STORMWATER MANAGEMENT REPORT

MULTI-FAMILY DWELLING

214 HAMILTON STREET
WORCESTER, MA 01604

Prepared by:

FODERA Engineering
28 Harbor Street, Suite 204
Danvers, MA 01923

Prepared for (Applicant):

Tal Patlazhan
REI Group LLC
51 Pleasant St, # 731
Malden, MA 02148

Date:

September 20, 2023

FODERA
ENGINEERING

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1.0: INTRODUCTION

The proposed project is the redevelopment of an existing four-unit building, into a proposed eight-unit building. The parcel is identified parcel ID: 18-46-1. The lot is 12,500 square feet (sf) with frontage on Hamilton Street and Warner Ave.

Stormwater design for the project has been designed in accordance with standards set forth in the Massachusetts Stormwater Handbook.

2.0: EXISTING CONDITIONS

2.1: EXISTING SITE CONDITONS

The existing lot currently has a four-story building on site with a curb cut on Warner Ave and a paved parking area on the south side of the property. The property is a corner lot with abutters to the east and south. About half the lot is pervious with grassed surface and the other half is impervious with pavement and building coverage.

The frontage along Hamilton Street is relatively flat, however, topography drops steeply to the south. Hamilton Street has about a 15% drop, and the site has similar characteristics. Elevations drop about twenty (20) feet from the north to south.

2.2: SITE SOILS & GROUNDWATER

Site soils were determined by test pit. A certified soil evaluator from Quetti Design Group evaluated the soils on August 31, 2023. The Estimate Seasonal High Water Table (ESHWT) was determined to be twenty-two (22) inches below grade at elevation 74.7 with respect to the vertical datum on the accompanied site plans dated 9/20/23. The soils are a dense gravelly fine sandy loam with an associated Rawl's Rate of 0.52 inches per hour. This Rawl's Rate is associated with a Hydrologic Soil Group B (HSG-B). Please refer to Appendix A for the test pit report.

2.3: EXISTING UTILITIES & STORMWATER INFRASTRUCTURE

The existing dwelling on site is serviced by public and private utilities. Public water and sanitary sewer provided by the city of Worcester are currently in place for the existing building. Gas and electricity separately are also in place. There are no known stormwater facilities currently on site to mitigate on-site runoff and is therefore discharged overland into the public rights-of-ways and abutting properties. There is an existing stormwater collection system within Hamilton Street north of the site, and southerly downgradient on Warner Avenue. Runoff from the site is directed to the south abutting properties and southerly on Warner Ave.

3.0: PROPOSED CONDITIONS

3.1: PROPOSED SITE CONDITONS

The project proposes to keep the existing structure, and to add an addition to expand the footprint. Additional ground parking, new utilities, and stormwater recharge will all be included.

3.2: PROPOSED UTILITIES & STORMWATER INFRASTRUCTURE

The proposed project will utilize all available public and private utilities. Existing utility connections will be cut and capped for the connections of new utility services. Proposed domestic water service and fire protection line will be tapped from the water main in Warner Ave. Sewer services will be connected by gravity flow to the sewer main in Warner Ave. Electric and gas services will be installed in coordination with their respective utility companies.

Stormwater measures are proposed to mitigate site improvements. Stormwater from the roof will be discharge by downspouts and flow overland to the proposed catch basin on site. The catch basin is then directed to the subsurface infiltration system. The infiltration system is made from twelve (12) SC-740 StormTech chambers. The first row will be an Isolator row for runoff treatment. All runoff that will not be captured to the infiltration system will be directed overland towards Warner Avenue. No new runoff will be added and the site will be improved from the existing conditions. The following sections demonstrate compliance with stormwater regulations.

4.0: MASSACHUSETTS STORMWATER MANAGEMENT STANDARDS

4.1: STANDARD 1 – NO NEW UNTREATED STORMWATER DISCHARGES

The Massachusetts Stormwater Handbook has been revised to meet wetland regulations, 310 CMR 10.00 and water quality regulations, 314 CMR 9.00. Volume 1, Chapter 1 of the handbook states that new stormwater conveyances shall not discharge untreated stormwater directly to open waters or wetlands of the Commonwealth. The level of stormwater treatment depends on project location and site soils and are regulated by requirements in the following standards.

The proposed development project has been designed in accordance with the Massachusetts Stormwater Handbook and Standards. All new stormwater conveyances will be treated in compliance with the following standards. Computations and strategies in the following section will demonstrate compliance.

4.2: STANDARD 2 – PEAK RATE OF DISCHARGE

Development projects resulting in new impervious surfaces generates stormwater runoff at high flow rates than previous site conditions. Standard 2 has been made for developments to attenuate runoff flow rates and to not exceed previously developed conditions. This Standard requires that the post-development peak discharge rate is equal to or less than the pre-development rate from the 2-, 10-, 25-, and 100-year, 24-hour storms.

The drainage analysis was performed using the Soil Conservation Service (SCS) TR-55 and TR-20 methodologies and the computer program HydroCAD 10.00 by HydroCAD Software Solutions, LLC. The analysis was performed on the 2-, 10-, 25-, and 100-year frequency rainfall events. The events were based on the 24 hour type-III duration storm. The 'time of concentration' (Tc) for each watershed was determined by finding the time necessary for runoff to travel from the most hydraulically distant point in the watershed to the point of concentration. The travel path was drawn based on the topography and the time was calculated using the TR-55 Method and HydroCAD. A minimum Tc of 5.0 minutes was used. Curve numbers were developed for each of the different use categories and hydrologic soil group types within each sub-area. The curve numbers were based on the SCS TR-55 methodology and are included in the HydroCAD input and output found in the Attachments. Rainfall depths were acquired from National Oceanic and Atmospheric Administration (NOAA), Atlas 14, Volume 10 for the specific site location. NOAA rainfall data is attached in Appendix A and the associated rainfall depths are summarized below.

Storm Event	Rainfall Depth
2-Year	3.19 inches
10-Year	4.92 inches
25-Year	6.01 inches
100-Year	7.68 inches

The overall site was analyzed with two (2) discharge points: Discharge Point 1 (DP1) being directed to the south abutters, and Discharge Point 2 (DP2) being directed towards Warner Ave. Subcatchment areas were separated accordingly. The following assumptions were made for the purpose of this hydrologic analysis:

- Whenever possible, the property line and/or an arbitrary line, outside the limit of proposed work was delineated as the watershed boundary.
- The total watershed area for the existing condition is used as the comparison base for the watershed area in the proposed condition.
- There are no known existing roof runoff discharge connection and is assumed to runoff from surface overland.

Existing Subcatchment areas E1 and E2 are associated to DP1 and DP2, respectively. Similarly, proposed subcatchment areas P1 and P2 are associated to DP1 and DP2. Proposed subcatchment P1 is further divided into sub-sections P1A and P1B. P1A is overland runoff directed to southerly abutters, and P1B is runoff directed to the infiltration system. The proposed infiltration system will have an overflow weir off the top of the retaining wall against the parking area, and near the catch basin. In the event of an extreme storm, overflow would flow over the wall and onto a rip-rap surface towards the southerly abutters. The peak rates of runoff towards the abutters is reduced in the post-development condition.

All subcatchment areas between pre- and post-development have times of concentrations to be 5.0 minutes. A summary of the pre- and post-development peak rate of discharge are in Table 4.2(1). HydroCAD calculations for peak rate discharges can be found in Appendix B.

EXISTING SUBCATCHMENT AREAS

E1 – Overland Runoff to southerly abutters (9,975 sf)
Impervious – 4,400 sf
Pervious (grassed) – 5,575 sf
E2 – Overland Runoff to Warner Ave (2,525 sf)
Impervious – 1,805 sf
Pervious (grassed) – 720 sf

PROPOSED SUBCATCHMENT AREAS

P1A – Overland Runoff to southerly abutters (785 sf)
Pervious (grassed) – 785 sf
P1B – Runoff to Recharge System, Overflow to southerly abutters (8,835 sf)
Impervious – 6,860 sf
Pervious – 1,975 sf
P2 –Overland Runoff towards Warner Ave (2,880 sf)
Impervious – 1,975 sf
Pervious (grassed) – 905 sf

Table 4.2(1): Peak Rate of Discharge Summary

	DP1 – to South Abutter		DP2 – to Warner Ave	
Storm Intensity	**PRE, *cfs**	**POST *cfs**	**PRE, *cfs**	****POST *cfs**
2-year Storm 3.19 inches	0.33	0.02	0.13	0.15
10-year Storm 4.92 inches	0.71	0.47	0.24	0.27
25-year Storm 6.01 inches	0.97	0.96	0.31	0.35
100-year Storm 7.68 inches	1.38	1.36	0.41	0.47

* Flow rate, cfs = cubic-feet per second
** minimal increase is considered insignificant and commonly accepted.

HydroCAD reports of existing and proposed peak rate discharges can be found in Appendix B.

4.3: STANDARD 3 – GROUNDWATER RECHARGE

As impervious surfaces are constructed from developments, exposed natural surfaces decrease resulting in the loss of natural rainfall infiltration from the new impervious surfaces. Standard 3 was implemented to design for recharge to, at a minimum, meet the natural conditions prior to constructed impervious surfaces. The post-development impervious area and properties of site soils are used to assist in determining the volume required for groundwater recharge.

As discussed in previous sections, data from NRCS determined site soils to be classified as hydraulic group "B". Refer to Appendix A for soil reports.

The method used to determine the required recharge volume for this project is the "static method" as detailed in Volume 3, Chapter 1 of the Massachusetts Stormwater Handbook. The static method is computed by the assumption that no infiltration occurs until the infiltration system is filled to the elevation associated with the required recharge volume. Computations to determine the required recharge volume use the rates specified by Rawls 1982. The associated Rawls rate below is multiplied by the added impervious area from the development to determine the required recharge volume.

Rawls rate: Hydraulic group B = 0.35 inches of runoff

Once the required recharge volume is determined, appropriate sizing of bottom area for the infiltration system is used to determine the drawdown time. Drawdown time is the time of required recharge volume to fully infiltrate through the bottom bed of the system and is calculated using the equation below.

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Where:
Rv = Storage Volume
K = Saturated Hydraulic Conductivity for the static method (Rawls Rate)
Bottom Area = Bottom Area of Recharge Structure

The proposed project has one (1) recharge system and is two (2) feet above the ESHGT. The system is made up of StormTech® SC-740 chambers. All computations for Standard 3 are in Appendix B and demonstrate that the proposed project meets this standard.

4.4: STANDARD 4 – WATER QUALITY

Runoff from impervious surfaces flow overland and gather solids as the stormwater is directed into conveyance systems and can have adverse effects to water pollution. Standard 4 was implemented for stormwater management systems to be designed to remove 80% of the average annual post-development load of Total Suspended Solids (TSS). Runoff volume requiring appropriate TSS treatment is known as the required water quality volume.

Water quality volume for the proposed project is calculated by the post-development impervious ground area multiplied by one-half (0.5) inch of runoff. Soil tests determined site soils to have an infiltration rate of 0.52 inches/ hour, as determined by the 1982 Rawls Rates displayed in Table 4.4(1).

Table 4.4(1): Rawls Rates

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Loam	B	0.52

The proposed recharge system provides sufficient volume to demonstrate that the required water quality volume is fully contained within each system. Computations for TSS removal are required as pre-treatment prior to stormwater discharge. Pre-treatment prior to groundwater recharge is achieved, however, all runoff directed to the recharge system is roof runoff and is classified as "clean" runoff.

The Massachusetts Stormwater Handbook state that this standard is met when:

a) Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;

b) Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and

c) Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

The proposed project meets this standard, and all computations are in Appendix B.

4.5: STANDARD 5 – LAND USES WITH HIGHER POLLUTION PREVENTION LOADS

For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. Due to the generally low-intensity-use of the proposed project, the site is not considered a Land Use with High Potential Pollutant Loads (LUHPPL).

4.6: STANDARD 6 – CRITICAL AREAS

Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. The project site does not discharge to a critical area and therefore, Standard 6 is not applicable.

4.7: STANDARD 7 – REDEVELOPMENT PROJECTS

For purposes of the Stormwater Management Standards, redevelopment projects are defined to include the following:

1. Maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, correcting substandard intersections, improving existing drainage systems, and repaving;
2. Development, rehabilitation, expansion and phased projects on previously developed sites, provided the redevelopment results in no net increase in impervious area; and
3. Remedial projects specifically designed to provide improved stormwater management, such as projects to separate storm drains and sanitary sewers and stormwater retrofit projects.

All redevelopment projects must fully comply with the provisions of the Stormwater Management Standards requiring the development and implementation of a construction period erosion and sedimentation control plan, a pollution prevention plan, an operation and maintenance plan, and the prohibition of illicit discharges. All redevelopment projects are also required to meet the following Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural stormwater best management practice requirements of Standards 4, 5, and 6.

The proposed project does not fit the category of a redevelopment since there is a net increase of impervious area and therefore, Standard 7 is not applicable.

4.8: STANDARD 8 – TEMPORARY EROSION, SEDIMENTATION, AND POLLUTION PREVENTION

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling, and reconstruction. Please refer to the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas provided by MassDEP for more detailed information.

Erosion control silt fence will be provided around the perimeter of the site, as well as installing inlet protection silt bags in nearby and new catch basins. With proper care and maintenance as outlined within this report, it is determined that these barriers will suffice as sedimental transfer protection to outside areas.

4.8.1: STABILIZATION SCHEDULE

The site shall be controlled and maintained with stabilization methods on disturbed areas. Disturbed areas are areas that will be exposed of dirt from construction activities. A temporary vegetative cover will be established on areas of exposed soils (including stockpiles) as described in Table 4.8.1(1). Disturbed areas shall be periodically inspected and after ever storm event of 0.5” of rainfall.

Table 4.8.1(1): Temporary Construction Stabilization Schedule

Area requiring permanent stabilization	Time frame to apply erosion controls
Any disturbed areas within 50 feet of a surface water of the State and not at final grade	Within two days of the most recent disturbance if the area will remain idle for more than 14 days
For all construction activities, any disturbed areas that will be dormant for more than fourteen (14) days but less than one year, and not within 50 feet of a surface water of the State	Within five (5) days of the most recent disturbance within the area. For residential subdivisions, disturbed areas must be stabilized at least seven days prior to transfer of permit coverage for the individual lot(s).
Disturbed areas that will be idle over winter	Prior to the onset of winter weather

4.8.2: POTENTIAL STORMWATER CONTAMINANTS

The purpose of this section is to identify methods to minimize potential pollutants that could impact storm water during construction. Pollutants that result from clearing, grading, excavation, and building materials and have the potential to be present in stormwater runoff.

To minimize the potential for stormwater contamination the following practices shall be followed:

- No solid or liquid waste, including building materials or their packaging, shall be discharged in stormwater runoff.
- Concrete trucks are not permitted to wash out directly into storm sewers, streams or drainage channels.
- Off-site tracking of sediments by construction vehicles must be minimized.
- Contaminated soils or soils where construction site chemicals have been spilled must be removed from the site and disposed of in accordance with federal, state and local regulations.
- Stormwater that comes in contact with contaminated soils or solid & industrial waste must be collected and disposed of as a wastewater.
- Fuel tanks and drums or other containers holding construction site chemicals must be stored within a diked area.
- Sediment-laden trench or groundwater must pass through a sediment-settling pond, or be dewatered in place using a sump pit, filter bag or other comparable method, prior to being discharged from the site.
- Trench and ground water free from sediment or other pollutants may be discharged without treatment, provided this water does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

4.9: STANDARD 9 – LONG-TERM OPERATION AND MAINTENANCE PLAN

The goal of the operation and maintenance plan is to protect resources in the region that may be adversely impacted by the proposed development. Water quality treatment measures and the implementation of Best Management Practices (BMP's) for structural controls will result in the treatment of site stormwater and the removal of a minimum of 80% of the TSS load in runoff prior to discharge from the site, consistent with the MA Stormwater Management Handbook.

The stormwater management system will be owned by the current and future landowner(s) who will be responsible for operation and maintenance. The estimated operation and maintenance budget is estimated to be approximately $2,000 (two-thousand) annually. Inspections shall be made for the following maintenance systems and shall be recorded with information of the inspection date, inspector’s name, system inspected, findings of inspection, and actions made for maintenance. A log for these inspections is attached in Appendix C.

4.9.1: STRUCTURAL POLLUTANT CONTROLS AND MAINTENANCE

The proposed stormwater management system(s) is(are) designed to protect runoff water quality through the removal of sediment and pollutants. Structural pollutant controls used to separate and capture stormwater pollutants are described below.

(1) Catch Basins / Inlets & Manholes

Proposed catch basins/ inlets at the site will be equipped with deep sumps and hooded outlets that trap debris, sediments, and floating contaminants, which are the largest constituents of urban runoff. The proper removal of sediments and associated pollutants and trash occurs only when catch basin inlets and sumps are cleaned out regularly. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. In addition, frequent cleaning also results in more volume available for future deposition and enhances overall performance.

Maintenance: All catch basins and inlets will be inspected at a minimum of at least once per year and cleaned when the sump has accumulated to a depth of one (1) foot of sediment. Sediment and/or floatable pollutants will be pumped from the inlet drain opening and disposed of at an approved offsite facility in accordance with all applicable regulations. Any structural damage or other indication of malfunction will be reported to the site manager and repaired as necessary. During colder periods, catch basin and inlet grates will be kept free of snow and ice. During warmer periods, catch basin and inlet grates will be kept free of leaves, litter, sand, and debris. Regular maintenance and cleaning of catch basins and inlets will assure adequate performance of these structures.

(2) Subsurface Infiltration System

The stormwater management system includes a subsurface infiltration system to provide water quality treatment and recharge, as well as attenuate peak flows. The maintenance of the system may affect the functioning of stormwater management practices.

Maintenance: Visual inspection of the subsurface infiltration system will occur twice per year and after every major storm during the first 3 months of operation. Remove any debris that might clog the system. If water is observed and it is at least 72 hours after a rain event, the system will require to be cleaned to remove any built-up sediment.

(3) Subsurface Infiltration System Isolator Row

The stormwater management system(s) include the use of an isolator row in the subsurface infiltration system to enhance total suspended solids removal and provide easier access for cleaning and maintenance. The proper function of these items is crucial to providing adequate groundwater recharge and flood control.

Maintenance: Subsurface infiltration system isolator row may affect the functioning of stormwater management practices. Visual inspection of the isolator row through the inspection port is to occur every six months in the first year of use. After the first year of use, visually inspect annually at a minimum. The isolator row shall be cleaned when the average depth of sediment exceeds three (3) inches. Refer to StormTech® Isolator Row O&M manual for cleaning

procedure. For more information and details on maintenance and cleaning of this particular product, it is recommended to seek advice from the manufacturer - StormTech®. StormTech® can be contacted by phone at 888-892-2694.

4.10: STANDARD 10 – PROHIBITED ILLICIT DISCHARGES

Standard 10 prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on-site, including stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater.

Proponents of projects within Wetlands jurisdiction must demonstrate compliance with this requirement by submitting to the issuing authority an Illicit Discharge Compliance Statement verifying that no illicit discharges exist on the site and by including in the pollution prevention plan measures to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

Illicit Discharge Compliance Statement

The proposed project at 214 Hamilton Street in Worcester, Masschusetts has been designed in accordance with the Massachusetts Stormwater Handbook and demonstrates that all proponents of the stormwater management design systems do not contain any new illicit discharges, in accordance with Standard 10. Please refer to the following appendices and civil design plans for compliance.

Date: September 20, 2023

Giovanni G. Fodera, PE, LSIT
President | Principal Engineer
FODERA Engineering
28 Harbor St., Suite 204
Danvers, MA 01923

APPENDIX A – SITE CONDITIONS
Soil Testing Report

551 Dorchester Ave #21
Boston, MA 02127
T: 413-281-6615
Kevin@quettidesigngroup.com

September 1, 2023 Quetti Project #285

Tal Klayman
REI Group LLC
108 Bayreuth Place
Cary, North Carolina 27513

214 Hamilton Street, Worcester, MA – Test Pit Report

Dear Mr. Klayman,

A test pit was conducted at the multi-family residence at the location noted above for the purposes of determining consistency or deviation of the soils in relation to the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) database. The attached exhibits include a site plan showing the approximate location of the test pits and soil profile. The test pit was during Quetti Design Group's site visit at 11:00 AM on Thursday, August 31, 2023. The observations are described below.

The property is defined in the NRCS database as having Paxton-Urban land complex, with 8 to 15 percent slopes. Paxton soils are classified as having a hydrologic soil group (HSG) rating C, and Urban Land a HSG D.

Soil Observations:

Test Pit #1

The test pit was divided into three layers for the purposes of analysis and report. Layer 1, the shallowest, was observed at 10 inches thick and consisted of a fine sandy loam fill material and was consistent with expectations for urban land. Layer 2 was observed at 32 inches thick and consisted of fine sandy loam. Layer 3 was observed at 54 inches thick to the bottom of excavation and consisted of a dense gravelly fine sandy loam layer. No groundwater was observed (likely due to the test being performed in late summer), but soil mottling was observed 22 inches below grade, indicating the presence of high groundwater. Based on this opinion, we would recommend a conservative Rawl's Infiltration Rate of 0.52 inches per hour be used for infiltration system design in this area due to the densic material observed within the C layer.

