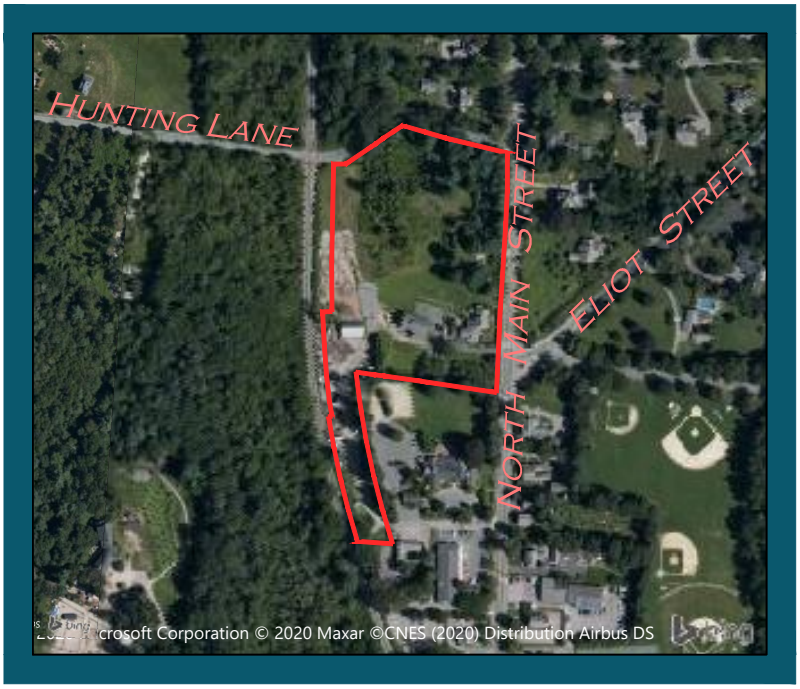
ALLEN & MAJOR ASSOCIATES, INC.

SITE LOCUS: 1" = 500'



THE PINE RESIDENCES

41 NORTH MAIN STREET

SHERBORN, MASSACHUSETTS

DRAINAGE REPORT

DATE PREPARED:
NOVEMBER 18, 2020

APPLICANT:
BARSKY ESTATE REALTY TRUST
23 HUNTING LANE
SHERBORN, MA 01770

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
100 COMMERCE WAY, SUITE 5
WOBURN, MASSACHUSETTS 01801

COMMONWEALTH OF MASSACHUSETTS
MICHAEL A. MALYNOWSKI
CIVIL
No. 47269
REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Michael Malynowski
Date: 2020.11.23 08:21:20-05'00'

A&M PROJECT NO. : 2513-01A

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100 COMMERCE WAY
WOBURN, MA 01888-0118

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A&M PROJECT #2513-01A

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SECTION 1.0

NARRATIVE

Section 1.0 Drainage Report

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- **INTRODUCTION**

The purpose of this drainage report is to provide an overview of the proposed stormwater management system for the proposed site development at 41 North Main Street in Sherborn, MA. The report will show by means of narrative, calculations and exhibits that the project meets MassDEP and the Town of Sherborn's Stormwater Management Regulations.

The proposed project consists of the development of a two parcels totaling 7.2 acres shown on Sherborn Assessor's Map 11 as lots 41 and 43. The project includes the construction of 60 multifamily residential units in two new three-story buildings. The property lines of the two parcels will be adjusted to accommodate the proposed development and the existing house on North Main Street will remain. The stormwater management onsite has been designed to meet the treatment requirements of the Town of Sherborn and the Massachusetts Department of Environmental Protection, Stormwater Standards and Stormwater Handbook.

The proposed site preparations include the removal of the existing barn, garage, and associated parking on 41 North Main Street. The site will be cleared of trees necessary for the development and then rough graded to install the paved driveway, parking, and building pads.

The proposed stormwater management system (SMS) incorporates structural and non-structural BMPs to provide stormwater quality treatment and conveyance. The SMS includes drainage piping and structures, water quality units (proprietary separators), and underground infiltration systems.

The proposed development plan will increase the impervious area onsite by approximately 72,000 square feet. The primary mechanisms to mitigate this increase in impervious area is through the proposed subsurface infiltration systems. The result is a reduction in the peak rate of stormwater runoff to the Study Points.

- **SITE CATEGORIZATION FOR STORMWATER REGULATIONS**

The proposed site improvements are considered a new development under the Massachusetts Department of Environmental Protection (MADEP) Stormwater Management Standards. A "new development" project is required to meet all ten (10) of the Stormwater Management Standards listed within the MA DEP Stormwater Handbook.

- **SITE LOCATION AND ACCESS**

The site is comprised of two lots, #41 North Main Street and #6 Powderhouse Lane, entirely within the Town of Sherborn. Lot #41 North Main Street has frontage on North Main Street and on Hunting Lane. Lot #6 Powderhouse Lane has frontage on Powderhouse Lane. The site has several existing buildings and three proposed buildings. The existing buildings, with exception of the existing 2.5 story house, will be removed. The proposed buildings include two residential apartment buildings with 30 multifamily units each, and a common building which will be used as a gathering space. The proposed development will be accessed from two locations, one at the end of Powderhouse Lane and one on Hunting Lane. The existing house to remain will maintain its driveway connection to North Main Street. The 60 multifamily units will not be accessible from the existing house's driveway.

- **WATERSHED**

The site is located within the Charles River Watershed, approximately 1.9 miles from the Charles River. The Charles River Watershed has an area of approximately 308 square miles, encompassing 35 City and cities south and west of Boston Massachusetts. There are 20 dams along the 80-mile long Charles River, which ultimately flows to Boston Harbor. Exhibit 1 shows the limits of the Charles River Watershed.

The existing site discharges untreated stormwater to the east into the municipal stormwater system or to the west where a culvert crosses beneath Hunting Lane. The site being located within the Charles River Watershed requires a TDML goal of a 16% reduction in the total phosphorus load discharged from the proposed site. With the installation of infiltration systems the drainage system reduction goal has been met. Please refer to the loading calculations located in the appendices of this report.

EXHIBIT 1: Charles River Watershed

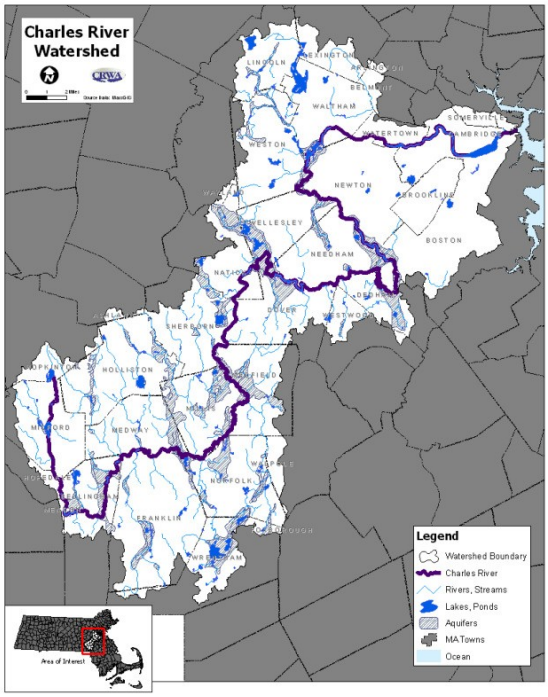

Image Source: Charles River Watershed Association

- **EXISTING SITE CONDITIONS**

The existing buildings sit on the southern side of #41 North Main Street. The majority of the site is grassed, with stands of old growth pine trees, and some areas of pavement and gravel driveways. The topography onsite ranges from flat to moderately steep, with a high point on the northeast side of the site and a low point on the northwest side of the site. The hilltop on the northeast side of the site is the highpoint with an elevation of 211±. The culvert crossing beneath Hunting Lane on the northwest side of the site is the lowest point, with an elevation of 167±. The existing house to remain has a first floor elevation of 192± and the elevation where the driveway connects to North Main Street is 187±.

The surface drainage flows have been analyzed at two (2) Study Points. Study Point #1 is the summation of onsite flows to the culvert which crosses beneath Hunting Lane. Study Point #2 is the summation of all onsite flows to the municipal system in North Main Street.

- **EXISTING SOIL CONDITIONS**

The on-site soils have been identified utilizing the USDA Natural Resources Conservation Services (NRCS) Soil Survey for Middlesex County. The southern side of the site is soil type 626B – Merrimac-Urban land complex. The eastern side of the site is soil type 307B – Paxton fine sandy loam. The western side of the site is primarily soil type 260B – Sudbury fine sandy loam. The center of the site is soil type 103D – Charlton-Hollis-Rock outcrop complex. There is also a small area on the east side of the site near

the intersection with Eliot Street which is identified as soil type 254A – Merrimac fine sandy loam. A copy of the soil map is included in the appendix of this report.

Further investigation on the underlying soils has been conducted by performing three (3) test pits in the location of the proposed infiltration system #2. The test pit's show underlying soils to be primarily sandy loam. An exfiltration rate for sandy loam has been determined to be 1.02 inches per hour based upon Table 2.3.3 1982 Rawls Rate, Volume 3: Documenting Compliance with the Massachusetts's Stormwater Handbook.

- **FEMA FLOODPLAIN**

The site is located within the FEMA Zone "X" or area outside the 0.2-percent-annual-chance-flood. The official Flood Insurance Rate Map (FIRM) on file with the Town of Sherborn is dated June 4, 2010, community panel 25017C0651E. A copy of this map is provided in the appendix of this report.

- **DRAINAGE ANALYSIS METHODOLOGY**

A peak rate of runoff has been determined using techniques and data found in the following:

1. Urban Hydrology for Small Watersheds – Technical Release 55 by the United States Department of Agriculture Soils Conservation Service, June 1986. Runoff curve numbers and 24-hour precipitation values were obtained from this reference.

2. HydroCAD© Stormwater Modeling System by HydroCAD Software Solutions LLC, version 10.00, 2020. 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 Middlesex County Massachusetts by United States Department of Agriculture, NRCS. Soil types and boundaries were obtained from this reference.

- **PEAK RATE OF RUNOFF**

A stormwater runoff analysis has been prepared for both the existing and proposed conditions and includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates have been developed using TR-55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD 10.00 computer program. Further, the analysis has been prepared in accordance with the Town of Sherborn requirements and standard engineering practices. The peak rate and volume of runoff will be estimated for each watershed during the 2, 10, 25 and 100-year storm events.

The stormwater runoff model indicates that the proposed site development reduces the rate of runoff during all storm events at the identified points of analysis. The following tables provide a summary of the estimated peak rate, in Cubic Feet per Second (CFS) at each of the four (4) Study Points for each of the design storm events. The HydroCAD worksheets are included in Section 3 and 4 of this report.

STUDY POINT #1 (on-site flow to Hunting Lane)				
	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.45	2.85	5.83	13.60
Proposed Flow (CFS)	0.43	1.99	5.35	12.74
Decrease (CFS)	**0.02**	**0.86**	**0.48**	**0.86**

STUDY POINT #2 (onsite flow to North Main Street)				
	2-Year	10-Year	25-Year	100-Year
Existing Flow (CFS)	0.81	2.50	4.08	7.67
Proposed Flow (CFS)	0.80	2.47	4.04	7.59
Decrease (CFS)	**0.01**	**0.03**	**0.04**	**0.08**

- **MA DEP STORMWATER PERFORMANCE STANDARDS**

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

BMP's implemented in the design include:

Deep sump Catch Basins
Hydro-dynamic (Proprietary) Separators
Underground Infiltration Systems
Specific maintenance schedule

Stormwater Best Management Practices (BMP's) have been incorporated into the design of the project to mitigate the anticipated pollutant loading. The stormwater management system incorporates structural and non-structural BMP's to provide stormwater quality treatment and conveyance.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw bale and/or silt fence barriers, inlet sediment traps, 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 enumerated below as well as a description as to how the Project will comply with the Standards:

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

   The proposed development will not introduce any new outfalls with direct discharge to a wetland area or waters of the Commonwealth of Massachusetts. All discharges will be treated for water quality and the rate will not be increased over existing conditions.

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 so that the post-development peak discharge rates do not exceed the predevelopment peak discharge rates. A summary of the existing and proposed discharge rates is included within this document.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development*

techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

The existing annual recharge for the Site will be approximated in the developed condition. Infiltration basins were designed to approximate the loss of annual recharge resulting from the development of the Site. See recharge calculations below;

Existing impervious area	= 35,797± square feet
Proposed impervious area	= 107,682 ± square feet
Change in impervious area	**= 71,885± square feet**

Total proposed impervious area (taken from HydroCAD model) = 107,682 ± square feet

Recharge Volume (Rv) = (F) x (Impervious Area)

Where:
Rv = Required Recharge Volume, expressed in cubic feet
F = Target Depth Factor associated with each Hydrologic Soil Group
Impervious Area = proposed impervious pavement, sidewalk, rooftop in square feet

Recharge Volume (Rv) = (F) x (Impervious Area)
= (0.60 inches)*(1/12 inches/ft)* (82,213 square feet) (A Soils)
+ (0.35 inches)*(1/12 inches/ft)*(11,333 square feet) (B Soils)
+ (0.25 inches)*(1/12 inches/ft)*(14,136 square feet) (C Soils)
= 4,736 cubic feet

Recharge Provided =14,649 ft^3 (IS #1) (See Appendix)
+ 3,571 ft^3 (IS #2)
18,220 ft^3

18,220 ft^3 > 4,736 ft^3 Required

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*

   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 for each study point, the 80% TSS removal standard has been met. Standard #4 is met when 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.

The water quality volume (WQV) for the proposed development is captured and treating using deep sump catch basins, proprietary separation devices, and underground infiltration systems. The TSS removal efficiencies are based on the values assigned in the TSS Removal Efficiencies for Best Management Practices table provided in the Massachusetts Stormwater Handbook. TSS removal calculations are provided in the Appendix of this Report.

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

   The site is not considered a source of higher potential pollutant loads.

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 is within an Interim Wellhead Protection Area. The project has incorporated structural stormwater BMPs as recommended by the Massachusetts Stormwater Handbook, including subsurface infiltration structures with pretreatment devices (proprietary hydrodynamic separators) which exceed 44% TSS removal. The project site does not discharge stormwater within a Zone II or near another critical area. Critical Areas are Outstanding Resource Waters as designated in 314 CMR 4.00, Special Resource Waters as designated in 314 CMR 4.00, recharge areas for public water supplies as defined in 310 CMR 22.02, bathing beaches as defined in 105 CMR 445.000, cold-water fisheries as defined in 314 CMR 9.02 and 310 CMR 10.04, and shellfish growing areas as defined in 314 CMR 9.02 and 310 CMR 10.04.

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 as there is an increase in the amount of total impervious area.

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

   A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities has been developed. 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. The applicant will submit the Illicit Discharge Compliance Statement prior to the discharge of stormwater runoff to the post-construction stormwater best management practices and prior to the issuance of a Certificate of Compliance.

SECTION 2.0

OPERATION & MAINTENANCE PLAN

Section 2.0 Operation & Maintenance Plan

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- **INTRODUCTION**

In accordance with the standards set forth by the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), Allen & Major Associates, Inc. has prepared the following Operation and Maintenance Plan for the new development of The Pines Residences, 41 North Main Street in Sherborn, MA.

The plan is broken down 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 a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long Term Maintenance Plan).

- **NOTIFICATION PROCEDURES FOR CHANGE OF RESPONSIBILITY FOR O&M**

The Stormwater Management System (SMS) for this project is owned by **Barsky Estate Realty Trust** (owner). The owner shall be legally responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance (O&M) Plan.

Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner shall notify the Commission that the succeeding owner has assumed such responsibility. Upon subsequent transfers, the responsibility shall continue to be that of transferring owner until the transferee owner notifies the Commission of its assumption of responsibility.

In the event the SMS will serve multiple lots/owners, such as the subdivision of the existing parcel or creation of lease areas, the owner(s) shall establish an association on other legally enforceable arrangements under which the association or a single party shall have legal responsibility for the operation and maintenance of the entire SMS. The legal instrument creating such responsibility shall be recorded with the Registry of Deeds and promptly following its recording, a copy thereof shall be furnished to the Commission.

- **CONTACT INFORMATION**

Stormwater Management System Owner: Barsky Estate Realty Trust
23 Hunting Lane
Sherborn, MA 01770
Phone: (617) 794-0001

Emergency Contact Information:

o Barsky Estate Realty Trust (owner/operator)	Phone (617) 794-0001
o Allen & Major Associates, Inc. (Site Civil Engineer)	Phone (781) 935-6889
o Sherborn Public Works	Phone (508) 651-7878
o Sherborn Conservation Commission	Phone (508) 651-7863
o Sherborn Fire Department (non-emergency line)	Phone (508) 653-3270
o DEP Emergency Response (Mass DEP)	Phone (888) 304-1133
o Clean Harbors Inc (24-Hour Line)	Phone (800) 645-8265

- **CONSTRUCTION PERIOD**

1. Contact the Sherborn Engineering Division at least fourteen (14) days prior to start of construction to schedule a pre-construction meeting.

2. Install the tubular barriers and construction fencing as shown on the Site Preparation Plan.

3. Install the construction entrance at the location shown on the Site Preparation Plan.

4. Site access shall be achieved only from the designated construction entrances.

5. Stockpiles shall be stabilized with erosion control matting or temporary seeding whenever practicable.

6. Install silt sacks and/or tubular barriers around each drain inlet prior to any demotion and or construction activities.

7. All erosion control measures shall be inspected weekly and after every rainfall event of 0.5" or more. 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, the Town Engineer, or the Conservation Agent.

9. Sediment accumulation up-gradient of the tubular barriers and stone check dams greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.

10. If it appears that sediment is exiting the site, 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.

11. Install stone check damns on site during construction as needed. 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 General and Erosion Control Notes as shown on the Site Development Plans and Specifications.

13. The stabilized construction entrances shall be inspected weekly by the contractor. 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.

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 will be designed to maintain a high level of water quality treatment for all stormwater discharge to the resource areas. 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 is a strict and complete manner.

- STORING OF MATERIALS AND WASTE PRODUCTS

There are proposed fenced-in exterior dumpster storage areas. The trash and waste program for the site includes exterior dumpsters. There will be a trash contractor used to pick up the waste material in the dumpsters. The stormwater drainage system has water quality inlets designed to capture trash and debris.

- VEHICLE WASHING

Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The proposed project does not include any designated vehicle washing areas, nor is it expected that any vehicle washing will take place on-site.

- 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.

- 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. No trees shall be planted over the drain lines or infiltration trenches, and that only shallow rooted plants and shrubs will be allowed.

- **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.

Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

Type: LESCO® 28-0-12 (Lawn Fertilizer)
MERIT® 0.2 Plus Turf Fertilizer
MOMENTUM™ Force Weed & Feed

- **Suggested Aeration Program**

In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- **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.
  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.

o 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 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 household or structural pests. 333 CMR 13.08.

Before beginning each application, the applicator must post a Department 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

Public Buildings - Applicators or their employers will provide pre-notification to any person upon their request. Pre-notification will include:

1. Name and phone number of the company making the application
2. Proposed date of application
3. Locations to be treated; and
4. Name, EPA Registration Number, and active ingredients of the products being used.

The applicator or their employers shall pre-notify the occupants of residential units between seven (7) days and forty-eight (48) hours prior to any application. The notification must include the following:

1. Name and phone number of company making the application
2. Proposed date and time of application
3. Locations to be treated
4. Product names, EPA Registration Numbers, and active ingredients for the pesticide products that may be used
5. Purpose of application
6. Preparation procedures required by the pesticide label to protect items such as food, utensils, and pests; and
7. Department approved Consumer Information Bulletin

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

- PET WASTE MANAGEMENT

The Town of Sherborn has a dog control ordinance and anti-littering ordinance that requires all persons to remove waste material from within any way within the Town. The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the project area. The pet waste shall be disposed of in accordance with local and state regulations.

- OPERATIONS AND MANAGEMENT OF SEPTIC SYSTEMS

There are no proposed septic systems within the limits of the project.

- MANAGEMENT OF DEICING CHEMICALS AND SNOW

Snow will be stockpiled on site until the accumulated snow becomes a hazard to the daily operations of the site. 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 #BWR G2019-01, 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.

- **LONG TERM MAINTENANCE PLAN – FACILITIES DESCRIPTION**

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.

The following is a description of the stormwater management system for the project site.

Stormwater Collection System – On Site:

The stormwater collection system is a series of inlets located at low points within the limits of the paved area. All of the proposed on-site catch basins incorporate a deep sump and hooded outlet. The catch basins are connected by a closed gravity pipe network that pass through proprietary separators prior to entering the underground infiltration system. Roof runoff will be directed to the underground infiltration systems as well. Stormwater overflows will surface discharge to the west and eventually enter the culvert beneath Hunting Lane.

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.

Deep Sump Catch Basins:

Inspect catch basins 4 times per year (specifically after foliage and snow season) to ensure that the catch basins are working in their intended fashion and that they are free of debris. Structures will be skimmed of floatable debris at each inspection and sediment will be removed when or

before sump is determined to be 50% full. If the basin outlet is designed with a hood to trap floatable materials (i.e. Snout), check to ensure watertight seal is working.

Proprietary Separators:
Inspect all proprietary separators with the same frequency as catch basins. Remove sediment when the isolated sump has reached 75% of its capacity. Refer to manufacturer's Maintenance Guide for additional information. 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.

Other BMPs and Accessories:

Underground Infiltration Pipe:
Sediment should be removed when accumulated to a depth of 3". Sediment and debris shall be removed by a vacuum truck. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations. Underground Detention Chambers shall be inspected twice per year.

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.

Vegetated Areas:
Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. Where rill erosion is evident, armor the area with an appropriate lining or divert the erosive flows to on-site areas able to withstand the concentrated flows.

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, Rip-Rap:
These accessories will be inspected twice per year for erosion, debris accumulation, and unwanted vegetation. Erosion will be stabilized and sediment, debris, and woody vegetation will be removed.

Mosquito Control Plan:

MA Stormwater Handbook; Volume 2, Chapter 5 (Attached)
Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance, and treatment with larvicides can minimize this potential.

The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

- **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.

