



ALLEN & MAJOR
ASSOCIATES, INC.

SITE LOCUS: N.T.S.



ELDERLY HOUSING DEVELOPMENT 470 BOSTON STREET TOPSFIELD, MASSACHUSETTS DRAINAGE REPORT

DATE PREPARED:

OCTOBER 13, 2016

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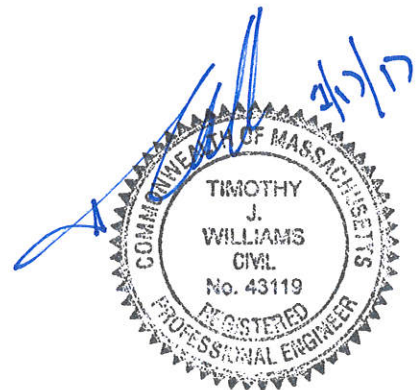
JANUARY 17, 2017

APPLICANT:

SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
P.O. BOX 2118
100 COMMERCE WAY
WOBURN, MASSACHUSETTS 01888-0118



DRAINAGE REPORT

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#470 BOSTON STREET
TOPSFIELD, MA

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A&M PROJECT #2165-01A

TITLE PAGE	i
TABLE OF CONTENTS.....	iii

Section 1.0 - Revised January 17, 2017

INTRODUCTION	1
SITE CHARACTERIZATION FOR STORMWATER REGULATIONS	1
SITE LOCATION AND ACCESS	1
WATERSHED	2
EXISTING SITE CONDITIONS.....	2
EXISTING SOIL CONDITIONS	3
FEMA FLOODPLAIN/ENVIRONMENTAL DUE DILIGENCE	3
DRAINAGE ANALYSIS METHODOLOGY.....	4
PEAK RATE OF RUNOFF.....	4
MADEP PERFORMANCE STANDARDS	7
TOWN OF TOPSFIELD PERFORMANCE STANDARDS.....	12
MADEP STORMWATER REPORT CHECKLIST.....	14

Section 2.0 - Included in October, 2016 Drainage Report, O&M Narrative Revised January 17, 2017

OPERATION AND MAINTENANCE PLAN.....	1
INTRODUCTION	1
DEMOLITION & CONSTRUCTION MAINTENANCE PLAN	2
LONG TERM POLLUTION PREVENTION PLAN	3
LANDSCAPED MAINTENANCE PLAN	5
STORAGE & USE OF HERBICIDES & PESTICIDES	6
MANAGEMENT OF DEICING CHEMICALS AND SNOW	8
POST CONSTRUCTION MAINTENANCE PLAN	8
OPERATION & MAINTENANCE SUMMARY TABLE	11
SNOW DISPOSAL GUIDANCE	12
MOSQUITO CONTROL IN STORMWATER PROJECTS	15
CULTEC OPERATION & MAINTENANCE MANUAL	19
STORMCEPTOR MAINTENANCE PROCEDURES	23
STORMCEPTOR OWNER'S MANUAL.....	25

Section 3.0 - Included in October, 2016 Drainage Report

USGS SITE LOCUS MAP	EX-1
AERIAL PHOTO	EX-2
FEMA FLOOD INSURANCE RATE MAP	EX-3

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

Section 4.0 - Revised January 17, 2017

EXISTING HYDROCAD	4.1
PROPOSED HYDROCAD	4.2

Section 5.0 - Revised January 17, 2017

EXISTING WATERSHED PLAN	EWP
PROPOSED WATERSHED PLAN	PWP
PROPOSED DRAINAGE PLAN	C4A-C4B
TEST PIT LOCATION PLAN	TPP

Section 6.0 - Included in October, 2016 Drainage Report, Sections 6.1, 6.2, 6.6 & 6.7 Revised January 17, 2017

SOIL HSG INFORMATION	6.1
TEST PIT LOGS – ALLEN & MAJOR ASSOCIATES.....	6.2
RAINFALL DATA.....	6.3
MANNING’S ROUGHNESS COEFFICIENT TABLE	6.4
WATER QUALITY UNIT #1 SIZING SUMMARY	6.5.1
WATER QUALITY UNIT #2 SIZING SUMMARY	6.5.2
WATER QUALITY UNIT #3 SIZING SUMMARY	6.5.3
STANDARD DEP CALCULATIONS	6.6
STORMWATER PIPE SIZING CHART.....	6.7
ILLICIT DISCHARGE STATEMENT.....	6.8

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

INTRODUCTION

The purpose of this drainage report is to provide an overview of the proposed stormwater management system (SMS) for the proposed site development at #470 Boston Street in Topsfield, MA. The 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 Environment Protection (DEP) stormwater standards, as well as the Town of Topsfield's Stormwater Management Regulations.

The proposed site improvements include construction of 15 condominium-style duplexes consisting of 30 elderly housing units, as well as two common area structures, pedestrian sidewalks, paved drives, landscaped islands, grading, underground utilities, and associated site work. Proposed site improvements also include Best Management Practices (BMP) to effectively handle stormwater runoff from the site.

The proposed Stormwater Management System (SMS) incorporates structural and non-structural BMPs to provide stormwater peak flow mitigation, quality treatment, stormwater infiltration and conveyance. The SMS includes roof drains, drain manholes, underground piping, deep-sump catch basins, proprietary hydro-dynamic separators, infiltration chambers to treat roof runoff, a surface detention/infiltration basin, and a long term Operation and Maintenance Plan.

SITE CATEGORIZATION FOR STORMWATER REGULATIONS

The proposed site improvements at #470 Boston Street are considered a new development under the MA DEP Stormwater Management Standards.

All improvements are considered a "new" development and shall comply with all ten (10) of the MA DEP Stormwater Management Standards. Furthermore, the Town of Topsfield Conservation Commission has eleven (11) Stormwater Standards of their own, which the project will comply with as well.

SITE LOCATION AND ACCESS

The project site is located at #470 Boston Street and is identified on the Town of Topsfield's Assessor's Map #7, Lot #3. The site is a single lot with frontage on Boston Street (Route 1). The site is comprised of 16.32± acres located within both the towns of Topsfield (13.24± acres) and Ipswich (3.08 ± acres), is located approximately 5.0 miles north of the Exit 50 off-ramp from Route 95 Northbound, and is owned by Sarkis Development Company. The site contains approximately 9.45± acres of "upland" area, which are considered buildable areas located outside of flagged bordering vegetated wetland resource areas.

The site has one existing paved access driveway from Boston Street, a public right-of-way 66

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

feet in width, also known as Route 1. This access drive will continue to serve as the primary access point for the development of the parcel. A gated emergency egress drive is proposed to be constructed just south of the existing drive, with access to Boston Street.

WATERSHED

The project site is located within the Ipswich River Watershed. The site primarily drains into surrounding wetlands to the north of the site, with a relatively small amount draining to a wetland along Boston Street.

EXISTING SITE CONDITIONS

The Site consists of approximately 16.32± acres, all of which is located within the Elderly Housing District (EHD) Overlay, known as "Rolling Green Elderly Housing District," per Article 33 of Annual and Special Town Meeting Warrant for fiscal year 2017, from the May 3, 2016 Town Meeting. The lot is currently occupied by a garage with a paved drive and gravel area nearby, as well as grassed meadow areas, a small garden area, vegetated wetlands and treed woodlands.

Southeast of the garage, is an abandoned residential dwelling, which is proposed to be razed. A concrete surface detention structure and associated catch basins and a drain manhole are also located on-site. The parcel is identified as Map #7 Lot #3 on the Town of Topsfield's Assessor's Maps. The surrounding land uses are primarily Business Park District (BP) and Outlying Residential and Agricultural District (ORA).

Areas of Bordering Vegetated Wetlands (BVW) to the southeast of the site were flagged by Seekamp Environmental Consulting on or between June 27 and June 30, 2016. **With the exception of the emergency drive and a 15" outlet pipe mandated by the Town Planning Board and Conservation Commission, respectively, it should be noted that all construction for the project is proposed outside of the 100' wetland buffer. No work is proposed to disturb the existing BVW.**

The majority of the site is comprised of undeveloped meadow and woodland. There is also a large wetland area to the north and a small wetland area abutting Boston Street. An impervious drive and a gravel area outside of the existing garage area slope towards existing catch basins and a drain manhole, which outlet to an existing concrete detention structure located on-site. The site generally slopes from south to north from approximate El. 84+/- at the southwestern property corner to El. 57+/- at the Bordering Vegetated Wetlands (BVW) to the north. See the attached Existing Watershed Plan (EWP) and Aerial Photo (EX-1).

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

Drainage peak flows and volumes were analyzed at three (3) Study Points:

- Study point 1: This point represents flows to the existing wetlands near Boston Street. Runoff from subcatchments areas E-1 and E-2 eventually collect at Study Point 1. Stormwater runoff from E-1 flows over the paved drive, to the existing catch basins within the existing drive, to a drain manhole, where it is eventually routed to an existing concrete surface detention basin. Overflow from the basin flows overland to the existing downgradient wetlands along Boston Street, designated as Study Point 1, where it is recharged to groundwater. Runoff from E-2 flows overland to the wetland area, defined as study point 1.
- Study Point 2 is a large wetland resource area on the northern portion of the site. Runoff from subcatchments areas E-3 flows overland and eventually reaches the wetland area, where it is recharged to groundwater.
- Study Point 3 is a natural on-site depression. Stormwater runoff from sub-catchment area E-4 flows overland, before it is collected at Study Point 3, and recharged to groundwater.

EXISTING SOIL CONDITIONS

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

- 52A (HSG - B/D) - Freetown Muck, 0-3% slopes
- 420B (HSG - A) - Canton Fine Sandy Loam, 3-8% slopes
- 420C (HSG - A) - Canton Fine Sandy Loam, 8-15% slopes
- 421C (HSG - C) - Canton Fine Sandy Loam, 8-15% slopes (Very stony)
- 421D (HSG - C) - Canton Fine Sandy Loam, 15-25% slopes (Very stony)

See the Section 6.1 of the Appendix of this report for a copy of the soil mapping with Hydrological Soil Groups (HSG).

FEMA FLOODPLAIN/ENVIRONMENTAL DUE DILIGENCE

An environmental due diligence was completed by consulting the latest Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) dated July 3, 2012 noted as community panel #25009CO266F (Exhibit 3 - FEMA FIRM). A portion of the project site lies within a 100-year floodplain area (Zone A – Areas subject to inundation by the 1-

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

percent-annual-chance flood, with no Base Flood Elevation (BFE)). No portion of the project site lies within the 500-year floodplain.

A review of the latest Massachusetts Natural Heritage Atlas (13th Edition) reveals that there are no Estimated Habitats, Priority Habitats or Certified Vernal Pools onsite or directly adjacent to the site (Exhibit 4 - Priority & Estimated Habitats). Additionally, the site is not located within any Areas of Critical Environmental Concern (ACEC).

On or between June 27 to June 30, 2016, approximately 1,600± linear feet of Bordering Vegetated Wetland to the north of the site was delineated by Seekamp Environmental Consultants, Inc. (SEC). Approximately 300± linear feet of Bordering Vegetated Wetland to the east of the site was delineated by SEC. In total, approximately, 1,900± linear feet of Bordering Vegetated Wetland were delineated on-site. The BVW and its associated buffer zone (100 ft. State Jurisdictional and Local Buffer) are shown on the plans.

DRAINAGE ANALYSIS METHODOLOGY

Peak rates of runoff were determined using techniques and data found in the following reference materials:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service (SCS), 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 10.00, 2013. 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).
3. Soil Survey of Essex County Massachusetts by United States Department of Agriculture, NRCS. Soil types and boundaries were obtained from this reference.

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 TR-55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD computer program. Furthermore, the analysis has been prepared in accordance with the MA DEP and the Town of Topsfield requirements, as well as standard engineering practices. The peak rates of runoff have been

DRAINAGE REPORT

Elderly Housing Development
Topsfield, MA

A&M Project # 2165-01A
January 17, 2017

estimated for each watershed for the theoretical 2-, 10-, and 25-year storm events.

A surface infiltration basin and subsurface infiltration chambers will receive stormwater directly from the proposed roofs and pretreated impervious site areas (parking lots and driveways). Pretreatment for runoff from paved surfaces is provided by deep sump catch basins and proprietary hydro-dynamic separators which prevents sediment from being deposited into the infiltration systems, inhibiting stormwater treatment. The systems have been designed to mitigate the required recharge and water quality volume generated on the developed surfaces. The systems maintain at least two (2) feet of separation from groundwater and drain down within the required 72 hours.

The HydroCAD storm water runoff model shows that *the proposed site development reduces the overall rate of runoff when the identified points of analysis are combined*. Furthermore, the analysis shows that the overall volume discharged from the site will also be reduced. The following tables provide a summary of the estimated peak rate at each Study Point during each of the design storm events. The HydroCAD worksheets are included in Section 4 of this report.

STUDY POINT #1 (Flow to wetland near Boston Street)

Peak Flows	2-Year	10-Year	25-Year
Existing Runoff (CFS)	0.07	0.58	1.14
Proposed Runoff (CFS)	0.01	0.18	0.45
% REDUCTION	85.7%	69.0%	60.5%

STUDY POINT #1 (Flow to wetland near Boston Street)

Peak Volumes	2-Year	10-Year	25-Year	100-Year
Existing Runoff (AF)	0.05	0.15	0.23	0.34
Proposed Runoff (AF)	0.01	0.07	0.12	0.20
% REDUCTION	80.0%	53.3%	47.8%	41.2%

STUDY POINT #2 (Flow to wetland to northeast of the project site)

Peak Flows	2-Year	10-Year	25-Year
Existing Runoff (CFS)	0.02	0.10	0.56
Proposed Runoff (CFS)	0.00	0.05	0.27
% REDUCTION	100.0%	50.0%	51.8%

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

STUDY POINT #2 (Flow to wetland to northeast of the project site)

Peak Volumes	2-Year	10-Year	25-Year	100-Year
Existing Runoff (AF)	0.00	0.06	0.13	0.25
Proposed Runoff (AF)	0.00	0.03	0.06	0.23
% REDUCTION	0.0%	50.0%	53.8%	8.0%

STUDY POINT #3 (Flow to wetland to northwest of the project site)

Peak Flows	2-Year	10-Year	25-Year
Existing Runoff (CFS)	0.01	0.22	0.79
Proposed Runoff (CFS)	0.00	0.21	0.93
% REDUCTION	100.0%	4.5%	+17.7%*

STUDY POINT #3 (Flow to wetland to northwest of the project site)

Peak Volumes	2-Year	10-Year	25-Year	100-Year
Existing Runoff (AF)	0.005	0.08	0.16	0.30
Proposed Runoff (AF)	0.00	0.07	0.23	0.46
% REDUCTION	100%	12.5%	+43.8%*	+53.3%*

*See total wetland flow and volume calculations below.

TOTAL STUDY POINT PEAK FLOWS (Combined peak flows of SP-1, 2 & 3)

Peak Flows	2-Year	10-Year	25-Year
Existing Runoff (CFS)	0.08	0.82	2.29
Proposed Runoff (CFS)	0.01	0.36	1.33
% REDUCTION	87.5%	56.1%	41.9%

TOTAL STUDY POINT VOLUMES (Combined peak volumes of SP-1, 2 & 3)

Peak Volumes	2-Year	10-Year	25-Year	100-Year
Existing Runoff (AF)	0.06	0.29	0.53	0.89
Proposed Runoff (AF)	0.01	0.16	0.41	0.89
% REDUCTION	83.3%	44.8%	22.6%	0.0%

As described in the tables above, the total existing storm water peak flow and volume directed to the northern wetland area decreases overall in the post-construction watershed, as compared to the pre-construction watershed. The three study points can be considered hydraulically connected and therefore, based on the HydroCAD model, the overall proposed watershed area will not increase in flow and/or volume.

MA DEP STORMWATER PERFORMANCE STANDARDS

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

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 (SMS) meets the standards set forth by the Policy.

Stormwater Best Management Practices (BMPs) implemented in the proposed SMS design include:

- Deep Sump Catch Basins with Hoods
- Surface Infiltration Basin
- Subsurface Infiltration Chambers
- Proprietary Hydro-dynamic Separators

Stormwater BMPs have been incorporated into the design of the project to mitigate the anticipated pollutant loading. Temporary erosion and sedimentation controls will be incorporated during the construction phase of the project. These temporary controls include coir logs and/or silt fence barriers, inlet sediment traps, diversion channels, 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 as follows:

- 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 outfalls with direct discharge to a wetland areas or waters of the Commonwealth of Massachusetts. All discharges will be treated for water quality.

- 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 has been designed such that the post-development peak discharge rates do not exceed the pre-development peak discharge rates. A summary of the existing and proposed discharge rates is included within this document.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

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 has been approximated in the developed condition. Subsurface infiltration chambers and a surface infiltration basin have been designed to meet this requirement. Soil test data can be found in the appendix of this report. The proposed Recharge Volume is based on the Static Method per the MA DEP Stormwater Management Standards, Volume 3, Chapter 1.

The primary on-site soils are classified as follows by the USDA NRSC:

- 52A (HSG - B/D) - Freetown Muck, 0-3% slopes
- 420B (HSG - A) - Canton Fine Sandy Loam, 3-8% slopes
- 420C (HSG - A) - Canton Fine Sandy Loam, 8-15% slopes
- 421C (HSG - C) - Canton Fine Sandy Loam, 8-15% slopes (Very stony)
- 421D (HSG - C) - Canton Fine Sandy Loam, 15-25% slopes (Very stony)

See attached Standard DEP Calculations in the appendix of this report for Recharge Volume and 72-hour drawdown time calculations.

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:*
 - a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
 - b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
 - c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

The proposed stormwater management system has been designed such that the 80% TSS removal standard will be met for each drainage area. Standard #4 is met when

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided 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.

Water quality volume for the developed site will be captured and treated using deep sump catch basins and proprietary hydro-dynamic separators. All systems will be sized to meet the water quality flow rate for the ½” storm event.

The TSS removal efficiencies for the deep sump catch basins and infiltration basin are based on the values assigned under the MA DEP Stormwater handbook. All proprietary separators have been sized using ***water quality discharge flow rate*** and for a minimum TSS removal based on values assigned by the PC version of EPA’s Stormwater Management Model (PCSWMM).

The PCSWMM program was used to size the proprietary separators. Water Quality Units #2 and #3 shall be Stormceptor STC-900 units, which will remove a minimum of 80% of total suspended solids (TSS). Water Quality Unit #1 is sized to be a Stormceptor 450i treatment unit, and in combination with catch basins with deep sumps and hoods as well as Underground Infiltration System #1 with an isolator row wrapped in filter fabric will achieve a minimum of 80% TSS removal. See the MADEP TSS removal worksheets in the Appendix for more data.

Standard #4 also requires that suitable source control measures are identified in the Long Term Pollution Prevention Plan including street sweeping and proper cleaning of the water quality swale, drainage structures (catch basins), and proprietary separators.

See attached Standard DEP Calculations in the appendix of this report for TSS removal and water quality discharge flow rate calculations.

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*

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

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 land use with higher potential pollutant loads (LUHPPL).

- 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 project site does not discharge stormwater within a Zone II and Interim Wellhead Protection Area or near 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 re-development project under the Stormwater Management Handbook guidelines because while there is an existing, abandoned structure, driveway, and garage, the total impervious area for the site will increase.

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

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

(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. A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that 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 and Maintenance (O&M) Plan has been developed for the proposed stormwater management system and can be found within this Drainage Report.

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

There are no expected illicit discharges to the stormwater management system. An Illicit Discharge Compliance Statement is attached in the Appendix of this report.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

TOWN OF TOPSFIELD STORMWATER PERFORMANCE STANDARDS

The Town of Topsfield has also developed their own Stormwater Standards to ensure that the waters within the town are protected.

- 1) Stormwater run-off directed or channeled into any resource area has the potential of degrading or altering that area as a result of pollution conveyed and/or the disposition of silt and sediments into that area. It is presumed that a fully viable resource area is significantly to the interests of the Act and the Bylaw. Therefore, any discharge of any stormwater directed or channeled into a resource area by any new or repaired stormwater management system shall conform to all listed standards contained in the **Massachusetts Stormwater Management Regulations** adopted by the Mass Department of Environmental Protection as they may amended from time to time, hereafter called the Stormwater Regulations, and the provisions of 310 CMR-10.05, paragraphs: (k), (m), (n), (p), and (q), as they may be amended over time. Detailed performance requirements of stormwater management systems constructed in compliance with the above standards are found in the **Massachusetts Stormwater Handbook volumes 1-4**.*

The proposed Stormwater Management System has been designed to meet or exceed all ten (10) of the Massachusetts Stormwater Standards (see section entitled “MA DEP Stormwater Performance Standards”, above.

- 2) Any lot proposed for development, redevelopment, or additional development that borders on or contains any resource area protected by the Act and the Bylaw located in the red zone of the Soils Map or on a drumlin shall demonstrate by engineered design that stormwater runoff from the proposed construction would be retained on-site in either bio-retention ponds, rain gardens, drywells, or similarly functioning low impact features. Where that is proved not to be feasible, the drainage system shall be designed to intercept suspended solids and hydrocarbon pollutants using best management practices (BMP's) in conformance with standard four of the Stormwater Regulations prior to being discharged into the resource area.*

The proposed Stormwater Management System has been designed to meet Standard #4 in the Massachusetts Stormwater Handbook. Subsurface infiltration chambers and an infiltration basin are used to ensure waters are kept on site and charged to groundwater.

- 3) All designs and BMPs managing stormwater runoff shall be sized to accommodate a 100-year storm frequency event without causing erosion or siltation of the retention area.*

The analysis shows the overall volume has been reduced for the 100-year storm and no erosion or scouring will be caused to the retention areas.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

- 4) *During the construction of the proposed development and until such time that the disturbed soil has been stabilized appropriately, erosion and sedimentation control measures shall be installed around the perimeter of the construction site in accordance with standard eight of the Stormwater Regulations. Erosion and sedimentation controls for the proposed construction site shall be approved by the Topsfield Conservation Commission or its designated agent prior to the start of any work onsite. All soils stored at the construction site for greater than 24 hours shall be covered by a waterproof tarpaulin or equivalent rainwater protection.*

A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

- 5) *No snow hauled from parking lots or public ways shall be deposited in any resource area under the jurisdiction of the Topsfield Conservation Commission unless authorized under (permit) conditions deemed necessary by the Topsfield Conservation Commission to protect interests of the Act and the Bylaw.*

Snow storage regulations have been included as part of the O&M Plan. See also the Snow Storage Plan.

- 6) *All stormwater management systems permitted hereunder shall have operations and maintenance plans approved by the Commission in conformance with standard nine of the Stormwater Regulations.*

An Operation and Maintenance (O&M) Plan is included within this drainage report. As part of the O&M Plan, there is an attachment entitled "Snow Disposal Guidance" issued by the MassDEP which outlines appropriate snow disposal methods.

- 7) *Impervious areas such as driveways, patios, and parking lots shall be graded to facilitate stormwater runoff into adjacent grassy swales or catchment areas. No driveway shall be constructed or modified with a pitch such that runoff is directed onto a public road or street. Wherever possible, vegetated drainage swales and rain gardens shall be located to retain stormwater runoff onsite. The Commission encourages the use of pervious pavement materials such as pavers and porous asphalt. For information on porous asphalt contact: National Asphalt Pavement Assoc.*

The proposed Stormwater Management System has been designed such that all stormwater remains on site. Subsurface infiltration chambers and a surface infiltration system infiltration the majority of the sites runoff back to groundwater. However, during intense storm events, the emergency overflow outlets both the subsurface infiltration chambers and the surface infiltration basin outlet to the abutting wetlands to prevent onsite flooding.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

- 8) *As part of new construction and modifications to existing structures, stormwater runoff from all roof drains shall be conveyed into infiltration trenches, drywells, rain gardens, or similar BMPs to facilitate groundwater recharge and protect water quality.*

All proposed roof drains are conveyed to infiltration chambers.

- 9) *Developments or construction in Riverfront Areas or Buffer Zones shall be designed to be in conformance with LID practices.*

The proposed site development is not located within a Riverfront Area and primarily avoids work within the wetland buffer zone, with the exception of the gravel emergency access driveway requested by the Town Planning Board. The access road will primarily be gravel to promote infiltration and an LID practice.

- 10) *As-built plans of stormwater management systems permitted hereunder shall be submitted to the Conservation Commission upon completion of the construction together with a certificate signed by an engineer or professional land surveyor that the system meets the relevant requirements of the Stormwater Regulations. This submission is required at least 14 days prior to the issuance of a Certificate of Compliance by the Commission.*

An as-built plan shall be submitted to the Topsfield Conservation Commission before the issuance of the Certificate of Compliance.

MA DEP CHECKLIST FOR STORMWATER REPORTS

See following pages.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

TOWN OF TOPSFIELD STORMWATER PERFORMANCE STANDARDS

The Town of Topsfield has also developed their own Stormwater Standards to ensure that the waters within the town are protected.

- 1) Stormwater run-off directed or channeled into any resource area has the potential of degrading or altering that area as a result of pollution conveyed and/or the disposition of silt and sediments into that area. It is presumed that a fully viable resource area is significantly to the interests of the Act and the Bylaw. Therefore, any discharge of any stormwater directed or channeled into a resource area by any new or repaired stormwater management system shall conform to all listed standards contained in the **Massachusetts Stormwater Management Regulations** adopted by the Mass Department of Environmental Protection as they may amended from time to time, hereafter called the Stormwater Regulations, and the provisions of 310 CMR-10.05, paragraphs: (k), (m), (n), (p), and (q), as they may be amended over time. Detailed performance requirements of stormwater management systems constructed in compliance with the above standards are found in the **Massachusetts Stormwater Handbook volumes 1-4**.*

The proposed Stormwater Management System has been designed to meet or exceed all ten (10) of the Massachusetts Stormwater Standards (see section entitled “MA DEP Stormwater Performance Standards”, above.

- 2) Any lot proposed for development, redevelopment, or additional development that borders on or contains any resource area protected by the Act and the Bylaw located in the red zone of the Soils Map or on a drumlin shall demonstrate by engineered design that stormwater runoff from the proposed construction would be retained on-site in either bio-retention ponds, rain gardens, drywells, or similarly functioning low impact features. Where that is proved not to be feasible, the drainage system shall be designed to intercept suspended solids and hydrocarbon pollutants using best management practices (BMP's) in conformance with standard four of the Stormwater Regulations prior to being discharged into the resource area.*

The proposed Stormwater Management System has been designed to meet Standard #4 in the Massachusetts Stormwater Handbook. Subsurface infiltration chambers and an infiltration basin are used to ensure waters are kept on site and charged to groundwater.

- 3) All designs and BMPs managing stormwater runoff shall be sized to accommodate a 100-year storm frequency event without causing erosion or siltation of the retention area.*

The analysis shows the overall volume has been reduced for the 100-year storm and no erosion or scouring will be caused to the retention areas.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

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A detailed Erosion and Sedimentation Control Plan is included in the Permit Drawings. The proponent will prepare and submit a Stormwater Pollution Prevention Plan (SWPPP) prior to commencement of construction activities that will result in the disturbance of one acre of land or more.

- 5) *No snow hauled from parking lots or public ways shall be deposited in any resource area under the jurisdiction of the Topsfield Conservation Commission unless authorized under (permit) conditions deemed necessary by the Topsfield Conservation Commission to protect interests of the Act and the Bylaw.*

Snow storage regulations have been included as part of the O&M Plan. See also the Snow Storage Plan.

- 6) *All stormwater management systems permitted hereunder shall have operations and maintenance plans approved by the Commission in conformance with standard nine of the Stormwater Regulations.*

An Operation and Maintenance (O&M) Plan is included within this drainage report. As part of the O&M Plan, there is an attachment entitled "Snow Disposal Guidance" issued by the MassDEP which outlines appropriate snow disposal methods.

- 7) *Impervious areas such as driveways, patios, and parking lots shall be graded to facilitate stormwater runoff into adjacent grassy swales or catchment areas. No driveway shall be constructed or modified with a pitch such that runoff is directed onto a public road or street. Wherever possible, vegetated drainage swales and rain gardens shall be located to retain stormwater runoff onsite. The Commission encourages the use of pervious pavement materials such as pavers and porous asphalt. For information on porous asphalt contact: National Asphalt Pavement Assoc.*

The proposed Stormwater Management System has been designed such that all stormwater remains on site. Subsurface infiltration chambers and a surface infiltration system infiltration the majority of the sites runoff back to groundwater. However, during intense storm events, the emergency overflow outlets both the subsurface infiltration chambers and the surface infiltration basin outlet to the abutting wetlands to prevent onsite flooding.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
January 17, 2017*

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All proposed roof drains are conveyed to infiltration chambers.

- 9) *Developments or construction in Riverfront Areas or Buffer Zones shall be designed to be in conformance with LID practices.*

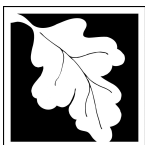
The proposed site development is not located within a Riverfront Area and primarily avoids work within the wetland buffer zone, with the exception of the gravel emergency access driveway requested by the Town Planning Board. The access road will primarily be gravel to promote infiltration and an LID practice.

- 10) *As-built plans of stormwater management systems permitted hereunder shall be submitted to the Conservation Commission upon completion of the construction together with a certificate signed by an engineer or professional land surveyor that the system meets the relevant requirements of the Stormwater Regulations. This submission is required at least 14 days prior to the issuance of a Certificate of Compliance by the Commission.*

An as-built plan shall be submitted to the Topsfield Conservation Commission before the issuance of the Certificate of Compliance.

MA DEP CHECKLIST FOR STORMWATER REPORTS

See following pages.



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 8²
- 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.



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.

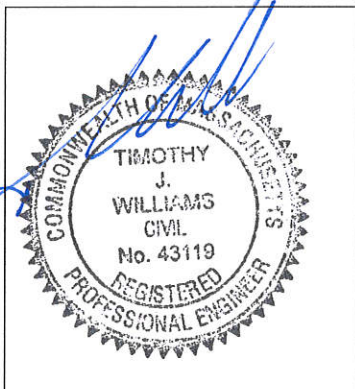
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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




Signature and Date

1/17/17

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 systems, reduced pavement width to 22' wide for onsite roadway, gravel emergency access road versus paved.

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 Field¹
- ☐ 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)

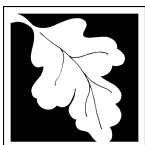
Standard 3: Recharge (continued)

- ☐ 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)

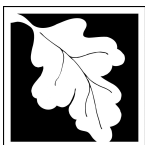
- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☒ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☒ The applicant proposes to use proprietary 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

*Elderly Housing Development
Topsfield, MA*

A&M Project # 2165-01A
October 13, 2016
January 17, 2017

OPERATION AND MAINTENANCE PLAN

In accordance with the standards set forth by the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), Allen & Major Associates, Inc. (A&M) has prepared the following Operation and Maintenance plan for the proposed elderly housing development and drainage improvements at #470 Boston Street (Route 1).

This plan is broken into three major sections. The first section describes construction-related erosion and sedimentation controls (Construction Period). The second section describes the long term pollution prevention measures (Long Term Pollution Prevention Plan). The third section is devoted to a post-development operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long Term Maintenance Plan). An operation and maintenance schedule has been included with this report.

Stormwater Management System Owner: Sarkis Development Company
2 Elm Square
Andover, MA 01810

Emergency Contact Information:

- Sarkis Development Company (Owner) Phone (978) 475-4055
- Allen & Major Associates, Inc. (Site Civil Engineer) Phone (781) 935-6889
- Topsfield Public Works - Water Phone (978) 887-1517
- Topsfield Public Works – Highway Phone (978) 887-1542
- Topsfield Conservation Commission Phone (978) 887-1510
- Topsfield Fire Department (non-emergency line) Phone (978) 887-5148
- DEP Emergency Response (Mass DEP) Phone (888) 304-1133

INTRODUCTION

The stormwater management system (SMS) for this project is owned by Sarkis Development Company, and shall be legally responsible for long-term operation and maintenance for this SMS as outlined in this Operation and Maintenance (O&M) Plan. Should ownership of the SMS change the succeeding owner will be presented with this O&M Plan and supporting attachments at or before legal conveyance of ownership and will assume the obligations of the O&M Plan.

In the event that the SMS will be operated and maintained by an entity other than that listed in this document, the applicant shall provide a plan and easement deed that provides a right of access for the legal entity to be able to perform said operation and maintenance functions. In the event the SMS will serve multiple lots/owners, the applicant shall also provide a copy

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

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 entire SMS.

DEMOLITION & CONSRUCTION MAINTENANCE PLAN

1. Contact the Topsfield Conservation Commission Agent at least three (3) days prior to start of demolition and/or construction activities.
2. Install Erosion Control measures as shown on the Plans prepared by A&M. The Topsfield Conservation agent shall approve the installation of coir logs and silt fencing prior to the start of any site demolition work. Install construction fencing, if determined to be necessary, at the commencement of construction.
3. Install construction entrances, coir logs and silt fence at the locations shown on the Demolition and Erosion Control Plan prepared by A&M.
4. Site access shall be achieved only from the designated construction entrances.
5. Stockpiles of materials subject to erosion shall be stabilized with erosion control matting or temporary seeding whenever practicable, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.
6. Install silt sacks and straw bales around each drain inlet prior to any demolition and or construction activities.
7. All erosion control measures shall be inspected weekly and after every rainfall event. Records of these inspections shall be kept on site for review.
8. All erosion control measures shall be maintained, repaired or replaced as required or at the direction of the owner's engineer or the Town Conservation Agent.
9. Sediment accumulation up-gradient of the straw bales, silt fence, and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.
10. Silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

11. Install stone check dams on site during construction as needed; refer to the erosion control details. Temporary sediment basins combined with stone check dams shall be installed on site during construction to control and collect runoff from upland areas of this site during demolition and construction activities.
12. The contractor shall comply with the Sedimentation and Erosion Control Notes as shown on the Site Development Plans and Specifications.
13. The stabilized construction entrances shall be inspected weekly and records of inspections kept. The entrances shall be maintained by adding additional clean, angular, durable stone to remove the soil from the construction vehicle's tires when exiting the site. If soil is still leaving the site via the construction vehicle tires, adjacent roadways shall be kept clean by street sweeping.
14. Dust pollution shall be controlled using on-site water trucks and or an approved soil stabilization product.
15. During demolition and construction activities, Status Reports on compliance with this O&M Document shall be submitted weekly to the Conservation agent. The report shall document any deficiencies and corrective actions taken by the applicant.

LONG TERM POLLUTION PREVENTION PLAN

Standard #4 from the MA DEP Stormwater Management Handbook requires that a Long Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures for the LTPPP.

○ HOUSEKEEPING

The proposed site development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland area. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

○ STORING OF MATERIALS AND WASTE PRODUCTS

There are no proposed exterior (un-covered) storage areas.. The stormwater drainage system has water quality inlets designed to capture trash and debris.

○ VEHICLE WASHING

The proposed project does not include any designated vehicle washing areas.

○ SPILL PREVENTION AND RESPONSE

Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

1. Spill Hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
4. All spills shall be cleaned up immediately after discovery
5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

LANDSCAPE MAINTENANCE PLAN

○ MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPED AREAS

It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff / landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis.

▪ Fertilizer

Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Both slow-release organic fertilizers and synthetic fertilizers can be used onsite. Fertilization of the planting, lawns and mulch areas will be performed within manufacturers labeling instructions. Examples of some fertilizers options include but is not limited to:

LESCO® 28-0-12 (Lawn Fertilizer)

MERIT® 0.2 Plus Turf Fertilizer

MOMENTUM™ Force Weed & Feed

▪ Landscape Maintenance Program Practices:

◆ Lawn

1. Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
4. Do not remove grass clippings after mowing.
5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

◆ Shrubs

1. Mulch not more than 3" depth with shredded pine or fir bark.
2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
3. Hand prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

◆ Trees

1. Provide aftercare for new tree plantings for the first three years.
2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
3. Water once a week for the first year; twice a month the second, once a month the third year.
4. Prune trees on a four-year cycle.

◆ Invasive Species

1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

○ STORAGE AND USE OF HERBICIDES AND PESTICIDES

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) will be retained who is licensed with the Commonwealth of Massachusetts Executive

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor or structural pests. 333 CMR 13.08.

Before beginning each application, the applicator must inform the conservation commission and post a state and local approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company
2. Date and time of the application;
3. Name and license number of the applicator
4. Target pests
5. Name and EPA Registration Number of pesticide products applied

The notification must be made in writing. The intent is so that individuals, who wish to avoid exposure or want to avoid encountering the applicator, can make necessary arrangements. Applicators are required by law to follow all directions on the pesticide label and must take all steps necessary to avoid applications with people present in a room or area to be treated. Individuals occupying a room or area to be treated at the time of application shall be informed of the procedure. Whenever possible, the applicator should not apply pesticides with anyone present. That may mean treating other areas and returning when occupants have left, asking people to leave the area while the work is being done, or treating before or after people occupy the room. If people do not leave, the applicator must make it clear that he is there to apply pesticides. The applicator will be prepared

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

to provide whatever information possible about the pesticides and techniques used.

○ MANAGEMENT OF DEICING CHEMICALS AND SNOW

It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to Massachusetts DEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations.

The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. The de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. De-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand and salt to the amounts needed for public safety.

POST CONSTRUCTION MAINTENANCE PLAN

The SMS shall be inspected immediately after construction. A maintenance log will be kept (i.e. report) summarizing inspections, maintenance, and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. The log will be made accessible to department staff and a copy provided to the department upon request.

Inspection and Maintenance Frequency and Corrective Measures:

In accordance with MA DEP Stormwater Handbook: Volume 2, Chapter 2; the following areas, facilities, and measures will be inspected and the identified deficiencies will be corrected. Clean-out must include the removal and legal disposal of any accumulated sediments, trash, and debris. In any and all cases, operations, inspections, and maintenance activities shall utilize best practical measures to avoid and minimize impacts to wetland resource areas outside the foot print of the SMS.

Structural Pretreatment BMPs: Regular maintenance of these BMPs is especially critical because they typically receive the highest concentration of suspended solids during the first flush of a storm event.

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

Deep Sump Catch Basins:

Inspect or clean catch basins at least 4 times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four (4) times a year or whenever the depth of the deposits is greater than or equal to open half of the bottom of the invert of the lowest pipe in the basin. Structures will be skimmed of floatable debris at each inspection and if the basin outlet is designed with a hood to trap floatable materials (i.e. Snout), check to ensure watertight seal is working. Clamshell buckets or vacuum trucks are typically used, however, vacuum trucks are preferred.

Proprietary Separators:

Proprietary Separators will be inspected and cleaned out in accordance with the manufacturer's requirements, or at least twice per year. Sediments and debris removed should be disposed of in accordance with all applicable local, state and federal laws and regulations including M.G.L.c. 21C and 310 CMR 30.00.

Cultec Isolator Row:

At a minimum, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observations. However, the isolator row should be inspected at least once a year. A stadia rod should be used during inspection to measure the depth of sediment in the isolator row. Once there is three inches (3") of sediment throughout the bottom of the isolator row, a clean-out should be performed. The isolator row should be cleaned using a JetVac process.

Infiltration BMPs:

Stormwater Infiltration Basin:

The basin must be inspected and preventive maintenance must be performed at least twice a year and after every time drainage discharges through the high outlet orifice. Maintenance of upstream pre-treatment measures is critically important to the function of infiltration BMPs. Pre-treatment BMPs should be inspected for sediment and floatables accumulation and maintained at least twice per year (every other month recommended) and after every major storm event.

Other BMPs and Accessories:

Culverts:

Inspect culverts 2 times per year (preferably in spring and fall) to ensure that the culverts are working in their intended fashion and that they are free of debris. Remove any obstructions to flow; remove accumulated sediments and debris at the inlet, at the outlet, and within the conduit and to repair any erosion damage at the culvert's inlet and outlet.

Surface Infiltration Basin:

DRAINAGE REPORT

*Elderly Housing Development
Topsfield, MA*

*A&M Project # 2165-01A
October 13, 2016
January 17, 2017*

The operation and maintenance plan required must include inspections and preventative maintenance at least twice a year, and after every time drainage discharges through the high outlet orifice. The basin should be inspected after every major storm event for the first few months to ensure it is stabilized and functioning properly. Note how long water remain in the basin after a major storm event; standing water within 48 to 72 hours of an event may indicate the infiltration capacity may have been overestimated.

Thereafter, inspect the infiltration basin at least twice a year. Important items to check include:

- Signs of differential settlement
- Cracking
- Erosion
- Leakage of embankments
- Tree growth on embankments
- Condition of rip-rap
- Sediment accumulation
- The health of the turf

At least twice a year the side slopes, buffer area, and basin bottom need to be mowed. Grass clippings should be removed to prevent an organic, impervious mat from forming.

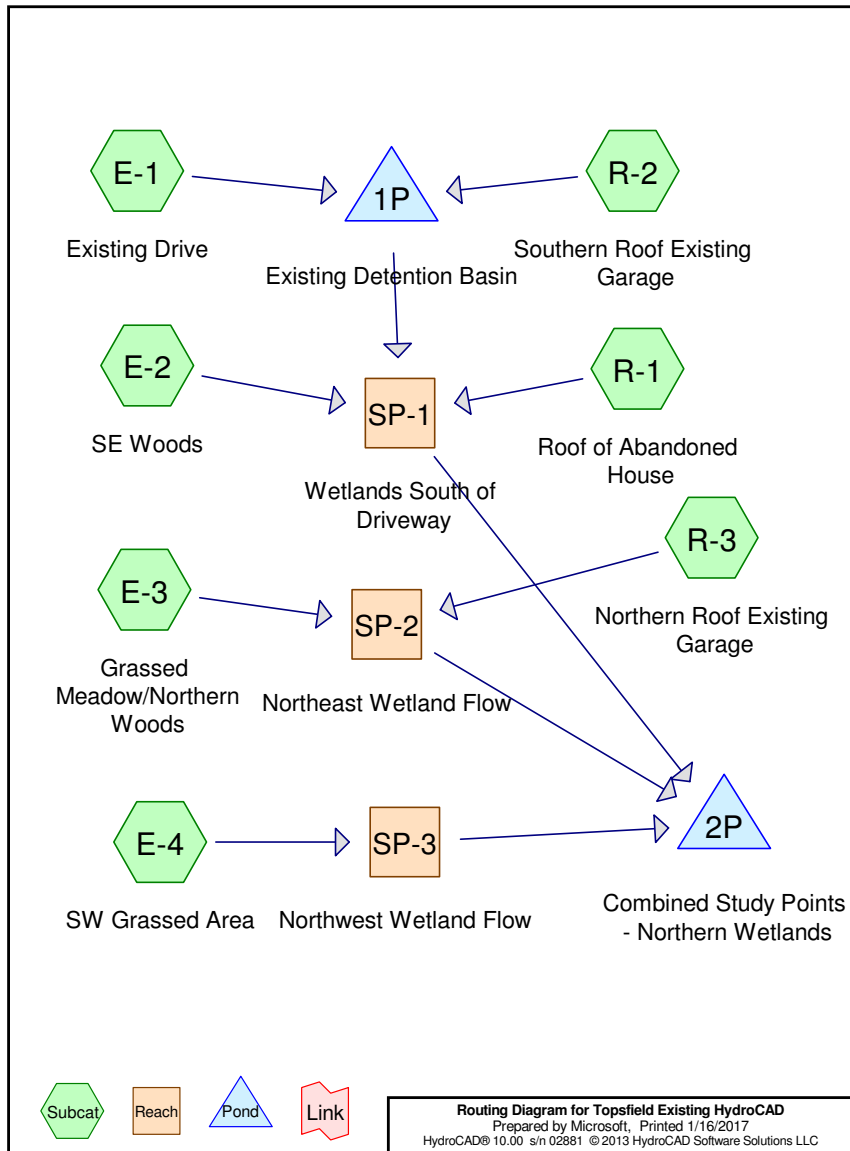
Roadways and Parking Surfaces:

Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring. Accumulations on pavement may be removed by pavement sweeping. Accumulations of sand along road shoulders may be removed by grading excess sand to the pavement edge and removing it manually or by a front-end loader.

Level Spreaders, Check Dams, and Rip-rap:

These accessories will be inspected twice a year for erosion, debris accumulation, and unwanted vegetation. Erosion will be stabilized and sediment, debris, and wood vegetation shall be removed.

Section 4.0 – HydroCAD Reports



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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.186	49	50-75% Grass cover, Fair, HSG A (E-1, E-2)
0.059	79	50-75% Grass cover, Fair, HSG C (E-1, E-2)
3.887	39	>75% Grass cover, Good, HSG A (E-3, E-4)
0.872	74	>75% Grass cover, Good, HSG C (E-3, E-4)
0.094	96	Gravel surface, HSG A (E-1)
0.320	98	Paved parking, HSG A (E-1)
0.026	98	Roofs, HSG A (R-1, R-3)
0.081	98	Unconnected pavement, HSG A (E-2)
0.008	98	Unconnected roofs, HSG A (R-2)
3.217	30	Woods, Good, HSG A (E-1, E-2, E-3, E-4)
0.315	55	Woods, Good, HSG B (E-3)
0.803	70	Woods, Good, HSG C (E-1, E-2, E-3, E-4)
0.140	77	Woods, Good, HSG D (E-2)
10.008	46	TOTAL AREA

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Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
7.819	HSG A	E-1, E-2, E-3, E-4, R-1, R-2, R-3
0.315	HSG B	E-3
1.734	HSG C	E-1, E-2, E-3, E-4
0.140	HSG D	E-2
0.000	Other	
10.008		TOTAL AREA

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.186	0.000	0.059	0.000	0.000	0.244	50-75% Grass cover, Fair	E-1, E-2
3.887	0.000	0.872	0.000	0.000	4.759	>75% Grass cover, Good	E-3, E-4
0.094	0.000	0.000	0.000	0.000	0.094	Gravel surface	E-1
0.320	0.000	0.000	0.000	0.000	0.320	Paved parking	E-1
0.026	0.000	0.000	0.000	0.000	0.026	Roofs	R-1, R-3
0.081	0.000	0.000	0.000	0.000	0.081	Unconnected pavement	E-2
0.008	0.000	0.000	0.000	0.000	0.008	Unconnected roofs	R-2
3.217	0.315	0.803	0.140	0.000	4.474	Woods, Good	E-1, E-2, E-3, E-4
7.819	0.315	1.734	0.140	0.000	10.008	TOTAL AREA	

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Page 5

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	E-1	0.00	0.00	25.0	0.0100	0.015	12.0	0.0	0.0

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 6

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: Existing DriveRunoff Area=22,922 sf 60.86% Impervious Runoff Depth>2.16"
Flow Length=444' Tc=10.2 min CN=91 Runoff=1.15 cfs 0.095 af**Subcatchment E-2: SE Woods**Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>0.17"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=0.05 cfs 0.016 af**Subcatchment E-3: Grassed Meadow/Northern**Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.00"
Flow Length=465' Tc=12.3 min CN=41 Runoff=0.00 cfs 0.001 af**Subcatchment E-4: SW Grassed Area**Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.01"
Flow Length=622' Tc=15.7 min CN=43 Runoff=0.01 cfs 0.005 af**Subcatchment R-1: Roof of Abandoned House**Runoff Area=787 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af**Subcatchment R-2: Southern Roof Existing**Runoff Area=346 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.02 cfs 0.002 af**Subcatchment R-3: Northern Roof Existing**Runoff Area=346 sf 100.00% Impervious Runoff Depth>2.87"
Tc=6.0 min CN=98 Runoff=0.02 cfs 0.002 af**Reach SP-1: Wetlands South of Driveway**Inflow=0.07 cfs 0.049 af
Outflow=0.07 cfs 0.049 af**Reach SP-2: Northeast Wetland Flow**Inflow=0.02 cfs 0.003 af
Outflow=0.02 cfs 0.003 af**Reach SP-3: Northwest Wetland Flow**Inflow=0.01 cfs 0.005 af
Outflow=0.01 cfs 0.005 af**Pond 1P: Existing Detention Basin**Peak Elev=58.23' Storage=3,183 cf Inflow=1.16 cfs 0.097 af
Outflow=0.05 cfs 0.028 af**Pond 2P: Combined Study Points - Northern Wetlands**Inflow=0.08 cfs 0.057 af
Primary=0.08 cfs 0.057 af**Total Runoff Area = 10.008 ac Runoff Volume = 0.125 af Average Runoff Depth = 0.15"**
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 7

Summary for Subcatchment E-1: Existing Drive

Runoff = 1.15 cfs @ 12.14 hrs, Volume= 0.095 af, Depth> 2.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		Shallow Concentrated Flow, C-D
					Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		Shallow Concentrated Flow, D-E
					Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		Shallow Concentrated Flow, E-F
					Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	Pipe Channel, F-G
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

Topsfield Existing HydroCAD

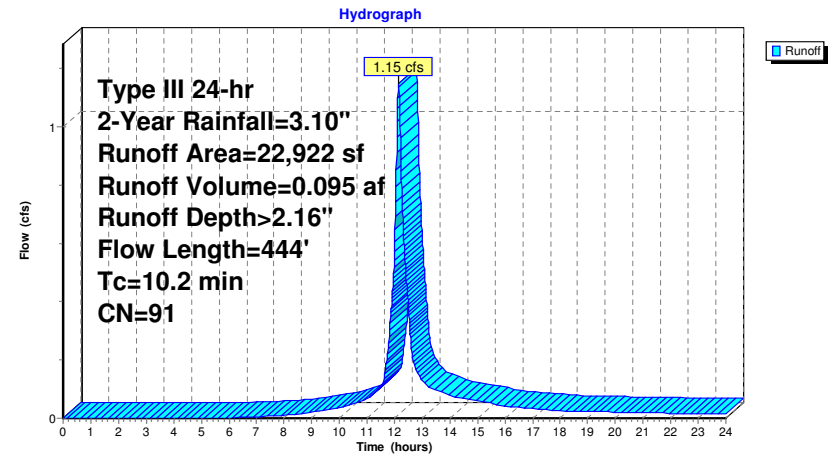
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Type III 24-hr 2-Year Rainfall=3.10"

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Page 8

Subcatchment E-1: Existing Drive

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 9

Summary for Subcatchment E-2: SE Woods

Runoff = 0.05 cfs @ 12.49 hrs, Volume= 0.016 af, Depth> 0.17"

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=3.10"

Area (sf)	CN	Adj	Description
3,550	98		Unconnected pavement, HSG A
7,582	49		50-75% Grass cover, Fair, HSG A
1,887	79		50-75% Grass cover, Fair, HSG C
18,787	30		Woods, Good, HSG A
11,389	70		Woods, Good, HSG C
6,083	77		Woods, Good, HSG D
49,278	55	53	Weighted Average, UI Adjusted
45,728			92.80% Pervious Area
3,550			7.20% Impervious Area
3,550			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
0.8	75	0.0930	1.52		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.4	35	0.0430	1.45		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
4.5	260	0.0370	0.96		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
12.0	420	Total			

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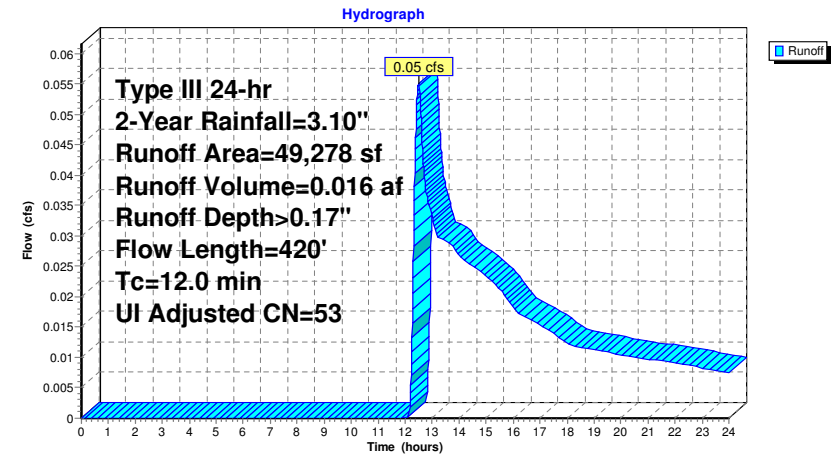
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Type III 24-hr 2-Year Rainfall=3.10"

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Page 10

Subcatchment E-2: SE Woods

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 11

Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

[73] Warning: Peak may fall outside time span

Runoff = 0.00 cfs @ 23.82 hrs, Volume= 0.001 af, Depth> 0.00"

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=3.10"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		Shallow Concentrated Flow, C-D
					Woodland Kv= 5.0 fps
12.3	465				Total

Topsfield Existing HydroCAD

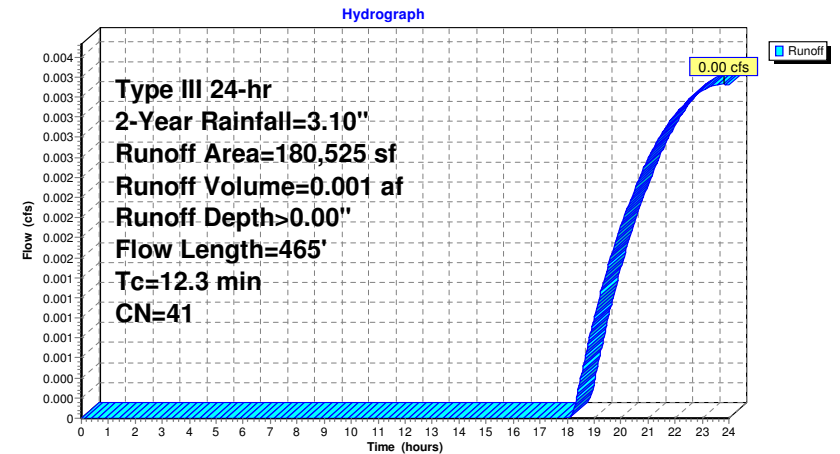
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Type III 24-hr 2-Year Rainfall=3.10"

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Page 12

Subcatchment E-3: Grassed Meadow/Northern Woods

Topsfield Existing HydroCAD

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 13

Summary for Subcatchment E-4: SW Grassed Area

Runoff = 0.01 cfs @ 21.44 hrs, Volume= 0.005 af, Depth> 0.01"

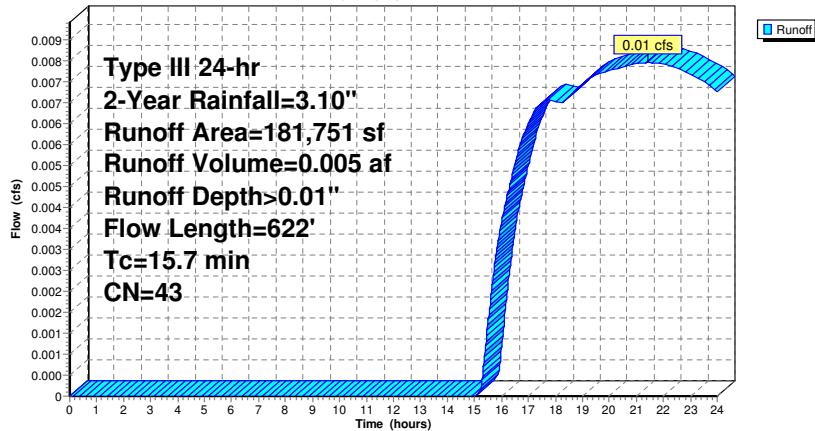
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
15.7	622				Total

Subcatchment E-4: SW Grassed Area

Hydrograph



Topsfield Existing HydroCAD

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 14

Summary for Subcatchment R-1: Roof of Abandoned House

Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 2.87"

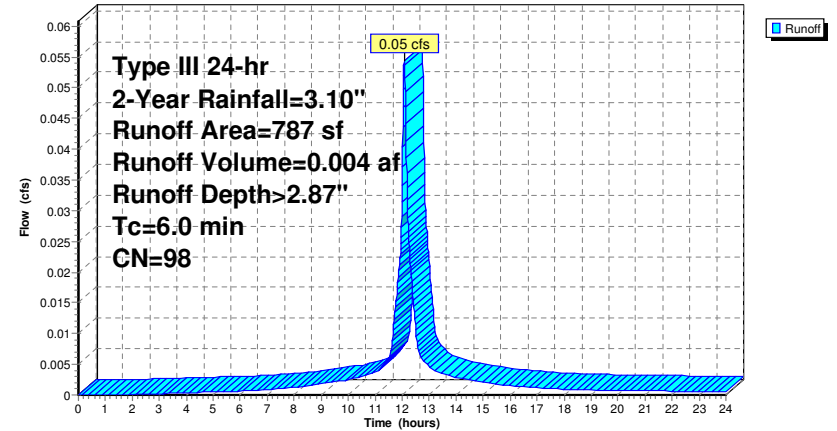
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House

Hydrograph



Summary for Subcatchment R-2: Southern Roof Existing Garage

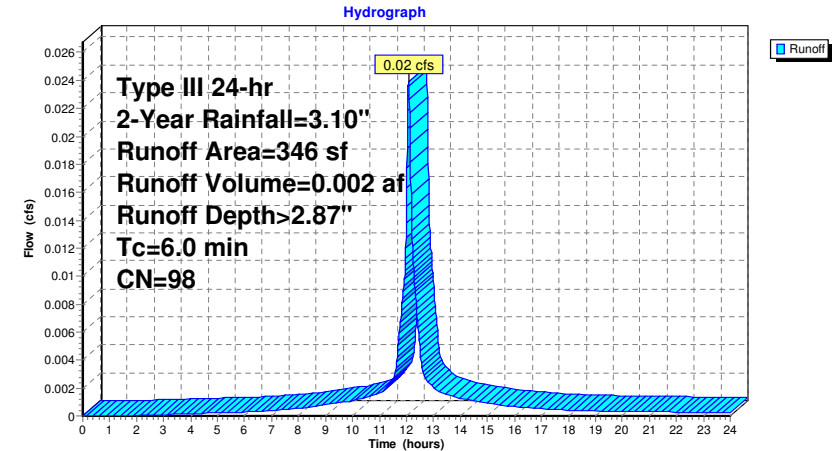
Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

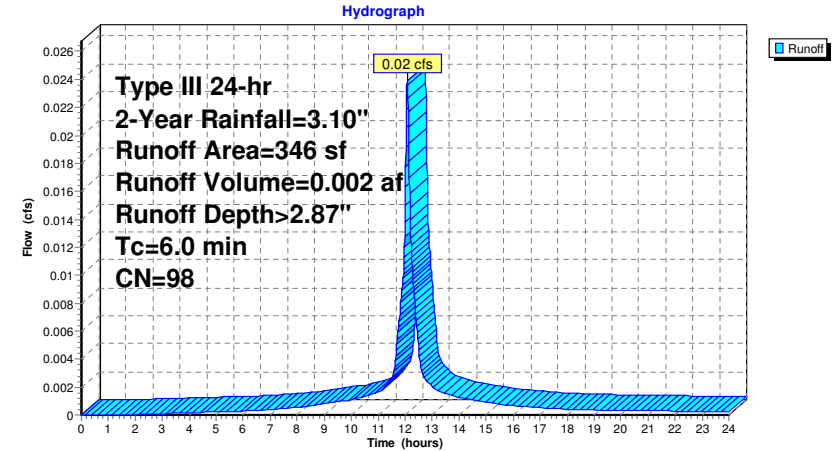
Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.002 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage

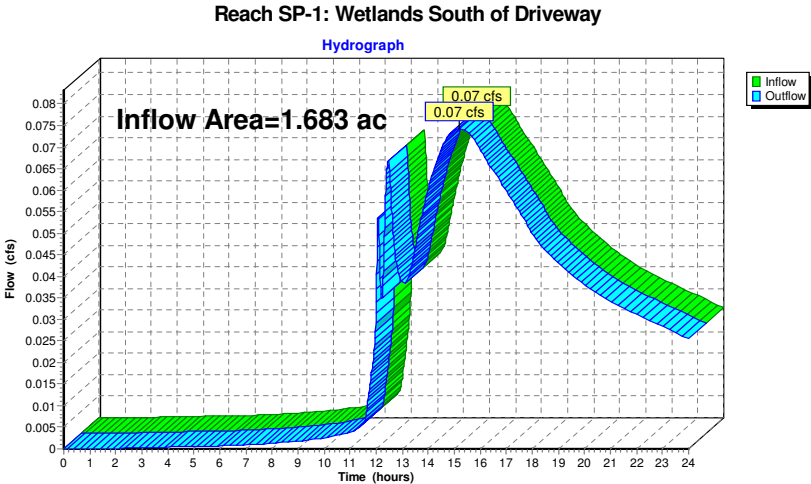


Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 0.35" for 2-Year event
Inflow = 0.07 cfs @ 15.19 hrs, Volume= 0.049 af
Outflow = 0.07 cfs @ 15.19 hrs, Volume= 0.049 af, Atten= 0%, Lag= 0.0 min

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

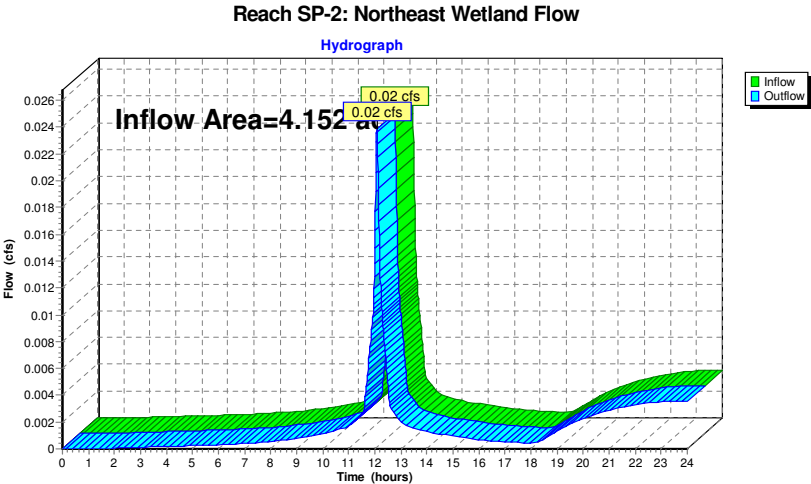


Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.152 ac, 0.19% Impervious, Inflow Depth > 0.01" for 2-Year event
Inflow = 0.02 cfs @ 12.08 hrs, Volume= 0.003 af
Outflow = 0.02 cfs @ 12.08 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

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



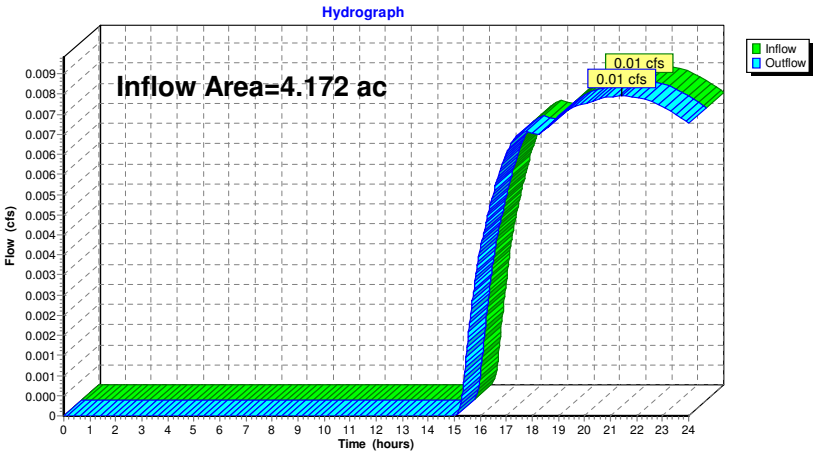
Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.172 ac, 0.00% Impervious, Inflow Depth > 0.01" for 2-Year event
Inflow = 0.01 cfs @ 21.44 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 21.44 hrs, Volume= 0.005 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: Northwest Wetland Flow



Summary for Pond 1P: Existing Detention Basin

Inflow Area = 0.534 ac, 61.44% Impervious, Inflow Depth > 2.17" for 2-Year event
Inflow = 1.16 cfs @ 12.14 hrs, Volume= 0.097 af
Outflow = 0.05 cfs @ 15.56 hrs, Volume= 0.028 af, Atten= 96%, Lag= 205.6 min
Primary = 0.05 cfs @ 15.56 hrs, Volume= 0.028 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.23' @ 15.56 hrs Surf.Area= 3,090 sf Storage= 3,183 cf

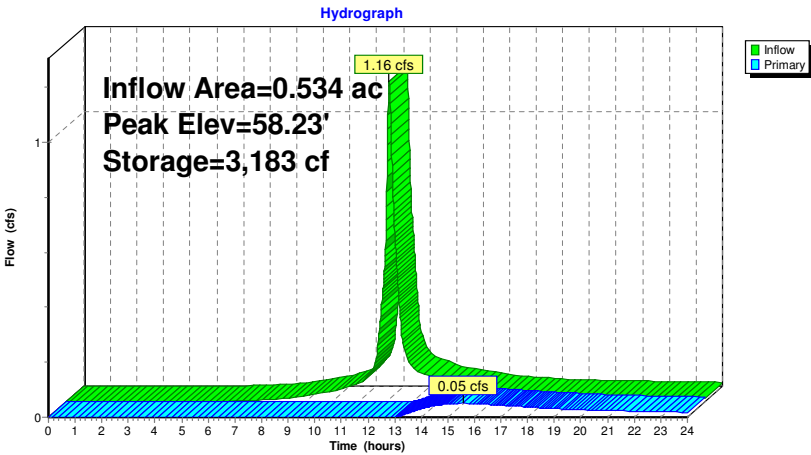
Plug-Flow detention time= 409.2 min calculated for 0.028 af (29% of inflow)
Center-of-Mass det. time= 270.3 min (1,075.8 - 805.5)

Volume	Invert	Avail.Storage	Storage Description	
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
57.20	3,090	0	0	
58.00	3,090	2,472	2,472	
59.00	3,090	3,090	5,562	
59.40	3,550	1,328	6,890	
60.00	3,550	2,130	9,020	

Device	Routing	Invert	Outlet Devices	
#1	Primary	58.08'	4.0" Vert. Orifice/Grate	C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate	C= 0.600

Primary OutFlow Max=0.05 cfs @ 15.56 hrs HW=58.23' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.05 cfs @ 1.32 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 1P: Existing Detention Basin



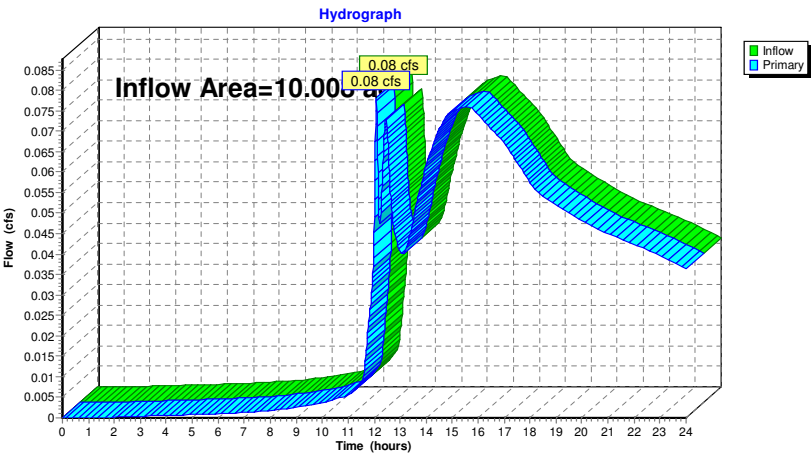
Summary for Pond 2P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.008 ac, 4.35% Impervious, Inflow Depth > 0.07" for 2-Year event
Inflow = 0.08 cfs @ 12.08 hrs, Volume= 0.057 af
Primary = 0.08 cfs @ 12.08 hrs, Volume= 0.057 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Combined Study Points - Northern Wetlands



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 23

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: Existing Drive

Runoff Area=22,922 sf 60.86% Impervious Runoff Depth>3.49"
Flow Length=444' Tc=10.2 min CN=91 Runoff=1.81 cfs 0.153 af

Subcatchment E-2: SE Woods

Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>0.64"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=0.44 cfs 0.060 af

Subcatchment E-3: Grassed Meadow/Northern

Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.16"
Flow Length=465' Tc=12.3 min CN=41 Runoff=0.10 cfs 0.056 af

Subcatchment E-4: SW Grassed Area

Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.22"
Flow Length=622' Tc=15.7 min CN=43 Runoff=0.22 cfs 0.078 af

Subcatchment R-1: Roof of Abandoned House

Runoff Area=787 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.08 cfs 0.006 af

Subcatchment R-2: Southern Roof Existing

Runoff Area=346 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.03 cfs 0.003 af

Subcatchment R-3: Northern Roof Existing

Runoff Area=346 sf 100.00% Impervious Runoff Depth>4.26"
Tc=6.0 min CN=98 Runoff=0.03 cfs 0.003 af

Reach SP-1: Wetlands South of Driveway

Inflow=0.58 cfs 0.153 af
Outflow=0.58 cfs 0.153 af

Reach SP-2: Northeast Wetland Flow

Inflow=0.10 cfs 0.059 af
Outflow=0.10 cfs 0.059 af

Reach SP-3: Northwest Wetland Flow

Inflow=0.22 cfs 0.078 af
Outflow=0.22 cfs 0.078 af

Pond 1P: Existing Detention Basin

Peak Elev=58.52' Storage=4,084 cf Inflow=1.84 cfs 0.156 af
Outflow=0.22 cfs 0.086 af

Pond 2P: Combined Study Points - Northern Wetlands

Inflow=0.82 cfs 0.290 af
Primary=0.82 cfs 0.290 af

Total Runoff Area = 10.008 ac Runoff Volume = 0.360 af Average Runoff Depth = 0.43"
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 24