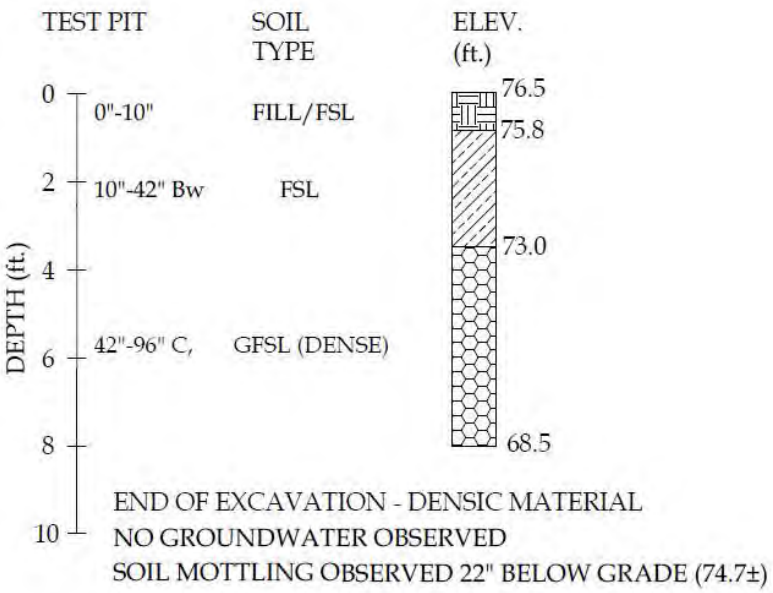
Paxton soils are known for being well drained. The infiltration design shall be designed to provide a minimum of 2 feet of vertical separation from groundwater and drawdown within the required 72-hour period as required by the Massachusetts Stormwater Handbook. All attempts to keep excavated land lower than surrounding lands (while maintaining proper erosion controls) should be exercised to help mitigate off-site runoff potential. The contractor shall construct and maintain erosion and sediment control measures in accordance with the latest edition of "Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas" prepared by the DEP and as directed by the local permitting authority. The contractor shall notify the engineer if any discrepancies from the data in this report are observed in the field prior to construction.

This analysis shall only be used for stormwater infiltration use to help determine the rate at which the system may drain. No other use is expressed or implied.

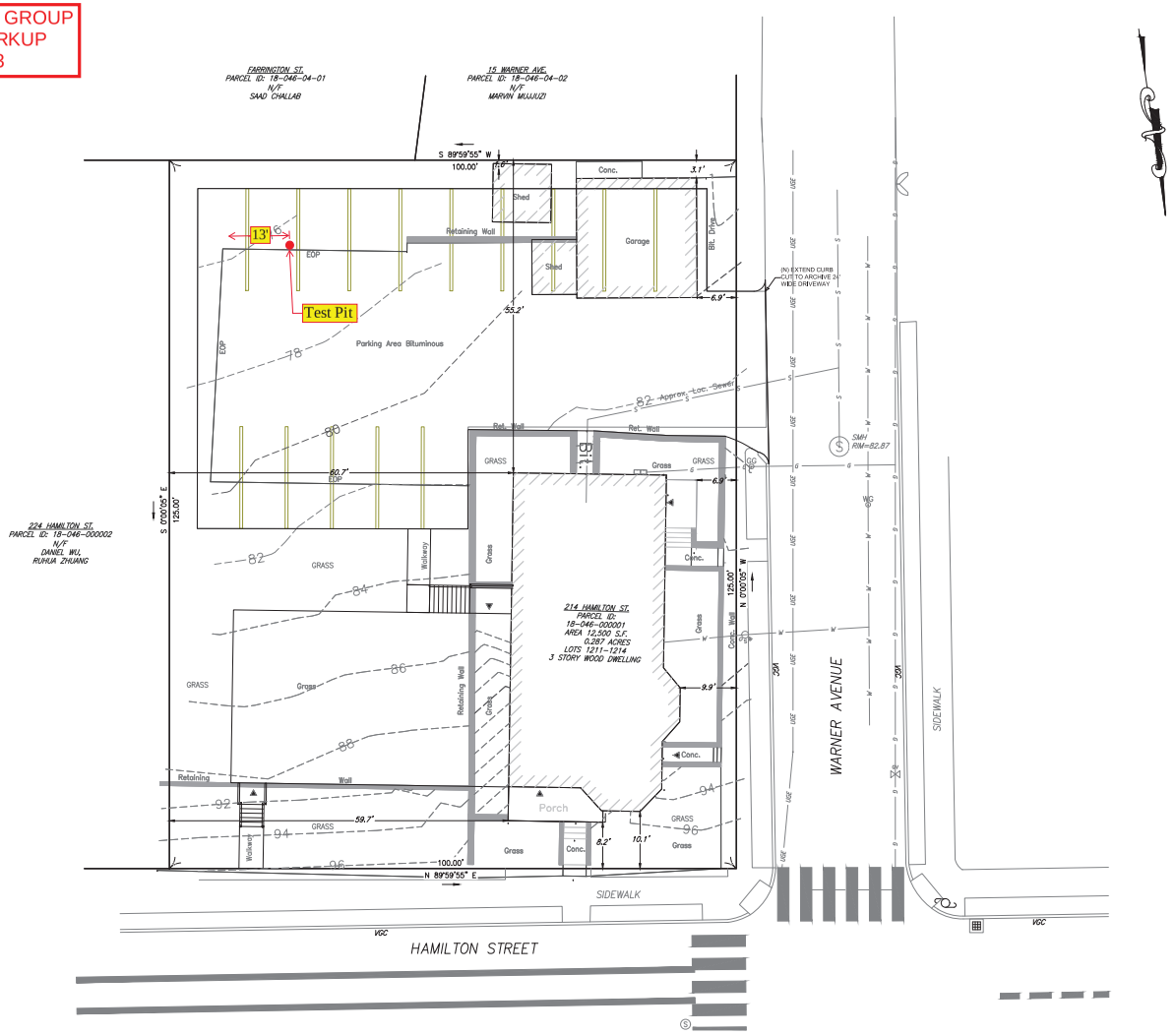
Respectfully submitted,

Kevin Quetti, PE
Principal Engineer
Quetti Design Group

Test Pit #1 Photo and Profile Sketch (Not to Scale)



QUETTI DESIGN GROUP
TEST PIT MARKUP
8/31/2023



EXISTING CONDITIONS PLAN
SCALE: 1" = 10'

PROPERTY INFORMATION

ADDRESS: 214 HAMILTON STREET
WORCESTER, MA 01604

PARCEL ID: 18_046_00001

LOT SIZE: 12,500± S.F. (0.287± AC.)

PLAN REFERENCES

– PLAN BY DAVID P TERENZONI

RECORD OWNER

214 HAMILTON STREET,
WORCESTER, MA 01604

GENERAL NOTES

1. THIS PLAN WAS PREPARED BY AN ON-THE-GROUND FIELD SURVEY BY DAVID P. TERENZONI, P.L.S. IN MAY 2023.
2. THIS PLAN WAS PREPARED WITHOUT THE BENEFIT OF A TITLE REPORT.
3. AS DISPLAYED ON THE STATE'S GEOGRAPHIC INFORMATION SYSTEM (GIS) ONLINE DATABASE MASSMAPPER, THERE ARE NO JURISDICTIONAL ENVIRONMENTAL PROTECTION RESOURCE AREAS WITHIN THE PROPERTY.
4. FROM GRAPHICAL GIS DISPLAY FROM MASSMAPPER, THE PROPERTY DOES NOT CONTAIN ANY 100 YEAR FLOOD ZONES.
5. THE HORIZONTAL DATUM IS CLOSELY REPRESENTING THE NORTH AMERICAN DATUM OF 1983 (NAD83).
6. THE VERTICAL DATUM IS ON AN ASSUMED DATUM.
7. UTILITIES DISPLAYED HEREON ARE SHOWN BASED ON FIELD OBSERVATIONS AND LOCATIONS MAY BE APPROXIMATE. ADDITIONAL UTILITIES MAY BE PRESENT AND MAY BE EXAMINED FURTHER.

ZONING INFORMATION

DWELLING DISTRICT

	REQUIRED	EXISTING
MIN. FRONTAGE	50'	100'
LOT AREA MIN.	5,000 SF	12,500 SF
MAX. HEIGHT (STORIES/FEET)	NA	NA
MIN. FRONT SETBACK	15'	8.2'
MIN. SIDE SETBACK	10'	9.9'
MIN. REAR SETBACK	15'	55.2'
MAX. F.A.R.	NA	NA

LEGEND

PROPERTY LINE
FENCE LINE
ZONING BOUNDARY
MAJOR CONTOUR
MINOR CONTOUR
CURB LINE
GAS LINE
STORM DRAIN LINE
SANITARY SEWER LINE
WATER LINE
OVERHEAD UTILITY WIRES
FIBER OPTIC LINE
GAS VALVE
WATER GATE/ VALVE
FIRE HYDRANT
UTILITY POLE
SEWER MANHOLE
DRAIN MANHOLE
CATCH BASIN
ELECTRICAL MANHOLE
TELEPHONE MANHOLE
SBLDH STONE BOUND DRILL HOLE
IRON PIN
VGC VERTICAL GRANITE CURB
BOP EDGE OF PAVEMENT
EOP

10 0 5 10 20
SCALE
1 inch = 10 ft.

PREPARED BY:
FODERA
ENGINEERING
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28 Harbor St., Suite 204
Danvers, MA 01923

PREPARED FOR:
REI GROUP, LLC
214 HAMILTON STREET
WORCESTER, MA 01604

REVISION	DATE	BY
–	–	–

PROJECT LOCATION:
214 HAMILTON ST.
WORCESTER, MA 01604

PARCEL ID:
18_046_00001

PLAN SET:
PLOT PLAN
214 HAMILTON STREET
WORCESTER, MA 01604

AUGUST 3, 2023

SCALE: 1" = 10'

PROFESSIONAL SEAL:

JOB NO.: 23317-363

SHEET TITLE:
EXISTING CONDITIONS PLAN

SHEET NUMBER:
C-2

Custom Soil Resource Report
Soil Map (214 Hamilton Street, Worcester, MA)

Map Scale: 1:2,140 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

Worcester County, Massachusetts, Northeastern Part

72A—Whitman fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2zggp
Elevation: 0 to 1,080 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Whitman

Setting

Landform: Drumlins, ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from granite and gneiss and/or schist

Typical profile

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drainageways, drumlins, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 6 percent
Landform: Outwash terraces, outwash deltas, drainageways, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 3 percent
Landform: Marshes, bogs, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge

Percent of map unit: 1 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

602—Urban land

Map Unit Setting

National map unit symbol: w3q8
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

622C—Paxton-Urban land complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w67n
Elevation: 0 to 1,030 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Paxton and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Paxton

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Udorthents

Percent of map unit: 9 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Canton

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 3 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 1 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope

Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

NOAA Rainfall Data

NOAA Atlas 14, Volume 10, Version 3
Location name: Worcester, Massachusetts, USA*
Latitude: 42.257°, Longitude: -71.7718°
Elevation: 552 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.342** (0.272-0.426)	**0.403** (0.320-0.502)	**0.503** (0.397-0.629)	**0.585** (0.460-0.737)	**0.699** (0.529-0.921)	**0.785** (0.581-1.06)	**0.874** (0.625-1.23)	**0.970** (0.657-1.40)	**1.10** (0.717-1.66)	**1.21** (0.766-1.86)
10-min	**0.485** (0.385-0.603)	**0.571** (0.453-0.712)	**0.712** (0.563-0.891)	**0.829** (0.651-1.04)	**0.990** (0.750-1.30)	**1.11** (0.823-1.50)	**1.24** (0.885-1.74)	**1.38** (0.933-1.99)	**1.56** (1.02-2.36)	**1.72** (1.09-2.64)
15-min	**0.570** (0.453-0.710)	**0.672** (0.533-0.837)	**0.838** (0.662-1.05)	**0.976** (0.767-1.23)	**1.16** (0.882-1.54)	**1.31** (0.968-1.76)	**1.46** (1.04-2.04)	**1.62** (1.10-2.34)	**1.84** (1.20-2.77)	**2.02** (1.28-3.11)
30-min	**0.773** (0.614-0.962)	**0.911** (0.723-1.14)	**1.14** (0.899-1.42)	**1.32** (1.04-1.67)	**1.58** (1.20-2.09)	**1.78** (1.32-2.40)	**1.98** (1.42-2.78)	**2.20** (1.49-3.18)	**2.50** (1.63-3.77)	**2.74** (1.74-4.23)
60-min	**0.975** (0.775-1.21)	**1.15** (0.913-1.43)	**1.44** (1.14-1.80)	**1.67** (1.32-2.11)	**2.00** (1.52-2.64)	**2.25** (1.66-3.03)	**2.50** (1.79-3.51)	**2.78** (1.88-4.03)	**3.17** (2.06-4.76)	**3.47** (2.20-5.35)
2-hr	**1.23** (0.985-1.52)	**1.46** (1.17-1.81)	**1.84** (1.47-2.29)	**2.16** (1.71-2.70)	**2.59** (1.98-3.41)	**2.92** (2.18-3.93)	**3.26** (2.36-4.59)	**3.66** (2.49-5.27)	**4.24** (2.76-6.34)	**4.72** (3.00-7.22)
3-hr	**1.41** (1.13-1.74)	**1.68** (1.35-2.08)	**2.13** (1.70-2.64)	**2.50** (1.99-3.12)	**3.02** (2.31-3.96)	**3.40** (2.55-4.57)	**3.80** (2.77-5.35)	**4.28** (2.92-6.15)	**5.00** (3.26-7.46)	**5.61** (3.57-8.55)
6-hr	**1.77** (1.43-2.17)	**2.13** (1.72-2.61)	**2.72** (2.19-3.35)	**3.21** (2.56-3.98)	**3.89** (3.00-5.08)	**4.39** (3.31-5.88)	**4.93** (3.61-6.91)	**5.58** (3.81-7.96)	**6.56** (4.30-9.72)	**7.40** (4.72-11.2)
12-hr	**2.19** (1.78-2.67)	**2.66** (2.16-3.25)	**3.43** (2.77-4.20)	**4.07** (3.27-5.01)	**4.94** (3.83-6.42)	**5.59** (4.24-7.45)	**6.29** (4.63-8.77)	**7.13** (4.89-10.1)	**8.41** (5.52-12.4)	**9.49** (6.07-14.3)
24-hr	**2.61** (2.13-3.15)	**3.19** (2.60-3.86)	**4.14** (3.36-5.03)	**4.92** (3.98-6.02)	**6.01** (4.69-7.76)	**6.81** (5.20-9.02)	**7.68** (5.68-10.6)	**8.73** (6.01-12.3)	**10.3** (6.80-15.1)	**11.7** (7.50-17.5)
2-day	**2.96** (2.44-3.56)	**3.64** (2.99-4.38)	**4.75** (3.89-5.74)	**5.68** (4.62-6.90)	**6.94** (5.46-8.93)	**7.88** (6.06-10.4)	**8.90** (6.64-12.3)	**10.2** (7.02-14.2)	**12.1** (8.00-17.6)	**13.8** (8.87-20.5)
3-day	**3.22** (2.66-3.85)	**3.95** (3.26-4.74)	**5.15** (4.23-6.20)	**6.14** (5.01-7.44)	**7.51** (5.92-9.61)	**8.51** (6.56-11.2)	**9.61** (7.19-13.2)	**11.0** (7.60-15.3)	**13.1** (8.66-18.9)	**14.9** (9.61-22.0)
4-day	**3.45** (2.86-4.12)	**4.22** (3.49-5.05)	**5.47** (4.51-6.57)	**6.52** (5.33-7.87)	**7.95** (6.28-10.1)	**9.00** (6.96-11.8)	**10.2** (7.61-13.9)	**11.6** (8.03-16.1)	**13.8** (9.14-19.9)	**15.7** (10.1-23.1)
7-day	**4.12** (3.43-4.90)	**4.95** (4.12-5.90)	**6.32** (5.23-7.55)	**7.45** (6.13-8.95)	**9.00** (7.14-11.4)	**10.2** (7.86-13.2)	**11.4** (8.55-15.5)	**12.9** (8.99-17.8)	**15.2** (10.1-21.8)	**17.1** (11.1-25.1)
10-day	**4.78** (4.00-5.67)	**5.65** (4.72-6.70)	**7.07** (5.88-8.42)	**8.25** (6.82-9.89)	**9.88** (7.85-12.4)	**11.1** (8.60-14.3)	**12.4** (9.27-16.7)	**13.9** (9.71-19.1)	**16.2** (10.8-23.1)	**18.1** (11.7-26.4)
20-day	**6.82** (5.74-8.03)	**7.75** (6.51-9.13)	**9.26** (7.75-11.0)	**10.5** (8.73-12.5)	**12.2** (9.75-15.2)	**13.5** (10.5-17.2)	**14.9** (11.1-19.6)	**16.3** (11.5-22.3)	**18.3** (12.3-26.0)	**19.9** (12.9-28.9)
30-day	**8.53** (7.21-10.0)	**9.49** (8.00-11.1)	**11.0** (9.28-13.0)	**12.3** (10.3-14.6)	**14.1** (11.3-17.4)	**15.5** (12.0-19.5)	**16.9** (12.5-22.0)	**18.2** (12.9-24.7)	**20.0** (13.4-28.2)	**21.3** (13.9-30.8)
45-day	**10.7** (9.04-12.5)	**11.6** (9.87-13.6)	**13.3** (11.2-15.6)	**14.6** (12.2-17.3)	**16.4** (13.2-20.1)	**17.9** (13.9-22.4)	**19.3** (14.3-24.9)	**20.6** (14.6-27.8)	**22.1** (14.9-31.0)	**23.2** (15.1-33.4)
60-day	**12.4** (10.6-14.5)	**13.5** (11.4-15.7)	**15.1** (12.8-17.7)	**16.5** (13.9-19.5)	**18.4** (14.8-22.5)	**19.9** (15.5-24.8)	**21.4** (15.9-27.4)	**22.6** (16.0-30.4)	**24.0** (16.2-33.6)	**24.9** (16.3-35.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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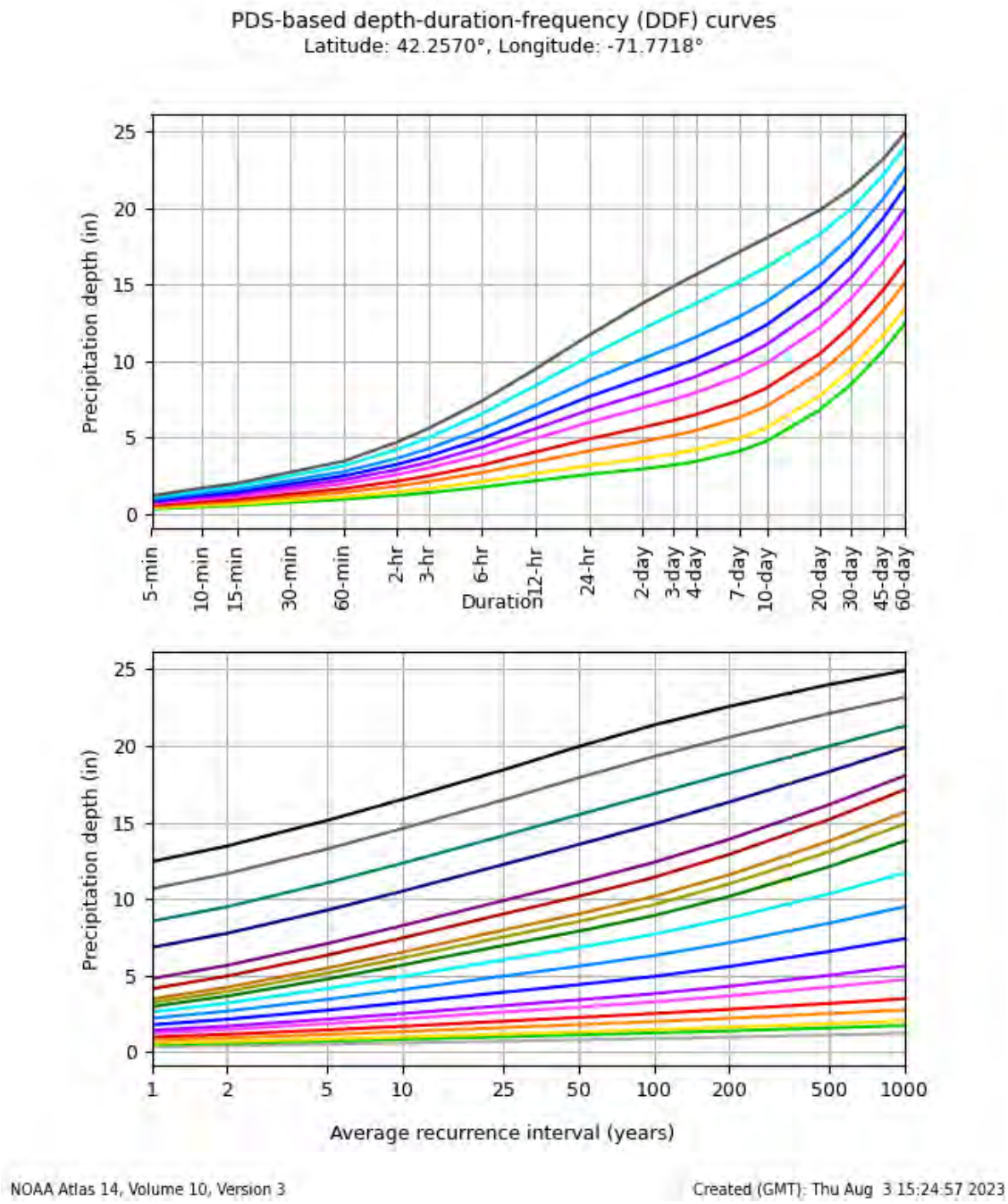
PF graphical