- **SUPPLEMENTAL INFORMATION**

- Operation & Maintenance Plan Schedule
- Massachusetts Stormwater Handbook, Chapter 5, Miscellaneous Stormwater Topics, Mosquito Control in Stormwater Management Practices.
- CDS Inspection and Maintenance Guide
- STC Stormceptor Owner's Manual
- CMP Detention and Infiltration Inspection and Maintenance Guide

OPERATION & MAINTENANCE PLAN SCHEDULE

Project: The Pines Residences
Address: 41 North Main Street
Sherborn, MA

Date:
Party Responsible for O & M Plan: Barsky Estate Realty Trust
Address: 23 Hunting Lane
Sherborn, MA 01770

Structure or Task	Maintenance Activity	Schedule/Notes	Maintenance Cost/Unit	Estimated Maintenance	Estimated Annual Maintenance Cost	Inspection Performed	
						Date:	By:
Street Sweeping	Sweep, power broom or vacuum paved areas.	Perform roadway sweeping following the spring thaw to remove any traction sand applied during the winter months. Perform roadway sweeping in the late fall to remove any leaf litter or debris. Maintain information that confirms that all street sweepings have been disposed in accordance with state and local requirements	$1,500/Sweeping	Semi-annually (Spring & Fall)	$3,000		
Deep Sump CB's	Inspect frames and grates. Empty sumps using a vacuum-truck.	Inspected and cleaned 4 times per year. Sediment and debris shall be removed by a vacuum truck. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations	$500/CB	CBs - quarterly			
Hydrodynamic Separators (CDS)	Inspect frames and covers. Empty sediment storage chamber using a vacuum truck. Refer to Manufacturers maintenance Procedures.	Inspected and cleaned 4 times per year. Sediment should be removed when accumulated to 75% of sump capacity. Sediment and debris shall be removed by a vacuum truck. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations	$4,000	Semi-annually (Spring & Fall)			
Underground Infiltration Systems	Remove trash/debris Check for sediment and outlet clogging	Twice a year Sediment should be removed when accumulated to a depth of 3". Sediment and debris shall be removed by a vacuum truck. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations	$500	Semi-annually (Spring & Fall)			
Outfall locations	Inspect for sign of erosion or displaced stone. Replace outlet protection stone if needed.	Inspect twice a year for the first three years of construction and once per year thereafter Check sediment build-up on a yearly basis and clean as needed using hand methods	$500 allowance	Annually			
Mosquito Control	CB management targeted larvicide treatment to CB's and all storm drains including proprietary separators to control mosquitoes in their aquatic stages.	Surveillance is a non chemical inspection method that involves classification of mosquito breeding sites, larval presence, and survey. Apply larvicide if larva growth is detected.	$500 allowance	CBs - quarterly			
Snow Storage	Debris from melted snow shall be cleared from the site and properly disposed of at the end of the snow season, but shall be cleared no later than May 15.	Avoid dumping snow removal over catch basins. Use areas designated on the approved layout plan for snow storage.	$500 allowance	Annually			

Chapter 5
Miscellaneous Stormwater Topics

Mosquito Control in Stormwater Management Practices

Both aboveground and underground stormwater BMPs have the potential to serve as mosquito breeding areas. Good design, proper operation and maintenance and treatment with larvicides can minimize this potential.

EPA recommends that stormwater treatment practices dewater within 3 days (72 hours) to reduce the number of mosquitoes that mature to adults, since the aquatic stage of many mosquito species is 7 to 10 days. Massachusetts has had a 72-hour dewatering rule in its Stormwater Management Standards since 1996. The 2008 technical specifications for BMPs set forth in Volume 2, Chapter 2 of the Massachusetts Stormwater Handbook also concur with this practice by requiring that all stormwater practices designed to drain do so within 72 hours.

Some stormwater practices are designed to include permanent wet pools. These practices – if maintained properly – can limit mosquito breeding by providing habitat for mosquito predators. Additional measures that can be taken to reduce mosquito populations include increasing water circulation, attracting mosquito predators by adding suitable habitat, and applying larvicides.

The Massachusetts State Reclamation and Mosquito Control Board (SRMCB), through the Massachusetts Mosquito Control Districts, can undertake further mosquito control actions specifically for the purpose of mosquito control pursuant to Massachusetts General Law Chapter 252. The Mosquito Control Board, http://www.mass.gov/agr/mosquito/, describes mosquito control methods and is in the process of developing guidance documents that describe Best Management Practices for mosquito control projects.

The SRMCB and Mosquito Control Districts are not responsible for operating and maintaining stormwater BMPs to reduce mosquito populations. The owners of property that construct the stormwater BMPs or municipalities that "accept" them through local subdivision approval are responsible for their maintenance.[1] The SRMCB is composed of officials from MassDEP, Department of Agricultural Resources, and Department of Conservation and Recreation. The nine (9) Mosquito Control Districts overseen by the SRMCB are located throughout Massachusetts, covering 176 municipalities.

Construction Period Best Management Practices for Mosquito Control

To minimize mosquito breeding during construction, it is essential that the following actions be taken to minimize the creation of standing pools by taking the following actions:

- ***Minimize Land Disturbance:*** Minimizing land disturbance reduces the likelihood of mosquito breeding by reducing silt in runoff that will cause construction period controls to clog and retain standing pools of water for more than 72 hours.
- ***Catch Basin inlets:*** Inspect and refresh filter fabric, hay bales, filter socks or stone dams on a regular basis to ensure that any stormwater ponded at the inlet drains within 8 hours after precipitation stops. Shorter periods may be necessary to avoid hydroplaning in roads

[1] MassDEP and MassHighway understand that the numerous stormwater BMPs along state highways pose a unique challenge. To address this challenge, the 2004 MassHighway Stormwater Handbook will provide additional information on appropriate operation and maintenance practices for mosquito control when the Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards..

caused by water ponded at the catch basin inlet. Treat catch basin sumps with larvicides such as *Bacillus sphaericus* (*Bs*) using a licensed pesticide applicator.

- ***Check Dams:*** If temporary check dams are used during the construction period to lag peak rate of runoff or pond runoff for exfiltration, inspect and repair the check dams on a regular basis to ensure that any stormwater ponded behind the check dam drains within 72 hours.
- ***Design construction period sediment traps*** to dewater within 72 hours after precipitation. Because these traps are subject to high silt loads and tend to clog, treat them with the larvicide *Bs* after it rains from June through October, until the first frost occurs.
- ***Construction period open conveyances:*** When temporary manmade ditches are used for channelizing construction period runoff, inspect them on a regular basis to remove any accumulated sediment to restore flow capacity to the temporary ditch.
- ***Revegetating Disturbed Surfaces:*** Revegetating disturbed surfaces reduces sediment in runoff that will cause construction period controls to clog and retain standing pools of water for greater than 72 hours.
- ***Sediment fences/hay bale barriers:*** When inspections find standing pools of water beyond the 24-hour period after a storm, take action to restore barrier to its normal function.

Post-Construction Stormwater Treatment Practices

- Mosquito control begins with the environmentally sensitive site design. Environmentally sensitive site design that minimizes impervious surfaces reduces the amount of stormwater runoff. Disconnecting runoff using the LID Site Design credits outlined in the Massachusetts Stormwater Handbook reduces the amount of stormwater that must be conveyed to a treatment practice. Utilizing green roofs minimizes runoff from smaller storms. Storage media must be designed to dewater within 72 hours after precipitation.
- Mosquito control continues with the selection of structural stormwater BMPs that are unlikely to become breeding grounds for mosquitoes, such as:
    - ***Bioretention Areas/Rain Gardens/Sand Filter:*** These practices tend not to result in mosquito breeding. If any level spreaders, weirs or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
    - ***Infiltration Trenches:*** This practice tends not to result in mosquito breeding. If any level spreaders, weirs, or sediment forebays are used as part of the design, inspect them and correct them as necessary to prevent standing pools of water for more than 72 hours.
- Another mosquito control strategy is to select BMPs that can become habitats for mosquito predators, such as:
    - ***Constructed Stormwater Wetlands:*** Habitat features can be incorporated in constructed stormwater wetlands to attract dragonflies, amphibians, turtles, birds, bats, and other natural predators of mosquitoes.
    - ***Wet Basins:*** Wet basins can be designed to incorporate fish habitat features, such as deep pools. Introduce fish in consultation with Massachusetts Division of Fisheries and Wildlife. Vegetation within wet basins designed as fish habitat must be properly managed to ensure that vegetation does not overtake the habitat. Proper design to ensure that no low circulation or "dead" zones are created may reduce the potential for mosquito breeding. Introducing bubblers may increase water circulation in the wet basin.

Effective mosquito controls require proponents to design structural BMPs to prevent ponding and facilitate maintenance and, if necessary, the application of larvicides. Examples of such design practices include the following:

- ***Basins:*** Provide perimeter access around wet basins, extended dry detention basins and dry detention basins for both larviciding and routine maintenance. Control vegetation to ensure that access pathways stay open.
- ***BMPs without a permanent pool of water:*** All structural BMPs that do not rely on a permanent pool of water must drain and completely dewater within 72 hours after precipitation. This includes dry detention basins, extended dry detention basins, infiltration basins, and dry water quality swales. Use underdrains at extended dry detention basins to drain the small pools that form due to accumulation of silts. Wallace indicates that extended dry extended detention basins may breed more mosquitoes than wet basins. It is, therefore, imperative to design outlets from extended dry detention basins to completely dewater within the 72-hour period.
- ***Energy Dissipators and Flow Spreaders:*** Currier and Moeller, 2000 indicate that shallow recesses in energy dissipators and flow spreaders trap water where mosquitoes breed. Set the riprap in grout to reduce the shallow recesses and minimize mosquito breeding.
- ***Outlet control structures:*** Debris trapped in small orifices or on trash racks of outlet control structures such as multiple stage outlet risers may clog the orifices or the trash rack, causing a standing pool of water. Optimize the orifice size or trash rack mesh size to provide required peak rate attenuation/water quality detention/retention time while minimizing clogging.
- ***Rain Barrels and Cisterns:*** Seal lids to reduce the likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over inlets. The cistern system should be designed to ensure that all collected water is drained into it within 72 hours.
- ***Subsurface Structures, Deep Sump Catch Basins, Oil Grit Separators, and Leaching Catch Basins:*** Seal all manhole covers to reduce likelihood of mosquitoes laying eggs in standing water. Install mosquito netting over the outlet (CALTRANS 2004).

The Operation and Maintenance Plan should provide for mosquito prevention and control.

- ***Check dams:*** Inspect permanent check dams on the schedule set forth in the O&M Plan. Inspect check dams 72 hours after storms for standing water ponding behind the dam. Take corrective action if standing water is found.
- ***Cisterns:*** Apply *Bs* larvicide in the cistern if any evidence of mosquitoes is found. The Operation and Maintenance Plan shall specify how often larvicides should be applied to waters in the cistern.
- ***Water quality swales:*** Remove and properly dispose of any accumulated sediment as scheduled in the Operation and Maintenance Plan.
- ***Larvicide Treatment:*** The Operation and Maintenance Plan must include measures to minimize mosquito breeding, including larviciding.
- The party identified in the Operation and Maintenance Plan as responsible for maintenance shall see that larvicides are applied as necessary to the following stormwater treatment practices: catch basins, oil/grit separators, wet basins, wet water quality swales, dry extended detention basins, infiltration basins, and constructed stormwater wetlands. The Operation and Maintenance Plan must ensure that all larvicides are applied by a licensed pesticide applicator and in compliance with all pesticide label requirements.
- The Operation and Maintenance Plan should identify the appropriate larvicide and the time and method of application. For example, *Bacillus sphaericus (Bs*), the preferred

larvicide for stormwater BMPs, should be hand-broadcast.[2] Alternatively, Altosid, a Methopren product, may be used. Because some practices are designed to dewater between storms, such as dry extended detention and infiltration basins, the Operation and Maintenance Plan should provide that larviciding must be conducted during or immediately after wet weather, when the detention or infiltration basin has a standing pool of water, unless a product is used that can withstand extended dry periods.

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[2] *Bacillus thuringienis israelensis* or *Bti* is usually applied by helicopter to wetlands and floodplains

Roads and Stormwater BMPs

In general, the stormwater BMPs used for land development projects can also be used for new roadways and roadway improvement projects. However, for improvement of existing roads, there are often constraints that limit the choice of BMP. These constraints derive from the linear configuration of the road, the limited area within the existing right-of-way, the structural and safety requirements attendant to good roadway design, and the long-term maintainability of the roadway drainage systems. The MassHighway Handbook provides strategies for dealing with the constraints associated with providing stormwater BMPs for roadway redevelopment projects.

Roadway design can minimize impacts caused by stormwater. Reducing roadway width reduces the total and peak volume of runoff. Designing a road with country drainage (no road shoulders or curbs) disconnects roadway runoff. Disconnection of roadway runoff is eligible for the Low Impact Site Design Credit provided the drainage is disconnected in accordance with specifications outlined in Volume 3.

Like other parties, municipalities that work within wetlands jurisdictional areas and adjacent buffer zones must design and implement structural stormwater best management practices in accordance with the Stormwater Management Standards and the Stormwater Management Handbook. In addition, in municipalities and areas where state agencies operate stormwater systems, the DPWs (or other town or state agencies) must meet the "good housekeeping" requirement of the municipality's or agency's MS4 permit.

MassHighway has taken stormwater management one step further by working with MassDEP to develop the MassHighway Storm Water Handbook for Highways and Bridges. The purpose of the MassHighway Handbook is to provide guidance for persons involved in the design, permitting, review and implementation of state highway projects, especially those involving existing roadways where physical constraints often limit the stormwater management options available. These constraints, like those common to redevelopment sites, may make it difficult to comply precisely with the requirements of the Stormwater Management Standards and the Massachusetts Stormwater Handbook.[3] In response to these constraints, MassDEP and MHD developed specific design, permitting, review and implementation practices that meet the unique challenges of providing environmental protection for existing state roads. The information in the MassHighway Handbook may also aid in the planning and design of projects to build new highways and to add lanes to existing highways, since they may face similar difficulties in meeting the requirements of the Stormwater Management Standards.

Although it is very useful, the MassHighway Handbook does not allow MassHighway projects to proceed without individual review and approval by the issuing authority when subject to the Wetlands Protection Act Regulations, 310 CMR 10.00, or the 401 Water Quality Certification Regulations, 314 CMR 9.00. For example, MassHighway must provide a Conservation Commission with a project-specific Operation and Maintenance Plan in accordance with Standard 9 that documents how the project's post-construction BMPs will be operated and maintained.[4]

[3] The 2004 MassHighway Handbook outlines standardized methods for dealing with these constraints as they apply to highway redevelopment projects. MassDEP and MassHighway intend to work together to provide guidance for add a lane projects when the 2004 Handbook is revised to reflect the 2008 changes to the Stormwater Management Standards.

[4] The general permit for municipal separate storm sewer systems (the MS4 Permit) requires MassHighway to develop and implement procedures for the proper operation and maintenance of stormwater BMPs. To

Some municipalities have asked if the MassHighway Handbook governs municipal road projects. The answer is no.[5] The MassHighway Handbook was developed in response to the unique problems and challenges arising out of the management of the state highway system. Like other project proponents, cities and towns planning road or other projects in areas subject to jurisdiction under the Wetlands Protection Act must design and implement LID, non-structural and structural best management practices in accordance with the Stormwater Management Standards and the Massachusetts Stormwater Handbook.

avoid duplication of effort, MassHighway may be able rely on the same procedures to fulfill the operation and maintenance requirements of Standard 9 and the MS 4 Permit.

[5] Although the MassHighway Handbook does not govern municipal road projects, cities and towns may find some of the information presented in the Handbook useful.

CONTECH®
CONSTRUCTION PRODUCTS INC.

CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	yd3	m3
CDS2015-4	4	1.2	3.0	0.9	0.5	0.4
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

CONTECH Construction Products Inc. provides site solutions for the civil engineering industry. CONTECH's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other CONTECH division offerings, visit contech-cpi.com or call 800.338.1122

CONTECH® CONSTRUCTION PRODUCTS INC.
800.925.5240
contechstormwater.com

CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than eighteen inches the system should be cleaned out. **Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

CONTECH®
ENGINEERED SOLUTIONS

Stormceptor® STC
Owner's Manual

Stormceptor® STC

Table of Contents

For patent information, go to www.ContechES.com/ip.

Your selection of a Stormceptor® means that you have chosen the most recognized and efficient stormwater oil/sediment separator available for protecting the environment. Stormceptor is a pollution control device often referred to as a "Hydrodynamic Separator (HDS)" or an "Oil Grit Separator (OGS)", engineered to remove and retain pollutants from stormwater runoff to protect our lakes, rivers and streams from the harmful effects of non-point source pollution.

1 – Stormceptor Overview

Stormceptor is a patented stormwater quality structure most often utilized as a treatment component of the underground storm drain network for stormwater pollution prevention. Stormceptor is designed to remove sediment, total suspended solids (TSS), other pollutants attached to sediment, hydrocarbons and free oil from stormwater runoff. Collectively the Stormceptor provides spill protection and prevents non-point source pollution from entering downstream waterways.

Key benefits of Stormceptor include:

- Removes sediment, suspended solids, debris, nutrients, heavy metals, and hydrocarbons (oil and grease) from runoff and snowmelt.
- Will not scour or re-suspend trapped pollutants.
- Provides sediment and oil storage.
- Provides spill control for accidents, commercial and industrial developments.
- Easy to inspect and maintain (vacuum truck).
- "STORMCEPTOR" is clearly marked on the access cover (excluding inlet designs).
- Relatively small footprint.
- 3rd Party tested and independently verified.
- Dedicated team of experts available to provide support.

Model Types:

- STC (Standard)
- EOS (Extended Oil Storage)
- OSR (Oil and Sand Removal)
- MAX (Custom designed unit, specific to site)

Configuration Types:

- Inlet unit (accommodates inlet flow entry, and multi-pipe entry)
- In-Line (accommodates multi-pipe entry)
- Submerged Unit (accommodates the site's tailwater conditions)
- Series Unit (combines treatment in two systems)

PLEASE MAINTAIN YOUR STORMCEPTOR

To ensure long-term environmental protection through continued performance as originally designed for your site, Stormceptor must be maintained, as any stormwater treatment practice does. The need for maintenance is determined through inspection of the Stormceptor. Procedures for inspection are provided within this document. Maintenance of the Stormceptor is performed from the surface via vacuum truck.

If you require information about Stormceptor, or assistance in finding resources to facilitate inspections or maintenance of your Stormceptor please call Contech at 1-800-338-1122.

2 – Stormceptor Operation and Components

Stormceptor is a flexibly designed underground stormwater quality treatment device that is unparalleled in its effectiveness for pollutant capture and retention using patented flow separation technology. Stormceptor creates a non-turbulent treatment environment below the insert platform within the system. The insert diverts water into the lower chamber, allowing free oils and debris to rise, and sediment to settle under relatively low velocity conditions. These pollutants are trapped and stored below the insert and protected from large runoff events for later removal during the maintenance procedure.

With thousands of units operating worldwide, Stormceptor delivers reliable protection every day, in every storm. The patented Stormceptor design prohibits the scour and release of captured pollutants, ensuring superior water quality treatment and protection during even the most extreme storm events. Stormceptor's proven performance is backed by the longest record of lab and field verification in the industry.

Stormceptor Schematic and Component Functions

Below are schematics of two common Stormceptor configurations with key components identified and their functions briefly described.

- **Manhole access cover** – provides access to the subsurface components
- **Precast reinforced concrete structure** – provides the vessel's watertight structural support
- **Fiberglass insert** – separates vessel into upper and lower chambers
- **Weir** – directs incoming stormwater and oil spills into the lower chamber
- **Orifice plate** – prevents scour of accumulated pollutants
- **Inlet drop tee** – conveys stormwater into the lower chamber
- **Fiberglass skirt** – provides double-wall containment of hydrocarbons
- **Outlet riser pipe** – conveys treated water to the upper chamber; primary vacuum line access port for sediment removal
- **Oil inspection port** – primary access for measuring oil depth and oil removal
- **Safety grate** – safety measure to cover riser pipe in the event of manned entry into vessel

Figure 1.

Inline Stormceptor

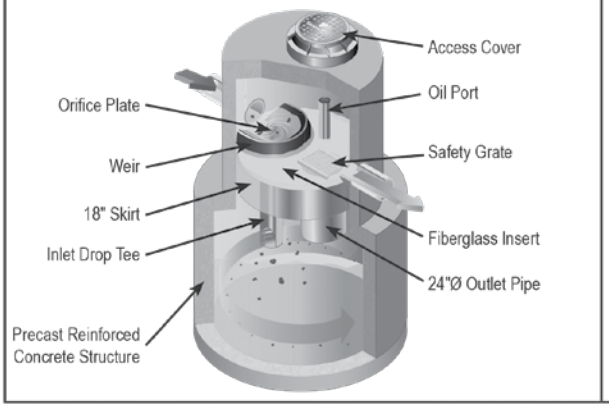
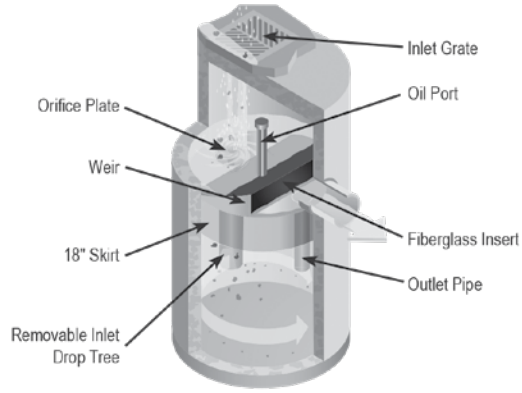


Figure 2.

Inlet Stormceptor



3 – Stormceptor Identification

Stormceptor is available in both precast concrete and fiberglass vessels, with precast concrete often being the dominant material of construction.

In the Stormceptor, a patented, engineered fiberglass insert separates the structure into an upper chamber and lower chamber. The lower chamber will remain full of water, as this is where the pollutants are sequestered for later removal. Multiple Stormceptor model (STC, OSR, EOS and MAX) configurations exist, each to be inspected and maintained in a similar fashion.

Each unit is easily identifiable as a Stormceptor by the trade name "Stormceptor" embossed on each access cover at the surface. To determine the location of "inlet" Stormceptor units with horizontal catch basin inlet, look down into the grate as the Stormceptor insert will be visible. The name "Stormceptor" is not embossed on inlet models due to the variability of inlet grates used/approved across North America.

Once the location of the Stormceptor is determined, the model number may be identified by comparing the measured depth from the fiberglass insert level at the outlet pipe's invert (water level) to the bottom of the tank using Table 1.

In addition, starting in 1996 a metal serial number tag containing the model number has been affixed to the inside of the unit, on the fiberglass insert. If the unit does not have a serial number, or if there is any uncertainty regarding the size of the unit using depth measurements, please contact your local Contech Representative for assistance.

Sizes/Models

Typical general dimensions and capacities of the standard precast STC, EOS and OSR Stormceptor models are provided in Tables 1 and 2. Typical rim to invert measurements are provided later in this document. The total depth for cleaning will be the sum of the depth from outlet pipe invert (generally the water level) to rim (grade) and the depth from outlet pipe invert to the precast bottom of the unit. Note that depths and capacities may vary slightly between regions.

Table 1. Stormceptor Dimensions - Insert to Base of Structure

STC Model	Insert to Base (in.)
450	60
900	55
1200	71
1800	105
2400	94
3600	134
4800	128
6000	150
7200	134
11000*	128
13000*	150
16000*	134

Notes:

1. Depth Below Pipe Inlet Invert to the Inside Top Base Slab can vary slightly by manufacturing facility, and can be modified to accommodate specific site designs, pollutant loads or site conditions. Contact your local representative for assistance.

