80 | Weighted Average |
| | 93,338 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 23.4 | 300 | 0.0191 | 0.21 | | **Sheet Flow, Sheet** Range n= 0.130 P2= 2.68" |

## Subcatchment 2S: Watershed A



## Hydrograph for Subcatchment 2S: Watershed A

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.01 | 0.00 | 0.00 |
| 1.60 | 0.02 | 0.00 | 0.00 |
| 2.00 | 0.02 | 0.00 | 0.00 |
| 2.40 | 0.03 | 0.00 | 0.00 |
| 2.80 | 0.04 | 0.00 | 0.00 |
| 3.20 | 0.05 | 0.00 | 0.00 |
| 3.60 | 0.06 | 0.00 | 0.00 |
| 4.00 | 0.07 | 0.00 | 0.00 |
| 4.40 | 0.08 | 0.00 | 0.00 |
| 4.80 | 0.09 | 0.00 | 0.00 |
| 5.20 | 0.11 | 0.00 | 0.00 |
| 5.60 | 0.12 | 0.00 | 0.00 |
| 6.00 | 0.14 | 0.00 | 0.00 |
| 6.40 | 0.15 | 0.00 | 0.00 |
| 6.80 | 0.17 | 0.00 | 0.00 |
| 7.20 | 0.19 | 0.00 | 0.00 |
| 7.60 | 0.21 | 0.00 | 0.00 |
| 8.00 | 0.23 | 0.00 | 0.00 |
| 8.40 | 0.25 | 0.00 | 0.00 |
| 8.80 | 0.27 | 0.00 | 0.00 |
| 9.20 | 0.30 | 0.00 | 0.00 |
| 9.60 | 0.33 | 0.00 | 0.00 |
| 10.00 | 0.37 | 0.00 | 0.00 |
| 10.40 | 0.41 | 0.00 | 0.00 |
| 10.80 | 0.47 | 0.00 | 0.00 |
| 11.20 | 0.57 | 0.00 | 0.00 |
| 11.60 | 0.72 | 0.02 | 0.05 |
| 12.00 | 1.25 | 0.17 | **0.34** |
| 12.40 | 1.98 | 0.55 | **2.16** |
| 12.80 | 2.13 | 0.64 | 0.79 |
| 13.20 | 2.23 | 0.70 | 0.41 |
| 13.60 | 2.29 | 0.75 | 0.28 |
| 14.00 | 2.33 | 0.77 | 0.17 |
| 14.40 | 2.37 | 0.80 | 0.14 |
| 14.80 | 2.40 | 0.82 | 0.14 |
| 15.20 | 2.43 | 0.84 | 0.12 |
| 15.60 | 2.45 | 0.86 | 0.08 |
| 16.00 | 2.47 | 0.87 | 0.08 |
| 16.40 | 2.49 | 0.88 | 0.07 |
| 16.80 | 2.51 | 0.90 | 0.07 |
| 17.20 | 2.53 | 0.91 | 0.07 |
| 17.60 | 2.55 | 0.92 | 0.06 |
| 18.00 | 2.56 | 0.93 | 0.06 |
| 18.40 | 2.58 | 0.94 | 0.06 |
| 18.80 | 2.59 | 0.95 | 0.06 |
| 19.20 | 2.61 | 0.96 | 0.05 |
| 19.60 | 2.62 | 0.97 | 0.05 |
| 20.00 | 2.63 | 0.98 | 0.05 |
| 20.40 | 2.64 | 0.99 | 0.04 |
| 20.80 | 2.65 | 0.99 | 0.04 |
| 21.20 | 2.66 | 1.00 | 0.04 |
| 21.60 | 2.67 | 1.01 | 0.03 |
| 22.00 | 2.68 | 1.01 | 0.03 |
| 22.40 | 2.68 | 1.02 | 0.03 |
| 22.80 | 2.69 | 1.02 | 0.02 |
| 23.20 | 2.69 | 1.02 | 0.02 |
| 23.60 | 2.70 | 1.03 | 0.02 |
| 24.00 | **2.70** | **1.03** | 0.01 |
| 24.40 | 2.70 | 1.03 | 0.00 |
| 24.80 | 2.70 | 1.03 | 0.00 |
| 25.20 | 2.70 | 1.03 | 0.00 |
| 25.60 | 2.70 | 1.03 | 0.00 |
| 26.00 | 2.70 | 1.03 | 0.00 |
| 26.40 | 2.70 | 1.03 | 0.00 |
| 26.80 | 2.70 | 1.03 | 0.00 |
| 27.20 | 2.70 | 1.03 | 0.00 |
| 27.60 | 2.70 | 1.03 | 0.00 |
| 28.00 | 2.70 | 1.03 | 0.00 |
| 28.40 | 2.70 | 1.03 | 0.00 |
| 28.80 | 2.70 | 1.03 | 0.00 |
| 29.20 | 2.70 | 1.03 | 0.00 |
| 29.60 | 2.70 | 1.03 | 0.00 |
| 30.00 | 2.70 | 1.03 | 0.00 |
| 30.40 | 2.70 | 1.03 | 0.00 |
| 30.80 | 2.70 | 1.03 | 0.00 |
| 31.20 | 2.70 | 1.03 | 0.00 |
| 31.60 | 2.70 | 1.03 | 0.00 |
| 32.00 | 2.70 | 1.03 | 0.00 |
| 32.40 | 2.70 | 1.03 | 0.00 |
| 32.80 | 2.70 | 1.03 | 0.00 |
| 33.20 | 2.70 | 1.03 | 0.00 |
| 33.60 | 2.70 | 1.03 | 0.00 |
| 34.00 | 2.70 | 1.03 | 0.00 |
| 34.40 | 2.70 | 1.03 | 0.00 |
| 34.80 | 2.70 | 1.03 | 0.00 |
| 35.20 | 2.70 | 1.03 | 0.00 |
| 35.60 | 2.70 | 1.03 | 0.00 |
| 36.00 | 2.70 | 1.03 | 0.00 |

## Summary for Subcatchment 3S: Watershed B

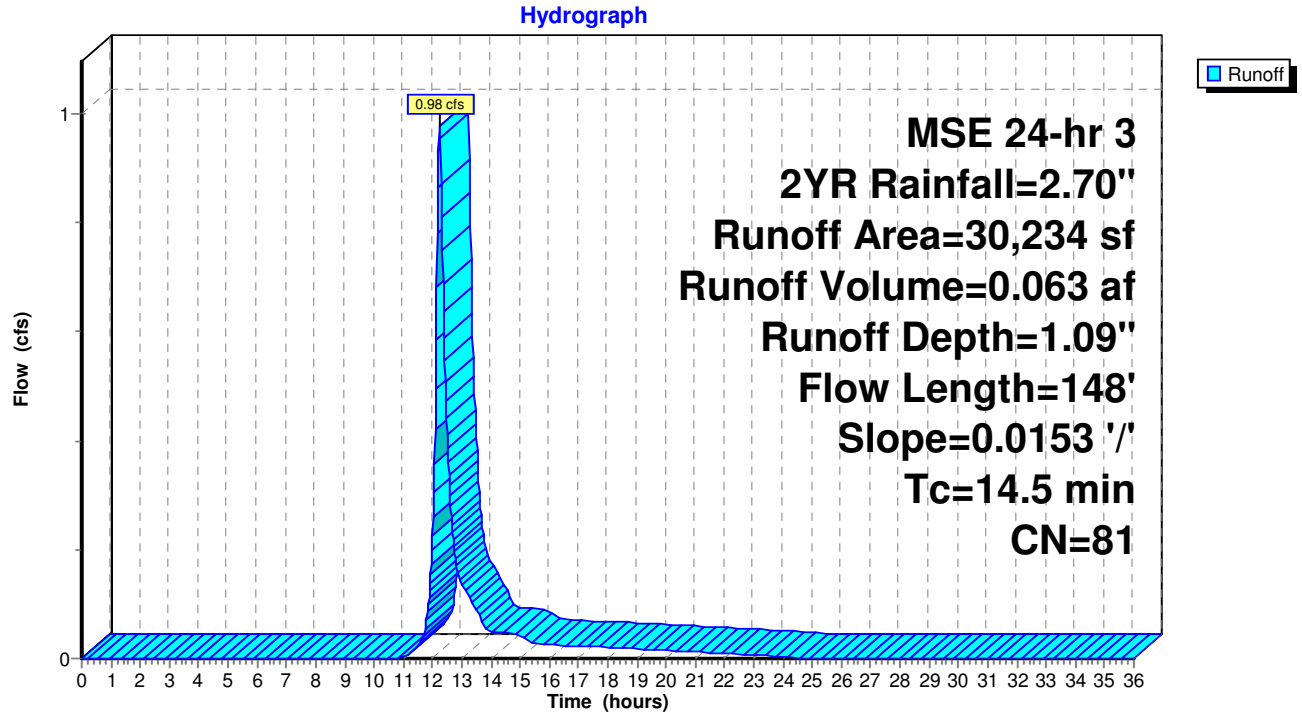
Runoff = 0.98 cfs @ 12.24 hrs, Volume= 0.063 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 2YR Rainfall=2.70"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 26,742 | 80 | Greenspace |
| * | 3,492 | 89 | Gravel |
| | 30,234 | 81 | Weighted Average |
| | 30,234 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.5 | 148 | 0.0153 | 0.17 | | **Sheet Flow, Sheet** Range n= 0.130 P2= 2.68" |

## Subcatchment 3S: Watershed B



## Hydrograph for Subcatchment 3S: Watershed B

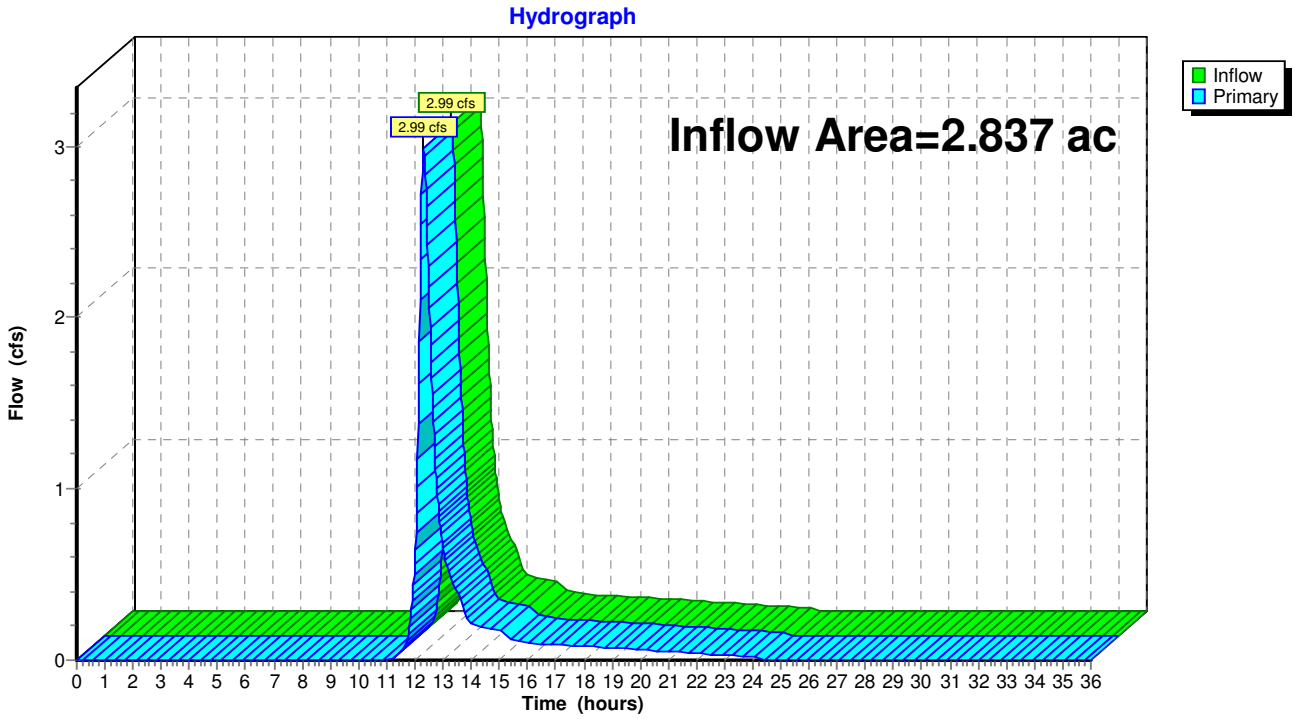
| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.01 | 0.00 | 0.00 |
| 1.60 | 0.02 | 0.00 | 0.00 |
| 2.00 | 0.02 | 0.00 | 0.00 |
| 2.40 | 0.03 | 0.00 | 0.00 |
| 2.80 | 0.04 | 0.00 | 0.00 |
| 3.20 | 0.05 | 0.00 | 0.00 |
| 3.60 | 0.06 | 0.00 | 0.00 |
| 4.00 | 0.07 | 0.00 | 0.00 |
| 4.40 | 0.08 | 0.00 | 0.00 |
| 4.80 | 0.09 | 0.00 | 0.00 |
| 5.20 | 0.11 | 0.00 | 0.00 |
| 5.60 | 0.12 | 0.00 | 0.00 |
| 6.00 | 0.14 | 0.00 | 0.00 |
| 6.40 | 0.15 | 0.00 | 0.00 |
| 6.80 | 0.17 | 0.00 | 0.00 |
| 7.20 | 0.19 | 0.00 | 0.00 |
| 7.60 | 0.21 | 0.00 | 0.00 |
| 8.00 | 0.23 | 0.00 | 0.00 |
| 8.40 | 0.25 | 0.00 | 0.00 |
| 8.80 | 0.27 | 0.00 | 0.00 |
| 9.20 | 0.30 | 0.00 | 0.00 |
| 9.60 | 0.33 | 0.00 | 0.00 |
| 10.00 | 0.37 | 0.00 | 0.00 |
| 10.40 | 0.41 | 0.00 | 0.00 |
| 10.80 | 0.47 | 0.00 | 0.00 |
| 11.20 | 0.57 | 0.00 | 0.01 |
| 11.60 | 0.72 | 0.02 | 0.03 |
| 12.00 | 1.25 | 0.19 | **0.23** |
| 12.40 | 1.98 | 0.59 | **0.59** |
| 12.80 | 2.13 | 0.69 | 0.17 |
| 13.20 | 2.23 | 0.75 | 0.12 |
| 13.60 | 2.29 | 0.79 | 0.08 |
| 14.00 | 2.33 | 0.82 | 0.05 |
| 14.40 | 2.37 | 0.85 | 0.05 |
| 14.80 | 2.40 | 0.87 | 0.04 |
| 15.20 | 2.43 | 0.89 | 0.04 |
| 15.60 | 2.45 | 0.91 | 0.03 |
| 16.00 | 2.47 | 0.92 | 0.03 |
| 16.40 | 2.49 | 0.94 | 0.02 |
| 16.80 | 2.51 | 0.95 | 0.02 |
| 17.20 | 2.53 | 0.96 | 0.02 |
| 17.60 | 2.55 | 0.98 | 0.02 |
| 18.00 | 2.56 | 0.99 | 0.02 |
| 18.40 | 2.58 | 1.00 | 0.02 |
| 18.80 | 2.59 | 1.01 | 0.02 |
| 19.20 | 2.61 | 1.02 | 0.02 |
| 19.60 | 2.62 | 1.03 | 0.02 |
| 20.00 | 2.63 | 1.04 | 0.01 |
| 20.40 | 2.64 | 1.04 | 0.01 |
| 20.80 | 2.65 | 1.05 | 0.01 |
| 21.20 | 2.66 | 1.06 | 0.01 |
| 21.60 | 2.67 | 1.06 | 0.01 |
| 22.00 | 2.68 | 1.07 | 0.01 |
| 22.40 | 2.68 | 1.07 | 0.01 |
| 22.80 | 2.69 | 1.08 | 0.01 |
| 23.20 | 2.69 | 1.08 | 0.01 |
| 23.60 | 2.70 | 1.09 | 0.01 |
| 24.00 | **2.70** | **1.09** | 0.00 |
| 24.40 | 2.70 | 1.09 | 0.00 |
| 24.80 | 2.70 | 1.09 | 0.00 |
| 25.20 | 2.70 | 1.09 | 0.00 |
| 25.60 | 2.70 | 1.09 | 0.00 |
| 26.00 | 2.70 | 1.09 | 0.00 |
| 26.40 | 2.70 | 1.09 | 0.00 |
| 26.80 | 2.70 | 1.09 | 0.00 |
| 27.20 | 2.70 | 1.09 | 0.00 |
| 27.60 | 2.70 | 1.09 | 0.00 |
| 28.00 | 2.70 | 1.09 | 0.00 |
| 28.40 | 2.70 | 1.09 | 0.00 |
| 28.80 | 2.70 | 1.09 | 0.00 |
| 29.20 | 2.70 | 1.09 | 0.00 |
| 29.60 | 2.70 | 1.09 | 0.00 |
| 30.00 | 2.70 | 1.09 | 0.00 |
| 30.40 | 2.70 | 1.09 | 0.00 |
| 30.80 | 2.70 | 1.09 | 0.00 |
| 31.20 | 2.70 | 1.09 | 0.00 |
| 31.60 | 2.70 | 1.09 | 0.00 |
| 32.00 | 2.70 | 1.09 | 0.00 |
| 32.40 | 2.70 | 1.09 | 0.00 |
| 32.80 | 2.70 | 1.09 | 0.00 |
| 33.20 | 2.70 | 1.09 | 0.00 |
| 33.60 | 2.70 | 1.09 | 0.00 |
| 34.00 | 2.70 | 1.09 | 0.00 |
| 34.40 | 2.70 | 1.09 | 0.00 |
| 34.80 | 2.70 | 1.09 | 0.00 |
| 35.20 | 2.70 | 1.09 | 0.00 |
| 35.60 | 2.70 | 1.09 | 0.00 |
| 36.00 | 2.70 | 1.09 | 0.00 |

## Summary for Link 1L: Total

Inflow Area = 2.837 ac, 0.00% Impervious, Inflow Depth = 1.04" for 2YR event
Inflow = 2.99 cfs @ 12.31 hrs, Volume= 0.247 af
Primary = 2.99 cfs @ 12.31 hrs, Volume= 0.247 af, Atten= 0%, Lag= 0.0 min

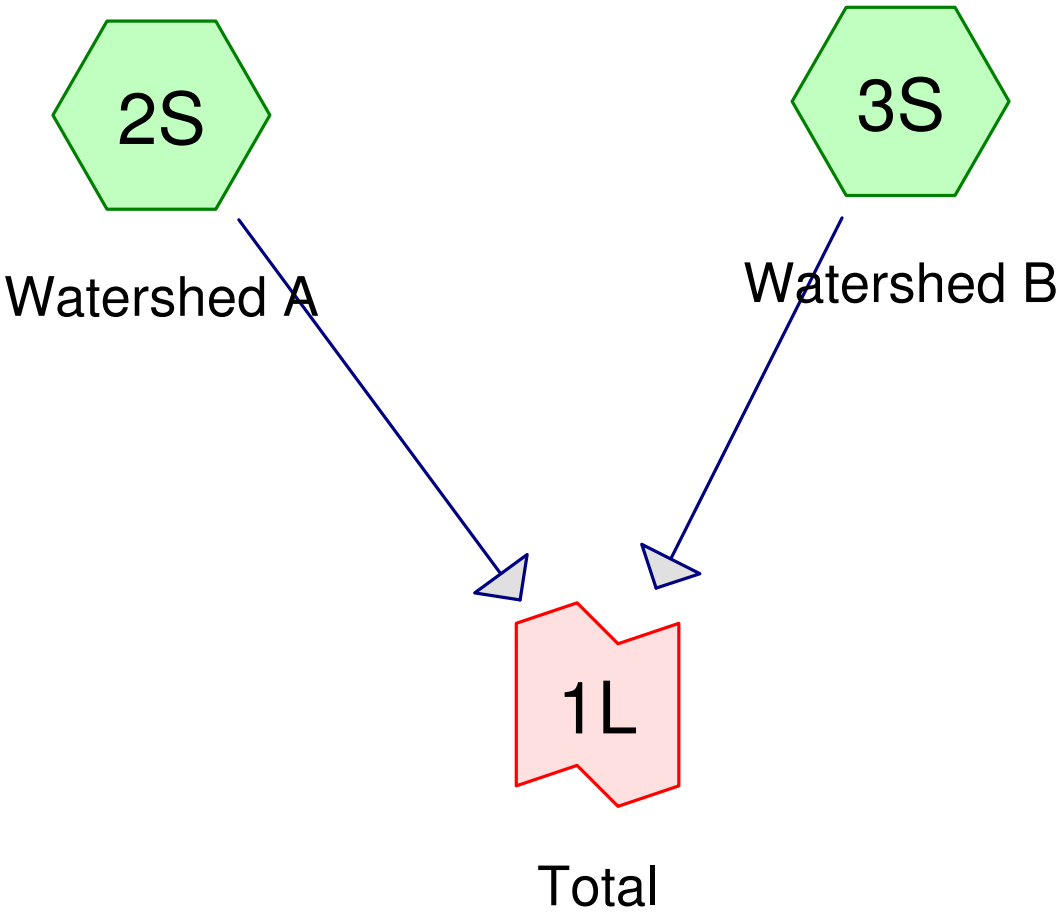
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

## Link 1L: Total



## Hydrograph for Link 1L: Total

| Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) | Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | **0.00** | 0.00 | 20.80 | 0.05 | 0.00 | 0.05 |
| 0.40 | 0.00 | 0.00 | 0.00 | 21.20 | 0.05 | 0.00 | 0.05 |
| 0.80 | 0.00 | 0.00 | 0.00 | 21.60 | 0.04 | 0.00 | 0.04 |
| 1.20 | 0.00 | 0.00 | 0.00 | 22.00 | 0.04 | 0.00 | 0.04 |
| 1.60 | 0.00 | 0.00 | 0.00 | 22.40 | 0.04 | 0.00 | 0.04 |
| 2.00 | 0.00 | 0.00 | 0.00 | 22.80 | 0.03 | 0.00 | 0.03 |
| 2.40 | 0.00 | 0.00 | 0.00 | 23.20 | 0.03 | 0.00 | 0.03 |
| 2.80 | 0.00 | 0.00 | 0.00 | 23.60 | 0.02 | 0.00 | 0.02 |
| 3.20 | 0.00 | 0.00 | 0.00 | 24.00 | 0.02 | 0.00 | 0.02 |
| 3.60 | 0.00 | 0.00 | 0.00 | 24.40 | 0.00 | 0.00 | 0.00 |
| 4.00 | 0.00 | 0.00 | 0.00 | 24.80 | 0.00 | 0.00 | 0.00 |
| 4.40 | 0.00 | 0.00 | 0.00 | 25.20 | 0.00 | 0.00 | 0.00 |
| 4.80 | 0.00 | 0.00 | 0.00 | 25.60 | 0.00 | 0.00 | 0.00 |
| 5.20 | 0.00 | 0.00 | 0.00 | 26.00 | 0.00 | 0.00 | 0.00 |
| 5.60 | 0.00 | 0.00 | 0.00 | 26.40 | 0.00 | 0.00 | 0.00 |
| 6.00 | 0.00 | 0.00 | 0.00 | 26.80 | 0.00 | 0.00 | 0.00 |
| 6.40 | 0.00 | 0.00 | 0.00 | 27.20 | 0.00 | 0.00 | 0.00 |
| 6.80 | 0.00 | 0.00 | 0.00 | 27.60 | 0.00 | 0.00 | 0.00 |
| 7.20 | 0.00 | 0.00 | 0.00 | 28.00 | 0.00 | 0.00 | 0.00 |
| 7.60 | 0.00 | 0.00 | 0.00 | 28.40 | 0.00 | 0.00 | 0.00 |
| 8.00 | 0.00 | 0.00 | 0.00 | 28.80 | 0.00 | 0.00 | 0.00 |
| 8.40 | 0.00 | 0.00 | 0.00 | 29.20 | 0.00 | 0.00 | 0.00 |
| 8.80 | 0.00 | 0.00 | 0.00 | 29.60 | 0.00 | 0.00 | 0.00 |
| 9.20 | 0.00 | 0.00 | 0.00 | 30.00 | 0.00 | 0.00 | 0.00 |
| 9.60 | 0.00 | 0.00 | 0.00 | 30.40 | 0.00 | 0.00 | 0.00 |
| 10.00 | 0.00 | 0.00 | 0.00 | 30.80 | 0.00 | 0.00 | 0.00 |
| 10.40 | 0.00 | 0.00 | 0.00 | 31.20 | 0.00 | 0.00 | 0.00 |
| 10.80 | 0.00 | 0.00 | 0.00 | 31.60 | 0.00 | 0.00 | 0.00 |
| 11.20 | 0.01 | 0.00 | 0.01 | 32.00 | 0.00 | 0.00 | 0.00 |
| 11.60 | 0.08 | 0.00 | 0.08 | 32.40 | 0.00 | 0.00 | 0.00 |
| 12.00 | **0.57** | 0.00 | **0.57** | 32.80 | 0.00 | 0.00 | 0.00 |
| 12.40 | **2.75** | 0.00 | **2.75** | 33.20 | 0.00 | 0.00 | 0.00 |
| 12.80 | 0.96 | 0.00 | 0.96 | 33.60 | 0.00 | 0.00 | 0.00 |
| 13.20 | 0.53 | 0.00 | 0.53 | 34.00 | 0.00 | 0.00 | 0.00 |
| 13.60 | 0.36 | 0.00 | 0.36 | 34.40 | 0.00 | 0.00 | 0.00 |
| 14.00 | 0.21 | 0.00 | 0.21 | 34.80 | 0.00 | 0.00 | 0.00 |
| 14.40 | 0.19 | 0.00 | 0.19 | 35.20 | 0.00 | 0.00 | 0.00 |
| 14.80 | 0.18 | 0.00 | 0.18 | 35.60 | 0.00 | 0.00 | 0.00 |
| 15.20 | 0.16 | 0.00 | 0.16 | 36.00 | 0.00 | 0.00 | 0.00 |
| 15.60 | 0.11 | 0.00 | 0.11 | | | | |
| 16.00 | 0.10 | 0.00 | 0.10 | | | | |
| 16.40 | 0.10 | 0.00 | 0.10 | | | | |
| 16.80 | 0.09 | 0.00 | 0.09 | | | | |
| 17.20 | 0.09 | 0.00 | 0.09 | | | | |
| 17.60 | 0.09 | 0.00 | 0.09 | | | | |
| 18.00 | 0.08 | 0.00 | 0.08 | | | | |
| 18.40 | 0.08 | 0.00 | 0.08 | | | | |
| 18.80 | 0.07 | 0.00 | 0.07 | | | | |
| 19.20 | 0.07 | 0.00 | 0.07 | | | | |
| 19.60 | 0.07 | 0.00 | 0.07 | | | | |
| 20.00 | 0.06 | 0.00 | 0.06 | | | | |
| 20.40 | 0.06 | 0.00 | 0.06 | | | | |




Subcat Reach Pond Link

**Routing Diagram for 16923 Existing**
Prepared by {enter your company name here}, Printed 6/9/2017

## Summary for Subcatchment 2S: Watershed A

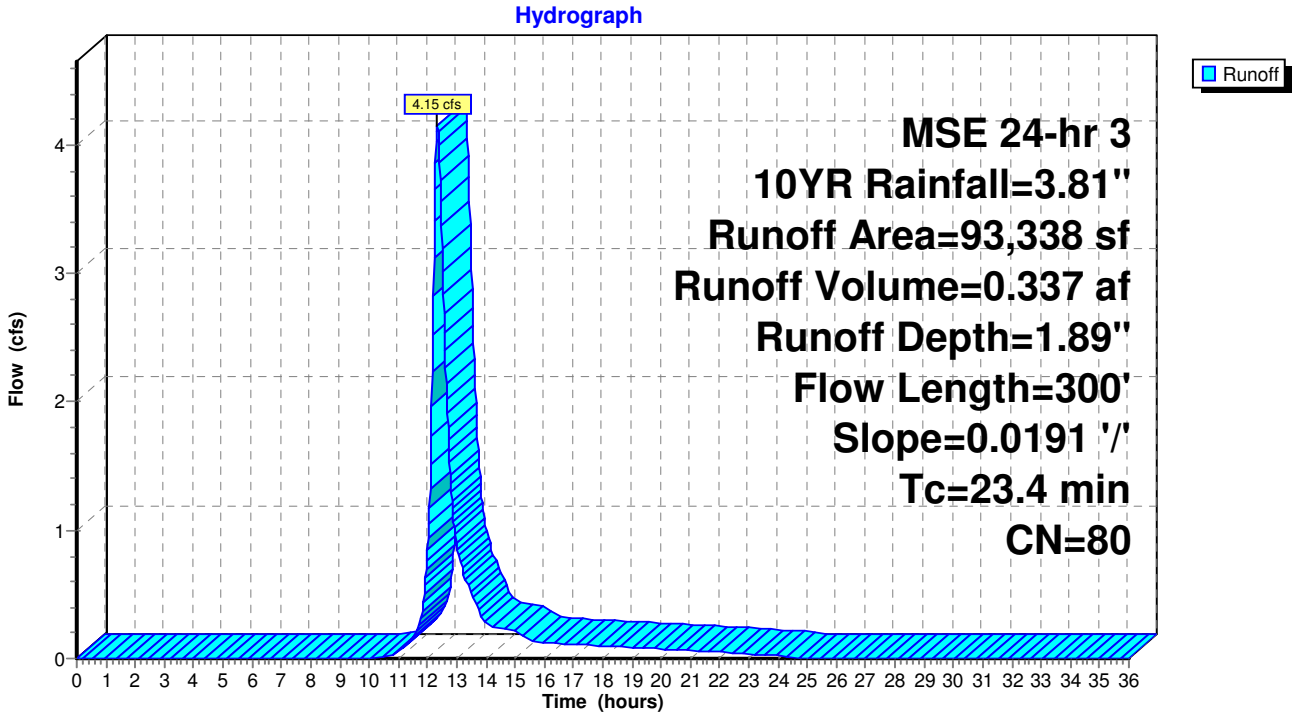
Runoff = 4.15 cfs @ 12.35 hrs, Volume= 0.337 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 10YR Rainfall=3.81"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 90,409 | 80 | Greenspace |
| * | 2,929 | 89 | Gravel |
| | 93,338 | 80 | Weighted Average |
| | 93,338 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 23.4 | 300 | 0.0191 | 0.21 | | **Sheet Flow, Sheet** Range n= 0.130 P2= 2.68" |