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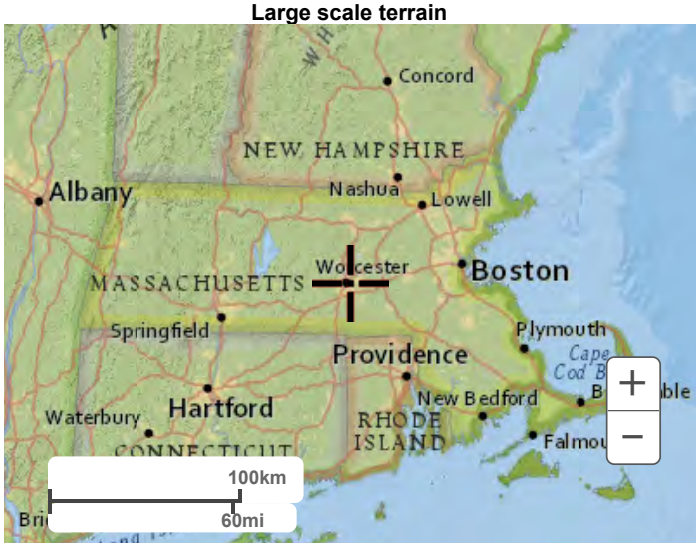
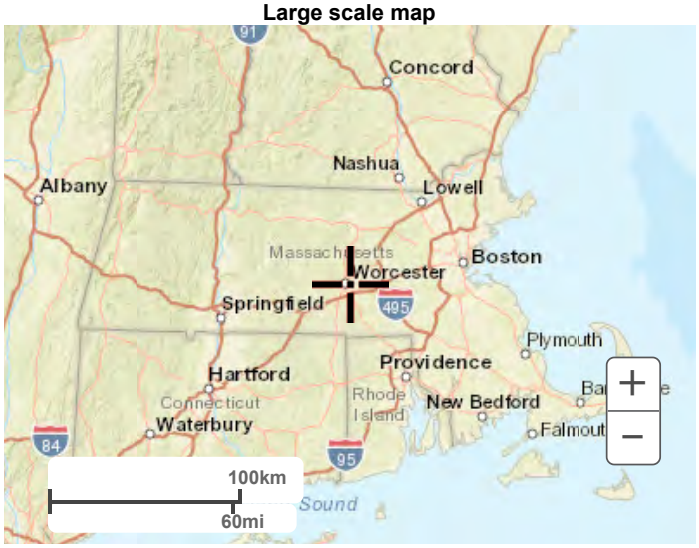
Maps & aerials

Small scale terrain

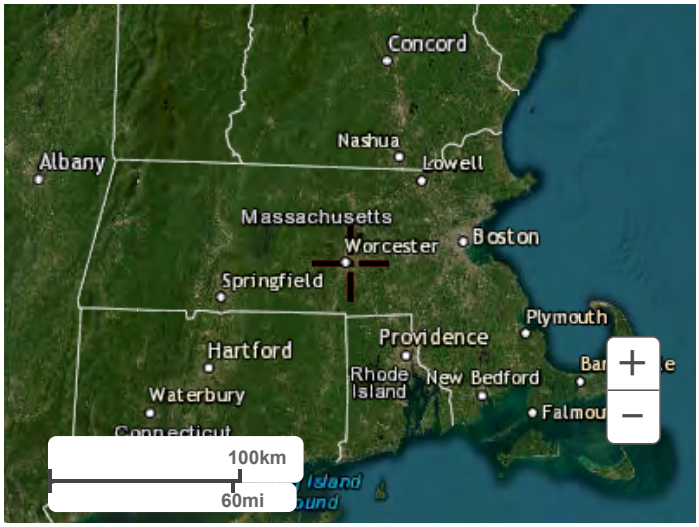
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

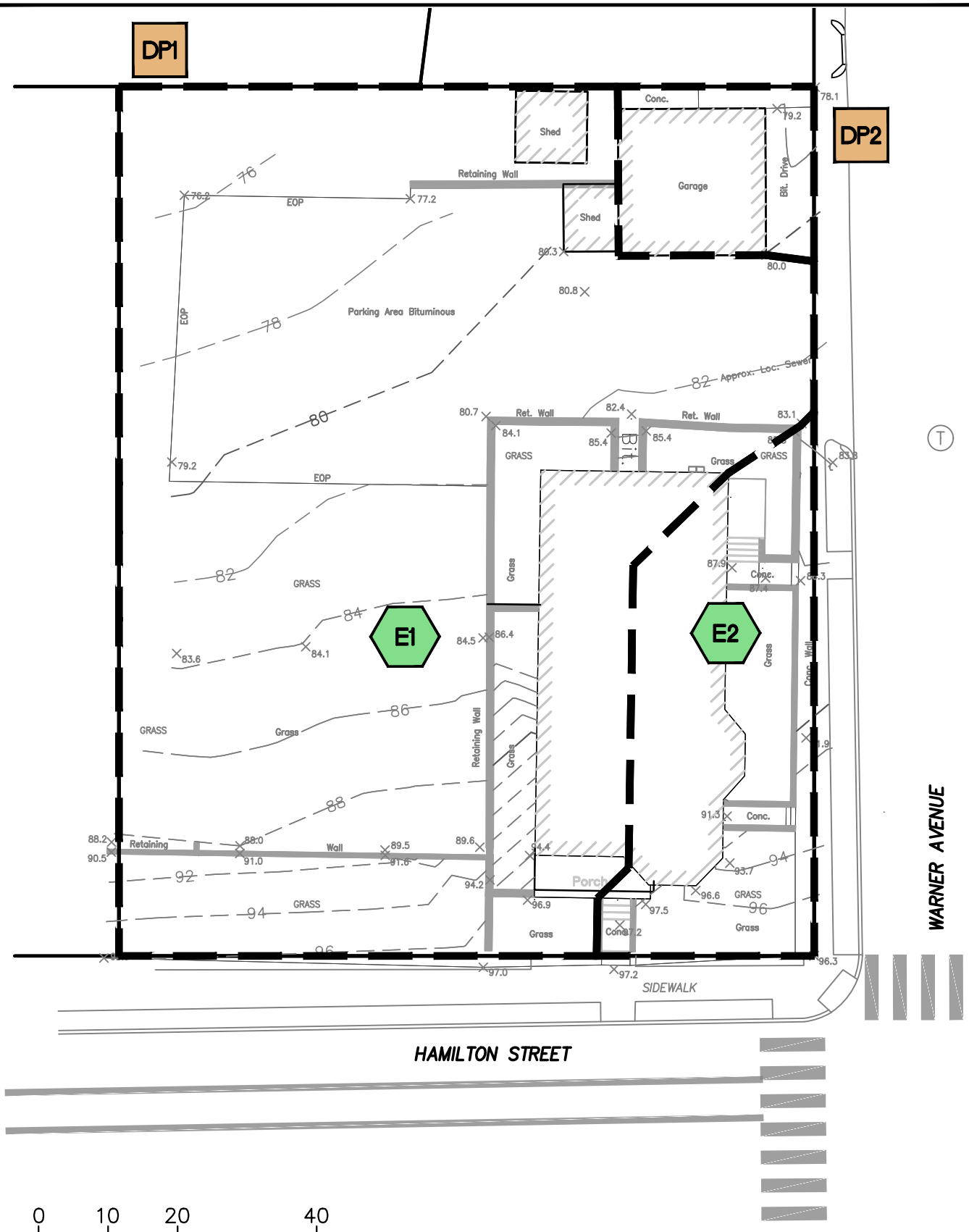
APPENDIX B – STORMWATER CALCAULATIONS

Standard 2 – Peak Rate of Runoff

Standard 3 – Groundwater Recharge

Standard 4 – Water Quality

Standard 2 – Peak Rate of Runoff

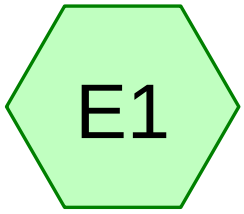


0 10 20 40

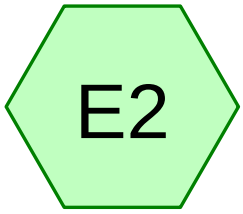
SCALE
1 inch = 20 ft.

PRE-DEVELOPMENT DRAINAGE MAP

SCALE: 1" = 20'



To South Abutter



To Warner Ave

Subcat Reach Pond Link

Routing Diagram for 2023-09-19_PRE-DRAINAGE_MASTER
Prepared by {enter your company name here}, Printed 9/20/2023

Summary for Subcatchment E1: To South Abutter

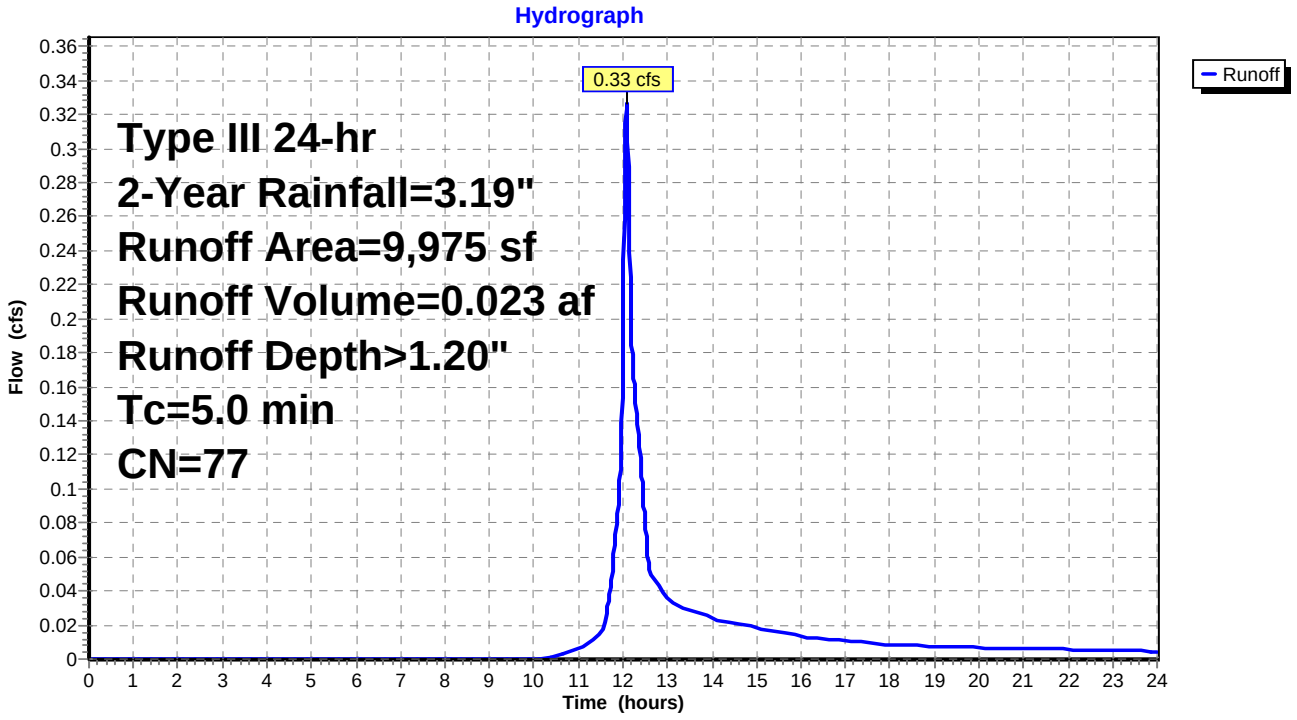
Runoff = 0.33 cfs @ 12.08 hrs, Volume= 0.023 af, Depth> 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.19"

	Area (sf)	CN	Description
*	4,400	98	Impervious, HSG A
	5,575	61	>75% Grass cover, Good, HSG B
	9,975	77	Weighted Average
	5,575		55.89% Pervious Area
	4,400		44.11% Impervious Area

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

Subcatchment E1: To South Abutter



Summary for Subcatchment E2: To Warner Ave

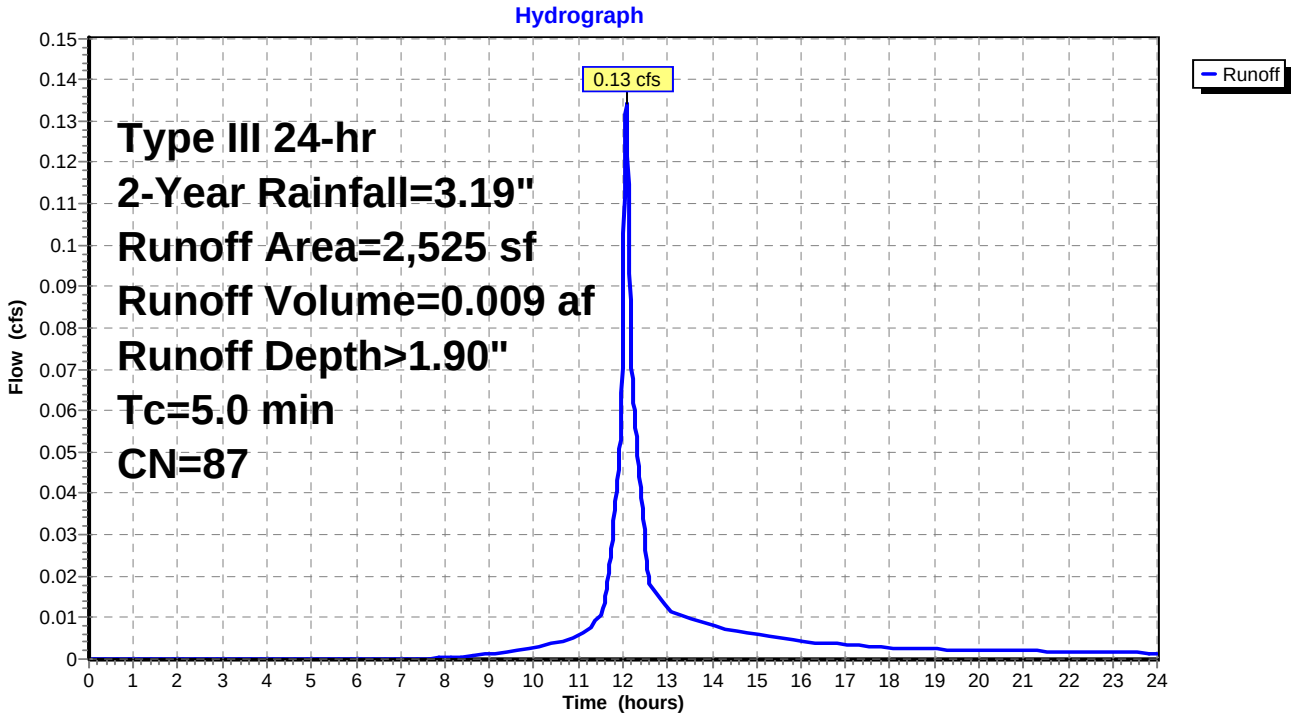
Runoff = 0.13 cfs @ 12.07 hrs, Volume= 0.009 af, Depth> 1.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.19"

	Area (sf)	CN	Description
*	1,805	98	Impervious, HSG A
	720	61	>75% Grass cover, Good, HSG B
	2,525	87	Weighted Average
	720		28.51% Pervious Area
	1,805		71.49% Impervious Area

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

Subcatchment E2: To Warner Ave



Summary for Subcatchment E1: To South Abutter

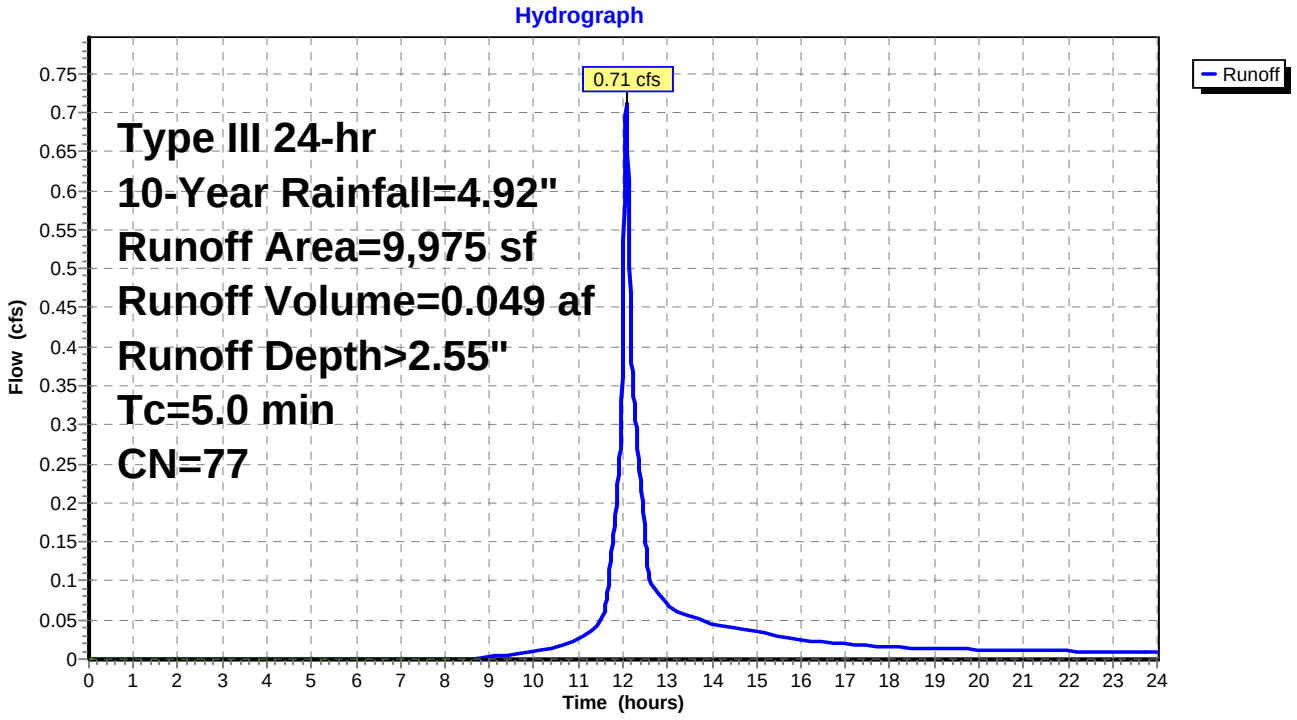
Runoff = 0.71 cfs @ 12.08 hrs, Volume= 0.049 af, Depth> 2.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

	Area (sf)	CN	Description
*	4,400	98	Impervious, HSG A
	5,575	61	>75% Grass cover, Good, HSG B
	9,975	77	Weighted Average
	5,575		55.89% Pervious Area
	4,400		44.11% Impervious Area

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

Subcatchment E1: To South Abutter



Summary for Subcatchment E2: To Warner Ave

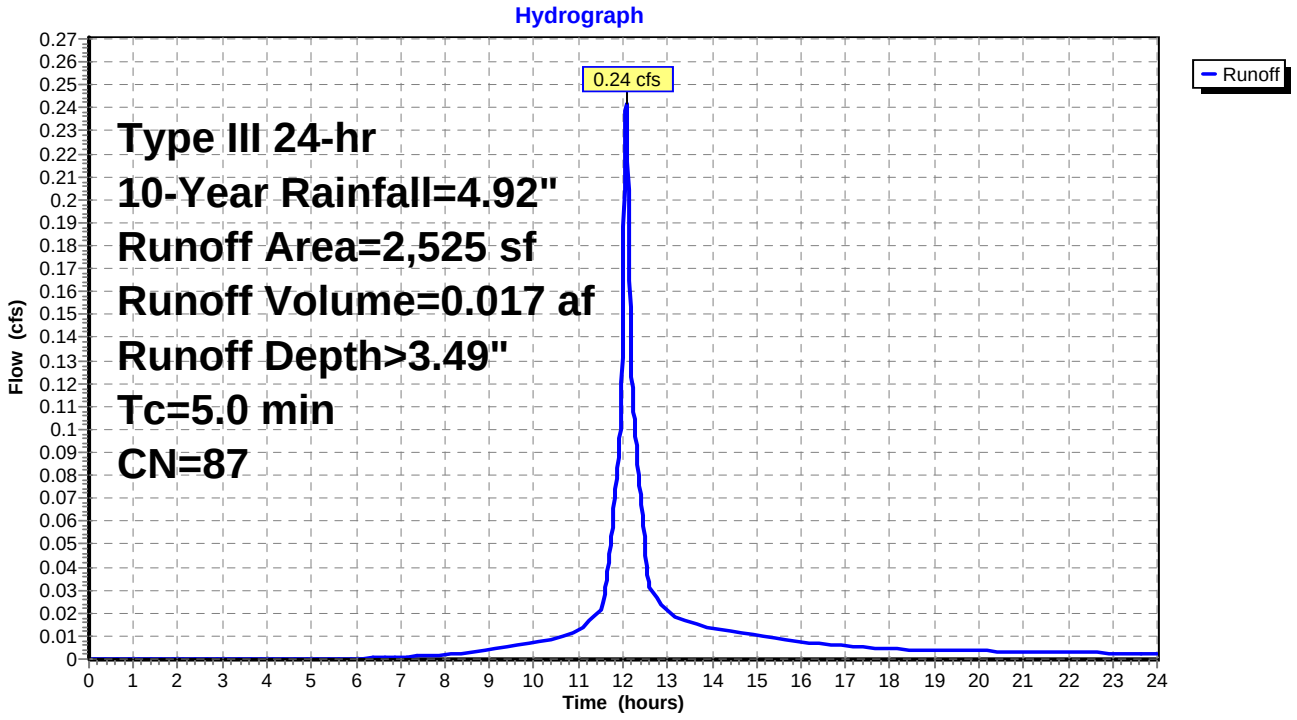
Runoff = 0.24 cfs @ 12.07 hrs, Volume= 0.017 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