**Consist of two chamber structures in series.*

Table 2. Storage Capacities

STC Model	Hydrocarbon Storage Capacity (gal)	Sediment Capacity (ft^3)
450	86	46
900	251	89
1200	251	127
1800	251	207
2400	840	205
3600	840	373
4800	909	543
6000	909	687
7200	1059	839
11000*	2797	1089
13000*	2797	1374
16000*	3055	1677

Notes:

1. Hydrocarbon and Sediment capacities can be modified to accommodate specific site design requirements, contact your local representative for assistance.

**Consist of two chamber structures in series*

4 – Stormceptor Inspection and Maintenance

Regular inspection and maintenance is a proven, cost-effective way to maximize water resource protection for all stormwater pollution control practices, and is required to insure proper functioning of the Stormceptor. Both inspection and maintenance of the Stormceptor is easily performed from the surface. Stormceptor's patented technology has no moving parts, simplifying the inspection and maintenance process.

Please refer to the following information and guidelines before conducting inspection and maintenance activities.

When is inspection needed?

- Post-construction inspection is required prior to putting the Stormceptor into service.
- Routine inspections are recommended during the first year of operation to accurately assess the sediment accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

When is maintenance cleaning needed?

- For optimum performance, the unit should be cleaned out once the sediment depth reaches the recommended maintenance sediment depth, which is approximately 15% of the unit's total storage capacity (see Table 3). The frequency should be adjusted based on historical inspection results due to variable site pollutant loading.
- Sediment removal is easier when removed on a regular basis at or prior to the recommended maintenance sediment depths, as sediment build-up can compact making removal more difficult.
- The unit should be cleaned out immediately after an oil, fuel or chemical spill.

What conditions can compromise Stormceptor performance?

- If construction sediment and debris is not removed prior to activating the Stormceptor unit, maintenance frequency may be reduced.
- If the system is not maintained regularly and fills with sediment and debris beyond the capacity as indicated in Table 2, pollutant removal efficiency may be reduced.
- If an oil spill(s) exceeds the oil capacity of the system, subsequent spills may not be captured.
- If debris clogs the inlet of the system, removal efficiency of sediment and hydrocarbons may be reduced.
- If a downstream blockage occurs, a backwater condition may occur for the Stormceptor and removal efficiency of sediment and hydrocarbons may be reduced.

What training is required?

The Stormceptor is to be inspected and maintained by professional vacuum cleaning service providers with experience in the maintenance of underground tanks, sewers and catch basins.

For typical inspection and maintenance activities, no specific supplemental training is required

Recommended Stormceptor Inspection Procedure:

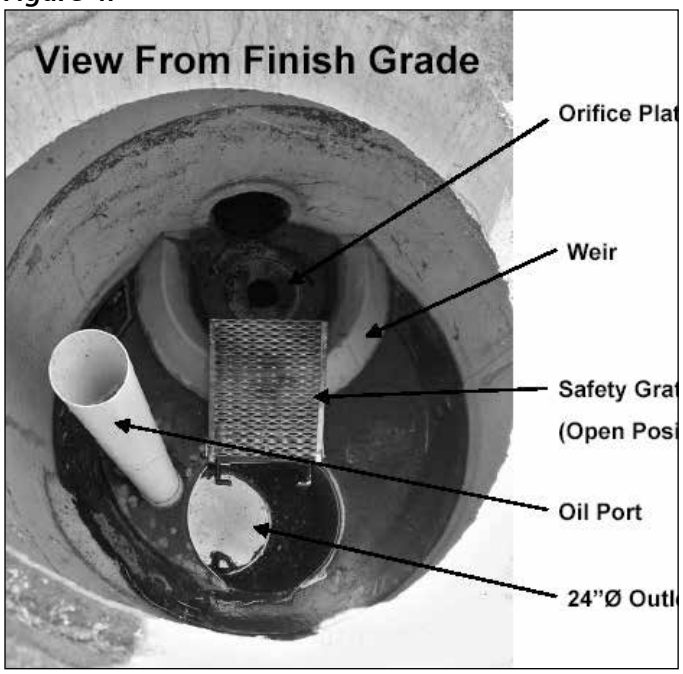
- Stormceptor is to be inspected from grade through a standard surface manhole access cover.
- Sediment and oil depth inspections are performed with a sediment probe and oil dipstick.
- Oil depth is measured through the oil inspection port, either a 4-inch or 6-inch diameter port.
- Sediment depth can be measured through the oil inspection port or the 24-inch diameter outlet riser pipe.
- Inspections also involve a visual inspection of the internal components of the system.

What equipment is typically required for maintenance?

- Vacuum truck equipped with water hose and jet nozzle
- Small pump and tubing for oil removal
- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Gas analyzer, respiratory gear, hoist and safety harness for specially trained personnel if confined space entry is required

Figure 3.

Figure 4.



Recommended Stormceptor Maintenance Procedure

Maintenance of Stormceptor is performed using a vacuum truck. No entry into the unit is required for maintenance. DO NOT ENTER THE STORMCEPTOR CHAMBER unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational Safety and Health Regulations (e.g. 29 CFR 1910.146). Without the proper equipment, training and permit, entry into confined spaces can result in serious bodily harm and potentially death. Consult local and/or state regulations to determine the requirements for confined space entry. Be aware, and take precaution that the Stormceptor fiberglass insert may be slippery. In addition, be aware that some units do not have a safety grate to cover the outlet riser pipe that leads to the submerged, lower chamber.

- Ideally maintenance should be conducted during dry weather conditions when no flow is entering the unit.
- Stormceptor is to be maintained through a standard surface manhole access cover.
- Insert the oil dipstick into the oil inspection port. If oil is present, pump off the oil layer into separate containment using a small pump and tubing.
- Maintenance cleaning of accumulated sediment is performed with a vacuum truck.
  - » For 6-ft diameter models and larger, the vacuum hose is inserted into the lower chamber via the 24-inch outlet riser pipe (See Fig. 5).
  - » For 4-ft diameter model, the removable drop tee is lifted out, and the vacuum hose is inserted into the lower chamber via the 12-inch drop tee hole (See Fig. 6).

Figure 5.

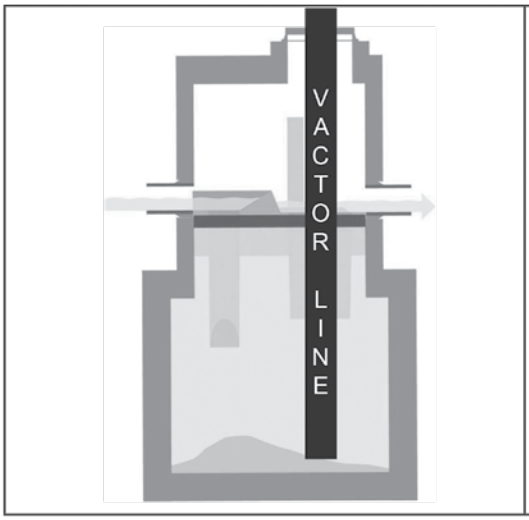
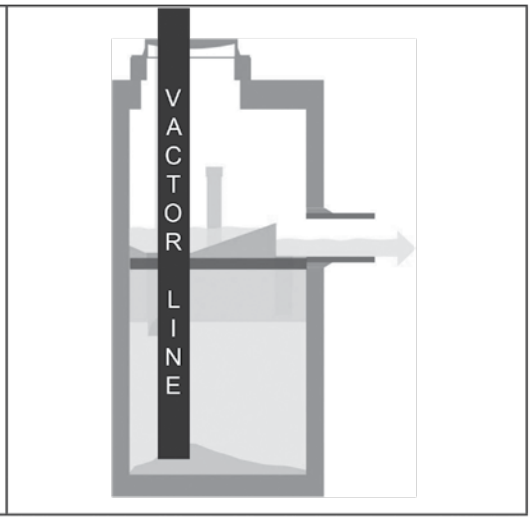


Figure 6.



- Using the vacuum hose, decant the water from the lower chamber into a separate containment tank or to the sanitary sewer, if permitted by the local regulating authority.
- Remove the sediment sludge from the bottom of the unit using the vacuum hose. For large Stormceptor units, a flexible hose is often connected to the primary vacuum line for ease of movement in the lower chamber.
- Units that have not been maintained regularly, have surpassed the maximum recommended sediment capacity, or contain damaged components may require manned entry by trained personnel using safe and proper confined space entry procedures.

What is required for proper disposal?

The requirements for the disposal of material removed from Stormceptor units are similar to that of any other stormwater treatment Best Management Practices (BMP). Local guidelines should be consulted prior to disposal of the separator contents. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste. This could be site and pollutant dependent. In some cases, approval from the disposal facility operator/agency may be required.

What about oil spills?

Stormceptor is often implemented in areas where there is high potential for oil, fuel or other hydrocarbon or chemical spills. Stormceptor units should be cleaned immediately after a spill occurs by a licensed liquid waste hauler. You should also notify the appropriate regulatory agencies as required in the event of a spill.

What if I see an oil rainbow or sheen at the Stormceptor outlet?

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a hydrocarbon rainbow or sheen can be seen at very small oil concentrations (< 10 ppm). Stormceptor is effective at removing 95% of free oil, and the appearance of a sheen at the outlet with high influent oil concentrations does not mean unit is not working to this level of removal. In addition, if the influent oil is emulsified, the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified or dissolved oil conditions.

What factors affect the costs involved with inspection/maintenance?

The Vacuum Service Industry for stormwater drainage and sewer systems is a well-established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean Stormceptor units will vary. Inspection and maintenance costs are most often based on unit size, the number of units on a site, sediment/oil/hazardous material loads, transportation distances, tipping fees, disposal requirements and other local regulations.

What factors predict maintenance frequency?

Maintenance frequency will vary with the amount of pollution on your site (number of hydrocarbon spills, amount of sediment, site activity and use, etc.). It is recommended that the frequency of maintenance be increased or reduced based on local conditions. If the sediment load is high from an unstable site or sediment loads transported from upstream catchments, maintenance may be required semi-annually. Conversely once a site has stabilized, maintenance may be required less frequently (for example: two to seven year, site and situation dependent). Maintenance should be performed immediately after an oil spill or once the sediment depth in Stormceptor reaches the value specified in Table 3 based on the unit size.

Table 3. Recommended Sediment Depths Indicating Maintenance

STC Model	Maintenance Sediment Depth (in)
450	8
900	8
1200	10
1800	15
2400	12
3600	17
4800	15
6000	18
7200	15
11000*	17
13000*	20
16000*	17

Notes:

1. The values above are for typical standard units.

** Per structure.*

Replacement parts

Since there are no moving parts during operation in a Stormceptor, broken, damaged, or worn parts are not typically encountered. Therefore, inspection and maintenance activities are generally focused on pollutant removal. However, if replacements parts are necessary, they may be purchased by contacting your local Contech Representative or call 800-338-1122.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to Stormceptor's long and effective service life.

Stormceptor Inspection and Maintenance Log

Stormceptor Model No: _____

Allowable Sediment Depth: _____

Serial Number: _____

Installation Date: _____

Location Description of Unit: _____

Other Comments: _____

5 – Contact Information

Questions regarding the Stormceptor can be addressed by contacting your local Contech representative or by calling 800-338-1122.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

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URBANGREEN™

CMP Detention and Infiltration Inspection and Maintenance Guide

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Maintenance

Underground storm water detention and retention systems should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size or configuration of the system.

Inspection

Inspection is the key to effective maintenance and is easily performed. Contech Engineered Solutions recommends ongoing quarterly inspections of the accumulated sediment. Sediment deposition and transport may vary from year to year and quarterly inspections will help insure that systems are cleaned out at the appropriate time. Inspections should be performed more often in the winter months in climates where sanding operations may lead to rapid accumulations, or in equipment washdown areas. It is very useful to keep a record of each inspection. A sample inspection log is included for your use.

Systems should be cleaned when inspection reveals that accumulated sediment or trash is clogging the discharge orifice. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Cleaning

Maintaining an underground detention or retention system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities.

Inspection & Maintenance Log Sample Template

_____ " Diameter System			Location:		
Date	**Depth of Sediment**	**Accumulated Trash**	**Maintenance Performed**	**Maintenance Personnel**	**Comments**

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Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other Contech division offerings, visit ContechES.com or call 800.338.1122

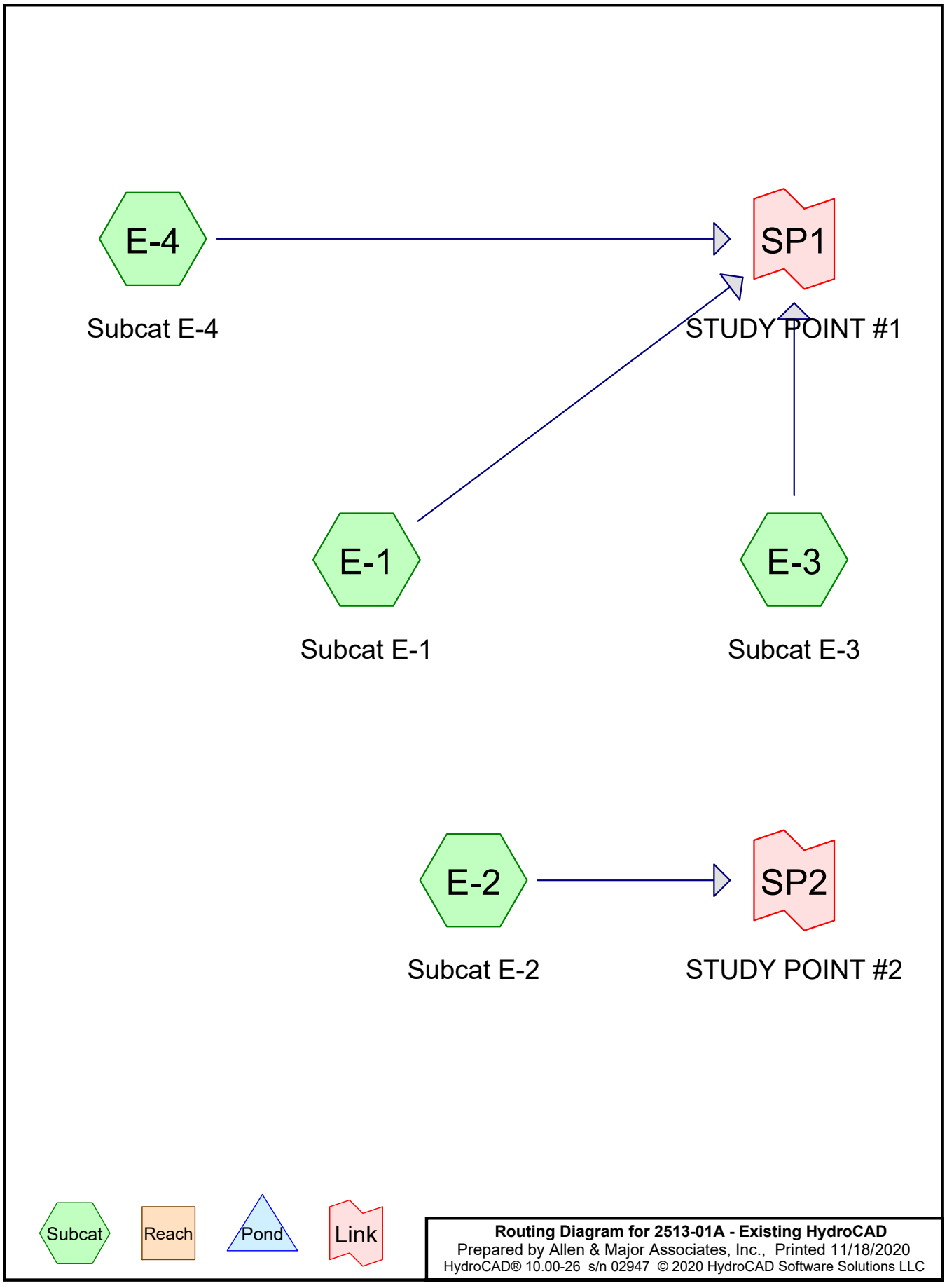
Support

- Drawings and specifications are available at contechstormwater.com.
- Site-specific design support is available from our engineers.

ug_cmp_design guide 06/12

SECTION 3.0

HYROCAD WORKSHEETS……EXISTING CONDITIONS



Routing Diagram for 2513-01A - Existing HydroCAD
Prepared by Allen & Major Associates, Inc., Printed 11/18/2020

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
132,491	39	>75% Grass cover, Good, HSG A (E-1, E-2, E-3, E-4)
22,022	61	>75% Grass cover, Good, HSG B (E-1, E-3, E-4)
53,625	74	>75% Grass cover, Good, HSG C (E-1, E-2, E-3, E-4)
14,191	98	Paved parking, HSG A (E-1, E-4)
2,285	98	Paved parking, HSG B (E-1, E-4)
12,868	98	Paved parking, HSG C (E-1, E-2, E-4)
2,473	98	Roofs, HSG A (E-1)
1,507	98	Roofs, HSG B (E-1)
2,473	98	Roofs, HSG C (E-1, E-2)
18,912	30	Woods, Good, HSG A (E-1, E-2, E-3)
30,169	70	Woods, Good, HSG C (E-2, E-3)
293,017	**57**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
168,067	HSG A	E-1, E-2, E-3, E-4
25,814	HSG B	E-1, E-3, E-4
99,136	HSG C	E-1, E-2, E-3, E-4
0	HSG D	
0	Other	
293,017		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
132,491	22,022	53,625	0	0	208,138	>75% Grass cover, Good	
14,191	2,285	12,868	0	0	29,344	Paved parking	
2,473	1,507	2,473	0	0	6,453	Roofs	
18,912	0	30,169	0	0	49,081	Woods, Good	
168,067	**25,814**	**99,136**	**0**	**0**	**293,017**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 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: Subcat E-1 Runoff Area=152,693 sf 15.32% Impervious Runoff Depth=0.28"
Flow Length=430' Tc=8.1 min CN=56 Runoff=0.42 cfs 3,518 cf

Subcatchment E-2: Subcat E-2 Runoff Area=74,035 sf 2.79% Impervious Runoff Depth=0.60"
Flow Length=347' Tc=9.2 min CN=65 Runoff=0.81 cfs 3,674 cf

Subcatchment E-3: Subcat E-3 Runoff Area=27,095 sf 0.00% Impervious Runoff Depth=0.01"
Flow Length=308' Tc=7.5 min CN=41 Runoff=0.00 cfs 15 cf

Subcatchment E-4: Subcat E-4 Runoff Area=39,194 sf 26.37% Impervious Runoff Depth=0.28"
Flow Length=850' Tc=32.5 min CN=56 Runoff=0.08 cfs 903 cf

Link SP1: STUDY POINT #1 Inflow=0.45 cfs 4,436 cf
Primary=0.45 cfs 4,436 cf

Link SP2: STUDY POINT #2 Inflow=0.81 cfs 3,674 cf
Primary=0.81 cfs 3,674 cf

Total Runoff Area = 293,017 sf Runoff Volume = 8,110 cf Average Runoff Depth = 0.33"
87.78% Pervious = 257,219 sf 12.22% Impervious = 35,797 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.42 cfs @ 12.34 hrs, Volume= 3,518 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
87,302	39	>75% Grass cover, Good, HSG A
17,681	61	>75% Grass cover, Good, HSG B
23,223	74	>75% Grass cover, Good, HSG C
4,969	98	Paved parking, HSG A
1,333	98	Paved parking, HSG B
11,496	98	Paved parking, HSG C
2,473	98	Roofs, HSG A
1,507	98	Roofs, HSG B
1,615	98	Roofs, HSG C
1,094	30	Woods, Good, HSG A
152,693	56	Weighted Average
129,299		84.68% Pervious Area
23,393		15.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.16		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		**Shallow Concentrated Flow, C TO D** Grassed Waterway Kv= 15.0 fps
8.1	430	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.81 cfs @ 12.16 hrs, Volume= 3,674 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
9,480	39	>75% Grass cover, Good, HSG A
27,536	74	>75% Grass cover, Good, HSG C
1,211	98	Paved parking, HSG C
857	98	Roofs, HSG C
5,722	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
74,035	65	Weighted Average
71,966		97.21% Pervious Area
2,069		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.00 cfs @ 22.84 hrs, Volume= 15 cf, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
9,181	39	>75% Grass cover, Good, HSG A
2,143	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
12,096	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
27,095	41	Weighted Average
27,095		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		**Shallow Concentrated Flow, C TO D** Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		**Shallow Concentrated Flow, D TO E** Paved Kv= 20.3 fps
7.5	308	Total			

Summary for Subcatchment E-4: Subcat E-4

Runoff = 0.08 cfs @ 12.70 hrs, Volume= 903 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
26,529	39	>75% Grass cover, Good, HSG A
2,198	61	>75% Grass cover, Good, HSG B
131	74	>75% Grass cover, Good, HSG C
9,222	98	Paved parking, HSG A
952	98	Paved parking, HSG B
161	98	Paved parking, HSG C
39,194	56	Weighted Average
28,859		73.63% Pervious Area
10,335		26.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0090	0.11		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

Summary for Link SP1: STUDY POINT #1

Inflow Area = 218,982 sf, 15.40% Impervious, Inflow Depth = 0.24" for 2-year event
Inflow = 0.45 cfs @ 12.37 hrs, Volume= 4,436 cf
Primary = 0.45 cfs @ 12.37 hrs, Volume= 4,436 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Summary for Link SP2: STUDY POINT #2

Inflow Area = 74,035 sf, 2.79% Impervious, Inflow Depth = 0.60" for 2-year event
Inflow = 0.81 cfs @ 12.16 hrs, Volume= 3,674 cf
Primary = 0.81 cfs @ 12.16 hrs, Volume= 3,674 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 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: Subcat E-1 Runoff Area=152,693 sf 15.32% Impervious Runoff Depth=0.93"
Flow Length=430' Tc=8.1 min CN=56 Runoff=2.80 cfs 11,838 cf

Subcatchment E-2: Subcat E-2 Runoff Area=74,035 sf 2.79% Impervious Runoff Depth=1.51"
Flow Length=347' Tc=9.2 min CN=65 Runoff=2.50 cfs 9,310 cf

Subcatchment E-3: Subcat E-3 Runoff Area=27,095 sf 0.00% Impervious Runoff Depth=0.22"
Flow Length=308' Tc=7.5 min CN=41 Runoff=0.03 cfs 501 cf

Subcatchment E-4: Subcat E-4 Runoff Area=39,194 sf 26.37% Impervious Runoff Depth=0.93"
Flow Length=850' Tc=32.5 min CN=56 Runoff=0.43 cfs 3,039 cf

