Memorandum

5th Ward – Stormwater Management

To:	City of La Crosse – Engineering Department
	Attn: Yuri Nasonovs
From:	Kris Roppe, PE
Date:	September 17, 2021
Subject:	5th Ward – Stormwater Management

This stormwater management memo has been prepared to accompany the submitted plans and stormwater calculations for the proposed 5th Ward Development which will be located at 1325 Saint Andrew ST. The property is currently zoned Planned Development. Therefore, the project will need to meet the requirements of the City of La Crosse Commercial Design Standards Handbook. The project will consist of the construction of 2 multi-family apartments, 2 townhomes, and an activity center, along with concrete pavement, concrete walk, utilities, erosion control, stormwater management, and landscaping. Since the project will be multi-family the City of La Crosse Multi-Family Housing Design standards have been followed. A project location map is provided on Sheet G1-10 in the submitted plan set.

A geotechnical Investigation has been completed by Braun Intertec, Inc. A previous report was also prepared by Braun Intertec on August 15, 2019 and is included for reference. Soil evaluations indicate that the infiltration rates on site range from 0.5 inches/hour to 3.6 inches/hour based on the requirements of Wisconsin DNR Conservation Practice Standard 1002. Although infiltration rates are generally adequate for stormwater infiltration no infiltration has been included as part of the project since soil and groundwater contamination are present. Prior to construction, a soil management plan will be prepared for testing and handling of contaminated soil during excavation.

DESIGN STANDARDS

The existing site is currently vacant however was fully developed prior to 2008/2009. Therefore, the project will follow redevelopment standards from NR 151 as listed in the table below. Peak runoff from the site has also been evaluated to maintain or reduce based on current conditions as required by the City of La Crosse.

Table 1. Design Criteria

	Performance Standard	Requirements
Wisconsin Department of Natural Resources NR 151	Total Suspended Solids NR 151.122	Redevelopment – 40% TSS reduction from parking areas and roads.
	Peak Discharge NR 151.123	Exempt per NR 151.123(2)(b) – Redevelopment Site.
	Infiltration NR 151.124	Exempt per NR 151.124 (3)(b)3 – Redevelopment Site.
	Protective Areas NR 151.125	N/A – No protective areas within proposed site.
	Fueling & Vehicle Maintenance NR 151.126	N/A – No fueling or vehicle maintenance areas within proposed site.
	Location NR 151.127	BMP's will be located on site.
	Timing NR 151.128	BMP's will be installed prior to final stabilization.

The disturbed area for this project is 3.95 acres and will increase the onsite impervious area by 2.624 acres compared to current vacant conditions. Due to the fact that the disturbed area for this project is over an acre, a Wisconsin DNR WPDES permit will be required.

EXISTING CONDITIONS

The existing site is currently vacant grass area which has been raised up approximately 5 feet to get out of the floodplain. There are retaining walls along the north, south, and west side of the site. The existing drainage areas and ground cover are provided in the attachments.

PROPOSED CONDISTIONS

The proposed site has been separated into 11 drainage areas. Stormwater management for the site will consist of an ADS MC-3500 Stormtech Chamber System with Isolator Row located on Lot 2 under the parking lot for site stormwater runoff. The systems will provide both water quality and peak flow reduction for all 4 lots within the development. The system has been designed with a liner to prevent stormwater from infiltrating into the soils below. The proposed watersheds and ground cover are provided in the attachments.

CALCULATION SUMMARY

Water quantity calculations were completed using hydraulic models developed by utilizing the design data and the HydroCAD Version 10.10-6a computer modeling system. This was used to provide sizing and analysis for the Stormtech Chambers. Hydrographs for existing and proposed scenarios were generated and routed through these models using the Atlas-14 rainfall distribution. The proposed runoff from the analyzed events is provided in the table below. The HydroCAD calculations for the proposed conditions are included in the attachments. The table below shows that the runoff from the site is reduced compared to existing conditions up to the 100-year storm event and the 100-year storm event is safely conveyed by the proposed stormwater management for the site.

Table 2. Runoff Calculations

Rainfall Event	Existing Conditions Peak Flow (CFS)	Proposed Conditions Peak Flow (CFS)
1-Year	1.17	0.73
2-Year	1.88	1.27
5-Year	3.39	3.35
10-Year	4.90	4.82
25-Year	7.34	7.28
100-Year	11.63	10.60

Water quality calculations were completed by utilizing the design data and the WinSLAMM Version 10.4.1 computer modeling system. This was used to provide analysis of the reduction in total suspended solids for the Stormtech Chambers. Results show a reduction of 53.38% of the total suspended solids from the proposed site conditions using suitable parameters for the La Crosse area when compared to no controls. The WinSLAMM models show that the proposed conditions meet the City and State requirements to reduce total suspended solids by 40% from parking areas and road surfaces compared to no controls. The WinSLAMM Output Report with input parameters can be found in the attachments.

A maintenance agreement with the City will be required for the underground chambers. A draft maintenance plan for the permanent stormwater management facilities on site can be found in the attachments.

Attachments:

- 5th Ward Site Plans
- Braun Intertec Geotechnical Reports
- Existing Drainage Map
- Proposed Drainage Map
- HydroCAD Analysis
- WinSLAMM Report
- Draft Maintenance Plan

Geotechnical Evaluation Report

Proposed STAR Center Facility
1319 and 1325 St. Andrew Street
La Crosse, Wisconsin

Prepared for

STAR Association

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Wisconsin.

Benjamin R. Sullivan, PE
Project Engineer
License Number: 46821
August 15, 2019

Project B1907847

Braun Intertec Corporation

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The Science You Build On.

BRAUN INTERTEC
The Science You Build On.

Braun Intertec Corporation
2309 Palace Street
La Crosse, WI 54603

Phone: 608.781.7277
Fax: 608.781.7279
Web: braunintertec.com

August 15, 2019 Project B1907847

Ms. Virginia Wintersteen
STAR Association
PO Box 1024
La Crosse, Wisconsin 54602

Re: Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 St. Andrew Street
La Crosse, Wisconsin

Dear Ms. Wintersteen:

We are pleased to present this Geotechnical Evaluation Report for the proposed STAR Center Facility to be located at 1319 and 1325 St. Andrew Street in La Crosse, Wisconsin.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Ben Sullivan or Brandon Wright at 608.781.7277 or by email at bsullivan@braunintertec.com or bwright@braunintertec.com.

Sincerely,

BRAUN INTERTEC CORPORATION

Benjamin R. Sullivan, PE
Project Engineer

Brandon K. Wright, PE
Senior Engineer

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Appendix

Soil Boring Location Sketch
Log of Boring Sheets (ST-1 to ST-6)
Fence Diagram
Descriptive Terminology of Soil
Mechanical Sieve Analysis Test Report
Wisconsin DNR – Soil Evaluation Storm Form

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the proposed design and construction of the STAR Center Facility to be located at 1319 and 1325 St. Andrew Street in La Crosse, Wisconsin. The project will include construction of an approximate 63,435 square-foot, one- and two-story, structural-steel framed building with structural masonry walls and concrete floor slabs. Construction will also include pavements for parking lots as well as associated utilities and storm water improvements. Table 1 provides the project details.

Table 1. Project Description

Aspect	Description
Proposed STAR Center Facility	▪ One- and two-story, structural steel-framed building with structural masonry walls and concrete floor slabs. ▪ Construction will also include an in-ground swimming pool and therapy pool supported on pier foundations with structural floor slabs. ▪ We have assumed that column loads will be 350 kips or less, walls loads will be 25 kips per lineal foot or less, and interior floor slabs will support 100 pounds per square foot or less. ▪ According to I & S Group, Inc. the preliminary finished floor elevation is reported to be 648.0 with fills of less than 1-foot expected to achieve finished floor elevation.
Pavement and Assumed Traffic Loads	▪ Bituminous flexible pavements for the parking lot. ▪ Concrete rigid pavements for access drives. ▪ Light-duty parking areas: 50,000 ESALs* ▪ Heavy-duty drive lanes: 250,000 ESALs* ▪ Cuts and fills of 2 feet or less assumed.

*Equivalent 18,000-lb single axle loads based on 20-year design for bituminous pavements and 35-year for concrete pavements.

The figure below shows an illustration of the proposed site layout.

Figure 1. Site Layout

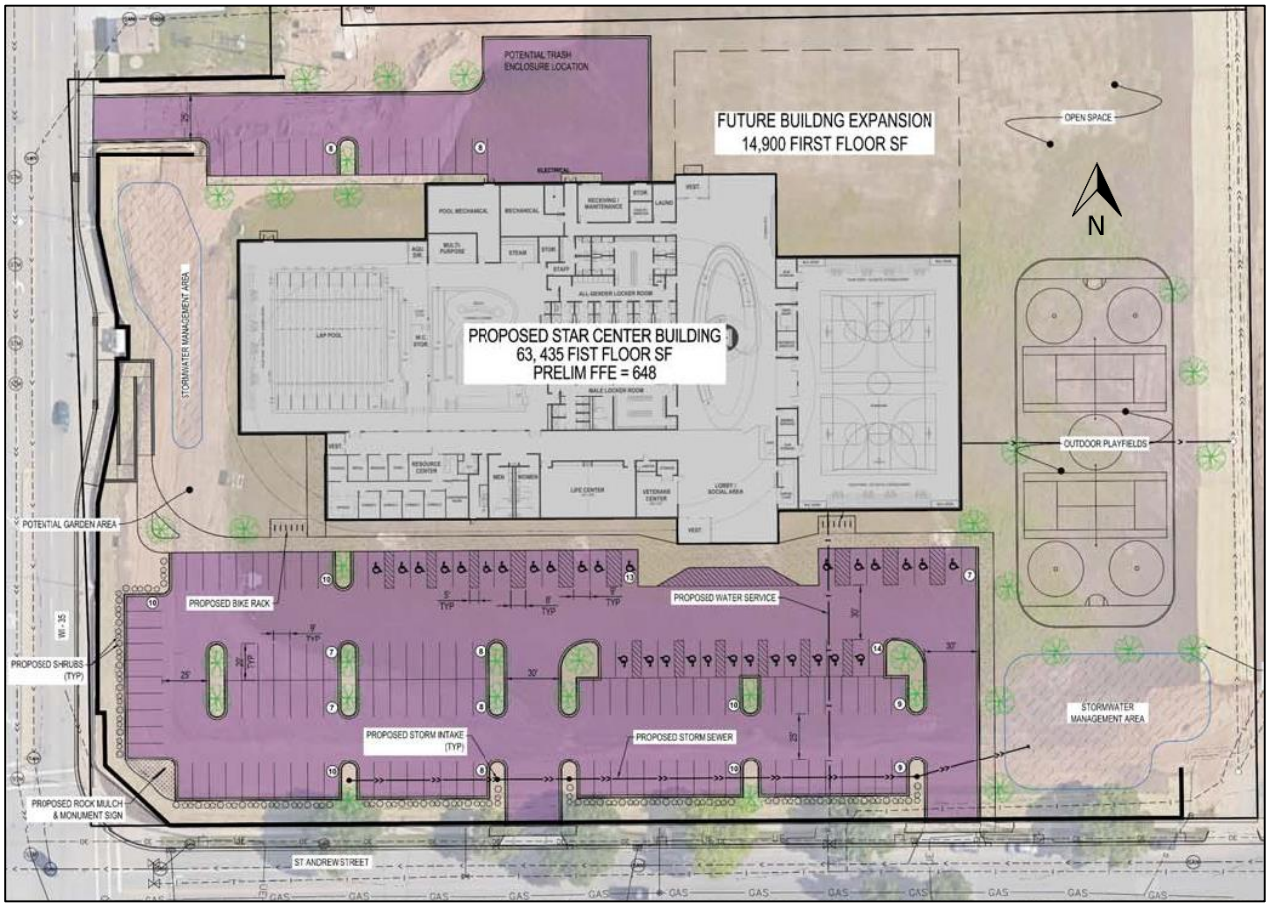


Figure provided by I & S Group, Inc., dated August 2, 2019.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

A.2. Site Conditions and History

Based on our referenced documents and knowledge of the site, we understand the site was previously developed. The previous structure was demolished and backfilled. To our knowledge, earthwork associated with the backfill, including proper lift thickness, compaction effort, testing records, and

documentation of the backfill was not conducted during the demolition process. The site was then elevated above the flood plain by importing approximately 60,000 cubic yards of soil, bringing the site to the approximate elevation of 648. The additional fill brought to the site was tested for in-place density and level of compaction.

The site currently exists as a vacant lot with surficial vegetation. Based on elevations at the boring locations, the site is relatively flat and has less than 1-foot of relief. The photograph below provides an aerial image of the site.

Photograph 1. Aerial Photograph of the Site

Photograph provided by Google Earth, dated September 28, 2015.

A.3. Purpose

The purpose of our geotechnical evaluation was to characterize subsurface geologic conditions at selected exploration locations, evaluate their impact and provide geotechnical recommendations for the design and construction of the proposed building and associated site improvements.

A.4. Background Information and Reference Documents

We reviewed the following information:

- Historical aerial photographs and topographic maps of the site.
- Geologic maps of La Crosse County, Wisconsin.
- Preliminary site layout plan prepared by I & S Group, Inc., dated August 2, 2019.
- Proposed concept design prepared by I & S Group, River Architects, and KPF, dated August 2, 2019.
- Final site grading plan prepared by Cedar Corporation, dated September 2015.
- Previous Geotechnical Evaluation Report prepared by Braun Intertec, project number B1407491, dated December 17, 2014.
- Addendum to Final Case Closure with Continuing Obligations Letter Dated January 30, 2014; Former Trane Company Plant #6 Located at 606 George Street/1319 St. Andrew Street (f/k/a 1305 St. Andrew Street) La Crosse, Wisconsin WDNR BRRT Activity # 02-32-000195 & # 07-32-547753, dated April 30, 2015.
- Communications with River Architects, Inc., and I & S Group, Inc. regarding project details.

Our referenced documents and past project experience in the general area indicate that the site is underlain with engineered fill over uncontrolled fill and undocumented fill over buried topsoil and alluvial sand soils.

A.5. Scope of Services

We performed our scope of services for the project in accordance with our Proposal QTB104228 to STAR Association, dated July 17, 2019, who authorized us to proceed. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.

- Staking and clearing the exploration location of underground utilities. I & S Group, Inc. selected, and we staked the boring exploration locations. We acquired the surface elevations and locations with GPS technology using the State of Minnesota's permanent GPS base station network. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.

- Performing six (6) standard penetration test (SPT) borings, denoted as ST-1 to ST-6, to nominal depths of 15 to 30 feet below grade across the site.

- Performing laboratory testing on select samples to aid in soil classification and engineering analysis.

- Preparing this report containing a boring location sketch, logs of soil borings, a summary of the soils encountered, results of laboratory tests, and recommendations for structure and pavement subgrade preparation and the design of foundations, floor slabs, below-grade walls, exterior slabs, pavements, underground utilities, and stormwater improvements.

Our scope of services did not include environmental services or testing, and we did not train the personnel performing this evaluation to provide environmental services or testing. We can provide these services or testing at your request.

B. Results

B.1. Geologic Overview

We based the geologic origins used in this report on the soil types, laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Previous Geotechnical Information

We performed six (6) soil borings at this site in October of 2014 and completed a Geotechnical Evaluation Report for a proposed site redevelopment. The previous evaluation was completed prior to the additional fill brought to the site to raise site grades above the flood plain to elevation 648. Those borings encountered approximately 4 to 9 feet of uncontrolled and undocumented fill that contained pockets of debris including concrete, glass, bricks, and large voids over buried topsoil. Below the fill and buried topsoil, the borings encountered alluvial sand soils.

B.3. Boring Results

Table 2 provides a summary of the soil boring results, in the general order we encountered the strata. Please refer to the Log of Boring sheets in the Appendix for additional details. The Descriptive Terminology sheets in the Appendix include definitions of abbreviations used in Table 2.

Table 2. Subsurface Profile Summary*

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Topsoil Fill	SM	---	▪ Topsoil fill was encountered at the ground surface in all borings. ▪ The topsoil fill consisted of silty sand (SM) with roots that was dark brown in color and was moist. ▪ Thicknesses at the boring locations varied from less than ½-foot to 2 feet.

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Engineered Fill	SP, SP-SM	9 to 42 BPF	▪ Engineered fill was encountered below the topsoil in all borings and extended to depths of about 4 to 5 feet. ▪ This fill was placed to elevate the site above the flood plain and has been tested for in-place density and level of compaction during placement. ▪ The fill consisted of fine- to medium-grained poorly graded sand (SP) and poorly graded sand with silt (SP-SM) that was brown and was moist.
Undocumented Fill	SP, SP-SM	4 to 28 BPF	▪ Fill was encountered in all borings below the topsoil fill and engineered fill, and extended to depths of approximately 8 to 17 feet. ▪ General penetration resistance suggests the fill received variable compaction. ▪ The fill consisted of fine- to medium-grained poorly graded sand (SP), poorly graded sand with silt (SP-SM), and silty sand (SM) that was light brown, brown, and yellowish brown in color and was moist to wet. ▪ The fill contained various amounts of gravel.
Alluvial	SP, SP-SM, SM	3 to 21 BPF	▪ Alluvial soils were encountered in all borings below the topsoil fill and fill and extended to the termination depths of our borings. ▪ Penetration resistance testing in the sandy alluvial soils indicates they are very loose to medium dense in relative density. ▪ Consisted of fine- to coarse-grained poorly graded sand (SP), poorly graded sand with silt (SP-SM), and silty sand (SM) that contained with traces of gravel that was brown and gray in color. ▪ Moisture condition was wet. ▪ Trace organics encountered in Boring ST-4 at a depth of 12 to 14 feet.

*Abbreviations defined in the attached Descriptive Terminology sheets.

B.4. Groundwater

Table 3 summarizes the depths where we observed groundwater; the attached Log of Boring sheets in the Appendix also include this information and additional details. Corresponding groundwater elevations were determined from comparisons of the measured/estimated depths to groundwater and surface elevations and were rounded to the nearest ½-foot.

Table 3. Groundwater Summary

Location	Surface Elevation	Measured or Estimated Depth to Groundwater (ft)	Corresponding Groundwater Elevation (ft)
ST-1	647.7	11	636 ½
ST-2	647.8	12	636
ST-3	647.7	12	635 ½
ST-4	648.0	11	637
ST-5	647.6	9 ½	638
ST-6	647.9	10	638

At the time of our observation, we observed groundwater at depths of 9 ½ to 12 feet as our borings were advanced. These depths correspond to elevation 635 ½ to 638. Seasonal and annual fluctuations of groundwater should also be anticipated.

B.5. Environmental Discussion

We understand contaminated soil, slag, and rubble were identified in Wisconsin Department of Natural Resources (WDNR) approved NR700 Remedial Action Plan. The cleanup site is register as WDNR BRRTS #02-32-000195 and #07-32-547753. Continuing obligations remain associated with the site. It is imperative that a soil management plan be developed and implemented prior to any earthwork taking placed in the impacted areas. The soil management plan will provide direction to properly handle all impacted soils properly during all aspects of the new construction. We can be contacted to help the project team with the soil management plan prior to construction.

B.6. Laboratory Test Results

Overall, the soils encountered within our borings at this site consisted of sandy soils. These soils are not expansive. More information, soil characteristics, and test results are presented in the following sections.

B.6.a. Mechanical Sieve Analysis Tests

We performed a mechanical sieve analysis (ASTM D6913) on a selected sample from Boring ST-3 at a depth of 20 feet to assist in classification. The test indicated the sample tested classified as poorly graded sand (SP). The Log of Boring sheets present the percent passing a #200 sieve result and the Appendix includes a graph showing the results of the mechanical sieve analysis.

B.6.b. Moisture Content and Particles Passing a #200 Sieve Tests

Results of our laboratory tests for soil classification, moisture content, and particles passing a #200 sieve are presented below in Table 4.

Table 4. Laboratory Classification Test Results

Location	Sample Depth (ft)	Classification	Moisture Content (w, %)	Percent Passing a #200 Sieve
ST-1	5	FILL: Poorly Graded Sand (SP)	8	5
ST-2	6	FILL: Poorly Graded Sand (SP)	8	5
ST-3	20	Poorly Graded Sand (SP)	23	1
ST-4	2 ½	FILL: Poorly Graded Sand with Silt (SP-SM)	9	9
ST-5	2	FILL: Poorly Graded Sand with Silt (SP-SM)	9	10

C. Basis for Recommendations

C.1. Design Considerations

C.1.a. Introduction

The site contains fill that extends to depths of 8 to 17 feet across the site, corresponding to elevation 631 to 640. The fill was noted to have variable compaction and consistency. Based on previous site explorations, buried topsoil is also likely present beneath the fill. These materials are not suitable for

support of the proposed building. To limit post-construction settlement, the building should be supported on improved subgrades or intermediate foundation systems. Removal and replacement of the soils will require installation of dewatering systems and careful handling of contaminated fill soils. Installation of intermediate foundation systems, however, would limit the need for dewatering systems and reduce the handling and amount of disturbance to the contaminated soils. After discussing this with I & S Group, Inc. and River Architects, we developed our recommendations for improving subgrades by installation of rammed aggregate piers.

C.1.b. Building Support

As mentioned above, to reduce the risk of future excessive building and site settlements it is our opinion the building will need to be supported on intermediate foundations. The proposed building foundations, pools, and interior slabs should be supported on rammed aggregate piers.

Alternatively, if the owner is willing to accept the risk of some settlement, then the fill below the interior slabs could be surface-compacted and left in place provided the building foundations and pool areas are supported on rammed aggregate piers. The amount of settlement associate with this approach is dependent on the amount of compacted soil below the structure and the composition of the existing fill but is expected to be less than 1-inch under the assumed loads. Additional settlements may occur if undetected loose fill, deleterious material, or voids are present within the fill that were not detected by the soil borings.

There is some risk associated with this approach. The recommendations and parameters discussed below are based on the conditions encountered in our borings and our experiences on similar sites. Please note that actual settlements will vary and could be much higher, if voids or compressible materials are concealed by the fill. The owner needs to accept the additional risk of differential settlement by leaving the fill in place, in return for the cost savings. These risks can be reduced through additional testing and observations but cannot be eliminated unless the fill is removed in its entirety, or an intermediate foundation system is used to support all components of the proposed building.

C.1.c. Swimming Pools and Below-Grade Walls

Swimming pools and below-grade walls should be backfilled with medium- to coarse-grained sand or gravel to limit buildup of hydrostatic pressure on the walls and to promote drainage of subsurface and accumulated water to a drain tile or sump pump.

C.1.d. Pavements

Areas receiving new pavements should be prepared by removing the topsoil fill and surficial vegetation from below the proposed pavement subgrade elevations and be replaced with granular fill. Prior to elevating or placing additional fill required, the exposed subgrade soils should be surface-compacted to densify and enhance uniformity of the exposed soils. The fill present below these materials appeared to be free of debris and can be left in place provided it is evaluated for suitability at the time of construction. If the fill is considered suitable, it should be surface-compacted. If the fill is unsuitable, additional sub-cuts and subgrade improvements may be required. A proofroll should also be performed after the aggregate base material is in place, and prior to placing bituminous or concrete pavement.

C.2. Construction Considerations

From a construction perspective, the project team should also be aware that:

- Excavations will penetrate the groundwater surface at a depth of approximately 9 ½ to 12 feet. Dewatering will be required for excavations that extent below elevation 638 to facilitate an evaluation of the geologic materials exposed in the excavation sides and bottoms, and the placement and compaction of backfill.

- The on-site existing fill can be considered for re-use as backfill and additional required fill provided debris and organic soils (if encountered) is first removed. The alluvial soils can also be considered for reuse as backfill and additional required fill.

- Imported material needed to replace excavation spoils or balance cut and fill quantities, should consist of sandy soils having less than 20 percent of the particles by weight passing a #200 sieve. Soil needed to facilitate drainage should consist of sand and gravel soils with less than 5 percent passing a #200 sieve.

D. Recommendations

D.1. Earthwork

D.1.a. Building Subgrade Preparation

We recommend removing the topsoil fill and surficial vegetation from below the proposed building footprint and their oversize areas. To provide support for construction equipment for installation of the rammed aggregate piers, we recommend the building pad be filled to subgrade elevation with granular soils having less than 20 percent passing a #200 sieve followed by 6 inches of aggregate base.

A geotechnical representative should observe the excavations to make the necessary field judgments regarding the suitability of the exposed soils.

D.1.b. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will consist of sandy fill and alluvial sand soils. These soils are considered Type C Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type C soils should have a gradient no steeper than 1 ½H:1V. Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, “Excavations and Trenches.” This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

D.1.c. Excavation Dewatering

We recommend removing groundwater from the excavations with well points. Dewatering of high-permeability soils (e.g., sands) from within the excavation with conventional pumps has the potential to loosen the soils, due to upward flow. A dewatering contractor should develop a dewatering plan; the design team should review this plan.

D.1.d. Surface Compaction

Due to the areas of loose sandy fill soils below the proposed building and pavement areas, we recommend that exposed soils be surface-compacted prior to placing additional required fill and slabs for

the proposed building and pavement areas. This will densify and enhance uniformity of the exposed soils.

D.1.e. Engineered Fill Materials and Compaction

We recommend spreading fill in loose lifts of approximately 12 inches thick. Table 5 below contains our recommendations for fill materials, gradation, and minimum compaction level for compacted fills.

Table 5. Soil for Fill Description*

Fill Classification	Locations to Be Used	Fill Source and Soil Descriptions	Gradation	Relative Compaction, percent (ASTM D1557 – Modified Proctor)
Structural fill	▪ General site grading ▪ Elevating the building pad to finished floor elevation ▪ Interior and exterior foundation wall backfill ▪ Below interior and exterior slabs	On-site fill free of debris or imported sand and gravel consisting of GP, GW, SW, SP, SP-SM, SM	100% passing 2-inch sieve <20% passing #200 sieve < 2% Organic Content (OC)	95
Non-frost-susceptible fill	Non-frost-susceptible below building entry slabs	Imported sand or gravel: GP, GW, SP, SW	100% passing 1-inch sieve < 50% passing #40 sieve < 5% passing #200 sieve < 2% OC	95
Retained fill	Drainage layer behind below-grade walls and retaining walls	Imported sand or gravel: GP, GW, SP, SW	100% passing 3-inch sieve < 5% passing #200 sieve < 2% OC	95
	Re-placed or retained on-site soils	On-site soils or imported sand and gravel consisting of GP, GW, SW, SP, SP-SM, SM	100% passing 2-inch sieve <20% passing #200 sieve < 2% OC	95
Non-structural fill	Below landscaped surfaces, where subsidence is not a concern	On-site soils and imported soils	100% passing 6-inch sieve < 10% OC	90

* More select soils comprised of coarse sands with < 5% passing #200 sieve may be needed to accommodate work occurring in periods of wet or freezing weather.

Sand soil with less than 12 percent particles by weight passing a number 200 sieve may be compacted without moisture conditioning, although, some water may be needed to achieve compaction. Silty sand,

soils used as backfill should be moisture conditioned to between 3 percent below to 3 percent above their optimum moisture content.

The project documents should not allow the contractor to use frozen material as fill or to place fill on frozen material. Frost should not penetrate under foundations or slabs during construction.

We recommend performing density tests in fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

D.2. Foundation Support on Rammed Aggregate Piers

D.2.a. Rammed Aggregate Piers

Based on the anticipated depth of excavations needed to remove the existing fill from the proposed building footprint, it appears that conventional soil corrections would add a significant cost to the project. Thus, we recommend performing ground improvements with rammed aggregate piers.

A subgrade improved with rammed aggregate piers will reduce the potential for detrimental settlement associated with the existing fill to occur, provide adequate bearing capacity, eliminate the need for deep excavations, reduce the need to dewatering excavations, reduce the need to handle contaminated soils, reduce impacts to adjacent site features, and reduce the volume of subgrade soils disturbed at this site.

Different contractors use varying techniques to construct rammed aggregate piers, but generally consist of excavating soil from a hole with an auger or vibrating a probe into the ground, and then building a column of clean, open-graded aggregate. The contractor constructs the pier by placing the aggregate in lifts from the bottom of the pier and compacting each lift before placing aggregate for the subsequent lift. The vibratory energy, and sometimes ramming action, causes the aggregate to interlock, forming a stiff pier that provides soil reinforcement and increases shear resistance. Due to the many variations in techniques, we recommend using performance-based specifications with design-build contracting. We recommend requiring the contractor to have at least five years of experience in performing this work, and to demonstrate performing the proposed protection system(s) on at least three previous projects of similar size and scope. The specifications should require the design engineer be licensed in the project state. We can assist you with developing a list of pre-qualified contractors prior to bidding or with reviewing contractor experience as part of the bidding process.

Rammed aggregate piers are a Special Inspection item in accordance with Chapter 17 of the IBC. The observations should include installed length, consistency of soil profile with the geotechnical evaluation confirmation of the materials, and confirmation of installation techniques.

We recommend installing rammed aggregate piers under both foundations and pools for the building. The rammed aggregate piers should extend through the existing fill to bear on the alluvial sand soils at depth.

D.2.b. Spread Footing Design Parameters

Table 6 below contains our design parameters for foundations supported on rammed aggregate piers.

Table 6. Recommended Spread Footing Design Parameters on Rammed Aggregate Piers

Item	Description
Maximum net allowable bearing pressure (psf) Interior column pad footings Perimeter strip footings	Determined by aggregate pier designer.
Minimum embedment below final exterior grade for heated structures (inches)	48
Minimum embedment below final exterior grade for unheated structures or for footings not protected from freezing temperatures during construction (inches)	60
Total and Differential settlement	Typically, less than 1-inch and ½-inch, respectively. *

* Actual settlement amounts will depend on final loads, foundation layout, and design criteria from aggregate pier designer.

D.3. Interior Slabs

D.3.a. Subgrade Modulus

We recommend the interior slabs be supported on rammed aggregate piers that extend through the existing fill to bear on the alluvial sand soils at depth. The aggregate pier designer will provide a modulus of subgrade reaction for slab design based on the pier layout and load transfer platform design.

Alternatively, if the owner is willing to accept the risk of some settlement, then interior slabs could be supported on the existing fill provided it is surface-compacted prior to place additional fill required or

concrete. Interiors slabs supported on surface-compacted engineered fill may be designed using a modulus of subgrade reaction, k, of 200 pounds per square inch per inch of deflection (pci). If the slab design requires placing 6 inches of compacted crushed aggregate base immediately below the slab, the slab design may increase the k-value by 50 pci. We recommend that the aggregate base materials be free of bituminous. In addition to improving the modulus of subgrade reaction, an aggregate base facilitates construction activities and is less weather sensitive.

There is an elevated risk of settlement with this approach based on the nature of the fill and that the fill could contain voids or compressible materials. The owner needs to accept the additional risk of differential settlement by leaving a portion of the fill in place, in return for the cost savings. These risks can be reduced through additional testing and observations but cannot be eliminated unless the interior slabs are supported on rammed aggregate piers.

D.3.b. Moisture Vapor Protection

Excess transmission of water vapor could cause floor dampness, certain types of floor bonding agents to separate, or mold to form under floor coverings. If project planning includes using floor coverings or coatings, we recommend placing a vapor retarder or vapor barrier immediately beneath the slab. We also recommend consulting with floor covering manufacturers regarding the appropriate type, use and installation of the vapor retarder or barrier to preserve warranty assurances.

D.3.c. Water Table Separation

We recommend maintaining a 5-foot separation from anticipated long-term water levels. This separation will reduce the risk of seepage, buoyant forces, and other water related issues.

D.4. Swimming Pool and Therapy Pool

D.4.a. Swimming Pool and Therapy Pool Support

We understand the swimming pool and therapy pool will be supported on rammed aggregate piers with a structural floor slab around the pools.

D.4.b. Hydrostatic Pressure

The swimming pool and therapy pool should be designed for hydrostatic uplift up to elevation 641 (this is the anticipated groundwater elevation due to seasonal fluctuation).

We recommend the fill located within 5 feet of the walls consist of free-draining fill with less than 5 percent passing a #200 sieve. This material will control lateral pressures on the wall. If final design uses non-sand material for fill, project planning should account for the following items:

- Other fill material may result in higher lateral pressure on the wall.
- Other fill material may be more difficult to compact.
- Post-construction consolidation of other fill material may result in settlement-related damage to the structures or slabs supported on the fill.

D.4.c. Configuring and Resisting Lateral Loads

The swimming pool and therapy pool wall design can use at-rest earth pressure conditions. Table 7 presents our recommended equivalent fluid pressures for wall design of active, at-rest, and passive earth pressure conditions. The table also provides recommended wet unit weights and internal friction angles. Designs should also consider the slope of any fill and dead or live loads placed behind the walls within a horizontal distance that is equal to the height of the walls. Our recommended values assume the wall design provides drainage, so water cannot accumulate behind the walls. The construction documents should clearly identify what soils the contractor should use for the fill of walls.

Table 7. Recommended Pool Wall Design Parameters – Drained Conditions

Retained Soil	Wet Unit Weight (pcf)	Friction Angle (degrees)	Active Equivalent Fluid Pressure* (pcf)	At-Rest Equivalent Fluid Pressure* (pcf)	Passive Equivalent Fluid Pressure* (pcf)
Free-draining fill	120	32	37	56	390

* Based on Rankine model for soils in a region behind the wall extending at least 2 horizontal feet beyond the bottom outer edges of the wall footings and then rising up and away from the wall at an angle no steeper than 60 degrees from horizontal.

The values presented in the table above are un-factored.

D.5. Below-Grade Walls

D.5.a. Below-Grade Wall Support

We understand the below-grade walls for elevator pits and pool maintenance room will be supported by rammed aggregate piers with a concrete floor slab below.

D.5.b. Hydrostatic Pressure

Below-grade walls that extent below the groundwater table should be designed for hydrostatic uplift up to elevation 641 (this is the anticipated groundwater elevation due to seasonal fluctuation).

We recommend the fill located within 5 feet of the walls consist of free-draining fill with less than 5 percent passing a #200 sieve. This material will control lateral pressures on the wall. If final design uses non-sand material for fill, project planning should account for the following items:

- Other fill material may result in higher lateral pressure on the wall.
- Other fill material may be more difficult to compact.
- Post-construction consolidation of other fill material may result in settlement-related damage to the structures or slabs supported on the fill.

D.5.c. Drainage Control and Waterproofing

We recommend below-grade walls be backfilled with medium- to coarse-grained sand or gravel to limit buildup of hydrostatic pressure on the walls. We also recommend general waterproofing of below-grade walls that surround occupied or potentially occupied areas because of the potential cost impacts related to seepage after construction is complete.

D.5.d. Configuring and Resisting Lateral Loads

Below-grade wall design can use at-rest earth pressure conditions. Table 8 presents our recommended equivalent fluid pressures for wall design of active, at-rest, and passive earth pressure conditions. The table also provides recommended wet unit weights and internal friction angles. Designs should also consider the slope of any fill and dead or live loads placed behind the walls within a horizontal distance that is equal to the height of the walls. Our recommended values assume the wall design provides drainage, so water cannot accumulate behind the walls. The construction documents should clearly identify what soils the contractor should use for the fill of walls.

Table 8. Recommended Below-Grade Wall Design Parameters – Drained Conditions

Retained Soil	Wet Unit Weight (pcf)	Friction Angle (degrees)	Active Equivalent Fluid Pressure* (pcf)	At-Rest Equivalent Fluid Pressure* (pcf)	Passive Equivalent Fluid Pressure* (pcf)
Free-draining fill	120	32	37	56	390

* Based on Rankine model for soils in a region behind the wall extending at least 2 horizontal feet beyond the bottom outer edges of the wall footings and then rising up and away from the wall at an angle no steeper than 60 degrees from horizontal.

Sliding resistance between the bottom of the footing and the soil can also resist lateral pressures. We recommend assuming a sliding coefficient equal to 0.40 between the concrete and soil.

The values presented in this section are un-factored.

D.6. Pavements and Exterior Slabs

D.6.a. Pavement Subgrade Preparation

We recommend areas receiving new pavement be prepared by removing the topsoil fill and surficial vegetation from below the proposed pavement subgrade elevations and be replaced with granular fill. Prior to elevating or placing additional fill required, we recommend surface-compacting the exposed subgrade soils to densify and enhance uniformity of the exposed soils. The fill present below these materials appeared to be free of debris and could be left in place provided it is evaluated for suitability at the time of construction. If the fill is considered suitable, it should be surface compacted. If the fill is unsuitable, additional sub-cuts and subgrade improvements may be required.

We also recommend performing a proofroll with a fully loaded tandem-axle truck after the aggregate base material is in place, and prior to placing bituminous or concrete pavement. The contractor should correct areas that display excessive yielding or rutting during the proofroll, as determined by the geotechnical representative. Possible options for subgrade correction include moisture conditioning and re-compaction or sub-cutting and replacement with soil or crushed aggregate.

D.6.b. Pavement and Exterior Slab Design Sections

Our scope of services for this project did not include laboratory tests on subgrade soils to determine a California Bearing Ratio (CBR) value for pavement design. Based on our experience with sand soils anticipated at the pavement subgrade elevation, we recommend pavement design assume a CBR-value of 15. Note the contractor may need to perform limited removal of unsuitable or less suitable soils and

surface compact subgrade soils to achieve this value. Table 9 provides recommended bituminous pavement sections, based on the soils estimated support and assumed traffic loads.

Table 9. Recommended Bituminous Pavement Sections

Pavement Material	Light Duty Pavements Thickness/Preparations	Heavy Duty Pavements Thickness/Preparations
Minimum Bituminous Thickness (in.)	3	4
Minimum Aggregate Base Thickness (in.)	8	12
Subgrade Preparation	Surface compact, then proofroll after placement of aggregate base to locate loose or weak subgrade materials prior to placement of pavement materials.	

For concrete pavements based upon the aforementioned traffic loads and an estimated modulus of subgrade reaction (k) of 200 pci, we recommend light- and heavy-duty pavement section as shown in Table 10 below.

Table 10. Recommended Concrete Pavement Sections

Pavement Material	Light Duty Pavements Thickness/Preparations	Heavy Duty Pavements Thickness/Preparations
Minimum Concrete Thickness (in.)	5	6 ½
Minimum Aggregate Base Thickness (in.)	4	4
Subgrade Preparation	Surface compact, then proofroll after placement of aggregate base to locate loose or weak subgrade materials prior to placement of pavement materials.	

D.6.c. Bituminous Pavements

Appropriate mix designs are critical to the performance of flexible pavements. We recommend utilizing hot mix asphalt meeting the specifications of Wisconsin Department of Transportation (WisDOT) Section 460. We recommend utilizing a nominal 12.5 mm gradation for the base course and a nominal 9.5 mm gradation for the surface course as defined in Table 460-1 in Section 460.2.2.3. We recommend the Performance Graded Asphalt cement be a PG 58-28 in the lower layer and a PG 58-28 in the upper layer.

D.6.d. Concrete Pavements

We recommend specifying concrete for pavements that has a minimum 28-day compressive strength of 4,000 psi, and a modulus of rupture (M_r) of at least 600 psi. We also recommend Type I cement meeting the requirements of ASTM International C 150. We recommend specifying 5 to 7 percent entrained air

for exposed concrete to provide resistance to freeze-thaw deterioration. We also recommend using a water/cement ratio of 0.45 or less for concrete exposed to deicers.

We assumed the concrete pavement sections in Table 10 will have edge support. We recommend placing an aggregate base below the pavement to provide a suitable subgrade for concrete placement, reduce faulting and help dissipate loads. Appropriate mix designs, panel sizing, jointing, doweling and edge reinforcement are critical to performance of rigid pavements. We recommend you contact your civil engineer to determine the final design or consult with us for guidance on these items.

D.6.e. Pavement Materials and Compaction

Table 11 below contains our recommendations for fill materials, minimum compaction level, and moisture content for compacted fills.

Table 11. Recommended Pavement Materials and Compaction

Locations to Be Used	Fill Source and Soil Descriptions	Gradation	Relative Compaction, percent (ASTM D1557 – Modified Proctor)	Moisture Content Variance from Optimum, percentage points
Dense Graded Base	Imported aggregate	WisDOT Standard Spec 305 Dense Graded Base	95	-3 to +3 for aggregate base
Granular Subbase	Imported sand and gravel	WisDOT Standard Spec 209 Grade 1 or Grade 2	95	-6 to +3 for granular subbase
Pavements subgrades and grading	On-site soils	100% passing 3-inch sieve < 2% OC	95	-6 to +3 for pavement subgrade

D.6.f. Performance and Maintenance

We based the above pavement designs on a 20-year performance life for bituminous and a 35-year life for concrete. This is the amount of time before we anticipate the pavement will require reconstruction. This performance life assumes routine maintenance, such as seal coating and crack sealing. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.

It is common to place the binder course of bituminous and then delay placement of wear course. For this situation, we recommend evaluating if the reduced pavement section will have sufficient structure to support construction traffic.

Many conditions affect the overall performance of the exterior slabs and pavements. Some of these conditions include the environment, loading conditions and the level of ongoing maintenance. With

regard to bituminous pavements in particular, it is common to have thermal cracking develop within the first few years of placement and continue throughout the life of the pavement. We recommend developing a regular maintenance plan for filling cracks in exterior slabs and pavements to lessen the potential impacts for cold weather distress due to frost heave or warm weather distress due to wetting and softening of the subgrade.

D.7. Utilities

D.7.a. Subgrade Stabilization

Earthwork activities associated with utility installations located inside the building area should adhere to the recommendations in Section D.1.

For exterior utilities, we anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions such as soft clay, organic soils or perched water at invert grades, the unsuitable soils may require some additional sub cutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

D.7.b. Corrosion Potential

A majority of the soil borings indicated the site predominantly consists of sandy soils. We consider these soils non- to slightly-corrosive to metallic conduits. If utilities extend through clay soils, we recommend bedding the utilities in sandy soil free of any clay lumps or constructing the utilities with non-corrosive materials.

D.8. Storm Water

Borings ST-2, ST-3, ST-5, and ST-6 were drilled and sampled continuously to depths of approximately 15 feet near the proposed storm water drainage system locations. The borings encountered fill and alluvial soils consisting of fine- to coarse-grained loamy sand, sandy loam, and sand. Groundwater was encountered at depths of 9 ½ to 12 feet as our borings were advanced. These depths correspond to elevation 635 ½ to 638 and are the elevations of the limiting factor per the Wisconsin DNR. Seasonal and annual fluctuations of groundwater should also be anticipated.

Infiltration rates associated with the soils present at this location are included on the Soil Evaluation – Storm form included in the Appendix of this report. The reported infiltration rates were determined by

referencing Table 2 in the Wisconsin DNR Storm Water Infiltration Technical Standard 1002, dated September 2017.

Fine-grained soils (silts and clays), topsoil or organic matter that mixes into or washes onto the soil will lower the permeability. The contractor should maintain and protect infiltration areas during construction. Furthermore, organic matter and silt washed into the system after construction can fill the soil pores and reduce permeability over time. Proper maintenance is important for long-term performance of infiltration systems.

This geotechnical evaluation does not constitute a review of site suitability for storm water infiltration or evaluate the potential impacts, if any, from infiltration of large amounts of storm water.

D.9. Equipment Support

The recommendations included in the report may not be applicable to equipment used for the construction and maintenance of this project. We recommend evaluating subgrade conditions in areas of shoring, scaffolding, cranes, pumps, lifts and other construction equipment prior to mobilization to determine if the exposed materials are suitable for equipment support or require some form of subgrade improvement. We also recommend project planning consider the effect that loads applied by such equipment may have on structures they bear on or surcharge – including pavements, buried utilities, below-grade walls, etc. We can assist you in this evaluation.

E. Procedures

E.1. Penetration Test Borings

We drilled the penetration test borings with a truck-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 ½- or 5-foot intervals in general accordance to ASTM D1586. The boring logs show the actual sample intervals and corresponding depths.

We sealed penetration test boreholes meeting the Wisconsin Administrative Code NR 141.25 criteria using 3/8-inch bentonite chips. A copy of the sealing record can be obtained upon request.

E.2. Exploration Logs

E.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on penetration test samples and groundwater measurements. The Appendix also includes a Fence Diagram intended to provide a summarized cross-sectional view of the soil profile across the site.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

E.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

E.3. Material Classification and Testing

E.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

E.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM procedures.

E.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes or allowed them to remain open for an extended period of observation, as noted on the boring logs.

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

F.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

F.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

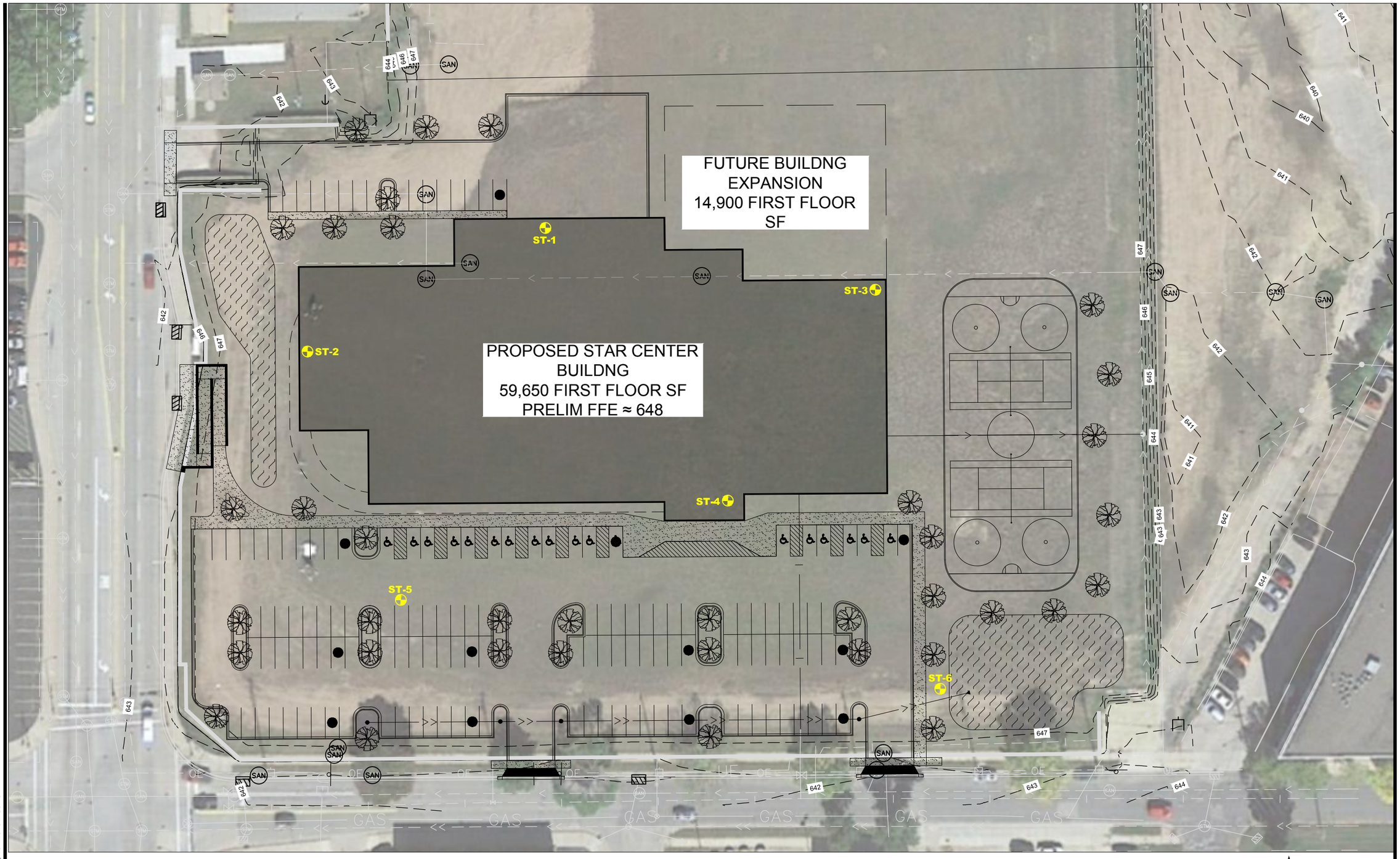
F.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

30' 0 60'

SCALE: 1"= 60'

F:\2019\B1907847.dwg,Geotech,7/31/2019 2:55:45 PM

BRAUN INTERTEC
The Science You Build On.

11001 Hampshire Avenue S
Minneapolis, MN 55438
952.995.2000
braunintertec.com

Drawing Information

Project No:	B1907847
Drawing No:	B1907847
Drawn By:	JAG
Date Drawn:	7/23/19
Checked By:	BS
Last Modified:	7/31/19

Project Information

Proposed STAR Center Facility

1319 and 1325 St. Andrew Street

La Crosse, Wisconsin

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-1**

LOCATION: See attached sketch

NORTHING: 139810 EASTING: 448635

DRILLER: Geotechnical Drilling Contractors | LOGGED BY: B. Sullivan | START DATE: 07/30/19 | END DATE: 07/30/19

SURFACE ELEVATION: 647.7 ft | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: Grass | WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.2		SILTY SAND (SM), fine-grained Sand, with roots, dark brown, moist (TOPSOIL FILL)					Benchmark: Boring elevations and surface elevations were measured with GPS technology.
0.5		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, moist to wet		6-8-11 (19)			
			5	5-7-12 (19)		8	P200=5%
				7-7-14 (21)			
			10	6-8-12 (20)			
	▽			5-7-8 (15)			
634.7							
13.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, wet, loose (ALLUVIUM)	15	4-4-6 (10)			
630.7							
17.0		POORLY GRADED SAND (SP), fine to coarse-grained Sand, trace Gravel, brown, wet, loose (ALLUVIUM)		3-4-5			

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-1**

LOCATION: See attached sketch

NORTHING: 139810 EASTING: 448635

DRILLER: Geotechnical Drilling Contractors | LOGGED BY: B. Sullivan | START DATE: 07/30/19 | END DATE: 07/30/19

SURFACE ELEVATION: 647.7 ft | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: Grass | WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to coarse-grained Sand, trace Gravel, brown, wet, loose (ALLUVIUM)		(9)			
			25	4-4-5 (9)			
619.7							
28.0		POORLY GRADED SAND (SP), fine-grained Sand, brown, wet, loose (ALLUVIUM)					
			30	2-3-5 (8)			
616.7							
31.0		END OF BORING					Water observed at 11.0 feet while drilling.
		Boring immediately backfilled with bentonite grout					Cave-in depth of 13.0 feet immediately after withdrawal of auger.
			35				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-2**

LOCATION: See attached sketch

NORTHING:	139731	EASTING:	448482
DRILLER:	Geotechnical Drilling Contractors	LOGGED BY:	B. Sullivan
START DATE:	07/30/19	END DATE:	07/30/19
SURFACE ELEVATION:	647.8 ft	RIG:	Subcontractor
METHOD:	4 1/4" HSA	SURFACING:	Grass
WEATHER:	Sunny		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
645.8		SILTY SAND (SM), fine-grained Sand, with roots, dark brown, moist (TOPSOIL FILL)					
2.0 / 644.8		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, brown, moist		4-6 (10)			
3.0		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, yellowish brown, moist to wet		6-8 (14)			
				6-14 (20)			
			5	21-21 (42)		8	P200=5%
				14-14 (28)			
				11-12 (23)			
				10-11 (21)			
				14-14 (28)			
			10	8-12 (20)			
	▽			12-12 (24)			
				8-10 (18)			
				10-9 (19)			
				8-12 (20)			
			15	7-7 (14)			No recovery
630.8							
17.0		POORLY GRADED SAND (SP), fine to coarse-grained Sand, trace Gravel, brown, wet, medium dense to loose (ALLUVIUM)					
				3-4-7			

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-2**

LOCATION: See attached sketch

NORTHING: 139731 EASTING: 448482

DRILLER:	Geotechnical Drilling Contractors	LOGGED BY:	B. Sullivan	START DATE:	07/30/19	END DATE:	07/30/19
SURFACE ELEVATION:	647.8 ft	RIG:	Subcontractor	METHOD:	4 1/4" HSA	SURFACING:	Grass	WEATHER:	Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to coarse-grained Sand, trace Gravel, brown, wet, medium dense to loose (ALLUVIUM)		(11)			
			25	3-4-6 (10)			
			30	3-3-4 (7)			
616.8							
31.0		END OF BORING					Water observed at 12.0 feet while drilling.
		Boring immediately backfilled with bentonite grout					Cave-in depth of 11.0 feet immediately after withdrawal of auger.
			35				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-3**

LOCATION: See attached sketch

NORTHING: 139771 EASTING: 448847

DRILLER: Geotechnical Drilling Contractors | LOGGED BY: B. Sullivan | START DATE: 07/30/19 | END DATE: 07/30/19

SURFACE ELEVATION: 647.7 ft | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: Grass | WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.0		SILTY SAND (SM), fine-grained Sand, with roots, dark brown, moist (TOPSOIL FILL)					
0.7		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, moist					
				4-5 (9)			
				5-7 (12)			
				4-5 (9)			
			5	6-5 (11)			
				4-4 (8)			
				2-2 (4)			
				5-8 (13)			No recovery
				8-7 (15)			
			10	5-7 (12)			
				7-7 (14)			
635.7	▽						
12.0		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, brownish gray, moist (ALLUVIUM)		7-8 (15)			
				8-10 (18)			
				5-8 (13)			
			15	10-11 (21)			
630.7							
17.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, wet, loose to medium dense (ALLUVIUM)					
				2-2-3		23	P200=1%

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-3**
LOCATION: See attached sketch
NORTHING: 139771 EASTING: 448847
START DATE: 07/30/19 END DATE: 07/30/19
SURFACE ELEVATION: 647.7 ft
DRILLER: Geotechnical Drilling Contractors
LOGGED BY: B. Sullivan
RIG: Subcontractor
METHOD: 4 1/4" HSA
SURFACING: Grass
WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, wet, loose to medium dense (ALLUVIUM)		(5)			
25				4-5-7 (12)			
30				3-5-7 (12)			
616.7 31.0		END OF BORING Boring immediately backfilled with bentonite grout					Water observed at 12.0 feet while drilling. Cave-in depth of 15.0 feet immediately after withdrawal of auger.
35							

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-4**

LOCATION: See attached sketch

NORTHING: 139635 EASTING: 448752

DRILLER: Geotechnical Drilling Contractors | LOGGED BY: B. Sullivan | START DATE: 07/30/19 | END DATE: 07/30/19

SURFACE ELEVATION: 648.0 ft | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: Grass | WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
646.8		SILTY SAND (SM), fine-grained Sand, with roots, dark brown, moist (TOPSOIL FILL)					
1.2		FILL: POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, brown, moist		6-8-12 (20)		9	P200=9%
			5	8-12-12 (24)			
				4-5-6 (11)			
			10	4-4-5 (9)			
636.0	▽						
12.0		SILTY SAND (SM), fine to medium-grained Sand, trace organics, gray, wet, loose (ALLUVIUM)		3-4-4 (8)			
634.0							
14.0		POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained Sand, brownish gray, wet, loose (ALLUVIUM)	15	2-3-4 (7)			
631.0							
17.0		POORLY GRADED SAND (SP), fine to medium-grained Sand, light brown, wet, loose to medium dense (ALLUVIUM)					
				2-4-6			

Continued on next page

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-4**

LOCATION: See attached sketch

NORTHING: 139635 EASTING: 448752

DRILLER: Geotechnical Drilling Contractors | LOGGED BY: B. Sullivan | START DATE: 07/30/19 | END DATE: 07/30/19

SURFACE ELEVATION: 648.0 ft | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: Grass | WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
		POORLY GRADED SAND (SP), fine to medium-grained Sand, light brown, wet, loose to medium dense (ALLUVIUM)		(10)			
			25	3-5-9 (14)			
			30	5-7-7 (14)			
617.0 31.0		END OF BORING Boring immediately backfilled with bentonite grout					Water observed at 11.0 feet while drilling. Cave-in depth of 12.5 feet immediately after withdrawal of auger.
			35				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-5**

LOCATION: See attached sketch

NORTHING: 139572 EASTING: 448542

DRILLER: Geotechnical Drilling Contractors | LOGGED BY: B. Sullivan | START DATE: 07/30/19 | END DATE: 07/30/19

SURFACE ELEVATION: 647.6 ft | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: Grass | WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
645.8		SILTY SAND (SM), fine-grained Sand, with roots, dark brown, moist (TOPSOIL FILL)					
1.8		FILL: POORLY GRADED SAND with SILT (SP-SM), with Gravel, brown, moist		10-10 (20)		9	P200=10%
				12-14 (26)			
				12-12 (24)			
			5	14-7 (21)			
641.6							
6.0		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, trace Gravel, brown, moist		10-10 (20)			
				11-14 (25)			
				6-8 (14)			
				2-3 (5)			
637.6	▽		10				
10.0		POORLY GRADED SAND (SP), fine-grained Sand, brown, wet, very loose to medium dense (ALLUVIUM)		2-1 (3)			
				3-3 (6)			
		Silt seam at 12 feet		2-4 (6)			
				5-7 (12)			
				2-4 (6)			
			15	6-4 (10)			
631.6							
16.0		END OF BORING					Water observed at 9.5 feet while drilling.
		Boring immediately backfilled with bentonite grout					

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B1907847
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-6**

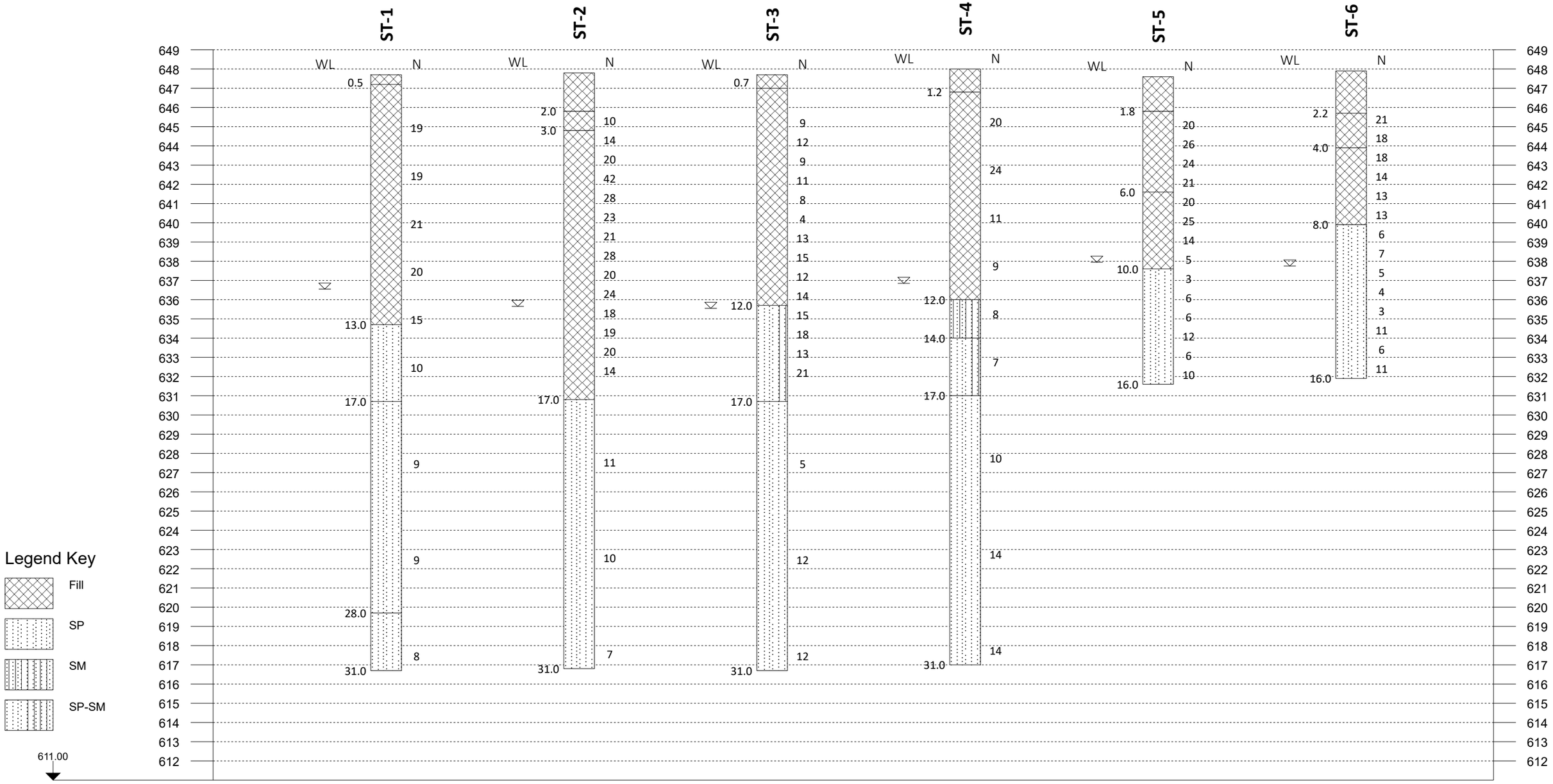
LOCATION: See attached sketch

NORTHING: 139514 EASTING: 448889

DRILLER: Geotechnical Drilling Contractors | LOGGED BY: B. Sullivan | START DATE: 07/30/19 | END DATE: 07/30/19

SURFACE ELEVATION: 647.9 ft | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: Grass | WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
645.7		SILTY SAND (SM), fine-grained Sand, with roots, dark brown, moist (TOPSOIL FILL)					
2.2		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, brown, moist		10-11 (21)			
643.9				9-9 (18)			
4.0		FILL: POORLY GRADED SAND (SP), fine to medium-grained Sand, light brown, moist	5	9-9 (18)			
639.9				8-6 (14)			
				6-7 (13)			
				7-6 (13)			
8.0	▽	POORLY GRADED SAND (SP), fine to medium-grained Sand, black, moist to wet, very loose to medium dense (ALLUVIUM)		3-3 (6)			
				3-4 (7)			
			10	2-3 (5)			
				2-2 (4)			
				1-2 (3)			
				4-7 (11)			
				3-3 (6)			
			15	4-7 (11)			
631.9							
16.0		END OF BORING Boring immediately backfilled with bentonite grout					Water observed at 10.0 feet while drilling. Cave-in depth of 11.0 feet immediately after withdrawal of auger.



Project ID: B1907847
Vert. Scale: 1"= 5"
Hor. Scale: NTS
Date: 08-07-2019

Fence Diagram
Geotechnical Evaluation
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, Wisconsin

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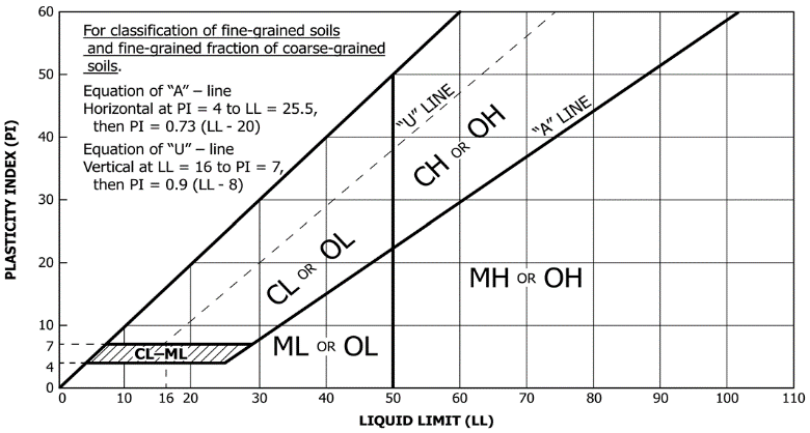
Descriptive Terminology of Soil

Based on Standards ASTM D2487/2488
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines[C])	$C_u \geq 4$ and $1 \leq C_c \leq 3$[D]	GW	Well-graded gravel[E]
			$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$)[D]	GP	Poorly graded gravel[E]
		Gravels with Fines (More than 12% fines[C])	Fines classify as ML or MH	GM	Silty gravel[E F G]
			Fines Classify as CL or CH	GC	Clayey gravel[E F G]
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines[H])	$C_u \geq 6$ and $1 \leq C_c \leq 3$[D]	SW	Well-graded sand[I]
			$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$)[D]	SP	Poorly graded sand[J]
		Sands with Fines (More than 12% fines[H])	Fines classify as ML or MH	SM	Silty sand[F G I]
			Fines classify as CL or CH	SC	Clayey sand[F G I]
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K L M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K L M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OL	Organic clay[K L M N] / Organic silt[K L M O]
	Silts and Clays (Liquid limit 50 or more)	Inorganic	PI plots on or above "A" line	CH	Fat clay[K L M]
			PI plots below "A" line	MH	Elastic silt[K L M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OH	Organic clay[K L M P] / Organic silt[K L M Q]
Highly Organic Soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

A. Based on the material passing the 3-inch (75-mm) sieve.
B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C. Gravels with 5 to 12% fines require dual symbols:
   GW-GM well-graded gravel with silt
   GW-GC well-graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. Sands with 5 to 12% fines require dual symbols:
   SW-SM well-graded sand with silt
   SW-SC well-graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
L. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
M. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
N. PI ≥ 4 and plots on or above "A" line.
O. PI < 4 or plots below "A" line.
P. PI plots on or above "A" line.
Q. PI plots below "A" line.



Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
  Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
  Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
  Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
  Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
  Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions[L, M]

trace..... 0 to 5%
little..... 6 to 14%
with..... ≥ 15%

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose ..... 0 to 4 BPF
Loose ..... 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils	Blows Per Foot	Approximate Unconfined Compressive Strength
Very soft	0 to 1 BPF	< 0.25 tsf
Soft	2 to 4 BPF	0.25 to 0.5 tsf
Medium	5 to 8 BPF	0.5 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF	> 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (▽), at the end of drilling (▼), or at some time after drilling (▼).

Laboratory Tests

DD	Dry density, pcf	**OC**	Organic content, %	**LL**	Liquid limit
WD	Wet density, pcf	**q_p**	Pocket penetrometer strength, tsf	**PL**	Plastic limit
P200	% Passing #200 sieve	**MC**	Moisture content, %	**PI**	Plasticity index
		q_U	Unconfined compression test, tsf		

3/2019

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Sieve Analysis Of Soil

ASTM D6913

8/6/2019

2309 Palace Street
La Crosse, WI 54603
Phone: 608-781-7277

Client:

STAR (Sports, Therapeutic and Adaptive Recreation) Association
PO Box 1024
Lacrosse, WI 54602

Project:

B1907847
Proposed STAR Center Facility
1319 and 1325 Saint Andrew Street
La Crosse, WI 54602

Sample Information

Sample Number: 258813
Depth (ft): 20
Sampling Method: Penetration Boring ASTM D1586
Sampled By: Contractor
Boring Number: ST-3
Location: Native Soil
Location Details: Proposed building footprint
Sample Date: 07/30/2019
Received Date: 07/31/2019
Lab: 2309 Palace Street, La Crosse, WI
Tested Date: 08/02/2019

Sieve Data

Sieve Size	Percent Passing	Specifications
4.75 mm (No. 4)	100	-
2 mm (No. 10)	100	-
850 µm (No. 20)	99	-
600 µm (No. 30)	96	-
425 µm (No. 40)	74	-
300 µm (No. 50)	22	-
250 µm (No. 60)	11	-
150 µm (No. 100)	3	-
75 µm (No. 200)	1.3	-

Classification: SP Poorly graded sand
Specimen Obtained: Moist
Test Method: Method A (Composite Sieving)
Dispersion Apparatus: Shaking

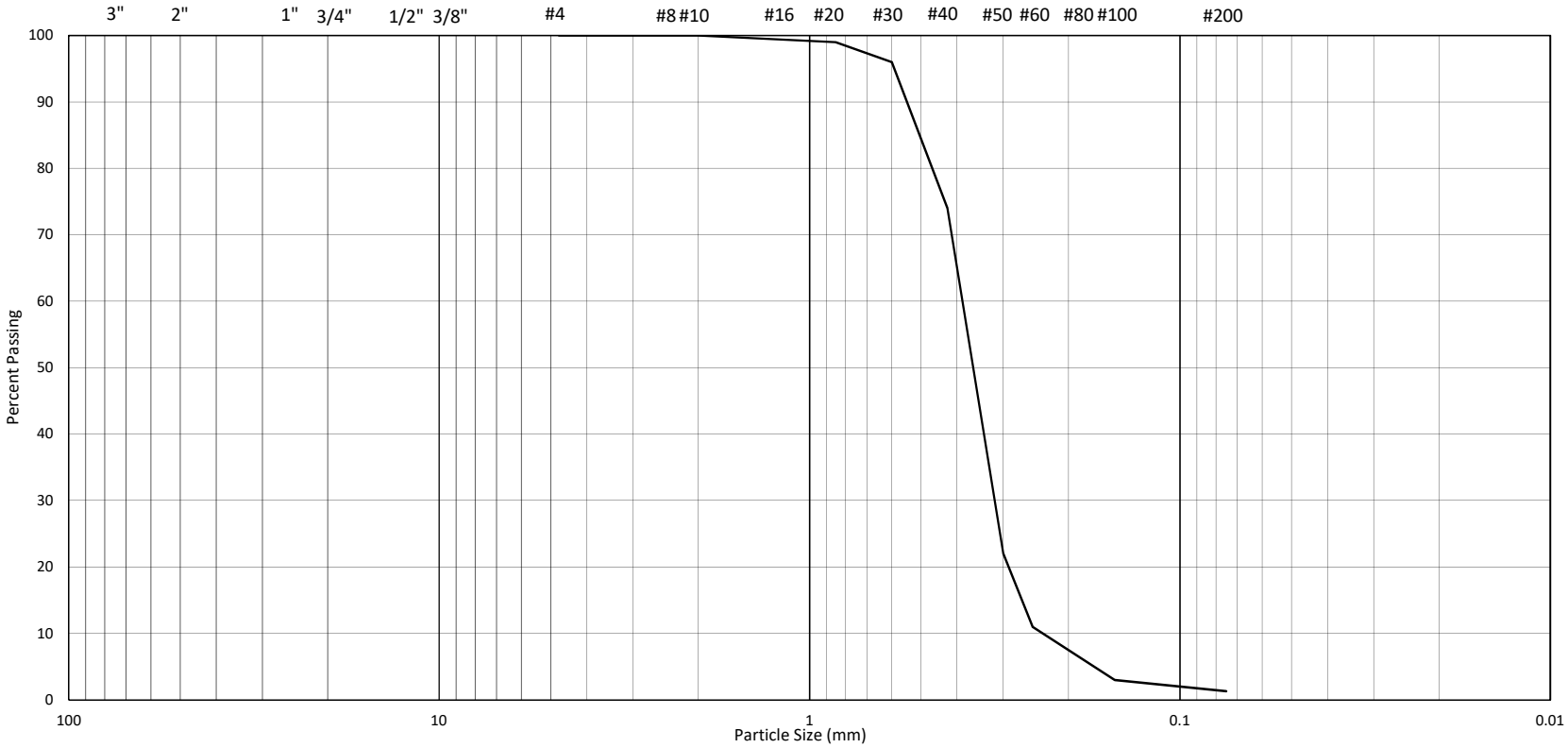
General

Results: The test is for informational purposes.

See Gradation G-01.pdf in the documents section at the end of this report.

Grain Size Accumulation Curve (ASTM)

Gravel		Sand			Fines
Coarse	Fine	Coarse	Medium	Fine	Silt & Clay



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Project Number	B1907847
Sample Number	G-01
Boring Number	ST-3
Depth	20

Gravel	0.0		
Sand	98.7		
Silt & Clay	1.3		
D60=	0.3910	Cu=	1.6
D30=	0.3190		
D10=	0.2380	Cc=	1.1

Classification

Brown Poorly Graded Sand (SP)

1002-CPS-23
Division of Industry Services
PO Box 2658
Madison, Wisconsin

Attachment 2:

SOIL AND SITE EVALUATION - STORM

In accordance with SPS 382.365, 385, Wis. Adm. Code, and WDNR Standard 1002

Attach a complete site plan on paper not less than 8 ½ x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent of slope, scale or dimensions, north arrow, and BM reference to nearest road. ***Please print all information*** Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m)]	County La Crosse Parcel I.D. 17-10289-40 Reviewed by: Date:

Property Owner: Stizo Development, LLC	Property Location Govt. Lot SW¼ NE¼ S29 T07 R16 W		
Property Owner's Mailing Address: PO Box 609	Lot	Block #	Subd. Name or CSM #
City, State Zip Phone Number La Crosse, WI 54602	☒ City ☐ Village ☐ Town La Crosse		Nearest Road Saint Andrew Street

Drainage Area _____ ☐ sq. ft. ☐ acres Test site suitable for (check all that apply): ☐ Bio-retention; ☐ Subsurface Dispersal System; ☐ Reuse; ☐ Irrigation ☒ Other	Hydraulic Application Test Method ☒ Morphological Evaluation ☐ Double Ring Infiltrometer Other: (specify)	Soil Moisture Date of soil Borings: July 30, 2019 USDA-NRCS WETS Value: ☐ Dry = 1; ☒ Normal = 2; ☒ Wet = 3.

ST-2 #OBS ☐ Pit ☒ Boring Ground surface Elevation 647.8 ft. Elevation of limiting factor 12 ft.

Horizon	Depth In.	Dominate Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr.
FILL	0 - 25	10YR 3/2	---	f.sl	0.sg.f	ml	c	0	< 20	0.50
FILL	25 - 36	10YR 3/3	---	f.ls	0.sg.f	ml	a	0	< 10	0.50
FILL	36 - 204	2.5Y 7/6	---	f.s	0.sg.f	ml	c	10	< 5	0.50
C	204 - 372	10YR 5/3	---	c.s	0.sg.c	ml	c	10	< 5	3.60

Comments: Groundwater was encountered at 12 feet while drilling and is a limiting layer. Seasonal and annual fluctuations of groundwater should also be anticipated.

ST-3 #OBS ☐ Pit ☒ Boring Ground surface Elevation 647.7 ft. Elevation of limiting factor 12 ft.

Horizon	Depth In.	Dominate Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr.
FILL	0 - 8	10YR 3/2	---	f.sl	0.sg.f	ml	c	0	< 20	0.50
FILL	8 - 144	10YR 4/4	---	f.s	0.sg.f	ml	g	0	< 5	0.50
FILL	144 - 204	10YR 4/1	---	f.ls	0.sg.f	ml	g	0	< 10	0.50
C	204 - 372	10YR 5/3	---	m.s	0.sg.m	ml	g	0	< 5	3.60

Comments: Groundwater was encountered at 12 feet while drilling and is a limiting layer. Seasonal and annual fluctuations of groundwater should also be anticipated.

Name: Benjamin R. Sullivan	Signature: Ben Sullivan	Credential Number: 1324025
Address: 2309 Palace Street, La Crosse, WI	Date of Evaluation: 8/2/2019	Phone Number: 608.781.7277

ST-5 #OBS ☐ Pit ☒ Boring Ground surface Elevation 647.6 ft. Elevation of limiting factor 9 ½ ft.

Horizon	Depth In.	Dominate Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr.
FILL	0 - 22	10YR 3/2	---	f.sl	0.sg.f	ml	c	0	< 20	0.50
FILL	22 - 72	10YR 4/4	---	f.ls	0.sg.f	ml	g	15	< 10	0.50
FILL	72 - 120	10YR 4/4	---	f.s	0.sg.f	ml	g	0	< 5	0.50
C	120 - 192	10YR 4/3	---	f.s	0.sg.f	ml	g	0	< 5	0.50

Comments: Groundwater was encountered at 9 ½ feet while drilling and is a limiting layer. Seasonal and annual fluctuations of groundwater should also be anticipated.

