ALLEN & MAJOR ASSOCIATES, INC.

DRAINAGE REPORT

The Residences at Spot Pond
5 Woodland Road
Map 27 Lots 3, 3C and 6
Stoneham, MA

Site Locus – Not to Scale

Prepared: September 8, 2023
Revised: April 5, 2024

CLIENT:
Fellsway Development, LLC
c/o The Gutierrez Company
200 Summit Drive, Suite 400
Burlington, MA 01803

PREPARED BY:
Allen & Major Associates, Inc.
E.O.R.: Carlton M. Quinn, PE
100 Commerce Way, Suite 5
Woburn, Massachusetts 01801

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A&M PROJECT NO.:
1145-01T

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SECTION 1.0

INTRODUCTION

The purpose of this drainage report is to provide an overview of the proposed stormwater management system (SMS) for the proposed multi-family residential development known as The Residences at Spot Pond located at 5 Woodland Road and a paved parking area proposed at 11 Executive Drive which are identified on Town of Stoneham Assessors Database as Map 27 Lot 3 and Assessors Map 27 Lot 3C, and Map 27 Lot 6, and are located entirely within the Town of Stoneham. The project site is currently occupied by the defunct Boston Regional Medical Center (BRMC) as well as paved parking areas, a church and a vacant power plant. This report will show by means of narrative calculations and exhibits that the proposed stormwater management system will meet or exceed the 10 Massachusetts Department of Environmental Protection (MassDEP) stormwater standards.

The proposed site improvements include the demolition of the existing hospital and surrounding outbuildings and the construction of two (2) proposed multi-family garden style apartment buildings totaling 378 units with at-grade surface parking proposed on-site as well as beneath Building B, and stormwater management systems, site utilities and associated infrastructure as well as site landscaping, grading and lighting. The project will be serviced by municipal sewer and water and private gas (pool heater only), telecom and electric services. The existing medical arts building is proposed to remain.

The SMS incorporates structural and non-structural Best Management Practices (BMPs) to provide stormwater peak flow mitigation, quality treatment, and conveyance. The SMS includes catch basins with deep sumps and hoods, drain manholes, subsurface infiltration drainage systems and proprietary hydrodynamic separators to improve effluent water quality.

SITE CATEGORIZATION FOR STORMWATER REGULATIONS

The proposed site improvements at 5 Woodland Road are considered a new development under the DEP Stormwater Management Standards due to the net increase in impervious area. A "new development" project is required to meet all of the Stormwater Management Standards listed within the MA DEP Stormwater Handbook.

SITE LOCATION AND ACCESS

The subject site ("the Site") is located at 5 Woodland Road, in Stoneham, MA. The parcel is located entirely within the town of Stoneham, near to the Stoneham/Medford town line and the Stoneham/Melrose town line.

Stoneham is located in Middlesex County and is approximately 8.5 miles north of Boston. The site is also approximately located 0.75 miles east of Interstate 93.

The Site is accessed at several points by means of Executive Drive, a developed subdivision road which circumnavigates the project site. Site access is granted via Executive Drive to the west to an existing parking lot which will service the proposed building, and to the south and east by means of multiple access drives located along Executive Drive to proposed surface parking lots.

EXISTING SITE CONDITIONS

The site currently includes 5 Woodland Road, identified as the Town of Stoneham Assessors Map 27 Lot 3 (10.02+/- acres) and 11 Executive Drive, identified as Map 27 Lot 3C (5.31+/- acres). The project site is currently a developed lot which includes a vacant hospital, existing paved driveways, landscaped and grassed areas and utility infrastructure. Eleven Executive Drive is currently grassed and will be developed into a paved parking area with landscaped areas and an infiltration drainage system. Only a portion of 11 Executive Drive is proposed to be developed. An existing grassed easement area is proposed to be developed with paved parking and a drainage system.

The lot is near Spot Pond due west, industrial lots on Executive Drive to the east as well as to the south, Woodland Road to the west, and is located within Executive Drive subdivision road, which surrounds the majority of the site.

The highest point on the site is along Executive Drive at approximately elevation 233 at the southeast corner. From the center of the 5 Woodland Road subject site, slopes run down toward Woodland Road to the west. The north portion of the site property at the existing parking lot is the low point on-site, and vary in elevation, but typically fall in elevation range of Elev. 190 to the north to Elev. 233 to the west.

WATERSHED

The subject property is located within the Boston Harbor Watershed which consists of a large network of tributaries that flow into the Mystic River. The three major rivers that flow through the watershed - the Charles, Neponset, and Mystic - have been recognized for their outstanding ecological, historical, and recreational values. The Mystic River Watershed covers 76 square miles or roughly 1% of the land area of Massachusetts. It includes all the land area that drains into the Mystic River. Its headwaters begin in Reading, MA and form the Aberjona River, then flow into the Upper Mystic Lake in Winchester. From the Lower Mystic Lake, the Mystic River flows through Arlington, Somerville, Medford, Everett, Chelsea, Charlestown, and East Boston before emptying into Boston Harbor.

EXISTING SOIL CONDITIONS

The on-site soils were identified using the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Middlesex County. The site soil types and corresponding Hydrologic Soil Groups (HSG) include:

- SCS 631C – Charlton-Urban Land-Hollis Complex, 3 to 15 percent slopes, HSG A

Soils on-site include type A, however, to be consist with the MWRA Drainage report previously prepared for the Site, HSG "C" has been assumed for the in-situ soils, to remain consist with the previous drainage report entitled "Drainage Report For Langwood Executive Center and MWRA Water Storage Tank Site Stoneham, Massachusetts," prepared for Massachusetts Water Resources Authority, and prepared by Green International Affiliates, Inc., 239 Littleton Rd., Unit 3, Westford, Ma. 01886, and dated February, 2011. A copy of this drain report for the MWRA has been included in the Appendix of this report. A copy of the soil mapping from the NRCS website is included in the Appendix of this report. Soils within the proposed development and stormwater management system are modeled as HSG "C", and the HydroCAD model reflects this HSG group.

FEMA FLOODPLAIN/ENVIRONMENTAL DUE DILIGENCE

The Flood Insurance Rate Map (FIRM) (Map Number 25017C0429E) for the town of Stoneham dated 06/04/2010 indicates that the parcel lies outside of the 100-year flood plain. No Base Flood Elevations (BFEs) are identified for the subject site. The subject parcel site is outside of the 500-year Floodplains. See the Exhibits section of this report for a copy of the FEMA FIRM.

ENVIRONMENTALLY SENSITIVE ZONES

The Commonwealth of Massachusetts asserts control over numerous protected and regulated areas including: Areas of Critical Environmental Concern (ACEC); Outstanding Resource Waters (ORWs); areas protected under the Wetlands Protection Act and the Rivers Protection Act, as well as Priority and Protected Habitat for rare and endangered species. According to the MassGIS online map viewer OLIVER, the subject property is not located within ACEC or ORW areas.

EXISTING WATERSHED DESCRIPTION

To study peak flow rates under existing conditions, the site is broken into 3 study points and multiple watersheds. Under existing conditions, study point 1 is the existing closed pipe municipal drainage southwest of the site development area (flow to Woodland Road south), and study point 2 is the existing closed pipe drainage system located at the northeastern portion of the development area, which ultimately discharges to the existing MWRA stormwater basin near the project development site. The MWRA report

prepared by Green International indicates that a particular stormwater capacity has been allocated for discharge from the project site to the MWRA drainage system. See the MWRA stormwater HydroCAD model for more detailed information.

Study Point 3 is located just upstream of an existing manhole near the northern intersection of Executive Drive with Woodland Road (flow to Woodland Road north). It should be noted that drainage within Woodland Road is owned and maintained by the Massachusetts Department of Conservation and Recreation, and is not subject to the Town of Stoneham's Municipal Separate Storm Sewer System (MS4) regulations.

Under existing conditions, runoff from watershed E-1 is directed to Study Point 1. The total area draining to the Study Point is approximately 1.79 acres and consists of impervious roof and paved areas and landscaped grassed areas. See the Existing Watershed Plan included in the Appendix of this report for more information.

Runoff from watersheds E-2 is directed to Study point 2. The total area draining to the study point is 5.50 acres and consists of impervious roof and paved areas and landscaped grassed areas. See existing watershed plan for more information.

Runoff from watershed E-3 is directed to Study point 1. The total area draining to the study point is 0.68 acres and consists of paved areas and landscaped grassed areas. See existing watershed plan for more information.

Runoff from watershed E-4 is directed to Study Point 3. The total area draining to the Study Point is approximately 4.11 acres and consists of impervious paved areas and landscaped grassed areas. See the Existing Watershed Plan included in the Appendix of this report for more information.

All four existing watershed areas total 12.08+/- acres.

DRAINAGE ANALYSIS METHODOLOGY

A peak rate of runoff will be determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.
2. HydroCAD© Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.20, 2023. The HydroCAD program was used to generate the runoff

hydrographs for the watershed areas, to determine discharge/ stage/storage characteristics for the stormwater BMPs, to perform drainage routing and to combine the results of the runoff hydrographs. HydroCAD uses the TR-20 methodology of the SCS Unit Hydrograph procedure (SCS-UH).

PROPOSED CONDITIONS – PEAK RATE OF RUNOFF

The storm water runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Further, the analysis has been prepared in accordance with the MassDEP and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 2, 10, 25 and 100-year storm events.

Per Town of Stoneham Stormwater Management Regulations, Atlas 14 rainfall event depths have been used and reflected in the HydroCAD outputs. The following ATLAS-14 rainfall values were utilized for the project:

- 2-year storm = 3.29 inches rainfall depth
- 10-year storm = 5.17 inches rainfall depth
- 25-year storm = 6.35 inches rainfall depth
- 100-year storm = 8.16 inches rainfall depth

Study point 1 receives runoff from watersheds P-2 and P-3. The total area draining to the study point is 1.58 acres, and consists of impervious roof and paved areas and pervious landscaped and grassed areas. See the proposed watershed plan and grading and drainage plan, included in this report for more information.

Study point 2 receives runoff from watersheds P-5 and P-6. The total area draining to the study point is 3.16 acres, and consists of impervious roof and paved areas and pervious landscaped and grassed areas. See proposed watershed plan and grading and drainage plan for more information.

Study point 3 receives runoff from watershed P-1 and P-4. The total area draining to the study point is 7.35 acres, and consists of impervious roof and paved areas and pervious landscaped and grassed areas. See proposed watershed plan and grading and drainage plan for more information.

The following Table 1 summarizes the existing and proposed peak flows for the existing and proposed watershed areas.

TABLE 1 - Summary of Stormwater Peak Flows

Peak Flow Rates to Study Point #1

Study Point #1 (Flow to Woodland Road drainage south)

	2-Year	10-Year	25-Year	100-Year
Existing Runoff (CFS)	4.21	8.89	11.97	16.77
Proposed Runoff (CFS)	0.76	4.36	6.33	7.92
% REDUCTION	82%	51%	47%	53%

Peak Flow Rates to Study Point #2

Study Point #2 (Flow to MWRA drainage)

	2-Year	10-Year	25-Year	100-Year
Existing Runoff (CFS)	10.33	20.33	26.75	36.61
Calc'd MWRA Flow (CFS) (Controls)	9.40	14.58	18.60	26.83
Proposed Runoff (CFS)	7.75	14.11	18.12	24.22
% REDUCTION	18%	3.2%	2.5%	9.7%

Peak Flow Rates to Study Point #3

Study Point #3 (Flow to Woodland Road drainage north)

	2-Year	10-Year	25-Year	100-Year
Existing Runoff (CFS)	14.41	24.09	30.09	39.22
Proposed Runoff (CFS)	10.82	21.55	29.31	39.15
% REDUCTION	25%	11%	2.6%	0.2%

As indicated in the above tables and summary statement, not only is the proposed project in conformance with the DEP Stormwater Regulations, but also in conformance with the Town of Stoneham Stormwater Management Regulations. The net stormwater runoff flows to each study point are reduced in the post-construction model as compared to the pre-construction model. Additionally, the project also complies with the allowed maximum flow rates which are proposed to be directed to the MWRA drainage basin to the east of the proposed development, based on the areas and flows, per the report entitled "Drainage Report For Langwood Executive Center and MWRA Water Storage Tank Site Stoneham, Massachusetts," prepared for Massachusetts Water Resources Authority, and prepared by Green International Affiliates, Inc., 239 Littleton Rd., Unit 3, Westford, Ma. 01886, and dated February, 2011. A copy of this drain report for the MWRA has been included in the Appendix of this report. The flow rates for the MWRA drainage basin above are not to be exceeded under post-construction conditions, which have been met.

MASSDEP STORMWATER PERFORMANCE STANDARDS

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for storm water management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include –

- Deep-sump, hooded catch basins
- Hydro-dynamic (Proprietary) separators
- Subsurface infiltration systems
- Specific maintenance schedule

Stormwater Best Management Practices have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw bale and/or silt fence barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is

presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are enumerated below as well as descriptions and supporting calculations as to how the Project will comply with the Standards:

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

   The proposed development will not introduce any new stormwater conveyances (e.g. outfalls) that discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

   The proposed development will be designed so that the post-development peak discharge rates do not exceed the pre-development peak discharge rates. See the peak flow rate table, Table 1, above.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

   The existing annual recharge for the site will be exceeded in the developed condition. Infiltration basins will be designed to meet this requirement. All Infiltration Systems were designed using the Static Method per the MassDEP Stormwater Management Standards, Volume 3, Chapter 1. See Section 6.5 for water quality/recharge calculations in the DEP Standard calculations located in the Appendix of this Drainage report for more detailed information. The DEP Standard Calculations utilize a water quality volume of 1/2 inch, as the site is not considered a Land Use with Higher Potential for Pollutant Loading (LUHPPL). Test pits have been performed in March 2024 in the footprints of each basin, and confirm the assumed groundwater elevation and soil textural analysis data. No changes to the stormwater systems are required.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:*
    - *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
    - *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
    - *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

    The proposed stormwater management system will be designed so that effluent will meet the 80% TSS treatment removal standard. Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-Term Pollution Prevention Plan. The 80% total TSS removal standard will be met using some combination of the following: deep-sump, hooded catch basins, infiltration basins and proprietary separators.

    The water quality volume for the site development will be captured and treated using proprietary separators and infiltration basins. All systems will be sized to meet the water quality flow rate for the 0.5 inch storm event. See DEP Calculations in the appendix of this report for water quality flow rate and volume calculations, as well as the TSS treatment train for the proposed infiltration system.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.*

The proposed development is not considered a source of higher potential pollutant loads and the drainage system will be designed to treat a 0.5" water quality volume. The SMS will be designed with deep-sump, hooded catch basins, proprietary separators, and infiltration basins.

6. *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. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

   The proposed project is not located within a critical area.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

   The proposed project is not considered a redevelopment project under the Stormwater Management Handbook guidelines as there is an increase in the amount of impervious area. A "new development" project is required to meet all of the ten Stormwater Standards listed within the MA DEP Stormwater Handbook.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities

has been developed, see Sheets C-102 "Erosion Control Plan" and Sheet C-101 "Site Preparation & Demolition Plan" for more information. The permanent infiltration basins shall not be used to store stormwater runoff during construction. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities for this project as it will result in the disturbance of one acre of land or more.

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

   A Long-Term Operation & Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Section 2.0 of this report.

10. *All illicit discharges to the stormwater management system are prohibited.*

    There are no expected illicit discharges to the stormwater management system. The applicant has submitted the Illicit Discharge Compliance Statement with this report.

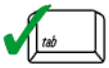
See the next page for the MassDEP Stormwater Checklist.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

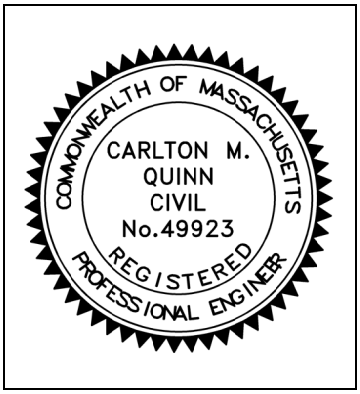
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature



9.8.23

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Subsurface Infiltration Drainage Systems; Hydrodynamic Separators, Catch Basins with Deep Sumps and Hoods

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☒ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☒ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☒ Estimated operation and maintenance budget; and
- ☒ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

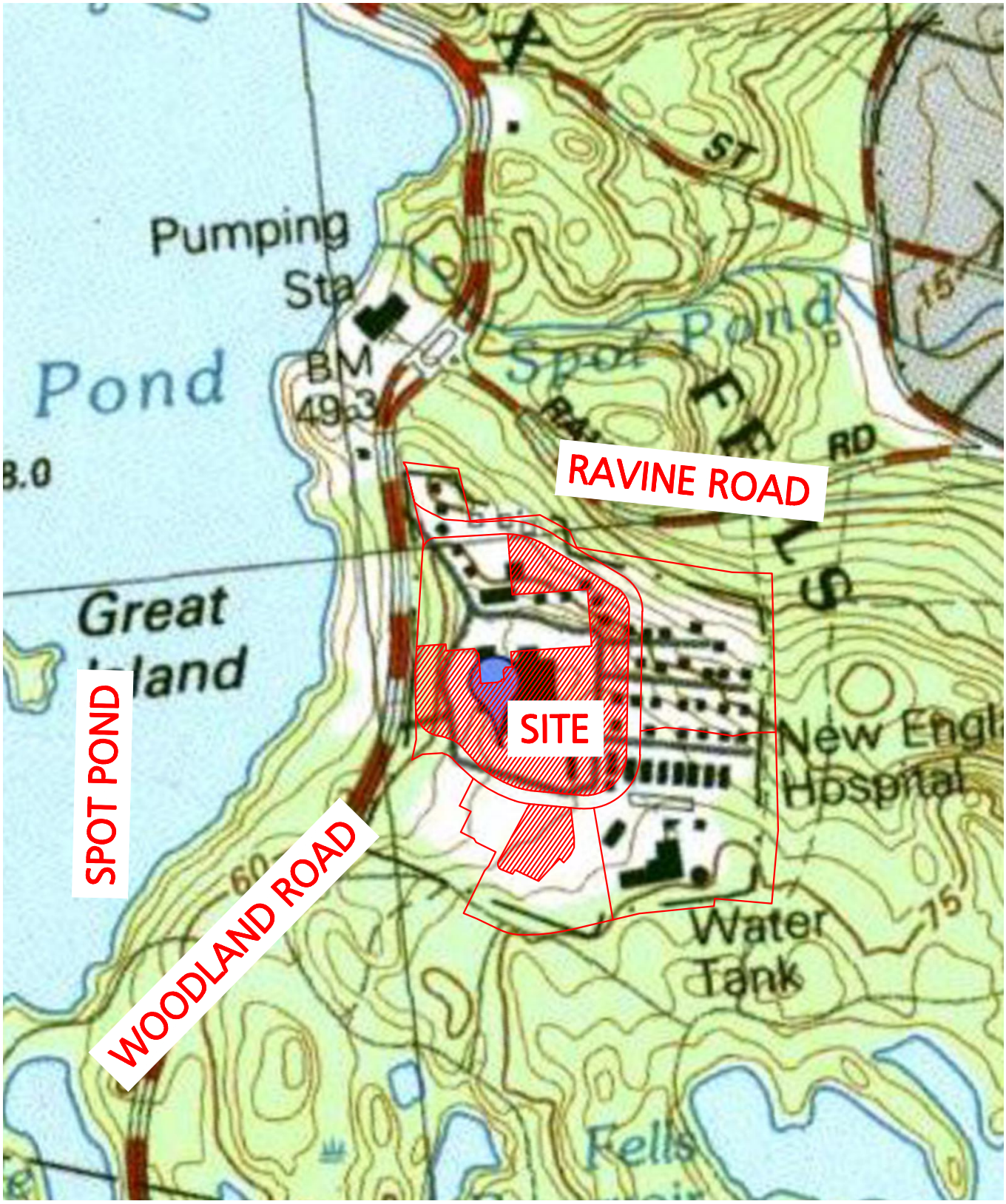
SECTION 2.0

OPERATION & MAINTENANCE PLAN

(Under separate cover)

SECTION 3.0

EXHIBITS



PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.

civil engineering ◆ land surveying environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY
P.O. BOX 2118
WOBURN MA 01888-0118
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT: THE RESIDENCE AT SPOT POND, 5 WOODLAND DRIVE

STONEHAM, MA 02180

USGS SITE LOCUS MAP

PROJECT NO. 1145-01T	DATE: SEPTEMBER 8, 2023
SCALE: NTS	DWG. NAME: EXHIBITS
DESIGNED BY: TJW/DMR	CHECKED BY: TJW

SHEET No.

EX-1

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civil engineering ◆ land surveying environmental consulting ◆ landscape architecture
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100 COMMERCE WAY
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PROJECT: THE RESIDENCE AT SPOT POND, 5 WOODLAND DRIVE

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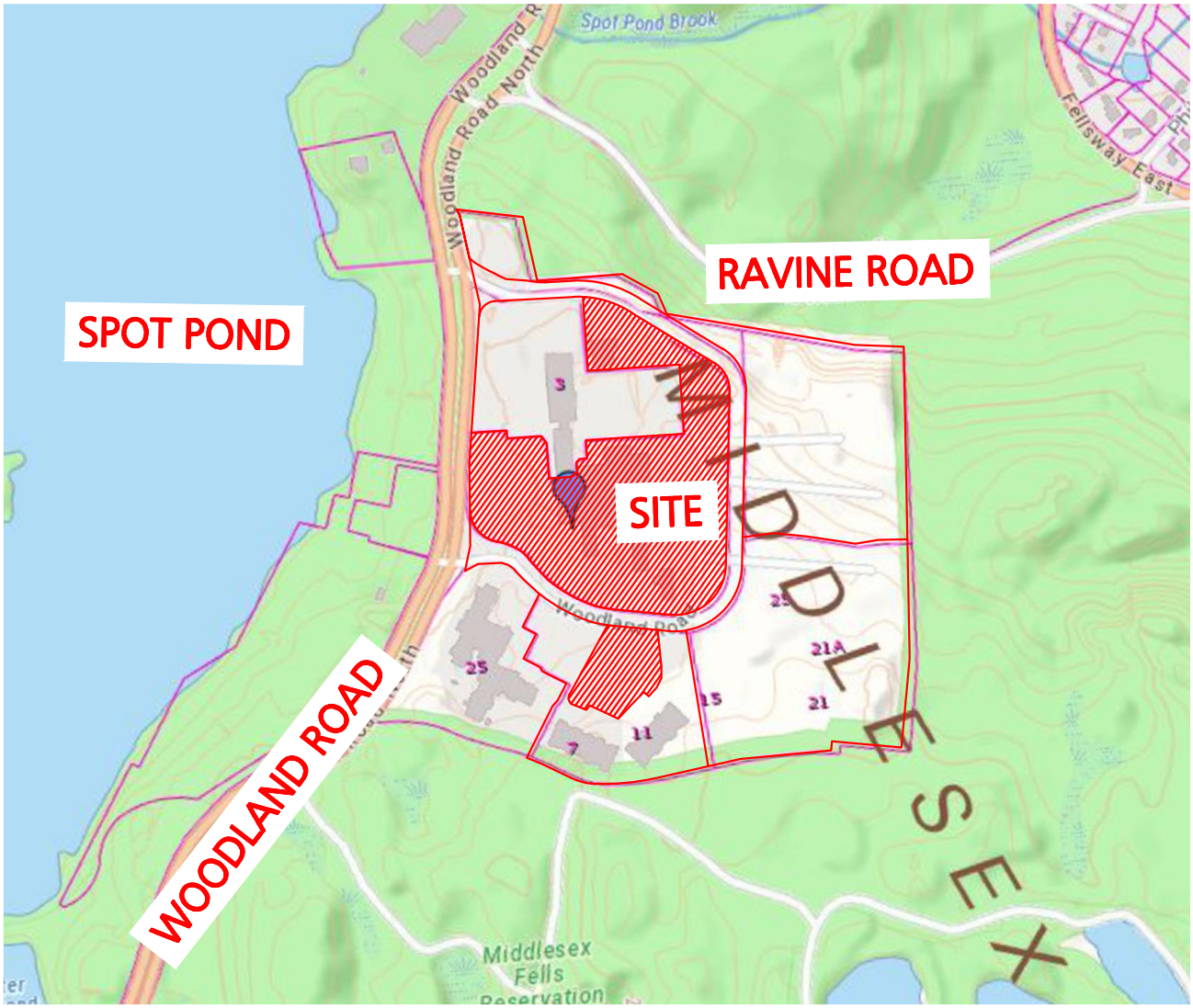
AERIAL PHOTO

PROJECT NO. 1145-01T	DATE: SEPTEMBER 8, 2023
SCALE: NTS	DWG. NAME: EXHIBITS
DESIGNED BY: TJW/DMR	CHECKED BY: TJW

SHEET No.

EX-2



LEGEND

FEMA National Flood Hazard Layer

- A: 1% Annual Chance of Flooding, no BFE
- AE: 1% Annual Chance of Flooding, with BFE
- AE: Regulatory Floodway
- AH: 1% Annual Chance of 1-3ft Ponding, with BFE
- AO: 1% Annual Chance of 1-3ft Sheet Flow Flooding, with Depth
- VE: High Risk Coastal Area
- D: Possible But Undetermined Hazard
- X: 0.2% Annual Chance of Flooding
- X: 1% Drainage Area < 1 Sq. Mi.
- X: Reduced Flood Risk due to Levee
- Area Not Included
- Area with no DFIRM - Paper FIRMs in Effect

FEMA FLOOD INSURANCE RATE MAP
MIDDLESEX COUNTY, MASSACHUSETTS
COMMUNITY PANEL 429 OF 656
MAP NUMBER 25017C0429E
EFFECTIVE DATE: JUNE 4, 2010

NOTE: SITE IS OUTSIDE OF 100-YEAR FLOOD PLAIN.

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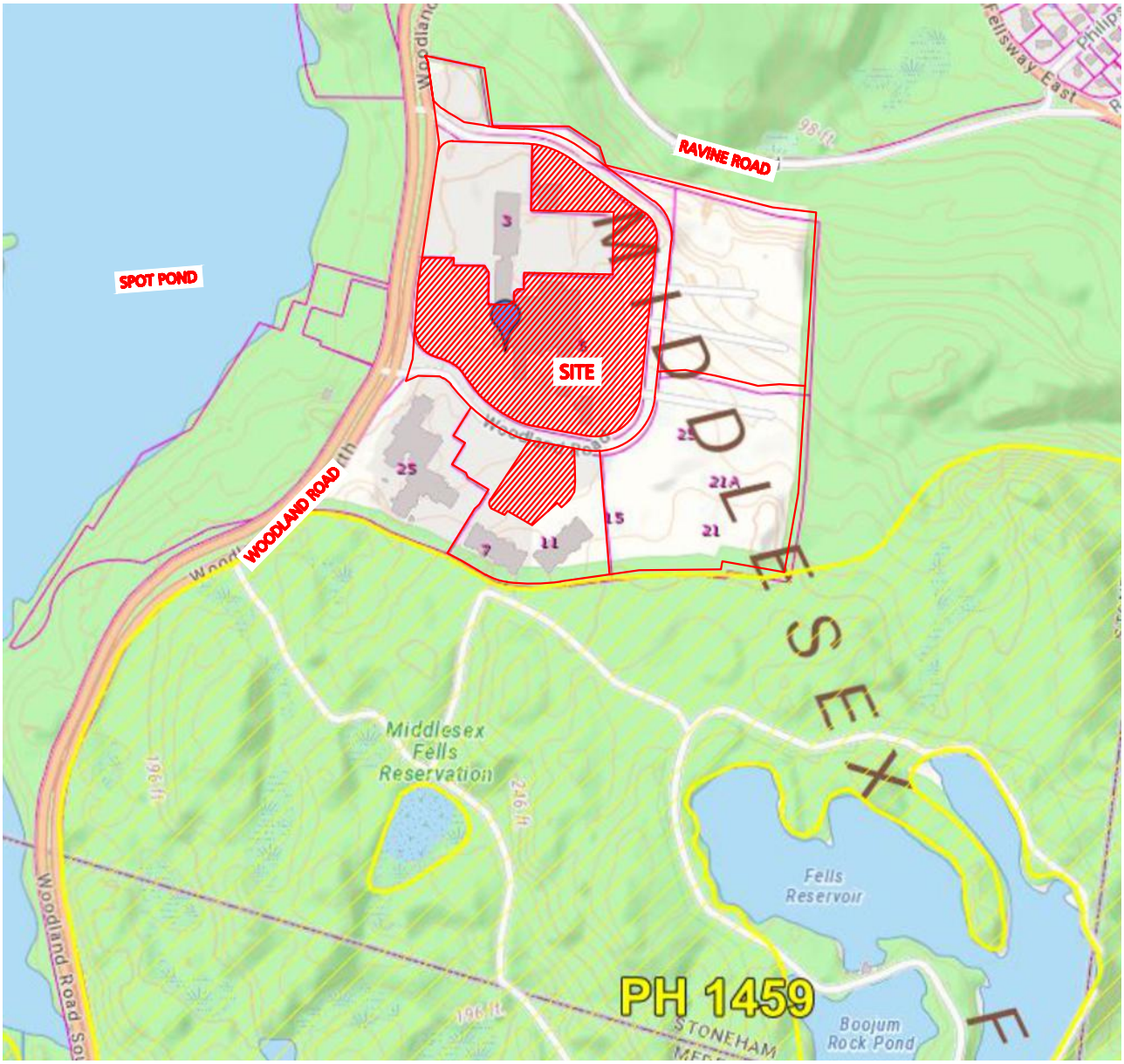
PROJECT: THE RESIDENCE AT SPOT POND, 5 WOODLAND DRIVE

STONEHAM, MA 02180

FEMA FIRM MAP

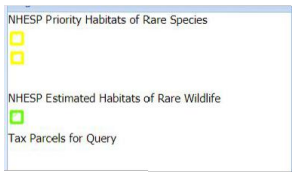
PROJECT NO. 1145-01T	DATE: SEPTEMBER 8, 2023
SCALE: NTS	DWG. NAME: EXHIBITS
DESIGNED BY: TJW/DMR	CHECKED BY: TJW

SHEET No.
EX-3



MA GIS NHESP 2008 PRIORITY & ESTIMATED HABITATS

LEGEND



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WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

PROJECT: THE RESIDENCE AT SPOT POND, 5 WOODLAND DRIVE

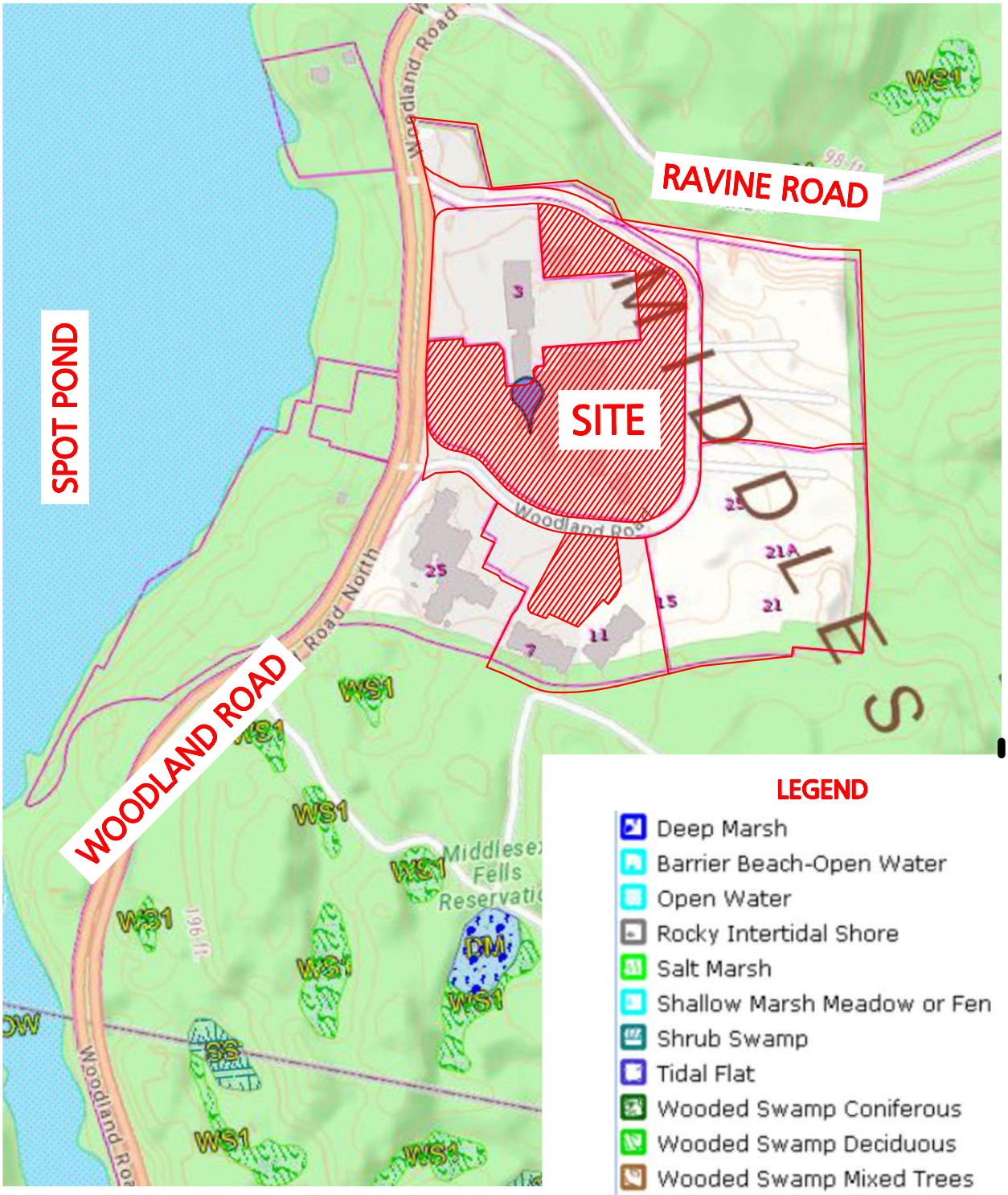
STONEHAM, MA 02180

PRIORITY & ESTIMATED HABITATS

PROJECT NO. 1145-01T	DATE: SEPTEMBER 8, 2023
SCALE: 1"=300'	DWG. NAME: EXHIBITS
DESIGNED BY: TJW/DMR	CHECKED BY: TJW

SHEET No.

EX-4



LEGEND

- Deep Marsh
- Barrier Beach-Open Water
- Open Water
- Rocky Intertidal Shore
- Salt Marsh
- Shallow Marsh Meadow or Fen
- Shrub Swamp
- Tidal Flat
- Wooded Swamp Coniferous
- Wooded Swamp Deciduous
- Wooded Swamp Mixed Trees

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www.allenmajor.com

100 COMMERCE WAY
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WOBURN MA 01888-0118
TEL: (781) 935-6889
FAX: (781) 935-2896

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PROJECT: THE RESIDENCE AT SPOT POND, 5 WOODLAND DRIVE

STONEHAM, MA 02180

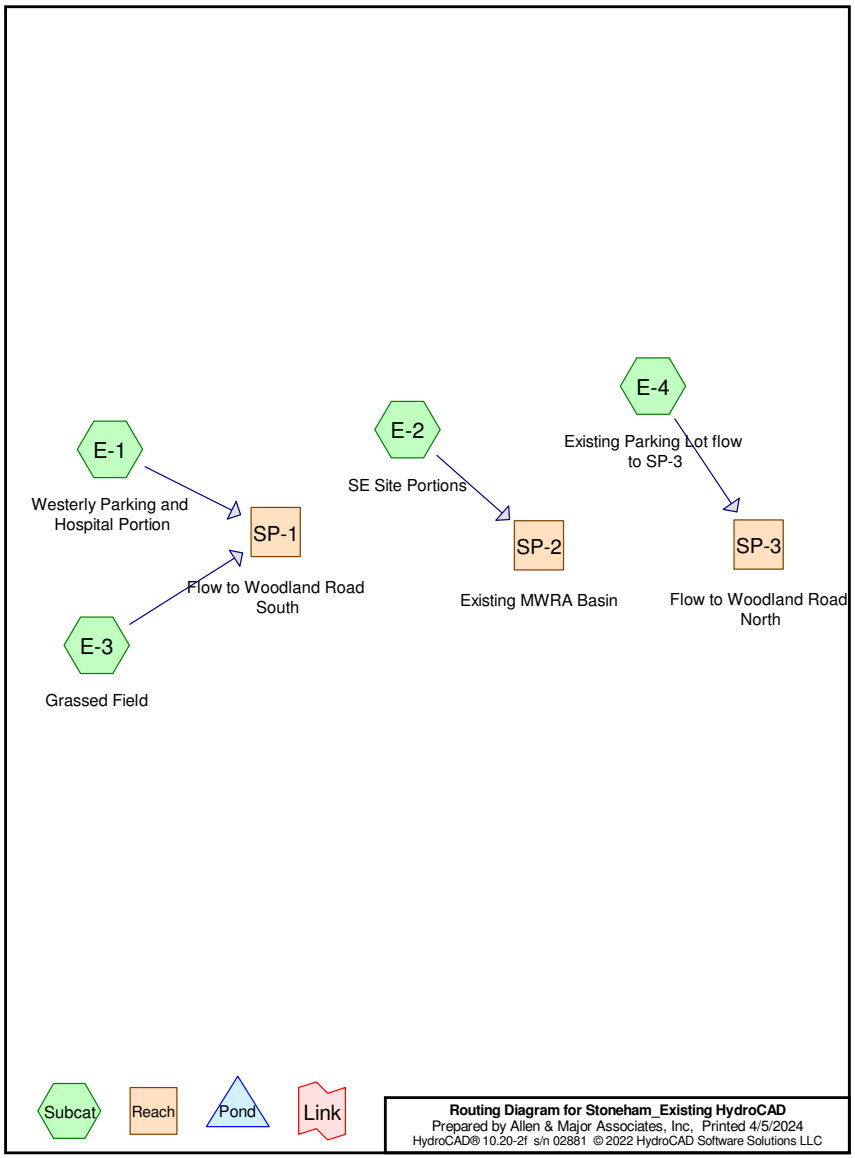
MA GIS WETLANDS MAP

PROJECT NO. 1145-01T	DATE: SEPTEMBER 8, 2023
SCALE: 1"=150'	DWG. NAME: EXHIBITS
DESIGNED BY: TJW/DMR	CHECKED BY: TJW

SHEET No.

EX-5

SECTION 4.0
HYDROCAD



Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.29	2
2	10-Year	Type III 24-hr		Default	24.00	1	5.17	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.35	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.16	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.372	74	>75% Grass cover, Good, HSG C (E-1, E-2, E-3, E-4)
4.008	98	Paved parking, HSG C (E-1, E-2, E-4)
1.703	98	Roofs, HSG C (E-1, E-2, E-4)
12.083	**85**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
12.083	HSG C	E-1, E-2, E-3, E-4
0.000	HSG D	
0.000	Other	
12.083		**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	0.000	6.372	0.000	0.000	6.372	>75% Grass cover, Good	E-1, E-2, E-3, E-4
0.000	0.000	4.008	0.000	0.000	4.008	Paved parking	E-1, E-2, E-4
0.000	0.000	1.703	0.000	0.000	1.703	Roofs	E-1, E-2, E-4
0.000	**0.000**	**12.083**	**0.000**	**0.000**	**12.083**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Westerly Parking and Runoff Area=1.792 ac 28.57% Impervious Runoff Depth>1.54"
Flow Length=485' Tc=5.0 min CN=81 Runoff=3.34 cfs 0.230 af

Subcatchment E-2: SE Site Portions Runoff Area=5.498 ac 35.61% Impervious Runoff Depth>1.68"
Flow Length=321' Tc=7.4 min CN=83 Runoff=10.33 cfs 0.770 af

Subcatchment E-3: Grassed Field Runoff Area=0.683 ac 0.00% Impervious Runoff Depth>1.10"
Tc=5.0 min CN=74 Runoff=0.87 cfs 0.062 af

Subcatchment E-4: Existing Parking Lot flow to Runoff Area=4.110 ac 78.86% Impervious Runoff Depth>2.53"
Tc=0.0 min CN=93 Runoff=14.41 cfs 0.867 af

Reach SP-1: Flow to Woodland Road South Inflow=4.21 cfs 0.292 af
Outflow=4.21 cfs 0.292 af

Reach SP-2: Existing MWRA Basin Inflow=10.33 cfs 0.770 af
Outflow=10.33 cfs 0.770 af

Reach SP-3: Flow to Woodland Road North Inflow=14.41 cfs 0.867 af
Outflow=14.41 cfs 0.867 af

Total Runoff Area = 12.083 ac Runoff Volume = 1.930 af Average Runoff Depth = 1.92"
52.74% Pervious = 6.372 ac 47.26% Impervious = 5.711 ac

Summary for Subcatchment E-1: Westerly Parking and Hospital Portion

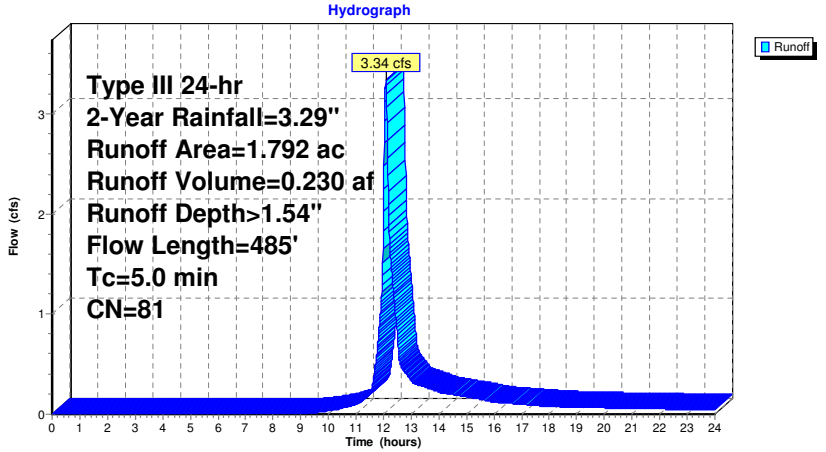
Runoff = 3.34 cfs @ 12.08 hrs, Volume= 0.230 af, Depth> 1.54"
Routed to Reach SP-1 : Flow to Woodland Road South

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=3.29"

Area (ac)	CN	Description
0.102	98	Roofs, HSG C
0.410	98	Paved parking, HSG C
1.280	74	>75% Grass cover, Good, HSG C
1.792	81	Weighted Average
1.280		71.43% Pervious Area
0.512		28.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2000	0.37		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.2000	3.13		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	310	0.0260	3.27		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.9	65	0.0300	1.21		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
5.0	485	Total			

Subcatchment E-1: Westerly Parking and Hospital Portion



Summary for Subcatchment E-2: SE Site Portions

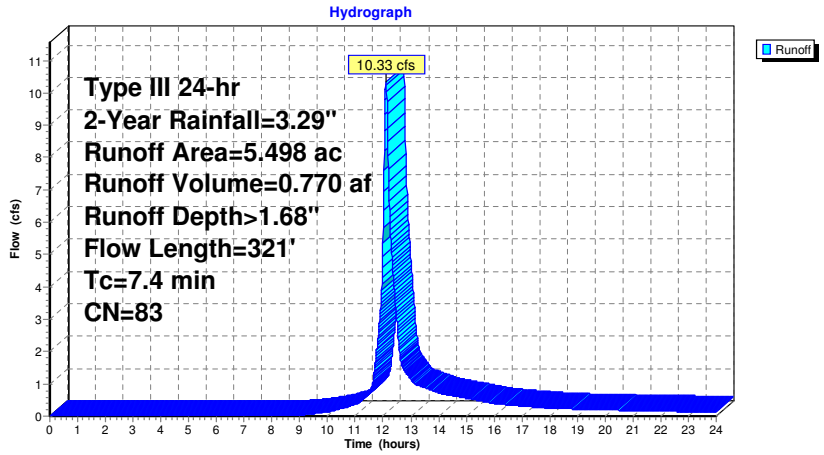
Runoff = 10.33 cfs @ 12.11 hrs, Volume= 0.770 af, Depth> 1.68"
Routed to Reach SP-2 : Existing MWRA Basin

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=3.29"

Area (ac)	CN	Description
1.050	98	Roofs, HSG C
0.908	98	Paved parking, HSG C
3.540	74	>75% Grass cover, Good, HSG C
5.498	83	Weighted Average
3.540		64.39% Pervious Area
1.958		35.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	271	0.0440	1.47		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.4	321	Total			

Subcatchment E-2: SE Site Portions



Summary for Subcatchment E-3: Grassed Field

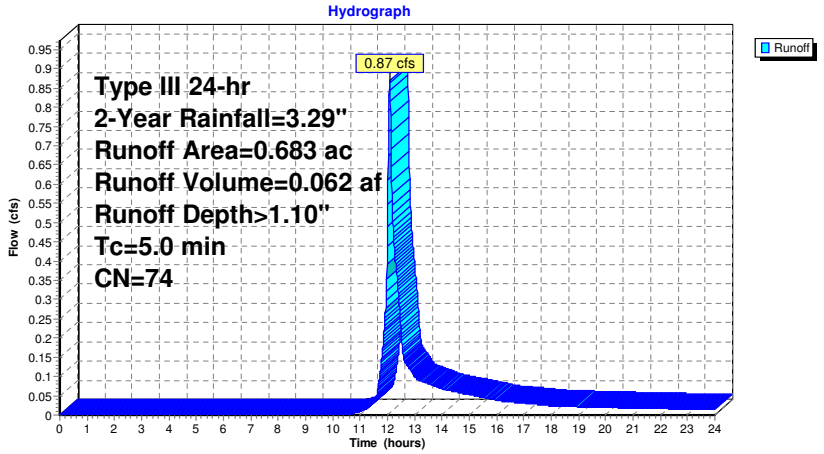
Runoff = 0.87 cfs @ 12.08 hrs, Volume= 0.062 af, Depth> 1.10"
Routed to Reach SP-1 : Flow to Woodland Road South

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=3.29"

Area (ac)	CN	Description
0.683	74	>75% Grass cover, Good, HSG C
0.683		100.00% Pervious Area

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

Subcatchment E-3: Grassed Field



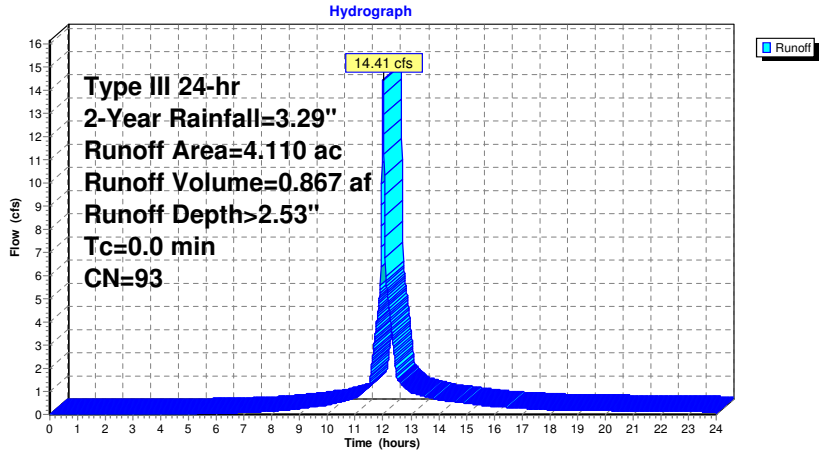
Summary for Subcatchment E-4: Existing Parking Lot flow to SP-3

Runoff = 14.41 cfs @ 12.00 hrs, Volume= 0.867 af, Depth> 2.53"
Routed to Reach SP-3 : Flow to Woodland Road North

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=3.29"

Area (ac)	CN	Description
0.551	98	Roofs, HSG C
2.690	98	Paved parking, HSG C
0.869	74	>75% Grass cover, Good, HSG C
4.110	93	Weighted Average
0.869		21.14% Pervious Area
3.241		78.86% Impervious Area

Subcatchment E-4: Existing Parking Lot flow to SP-3

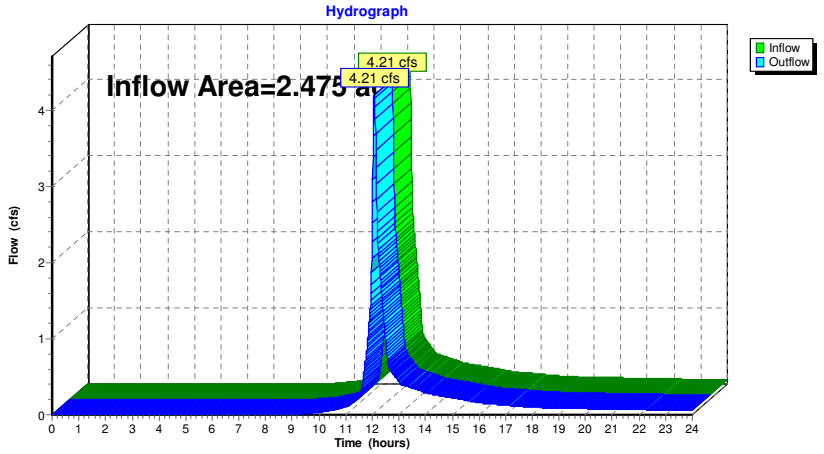


Summary for Reach SP-1: Flow to Woodland Road South

Inflow Area = 2.475 ac, 20.69% Impervious, Inflow Depth > 1.42" for 2-Year event
Inflow = 4.21 cfs @ 12.08 hrs, Volume= 0.292 af
Outflow = 4.21 cfs @ 12.08 hrs, Volume= 0.292 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 SP-1: Flow to Woodland Road South

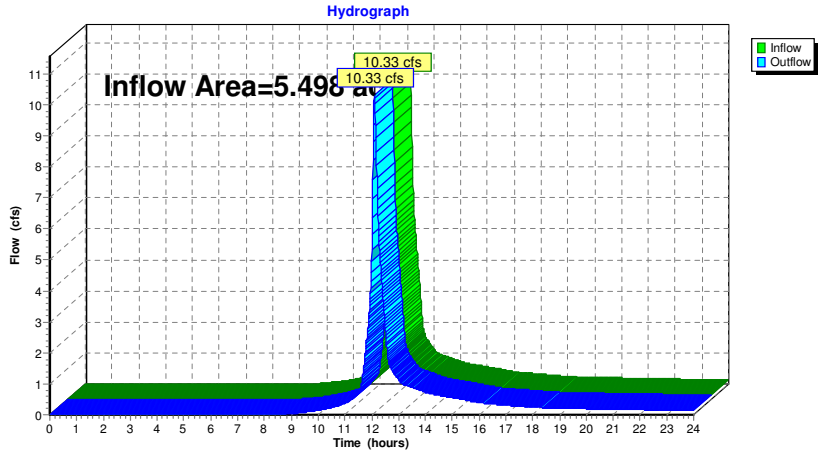


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 5.498 ac, 35.61% Impervious, Inflow Depth > 1.68" for 2-Year event
Inflow = 10.33 cfs @ 12.11 hrs, Volume= 0.770 af
Outflow = 10.33 cfs @ 12.11 hrs, Volume= 0.770 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 SP-2: Existing MWRA Basin

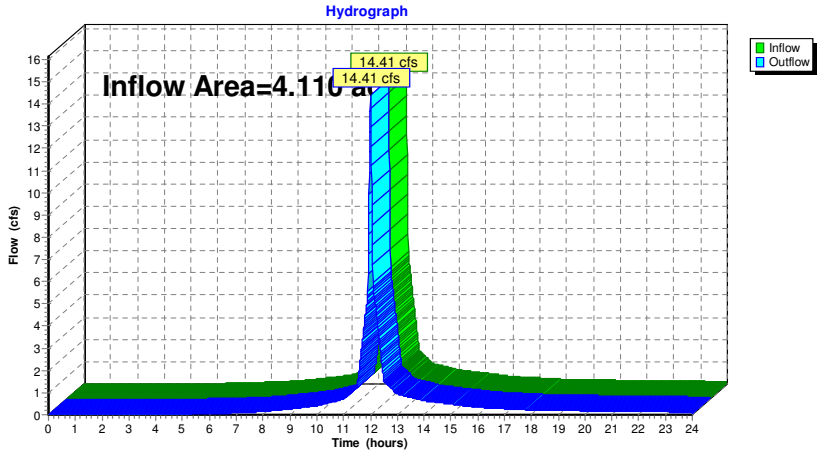


Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 4.110 ac, 78.86% Impervious, Inflow Depth > 2.53" for 2-Year event
Inflow = 14.41 cfs @ 12.00 hrs, Volume= 0.867 af
Outflow = 14.41 cfs @ 12.00 hrs, Volume= 0.867 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 SP-3: Flow to Woodland Road North