Link SP1: STUDY POINT #1 Inflow=2.85 cfs 15,378 cf
Primary=2.85 cfs 15,378 cf

Link SP2: STUDY POINT #2 Inflow=2.50 cfs 9,310 cf
Primary=2.50 cfs 9,310 cf

Total Runoff Area = 293,017 sf Runoff Volume = 24,688 cf Average Runoff Depth = 1.01"
87.78% Pervious = 257,219 sf 12.22% Impervious = 35,797 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 2.80 cfs @ 12.14 hrs, Volume= 11,838 cf, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
87,302	39	>75% Grass cover, Good, HSG A
17,681	61	>75% Grass cover, Good, HSG B
23,223	74	>75% Grass cover, Good, HSG C
4,969	98	Paved parking, HSG A
1,333	98	Paved parking, HSG B
11,496	98	Paved parking, HSG C
2,473	98	Roofs, HSG A
1,507	98	Roofs, HSG B
1,615	98	Roofs, HSG C
1,094	30	Woods, Good, HSG A
152,693	56	Weighted Average
129,299		84.68% Pervious Area
23,393		15.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.16		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		**Shallow Concentrated Flow, C TO D** Grassed Waterway Kv= 15.0 fps
8.1	430	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 2.50 cfs @ 12.14 hrs, Volume= 9,310 cf, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
9,480	39	>75% Grass cover, Good, HSG A
27,536	74	>75% Grass cover, Good, HSG C
1,211	98	Paved parking, HSG C
857	98	Roofs, HSG C
5,722	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
74,035	65	Weighted Average
71,966		97.21% Pervious Area
2,069		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.03 cfs @ 12.47 hrs, Volume= 501 cf, Depth= 0.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
9,181	39	>75% Grass cover, Good, HSG A
2,143	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
12,096	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
27,095	41	Weighted Average
27,095		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		**Shallow Concentrated Flow, C TO D** Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		**Shallow Concentrated Flow, D TO E** Paved Kv= 20.3 fps
7.5	308	Total			

Summary for Subcatchment E-4: Subcat E-4

Runoff = 0.43 cfs @ 12.55 hrs, Volume= 3,039 cf, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
26,529	39	>75% Grass cover, Good, HSG A
2,198	61	>75% Grass cover, Good, HSG B
131	74	>75% Grass cover, Good, HSG C
9,222	98	Paved parking, HSG A
952	98	Paved parking, HSG B
161	98	Paved parking, HSG C
39,194	56	Weighted Average
28,859		73.63% Pervious Area
10,335		26.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0090	0.11		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

Summary for Link SP1: STUDY POINT #1

Inflow Area = 218,982 sf, 15.40% Impervious, Inflow Depth = 0.84" for 10-year event
Inflow = 2.85 cfs @ 12.14 hrs, Volume= 15,378 cf
Primary = 2.85 cfs @ 12.14 hrs, Volume= 15,378 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Summary for Link SP2: STUDY POINT #2

Inflow Area = 74,035 sf, 2.79% Impervious, Inflow Depth = 1.51" for 10-year event
Inflow = 2.50 cfs @ 12.14 hrs, Volume= 9,310 cf
Primary = 2.50 cfs @ 12.14 hrs, Volume= 9,310 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 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: Subcat E-1 Runoff Area=152,693 sf 15.32% Impervious Runoff Depth=1.60"
Flow Length=430' Tc=8.1 min CN=56 Runoff=5.47 cfs 20,388 cf

Subcatchment E-2: Subcat E-2 Runoff Area=74,035 sf 2.79% Impervious Runoff Depth=2.36"
Flow Length=347' Tc=9.2 min CN=65 Runoff=4.08 cfs 14,552 cf

Subcatchment E-3: Subcat E-3 Runoff Area=27,095 sf 0.00% Impervious Runoff Depth=0.56"
Flow Length=308' Tc=7.5 min CN=41 Runoff=0.16 cfs 1,264 cf

Subcatchment E-4: Subcat E-4 Runoff Area=39,194 sf 26.37% Impervious Runoff Depth=1.60"
Flow Length=850' Tc=32.5 min CN=56 Runoff=0.83 cfs 5,233 cf

Link SP1: STUDY POINT #1 Inflow=5.83 cfs 26,885 cf
Primary=5.83 cfs 26,885 cf

Link SP2: STUDY POINT #2 Inflow=4.08 cfs 14,552 cf
Primary=4.08 cfs 14,552 cf

Total Runoff Area = 293,017 sf Runoff Volume = 41,437 cf Average Runoff Depth = 1.70"
87.78% Pervious = 257,219 sf 12.22% Impervious = 35,797 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 5.47 cfs @ 12.13 hrs, Volume= 20,388 cf, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
87,302	39	>75% Grass cover, Good, HSG A
17,681	61	>75% Grass cover, Good, HSG B
23,223	74	>75% Grass cover, Good, HSG C
4,969	98	Paved parking, HSG A
1,333	98	Paved parking, HSG B
11,496	98	Paved parking, HSG C
2,473	98	Roofs, HSG A
1,507	98	Roofs, HSG B
1,615	98	Roofs, HSG C
1,094	30	Woods, Good, HSG A
152,693	56	Weighted Average
129,299		84.68% Pervious Area
23,393		15.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.16		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		**Shallow Concentrated Flow, C TO D** Grassed Waterway Kv= 15.0 fps
8.1	430	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 4.08 cfs @ 12.14 hrs, Volume= 14,552 cf, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
9,480	39	>75% Grass cover, Good, HSG A
27,536	74	>75% Grass cover, Good, HSG C
1,211	98	Paved parking, HSG C
857	98	Roofs, HSG C
5,722	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
74,035	65	Weighted Average
71,966		97.21% Pervious Area
2,069		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.16 cfs @ 12.31 hrs, Volume= 1,264 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
9,181	39	>75% Grass cover, Good, HSG A
2,143	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
12,096	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
27,095	41	Weighted Average
27,095		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		**Shallow Concentrated Flow, C TO D** Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		**Shallow Concentrated Flow, D TO E** Paved Kv= 20.3 fps
7.5	308	Total			

Summary for Subcatchment E-4: Subcat E-4

Runoff = 0.83 cfs @ 12.51 hrs, Volume= 5,233 cf, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
26,529	39	>75% Grass cover, Good, HSG A
2,198	61	>75% Grass cover, Good, HSG B
131	74	>75% Grass cover, Good, HSG C
9,222	98	Paved parking, HSG A
952	98	Paved parking, HSG B
161	98	Paved parking, HSG C
39,194	56	Weighted Average
28,859		73.63% Pervious Area
10,335		26.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0090	0.11		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

Summary for Link SP1: STUDY POINT #1

Inflow Area = 218,982 sf, 15.40% Impervious, Inflow Depth = 1.47" for 25-year event
Inflow = 5.83 cfs @ 12.13 hrs, Volume= 26,885 cf
Primary = 5.83 cfs @ 12.13 hrs, Volume= 26,885 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Summary for Link SP2: STUDY POINT #2

Inflow Area = 74,035 sf, 2.79% Impervious, Inflow Depth = 2.36" for 25-year event
Inflow = 4.08 cfs @ 12.14 hrs, Volume= 14,552 cf
Primary = 4.08 cfs @ 12.14 hrs, Volume= 14,552 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 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: Subcat E-1 Runoff Area=152,693 sf 15.32% Impervious Runoff Depth=3.27"
Flow Length=430' Tc=8.1 min CN=56 Runoff=12.07 cfs 41,587 cf

Subcatchment E-2: Subcat E-2 Runoff Area=74,035 sf 2.79% Impervious Runoff Depth=4.33"
Flow Length=347' Tc=9.2 min CN=65 Runoff=7.67 cfs 26,696 cf

Subcatchment E-3: Subcat E-3 Runoff Area=27,095 sf 0.00% Impervious Runoff Depth=1.59"
Flow Length=308' Tc=7.5 min CN=41 Runoff=0.85 cfs 3,599 cf

Subcatchment E-4: Subcat E-4 Runoff Area=39,194 sf 26.37% Impervious Runoff Depth=3.27"
Flow Length=850' Tc=32.5 min CN=56 Runoff=1.82 cfs 10,675 cf

Link SP1: STUDY POINT #1 Inflow=13.60 cfs 55,860 cf
Primary=13.60 cfs 55,860 cf

Link SP2: STUDY POINT #2 Inflow=7.67 cfs 26,696 cf
Primary=7.67 cfs 26,696 cf

Total Runoff Area = 293,017 sf Runoff Volume = 82,556 cf Average Runoff Depth = 3.38"
87.78% Pervious = 257,219 sf 12.22% Impervious = 35,797 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 12.07 cfs @ 12.12 hrs, Volume= 41,587 cf, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
87,302	39	>75% Grass cover, Good, HSG A
17,681	61	>75% Grass cover, Good, HSG B
23,223	74	>75% Grass cover, Good, HSG C
4,969	98	Paved parking, HSG A
1,333	98	Paved parking, HSG B
11,496	98	Paved parking, HSG C
2,473	98	Roofs, HSG A
1,507	98	Roofs, HSG B
1,615	98	Roofs, HSG C
1,094	30	Woods, Good, HSG A
152,693	56	Weighted Average
129,299		84.68% Pervious Area
23,393		15.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0600	0.16		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		**Shallow Concentrated Flow, C TO D** Grassed Waterway Kv= 15.0 fps
8.1	430	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 7.67 cfs @ 12.13 hrs, Volume= 26,696 cf, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
9,480	39	>75% Grass cover, Good, HSG A
27,536	74	>75% Grass cover, Good, HSG C
1,211	98	Paved parking, HSG C
857	98	Roofs, HSG C
5,722	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
74,035	65	Weighted Average
71,966		97.21% Pervious Area
2,069		2.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.85 cfs @ 12.13 hrs, Volume= 3,599 cf, Depth= 1.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
9,181	39	>75% Grass cover, Good, HSG A
2,143	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
12,096	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
27,095	41	Weighted Average
27,095		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		**Shallow Concentrated Flow, C TO D** Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		**Shallow Concentrated Flow, D TO E** Paved Kv= 20.3 fps
7.5	308	Total			

Summary for Subcatchment E-4: Subcat E-4

Runoff = 1.82 cfs @ 12.48 hrs, Volume= 10,675 cf, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
26,529	39	>75% Grass cover, Good, HSG A
2,198	61	>75% Grass cover, Good, HSG B
131	74	>75% Grass cover, Good, HSG C
9,222	98	Paved parking, HSG A
952	98	Paved parking, HSG B
161	98	Paved parking, HSG C
39,194	56	Weighted Average
28,859		73.63% Pervious Area
10,335		26.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.9	50	0.0090	0.11		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

Summary for Link SP1: STUDY POINT #1

Inflow Area = 218,982 sf, 15.40% Impervious, Inflow Depth = 3.06" for 100-year event
Inflow = 13.60 cfs @ 12.13 hrs, Volume= 55,860 cf
Primary = 13.60 cfs @ 12.13 hrs, Volume= 55,860 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

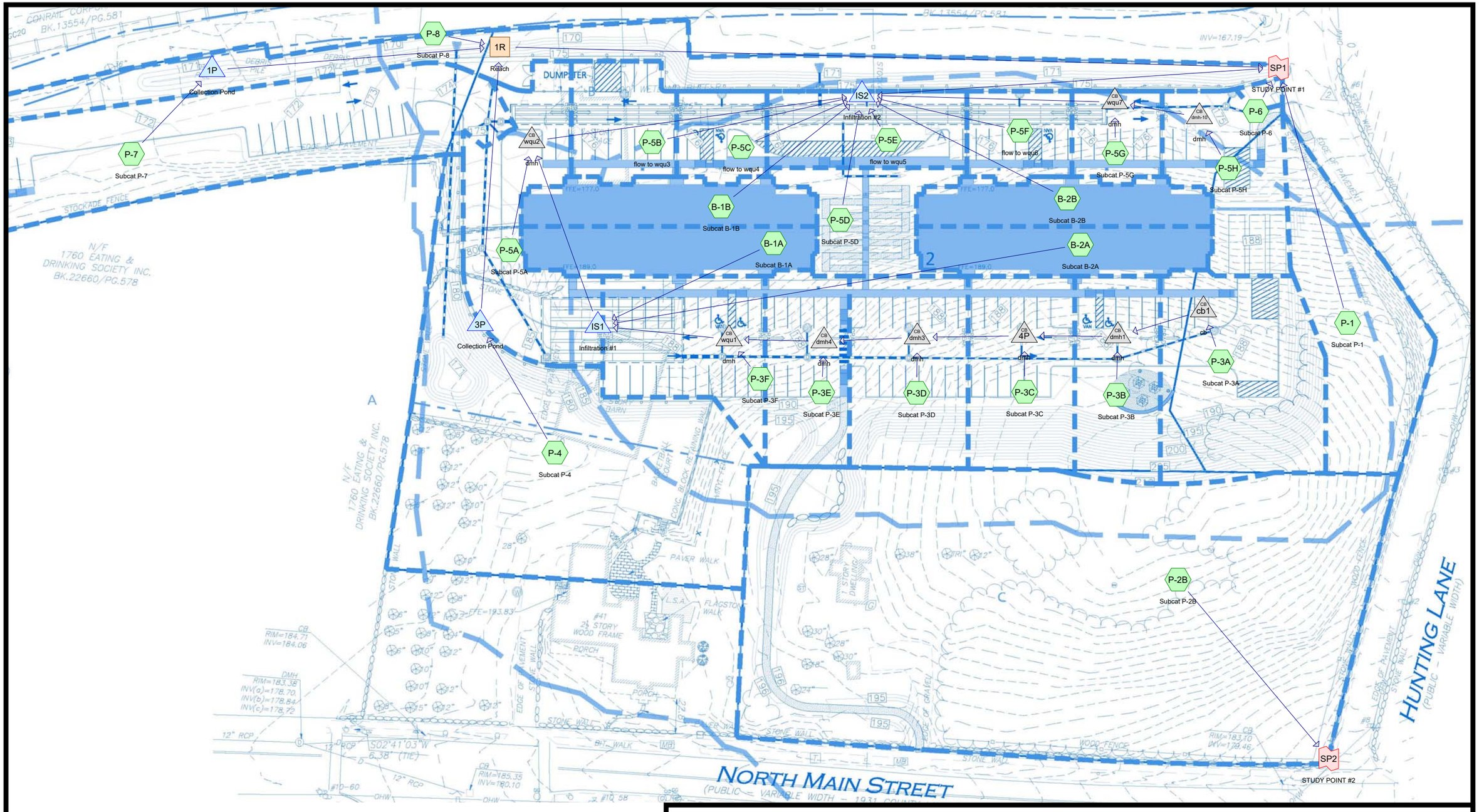
Summary for Link SP2: STUDY POINT #2

Inflow Area = 74,035 sf, 2.79% Impervious, Inflow Depth = 4.33" for 100-year event
Inflow = 7.67 cfs @ 12.13 hrs, Volume= 26,696 cf
Primary = 7.67 cfs @ 12.13 hrs, Volume= 26,696 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

SECTION 4.0

HYROCAD WORKSHEETS……PROPOSED CONDITIONS



Subcat | Reach | Pond | Link

Routing Diagram for 2513-01A - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc., Printed 11/18/2020

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
72,778	39	>75% Grass cover, Good, HSG A (P-1, P-2B, P-3A, P-3B, P-3C, P-3D, P-3E, P-3F, P-4, P-5A, P-5B, P-5C, P-5D, P-5E, P-5F, P-5G, P-5H, P-7, P-8)
14,481	61	>75% Grass cover, Good, HSG B (P-1, P-5A, P-5H, P-7, P-8)
54,830	74	>75% Grass cover, Good, HSG C (P-1, P-2B, P-4, P-5A, P-5B, P-7)
60,410	98	Paved parking, HSG A (P-2B, P-3A, P-3B, P-3C, P-3D, P-3E, P-3F, P-5A, P-5B, P-5C, P-5D, P-5E, P-5F, P-5G, P-5H, P-7)
11,333	98	Paved parking, HSG B (P-1, P-5A, P-5B, P-5C, P-5E, P-5G, P-5H, P-6, P-7, P-8)
11,756	98	Paved parking, HSG C (P-2B, P-4, P-5A, P-5B, P-7)
21,803	98	Roofs, HSG A (B-1A, B-1B, B-2A, B-2B, P-7)
2,380	98	Roofs, HSG C (B-1A, B-1B)
13,076	30	Woods, Good, HSG A (P-1, P-2B, P-3A)
30,169	70	Woods, Good, HSG C (P-1, P-2B)
293,017	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
168,067	HSG A	B-1A, B-1B, B-2A, B-2B, P-1, P-2B, P-3A, P-3B, P-3C, P-3D, P-3E, P-3F, P-4, P-5A, P-5B, P-5C, P-5D, P-5E, P-5F, P-5G, P-5H, P-7, P-8
25,814	HSG B	P-1, P-5A, P-5B, P-5C, P-5E, P-5G, P-5H, P-6, P-7, P-8
99,136	HSG C	B-1A, B-1B, P-1, P-2B, P-4, P-5A, P-5B, P-7
0	HSG D	
0	Other	
293,017		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
72,778	14,481	54,830	0	0	142,089	>75% Grass cover, Good	
60,410	11,333	11,756	0	0	83,499	Paved parking	
21,803	0	2,380	0	0	24,183	Roofs	
13,076	0	30,169	0	0	43,245	Woods, Good	
168,067	**25,814**	**99,136**	**0**	**0**	**293,017**	**TOTAL AREA**	

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	3P	172.50	171.50	100.0	0.0100	0.012	15.0	0.0	0.0
2	cb1	184.40	183.75	65.0	0.0100	0.013	12.0	0.0	0.0
3	dmh-10	171.30	170.85	71.0	0.0063	0.013	12.0	0.0	0.0
4	dmh1	183.65	183.03	62.0	0.0100	0.013	12.0	0.0	0.0
5	dmh2	182.93	182.20	73.0	0.0100	0.013	12.0	0.0	0.0
6	dmh3	181.95	181.29	66.0	0.0100	0.013	15.0	0.0	0.0
7	dmh4	181.19	180.64	55.0	0.0100	0.013	15.0	0.0	0.0
8	IS1	182.40	178.31	82.0	0.0499	0.013	12.0	0.0	0.0
9	IS2	171.55	171.25	9.0	0.0333	0.012	15.0	0.0	0.0
10	wqu1	179.89	179.63	26.0	0.0100	0.013	24.0	0.0	0.0
11	wqu2	170.84	170.70	7.0	0.0200	0.025	24.0	0.0	0.0
12	wqu7	170.75	170.70	8.0	0.0063	0.013	12.0	0.0	0.0

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment B-1A: Subcat B-1A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=2.96"
Tc=6.0 min CN=98 Runoff=0.41 cfs 1,448 cf

Subcatchment B-1B: Subcat B-1B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=2.96"
Tc=6.0 min CN=98 Runoff=0.39 cfs 1,363 cf

Subcatchment B-2A: Subcat B-2A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=2.96"
Tc=6.0 min CN=98 Runoff=0.41 cfs 1,448 cf

Subcatchment B-2B: Subcat B-2B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=2.96"
Tc=6.0 min CN=98 Runoff=0.39 cfs 1,363 cf

Subcatchment P-1: Subcat P-1 Runoff Area=11,595 sf 0.33% Impervious Runoff Depth=0.11"
Flow Length=424' Tc=8.0 min CN=49 Runoff=0.00 cfs 103 cf

Subcatchment P-2B: Subcat P-2B Runoff Area=73,254 sf 1.81% Impervious Runoff Depth=0.60"
Flow Length=347' Tc=9.2 min CN=65 Runoff=0.80 cfs 3,635 cf

Subcatchment P-3A: Subcat P-3A Runoff Area=13,530 sf 32.33% Impervious Runoff Depth=0.28"
Tc=6.0 min CN=56 Runoff=0.04 cfs 312 cf

Subcatchment P-3B: Subcat P-3B Runoff Area=7,310 sf 48.64% Impervious Runoff Depth=0.73"
Tc=6.0 min CN=68 Runoff=0.12 cfs 443 cf

Subcatchment P-3C: Subcat P-3C Runoff Area=8,624 sf 49.20% Impervious Runoff Depth=0.73"
Tc=6.0 min CN=68 Runoff=0.14 cfs 523 cf

Subcatchment P-3D: Subcat P-3D Runoff Area=9,535 sf 52.42% Impervious Runoff Depth=0.82"
Tc=6.0 min CN=70 Runoff=0.19 cfs 653 cf

Subcatchment P-3E: Subcat P-3E Runoff Area=6,815 sf 59.34% Impervious Runoff Depth=1.03"
Tc=6.0 min CN=74 Runoff=0.18 cfs 586 cf

Subcatchment P-3F: Subcat P-3F Runoff Area=8,965 sf 80.23% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=86 Runoff=0.44 cfs 1,364 cf

Subcatchment P-4: Subcat P-4 Runoff Area=32,379 sf 17.90% Impervious Runoff Depth=0.87"
Tc=6.0 min CN=71 Runoff=0.68 cfs 2,353 cf

Subcatchment P-5A: Subcat P-5A Runoff Area=10,690 sf 65.28% Impervious Runoff Depth=1.99"
Tc=6.0 min CN=88 Runoff=0.56 cfs 1,771 cf

Subcatchment P-5B: flow to wqu3 Runoff Area=5,018 sf 90.53% Impervious Runoff Depth=2.44"
Tc=6.0 min CN=93 Runoff=0.32 cfs 1,019 cf

Subcatchment P-5C: flow to wqu4 Runoff Area=3,335 sf 77.86% Impervious Runoff Depth=1.75"
Tc=6.0 min CN=85 Runoff=0.16 cfs 486 cf

Subcatchment P-5D: Subcat P-5D Runoff Area=5,493 sf 31.16% Impervious Runoff Depth=0.31"
Tc=6.0 min CN=57 Runoff=0.02 cfs 140 cf

Subcatchment P-5E: flow to wqu5 Runoff Area=6,404 sf 94.96% Impervious Runoff Depth=2.64"
Tc=6.0 min CN=95 Runoff=0.43 cfs 1,406 cf

Subcatchment P-5F: flow to wqu6 Runoff Area=3,883 sf 87.69% Impervious Runoff Depth=2.25"
Tc=6.0 min CN=91 Runoff=0.23 cfs 728 cf

Subcatchment P-5G: Subcat P-5G Runoff Area=3,335 sf 87.45% Impervious Runoff Depth=2.25"
Tc=6.0 min CN=91 Runoff=0.20 cfs 625 cf

Subcatchment P-5H: Subcat P-5H Runoff Area=7,488 sf 40.45% Impervious Runoff Depth=0.60"
Tc=6.0 min CN=65 Runoff=0.09 cfs 372 cf

Subcatchment P-6: Subcat P-6 Runoff Area=424 sf 100.00% Impervious Runoff Depth=2.96"
Tc=6.0 min CN=98 Runoff=0.03 cfs 105 cf

Subcatchment P-7: Subcat P-7 Runoff Area=29,242 sf 60.18% Impervious Runoff Depth=1.09"
Flow Length=178' Tc=9.4 min CN=75 Runoff=0.72 cfs 2,649 cf

Subcatchment P-8: Subcat P-8 Runoff Area=22,888 sf 0.10% Impervious Runoff Depth=0.13"
Flow Length=852' Tc=30.4 min CN=50 Runoff=0.01 cfs 241 cf