Summary for Subcatchment E-1: Existing Drive

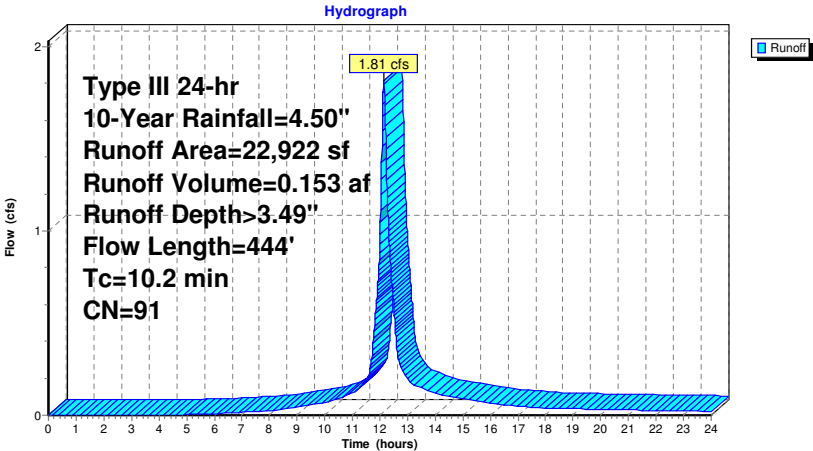
Runoff = 1.81 cfs @ 12.14 hrs, Volume= 0.153 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		Shallow Concentrated Flow, C-D
					Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		Shallow Concentrated Flow, D-E
					Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		Shallow Concentrated Flow, E-F
					Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	Pipe Channel, F-G
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

Subcatchment E-1: Existing Drive



Summary for Subcatchment E-2: SE Woods

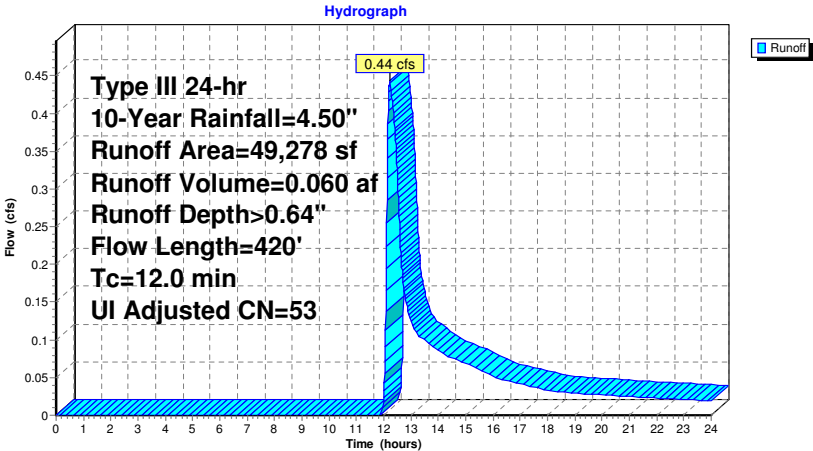
Runoff = 0.44 cfs @ 12.23 hrs, Volume= 0.060 af, Depth> 0.64"

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=4.50"

Area (sf)	CN	Adj	Description
3,550	98		Unconnected pavement, HSG A
7,582	49		50-75% Grass cover, Fair, HSG A
1,887	79		50-75% Grass cover, Fair, HSG C
18,787	30		Woods, Good, HSG A
11,389	70		Woods, Good, HSG C
6,083	77		Woods, Good, HSG D
49,278	55	53	Weighted Average, UI Adjusted
45,728			92.80% Pervious Area
3,550			7.20% Impervious Area
3,550			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.1100	0.13		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
0.8	75	0.0930	1.52		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
0.4	35	0.0430	1.45		Shallow Concentrated Flow, C-D Short Grass Pasture Kv= 7.0 fps
4.5	260	0.0370	0.96		Shallow Concentrated Flow, D-E Woodland Kv= 5.0 fps
12.0	420	Total			

Subcatchment E-2: SE Woods



Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

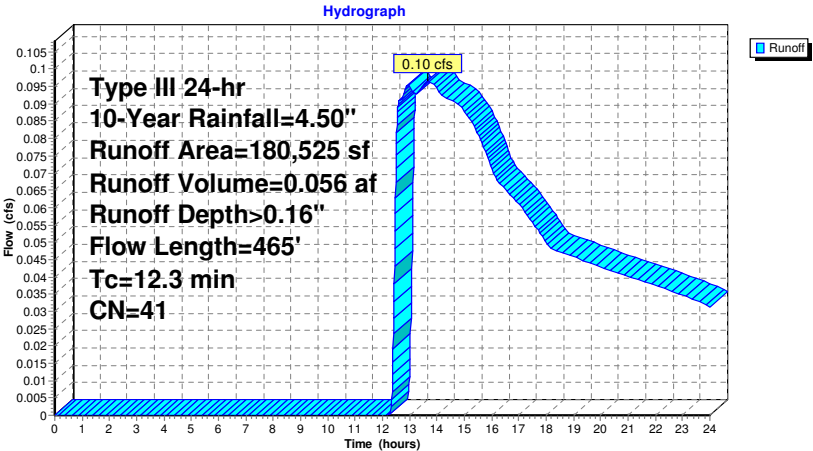
Runoff = 0.10 cfs @ 13.68 hrs, Volume= 0.056 af, Depth> 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
12.3	465	Total			

Subcatchment E-3: Grassed Meadow/Northern Woods



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 29

Summary for Subcatchment E-4: SW Grassed Area

Runoff = 0.22 cfs @ 12.57 hrs, Volume= 0.078 af, Depth> 0.22"

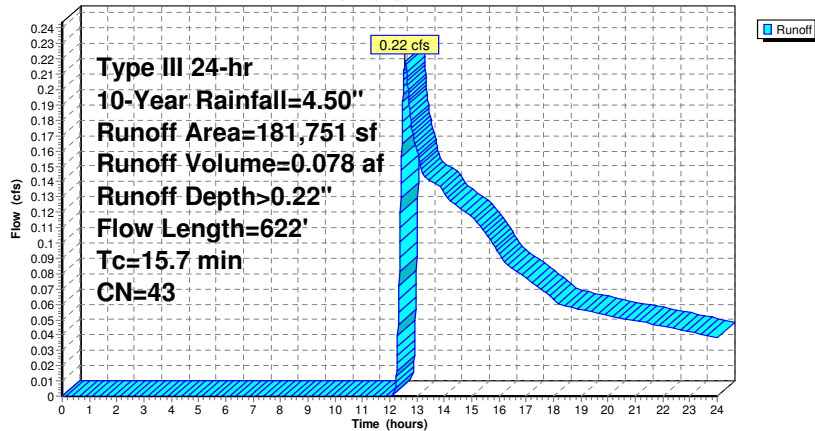
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
15.7	622				Total

Subcatchment E-4: SW Grassed Area

Hydrograph

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 30

Summary for Subcatchment R-1: Roof of Abandoned House

Runoff = 0.08 cfs @ 12.08 hrs, Volume= 0.006 af, Depth> 4.26"

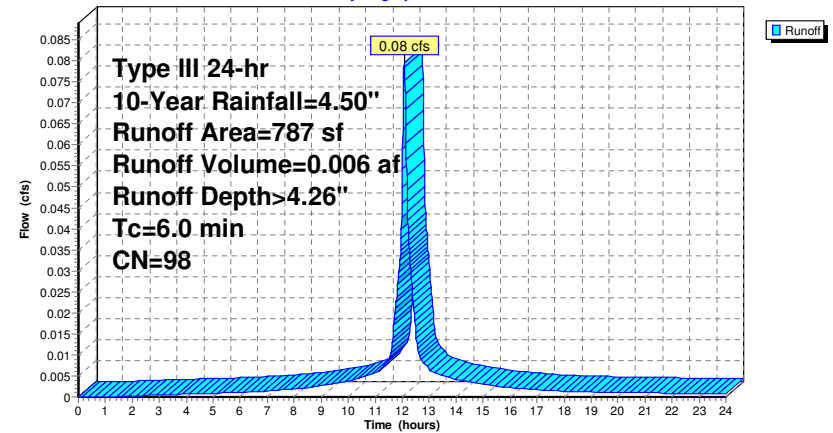
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House

Hydrograph



Summary for Subcatchment R-2: Southern Roof Existing Garage

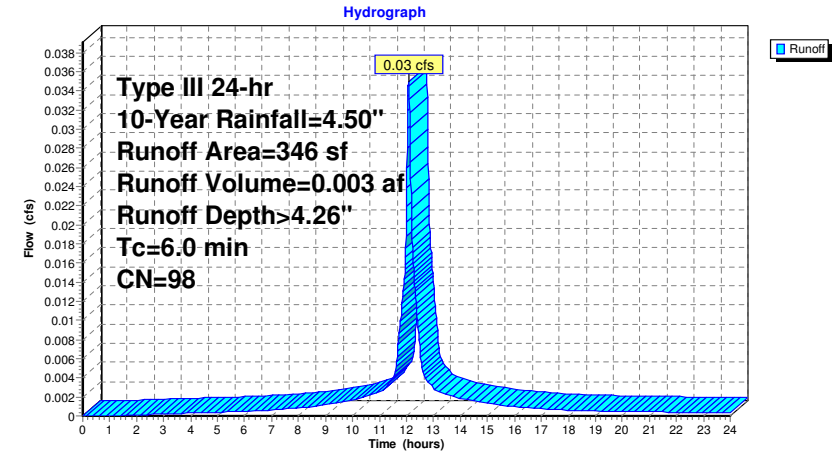
Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

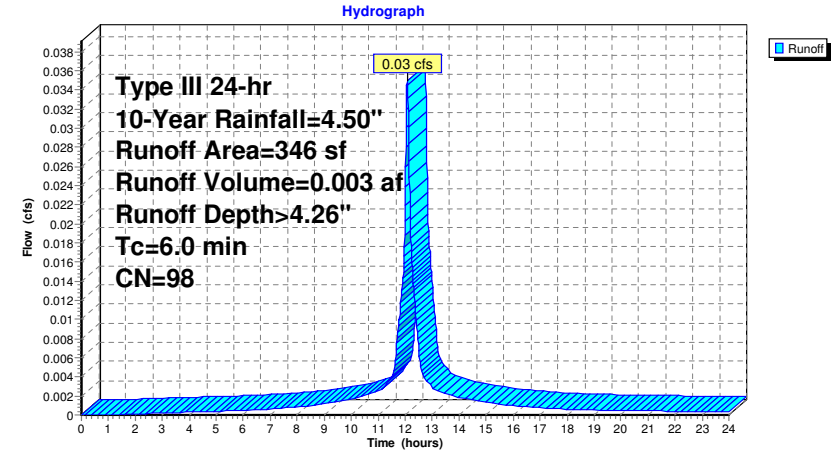
Runoff = 0.03 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage



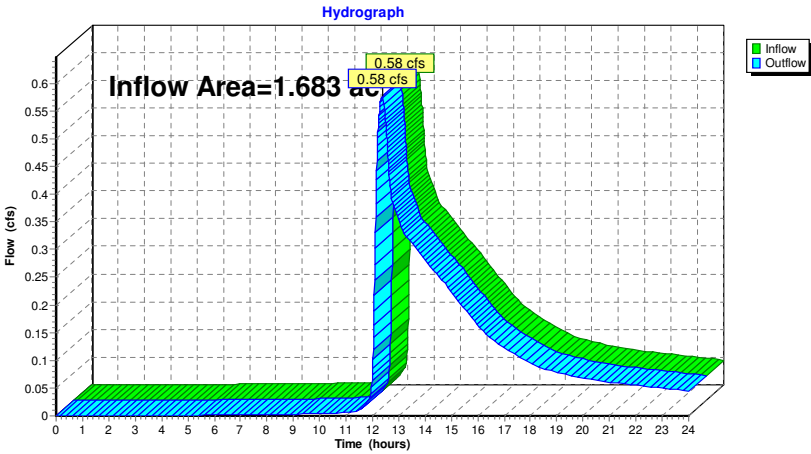
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 1.09" for 10-Year event
Inflow = 0.58 cfs @ 12.36 hrs, Volume= 0.153 af
Outflow = 0.58 cfs @ 12.36 hrs, Volume= 0.153 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: Wetlands South of Driveway



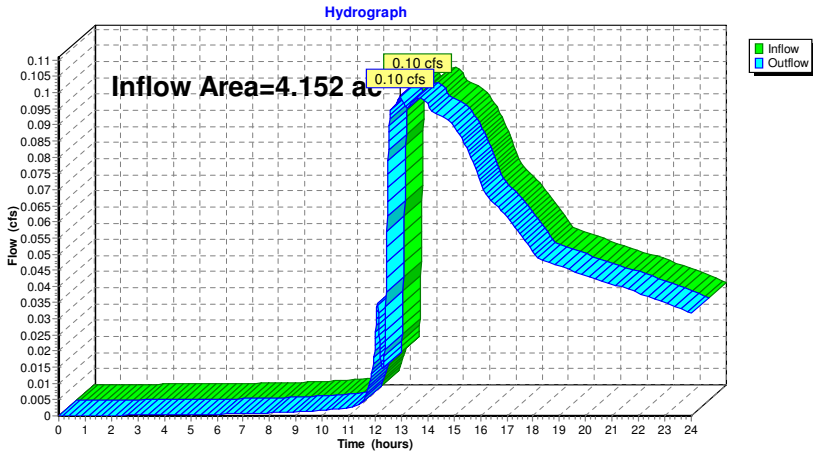
Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.152 ac, 0.19% Impervious, Inflow Depth > 0.17" for 10-Year event
Inflow = 0.10 cfs @ 12.94 hrs, Volume= 0.059 af
Outflow = 0.10 cfs @ 12.94 hrs, Volume= 0.059 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: Northeast Wetland Flow



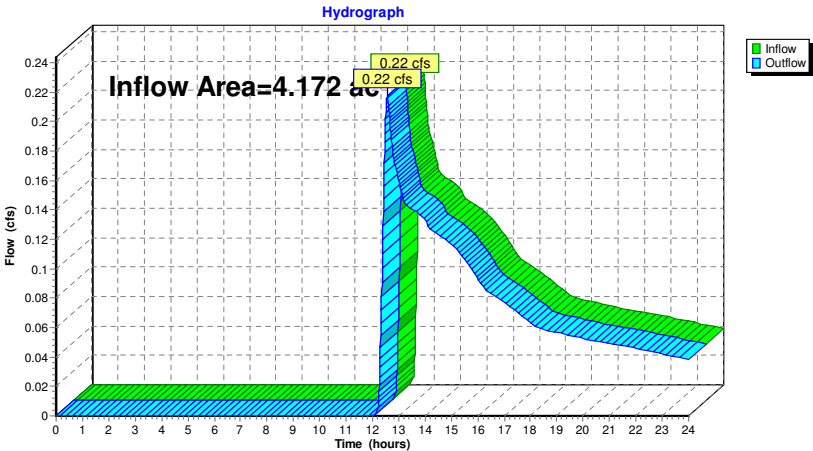
Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.172 ac, 0.00% Impervious, Inflow Depth > 0.22" for 10-Year event
Inflow = 0.22 cfs @ 12.57 hrs, Volume= 0.078 af
Outflow = 0.22 cfs @ 12.57 hrs, Volume= 0.078 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: Northwest Wetland Flow



Summary for Pond 1P: Existing Detention Basin

Inflow Area = 0.534 ac, 61.44% Impervious, Inflow Depth > 3.50" for 10-Year event
Inflow = 1.84 cfs @ 12.14 hrs, Volume= 0.156 af
Outflow = 0.22 cfs @ 12.91 hrs, Volume= 0.086 af, Atten= 88%, Lag= 46.1 min
Primary = 0.22 cfs @ 12.91 hrs, Volume= 0.086 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.52' @ 12.91 hrs Surf.Area= 3,090 sf Storage= 4,084 cf

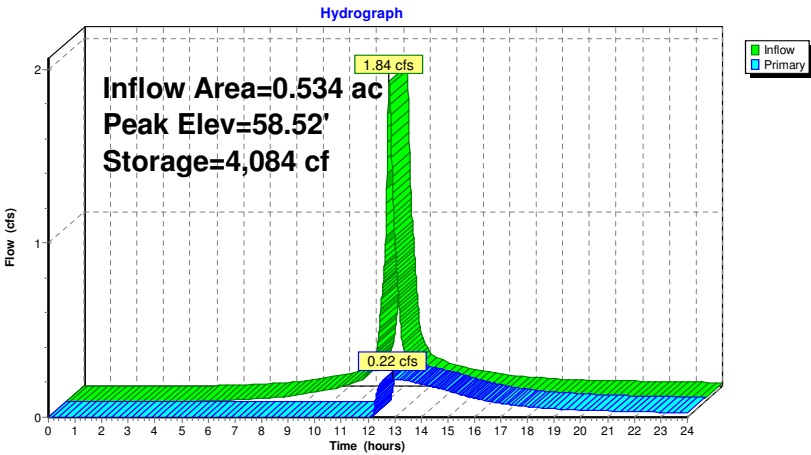
Plug-Flow detention time= 265.0 min calculated for 0.086 af (55% of inflow)
Center-of-Mass det. time= 157.9 min (950.3 - 792.4)

Volume	Invert	Avail.Storage	Storage Description	
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
57.20	3,090	0	0	
58.00	3,090	2,472	2,472	
59.00	3,090	3,090	5,562	
59.40	3,550	1,328	6,890	
60.00	3,550	2,130	9,020	

Device	Routing	Invert	Outlet Devices	
#1	Primary	58.08'	4.0" Vert. Orifice/Grate	C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate	C= 0.600

Primary OutFlow Max=0.22 cfs @ 12.91 hrs HW=58.52' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.22 cfs @ 2.53 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond 1P: Existing Detention Basin



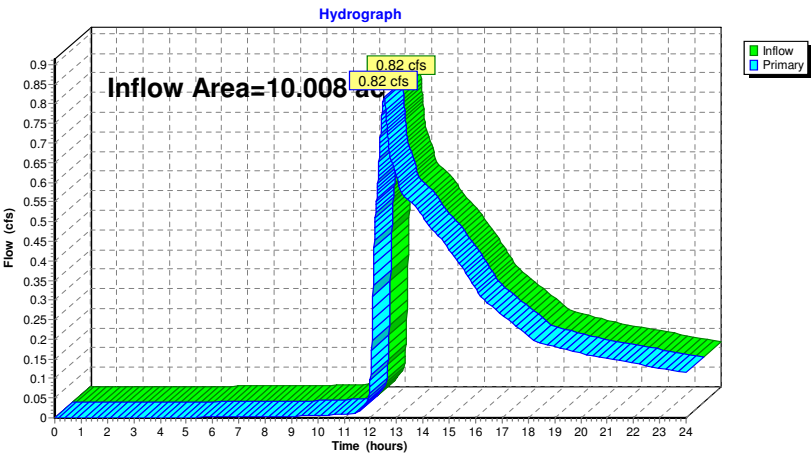
Summary for Pond 2P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.008 ac, 4.35% Impervious, Inflow Depth > 0.35" for 10-Year event
Inflow = 0.82 cfs @ 12.51 hrs, Volume= 0.290 af
Primary = 0.82 cfs @ 12.51 hrs, Volume= 0.290 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Combined Study Points - Northern Wetlands



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Type III 24-hr 25-Year Rainfall=5.40"

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Page 39

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: Existing Drive

Runoff Area=22,922 sf 60.86% Impervious Runoff Depth>4.36"
Flow Length=444' Tc=10.2 min CN=91 Runoff=2.24 cfs 0.191 af

Subcatchment E-2: SE Woods

Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>1.05"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=0.90 cfs 0.099 af

Subcatchment E-3: Grassed Meadow/Northern

Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.37"
Flow Length=465' Tc=12.3 min CN=41 Runoff=0.55 cfs 0.129 af

Subcatchment E-4: SW Grassed Area

Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.47"
Flow Length=622' Tc=15.7 min CN=43 Runoff=0.79 cfs 0.163 af

Subcatchment R-1: Roof of Abandoned House

Runoff Area=787 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.10 cfs 0.008 af

Subcatchment R-2: Southern Roof Existing

Runoff Area=346 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.04 cfs 0.003 af

Subcatchment R-3: Northern Roof Existing

Runoff Area=346 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.04 cfs 0.003 af

Reach SP-1: Wetlands South of Driveway

Inflow=1.14 cfs 0.231 af
Outflow=1.14 cfs 0.231 af

Reach SP-2: Northeast Wetland Flow

Inflow=0.56 cfs 0.132 af
Outflow=0.56 cfs 0.132 af

Reach SP-3: Northwest Wetland Flow

Inflow=0.79 cfs 0.163 af
Outflow=0.79 cfs 0.163 af

Pond 1P: Existing Detention Basin

Peak Elev=58.81' Storage=4,979 cf Inflow=2.27 cfs 0.195 af
Outflow=0.32 cfs 0.124 af

Pond 2P: Combined Study Points - Northern Wetlands

Inflow=2.29 cfs 0.526 af
Primary=2.29 cfs 0.526 af

Total Runoff Area = 10.008 ac Runoff Volume = 0.597 af Average Runoff Depth = 0.72"
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 40

Summary for Subcatchment E-1: Existing Drive

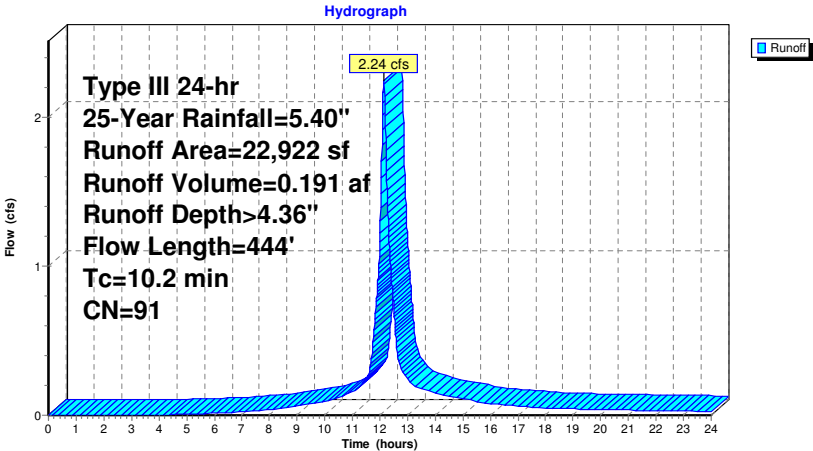
Runoff = 2.24 cfs @ 12.14 hrs, Volume= 0.191 af, Depth> 4.36"

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=5.40"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		Shallow Concentrated Flow, C-D
					Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		Shallow Concentrated Flow, D-E
					Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		Shallow Concentrated Flow, E-F
					Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	Pipe Channel, F-G
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

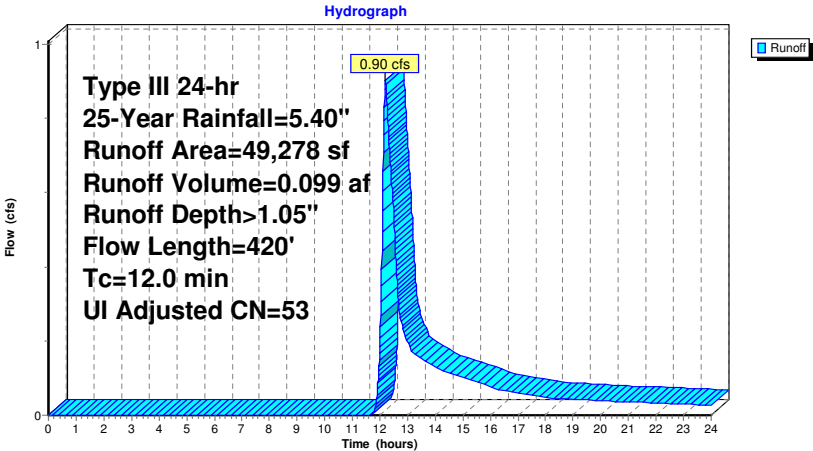
Subcatchment E-1: Existing Drive



Summary for Subcatchment E-2: SE Woods

Runoff	=	0.90 cfs @ 12.20 hrs	Volume=	0.099 af	Depth>	1.05"
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=5.40"						
Area (sf)	CN	Adj	Description			
3,550	98		Unconnected pavement, HSG A			
7,582	49		50-75% Grass cover, Fair, HSG A			
1,887	79		50-75% Grass cover, Fair, HSG C			
18,787	30		Woods, Good, HSG A			
11,389	70		Woods, Good, HSG C			
6,083	77		Woods, Good, HSG D			
49,278	55	53	Weighted Average, UI Adjusted			
45,728			92.80% Pervious Area			
3,550			7.20% Impervious Area			
3,550			100.00% Unconnected			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
6.3	50	0.1100	0.13		Sheet Flow, A-B	
					Woods: Light underbrush n= 0.400 P2= 3.10"	
0.8	75	0.0930	1.52		Shallow Concentrated Flow, B-C	
					Woodland Kv= 5.0 fps	
0.4	35	0.0430	1.45		Shallow Concentrated Flow, C-D	
					Short Grass Pasture Kv= 7.0 fps	
4.5	260	0.0370	0.96		Shallow Concentrated Flow, D-E	
					Woodland Kv= 5.0 fps	
12.0	420	Total				

Subcatchment E-2: SE Woods



Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

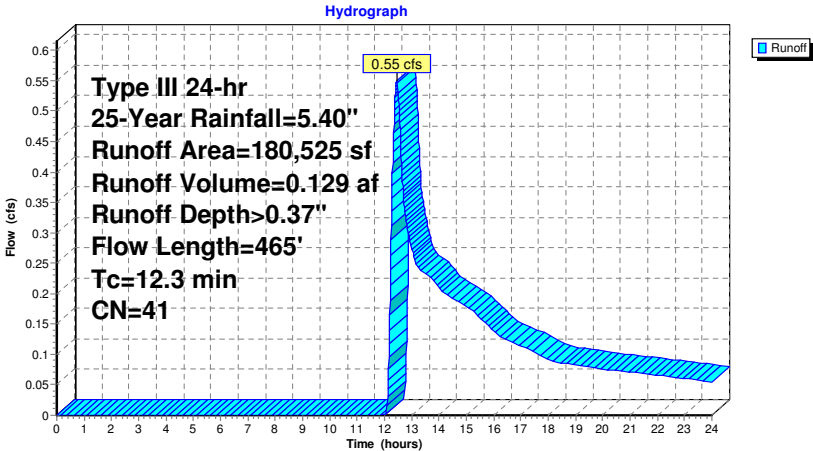
Runoff = 0.55 cfs @ 12.45 hrs, Volume= 0.129 af, Depth> 0.37"

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=5.40"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
12.3	465	Total			

Subcatchment E-3: Grassed Meadow/Northern Woods



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Type III 24-hr 25-Year Rainfall=5.40"

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Page 45

Summary for Subcatchment E-4: SW Grassed Area

Runoff = 0.79 cfs @ 12.47 hrs, Volume= 0.163 af, Depth> 0.47"

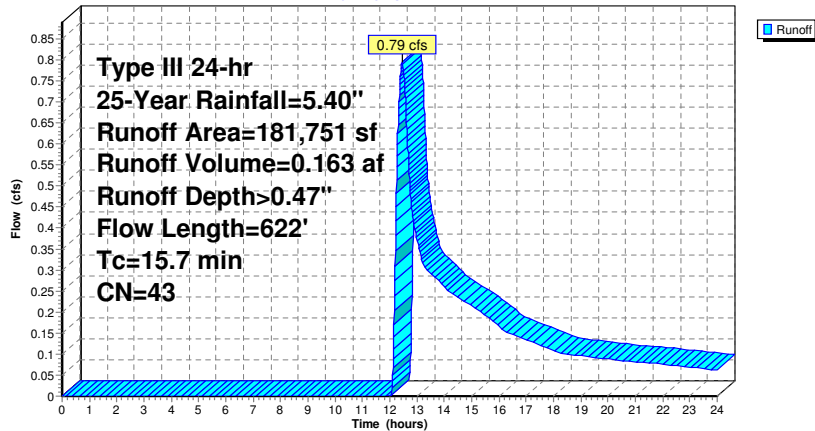
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
15.7	622				Total

Subcatchment E-4: SW Grassed Area

Hydrograph

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 46

Summary for Subcatchment R-1: Roof of Abandoned House

Runoff = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af, Depth> 5.16"

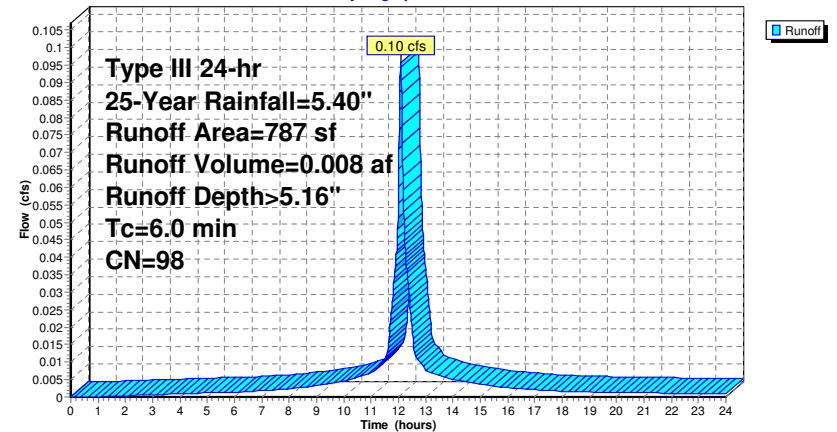
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House

Hydrograph



Summary for Subcatchment R-2: Southern Roof Existing Garage

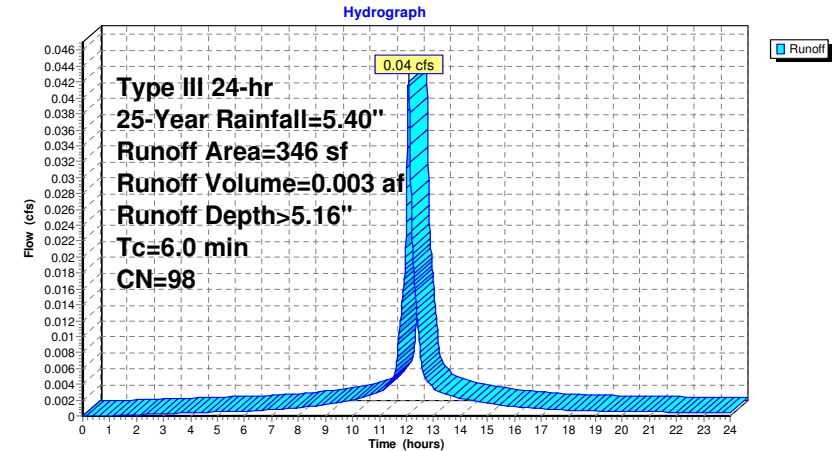
Runoff = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

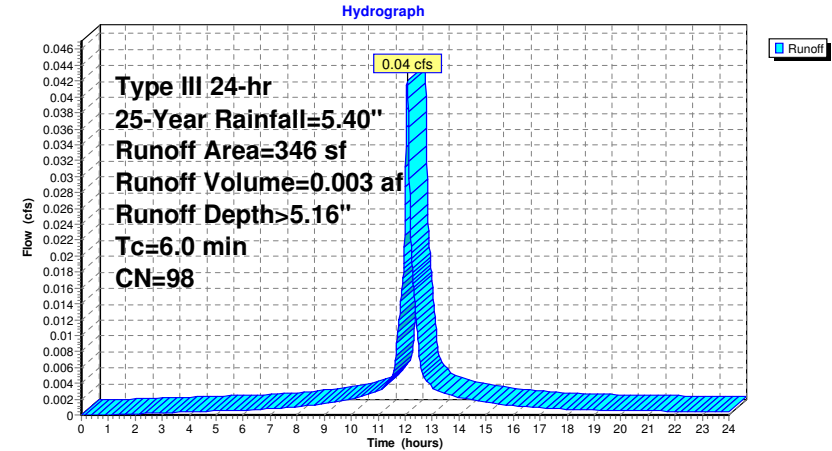
Runoff = 0.04 cfs @ 12.08 hrs, Volume= 0.003 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage

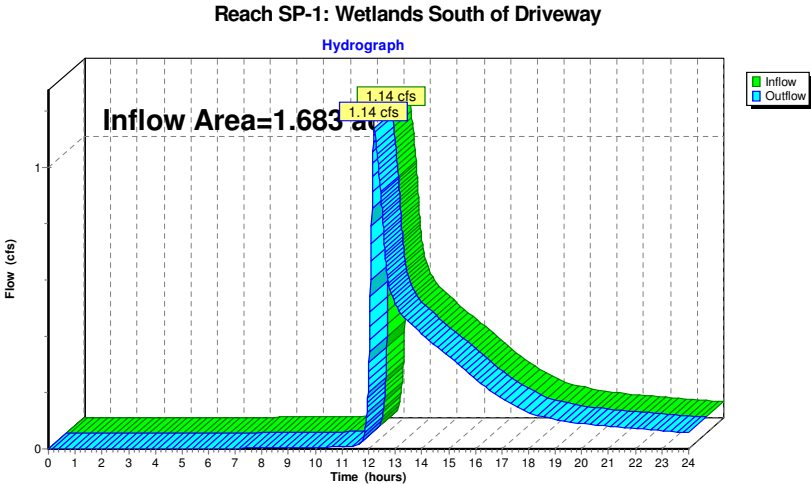


Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 1.65" for 25-Year event
Inflow = 1.14 cfs @ 12.21 hrs, Volume= 0.231 af
Outflow = 1.14 cfs @ 12.21 hrs, Volume= 0.231 af, Atten= 0%, Lag= 0.0 min

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

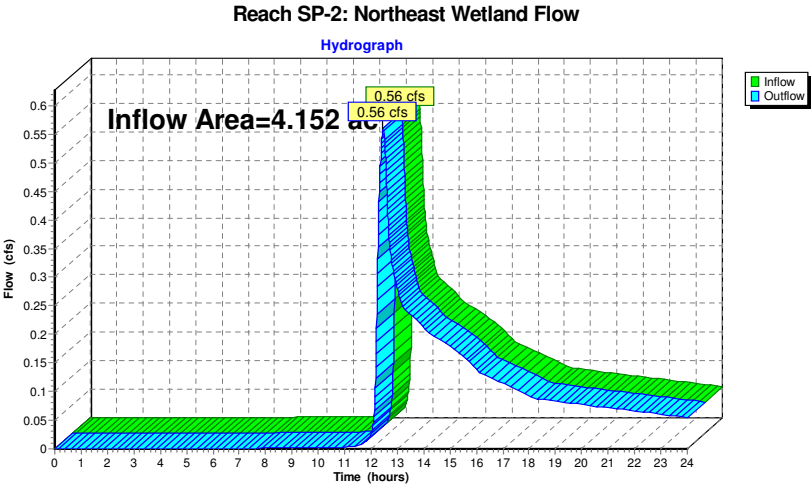


Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.152 ac, 0.19% Impervious, Inflow Depth > 0.38" for 25-Year event
Inflow = 0.56 cfs @ 12.45 hrs, Volume= 0.132 af
Outflow = 0.56 cfs @ 12.45 hrs, Volume= 0.132 af, Atten= 0%, Lag= 0.0 min

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



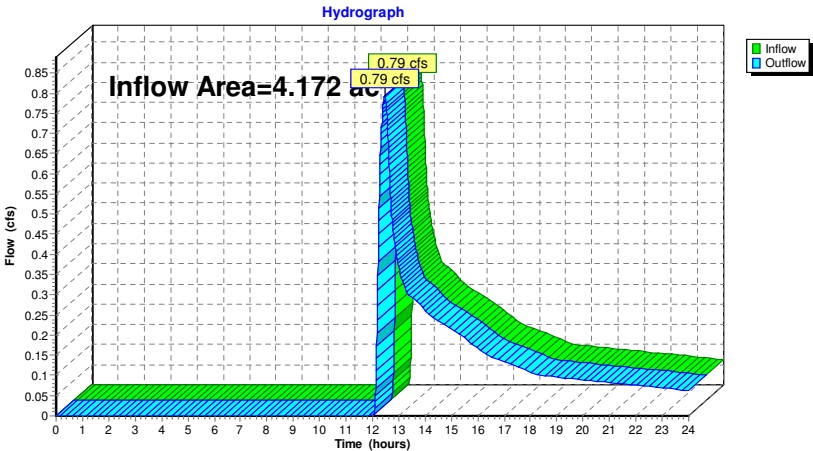
Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.172 ac, 0.00% Impervious, Inflow Depth > 0.47" for 25-Year event
Inflow = 0.79 cfs @ 12.47 hrs, Volume= 0.163 af
Outflow = 0.79 cfs @ 12.47 hrs, Volume= 0.163 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: Northwest Wetland Flow



Summary for Pond 1P: Existing Detention Basin

Inflow Area = 0.534 ac, 61.44% Impervious, Inflow Depth > 4.38" for 25-Year event
Inflow = 2.27 cfs @ 12.14 hrs, Volume= 0.195 af
Outflow = 0.32 cfs @ 12.76 hrs, Volume= 0.124 af, Atten= 86%, Lag= 37.5 min
Primary = 0.32 cfs @ 12.76 hrs, Volume= 0.124 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.81' @ 12.76 hrs Surf.Area= 3,090 sf Storage= 4,979 cf

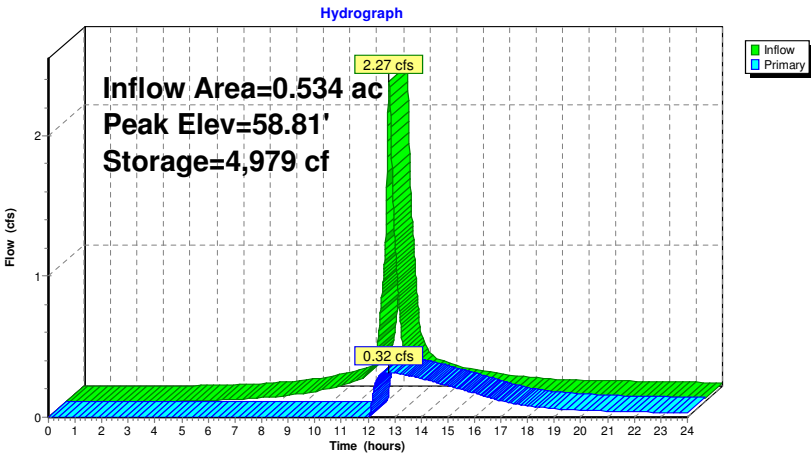
Plug-Flow detention time= 248.3 min calculated for 0.124 af (64% of inflow)
Center-of-Mass det. time= 149.9 min (936.4 - 786.5)

Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.32 cfs @ 12.76 hrs HW=58.81' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.32 cfs @ 3.62 fps)
2=Orifice/Grate (Orifice Controls 0.00 cfs @ 0.36 fps)

Pond 1P: Existing Detention Basin



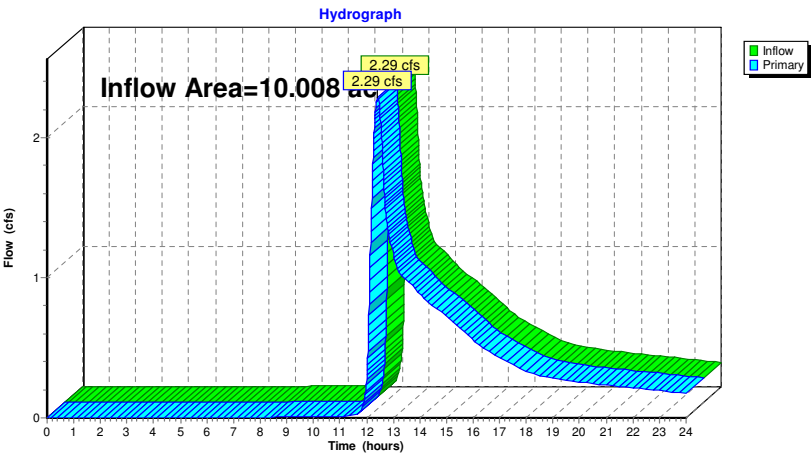
Summary for Pond 2P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.008 ac, 4.35% Impervious, Inflow Depth > 0.63" for 25-Year event
Inflow = 2.29 cfs @ 12.42 hrs, Volume= 0.526 af
Primary = 2.29 cfs @ 12.42 hrs, Volume= 0.526 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Combined Study Points - Northern Wetlands



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Type III 24-hr 100-Year Rainfall=6.50"

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Page 55

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: Existing Drive

Runoff Area=22,922 sf 60.86% Impervious Runoff Depth>5.44"
Flow Length=444' Tc=10.2 min CN=91 Runoff=2.76 cfs 0.239 af

Subcatchment E-2: SE Woods

Runoff Area=49,278 sf 7.20% Impervious Runoff Depth>1.64"
Flow Length=420' Tc=12.0 min UI Adjusted CN=53 Runoff=1.57 cfs 0.154 af

Subcatchment E-3: Grassed Meadow/Northern

Runoff Area=180,525 sf 0.00% Impervious Runoff Depth>0.72"
Flow Length=465' Tc=12.3 min CN=41 Runoff=1.50 cfs 0.250 af

Subcatchment E-4: SW Grassed Area

Runoff Area=181,751 sf 0.00% Impervious Runoff Depth>0.86"
Flow Length=622' Tc=15.7 min CN=43 Runoff=1.94 cfs 0.299 af

Subcatchment R-1: Roof of Abandoned House

Runoff Area=787 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.12 cfs 0.009 af

Subcatchment R-2: Southern Roof Existing

Runoff Area=346 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Subcatchment R-3: Northern Roof Existing

Runoff Area=346 sf 100.00% Impervious Runoff Depth>6.26"
Tc=6.0 min CN=98 Runoff=0.05 cfs 0.004 af

Reach SP-1: Wetlands South of Driveway

Inflow=1.93 cfs 0.335 af
Outflow=1.93 cfs 0.335 af

Reach SP-2: Northeast Wetland Flow

Inflow=1.52 cfs 0.254 af
Outflow=1.52 cfs 0.254 af

Reach SP-3: Northwest Wetland Flow

Inflow=1.94 cfs 0.299 af
Outflow=1.94 cfs 0.299 af

Pond 1P: Existing Detention Basin

Peak Elev=59.10' Storage=5,880 cf Inflow=2.80 cfs 0.243 af
Outflow=0.67 cfs 0.171 af

Pond 2P: Combined Study Points - Northern Wetlands

Inflow=5.19 cfs 0.889 af
Primary=5.19 cfs 0.889 af

Total Runoff Area = 10.008 ac Runoff Volume = 0.960 af Average Runoff Depth = 1.15"
95.65% Pervious = 9.572 ac 4.35% Impervious = 0.436 ac

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 56

Summary for Subcatchment E-1: Existing Drive

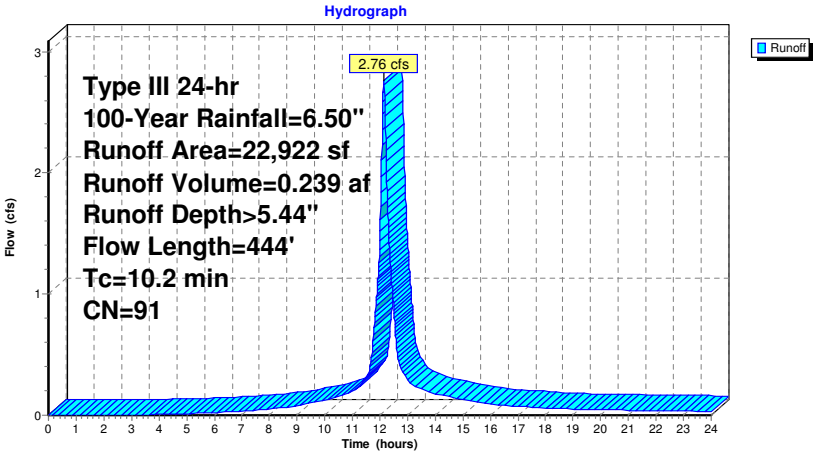
Runoff = 2.76 cfs @ 12.14 hrs, Volume= 0.239 af, Depth> 5.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
13,950	98	Paved parking, HSG A
4,096	96	Gravel surface, HSG A
411	30	Woods, Good, HSG A
3,284	70	Woods, Good, HSG C
509	49	50-75% Grass cover, Fair, HSG A
672	79	50-75% Grass cover, Fair, HSG C
22,922	91	Weighted Average
8,972		39.14% Pervious Area
13,950		60.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	50	0.0600	0.10		Sheet Flow, A-B
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.3	33	0.1060	1.63		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
0.1	19	0.2200	3.28		Shallow Concentrated Flow, C-D
					Short Grass Pasture Kv= 7.0 fps
0.5	112	0.0450	3.42		Shallow Concentrated Flow, D-E
					Unpaved Kv= 16.1 fps
1.1	205	0.0240	3.14		Shallow Concentrated Flow, E-F
					Paved Kv= 20.3 fps
0.1	25	0.0100	3.93	3.09	Pipe Channel, F-G
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.015 Corrugated PE, smooth interior
10.2	444	Total			

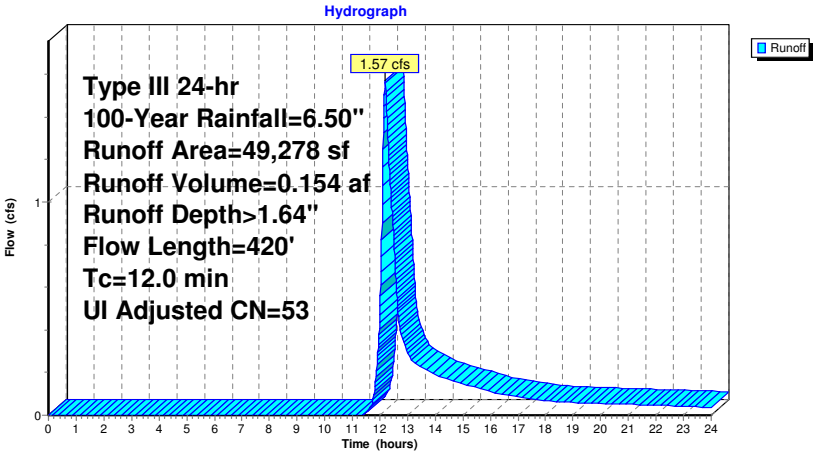
Subcatchment E-1: Existing Drive



Summary for Subcatchment E-2: SE Woods

Runoff	=	1.57 cfs @ 12.18 hrs	Volume=	0.154 af	Depth>	1.64"
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=6.50"						
Area (sf)	CN	Adj	Description			
3,550	98		Unconnected pavement, HSG A			
7,582	49		50-75% Grass cover, Fair, HSG A			
1,887	79		50-75% Grass cover, Fair, HSG C			
18,787	30		Woods, Good, HSG A			
11,389	70		Woods, Good, HSG C			
6,083	77		Woods, Good, HSG D			
49,278	55	53	Weighted Average, UI Adjusted			
45,728			92.80% Pervious Area			
3,550			7.20% Impervious Area			
3,550			100.00% Unconnected			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description	
6.3	50	0.1100	0.13		Sheet Flow, A-B	
					Woods: Light underbrush n= 0.400 P2= 3.10"	
0.8	75	0.0930	1.52		Shallow Concentrated Flow, B-C	
					Woodland Kv= 5.0 fps	
0.4	35	0.0430	1.45		Shallow Concentrated Flow, C-D	
					Short Grass Pasture Kv= 7.0 fps	
4.5	260	0.0370	0.96		Shallow Concentrated Flow, D-E	
					Woodland Kv= 5.0 fps	
12.0	420	Total				

Subcatchment E-2: SE Woods



Summary for Subcatchment E-3: Grassed Meadow/Northern Woods

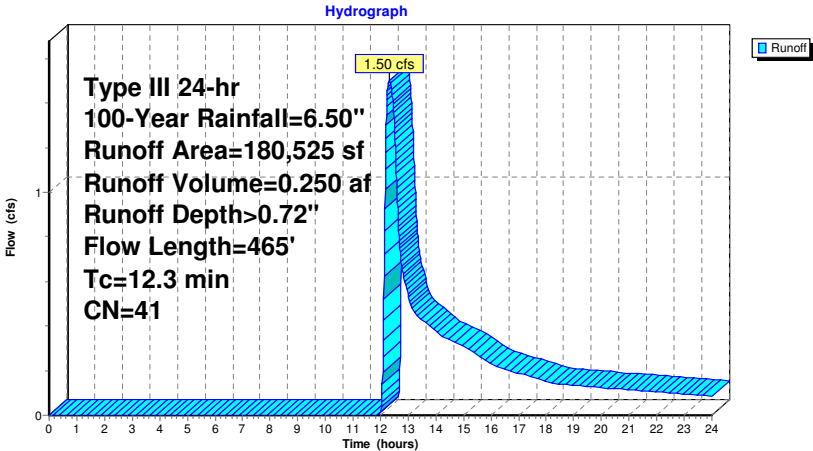
Runoff = 1.50 cfs @ 12.34 hrs, Volume= 0.250 af, Depth> 0.72"

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=6.50"

Area (sf)	CN	Description
76,402	30	Woods, Good, HSG A
13,713	55	Woods, Good, HSG B
15,503	70	Woods, Good, HSG C
67,450	39	>75% Grass cover, Good, HSG A
7,457	74	>75% Grass cover, Good, HSG C
180,525	41	Weighted Average
180,525		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.2	50	0.0800	0.12		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
3.6	293	0.0375	1.36		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.5	122	0.0740	1.36		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
12.3	465	Total			

Subcatchment E-3: Grassed Meadow/Northern Woods



Summary for Subcatchment E-4: SW Grassed Area

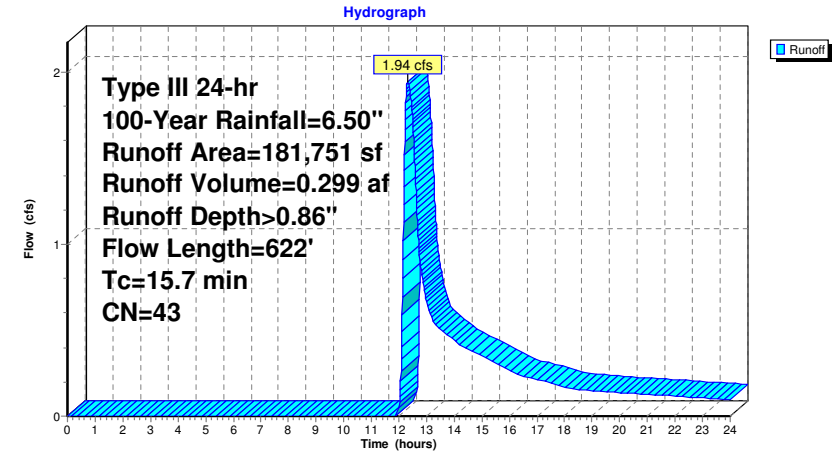
Runoff = 1.94 cfs @ 12.33 hrs, Volume= 0.299 af, Depth> 0.86"

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=6.50"

Area (sf)	CN	Description
44,530	30	Woods, Good, HSG A
4,806	70	Woods, Good, HSG C
101,870	39	>75% Grass cover, Good, HSG A
30,545	74	>75% Grass cover, Good, HSG C
181,751	43	Weighted Average
181,751		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.7	50	0.0500	0.10		Sheet Flow, A-B Woods: Light underbrush n= 0.400 P2= 3.10"
5.6	462	0.0390	1.38		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.4	110	0.0682	1.31		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
15.7	622				Total

Subcatchment E-4: SW Grassed Area



Summary for Subcatchment R-1: Roof of Abandoned House

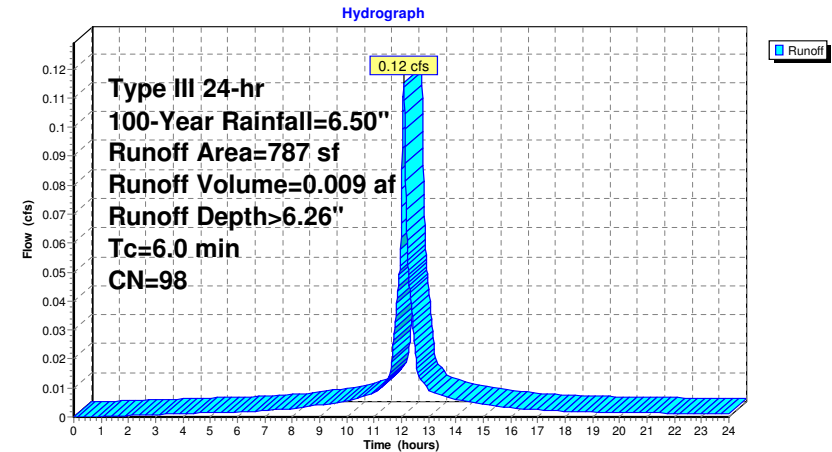
Runoff = 0.12 cfs @ 12.08 hrs, Volume= 0.009 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
787	98	Roofs, HSG A
787		100.00% Impervious Area

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

Subcatchment R-1: Roof of Abandoned House



Summary for Subcatchment R-2: Southern Roof Existing Garage

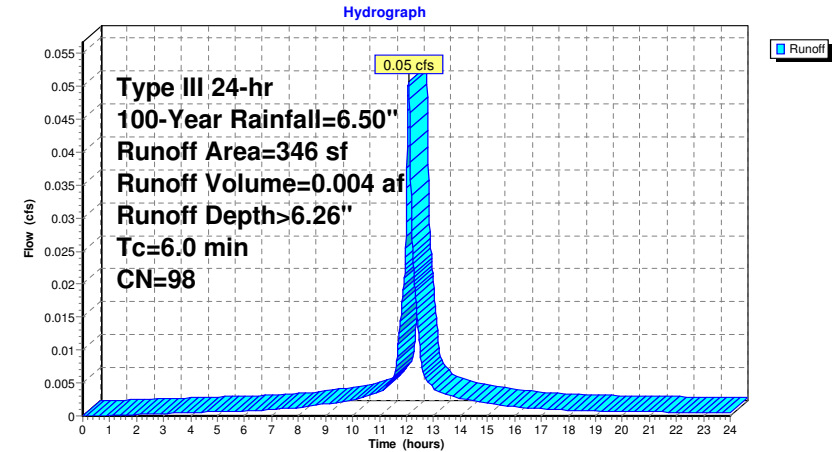
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
346	98	Unconnected roofs, HSG A
346		100.00% Impervious Area
346		100.00% Unconnected

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

Subcatchment R-2: Southern Roof Existing Garage



Summary for Subcatchment R-3: Northern Roof Existing Garage

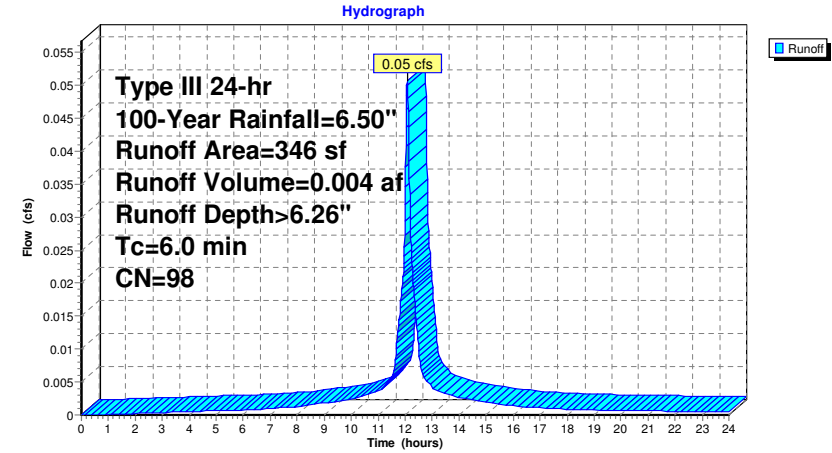
Runoff = 0.05 cfs @ 12.08 hrs, Volume= 0.004 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
346	98	Roofs, HSG A
346		100.00% Impervious Area

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

Subcatchment R-3: Northern Roof Existing Garage

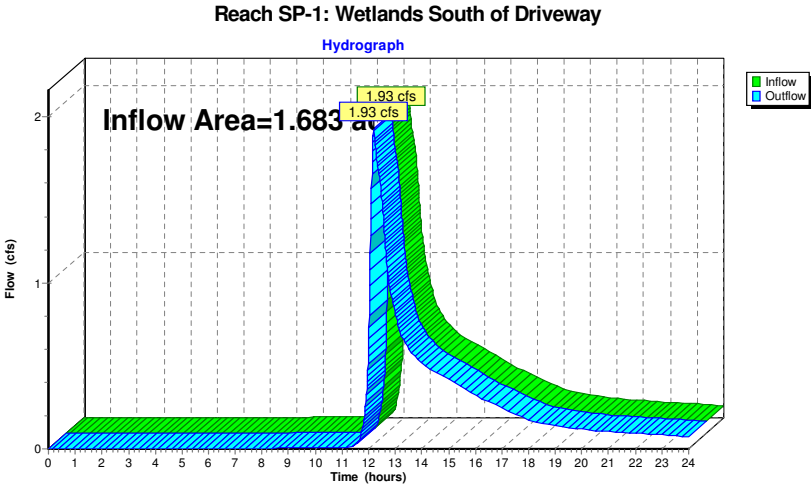


Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.683 ac, 25.41% Impervious, Inflow Depth > 2.39" for 100-Year event
Inflow = 1.93 cfs @ 12.19 hrs, Volume= 0.335 af
Outflow = 1.93 cfs @ 12.19 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

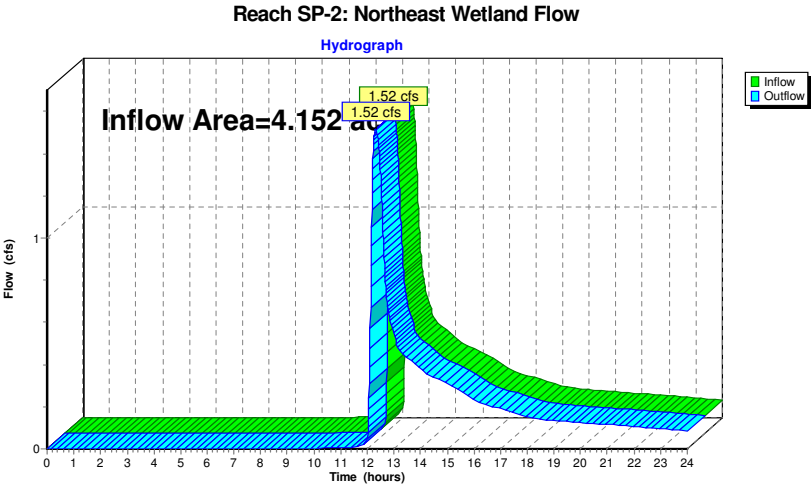


Summary for Reach SP-2: Northeast Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.152 ac, 0.19% Impervious, Inflow Depth > 0.74" for 100-Year event
Inflow = 1.52 cfs @ 12.32 hrs, Volume= 0.254 af
Outflow = 1.52 cfs @ 12.32 hrs, Volume= 0.254 af, Atten= 0%, Lag= 0.0 min

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

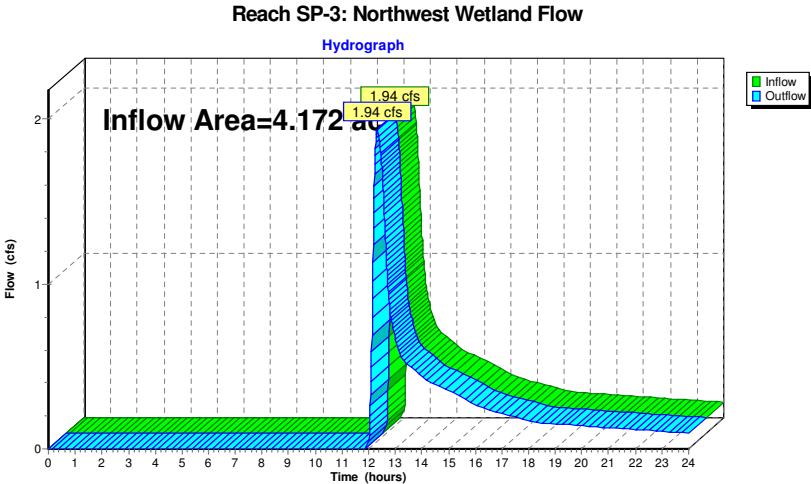


Summary for Reach SP-3: Northwest Wetland Flow

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.172 ac, 0.00% Impervious, Inflow Depth > 0.86" for 100-Year event
Inflow = 1.94 cfs @ 12.33 hrs, Volume= 0.299 af
Outflow = 1.94 cfs @ 12.33 hrs, Volume= 0.299 af, Atten= 0%, Lag= 0.0 min

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



Summary for Pond 1P: Existing Detention Basin

Inflow Area = 0.534 ac, 61.44% Impervious, Inflow Depth > 5.45" for 100-Year event
Inflow = 2.80 cfs @ 12.14 hrs, Volume= 0.243 af
Outflow = 0.67 cfs @ 12.57 hrs, Volume= 0.171 af, Atten= 76%, Lag= 25.8 min
Primary = 0.67 cfs @ 12.57 hrs, Volume= 0.171 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 59.10' @ 12.57 hrs Surf.Area= 3,206 sf Storage= 5,880 cf

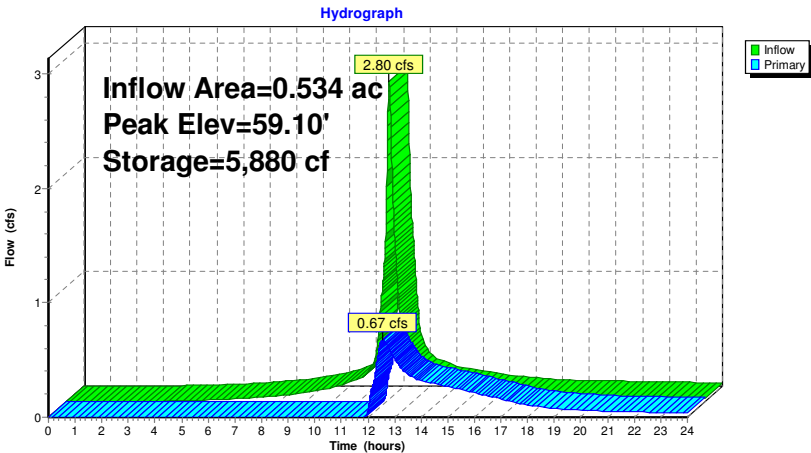
Plug-Flow detention time= 228.3 min calculated for 0.171 af (71% of inflow)
Center-of-Mass det. time= 138.2 min (919.0 - 780.8)

Volume	Invert	Avail.Storage	Storage Description	
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)	
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
57.20	3,090	0	0	
58.00	3,090	2,472	2,472	
59.00	3,090	3,090	5,562	
59.40	3,550	1,328	6,890	
60.00	3,550	2,130	9,020	

Device	Routing	Invert	Outlet Devices	
#1	Primary	58.08'	4.0" Vert. Orifice/Grate	C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate	C= 0.600

Primary OutFlow Max=0.67 cfs @ 12.57 hrs HW=59.10' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.39 cfs @ 4.45 fps)
2=Orifice/Grate (Orifice Controls 0.29 cfs @ 1.87 fps)

Pond 1P: Existing Detention Basin



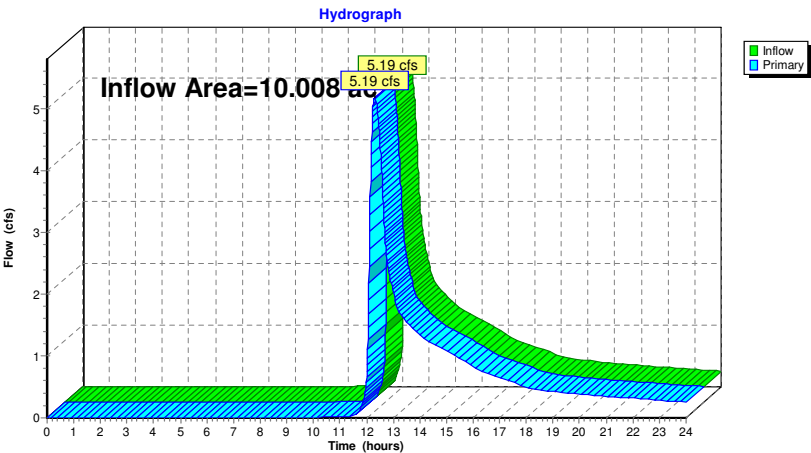
Summary for Pond 2P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.008 ac, 4.35% Impervious, Inflow Depth > 1.07" for 100-Year event
Inflow = 5.19 cfs @ 12.30 hrs, Volume= 0.889 af
Primary = 5.19 cfs @ 12.30 hrs, Volume= 0.889 af, Atten= 0%, Lag= 0.0 min

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

Pond 2P: Combined Study Points - Northern Wetlands



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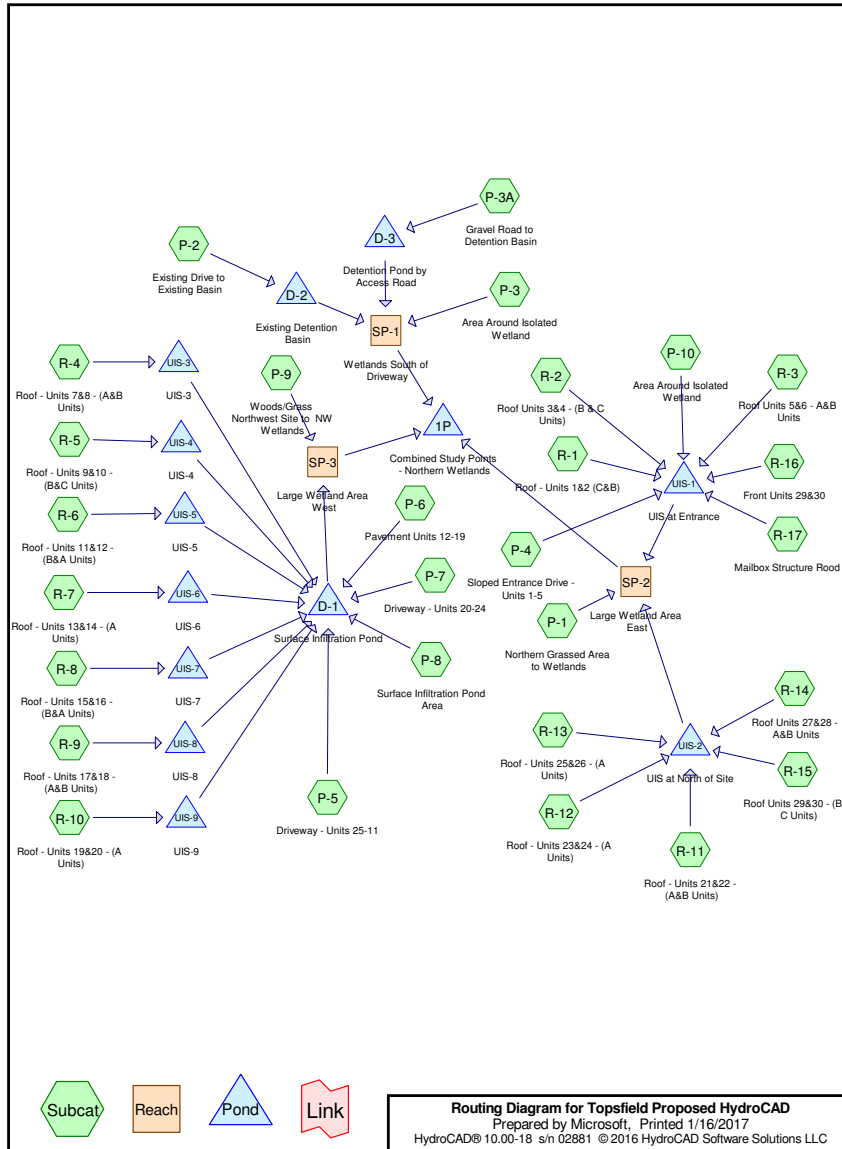
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Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.376	49	50-75% Grass cover, Fair, HSG A (P-6, P-7)
2.422	39	>75% Grass cover, Good, HSG A (P-1, P-2, P-3, P-3A, P-4, P-5, P-8, P-9)
0.926	74	>75% Grass cover, Good, HSG C (P-10, P-2, P-3, P-4, P-5, P-9)
0.047	72	Dirt roads, HSG A (P-9)
0.101	76	Gravel roads, HSG A (P-2, P-3, P-3A)
1.543	98	Paved parking, HSG A (P-2, P-3A, P-4, P-5, P-6, P-7, P-8)
0.166	98	Roofs, HSG A (R-14, R-3)
0.134	98	Unconnected pavement, HSG A (P-3, P-9)
1.157	98	Unconnected roofs, HSG A (P-10, R-1, R-10, R-11, R-12, R-13, R-15, R-16, R-17, R-2, R-4, R-5, R-6, R-7, R-8, R-9)
2.435	30	Woods, Good, HSG A (P-1, P-3, P-9)
0.323	55	Woods, Good, HSG B (P-1, P-9)
0.297	70	Woods, Good, HSG C (P-1, P-3)
0.118	77	Woods, Good, HSG D (P-3)
10.046	60	TOTAL AREA



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Page 3

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
8.382	HSG A	P-1, P-10, P-2, P-3, P-3A, P-4, P-5, P-6, P-7, P-8, P-9, R-1, R-10, R-11, R-12, R-13, R-14, R-15, R-16, R-17, R-2, R-3, R-4, R-5, R-6, R-7, R-8, R-9
0.323	HSG B	P-1, P-9
1.223	HSG C	P-1, P-10, P-2, P-3, P-4, P-5, P-9
0.118	HSG D	P-3
0.000	Other	
10.046		TOTAL AREA