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Westerly Parking and Runoff Area=1.792 ac 28.57% Impervious Runoff Depth>3.13"
Flow Length=485' Tc=5.0 min CN=81 Runoff=6.82 cfs 0.468 af

Subcatchment E-2: SE Site Portions Runoff Area=5.498 ac 35.61% Impervious Runoff Depth>3.32"
Flow Length=321' Tc=7.4 min CN=83 Runoff=20.33 cfs 1.523 af

Subcatchment E-3: Grassed Field Runoff Area=0.683 ac 0.00% Impervious Runoff Depth>2.50"
Tc=5.0 min CN=74 Runoff=2.07 cfs 0.142 af

Subcatchment E-4: Existing Parking Lot flow to Runoff Area=4.110 ac 78.86% Impervious Runoff Depth>4.36"
Tc=0.0 min CN=93 Runoff=24.09 cfs 1.495 af

Reach SP-1: Flow to Woodland Road South Inflow=8.89 cfs 0.610 af
Outflow=8.89 cfs 0.610 af

Reach SP-2: Existing MWRA Basin Inflow=20.33 cfs 1.523 af
Outflow=20.33 cfs 1.523 af

Reach SP-3: Flow to Woodland Road North Inflow=24.09 cfs 1.495 af
Outflow=24.09 cfs 1.495 af

Total Runoff Area = 12.083 ac Runoff Volume = 3.628 af Average Runoff Depth = 3.60"
52.74% Pervious = 6.372 ac 47.26% Impervious = 5.711 ac

Summary for Subcatchment E-1: Westerly Parking and Hospital Portion

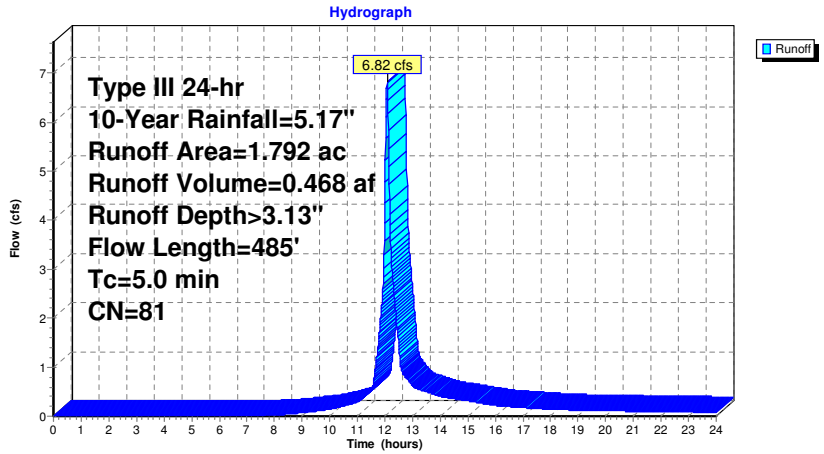
Runoff = 6.82 cfs @ 12.07 hrs, Volume= 0.468 af, Depth> 3.13"
Routed to Reach SP-1 : Flow to Woodland Road South

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=5.17"

Area (ac)	CN	Description
0.102	98	Roofs, HSG C
0.410	98	Paved parking, HSG C
1.280	74	>75% Grass cover, Good, HSG C
1.792	81	Weighted Average
1.280		71.43% Pervious Area
0.512		28.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2000	0.37		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.2000	3.13		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	310	0.0260	3.27		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.9	65	0.0300	1.21		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
5.0	485	Total			

Subcatchment E-1: Westerly Parking and Hospital Portion



Summary for Subcatchment E-2: SE Site Portions

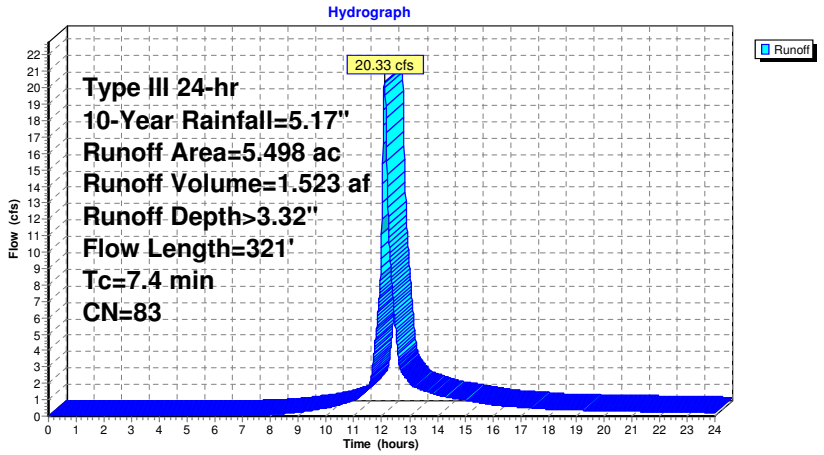
Runoff = 20.33 cfs @ 12.11 hrs, Volume= 1.523 af, Depth> 3.32"
Routed to Reach SP-2 : Existing MWRA Basin

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=5.17"

Area (ac)	CN	Description
1.050	98	Roofs, HSG C
0.908	98	Paved parking, HSG C
3.540	74	>75% Grass cover, Good, HSG C
5.498	83	Weighted Average
3.540		64.39% Pervious Area
1.958		35.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	271	0.0440	1.47		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.4	321	Total			

Subcatchment E-2: SE Site Portions



Summary for Subcatchment E-3: Grassed Field

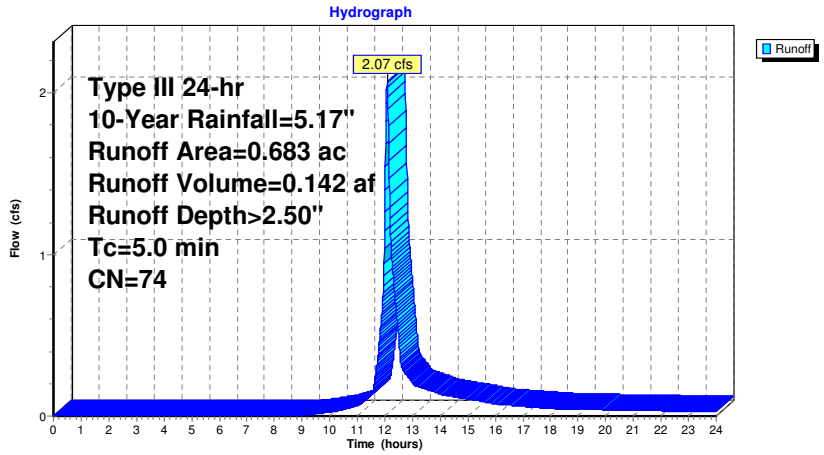
Runoff = 2.07 cfs @ 12.08 hrs, Volume= 0.142 af, Depth> 2.50"
Routed to Reach SP-1 : Flow to Woodland Road South

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=5.17"

Area (ac)	CN	Description
0.683	74	>75% Grass cover, Good, HSG C
0.683		100.00% Pervious Area

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

Subcatchment E-3: Grassed Field



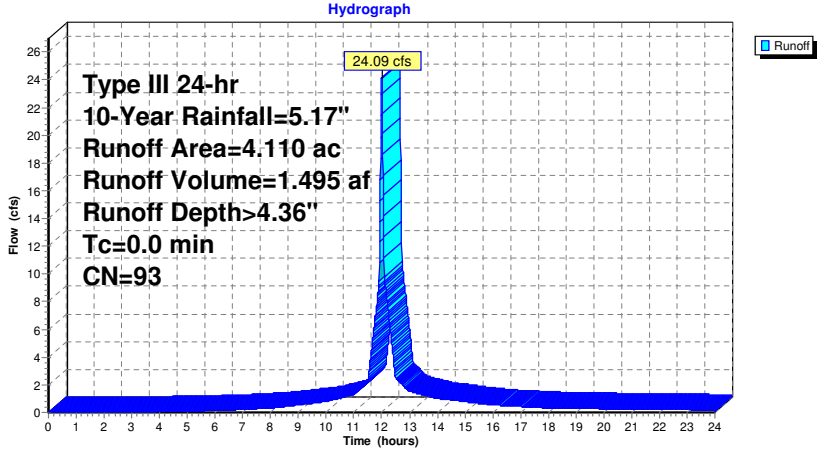
Summary for Subcatchment E-4: Existing Parking Lot flow to SP-3

Runoff = 24.09 cfs @ 12.00 hrs, Volume= 1.495 af, Depth> 4.36"
Routed to Reach SP-3 : Flow to Woodland Road North

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=5.17"

Area (ac)	CN	Description
0.551	98	Roofs, HSG C
2.690	98	Paved parking, HSG C
0.869	74	>75% Grass cover, Good, HSG C
4.110	93	Weighted Average
0.869		21.14% Pervious Area
3.241		78.86% Impervious Area

Subcatchment E-4: Existing Parking Lot flow to SP-3

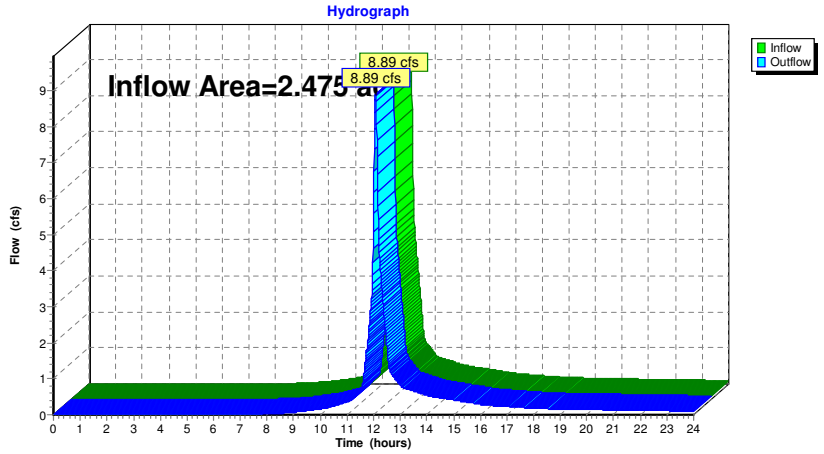


Summary for Reach SP-1: Flow to Woodland Road South

Inflow Area = 2.475 ac, 20.69% Impervious, Inflow Depth > 2.96" for 10-Year event
Inflow = 8.89 cfs @ 12.07 hrs, Volume= 0.610 af
Outflow = 8.89 cfs @ 12.07 hrs, Volume= 0.610 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 SP-1: Flow to Woodland Road South

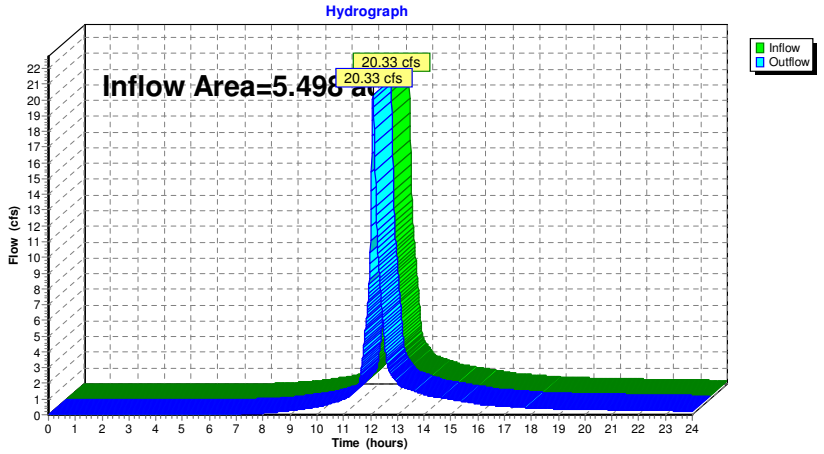


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 5.498 ac, 35.61% Impervious, Inflow Depth > 3.32" for 10-Year event
Inflow = 20.33 cfs @ 12.11 hrs, Volume= 1.523 af
Outflow = 20.33 cfs @ 12.11 hrs, Volume= 1.523 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 SP-2: Existing MWRA Basin

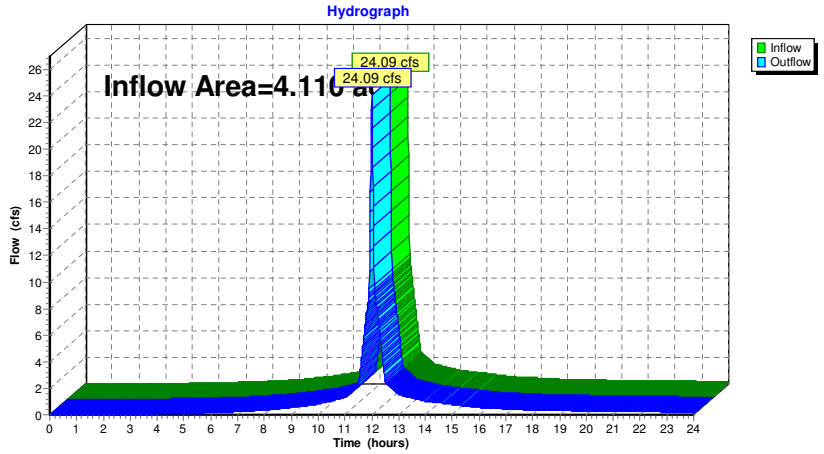


Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 4.110 ac, 78.86% Impervious, Inflow Depth > 4.36" for 10-Year event
Inflow = 24.09 cfs @ 12.00 hrs, Volume= 1.495 af
Outflow = 24.09 cfs @ 12.00 hrs, Volume= 1.495 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 SP-3: Flow to Woodland Road North



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Westerly Parking and Runoff Area=1.792 ac 28.57% Impervious Runoff Depth>4.20"
Flow Length=485' Tc=5.0 min CN=81 Runoff=9.08 cfs 0.627 af

Subcatchment E-2: SE Site Portions Runoff Area=5.498 ac 35.61% Impervious Runoff Depth>4.41"
Flow Length=321' Tc=7.4 min CN=83 Runoff=26.75 cfs 2.021 af

Subcatchment E-3: Grassed Field Runoff Area=0.683 ac 0.00% Impervious Runoff Depth>3.48"
Tc=5.0 min CN=74 Runoff=2.89 cfs 0.198 af

Subcatchment E-4: Existing Parking Lot flow to Runoff Area=4.110 ac 78.86% Impervious Runoff Depth>5.53"
Tc=0.0 min CN=93 Runoff=30.09 cfs 1.893 af

Reach SP-1: Flow to Woodland Road South Inflow=11.97 cfs 0.825 af
Outflow=11.97 cfs 0.825 af

Reach SP-2: Existing MWRA Basin Inflow=26.75 cfs 2.021 af
Outflow=26.75 cfs 2.021 af

Reach SP-3: Flow to Woodland Road North Inflow=30.09 cfs 1.893 af
Outflow=30.09 cfs 1.893 af

Total Runoff Area = 12.083 ac Runoff Volume = 4.740 af Average Runoff Depth = 4.71"
52.74% Pervious = 6.372 ac 47.26% Impervious = 5.711 ac

Summary for Subcatchment E-1: Westerly Parking and Hospital Portion

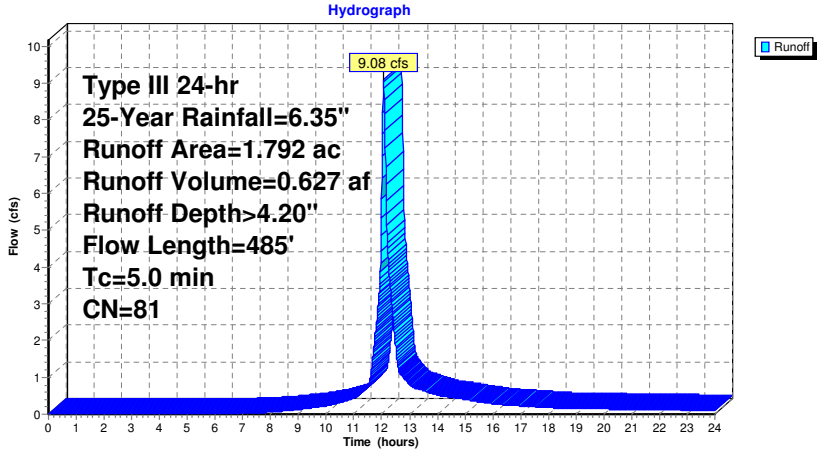
Runoff = 9.08 cfs @ 12.07 hrs, Volume= 0.627 af, Depth> 4.20"
Routed to Reach SP-1 : Flow to Woodland Road South

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=6.35"

Area (ac)	CN	Description
0.102	98	Roofs, HSG C
0.410	98	Paved parking, HSG C
1.280	74	>75% Grass cover, Good, HSG C
1.792	81	Weighted Average
1.280		71.43% Pervious Area
0.512		28.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2000	0.37		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.2000	3.13		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	310	0.0260	3.27		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.9	65	0.0300	1.21		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
5.0	485	Total			

Subcatchment E-1: Westerly Parking and Hospital Portion



Summary for Subcatchment E-2: SE Site Portions

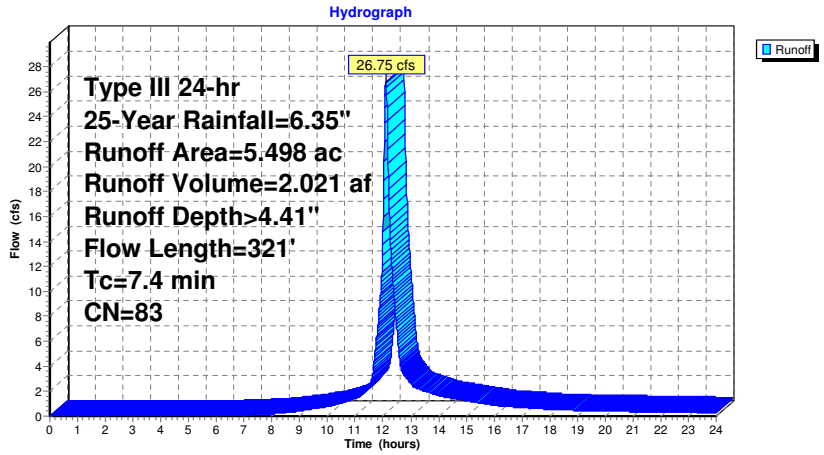
Runoff = 26.75 cfs @ 12.10 hrs, Volume= 2.021 af, Depth> 4.41"
Routed to Reach SP-2 : Existing MWRA Basin

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=6.35"

Area (ac)	CN	Description
1.050	98	Roofs, HSG C
0.908	98	Paved parking, HSG C
3.540	74	>75% Grass cover, Good, HSG C
5.498	83	Weighted Average
3.540		64.39% Pervious Area
1.958		35.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	271	0.0440	1.47		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.4	321	Total			

Subcatchment E-2: SE Site Portions



Summary for Subcatchment E-3: Grassed Field

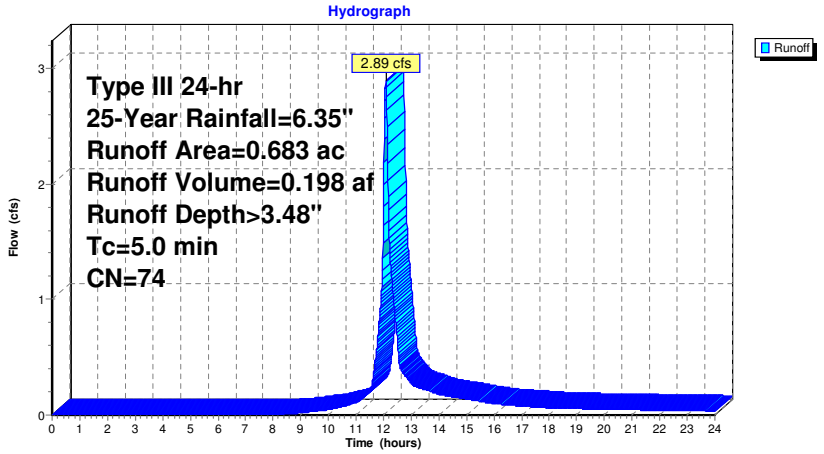
Runoff = 2.89 cfs @ 12.08 hrs, Volume= 0.198 af, Depth> 3.48"
Routed to Reach SP-1 : Flow to Woodland Road South

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=6.35"

Area (ac)	CN	Description
0.683	74	>75% Grass cover, Good, HSG C
0.683		100.00% Pervious Area

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

Subcatchment E-3: Grassed Field



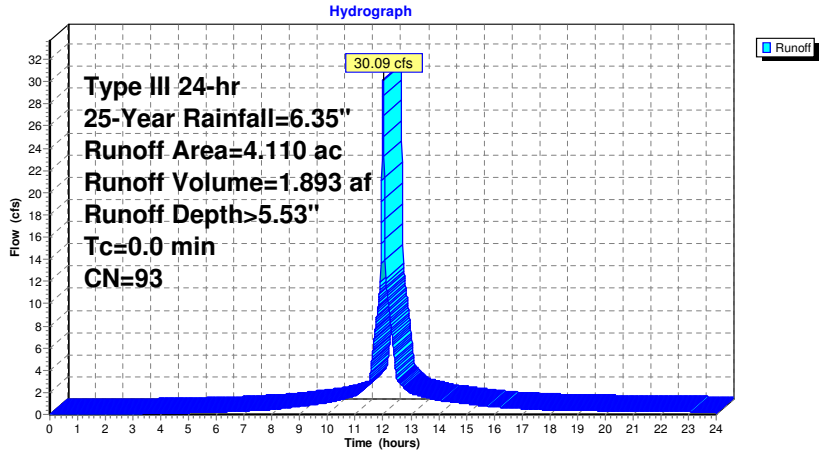
Summary for Subcatchment E-4: Existing Parking Lot flow to SP-3

Runoff = 30.09 cfs @ 12.00 hrs, Volume= 1.893 af, Depth> 5.53"
Routed to Reach SP-3 : Flow to Woodland Road North

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=6.35"

Area (ac)	CN	Description
0.551	98	Roofs, HSG C
2.690	98	Paved parking, HSG C
0.869	74	>75% Grass cover, Good, HSG C
4.110	93	Weighted Average
0.869		21.14% Pervious Area
3.241		78.86% Impervious Area

Subcatchment E-4: Existing Parking Lot flow to SP-3

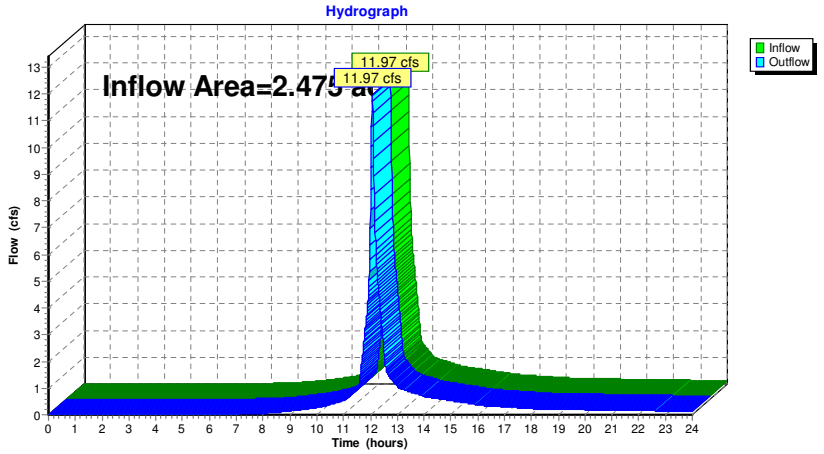


Summary for Reach SP-1: Flow to Woodland Road South

Inflow Area = 2.475 ac, 20.69% Impervious, Inflow Depth > 4.00" for 25-Year event
Inflow = 11.97 cfs @ 12.07 hrs, Volume= 0.825 af
Outflow = 11.97 cfs @ 12.07 hrs, Volume= 0.825 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 SP-1: Flow to Woodland Road South

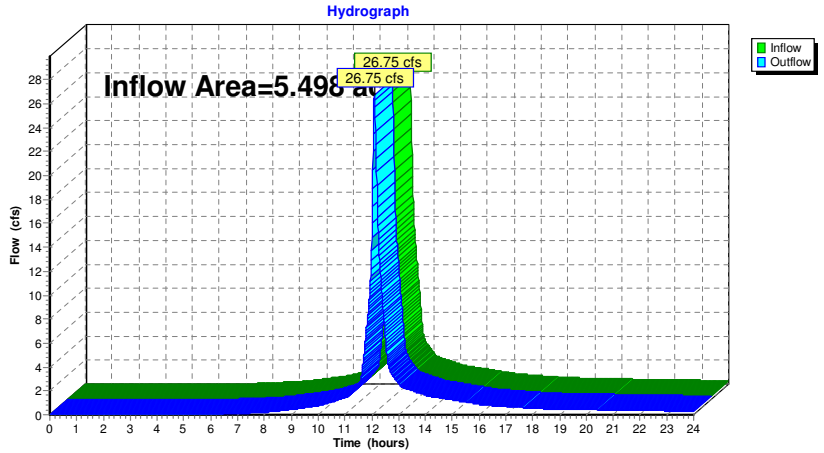


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 5.498 ac, 35.61% Impervious, Inflow Depth > 4.41" for 25-Year event
Inflow = 26.75 cfs @ 12.10 hrs, Volume= 2.021 af
Outflow = 26.75 cfs @ 12.10 hrs, Volume= 2.021 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 SP-2: Existing MWRA Basin

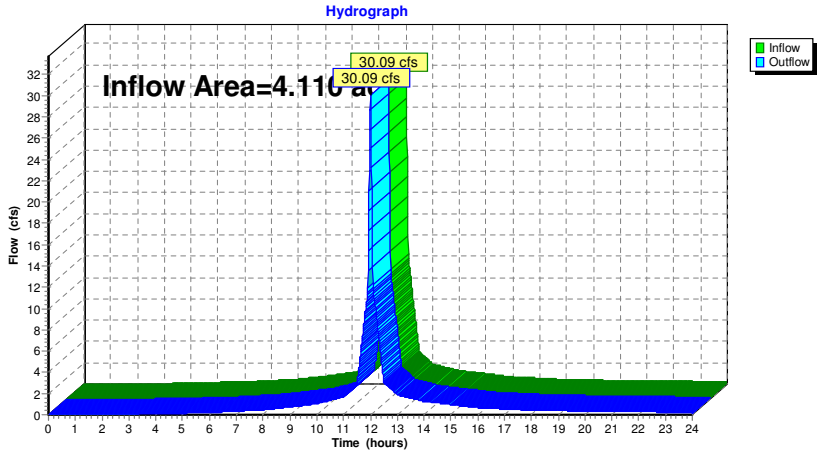


Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 4.110 ac, 78.86% Impervious, Inflow Depth > 5.53" for 25-Year event
Inflow = 30.09 cfs @ 12.00 hrs, Volume= 1.893 af
Outflow = 30.09 cfs @ 12.00 hrs, Volume= 1.893 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 SP-3: Flow to Woodland Road North



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Westerly Parking and Runoff Area=1.792 ac 28.57% Impervious Runoff Depth>5.89"
Flow Length=485' Tc=5.0 min CN=81 Runoff=12.57 cfs 0.879 af

Subcatchment E-2: SE Site Portions Runoff Area=5.498 ac 35.61% Impervious Runoff Depth>6.12"
Flow Length=321' Tc=7.4 min CN=83 Runoff=36.61 cfs 2.805 af

Subcatchment E-3: Grassed Field Runoff Area=0.683 ac 0.00% Impervious Runoff Depth>5.06"
Tc=5.0 min CN=74 Runoff=4.20 cfs 0.288 af

Subcatchment E-4: Existing Parking Lot flow to Runoff Area=4.110 ac 78.86% Impervious Runoff Depth>7.32"
Tc=0.0 min CN=93 Runoff=39.22 cfs 2.508 af

Reach SP-1: Flow to Woodland Road South Inflow=16.77 cfs 1.168 af
Outflow=16.77 cfs 1.168 af

Reach SP-2: Existing MWRA Basin Inflow=36.61 cfs 2.805 af
Outflow=36.61 cfs 2.805 af

Reach SP-3: Flow to Woodland Road North Inflow=39.22 cfs 2.508 af
Outflow=39.22 cfs 2.508 af

Total Runoff Area = 12.083 ac Runoff Volume = 6.481 af Average Runoff Depth = 6.44"
52.74% Pervious = 6.372 ac 47.26% Impervious = 5.711 ac

Summary for Subcatchment E-1: Westerly Parking and Hospital Portion

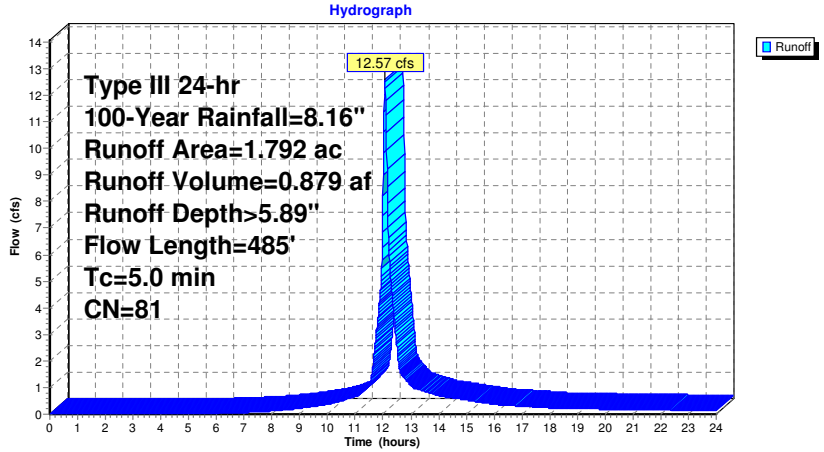
Runoff = 12.57 cfs @ 12.07 hrs, Volume= 0.879 af, Depth> 5.89"
Routed to Reach SP-1 : Flow to Woodland Road South

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=8.16"

Area (ac)	CN	Description
0.102	98	Roofs, HSG C
0.410	98	Paved parking, HSG C
1.280	74	>75% Grass cover, Good, HSG C
1.792	81	Weighted Average
1.280		71.43% Pervious Area
0.512		28.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.2	50	0.2000	0.37		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.3	60	0.2000	3.13		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
1.6	310	0.0260	3.27		**Shallow Concentrated Flow, C-D** Paved Kv= 20.3 fps
0.9	65	0.0300	1.21		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
5.0	485	Total			

Subcatchment E-1: Westerly Parking and Hospital Portion



Summary for Subcatchment E-2: SE Site Portions

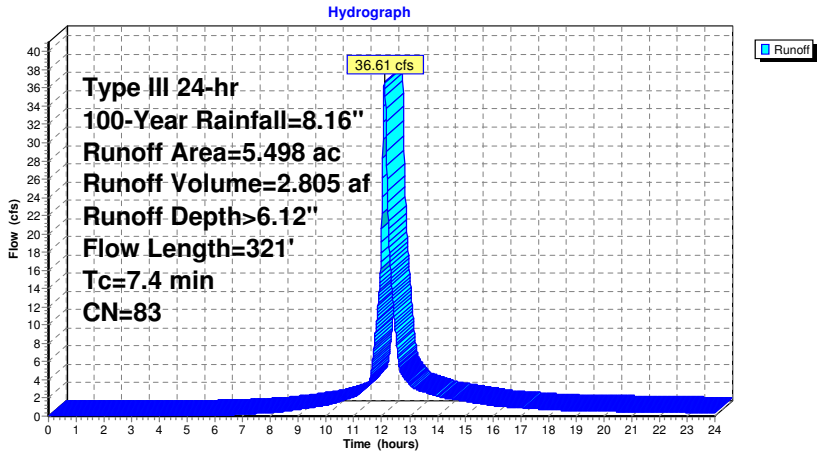
Runoff = 36.61 cfs @ 12.10 hrs, Volume= 2.805 af, Depth> 6.12"
Routed to Reach SP-2 : Existing MWRA Basin

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=8.16"

Area (ac)	CN	Description
1.050	98	Roofs, HSG C
0.908	98	Paved parking, HSG C
3.540	74	>75% Grass cover, Good, HSG C
5.498	83	Weighted Average
3.540		64.39% Pervious Area
1.958		35.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.3	50	0.0400	0.20		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	271	0.0440	1.47		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.4	321	Total			

Subcatchment E-2: SE Site Portions



Summary for Subcatchment E-3: Grassed Field

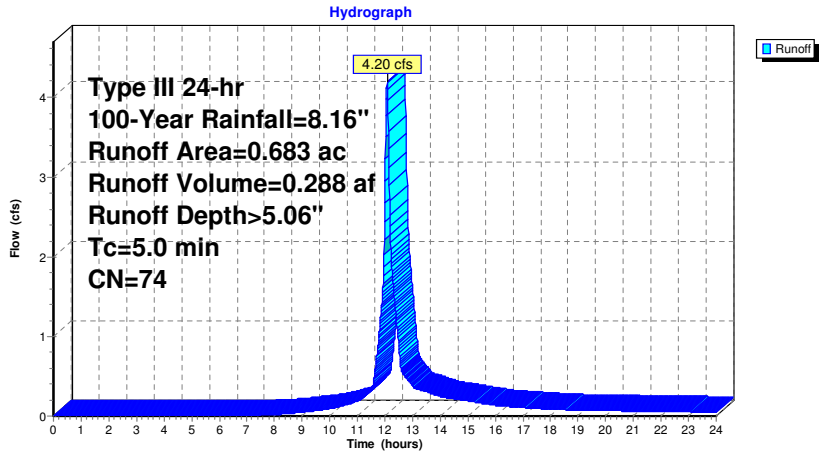
Runoff = 4.20 cfs @ 12.07 hrs, Volume= 0.288 af, Depth> 5.06"
Routed to Reach SP-1 : Flow to Woodland Road South

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=8.16"

Area (ac)	CN	Description
0.683	74	>75% Grass cover, Good, HSG C
0.683		100.00% Pervious Area

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

Subcatchment E-3: Grassed Field



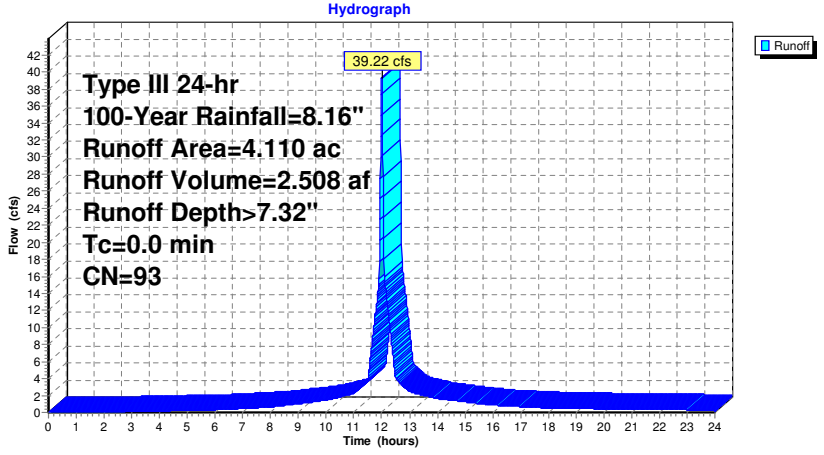
Summary for Subcatchment E-4: Existing Parking Lot flow to SP-3

Runoff = 39.22 cfs @ 12.00 hrs, Volume= 2.508 af, Depth> 7.32"
Routed to Reach SP-3 : Flow to Woodland Road North

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=8.16"

Area (ac)	CN	Description
0.551	98	Roofs, HSG C
2.690	98	Paved parking, HSG C
0.869	74	>75% Grass cover, Good, HSG C
4.110	93	Weighted Average
0.869		21.14% Pervious Area
3.241		78.86% Impervious Area

Subcatchment E-4: Existing Parking Lot flow to SP-3

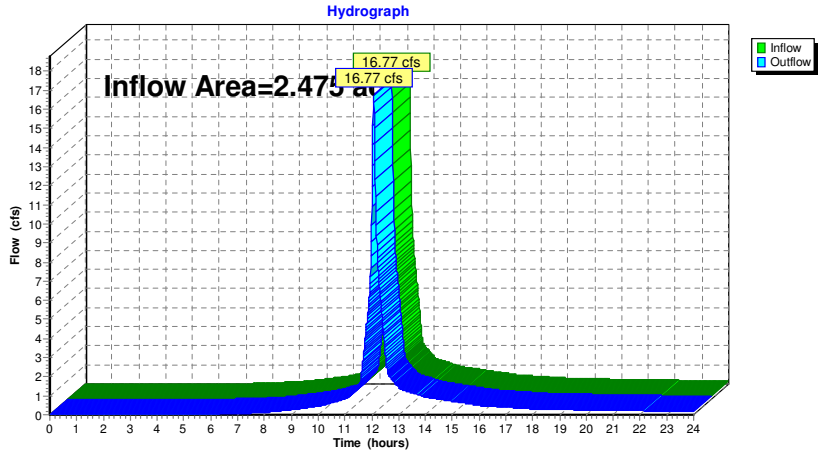


Summary for Reach SP-1: Flow to Woodland Road South

Inflow Area = 2.475 ac, 20.69% Impervious, Inflow Depth > 5.66" for 100-Year event
Inflow = 16.77 cfs @ 12.07 hrs, Volume= 1.168 af
Outflow = 16.77 cfs @ 12.07 hrs, Volume= 1.168 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 SP-1: Flow to Woodland Road South

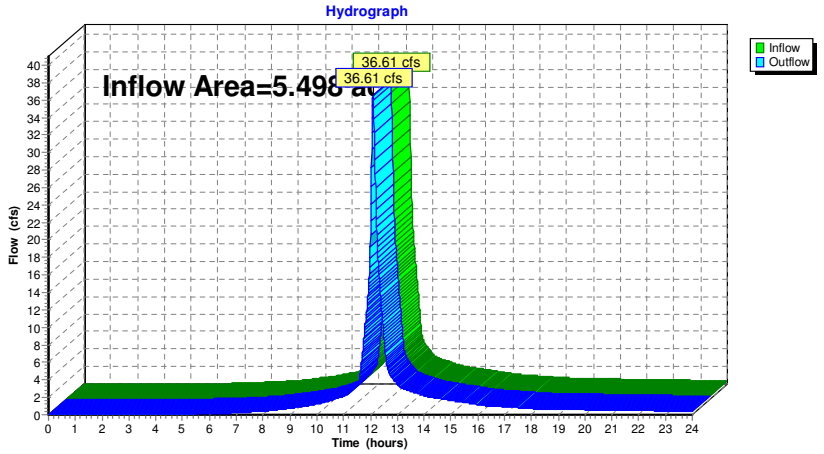


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 5.498 ac, 35.61% Impervious, Inflow Depth > 6.12" for 100-Year event
Inflow = 36.61 cfs @ 12.10 hrs, Volume= 2.805 af
Outflow = 36.61 cfs @ 12.10 hrs, Volume= 2.805 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 SP-2: Existing MWRA Basin

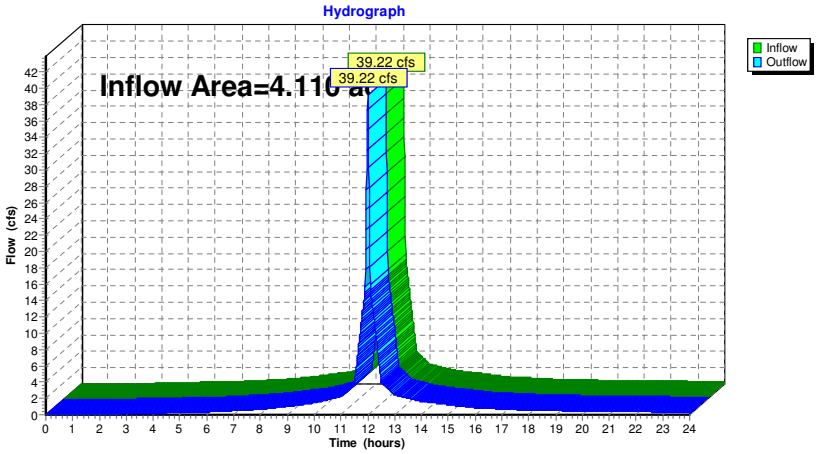


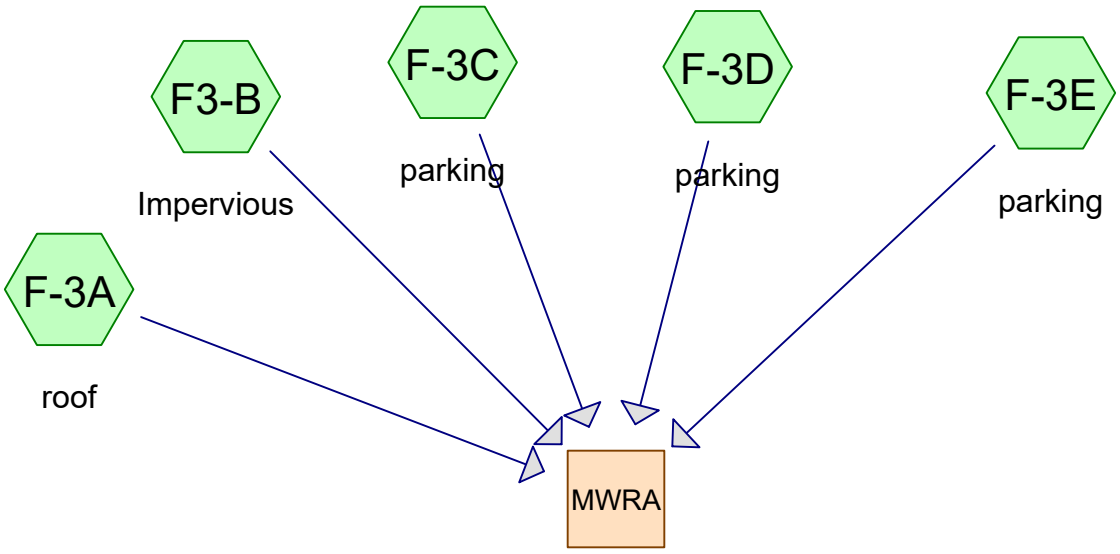
Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 4.110 ac, 78.86% Impervious, Inflow Depth > 7.32" for 100-Year event
Inflow = 39.22 cfs @ 12.00 hrs, Volume= 2.508 af
Outflow = 39.22 cfs @ 12.00 hrs, Volume= 2.508 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 SP-3: Flow to Woodland Road North





MWRA Detention Pond
Contribution

Subcat Reach Pond Link

Routing Diagram for Stoneham_Flow to MWRA Basin
Prepared by Allen & Major Associates, Inc, Printed 9/7/2023

Project Notes

Rainfall events imported from "Atlas-14-Rain.txt" for 6680 MA Middlesex South
Rainfall events imported from "Atlas-14-Rain.txt" for 6680 MA Middlesex South

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.271	74	>75% Grass cover, Good, HSG C (F-3C, F-3D, F-3E)
2.883	98	Paved parking & roofs (F-3A, F-3C, F-3D, F-3E)
0.040	98	Unconnected pavement, HSG C (F3-B)
3.194	**96**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.311	HSG C	F-3C, F-3D, F-3E, F3-B
0.000	HSG D	
2.883	Other	F-3A, F-3C, F-3D, F-3E
3.194		**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	0.000	0.271	0.000	0.000	0.271	>75% Grass cover, Good	F-3C, F-3D, F-3E
0.000	0.000	0.000	0.000	2.883	2.883	Paved parking & roofs	F-3A, F-3C, F-3D, F-3E
0.000	0.000	0.040	0.000	0.000	0.040	Unconnected pavement	F3-B
0.000	**0.000**	**0.311**	**0.000**	**2.883**	**3.194**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth>2.93"
Tc=6.0 min CN=98 Runoff=2.62 cfs 0.208 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth>2.81"
Tc=6.0 min CN=97 Runoff=1.74 cfs 0.135 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth>2.71"
Tc=6.0 min CN=96 Runoff=3.37 cfs 0.257 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth>2.31"
Tc=6.0 min CN=92 Runoff=1.55 cfs 0.113 af

Subcatchment F3-B: Impervious Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>2.93"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.010 af

Reach MWRA: MWRA Detention Pond Contribution Inflow=9.40 cfs 0.723 af
Outflow=9.40 cfs 0.723 af

Total Runoff Area = 3.194 ac Runoff Volume = 0.723 af Average Runoff Depth = 2.71"
8.48% Pervious = 0.271 ac 91.52% Impervious = 2.923 ac

Summary for Subcatchment F-3A: roof

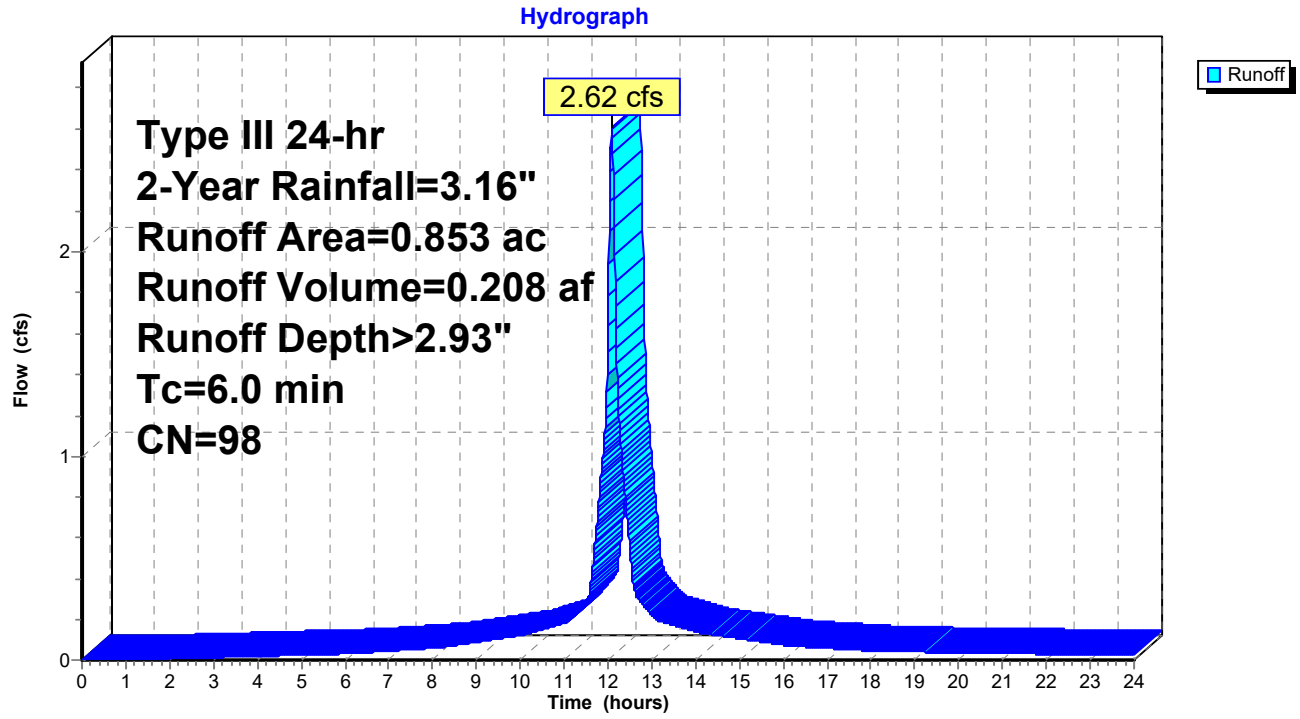
Runoff = 2.62 cfs @ 12.08 hrs, Volume= 0.208 af, Depth> 2.93"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=3.16"

Area (ac)	CN	Description
0.853	98	Paved parking & roofs
0.853		100.00% Impervious Area

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

Subcatchment F-3A: roof



Summary for Subcatchment F-3C: parking

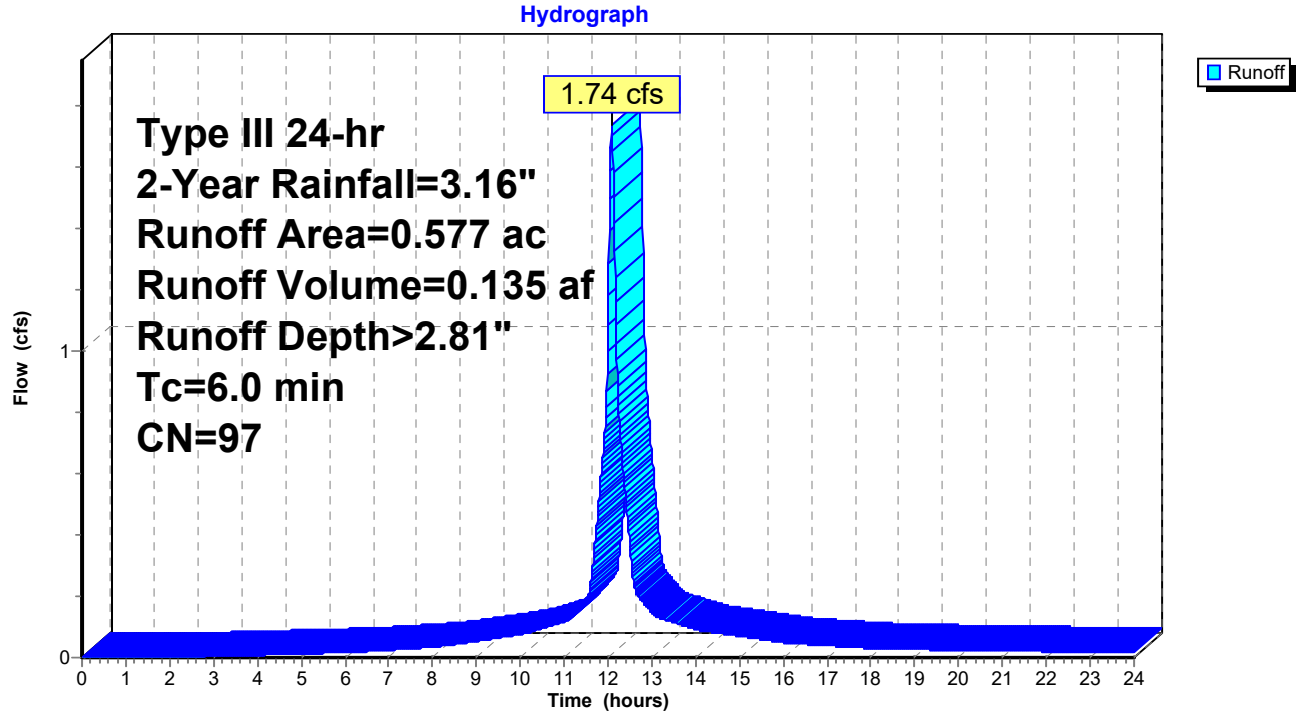
Runoff = 1.74 cfs @ 12.08 hrs, Volume= 0.135 af, Depth> 2.81"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=3.16"

Area (ac)	CN	Description
0.561	98	Paved parking & roofs
0.016	74	>75% Grass cover, Good, HSG C
0.577	97	Weighted Average
0.016		2.77% Pervious Area
0.561		97.23% Impervious Area