## Subcatchment 2S: Watershed A



## Hydrograph for Subcatchment 2S: Watershed A

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.02 | 0.00 | 0.00 |
| 1.60 | 0.03 | 0.00 | 0.00 |
| 2.00 | 0.03 | 0.00 | 0.00 |
| 2.40 | 0.05 | 0.00 | 0.00 |
| 2.80 | 0.06 | 0.00 | 0.00 |
| 3.20 | 0.07 | 0.00 | 0.00 |
| 3.60 | 0.08 | 0.00 | 0.00 |
| 4.00 | 0.10 | 0.00 | 0.00 |
| 4.40 | 0.12 | 0.00 | 0.00 |
| 4.80 | 0.13 | 0.00 | 0.00 |
| 5.20 | 0.15 | 0.00 | 0.00 |
| 5.60 | 0.17 | 0.00 | 0.00 |
| 6.00 | 0.19 | 0.00 | 0.00 |
| 6.40 | 0.22 | 0.00 | 0.00 |
| 6.80 | 0.24 | 0.00 | 0.00 |
| 7.20 | 0.27 | 0.00 | 0.00 |
| 7.60 | 0.29 | 0.00 | 0.00 |
| 8.00 | 0.32 | 0.00 | 0.00 |
| 8.40 | 0.35 | 0.00 | 0.00 |
| 8.80 | 0.38 | 0.00 | 0.00 |
| 9.20 | 0.42 | 0.00 | 0.00 |
| 9.60 | 0.47 | 0.00 | 0.00 |
| 10.00 | 0.52 | 0.00 | 0.00 |
| 10.40 | 0.58 | 0.00 | 0.01 |
| 10.80 | 0.67 | 0.01 | 0.03 |
| 11.20 | 0.81 | 0.03 | 0.09 |
| 11.60 | 1.01 | 0.09 | 0.20 |
| 12.00 | 1.76 | 0.42 | **0.84** |
| 12.40 | 2.80 | 1.10 | **3.99** |
| 12.80 | 3.00 | 1.25 | 1.36 |
| 13.20 | 3.14 | 1.36 | 0.69 |
| 13.60 | 3.23 | 1.42 | 0.46 |
| 14.00 | 3.29 | 1.47 | 0.27 |
| 14.40 | 3.34 | 1.51 | 0.24 |
| 14.80 | 3.39 | 1.55 | 0.22 |
| 15.20 | 3.43 | 1.58 | 0.20 |
| 15.60 | 3.46 | 1.61 | 0.14 |
| 16.00 | 3.49 | 1.63 | 0.12 |
| 16.40 | 3.52 | 1.65 | 0.12 |
| 16.80 | 3.54 | 1.67 | 0.11 |
| 17.20 | 3.57 | 1.69 | 0.11 |
| 17.60 | 3.59 | 1.71 | 0.10 |
| 18.00 | 3.62 | 1.73 | 0.10 |
| 18.40 | 3.64 | 1.75 | 0.09 |
| 18.80 | 3.66 | 1.76 | 0.09 |
| 19.20 | 3.68 | 1.78 | 0.08 |
| 19.60 | 3.69 | 1.79 | 0.08 |
| 20.00 | 3.71 | 1.81 | 0.07 |
| 20.40 | 3.73 | 1.82 | 0.07 |
| 20.80 | 3.74 | 1.83 | 0.06 |
| 21.20 | 3.75 | 1.84 | 0.06 |
| 21.60 | 3.76 | 1.85 | 0.05 |
| 22.00 | 3.78 | 1.86 | 0.05 |
| 22.40 | 3.78 | 1.87 | 0.04 |
| 22.80 | 3.79 | 1.87 | 0.04 |
| 23.20 | 3.80 | 1.88 | 0.03 |
| 23.60 | 3.81 | 1.88 | 0.03 |
| 24.00 | **3.81** | **1.89** | 0.02 |
| 24.40 | 3.81 | 1.89 | 0.01 |
| 24.80 | 3.81 | 1.89 | 0.00 |
| 25.20 | 3.81 | 1.89 | 0.00 |
| 25.60 | 3.81 | 1.89 | 0.00 |
| 26.00 | 3.81 | 1.89 | 0.00 |
| 26.40 | 3.81 | 1.89 | 0.00 |
| 26.80 | 3.81 | 1.89 | 0.00 |
| 27.20 | 3.81 | 1.89 | 0.00 |
| 27.60 | 3.81 | 1.89 | 0.00 |
| 28.00 | 3.81 | 1.89 | 0.00 |
| 28.40 | 3.81 | 1.89 | 0.00 |
| 28.80 | 3.81 | 1.89 | 0.00 |
| 29.20 | 3.81 | 1.89 | 0.00 |
| 29.60 | 3.81 | 1.89 | 0.00 |
| 30.00 | 3.81 | 1.89 | 0.00 |
| 30.40 | 3.81 | 1.89 | 0.00 |
| 30.80 | 3.81 | 1.89 | 0.00 |
| 31.20 | 3.81 | 1.89 | 0.00 |
| 31.60 | 3.81 | 1.89 | 0.00 |
| 32.00 | 3.81 | 1.89 | 0.00 |
| 32.40 | 3.81 | 1.89 | 0.00 |
| 32.80 | 3.81 | 1.89 | 0.00 |
| 33.20 | 3.81 | 1.89 | 0.00 |
| 33.60 | 3.81 | 1.89 | 0.00 |
| 34.00 | 3.81 | 1.89 | 0.00 |
| 34.40 | 3.81 | 1.89 | 0.00 |
| 34.80 | 3.81 | 1.89 | 0.00 |
| 35.20 | 3.81 | 1.89 | 0.00 |
| 35.60 | 3.81 | 1.89 | 0.00 |
| 36.00 | 3.81 | 1.89 | 0.00 |

## Summary for Subcatchment 3S: Watershed B

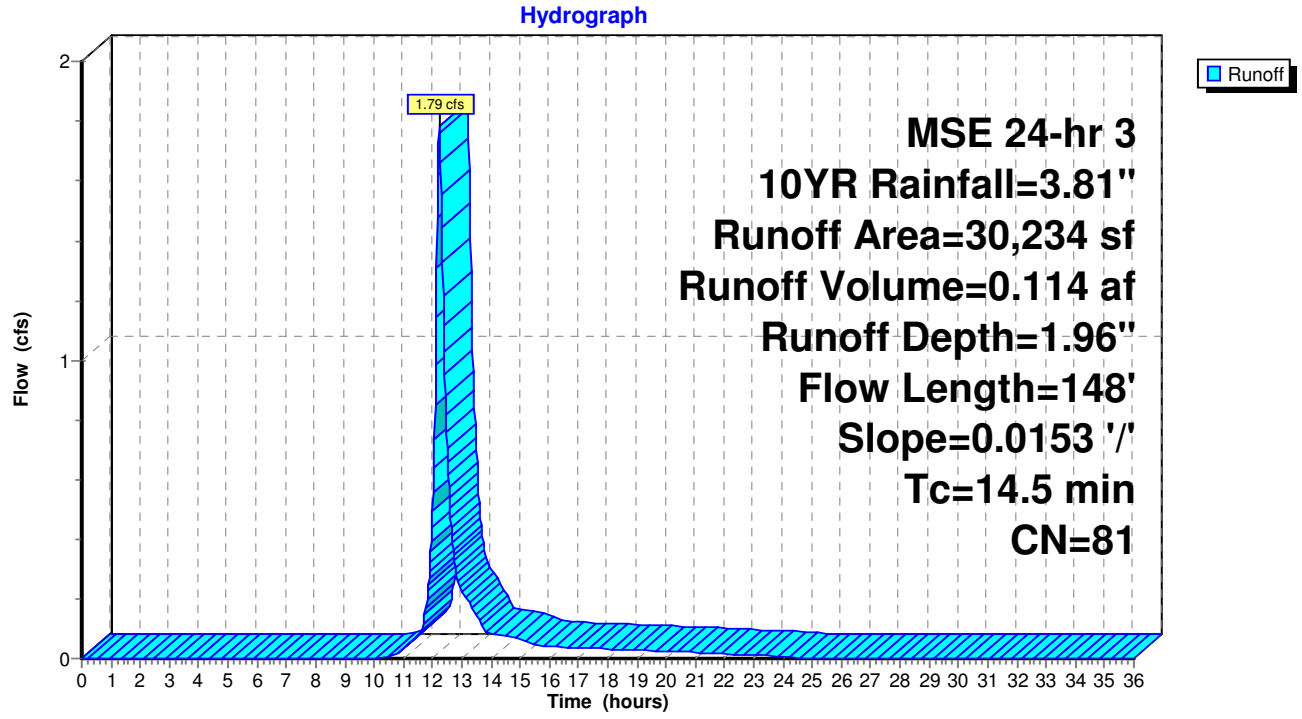
Runoff = 1.79 cfs @ 12.23 hrs, Volume= 0.114 af, Depth= 1.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 10YR Rainfall=3.81"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 26,742 | 80 | Greenspace |
| * | 3,492 | 89 | Gravel |
| | 30,234 | 81 | Weighted Average |
| | 30,234 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.5 | 148 | 0.0153 | 0.17 | | **Sheet Flow, Sheet** Range n= 0.130 P2= 2.68" |

## Subcatchment 3S: Watershed B



## Hydrograph for Subcatchment 3S: Watershed B

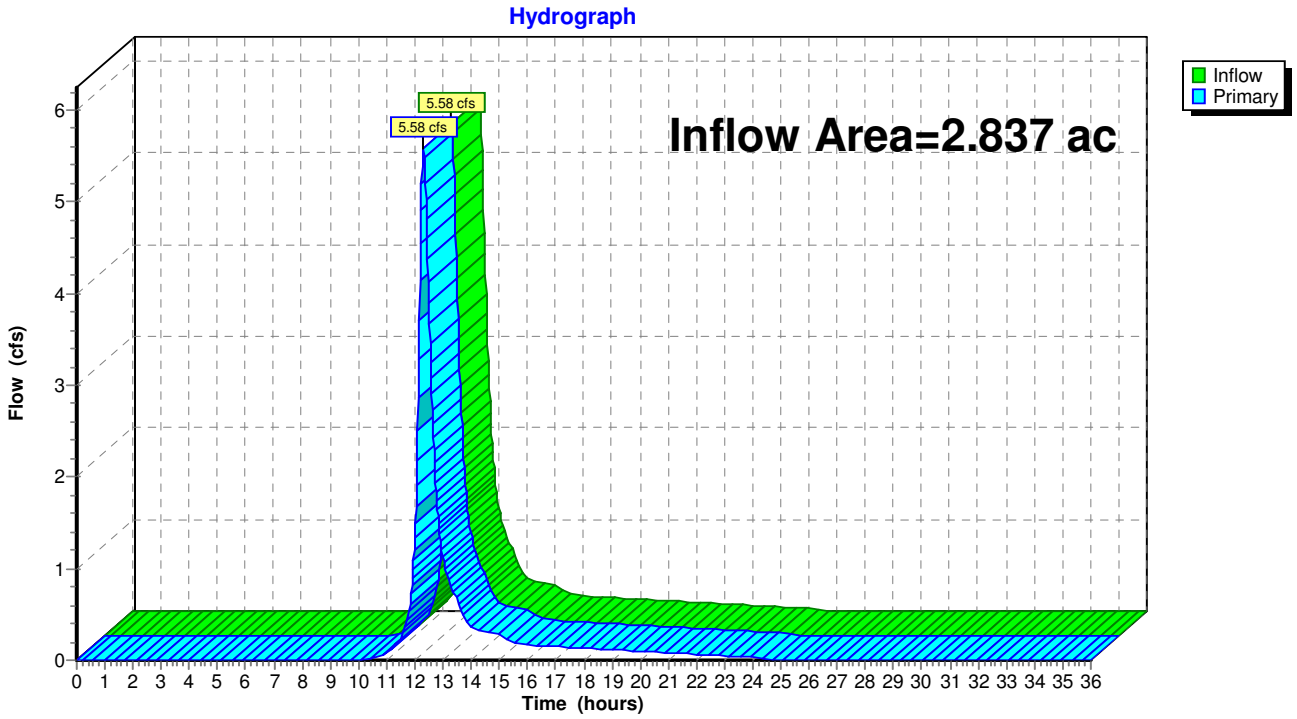
| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.02 | 0.00 | 0.00 |
| 1.60 | 0.03 | 0.00 | 0.00 |
| 2.00 | 0.03 | 0.00 | 0.00 |
| 2.40 | 0.05 | 0.00 | 0.00 |
| 2.80 | 0.06 | 0.00 | 0.00 |
| 3.20 | 0.07 | 0.00 | 0.00 |
| 3.60 | 0.08 | 0.00 | 0.00 |
| 4.00 | 0.10 | 0.00 | 0.00 |
| 4.40 | 0.12 | 0.00 | 0.00 |
| 4.80 | 0.13 | 0.00 | 0.00 |
| 5.20 | 0.15 | 0.00 | 0.00 |
| 5.60 | 0.17 | 0.00 | 0.00 |
| 6.00 | 0.19 | 0.00 | 0.00 |
| 6.40 | 0.22 | 0.00 | 0.00 |
| 6.80 | 0.24 | 0.00 | 0.00 |
| 7.20 | 0.27 | 0.00 | 0.00 |
| 7.60 | 0.29 | 0.00 | 0.00 |
| 8.00 | 0.32 | 0.00 | 0.00 |
| 8.40 | 0.35 | 0.00 | 0.00 |
| 8.80 | 0.38 | 0.00 | 0.00 |
| 9.20 | 0.42 | 0.00 | 0.00 |
| 9.60 | 0.47 | 0.00 | 0.00 |
| 10.00 | 0.52 | 0.00 | 0.00 |
| 10.40 | 0.58 | 0.01 | 0.01 |
| 10.80 | 0.67 | 0.02 | 0.02 |
| 11.20 | 0.81 | 0.04 | 0.05 |
| 11.60 | 1.01 | 0.10 | 0.09 |
| 12.00 | 1.76 | 0.46 | **0.49** |
| 12.40 | 2.80 | 1.16 | **1.03** |
| 12.80 | 3.00 | 1.31 | 0.29 |
| 13.20 | 3.14 | 1.42 | 0.19 |
| 13.60 | 3.23 | 1.49 | 0.13 |
| 14.00 | 3.29 | 1.54 | 0.08 |
| 14.40 | 3.34 | 1.58 | 0.08 |
| 14.80 | 3.39 | 1.62 | 0.07 |
| 15.20 | 3.43 | 1.65 | 0.06 |
| 15.60 | 3.46 | 1.68 | 0.04 |
| 16.00 | 3.49 | 1.70 | 0.04 |
| 16.40 | 3.52 | 1.72 | 0.04 |
| 16.80 | 3.54 | 1.74 | 0.04 |
| 17.20 | 3.57 | 1.77 | 0.04 |
| 17.60 | 3.59 | 1.78 | 0.03 |
| 18.00 | 3.62 | 1.80 | 0.03 |
| 18.40 | 3.64 | 1.82 | 0.03 |
| 18.80 | 3.66 | 1.84 | 0.03 |
| 19.20 | 3.68 | 1.85 | 0.03 |
| 19.60 | 3.69 | 1.87 | 0.03 |
| 20.00 | 3.71 | 1.88 | 0.02 |
| 20.40 | 3.73 | 1.89 | 0.02 |
| 20.80 | 3.74 | 1.90 | 0.02 |
| 21.20 | 3.75 | 1.92 | 0.02 |
| 21.60 | 3.76 | 1.93 | 0.02 |
| 22.00 | 3.78 | 1.93 | 0.02 |
| 22.40 | 3.78 | 1.94 | 0.01 |
| 22.80 | 3.79 | 1.95 | 0.01 |
| 23.20 | 3.80 | 1.95 | 0.01 |
| 23.60 | 3.81 | 1.96 | 0.01 |
| 24.00 | **3.81** | **1.96** | 0.01 |
| 24.40 | 3.81 | 1.96 | 0.00 |
| 24.80 | 3.81 | 1.96 | 0.00 |
| 25.20 | 3.81 | 1.96 | 0.00 |
| 25.60 | 3.81 | 1.96 | 0.00 |
| 26.00 | 3.81 | 1.96 | 0.00 |
| 26.40 | 3.81 | 1.96 | 0.00 |
| 26.80 | 3.81 | 1.96 | 0.00 |
| 27.20 | 3.81 | 1.96 | 0.00 |
| 27.60 | 3.81 | 1.96 | 0.00 |
| 28.00 | 3.81 | 1.96 | 0.00 |
| 28.40 | 3.81 | 1.96 | 0.00 |
| 28.80 | 3.81 | 1.96 | 0.00 |
| 29.20 | 3.81 | 1.96 | 0.00 |
| 29.60 | 3.81 | 1.96 | 0.00 |
| 30.00 | 3.81 | 1.96 | 0.00 |
| 30.40 | 3.81 | 1.96 | 0.00 |
| 30.80 | 3.81 | 1.96 | 0.00 |
| 31.20 | 3.81 | 1.96 | 0.00 |
| 31.60 | 3.81 | 1.96 | 0.00 |
| 32.00 | 3.81 | 1.96 | 0.00 |
| 32.40 | 3.81 | 1.96 | 0.00 |
| 32.80 | 3.81 | 1.96 | 0.00 |
| 33.20 | 3.81 | 1.96 | 0.00 |
| 33.60 | 3.81 | 1.96 | 0.00 |
| 34.00 | 3.81 | 1.96 | 0.00 |
| 34.40 | 3.81 | 1.96 | 0.00 |
| 34.80 | 3.81 | 1.96 | 0.00 |
| 35.20 | 3.81 | 1.96 | 0.00 |
| 35.60 | 3.81 | 1.96 | 0.00 |
| 36.00 | 3.81 | 1.96 | 0.00 |

## Summary for Link 1L: Total

Inflow Area = 2.837 ac, 0.00% Impervious, Inflow Depth = 1.90" for 10YR event
Inflow = 5.58 cfs @ 12.30 hrs, Volume= 0.450 af
Primary = 5.58 cfs @ 12.30 hrs, Volume= 0.450 af, Atten= 0%, Lag= 0.0 min

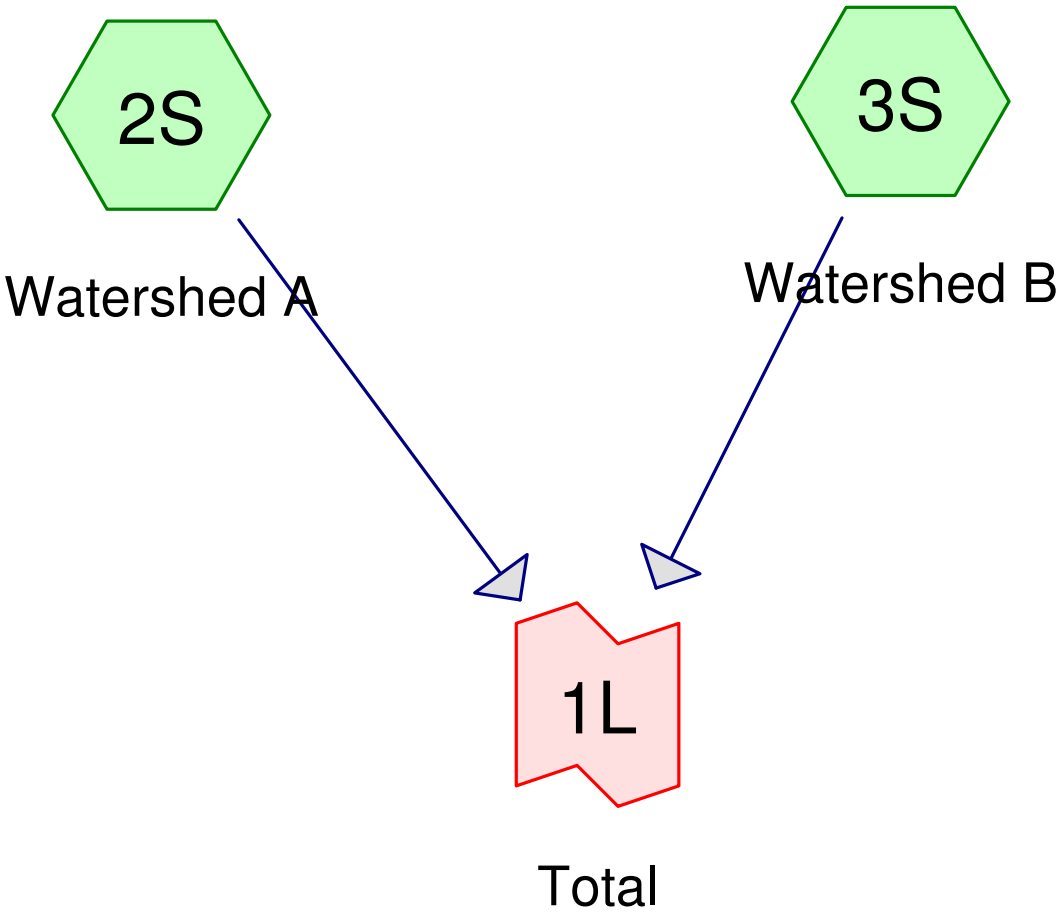
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

## Link 1L: Total



## Hydrograph for Link 1L: Total

| Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | **0.00** | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.00 | 0.00 | 0.00 |
| 1.20 | 0.00 | 0.00 | 0.00 |
| 1.60 | 0.00 | 0.00 | 0.00 |
| 2.00 | 0.00 | 0.00 | 0.00 |
| 2.40 | 0.00 | 0.00 | 0.00 |
| 2.80 | 0.00 | 0.00 | 0.00 |
| 3.20 | 0.00 | 0.00 | 0.00 |
| 3.60 | 0.00 | 0.00 | 0.00 |
| 4.00 | 0.00 | 0.00 | 0.00 |
| 4.40 | 0.00 | 0.00 | 0.00 |
| 4.80 | 0.00 | 0.00 | 0.00 |
| 5.20 | 0.00 | 0.00 | 0.00 |
| 5.60 | 0.00 | 0.00 | 0.00 |
| 6.00 | 0.00 | 0.00 | 0.00 |
| 6.40 | 0.00 | 0.00 | 0.00 |
| 6.80 | 0.00 | 0.00 | 0.00 |
| 7.20 | 0.00 | 0.00 | 0.00 |
| 7.60 | 0.00 | 0.00 | 0.00 |
| 8.00 | 0.00 | 0.00 | 0.00 |
| 8.40 | 0.00 | 0.00 | 0.00 |
| 8.80 | 0.00 | 0.00 | 0.00 |
| 9.20 | 0.00 | 0.00 | 0.00 |
| 9.60 | 0.00 | 0.00 | 0.00 |
| 10.00 | 0.00 | 0.00 | 0.00 |
| 10.40 | 0.01 | 0.00 | 0.01 |
| 10.80 | 0.05 | 0.00 | 0.05 |
| 11.20 | 0.14 | 0.00 | 0.14 |
| 11.60 | 0.30 | 0.00 | 0.30 |
| 12.00 | **1.34** | 0.00 | **1.34** |
| 12.40 | **5.02** | 0.00 | **5.02** |
| 12.80 | 1.65 | 0.00 | 1.65 |
| 13.20 | 0.88 | 0.00 | 0.88 |
| 13.60 | 0.59 | 0.00 | 0.59 |
| 14.00 | 0.35 | 0.00 | 0.35 |
| 14.40 | 0.31 | 0.00 | 0.31 |
| 14.80 | 0.30 | 0.00 | 0.30 |
| 15.20 | 0.26 | 0.00 | 0.26 |
| 15.60 | 0.18 | 0.00 | 0.18 |
| 16.00 | 0.17 | 0.00 | 0.17 |
| 16.40 | 0.16 | 0.00 | 0.16 |
| 16.80 | 0.15 | 0.00 | 0.15 |
| 17.20 | 0.15 | 0.00 | 0.15 |
| 17.60 | 0.14 | 0.00 | 0.14 |
| 18.00 | 0.13 | 0.00 | 0.13 |
| 18.40 | 0.13 | 0.00 | 0.13 |
| 18.80 | 0.12 | 0.00 | 0.12 |
| 19.20 | 0.11 | 0.00 | 0.11 |
| 19.60 | 0.11 | 0.00 | 0.11 |
| 20.00 | 0.10 | 0.00 | 0.10 |
| 20.40 | 0.09 | 0.00 | 0.09 |
| 20.80 | 0.08 | 0.00 | 0.08 |
| 21.20 | 0.08 | 0.00 | 0.08 |
| 21.60 | 0.07 | 0.00 | 0.07 |
| 22.00 | 0.06 | 0.00 | 0.06 |
| 22.40 | 0.06 | 0.00 | 0.06 |
| 22.80 | 0.05 | 0.00 | 0.05 |
| 23.20 | 0.04 | 0.00 | 0.04 |
| 23.60 | 0.04 | 0.00 | 0.04 |
| 24.00 | 0.03 | 0.00 | 0.03 |
| 24.40 | 0.01 | 0.00 | 0.01 |
| 24.80 | 0.00 | 0.00 | 0.00 |
| 25.20 | 0.00 | 0.00 | 0.00 |
| 25.60 | 0.00 | 0.00 | 0.00 |
| 26.00 | 0.00 | 0.00 | 0.00 |
| 26.40 | 0.00 | 0.00 | 0.00 |
| 26.80 | 0.00 | 0.00 | 0.00 |
| 27.20 | 0.00 | 0.00 | 0.00 |
| 27.60 | 0.00 | 0.00 | 0.00 |
| 28.00 | 0.00 | 0.00 | 0.00 |
| 28.40 | 0.00 | 0.00 | 0.00 |
| 28.80 | 0.00 | 0.00 | 0.00 |
| 29.20 | 0.00 | 0.00 | 0.00 |
| 29.60 | 0.00 | 0.00 | 0.00 |
| 30.00 | 0.00 | 0.00 | 0.00 |
| 30.40 | 0.00 | 0.00 | 0.00 |
| 30.80 | 0.00 | 0.00 | 0.00 |
| 31.20 | 0.00 | 0.00 | 0.00 |
| 31.60 | 0.00 | 0.00 | 0.00 |
| 32.00 | 0.00 | 0.00 | 0.00 |
| 32.40 | 0.00 | 0.00 | 0.00 |
| 32.80 | 0.00 | 0.00 | 0.00 |
| 33.20 | 0.00 | 0.00 | 0.00 |
| 33.60 | 0.00 | 0.00 | 0.00 |
| 34.00 | 0.00 | 0.00 | 0.00 |
| 34.40 | 0.00 | 0.00 | 0.00 |
| 34.80 | 0.00 | 0.00 | 0.00 |
| 35.20 | 0.00 | 0.00 | 0.00 |
| 35.60 | 0.00 | 0.00 | 0.00 |
| 36.00 | 0.00 | 0.00 | 0.00 |




Subcat Reach Pond Link

**Routing Diagram for 16923 Existing**
Prepared by {enter your company name here}, Printed 6/9/2017

## Summary for Subcatchment 2S: Watershed A

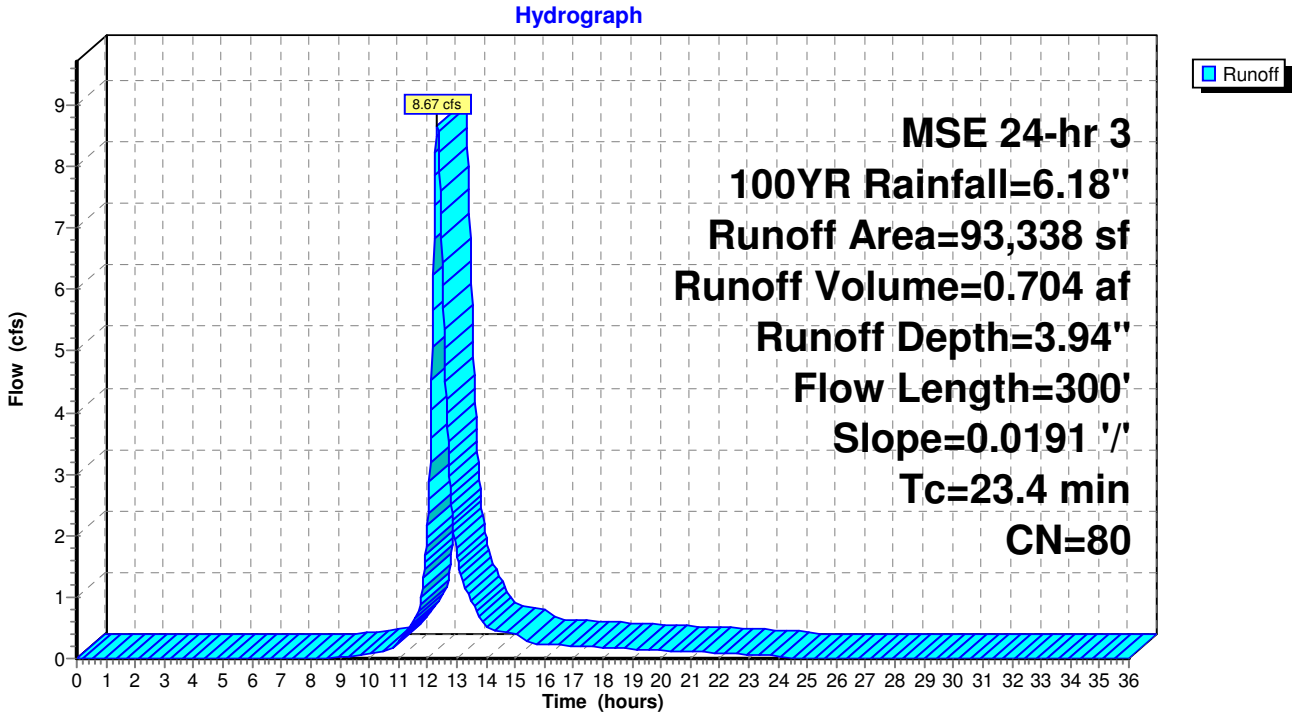
Runoff = 8.67 cfs @ 12.34 hrs, Volume= 0.704 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100YR Rainfall=6.18"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 90,409 | 80 | Greenspace |
| * | 2,929 | 89 | Gravel |
| | 93,338 | 80 | Weighted Average |
| | 93,338 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 23.4 | 300 | 0.0191 | 0.21 | | **Sheet Flow, Sheet** Range n= 0.130 P2= 2.68" |