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Page 4

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.376	0.000	0.000	0.000	0.000	0.376	50-75% Grass cover, Fair	P-6, P-7
2.422	0.000	0.926	0.000	0.000	3.348	>75% Grass cover, Good	P-1, P-10, P-2, P-3, P-3A, P-4, P-5, P-8, P-9
0.047	0.000	0.000	0.000	0.000	0.047	Dirt roads	P-9
0.101	0.000	0.000	0.000	0.000	0.101	Gravel roads	P-2, P-3, P-3A
1.543	0.000	0.000	0.000	0.000	1.543	Paved parking	P-2, P-3A, P-4, P-5, P-6, P-7, P-8
0.166	0.000	0.000	0.000	0.000	0.166	Roofs	R-14, R-3
0.134	0.000	0.000	0.000	0.000	0.134	Unconnected pavement	P-3, P-9
1.157	0.000	0.000	0.000	0.000	1.157	Unconnected roofs	P-10, R-1, R-10, R-11, R-12, R-13, R-15, R-16, R-17, R-2, R-4, R-5, R-6, R-7, R-8, R-9
2.435	0.323	0.297	0.118	0.000	3.174	Woods, Good	P-1, P-3, P-9
8.382	0.323	1.223	0.118	0.000	10.046	TOTAL AREA	

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Page 5

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	D-1	70.00	65.40	252.0	0.0183	0.015	15.0	0.0	0.0
2	UIS-3	73.40	70.70	30.0	0.0900	0.011	6.0	0.0	0.0
3	UIS-4	74.20	74.06	30.0	0.0047	0.011	6.0	0.0	0.0
4	UIS-5	74.80	74.60	22.0	0.0091	0.011	6.0	0.0	0.0
5	UIS-6	74.00	72.18	106.0	0.0172	0.011	6.0	0.0	0.0
6	UIS-7	73.50	73.00	17.5	0.0286	0.011	6.0	0.0	0.0
7	UIS-8	72.80	72.18	37.0	0.0168	0.011	6.0	0.0	0.0
8	UIS-9	72.18	71.38	79.0	0.0101	0.011	6.0	0.0	0.0

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 6

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: Northern Grassed Area to	Runoff Area=81,522 sf 0.00% Impervious Runoff Depth>0.00" Tc=6.0 min CN=41 Runoff=0.00 cfs 0.001 af
Subcatchment P-10: Area Around Isolated	Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>1.03" Flow Length=533' Tc=6.0 min UI Adjusted CN=75 Runoff=0.83 cfs 0.062 af
Subcatchment P-2: Existing Drive to Existing	Runoff Area=23,114 sf 59.77% Impervious Runoff Depth>1.39" Tc=6.0 min CN=81 Runoff=0.86 cfs 0.061 af
Subcatchment P-3: Area Around Isolated	Runoff Area=27,582 sf 12.85% Impervious Runoff Depth>0.11" Tc=6.0 min UI Adjusted CN=50 Runoff=0.01 cfs 0.006 af
Subcatchment P-3A: Gravel Road to Detention	Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>0.82" Tc=6.0 min CN=71 Runoff=0.10 cfs 0.008 af
Subcatchment P-4: Sloped Entrance Drive -	Runoff Area=21,573 sf 55.93% Impervious Runoff Depth>1.08" Tc=6.0 min CN=76 Runoff=0.60 cfs 0.045 af
Subcatchment P-5: Driveway - Units 25-11	Runoff Area=39,272 sf 51.57% Impervious Runoff Depth>0.97" Tc=6.0 min CN=74 Runoff=0.97 cfs 0.073 af
Subcatchment P-6: Pavement Units 12-19	Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>1.20" Tc=6.0 min CN=78 Runoff=0.60 cfs 0.044 af
Subcatchment P-7: Driveway - Units 20-24	Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>0.82" Tc=6.0 min CN=71 Runoff=0.31 cfs 0.024 af
Subcatchment P-8: Surface Infiltration Pond	Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.01" Tc=6.0 min CN=43 Runoff=0.00 cfs 0.000 af
Subcatchment P-9: Woods/Grass Northwest	Runoff Area=102,567 sf 2.25% Impervious Runoff Depth=0.00" Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.00 cfs 0.000 af
Subcatchment R-1: Roof - Units 1&2 (C&B)	Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.22 cfs 0.017 af
Subcatchment R-10: Roof - Units 19&20 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af
Subcatchment R-11: Roof - Units 21&22 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af
Subcatchment R-12: Roof - Units 23&24 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af
Subcatchment R-13: Roof - Units 25&26 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 7

Subcatchment R-14: Roof Units 27&28 - A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af
Subcatchment R-15: Roof Units 29&30 - (B & C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af
Subcatchment R-16: Front Units 29&30	Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.10 cfs 0.008 af
Subcatchment R-17: Mailbox Structure Rood	Runoff Area=120 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.01 cfs 0.001 af
Subcatchment R-2: Roof Units 3&4 - (B & C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af
Subcatchment R-3: Roof Units 5&6 - A&B Units	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af
Subcatchment R-4: Roof - Units 7&8 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af
Subcatchment R-5: Roof - Units 9&10 - (B&C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af
Subcatchment R-6: Roof - Units 11&12 - (B&A	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af
Subcatchment R-7: Roof - Units 13&14 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.27 cfs 0.021 af
Subcatchment R-8: Roof - Units 15&16 - (B&A	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af
Subcatchment R-9: Roof - Units 17&18 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>2.87" Tc=6.0 min CN=98 Runoff=0.25 cfs 0.020 af
Reach SP-1: Wetlands South of Driveway	Inflow=0.01 cfs 0.006 af Outflow=0.01 cfs 0.006 af
Reach SP-2: Large Wetland Area East	Inflow=0.00 cfs 0.001 af Outflow=0.00 cfs 0.001 af
Reach SP-3: Large Wetland Area West	Inflow=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af
Pond 1P: Combined Study Points - Northern Wetlands	Inflow=0.01 cfs 0.006 af Primary=0.01 cfs 0.006 af
Pond D-1: Surface Infiltration Pond	Peak Elev=68.76' Storage=7,349 cf Inflow=3.58 cfs 0.236 af Discarded=0.09 cfs 0.086 af Primary=0.00 cfs 0.000 af Outflow=0.09 cfs 0.086 af

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 8

Pond D-2: Existing Detention Basin	Peak Elev=58.07' Storage=2,675 cf Inflow=0.86 cfs 0.061 af Outflow=0.00 cfs 0.000 af
Pond D-3: Detention Pond by Access Road	Peak Elev=63.24' Storage=81 cf Inflow=0.10 cfs 0.008 af Discarded=0.02 cfs 0.008 af Primary=0.00 cfs 0.000 af Outflow=0.02 cfs 0.008 af
Pond UIS-1: UIS at Entrance	Peak Elev=61.91' Storage=4,105 cf Inflow=2.23 cfs 0.170 af Discarded=0.08 cfs 0.099 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.099 af
Pond UIS-2: UIS at North of Site	Peak Elev=63.15' Storage=1,100 cf Inflow=1.26 cfs 0.100 af Discarded=0.23 cfs 0.100 af Primary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.100 af
Pond UIS-3: UIS-3	Peak Elev=73.67' Storage=130 cf Inflow=0.25 cfs 0.020 af Discarded=0.00 cfs 0.004 af Primary=0.25 cfs 0.013 af Outflow=0.25 cfs 0.017 af
Pond UIS-4: UIS-4	Peak Elev=74.55' Storage=134 cf Inflow=0.22 cfs 0.018 af Discarded=0.00 cfs 0.004 af Primary=0.21 cfs 0.011 af Outflow=0.22 cfs 0.015 af
Pond UIS-5: UIS-5	Peak Elev=75.17' Storage=136 cf Inflow=0.25 cfs 0.020 af Discarded=0.00 cfs 0.004 af Primary=0.24 cfs 0.013 af Outflow=0.24 cfs 0.017 af
Pond UIS-6: UIS-6	Peak Elev=74.39' Storage=137 cf Inflow=0.27 cfs 0.021 af Discarded=0.00 cfs 0.004 af Primary=0.26 cfs 0.015 af Outflow=0.26 cfs 0.019 af
Pond UIS-7: UIS-7	Peak Elev=73.87' Storage=136 cf Inflow=0.25 cfs 0.020 af Discarded=0.00 cfs 0.004 af Primary=0.24 cfs 0.013 af Outflow=0.24 cfs 0.017 af
Pond UIS-8: UIS-8	Peak Elev=73.17' Storage=136 cf Inflow=0.25 cfs 0.020 af Discarded=0.00 cfs 0.004 af Primary=0.24 cfs 0.013 af Outflow=0.24 cfs 0.017 af
Pond UIS-9: UIS-9	Peak Elev=72.57' Storage=81 cf Inflow=0.27 cfs 0.021 af Discarded=0.00 cfs 0.004 af Primary=0.26 cfs 0.016 af Outflow=0.26 cfs 0.020 af
Total Runoff Area = 10.046 ac Runoff Volume = 0.627 af Average Runoff Depth = 0.75" 70.14% Pervious = 7.046 ac 29.86% Impervious = 3.000 ac	

Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

[73] Warning: Peak may fall outside time span

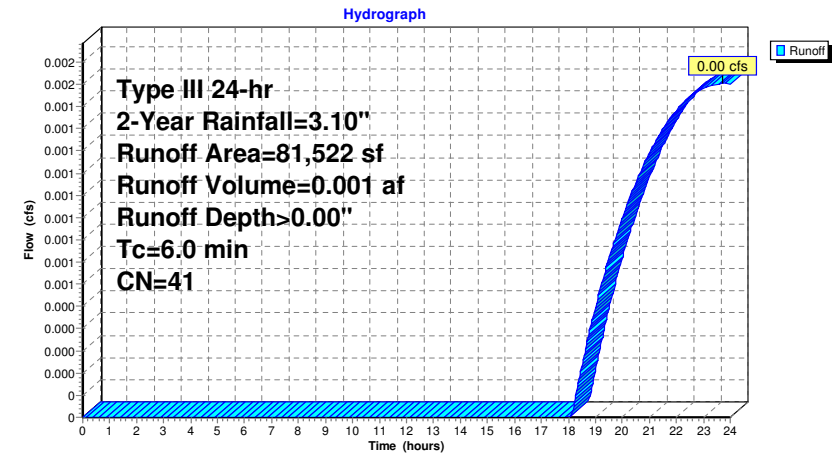
Runoff = 0.00 cfs @ 23.74 hrs, Volume= 0.001 af, Depth> 0.00"

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=3.10"

Area (sf)	CN	Description
38,137	30	Woods, Good, HSG A
10,782	70	Woods, Good, HSG C
9,419	55	Woods, Good, HSG B
23,184	39	>75% Grass cover, Good, HSG A
81,522	41	Weighted Average
81,522		100.00% Pervious Area

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

Subcatchment P-1: Northern Grassed Area to Wetlands



Summary for Subcatchment P-10: Area Around Isolated Wetland

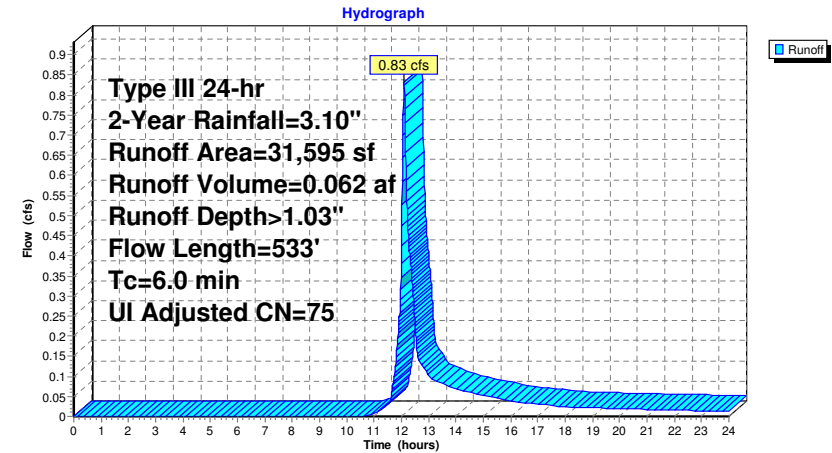
Runoff = 0.83 cfs @ 12.10 hrs, Volume= 0.062 af, Depth> 1.03"

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=3.10"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1100	0.29		Sheet Flow, A-B
					Grass: Short n= 0.150 P2= 3.10"
2.9	483	0.1600	2.80		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
5.8	533				Total, Increased to minimum Tc = 6.0 min

Subcatchment P-10: Area Around Isolated Wetland



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Type III 24-hr 2-Year Rainfall=3.10"

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Page 11

Summary for Subcatchment P-2: Existing Drive to Existing Basin

Runoff = 0.86 cfs @ 12.09 hrs, Volume= 0.061 af, Depth> 1.39"

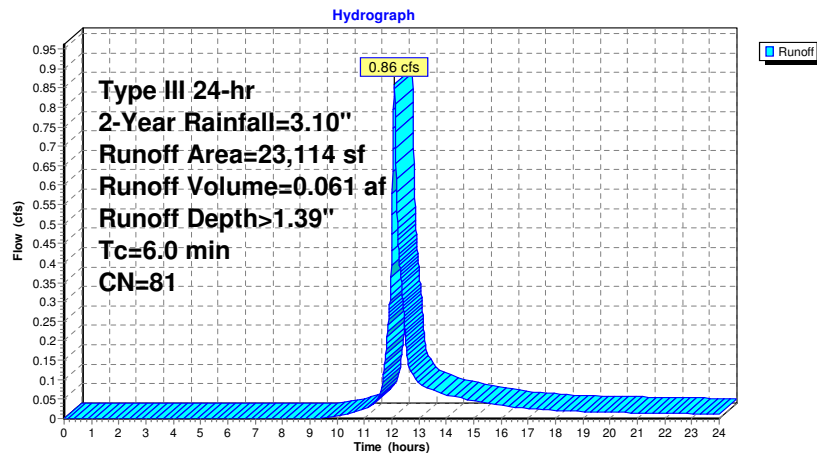
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
13,815	98	Paved parking, HSG A
1,353	76	Gravel roads, HSG A
4,896	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
23,114	81	Weighted Average
9,299		40.23% Pervious Area
13,815		59.77% Impervious Area

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

Subcatchment P-2: Existing Drive to Existing Basin



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Type III 24-hr 2-Year Rainfall=3.10"

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Page 12

Summary for Subcatchment P-3: Area Around Isolated Wetland

Runoff = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af, Depth> 0.11"

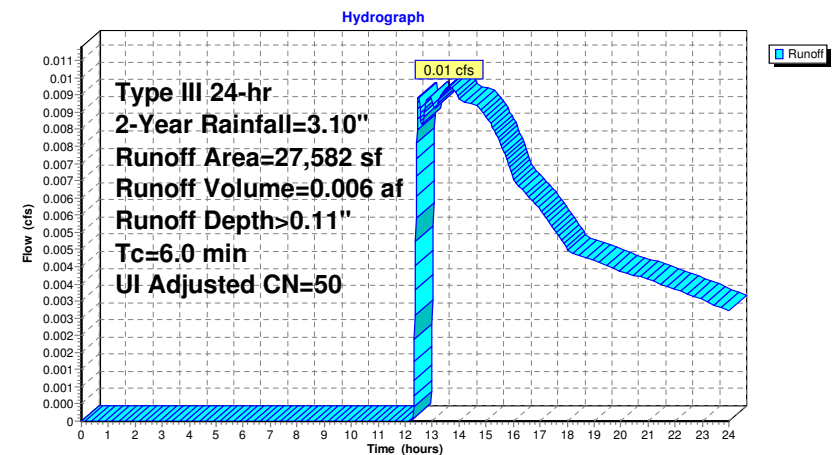
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Adj	Description
3,545	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,582	53	50	Weighted Average, UI Adjusted
24,037			87.15% Pervious Area
3,545			12.85% Impervious Area
3,545			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



Summary for Subcatchment P-3A: Gravel Road to Detention Basin

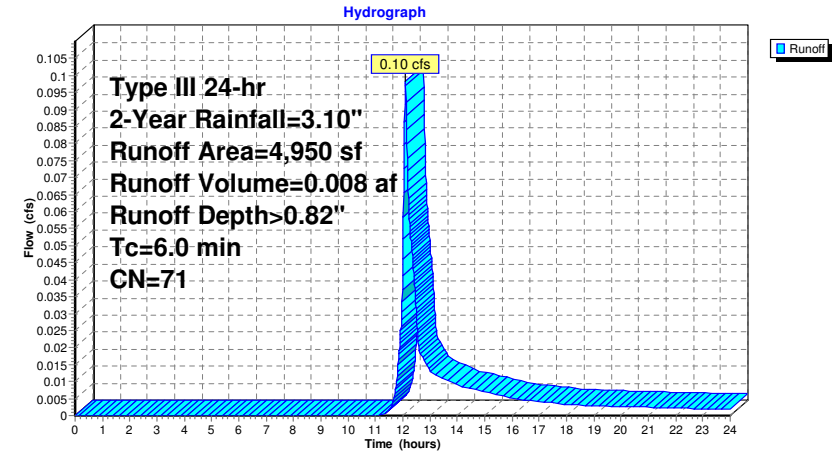
Runoff = 0.10 cfs @ 12.10 hrs, Volume= 0.008 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

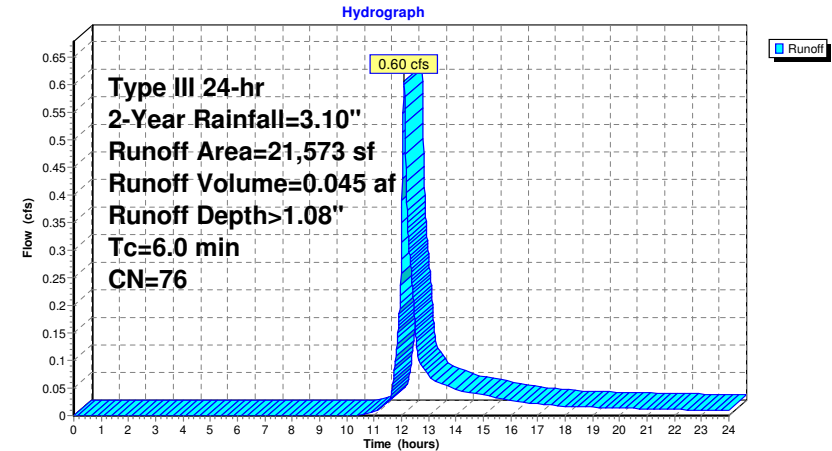
Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.045 af, Depth> 1.08"

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=3.10"

Area (sf)	CN	Description
12,066	98	Paved parking, HSG A
6,808	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,573	76	Weighted Average
9,507		44.07% Pervious Area
12,066		55.93% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5



Summary for Subcatchment P-5: Driveway - Units 25-11

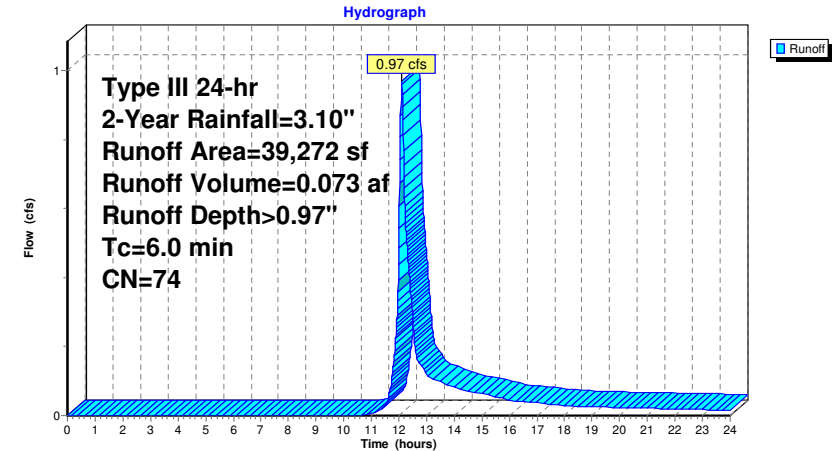
Runoff = 0.97 cfs @ 12.10 hrs, Volume= 0.073 af, Depth> 0.97"

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=3.10"

Area (sf)	CN	Description
20,251	98	Paved parking, HSG A
14,308	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
39,272	74	Weighted Average
19,021		48.43% Pervious Area
20,251		51.57% Impervious Area

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

Subcatchment P-5: Driveway - Units 25-11



Summary for Subcatchment P-6: Pavement Units 12-19

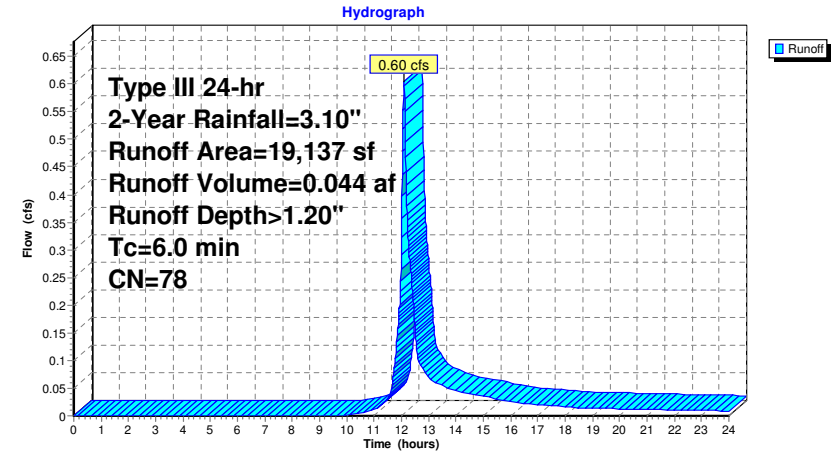
Runoff = 0.60 cfs @ 12.09 hrs, Volume= 0.044 af, Depth> 1.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

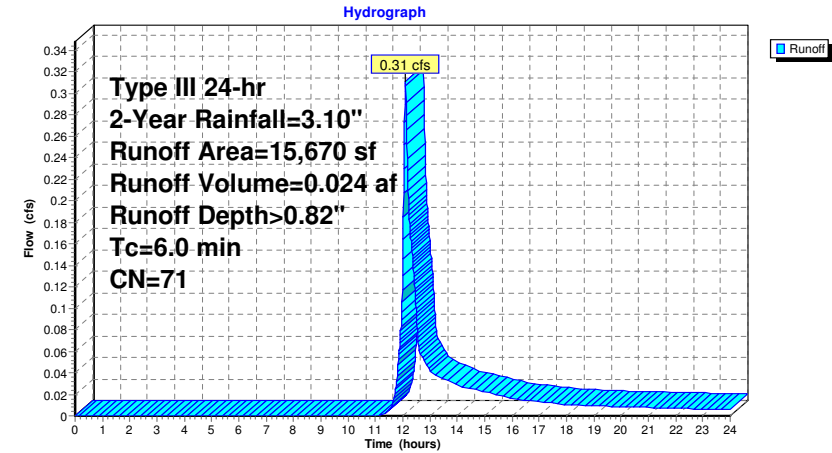
Runoff = 0.31 cfs @ 12.10 hrs, Volume= 0.024 af, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



Summary for Subcatchment P-8: Surface Infiltration Pond Area

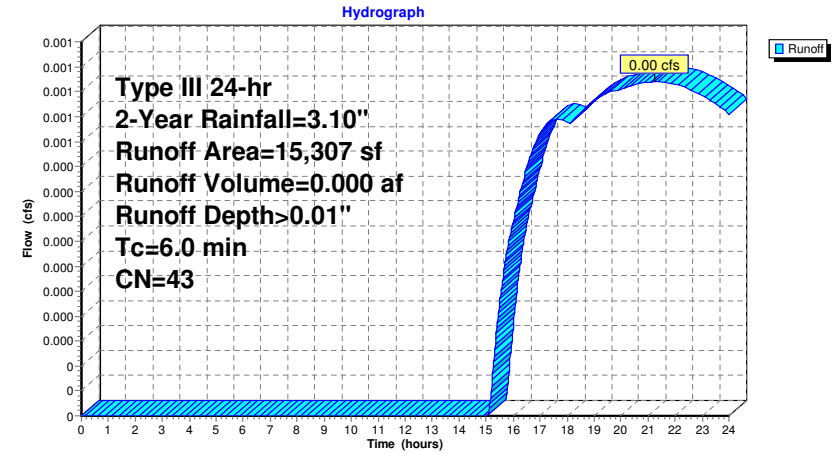
Runoff = 0.00 cfs @ 21.26 hrs, Volume= 0.000 af, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area



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Type III 24-hr 2-Year Rainfall=3.10"

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Page 19

Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

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=3.10"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		Sheet Flow, A-B
					Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		Shallow Concentrated Flow, C-D
					Woodland Kv= 5.0 fps
10.8	502	Total			

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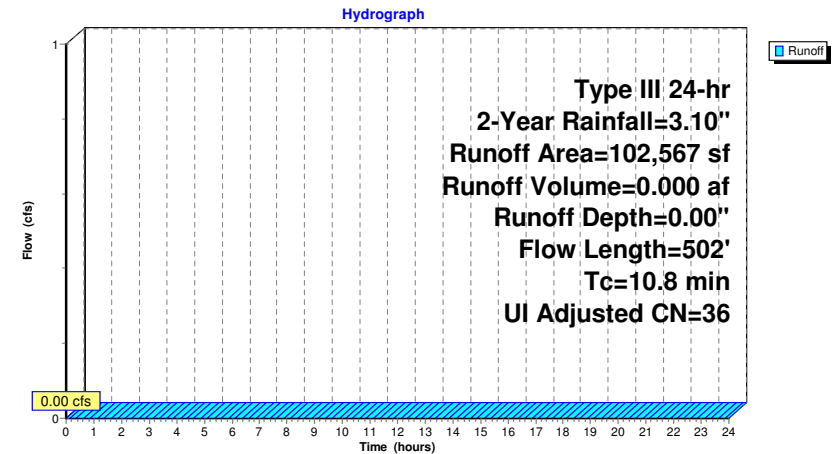
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Type III 24-hr 2-Year Rainfall=3.10"

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Page 20

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 21

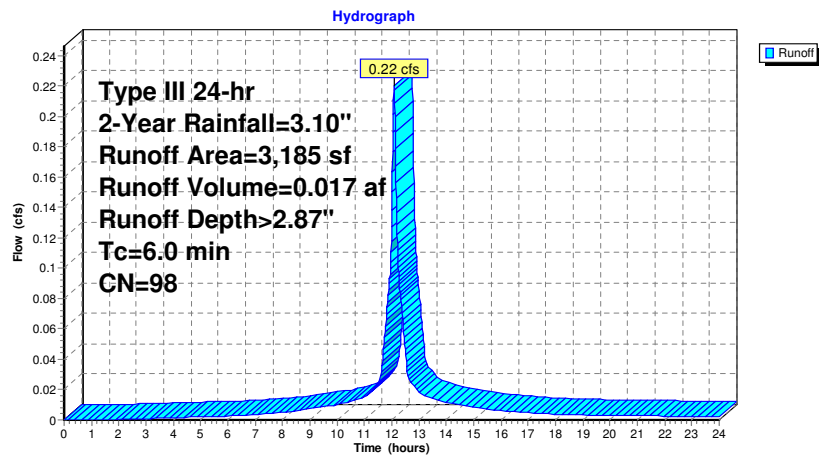
Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.017 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)**Topsfield Proposed HydroCAD**

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Page 22

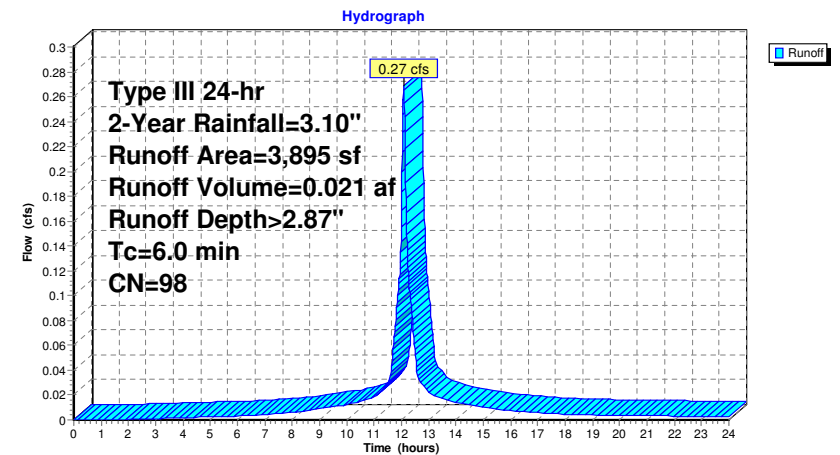
Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 23

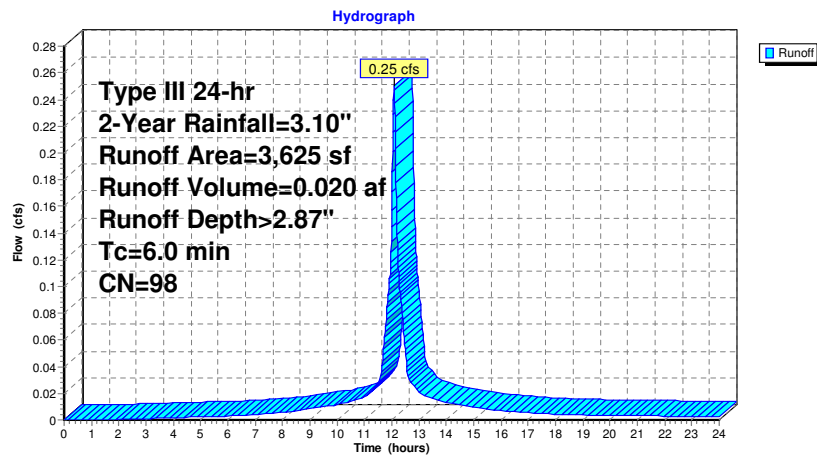
Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)**Topsfield Proposed HydroCAD**

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 24

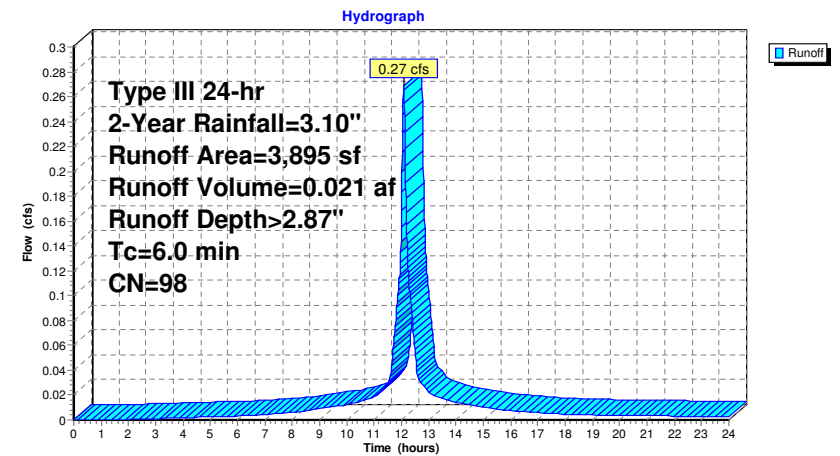
Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)

Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

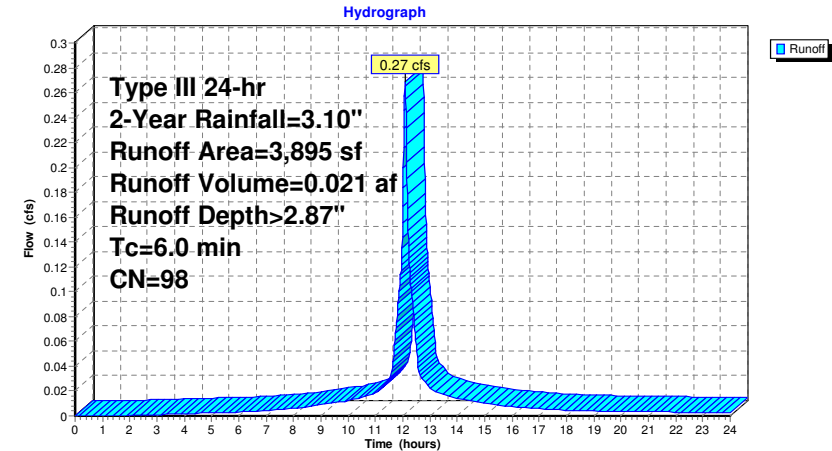
Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)



Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

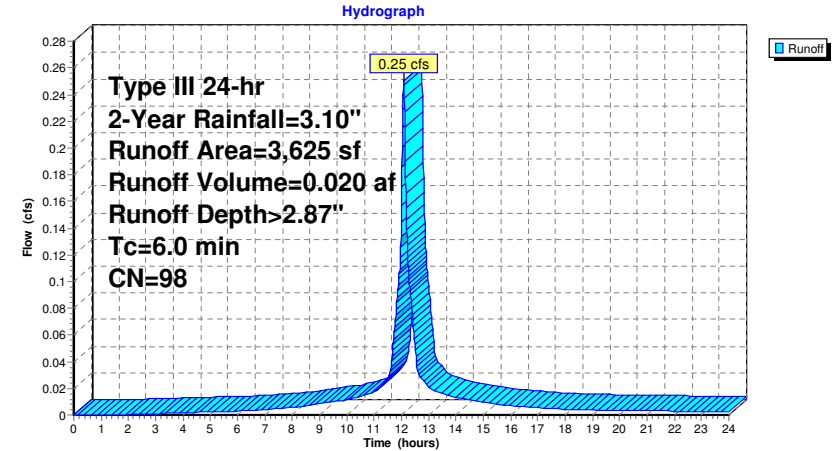
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

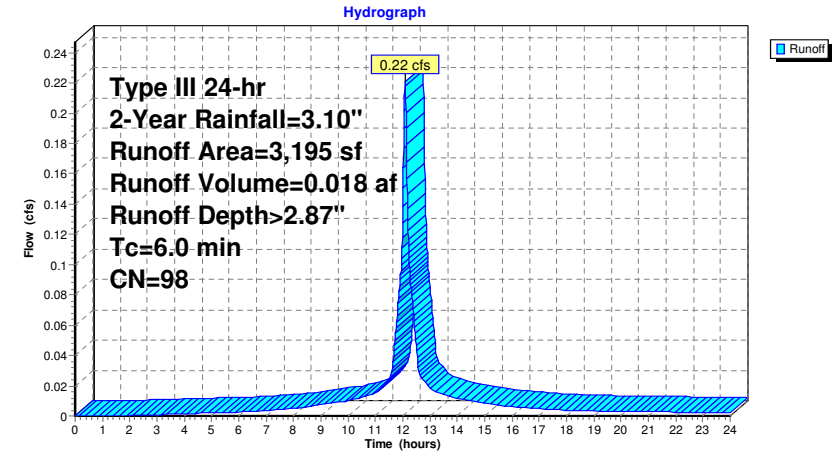
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

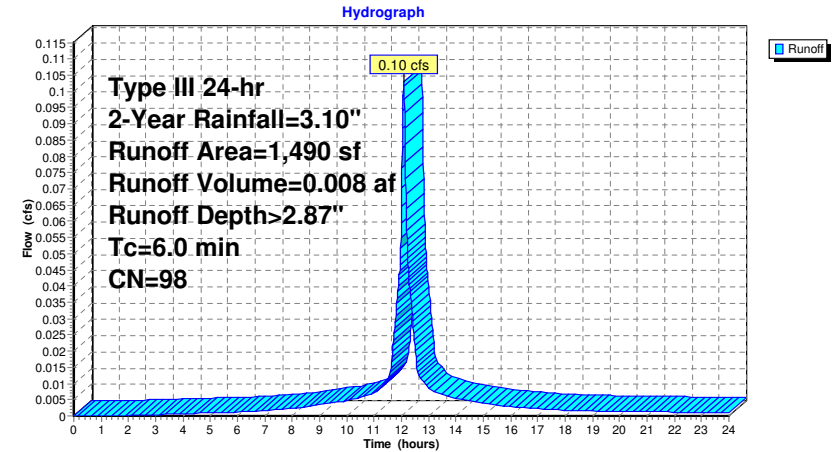
Runoff = 0.10 cfs @ 12.08 hrs, Volume= 0.008 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

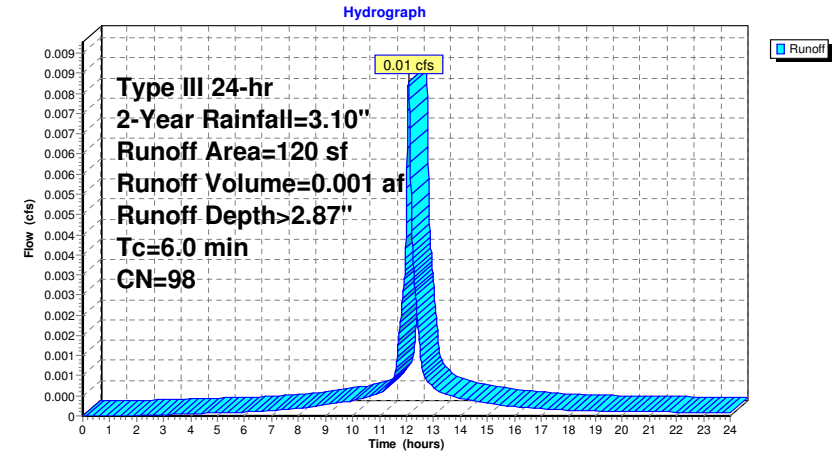
Runoff = 0.01 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

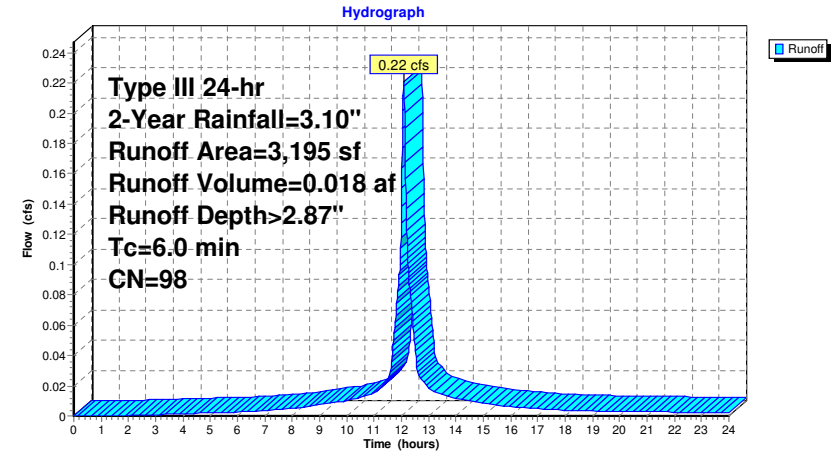
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

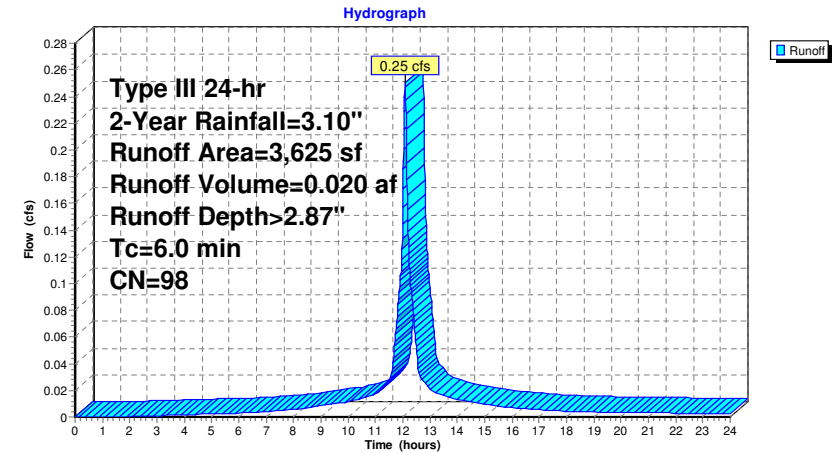
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

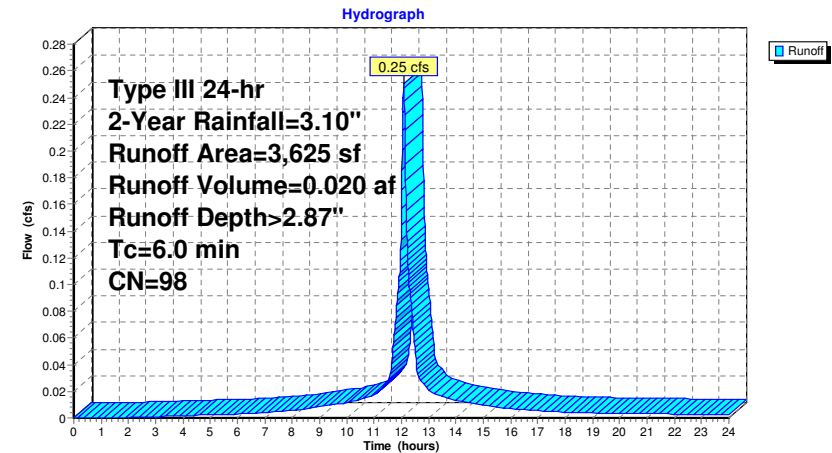
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



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Type III 24-hr 2-Year Rainfall=3.10"

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Page 33

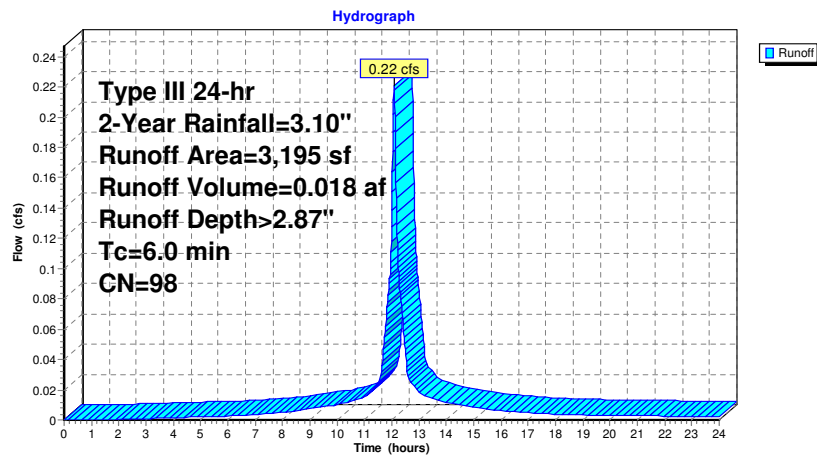
Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)**Topsfield Proposed HydroCAD**

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 34

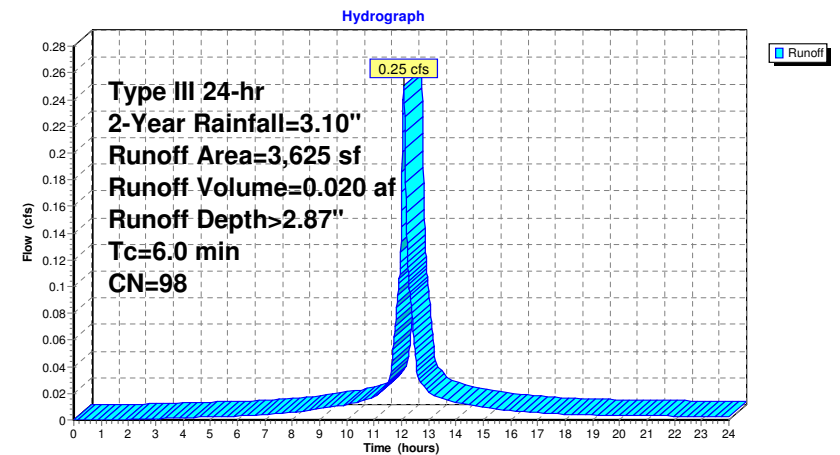
Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

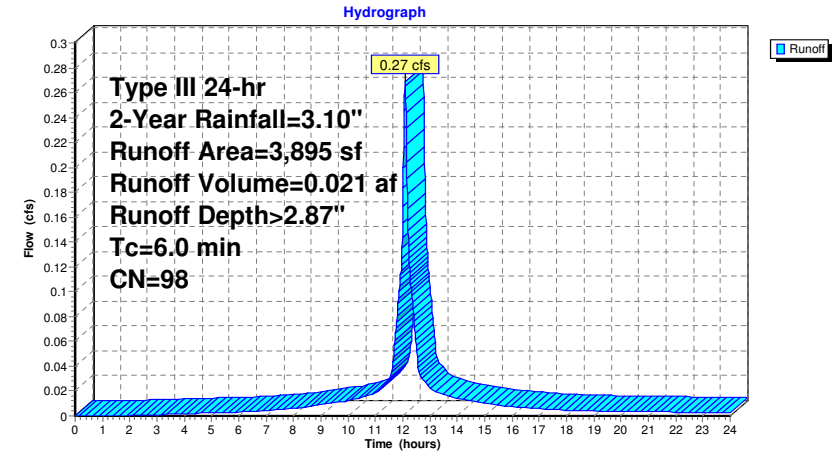
Runoff = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)



Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

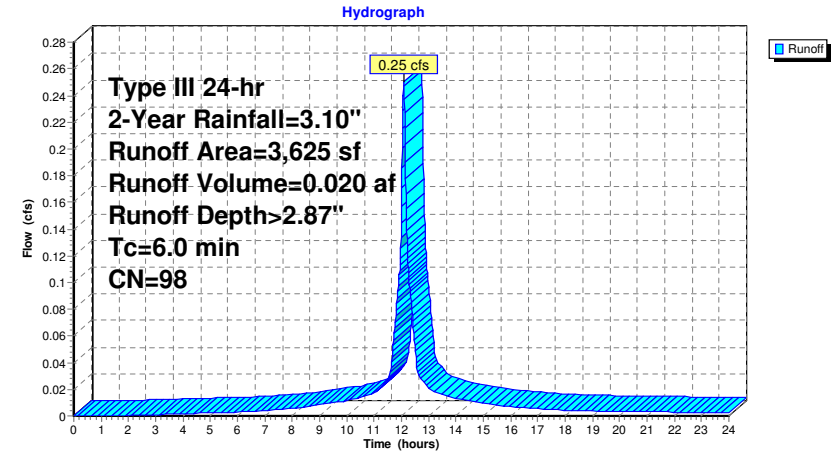
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)



Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

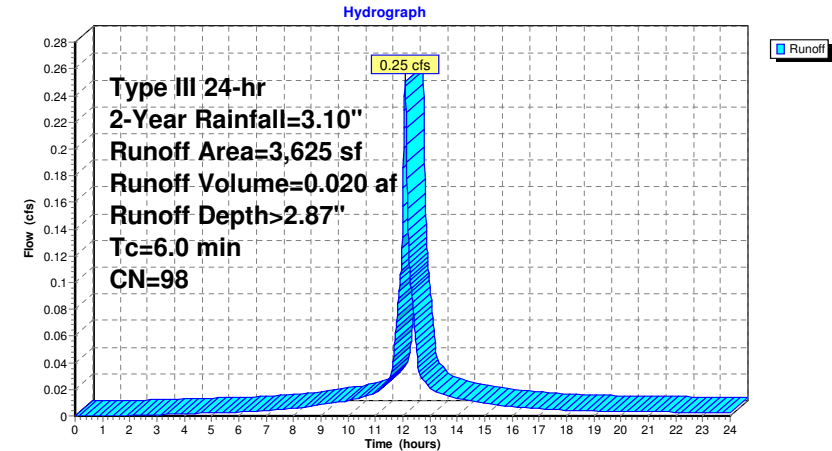
Runoff = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af, Depth> 2.87"

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=3.10"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)



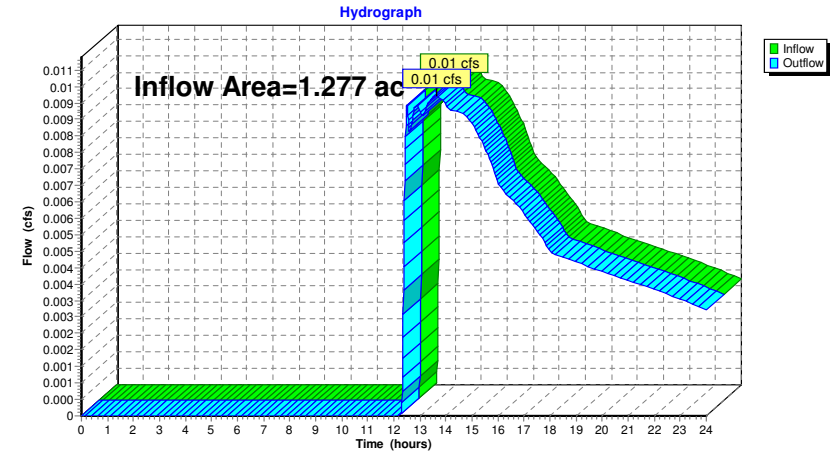
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.277 ac, 33.99% Impervious, Inflow Depth > 0.05" for 2-Year event
Inflow = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af
Outflow = 0.01 cfs @ 13.62 hrs, Volume= 0.006 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: Wetlands South of Driveway



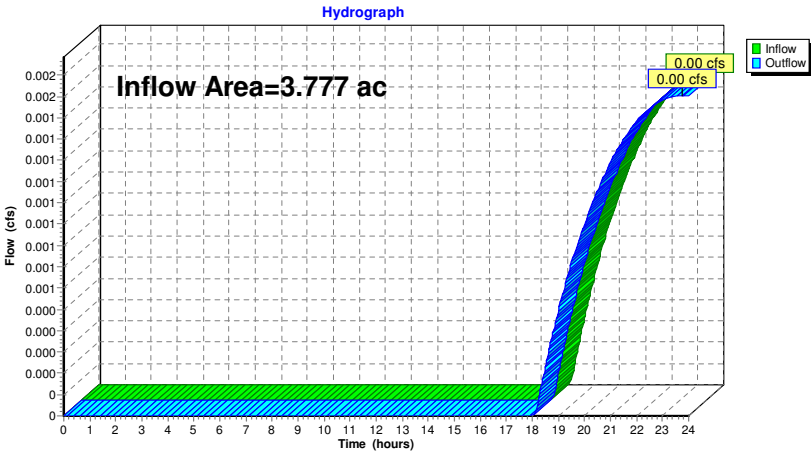
Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.777 ac, 26.87% Impervious, Inflow Depth > 0.00" for 2-Year event
Inflow = 0.00 cfs @ 23.74 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 23.74 hrs, Volume= 0.001 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: Large Wetland Area East



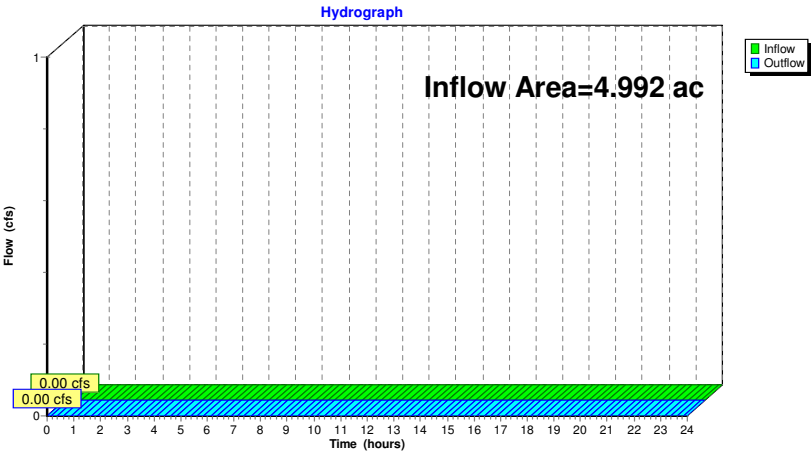
Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.992 ac, 31.07% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 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: Large Wetland Area West



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Type III 24-hr 2-Year Rainfall=3.10"

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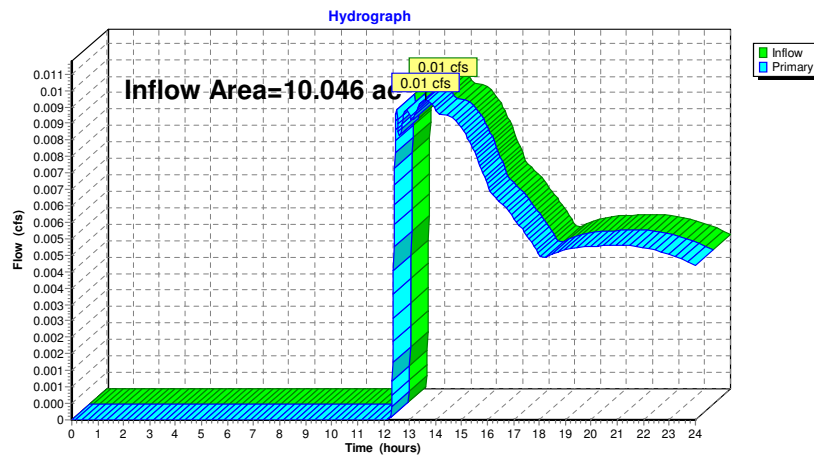
Page 41

Summary for Pond 1P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.046 ac, 29.86% Impervious, Inflow Depth > 0.01" for 2-Year event
 Inflow = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af
 Primary = 0.01 cfs @ 13.62 hrs, Volume= 0.006 af, Atten= 0%, Lag= 0.0 min

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

Pond 1P: Combined Study Points - Northern Wetlands**Topsfield Proposed HydroCAD**

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 42

Summary for Pond D-1: Surface Infiltration Pond

Inflow Area = 2.637 ac, 56.80% Impervious, Inflow Depth > 1.07" for 2-Year event
 Inflow = 3.58 cfs @ 12.10 hrs, Volume= 0.236 af
 Outflow = 0.09 cfs @ 17.35 hrs, Volume= 0.086 af, Atten= 98%, Lag= 315.0 min
 Discarded = 0.09 cfs @ 17.35 hrs, Volume= 0.086 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 68.76' @ 17.35 hrs Surf.Area= 3,625 sf Storage= 7,349 cf
 Flood Elev= 71.10' Surf.Area= 5,491 sf Storage= 17,958 cf

Plug-Flow detention time= 352.4 min calculated for 0.086 af (36% of inflow)
 Center-of-Mass det. time= 241.3 min (1,068.4 - 827.1)

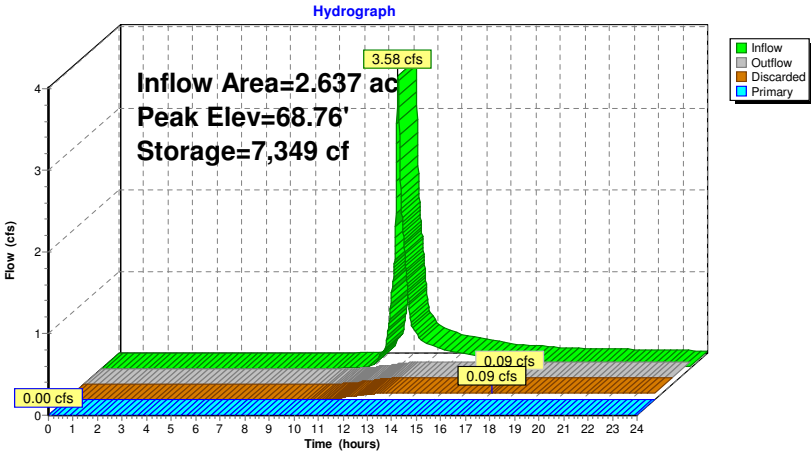
Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	56,233 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	70.00'	15.0" Round Culvert L= 252.0' Ke= 0.200 Inlet / Outlet Invert= 70.00' / 65.40' S= 0.0183 1" Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.09 cfs @ 17.35 hrs HW=68.76' (Free Discharge)
 ↑1=Exfiltration (Exfiltration Controls 0.09 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=66.00' (Free Discharge)
 ↑2=Culvert (Controls 0.00 cfs)

Pond D-1: Surface Infiltration Pond



Summary for Pond D-2: Existing Detention Basin

Inflow Area = 0.531 ac, 59.77% Impervious, Inflow Depth > 1.39" for 2-Year event
Inflow = 0.86 cfs @ 12.09 hrs, Volume= 0.061 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.07' @ 24.00 hrs Surf.Area= 3,090 sf Storage= 2,675 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

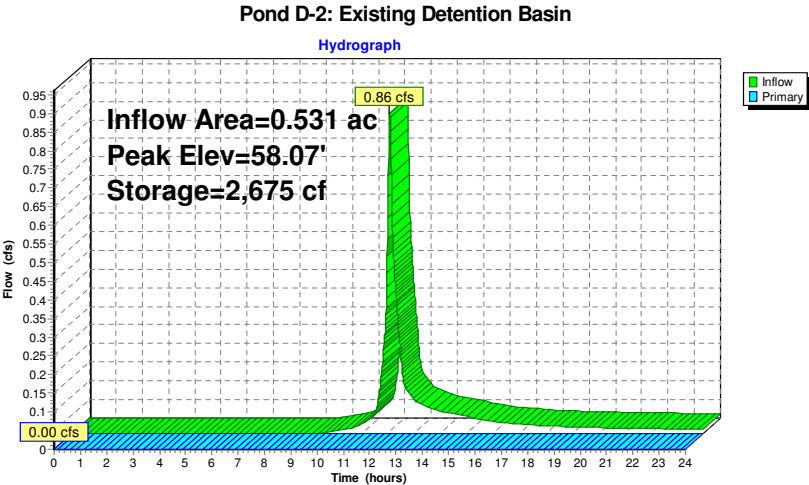
Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=57.20' (Free Discharge)
1=Orifice/Grate (Controls 0.00 cfs)
2=Orifice/Grate (Controls 0.00 cfs)



Summary for Pond D-3: Detention Pond by Access Road

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 0.82" for 2-Year event
Inflow = 0.10 cfs @ 12.10 hrs, Volume= 0.008 af
Outflow = 0.02 cfs @ 12.58 hrs, Volume= 0.008 af, Atten= 78%, Lag= 28.7 min
Discarded = 0.02 cfs @ 12.58 hrs, Volume= 0.008 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.24' @ 12.58 hrs Surf.Area= 386 sf Storage= 81 cf

Plug-Flow detention time= 26.9 min calculated for 0.008 af (100% of inflow)
Center-of-Mass det. time= 26.3 min (899.9 - 873.6)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

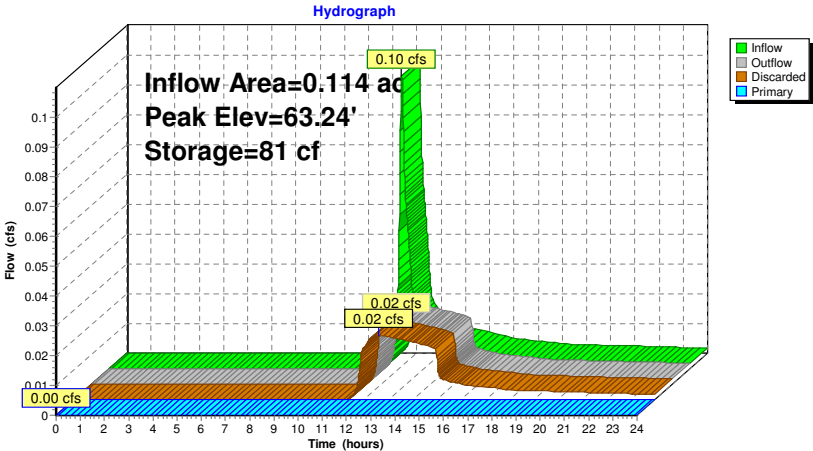
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.02 cfs @ 12.58 hrs HW=63.24' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond D-3: Detention Pond by Access Road



Summary for Pond UIS-1: UIS at Entrance

Inflow Area = 1.487 ac, 40.11% Impervious, Inflow Depth > 1.37" for 2-Year event
Inflow = 2.23 cfs @ 12.09 hrs, Volume= 0.170 af
Outflow = 0.08 cfs @ 11.39 hrs, Volume= 0.099 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.08 cfs @ 11.39 hrs, Volume= 0.099 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 61.91' @ 16.20 hrs Surf.Area= 3,486 sf Storage= 4,105 cf
Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,284 cf

Plug-Flow detention time= 292.9 min calculated for 0.099 af (58% of inflow)
Center-of-Mass det. time= 172.7 min (993.1 - 820.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,089 cf	50.50'W x 69.03'L x 6.00'H Field A 20,917 cf Overall - 8,195 cf Embedded = 12,722 cf x 40.0% Voids
#2A	61.00'	8,195 cf	Cultec R-902HD x 126 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67"L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 7 Rows of 18 Chambers Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
13,284 cf			Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	68.40'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 11.39 hrs HW=60.08' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=60.00' (Free Discharge)
2=Orifice/Grate (Controls 0.00 cfs)

Pond UIS-1: UIS at Entrance - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf

78.0" Wide + 6.0" Spacing = 84.0" C-C Row Spacing

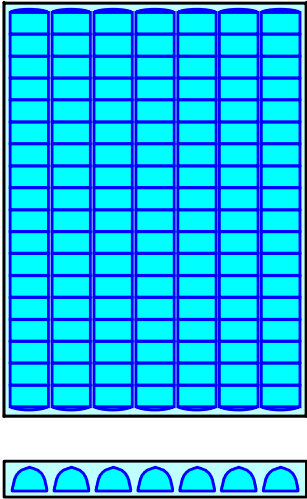
18 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 67.03' Row Length +12.0" End Stone x 2 = 69.03' Base Length
7 Rows x 78.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 50.50' Base Width
12.0" Base + 48.0" Chamber Height + 12.0" Cover = 6.00' Field Height

126 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 7 Rows = 8,195.2 cf Chamber Storage

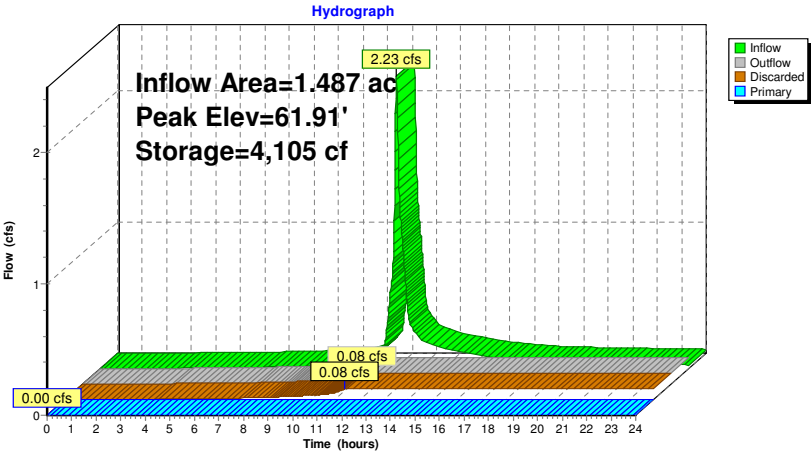
20,917.1 cf Field - 8,195.2 cf Chambers = 12,721.9 cf Stone x 40.0% Voids = 5,088.7 cf Stone Storage

Chamber Storage + Stone Storage = 13,284.0 cf = 0.305 af
Overall Storage Efficiency = 63.5%
Overall System Size = 69.03' x 50.50' x 6.00'

126 Chambers
774.7 cy Field
471.2 cy Stone



Pond UIS-1: UIS at Entrance



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Page 51

Summary for Pond UIS-2: UIS at North of Site

Inflow Area = 0.419 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
 Inflow = 1.26 cfs @ 12.08 hrs, Volume= 0.100 af
 Outflow = 0.23 cfs @ 11.70 hrs, Volume= 0.100 af, Atten= 82%, Lag= 0.0 min
 Discarded = 0.23 cfs @ 11.70 hrs, Volume= 0.100 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 63.15' @ 12.53 hrs Surf.Area= 1,176 sf Storage= 1,100 cf
 Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 26.6 min calculated for 0.100 af (100% of inflow)
 Center-of-Mass det. time= 26.4 min (782.9 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	16.00'W x 73.50'L x 4.04'H Field A 4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	Cultec R-330XLHD x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	68.25'	6.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.70 hrs HW=61.57' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.23 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=61.50' (Free Discharge)↑**2=Orifice/Grate** (Controls 0.00 cfs)**Topsfield Proposed HydroCAD**

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Page 52

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50'

Base Length

3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width

12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af

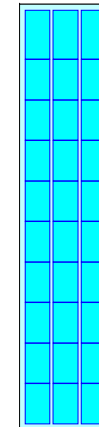
Overall Storage Efficiency = 60.2%

Overall System Size = 73.50' x 16.00' x 4.04'

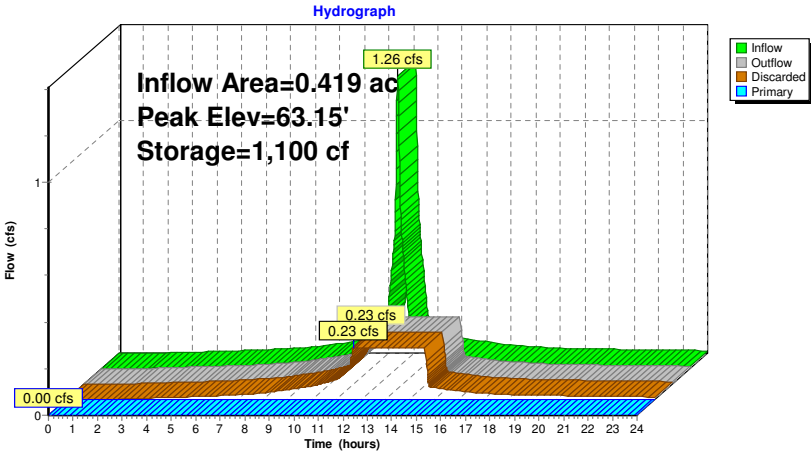
30 Chambers

176.0 cy Field

116.8 cy Stone



Pond UIS-2: UIS at North of Site



Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.46' above defined flood level

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event

Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af

Outflow = 0.25 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 1%, Lag= 0.7 min

Discarded = 0.00 cfs @ 5.30 hrs, Volume= 0.004 af

Primary = 0.25 cfs @ 12.10 hrs, Volume= 0.013 af

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

Peak Elev= 73.67' @ 12.10 hrs Surf.Area= 103 sf Storage= 130 cf

Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 87.7 min calculated for 0.017 af (87% of inflow)

Center-of-Mass det. time= 29.7 min (786.3 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.40'	6.0" Round Culvert L= 30.0' Ke= 0.200 Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=71.72' (Free Discharge)

↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.24 cfs @ 12.10 hrs HW=73.67' (Free Discharge)

↑**2=Culvert** (Inlet Controls 0.24 cfs @ 2.23 fps)

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Page 55

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

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

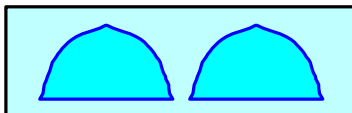
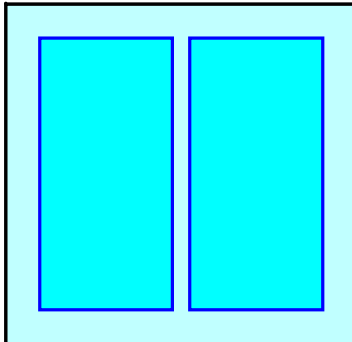
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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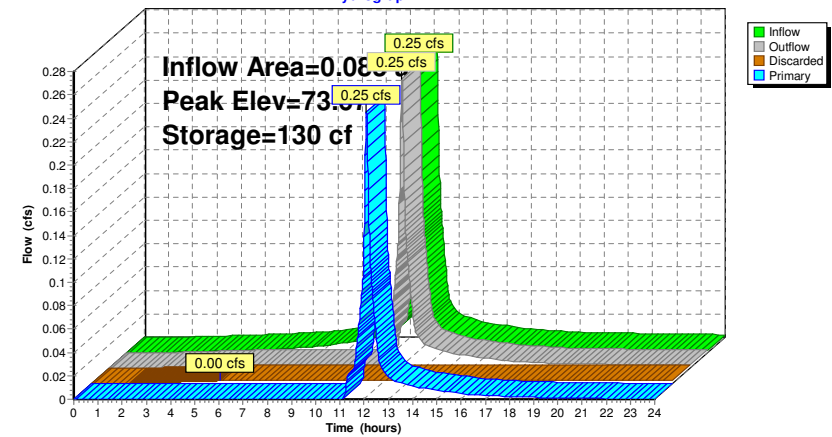
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Page 56

Pond UIS-3: UIS-3

Hydrograph



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Page 57

Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.35' above defined flood level

Inflow Area = 0.073 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
 Inflow = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af
 Outflow = 0.22 cfs @ 12.10 hrs, Volume= 0.015 af, Atten= 2%, Lag= 1.1 min
 Discarded = 0.00 cfs @ 5.85 hrs, Volume= 0.004 af
 Primary = 0.21 cfs @ 12.10 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 74.55' @ 12.10 hrs Surf.Area= 103 sf Storage= 134 cf
 Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 94.4 min calculated for 0.015 af (86% of inflow)
 Center-of-Mass det. time= 32.3 min (788.8 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.20'	6.0" Round Culvert L= 30.0' Ke= 1.000 Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.85 hrs HW=72.53' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.21 cfs @ 12.10 hrs HW=74.55' (Free Discharge)↑**2=Culvert** (Barrel Controls 0.21 cfs @ 2.01 fps)**Topsfield Proposed HydroCAD**

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Page 58

Pond UIS-4: UIS-4 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
 Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
 Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

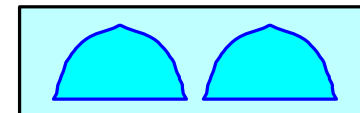
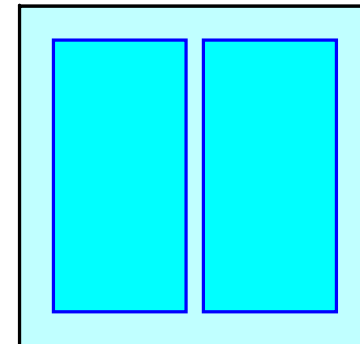
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
 2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
 6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