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

Subcatchment F-3C: parking



Summary for Subcatchment F-3D: parking

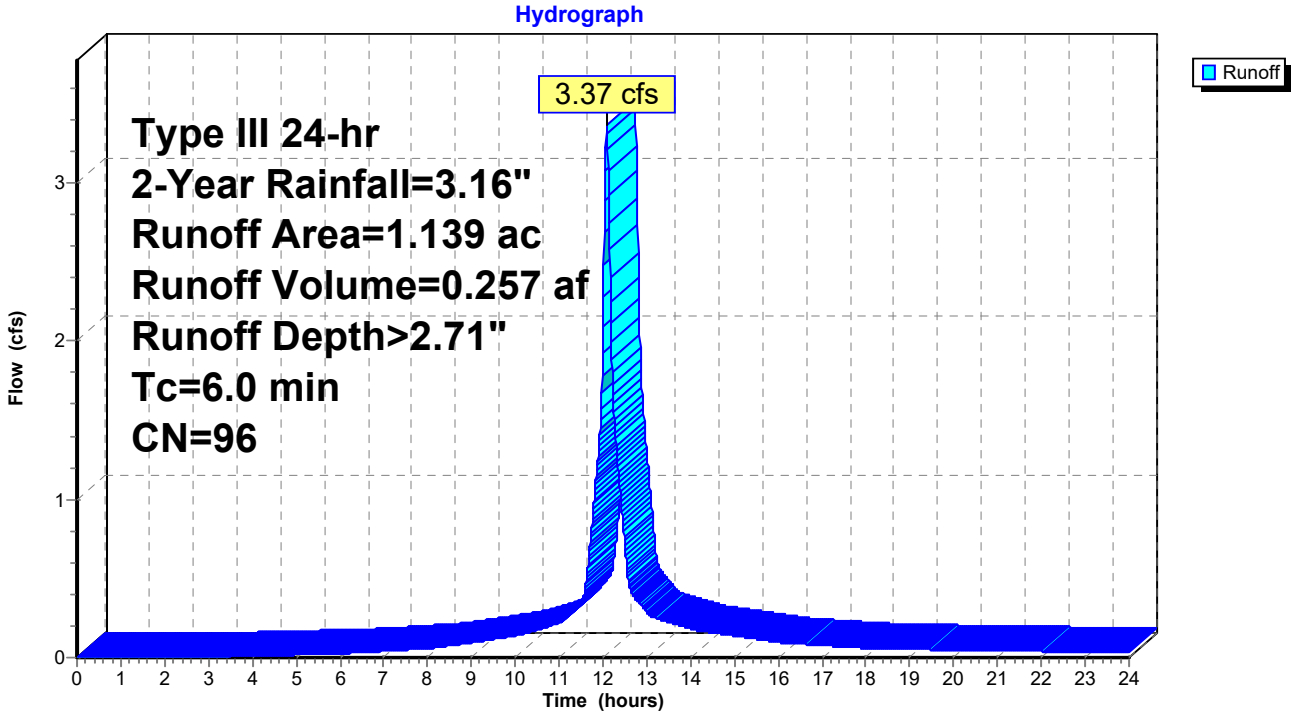
Runoff = 3.37 cfs @ 12.08 hrs, Volume= 0.257 af, Depth> 2.71"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=3.16"

Area (ac)	CN	Description
1.038	98	Paved parking & roofs
0.101	74	>75% Grass cover, Good, HSG C
1.139	96	Weighted Average
0.101		8.87% Pervious Area
1.038		91.13% Impervious Area

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

Subcatchment F-3D: parking



Summary for Subcatchment F-3E: parking

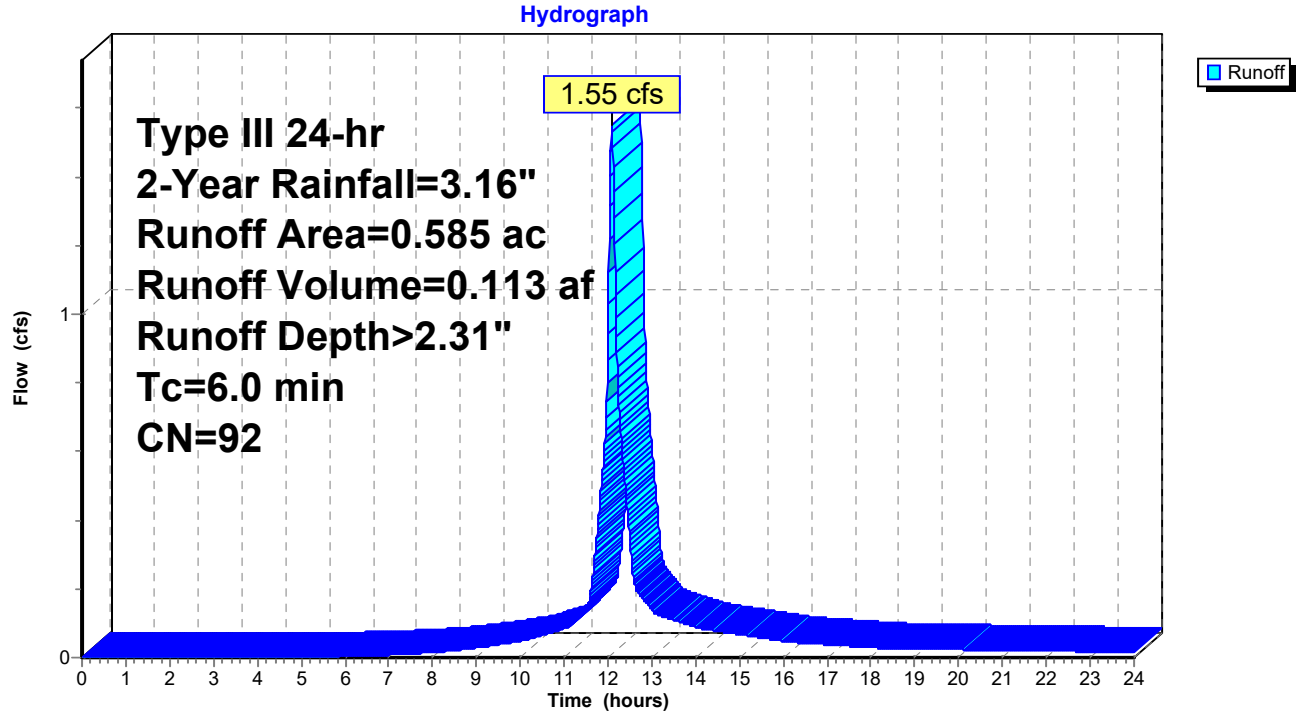
Runoff = 1.55 cfs @ 12.09 hrs, Volume= 0.113 af, Depth> 2.31"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=3.16"

Area (ac)	CN	Description
0.431	98	Paved parking & roofs
0.154	74	>75% Grass cover, Good, HSG C
0.585	92	Weighted Average
0.154		26.32% Pervious Area
0.431		73.68% Impervious Area

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

Subcatchment F-3E: parking



Summary for Subcatchment F3-B: Impervious

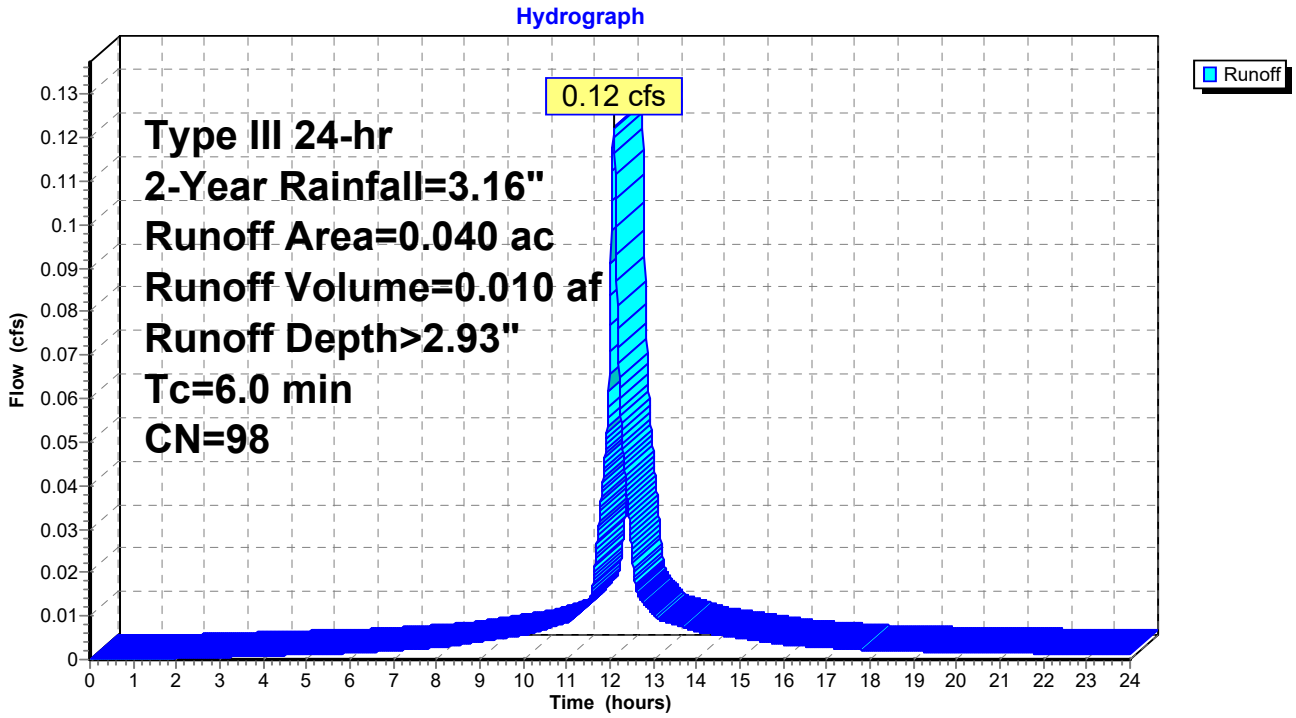
Runoff = 0.12 cfs @ 12.08 hrs, Volume= 0.010 af, Depth> 2.93"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=3.16"

Area (ac)	CN	Description
0.040	98	Unconnected pavement, HSG C
0.040		100.00% Impervious Area
0.040		100.00% Unconnected

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

Subcatchment F3-B: Impervious

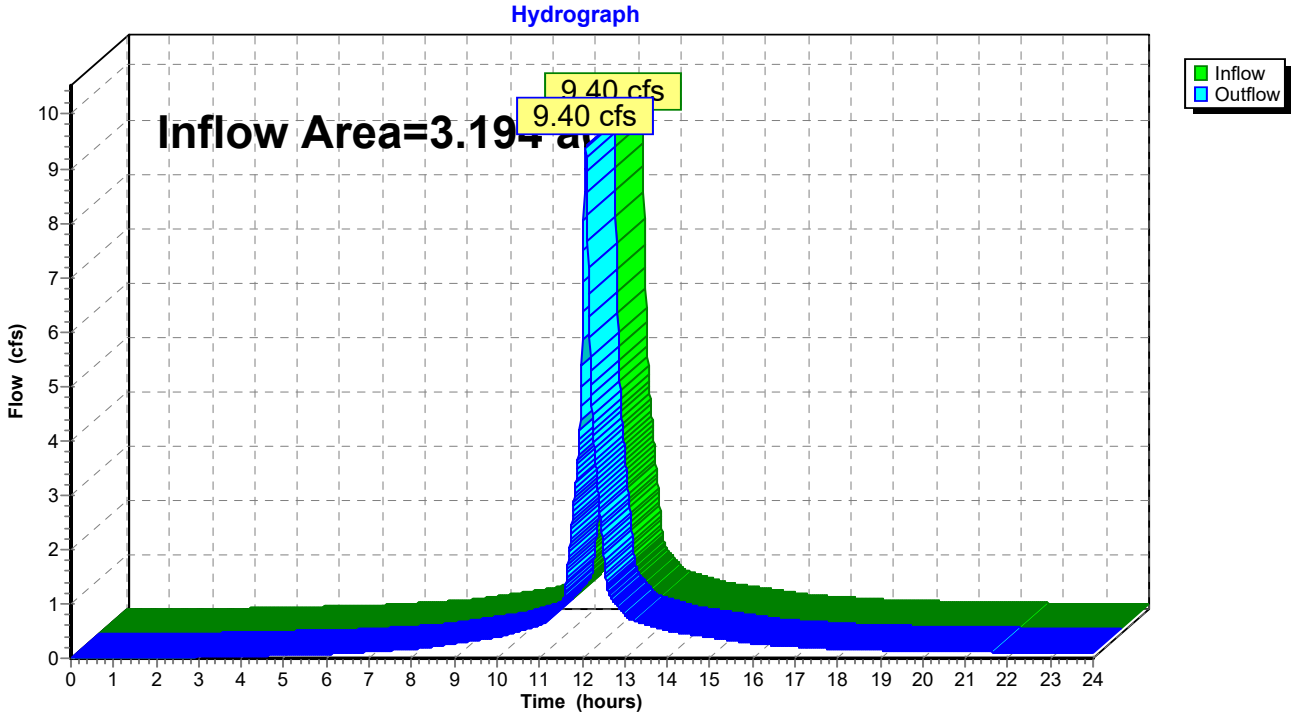


Summary for Reach MWRA: MWRA Detention Pond Contribution

Inflow Area = 3.194 ac, 91.52% Impervious, Inflow Depth > 2.71" for 2-Year event
Inflow = 9.40 cfs @ 12.08 hrs, Volume= 0.723 af
Outflow = 9.40 cfs @ 12.08 hrs, Volume= 0.723 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 MWRA: MWRA Detention Pond Contribution



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth>4.53"
Tc=6.0 min CN=98 Runoff=3.98 cfs 0.322 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth>4.41"
Tc=6.0 min CN=97 Runoff=2.67 cfs 0.212 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth>4.30"
Tc=6.0 min CN=96 Runoff=5.22 cfs 0.408 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth>3.86"
Tc=6.0 min CN=92 Runoff=2.52 cfs 0.188 af

Subcatchment F3-B: Impervious Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>4.53"
Tc=6.0 min CN=98 Runoff=0.19 cfs 0.015 af

Reach MWRA: MWRA Detention Pond Contribution Inflow=14.58 cfs 1.146 af
Outflow=14.58 cfs 1.146 af

Total Runoff Area = 3.194 ac Runoff Volume = 1.146 af Average Runoff Depth = 4.30"
8.48% Pervious = 0.271 ac 91.52% Impervious = 2.923 ac

Summary for Subcatchment F-3A: roof

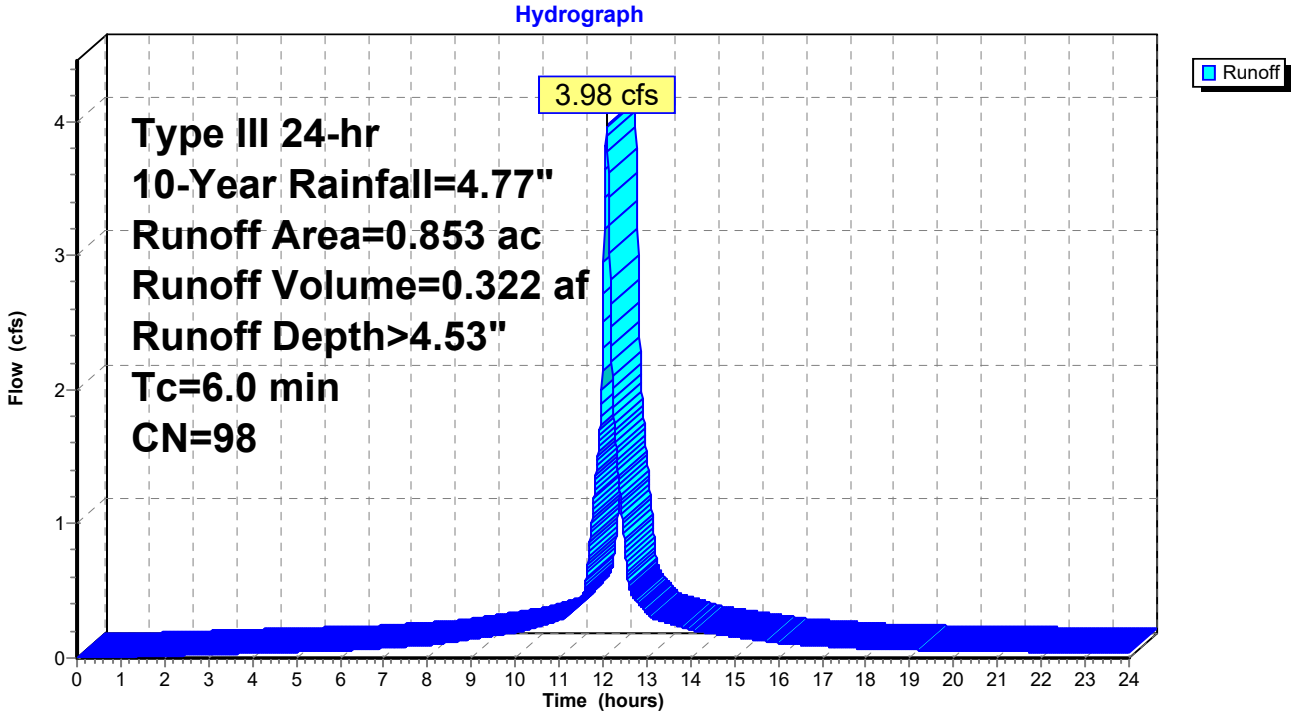
Runoff = 3.98 cfs @ 12.08 hrs, Volume= 0.322 af, Depth> 4.53"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=4.77"

Area (ac)	CN	Description
0.853	98	Paved parking & roofs
0.853		100.00% Impervious Area

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

Subcatchment F-3A: roof



Summary for Subcatchment F-3C: parking

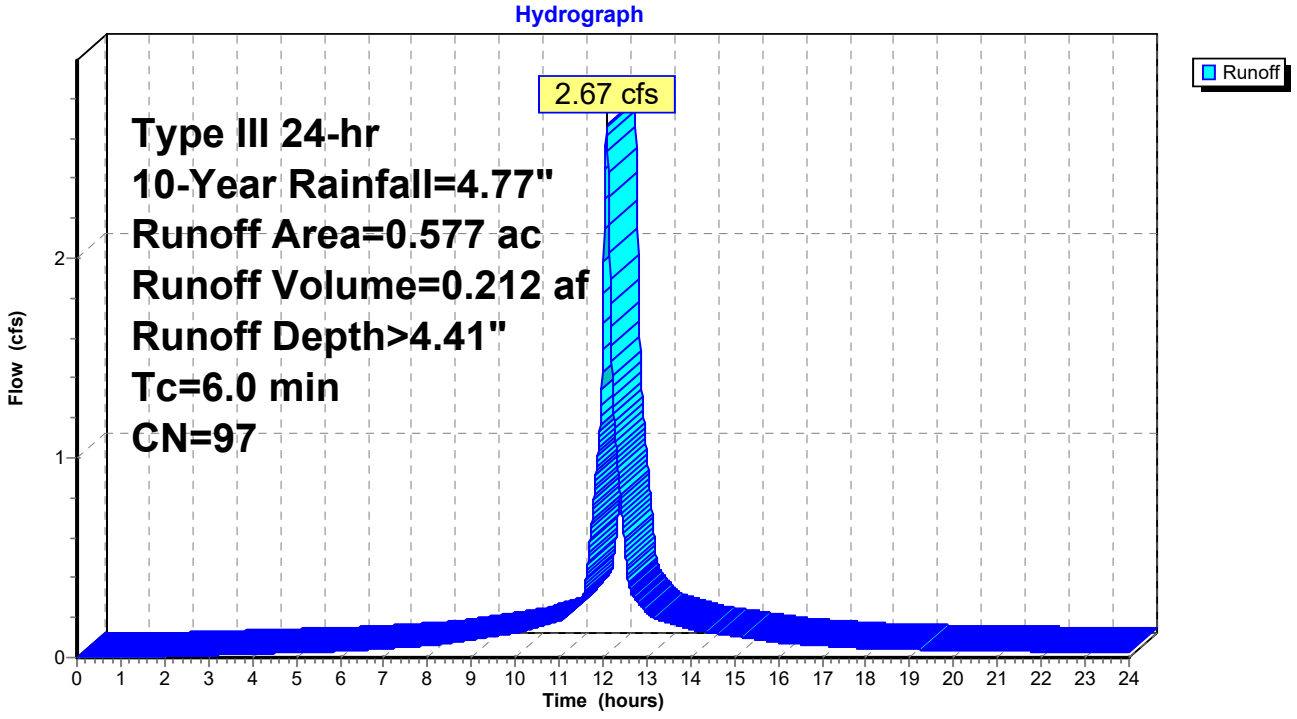
Runoff = 2.67 cfs @ 12.08 hrs, Volume= 0.212 af, Depth> 4.41"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=4.77"

Area (ac)	CN	Description
0.561	98	Paved parking & roofs
0.016	74	>75% Grass cover, Good, HSG C
0.577	97	Weighted Average
0.016		2.77% Pervious Area
0.561		97.23% Impervious Area

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

Subcatchment F-3C: parking



Summary for Subcatchment F-3D: parking

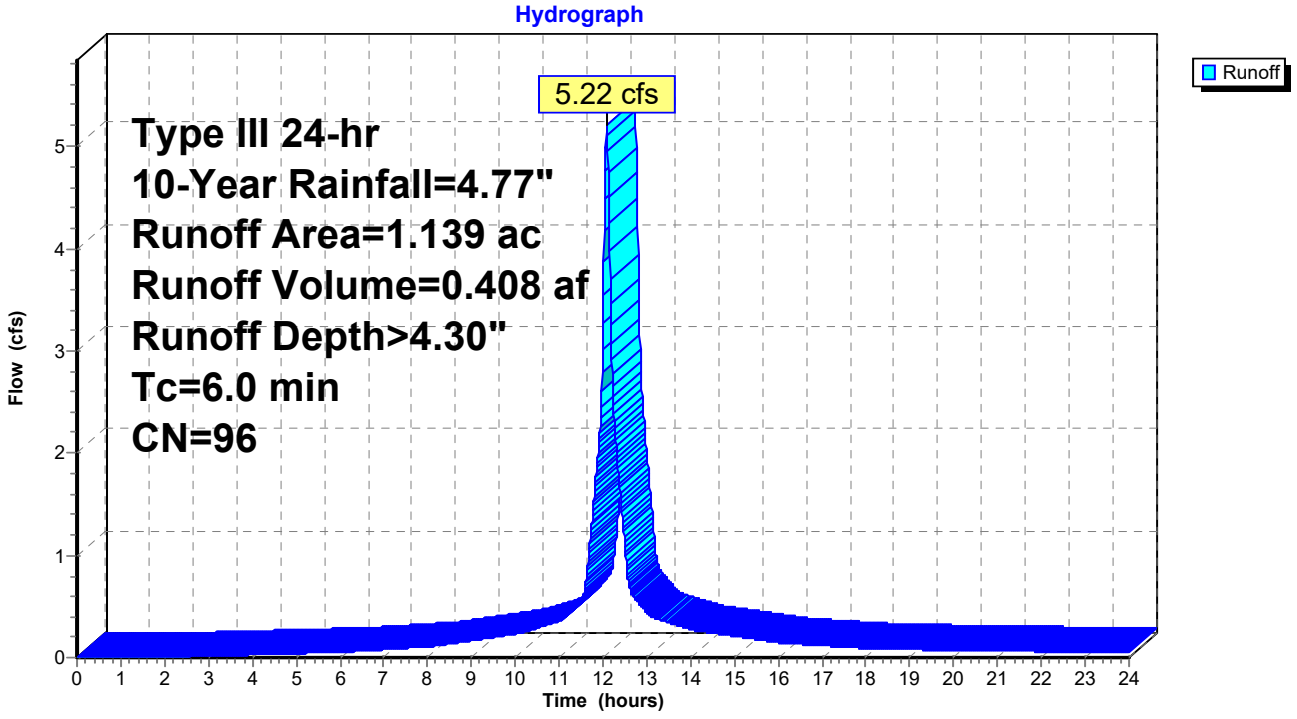
Runoff = 5.22 cfs @ 12.08 hrs, Volume= 0.408 af, Depth> 4.30"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=4.77"

Area (ac)	CN	Description
1.038	98	Paved parking & roofs
0.101	74	>75% Grass cover, Good, HSG C
1.139	96	Weighted Average
0.101		8.87% Pervious Area
1.038		91.13% Impervious Area

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

Subcatchment F-3D: parking



Summary for Subcatchment F-3E: parking

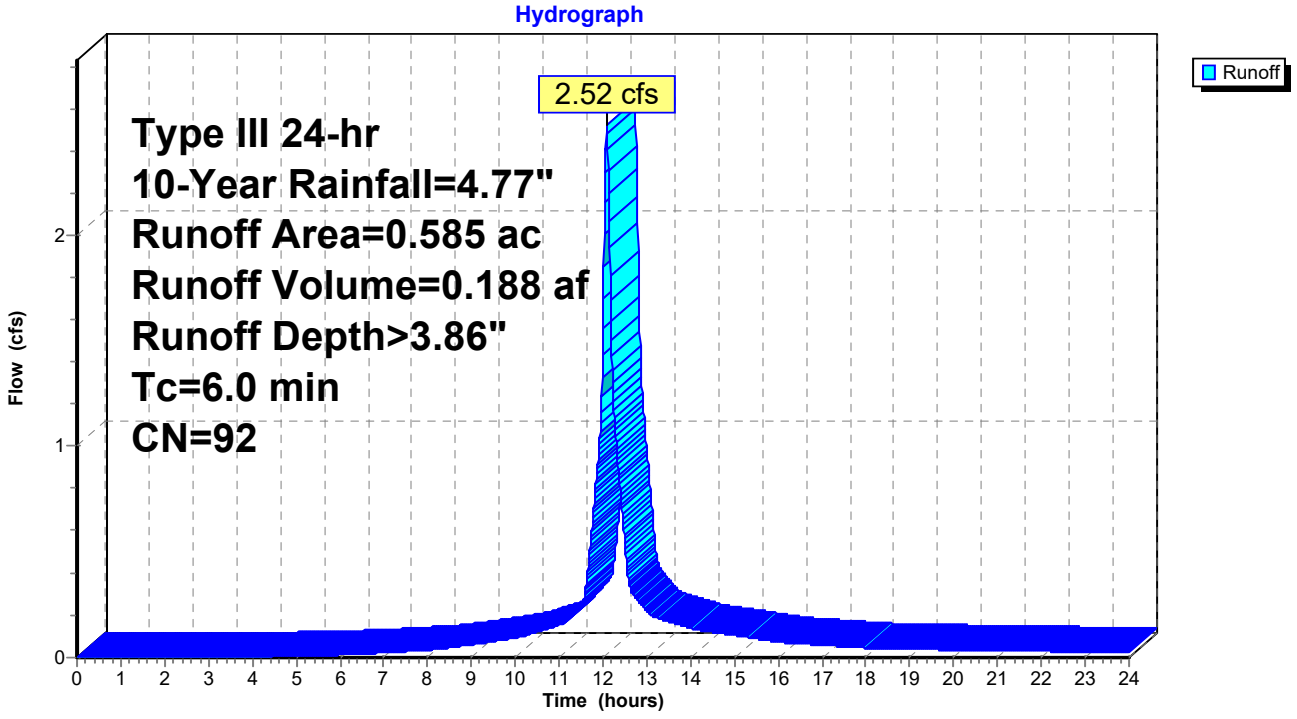
Runoff = 2.52 cfs @ 12.08 hrs, Volume= 0.188 af, Depth> 3.86"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=4.77"

Area (ac)	CN	Description
0.431	98	Paved parking & roofs
0.154	74	>75% Grass cover, Good, HSG C
0.585	92	Weighted Average
0.154		26.32% Pervious Area
0.431		73.68% Impervious Area

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

Subcatchment F-3E: parking



Summary for Subcatchment F3-B: Impervious

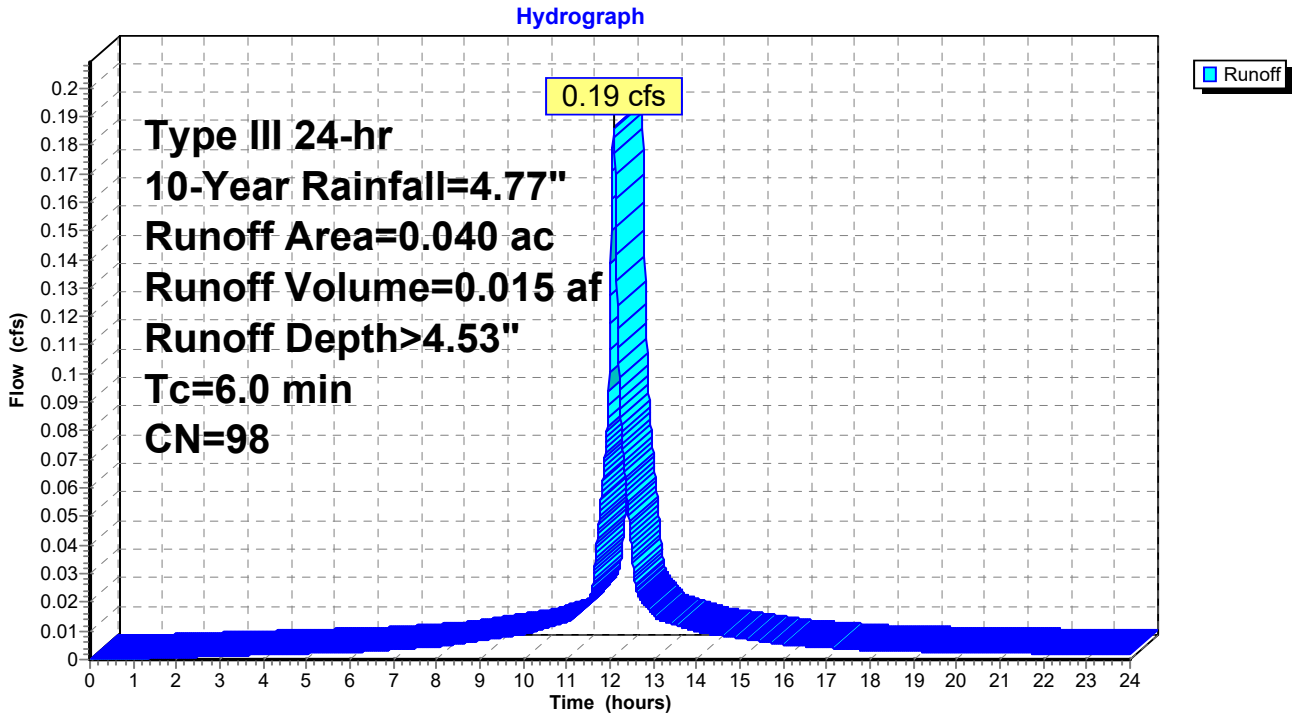
Runoff = 0.19 cfs @ 12.08 hrs, Volume= 0.015 af, Depth> 4.53"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=4.77"

Area (ac)	CN	Description
0.040	98	Unconnected pavement, HSG C
0.040		100.00% Impervious Area
0.040		100.00% Unconnected

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

Subcatchment F3-B: Impervious

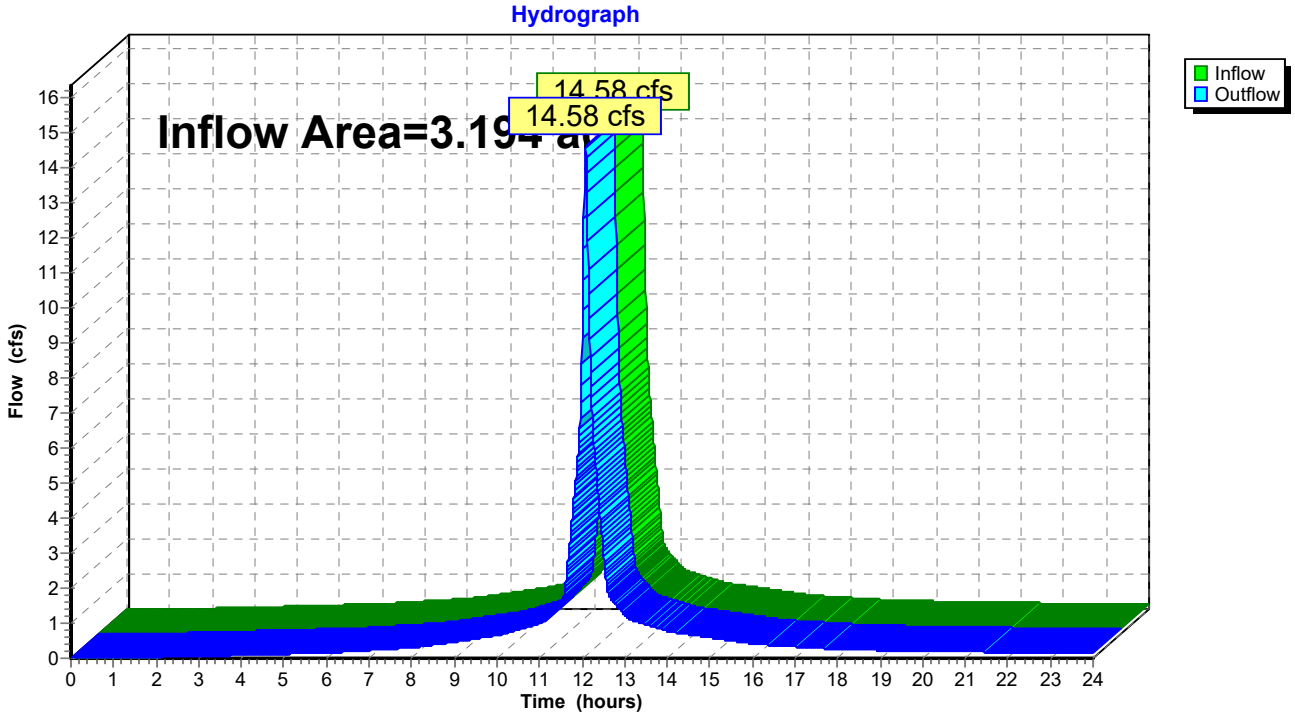


Summary for Reach MWRA: MWRA Detention Pond Contribution

Inflow Area = 3.194 ac, 91.52% Impervious, Inflow Depth > 4.30" for 10-Year event
Inflow = 14.58 cfs @ 12.08 hrs, Volume= 1.146 af
Outflow = 14.58 cfs @ 12.08 hrs, Volume= 1.146 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 MWRA: MWRA Detention Pond Contribution



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth>5.79"
Tc=6.0 min CN=98 Runoff=5.04 cfs 0.411 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth>5.67"
Tc=6.0 min CN=97 Runoff=3.39 cfs 0.273 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth>5.55"
Tc=6.0 min CN=96 Runoff=6.65 cfs 0.527 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth>5.09"
Tc=6.0 min CN=92 Runoff=3.28 cfs 0.248 af

Subcatchment F3-B: Impervious Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>5.79"
Tc=6.0 min CN=98 Runoff=0.24 cfs 0.019 af

Reach MWRA: MWRA Detention Pond Contribution Inflow=18.60 cfs 1.479 af
Outflow=18.60 cfs 1.479 af

Total Runoff Area = 3.194 ac Runoff Volume = 1.479 af Average Runoff Depth = 5.56"
8.48% Pervious = 0.271 ac 91.52% Impervious = 2.923 ac

Summary for Subcatchment F-3A: roof

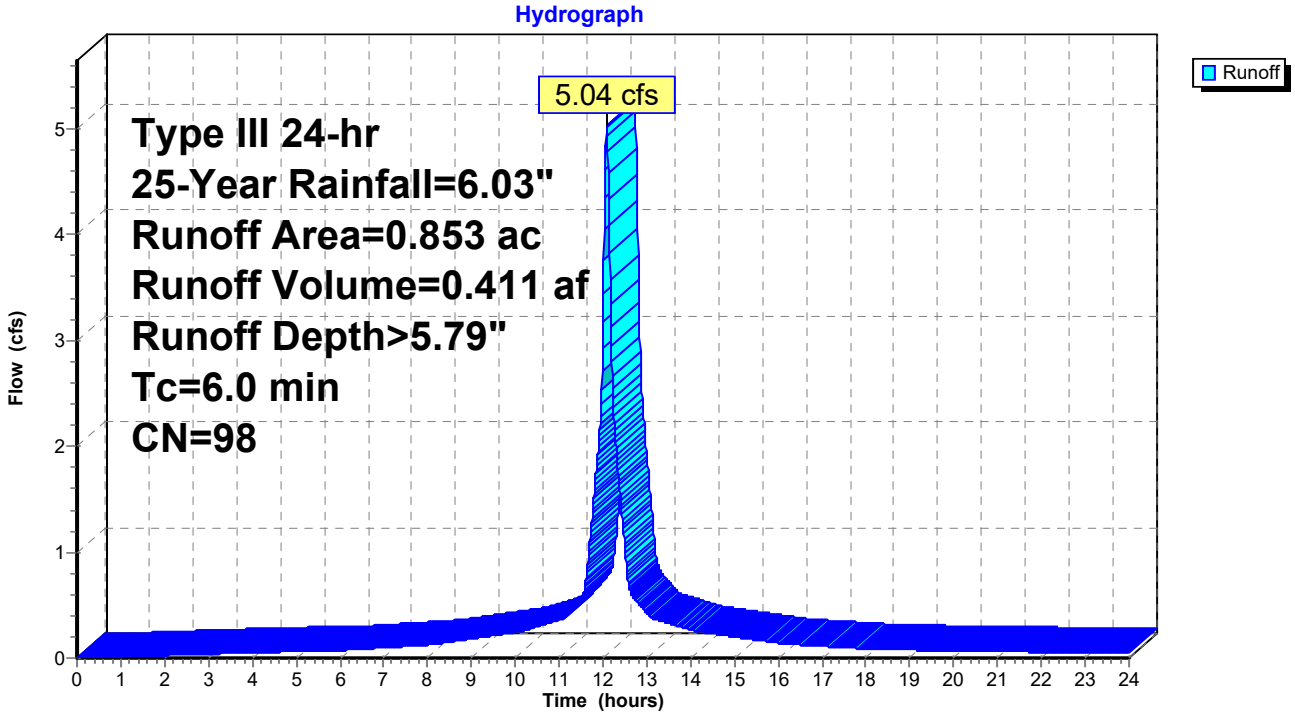
Runoff = 5.04 cfs @ 12.08 hrs, Volume= 0.411 af, Depth> 5.79"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=6.03"

Area (ac)	CN	Description
0.853	98	Paved parking & roofs
0.853		100.00% Impervious Area

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

Subcatchment F-3A: roof



Summary for Subcatchment F-3C: parking

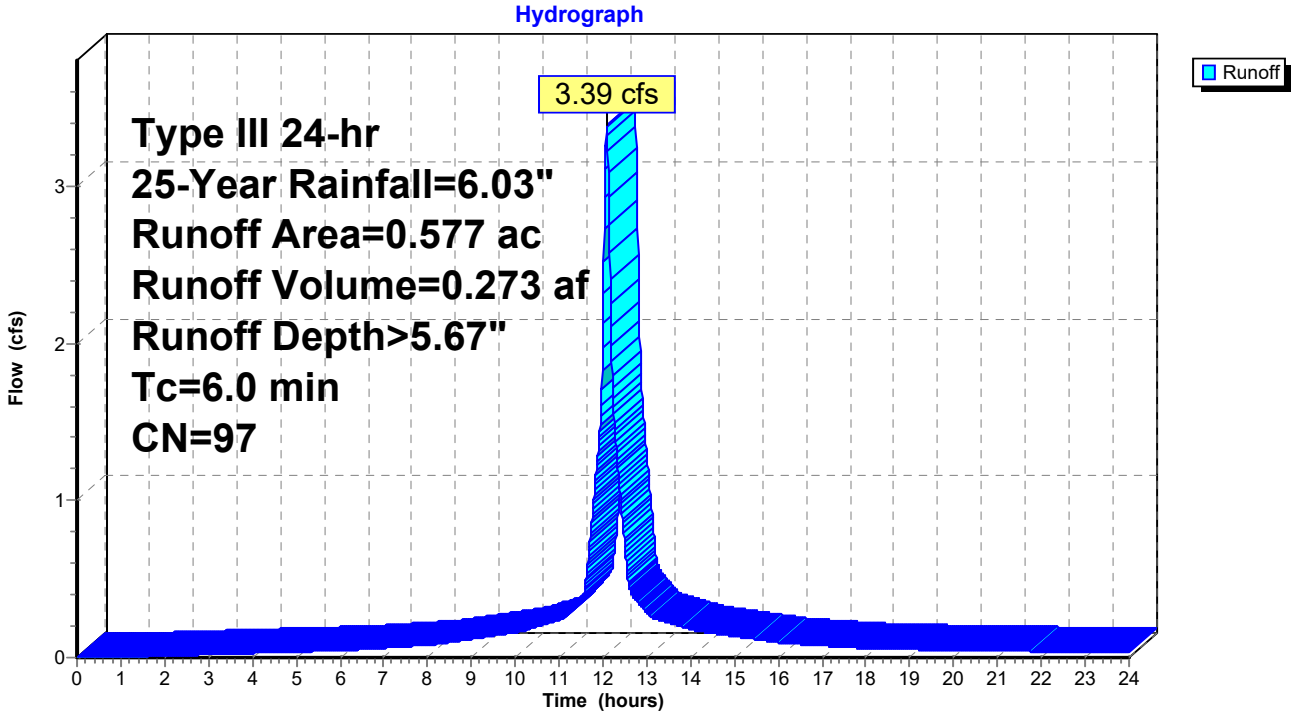
Runoff = 3.39 cfs @ 12.08 hrs, Volume= 0.273 af, Depth> 5.67"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=6.03"

Area (ac)	CN	Description
0.561	98	Paved parking & roofs
0.016	74	>75% Grass cover, Good, HSG C
0.577	97	Weighted Average
0.016		2.77% Pervious Area
0.561		97.23% Impervious Area

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

Subcatchment F-3C: parking



Summary for Subcatchment F-3D: parking

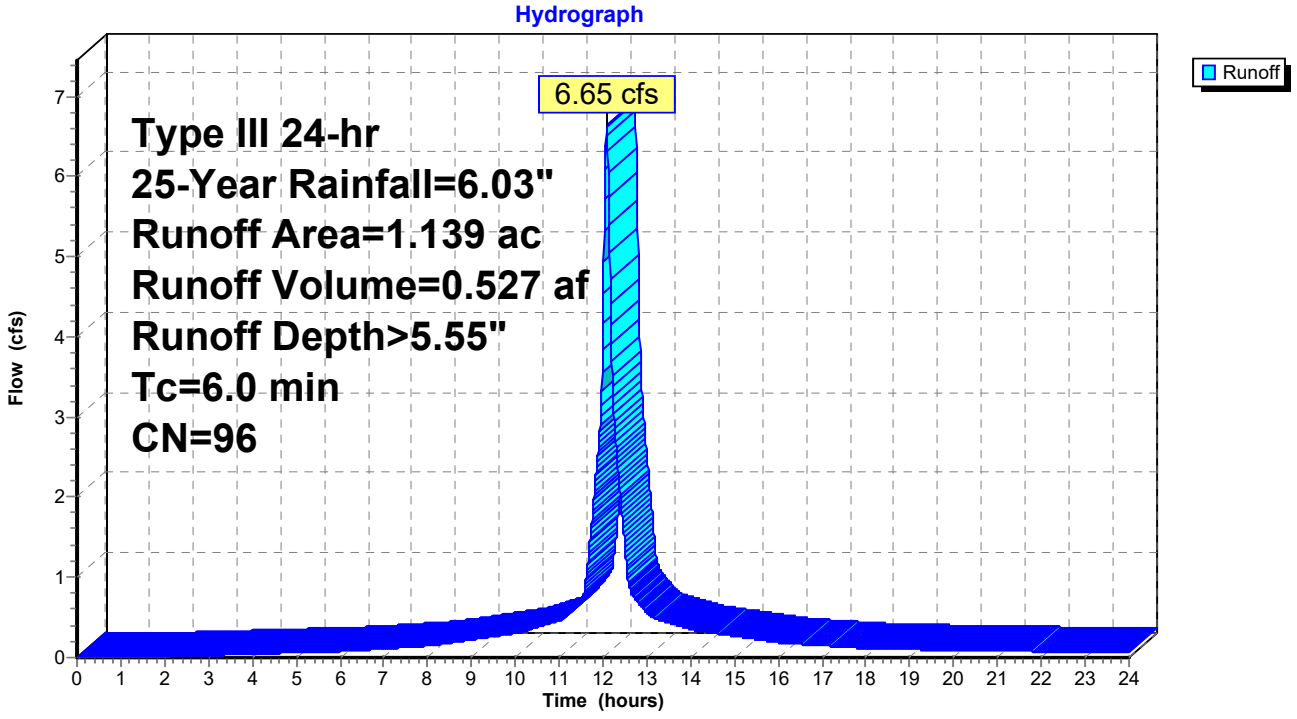
Runoff = 6.65 cfs @ 12.08 hrs, Volume= 0.527 af, Depth> 5.55"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=6.03"

Area (ac)	CN	Description
1.038	98	Paved parking & roofs
0.101	74	>75% Grass cover, Good, HSG C
1.139	96	Weighted Average
0.101		8.87% Pervious Area
1.038		91.13% Impervious Area

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

Subcatchment F-3D: parking



Summary for Subcatchment F-3E: parking

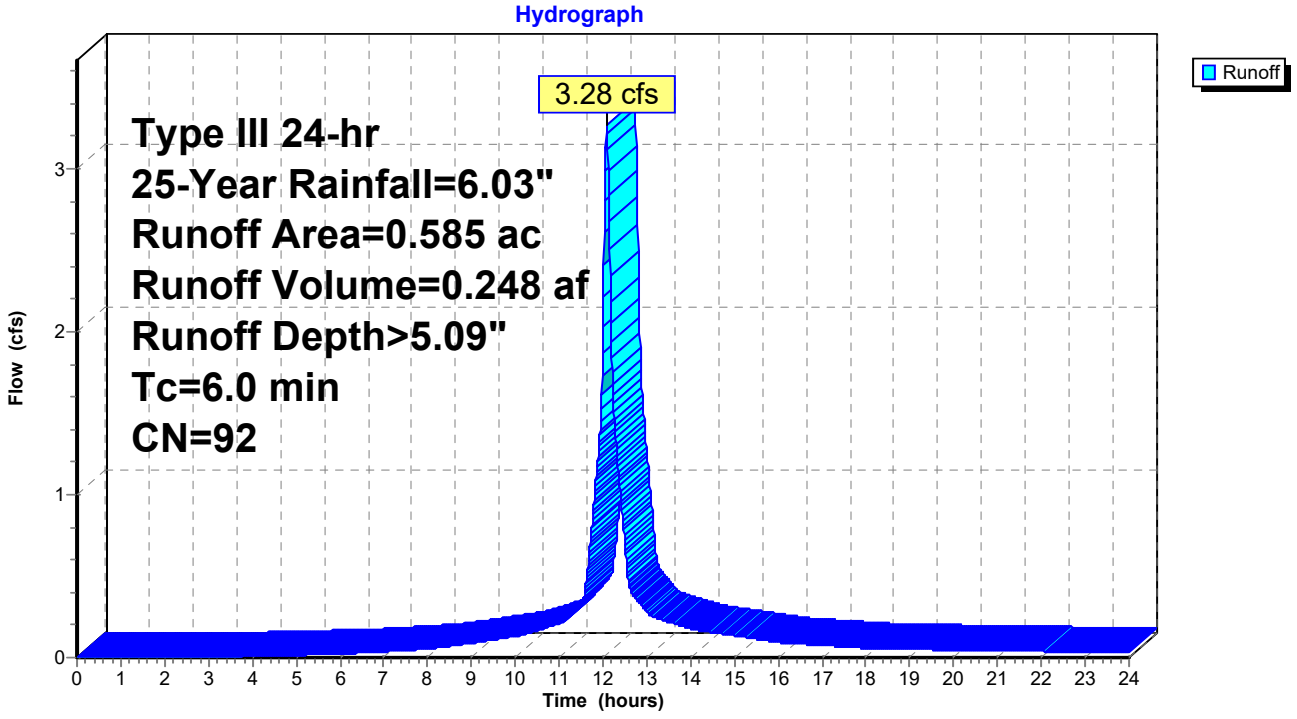
Runoff = 3.28 cfs @ 12.08 hrs, Volume= 0.248 af, Depth> 5.09"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=6.03"

Area (ac)	CN	Description
0.431	98	Paved parking & roofs
0.154	74	>75% Grass cover, Good, HSG C
0.585	92	Weighted Average
0.154		26.32% Pervious Area
0.431		73.68% Impervious Area

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

Subcatchment F-3E: parking



Summary for Subcatchment F3-B: Impervious

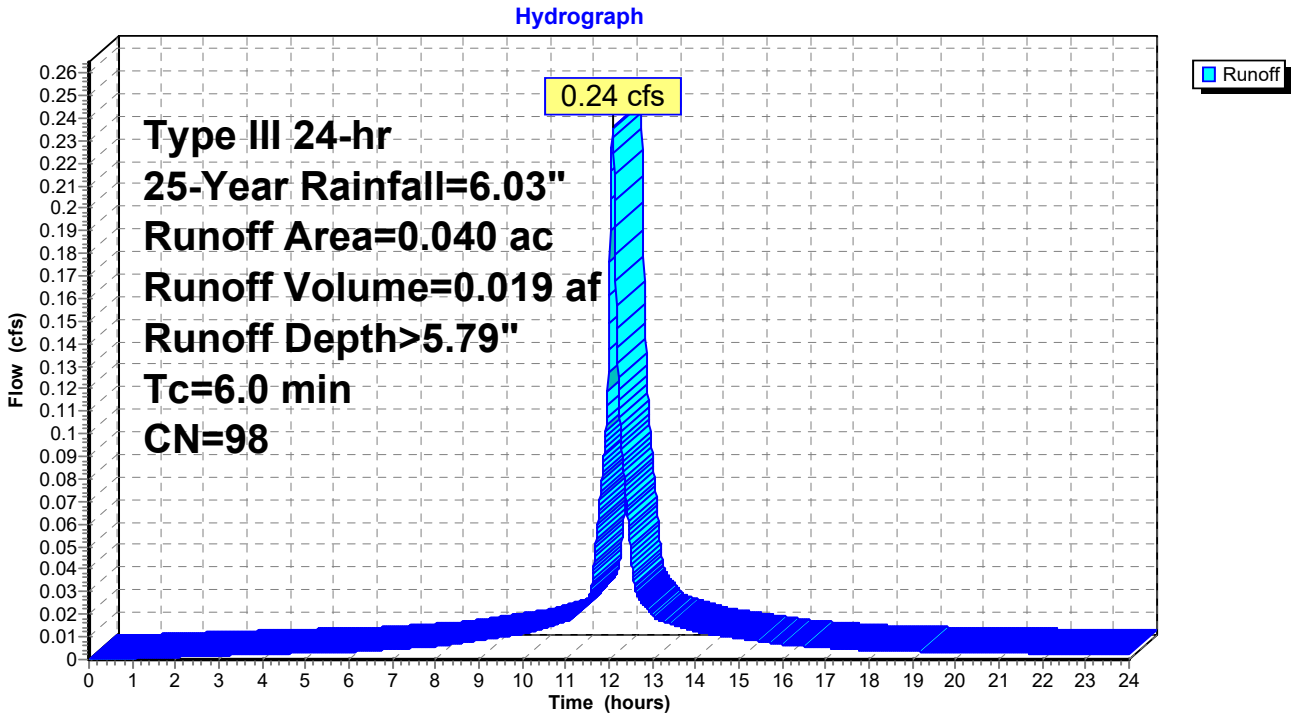
Runoff = 0.24 cfs @ 12.08 hrs, Volume= 0.019 af, Depth> 5.79"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=6.03"

Area (ac)	CN	Description
0.040	98	Unconnected pavement, HSG C
0.040		100.00% Impervious Area
0.040		100.00% Unconnected

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

Subcatchment F3-B: Impervious

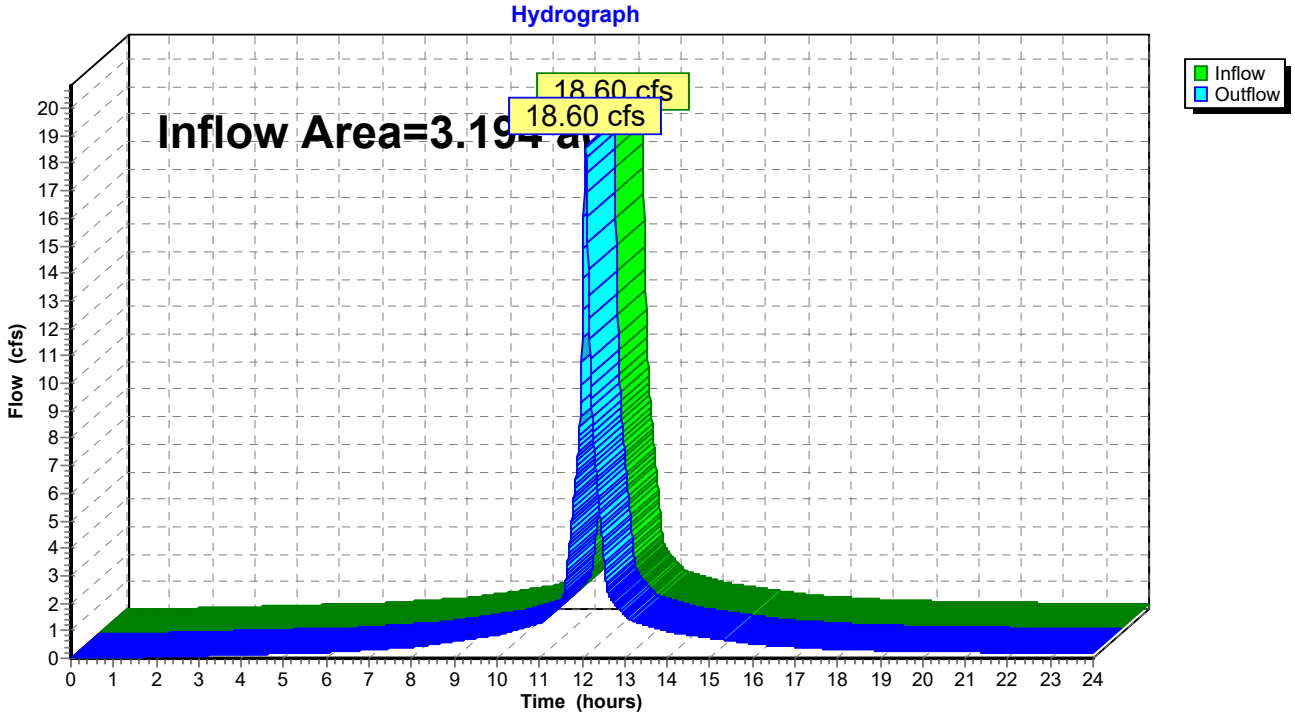


Summary for Reach MWRA: MWRA Detention Pond Contribution

Inflow Area = 3.194 ac, 91.52% Impervious, Inflow Depth > 5.56" for 25-Year event
Inflow = 18.60 cfs @ 12.08 hrs, Volume= 1.479 af
Outflow = 18.60 cfs @ 12.08 hrs, Volume= 1.479 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 MWRA: MWRA Detention Pond Contribution