ST-6 #OBS ☐ Pit ☒ Boring Ground surface Elevation 647.9 ft. Elevation of limiting factor 10 ft.

Horizon	Depth In.	Dominate Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr.
FILL	0 - 26	10YR 3/2	---	f.sl	0.sg.f	ml	c	0	< 20	0.50
FILL	26 - 48	10YR 5/4	---	f.s	0.sg.f	ml	g	0	< 5	0.50
FILL	48 - 96	10YR 5/3	---	f.s	0.sg.f	ml	g	0	< 5	0.50
C	96 - 192	10YR 5/6	---	f.s	0.sg.f	ml	g	0	< 5	0.50

Comments: Groundwater was encountered at 10 feet while drilling and is a limiting layer. Seasonal and annual fluctuations of groundwater should also be anticipated.

Overall Site Comments: The site contains deep fills that consist of sandy soils. Groundwater was encountered at depths of 9 ½ to 12 feet across the site.

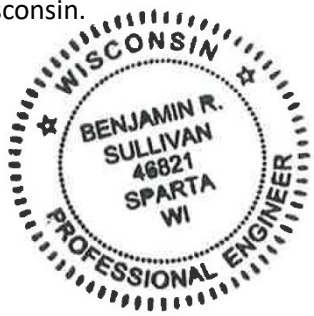
Geotechnical Evaluation Report

Proposed 5th Ward Residential Development
1325 Saint Andrew Street
La Crosse, Wisconsin

Prepared for

5th Ward Residence, LLC

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Wisconsin.



Benjamin R. Sullivan, PE
Project Engineer
License Number: 46821
August 25, 2021

BRAUN INTERTEC
The Science You Build On.

Project B2106376

Braun Intertec Corporation

BRAUN INTERTEC
The Science You Build On.

Braun Intertec Corporation
2309 Palace Street
La Crosse, WI 54603

Phone: 608.781.7277
Fax: 608.781.7279
Web: braunintertec.com

August 25, 2021 Project B2106376

Mr. Paul Borsheim
5th Ward Residence, LLC
2 Copeland Avenue, Suite 201
La Crosse, WI 54601

Re: Geotechnical Evaluation
Proposed 5th Ward Residential Development
1325 Saint Andrew Street
La Crosse, Wisconsin

Dear Mr. Borsheim:

We are pleased to present this Geotechnical Evaluation Report for the proposed 5th Ward Residential Development to be located at 1319 and 1325 Saint Andrew Street in La Crosse, Wisconsin.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Ben Sullivan or Brandon Wright at 608.781.7277 or by email at bsullivan@braunintertec.com or bwright@braunintertec.com.

Sincerely,

BRAUN INTERTEC CORPORATION

Benjamin R. Sullivan, PE
Project Engineer

Brandon K. Wright, PE
Senior Engineer

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Appendix

Soil Boring Location Sketch
Log of Boring Sheets (ST-1 to ST-18)
Fence Diagrams (ST-1 to ST-9 and ST-10 to ST-18)
Descriptive Terminology of Soil
Mechanical Sieve Analysis Test Reports
Wisconsin DNR – Soil Evaluation Storm Form

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the proposed design and construction of the 5th Ward Residential Development to be located at 1325 Saint Andrew Street in La Crosse, Wisconsin. The project will include design and construction of five new buildings including two five-story 72-unit apartment complexes with above grade parking under them, two two-story 7-unit townhomes with garage stalls and one single-story activity center. The project will also include associated site improvements including concrete and bituminous pavements, sidewalks, utilities, storm water drainage systems, and outdoor activity space. Table 1 provides the project details.

Table 1. Project Description

Aspect	Description
Proposed Apartment Complex Buildings	▪ Five-story, slab-on-grade, wood-framed and precast concrete structures. Each structure will have 72 units with 42 above grade parking stalls on the ground level of the structures. ▪ Approximately 84,325 square feet each. ▪ Based on our conversations with I & S Group, Inc., we have assumed that column loads will be 350 kips or less, wall loads will be 10,000 pounds per lineal foot (plf) or less, and interior floor slabs will support 250 pounds per square foot (psf) or less. ▪ According to preliminary grading plans provided by I & S Group, Inc., the proposed finished floor elevations of the apartment buildings are 648 feet. ▪ Based on the preliminary site grading plans fills of 2 feet or less from existing grades will be required to achieve finished floor elevation.
Proposed Townhome Buildings	▪ Two-story, slab-on-grade, wood-framed structures. Each structure will have 7 units with 8 garage stalls. ▪ Approximately 7,675 square feet each. ▪ Based on our conversations with I & S Group, Inc., we have assumed that column loads will be 100 kips or less, wall loads will be 5,000 plf or less, and interior floor slabs will support 100 psf or less. ▪ According to preliminary grading plans provided by I & S Group, Inc., the proposed finished floor elevations of the townhomes are 648.3 feet. ▪ Based on the preliminary site grading plans fills of 2 feet or less from existing grades will be required to achieve finished floor elevation.

Aspect	Description
Proposed Activity Center Building	▪ Single-story, slab-on-grade, wood-framed structure. ▪ Approximately 4,785 square feet. ▪ Based on our conversations with I & S Group, Inc., we have assumed that column loads will be 100 kips or less, wall loads will be 5,000 plf or less, and interior floor slabs will support 100 psf or less. ▪ According to preliminary grading plans provided by I & S Group, Inc., the proposed finished floor elevation of the activity center is 648 feet. ▪ Based on the preliminary site grading plans fills of 2 feet or less from existing grades will be required to achieve finished floor elevation.
Pavement and Assumed Traffic Loads	▪ Flexible bituminous pavements for existing pavement patching ▪ Rigid concrete pavements for the extension of Hagar Street and the parking lots and drive lanes throughout the development. ▪ Light-duty pavements: 50,000 ESALs* ▪ Medium-duty pavements: 150,000 ESALs* ▪ Cuts and fills of 2 feet or less from existing grades paved on preliminary site grading plans.

*Equivalent 18,000-lb single axle loads based on 20-year design for bituminous and 35-year design for concrete pavements.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

The figure below shows an illustration of the proposed site layout.

Figure 1. Preliminary Site Layout

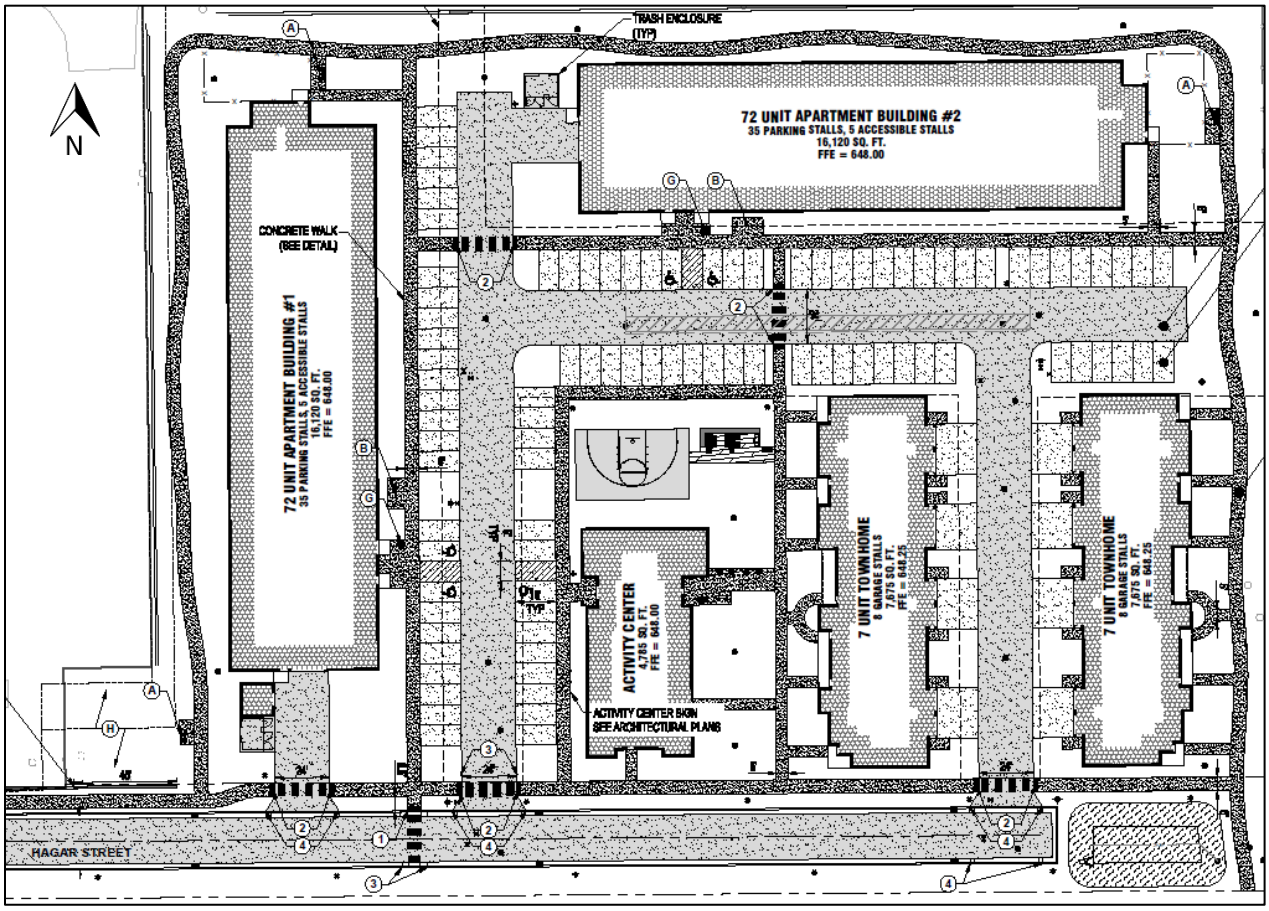


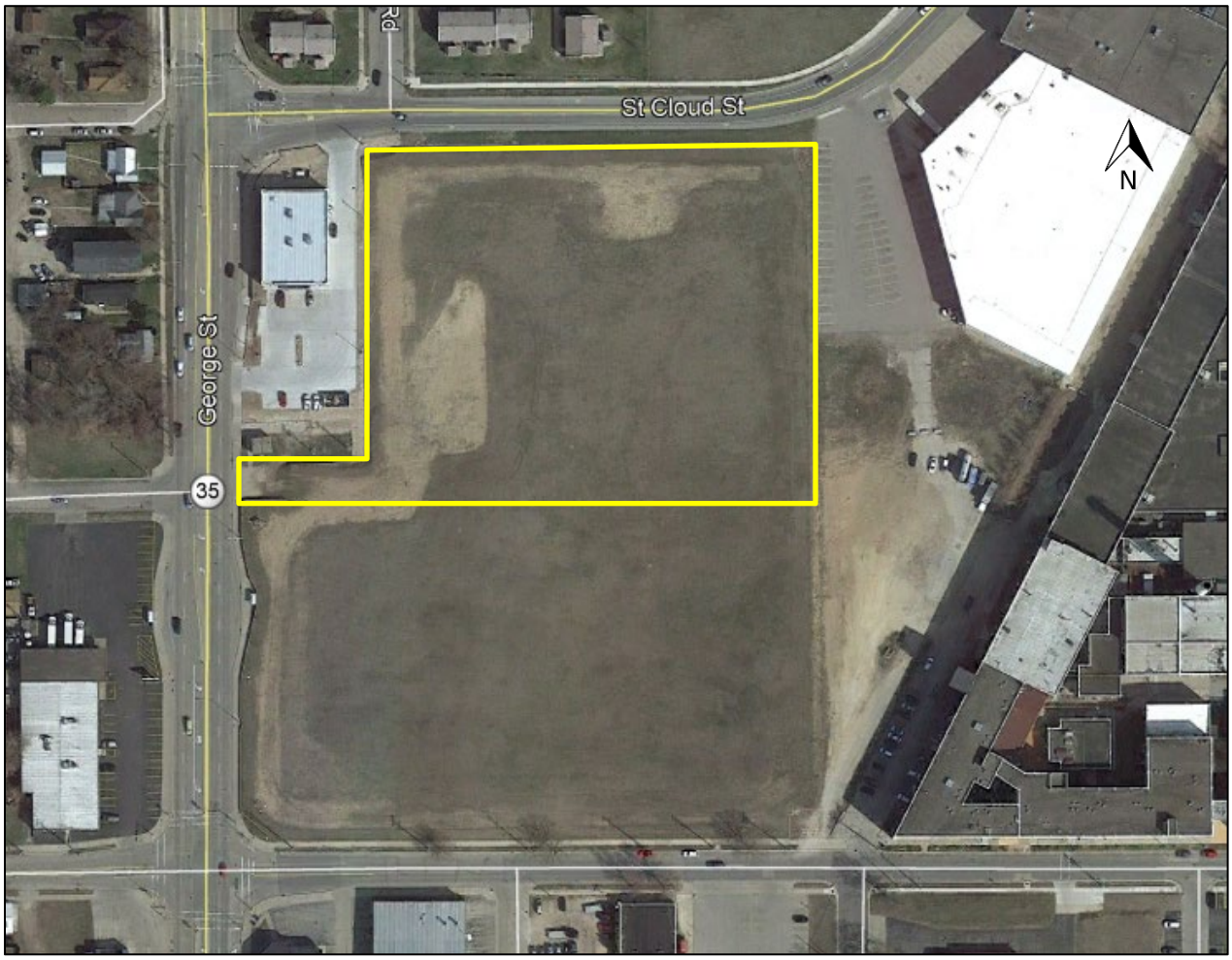
Figure provided by I & S Group, Inc., dated April 2, 2021.

A.2. Site Conditions and History

Based on our referenced documents and knowledge of the site, we understand the site was previously developed. The previous structure was demolished and backfilled. To our knowledge, earthwork associated with the backfill, including proper lift thickness, compaction effort, testing records, and documentation of the backfill was not conducted during the demolition process. In 2015, the site was elevated above the flood plain by importing approximately 60,000 cubic yards of soil, bringing the site to the approximate elevation of 647 ½ feet, leaving the underlying fill in place. The additional fill brought to the site was tested for in-place density and level of compaction.

The site currently exists as a vacant lot with surficial vegetation. Based on elevations at the boring locations, the site is relatively flat and has less than 1-foot of grade relief. The photograph below provides an aerial image of the site.

Photograph 1. Aerial Photograph of the Site



Photograph provided by Google Earth, dated April 2, 2021.

A.3. Purpose

The purpose of our geotechnical evaluation was to characterize subsurface geologic conditions at selected exploration locations, evaluate their impact on the project, and provide geotechnical recommendations for the design and construction of the proposed building foundations and floor slabs, pavements, underground utilities, and storm water drainage systems.

A.4. Background Information and Reference Documents

We reviewed the following information:

- Historical aerial photographs and topographic maps of the site.
- Geologic maps of La Crosse County, Wisconsin.
- Preliminary site layout plan prepared by I & S Group, Inc., dated April 2, 2021.
- Preliminary apartment complex building elevation, floor layout, and structural plans prepared by I &S Group, Inc., dated July 30, 2021.
- Preliminary townhome building elevation, floor layout, and foundation plans prepared by Master Craft Homes, dated March 1, 2021.
- Preliminary activity center building elevation and floor layout plans prepared by I & S Group, Inc., dated March 19, 2021.
- Final site grading plan prepared by Cedar Corporation, dated September 2015.
- Previous Geotechnical Evaluation Report prepared by Braun Intertec, project number B1407491, dated December 17, 2014.
- Previous Geotechnical Evaluation Report prepared by Braun Intertec, project number B1907847, dated August 15, 2019.
- Addendum to Final Case Closure with Continuing Obligations Letter Dated January 30, 2014; Former Trane Company Plant #6 Located at 606 George Street/1319 St. Andrew Street (f/k/a 1305 St. Andrew Street) La Crosse, Wisconsin WDNR BRRT Activity # 02-32-000195 & # 07-32-547753, dated April 30, 2015.
- Communications with the project team including 5th Ward Residence, LLC and I & S Group, Inc. regarding project details.

Our referenced documents and past project experience in the general area indicate that the site is underlain with engineered fill over uncontrolled fill and undocumented fill over buried topsoil and alluvial sand soils at depth.

A.5. Scope of Services

We performed our scope of services for the project in accordance with our Proposal QTB137044 to Mr. Paul Borsheim of 5th Ward Residence, LLC, dated April 13, 2021, and authorized on July 9, 2021. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.
- Staking and clearing the exploration location of underground utilities. We selected and we staked the boring exploration locations. We acquired the surface elevations and locations with GPS technology. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.
- Performing 18 standard penetration test (SPT) borings, denoted as ST-1 to ST-18, to nominal depths of 20 to 31 feet below grade across the site.
- Performing laboratory testing on select samples to aid in soil classification and engineering analysis.
- Preparing this report containing a boring location sketch, logs of soil borings, a summary of the soils encountered, results of laboratory tests, and recommendations for structure and pavement subgrade preparation and the design of foundations, floor slabs, exterior slabs, pavements, underground utilities, stormwater improvements.

Our scope of services did not include environmental services or testing, and we did not train the personnel performing this evaluation to provide environmental services or testing. We can provide these services or testing at your request.

B. Results

B.1. Geologic Overview

We based the geologic origins used in this report on the soil types, laboratory testing, and available interpreted knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Previous Geotechnical Information

We performed six soil borings at this site in October of 2014 and completed a Geotechnical Evaluation Report for a proposed site redevelopment. The previous evaluation was completed prior to the additional fill brought to the site to raise site grades above the flood plain to an approximate elevation of 647 ½ feet. Those borings encountered approximately 4 to 9 feet of uncontrolled and undocumented fill that contained pockets of debris including concrete, glass, bricks, and large voids over buried topsoil. Below the fill and buried topsoil, the borings encountered alluvial sand soils.

In July of 2019, we performed six additional soil borings on the south side of this parcel and completed a Geotechnical Evaluation Report for a proposed site development. This evaluation was completed after the additional fill was brought to the site to raise site grades above the flood plain to an approximate elevation of 647 ½ feet. Those borings encountered approximately 4 to 5 feet of engineered fill over uncontrolled and undocumented fill that extended to depths of approximately 8 to 17 feet below existing grades. Buried topsoil was not encountered but was likely present based on the previous site evaluation. Below the fill, the borings encountered alluvial sand soils.

B.3. Boring Results

Table 2 provides a summary of the soil boring results; in the general order we encountered the strata. Please refer to the Log of Boring sheets in the Appendix for additional details. The Descriptive Terminology sheets in the Appendix include definitions of abbreviations used in Table 2.

Table 2. Subsurface Profile Summary*

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Topsoil Fill	SP, SP-SM, SM	---	▪ Topsoil fill was encountered at the ground surface in all borings except ST-9, ST-11, and ST-15. ▪ The topsoil fill consisted of poorly graded sand (SP), poorly graded sand with silt (SP-SM), and silty sand (SM) with roots and various amounts of gravel that was dark brown in color and was dry to moist. ▪ Thicknesses at the boring locations varied from less than ½-foot to about 1-foot.
Engineered Fill	SP, SP-SM, SM	5 to 55 BPF	▪ Engineered fill was encountered below the topsoil fill and at the surface in all borings and extended to depths of about 4 to 5 feet. ▪ This fill was placed in 2015 to elevate the site above the flood plain and was tested for in-place density and level of compaction during placement. ▪ The fill consisted of fine- to medium-grained poorly graded sand (SP), poorly graded sand with silt (SP-SM), and silty sand (SM) that contained various amounts of gravel and was brown, tan, and yellow in color and was moist.
Undocumented Fill	SP, SP-SM, SM, CL, OL	3 to 45 BPF	▪ Undocumented fill was encountered in all borings below the engineered fill and extended to depths of approximately 8 to 15 feet. ▪ General penetration resistance suggests the fill received variable compaction. ▪ The fill consisted of fine- to medium-grained poorly graded sand (SP), poorly graded sand with silt (SP-SM), silty sand (SM), sandy lean clay (CL), and organic clay (OL) that was light brown, brown, dark brown, tan, black, and yellowish brown in color and was moist to wet. ▪ The fill contained various amounts of gravel, intermixed clay, silt, and gravel seams. ▪ Contained trace amounts of debris including concrete and brick as well as organic matter.
Buried Topsoil	SM, SC, OL	2 to 25 BPF	▪ Buried topsoil was encountered in Borings below the undocumented fill and extended to depths of approximately 11 ½ to 17 feet. ▪ Thicknesses at boring locations varied from about 2 feet to 5 feet. ▪ The buried topsoil consisted of fine-grained silty sand (SM), clayey sand (SC), and organic clay (OL) that slightly organic to organic and was dark brown and black in color and was moist to wet.

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Alluvium	SP, SP-SM	4 to 28 BPF	▪ Alluvial soils were encountered in all borings below the topsoil fill, fill, and buried topsoil and extended to the termination depths of our borings. ▪ Consisted of fine- to coarse-grained poorly graded sand (SP) and poorly graded sand with silt (SP-SM) that contained with traces of gravel that was brown and gray in color and wet. ▪ Penetration resistance testing in the sandy alluvial soils indicates they are very loose to medium dense in relative density.

*Abbreviations defined in the attached Descriptive Terminology sheets.

B.4. Groundwater

Table 3 summarizes the depths where we observed groundwater; the attached Log of Boring sheets in the Appendix also include this information and additional details. Corresponding groundwater elevations were determined from comparisons of the measured and estimated depths to groundwater and surface elevations and were rounded to the nearest ½-foot.

Table 3. Groundwater Summary

Boring Location	Surface Elevation (feet)	Measured or Estimated Depth to Groundwater (feet)	Corresponding Groundwater Elevation (feet)
ST-1	647.1	12 ½	634 ½
ST-2	646.9	12 ½	634 ½
ST-3	647.2	14	633 ½
ST-4	647.1	12 ½	634 ½
ST-5	647.5	12 ½	635
ST-6	647.1	12 ½	634 ½
ST-7	647.4	14	633 ½
ST-8	647.1	12 ½	634 ½
ST-9	647.5	15	632 ½
ST-10	647.5	14	633 ½
ST-11	647.6	12 ½	635
ST-12	647.5	12 ½	635

Boring Location	Surface Elevation (feet)	Measured or Estimated Depth to Groundwater (feet)	Corresponding Groundwater Elevation (feet)
ST-13	647.5	15	632 ½
ST-14	647.3	12 ½	635
ST-15	647.5	12 ½	635
ST-16	647.4	12 ½	635
ST-17	647.4	12	635 ½
ST-18	647.4	14	633 ½

At the time of our observation, we observed groundwater at depths of 12 to 15 feet as our borings were advanced. These depths correspond to elevation 632 ½ to 635 ½ feet. Seasonal and annual fluctuations of groundwater should also be anticipated.

B.5. Environmental Discussion

We understand contaminated soil, slag, and rubble were identified in Wisconsin Department of Natural Resources (WDNR) approved NR700 Remedial Action Plan. The cleanup site is register as WDNR BRRTS #02-32-000195 and #07-32-547753. Continuing obligations remain associated with the site. It is imperative that a soil management plan be developed and implemented prior to any earthwork taking placed in the impacted areas. The soil management plan will provide direction to properly handle all impacted soils properly during all aspects of the new construction. The client has indicated they have retained Bay West, LLC, an environmental consultant to provide environmental management of the project.

B.6. Laboratory Test Results

The following sections summarize our laboratory testing results. Laboratory testing was completed in general accordance with ASTM standards.

B.6.a. Mechanical Sieve Analysis Tests

We performed mechanical sieve analyses (ASTM C136) on a selected sample to assist in soil classification and particle size analysis. The test indicated the sample tested classified as poorly graded sand (SP) and poorly graded sand with silt (SP-SM). The Log of Boring sheets present the moisture content and percent passing a #200 sieve results and the Appendix includes a graph showing the results of the mechanical sieve analysis.

B.6.b. Moisture Content, Particles Passing a #200 Sieve, and Organic Content Tests

Results of our laboratory tests for soil classification, moisture content, particles passing a #200 sieve, and organic content are presented below in Table 4.

Table 4. Laboratory Classification Test Results

Boring Location	Sample Depth (feet)	USCS Soil Classification	Moisture Content (w, %)	Percent Passing a #200 Sieve	Organic Content (%)
ST-1	2 ½	FILL: SM	8	36	---
ST-1	10	SM	20	---	3
ST-1	15	SP	22	2	---
ST-2	10	SM	11	---	3
ST-3	2 ½	FILL: SM	7	18	---
ST-3	10	FILL: SM	13	17	---
ST-4	7 ½	FILL: SP-SM	7	6	---
ST-5	7 ½	FILL: SP-SM	8	9	---
ST-5	10	FILL: SP-SM	11	---	3
ST-6	7 ½	FILL: SM	15	---	5
ST-6	10	FILL: SM	19	---	---
ST-7	5	FILL: SP	8	5	---
ST-7	7 ½	FILL: OL	26	---	7
ST-7	12 ½	SC	23	---	4
ST-7	15	SC	35	---	---
ST-8	7 ½	FILL: SP	16	5	---
ST-8	12 ½	FILL: SM	28	---	---
ST-8	15	OL	51	---	6
ST-8	17 ½	SP	21	2	---
ST-9	15	SP	17	3	---
ST-10	2 ½	FILL: SP	7	3	---
ST-10	15	SP	20	---	---
ST-11	7 ½	FILL: SM	10	13	---
ST-11	15	SP	18	---	---
ST-11	17 ½	SP	21	4	---
ST-12	7 ½	FILL: SP-SM	9	10	---
ST-13	5	FILL: CL	22	67	---

Boring Location	Sample Depth (feet)	USCS Soil Classification	Moisture Content (w, %)	Percent Passing a #200 Sieve	Organic Content (%)
ST-14	12 ½	FILL: SP	19	5	---
ST-14	15	SC	36	---	4
ST-15	5	FILL: SP-SM	11	12	---
ST-16	10	FILL: SP-SM	13	7	---
ST-17	2	FILL: SM	9	26	---
ST-17	8	FILL: SP-SM	15	11	---
ST-17	12	SC	21	---	3
ST-18	4	FILL: SM	11	27	---
ST-18	8	FILL: SM	15	---	---
ST-18	12	OL	19	---	5
ST-18	16	SP-SM	20	11	---

C. Basis for Recommendations

C.1. Design Discussion

C.1.a. Introduction

The site contains unsuitable materials including undocumented fill and buried topsoil that extends to depths of approximately 11 ½ to 17 feet across the site, corresponding to elevation 630 to 636 feet. The fill was noted to have variable compaction and consistency and contained trace amounts of debris and organics, and the buried topsoil could be compressible. These findings are consistent with previous subsurface explorations at the site. These materials are not suitable for support of the proposed buildings. To limit post-construction settlement, the buildings should be supported on improved subgrades or intermediate foundation systems. After discussing this with the project team including 5th Ward Residences, LLC and I & S Group, Inc., we developed our recommendations for improving subgrades by installation of rammed aggregate piers.

C.1.b. Building Foundation and Slab Support

As mentioned above, to reduce the risk of future excessive building and site settlements, it is our opinion the proposed buildings will need to be supported on intermediate foundations. The proposed building foundations and interior floor slabs should be supported on rammed aggregate piers.

Alternatively, if the owner is willing to accept the risk of some settlement, then the fill below the interior floor slabs could be surface-compacted and left in place under the activity center building and townhome buildings provided the building foundations are supported on rammed aggregate piers. The amount of settlement associated with this approach is dependent on the amount of compacted soil below the interior floor slabs and the composition of the existing fill left in place but is expected to be less than 1-inch under the assumed loads. There is some risk associated with this alternate approach. The recommendations and parameters discussed below are based on the conditions encountered in our borings and our experiences on similar sites. Please note that actual settlements will vary and could be much higher if voids or compressible materials are concealed by the fill. The owner needs to accept the additional risk of differential settlement by leaving the fill in place, in return for the cost savings. These risks can be reduced through additional testing and observations but cannot be eliminated unless the fill is removed in its entirety, or an intermediate foundation system is used to support all components of the proposed buildings.

C.1.c. Pavements

Areas receiving new pavements should be prepared by removing the topsoil fill and surficial vegetation from below the proposed pavement subgrade elevations and be replaced with compacted granular fill. These materials are anticipated to be about 1-foot thick or less. Prior to elevating or placing additional fill required, the exposed subgrade soils should be surface compacted to densify and enhance uniformity of the exposed soils. The fill present below these materials appeared to be free of debris and can be left in place provided it is evaluated for suitability at the time of construction. If the fill is considered suitable, it should be surface-compacted. If the fill is unsuitable, additional sub-cuts and subgrade improvements may be required. A proofroll should also be performed after the aggregate base material is in place, and prior to placing bituminous or concrete pavement.

C.2. Construction Considerations

From a construction perspective, the project team should also be aware that:

- Excavations will penetrate the groundwater surface at a depth of approximately 12 to 15 feet. Dewatering will be required for excavations (particularly for installation of underground utilities with deep invert elevations) that extent below elevation 636 feet to facilitate an evaluation of the geologic materials exposed in the excavation sides and bottoms, and the placement and compaction of backfill.

- The on-site existing fill can be considered for re-use as backfill and additional required fill provided debris and organic soils are first removed. The alluvial soils can also be considered for reuse as backfill and additional required fill.

- Imported material needed to replace excavation spoils or balance cut and fill quantities, should consist of sandy soils having less than 20 percent of the particles by weight passing a #200 sieve. Soil needed to facilitate drainage should consist of sand and gravel soils with less than 5 percent passing a #200 sieve.

D. Recommendations

D.1. Earthwork

D.1.a. Building Subgrade Preparation

We recommend removing the topsoil fill and surficial vegetation from below the proposed building footprints and their oversize areas. To provide support for construction equipment for installation of the rammed aggregate piers, we recommend the building pad be filled to subgrade elevation with granular soils having less than 20 percent passing a #200 sieve followed by a minimum of 6 inches of crushed aggregate base material.

A geotechnical representative should observe the excavations to make the necessary field judgments regarding the suitability of the exposed soils.

D.1.b. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will consist of sandy fill and alluvial sand soils. These soils are considered Type C Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type C soils should have a gradient no steeper than 1 ½H:1V. Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, “Excavations and Trenches.” This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

D.1.c. Excavation Dewatering

We do not anticipate dewatering will be required for this project but could be necessary during the installation of underground utilities depending on the final design invert elevations. We recommend removing groundwater from the excavations. Project planning should include temporary sumps and pumps for excavations where groundwater is encountered. Dewatering of high-permeability soils (e.g., sands) from within the excavation with conventional pumps has the potential to loosen the soils, due to upward flow. If excavations will be opened for an extended period, then a dewatering contractor should develop a dewatering plan; the design team should review this plan.

D.1.d. Surface Compaction

We recommend that exposed soils be surface compacted prior to placing additional required fill, footings, and floor slabs for the proposed buildings and pavement areas. This will densify and enhance uniformity of the exposed soils. We recommend surface compacting the exposed soils with a minimum of five passes by a large (minimum diameter of 3 ½ feet), smooth-drum compactor. Areas that yield or pump during surface compaction may require additional sub-cutting.

D.1.e. Engineered Fill Materials and Compaction

We recommend spreading fill in loose lifts of approximately 12 inches thick. Table 5 below contains our recommendations for fill materials, gradation, and minimum compaction level for compacted fills.

Table 5. Soil for Fill Description*

Fill Classification	Locations to Be Used	Fill Source and Soil Descriptions	Gradation	Relative Compaction, percent (ASTM D1557 – Modified Proctor)
Structural Fill	▪ General site grading ▪ Elevating the building pad to finished floor elevation ▪ Interior and exterior foundation wall backfill ▪ Below interior floor slabs and exterior slabs	On-site fill free of debris and organics or imported sand and gravel consisting of GP, GW, SW, SP, SP-SM, SP-SC, SM, SC	100% passing 2-inch sieve <20% passing #200 sieve < 2% Organic Content (OC)	95
Trench Backfill	Utility trench backfill	On-site soils free of debris and organics or imported sand and gravel consisting of GP, GW, SW, SP, SP-SM, SP-SC, SM, SC	100% passing 2-inch sieve <20% passing #200 sieve < 2% OC	95

Fill Classification	Locations to Be Used	Fill Source and Soil Descriptions	Gradation	Relative Compaction, percent (ASTM D1557 – Modified Proctor)
Non-Frost-Susceptible Fill	Non-frost-susceptible below building entry slabs	Imported sand or gravel: GP, GW, SP, SW	100% passing 1-inch sieve < 50% passing #40 sieve < 5% passing #200 sieve < 2% OC	95
Non-Structural Fill	Below landscaped surfaces, where subsidence is not a concern	On-site soils and imported soils	100% passing 6-inch sieve < 10% OC	90

* More select soils comprised of coarse sands with < 5% passing #200 sieve may be needed to accommodate work occurring in periods of wet or freezing weather.

Sandy soil with less than 12 percent particles by weight passing a number 200 sieve may be compacted without moisture conditioning, although, some water may be needed to achieve compaction. Silty sand, soils used as backfill should be moisture conditioned to between 1 percent below to 3 percent above their optimum moisture content.

The project documents should not allow the contractor to use frozen material as fill or to place fill on frozen material. Frost should not penetrate under foundations or slabs during construction.

We recommend performing density tests in fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

D.2. Foundation Support on Rammed Aggregate Piers

D.2.a. Rammed Aggregate Piers

Based on the anticipated depth of excavations needed to remove the existing fill from the proposed building footprints and their oversize areas, it appears that conventional soil corrections would add a significant cost to the project. Thus, based on discussions with the project team, we recommend installing rammed aggregate piers.

A subgrade improved with rammed aggregate piers will reduce the potential for detrimental settlement associated with the existing fill to occur, provide adequate bearing capacity, eliminate the need for deep excavations, reduce the need to dewatering excavations, reduce the need to handle contaminated soils (if encountered), reduce impacts to adjacent site features, and reduce the volume of subgrade soils disturbed at this site.

Different contractors use varying techniques to construct rammed aggregate piers, but generally consist of excavating soil from a hole with an auger or vibrating a probe into the ground, and then building a column of clean, open-graded aggregate. The contractor constructs the pier by placing the aggregate in lifts from the bottom of the pier and compacting each lift before placing aggregate for the subsequent lift. The vibratory energy, and sometimes ramming action, causes the aggregate to interlock, forming a stiff pier that provides soil reinforcement and increases shear resistance. Due to the many variations in techniques, we recommend using performance-based specifications with design-build contracting. We recommend requiring the contractor to have at least five years of experience in performing this work, and to demonstrate performing the proposed protection system(s) on at least three previous projects of similar size and scope. The specifications should require the design engineer be licensed in the project state. We can assist you with developing a list of pre-qualified contractors prior to bidding or with reviewing contractor experience as part of the bidding process.

Rammed aggregate piers are a Special Inspection item in accordance with Chapter 17 of the IBC. The observations should include installed length, consistency of soil profile with the geotechnical evaluation confirmation of the materials, and confirmation of installation techniques.

We recommend installing rammed aggregate piers under foundations for all the proposed buildings. The rammed aggregate piers should extend through the existing fill to bear within the alluvial sand soils at depth.

Note, this approach may encounter installation difficulties in the engineered fill near the surface and if large objects or debris cannot be penetrated in the undocumented fill with installation equipment. The pier installation contractor may find it necessary to pre-drill locations where installation difficulties are encountered. For this reason, the project team should also consider exploratory test pits throughout the proposed building locations which may provide more details and information to aid in preconstruction planning.

D.2.b. Spread Footing Design Parameters

Table 6 below contains our design parameters for foundations supported on rammed aggregate piers.

Table 6. Recommended Spread Footing Design Parameters on Rammed Aggregate Piers

Item	Description
Bearing Soils	Footings shall be supported on improved subgrades by means of rammed aggregate piers in accordance with Section D.2.
Maximum net allowable bearing pressure (psf) Interior column pad footings Perimeter strip footings	Determined by aggregate pier designer.
Minimum embedment below final exterior grade for heated structures (inches)	48
Minimum embedment below final exterior grade for unheated structures or for footings not protected from freezing temperatures during construction (inches)	60
Total and Differential settlement	Typically, less than 1-inch and ½-inch, respectively. *

* Actual settlement amounts will depend on final loads, foundation layout, and design criteria from aggregate pier designer.

D.3. Interior Floor Slabs

D.3.a. Subgrade Modulus

We recommend the interior floor slabs be supported on rammed aggregate piers that extend through the existing fill to bear on the alluvial sand soils at depth for all the proposed buildings. The aggregate pier designer will provide a modulus of subgrade reaction for slab design based on the pier layout and load transfer platform design.

Alternatively, if the owner is willing to accept the risk of some settlement, then the interior floor slabs for the activity center building and townhome buildings could be supported on the existing fill provided it is surface compacted prior to place additional fill required or concrete. We recommend the interior floor slabs for the apartment complex buildings remain supported on rammed aggregate piers based on the anticipated floor loads. Interior floor slabs supported on surface compacted engineered fill may be designed using a modulus of subgrade reaction, k, of 200 pounds per square inch per inch of deflection (pci). If the slab design requires placing 6 inches of compacted crushed aggregate base immediately below the slab, the slab design may increase the k-value by 50 pci. We recommend that the aggregate base materials be free of bituminous. In addition to improving the modulus of subgrade reaction, an aggregate base facilitates construction activities and is less weather sensitive.

There is an elevated risk of settlement with this alternate approach based on the nature of the fill and that the fill could contain voids or compressible materials. The owner needs to accept the additional risk of differential settlement by leaving a portion of the fill in place, in return for the cost savings. These risks can be reduced through additional testing and observations but cannot be eliminated unless all the interior slabs are supported on rammed aggregate piers.

D.3.b. Moisture Vapor Protection

Excess transmission of water vapor could cause floor dampness, certain types of floor bonding agents to separate, or mold to form under floor coverings. If project planning includes using floor coverings or coatings, we recommend placing a vapor retarder or vapor barrier immediately beneath the slab. We also recommend consulting with floor covering manufacturers regarding the appropriate type, use and installation of the vapor retarder or barrier to preserve warranty assurances.

D.4. Frost Protection

We consider the sandy fill to be non- to slightly-frost susceptible. Unfavorable amounts of heaving could occur if these soils become saturated and freeze. Soils with silt and clay content over 7 percent will have an elevated potential to heave when frozen and reduced strength during spring thaw. Site grades should be graded to promote drainage of the pavement areas and help limit the potential for saturation and subsequent heaving to occur. Over the life of the pavement or slab, cracks may develop, and joints may open, which will expose the subgrade and allow water to enter the subgrade. This water entering the subgrade increases the likelihood of heave. It will be critical that the owner develop a detailed maintenance program to repair any cracks and joints that may develop during the useful life of the various surface features.

The maintenance program should pay special attention to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

D.5. Pavements and Exterior Slabs

D.5.a. Pavement Subgrade Preparation

We recommend areas receiving new pavement be prepared by removing the topsoil fill and surficial vegetation from below the proposed pavement subgrade elevations and be replaced with compacted granular fill. These materials are anticipated to be about 1-foot thick or less. Prior to placing additional fill required, we recommend surface compacting the exposed subgrade soils to densify and enhance uniformity of the exposed soils. The fill present below these materials appeared to be free of debris and could be left in place provided it is evaluated for suitability at the time of construction. If the fill is considered suitable, it should be surface compacted. If the fill is considered to be unsuitable, additional sub-cuts and subgrade improvements may be required.

D.5.b. Proofroll

We recommend performing a proofroll with a fully loaded tandem-axle truck after the aggregate base material is in place, and prior to placing bituminous or concrete pavement to located loose, soft, and weak subgrade materials. The contractor should correct areas that display excessive yielding or rutting (1-inch or more) during the proofroll, as determined by the geotechnical representative. Possible options for subgrade correction include moisture conditioning and re-compaction or sub-cutting and replacement with soil or crushed aggregate.

D.5.c. Pavement Design Sections

Our scope of services for this project did not include laboratory tests on subgrade soils to determine a California Bearing Ratio (CBR) value for pavement design. Based on our experience with similar sand soils anticipated at the pavement subgrade elevation, we recommend pavement design assume a CBR-value of 15. Note the contractor may need to perform limited removal of unsuitable or less suitable soils and surface compact subgrade soils to achieve this value. Table 7 provides recommended light- and medium-duty bituminous pavement sections, based on the soils estimated support and assumed traffic loads provided in Table 1 in Section A.1 above.

Table 7. Recommended Bituminous Pavement Sections

Pavement Material	Light-Duty Pavements Thickness/Preparations	Medium-Duty Pavements Thickness/Preparations
Minimum Bituminous Thickness (in.)	3 ½	4 ½
Minimum Aggregate Base Thickness (in.)	8	10
Subgrade Preparation	Surface compact, then proofroll after placement of aggregate base to locate loose or weak subgrade materials prior to placement of pavement materials.	

For concrete pavements based upon the assumed traffic loads, and an estimated modulus of subgrade reaction (k) of 200 pci, we recommend light- and medium-duty concrete pavement sections as shown in Table 8 below.

Table 8. Recommended Concrete Pavement Sections

Pavement Material	Light-Duty Pavements Thickness/Preparations	Medium-Duty Pavements Thickness/Preparations
Minimum Concrete Thickness (in.)	5	6
Minimum Aggregate Base Thickness (in.)	4	6
Subgrade Preparation	Surface compact, then proofroll after placement of aggregate base to locate loose or weak subgrade materials prior to placement of pavement materials.	

D.5.d. Concrete Pavements

We recommend specifying concrete for pavements that has a minimum 28-day compressive strength of 4,500 psi, and a modulus of rupture (Mr) of at least 650 psi. We also recommend Type I or Type II cement meeting the requirements of ASTM International C 150. We recommend specifying 4.5 to 7.5 percent entrained air for exposed concrete to provide resistance to freeze-thaw deterioration. We also recommend using a water/cement ratio of 0.42 or less for concrete exposed to deicers.

We assumed the concrete pavement sections in Table 8 will have edge support. We recommend placing an aggregate base below the pavement to provide a suitable subgrade for concrete placement, reduce faulting, and help dissipate loads. Appropriate mix designs, panel sizing, jointing, doweling, and edge reinforcement are critical to performance of rigid pavements. We recommend you contact your civil engineer for the final design.

D.5.e. Bituminous Pavement Materials

Appropriate mix designs are critical to the performance of flexible pavements. We recommend utilizing hot mix asphalt meeting the specifications of Wisconsin Department of Transportation (WisDOT) Section 460. We recommend utilizing a nominal 12.5 mm gradation for the base course and a nominal 9.5 mm gradation for the surface course as defined in Table 460-1 in Section 460.2.2.3. We recommend the Performance Graded Asphalt cement be a PG 58-28.

D.5.f. Pavement Materials and Compaction

Table 9 below contains our recommendations for fill materials, minimum compaction level, and moisture content for compacted fills.

Table 9. Recommended Pavement Materials and Compaction

Locations To Be Used	Fill Source and Soil Descriptions	Gradation	Relative Compaction, percent (ASTM D1557 – Modified Proctor)	Moisture Content Variance from Optimum, percentage points
Dense Graded Base	Imported aggregate	WisDOT Standard Spec 305 Dense Graded Base	95	-3 to +3 for aggregate base
Granular Subbase	Imported sand and gravel	WisDOT Standard Spec 209 Grade 1 or Grade 2	95	-6 to +3 for granular subbase
Pavement subgrades and grading	On-site soils free of debris and organics	100% passing 3-inch sieve < 2% OC	95	-6 to +3 for pavement subgrade

D.5.g. Performance and Maintenance

We based the above pavement designs on a 20-year performance life for bituminous pavements and a 35-year life for concrete pavements. This is the amount of time before we anticipate the pavement will require reconstruction. This performance life assumes routine maintenance, such as seal coating and crack sealing. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.

It is common to place the binder (base) course of bituminous and then delay placement of wear course. For this situation, we recommend evaluating if the reduced pavement section will have sufficient structure to support construction traffic.

Many conditions affect the overall performance of the exterior slabs and pavements. Some of these conditions include the environment, loading conditions and the level of ongoing maintenance. Regarding bituminous pavements, it is common to have thermal cracking develop within the first few years of placement and continue throughout the life of the pavement. We recommend developing a regular maintenance plan for filling cracks in exterior slabs and pavements to lessen the potential impacts for cold weather distress due to frost heave or warm weather distress due to wetting and softening of the subgrade.

Note if debris laden fill is left in place, more than normal maintenance should be anticipated.

D.6. Underground Utilities

D.6.a. Subgrade Stabilization

Earthwork activities associated with utility installations located inside the building area should adhere to the recommendations in Section D.1.

For exterior utilities, we anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions such as soft clay, organic soils or perched water at invert grades, the unsuitable soils may require some additional subcutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

D.6.b. Corrosion Potential

A majority of the soil borings indicated the site predominantly consists of sandy soils. We consider these soils non- to slightly-corrosive to metallic conduits. If utilities extend through clay soils, we recommend bedding the utilities in sandy soil free of any clay lumps or constructing the utilities with non-corrosive materials.

D.6.c. Backfill

Utility trench backfill should adhere to the recommendations in Section D.1.e above.

D.7. Stormwater

Borings ST-17 and ST-18 were drilled and sampled continuously to depths of approximately 20 feet for the proposed storm water drainage system locations. The borings encountered fill, buried topsoil, and alluvial soils consisting of fine- to medium-grained loamy sand, sandy loam, clayey sand, and sand. Groundwater was encountered at depths of 12 to 15 feet as our borings were advanced. These depths correspond to an elevation of 632 ½ to 635 ½ feet and are the elevations of the limiting factor per the Wisconsin DNR. Seasonal and annual fluctuations of groundwater should also be anticipated.

Infiltration rates associated with the soils present at this location are included on the Soil Evaluation – Storm form included in the Appendix of this report. The reported infiltration rates were determined by referencing Table 2 in the Wisconsin DNR Storm Water Infiltration Technical Standard 1002, dated September 2017.

Fine-grained soils (silts and clays), topsoil or organic matter that mixes into or washes onto the soil will lower the permeability. The contractor should maintain and protect infiltration areas during construction. Furthermore, organic matter and silt washed into the system after construction can fill the soil pores and reduce permeability over time. Proper maintenance is important for long-term performance of infiltration systems.

This geotechnical evaluation does not constitute a review of site suitability for storm water infiltration or evaluate the potential impacts, if any, from infiltration of large amounts of storm water.

D.8. Equipment Support

The recommendations included in the report may not be applicable to equipment used for the construction and maintenance of this project. We recommend evaluating subgrade conditions in areas of shoring, scaffolding, cranes, pumps, lifts and other construction equipment prior to mobilization to determine if the exposed materials are suitable for equipment support, or require some form of subgrade improvement. We also recommend project planning consider the effect that loads applied by such equipment may have on structures they bear on or surcharge – including pavements, buried utilities, below-grade walls, etc. We can assist you in this evaluation.

E. Procedures

E.1. Penetration Test Borings

We drilled the penetration test borings with a floatation tire-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 ½- or 5-foot intervals in general accordance with ASTM D1586. The boring logs show the actual sample intervals and corresponding depths.

We sealed penetration test boreholes meeting the Wisconsin Administrative Code NR 141.25 criteria using 3/8-inch bentonite chips and auger cuttings. A copy of the sealing record can be obtained upon request.

E.2. Exploration Logs

E.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials and present the results of penetration resistance tests performed. The logs also present the results of laboratory tests performed on penetration test samples and groundwater measurements. The Appendix also includes a Fence Diagram intended to provide a summarized cross-sectional view of the soil profile across the site.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

E.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance testing performed for the project, (4) laboratory test results, and (5) available interpreted knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

E.3. Material Classification and Testing

E.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

E.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM procedures.

E.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes as noted on the boring logs.

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

We developed our evaluation, analyses, and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation, and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

F.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

We based this report on a limited amount of information, and we made several assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

F.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

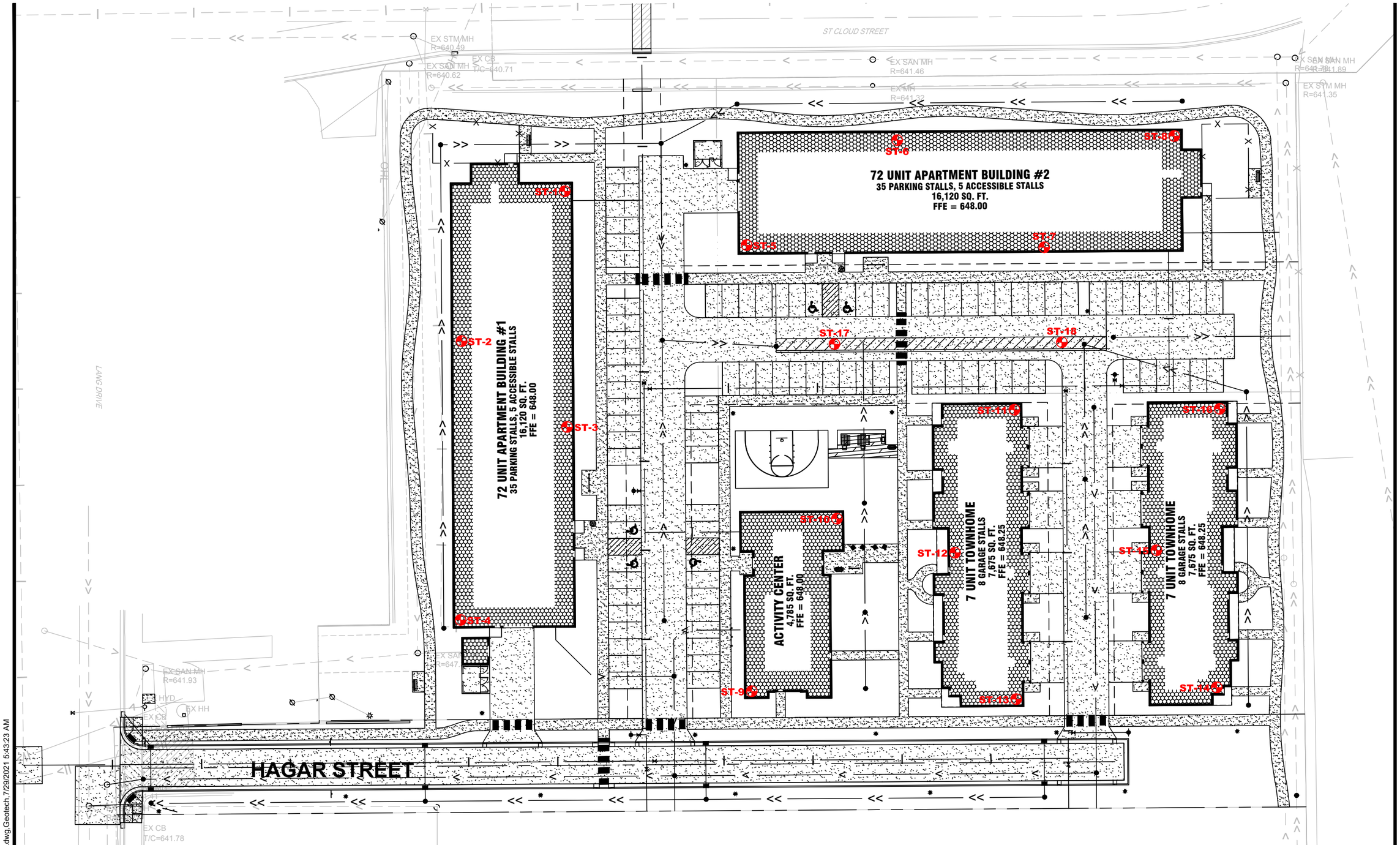
F.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

N

25' 0 50'

SCALE: 1"= 50'

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BRAUN INTERTEC
The Science You Build On.

11001 Hampshire Avenue S
Minneapolis, MN 55438
952.995.2000
braunintertec.com

Drawing Information

Project No:	B2106376
Drawing No:	B2106376
Drawn By:	JAG
Date Drawn:	7/14/21
Checked By:	BRS
Last Modified:	7/29/21

Project Information

Proposed 5th Ward Residence Development

1325 St. Andrew Street

La Crosse, Wisconsin

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-01**
LOCATION: See attached location sketch
NORTHING: 140164 EASTING: 448627
DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/26/21 END DATE: 07/26/21
SURFACE ELEVATION: 647.1 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
646.4		SILTY SAND with GRAVEL (SM), fine-grained, brown, dry (TOPSOIL FILL)					
0.7		FILL: SILTY SAND with GRAVEL (SM), fine to medium-grained, brown and tan, moist		7-7-10 (17) 14"		8	P200=36%
			5	6-6-6 (12) 3"			
640.6							
6.5		FILL: POORLY GRADED SAND (SP), fine-grained, yellow, moist		5-5-8 (13) 12"			
639.1							
8.0		SILTY SAND (SM), fine-grained, slightly organic, trace Gravel, black, moist (BURIED TOPSOIL)	10	7-11-7 (18) 14"		20	OC=3%
635.6							
11.5	▽	POORLY GRADED SAND (SP), fine to medium-grained, brown, moist to wet, medium dense to loose (ALLUVIUM)		3-5-7 (12) 18"			
			15	3-4-3 (7) 14"		22	P200=2%
630.6	▼						
16.5		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, loose (ALLUVIUM)		3-3-3 (6) 18"			
			20	3-3-4 (7) 18"			
			25	2-3-5 (8) 18"			Boring elevations and surface elevations were measured by Braun Intertec using GPS technology
			30	6-6-3 (9) 18"			
616.1							
31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 12.5 feet while drilling. Water observed at 16.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-02**

LOCATION: See attached location sketch

NORTHING: 140083 EASTING: 448572

DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/26/21 END DATE: 07/26/21

SURFACE ELEVATION: 646.9 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
646.0		POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, dry (TOPSOIL FILL)					
0.9		FILL: SILTY SAND with GRAVEL (SM), fine to medium-grained, brown and tan, moist		12-15-11 (26) 15"			
		Possible cobbles from 5 to 10 feet	5	14-10-35 (45) 16"			
638.9				7-12-20 (32) 14"			
8.0		SILTY SAND (SM), fine-grained, slightly organic, black, moist to wet (BURIED TOPSOIL)	10	12-9-16 (25) 16"		11	OC=3%
633.9	▽			2-3-5 (8) 13"			
13.0	▼	POORLY GRADED SAND (SP), fine-grained, brown, wet, loose (ALLUVIUM)	15	1-2-4 (6) 14"			
628.9				2-4-3 (7) 0"			
18.0		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)	20	2-2-3 (5) 18"			
			25	7-4-6 (10) 18"			
			30	9-6-7 (13) 18"			
615.9							
31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 12.5 feet while drilling. Water observed at 15.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-03**

LOCATION: See attached location sketch

NORTHING: 140037 EASTING: 448629

DRILLER: E. Rislov | LOGGED BY: B. Sullivan | START DATE: 07/28/21 | END DATE: 07/28/21

SURFACE ELEVATION: 647.2 ft | RIG: 75010 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER: Rain/Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~646.9~~ 0.3		POORLY GRADED SAND (SP), fine-grained, trace Gravel, brown and tan, moist (TOPSOIL FILL)					
643.2		FILL: SILTY SAND (SM), fine-grained, with Sandstone, brown, moist		6-12-17 (29) 14"		7	P200=18%
4.0		FILL: POORLY GRADED SAND (SP), fine-grained, brown, moist	5	6-12-14 (26) 16"			
638.2				6-9-11 (20) 16"			
9.0		FILL: SILTY SAND (SM), fine-grained, brown, moist	10	7-8-14 (22) 18"		13	P200=17%
635.7							
11.5		FILL: POORLY GRADED SAND (SP), fine-grained, brown, moist to wet		6-8-9 (17) 16"			
633.2	▽						
14.0		POORLY GRADED SAND (SP), fine-grained, trace Gravel, brown, wet, loose (ALLUVIUM)	15	3-3-3 (6) 9"			
630.7	▼						
16.5		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, loose (ALLUVIUM)		4-3-4 (7) 18"			
			20	3-3-3 (6) 20"			
			25	2-3-4 (7) 18"			
			30	0"			
616.2							
31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 14.0 feet while drilling. Water observed at 16.0 feet at end of drilling.

BRAUN INTERTEC
The Science You Build On.

LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-04**

LOCATION: See attached location sketch

NORTHING:	139933	EASTING:	448571
DRILLER: E. Rislov	LOGGED BY: B. Sullivan	START DATE: 07/26/21	END DATE: 07/26/21
SURFACE ELEVATION: 647.1 ft	RIG: 75010	METHOD: 3 1/4" HSA	SURFACING: Grass	WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~646.7~~ 0.4		POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, dry (TOPSOIL FILL)					
		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown		4-12-12 (24) 16"			
		Trace Gravel at 5 feet	5	4-4-3 (7) 14"			
				4-6-9 (15) 18"		7	P200=6%
		Trace brick at 10 feet	10	4-4-2 (6) 12"			
635.6 11.5	▽	POORLY GRADED SAND (SP), fine-grained, brown, moist to wet, loose (ALLUVIUM)		4-5-4 (9) 16"			
	▼		15	1-2-4 (6) 14"			
629.1 18.0		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, very loose to medium dense (ALLUVIUM)		4-2-4 (6) 18"			
			20	5-2-3 (5) 16"			
			25	1-2-2 (4) 18"			
			30	2-5-7 (12) 18"			
616.1 31.0		END OF BORING					Water observed at 12.5 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 15.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-05**
LOCATION: See attached location sketch
NORTHING: 140135 EASTING: 448725
DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/26/21 END DATE: 07/26/21
SURFACE ELEVATION: 647.5 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.0		SILTY SAND (SM), fine-grained, brown, dry (TOPSOIL FILL)					
0.5		FILL: POORLY GRADED SAND with SILT and GRAVEL (SP-SM), fine to medium-grained, brown and tan, moist		5-8-7 (15) 16"			
			5	7-9-9 (18) 14"			
641.0							
6.5		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, trace brick fragments, and glass, with roots, slightly organic, trace Gravel, dark brown and black, moist		5-5-8 (13) 14"		8	P200=9%
			10	6-7-8 (15) 16"		11	OC=3%
636.0							
11.5	▽	POORLY GRADED SAND (SP), fine-grained, brown and gray, moist to wet, loose (ALLUVIUM)		2-3-3 (6) 14"			
			15	2-3-2 (5) 14"			
631.0							
16.5	▼	POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, light brown, wet, loose (ALLUVIUM)		2-3-3 (6) 16"			
			20	3-3-3 (6) 20"			
			25	6-2-4 (6) 18"			
			30	2-2-5 (7) 16"			
616.5							
31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 12.5 feet while drilling. Water observed at 17.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-06**
LOCATION: See attached location sketch
NORTHING: 140192 EASTING: 448807
DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/26/21 END DATE: 07/26/21
SURFACE ELEVATION: 647.1 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
645.9		POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, dry (TOPSOIL FILL)					
1.2		FILL: SILTY SAND with GRAVEL (SM), fine to medium-grained, brown and tan, moist		8-8-10 (18) 16"			
643.1							
4.0		FILL: POORLY GRADED SAND (SP), fine-grained, tan and yellow, moist	5	2-5-7 (12) 14"			
640.6							
6.5		FILL: SILTY SAND (SM), fine-grained, with concrete fragments, and roots, with organics, dark brown and black, moist		3-4-7 (11) 10"		15	OC=5%
		Brick at 10 feet	10	6-9-8 (17) 16"		19	
635.6							
11.5	▽	POORLY GRADED SAND (SP), fine-grained, brown, moist to wet, loose (ALLUVIUM)		5-5-5 (10) 18"			
			15	2-5-4 (9) 16"			
630.6	▼						
16.5		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)		2-4-3 (7) 20"			
			20	2-3-3 (6) 18"			
			25	2-3-4 (7) 18"			
			30	12-8-6 (14) 18"			
616.1							
31.0		END OF BORING					Water observed at 12.5 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 16.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-07**

LOCATION: See attached location sketch

NORTHING: 140134 EASTING: 448886

DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/27/21 END DATE: 07/27/21

SURFACE ELEVATION: 647.4 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny/Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.1							
0.3		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
		FILL: SILTY SAND with GRAVEL (SM), fine to medium-grained, brown and tan, moist		20-30-25 (55) 4"			
643.4							
4.0		FILL: POORLY GRADED SAND (SP), fine-grained, with Sandstone, tan and brown, moist	5	8-8-12 (20) 18"		8	P200=5%
640.9							
6.5		FILL: ORGANIC CLAY (OL), with Clay seams, black, moist		3-4-3 (7) 14"		26	OC=7%
			10	0"			
635.9							
11.5		CLAYEY SAND (SC), trace Gravel, slightly organic, black, moist to wet, medium to stiff (BURIED TOPSOIL)		4-7-3 (10) 16"		23	OC=4%
	▽		15	1-2-3 (5) 3"		35	
630.9							
16.5		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, wet, loose (ALLUVIUM)		4-5-4 (9) 14"			
627.4							
20.0		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, loose (ALLUVIUM)	20	2-3-3 (6) 18"			
			25	3-3-3 (6) 20"			
			30	4-5-4 (9) 20"			
616.4							
31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 14.0 feet while drilling. Water observed at 15.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-08**
LOCATION: See attached location sketch
NORTHING: 140194 EASTING: 448956
DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/27/21 END DATE: 07/27/21
SURFACE ELEVATION: 647.1 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny/Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
646.1		POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, moist (TOPSOIL FILL)					
1.0		FILL: SILTY SAND (SM), fine-grained, with Sandstone, brown and tan, moist		5-8-8 (16) 18"			
			5	5-5-4 (9) 14"			
640.6							
6.5		FILL: POORLY GRADED SAND (SP), fine-grained, trace Gravel, dark brown, moist		5-6-6 (12) 14"		16	P200=5%
			10	6-6-8 (14) 14"			
635.6							
11.5	▽	FILL: SILTY SAND (SM), fine-grained, trace Gravel, slightly organic, black, moist to wet		2-2-1 (3) 16"		28	
633.1							
14.0	▼	ORGANIC CLAY with SAND (OL), black, wet (BURIED TOPSOIL)	15	1-2-4 (6) 16"		51	OC=6%
630.6							
16.5		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, wet, loose (ALLUVIUM)		2-3-5 (8) 18"		21	P200=2%
627.1			20	5-4-5 (9) 18"			
20.0		POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, wet, loose (ALLUVIUM)					
624.1							
23.0		POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, wet, loose (ALLUVIUM)	25	2-3-4 (7) 20"			
			30	3-3-3 (6) 20"			
616.1							
31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 12.5 feet while drilling. Water observed at 15.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-09**

LOCATION: See attached location sketch

NORTHING: 139895 EASTING: 448728

DRILLER: E. Rislov | LOGGED BY: B. Sullivan | START DATE: 07/28/21 | END DATE: 07/28/21

SURFACE ELEVATION: 647.5 ft | RIG: 75010 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER: Rain/Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
643.5		FILL: POORLY GRADED SAND (SP), fine-grained, brown, moist		3-6-9 (15) 14"			
4.0 641.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, trace Gravel, trace concrete, brown, moist	5	6-6-10 (16) 12"			
6.5 633.5		FILL: POORLY GRADED SAND (SP), fine-grained, brown, moist		4-4-6 (10) 16"			
			10	5-5-5 (10) 16"			
				6-7-11 (18) 14"			
14.0	▽	POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, wet, loose to medium dense (ALLUVIUM)	15	3-5-7 (12) 15"		17	P200=3%
				3-4-3 (7) 16"			
			20	1-2-4 (6) 18"			
			25	5-6-7 (13) 20"			
616.5			30	6-5-6 (11) 16"			
31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 15.0 feet while drilling. Water observed at 16.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-10**
LOCATION: See attached location sketch
NORTHING: 139988 EASTING: 448774
DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/28/21 END DATE: 07/28/21
SURFACE ELEVATION: 647.5 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Rain/Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~647.1~~ 0.4		POORLY GRADED SAND with SILT (SP-SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
		FILL: POORLY GRADED SAND (SP), fine-grained, brown, moist		2-3-4 (7) 14"		7	P200=3%
			5	10-14-8 (22) 15"			
				6-8-11 (19) 16"			
			10	4-6-10 (16) 14"			
				7-9-12 (21) 16"			
633.5 14.0	▽	POORLY GRADED SAND (SP), fine to medium-grained, brown and gray, wet, medium dense (ALLUVIUM)	15	7-7-8 (15) 16"		20	
	▼			7-7-7 (14) 18"			
628.5 19.0		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, loose (ALLUVIUM)	20	1-3-4 (7) 18"			
			25	3-3-4 (7) 18"			
			30	6-3-4 (7) 20"			
616.5 31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 14.0 feet while drilling. Water observed at 16.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-11**

LOCATION: See attached location sketch

NORTHING:	140046	EASTING:	448870
DRILLER:	E. Rislov	LOGGED BY:	B. Sullivan
START DATE:	07/29/21	END DATE:	07/29/21
SURFACE ELEVATION:	647.6 ft	RIG:	75010
METHOD:	3 1/4" HSA	SURFACING:	Grass
WEATHER:	Sunny		

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
643.6		FILL: POORLY GRADED SAND with SILT and GRAVEL (SP-SM), fine-grained, brown and tan, moist		5-5-5 (10) 20"			
4.0		FILL: SILTY SAND (SM), fine-grained, brown, moist to wet	5	13-15-15 (30) 14"			
				8-8-10 (18) 14"		10	P200=13%
		Trace Clay at 10 feet	10	7-7-7 (14) 14"			
	▽			5-5-6 (11) 16"			
633.6							
14.0		POORLY GRADED SAND (SP), fine to medium-grained, brown and gray, wet, medium dense (ALLUVIUM)	15	5-6-8 (14) 16"		18	
	▼			2-3-8 (11) 18"		21	P200=4%
628.6							
19.0		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, loose (ALLUVIUM)	20	3-4-5 (9) 18"			
			25	2-3-2 (5) 18"			
			30	2-3-3 (6) 18"			
616.6							
31.0		END OF BORING					Water observed at 12.5 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 18.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-12**

LOCATION: See attached location sketch

NORTHING:	139969	EASTING:	448838
DRILLER: E. Rislov	LOGGED BY: B. Sullivan	START DATE: 07/28/21	END DATE: 07/28/21
SURFACE ELEVATION: 647.5 ft	RIG: 75010	METHOD: 3 1/4" HSA	SURFACING: Grass	WEATHER: Rain/Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.0		POORLY GRADED SAND with SILT (SP-SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
0.5		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, moist		3-3-2 (5) 14"			
			5	5-9-7 (16) 16"			
				4-8-9 (17) 12"		9	P200=10%
			10	4-7-9 (16) 16"			
	▽	*Wet at 12 1/2 feet*		5-6-6 (12) 14"			
633.5							
14.0	▼	POORLY GRADED SAND (SP), fine to medium-grained, brown, wet, medium dense (ALLUVIUM)	15	5-9-7 (16) 18"			
				5-12-12 (24) 20"			
628.5							
19.0		POORLY GRADED SAND (SP), fine to coarse-grained, trace Gravel, brown, wet, medium dense (ALLUVIUM)	20	4-6-7 (13) 20"			
			25	4-5-7 (12) 18"			
			30	3-7-5 (12) 0"			
616.5							
31.0		END OF BORING					Water observed at 12.5 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 15.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-13**

LOCATION: See attached location sketch

NORTHING: 139890 EASTING: 448871

DRILLER: E. Rislov | LOGGED BY: B. Sullivan | START DATE: 07/28/21 | END DATE: 07/28/21

SURFACE ELEVATION: 647.5 ft | RIG: 75010 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER: Rain/Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~647.2~~ 0.3		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)					
		FILL: POORLY GRADED SAND with SILT (SP-SM), trace Gravel, brown and tan, moist		2-5-10 (15) 16"			
643.5 4.0		FILL: LEAN CLAY with SAND (CL), brown, moist	5	5-9-10 (19) 18"		22	P200=67%
641.0 6.5		FILL: POORLY GRADED SAND (SP), fine-grained, brown, moist		5-8-11 (19) 16"			
			10	5-6-11 (17) 14"			
633.5 14.0	▽	POORLY GRADED SAND (SP), fine to medium-grained, brown, wet, loose (ALLUVIUM)		8-11-9 (20) 16"			
			15	2-5-4 (9) 15"			
	▼	*Trace Gravel at 17 1/2 feet*		3-4-6 (10) 20"			
			20	2-3-4 (7) 18"			
			25	3-3-3 (6) 16"			
			30	4-3-4 (7) 20"			
616.5 31.0		*Trace Gravel at 30 feet*					
		END OF BORING					Water observed at 15.0 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 18.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-14**
LOCATION: See attached location sketch
NORTHING: 139897 EASTING: 448979
DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/27/21 END DATE: 07/27/21
SURFACE ELEVATION: 647.3 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny/Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
646.3		POORLY GRADED SAND with SILT (SP-SM), fine-grained, dark brown to brown, moist (TOPSOIL FILL)					
1.0		FILL: POORLY GRADED SAND (SP), fine-grained, brown, moist		4-5-6 (11) 15"			
		Little Clay at 5 feet	5	4-6-8 (14) 16"			
				4-5-9 (14) 18"			
		Clay seams at 10 feet	10	6-9-12 (21) 14"			
635.8							
11.5	▽	FILL: POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist to wet		6-6-10 (16) 12"		19	P200=5%
632.3			15	2-2-2 (4) 15"		36	OC=4%
15.0		CLAYEY SAND (SC), trace Gravel, slightly organic, black, wet (BURIED TOPSOIL)					Petroleum like odor at 15 feet
630.3							
17.0	▼	POORLY GRADED SAND (SP), fine to medium-grained, brown, wet, loose (ALLUVIUM)		2-3-3 (6) 20"			
			20	3-3-4 (7) 20"			
			25	2-3-3 (6) 20"			
		Trace Gravel at 30 feet	30	3-4-3 (7) 20"			
616.3							
31.0		END OF BORING					Water observed at 12.5 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 19.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-15**

LOCATION: See attached location sketch

NORTHING:	139971	EASTING:	448946
DRILLER: E. Rislov	LOGGED BY: B. Sullivan	START DATE: 07/27/21	END DATE: 07/27/21
SURFACE ELEVATION: 647.5 ft	RIG: 75010	METHOD: 3 1/4" HSA	SURFACING: Grass	WEATHER: Sunny/Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, moist		2-3-7 (10) 14"			
			5	6-9-14 (23) 16"		11	P200=12%
		Clay seams at 7 feet		7-9-11 (20) 18"			
			10	4-6-7 (13) 14"			
	▽	*Wet at 12 1/2 feet*		3-7-11 (18) 14"			
633.5 14.0		POORLY GRADED SAND (SP), fine to medium-grained, brown, wet, loose to medium dense (ALLUVIUM)	15	2-4-4 (8) 16"			
	▼			6-6-6 (12) 18"			
			20	2-3-5 (8) 18"			
			25	3-3-5 (8) 20"			
			30	3-4-3 (7) 18"			
616.5 31.0		END OF BORING					Water observed at 12.5 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 18.0 feet at end of drilling.

BRAUN INTERTEC
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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-16**

LOCATION: See attached location sketch

NORTHING: 140047 EASTING: 448980

DRILLER: E. Rislov | LOGGED BY: B. Sullivan | START DATE: 07/27/21 | END DATE: 07/27/21

SURFACE ELEVATION: 647.4 ft | RIG: 75010 | METHOD: 3 1/4" HSA | SURFACING: Grass | WEATHER: Sunny/Cloudy

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.2 0.2		POORLY GRADED SAND with SILT (SP-SM), fine-grained, trace roots, brown, moist (TOPSOIL FILL)					
		FILL: SILTY SAND (SM), fine-grained, with Sandstone, brown and yellow, moist		3-13-16 (29) 12"			
643.4 4.0		FILL: POORLY GRADED SAND (SP), fine-grained, trace Gravel, brown, moist	5	3-4-12 (16) 18"			
				6-8-10 (18) 16"			
638.4 9.0		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, moist	10	6-6-8 (14) 16"		13	P200=7%
635.9 11.5	▽	POORLY GRADED SAND (SP), fine to medium-grained, trace Gravel, brown, moist to wet, medium dense to loose (ALLUVIUM)		4-7-10 (17) 14"			
	▼		15	2-5-5 (10) 18"			
				6-5-8 (13) 20"			
			20	2-5-6 (11) 18"			
			25	4-4-3 (7) 18"			
			30	4-3-6 (9) 20"			
616.4 31.0		END OF BORING Boring then backfilled with bentonite chips					Water observed at 12.5 feet while drilling. Water observed at 16.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-17**
LOCATION: See attached location sketch
NORTHING: 140082 EASTING: 448773
DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/29/21 END DATE: 07/29/21
SURFACE ELEVATION: 647.4 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.0							
0.4		SILTY SAND (SM), fine-grained, with roots, dark brown, moist (TOPSOIL FILL)		3-5-10-20 (15) 18"			
		FILL: SILTY SAND with GRAVEL (SM), fine-grained, and Sandstone, brown and tan, moist		10-12-19-14 (31) 20"		9	P200=26%
				6-6-10-8 (16) 15"			
			5				
640.9				12-12-15-16 (27) 18"			
6.5		FILL: POORLY GRADED SAND with SILT (SP-SM), fine-grained, dark brown, moist		4-4-5-5 (9) 16"		15	P200=11%
		Gravel at 10 to 12 feet	10	3-4-5-5 (9) 0"			
635.4	▽						
12.0		CLAYEY SAND (SC), trace Gravel, slightly organic, black to gray, wet (BURIED TOPSOIL)		2-2-2-4 (4) 12"		21	OC=3%
633.4							
14.0		POORLY GRADED SAND (SP), fine to medium-grained, brown, wet, very loose to medium dense (ALLUVIUM)		3-5-7-8 (12) 18"			
			15	1-2-2-2 (4) 16"			
	▼			3-3-3-9 (6) 20"			
627.4			20				
20.0		END OF BORING					Water observed at 12.0 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 18.0 feet at end of drilling.