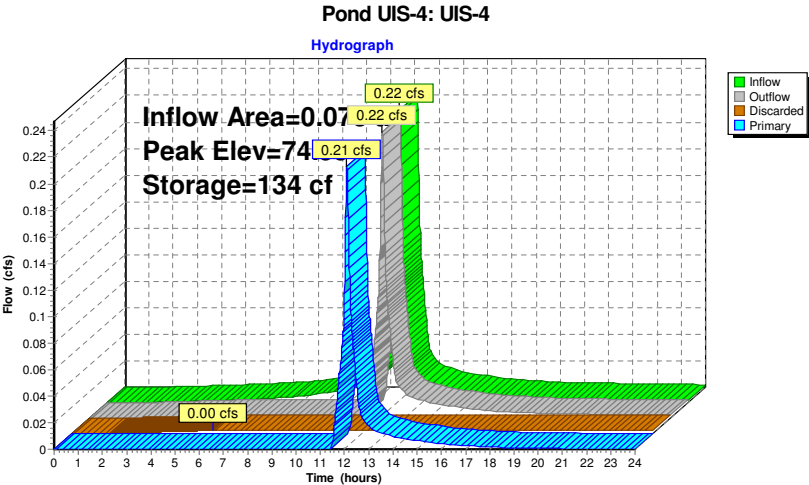
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
 Overall Storage Efficiency = 57.6%
 Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
 12.3 cy Field
 8.7 cy Stone





Summary for Pond UIS-5: UIS-5

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af
Outflow = 0.24 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 2%, Lag= 1.0 min
Discarded = 0.00 cfs @ 5.30 hrs, Volume= 0.004 af
Primary = 0.24 cfs @ 12.10 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 75.17' @ 12.10 hrs Surf.Area= 103 sf Storage= 136 cf

Plug-Flow detention time= 88.8 min calculated for 0.017 af (87% of inflow)
Center-of-Mass det. time= 30.6 min (787.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.80'	6.0" Round Culvert L= 22.0' Ke= 1.000 Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=73.12' (Free Discharge)
↳ **1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.24 cfs @ 12.10 hrs HW=75.17' (Free Discharge)
↳ **2=Culvert** (Inlet Controls 0.24 cfs @ 1.55 fps)

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Page 61

Pond UIS-5: UIS-5 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

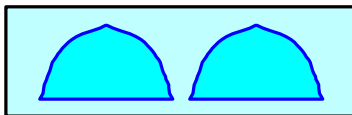
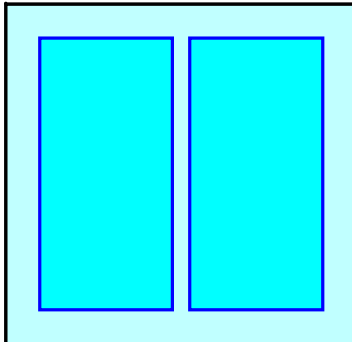
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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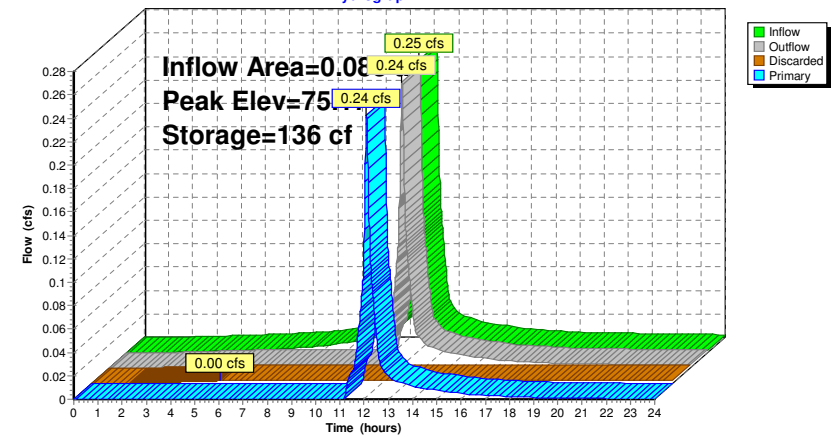
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Page 62

Pond UIS-5: UIS-5

Hydrograph



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Page 63

Summary for Pond UIS-6: UIS-6

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
 Inflow = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af
 Outflow = 0.26 cfs @ 12.10 hrs, Volume= 0.019 af, Atten= 2%, Lag= 1.0 min
 Discarded = 0.00 cfs @ 5.03 hrs, Volume= 0.004 af
 Primary = 0.26 cfs @ 12.10 hrs, Volume= 0.015 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 74.39' @ 12.10 hrs Surf.Area= 103 sf Storage= 137 cf

Plug-Flow detention time= 85.5 min calculated for 0.019 af (88% of inflow)
 Center-of-Mass det. time= 30.0 min (786.5 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.00'	6.0" Round Culvert L= 106.0' Ke= 1.000 Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.03 hrs HW=72.32' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.26 cfs @ 12.10 hrs HW=74.39' (Free Discharge)**2=Culvert** (Inlet Controls 0.26 cfs @ 1.59 fps)**Topsfield Proposed HydroCAD**

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Page 64

Pond UIS-6: UIS-6 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

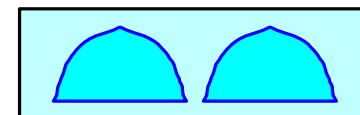
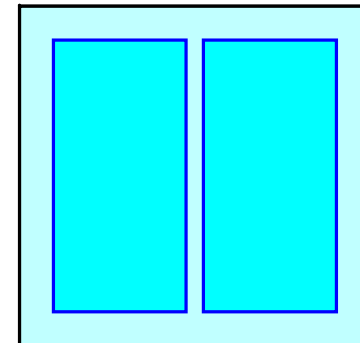
Overall Storage Efficiency = 57.6%

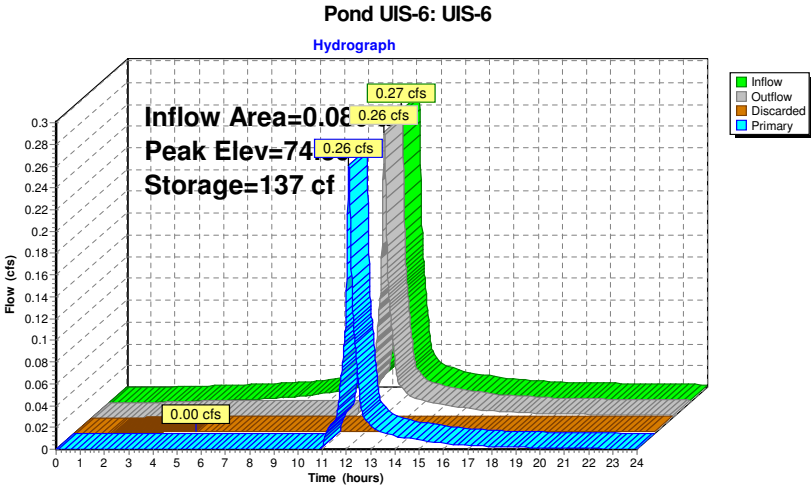
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-7: UIS-7

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af
Outflow = 0.24 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 2%, Lag= 1.0 min
Discarded = 0.00 cfs @ 5.30 hrs, Volume= 0.004 af
Primary = 0.24 cfs @ 12.10 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.87' @ 12.10 hrs Surf.Area= 103 sf Storage= 136 cf

Plug-Flow detention time= 88.8 min calculated for 0.017 af (87% of inflow)
Center-of-Mass det. time= 30.6 min (787.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.50'	6.0" Round Culvert L= 17.5' Ke= 1.000 Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=71.82' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.24 cfs @ 12.10 hrs HW=73.87' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.24 cfs @ 1.55 fps)

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Page 67

Pond UIS-7: UIS-7 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

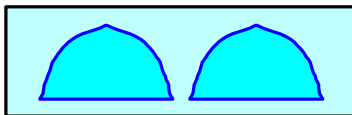
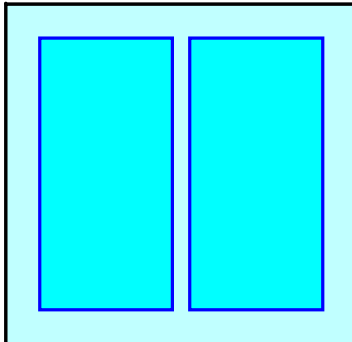
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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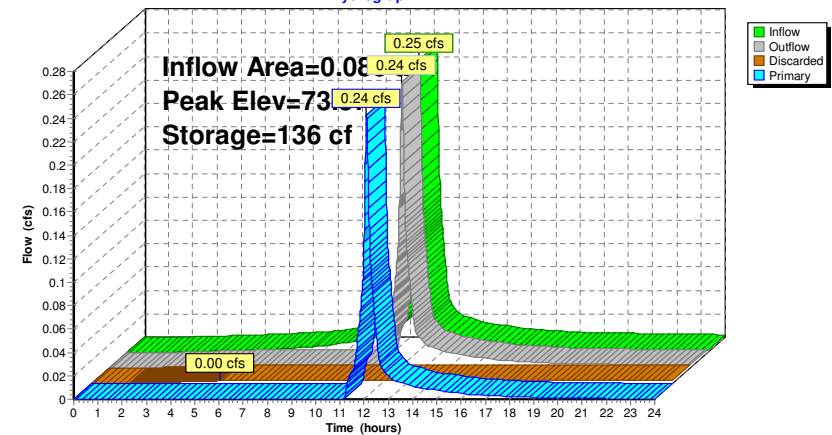
Type III 24-hr 2-Year Rainfall=3.10"

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Page 68

Pond UIS-7: UIS-7

Hydrograph



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Page 69

Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
 Inflow = 0.25 cfs @ 12.08 hrs, Volume= 0.020 af
 Outflow = 0.24 cfs @ 12.10 hrs, Volume= 0.017 af, Atten= 2%, Lag= 1.0 min
 Discarded = 0.00 cfs @ 5.30 hrs, Volume= 0.004 af
 Primary = 0.24 cfs @ 12.10 hrs, Volume= 0.013 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 73.17' @ 12.10 hrs Surf.Area= 103 sf Storage= 136 cf

Plug-Flow detention time= 88.8 min calculated for 0.017 af (87% of inflow)
 Center-of-Mass det. time= 30.6 min (787.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.80'	6.0" Round Culvert L= 37.0' Ke= 1.000 Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.30 hrs HW=71.12' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.24 cfs @ 12.10 hrs HW=73.17' (Free Discharge)**2=Culvert** (Inlet Controls 0.24 cfs @ 1.55 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 2-Year Rainfall=3.10"

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Page 70

Pond UIS-8: UIS-8 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

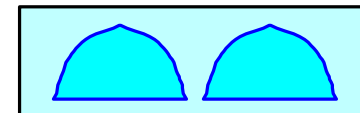
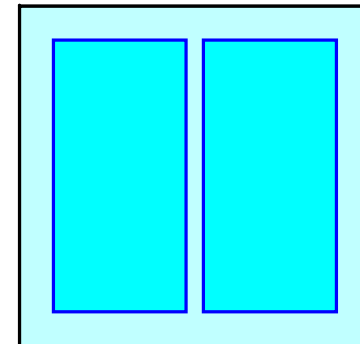
Overall Storage Efficiency = 57.6%

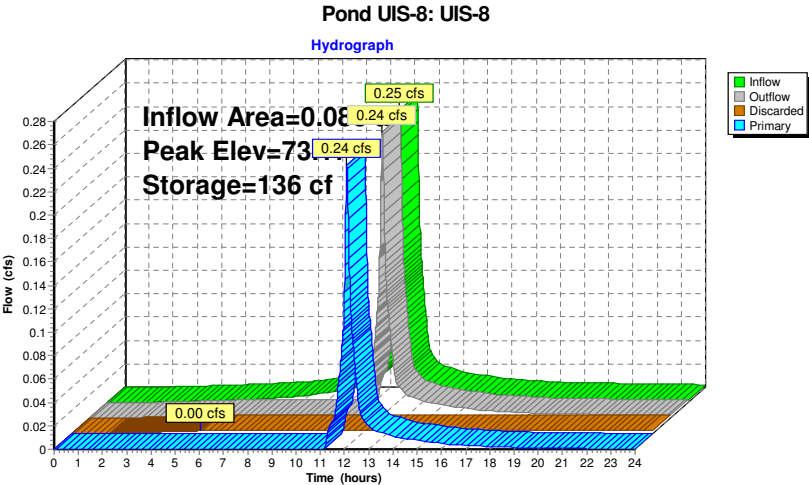
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-9: UIS-9

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 2.87" for 2-Year event
Inflow = 0.27 cfs @ 12.08 hrs, Volume= 0.021 af
Outflow = 0.26 cfs @ 12.10 hrs, Volume= 0.020 af, Atten= 3%, Lag= 1.2 min
Discarded = 0.00 cfs @ 5.03 hrs, Volume= 0.004 af
Primary = 0.26 cfs @ 12.10 hrs, Volume= 0.016 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 72.57' @ 12.10 hrs Surf.Area= 103 sf Storage= 81 cf

Plug-Flow detention time= 51.1 min calculated for 0.020 af (94% of inflow)
Center-of-Mass det. time= 19.6 min (776.1 - 756.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.18'	6.0" Round Culvert L= 79.0' Ke= 1.000 Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 ' S Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 5.03 hrs HW=71.31' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.26 cfs @ 12.10 hrs HW=72.57' (Free Discharge)
2=Culvert (Inlet Controls 0.26 cfs @ 1.59 fps)

Pond UIS-9: UIS-9 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)
Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

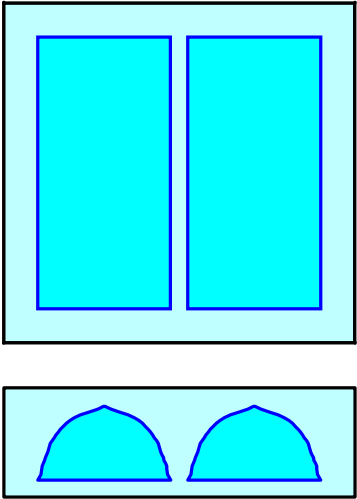
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

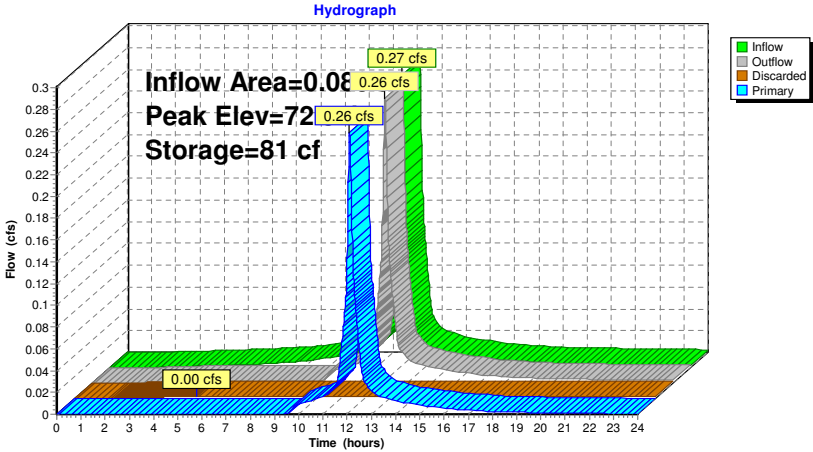
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-9: UIS-9



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Page 75

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: Northern Grassed Area to	Runoff Area=81,522 sf 0.00% Impervious Runoff Depth>0.16" Tc=6.0 min CN=41 Runoff=0.05 cfs 0.026 af
Subcatchment P-10: Area Around Isolated	Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>2.05" Flow Length=533' Tc=6.0 min UI Adjusted CN=75 Runoff=1.73 cfs 0.124 af
Subcatchment P-2: Existing Drive to Existing	Runoff Area=23,114 sf 59.77% Impervious Runoff Depth>2.55" Tc=6.0 min CN=81 Runoff=1.59 cfs 0.113 af
Subcatchment P-3: Area Around Isolated	Runoff Area=27,582 sf 12.85% Impervious Runoff Depth>0.50" Tc=6.0 min UI Adjusted CN=50 Runoff=0.18 cfs 0.026 af
Subcatchment P-3A: Gravel Road to Detention	Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>1.74" Tc=6.0 min CN=71 Runoff=0.23 cfs 0.017 af
Subcatchment P-4: Sloped Entrance Drive -	Runoff Area=21,573 sf 55.93% Impervious Runoff Depth>2.13" Tc=6.0 min CN=76 Runoff=1.23 cfs 0.088 af
Subcatchment P-5: Driveway - Units 25-11	Runoff Area=39,272 sf 51.57% Impervious Runoff Depth>1.97" Tc=6.0 min CN=74 Runoff=2.06 cfs 0.148 af
Subcatchment P-6: Pavement Units 12-19	Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>2.29" Tc=6.0 min CN=78 Runoff=1.18 cfs 0.084 af
Subcatchment P-7: Driveway - Units 20-24	Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>1.74" Tc=6.0 min CN=71 Runoff=0.72 cfs 0.052 af
Subcatchment P-8: Surface Infiltration Pond	Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.23" Tc=6.0 min CN=43 Runoff=0.02 cfs 0.007 af
Subcatchment P-9: Woods/Grass Northwest	Runoff Area=102,567 sf 2.25% Impervious Runoff Depth>0.05" Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.01 cfs 0.009 af
Subcatchment R-1: Roof - Units 1&2 (C&B)	Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af
Subcatchment R-10: Roof - Units 19&20 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af
Subcatchment R-11: Roof - Units 21&22 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af
Subcatchment R-12: Roof - Units 23&24 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af
Subcatchment R-13: Roof - Units 25&26 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

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Page 76

Subcatchment R-14: Roof Units 27&28 - A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af
Subcatchment R-15: Roof Units 29&30 - (B & C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af
Subcatchment R-16: Front Units 29&30	Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.15 cfs 0.012 af
Subcatchment R-17: Mailbox Structure Roof	Runoff Area=120 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.01 cfs 0.001 af
Subcatchment R-2: Roof Units 3&4 - (B & C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af
Subcatchment R-3: Roof Units 5&6 - A&B Units	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af
Subcatchment R-4: Roof - Units 7&8 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af
Subcatchment R-5: Roof - Units 9&10 - (B&C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.32 cfs 0.026 af
Subcatchment R-6: Roof - Units 11&12 - (B&A	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af
Subcatchment R-7: Roof - Units 13&14 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af
Subcatchment R-8: Roof - Units 15&16 - (B&A	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af
Subcatchment R-9: Roof - Units 17&18 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>4.26" Tc=6.0 min CN=98 Runoff=0.37 cfs 0.030 af
Reach SP-1: Wetlands South of Driveway	Inflow=0.18 cfs 0.070 af Outflow=0.18 cfs 0.070 af
Reach SP-2: Large Wetland Area East	Inflow=0.05 cfs 0.026 af Outflow=0.05 cfs 0.026 af
Reach SP-3: Large Wetland Area West	Inflow=0.21 cfs 0.065 af Outflow=0.21 cfs 0.065 af
Pond 1P: Combined Study Points - Northern Wetlands	Inflow=0.36 cfs 0.160 af Primary=0.36 cfs 0.160 af
Pond D-1: Surface Infiltration Pond	Peak Elev=70.18' Storage=13,275 cf Inflow=6.42 cfs 0.451 af Discarded=0.11 cfs 0.116 af Primary=0.20 cfs 0.056 af Outflow=0.31 cfs 0.172 af

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Page 77

Pond D-2: Existing Detention Basin Peak Elev=58.28' Storage=3,324 cf Inflow=1.59 cfs 0.113 af
Outflow=0.08 cfs 0.043 af

Pond D-3: Detention Pond by Access Road Peak Elev=63.62' Storage=253 cf Inflow=0.23 cfs 0.017 af
Discarded=0.03 cfs 0.017 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.017 af

Pond UIS-1: UIS at Entrance Peak Elev=63.66' Storage=8,986 cf Inflow=4.13 cfs 0.306 af
Discarded=0.08 cfs 0.108 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.108 af

Pond UIS-2: UIS at North of Site Peak Elev=64.08' Storage=1,956 cf Inflow=1.84 cfs 0.149 af
Discarded=0.23 cfs 0.149 af Primary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.149 af

Pond UIS-3: UIS-3 Peak Elev=73.74' Storage=135 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.36 cfs 0.023 af Outflow=0.36 cfs 0.027 af

Pond UIS-4: UIS-4 Peak Elev=74.65' Storage=141 cf Inflow=0.32 cfs 0.026 af
Discarded=0.00 cfs 0.004 af Primary=0.31 cfs 0.019 af Outflow=0.32 cfs 0.023 af

Pond UIS-5: UIS-5 Peak Elev=75.29' Storage=144 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.35 cfs 0.023 af Outflow=0.35 cfs 0.027 af

Pond UIS-6: UIS-6 Peak Elev=74.53' Storage=146 cf Inflow=0.39 cfs 0.032 af
Discarded=0.00 cfs 0.004 af Primary=0.38 cfs 0.025 af Outflow=0.38 cfs 0.029 af

Pond UIS-7: UIS-7 Peak Elev=73.99' Storage=144 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.35 cfs 0.023 af Outflow=0.35 cfs 0.027 af

Pond UIS-8: UIS-8 Peak Elev=73.29' Storage=144 cf Inflow=0.37 cfs 0.030 af
Discarded=0.00 cfs 0.004 af Primary=0.35 cfs 0.023 af Outflow=0.35 cfs 0.027 af

Pond UIS-9: UIS-9 Peak Elev=72.71' Storage=91 cf Inflow=0.39 cfs 0.032 af
Discarded=0.00 cfs 0.004 af Primary=0.37 cfs 0.026 af Outflow=0.38 cfs 0.031 af

Total Runoff Area = 10.046 ac Runoff Volume = 1.143 af Average Runoff Depth = 1.37"
70.14% Pervious = 7.046 ac 29.86% Impervious = 3.000 ac

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Page 78

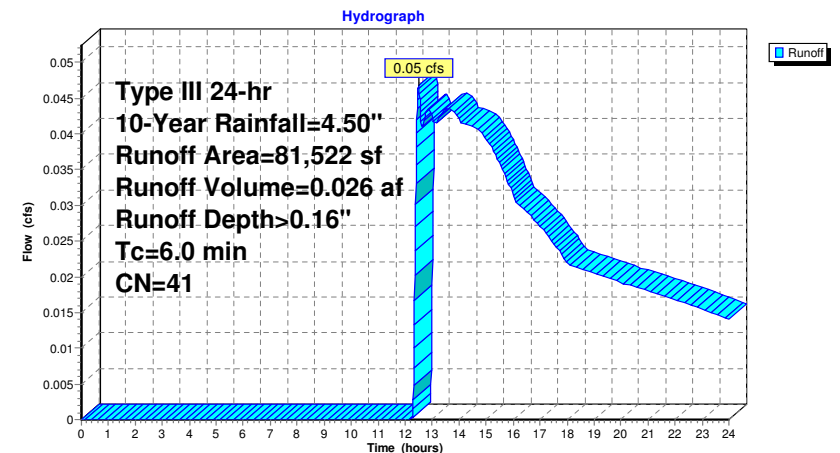
Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

Runoff = 0.05 cfs @ 12.50 hrs, Volume= 0.026 af, Depth> 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
38,137	30	Woods, Good, HSG A
10,782	70	Woods, Good, HSG C
9,419	55	Woods, Good, HSG B
23,184	39	>75% Grass cover, Good, HSG A
81,522	41	Weighted Average
81,522		100.00% Pervious Area

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

Subcatchment P-1: Northern Grassed Area to Wetlands

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 79

Summary for Subcatchment P-10: Area Around Isolated Wetland

Runoff = 1.73 cfs @ 12.09 hrs, Volume= 0.124 af, Depth> 2.05"

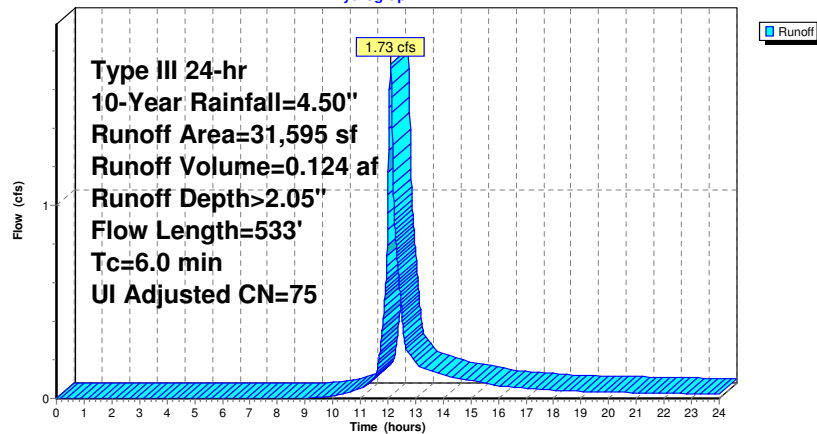
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1100	0.29		Sheet Flow, A-B
					Grass: Short n= 0.150 P2= 3.10"
2.9	483	0.1600	2.80		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
5.8	533				Total, Increased to minimum Tc = 6.0 min

Subcatchment P-10: Area Around Isolated Wetland

Hydrograph

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 80

Summary for Subcatchment P-2: Existing Drive to Existing Basin

Runoff = 1.59 cfs @ 12.09 hrs, Volume= 0.113 af, Depth> 2.55"

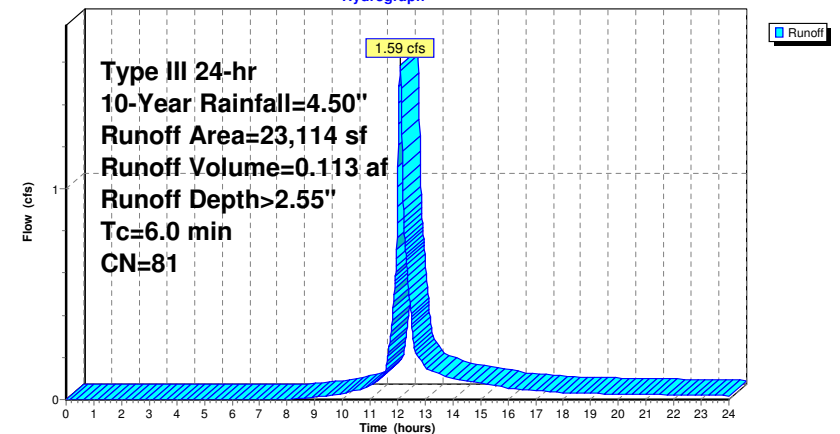
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
13,815	98	Paved parking, HSG A
1,353	76	Gravel roads, HSG A
4,896	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
23,114	81	Weighted Average
9,299		40.23% Pervious Area
13,815		59.77% Impervious Area

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

Subcatchment P-2: Existing Drive to Existing Basin

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 81

Summary for Subcatchment P-3: Area Around Isolated Wetland

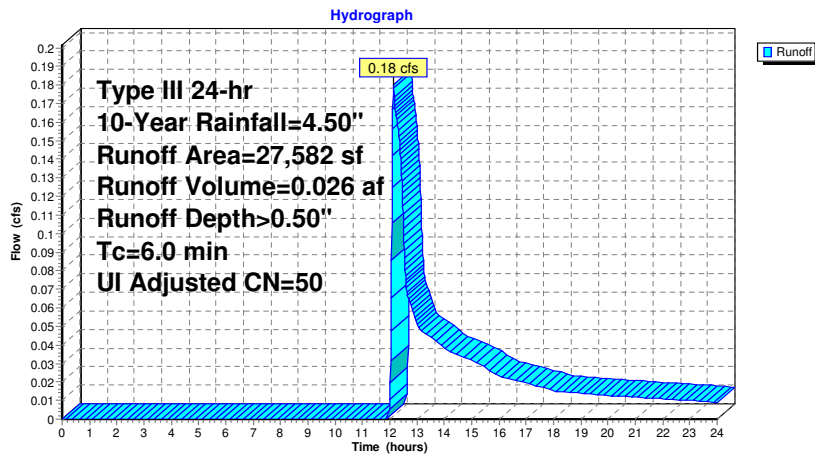
Runoff = 0.18 cfs @ 12.14 hrs, Volume= 0.026 af, Depth> 0.50"

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=4.50"

Area (sf)	CN	Adj	Description
3,545	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,582	53	50	Weighted Average, UI Adjusted
24,037			87.15% Pervious Area
3,545			12.85% Impervious Area
3,545			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 82

Summary for Subcatchment P-3A: Gravel Road to Detention Basin

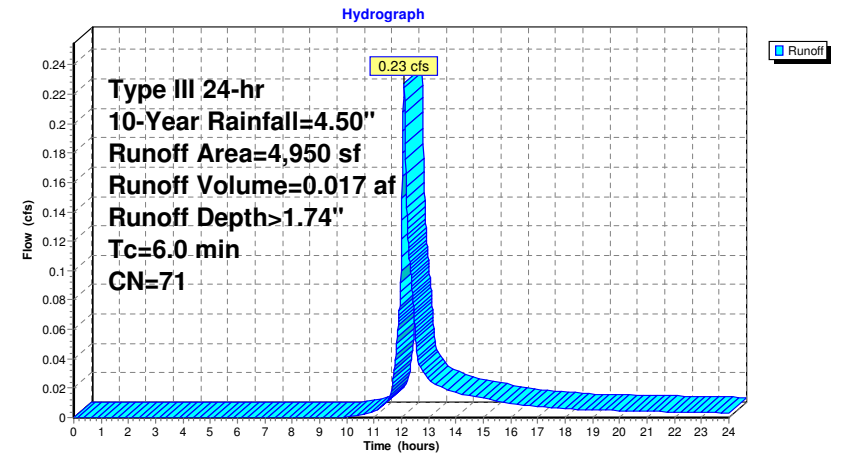
Runoff = 0.23 cfs @ 12.09 hrs, Volume= 0.017 af, Depth> 1.74"

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=4.50"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 83

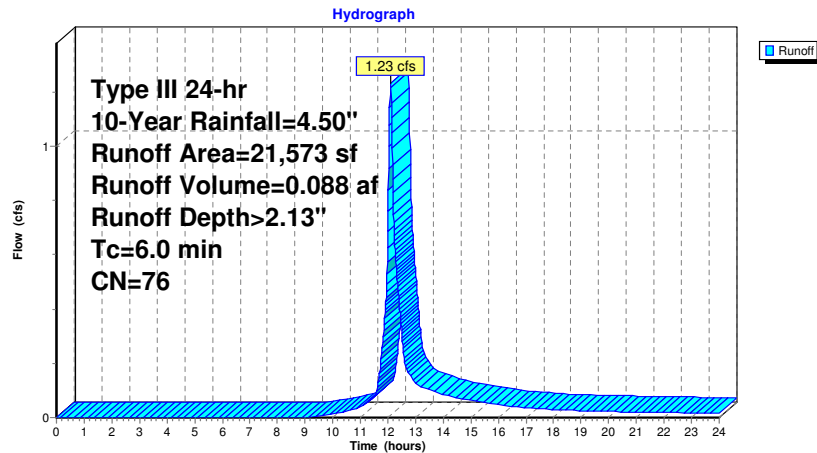
Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

Runoff = 1.23 cfs @ 12.09 hrs, Volume= 0.088 af, Depth> 2.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
12,066	98	Paved parking, HSG A
6,808	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,573	76	Weighted Average
9,507		44.07% Pervious Area
12,066		55.93% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5**Topsfield Proposed HydroCAD**

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 84

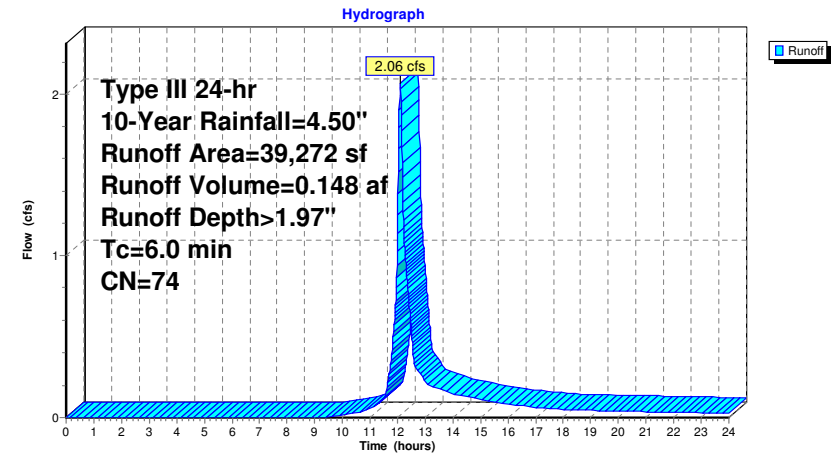
Summary for Subcatchment P-5: Driveway - Units 25-11

Runoff = 2.06 cfs @ 12.09 hrs, Volume= 0.148 af, Depth> 1.97"

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=4.50"

Area (sf)	CN	Description
20,251	98	Paved parking, HSG A
14,308	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
39,272	74	Weighted Average
19,021		48.43% Pervious Area
20,251		51.57% Impervious Area

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

Subcatchment P-5: Driveway - Units 25-11

Summary for Subcatchment P-6: Pavement Units 12-19

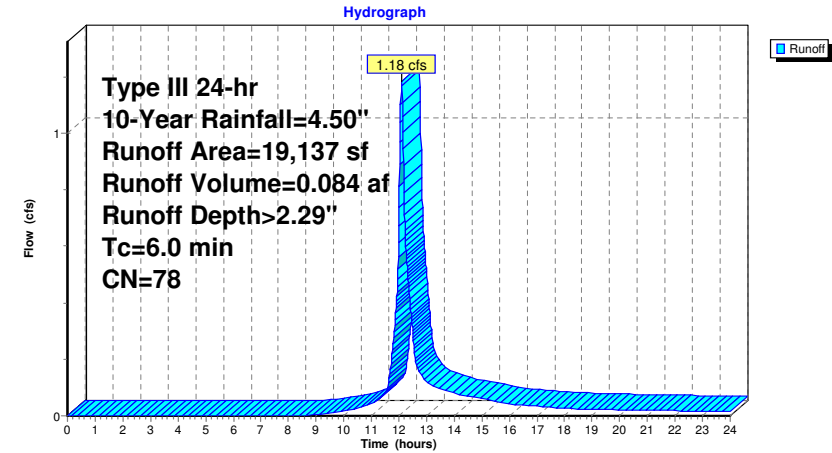
Runoff = 1.18 cfs @ 12.09 hrs, Volume= 0.084 af, Depth> 2.29"

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=4.50"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

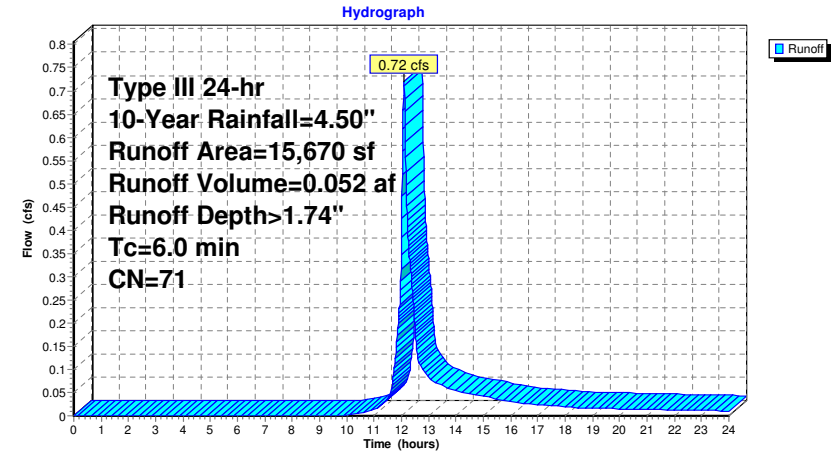
Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.052 af, Depth> 1.74"

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=4.50"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 87

Summary for Subcatchment P-8: Surface Infiltration Pond Area

Runoff = 0.02 cfs @ 12.42 hrs, Volume= 0.007 af, Depth> 0.23"

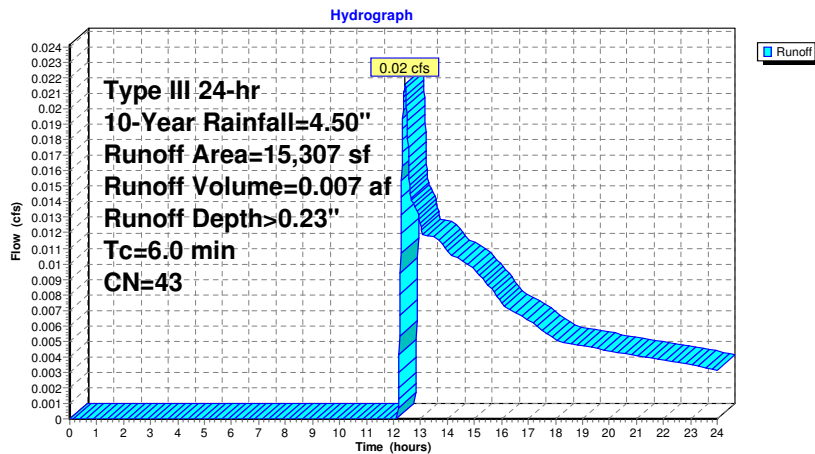
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 88

Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

Runoff = 0.01 cfs @ 15.71 hrs, Volume= 0.009 af, Depth> 0.05"

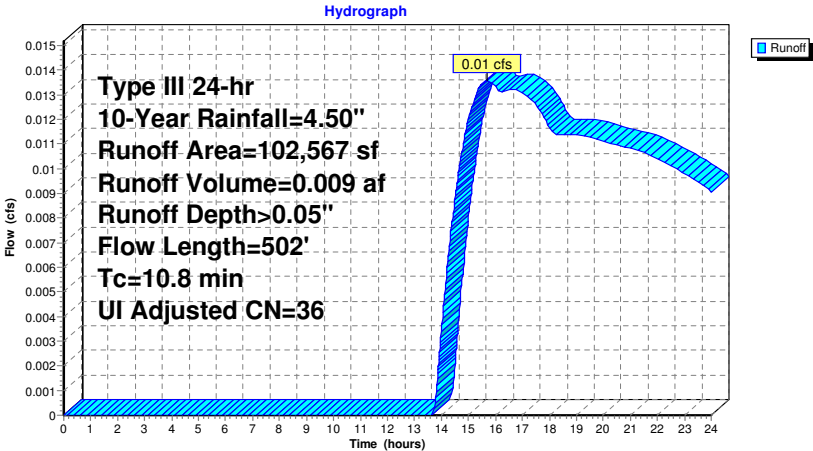
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type III 24-hr 10-Year Rainfall=4.50"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
10.8	502	Total			

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands



Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

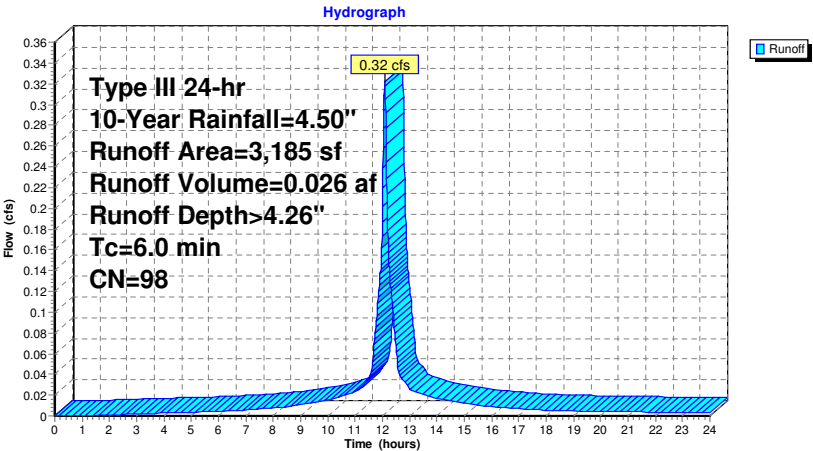
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)



Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

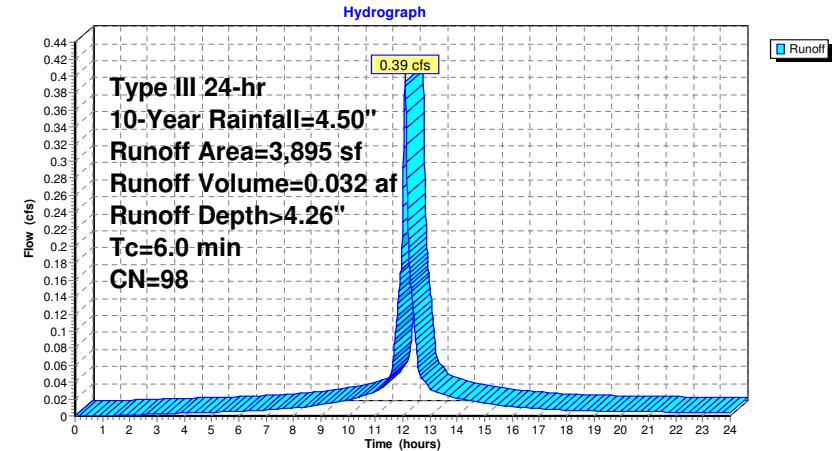
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)



Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

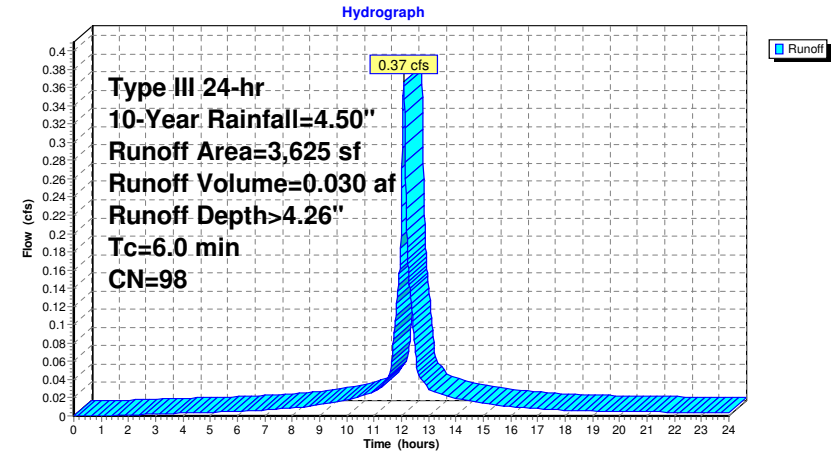
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 93

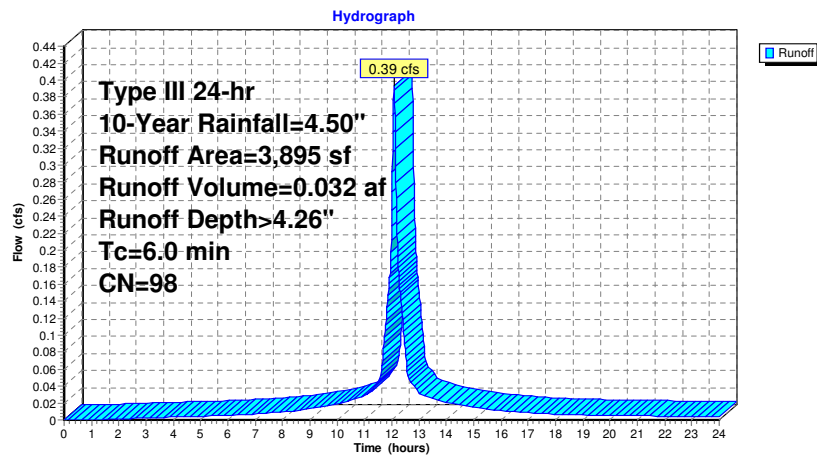
Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)**Topsfield Proposed HydroCAD**

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 94

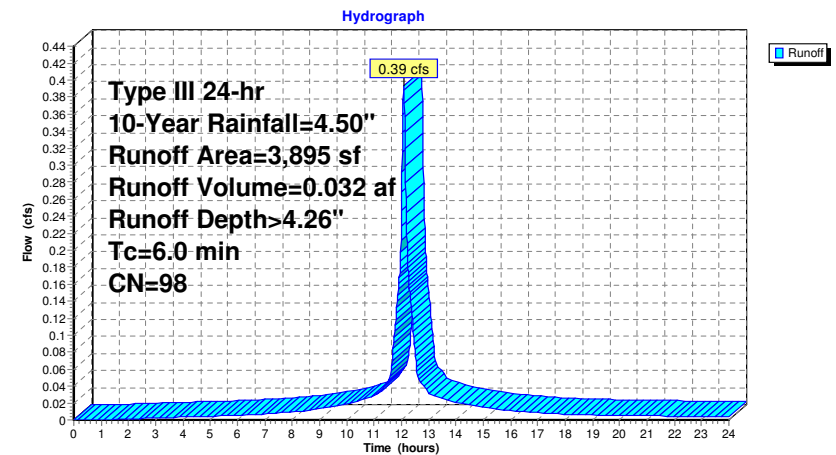
Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)

Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

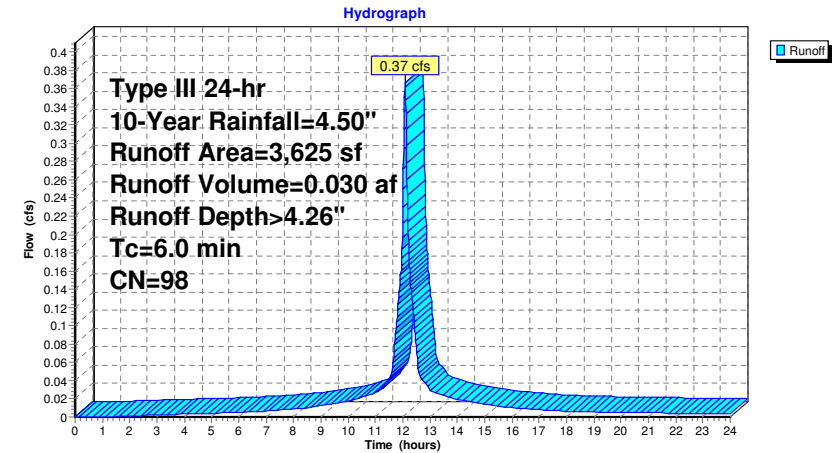
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

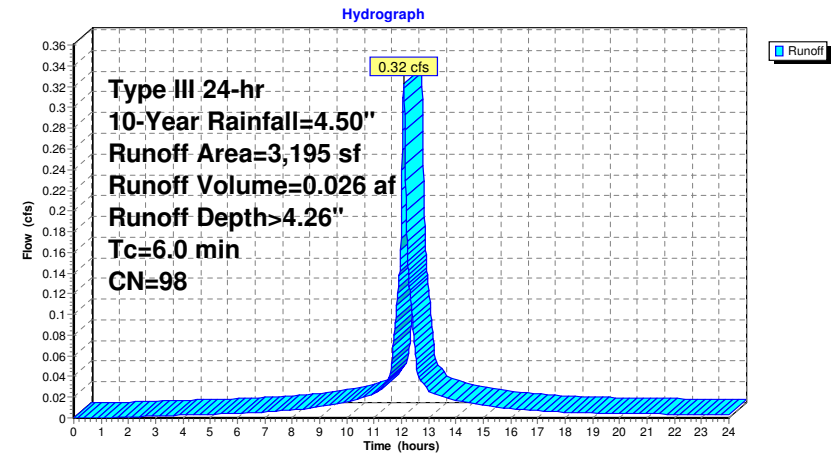
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

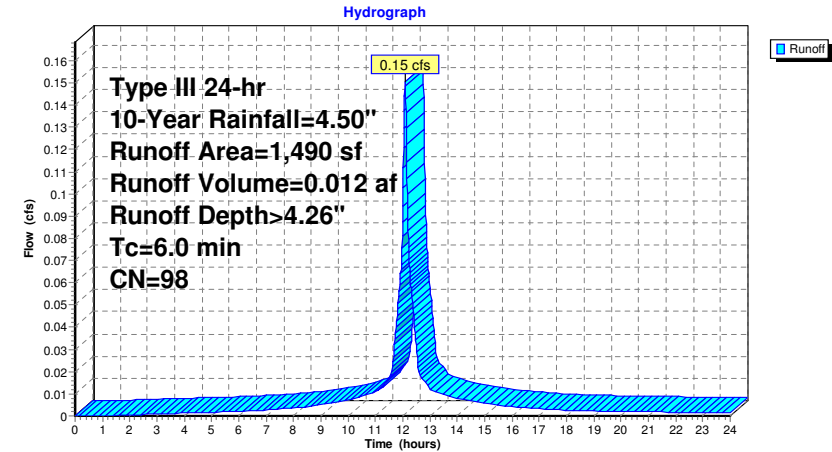
Runoff = 0.15 cfs @ 12.08 hrs, Volume= 0.012 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

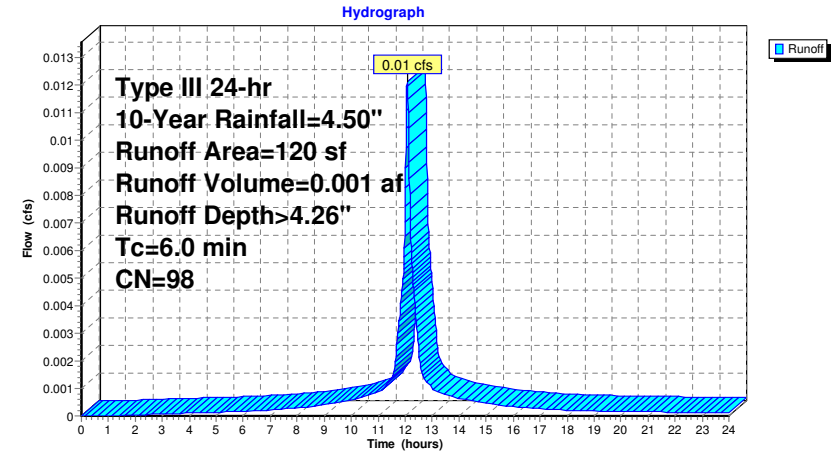
Runoff = 0.01 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

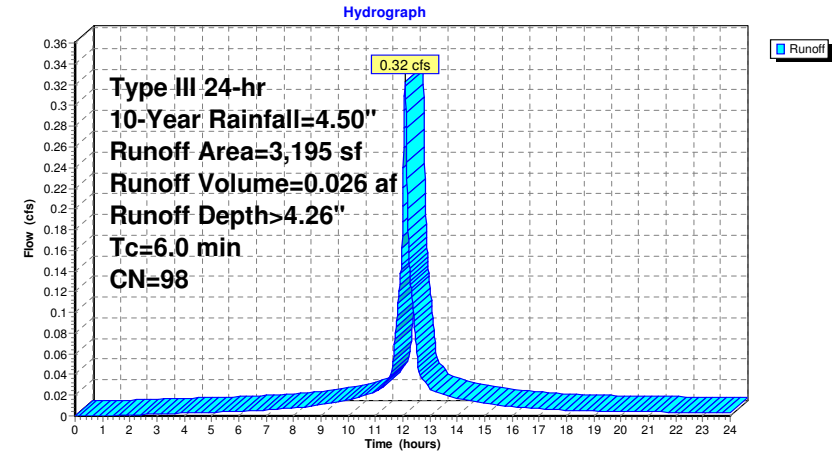
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

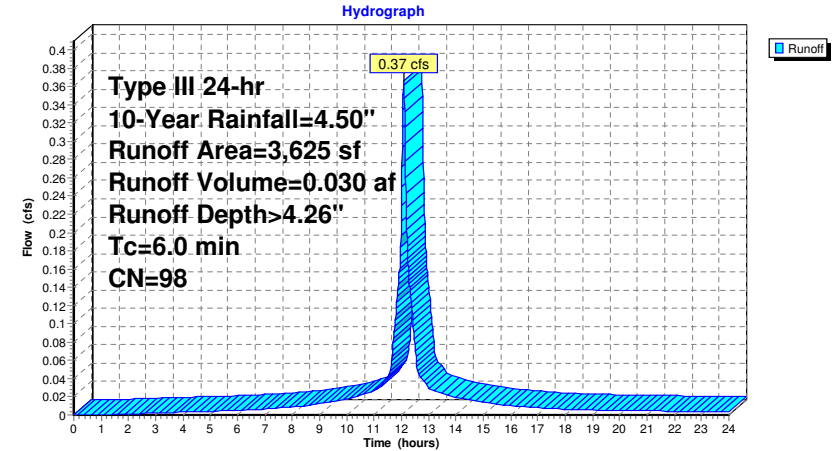
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

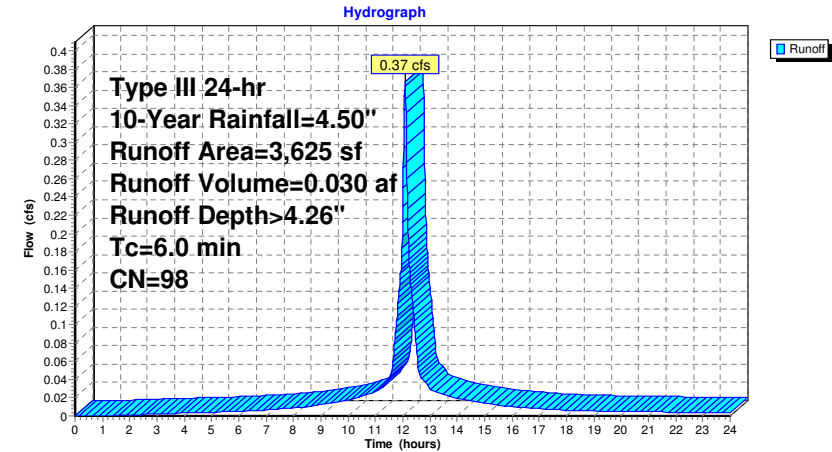
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

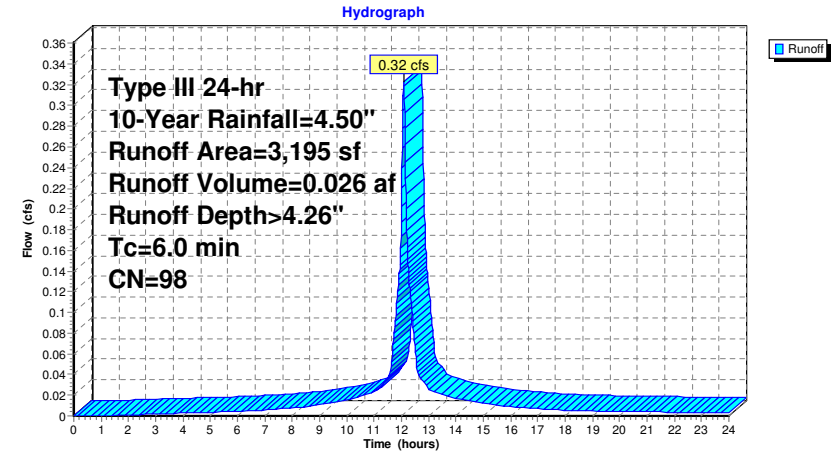
Runoff = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)



Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

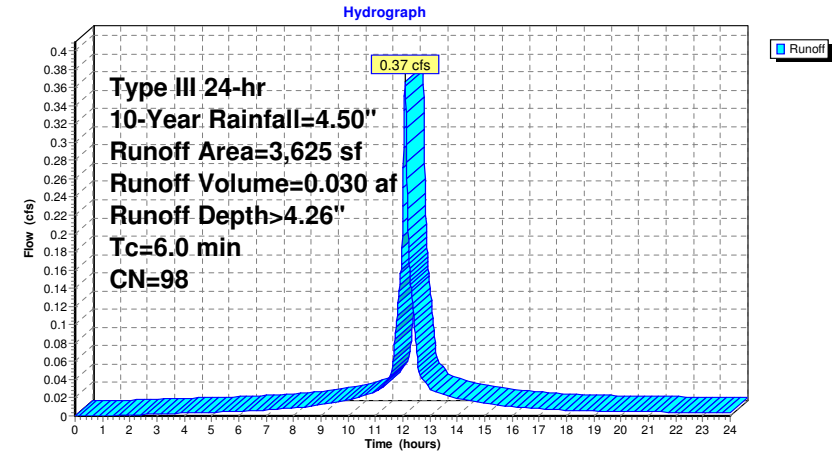
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)



Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

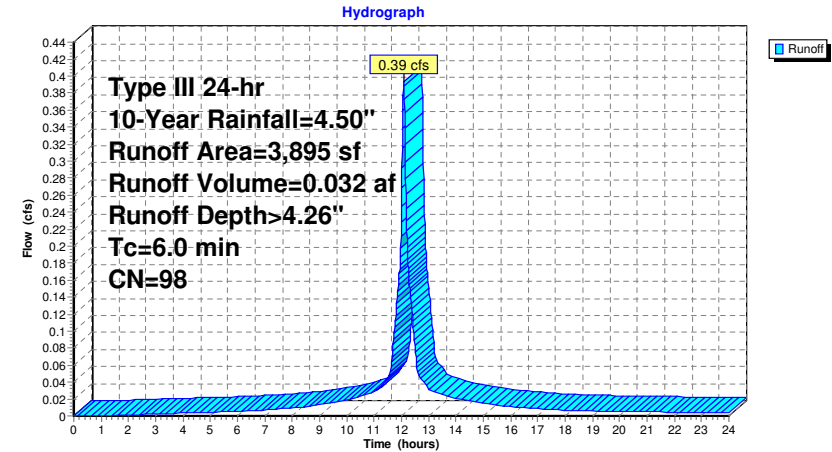
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)



Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

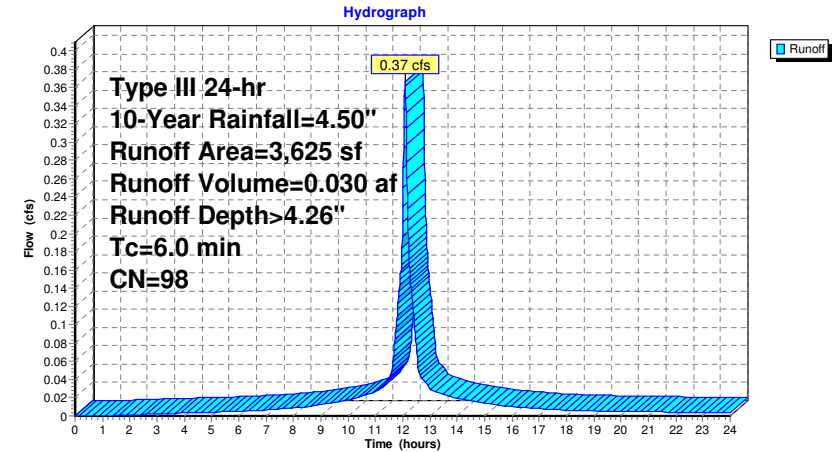
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)



Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

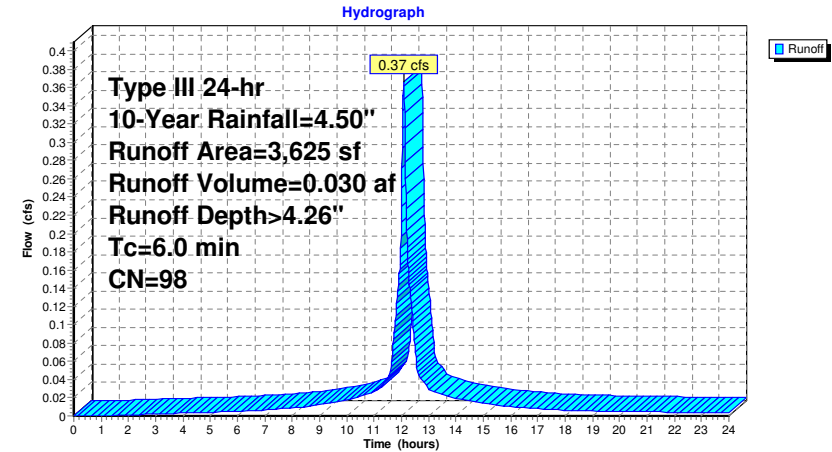
Runoff = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af, Depth> 4.26"

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=4.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

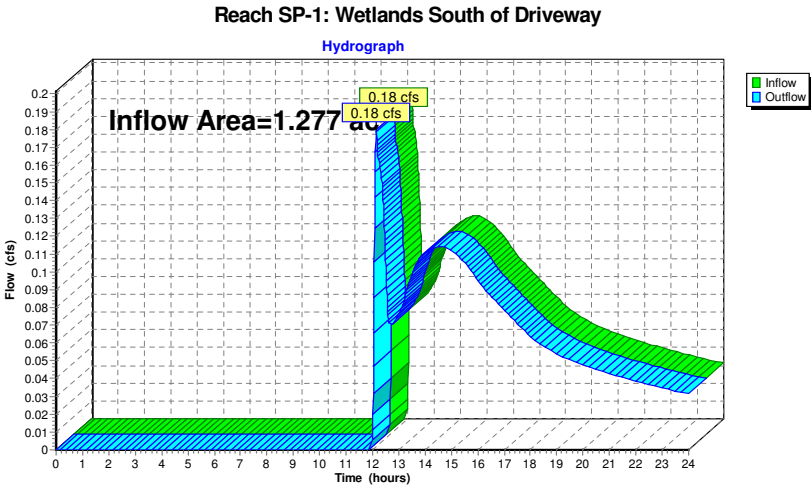


Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.277 ac, 33.99% Impervious, Inflow Depth > 0.65" for 10-Year event
Inflow = 0.18 cfs @ 12.14 hrs, Volume= 0.070 af
Outflow = 0.18 cfs @ 12.14 hrs, Volume= 0.070 af, Atten= 0%, Lag= 0.0 min

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

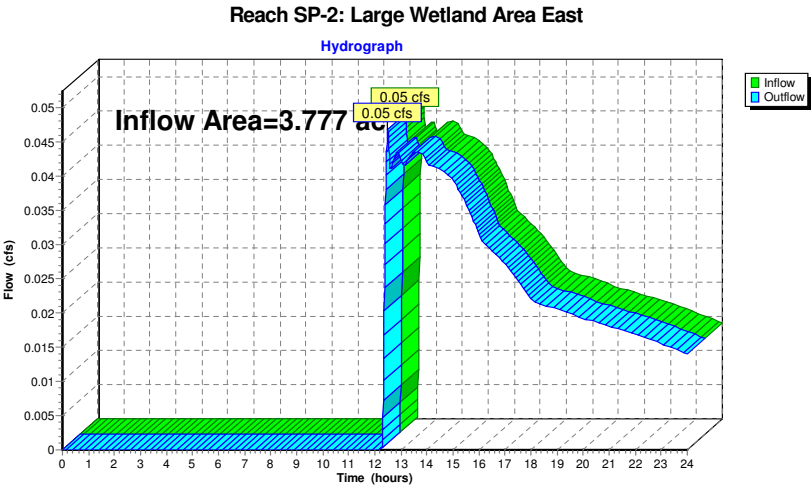


Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.777 ac, 26.87% Impervious, Inflow Depth > 0.08" for 10-Year event
Inflow = 0.05 cfs @ 12.50 hrs, Volume= 0.026 af
Outflow = 0.05 cfs @ 12.50 hrs, Volume= 0.026 af, Atten= 0%, Lag= 0.0 min

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

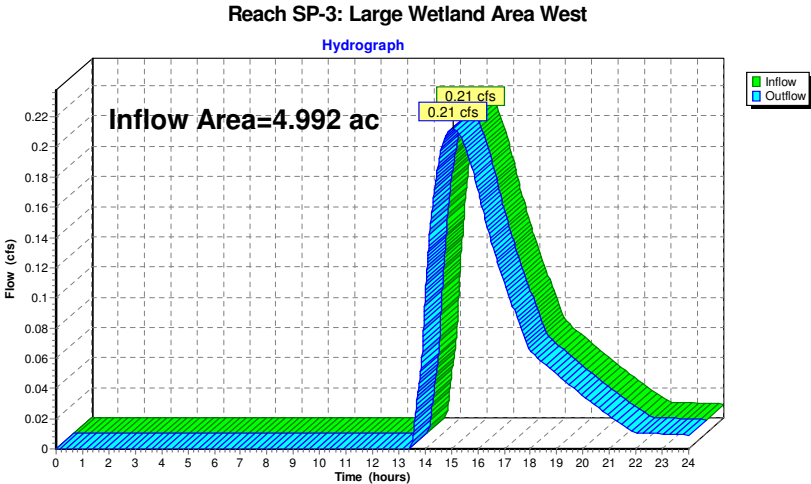


Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.992 ac, 31.07% Impervious, Inflow Depth > 0.16" for 10-Year event
Inflow = 0.21 cfs @ 15.04 hrs, Volume= 0.065 af
Outflow = 0.21 cfs @ 15.04 hrs, Volume= 0.065 af, Atten= 0%, Lag= 0.0 min

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

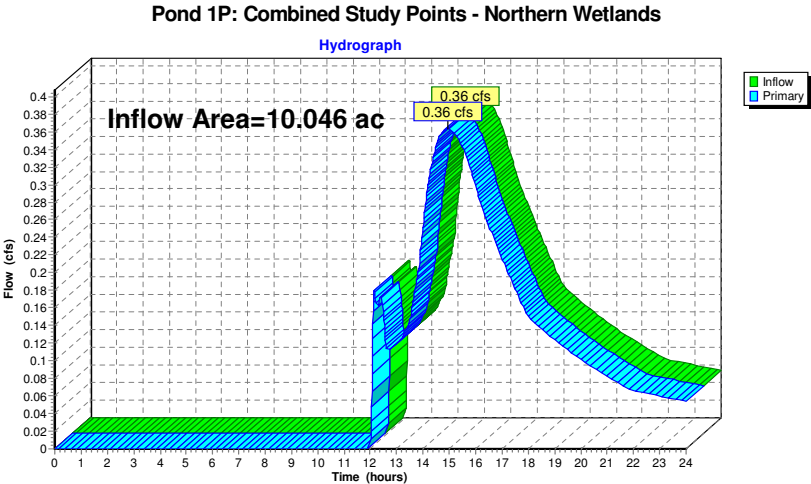


Summary for Pond 1P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.046 ac, 29.86% Impervious, Inflow Depth > 0.19" for 10-Year event
Inflow = 0.36 cfs @ 14.94 hrs, Volume= 0.160 af
Primary = 0.36 cfs @ 14.94 hrs, Volume= 0.160 af, Atten= 0%, Lag= 0.0 min

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



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 111

Summary for Pond D-1: Surface Infiltration Pond

Inflow Area = 2.637 ac, 56.80% Impervious, Inflow Depth > 2.05" for 10-Year event
 Inflow = 6.42 cfs @ 12.10 hrs, Volume= 0.451 af
 Outflow = 0.31 cfs @ 15.01 hrs, Volume= 0.172 af, Atten= 95%, Lag= 174.7 min
 Discarded = 0.11 cfs @ 15.01 hrs, Volume= 0.116 af
 Primary = 0.20 cfs @ 15.01 hrs, Volume= 0.056 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 70.18' @ 15.01 hrs Surf. Area= 4,734 sf Storage= 13,275 cf
 Flood Elev= 71.10' Surf. Area= 5,491 sf Storage= 17,958 cf

Plug-Flow detention time= 319.1 min calculated for 0.172 af (38% of inflow)
 Center-of-Mass det. time= 204.0 min (1,023.0 - 819.1)

Volume #1	Invert 66.00'	Avail. Storage 56,233 cf	Storage Description Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf. Area (sq-ft)	Inc. Store (cubic-feet)	Cum. Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	70.00'	15.0" Round Culvert L= 252.0' Ke= 0.200 Inlet / Outlet Invert= 70.00' / 65.40' S= 0.0183 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.11 cfs @ 15.01 hrs HW=70.18' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.19 cfs @ 15.01 hrs HW=70.18' (Free Discharge)

↑2=Culvert (Barrel Controls 0.19 cfs @ 2.60 fps)

Topsfield Proposed HydroCAD

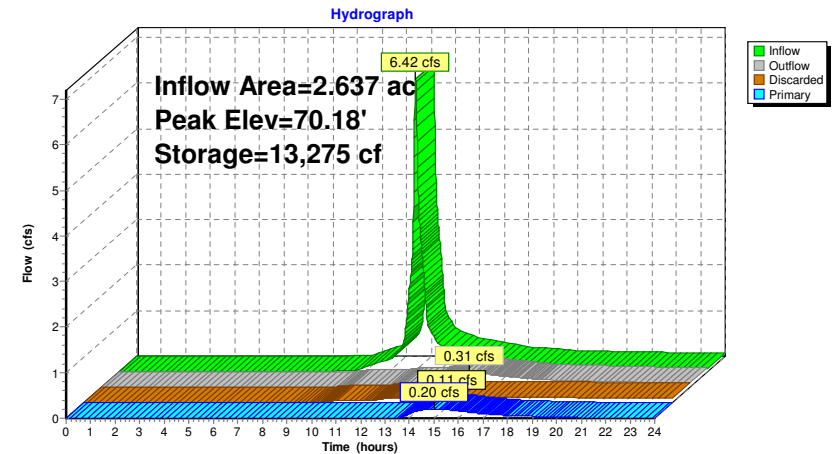
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Type III 24-hr 10-Year Rainfall=4.50"

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Page 112

Pond D-1: Surface Infiltration Pond

Summary for Pond D-2: Existing Detention Basin

[58] Hint: Peaked 0.20' above defined flood level

Inflow Area = 0.531 ac, 59.77% Impervious, Inflow Depth > 2.55" for 10-Year event
Inflow = 1.59 cfs @ 12.09 hrs, Volume= 0.113 af
Outflow = 0.08 cfs @ 14.85 hrs, Volume= 0.043 af, Atten= 95%, Lag= 165.6 min
Primary = 0.08 cfs @ 14.85 hrs, Volume= 0.043 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.28' @ 14.85 hrs Surf.Area= 3,090 sf Storage= 3,324 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

Plug-Flow detention time= 341.1 min calculated for 0.043 af (38% of inflow)
Center-of-Mass det. time= 218.2 min (1,041.1 - 822.9)