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth>8.37"
Tc=6.0 min CN=98 Runoff=7.22 cfs 0.595 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth>8.25"
Tc=6.0 min CN=97 Runoff=4.87 cfs 0.397 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth>8.13"
Tc=6.0 min CN=96 Runoff=9.58 cfs 0.772 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth>7.65"
Tc=6.0 min CN=92 Runoff=4.81 cfs 0.373 af

Subcatchment F3-B: Impervious Runoff Area=0.040 ac 100.00% Impervious Runoff Depth>8.37"
Tc=6.0 min CN=98 Runoff=0.34 cfs 0.028 af

Reach MWRA: MWRA Detention Pond Contribution Inflow=26.83 cfs 2.165 af
Outflow=26.83 cfs 2.165 af

Total Runoff Area = 3.194 ac Runoff Volume = 2.165 af Average Runoff Depth = 8.13"
8.48% Pervious = 0.271 ac 91.52% Impervious = 2.923 ac

Summary for Subcatchment F-3A: roof

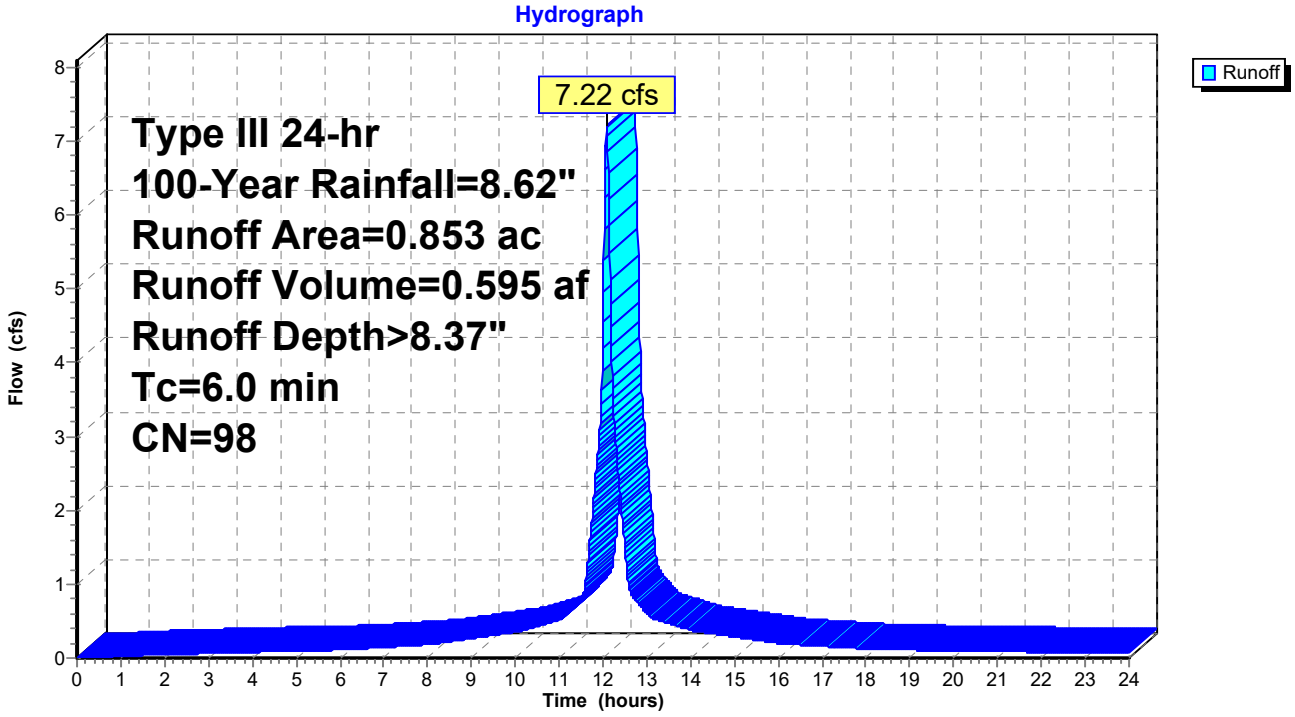
Runoff = 7.22 cfs @ 12.08 hrs, Volume= 0.595 af, Depth> 8.37"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=8.62"

Area (ac)	CN	Description
0.853	98	Paved parking & roofs
0.853		100.00% Impervious Area

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

Subcatchment F-3A: roof



Summary for Subcatchment F-3C: parking

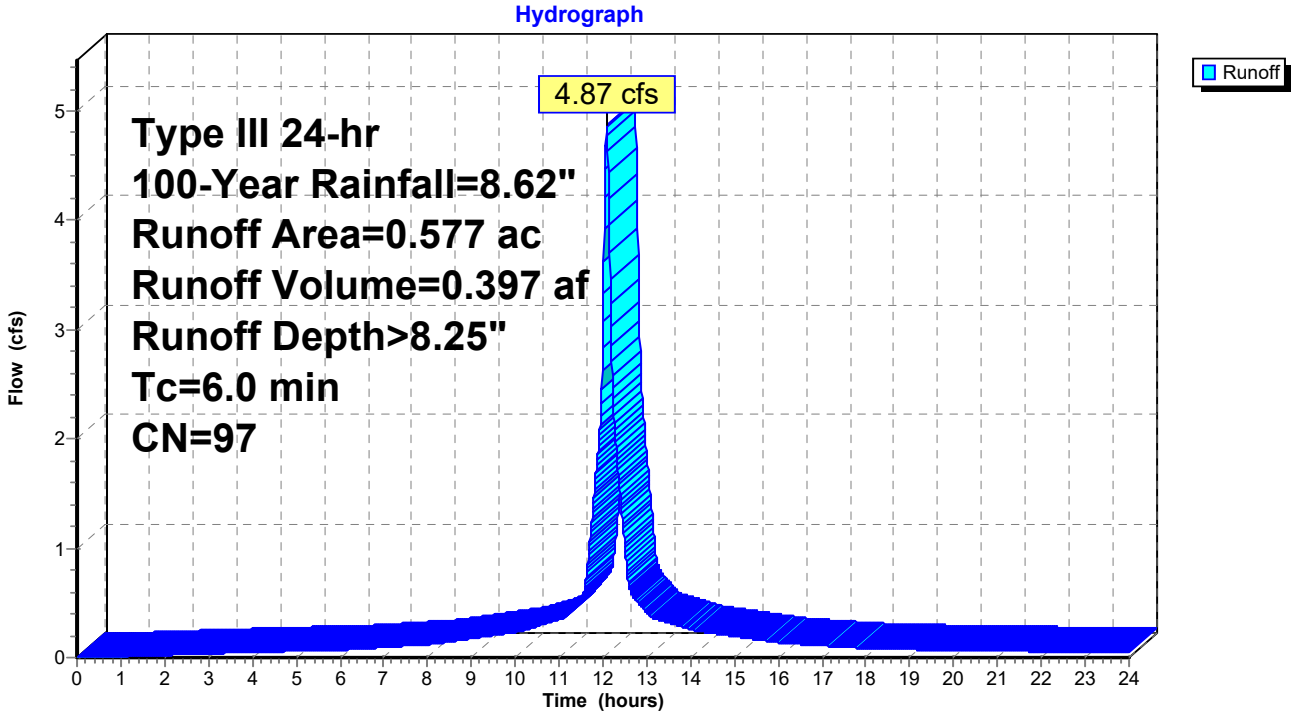
Runoff = 4.87 cfs @ 12.08 hrs, Volume= 0.397 af, Depth> 8.25"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=8.62"

Area (ac)	CN	Description
0.561	98	Paved parking & roofs
0.016	74	>75% Grass cover, Good, HSG C
0.577	97	Weighted Average
0.016		2.77% Pervious Area
0.561		97.23% Impervious Area

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

Subcatchment F-3C: parking



Summary for Subcatchment F-3D: parking

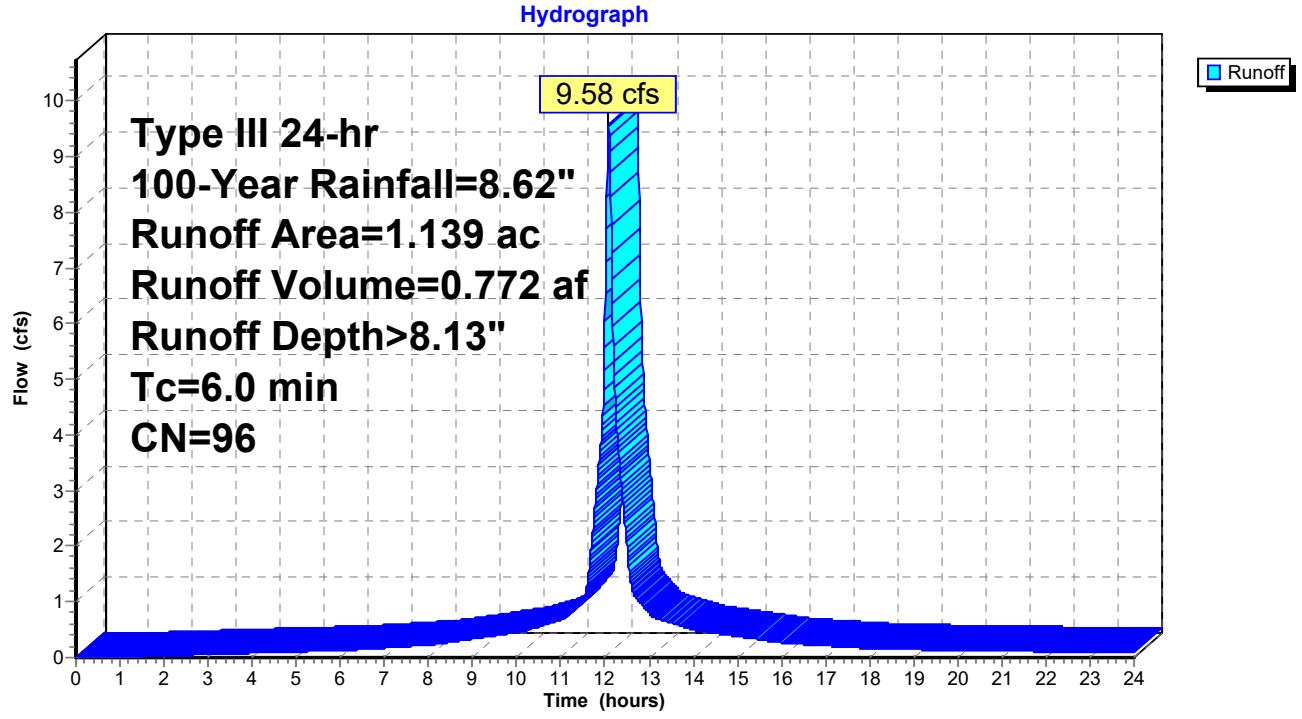
Runoff = 9.58 cfs @ 12.08 hrs, Volume= 0.772 af, Depth> 8.13"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=8.62"

Area (ac)	CN	Description
1.038	98	Paved parking & roofs
0.101	74	>75% Grass cover, Good, HSG C
1.139	96	Weighted Average
0.101		8.87% Pervious Area
1.038		91.13% Impervious Area

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

Subcatchment F-3D: parking



Summary for Subcatchment F-3E: parking

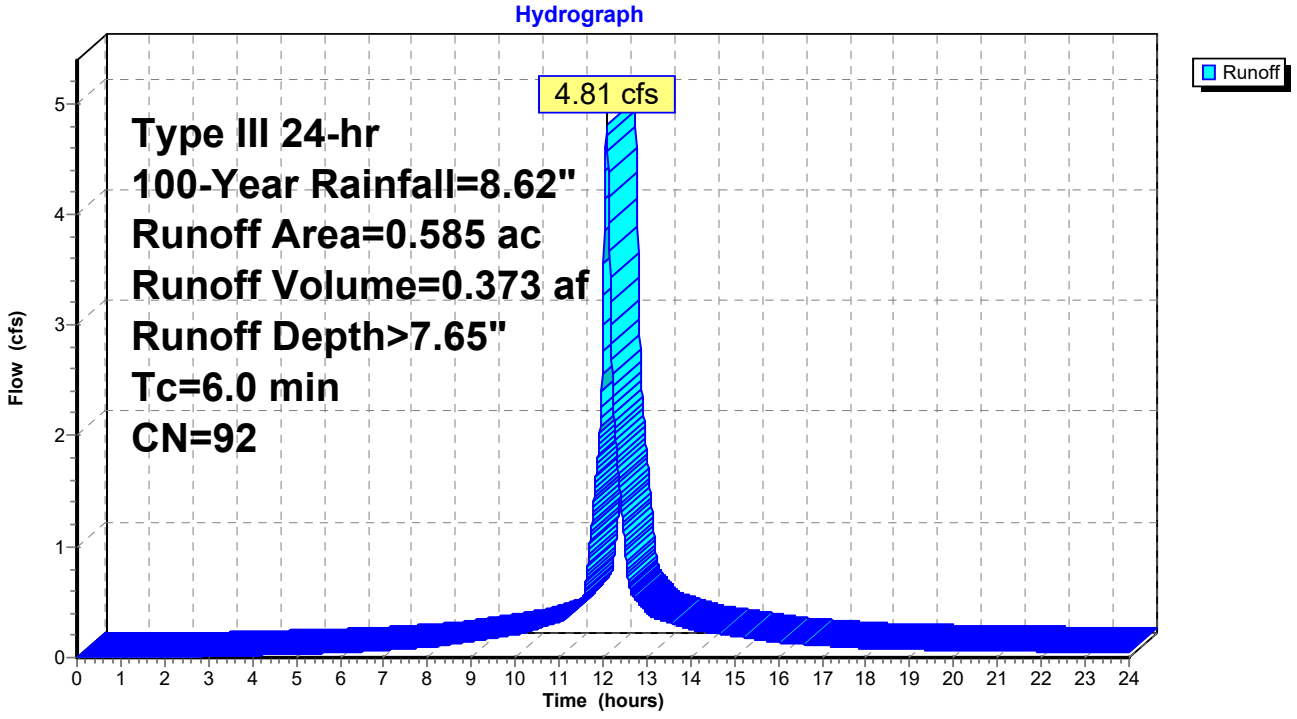
Runoff = 4.81 cfs @ 12.08 hrs, Volume= 0.373 af, Depth> 7.65"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=8.62"

Area (ac)	CN	Description
0.431	98	Paved parking & roofs
0.154	74	>75% Grass cover, Good, HSG C
0.585	92	Weighted Average
0.154		26.32% Pervious Area
0.431		73.68% Impervious Area

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

Subcatchment F-3E: parking



Summary for Subcatchment F3-B: Impervious

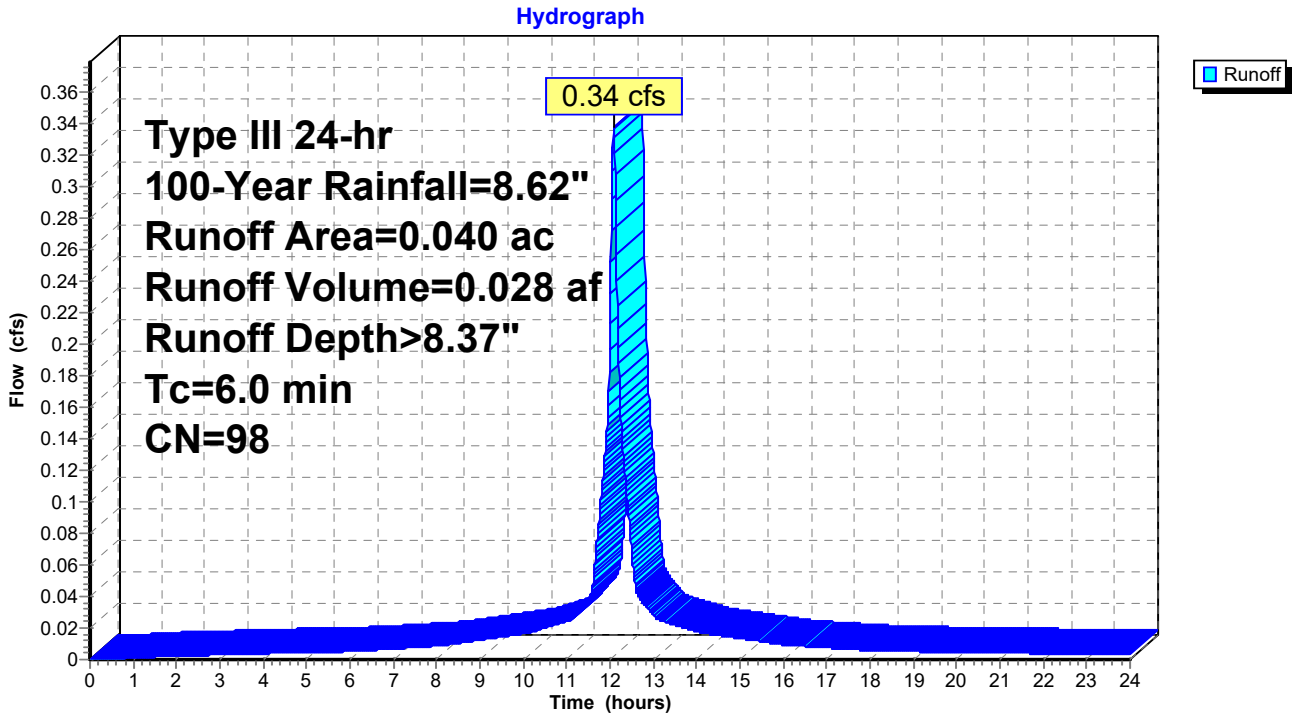
Runoff = 0.34 cfs @ 12.08 hrs, Volume= 0.028 af, Depth> 8.37"
Routed to Reach MWRA : MWRA Detention Pond Contribution

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=8.62"

Area (ac)	CN	Description
0.040	98	Unconnected pavement, HSG C
0.040		100.00% Impervious Area
0.040		100.00% Unconnected

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

Subcatchment F3-B: Impervious

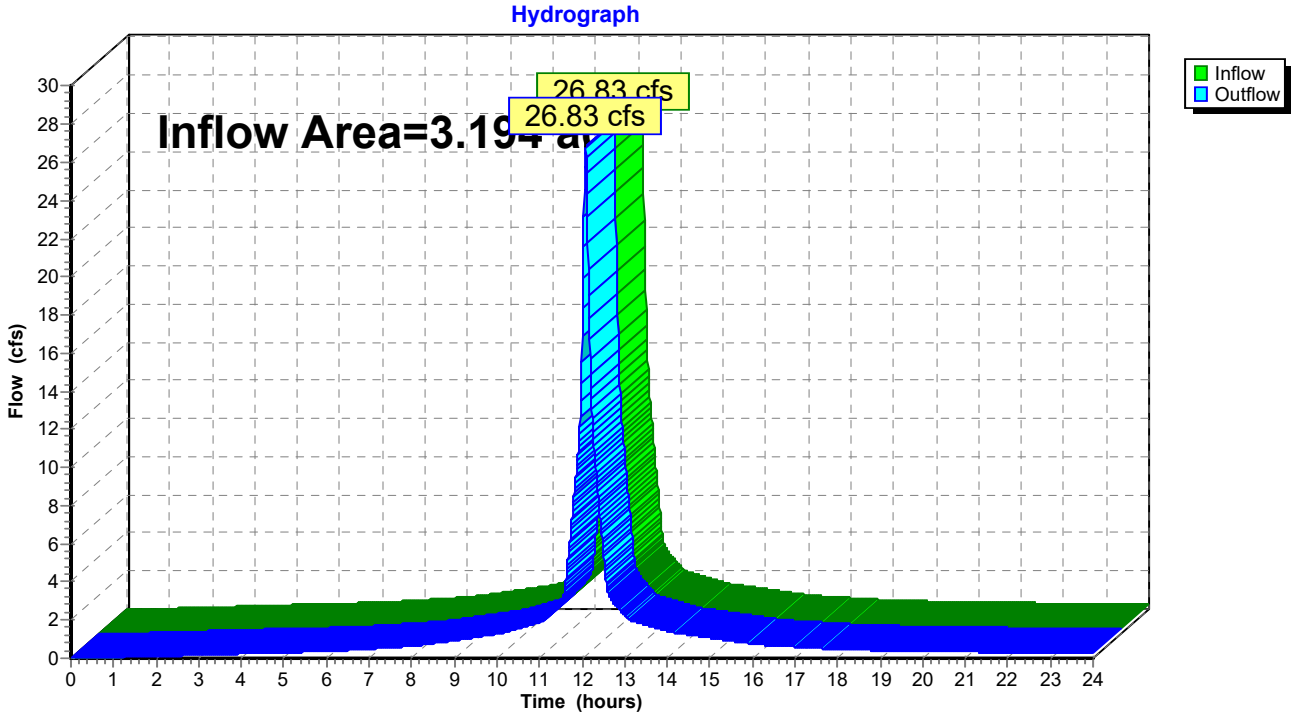


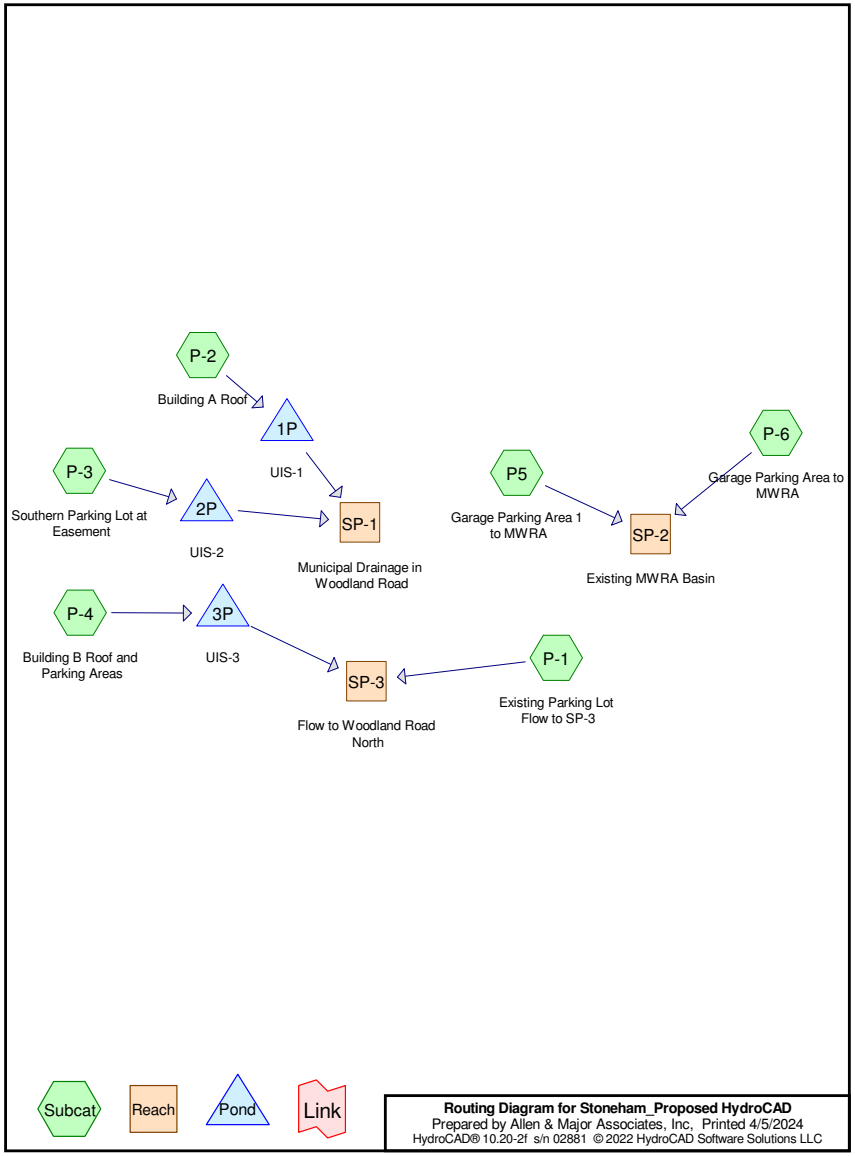
Summary for Reach MWRA: MWRA Detention Pond Contribution

Inflow Area = 3.194 ac, 91.52% Impervious, Inflow Depth > 8.13" for 100-Year event
Inflow = 26.83 cfs @ 12.08 hrs, Volume= 2.165 af
Outflow = 26.83 cfs @ 12.08 hrs, Volume= 2.165 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 MWRA: MWRA Detention Pond Contribution





Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.29	2
2	10-Year	Type III 24-hr		Default	24.00	1	5.17	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.35	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.16	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.395	74	>75% Grass cover, Good, HSG C (P-1, P-3, P-4, P-6, P5)
5.573	98	Paved parking, HSG C (P-1, P-3, P-4, P-6, P5)
2.590	98	Roofs, HSG C (P-2, P-4)
0.530	98	Unconnected roofs, HSG C (P-6, P5)
12.088	**91**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
12.088	HSG C	P-1, P-2, P-3, P-4, P-6, P5
0.000	HSG D	
0.000	Other	
12.088		**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	0.000	3.395	0.000	0.000	3.395	>75% Grass cover, Good	P-1, P-3, P-4, P-6, P5
0.000	0.000	5.573	0.000	0.000	5.573	Paved parking	P-1, P-3, P-4, P-6, P5
0.000	0.000	2.590	0.000	0.000	2.590	Roofs	P-2, P-4
0.000	0.000	0.530	0.000	0.000	0.530	Unconnected roofs	P-6, P5
0.000	**0.000**	**12.088**	**0.000**	**0.000**	**12.088**	**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	1P	194.78	194.51	27.0	0.0100	0.013	0.0	15.0	0.0
2	2P	213.50	212.00	100.0	0.0150	0.013	0.0	12.0	0.0
3	3P	209.00	208.00	50.0	0.0200	0.013	0.0	18.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Existing Parking Lot Flow Runoff Area=3.870 ac 71.06% Impervious Runoff Depth>2.34"
Tc=5.0 min CN=91 Runoff=10.82 cfs 0.755 af

Subcatchment P-2: Building A Roof Runoff Area=0.900 ac 100.00% Impervious Runoff Depth>3.06"
Tc=5.0 min CN=98 Runoff=2.98 cfs 0.229 af

Subcatchment P-3: Southern Parking Lot at Runoff Area=0.683 ac 94.88% Impervious Runoff Depth>2.94"
Tc=5.0 min CN=97 Runoff=2.23 cfs 0.168 af

Subcatchment P-4: Building B Roof and Runoff Area=3.475 ac 76.98% Impervious Runoff Depth>2.43"
Tc=5.0 min CN=92 Runoff=10.03 cfs 0.705 af

Subcatchment P-6: Garage Parking Area to Runoff Area=1.050 ac 65.71% Impervious Runoff Depth>2.25"
Tc=5.0 min CN=90 Runoff=2.84 cfs 0.197 af

Subcatchment P5: Garage Parking Area 1 to Runoff Area=2.110 ac 48.82% Impervious Runoff Depth>1.91"
Tc=5.0 min CN=86 Runoff=4.91 cfs 0.336 af

Reach SP-1: Municipal Drainage in Woodland Road Inflow=0.76 cfs 0.111 af
Outflow=0.76 cfs 0.111 af

Reach SP-2: Existing MWRA Basin Inflow=7.75 cfs 0.533 af
Outflow=7.75 cfs 0.533 af

Reach SP-3: Flow to Woodland Road North Inflow=10.82 cfs 0.943 af
Outflow=10.82 cfs 0.943 af

Pond 1P: UIS-1 Peak Elev=195.06' Storage=5,868 cf Inflow=2.98 cfs 0.229 af
Discarded=0.04 cfs 0.069 af Primary=0.18 cfs 0.031 af Outflow=0.23 cfs 0.099 af

Pond 2P: UIS-2 Peak Elev=214.40' Storage=2,645 cf Inflow=2.23 cfs 0.168 af
Discarded=0.04 cfs 0.064 af Primary=0.76 cfs 0.080 af Outflow=0.80 cfs 0.144 af

Pond 3P: UIS-3 Peak Elev=210.96' Storage=15,385 cf Inflow=10.03 cfs 0.705 af
Discarded=0.19 cfs 0.248 af Primary=0.95 cfs 0.188 af Outflow=1.14 cfs 0.435 af

Total Runoff Area = 12.088 ac Runoff Volume = 2.390 af Average Runoff Depth = 2.37"
28.09% Pervious = 3.395 ac 71.91% Impervious = 8.693 ac

Summary for Subcatchment P-1: Existing Parking Lot Flow to SP-3

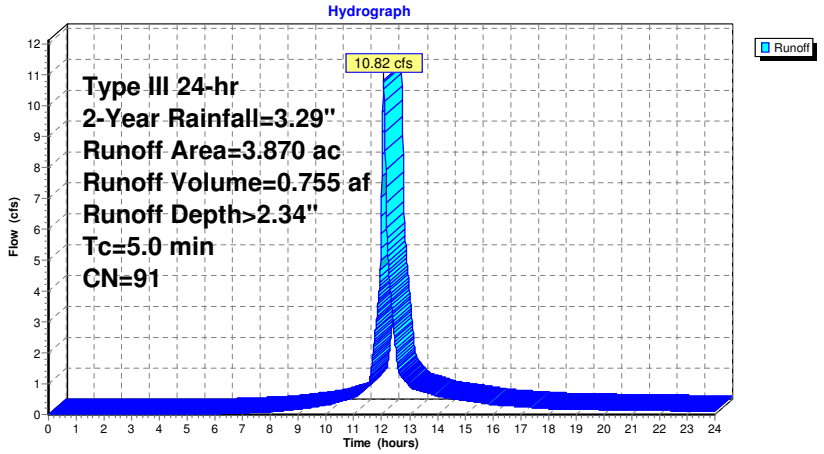
Runoff = 10.82 cfs @ 12.07 hrs, Volume= 0.755 af, Depth> 2.34"
Routed to Reach SP-3 : Flow to Woodland Road North

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=3.29"

Area (ac)	CN	Description
2.750	98	Paved parking, HSG C
1.120	74	>75% Grass cover, Good, HSG C
3.870	91	Weighted Average
1.120		28.94% Pervious Area
2.750		71.06% Impervious Area

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

Subcatchment P-1: Existing Parking Lot Flow to SP-3



Summary for Subcatchment P-2: Building A Roof

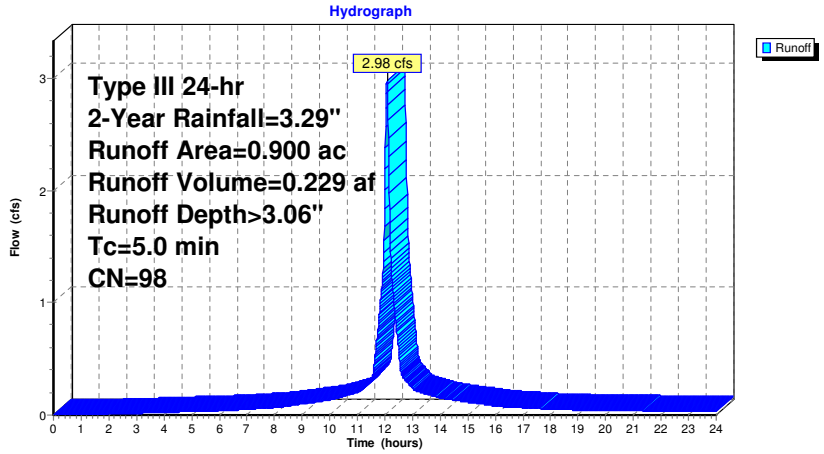
Runoff = 2.98 cfs @ 12.07 hrs, Volume= 0.229 af, Depth> 3.06"
Routed to Pond 1P : UIS-1

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=3.29"

Area (ac)	CN	Description
0.900	98	Roofs, HSG C
0.900		100.00% Impervious Area

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

Subcatchment P-2: Building A Roof



Summary for Subcatchment P-3: Southern Parking Lot at Easement

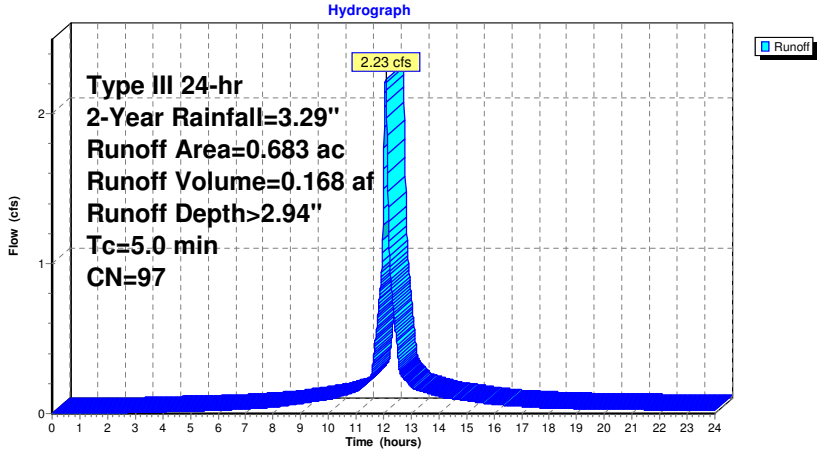
Runoff = 2.23 cfs @ 12.07 hrs, Volume= 0.168 af, Depth> 2.94"
Routed to Pond 2P : UIS-2

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=3.29"

Area (ac)	CN	Description
0.648	98	Paved parking, HSG C
0.035	74	>75% Grass cover, Good, HSG C
0.683	97	Weighted Average
0.035		5.12% Pervious Area
0.648		94.88% Impervious Area

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

Subcatchment P-3: Southern Parking Lot at Easement



Summary for Subcatchment P-4: Building B Roof and Parking Areas

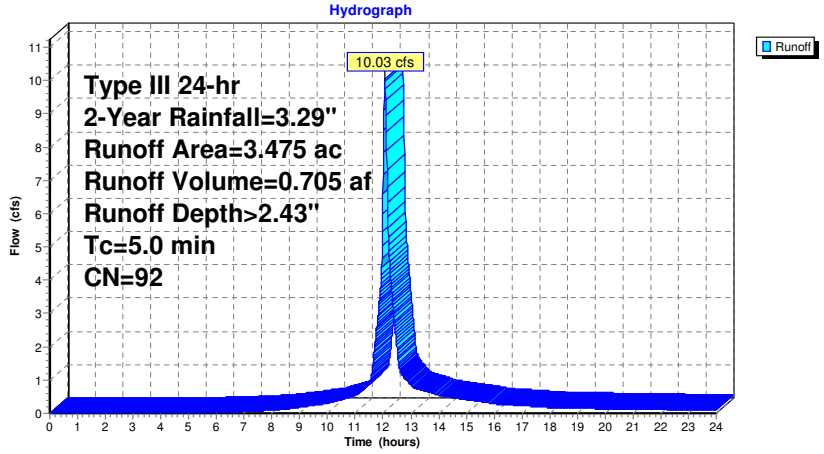
Runoff = 10.03 cfs @ 12.07 hrs, Volume= 0.705 af, Depth> 2.43"
Routed to Pond 3P : UIS-3

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=3.29"

Area (ac)	CN	Description
0.985	98	Paved parking, HSG C
1.690	98	Roofs, HSG C
0.800	74	>75% Grass cover, Good, HSG C
3.475	92	Weighted Average
0.800		23.02% Pervious Area
2.675		76.98% Impervious Area

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

Subcatchment P-4: Building B Roof and Parking Areas



Summary for Subcatchment P-6: Garage Parking Area to MWRA

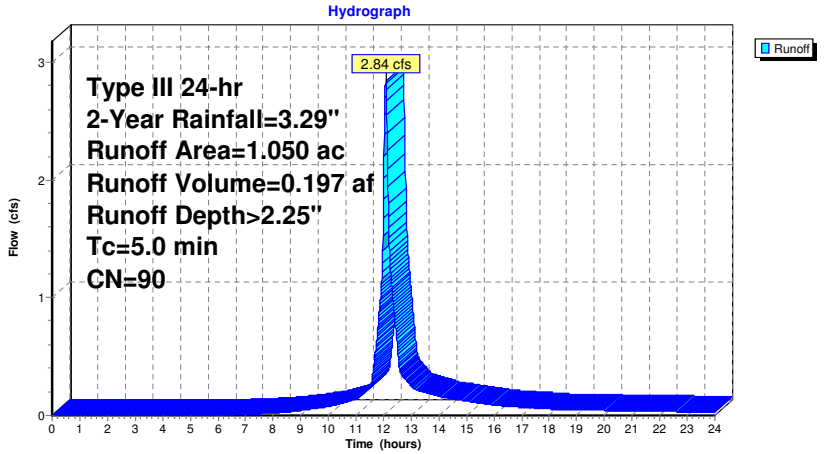
Runoff = 2.84 cfs @ 12.07 hrs, Volume= 0.197 af, Depth> 2.25"
Routed to Reach SP-2 : Existing MWRA Basin

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=3.29"

Area (ac)	CN	Description
0.300	98	Unconnected roofs, HSG C
0.390	98	Paved parking, HSG C
0.360	74	>75% Grass cover, Good, HSG C
1.050	90	Weighted Average
0.360		34.29% Pervious Area
0.690		65.71% Impervious Area
0.300		43.48% Unconnected

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

Subcatchment P-6: Garage Parking Area to MWRA



Summary for Subcatchment P5: Garage Parking Area 1 to MWRA

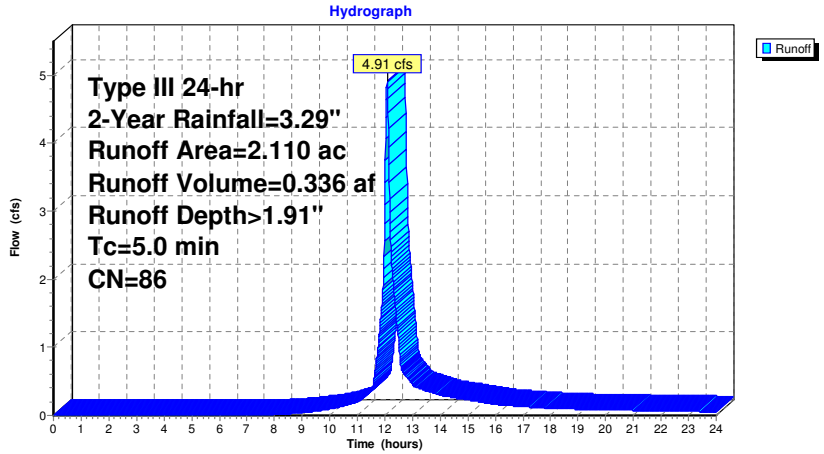
Runoff = 4.91 cfs @ 12.07 hrs, Volume= 0.336 af, Depth> 1.91"
Routed to Reach SP-2 : Existing MWRA Basin

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=3.29"

Area (ac)	CN	Description
0.230	98	Unconnected roofs, HSG C
1.080	74	>75% Grass cover, Good, HSG C
0.800	98	Paved parking, HSG C
2.110	86	Weighted Average
1.080		51.18% Pervious Area
1.030		48.82% Impervious Area
0.230		22.33% Unconnected

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

Subcatchment P5: Garage Parking Area 1 to MWRA

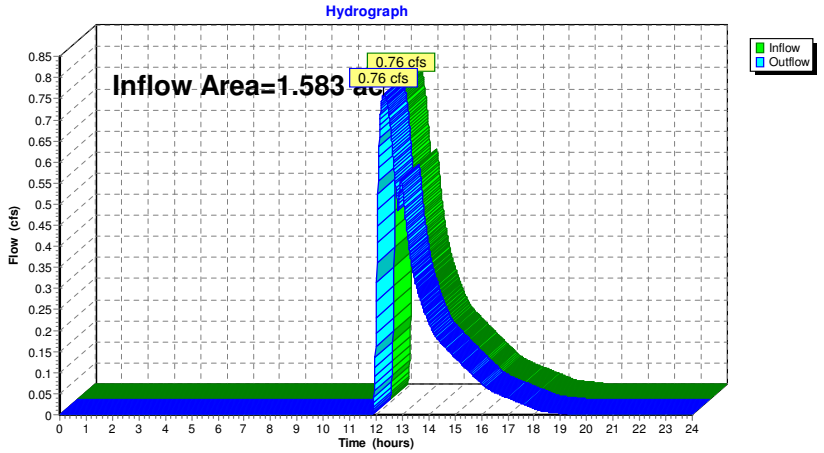


Summary for Reach SP-1: Municipal Drainage in Woodland Road

Inflow Area = 1.583 ac, 97.79% Impervious, Inflow Depth = 0.84" for 2-Year event
Inflow = 0.76 cfs @ 12.30 hrs, Volume= 0.111 af
Outflow = 0.76 cfs @ 12.30 hrs, Volume= 0.111 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 SP-1: Municipal Drainage in Woodland Road

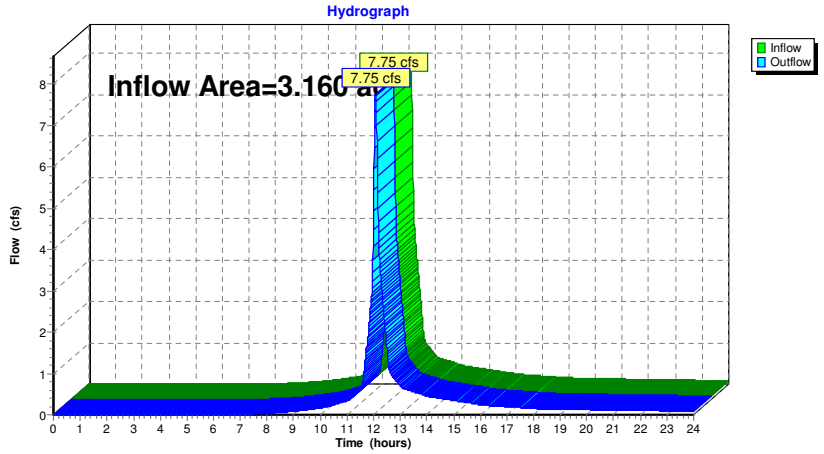


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 3.160 ac, 54.43% Impervious, Inflow Depth > 2.02" for 2-Year event
Inflow = 7.75 cfs @ 12.07 hrs, Volume= 0.533 af
Outflow = 7.75 cfs @ 12.07 hrs, Volume= 0.533 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 SP-2: Existing MWRA Basin

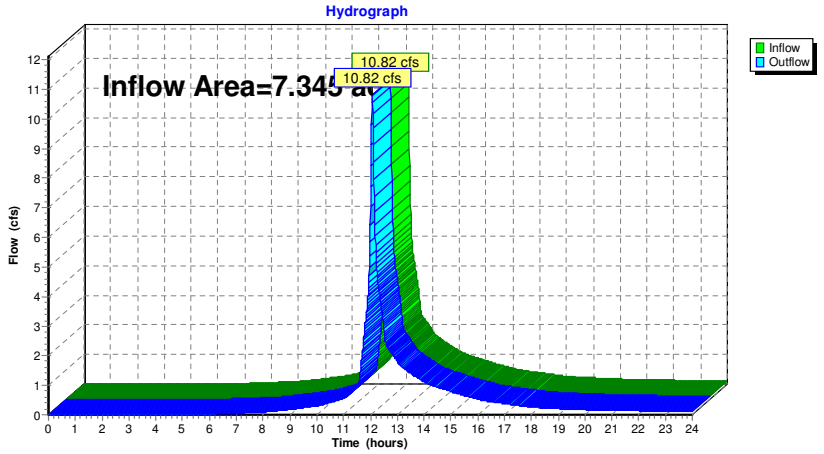


Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 7.345 ac, 73.86% Impervious, Inflow Depth > 1.54" for 2-Year event
Inflow = 10.82 cfs @ 12.07 hrs, Volume= 0.943 af
Outflow = 10.82 cfs @ 12.07 hrs, Volume= 0.943 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 SP-3: Flow to Woodland Road North



Summary for Pond 1P: UIS-1

Inflow Area = 0.900 ac,100.00% Impervious, Inflow Depth > 3.06" for 2-Year event
Inflow = 2.98 cfs @ 12.07 hrs, Volume= 0.229 af
Outflow = 0.23 cfs @ 13.04 hrs, Volume= 0.099 af, Atten= 92%, Lag= 58.3 min
Discarded = 0.04 cfs @ 6.85 hrs, Volume= 0.069 af
Primary = 0.18 cfs @ 13.04 hrs, Volume= 0.031 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 195.06' @ 13.04 hrs Surf.Area= 1,789 sf Storage= 5,868 cf

Plug-Flow detention time= 238.6 min calculated for 0.099 af (43% of inflow)
Center-of-Mass det. time= 99.2 min (853.7 - 754.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.25'	3,118 cf	**64.83'W x 27.59'L x 6.75'H Field A** 12,075 cf Overall - 4,280 cf Embedded = 7,795 cf x 40.0% Voids
#2A	191.00'	4,280 cf	**ADS_StormTech MC-4500 b +Cap** x 35 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 35 Chambers in 7 Rows Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf
		7,398 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	194.78'	**15.0" Round 15" Culvert** L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 194.78' / 194.51' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	195.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	190.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 6.85 hrs HW=190.32' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.18 cfs @ 13.04 hrs HW=195.06' (Free Discharge)
└**1=15" Culvert** (Passes 0.18 cfs of 0.34 cfs potential flow)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.18 cfs @ 0.70 fps)

Pond 1P: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

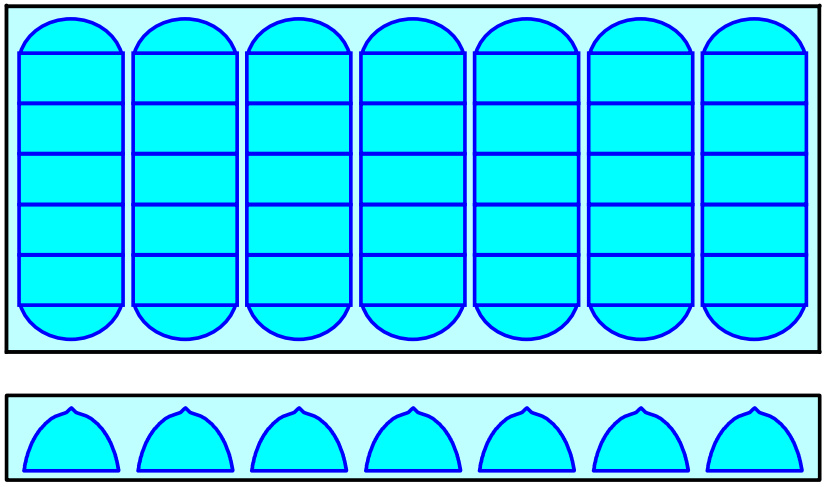
5 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 25.59' Row Length +12.0" End Stone x 2 = 27.59' Base Length
7 Rows x 100.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 64.83' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

35 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 7 Rows = 4,280.2 cf Chamber Storage

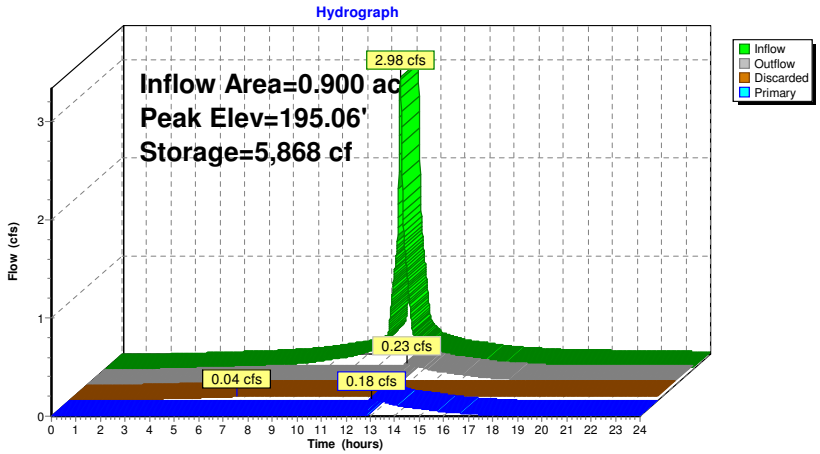
12,074.8 cf Field - 4,280.2 cf Chambers = 7,794.6 cf Stone x 40.0% Voids = 3,117.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,398.0 cf = 0.170 af
Overall Storage Efficiency = 61.3%
Overall System Size = 27.59' x 64.83' x 6.75'

35 Chambers
447.2 cy Field
288.7 cy Stone



Pond 1P: UIS-1



Summary for Pond 2P: UIS-2

Inflow Area = 0.683 ac, 94.88% Impervious, Inflow Depth > 2.94" for 2-Year event
Inflow = 2.23 cfs @ 12.07 hrs, Volume= 0.168 af
Outflow = 0.80 cfs @ 12.30 hrs, Volume= 0.144 af, Atten= 64%, Lag= 14.0 min
Discarded = 0.04 cfs @ 8.25 hrs, Volume= 0.064 af
Primary = 0.76 cfs @ 12.30 hrs, Volume= 0.080 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 214.40' @ 12.30 hrs Surf.Area= 1,819 sf Storage= 2,645 cf

Plug-Flow detention time= 130.6 min calculated for 0.144 af (86% of inflow)
Center-of-Mass det. time= 69.7 min (833.6 - 763.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	212.25'	3,027 cf	**28.50'W x 63.82'L x 6.75'H Field A** 12,277 cf Overall - 4,710 cf Embedded = 7,567 cf x 40.0% Voids
#2A	213.00'	4,710 cf	**ADS_StormTech MC-4500 b +Cap** x 42 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 42 Chambers in 3 Rows Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf
		7,736 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	**12.0" Round 12" Culvert Outlet** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 213.50' / 212.00' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	213.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	217.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	212.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 8.25 hrs HW=212.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.76 cfs @ 12.30 hrs HW=214.40' (Free Discharge)
└**1=12" Culvert Outlet** (Passes 0.76 cfs of 2.39 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.76 cfs @ 3.87 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: UIS-2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

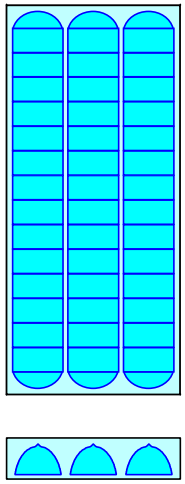
14 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 61.82' Row Length +12.0" End Stone x 2 = 63.82' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

42 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 3 Rows = 4,709.6 cf Chamber Storage

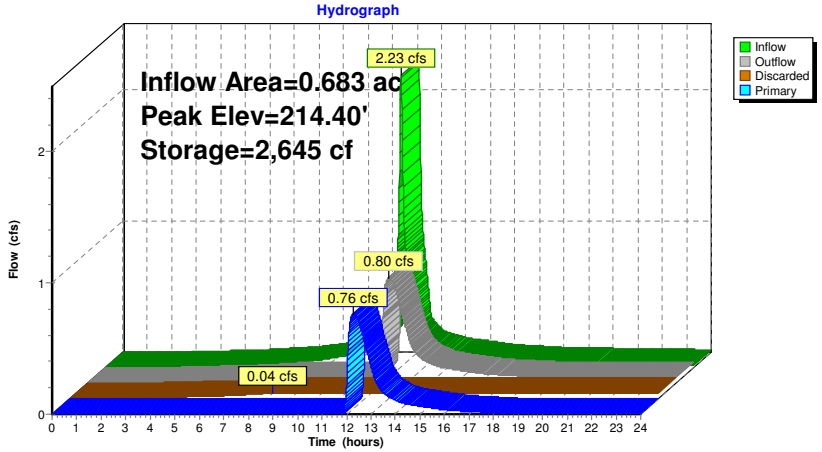
12,276.7 cf Field - 4,709.6 cf Chambers = 7,567.1 cf Stone x 40.0% Voids = 3,026.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,736.5 cf = 0.178 af
Overall Storage Efficiency = 63.0%
Overall System Size = 63.82' x 28.50' x 6.75'