	Area (sf)	CN	Description
*	1,805	98	Impervious, HSG A
	720	61	>75% Grass cover, Good, HSG B
	2,525	87	Weighted Average
	720		28.51% Pervious Area
	1,805		71.49% Impervious Area

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

Subcatchment E2: To Warner Ave



Summary for Subcatchment E1: To South Abutter

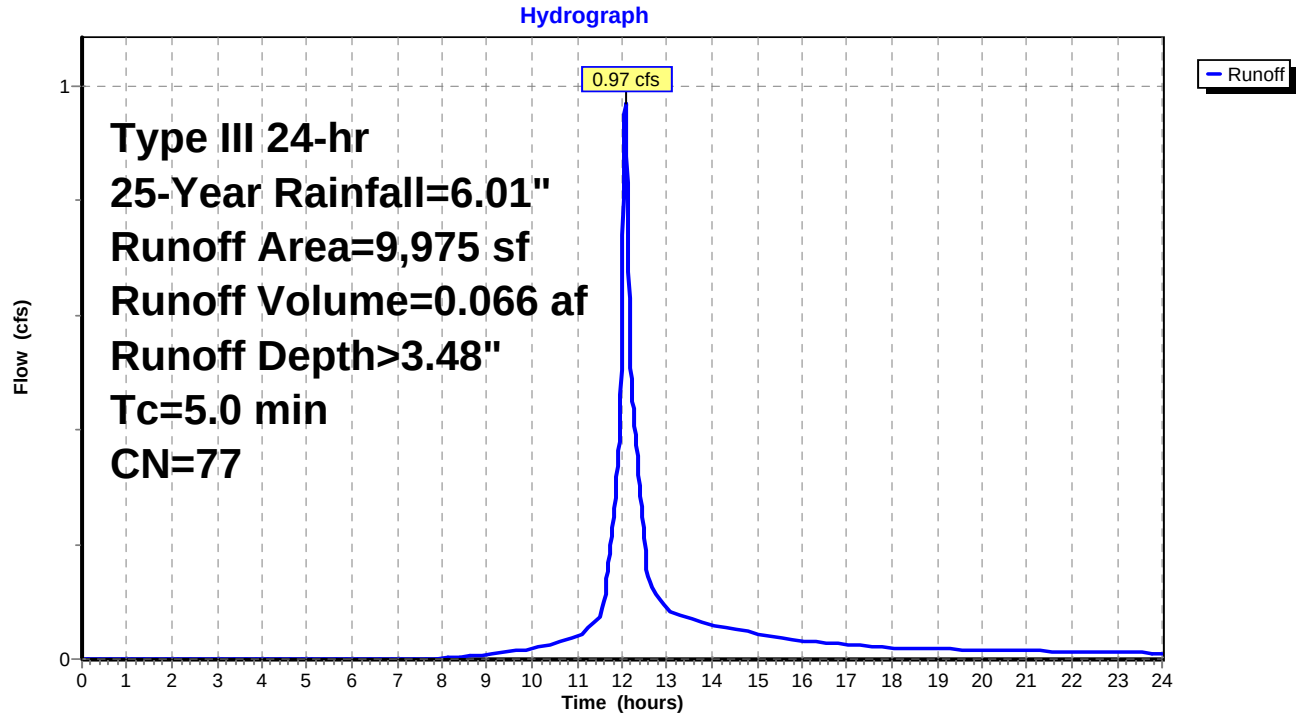
Runoff = 0.97 cfs @ 12.07 hrs, Volume= 0.066 af, Depth> 3.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.01"

	Area (sf)	CN	Description
*	4,400	98	Impervious, HSG A
	5,575	61	>75% Grass cover, Good, HSG B
	9,975	77	Weighted Average
	5,575		55.89% Pervious Area
	4,400		44.11% Impervious Area

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

Subcatchment E1: To South Abutter



Summary for Subcatchment E2: To Warner Ave

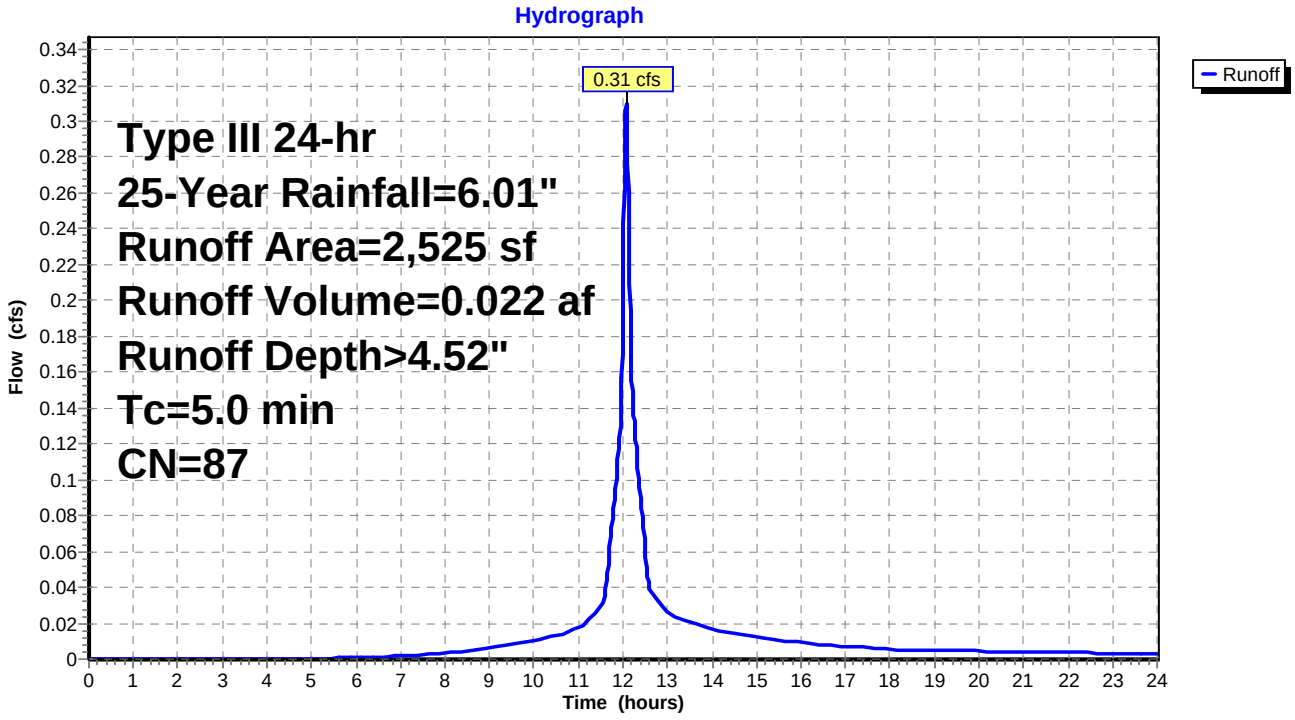
Runoff = 0.31 cfs @ 12.07 hrs, Volume= 0.022 af, Depth> 4.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.01"

	Area (sf)	CN	Description
*	1,805	98	Impervious, HSG A
	720	61	>75% Grass cover, Good, HSG B
	2,525	87	Weighted Average
	720		28.51% Pervious Area
	1,805		71.49% Impervious Area

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

Subcatchment E2: To Warner Ave



Summary for Subcatchment E1: To South Abutter

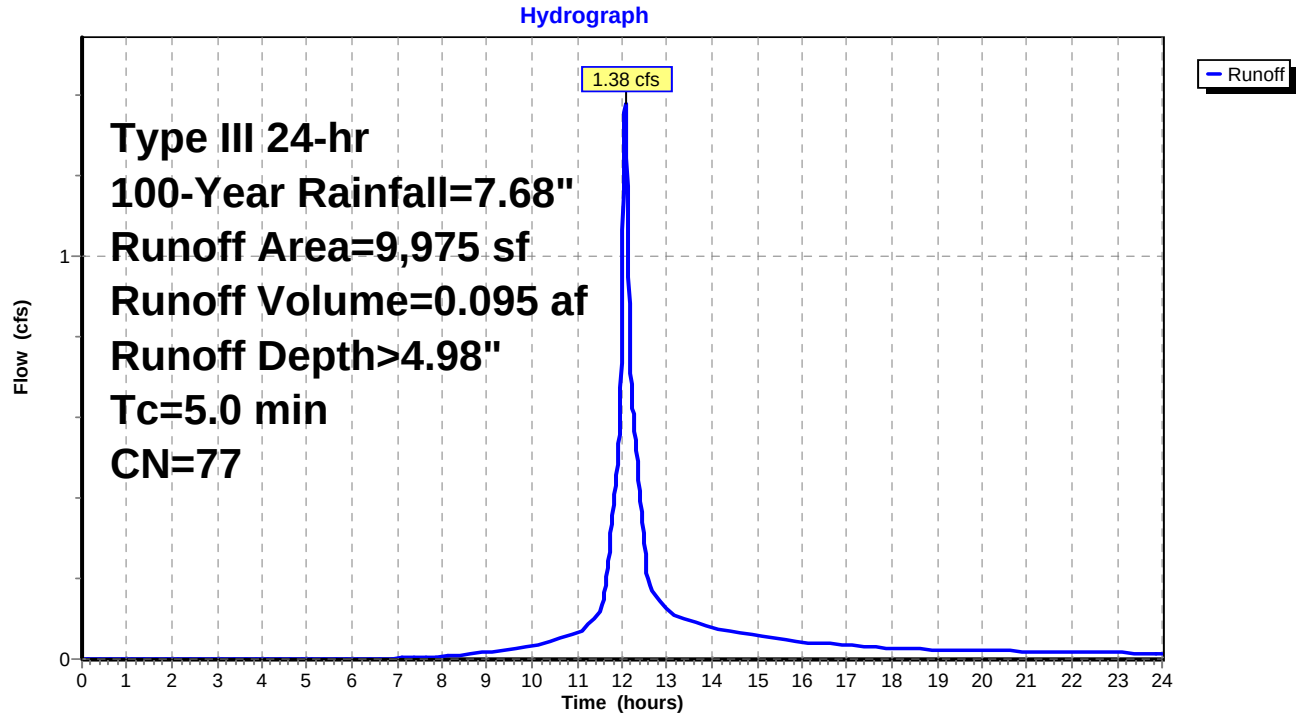
Runoff = 1.38 cfs @ 12.07 hrs, Volume= 0.095 af, Depth> 4.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.68"

	Area (sf)	CN	Description
*	4,400	98	Impervious, HSG A
	5,575	61	>75% Grass cover, Good, HSG B
	9,975	77	Weighted Average
	5,575		55.89% Pervious Area
	4,400		44.11% Impervious Area

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

Subcatchment E1: To South Abutter



Summary for Subcatchment E2: To Warner Ave

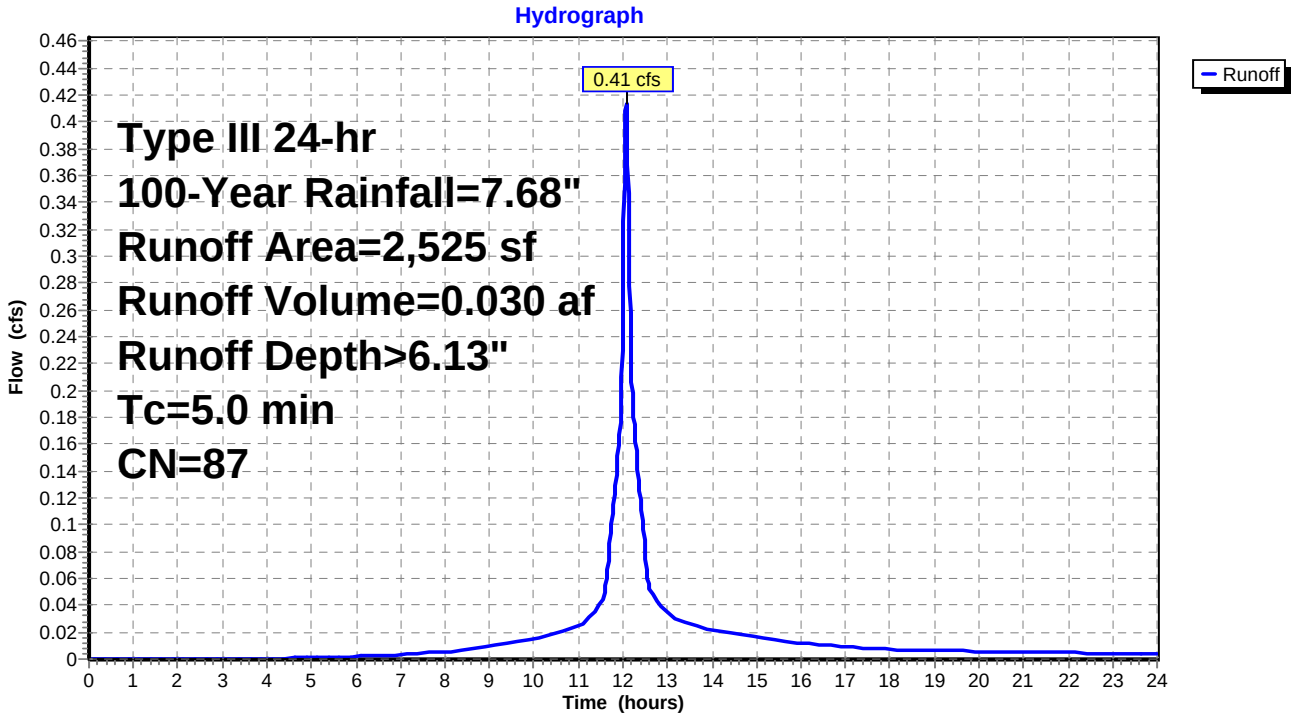
Runoff = 0.41 cfs @ 12.07 hrs, Volume= 0.030 af, Depth> 6.13"

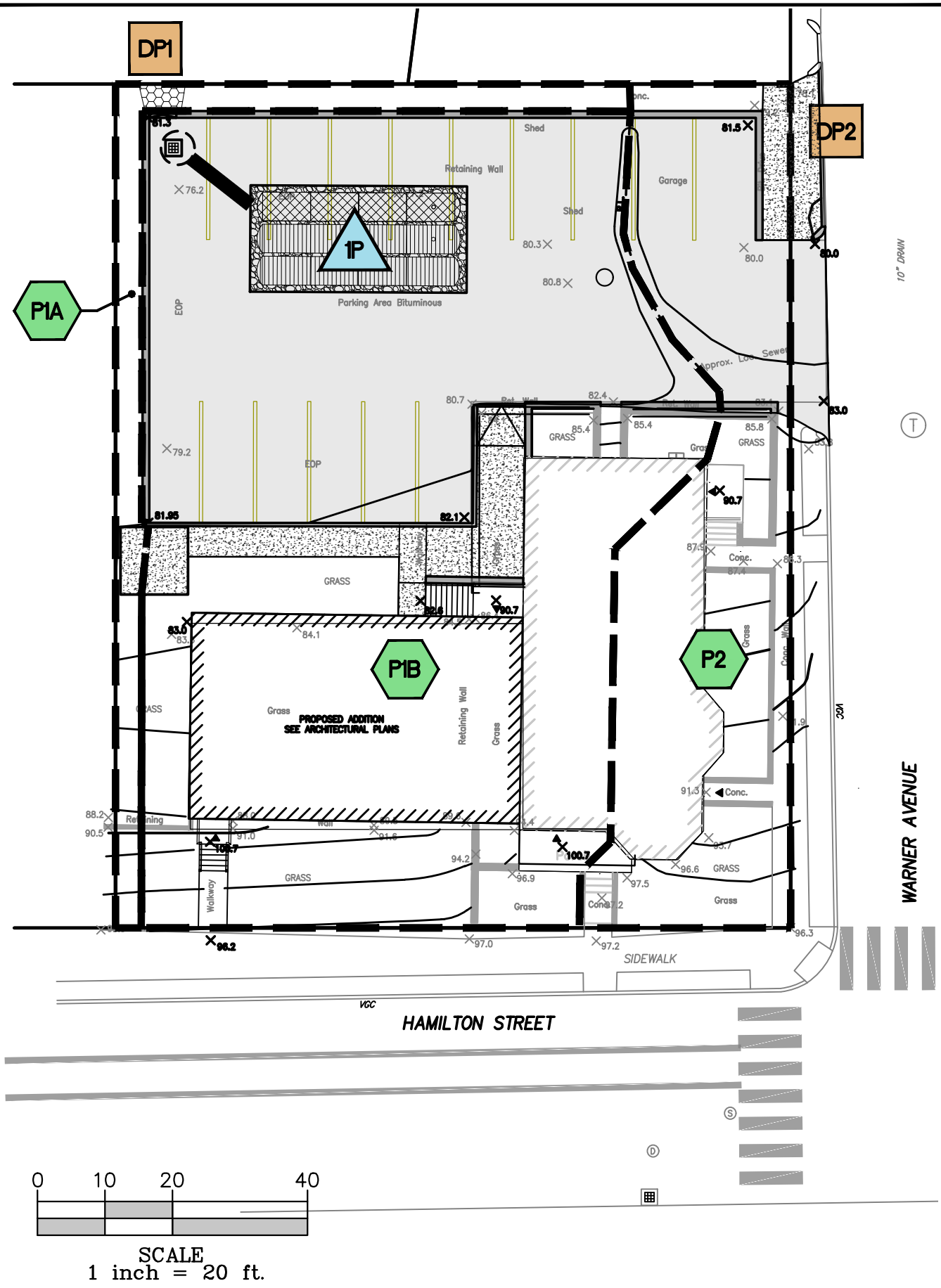
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.68"

	Area (sf)	CN	Description
*	1,805	98	Impervious, HSG A
	720	61	>75% Grass cover, Good, HSG B
	2,525	87	Weighted Average
	720		28.51% Pervious Area
	1,805		71.49% Impervious Area

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

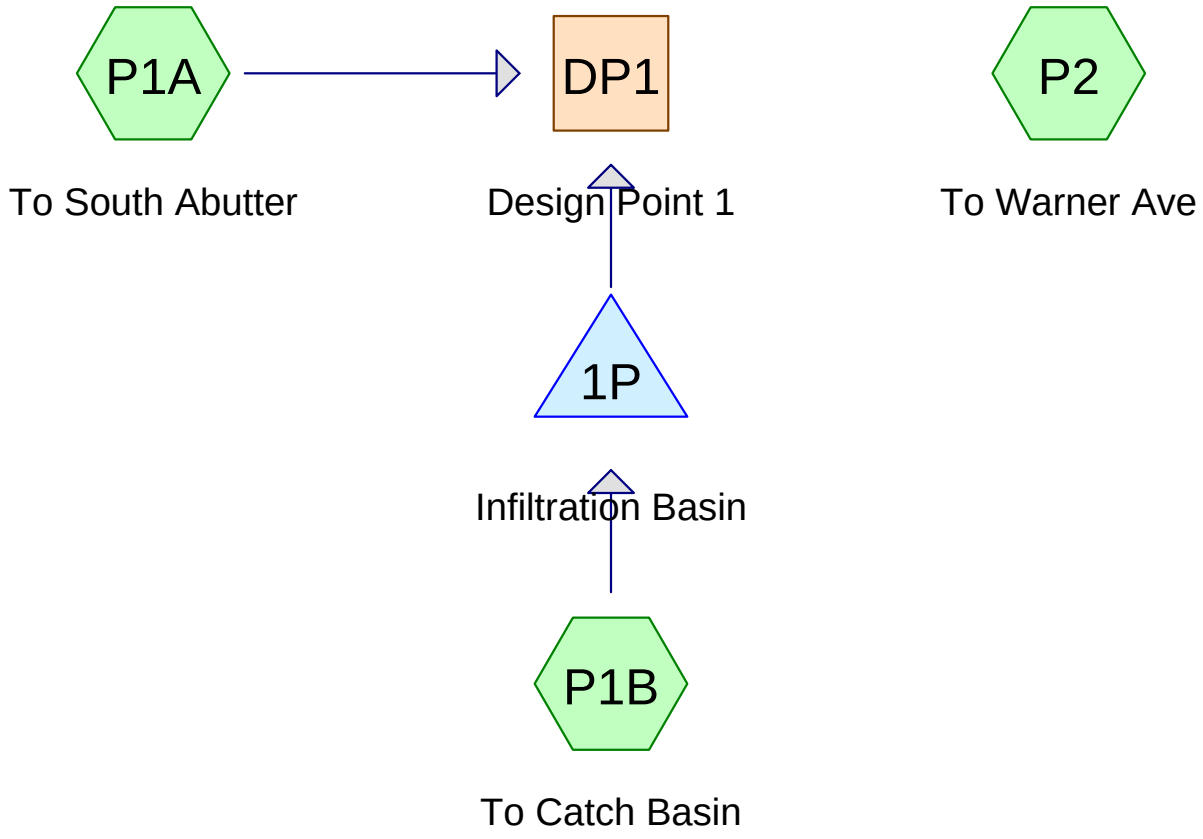
Subcatchment E2: To Warner Ave





POST-DEVELOPMENT DRAINAGE MAP

SCALE: 1" = 20'