## Subcatchment 2S: Watershed A



## Hydrograph for Subcatchment 2S: Watershed A

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.01 | 0.00 | 0.00 |
| 0.80 | 0.02 | 0.00 | 0.00 |
| 1.20 | 0.03 | 0.00 | 0.00 |
| 1.60 | 0.04 | 0.00 | 0.00 |
| 2.00 | 0.06 | 0.00 | 0.00 |
| 2.40 | 0.07 | 0.00 | 0.00 |
| 2.80 | 0.09 | 0.00 | 0.00 |
| 3.20 | 0.11 | 0.00 | 0.00 |
| 3.60 | 0.14 | 0.00 | 0.00 |
| 4.00 | 0.16 | 0.00 | 0.00 |
| 4.40 | 0.19 | 0.00 | 0.00 |
| 4.80 | 0.22 | 0.00 | 0.00 |
| 5.20 | 0.25 | 0.00 | 0.00 |
| 5.60 | 0.28 | 0.00 | 0.00 |
| 6.00 | 0.31 | 0.00 | 0.00 |
| 6.40 | 0.35 | 0.00 | 0.00 |
| 6.80 | 0.39 | 0.00 | 0.00 |
| 7.20 | 0.43 | 0.00 | 0.00 |
| 7.60 | 0.47 | 0.00 | 0.00 |
| 8.00 | 0.52 | 0.00 | 0.00 |
| 8.40 | 0.56 | 0.00 | 0.00 |
| 8.80 | 0.61 | 0.00 | 0.01 |
| 9.20 | 0.68 | 0.01 | 0.03 |
| 9.60 | 0.76 | 0.02 | 0.06 |
| 10.00 | 0.85 | 0.04 | 0.09 |
| 10.40 | 0.94 | 0.07 | 0.12 |
| 10.80 | 1.09 | 0.11 | 0.18 |
| 11.20 | 1.31 | 0.20 | 0.38 |
| 11.60 | 1.65 | 0.36 | 0.66 |
| 12.00 | 2.86 | 1.15 | **2.15** |
| 12.40 | 4.53 | 2.49 | **8.22** |
| 12.80 | 4.87 | 2.78 | 2.64 |
| 13.20 | 5.09 | 2.97 | 1.29 |
| 13.60 | 5.24 | 3.10 | 0.86 |
| 14.00 | 5.33 | 3.18 | 0.50 |
| 14.40 | 5.42 | 3.26 | 0.43 |
| 14.80 | 5.50 | 3.34 | 0.41 |
| 15.20 | 5.57 | 3.39 | 0.37 |
| 15.60 | 5.62 | 3.44 | 0.25 |
| 16.00 | 5.66 | 3.48 | 0.23 |
| 16.40 | 5.71 | 3.52 | 0.22 |
| 16.80 | 5.75 | 3.56 | 0.21 |
| 17.20 | 5.79 | 3.59 | 0.20 |
| 17.60 | 5.83 | 3.63 | 0.19 |
| 18.00 | 5.87 | 3.66 | 0.18 |
| 18.40 | 5.90 | 3.69 | 0.17 |
| 18.80 | 5.93 | 3.72 | 0.16 |
| 19.20 | 5.96 | 3.75 | 0.15 |
| 19.60 | 5.99 | 3.77 | 0.14 |
| 20.00 | 6.02 | 3.80 | 0.13 |
| 20.40 | 6.04 | 3.82 | 0.13 |
| 20.80 | 6.07 | 3.84 | 0.12 |
| 21.20 | 6.09 | 3.86 | 0.11 |
| 21.60 | 6.11 | 3.88 | 0.10 |
| 22.00 | 6.12 | 3.89 | 0.09 |
| 22.40 | 6.14 | 3.91 | 0.08 |
| 22.80 | 6.15 | 3.92 | 0.07 |
| 23.20 | 6.16 | 3.93 | 0.06 |
| 23.60 | 6.17 | 3.94 | 0.05 |
| 24.00 | **6.18** | **3.94** | 0.04 |
| 24.40 | 6.18 | 3.94 | 0.01 |
| 24.80 | 6.18 | 3.94 | 0.00 |
| 25.20 | 6.18 | 3.94 | 0.00 |
| 25.60 | 6.18 | 3.94 | 0.00 |
| 26.00 | 6.18 | 3.94 | 0.00 |
| 26.40 | 6.18 | 3.94 | 0.00 |
| 26.80 | 6.18 | 3.94 | 0.00 |
| 27.20 | 6.18 | 3.94 | 0.00 |
| 27.60 | 6.18 | 3.94 | 0.00 |
| 28.00 | 6.18 | 3.94 | 0.00 |
| 28.40 | 6.18 | 3.94 | 0.00 |
| 28.80 | 6.18 | 3.94 | 0.00 |
| 29.20 | 6.18 | 3.94 | 0.00 |
| 29.60 | 6.18 | 3.94 | 0.00 |
| 30.00 | 6.18 | 3.94 | 0.00 |
| 30.40 | 6.18 | 3.94 | 0.00 |
| 30.80 | 6.18 | 3.94 | 0.00 |
| 31.20 | 6.18 | 3.94 | 0.00 |
| 31.60 | 6.18 | 3.94 | 0.00 |
| 32.00 | 6.18 | 3.94 | 0.00 |
| 32.40 | 6.18 | 3.94 | 0.00 |
| 32.80 | 6.18 | 3.94 | 0.00 |
| 33.20 | 6.18 | 3.94 | 0.00 |
| 33.60 | 6.18 | 3.94 | 0.00 |
| 34.00 | 6.18 | 3.94 | 0.00 |
| 34.40 | 6.18 | 3.94 | 0.00 |
| 34.80 | 6.18 | 3.94 | 0.00 |
| 35.20 | 6.18 | 3.94 | 0.00 |
| 35.60 | 6.18 | 3.94 | 0.00 |
| 36.00 | 6.18 | 3.94 | 0.00 |

## Summary for Subcatchment 3S: Watershed B

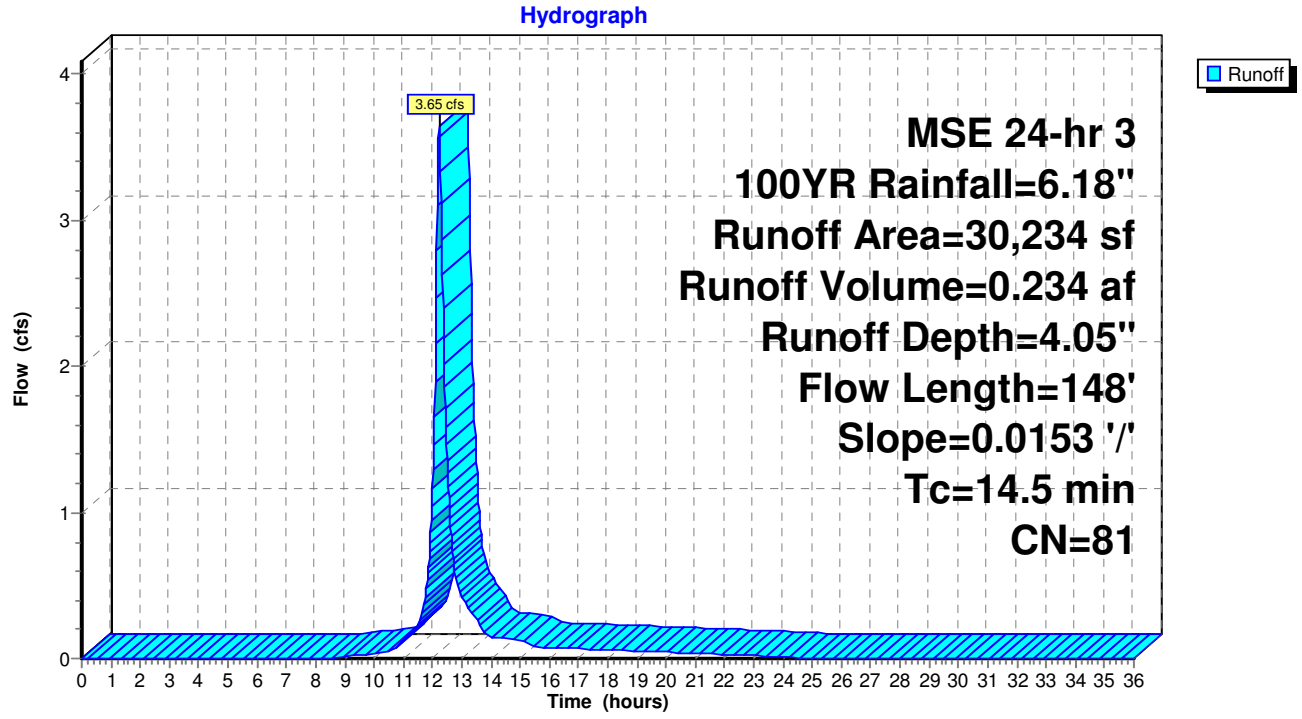
Runoff = 3.65 cfs @ 12.23 hrs, Volume= 0.234 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100YR Rainfall=6.18"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 26,742 | 80 | Greenspace |
| * | 3,492 | 89 | Gravel |
| | 30,234 | 81 | Weighted Average |
| | 30,234 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|---|---|---|---|---|---|
| 14.5 | 148 | 0.0153 | 0.17 | | **Sheet Flow, Sheet** Range n= 0.130 P2= 2.68" |

## Subcatchment 3S: Watershed B



## Hydrograph for Subcatchment 3S: Watershed B

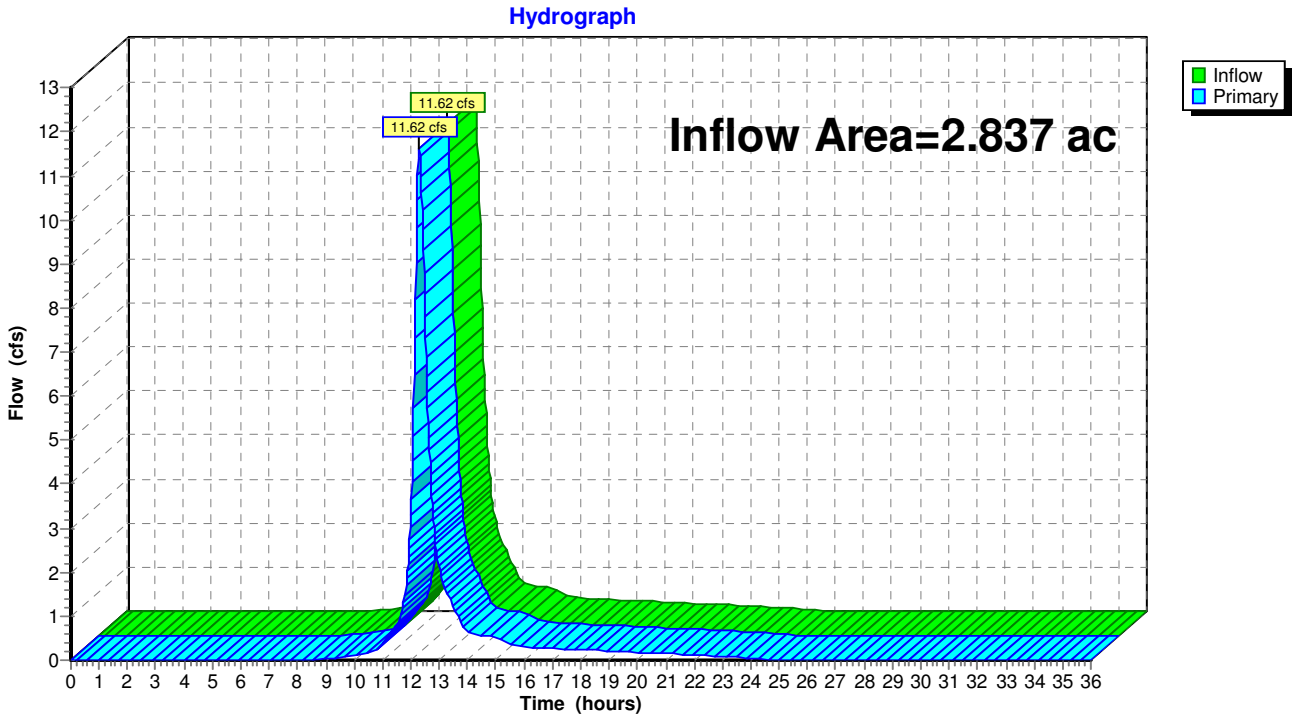
| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.01 | 0.00 | 0.00 |
| 0.80 | 0.02 | 0.00 | 0.00 |
| 1.20 | 0.03 | 0.00 | 0.00 |
| 1.60 | 0.04 | 0.00 | 0.00 |
| 2.00 | 0.06 | 0.00 | 0.00 |
| 2.40 | 0.07 | 0.00 | 0.00 |
| 2.80 | 0.09 | 0.00 | 0.00 |
| 3.20 | 0.11 | 0.00 | 0.00 |
| 3.60 | 0.14 | 0.00 | 0.00 |
| 4.00 | 0.16 | 0.00 | 0.00 |
| 4.40 | 0.19 | 0.00 | 0.00 |
| 4.80 | 0.22 | 0.00 | 0.00 |
| 5.20 | 0.25 | 0.00 | 0.00 |
| 5.60 | 0.28 | 0.00 | 0.00 |
| 6.00 | 0.31 | 0.00 | 0.00 |
| 6.40 | 0.35 | 0.00 | 0.00 |
| 6.80 | 0.39 | 0.00 | 0.00 |
| 7.20 | 0.43 | 0.00 | 0.00 |
| 7.60 | 0.47 | 0.00 | 0.00 |
| 8.00 | 0.52 | 0.00 | 0.00 |
| 8.40 | 0.56 | 0.00 | 0.00 |
| 8.80 | 0.61 | 0.01 | 0.01 |
| 9.20 | 0.68 | 0.02 | 0.01 |
| 9.60 | 0.76 | 0.03 | 0.03 |
| 10.00 | 0.85 | 0.05 | 0.04 |
| 10.40 | 0.94 | 0.08 | 0.05 |
| 10.80 | 1.09 | 0.13 | 0.08 |
| 11.20 | 1.31 | 0.22 | 0.16 |
| 11.60 | 1.65 | 0.39 | 0.27 |
| 12.00 | 2.86 | 1.21 | **1.16** |
| 12.40 | 4.53 | 2.58 | **2.01** |
| 12.80 | 4.87 | 2.87 | 0.54 |
| 13.20 | 5.09 | 3.07 | 0.36 |
| 13.60 | 5.24 | 3.20 | 0.24 |
| 14.00 | 5.33 | 3.28 | 0.15 |
| 14.40 | 5.42 | 3.36 | 0.14 |
| 14.80 | 5.50 | 3.43 | 0.13 |
| 15.20 | 5.57 | 3.49 | 0.10 |
| 15.60 | 5.62 | 3.54 | 0.08 |
| 16.00 | 5.66 | 3.58 | 0.07 |
| 16.40 | 5.71 | 3.62 | 0.07 |
| 16.80 | 5.75 | 3.66 | 0.07 |
| 17.20 | 5.79 | 3.69 | 0.06 |
| 17.60 | 5.83 | 3.73 | 0.06 |
| 18.00 | 5.87 | 3.76 | 0.06 |
| 18.40 | 5.90 | 3.79 | 0.06 |
| 18.80 | 5.93 | 3.82 | 0.05 |
| 19.20 | 5.96 | 3.85 | 0.05 |
| 19.60 | 5.99 | 3.88 | 0.05 |
| 20.00 | 6.02 | 3.90 | 0.04 |
| 20.40 | 6.04 | 3.92 | 0.04 |
| 20.80 | 6.07 | 3.94 | 0.04 |
| 21.20 | 6.09 | 3.96 | 0.03 |
| 21.60 | 6.11 | 3.98 | 0.03 |
| 22.00 | 6.12 | 4.00 | 0.03 |
| 22.40 | 6.14 | 4.01 | 0.02 |
| 22.80 | 6.15 | 4.02 | 0.02 |
| 23.20 | 6.16 | 4.03 | 0.02 |
| 23.60 | 6.17 | 4.04 | 0.02 |
| 24.00 | **6.18** | **4.05** | 0.01 |
| 24.40 | 6.18 | 4.05 | 0.00 |
| 24.80 | 6.18 | 4.05 | 0.00 |
| 25.20 | 6.18 | 4.05 | 0.00 |
| 25.60 | 6.18 | 4.05 | 0.00 |
| 26.00 | 6.18 | 4.05 | 0.00 |
| 26.40 | 6.18 | 4.05 | 0.00 |
| 26.80 | 6.18 | 4.05 | 0.00 |
| 27.20 | 6.18 | 4.05 | 0.00 |
| 27.60 | 6.18 | 4.05 | 0.00 |
| 28.00 | 6.18 | 4.05 | 0.00 |
| 28.40 | 6.18 | 4.05 | 0.00 |
| 28.80 | 6.18 | 4.05 | 0.00 |
| 29.20 | 6.18 | 4.05 | 0.00 |
| 29.60 | 6.18 | 4.05 | 0.00 |
| 30.00 | 6.18 | 4.05 | 0.00 |
| 30.40 | 6.18 | 4.05 | 0.00 |
| 30.80 | 6.18 | 4.05 | 0.00 |
| 31.20 | 6.18 | 4.05 | 0.00 |
| 31.60 | 6.18 | 4.05 | 0.00 |
| 32.00 | 6.18 | 4.05 | 0.00 |
| 32.40 | 6.18 | 4.05 | 0.00 |
| 32.80 | 6.18 | 4.05 | 0.00 |
| 33.20 | 6.18 | 4.05 | 0.00 |
| 33.60 | 6.18 | 4.05 | 0.00 |
| 34.00 | 6.18 | 4.05 | 0.00 |
| 34.40 | 6.18 | 4.05 | 0.00 |
| 34.80 | 6.18 | 4.05 | 0.00 |
| 35.20 | 6.18 | 4.05 | 0.00 |
| 35.60 | 6.18 | 4.05 | 0.00 |
| 36.00 | 6.18 | 4.05 | 0.00 |

## Summary for Link 1L: Total

Inflow Area = 2.837 ac, 0.00% Impervious, Inflow Depth = 3.97" for 100YR event
Inflow = 11.62 cfs @ 12.30 hrs, Volume= 0.938 af
Primary = 11.62 cfs @ 12.30 hrs, Volume= 0.938 af, Atten= 0%, Lag= 0.0 min

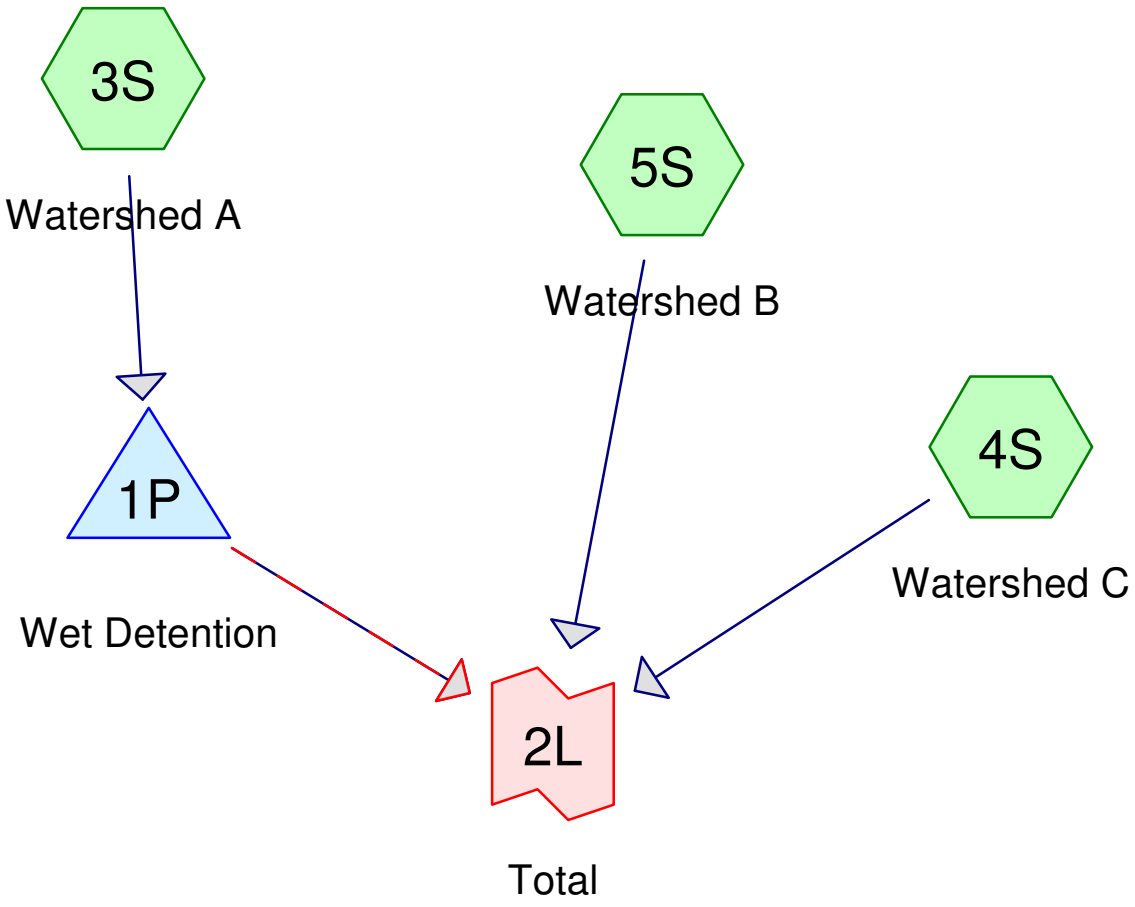
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

## Link 1L: Total



## Hydrograph for Link 1L: Total

| Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) | Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | **0.00** | 0.00 | 20.80 | 0.15 | 0.00 | 0.15 |
| 0.40 | 0.00 | 0.00 | 0.00 | 21.20 | 0.14 | 0.00 | 0.14 |
| 0.80 | 0.00 | 0.00 | 0.00 | 21.60 | 0.13 | 0.00 | 0.13 |
| 1.20 | 0.00 | 0.00 | 0.00 | 22.00 | 0.11 | 0.00 | 0.11 |
| 1.60 | 0.00 | 0.00 | 0.00 | 22.40 | 0.10 | 0.00 | 0.10 |
| 2.00 | 0.00 | 0.00 | 0.00 | 22.80 | 0.09 | 0.00 | 0.09 |
| 2.40 | 0.00 | 0.00 | 0.00 | 23.20 | 0.08 | 0.00 | 0.08 |
| 2.80 | 0.00 | 0.00 | 0.00 | 23.60 | 0.06 | 0.00 | 0.06 |
| 3.20 | 0.00 | 0.00 | 0.00 | 24.00 | 0.05 | 0.00 | 0.05 |
| 3.60 | 0.00 | 0.00 | 0.00 | 24.40 | 0.01 | 0.00 | 0.01 |
| 4.00 | 0.00 | 0.00 | 0.00 | 24.80 | 0.00 | 0.00 | 0.00 |
| 4.40 | 0.00 | 0.00 | 0.00 | 25.20 | 0.00 | 0.00 | 0.00 |
| 4.80 | 0.00 | 0.00 | 0.00 | 25.60 | 0.00 | 0.00 | 0.00 |
| 5.20 | 0.00 | 0.00 | 0.00 | 26.00 | 0.00 | 0.00 | 0.00 |
| 5.60 | 0.00 | 0.00 | 0.00 | 26.40 | 0.00 | 0.00 | 0.00 |
| 6.00 | 0.00 | 0.00 | 0.00 | 26.80 | 0.00 | 0.00 | 0.00 |
| 6.40 | 0.00 | 0.00 | 0.00 | 27.20 | 0.00 | 0.00 | 0.00 |
| 6.80 | 0.00 | 0.00 | 0.00 | 27.60 | 0.00 | 0.00 | 0.00 |
| 7.20 | 0.00 | 0.00 | 0.00 | 28.00 | 0.00 | 0.00 | 0.00 |
| 7.60 | 0.00 | 0.00 | 0.00 | 28.40 | 0.00 | 0.00 | 0.00 |
| 8.00 | 0.00 | 0.00 | 0.00 | 28.80 | 0.00 | 0.00 | 0.00 |
| 8.40 | 0.01 | 0.00 | 0.01 | 29.20 | 0.00 | 0.00 | 0.00 |
| 8.80 | 0.02 | 0.00 | 0.02 | 29.60 | 0.00 | 0.00 | 0.00 |
| 9.20 | 0.04 | 0.00 | 0.04 | 30.00 | 0.00 | 0.00 | 0.00 |
| 9.60 | 0.08 | 0.00 | 0.08 | 30.40 | 0.00 | 0.00 | 0.00 |
| 10.00 | 0.12 | 0.00 | 0.12 | 30.80 | 0.00 | 0.00 | 0.00 |
| 10.40 | 0.16 | 0.00 | 0.16 | 31.20 | 0.00 | 0.00 | 0.00 |
| 10.80 | 0.27 | 0.00 | 0.27 | 31.60 | 0.00 | 0.00 | 0.00 |
| 11.20 | 0.54 | 0.00 | 0.54 | 32.00 | 0.00 | 0.00 | 0.00 |
| 11.60 | 0.92 | 0.00 | 0.92 | 32.40 | 0.00 | 0.00 | 0.00 |
| 12.00 | **3.31** | 0.00 | **3.31** | 32.80 | 0.00 | 0.00 | 0.00 |
| 12.40 | **10.23** | 0.00 | **10.23** | 33.20 | 0.00 | 0.00 | 0.00 |
| 12.80 | 3.18 | 0.00 | 3.18 | 33.60 | 0.00 | 0.00 | 0.00 |
| 13.20 | 1.65 | 0.00 | 1.65 | 34.00 | 0.00 | 0.00 | 0.00 |
| 13.60 | 1.10 | 0.00 | 1.10 | 34.40 | 0.00 | 0.00 | 0.00 |
| 14.00 | 0.65 | 0.00 | 0.65 | 34.80 | 0.00 | 0.00 | 0.00 |
| 14.40 | 0.57 | 0.00 | 0.57 | 35.20 | 0.00 | 0.00 | 0.00 |
| 14.80 | 0.54 | 0.00 | 0.54 | 35.60 | 0.00 | 0.00 | 0.00 |
| 15.20 | 0.47 | 0.00 | 0.47 | 36.00 | 0.00 | 0.00 | 0.00 |
| 15.60 | 0.33 | 0.00 | 0.33 | | | | |
| 16.00 | 0.30 | 0.00 | 0.30 | | | | |
| 16.40 | 0.29 | 0.00 | 0.29 | | | | |
| 16.80 | 0.28 | 0.00 | 0.28 | | | | |
| 17.20 | 0.26 | 0.00 | 0.26 | | | | |
| 17.60 | 0.25 | 0.00 | 0.25 | | | | |
| 18.00 | 0.24 | 0.00 | 0.24 | | | | |
| 18.40 | 0.23 | 0.00 | 0.23 | | | | |
| 18.80 | 0.22 | 0.00 | 0.22 | | | | |
| 19.20 | 0.20 | 0.00 | 0.20 | | | | |
| 19.60 | 0.19 | 0.00 | 0.19 | | | | |
| 20.00 | 0.18 | 0.00 | 0.18 | | | | |
| 20.40 | 0.17 | 0.00 | 0.17 | | | | |




Subcat Reach Pond Link

**Routing Diagram for 16923 Proposed**
Prepared by {enter your company name here}, Printed 6/8/2017

## Summary for Subcatchment 3S: Watershed A

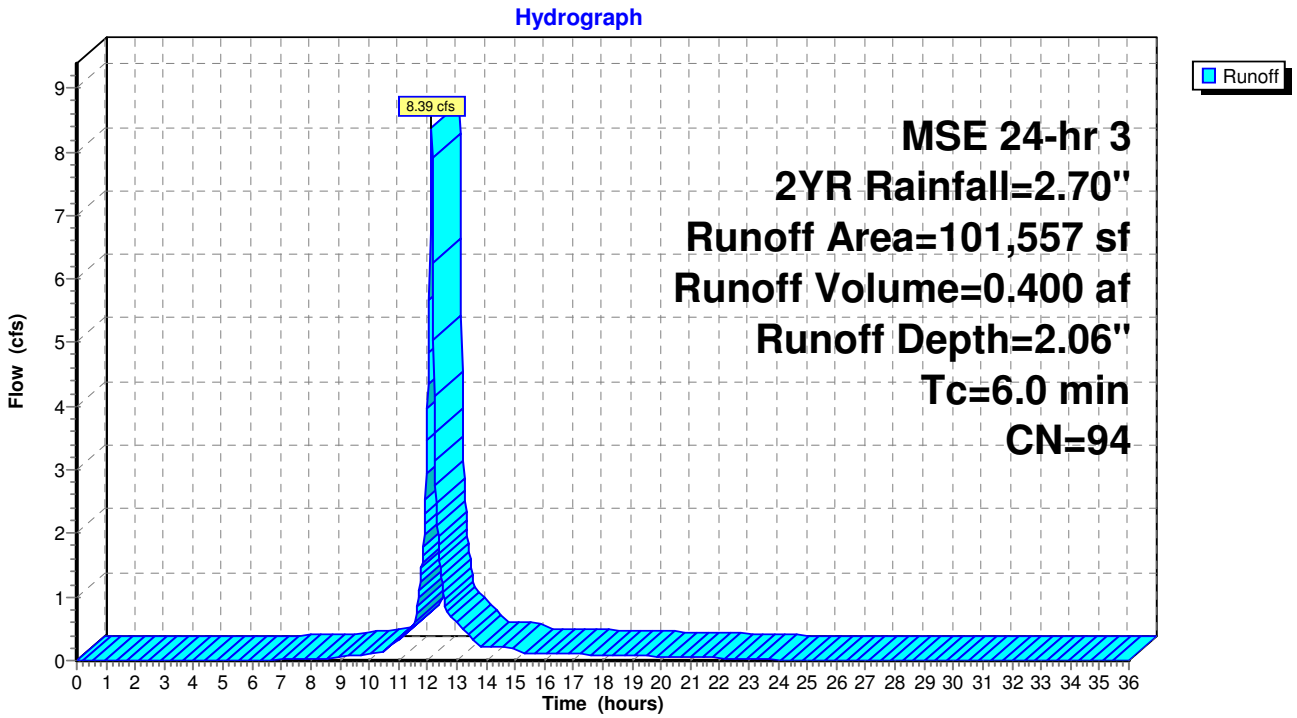
Runoff = 8.39 cfs @ 12.13 hrs, Volume= 0.400 af, Depth= 2.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 2YR Rainfall=2.70"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 55,243 | 98 | Paved parking, HSG D |
| * | 20,660 | 80 | Greenspace |
| | 8,454 | 98 | Water Surface, HSG D |
| | 17,200 | 98 | Roofs, HSG D |
| | 101,557 | 94 | Weighted Average |
| | 20,660 | | 20.34% Pervious Area |
| | 80,897 | | 79.66% Impervious Area |