Reach 1R: Reach Inflow=0.42 cfs 2,336 cf
Outflow=0.42 cfs 2,336 cf

Pond 1P: Collection Pond Peak Elev=170.72' Storage=731 cf Inflow=0.72 cfs 2,649 cf
Outflow=0.42 cfs 2,094 cf

Pond 3P: Collection Pond Peak Elev=173.50' Storage=1,511 cf Inflow=0.68 cfs 2,353 cf
Discarded=0.02 cfs 1,764 cf Primary=0.00 cfs 0 cf Outflow=0.02 cfs 1,764 cf

Pond cb1: cb Peak Elev=184.50' Inflow=0.04 cfs 312 cf
12.0" Round Culvert n=0.013 L=65.0' S=0.0100 '/' Outflow=0.04 cfs 312 cf

Pond dmh-10: dmh Peak Elev=171.64' Inflow=0.09 cfs 372 cf
12.0" Round Culvert n=0.013 L=71.0' S=0.0063 '/' Outflow=0.09 cfs 372 cf

Pond dmh1: dmh Peak Elev=183.84' Inflow=0.14 cfs 755 cf
12.0" Round Culvert n=0.013 L=62.0' S=0.0100 '/' Outflow=0.14 cfs 755 cf

Pond dmh2: dmh Peak Elev=183.19' Inflow=0.29 cfs 1,277 cf
12.0" Round Culvert n=0.013 L=73.0' S=0.0100 '/' Outflow=0.29 cfs 1,277 cf

Pond dmh3: dmh Peak Elev=182.27' Inflow=0.47 cfs 1,931 cf
15.0" Round Culvert n=0.013 L=66.0' S=0.0100 '/' Outflow=0.47 cfs 1,931 cf

Pond dmh4: dmh Peak Elev=181.57' Inflow=0.64 cfs 2,516 cf
15.0" Round Culvert n=0.013 L=55.0' S=0.0100 '/' Outflow=0.64 cfs 2,516 cf

Pond IS1: Infiltration #1 Peak Elev=178.67' Storage=3,086 cf Inflow=1.90 cfs 6,776 cf
Discarded=0.10 cfs 6,776 cf Primary=0.00 cfs 0 cf Outflow=0.10 cfs 6,776 cf

Pond IS2: Infiltration #2 Peak Elev=171.64' Storage=4,009 cf Inflow=2.77 cfs 9,274 cf
Discarded=0.16 cfs 9,037 cf Primary=0.03 cfs 237 cf Outflow=0.20 cfs 9,274 cf

Pond wqu1: dmh Peak Elev=180.34' Inflow=1.08 cfs 3,881 cf
24.0" Round Culvert n=0.013 L=26.0' S=0.0100 '/' Outflow=1.08 cfs 3,881 cf

Pond wqu2: dmh Peak Elev=171.64' Inflow=0.56 cfs 1,771 cf
24.0" Round Culvert n=0.025 L=7.0' S=0.0200 '/' Outflow=0.56 cfs 1,773 cf

Pond wqu7: dmh Peak Elev=171.64' Inflow=0.29 cfs 997 cf
12.0" Round Culvert n=0.013 L=8.0' S=0.0063 '/' Outflow=0.29 cfs 997 cf

Link SP1: STUDY POINT #1 Inflow=0.43 cfs 2,780 cf
Primary=0.43 cfs 2,780 cf

Link SP2: STUDY POINT #2 Inflow=0.80 cfs 3,635 cf
Primary=0.80 cfs 3,635 cf

Total Runoff Area = 293,017 sf Runoff Volume = 25,136 cf Average Runoff Depth = 1.03"
63.25% Pervious = 185,334 sf 36.75% Impervious = 107,683 sf

Summary for Subcatchment B-1A: Subcat B-1A

Runoff = 0.41 cfs @ 12.08 hrs, Volume= 1,448 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
4,811	98	Roofs, HSG A
1,064	98	Roofs, HSG C
5,875	98	Weighted Average
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-1B: Subcat B-1B

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 1,363 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
4,214	98	Roofs, HSG A
1,316	98	Roofs, HSG C
5,530	98	Weighted Average
5,530		100.00% Impervious Area

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

Summary for Subcatchment B-2A: Subcat B-2A

Runoff = 0.41 cfs @ 12.08 hrs, Volume= 1,448 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
5,875	98	Roofs, HSG A
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-2B: Subcat B-2B

Runoff = 0.39 cfs @ 12.08 hrs, Volume= 1,363 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
5,530	98	Roofs, HSG A
5,530		100.00% Impervious Area

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

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.00 cfs @ 13.71 hrs, Volume= 103 cf, Depth= 0.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
2,665	39	>75% Grass cover, Good, HSG A
1,275	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
38	98	Paved parking, HSG B
3,940	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
11,595	49	Weighted Average
11,556		99.67% Pervious Area
38		0.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1400	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		**Shallow Concentrated Flow, C TO D** Paved Kv= 20.3 fps
8.0	424	Total			

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 0.80 cfs @ 12.16 hrs, Volume= 3,635 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
8,707	39	>75% Grass cover, Good, HSG A
28,468	74	>75% Grass cover, Good, HSG C
189	98	Paved parking, HSG A
1,137	98	Paved parking, HSG C
5,524	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
73,254	65	Weighted Average
71,928		98.19% Pervious Area
1,325		1.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 0.04 cfs @ 12.31 hrs, Volume= 312 cf, Depth= 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
5,544	39	>75% Grass cover, Good, HSG A
4,374	98	Paved parking, HSG A
3,612	30	Woods, Good, HSG A
13,530	56	Weighted Average
9,155		67.67% Pervious Area
4,374		32.33% Impervious Area

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

Summary for Subcatchment P-3B: Subcat P-3B

Runoff = 0.12 cfs @ 12.11 hrs, Volume= 443 cf, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
3,755	39	>75% Grass cover, Good, HSG A
3,556	98	Paved parking, HSG A
7,310	68	Weighted Average
3,755		51.36% Pervious Area
3,556		48.64% Impervious Area

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

Summary for Subcatchment P-3C: Subcat P-3C

Runoff = 0.14 cfs @ 12.11 hrs, Volume= 523 cf, Depth= 0.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
4,381	39	>75% Grass cover, Good, HSG A
4,243	98	Paved parking, HSG A
8,624	68	Weighted Average
4,381		50.80% Pervious Area
4,243		49.20% Impervious Area

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

Summary for Subcatchment P-3D: Subcat P-3D

Runoff = 0.19 cfs @ 12.10 hrs, Volume= 653 cf, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
4,537	39	>75% Grass cover, Good, HSG A
4,998	98	Paved parking, HSG A
9,535	70	Weighted Average
4,537		47.58% Pervious Area
4,998		52.42% Impervious Area

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

Summary for Subcatchment P-3E: Subcat P-3E

Runoff = 0.18 cfs @ 12.10 hrs, Volume= 586 cf, Depth= 1.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
2,771	39	>75% Grass cover, Good, HSG A
4,044	98	Paved parking, HSG A
6,815	74	Weighted Average
2,771		40.66% Pervious Area
4,044		59.34% Impervious Area

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

Summary for Subcatchment P-3F: Subcat P-3F

Runoff = 0.44 cfs @ 12.09 hrs, Volume= 1,364 cf, Depth= 1.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
1,772	39	>75% Grass cover, Good, HSG A
7,192	98	Paved parking, HSG A
8,965	86	Weighted Average
1,772		19.77% Pervious Area
7,192		80.23% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.68 cfs @ 12.10 hrs, Volume= 2,353 cf, Depth= 0.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
6,551	39	>75% Grass cover, Good, HSG A
20,031	74	>75% Grass cover, Good, HSG C
5,797	98	Paved parking, HSG C
32,379	71	Weighted Average
26,582		82.10% Pervious Area
5,797		17.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Assumed**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-5A: Subcat P-5A

Runoff = 0.56 cfs @ 12.09 hrs, Volume= 1,771 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
547	39	>75% Grass cover, Good, HSG A
88	61	>75% Grass cover, Good, HSG B
3,077	74	>75% Grass cover, Good, HSG C
646	98	Paved parking, HSG A
1,804	98	Paved parking, HSG B
4,528	98	Paved parking, HSG C
10,690	88	Weighted Average
3,712		34.72% Pervious Area
6,978		65.28% Impervious Area

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

Summary for Subcatchment P-5B: flow to wqu3

Runoff = 0.32 cfs @ 12.09 hrs, Volume= 1,019 cf, Depth= 2.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
366	39	>75% Grass cover, Good, HSG A
109	74	>75% Grass cover, Good, HSG C
655	98	Paved parking, HSG A
3,712	98	Paved parking, HSG B
175	98	Paved parking, HSG C
5,018	93	Weighted Average
475		9.47% Pervious Area
4,543		90.53% Impervious Area

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

Summary for Subcatchment P-5C: flow to wqu4

Runoff = 0.16 cfs @ 12.09 hrs, Volume= 486 cf, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
738	39	>75% Grass cover, Good, HSG A
1,556	98	Paved parking, HSG A
1,041	98	Paved parking, HSG B
3,335	85	Weighted Average
738		22.14% Pervious Area
2,597		77.86% Impervious Area

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

Summary for Subcatchment P-5D: Subcat P-5D

Runoff = 0.02 cfs @ 12.28 hrs, Volume= 140 cf, Depth= 0.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
3,781	39	>75% Grass cover, Good, HSG A
1,712	98	Paved parking, HSG A
5,493	57	Weighted Average
3,781		68.84% Pervious Area
1,712		31.16% Impervious Area

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

Summary for Subcatchment P-5E: flow to wqu5

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 1,406 cf, Depth= 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
323	39	>75% Grass cover, Good, HSG A
5,991	98	Paved parking, HSG A
91	98	Paved parking, HSG B
6,404	95	Weighted Average
323		5.04% Pervious Area
6,081		94.96% Impervious Area

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

Summary for Subcatchment P-5F: flow to wqu6

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 728 cf, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
478	39	>75% Grass cover, Good, HSG A
3,405	98	Paved parking, HSG A
3,883	91	Weighted Average
478		12.31% Pervious Area
3,405		87.69% Impervious Area

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

Summary for Subcatchment P-5G: Subcat P-5G

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 625 cf, Depth= 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
418	39	>75% Grass cover, Good, HSG A
2,696	98	Paved parking, HSG A
220	98	Paved parking, HSG B
3,335	91	Weighted Average
418		12.55% Pervious Area
2,917		87.45% Impervious Area

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

Summary for Subcatchment P-5H: Subcat P-5H

Runoff = 0.09 cfs @ 12.11 hrs, Volume= 372 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
3,639	39	>75% Grass cover, Good, HSG A
820	61	>75% Grass cover, Good, HSG B
1,190	98	Paved parking, HSG A
1,838	98	Paved parking, HSG B
7,488	65	Weighted Average
4,459		59.55% Pervious Area
3,029		40.45% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 0.03 cfs @ 12.08 hrs, Volume= 105 cf, Depth= 2.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
424	98	Paved parking, HSG B
424		100.00% Impervious Area

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

Summary for Subcatchment P-7: Subcat P-7

Runoff = 0.72 cfs @ 12.14 hrs, Volume= 2,649 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
10,690	39	>75% Grass cover, Good, HSG A
545	61	>75% Grass cover, Good, HSG B
410	74	>75% Grass cover, Good, HSG C
13,964	98	Paved parking, HSG A
2,140	98	Paved parking, HSG B
119	98	Paved parking, HSG C
1,373	98	Roofs, HSG A
29,242	75	Weighted Average
11,646		39.82% Pervious Area
17,597		60.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0160	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		**Sheet Flow, C-D** Smooth surfaces n= 0.011 P2= 3.10"
9.4	178	Total			

Summary for Subcatchment P-8: Subcat P-8

Runoff = 0.01 cfs @ 13.20 hrs, Volume= 241 cf, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.19"

Area (sf)	CN	Description
11,113	39	>75% Grass cover, Good, HSG A
11,753	61	>75% Grass cover, Good, HSG B
22	98	Paved parking, HSG B
22,888	50	Weighted Average
22,866		99.90% Pervious Area
22		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

Summary for Reach 1R: Reach

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

Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 0.33" for 2-year event
Inflow = 0.42 cfs @ 12.34 hrs, Volume= 2,336 cf
Outflow = 0.42 cfs @ 12.34 hrs, Volume= 2,336 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Summary for Pond 1P: Collection Pond

Inflow Area = 29,242 sf, 60.18% Impervious, Inflow Depth = 1.09" for 2-year event
Inflow = 0.72 cfs @ 12.14 hrs, Volume= 2,649 cf
Outflow = 0.42 cfs @ 12.34 hrs, Volume= 2,094 cf, Atten= 41%, Lag= 12.0 min
Primary = 0.42 cfs @ 12.34 hrs, Volume= 2,094 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 170.72' @ 12.34 hrs Surf.Area= 854 sf Storage= 731 cf
Flood Elev= 172.00' Surf.Area= 7,699 sf Storage= 4,823 cf

Plug-Flow detention time= 135.7 min calculated for 2,092 cf (79% of inflow)
Center-of-Mass det. time= 52.5 min (914.6 - 862.2)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,823 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
169.00	58	127.0	0	0	58
170.00	507	161.0	245	245	850
171.00	1,011	179.0	745	990	1,366
172.00	7,699	640.0	3,833	4,823	31,414

Device	Routing	Invert	Outlet Devices
#1	Primary	170.50'	**120.0 deg x 1.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.48 (C= 3.10)

Primary OutFlow Max=0.42 cfs @ 12.34 hrs HW=170.72' TW=0.00' (Dynamic Tailwater)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 0.42 cfs @ 1.38 fps)

Summary for Pond 3P: Collection Pond

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Verify GW w/ TP

Inflow Area = 32,379 sf, 17.90% Impervious, Inflow Depth = 0.87" for 2-year event
Inflow = 0.68 cfs @ 12.10 hrs, Volume= 2,353 cf
Outflow = 0.02 cfs @ 17.95 hrs, Volume= 1,764 cf, Atten= 97%, Lag= 350.8 min
Discarded = 0.02 cfs @ 17.95 hrs, Volume= 1,764 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 173.50' @ 17.95 hrs Surf.Area= 886 sf Storage= 1,511 cf

Plug-Flow detention time= 624.0 min calculated for 1,762 cf (75% of inflow)
Center-of-Mass det. time= 529.1 min (1,401.5 - 872.4)

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,117 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	299	79.0	0	0	299
172.00	567	99.0	426	426	596
175.00	1,274	137.0	2,691	3,117	1,393

Device	Routing	Invert	Outlet Devices
#1	Discarded	171.00'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'
#2	Device 3	174.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	172.50'	**15.0" Round Culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.50' / 171.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.02 cfs @ 17.95 hrs HW=173.50' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=171.00' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Controls 0.00 cfs)
└**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond cb1: cb

Inflow Area = 13,530 sf, 32.33% Impervious, Inflow Depth = 0.28" for 2-year event
Inflow = 0.04 cfs @ 12.31 hrs, Volume= 312 cf
Outflow = 0.04 cfs @ 12.31 hrs, Volume= 312 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.04 cfs @ 12.31 hrs, Volume= 312 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 184.50' @ 12.31 hrs
Flood Elev= 187.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	**12.0" Round Culvert** L= 65.0' Ke= 0.500 Inlet / Outlet Invert= 184.40' / 183.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.04 cfs @ 12.31 hrs HW=184.50' TW=183.81' (Dynamic Tailwater)
└**1=Culvert** (Barrel Controls 0.04 cfs @ 1.46 fps)

Summary for Pond dmh-10: dmh

Inflow Area = 7,488 sf, 40.45% Impervious, Inflow Depth = 0.60" for 2-year event
Inflow = 0.09 cfs @ 12.11 hrs, Volume= 372 cf
Outflow = 0.09 cfs @ 12.11 hrs, Volume= 372 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.09 cfs @ 12.11 hrs, Volume= 372 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 171.64' @ 13.66 hrs
Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	**12.0" Round Culvert** L= 71.0' Ke= 0.500 Inlet / Outlet Invert= 171.30' / 170.85' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.08 cfs @ 12.11 hrs HW=171.49' TW=171.25' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.08 cfs @ 1.21 fps)

Summary for Pond dmh1: dmh

Inflow Area = 20,840 sf, 38.05% Impervious, Inflow Depth = 0.43" for 2-year event
Inflow = 0.14 cfs @ 12.12 hrs, Volume= 755 cf
Outflow = 0.14 cfs @ 12.12 hrs, Volume= 755 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.14 cfs @ 12.12 hrs, Volume= 755 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 183.84' @ 12.12 hrs
Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	**12.0" Round Culvert** L= 62.0' Ke= 0.500 Inlet / Outlet Invert= 183.65' / 183.03' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.14 cfs @ 12.12 hrs HW=183.84' TW=183.19' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.14 cfs @ 2.11 fps)

Summary for Pond dmh2: dmh

Inflow Area = 29,464 sf, 41.31% Impervious, Inflow Depth = 0.52" for 2-year event
Inflow = 0.29 cfs @ 12.12 hrs, Volume= 1,277 cf
Outflow = 0.29 cfs @ 12.12 hrs, Volume= 1,277 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.29 cfs @ 12.12 hrs, Volume= 1,277 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 183.19' @ 12.12 hrs
Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	**12.0" Round Culvert** L= 73.0' Ke= 0.500 Inlet / Outlet Invert= 182.93' / 182.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.28 cfs @ 12.12 hrs HW=183.19' TW=182.27' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 0.28 cfs @ 2.59 fps)

Summary for Pond dmh3: dmh

Inflow Area = 38,999 sf, 44.03% Impervious, Inflow Depth = 0.59" for 2-year event
Inflow = 0.47 cfs @ 12.11 hrs, Volume= 1,931 cf
Outflow = 0.47 cfs @ 12.11 hrs, Volume= 1,931 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.47 cfs @ 12.11 hrs, Volume= 1,931 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 182.27' @ 12.11 hrs
Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	**15.0" Round Culvert** L= 66.0' Ke= 0.500 Inlet / Outlet Invert= 181.95' / 181.29' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=0.46 cfs @ 12.11 hrs HW=182.27' TW=181.57' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.46 cfs @ 2.80 fps)

Summary for Pond dmh4: dmh

Inflow Area = 45,814 sf, 46.31% Impervious, Inflow Depth = 0.66" for 2-year event
Inflow = 0.64 cfs @ 12.11 hrs, Volume= 2,516 cf
Outflow = 0.64 cfs @ 12.11 hrs, Volume= 2,516 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.64 cfs @ 12.11 hrs, Volume= 2,516 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 181.57' @ 12.11 hrs
Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	**15.0" Round Culvert** L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 181.19' / 180.64' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=0.63 cfs @ 12.11 hrs HW=181.57' TW=180.33' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 0.63 cfs @ 3.05 fps)

Summary for Pond IS1: Infiltration #1

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Bottom of system placed above existing grade

Inflow Area = 66,528 sf, 60.36% Impervious, Inflow Depth = 1.22" for 2-year event
Inflow = 1.90 cfs @ 12.09 hrs, Volume= 6,776 cf
Outflow = 0.10 cfs @ 15.21 hrs, Volume= 6,776 cf, Atten= 95%, Lag= 187.3 min
Discarded = 0.10 cfs @ 15.21 hrs, Volume= 6,776 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 178.67' @ 15.21 hrs Surf.Area= 4,094 sf Storage= 3,086 cf

Plug-Flow detention time= 286.9 min calculated for 6,769 cf (100% of inflow)
Center-of-Mass det. time= 286.8 min (1,104.2 - 817.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	177.50'	4,569 cf	**44.50'W x 92.00'L x 5.50'H Field A** 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	**CMP Round 60** x 24 Inside #1 Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf Overall Size= 60.0"W x 60.0"H x 20.00'L 24 Chambers in 6 Rows 42.50' Header x 19.63 sf x 2 = 1,669.0 cf Inside
		15,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	182.40'	**12.0" Round Culvert** L= 82.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 182.40' / 178.31' S= 0.0499 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	177.50'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.10 cfs @ 15.21 hrs HW=178.67' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=177.50' TW=170.84' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond IS2: Infiltration #2

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

TP-1 GW @ 36" = El. 168.70

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[80] Warning: Exceeded Pond wqu2 by 0.56' @ 18.36 hrs (1.35 cfs 6,659 cf)
[80] Warning: Exceeded Pond wqu7 by 0.76' @ 16.88 hrs (1.39 cfs 9,223 cf)

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 0.90" for 2-year event
Inflow = 2.77 cfs @ 12.09 hrs, Volume= 9,274 cf
Outflow = 0.20 cfs @ 13.63 hrs, Volume= 9,274 cf, Atten= 93%, Lag= 92.6 min
Discarded = 0.16 cfs @ 13.63 hrs, Volume= 9,037 cf
Primary = 0.03 cfs @ 13.63 hrs, Volume= 237 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 171.64' @ 13.63 hrs Surf.Area= 6,176 sf Storage= 4,009 cf

Plug-Flow detention time= 214.0 min calculated for 9,264 cf (100% of inflow)
Center-of-Mass det. time= 213.9 min (1,008.1 - 794.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.70'	3,753 cf	**16.00'W x 386.00'L x 2.50'H Field A** 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	**CMP Round 24** x 95 Inside #1 Effective Size= 24.0"W x 24.0"H => 3.14 sf x 20.00'L = 62.8 cf Overall Size= 24.0"W x 24.0"H x 20.00'L 95 Chambers in 5 Rows 14.00' Header x 3.14 sf x 2 = 88.0 cf Inside
		9,810 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	171.55'	**15.0" Round Culvert** L= 9.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.55' / 171.25' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Discarded	170.70'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.16 cfs @ 13.63 hrs HW=171.64' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.16 cfs)

Primary OutFlow Max=0.03 cfs @ 13.63 hrs HW=171.64' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.03 cfs @ 0.81 fps)

Summary for Pond wqu1: dmh

Inflow Area = 54,779 sf, 51.86% Impervious, Inflow Depth = 0.85" for 2-year event
Inflow = 1.08 cfs @ 12.10 hrs, Volume= 3,881 cf
Outflow = 1.08 cfs @ 12.10 hrs, Volume= 3,881 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.08 cfs @ 12.10 hrs, Volume= 3,881 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 180.34' @ 12.10 hrs
Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	**24.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 179.89' / 179.63' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=1.05 cfs @ 12.10 hrs HW=180.33' TW=177.98' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 1.05 cfs @ 3.05 fps)

Summary for Pond wqu2: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=101)

Inflow Area = 77,218 sf, 61.04% Impervious, Inflow Depth = 0.28" for 2-year event
Inflow = 0.56 cfs @ 12.09 hrs, Volume= 1,771 cf
Outflow = 0.56 cfs @ 12.09 hrs, Volume= 1,773 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.56 cfs @ 12.09 hrs, Volume= 1,773 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 171.64' @ 13.63 hrs
Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	**24.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 170.84' / 170.70' S= 0.0200 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=0.56 cfs @ 12.09 hrs HW=171.28' TW=171.17' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.56 cfs @ 1.66 fps)