Subcat Reach Pond Link

Routing Diagram for 2023-09-19_POST-DRAINAGE_MASTER
Prepared by {enter your company name here}, Printed 9/20/2023

Summary for Subcatchment P1A: To South Abutter

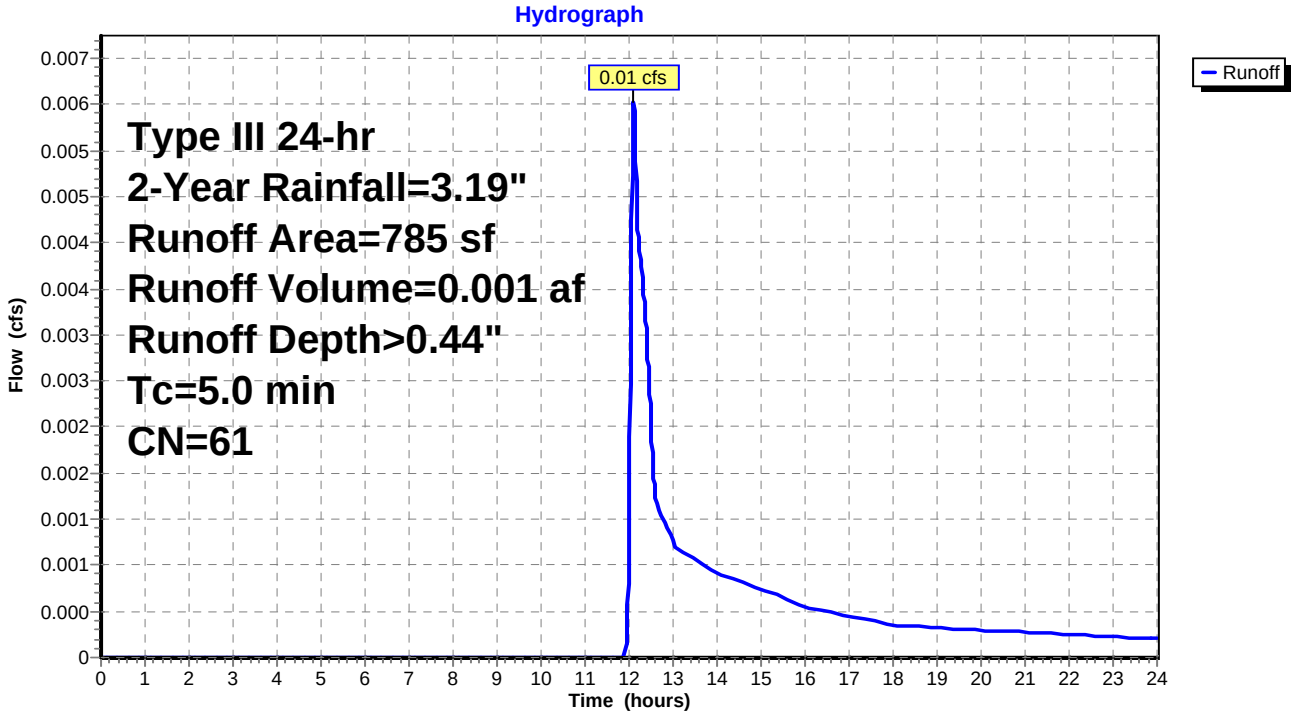
Runoff = 0.01 cfs @ 12.11 hrs, Volume= 0.001 af, Depth> 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.19"

Area (sf)	CN	Description
785	61	>75% Grass cover, Good, HSG B
785		100.00% Pervious Area

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

Subcatchment P1A: To South Abutter



Summary for Subcatchment P1B: To Catch Basin

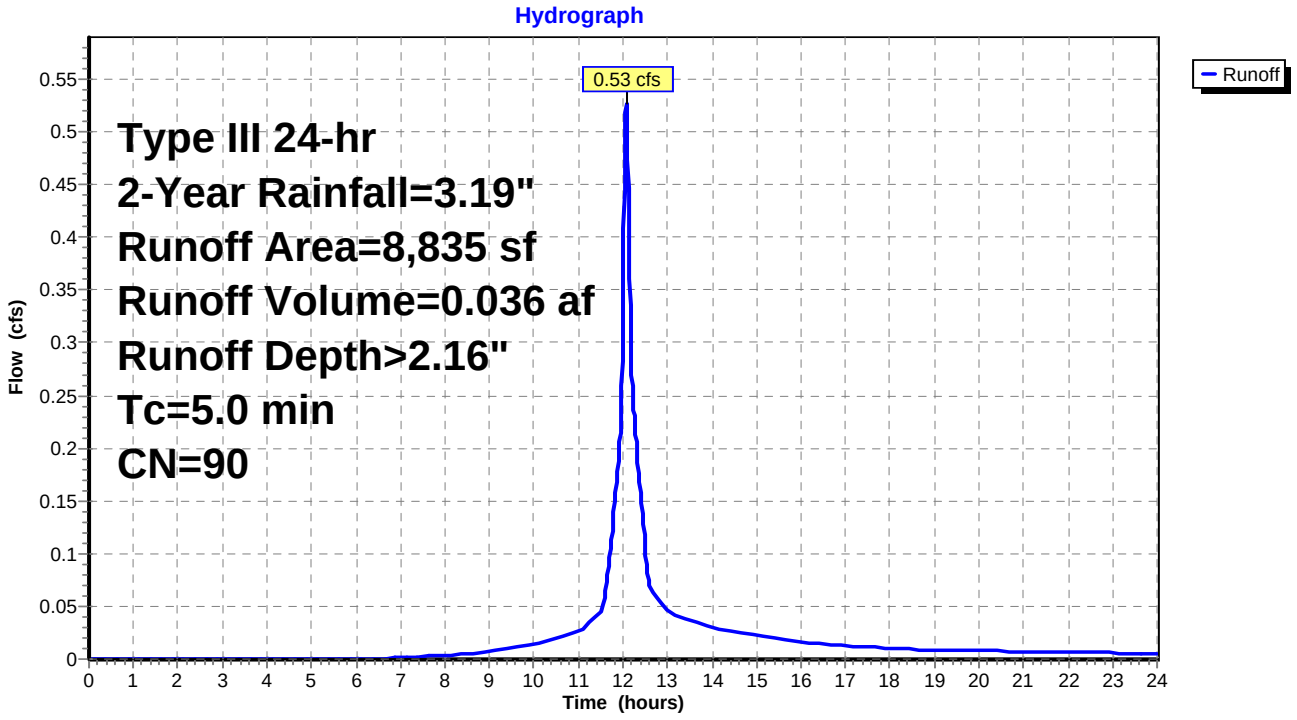
Runoff = 0.53 cfs @ 12.07 hrs, Volume= 0.036 af, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.19"

	Area (sf)	CN	Description
*	6,860	98	Impervious, HSG A
	1,975	61	>75% Grass cover, Good, HSG B
	8,835	90	Weighted Average
	1,975		22.35% Pervious Area
	6,860		77.65% Impervious Area

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

Subcatchment P1B: To Catch Basin



Summary for Subcatchment P2: To Warner Ave

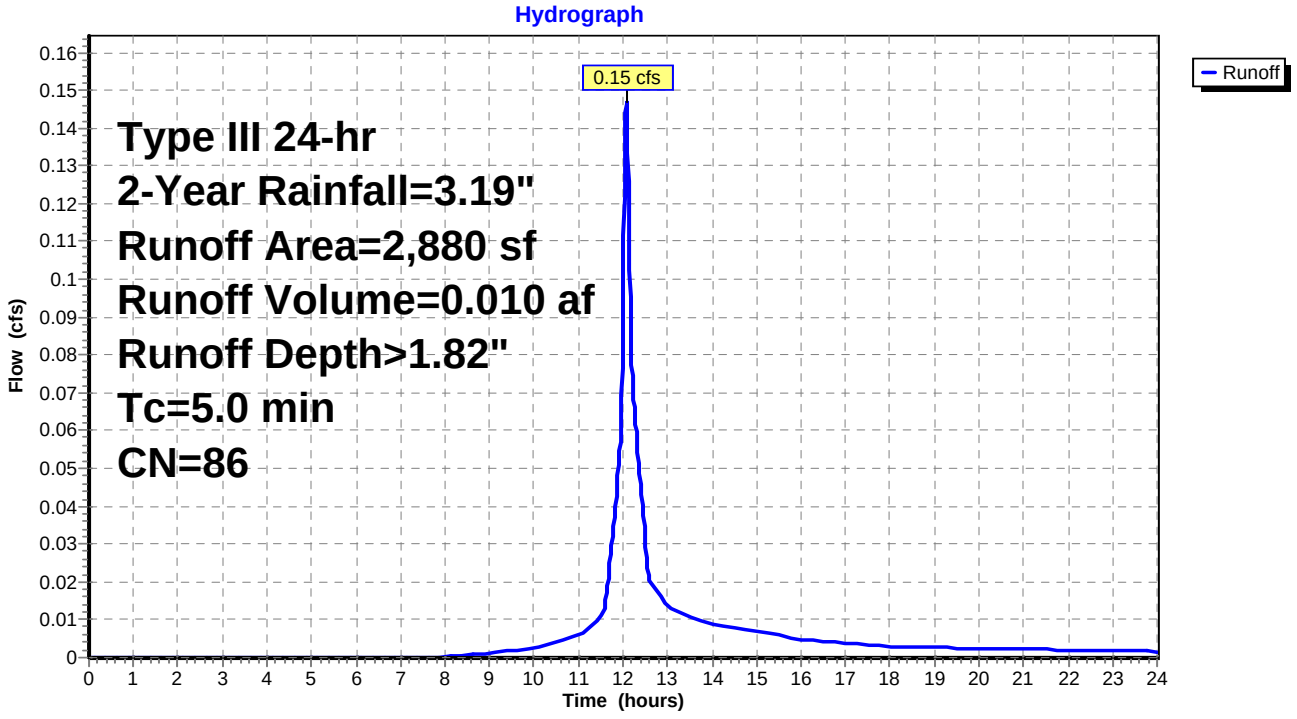
Runoff = 0.15 cfs @ 12.07 hrs, Volume= 0.010 af, Depth> 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.19"

Area (sf)	CN	Description
1,975	98	Unconnected pavement, HSG A
905	61	>75% Grass cover, Good, HSG B
2,880	86	Weighted Average
905		31.42% Pervious Area
1,975		68.58% Impervious Area
1,975		100.00% Unconnected

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

Subcatchment P2: To Warner Ave

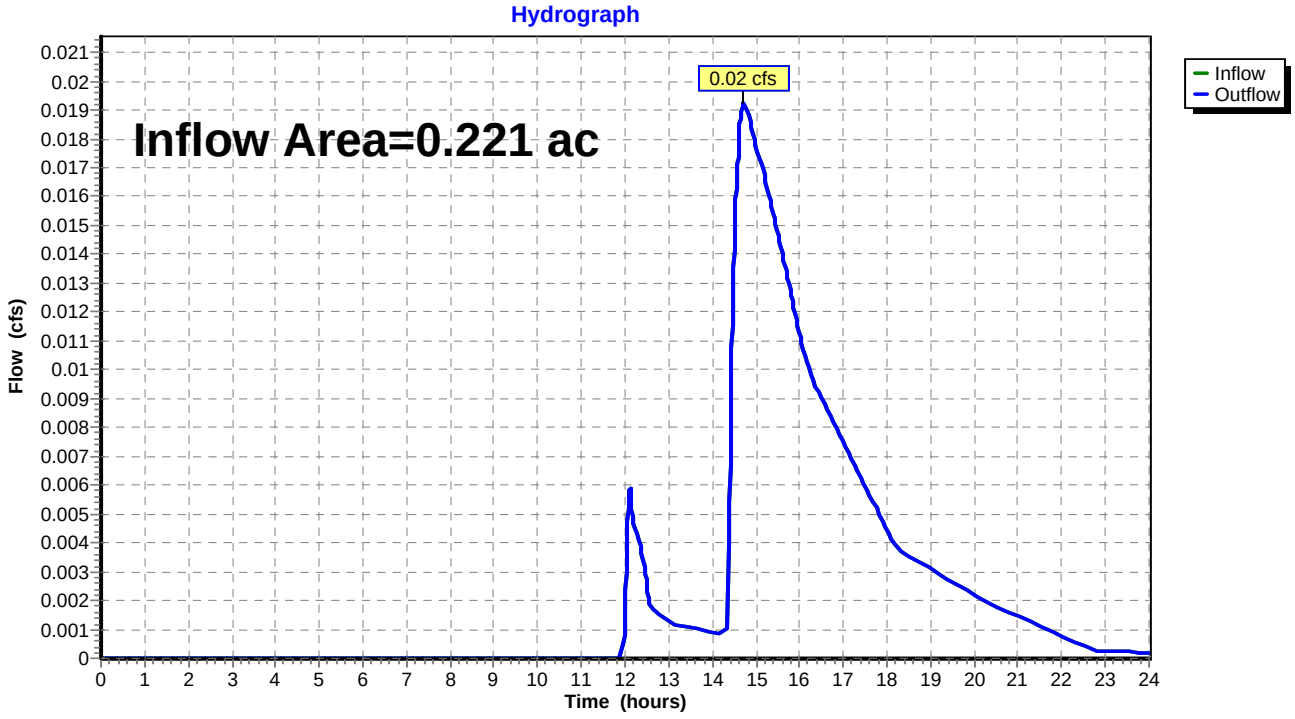


Summary for Reach DP1: Design Point 1

Inflow Area = 0.221 ac, 71.31% Impervious, Inflow Depth > 0.24" for 2-Year event
Inflow = 0.02 cfs @ 14.71 hrs, Volume= 0.004 af
Outflow = 0.02 cfs @ 14.71 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: Design Point 1



Summary for Pond 1P: Infiltration Basin

Inflow Area = 0.203 ac, 77.65% Impervious, Inflow Depth > 2.16" for 2-Year event
Inflow = 0.53 cfs @ 12.07 hrs, Volume= 0.036 af
Outflow = 0.02 cfs @ 14.72 hrs, Volume= 0.012 af, Atten= 95%, Lag= 158.6 min
Discarded = 0.01 cfs @ 9.13 hrs, Volume= 0.008 af
Primary = 0.02 cfs @ 14.72 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 81.36' @ 14.72 hrs Surf.Area= 506 sf Storage= 1,084 cf

Plug-Flow detention time= 295.7 min calculated for 0.012 af (32% of inflow)
Center-of-Mass det. time= 164.4 min (969.9 - 805.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	76.70'	487 cf	**15.75'W x 32.10'L x 3.50'H Field A** 1,769 cf Overall - 551 cf Embedded = 1,218 cf x 40.0% Voids
#2A	77.20'	551 cf	**ADS_StormTech SC-740 +Cap** x 12 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 3 Rows
#3	81.20'	1,388 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious
		2,426 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.20	1	0	0
81.50	1,000	150	150
82.00	3,950	1,238	1,388

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.70'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	81.35'	**3.0' long (Profile 14) Broad-Crested Rectangular Weir** Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.37 3.37 3.37 3.37 3.37

Discarded OutFlow Max=0.01 cfs @ 9.13 hrs HW=76.75' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.02 cfs @ 14.72 hrs HW=81.36' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.41 fps)

Pond 1P: Infiltration Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

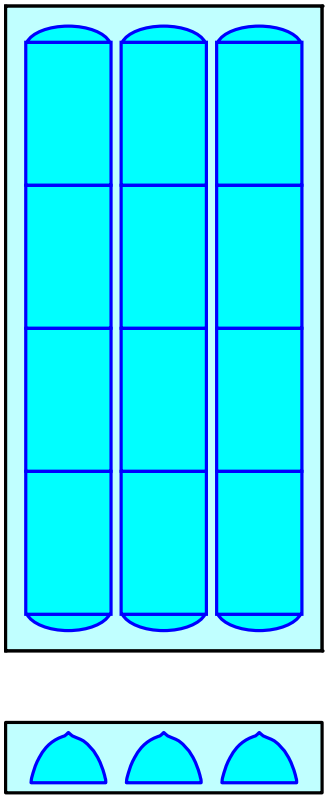
4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

12 Chambers x 45.9 cf = 551.3 cf Chamber Storage

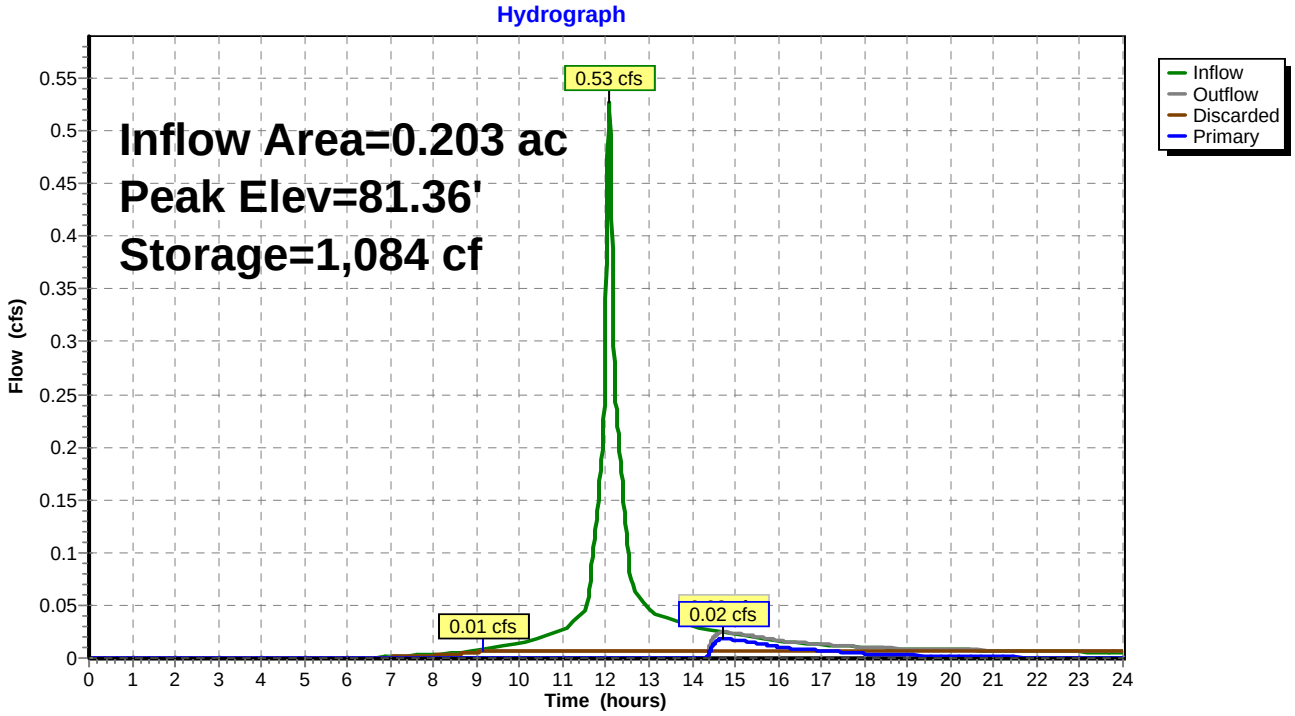
1,769.3 cf Field - 551.3 cf Chambers = 1,218.0 cf Stone x 40.0% Voids = 487.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,038.5 cf = 0.024 af
Overall Storage Efficiency = 58.7%
Overall System Size = 32.10' x 15.75' x 3.50'

12 Chambers
65.5 cy Field
45.1 cy Stone



Pond 1P: Infiltration Basin



Summary for Subcatchment P1A: To South Abutter

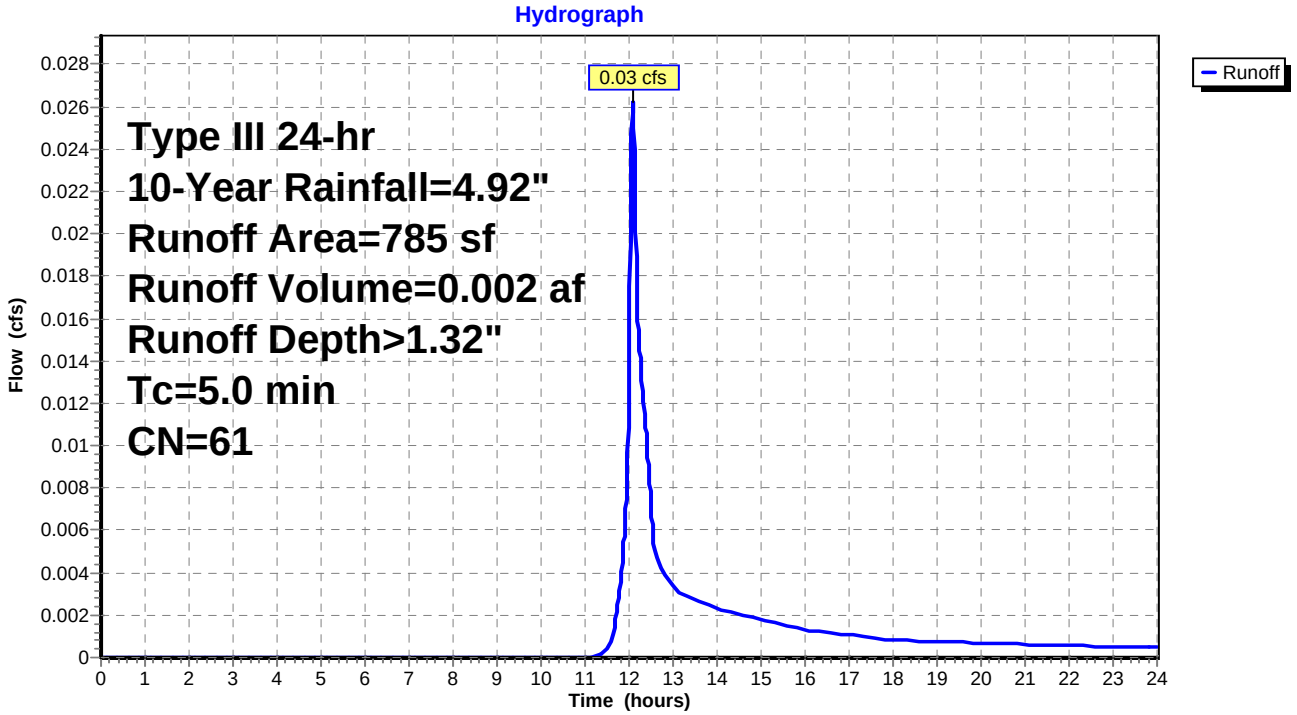
Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
785	61	>75% Grass cover, Good, HSG B
785		100.00% Pervious Area