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

## Subcatchment 3S: Watershed A



## Hydrograph for Subcatchment 3S: Watershed A

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.01 | 0.00 | 0.00 |
| 1.60 | 0.02 | 0.00 | 0.00 |
| 2.00 | 0.02 | 0.00 | 0.00 |
| 2.40 | 0.03 | 0.00 | 0.00 |
| 2.80 | 0.04 | 0.00 | 0.00 |
| 3.20 | 0.05 | 0.00 | 0.00 |
| 3.60 | 0.06 | 0.00 | 0.00 |
| 4.00 | 0.07 | 0.00 | 0.00 |
| 4.40 | 0.08 | 0.00 | 0.00 |
| 4.80 | 0.09 | 0.00 | 0.00 |
| 5.20 | 0.11 | 0.00 | 0.00 |
| 5.60 | 0.12 | 0.00 | 0.00 |
| 6.00 | 0.14 | 0.00 | 0.00 |
| 6.40 | 0.15 | 0.00 | 0.01 |
| 6.80 | 0.17 | 0.00 | 0.01 |
| 7.20 | 0.19 | 0.01 | 0.02 |
| 7.60 | 0.21 | 0.01 | 0.02 |
| 8.00 | 0.23 | 0.01 | 0.03 |
| 8.40 | 0.25 | 0.02 | 0.03 |
| 8.80 | 0.27 | 0.03 | 0.04 |
| 9.20 | 0.30 | 0.04 | 0.07 |
| 9.60 | 0.33 | 0.05 | 0.09 |
| 10.00 | 0.37 | 0.07 | 0.11 |
| 10.40 | 0.41 | 0.09 | 0.12 |
| 10.80 | 0.47 | 0.12 | 0.25 |
| 11.20 | 0.57 | 0.18 | 0.40 |
| 11.60 | 0.72 | 0.28 | 0.73 |
| 12.00 | 1.25 | 0.72 | **3.96** |
| 12.40 | 1.98 | 1.38 | **1.67** |
| 12.80 | 2.13 | 1.51 | 0.68 |
| 13.20 | 2.23 | 1.61 | 0.50 |
| 13.60 | 2.29 | 1.67 | 0.27 |
| 14.00 | 2.33 | 1.71 | 0.22 |
| 14.40 | 2.37 | 1.74 | 0.21 |
| 14.80 | 2.40 | 1.78 | 0.20 |
| 15.20 | 2.43 | 1.81 | 0.12 |
| 15.60 | 2.45 | 1.83 | 0.12 |
| 16.00 | 2.47 | 1.84 | 0.11 |
| 16.40 | 2.49 | 1.86 | 0.11 |
| 16.80 | 2.51 | 1.88 | 0.10 |
| 17.20 | 2.53 | 1.90 | 0.10 |
| 17.60 | 2.55 | 1.91 | 0.09 |
| 18.00 | 2.56 | 1.93 | 0.09 |
| 18.40 | 2.58 | 1.94 | 0.08 |
| 18.80 | 2.59 | 1.96 | 0.08 |
| 19.20 | 2.61 | 1.97 | 0.07 |
| 19.60 | 2.62 | 1.98 | 0.07 |
| 20.00 | 2.63 | 1.99 | 0.06 |
| 20.40 | 2.64 | 2.00 | 0.06 |
| 20.80 | 2.65 | 2.01 | 0.06 |
| 21.20 | 2.66 | 2.02 | 0.05 |
| 21.60 | 2.67 | 2.03 | 0.05 |
| 22.00 | 2.68 | 2.04 | 0.04 |
| 22.40 | 2.68 | 2.04 | 0.04 |
| 22.80 | 2.69 | 2.05 | 0.03 |
| 23.20 | 2.69 | 2.05 | 0.03 |
| 23.60 | 2.70 | 2.06 | 0.02 |
| 24.00 | **2.70** | **2.06** | 0.02 |
| 24.40 | 2.70 | 2.06 | 0.00 |
| 24.80 | 2.70 | 2.06 | 0.00 |
| 25.20 | 2.70 | 2.06 | 0.00 |
| 25.60 | 2.70 | 2.06 | 0.00 |
| 26.00 | 2.70 | 2.06 | 0.00 |
| 26.40 | 2.70 | 2.06 | 0.00 |
| 26.80 | 2.70 | 2.06 | 0.00 |
| 27.20 | 2.70 | 2.06 | 0.00 |
| 27.60 | 2.70 | 2.06 | 0.00 |
| 28.00 | 2.70 | 2.06 | 0.00 |
| 28.40 | 2.70 | 2.06 | 0.00 |
| 28.80 | 2.70 | 2.06 | 0.00 |
| 29.20 | 2.70 | 2.06 | 0.00 |
| 29.60 | 2.70 | 2.06 | 0.00 |
| 30.00 | 2.70 | 2.06 | 0.00 |
| 30.40 | 2.70 | 2.06 | 0.00 |
| 30.80 | 2.70 | 2.06 | 0.00 |
| 31.20 | 2.70 | 2.06 | 0.00 |
| 31.60 | 2.70 | 2.06 | 0.00 |
| 32.00 | 2.70 | 2.06 | 0.00 |
| 32.40 | 2.70 | 2.06 | 0.00 |
| 32.80 | 2.70 | 2.06 | 0.00 |
| 33.20 | 2.70 | 2.06 | 0.00 |
| 33.60 | 2.70 | 2.06 | 0.00 |
| 34.00 | 2.70 | 2.06 | 0.00 |
| 34.40 | 2.70 | 2.06 | 0.00 |
| 34.80 | 2.70 | 2.06 | 0.00 |
| 35.20 | 2.70 | 2.06 | 0.00 |
| 35.60 | 2.70 | 2.06 | 0.00 |
| 36.00 | 2.70 | 2.06 | 0.00 |

## Summary for Subcatchment 4S: Watershed C

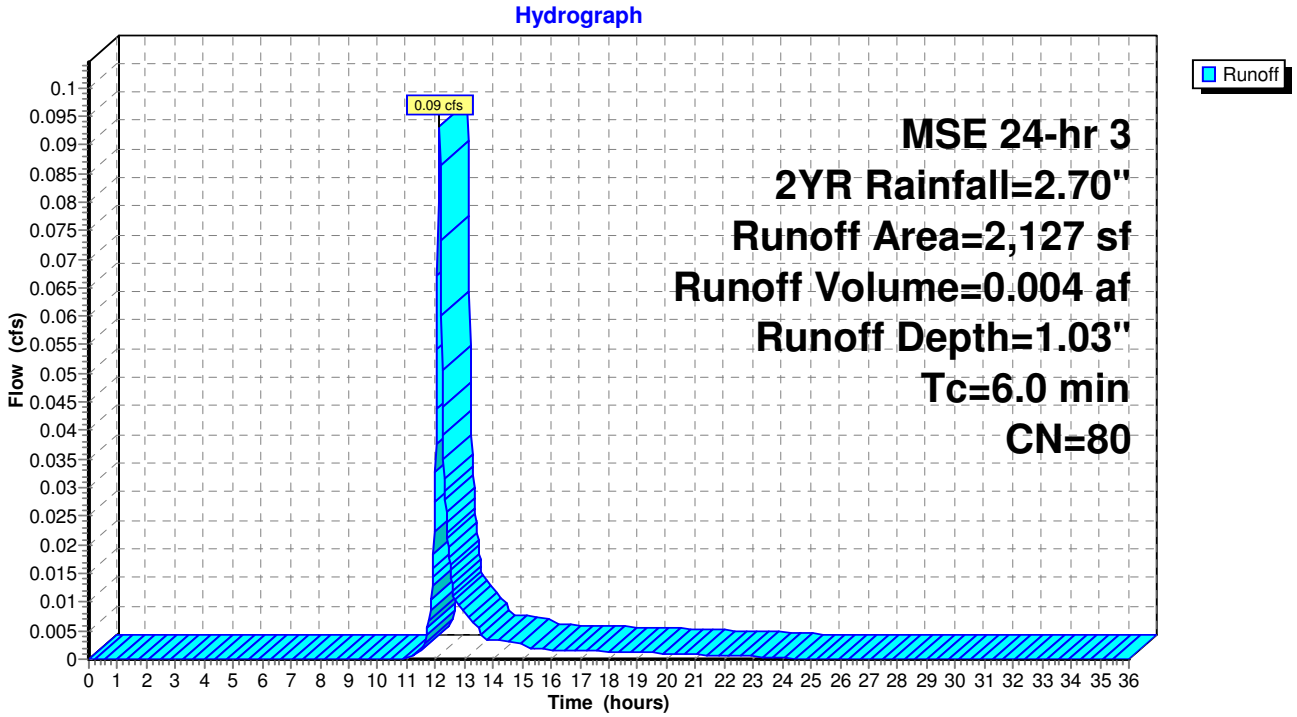
Runoff = 0.09 cfs @ 12.14 hrs, Volume= 0.004 af, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 2YR Rainfall=2.70"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 2,127 | 80 | Greenspace |
| | 2,127 | | 100.00% Pervious Area |

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

## Subcatchment 4S: Watershed C



## Hydrograph for Subcatchment 4S: Watershed C

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.01 | 0.00 | 0.00 |
| 1.60 | 0.02 | 0.00 | 0.00 |
| 2.00 | 0.02 | 0.00 | 0.00 |
| 2.40 | 0.03 | 0.00 | 0.00 |
| 2.80 | 0.04 | 0.00 | 0.00 |
| 3.20 | 0.05 | 0.00 | 0.00 |
| 3.60 | 0.06 | 0.00 | 0.00 |
| 4.00 | 0.07 | 0.00 | 0.00 |
| 4.40 | 0.08 | 0.00 | 0.00 |
| 4.80 | 0.09 | 0.00 | 0.00 |
| 5.20 | 0.11 | 0.00 | 0.00 |
| 5.60 | 0.12 | 0.00 | 0.00 |
| 6.00 | 0.14 | 0.00 | 0.00 |
| 6.40 | 0.15 | 0.00 | 0.00 |
| 6.80 | 0.17 | 0.00 | 0.00 |
| 7.20 | 0.19 | 0.00 | 0.00 |
| 7.60 | 0.21 | 0.00 | 0.00 |
| 8.00 | 0.23 | 0.00 | 0.00 |
| 8.40 | 0.25 | 0.00 | 0.00 |
| 8.80 | 0.27 | 0.00 | 0.00 |
| 9.20 | 0.30 | 0.00 | 0.00 |
| 9.60 | 0.33 | 0.00 | 0.00 |
| 10.00 | 0.37 | 0.00 | 0.00 |
| 10.40 | 0.41 | 0.00 | 0.00 |
| 10.80 | 0.47 | 0.00 | 0.00 |
| 11.20 | 0.57 | 0.00 | 0.00 |
| 11.60 | 0.72 | 0.02 | 0.00 |
| 12.00 | 1.25 | 0.17 | **0.03** |
| 12.40 | 1.98 | 0.55 | **0.02** |
| 12.80 | 2.13 | 0.64 | 0.01 |
| 13.20 | 2.23 | 0.70 | 0.01 |
| 13.60 | 2.29 | 0.75 | 0.00 |
| 14.00 | 2.33 | 0.77 | 0.00 |
| 14.40 | 2.37 | 0.80 | 0.00 |
| 14.80 | 2.40 | 0.82 | 0.00 |
| 15.20 | 2.43 | 0.84 | 0.00 |
| 15.60 | 2.45 | 0.86 | 0.00 |
| 16.00 | 2.47 | 0.87 | 0.00 |
| 16.40 | 2.49 | 0.88 | 0.00 |
| 16.80 | 2.51 | 0.90 | 0.00 |
| 17.20 | 2.53 | 0.91 | 0.00 |
| 17.60 | 2.55 | 0.92 | 0.00 |
| 18.00 | 2.56 | 0.93 | 0.00 |
| 18.40 | 2.58 | 0.94 | 0.00 |
| 18.80 | 2.59 | 0.95 | 0.00 |
| 19.20 | 2.61 | 0.96 | 0.00 |
| 19.60 | 2.62 | 0.97 | 0.00 |
| 20.00 | 2.63 | 0.98 | 0.00 |
| 20.40 | 2.64 | 0.99 | 0.00 |
| 20.80 | 2.65 | 0.99 | 0.00 |
| 21.20 | 2.66 | 1.00 | 0.00 |
| 21.60 | 2.67 | 1.01 | 0.00 |
| 22.00 | 2.68 | 1.01 | 0.00 |
| 22.40 | 2.68 | 1.02 | 0.00 |
| 22.80 | 2.69 | 1.02 | 0.00 |
| 23.20 | 2.69 | 1.02 | 0.00 |
| 23.60 | 2.70 | 1.03 | 0.00 |
| 24.00 | **2.70** | **1.03** | 0.00 |
| 24.40 | 2.70 | 1.03 | 0.00 |
| 24.80 | 2.70 | 1.03 | 0.00 |
| 25.20 | 2.70 | 1.03 | 0.00 |
| 25.60 | 2.70 | 1.03 | 0.00 |
| 26.00 | 2.70 | 1.03 | 0.00 |
| 26.40 | 2.70 | 1.03 | 0.00 |
| 26.80 | 2.70 | 1.03 | 0.00 |
| 27.20 | 2.70 | 1.03 | 0.00 |
| 27.60 | 2.70 | 1.03 | 0.00 |
| 28.00 | 2.70 | 1.03 | 0.00 |
| 28.40 | 2.70 | 1.03 | 0.00 |
| 28.80 | 2.70 | 1.03 | 0.00 |
| 29.20 | 2.70 | 1.03 | 0.00 |
| 29.60 | 2.70 | 1.03 | 0.00 |
| 30.00 | 2.70 | 1.03 | 0.00 |
| 30.40 | 2.70 | 1.03 | 0.00 |
| 30.80 | 2.70 | 1.03 | 0.00 |
| 31.20 | 2.70 | 1.03 | 0.00 |
| 31.60 | 2.70 | 1.03 | 0.00 |
| 32.00 | 2.70 | 1.03 | 0.00 |
| 32.40 | 2.70 | 1.03 | 0.00 |
| 32.80 | 2.70 | 1.03 | 0.00 |
| 33.20 | 2.70 | 1.03 | 0.00 |
| 33.60 | 2.70 | 1.03 | 0.00 |
| 34.00 | 2.70 | 1.03 | 0.00 |
| 34.40 | 2.70 | 1.03 | 0.00 |
| 34.80 | 2.70 | 1.03 | 0.00 |
| 35.20 | 2.70 | 1.03 | 0.00 |
| 35.60 | 2.70 | 1.03 | 0.00 |
| 36.00 | 2.70 | 1.03 | 0.00 |

## Summary for Subcatchment 5S: Watershed B

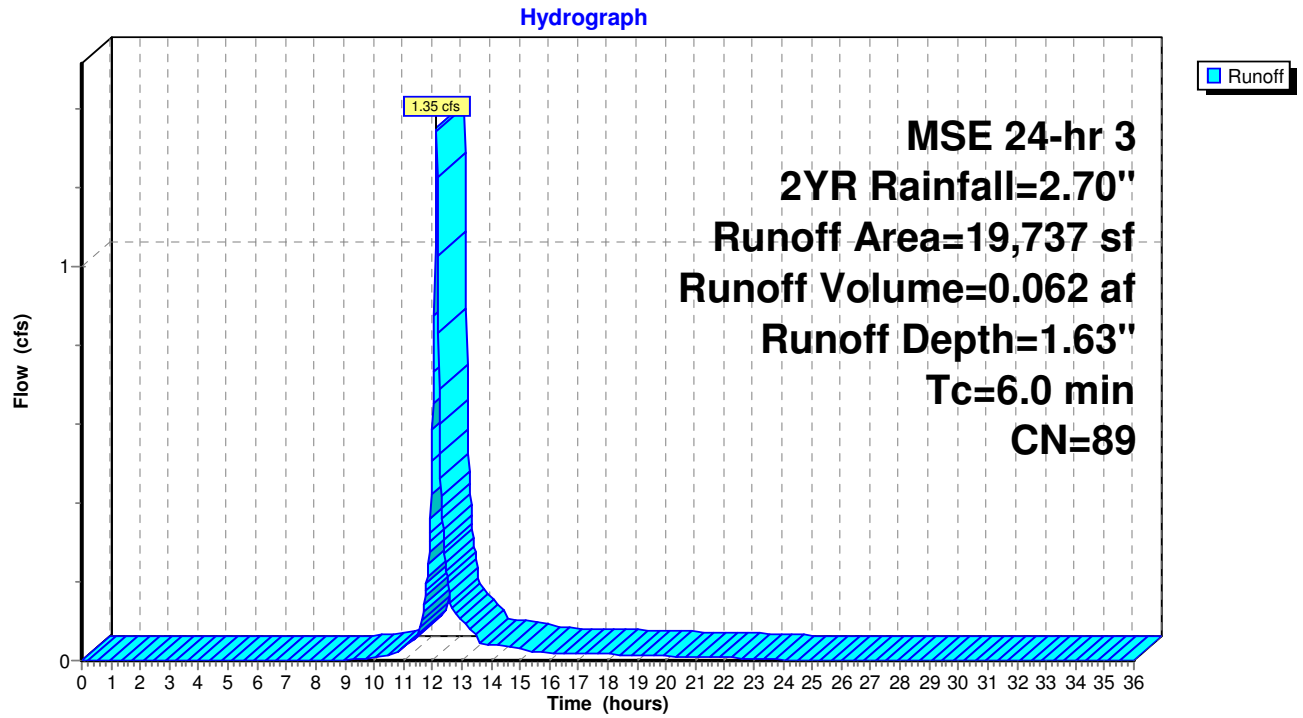
Runoff = 1.35 cfs @ 12.13 hrs, Volume= 0.062 af, Depth= 1.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 2YR Rainfall=2.70"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 5,439 | 98 | Paved parking, HSG D |
| * | 9,710 | 80 | Greenspace |
| | 4,250 | 98 | Paved parking, HSG D |
| * | 338 | 80 | Greenspace |
| | 19,737 | 89 | Weighted Average |
| | 10,048 | | 50.91% Pervious Area |
| | 9,689 | | 49.09% Impervious Area |

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

## Subcatchment 5S: Watershed B



## Hydrograph for Subcatchment 5S: Watershed B

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.01 | 0.00 | 0.00 |
| 1.60 | 0.02 | 0.00 | 0.00 |
| 2.00 | 0.02 | 0.00 | 0.00 |
| 2.40 | 0.03 | 0.00 | 0.00 |
| 2.80 | 0.04 | 0.00 | 0.00 |
| 3.20 | 0.05 | 0.00 | 0.00 |
| 3.60 | 0.06 | 0.00 | 0.00 |
| 4.00 | 0.07 | 0.00 | 0.00 |
| 4.40 | 0.08 | 0.00 | 0.00 |
| 4.80 | 0.09 | 0.00 | 0.00 |
| 5.20 | 0.11 | 0.00 | 0.00 |
| 5.60 | 0.12 | 0.00 | 0.00 |
| 6.00 | 0.14 | 0.00 | 0.00 |
| 6.40 | 0.15 | 0.00 | 0.00 |
| 6.80 | 0.17 | 0.00 | 0.00 |
| 7.20 | 0.19 | 0.00 | 0.00 |
| 7.60 | 0.21 | 0.00 | 0.00 |
| 8.00 | 0.23 | 0.00 | 0.00 |
| 8.40 | 0.25 | 0.00 | 0.00 |
| 8.80 | 0.27 | 0.00 | 0.00 |
| 9.20 | 0.30 | 0.00 | 0.00 |
| 9.60 | 0.33 | 0.01 | 0.00 |
| 10.00 | 0.37 | 0.01 | 0.01 |
| 10.40 | 0.41 | 0.02 | 0.01 |
| 10.80 | 0.47 | 0.04 | 0.02 |
| 11.20 | 0.57 | 0.07 | 0.04 |
| 11.60 | 0.72 | 0.13 | 0.09 |
| 12.00 | 1.25 | 0.45 | **0.59** |
| 12.40 | 1.98 | 1.01 | **0.29** |
| 12.80 | 2.13 | 1.13 | 0.12 |
| 13.20 | 2.23 | 1.22 | 0.09 |
| 13.60 | 2.29 | 1.27 | 0.05 |
| 14.00 | 2.33 | 1.31 | 0.04 |
| 14.40 | 2.37 | 1.34 | 0.04 |
| 14.80 | 2.40 | 1.37 | 0.04 |
| 15.20 | 2.43 | 1.40 | 0.02 |
| 15.60 | 2.45 | 1.41 | 0.02 |
| 16.00 | 2.47 | 1.43 | 0.02 |
| 16.40 | 2.49 | 1.45 | 0.02 |
| 16.80 | 2.51 | 1.47 | 0.02 |
| 17.20 | 2.53 | 1.48 | 0.02 |
| 17.60 | 2.55 | 1.50 | 0.02 |
| 18.00 | 2.56 | 1.51 | 0.02 |
| 18.40 | 2.58 | 1.52 | 0.01 |
| 18.80 | 2.59 | 1.54 | 0.01 |
| 19.20 | 2.61 | 1.55 | 0.01 |
| 19.60 | 2.62 | 1.56 | 0.01 |
| 20.00 | 2.63 | 1.57 | 0.01 |
| 20.40 | 2.64 | 1.58 | 0.01 |
| 20.80 | 2.65 | 1.59 | 0.01 |
| 21.20 | 2.66 | 1.60 | 0.01 |
| 21.60 | 2.67 | 1.60 | 0.01 |
| 22.00 | 2.68 | 1.61 | 0.01 |
| 22.40 | 2.68 | 1.62 | 0.01 |
| 22.80 | 2.69 | 1.62 | 0.01 |
| 23.20 | 2.69 | 1.62 | 0.00 |
| 23.60 | 2.70 | 1.63 | 0.00 |
| 24.00 | **2.70** | **1.63** | 0.00 |
| 24.40 | 2.70 | 1.63 | 0.00 |
| 24.80 | 2.70 | 1.63 | 0.00 |
| 25.20 | 2.70 | 1.63 | 0.00 |
| 25.60 | 2.70 | 1.63 | 0.00 |
| 26.00 | 2.70 | 1.63 | 0.00 |
| 26.40 | 2.70 | 1.63 | 0.00 |
| 26.80 | 2.70 | 1.63 | 0.00 |
| 27.20 | 2.70 | 1.63 | 0.00 |
| 27.60 | 2.70 | 1.63 | 0.00 |
| 28.00 | 2.70 | 1.63 | 0.00 |
| 28.40 | 2.70 | 1.63 | 0.00 |
| 28.80 | 2.70 | 1.63 | 0.00 |
| 29.20 | 2.70 | 1.63 | 0.00 |
| 29.60 | 2.70 | 1.63 | 0.00 |
| 30.00 | 2.70 | 1.63 | 0.00 |
| 30.40 | 2.70 | 1.63 | 0.00 |
| 30.80 | 2.70 | 1.63 | 0.00 |
| 31.20 | 2.70 | 1.63 | 0.00 |
| 31.60 | 2.70 | 1.63 | 0.00 |
| 32.00 | 2.70 | 1.63 | 0.00 |
| 32.40 | 2.70 | 1.63 | 0.00 |
| 32.80 | 2.70 | 1.63 | 0.00 |
| 33.20 | 2.70 | 1.63 | 0.00 |
| 33.60 | 2.70 | 1.63 | 0.00 |
| 34.00 | 2.70 | 1.63 | 0.00 |
| 34.40 | 2.70 | 1.63 | 0.00 |
| 34.80 | 2.70 | 1.63 | 0.00 |
| 35.20 | 2.70 | 1.63 | 0.00 |
| 35.60 | 2.70 | 1.63 | 0.00 |
| 36.00 | 2.70 | 1.63 | 0.00 |

## Summary for Pond 1P: Wet Detention

Inflow Area = 2.331 ac, 79.66% Impervious, Inflow Depth = 2.06" for 2YR event
Inflow = 8.39 cfs @ 12.13 hrs, Volume= 0.400 af
Outflow = 1.50 cfs @ 12.44 hrs, Volume= 0.392 af, Atten= 82%, Lag= 18.5 min
Primary = 1.50 cfs @ 12.44 hrs, Volume= 0.392 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 850.48' @ 12.44 hrs Surf.Area= 10,159 sf Storage= 9,001 cf

Plug-Flow detention time= 158.9 min calculated for 0.392 af (98% of inflow)
Center-of-Mass det. time= 147.2 min ( 926.3 - 779.1 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 849.50' | 28,439 cf | **Pond (Prismatic)** Listed below (Recalc) |

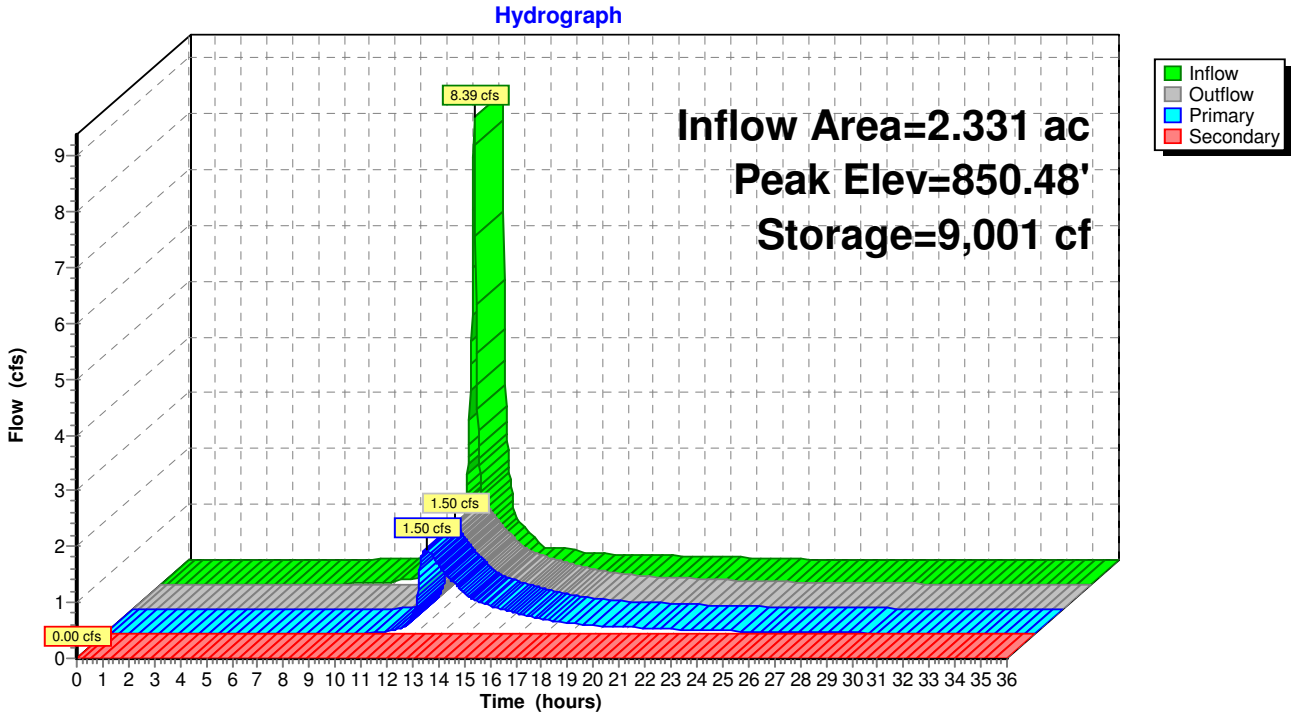
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 849.50 | 8,454 | 0 | 0 |
| 850.00 | 9,153 | 4,402 | 4,402 |
| 851.00 | 11,264 | 10,209 | 14,610 |
| 852.00 | 16,393 | 13,829 | 28,439 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 849.50' | **15.0" Round Culvert**<br>L= 26.5' CMP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 849.50' / 845.39' S= 0.1551 '/' Cc= 0.900<br>n= 0.013, Flow Area= 1.23 sf |
| #2 | Device 1 | 849.50' | **6.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Device 1 | 850.00' | **9.0" Vert. Orifice/Grate** C= 0.600 |
| #4 | Device 1 | 851.25' | **60.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #5 | Secondary | 851.50' | **10.0' long x 10.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Primary OutFlow** Max=1.50 cfs @ 12.44 hrs HW=850.48' (Free Discharge)
└**1=Culvert** (Passes 1.50 cfs of 2.73 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.81 cfs @ 4.10 fps)
  ├**3=Orifice/Grate** (Orifice Controls 0.70 cfs @ 2.35 fps)
  └**4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=849.50' (Free Discharge)
└**5=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 1P: Wet Detention



## Hydrograph for Pond 1P: Wet Detention

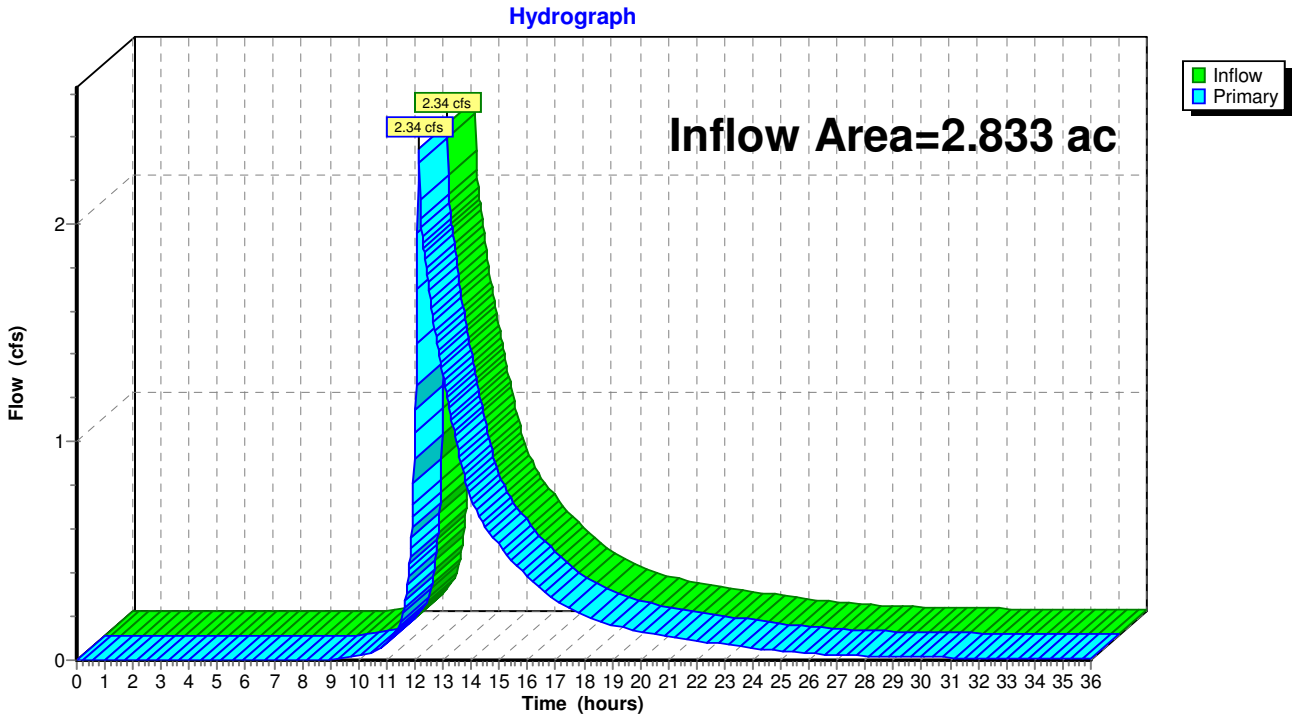
| Time (hours) | Inflow (cfs) | Storage (cubic-feet) | Elevation (feet) | Outflow (cfs) | Primary (cfs) | Secondary (cfs) |
|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | **0.00** |
| 1.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 2.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 3.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 4.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 5.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 6.00 | 0.00 | 1 | 849.50 | 0.00 | 0.00 | 0.00 |
| 7.00 | 0.01 | 27 | 849.50 | 0.00 | 0.00 | 0.00 |
| 8.00 | 0.03 | 99 | 849.51 | 0.00 | 0.00 | 0.00 |
| 9.00 | 0.04 | 221 | 849.53 | 0.00 | 0.00 | 0.00 |
| 10.00 | 0.11 | 504 | 849.56 | 0.01 | 0.01 | 0.00 |
| 11.00 | 0.32 | 1,044 | 849.62 | 0.04 | 0.04 | 0.00 |
| 12.00 | **3.96** | **3,933** | **849.95** | **0.42** | **0.42** | 0.00 |
| 13.00 | **0.59** | **7,921** | **850.37** | **1.19** | **1.19** | 0.00 |
| 14.00 | 0.22 | 5,898 | 850.16 | 0.70 | 0.70 | 0.00 |
| 15.00 | 0.20 | 4,572 | 850.02 | 0.49 | 0.49 | 0.00 |
| 16.00 | 0.11 | 3,480 | 849.90 | 0.36 | 0.36 | 0.00 |
| 17.00 | 0.10 | 2,770 | 849.82 | 0.25 | 0.25 | 0.00 |
| 18.00 | 0.09 | 2,320 | 849.77 | 0.19 | 0.19 | 0.00 |
| 19.00 | 0.08 | 2,015 | 849.73 | 0.15 | 0.15 | 0.00 |
| 20.00 | 0.06 | 1,789 | 849.71 | 0.12 | 0.12 | 0.00 |
| 21.00 | 0.05 | 1,607 | 849.69 | 0.10 | 0.10 | 0.00 |
| 22.00 | 0.04 | 1,451 | 849.67 | 0.08 | 0.08 | 0.00 |
| 23.00 | 0.03 | 1,307 | 849.65 | 0.07 | 0.07 | 0.00 |
| 24.00 | 0.02 | 1,168 | 849.64 | 0.06 | 0.06 | 0.00 |
| 25.00 | 0.00 | 1,002 | 849.62 | 0.04 | 0.04 | 0.00 |
| 26.00 | 0.00 | 872 | 849.60 | 0.03 | 0.03 | 0.00 |
| 27.00 | 0.00 | 770 | 849.59 | 0.03 | 0.03 | 0.00 |
| 28.00 | 0.00 | 689 | 849.58 | 0.02 | 0.02 | 0.00 |
| 29.00 | 0.00 | 623 | 849.57 | 0.02 | 0.02 | 0.00 |
| 30.00 | 0.00 | 568 | 849.57 | 0.01 | 0.01 | 0.00 |
| 31.00 | 0.00 | 521 | 849.56 | 0.01 | 0.01 | 0.00 |
| 32.00 | 0.00 | 481 | 849.56 | 0.01 | 0.01 | 0.00 |
| 33.00 | 0.00 | 447 | 849.55 | 0.01 | 0.01 | 0.00 |
| 34.00 | 0.00 | 417 | 849.55 | 0.01 | 0.01 | 0.00 |
| 35.00 | 0.00 | 391 | 849.55 | 0.01 | 0.01 | 0.00 |
| 36.00 | 0.00 | 368 | 849.54 | 0.01 | 0.01 | 0.00 |