42 Chambers
454.7 cy Field
280.3 cy Stone



Pond 2P: UIS-2



Summary for Pond 3P: UIS-3

Inflow Area = 3.475 ac, 76.98% Impervious, Inflow Depth > 2.43" for 2-Year event
Inflow = 10.03 cfs @ 12.07 hrs, Volume= 0.705 af
Outflow = 1.14 cfs @ 12.71 hrs, Volume= 0.435 af, Atten= 89%, Lag= 38.1 min
Discarded = 0.19 cfs @ 9.29 hrs, Volume= 0.248 af
Primary = 0.95 cfs @ 12.71 hrs, Volume= 0.188 af
Routed to Reach SP-3 : Flow to Woodland Road North

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 210.96' @ 12.71 hrs Surf.Area= 7,862 sf Storage= 15,385 cf
Flood Elev= 210.50' Surf.Area= 7,862 sf Storage= 12,421 cf

Plug-Flow detention time= 217.3 min calculated for 0.435 af (62% of inflow)
Center-of-Mass det. time= 116.1 min (911.4 - 795.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	208.25'	12,550 cf	**46.67'W x 168.47'L x 6.75'H Field A** 53,067 cf Overall - 21,693 cf Embedded = 31,374 cf x 40.0% Voids
#2A	209.00'	21,693 cf	**ADS_StormTech MC-4500 b +Cap** x 200 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 200 Chambers in 5 Rows Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf
		34,243 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	209.00'	**18.0" Round 18" Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 209.00' / 208.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	210.50'	**15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	213.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	208.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 9.29 hrs HW=208.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.95 cfs @ 12.71 hrs HW=210.96' (Free Discharge)
└**1=18" Culvert** (Passes 0.95 cfs of 9.36 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 0.95 cfs @ 2.31 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: UIS-3 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

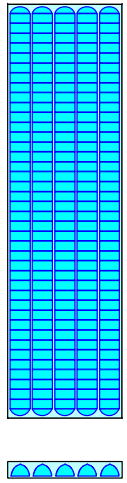
40 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 166.47' Row Length +12.0" End Stone x 2 = 168.47' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

200 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 5 Rows = 21,693.1 cf Chamber Storage

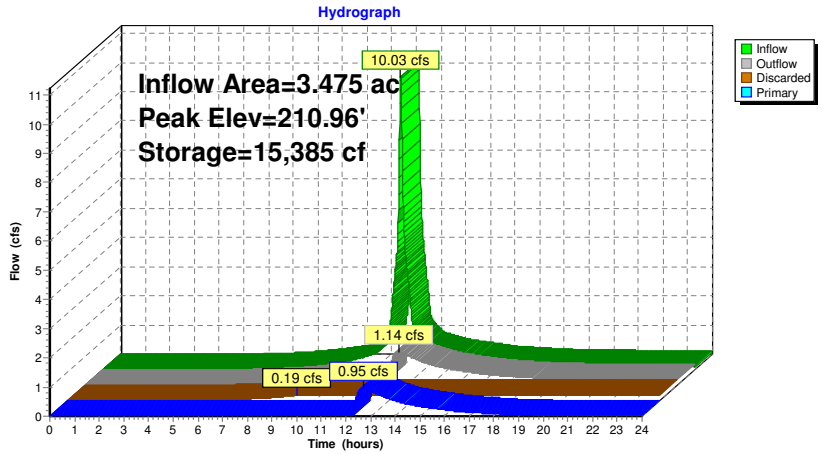
53,067.0 cf Field - 21,693.1 cf Chambers = 31,373.9 cf Stone x 40.0% Voids = 12,549.6 cf Stone Storage

Chamber Storage + Stone Storage = 34,242.7 cf = 0.786 af
Overall Storage Efficiency = 64.5%
Overall System Size = 168.47' x 46.67' x 6.75'

200 Chambers
1,965.4 cy Field
1,162.0 cy Stone



Pond 3P: UIS-3



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Existing Parking Lot Flow Runoff Area=3.870 ac 71.06% Impervious Runoff Depth>4.14"
Tc=5.0 min CN=91 Runoff=18.62 cfs 1.336 af

Subcatchment P-2: Building A Roof Runoff Area=0.900 ac 100.00% Impervious Runoff Depth>4.93"
Tc=5.0 min CN=98 Runoff=4.72 cfs 0.370 af

Subcatchment P-3: Southern Parking Lot at Runoff Area=0.683 ac 94.88% Impervious Runoff Depth>4.81"
Tc=5.0 min CN=97 Runoff=3.56 cfs 0.274 af

Subcatchment P-4: Building B Roof and Runoff Area=3.475 ac 76.98% Impervious Runoff Depth>4.25"
Tc=5.0 min CN=92 Runoff=17.01 cfs 1.231 af

Subcatchment P-6: Garage Parking Area to Runoff Area=1.050 ac 65.71% Impervious Runoff Depth>4.04"
Tc=5.0 min CN=90 Runoff=4.96 cfs 0.353 af

Subcatchment P5: Garage Parking Area 1 to Runoff Area=2.110 ac 48.82% Impervious Runoff Depth>3.62"
Tc=5.0 min CN=86 Runoff=9.15 cfs 0.637 af

Reach SP-1: Municipal Drainage in Woodland Road Inflow=4.36 cfs 0.335 af
Outflow=4.36 cfs 0.335 af

Reach SP-2: Existing MWRA Basin Inflow=14.11 cfs 0.990 af
Outflow=14.11 cfs 0.990 af

Reach SP-3: Flow to Woodland Road North Inflow=21.55 cfs 1.999 af
Outflow=21.55 cfs 1.999 af

Pond 1P: UIS-1 Peak Elev=195.81' Storage=6,539 cf Inflow=4.72 cfs 0.370 af
Discarded=0.04 cfs 0.075 af Primary=3.24 cfs 0.162 af Outflow=3.28 cfs 0.237 af

Pond 2P: UIS-2 Peak Elev=215.35' Storage=4,012 cf Inflow=3.56 cfs 0.274 af
Discarded=0.04 cfs 0.071 af Primary=1.20 cfs 0.173 af Outflow=1.24 cfs 0.245 af

Pond 3P: UIS-3 Peak Elev=212.05' Storage=21,985 cf Inflow=17.01 cfs 1.231 af
Discarded=0.19 cfs 0.276 af Primary=5.67 cfs 0.663 af Outflow=5.86 cfs 0.939 af

Total Runoff Area = 12.088 ac Runoff Volume = 4.202 af Average Runoff Depth = 4.17"
28.09% Pervious = 3.395 ac 71.91% Impervious = 8.693 ac

Summary for Subcatchment P-1: Existing Parking Lot Flow to SP-3

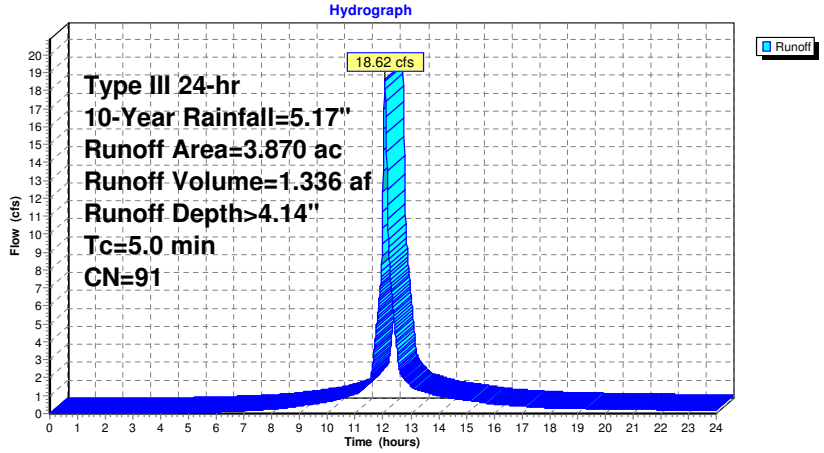
Runoff = 18.62 cfs @ 12.07 hrs, Volume= 1.336 af, Depth> 4.14"
Routed to Reach SP-3 : Flow to Woodland Road North

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=5.17"

Area (ac)	CN	Description
2.750	98	Paved parking, HSG C
1.120	74	>75% Grass cover, Good, HSG C
3.870	91	Weighted Average
1.120		28.94% Pervious Area
2.750		71.06% Impervious Area

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

Subcatchment P-1: Existing Parking Lot Flow to SP-3



Summary for Subcatchment P-2: Building A Roof

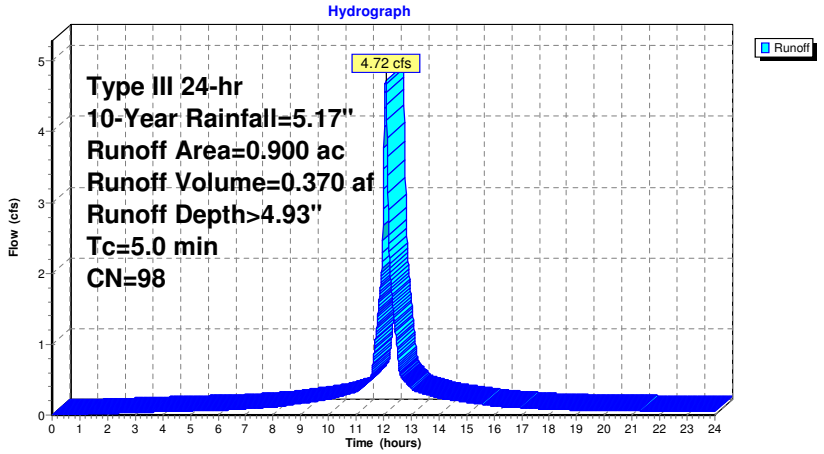
Runoff = 4.72 cfs @ 12.07 hrs, Volume= 0.370 af, Depth> 4.93"
Routed to Pond 1P : UIS-1

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=5.17"

Area (ac)	CN	Description
0.900	98	Roofs, HSG C
0.900		100.00% Impervious Area

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

Subcatchment P-2: Building A Roof



Summary for Subcatchment P-3: Southern Parking Lot at Easement

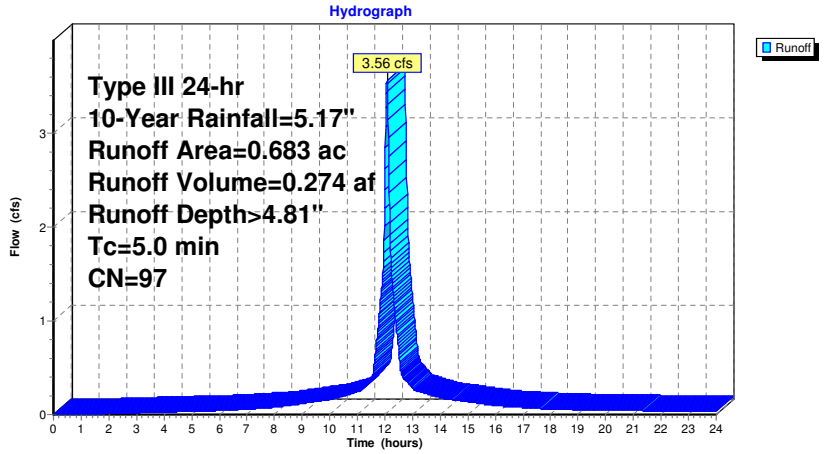
Runoff = 3.56 cfs @ 12.07 hrs, Volume= 0.274 af, Depth> 4.81"
Routed to Pond 2P : UIS-2

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=5.17"

Area (ac)	CN	Description
0.648	98	Paved parking, HSG C
0.035	74	>75% Grass cover, Good, HSG C
0.683	97	Weighted Average
0.035		5.12% Pervious Area
0.648		94.88% Impervious Area

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

Subcatchment P-3: Southern Parking Lot at Easement



Summary for Subcatchment P-4: Building B Roof and Parking Areas

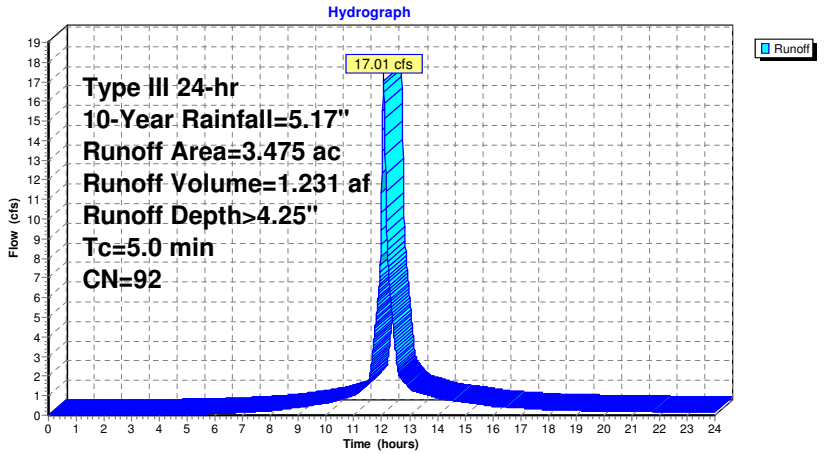
Runoff = 17.01 cfs @ 12.07 hrs, Volume= 1.231 af, Depth> 4.25"
Routed to Pond 3P : UIS-3

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=5.17"

Area (ac)	CN	Description
0.985	98	Paved parking, HSG C
1.690	98	Roofs, HSG C
0.800	74	>75% Grass cover, Good, HSG C
3.475	92	Weighted Average
0.800		23.02% Pervious Area
2.675		76.98% Impervious Area

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

Subcatchment P-4: Building B Roof and Parking Areas



Summary for Subcatchment P-6: Garage Parking Area to MWRA

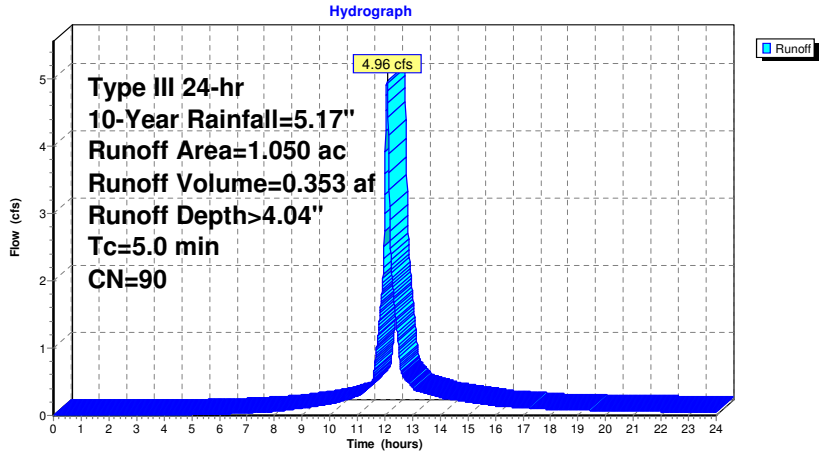
Runoff = 4.96 cfs @ 12.07 hrs, Volume= 0.353 af, Depth> 4.04"
Routed to Reach SP-2 : Existing MWRA Basin

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=5.17"

Area (ac)	CN	Description
0.300	98	Unconnected roofs, HSG C
0.390	98	Paved parking, HSG C
0.360	74	>75% Grass cover, Good, HSG C
1.050	90	Weighted Average
0.360		34.29% Pervious Area
0.690		65.71% Impervious Area
0.300		43.48% Unconnected

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

Subcatchment P-6: Garage Parking Area to MWRA



Summary for Subcatchment P5: Garage Parking Area 1 to MWRA

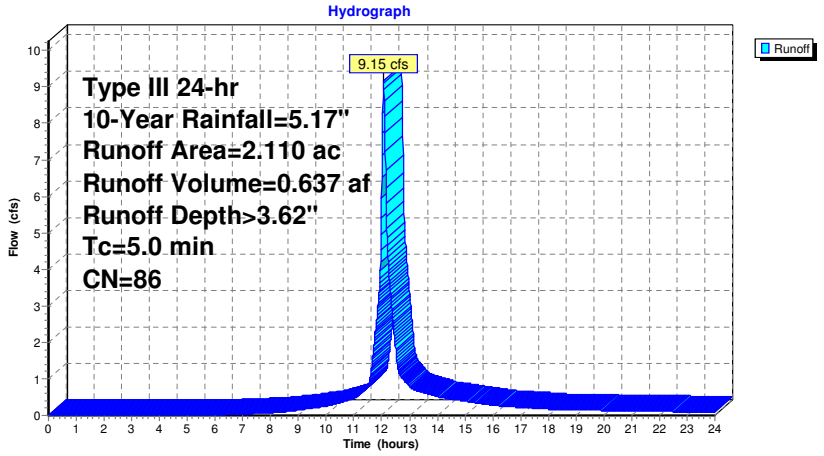
Runoff = 9.15 cfs @ 12.07 hrs, Volume= 0.637 af, Depth> 3.62"
Routed to Reach SP-2 : Existing MWRA Basin

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=5.17"

Area (ac)	CN	Description
0.230	98	Unconnected roofs, HSG C
1.080	74	>75% Grass cover, Good, HSG C
0.800	98	Paved parking, HSG C
2.110	86	Weighted Average
1.080		51.18% Pervious Area
1.030		48.82% Impervious Area
0.230		22.33% Unconnected

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

Subcatchment P5: Garage Parking Area 1 to MWRA

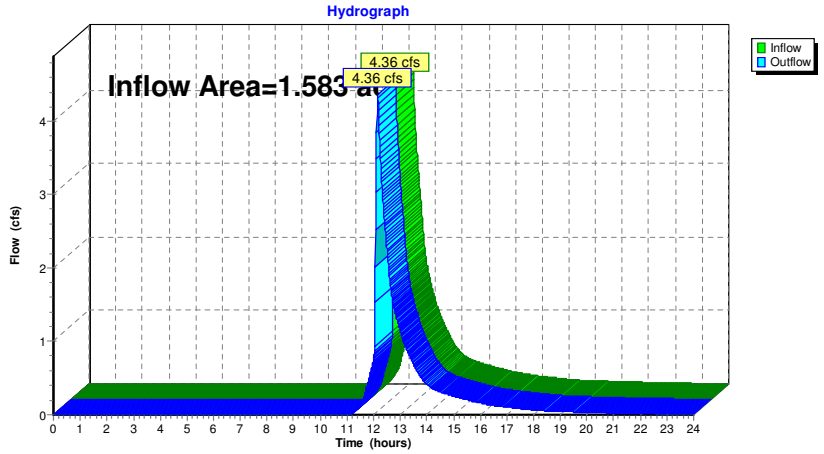


Summary for Reach SP-1: Municipal Drainage in Woodland Road

Inflow Area = 1.583 ac, 97.79% Impervious, Inflow Depth = 2.54" for 10-Year event
Inflow = 4.36 cfs @ 12.15 hrs, Volume= 0.335 af
Outflow = 4.36 cfs @ 12.15 hrs, Volume= 0.335 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 SP-1: Municipal Drainage in Woodland Road

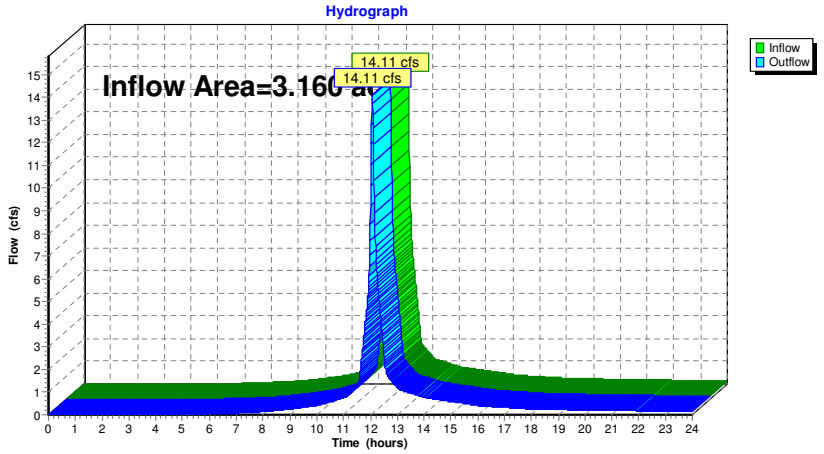


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 3.160 ac, 54.43% Impervious, Inflow Depth > 3.76" for 10-Year event
Inflow = 14.11 cfs @ 12.07 hrs, Volume= 0.990 af
Outflow = 14.11 cfs @ 12.07 hrs, Volume= 0.990 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 SP-2: Existing MWRA Basin

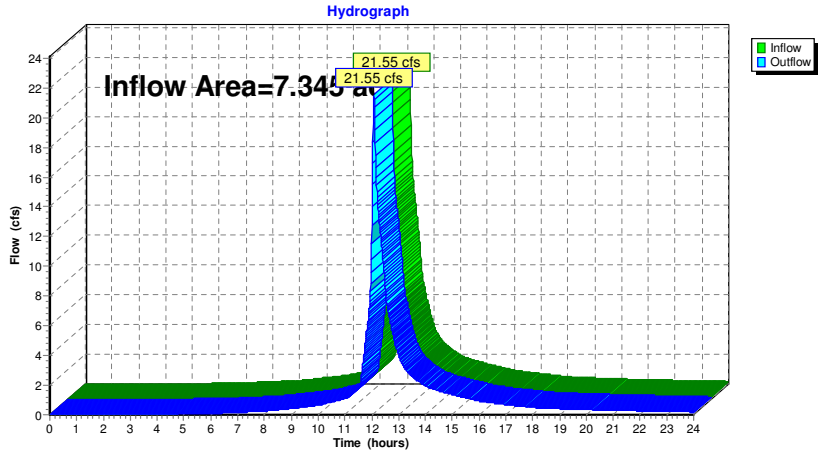


Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 7.345 ac, 73.86% Impervious, Inflow Depth > 3.27" for 10-Year event
Inflow = 21.55 cfs @ 12.08 hrs, Volume= 1.999 af
Outflow = 21.55 cfs @ 12.08 hrs, Volume= 1.999 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 SP-3: Flow to Woodland Road North



Summary for Pond 1P: UIS-1

Inflow Area = 0.900 ac,100.00% Impervious, Inflow Depth > 4.93" for 10-Year event
Inflow = 4.72 cfs @ 12.07 hrs, Volume= 0.370 af
Outflow = 3.28 cfs @ 12.14 hrs, Volume= 0.237 af, Atten= 31%, Lag= 4.5 min
Discarded = 0.04 cfs @ 4.25 hrs, Volume= 0.075 af
Primary = 3.24 cfs @ 12.14 hrs, Volume= 0.162 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 195.81' @ 12.14 hrs Surf.Area= 1,789 sf Storage= 6,539 cf

Plug-Flow detention time= 163.8 min calculated for 0.237 af (64% of inflow)
Center-of-Mass det. time= 59.6 min (805.7 - 746.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.25'	3,118 cf	**64.83'W x 27.59'L x 6.75'H Field A** 12,075 cf Overall - 4,280 cf Embedded = 7,795 cf x 40.0% Voids
#2A	191.00'	4,280 cf	**ADS_StormTech MC-4500 b +Cap** x 35 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 35 Chambers in 7 Rows Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf
		7,398 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	194.78'	**15.0" Round 15" Culvert** L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 194.78' / 194.51' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	195.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	190.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 4.25 hrs HW=190.32' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=3.23 cfs @ 12.14 hrs HW=195.80' (Free Discharge)
└**1=15" Culvert** (Barrel Controls 3.23 cfs @ 4.08 fps)
└**2=Broad-Crested Rectangular Weir** (Passes 3.23 cfs of 9.53 cfs potential flow)

Pond 1P: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

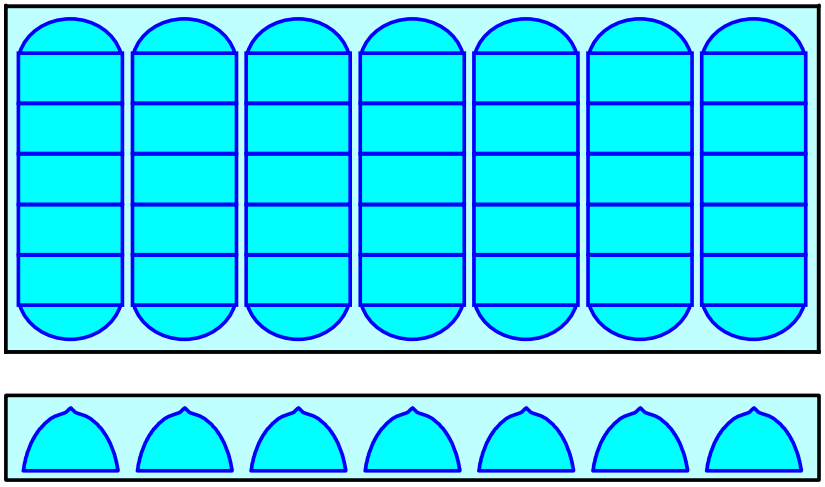
5 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 25.59' Row Length +12.0" End Stone x 2 = 27.59' Base Length
7 Rows x 100.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 64.83' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

35 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 7 Rows = 4,280.2 cf Chamber Storage

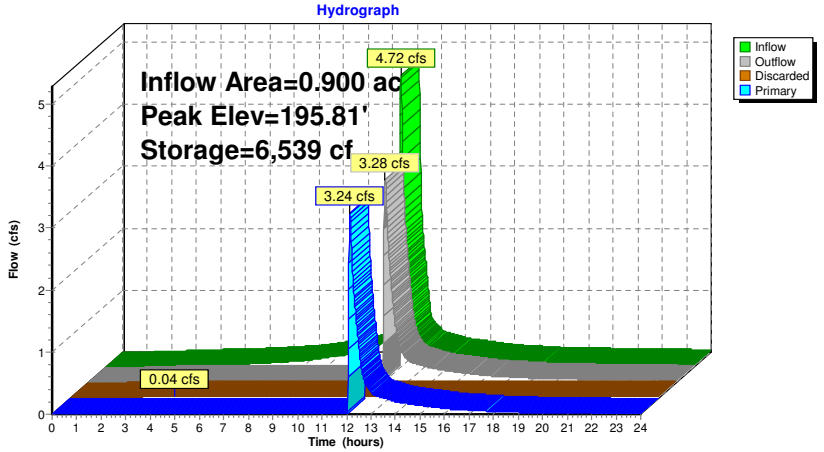
12,074.8 cf Field - 4,280.2 cf Chambers = 7,794.6 cf Stone x 40.0% Voids = 3,117.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,398.0 cf = 0.170 af
Overall Storage Efficiency = 61.3%
Overall System Size = 27.59' x 64.83' x 6.75'

35 Chambers
447.2 cy Field
288.7 cy Stone



Pond 1P: UIS-1



Summary for Pond 2P: UIS-2

Inflow Area = 0.683 ac, 94.88% Impervious, Inflow Depth > 4.81" for 10-Year event
Inflow = 3.56 cfs @ 12.07 hrs, Volume= 0.274 af
Outflow = 1.24 cfs @ 12.31 hrs, Volume= 0.245 af, Atten= 65%, Lag= 14.7 min
Discarded = 0.04 cfs @ 6.33 hrs, Volume= 0.071 af
Primary = 1.20 cfs @ 12.31 hrs, Volume= 0.173 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 215.35' @ 12.31 hrs Surf.Area= 1,819 sf Storage= 4,012 cf

Plug-Flow detention time= 102.9 min calculated for 0.245 af (89% of inflow)
Center-of-Mass det. time= 51.3 min (805.0 - 753.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	212.25'	3,027 cf	**28.50'W x 63.82'L x 6.75'H Field A** 12,277 cf Overall - 4,710 cf Embedded = 7,567 cf x 40.0% Voids
#2A	213.00'	4,710 cf	**ADS_StormTech MC-4500 b +Cap** x 42 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 42 Chambers in 3 Rows Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf
		7,736 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	**12.0" Round 12" Culvert Outlet** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 213.50' / 212.00' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	213.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	217.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	212.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 6.33 hrs HW=212.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.20 cfs @ 12.31 hrs HW=215.35' (Free Discharge)
└**1=12" Culvert Outlet** (Passes 1.20 cfs of 4.40 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.20 cfs @ 6.10 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: UIS-2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

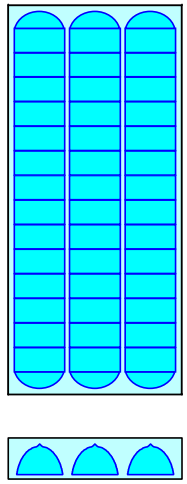
14 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 61.82' Row Length +12.0" End Stone x 2 = 63.82' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

42 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 3 Rows = 4,709.6 cf Chamber Storage

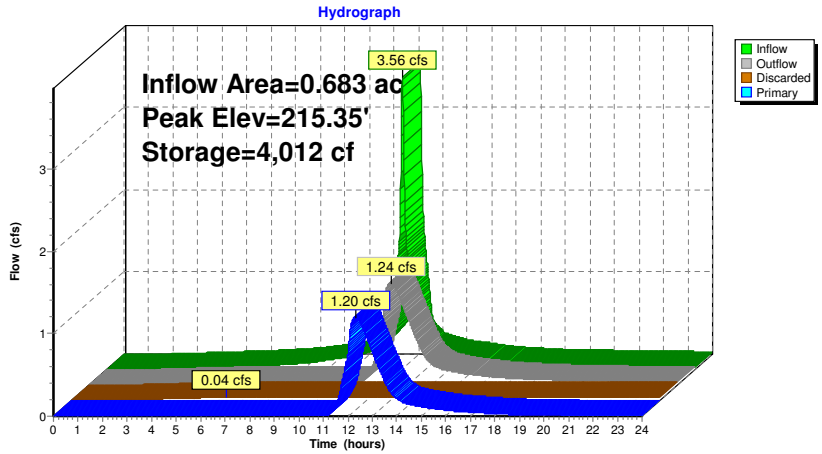
12,276.7 cf Field - 4,709.6 cf Chambers = 7,567.1 cf Stone x 40.0% Voids = 3,026.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,736.5 cf = 0.178 af
Overall Storage Efficiency = 63.0%
Overall System Size = 63.82' x 28.50' x 6.75'

42 Chambers
454.7 cy Field
280.3 cy Stone



Pond 2P: UIS-2



Summary for Pond 3P: UIS-3

Inflow Area = 3.475 ac, 76.98% Impervious, Inflow Depth > 4.25" for 10-Year event
Inflow = 17.01 cfs @ 12.07 hrs, Volume= 1.231 af
Outflow = 5.86 cfs @ 12.33 hrs, Volume= 0.939 af, Atten= 66%, Lag= 15.4 min
Discarded = 0.19 cfs @ 7.61 hrs, Volume= 0.276 af
Primary = 5.67 cfs @ 12.33 hrs, Volume= 0.663 af
Routed to Reach SP-3 : Flow to Woodland Road North

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 212.05' @ 12.33 hrs Surf.Area= 7,862 sf Storage= 21,985 cf
Flood Elev= 210.50' Surf.Area= 7,862 sf Storage= 12,421 cf

Plug-Flow detention time= 147.9 min calculated for 0.939 af (76% of inflow)
Center-of-Mass det. time= 66.0 min (846.3 - 780.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	208.25'	12,550 cf	**46.67'W x 168.47'L x 6.75'H Field A** 53,067 cf Overall - 21,693 cf Embedded = 31,374 cf x 40.0% Voids
#2A	209.00'	21,693 cf	**ADS_StormTech MC-4500 b +Cap** x 200 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 200 Chambers in 5 Rows Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf
		34,243 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	209.00'	**18.0" Round 18" Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 209.00' / 208.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	210.50'	**15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	213.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	208.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 7.61 hrs HW=208.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=5.67 cfs @ 12.33 hrs HW=212.05' (Free Discharge)
└**1=18" Culvert** (Passes 5.67 cfs of 12.89 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 5.67 cfs @ 4.62 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: UIS-3 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

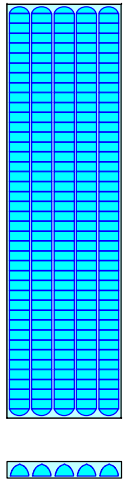
40 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 166.47' Row Length +12.0" End Stone x 2 = 168.47' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

200 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 5 Rows = 21,693.1 cf Chamber Storage

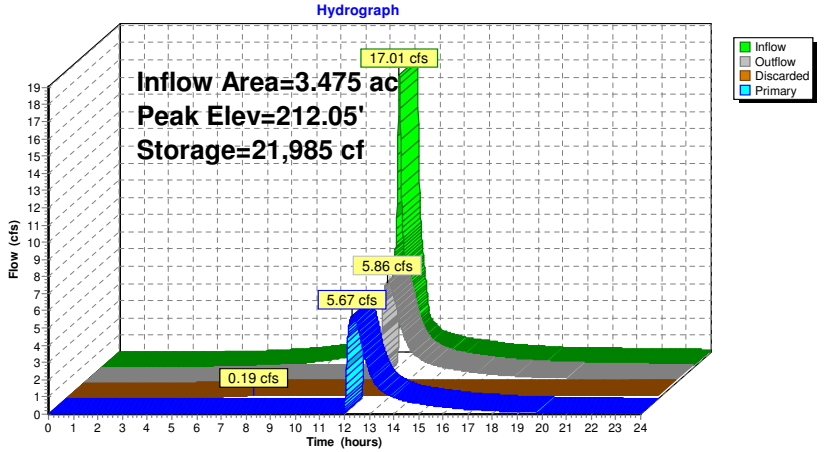
53,067.0 cf Field - 21,693.1 cf Chambers = 31,373.9 cf Stone x 40.0% Voids = 12,549.6 cf Stone Storage

Chamber Storage + Stone Storage = 34,242.7 cf = 0.786 af
Overall Storage Efficiency = 64.5%
Overall System Size = 168.47' x 46.67' x 6.75'

200 Chambers
1,965.4 cy Field
1,162.0 cy Stone



Pond 3P: UIS-3



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Existing Parking Lot Flow Runoff Area=3.870 ac 71.06% Impervious Runoff Depth>5.30"
Tc=5.0 min CN=91 Runoff=23.47 cfs 1.708 af

Subcatchment P-2: Building A Roof Runoff Area=0.900 ac 100.00% Impervious Runoff Depth>6.11"
Tc=5.0 min CN=98 Runoff=5.80 cfs 0.458 af

Subcatchment P-3: Southern Parking Lot at Runoff Area=0.683 ac 94.88% Impervious Runoff Depth>5.99"
Tc=5.0 min CN=97 Runoff=4.39 cfs 0.341 af

Subcatchment P-4: Building B Roof and Runoff Area=3.475 ac 76.98% Impervious Runoff Depth>5.41"
Tc=5.0 min CN=92 Runoff=21.34 cfs 1.567 af

Subcatchment P-6: Garage Parking Area to Runoff Area=1.050 ac 65.71% Impervious Runoff Depth>5.18"
Tc=5.0 min CN=90 Runoff=6.28 cfs 0.454 af

Subcatchment P5: Garage Parking Area 1 to Runoff Area=2.110 ac 48.82% Impervious Runoff Depth>4.74"
Tc=5.0 min CN=86 Runoff=11.83 cfs 0.833 af

Reach SP-1: Municipal Drainage in Woodland Road Inflow=6.33 cfs 0.484 af
Outflow=6.33 cfs 0.484 af

Reach SP-2: Existing MWRA Basin Inflow=18.12 cfs 1.287 af
Outflow=18.12 cfs 1.287 af

Reach SP-3: Flow to Woodland Road North Inflow=29.31 cfs 2.686 af
Outflow=29.31 cfs 2.686 af

Pond 1P: UIS-1 Peak Elev=196.22' Storage=6,841 cf Inflow=5.80 cfs 0.458 af
Discarded=0.04 cfs 0.077 af Primary=5.09 cfs 0.248 af Outflow=5.14 cfs 0.325 af

Pond 2P: UIS-2 Peak Elev=215.94' Storage=4,802 cf Inflow=4.39 cfs 0.341 af
Discarded=0.04 cfs 0.074 af Primary=1.40 cfs 0.236 af Outflow=1.44 cfs 0.310 af

Pond 3P: UIS-3 Peak Elev=212.90' Storage=26,602 cf Inflow=21.34 cfs 1.567 af
Discarded=0.19 cfs 0.290 af Primary=7.87 cfs 0.978 af Outflow=8.05 cfs 1.268 af

Total Runoff Area = 12.088 ac Runoff Volume = 5.360 af Average Runoff Depth = 5.32"
28.09% Pervious = 3.395 ac 71.91% Impervious = 8.693 ac

Summary for Subcatchment P-1: Existing Parking Lot Flow to SP-3

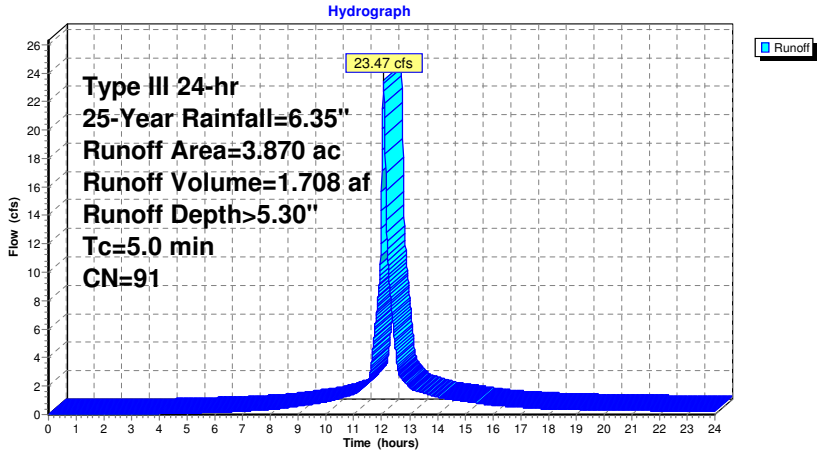
Runoff = 23.47 cfs @ 12.07 hrs, Volume= 1.708 af, Depth> 5.30"
Routed to Reach SP-3 : Flow to Woodland Road North

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=6.35"

Area (ac)	CN	Description
2.750	98	Paved parking, HSG C
1.120	74	>75% Grass cover, Good, HSG C
3.870	91	Weighted Average
1.120		28.94% Pervious Area
2.750		71.06% Impervious Area

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

Subcatchment P-1: Existing Parking Lot Flow to SP-3



Summary for Subcatchment P-2: Building A Roof

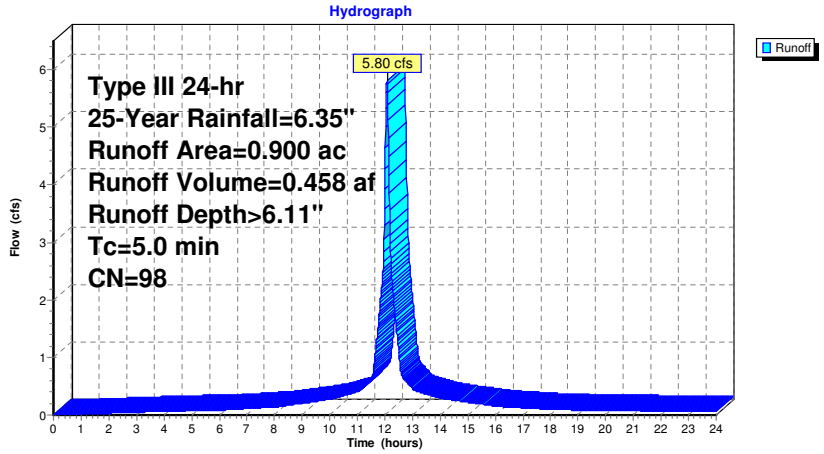
Runoff = 5.80 cfs @ 12.07 hrs, Volume= 0.458 af, Depth> 6.11"
Routed to Pond 1P : UIS-1

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=6.35"

Area (ac)	CN	Description
0.900	98	Roofs, HSG C
0.900		100.00% Impervious Area

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

Subcatchment P-2: Building A Roof



Summary for Subcatchment P-3: Southern Parking Lot at Easement

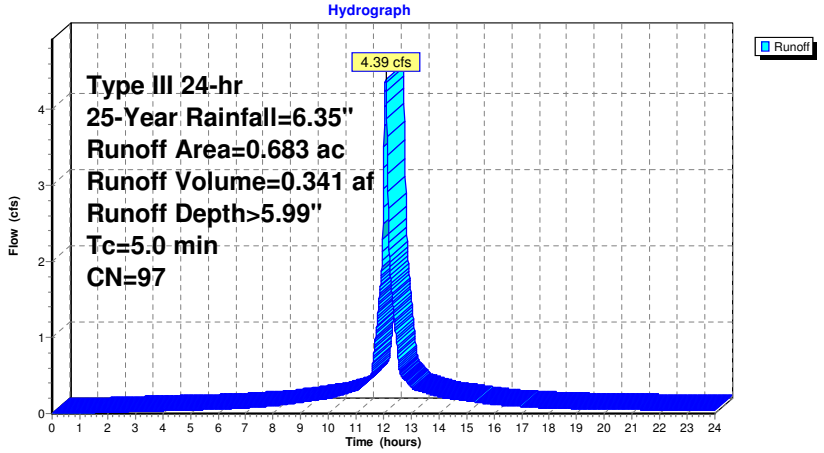
Runoff = 4.39 cfs @ 12.07 hrs, Volume= 0.341 af, Depth> 5.99"
Routed to Pond 2P : UIS-2

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=6.35"

Area (ac)	CN	Description
0.648	98	Paved parking, HSG C
0.035	74	>75% Grass cover, Good, HSG C
0.683	97	Weighted Average
0.035		5.12% Pervious Area
0.648		94.88% Impervious Area

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

Subcatchment P-3: Southern Parking Lot at Easement



Summary for Subcatchment P-4: Building B Roof and Parking Areas

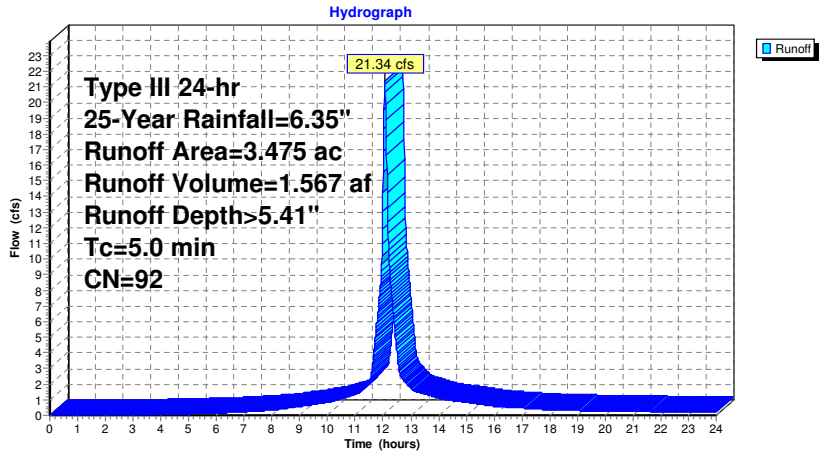
Runoff = 21.34 cfs @ 12.07 hrs, Volume= 1.567 af, Depth> 5.41"
Routed to Pond 3P : UIS-3

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=6.35"

Area (ac)	CN	Description
0.985	98	Paved parking, HSG C
1.690	98	Roofs, HSG C
0.800	74	>75% Grass cover, Good, HSG C
3.475	92	Weighted Average
0.800		23.02% Pervious Area
2.675		76.98% Impervious Area

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

Subcatchment P-4: Building B Roof and Parking Areas



Summary for Subcatchment P-6: Garage Parking Area to MWRA

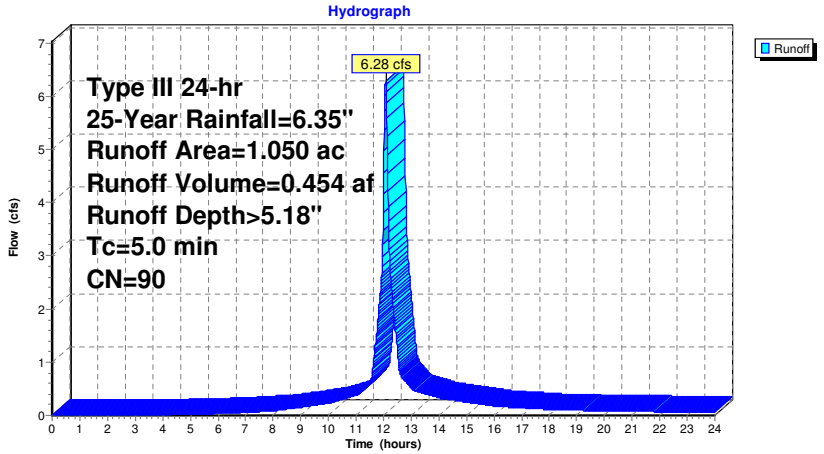
Runoff = 6.28 cfs @ 12.07 hrs, Volume= 0.454 af, Depth> 5.18"
Routed to Reach SP-2 : Existing MWRA Basin

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=6.35"

Area (ac)	CN	Description
0.300	98	Unconnected roofs, HSG C
0.390	98	Paved parking, HSG C
0.360	74	>75% Grass cover, Good, HSG C
1.050	90	Weighted Average
0.360		34.29% Pervious Area
0.690		65.71% Impervious Area
0.300		43.48% Unconnected

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

Subcatchment P-6: Garage Parking Area to MWRA



Summary for Subcatchment P5: Garage Parking Area 1 to MWRA

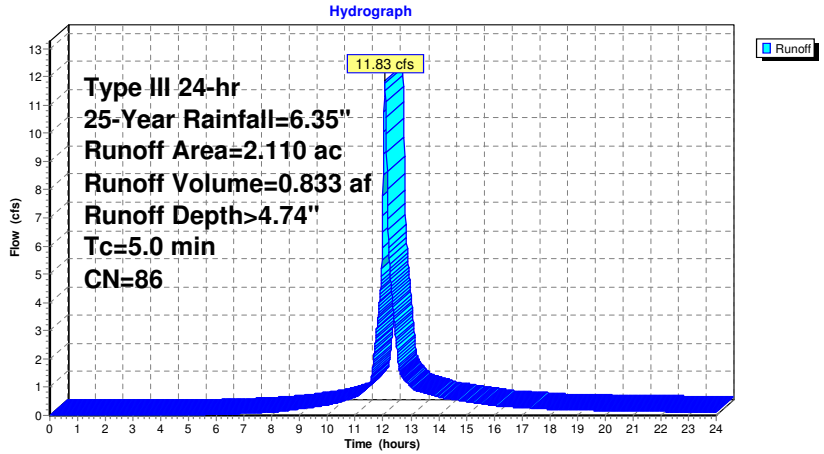
Runoff = 11.83 cfs @ 12.07 hrs, Volume= 0.833 af, Depth> 4.74"
Routed to Reach SP-2 : Existing MWRA Basin

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=6.35"

Area (ac)	CN	Description
0.230	98	Unconnected roofs, HSG C
1.080	74	>75% Grass cover, Good, HSG C
0.800	98	Paved parking, HSG C
2.110	86	Weighted Average
1.080		51.18% Pervious Area
1.030		48.82% Impervious Area
0.230		22.33% Unconnected

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

Subcatchment P5: Garage Parking Area 1 to MWRA

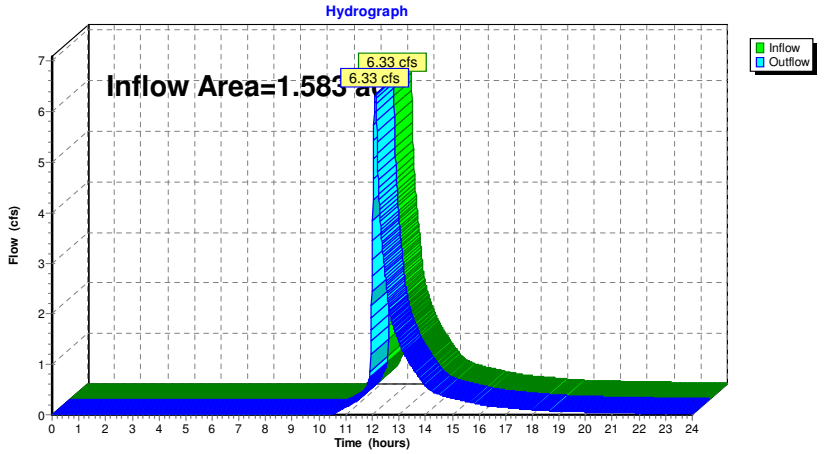


Summary for Reach SP-1: Municipal Drainage in Woodland Road

Inflow Area = 1.583 ac, 97.79% Impervious, Inflow Depth > 3.67" for 25-Year event
Inflow = 6.33 cfs @ 12.11 hrs, Volume= 0.484 af
Outflow = 6.33 cfs @ 12.11 hrs, Volume= 0.484 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 SP-1: Municipal Drainage in Woodland Road

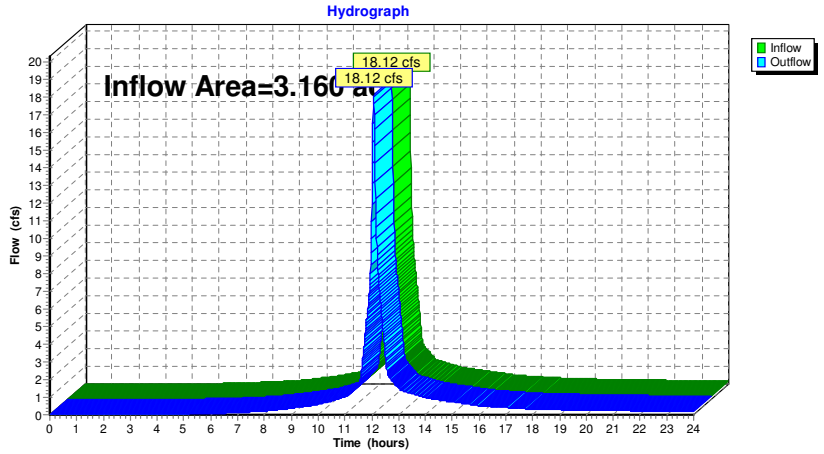


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 3.160 ac, 54.43% Impervious, Inflow Depth > 4.89" for 25-Year event
Inflow = 18.12 cfs @ 12.07 hrs, Volume= 1.287 af
Outflow = 18.12 cfs @ 12.07 hrs, Volume= 1.287 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 SP-2: Existing MWRA Basin

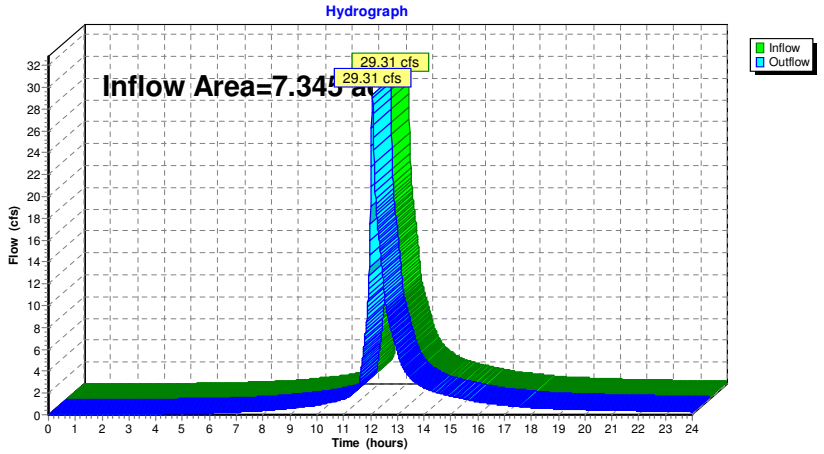


Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 7.345 ac, 73.86% Impervious, Inflow Depth > 4.39" for 25-Year event
Inflow = 29.31 cfs @ 12.08 hrs, Volume= 2.686 af
Outflow = 29.31 cfs @ 12.08 hrs, Volume= 2.686 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 SP-3: Flow to Woodland Road North



Summary for Pond 1P: UIS-1

Inflow Area = 0.900 ac,100.00% Impervious, Inflow Depth > 6.11" for 25-Year event
Inflow = 5.80 cfs @ 12.07 hrs, Volume= 0.458 af
Outflow = 5.14 cfs @ 12.11 hrs, Volume= 0.325 af, Atten= 11%, Lag= 2.4 min
Discarded = 0.04 cfs @ 3.23 hrs, Volume= 0.077 af
Primary = 5.09 cfs @ 12.11 hrs, Volume= 0.248 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 196.22' @ 12.11 hrs Surf.Area= 1,789 sf Storage= 6,841 cf