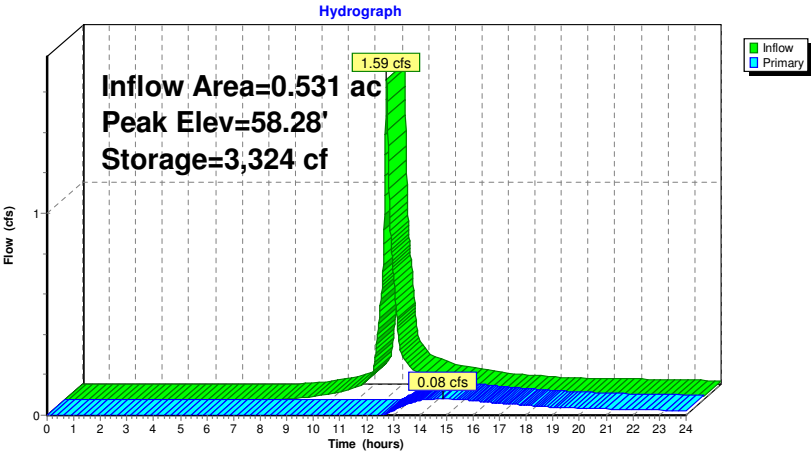
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.08 cfs @ 14.85 hrs HW=58.28' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.08 cfs @ 1.51 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond D-2: Existing Detention Basin



Summary for Pond D-3: Detention Pond by Access Road

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 1.74" for 10-Year event
Inflow = 0.23 cfs @ 12.09 hrs, Volume= 0.017 af
Outflow = 0.03 cfs @ 12.89 hrs, Volume= 0.017 af, Atten= 87%, Lag= 48.1 min
Discarded = 0.03 cfs @ 12.89 hrs, Volume= 0.017 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.62' @ 12.89 hrs Surf.Area= 517 sf Storage= 253 cf

Plug-Flow detention time= 83.5 min calculated for 0.016 af (100% of inflow)
Center-of-Mass det. time= 83.0 min (933.0 - 850.0)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

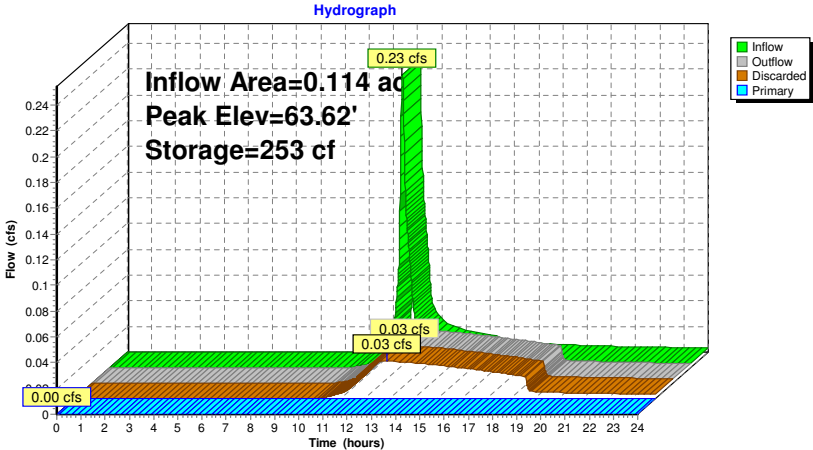
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.03 cfs @ 12.89 hrs HW=63.62' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond D-3: Detention Pond by Access Road



Summary for Pond UIS-1: UIS at Entrance

Inflow Area = 1.487 ac, 40.11% Impervious, Inflow Depth > 2.47" for 10-Year event
Inflow = 4.13 cfs @ 12.09 hrs, Volume= 0.306 af
Outflow = 0.08 cfs @ 10.34 hrs, Volume= 0.108 af, Atten= 98%, Lag= 0.0 min
Discarded = 0.08 cfs @ 10.34 hrs, Volume= 0.108 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.66' @ 18.75 hrs Surf.Area= 3,486 sf Storage= 8,986 cf
Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,284 cf

Plug-Flow detention time= 285.0 min calculated for 0.108 af (35% of inflow)
Center-of-Mass det. time= 142.9 min (953.6 - 810.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,089 cf	50.50'W x 69.03'L x 6.00'H Field A 20,917 cf Overall - 8,195 cf Embedded = 12,722 cf x 40.0% Voids
#2A	61.00'	8,195 cf	Cultec R-902HD x 126 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 7 Rows of 18 Chambers Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
13,284 cf			Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	68.40'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 10.34 hrs HW=60.08' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=60.00' (Free Discharge)
2=Orifice/Grate (Controls 0.00 cfs)

Pond UIS-1: UIS at Entrance - Chamber Wizard Field A

Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)
Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf
Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap
Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf

78.0" Wide + 6.0" Spacing = 84.0" C-C Row Spacing

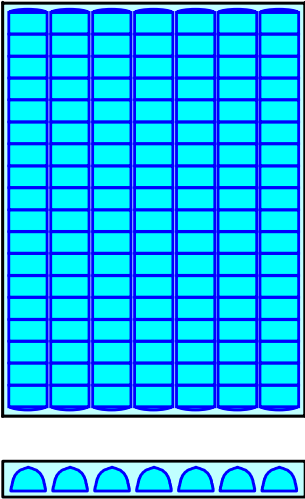
18 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 67.03' Row Length +12.0" End Stone x 2 = 69.03' Base Length
7 Rows x 78.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 50.50' Base Width
12.0" Base + 48.0" Chamber Height + 12.0" Cover = 6.00' Field Height

126 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 7 Rows = 8,195.2 cf Chamber Storage

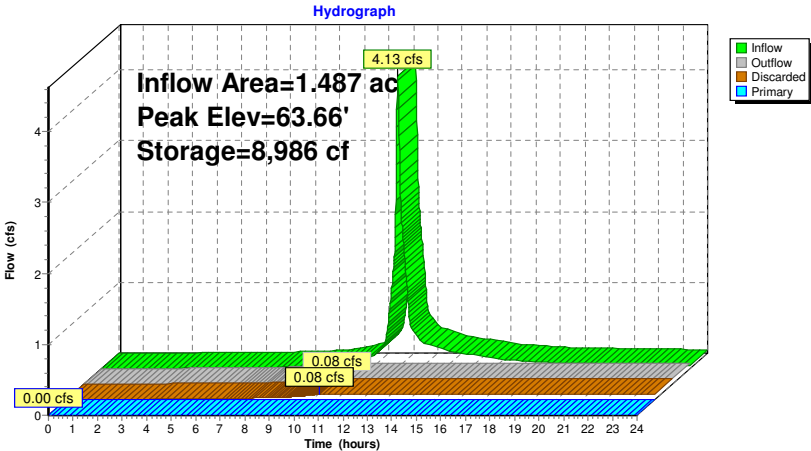
20,917.1 cf Field - 8,195.2 cf Chambers = 12,721.9 cf Stone x 40.0% Voids = 5,088.7 cf Stone Storage

Chamber Storage + Stone Storage = 13,284.0 cf = 0.305 af
Overall Storage Efficiency = 63.5%
Overall System Size = 69.03' x 50.50' x 6.00'

126 Chambers
774.7 cy Field
471.2 cy Stone



Pond UIS-1: UIS at Entrance



Summary for Pond UIS-2: UIS at North of Site

Inflow Area = 0.419 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
Inflow = 1.84 cfs @ 12.08 hrs, Volume= 0.149 af
Outflow = 0.23 cfs @ 11.60 hrs, Volume= 0.149 af, Atten= 88%, Lag= 0.0 min
Discarded = 0.23 cfs @ 11.60 hrs, Volume= 0.149 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 64.08' @ 12.64 hrs Surf.Area= 1,176 sf Storage= 1,956 cf
Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 53.5 min calculated for 0.149 af (100% of inflow)
Center-of-Mass det. time= 53.3 min (802.5 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	16.00'W x 73.50'L x 4.04'H Field A 4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	Cultec R-330XLHD x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	68.25'	6.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.60 hrs HW=61.57' (Free Discharge)
↑1=Exfiltration (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=61.50' (Free Discharge)
↑2=Orifice/Grate (Controls 0.00 cfs)

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

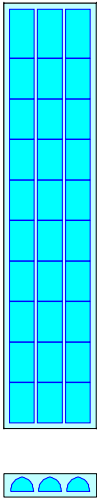
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

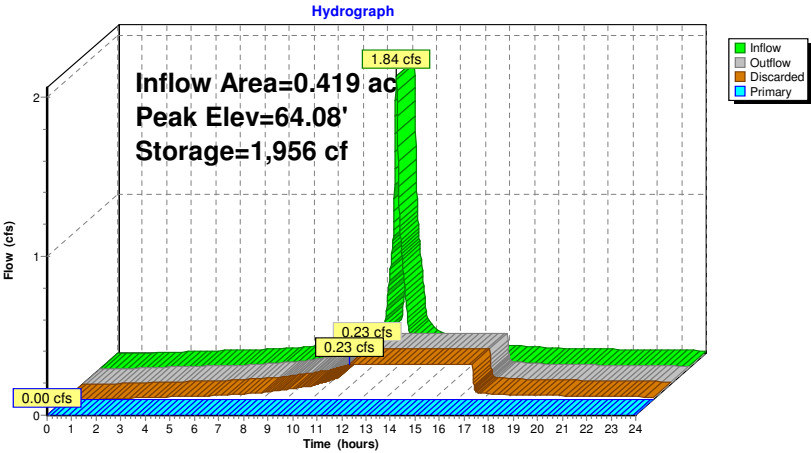
4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af
Overall Storage Efficiency = 60.2%
Overall System Size = 73.50' x 16.00' x 4.04'

30 Chambers
176.0 cy Field
116.8 cy Stone



Pond UIS-2: UIS at North of Site



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 123

Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.53' above defined flood level

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
 Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af
 Outflow = 0.36 cfs @ 12.09 hrs, Volume= 0.027 af, Atten= 1%, Lag= 0.7 min
 Discarded = 0.00 cfs @ 3.34 hrs, Volume= 0.004 af
 Primary = 0.36 cfs @ 12.09 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 73.74' @ 12.09 hrs Surf.Area= 103 sf Storage= 135 cf
 Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 72.9 min calculated for 0.027 af (91% of inflow)
 Center-of-Mass det. time= 28.0 min (777.3 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.40'	6.0" Round Culvert L= 30.0' Ke= 0.200 Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 ' S Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=71.72' (Free Discharge)↑ **1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.36 cfs @ 12.09 hrs HW=73.74' (Free Discharge)↑ **2=Culvert** (Inlet Controls 0.36 cfs @ 2.50 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 124

Pond UIS-3: UIS-3 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
 Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
 Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'
 Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
 6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

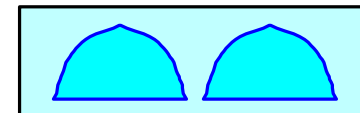
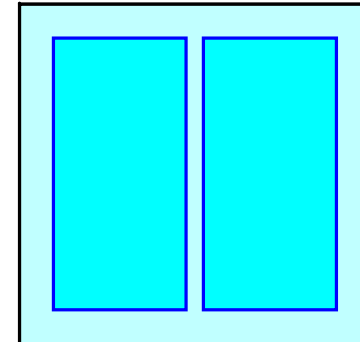
Overall Storage Efficiency = 57.6%

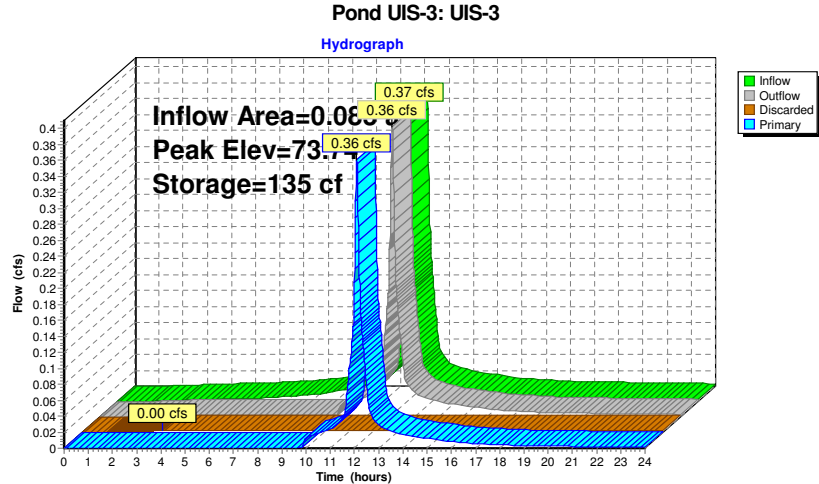
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.45' above defined flood level

Inflow Area = 0.073 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event

Inflow = 0.32 cfs @ 12.08 hrs, Volume= 0.026 af

Outflow = 0.32 cfs @ 12.10 hrs, Volume= 0.023 af, Atten= 2%, Lag= 1.0 min

Discarded = 0.00 cfs @ 3.68 hrs, Volume= 0.004 af

Primary = 0.31 cfs @ 12.10 hrs, Volume= 0.019 af

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

Peak Elev= 74.65' @ 12.10 hrs Surf.Area= 103 sf Storage= 141 cf

Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 78.6 min calculated for 0.023 af (90% of inflow)

Center-of-Mass det. time= 29.9 min (779.1 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.20'	6.0" Round Culvert L= 30.0' Ke= 1.000 Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 ' S= 0.0047 ' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.68 hrs HW=72.53' (Free Discharge)

1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.31 cfs @ 12.10 hrs HW=74.65' (Free Discharge)

2=Culvert (Barrel Controls 0.31 cfs @ 2.20 fps)

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 127

Pond UIS-4: UIS-4 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

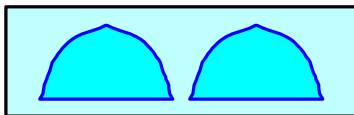
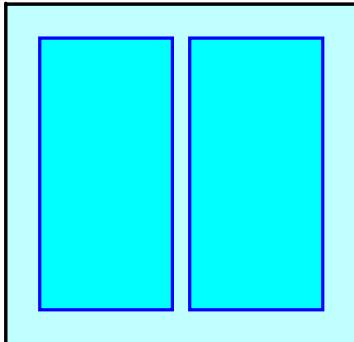
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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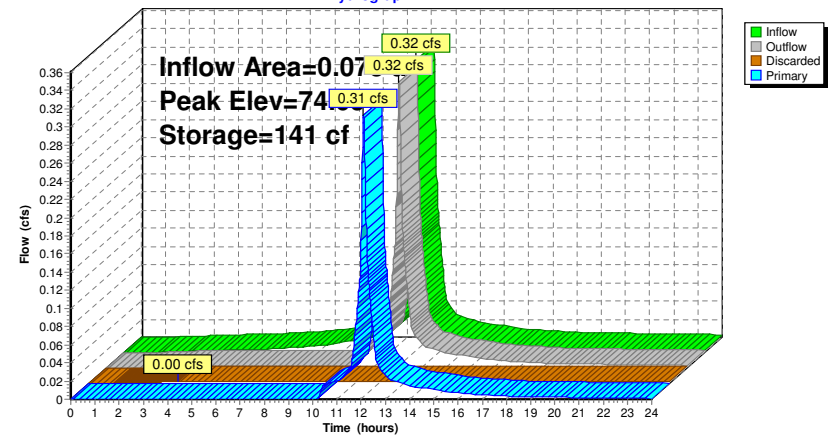
Type III 24-hr 10-Year Rainfall=4.50"

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Page 128

Pond UIS-4: UIS-4

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 129

Summary for Pond UIS-5: UIS-5

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
 Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af
 Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 3%, Lag= 1.3 min
 Discarded = 0.00 cfs @ 3.34 hrs, Volume= 0.004 af
 Primary = 0.35 cfs @ 12.10 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 75.29' @ 12.10 hrs Surf.Area= 103 sf Storage= 144 cf

Plug-Flow detention time= 73.6 min calculated for 0.027 af (91% of inflow)
 Center-of-Mass det. time= 28.5 min (777.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
			191 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.80'	6.0" Round Culvert L= 22.0' Ke= 1.000 Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 ' /' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=73.12' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.35 cfs @ 12.10 hrs HW=75.29' (Free Discharge)**2=Culvert** (Inlet Controls 0.35 cfs @ 1.80 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 130

Pond UIS-5: UIS-5 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

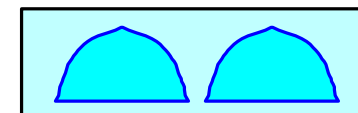
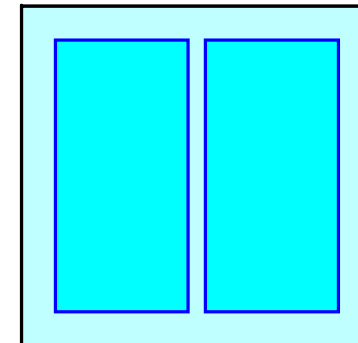
Overall Storage Efficiency = 57.6%

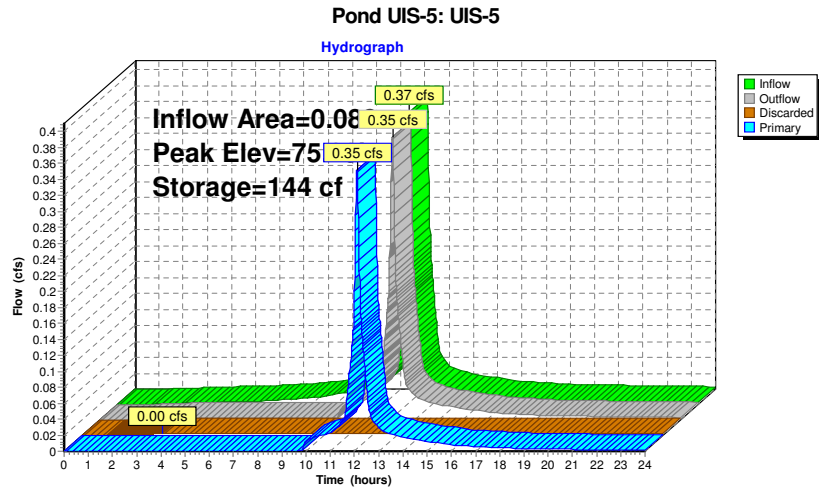
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-6: UIS-6

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event

Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af

Outflow = 0.38 cfs @ 12.11 hrs, Volume= 0.029 af, Atten= 4%, Lag= 1.3 min

Discarded = 0.00 cfs @ 3.17 hrs, Volume= 0.004 af

Primary = 0.38 cfs @ 12.11 hrs, Volume= 0.025 af

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

Peak Elev= 74.53' @ 12.11 hrs Surf.Area= 103 sf Storage= 146 cf

Plug-Flow detention time= 70.5 min calculated for 0.029 af (92% of inflow)

Center-of-Mass det. time= 27.8 min (777.1 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.00'	6.0" Round Culvert L= 106.0' Ke= 1.000 Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 ' /' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.17 hrs HW=72.32' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.38 cfs @ 12.11 hrs HW=74.53' (Free Discharge)

↳ **2=Culvert** (Inlet Controls 0.38 cfs @ 1.92 fps)

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 133

Pond UIS-6: UIS-6 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

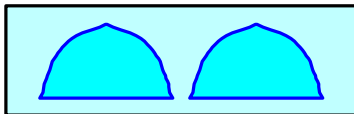
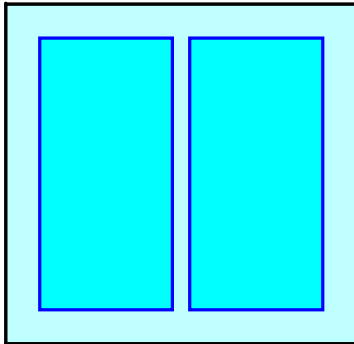
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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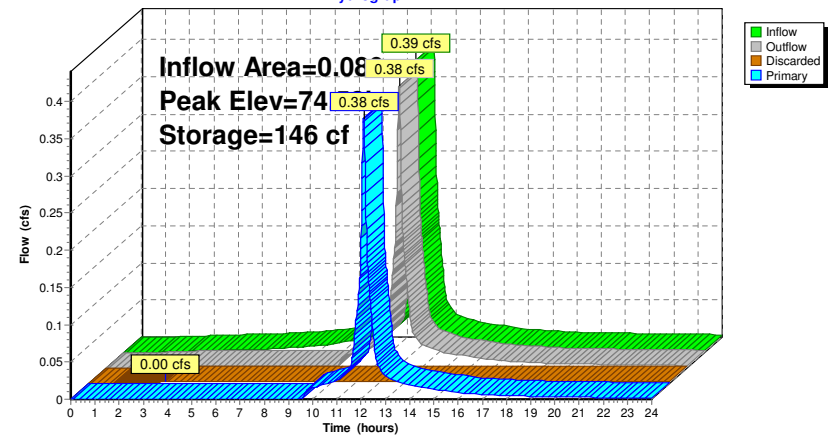
Type III 24-hr 10-Year Rainfall=4.50"

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Page 134

Pond UIS-6: UIS-6

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 135

Summary for Pond UIS-7: UIS-7

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
 Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af
 Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 3%, Lag= 1.3 min
 Discarded = 0.00 cfs @ 3.34 hrs, Volume= 0.004 af
 Primary = 0.35 cfs @ 12.10 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 73.99' @ 12.10 hrs Surf.Area= 103 sf Storage= 144 cf

Plug-Flow detention time= 73.6 min calculated for 0.027 af (91% of inflow)
 Center-of-Mass det. time= 28.5 min (777.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.50'	6.0" Round Culvert L= 17.5' Ke= 1.000 Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 ' /' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=71.82' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.35 cfs @ 12.10 hrs HW=73.99' (Free Discharge)**2=Culvert** (Inlet Controls 0.35 cfs @ 1.80 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 136

Pond UIS-7: UIS-7 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

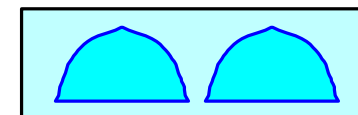
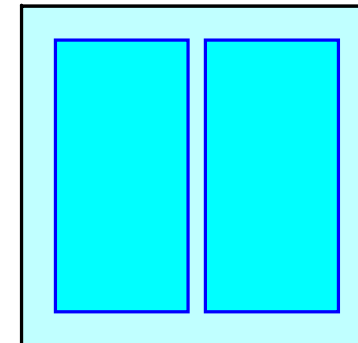
Overall Storage Efficiency = 57.6%

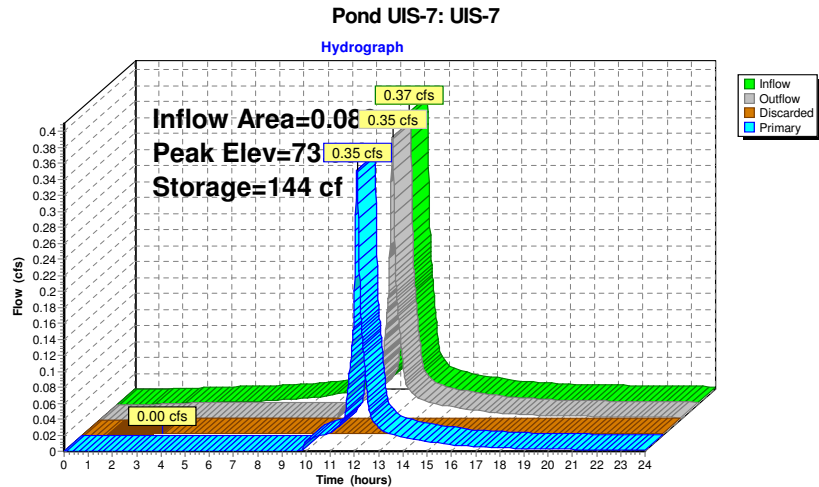
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event

Inflow = 0.37 cfs @ 12.08 hrs, Volume= 0.030 af

Outflow = 0.35 cfs @ 12.10 hrs, Volume= 0.027 af, Atten= 3%, Lag= 1.3 min

Discarded = 0.00 cfs @ 3.34 hrs, Volume= 0.004 af

Primary = 0.35 cfs @ 12.10 hrs, Volume= 0.023 af

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

Peak Elev= 73.29' @ 12.10 hrs Surf.Area= 103 sf Storage= 144 cf

Plug-Flow detention time= 73.6 min calculated for 0.027 af (91% of inflow)

Center-of-Mass det. time= 28.5 min (777.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.80'	6.0" Round Culvert L= 37.0' Ke= 1.000 Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.34 hrs HW=71.12' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.35 cfs @ 12.10 hrs HW=73.29' (Free Discharge)

↳ **2=Culvert** (Inlet Controls 0.35 cfs @ 1.80 fps)

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Page 139

Pond UIS-8: UIS-8 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

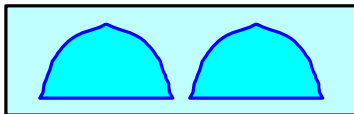
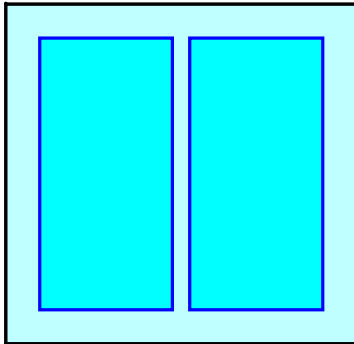
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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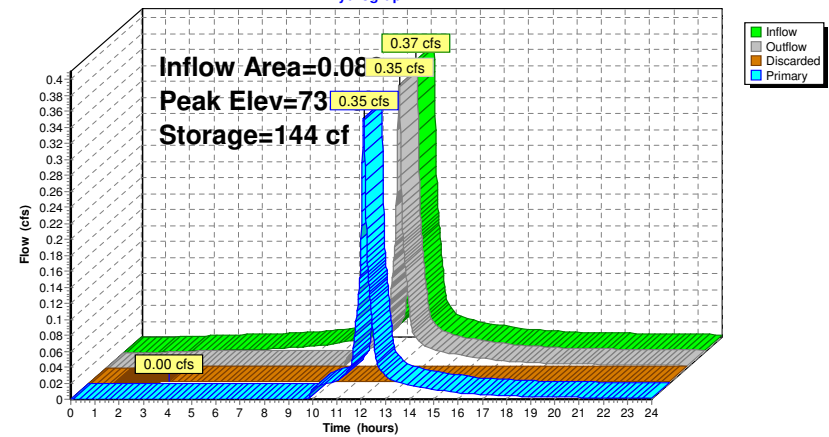
Type III 24-hr 10-Year Rainfall=4.50"

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Page 140

Pond UIS-8: UIS-8

Hydrograph



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Type III 24-hr 10-Year Rainfall=4.50"

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Page 141

Summary for Pond UIS-9: UIS-9

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 4.26" for 10-Year event
 Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af
 Outflow = 0.38 cfs @ 12.11 hrs, Volume= 0.031 af, Atten= 4%, Lag= 1.5 min
 Discarded = 0.00 cfs @ 3.17 hrs, Volume= 0.004 af
 Primary = 0.37 cfs @ 12.11 hrs, Volume= 0.026 af

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

Peak Elev= 72.71' @ 12.11 hrs Surf.Area= 103 sf Storage= 91 cf

Plug-Flow detention time= 40.7 min calculated for 0.031 af (96% of inflow)

Center-of-Mass det. time= 17.5 min (766.8 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.18'	6.0" Round Culvert L= 79.0' Ke= 1.000 Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 ' / Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 3.17 hrs HW=71.31' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.37 cfs @ 12.11 hrs HW=72.71' (Free Discharge)**2=Culvert** (Inlet Controls 0.37 cfs @ 1.90 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 10-Year Rainfall=4.50"

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Page 142

Pond UIS-9: UIS-9 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

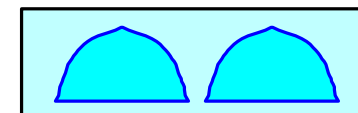
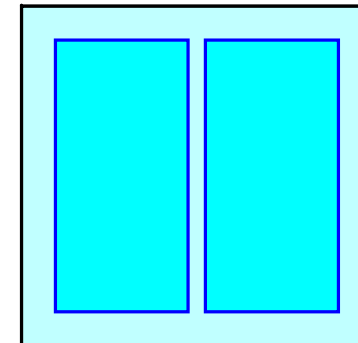
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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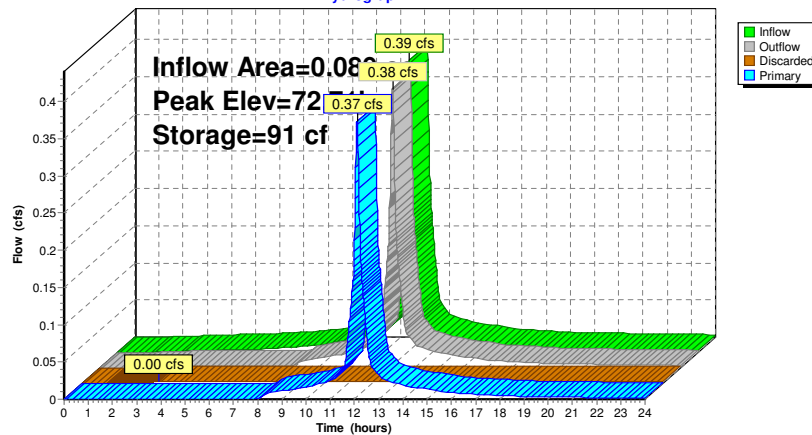
Type III 24-hr 10-Year Rainfall=4.50"

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Page 143

Pond UIS-9: UIS-9

Hydrograph



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Type III 24-hr 25-Year Rainfall=5.40"

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Page 144

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: Northern Grassed Area to	Runoff Area=81,522 sf 0.00% Impervious Runoff Depth>0.37" Tc=6.0 min CN=41 Runoff=0.27 cfs 0.058 af
Subcatchment P-10: Area Around Isolated	Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>2.77" Flow Length=533' Tc=6.0 min UI Adjusted CN=75 Runoff=2.36 cfs 0.168 af
Subcatchment P-2: Existing Drive to Existing	Runoff Area=23,114 sf 59.77% Impervious Runoff Depth>3.34" Tc=6.0 min CN=81 Runoff=2.07 cfs 0.148 af
Subcatchment P-3: Area Around Isolated	Runoff Area=27,582 sf 12.85% Impervious Runoff Depth>0.86" Tc=6.0 min UI Adjusted CN=50 Runoff=0.45 cfs 0.045 af
Subcatchment P-3A: Gravel Road to Detention	Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>2.42" Tc=6.0 min CN=71 Runoff=0.32 cfs 0.023 af
Subcatchment P-4: Sloped Entrance Drive -	Runoff Area=21,573 sf 55.93% Impervious Runoff Depth>2.87" Tc=6.0 min CN=76 Runoff=1.67 cfs 0.118 af
Subcatchment P-5: Driveway - Units 25-11	Runoff Area=39,272 sf 51.57% Impervious Runoff Depth>2.68" Tc=6.0 min CN=74 Runoff=2.84 cfs 0.202 af
Subcatchment P-6: Pavement Units 12-19	Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>3.05" Tc=6.0 min CN=78 Runoff=1.57 cfs 0.112 af
Subcatchment P-7: Driveway - Units 20-24	Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>2.42" Tc=6.0 min CN=71 Runoff=1.01 cfs 0.073 af
Subcatchment P-8: Surface Infiltration Pond	Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.47" Tc=6.0 min CN=43 Runoff=0.07 cfs 0.014 af
Subcatchment P-9: Woods/Grass Northwest	Runoff Area=102,567 sf 2.25% Impervious Runoff Depth>0.17" Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.06 cfs 0.034 af
Subcatchment R-1: Roof - Units 1&2 (C&B)	Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>5.16" Tc=6.0 min CN=98 Runoff=0.39 cfs 0.031 af
Subcatchment R-10: Roof - Units 19&20 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16" Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af
Subcatchment R-11: Roof - Units 21&22 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16" Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af
Subcatchment R-12: Roof - Units 23&24 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16" Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af
Subcatchment R-13: Roof - Units 25&26 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16" Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 145

Subcatchment R-14: Roof Units 27&28 - A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-15: Roof Units 29&30 - (B & C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-16: Front Units 29&30 Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.18 cfs 0.015 af

Subcatchment R-17: Mailbox Structure Rood Runoff Area=120 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.01 cfs 0.001 af

Subcatchment R-2: Roof Units 3&4 - (B & C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-3: Roof Units 5&6 - A&B Units Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-4: Roof - Units 7&8 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-5: Roof - Units 9&10 - (B&C Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.39 cfs 0.032 af

Subcatchment R-6: Roof - Units 11&12 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-7: Roof - Units 13&14 - (A Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af

Subcatchment R-8: Roof - Units 15&16 - (B&A Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Subcatchment R-9: Roof - Units 17&18 - (A&B Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>5.16"
Tc=6.0 min CN=98 Runoff=0.44 cfs 0.036 af

Reach SP-1: Wetlands South of Driveway Inflow=0.45 cfs 0.123 af
Outflow=0.45 cfs 0.123 af

Reach SP-2: Large Wetland Area East Inflow=0.27 cfs 0.058 af
Outflow=0.27 cfs 0.058 af

Reach SP-3: Large Wetland Area West Inflow=0.93 cfs 0.229 af
Outflow=0.93 cfs 0.229 af

Pond 1P: Combined Study Points - Northern Wetlands Inflow=1.33 cfs 0.410 af
Primary=1.33 cfs 0.410 af

Pond D-1: Surface Infiltration Pond Peak Elev=70.39' Storage=14,288 cf Inflow=8.39 cfs 0.603 af
Discarded=0.12 cfs 0.122 af Primary=0.89 cfs 0.195 af Outflow=1.00 cfs 0.318 af

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Page 146

Pond D-2: Existing Detention Basin Peak Elev=58.41' Storage=3,752 cf Inflow=2.07 cfs 0.148 af
Outflow=0.17 cfs 0.078 af

Pond D-3: Detention Pond by Access Road Peak Elev=63.86' Storage=390 cf Inflow=0.32 cfs 0.023 af
Discarded=0.03 cfs 0.023 af Primary=0.00 cfs 0.000 af Outflow=0.03 cfs 0.023 af

Pond UIS-1: UIS at Entrance Peak Elev=65.55' Storage=12,660 cf Inflow=5.43 cfs 0.401 af
Discarded=0.08 cfs 0.113 af Primary=0.00 cfs 0.000 af Outflow=0.08 cfs 0.113 af

Pond UIS-2: UIS at North of Site Peak Elev=64.89' Storage=2,548 cf Inflow=2.21 cfs 0.180 af
Discarded=0.23 cfs 0.180 af Primary=0.00 cfs 0.000 af Outflow=0.23 cfs 0.180 af

Pond UIS-3: UIS-3 Peak Elev=73.79' Storage=137 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.43 cfs 0.029 af Outflow=0.44 cfs 0.033 af

Pond UIS-4: UIS-4 Peak Elev=74.73' Storage=146 cf Inflow=0.39 cfs 0.032 af
Discarded=0.00 cfs 0.004 af Primary=0.37 cfs 0.024 af Outflow=0.38 cfs 0.029 af

Pond UIS-5: UIS-5 Peak Elev=75.40' Storage=151 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.42 cfs 0.029 af Outflow=0.42 cfs 0.033 af

Pond UIS-6: UIS-6 Peak Elev=74.65' Storage=154 cf Inflow=0.47 cfs 0.038 af
Discarded=0.00 cfs 0.005 af Primary=0.45 cfs 0.031 af Outflow=0.45 cfs 0.036 af

Pond UIS-7: UIS-7 Peak Elev=74.10' Storage=151 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.42 cfs 0.029 af Outflow=0.42 cfs 0.033 af

Pond UIS-8: UIS-8 Peak Elev=73.40' Storage=151 cf Inflow=0.44 cfs 0.036 af
Discarded=0.00 cfs 0.004 af Primary=0.42 cfs 0.029 af Outflow=0.42 cfs 0.033 af

Pond UIS-9: UIS-9 Peak Elev=72.82' Storage=99 cf Inflow=0.47 cfs 0.038 af
Discarded=0.00 cfs 0.005 af Primary=0.44 cfs 0.033 af Outflow=0.45 cfs 0.037 af

Total Runoff Area = 10.046 ac Runoff Volume = 1,540 af Average Runoff Depth = 1.84"
70.14% Pervious = 7.046 ac 29.86% Impervious = 3.000 ac

Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

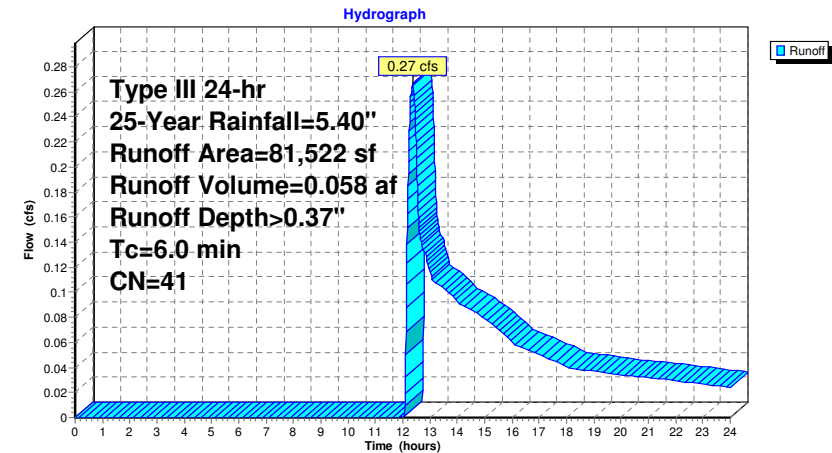
Runoff = 0.27 cfs @ 12.36 hrs, Volume= 0.058 af, Depth> 0.37"

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=5.40"

Area (sf)	CN	Description
38,137	30	Woods, Good, HSG A
10,782	70	Woods, Good, HSG C
9,419	55	Woods, Good, HSG B
23,184	39	>75% Grass cover, Good, HSG A
81,522	41	Weighted Average
81,522		100.00% Pervious Area

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

Subcatchment P-1: Northern Grassed Area to Wetlands



Summary for Subcatchment P-10: Area Around Isolated Wetland

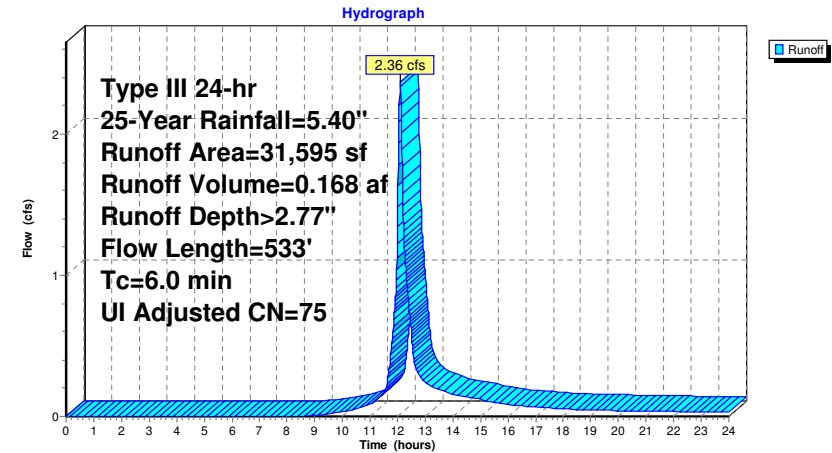
Runoff = 2.36 cfs @ 12.09 hrs, Volume= 0.168 af, Depth> 2.77"

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=5.40"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1100	0.29		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.10"
2.9	483	0.1600	2.80		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
5.8	533				Total, Increased to minimum Tc = 6.0 min

Subcatchment P-10: Area Around Isolated Wetland



Summary for Subcatchment P-2: Existing Drive to Existing Basin

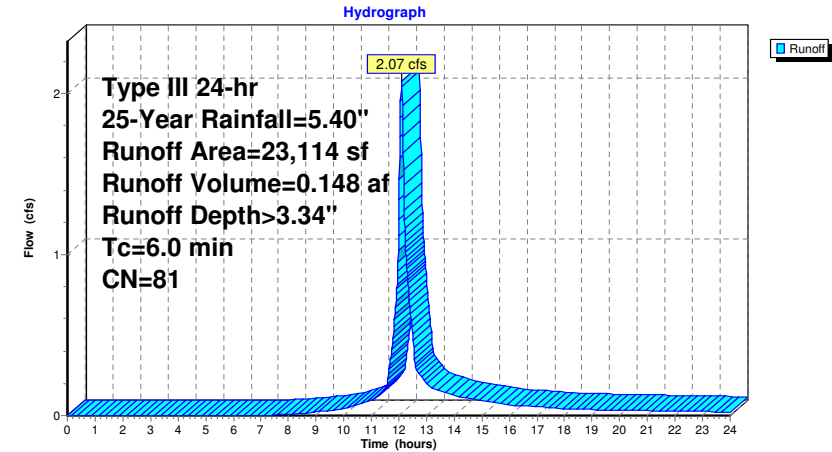
Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.148 af, Depth> 3.34"

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=5.40"

Area (sf)	CN	Description
13,815	98	Paved parking, HSG A
1,353	76	Gravel roads, HSG A
4,896	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
23,114	81	Weighted Average
9,299		40.23% Pervious Area
13,815		59.77% Impervious Area

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

Subcatchment P-2: Existing Drive to Existing Basin



Summary for Subcatchment P-3: Area Around Isolated Wetland

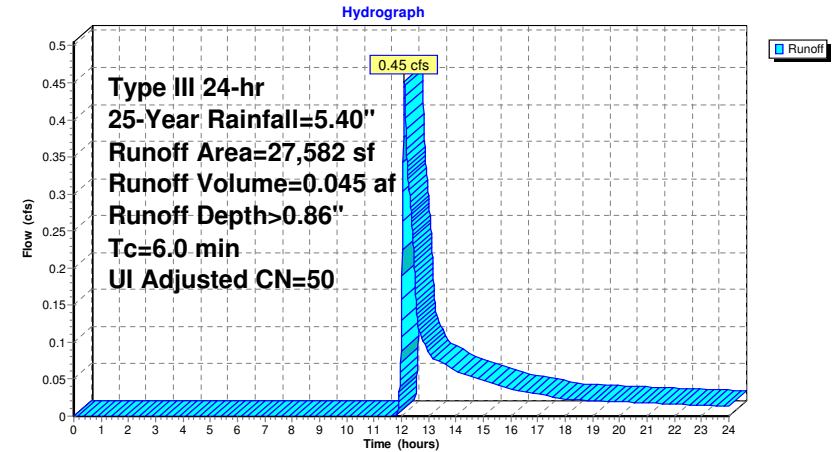
Runoff = 0.45 cfs @ 12.11 hrs, Volume= 0.045 af, Depth> 0.86"

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=5.40"

Area (sf)	CN	Adj	Description
3,545	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,582	53	50	Weighted Average, UI Adjusted
24,037			87.15% Pervious Area
3,545			12.85% Impervious Area
3,545			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



Summary for Subcatchment P-3A: Gravel Road to Detention Basin

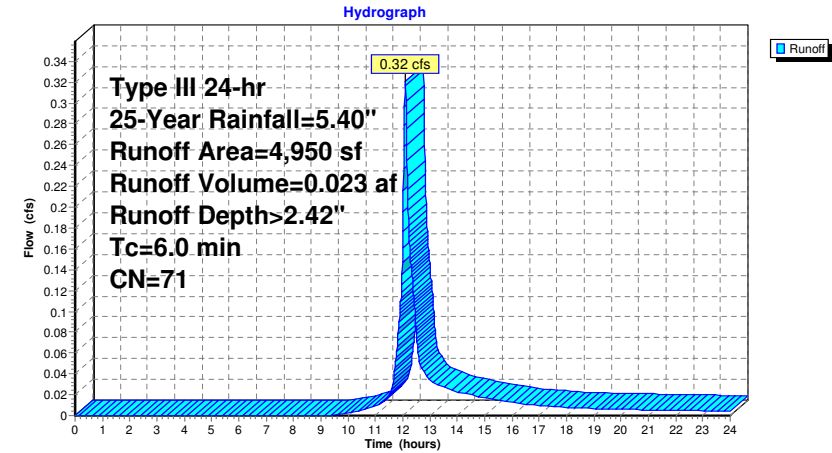
Runoff = 0.32 cfs @ 12.09 hrs, Volume= 0.023 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

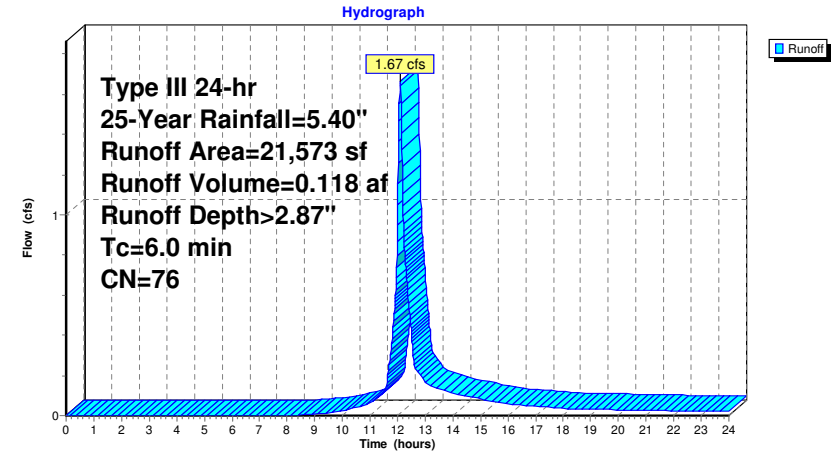
Runoff = 1.67 cfs @ 12.09 hrs, Volume= 0.118 af, Depth> 2.87"

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=5.40"

Area (sf)	CN	Description
12,066	98	Paved parking, HSG A
6,808	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,573	76	Weighted Average
9,507		44.07% Pervious Area
12,066		55.93% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5



Summary for Subcatchment P-5: Driveway - Units 25-11

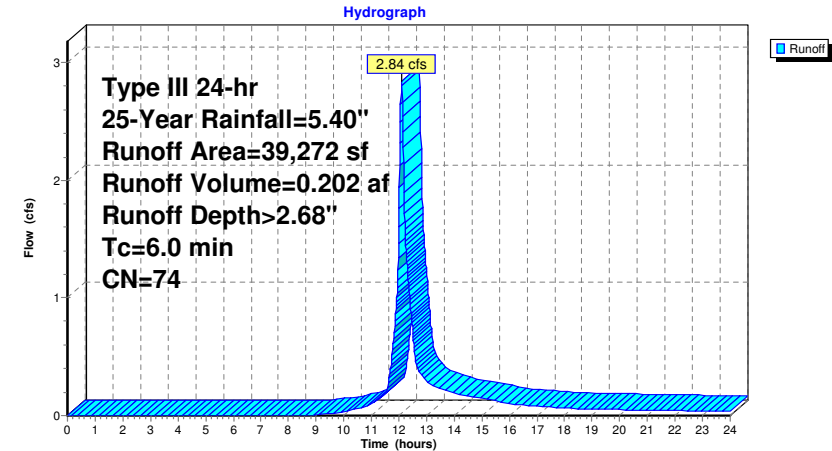
Runoff = 2.84 cfs @ 12.09 hrs, Volume= 0.202 af, Depth> 2.68"

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=5.40"

Area (sf)	CN	Description
20,251	98	Paved parking, HSG A
14,308	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
39,272	74	Weighted Average
19,021		48.43% Pervious Area
20,251		51.57% Impervious Area

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

Subcatchment P-5: Driveway - Units 25-11



Summary for Subcatchment P-6: Pavement Units 12-19

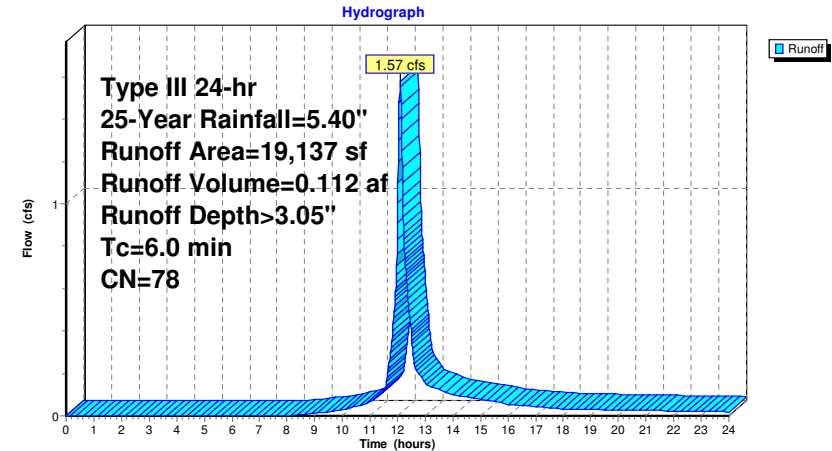
Runoff = 1.57 cfs @ 12.09 hrs, Volume= 0.112 af, Depth> 3.05"

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=5.40"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

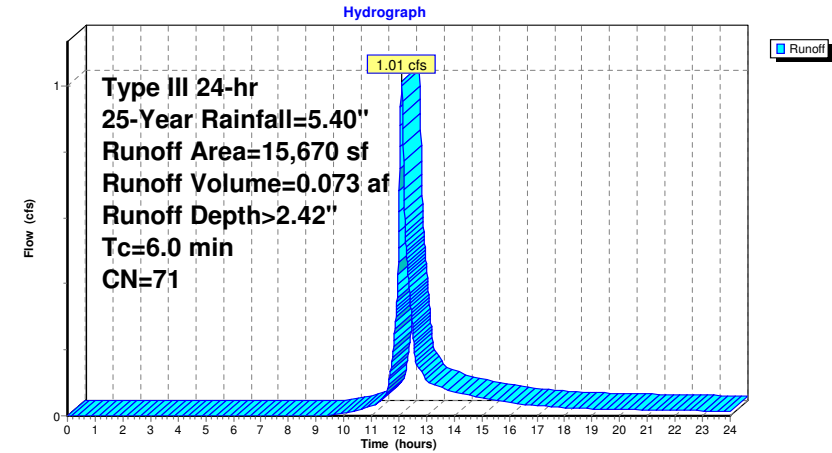
Runoff = 1.01 cfs @ 12.09 hrs, Volume= 0.073 af, Depth> 2.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



Summary for Subcatchment P-8: Surface Infiltration Pond Area

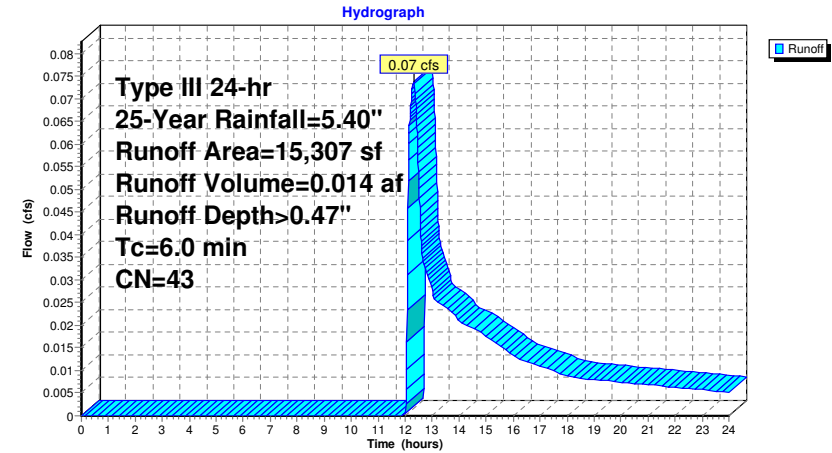
Runoff = 0.07 cfs @ 12.31 hrs, Volume= 0.014 af, Depth> 0.47"

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=5.40"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area



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Page 157

Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

Runoff = 0.06 cfs @ 13.79 hrs, Volume= 0.034 af, Depth> 0.17"

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=5.40"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
10.8	502	Total			

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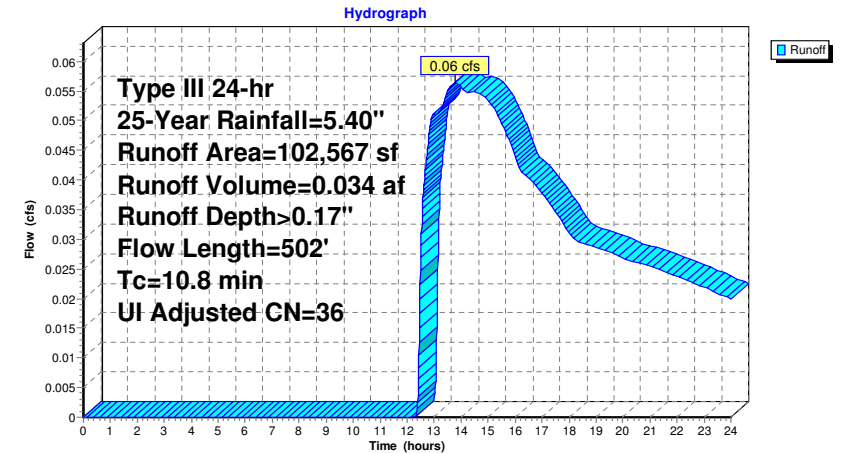
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Type III 24-hr 25-Year Rainfall=5.40"

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Page 158

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

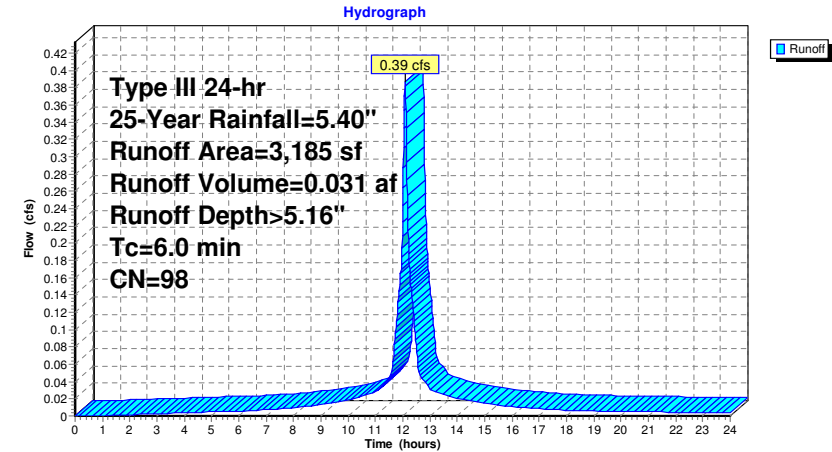
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.031 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)



Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

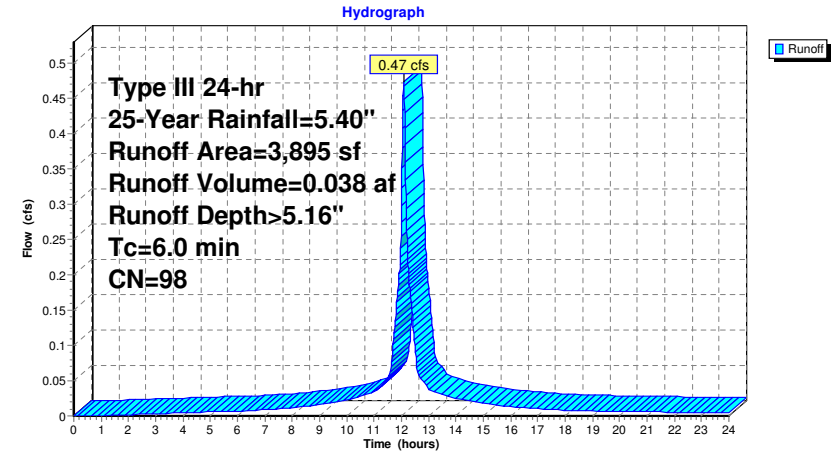
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)



Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

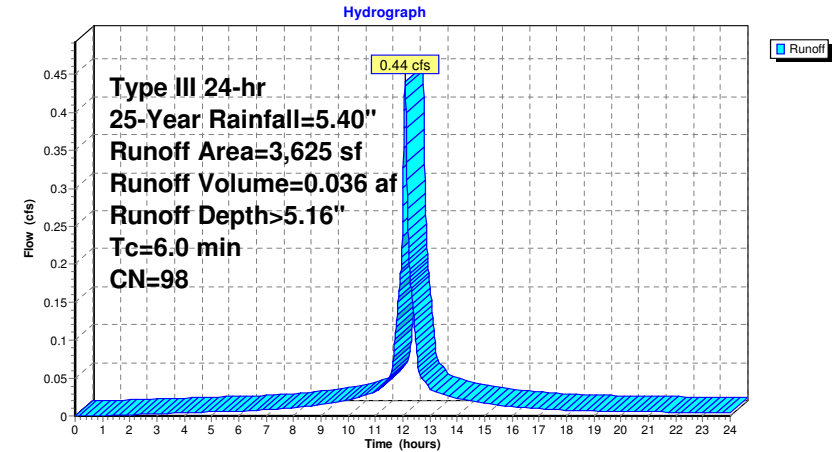
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)



Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

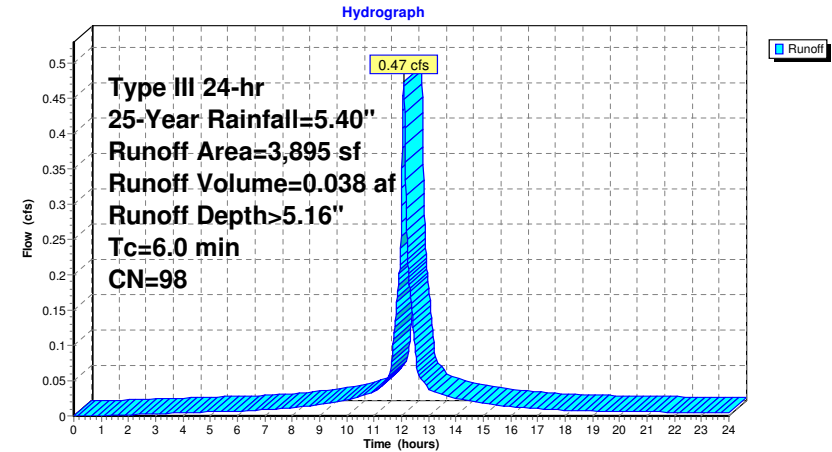
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)



Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

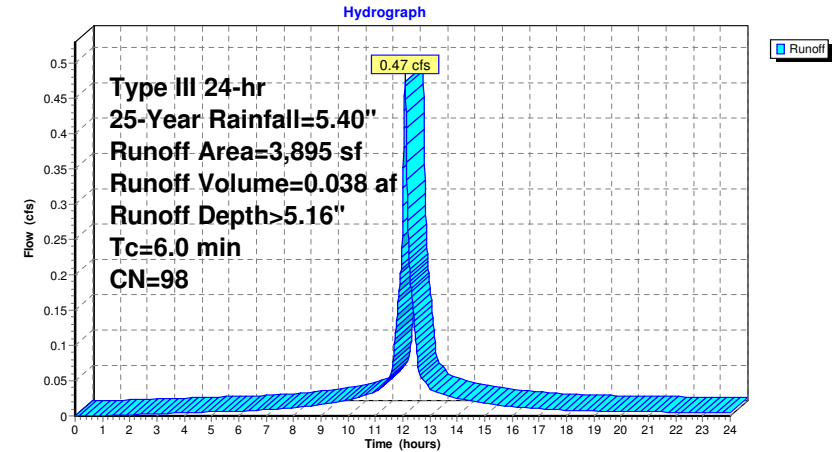
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)



Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

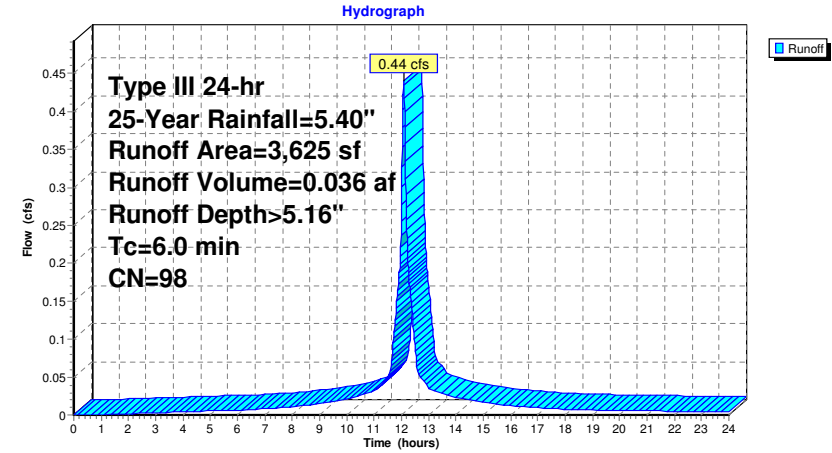
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

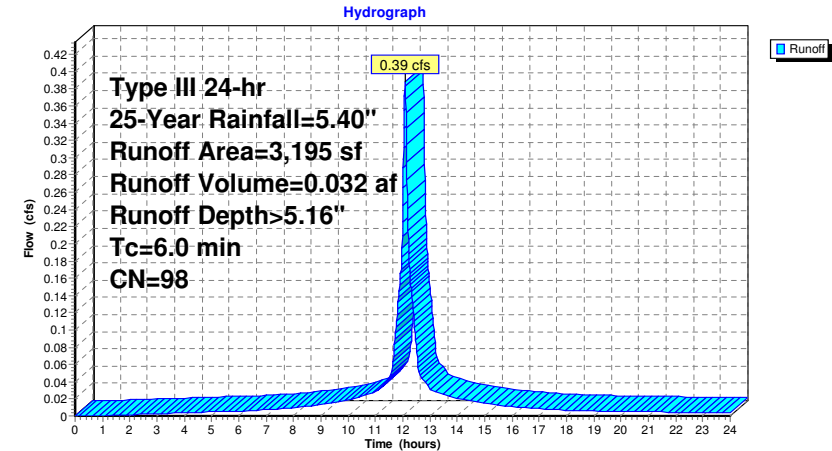
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

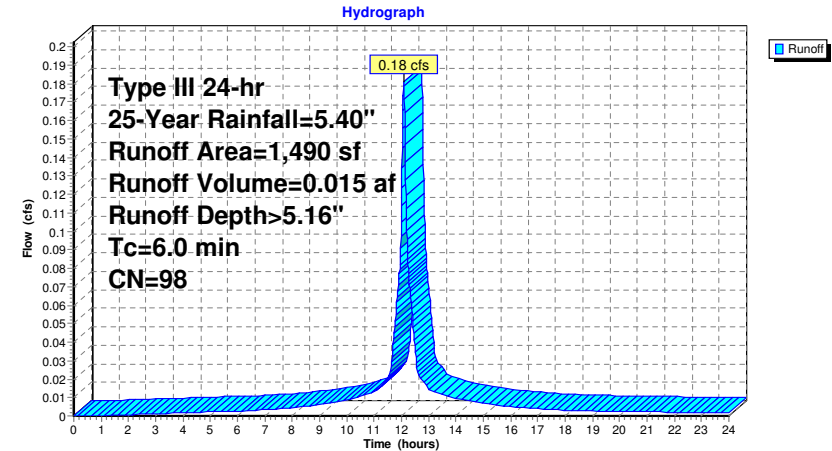
Runoff = 0.18 cfs @ 12.08 hrs, Volume= 0.015 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

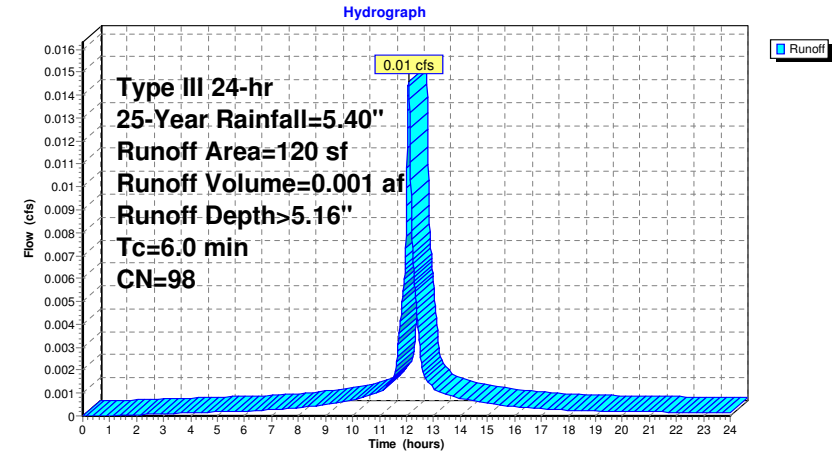
Runoff = 0.01 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

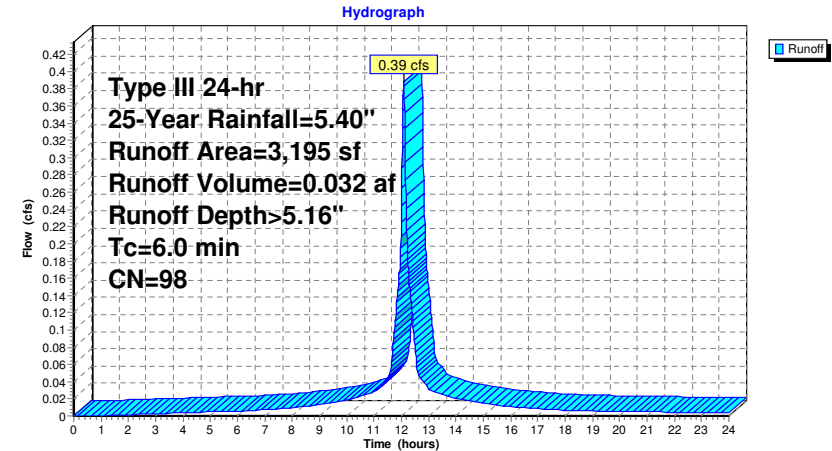
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

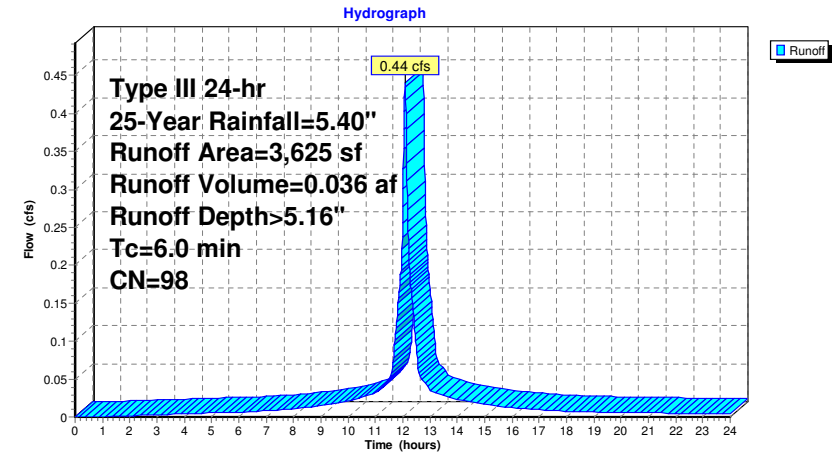
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

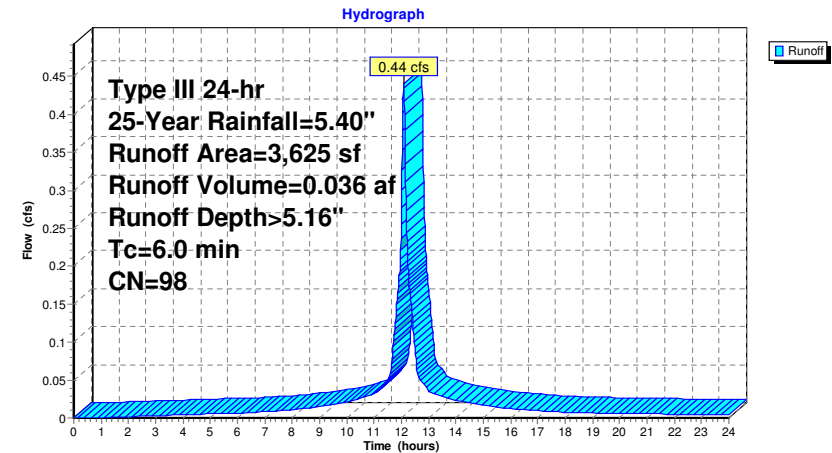
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

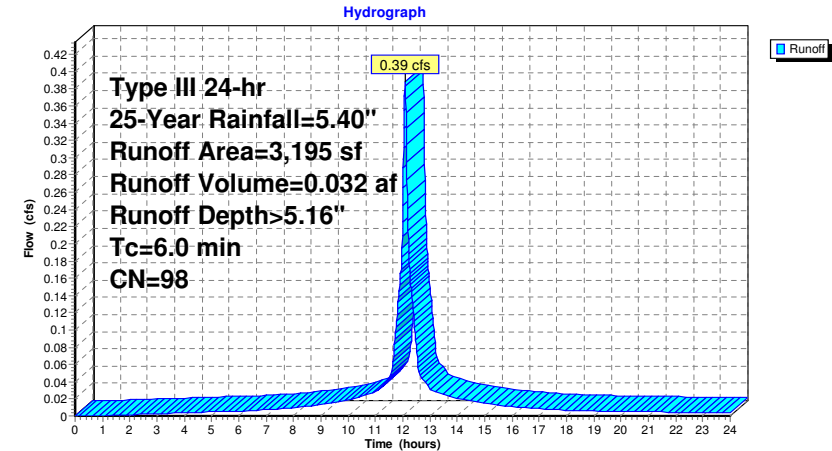
Runoff = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)



Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

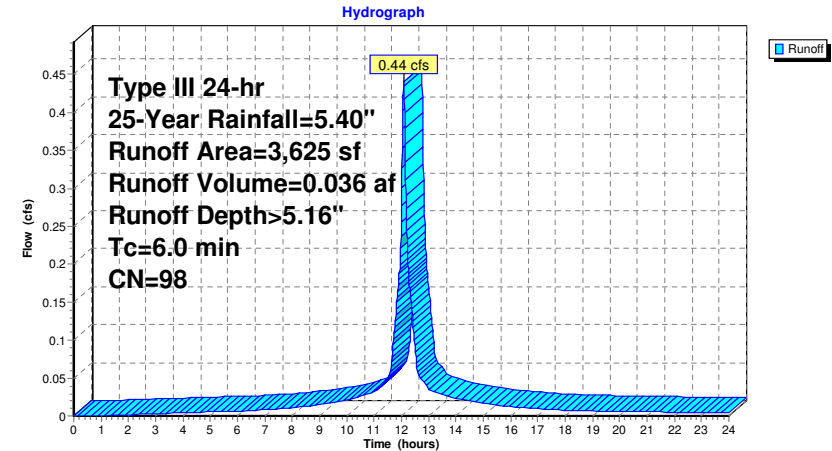
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)