## Summary for Link 2L: Total

Inflow Area = 2.833 ac, 73.40% Impervious, Inflow Depth > 1.94" for 2YR event
Inflow = 2.34 cfs @ 12.15 hrs, Volume= 0.458 af
Primary = 2.34 cfs @ 12.15 hrs, Volume= 0.458 af, Atten= 0%, Lag= 0.0 min

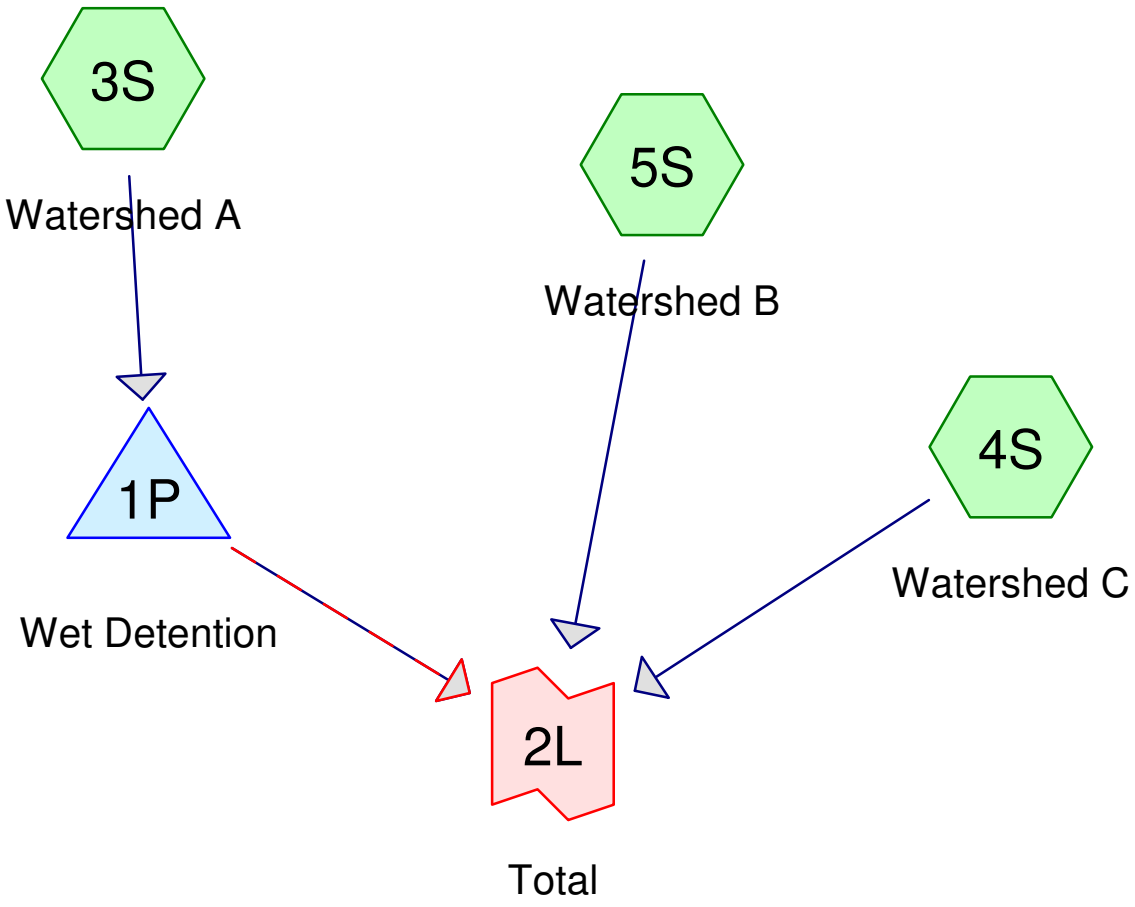
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

## Link 2L: Total



## Hydrograph for Link 2L: Total

| Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) | Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | **0.00** | 0.00 | 20.80 | 0.11 | 0.00 | 0.11 |
| 0.40 | 0.00 | 0.00 | 0.00 | 21.20 | 0.11 | 0.00 | 0.11 |
| 0.80 | 0.00 | 0.00 | 0.00 | 21.60 | 0.10 | 0.00 | 0.10 |
| 1.20 | 0.00 | 0.00 | 0.00 | 22.00 | 0.09 | 0.00 | 0.09 |
| 1.60 | 0.00 | 0.00 | 0.00 | 22.40 | 0.08 | 0.00 | 0.08 |
| 2.00 | 0.00 | 0.00 | 0.00 | 22.80 | 0.08 | 0.00 | 0.08 |
| 2.40 | 0.00 | 0.00 | 0.00 | 23.20 | 0.07 | 0.00 | 0.07 |
| 2.80 | 0.00 | 0.00 | 0.00 | 23.60 | 0.06 | 0.00 | 0.06 |
| 3.20 | 0.00 | 0.00 | 0.00 | 24.00 | 0.06 | 0.00 | 0.06 |
| 3.60 | 0.00 | 0.00 | 0.00 | 24.40 | 0.05 | 0.00 | 0.05 |
| 4.00 | 0.00 | 0.00 | 0.00 | 24.80 | 0.04 | 0.00 | 0.04 |
| 4.40 | 0.00 | 0.00 | 0.00 | 25.20 | 0.04 | 0.00 | 0.04 |
| 4.80 | 0.00 | 0.00 | 0.00 | 25.60 | 0.04 | 0.00 | 0.04 |
| 5.20 | 0.00 | 0.00 | 0.00 | 26.00 | 0.03 | 0.00 | 0.03 |
| 5.60 | 0.00 | 0.00 | 0.00 | 26.40 | 0.03 | 0.00 | 0.03 |
| 6.00 | 0.00 | 0.00 | 0.00 | 26.80 | 0.03 | 0.00 | 0.03 |
| 6.40 | 0.00 | 0.00 | 0.00 | 27.20 | 0.02 | 0.00 | 0.02 |
| 6.80 | 0.00 | 0.00 | 0.00 | 27.60 | 0.02 | 0.00 | 0.02 |
| 7.20 | 0.00 | 0.00 | 0.00 | 28.00 | 0.02 | 0.00 | 0.02 |
| 7.60 | 0.00 | 0.00 | 0.00 | 28.40 | 0.02 | 0.00 | 0.02 |
| 8.00 | 0.00 | 0.00 | 0.00 | 28.80 | 0.02 | 0.00 | 0.02 |
| 8.40 | 0.00 | 0.00 | 0.00 | 29.20 | 0.02 | 0.00 | 0.02 |
| 8.80 | 0.00 | 0.00 | 0.00 | 29.60 | 0.02 | 0.00 | 0.02 |
| 9.20 | 0.01 | 0.00 | 0.01 | 30.00 | 0.01 | 0.00 | 0.01 |
| 9.60 | 0.01 | 0.00 | 0.01 | 30.40 | 0.01 | 0.00 | 0.01 |
| 10.00 | 0.02 | 0.00 | 0.02 | 30.80 | 0.01 | 0.00 | 0.01 |
| 10.40 | 0.03 | 0.00 | 0.03 | 31.20 | 0.01 | 0.00 | 0.01 |
| 10.80 | 0.05 | 0.00 | 0.05 | 31.60 | 0.01 | 0.00 | 0.01 |
| 11.20 | 0.11 | 0.00 | 0.11 | 32.00 | 0.01 | 0.00 | 0.01 |
| 11.60 | 0.22 | 0.00 | 0.22 | 32.40 | 0.01 | 0.00 | 0.01 |
| 12.00 | **1.04** | 0.00 | **1.04** | 32.80 | 0.01 | 0.00 | 0.01 |
| 12.40 | **1.81** | 0.00 | **1.81** | 33.20 | 0.01 | 0.00 | 0.01 |
| 12.80 | 1.44 | 0.00 | 1.44 | 33.60 | 0.01 | 0.00 | 0.01 |
| 13.20 | 1.17 | 0.00 | 1.17 | 34.00 | 0.01 | 0.00 | 0.01 |
| 13.60 | 0.92 | 0.00 | 0.92 | 34.40 | 0.01 | 0.00 | 0.01 |
| 14.00 | 0.74 | 0.00 | 0.74 | 34.80 | 0.01 | 0.00 | 0.01 |
| 14.40 | 0.63 | 0.00 | 0.63 | 35.20 | 0.01 | 0.00 | 0.01 |
| 14.80 | 0.56 | 0.00 | 0.56 | 35.60 | 0.01 | 0.00 | 0.01 |
| 15.20 | 0.49 | 0.00 | 0.49 | 36.00 | 0.01 | 0.00 | 0.01 |
| 15.60 | 0.44 | 0.00 | 0.44 | | | | |
| 16.00 | 0.38 | 0.00 | 0.38 | | | | |
| 16.40 | 0.33 | 0.00 | 0.33 | | | | |
| 16.80 | 0.29 | 0.00 | 0.29 | | | | |
| 17.20 | 0.26 | 0.00 | 0.26 | | | | |
| 17.60 | 0.23 | 0.00 | 0.23 | | | | |
| 18.00 | 0.21 | 0.00 | 0.21 | | | | |
| 18.40 | 0.19 | 0.00 | 0.19 | | | | |
| 18.80 | 0.17 | 0.00 | 0.17 | | | | |
| 19.20 | 0.16 | 0.00 | 0.16 | | | | |
| 19.60 | 0.14 | 0.00 | 0.14 | | | | |
| 20.00 | 0.13 | 0.00 | 0.13 | | | | |
| 20.40 | 0.12 | 0.00 | 0.12 | | | | |




Subcat Reach Pond Link

**Routing Diagram for 16923 Proposed**
Prepared by {enter your company name here}, Printed 6/8/2017

## Summary for Subcatchment 3S: Watershed A

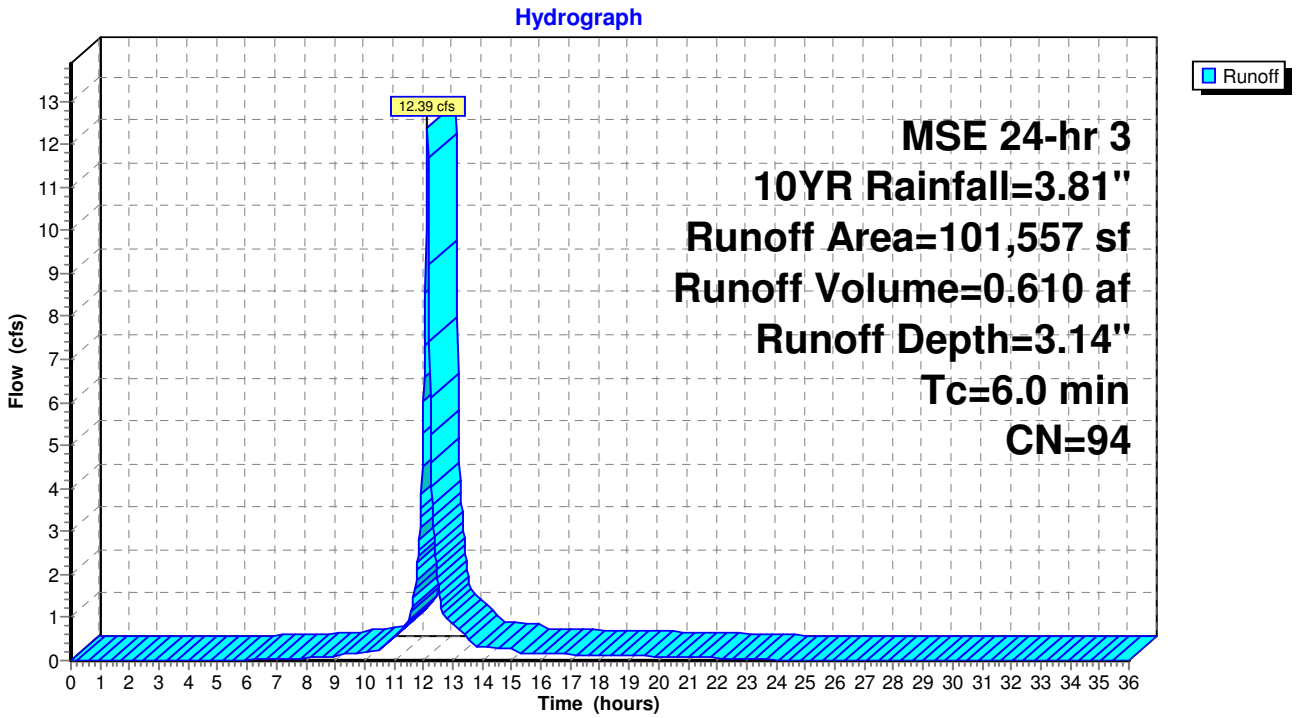
Runoff = 12.39 cfs @ 12.13 hrs, Volume= 0.610 af, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 10YR Rainfall=3.81"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 55,243 | 98 | Paved parking, HSG D |
| * | 20,660 | 80 | Greenspace |
| | 8,454 | 98 | Water Surface, HSG D |
| | 17,200 | 98 | Roofs, HSG D |
| | 101,557 | 94 | Weighted Average |
| | 20,660 | | 20.34% Pervious Area |
| | 80,897 | | 79.66% Impervious Area |

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

## Subcatchment 3S: Watershed A



## Hydrograph for Subcatchment 3S: Watershed A

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.02 | 0.00 | 0.00 |
| 1.60 | 0.03 | 0.00 | 0.00 |
| 2.00 | 0.03 | 0.00 | 0.00 |
| 2.40 | 0.05 | 0.00 | 0.00 |
| 2.80 | 0.06 | 0.00 | 0.00 |
| 3.20 | 0.07 | 0.00 | 0.00 |
| 3.60 | 0.08 | 0.00 | 0.00 |
| 4.00 | 0.10 | 0.00 | 0.00 |
| 4.40 | 0.12 | 0.00 | 0.00 |
| 4.80 | 0.13 | 0.00 | 0.00 |
| 5.20 | 0.15 | 0.00 | 0.01 |
| 5.60 | 0.17 | 0.00 | 0.01 |
| 6.00 | 0.19 | 0.01 | 0.02 |
| 6.40 | 0.22 | 0.01 | 0.03 |
| 6.80 | 0.24 | 0.02 | 0.04 |
| 7.20 | 0.27 | 0.02 | 0.05 |
| 7.60 | 0.29 | 0.03 | 0.06 |
| 8.00 | 0.32 | 0.04 | 0.06 |
| 8.40 | 0.35 | 0.06 | 0.07 |
| 8.80 | 0.38 | 0.07 | 0.08 |
| 9.20 | 0.42 | 0.09 | 0.15 |
| 9.60 | 0.47 | 0.12 | 0.17 |
| 10.00 | 0.52 | 0.15 | 0.20 |
| 10.40 | 0.58 | 0.19 | 0.22 |
| 10.80 | 0.67 | 0.25 | 0.43 |
| 11.20 | 0.81 | 0.35 | 0.68 |
| 11.60 | 1.01 | 0.52 | 1.18 |
| 12.00 | 1.76 | 1.18 | **6.03** |
| 12.40 | 2.80 | 2.15 | **2.43** |
| 12.80 | 3.00 | 2.35 | 0.98 |
| 13.20 | 3.14 | 2.49 | 0.72 |
| 13.60 | 3.23 | 2.57 | 0.40 |
| 14.00 | 3.29 | 2.63 | 0.32 |
| 14.40 | 3.34 | 2.68 | 0.31 |
| 14.80 | 3.39 | 2.73 | 0.29 |
| 15.20 | 3.43 | 2.77 | 0.18 |
| 15.60 | 3.46 | 2.80 | 0.17 |
| 16.00 | 3.49 | 2.83 | 0.16 |
| 16.40 | 3.52 | 2.85 | 0.15 |
| 16.80 | 3.54 | 2.88 | 0.15 |
| 17.20 | 3.57 | 2.90 | 0.14 |
| 17.60 | 3.59 | 2.93 | 0.13 |
| 18.00 | 3.62 | 2.95 | 0.13 |
| 18.40 | 3.64 | 2.97 | 0.12 |
| 18.80 | 3.66 | 2.99 | 0.11 |
| 19.20 | 3.68 | 3.01 | 0.11 |
| 19.60 | 3.69 | 3.03 | 0.10 |
| 20.00 | 3.71 | 3.04 | 0.09 |
| 20.40 | 3.73 | 3.06 | 0.09 |
| 20.80 | 3.74 | 3.07 | 0.08 |
| 21.20 | 3.75 | 3.08 | 0.07 |
| 21.60 | 3.76 | 3.09 | 0.07 |
| 22.00 | 3.78 | 3.10 | 0.06 |
| 22.40 | 3.78 | 3.11 | 0.05 |
| 22.80 | 3.79 | 3.12 | 0.04 |
| 23.20 | 3.80 | 3.13 | 0.04 |
| 23.60 | 3.81 | 3.13 | 0.03 |
| 24.00 | **3.81** | **3.14** | 0.02 |
| 24.40 | 3.81 | 3.14 | 0.00 |
| 24.80 | 3.81 | 3.14 | 0.00 |
| 25.20 | 3.81 | 3.14 | 0.00 |
| 25.60 | 3.81 | 3.14 | 0.00 |
| 26.00 | 3.81 | 3.14 | 0.00 |
| 26.40 | 3.81 | 3.14 | 0.00 |
| 26.80 | 3.81 | 3.14 | 0.00 |
| 27.20 | 3.81 | 3.14 | 0.00 |
| 27.60 | 3.81 | 3.14 | 0.00 |
| 28.00 | 3.81 | 3.14 | 0.00 |
| 28.40 | 3.81 | 3.14 | 0.00 |
| 28.80 | 3.81 | 3.14 | 0.00 |
| 29.20 | 3.81 | 3.14 | 0.00 |
| 29.60 | 3.81 | 3.14 | 0.00 |
| 30.00 | 3.81 | 3.14 | 0.00 |
| 30.40 | 3.81 | 3.14 | 0.00 |
| 30.80 | 3.81 | 3.14 | 0.00 |
| 31.20 | 3.81 | 3.14 | 0.00 |
| 31.60 | 3.81 | 3.14 | 0.00 |
| 32.00 | 3.81 | 3.14 | 0.00 |
| 32.40 | 3.81 | 3.14 | 0.00 |
| 32.80 | 3.81 | 3.14 | 0.00 |
| 33.20 | 3.81 | 3.14 | 0.00 |
| 33.60 | 3.81 | 3.14 | 0.00 |
| 34.00 | 3.81 | 3.14 | 0.00 |
| 34.40 | 3.81 | 3.14 | 0.00 |
| 34.80 | 3.81 | 3.14 | 0.00 |
| 35.20 | 3.81 | 3.14 | 0.00 |
| 35.60 | 3.81 | 3.14 | 0.00 |
| 36.00 | 3.81 | 3.14 | 0.00 |

## Summary for Subcatchment 4S: Watershed C

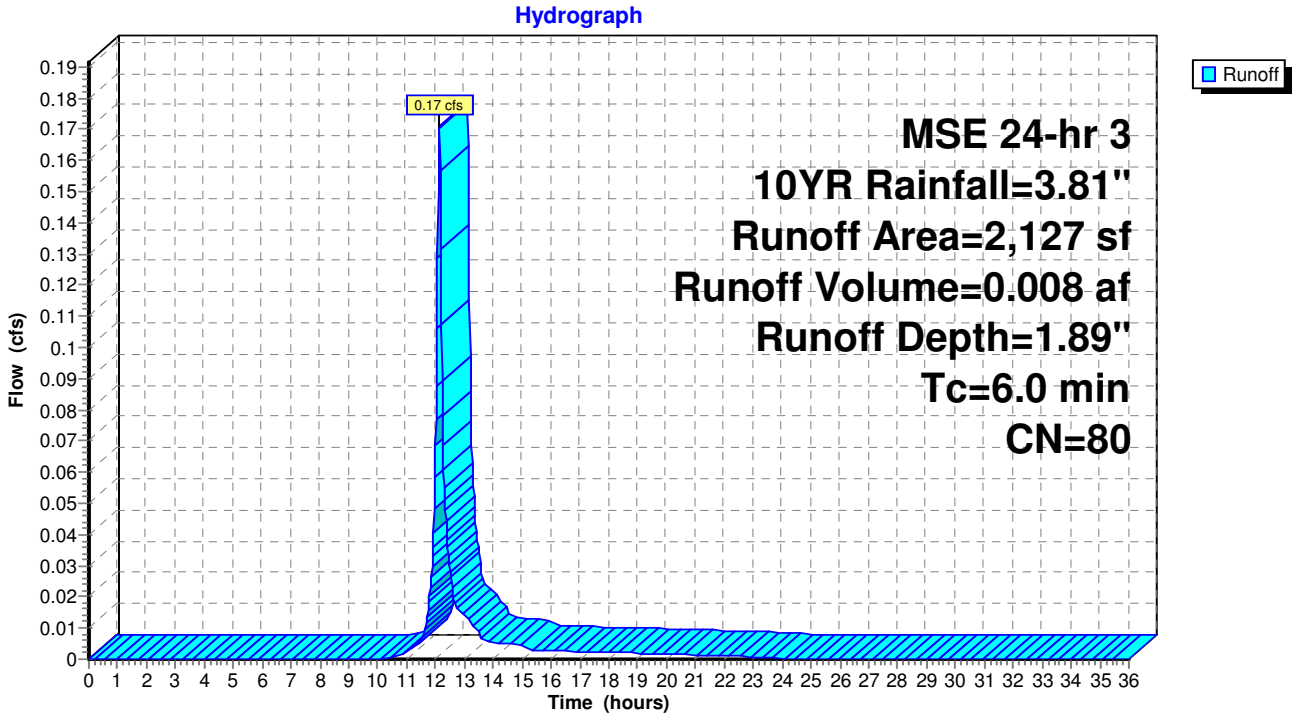
Runoff = 0.17 cfs @ 12.13 hrs, Volume= 0.008 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 10YR Rainfall=3.81"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 2,127 | 80 | Greenspace |
| | 2,127 | | 100.00% Pervious Area |

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

## Subcatchment 4S: Watershed C



## Hydrograph for Subcatchment 4S: Watershed C

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.02 | 0.00 | 0.00 |
| 1.60 | 0.03 | 0.00 | 0.00 |
| 2.00 | 0.03 | 0.00 | 0.00 |
| 2.40 | 0.05 | 0.00 | 0.00 |
| 2.80 | 0.06 | 0.00 | 0.00 |
| 3.20 | 0.07 | 0.00 | 0.00 |
| 3.60 | 0.08 | 0.00 | 0.00 |
| 4.00 | 0.10 | 0.00 | 0.00 |
| 4.40 | 0.12 | 0.00 | 0.00 |
| 4.80 | 0.13 | 0.00 | 0.00 |
| 5.20 | 0.15 | 0.00 | 0.00 |
| 5.60 | 0.17 | 0.00 | 0.00 |
| 6.00 | 0.19 | 0.00 | 0.00 |
| 6.40 | 0.22 | 0.00 | 0.00 |
| 6.80 | 0.24 | 0.00 | 0.00 |
| 7.20 | 0.27 | 0.00 | 0.00 |
| 7.60 | 0.29 | 0.00 | 0.00 |
| 8.00 | 0.32 | 0.00 | 0.00 |
| 8.40 | 0.35 | 0.00 | 0.00 |
| 8.80 | 0.38 | 0.00 | 0.00 |
| 9.20 | 0.42 | 0.00 | 0.00 |
| 9.60 | 0.47 | 0.00 | 0.00 |
| 10.00 | 0.52 | 0.00 | 0.00 |
| 10.40 | 0.58 | 0.00 | 0.00 |
| 10.80 | 0.67 | 0.01 | 0.00 |
| 11.20 | 0.81 | 0.03 | 0.00 |
| 11.60 | 1.01 | 0.09 | 0.01 |
| 12.00 | 1.76 | 0.42 | **0.07** |
| 12.40 | 2.80 | 1.10 | **0.04** |
| 12.80 | 3.00 | 1.25 | 0.02 |
| 13.20 | 3.14 | 1.36 | 0.01 |
| 13.60 | 3.23 | 1.42 | 0.01 |
| 14.00 | 3.29 | 1.47 | 0.01 |
| 14.40 | 3.34 | 1.51 | 0.01 |
| 14.80 | 3.39 | 1.55 | 0.00 |
| 15.20 | 3.43 | 1.58 | 0.00 |
| 15.60 | 3.46 | 1.61 | 0.00 |
| 16.00 | 3.49 | 1.63 | 0.00 |
| 16.40 | 3.52 | 1.65 | 0.00 |
| 16.80 | 3.54 | 1.67 | 0.00 |
| 17.20 | 3.57 | 1.69 | 0.00 |
| 17.60 | 3.59 | 1.71 | 0.00 |
| 18.00 | 3.62 | 1.73 | 0.00 |
| 18.40 | 3.64 | 1.75 | 0.00 |
| 18.80 | 3.66 | 1.76 | 0.00 |
| 19.20 | 3.68 | 1.78 | 0.00 |
| 19.60 | 3.69 | 1.79 | 0.00 |
| 20.00 | 3.71 | 1.81 | 0.00 |
| 20.40 | 3.73 | 1.82 | 0.00 |
| 20.80 | 3.74 | 1.83 | 0.00 |
| 21.20 | 3.75 | 1.84 | 0.00 |
| 21.60 | 3.76 | 1.85 | 0.00 |
| 22.00 | 3.78 | 1.86 | 0.00 |
| 22.40 | 3.78 | 1.87 | 0.00 |
| 22.80 | 3.79 | 1.87 | 0.00 |
| 23.20 | 3.80 | 1.88 | 0.00 |
| 23.60 | 3.81 | 1.88 | 0.00 |
| 24.00 | **3.81** | **1.89** | 0.00 |
| 24.40 | 3.81 | 1.89 | 0.00 |
| 24.80 | 3.81 | 1.89 | 0.00 |
| 25.20 | 3.81 | 1.89 | 0.00 |
| 25.60 | 3.81 | 1.89 | 0.00 |
| 26.00 | 3.81 | 1.89 | 0.00 |
| 26.40 | 3.81 | 1.89 | 0.00 |
| 26.80 | 3.81 | 1.89 | 0.00 |
| 27.20 | 3.81 | 1.89 | 0.00 |
| 27.60 | 3.81 | 1.89 | 0.00 |
| 28.00 | 3.81 | 1.89 | 0.00 |
| 28.40 | 3.81 | 1.89 | 0.00 |
| 28.80 | 3.81 | 1.89 | 0.00 |
| 29.20 | 3.81 | 1.89 | 0.00 |
| 29.60 | 3.81 | 1.89 | 0.00 |
| 30.00 | 3.81 | 1.89 | 0.00 |
| 30.40 | 3.81 | 1.89 | 0.00 |
| 30.80 | 3.81 | 1.89 | 0.00 |
| 31.20 | 3.81 | 1.89 | 0.00 |
| 31.60 | 3.81 | 1.89 | 0.00 |
| 32.00 | 3.81 | 1.89 | 0.00 |
| 32.40 | 3.81 | 1.89 | 0.00 |
| 32.80 | 3.81 | 1.89 | 0.00 |
| 33.20 | 3.81 | 1.89 | 0.00 |
| 33.60 | 3.81 | 1.89 | 0.00 |
| 34.00 | 3.81 | 1.89 | 0.00 |
| 34.40 | 3.81 | 1.89 | 0.00 |
| 34.80 | 3.81 | 1.89 | 0.00 |
| 35.20 | 3.81 | 1.89 | 0.00 |
| 35.60 | 3.81 | 1.89 | 0.00 |
| 36.00 | 3.81 | 1.89 | 0.00 |

## Summary for Subcatchment 5S: Watershed B

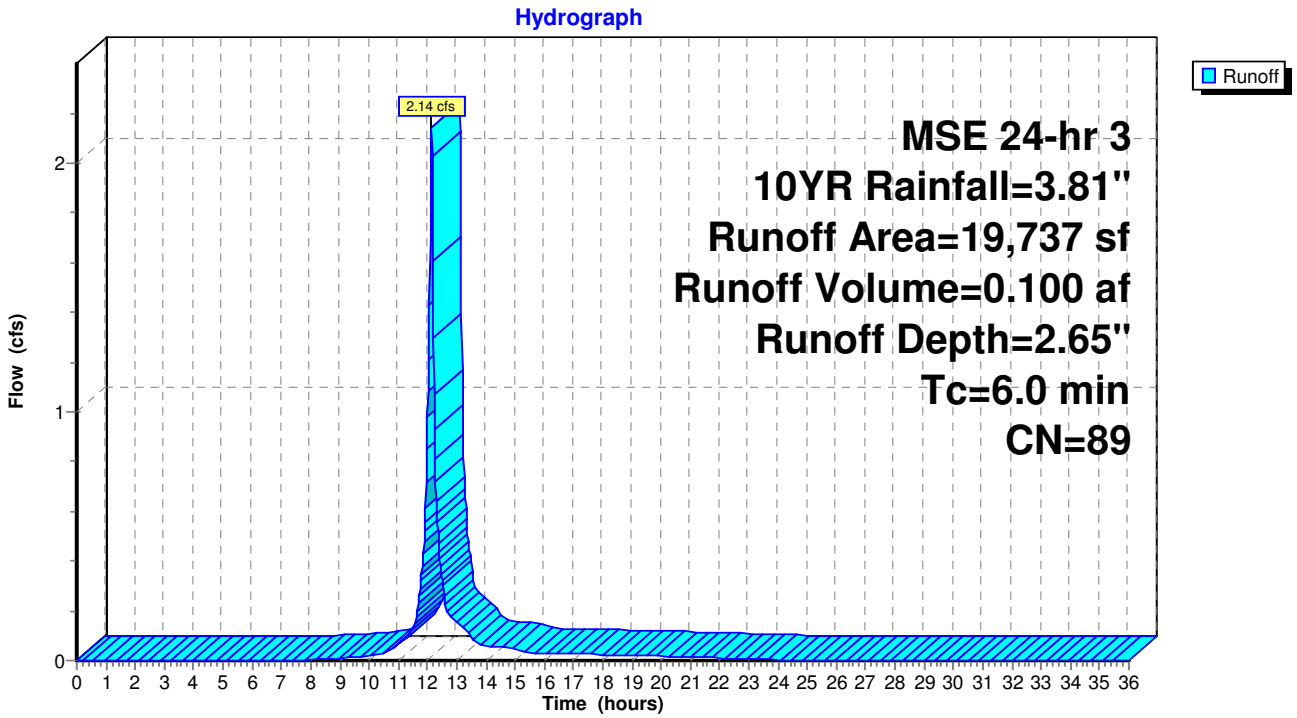
Runoff = 2.14 cfs @ 12.13 hrs, Volume= 0.100 af, Depth= 2.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 10YR Rainfall=3.81"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 5,439 | 98 | Paved parking, HSG D |
| * | 9,710 | 80 | Greenspace |
| | 4,250 | 98 | Paved parking, HSG D |
| * | 338 | 80 | Greenspace |
| | 19,737 | 89 | Weighted Average |
| | 10,048 | | 50.91% Pervious Area |
| | 9,689 | | 49.09% Impervious Area |