Plug-Flow detention time= 150.9 min calculated for 0.325 af (71% of inflow)
Center-of-Mass det. time= 56.9 min (799.9 - 742.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.25'	3,118 cf	**64.83'W x 27.59'L x 6.75'H Field A** 12,075 cf Overall - 4,280 cf Embedded = 7,795 cf x 40.0% Voids
#2A	191.00'	4,280 cf	**ADS_StormTech MC-4500 b +Cap** x 35 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 35 Chambers in 7 Rows Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf
		7,398 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	194.78'	**15.0" Round 15" Culvert** L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 194.78' / 194.51' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	195.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	190.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 3.23 hrs HW=190.32' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=5.10 cfs @ 12.11 hrs HW=196.22' (Free Discharge)
└**1=15" Culvert** (Barrel Controls 5.10 cfs @ 4.52 fps)
└**2=Broad-Crested Rectangular Weir** (Passes 5.10 cfs of 17.94 cfs potential flow)

Pond 1P: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

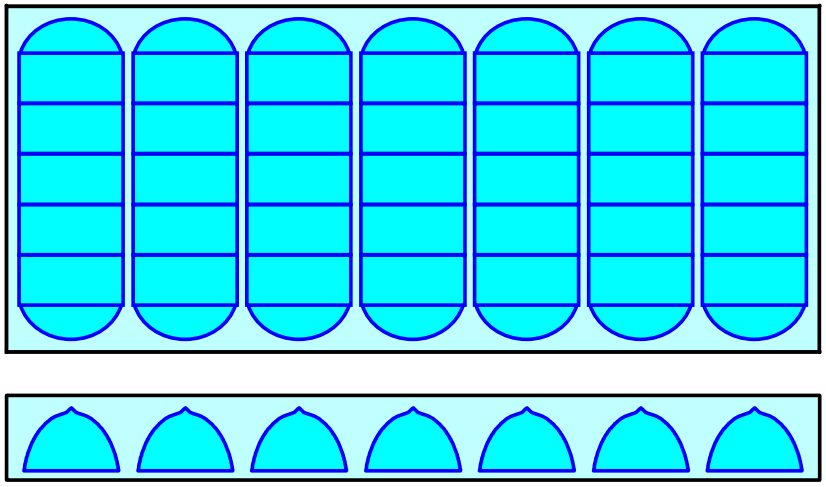
5 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 25.59' Row Length +12.0" End Stone x 2 = 27.59' Base Length
7 Rows x 100.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 64.83' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

35 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 7 Rows = 4,280.2 cf Chamber Storage

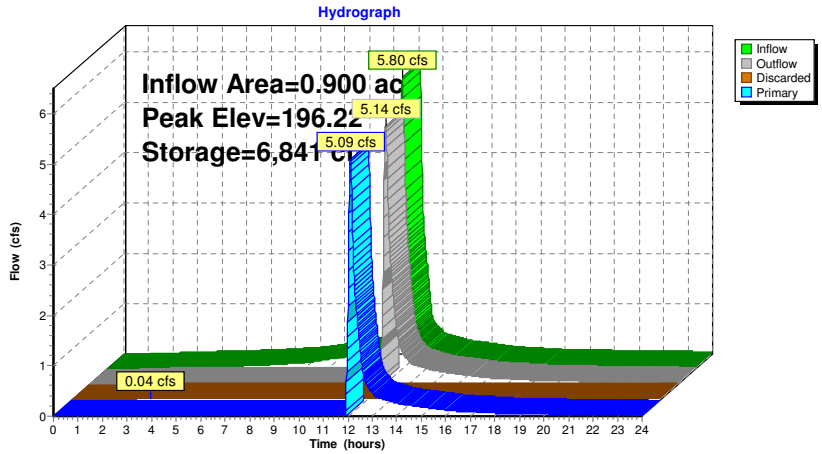
12,074.8 cf Field - 4,280.2 cf Chambers = 7,794.6 cf Stone x 40.0% Voids = 3,117.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,398.0 cf = 0.170 af
Overall Storage Efficiency = 61.3%
Overall System Size = 27.59' x 64.83' x 6.75'

35 Chambers
447.2 cy Field
288.7 cy Stone



Pond 1P: UIS-1



Summary for Pond 2P: UIS-2

Inflow Area = 0.683 ac, 94.88% Impervious, Inflow Depth > 5.99" for 25-Year event
Inflow = 4.39 cfs @ 12.07 hrs, Volume= 0.341 af
Outflow = 1.44 cfs @ 12.34 hrs, Volume= 0.310 af, Atten= 67%, Lag= 16.0 min
Discarded = 0.04 cfs @ 5.00 hrs, Volume= 0.074 af
Primary = 1.40 cfs @ 12.34 hrs, Volume= 0.236 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 215.94' @ 12.34 hrs Surf.Area= 1,819 sf Storage= 4,802 cf

Plug-Flow detention time= 95.9 min calculated for 0.310 af (91% of inflow)
Center-of-Mass det. time= 49.8 min (799.5 - 749.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	212.25'	3,027 cf	**28.50'W x 63.82'L x 6.75'H Field A** 12,277 cf Overall - 4,710 cf Embedded = 7,567 cf x 40.0% Voids
#2A	213.00'	4,710 cf	**ADS_StormTech MC-4500 b +Cap** x 42 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 42 Chambers in 3 Rows Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf
		7,736 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	**12.0" Round 12" Culvert Outlet** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 213.50' / 212.00' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	213.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	217.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	212.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 5.00 hrs HW=212.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.40 cfs @ 12.34 hrs HW=215.94' (Free Discharge)
└**1=12" Culvert Outlet** (Passes 1.40 cfs of 5.02 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.40 cfs @ 7.12 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: UIS-2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

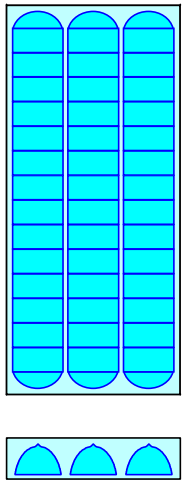
14 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 61.82' Row Length +12.0" End Stone x 2 = 63.82' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

42 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 3 Rows = 4,709.6 cf Chamber Storage

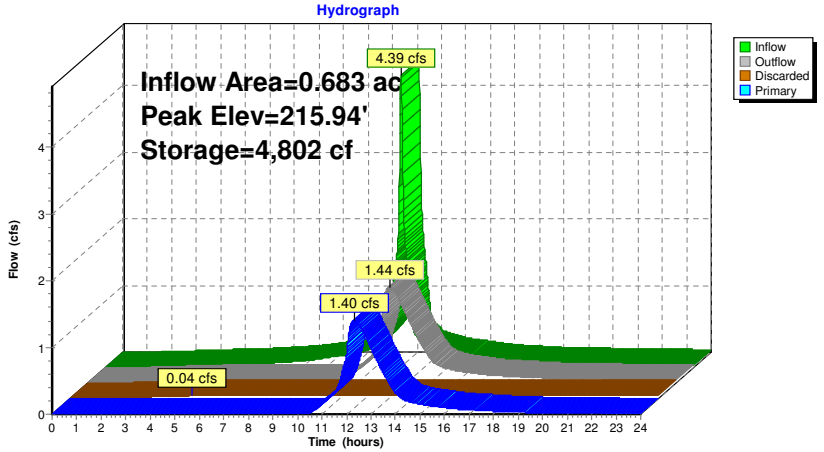
12,276.7 cf Field - 4,709.6 cf Chambers = 7,567.1 cf Stone x 40.0% Voids = 3,026.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,736.5 cf = 0.178 af
Overall Storage Efficiency = 63.0%
Overall System Size = 63.82' x 28.50' x 6.75'

42 Chambers
454.7 cy Field
280.3 cy Stone



Pond 2P: UIS-2



Summary for Pond 3P: UIS-3

Inflow Area = 3.475 ac, 76.98% Impervious, Inflow Depth > 5.41" for 25-Year event
Inflow = 21.34 cfs @ 12.07 hrs, Volume= 1.567 af
Outflow = 8.05 cfs @ 12.29 hrs, Volume= 1.268 af, Atten= 62%, Lag= 13.1 min
Discarded = 0.19 cfs @ 6.74 hrs, Volume= 0.290 af
Primary = 7.87 cfs @ 12.29 hrs, Volume= 0.978 af
Routed to Reach SP-3 : Flow to Woodland Road North

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 212.90' @ 12.29 hrs Surf.Area= 7,862 sf Storage= 26,602 cf
Flood Elev= 210.50' Surf.Area= 7,862 sf Storage= 12,421 cf

Plug-Flow detention time= 132.9 min calculated for 1.268 af (81% of inflow)
Center-of-Mass det. time= 59.8 min (833.9 - 774.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	208.25'	12,550 cf	**46.67'W x 168.47'L x 6.75'H Field A** 53,067 cf Overall - 21,693 cf Embedded = 31,374 cf x 40.0% Voids
#2A	209.00'	21,693 cf	**ADS_StormTech MC-4500 b +Cap** x 200 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 200 Chambers in 5 Rows Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf
		34,243 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	209.00'	**18.0" Round 18" Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 209.00' / 208.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	210.50'	**15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	213.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	208.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 6.74 hrs HW=208.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=7.87 cfs @ 12.29 hrs HW=212.90' (Free Discharge)
└**1=18" Culvert** (Passes 7.87 cfs of 15.09 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 7.87 cfs @ 6.41 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: UIS-3 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

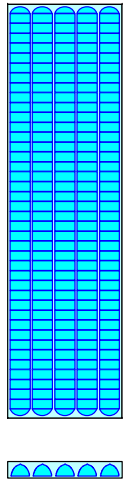
40 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 166.47' Row Length +12.0" End Stone x 2 = 168.47' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

200 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 5 Rows = 21,693.1 cf Chamber Storage

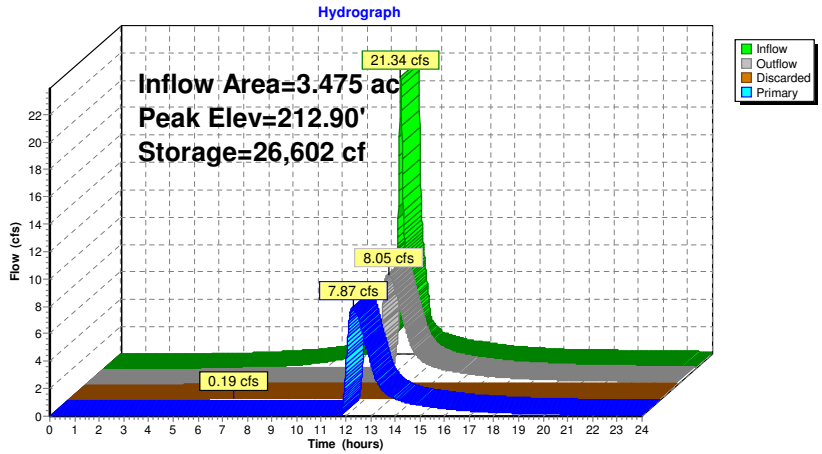
53,067.0 cf Field - 21,693.1 cf Chambers = 31,373.9 cf Stone x 40.0% Voids = 12,549.6 cf Stone Storage

Chamber Storage + Stone Storage = 34,242.7 cf = 0.786 af
Overall Storage Efficiency = 64.5%
Overall System Size = 168.47' x 46.67' x 6.75'

200 Chambers
1,965.4 cy Field
1,162.0 cy Stone



Pond 3P: UIS-3



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Existing Parking Lot Flow Runoff Area=3.870 ac 71.06% Impervious Runoff Depth>7.08"
Tc=5.0 min CN=91 Runoff=30.85 cfs 2.282 af

Subcatchment P-2: Building A Roof Runoff Area=0.900 ac 100.00% Impervious Runoff Depth>7.92"
Tc=5.0 min CN=98 Runoff=7.47 cfs 0.594 af

Subcatchment P-3: Southern Parking Lot at Runoff Area=0.683 ac 94.88% Impervious Runoff Depth>7.80"
Tc=5.0 min CN=97 Runoff=5.65 cfs 0.444 af

Subcatchment P-4: Building B Roof and Runoff Area=3.475 ac 76.98% Impervious Runoff Depth>7.20"
Tc=5.0 min CN=92 Runoff=27.94 cfs 2.084 af

Subcatchment P-6: Garage Parking Area to Runoff Area=1.050 ac 65.71% Impervious Runoff Depth>6.96"
Tc=5.0 min CN=90 Runoff=8.29 cfs 0.609 af

Subcatchment P5: Garage Parking Area 1 to Runoff Area=2.110 ac 48.82% Impervious Runoff Depth>6.48"
Tc=5.0 min CN=86 Runoff=15.93 cfs 1.140 af

Reach SP-1: Municipal Drainage in Woodland Road Inflow=7.92 cfs 0.716 af
Outflow=7.92 cfs 0.716 af

Reach SP-2: Existing MWRA Basin Inflow=24.22 cfs 1.749 af
Outflow=24.22 cfs 1.749 af

Reach SP-3: Flow to Woodland Road North Inflow=39.15 cfs 3.754 af
Outflow=39.15 cfs 3.754 af

Pond 1P: UIS-1 Peak Elev=196.67' Storage=7,163 cf Inflow=7.47 cfs 0.594 af
Discarded=0.04 cfs 0.079 af Primary=6.44 cfs 0.381 af Outflow=6.49 cfs 0.460 af

Pond 2P: UIS-2 Peak Elev=216.94' Storage=6,036 cf Inflow=5.65 cfs 0.444 af
Discarded=0.04 cfs 0.077 af Primary=1.69 cfs 0.334 af Outflow=1.73 cfs 0.412 af

Pond 3P: UIS-3 Peak Elev=214.08' Storage=31,344 cf Inflow=27.94 cfs 2.084 af
Discarded=0.19 cfs 0.307 af Primary=15.55 cfs 1.472 af Outflow=15.74 cfs 1.778 af

Total Runoff Area = 12.088 ac Runoff Volume = 7.152 af Average Runoff Depth = 7.10"
28.09% Pervious = 3.395 ac 71.91% Impervious = 8.693 ac

Summary for Subcatchment P-1: Existing Parking Lot Flow to SP-3

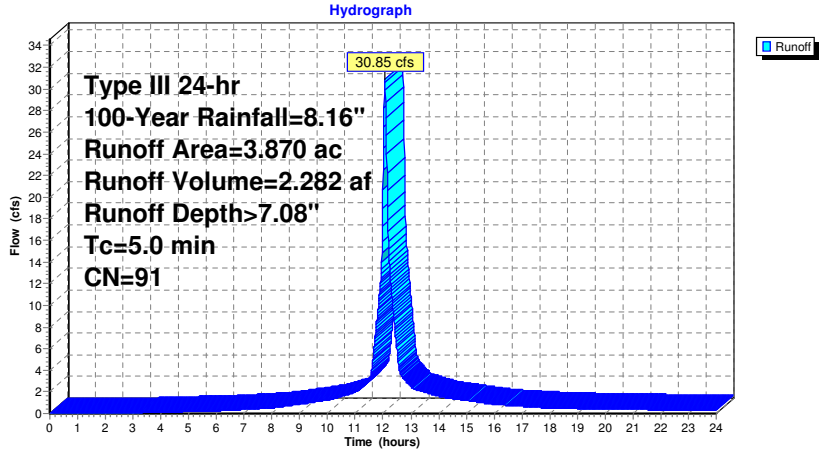
Runoff = 30.85 cfs @ 12.07 hrs, Volume= 2.282 af, Depth> 7.08"
Routed to Reach SP-3 : Flow to Woodland Road North

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=8.16"

Area (ac)	CN	Description
2.750	98	Paved parking, HSG C
1.120	74	>75% Grass cover, Good, HSG C
3.870	91	Weighted Average
1.120		28.94% Pervious Area
2.750		71.06% Impervious Area

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

Subcatchment P-1: Existing Parking Lot Flow to SP-3



Summary for Subcatchment P-2: Building A Roof

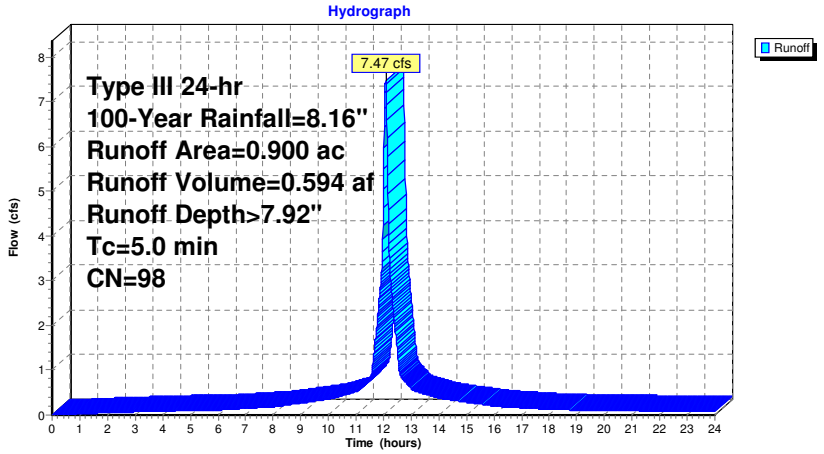
Runoff = 7.47 cfs @ 12.07 hrs, Volume= 0.594 af, Depth> 7.92"
Routed to Pond 1P : UIS-1

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=8.16"

Area (ac)	CN	Description
0.900	98	Roofs, HSG C
0.900		100.00% Impervious Area

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

Subcatchment P-2: Building A Roof



Summary for Subcatchment P-3: Southern Parking Lot at Easement

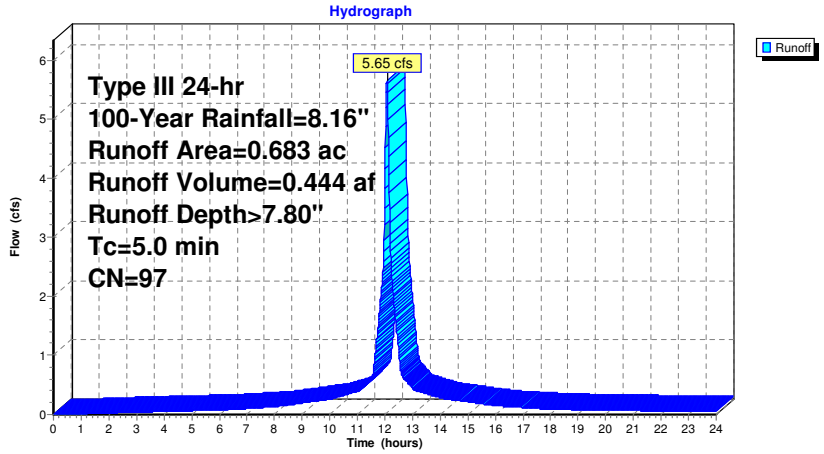
Runoff = 5.65 cfs @ 12.07 hrs, Volume= 0.444 af, Depth> 7.80"
Routed to Pond 2P : UIS-2

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=8.16"

Area (ac)	CN	Description
0.648	98	Paved parking, HSG C
0.035	74	>75% Grass cover, Good, HSG C
0.683	97	Weighted Average
0.035		5.12% Pervious Area
0.648		94.88% Impervious Area

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

Subcatchment P-3: Southern Parking Lot at Easement



Summary for Subcatchment P-4: Building B Roof and Parking Areas

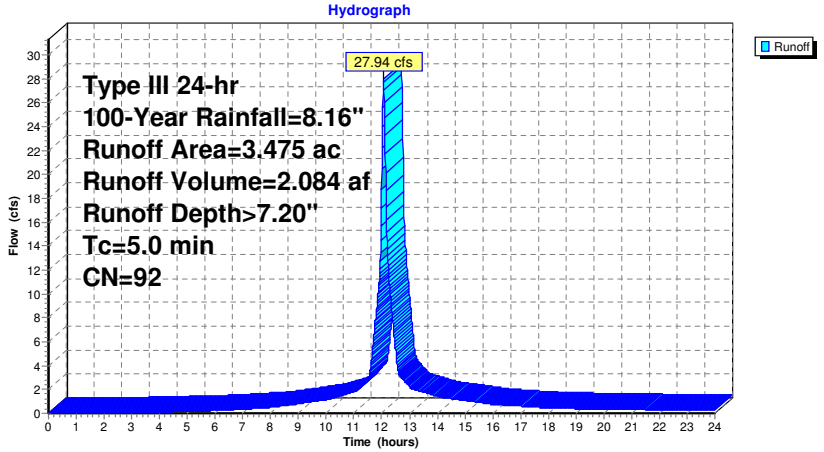
Runoff = 27.94 cfs @ 12.07 hrs, Volume= 2.084 af, Depth> 7.20"
Routed to Pond 3P : UIS-3

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=8.16"

Area (ac)	CN	Description
0.985	98	Paved parking, HSG C
1.690	98	Roofs, HSG C
0.800	74	>75% Grass cover, Good, HSG C
3.475	92	Weighted Average
0.800		23.02% Pervious Area
2.675		76.98% Impervious Area

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

Subcatchment P-4: Building B Roof and Parking Areas



Summary for Subcatchment P-6: Garage Parking Area to MWRA

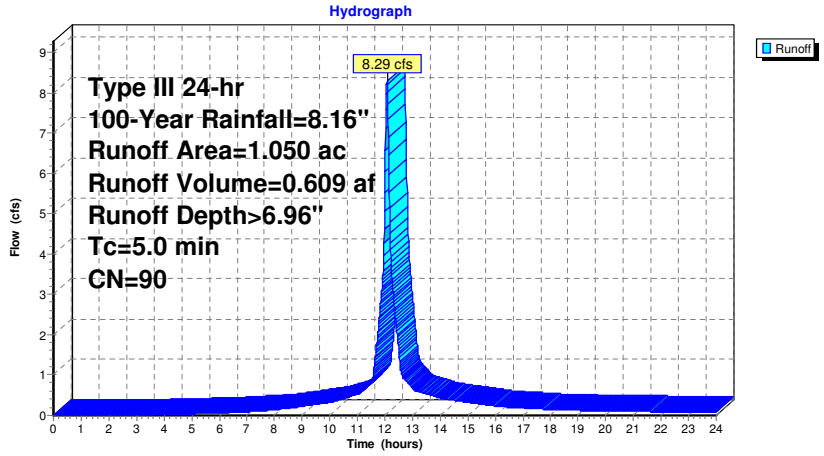
Runoff = 8.29 cfs @ 12.07 hrs, Volume= 0.609 af, Depth> 6.96"
Routed to Reach SP-2 : Existing MWRA Basin

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=8.16"

Area (ac)	CN	Description
0.300	98	Unconnected roofs, HSG C
0.390	98	Paved parking, HSG C
0.360	74	>75% Grass cover, Good, HSG C
1.050	90	Weighted Average
0.360		34.29% Pervious Area
0.690		65.71% Impervious Area
0.300		43.48% Unconnected

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

Subcatchment P-6: Garage Parking Area to MWRA



Summary for Subcatchment P5: Garage Parking Area 1 to MWRA

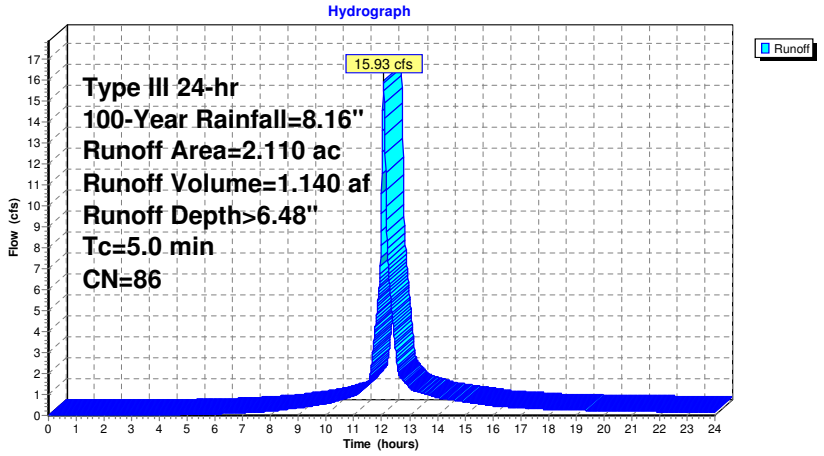
Runoff = 15.93 cfs @ 12.07 hrs, Volume= 1.140 af, Depth> 6.48"
Routed to Reach SP-2 : Existing MWRA Basin

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=8.16"

Area (ac)	CN	Description
0.230	98	Unconnected roofs, HSG C
1.080	74	>75% Grass cover, Good, HSG C
0.800	98	Paved parking, HSG C
2.110	86	Weighted Average
1.080		51.18% Pervious Area
1.030		48.82% Impervious Area
0.230		22.33% Unconnected

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

Subcatchment P5: Garage Parking Area 1 to MWRA

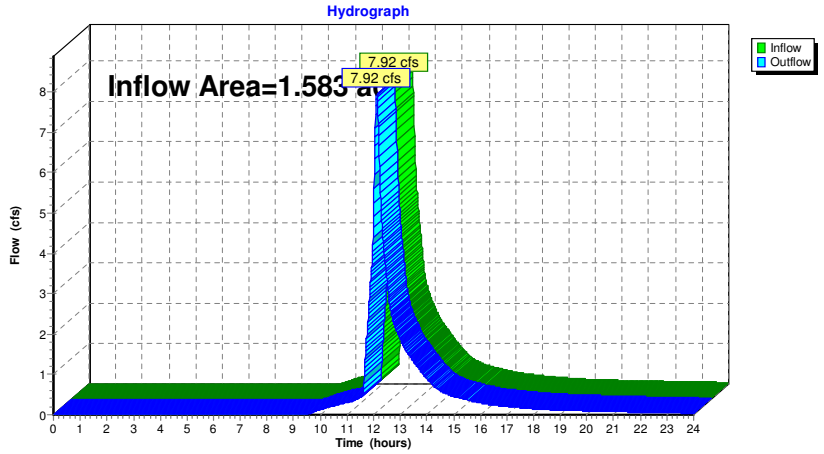


Summary for Reach SP-1: Municipal Drainage in Woodland Road

Inflow Area = 1.583 ac, 97.79% Impervious, Inflow Depth > 5.43" for 100-Year event
Inflow = 7.92 cfs @ 12.12 hrs, Volume= 0.716 af
Outflow = 7.92 cfs @ 12.12 hrs, Volume= 0.716 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 SP-1: Municipal Drainage in Woodland Road

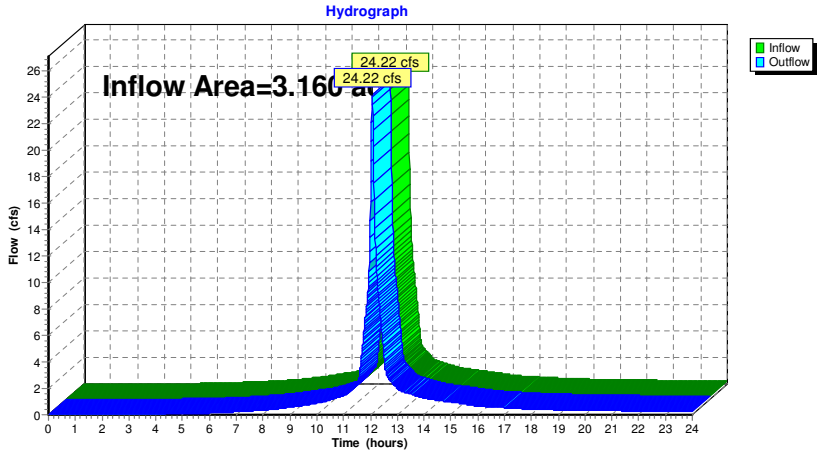


Summary for Reach SP-2: Existing MWRA Basin

Inflow Area = 3.160 ac, 54.43% Impervious, Inflow Depth > 6.64" for 100-Year event
Inflow = 24.22 cfs @ 12.07 hrs, Volume= 1.749 af
Outflow = 24.22 cfs @ 12.07 hrs, Volume= 1.749 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 SP-2: Existing MWRA Basin

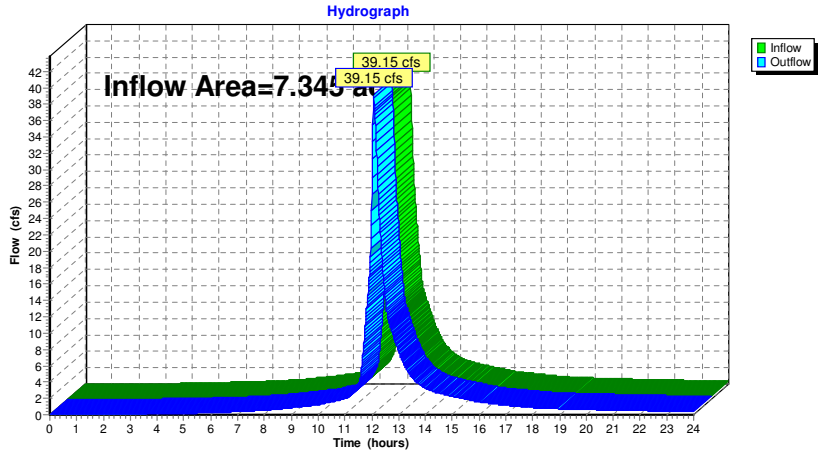


Summary for Reach SP-3: Flow to Woodland Road North

Inflow Area = 7.345 ac, 73.86% Impervious, Inflow Depth > 6.13" for 100-Year event
Inflow = 39.15 cfs @ 12.08 hrs, Volume= 3.754 af
Outflow = 39.15 cfs @ 12.08 hrs, Volume= 3.754 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 SP-3: Flow to Woodland Road North



Summary for Pond 1P: UIS-1

Inflow Area = 0.900 ac,100.00% Impervious, Inflow Depth > 7.92" for 100-Year event
Inflow = 7.47 cfs @ 12.07 hrs, Volume= 0.594 af
Outflow = 6.49 cfs @ 12.11 hrs, Volume= 0.460 af, Atten= 13%, Lag= 2.6 min
Discarded = 0.04 cfs @ 2.24 hrs, Volume= 0.079 af
Primary = 6.44 cfs @ 12.11 hrs, Volume= 0.381 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 196.67' @ 12.11 hrs Surf.Area= 1,789 sf Storage= 7,163 cf

Plug-Flow detention time= 138.7 min calculated for 0.460 af (78% of inflow)
Center-of-Mass det. time= 55.8 min (795.4 - 739.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	190.25'	3,118 cf	**64.83'W x 27.59'L x 6.75'H Field A** 12,075 cf Overall - 4,280 cf Embedded = 7,795 cf x 40.0% Voids
#2A	191.00'	4,280 cf	**ADS_StormTech MC-4500 b +Cap** x 35 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 35 Chambers in 7 Rows Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf
		7,398 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	194.78'	**15.0" Round 15" Culvert** L= 27.0' Ke= 0.500 Inlet / Outlet Invert= 194.78' / 194.51' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Device 1	195.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#3	Discarded	190.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 2.24 hrs HW=190.32' (Free Discharge)
└**3=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=6.44 cfs @ 12.11 hrs HW=196.67' (Free Discharge)
└**1=15" Culvert** (Barrel Controls 6.44 cfs @ 5.25 fps)
└**2=Broad-Crested Rectangular Weir** (Passes 6.44 cfs of 28.66 cfs potential flow)

Pond 1P: UIS-1 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 7 rows = 553.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

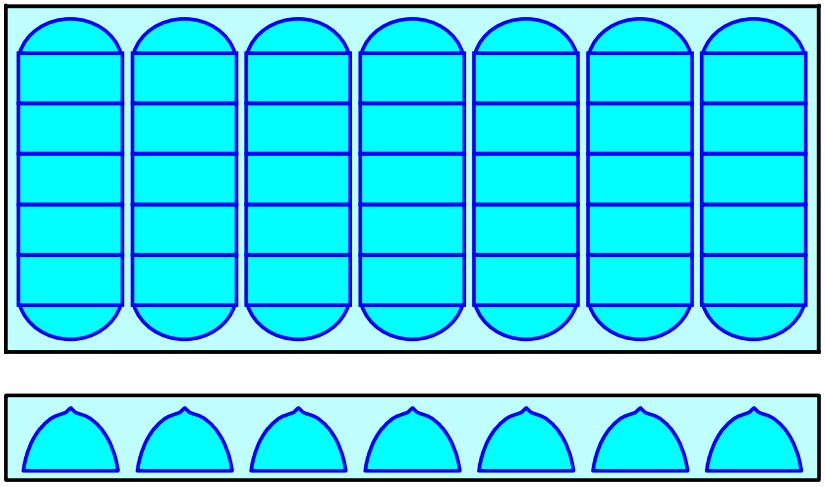
5 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 25.59' Row Length +12.0" End Stone x 2 = 27.59' Base Length
7 Rows x 100.0" Wide + 9.0" Spacing x 6 + 12.0" Side Stone x 2 = 64.83' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

35 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 7 Rows = 4,280.2 cf Chamber Storage

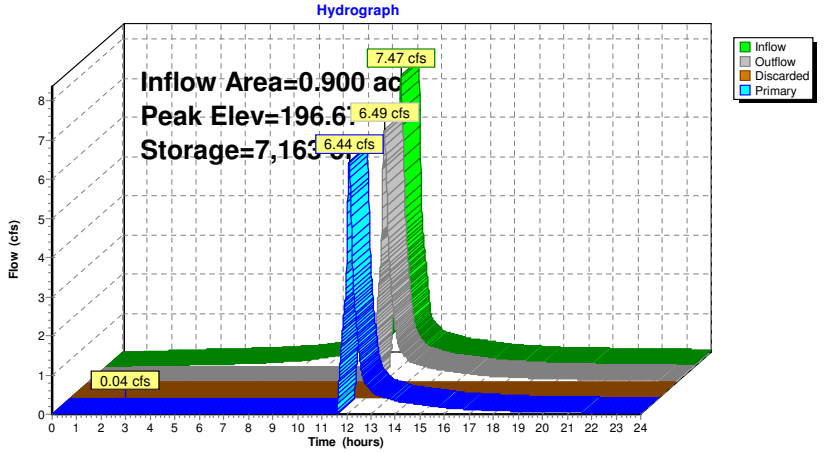
12,074.8 cf Field - 4,280.2 cf Chambers = 7,794.6 cf Stone x 40.0% Voids = 3,117.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,398.0 cf = 0.170 af
Overall Storage Efficiency = 61.3%
Overall System Size = 27.59' x 64.83' x 6.75'

35 Chambers
447.2 cy Field
288.7 cy Stone



Pond 1P: UIS-1



Summary for Pond 2P: UIS-2

Inflow Area = 0.683 ac, 94.88% Impervious, Inflow Depth > 7.80" for 100-Year event
Inflow = 5.65 cfs @ 12.07 hrs, Volume= 0.444 af
Outflow = 1.73 cfs @ 12.36 hrs, Volume= 0.412 af, Atten= 69%, Lag= 17.5 min
Discarded = 0.04 cfs @ 3.63 hrs, Volume= 0.077 af
Primary = 1.69 cfs @ 12.36 hrs, Volume= 0.334 af
Routed to Reach SP-1 : Municipal Drainage in Woodland Road

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 216.94' @ 12.36 hrs Surf.Area= 1,819 sf Storage= 6,036 cf

Plug-Flow detention time= 89.4 min calculated for 0.412 af (93% of inflow)
Center-of-Mass det. time= 50.1 min (795.6 - 745.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	212.25'	3,027 cf	**28.50'W x 63.82'L x 6.75'H Field A** 12,277 cf Overall - 4,710 cf Embedded = 7,567 cf x 40.0% Voids
#2A	213.00'	4,710 cf	**ADS_StormTech MC-4500 b +Cap** x 42 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 42 Chambers in 3 Rows Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf
		7,736 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	213.50'	**12.0" Round 12" Culvert Outlet** L= 100.0' Ke= 0.500 Inlet / Outlet Invert= 213.50' / 212.00' S= 0.0150 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	213.50'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	217.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	212.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.04 cfs @ 3.63 hrs HW=212.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.69 cfs @ 12.36 hrs HW=216.94' (Free Discharge)
└**1=12" Culvert Outlet** (Passes 1.69 cfs of 5.81 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 1.69 cfs @ 8.60 fps)
  └**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: UIS-2 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 3 rows = 237.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

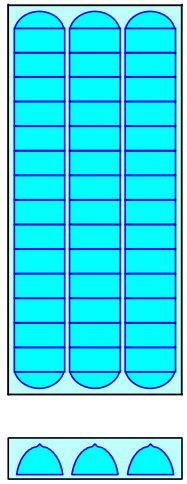
14 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 61.82' Row Length +12.0" End Stone x 2 = 63.82' Base Length
3 Rows x 100.0" Wide + 9.0" Spacing x 2 + 12.0" Side Stone x 2 = 28.50' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

42 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 3 Rows = 4,709.6 cf Chamber Storage

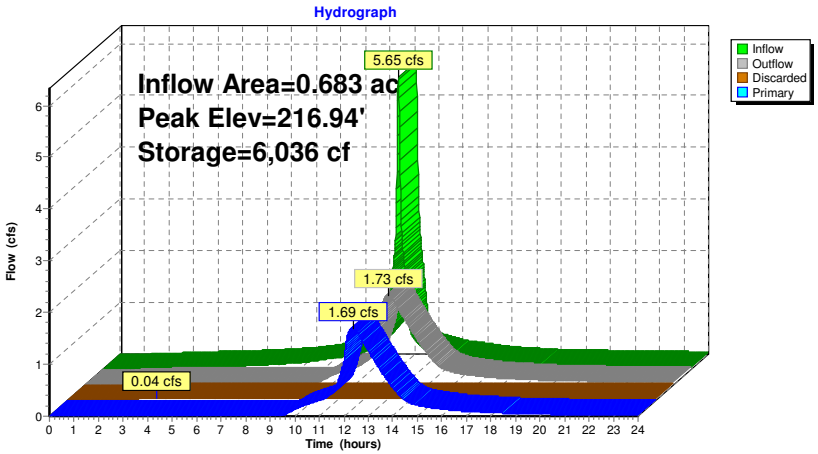
12,276.7 cf Field - 4,709.6 cf Chambers = 7,567.1 cf Stone x 40.0% Voids = 3,026.9 cf Stone Storage

Chamber Storage + Stone Storage = 7,736.5 cf = 0.178 af
Overall Storage Efficiency = 63.0%
Overall System Size = 63.82' x 28.50' x 6.75'

42 Chambers
454.7 cy Field
280.3 cy Stone



Pond 2P: UIS-2



Summary for Pond 3P: UIS-3

Inflow Area = 3.475 ac, 76.98% Impervious, Inflow Depth > 7.20" for 100-Year event
Inflow = 27.94 cfs @ 12.07 hrs, Volume= 2.084 af
Outflow = 15.74 cfs @ 12.17 hrs, Volume= 1.778 af, Atten= 44%, Lag= 6.2 min
Discarded = 0.19 cfs @ 5.47 hrs, Volume= 0.307 af
Primary = 15.55 cfs @ 12.17 hrs, Volume= 1.472 af
Routed to Reach SP-3 : Flow to Woodland Road North

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 214.08' @ 12.17 hrs Surf.Area= 7,862 sf Storage= 31,344 cf
Flood Elev= 210.50' Surf.Area= 7,862 sf Storage= 12,421 cf

Plug-Flow detention time= 117.9 min calculated for 1.778 af (85% of inflow)
Center-of-Mass det. time= 55.1 min (822.3 - 767.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	208.25'	12,550 cf	**46.67'W x 168.47'L x 6.75'H Field A** 53,067 cf Overall - 21,693 cf Embedded = 31,374 cf x 40.0% Voids
#2A	209.00'	21,693 cf	**ADS_StormTech MC-4500 b +Cap** x 200 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 200 Chambers in 5 Rows Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf
		34,243 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	209.00'	**18.0" Round 18" Culvert** L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 209.00' / 208.00' S= 0.0200 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	210.50'	**15.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	213.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32
#4	Discarded	208.25'	**1.020 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.19 cfs @ 5.47 hrs HW=208.32' (Free Discharge)
└**4=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=15.51 cfs @ 12.17 hrs HW=214.08' (Free Discharge)
└**1=18" Culvert** (Passes 15.51 cfs of 17.70 cfs potential flow)
  └**2=Orifice/Grate** (Orifice Controls 10.15 cfs @ 8.27 fps)
  └**3=Broad-Crested Rectangular Weir** (Weir Controls 5.36 cfs @ 2.32 fps)

Pond 3P: UIS-3 - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-4500 b +Cap (ADS StormTech® MC-4500 with cap volume)
Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf
Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap
Cap Storage= 39.5 cf x 2 x 5 rows = 395.0 cf

100.0" Wide + 9.0" Spacing = 109.0" C-C Row Spacing

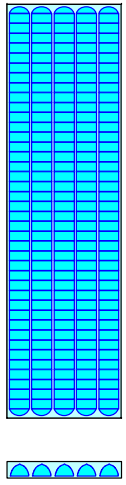
40 Chambers/Row x 4.02' Long +2.73' Cap Length x 2 = 166.47' Row Length +12.0" End Stone x 2 = 168.47' Base Length
5 Rows x 100.0" Wide + 9.0" Spacing x 4 + 12.0" Side Stone x 2 = 46.67' Base Width
9.0" Stone Base + 60.0" Chamber Height + 12.0" Stone Cover = 6.75' Field Height

200 Chambers x 106.5 cf + 39.5 cf Cap Volume x 2 x 5 Rows = 21,693.1 cf Chamber Storage

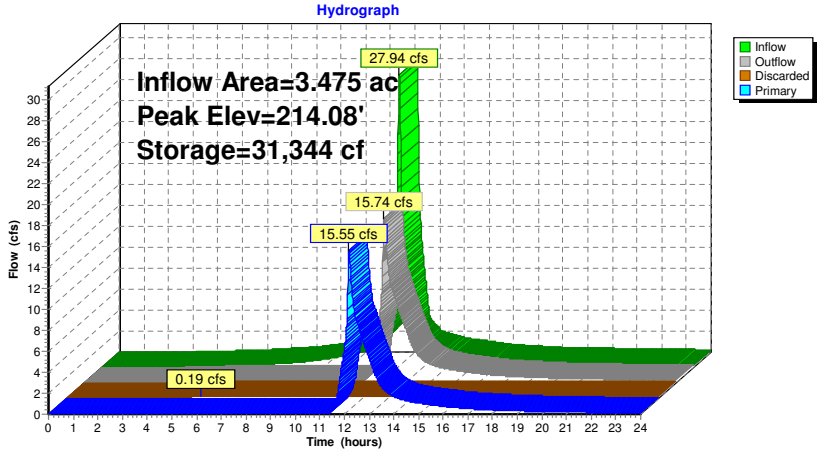
53,067.0 cf Field - 21,693.1 cf Chambers = 31,373.9 cf Stone x 40.0% Voids = 12,549.6 cf Stone Storage

Chamber Storage + Stone Storage = 34,242.7 cf = 0.786 af
Overall Storage Efficiency = 64.5%
Overall System Size = 168.47' x 46.67' x 6.75'

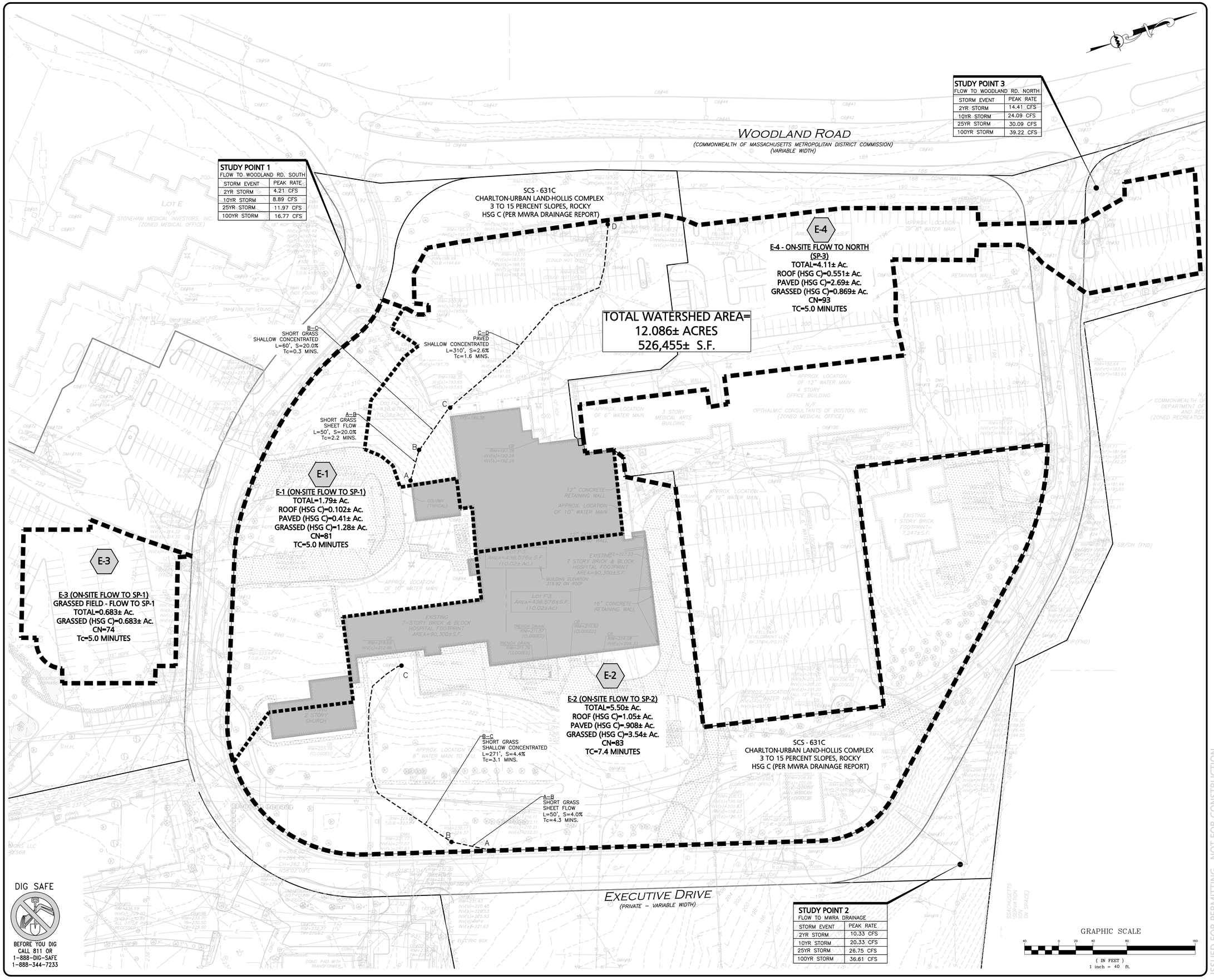
200 Chambers
1,965.4 cy Field
1,162.0 cy Stone



Pond 3P: UIS-3



SECTION 5.0
WATERSHED PLAN



DIG SAFE

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N:\PROJECTS\1145-01T\CIVIL DRAWINGS\CURRENT\C-1145-01T - EXISTING WATERSHED PLAN.DWG

ISSUED FOR PERMITTING - NOT FOR CONSTRUCTION

ISSUED FOR DRAINAGE REPORT
2024-04-05

PROFESSIONAL ENGINEER FOR ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION

APPLICANT\OWNER:
FELLSWAY DEVELOPMENT LLC
c/o THE GUTIERREZ CO.
200 SUMMIT DRIVE, SUITE 400
BURLINGTON, MA 01803

PROJECT:
THE RESIDENCES AT SPOT POND
MULTI-FAMILY HOUSING
5 WOODLAND ROAD
STONEHAM, MA 02180

PROJECT NO.	1145-01T	DATE:	2023-11-16
SCALE:	1"=40'	DWG. NAME:	C-1145-01T
DESIGNED BY:	DMR/MTB	CHECKED BY:	CMQ

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY, SUITE 5
WOBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:	SHEET No.
EXISTING WATERSHED PLAN	EWS-1

WOODLAND ROAD
(COMMONWEALTH OF MASSACHUSETTS METROPOLITAN DISTRICT COMMISSION)

WOODLAND ROAD
(COMMONWEALTH OF MASSACHUSETTS METROPOLITAN DISTRICT COMMISSION)
(VARIABLE WIDTH)

STUDY POINT 3
FLOW TO WOODLAND RD. NORTH

STORM EVENT	PEAK RATE
2YR STORM	10.82 CFS
10YR STORM	21.55 CFS
25YR STORM	29.31 CFS
100YR STORM	39.15 CFS

STUDY POINT 1
FLOW TO WOODLAND RD SOUTH

STORM EVENT	PEAK RATE
2YR STORM	0.76 CFS
10YR STORM	4.36 CFS
25YR STORM	6.33 CFS
100YR STORM	7.92 CFS

SCS - 631C
CHARLTON-URBAN LAND-HOLLIS COMPLEX
3 TO 15 PERCENT SLOPES, ROCKY
HSG C (PER MWRA DRAINAGE REPORT)

SCS - 631C
CHARLTON-URBAN LAND-HOLLIS COMPLEX
3 TO 15 PERCENT SLOPES, ROCKY
HSG C (PER MWRA DRAINAGE REPORT)

P-1

P-1 (EXISTING PARKING AREA FLOW TO SP-3)
TOTAL=3.87± Ac.
PAVED (HSG C)=2.75± Ac.
GRASSED (HSG C)=1.12± Ac.
CN=91
TC=5.0 MINUTES

TOTAL WATERSHED AREA=
12.086± ACRES
526,455± S.F.

UIS-1

P-2

P-2 (BUILDING A FLOW TO SP-1)
TOTAL=0.90± Ac.
ROOF (HSG C)=0.90± Ac.
CN=98
TC=5.0 MINUTES

P-3

UIS-2

P-3 (OFF-SITE PARKING AREA FLOW TO SP-1)
TOTAL=0.683± Ac.
PAVED (HSG C)=0.648± Ac.
GRASSED (HSG C)=0.035± Ac.
CN=97
TC=5.0 MINUTES

UIS-3

SCS - 631C
CHARLTON-URBAN LAND-HOLLIS COMPLEX
3 TO 15 PERCENT SLOPES, ROCKY
HSG C (PER MWRA DRAINAGE REPORT)

P-4

P-4 (BUILDING B AND PARKING AREA FLOW TO SP-1)
TOTAL=3.47± Ac.
ROOF (HSG C)=1.69± Ac.
PAVED (HSG C)=0.985± Ac.
GRASSED (HSG C)=0.80± Ac.
CN=92
TC=5.0 MINUTES

P-5

P-5 (GARAGE PARKING AREA 1 FLOW TO MWRA SP-2)
TOTAL=2.11± Ac.
ROOF (HSG C)=0.230± Ac.
PAVED (HSG C)=0.80± Ac.
GRASSED (HSG C)=1.08± Ac.
CN=86
TC=5.0 MINUTES

P-6 (GARAGE PARKING AREA2 FLOW TO MWRA SP-2)
TOTAL=1.05± Ac.
ROOF (HSG C)=0.30± Ac.
PAVED (HSG C)=0.39± Ac.
GRASSED (HSG C)=0.36± Ac.
CN=90
TC=5.0 MINUTES

EXECUTIVE DRIVE
(PRIVATE – VARIABLE WIDTH)

STUDY POINT 2
FLOW TO MWRA DRAINAGE

STORM EVENT	PEAK RATE
2YR STORM	7.75 CFS
10YR STORM	14.11 CFS
25YR STORM	18.12 CFS
100YR STORM	24.22 CFS

EXISTING WATERSHED
SCS SOILS BOUNDARY
Tc FLOW PATH (A – B)
SUBCATCHMENT LABEL (E-1)
SUBCATCHMENT BOUNDARY
PROPOSED ROOF AREA
PROPOSED PAVED AREA

NOTES:

1. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR IT'S REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
2. THE INFORMATION SHOWN ON THIS PLAN IS THE SOLE PROPERTY OF ALLEN & MAJOR ASSOCIATES, INC. ITS INTENDED USE IS TO PROVIDE INFORMATION. ANY ALTERATION, MISUSE, OR RECALCULATION OF INFORMATION OR DATA WITHOUT THE EXPRESSED, WRITTEN CONSENT OF ALLEN & MAJOR ASSOCIATES, INC. IS STRICTLY PROHIBITED.
3. BASE PLAN TAKEN FROM PLAN ENTITLED "EXISTING CONDITIONS – V–101 & V–102" PREPARED BY ALLEN & MAJOR ASSOCIATES, DATED SEPTEMBER 8, 2023, ORIGINAL SCALE 1"=40'.
4. ALL EXISTING AND PROPOSED COVER TYPES SHALL BE CONSIDERED "GOOD" FOR MODELING PURPOSES UNLESS OTHERWISE NOTED.
5. TOTAL SITE WATERSHED AREA IS 10.7± ACRES.
6. MINIMUM TIME OF CONCENTRATION IS 5.0 MINUTES.
7. LANDSCAPED OR GRASSED AREAS ARE UNSHADED.