Summary for Pond wqu7: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=116)

Inflow Area = 10,823 sf, 54.93% Impervious, Inflow Depth = 1.11" for 2-year event
Inflow = 0.29 cfs @ 12.09 hrs, Volume= 997 cf
Outflow = 0.29 cfs @ 12.09 hrs, Volume= 997 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.29 cfs @ 12.09 hrs, Volume= 997 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 171.64' @ 13.63 hrs
Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	**12.0" Round Culvert** L= 8.0' Ke= 0.500 Inlet / Outlet Invert= 170.75' / 170.70' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.28 cfs @ 12.09 hrs HW=171.22' TW=171.18' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.28 cfs @ 1.15 fps)

Summary for Link SP1: STUDY POINT #1

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth = 0.15" for 2-year event
Inflow = 0.43 cfs @ 12.34 hrs, Volume= 2,780 cf
Primary = 0.43 cfs @ 12.34 hrs, Volume= 2,780 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Summary for Link SP2: STUDY POINT #2

Inflow Area = 73,254 sf, 1.81% Impervious, Inflow Depth = 0.60" for 2-year event
Inflow = 0.80 cfs @ 12.16 hrs, Volume= 3,635 cf
Primary = 0.80 cfs @ 12.16 hrs, Volume= 3,635 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment B-1A: Subcat B-1A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=98 Runoff=0.62 cfs 2,224 cf

Subcatchment B-1B: Subcat B-1B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=98 Runoff=0.59 cfs 2,094 cf

Subcatchment B-2A: Subcat B-2A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=98 Runoff=0.62 cfs 2,224 cf

Subcatchment B-2B: Subcat B-2B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=98 Runoff=0.59 cfs 2,094 cf

Subcatchment P-1: Subcat P-1 Runoff Area=11,595 sf 0.33% Impervious Runoff Depth=0.56"
Flow Length=424' Tc=8.0 min CN=49 Runoff=0.08 cfs 537 cf

Subcatchment P-2B: Subcat P-2B Runoff Area=73,254 sf 1.81% Impervious Runoff Depth=1.51"
Flow Length=347' Tc=9.2 min CN=65 Runoff=2.47 cfs 9,211 cf

Subcatchment P-3A: Subcat P-3A Runoff Area=13,530 sf 32.33% Impervious Runoff Depth=0.93"
Tc=6.0 min CN=56 Runoff=0.27 cfs 1,049 cf

Subcatchment P-3B: Subcat P-3B Runoff Area=7,310 sf 48.64% Impervious Runoff Depth=1.72"
Tc=6.0 min CN=68 Runoff=0.32 cfs 1,051 cf

Subcatchment P-3C: Subcat P-3C Runoff Area=8,624 sf 49.20% Impervious Runoff Depth=1.72"
Tc=6.0 min CN=68 Runoff=0.38 cfs 1,239 cf

Subcatchment P-3D: Subcat P-3D Runoff Area=9,535 sf 52.42% Impervious Runoff Depth=1.87"
Tc=6.0 min CN=70 Runoff=0.47 cfs 1,490 cf

Subcatchment P-3E: Subcat P-3E Runoff Area=6,815 sf 59.34% Impervious Runoff Depth=2.19"
Tc=6.0 min CN=74 Runoff=0.40 cfs 1,244 cf

Subcatchment P-3F: Subcat P-3F Runoff Area=8,965 sf 80.23% Impervious Runoff Depth=3.26"
Tc=6.0 min CN=86 Runoff=0.77 cfs 2,437 cf

Subcatchment P-4: Subcat P-4 Runoff Area=32,379 sf 17.90% Impervious Runoff Depth=1.95"
Tc=6.0 min CN=71 Runoff=1.66 cfs 5,266 cf

Subcatchment P-5A: Subcat P-5A Runoff Area=10,690 sf 65.28% Impervious Runoff Depth=3.46"
Tc=6.0 min CN=88 Runoff=0.97 cfs 3,083 cf

Subcatchment P-5B: flow to wqu3 Runoff Area=5,018 sf 90.53% Impervious Runoff Depth=3.98"
Tc=6.0 min CN=93 Runoff=0.50 cfs 1,665 cf

Subcatchment P-5C: flow to wqu4 Runoff Area=3,335 sf 77.86% Impervious Runoff Depth=3.17"
Tc=6.0 min CN=85 Runoff=0.28 cfs 880 cf

Subcatchment P-5D: Subcat P-5D Runoff Area=5,493 sf 31.16% Impervious Runoff Depth=0.99"
Tc=6.0 min CN=57 Runoff=0.12 cfs 453 cf

Subcatchment P-5E: flow to wqu5 Runoff Area=6,404 sf 94.96% Impervious Runoff Depth=4.20"
Tc=6.0 min CN=95 Runoff=0.66 cfs 2,242 cf

Subcatchment P-5F: flow to wqu6 Runoff Area=3,883 sf 87.69% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=91 Runoff=0.37 cfs 1,220 cf

Subcatchment P-5G: Subcat P-5G Runoff Area=3,335 sf 87.45% Impervious Runoff Depth=3.77"
Tc=6.0 min CN=91 Runoff=0.32 cfs 1,047 cf

Subcatchment P-5H: Subcat P-5H Runoff Area=7,488 sf 40.45% Impervious Runoff Depth=1.51"
Tc=6.0 min CN=65 Runoff=0.28 cfs 942 cf

Subcatchment P-6: Subcat P-6 Runoff Area=424 sf 100.00% Impervious Runoff Depth=4.54"
Tc=6.0 min CN=98 Runoff=0.05 cfs 161 cf

Subcatchment P-7: Subcat P-7 Runoff Area=29,242 sf 60.18% Impervious Runoff Depth=2.27"
Flow Length=178' Tc=9.4 min CN=75 Runoff=1.57 cfs 5,537 cf

Subcatchment P-8: Subcat P-8 Runoff Area=22,888 sf 0.10% Impervious Runoff Depth=0.60"
Flow Length=852' Tc=30.4 min CN=50 Runoff=0.13 cfs 1,153 cf

Reach 1R: Reach Inflow=1.46 cfs 7,578 cf
Outflow=1.46 cfs 7,578 cf

Pond 1P: Collection Pond Peak Elev=170.94' Storage=928 cf Inflow=1.57 cfs 5,537 cf
Outflow=1.44 cfs 4,982 cf

Pond 3P: Collection Pond Peak Elev=174.56' Storage=2,584 cf Inflow=1.66 cfs 5,266 cf
Discarded=0.03 cfs 2,429 cf Primary=0.19 cfs 1,443 cf Outflow=0.22 cfs 3,872 cf

Pond cb1: cb Peak Elev=184.67' Inflow=0.27 cfs 1,049 cf
12.0" Round Culvert n=0.013 L=65.0' S=0.0100 '/' Outflow=0.27 cfs 1,049 cf

Pond dmh-10: dmh Peak Elev=172.07' Inflow=0.28 cfs 942 cf
12.0" Round Culvert n=0.013 L=71.0' S=0.0063 '/' Outflow=0.28 cfs 942 cf

Pond dmh1: dmh Peak Elev=184.05' Inflow=0.58 cfs 2,100 cf
12.0" Round Culvert n=0.013 L=62.0' S=0.0100 '/' Outflow=0.58 cfs 2,100 cf

Pond dmh2: dmh Peak Elev=183.44' Inflow=0.97 cfs 3,339 cf
12.0" Round Culvert n=0.013 L=73.0' S=0.0100 '/' Outflow=0.97 cfs 3,339 cf

Pond dmh3: dmh Peak Elev=182.56' Inflow=1.44 cfs 4,829 cf
15.0" Round Culvert n=0.013 L=66.0' S=0.0100 '/' Outflow=1.44 cfs 4,829 cf

Pond dmh4: dmh Peak Elev=181.87' Inflow=1.83 cfs 6,072 cf
15.0" Round Culvert n=0.013 L=55.0' S=0.0100 '/' Outflow=1.83 cfs 6,072 cf

Pond IS1: Infiltration #1 Peak Elev=180.08' Storage=7,680 cf Inflow=3.84 cfs 12,958 cf
Discarded=0.11 cfs 10,912 cf Primary=0.00 cfs 0 cf Outflow=0.11 cfs 10,912 cf

Pond IS2: Infiltration #2 Peak Elev=172.07' Storage=6,019 cf Inflow=4.68 cfs 15,720 cf
Discarded=0.17 cfs 11,123 cf Primary=0.92 cfs 4,597 cf Outflow=1.09 cfs 15,720 cf

Pond wqu1: dmh Peak Elev=180.62' Inflow=2.60 cfs 8,509 cf
24.0" Round Culvert n=0.013 L=26.0' S=0.0100 '/' Outflow=2.60 cfs 8,509 cf

Pond wqu2: dmh Peak Elev=172.07' Inflow=0.97 cfs 3,083 cf
24.0" Round Culvert n=0.025 L=7.0' S=0.0200 '/' Outflow=0.97 cfs 3,083 cf

Pond wqu7: dmh Peak Elev=172.07' Inflow=0.60 cfs 1,989 cf
12.0" Round Culvert n=0.013 L=8.0' S=0.0063 '/' Outflow=0.60 cfs 1,989 cf

Link SP1: STUDY POINT #1 Inflow=1.99 cfs 12,872 cf
Primary=1.99 cfs 12,872 cf

Link SP2: STUDY POINT #2 Inflow=2.47 cfs 9,211 cf
Primary=2.47 cfs 9,211 cf

Total Runoff Area = 293,017 sf Runoff Volume = 50,542 cf Average Runoff Depth = 2.07"
63.25% Pervious = 185,334 sf 36.75% Impervious = 107,683 sf

Summary for Subcatchment B-1A: Subcat B-1A

Runoff = 0.62 cfs @ 12.08 hrs, Volume= 2,224 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
4,811	98	Roofs, HSG A
1,064	98	Roofs, HSG C
5,875	98	Weighted Average
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-1B: Subcat B-1B

Runoff = 0.59 cfs @ 12.08 hrs, Volume= 2,094 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
4,214	98	Roofs, HSG A
1,316	98	Roofs, HSG C
5,530	98	Weighted Average
5,530		100.00% Impervious Area

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

Summary for Subcatchment B-2A: Subcat B-2A

Runoff = 0.62 cfs @ 12.08 hrs, Volume= 2,224 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
5,875	98	Roofs, HSG A
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-2B: Subcat B-2B

Runoff = 0.59 cfs @ 12.08 hrs, Volume= 2,094 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
5,530	98	Roofs, HSG A
5,530		100.00% Impervious Area

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

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.08 cfs @ 12.18 hrs, Volume= 537 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
2,665	39	>75% Grass cover, Good, HSG A
1,275	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
38	98	Paved parking, HSG B
3,940	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
11,595	49	Weighted Average
11,556		99.67% Pervious Area
38		0.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1400	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		**Shallow Concentrated Flow, C TO D** Paved Kv= 20.3 fps
8.0	424	Total			

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 2.47 cfs @ 12.14 hrs, Volume= 9,211 cf, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
8,707	39	>75% Grass cover, Good, HSG A
28,468	74	>75% Grass cover, Good, HSG C
189	98	Paved parking, HSG A
1,137	98	Paved parking, HSG C
5,524	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
73,254	65	Weighted Average
71,928		98.19% Pervious Area
1,325		1.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 0.27 cfs @ 12.11 hrs, Volume= 1,049 cf, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
5,544	39	>75% Grass cover, Good, HSG A
4,374	98	Paved parking, HSG A
3,612	30	Woods, Good, HSG A
13,530	56	Weighted Average
9,155		67.67% Pervious Area
4,374		32.33% Impervious Area

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

Summary for Subcatchment P-3B: Subcat P-3B

Runoff = 0.32 cfs @ 12.10 hrs, Volume= 1,051 cf, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
3,755	39	>75% Grass cover, Good, HSG A
3,556	98	Paved parking, HSG A
7,310	68	Weighted Average
3,755		51.36% Pervious Area
3,556		48.64% Impervious Area

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

Summary for Subcatchment P-3C: Subcat P-3C

Runoff = 0.38 cfs @ 12.10 hrs, Volume= 1,239 cf, Depth= 1.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
4,381	39	>75% Grass cover, Good, HSG A
4,243	98	Paved parking, HSG A
8,624	68	Weighted Average
4,381		50.80% Pervious Area
4,243		49.20% Impervious Area

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

Summary for Subcatchment P-3D: Subcat P-3D

Runoff = 0.47 cfs @ 12.09 hrs, Volume= 1,490 cf, Depth= 1.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
4,537	39	>75% Grass cover, Good, HSG A
4,998	98	Paved parking, HSG A
9,535	70	Weighted Average
4,537		47.58% Pervious Area
4,998		52.42% Impervious Area

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

Summary for Subcatchment P-3E: Subcat P-3E

Runoff = 0.40 cfs @ 12.09 hrs, Volume= 1,244 cf, Depth= 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
2,771	39	>75% Grass cover, Good, HSG A
4,044	98	Paved parking, HSG A
6,815	74	Weighted Average
2,771		40.66% Pervious Area
4,044		59.34% Impervious Area

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

Summary for Subcatchment P-3F: Subcat P-3F

Runoff = 0.77 cfs @ 12.09 hrs, Volume= 2,437 cf, Depth= 3.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
1,772	39	>75% Grass cover, Good, HSG A
7,192	98	Paved parking, HSG A
8,965	86	Weighted Average
1,772		19.77% Pervious Area
7,192		80.23% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 1.66 cfs @ 12.09 hrs, Volume= 5,266 cf, Depth= 1.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
6,551	39	>75% Grass cover, Good, HSG A
20,031	74	>75% Grass cover, Good, HSG C
5,797	98	Paved parking, HSG C
32,379	71	Weighted Average
26,582		82.10% Pervious Area
5,797		17.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Assumed**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-5A: Subcat P-5A

Runoff = 0.97 cfs @ 12.09 hrs, Volume= 3,083 cf, Depth= 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
547	39	>75% Grass cover, Good, HSG A
88	61	>75% Grass cover, Good, HSG B
3,077	74	>75% Grass cover, Good, HSG C
646	98	Paved parking, HSG A
1,804	98	Paved parking, HSG B
4,528	98	Paved parking, HSG C
10,690	88	Weighted Average
3,712		34.72% Pervious Area
6,978		65.28% Impervious Area

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

Summary for Subcatchment P-5B: flow to wqu3

Runoff = 0.50 cfs @ 12.09 hrs, Volume= 1,665 cf, Depth= 3.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
366	39	>75% Grass cover, Good, HSG A
109	74	>75% Grass cover, Good, HSG C
655	98	Paved parking, HSG A
3,712	98	Paved parking, HSG B
175	98	Paved parking, HSG C
5,018	93	Weighted Average
475		9.47% Pervious Area
4,543		90.53% Impervious Area

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

Summary for Subcatchment P-5C: flow to wqu4

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 880 cf, Depth= 3.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
738	39	>75% Grass cover, Good, HSG A
1,556	98	Paved parking, HSG A
1,041	98	Paved parking, HSG B
3,335	85	Weighted Average
738		22.14% Pervious Area
2,597		77.86% Impervious Area

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

Summary for Subcatchment P-5D: Subcat P-5D

Runoff = 0.12 cfs @ 12.11 hrs, Volume= 453 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
3,781	39	>75% Grass cover, Good, HSG A
1,712	98	Paved parking, HSG A
5,493	57	Weighted Average
3,781		68.84% Pervious Area
1,712		31.16% Impervious Area

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

Summary for Subcatchment P-5E: flow to wqu5

Runoff = 0.66 cfs @ 12.08 hrs, Volume= 2,242 cf, Depth= 4.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
323	39	>75% Grass cover, Good, HSG A
5,991	98	Paved parking, HSG A
91	98	Paved parking, HSG B
6,404	95	Weighted Average
323		5.04% Pervious Area
6,081		94.96% Impervious Area

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

Summary for Subcatchment P-5F: flow to wqu6

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,220 cf, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
478	39	>75% Grass cover, Good, HSG A
3,405	98	Paved parking, HSG A
3,883	91	Weighted Average
478		12.31% Pervious Area
3,405		87.69% Impervious Area

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

Summary for Subcatchment P-5G: Subcat P-5G

Runoff = 0.32 cfs @ 12.09 hrs, Volume= 1,047 cf, Depth= 3.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
418	39	>75% Grass cover, Good, HSG A
2,696	98	Paved parking, HSG A
220	98	Paved parking, HSG B
3,335	91	Weighted Average
418		12.55% Pervious Area
2,917		87.45% Impervious Area

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

Summary for Subcatchment P-5H: Subcat P-5H

Runoff = 0.28 cfs @ 12.10 hrs, Volume= 942 cf, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
3,639	39	>75% Grass cover, Good, HSG A
820	61	>75% Grass cover, Good, HSG B
1,190	98	Paved parking, HSG A
1,838	98	Paved parking, HSG B
7,488	65	Weighted Average
4,459		59.55% Pervious Area
3,029		40.45% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 0.05 cfs @ 12.08 hrs, Volume= 161 cf, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
424	98	Paved parking, HSG B
424		100.00% Impervious Area

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

Summary for Subcatchment P-7: Subcat P-7

Runoff = 1.57 cfs @ 12.14 hrs, Volume= 5,537 cf, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
10,690	39	>75% Grass cover, Good, HSG A
545	61	>75% Grass cover, Good, HSG B
410	74	>75% Grass cover, Good, HSG C
13,964	98	Paved parking, HSG A
2,140	98	Paved parking, HSG B
119	98	Paved parking, HSG C
1,373	98	Roofs, HSG A
29,242	75	Weighted Average
11,646		39.82% Pervious Area
17,597		60.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0160	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		**Sheet Flow, C-D** Smooth surfaces n= 0.011 P2= 3.10"
9.4	178	Total			

Summary for Subcatchment P-8: Subcat P-8

Runoff = 0.13 cfs @ 12.59 hrs, Volume= 1,153 cf, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.78"

Area (sf)	CN	Description
11,113	39	>75% Grass cover, Good, HSG A
11,753	61	>75% Grass cover, Good, HSG B
22	98	Paved parking, HSG B
22,888	50	Weighted Average
22,866		99.90% Pervious Area
22		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

Summary for Reach 1R: Reach

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

Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 1.08" for 10-year event
Inflow = 1.46 cfs @ 12.19 hrs, Volume= 7,578 cf
Outflow = 1.46 cfs @ 12.19 hrs, Volume= 7,578 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Summary for Pond 1P: Collection Pond

Inflow Area = 29,242 sf, 60.18% Impervious, Inflow Depth = 2.27" for 10-year event
Inflow = 1.57 cfs @ 12.14 hrs, Volume= 5,537 cf
Outflow = 1.44 cfs @ 12.18 hrs, Volume= 4,982 cf, Atten= 8%, Lag= 2.9 min
Primary = 1.44 cfs @ 12.18 hrs, Volume= 4,982 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 170.94' @ 12.18 hrs Surf.Area= 975 sf Storage= 928 cf
Flood Elev= 172.00' Surf.Area= 7,699 sf Storage= 4,823 cf

Plug-Flow detention time= 76.2 min calculated for 4,976 cf (90% of inflow)
Center-of-Mass det. time= 27.9 min (868.1 - 840.2)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,823 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
169.00	58	127.0	0	0	58
170.00	507	161.0	245	245	850
171.00	1,011	179.0	745	990	1,366
172.00	7,699	640.0	3,833	4,823	31,414

Device	Routing	Invert	Outlet Devices
#1	Primary	170.50'	**120.0 deg x 1.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.48 (C= 3.10)

Primary OutFlow Max=1.43 cfs @ 12.18 hrs HW=170.94' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 1.43 cfs @ 1.87 fps)

Summary for Pond 3P: Collection Pond

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Verify GW w/ TP

Inflow Area = 32,379 sf, 17.90% Impervious, Inflow Depth = 1.95" for 10-year event
Inflow = 1.66 cfs @ 12.09 hrs, Volume= 5,266 cf
Outflow = 0.22 cfs @ 12.84 hrs, Volume= 3,872 cf, Atten= 87%, Lag= 44.5 min
Discarded = 0.03 cfs @ 12.84 hrs, Volume= 2,429 cf
Primary = 0.19 cfs @ 12.84 hrs, Volume= 1,443 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 174.56' @ 12.84 hrs Surf.Area= 1,153 sf Storage= 2,584 cf

Plug-Flow detention time= 445.7 min calculated for 3,867 cf (73% of inflow)
Center-of-Mass det. time= 352.0 min (1,199.5 - 847.5)

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,117 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	299	79.0	0	0	299
172.00	567	99.0	426	426	596
175.00	1,274	137.0	2,691	3,117	1,393

Device	Routing	Invert	Outlet Devices
#1	Discarded	171.00'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'
#2	Device 3	174.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	172.50'	**15.0" Round Culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.50' / 171.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.03 cfs @ 12.84 hrs HW=174.56' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.19 cfs @ 12.84 hrs HW=174.56' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.19 cfs of 5.59 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 0.19 cfs @ 0.80 fps)

Summary for Pond cb1: cb

Inflow Area = 13,530 sf, 32.33% Impervious, Inflow Depth = 0.93" for 10-year event
Inflow = 0.27 cfs @ 12.11 hrs, Volume= 1,049 cf
Outflow = 0.27 cfs @ 12.11 hrs, Volume= 1,049 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.27 cfs @ 12.11 hrs, Volume= 1,049 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 184.67' @ 12.11 hrs
Flood Elev= 187.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	**12.0" Round Culvert** L= 65.0' Ke= 0.500 Inlet / Outlet Invert= 184.40' / 183.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.26 cfs @ 12.11 hrs HW=184.66' TW=184.05' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.26 cfs @ 2.38 fps)

Summary for Pond dmh-10: dmh

Inflow Area = 7,488 sf, 40.45% Impervious, Inflow Depth = 1.51" for 10-year event
Inflow = 0.28 cfs @ 12.10 hrs, Volume= 942 cf
Outflow = 0.28 cfs @ 12.10 hrs, Volume= 942 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.28 cfs @ 12.10 hrs, Volume= 942 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.07' @ 12.52 hrs
Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	**12.0" Round Culvert** L= 71.0' Ke= 0.500 Inlet / Outlet Invert= 171.30' / 170.85' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.16 cfs @ 12.10 hrs HW=171.70' TW=171.64' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.16 cfs @ 0.80 fps)

Summary for Pond dmh1: dmh

Inflow Area = 20,840 sf, 38.05% Impervious, Inflow Depth = 1.21" for 10-year event
Inflow = 0.58 cfs @ 12.10 hrs, Volume= 2,100 cf
Outflow = 0.58 cfs @ 12.10 hrs, Volume= 2,100 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.58 cfs @ 12.10 hrs, Volume= 2,100 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 184.05' @ 12.10 hrs
Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	**12.0" Round Culvert** L= 62.0' Ke= 0.500 Inlet / Outlet Invert= 183.65' / 183.03' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.57 cfs @ 12.10 hrs HW=184.05' TW=183.43' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 0.57 cfs @ 2.90 fps)