Topsfield Proposed HydroCAD

Prepared by Microsoft

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 173

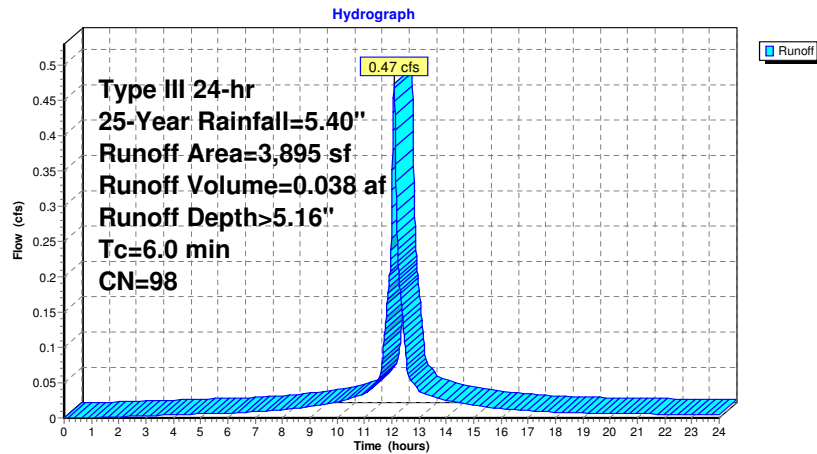
Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)**Topsfield Proposed HydroCAD**

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 174

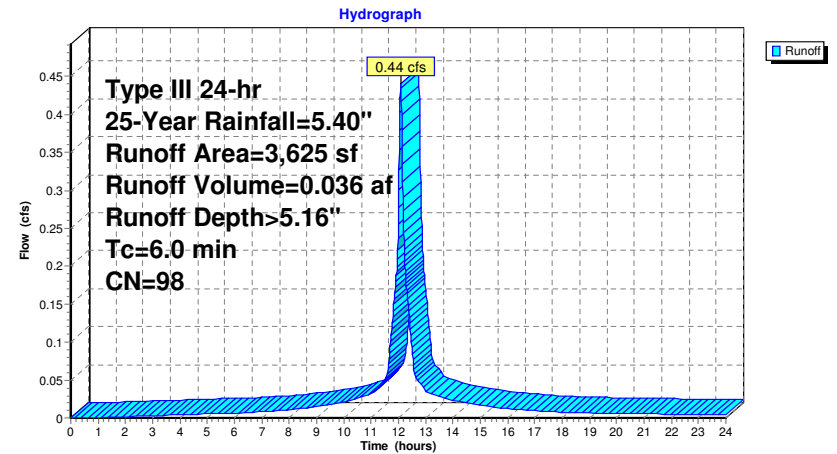
Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

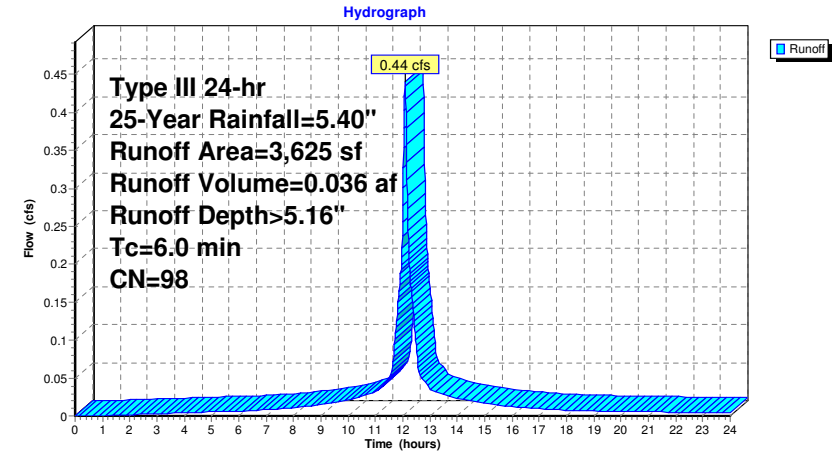
Runoff = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af, Depth> 5.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.40"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)



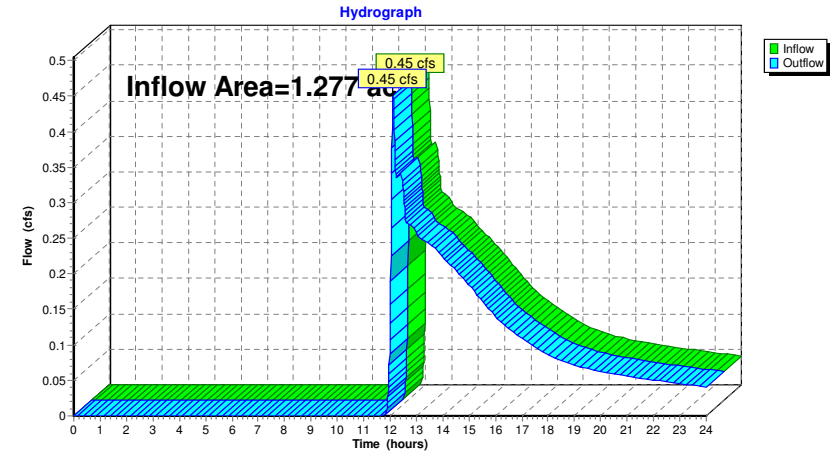
Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.277 ac, 33.99% Impervious, Inflow Depth > 1.15" for 25-Year event
Inflow = 0.45 cfs @ 12.11 hrs, Volume= 0.123 af
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.123 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: Wetlands South of Driveway



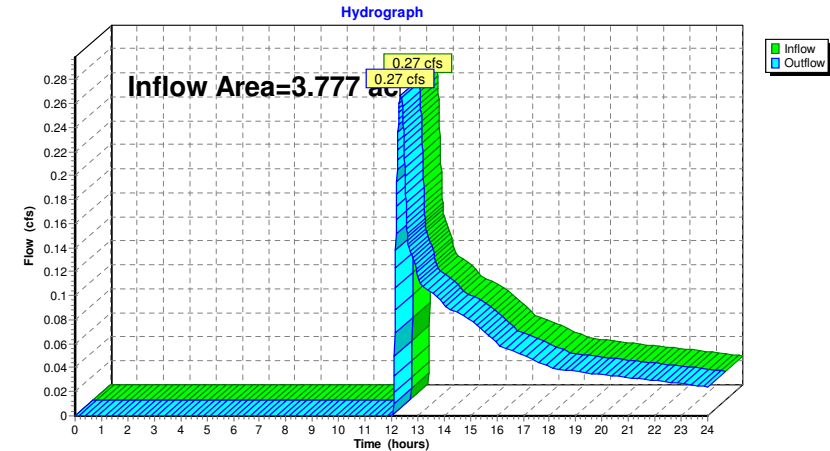
Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.777 ac, 26.87% Impervious, Inflow Depth > 0.19" for 25-Year event
Inflow = 0.27 cfs @ 12.36 hrs, Volume= 0.058 af
Outflow = 0.27 cfs @ 12.36 hrs, Volume= 0.058 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: Large Wetland Area East



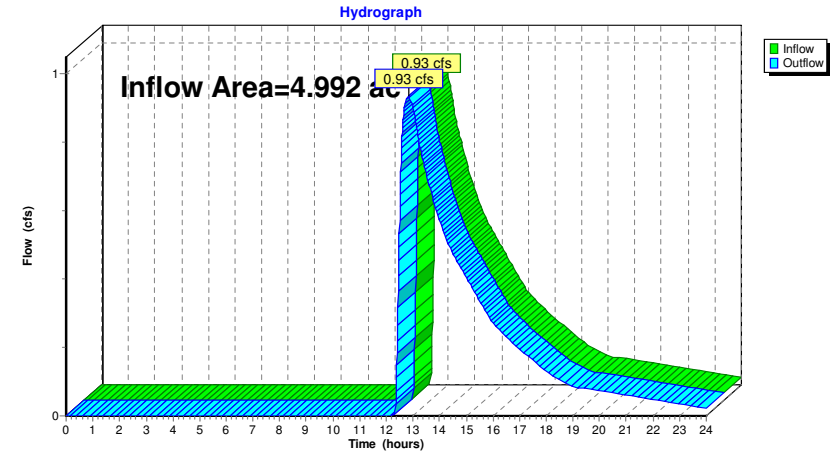
Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.992 ac, 31.07% Impervious, Inflow Depth > 0.55" for 25-Year event
Inflow = 0.93 cfs @ 12.83 hrs, Volume= 0.229 af
Outflow = 0.93 cfs @ 12.83 hrs, Volume= 0.229 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: Large Wetland Area West

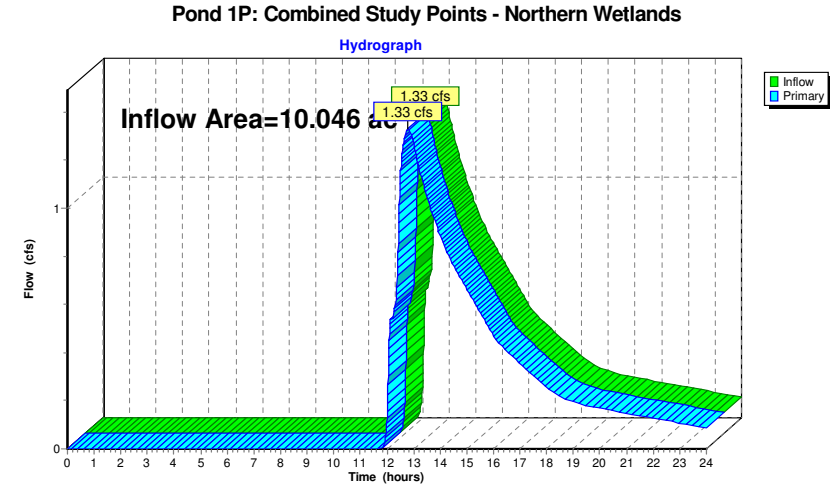


Summary for Pond 1P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.046 ac, 29.86% Impervious, Inflow Depth > 0.49" for 25-Year event
Inflow = 1.33 cfs @ 12.80 hrs, Volume= 0.410 af
Primary = 1.33 cfs @ 12.80 hrs, Volume= 0.410 af, Atten= 0%, Lag= 0.0 min

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



Summary for Pond D-1: Surface Infiltration Pond

Inflow Area = 2.637 ac, 56.80% Impervious, Inflow Depth > 2.74" for 25-Year event
Inflow = 8.39 cfs @ 12.10 hrs, Volume= 0.603 af
Outflow = 1.00 cfs @ 12.82 hrs, Volume= 0.318 af, Atten= 88%, Lag= 43.5 min
Discarded = 0.12 cfs @ 12.82 hrs, Volume= 0.122 af
Primary = 0.89 cfs @ 12.82 hrs, Volume= 0.195 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 70.39' @ 12.82 hrs Surf.Area= 4,906 sf Storage= 14,288 cf
Flood Elev= 71.10' Surf.Area= 5,491 sf Storage= 17,958 cf

Plug-Flow detention time= 236.6 min calculated for 0.317 af (53% of inflow)
Center-of-Mass det. time= 130.0 min (944.0 - 814.0)

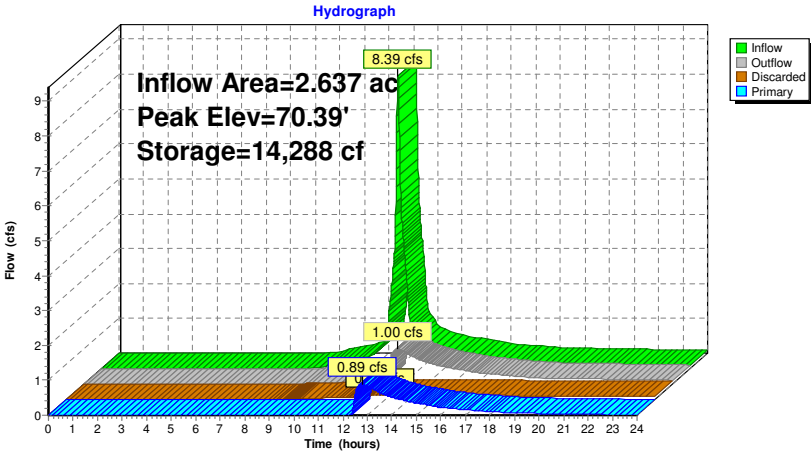
Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	56,233 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	70.00'	15.0" Round Culvert L= 252.0' Ke= 0.200 Inlet / Outlet Invert= 70.00' / 65.40' S= 0.0183 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.12 cfs @ 12.82 hrs HW=70.39' (Free Discharge)
↑1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.88 cfs @ 12.82 hrs HW=70.39' (Free Discharge)
↑2=Culvert (Inlet Controls 0.88 cfs @ 2.67 fps)

Pond D-1: Surface Infiltration Pond



Summary for Pond D-2: Existing Detention Basin

[58] Hint: Peaked 0.33' above defined flood level

Inflow Area = 0.531 ac, 59.77% Impervious, Inflow Depth > 3.34" for 25-Year event
Inflow = 2.07 cfs @ 12.09 hrs, Volume= 0.148 af
Outflow = 0.17 cfs @ 13.19 hrs, Volume= 0.078 af, Atten= 92%, Lag= 66.3 min
Primary = 0.17 cfs @ 13.19 hrs, Volume= 0.078 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.41' @ 13.19 hrs Surf.Area= 3,090 sf Storage= 3,752 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

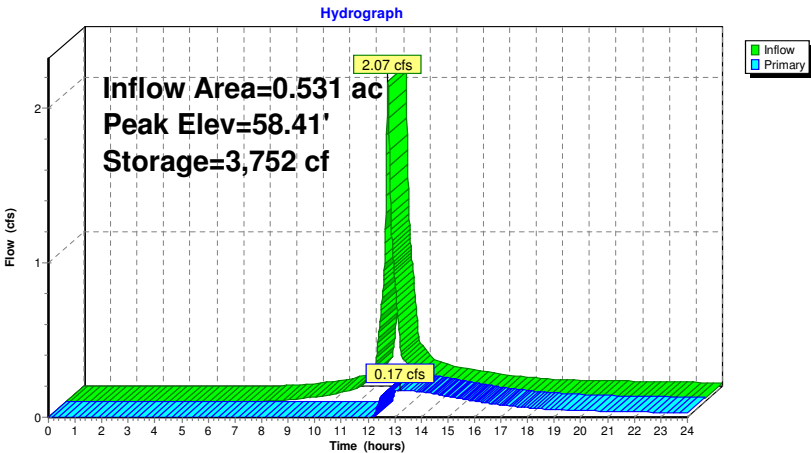
Plug-Flow detention time= 269.3 min calculated for 0.078 af (53% of inflow)
Center-of-Mass det. time= 158.1 min (973.3 - 815.2)

Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.17 cfs @ 13.19 hrs HW=58.41' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.17 cfs @ 1.97 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond D-2: Existing Detention Basin



Summary for Pond D-3: Detention Pond by Access Road

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 2.42" for 25-Year event
Inflow = 0.32 cfs @ 12.09 hrs, Volume= 0.023 af
Outflow = 0.03 cfs @ 13.03 hrs, Volume= 0.023 af, Atten= 90%, Lag= 56.1 min
Discarded = 0.03 cfs @ 13.03 hrs, Volume= 0.023 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 63.86' @ 13.03 hrs Surf.Area= 602 sf Storage= 390 cf

Plug-Flow detention time= 118.7 min calculated for 0.023 af (100% of inflow)
Center-of-Mass det. time= 118.2 min (958.6 - 840.3)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

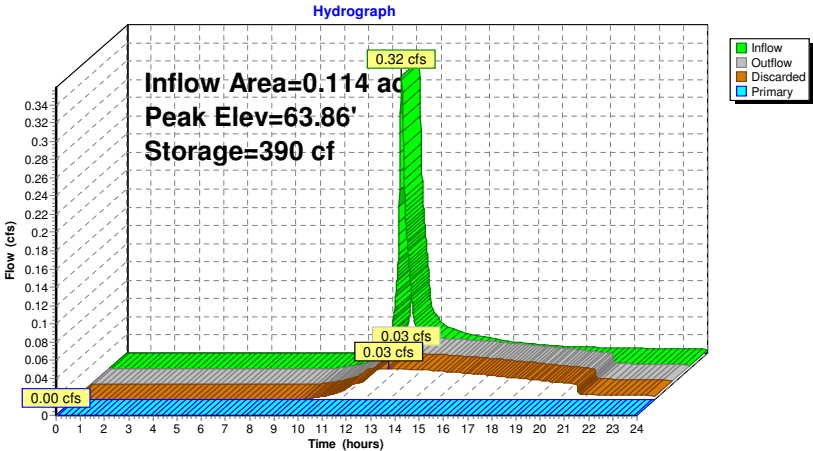
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.03 cfs @ 13.03 hrs HW=63.86' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Pond D-3: Detention Pond by Access Road



Summary for Pond UIS-1: UIS at Entrance

Inflow Area = 1.487 ac, 40.11% Impervious, Inflow Depth > 3.23" for 25-Year event
Inflow = 5.43 cfs @ 12.09 hrs, Volume= 0.401 af
Outflow = 0.08 cfs @ 9.67 hrs, Volume= 0.113 af, Atten= 98%, Lag= 0.0 min
Discarded = 0.08 cfs @ 9.67 hrs, Volume= 0.113 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 65.55' @ 21.11 hrs Surf.Area= 3,486 sf Storage= 12,660 cf
Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,284 cf

Plug-Flow detention time= 282.9 min calculated for 0.113 af (28% of inflow)
Center-of-Mass det. time= 127.3 min (932.9 - 805.6)

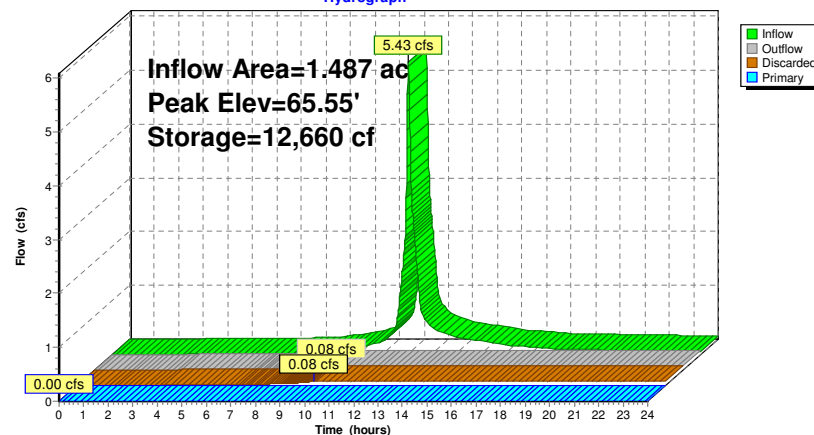
Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,089 cf	50.50'W x 69.03'L x 6.00'H Field A 20,917 cf Overall - 8,195 cf Embedded = 12,722 cf x 40.0% Voids
#2A	61.00'	8,195 cf	Cultec R-902HD x 126 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 7 Rows of 18 Chambers Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
		13,284 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	68.40'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 9.67 hrs HW=60.08' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=60.00' (Free Discharge)
2=Orifice/Grate (Controls 0.00 cfs)



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Type III 24-hr 25-Year Rainfall=5.40"

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Page 189

Summary for Pond UIS-2: UIS at North of Site

Inflow Area = 0.419 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
 Inflow = 2.21 cfs @ 12.08 hrs, Volume= 0.180 af
 Outflow = 0.23 cfs @ 11.43 hrs, Volume= 0.180 af, Atten= 90%, Lag= 0.0 min
 Discarded = 0.23 cfs @ 11.43 hrs, Volume= 0.180 af
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 64.89' @ 12.81 hrs Surf.Area= 1,176 sf Storage= 2,548 cf
 Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 74.0 min calculated for 0.180 af (100% of inflow)
 Center-of-Mass det. time= 73.8 min (820.0 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	16.00'W x 73.50'L x 4.04'H Field A 4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	Cultec R-330XLHD x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	68.25'	6.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.43 hrs HW=61.57' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.23 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=61.50' (Free Discharge)**2=Orifice/Grate** (Controls 0.00 cfs)**Topsfield Proposed HydroCAD**

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 190

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A**Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)**

Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf

Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap

Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50'

Base Length

3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width

12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af

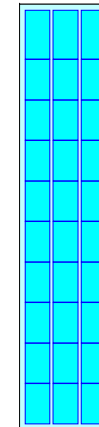
Overall Storage Efficiency = 60.2%

Overall System Size = 73.50' x 16.00' x 4.04'

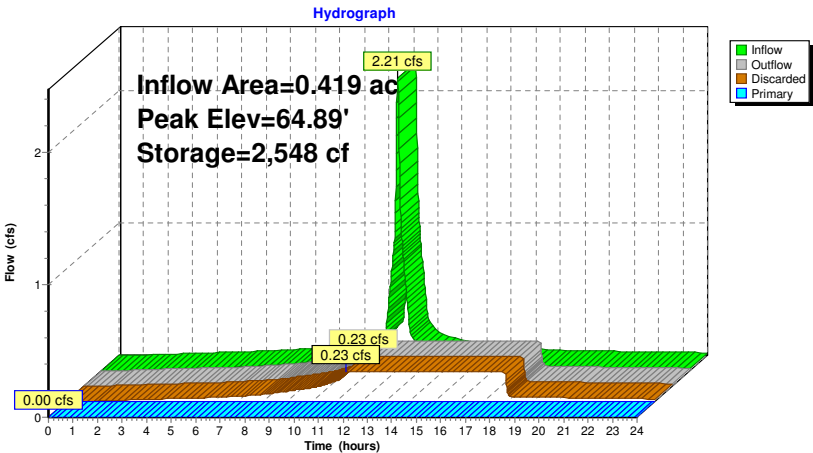
30 Chambers

176.0 cy Field

116.8 cy Stone



Pond UIS-2: UIS at North of Site



Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.58' above defined flood level

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event

Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af

Outflow = 0.44 cfs @ 12.09 hrs, Volume= 0.033 af, Atten= 1%, Lag= 0.6 min

Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af

Primary = 0.43 cfs @ 12.09 hrs, Volume= 0.029 af

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

Peak Elev= 73.79' @ 12.09 hrs Surf.Area= 103 sf Storage= 137 cf

Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 65.9 min calculated for 0.033 af (93% of inflow)

Center-of-Mass det. time= 26.7 min (772.9 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.40'	6.0" Round Culvert L= 30.0' Ke= 0.200 Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=71.72' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.43 cfs @ 12.09 hrs HW=73.79' (Free Discharge)

↑2=Culvert (Inlet Controls 0.43 cfs @ 2.65 fps)

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Page 193

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

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

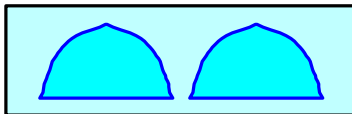
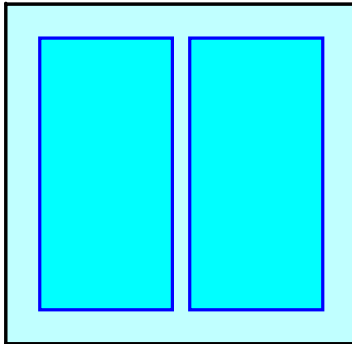
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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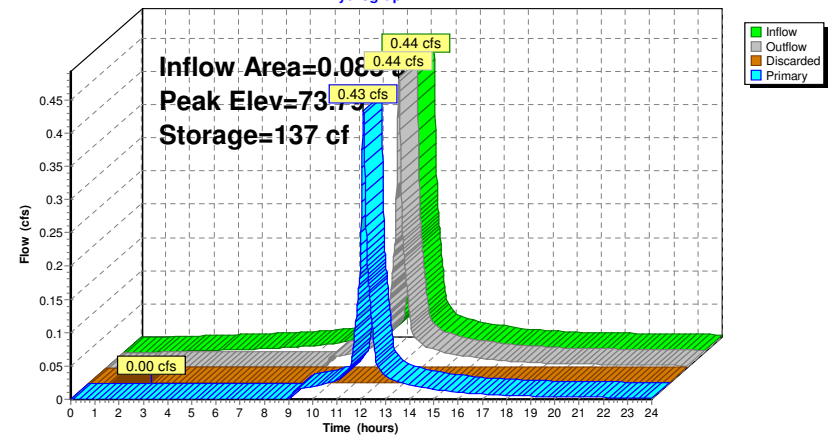
Type III 24-hr 25-Year Rainfall=5.40"

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Page 194

Pond UIS-3: UIS-3

Hydrograph



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Page 195

Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.53' above defined flood level

Inflow Area = 0.073 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
 Inflow = 0.39 cfs @ 12.08 hrs, Volume= 0.032 af
 Outflow = 0.38 cfs @ 12.10 hrs, Volume= 0.029 af, Atten= 3%, Lag= 1.2 min
 Discarded = 0.00 cfs @ 2.88 hrs, Volume= 0.004 af
 Primary = 0.37 cfs @ 12.10 hrs, Volume= 0.024 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 74.73' @ 12.10 hrs Surf.Area= 103 sf Storage= 146 cf
 Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 71.7 min calculated for 0.029 af (92% of inflow)
 Center-of-Mass det. time= 28.8 min (775.0 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.20'	6.0" Round Culvert L= 30.0' Ke= 1.000 Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.88 hrs HW=72.53' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.37 cfs @ 12.10 hrs HW=74.73' (Free Discharge)↑**2=Culvert** (Inlet Controls 0.37 cfs @ 1.90 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 196

Pond UIS-4: UIS-4 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
 Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
 Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

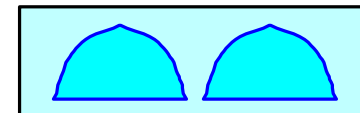
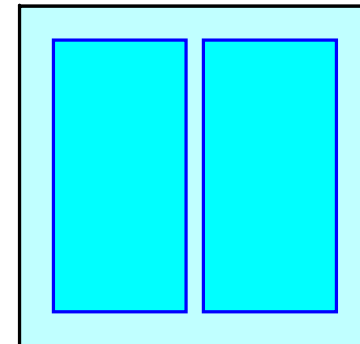
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
 2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
 6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

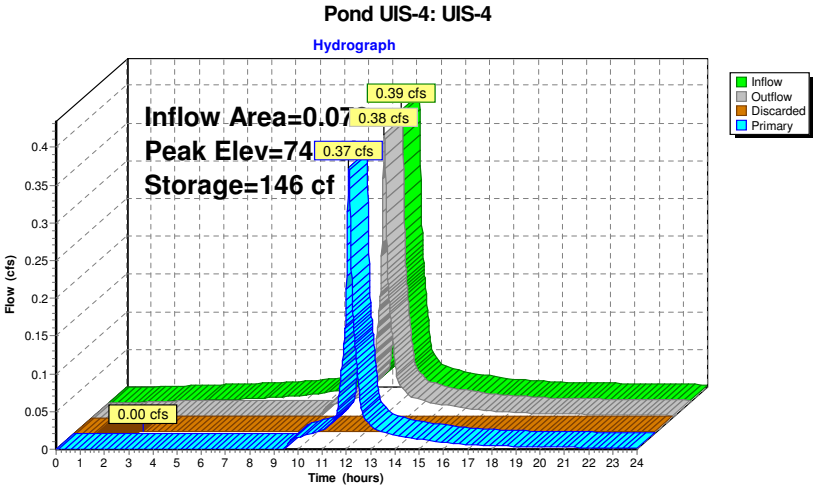
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
 Overall Storage Efficiency = 57.6%
 Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
 12.3 cy Field
 8.7 cy Stone





Summary for Pond UIS-5: UIS-5

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.42 cfs @ 12.11 hrs, Volume= 0.033 af, Atten= 4%, Lag= 1.4 min
Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af
Primary = 0.42 cfs @ 12.11 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 75.40' @ 12.11 hrs Surf.Area= 103 sf Storage= 151 cf

Plug-Flow detention time= 66.5 min calculated for 0.033 af (93% of inflow)
Center-of-Mass det. time= 27.3 min (773.5 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.80'	6.0" Round Culvert L= 22.0' Ke= 1.000 Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=73.12' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.42 cfs @ 12.11 hrs HW=75.40' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.42 cfs @ 2.14 fps)

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 199

Pond UIS-5: UIS-5 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

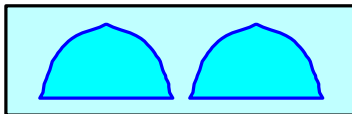
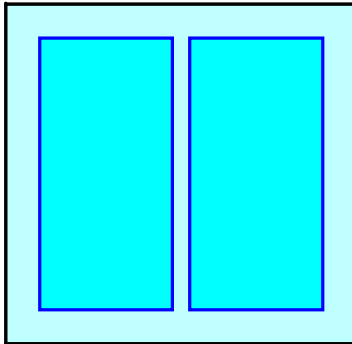
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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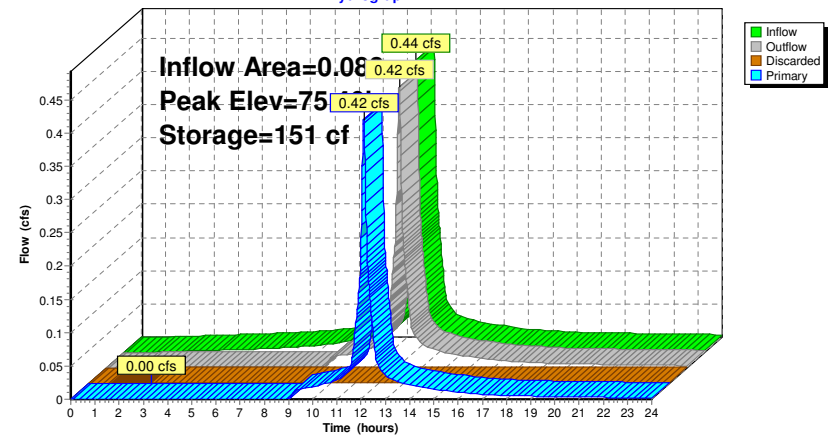
Type III 24-hr 25-Year Rainfall=5.40"

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Page 200

Pond UIS-5: UIS-5

Hydrograph



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Page 201

Summary for Pond UIS-6: UIS-6

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
 Inflow = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af
 Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.036 af, Atten= 4%, Lag= 1.4 min
 Discarded = 0.00 cfs @ 2.48 hrs, Volume= 0.005 af
 Primary = 0.45 cfs @ 12.11 hrs, Volume= 0.031 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 74.65' @ 12.11 hrs Surf.Area= 103 sf Storage= 154 cf

Plug-Flow detention time= 63.7 min calculated for 0.036 af (93% of inflow)
 Center-of-Mass det. time= 26.6 min (772.8 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.00'	6.0" Round Culvert L= 106.0' Ke= 1.000 Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 ' /' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.48 hrs HW=72.32' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.45 cfs @ 12.11 hrs HW=74.65' (Free Discharge)**2=Culvert** (Inlet Controls 0.45 cfs @ 2.29 fps)**Topsfield Proposed HydroCAD**

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Page 202

Pond UIS-6: UIS-6 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

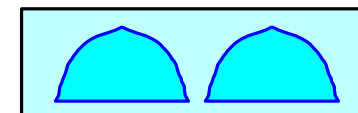
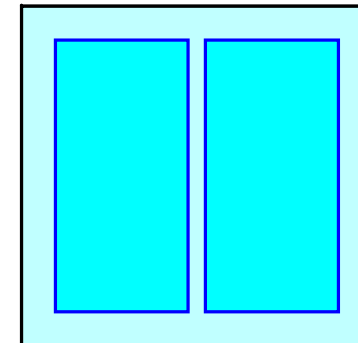
Overall Storage Efficiency = 57.6%

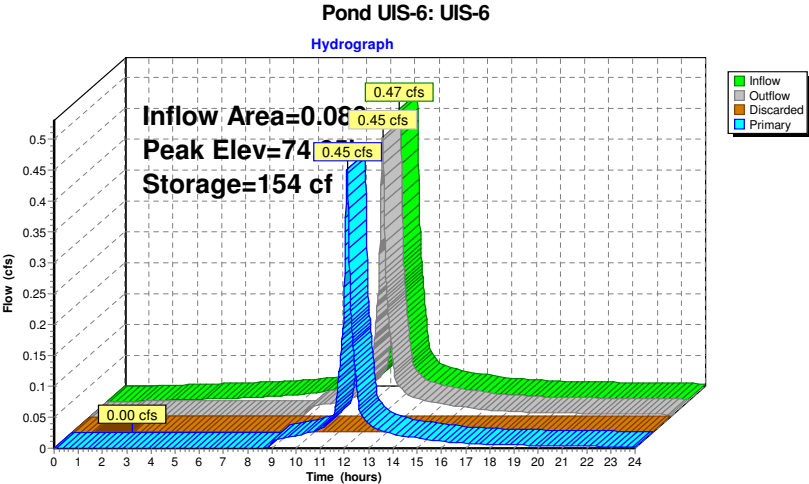
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-7: UIS-7

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af
Outflow = 0.42 cfs @ 12.11 hrs, Volume= 0.033 af, Atten= 4%, Lag= 1.4 min
Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af
Primary = 0.42 cfs @ 12.11 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.10' @ 12.11 hrs Surf.Area= 103 sf Storage= 151 cf

Plug-Flow detention time= 66.5 min calculated for 0.033 af (93% of inflow)
Center-of-Mass det. time= 27.3 min (773.5 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.50'	6.0" Round Culvert L= 17.5' Ke= 1.000 Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=71.82' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.42 cfs @ 12.11 hrs HW=74.10' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.42 cfs @ 2.14 fps)

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 205

Pond UIS-7: UIS-7 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

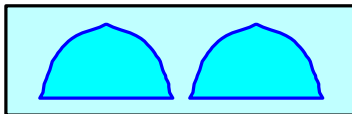
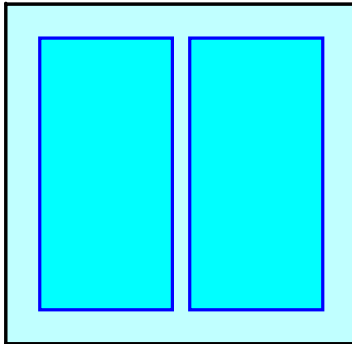
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone



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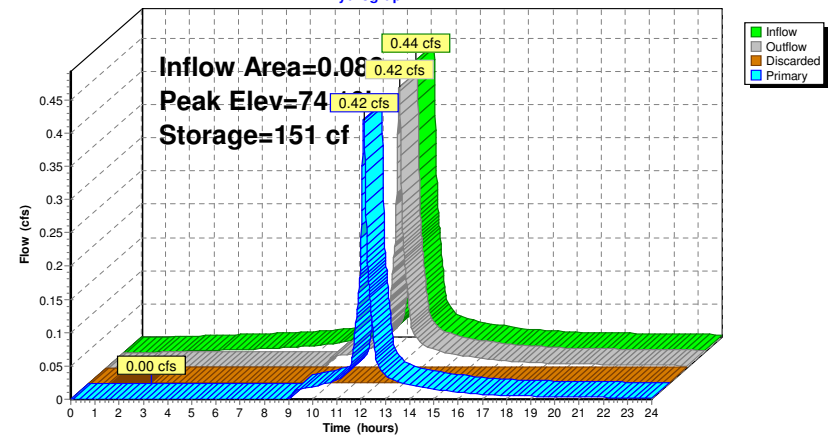
Type III 24-hr 25-Year Rainfall=5.40"

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Page 206

Pond UIS-7: UIS-7

Hydrograph



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Type III 24-hr 25-Year Rainfall=5.40"

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Page 207

Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
 Inflow = 0.44 cfs @ 12.08 hrs, Volume= 0.036 af
 Outflow = 0.42 cfs @ 12.11 hrs, Volume= 0.033 af, Atten= 4%, Lag= 1.4 min
 Discarded = 0.00 cfs @ 2.62 hrs, Volume= 0.004 af
 Primary = 0.42 cfs @ 12.11 hrs, Volume= 0.029 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 73.40' @ 12.11 hrs Surf.Area= 103 sf Storage= 151 cf

Plug-Flow detention time= 66.5 min calculated for 0.033 af (93% of inflow)
 Center-of-Mass det. time= 27.3 min (773.5 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
			191 cf Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.80'	6.0" Round Culvert L= 37.0' Ke= 1.000 Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/ Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.62 hrs HW=71.12' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.42 cfs @ 12.11 hrs HW=73.40' (Free Discharge)**2=Culvert** (Inlet Controls 0.42 cfs @ 2.14 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 25-Year Rainfall=5.40"

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Page 208

Pond UIS-8: UIS-8 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

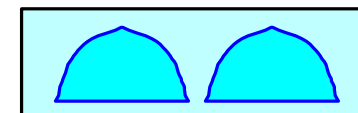
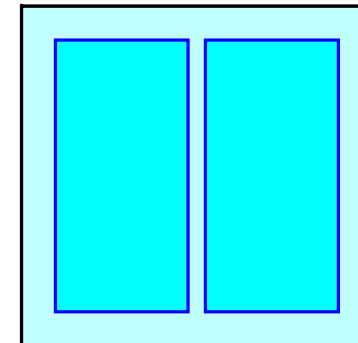
Overall Storage Efficiency = 57.6%

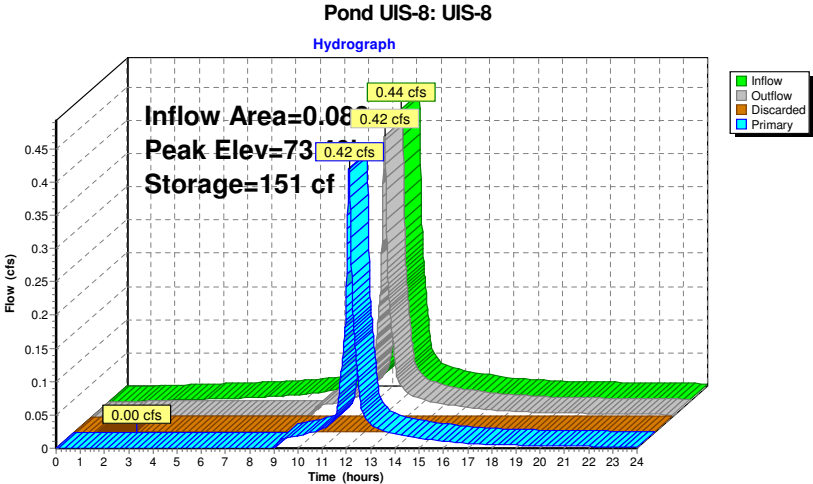
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-9: UIS-9

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 5.16" for 25-Year event
Inflow = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af
Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.037 af, Atten= 5%, Lag= 1.7 min
Discarded = 0.00 cfs @ 2.48 hrs, Volume= 0.005 af
Primary = 0.44 cfs @ 12.11 hrs, Volume= 0.033 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 72.82' @ 12.11 hrs Surf.Area= 103 sf Storage= 99 cf

Plug-Flow detention time= 36.2 min calculated for 0.037 af (97% of inflow)
Center-of-Mass det. time= 16.4 min (762.7 - 746.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.18'	6.0" Round Culvert L= 79.0' Ke= 1.000 Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 ' S Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.48 hrs HW=71.31' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.44 cfs @ 12.11 hrs HW=72.82' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.44 cfs @ 2.26 fps)

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Page 213

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: Northern Grassed Area to	Runoff Area=81,522 sf 0.00% Impervious Runoff Depth>0.73" Tc=6.0 min CN=41 Runoff=0.78 cfs 0.113 af
Subcatchment P-10: Area Around Isolated	Runoff Area=31,595 sf 7.29% Impervious Runoff Depth>3.71" Flow Length=533' Tc=6.0 min UI Adjusted CN=75 Runoff=3.16 cfs 0.224 af
Subcatchment P-2: Existing Drive to Existing	Runoff Area=23,114 sf 59.77% Impervious Runoff Depth>4.34" Tc=6.0 min CN=81 Runoff=2.68 cfs 0.192 af
Subcatchment P-3: Area Around Isolated	Runoff Area=27,582 sf 12.85% Impervious Runoff Depth>1.39" Tc=6.0 min UI Adjusted CN=50 Runoff=0.87 cfs 0.074 af
Subcatchment P-3A: Gravel Road to Detention	Runoff Area=4,950 sf 31.35% Impervious Runoff Depth>3.30" Tc=6.0 min CN=71 Runoff=0.44 cfs 0.031 af
Subcatchment P-4: Sloped Entrance Drive -	Runoff Area=21,573 sf 55.93% Impervious Runoff Depth>3.81" Tc=6.0 min CN=76 Runoff=2.21 cfs 0.157 af
Subcatchment P-5: Driveway - Units 25-11	Runoff Area=39,272 sf 51.57% Impervious Runoff Depth>3.61" Tc=6.0 min CN=74 Runoff=3.82 cfs 0.271 af
Subcatchment P-6: Pavement Units 12-19	Runoff Area=19,137 sf 59.86% Impervious Runoff Depth>4.02" Tc=6.0 min CN=78 Runoff=2.07 cfs 0.147 af
Subcatchment P-7: Driveway - Units 20-24	Runoff Area=15,670 sf 44.56% Impervious Runoff Depth>3.30" Tc=6.0 min CN=71 Runoff=1.39 cfs 0.099 af
Subcatchment P-8: Surface Infiltration Pond	Runoff Area=15,307 sf 7.00% Impervious Runoff Depth>0.86" Tc=6.0 min CN=43 Runoff=0.21 cfs 0.025 af
Subcatchment P-9: Woods/Grass Northwest	Runoff Area=102,567 sf 2.25% Impervious Runoff Depth>0.42" Flow Length=502' Tc=10.8 min UI Adjusted CN=36 Runoff=0.33 cfs 0.082 af
Subcatchment R-1: Roof - Units 1&2 (C&B)	Runoff Area=3,185 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af
Subcatchment R-10: Roof - Units 19&20 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af
Subcatchment R-11: Roof - Units 21&22 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af
Subcatchment R-12: Roof - Units 23&24 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af
Subcatchment R-13: Roof - Units 25&26 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af

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Page 214

Subcatchment R-14: Roof Units 27&28 - A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af
Subcatchment R-15: Roof Units 29&30 - (B & C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af
Subcatchment R-16: Front Units 29&30	Runoff Area=1,490 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.22 cfs 0.018 af
Subcatchment R-17: Mailbox Structure Roof	Runoff Area=120 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.02 cfs 0.001 af
Subcatchment R-2: Roof Units 3&4 - (B & C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af
Subcatchment R-3: Roof Units 5&6 - A&B Units	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af
Subcatchment R-4: Roof - Units 7&8 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af
Subcatchment R-5: Roof - Units 9&10 - (B&C	Runoff Area=3,195 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.47 cfs 0.038 af
Subcatchment R-6: Roof - Units 11&12 - (B&A	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af
Subcatchment R-7: Roof - Units 13&14 - (A	Runoff Area=3,895 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.57 cfs 0.047 af
Subcatchment R-8: Roof - Units 15&16 - (B&A	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af
Subcatchment R-9: Roof - Units 17&18 - (A&B	Runoff Area=3,625 sf 100.00% Impervious Runoff Depth>6.26" Tc=6.0 min CN=98 Runoff=0.53 cfs 0.043 af
Reach SP-1: Wetlands South of Driveway	Inflow=0.90 cfs 0.197 af Outflow=0.90 cfs 0.197 af
Reach SP-2: Large Wetland Area East	Inflow=2.02 cfs 0.222 af Outflow=2.02 cfs 0.222 af
Reach SP-3: Large Wetland Area West	Inflow=3.39 cfs 0.462 af Outflow=3.39 cfs 0.462 af
Pond 1P: Combined Study Points - Northern Wetlands	Inflow=5.94 cfs 0.881 af Primary=5.94 cfs 0.881 af
Pond D-1: Surface Infiltration Pond	Peak Elev=70.78' Storage=16,269 cf Inflow=10.97 cfs 0.799 af Discarded=0.12 cfs 0.128 af Primary=3.06 cfs 0.380 af Outflow=3.18 cfs 0.508 af

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Page 215

Pond D-2: Existing Detention Basin Peak Elev=58.71' Storage=4,665 cf Inflow=2.68 cfs 0.192 af
Outflow=0.29 cfs 0.121 af

Pond D-3: Detention Pond by Access Road Peak Elev=64.06' Storage=478 cf Inflow=0.44 cfs 0.031 af
Discarded=0.04 cfs 0.029 af Primary=0.17 cfs 0.003 af Outflow=0.21 cfs 0.031 af

Pond UIS-1: UIS at Entrance Peak Elev=68.51' Storage=13,284 cf Inflow=7.07 cfs 0.520 af
Discarded=0.08 cfs 0.118 af Primary=0.99 cfs 0.098 af Outflow=1.07 cfs 0.216 af

Pond UIS-2: UIS at North of Site Peak Elev=70.33' Storage=2,860 cf Inflow=2.67 cfs 0.218 af
Discarded=0.23 cfs 0.207 af Primary=1.36 cfs 0.011 af Outflow=1.59 cfs 0.218 af

Pond UIS-3: UIS-3 Peak Elev=73.84' Storage=141 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.52 cfs 0.036 af Outflow=0.53 cfs 0.041 af

Pond UIS-4: UIS-4 Peak Elev=74.85' Storage=153 cf Inflow=0.47 cfs 0.038 af
Discarded=0.00 cfs 0.005 af Primary=0.45 cfs 0.031 af Outflow=0.45 cfs 0.036 af

Pond UIS-5: UIS-5 Peak Elev=75.56' Storage=159 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.50 cfs 0.036 af Outflow=0.51 cfs 0.041 af

Pond UIS-6: UIS-6 Peak Elev=74.83' Storage=163 cf Inflow=0.57 cfs 0.047 af
Discarded=0.00 cfs 0.005 af Primary=0.54 cfs 0.039 af Outflow=0.54 cfs 0.044 af

Pond UIS-7: UIS-7 Peak Elev=74.26' Storage=159 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.50 cfs 0.036 af Outflow=0.51 cfs 0.041 af

Pond UIS-8: UIS-8 Peak Elev=73.56' Storage=159 cf Inflow=0.53 cfs 0.043 af
Discarded=0.00 cfs 0.005 af Primary=0.50 cfs 0.036 af Outflow=0.51 cfs 0.041 af

Pond UIS-9: UIS-9 Peak Elev=72.99' Storage=111 cf Inflow=0.57 cfs 0.047 af
Discarded=0.00 cfs 0.005 af Primary=0.53 cfs 0.041 af Outflow=0.53 cfs 0.045 af

Total Runoff Area = 10.046 ac Runoff Volume = 2.078 af Average Runoff Depth = 2.48"
70.14% Pervious = 7.046 ac 29.86% Impervious = 3.000 ac

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Page 216

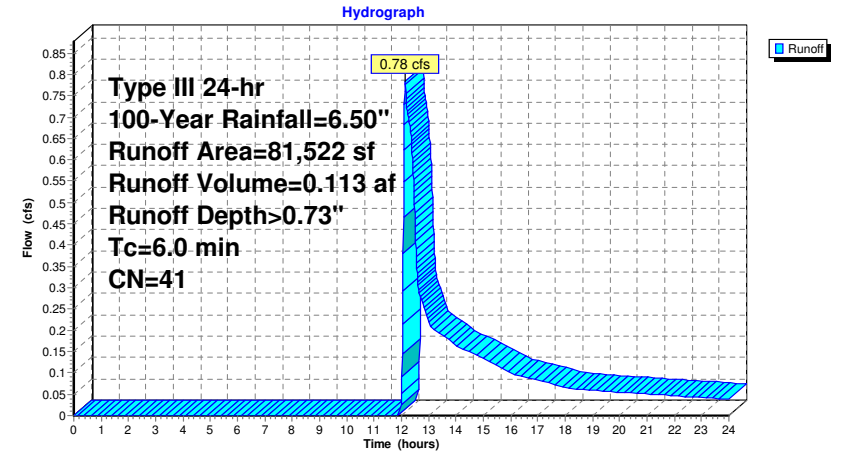
Summary for Subcatchment P-1: Northern Grassed Area to Wetlands

Runoff = 0.78 cfs @ 12.14 hrs, Volume= 0.113 af, Depth> 0.73"

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=6.50"

Area (sf)	CN	Description
38,137	30	Woods, Good, HSG A
10,782	70	Woods, Good, HSG C
9,419	55	Woods, Good, HSG B
23,184	39	>75% Grass cover, Good, HSG A
81,522	41	Weighted Average
81,522		100.00% Pervious Area

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

Subcatchment P-1: Northern Grassed Area to Wetlands

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 217

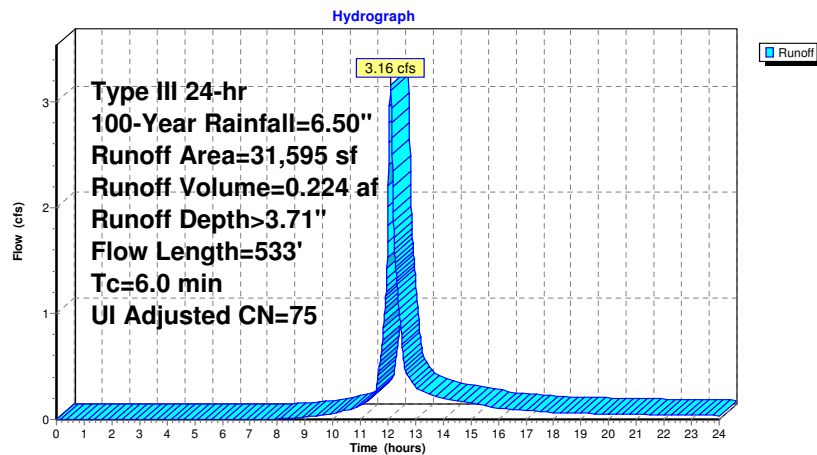
Summary for Subcatchment P-10: Area Around Isolated Wetland

Runoff = 3.16 cfs @ 12.09 hrs, Volume= 0.224 af, Depth> 3.71"

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=6.50"

Area (sf)	CN	Adj	Description
2,304	98		Unconnected roofs, HSG A
29,291	74		>75% Grass cover, Good, HSG C
31,595	76	75	Weighted Average, UI Adjusted
29,291			92.71% Pervious Area
2,304			7.29% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.9	50	0.1100	0.29		Sheet Flow, A-B
					Grass: Short n= 0.150 P2= 3.10"
2.9	483	0.1600	2.80		Shallow Concentrated Flow, B-C
					Short Grass Pasture Kv= 7.0 fps
5.8	533				Total, Increased to minimum Tc = 6.0 min

Subcatchment P-10: Area Around Isolated Wetland**Topsfield Proposed HydroCAD**

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Page 218

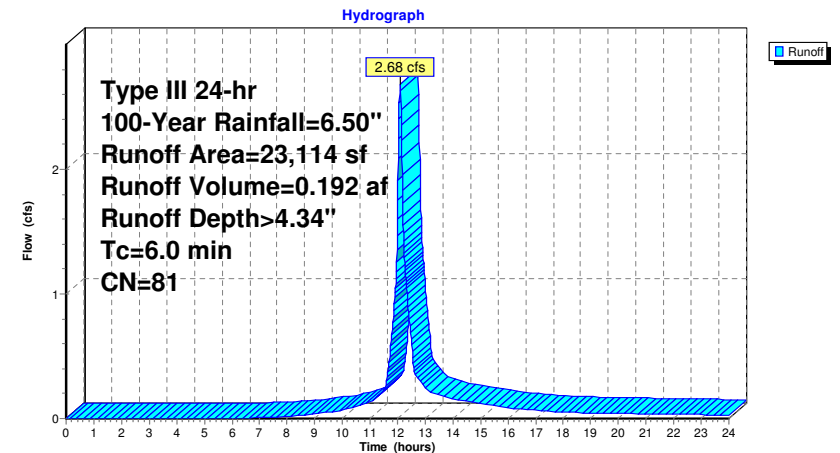
Summary for Subcatchment P-2: Existing Drive to Existing Basin

Runoff = 2.68 cfs @ 12.09 hrs, Volume= 0.192 af, Depth> 4.34"

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=6.50"

Area (sf)	CN	Description
13,815	98	Paved parking, HSG A
1,353	76	Gravel roads, HSG A
4,896	39	>75% Grass cover, Good, HSG A
3,050	74	>75% Grass cover, Good, HSG C
23,114	81	Weighted Average
9,299		40.23% Pervious Area
13,815		59.77% Impervious Area

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

Subcatchment P-2: Existing Drive to Existing Basin

Summary for Subcatchment P-3: Area Around Isolated Wetland

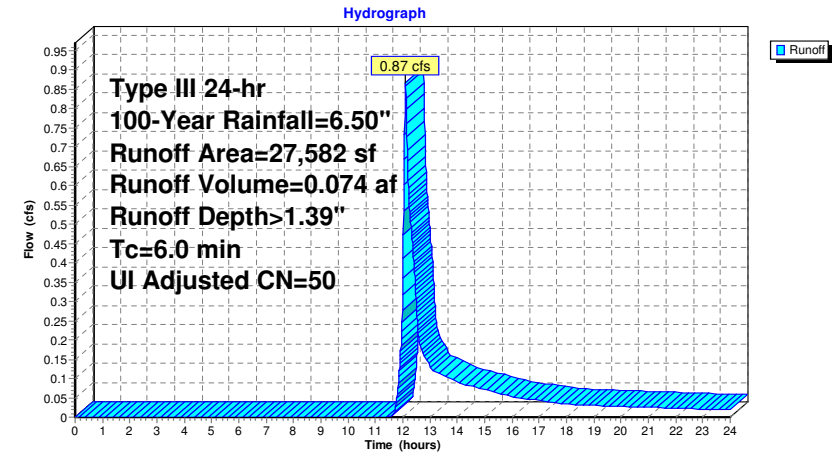
Runoff = 0.87 cfs @ 12.10 hrs, Volume= 0.074 af, Depth> 1.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
3,545	98		Unconnected pavement, HSG A
1,224	76		Gravel roads, HSG A
212	74		>75% Grass cover, Good, HSG C
2,166	70		Woods, Good, HSG C
5,125	77		Woods, Good, HSG D
14,867	30		Woods, Good, HSG A
443	39		>75% Grass cover, Good, HSG A
27,582	53	50	Weighted Average, UI Adjusted
24,037			87.15% Pervious Area
3,545			12.85% Impervious Area
3,545			100.00% Unconnected

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

Subcatchment P-3: Area Around Isolated Wetland



Summary for Subcatchment P-3A: Gravel Road to Detention Basin

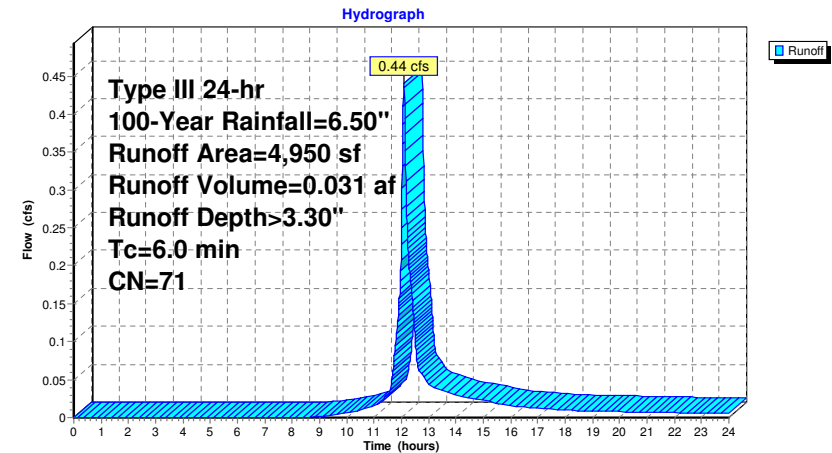
Runoff = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af, Depth> 3.30"

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=6.50"

Area (sf)	CN	Description
1,552	98	Paved parking, HSG A
1,841	76	Gravel roads, HSG A
1,557	39	>75% Grass cover, Good, HSG A
4,950	71	Weighted Average
3,398		68.65% Pervious Area
1,552		31.35% Impervious Area

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

Subcatchment P-3A: Gravel Road to Detention Basin



Summary for Subcatchment P-4: Sloped Entrance Drive - Units 1-5

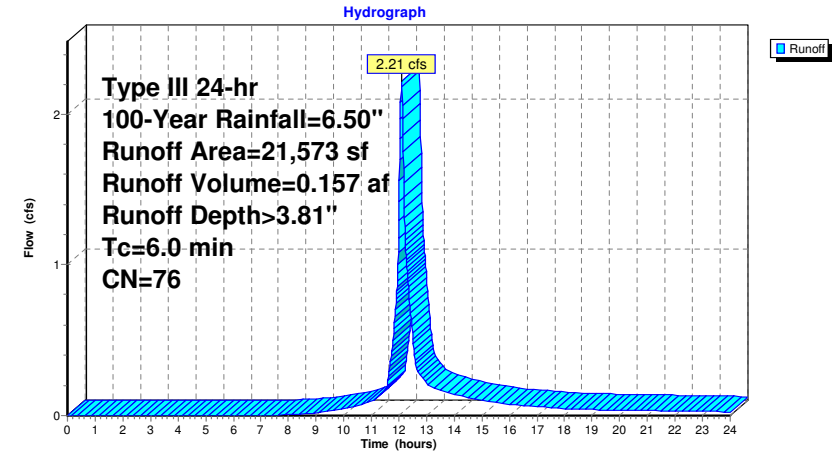
Runoff = 2.21 cfs @ 12.09 hrs, Volume= 0.157 af, Depth> 3.81"

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=6.50"

Area (sf)	CN	Description
12,066	98	Paved parking, HSG A
6,808	39	>75% Grass cover, Good, HSG A
2,699	74	>75% Grass cover, Good, HSG C
21,573	76	Weighted Average
9,507		44.07% Pervious Area
12,066		55.93% Impervious Area

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

Subcatchment P-4: Sloped Entrance Drive - Units 1-5



Summary for Subcatchment P-5: Driveway - Units 25-11

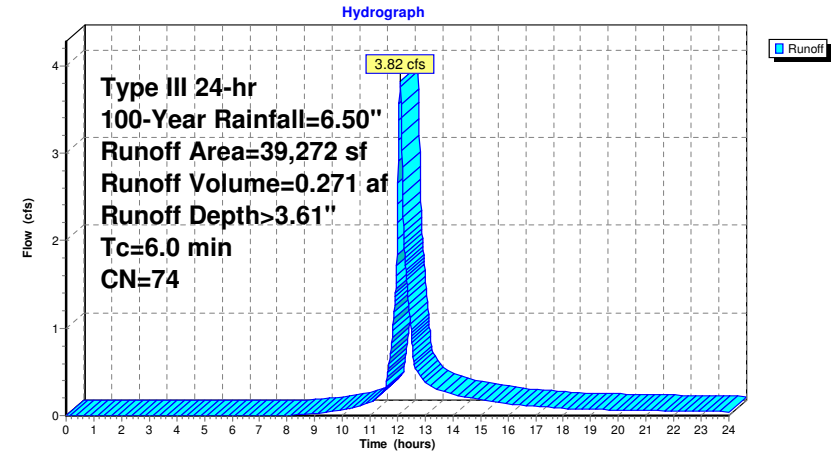
Runoff = 3.82 cfs @ 12.09 hrs, Volume= 0.271 af, Depth> 3.61"

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=6.50"

Area (sf)	CN	Description
20,251	98	Paved parking, HSG A
14,308	39	>75% Grass cover, Good, HSG A
4,713	74	>75% Grass cover, Good, HSG C
39,272	74	Weighted Average
19,021		48.43% Pervious Area
20,251		51.57% Impervious Area

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

Subcatchment P-5: Driveway - Units 25-11



Summary for Subcatchment P-6: Pavement Units 12-19

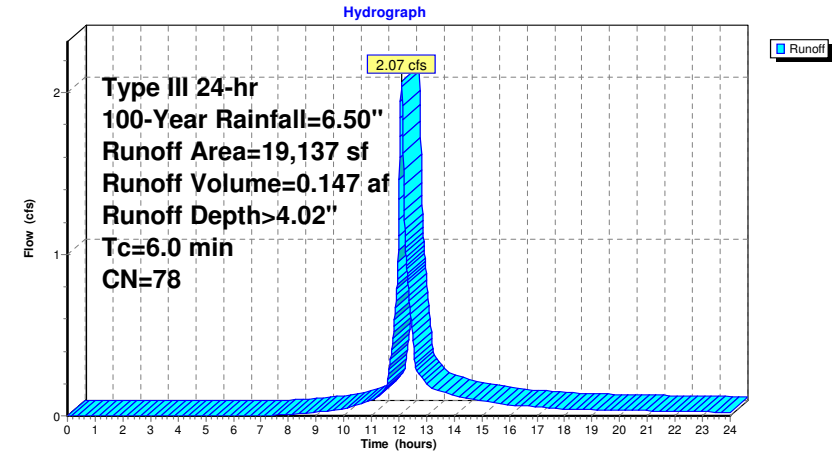
Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.147 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Description
11,455	98	Paved parking, HSG A
7,682	49	50-75% Grass cover, Fair, HSG A
19,137	78	Weighted Average
7,682		40.14% Pervious Area
11,455		59.86% Impervious Area

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

Subcatchment P-6: Pavement Units 12-19



Summary for Subcatchment P-7: Driveway - Units 20-24

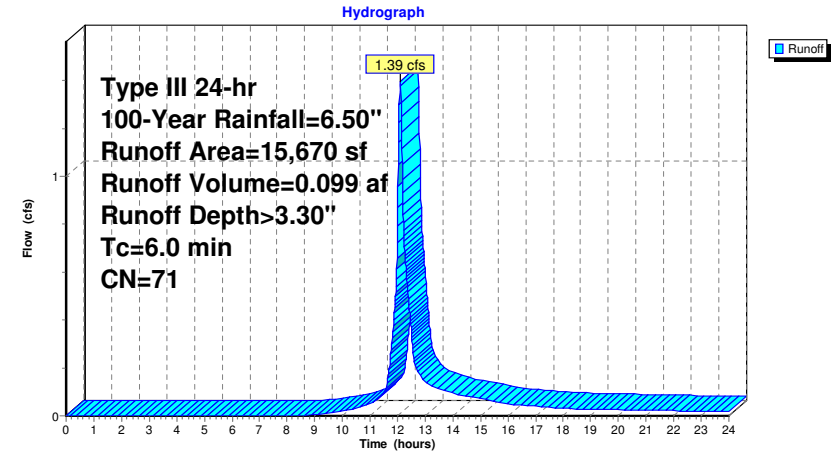
Runoff = 1.39 cfs @ 12.09 hrs, Volume= 0.099 af, Depth> 3.30"

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=6.50"

Area (sf)	CN	Description
6,983	98	Paved parking, HSG A
8,687	49	50-75% Grass cover, Fair, HSG A
15,670	71	Weighted Average
8,687		55.44% Pervious Area
6,983		44.56% Impervious Area

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

Subcatchment P-7: Driveway - Units 20-24



Topsfield Proposed HydroCAD

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 225

Summary for Subcatchment P-8: Surface Infiltration Pond Area

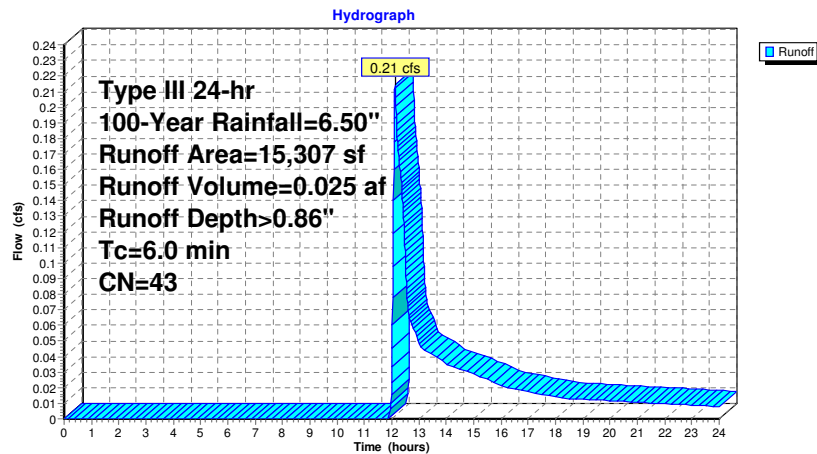
Runoff = 0.21 cfs @ 12.12 hrs, Volume= 0.025 af, Depth> 0.86"

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=6.50"

Area (sf)	CN	Description
1,072	98	Paved parking, HSG A
14,235	39	>75% Grass cover, Good, HSG A
15,307	43	Weighted Average
14,235		93.00% Pervious Area
1,072		7.00% Impervious Area

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

Subcatchment P-8: Surface Infiltration Pond Area**Topsfield Proposed HydroCAD**

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 226

Summary for Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands

Walking path in woods described as "Dirt road," closest CN value in HydroCAD, actual material to be mulch, wood chips or packed earth

Runoff = 0.33 cfs @ 12.45 hrs, Volume= 0.082 af, Depth> 0.42"

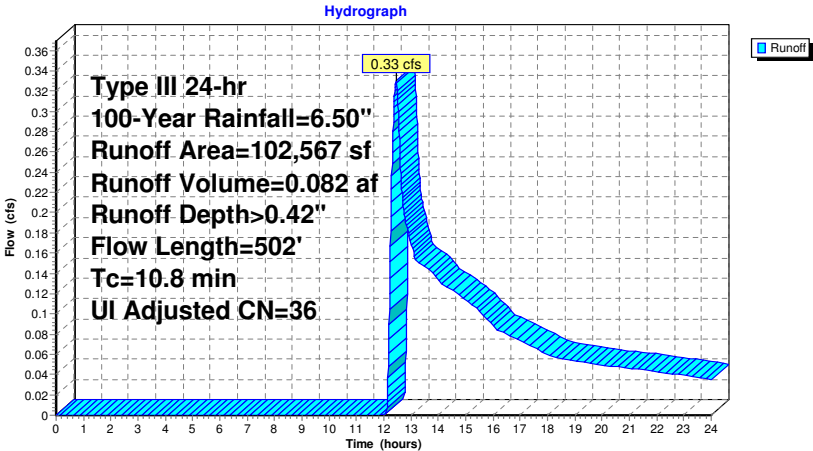
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Type III 24-hr 100-Year Rainfall=6.50"

Area (sf)	CN	Adj	Description
2,068	72		Dirt roads, HSG A
40,086	39		>75% Grass cover, Good, HSG A
357	74		>75% Grass cover, Good, HSG C
53,082	30		Woods, Good, HSG A
4,670	55		Woods, Good, HSG B
2,304	98		Unconnected pavement, HSG A
102,567	37	36	Weighted Average, UI Adjusted
100,263			97.75% Pervious Area
2,304			2.25% Impervious Area
2,304			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	50	0.0300	0.17		Sheet Flow, A-B Grass: Short n= 0.150 P2= 3.10"
4.9	342	0.0280	1.17		Shallow Concentrated Flow, B-C Short Grass Pasture Kv= 7.0 fps
1.0	110	0.1270	1.78		Shallow Concentrated Flow, C-D Woodland Kv= 5.0 fps
10.8	502	Total			

Subcatchment P-9: Woods/Grass Northwest Site to NW Wetlands



Summary for Subcatchment R-1: Roof - Units 1&2 (C&B)

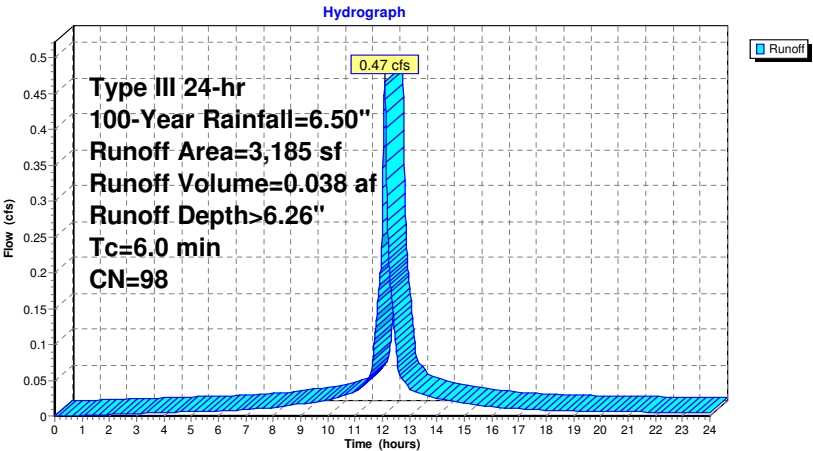
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,185	98	Unconnected roofs, HSG A
3,185		100.00% Impervious Area
3,185		100.00% Unconnected

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

Subcatchment R-1: Roof - Units 1&2 (C&B)



Summary for Subcatchment R-10: Roof - Units 19&20 - (A Units)

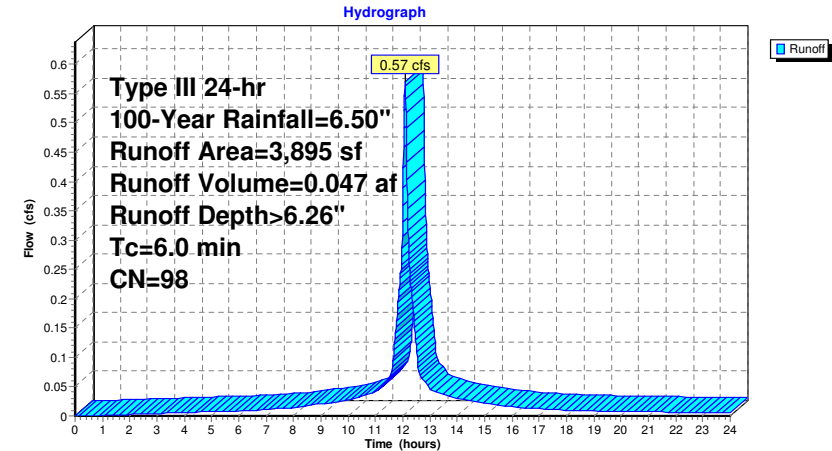
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-10: Roof - Units 19&20 - (A Units)