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

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1-888-DIG-SAFE
1-888-344-7233

N:\PROJECTS\1145-01T\CIVIL\DRAWINGS\CURRENT\C-1145-01T – PROPOSED WATERSHED PLAN.DWG

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ISSUED FOR DRAIN REPORT
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PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

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PREPARED BY:

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FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:
PROPOSED
WATERSHED PLAN

SHEET No.
PWS

SECTION 6.0

APPENDIX

PDS-based 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	0.306 (0.235-0.387)	0.371 (0.286-0.471)	0.478 (0.366-0.608)	0.567 (0.432-0.726)	0.690 (0.513-0.934)	0.781 (0.570-1.08)	0.879 (0.628-1.28)	0.998 (0.670-1.48)	1.18 (0.763-1.81)	1.34 (0.846-2.10)
10-min	0.433 (0.333-0.549)	0.526 (0.405-0.667)	0.678 (0.520-0.863)	0.804 (0.612-1.03)	0.978 (0.726-1.32)	1.11 (0.807-1.54)	1.25 (0.889-1.81)	1.42 (0.949-2.09)	1.67 (1.08-2.57)	1.89 (1.20-2.97)
15-min	0.510 (0.392-0.645)	0.619 (0.476-0.785)	0.798 (0.612-1.02)	0.946 (0.721-1.21)	1.15 (0.854-1.56)	1.30 (0.951-1.81)	1.47 (1.05-2.13)	1.66 (1.12-2.46)	1.97 (1.27-3.02)	2.23 (1.41-3.50)
30-min	0.701 (0.539-0.887)	0.852 (0.655-1.08)	1.10 (0.843-1.40)	1.30 (0.993-1.67)	1.58 (1.18-2.14)	1.79 (1.31-2.49)	2.02 (1.44-2.94)	2.30 (1.54-3.39)	2.72 (1.76-4.18)	3.09 (1.95-4.84)
60-min	0.891 (0.686-1.13)	1.08 (0.833-1.37)	1.40 (1.07-1.78)	1.66 (1.26-2.13)	2.02 (1.50-2.73)	2.28 (1.67-3.18)	2.57 (1.84-3.75)	2.93 (1.96-4.33)	3.47 (2.25-5.34)	3.94 (2.50-6.19)
2-hr	1.15 (0.890-1.44)	1.41 (1.09-1.77)	1.83 (1.42-2.32)	2.19 (1.68-2.78)	2.67 (2.00-3.59)	3.03 (2.23-4.19)	3.42 (2.47-4.96)	3.91 (2.63-5.73)	4.68 (3.04-7.12)	5.36 (3.40-8.32)
3-hr	1.33 (1.04-1.67)	1.64 (1.28-2.05)	2.14 (1.66-2.69)	2.55 (1.97-3.23)	3.12 (2.35-4.19)	3.54 (2.62-4.88)	4.01 (2.90-5.79)	4.59 (3.10-6.68)	5.51 (3.58-8.32)	6.31 (4.01-9.74)
6-hr	1.73 (1.36-2.15)	2.12 (1.66-2.64)	2.76 (2.16-3.45)	3.30 (2.56-4.15)	4.04 (3.05-5.36)	4.58 (3.40-6.24)	5.17 (3.76-7.39)	5.91 (4.01-8.52)	7.08 (4.62-10.6)	8.09 (5.16-12.3)
12-hr	2.21 (1.75-2.73)	2.71 (2.14-3.34)	3.52 (2.77-4.36)	4.19 (3.28-5.23)	5.12 (3.89-6.73)	5.80 (4.33-7.83)	6.54 (4.77-9.24)	7.46 (5.08-10.6)	8.87 (5.81-13.1)	10.1 (6.46-15.2)
24-hr	2.66 (2.12-3.26)	3.29 (2.62-4.04)	4.32 (3.43-5.32)	5.17 (4.08-6.41)	6.35 (4.87-8.30)	7.21 (5.43-9.66)	8.16 (6.00-11.4)	9.34 (6.38-13.2)	11.2 (7.34-16.4)	12.8 (8.20-19.1)
2-day	[illegible] (2.42-3.67)	[illegible] (3.05-4.63)	[illegible] (4.07-6.22)	[illegible] (4.89-7.56)	[illegible] (5.89-9.91)	[illegible] (6.60-11.6)	[illegible] (7.34-13.8)	11.4 (7.83-16.0)	13.9 (9.14-20.1)	16.1 (10.3-23.7)
3-day	3.29 (2.66-3.99)	4.14 (3.34-5.02)	5.52 (4.44-6.72)	6.66 (5.32-8.16)	8.24 (6.40-10.7)	9.39 (7.16-12.5)	10.7 (7.97-14.9)	12.3 (8.48-17.2)	15.0 (9.92-21.6)	17.4 (11.2-25.5)
4-day	3.56 (2.88-4.30)	4.43 (3.59-5.36)	5.86 (4.72-7.11)	7.04 (5.64-8.59)	8.67 (6.75-11.2)	9.86 (7.54-13.0)	11.2 (8.36-15.5)	12.9 (8.89-17.9)	15.7 (10.4-22.4)	18.1 (11.7-26.4)
7-day	4.32 (3.52-5.19)	5.23 (4.26-6.29)	6.72 (5.45-8.10)	7.95 (6.42-9.65)	9.65 (7.55-12.3)	10.9 (8.36-14.3)	12.3 (9.18-16.8)	14.0 (9.71-19.3)	16.8 (11.2-23.9)	19.3 (12.5-27.9)
10-day	5.01 (4.11-6.00)	5.95 (4.87-7.13)	7.49 (6.10-9.00)	8.76 (7.10-10.6)	10.5 (8.25-13.3)	11.8 (9.07-15.3)	13.2 (9.87-17.9)	15.0 (10.4-20.4)	17.7 (11.8-25.0)	20.1 (13.0-28.9)
20-day	6.99 (5.78-8.31)	8.02 (6.62-9.54)	9.71 (7.98-11.6)	11.1 (9.07-13.3)	13.0 (10.3-16.3)	14.5 (11.1-18.4)	16.0 (11.9-21.1)	17.7 (12.4-23.9)	20.2 (13.5-28.2)	22.3 (14.5-31.6)
30-day	8.64 (7.17-10.2)	9.74 (8.08-11.5)	11.5 (9.53-13.7)	13.0 (10.7-15.6)	15.1 (11.9-18.7)	16.7 (12.8-21.0)	18.3 (13.5-23.7)	20.0 (14.0-26.7)	22.3 (14.9-30.8)	24.1 (15.7-34.0)
45-day	10.7 (8.95-12.6)	11.9 (9.92-14.0)	13.8 (11.5-16.4)	15.4 (12.7-18.3)	17.6 (13.9-21.6)	19.3 (14.9-24.1)	21.0 (15.5-26.9)	22.6 (16.0-30.1)	24.8 (16.7-34.0)	26.3 (17.2-36.9)
60-day	12.5 (10.5-14.7)	13.8 (11.5-16.2)	15.8 (13.1-18.6)	17.4 (14.4-20.6)	19.7 (15.6-24.1)	21.5 (16.6-26.7)	23.3 (17.2-29.6)	24.9 (17.6-32.8)	26.9 (18.1-36.6)	28.2 (18.5-39.3)

[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.

NOAA ATLAS-14 Rainfall Values

Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
Closed Conduits	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe	
Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic)	
Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgtn.)	
Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay	
Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017
Open Channels	
Lined Channels	
Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged	
Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet)	
Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Middlesex County, Massachusetts

October 13, 2021

Contents

Custom Soil Resource Report
Soil Map

Map Scale: 1:4,020 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 13, 2020—Oct 18, 2020

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	7.3	10.5%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	2.7	3.9%
105E	Rock outcrop-Hollis complex, 3 to 35 percent slopes	12.6	18.1%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	41.0	58.7%
656	Udorthents-Urban land complex	6.2	8.9%
Totals for Area of Interest		**69.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Map Scale: 1:4,020 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 13, 2020—Oct 18, 2020

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
104C	Hollis-Rock outcrop-Charlton complex, 0 to 15 percent slopes	D	7.3	10.5%
104D	Hollis-Rock outcrop-Charlton complex, 15 to 25 percent slopes	D	2.7	3.9%
105E	Rock outcrop-Hollis complex, 3 to 35 percent slopes		12.6	18.1%
631C	Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky	A	41.0	58.7%
656	Udorthents-Urban land complex		6.2	8.9%
Totals for Area of Interest			**69.8**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Title	***MA DEP Standard Calculations***
Project	*The Residences at Spot Pond*
Location	5 Woodland Road, Stoneham, MA
Date	September 8, 2023
Revised	April 5, 2024

Computation Sheet

By	DMR
Chk'd	MB
Apprv'd	CMQ

Stormwater Recharge/Water Quality Volume Table

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft^3, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft^3*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

					Recharge Required			***Water Quality Volume Required***	
Watershed	**On-Site Area (Sq. Ft.)**	**Landscaped**	**Impervious Area (Square Feet)**						
			HSG A (F=.6)	**HSG C (F=.25)**	***F Avg. (Inches)***	***Impervious Area (Feet)***	***Rv*** (ft^3)	D_{WQ*} *(Inch)*	A_{WQ}
P-1	168,577	48,787	0	119,790	0.25	119,790	2,496	0.5	4,991
P-2	39,204	0	0	39,204	0.25	39,204	817	0.5	1,634
P-3	29,751	1,524	0	28,227	0.25	28,227	588	0.5	1,176
P-4	151,153	34,848	0	116,305	0.25	116,305	2,423	0.5	4,846
P-5	91,911	47,044	0	44,867	0.25	44,867	935	0.5	1,869
P-6	45,738	15,682	0	30,056	0.25	30,056	626	0.5	1,252
Total	**526,334**	**147,885**	**0**	**378,449**		**378,449**	**7,884**		**15,769**

**Site is not considered a Land Use with Higher Potential for Pollutant Loading, therefore, the 1/2" water quality volume shall be utilized.*

		Computation Sheet	
Title	***MA DEP Standard Calculations***	By	DMR
Project	*The Residences at Spot Pond*	Chk'd	MB
Location	5 Woodland Road, Stoneham, MA	Apprv'd	CMQ
Date	September 8, 2023		

Stormwater Recharge Summary

Rv = F * Impervious Area

Rv *= Required Recharge Volume, expressed in ft³, cubic yards or acre-feet*

F *= Target Depth Factor associated with each Hydraulic Soil Group*

Impervious Area *= pavement & rooftop area on site*

	Required (cf)	***Provided (cf)***	
ARv =	***817***	***5,801***	***Infiltration Pond #1 (P-2)***
ARv =	***588***	***3,308***	***Infiltration Pond #2 (P-3)***
ARv =	***2,423***	***15,421***	***Infiltration Pond #3 (P-4)***
ARv =	***3,828***	***24,530***	***Total***

Water Quality Volume

A_{WQ} *= Required Water Quality Treatment Volume, expressed in ft³*

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area (excluding non-metal roofs)*

	Required (cf)	***Provided (cf)***	
ARv =	***4,991***	***0***	***(P-1)***
ARv =	***1,634***	***5,801***	***Infiltration Pond #1 (P-2)***
ARv =	***1,176***	***3,308***	***Infiltration Pond #2 (P-3)***
ARv =	***4,846***	***15,421***	***Infiltration Pond #3 (P-4)***
ARv =	***1,869***	***0***	***(P-5)***
ARv =	***1,252***	***0***	***(P-6)***
ARv =	***15,769***	***24,530***	***Total***

Draindown Within 72 Hours

$Time_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration Pond #1 (Fine Sandy Loam)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	1,692
Infiltration Volume (ft^3) =	5,801
$Time_{drawdown}$ (Hours)=	40.34

$Time_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration Pond #2 (Fine Sandy Loam)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	1,816
Infiltration Volume (ft^3) =	3,308
$Time_{drawdown}$ (Hours)=	21.43

$Time_{drawdown}$=(Rv) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Infiltration Pond #3 (Fine Sandy Loam)	
Infiltration Rate (in/Hr)=	1.02

		Computation Sheet	
Title	***MA DEP Standard Calculations***	By	DMR
Project	*The Residences at Spot Pond*	Chk'd	MB
Location	5 Woodland Road, Stoneham, MA	Apprv'd	CMQ
Date	September 8, 2023		

Bottom Area (ft^2) =	7,981
Infiltration Volume (ft^3) =	15,421
$Time_{drawdown}$ (Hours)=	22.73

Mounding Analysis

Infiltration Ponds	*Min. Water Table**	*System Bottom*	*Vertical Separation*	*Attenuated System*	*Mounding Analysis Required**
1	186.2	190.2	>4	NO	NO
2	208.3	212.3	>4	NO	NO
3	204.2	208.2	>4	NO	NO

*NOTE: Test pits performed March 19, 2024 confirm minimum 4 feet of vertical separation to groundwater table for Ponds 1 and 3. Pond 2 shall be performed prior to construction, if needed.

Phosphorous Removal Calcs

Per Section 3. (ii) Stormwater management systems on Redevelopment sites shall also improve existing conditions by requiring that stormwater management systems be designed to: 1) Retain the volume of runoff equivalent to, or greater than, 0.80 inch multiplied by the total post-construction impervious surface area on the site and/or 2) Remove 80% of the average annual post-construction load of Total Suspended Solids (TSS) generated from the total post-construction impervious area on the site and 50% of the average annual load of Total Phosphorus (TP) generated from the total postconstruction impervious surface area on the site.

Per the proposed watershed plan dated September 8, 2023 and submitted to the Town of Stoneham, the total post-construction impervious area on-site is **321,037 s.f.**

Per the above referenced Stormwater Regulation, the stormwater system must retain 0.8 inches (0.067 feet) of runoff over the total post-construction impervious area

(321,037 s.f.)*(0.8 in. / 12 in./ft.) = **21,402** cubic feet (c.f.) minimum required volumetric capacity

Per the above Standard DEP Calcs regarding Recharge and Waterquality, the total volumetric capacity of the three (1) stormwater systems on-site is 17,093 **c.f.**

22,093 c.f. (Provided) >21,402 **c.f.** (Minimum required), therefore the refernced Stormwater Regulation is met with regards to sufficient volumetric capacity proposed on-site for phosphorous removal and mitigation. Additionally, per the submitted TSS removal calculations, greater than 80% of TSS is proposed to be removed.

Computation Sheet

Title Pipe Sizing Table
Project 5 Woodland Road - Multi Family Develoment
Issued 9/11/2023
Revised 4/5/2024
A&M Project Number: 1145-01T

Minimum Slope: 0.50%
Minimum Pipe Size: 12
Rainfall Intensity (in/hr): 6.35 (25 year storm)
Manning's n: 0.013 HDPE
Minimum Pipe Cover: 0.69

By SF
Chk'd DMR
Apprv'd TJW

Line						Req'd. Capac.	Pipe Size	Slope	Design Capacity		Drop	Invert Elevation		Rim Elev.	
From	To	Length	Area	wgt. *C*	CA	Qd	D	s	Q_{full}	V_{full}		Upper	Lower	Upper	Cover
Upper	Lower	(feet)	(acres)			(cfs)	(in)	(%)	(cfs)	(fps)	(feet)	(ft)	(ft)	(ft)	(ft)
CB-1A	DMH-1(WQU)	63	0.365	0.95	0.347	2.20	12	1.00%	3.6	4.54	0.63	213.63	213.00	222.00	7.25
CB-1B	DMH-1(WQU)	31	0.365	0.95	0.347	2.20	12	1.00%	3.6	4.54	0.31	213.31	213.00	219.60	5.16
CB-2A	DMH-2	61	0.349	0.95	0.331	2.10	12	0.98%	3.5	4.50	0.60	209.87	209.27	217.50	6.51
CB-2B	DMH-2	44	0.238	0.95	0.226	1.44	12	1.00%	3.6	4.54	0.44	209.70	209.26	217.50	6.68
DMH-2(WQU)	DMH-29	17				3.54	12	1.00%	3.6	4.54	0.17	209.17	209.00	218.00	7.71
AD-1	DMH-24	123	0.195	0.95	0.185	1.18	12	0.99%	3.6	4.52	1.22	210.98	209.76	216.70	4.60
AD-2	DMH-24	27	0.195	0.95	0.185	1.18	12	1.00%	3.6	4.54	0.27	210.03	209.76	216.50	5.35
DMH-24	DMH-25	66				2.35	12	1.00%	3.6	4.54	0.66	209.66	209.00	217.00	6.22
CB-3A	DMH-3	23	0.266	0.95	0.253	1.60	12	0.52%	2.6	3.28	0.12	209.51	209.39	217.60	6.97
CB-3B	DMH-3	106	0.245	0.95	0.233	1.48	12	1.00%	3.6	4.54	1.06	210.45	209.39	217.40	5.83
DMH-3(WQU)	DMH-25	29				3.08	12	1.00%	3.6	4.54	0.29	209.29	209.00	218.00	7.59
HEADER-3	DMH-30	11	3.210	0.95	3.049	19.36	24	1.04%	23.1	7.33	0.11	209.11	209.00	220.00	8.76
HEADER-4	UIS-3-IN4	11	3.210	0.95	3.049	19.36	24	1.00%	22.7	7.20	0.11	209.11	209.00	220.00	8.76
HEADER-1	DMH-23	27	1.837	0.95	1.745	11.08	18	1.00%	10.5	5.94	0.27	191.27	191.00	203.00	10.11
HEADER-2	DMH-22	10	1.837	0.95	1.745	11.08	18	1.50%	12.9	7.28	0.15	191.15	191.00	203.00	10.23
CB-8A	DMH-8	21	0.349	0.95	0.331	2.10	12	1.00%	3.6	4.54	0.21	219.10	218.89	231.50	11.28
CB-8B	DMH-8	158	0.337	0.95	0.320	2.03	12	4.00%	7.1	9.07	6.32	225.21	218.89	231.50	5.16
DMH-8	DMH-26	110				4.14	12	4.01%	7.1	9.08	4.41	218.79	214.38	232.00	12.09
DMH-26	DMH-4(WQU)	79				4.14	12	4.01%	7.2	9.09	3.17	214.28	211.11	225.00	9.60
CB-7	DMH-7	56	0.123	0.95	0.117	0.74	12	0.54%	2.6	3.32	0.30	212.70	212.40	214.51	0.69
DMH-7	DMH-6	59				0.74	12	0.51%	2.5	3.23	0.30	212.30	212.00	216.20	2.77
CB-6	DMH-6	38	0.154	0.95	0.146	0.93	12	0.95%	3.5	4.42	0.36	212.37	212.01	214.50	1.01
DMH-6	DMH-5	116				1.67	12	0.50%	2.5	3.21	0.58	211.91	211.33	216.60	3.57
CB-5A	DMH-5	59	0.153	0.95	0.145	0.92	12	0.98%	3.5	4.50	0.58	211.91	211.33	216.50	3.47
CB-5B	DMH-5	7	0.265	0.95	0.251	1.60	12	2.43%	5.6	7.07	0.17	211.50	211.33	214.50	1.88
DMH-5	DMH-4(WQU)	12				4.19	15	1.00%	6.5	5.26	0.12	211.23	211.11	216.80	4.20
CB-4	DMH-4	209	0.129	0.95	0.122	0.78	12	1.00%	3.6	4.54	2.09	213.20	211.11	218.70	4.38
DMH-4(WQU)	DMH-27	70				9.10	18	1.01%	10.6	5.99	0.71	211.01	210.30	227.99	15.36
CB-9	DMH-9	61	0.170	0.95	0.161	1.02	12	1.00%	3.6	4.54	0.61	197.50	196.89	200.50	1.88
DMH-9	DMH-10	23				1.02	12	1.00%	3.6	4.54	0.23	196.79	196.56	200.90	2.99
CB-10	DMH-10	8	0.091	0.95	0.086	0.55	12	1.00%	3.6	4.54	0.08	196.64	196.56	200.50	2.74
DMH-10	DMH-12	64				1.57	12	1.00%	3.6	4.54	0.64	196.46	195.82	200.80	3.22
CB-12	DMH-12	18	0.184	1.02	0.188	1.19	12	1.00%	3.6	4.54	0.18	196.00	195.82	199.75	2.63
DMH-12	DMH-11	46				2.76	15	1.00%	6.5	5.26	0.46	195.72	195.26	200.80	3.71
CB-11	DMH-11	105	0.137	0.95	0.131	0.83	12	1.00%	3.6	4.54	1.05	196.31	195.26	200.50	3.07
DMH-11	DMH-13	46				3.59	15	1.00%	6.5	5.26	0.46	195.16	194.70	201.30	4.77

Computation Sheet

Title	Pipe Sizing Table	Minimum Slope:	0.50%		By SF
Project	5 Woodland Road - Multi Family Develoment	Minimum Pipe Size:	12		Chk'd DMR
Issued	9/11/2023	Rainfall Intensity (in/hr):	6.35	(25 year storm)	Apprv'd TJW
Revised	4/5/2024	Manning's n:	0.013	HDPE	
A&M Project Number: 1145-01T		Minimum Pipe Cover:	0.69		

Line						Req'd. Capac.	Pipe Size	Slope	Design Capacity		Drop	Invert Elevation		Rim Elev.	
From	To	Length	Area	wgt. *C*	CA	Qd	D	s	Q_{full}	V_{full}		Upper	Lower	Upper	Cover
Upper	Lower	(feet)	(acres)			(cfs)	(in)	(%)	(cfs)	(fps)	(feet)	(ft)	(ft)	(ft)	(ft)
CB-13	DMH-13	7	0.171	0.95	0.162	1.03	12	1.00%	3.6	4.54	0.07	194.77	194.70	200.75	4.85
DMH-13	DMH-5(WQU)	79				4.62	15	0.73%	5.5	4.51	0.58	194.60	194.02	201.00	5.03
DMH-5(WQU)	DMH-EX-2	12				4.62	15	0.58%	4.9	4.02	0.07	193.92	193.85	201.30	6.01
DMH-21(OCS)	DMH-20	27	***From Hydro-CAD: 25-Year Storm***			5.80	15	1.00%	6.5	5.26	0.27	191.00	190.73	201.50	9.13
DMH-20	DMH-19	70				5.80	15	1.00%	6.5	5.26	0.70	190.63	189.93	201.00	9.00
DMH-16(OCS)	DMH-17	111	***From Hydro-CAD: 25-Year Storm***			8.05	18	1.00%	10.5	5.94	1.11	194.56	193.45	219.00	22.82
DMH-17	DMH-18	199				8.05	18	1.01%	10.6	5.96	2.00	193.35	191.35	217.80	22.83
DMH-18	DMH-19	133				8.05	18	0.99%	10.5	5.92	1.32	191.25	189.93	216.00	23.13
CB-EX1	DMH-19	7	0.069	2.47	0.170	1.08	15	1.00%	6.5	5.26	0.07	190.00	189.93	201.00	9.63
DMH-19	DMH-28	46				5.80	15	1.00%	6.5	5.26	0.46	189.83	189.37	214.45	23.25
DMH-14(OCS)	DMH-15	30.000	***From Hydro-CAD: 25-Year Storm***			1.39	12	0.53%	2.6	3.31	0.16	213.50	213.34	219.60	4.97
DMH-15	DMH-EX-1	81.000				1.39	12	0.50%	2.5	3.21	0.41	213.33	212.92	220.00	5.55

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: The Residences at Spot Pond - 5 Woodland

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: The Residences at Spot Pond
Prepared By: DMR
Date: Septmeber 8, 2023

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

The Residences at Spot Pond

Computation Sheet

By SMF
Chk'd DMR
Apprv'd CMQ

Title ***Inlet Grate Capacity***
Project Multi Family Housing
Date MARCH 26, 2024
A&M Project Number: 1145-01T

SUMP CATCH BASINS (at a low point, not gutter flow)

Rainfall Intensity (in/hr):	8.62	(100 year storm)
Single Grate Open Area (s.f.):	1.1	(Neenah R-2501)
Double Grate Open Area (s.f.):	2.2	
2-Double Grate Open Area (s.f.):	4.4	
Orifice Coefficient:	0.6	
gravitational constant (fps^2):	32.2	(unless along a curb)
Perimeter of single CB (ft):	8	(unless along a curb)
Perimeter of double CB (ft):	12	

Structure I.D.	Contributing Area (acres)	Weighted CN value	C*A	$Q_{10\ Year\ Storm}$	Orifice Flow Ponding depth (ft)	Perimeter of grate for weir flow	Weir Flow Ponding Depth	Total depth of ponding (ft)	CB Rim Elevation	Peak Elevation
CB1A	0.170	0.85	0.144	1.2	0.06	6.0	0.16	0.16	222.00	222.16
CB1B	0.566	0.85	0.481	4.1	0.61	4.0	0.46	0.61	219.60	220.21
CB2A	0.143	0.85	0.122	1.0	0.04	8.0	0.12	0.12	217.50	217.62
CB2B	0.273	0.85	0.232	2.0	0.14	6.0	0.22	0.22	217.50	217.72
CB3A	0.265	0.85	0.225	1.9	0.13	6.0	0.21	0.21	217.60	217.81
CB3B	0.435	0.85	0.370	3.2	0.36	6.0	0.30	0.36	217.40	217.76
AD1	0.134	0.85	0.114	1.0	0.00	8.0	0.11	0.11	216.70	216.81
AD2	0.207	0.85	0.176	1.5	0.02	8.0	0.15	0.15	216.50	216.65
CB4	0.124	0.85	0.105	0.9	0.01	8.0	0.11	0.11	218.70	218.81
CB5A	0.280	0.85	0.238	2.1	0.01	6.0	0.22	0.22	214.50	214.72
CB5B	0.156	0.85	0.133	1.1	0.01	8.0	0.12	0.12	216.50	216.62
CB6	0.171	0.85	0.145	1.3	0.01	8.0	0.13	0.13	214.50	214.63
CB7	0.126	0.85	0.107	0.9	0.01	8.0	0.11	0.11	214.50	214.61
CB8A	0.255	0.85	0.217	1.9	0.03	6.0	0.21	0.21	231.50	231.71
CB8B	0.277	0.85	0.235	2.0	0.04	6.0	0.22	0.22	231.50	231.72
CB9	0.163	0.85	0.139	1.2	0.01	8.0	0.13	0.13	200.50	200.63
CB10	0.074	0.85	0.063	0.5	0.00	8.0	0.07	0.07	200.50	200.57
CB11	0.133	0.85	0.113	1.0	0.01	8.0	0.11	0.11	200.50	200.61
CB12	0.199	0.85	0.169	1.5	0.02	8.0	0.15	0.15	199.75	199.90
CB13	0.147	0.85	0.125	1.1	0.01	8.0	0.12	0.12	200.75	200.87

Orifice Equation: Q = C*A*(2*g*h)^.5
Solve for h yields: $(Q/(C*A))^2/(2*g)$

Weir Flow Equation: $Q=3.3*P(h)^{1.5}$
Solve for h yields: $(Q/(3.3*P))^{0.667}$

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Fellsway Development, LLC
Owner Name

5 woodland road
Street Address

Map 27, Lots 3, 3CM, & 6
Map/Lot #

Stoneham
City

MA
State

02180
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — Web Soil Survey (Source); 631C (Soil Map Unit); Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky (Soil Series)

   N/A
   Landform

   N/A
   Soil Limitations

   Fill
   Soil Parent material

3. Surficial Geological Report
   Year Published/Source
   Map Unit
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No — If yes, MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 3/19/24
   Month/Day/ Year
   Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:
   (Zone II, IWPA, Zone A, EEA Data Portal, etc.)
   Not in Zone A, Zone II, or IWPA Zone.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-101 (Hole #) | 3/19/2024 (Date) | 9:00 am (Time) | Sunny, 40° (Weather) | _____ (Latitude) | _____ (Longitude)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: In lot F-3, the western parking lot, the southern parking stalls closest to the building

2. Soil Parent Material: Fill (Sandy Loam) | N/A (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 620 feet | Drainage Way N/A feet | Wetlands N/A feet | Property Line 105 feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-121	C1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	5%Gravel 2% Cobbles
121-156	C2	FLS			Cnc : Dpl:				Massive	Friable	5%Gravel 2% Cobbles
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: no weeping, no standing water, no redox noted. Fill material throughout.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-102 (Hole #) | 3/19/2024 (Date) | 9:30 am (Time) | Sunny, 40° (Weather) | _____ (Latitude) | _____ (Longitude)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: In lot F-3, the western parking lot, the southern parking stalls closest to the building

2. Soil Parent Material: Fill (Sandy Loam) | N/A (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 645 feet | Drainage Way N/A feet | Wetlands N/A feet | Property Line 125 feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-135	C1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	5%Gravel, 2% Cobbles, 1% Boulders
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes: Large boulder at bottom of hole (135" B.G.), no weeping, no standing water, no redox noted. Fill material throughout.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # TP-101	Obs. Hole # TP-102
☐ Depth to soil redoximorphic features	>156 inches	>135 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☐ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	Date: April 2, 2024
DAVID M ROBINSON, EIT SE#13799	June 30, 2024
Typed or Printed Name of Soil Evaluator / License #	Expiration Date of License
Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

See Test Pits Plan

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Fellsway Development, LLC
Owner Name

5 woodland road
Street Address

Map 27, Lots 3, 3CM, & 6
Map/Lot #

Stoneham
City

MA
State

02180
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — Web Soil Survey (Source); 631C (Soil Map Unit); Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky (Soil Series)

   N/A
   Landform

   N/A
   Soil Limitations

   Fill
   Soil Parent material

3. Surficial Geological Report
   Year Published/Source
   Map Unit
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No — If yes, MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 3/19/24
   Month/Day/ Year
   Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:
   (Zone II, IWPA, Zone A, EEA Data Portal, etc.)
   Not in Zone A, Zone II, or IWPA Zone.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-103 (Hole #) | 3/19/2024 (Date) | 10:00 am (Time) | Sunny, 40° (Weather) | _____ (Latitude) | _____ (Longitude)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: In lot F-3, in between the main southern entrance and the south eastern portion of the existing main building.

2. Soil Parent Material: Fill (Sandy Loam) | N/A (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 865 feet | Drainage Way N/A feet | Wetlands N/A feet | Property Line 256 feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	5%Gravel 2% Cobbles
12-36	Bw1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	5%Gravel 2% Cobbles
36-121	C1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	5%Gravel 2% Cobbles
121-156	C2	Fine loamy sand			Cnc : Dpl:				Massive	Friable	5% Gravel 2% cobbles
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-104 (Hole #) | 3/19/2024 (Date) | 10:30 am (Time) | Sunny, 40° (Weather) | _____ (Latitude) | _____ (Longitude)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: In lot F-3, in between the main southern entrance and the south eastern portion of the existing main building.

2. Soil Parent Material: Fill (Sandy Loam) | N/A (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 880 feet | Drainage Way N/A feet | Wetlands N/A feet | Property Line 225 feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	
12-36	Bw1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	
36-168	C1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	
					Cnc : Dpl:						
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # TP-103	Obs. Hole # TP-104
☐ Depth to soil redoximorphic features	156 inches	168 inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number _____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

      ☐ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	April 1, 2024 Date
David M. Robinson, EIT SE#13799 Typed or Printed Name of Soil Evaluator / License #	June 30, 2024 Expiration Date of License
N/A Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

See test pit plan for summary and location

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Fellsway Development, LLC
Owner Name

5 woodland road
Street Address

Map 27, Lots 3, 3CM, & 6
Map/Lot #

Stoneham
City

MA
State

02180
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade

2. Soil Survey — Web Soil Survey (Source); 631C (Soil Map Unit); Charlton-Urban land-Hollis complex, 3 to 15 percent slopes, rocky (Soil Series)

   N/A
   Landform

   N/A
   Soil Limitations

   Fill
   Soil Parent material

3. Surficial Geological Report
   Year Published/Source
   Map Unit
   Description of Geologic Map Unit:

4. Flood Rate Insurance Map — Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No — If yes, MassGIS Wetland Data Layer:
   Wetland Type

7. Current Water Resource Conditions (USGS): 3/19/24
   Month/Day/ Year
   Range: ☐ Above Normal ☒ Normal ☐ Below Normal

8. Other references reviewed:
   (Zone II, IWPA, Zone A, EEA Data Portal, etc.)
   Not in Zone A, Zone II, or IWPA Zone.

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-105 (Hole #) | 3/19/2024 (Date) | 11:00 am (Time) | Sunny, 40° (Weather) | _____ (Latitude) | _____ (Longitude)

1. Land Use: Parking lot (e.g., woodland, agricultural field, vacant lot, etc.) | N/A (Vegetation) | N/A (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 0-3 (Slope (%))

Description of Location: In lot F-3, in between the main southern entrance and the south eastern portion of the existing main building.

2. Soil Parent Material: Fill (Sandy Loam) | N/A (Landform) | _____ (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body 895 feet | Drainage Way N/A feet | Wetlands N/A feet | Property Line 170 feet | Drinking Water Well N/A feet | Other N/A feet

4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☒ Disturbed Soil/Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-12	A	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	
12-36	Bw1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	
36-168	C1	Fine Sandy Loam			Cnc : Dpl:				Massive	Friable	
168-180	C2	Fine loamy sand			Cnc : Dpl:				Mass.	Fri.	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # TP-105	Obs. Hole # _____
☐ Depth to soil redoximorphic features	180 inches	_____ inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

Index Well Number _____ Reading Date _____

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☐ Yes ☐ No

   b. If yes, at what depth was it observed (exclude O, A, and E Horizons)? Upper boundary: _____ inches Lower boundary: _____ inches

   c. If no, at what depth was impervious material observed? Upper boundary: _____ inches Lower boundary: _____ inches

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Certification

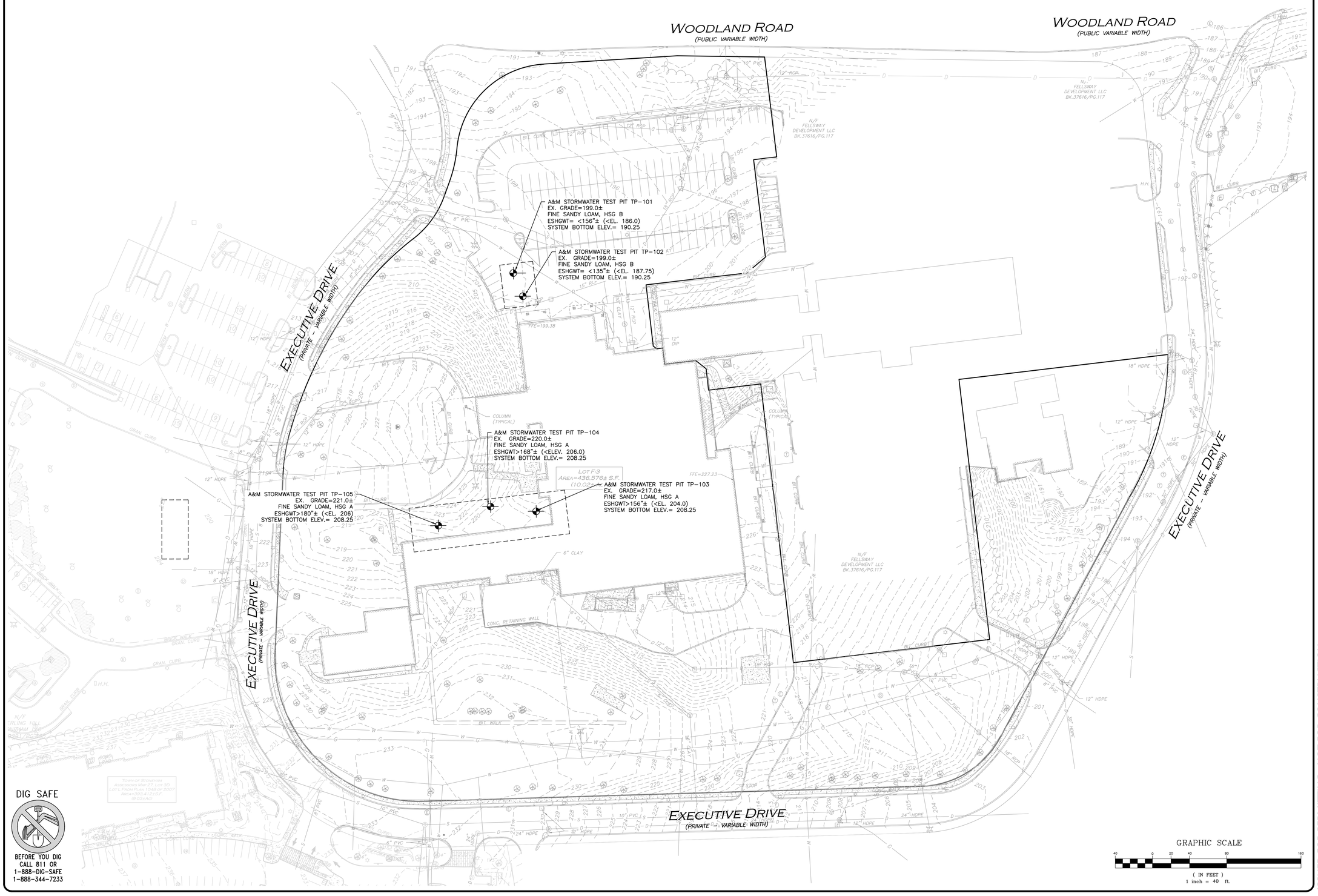
I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Signature of Soil Evaluator	April1, 2023 Date
David M. Robinson, EIT, SE #13799 Typed or Printed Name of Soil Evaluator / License #	June 30, 2024 Expiration Date of License
N/A Name of Approving Authority Witness	Approving Authority

Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Field Diagrams: Use this area for field diagrams:

See test pits plan for location and summary.



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1-888-344-7233

N:\PROJECTS\1145-01T\CIVIL\DRAWINGS\CURRENT\C-1145-01T - TEST PITS PLAN.DWG

ISSUED FOR PERMITTING - NOT FOR CONSTRUCTION

ISSUED FOR DRAINAGE REPORT
APRIL 05, 2024

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION

APPLICANT\OWNER:
FELLSWAY DEVELOPMENT LLC
c/o THE GUTIERREZ CO.
200 SUMMIT DRIVE, SUITE 400
BURLINGTON, MA 01803

PROJECT:
THE RESIDENCES AT SPOT POND
MULTI-FAMILY HOUSING
5 WOODLAND ROAD
STONEHAM, MA 02180

PROJECT NO.	1145-01T	DATE:	2023-11-16
SCALE:	1"=40'	DWG. NAME:	C-1145-01T
DESIGNED BY:	DMR/MTB	CHECKED BY:	CMQ

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY, SUITE 5
WOBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:	SHEET No.
TEST PITS PLAN	TPP

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the USEPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by the USEPA).

OWNER NAME: Fellsway Development, LLC

ADDRESS: 200 Summit Drive, Suite 400

Burlington, MA 03081

TEL. NUMBER: (781)-272-7000

Engineer's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel properly gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

For a redevelopment project (if applicable), all actions taken to identify and remove illicit discharges, including without limitation, visual screening, dye or smoke testing, and the removal of any sources of illicit discharges to the stormwater management system are documented and included with this statement.

Owner Signature: _____

Owner Name: _____

Date: _____

DRAINAGE REPORT

FOR

LANGWOOD EXECUTIVE CENTER
AND MWRA WATER STORAGE TANK SITE

STONEHAM, MASSACHUSETTS

Prepared for

MASSACHUSETTS WATER RESOURCES AUTHORITY

Prepared by

Green International Affiliates, Inc.
239 Littleton Rd., Unit 3
Westford, MA 01886

February, 2011

Table of Contents

1. INTRODUCTION

A Stormwater Management Report for "Langwood Executive Center, Stoneham, MA" was prepared by Allen and Major in July, 2008. The report describes the redevelopment of a 40.7 acre site off Woodland Rd. in Stoneham, MA as shown on Figure 1. Currently, the existing site contains approximately 360,000 sf of hospital/medical office space along with a chapel, power plant and remote administration building. As part of the proposed redevelopment, a new office building will be constructed on a section of the site that is currently occupied by the aforementioned buildings. Additionally, residential facilities will be constructed on a parcel of land adjacent to the new office building. Lastly, the Massachusetts Water Resources Authority (MWRA) will be constructing a potable water storage tank on a parcel located along the northeast side of this new development. An extended detention basin will also be constructed within MWRA's property and adjacent to the storage tank.

Drainage systems will collect water from portions of the site including portions of the new office building, residences and water storage tank and discharge into the extended detention basin. The outflow from the detention basin, along with runoff from additional sub-areas on the site, will flow to an existing culvert that crosses beneath Ravine Road and discharges into Spot Pond Brook. This is the point of interest for the purpose of this report and is referred to as Design Point 4 (DP4). This report only discusses the subareas that are tributary to DP4.

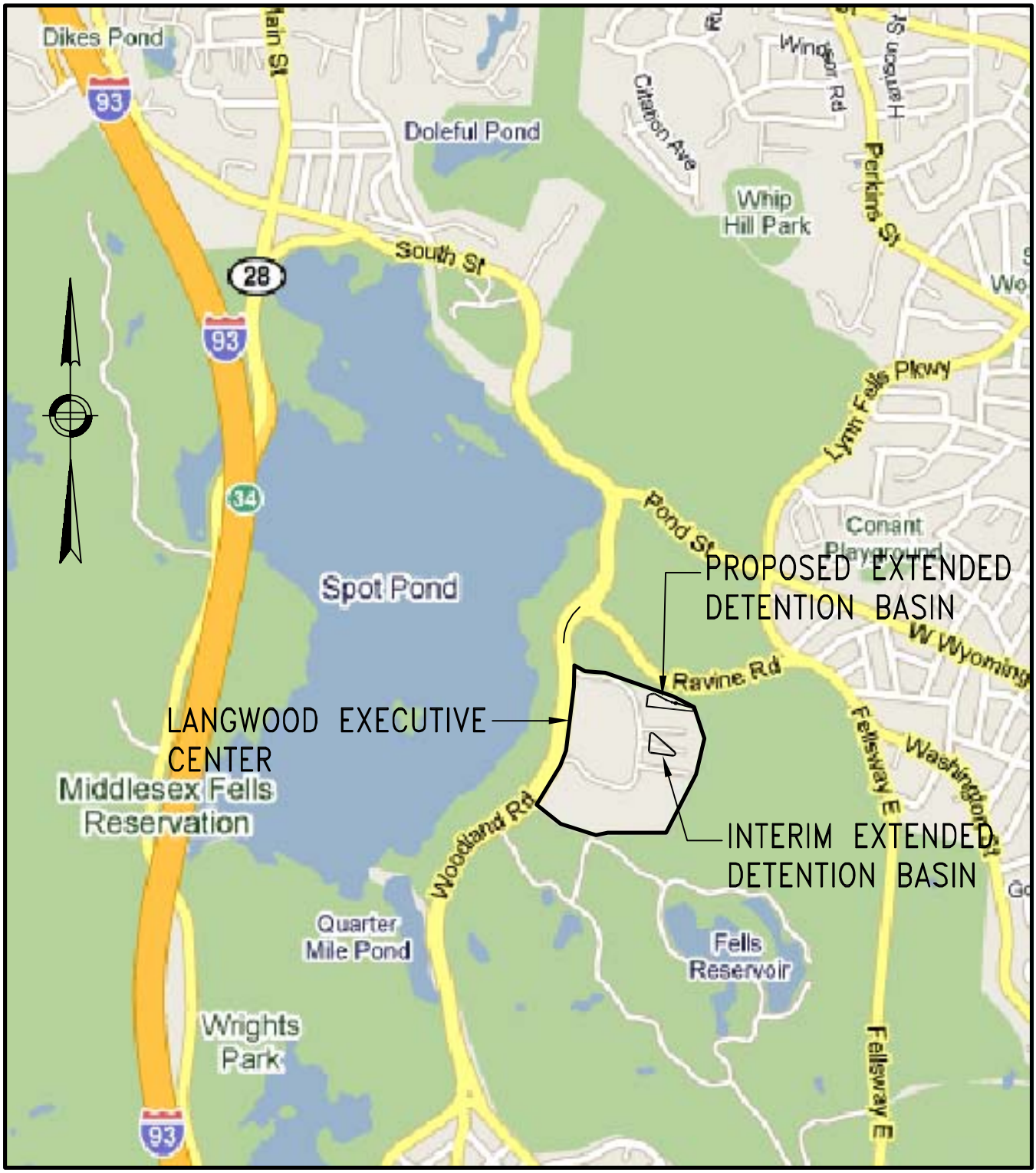
The property off of MWRA's site will begin to be developed prior to construction of the potable water storage tank. The MWRA has an agreement in place with the owner's of Langwood Executive Center to provide stormwater storage on the MWRA site beginning in the summer of 2011. An extended stormwater detention basin will not be provided with the final proposed configuration prior to this date. In order for the MWRA to meet their obligations with the Langwood Executive Center owners a temporary extended detention basin will be constructed on MWRA's property. This basin will be referred to as the Interim Extended Detention Basin for the purposes of this report and the permanent extended detention basin that will be constructed adjacent to the water storage tank will be referred to as Proposed Extended Detention Basin.

MWRA has retained the services of Green International Affiliates, Inc. (Green) to provide civil engineering services associated with the design of the proposed extended detention basins.

2. ENGINEERING ANALYSIS

Watershed areas for existing, interim and proposed conditions were developed using an existing conditions topographic plan (two foot contour interval) and the proposed grading design plan (two foot contour as well). The existing conditions were taken from the "Present Watershed Plan" for the "Master Plan for Langwood Commons - Stoneham, MA" project prepared by Allen & Major Associates Inc., dated August 12, 2008. The assumptions made for each condition are described below.

The existing conditions were based on the "Present Watershed Plan" and basemap provided by Allen and Major and assumed no site development.



LOCUS MAP

DATE: JANUARY, 2011	DRAWN BY: A.F.	MASSACHUSETTS WATER RESOURCES AUTHORITY	
SCALE: NOT TO SCALE	CHECKED BY: A.S.	PROJECT LOCATION PLAN STONEHAM, MA	FIG. NO. 1
	APPROVED BY: M.P.		Page 2

The interim conditions utilize the same site conditions as the existing conditions with the exception of the interim detention basin and the residential housing development, as shown in "Conceptual Grading Plan" for Langwood Commons prepared by Allen and Major Associates in August, 2010, are assumed to be completed.

For the proposed conditions the interim basin is no longer in place and the entire development, including the residential housing, new medical facilities and MWRA's water storage tank, as shown on the "Spot Pond Storage Facility and Pumping Station" plans prepared by CDM/Green in January, 2011, have already been completed.

2.1 Hydrologic & Hydraulic Analysis

The HydroCAD computer program was used to calculate existing and proposed conditions hydrographs for the 2-year, 10-year, and 25-year storm and 100-year storm events. Hydrographs were developed using the United States Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) unit hydrograph methodology in HydroCAD. Weighted curve numbers (CN) were calculated within the program for each watershed sub-area. Lag times for each sub-area were calculated using the NRCS lag time formula.

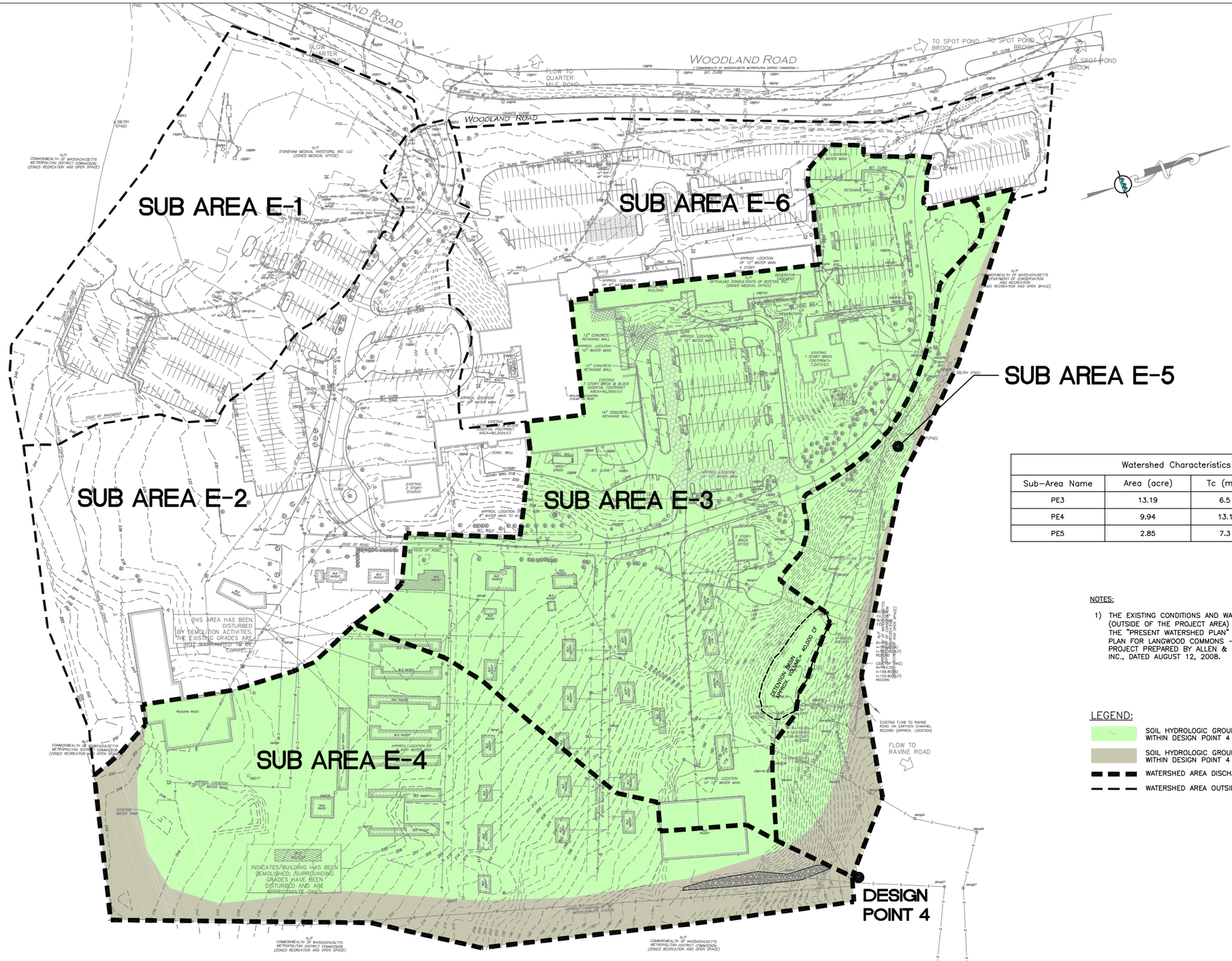
The Hydrologic Soil Groups, as determined by the USDA NRCS, were used to calculate weighted CN for the project area. The NRCS currently classifies the majority of the site as Hydrologic Soil Group B. However, for the purposes of this report, a hydrologic soil rating of "C" was used for all calculations because that was the original rating when the site's drainage system was examined in January, 2008. This is a conservative assumption that produces more stormwater runoff. The same soil classification was used for the existing, interim and proposed conditions.

A description of existing, interim and proposed conditions for the project site is summarized below.

2.1.1 Existing Conditions

The existing site contains approximately 360,000 sf of hospital/medical office building, chapel, power plant and remote administration building. The site also contains paved parking lots and roads, wooded areas and undeveloped areas with vegetated growth.

The existing conditions watershed area is divided into six subareas, subareas E-1 - E-6. These subareas were divided based on the existing topography of the site as depicted on Figure 2. Design point (DP4) is located at the northerly property line and it receives flows from the detention basin, E-4, and E-5. The ultimate destination for flow at DP4 is the existing culvert on the south side of Ravine Road; combined flows typically pass through the culvert the road to Spot Pond Brook. Subareas E-3 - E-5 are summarized below. Stormwater runoff from the remaining portion of the site will discharge to the drainage system on Woodland Road.



Watershed Characteristics			
Sub-Area Name	Area (acre)	Tc (min)	Weighted Cn
PE3	13.19	6.5	85
PE4	9.94	13.1	79
PE5	2.85	7.3	72

NOTES:

1) THE EXISTING CONDITIONS AND WATERSHED AREAS (OUTSIDE OF THE PROJECT AREA) WERE TAKEN FROM THE "PRESENT WATERSHED PLAN" FOR THE "MASTER PLAN FOR LANGWOOD COMMONS – STONEHAM, MA" PROJECT PREPARED BY ALLEN & MAJOR ASSOCIATES INC., DATED AUGUST 12, 2008.