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2106376
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

BORING: **ST-18**

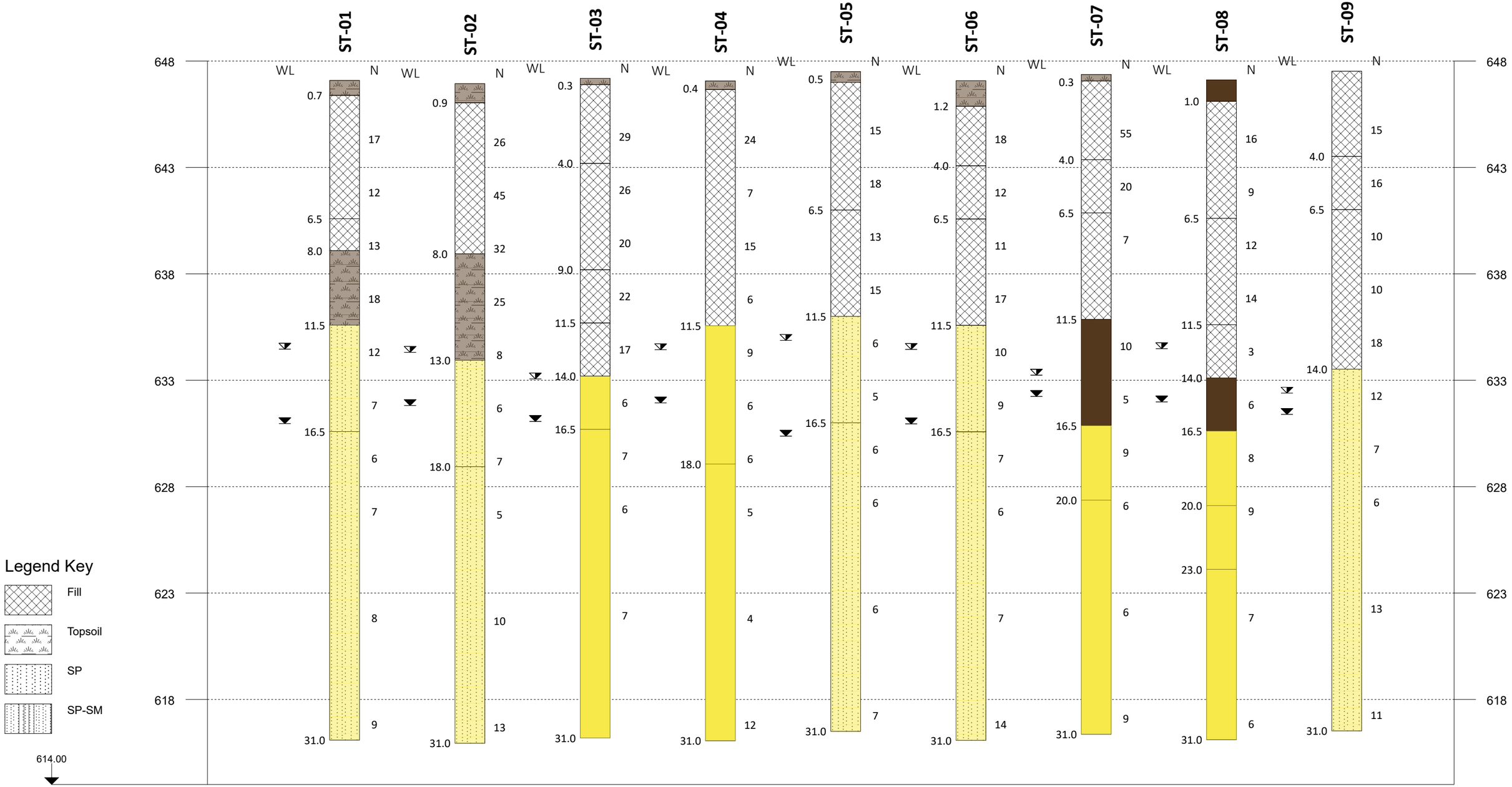
LOCATION: See attached location sketch

NORTHING: 140083 EASTING: 448895

DRILLER: E. Rislov LOGGED BY: B. Sullivan START DATE: 07/29/21 END DATE: 07/29/21

SURFACE ELEVATION: 647.4 ft RIG: 75010 METHOD: 3 1/4" HSA SURFACING: Grass WEATHER: Sunny

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
647.0		POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown, moist (TOPSOIL FILL)		3-7-30-15 (37) 15"			
0.4		FILL: SILTY SAND with GRAVEL (SM), fine-grained, and Sandstone, brown and tan, moist		8-15-13-10 (28) 14"			
				6-6-7-8 (13) 14"			
			5			11	P200=27%
641.4				15-9-9-12 (18) 20"			
6.0		FILL: SILTY SAND (SM), fine-grained, black, moist					
640.4							
7.0		FILL: POORLY GRADED SAND (SP), fine-grained, with Sandstone, reddish brown, moist					
639.4				4-5-5-4 (10) 6"		15	
8.0		SILTY SAND (SM), fine-grained, trace Gravel, black, moist					
637.4			10	3-5-6-6 (11) 4"			
10.0		FILL: SILTY SAND with GRAVEL (SM), fine-grained, black and brown, moist					
635.4				1-1-1-1 (2) 5"		19	OC=5%
12.0		ORGANIC CLAY (OL), with wood fragments, and Sand, black, wet (BURIED TOPSOIL)					
633.4	▽			1-3-4-4 (7) 12"			
14.0		POORLY GRADED SAND with SILT (SP-SM), fine-grained, brown and gray, wet, loose to medium dense (ALLUVIUM)	15				
		With Clay seams from 16 to 20 feet		5-7-8-8 (15) 16"		20	P200=11%
	▼			8-14-14-14 (28) 20"			
627.4			20				
20.0		END OF BORING					Water observed at 14.0 feet while drilling.
		Boring then backfilled with bentonite chips					Water observed at 17.0 feet at end of drilling.



SECTION LINE 1

Fence Diagram
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

Project ID:	B2106376
Vert. Scale:	1"= xxx'
Hor. Scale:	NTS
Date:	08/23/2021

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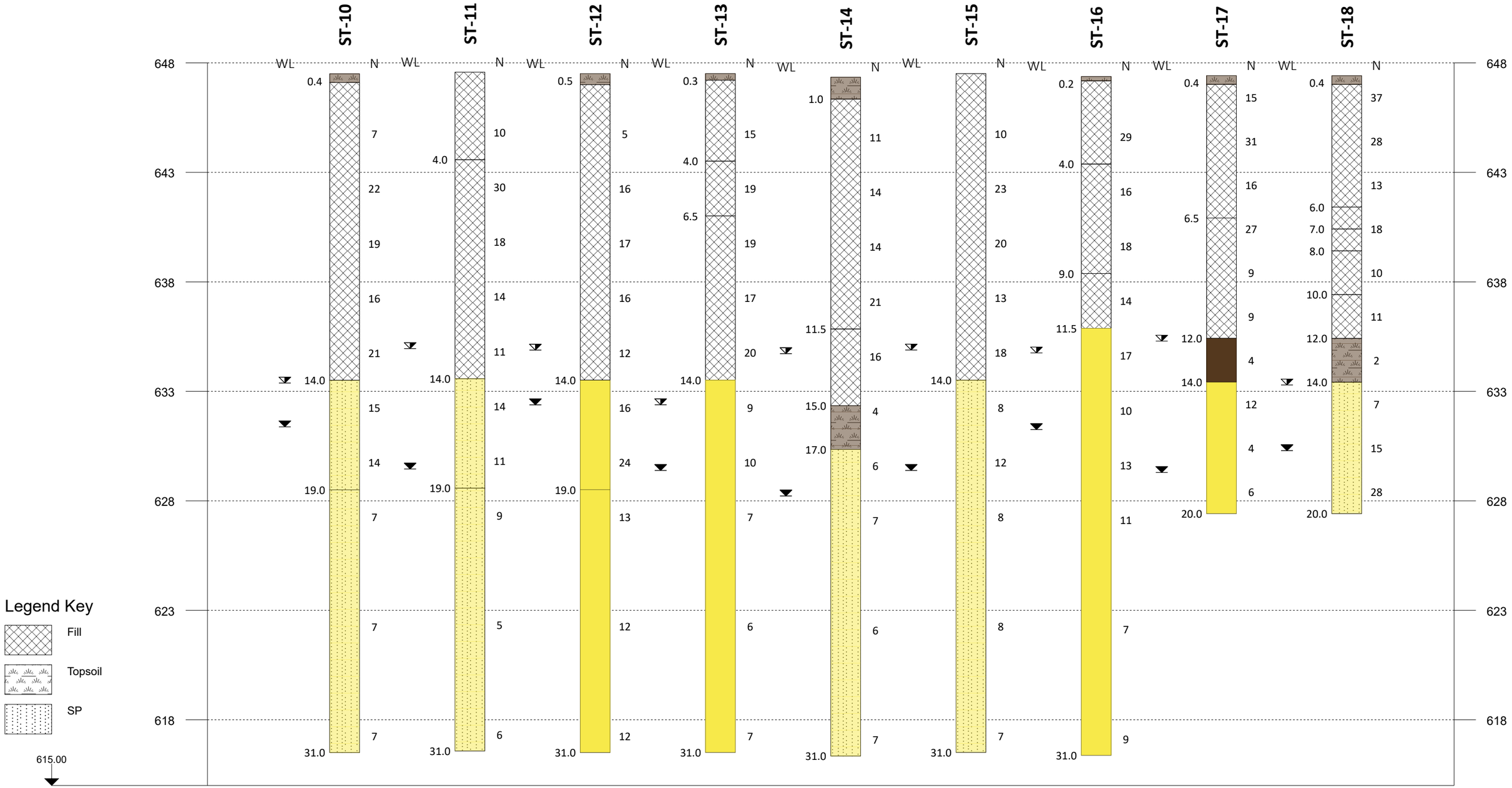

Legend Key

- Fill
- Topsoil
- SP

Project ID:	B2106376
Vert. Scale:	1"=
Hor. Scale:	NTS
Date:	08/23/2021

Fence Diagram
Geotechnical Evaluation
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, Wisconsin

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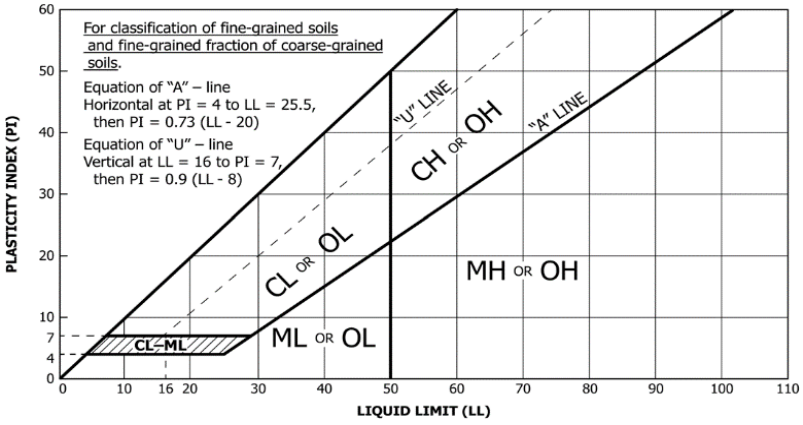
Descriptive Terminology of Soil

Based on Standards ASTM D2487/2488
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines[C])	$C_u \geq 4$ and $1 \leq C_c \leq 3$[D]	GW	Well-graded gravel[E]
			$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$)[D]	GP	Poorly graded gravel[E]
		Gravels with Fines (More than 12% fines[C])	Fines classify as ML or MH	GM	Silty gravel[E F G]
			Fines Classify as CL or CH	GC	Clayey gravel[E F G]
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines[H])	$C_u \geq 6$ and $1 \leq C_c \leq 3$[D]	SW	Well-graded sand[I]
			$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$)[D]	SP	Poorly graded sand[I]
		Sands with Fines (More than 12% fines[H])	Fines classify as ML or MH	SM	Silty sand[F G I]
			Fines classify as CL or CH	SC	Clayey sand[F G I]
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K L M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K L M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OL	Organic clay[K L M N] / Organic silt[K L M O]
	Silts and Clays (Liquid limit 50 or more)	Inorganic	PI plots on or above "A" line	CH	Fat clay[K L M]
			PI plots below "A" line	MH	Elastic silt[K L M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OH	Organic clay[K L M P] / Organic silt[K L M Q]
Highly Organic Soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

A. Based on the material passing the 3-inch (75-mm) sieve.
B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C. Gravels with 5 to 12% fines require dual symbols:
   GW-GM well-graded gravel with silt
   GW-GC well-graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. Sands with 5 to 12% fines require dual symbols:
   SW-SM well-graded sand with silt
   SW-SC well-graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
L. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
M. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
N. PI ≥ 4 and plots on or above "A" line.
O. PI < 4 or plots below "A" line.
P. PI plots on or above "A" line.
Q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	**q_p**	Pocket penetrometer strength, tsf
WD	Wet density, pcf	**q_U**	Unconfined compression test, tsf
P200	% Passing #200 sieve	**LL**	Liquid limit
MC	Moisture content, %	**PL**	Plastic limit
OC	Organic content, %	**PI**	Plasticity index

Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
  Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
  Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
  Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
  Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
  Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions[L, M]

trace..... 0 to 5%
little..... 6 to 14%
with..... ≥ 15%

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose ..... 0 to 4 BPF
Loose ..... 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils	Blows Per Foot	Approximate Unconfined Compressive Strength
Very soft	0 to 1 BPF	< 0.25 tsf
Soft	2 to 4 BPF	0.25 to 0.5 tsf
Medium	5 to 8 BPF	0.5 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF	> 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

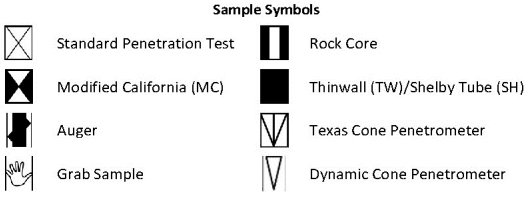
Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (▽), at the end of drilling (▼), or at some time after drilling (▼).

Sample Symbols



5/2021

BRAUN INTERTEC
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Sieve Analysis Of Aggregate

ASTM C136

08/02/2021

2309 Palace Street
La Crosse, WI 54603
Phone: 608-781-7277

Client:

5th Ward Residences, LLC
2 Copeland Avenue, Ste 201
La Crosse, WI 54601

Project:

B2106376
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, WI 54603

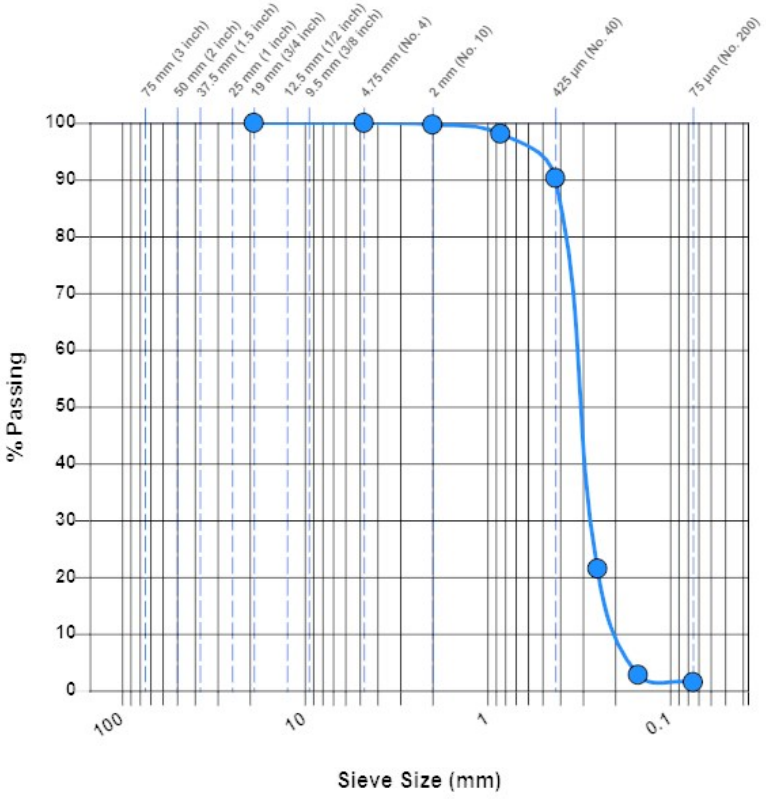
Sample Information

Sample Number: 393142
Sampled By: Drill Crew
Sampling Method:
Sample From: Splitspoon
Location: In-place
Location Details: Boring ST-1 at 15 feet
Sample Date: 07/26/2021
Received Date: 07/26/2021
Lab: 2309 Palace Street, La Crosse, WI
Tested Date: 07/27/2021
Tested By: Tos, Yot

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100	
4.75 mm (No. 4)	100	
2 mm (No. 10)	100	
850 µm (No. 20)	98	
425 µm (No. 40)	90	
250 µm (No. 60)	22	
150 µm (No. 100)	3	
75 µm (No. 200)	1.5	

#200 Wash Loss ASTM C117 (%) 2.1



Gravel (%): 0.0 **Sand (%):** 98.5 **Silt & Clay (%):** 1.5

D_{60} (mm): 0.35 **D_{30} (mm):** 0.27 **D_{10} (mm):** 0.19 **C_U:** 1.84 **C_C:** 1.10

General

Results: The test is for informational purposes.

Remarks: Moisture Content (ASTM D2216) = 22%

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Sieve Analysis Of Aggregate

ASTM C136

08/02/2021

2309 Palace Street
La Crosse, WI 54603
Phone: 608-781-7277

Client:

5th Ward Residences, LLC
2 Copeland Avenue, Ste 201
La Crosse, WI 54601

Project:

B2106376
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, WI 54603

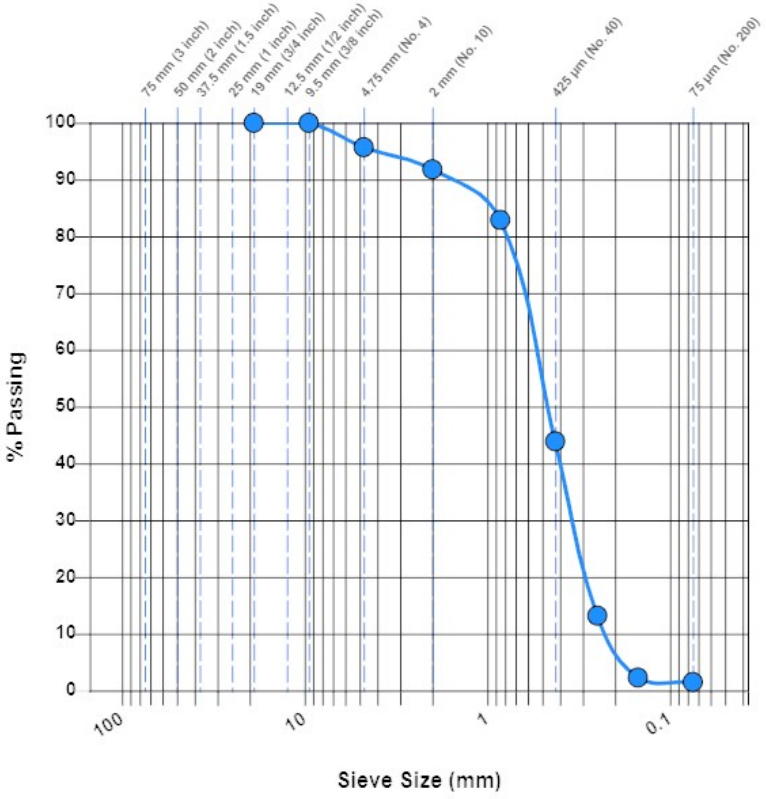
Sample Information

Sample Number: 393145
Sampled By: Drill Crew
Sampling Method:
Sample From: Splitspoon
Location: In-place
Location Details: Boring ST-8 at 17 1/2 feet
Sample Date: 07/27/2021
Received Date: 07/27/2021
Lab: 2309 Palace Street, La Crosse, WI
Tested Date: 07/28/2021
Tested By: Tos, Yot

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100	
9.5 mm (3/8 inch)	100	
4.75 mm (No. 4)	96	
2 mm (No. 10)	92	
850 µm (No. 20)	83	
425 µm (No. 40)	44	
250 µm (No. 60)	13	
150 µm (No. 100)	2	
75 µm (No. 200)	1.5	

#200 Wash Loss ASTM C117 (%) 1.4



Gravel (%): 4.3 **Sand (%):** 94.2 **Silt & Clay (%):** 1.5

D_{60} (mm): 0.60 **D_{30} (mm):** 0.35 **D_{10} (mm):** 0.22 **C_U:** 2.73 **C_C:** 0.93

General

Results: The test is for informational purposes.

Remarks: Moisture Content (ASTM D2216) = 21%

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Sieve Analysis Of Aggregate

ASTM C136

08/02/2021

2309 Palace Street
La Crosse, WI 54603
Phone: 608-781-7277

Client:

5th Ward Residences, LLC
2 Copeland Avenue, Ste 201
La Crosse, WI 54601

Project:

B2106376
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, WI 54603

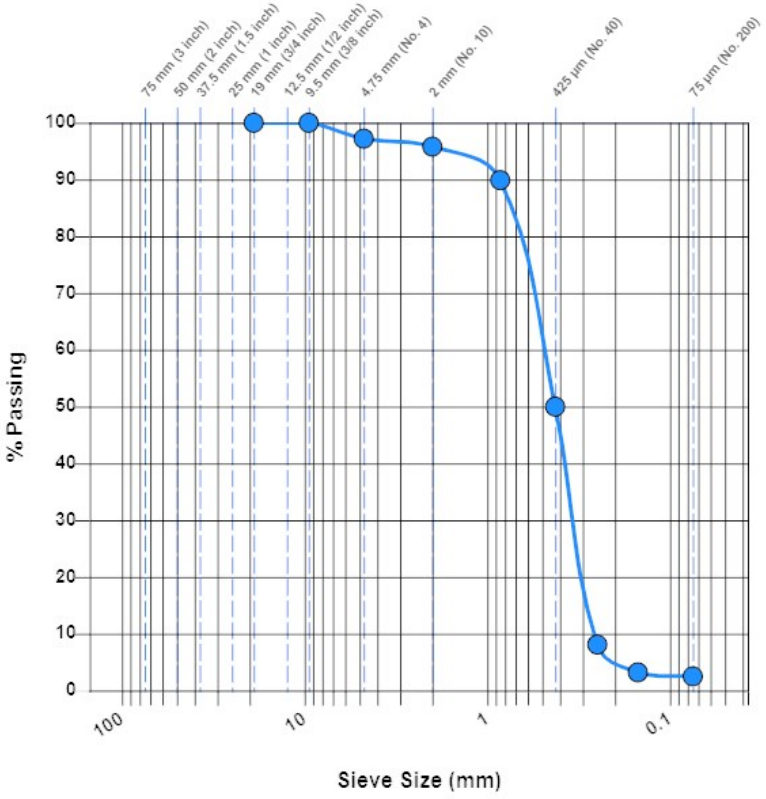
Sample Information

Sample Number: 393148
Sampled By: Drill Crew
Sampling Method:
Sample From: Splitspoon
Location: In-place
Location Details: Boring ST-9 at 15 feet
Sample Date: 07/28/2021
Received Date: 07/28/2021
Lab: 2309 Palace Street, La Crosse, WI
Tested Date: 07/29/2021
Tested By: Tos, Yot

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100	
9.5 mm (3/8 inch)	100	
4.75 mm (No. 4)	97	
2 mm (No. 10)	96	
850 µm (No. 20)	90	
425 µm (No. 40)	50	
250 µm (No. 60)	8	
150 µm (No. 100)	3	
75 µm (No. 200)	2.5	

#200 Wash Loss ASTM C117 (%) 2.1



Gravel (%): 2.8 **Sand (%):** 94.7 **Silt & Clay (%):** 2.5

D_{60} (mm): 0.53 **D_{30} (mm):** 0.34 **D_{10} (mm):** 0.26 **C_U:** 2.04 **C_C:** 0.84

General

Results: The test is for informational purposes.

Remarks: Moisture Content (ASTM D2216) = 17%

BRAUN INTERTEC
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Sieve Analysis Of Aggregate

ASTM C136

08/03/2021

2309 Palace Street
La Crosse, WI 54603
Phone: 608-781-7277

Client:

5th Ward Residences, LLC
2 Copeland Avenue, Ste 201
La Crosse, WI 54601

Project:

B2106376
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, WI 54603

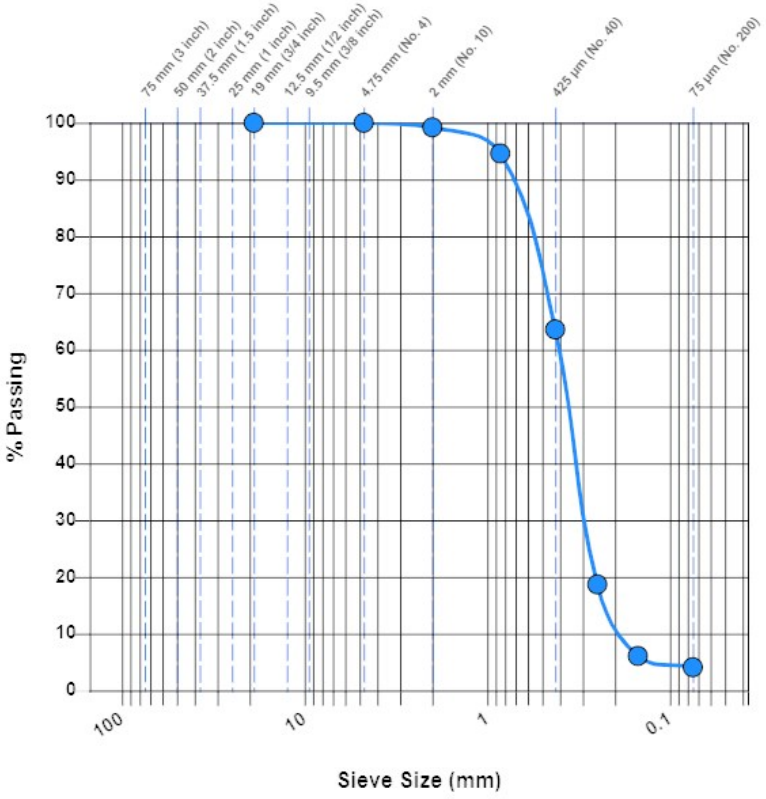
Sample Information

Sample Number: 393220
Sampled By: Drill Crew
Sampling Method:
Sample From: Splitspoon
Location: Native Soil
Location Details: Boring ST-11 at 17 1/2 feet
Sample Date: 07/29/2021
Received Date: 07/29/2021
Lab: 2309 Palace Street, La Crosse, WI
Tested Date: 08/02/2021
Tested By: Tos, Yot

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100	
4.75 mm (No. 4)	100	
2 mm (No. 10)	99	
850 µm (No. 20)	95	
425 µm (No. 40)	64	
250 µm (No. 60)	19	
150 µm (No. 100)	6	
75 µm (No. 200)	4.1	

#200 Wash Loss ASTM C117 (%) 3.3



Gravel (%): 0.0 **Sand (%):** 95.9 **Silt & Clay (%):** 4.1

D_{60} (mm): 0.41 **D_{30} (mm):** 0.29 **D_{10} (mm):** 0.18 **C_U:** 2.28 **C_C:** 1.14

General

Results: The test is for informational purposes.
Remarks: Moisture Content (ASTM D2216) = 21%

BRAUN INTERTEC
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Sieve Analysis Of Aggregate

ASTM C136

08/02/2021

2309 Palace Street
La Crosse, WI 54603
Phone: 608-781-7277

Client:

5th Ward Residences, LLC
2 Copeland Avenue, Ste 201
La Crosse, WI 54601

Project:

B2106376
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, WI 54603

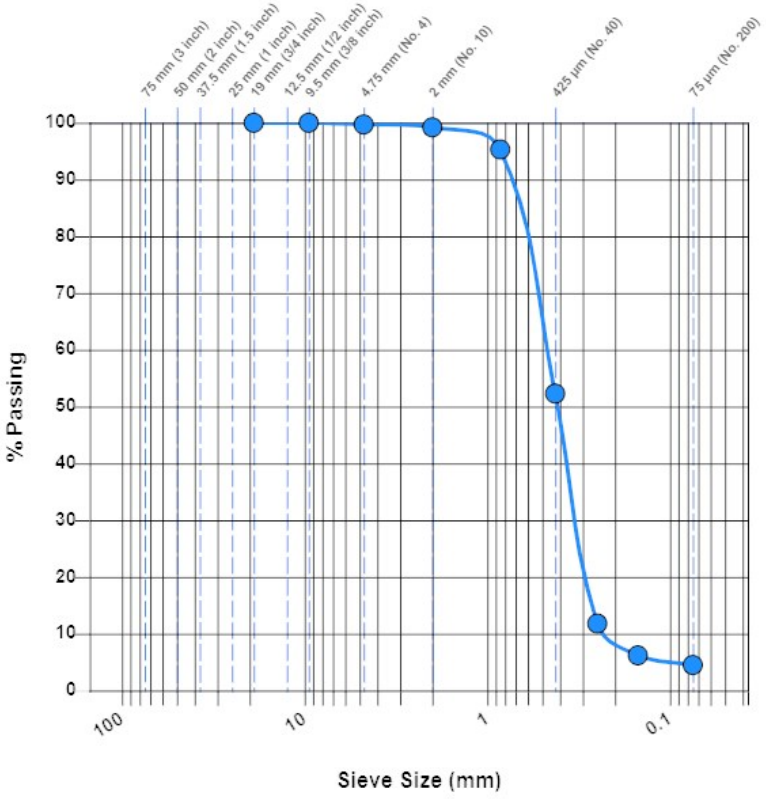
Sample Information

Sample Number: 393146
Sampled By: Drill Crew
Sampling Method:
Sample From: Splitspoon
Location: In-place
Location Details: Boring ST-14 at 12 1/2 feet
Sample Date: 07/28/2021
Received Date: 07/28/2021
Lab: 2309 Palace Street, La Crosse, WI
Tested Date: 07/29/2021
Tested By: Tos, Yot

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100	
9.5 mm (3/8 inch)	100	
4.75 mm (No. 4)	100	
2 mm (No. 10)	99	
850 µm (No. 20)	95	
425 µm (No. 40)	52	
250 µm (No. 60)	12	
150 µm (No. 100)	6	
75 µm (No. 200)	4.5	

#200 Wash Loss ASTM C117 (%) 4.3



Gravel (%): 0.3 **Sand (%):** 95.2 **Silt & Clay (%):** 4.5

D_{60} (mm): 0.50 **D_{30} (mm):** 0.33 **D_{10} (mm):** 0.22 **C_U:** 2.27 **C_C:** 0.99

General

Results: The test is for informational purposes.

Remarks: Moisture Content (ASTM D2216) = 19%

BRAUN INTERTEC
The Science You Build On.

Sieve Analysis Of Aggregate

ASTM C136

08/03/2021

2309 Palace Street
La Crosse, WI 54603
Phone: 608-781-7277

Client:

5th Ward Residences, LLC
2 Copeland Avenue, Ste 201
La Crosse, WI 54601

Project:

B2106376
Proposed 5th Ward Residence Development
1325 Saint Andrew Street
La Crosse, WI 54603

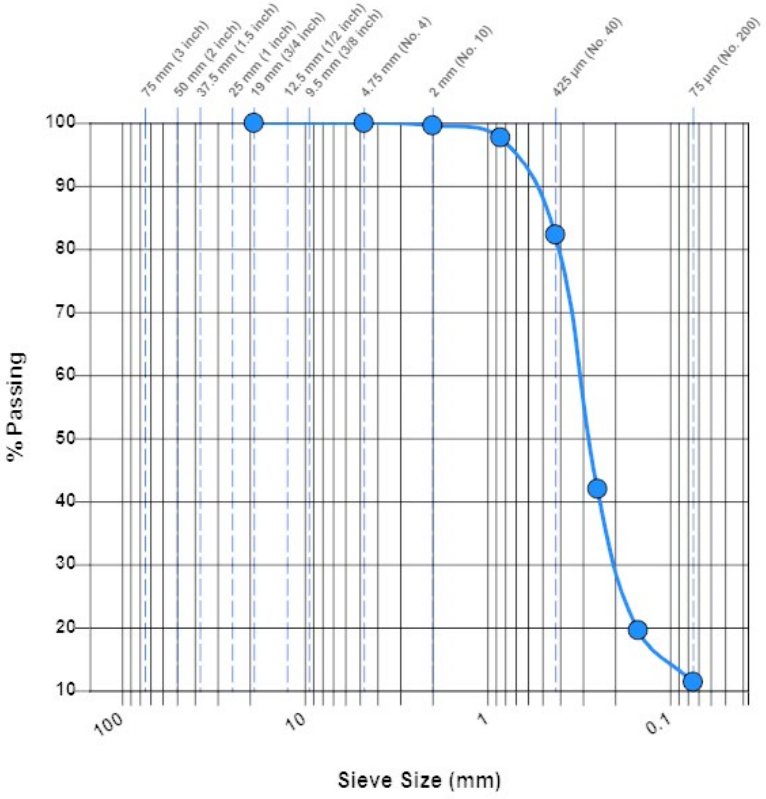
Sample Information

Sample Number: 393219
Sampled By: Drill Crew
Sampling Method:
Sample From: Splitspoon
Location: Native Soil
Location Details: Boring ST-18 at 17 feet
Sample Date: 07/29/2021
Received Date: 07/29/2021
Lab: 2309 Palace Street, La Crosse, WI
Tested Date: 08/02/2021
Tested By: Tos, Yot

Laboratory Data

Sieve Size	Passing (%)	Specification
19 mm (3/4 inch)	100	
4.75 mm (No. 4)	100	
2 mm (No. 10)	100	
850 µm (No. 20)	98	
425 µm (No. 40)	82	
250 µm (No. 60)	42	
150 µm (No. 100)	20	
75 µm (No. 200)	11.4	

#200 Wash Loss ASTM C117 (%) 10.1



Gravel (%): 0.0 **Sand (%):** 88.6 **Silt & Clay (%):** 11.4

D_{60} (mm): 0.33 **D_{30} (mm):** 0.20

General

Results: The test is for informational purposes.

Remarks: Moisture Content (ASTM D2216) = 20%

1002-CPS-23
Division of Industry Services
PO Box 2658
Madison, Wisconsin

Attachment 2:

SOIL AND SITE EVALUATION - STORM

In accordance with SPS 382.365, 385, Wis. Adm. Code, and WDNR Standard 1002

Attach a complete site plan on paper not less than 8 ½ x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent of slope, scale or dimensions, north arrow, and BM reference to nearest road. ***Please print all information*** Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04(1)(m)]	County La Crosse Parcel I.D. 17-10289-40 Reviewed by: Date:

Property Owner: Stizo Development, LLC	Property Location Govt. Lot SW¼ NE¼ S29 T07 R16 W		
Property Owner's Mailing Address: PO Box 609	Lot	Block #	Subd. Name or CSM #
City, State Zip Phone Number La Crosse, WI 54602	☒ City ☐ Village ☐ Town La Crosse		Nearest Road Saint Andrew Street
Drainage Area _____ ☐ sq. ft. ☐ acres Test site suitable for (check all that apply): ☐ Bio-retention; ☐ Subsurface Dispersal System; ☐ Reuse; ☐ Irrigation ☐ Other	Hydraulic Application Test Method ☒ Morphological Evaluation ☐ Double Ring Infiltrometer Other: (specify)		Soil Moisture Date of soil Borings: July 29, 2021 USDA-NRCS WETS Value: ☐ Dry = 1; ☒ Normal = 2; ☒ Wet = 3.

ST-17 #OBS ☐ Pit ☒ Boring Ground surface Elevation 647.4 ft. Elevation of limiting factor 12 ft.

Horizon	Depth In.	Dominate Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr.
FILL	0 - 5	10YR 3/2	---	f.sl	0.f.sg	mvfr	c	0	< 20	0.50
FILL	5 - 78	10YR 5/4	---	f.sl	0.f.sg	ml	c	30	26	0.50
FILL	78 - 144	10YR 3/1	---	f.ls	0.f.sg	mvfr	c	20	11	0.50
E	144 - 168	10YR 2.5/1	---	sc	0.f.gr	mfr	c	10	< 50	0.04
C	168 - 240	10YR 5/2	---	f/m.s	0.f/m.sg	ml	g	0	<5	1.63

Comments: Gravel layer from 10 to 12 feet. Groundwater was encountered at 12 feet while drilling and is a limiting layer. Seasonal and annual fluctuations of groundwater should also be anticipated.

ST-18 #OBS ☐ Pit ☒ Boring Ground surface Elevation 647.4 ft. Elevation of limiting factor 14 ft.

Horizon	Depth In.	Dominate Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frags.	% Fines	Hydraulic App Rate Inches/Hr.
FILL	0 - 5	10YR 5/4	---	f.ls	0.f.sg	mvfr	c	0	< 15	0.50
FILL	5 - 72	10YR 5/3	---	f.sl	0.f.sg	ml	g	30	27	0.50
FILL	72 - 84	10YR 3/1	---	f.sl	0.f.sg	mvfr	c	0	< 30	0.50
FILL	84 - 96	10YR 4/4	---	f.s	0.f.sg	ml	c	10	< 5	0.50
FILL	96 - 120	10YR 3/1	---	f.sl	0.f.sg	mvfr	c	10	< 30	0.50
FILL	120 - 144	10YR 4/2	---	f.sl	0.f.sg	mvfr	g	20	< 30	0.50
E	144 - 168	10YR 2.5/1	---	sc	0.f.gr	mfr	c	0	< 75	0.04
C	168 - 240	10YR 5/2	---	f/m.ls	0.f/m.sg	ml	c	0	11	1.63

Comments: Groundwater was encountered at 14 feet while drilling and is a limiting layer. Seasonal and annual fluctuations of groundwater should also be anticipated.

Name: Benjamin R. Sullivan	Signature: Ben Sullivan	Credential Number: SP-091500003
Address: 2309 Palace Street, La Crosse, WI	Date of Evaluation: 8/2/2021	Phone Number: 608.781.7277

Overall Site Comments: The site contains deep fills that generally consist of sandy soils with trace amounts of debris and organics. Buried topsoil was also encountered below the fill with alluvial sand soils at depth. Groundwater was encountered at depths of 12 to 15 feet across the site corresponding to an elevation of 632 ½ to 635 ½ feet. Seasonal and annual fluctuations of groundwater should be anticipated.

Watershed	Surface Cover	Area (SF)	Area (AC)	Percent Impervious
EX DA-1	Impervious	0	0.000	0%
	Pervious	157650	3.619	
	Total	157650	3.619	

TOTAL IMPERVIOUS	0.000	0%
TOTAL PERVIOUS	3.619	
TOTAL AREA	3.619	

LEGEND

EXISTING		PROPOSED
>>	STORM DRAIN	>>
>	SANITARY SEWER	>
II>	SANITARY SEWER FORCEMAIN	II>
W	WATER MAIN	W
G	GAS	G
OE	OVERHEAD ELECTRIC	OE
UE	UNDERGROUND ELECTRIC	UE
UT	UNDERGROUND TELEPHONE	UT
UTV	UNDERGROUND TV	
OHL	OVERHEAD UTILITY	
UTL	UNDERGROUND UTILITY	
FBO	FIBER OPTIC	
WET	WETLAND	
W	WATER EDGE	
X	FENCE LINE	
	PROPERTY / LOT LINE	
	RIGHT OF WAY LINE	
△ △	ACCESS CONTROL	
	EASEMENT LINE	
100	CONTOURS (MAJOR)	100
101	CONTOURS (MINOR)	101
XXX.XX	SPOT ELEVATION	XXX.XX
	TOP BACK OF CURB SPOT ELEVATION	XXX.XX

NOTE:
CONTRACTOR SHALL FIELD VERIFY THE LOCATIONS OF ALL EXISTING UTILITIES.

WINNESHIEK ROAD

ST CLOUD STREET

EXISTING FLOW PATH

EXISTING FLOW ARROW, TYP

EXISTING CONTOUR, TYP
(0.5' INTERVAL)

EX DA-1

WATERSHED BOUNDARY

N

0 30 60
SCALE IN FEET

ISG

PROJECT

5TH WARD RESIDENCES

LA CROSSE WISCONSIN

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	20-24403
FILE NAME	24403 EXISTING STORMWATER
DRAWN BY	CLF, SMD
DESIGNED BY	KBR
REVIEWED BY	KBR
ORIGINAL ISSUE DATE	9/17/2021
CLIENT PROJECT NO.	-

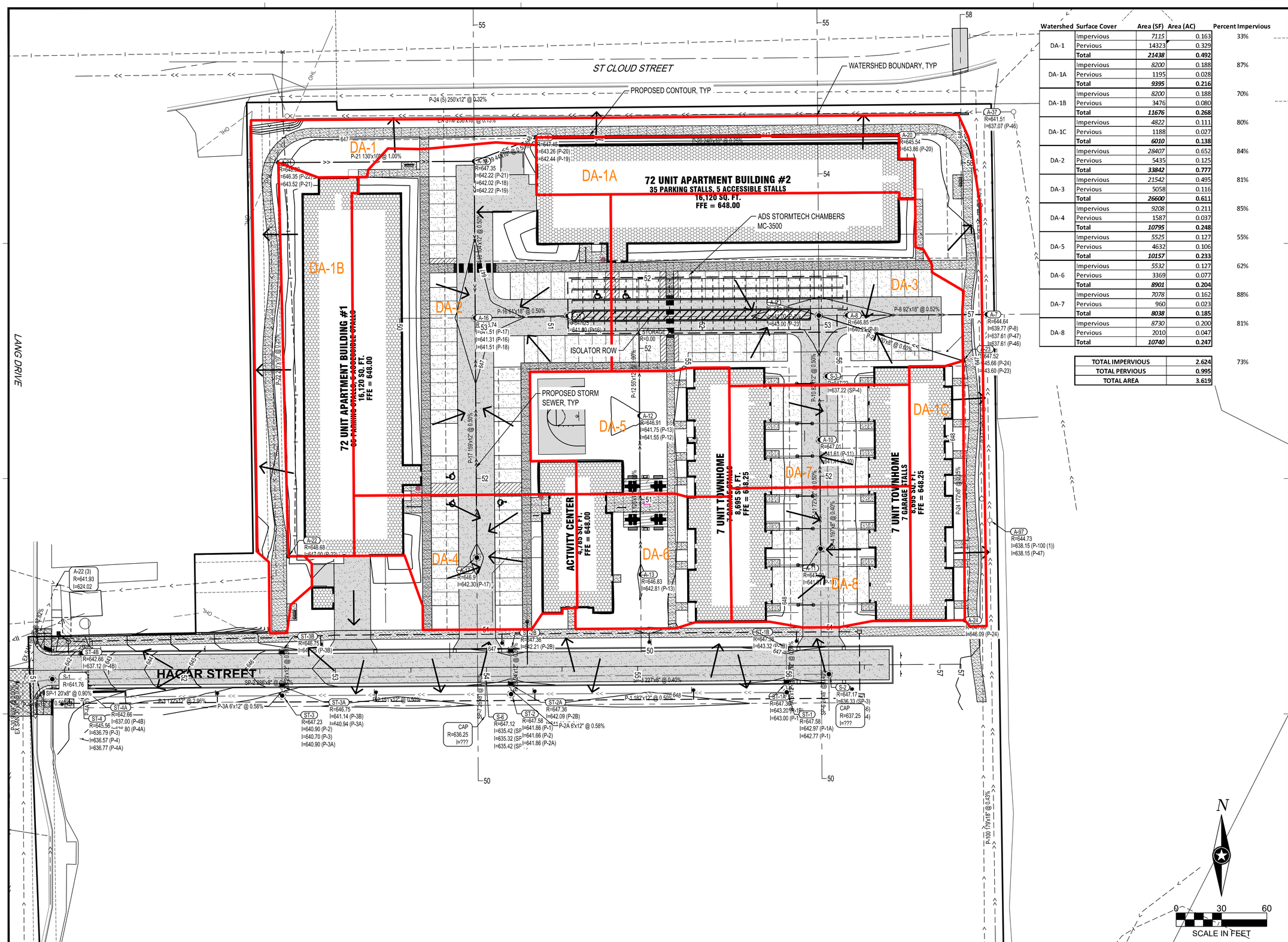
TITLE

EXISTING DRAINAGE CONDITIONS

SHEET

A

-



Watershed	Surface Cover	Area (SF)	Area (AC)	Percent Impervious
DA-1	Impervious	7115	0.163	33%
	Pervious	14323	0.329	
	Total	**21438**	**0.492**	
DA-1A	Impervious	8200	0.188	87%
	Pervious	1195	0.028	
	Total	**9395**	**0.216**	
DA-1B	Impervious	8200	0.188	70%
	Pervious	3476	0.080	
	Total	**11676**	**0.268**	
DA-1C	Impervious	4822	0.111	80%
	Pervious	1188	0.027	
	Total	**6010**	**0.138**	
DA-2	Impervious	28407	0.652	84%
	Pervious	5435	0.125	
	Total	**33842**	**0.777**	
DA-3	Impervious	21542	0.495	81%
	Pervious	5058	0.116	
	Total	**26600**	**0.611**	
DA-4	Impervious	9208	0.211	85%
	Pervious	1587	0.037	
	Total	**10795**	**0.248**	
DA-5	Impervious	5525	0.127	55%
	Pervious	4632	0.106	
	Total	**10157**	**0.233**	
DA-6	Impervious	5532	0.127	62%
	Pervious	3369	0.077	
	Total	**8901**	**0.204**	
DA-7	Impervious	7078	0.162	88%
	Pervious	960	0.023	
	Total	**8038**	**0.185**	
DA-8	Impervious	8730	0.200	81%
	Pervious	2010	0.047	
	Total	**10740**	**0.247**	

TOTAL IMPERVIOUS	**2.624**
TOTAL PERVIOUS	**0.995**
TOTAL AREA	**3.619**

73%

ISG

PROJECT

5TH WARD RESIDENCES

LA CROSSE WISCONSIN

REVISION SCHEDULE

DATE	DESCRIPTION	BY

PROJECT NO.	20-24403
FILE NAME	24403 PROPOSED STORMWATER
DRAWN BY	CLF, SMD
DESIGNED BY	KBR
REVIEWED BY	KBR
ORIGINAL ISSUE DATE	9/17/2021
CLIENT PROJECT NO.	-

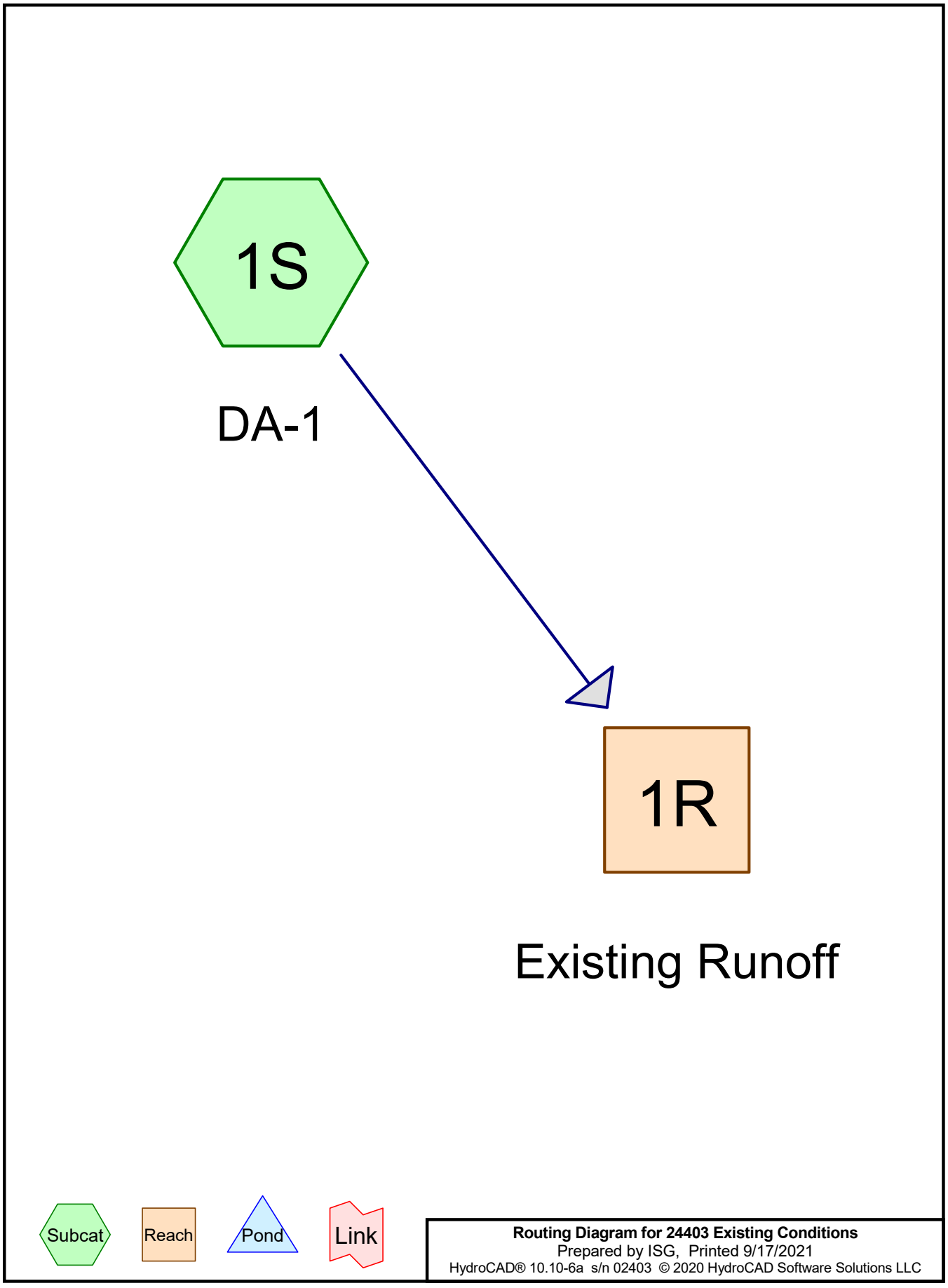
TITLE

PROPOSED DRAINAGE CONDITIONS

SHEET

B

-



Routing Diagram for 24403 Existing Conditions
Prepared by ISG, Printed 9/17/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	fe_text_mean 24-hr S0	1-yr	Default	24.00	1	2.61	2
2	2-yr	fe_text_mean 24-hr S0	2-yr	Default	24.00	1	3.01	2
3	5-yr	fe_text_mean 24-hr S0	5-yr	Default	24.00	1	3.75	2
4	10-yr	fe_text_mean 24-hr S0	10-yr	Default	24.00	1	4.46	2
5	25-yr	fe_text_mean 24-hr S0	25-yr	Default	24.00	1	5.56	2
6	100-yr	fe_text_mean 24-hr S0	100-yr	Default	24.00	1	7.55	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.619	69	50-75% Grass cover, Fair, HSG B (1S)
3.619	**69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.619	HSG B	1S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
3.619		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	3.619	0.000	0.000	0.000	3.619	50-75% Grass cover, Fair	1S
0.000	**3.619**	**0.000**	**0.000**	**0.000**	**3.619**	**TOTAL AREA**	

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: DA-1 Runoff Area=3.619 ac 0.00% Impervious Runoff Depth=0.47"
Flow Length=185' Slope=0.0030 '/' Tc=25.3 min CN=69 Runoff=1.17 cfs 0.142 af

Reach 1R: Existing Runoff Inflow=1.17 cfs 0.142 af
Outflow=1.17 cfs 0.142 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.142 af Average Runoff Depth = 0.47"
100.00% Pervious = 3.619 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA-1

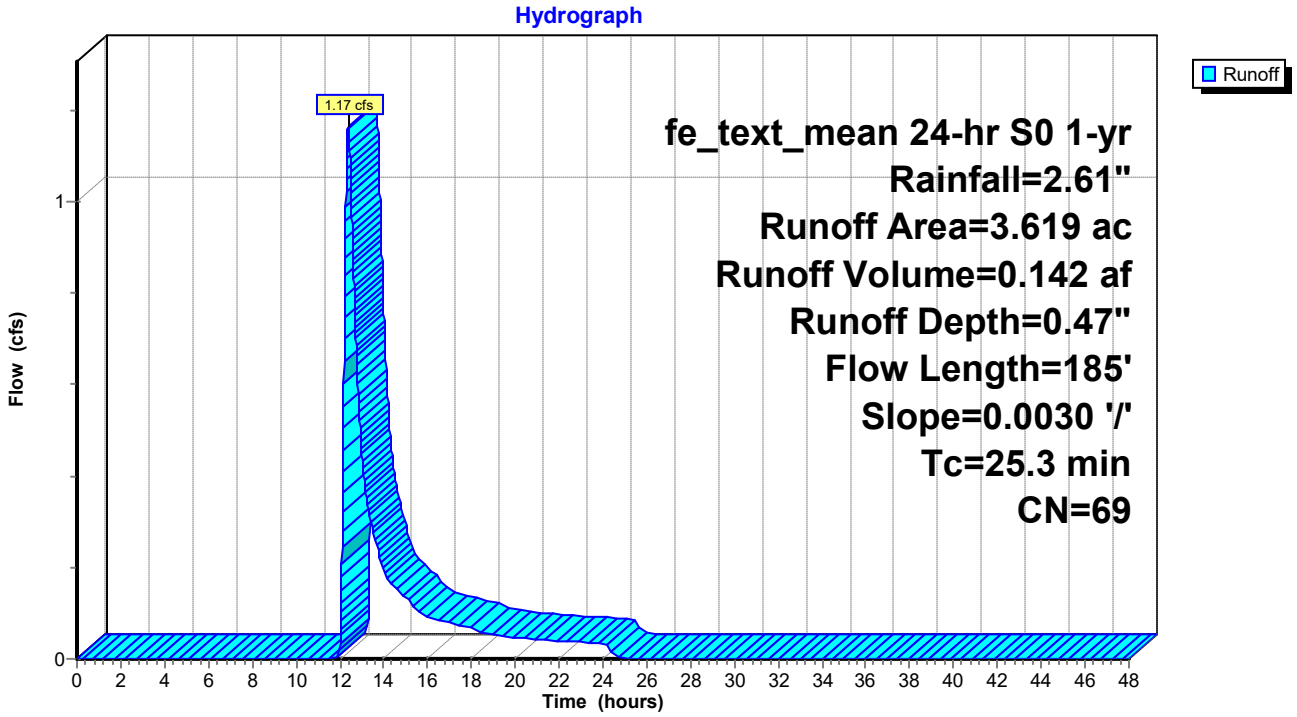
Runoff = 1.17 cfs @ 12.39 hrs, Volume= 0.142 af, Depth= 0.47"
Routed to Reach 1R : Existing Runoff

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

Area (ac)	CN	Description
3.619	69	50-75% Grass cover, Fair, HSG B
0.000	98	Paved parking, HSG B
3.619	69	Weighted Average
3.619		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0030	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.01"
3.7	85	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.3	185	Total			

Subcatchment 1S: DA-1

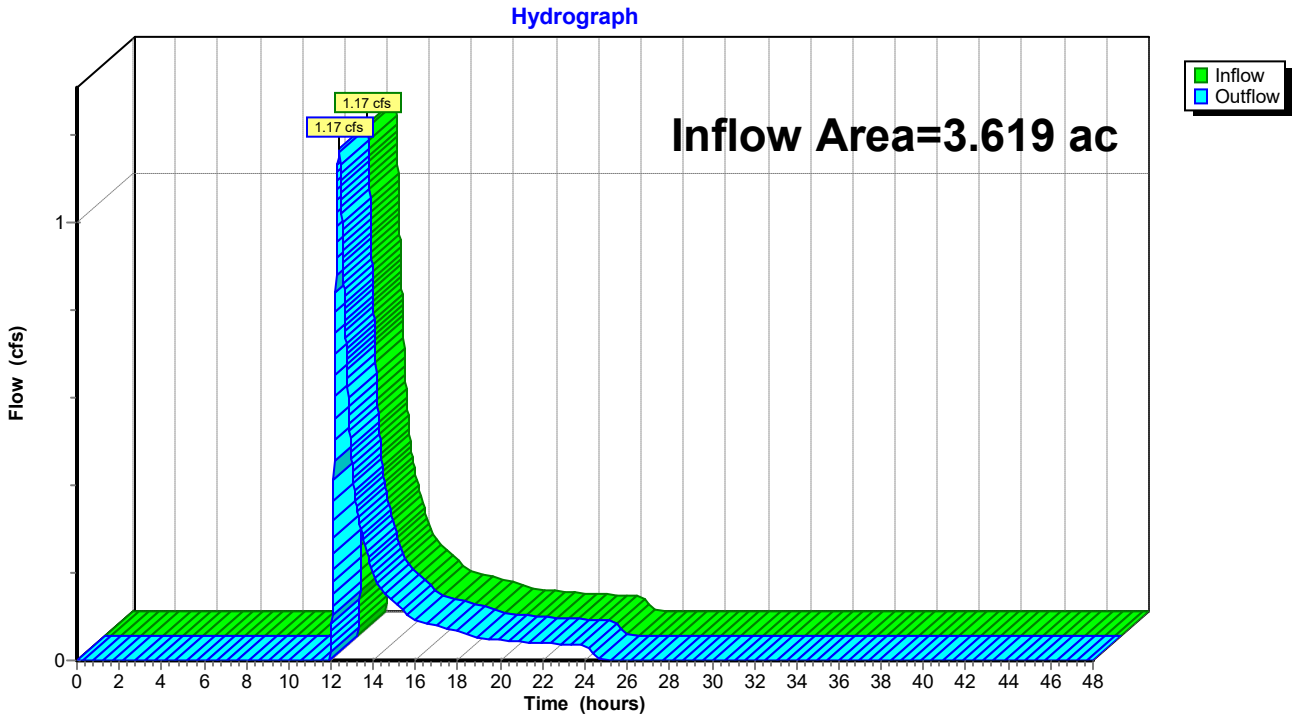


Summary for Reach 1R: Existing Runoff

Inflow Area = 3.619 ac, 0.00% Impervious, Inflow Depth = 0.47" for 1-yr event
Inflow = 1.17 cfs @ 12.39 hrs, Volume= 0.142 af
Outflow = 1.17 cfs @ 12.39 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Existing Runoff



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: DA-1 Runoff Area=3.619 ac 0.00% Impervious Runoff Depth=0.68"
Flow Length=185' Slope=0.0030 '/' Tc=25.3 min CN=69 Runoff=1.88 cfs 0.204 af

Reach 1R: Existing Runoff Inflow=1.88 cfs 0.204 af
Outflow=1.88 cfs 0.204 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.204 af Average Runoff Depth = 0.68"
100.00% Pervious = 3.619 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA-1

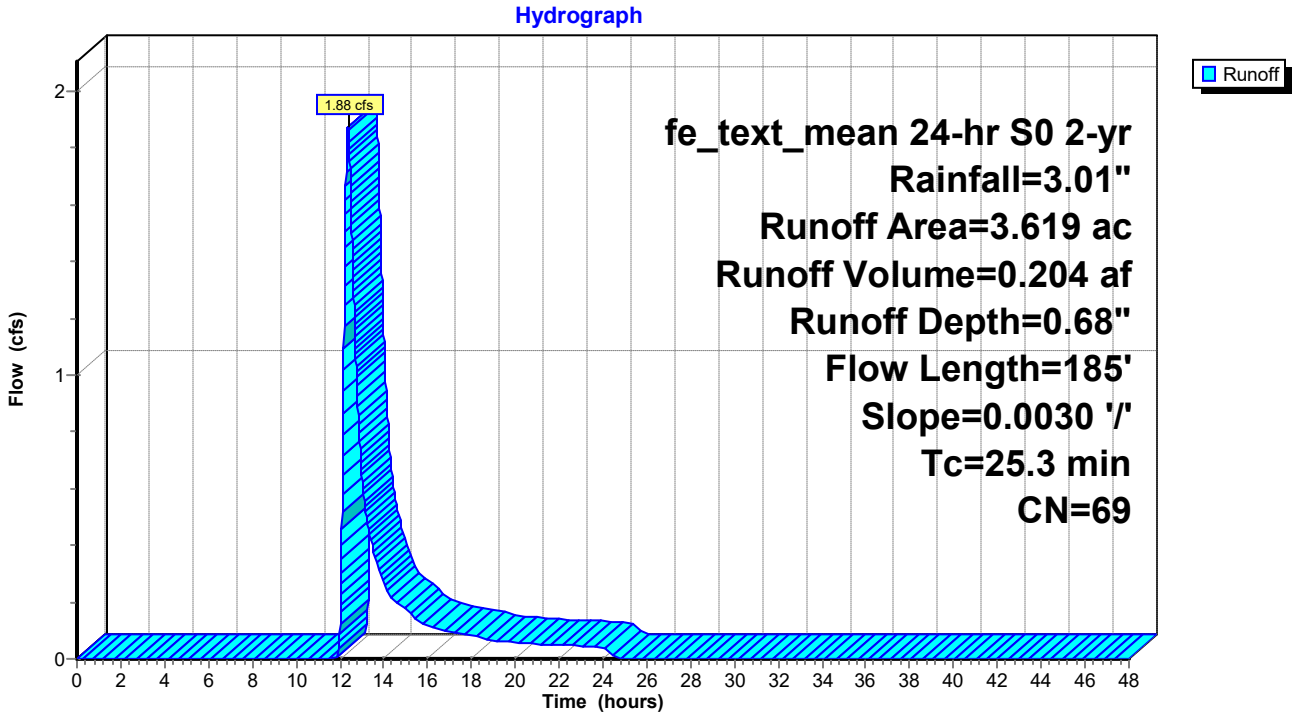
Runoff = 1.88 cfs @ 12.37 hrs, Volume= 0.204 af, Depth= 0.68"
Routed to Reach 1R : Existing Runoff

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

Area (ac)	CN	Description
3.619	69	50-75% Grass cover, Fair, HSG B
0.000	98	Paved parking, HSG B
3.619	69	Weighted Average
3.619		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0030	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.01"
3.7	85	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.3	185	Total			

Subcatchment 1S: DA-1

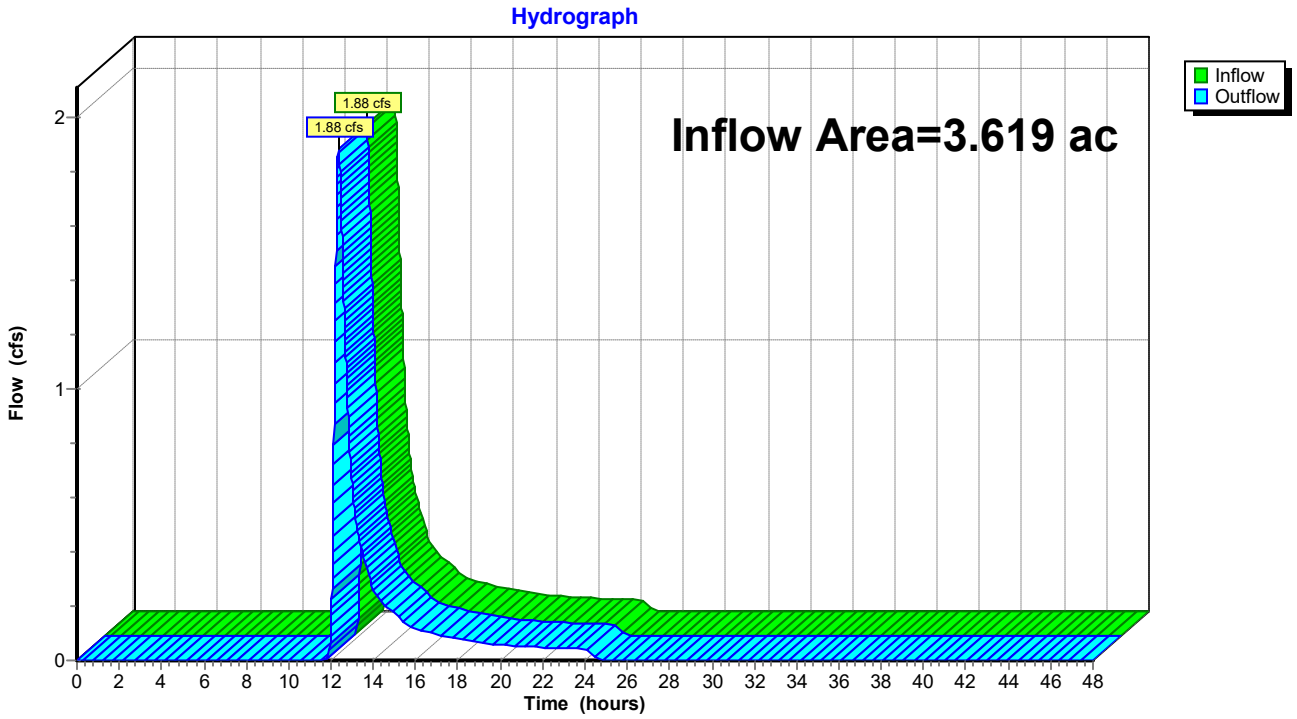


Summary for Reach 1R: Existing Runoff

Inflow Area = 3.619 ac, 0.00% Impervious, Inflow Depth = 0.68" for 2-yr event
Inflow = 1.88 cfs @ 12.37 hrs, Volume= 0.204 af
Outflow = 1.88 cfs @ 12.37 hrs, Volume= 0.204 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Existing Runoff



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: DA-1 Runoff Area=3.619 ac 0.00% Impervious Runoff Depth=1.11"
Flow Length=185' Slope=0.0030 '/' Tc=25.3 min CN=69 Runoff=3.39 cfs 0.334 af

Reach 1R: Existing Runoff Inflow=3.39 cfs 0.334 af
Outflow=3.39 cfs 0.334 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.334 af Average Runoff Depth = 1.11"
100.00% Pervious = 3.619 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA-1

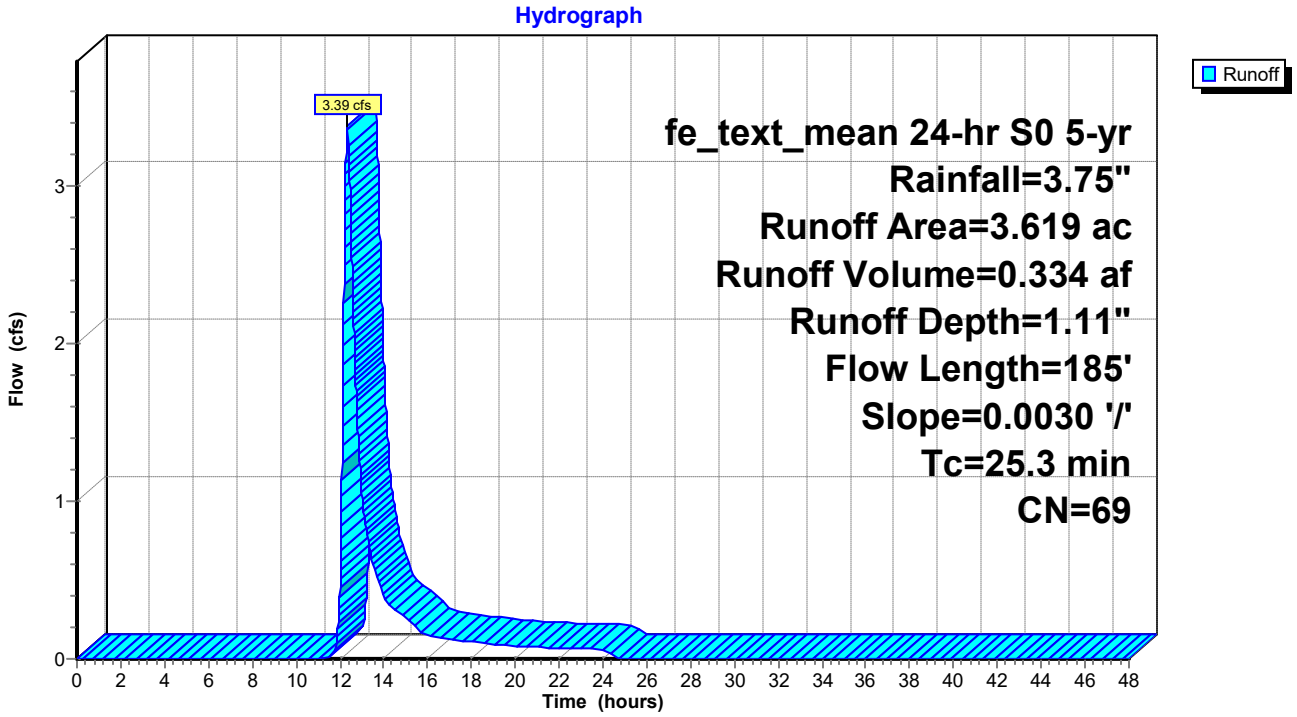
Runoff = 3.39 cfs @ 12.34 hrs, Volume= 0.334 af, Depth= 1.11"
Routed to Reach 1R : Existing Runoff

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

Area (ac)	CN	Description
3.619	69	50-75% Grass cover, Fair, HSG B
0.000	98	Paved parking, HSG B
3.619	69	Weighted Average
3.619		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0030	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.01"
3.7	85	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.3	185	Total			

Subcatchment 1S: DA-1

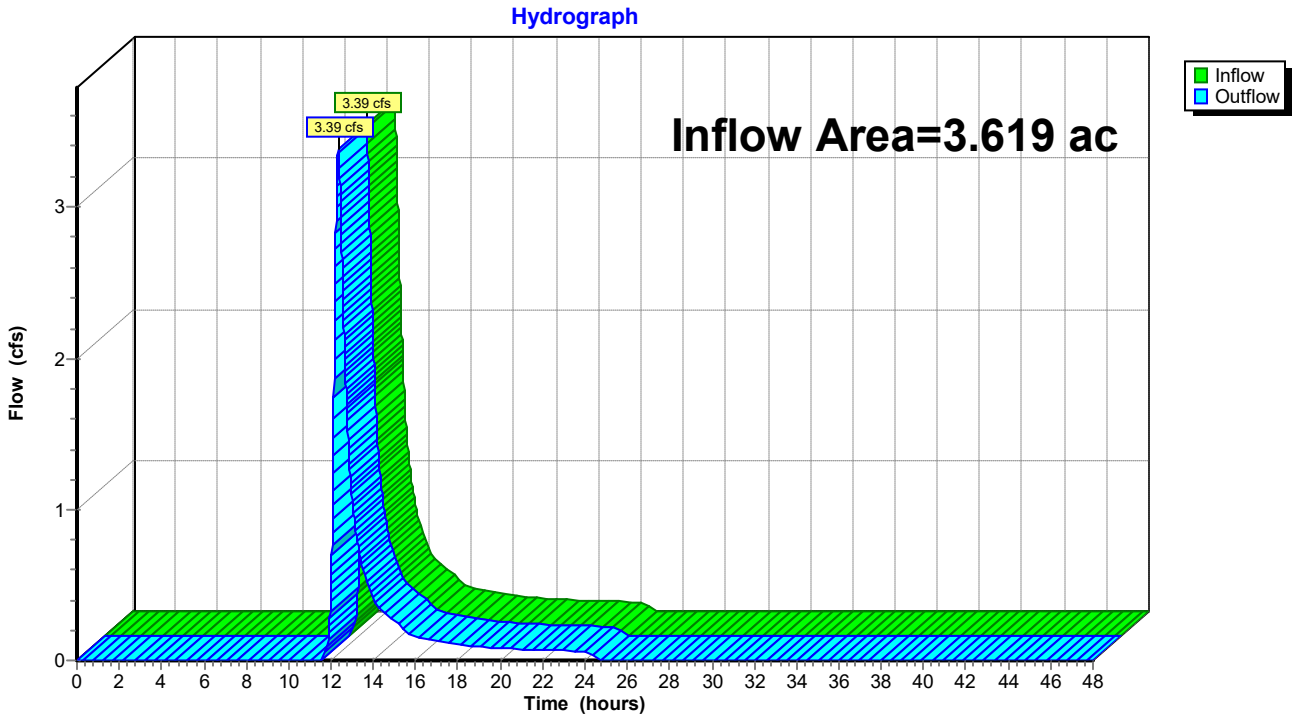


Summary for Reach 1R: Existing Runoff

Inflow Area = 3.619 ac, 0.00% Impervious, Inflow Depth = 1.11" for 5-yr event
Inflow = 3.39 cfs @ 12.34 hrs, Volume= 0.334 af
Outflow = 3.39 cfs @ 12.34 hrs, Volume= 0.334 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Existing Runoff



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: DA-1 Runoff Area=3.619 ac 0.00% Impervious Runoff Depth=1.57"
Flow Length=185' Slope=0.0030 '/' Tc=25.3 min CN=69 Runoff=4.90 cfs 0.475 af

Reach 1R: Existing Runoff Inflow=4.90 cfs 0.475 af
Outflow=4.90 cfs 0.475 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.475 af Average Runoff Depth = 1.57"
100.00% Pervious = 3.619 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA-1

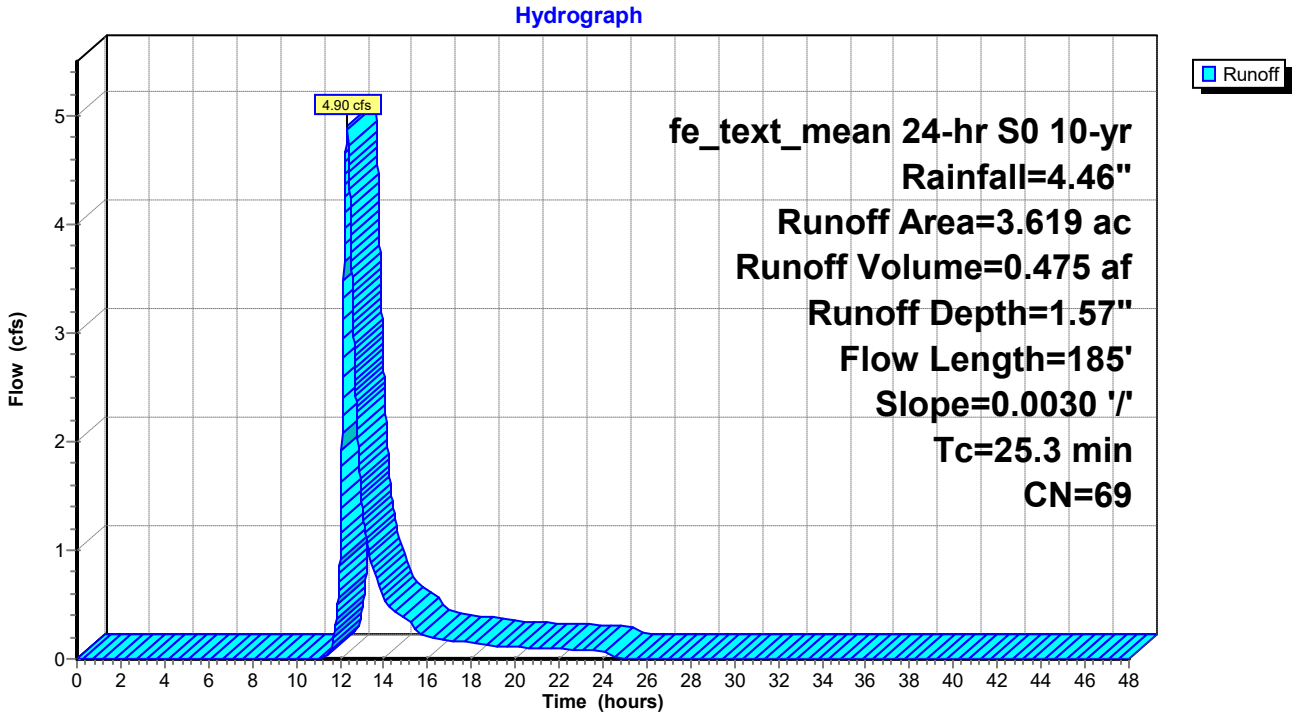
Runoff = 4.90 cfs @ 12.34 hrs, Volume= 0.475 af, Depth= 1.57"
Routed to Reach 1R : Existing Runoff

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

Area (ac)	CN	Description
3.619	69	50-75% Grass cover, Fair, HSG B
0.000	98	Paved parking, HSG B
3.619	69	Weighted Average
3.619		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0030	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.01"
3.7	85	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.3	185	Total			