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

Subcatchment P1A: To South Abutter



Summary for Subcatchment P1B: To Catch Basin

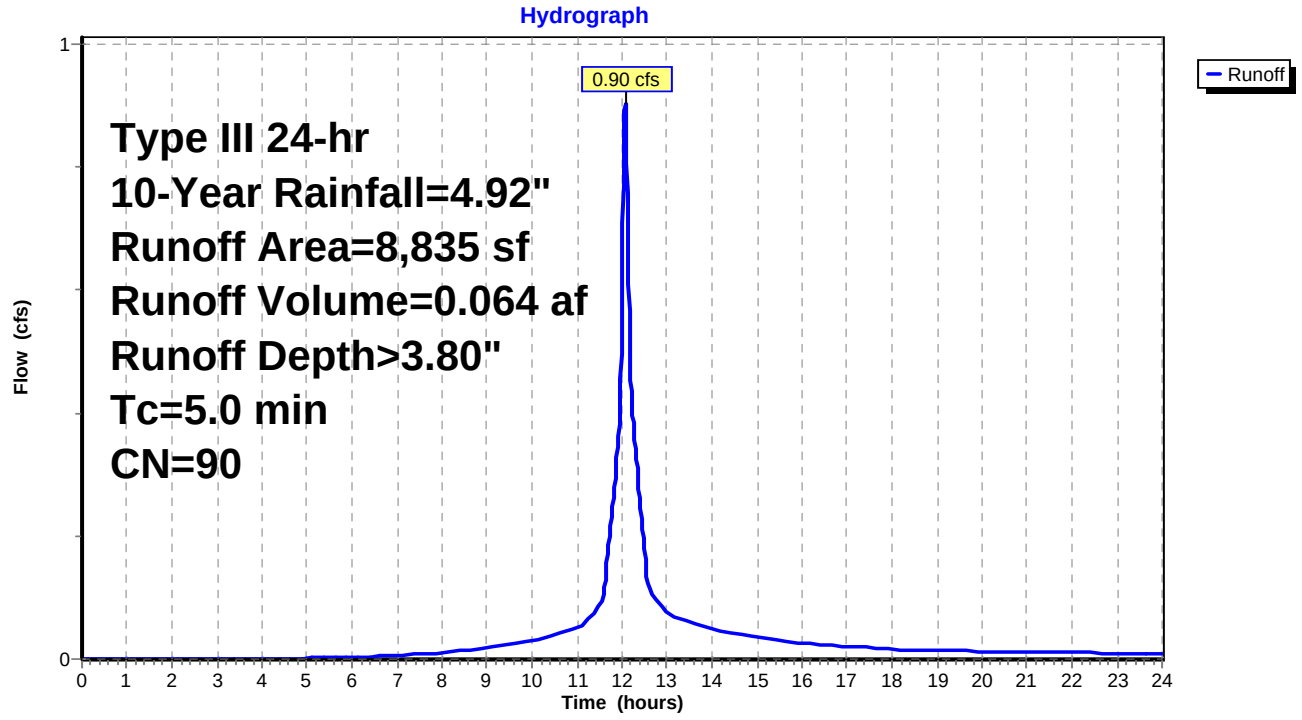
Runoff = 0.90 cfs @ 12.07 hrs, Volume= 0.064 af, Depth> 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

	Area (sf)	CN	Description
*	6,860	98	Impervious, HSG A
	1,975	61	>75% Grass cover, Good, HSG B
	8,835	90	Weighted Average
	1,975		22.35% Pervious Area
	6,860		77.65% Impervious Area

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

Subcatchment P1B: To Catch Basin



Summary for Subcatchment P2: To Warner Ave

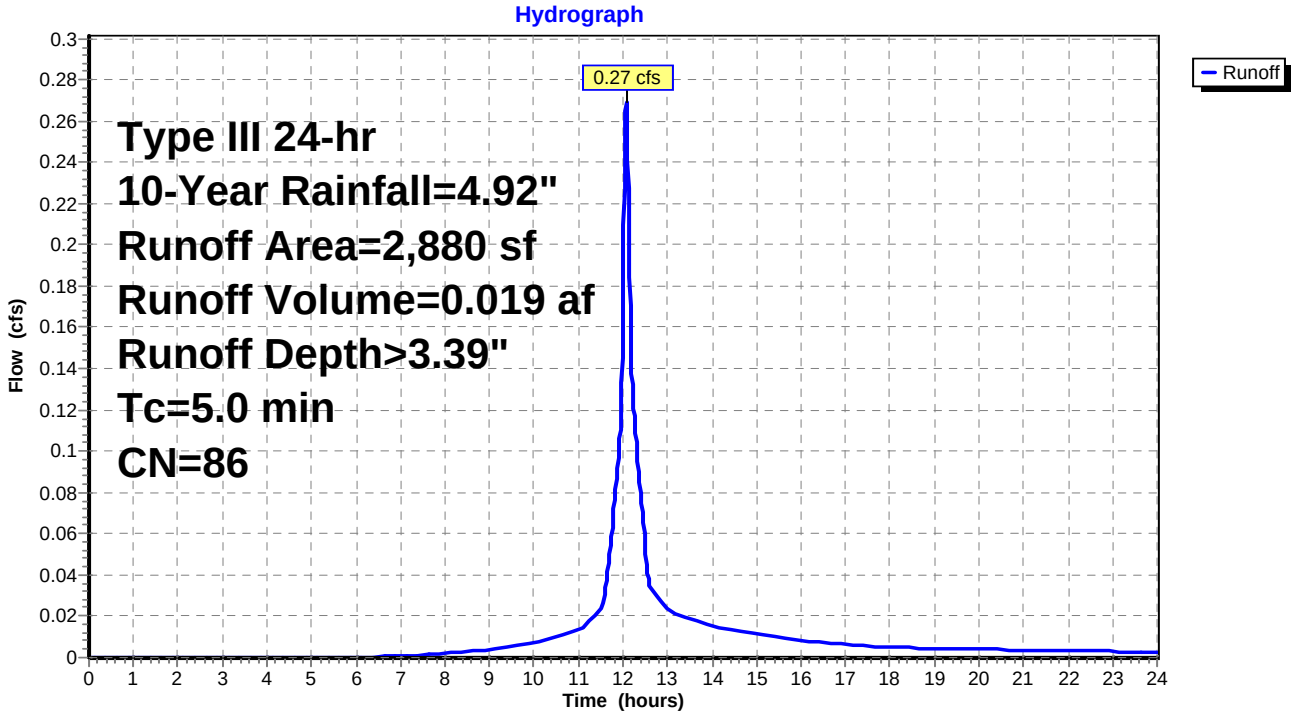
Runoff = 0.27 cfs @ 12.07 hrs, Volume= 0.019 af, Depth> 3.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.92"

Area (sf)	CN	Description
1,975	98	Unconnected pavement, HSG A
905	61	>75% Grass cover, Good, HSG B
2,880	86	Weighted Average
905		31.42% Pervious Area
1,975		68.58% Impervious Area
1,975		100.00% Unconnected

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

Subcatchment P2: To Warner Ave

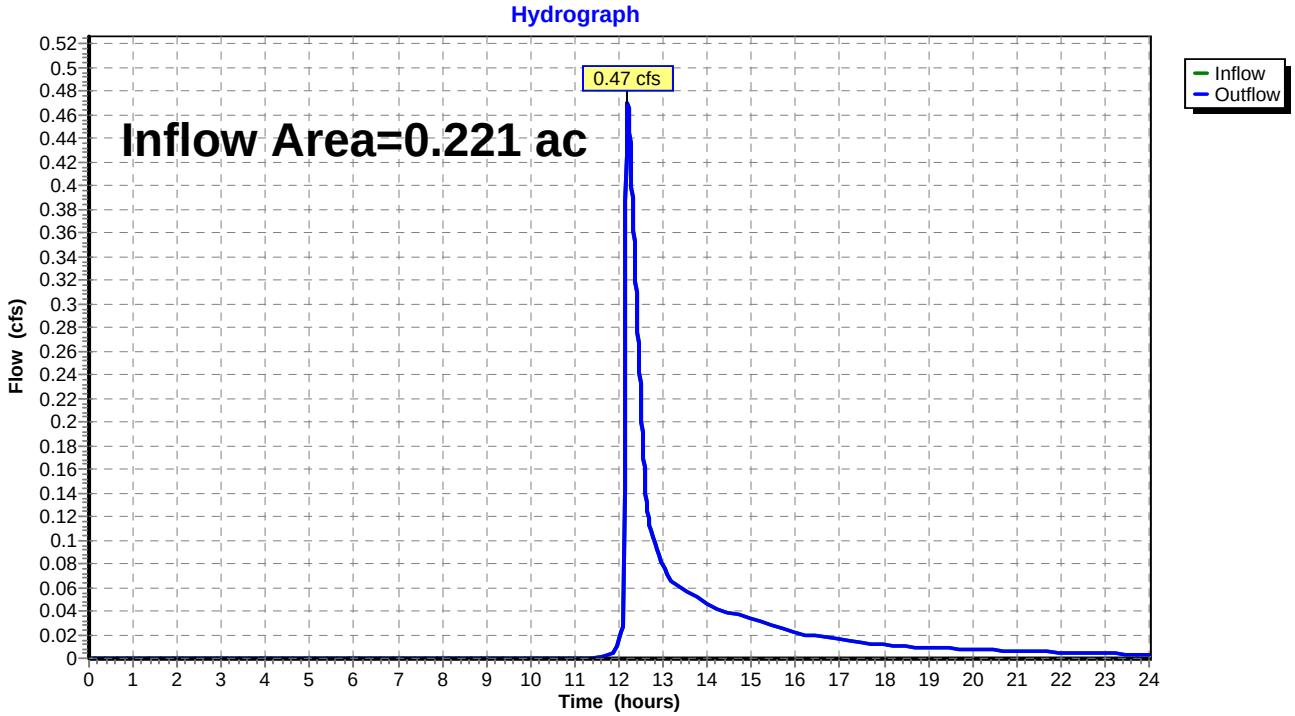


Summary for Reach DP1: Design Point 1

Inflow Area = 0.221 ac, 71.31% Impervious, Inflow Depth > 1.77" for 10-Year event
Inflow = 0.47 cfs @ 12.20 hrs, Volume= 0.032 af
Outflow = 0.47 cfs @ 12.20 hrs, Volume= 0.032 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: Design Point 1



Summary for Pond 1P: Infiltration Basin

Inflow Area = 0.203 ac, 77.65% Impervious, Inflow Depth > 3.80" for 10-Year event
Inflow = 0.90 cfs @ 12.07 hrs, Volume= 0.064 af
Outflow = 0.46 cfs @ 12.20 hrs, Volume= 0.039 af, Atten= 49%, Lag= 7.5 min
Discarded = 0.01 cfs @ 7.43 hrs, Volume= 0.009 af
Primary = 0.45 cfs @ 12.20 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 81.48' @ 12.20 hrs Surf.Area= 506 sf Storage= 1,166 cf

Plug-Flow detention time= 171.4 min calculated for 0.039 af (61% of inflow)
Center-of-Mass det. time= 70.1 min (860.0 - 789.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	76.70'	487 cf	**15.75'W x 32.10'L x 3.50'H Field A** 1,769 cf Overall - 551 cf Embedded = 1,218 cf x 40.0% Voids
#2A	77.20'	551 cf	**ADS_StormTech SC-740 +Cap** x 12 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 3 Rows
#3	81.20'	1,388 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious
		2,426 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.20	1	0	0
81.50	1,000	150	150
82.00	3,950	1,238	1,388

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.70'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	81.35'	**3.0' long (Profile 14) Broad-Crested Rectangular Weir** Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.37 3.37 3.37 3.37 3.37

Discarded OutFlow Max=0.01 cfs @ 7.43 hrs HW=76.75' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.45 cfs @ 12.20 hrs HW=81.48' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.45 cfs @ 1.20 fps)

Pond 1P: Infiltration Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

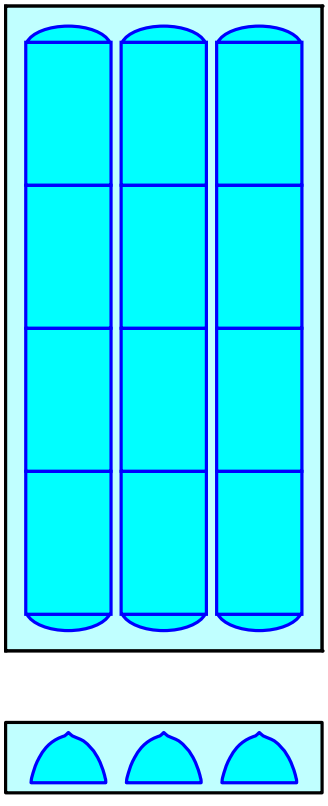
4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

12 Chambers x 45.9 cf = 551.3 cf Chamber Storage

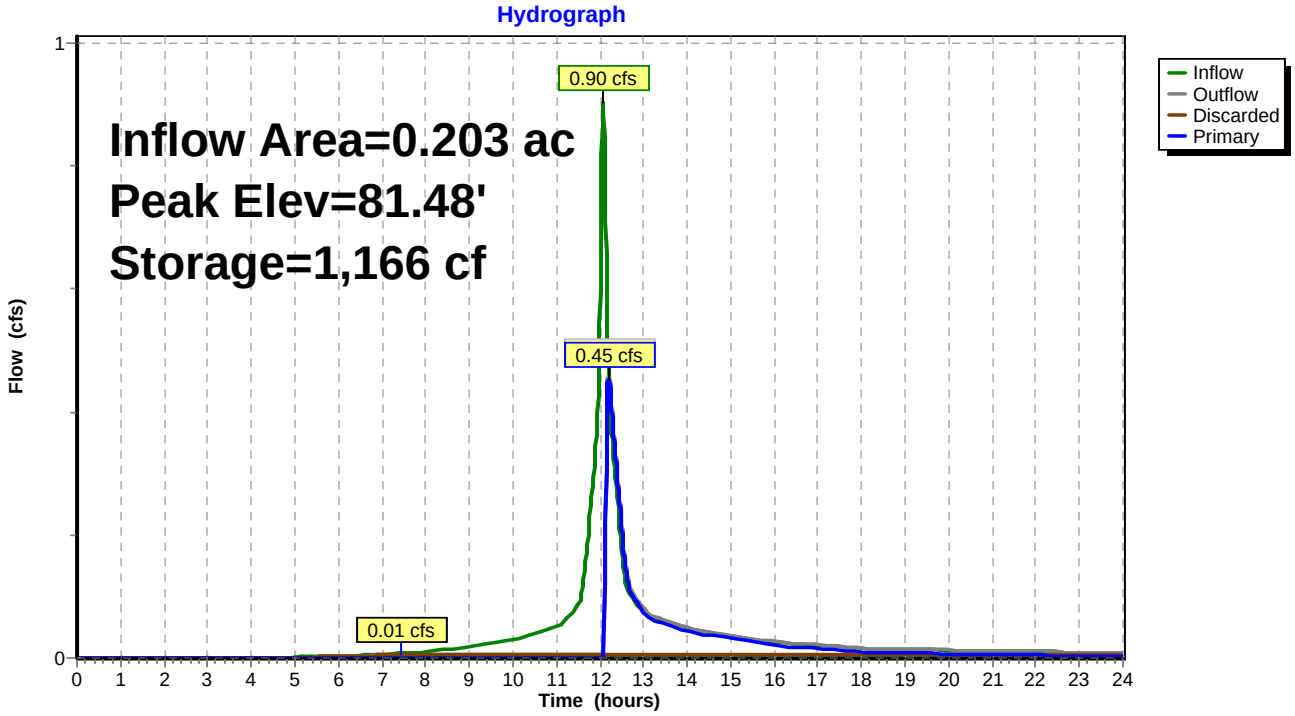
1,769.3 cf Field - 551.3 cf Chambers = 1,218.0 cf Stone x 40.0% Voids = 487.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,038.5 cf = 0.024 af
Overall Storage Efficiency = 58.7%
Overall System Size = 32.10' x 15.75' x 3.50'

12 Chambers
65.5 cy Field
45.1 cy Stone



Pond 1P: Infiltration Basin



Summary for Subcatchment P1A: To South Abutter

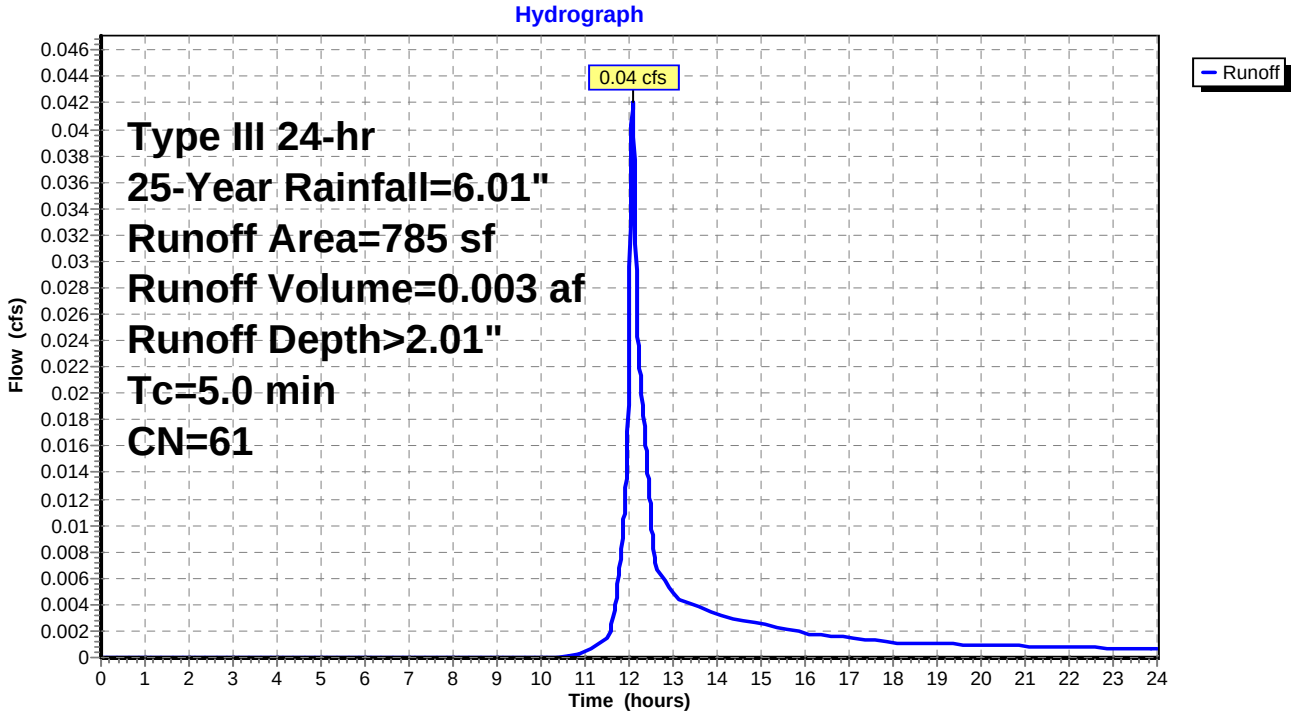
Runoff = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.01"

Area (sf)	CN	Description
785	61	>75% Grass cover, Good, HSG B
785		100.00% Pervious Area