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

## Subcatchment 5S: Watershed B



## Hydrograph for Subcatchment 5S: Watershed B

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.00 | 0.00 | 0.00 |
| 0.80 | 0.01 | 0.00 | 0.00 |
| 1.20 | 0.02 | 0.00 | 0.00 |
| 1.60 | 0.03 | 0.00 | 0.00 |
| 2.00 | 0.03 | 0.00 | 0.00 |
| 2.40 | 0.05 | 0.00 | 0.00 |
| 2.80 | 0.06 | 0.00 | 0.00 |
| 3.20 | 0.07 | 0.00 | 0.00 |
| 3.60 | 0.08 | 0.00 | 0.00 |
| 4.00 | 0.10 | 0.00 | 0.00 |
| 4.40 | 0.12 | 0.00 | 0.00 |
| 4.80 | 0.13 | 0.00 | 0.00 |
| 5.20 | 0.15 | 0.00 | 0.00 |
| 5.60 | 0.17 | 0.00 | 0.00 |
| 6.00 | 0.19 | 0.00 | 0.00 |
| 6.40 | 0.22 | 0.00 | 0.00 |
| 6.80 | 0.24 | 0.00 | 0.00 |
| 7.20 | 0.27 | 0.00 | 0.00 |
| 7.60 | 0.29 | 0.00 | 0.00 |
| 8.00 | 0.32 | 0.00 | 0.00 |
| 8.40 | 0.35 | 0.01 | 0.00 |
| 8.80 | 0.38 | 0.01 | 0.01 |
| 9.20 | 0.42 | 0.02 | 0.01 |
| 9.60 | 0.47 | 0.03 | 0.02 |
| 10.00 | 0.52 | 0.05 | 0.02 |
| 10.40 | 0.58 | 0.07 | 0.02 |
| 10.80 | 0.67 | 0.11 | 0.05 |
| 11.20 | 0.81 | 0.18 | 0.09 |
| 11.60 | 1.01 | 0.29 | 0.17 |
| 12.00 | 1.76 | 0.84 | **0.98** |
| 12.40 | 2.80 | 1.72 | **0.44** |
| 12.80 | 3.00 | 1.90 | 0.18 |
| 13.20 | 3.14 | 2.03 | 0.13 |
| 13.60 | 3.23 | 2.11 | 0.07 |
| 14.00 | 3.29 | 2.16 | 0.06 |
| 14.40 | 3.34 | 2.21 | 0.06 |
| 14.80 | 3.39 | 2.26 | 0.05 |
| 15.20 | 3.43 | 2.30 | 0.03 |
| 15.60 | 3.46 | 2.32 | 0.03 |
| 16.00 | 3.49 | 2.35 | 0.03 |
| 16.40 | 3.52 | 2.37 | 0.03 |
| 16.80 | 3.54 | 2.40 | 0.03 |
| 17.20 | 3.57 | 2.42 | 0.03 |
| 17.60 | 3.59 | 2.44 | 0.02 |
| 18.00 | 3.62 | 2.46 | 0.02 |
| 18.40 | 3.64 | 2.48 | 0.02 |
| 18.80 | 3.66 | 2.50 | 0.02 |
| 19.20 | 3.68 | 2.52 | 0.02 |
| 19.60 | 3.69 | 2.54 | 0.02 |
| 20.00 | 3.71 | 2.55 | 0.02 |
| 20.40 | 3.73 | 2.57 | 0.02 |
| 20.80 | 3.74 | 2.58 | 0.01 |
| 21.20 | 3.75 | 2.59 | 0.01 |
| 21.60 | 3.76 | 2.60 | 0.01 |
| 22.00 | 3.78 | 2.61 | 0.01 |
| 22.40 | 3.78 | 2.62 | 0.01 |
| 22.80 | 3.79 | 2.63 | 0.01 |
| 23.20 | 3.80 | 2.64 | 0.01 |
| 23.60 | 3.81 | 2.64 | 0.01 |
| 24.00 | **3.81** | **2.65** | 0.00 |
| 24.40 | 3.81 | 2.65 | 0.00 |
| 24.80 | 3.81 | 2.65 | 0.00 |
| 25.20 | 3.81 | 2.65 | 0.00 |
| 25.60 | 3.81 | 2.65 | 0.00 |
| 26.00 | 3.81 | 2.65 | 0.00 |
| 26.40 | 3.81 | 2.65 | 0.00 |
| 26.80 | 3.81 | 2.65 | 0.00 |
| 27.20 | 3.81 | 2.65 | 0.00 |
| 27.60 | 3.81 | 2.65 | 0.00 |
| 28.00 | 3.81 | 2.65 | 0.00 |
| 28.40 | 3.81 | 2.65 | 0.00 |
| 28.80 | 3.81 | 2.65 | 0.00 |
| 29.20 | 3.81 | 2.65 | 0.00 |
| 29.60 | 3.81 | 2.65 | 0.00 |
| 30.00 | 3.81 | 2.65 | 0.00 |
| 30.40 | 3.81 | 2.65 | 0.00 |
| 30.80 | 3.81 | 2.65 | 0.00 |
| 31.20 | 3.81 | 2.65 | 0.00 |
| 31.60 | 3.81 | 2.65 | 0.00 |
| 32.00 | 3.81 | 2.65 | 0.00 |
| 32.40 | 3.81 | 2.65 | 0.00 |
| 32.80 | 3.81 | 2.65 | 0.00 |
| 33.20 | 3.81 | 2.65 | 0.00 |
| 33.60 | 3.81 | 2.65 | 0.00 |
| 34.00 | 3.81 | 2.65 | 0.00 |
| 34.40 | 3.81 | 2.65 | 0.00 |
| 34.80 | 3.81 | 2.65 | 0.00 |
| 35.20 | 3.81 | 2.65 | 0.00 |
| 35.60 | 3.81 | 2.65 | 0.00 |
| 36.00 | 3.81 | 2.65 | 0.00 |

## Summary for Pond 1P: Wet Detention

Inflow Area = 2.331 ac, 79.66% Impervious, Inflow Depth = 3.14" for 10YR event
Inflow = 12.39 cfs @ 12.13 hrs, Volume= 0.610 af
Outflow = 2.49 cfs @ 12.39 hrs, Volume= 0.601 af, Atten= 80%, Lag= 15.9 min
Primary = 2.49 cfs @ 12.39 hrs, Volume= 0.601 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 850.87' @ 12.39 hrs Surf.Area= 10,983 sf Storage= 13,131 cf

Plug-Flow detention time= 136.9 min calculated for 0.601 af (99% of inflow)
Center-of-Mass det. time= 128.2 min ( 899.1 - 770.9 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 849.50' | 28,439 cf | **Pond (Prismatic)** Listed below (Recalc) |

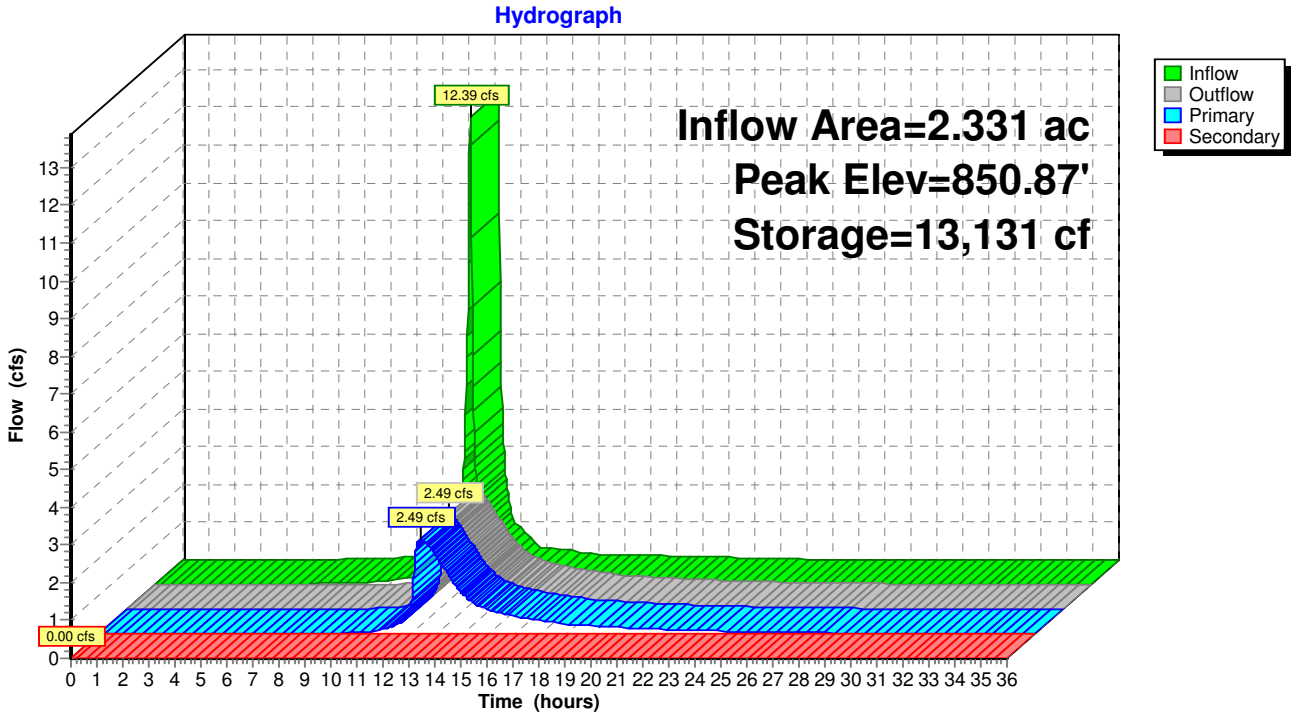
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 849.50 | 8,454 | 0 | 0 |
| 850.00 | 9,153 | 4,402 | 4,402 |
| 851.00 | 11,264 | 10,209 | 14,610 |
| 852.00 | 16,393 | 13,829 | 28,439 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 849.50' | **15.0" Round Culvert**<br>L= 26.5' CMP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 849.50' / 845.39' S= 0.1551 '/' Cc= 0.900<br>n= 0.013, Flow Area= 1.23 sf |
| #2 | Device 1 | 849.50' | **6.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Device 1 | 850.00' | **9.0" Vert. Orifice/Grate** C= 0.600 |
| #4 | Device 1 | 851.25' | **60.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #5 | Secondary | 851.50' | **10.0' long x 10.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Primary OutFlow** Max=2.49 cfs @ 12.39 hrs HW=850.87' (Free Discharge)
└**1=Culvert** (Passes 2.49 cfs of 4.02 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.00 cfs @ 5.09 fps)
  ├**3=Orifice/Grate** (Orifice Controls 1.49 cfs @ 3.38 fps)
  └**4=Orifice/Grate** ( Controls 0.00 cfs)

**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=849.50' (Free Discharge)
└**5=Broad-Crested Rectangular Weir** ( Controls 0.00 cfs)

## Pond 1P: Wet Detention



## Hydrograph for Pond 1P: Wet Detention

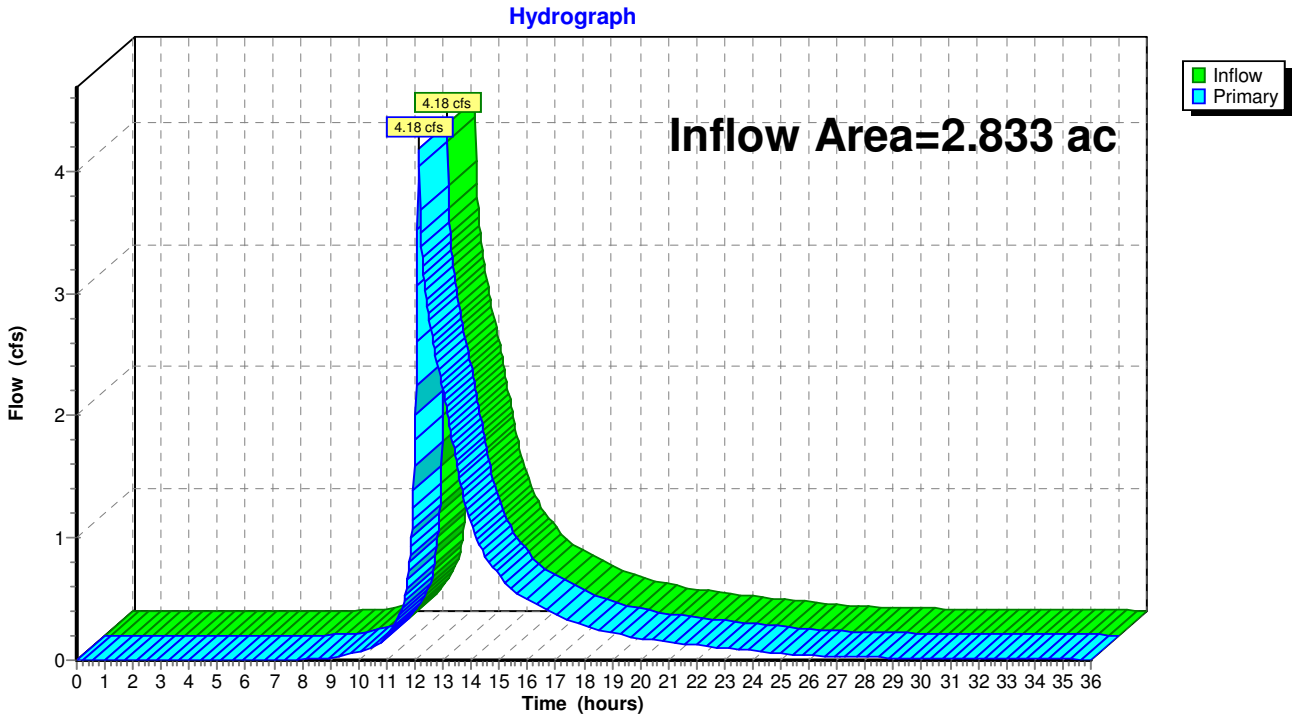
| Time (hours) | Inflow (cfs) | Storage (cubic-feet) | Elevation (feet) | Outflow (cfs) | Primary (cfs) | Secondary (cfs) |
|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | **0.00** |
| 1.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 2.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 3.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 4.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 5.00 | 0.00 | 2 | 849.50 | 0.00 | 0.00 | 0.00 |
| 6.00 | 0.02 | 45 | 849.51 | 0.00 | 0.00 | 0.00 |
| 7.00 | 0.04 | 155 | 849.52 | 0.00 | 0.00 | 0.00 |
| 8.00 | 0.06 | 337 | 849.54 | 0.01 | 0.01 | 0.00 |
| 9.00 | 0.09 | 580 | 849.57 | 0.01 | 0.01 | 0.00 |
| 10.00 | 0.20 | 1,067 | 849.62 | 0.05 | 0.05 | 0.00 |
| 11.00 | 0.55 | 1,885 | 849.72 | 0.13 | 0.13 | 0.00 |
| 12.00 | **6.03** | **6,168** | **850.19** | **0.76** | **0.76** | 0.00 |
| 13.00 | **0.85** | **10,902** | **850.66** | **2.04** | **2.04** | 0.00 |
| 14.00 | 0.32 | 7,376 | 850.31 | 1.04 | 1.04 | 0.00 |
| 15.00 | 0.28 | 5,570 | 850.13 | 0.64 | 0.64 | 0.00 |
| 16.00 | 0.16 | 4,285 | 849.99 | 0.46 | 0.46 | 0.00 |
| 17.00 | 0.14 | 3,382 | 849.89 | 0.35 | 0.35 | 0.00 |
| 18.00 | 0.13 | 2,795 | 849.82 | 0.26 | 0.26 | 0.00 |
| 19.00 | 0.11 | 2,403 | 849.78 | 0.20 | 0.20 | 0.00 |
| 20.00 | 0.09 | 2,119 | 849.75 | 0.16 | 0.16 | 0.00 |
| 21.00 | 0.08 | 1,894 | 849.72 | 0.13 | 0.13 | 0.00 |
| 22.00 | 0.06 | 1,701 | 849.70 | 0.11 | 0.11 | 0.00 |
| 23.00 | 0.04 | 1,523 | 849.68 | 0.09 | 0.09 | 0.00 |
| 24.00 | 0.02 | 1,350 | 849.66 | 0.07 | 0.07 | 0.00 |
| 25.00 | 0.00 | 1,136 | 849.63 | 0.05 | 0.05 | 0.00 |
| 26.00 | 0.00 | 974 | 849.61 | 0.04 | 0.04 | 0.00 |
| 27.00 | 0.00 | 850 | 849.60 | 0.03 | 0.03 | 0.00 |
| 28.00 | 0.00 | 753 | 849.59 | 0.02 | 0.02 | 0.00 |
| 29.00 | 0.00 | 675 | 849.58 | 0.02 | 0.02 | 0.00 |
| 30.00 | 0.00 | 612 | 849.57 | 0.02 | 0.02 | 0.00 |
| 31.00 | 0.00 | 558 | 849.57 | 0.01 | 0.01 | 0.00 |
| 32.00 | 0.00 | 513 | 849.56 | 0.01 | 0.01 | 0.00 |
| 33.00 | 0.00 | 474 | 849.56 | 0.01 | 0.01 | 0.00 |
| 34.00 | 0.00 | 441 | 849.55 | 0.01 | 0.01 | 0.00 |
| 35.00 | 0.00 | 412 | 849.55 | 0.01 | 0.01 | 0.00 |
| 36.00 | 0.00 | 387 | 849.55 | 0.01 | 0.01 | 0.00 |

## Summary for Link 2L: Total

Inflow Area = 2.833 ac, 73.40% Impervious, Inflow Depth > 3.00" for 10YR event
Inflow = 4.18 cfs @ 12.15 hrs, Volume= 0.708 af
Primary = 4.18 cfs @ 12.15 hrs, Volume= 0.708 af, Atten= 0%, Lag= 0.0 min

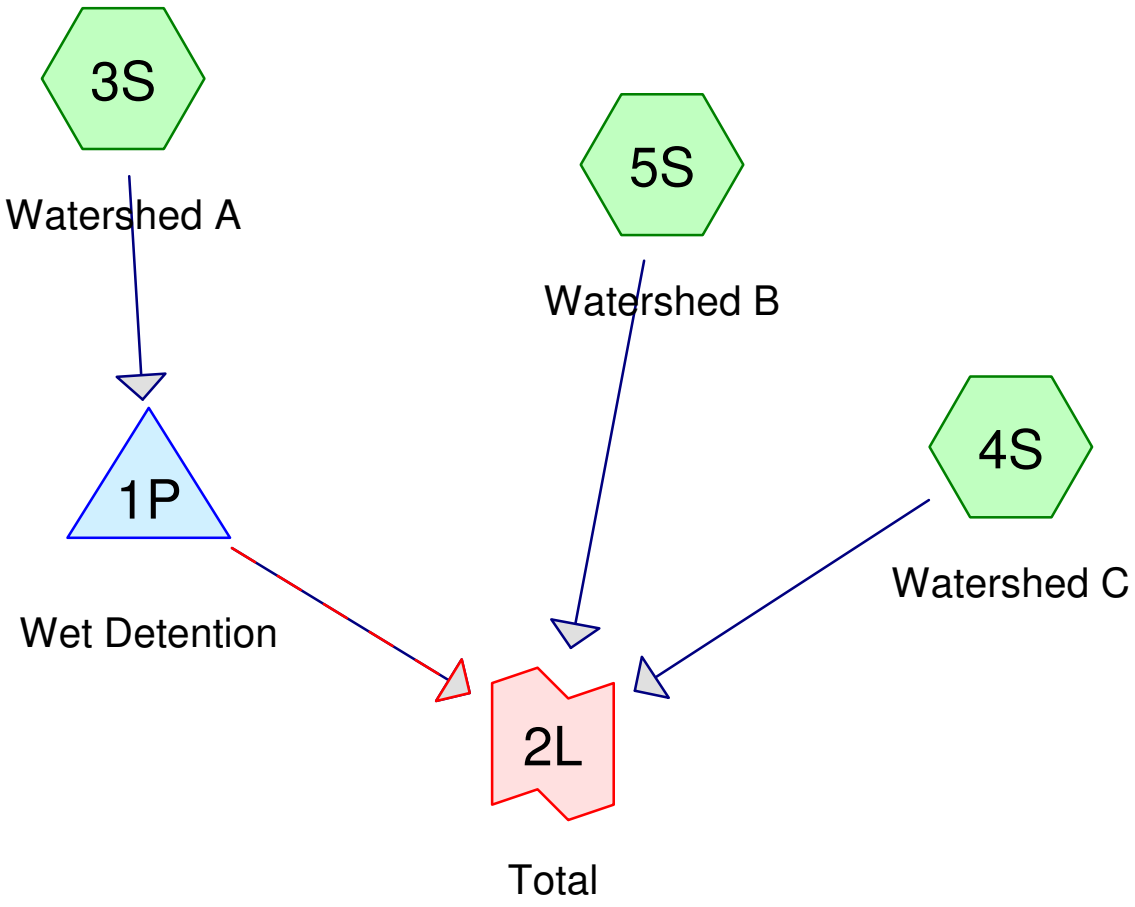
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

## Link 2L: Total



## Hydrograph for Link 2L: Total

| Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) | Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | **0.00** | 0.00 | 20.80 | 0.15 | 0.00 | 0.15 |
| 0.40 | 0.00 | 0.00 | 0.00 | 21.20 | 0.14 | 0.00 | 0.14 |
| 0.80 | 0.00 | 0.00 | 0.00 | 21.60 | 0.13 | 0.00 | 0.13 |
| 1.20 | 0.00 | 0.00 | 0.00 | 22.00 | 0.12 | 0.00 | 0.12 |
| 1.60 | 0.00 | 0.00 | 0.00 | 22.40 | 0.11 | 0.00 | 0.11 |
| 2.00 | 0.00 | 0.00 | 0.00 | 22.80 | 0.10 | 0.00 | 0.10 |
| 2.40 | 0.00 | 0.00 | 0.00 | 23.20 | 0.09 | 0.00 | 0.09 |
| 2.80 | 0.00 | 0.00 | 0.00 | 23.60 | 0.09 | 0.00 | 0.09 |
| 3.20 | 0.00 | 0.00 | 0.00 | 24.00 | 0.08 | 0.00 | 0.08 |
| 3.60 | 0.00 | 0.00 | 0.00 | 24.40 | 0.06 | 0.00 | 0.06 |
| 4.00 | 0.00 | 0.00 | 0.00 | 24.80 | 0.06 | 0.00 | 0.06 |
| 4.40 | 0.00 | 0.00 | 0.00 | 25.20 | 0.05 | 0.00 | 0.05 |
| 4.80 | 0.00 | 0.00 | 0.00 | 25.60 | 0.04 | 0.00 | 0.04 |
| 5.20 | 0.00 | 0.00 | 0.00 | 26.00 | 0.04 | 0.00 | 0.04 |
| 5.60 | 0.00 | 0.00 | 0.00 | 26.40 | 0.04 | 0.00 | 0.04 |
| 6.00 | 0.00 | 0.00 | 0.00 | 26.80 | 0.03 | 0.00 | 0.03 |
| 6.40 | 0.00 | 0.00 | 0.00 | 27.20 | 0.03 | 0.00 | 0.03 |
| 6.80 | 0.00 | 0.00 | 0.00 | 27.60 | 0.03 | 0.00 | 0.03 |
| 7.20 | 0.00 | 0.00 | 0.00 | 28.00 | 0.02 | 0.00 | 0.02 |
| 7.60 | 0.00 | 0.00 | 0.00 | 28.40 | 0.02 | 0.00 | 0.02 |
| 8.00 | 0.01 | 0.00 | 0.01 | 28.80 | 0.02 | 0.00 | 0.02 |
| 8.40 | 0.01 | 0.00 | 0.01 | 29.20 | 0.02 | 0.00 | 0.02 |
| 8.80 | 0.02 | 0.00 | 0.02 | 29.60 | 0.02 | 0.00 | 0.02 |
| 9.20 | 0.03 | 0.00 | 0.03 | 30.00 | 0.02 | 0.00 | 0.02 |
| 9.60 | 0.05 | 0.00 | 0.05 | 30.40 | 0.02 | 0.00 | 0.02 |
| 10.00 | 0.07 | 0.00 | 0.07 | 30.80 | 0.01 | 0.00 | 0.01 |
| 10.40 | 0.09 | 0.00 | 0.09 | 31.20 | 0.01 | 0.00 | 0.01 |
| 10.80 | 0.15 | 0.00 | 0.15 | 31.60 | 0.01 | 0.00 | 0.01 |
| 11.20 | 0.27 | 0.00 | 0.27 | 32.00 | 0.01 | 0.00 | 0.01 |
| 11.60 | 0.48 | 0.00 | 0.48 | 32.40 | 0.01 | 0.00 | 0.01 |
| 12.00 | **1.80** | 0.00 | **1.80** | 32.80 | 0.01 | 0.00 | 0.01 |
| 12.40 | **2.97** | 0.00 | **2.97** | 33.20 | 0.01 | 0.00 | 0.01 |
| 12.80 | 2.43 | 0.00 | 2.43 | 33.60 | 0.01 | 0.00 | 0.01 |
| 13.20 | 1.96 | 0.00 | 1.96 | 34.00 | 0.01 | 0.00 | 0.01 |
| 13.60 | 1.47 | 0.00 | 1.47 | 34.40 | 0.01 | 0.00 | 0.01 |
| 14.00 | 1.11 | 0.00 | 1.11 | 34.80 | 0.01 | 0.00 | 0.01 |
| 14.40 | 0.89 | 0.00 | 0.89 | 35.20 | 0.01 | 0.00 | 0.01 |
| 14.80 | 0.75 | 0.00 | 0.75 | 35.60 | 0.01 | 0.00 | 0.01 |
| 15.20 | 0.63 | 0.00 | 0.63 | 36.00 | 0.01 | 0.00 | 0.01 |
| 15.60 | 0.55 | 0.00 | 0.55 | | | | |
| 16.00 | 0.49 | 0.00 | 0.49 | | | | |
| 16.40 | 0.45 | 0.00 | 0.45 | | | | |
| 16.80 | 0.40 | 0.00 | 0.40 | | | | |
| 17.20 | 0.35 | 0.00 | 0.35 | | | | |
| 17.60 | 0.32 | 0.00 | 0.32 | | | | |
| 18.00 | 0.28 | 0.00 | 0.28 | | | | |
| 18.40 | 0.26 | 0.00 | 0.26 | | | | |
| 18.80 | 0.23 | 0.00 | 0.23 | | | | |
| 19.20 | 0.21 | 0.00 | 0.21 | | | | |
| 19.60 | 0.20 | 0.00 | 0.20 | | | | |
| 20.00 | 0.18 | 0.00 | 0.18 | | | | |
| 20.40 | 0.17 | 0.00 | 0.17 | | | | |




Subcat Reach Pond Link

**Routing Diagram for 16923 Proposed**
Prepared by {enter your company name here}, Printed 6/8/2017

## Summary for Subcatchment 3S: Watershed A

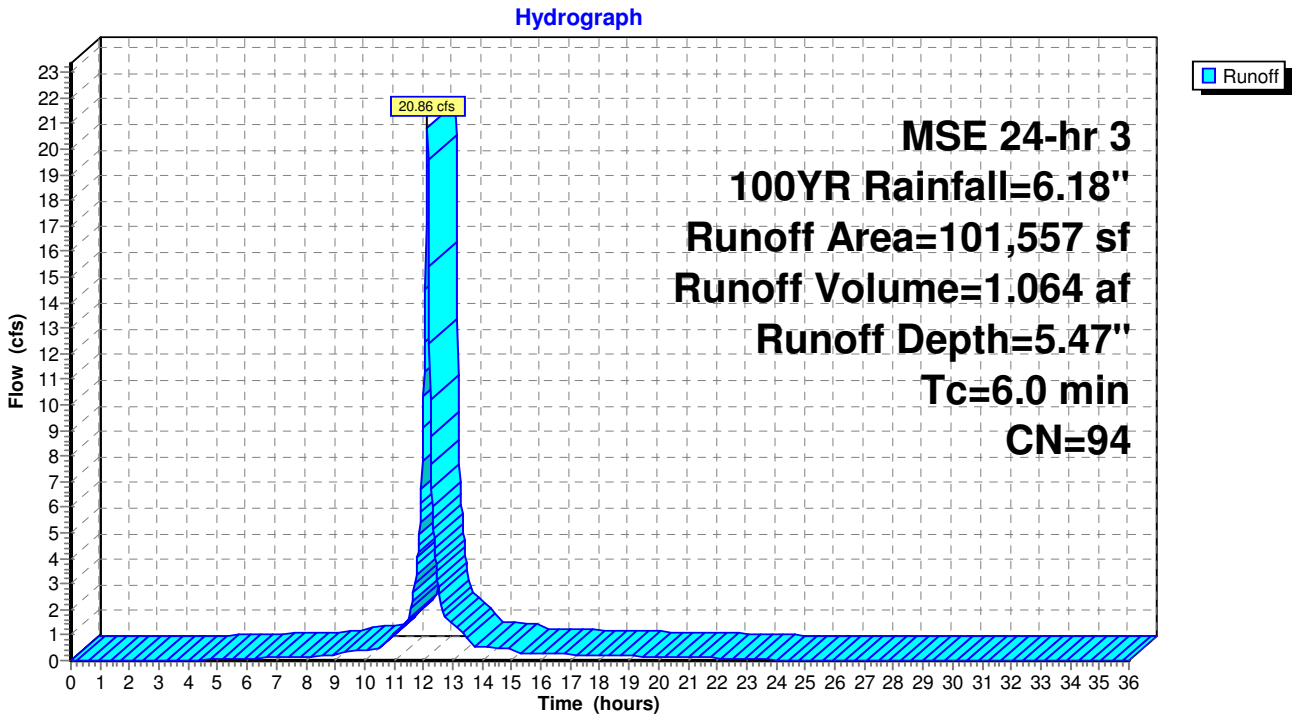
Runoff = 20.86 cfs @ 12.13 hrs, Volume= 1.064 af, Depth= 5.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100YR Rainfall=6.18"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 55,243 | 98 | Paved parking, HSG D |
| * | 20,660 | 80 | Greenspace |
| | 8,454 | 98 | Water Surface, HSG D |
| | 17,200 | 98 | Roofs, HSG D |
| | 101,557 | 94 | Weighted Average |
| | 20,660 | | 20.34% Pervious Area |
| | 80,897 | | 79.66% Impervious Area |