Subcatchment 1S: DA-1

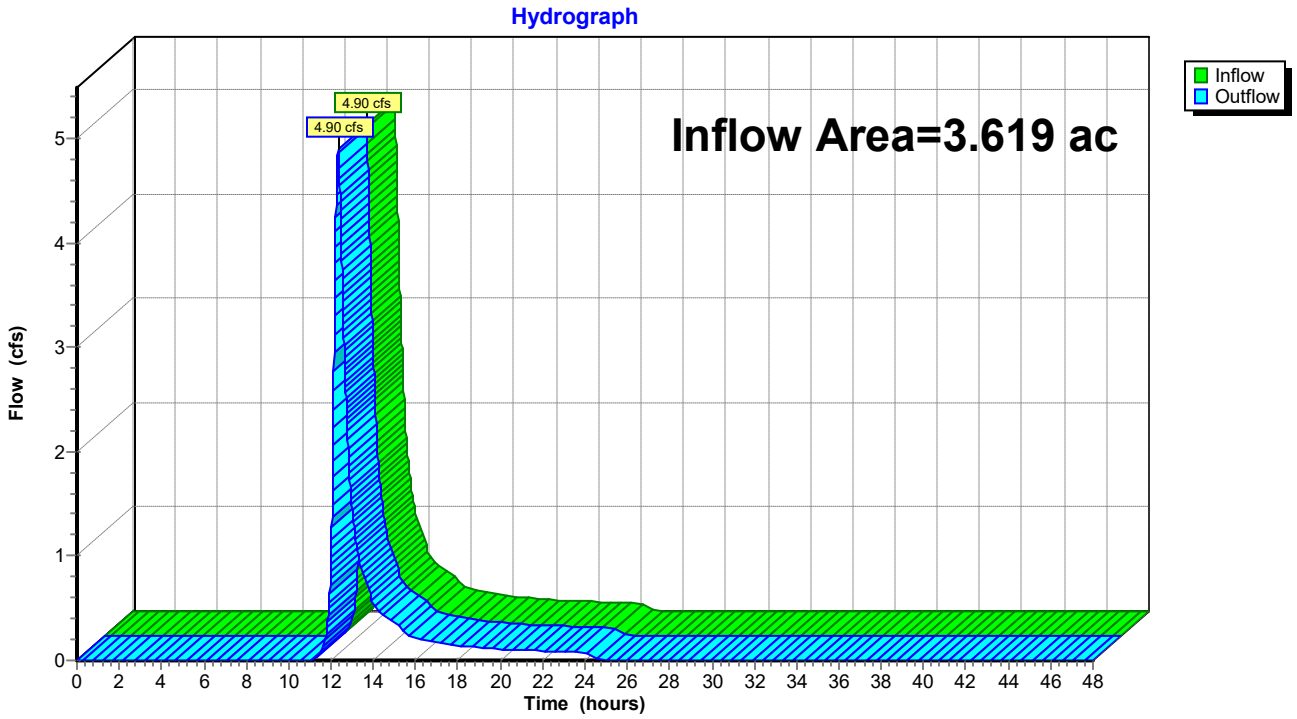


Summary for Reach 1R: Existing Runoff

Inflow Area = 3.619 ac, 0.00% Impervious, Inflow Depth = 1.57" for 10-yr event
Inflow = 4.90 cfs @ 12.34 hrs, Volume= 0.475 af
Outflow = 4.90 cfs @ 12.34 hrs, Volume= 0.475 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Existing Runoff



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: DA-1 Runoff Area=3.619 ac 0.00% Impervious Runoff Depth=2.37"
Flow Length=185' Slope=0.0030 '/' Tc=25.3 min CN=69 Runoff=7.34 cfs 0.716 af

Reach 1R: Existing Runoff Inflow=7.34 cfs 0.716 af
Outflow=7.34 cfs 0.716 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.716 af Average Runoff Depth = 2.37"
100.00% Pervious = 3.619 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA-1

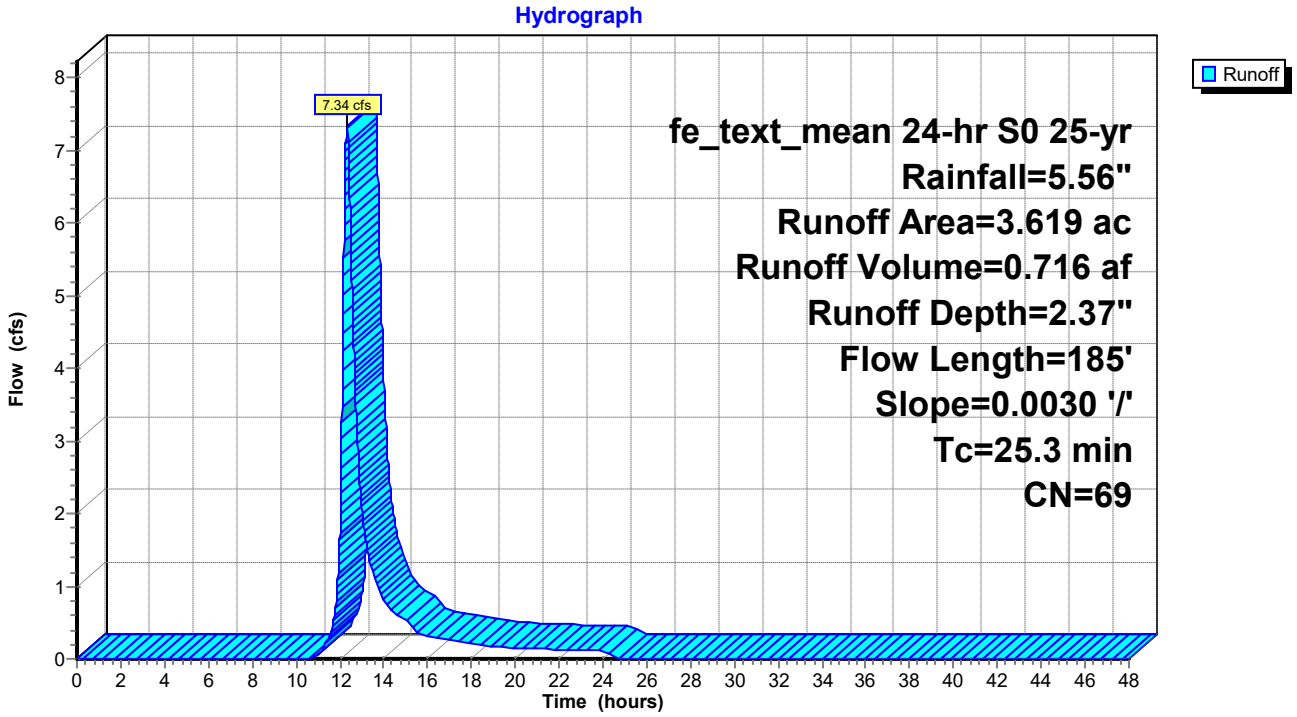
Runoff = 7.34 cfs @ 12.33 hrs, Volume= 0.716 af, Depth= 2.37"
Routed to Reach 1R : Existing Runoff

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

Area (ac)	CN	Description
3.619	69	50-75% Grass cover, Fair, HSG B
0.000	98	Paved parking, HSG B
3.619	69	Weighted Average
3.619		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0030	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.01"
3.7	85	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.3	185	Total			

Subcatchment 1S: DA-1

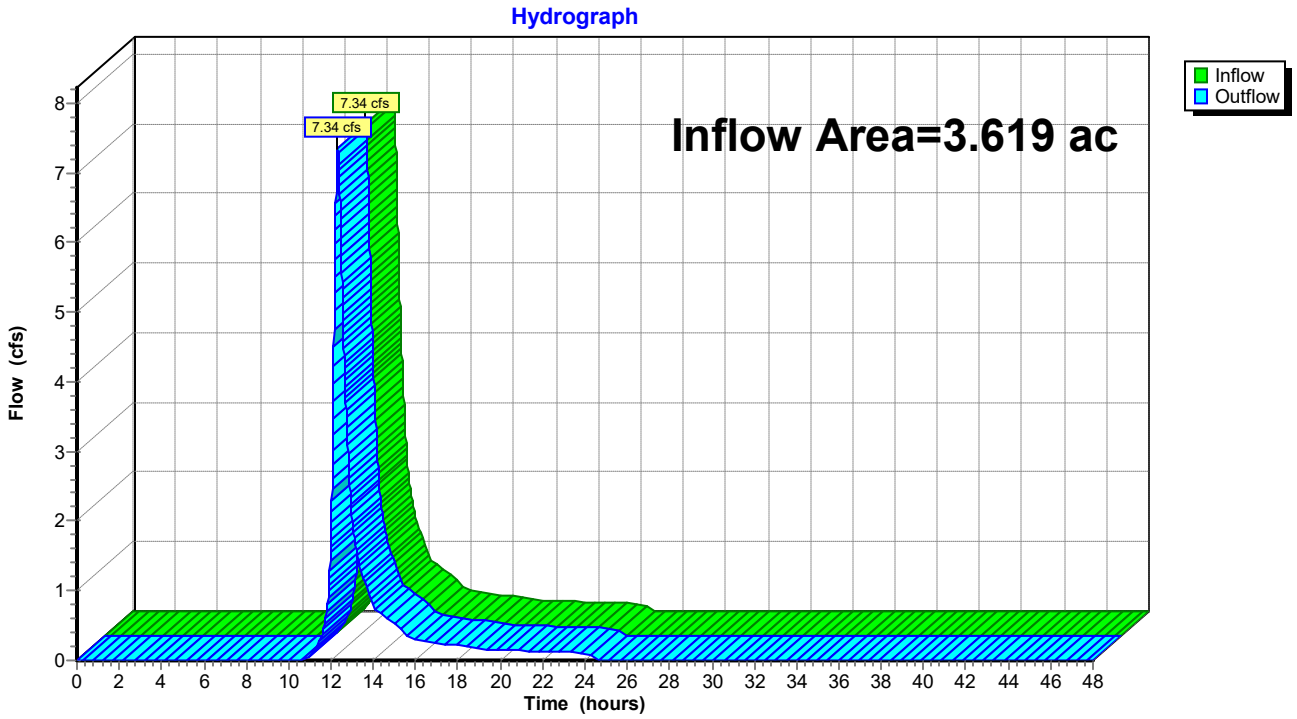


Summary for Reach 1R: Existing Runoff

Inflow Area = 3.619 ac, 0.00% Impervious, Inflow Depth = 2.37" for 25-yr event
Inflow = 7.34 cfs @ 12.33 hrs, Volume= 0.716 af
Outflow = 7.34 cfs @ 12.33 hrs, Volume= 0.716 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Existing Runoff



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: DA-1 Runoff Area=3.619 ac 0.00% Impervious Runoff Depth=3.97"
Flow Length=185' Slope=0.0030 '/' Tc=25.3 min CN=69 Runoff=11.63 cfs 1.197 af

Reach 1R: Existing Runoff Inflow=11.63 cfs 1.197 af
Outflow=11.63 cfs 1.197 af

Total Runoff Area = 3.619 ac Runoff Volume = 1.197 af Average Runoff Depth = 3.97"
100.00% Pervious = 3.619 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: DA-1

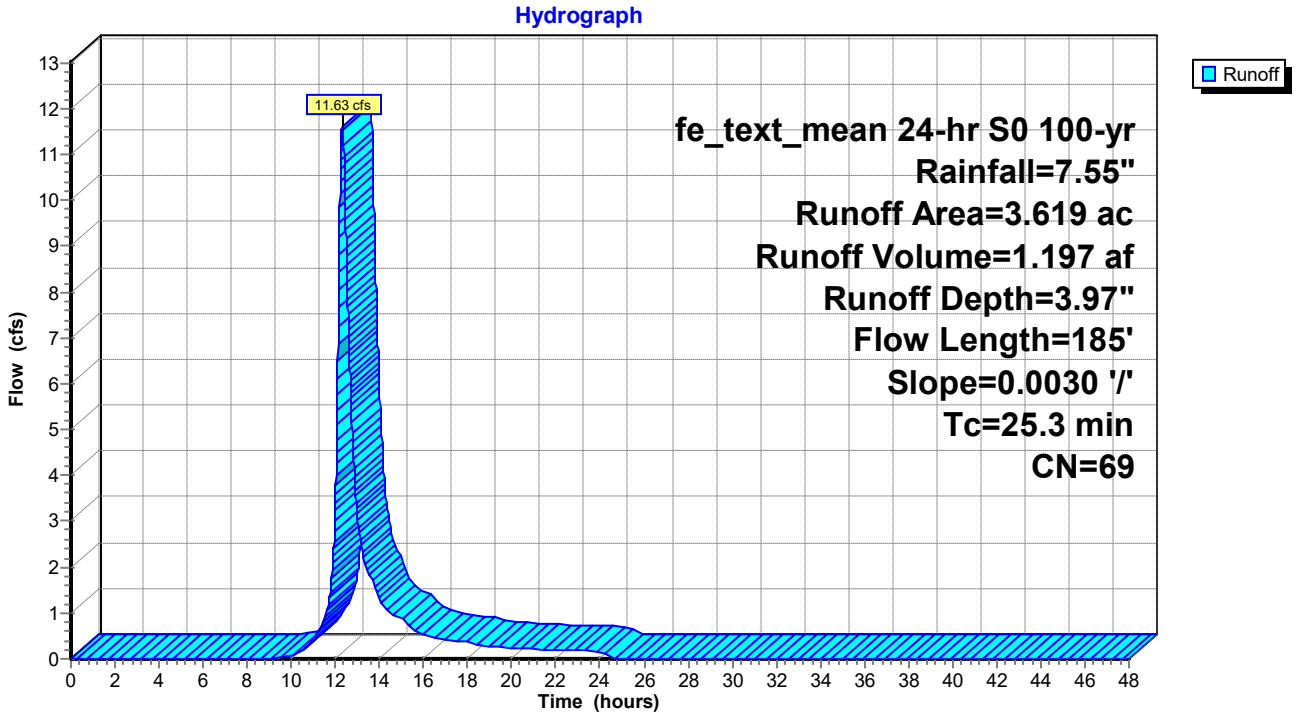
Runoff = 11.63 cfs @ 12.31 hrs, Volume= 1.197 af, Depth= 3.97"
Routed to Reach 1R : Existing Runoff

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

Area (ac)	CN	Description
3.619	69	50-75% Grass cover, Fair, HSG B
0.000	98	Paved parking, HSG B
3.619	69	Weighted Average
3.619		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.6	100	0.0030	0.08		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.01"
3.7	85	0.0030	0.38		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
25.3	185	Total			

Subcatchment 1S: DA-1

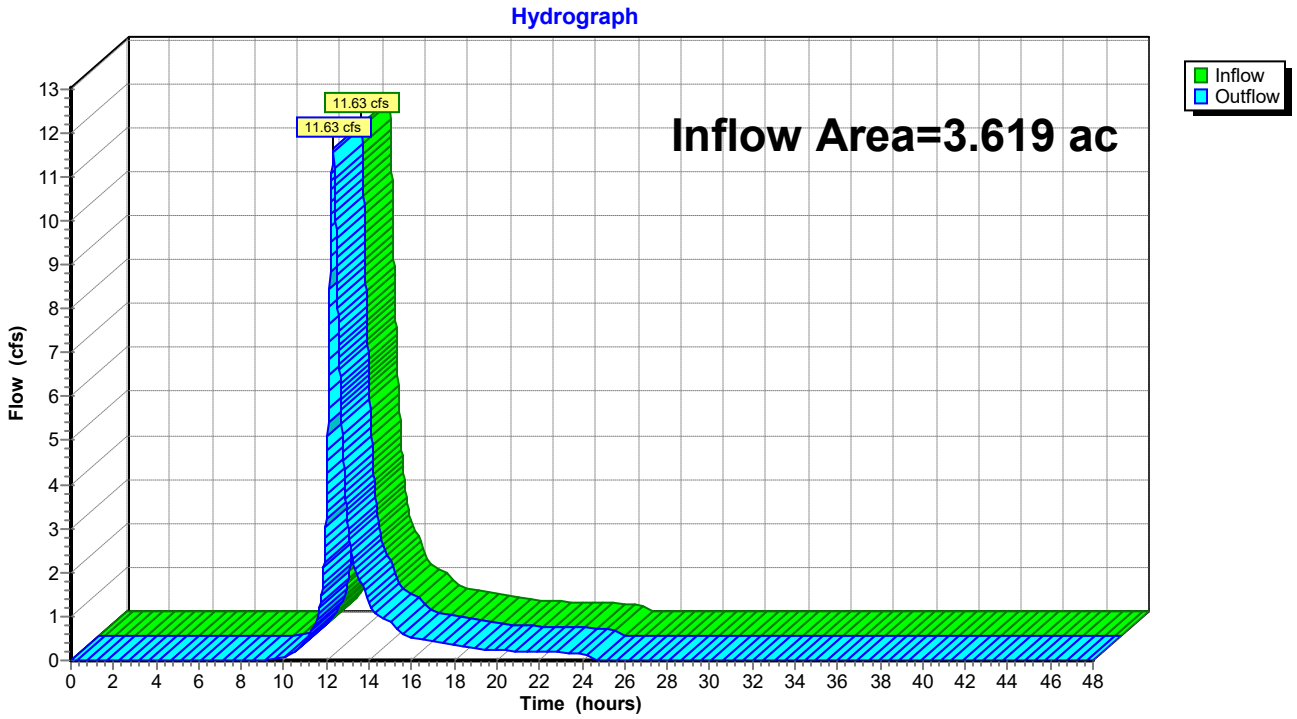


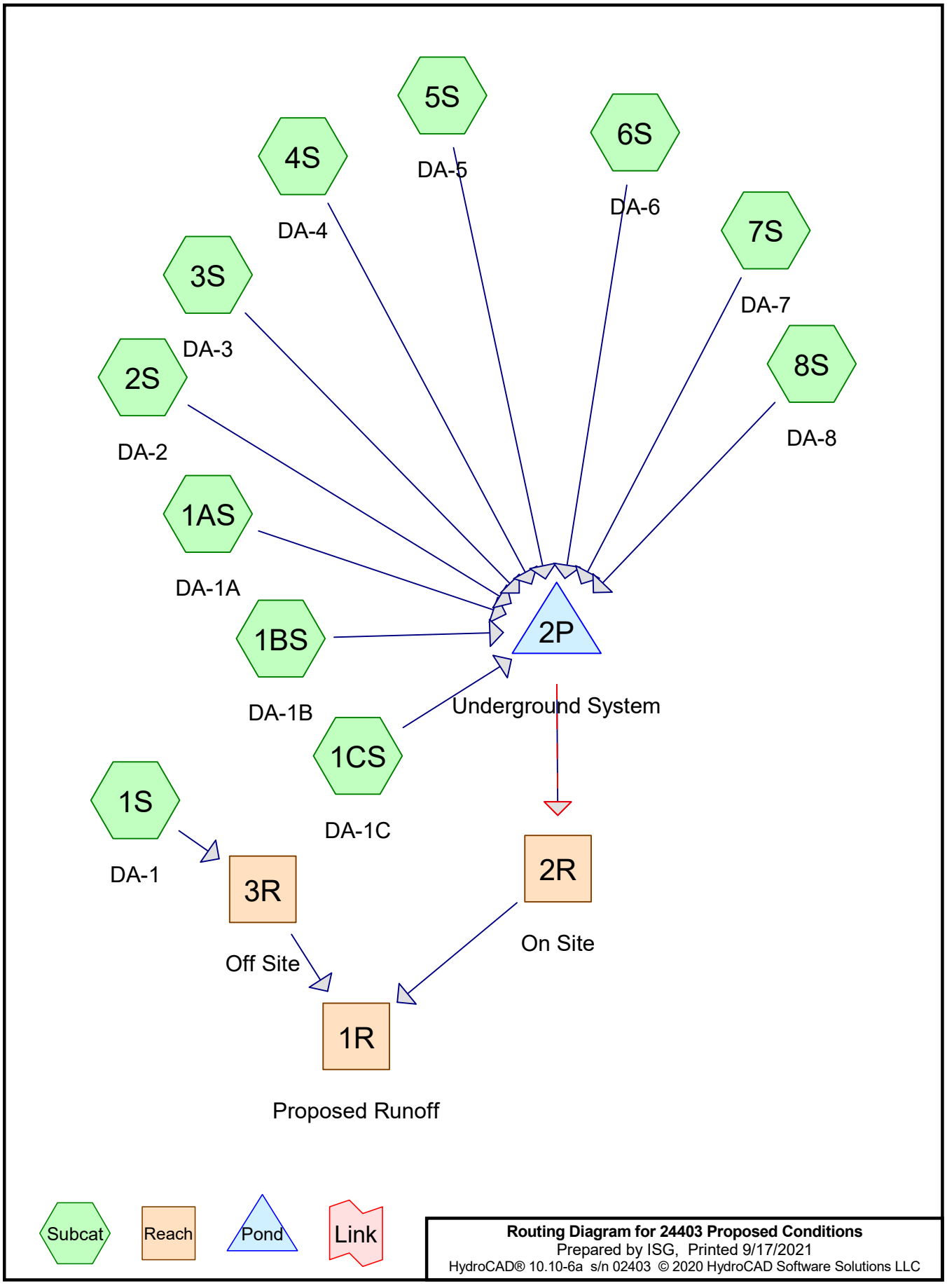
Summary for Reach 1R: Existing Runoff

Inflow Area = 3.619 ac, 0.00% Impervious, Inflow Depth = 3.97" for 100-yr event
Inflow = 11.63 cfs @ 12.31 hrs, Volume= 1.197 af
Outflow = 11.63 cfs @ 12.31 hrs, Volume= 1.197 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Existing Runoff





Routing Diagram for 24403 Proposed Conditions
Prepared by ISG, Printed 9/17/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1-yr	fe_text_mean 24-hr S0	1-yr	Default	24.00	1	2.61	2
2	2-yr	fe_text_mean 24-hr S0	2-yr	Default	24.00	1	3.01	2
3	5-yr	fe_text_mean 24-hr S0	5-yr	Default	24.00	1	3.75	2
4	10-yr	fe_text_mean 24-hr S0	10-yr	Default	24.00	1	4.46	2
5	25-yr	fe_text_mean 24-hr S0	25-yr	Default	24.00	1	5.56	2
6	100-yr	fe_text_mean 24-hr S0	100-yr	Default	24.00	1	7.55	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.995	61	>75% Grass cover, Good, HSG B (1AS, 1BS, 1CS, 1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S)
2.624	98	Impervious, HSG B (1AS, 1BS, 1CS, 1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S)
3.619	**88**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.619	HSG B	1AS, 1BS, 1CS, 1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
3.619		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.995	0.000	0.000	0.000	0.995	>75% Grass cover, Good	1AS, 1BS, 1CS, 1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S
0.000	2.624	0.000	0.000	0.000	2.624	Impervious	1AS, 1BS, 1CS, 1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S
0.000	**3.619**	**0.000**	**0.000**	**0.000**	**3.619**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	2P	640.25	639.75	100.0	0.0050	0.013	0.0	12.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AS: DA-1A Runoff Area=0.216 ac 87.04% Impervious Runoff Depth=1.88"
Tc=5.0 min CN=93 Runoff=0.72 cfs 0.034 af

Subcatchment 1BS: DA-1B Runoff Area=0.268 ac 70.15% Impervious Runoff Depth=1.40"
Tc=5.0 min CN=87 Runoff=0.67 cfs 0.031 af

Subcatchment 1CS: DA-1C Runoff Area=0.138 ac 80.43% Impervious Runoff Depth=1.71"
Tc=5.0 min CN=91 Runoff=0.42 cfs 0.020 af

Subcatchment 1S: DA-1 Runoff Area=0.492 ac 33.13% Impervious Runoff Depth=0.63"
Tc=5.0 min CN=73 Runoff=0.47 cfs 0.026 af

Subcatchment 2S: DA-2 Runoff Area=0.777 ac 83.91% Impervious Runoff Depth=1.80"
Tc=5.0 min CN=92 Runoff=2.47 cfs 0.116 af

Subcatchment 3S: DA-3 Runoff Area=0.611 ac 81.01% Impervious Runoff Depth=1.71"
Tc=5.0 min CN=91 Runoff=1.86 cfs 0.087 af

Subcatchment 4S: DA-4 Runoff Area=0.248 ac 85.08% Impervious Runoff Depth=1.80"
Tc=5.0 min CN=92 Runoff=0.79 cfs 0.037 af

Subcatchment 5S: DA-5 Runoff Area=0.233 ac 54.51% Impervious Runoff Depth=1.02"
Tc=5.0 min CN=81 Runoff=0.41 cfs 0.020 af

Subcatchment 6S: DA-6 Runoff Area=0.204 ac 62.25% Impervious Runoff Depth=1.20"
Tc=5.0 min CN=84 Runoff=0.43 cfs 0.020 af

Subcatchment 7S: DA-7 Runoff Area=0.185 ac 87.57% Impervious Runoff Depth=1.88"
Tc=5.0 min CN=93 Runoff=0.61 cfs 0.029 af

Subcatchment 8S: DA-8 Runoff Area=0.247 ac 80.97% Impervious Runoff Depth=1.71"
Tc=5.0 min CN=91 Runoff=0.75 cfs 0.035 af

Reach 1R: Proposed Runoff Inflow=0.73 cfs 0.455 af
Outflow=0.73 cfs 0.455 af

Reach 2R: On Site Inflow=0.47 cfs 0.429 af
Outflow=0.47 cfs 0.429 af

Reach 3R: Off Site Inflow=0.47 cfs 0.026 af
Outflow=0.47 cfs 0.026 af

Pond 2P: Underground System Peak Elev=642.66' Storage=0.256 af Inflow=9.14 cfs 0.430 af
Primary=0.47 cfs 0.429 af Secondary=0.00 cfs 0.000 af Outflow=0.47 cfs 0.429 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.456 af Average Runoff Depth = 1.51"
27.49% Pervious = 0.995 ac 72.51% Impervious = 2.624 ac

Summary for Subcatchment 1AS: DA-1A

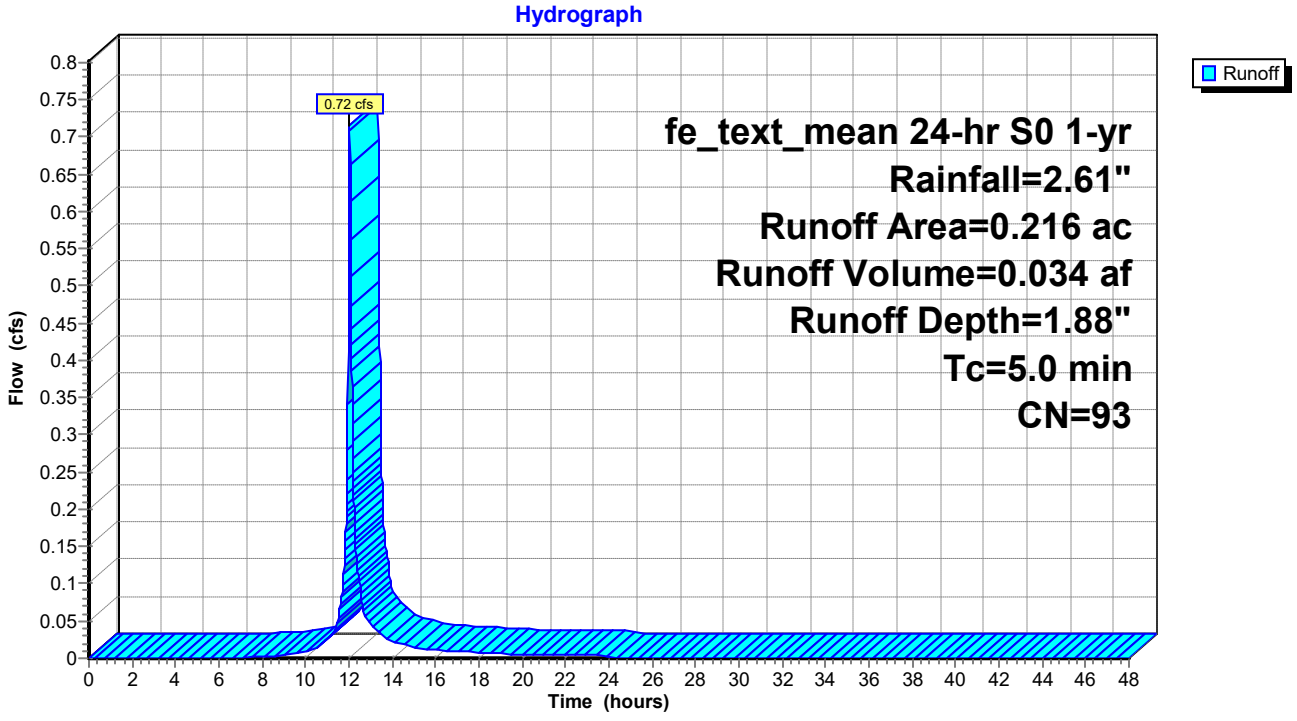
Runoff = 0.72 cfs @ 12.03 hrs, Volume= 0.034 af, Depth= 1.88"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.028	61	>75% Grass cover, Good, HSG B
	0.216	93	Weighted Average
	0.028		12.96% Pervious Area
	0.188		87.04% Impervious Area

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

Subcatchment 1AS: DA-1A



Summary for Subcatchment 1BS: DA-1B

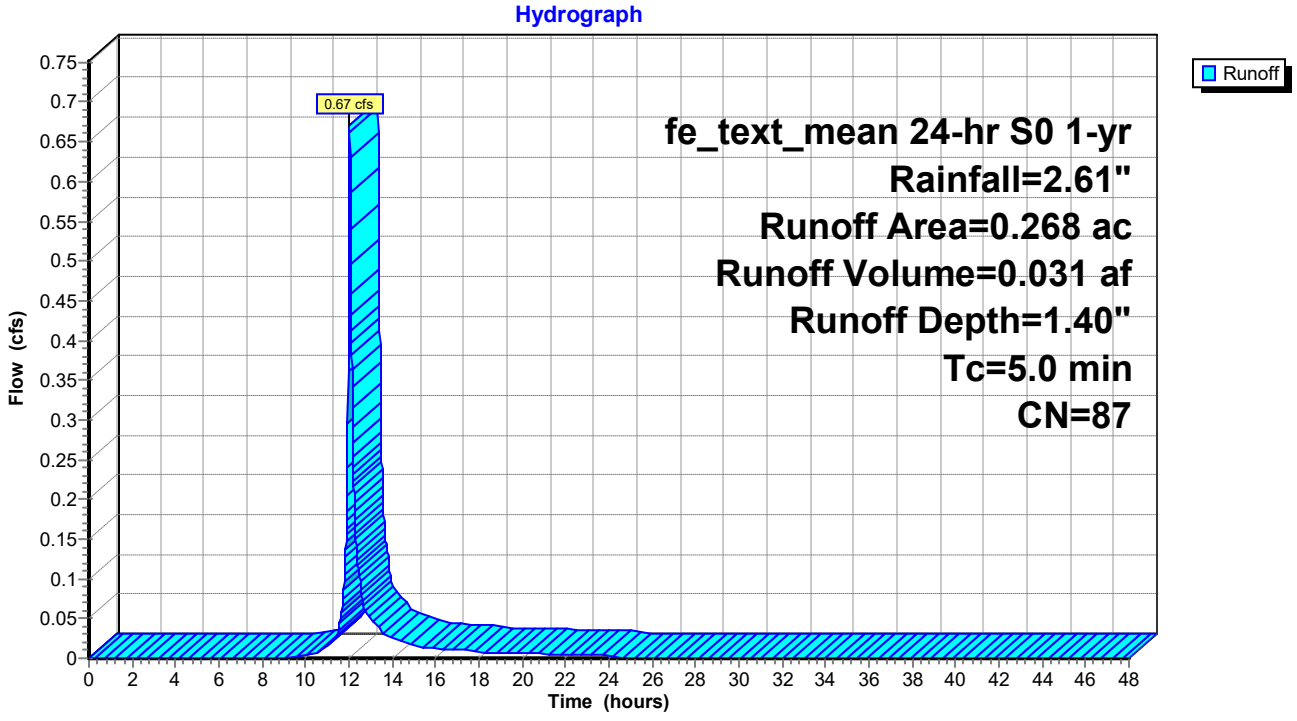
Runoff = 0.67 cfs @ 12.03 hrs, Volume= 0.031 af, Depth= 1.40"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.080	61	>75% Grass cover, Good, HSG B
	0.268	87	Weighted Average
	0.080		29.85% Pervious Area
	0.188		70.15% Impervious Area

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

Subcatchment 1BS: DA-1B



Summary for Subcatchment 1CS: DA-1C

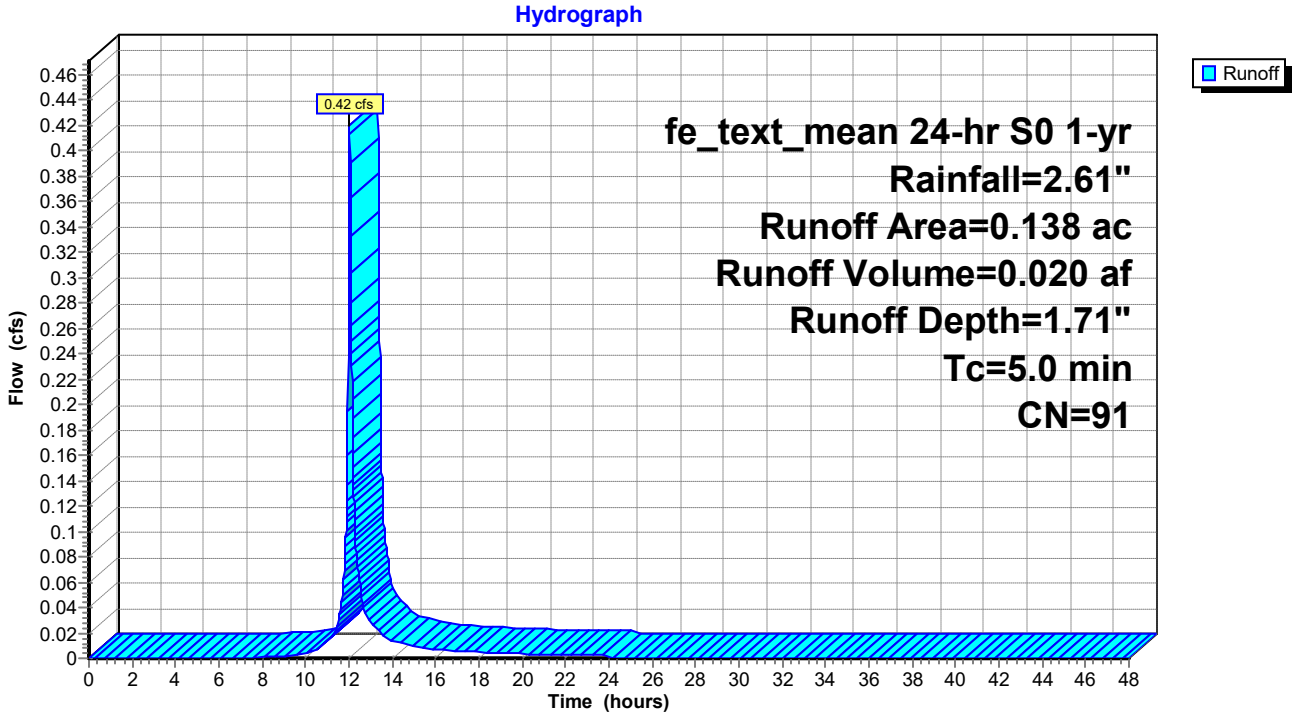
Runoff = 0.42 cfs @ 12.03 hrs, Volume= 0.020 af, Depth= 1.71"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.111	98	Impervious, HSG B
	0.027	61	>75% Grass cover, Good, HSG B
	0.138	91	Weighted Average
	0.027		19.57% Pervious Area
	0.111		80.43% Impervious Area

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

Subcatchment 1CS: DA-1C



Summary for Subcatchment 1S: DA-1

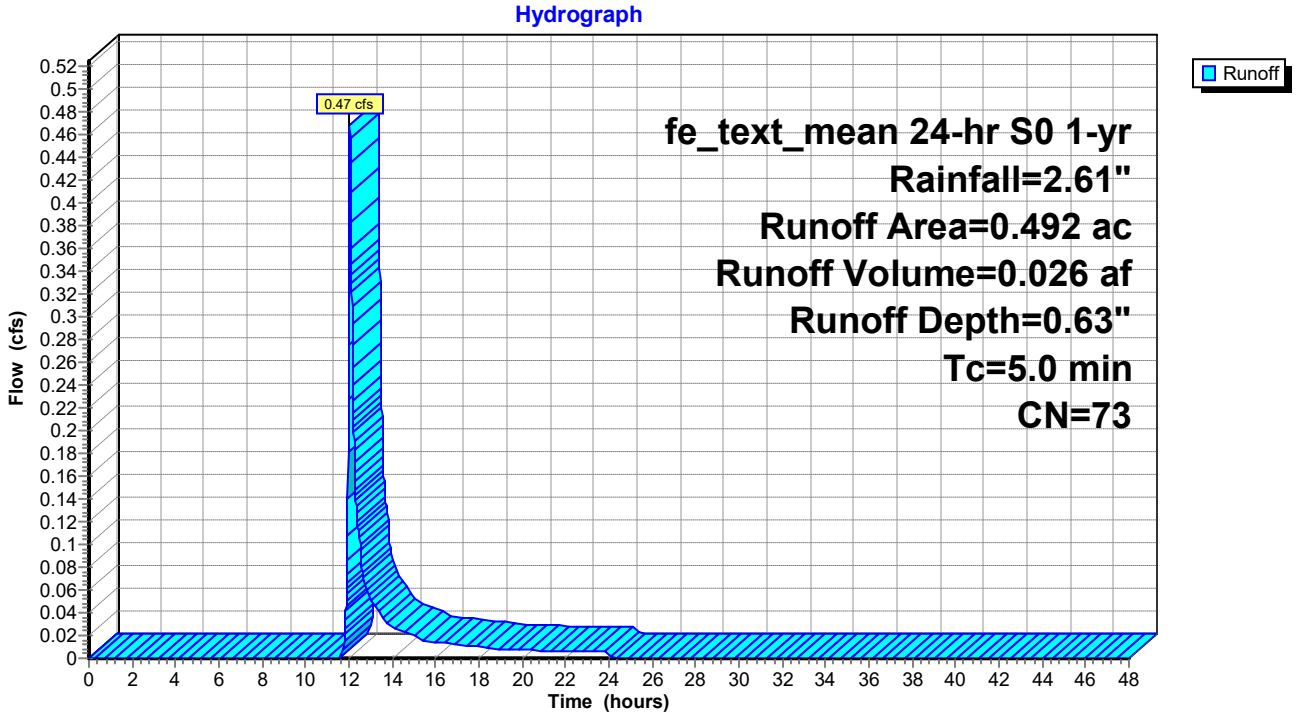
Runoff = 0.47 cfs @ 12.04 hrs, Volume= 0.026 af, Depth= 0.63"
Routed to Reach 3R : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.163	98	Impervious, HSG B
	0.329	61	>75% Grass cover, Good, HSG B
	0.492	73	Weighted Average
	0.329		66.87% Pervious Area
	0.163		33.13% Impervious Area

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

Subcatchment 1S: DA-1



Summary for Subcatchment 2S: DA-2

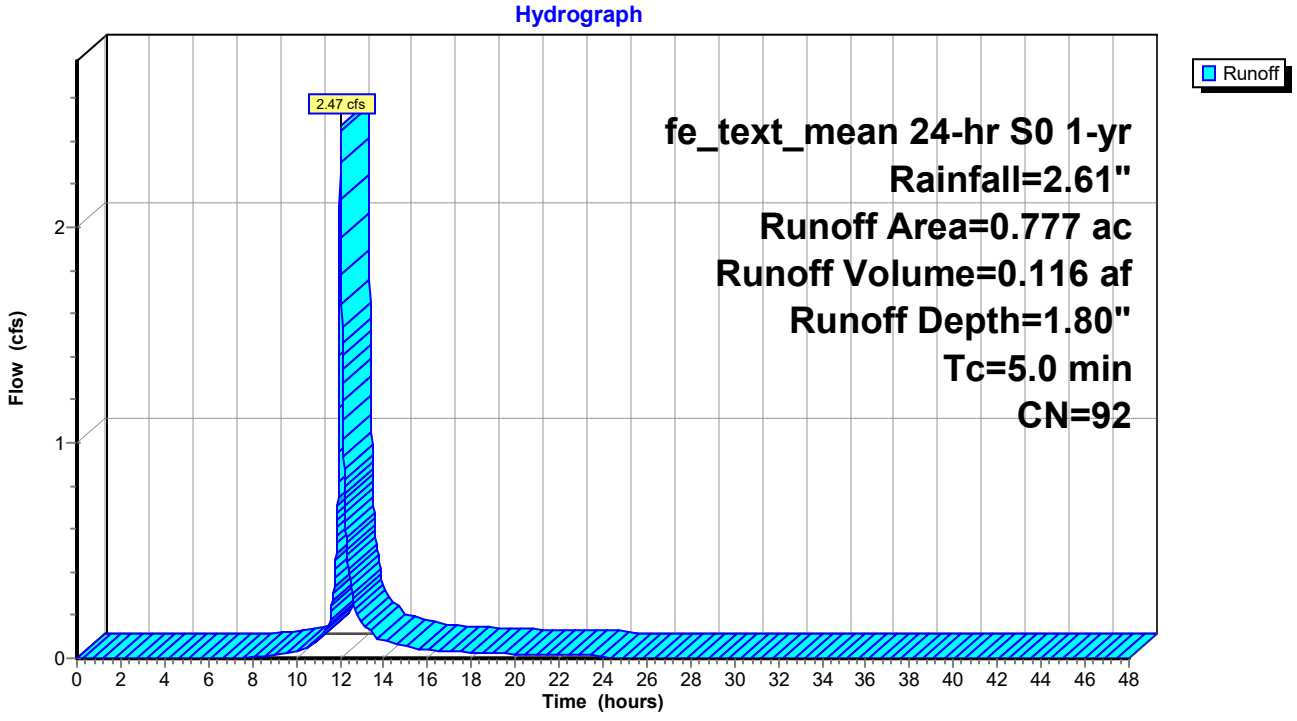
Runoff = 2.47 cfs @ 12.03 hrs, Volume= 0.116 af, Depth= 1.80"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.652	98	Impervious, HSG B
	0.125	61	>75% Grass cover, Good, HSG B
	0.777	92	Weighted Average
	0.125		16.09% Pervious Area
	0.652		83.91% Impervious Area

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

Subcatchment 2S: DA-2



Summary for Subcatchment 3S: DA-3

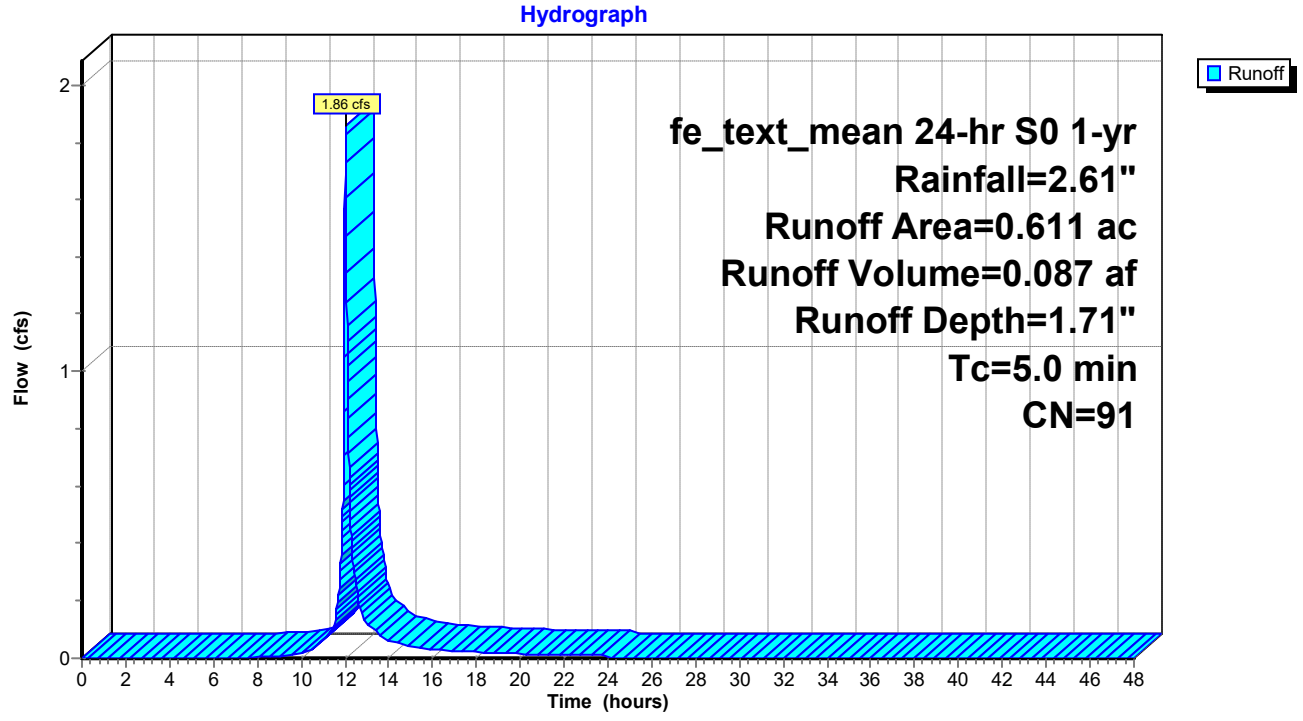
Runoff = 1.86 cfs @ 12.03 hrs, Volume= 0.087 af, Depth= 1.71"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.495	98	Impervious, HSG B
	0.116	61	>75% Grass cover, Good, HSG B
	0.611	91	Weighted Average
	0.116		18.99% Pervious Area
	0.495		81.01% Impervious Area

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

Subcatchment 3S: DA-3



Summary for Subcatchment 4S: DA-4

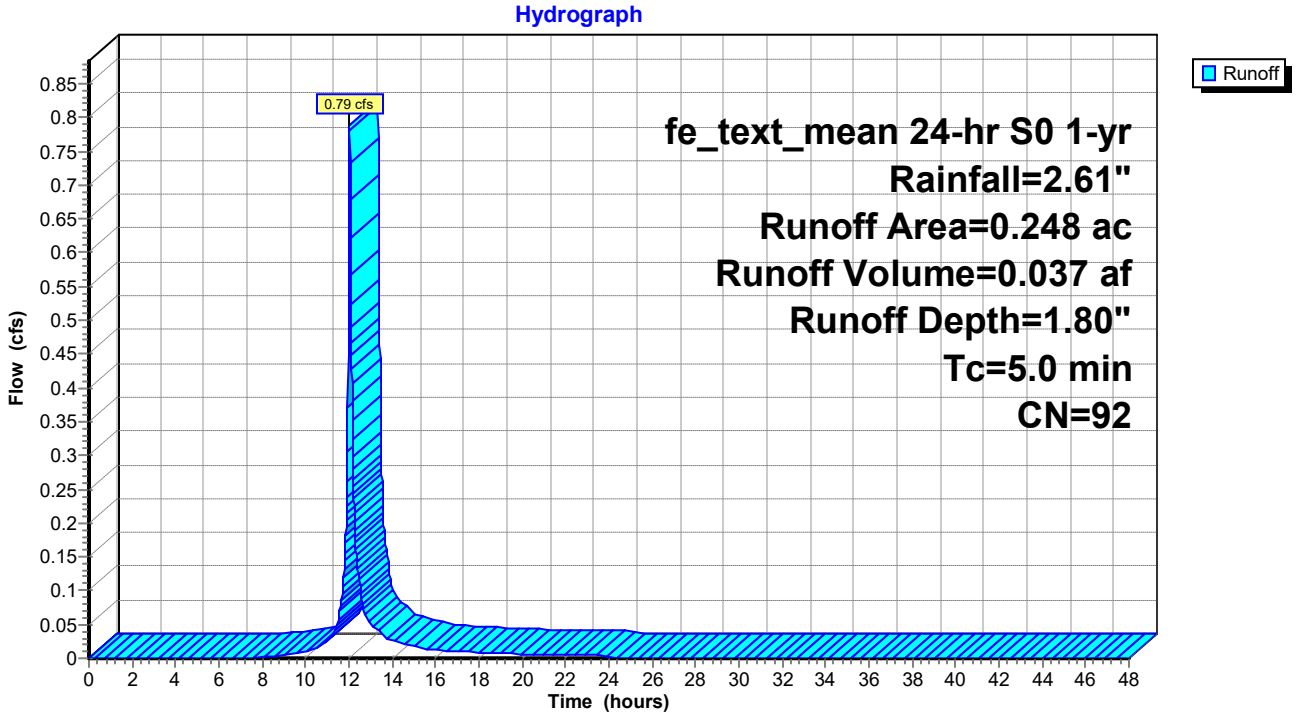
Runoff = 0.79 cfs @ 12.03 hrs, Volume= 0.037 af, Depth= 1.80"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.211	98	Impervious, HSG B
	0.037	61	>75% Grass cover, Good, HSG B
	0.248	92	Weighted Average
	0.037		14.92% Pervious Area
	0.211		85.08% Impervious Area

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

Subcatchment 4S: DA-4



Summary for Subcatchment 5S: DA-5

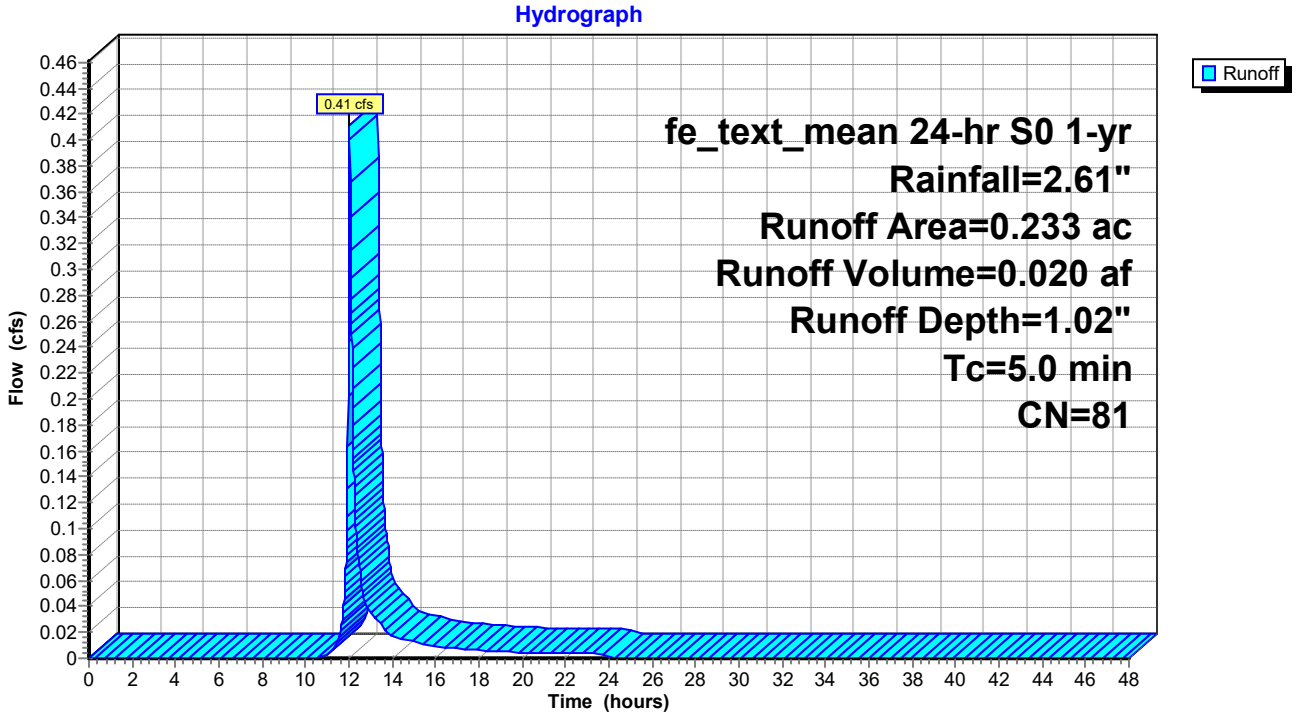
Runoff = 0.41 cfs @ 12.03 hrs, Volume= 0.020 af, Depth= 1.02"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.106	61	>75% Grass cover, Good, HSG B
	0.233	81	Weighted Average
	0.106		45.49% Pervious Area
	0.127		54.51% Impervious Area

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

Subcatchment 5S: DA-5



Summary for Subcatchment 6S: DA-6

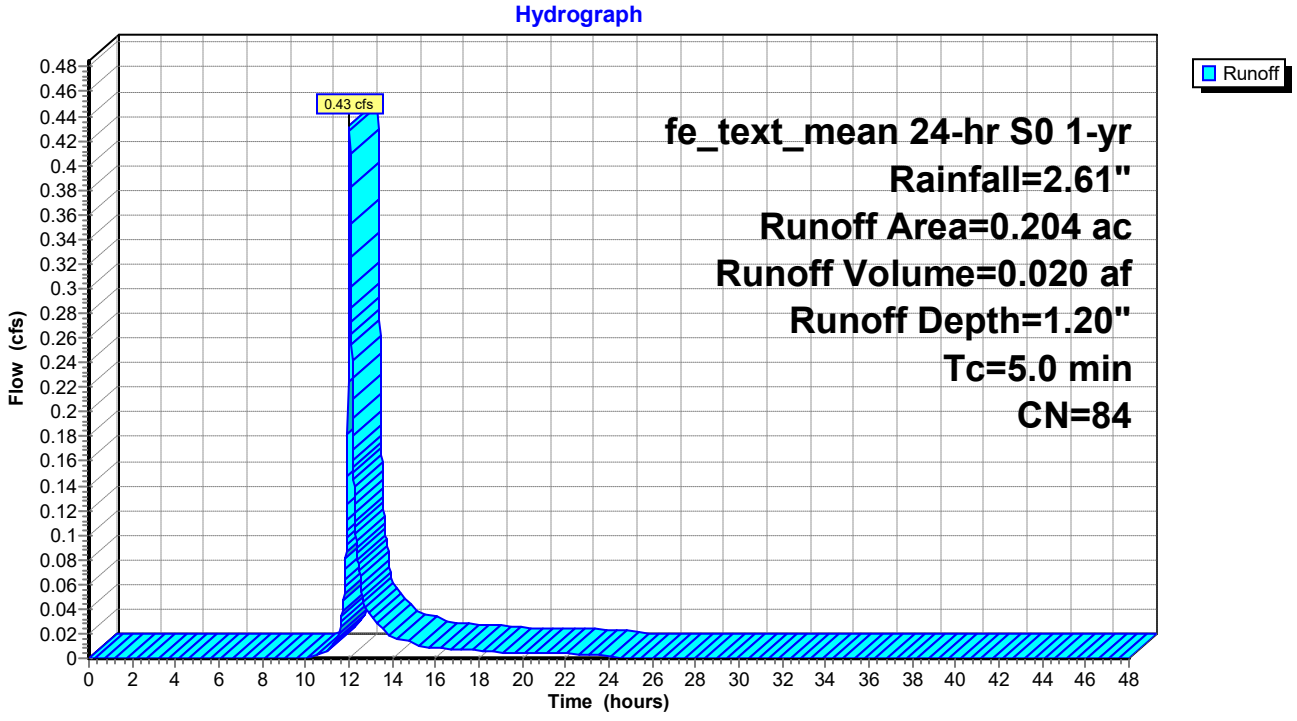
Runoff = 0.43 cfs @ 12.03 hrs, Volume= 0.020 af, Depth= 1.20"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.077	61	>75% Grass cover, Good, HSG B
	0.204	84	Weighted Average
	0.077		37.75% Pervious Area
	0.127		62.25% Impervious Area

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

Subcatchment 6S: DA-6



Summary for Subcatchment 7S: DA-7

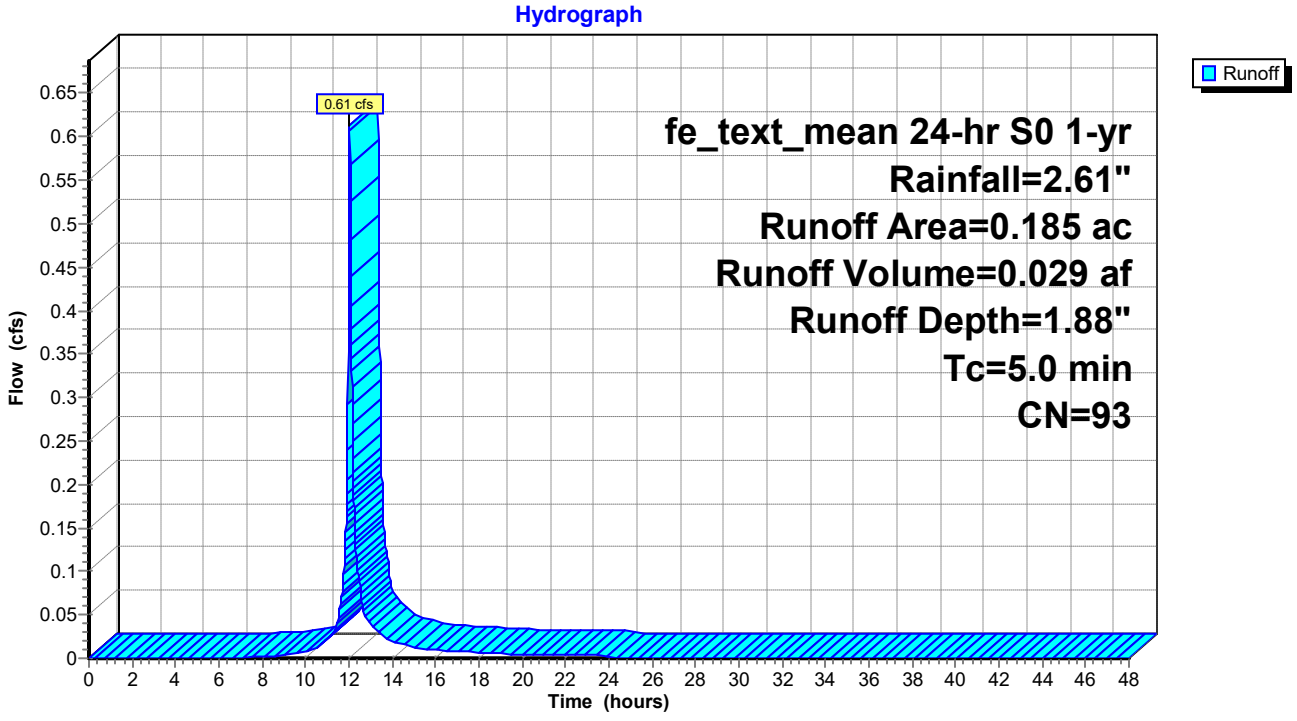
Runoff = 0.61 cfs @ 12.03 hrs, Volume= 0.029 af, Depth= 1.88"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.162	98	Impervious, HSG B
	0.023	61	>75% Grass cover, Good, HSG B
	0.185	93	Weighted Average
	0.023		12.43% Pervious Area
	0.162		87.57% Impervious Area

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

Subcatchment 7S: DA-7



Summary for Subcatchment 8S: DA-8

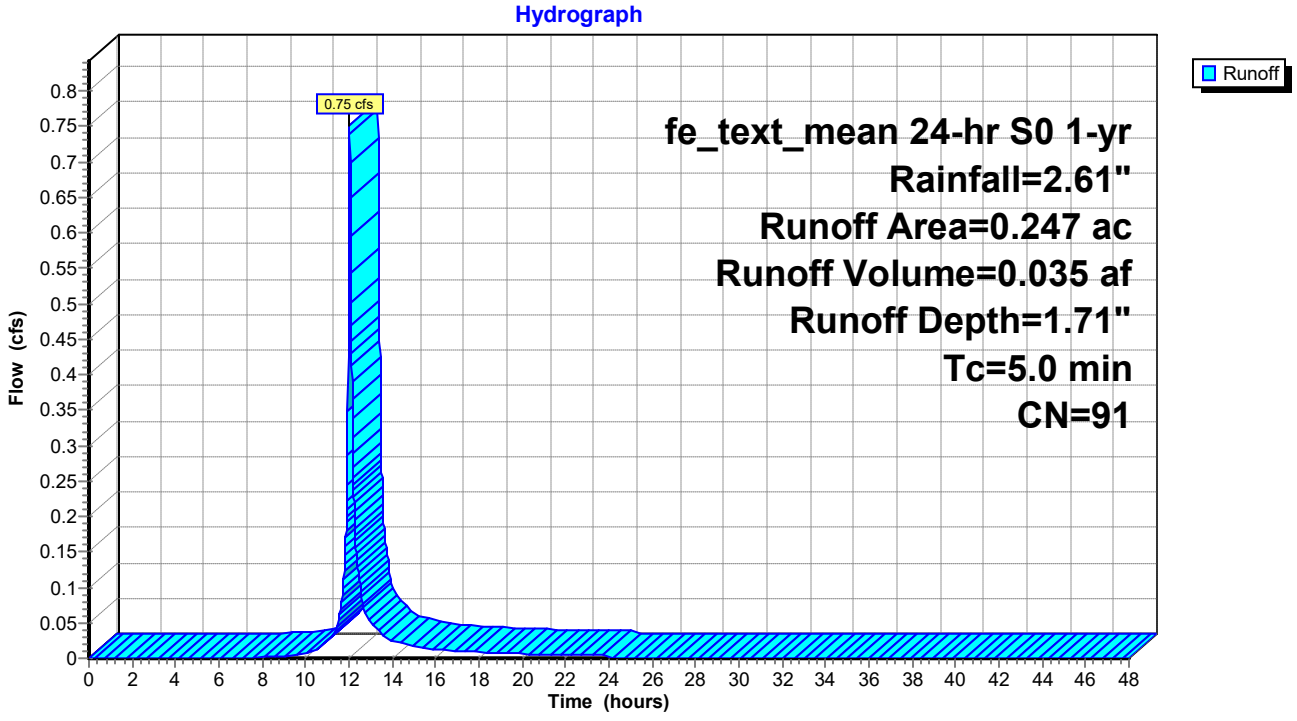
Runoff = 0.75 cfs @ 12.03 hrs, Volume= 0.035 af, Depth= 1.71"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 1-yr Rainfall=2.61"

	Area (ac)	CN	Description
*	0.200	98	Impervious, HSG B
	0.047	61	>75% Grass cover, Good, HSG B
	0.247	91	Weighted Average
	0.047		19.03% Pervious Area
	0.200		80.97% Impervious Area

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

Subcatchment 8S: DA-8

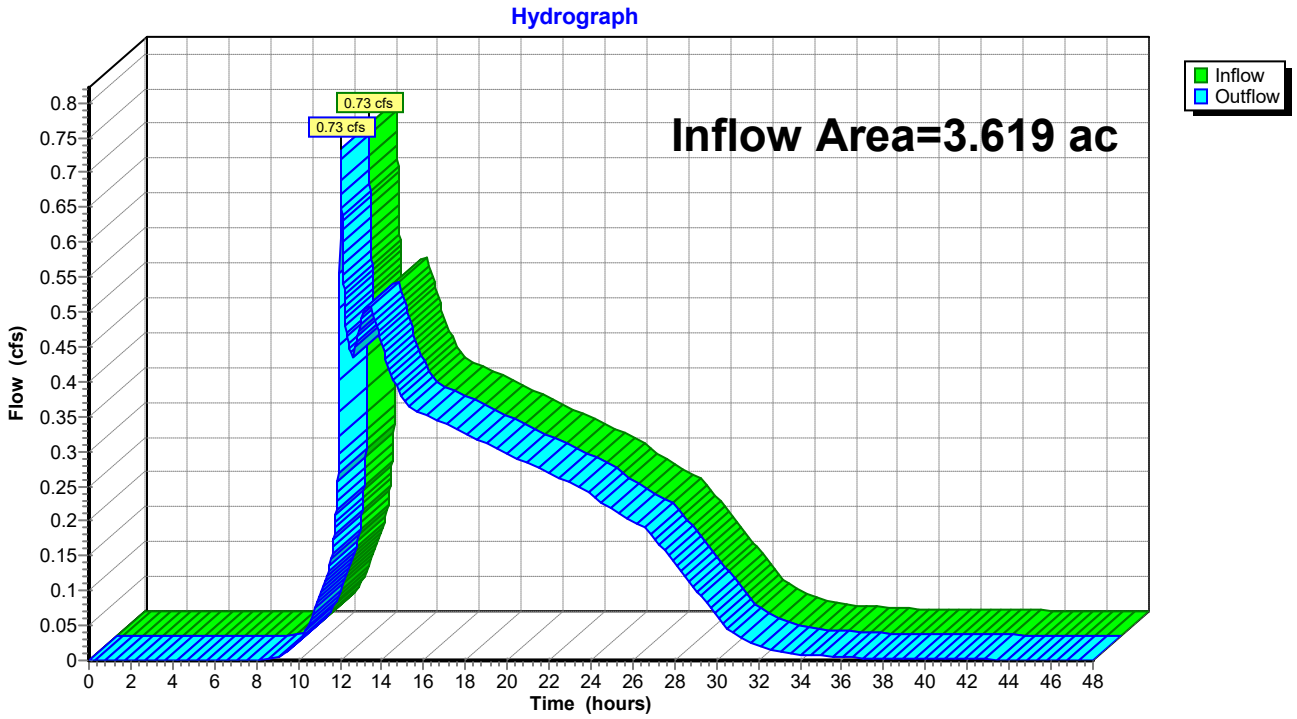


Summary for Reach 1R: Proposed Runoff

Inflow Area = 3.619 ac, 72.51% Impervious, Inflow Depth > 1.51" for 1-yr event
Inflow = 0.73 cfs @ 12.04 hrs, Volume= 0.455 af
Outflow = 0.73 cfs @ 12.04 hrs, Volume= 0.455 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Proposed Runoff

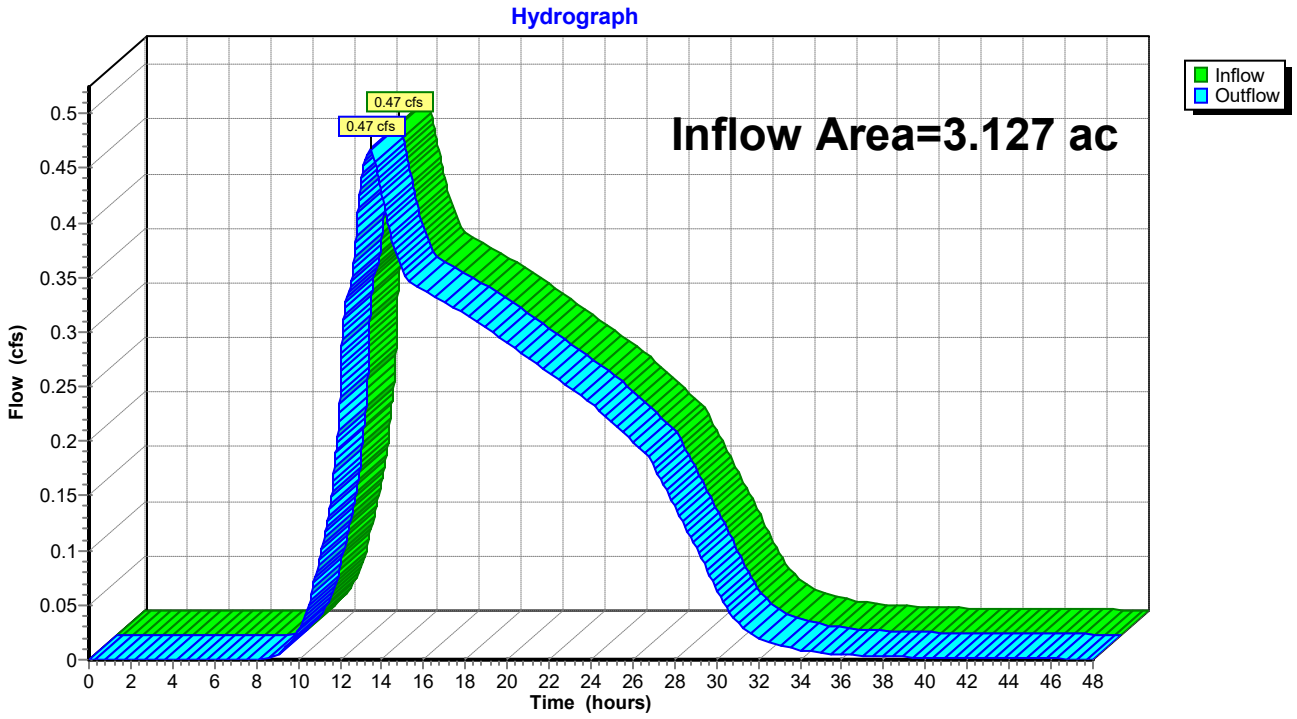


Summary for Reach 2R: On Site

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth > 1.65" for 1-yr event
Inflow = 0.47 cfs @ 13.47 hrs, Volume= 0.429 af
Outflow = 0.47 cfs @ 13.47 hrs, Volume= 0.429 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: On Site

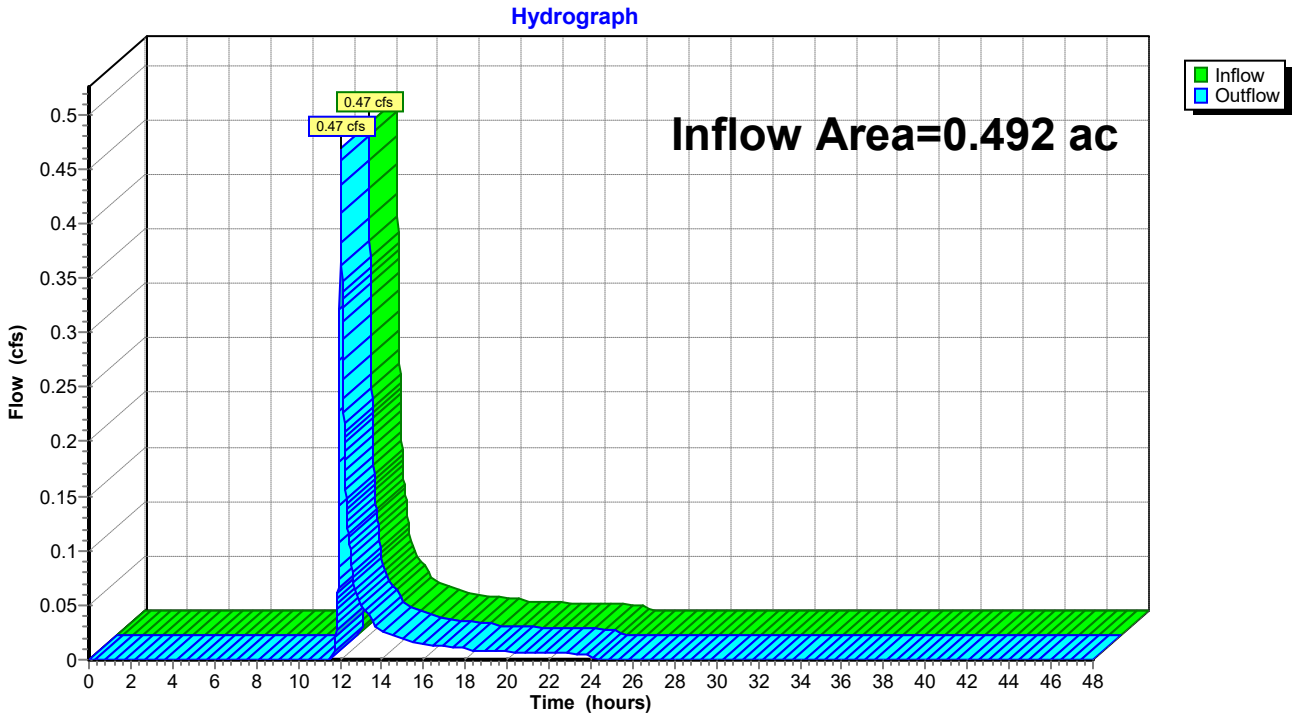


Summary for Reach 3R: Off Site

Inflow Area = 0.492 ac, 33.13% Impervious, Inflow Depth = 0.63" for 1-yr event
Inflow = 0.47 cfs @ 12.04 hrs, Volume= 0.026 af
Outflow = 0.47 cfs @ 12.04 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 3R: Off Site



Summary for Pond 2P: Underground System

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth = 1.65" for 1-yr event
Inflow = 9.14 cfs @ 12.03 hrs, Volume= 0.430 af
Outflow = 0.47 cfs @ 13.47 hrs, Volume= 0.429 af, Atten= 95%, Lag= 86.5 min
Primary = 0.47 cfs @ 13.47 hrs, Volume= 0.429 af
Routed to Reach 2R : On Site
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : On Site

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 642.66' @ 13.47 hrs Surf.Area= 0.152 ac Storage= 0.256 af

Plug-Flow detention time= 363.8 min calculated for 0.429 af (100% of inflow)
Center-of-Mass det. time= 362.2 min (1,159.7 - 797.5)

Volume	Invert	Avail.Storage	Storage Description
#1	640.25'	0.006 af	**4.00'D x 6.50'H Vertical Cone/Cylinder** x 3
#2A	640.25'	0.210 af	**37.08'W x 177.78'L x 5.50'H Field A** 0.832 af Overall - 0.306 af Embedded = 0.526 af x 40.0% Voids
#3A	641.00'	0.306 af	**ADS_StormTech MC-3500 d +Cap** x 120 Inside #2 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 120 Chambers in 5 Rows Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf
#4	646.60'	2.683 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		3.205 af	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
646.60	0.000	0.000	0.000
647.00	0.190	0.038	0.038
648.00	5.100	2.645	2.683

Device	Routing	Invert	Outlet Devices
#1	Device 3	640.25'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	642.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	640.25'	**12.0" Round Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 640.25' / 639.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	647.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.20 1.20 Width (feet) 0.00 20.00 80.00

Primary OutFlow Max=0.47 cfs @ 13.47 hrs HW=642.66' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.47 cfs of 4.04 cfs potential flow)
  ├**1=Orifice/Grate** (Orifice Controls 0.36 cfs @ 7.28 fps)
  └**2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 1.36 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=640.25' TW=0.00' (Dynamic Tailwater)
└**4=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 2P: Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

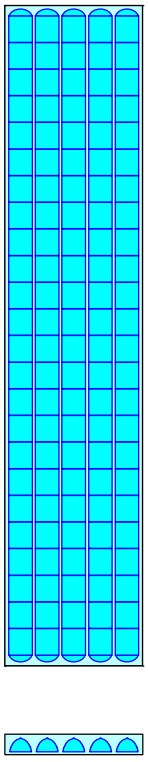
24 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 175.78' Row Length +12.0" End Stone x 2 = 177.78' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

120 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 13,343.2 cf Chamber Storage