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

Subcatchment P1A: To South Abutter



Summary for Subcatchment P1B: To Catch Basin

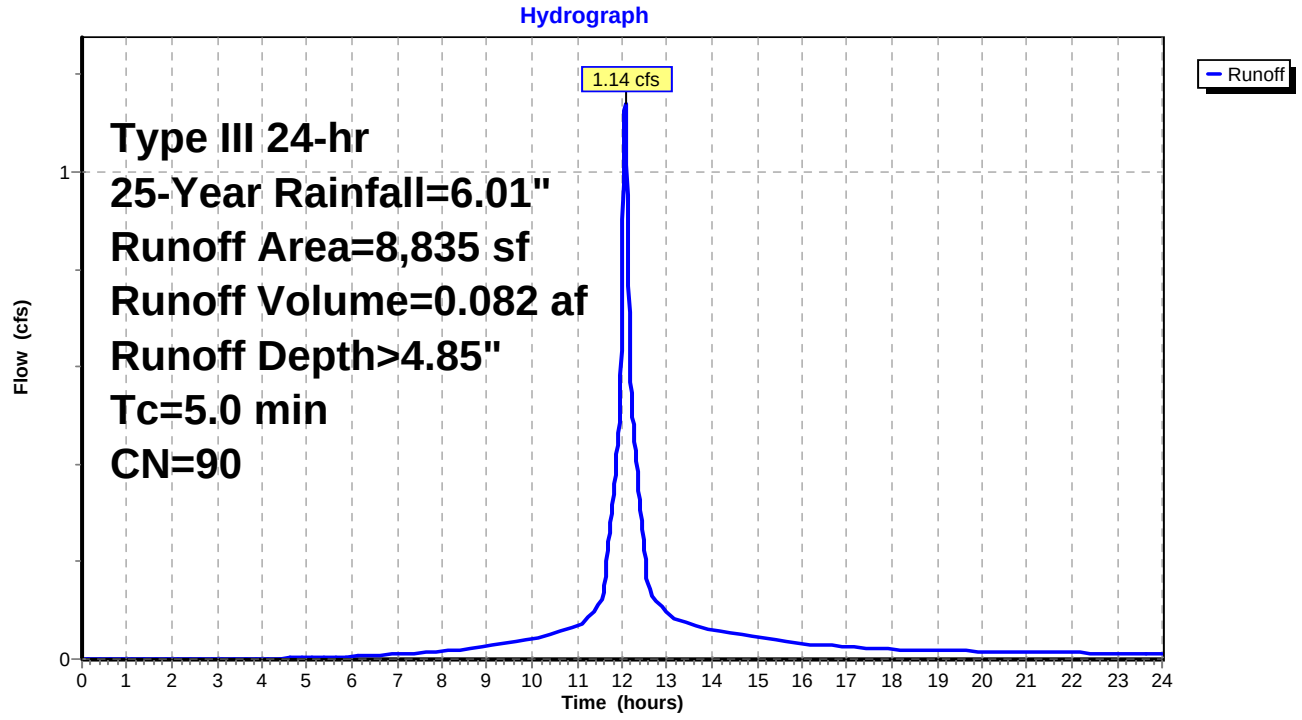
Runoff = 1.14 cfs @ 12.07 hrs, Volume= 0.082 af, Depth> 4.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.01"

	Area (sf)	CN	Description
*	6,860	98	Impervious, HSG A
	1,975	61	>75% Grass cover, Good, HSG B
	8,835	90	Weighted Average
	1,975		22.35% Pervious Area
	6,860		77.65% Impervious Area

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

Subcatchment P1B: To Catch Basin



Summary for Subcatchment P2: To Warner Ave

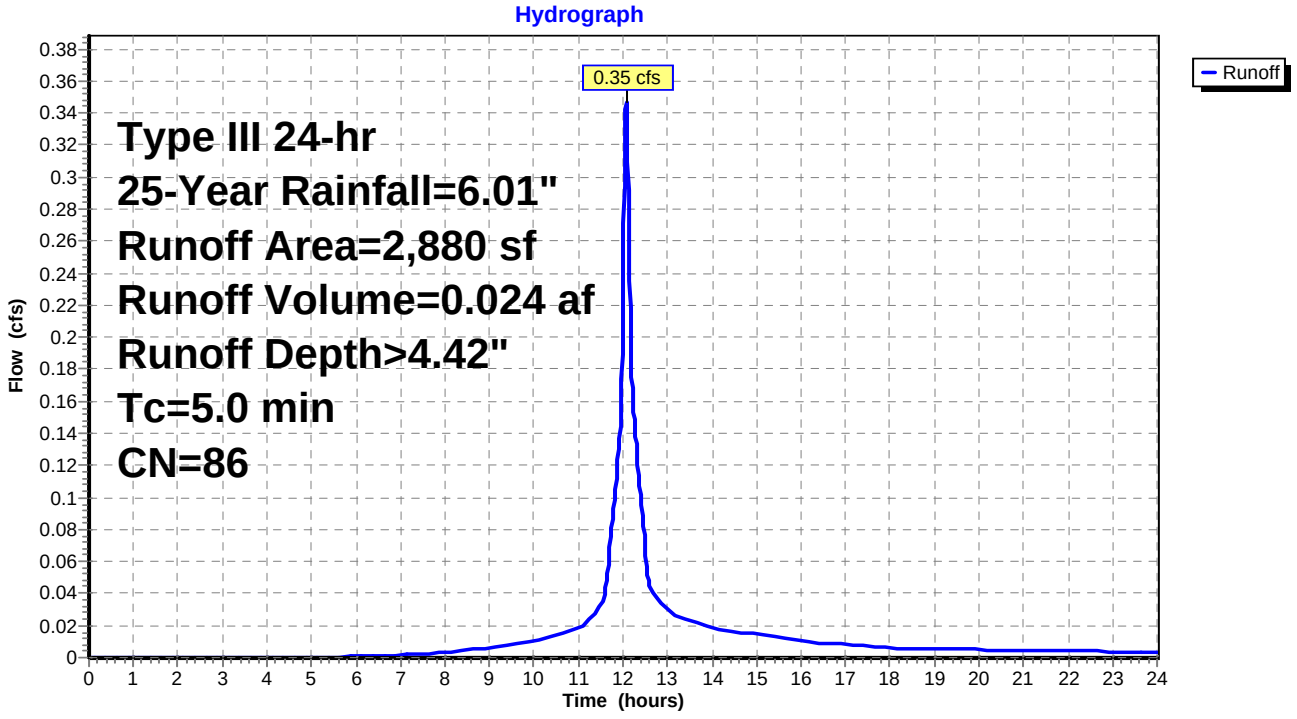
Runoff = 0.35 cfs @ 12.07 hrs, Volume= 0.024 af, Depth> 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.01"

Area (sf)	CN	Description
1,975	98	Unconnected pavement, HSG A
905	61	>75% Grass cover, Good, HSG B
2,880	86	Weighted Average
905		31.42% Pervious Area
1,975		68.58% Impervious Area
1,975		100.00% Unconnected

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

Subcatchment P2: To Warner Ave

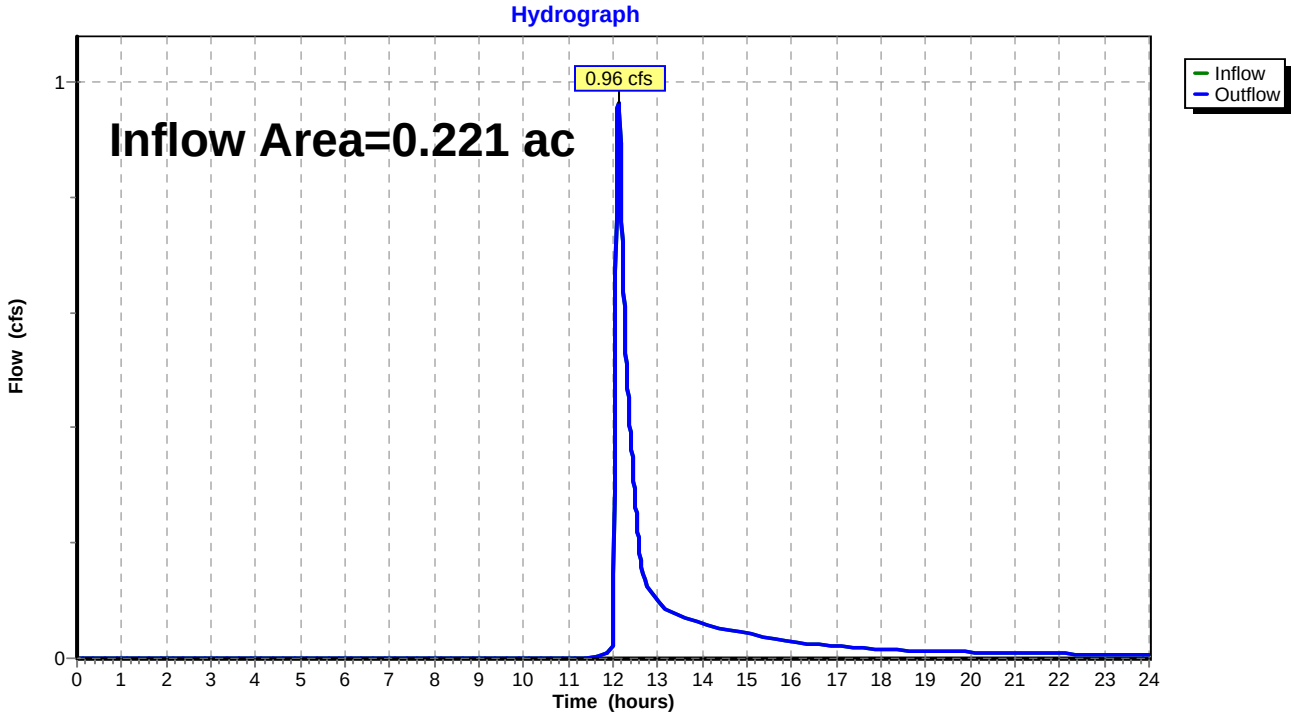


Summary for Reach DP1: Design Point 1

Inflow Area = 0.221 ac, 71.31% Impervious, Inflow Depth > 2.77" for 25-Year event
Inflow = 0.96 cfs @ 12.12 hrs, Volume= 0.051 af
Outflow = 0.96 cfs @ 12.12 hrs, Volume= 0.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: Design Point 1



Summary for Pond 1P: Infiltration Basin

Inflow Area = 0.203 ac, 77.65% Impervious, Inflow Depth > 4.85" for 25-Year event
Inflow = 1.14 cfs @ 12.07 hrs, Volume= 0.082 af
Outflow = 0.93 cfs @ 12.12 hrs, Volume= 0.057 af, Atten= 18%, Lag= 3.2 min
Discarded = 0.01 cfs @ 6.58 hrs, Volume= 0.009 af
Primary = 0.93 cfs @ 12.12 hrs, Volume= 0.048 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 81.55' @ 12.12 hrs Surf.Area= 506 sf Storage= 1,249 cf

Plug-Flow detention time= 148.0 min calculated for 0.057 af (70% of inflow)
Center-of-Mass det. time= 56.2 min (839.5 - 783.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	76.70'	487 cf	**15.75'W x 32.10'L x 3.50'H Field A** 1,769 cf Overall - 551 cf Embedded = 1,218 cf x 40.0% Voids
#2A	77.20'	551 cf	**ADS_StormTech SC-740 +Cap** x 12 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 3 Rows
#3	81.20'	1,388 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious
		2,426 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.20	1	0	0
81.50	1,000	150	150
82.00	3,950	1,238	1,388

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.70'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	81.35'	**3.0' long (Profile 14) Broad-Crested Rectangular Weir** Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.37 3.37 3.37 3.37 3.37

Discarded OutFlow Max=0.01 cfs @ 6.58 hrs HW=76.75' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.92 cfs @ 12.12 hrs HW=81.55' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.92 cfs @ 1.51 fps)

Pond 1P: Infiltration Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

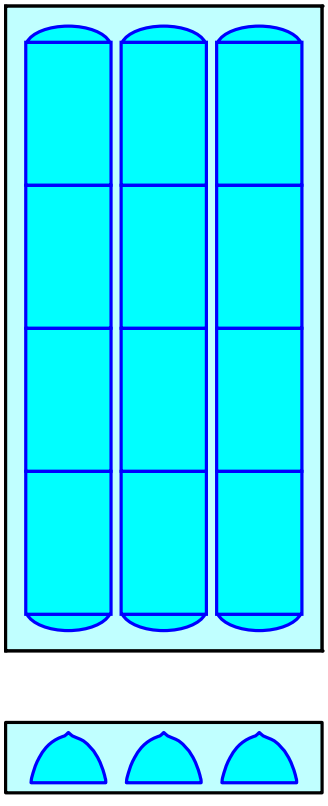
4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

12 Chambers x 45.9 cf = 551.3 cf Chamber Storage

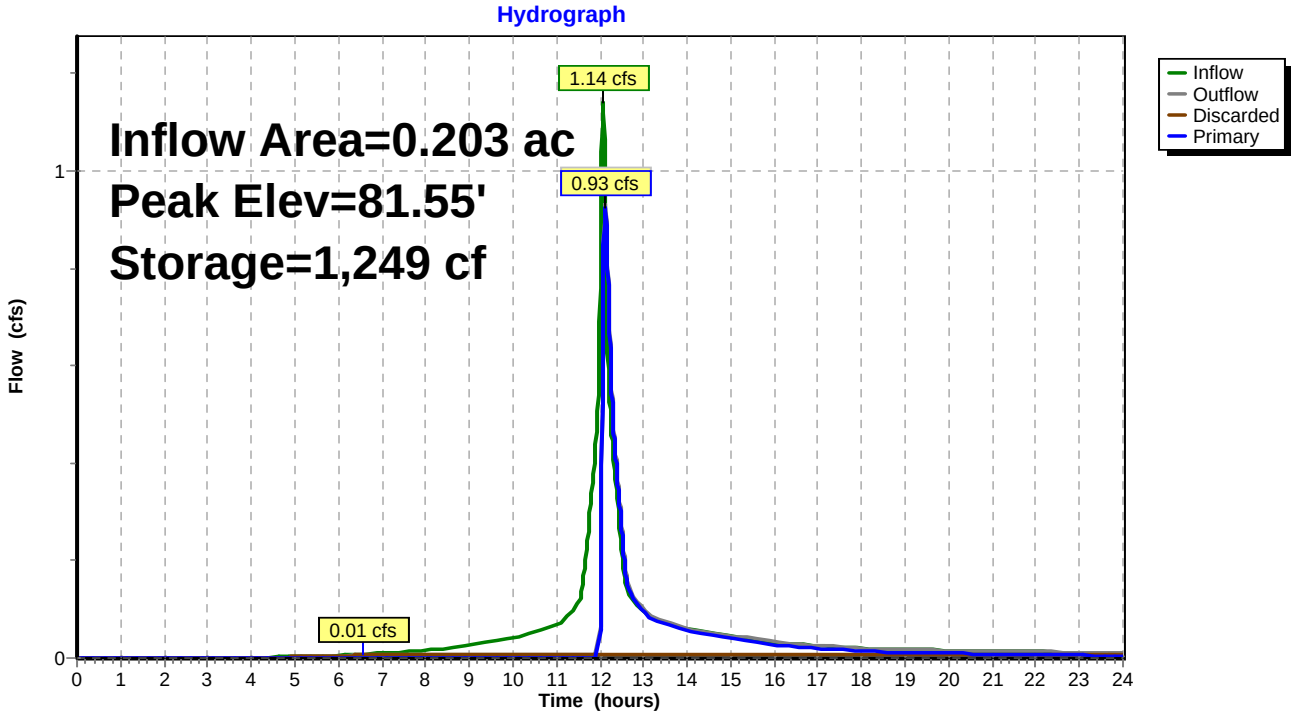
1,769.3 cf Field - 551.3 cf Chambers = 1,218.0 cf Stone x 40.0% Voids = 487.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,038.5 cf = 0.024 af
Overall Storage Efficiency = 58.7%
Overall System Size = 32.10' x 15.75' x 3.50'

12 Chambers
65.5 cy Field
45.1 cy Stone



Pond 1P: Infiltration Basin



Summary for Subcatchment P1A: To South Abutter

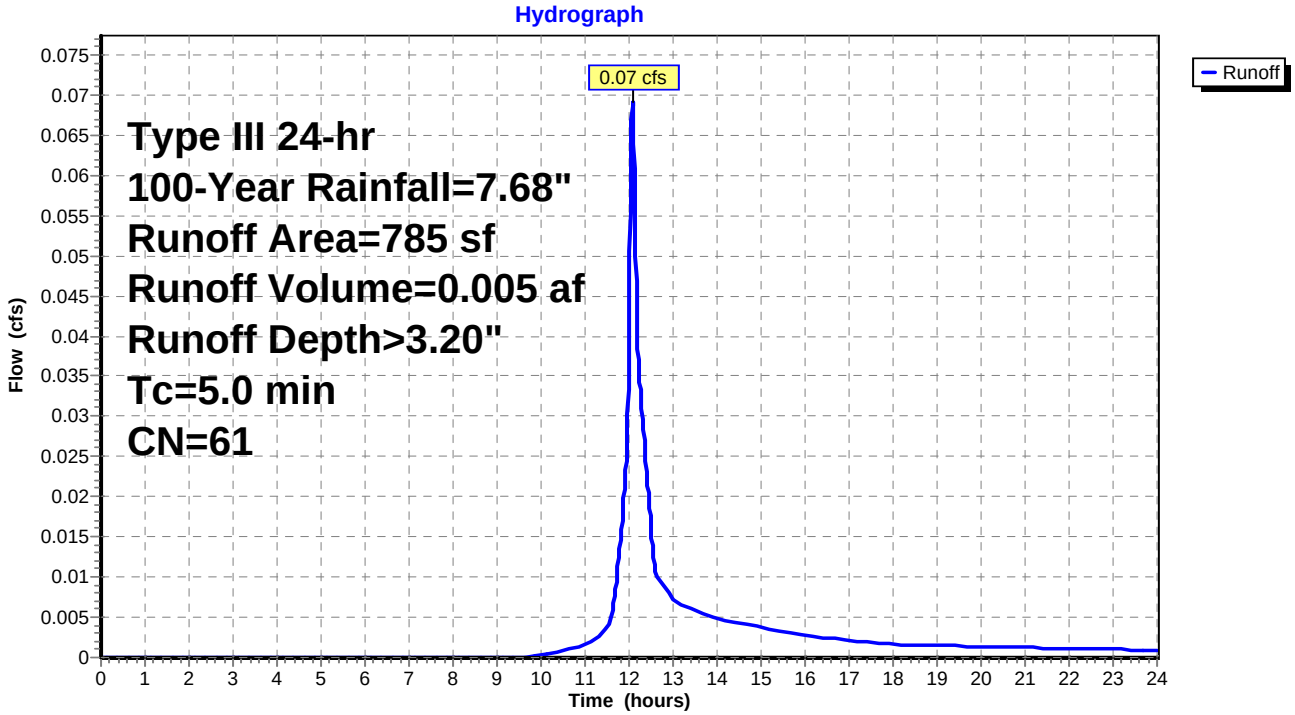
Runoff = 0.07 cfs @ 12.08 hrs, Volume= 0.005 af, Depth> 3.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.68"

Area (sf)	CN	Description
785	61	>75% Grass cover, Good, HSG B
785		100.00% Pervious Area

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

Subcatchment P1A: To South Abutter



Summary for Subcatchment P1B: To Catch Basin

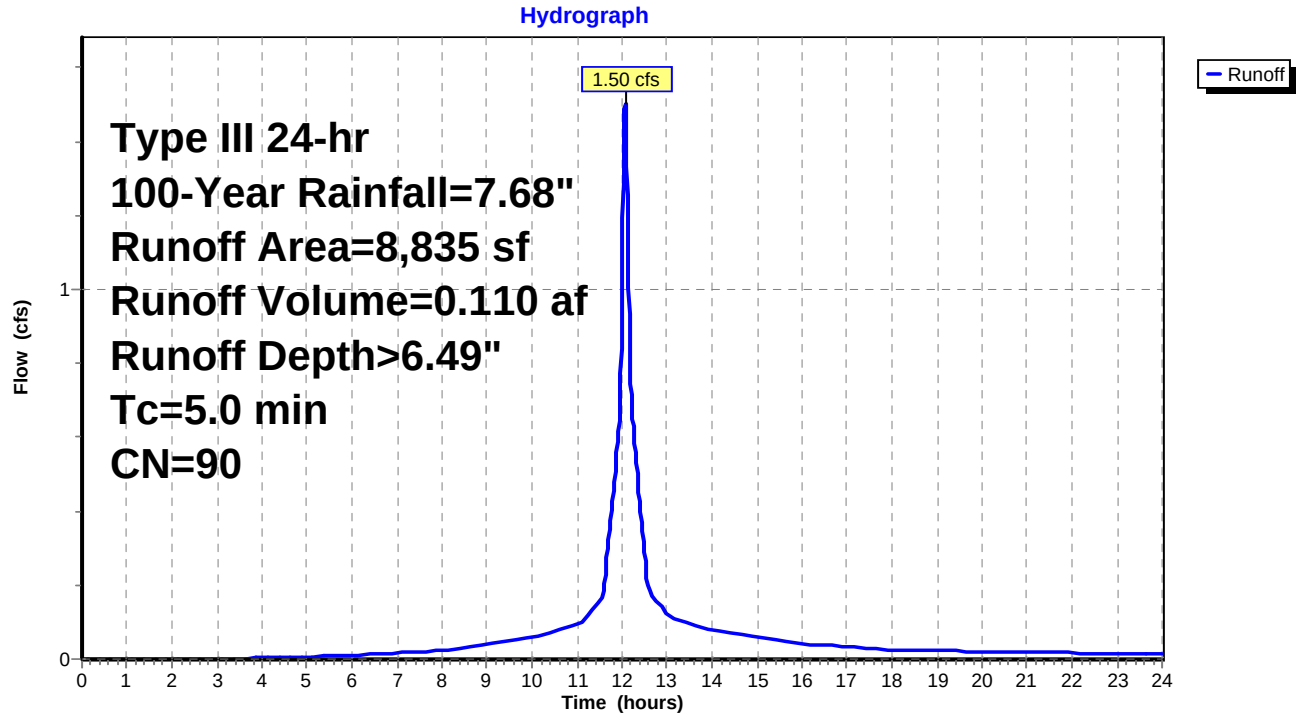
Runoff = 1.50 cfs @ 12.07 hrs, Volume= 0.110 af, Depth> 6.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.68"