Summary for Subcatchment R-11: Roof - Units 21&22 - (A&B Units)

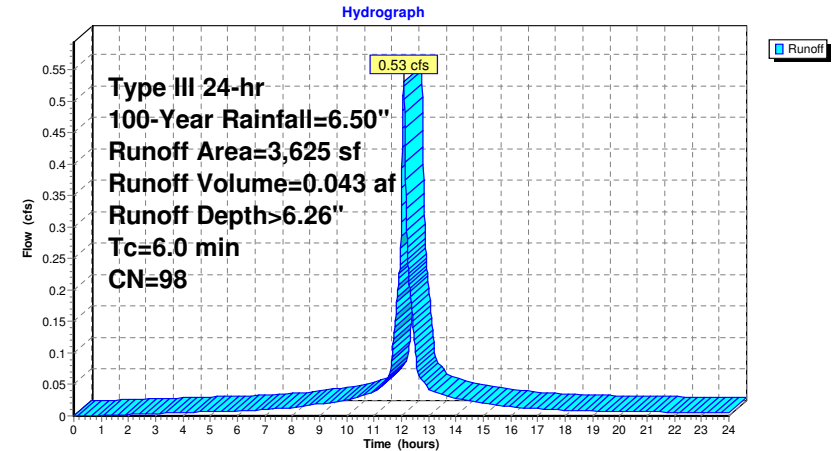
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-11: Roof - Units 21&22 - (A&B Units)



Summary for Subcatchment R-12: Roof - Units 23&24 - (A Units)

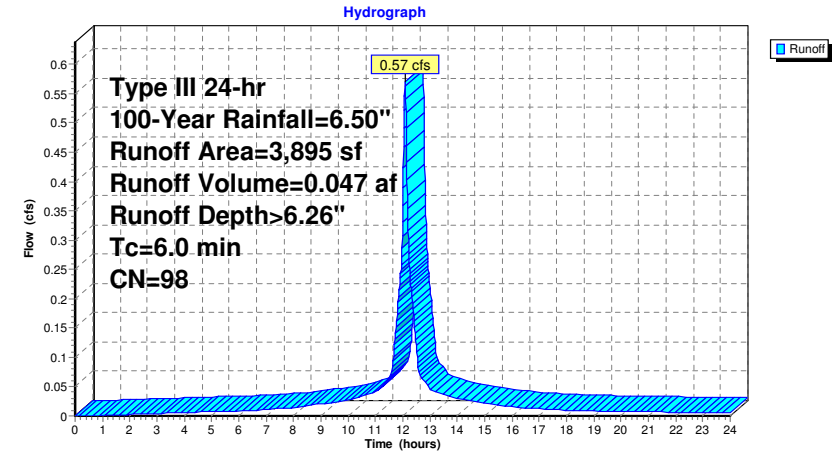
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-12: Roof - Units 23&24 - (A Units)



Summary for Subcatchment R-13: Roof - Units 25&26 - (A Units)

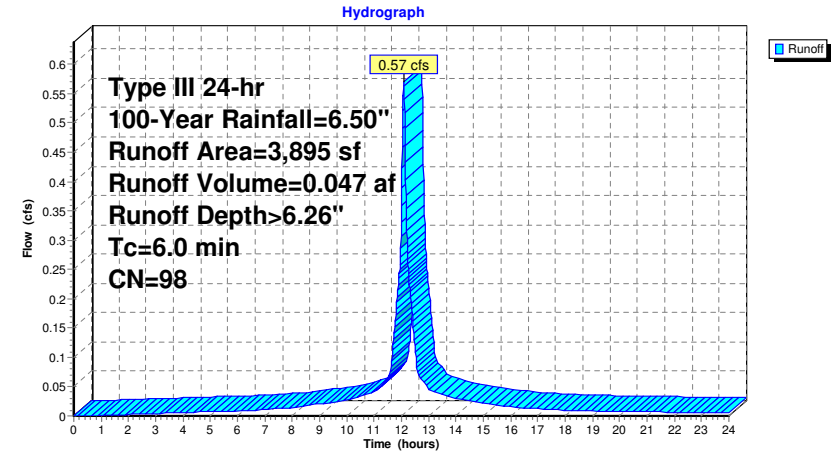
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-13: Roof - Units 25&26 - (A Units)



Summary for Subcatchment R-14: Roof Units 27&28 - A&B Units

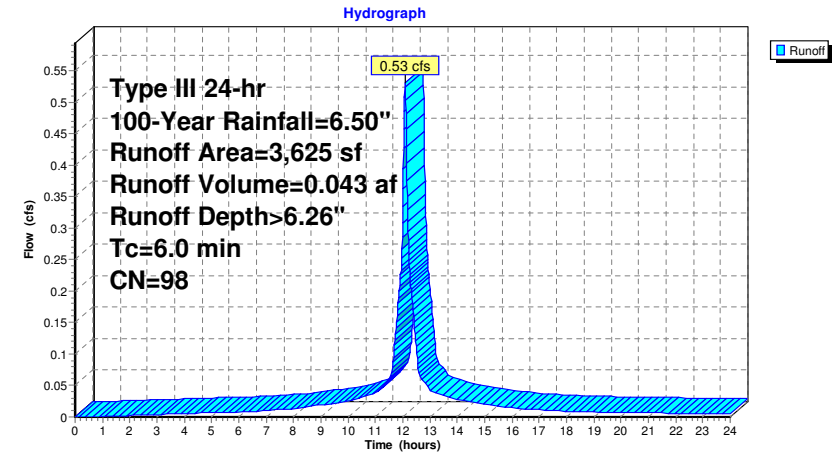
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-14: Roof Units 27&28 - A&B Units



Summary for Subcatchment R-15: Roof Units 29&30 - (B & C Units)

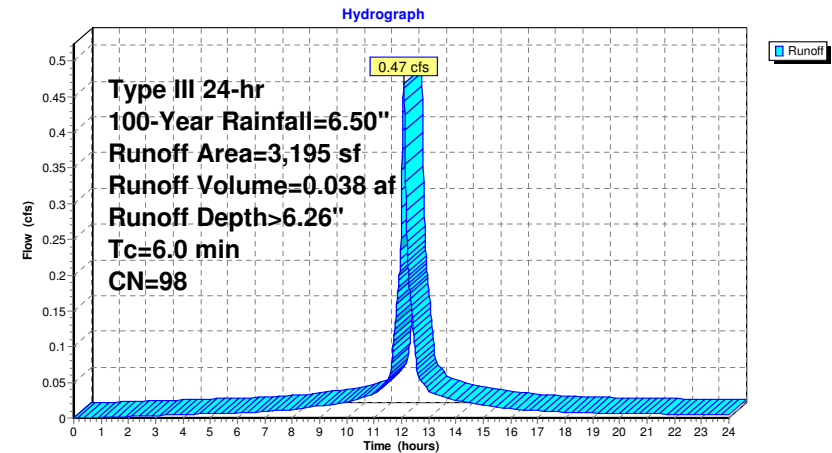
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-15: Roof Units 29&30 - (B & C Units)



Summary for Subcatchment R-16: Front Units 29&30

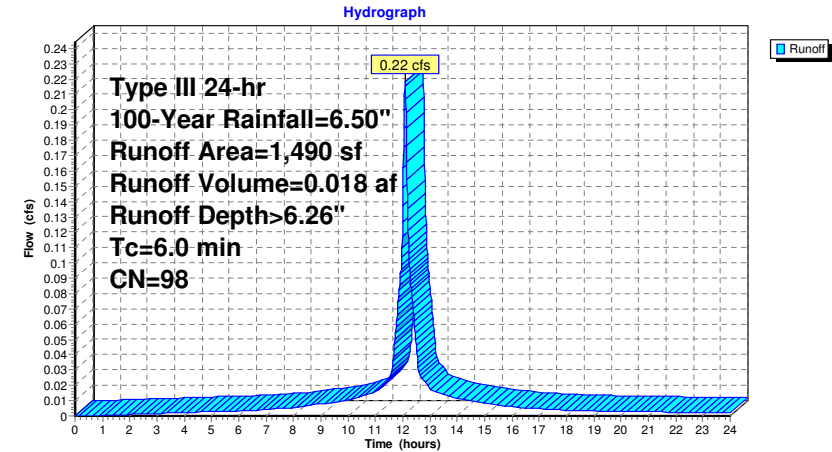
Runoff = 0.22 cfs @ 12.08 hrs, Volume= 0.018 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
1,490	98	Unconnected roofs, HSG A
1,490		100.00% Impervious Area
1,490		100.00% Unconnected

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

Subcatchment R-16: Front Units 29&30



Summary for Subcatchment R-17: Mailbox Structure Rood

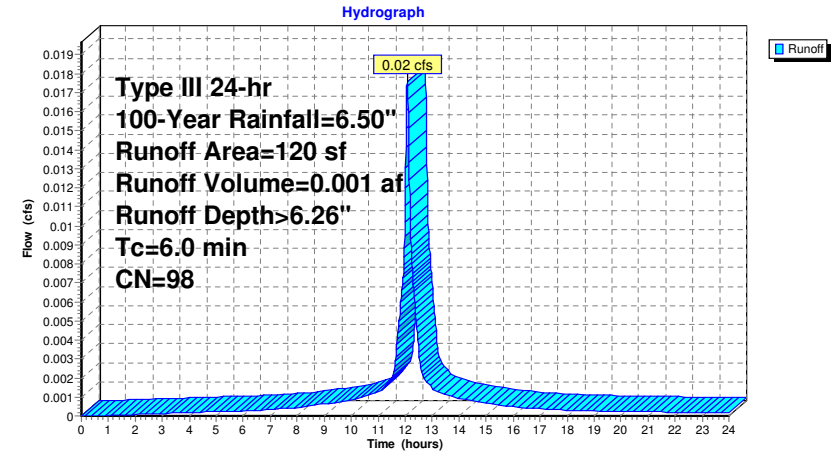
Runoff = 0.02 cfs @ 12.08 hrs, Volume= 0.001 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
120	98	Unconnected roofs, HSG A
120		100.00% Impervious Area
120		100.00% Unconnected

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

Subcatchment R-17: Mailbox Structure Rood



Summary for Subcatchment R-2: Roof Units 3&4 - (B & C Units)

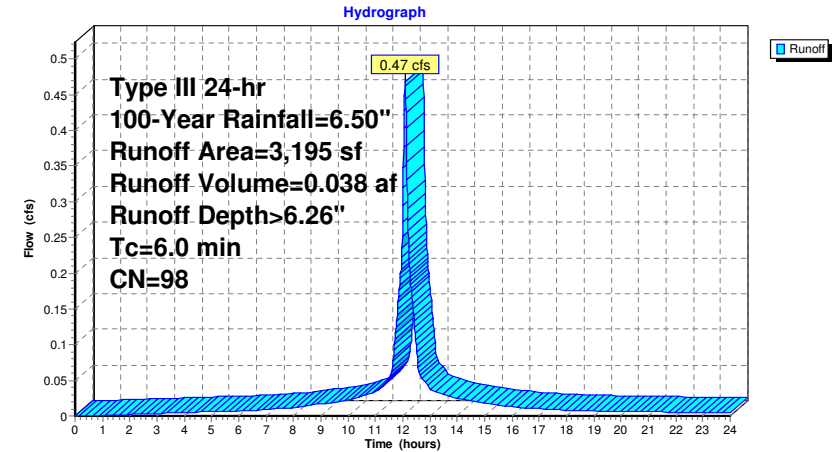
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-2: Roof Units 3&4 - (B & C Units)



Summary for Subcatchment R-3: Roof Units 5&6 - A&B Units

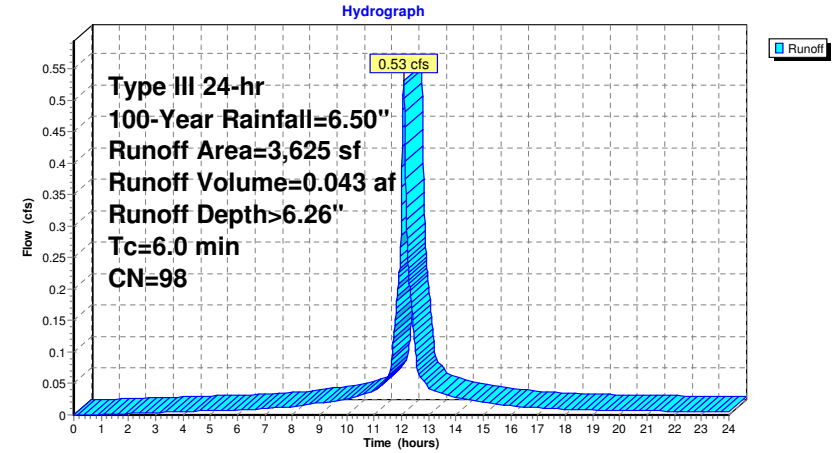
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,625	98	Roofs, HSG A
3,625		100.00% Impervious Area

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

Subcatchment R-3: Roof Units 5&6 - A&B Units



Summary for Subcatchment R-4: Roof - Units 7&8 - (A&B Units)

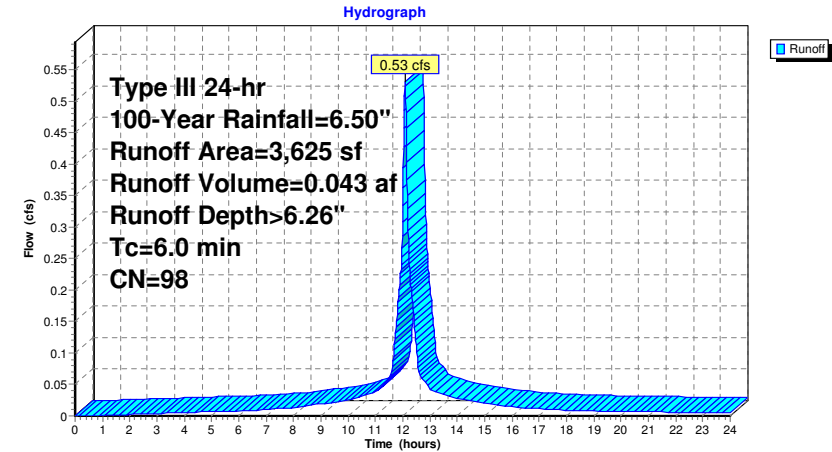
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-4: Roof - Units 7&8 - (A&B Units)



Summary for Subcatchment R-5: Roof - Units 9&10 - (B&C Units)

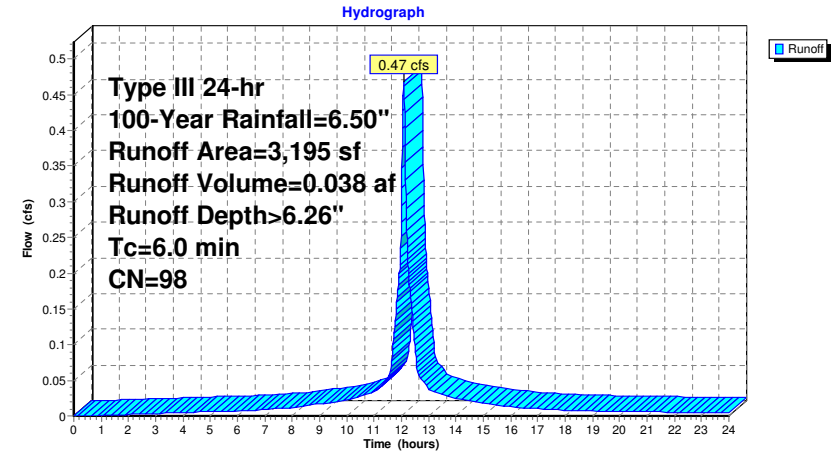
Runoff = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,195	98	Unconnected roofs, HSG A
3,195		100.00% Impervious Area
3,195		100.00% Unconnected

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

Subcatchment R-5: Roof - Units 9&10 - (B&C Units)



Summary for Subcatchment R-6: Roof - Units 11&12 - (B&A Units)

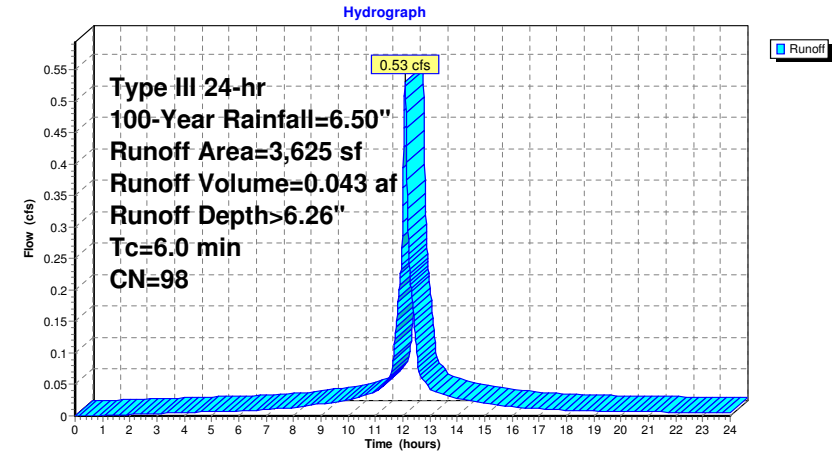
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-6: Roof - Units 11&12 - (B&A Units)



Summary for Subcatchment R-7: Roof - Units 13&14 - (A Units)

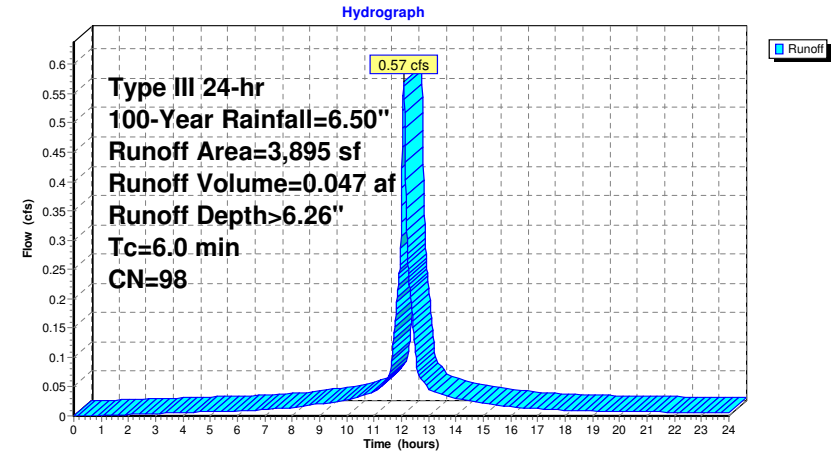
Runoff = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,895	98	Unconnected roofs, HSG A
3,895		100.00% Impervious Area
3,895		100.00% Unconnected

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

Subcatchment R-7: Roof - Units 13&14 - (A Units)



Summary for Subcatchment R-8: Roof - Units 15&16 - (B&A Units)

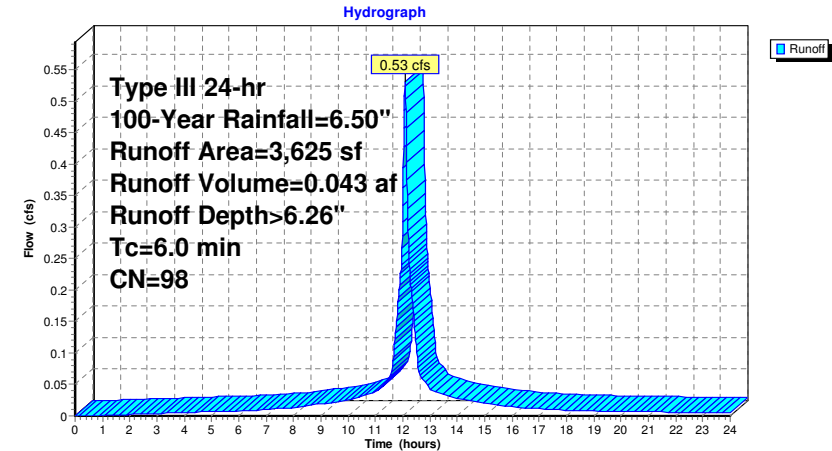
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-8: Roof - Units 15&16 - (B&A Units)



Summary for Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

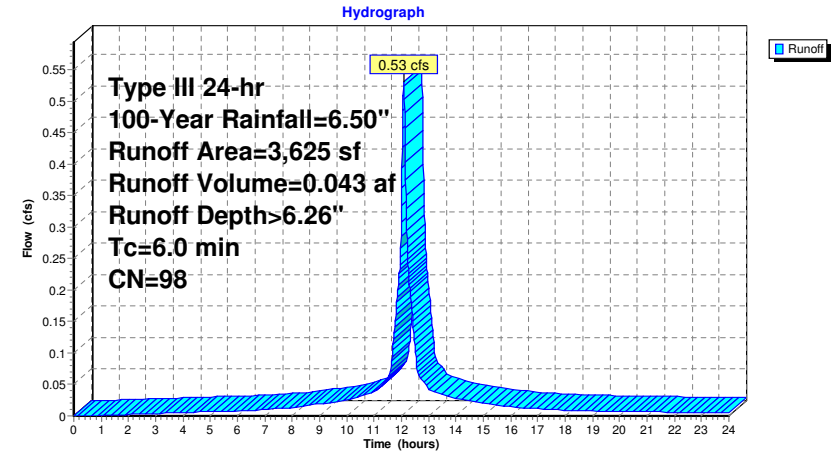
Runoff = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af, Depth> 6.26"

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=6.50"

Area (sf)	CN	Description
3,625	98	Unconnected roofs, HSG A
3,625		100.00% Impervious Area
3,625		100.00% Unconnected

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

Subcatchment R-9: Roof - Units 17&18 - (A&B Units)

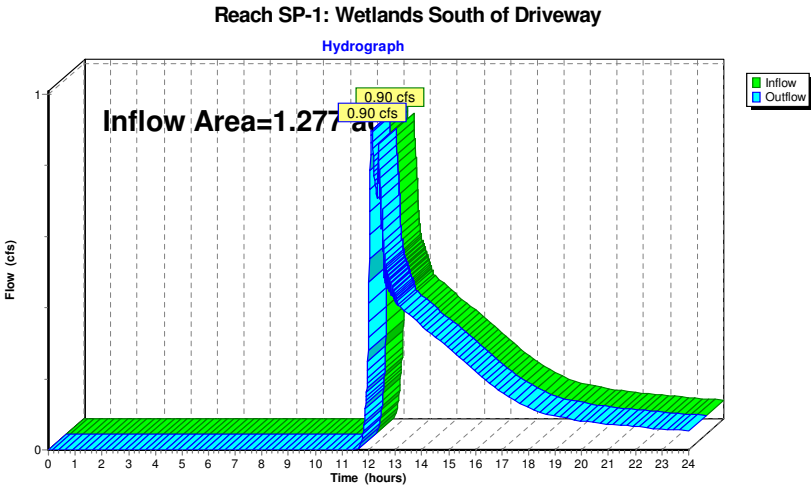


Summary for Reach SP-1: Wetlands South of Driveway

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 1.277 ac, 33.99% Impervious, Inflow Depth > 1.85" for 100-Year event
Inflow = 0.90 cfs @ 12.12 hrs, Volume= 0.197 af
Outflow = 0.90 cfs @ 12.12 hrs, Volume= 0.197 af, Atten= 0%, Lag= 0.0 min

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

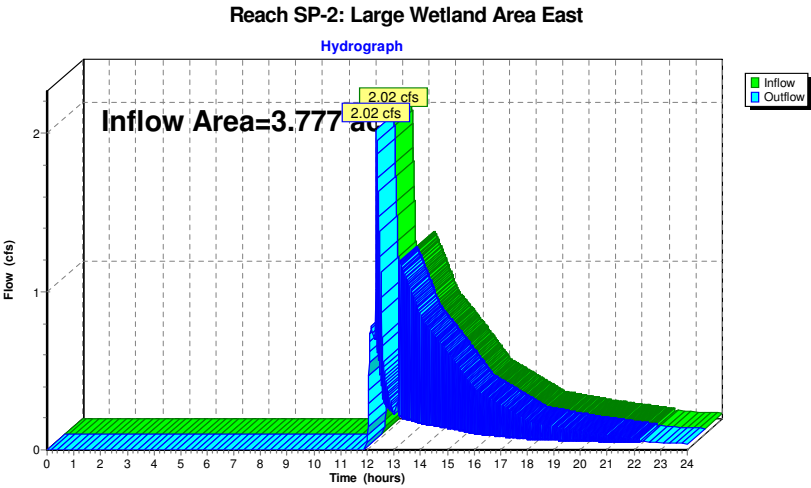


Summary for Reach SP-2: Large Wetland Area East

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 3.777 ac, 26.87% Impervious, Inflow Depth > 0.71" for 100-Year event
Inflow = 2.02 cfs @ 12.34 hrs, Volume= 0.222 af
Outflow = 2.02 cfs @ 12.34 hrs, Volume= 0.222 af, Atten= 0%, Lag= 0.0 min

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

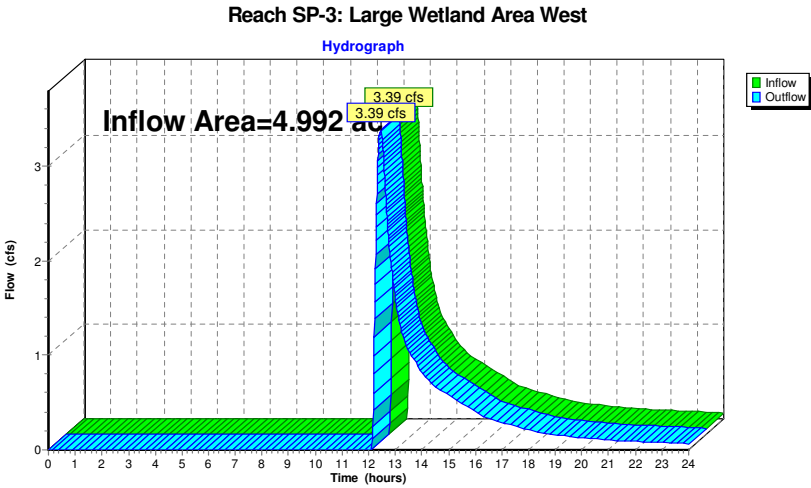


Summary for Reach SP-3: Large Wetland Area West

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 4.992 ac, 31.07% Impervious, Inflow Depth > 1.11" for 100-Year event
Inflow = 3.39 cfs @ 12.45 hrs, Volume= 0.462 af
Outflow = 3.39 cfs @ 12.45 hrs, Volume= 0.462 af, Atten= 0%, Lag= 0.0 min

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

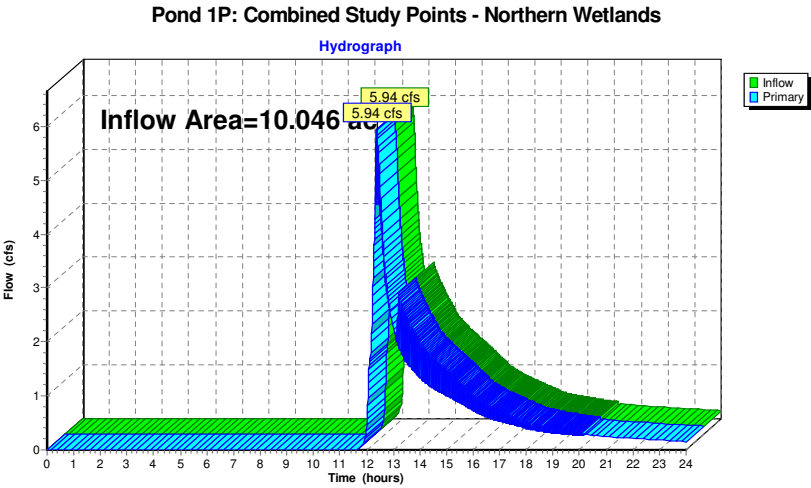


Summary for Pond 1P: Combined Study Points - Northern Wetlands

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10.046 ac, 29.86% Impervious, Inflow Depth > 1.05" for 100-Year event
Inflow = 5.94 cfs @ 12.38 hrs, Volume= 0.881 af
Primary = 5.94 cfs @ 12.38 hrs, Volume= 0.881 af, Atten= 0%, Lag= 0.0 min

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



Summary for Pond D-1: Surface Infiltration Pond

[79] Warning: Submerged Pond UIS-3 Primary device # 2 OUTLET by 0.08'

Inflow Area = 2.637 ac, 56.80% Impervious, Inflow Depth > 3.63" for 100-Year event
Inflow = 10.97 cfs @ 12.09 hrs, Volume= 0.799 af
Outflow = 3.18 cfs @ 12.45 hrs, Volume= 0.508 af, Atten= 71%, Lag= 21.4 min
Discarded = 0.12 cfs @ 12.45 hrs, Volume= 0.128 af
Primary = 3.06 cfs @ 12.45 hrs, Volume= 0.380 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 70.78' @ 12.45 hrs Surf.Area= 5,227 sf Storage= 16,269 cf
Flood Elev= 71.10' Surf.Area= 5,491 sf Storage= 17,958 cf

Plug-Flow detention time= 189.0 min calculated for 0.508 af (64% of inflow)
Center-of-Mass det. time= 90.6 min (899.1 - 808.6)

Volume	Invert	Avail.Storage	Storage Description
#1	66.00'	56,233 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

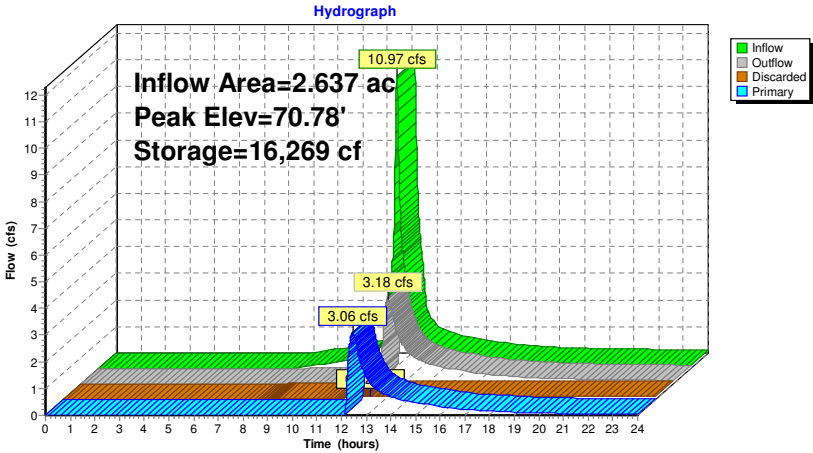
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
66.00	1,817	0	0
67.00	2,361	2,089	2,089
68.00	3,059	2,710	4,799
69.00	3,800	3,430	8,229
70.00	4,583	4,192	12,420
71.00	5,403	4,993	17,413
72.00	6,280	5,842	23,255
73.00	7,213	6,747	30,001
74.00	8,202	7,708	37,709
75.00	9,248	8,725	46,434
76.00	10,350	9,799	56,233

Device	Routing	Invert	Outlet Devices
#1	Discarded	66.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	70.00'	15.0" Round Culvert L= 252.0' Ke= 0.200 Inlet / Outlet Invert= 70.00' / 65.40' S= 0.0183 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.12 cfs @ 12.45 hrs HW=70.78' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=3.06 cfs @ 12.45 hrs HW=70.78' (Free Discharge)
2=Culvert (Inlet Controls 3.06 cfs @ 3.77 fps)

Pond D-1: Surface Infiltration Pond



Summary for Pond D-2: Existing Detention Basin

[58] Hint: Peaked 0.63' above defined flood level

Inflow Area = 0.531 ac, 59.77% Impervious, Inflow Depth > 4.34" for 100-Year event
Inflow = 2.68 cfs @ 12.09 hrs, Volume= 0.192 af
Outflow = 0.29 cfs @ 12.86 hrs, Volume= 0.121 af, Atten= 89%, Lag= 46.7 min
Primary = 0.29 cfs @ 12.86 hrs, Volume= 0.121 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 58.71' @ 12.86 hrs Surf.Area= 3,090 sf Storage= 4,665 cf
Flood Elev= 58.08' Surf.Area= 3,090 sf Storage= 2,719 cf

Plug-Flow detention time= 240.7 min calculated for 0.121 af (63% of inflow)
Center-of-Mass det. time= 139.7 min (947.4 - 807.7)

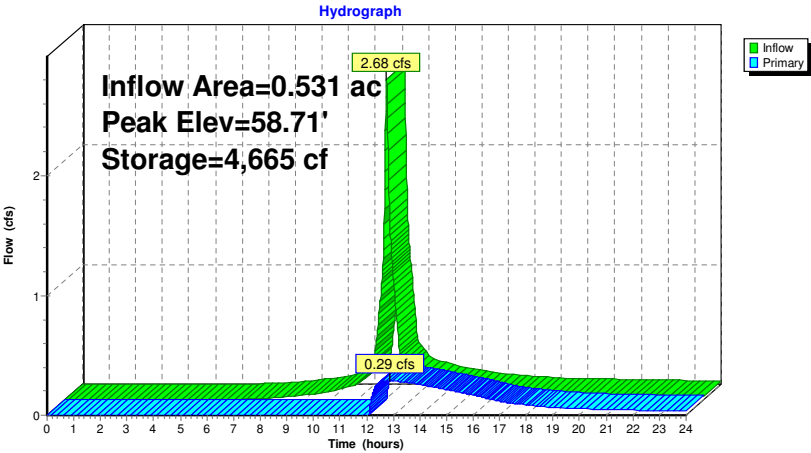
Volume	Invert	Avail.Storage	Storage Description
#1	57.20'	9,020 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
57.20	3,090	0	0
58.00	3,090	2,472	2,472
59.00	3,090	3,090	5,562
59.40	3,550	1,328	6,890
60.00	3,550	2,130	9,020

Device	Routing	Invert	Outlet Devices
#1	Primary	58.08'	4.0" Vert. Orifice/Grate C= 0.600
#2	Primary	58.80'	8.0" Vert. Orifice/Grate C= 0.600

Primary OutFlow Max=0.29 cfs @ 12.86 hrs HW=58.71' (Free Discharge)
1=Orifice/Grate (Orifice Controls 0.29 cfs @ 3.28 fps)
2=Orifice/Grate (Controls 0.00 cfs)

Pond D-2: Existing Detention Basin



Summary for Pond D-3: Detention Pond by Access Road

[93] Warning: Storage range exceeded by 0.06'
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=50)

Inflow Area = 0.114 ac, 31.35% Impervious, Inflow Depth > 3.30" for 100-Year event
Inflow = 0.44 cfs @ 12.09 hrs, Volume= 0.031 af
Outflow = 0.21 cfs @ 12.36 hrs, Volume= 0.031 af, Atten= 53%, Lag= 16.2 min
Discarded = 0.04 cfs @ 12.35 hrs, Volume= 0.029 af
Primary = 0.17 cfs @ 12.36 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 64.06' @ 12.36 hrs Surf.Area= 650 sf Storage= 478 cf

Plug-Flow detention time= 130.5 min calculated for 0.031 af (100% of inflow)
Center-of-Mass det. time= 130.1 min (961.4 - 831.3)

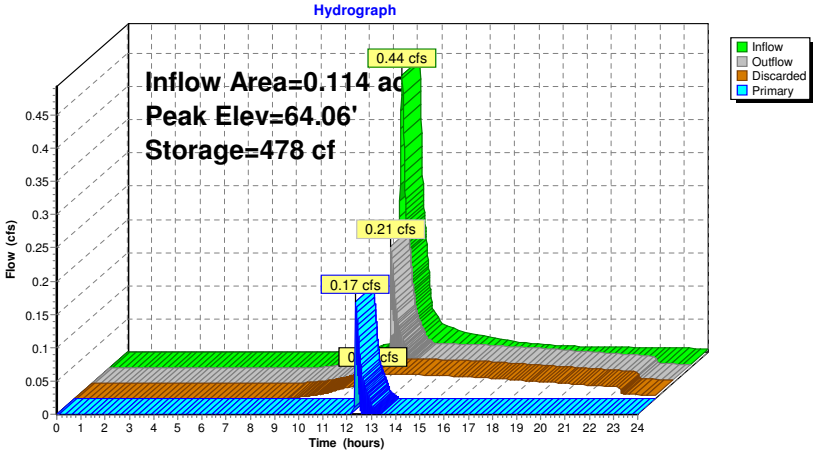
Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	478 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	305	0	0
64.00	650	478	478

Device	Routing	Invert	Outlet Devices
#1	Primary	64.00'	5.0' long x 5.0' breadth Broad-Crested Rectangular Weir Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Discarded	63.00'	2.410 in/hr Exfiltration over Horizontal area

Discarded OutFlow Max=0.04 cfs @ 12.35 hrs HW=64.04' (Free Discharge)
↑2=Exfiltration (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.17 cfs @ 12.36 hrs HW=64.06' (Free Discharge)
↑1=Broad-Crested Rectangular Weir (Weir Controls 0.17 cfs @ 0.57 fps)

Pond D-3: Detention Pond by Access Road



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Page 255

Summary for Pond UIS-1: UIS at Entrance

[93] Warning: Storage range exceeded by 2.51'

[58] Hint: Peaked 68.51' @ 13.17 hrs Surf.Area= 3,486 sf Storage= 13,284 cf

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=487)

Inflow Area = 1.487 ac, 40.11% Impervious, Inflow Depth > 4.20" for 100-Year event
 Inflow = 7.07 cfs @ 12.09 hrs, Volume= 0.520 af
 Outflow = 1.07 cfs @ 13.17 hrs, Volume= 0.216 af, Atten= 85%, Lag= 65.0 min
 Discarded = 0.08 cfs @ 9.00 hrs, Volume= 0.118 af
 Primary = 0.99 cfs @ 13.17 hrs, Volume= 0.098 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 68.51' @ 13.17 hrs Surf.Area= 3,486 sf Storage= 13,284 cf
 Flood Elev= 68.40' Surf.Area= 3,486 sf Storage= 13,284 cf

Plug-Flow detention time= 246.1 min calculated for 0.216 af (41% of inflow)
 Center-of-Mass det. time= 116.2 min (916.6 - 800.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	60.00'	5,089 cf	50.50'W x 69.03'L x 6.00'H Field A 20,917 cf Overall - 8,195 cf Embedded = 12,722 cf x 40.0% Voids
#2A	61.00'	8,195 cf	Cultec R-902HD x 126 Inside #1 Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap 7 Rows of 18 Chambers Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf
		13,284 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	60.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	68.40'	24.0" x 24.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.08 cfs @ 9.00 hrs HW=60.08' (Free Discharge)

1=Exfiltration (Exfiltration Controls 0.08 cfs)

Primary OutFlow Max=0.95 cfs @ 13.17 hrs HW=68.51' (Free Discharge)

2=Orifice/Grate (Weir Controls 0.95 cfs @ 1.08 fps)

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 256

Pond UIS-1: UIS at Entrance - Chamber Wizard Field A**Chamber Model = Cultec R-902HD (Cultec Recharger® 902HD)**

Effective Size= 69.8"W x 48.0"H => 17.65 sf x 3.67'L = 64.7 cf

Overall Size= 78.0"W x 48.0"H x 4.10'L with 0.44' Overlap

Cap Storage= +2.8 cf x 2 x 7 rows = 38.6 cf

78.0" Wide + 6.0" Spacing = 84.0" C-C Row Spacing

18 Chambers/Row x 3.67' Long +0.52' Cap Length x 2 = 67.03' Row Length +12.0" End Stone x 2 = 69.03'
 Base Length

7 Rows x 78.0" Wide + 6.0" Spacing x 6 + 12.0" Side Stone x 2 = 50.50' Base Width

12.0" Base + 48.0" Chamber Height + 12.0" Cover = 6.00' Field Height

126 Chambers x 64.7 cf + 2.8 cf Cap Volume x 2 x 7 Rows = 8,195.2 cf Chamber Storage

20,917.1 cf Field - 8,195.2 cf Chambers = 12,721.9 cf Stone x 40.0% Voids = 5,088.7 cf Stone Storage

Chamber Storage + Stone Storage = 13,284.0 cf = 0.305 af

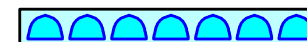
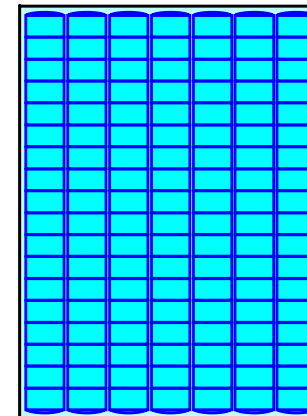
Overall Storage Efficiency = 63.5%

Overall System Size = 69.03' x 50.50' x 6.00'

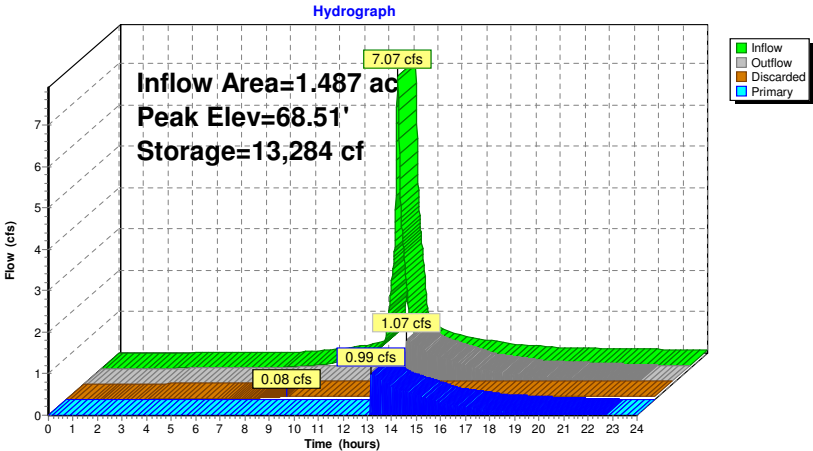
126 Chambers

774.7 cy Field

471.2 cy Stone



Pond UIS-1: UIS at Entrance



Summary for Pond UIS-2: UIS at North of Site

[93] Warning: Storage range exceeded by 4.79'
[58] Hint: Peaked 2.08' above defined flood level
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=29)

Inflow Area = 0.419 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 2.67 cfs @ 12.08 hrs, Volume= 0.218 af
Outflow = 1.59 cfs @ 12.34 hrs, Volume= 0.218 af, Atten= 40%, Lag= 15.4 min
Discarded = 0.23 cfs @ 11.24 hrs, Volume= 0.207 af
Primary = 1.36 cfs @ 12.34 hrs, Volume= 0.011 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 70.33' @ 12.34 hrs Surf.Area= 1,176 sf Storage= 2,860 cf
Flood Elev= 68.25' Surf.Area= 1,176 sf Storage= 2,860 cf

Plug-Flow detention time= 82.3 min calculated for 0.218 af (100% of inflow)
Center-of-Mass det. time= 82.0 min (825.5 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	61.50'	1,262 cf	16.00'W x 73.50'L x 4.04'H Field A 4,753 cf Overall - 1,598 cf Embedded = 3,155 cf x 40.0% Voids
#2A	62.50'	1,598 cf	Cultec R-330XLHD x 30 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 3 rows
		2,860 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	61.50'	8.270 in/hr Exfiltration over Surface area
#2	Primary	68.25'	6.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.23 cfs @ 11.24 hrs HW=61.57' (Free Discharge)
↑1=Exfiltration (Exfiltration Controls 0.23 cfs)

Primary OutFlow Max=1.36 cfs @ 12.34 hrs HW=70.33' (Free Discharge)
↑2=Orifice/Grate (Orifice Controls 1.36 cfs @ 6.94 fps)

Pond UIS-2: UIS at North of Site - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 3 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

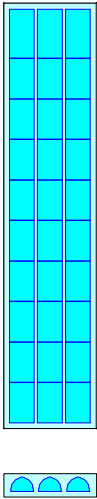
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
3 Rows x 52.0" Wide + 6.0" Spacing x 2 + 12.0" Side Stone x 2 = 16.00' Base Width
12.0" Base + 30.5" Chamber Height + 6.0" Cover = 4.04' Field Height

30 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 3 Rows = 1,598.2 cf Chamber Storage

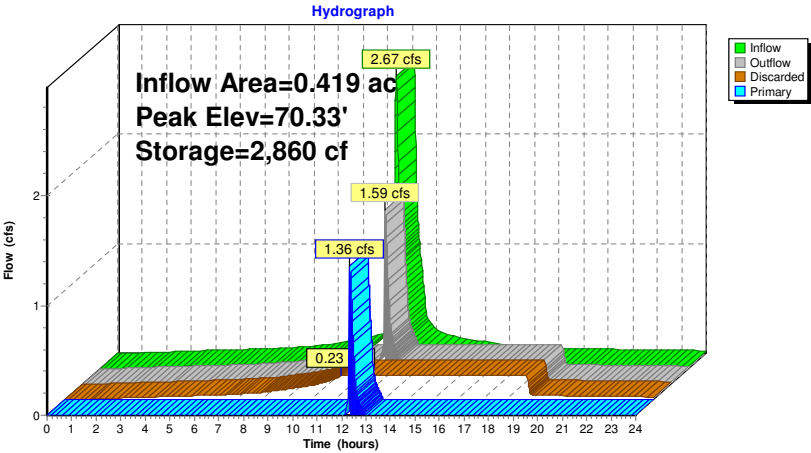
4,753.0 cf Field - 1,598.2 cf Chambers = 3,154.8 cf Stone x 40.0% Voids = 1,261.9 cf Stone Storage

Chamber Storage + Stone Storage = 2,860.1 cf = 0.066 af
Overall Storage Efficiency = 60.2%
Overall System Size = 73.50' x 16.00' x 4.04'

30 Chambers
176.0 cy Field
116.8 cy Stone



Pond UIS-2: UIS at North of Site



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Page 261

Summary for Pond UIS-3: UIS-3

[58] Hint: Peaked 1.63' above defined flood level

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
 Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
 Outflow = 0.53 cfs @ 12.09 hrs, Volume= 0.041 af, Atten= 1%, Lag= 0.7 min
 Discarded = 0.00 cfs @ 1.97 hrs, Volume= 0.005 af
 Primary = 0.52 cfs @ 12.09 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 73.84' @ 12.09 hrs Surf.Area= 103 sf Storage= 141 cf
 Flood Elev= 72.21' Surf.Area= 103 sf Storage= 22 cf

Plug-Flow detention time= 59.0 min calculated for 0.041 af (94% of inflow)
 Center-of-Mass det. time= 25.2 min (768.7 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.69'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.19'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.69'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.40'	6.0" Round Culvert L= 30.0' Ke= 0.200 Inlet / Outlet Invert= 73.40' / 70.70' S= 0.0900 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=71.72' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.52 cfs @ 12.09 hrs HW=73.84' (Free Discharge)↑**2=Culvert** (Inlet Controls 0.52 cfs @ 2.83 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 262

Pond UIS-3: UIS-3 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
 Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
 Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

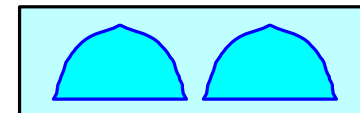
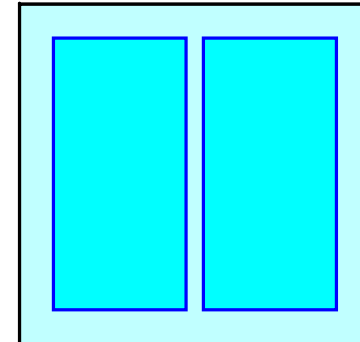
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
 2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
 6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

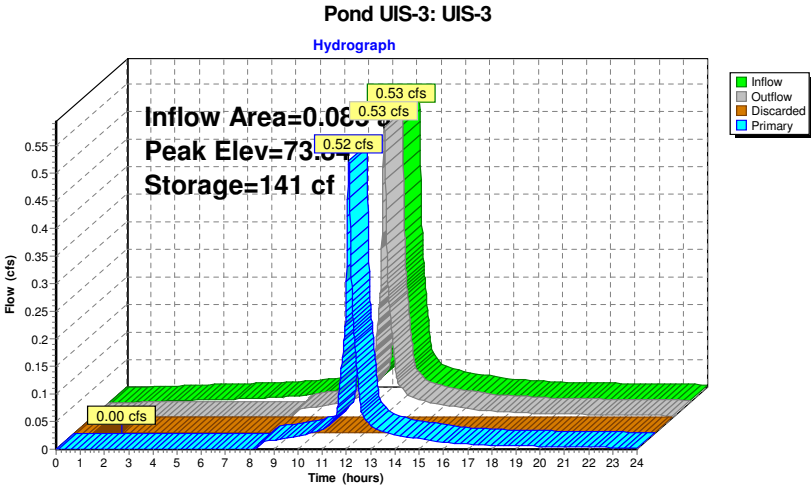
2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
 Overall Storage Efficiency = 57.6%
 Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
 12.3 cy Field
 8.7 cy Stone





Summary for Pond UIS-4: UIS-4

[58] Hint: Peaked 0.65' above defined flood level

Inflow Area = 0.073 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event

Inflow = 0.47 cfs @ 12.08 hrs, Volume= 0.038 af

Outflow = 0.45 cfs @ 12.11 hrs, Volume= 0.036 af, Atten= 4%, Lag= 1.4 min

Discarded = 0.00 cfs @ 2.21 hrs, Volume= 0.005 af

Primary = 0.45 cfs @ 12.11 hrs, Volume= 0.031 af

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

Peak Elev= 74.85' @ 12.11 hrs Surf.Area= 103 sf Storage= 153 cf

Flood Elev= 74.20' Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 64.5 min calculated for 0.036 af (93% of inflow)

Center-of-Mass det. time= 27.3 min (770.7 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	72.50'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.00'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.50'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.20'	6.0" Round Culvert L= 30.0' Ke= 1.000 Inlet / Outlet Invert= 74.20' / 74.06' S= 0.0047 ' S= 0.0047 ' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 2.21 hrs HW=72.53' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.45 cfs @ 12.11 hrs HW=74.84' (Free Discharge)

↑2=Culvert (Inlet Controls 0.45 cfs @ 2.27 fps)

Pond UIS-4: UIS-4 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long + 1.00' Row Adjustment = 8.00' Row Length + 12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

$$331.5 \text{ cf Field} - 97.1 \text{ cf Chambers} = 234.4 \text{ cf Stone} \times 40.0\% \text{ Voids} = 93.8 \text{ cf Stone Storage}$$

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

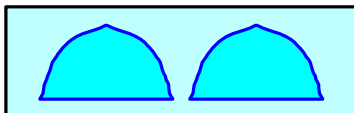
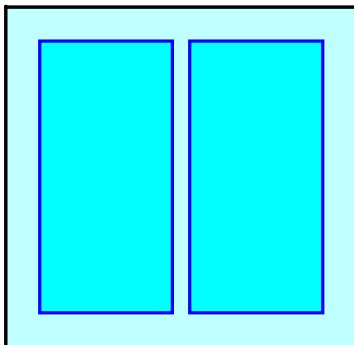
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

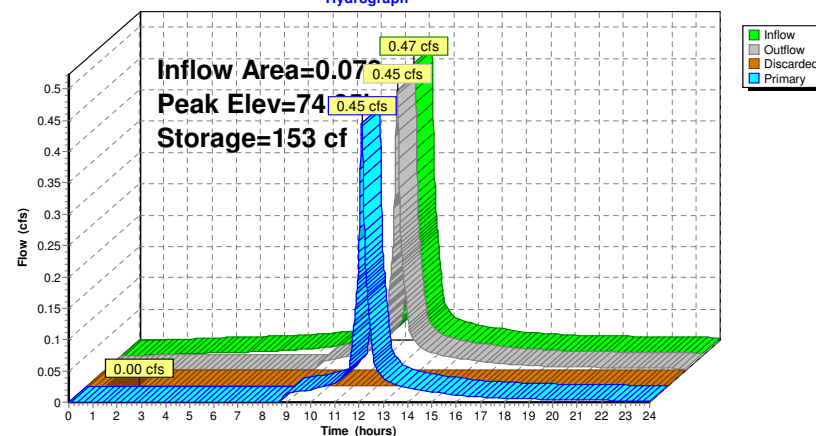
12.3 cy Field

8.7 cy Stone



Pond UIS-4: UIS-4

Hydrograph



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Type III 24-hr 100-Year Rainfall=6.50"

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Page 267

Summary for Pond UIS-5: UIS-5

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
 Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
 Outflow = 0.51 cfs @ 12.11 hrs, Volume= 0.041 af, Atten= 5%, Lag= 1.5 min
 Discarded = 0.00 cfs @ 1.97 hrs, Volume= 0.005 af
 Primary = 0.50 cfs @ 12.11 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 75.56' @ 12.11 hrs Surf.Area= 103 sf Storage= 159 cf

Plug-Flow detention time= 59.8 min calculated for 0.041 af (94% of inflow)
 Center-of-Mass det. time= 25.9 min (769.3 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	73.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	73.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	73.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.80'	6.0" Round Culvert L= 22.0' Ke= 1.000 Inlet / Outlet Invert= 74.80' / 74.60' S= 0.0091 ' /' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=73.12' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.50 cfs @ 12.11 hrs HW=75.55' (Free Discharge)**2=Culvert** (Inlet Controls 0.50 cfs @ 2.56 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 268

Pond UIS-5: UIS-5 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

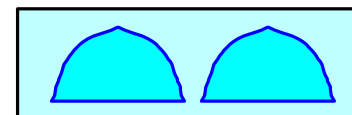
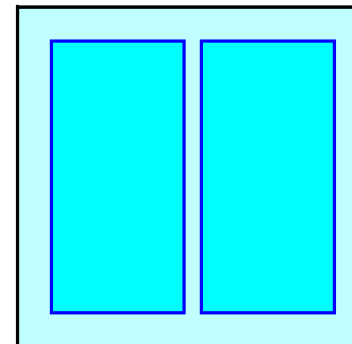
Overall Storage Efficiency = 57.6%

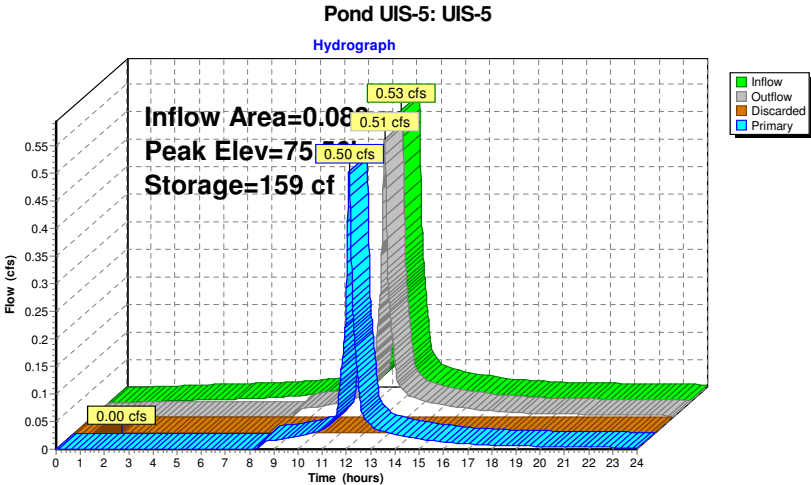
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-6: UIS-6

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af
Outflow = 0.54 cfs @ 12.11 hrs, Volume= 0.044 af, Atten= 5%, Lag= 1.5 min
Discarded = 0.00 cfs @ 1.86 hrs, Volume= 0.005 af
Primary = 0.54 cfs @ 12.11 hrs, Volume= 0.039 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 74.83' @ 12.11 hrs Surf.Area= 103 sf Storage= 163 cf

Plug-Flow detention time= 57.1 min calculated for 0.044 af (94% of inflow)
Center-of-Mass det. time= 25.0 min (768.4 - 743.4)

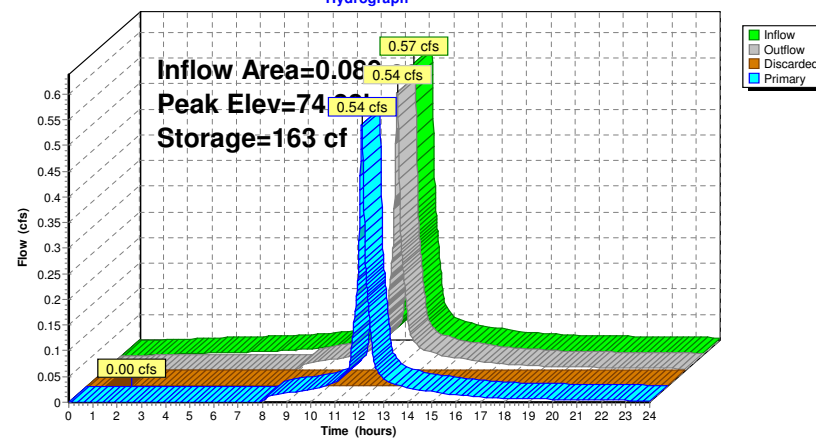
Volume	Invert	Avail.Storage	Storage Description
#1A	72.29'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.79'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	72.29'	1.020 in/hr Exfiltration over Surface area
#2	Primary	74.00'	6.0" Round Culvert L= 106.0' Ke= 1.000 Inlet / Outlet Invert= 74.00' / 72.18' S= 0.0172 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.86 hrs HW=72.32' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.54 cfs @ 12.11 hrs HW=74.83' (Free Discharge)
↑**2=Culvert** (Inlet Controls 0.54 cfs @ 2.75 fps)



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Type III 24-hr 100-Year Rainfall=6.50"

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Page 273

Summary for Pond UIS-7: UIS-7

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
 Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
 Outflow = 0.51 cfs @ 12.11 hrs, Volume= 0.041 af, Atten= 5%, Lag= 1.5 min
 Discarded = 0.00 cfs @ 1.97 hrs, Volume= 0.005 af
 Primary = 0.50 cfs @ 12.11 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 74.26' @ 12.11 hrs Surf.Area= 103 sf Storage= 159 cf

Plug-Flow detention time= 59.8 min calculated for 0.041 af (94% of inflow)
 Center-of-Mass det. time= 25.9 min (769.3 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.79'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	72.29'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.79'	1.020 in/hr Exfiltration over Surface area
#2	Primary	73.50'	6.0" Round Culvert L= 17.5' Ke= 1.000 Inlet / Outlet Invert= 73.50' / 73.00' S= 0.0286 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=71.82' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.50 cfs @ 12.11 hrs HW=74.25' (Free Discharge)**2=Culvert** (Inlet Controls 0.50 cfs @ 2.56 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 274

Pond UIS-7: UIS-7 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

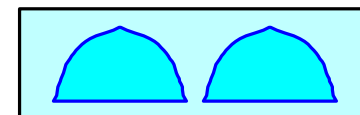
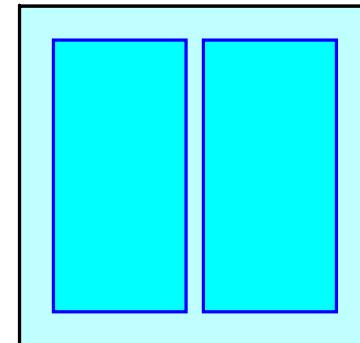
Overall Storage Efficiency = 57.6%

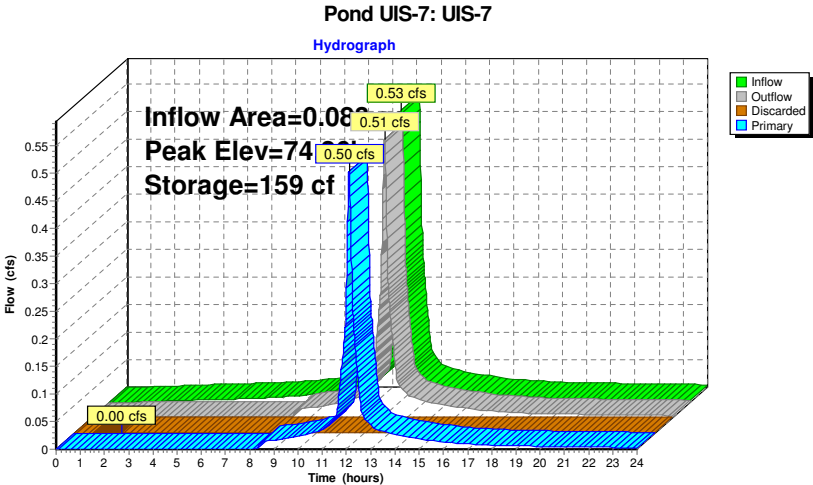
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

12.3 cy Field

8.7 cy Stone





Summary for Pond UIS-8: UIS-8

Inflow Area = 0.083 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
Inflow = 0.53 cfs @ 12.08 hrs, Volume= 0.043 af
Outflow = 0.51 cfs @ 12.11 hrs, Volume= 0.041 af, Atten= 5%, Lag= 1.5 min
Discarded = 0.00 cfs @ 1.97 hrs, Volume= 0.005 af
Primary = 0.50 cfs @ 12.11 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 73.56' @ 12.11 hrs Surf.Area= 103 sf Storage= 159 cf

Plug-Flow detention time= 59.8 min calculated for 0.041 af (94% of inflow)
Center-of-Mass det. time= 25.9 min (769.3 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.09'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.59'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.09'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.80'	6.0" Round Culvert L= 37.0' Ke= 1.000 Inlet / Outlet Invert= 72.80' / 72.18' S= 0.0168 '/' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.97 hrs HW=71.12' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.50 cfs @ 12.11 hrs HW=73.55' (Free Discharge)
2=Culvert (Inlet Controls 0.50 cfs @ 2.56 fps)

Pond UIS-8: UIS-8 - Chamber Wizard Field A

Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)
Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf
Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap
Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

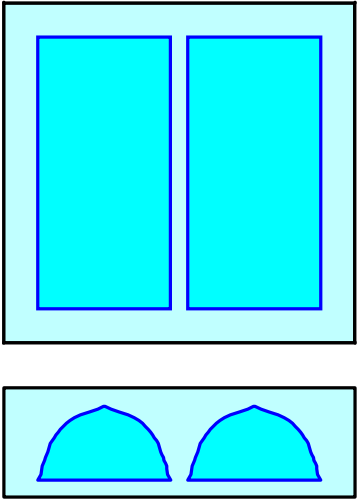
1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00' Base Length
2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width
6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

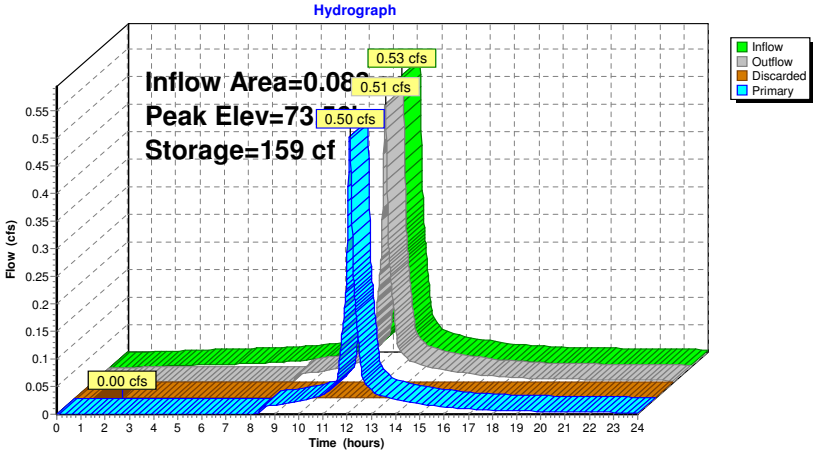
331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af
Overall Storage Efficiency = 57.6%
Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers
12.3 cy Field
8.7 cy Stone



Pond UIS-8: UIS-8



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Page 279

Summary for Pond UIS-9: UIS-9

Inflow Area = 0.089 ac, 100.00% Impervious, Inflow Depth > 6.26" for 100-Year event
 Inflow = 0.57 cfs @ 12.08 hrs, Volume= 0.047 af
 Outflow = 0.53 cfs @ 12.11 hrs, Volume= 0.045 af, Atten= 7%, Lag= 1.9 min
 Discarded = 0.00 cfs @ 1.86 hrs, Volume= 0.005 af
 Primary = 0.53 cfs @ 12.11 hrs, Volume= 0.041 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 72.99' @ 12.11 hrs Surf.Area= 103 sf Storage= 111 cf

Plug-Flow detention time= 32.1 min calculated for 0.045 af (97% of inflow)
 Center-of-Mass det. time= 15.2 min (758.7 - 743.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	71.28'	94 cf	10.33'W x 10.00'L x 3.21'H Field A 332 cf Overall - 97 cf Embedded = 234 cf x 40.0% Voids
#2A	71.78'	97 cf	Cultec R-280HD x 2 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		191 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	71.28'	1.020 in/hr Exfiltration over Surface area
#2	Primary	72.18'	6.0" Round Culvert L= 79.0' Ke= 1.000 Inlet / Outlet Invert= 72.18' / 71.38' S= 0.0101 ' /' Cc= 0.900 n= 0.011 PVC, smooth interior, Flow Area= 0.20 sf

Discarded OutFlow Max=0.00 cfs @ 1.86 hrs HW=71.31' (Free Discharge)**1=Exfiltration** (Exfiltration Controls 0.00 cfs)**Primary OutFlow** Max=0.53 cfs @ 12.11 hrs HW=72.99' (Free Discharge)**2=Culvert** (Inlet Controls 0.53 cfs @ 2.69 fps)**Topsfield Proposed HydroCAD**

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Type III 24-hr 100-Year Rainfall=6.50"

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Page 280

Pond UIS-9: UIS-9 - Chamber Wizard Field A**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

1 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 8.00' Row Length +12.0" End Stone x 2 = 10.00'

Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

2 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 97.1 cf Chamber Storage

331.5 cf Field - 97.1 cf Chambers = 234.4 cf Stone x 40.0% Voids = 93.8 cf Stone Storage

Chamber Storage + Stone Storage = 190.9 cf = 0.004 af

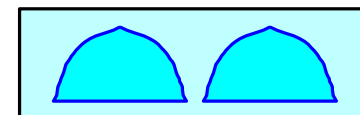
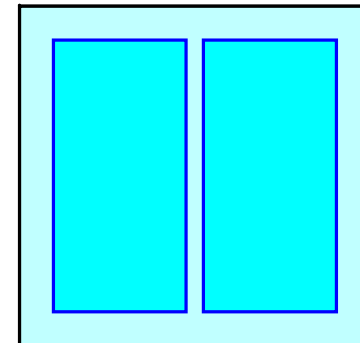
Overall Storage Efficiency = 57.6%

Overall System Size = 10.00' x 10.33' x 3.21'

2 Chambers

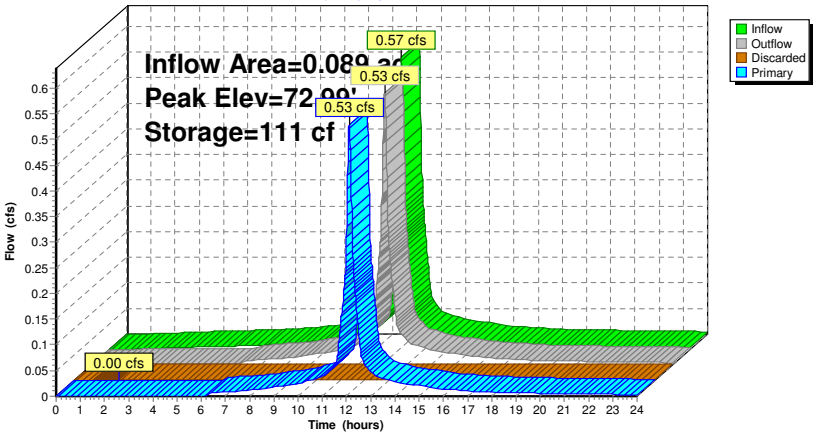
12.3 cy Field

8.7 cy Stone



Pond UIS-9: UIS-9

Hydrograph



Section 5.0 – Drainage Site Plans

STUDY POINT #3	
STORM EVENT	PEAK RATE
2-YR STORM	0.01 CFS
10-YR STORM	0.22 CFS
25-YR STORM	0.79 CFS

STUDY POINT #2	
STORM EVENT	PEAK RATE
2-YR STORM	0.02 CFS
10-YR STORM	0.10 CFS
25-YR STORM	0.56 CFS

STUDY POINT #1	
STORM EVENT	PEAK RATE
2-YR STORM	0.07 CFS
10-YR STORM	0.58 CFS
25-YR STORM	1.14 CFS

SCS - 52A
FREETOWN MUCK
HSG B/D

SCS - 420C
CANTON FINE SANDY LOAM
HSG A

SCS - 420B
CANTON FINE SANDY LOAM
HSG A

SCS - 421C
CANTON FINE SANDY LOAM
(VERY STONY)
HSG C

SCS - 421D
CANTON FINE SANDY LOAM
(VERY STONY)
HSG C

TOTAL=22,922± S.F.
PAVED IMPERVIOUS = 13,950± S.F.
GRAVEL (HSG A) = 4,096± S.F.
WOODS (HSG A) = 411± S.F.
WOODS (HSG C) = 3,284± S.F.
GRASS (HSG A) = 509± S.F.
GRASS (HSG C) = 672± S.F.
CN=91
TC=10.2

TOTAL=346± S.F.
IMPERVIOUS ROOF=346± S.F.
CN=98
TC=6.0

TOTAL=787± S.F.
IMPERVIOUS ROOF=787± S.F.
CN=98
TC=6.0

TOTAL=346± S.F.
IMPERVIOUS ROOF=346± S.F.
CN=98
TC=6.0

TOTAL=49,278± S.F.
IMPERVIOUS = 3,550± S.F.
GRASS (HSG A) = 7,582± S.F.
GRASS (HSG C) = 1,887± S.F.
WOODS (HSG A) = 24,087± S.F.
WOODS (HSG C) = 11,389± S.F.
WOODS (HSG D) = 6,083± S.F.
CN=55
TC=12.0

TOTAL=181,751± S.F.
WOODS (HSG A) = 44,530± S.F.
WOODS (HSG C) = 4,806± S.F.
GRASS (HSG A) = 101,870± S.F.
GRASS (HSG C) = 30,545± S.F.
CN=43
TC=15.7

TOTAL=180,525± S.F.
WOODS (HSG A) = 76,402± S.F.
WOODS (HSG B) = 13,713± S.F.
WOODS (HSG C) = 15,503± S.F.
GRASS (HSG A) = 67,450± S.F.
GRASS (HSG C) = 7,457± S.F.
CN=41
TC=12.3

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- SITE IS LOCATED ENTIRELY WITHIN ELDERLY HOUSING DISTRICT (EHD) OVERLAY, KNOWN AS "ROLLING GREEN ELDERLY HOUSING DISTRICT," PER ARTICLE 33 OF ANNUAL AND SPECIAL TOWN MEETING WARRANT FOR FISCAL YEAR 2017, FROM MAY 3, 2016 TOWN MEETING.
- SITE IS LOCATED WITHIN FEMA FLOODPLAIN ZONE A - AREAS SUBJECT TO INUNDATION BY THE 1-PERCENT-ANNUAL-CHANCE FLOOD EVENT AS SHOWN ON FEMA MAP 25009C0266F, EFFECTIVE DATE JULY 3, 2012.