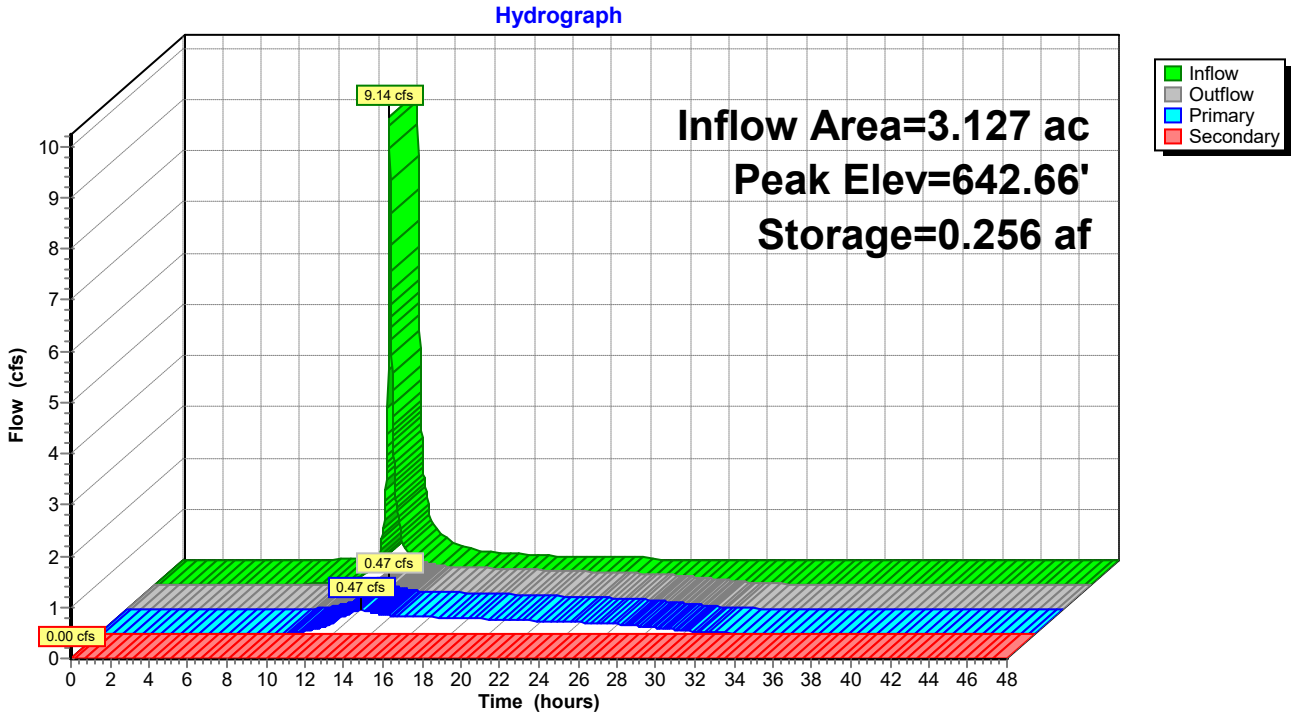
36,259.7 cf Field - 13,343.2 cf Chambers = 22,916.5 cf Stone x 40.0% Voids = 9,166.6 cf Stone Storage

Chamber Storage + Stone Storage = 22,509.8 cf = 0.517 af
Overall Storage Efficiency = 62.1%
Overall System Size = 177.78' x 37.08' x 5.50'

120 Chambers
1,343.0 cy Field
848.8 cy Stone



Pond 2P: Underground System



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AS: DA-1A Runoff Area=0.216 ac 87.04% Impervious Runoff Depth=2.26"
Tc=5.0 min CN=93 Runoff=0.86 cfs 0.041 af

Subcatchment 1BS: DA-1B Runoff Area=0.268 ac 70.15% Impervious Runoff Depth=1.75"
Tc=5.0 min CN=87 Runoff=0.84 cfs 0.039 af

Subcatchment 1CS: DA-1C Runoff Area=0.138 ac 80.43% Impervious Runoff Depth=2.08"
Tc=5.0 min CN=91 Runoff=0.51 cfs 0.024 af

Subcatchment 1S: DA-1 Runoff Area=0.492 ac 33.13% Impervious Runoff Depth=0.86"
Tc=5.0 min CN=73 Runoff=0.69 cfs 0.035 af

Subcatchment 2S: DA-2 Runoff Area=0.777 ac 83.91% Impervious Runoff Depth=2.17"
Tc=5.0 min CN=92 Runoff=2.99 cfs 0.141 af

Subcatchment 3S: DA-3 Runoff Area=0.611 ac 81.01% Impervious Runoff Depth=2.08"
Tc=5.0 min CN=91 Runoff=2.26 cfs 0.106 af

Subcatchment 4S: DA-4 Runoff Area=0.248 ac 85.08% Impervious Runoff Depth=2.17"
Tc=5.0 min CN=92 Runoff=0.95 cfs 0.045 af

Subcatchment 5S: DA-5 Runoff Area=0.233 ac 54.51% Impervious Runoff Depth=1.32"
Tc=5.0 min CN=81 Runoff=0.54 cfs 0.026 af

Subcatchment 6S: DA-6 Runoff Area=0.204 ac 62.25% Impervious Runoff Depth=1.52"
Tc=5.0 min CN=84 Runoff=0.56 cfs 0.026 af

Subcatchment 7S: DA-7 Runoff Area=0.185 ac 87.57% Impervious Runoff Depth=2.26"
Tc=5.0 min CN=93 Runoff=0.74 cfs 0.035 af

Subcatchment 8S: DA-8 Runoff Area=0.247 ac 80.97% Impervious Runoff Depth=2.08"
Tc=5.0 min CN=91 Runoff=0.91 cfs 0.043 af

Reach 1R: Proposed Runoff Inflow=1.27 cfs 0.559 af
Outflow=1.27 cfs 0.559 af

Reach 2R: On Site Inflow=1.15 cfs 0.523 af
Outflow=1.15 cfs 0.523 af

Reach 3R: Off Site Inflow=0.69 cfs 0.035 af
Outflow=0.69 cfs 0.035 af

Pond 2P: Underground System Peak Elev=642.95' Storage=0.290 af Inflow=11.16 cfs 0.524 af
Primary=1.15 cfs 0.523 af Secondary=0.00 cfs 0.000 af Outflow=1.15 cfs 0.523 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.560 af Average Runoff Depth = 1.86"
27.49% Pervious = 0.995 ac 72.51% Impervious = 2.624 ac

Summary for Subcatchment 1AS: DA-1A

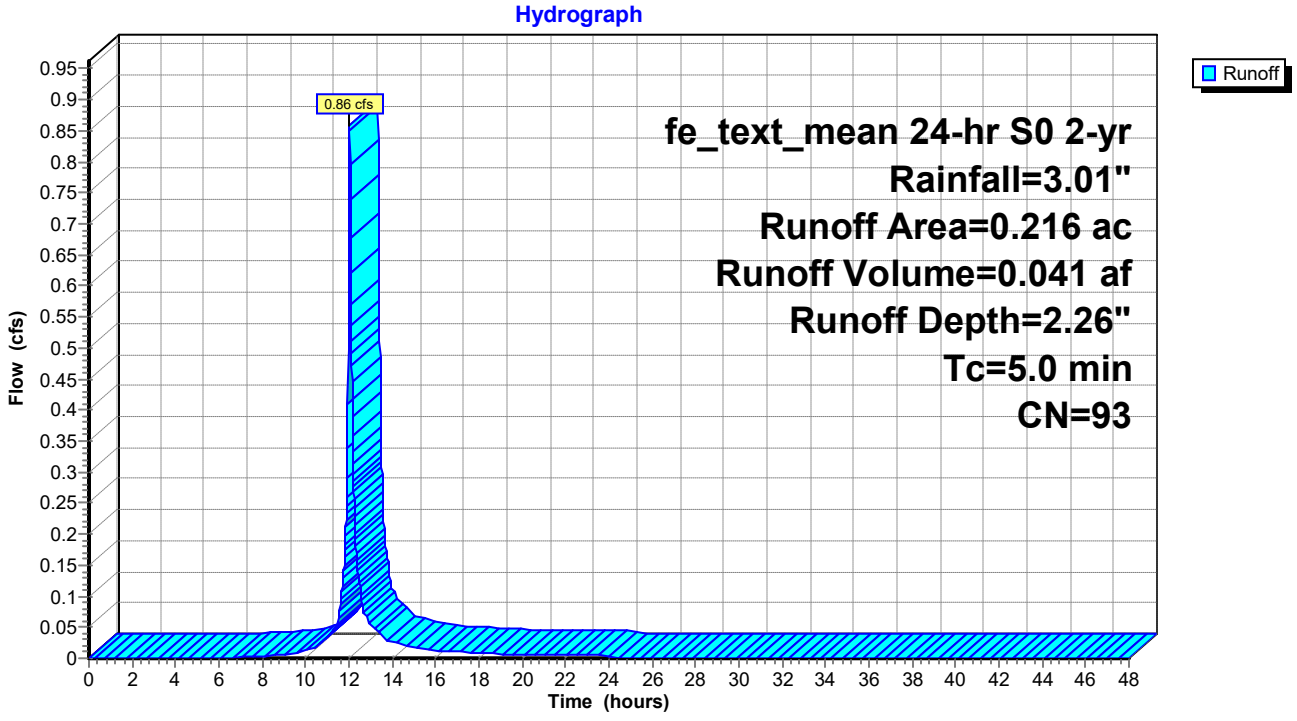
Runoff = 0.86 cfs @ 12.03 hrs, Volume= 0.041 af, Depth= 2.26"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.028	61	>75% Grass cover, Good, HSG B
	0.216	93	Weighted Average
	0.028		12.96% Pervious Area
	0.188		87.04% Impervious Area

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

Subcatchment 1AS: DA-1A



Summary for Subcatchment 1BS: DA-1B

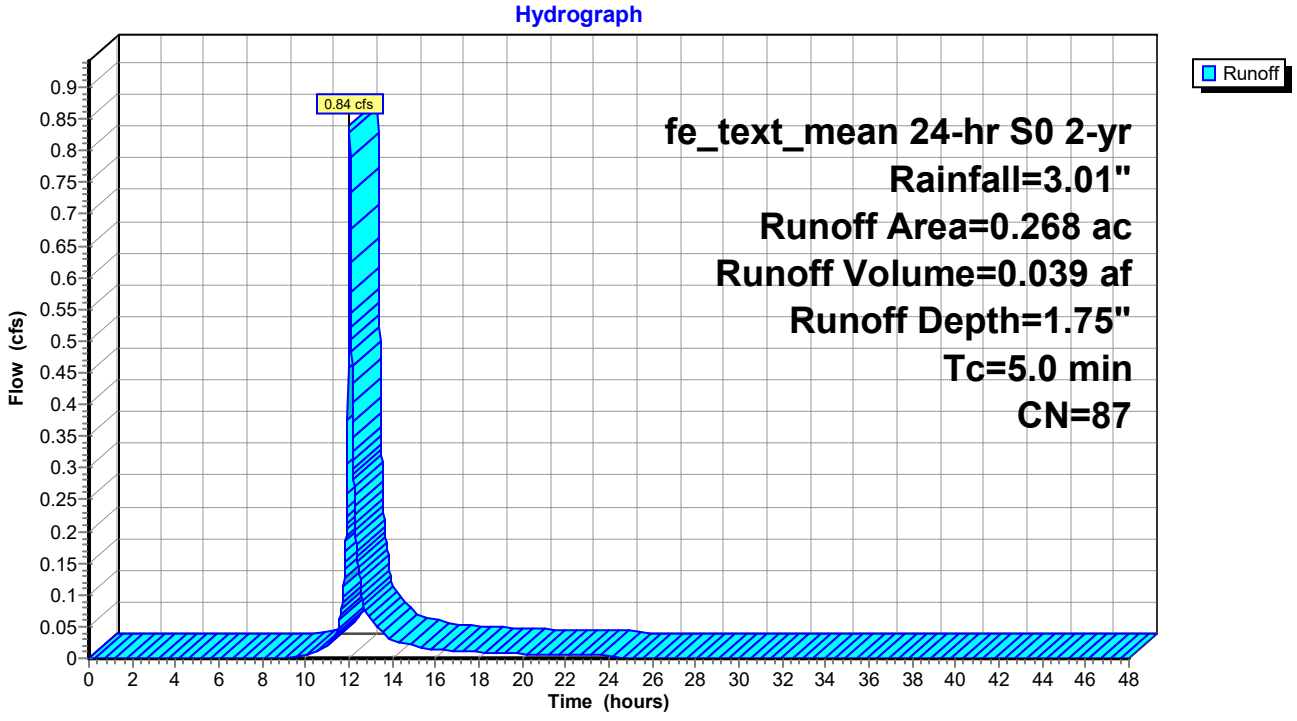
Runoff = 0.84 cfs @ 12.03 hrs, Volume= 0.039 af, Depth= 1.75"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.080	61	>75% Grass cover, Good, HSG B
	0.268	87	Weighted Average
	0.080		29.85% Pervious Area
	0.188		70.15% Impervious Area

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

Subcatchment 1BS: DA-1B



Summary for Subcatchment 1CS: DA-1C

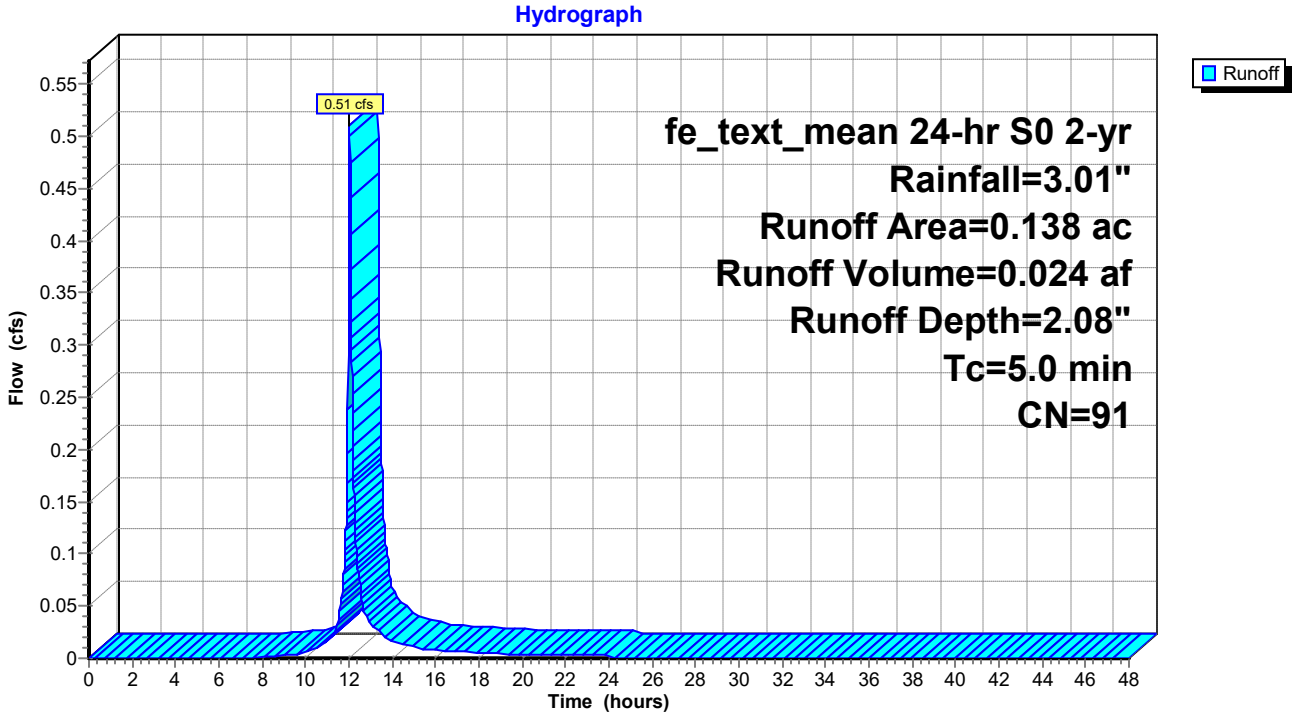
Runoff = 0.51 cfs @ 12.03 hrs, Volume= 0.024 af, Depth= 2.08"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.111	98	Impervious, HSG B
	0.027	61	>75% Grass cover, Good, HSG B
	0.138	91	Weighted Average
	0.027		19.57% Pervious Area
	0.111		80.43% Impervious Area

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

Subcatchment 1CS: DA-1C



Summary for Subcatchment 1S: DA-1

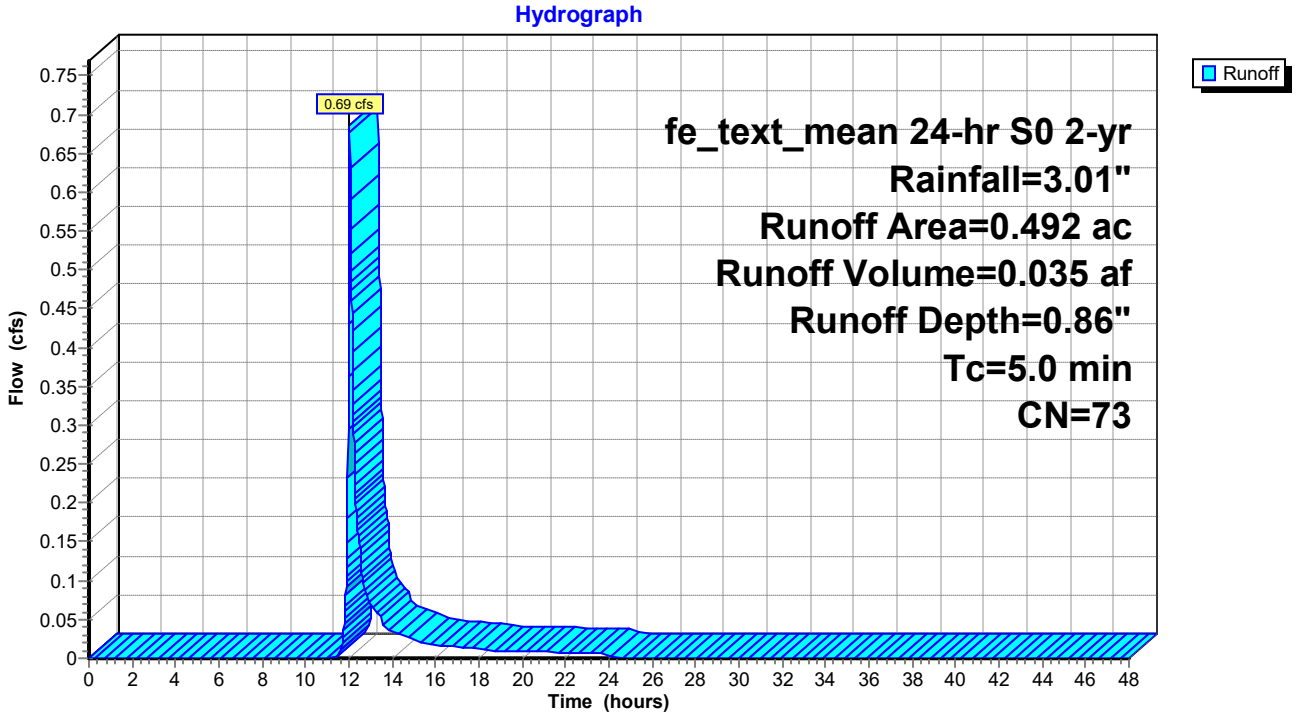
Runoff = 0.69 cfs @ 12.04 hrs, Volume= 0.035 af, Depth= 0.86"
Routed to Reach 3R : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.163	98	Impervious, HSG B
	0.329	61	>75% Grass cover, Good, HSG B
	0.492	73	Weighted Average
	0.329		66.87% Pervious Area
	0.163		33.13% Impervious Area

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

Subcatchment 1S: DA-1



Summary for Subcatchment 2S: DA-2

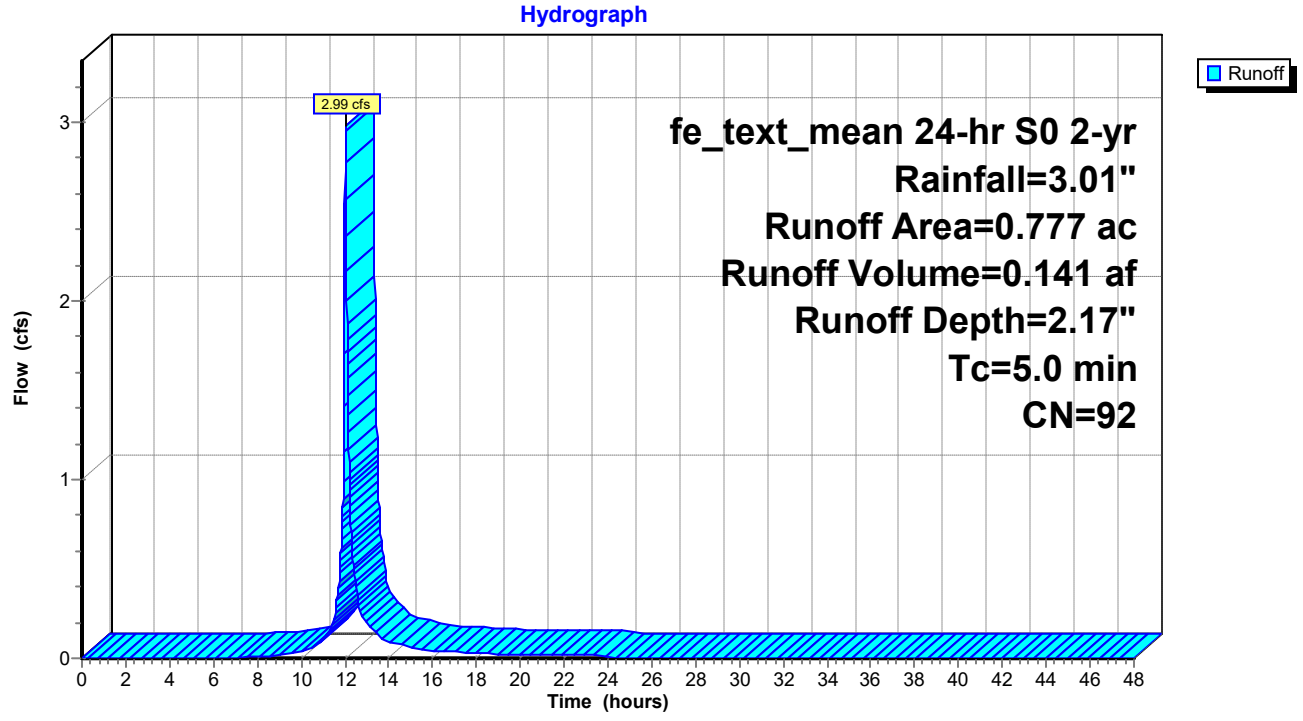
Runoff = 2.99 cfs @ 12.03 hrs, Volume= 0.141 af, Depth= 2.17"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.652	98	Impervious, HSG B
	0.125	61	>75% Grass cover, Good, HSG B
	0.777	92	Weighted Average
	0.125		16.09% Pervious Area
	0.652		83.91% Impervious Area

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

Subcatchment 2S: DA-2



Summary for Subcatchment 3S: DA-3

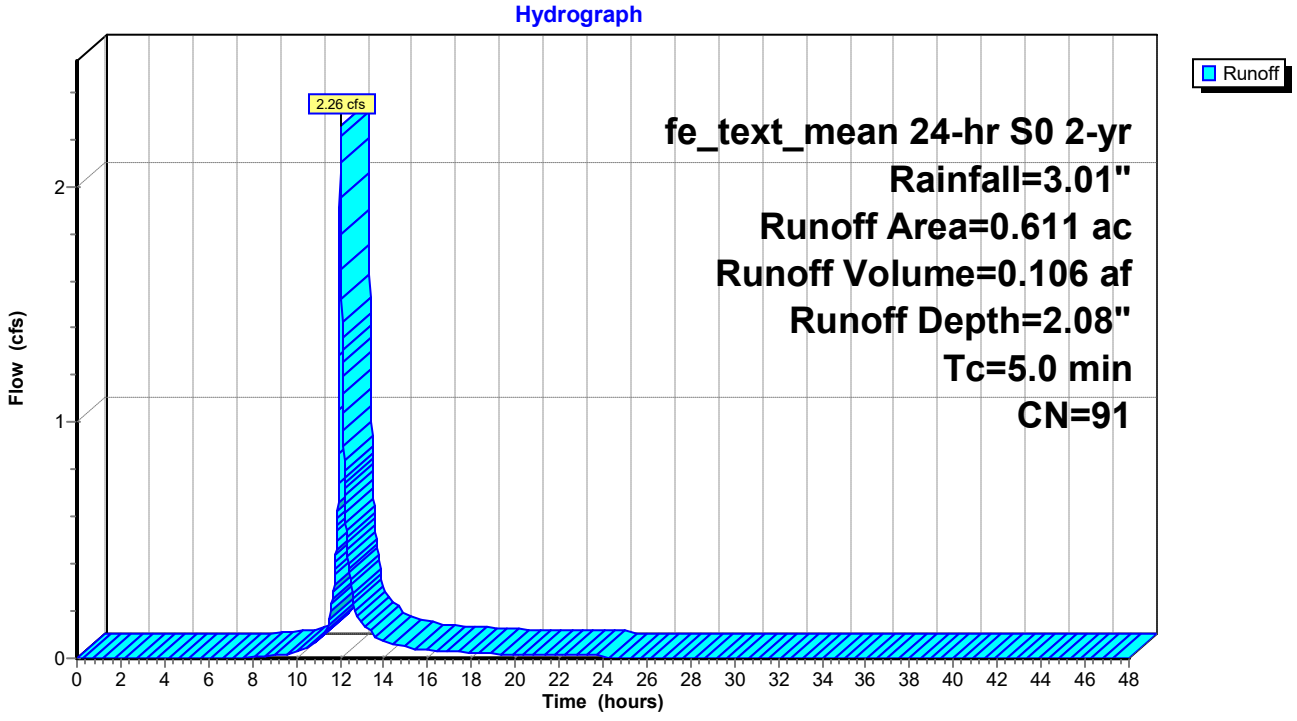
Runoff = 2.26 cfs @ 12.03 hrs, Volume= 0.106 af, Depth= 2.08"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.495	98	Impervious, HSG B
	0.116	61	>75% Grass cover, Good, HSG B
	0.611	91	Weighted Average
	0.116		18.99% Pervious Area
	0.495		81.01% Impervious Area

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

Subcatchment 3S: DA-3



Summary for Subcatchment 4S: DA-4

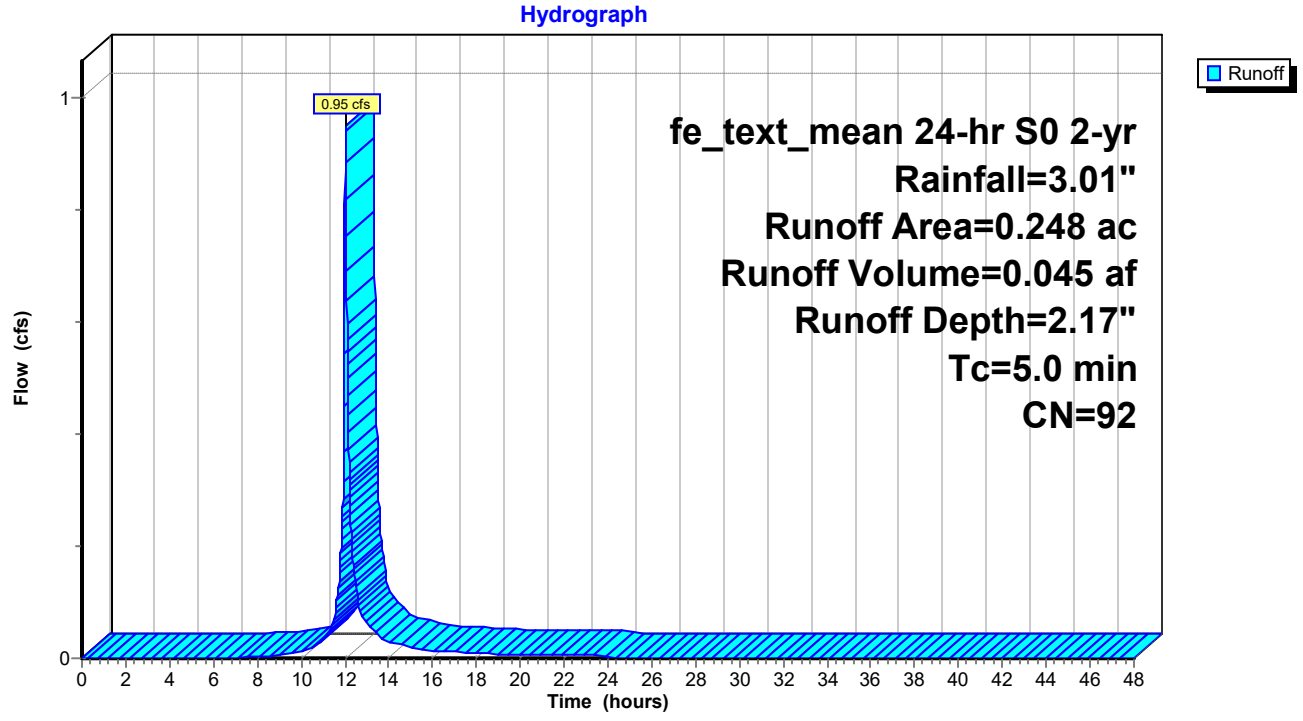
Runoff = 0.95 cfs @ 12.03 hrs, Volume= 0.045 af, Depth= 2.17"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.211	98	Impervious, HSG B
	0.037	61	>75% Grass cover, Good, HSG B
	0.248	92	Weighted Average
	0.037		14.92% Pervious Area
	0.211		85.08% Impervious Area

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

Subcatchment 4S: DA-4



Summary for Subcatchment 5S: DA-5

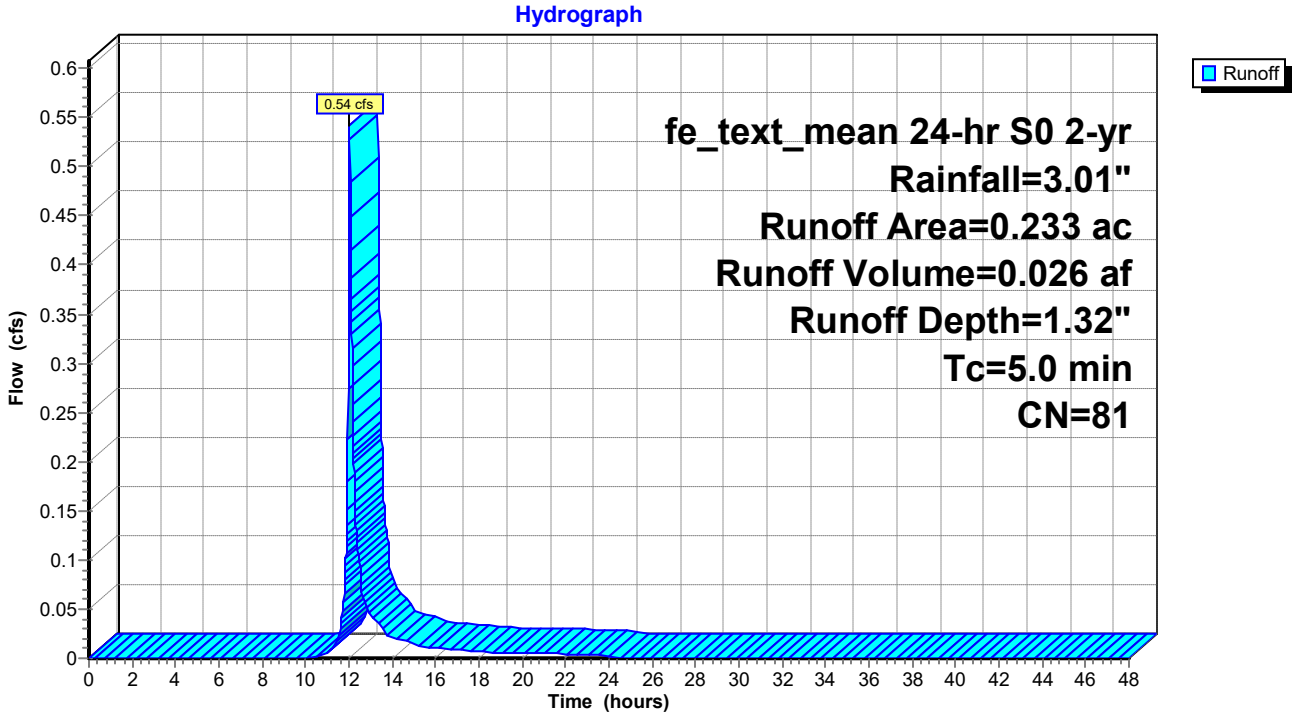
Runoff = 0.54 cfs @ 12.03 hrs, Volume= 0.026 af, Depth= 1.32"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.106	61	>75% Grass cover, Good, HSG B
	0.233	81	Weighted Average
	0.106		45.49% Pervious Area
	0.127		54.51% Impervious Area

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

Subcatchment 5S: DA-5



Summary for Subcatchment 6S: DA-6

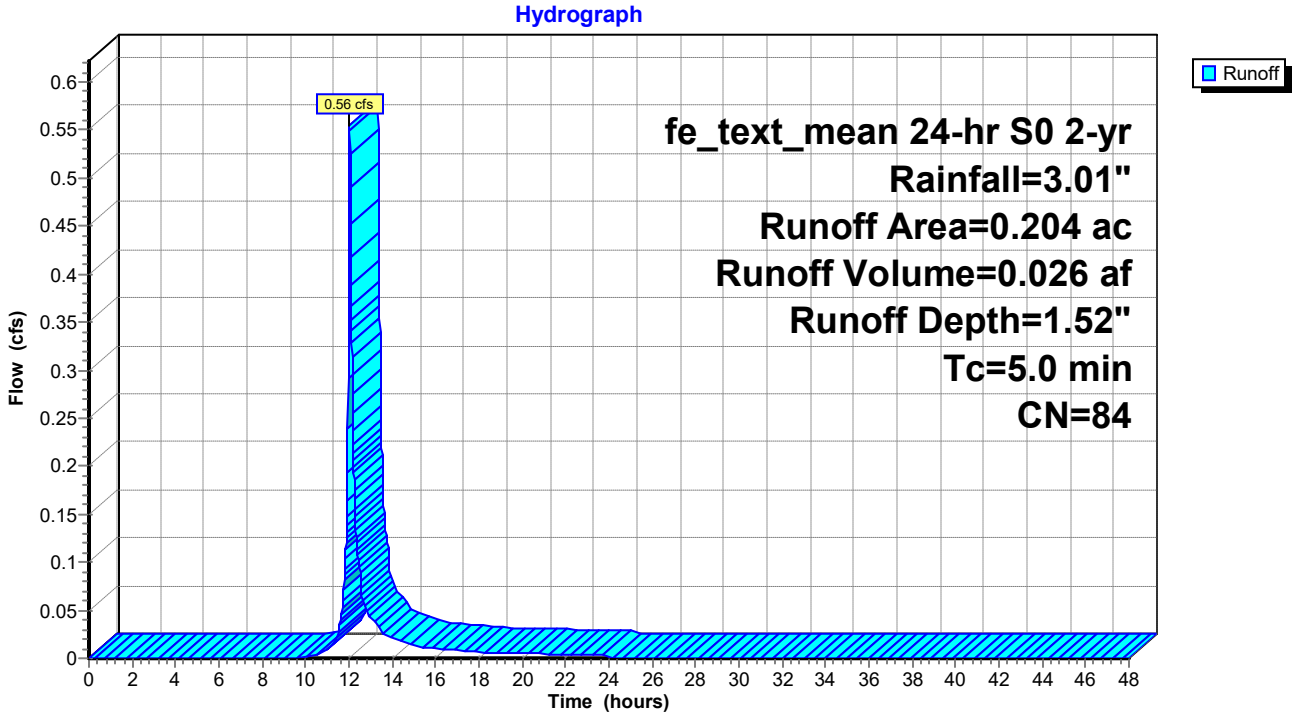
Runoff = 0.56 cfs @ 12.03 hrs, Volume= 0.026 af, Depth= 1.52"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.077	61	>75% Grass cover, Good, HSG B
	0.204	84	Weighted Average
	0.077		37.75% Pervious Area
	0.127		62.25% Impervious Area

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

Subcatchment 6S: DA-6



Summary for Subcatchment 7S: DA-7

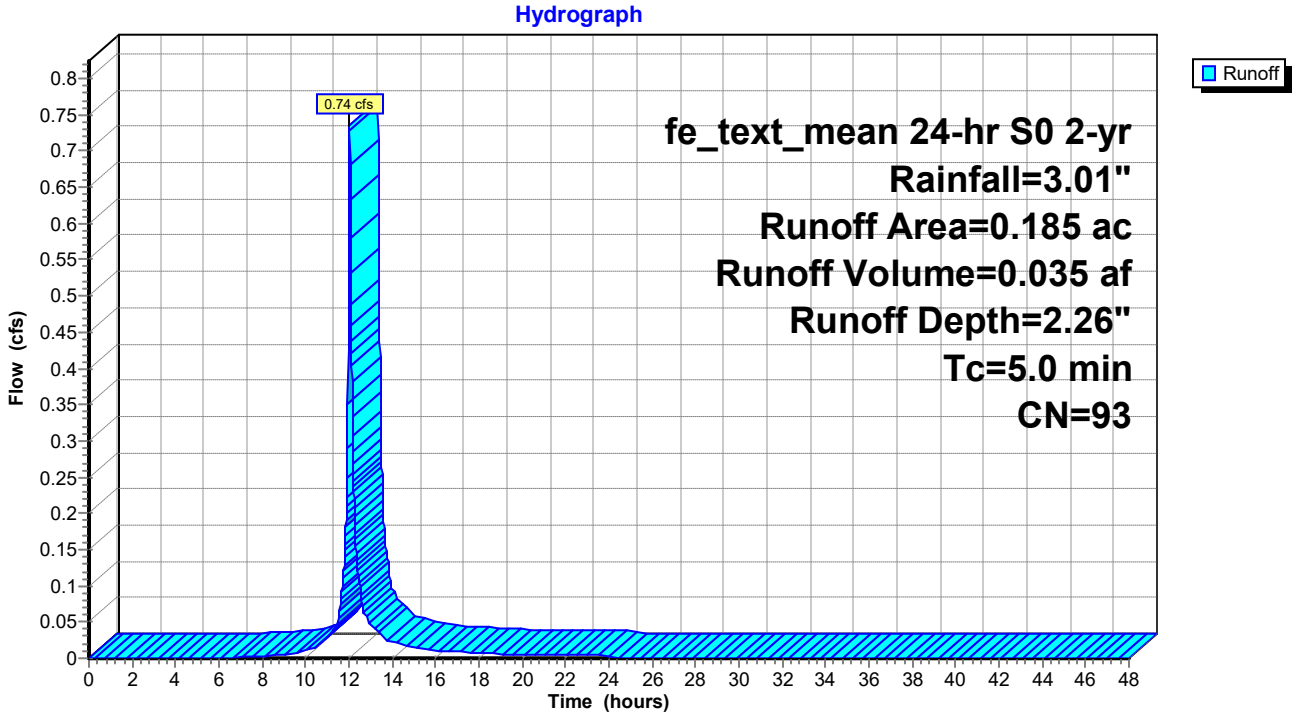
Runoff = 0.74 cfs @ 12.03 hrs, Volume= 0.035 af, Depth= 2.26"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.162	98	Impervious, HSG B
	0.023	61	>75% Grass cover, Good, HSG B
	0.185	93	Weighted Average
	0.023		12.43% Pervious Area
	0.162		87.57% Impervious Area

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

Subcatchment 7S: DA-7



Summary for Subcatchment 8S: DA-8

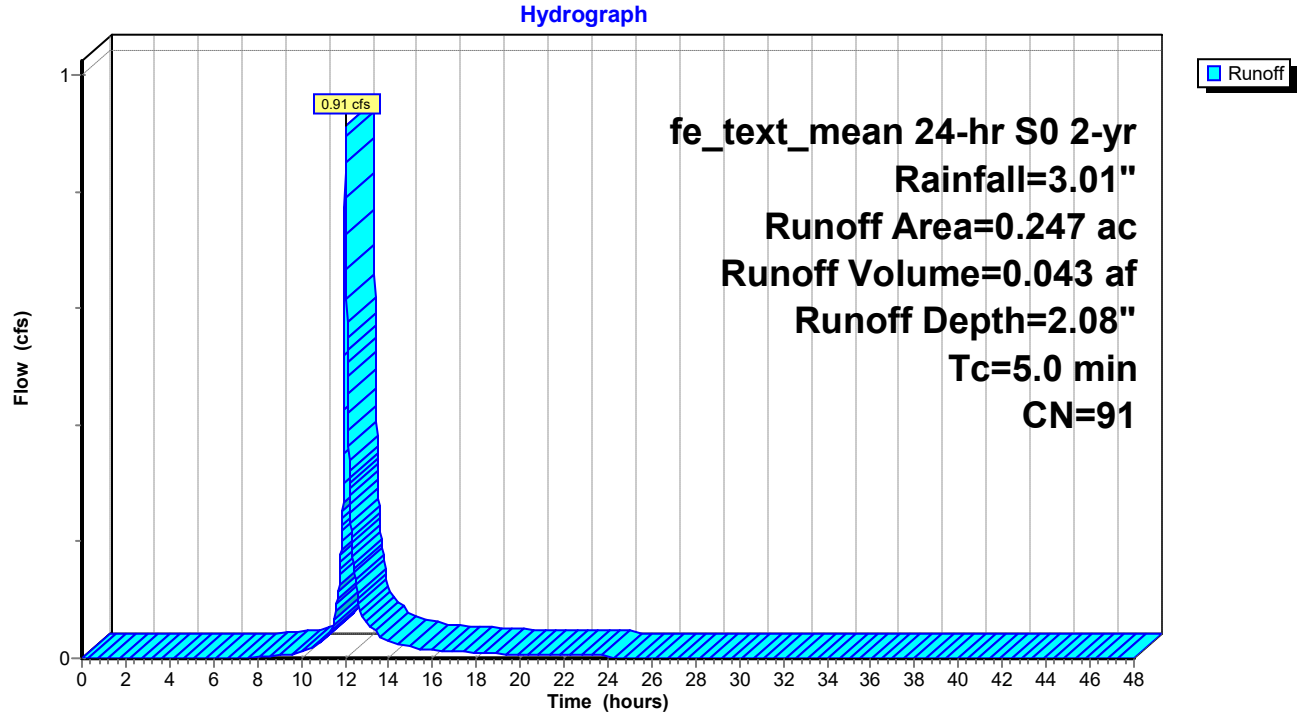
Runoff = 0.91 cfs @ 12.03 hrs, Volume= 0.043 af, Depth= 2.08"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 2-yr Rainfall=3.01"

	Area (ac)	CN	Description
*	0.200	98	Impervious, HSG B
	0.047	61	>75% Grass cover, Good, HSG B
	0.247	91	Weighted Average
	0.047		19.03% Pervious Area
	0.200		80.97% Impervious Area

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

Subcatchment 8S: DA-8

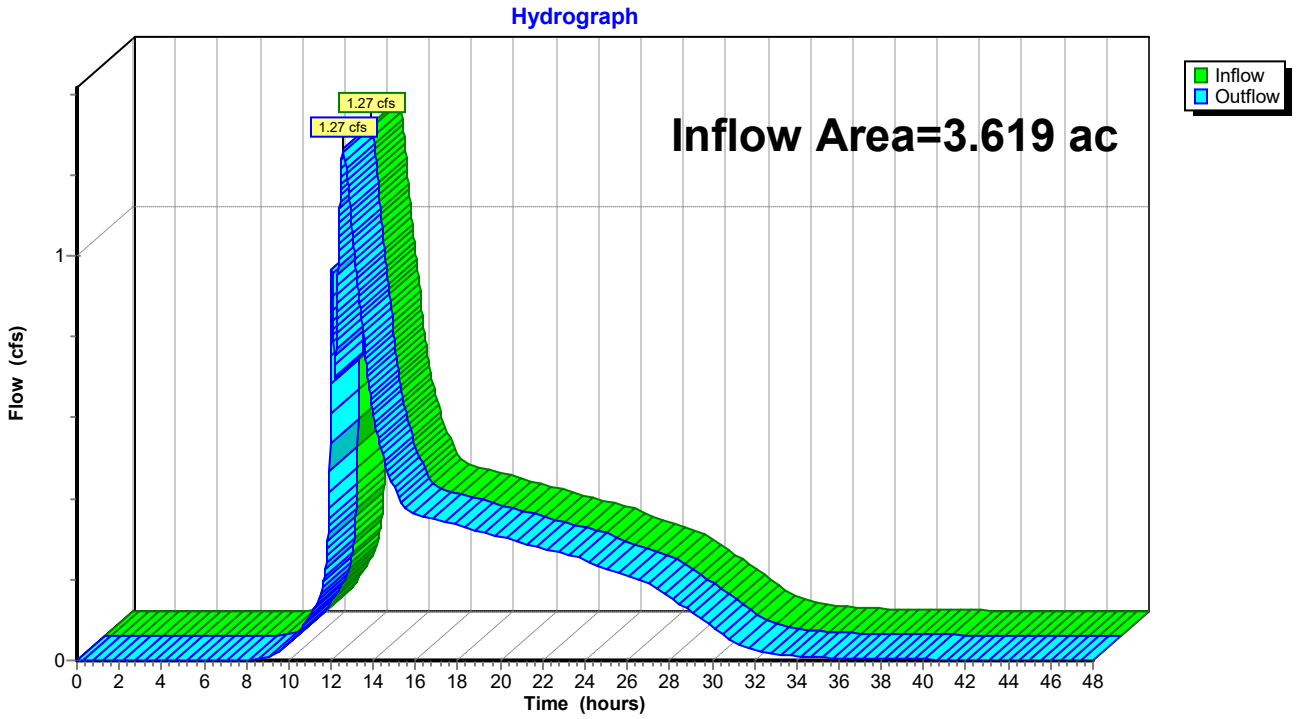


Summary for Reach 1R: Proposed Runoff

Inflow Area = 3.619 ac, 72.51% Impervious, Inflow Depth > 1.85" for 2-yr event
Inflow = 1.27 cfs @ 12.56 hrs, Volume= 0.559 af
Outflow = 1.27 cfs @ 12.56 hrs, Volume= 0.559 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Proposed Runoff

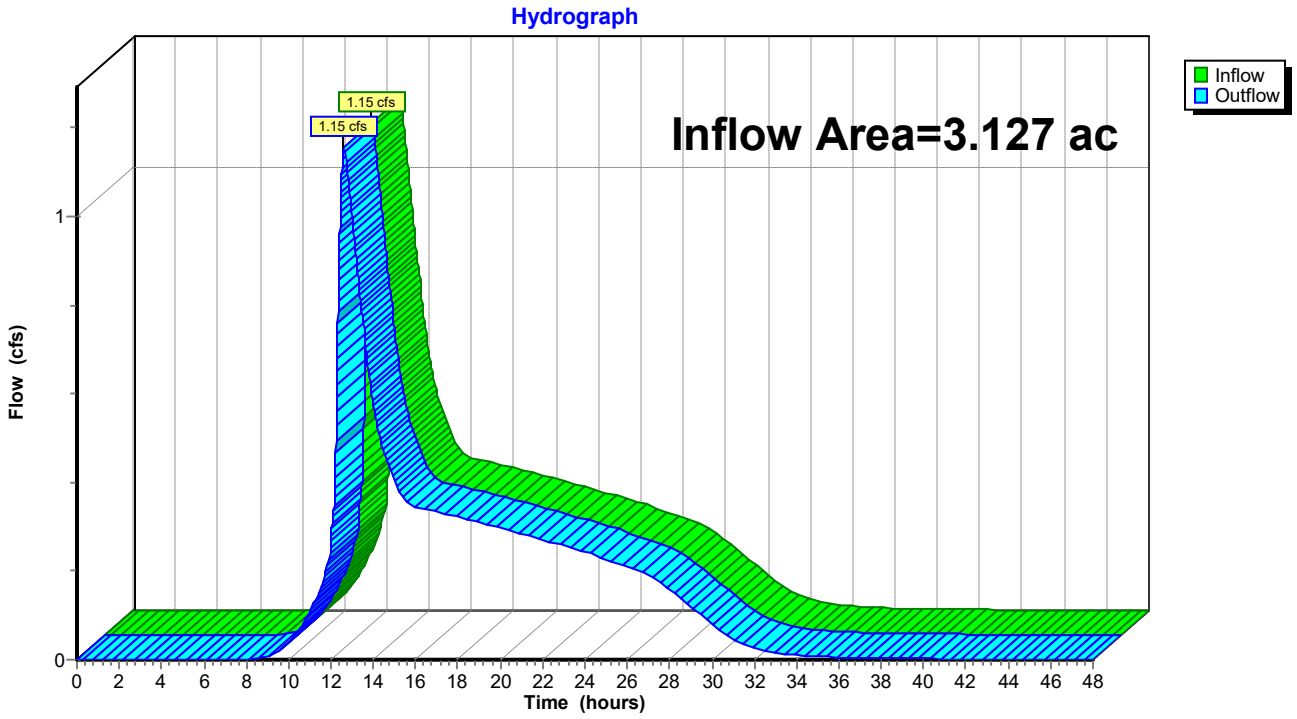


Summary for Reach 2R: On Site

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth > 2.01" for 2-yr event
Inflow = 1.15 cfs @ 12.61 hrs, Volume= 0.523 af
Outflow = 1.15 cfs @ 12.61 hrs, Volume= 0.523 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: On Site

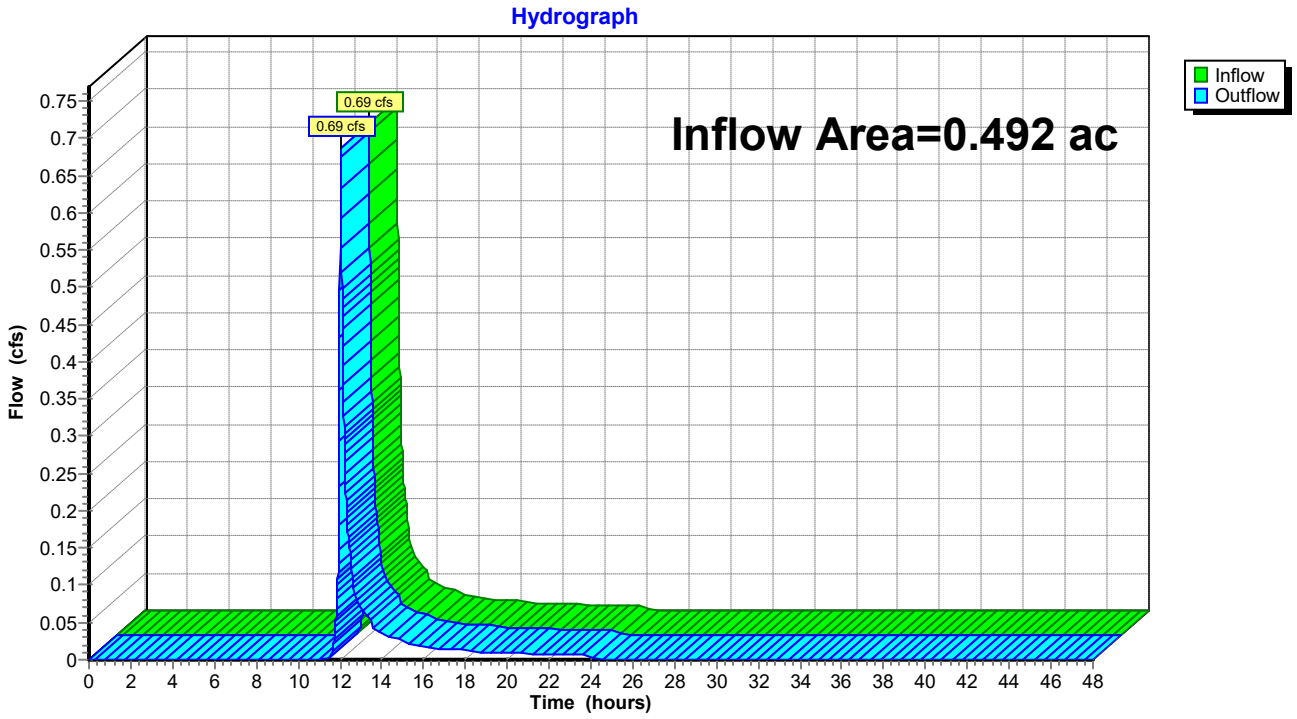


Summary for Reach 3R: Off Site

Inflow Area = 0.492 ac, 33.13% Impervious, Inflow Depth = 0.86" for 2-yr event
Inflow = 0.69 cfs @ 12.04 hrs, Volume= 0.035 af
Outflow = 0.69 cfs @ 12.04 hrs, Volume= 0.035 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 3R: Off Site



Summary for Pond 2P: Underground System

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth = 2.01" for 2-yr event
Inflow = 11.16 cfs @ 12.03 hrs, Volume= 0.524 af
Outflow = 1.15 cfs @ 12.61 hrs, Volume= 0.523 af, Atten= 90%, Lag= 34.9 min
Primary = 1.15 cfs @ 12.61 hrs, Volume= 0.523 af
Routed to Reach 2R : On Site
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : On Site

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 642.95' @ 12.61 hrs Surf.Area= 0.152 ac Storage= 0.290 af

Plug-Flow detention time= 322.6 min calculated for 0.523 af (100% of inflow)
Center-of-Mass det. time= 321.5 min (1,112.1 - 790.6)

Volume	Invert	Avail.Storage	Storage Description
#1	640.25'	0.006 af	**4.00'D x 6.50'H Vertical Cone/Cylinder** x 3
#2A	640.25'	0.210 af	**37.08'W x 177.78'L x 5.50'H Field A** 0.832 af Overall - 0.306 af Embedded = 0.526 af x 40.0% Voids
#3A	641.00'	0.306 af	**ADS_StormTech MC-3500 d +Cap** x 120 Inside #2 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 120 Chambers in 5 Rows Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf
#4	646.60'	2.683 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		3.205 af	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
646.60	0.000	0.000	0.000
647.00	0.190	0.038	0.038
648.00	5.100	2.645	2.683

Device	Routing	Invert	Outlet Devices
#1	Device 3	640.25'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	642.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	640.25'	**12.0" Round Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 640.25' / 639.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	647.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.20 1.20 Width (feet) 0.00 20.00 80.00

Primary OutFlow Max=1.15 cfs @ 12.61 hrs HW=642.95' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Passes 1.15 cfs of 4.34 cfs potential flow)
  ├─**1=Orifice/Grate** (Orifice Controls 0.38 cfs @ 7.72 fps)
  └─**2=Orifice/Grate** (Orifice Controls 0.77 cfs @ 2.28 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=640.25' TW=0.00' (Dynamic Tailwater)
└─**4=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 2P: Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

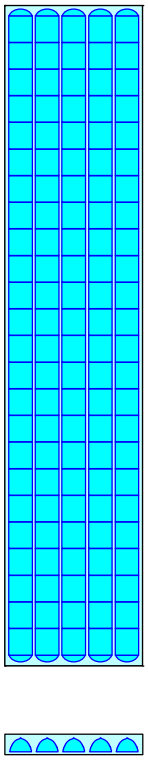
24 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 175.78' Row Length +12.0" End Stone x 2 = 177.78' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

120 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 13,343.2 cf Chamber Storage

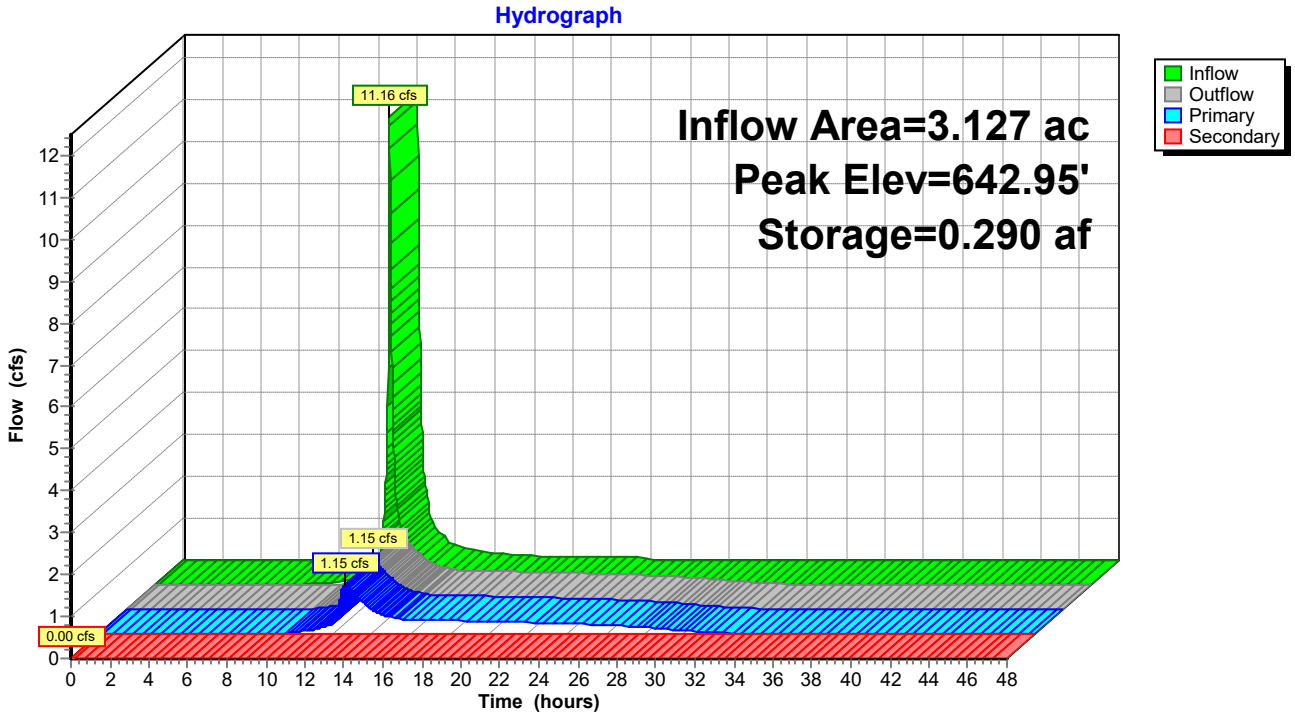
36,259.7 cf Field - 13,343.2 cf Chambers = 22,916.5 cf Stone x 40.0% Voids = 9,166.6 cf Stone Storage

Chamber Storage + Stone Storage = 22,509.8 cf = 0.517 af
Overall Storage Efficiency = 62.1%
Overall System Size = 177.78' x 37.08' x 5.50'

120 Chambers
1,343.0 cy Field
848.8 cy Stone



Pond 2P: Underground System



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AS: DA-1A Runoff Area=0.216 ac 87.04% Impervious Runoff Depth=2.98"
Tc=5.0 min CN=93 Runoff=1.12 cfs 0.054 af

Subcatchment 1BS: DA-1B Runoff Area=0.268 ac 70.15% Impervious Runoff Depth=2.41"
Tc=5.0 min CN=87 Runoff=1.15 cfs 0.054 af

Subcatchment 1CS: DA-1C Runoff Area=0.138 ac 80.43% Impervious Runoff Depth=2.78"
Tc=5.0 min CN=91 Runoff=0.68 cfs 0.032 af

Subcatchment 1S: DA-1 Runoff Area=0.492 ac 33.13% Impervious Runoff Depth=1.35"
Tc=5.0 min CN=73 Runoff=1.13 cfs 0.055 af

Subcatchment 2S: DA-2 Runoff Area=0.777 ac 83.91% Impervious Runoff Depth=2.88"
Tc=5.0 min CN=92 Runoff=3.91 cfs 0.186 af

Subcatchment 3S: DA-3 Runoff Area=0.611 ac 81.01% Impervious Runoff Depth=2.78"
Tc=5.0 min CN=91 Runoff=2.99 cfs 0.141 af

Subcatchment 4S: DA-4 Runoff Area=0.248 ac 85.08% Impervious Runoff Depth=2.88"
Tc=5.0 min CN=92 Runoff=1.25 cfs 0.059 af

Subcatchment 5S: DA-5 Runoff Area=0.233 ac 54.51% Impervious Runoff Depth=1.91"
Tc=5.0 min CN=81 Runoff=0.80 cfs 0.037 af

Subcatchment 6S: DA-6 Runoff Area=0.204 ac 62.25% Impervious Runoff Depth=2.15"
Tc=5.0 min CN=84 Runoff=0.79 cfs 0.037 af

Subcatchment 7S: DA-7 Runoff Area=0.185 ac 87.57% Impervious Runoff Depth=2.98"
Tc=5.0 min CN=93 Runoff=0.96 cfs 0.046 af

Subcatchment 8S: DA-8 Runoff Area=0.247 ac 80.97% Impervious Runoff Depth=2.78"
Tc=5.0 min CN=91 Runoff=1.21 cfs 0.057 af

Reach 1R: Proposed Runoff Inflow=3.21 cfs 0.758 af
Outflow=3.21 cfs 0.758 af

Reach 2R: On Site Inflow=2.91 cfs 0.702 af
Outflow=2.91 cfs 0.702 af

Reach 3R: Off Site Inflow=1.13 cfs 0.055 af
Outflow=1.13 cfs 0.055 af

Pond 2P: Underground System Peak Elev=643.43' Storage=0.344 af Inflow=14.84 cfs 0.703 af
Primary=2.91 cfs 0.702 af Secondary=0.00 cfs 0.000 af Outflow=2.91 cfs 0.702 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.759 af Average Runoff Depth = 2.52"
27.49% Pervious = 0.995 ac 72.51% Impervious = 2.624 ac

Summary for Subcatchment 1AS: DA-1A

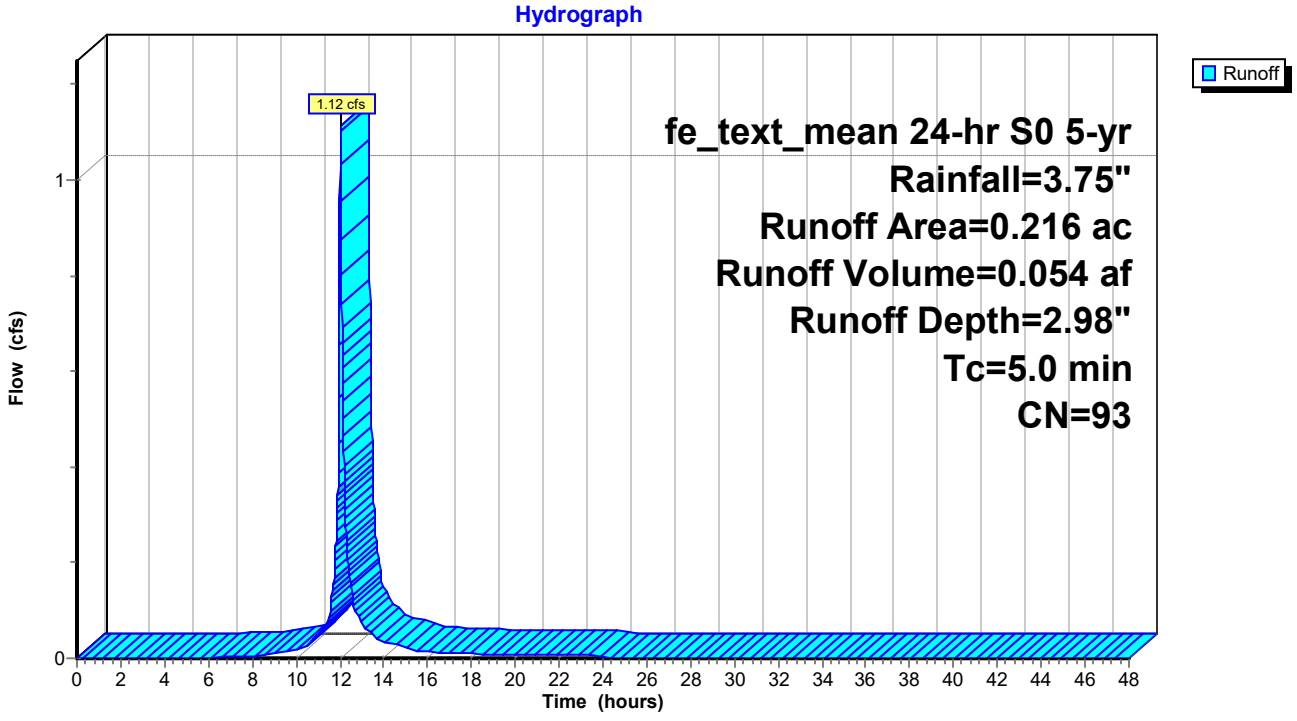
Runoff = 1.12 cfs @ 12.03 hrs, Volume= 0.054 af, Depth= 2.98"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.028	61	>75% Grass cover, Good, HSG B
	0.216	93	Weighted Average
	0.028		12.96% Pervious Area
	0.188		87.04% Impervious Area

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

Subcatchment 1AS: DA-1A



Summary for Subcatchment 1BS: DA-1B

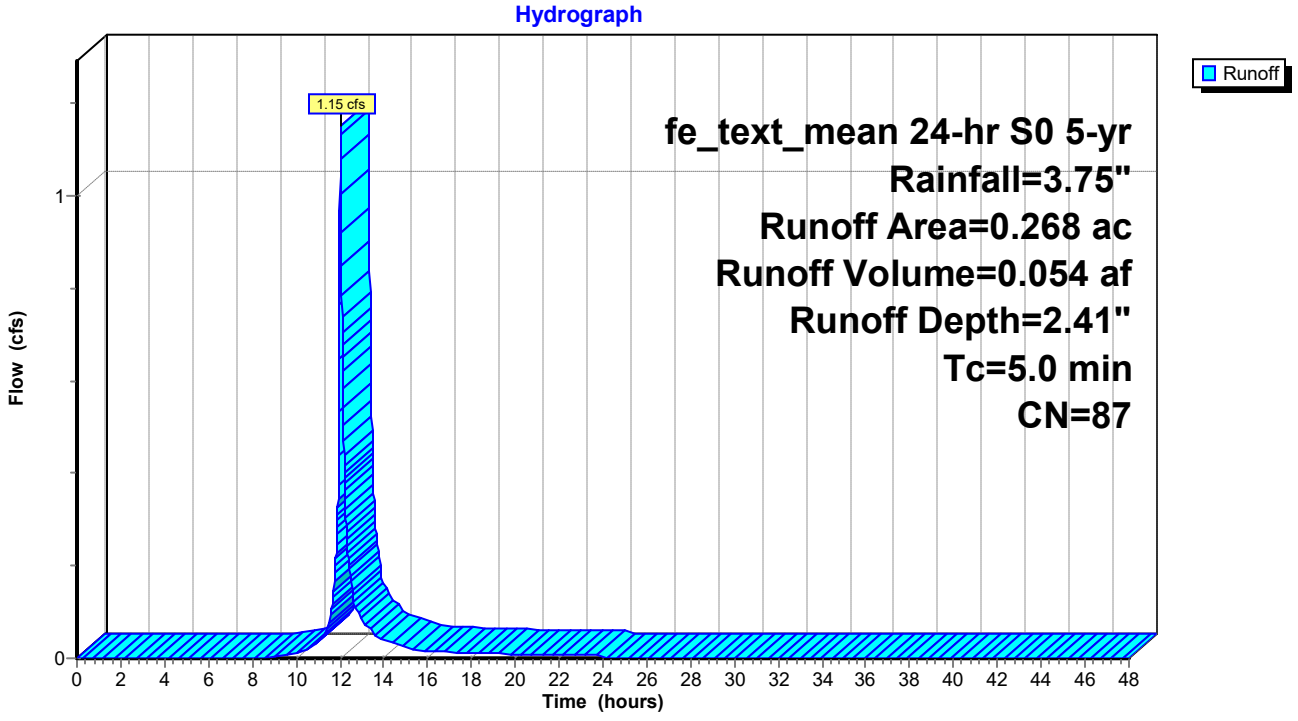
Runoff = 1.15 cfs @ 12.03 hrs, Volume= 0.054 af, Depth= 2.41"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.080	61	>75% Grass cover, Good, HSG B
	0.268	87	Weighted Average
	0.080		29.85% Pervious Area
	0.188		70.15% Impervious Area

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

Subcatchment 1BS: DA-1B



Summary for Subcatchment 1CS: DA-1C

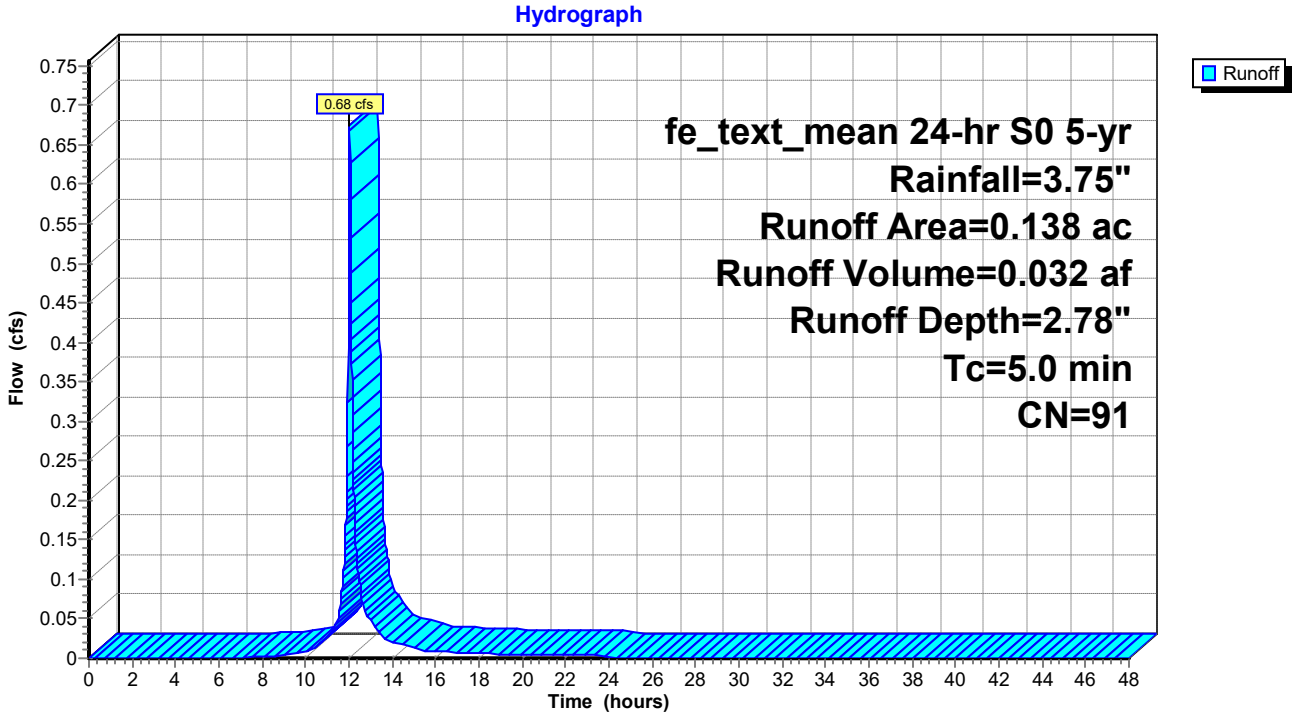
Runoff = 0.68 cfs @ 12.03 hrs, Volume= 0.032 af, Depth= 2.78"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.111	98	Impervious, HSG B
	0.027	61	>75% Grass cover, Good, HSG B
	0.138	91	Weighted Average
	0.027		19.57% Pervious Area
	0.111		80.43% Impervious Area

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

Subcatchment 1CS: DA-1C



Summary for Subcatchment 1S: DA-1

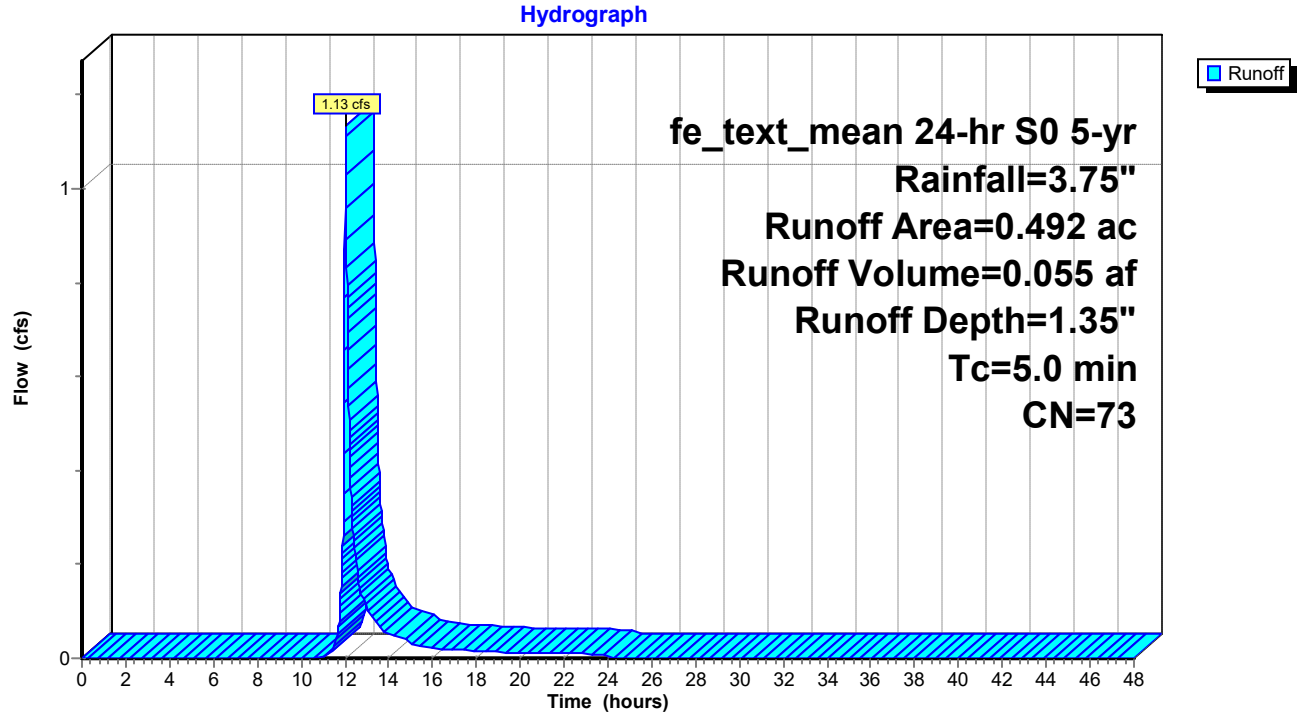
Runoff = 1.13 cfs @ 12.03 hrs, Volume= 0.055 af, Depth= 1.35"
Routed to Reach 3R : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.163	98	Impervious, HSG B
	0.329	61	>75% Grass cover, Good, HSG B
	0.492	73	Weighted Average
	0.329		66.87% Pervious Area
	0.163		33.13% Impervious Area