Summary for Pond dmh2: dmh

Inflow Area = 29,464 sf, 41.31% Impervious, Inflow Depth = 1.36" for 10-year event
Inflow = 0.97 cfs @ 12.10 hrs, Volume= 3,339 cf
Outflow = 0.97 cfs @ 12.10 hrs, Volume= 3,339 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.97 cfs @ 12.10 hrs, Volume= 3,339 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 183.44' @ 12.10 hrs
Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	**12.0" Round Culvert** L= 73.0' Ke= 0.500 Inlet / Outlet Invert= 182.93' / 182.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.95 cfs @ 12.10 hrs HW=183.43' TW=182.55' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 0.95 cfs @ 3.50 fps)

Summary for Pond dmh3: dmh

Inflow Area = 38,999 sf, 44.03% Impervious, Inflow Depth = 1.49" for 10-year event
Inflow = 1.44 cfs @ 12.10 hrs, Volume= 4,829 cf
Outflow = 1.44 cfs @ 12.10 hrs, Volume= 4,829 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.44 cfs @ 12.10 hrs, Volume= 4,829 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 182.56' @ 12.10 hrs
Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	**15.0" Round Culvert** L= 66.0' Ke= 0.500 Inlet / Outlet Invert= 181.95' / 181.29' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.40 cfs @ 12.10 hrs HW=182.55' TW=181.86' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 1.40 cfs @ 3.52 fps)

Summary for Pond dmh4: dmh

Inflow Area = 45,814 sf, 46.31% Impervious, Inflow Depth = 1.59" for 10-year event
Inflow = 1.83 cfs @ 12.10 hrs, Volume= 6,072 cf
Outflow = 1.83 cfs @ 12.10 hrs, Volume= 6,072 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.83 cfs @ 12.10 hrs, Volume= 6,072 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 181.87' @ 12.10 hrs
Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	**15.0" Round Culvert** L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 181.19' / 180.64' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=1.78 cfs @ 12.10 hrs HW=181.86' TW=180.61' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 1.78 cfs @ 3.88 fps)

Summary for Pond IS1: Infiltration #1

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Bottom of system placed above existing grade

Inflow Area = 66,528 sf, 60.36% Impervious, Inflow Depth = 2.34" for 10-year event
Inflow = 3.84 cfs @ 12.09 hrs, Volume= 12,958 cf
Outflow = 0.11 cfs @ 17.07 hrs, Volume= 10,912 cf, Atten= 97%, Lag= 298.6 min
Discarded = 0.11 cfs @ 17.07 hrs, Volume= 10,912 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 180.08' @ 17.07 hrs Surf.Area= 4,094 sf Storage= 7,680 cf

Plug-Flow detention time= 572.0 min calculated for 10,912 cf (84% of inflow)
Center-of-Mass det. time= 502.2 min (1,312.7 - 810.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	177.50'	4,569 cf	**44.50'W x 92.00'L x 5.50'H Field A** 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	**CMP Round 60** x 24 Inside #1 Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf Overall Size= 60.0"W x 60.0"H x 20.00'L 24 Chambers in 6 Rows 42.50' Header x 19.63 sf x 2 = 1,669.0 cf Inside
		15,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	182.40'	**12.0" Round Culvert** L= 82.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 182.40' / 178.31' S= 0.0499 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	177.50'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.11 cfs @ 17.07 hrs HW=180.08' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=177.50' TW=170.84' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond IS2: Infiltration #2

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

TP-1 GW @ 36" = El. 168.70

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[80] Warning: Exceeded Pond wqu2 by 0.29' @ 24.12 hrs (0.37 cfs 1,794 cf)
[80] Warning: Exceeded Pond wqu7 by 0.83' @ 17.84 hrs (1.59 cfs 12,686 cf)

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 1.53" for 10-year event
Inflow = 4.68 cfs @ 12.09 hrs, Volume= 15,720 cf
Outflow = 1.09 cfs @ 12.49 hrs, Volume= 15,720 cf, Atten= 77%, Lag= 24.2 min
Discarded = 0.17 cfs @ 12.49 hrs, Volume= 11,123 cf
Primary = 0.92 cfs @ 12.49 hrs, Volume= 4,597 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.07' @ 12.49 hrs Surf.Area= 6,176 sf Storage= 6,019 cf

Plug-Flow detention time= 180.0 min calculated for 15,702 cf (100% of inflow)
Center-of-Mass det. time= 180.0 min (965.0 - 785.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.70'	3,753 cf	**16.00'W x 386.00'L x 2.50'H Field A** 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	**CMP Round 24** x 95 Inside #1 Effective Size= 24.0"W x 24.0"H => 3.14 sf x 20.00'L = 62.8 cf Overall Size= 24.0"W x 24.0"H x 20.00'L 95 Chambers in 5 Rows 14.00' Header x 3.14 sf x 2 = 88.0 cf Inside
		9,810 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	171.55'	**15.0" Round Culvert** L= 9.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.55' / 171.25' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Discarded	170.70'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.17 cfs @ 12.49 hrs HW=172.07' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.92 cfs @ 12.49 hrs HW=172.07' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.92 cfs @ 1.93 fps)

Summary for Pond wqu1: dmh

Inflow Area = 54,779 sf, 51.86% Impervious, Inflow Depth = 1.86" for 10-year event
Inflow = 2.60 cfs @ 12.09 hrs, Volume= 8,509 cf
Outflow = 2.60 cfs @ 12.09 hrs, Volume= 8,509 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.60 cfs @ 12.09 hrs, Volume= 8,509 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 180.62' @ 12.09 hrs
Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	**24.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 179.89' / 179.63' S= 0.0100 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=2.54 cfs @ 12.09 hrs HW=180.61' TW=178.54' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 2.54 cfs @ 3.68 fps)

Summary for Pond wqu2: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=76)

Inflow Area = 77,218 sf, 61.04% Impervious, Inflow Depth = 0.48" for 10-year event
Inflow = 0.97 cfs @ 12.09 hrs, Volume= 3,083 cf
Outflow = 0.97 cfs @ 12.09 hrs, Volume= 3,083 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.97 cfs @ 12.09 hrs, Volume= 3,083 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.07' @ 12.49 hrs
Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	**24.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 170.84' / 170.70' S= 0.0200 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=0.96 cfs @ 12.09 hrs HW=171.63' TW=171.58' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.96 cfs @ 1.24 fps)

Summary for Pond wqu7: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=88)
[80] Warning: Exceeded Pond dmh-10 by 0.05' @ 12.20 hrs (0.30 cfs 320 cf)

Inflow Area = 10,823 sf, 54.93% Impervious, Inflow Depth = 2.21" for 10-year event
Inflow = 0.60 cfs @ 12.09 hrs, Volume= 1,989 cf
Outflow = 0.60 cfs @ 12.09 hrs, Volume= 1,989 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.60 cfs @ 12.09 hrs, Volume= 1,989 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.07' @ 12.49 hrs
Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	**12.0" Round Culvert** L= 8.0' Ke= 0.500 Inlet / Outlet Invert= 170.75' / 170.70' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.60 cfs @ 12.09 hrs HW=171.63' TW=171.59' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 0.60 cfs @ 1.09 fps)

Summary for Link SP1: STUDY POINT #1

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth = 0.70" for 10-year event
Inflow = 1.99 cfs @ 12.25 hrs, Volume= 12,872 cf
Primary = 1.99 cfs @ 12.25 hrs, Volume= 12,872 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Summary for Link SP2: STUDY POINT #2

Inflow Area = 73,254 sf, 1.81% Impervious, Inflow Depth = 1.51" for 10-year event
Inflow = 2.47 cfs @ 12.14 hrs, Volume= 9,211 cf
Primary = 2.47 cfs @ 12.14 hrs, Volume= 9,211 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment B-1A: Subcat B-1A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=98 Runoff=0.79 cfs 2,826 cf

Subcatchment B-1B: Subcat B-1B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=98 Runoff=0.74 cfs 2,660 cf

Subcatchment B-2A: Subcat B-2A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=98 Runoff=0.79 cfs 2,826 cf

Subcatchment B-2B: Subcat B-2B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=98 Runoff=0.74 cfs 2,660 cf

Subcatchment P-1: Subcat P-1 Runoff Area=11,595 sf 0.33% Impervious Runoff Depth=1.08"
Flow Length=424' Tc=8.0 min CN=49 Runoff=0.23 cfs 1,040 cf

Subcatchment P-2B: Subcat P-2B Runoff Area=73,254 sf 1.81% Impervious Runoff Depth=2.36"
Flow Length=347' Tc=9.2 min CN=65 Runoff=4.04 cfs 14,398 cf

Subcatchment P-3A: Subcat P-3A Runoff Area=13,530 sf 32.33% Impervious Runoff Depth=1.60"
Tc=6.0 min CN=56 Runoff=0.52 cfs 1,807 cf

Subcatchment P-3B: Subcat P-3B Runoff Area=7,310 sf 48.64% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=68 Runoff=0.51 cfs 1,601 cf

Subcatchment P-3C: Subcat P-3C Runoff Area=8,624 sf 49.20% Impervious Runoff Depth=2.63"
Tc=6.0 min CN=68 Runoff=0.60 cfs 1,889 cf

Subcatchment P-3D: Subcat P-3D Runoff Area=9,535 sf 52.42% Impervious Runoff Depth=2.81"
Tc=6.0 min CN=70 Runoff=0.71 cfs 2,235 cf

Subcatchment P-3E: Subcat P-3E Runoff Area=6,815 sf 59.34% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=74 Runoff=0.58 cfs 1,814 cf

Subcatchment P-3F: Subcat P-3F Runoff Area=8,965 sf 80.23% Impervious Runoff Depth=4.42"
Tc=6.0 min CN=86 Runoff=1.03 cfs 3,301 cf

Subcatchment P-4: Subcat P-4 Runoff Area=32,379 sf 17.90% Impervious Runoff Depth=2.91"
Tc=6.0 min CN=71 Runoff=2.50 cfs 7,843 cf

Subcatchment P-5A: Subcat P-5A Runoff Area=10,690 sf 65.28% Impervious Runoff Depth=4.64"
Tc=6.0 min CN=88 Runoff=1.28 cfs 4,129 cf

Subcatchment P-5B: flow to wqu3 Runoff Area=5,018 sf 90.53% Impervious Runoff Depth=5.19"
Tc=6.0 min CN=93 Runoff=0.65 cfs 2,171 cf

Subcatchment P-5C: flow to wqu4 Runoff Area=3,335 sf 77.86% Impervious Runoff Depth=4.31"
Tc=6.0 min CN=85 Runoff=0.38 cfs 1,198 cf

Subcatchment P-5D: Subcat P-5D Runoff Area=5,493 sf 31.16% Impervious Runoff Depth=1.68"
Tc=6.0 min CN=57 Runoff=0.23 cfs 770 cf

Subcatchment P-5E: flow to wqu5 Runoff Area=6,404 sf 94.96% Impervious Runoff Depth=5.42"
Tc=6.0 min CN=95 Runoff=0.84 cfs 2,893 cf

Subcatchment P-5F: flow to wqu6 Runoff Area=3,883 sf 87.69% Impervious Runoff Depth=4.97"
Tc=6.0 min CN=91 Runoff=0.49 cfs 1,607 cf

Subcatchment P-5G: Subcat P-5G Runoff Area=3,335 sf 87.45% Impervious Runoff Depth=4.97"
Tc=6.0 min CN=91 Runoff=0.42 cfs 1,380 cf

Subcatchment P-5H: Subcat P-5H Runoff Area=7,488 sf 40.45% Impervious Runoff Depth=2.36"
Tc=6.0 min CN=65 Runoff=0.46 cfs 1,472 cf

Subcatchment P-6: Subcat P-6 Runoff Area=424 sf 100.00% Impervious Runoff Depth=5.77"
Tc=6.0 min CN=98 Runoff=0.06 cfs 204 cf

Subcatchment P-7: Subcat P-7 Runoff Area=29,242 sf 60.18% Impervious Runoff Depth=3.29"
Flow Length=178' Tc=9.4 min CN=75 Runoff=2.29 cfs 8,019 cf

Subcatchment P-8: Subcat P-8 Runoff Area=22,888 sf 0.10% Impervious Runoff Depth=1.15"
Flow Length=852' Tc=30.4 min CN=50 Runoff=0.32 cfs 2,189 cf

Reach 1R: Reach Inflow=3.26 cfs 13,590 cf
Outflow=3.26 cfs 13,590 cf

Pond 1P: Collection Pond Peak Elev=171.04' Storage=1,033 cf Inflow=2.29 cfs 8,019 cf
Outflow=2.15 cfs 7,464 cf

Pond 3P: Collection Pond Peak Elev=174.71' Storage=2,759 cf Inflow=2.50 cfs 7,843 cf
Discarded=0.03 cfs 2,489 cf Primary=1.23 cfs 3,937 cf Outflow=1.26 cfs 6,426 cf

Pond cb1: cb Peak Elev=184.79' Inflow=0.52 cfs 1,807 cf
12.0" Round Culvert n=0.013 L=65.0' S=0.0100 '/' Outflow=0.52 cfs 1,807 cf

Pond dmh-10: dmh Peak Elev=172.37' Inflow=0.46 cfs 1,472 cf
12.0" Round Culvert n=0.013 L=71.0' S=0.0063 '/' Outflow=0.46 cfs 1,472 cf

Pond dmh1: dmh Peak Elev=184.22' Inflow=1.03 cfs 3,408 cf
12.0" Round Culvert n=0.013 L=62.0' S=0.0100 '/' Outflow=1.03 cfs 3,408 cf

Pond dmh2: dmh Peak Elev=183.63' Inflow=1.62 cfs 5,297 cf
12.0" Round Culvert n=0.013 L=73.0' S=0.0100 '/' Outflow=1.62 cfs 5,297 cf

Pond dmh3: dmh Peak Elev=182.78' Inflow=2.34 cfs 7,532 cf
15.0" Round Culvert n=0.013 L=66.0' S=0.0100 '/' Outflow=2.34 cfs 7,532 cf

Pond dmh4: dmh Peak Elev=182.09' Inflow=2.92 cfs 9,346 cf
15.0" Round Culvert n=0.013 L=55.0' S=0.0100 '/' Outflow=2.92 cfs 9,346 cf

Pond IS1: Infiltration #1 Peak Elev=181.41' Storage=11,997 cf Inflow=5.52 cfs 18,298 cf
Discarded=0.12 cfs 11,959 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 11,959 cf

Pond IS2: Infiltration #2 Peak Elev=172.36' Storage=7,324 cf Inflow=6.21 cfs 20,942 cf
Discarded=0.18 cfs 12,274 cf Primary=2.03 cfs 8,668 cf Outflow=2.21 cfs 20,942 cf

Pond wqu1: dmh Peak Elev=181.41' Inflow=3.95 cfs 12,647 cf
24.0" Round Culvert n=0.013 L=26.0' S=0.0100 '/' Outflow=3.95 cfs 12,647 cf

Pond wqu2: dmh Peak Elev=172.36' Inflow=1.28 cfs 4,129 cf
24.0" Round Culvert n=0.025 L=7.0' S=0.0200 '/' Outflow=1.28 cfs 4,130 cf

Pond wqu7: dmh Peak Elev=172.37' Inflow=0.88 cfs 2,852 cf
12.0" Round Culvert n=0.013 L=8.0' S=0.0063 '/' Outflow=0.88 cfs 2,852 cf

Link SP1: STUDY POINT #1 Inflow=5.35 cfs 23,502 cf
Primary=5.35 cfs 23,502 cf

Link SP2: STUDY POINT #2 Inflow=4.04 cfs 14,398 cf
Primary=4.04 cfs 14,398 cf

Total Runoff Area = 293,017 sf Runoff Volume = 72,933 cf Average Runoff Depth = 2.99"
63.25% Pervious = 185,334 sf 36.75% Impervious = 107,683 sf

Summary for Subcatchment B-1A: Subcat B-1A

Runoff = 0.79 cfs @ 12.08 hrs, Volume= 2,826 cf, Depth= 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
4,811	98	Roofs, HSG A
1,064	98	Roofs, HSG C
5,875	98	Weighted Average
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-1B: Subcat B-1B

Runoff = 0.74 cfs @ 12.08 hrs, Volume= 2,660 cf, Depth= 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
4,214	98	Roofs, HSG A
1,316	98	Roofs, HSG C
5,530	98	Weighted Average
5,530		100.00% Impervious Area

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

Summary for Subcatchment B-2A: Subcat B-2A

Runoff = 0.79 cfs @ 12.08 hrs, Volume= 2,826 cf, Depth= 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
5,875	98	Roofs, HSG A
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-2B: Subcat B-2B

Runoff = 0.74 cfs @ 12.08 hrs, Volume= 2,660 cf, Depth= 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
5,530	98	Roofs, HSG A
5,530		100.00% Impervious Area

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

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.23 cfs @ 12.14 hrs, Volume= 1,040 cf, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
2,665	39	>75% Grass cover, Good, HSG A
1,275	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
38	98	Paved parking, HSG B
3,940	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
11,595	49	Weighted Average
11,556		99.67% Pervious Area
38		0.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1400	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		**Shallow Concentrated Flow, C TO D** Paved Kv= 20.3 fps
8.0	424	Total			

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 4.04 cfs @ 12.14 hrs, Volume= 14,398 cf, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
8,707	39	>75% Grass cover, Good, HSG A
28,468	74	>75% Grass cover, Good, HSG C
189	98	Paved parking, HSG A
1,137	98	Paved parking, HSG C
5,524	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
73,254	65	Weighted Average
71,928		98.19% Pervious Area
1,325		1.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 0.52 cfs @ 12.10 hrs, Volume= 1,807 cf, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
5,544	39	>75% Grass cover, Good, HSG A
4,374	98	Paved parking, HSG A
3,612	30	Woods, Good, HSG A
13,530	56	Weighted Average
9,155		67.67% Pervious Area
4,374		32.33% Impervious Area

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

Summary for Subcatchment P-3B: Subcat P-3B

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 1,601 cf, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
3,755	39	>75% Grass cover, Good, HSG A
3,556	98	Paved parking, HSG A
7,310	68	Weighted Average
3,755		51.36% Pervious Area
3,556		48.64% Impervious Area

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

Summary for Subcatchment P-3C: Subcat P-3C

Runoff = 0.60 cfs @ 12.09 hrs, Volume= 1,889 cf, Depth= 2.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
4,381	39	>75% Grass cover, Good, HSG A
4,243	98	Paved parking, HSG A
8,624	68	Weighted Average
4,381		50.80% Pervious Area
4,243		49.20% Impervious Area

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

Summary for Subcatchment P-3D: Subcat P-3D

Runoff = 0.71 cfs @ 12.09 hrs, Volume= 2,235 cf, Depth= 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
4,537	39	>75% Grass cover, Good, HSG A
4,998	98	Paved parking, HSG A
9,535	70	Weighted Average
4,537		47.58% Pervious Area
4,998		52.42% Impervious Area

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

Summary for Subcatchment P-3E: Subcat P-3E

Runoff = 0.58 cfs @ 12.09 hrs, Volume= 1,814 cf, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
2,771	39	>75% Grass cover, Good, HSG A
4,044	98	Paved parking, HSG A
6,815	74	Weighted Average
2,771		40.66% Pervious Area
4,044		59.34% Impervious Area

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

Summary for Subcatchment P-3F: Subcat P-3F

Runoff = 1.03 cfs @ 12.09 hrs, Volume= 3,301 cf, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
1,772	39	>75% Grass cover, Good, HSG A
7,192	98	Paved parking, HSG A
8,965	86	Weighted Average
1,772		19.77% Pervious Area
7,192		80.23% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 2.50 cfs @ 12.09 hrs, Volume= 7,843 cf, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
6,551	39	>75% Grass cover, Good, HSG A
20,031	74	>75% Grass cover, Good, HSG C
5,797	98	Paved parking, HSG C
32,379	71	Weighted Average
26,582		82.10% Pervious Area
5,797		17.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Assumed**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-5A: Subcat P-5A

Runoff = 1.28 cfs @ 12.09 hrs, Volume= 4,129 cf, Depth= 4.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
547	39	>75% Grass cover, Good, HSG A
88	61	>75% Grass cover, Good, HSG B
3,077	74	>75% Grass cover, Good, HSG C
646	98	Paved parking, HSG A
1,804	98	Paved parking, HSG B
4,528	98	Paved parking, HSG C
10,690	88	Weighted Average
3,712		34.72% Pervious Area
6,978		65.28% Impervious Area

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

Summary for Subcatchment P-5B: flow to wqu3

Runoff = 0.65 cfs @ 12.08 hrs, Volume= 2,171 cf, Depth= 5.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
366	39	>75% Grass cover, Good, HSG A
109	74	>75% Grass cover, Good, HSG C
655	98	Paved parking, HSG A
3,712	98	Paved parking, HSG B
175	98	Paved parking, HSG C
5,018	93	Weighted Average
475		9.47% Pervious Area
4,543		90.53% Impervious Area

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

Summary for Subcatchment P-5C: flow to wqu4

Runoff = 0.38 cfs @ 12.09 hrs, Volume= 1,198 cf, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
738	39	>75% Grass cover, Good, HSG A
1,556	98	Paved parking, HSG A
1,041	98	Paved parking, HSG B
3,335	85	Weighted Average
738		22.14% Pervious Area
2,597		77.86% Impervious Area

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

Summary for Subcatchment P-5D: Subcat P-5D

Runoff = 0.23 cfs @ 12.10 hrs, Volume= 770 cf, Depth= 1.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
3,781	39	>75% Grass cover, Good, HSG A
1,712	98	Paved parking, HSG A
5,493	57	Weighted Average
3,781		68.84% Pervious Area
1,712		31.16% Impervious Area

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

Summary for Subcatchment P-5E: flow to wqu5

Runoff = 0.84 cfs @ 12.08 hrs, Volume= 2,893 cf, Depth= 5.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
323	39	>75% Grass cover, Good, HSG A
5,991	98	Paved parking, HSG A
91	98	Paved parking, HSG B
6,404	95	Weighted Average
323		5.04% Pervious Area
6,081		94.96% Impervious Area

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

Summary for Subcatchment P-5F: flow to wqu6

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,607 cf, Depth= 4.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
478	39	>75% Grass cover, Good, HSG A
3,405	98	Paved parking, HSG A
3,883	91	Weighted Average
478		12.31% Pervious Area
3,405		87.69% Impervious Area

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

Summary for Subcatchment P-5G: Subcat P-5G

Runoff = 0.42 cfs @ 12.09 hrs, Volume= 1,380 cf, Depth= 4.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
418	39	>75% Grass cover, Good, HSG A
2,696	98	Paved parking, HSG A
220	98	Paved parking, HSG B
3,335	91	Weighted Average
418		12.55% Pervious Area
2,917		87.45% Impervious Area