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

## Subcatchment 3S: Watershed A



## Hydrograph for Subcatchment 3S: Watershed A

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.01 | 0.00 | 0.00 |
| 0.80 | 0.02 | 0.00 | 0.00 |
| 1.20 | 0.03 | 0.00 | 0.00 |
| 1.60 | 0.04 | 0.00 | 0.00 |
| 2.00 | 0.06 | 0.00 | 0.00 |
| 2.40 | 0.07 | 0.00 | 0.00 |
| 2.80 | 0.09 | 0.00 | 0.00 |
| 3.20 | 0.11 | 0.00 | 0.00 |
| 3.60 | 0.14 | 0.00 | 0.00 |
| 4.00 | 0.16 | 0.00 | 0.01 |
| 4.40 | 0.19 | 0.01 | 0.02 |
| 4.80 | 0.22 | 0.01 | 0.04 |
| 5.20 | 0.25 | 0.02 | 0.05 |
| 5.60 | 0.28 | 0.03 | 0.07 |
| 6.00 | 0.31 | 0.04 | 0.08 |
| 6.40 | 0.35 | 0.06 | 0.10 |
| 6.80 | 0.39 | 0.08 | 0.11 |
| 7.20 | 0.43 | 0.10 | 0.13 |
| 7.60 | 0.47 | 0.12 | 0.14 |
| 8.00 | 0.52 | 0.15 | 0.16 |
| 8.40 | 0.56 | 0.18 | 0.18 |
| 8.80 | 0.61 | 0.21 | 0.19 |
| 9.20 | 0.68 | 0.25 | 0.33 |
| 9.60 | 0.76 | 0.32 | 0.37 |
| 10.00 | 0.85 | 0.38 | 0.41 |
| 10.40 | 0.94 | 0.46 | 0.44 |
| 10.80 | 1.09 | 0.58 | 0.84 |
| 11.20 | 1.31 | 0.77 | 1.26 |
| 11.60 | 1.65 | 1.07 | 2.13 |
| 12.00 | 2.86 | 2.22 | **10.37** |
| 12.40 | 4.53 | 3.85 | **4.04** |
| 12.80 | 4.87 | 4.18 | 1.63 |
| 13.20 | 5.09 | 4.40 | 1.19 |
| 13.60 | 5.24 | 4.54 | 0.66 |
| 14.00 | 5.33 | 4.63 | 0.53 |
| 14.40 | 5.42 | 4.72 | 0.51 |
| 14.80 | 5.50 | 4.80 | 0.48 |
| 15.20 | 5.57 | 4.87 | 0.29 |
| 15.60 | 5.62 | 4.92 | 0.28 |
| 16.00 | 5.66 | 4.96 | 0.27 |
| 16.40 | 5.71 | 5.01 | 0.26 |
| 16.80 | 5.75 | 5.05 | 0.24 |
| 17.20 | 5.79 | 5.09 | 0.23 |
| 17.60 | 5.83 | 5.13 | 0.22 |
| 18.00 | 5.87 | 5.16 | 0.21 |
| 18.40 | 5.90 | 5.20 | 0.20 |
| 18.80 | 5.93 | 5.23 | 0.19 |
| 19.20 | 5.96 | 5.26 | 0.18 |
| 19.60 | 5.99 | 5.29 | 0.16 |
| 20.00 | 6.02 | 5.32 | 0.15 |
| 20.40 | 6.04 | 5.34 | 0.14 |
| 20.80 | 6.07 | 5.36 | 0.13 |
| 21.20 | 6.09 | 5.38 | 0.12 |
| 21.60 | 6.11 | 5.40 | 0.11 |
| 22.00 | 6.12 | 5.42 | 0.10 |
| 22.40 | 6.14 | 5.43 | 0.08 |
| 22.80 | 6.15 | 5.45 | 0.07 |
| 23.20 | 6.16 | 5.46 | 0.06 |
| 23.60 | 6.17 | 5.47 | 0.05 |
| 24.00 | **6.18** | **5.47** | 0.04 |
| 24.40 | 6.18 | 5.47 | 0.00 |
| 24.80 | 6.18 | 5.47 | 0.00 |
| 25.20 | 6.18 | 5.47 | 0.00 |
| 25.60 | 6.18 | 5.47 | 0.00 |
| 26.00 | 6.18 | 5.47 | 0.00 |
| 26.40 | 6.18 | 5.47 | 0.00 |
| 26.80 | 6.18 | 5.47 | 0.00 |
| 27.20 | 6.18 | 5.47 | 0.00 |
| 27.60 | 6.18 | 5.47 | 0.00 |
| 28.00 | 6.18 | 5.47 | 0.00 |
| 28.40 | 6.18 | 5.47 | 0.00 |
| 28.80 | 6.18 | 5.47 | 0.00 |
| 29.20 | 6.18 | 5.47 | 0.00 |
| 29.60 | 6.18 | 5.47 | 0.00 |
| 30.00 | 6.18 | 5.47 | 0.00 |
| 30.40 | 6.18 | 5.47 | 0.00 |
| 30.80 | 6.18 | 5.47 | 0.00 |
| 31.20 | 6.18 | 5.47 | 0.00 |
| 31.60 | 6.18 | 5.47 | 0.00 |
| 32.00 | 6.18 | 5.47 | 0.00 |
| 32.40 | 6.18 | 5.47 | 0.00 |
| 32.80 | 6.18 | 5.47 | 0.00 |
| 33.20 | 6.18 | 5.47 | 0.00 |
| 33.60 | 6.18 | 5.47 | 0.00 |
| 34.00 | 6.18 | 5.47 | 0.00 |
| 34.40 | 6.18 | 5.47 | 0.00 |
| 34.80 | 6.18 | 5.47 | 0.00 |
| 35.20 | 6.18 | 5.47 | 0.00 |
| 35.60 | 6.18 | 5.47 | 0.00 |
| 36.00 | 6.18 | 5.47 | 0.00 |

## Summary for Subcatchment 4S: Watershed C

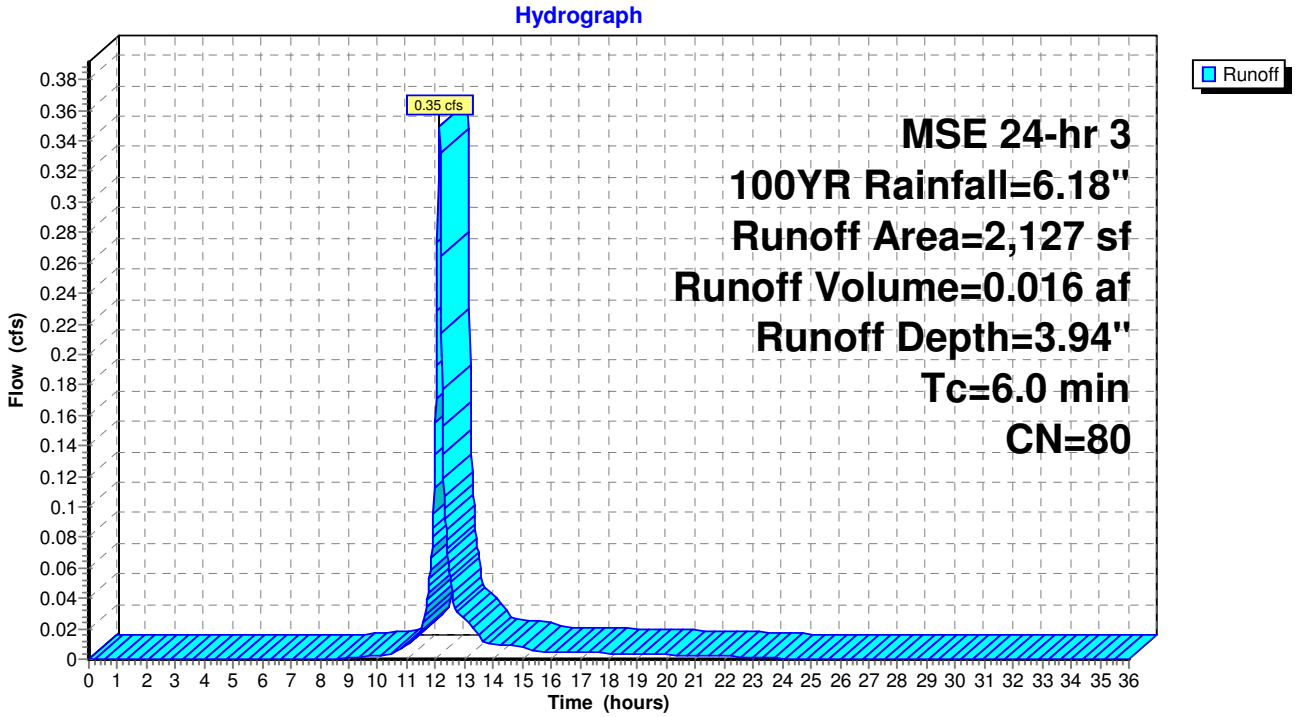
Runoff = 0.35 cfs @ 12.13 hrs, Volume= 0.016 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100YR Rainfall=6.18"

| | Area (sf) | CN | Description |
|---|---|---|---|
| * | 2,127 | 80 | Greenspace |
| | 2,127 | | 100.00% Pervious Area |

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

## Subcatchment 4S: Watershed C



## Hydrograph for Subcatchment 4S: Watershed C

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.01 | 0.00 | 0.00 |
| 0.80 | 0.02 | 0.00 | 0.00 |
| 1.20 | 0.03 | 0.00 | 0.00 |
| 1.60 | 0.04 | 0.00 | 0.00 |
| 2.00 | 0.06 | 0.00 | 0.00 |
| 2.40 | 0.07 | 0.00 | 0.00 |
| 2.80 | 0.09 | 0.00 | 0.00 |
| 3.20 | 0.11 | 0.00 | 0.00 |
| 3.60 | 0.14 | 0.00 | 0.00 |
| 4.00 | 0.16 | 0.00 | 0.00 |
| 4.40 | 0.19 | 0.00 | 0.00 |
| 4.80 | 0.22 | 0.00 | 0.00 |
| 5.20 | 0.25 | 0.00 | 0.00 |
| 5.60 | 0.28 | 0.00 | 0.00 |
| 6.00 | 0.31 | 0.00 | 0.00 |
| 6.40 | 0.35 | 0.00 | 0.00 |
| 6.80 | 0.39 | 0.00 | 0.00 |
| 7.20 | 0.43 | 0.00 | 0.00 |
| 7.60 | 0.47 | 0.00 | 0.00 |
| 8.00 | 0.52 | 0.00 | 0.00 |
| 8.40 | 0.56 | 0.00 | 0.00 |
| 8.80 | 0.61 | 0.00 | 0.00 |
| 9.20 | 0.68 | 0.01 | 0.00 |
| 9.60 | 0.76 | 0.02 | 0.00 |
| 10.00 | 0.85 | 0.04 | 0.00 |
| 10.40 | 0.94 | 0.07 | 0.00 |
| 10.80 | 1.09 | 0.11 | 0.01 |
| 11.20 | 1.31 | 0.20 | 0.01 |
| 11.60 | 1.65 | 0.36 | 0.02 |
| 12.00 | 2.86 | 1.15 | **0.15** |
| 12.40 | 4.53 | 2.49 | **0.07** |
| 12.80 | 4.87 | 2.78 | 0.03 |
| 13.20 | 5.09 | 2.97 | 0.02 |
| 13.60 | 5.24 | 3.10 | 0.01 |
| 14.00 | 5.33 | 3.18 | 0.01 |
| 14.40 | 5.42 | 3.26 | 0.01 |
| 14.80 | 5.50 | 3.34 | 0.01 |
| 15.20 | 5.57 | 3.39 | 0.01 |
| 15.60 | 5.62 | 3.44 | 0.01 |
| 16.00 | 5.66 | 3.48 | 0.01 |
| 16.40 | 5.71 | 3.52 | 0.00 |
| 16.80 | 5.75 | 3.56 | 0.00 |
| 17.20 | 5.79 | 3.59 | 0.00 |
| 17.60 | 5.83 | 3.63 | 0.00 |
| 18.00 | 5.87 | 3.66 | 0.00 |
| 18.40 | 5.90 | 3.69 | 0.00 |
| 18.80 | 5.93 | 3.72 | 0.00 |
| 19.20 | 5.96 | 3.75 | 0.00 |
| 19.60 | 5.99 | 3.77 | 0.00 |
| 20.00 | 6.02 | 3.80 | 0.00 |
| 20.40 | 6.04 | 3.82 | 0.00 |
| 20.80 | 6.07 | 3.84 | 0.00 |
| 21.20 | 6.09 | 3.86 | 0.00 |
| 21.60 | 6.11 | 3.88 | 0.00 |
| 22.00 | 6.12 | 3.89 | 0.00 |
| 22.40 | 6.14 | 3.91 | 0.00 |
| 22.80 | 6.15 | 3.92 | 0.00 |
| 23.20 | 6.16 | 3.93 | 0.00 |
| 23.60 | 6.17 | 3.94 | 0.00 |
| 24.00 | **6.18** | **3.94** | 0.00 |
| 24.40 | 6.18 | 3.94 | 0.00 |
| 24.80 | 6.18 | 3.94 | 0.00 |
| 25.20 | 6.18 | 3.94 | 0.00 |
| 25.60 | 6.18 | 3.94 | 0.00 |
| 26.00 | 6.18 | 3.94 | 0.00 |
| 26.40 | 6.18 | 3.94 | 0.00 |
| 26.80 | 6.18 | 3.94 | 0.00 |
| 27.20 | 6.18 | 3.94 | 0.00 |
| 27.60 | 6.18 | 3.94 | 0.00 |
| 28.00 | 6.18 | 3.94 | 0.00 |
| 28.40 | 6.18 | 3.94 | 0.00 |
| 28.80 | 6.18 | 3.94 | 0.00 |
| 29.20 | 6.18 | 3.94 | 0.00 |
| 29.60 | 6.18 | 3.94 | 0.00 |
| 30.00 | 6.18 | 3.94 | 0.00 |
| 30.40 | 6.18 | 3.94 | 0.00 |
| 30.80 | 6.18 | 3.94 | 0.00 |
| 31.20 | 6.18 | 3.94 | 0.00 |
| 31.60 | 6.18 | 3.94 | 0.00 |
| 32.00 | 6.18 | 3.94 | 0.00 |
| 32.40 | 6.18 | 3.94 | 0.00 |
| 32.80 | 6.18 | 3.94 | 0.00 |
| 33.20 | 6.18 | 3.94 | 0.00 |
| 33.60 | 6.18 | 3.94 | 0.00 |
| 34.00 | 6.18 | 3.94 | 0.00 |
| 34.40 | 6.18 | 3.94 | 0.00 |
| 34.80 | 6.18 | 3.94 | 0.00 |
| 35.20 | 6.18 | 3.94 | 0.00 |
| 35.60 | 6.18 | 3.94 | 0.00 |
| 36.00 | 6.18 | 3.94 | 0.00 |

## Summary for Subcatchment 5S: Watershed B

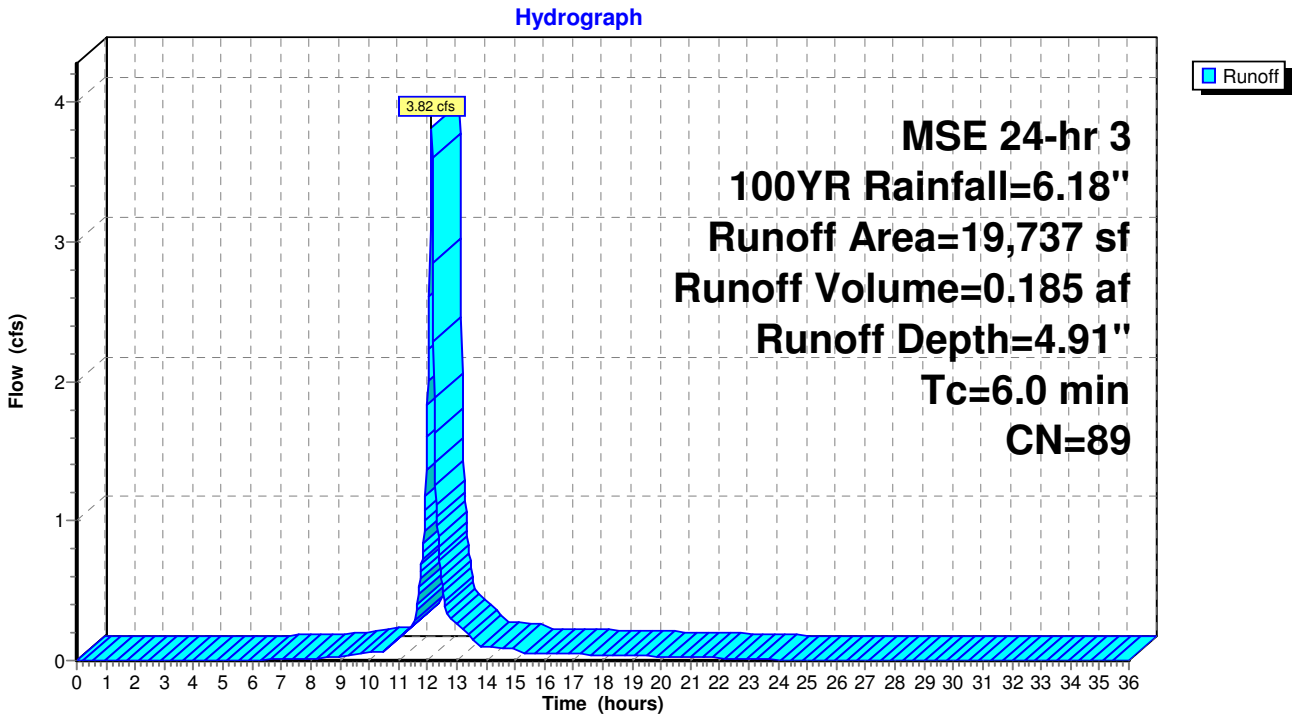
Runoff = 3.82 cfs @ 12.13 hrs, Volume= 0.185 af, Depth= 4.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
MSE 24-hr 3 100YR Rainfall=6.18"

| | Area (sf) | CN | Description |
|---|---|---|---|
| | 5,439 | 98 | Paved parking, HSG D |
| * | 9,710 | 80 | Greenspace |
| | 4,250 | 98 | Paved parking, HSG D |
| * | 338 | 80 | Greenspace |
| | 19,737 | 89 | Weighted Average |
| | 10,048 | | 50.91% Pervious Area |
| | 9,689 | | 49.09% Impervious Area |

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

## Subcatchment 5S: Watershed B



## Hydrograph for Subcatchment 5S: Watershed B

| Time (hours) | Precip. (inches) | Excess (inches) | Runoff (cfs) |
|---|---|---|---|
| 0.00 | 0.00 | 0.00 | 0.00 |
| 0.40 | 0.01 | 0.00 | 0.00 |
| 0.80 | 0.02 | 0.00 | 0.00 |
| 1.20 | 0.03 | 0.00 | 0.00 |
| 1.60 | 0.04 | 0.00 | 0.00 |
| 2.00 | 0.06 | 0.00 | 0.00 |
| 2.40 | 0.07 | 0.00 | 0.00 |
| 2.80 | 0.09 | 0.00 | 0.00 |
| 3.20 | 0.11 | 0.00 | 0.00 |
| 3.60 | 0.14 | 0.00 | 0.00 |
| 4.00 | 0.16 | 0.00 | 0.00 |
| 4.40 | 0.19 | 0.00 | 0.00 |
| 4.80 | 0.22 | 0.00 | 0.00 |
| 5.20 | 0.25 | 0.00 | 0.00 |
| 5.60 | 0.28 | 0.00 | 0.00 |
| 6.00 | 0.31 | 0.00 | 0.00 |
| 6.40 | 0.35 | 0.01 | 0.01 |
| 6.80 | 0.39 | 0.01 | 0.01 |
| 7.20 | 0.43 | 0.02 | 0.01 |
| 7.60 | 0.47 | 0.03 | 0.01 |
| 8.00 | 0.52 | 0.05 | 0.02 |
| 8.40 | 0.56 | 0.06 | 0.02 |
| 8.80 | 0.61 | 0.08 | 0.02 |
| 9.20 | 0.68 | 0.11 | 0.04 |
| 9.60 | 0.76 | 0.15 | 0.05 |
| 10.00 | 0.85 | 0.20 | 0.06 |
| 10.40 | 0.94 | 0.25 | 0.06 |
| 10.80 | 1.09 | 0.34 | 0.12 |
| 11.20 | 1.31 | 0.49 | 0.20 |
| 11.60 | 1.65 | 0.74 | 0.35 |
| 12.00 | 2.86 | 1.77 | **1.84** |
| 12.40 | 4.53 | 3.33 | **0.76** |
| 12.80 | 4.87 | 3.64 | 0.31 |
| 13.20 | 5.09 | 3.86 | 0.23 |
| 13.60 | 5.24 | 4.00 | 0.12 |
| 14.00 | 5.33 | 4.09 | 0.10 |
| 14.40 | 5.42 | 4.17 | 0.10 |
| 14.80 | 5.50 | 4.26 | 0.09 |
| 15.20 | 5.57 | 4.32 | 0.06 |
| 15.60 | 5.62 | 4.36 | 0.05 |
| 16.00 | 5.66 | 4.41 | 0.05 |
| 16.40 | 5.71 | 4.45 | 0.05 |
| 16.80 | 5.75 | 4.49 | 0.05 |
| 17.20 | 5.79 | 4.53 | 0.04 |
| 17.60 | 5.83 | 4.57 | 0.04 |
| 18.00 | 5.87 | 4.60 | 0.04 |
| 18.40 | 5.90 | 4.64 | 0.04 |
| 18.80 | 5.93 | 4.67 | 0.04 |
| 19.20 | 5.96 | 4.70 | 0.03 |
| 19.60 | 5.99 | 4.73 | 0.03 |
| 20.00 | 6.02 | 4.75 | 0.03 |
| 20.40 | 6.04 | 4.78 | 0.03 |
| 20.80 | 6.07 | 4.80 | 0.02 |
| 21.20 | 6.09 | 4.82 | 0.02 |
| 21.60 | 6.11 | 4.84 | 0.02 |
| 22.00 | 6.12 | 4.86 | 0.02 |
| 22.40 | 6.14 | 4.87 | 0.02 |
| 22.80 | 6.15 | 4.88 | 0.01 |
| 23.20 | 6.16 | 4.89 | 0.01 |
| 23.60 | 6.17 | 4.90 | 0.01 |
| 24.00 | **6.18** | **4.91** | 0.01 |
| 24.40 | 6.18 | 4.91 | 0.00 |
| 24.80 | 6.18 | 4.91 | 0.00 |
| 25.20 | 6.18 | 4.91 | 0.00 |
| 25.60 | 6.18 | 4.91 | 0.00 |
| 26.00 | 6.18 | 4.91 | 0.00 |
| 26.40 | 6.18 | 4.91 | 0.00 |
| 26.80 | 6.18 | 4.91 | 0.00 |
| 27.20 | 6.18 | 4.91 | 0.00 |
| 27.60 | 6.18 | 4.91 | 0.00 |
| 28.00 | 6.18 | 4.91 | 0.00 |
| 28.40 | 6.18 | 4.91 | 0.00 |
| 28.80 | 6.18 | 4.91 | 0.00 |
| 29.20 | 6.18 | 4.91 | 0.00 |
| 29.60 | 6.18 | 4.91 | 0.00 |
| 30.00 | 6.18 | 4.91 | 0.00 |
| 30.40 | 6.18 | 4.91 | 0.00 |
| 30.80 | 6.18 | 4.91 | 0.00 |
| 31.20 | 6.18 | 4.91 | 0.00 |
| 31.60 | 6.18 | 4.91 | 0.00 |
| 32.00 | 6.18 | 4.91 | 0.00 |
| 32.40 | 6.18 | 4.91 | 0.00 |
| 32.80 | 6.18 | 4.91 | 0.00 |
| 33.20 | 6.18 | 4.91 | 0.00 |
| 33.60 | 6.18 | 4.91 | 0.00 |
| 34.00 | 6.18 | 4.91 | 0.00 |
| 34.40 | 6.18 | 4.91 | 0.00 |
| 34.80 | 6.18 | 4.91 | 0.00 |
| 35.20 | 6.18 | 4.91 | 0.00 |
| 35.60 | 6.18 | 4.91 | 0.00 |
| 36.00 | 6.18 | 4.91 | 0.00 |

## Summary for Pond 1P: Wet Detention

Inflow Area = 2.331 ac, 79.66% Impervious, Inflow Depth = 5.47" for 100YR event
Inflow = 20.86 cfs @ 12.13 hrs, Volume= 1.064 af
Outflow = 5.54 cfs @ 12.32 hrs, Volume= 1.054 af, Atten= 73%, Lag= 11.5 min
Primary = 5.49 cfs @ 12.32 hrs, Volume= 1.054 af
Secondary = 0.05 cfs @ 12.32 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs
Peak Elev= 851.51' @ 12.32 hrs Surf.Area= 13,888 sf Storage= 21,043 cf

Plug-Flow detention time= 114.6 min calculated for 1.054 af (99% of inflow)
Center-of-Mass det. time= 109.0 min ( 869.6 - 760.6 )

| Volume | Invert | Avail.Storage | Storage Description |
|---|---|---|---|
| #1 | 849.50' | 28,439 cf | **Pond (Prismatic)** Listed below (Recalc) |

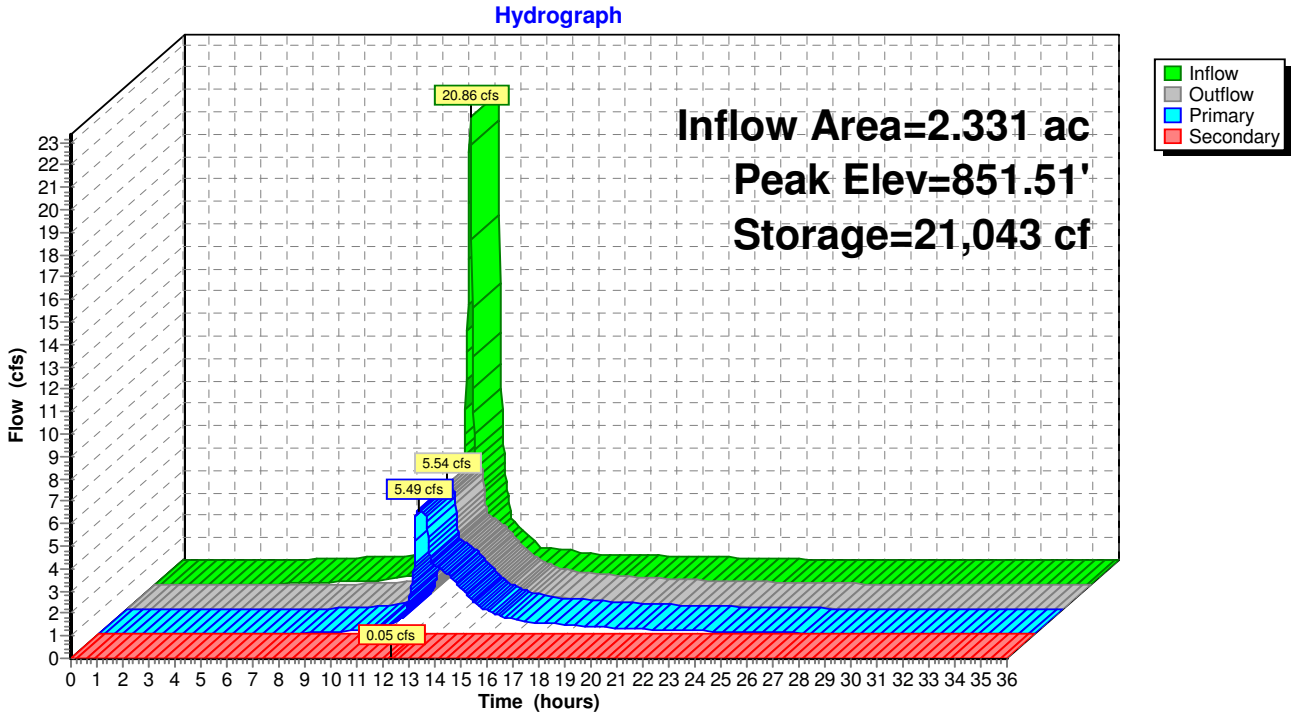
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) |
|---|---|---|---|
| 849.50 | 8,454 | 0 | 0 |
| 850.00 | 9,153 | 4,402 | 4,402 |
| 851.00 | 11,264 | 10,209 | 14,610 |
| 852.00 | 16,393 | 13,829 | 28,439 |

| Device | Routing | Invert | Outlet Devices |
|---|---|---|---|
| #1 | Primary | 849.50' | **15.0" Round Culvert**<br>L= 26.5' CMP, projecting, no headwall, Ke= 0.900<br>Inlet / Outlet Invert= 849.50' / 845.39' S= 0.1551 '/' Cc= 0.900<br>n= 0.013, Flow Area= 1.23 sf |
| #2 | Device 1 | 849.50' | **6.0" Vert. Orifice/Grate** C= 0.600 |
| #3 | Device 1 | 850.00' | **9.0" Vert. Orifice/Grate** C= 0.600 |
| #4 | Device 1 | 851.25' | **60.0" Horiz. Orifice/Grate** C= 0.600<br>Limited to weir flow at low heads |
| #5 | Secondary | 851.50' | **10.0' long x 10.0' breadth Broad-Crested Rectangular Weir**<br>Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60<br>Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64 |

**Primary OutFlow** Max=5.49 cfs @ 12.32 hrs HW=851.51' (Free Discharge)
└**1=Culvert** (Inlet Controls 5.49 cfs @ 4.48 fps)
  ├**2=Orifice/Grate** (Passes < 1.25 cfs potential flow)
  ├**3=Orifice/Grate** (Passes < 2.27 cfs potential flow)
  └**4=Orifice/Grate** (Passes < 6.87 cfs potential flow)

**Secondary OutFlow** Max=0.03 cfs @ 12.32 hrs HW=851.51' (Free Discharge)
└**5=Broad-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.27 fps)