LEGEND:

- SOIL HYDROLOGIC GROUP "C" WITHIN DESIGN POINT 4 WATERSHED
- SOIL HYDROLOGIC GROUP "D" WITHIN DESIGN POINT 4 WATERSHED
- WATERSHED AREA DISCHARGES TO DESIGN POINT 4
- WATERSHED AREA OUTSIDE OF PROJECT AREA

NO.	DATE	BY	CHK'D	REVISION

CONTRACT NO. : 7243 T.O. 2	CAD FILE NO. :
ACCESSION NO. :	SECTION NO. :
DATE: AUGUST, 2010	DESIGNED BY:
	DRAWN BY: AF
	CHECKED BY: AS / MP
SCALE: NOT TO SCALE	APPROVED BY:

MASSACHUSETTS WATER RESOURCES AUTHORITY

PREPARED BY :
GREEN INTERNATIONAL AFFILIATES, INC.
239 LITTLETON RD, WESTFORD, MA 01886
TEL (978) 923-0400 FAX (978) 923-0404

WATER MAIN/ DETENTION BASIN DESIGN
CA SERVICES
STONEHAM, MA

FIGURE 2:
EXISTING WATERSHED AREAS

Subarea E-3

Subarea E-3 is approximately 13.19 acres in size. The groundcover of the area consists primarily of paved parking and buildings to the west, and hillside with brush to the east. The runoff from this area flows overland and via a closed drainage system to an existing detention basin located along the northerly site property line. The detention basin discharges via a dike and small diameter pipe to the hillside adjacent to Ravine Road.

Subarea E-4

Subarea E-4 is approximately 9.94 acres in size. This subarea consists of a hillside with approximately 10% slope and the ground is predominantly covered with brush. Surface runoff from the site flows overland to DP4 at the northeasterly corner of the site.

Subarea E-5

Subarea E-5 is approximately 2.84 acres in size. This subarea consists primarily of a wooded slope and the associated surface runoff flows overland to DP4.

2.1.2 Interim Conditions

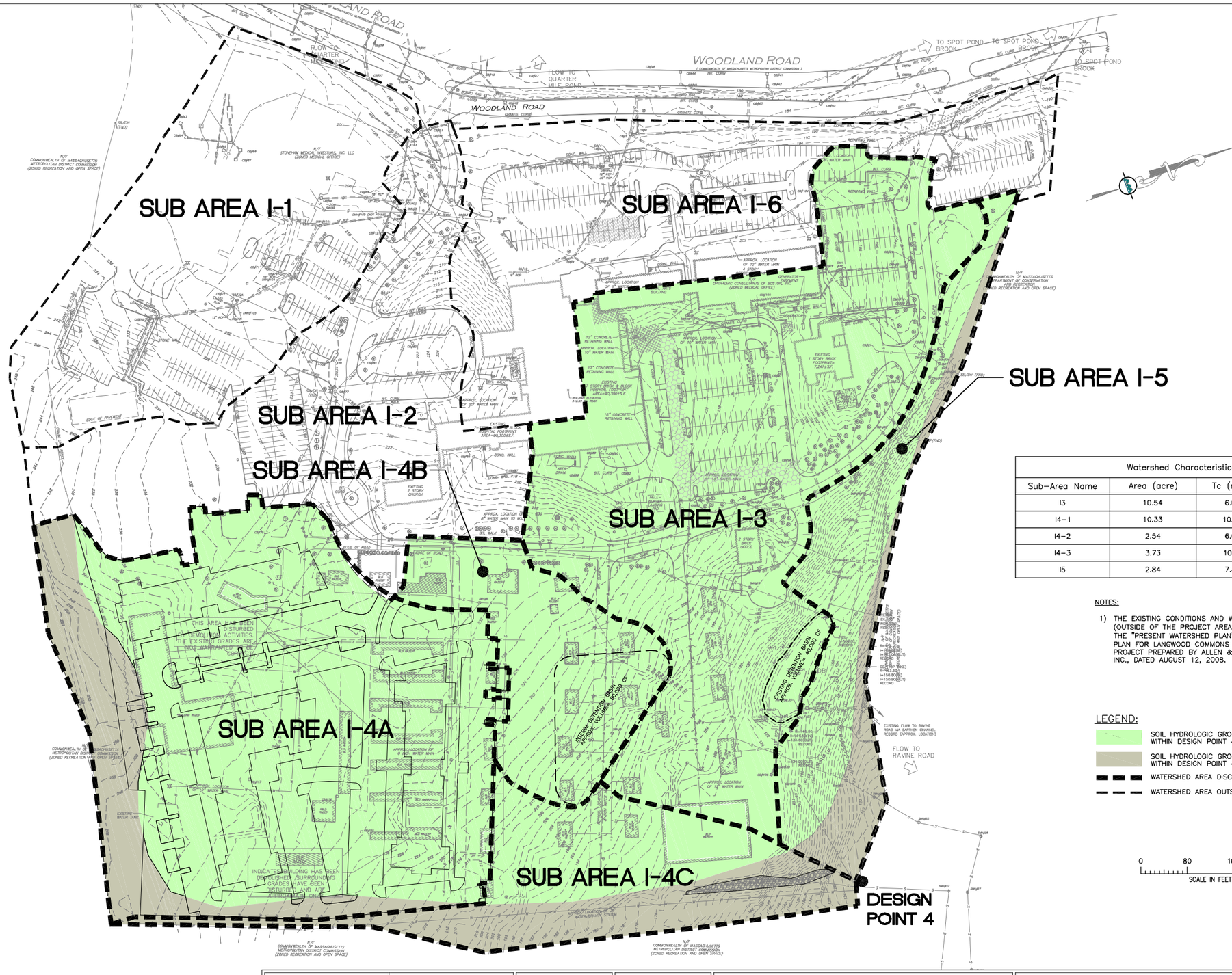
For the interim condition it is assumed that the residential portion of the Langwood Executive Center is completed, however the new Executive Drive as well as the remaining portions of the properties are unchanged from the existing conditions with the exception of the construction of an interim extended detention basin. The watershed boundaries for the interim conditions within the area of interest are described below and shown in Figure 3.

Subarea I-3

Subarea I-3 is part of existing subarea PE3 and is approximately 10.51 acres in size. Under interim conditions it is expected that subarea I3 will not be developed. The groundcover of this area consists primarily of paved parking and buildings to the west and hillside with brush to the east. The runoff from this area flows overland and via a closed drainage system to an existing detention basin along the northerly site property line. The detention basin discharges via a dike and small diameter pipe to the hillside adjacent to DP4.

Subarea I-4A

Subarea I-4A is approximately 10.32 acres in size and it comprises of the new residential housing area. Surface runoff from this subarea discharges via a closed drainage system to the interim extended detention basin. Flow from the interim detention basin exits through a temporary 36” pipe which discharges to a swale adjacent to Pipeline Road to the east of the site. The swale at Pipeline Road discharges to DP4.



Watershed Characteristics			
Sub-Area Name	Area (acre)	Tc (min)	Weighted Cn
I3	10.54	6.0	85
I4-1	10.33	10.6	88
I4-2	2.54	6.0	77
I4-3	3.73	10.1	77
I5	2.84	7.8	76

NOTES:

1) THE EXISTING CONDITIONS AND WATERSHED AREAS (OUTSIDE OF THE PROJECT AREA) WERE TAKEN FROM THE "PRESENT WATERSHED PLAN" FOR THE "MASTER PLAN FOR LANGWOOD COMMONS – STONEHAM, MA" PROJECT PREPARED BY ALLEN & MAJOR ASSOCIATES INC., DATED AUGUST 12, 2008.

LEGEND:

- SOIL HYDROLOGIC GROUP "C" WITHIN DESIGN POINT 4 WATERSHED
- SOIL HYDROLOGIC GROUP "D" WITHIN DESIGN POINT 4 WATERSHED
- WATERSHED AREA DISCHARGES TO DESIGN POINT 4
- WATERSHED AREA OUTSIDE OF PROJECT AREA

0 80 160 240
SCALE IN FEET

NO.	DATE	BY	CHK'D	REVISION

CONTRACT NO. : 7243 T.O. 2	CAD FILE NO. :
ACCESSION NO. :	SECTION NO. :
DATE: JANUARY, 2011	DESIGNED BY:
	DRAWN BY: AF
	CHECKED BY: AS / MP
SCALE: NOT TO SCALE	APPROVED BY:

MASSACHUSETTS WATER RESOURCES AUTHORITY

PREPARED BY :
GREEN INTERNATIONAL AFFILIATES, INC.
239 LITTLETON RD, WESTFORD, MA 01886
TEL (978) 923-0400 FAX (978) 923-0404

DRAINAGE REPORT FOR LANGWOOD EXECUTIVE CENTER AND MWRA WATER STORAGE TANK SITE
STONEHAM, MA

FIGURE 3:
INTERIM WATERSHED AREAS

Subarea I-4B

Subarea I-4B is approximately 2.54 acres in size and it is bounded by Subareas I-3 and I-4A. The groundcover is predominately a sloped hillside with brush. Surface runoff flows overland to the interim extended detention basin. The interim detention basin collects the runoff flow from this subarea and discharge from the detention basin ultimately ends up at DP4 through a combination of closed pipe flow and overland flow as described for Subarea I-4A.

Subarea I-4C

Subarea I-4C is approximately 3.73 acres in size. This subarea is comprised of sloped terrain with a mixture of brush and woods. Surface runoff flows overland from the subarea to DP4 which is located at the northeasterly corner of the site.

Subarea I-5

Subarea I-5 is approximately 2.84 acres in size. This subarea consists primarily of a wooded slope. Surface runoff from this subarea flows overland to DP4.

2.1.3 Proposed Conditions

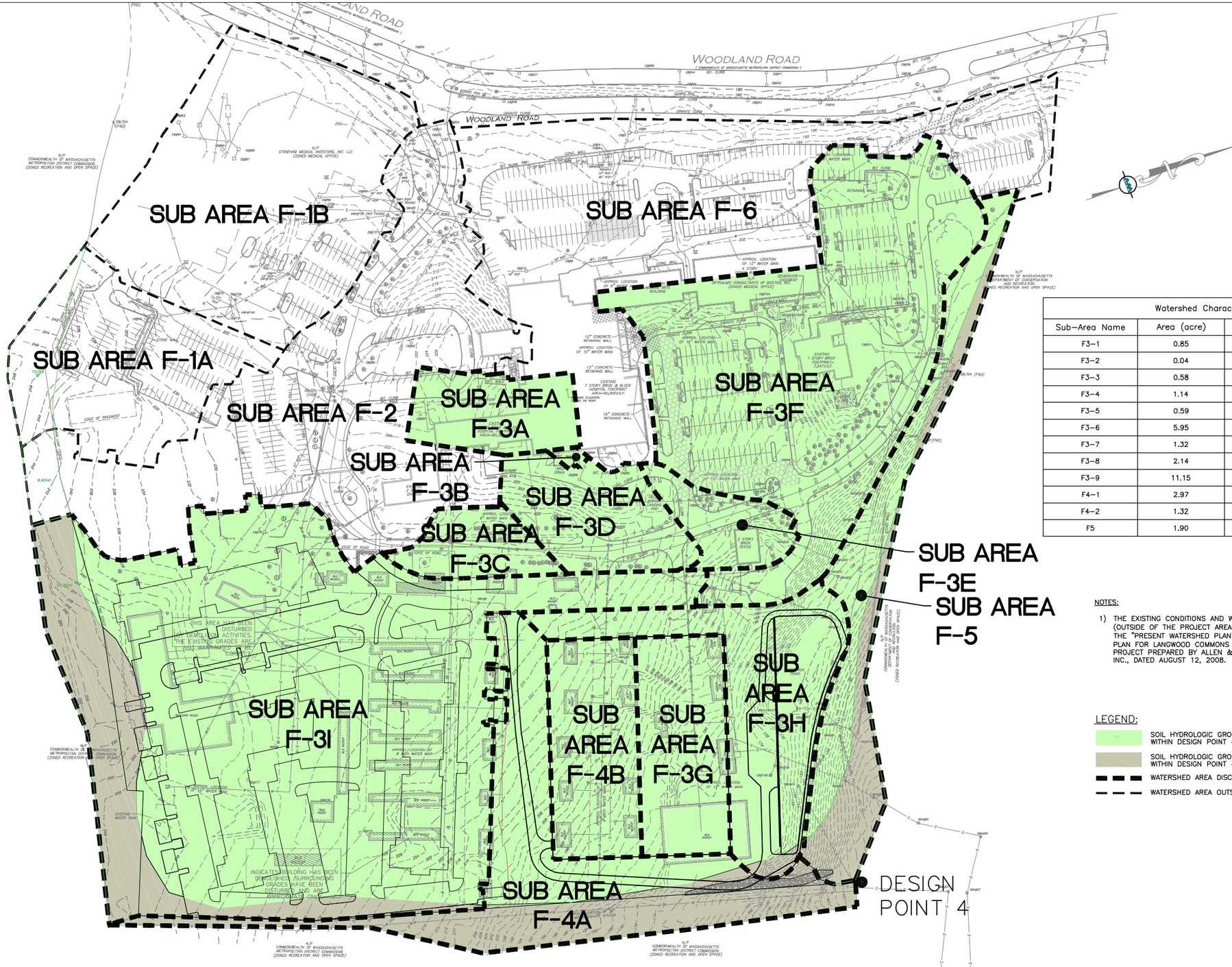
The proposed site is divided into six drainage subareas or divides. These divides are altered from present conditions by construction of both the proposed 225,000 sf office building, the proposed subdivision road called Executive Drive and the MWRA water storage tank. Although neither Executive Drive nor the residential development is part of this project, the drainage analysis includes impacts from the construction of these facilities. See Figure 4.

Subarea F-3

Subarea F-3 is approximately 23.75 acres in size and it contains the northeastern portion of Executive Drive, the eastern half of the proposed office building site, the residential development in the south eastern corner of the site, and the area adjacent to the extended detention basin including half of the surface area of the proposed water storage tank. Subarea F3 flows overland and via closed drainage systems to the proposed extended detention basin along the northerly site property line. Discharge from the extended detention basin is conveyed through 2-24" pipes to the same outfall location as the existing detention basin. The ultimate destination for this flow will be DP4.

Subarea F-4

Subarea F-4 is approximately 4.29 acres in size. This area includes half of the proposed water storage tank, a grassy area adjacent to the water storage tank, and the wooded slope on the eastern edge of the site. Surface runoff from this area will flow overland from the site to DP4.



Watershed Characteristics			
Sub-Area Name	Area (acre)	Tc (min)	Weighted Cn
F3-1	0.85	6.0	98
F3-2	0.04	6.0	98
F3-3	0.58	6.0	97
F3-4	1.14	6.0	96
F3-5	0.59	6.0	92
F3-6	5.95	6.5	91
F3-7	1.32	8.9	80
F3-8	2.14	6.0	80
F3-9	11.15	10.6	88
F4-1	2.97	20	79
F4-2	1.32	8.9	80
F5	1.90	7.3	73

NOTES:

1) THE EXISTING CONDITIONS AND WATERSHED AREAS (OUTSIDE OF THE PROJECT AREA) WERE TAKEN FROM THE "PRESENT WATERSHED PLAN" FOR THE "MASTER PLAN FOR LANGWOOD COMMONS – STONEHAM, MA" PROJECT PREPARED BY ALLEN & MAJOR ASSOCIATES INC., DATED AUGUST 12, 2008.

LEGEND:

- SOIL HYDROLOGIC GROUP "C" WITHIN DESIGN POINT 4 WATERSHED
- SOIL HYDROLOGIC GROUP "D" WITHIN DESIGN POINT 4 WATERSHED
- WATERSHED AREA DISCHARGES TO DESIGN POINT 4
- WATERSHED AREA OUTSIDE OF PROJECT AREA

NO.	DATE	BY	CHK'D	REVISION

CONTRACT NO. : 7243 T.O. 2 | CAD FILE NO. :

ACCESSION NO. : | SECTION NO. :

DATE: JANUARY, 2011 | DESIGNED BY:

DRAWN BY: AF

CHECKED BY: AS / MP

SCALE: NOT TO SCALE | APPROVED BY:

MASSACHUSETTS WATER RESOURCES AUTHORITY

PREPARED BY :
GREEN INTERNATIONAL AFFILIATES, INC.
239 LITTLETON RD, WESTFORD, MA 01886
TEL (978) 923-0400 FAX (978) 923-0404

DRAINAGE REPORT FOR LANGWOOD EXECUTIVE CENTER AND MWRA WATER STORAGE TANK SITE
STONEHAM, MA

FIGURE 4:
PROPOSED WATERSHED AREAS

Subarea F-5

Subarea F-5 approximately 1.90 acres in size and is similar to existing conditions subarea E-5, except for the southerly edge where it will be modified under proposed conditions to accommodate the new driveway and detention basin. This subarea consists primarily of a wooded slope and surface runoff will flow overland to DP4.

3. Conclusion

A summary of peak rate of discharge and runoff volumes at DP4 for existing, interim, and proposed conditions is depicted on Table 1 below.

Table 1: Drainage Summary of Peak Discharge Runoff Volumes

	Existing Conditions	**Interim Conditions**	**Proposed Conditions**
Area to Design Point 4			
Total Drainage Area (Ac.)	25.98	29.98	29.94
Peak Rate of Runoff (cfs)			
2-year	15.51	12.03	11.96
10-year	65.56	43.35	41.17
25-year	88.09	72.49	66.22
100-year	111.26	99.49	109.41
Total Runoff Volume (Ac.Ft.)			
2-year	3.09	3.96	4.51
10-year	5.60	6.96	7.62
25-year	7.10	8.74	9.46
100-year	9.49	11.55	12.28

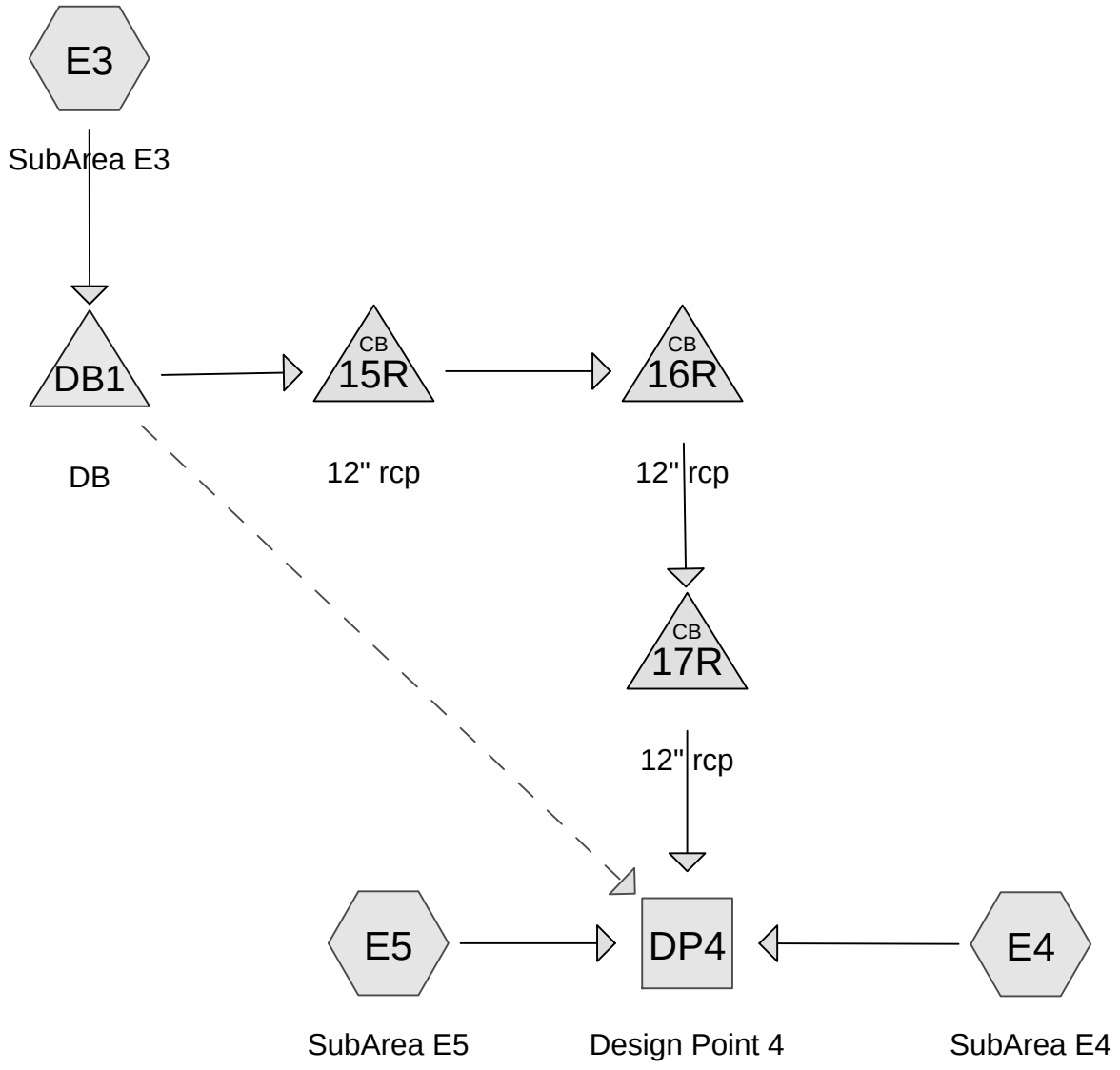
Based on our drainage analysis for all three conditions, there will be no increase in the peak rate of runoff from the site at DP4 for the 2-year, 10-year, 25-year and 100-year design storms under the proposed conditions.

The results from the HydroCAD model indicate that the 12" outlet pipe from the existing detention basin is undersized to control the 10-yr design storm or any larger storm events. Stormwater overtops the existing detention basin's berm wall during these large storm events and spills down the slope adjacent to DP4. Under proposed conditions, 2-24" pipes are proposed to control the flow from storms as large as a 100-yr design storm without the proposed extended detention basin overtopping the emergency spillway. The additional pipe flow does not result in an increase in peak flow at DP4 for any of the design storms that were examined as part of this report.

There is an increase in total site runoff volume to the design point. This is due to the additional drainage area coming to DP4 as well as the increase in impervious area within the overall watershed area.

APPENDIX A

EXISTING CONDITIONS
BACK UP CALCULATION



Subcat Reach Pond Link

Drainage Diagram for Existing to Design Point 4
Prepared by {enter your company name here}, Printed 2/16/2011

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E3: SubArea E3 Runoff Area=13.190 ac 46.93% Impervious Runoff Depth=1.67"
Tc=6.5 min CN=85 Runoff=25.04 cfs 1.838 af

Subcatchment E4: SubArea E4 Runoff Area=9.940 ac 15.59% Impervious Runoff Depth=1.26"
Tc=13.1 min CN=79 Runoff=11.35 cfs 1.045 af

Subcatchment E5: SubArea E5 Runoff Area=2.850 ac 0.00% Impervious Runoff Depth=0.87"
Tc=7.3 min CN=72 Runoff=2.50 cfs 0.206 af

Reach DP4: Design Point 4 Inflow=15.51 cfs 3.090 af
Outflow=15.51 cfs 3.090 af

Pond 15R: 12" rcp Peak Elev=151.59' Inflow=2.46 cfs 1.838 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0271 '/' Outflow=2.46 cfs 1.838 af

Pond 16R: 12" rcp Peak Elev=143.14' Inflow=2.46 cfs 1.838 af
12.0" Round Culvert n=0.012 L=34.0' S=0.0129 '/' Outflow=2.46 cfs 1.838 af

Pond 17R: 12" rcp Peak Elev=135.54' Inflow=2.46 cfs 1.838 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0267 '/' Outflow=2.46 cfs 1.838 af

Pond DB1: DB Peak Elev=163.35' Storage=34,058 cf Inflow=25.04 cfs 1.838 af
Primary=2.46 cfs 1.838 af Secondary=0.00 cfs 0.000 af Outflow=2.46 cfs 1.838 af

Total Runoff Area = 25.980 ac Runoff Volume = 3.090 af Average Runoff Depth = 1.43"
70.21% Pervious = 18.240 ac 29.79% Impervious = 7.740 ac

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E3: SubArea E3 Runoff Area=13.190 ac 46.93% Impervious Runoff Depth=2.91"
Tc=6.5 min CN=85 Runoff=43.24 cfs 3.198 af

Subcatchment E4: SubArea E4 Runoff Area=9.940 ac 15.59% Impervious Runoff Depth=2.38"
Tc=13.1 min CN=79 Runoff=21.81 cfs 1.969 af

Subcatchment E5: SubArea E5 Runoff Area=2.850 ac 0.00% Impervious Runoff Depth=1.82"
Tc=7.3 min CN=72 Runoff=5.63 cfs 0.432 af

Reach DP4: Design Point 4 Inflow=65.56 cfs 5.603 af
Outflow=65.56 cfs 5.603 af

Pond 15R: 12" rcp Peak Elev=153.55' Inflow=5.94 cfs 2.538 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0271 '/' Outflow=5.94 cfs 2.538 af

Pond 16R: 12" rcp Peak Elev=145.10' Inflow=5.94 cfs 2.538 af
12.0" Round Culvert n=0.012 L=34.0' S=0.0129 '/' Outflow=5.94 cfs 2.538 af

Pond 17R: 12" rcp Peak Elev=137.50' Inflow=5.94 cfs 2.538 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0267 '/' Outflow=5.94 cfs 2.538 af

Pond DB1: DB Peak Elev=163.76' Storage=38,134 cf Inflow=43.24 cfs 3.198 af
Primary=5.94 cfs 2.538 af Secondary=33.04 cfs 0.664 af Outflow=38.98 cfs 3.202 af

Total Runoff Area = 25.980 ac Runoff Volume = 5.598 af Average Runoff Depth = 2.59"
70.21% Pervious = 18.240 ac 29.79% Impervious = 7.740 ac

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E3: SubArea E3 Runoff Area=13.190 ac 46.93% Impervious Runoff Depth=3.65"
Tc=6.5 min CN=85 Runoff=53.82 cfs 4.008 af

Subcatchment E4: SubArea E4 Runoff Area=9.940 ac 15.59% Impervious Runoff Depth=3.06"
Tc=13.1 min CN=79 Runoff=28.12 cfs 2.536 af

Subcatchment E5: SubArea E5 Runoff Area=2.850 ac 0.00% Impervious Runoff Depth=2.43"
Tc=7.3 min CN=72 Runoff=7.62 cfs 0.577 af

Reach DP4: Design Point 4 Inflow=88.09 cfs 7.100 af
Outflow=88.09 cfs 7.100 af

Pond 15R: 12" rcp Peak Elev=154.36' Inflow=6.81 cfs 2.852 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0271 '/' Outflow=6.81 cfs 2.852 af

Pond 16R: 12" rcp Peak Elev=145.91' Inflow=6.81 cfs 2.852 af
12.0" Round Culvert n=0.012 L=34.0' S=0.0129 '/' Outflow=6.81 cfs 2.852 af

Pond 17R: 12" rcp Peak Elev=138.31' Inflow=6.81 cfs 2.852 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0267 '/' Outflow=6.81 cfs 2.852 af

Pond DB1: DB Peak Elev=163.80' Storage=38,576 cf Inflow=53.82 cfs 4.008 af
Primary=6.81 cfs 2.852 af Secondary=48.87 cfs 1.135 af Outflow=55.68 cfs 3.987 af

Total Runoff Area = 25.980 ac Runoff Volume = 7.121 af Average Runoff Depth = 3.29"
70.21% Pervious = 18.240 ac 29.79% Impervious = 7.740 ac

Time span=0.00-35.00 hrs, dt=0.05 hrs, 701 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E3: SubArea E3 Runoff Area=13.190 ac 46.93% Impervious Runoff Depth=4.78"
Tc=6.5 min CN=85 Runoff=69.71 cfs 5.250 af

Subcatchment E4: SubArea E4 Runoff Area=9.940 ac 15.59% Impervious Runoff Depth=4.13"
Tc=13.1 min CN=79 Runoff=37.80 cfs 3.420 af

Subcatchment E5: SubArea E5 Runoff Area=2.850 ac 0.00% Impervious Runoff Depth=3.41"
Tc=7.3 min CN=72 Runoff=10.74 cfs 0.809 af

Reach DP4: Design Point 4 Inflow=111.26 cfs 9.491 af
Outflow=111.26 cfs 9.491 af

Pond 15R: 12" rcp Peak Elev=154.78' Inflow=7.18 cfs 3.275 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0271 '/' Outflow=7.18 cfs 3.275 af

Pond 16R: 12" rcp Peak Elev=146.33' Inflow=7.18 cfs 3.275 af
12.0" Round Culvert n=0.012 L=34.0' S=0.0129 '/' Outflow=7.18 cfs 3.275 af

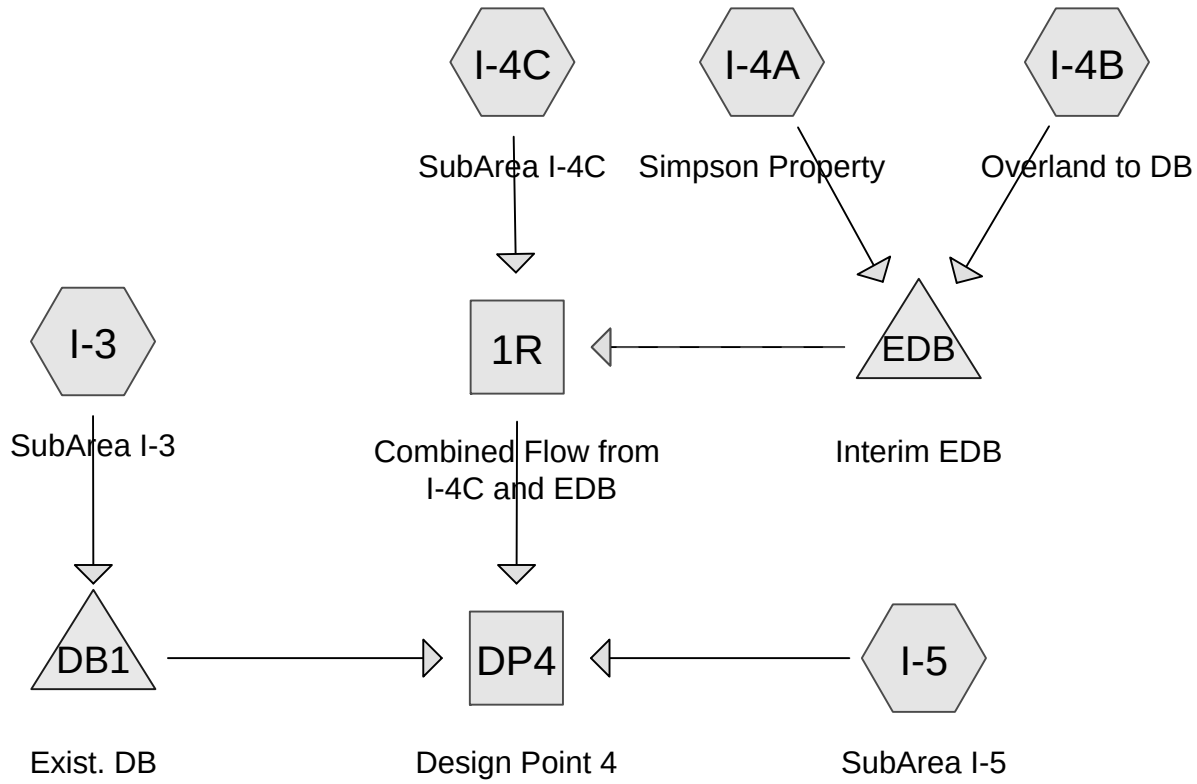
Pond 17R: 12" rcp Peak Elev=138.73' Inflow=7.18 cfs 3.275 af
12.0" Round Culvert n=0.012 L=24.0' S=0.0267 '/' Outflow=7.18 cfs 3.275 af

Pond DB1: DB Peak Elev=163.84' Storage=38,975 cf Inflow=69.71 cfs 5.250 af
Primary=7.18 cfs 3.275 af Secondary=60.84 cfs 1.986 af Outflow=68.03 cfs 5.262 af

Total Runoff Area = 25.980 ac Runoff Volume = 9.479 af Average Runoff Depth = 4.38"
70.21% Pervious = 18.240 ac 29.79% Impervious = 7.740 ac

APPENDIX B

INTERIM CONDITIONS
BACK UP CALCULATION



Subcat Reach Pond Link

Drainage Diagram for Interim to Design Point 4

Prepared by {enter your company name here}, Printed 2/16/2011

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment I-3: SubArea I-3 Runoff Area=10.539 ac 47.11% Impervious Runoff Depth=1.67"
Tc=6.0 min CN=85 Runoff=20.26 cfs 1.469 af

Subcatchment I-4A: Simpson Property Runoff Area=10.331 ac 53.93% Impervious Runoff Depth=1.91"
Tc=10.6 min CN=88 Runoff=19.59 cfs 1.642 af

Subcatchment I-4B: Overland to DB Runoff Area=2.542 ac 0.00% Impervious Runoff Depth=1.14"
Tc=6.0 min CN=77 Runoff=3.24 cfs 0.242 af

Subcatchment I-4C: SubArea I-4C Runoff Area=3.727 ac 0.00% Impervious Runoff Depth=1.14"
Tc=10.1 min CN=77 Runoff=4.15 cfs 0.354 af

Subcatchment I-5: SubArea I-5 Runoff Area=2.843 ac 0.00% Impervious Runoff Depth=1.08"
Tc=7.8 min CN=76 Runoff=3.21 cfs 0.257 af

Reach 1R: Combined Flow from I-4C and EDB Inflow=8.57 cfs 2.235 af
Outflow=8.57 cfs 2.235 af

Reach DP4: Design Point 4 Inflow=12.03 cfs 3.961 af
Outflow=12.03 cfs 3.961 af

Pond DB1: Exist. DB Peak Elev=162.52' Storage=25,803 cf Inflow=20.26 cfs 1.469 af
Outflow=2.23 cfs 1.469 af

Pond EDB: Interim EDB Peak Elev=203.04' Storage=34,823 cf Inflow=22.36 cfs 1.884 af
Primary=6.90 cfs 1.881 af Secondary=0.00 cfs 0.000 af Outflow=6.90 cfs 1.881 af

Total Runoff Area = 29.982 ac Runoff Volume = 3.964 af Average Runoff Depth = 1.59"
64.86% Pervious = 19.446 ac 35.14% Impervious = 10.536 ac

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment I-3: SubArea I-3 Runoff Area=10.539 ac 47.11% Impervious Runoff Depth=2.91"
Tc=6.0 min CN=85 Runoff=34.97 cfs 2.555 af

Subcatchment I-4A: Simpson Property Runoff Area=10.331 ac 53.93% Impervious Runoff Depth=3.20"
Tc=10.6 min CN=88 Runoff=32.37 cfs 2.752 af

Subcatchment I-4B: Overland to DB Runoff Area=2.542 ac 0.00% Impervious Runoff Depth=2.21"
Tc=6.0 min CN=77 Runoff=6.45 cfs 0.468 af

Subcatchment I-4C: SubArea I-4C Runoff Area=3.727 ac 0.00% Impervious Runoff Depth=2.21"
Tc=10.1 min CN=77 Runoff=8.29 cfs 0.687 af

Subcatchment I-5: SubArea I-5 Runoff Area=2.843 ac 0.00% Impervious Runoff Depth=2.13"
Tc=7.8 min CN=76 Runoff=6.55 cfs 0.505 af

Reach 1R: Combined Flow from I-4C and EDB Inflow=20.75 cfs 3.904 af
Outflow=20.75 cfs 3.904 af

Reach DP4: Design Point 4 Inflow=43.35 cfs 6.958 af
Outflow=43.35 cfs 6.958 af

Pond DB1: Exist. DB Peak Elev=163.64' Storage=36,887 cf Inflow=34.97 cfs 2.555 af
Outflow=18.81 cfs 2.550 af

Pond EDB: Interim EDB Peak Elev=203.99' Storage=51,560 cf Inflow=37.83 cfs 3.220 af
Primary=15.95 cfs 3.217 af Secondary=0.00 cfs 0.000 af Outflow=15.95 cfs 3.217 af

Total Runoff Area = 29.982 ac Runoff Volume = 6.966 af Average Runoff Depth = 2.79"
64.86% Pervious = 19.446 ac 35.14% Impervious = 10.536 ac

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment I-3: SubArea I-3 Runoff Area=10.539 ac 47.11% Impervious Runoff Depth=3.65"
Tc=6.0 min CN=85 Runoff=43.52 cfs 3.202 af

Subcatchment I-4A: Simpson Property Runoff Area=10.331 ac 53.93% Impervious Runoff Depth=3.95"
Tc=10.6 min CN=88 Runoff=39.70 cfs 3.405 af

Subcatchment I-4B: Overland to DB Runoff Area=2.542 ac 0.00% Impervious Runoff Depth=2.88"
Tc=6.0 min CN=77 Runoff=8.40 cfs 0.609 af

Subcatchment I-4C: SubArea I-4C Runoff Area=3.727 ac 0.00% Impervious Runoff Depth=2.88"
Tc=10.1 min CN=77 Runoff=10.82 cfs 0.893 af

Subcatchment I-5: SubArea I-5 Runoff Area=2.843 ac 0.00% Impervious Runoff Depth=2.78"
Tc=7.8 min CN=76 Runoff=8.61 cfs 0.660 af

Reach 1R: Combined Flow from I-4C and EDB Inflow=29.35 cfs 4.904 af
Outflow=29.35 cfs 4.904 af

Reach DP4: Design Point 4 Inflow=72.49 cfs 8.741 af
Outflow=72.49 cfs 8.741 af

Pond DB1: Exist. DB Peak Elev=163.73' Storage=37,883 cf Inflow=43.52 cfs 3.202 af
Outflow=38.36 cfs 3.177 af

Pond EDB: Interim EDB Peak Elev=204.39' Storage=59,782 cf Inflow=46.80 cfs 4.014 af
Primary=23.33 cfs 4.011 af Secondary=0.00 cfs 0.000 af Outflow=23.33 cfs 4.011 af

Total Runoff Area = 29.982 ac Runoff Volume = 8.769 af Average Runoff Depth = 3.51"
64.86% Pervious = 19.446 ac 35.14% Impervious = 10.536 ac

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment I-3: SubArea I-3 Runoff Area=10.539 ac 47.11% Impervious Runoff Depth=4.78"
Tc=6.0 min CN=85 Runoff=56.36 cfs 4.194 af

Subcatchment I-4A: Simpson Property Runoff Area=10.331 ac 53.93% Impervious Runoff Depth=5.11"
Tc=10.6 min CN=88 Runoff=50.65 cfs 4.398 af

Subcatchment I-4B: Overland to DB Runoff Area=2.542 ac 0.00% Impervious Runoff Depth=3.92"
Tc=6.0 min CN=77 Runoff=11.42 cfs 0.830 af

Subcatchment I-4C: SubArea I-4C Runoff Area=3.727 ac 0.00% Impervious Runoff Depth=3.92"
Tc=10.1 min CN=77 Runoff=14.73 cfs 1.217 af

Subcatchment I-5: SubArea I-5 Runoff Area=2.843 ac 0.00% Impervious Runoff Depth=3.82"
Tc=7.8 min CN=76 Runoff=11.80 cfs 0.904 af

Reach 1R: Combined Flow from I-4C and EDB Inflow=42.85 cfs 6.442 af
Outflow=42.85 cfs 6.442 af

Reach DP4: Design Point 4 Inflow=99.49 cfs 11.545 af
Outflow=99.49 cfs 11.545 af

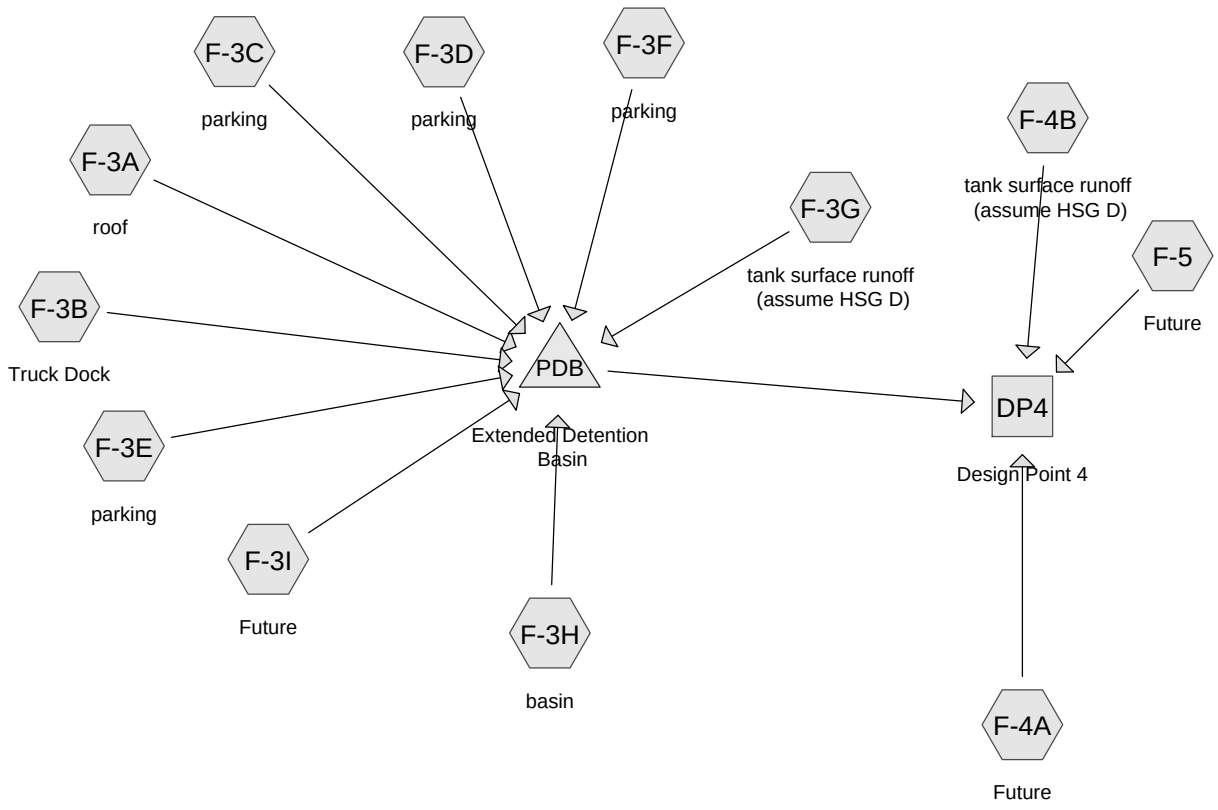
Pond DB1: Exist. DB Peak Elev=163.80' Storage=38,504 cf Inflow=56.36 cfs 4.194 af
Outflow=55.04 cfs 4.199 af

Pond EDB: Interim EDB Peak Elev=204.91' Storage=70,590 cf Inflow=60.29 cfs 5.228 af
Primary=32.22 cfs 5.225 af Secondary=0.00 cfs 0.000 af Outflow=32.22 cfs 5.225 af

Total Runoff Area = 29.982 ac Runoff Volume = 11.544 af Average Runoff Depth = 4.62"
64.86% Pervious = 19.446 ac 35.14% Impervious = 10.536 ac

APPENDIX C

PROPOSED CONDITIONS
BACK UP CALCULATION



Subcat Reach Pond Link

Drainage Diagram for Proposed to Design Point 4

Prepared by {enter your company name here}, Printed 2/16/2011

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=2.50 cfs 0.204 af

Subcatchment F-3B: Truck Dock Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=2.87"
Tc=6.0 min CN=98 Runoff=0.10 cfs 0.008 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth=2.76"
Tc=6.0 min CN=97 Runoff=1.67 cfs 0.133 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth=2.65"
Tc=6.0 min CN=96 Runoff=3.23 cfs 0.252 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth=2.26"
Tc=6.0 min CN=92 Runoff=1.48 cfs 0.110 af

Subcatchment F-3F: parking Runoff Area=5.949 ac 71.36% Impervious Runoff Depth=2.16"
Tc=6.5 min CN=91 Runoff=14.38 cfs 1.073 af

Subcatchment F-3G: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=1.33"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=1.80 cfs 0.146 af

Subcatchment F-3H: basin Runoff Area=93,364 sf 18.65% Impervious Runoff Depth=1.33"
Tc=6.0 min CN=80 Runoff=3.23 cfs 0.237 af

Subcatchment F-3I: Future Runoff Area=485,502 sf 56.30% Impervious Runoff Depth=1.91"
Tc=10.6 min CN=88 Runoff=21.14 cfs 1.772 af

Subcatchment F-4A: Future Runoff Area=129,529 sf 9.64% Impervious Runoff Depth=1.26"
Tc=20.0 min CN=79 Runoff=2.89 cfs 0.313 af

Subcatchment F-4B: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=1.33"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=1.80 cfs 0.146 af

Subcatchment F-5: Future Runoff Area=82,581 sf 0.00% Impervious Runoff Depth=0.92"
Tc=7.3 min CN=73 Runoff=1.79 cfs 0.145 af

Reach DP4: Design Point 4 Inflow=11.96 cfs 4.510 af
Outflow=11.96 cfs 4.510 af

Pond PDB: Extended Detention Basin Peak Elev=155.63' Storage=83,056 cf Inflow=47.71 cfs 3.933 af
Outflow=9.13 cfs 3.906 af

Total Runoff Area = 29.936 ac Runoff Volume = 4.537 af Average Runoff Depth = 1.82"
52.82% Pervious = 15.811 ac 47.18% Impervious = 14.125 ac

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=3.66 cfs 0.303 af

Subcatchment F-3B: Truck Dock Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=4.26"
Tc=6.0 min CN=98 Runoff=0.15 cfs 0.012 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth=4.15"
Tc=6.0 min CN=97 Runoff=2.46 cfs 0.199 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth=4.04"
Tc=6.0 min CN=96 Runoff=4.80 cfs 0.383 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth=3.60"
Tc=6.0 min CN=92 Runoff=2.31 cfs 0.176 af

Subcatchment F-3F: parking Runoff Area=5.949 ac 71.36% Impervious Runoff Depth=3.50"
Tc=6.5 min CN=91 Runoff=22.72 cfs 1.734 af

Subcatchment F-3G: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=2.46"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=3.38 cfs 0.271 af

Subcatchment F-3H: basin Runoff Area=93,364 sf 18.65% Impervious Runoff Depth=2.46"
Tc=6.0 min CN=80 Runoff=6.07 cfs 0.440 af

Subcatchment F-3I: Future Runoff Area=485,502 sf 56.30% Impervious Runoff Depth=3.20"
Tc=10.6 min CN=88 Runoff=34.93 cfs 2.969 af

Subcatchment F-4A: Future Runoff Area=129,529 sf 9.64% Impervious Runoff Depth=2.38"
Tc=20.0 min CN=79 Runoff=5.56 cfs 0.589 af

Subcatchment F-4B: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=2.46"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=3.38 cfs 0.271 af

Subcatchment F-5: Future Runoff Area=82,581 sf 0.00% Impervious Runoff Depth=1.90"
Tc=7.3 min CN=73 Runoff=3.92 cfs 0.299 af

Reach DP4: Design Point 4 Inflow=41.17 cfs 7.618 af
Outflow=41.17 cfs 7.618 af

Pond PDB: Extended Detention Basin Peak Elev=157.01' Storage=111,373 cf Inflow=77.71 cfs 6.487 af
Outflow=32.48 cfs 6.459 af

Total Runoff Area = 29.936 ac Runoff Volume = 7.646 af Average Runoff Depth = 3.06"
52.82% Pervious = 15.811 ac 47.18% Impervious = 14.125 ac

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=98 Runoff=4.32 cfs 0.360 af

Subcatchment F-3B: Truck Dock Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=5.06"
Tc=6.0 min CN=98 Runoff=0.18 cfs 0.015 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth=4.95"
Tc=6.0 min CN=97 Runoff=2.90 cfs 0.238 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth=4.83"
Tc=6.0 min CN=96 Runoff=5.69 cfs 0.459 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth=4.38"
Tc=6.0 min CN=92 Runoff=2.78 cfs 0.214 af

Subcatchment F-3F: parking Runoff Area=5.949 ac 71.36% Impervious Runoff Depth=4.27"
Tc=6.5 min CN=91 Runoff=27.46 cfs 2.119 af

Subcatchment F-3G: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=3.16"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=4.33 cfs 0.347 af

Subcatchment F-3H: basin Runoff Area=93,364 sf 18.65% Impervious Runoff Depth=3.16"
Tc=6.0 min CN=80 Runoff=7.76 cfs 0.564 af

Subcatchment F-3I: Future Runoff Area=485,502 sf 56.30% Impervious Runoff Depth=3.95"
Tc=10.6 min CN=88 Runoff=42.83 cfs 3.673 af

Subcatchment F-4A: Future Runoff Area=129,529 sf 9.64% Impervious Runoff Depth=3.06"
Tc=20.0 min CN=79 Runoff=7.17 cfs 0.759 af

Subcatchment F-4B: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=3.16"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=4.33 cfs 0.347 af

Subcatchment F-5: Future Runoff Area=82,581 sf 0.00% Impervious Runoff Depth=2.52"
Tc=7.3 min CN=73 Runoff=5.26 cfs 0.398 af

Reach DP4: Design Point 4 Inflow=66.22 cfs 9.463 af
Outflow=66.22 cfs 9.463 af

Pond PDB: Extended Detention Basin Peak Elev=157.56' Storage=123,659 cf Inflow=94.96 cfs 7.987 af
Outflow=53.69 cfs 7.960 af

Total Runoff Area = 29.936 ac Runoff Volume = 9.491 af Average Runoff Depth = 3.80"
52.82% Pervious = 15.811 ac 47.18% Impervious = 14.125 ac

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment F-3A: roof Runoff Area=0.853 ac 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=5.31 cfs 0.445 af

Subcatchment F-3B: Truck Dock Runoff Area=0.035 ac 100.00% Impervious Runoff Depth=6.26"
Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af

Subcatchment F-3C: parking Runoff Area=0.577 ac 97.23% Impervious Runoff Depth=6.14"
Tc=6.0 min CN=97 Runoff=3.58 cfs 0.295 af

Subcatchment F-3D: parking Runoff Area=1.139 ac 91.13% Impervious Runoff Depth=6.03"
Tc=6.0 min CN=96 Runoff=7.02 cfs 0.572 af

Subcatchment F-3E: parking Runoff Area=0.585 ac 73.68% Impervious Runoff Depth=5.56"
Tc=6.0 min CN=92 Runoff=3.48 cfs 0.271 af

Subcatchment F-3F: parking Runoff Area=5.949 ac 71.36% Impervious Runoff Depth=5.45"
Tc=6.5 min CN=91 Runoff=34.52 cfs 2.701 af

Subcatchment F-3G: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=4.24"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=5.77 cfs 0.466 af

Subcatchment F-3H: basin Runoff Area=93,364 sf 18.65% Impervious Runoff Depth=4.24"
Tc=6.0 min CN=80 Runoff=10.35 cfs 0.756 af

Subcatchment F-3I: Future Runoff Area=485,502 sf 56.30% Impervious Runoff Depth=5.11"
Tc=10.6 min CN=88 Runoff=54.65 cfs 4.745 af

Subcatchment F-4A: Future Runoff Area=129,529 sf 9.64% Impervious Runoff Depth=4.13"
Tc=20.0 min CN=79 Runoff=9.67 cfs 1.023 af

Subcatchment F-4B: tank surface runoff Runoff Area=57,488 sf 0.00% Impervious Runoff Depth=4.24"
Flow Length=153' Slope=0.0131 '/' Tc=8.9 min CN=80 Runoff=5.77 cfs 0.466 af

Subcatchment F-5: Future Runoff Area=82,581 sf 0.00% Impervious Runoff Depth=3.51"
Tc=7.3 min CN=73 Runoff=7.36 cfs 0.554 af

Reach DP4: Design Point 4 Inflow=109.41 cfs 12.284 af
Outflow=109.41 cfs 12.284 af

Pond PDB: Extended Detention Basin Peak Elev=157.96' Storage=132,727 cf Inflow=120.80 cfs 10.269 af
Outflow=90.98 cfs 10.241 af

Total Runoff Area = 29.936 ac Runoff Volume = 12.313 af Average Runoff Depth = 4.94"
52.82% Pervious = 15.811 ac 47.18% Impervious = 14.125 ac