LEGEND:

EX. PROPERTY LINE
PRE-DEV. WATERSHED AREA
SCS SOILS BOUNDARY
WATERSHED NO. **E1**
EDGE OF WETLANDS
TIME OF CONCENTRATION (T_c)

DIG SAFE



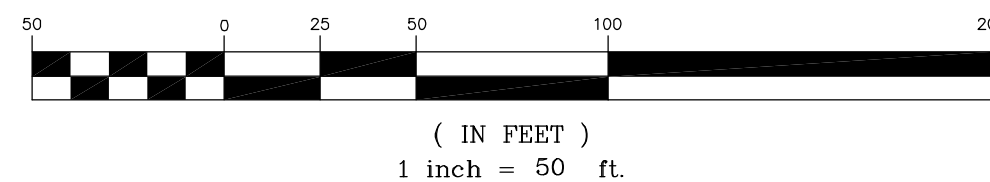
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TOWN OF TOPSFIELD, MA SITE PLAN REVIEW AND SPECIAL PERMIT

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE DATE

GRAPHIC SCALE



N:\PROJECTS\2165-01A\CIVIL\DRAWINGS\CURRENT\C-2165-01A - PRE-DEVELOPMENT WATERSHED PLAN.DWG

ISSUED FOR DRAINAGE REPORT 01-17-2017

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT/OWNER:

SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:

RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO. 2165-01A DATE: 10-13-2016

SCALE: 1"=50' DWG. NAME: C-2165-01A

DESIGNED BY: DMR CHECKED BY: RB

PREPARED BY:



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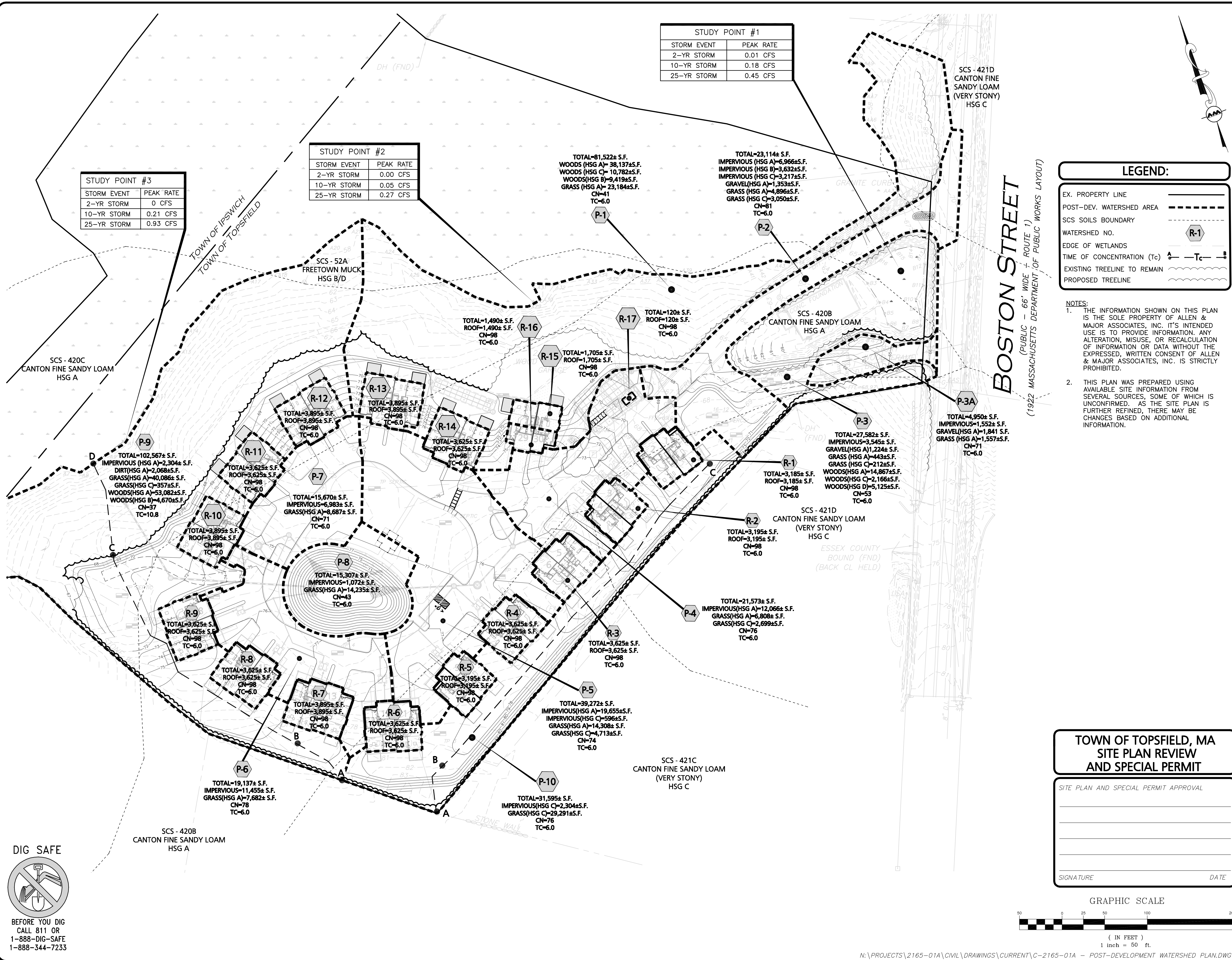
DRAWING TITLE:

EXISTING
WATERSHED PLAN

SHEET No.

EWS

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STUDY POINT #1	
STORM EVENT	PEAK RATE
2-YR STORM	0.01 CFS
10-YR STORM	0.18 CFS
25-YR STORM	0.45 CFS

STUDY POINT #2	
STORM EVENT	PEAK RATE
2-YR STORM	0.00 CFS
10-YR STORM	0.05 CFS
25-YR STORM	0.27 CFS

STUDY POINT #3	
STORM EVENT	PEAK RATE
2-YR STORM	0 CFS
10-YR STORM	0.21 CFS
25-YR STORM	0.93 CFS

LEGEND:

EX. PROPERTY LINE

POST-DEV. WATERSHED AREA

SCS SOILS BOUNDARY

WATERSHED NO.

EDGE OF WETLANDS

TIME OF CONCENTRATION (Tc)

EXISTING TREELINE TO REMAIN

PROPOSED TREELINE

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01-17-2017

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS
REV	DATE	DESCRIPTION

APPLICANT/OWNER:
SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=50'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

PREPARED BY:

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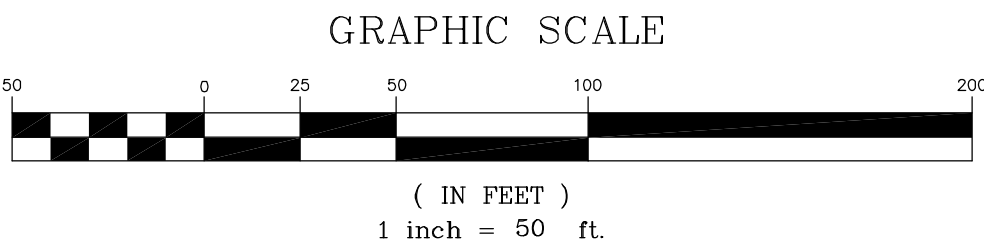
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DRAWING TITLE:	SHEET No.
PROPOSED WATERSHED PLAN	PWS

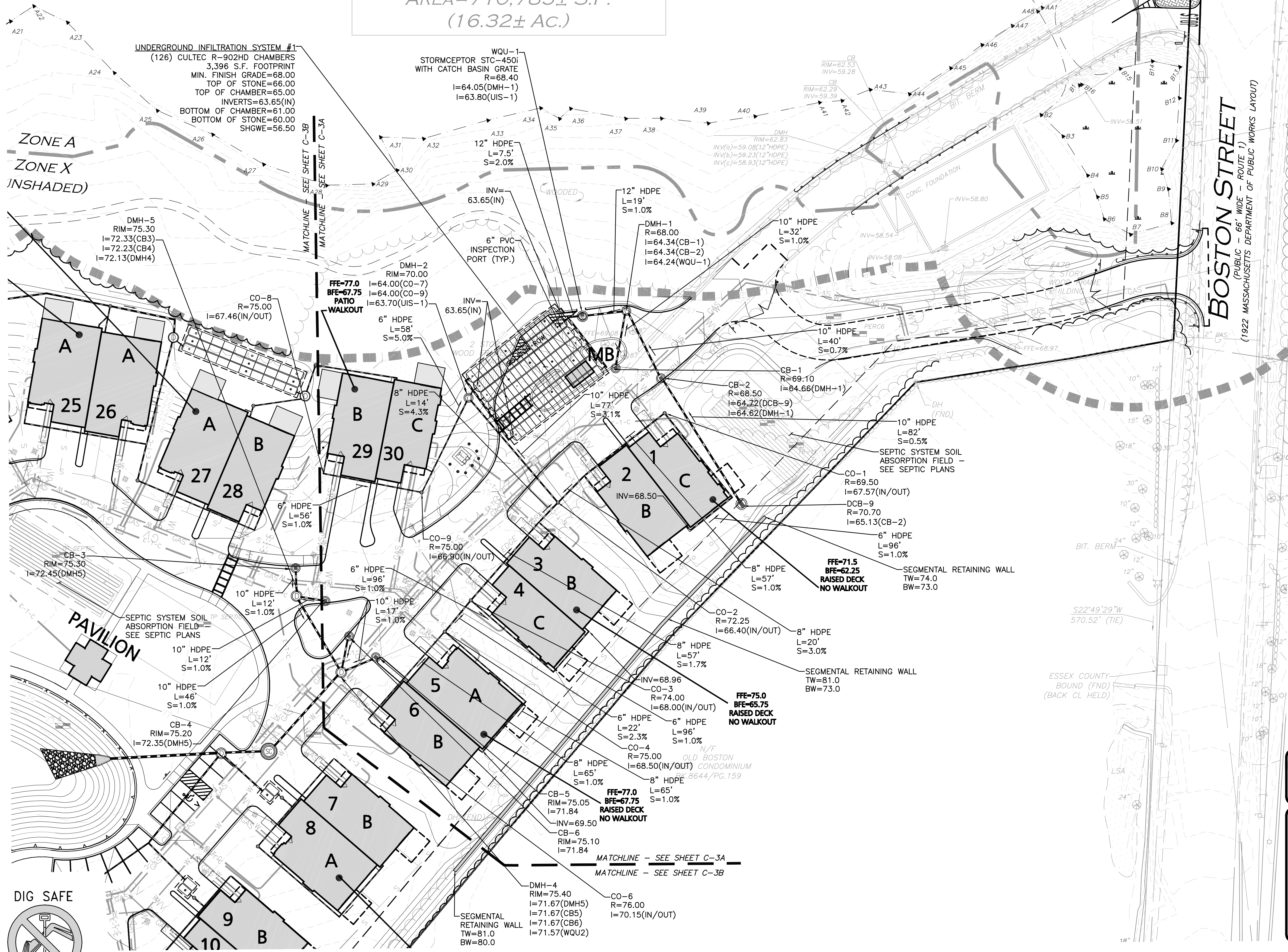
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TOWN OF TOPSFIELD
ASSESSORS MAP 7, LOT 3
TOWN OF IPSWICH
ASSESSORS MAP 49, LOTS 1 & 2
AREA=710,785± S.F.
(16.32± Ac.)



LEGEND:

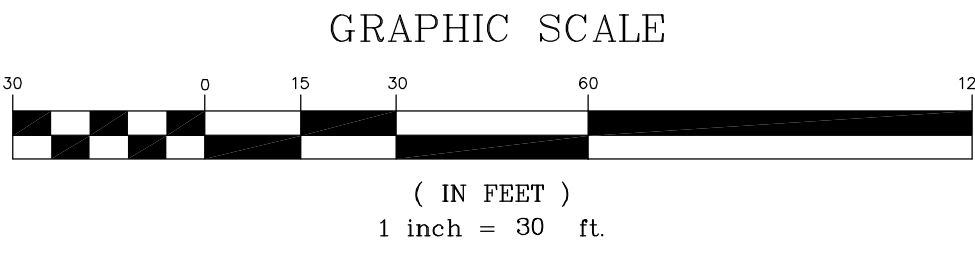
- DRAIN MANHOLE
- CATCH BASIN
- CATCH BASIN - DOUBLE GRATE
- FLARED END SECTION
- DRAIN LINE
- RIPRAP OUTFALL
- OUTLET CONTROL STRUCT.
- 5' CONTOUR
- 1' CONTOUR
- SPOT GRADE
- TOP OF BERM
- DETENTION BASIN
- SAW-CUT LINE
- INFILTRATION SYSTEM

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**TOWN OF TOPSFIELD, MA
SITE PLAN REVIEW
AND SPECIAL PERMIT**

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE _____ DATE _____



**ISSUED FOR
DRAINAGE REPORT**
01-17-2017

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT/OWNER:
SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:
RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=30'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

PREPARED BY:
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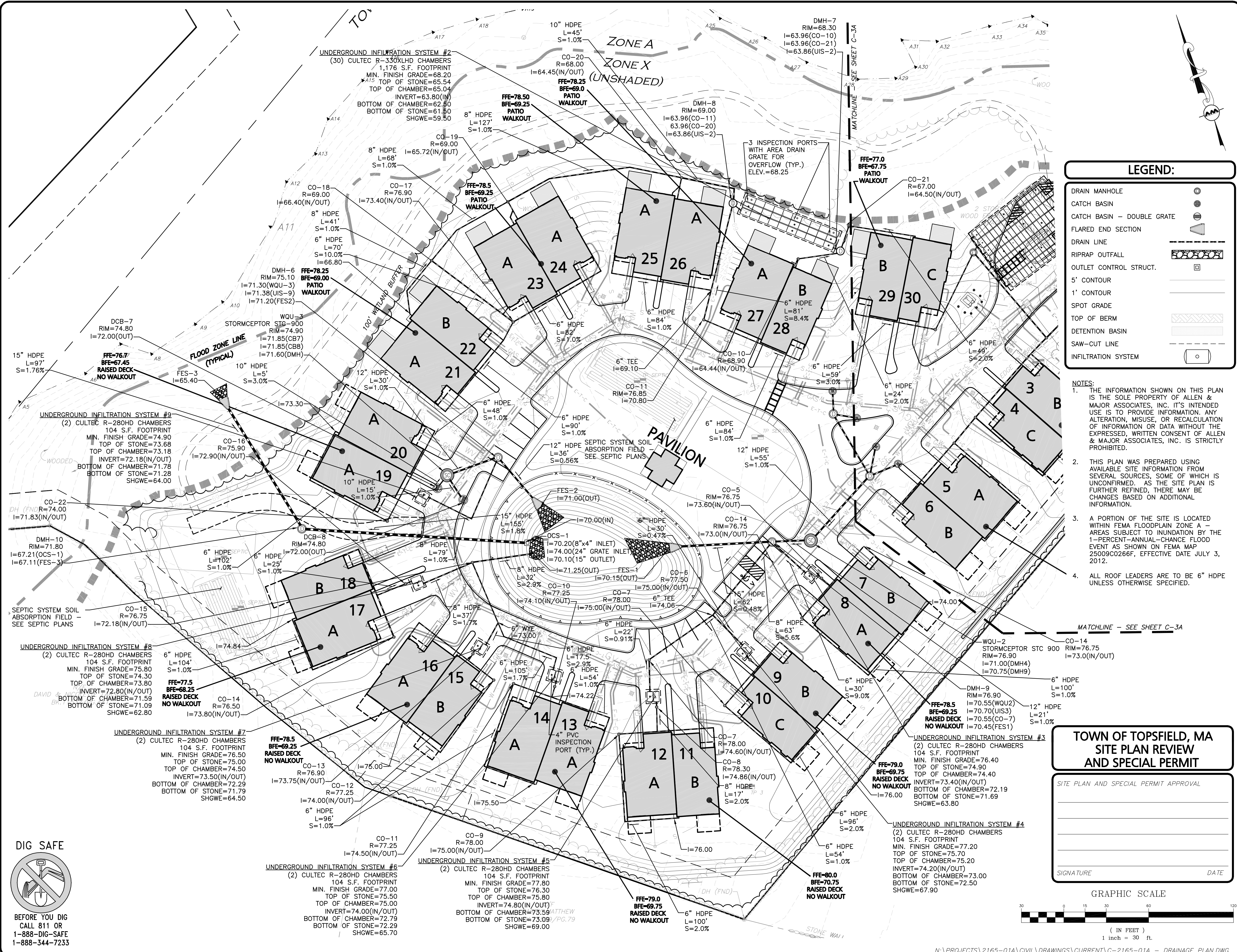
DRAWING TITLE:	SHEET No.
DRAINAGE PLAN	C-4A

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LEGEND:

DRAIN MANHOLE

CATCH BASIN

CATCH BASIN - DOUBLE GRATE

FLARED END SECTION

DRAIN LINE

RIPRAP OUTFALL

OUTLET CONTROL STRUCT.

5' CONTOUR

1' CONTOUR

SPOT GRADE

TOP OF BERM

DETENTION BASIN

SAW-CUT LINE

INFILTRATION SYSTEM

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4. ALL ROOF LEADERS ARE TO BE 6" HDPE UNLESS OTHERWISE SPECIFIED.

TOWN OF TOPSFIELD, MA

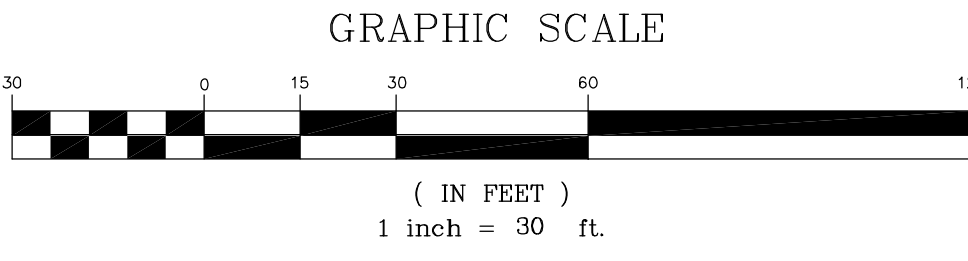
SITE PLAN REVIEW

AND SPECIAL PERMIT

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE

DATE



ISSUED FOR

DRAINAGE REPORT

01-17-2017

PROFESSIONAL ENGINEER FOR

ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT/OWNER:

SARKIS DEVELOPMENT COMPANY

2 ELM SQUARE

ANDOVER, MA 01810

PROJECT:

RESIDENTIAL DEVELOPMENT

470 BOSTON STREET (ROUTE 1)

TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=30'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

PREPARED BY:

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DRAWING TITLE:	SHEET NO.
DRAINAGE PLAN	C-4B

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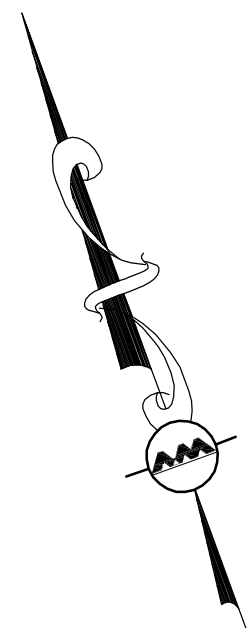
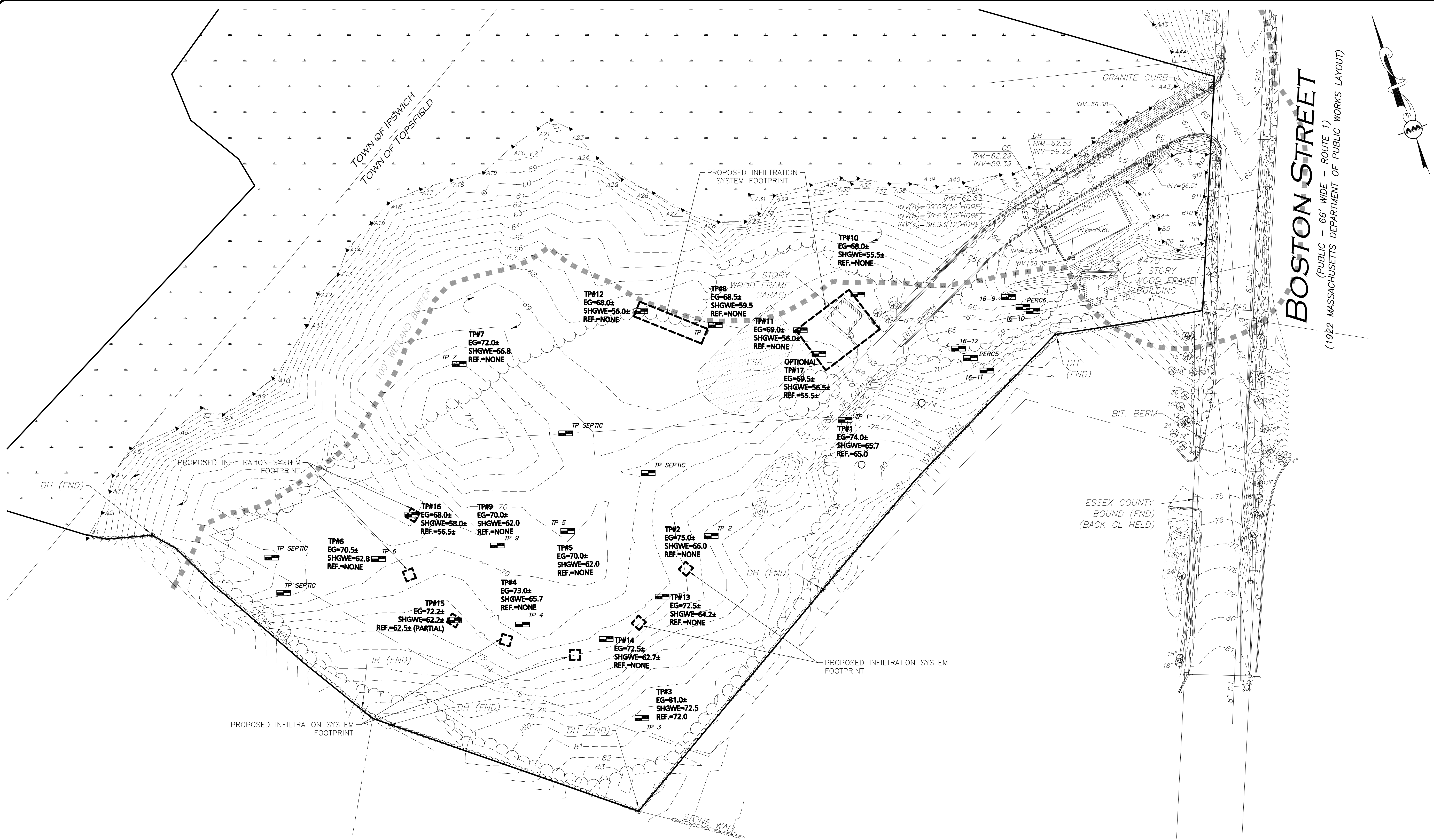
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BOSTON STREET
(PUBLIC - 66' WIDE - ROUTE 1)
(1922 MASSACHUSETTS DEPARTMENT OF PUBLIC WORKS LAYOUT)

**ISSUED FOR
DRAINAGE REPORT**
01-17-2017

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
1	1-17-2017	REVISED PER PEER REVIEW & TOWN COMMENTS

APPLICANT/OWNER:

SARKIS DEVELOPMENT COMPANY
2 ELM SQUARE
ANDOVER, MA 01810

PROJECT:

RESIDENTIAL DEVELOPMENT
470 BOSTON STREET (ROUTE 1)
TOPSFIELD, MA

PROJECT NO.	2165-01A	DATE:	10-13-2016
SCALE:	1"=50'	DWG. NAME:	C-2165-01A
DESIGNED BY:	DMR	CHECKED BY:	RB

PREPARED BY:



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DRAWING TITLE:

TEST PITS PLAN

SHEET No.

TPP-1

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**TOWN OF TOPSFIELD, MA
SITE PLAN REVIEW
AND SPECIAL PERMIT**

SITE PLAN AND SPECIAL PERMIT APPROVAL

SIGNATURE

DATE

GRAPHIC SCALE



(IN FEET)
1 inch = 50 ft.

N:\PROJECTS\2165-01A\CIVIL\DRAWINGS\CURRENT\C-2165-01A - TEST PIT LOCATIONS PLAN.DWG

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Section 6.0 - Appendix



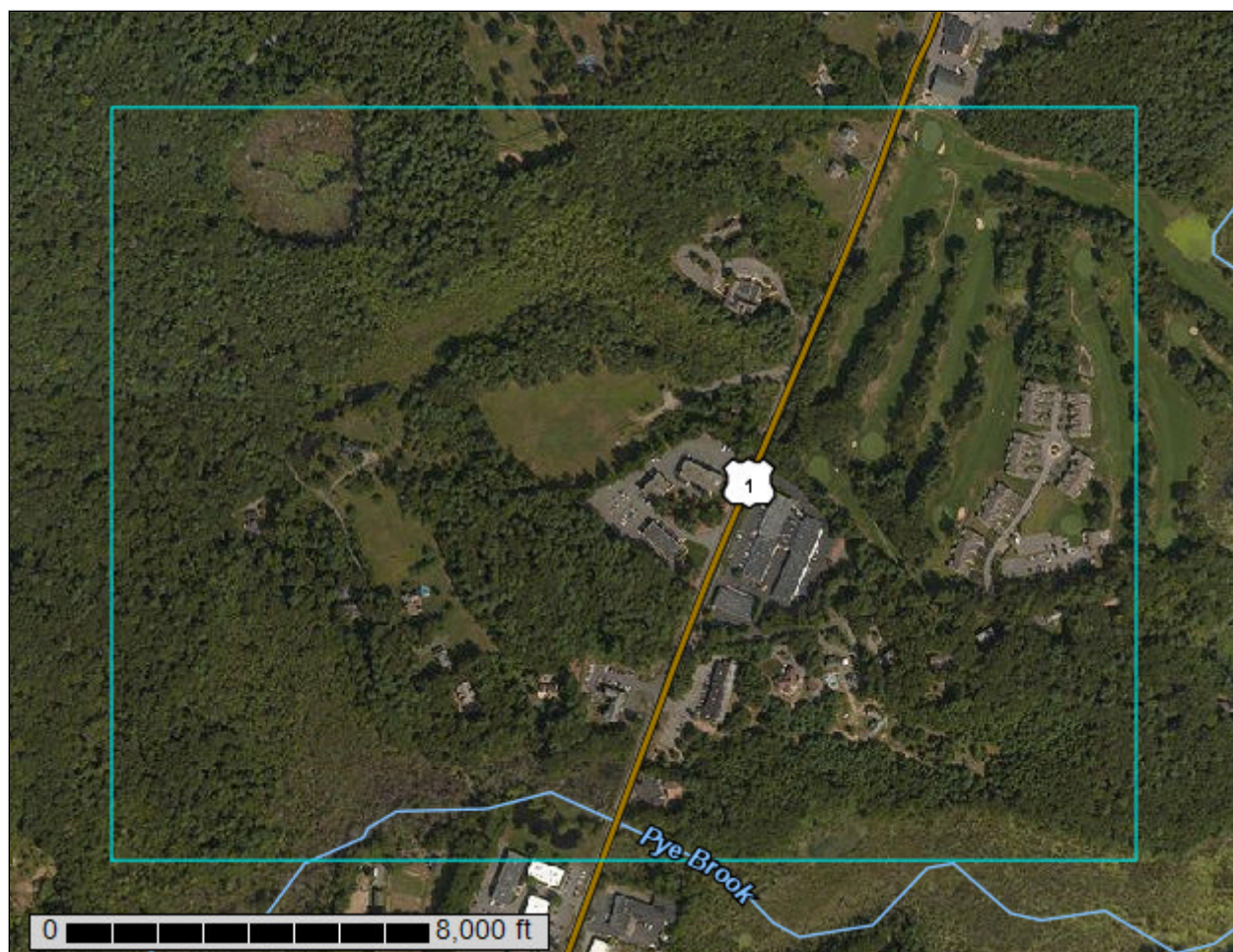
United States
Department of
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NRCS

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 Essex County, Massachusetts, Northern Part; and Essex County, Massachusetts, Southern Part



Custom Soil Resource Report Soil Map



Map Unit Legend

Essex County, Massachusetts, Northern Part (MA605)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1	Water	1.2	0.6%
31A	Walpole sandy loam, 0 to 3 percent slopes	1.9	0.9%
32A	Wareham loamy sand, 0 to 3 percent slopes	0.5	0.2%
52A	Freetown muck, 0 to 1 percent slopes	31.2	14.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	16.9	7.7%
253C	Hinckley loamy sand, 8 to 15 percent slopes	4.8	2.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	5.7	2.6%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	14.5	6.7%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	17.5	8.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	6.1	2.8%
420C	Canton fine sandy loam, 8 to 15 percent slopes	9.8	4.5%
420D	Canton fine sandy loam, 15 to 25 percent slopes	0.1	0.0%
421B	Canton fine sandy loam, 3 to 8 percent slopes, very stony	10.2	4.7%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	21.1	9.7%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	17.6	8.1%
600	Pits, gravel	8.9	4.1%
651	Udorthents, smoothed	4.0	1.8%
717E	Rock outcrop-Charlton-Hollis complex, 15 to 35 percent slopes	1.2	0.6%
Subtotals for Soil Survey Area		173.2	79.3%
Totals for Area of Interest		218.4	100.0%

Essex County, Massachusetts, Southern Part (MA606)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
31B	Walpole fine sandy loam, 3 to 8 percent slopes	2.6	1.2%
52A	Freetown muck, 0 to 1 percent slopes	13.5	6.2%

Custom Soil Resource Report

Essex County, Massachusetts, Southern Part (MA606)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
242B	Hinckley gravelly fine sandy loam, 3 to 8 percent slopes	11.1	5.1%
242C	Hinckley loamy sand, 8 to 15 percent slopes	12.7	5.8%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	0.2	0.1%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	1.8	0.8%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	1.7	0.8%
392E	Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony	0.0	0.0%
420C	Canton fine sandy loam, 8 to 20 percent slopes	1.2	0.6%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	0.5	0.2%
Subtotals for Soil Survey Area		45.2	20.7%
Totals for Area of Interest		218.4	100.0%

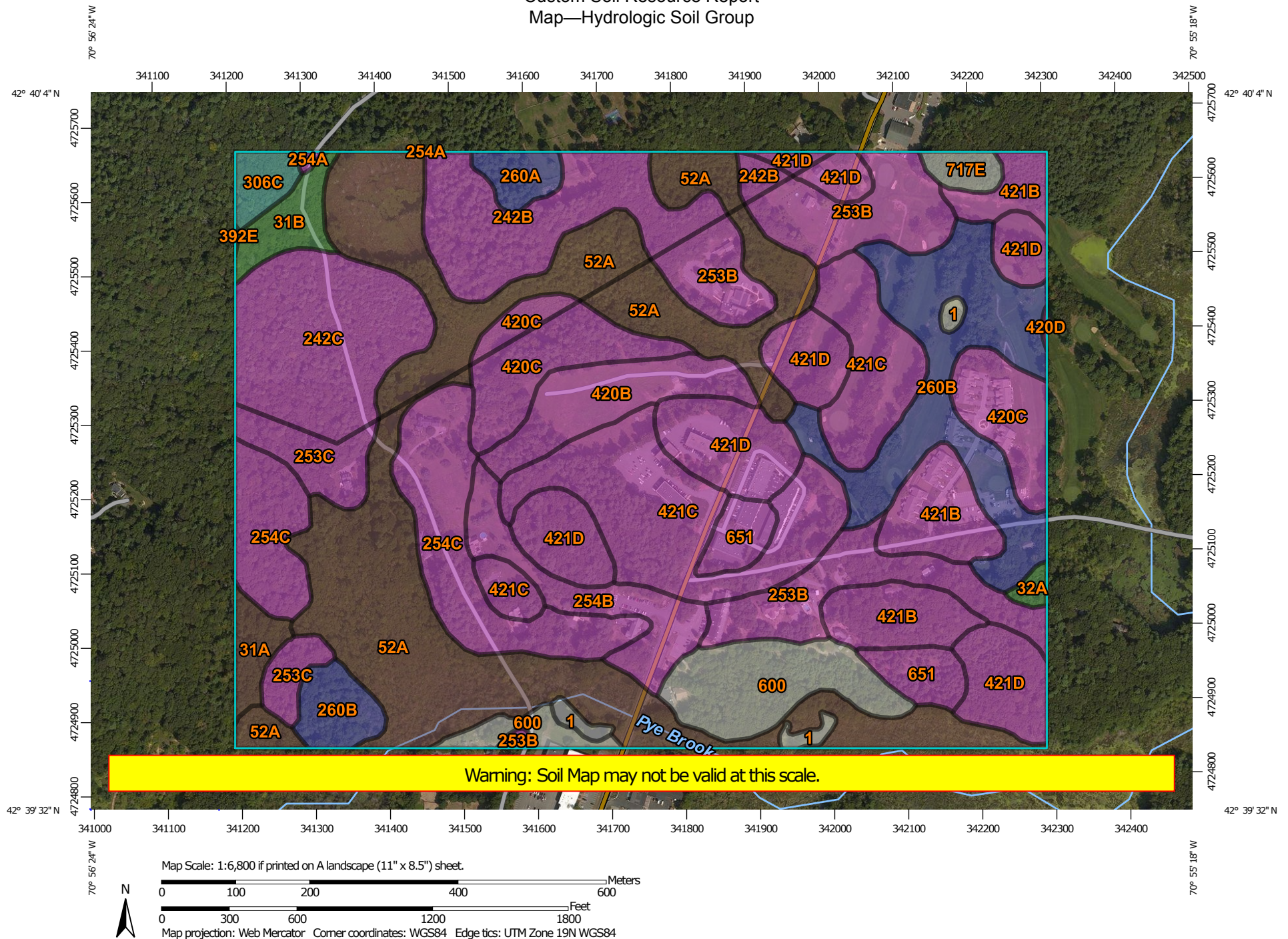
Map Unit Descriptions

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

Custom Soil Resource Report Map—Hydrologic Soil Group



MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines


 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points






 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available


Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
 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: Essex County, Massachusetts, Northern Part
 Survey Area Data: Version 11, Sep 28, 2015

Soil Survey Area: Essex County, Massachusetts, Southern Part
 Survey Area Data: Version 12, Sep 28, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

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

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Essex County, Massachusetts, Northern Part (MA605)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		1.2	0.6%
31A	Walpole sandy loam, 0 to 3 percent slopes	B/D	1.9	0.9%
32A	Wareham loamy sand, 0 to 3 percent slopes	A/D	0.5	0.2%
52A	Freetown muck, 0 to 1 percent slopes	B/D	31.2	14.3%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	16.9	7.7%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	4.8	2.2%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	5.7	2.6%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	14.5	6.7%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	17.5	8.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	A	6.1	2.8%
420C	Canton fine sandy loam, 8 to 15 percent slopes	A	9.8	4.5%
420D	Canton fine sandy loam, 15 to 25 percent slopes	A	0.1	0.0%
421B	Canton fine sandy loam, 3 to 8 percent slopes, very stony	A	10.2	4.7%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	A	21.1	9.7%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	17.6	8.1%
600	Pits, gravel		8.9	4.1%
651	Udorthents, smoothed	A	4.0	1.8%
717E	Rock outcrop-Charlton-Hollis complex, 15 to 35 percent slopes		1.2	0.6%
Subtotals for Soil Survey Area			173.2	79.3%
Totals for Area of Interest			218.4	100.0%

Custom Soil Resource Report

Hydrologic Soil Group— Summary by Map Unit — Essex County, Massachusetts, Southern Part (MA606)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
31B	Walpole fine sandy loam, 3 to 8 percent slopes	A/D	2.6	1.2%
52A	Freetown muck, 0 to 1 percent slopes	B/D	13.5	6.2%
242B	Hinckley gravelly fine sandy loam, 3 to 8 percent slopes	A	11.1	5.1%
242C	Hinckley loamy sand, 8 to 15 percent slopes	A	12.7	5.8%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	0.2	0.1%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	B	1.8	0.8%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	1.7	0.8%
392E	Paxton and Montauk fine sandy loams, 15 to 35 percent slopes, extremely stony	C	0.0	0.0%
420C	Canton fine sandy loam, 8 to 20 percent slopes	A	1.2	0.6%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	A	0.5	0.2%
Subtotals for Soil Survey Area			45.2	20.7%
Totals for Area of Interest			218.4	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Landform
Morraine
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No If Yes, continue to #5.
Within the 100-year flood boundary? ☒ Yes ☐ No
FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-1 7/7/2016 8:00AM Overcast, 65 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 74.0 feet Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Crushed stone drive near end of paved driveway

2. Land Use

Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from:

Open Water Body N/A Drainage Way N/A Wetlands 200+ feet
feet
Property Line 110' Drinking Water Well N/A Other N/A
feet feet

4. Parent Material:

Sandy till Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☒ Impervious Layer(s) ☒ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed:

☐ Yes ☒ No

If yes:

N/A N/A
Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 100" 65.7
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
2-0	Crushed stone										
0-66	2C ₁	5R3/6				SL	5%	10%			
66-108	2C ₂	5R3/6	100	7.5YR6/8	2%	SL	5%	15%			

Additional Notes:

Fractured/weathered rock throughout. No water noted, no weeping.

ESHWT @ 100" (2% mottles - concentrations)

Refusal @ 108" (Ledge)



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-1

Obs. Hole #

inches

inches

inches

inches

100"

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

108

inches

c. If no, at what depth was impervious material observed?

Upper boundary:

inches

Lower boundary:

inches

*Significant amounts fractured rock throughout



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material Landform
Morraine
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016 Range: ☐ Above Normal ☐ Normal ☒ Below Normal
Month/Year
8. Other references reviewed: N/A



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-2 Date: 7/7/2016 Time: 8:00AM Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 75.0 feet Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Slope along southern property line, 110' from PL

2. Land Use

Open field N/A 3-8%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from:

Open Water Body N/A Drainage Way N/A Wetlands 300+ feet
feet
Property Line 110' Drinking Water Well N/A Other N/A
feet feet

4. Parent Material:

Sandy till Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☒ Impervious Layer(s) ☒ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed:

☐ Yes ☒ No

If yes:

N/A N/A
Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 108" 66.0
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR5/6				FSL					
8-24	B	10YR4/6				SL	5%	15%			
24-150	C	10YR3/6	108	7.5YR6/8	2%	S&G	5%	15%			

Additional Notes:

Fractured/weathered rock 60"-150". No water noted, no weeping.

ESHWT @ 108" (2% mottles - concentrations)

No Refusal



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-2

Obs. Hole #

inches

inches

inches

inches

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

150

inches

c. If no, at what depth was impervious material observed?

Upper boundary:

inches

Lower boundary:

inches

*Significant amounts fractured rock throughout



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA
State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Morraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No If Yes, continue to #5.
Within the 100-year flood boundary? ☒ Yes ☐ No
FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-3 7/7/2016 8:00AM Overcast, 65 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 81.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southwestern corner

2. Land Use Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 500+ feet
feet
Property Line 45' Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☒ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☒ Impervious Layer(s) ☒ Weathered/Fractured Rock ☒ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: N/A N/A
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 102" 72.5
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR4/4				FSL					
8-32	B	10YR3/6				LS		10%			
32-108	C	10YR3/6	102	7.5YR6/8	2%	LS		10%			Ref.@108"

Additional Notes:

No water noted, no weeping. ESHWT @ 102"

Angular cobbles and fractured rock throughout B & C layers

Refusal @ 108" (Ledge)



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-3

Obs. Hole #

inches

inches

inches

inches

102"

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

108

inches

c. If no, at what depth was impervious material observed?

Upper boundary:

inches

Lower boundary:

inches

*Significant amounts fractured rock throughout



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name Bedrock
Sandy till Soil Limitations
Geologic/Parent Material Moraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016 Range: ☐ Above Normal ☐ Normal ☒ Below Normal
Month/Year
8. Other references reviewed: N/A



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-4 7/7/2016 8:00AM Overcast, 65 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 73.0 feet Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southwest corner of property

2. Land Use

Open field N/A 3-8%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 500+ feet
feet
Property Line 110' Drinking Water Well N/A Other N/A
feet feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: N/A 144"
Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 88" 65.7
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	A	10YR3/1				SL					
10-22	B	10YR3/2				SL					
22-80	B/C	10YR5/6				Sand					
80-144	C	10YR5/4	88	7.5YR5/8	5%	F. Sand					Moist

Additional Notes:

Standing water @ 144". ESHWT @ 88" (Some mottling in B/C transition layer - concentrations & depletions)

Concentrations - 5YR5/8, depletions - 10YR6/1

No Refusal.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-4

Obs. Hole #

inches

inches

inches

inches

88"

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

144

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Morraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No If Yes, continue to #5.
Within the 100-year flood boundary? ☒ Yes ☐ No
FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-5 Date: 7/7/2016 Time: 8:00AM Weather: Overcast, 65 degrees

1. Location

Ground Elevation at Surface of Hole: 70.0 feet Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Crushed stone drive near end of paved driveway

2. Land Use

Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 375+ feet
feet
Property Line 220' Drinking Water Well N/A Other N/A
feet feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: N/A 132"
Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 96" 62.0
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR3/2				SL					
8-34	B	10YR3/1				SL					
34-72	2C ₁	10YR5/8				M. sand					Moist
72-132	2C ₂	10YR5/4	96	7.5YR6/8	5%	Sand			Loose, SG		

Additional Notes:

ESHWT @ 96" (5% mottles - concentrations & depletions)

Standing water @ 132" (bottom)

No Refusal, coarse sand layer at 60-70".



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-5

Obs. Hole #

inches

inches

inches

inches

96"

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

132

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA
State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material Landform
Morraine
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016 Range: ☐ Above Normal ☐ Normal ☒ Below Normal
Month/Year
8. Other references reviewed: N/A



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-6 7/7/2016 8:00AM Overcast, 65 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 70.5 feet Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Crushed stone drive near end of paved driveway

2. Land Use

Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 175+ feet
feet feet feet
Property Line 115' Drinking Water Well N/A Other N/A
feet feet feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: N/A N/A
Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 92" 62.8
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR4/3				FSL					
8-28	B	10YR6/6				FSL					
28-72	B/C	10YR3/3				FSL	5%	2%			
72-136	C	10YR3/3	92"	7.5YR6/8	2%	FSL	5%	2%			

Additional Notes:

ESHWT @ 92". No refusal, no weeping, no standing water.

Heavy manganese deposits throughout B/C and C layers, color 10R3/3



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐

Disturbed Soil

☐

Fill Material

☐

Impervious Layer(s)

☐

Weathered/Fractured Rock

☐

Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes: _____

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-6

Obs. Hole #

inches

inches

inches

inches

92"

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

136

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material Landform
Morraine
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-7 7/7/2016 8:00AM Overcast, 65 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 72.0 feet Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Woodland area by wetlands

2. Land Use Woodland N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 130+ feet
feet feet feet
Property Line 250' Drinking Water Well N/A Other N/A
feet feet feet

4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: N/A N/A
Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 62" 66.8
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-7

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR3/3				FSL					
8-28	B	10YR5/6				FSL	5%	10%			
28-76	B/C	10YR4/4	62	7.5YR6/8	2%	FSL	5%	15%	Massive, fri.		
76-144	C	10YR4/4				FSL			Massive, fri.		5% cobbles

Additional Notes:

No water noted, no weeping. No refusal.

ESHWT @ 62" (Significant mottling - concentrations, color 7.5YR6/8)



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-7

Obs. Hole # _____

_____ inches

_____ inches

_____ inches

62"

_____ inches

_____ inches

_____ inches

_____ inches

_____ inches

_____ Index Well Number

_____ Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Obs. Hole # _____ 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?

Upper boundary:

0

_____ inches

Lower boundary:

144

_____ 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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name Bedrock
Sandy till Soil Limitations
Geologic/Parent Material Moraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016 Range: ☐ Above Normal ☐ Normal ☒ Below Normal
Month/Year
8. Other references reviewed: N/A



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-8 7/7/2016 8:00AM Overcast, 65 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 68.5 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Northern treeline, 50' back corner existing garage

2. Land Use Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 115+ feet
feet feet feet
Property Line 275' Drinking Water Well N/A Other N/A
feet feet feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: N/A 150"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 108" 59.5
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-8

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR4/3				LS					
8-18	B	10YR5/6				LS	5%				
18-45	B/C	10YR5/8				LS	20%				
45-150	C	10YR5/6	108	7.5YR6/8	2%	Fine sand			Loose, SG		

Additional Notes:

ESHWT @ 108", some mottling, concentrations, color 7.5YR6/8

Standing water @ 150"

No Refusal. Well defined transition from LS to fine sand.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-8

Obs. Hole #

inches

inches

inches

inches

108"

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

108

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Morraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No If Yes, continue to #5. Within the 100-year flood boundary? ☒ Yes ☐ No
FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): June, 2016 Range: ☐ Above Normal ☐ Normal ☒ Below Normal
Month/Year
8. Other references reviewed: N/A



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-9 7/7/2016 8:00AM Overcast, 65 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 70.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Open field, proposed detention basin

2. Land Use Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 225+ feet
feet
Property Line 175' Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: 120" 138"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 96" 62.0
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-9

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	A	10YR3/3				LS					
8-32	B	10YR5/4				LS					
32-72	2C ₁	10YR6/6				Sand					
72-138	2C ₂	10YR3/6	96	7.5YR6/8	2%	LS	10%				

Additional Notes:

Fractured/weathered rock throughout C layer. Standing water at 138", weeping at 120". ESHWT @ 96" (mottling)

No Refusal.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☒ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-9

Obs. Hole #

inches

inches

inches

inches

96"

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

138

inches

c. If no, at what depth was impervious material observed?

Upper boundary:

inches

Lower boundary:

inches

*Significant amounts fractured rock throughout



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

F. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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.

David M. Robinson

Signature of Soil Evaluator

David M. Robinson, S.E. # 13799

Typed or Printed Name of Soil Evaluator / License #

July 8, 2016

Date

July 1, 2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name Bedrock
Sandy till Soil Limitations
Geologic/Parent Material Moraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016 Range: ☐ Above Normal ☐ Normal ☒ Below Normal
Month/Year
8. Other references reviewed: N/A



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-10 12/9/2016 7:30AM Overcast, 35 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 68.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Northeast corner existing garage

2. Land Use

Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from:

Open Water Body N/A Drainage Way N/A Wetlands 120+/- feet
feet
Property Line 150'+/- Drinking Water Well N/A Other N/A
feet feet

4. Parent Material:

Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No

If yes: 150" 154"
Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: 150" 55.5
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-10

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-18	A	10YR2/3				SL					
18-28	B	10YR5/6				LS	10%				
28-60	1C	10YR5/6				SL		2%			
60-156	2C	10YR5/6				SL		2%			

Additional Notes:

Water noted at 154", weeping at 150. ESHWT @ 150"

Cobbles and stones throughout B & C layers, no refusal,

layer fine sand at 60-70", no mottling noted.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

Obs. Hole # TP-10

Obs. Hole #

154

inches

inches

☐ Depth weeping from side of observation hole

150

inches

inches

☐ Depth to soil redoximorphic features (mottles)

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 # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

156

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Morraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-11 12/9/2016 8:00AM Overcast, 35 degrees
Date Time Weather

1. Location

Ground Elevation at Surface of Hole: 69.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: SouthWest corner existing garage

2. Land Use Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 120+/- feet
feet
Property Line 150'+/- Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 156" 174"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 156" 56.0
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-11

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR2/3				SL					
12-36	B1	10YR5/4				LS					
36-66	B2	10YR5/6				Coarse sand	10-15%		Loose, SG		
66-120	1C	10YR5/8				Sand			Loose, SG		
120-180	2C	10YR5/8				LS					

Additional Notes:

Standing Water noted at 174", weeping at 156. ESHWT

@ 156", no refusal, no mottling noted.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes: _____

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☐ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-11

Obs. Hole #

174

inches

156

inches

inches

inches

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

180

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA
State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Morraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____
Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-12 Date: 12/9/2016 Time: 8:30AM Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 68.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: North west corner proposed UIS-2, along treeline

2. Land Use Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 100+/- feet
feet
Property Line 300'+/- Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 144" 158"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 144" 56.0
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-12

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-6	A	10YR2/3				SL					
6-26	Bw	10YR5/4				LS	5-7%				
26-78	1C	10YR5/6				Med. sand			Loose, SG		Boulder, abrupt boundary
78-162	2C	10YR5/8				Sand					Angular cobbles

Additional Notes:

Standing Water noted at 158", weeping at 144.

ESHWI @ 144", no refusal, very little/no mottling

noted. Some fractured ledge at 160", easily broken up.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

Obs. Hole # TP-12

Obs. Hole #

158

inches

inches

☐ Depth weeping from side of observation hole

144

inches

inches

☐ Depth to soil redoximorphic features (mottles)

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 # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

162

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Landform
Morraine
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-13 Date: 12/9/2016 Time: 9:30AM Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 72.5 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southeast corner (See Test Pits Plan, TPP-1)

2. Land Use Open field N/A 3-8%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 450+/- feet
feet
Property Line 100'+/- Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 100" 122"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 122" 62.3
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-13

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	A	10YR2/3				FSL					
10-40	Bw	10YR5/4				FSL					
40-132	C	10YR5/6				FSL		2%	Massive, friable		Some fractured
											ledge

Additional Notes:

Standing Water noted at 122", weeping at 100. ESHWT @ 100", no

refusal, very little/no mottling noted. Some fractured ledge in C

horizon, easily broken up.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

_____ Date _____

_____ Time _____

_____ Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.)

Slope (%)

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes: _____

Depth Weeping from Pit

Depth Standing Water in Hole

Estimated Depth to High Groundwater: _____

inches

elevation



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

Obs. Hole # TP-13

Obs. Hole #

122

inches

inches

☐ Depth weeping from side of observation hole

100

inches

inches

☐ Depth to soil redoximorphic features (mottles)

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 # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

132

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA
State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Morraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-14 Date: 12/9/2016 Time: 10:30AM Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 72.5 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southern corner (See Test Pits Plan, TPP-1)

2. Land Use Open field N/A 3-8%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 430+/- feet
feet
Property Line 125'+/- Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 118" 122"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 122" 62.7
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-14

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR2/3				LS					
12-36	Bw	10YR5/4				LS					
36-132	C	10YR5/6				FSL		2%	Massive, friable		

Additional Notes:

Standing Water noted at 122", weeping at 118. ESHWT @ 118",

no refusal, very little/no mottling noted.



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

Obs. Hole # TP-14

Obs. Hole #

122

inches

inches

☐ Depth weeping from side of observation hole

118

inches

inches

☐ Depth to soil redoximorphic features (mottles)

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 # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

132

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Landform
Morraine
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-15 Date: 12/9/2016 Time: 11:00AM Weather: Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 72.2 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southern corner (See Test Pits Plan, TPP-1)

2. Land Use Open field N/A 3-8%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 300+/- feet
feet
Property Line 125'+/- Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 120" 136"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 120 62.2
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-15

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-12	A	10YR2/3				FSL					
12-40	Bw	10YR5/4				FSL					
40-140	C	10YR5/6				SL		5%	Massive, friable		Angular cobbles

Additional Notes:

Standing Water noted at 136", weeping at 120. ESHWT @ 120", partial refusal west

side of pit @116", mottling noted below weep line. Some fine materials in C layer.

Some angular cobbles in C layer (~5%)



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

Obs. Hole # TP-15

Obs. Hole #

136
inches

inches

☐ Depth weeping from side of observation hole

120
inches

inches

☐ Depth to soil redoximorphic features (mottles)

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 # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0
inches

Lower boundary:

140
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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Morraine
Landform
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: _____ Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-16 Date 12/9/2016 Time 11:30AM Weather Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 68.0 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Center of site (See Test Pits Plan, TPP-1)

2. Land Use Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 200+/- feet
feet
Property Line 180'+/- Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: 120" 128"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 120 58.0
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-16

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-18	A	10YR2/3				FSL					
18-24	Bw	10YR5/4				FSL					
24-60	1C	10YR5/6				Sand					
60-138	2C	10YR5/6				SL		5%			Angular cobbles

Additional Notes:

Standing Water noted at 128", weeping at 120. ESHWT @ 120", refusal @

138" (bedrock), Some angular cobbles in C layer (~5%)



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present: _____

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

Obs. Hole # TP-16

Obs. Hole #

128

inches

inches

☐ Depth weeping from side of observation hole

120

inches

inches

☐ Depth to soil redoximorphic features (mottles)

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 # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary: 0
inches

Lower boundary: 138
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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

Sarkis Development Company

Owner Name

470 Boston Street

Street Address

Topsfield

City

MA

State

Map 2, Lot 5

Map/Lot #

01983

Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair
2. Soil Survey Available? ☒ Yes ☐ No If yes: UC Davis Web Soil Survey 420B, 421C
Source Soil Map Unit
Canton Fine Sandy Loam
Soil Name
Sandy till
Soil Limitations
Bedrock
Geologic/Parent Material
Landform
Morraine
3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Map Unit
4. Flood Rate Insurance Map
Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☒ Yes ☐ No
If Yes, continue to #5. FEMA Zone A
5. Within a velocity zone? ☐ Yes ☒ No
6. Within a Mapped Wetland Area? ☒ Yes ☐ No MassGIS Wetland Data Layer: Wooded Swamp Deciduous/Mixed Trees
Wetland Type
7. Current Water Resource Conditions (USGS): Dec, 2016
Month/Year Range: ☐ Above Normal ☐ Normal ☒ Below Normal
8. Other references reviewed: N/A



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-17 Date 12/9/2016 Time 12:30AM Weather Overcast, 35 degrees

1. Location

Ground Elevation at Surface of Hole: 69.5 Latitude/Longitude: 42.664163 / -70.930328

Description of Location: Southern corner of existing garage (See Test Pits Plan, TPP-1)

2. Land Use Open field N/A 0-3%
(e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
Grass Moraine N/A
Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body N/A Drainage Way N/A Wetlands 150+/- feet
feet
Property Line 160'+/- Drinking Water Well N/A Other N/A
feet
4. Parent Material: Sandy till Unsuitable Materials Present: Yes No

If Yes: Disturbed Soil Fill Material Impervious Layer(s) Weathered/Fractured Rock Bedrock

5. Groundwater Observed: Yes No If yes: 156" 166"
Depth Weeping from Pit Depth Standing Water in Hole
Estimated Depth to High Groundwater: 156 55.5
inches elevation



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: TP-17

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-20	A	10YR2/1				LS					Heavily plowed
20-36	Bw	10YR5/8				SL					
36-60	1C	10YR5/6				Med. Sand		5%			Some coarse sand
60-168	2C	10YR5/6				SL					Angular cobbles
											manganese deposits

Additional Notes:

Standing Water noted at 166", weeping at 156. ESHWT @ 156", refusal

@ 168" (bedrock), Some angular cobbles in 1C layer (~5%)



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Date _____

Time _____

Weather _____

1. Location

Ground Elevation at Surface of Hole: _____

feet

Latitude/Longitude: _____ / _____

2. Land Use

(e.g., woodland, agricultural field, vacant lot, etc.)

Surface Stones (e.g., cobbles, stones, boulders, etc.) _____

Slope (%) _____

3. Distances from:

Vegetation _____

Landform _____

Position on Landscape (SU, SH, BS, FS, _____)

Open Water Body _____

Drainage Way _____

Wetlands _____

feet

feet

feet

Property Line _____

Drinking Water Well _____

Other _____

feet

feet

feet

4. Parent Material: _____

Unsuitable Materials Present:

☐ Yes

☐ No

If Yes:

☐ Disturbed Soil

☐ Fill Material

☐ Impervious Layer(s)

☐ Weathered/Fractured Rock

☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No

If yes:

Depth Weeping from Pit _____

Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____

inches

elevation _____



Commonwealth of Massachusetts

City/Town of _____

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (continued)

Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			

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:

☐ Depth observed standing water in observation hole

☐ Depth weeping from side of observation hole

☐ Depth to soil redoximorphic features (mottles)

☐ Depth to adjusted seasonal high groundwater (S_h)
(USGS methodology)

Obs. Hole # TP-17

Obs. Hole #

166

inches

156

inches

inches

inches

inches

inches

inches

inches

Index Well Number

Reading Date

$$S_h = S_c - [S_r \times (OW_c - OW_{max}) / OW_r]$$

Obs. Hole # S_c S_r OW_c OW_{max} OW_r S_h

Obs. Hole # 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?

Upper boundary:

0

inches

Lower boundary:

166

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. Board of Health Witness

Name of Board of Health Witness

Board of Health

G. Soil Evaluator 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

David M. Robinson, SE 13799

Typed or Printed Name of Soil Evaluator / License #

12/27/2016

Date

7/1/2018

Expiration Date of License

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](#).



Commonwealth of Massachusetts

City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Field Diagrams

Use this sheet for field diagrams:

See attached Sketch, "Test Pit Locations Plan, TPP-1"

Title **MA DEP Standard Calculations**
 Project **Rolling Green Elderly Housing Development, Topsfield, MA**
 Date **October 13, 2016**
 Revised **January 17, 2017**

By DMR
 Chk'd SRC
 Apprv'd SRC

Stormwater Recharge/Water Quality Volume Table**Required Recharge Equation: $R_v = F * \text{Impervious Area}$**

R_v = 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

Required Water Quality Treatment Volume Equation: $V_{wq} = (D_{wq}/12 \text{ inches/foot}) * (A_{imp} * 43,560 \text{ square feet/acre})$

V_{wq} = Required Water Quality Treatment Volume, expressed in ft^3

D_{wq} = Water Quality Depth

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

W'SHED	Area (Feet)	Pervious	Impervious Area (Feet)				Recharge Required			Water Quality Volume Required	
			HSG A (F=0.6)*	HSG B (F=0.35)*	HSG C (F=0.25)*	HSG D (F=0.1)*	F Avg. (Inches)	Impervious Area (Feet)	R_v (ft^3)	D_{wq} (Inch)	V_{wq}
P-1	81,522	81,522	0	0	0	0	0.000	0	0	0.5	0
P-2	23,114	7,946	8,319	3,632	3,217	0	0.466	15,168	589	0.5	632
P-3	27,582	24,037	3,545	0	0	0	0.600	3,545	177	0.5	148
P-3A	4,950	1,557	3,393	0	0	0	0.600	3,393	170	0.5	141
P-4	21,573	9,507	12,066	0	0	0	0.600	12,066	603	0.5	503
P-5	39,272	19,021	19,655	0	596	0	0.590	20,251	995	0.5	844
P-6	19,137	7,682	11,455	0	0	0	0.600	11,455	573	0.5	477
P-7	15,670	8,687	6,983	0	0	0	0.600	6,983	349	0.5	291
P-8	15,307	14,235	1,072	0	0	0	0.600	1,072	54	0.5	45
P-9	102,567	98,195	4,372	0	0	0	0.600	4,372	219	0.5	182
P-10	31,595	29,291	0	0	2,304	0	0.250	2,304	48	0.5	96
R-1	3,185	0	850	0	2,335	0	0.343	3,185	91	0.5	133
R-2	3,195	0	0	0	3,195	0	0.250	3,195	67	0.5	133
R-3	3,625	0	0	0	3,625	0	0.250	3,625	76	0.5	151
R-4	3,625	0	0	0	3,625	0	0.250	3,625	76	0.5	151
R-5	3,195	0	0	0	3,195	0	0.250	3,195	67	0.5	133
R-6	3,625	0	630	0	2,995	0	0.311	3,625	94	0.5	151
R-7	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-8	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-9	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-10	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-11	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-12	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-13	3,895	0	3,895	0	0	0	0.600	3,895	195	0.5	162
R-14	3,625	0	3,625	0	0	0	0.600	3,625	181	0.5	151
R-15	1,705	0	1,705	0	0	0	0.600	1,705	85	0.5	71
R-16	1,490	0	1,490	0	0	0	0.600	1,490	75	0.5	62
R-17	120	0	120	0	0	0	0.600	120	6	1.5	15
Total	436,014	0			0	0			5,909		5,597

Title **MA DEP Standard Calculations**
 Project *Rolling Green Elderly Housing Development, Topsfield, MA*
 Date October 13, 2016
 Revised January 17, 2017

By DMR
 Chk'd SRC
 Apprv'd SRC

Equations provided above **$R_v = F * \text{Impervious Area}$** **$R_v$** = 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)

	Required (cf)	Provided (cf)			
$A_{wQ} =$	5,909	34,716			Underground Infiltration System #1 - #9 and Surface Detention Basins #1-3
$A_{wQ} =$	5,909	34,716			Total

Water Quality Volume **A_{wQ}** = Required Water Quality Treatment Volume, expressed in ft^3 **D_{wQ}** = Water Quality Depth **A_{IMP}** = Impervious Area (excluding non-metal roofs)

	Required (cf)	Provided (cf)			
$A_{wQ} =$	5,597	34,716			Underground Infiltration System #1 - #9 and Surface Detention Basins #1-3
$A_{wQ} =$	5,597	34,716			Total

Draindown Within 72 Hours**Time_{drawdown}**=(R_v) (1/Design Infiltration Rate in inches per hour) (Conversion for inches to feet) (1/bottom area in feet)

Underground Infiltration System #1 (Assumed Sand)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	3,396
Infiltration Volume (ft^3) =	965
Time_{drawdown} (Hours)=	3.34

Underground Infiltration System #2 (Sand)	
Infiltration Rate (in/Hr)=	8.27
Bottom Area (ft^2) =	1,176
Infiltration Volume (ft^3) =	837
Time_{drawdown} (Hours)=	1.03

Underground Infiltration Systems #3-9 (Sandy Loam)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	104
Infiltration Volume (ft^3) =	195
Time_{drawdown} (Hours)=	22.03

Surface Infiltration System (Sandy Loam & Sand)	
Infiltration Rate (in/Hr)=	1.02
Bottom Area (ft^2) =	4,743
Infiltration Volume (ft^3) =	2,959
Time_{drawdown} (Hours)=	7.34

Title **MA DEP Standard Calculations**
 Project *Rolling Green Elderly Housing Development, Topsfield, MA*
 Date October 13, 2016
 Revised January 17, 2017

By DMR
 Chk'd SRC
 Apprv'd SRC

TSS Removal Worksheet

A	B	C		D		E	F	
	BMP'	TSS Removal Rate'		Starting TSS Load*		Amount Removed (C*D)	Remaining Load (D-E)	
TSS Removal Calculation Worksheet - UIS#1	Deep Sump and Hooded Catch Basin	0.25			1.00	0.25	0.75	(25% has been removed prior to infiltration)
	Proprietary Treatment Practice WQU-1	0.77			0.75	0.58	0.17	
	Subsurface Infiltration Basin #1 with Filter Fabric	0.80			0.17	0.14	0.03	

Total TSS Removal =

97%

A	B	C		D		E	F	
	BMP'	TSS Removal Rate'		Starting TSS Load*		Amount Removed (C*D)	Remaining Load (D-E)	
TSS Removal Calculation Worksheet - UIS #2	Deep Sump Catch Basins	0.25			1.00	0.25	0.75	(25% has been removed prior to infiltration)
	Subsurface Infiltration Basin #1	0.80			0.75	0.60	0.15	

Total TSS Removal =

85%

Title **MA DEP Standard Calculations**
 Project *Rolling Green Elderly Housing Development, Topsfield, MA*
 Date October 13, 2016
 Revised January 17, 2017

By DMR
 Chk'd SRC
 Apprv'd SRC

TSS Removal Calculation Worksheet - WQU #2 & 3	A	B	C		D	E	F	
		BMP ¹	TSS Removal Rate ¹		Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)	
		Deep Sump Catch Basins	0.25		1.00	0.25	0.75	(25% has been removed prior to infiltration)
		Proprietary Treatment Practice	0.80		0.75	0.60	0.15	
		Infiltration Basin	0.80		0.15	0.12	0.03	

Total TSS Removal =

97%

Mounding Analysis

Infiltration System	Water Table			System Bottom	Vertical Separation	Attenuated System	Mounding Analysis Required
1	56.50			60.00	3.5	YES	YES
2	59.50			61.50	2.0	YES	YES

Title **Pipe Sizing Table**
 Project Topsfield Elderly Housing Development
 Date October 13, 2016
 Revised January 17, 2017
 A&M Project Number: 2165-01A

Minimum Slope: 0.0047
 Minimum Pipe Size: 6
 Rainfall Intensity (in/hr): 5.40 (25 year storm)
 Manning's n: 0.011 HDPE/PVC
 Manning's n: 0.013 RCP
 Minimum Pipe Cover: 1.84'

By DMR
 Chk'd SRC
 Appr'd TJW

Elderly Housing Development - Topsfield, MA

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)
CB1	DMH-1	32	0.402	0.57	0.228	1.23	10	1.00%	2.6	4.75	0.32	64.66	64.34	69.10	3.48
CB2	DMH-1	40	0.060	0.91	0.054	0.29	10	0.70%	2.2	3.97	0.28	64.62	64.34	68.50	2.92
DMH-1	WQU-1	19				1.52	12	1.53%	5.2	6.62	0.29	64.34	64.05	68.00	2.54
REAR OF UNITS	CLEANOUT	100	0.046	0.95	0.044	0.24	6	1.00%	0.7	3.38	1.00	100.00	99.00	102.00	VARIES
LARGEST UNIT (AA)	CLEANOUT	100	0.087	0.95	0.083	0.45	6	1.00%	0.7	3.38	1.00	100.00	99.00	102.00	VARIES
WQU1	UIS1	7.5	1.047	0.69	0.719	2.21	12	2.00%	6.0	7.58	0.15	63.80	63.65	68.40	3.48
CB3	DMH5	12	0.130	0.79	0.103	0.55	10	1.00%	2.6	4.75	0.12	72.45	72.33	75.30	1.89
CB4	DMH5	12	0.130	0.79	0.103	0.55	10	1.00%	2.6	4.75	0.12	72.35	72.23	75.20	1.89
CB5	DMH4	17	0.207	0.75	0.155	0.84	10	1.00%	2.6	4.75	0.17	71.84	71.67	75.05	2.25
CB6	DMH4	17	0.207	0.75	0.155	0.84	10	1.00%	2.6	4.75	0.17	71.84	71.67	75.10	2.30
WQU2	DMH9	21	0.673	3.08	0.515	2.78	12	0.95%	4.1	5.23	0.20	70.75	70.55	76.90	5.03
UIS 3	DMH9	30	0.083	0.95	0.079	0.43	6	9.00%	2.0	10.13	2.70	73.40	70.70	76.75	2.72
UIS 4	6" TEE	30	0.073	0.95	0.070	0.38	6	0.47%	0.5	2.31	0.14	74.20	74.06	77.50	2.68
UIS 5	CO-7	22	0.083	0.95	0.079	0.43	6	0.91%	0.6	3.22	0.20	74.80	74.60	78.30	2.88
CO-7	6" TEE	54	0.083	0.95	0.079	0.43	6	1.00%	0.7	3.38	0.54	74.60	74.06	78.00	2.78
6" TEE	DMH 9	63	0.083	0.95	0.079	0.43	8	5.57%	3.4	9.66	3.51	74.06	70.55	78.00	3.15
DMH9	FES1	62				3.58	15	0.48%	5.3	4.33	0.30	70.45	70.15	76.90	5.08
DMH5	DMH4	46	0.402	0.57	0.228	1.23	10	1.00%	2.6	4.75	0.46	72.13	71.67	75.30	2.21
CB7	WQU3	5	0.281	0.80	0.226	1.22	10	3.00%	4.5	8.22	0.15	72.00	71.85	74.80	1.84
CB8	WQU3	15	0.281	0.80	0.226	1.22	10	1.00%	2.6	4.75	0.15	72.00	71.85	74.80	1.84
WQU3	DMH6	31	0.562	1.61	0.452	2.44	12	0.97%	4.2	5.27	0.30	71.60	71.30	74.90	2.18
DMH-6	FES-2	36	0.888	0.70	0.619	3.34	12	0.56%	3.1	4.00	0.20	71.20	71.00	75.10	2.77
OCS-1	DMH-10	155				9.45	15	1.80%	10.3	8.35	2.79	70.00	67.21	74.00	2.63
DMH-10	FES-3	97				9.45	15	1.76%	10.2	8.26	1.71	67.11	65.40	71.80	3.32
DCB-9	CB-2	82	0.725	0.39	0.286	1.54	10	0.50%	1.8	3.36	0.41	65.13	64.72	70.70	4.61

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: Sarkis Development Company

ADDRESS: 2 Elm Square

Andover, MA 01810

TEL. NUMBER: (978) 475-4055

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.