## Pond 1P: Wet Detention



## Hydrograph for Pond 1P: Wet Detention

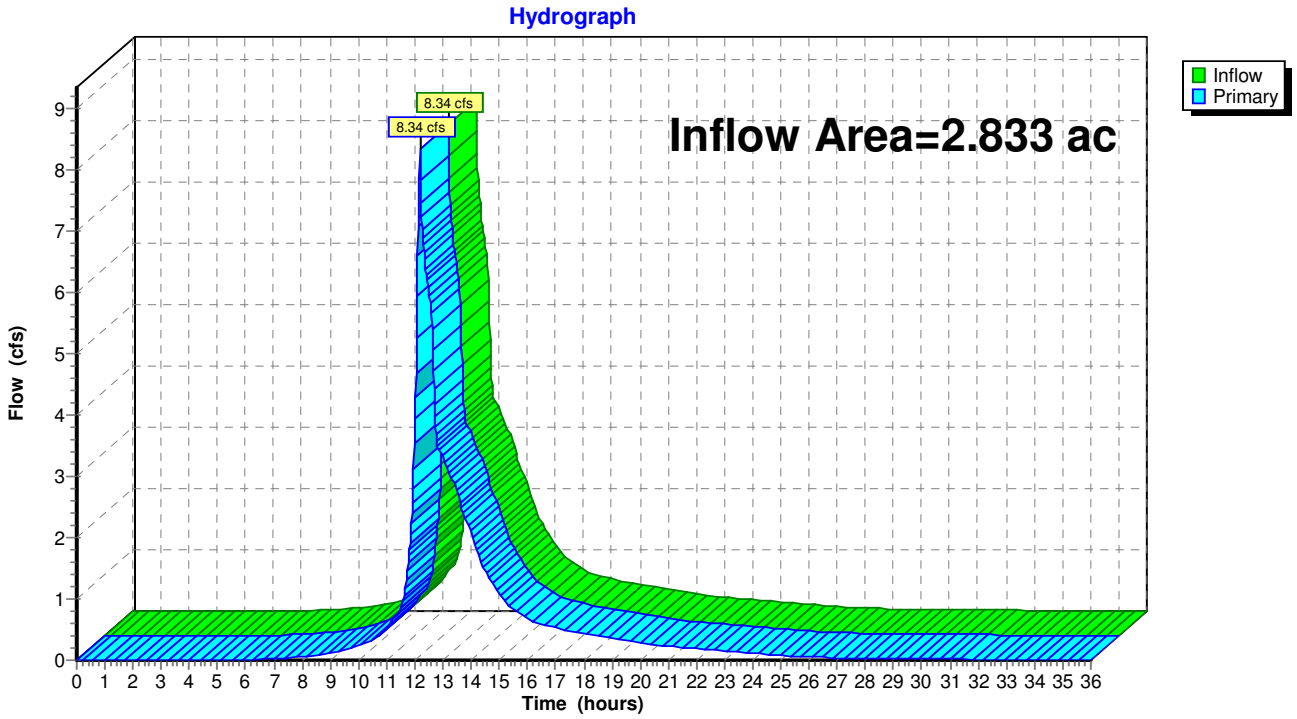
| Time (hours) | Inflow (cfs) | Storage (cubic-feet) | Elevation (feet) | Outflow (cfs) | Primary (cfs) | Secondary (cfs) |
|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 1.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 2.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 3.00 | 0.00 | 0 | 849.50 | 0.00 | 0.00 | 0.00 |
| 4.00 | 0.01 | 10 | 849.50 | 0.00 | 0.00 | 0.00 |
| 5.00 | 0.04 | 107 | 849.51 | 0.00 | 0.00 | 0.00 |
| 6.00 | 0.08 | 322 | 849.54 | 0.00 | 0.00 | 0.00 |
| 7.00 | 0.12 | 645 | 849.58 | 0.02 | 0.02 | 0.00 |
| 8.00 | 0.16 | 1,041 | 849.62 | 0.04 | 0.04 | 0.00 |
| 9.00 | 0.20 | 1,463 | 849.67 | 0.08 | 0.08 | 0.00 |
| 10.00 | 0.41 | 2,260 | 849.76 | 0.18 | 0.18 | 0.00 |
| 11.00 | 1.05 | 3,519 | 849.90 | 0.37 | 0.37 | 0.00 |
| 12.00 | **10.37** | **10,552** | **850.63** | **1.95** | **1.95** | **0.00** |
| 13.00 | **1.41** | **16,476** | **851.16** | **3.01** | **3.01** | **0.00** |
| 14.00 | 0.53 | 10,517 | 850.62 | 1.94 | 1.94 | 0.00 |
| 15.00 | 0.47 | 7,276 | 850.30 | 1.02 | 1.02 | 0.00 |
| 16.00 | 0.27 | 5,496 | 850.12 | 0.63 | 0.63 | 0.00 |
| 17.00 | 0.24 | 4,455 | 850.01 | 0.48 | 0.48 | 0.00 |
| 18.00 | 0.21 | 3,692 | 849.92 | 0.39 | 0.39 | 0.00 |
| 19.00 | 0.18 | 3,141 | 849.86 | 0.31 | 0.31 | 0.00 |
| 20.00 | 0.15 | 2,740 | 849.82 | 0.25 | 0.25 | 0.00 |
| 21.00 | 0.12 | 2,425 | 849.78 | 0.20 | 0.20 | 0.00 |
| 22.00 | 0.10 | 2,157 | 849.75 | 0.17 | 0.17 | 0.00 |
| 23.00 | 0.07 | 1,910 | 849.72 | 0.14 | 0.14 | 0.00 |
| 24.00 | 0.04 | 1,671 | 849.69 | 0.11 | 0.11 | 0.00 |
| 25.00 | 0.00 | 1,363 | 849.66 | 0.07 | 0.07 | 0.00 |
| 26.00 | 0.00 | 1,140 | 849.63 | 0.05 | 0.05 | 0.00 |
| 27.00 | 0.00 | 976 | 849.61 | 0.04 | 0.04 | 0.00 |
| 28.00 | 0.00 | 852 | 849.60 | 0.03 | 0.03 | 0.00 |
| 29.00 | 0.00 | 755 | 849.59 | 0.02 | 0.02 | 0.00 |
| 30.00 | 0.00 | 676 | 849.58 | 0.02 | 0.02 | 0.00 |
| 31.00 | 0.00 | 613 | 849.57 | 0.02 | 0.02 | 0.00 |
| 32.00 | 0.00 | 559 | 849.57 | 0.01 | 0.01 | 0.00 |
| 33.00 | 0.00 | 513 | 849.56 | 0.01 | 0.01 | 0.00 |
| 34.00 | 0.00 | 474 | 849.56 | 0.01 | 0.01 | 0.00 |
| 35.00 | 0.00 | 441 | 849.55 | 0.01 | 0.01 | 0.00 |
| 36.00 | 0.00 | 413 | 849.55 | 0.01 | 0.01 | 0.00 |

## Summary for Link 2L: Total

Inflow Area = 2.833 ac, 73.40% Impervious, Inflow Depth > 5.32" for 100YR event
Inflow = 8.34 cfs @ 12.18 hrs, Volume= 1.256 af
Primary = 8.34 cfs @ 12.18 hrs, Volume= 1.256 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.02 hrs

## Link 2L: Total



## Hydrograph for Link 2L: Total

| Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) | Time (hours) | Inflow (cfs) | Elevation (feet) | Primary (cfs) |
|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | **0.00** | 0.00 | 20.80 | 0.24 | 0.00 | 0.24 |
| 0.40 | 0.00 | 0.00 | 0.00 | 21.20 | 0.22 | 0.00 | 0.22 |
| 0.80 | 0.00 | 0.00 | 0.00 | 21.60 | 0.20 | 0.00 | 0.20 |
| 1.20 | 0.00 | 0.00 | 0.00 | 22.00 | 0.19 | 0.00 | 0.19 |
| 1.60 | 0.00 | 0.00 | 0.00 | 22.40 | 0.17 | 0.00 | 0.17 |
| 2.00 | 0.00 | 0.00 | 0.00 | 22.80 | 0.16 | 0.00 | 0.16 |
| 2.40 | 0.00 | 0.00 | 0.00 | 23.20 | 0.14 | 0.00 | 0.14 |
| 2.80 | 0.00 | 0.00 | 0.00 | 23.60 | 0.13 | 0.00 | 0.13 |
| 3.20 | 0.00 | 0.00 | 0.00 | 24.00 | 0.11 | 0.00 | 0.11 |
| 3.60 | 0.00 | 0.00 | 0.00 | 24.40 | 0.09 | 0.00 | 0.09 |
| 4.00 | 0.00 | 0.00 | 0.00 | 24.80 | 0.08 | 0.00 | 0.08 |
| 4.40 | 0.00 | 0.00 | 0.00 | 25.20 | 0.07 | 0.00 | 0.07 |
| 4.80 | 0.00 | 0.00 | 0.00 | 25.60 | 0.06 | 0.00 | 0.06 |
| 5.20 | 0.00 | 0.00 | 0.00 | 26.00 | 0.05 | 0.00 | 0.05 |
| 5.60 | 0.00 | 0.00 | 0.00 | 26.40 | 0.05 | 0.00 | 0.05 |
| 6.00 | 0.01 | 0.00 | 0.01 | 26.80 | 0.04 | 0.00 | 0.04 |
| 6.40 | 0.01 | 0.00 | 0.01 | 27.20 | 0.04 | 0.00 | 0.04 |
| 6.80 | 0.02 | 0.00 | 0.02 | 27.60 | 0.03 | 0.00 | 0.03 |
| 7.20 | 0.03 | 0.00 | 0.03 | 28.00 | 0.03 | 0.00 | 0.03 |
| 7.60 | 0.05 | 0.00 | 0.05 | 28.40 | 0.03 | 0.00 | 0.03 |
| 8.00 | 0.06 | 0.00 | 0.06 | 28.80 | 0.03 | 0.00 | 0.03 |
| 8.40 | 0.08 | 0.00 | 0.08 | 29.20 | 0.02 | 0.00 | 0.02 |
| 8.80 | 0.10 | 0.00 | 0.10 | 29.60 | 0.02 | 0.00 | 0.02 |
| 9.20 | 0.14 | 0.00 | 0.14 | 30.00 | 0.02 | 0.00 | 0.02 |
| 9.60 | 0.19 | 0.00 | 0.19 | 30.40 | 0.02 | 0.00 | 0.02 |
| 10.00 | 0.24 | 0.00 | 0.24 | 30.80 | 0.02 | 0.00 | 0.02 |
| 10.40 | 0.29 | 0.00 | 0.29 | 31.20 | 0.02 | 0.00 | 0.02 |
| 10.80 | 0.43 | 0.00 | 0.43 | 31.60 | 0.01 | 0.00 | 0.01 |
| 11.20 | 0.65 | 0.00 | 0.65 | 32.00 | 0.01 | 0.00 | 0.01 |
| 11.60 | 1.00 | 0.00 | 1.00 | 32.40 | 0.01 | 0.00 | 0.01 |
| 12.00 | **3.94** | 0.00 | **3.94** | 32.80 | 0.01 | 0.00 | 0.01 |
| 12.40 | **6.29** | 0.00 | **6.29** | 33.20 | 0.01 | 0.00 | 0.01 |
| 12.80 | 3.49 | 0.00 | 3.49 | 33.60 | 0.01 | 0.00 | 0.01 |
| 13.20 | 3.09 | 0.00 | 3.09 | 34.00 | 0.01 | 0.00 | 0.01 |
| 13.60 | 2.58 | 0.00 | 2.58 | 34.40 | 0.01 | 0.00 | 0.01 |
| 14.00 | 2.05 | 0.00 | 2.05 | 34.80 | 0.01 | 0.00 | 0.01 |
| 14.40 | 1.56 | 0.00 | 1.56 | 35.20 | 0.01 | 0.00 | 0.01 |
| 14.80 | 1.23 | 0.00 | 1.23 | 35.60 | 0.01 | 0.00 | 0.01 |
| 15.20 | 0.97 | 0.00 | 0.97 | 36.00 | 0.01 | 0.00 | 0.01 |
| 15.60 | 0.80 | 0.00 | 0.80 | | | | |
| 16.00 | 0.68 | 0.00 | 0.68 | | | | |
| 16.40 | 0.60 | 0.00 | 0.60 | | | | |
| 16.80 | 0.55 | 0.00 | 0.55 | | | | |
| 17.20 | 0.51 | 0.00 | 0.51 | | | | |
| 17.60 | 0.47 | 0.00 | 0.47 | | | | |
| 18.00 | 0.43 | 0.00 | 0.43 | | | | |
| 18.40 | 0.40 | 0.00 | 0.40 | | | | |
| 18.80 | 0.36 | 0.00 | 0.36 | | | | |
| 19.20 | 0.33 | 0.00 | 0.33 | | | | |
| 19.60 | 0.31 | 0.00 | 0.31 | | | | |
| 20.00 | 0.28 | 0.00 | 0.28 | | | | |
| 20.40 | 0.26 | 0.00 | 0.26 | | | | |

# Appendix C

# Storm Water Quality (WinSLAMM) Modeling

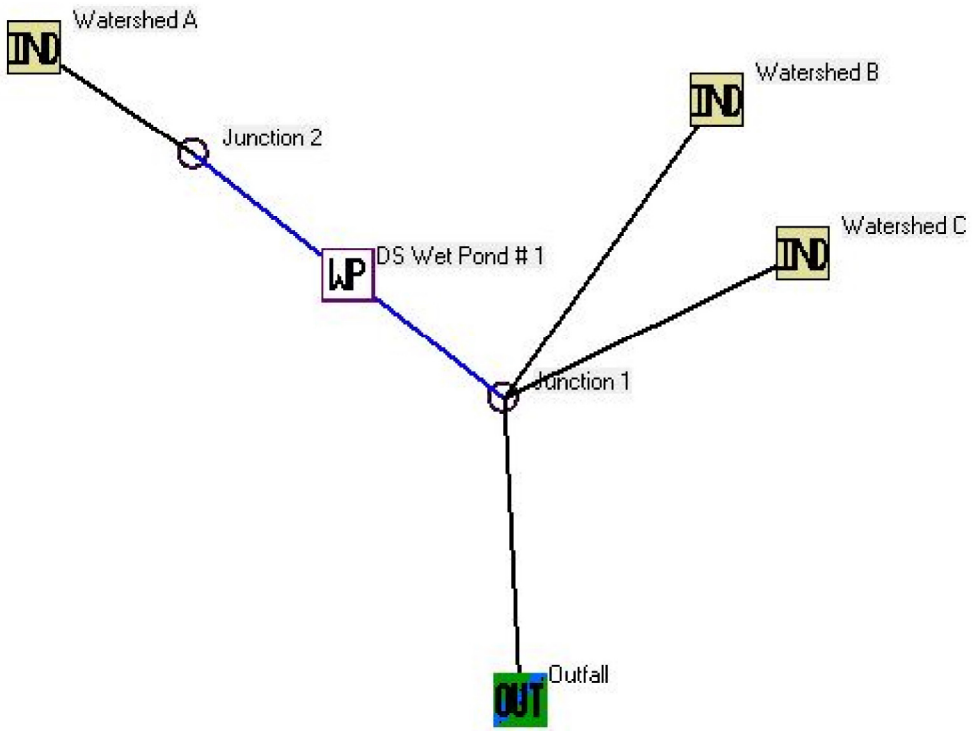
WinSLAMM v 10 Data File: [I:\Korb\16923 Pearl Street Civil\060 CAD\C - Civil\100 Modeling\Storm Sewer\030 SLAMM\16923 Slamm.mdb] - [Land Use Model]

File Current File Data Pollutants Tools Run Utilities Help

RES INS COM IND OU FRE GS CB WP BF PP HD OD FS

**Element Name:**

| Land Use # | Land Use Type | Land Use Label | Land Use Area (acres) |
|---|---|---|---|
| 1 | Industrial | Watershed A | 2.333 |
| 2 | Industrial | Watershed B | 0.453 |
| 3 | Industrial | Watershed C | 0.049 |




Current File Data Entered | Total Area = 2.835 acres | Upstream Drainage Area = 0.000 acres | Icon Number | Index Number = | Icons Left = | Start Date: 01/05/69 | End Date: 12/31/69

Data file name:  I:\Korb\16923 Pearl Street Civil\060 CAD\C - Civil\100 Modeling\Storm Sewer\030 SLAMM\16923 Slamm.mdb
WinSLAMM Version 10.2.0
Rain file name:  N:\000-CAD Resource Library\Software Support Files\WinSLAMM\Vers 10.0.2 Downloaded November 11, 2013\Parameter Files v10\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name:  C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name:  C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name:  C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name:  C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name:  C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name:  C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name:  C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name:  C:\WinSLAMM Files\Freeway Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance:  False
Pollutant Relative Concentration file name:  C:\WinSLAMM Files\WI_GEO03.ppdx
Source Area PSD and Peak to Average Flow Ratio File:  C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
Seed for random number generator:  -42
Study period starting date:  01/05/69  Study period ending date:  12/31/69
Start of Winter Season:  12/06  End of Winter Season:  03/28
Date:  06-08-2017  Time:  14:54:27
Site information:

LU# 1 - Industrial:  Watershed A  Total area (ac):  2.333
  1 - Roofs 1:  0.395 ac.  Pitched  Connected  Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  13 - Paved Parking 1:  1.270 ac.  Connected  Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  51 - Small Landscaped Areas 1:  0.474 ac.  Normal Clayey  Low Density  Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  70 - Water Body Areas:  0.194 ac.  Source Area PSD File:

LU# 2 - Industrial:  Watershed B  Total area (ac):  0.453
  13 - Paved Parking 1:  0.222 ac.  Connected  Source Area PSD File: C:\WinSLAMM Files\NURP.cpz
  51 - Small Landscaped Areas 1:  0.231 ac.  Normal Clayey  Low Density  Source Area PSD File: C:\WinSLAMM Files\NURP.cpz

LU# 3 - Industrial:  Watershed C     Total area (ac):  0.049
     51 - Small Landscaped Areas 1:  0.049 ac.    Normal Clayey    Low Density    Source Area PSD File:
C:\WinSLAMM Files\NURP.cpz

Control Practice 1:  Wet Detention Pond CP# 1 (DS) - DS Wet Pond # 1
Particle Size Distribution file name:  Not needed - calculated by program
Initial stage elevation (ft):   5
Peak to Average Flow Ratio:   3.8
Maximum flow allowed into pond (cfs):  No maximum value entered
Outlet Characteristics:
Outlet type:  Orifice 1
1.  Orifice diameter (ft):   0.5
2.  Number of orifices:   1
3.  Invert elevation above datum (ft):   5
Outlet type:  Orifice 2
1.  Orifice diameter (ft):   0.75
2.  Number of orifices:   1
3.  Invert elevation above datum (ft):   5.5
Outlet type:  Broad Crested Weir
1.  Weir crest length (ft):   10
2.  Weir crest width (ft):   10
3.  Height from datum to bottom of weir opening:   7
Outlet type:  Vertical Stand Pipe
1.  Stand pipe diameter (ft):   5
2.  Stand pipe height above datum (ft):   6.75
Pond stage and surface area

| Entry Number | Stage (ft) | Pond Area (acres) | Natural Seepage (in/hr) | Other Outflow (cfs) |
|---|---|---|---|---|
| 0 | 0.00 | 0.0000 | 0.00 | 0.00 |
| 1 | 0.01 | 0.0330 | 0.00 | 0.00 |
| 2 | 1.00 | 0.0470 | 0.00 | 0.00 |
| 3 | 2.00 | 0.0640 | 0.00 | 0.00 |

| | | | | |
|---|---|---|---|---|
| 4 | 3.00 | 0.0840 | 0.00 | 0.00 |
| 5 | 4.00 | 0.1050 | 0.00 | 0.00 |
| 6 | 5.00 | 0.1940 | 0.00 | 0.00 |
| 7 | 5.50 | 0.2100 | 0.00 | 0.00 |
| 8 | 6.50 | 0.2690 | 0.00 | 0.00 |
| 9 | 7.50 | 0.3760 | 0.00 | 0.00 |

# 16923 Slamm - Output Summary

SLAMM for Windows Version 10.2.0


Data file name: I:\Korb\16923 Pearl Street Civil\060 CAD\C - Civil\100 Modeling\Storm Sewer\030 SLAMM\16923 Slamm.mdb
Data file description:
Rain file name: N:\000-CAD Resource Library\Software Support Files\WinSLAMM\Vers 10.0.2 Downloaded November 11, 2013\Parameter Files v10\WisReg - Milwaukee WI 1969.RAN
Particulate Solids Concentration file name: C:\WinSLAMM Files\v10.1 WI_AVG01.pscx
Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Com Inst Indust Dec06.std
Other Urban Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Freeway Street Delivery file name: C:\WinSLAMM Files\Freeway Dec06.std
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Start of Winter Season: 12/06 End of Winter Season: 03/28
Model Run Start Date: 01/05/69 Model Run End Date: 12/31/69
Date of run: 06-08-2017 Time of run: 14:54:40
Total Area Modeled (acres): 2.835
Years in Model Run: 0.99

| | Runoff Volume (cu ft) | Percent Runoff Volume Reduction | Particulate Solids Conc. (mg/L) | Particulate Solids Yield (lbs) | Percent Particulate Solids Reduction |
|---|---|---|---|---|---|
| Total of all Land Uses without Controls: | 179001 | - | 173.7 | 1941 | - |
| Outfall Total with Controls: | 178716 | 0.16% | 56.38 | 629.1 | 67.59% |
| Annualized Total After Outfall Controls: | 181198 | | | 637.8 | |

# Appendix D

## Storm Water Management System Maintenance Requirements

**Beaudry Services, Inc. Development**
**1522 Pearl Street**
**Waukesha, Wisconsin**
**Operation, Maintenance, and Inspection Schedule and Practices**
**for Storm Water Management Facilities**

This document summarizes the minimum operation, maintenance inspection requirements for the storm water management facilities associated with the Beaudry Services, Inc. development to remain compliant with conditions of development approval, storm water management plan approval, and municipal ordinance and policies. The maintenance activities listed below are aimed to ensure that the storm water management system continues to serve its intended functions in perpetuity. The list of activities is not all inclusive, but outlines minimum operation, maintenance and inspection requirements for the development storm water management system.

## Wet Detention Basin

### Inspection

Inspect the basin on a semi-annual basis (April and October) by Beaudry Services, Inc:

1. Inspect basin for erosion damage.
2. Inspect for litter
3. Inspect the basin inlets, outlet and outlet control structure for blockage and structural integrity on an annual basis.
4. Inspect for sediment build up within the outlet control structures, outlet pipes and wet detention basin.

### Maintenance

To ensure the proper function of the wet detention basin described above, the following activities must be completed on a semi-annual basis (April and October) by Beaudry Services, Inc.:

1. The basin outlet orifices and emergency spillway must be checked to ensure no blockage from debris. Any blockage must be removed immediately.
2. No trees are to be planted or allowed to grow on the earth berms. Tree root systems can reduce soil compaction and cause berm failure. The berms must be inspected annually and any woody vegetation removed.
3. When sediment in the basin has accumulated to a point where the volume of the basin is reduced, it must be removed. The volume has been reduced when the depth of the permanent pool is less than 3 feet. All removed sediment must be placed in an appropriate upland disposal site and stabilized (grass cover) to prevent the sediment from washing backing into the basin.
4. No grading or filling of the basin or berms other than for sediment removal is allowed, unless otherwise approved by the City of Waukesha.
5. Any other repair or maintenance needed to ensure the continued function of the wet detention basin.

## General Site

Inspection and Maintenance shall be provided by Beaudry Services, Inc.

### Inspection

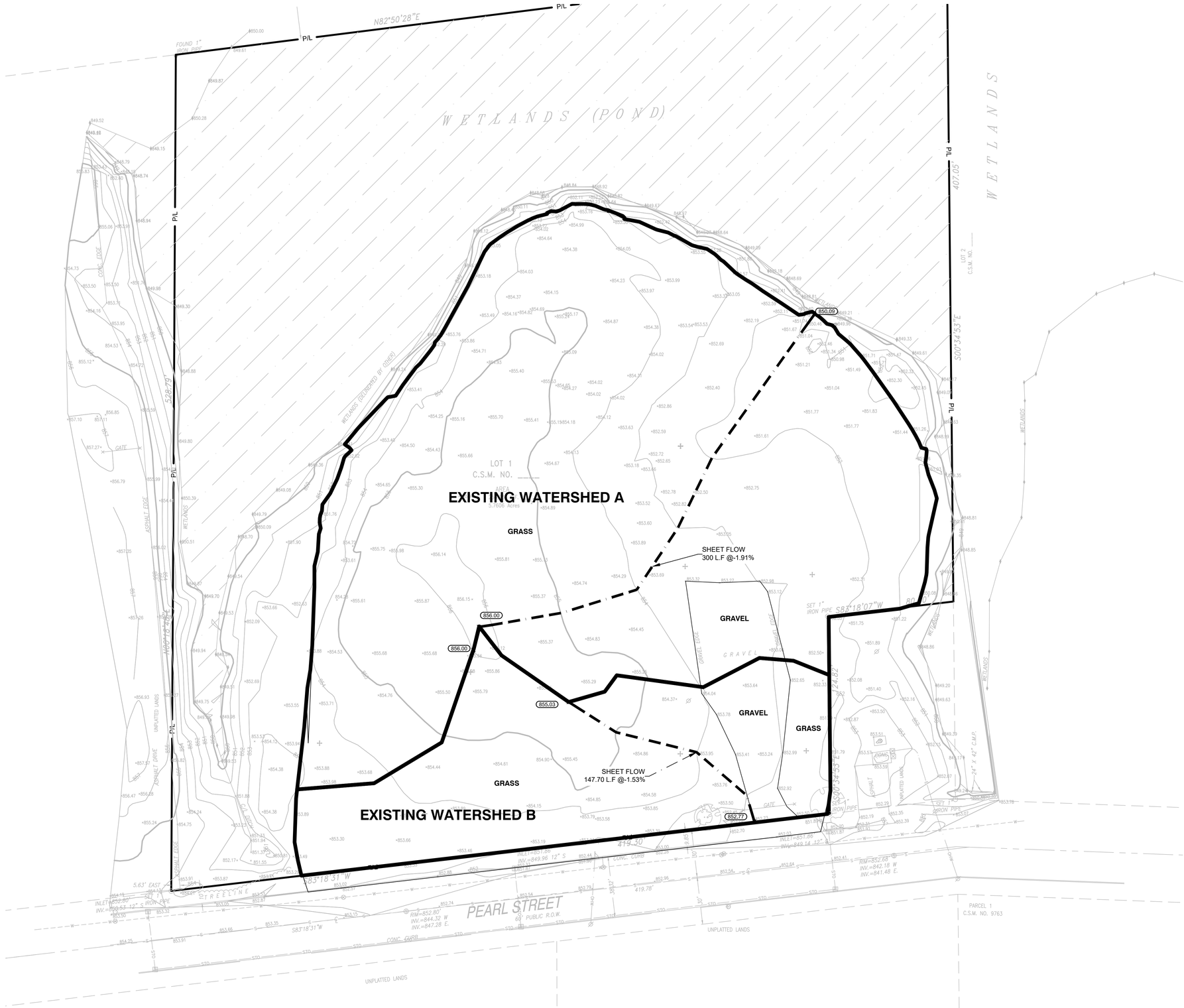
1. Inspect site weekly for litter/debris

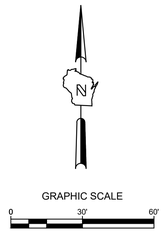
Maintenance

1. Pick up litter debris as needed
2. Power sweep/vacuum parking lot on a semi-annual basis

**Figure: SWM 1.0**

**Storm Water Management Plan – Pre-Development Conditions Plan**




| EXISTING WATERSHED A | | | |
|---|---|---|---|
| Tc = 23.4 min | SF | ACRE | CN |
| GRASS | 90409 | 2.076 | 80 |
| GRAVEL | 2929 | 0.067 | 89 |
| TOTAL | 93338 | 2.143 | 80 |
| Q (2yr, 10yr, 100yr) | 2.22 CFS | 4.15 CFS | 8.67 CFS |

| EXISTING WATERSHED B | | | |
|---|---|---|---|
| Tc = 14.5 min | SF | ACRE | CN |
| GRASS | 26742 | 0.614 | 80 |
| GRAVEL | 3492 | 0.080 | 89 |
| TOTAL | 30234 | 0.694 | 81 |
| Q (2yr, 10yr, 100yr) | 0.98 CFS | 1.79 CFS | 3.65 CFS |

KORB + ASSOCIATES ARCHITECTS

THE SIGMA GROUP
Single Source. Sound Solutions.
www.thesigmagroup.com
1300 West Canal Street
Milwaukee, WI 53233
Phone: 414-643-4200
Fax: 414-643-4210

# STORM WATER MANAGEMENT PLAN EXISTING CONDITIONS

PROJECT:
BEAUDRY SERVICES, INC.

OWNER:
BEAUDRY SERVICES, INC.
1522 Pearl St.
Waukesha, WI 53186

ARCHITECT:
KORB AND ASSOCIATES ARCHITECTS
648 N. Plankinton Ave.
Suite 240
Milwaukee, WI 53203

CONSTRUCTION MANAGER:
CONSTRUCTION MANAGER

CIVIL ENGINEER
THE SIGMA GROUP

| REVISION NO: | DATE: |
|---|---|
| | |

| | |
|---|---|
| COMM NO: | 17007-01 |
| SCALE: | AS NOTED |
| PHASE: | SCHEMATIC DESIGN |
| DATE: | 3/21/2017 |

SW 1.0



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**Figure: SWM 2.0**

**Storm Water Management Plan – Post-Development Conditions Plan**


GRAPHIC SCALE

0 30' 60'

| WATERSHED A | | | |
|---|---|---|---|
| Tc = 6.0 min | SF | ACRE | CN |
| PAVEMENT | 55243 | 1.268 | 98 |
| BUILDING | 17200 | 0.395 | 98 |
| GREENSPACE | 20660 | 0.474 | 80 |
| WATER | 8454 | 0.194 | 98 |
| TOTAL | 101557 | 2.331 | 94 |
| | | | |
| Q (2yr, 10yr, 100yr) | 8.39 CFS | 12.39 CFS | 20.86 CFS |

| WATERSHED B | | | |
|---|---|---|---|
| Tc = 6.0 min | SF | ACRE | CN |
| PAVEMENT | 9689 | 0.222 | 98 |
| GREENSPACE | 10048 | 0.231 | 80 |
| TOTAL | 19737 | 0.453 | 89 |
| | | | |
| Q (2yr, 10yr, 100yr) | 1.35 CFS | 2.14 CFS | 3.82 CFS |

| WATERSHED C | | | |
|---|---|---|---|
| Tc = 6.0 min | SF | ACRE | CN |
| GREENSPACE | 2127 | 0.049 | 80 |
| TOTAL | 2127 | 0.049 | 80 |
| | | | |
| Q (2yr, 10yr, 100yr) | 0.09 CFS | 0.17 CFS | 0.35 CFS |

KORB + ASSOCIATES ARCHITECTS

THE SIGMA GROUP
Single Source. Sound Solutions.
www.thesigmagroup.com
1300 West Canal Street
Milwaukee, WI 53233
Phone: 414-643-4200
Fax: 414-643-4210

# STORM WATER MANAGEMENT PLAN PROPOSED CONDITIONS

PROJECT:
BEAUDRY SERVICES, INC.

OWNER:
BEAUDRY SERVICES, INC.
1522 Pearl St.
Waukesha, WI 53186

ARCHITECT:
KORB AND ASSOCIATES ARCHITECTS
648 N. Plankinton Ave.
Suite 240
Milwaukee, WI 53203

CONSTRUCTION MANAGER:
CONSTRUCTION MANAGER

CIVIL ENGINEER
THE SIGMA GROUP

| REVISION NO: | DATE: |
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| COMM NO: | 17007-01 |
| SCALE: | AS NOTED |
| PHASE: | SCHEMATIC DESIGN |
| DATE: | 3/21/2017 |

**SW 2.0**



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