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

Subcatchment 1S: DA-1



Summary for Subcatchment 2S: DA-2

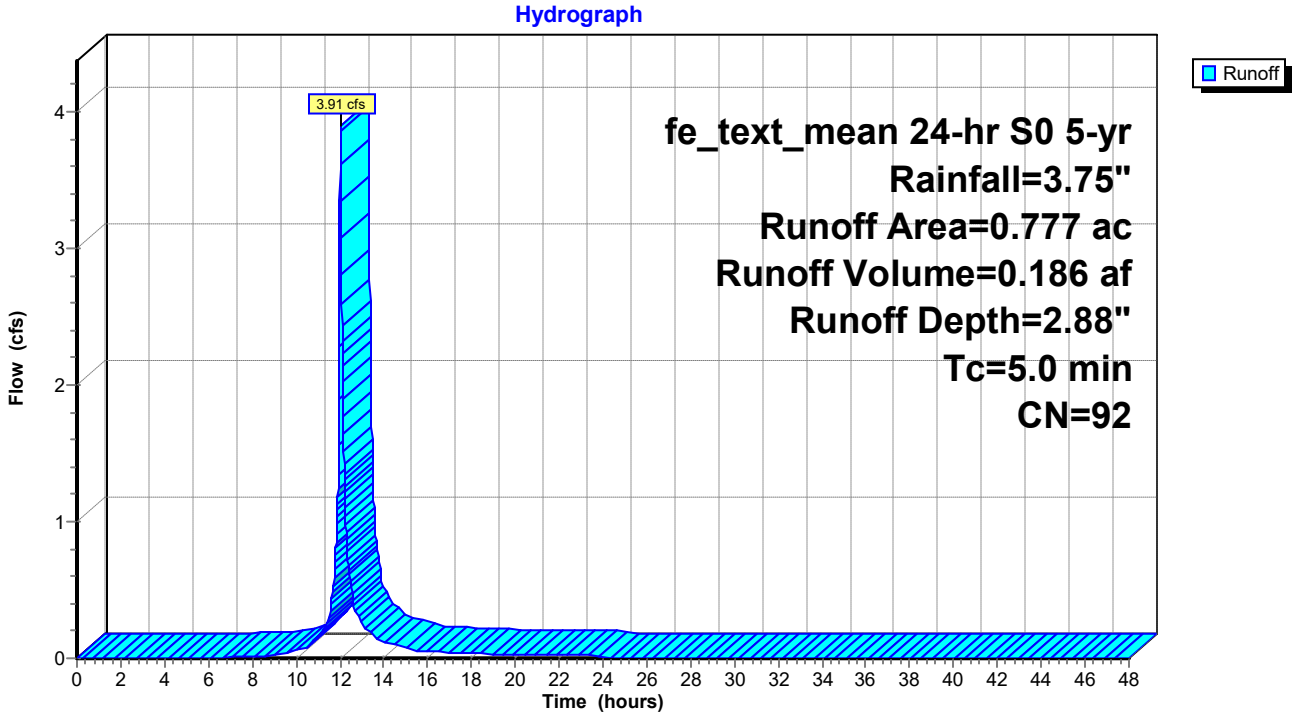
Runoff = 3.91 cfs @ 12.03 hrs, Volume= 0.186 af, Depth= 2.88"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.652	98	Impervious, HSG B
	0.125	61	>75% Grass cover, Good, HSG B
	0.777	92	Weighted Average
	0.125		16.09% Pervious Area
	0.652		83.91% Impervious Area

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

Subcatchment 2S: DA-2



Summary for Subcatchment 3S: DA-3

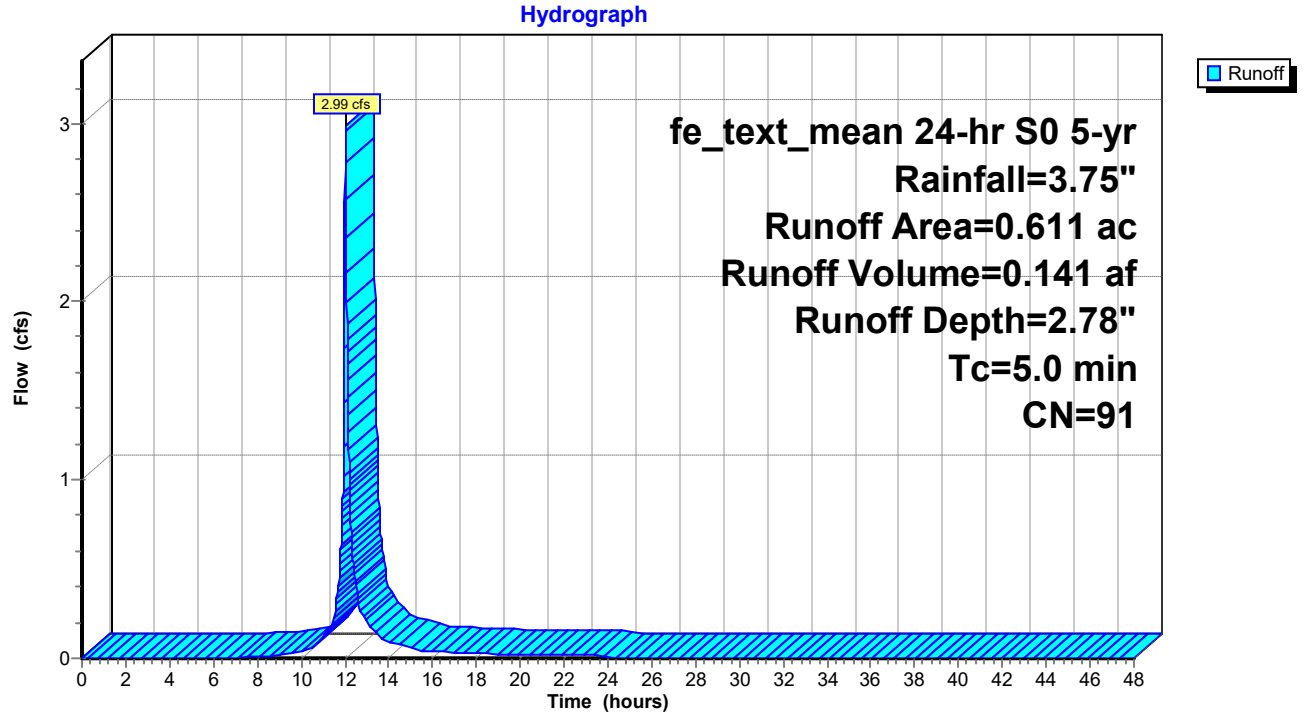
Runoff = 2.99 cfs @ 12.03 hrs, Volume= 0.141 af, Depth= 2.78"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.495	98	Impervious, HSG B
	0.116	61	>75% Grass cover, Good, HSG B
	0.611	91	Weighted Average
	0.116		18.99% Pervious Area
	0.495		81.01% Impervious Area

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

Subcatchment 3S: DA-3



Summary for Subcatchment 4S: DA-4

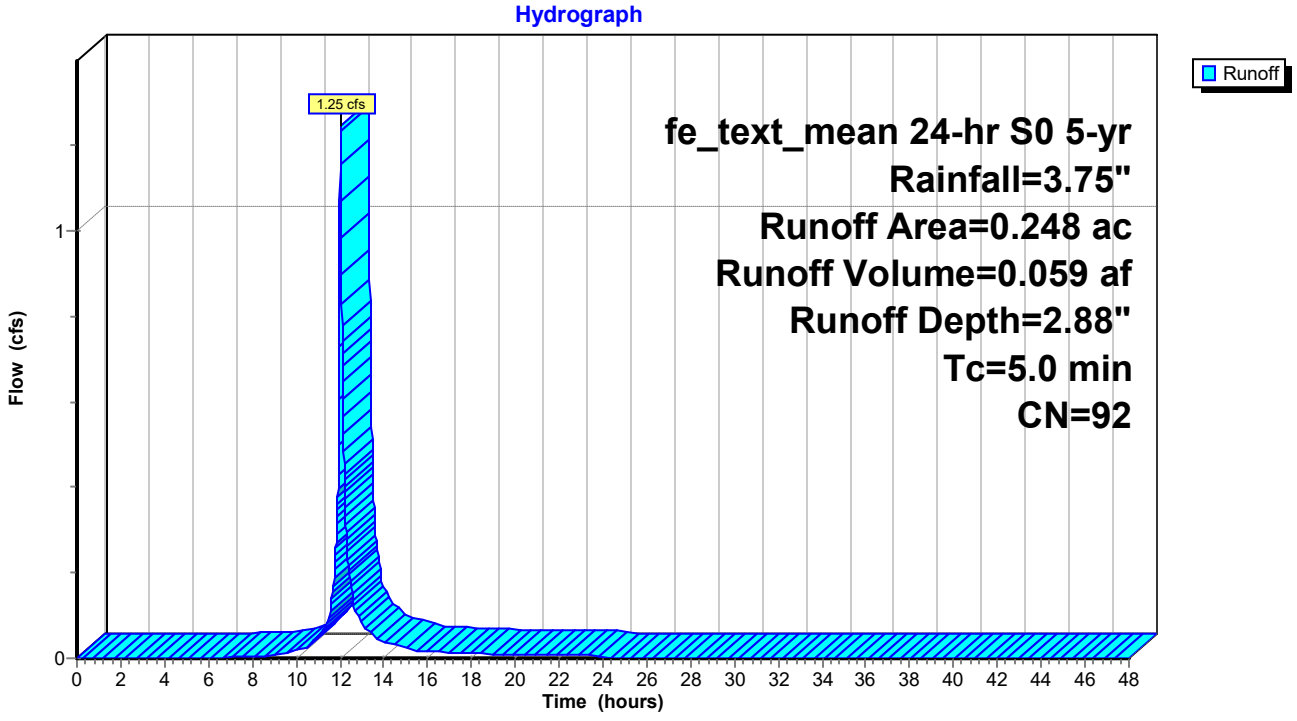
Runoff = 1.25 cfs @ 12.03 hrs, Volume= 0.059 af, Depth= 2.88"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.211	98	Impervious, HSG B
	0.037	61	>75% Grass cover, Good, HSG B
	0.248	92	Weighted Average
	0.037		14.92% Pervious Area
	0.211		85.08% Impervious Area

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

Subcatchment 4S: DA-4



Summary for Subcatchment 5S: DA-5

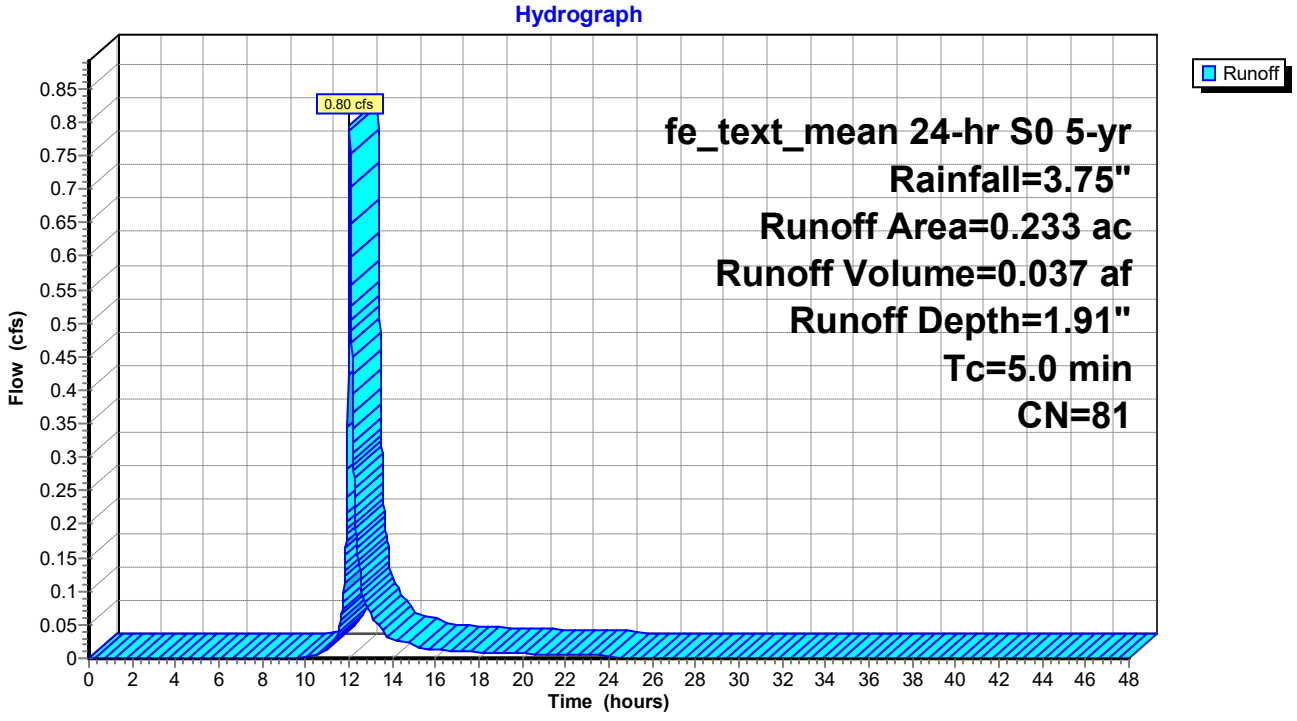
Runoff = 0.80 cfs @ 12.03 hrs, Volume= 0.037 af, Depth= 1.91"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.106	61	>75% Grass cover, Good, HSG B
	0.233	81	Weighted Average
	0.106		45.49% Pervious Area
	0.127		54.51% Impervious Area

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

Subcatchment 5S: DA-5



Summary for Subcatchment 6S: DA-6

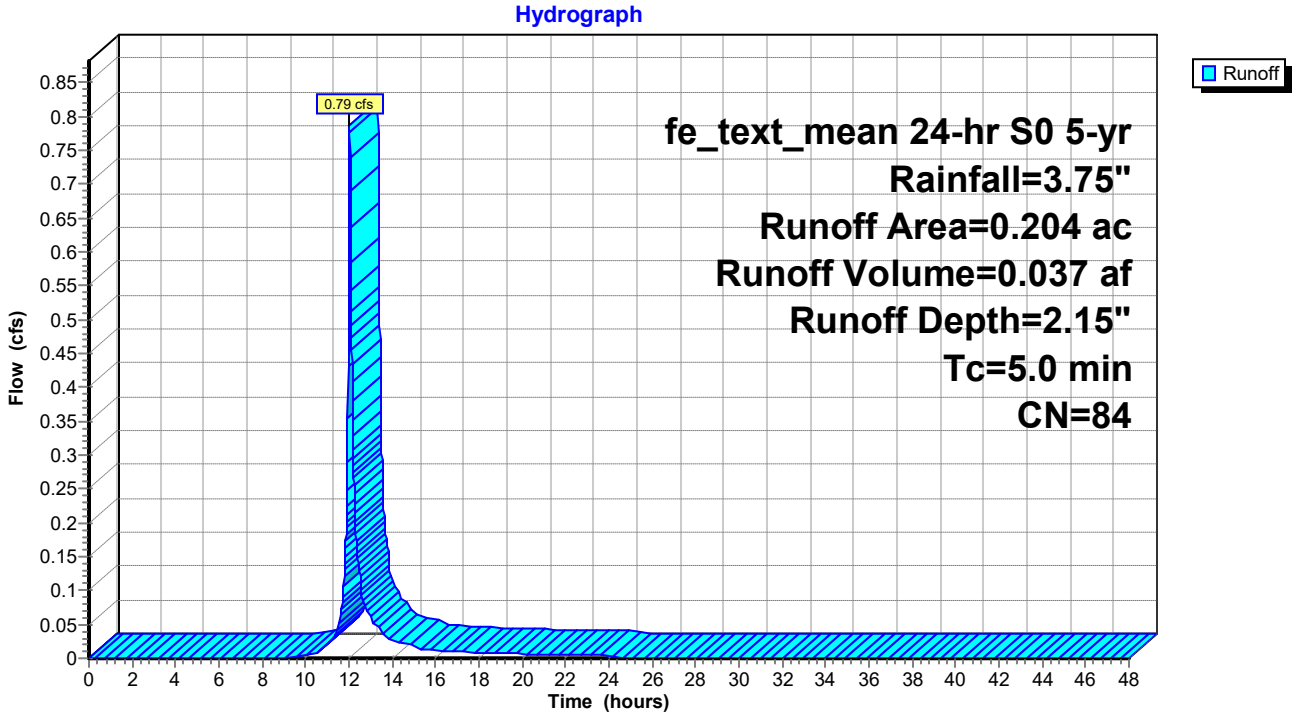
Runoff = 0.79 cfs @ 12.03 hrs, Volume= 0.037 af, Depth= 2.15"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.077	61	>75% Grass cover, Good, HSG B
	0.204	84	Weighted Average
	0.077		37.75% Pervious Area
	0.127		62.25% Impervious Area

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

Subcatchment 6S: DA-6



Summary for Subcatchment 7S: DA-7

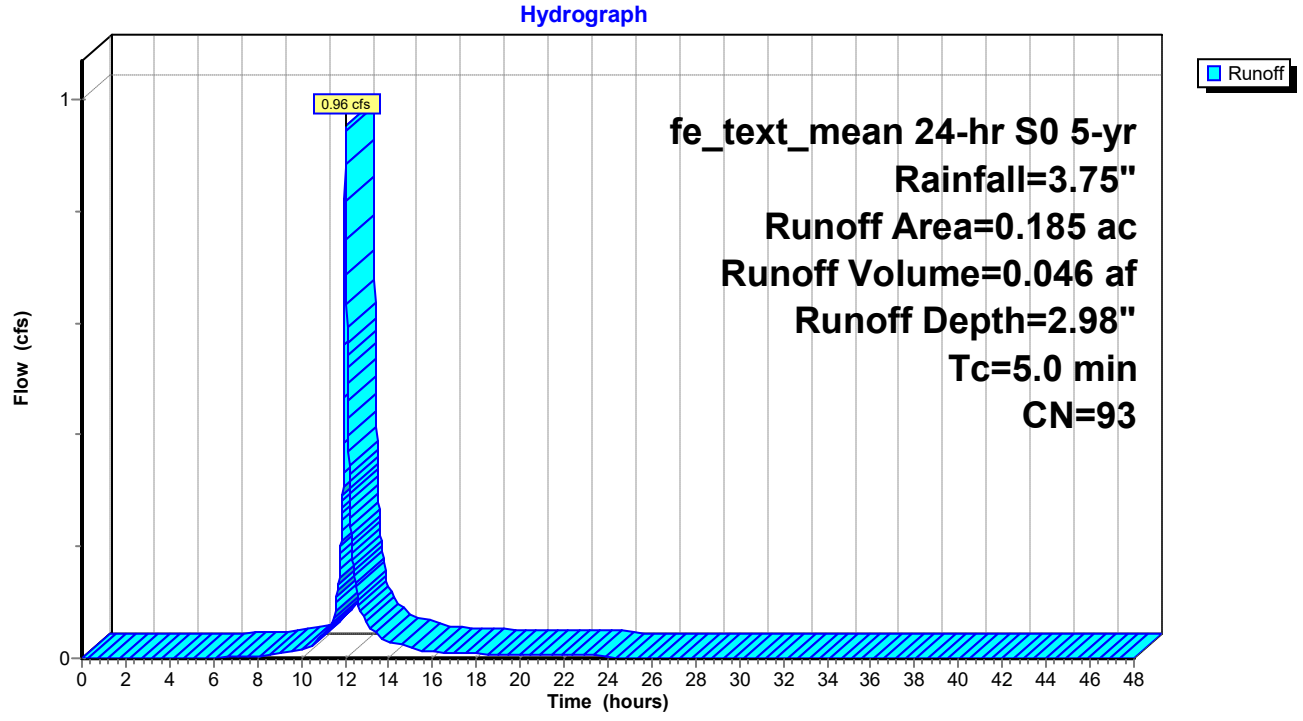
Runoff = 0.96 cfs @ 12.03 hrs, Volume= 0.046 af, Depth= 2.98"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.162	98	Impervious, HSG B
	0.023	61	>75% Grass cover, Good, HSG B
	0.185	93	Weighted Average
	0.023		12.43% Pervious Area
	0.162		87.57% Impervious Area

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

Subcatchment 7S: DA-7



Summary for Subcatchment 8S: DA-8

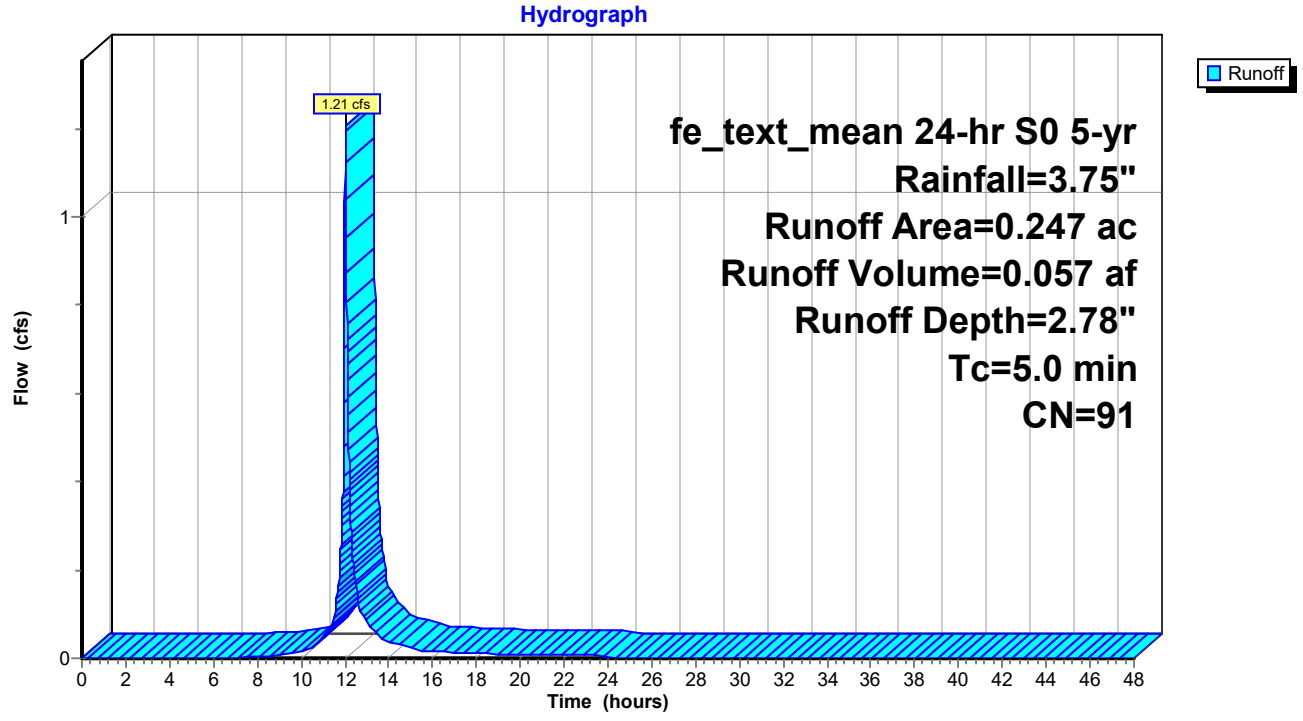
Runoff = 1.21 cfs @ 12.03 hrs, Volume= 0.057 af, Depth= 2.78"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 5-yr Rainfall=3.75"

	Area (ac)	CN	Description
*	0.200	98	Impervious, HSG B
	0.047	61	>75% Grass cover, Good, HSG B
	0.247	91	Weighted Average
	0.047		19.03% Pervious Area
	0.200		80.97% Impervious Area

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

Subcatchment 8S: DA-8

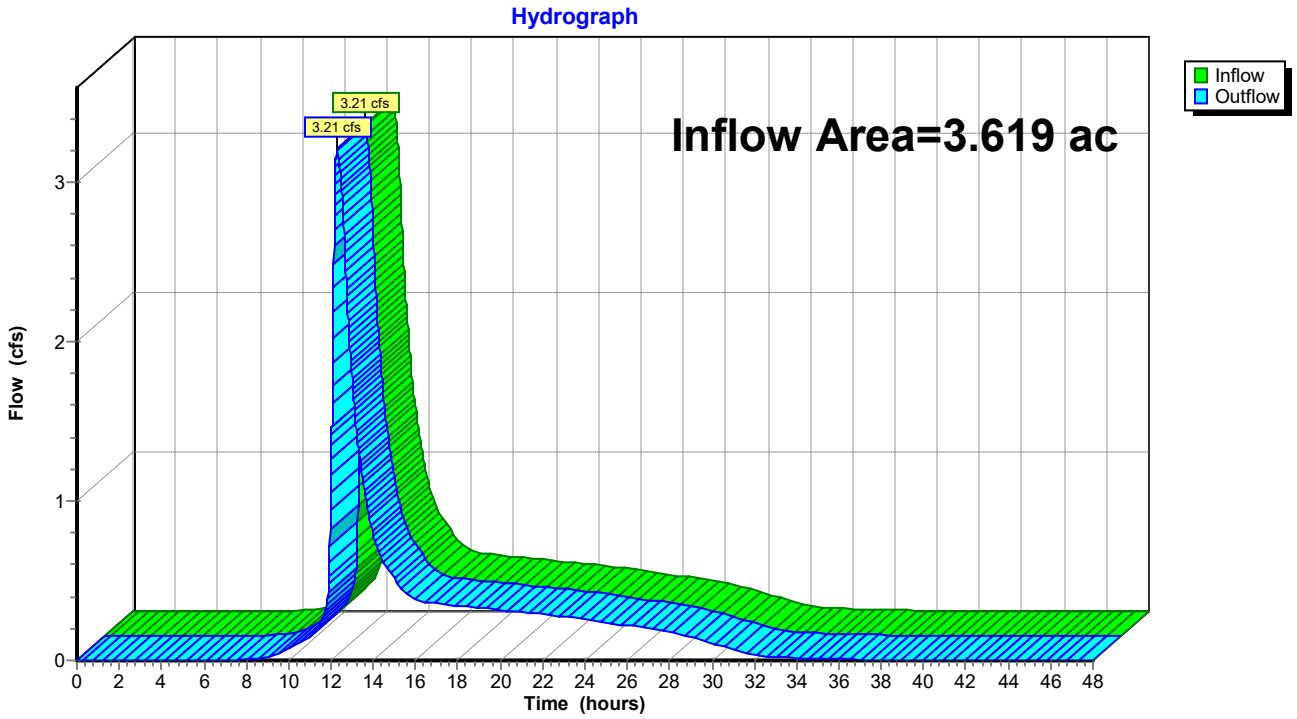


Summary for Reach 1R: Proposed Runoff

Inflow Area = 3.619 ac, 72.51% Impervious, Inflow Depth > 2.51" for 5-yr event
Inflow = 3.21 cfs @ 12.28 hrs, Volume= 0.758 af
Outflow = 3.21 cfs @ 12.28 hrs, Volume= 0.758 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Proposed Runoff

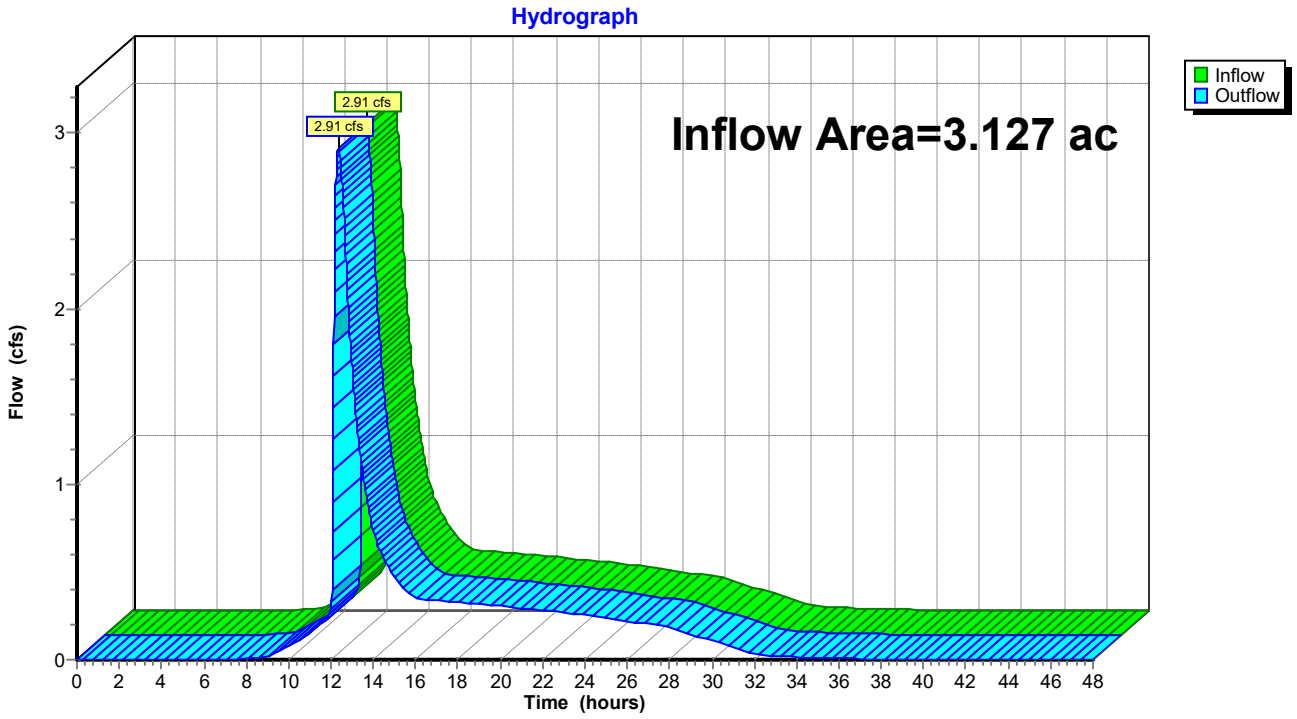


Summary for Reach 2R: On Site

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth > 2.69" for 5-yr event
Inflow = 2.91 cfs @ 12.34 hrs, Volume= 0.702 af
Outflow = 2.91 cfs @ 12.34 hrs, Volume= 0.702 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: On Site

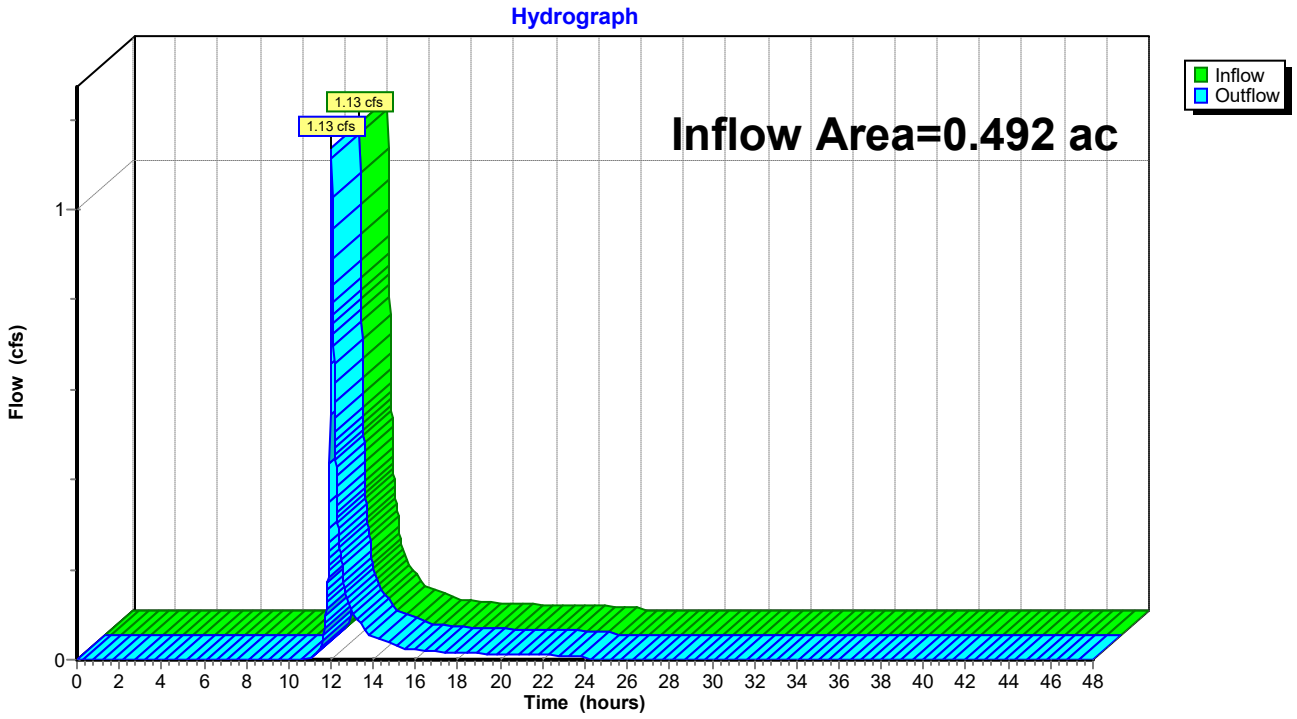


Summary for Reach 3R: Off Site

Inflow Area = 0.492 ac, 33.13% Impervious, Inflow Depth = 1.35" for 5-yr event
Inflow = 1.13 cfs @ 12.03 hrs, Volume= 0.055 af
Outflow = 1.13 cfs @ 12.03 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 3R: Off Site



Summary for Pond 2P: Underground System

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth = 2.70" for 5-yr event
Inflow = 14.84 cfs @ 12.03 hrs, Volume= 0.703 af
Outflow = 2.91 cfs @ 12.34 hrs, Volume= 0.702 af, Atten= 80%, Lag= 18.9 min
Primary = 2.91 cfs @ 12.34 hrs, Volume= 0.702 af
Routed to Reach 2R : On Site
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : On Site

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 643.43' @ 12.34 hrs Surf.Area= 0.152 ac Storage= 0.344 af

Plug-Flow detention time= 264.5 min calculated for 0.702 af (100% of inflow)
Center-of-Mass det. time= 263.7 min (1,046.5 - 782.9)

Volume	Invert	Avail.Storage	Storage Description
#1	640.25'	0.006 af	**4.00'D x 6.50'H Vertical Cone/Cylinder** x 3
#2A	640.25'	0.210 af	**37.08'W x 177.78'L x 5.50'H Field A** 0.832 af Overall - 0.306 af Embedded = 0.526 af x 40.0% Voids
#3A	641.00'	0.306 af	**ADS_StormTech MC-3500 d +Cap** x 120 Inside #2 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 120 Chambers in 5 Rows Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf
#4	646.60'	2.683 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		3.205 af	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
646.60	0.000	0.000	0.000
647.00	0.190	0.038	0.038
648.00	5.100	2.645	2.683

Device	Routing	Invert	Outlet Devices
#1	Device 3	640.25'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	642.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	640.25'	**12.0" Round Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 640.25' / 639.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	647.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.20 1.20 Width (feet) 0.00 20.00 80.00

Primary OutFlow Max=2.91 cfs @ 12.34 hrs HW=643.43' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Passes 2.91 cfs of 4.79 cfs potential flow)
  ├─**1=Orifice/Grate** (Orifice Controls 0.41 cfs @ 8.42 fps)
  └─**2=Orifice/Grate** (Orifice Controls 2.50 cfs @ 3.28 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=640.25' TW=0.00' (Dynamic Tailwater)
└─**4=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 2P: Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

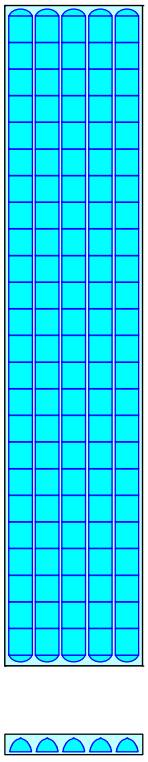
24 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 175.78' Row Length +12.0" End Stone x 2 = 177.78' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

120 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 13,343.2 cf Chamber Storage

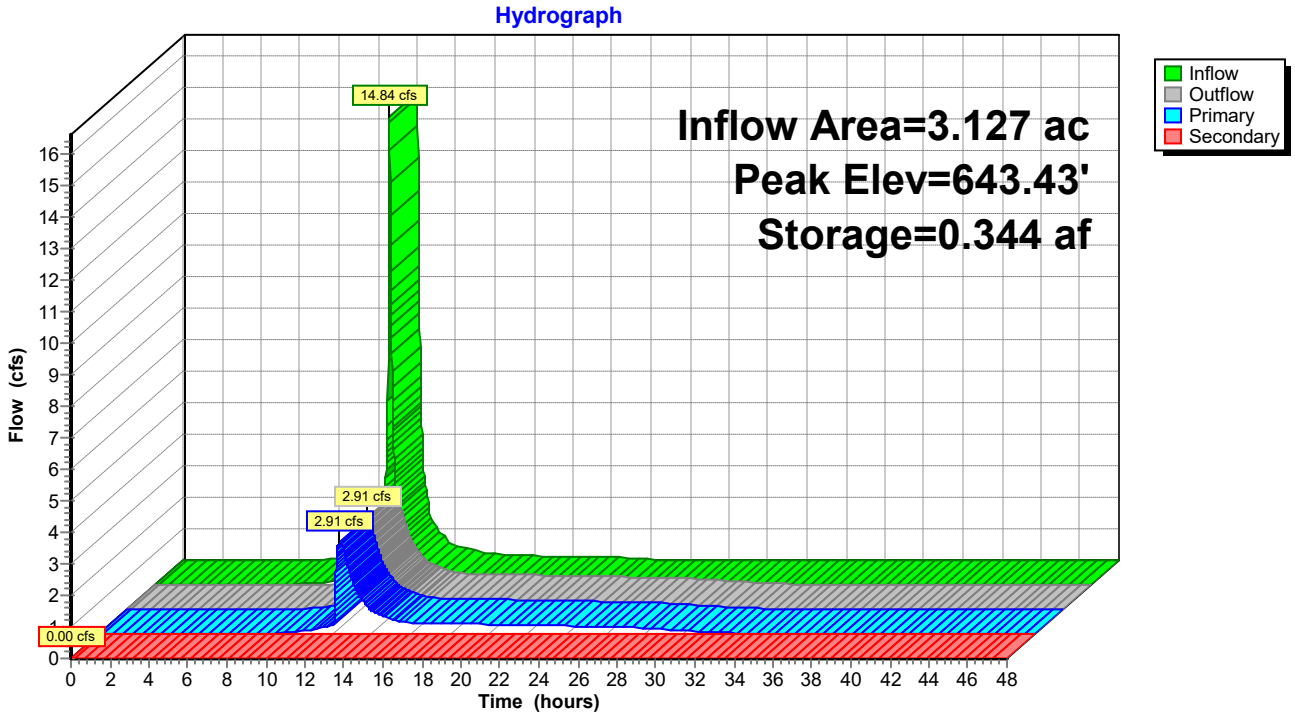
36,259.7 cf Field - 13,343.2 cf Chambers = 22,916.5 cf Stone x 40.0% Voids = 9,166.6 cf Stone Storage

Chamber Storage + Stone Storage = 22,509.8 cf = 0.517 af
Overall Storage Efficiency = 62.1%
Overall System Size = 177.78' x 37.08' x 5.50'

120 Chambers
1,343.0 cy Field
848.8 cy Stone



Pond 2P: Underground System



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AS: DA-1A Runoff Area=0.216 ac 87.04% Impervious Runoff Depth=3.67"
Tc=5.0 min CN=93 Runoff=1.33 cfs 0.066 af

Subcatchment 1BS: DA-1B Runoff Area=0.268 ac 70.15% Impervious Runoff Depth=3.06"
Tc=5.0 min CN=87 Runoff=1.43 cfs 0.068 af

Subcatchment 1CS: DA-1C Runoff Area=0.138 ac 80.43% Impervious Runoff Depth=3.46"
Tc=5.0 min CN=91 Runoff=0.81 cfs 0.040 af

Subcatchment 1S: DA-1 Runoff Area=0.492 ac 33.13% Impervious Runoff Depth=1.87"
Tc=5.0 min CN=73 Runoff=1.57 cfs 0.076 af

Subcatchment 2S: DA-2 Runoff Area=0.777 ac 83.91% Impervious Runoff Depth=3.56"
Tc=5.0 min CN=92 Runoff=4.68 cfs 0.231 af

Subcatchment 3S: DA-3 Runoff Area=0.611 ac 81.01% Impervious Runoff Depth=3.46"
Tc=5.0 min CN=91 Runoff=3.60 cfs 0.176 af

Subcatchment 4S: DA-4 Runoff Area=0.248 ac 85.08% Impervious Runoff Depth=3.56"
Tc=5.0 min CN=92 Runoff=1.49 cfs 0.074 af

Subcatchment 5S: DA-5 Runoff Area=0.233 ac 54.51% Impervious Runoff Depth=2.51"
Tc=5.0 min CN=81 Runoff=1.02 cfs 0.049 af

Subcatchment 6S: DA-6 Runoff Area=0.204 ac 62.25% Impervious Runoff Depth=2.78"
Tc=5.0 min CN=84 Runoff=0.99 cfs 0.047 af

Subcatchment 7S: DA-7 Runoff Area=0.185 ac 87.57% Impervious Runoff Depth=3.67"
Tc=5.0 min CN=93 Runoff=1.14 cfs 0.057 af

Subcatchment 8S: DA-8 Runoff Area=0.247 ac 80.97% Impervious Runoff Depth=3.46"
Tc=5.0 min CN=91 Runoff=1.45 cfs 0.071 af

Reach 1R: Proposed Runoff Inflow=4.82 cfs 0.954 af
Outflow=4.82 cfs 0.954 af

Reach 2R: On Site Inflow=4.29 cfs 0.877 af
Outflow=4.29 cfs 0.877 af

Reach 3R: Off Site Inflow=1.57 cfs 0.076 af
Outflow=1.57 cfs 0.076 af

Pond 2P: Underground System Peak Elev=644.03' Storage=0.405 af Inflow=17.94 cfs 0.879 af
Primary=4.29 cfs 0.877 af Secondary=0.00 cfs 0.000 af Outflow=4.29 cfs 0.877 af

Total Runoff Area = 3.619 ac Runoff Volume = 0.955 af Average Runoff Depth = 3.17"
27.49% Pervious = 0.995 ac 72.51% Impervious = 2.624 ac

Summary for Subcatchment 1AS: DA-1A

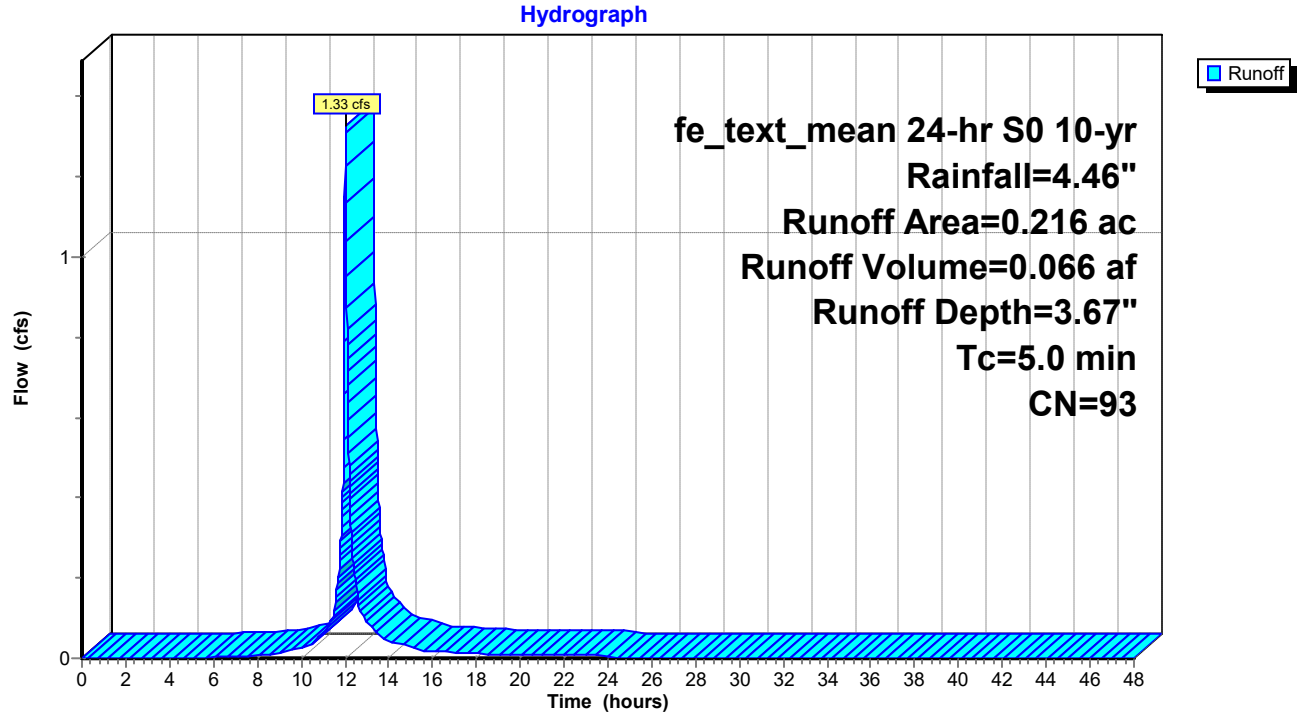
Runoff = 1.33 cfs @ 12.03 hrs, Volume= 0.066 af, Depth= 3.67"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.028	61	>75% Grass cover, Good, HSG B
	0.216	93	Weighted Average
	0.028		12.96% Pervious Area
	0.188		87.04% Impervious Area

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

Subcatchment 1AS: DA-1A



Summary for Subcatchment 1BS: DA-1B

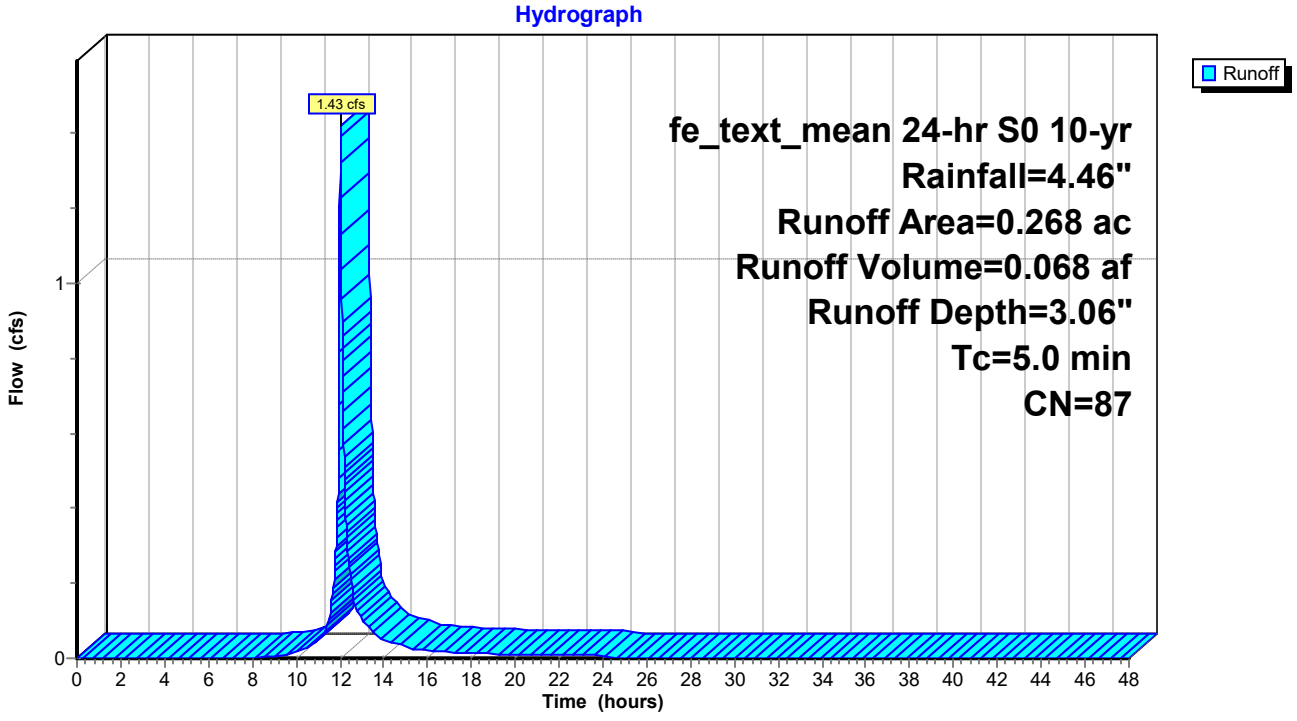
Runoff = 1.43 cfs @ 12.03 hrs, Volume= 0.068 af, Depth= 3.06"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.080	61	>75% Grass cover, Good, HSG B
	0.268	87	Weighted Average
	0.080		29.85% Pervious Area
	0.188		70.15% Impervious Area

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

Subcatchment 1BS: DA-1B



Summary for Subcatchment 1CS: DA-1C

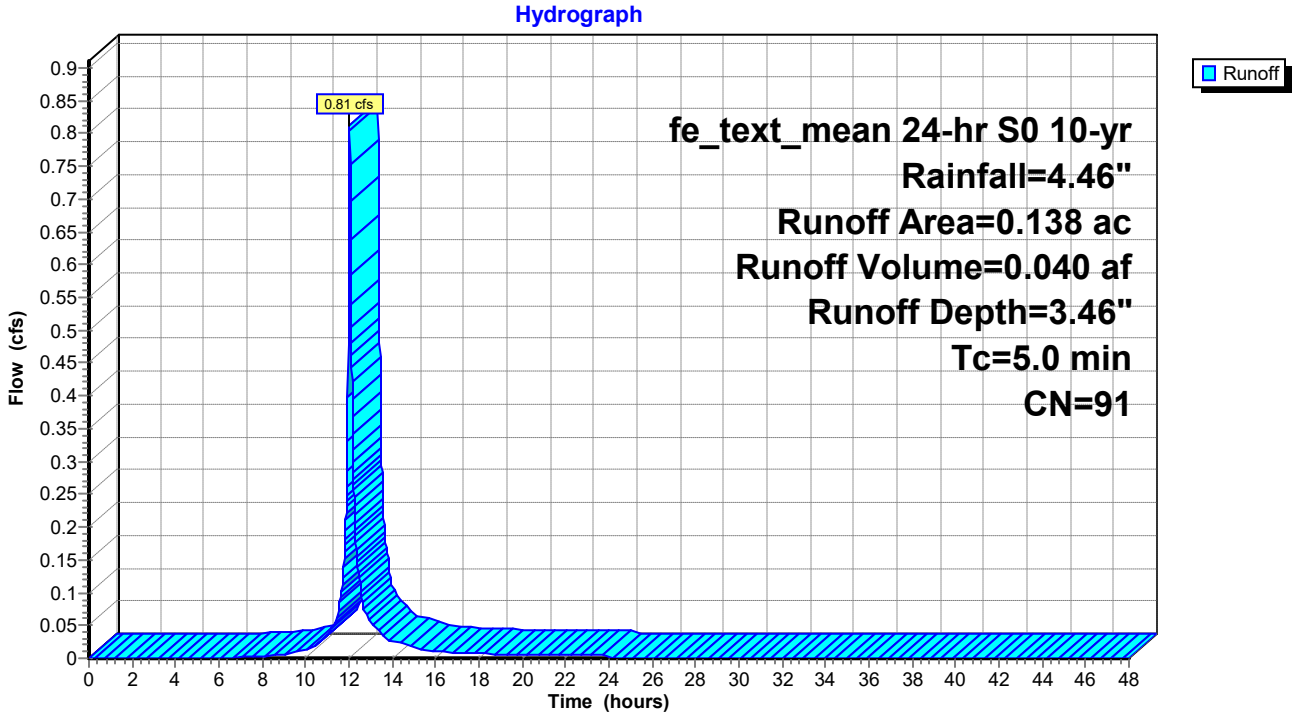
Runoff = 0.81 cfs @ 12.03 hrs, Volume= 0.040 af, Depth= 3.46"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.111	98	Impervious, HSG B
	0.027	61	>75% Grass cover, Good, HSG B
	0.138	91	Weighted Average
	0.027		19.57% Pervious Area
	0.111		80.43% Impervious Area

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

Subcatchment 1CS: DA-1C



Summary for Subcatchment 1S: DA-1

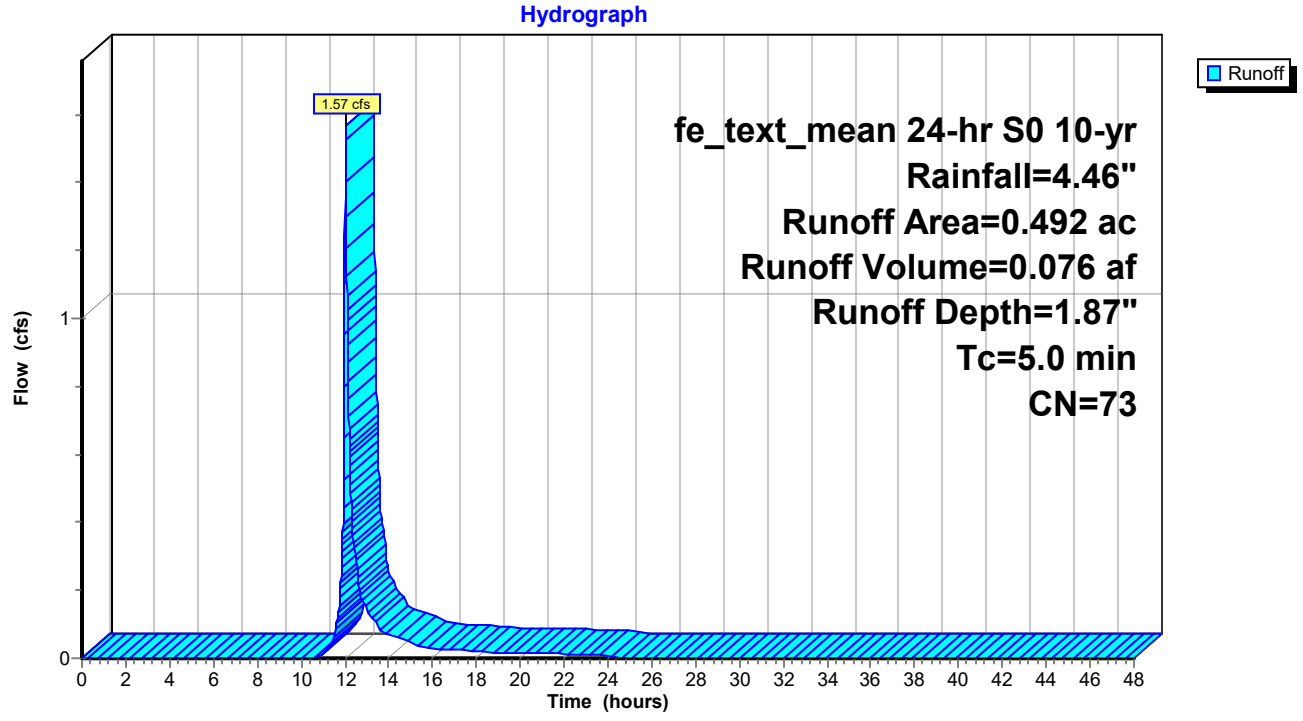
Runoff = 1.57 cfs @ 12.03 hrs, Volume= 0.076 af, Depth= 1.87"
Routed to Reach 3R : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.163	98	Impervious, HSG B
	0.329	61	>75% Grass cover, Good, HSG B
	0.492	73	Weighted Average
	0.329		66.87% Pervious Area
	0.163		33.13% Impervious Area

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

Subcatchment 1S: DA-1



Summary for Subcatchment 2S: DA-2

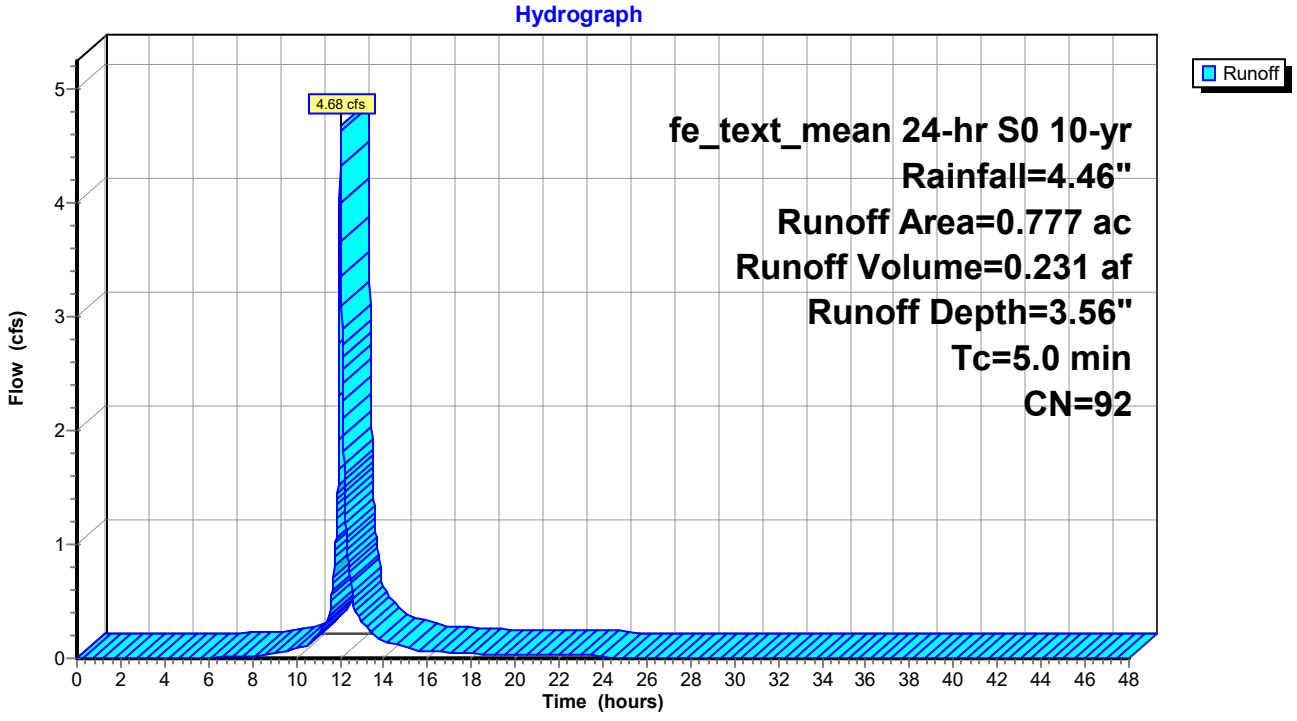
Runoff = 4.68 cfs @ 12.03 hrs, Volume= 0.231 af, Depth= 3.56"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.652	98	Impervious, HSG B
	0.125	61	>75% Grass cover, Good, HSG B
	0.777	92	Weighted Average
	0.125		16.09% Pervious Area
	0.652		83.91% Impervious Area

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

Subcatchment 2S: DA-2



Summary for Subcatchment 3S: DA-3

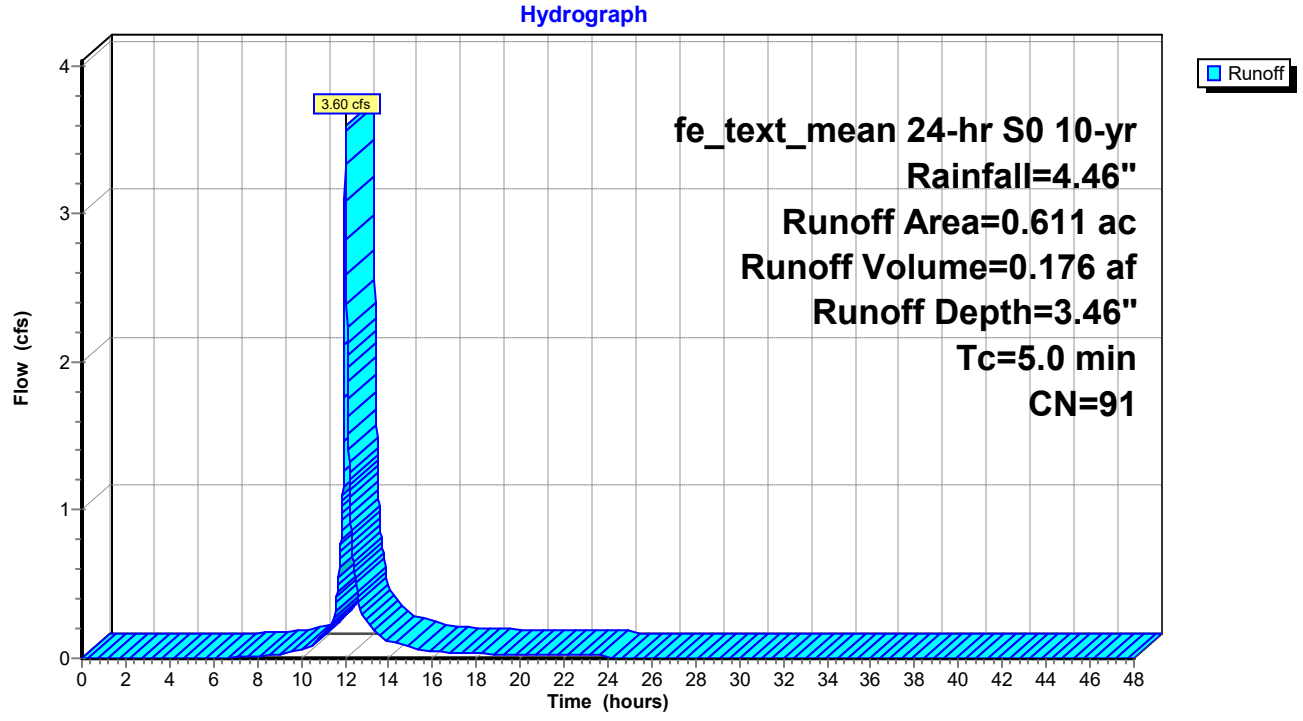
Runoff = 3.60 cfs @ 12.03 hrs, Volume= 0.176 af, Depth= 3.46"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.495	98	Impervious, HSG B
	0.116	61	>75% Grass cover, Good, HSG B
	0.611	91	Weighted Average
	0.116		18.99% Pervious Area
	0.495		81.01% Impervious Area

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

Subcatchment 3S: DA-3



Summary for Subcatchment 4S: DA-4

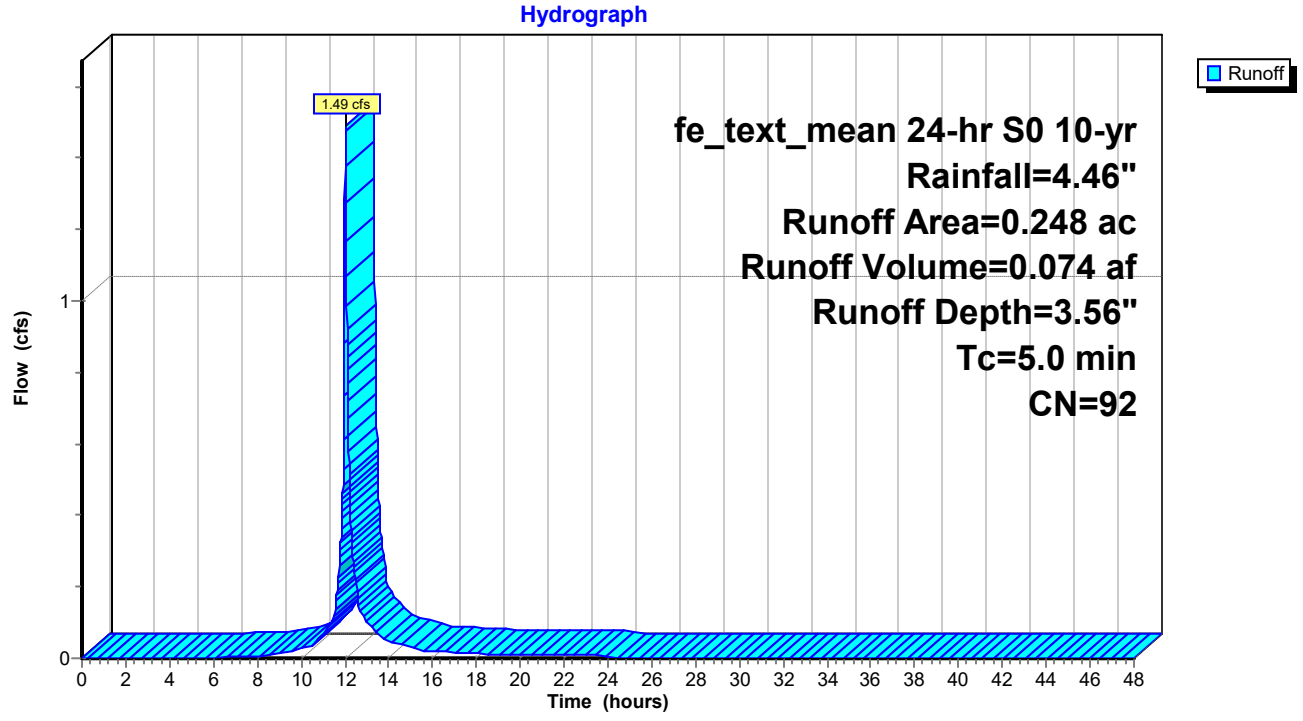
Runoff = 1.49 cfs @ 12.03 hrs, Volume= 0.074 af, Depth= 3.56"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.211	98	Impervious, HSG B
	0.037	61	>75% Grass cover, Good, HSG B
	0.248	92	Weighted Average
	0.037		14.92% Pervious Area
	0.211		85.08% Impervious Area

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

Subcatchment 4S: DA-4



Summary for Subcatchment 5S: DA-5

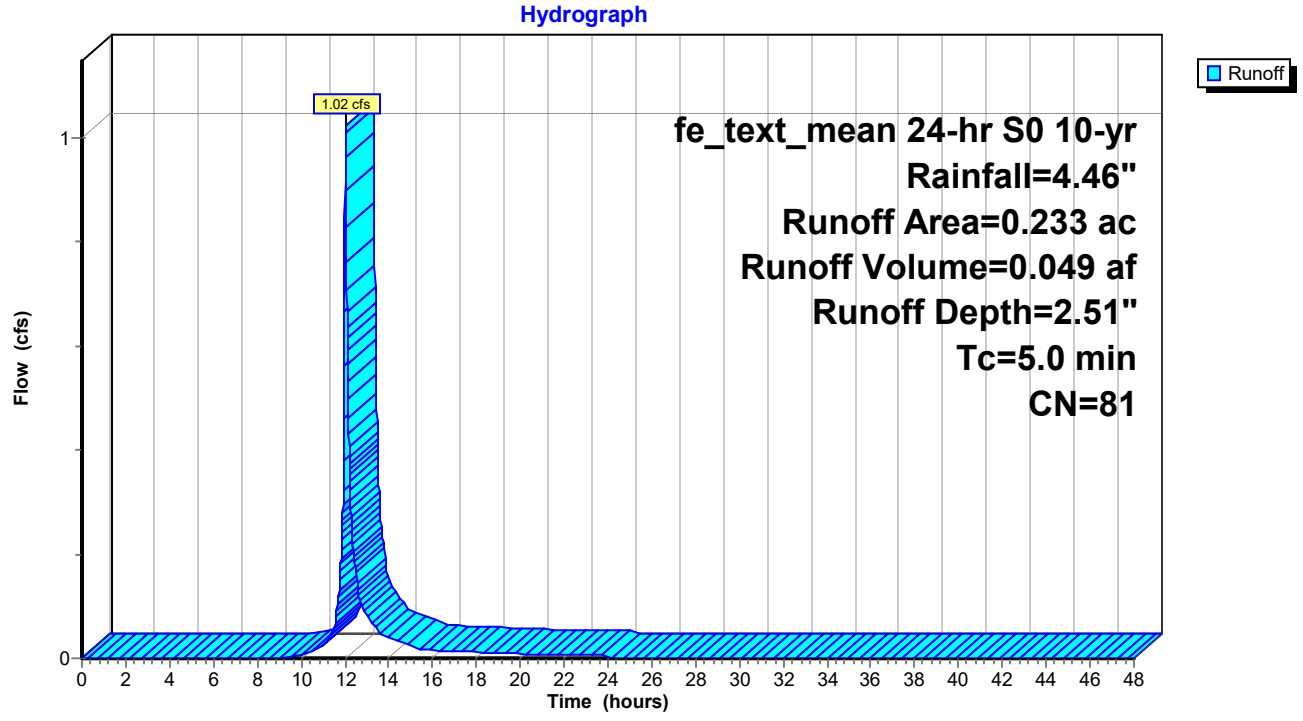
Runoff = 1.02 cfs @ 12.03 hrs, Volume= 0.049 af, Depth= 2.51"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.106	61	>75% Grass cover, Good, HSG B
	0.233	81	Weighted Average
	0.106		45.49% Pervious Area
	0.127		54.51% Impervious Area

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

Subcatchment 5S: DA-5



Summary for Subcatchment 6S: DA-6

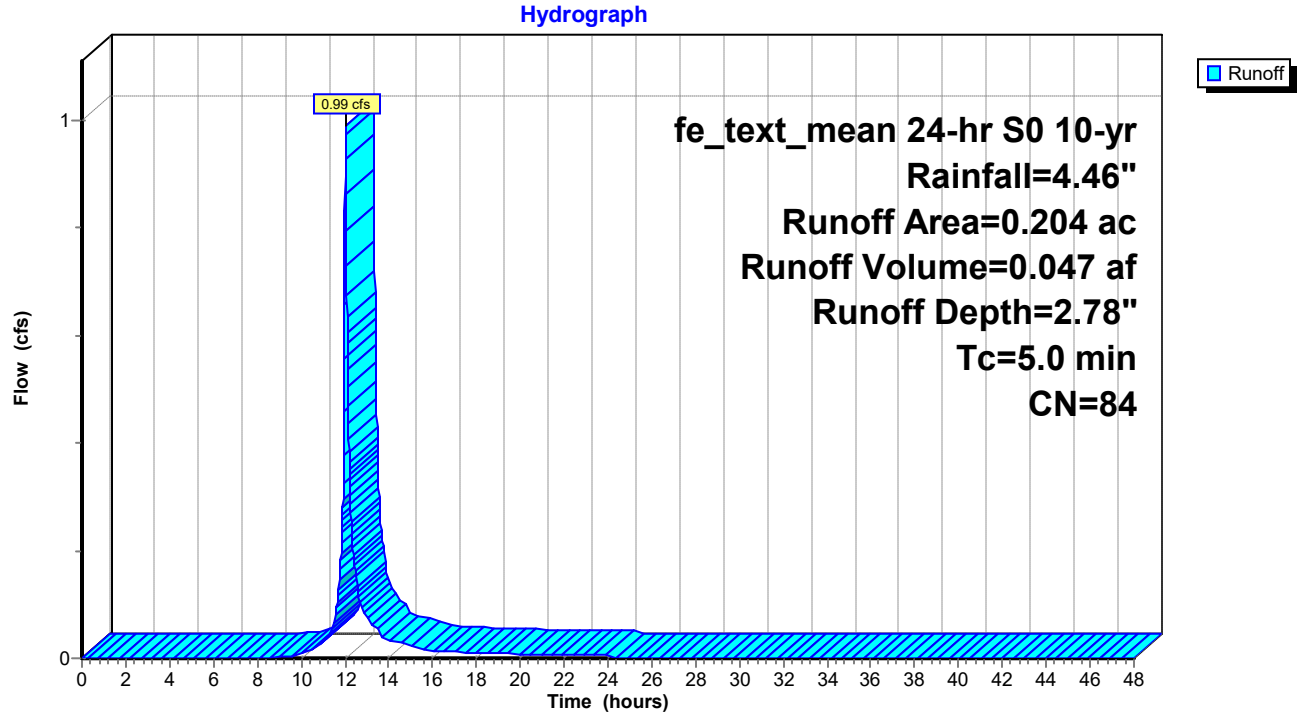
Runoff = 0.99 cfs @ 12.03 hrs, Volume= 0.047 af, Depth= 2.78"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.077	61	>75% Grass cover, Good, HSG B
	0.204	84	Weighted Average
	0.077		37.75% Pervious Area
	0.127		62.25% Impervious Area

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

Subcatchment 6S: DA-6



Summary for Subcatchment 7S: DA-7

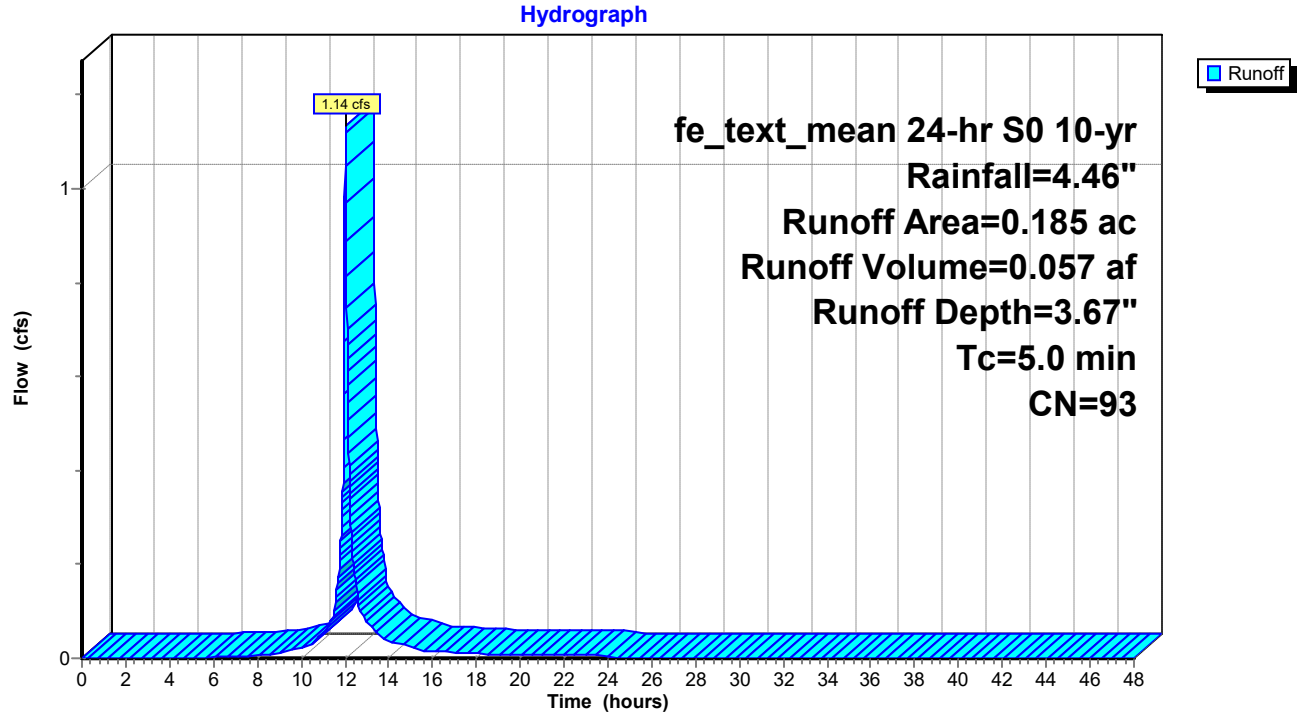
Runoff = 1.14 cfs @ 12.03 hrs, Volume= 0.057 af, Depth= 3.67"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.162	98	Impervious, HSG B
	0.023	61	>75% Grass cover, Good, HSG B
	0.185	93	Weighted Average
	0.023		12.43% Pervious Area
	0.162		87.57% Impervious Area