	Area (sf)	CN	Description
*	6,860	98	Impervious, HSG A
	1,975	61	>75% Grass cover, Good, HSG B
	8,835	90	Weighted Average
	1,975		22.35% Pervious Area
	6,860		77.65% Impervious Area

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

Subcatchment P1B: To Catch Basin



Summary for Subcatchment P2: To Warner Ave

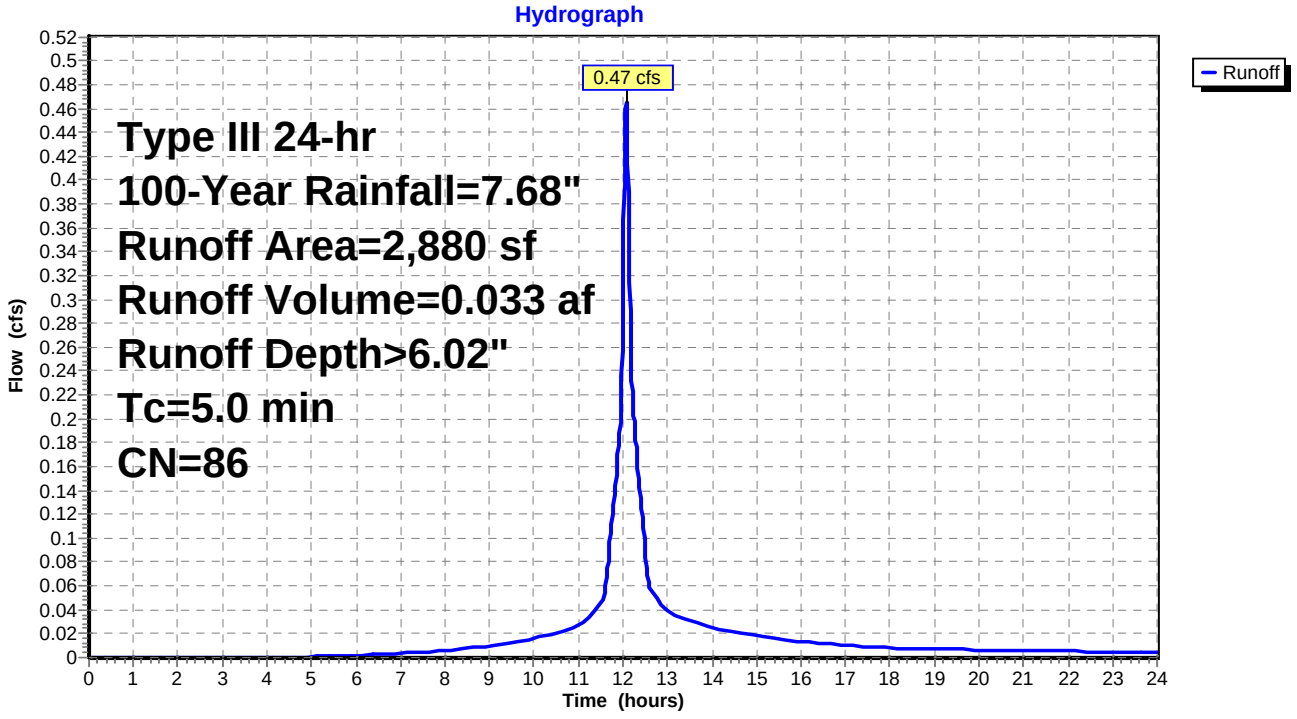
Runoff = 0.47 cfs @ 12.07 hrs, Volume= 0.033 af, Depth> 6.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.68"

Area (sf)	CN	Description
1,975	98	Unconnected pavement, HSG A
905	61	>75% Grass cover, Good, HSG B
2,880	86	Weighted Average
905		31.42% Pervious Area
1,975		68.58% Impervious Area
1,975		100.00% Unconnected

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

Subcatchment P2: To Warner Ave

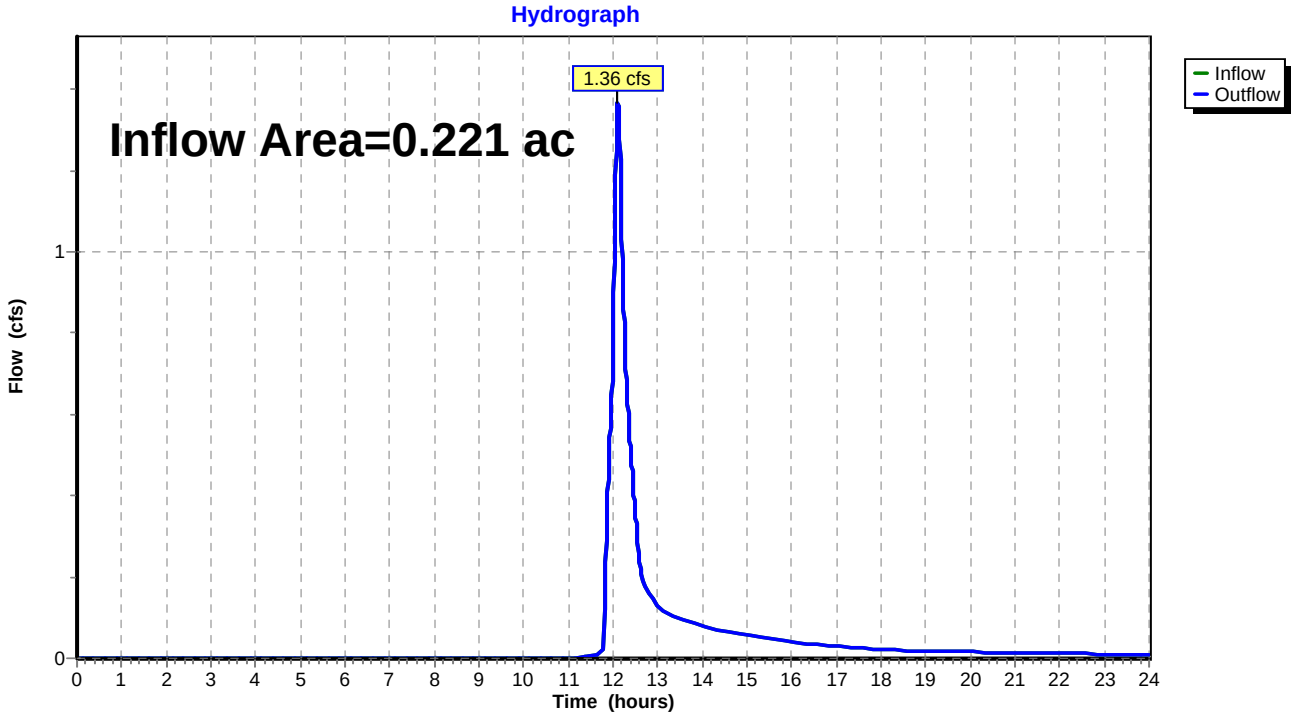


Summary for Reach DP1: Design Point 1

Inflow Area = 0.221 ac, 71.31% Impervious, Inflow Depth > 4.33" for 100-Year event
Inflow = 1.36 cfs @ 12.11 hrs, Volume= 0.080 af
Outflow = 1.36 cfs @ 12.11 hrs, Volume= 0.080 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: Design Point 1



Summary for Pond 1P: Infiltration Basin

Inflow Area = 0.203 ac, 77.65% Impervious, Inflow Depth > 6.49" for 100-Year event
Inflow = 1.50 cfs @ 12.07 hrs, Volume= 0.110 af
Outflow = 1.31 cfs @ 12.11 hrs, Volume= 0.085 af, Atten= 13%, Lag= 2.5 min
Discarded = 0.01 cfs @ 5.36 hrs, Volume= 0.010 af
Primary = 1.30 cfs @ 12.11 hrs, Volume= 0.075 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 81.60' @ 12.11 hrs Surf.Area= 506 sf Storage= 1,325 cf

Plug-Flow detention time= 128.0 min calculated for 0.085 af (77% of inflow)
Center-of-Mass det. time= 47.9 min (823.6 - 775.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	76.70'	487 cf	**15.75'W x 32.10'L x 3.50'H Field A** 1,769 cf Overall - 551 cf Embedded = 1,218 cf x 40.0% Voids
#2A	77.20'	551 cf	**ADS_StormTech SC-740 +Cap** x 12 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 12 Chambers in 3 Rows
#3	81.20'	1,388 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) -Impervious
		2,426 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.20	1	0	0
81.50	1,000	150	150
82.00	3,950	1,238	1,388

Device	Routing	Invert	Outlet Devices
#1	Discarded	76.70'	**0.520 in/hr Exfiltration over Surface area**
#2	Primary	81.35'	**3.0' long (Profile 14) Broad-Crested Rectangular Weir** Head (feet) 1.97 2.46 2.95 3.94 4.92 Coef. (English) 3.37 3.37 3.37 3.37 3.37

Discarded OutFlow Max=0.01 cfs @ 5.36 hrs HW=76.75' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.29 cfs @ 12.11 hrs HW=81.60' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 1.29 cfs @ 1.70 fps)

Pond 1P: Infiltration Basin - Chamber Wizard Field A

Chamber Model = ADS_StormTech SC-740 +Cap (ADS StormTech® SC-740 with cap length)
Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf
Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap

51.0" Wide + 6.0" Spacing = 57.0" C-C Row Spacing

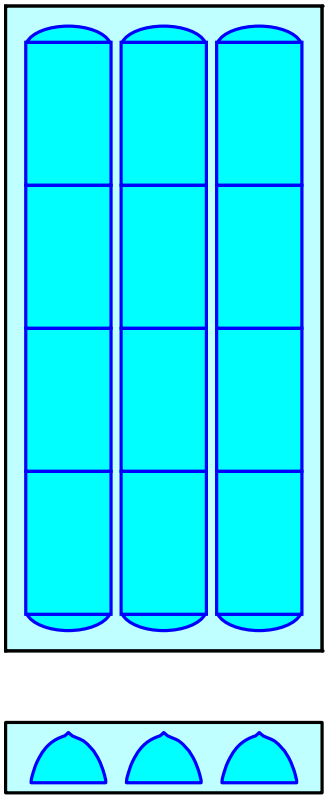
4 Chambers/Row x 7.12' Long +0.81' Cap Length x 2 = 30.10' Row Length +12.0" End Stone x 2 = 32.10' Base Length
3 Rows x 51.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 15.75' Base Width
6.0" Stone Base + 30.0" Chamber Height + 6.0" Stone Cover = 3.50' Field Height

12 Chambers x 45.9 cf = 551.3 cf Chamber Storage

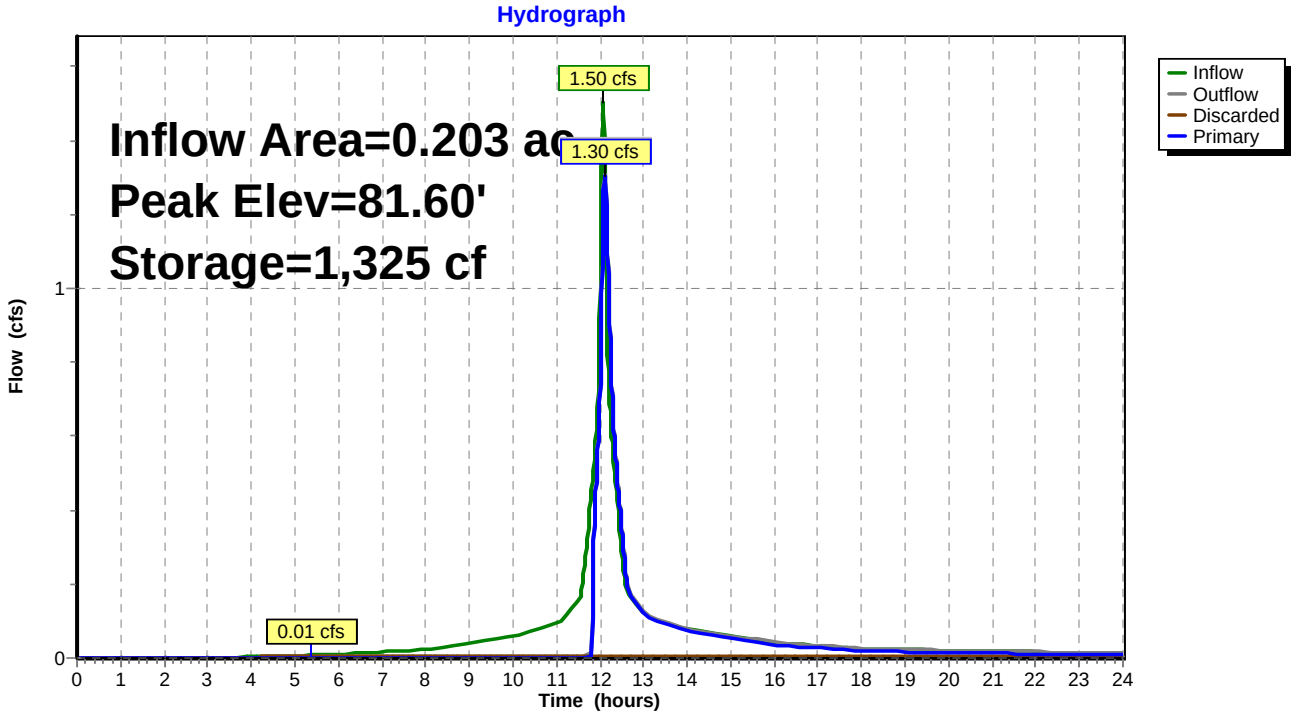
1,769.3 cf Field - 551.3 cf Chambers = 1,218.0 cf Stone x 40.0% Voids = 487.2 cf Stone Storage

Chamber Storage + Stone Storage = 1,038.5 cf = 0.024 af
Overall Storage Efficiency = 58.7%
Overall System Size = 32.10' x 15.75' x 3.50'

12 Chambers
65.5 cy Field
45.1 cy Stone



Pond 1P: Infiltration Basin



Standard 3 – Groundwater Recharge

FODERA ENGINEERING

Project: *Multi-Family Dwelling, High Rise*
Address *214 Hamilton Street, Worcester MA*
Calculated By: *Giovanni G. Fodera, P.E.*
Date: *9/20/2023*

Standard 3 in the Massachusetts Stormwater Handbook, completed in accordance with 310 CMR 10.00 and 314 CMR 9.00

RECHARGE VOLUME CALCULATIONS, VOLUME

The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. Standard 3 requires the restoration of recharge, using infiltration measures and careful site design. Through judicious use of low impact development techniques and other approaches that minimize impervious surfaces and mimic natural conditions, new developments can approximate pre-development recharge for most storms.

Soil Evaluation: Soil test were completed by a MassDEP approved soil evaluator on August 31, 2023 by observation holes and determined the soils to be Sandy Loam. Sandy Loam is categorized as Hydrologic Soil Group B (HSG-B).

Hydrologic Group Volume to Recharge (x Total Impervious Area)			
Hydrologic Soil Group	Soil Texture	Target Depth Factor (F)	
A	Sand	0.60	inches
B	Loam	0.35	inches
C	Silty Loam	0.25	inches
D	Clay	0.10	inches

Impervious Area Analysis:

	Pre-Development Impervious Area	Post-Development Impervious Area	Δ Impervious Area
Total	6,205	8,835	**2,630**

Required Recharge Volume:

Added Impervious Area (sf)	Target Depth (in)	Volume Required (cf)*
2,630	0.35	77

Required minimum 65% of site impervious directed to infiltration systems =	5,743	sf
Amount of site impervious directed to infiltration systems =	6,860	sf
Capture Area Adjustment (post dev. imp. area/imp. area routed through infiltration systems) =	1.288	
Therefore, total required recharge volume =	**99**	**cf**

Recharge Volume Provided:

Infiltration Basin

Impervious area contributing to Basin 1:	6,860 sf
Total Basin 1 volume (per HydroCAD):	**1,038 cf**

Total Volume of Recharge =	**1,038**	**>**	**99**	**(standard is met)**

FODERA ENGINEERING

Project: *Multi-Family Dwelling, High Rise*
Address *214 Hamilton Street, Worcester MA*
Calculated By: *Giovanni G. Fodera, P.E.*
Date: *9/20/2023*

Standard 3 in the Massachusetts Stormwater Handbook, completed in accordance with 310 CMR 10.00 and 314 CMR 9.00

RECHARGE VOLUME CALCULATIONS, DRAWDOWN TIME

The intent of this standard is to ensure that the infiltration volume of precipitation into the ground under post-development conditions is at least as much as the infiltration volume under pre-development conditions. Standard 3 requires the restoration of recharge, using infiltration measures and careful site design. Through judicious use of low impact development techniques and other approaches that minimize impervious surfaces and mimic natural conditions, new developments can approximate pre-development recharge for most storms. The intent of this calculation is to size an infiltration system that will approximate the annual recharge from the existing conditions.

Soil Evaluation: Soil test were completed by a MassDEP approved soil evaluator on August 31, 2023 by observation holes and determined the soils to be Sandy Loam. Sandy Loam is categorized as Hydrologic Soil Group B (HSG-B).

Rawl's Rates		
Texture Class	NRCS HSG	K
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay Loam	D	0.02

Required Drawdown Time: Drawdown time calculated below must meet a minimum of 72 hours to conform to the MA Stormwater Handbook.

$$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ Area)}$$

Rv = Storage Volume
K = Saturated Hydraulic Conductivity for the static method (Rawls Rate)
Bottom Area = Bottom Area of Recharge Structure

Infiltration Basin

Rv (cu-ft) = 1,038
K = 0.52
Bottom Area (sq-ft) = 505

Drawdown Time (hrs) = 3.95 (Conforms to Standard 3)

Standard 4 – Water Quality

FODERA ENGINEERING

Project: *Multi-Family Dwelling, High Rise*
Address *214 Hamilton Street, Worcester MA*
Calculated By: *Giovanni G. Fodera, P.E.*
Date: *9/20/2023*

Standard 4 in the Massachusetts Stormwater Handbook, completed in accordance with 310 CMR 10.00 and 314 CMR 9.00

WATER QUALITY CALCULATIONS, WQ VOLUME

Runoff from impervious surfaces flow overland and gather solids as the stormwater is directed into conveyance systems, and can have adverse effects to water pollution. Standard 4 was implemented for stormwater management systems to be designed to remove 80% of the average annual post-development load of Total Suspended Solids (TSS). Runoff volume requiring appropriate TSS treatment is known as the required water quality volume.

Pavement Area Analysis:

	Pre-Development Impervious Area	Post-Development Impervious Area	Δ Impervious Area
Total Pavement	6,205	8,835	**2,630**

Land Type: 1" of runoff multipled by post-development impervious area for sites located in LUHPPL, rapid infiltration rates, Zone II, Interim Wellhead Protection Areas, or critical areas.
0.5" of runoff multipled by post-development imperious area for all other land types.

Design Calculation: WQ Volume = 0.5" x post-development impervious area
(Site is in an area of all other land types)

Required Water Quality Volume:

Post-development Impervious Area (sf)	Target Depth (in)	Volume Required (cf)*
2,630	0.5	110

Total required WQ volume = 110 cf

Basin Volume Provided: **Infiltration Basin**
Total Basin 1 volume (per HydroCAD): **1,038 cf**

Total WQ Volume Recharged =	**1,038**	**>**	**110**	**(standard is met)**

FODERA ENGINEERING

Project: *Multi-Family Dwelling, High Rise*
Address *214 Hamilton Street, Worcester MA*
Calculated By: *Giovanni G. Fodera, P.E.*
Date: *9/20/2023*

Standard 4 in the Massachusetts Stormwater Handbook, completed in accordance with 310 CMR 10.00 and 314 CMR 9.00

WATER QUALITY CALCULATIONS, TSS REMOVAL

Runoff from impervious surfaces flow overland and gather solids as the stormwater is directed into conveyance systems, and can have adverse effects to water pollution. Standard 4 was implemented for stormwater management systems to be designed to remove 80% of the average annual post-development load of Total Suspended Solids (TSS). Runoff volume requiring appropriate TSS treatment is known as the required water quality volume.

Treatment Train: **1. Catch Basin with Deep Sump & Hood**
2. Isolator Row

	B	C	D	E	F
Pretreatment BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (BxC)	Remaining Load (C-D)	TSS Removal Rate
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**	**25%**

	B	C	D	E	F
Treatment BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (BxC)	Remaining Load (C-D)	TSS Removal Rate
Subsurface Infiltration Structure	**0.80**	**0.75**	**0.60**	**0.15**	**85%**

Pretreatment TSS Removal =	**25%**	**(standard is met)**
Treatment TSS Removal =	**85%**	**(standard is met)**

Note: Roof runoff does not require pretreatment

APPENDIX C – Operation and Maintenance
Maintenance Logs

OPERATION & MAINTENANCE LOG

214 Hamilton Street
Worcester, MA 01604

Inspection Date:_____

Inspector's Name:_____

Catch Basin / Manholes: Inspect at least four times per year and cleaned when the sump is half full of sediment		
Subsurface Infiltration and Isolator Row: Inspect through inspection port as detailed in the Long-Term Operation and Maintenance Plan, and/ or as detailed in the StormTech® Isolator Row O&M Manual.		