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

Subcatchment 7S: DA-7



Summary for Subcatchment 8S: DA-8

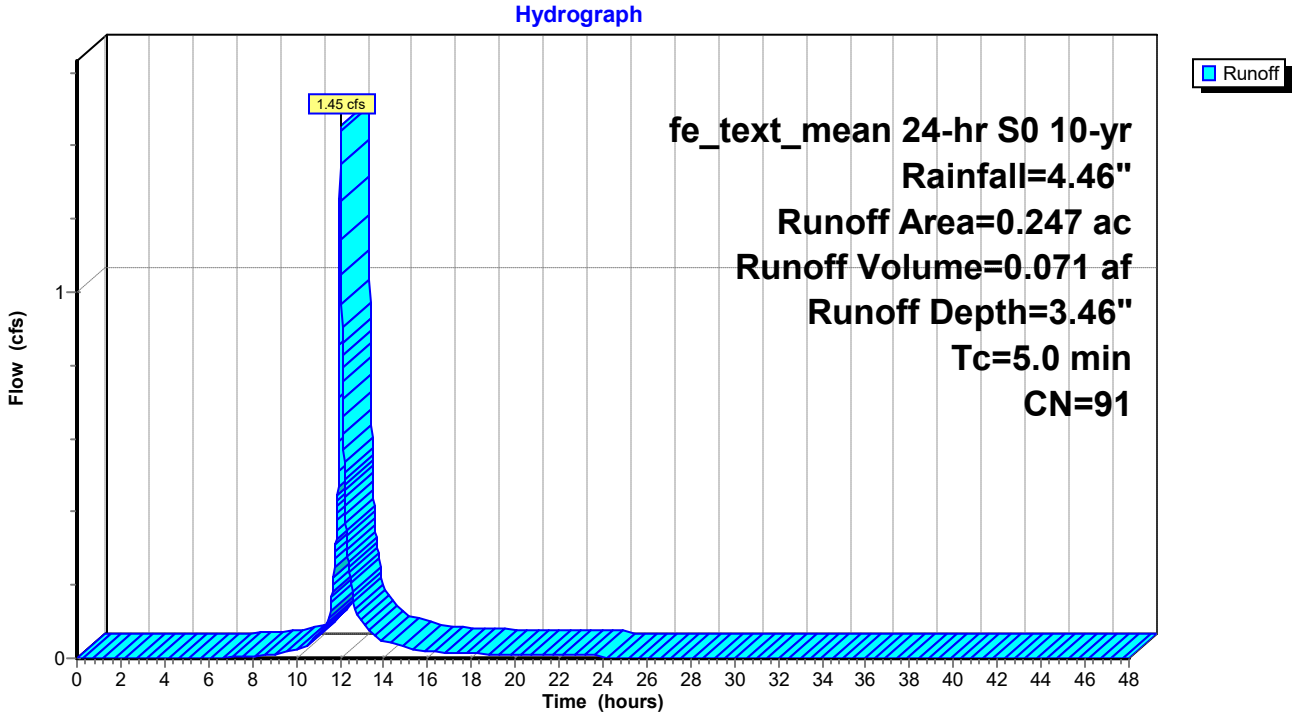
Runoff = 1.45 cfs @ 12.03 hrs, Volume= 0.071 af, Depth= 3.46"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 10-yr Rainfall=4.46"

	Area (ac)	CN	Description
*	0.200	98	Impervious, HSG B
	0.047	61	>75% Grass cover, Good, HSG B
	0.247	91	Weighted Average
	0.047		19.03% Pervious Area
	0.200		80.97% Impervious Area

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

Subcatchment 8S: DA-8

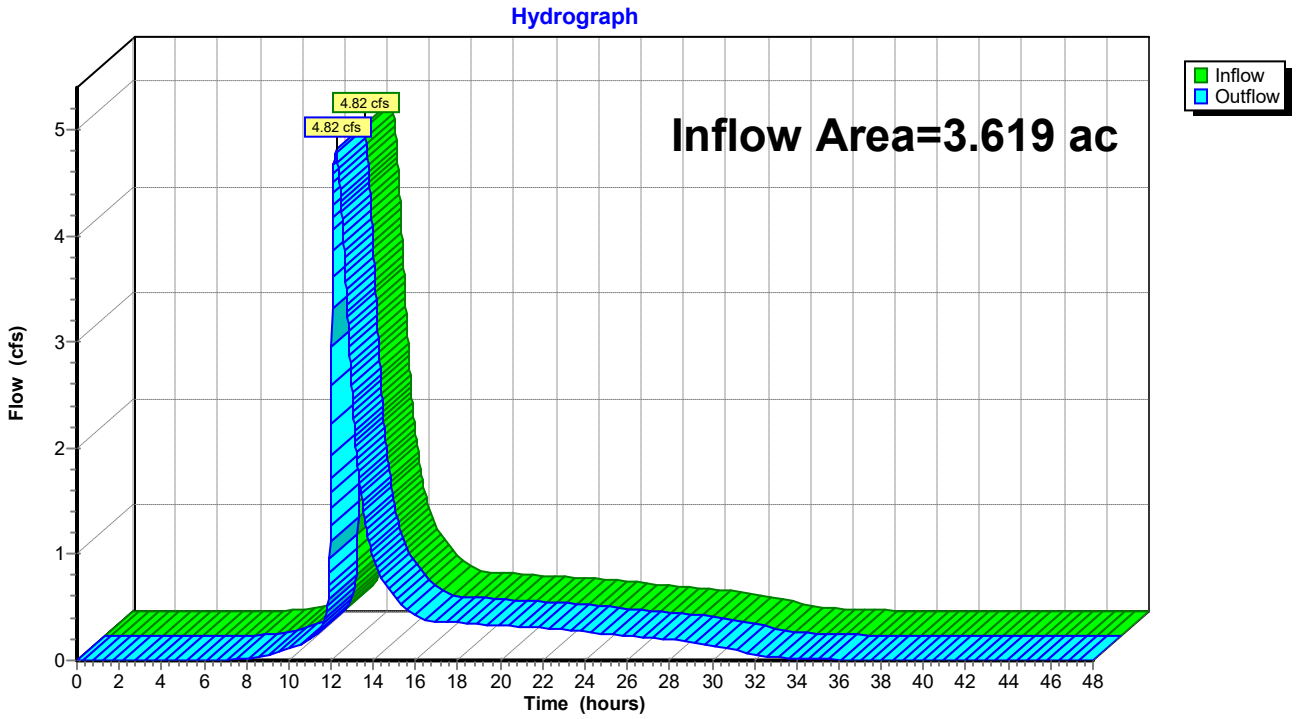


Summary for Reach 1R: Proposed Runoff

Inflow Area = 3.619 ac, 72.51% Impervious, Inflow Depth > 3.16" for 10-yr event
Inflow = 4.82 cfs @ 12.24 hrs, Volume= 0.954 af
Outflow = 4.82 cfs @ 12.24 hrs, Volume= 0.954 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Proposed Runoff

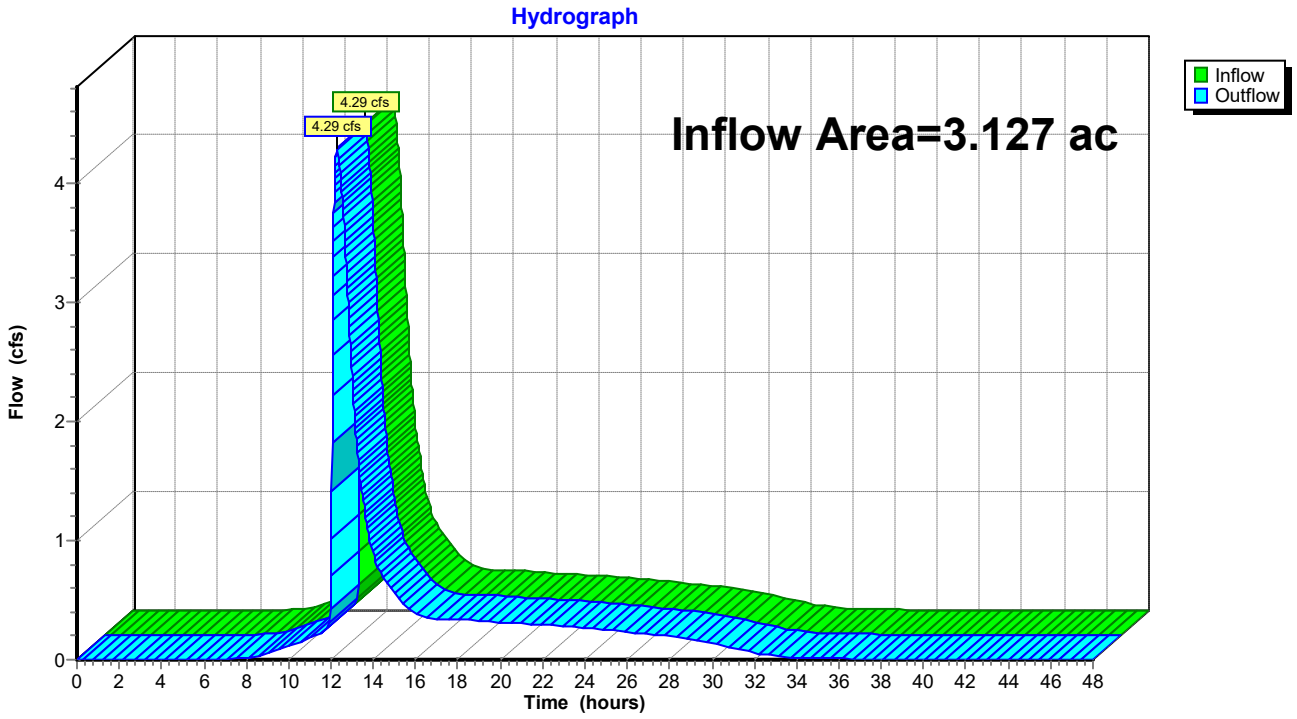


Summary for Reach 2R: On Site

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth > 3.37" for 10-yr event
Inflow = 4.29 cfs @ 12.28 hrs, Volume= 0.877 af
Outflow = 4.29 cfs @ 12.28 hrs, Volume= 0.877 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: On Site

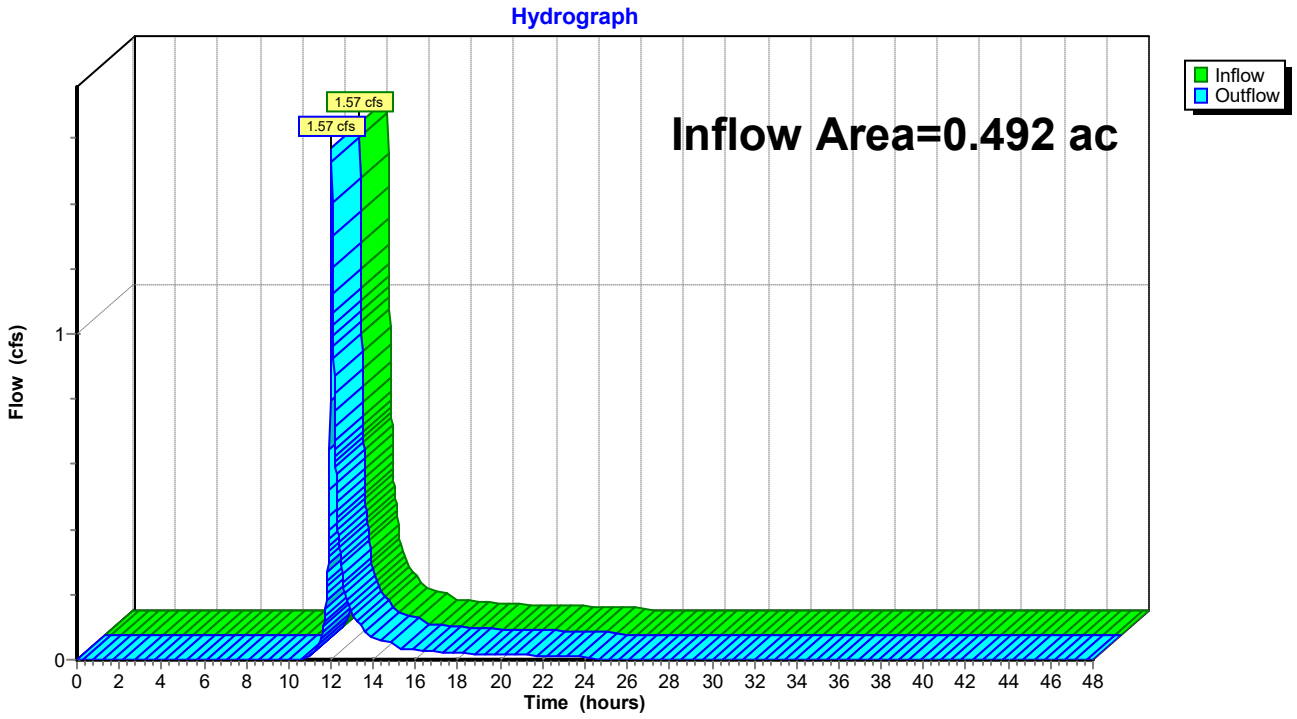


Summary for Reach 3R: Off Site

Inflow Area = 0.492 ac, 33.13% Impervious, Inflow Depth = 1.87" for 10-yr event
Inflow = 1.57 cfs @ 12.03 hrs, Volume= 0.076 af
Outflow = 1.57 cfs @ 12.03 hrs, Volume= 0.076 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 3R: Off Site



Summary for Pond 2P: Underground System

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth = 3.37" for 10-yr event
Inflow = 17.94 cfs @ 12.03 hrs, Volume= 0.879 af
Outflow = 4.29 cfs @ 12.28 hrs, Volume= 0.877 af, Atten= 76%, Lag= 15.3 min
Primary = 4.29 cfs @ 12.28 hrs, Volume= 0.877 af
Routed to Reach 2R : On Site
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : On Site

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 644.03' @ 12.28 hrs Surf.Area= 0.152 ac Storage= 0.405 af

Plug-Flow detention time= 232.4 min calculated for 0.877 af (100% of inflow)
Center-of-Mass det. time= 231.7 min (1,010.2 - 778.5)

Volume	Invert	Avail.Storage	Storage Description
#1	640.25'	0.006 af	**4.00'D x 6.50'H Vertical Cone/Cylinder** x 3
#2A	640.25'	0.210 af	**37.08'W x 177.78'L x 5.50'H Field A** 0.832 af Overall - 0.306 af Embedded = 0.526 af x 40.0% Voids
#3A	641.00'	0.306 af	**ADS_StormTech MC-3500 d +Cap** x 120 Inside #2 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 120 Chambers in 5 Rows Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf
#4	646.60'	2.683 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		3.205 af	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
646.60	0.000	0.000	0.000
647.00	0.190	0.038	0.038
648.00	5.100	2.645	2.683

Device	Routing	Invert	Outlet Devices
#1	Device 3	640.25'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	642.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	640.25'	**12.0" Round Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 640.25' / 639.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	647.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.20 1.20 Width (feet) 0.00 20.00 80.00

Primary OutFlow Max=4.29 cfs @ 12.28 hrs HW=644.03' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Passes 4.29 cfs of 5.30 cfs potential flow)
  ├─**1=Orifice/Grate** (Orifice Controls 0.45 cfs @ 9.21 fps)
  └─**2=Orifice/Grate** (Orifice Controls 3.84 cfs @ 4.89 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=640.25' TW=0.00' (Dynamic Tailwater)
└─**4=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 2P: Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

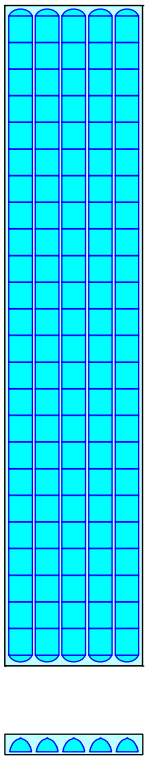
24 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 175.78' Row Length +12.0" End Stone x 2 = 177.78' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

120 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 13,343.2 cf Chamber Storage

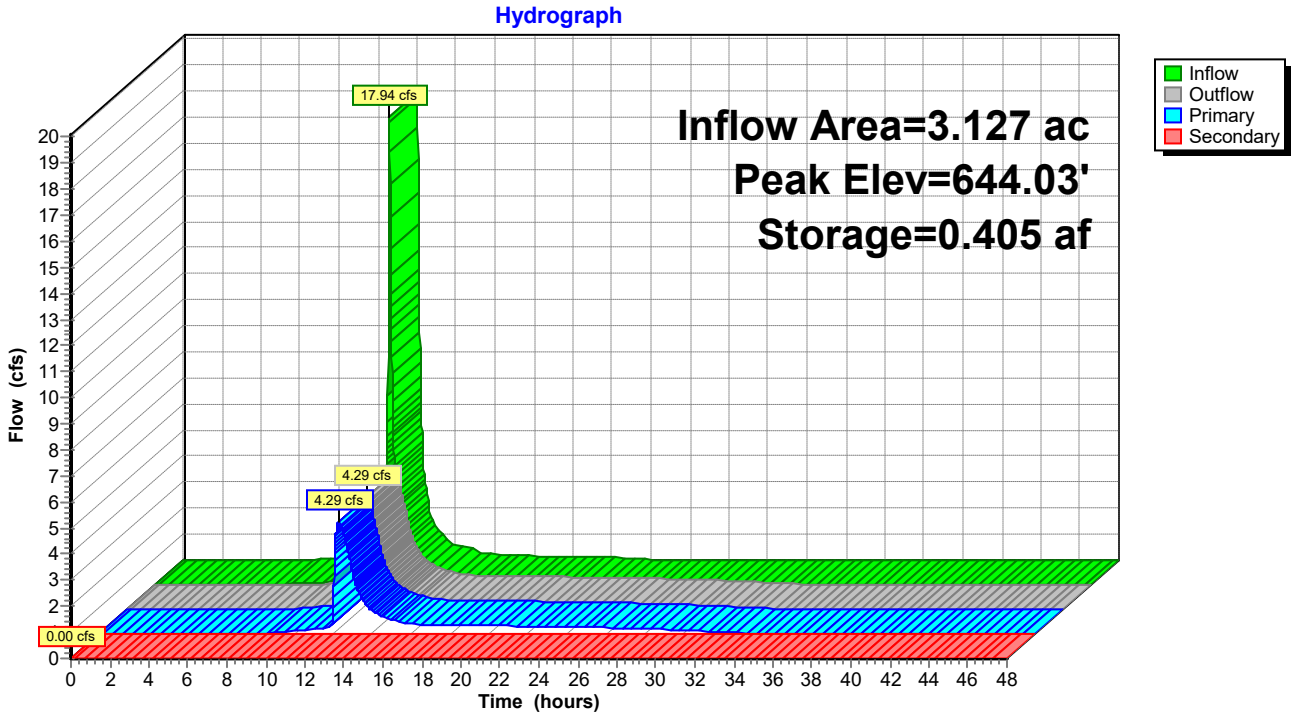
36,259.7 cf Field - 13,343.2 cf Chambers = 22,916.5 cf Stone x 40.0% Voids = 9,166.6 cf Stone Storage

Chamber Storage + Stone Storage = 22,509.8 cf = 0.517 af
Overall Storage Efficiency = 62.1%
Overall System Size = 177.78' x 37.08' x 5.50'

120 Chambers
1,343.0 cy Field
848.8 cy Stone



Pond 2P: Underground System



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AS: DA-1A Runoff Area=0.216 ac 87.04% Impervious Runoff Depth=4.75"
Tc=5.0 min CN=93 Runoff=1.63 cfs 0.085 af

Subcatchment 1BS: DA-1B Runoff Area=0.268 ac 70.15% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=87 Runoff=1.82 cfs 0.092 af

Subcatchment 1CS: DA-1C Runoff Area=0.138 ac 80.43% Impervious Runoff Depth=4.53"
Tc=5.0 min CN=91 Runoff=1.01 cfs 0.052 af

Subcatchment 1S: DA-1 Runoff Area=0.492 ac 33.13% Impervious Runoff Depth=2.73"
Tc=5.0 min CN=73 Runoff=2.25 cfs 0.112 af

Subcatchment 2S: DA-2 Runoff Area=0.777 ac 83.91% Impervious Runoff Depth=4.64"
Tc=5.0 min CN=92 Runoff=5.78 cfs 0.300 af

Subcatchment 3S: DA-3 Runoff Area=0.611 ac 81.01% Impervious Runoff Depth=4.53"
Tc=5.0 min CN=91 Runoff=4.47 cfs 0.231 af

Subcatchment 4S: DA-4 Runoff Area=0.248 ac 85.08% Impervious Runoff Depth=4.64"
Tc=5.0 min CN=92 Runoff=1.85 cfs 0.096 af

Subcatchment 5S: DA-5 Runoff Area=0.233 ac 54.51% Impervious Runoff Depth=3.49"
Tc=5.0 min CN=81 Runoff=1.37 cfs 0.068 af

Subcatchment 6S: DA-6 Runoff Area=0.204 ac 62.25% Impervious Runoff Depth=3.79"
Tc=5.0 min CN=84 Runoff=1.29 cfs 0.064 af

Subcatchment 7S: DA-7 Runoff Area=0.185 ac 87.57% Impervious Runoff Depth=4.75"
Tc=5.0 min CN=93 Runoff=1.40 cfs 0.073 af

Subcatchment 8S: DA-8 Runoff Area=0.247 ac 80.97% Impervious Runoff Depth=4.53"
Tc=5.0 min CN=91 Runoff=1.81 cfs 0.093 af

Reach 1R: Proposed Runoff Inflow=7.28 cfs 1.265 af
Outflow=7.28 cfs 1.265 af

Reach 2R: On Site Inflow=6.32 cfs 1.153 af
Outflow=6.32 cfs 1.153 af

Reach 3R: Off Site Inflow=2.25 cfs 0.112 af
Outflow=2.25 cfs 0.112 af

Pond 2P: Underground System Peak Elev=645.42' Storage=0.501 af Inflow=22.43 cfs 1.154 af
Primary=6.32 cfs 1.153 af Secondary=0.00 cfs 0.000 af Outflow=6.32 cfs 1.153 af

Total Runoff Area = 3.619 ac Runoff Volume = 1.266 af Average Runoff Depth = 4.20"
27.49% Pervious = 0.995 ac 72.51% Impervious = 2.624 ac

Summary for Subcatchment 1AS: DA-1A

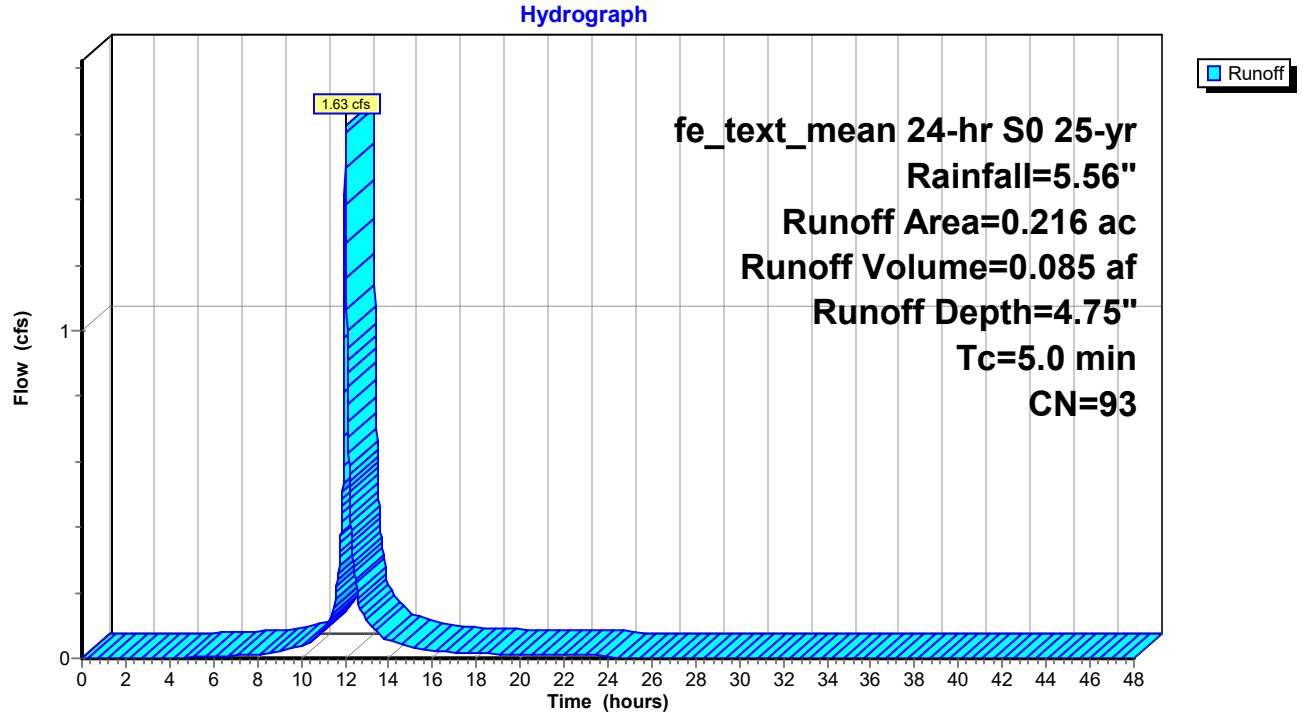
Runoff = 1.63 cfs @ 12.03 hrs, Volume= 0.085 af, Depth= 4.75"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.028	61	>75% Grass cover, Good, HSG B
	0.216	93	Weighted Average
	0.028		12.96% Pervious Area
	0.188		87.04% Impervious Area

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

Subcatchment 1AS: DA-1A



Summary for Subcatchment 1BS: DA-1B

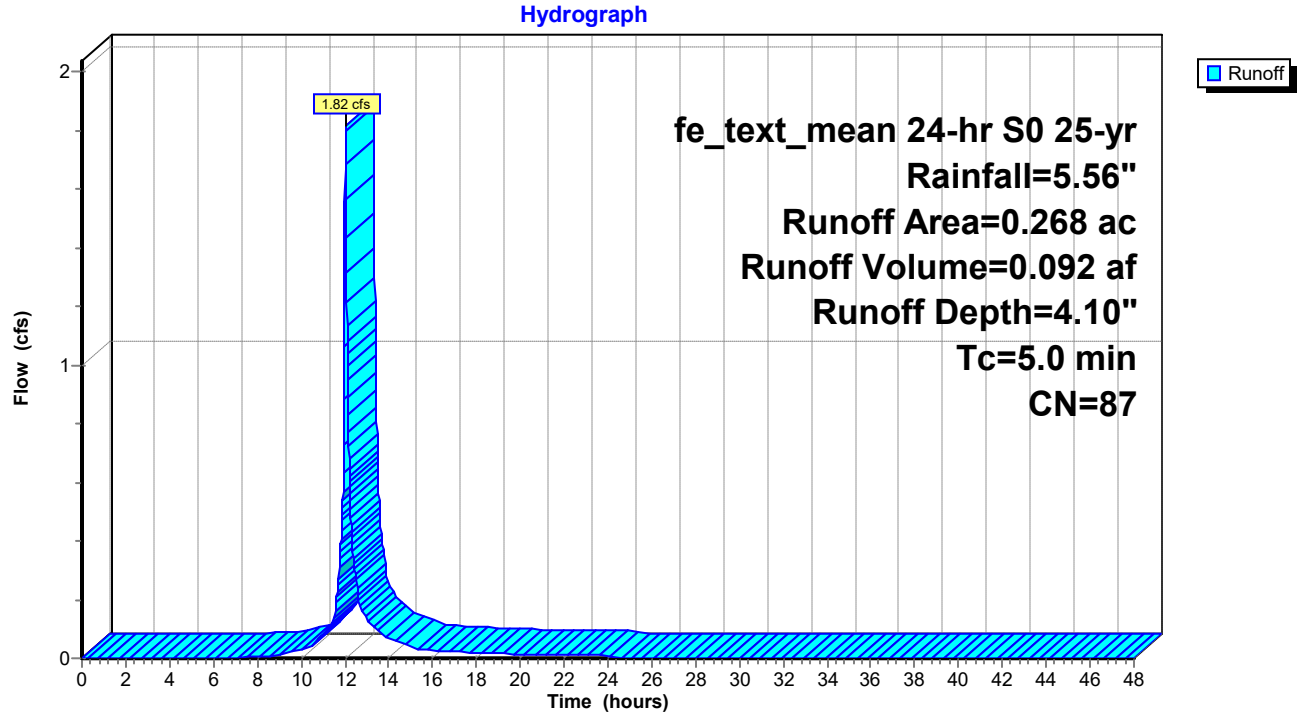
Runoff = 1.82 cfs @ 12.03 hrs, Volume= 0.092 af, Depth= 4.10"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.080	61	>75% Grass cover, Good, HSG B
	0.268	87	Weighted Average
	0.080		29.85% Pervious Area
	0.188		70.15% Impervious Area

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

Subcatchment 1BS: DA-1B



Summary for Subcatchment 1CS: DA-1C

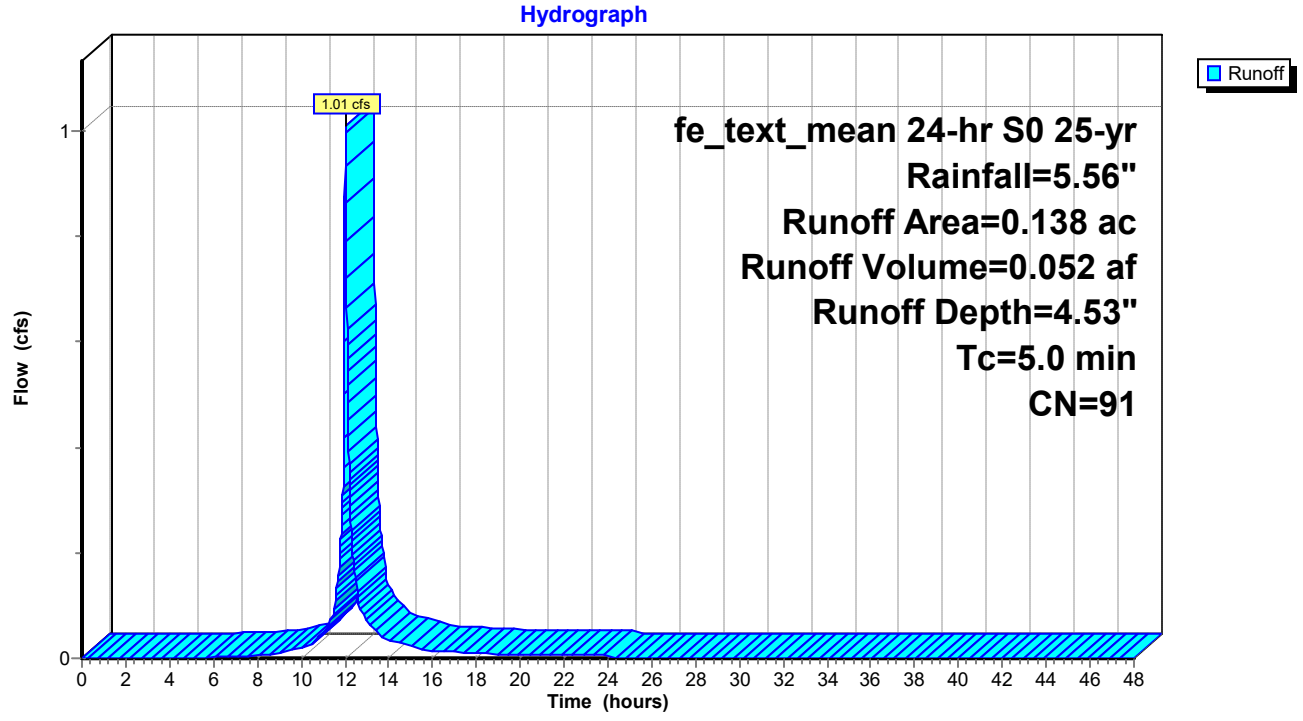
Runoff = 1.01 cfs @ 12.03 hrs, Volume= 0.052 af, Depth= 4.53"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.111	98	Impervious, HSG B
	0.027	61	>75% Grass cover, Good, HSG B
	0.138	91	Weighted Average
	0.027		19.57% Pervious Area
	0.111		80.43% Impervious Area

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

Subcatchment 1CS: DA-1C



Summary for Subcatchment 1S: DA-1

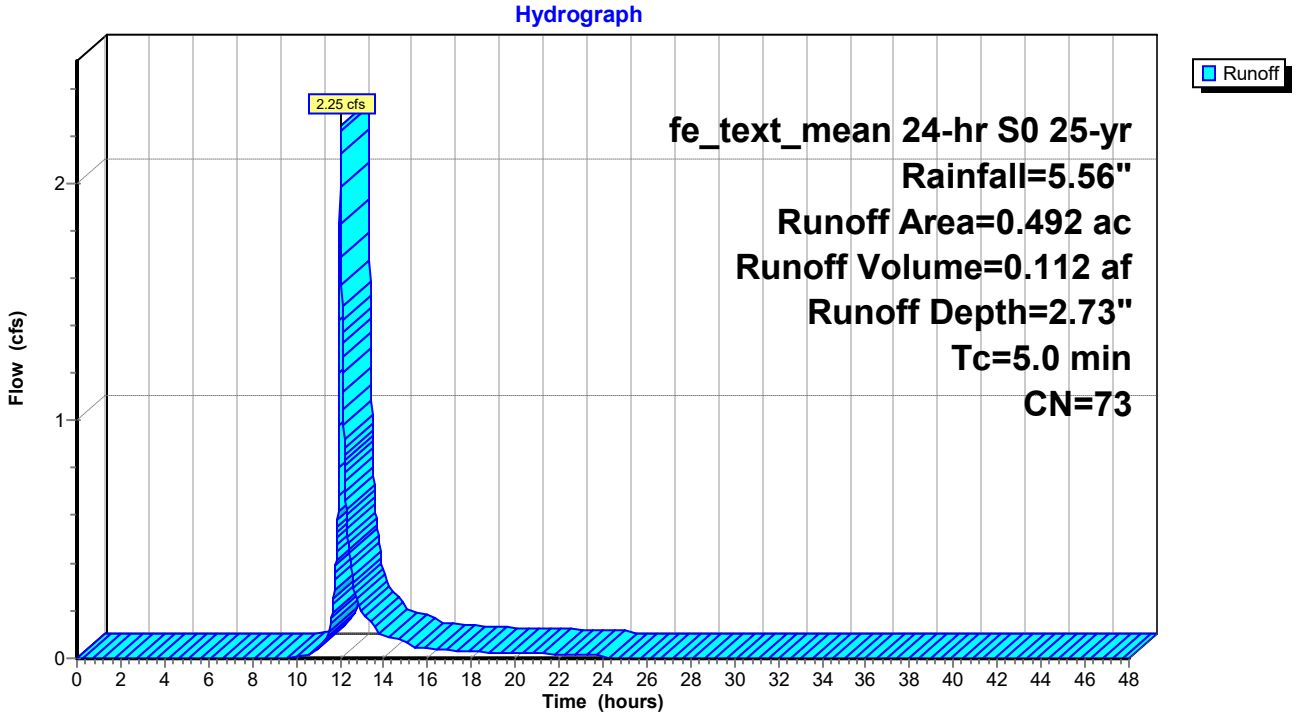
Runoff = 2.25 cfs @ 12.03 hrs, Volume= 0.112 af, Depth= 2.73"
Routed to Reach 3R : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.163	98	Impervious, HSG B
	0.329	61	>75% Grass cover, Good, HSG B
	0.492	73	Weighted Average
	0.329		66.87% Pervious Area
	0.163		33.13% Impervious Area

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

Subcatchment 1S: DA-1



Summary for Subcatchment 2S: DA-2

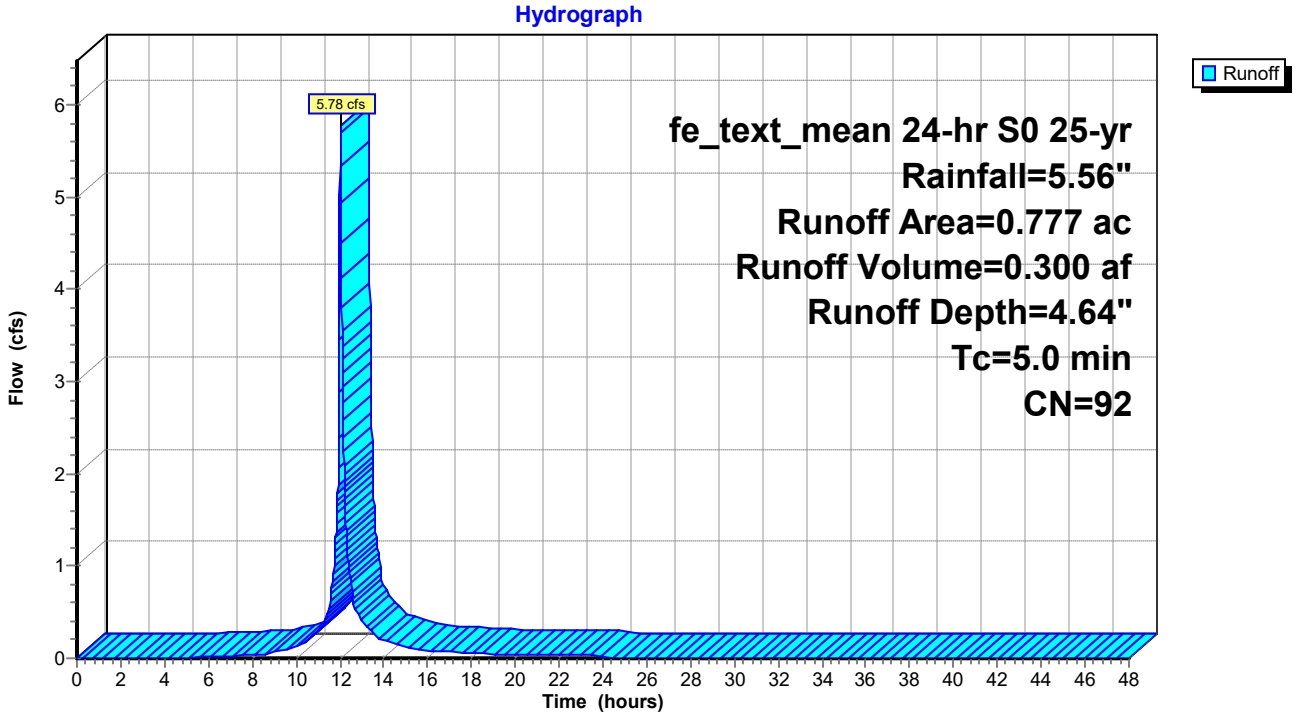
Runoff = 5.78 cfs @ 12.03 hrs, Volume= 0.300 af, Depth= 4.64"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.652	98	Impervious, HSG B
	0.125	61	>75% Grass cover, Good, HSG B
	0.777	92	Weighted Average
	0.125		16.09% Pervious Area
	0.652		83.91% Impervious Area

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

Subcatchment 2S: DA-2



Summary for Subcatchment 3S: DA-3

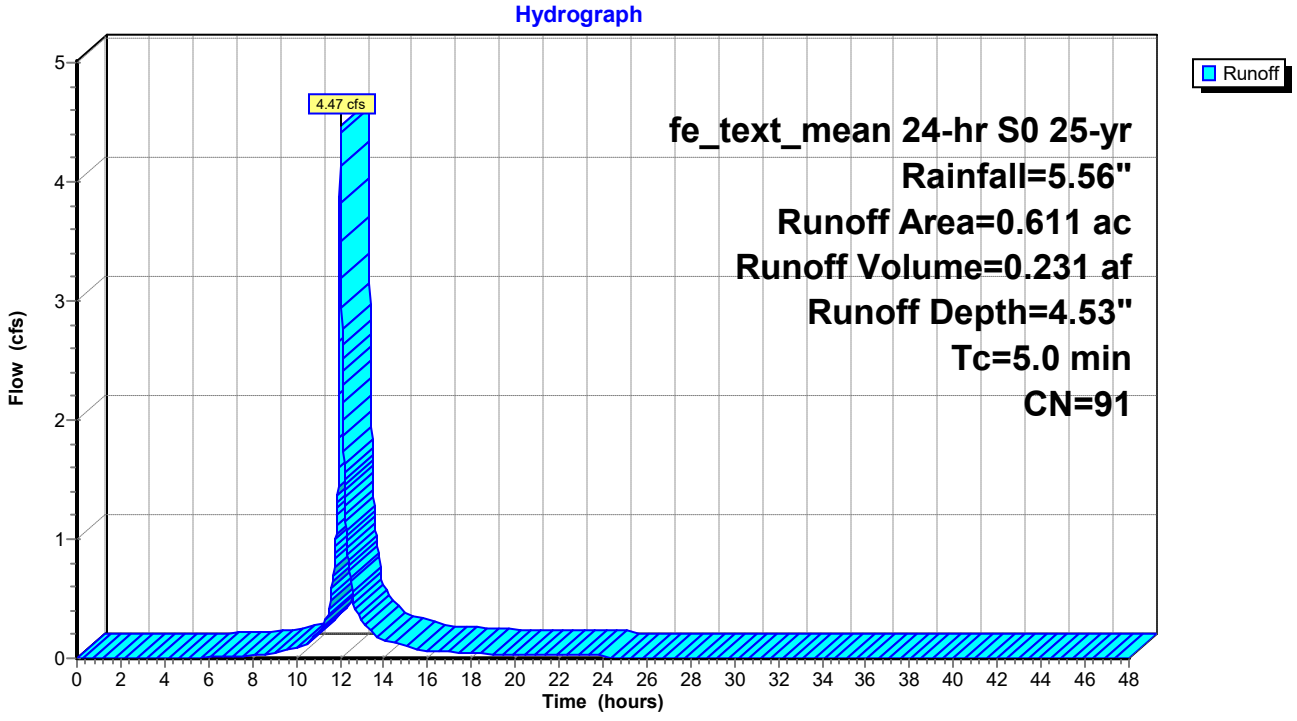
Runoff = 4.47 cfs @ 12.03 hrs, Volume= 0.231 af, Depth= 4.53"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.495	98	Impervious, HSG B
	0.116	61	>75% Grass cover, Good, HSG B
	0.611	91	Weighted Average
	0.116		18.99% Pervious Area
	0.495		81.01% Impervious Area

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

Subcatchment 3S: DA-3



Summary for Subcatchment 4S: DA-4

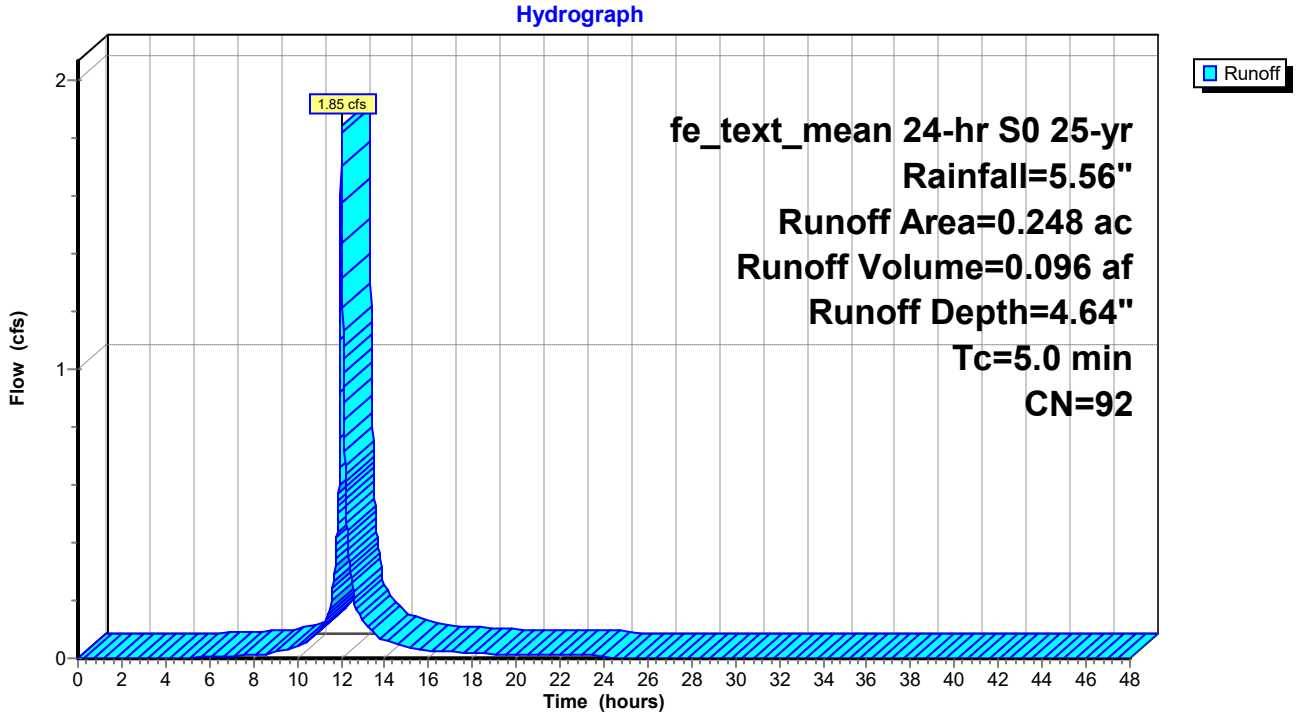
Runoff = 1.85 cfs @ 12.03 hrs, Volume= 0.096 af, Depth= 4.64"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.211	98	Impervious, HSG B
	0.037	61	>75% Grass cover, Good, HSG B
	0.248	92	Weighted Average
	0.037		14.92% Pervious Area
	0.211		85.08% Impervious Area

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

Subcatchment 4S: DA-4



Summary for Subcatchment 5S: DA-5

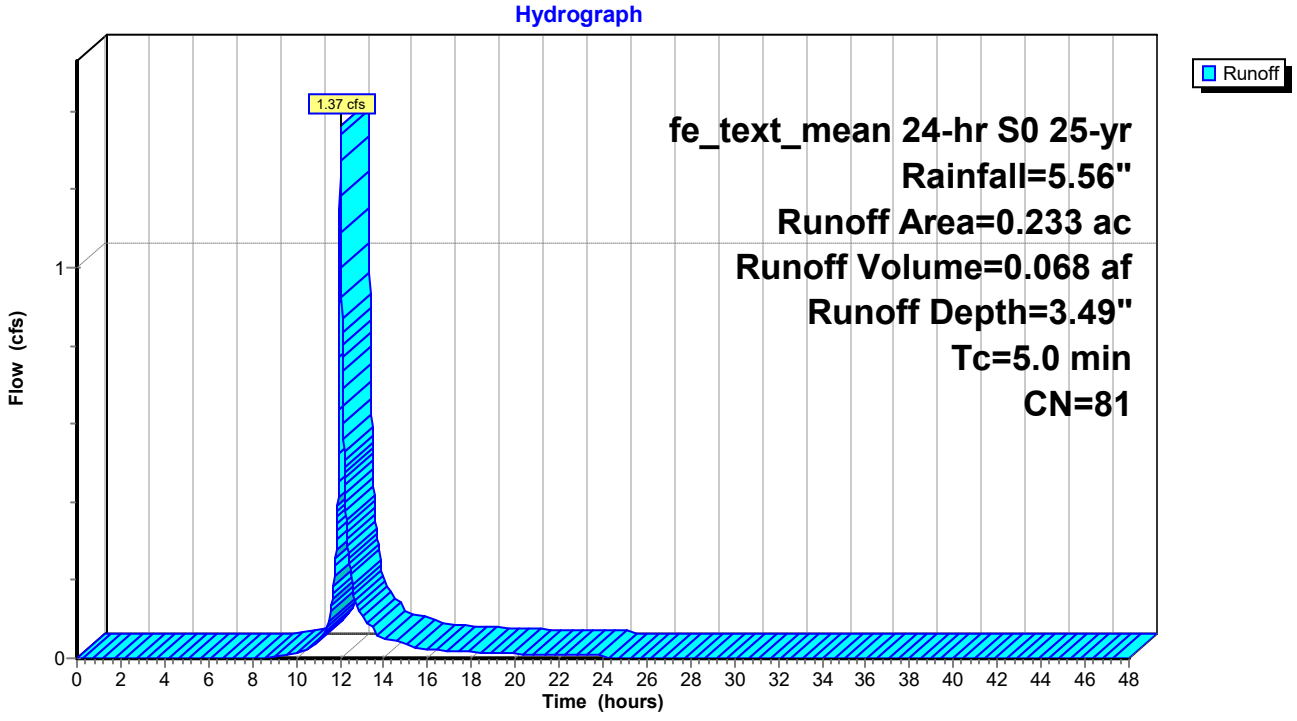
Runoff = 1.37 cfs @ 12.03 hrs, Volume= 0.068 af, Depth= 3.49"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.106	61	>75% Grass cover, Good, HSG B
	0.233	81	Weighted Average
	0.106		45.49% Pervious Area
	0.127		54.51% Impervious Area

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

Subcatchment 5S: DA-5



Summary for Subcatchment 6S: DA-6

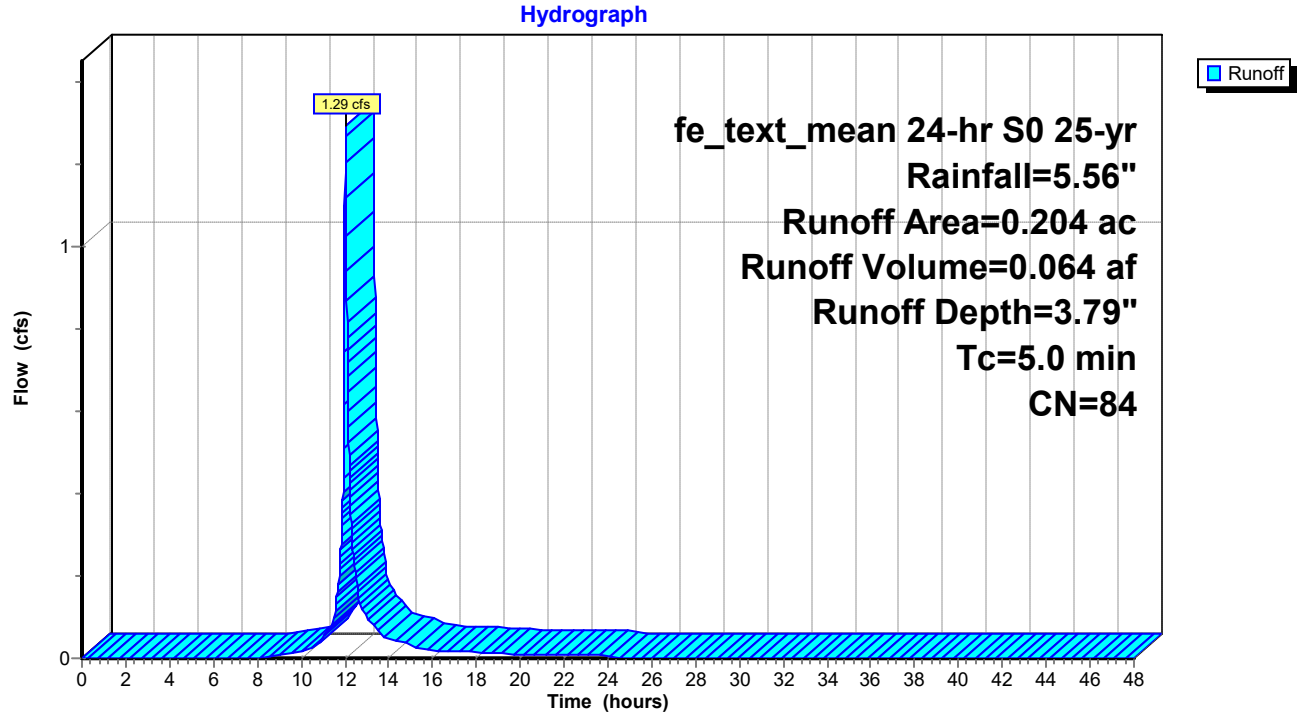
Runoff = 1.29 cfs @ 12.03 hrs, Volume= 0.064 af, Depth= 3.79"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.077	61	>75% Grass cover, Good, HSG B
	0.204	84	Weighted Average
	0.077		37.75% Pervious Area
	0.127		62.25% Impervious Area

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

Subcatchment 6S: DA-6



Summary for Subcatchment 7S: DA-7

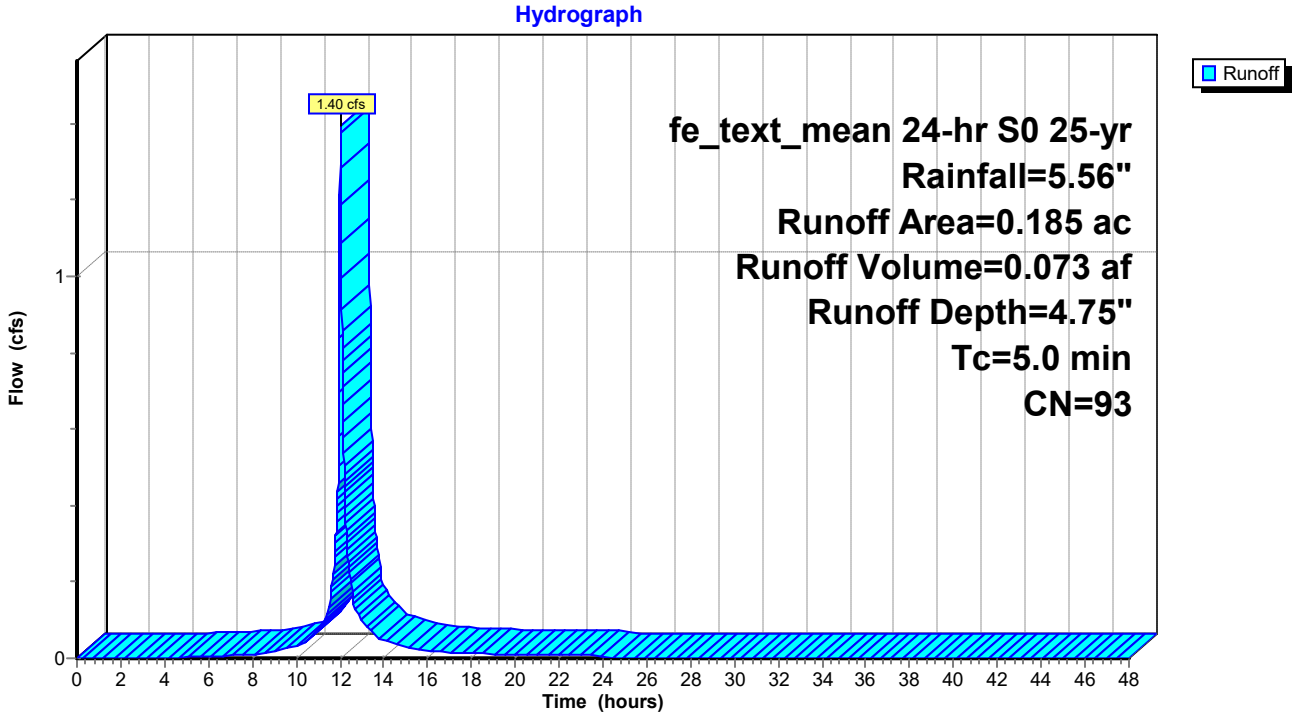
Runoff = 1.40 cfs @ 12.03 hrs, Volume= 0.073 af, Depth= 4.75"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.162	98	Impervious, HSG B
	0.023	61	>75% Grass cover, Good, HSG B
	0.185	93	Weighted Average
	0.023		12.43% Pervious Area
	0.162		87.57% Impervious Area

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

Subcatchment 7S: DA-7



Summary for Subcatchment 8S: DA-8

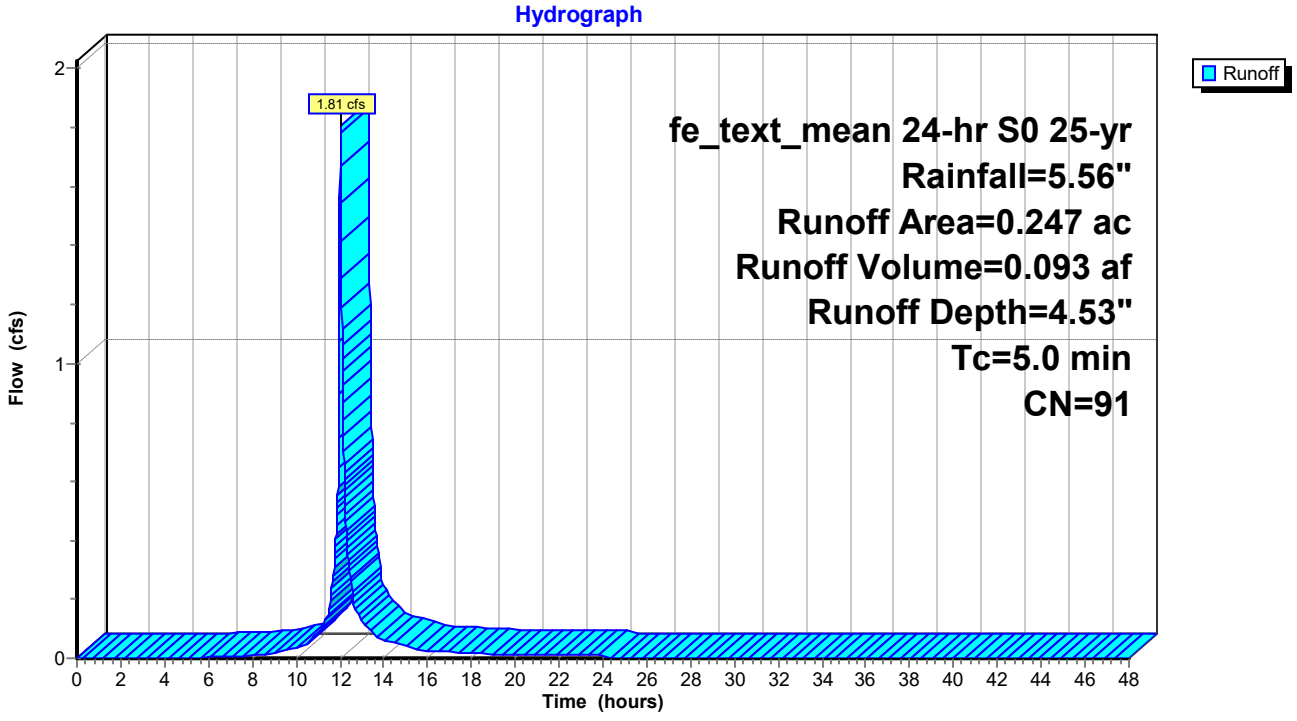
Runoff = 1.81 cfs @ 12.03 hrs, Volume= 0.093 af, Depth= 4.53"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 25-yr Rainfall=5.56"

	Area (ac)	CN	Description
*	0.200	98	Impervious, HSG B
	0.047	61	>75% Grass cover, Good, HSG B
	0.247	91	Weighted Average
	0.047		19.03% Pervious Area
	0.200		80.97% Impervious Area

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

Subcatchment 8S: DA-8

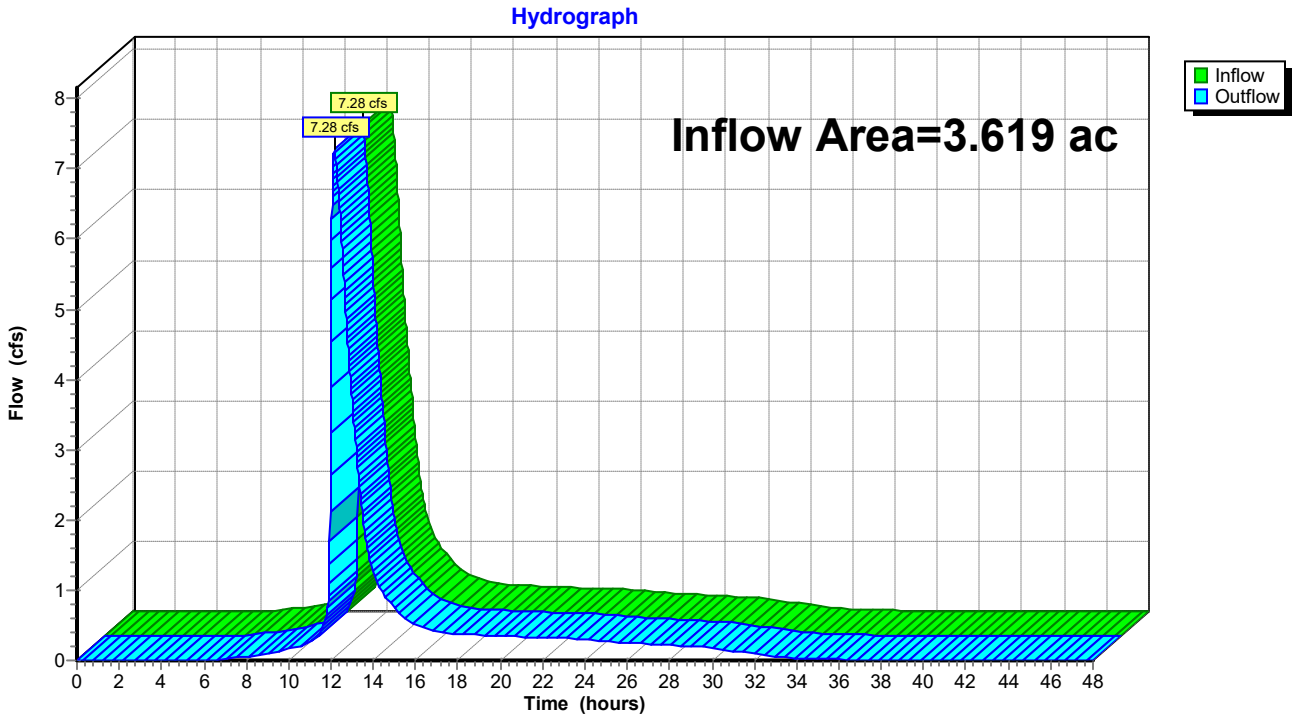


Summary for Reach 1R: Proposed Runoff

Inflow Area = 3.619 ac, 72.51% Impervious, Inflow Depth > 4.19" for 25-yr event
Inflow = 7.28 cfs @ 12.16 hrs, Volume= 1.265 af
Outflow = 7.28 cfs @ 12.16 hrs, Volume= 1.265 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Proposed Runoff

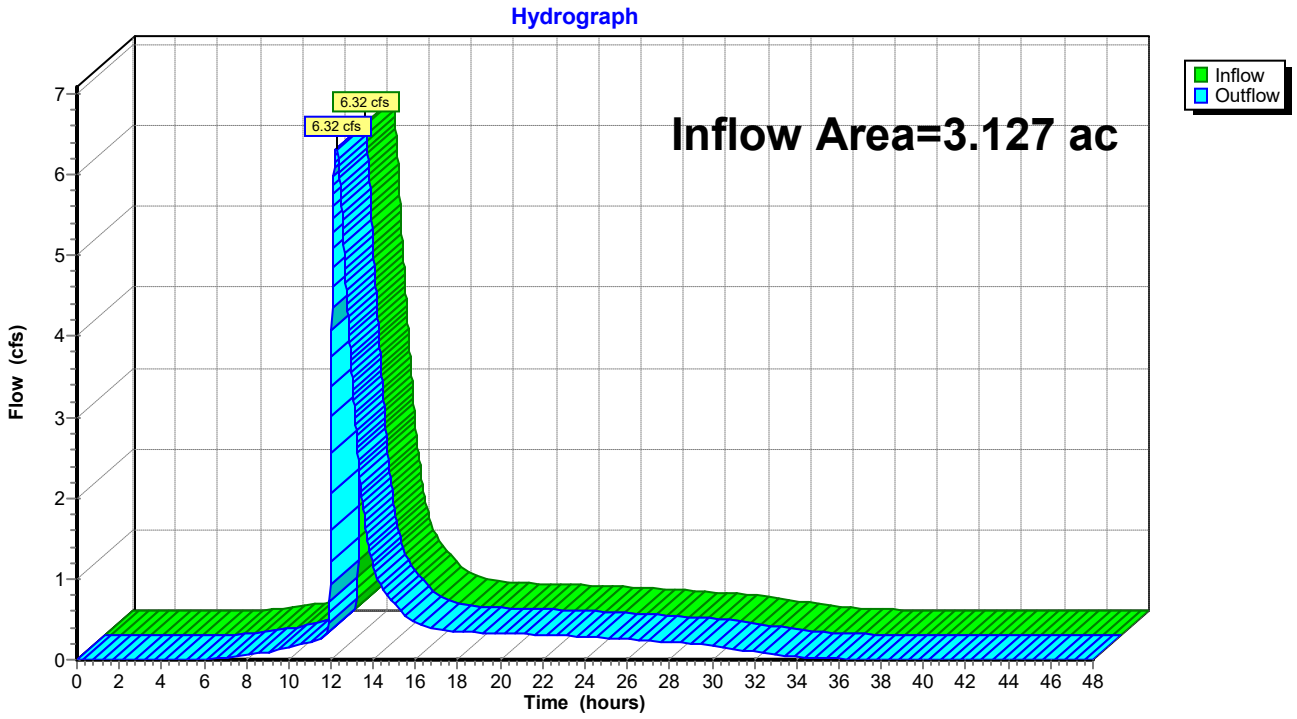


Summary for Reach 2R: On Site

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth > 4.42" for 25-yr event
Inflow = 6.32 cfs @ 12.25 hrs, Volume= 1.153 af
Outflow = 6.32 cfs @ 12.25 hrs, Volume= 1.153 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: On Site

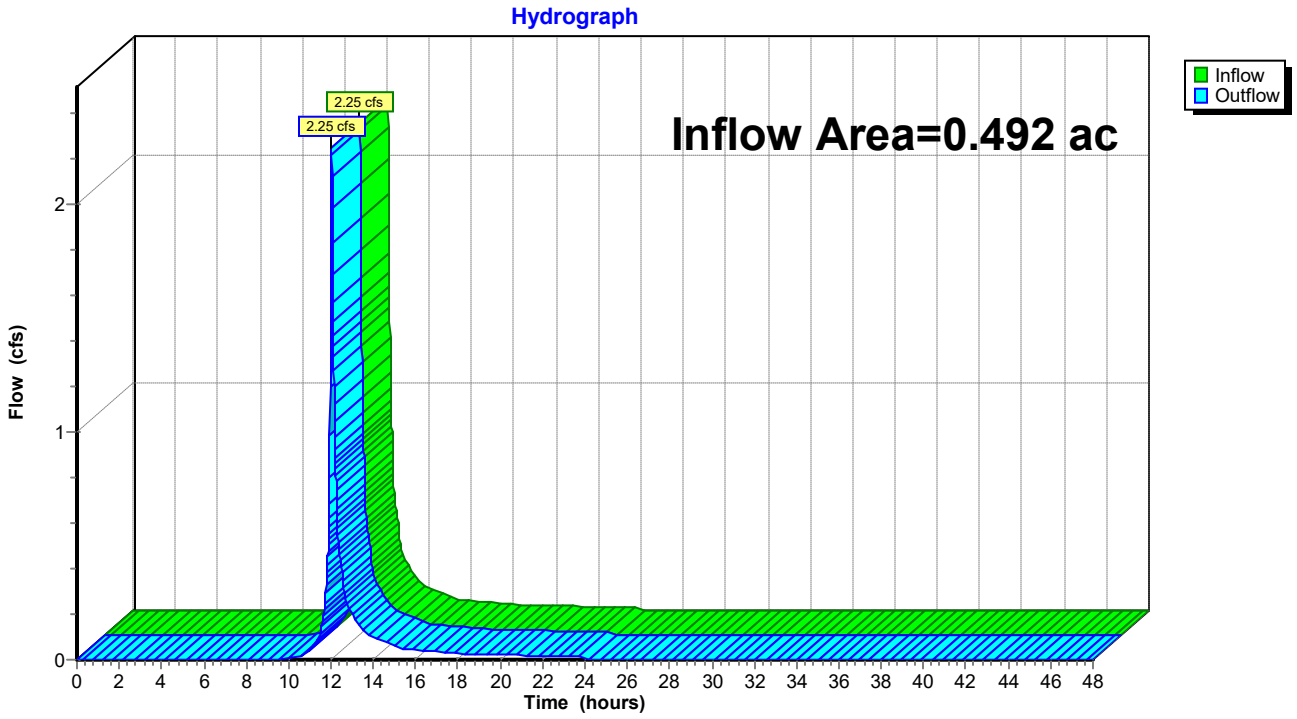


Summary for Reach 3R: Off Site

Inflow Area = 0.492 ac, 33.13% Impervious, Inflow Depth = 2.73" for 25-yr event
Inflow = 2.25 cfs @ 12.03 hrs, Volume= 0.112 af
Outflow = 2.25 cfs @ 12.03 hrs, Volume= 0.112 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 3R: Off Site



Summary for Pond 2P: Underground System

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth = 4.43" for 25-yr event
Inflow = 22.43 cfs @ 12.03 hrs, Volume= 1.154 af
Outflow = 6.32 cfs @ 12.25 hrs, Volume= 1.153 af, Atten= 72%, Lag= 13.6 min
Primary = 6.32 cfs @ 12.25 hrs, Volume= 1.153 af
Routed to Reach 2R : On Site
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach 2R : On Site

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 645.42' @ 12.25 hrs Surf.Area= 0.152 ac Storage= 0.501 af

Plug-Flow detention time= 202.5 min calculated for 1.153 af (100% of inflow)
Center-of-Mass det. time= 201.7 min (975.9 - 774.2)

Volume	Invert	Avail.Storage	Storage Description
#1	640.25'	0.006 af	**4.00'D x 6.50'H Vertical Cone/Cylinder** x 3
#2A	640.25'	0.210 af	**37.08'W x 177.78'L x 5.50'H Field A** 0.832 af Overall - 0.306 af Embedded = 0.526 af x 40.0% Voids
#3A	641.00'	0.306 af	**ADS_StormTech MC-3500 d +Cap** x 120 Inside #2 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 120 Chambers in 5 Rows Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf
#4	646.60'	2.683 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		3.205 af	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
646.60	0.000	0.000	0.000
647.00	0.190	0.038	0.038
648.00	5.100	2.645	2.683

Device	Routing	Invert	Outlet Devices
#1	Device 3	640.25'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	642.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	640.25'	**12.0" Round Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 640.25' / 639.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	647.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.20 1.20 Width (feet) 0.00 20.00 80.00

Primary OutFlow Max=6.32 cfs @ 12.25 hrs HW=645.42' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Barrel Controls 6.32 cfs @ 8.05 fps)
  ├─**1=Orifice/Grate** (Passes < 0.53 cfs potential flow)
  └─**2=Orifice/Grate** (Passes < 5.88 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=640.25' TW=0.00' (Dynamic Tailwater)
└─**4=Custom Weir/Orifice** (Controls 0.00 cfs)

Pond 2P: Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

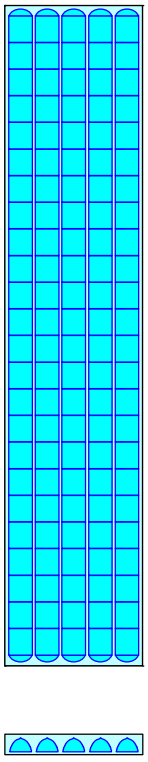
24 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 175.78' Row Length +12.0" End Stone x 2 = 177.78' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

120 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 13,343.2 cf Chamber Storage

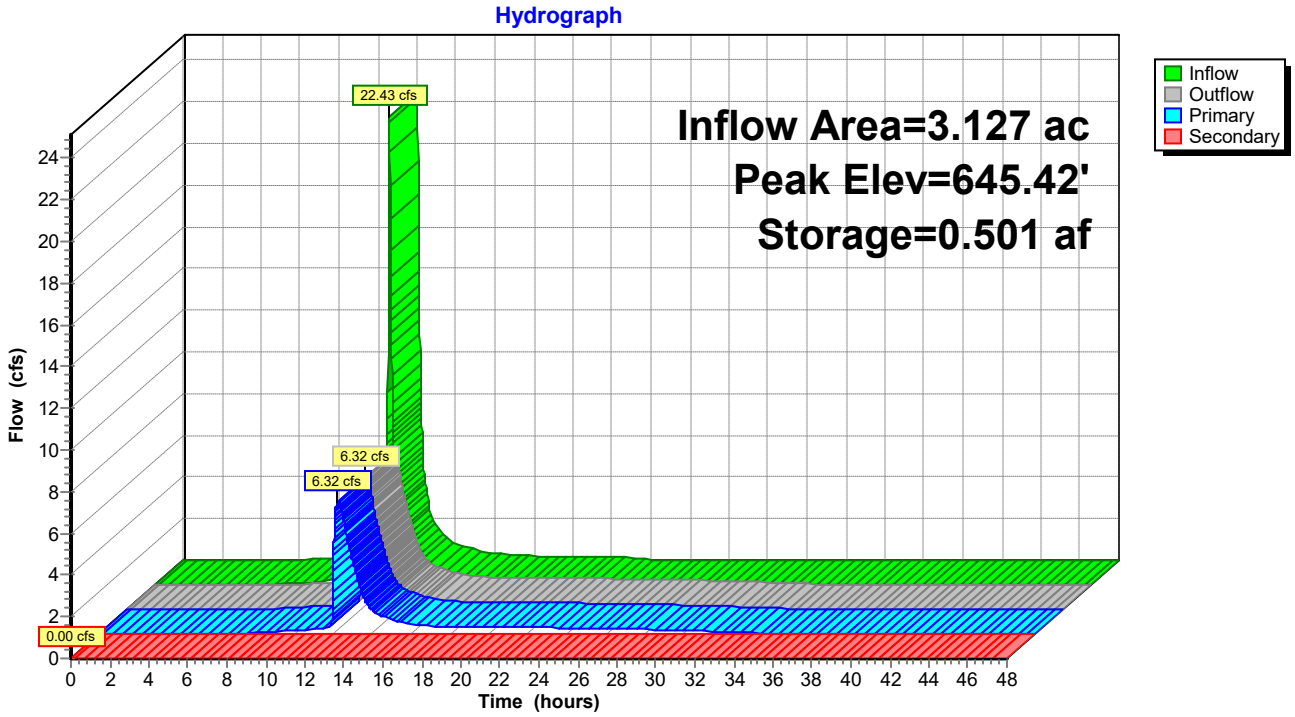
36,259.7 cf Field - 13,343.2 cf Chambers = 22,916.5 cf Stone x 40.0% Voids = 9,166.6 cf Stone Storage

Chamber Storage + Stone Storage = 22,509.8 cf = 0.517 af
Overall Storage Efficiency = 62.1%
Overall System Size = 177.78' x 37.08' x 5.50'

120 Chambers
1,343.0 cy Field
848.8 cy Stone



Pond 2P: Underground System



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1AS: DA-1A Runoff Area=0.216 ac 87.04% Impervious Runoff Depth=6.72"
Tc=5.0 min CN=93 Runoff=2.10 cfs 0.121 af

Subcatchment 1BS: DA-1B Runoff Area=0.268 ac 70.15% Impervious Runoff Depth=6.01"
Tc=5.0 min CN=87 Runoff=2.43 cfs 0.134 af

Subcatchment 1CS: DA-1C Runoff Area=0.138 ac 80.43% Impervious Runoff Depth=6.48"
Tc=5.0 min CN=91 Runoff=1.31 cfs 0.075 af

Subcatchment 1S: DA-1 Runoff Area=0.492 ac 33.13% Impervious Runoff Depth=4.41"
Tc=5.0 min CN=73 Runoff=3.39 cfs 0.181 af

Subcatchment 2S: DA-2 Runoff Area=0.777 ac 83.91% Impervious Runoff Depth=6.60"
Tc=5.0 min CN=92 Runoff=7.47 cfs 0.427 af

Subcatchment 3S: DA-3 Runoff Area=0.611 ac 81.01% Impervious Runoff Depth=6.48"
Tc=5.0 min CN=91 Runoff=5.81 cfs 0.330 af

Subcatchment 4S: DA-4 Runoff Area=0.248 ac 85.08% Impervious Runoff Depth=6.60"
Tc=5.0 min CN=92 Runoff=2.38 cfs 0.136 af

Subcatchment 5S: DA-5 Runoff Area=0.233 ac 54.51% Impervious Runoff Depth=5.32"
Tc=5.0 min CN=81 Runoff=1.91 cfs 0.103 af

Subcatchment 6S: DA-6 Runoff Area=0.204 ac 62.25% Impervious Runoff Depth=5.66"
Tc=5.0 min CN=84 Runoff=1.77 cfs 0.096 af

Subcatchment 7S: DA-7 Runoff Area=0.185 ac 87.57% Impervious Runoff Depth=6.72"
Tc=5.0 min CN=93 Runoff=1.79 cfs 0.104 af

Subcatchment 8S: DA-8 Runoff Area=0.247 ac 80.97% Impervious Runoff Depth=6.48"
Tc=5.0 min CN=91 Runoff=2.35 cfs 0.133 af

Reach 1R: Proposed Runoff Inflow=10.60 cfs 1.839 af
Outflow=10.60 cfs 1.839 af

Reach 2R: On Site Inflow=8.85 cfs 1.658 af
Outflow=8.85 cfs 1.658 af

Reach 3R: Off Site Inflow=3.39 cfs 0.181 af
Outflow=3.39 cfs 0.181 af

Pond 2P: Underground System Peak Elev=647.16' Storage=0.658 af Inflow=29.33 cfs 1.660 af
Primary=7.41 cfs 1.620 af Secondary=1.44 cfs 0.039 af Outflow=8.85 cfs 1.658 af

Total Runoff Area = 3.619 ac Runoff Volume = 1.841 af Average Runoff Depth = 6.10"
27.49% Pervious = 0.995 ac 72.51% Impervious = 2.624 ac

Summary for Subcatchment 1AS: DA-1A

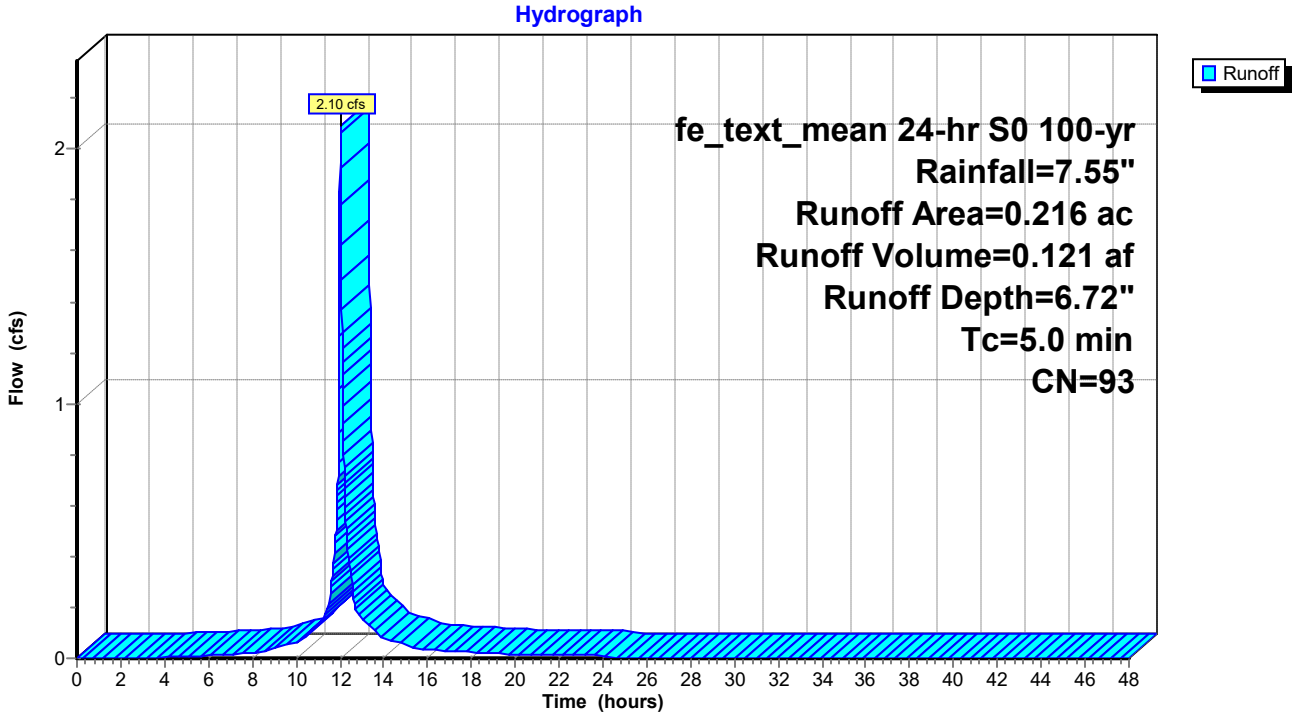
Runoff = 2.10 cfs @ 12.03 hrs, Volume= 0.121 af, Depth= 6.72"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.028	61	>75% Grass cover, Good, HSG B
	0.216	93	Weighted Average
	0.028		12.96% Pervious Area
	0.188		87.04% Impervious Area

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

Subcatchment 1AS: DA-1A



Summary for Subcatchment 1BS: DA-1B

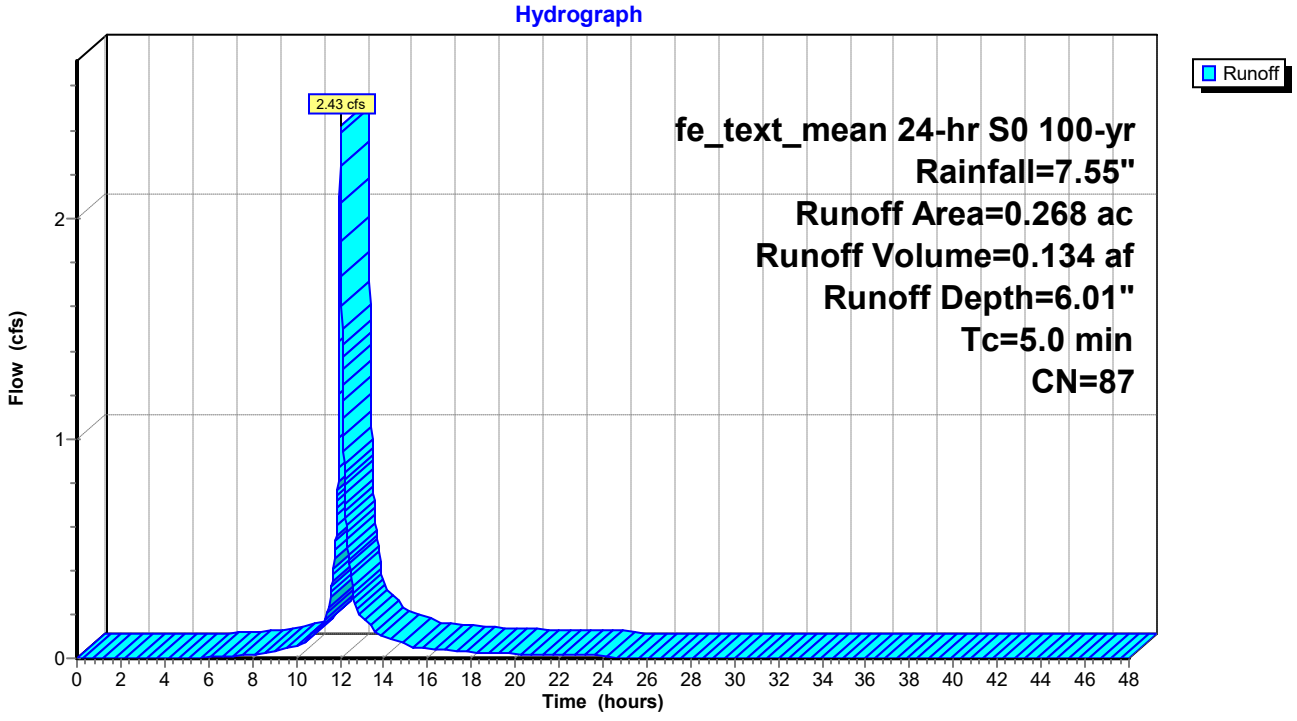
Runoff = 2.43 cfs @ 12.03 hrs, Volume= 0.134 af, Depth= 6.01"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.188	98	Impervious, HSG B
	0.080	61	>75% Grass cover, Good, HSG B
	0.268	87	Weighted Average
	0.080		29.85% Pervious Area
	0.188		70.15% Impervious Area

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

Subcatchment 1BS: DA-1B



Summary for Subcatchment 1CS: DA-1C

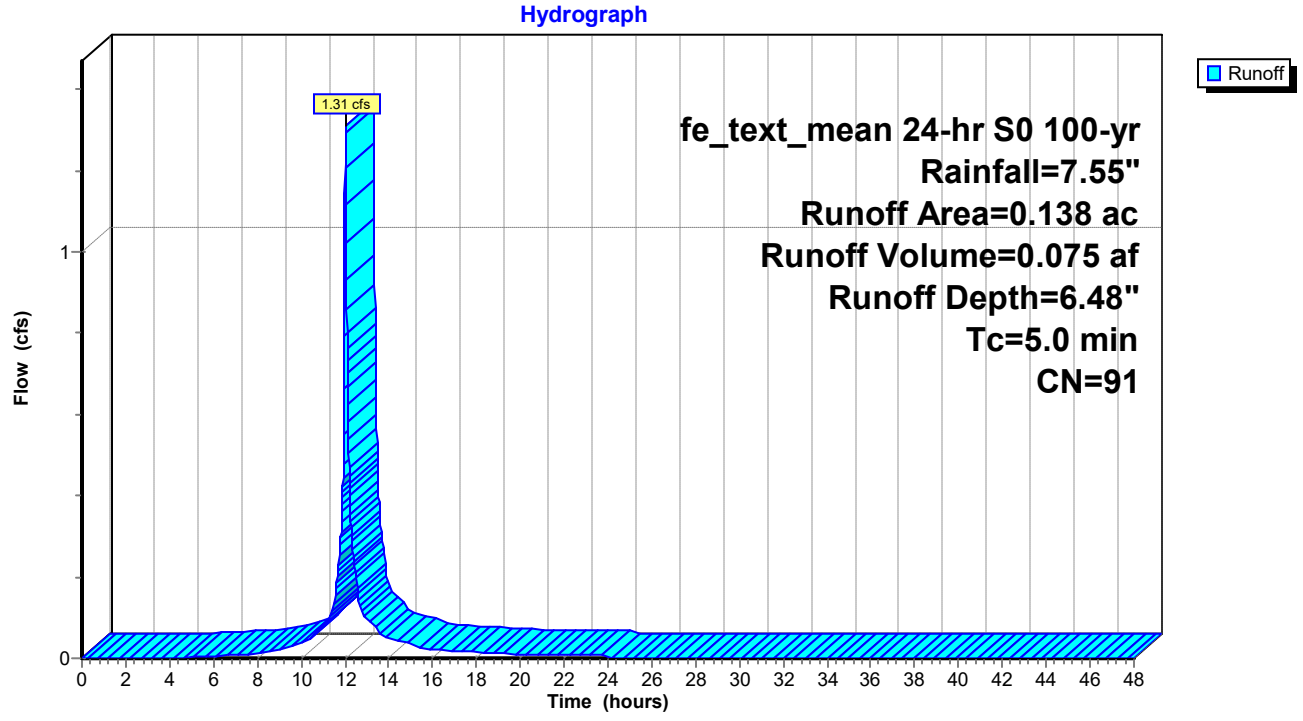
Runoff = 1.31 cfs @ 12.03 hrs, Volume= 0.075 af, Depth= 6.48"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.111	98	Impervious, HSG B
	0.027	61	>75% Grass cover, Good, HSG B
	0.138	91	Weighted Average
	0.027		19.57% Pervious Area
	0.111		80.43% Impervious Area

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

Subcatchment 1CS: DA-1C



Summary for Subcatchment 1S: DA-1

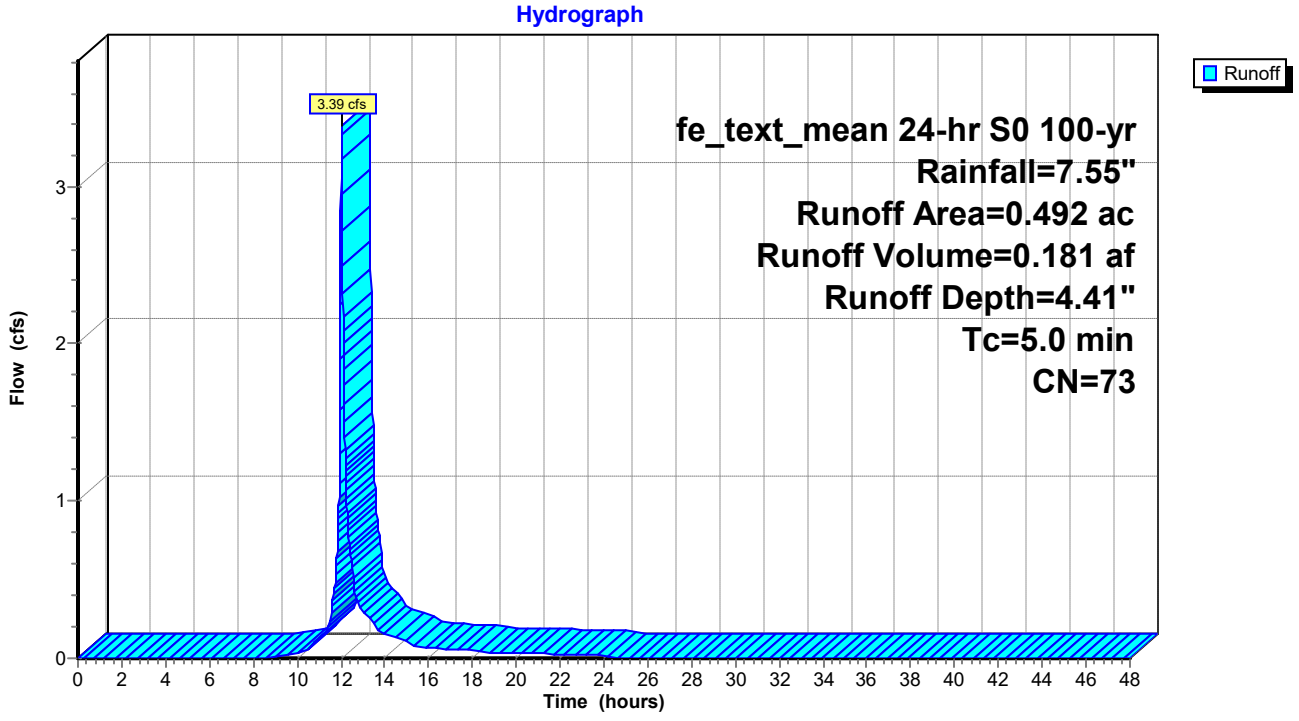
Runoff = 3.39 cfs @ 12.03 hrs, Volume= 0.181 af, Depth= 4.41"
Routed to Reach 3R : Off Site

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.163	98	Impervious, HSG B
	0.329	61	>75% Grass cover, Good, HSG B
	0.492	73	Weighted Average
	0.329		66.87% Pervious Area
	0.163		33.13% Impervious Area

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

Subcatchment 1S: DA-1



Summary for Subcatchment 2S: DA-2

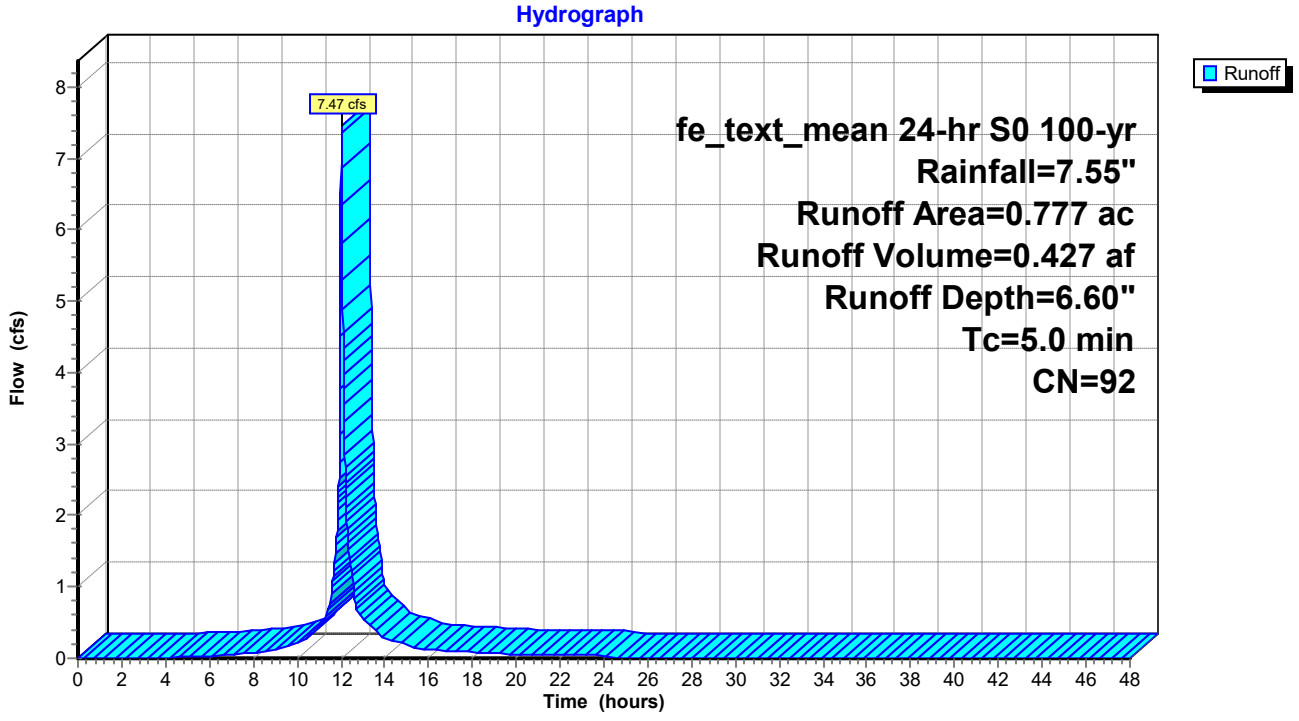
Runoff = 7.47 cfs @ 12.03 hrs, Volume= 0.427 af, Depth= 6.60"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.652	98	Impervious, HSG B
	0.125	61	>75% Grass cover, Good, HSG B
	0.777	92	Weighted Average
	0.125		16.09% Pervious Area
	0.652		83.91% Impervious Area

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

Subcatchment 2S: DA-2



Summary for Subcatchment 3S: DA-3

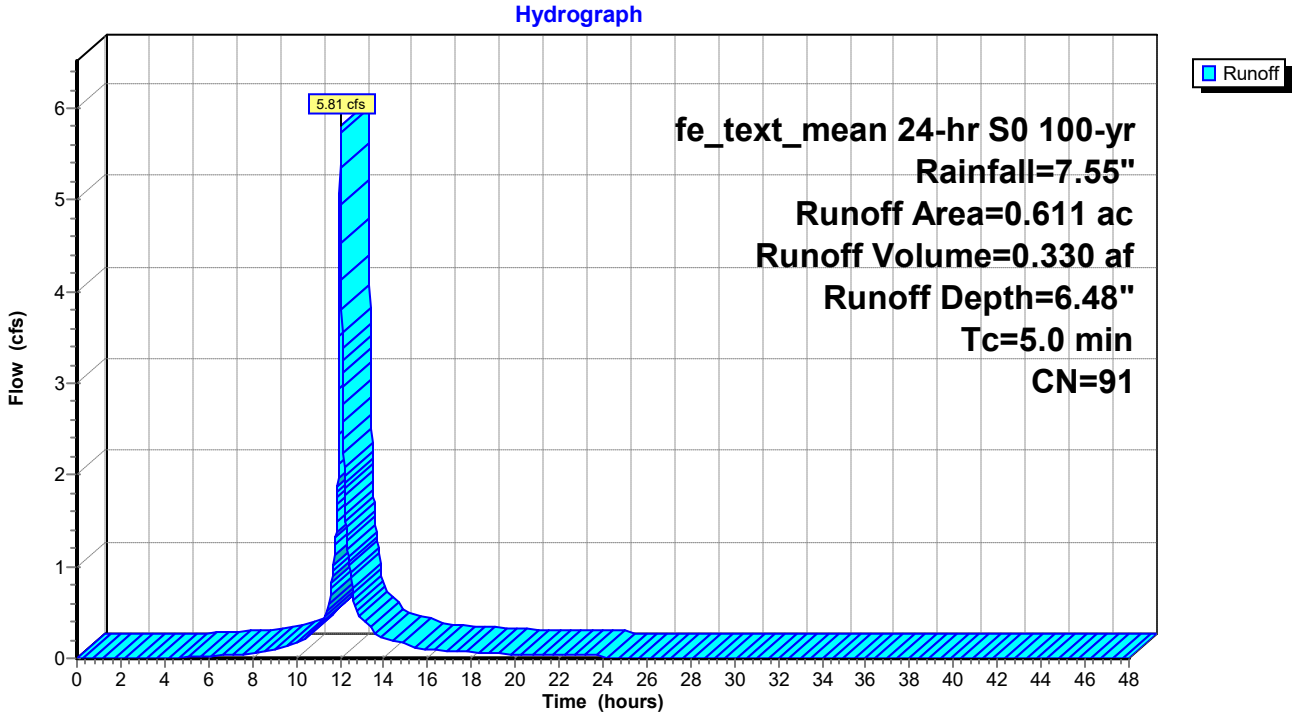
Runoff = 5.81 cfs @ 12.03 hrs, Volume= 0.330 af, Depth= 6.48"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.495	98	Impervious, HSG B
	0.116	61	>75% Grass cover, Good, HSG B
	0.611	91	Weighted Average
	0.116		18.99% Pervious Area
	0.495		81.01% Impervious Area

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

Subcatchment 3S: DA-3



Summary for Subcatchment 4S: DA-4

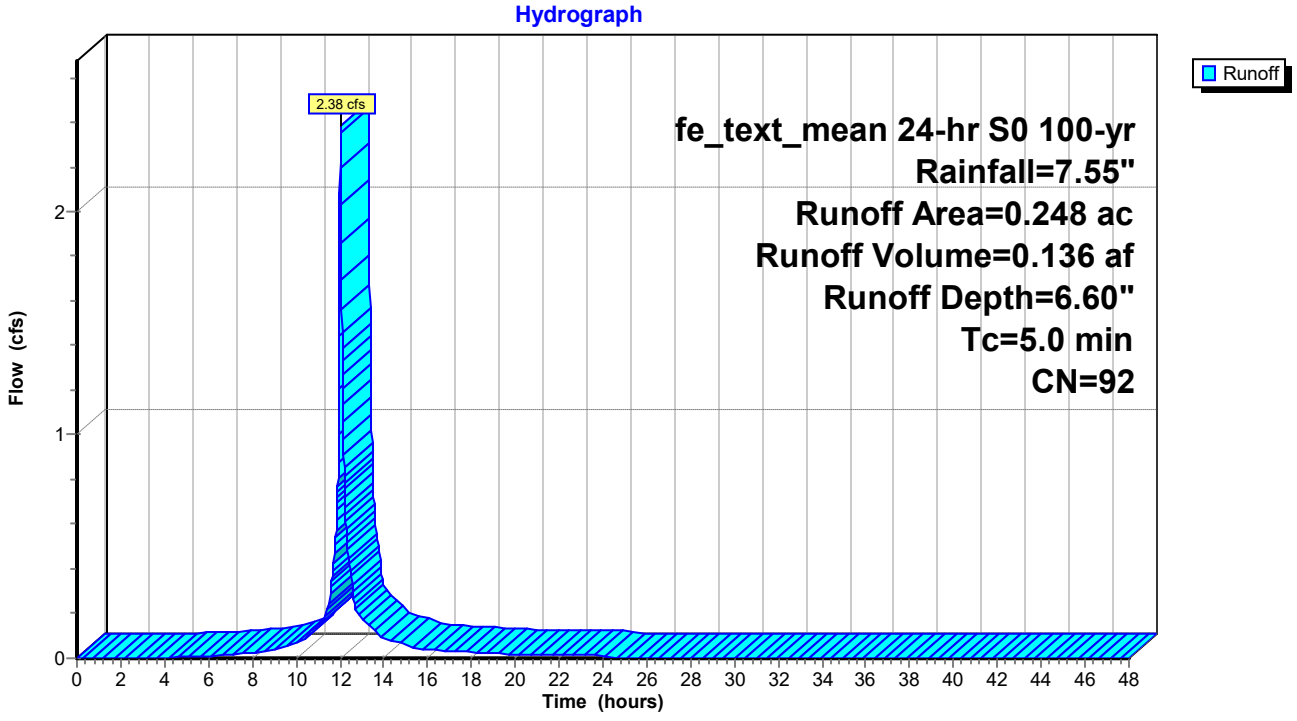
Runoff = 2.38 cfs @ 12.03 hrs, Volume= 0.136 af, Depth= 6.60"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.211	98	Impervious, HSG B
	0.037	61	>75% Grass cover, Good, HSG B
	0.248	92	Weighted Average
	0.037		14.92% Pervious Area
	0.211		85.08% Impervious Area

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

Subcatchment 4S: DA-4



Summary for Subcatchment 5S: DA-5

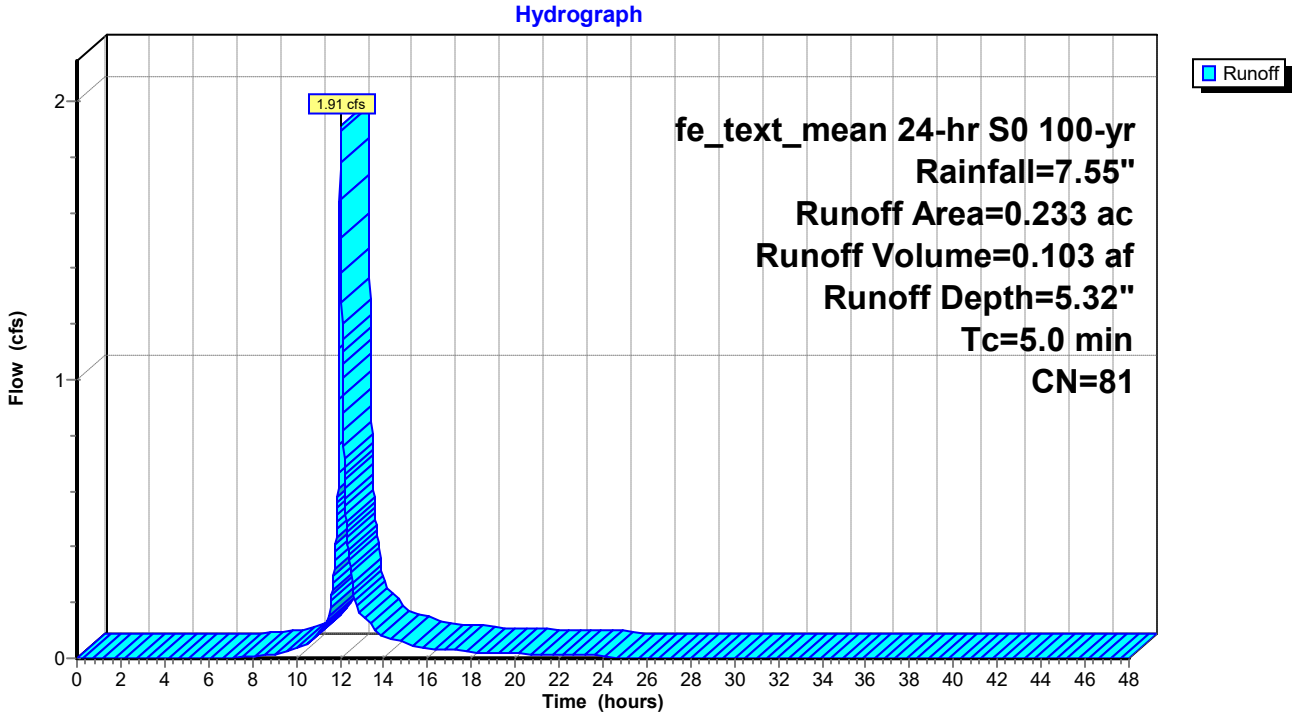
Runoff = 1.91 cfs @ 12.03 hrs, Volume= 0.103 af, Depth= 5.32"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.106	61	>75% Grass cover, Good, HSG B
	0.233	81	Weighted Average
	0.106		45.49% Pervious Area
	0.127		54.51% Impervious Area

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

Subcatchment 5S: DA-5



Summary for Subcatchment 6S: DA-6

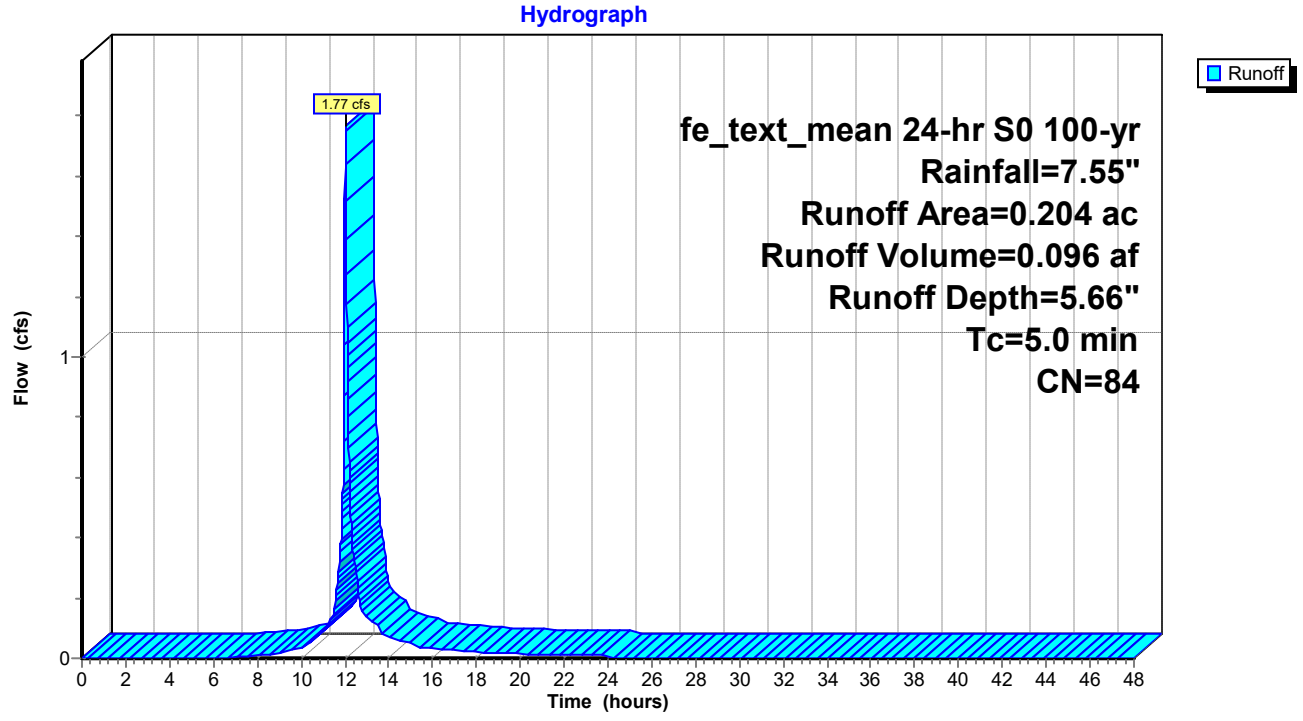
Runoff = 1.77 cfs @ 12.03 hrs, Volume= 0.096 af, Depth= 5.66"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.127	98	Impervious, HSG B
	0.077	61	>75% Grass cover, Good, HSG B
	0.204	84	Weighted Average
	0.077		37.75% Pervious Area
	0.127		62.25% Impervious Area

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

Subcatchment 6S: DA-6



Summary for Subcatchment 7S: DA-7

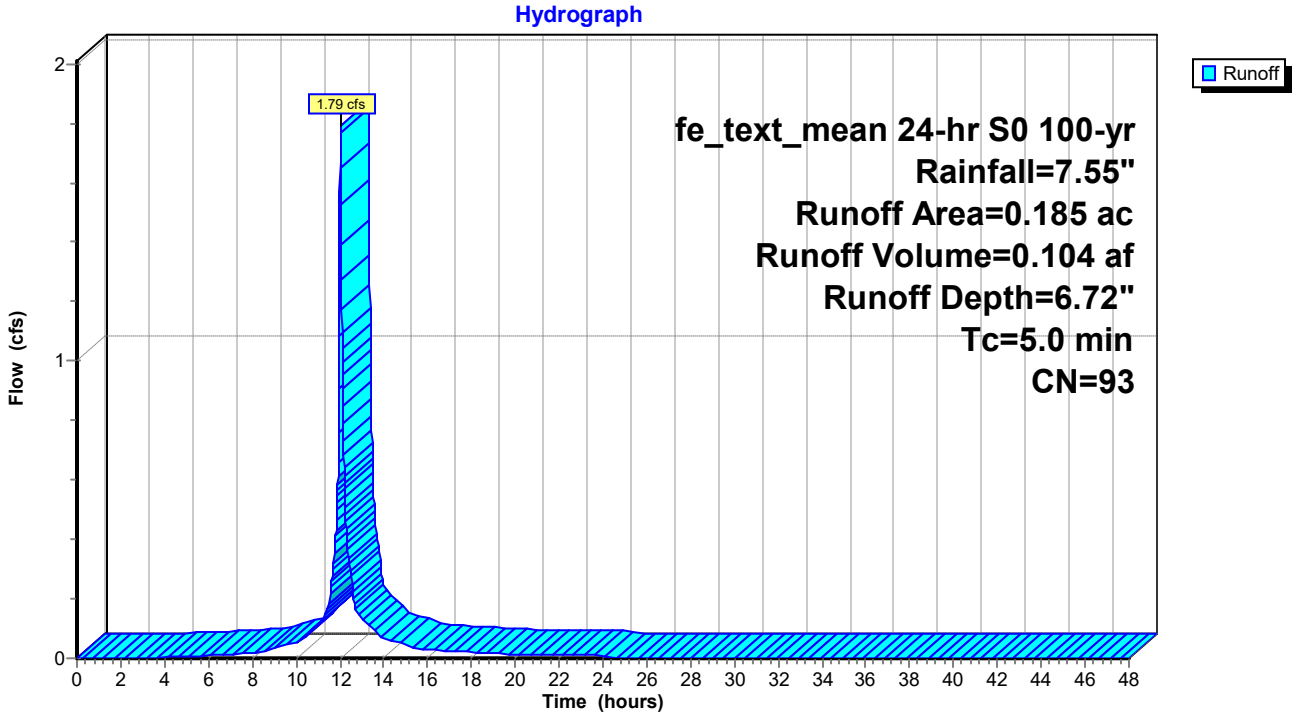
Runoff = 1.79 cfs @ 12.03 hrs, Volume= 0.104 af, Depth= 6.72"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.162	98	Impervious, HSG B
	0.023	61	>75% Grass cover, Good, HSG B
	0.185	93	Weighted Average
	0.023		12.43% Pervious Area
	0.162		87.57% Impervious Area

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

Subcatchment 7S: DA-7



Summary for Subcatchment 8S: DA-8

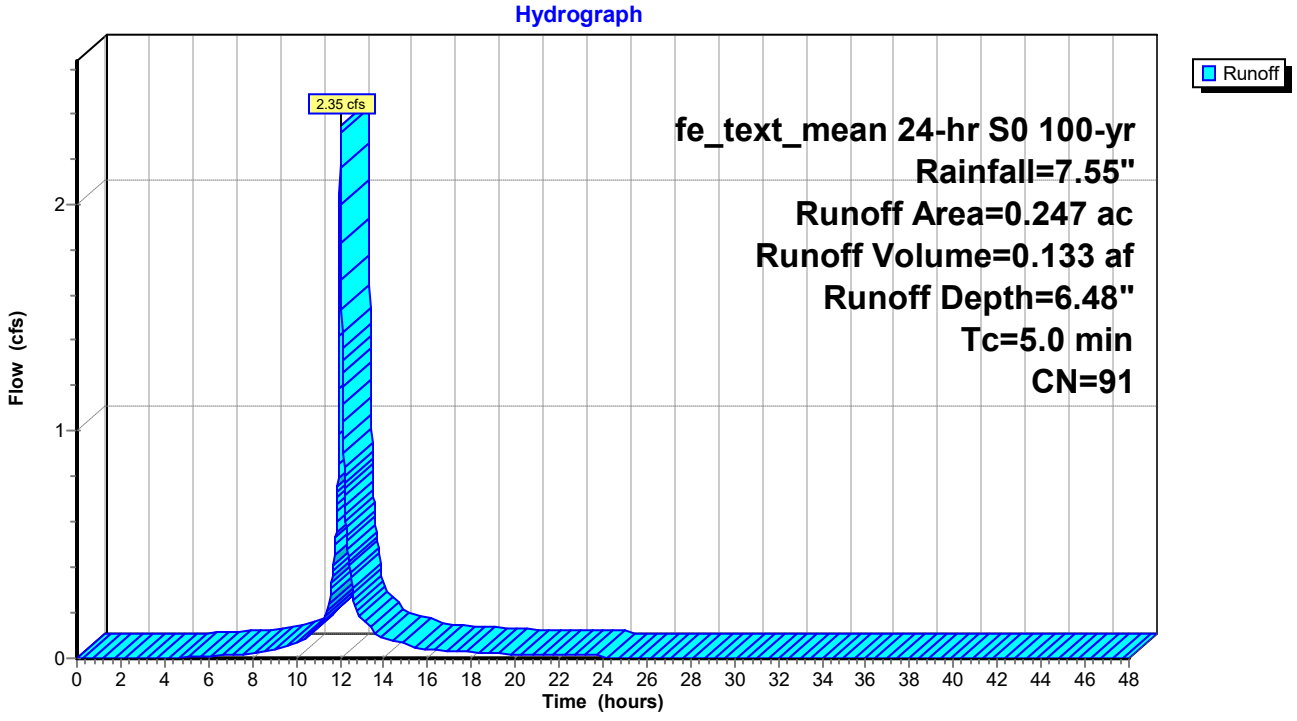
Runoff = 2.35 cfs @ 12.03 hrs, Volume= 0.133 af, Depth= 6.48"
Routed to Pond 2P : Underground System

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
fe_text_mean 24-hr S0 100-yr Rainfall=7.55"

	Area (ac)	CN	Description
*	0.200	98	Impervious, HSG B
	0.047	61	>75% Grass cover, Good, HSG B
	0.247	91	Weighted Average
	0.047		19.03% Pervious Area
	0.200		80.97% Impervious Area

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

Subcatchment 8S: DA-8

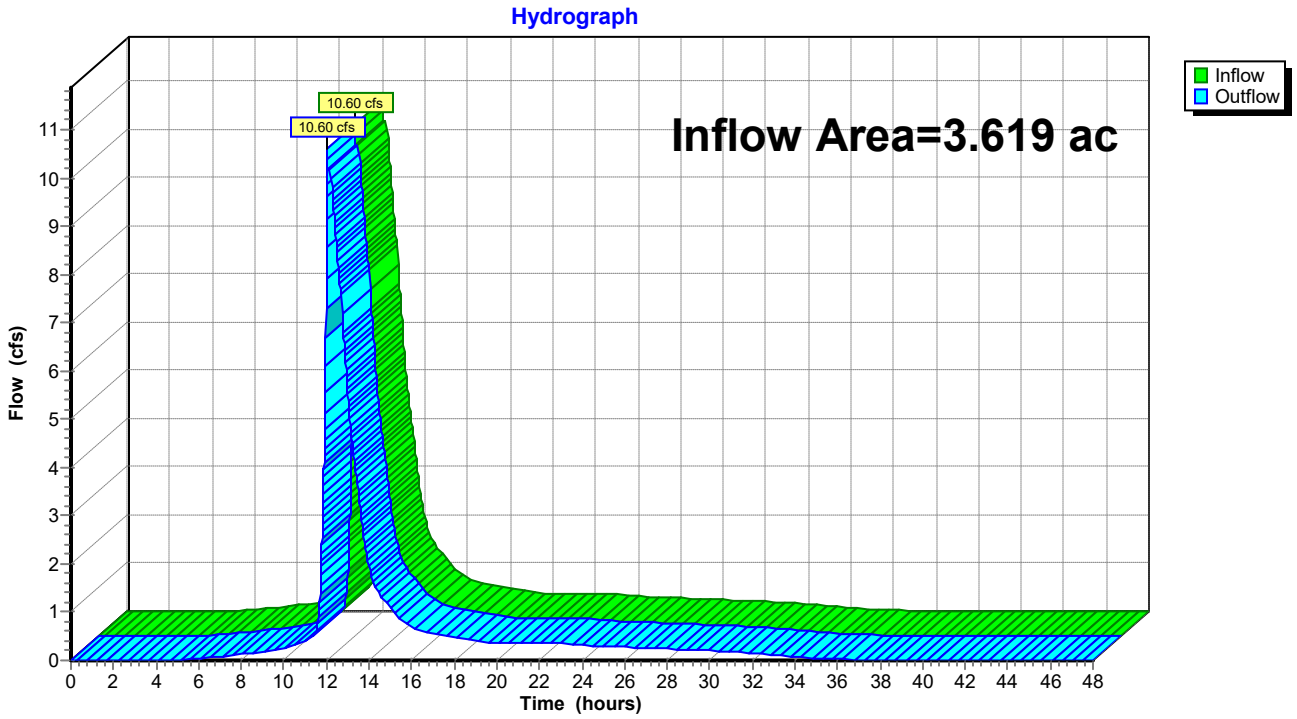


Summary for Reach 1R: Proposed Runoff

Inflow Area = 3.619 ac, 72.51% Impervious, Inflow Depth > 6.10" for 100-yr event
Inflow = 10.60 cfs @ 12.04 hrs, Volume= 1.839 af
Outflow = 10.60 cfs @ 12.04 hrs, Volume= 1.839 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 1R: Proposed Runoff

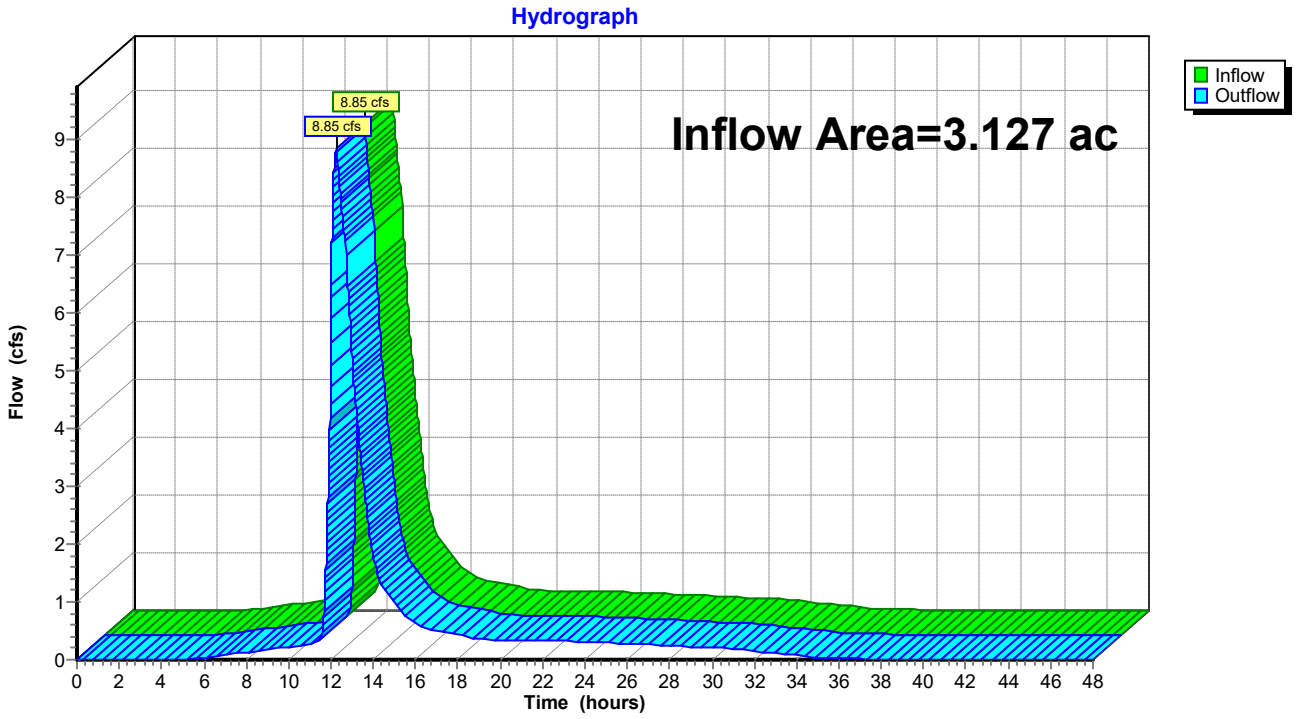


Summary for Reach 2R: On Site

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth > 6.36" for 100-yr event
Inflow = 8.85 cfs @ 12.24 hrs, Volume= 1.658 af
Outflow = 8.85 cfs @ 12.24 hrs, Volume= 1.658 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 2R: On Site

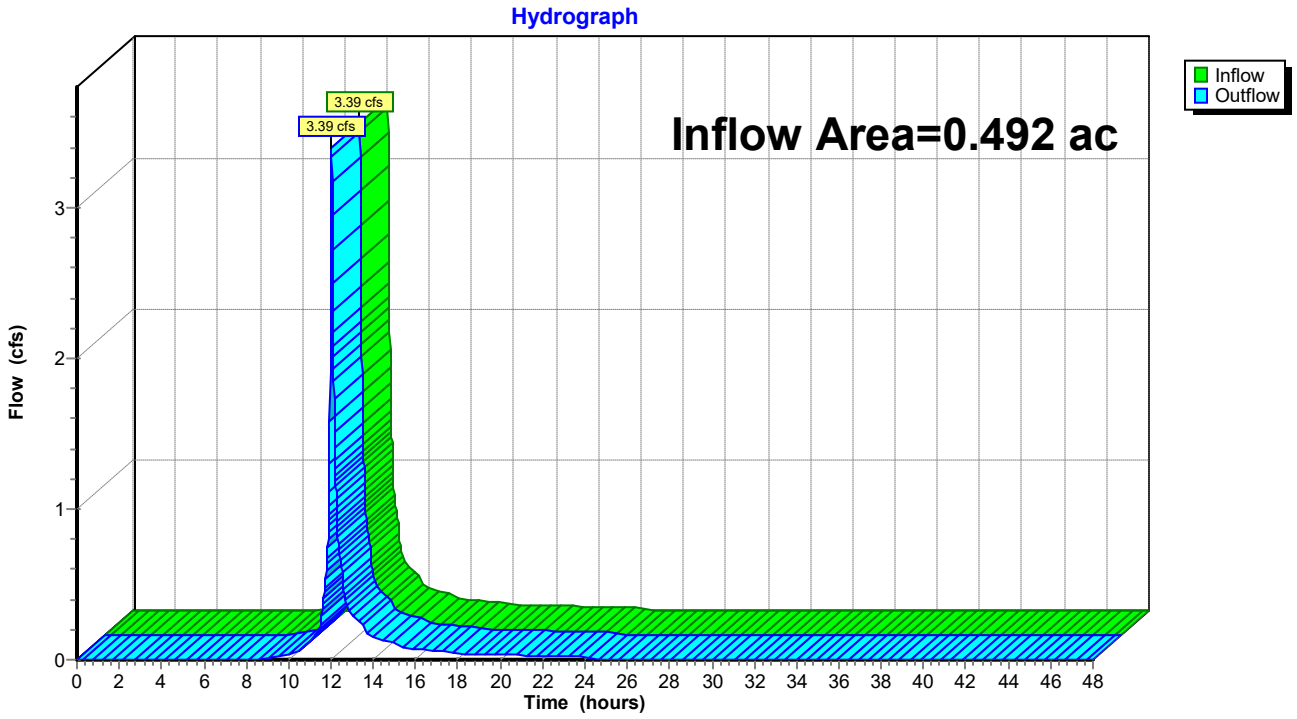


Summary for Reach 3R: Off Site

Inflow Area = 0.492 ac, 33.13% Impervious, Inflow Depth = 4.41" for 100-yr event
Inflow = 3.39 cfs @ 12.03 hrs, Volume= 0.181 af
Outflow = 3.39 cfs @ 12.03 hrs, Volume= 0.181 af, Atten= 0%, Lag= 0.0 min
Routed to Reach 1R : Proposed Runoff

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach 3R: Off Site



Summary for Pond 2P: Underground System

Inflow Area = 3.127 ac, 78.70% Impervious, Inflow Depth = 6.37" for 100-yr event
Inflow = 29.33 cfs @ 12.03 hrs, Volume= 1.660 af
Outflow = 8.85 cfs @ 12.24 hrs, Volume= 1.658 af, Atten= 70%, Lag= 12.7 min
Primary = 7.41 cfs @ 12.24 hrs, Volume= 1.620 af
Routed to Reach 2R : On Site
Secondary = 1.44 cfs @ 12.24 hrs, Volume= 0.039 af
Routed to Reach 2R : On Site

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 647.16' @ 12.24 hrs Surf.Area= 1.151 ac Storage= 0.658 af

Plug-Flow detention time= 171.7 min calculated for 1.658 af (100% of inflow)
Center-of-Mass det. time= 171.4 min (939.8 - 768.4)

Volume	Invert	Avail.Storage	Storage Description
#1	640.25'	0.006 af	**4.00'D x 6.50'H Vertical Cone/Cylinder** x 3
#2A	640.25'	0.210 af	**37.08'W x 177.78'L x 5.50'H Field A** 0.832 af Overall - 0.306 af Embedded = 0.526 af x 40.0% Voids
#3A	641.00'	0.306 af	**ADS_StormTech MC-3500 d +Cap** x 120 Inside #2 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 120 Chambers in 5 Rows Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf
#4	646.60'	2.683 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		3.205 af	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
646.60	0.000	0.000	0.000
647.00	0.190	0.038	0.038
648.00	5.100	2.645	2.683

Device	Routing	Invert	Outlet Devices
#1	Device 3	640.25'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Device 3	642.50'	**12.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	640.25'	**12.0" Round Culvert** L= 100.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 640.25' / 639.75' S= 0.0050 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#4	Secondary	647.00'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 0.20 1.20 Width (feet) 0.00 20.00 80.00

Primary OutFlow Max=7.41 cfs @ 12.24 hrs HW=647.16' TW=0.00' (Dynamic Tailwater)
└─**3=Culvert** (Barrel Controls 7.41 cfs @ 9.44 fps)
  ├─**1=Orifice/Grate** (Passes < 0.62 cfs potential flow)
  └─**2=Orifice/Grate** (Passes < 7.72 cfs potential flow)

Secondary OutFlow Max=1.44 cfs @ 12.24 hrs HW=647.16' TW=0.00' (Dynamic Tailwater)
└─**4=Custom Weir/Orifice** (Weir Controls 1.44 cfs @ 1.06 fps)

Pond 2P: Underground System - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= 14.9 cf x 2 x 5 rows = 149.0 cf

77.0" Wide + 9.0" Spacing = 86.0" C-C Row Spacing

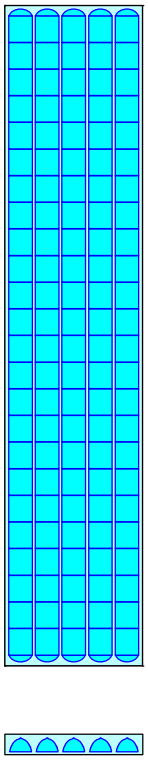
24 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 175.78' Row Length +12.0" End Stone x 2 = 177.78' Base Length
5 Rows x 77.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 37.08' Base Width
9.0" Stone Base + 45.0" Chamber Height + 12.0" Stone Cover = 5.50' Field Height

120 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 5 Rows = 13,343.2 cf Chamber Storage

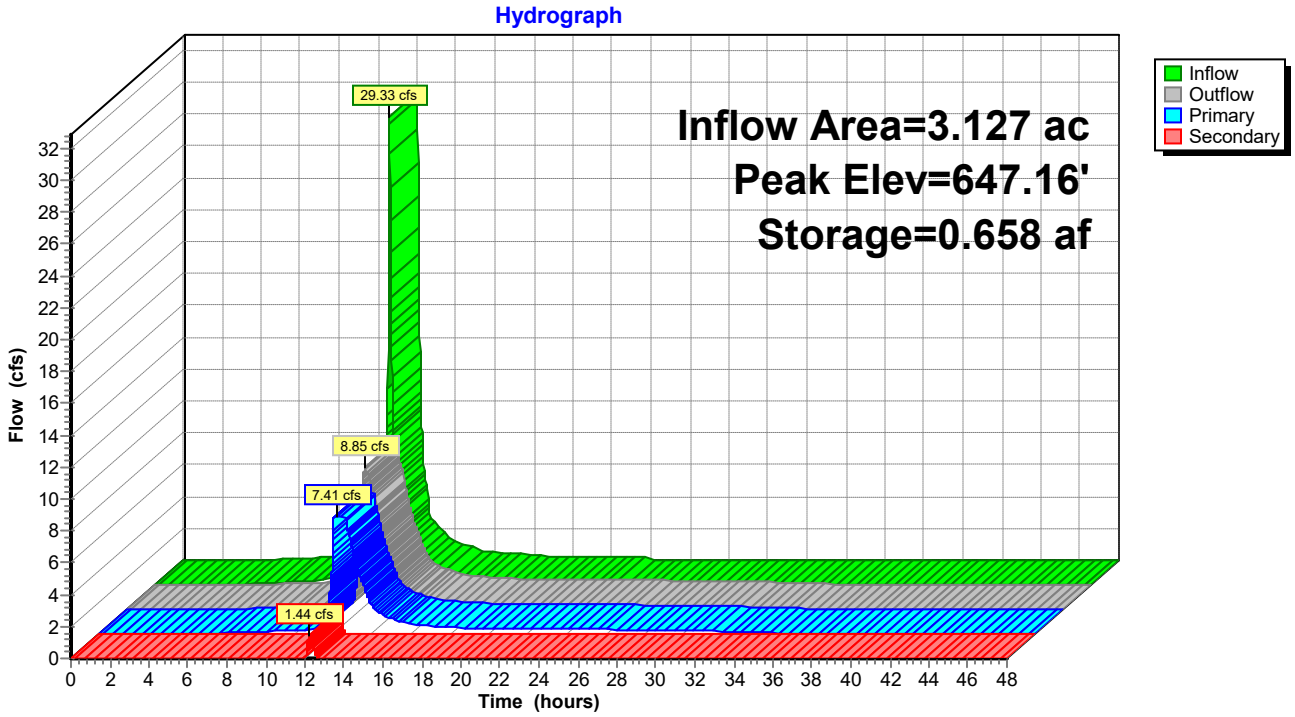
36,259.7 cf Field - 13,343.2 cf Chambers = 22,916.5 cf Stone x 40.0% Voids = 9,166.6 cf Stone Storage

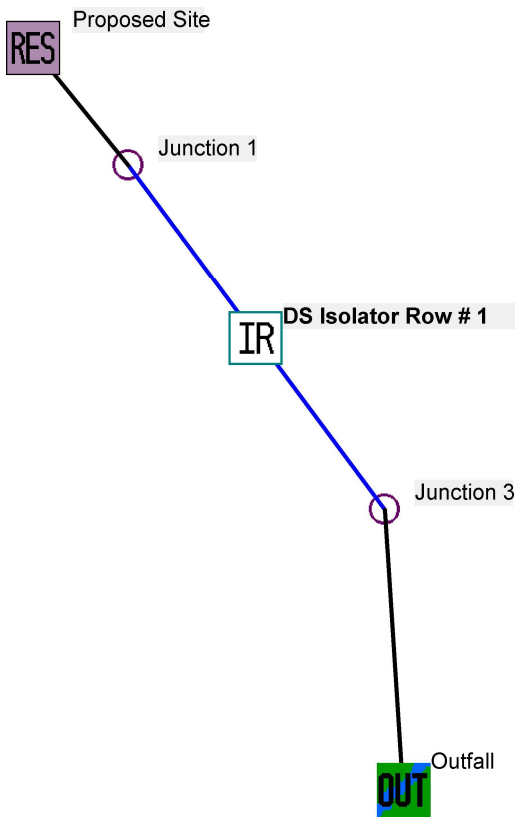
Chamber Storage + Stone Storage = 22,509.8 cf = 0.517 af
Overall Storage Efficiency = 62.1%
Overall System Size = 177.78' x 37.08' x 5.50'

120 Chambers
1,343.0 cy Field
848.8 cy Stone



Pond 2P: Underground System




Proposed Site
RES
Junction 1
IR
DS Isolator Row # 1
Junction 3
Outfall
OUT

Data file name: \\isgfile1\Shared\Projects\24000 PROJ\24400-24499\24403 Red Cloud Development La Crosse, WI\24403 Civil-Survey\Civil Calcs\Stormwater\24403 P
WinSLAMM Version 10.4.1
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Minneapolis MN 1959.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_Res and Other Urban Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban 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\WI_Res and Other Urban 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:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/02/59 Study period ending date: 12/28/59
Start of Winter Season: 12/02 End of Winter Season: 03/12
Date: 09-17-2021 Time: 15:17:22
Site information:

LU# 1 - Residential: Proposed Site Total area (ac): 3.619
1 - Roofs 1: 1.262 ac. Pitched Connected PSD File: C:\WinSLAMM Files\NURP.cpz
13 - Paved Parking 1: 1.362 ac. Connected PSD File: C:\WinSLAMM Files\NURP.cpz
45 - Large Landscaped Areas 1: 0.995 ac. Moderately Compacted Sandy PSD File: C:\WinSLAMM Files\NURP.cpz

Control Practice 1: Isolator Row CP# 1 (DS) - DS Isolator Row # 1
Total available system length (ft) = 178
Total available system width (ft) = 37
Available height from chamber base to surface (ft) = 6.00
Number of isolator rows = 1
Native soil infiltration rate (in/hr) = 0.00
Assumed stone porosity () = 0.40
Sizing option: Number of rows and row length
Number of rows = 5
Row length (ft) = 178
Selected Chamber Information
Chamber type: MC-3500
Chamber height (in): 45.00
Chamber width (in): 86.00
Chamber segment length (in): 86.00
Final storage volume (cf): 22414
Number of rows: 5
Row length (ft): 178.0
Total system length (ft): 890.0
Total system width (ft): 35.8
Number of chambers: 120
Overflow weir invert elevation (ft) = 0.00
Orifice 1 invert elevation (ft) = 0.00
Orifice 1 diameter (ft) = 0.00
Orifice 2 invert elevation (ft) = 0.00
Orifice 2 diameter (ft) = 0.00

SLAMM for Windows Version 10.4.1

Data file name: \\isgfile1\Shared\Projects\24000 PROJ\24400-24499\24403 Red Cloud Development La Crosse, WI\24403 Civil-Survey\Civil Calcs\Stormwater\24403 F
WinSLAMM Version 10.4.1
Rain file name: C:\WinSLAMM Files\Rain Files\WisReg - Minneapolis MN 1959.RAN
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Runoff Coefficient file name: C:\WinSLAMM Files\WI_SL06 Dec06.rsvx
Pollutant Relative Concentration file name: C:\WinSLAMM Files\WI_GEO03.ppdx
Residential Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Institutional Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Commercial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban Dec06.std
Industrial Street Delivery file name: C:\WinSLAMM Files\WI_Res and Other Urban 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\WI_Res and Other Urban Dec06.std
Apply Street Delivery Files to Adjust the After Event Load Street Dirt Mass Balance: False
Source Area PSD and Peak to Average Flow Ratio File: C:\WinSLAMM Files\NURP Source Area PSD Files.csv
Cost Data file name:
If Other Device Pollutant Load Reduction Values = 1, Off-site Pollutant Loads are Removed from Pollutant Load % Reduction calculations
Seed for random number generator: -42
Study period starting date: 01/02/59 Study period ending date: 12/28/59
Start of Winter Season: 12/02 End of Winter Season: 03/12
Model Run Start Date: 01/02/59 Model Run End Date: 12/28/59
Date of run: 09-17-2021 Time of run: 15:16:35
Total Area Modeled (acres): 3.619
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:	229721	-	107.4	1540	-
Outfall Total with Controls:	230281	-0.24%	49.94	718.0	53.38%
Annualized Total After Outfall Controls:	233480			727.9	

Post-Construction Stormwater Management Maintenance Agreement

This Maintenance Agreement is made this _____ day of _____, by and between _____., hereinafter referred to as "Grantor" and the City of La Crosse hereinafter referred to as the "Grantee".

WITNESSETH

WHEREAS, the "Grantee" is authorized to regulate and control disposition of storm and surface waters within the City of La Crosse as set forth by the City of La Crosse, Wisconsin code of ordinances; and

WHEREAS, the Grantor is the owner of the certain tract or parcel of land more particularly described as:

LOT 1, LOT 2, LOT 3, AND LOT 4 OF THE RED CLOUD ADDITION IN THE CITY OF LA CROSSE, COUNTY OF LA CROSSE, STATE OF WISCONSIN

such property being hereinafter referred to as "the property."

WHEREAS, the Grantor desires to construct certain improvements on the property which will alter existing storm and surface water conditions on the property and adjacent lands; and

WHEREAS, in order to accommodate and regulate these anticipated changes in existing storm and surface water flow conditions, the Grantor, its successors and assigns, desire to build and maintain at their expense a storm and surface water management facility and system more specifically described as an ADS Stormtech Chamber System Located on Lot 2 to serve the property as shown and described in the Post-Construction Stormwater management Maintenance Plan, copies of which are attached here to as Exhibit A; and

WHEREAS, the Grantee has reviewed and approved these plans subject to execution of this agreement.

NOW THEREFORE, in consideration of the benefit received by the Grantor, its heirs and assigns, and as a result of the City of La Crosse's approval of its plans, the Grantor, its successors and assigns, with full authority to execute this Maintenance Agreement hereby covenants with the City of La Crosse as follows:

1. Grantor, its successors and assigns shall construct and perpetually maintain, at its sole expense, the above referenced storm and surface water management facility and system in strict accordance with the plan approval granted by the City of La Crosse.
2. Grantor, its successors and assigns shall, at its sole expense, make such changes or modifications to the storm and surface water management facility and system as may, at the City of La Crosse's discretion, and within its lawful regulatory authority, be determined necessary to ensure that the facility and system are properly maintained and continues to operate as designed and approved.
3. The City of La Crosse, its agents, employees and contractors shall have the perpetual right of ingress and egress over the Property to inspect the storm and surface water management facility and system to ensure that the system is being properly maintained and is continuing to perform in an adequate manner.
4. The Grantor, its successors and assigns agree that should it fail to correct any defects in the above described facility and system within ten days from the issuance of written notice, or shall fail to maintain the facility in accordance with the approved design standards and in accordance with the law and applicable regulations, or in the event of an emergency as determined by the City of La Crosse in its sole discretion, the City of La Crosse is authorized to enter the Property to make all repairs, and to perform all maintenance, construction and reconstruction the City of La Crosse deems necessary. The City of La Crosse shall assess the Grantor, its successors or assigns for the cost of the work and applicable penalties per City of La Crosse ordinances. Said assessment shall be a

lien against all properties described within this Maintenance Agreement and may be placed on the property tax bills of said properties and collected as ordinary taxes by the City of La Crosse.

5. Grantor, its successors and assigns shall indemnify, hold harmless and defend the City of La Crosse from and against any and all claims, demands, suits, liabilities, losses, damages and payments, including attorney fees claimed or made against the City of La Crosse that are alleged or proven to result or arise from the failure of Grantor or Grantor's successors or assigns to comply with the terms and conditions of the Maintenance Agreement.
6. The Covenants contained herein shall run with the land and the Grantor, its successors and assigns further agree whenever the Property shall be held, sold and conveyed, it shall be subject to the covenants, stipulations, agreements and provisions of this Agreement, which shall apply to, bind all present and subsequent owners of the Property described herein, provided, however, that the Grantor and its successors and assigns shall have no further liability under this Maintenance Agreement after such party has transferred its fee simple interest in the Property, except for any obligations that occurred during such party's period of ownership.
7. The provisions of this Maintenance Agreement shall be severable and if any phase, clause, sentence, or provision is declared unconstitutional, or the applicability to the Grantor, its successors and assigns is held invalid, the remainder of this Agreement shall not be affected thereby.
8. The Maintenance Agreement shall be recorded with the La Crosse City Recorder's Office at the Grantor's expense.
9. In the event that the City of La Crosse shall determine in its sole discretion at any future time that this Maintenance Agreement is no longer required, then the City of La Crosse and the Grantor or its successors or assigns, shall execute a release of this Maintenance Agreement, which the Grantor, its successors and assigns shall record, in the La Crosse City Recorder's Office at its expense.

IN WITNESS THEREOF, the Grantor has executed this Maintenance Agreement
On the _____ day of _____.

By Officer or Authorized Agent:_____

Title:_____

Date:_____

State of Wisconsin:
City of La Crosse:

To with: The foregoing instrument was acknowledged before me this _____ day of _____, by _____

Notary Public
My Commission Expires:_____

Exhibit A

Post Construction Stormwater Management Maintenance Plan

Red Cloud – La Crosse, Wisconsin

This document will provide direction for performing an inspection and any necessary maintenance of stormwater management practices. It is the responsibility of the property owner to perform the inspections of the stormwater management practices and to perform maintenance as needed. This maintenance plan provides a map of the site which identifies all applicable maintenance areas as well as an inspection checklist to be used by the inspector.

This plan shall remain onsite and be available for inspection when requested by the State of Wisconsin. When requested, the owner shall make available for inspection all maintenance records to the State of Wisconsin for the life of the system.

The Inspection Process

Below are the manufacturer's instructions and inspection checklists to be completed on a scheduled interval stated on each checklist by the property owner or an assigned subcontractor. Refer to the Site Map for item identification.

Perform Necessary Maintenance

After performing the inspection process, any required maintenance must be performed by the property owner or an assigned subcontractor within 30 calendar days.

During inspections, if 3 inches or more sediment is observed on the bottom of the isolator row, maintenance should be performed. Maintenance shall include jetting and vacuuming the accumulated sediment according to manufacturer recommendations. If standing water is observed in the underground infiltration system greater than 48 hours after a storm event, the system may have become clogged. Refer to manufacturer recommendations for further maintenance requirements to repair the system. Outlet structure and pipe shall be cleaned annually (at a minimum) and as needed to remove trash/debris and sediment to provide proper conveyance from the underground infiltration system. All removed material shall be properly disposed in a landfill in accordance with state and local laws.

All removed sediment must be disposed of according to applicable regulations.

It is assumed that maintenance will consist of a combination of labor and equipment use to accomplish tasks ranging from sediment removal to trash cleanup.

Additional Underground System Maintenance

After construction of the system and prior to operation beginning, a post installation inspection shall be performed by the owner/operator of the system to measure the invert and inspect the system prior to the accumulation of sediment. Adequate maintenance access shall be maintained to the underground system at all times. During inspections the sediment buildup shall be measured at each riser, inspection port, and cleanout location and if in any case the sediment buildup is greater than 20% of the pipe diameter, cleaning should be performed immediately. During inspections all manifolds, laterals, and outlet pipe should be inspected for sediment buildup, obstructions, damage or any other potential problems. When sediment removal is to take place is should be done using jetting and vacuuming according to manufacturer's recommendations. Manual removal should be avoided if at all possible. All applicable confined space entry procedures must be followed by all personal performing sediment removal or other system maintenance.

Vector Control

Eliminate all stagnant water and undesired ponding areas to prevent mosquito breeding. Eliminate all undesired vegetation from the site. Eliminate all potential tick breeding areas.

Contingency Plan in the Event of System Failure

In the event of plumbing failure, all stormwater would flow over land off the site before encroaching on the building. In the event of stormwater plumbing system failure, contingency plans for conveying

water and protecting the property include sand bagging, pumping, and earthen berms. In the event of standing water, the source of the standing water shall be determined and remedial steps shall be taken to eliminate the disturbance. Remedial methods shall not disturb or disrupt the integrity of each system component.

Record Keeping
It is the responsibility of the property owner to maintain accurate inspection and maintenance records. Inspection and maintenance records shall be kept on site and made available to the City of La Crosse upon request.

Annual Compliance Reporting
The City may request an annual report by which the property owner has up to 30 days to fulfill the request by the City.

City Inspection and Maintenance
If at any point the property owner falls behind on the required inspections or maintenance, the authority will perform an inspection at the cost of the property owner after sending a notice. If emergency maintenance is required and deemed necessary by the authority, the authority will perform the necessary maintenance at the property owner's cost. It is important to remember that the property owner is the party responsible for the inspection, maintenance, and the record keeping, and this responsibility should not be assumed to the authority.

StormTech
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

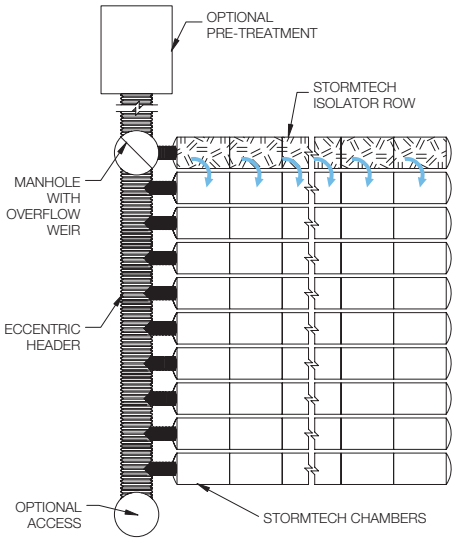
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

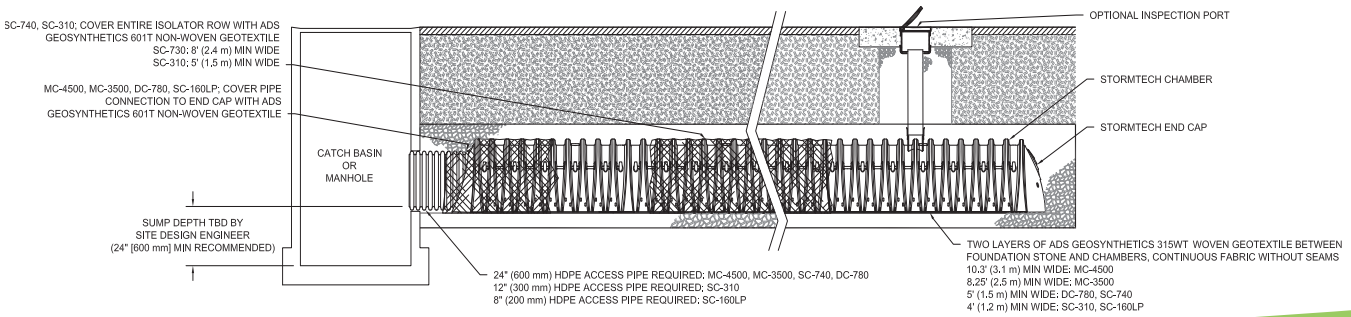
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



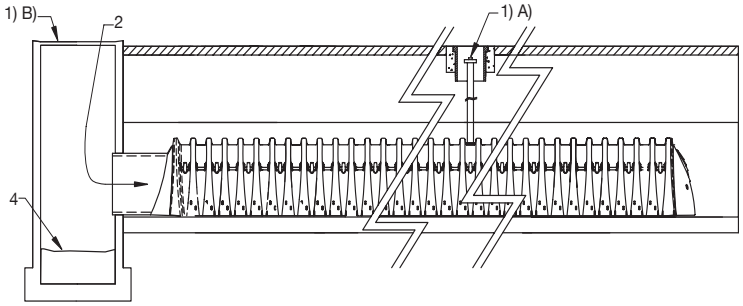
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

StormTech® Detention • Retention • Water Quality
A division of ADS

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

Maintenance Schedule and Inspection Checklist Information

Facility ID Red Cloud – La Crosse, WI

Location 1325 Saint Andrews ST Lacrosse, WI

Inspector(s) _____

Date _____

Time _____

Party/Department Responsible for Maintenance: _____

_____

_____

Contact(s): _____

_____

_____

Phone Number(s): _____

_____

Email: _____

_____

Mailing Address: _____

_____

_____

BMP Inspection Schedule and Checklist

A. Inlets
1 = Good Condition
2 = Acceptable, Item on Watch
3 = Item Requires Maintenance Within the Year
4 = Failed Item, Requires Immediate Maintenance

Note: All items associated with Pretreatment shall be inspected twice a year.
Once in early Spring and once in late Fall.

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
1. Structural deficiencies of concrete ring reinforcement? Spalling?																					
2. Damage to castings?																					
3. Sediment build up?																					
4. Free of debris?																					

B. ADS Stormtech Chambers
1 = Good Condition
2 = Acceptable, Item on Watch
3 = Item Requires Maintenance Within the Year
4 = Failed Item, Requires Immediate Maintenance

Note: All items associated with the Facility shall be inspected quarterly or as otherwise noted.

	2021	2021	2022	2022	2023	2023	2024	2024	2025	2025	2025	2026	2027	2027	2028	2028	2029	2029	2030	2030	2031
1. Maintenance access to facility																					
2. Excessive sediment accumulation																					
4. Is there evidence of pollution entering the system? Y/N. Where?																					
5. Outlets																					
a. Maintenance access to outlet																					
b. Outlet condition																					
d. Trash/debris accumulation (Remove as quickly as possible)																					

C. Miscellaneous
1 = Good Condition
2 = Acceptable, Item on Watch
3 = Item Requires Maintenance Within the Year
4 = Failed Item, Requires Immediate Maintenance

Note: All miscellaneous items shall be inspected annually or as otherwise noted.

	2021	2021	2022	2022	2023	2023	2024	2024	2025	2025	2025	2026	2027	2027	2028	2028	2029	2029	2030	2030	2031
1. Complaints from local residents																					
2. Pest problems																					
3. Adequate safety signage																					

BMP Inspection Schedule and Checklist

ISG

Inspector's Summary

BMP Inspection Schedule and Checklist

ISG

Photographs	
Photo ID	Description
1.	
2.	
3.	
4.	
5.	
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19.	
20.	

BMP Inspection Schedule and Checklist

ISG

Sketch of Facility