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

Summary for Subcatchment P-5H: Subcat P-5H

Runoff = 0.46 cfs @ 12.09 hrs, Volume= 1,472 cf, Depth= 2.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
3,639	39	>75% Grass cover, Good, HSG A
820	61	>75% Grass cover, Good, HSG B
1,190	98	Paved parking, HSG A
1,838	98	Paved parking, HSG B
7,488	65	Weighted Average
4,459		59.55% Pervious Area
3,029		40.45% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 0.06 cfs @ 12.08 hrs, Volume= 204 cf, Depth= 5.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
424	98	Paved parking, HSG B
424		100.00% Impervious Area

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

Summary for Subcatchment P-7: Subcat P-7

Runoff = 2.29 cfs @ 12.13 hrs, Volume= 8,019 cf, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
10,690	39	>75% Grass cover, Good, HSG A
545	61	>75% Grass cover, Good, HSG B
410	74	>75% Grass cover, Good, HSG C
13,964	98	Paved parking, HSG A
2,140	98	Paved parking, HSG B
119	98	Paved parking, HSG C
1,373	98	Roofs, HSG A
29,242	75	Weighted Average
11,646		39.82% Pervious Area
17,597		60.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0160	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		**Sheet Flow, C-D** Smooth surfaces n= 0.011 P2= 3.10"
9.4	178	Total			

Summary for Subcatchment P-8: Subcat P-8

Runoff = 0.32 cfs @ 12.52 hrs, Volume= 2,189 cf, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-year Rainfall=6.01"

Area (sf)	CN	Description
11,113	39	>75% Grass cover, Good, HSG A
11,753	61	>75% Grass cover, Good, HSG B
22	98	Paved parking, HSG B
22,888	50	Weighted Average
22,866		99.90% Pervious Area
22		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

Summary for Reach 1R: Reach

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

Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 1.93" for 25-year event
Inflow = 3.26 cfs @ 12.24 hrs, Volume= 13,590 cf
Outflow = 3.26 cfs @ 12.24 hrs, Volume= 13,590 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Summary for Pond 1P: Collection Pond

Inflow Area = 29,242 sf, 60.18% Impervious, Inflow Depth = 3.29" for 25-year event
Inflow = 2.29 cfs @ 12.13 hrs, Volume= 8,019 cf
Outflow = 2.15 cfs @ 12.17 hrs, Volume= 7,464 cf, Atten= 6%, Lag= 2.5 min
Primary = 2.15 cfs @ 12.17 hrs, Volume= 7,464 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 171.04' @ 12.17 hrs Surf.Area= 1,157 sf Storage= 1,033 cf
Flood Elev= 172.00' Surf.Area= 7,699 sf Storage= 4,823 cf

Plug-Flow detention time= 59.2 min calculated for 7,464 cf (93% of inflow)
Center-of-Mass det. time= 22.8 min (852.3 - 829.5)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,823 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
169.00	58	127.0	0	0	58
170.00	507	161.0	245	245	850
171.00	1,011	179.0	745	990	1,366
172.00	7,699	640.0	3,833	4,823	31,414

Device	Routing	Invert	Outlet Devices
#1	Primary	170.50'	**120.0 deg x 1.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.48 (C= 3.10)

Primary OutFlow Max=2.12 cfs @ 12.17 hrs HW=171.04' TW=0.00' (Dynamic Tailwater)
1=Sharp-Crested Vee/Trap Weir (Weir Controls 2.12 cfs @ 2.05 fps)

Summary for Pond 3P: Collection Pond

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Verify GW w/ TP

Inflow Area = 32,379 sf, 17.90% Impervious, Inflow Depth = 2.91" for 25-year event
Inflow = 2.50 cfs @ 12.09 hrs, Volume= 7,843 cf
Outflow = 1.26 cfs @ 12.27 hrs, Volume= 6,426 cf, Atten= 50%, Lag= 10.5 min
Discarded = 0.03 cfs @ 12.27 hrs, Volume= 2,489 cf
Primary = 1.23 cfs @ 12.27 hrs, Volume= 3,937 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 174.71' @ 12.27 hrs Surf.Area= 1,193 sf Storage= 2,759 cf

Plug-Flow detention time= 290.1 min calculated for 6,426 cf (82% of inflow)
Center-of-Mass det. time= 216.1 min (1,051.9 - 835.8)

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,117 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	299	79.0	0	0	299
172.00	567	99.0	426	426	596
175.00	1,274	137.0	2,691	3,117	1,393

Device	Routing	Invert	Outlet Devices
#1	Discarded	171.00'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'
#2	Device 3	174.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	172.50'	**15.0" Round Culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.50' / 171.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.03 cfs @ 12.27 hrs HW=174.71' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.22 cfs @ 12.27 hrs HW=174.71' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 1.22 cfs of 5.87 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 1.22 cfs @ 1.49 fps)

Summary for Pond cb1: cb

Inflow Area = 13,530 sf, 32.33% Impervious, Inflow Depth = 1.60" for 25-year event
Inflow = 0.52 cfs @ 12.10 hrs, Volume= 1,807 cf
Outflow = 0.52 cfs @ 12.10 hrs, Volume= 1,807 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.52 cfs @ 12.10 hrs, Volume= 1,807 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 184.79' @ 12.10 hrs
Flood Elev= 187.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	**12.0" Round Culvert** L= 65.0' Ke= 0.500 Inlet / Outlet Invert= 184.40' / 183.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.50 cfs @ 12.10 hrs HW=184.78' TW=184.21' (Dynamic Tailwater)
1=Culvert (Outlet Controls 0.50 cfs @ 2.70 fps)

Summary for Pond dmh-10: dmh

Inflow Area = 7,488 sf, 40.45% Impervious, Inflow Depth = 2.36" for 25-year event
Inflow = 0.46 cfs @ 12.09 hrs, Volume= 1,472 cf
Outflow = 0.46 cfs @ 12.09 hrs, Volume= 1,472 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.46 cfs @ 12.09 hrs, Volume= 1,472 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.37' @ 12.39 hrs
Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	**12.0" Round Culvert** L= 71.0' Ke= 0.500 Inlet / Outlet Invert= 171.30' / 170.85' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=171.95' TW=172.02' (Dynamic Tailwater)
1=Culvert (Controls 0.00 cfs)

Summary for Pond dmh1: dmh

Inflow Area = 20,840 sf, 38.05% Impervious, Inflow Depth = 1.96" for 25-year event
Inflow = 1.03 cfs @ 12.10 hrs, Volume= 3,408 cf
Outflow = 1.03 cfs @ 12.10 hrs, Volume= 3,408 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.03 cfs @ 12.10 hrs, Volume= 3,408 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 184.22' @ 12.10 hrs
Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	**12.0" Round Culvert** L= 62.0' Ke= 0.500 Inlet / Outlet Invert= 183.65' / 183.03' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.00 cfs @ 12.10 hrs HW=184.21' TW=183.62' (Dynamic Tailwater)
1=Culvert (Outlet Controls 1.00 cfs @ 3.18 fps)

Summary for Pond dmh2: dmh

Inflow Area = 29,464 sf, 41.31% Impervious, Inflow Depth = 2.16" for 25-year event
Inflow = 1.62 cfs @ 12.10 hrs, Volume= 5,297 cf
Outflow = 1.62 cfs @ 12.10 hrs, Volume= 5,297 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.62 cfs @ 12.10 hrs, Volume= 5,297 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 183.63' @ 12.10 hrs
Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	**12.0" Round Culvert** L= 73.0' Ke= 0.500 Inlet / Outlet Invert= 182.93' / 182.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.57 cfs @ 12.10 hrs HW=183.62' TW=182.77' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 1.57 cfs @ 3.83 fps)

Summary for Pond dmh3: dmh

Inflow Area = 38,999 sf, 44.03% Impervious, Inflow Depth = 2.32" for 25-year event
Inflow = 2.34 cfs @ 12.09 hrs, Volume= 7,532 cf
Outflow = 2.34 cfs @ 12.09 hrs, Volume= 7,532 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.34 cfs @ 12.09 hrs, Volume= 7,532 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 182.78' @ 12.09 hrs
Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	**15.0" Round Culvert** L= 66.0' Ke= 0.500 Inlet / Outlet Invert= 181.95' / 181.29' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.28 cfs @ 12.09 hrs HW=182.77' TW=182.08' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 2.28 cfs @ 3.81 fps)

Summary for Pond dmh4: dmh

Inflow Area = 45,814 sf, 46.31% Impervious, Inflow Depth = 2.45" for 25-year event
Inflow = 2.92 cfs @ 12.09 hrs, Volume= 9,346 cf
Outflow = 2.92 cfs @ 12.09 hrs, Volume= 9,346 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.92 cfs @ 12.09 hrs, Volume= 9,346 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 182.09' @ 12.09 hrs
Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	**15.0" Round Culvert** L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 181.19' / 180.64' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.84 cfs @ 12.09 hrs HW=182.08' TW=180.81' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 2.84 cfs @ 4.28 fps)

Summary for Pond IS1: Infiltration #1

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Bottom of system placed above existing grade

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[80] Warning: Exceeded Pond wqu1 by 1.43' @ 21.60 hrs (8.05 cfs 63,623 cf)

Inflow Area = 66,528 sf, 60.36% Impervious, Inflow Depth = 3.30" for 25-year event
Inflow = 5.52 cfs @ 12.09 hrs, Volume= 18,298 cf
Outflow = 0.12 cfs @ 17.96 hrs, Volume= 11,959 cf, Atten= 98%, Lag= 352.5 min
Discarded = 0.12 cfs @ 17.96 hrs, Volume= 11,959 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 181.41' @ 17.96 hrs Surf.Area= 4,094 sf Storage= 11,997 cf

Plug-Flow detention time= 600.2 min calculated for 11,946 cf (65% of inflow)
Center-of-Mass det. time= 493.8 min (1,299.4 - 805.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	177.50'	4,569 cf	**44.50'W x 92.00'L x 5.50'H Field A** 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	**CMP Round 60** x 24 Inside #1 Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf Overall Size= 60.0"W x 60.0"H x 20.00'L 24 Chambers in 6 Rows 42.50' Header x 19.63 sf x 2 = 1,669.0 cf Inside
		15,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	182.40'	**12.0" Round Culvert** L= 82.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 182.40' / 178.31' S= 0.0499 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	177.50'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.12 cfs @ 17.96 hrs HW=181.41' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.12 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=177.50' TW=170.84' (Dynamic Tailwater)
↑—**1=Culvert** (Controls 0.00 cfs)

Summary for Pond IS2: Infiltration #2

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

TP-1 GW @ 36" = El. 168.70

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[80] Warning: Exceeded Pond wqu2 by 0.54' @ 22.40 hrs (1.27 cfs 5,414 cf)
[80] Warning: Exceeded Pond wqu7 by 0.77' @ 19.96 hrs (1.43 cfs 10,346 cf)

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 2.04" for 25-year event
Inflow = 6.21 cfs @ 12.09 hrs, Volume= 20,942 cf
Outflow = 2.21 cfs @ 12.36 hrs, Volume= 20,942 cf, Atten= 64%, Lag= 16.4 min
Discarded = 0.18 cfs @ 12.36 hrs, Volume= 12,274 cf
Primary = 2.03 cfs @ 12.36 hrs, Volume= 8,668 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.36' @ 12.36 hrs Surf.Area= 6,176 sf Storage= 7,324 cf

Plug-Flow detention time= 158.1 min calculated for 20,919 cf (100% of inflow)
Center-of-Mass det. time= 158.2 min (938.2 - 780.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.70'	3,753 cf	**16.00'W x 386.00'L x 2.50'H Field A** 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	**CMP Round 24** x 95 Inside #1 Effective Size= 24.0"W x 24.0"H => 3.14 sf x 20.00'L = 62.8 cf Overall Size= 24.0"W x 24.0"H x 20.00'L 95 Chambers in 5 Rows 14.00' Header x 3.14 sf x 2 = 88.0 cf Inside
		9,810 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	171.55'	**15.0" Round Culvert** L= 9.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.55' / 171.25' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Discarded	170.70'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.18 cfs @ 12.36 hrs HW=172.36' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.18 cfs)

Primary OutFlow Max=2.03 cfs @ 12.36 hrs HW=172.36' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 2.03 cfs @ 2.42 fps)

Summary for Pond wqu1: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=55)

Inflow Area = 54,779 sf, 51.86% Impervious, Inflow Depth = 2.77" for 25-year event
Inflow = 3.95 cfs @ 12.09 hrs, Volume= 12,647 cf
Outflow = 3.95 cfs @ 12.09 hrs, Volume= 12,647 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.95 cfs @ 12.09 hrs, Volume= 12,647 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 181.41' @ 17.96 hrs
Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	**24.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 179.89' / 179.63' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=3.86 cfs @ 12.09 hrs HW=180.81' TW=179.07' (Dynamic Tailwater)
↑—**1=Culvert** (Barrel Controls 3.86 cfs @ 4.01 fps)

Summary for Pond wqu2: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=63)

Inflow Area = 77,218 sf, 61.04% Impervious, Inflow Depth = 0.64" for 25-year event
Inflow = 1.28 cfs @ 12.09 hrs, Volume= 4,129 cf
Outflow = 1.28 cfs @ 12.09 hrs, Volume= 4,130 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.28 cfs @ 12.09 hrs, Volume= 4,130 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.36' @ 12.36 hrs
Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	**24.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 170.84' / 170.70' S= 0.0200 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=1.27 cfs @ 12.09 hrs HW=171.97' TW=171.94' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 1.27 cfs @ 1.01 fps)

Summary for Pond wqu7: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=62)
[80] Warning: Exceeded Pond dmh-10 by 0.10' @ 12.12 hrs (0.69 cfs 555 cf)

Inflow Area = 10,823 sf, 54.93% Impervious, Inflow Depth = 3.16" for 25-year event
Inflow = 0.88 cfs @ 12.09 hrs, Volume= 2,852 cf
Outflow = 0.88 cfs @ 12.09 hrs, Volume= 2,852 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.88 cfs @ 12.09 hrs, Volume= 2,852 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 172.37' @ 12.35 hrs
Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	**12.0" Round Culvert** L= 8.0' Ke= 0.500 Inlet / Outlet Invert= 170.75' / 170.70' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.86 cfs @ 12.09 hrs HW=172.00' TW=171.95' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 0.86 cfs @ 1.09 fps)

Summary for Link SP1: STUDY POINT #1

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth = 1.28" for 25-year event
Inflow = 5.35 cfs @ 12.25 hrs, Volume= 23,502 cf
Primary = 5.35 cfs @ 12.25 hrs, Volume= 23,502 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Summary for Link SP2: STUDY POINT #2

Inflow Area = 73,254 sf, 1.81% Impervious, Inflow Depth = 2.36" for 25-year event
Inflow = 4.04 cfs @ 12.14 hrs, Volume= 14,398 cf
Primary = 4.04 cfs @ 12.14 hrs, Volume= 14,398 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Time span=0.00-36.00 hrs, dt=0.04 hrs, 901 points x 2
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment B-1A: Subcat B-1A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=8.29"
Tc=6.0 min CN=98 Runoff=1.12 cfs 4,058 cf

Subcatchment B-1B: Subcat B-1B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=8.29"
Tc=6.0 min CN=98 Runoff=1.05 cfs 3,821 cf

Subcatchment B-2A: Subcat B-2A Runoff Area=5,875 sf 100.00% Impervious Runoff Depth=8.29"
Tc=6.0 min CN=98 Runoff=1.12 cfs 4,058 cf

Subcatchment B-2B: Subcat B-2B Runoff Area=5,530 sf 100.00% Impervious Runoff Depth=8.29"
Tc=6.0 min CN=98 Runoff=1.05 cfs 3,821 cf

Subcatchment P-1: Subcat P-1 Runoff Area=11,595 sf 0.33% Impervious Runoff Depth=2.47"
Flow Length=424' Tc=8.0 min CN=49 Runoff=0.66 cfs 2,383 cf

Subcatchment P-2B: Subcat P-2B Runoff Area=73,254 sf 1.81% Impervious Runoff Depth=4.33"
Flow Length=347' Tc=9.2 min CN=65 Runoff=7.59 cfs 26,414 cf

Subcatchment P-3A: Subcat P-3A Runoff Area=13,530 sf 32.33% Impervious Runoff Depth=3.27"
Tc=6.0 min CN=56 Runoff=1.15 cfs 3,685 cf

Subcatchment P-3B: Subcat P-3B Runoff Area=7,310 sf 48.64% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=68 Runoff=0.91 cfs 2,854 cf

Subcatchment P-3C: Subcat P-3C Runoff Area=8,624 sf 49.20% Impervious Runoff Depth=4.68"
Tc=6.0 min CN=68 Runoff=1.08 cfs 3,366 cf

Subcatchment P-3D: Subcat P-3D Runoff Area=9,535 sf 52.42% Impervious Runoff Depth=4.92"
Tc=6.0 min CN=70 Runoff=1.25 cfs 3,912 cf

Subcatchment P-3E: Subcat P-3E Runoff Area=6,815 sf 59.34% Impervious Runoff Depth=5.40"
Tc=6.0 min CN=74 Runoff=0.98 cfs 3,068 cf

Subcatchment P-3F: Subcat P-3F Runoff Area=8,965 sf 80.23% Impervious Runoff Depth=6.85"
Tc=6.0 min CN=86 Runoff=1.56 cfs 5,114 cf

Subcatchment P-4: Subcat P-4 Runoff Area=32,379 sf 17.90% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=71 Runoff=4.35 cfs 13,607 cf

Subcatchment P-5A: Subcat P-5A Runoff Area=10,690 sf 65.28% Impervious Runoff Depth=7.09"
Tc=6.0 min CN=88 Runoff=1.91 cfs 6,313 cf

Subcatchment P-5B: flow to wqu3 Runoff Area=5,018 sf 90.53% Impervious Runoff Depth=7.69"
Tc=6.0 min CN=93 Runoff=0.93 cfs 3,215 cf

Subcatchment P-5C: flow to wqu4 Runoff Area=3,335 sf 77.86% Impervious Runoff Depth=6.73"
Tc=6.0 min CN=85 Runoff=0.57 cfs 1,869 cf

Subcatchment P-5D: Subcat P-5D Runoff Area=5,493 sf 31.16% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=57 Runoff=0.49 cfs 1,549 cf

Subcatchment P-5E: flow to wqu5 Runoff Area=6,404 sf 94.96% Impervious Runoff Depth=7.93"
Tc=6.0 min CN=95 Runoff=1.21 cfs 4,232 cf

Subcatchment P-5F: flow to wqu6 Runoff Area=3,883 sf 87.69% Impervious Runoff Depth=7.45"
Tc=6.0 min CN=91 Runoff=0.71 cfs 2,410 cf

Subcatchment P-5G: Subcat P-5G Runoff Area=3,335 sf 87.45% Impervious Runoff Depth=7.45"
Tc=6.0 min CN=91 Runoff=0.61 cfs 2,070 cf

Subcatchment P-5H: Subcat P-5H Runoff Area=7,488 sf 40.45% Impervious Runoff Depth=4.33"
Tc=6.0 min CN=65 Runoff=0.86 cfs 2,700 cf

Subcatchment P-6: Subcat P-6 Runoff Area=424 sf 100.00% Impervious Runoff Depth=8.29"
Tc=6.0 min CN=98 Runoff=0.08 cfs 293 cf

Subcatchment P-7: Subcat P-7 Runoff Area=29,242 sf 60.18% Impervious Runoff Depth=5.52"
Flow Length=178' Tc=9.4 min CN=75 Runoff=3.83 cfs 13,457 cf

Subcatchment P-8: Subcat P-8 Runoff Area=22,888 sf 0.10% Impervious Runoff Depth=2.58"
Flow Length=852' Tc=30.4 min CN=50 Runoff=0.83 cfs 4,920 cf

Reach 1R: Reach Inflow=7.66 cfs 27,414 cf
Outflow=7.66 cfs 27,414 cf

Pond 1P: Collection Pond Peak Elev=171.20' Storage=1,265 cf Inflow=3.83 cfs 13,457 cf
Outflow=3.54 cfs 12,902 cf

Pond 3P: Collection Pond Peak Elev=174.97' Storage=3,078 cf Inflow=4.35 cfs 13,607 cf
Discarded=0.03 cfs 2,591 cf Primary=4.05 cfs 9,591 cf Outflow=4.08 cfs 12,183 cf

Pond cb1: cb Peak Elev=185.06' Inflow=1.15 cfs 3,685 cf
12.0" Round Culvert n=0.013 L=65.0' S=0.0100 '/' Outflow=1.15 cfs 3,685 cf

Pond dmh-10: dmh Peak Elev=173.23' Inflow=0.86 cfs 2,700 cf
12.0" Round Culvert n=0.013 L=71.0' S=0.0063 '/' Outflow=0.86 cfs 2,700 cf

Pond dmh1: dmh Peak Elev=184.64' Inflow=2.06 cfs 6,538 cf
12.0" Round Culvert n=0.013 L=62.0' S=0.0100 '/' Outflow=2.06 cfs 6,538 cf

Pond dmh2: dmh Peak Elev=184.14' Inflow=3.14 cfs 9,905 cf
12.0" Round Culvert n=0.013 L=73.0' S=0.0100 '/' Outflow=3.14 cfs 9,905 cf

Pond dmh3: dmh Peak Elev=183.32' Inflow=4.39 cfs 13,817 cf
15.0" Round Culvert n=0.013 L=66.0' S=0.0100 '/' Outflow=4.39 cfs 13,817 cf

Pond dmh4: dmh Peak Elev=182.98' Inflow=5.37 cfs 16,885 cf
15.0" Round Culvert n=0.013 L=55.0' S=0.0100 '/' Outflow=5.37 cfs 16,885 cf

Pond IS1: Infiltration #1 Peak Elev=182.97' Storage=15,612 cf Inflow=9.17 cfs 30,109 cf
Discarded=0.13 cfs 13,132 cf Primary=0.94 cfs 7,614 cf Outflow=1.07 cfs 20,746 cf

Pond IS2: Infiltration #2 Peak Elev=173.18' Storage=9,759 cf Inflow=9.40 cfs 39,613 cf
Discarded=0.19 cfs 14,394 cf Primary=4.68 cfs 25,219 cf Outflow=4.87 cfs 39,613 cf

Pond wqu1: dmh Peak Elev=182.97' Inflow=6.93 cfs 21,999 cf
24.0" Round Culvert n=0.013 L=26.0' S=0.0100 '/' Outflow=6.93 cfs 21,992 cf

Pond wqu2: dmh Peak Elev=173.18' Inflow=1.91 cfs 13,927 cf
24.0" Round Culvert n=0.025 L=7.0' S=0.0200 '/' Outflow=1.91 cfs 13,927 cf

Pond wqu7: dmh Peak Elev=173.23' Inflow=1.47 cfs 4,770 cf
12.0" Round Culvert n=0.013 L=8.0' S=0.0063 '/' Outflow=1.47 cfs 4,770 cf

Link SP1: STUDY POINT #1 Inflow=12.74 cfs 55,310 cf
Primary=12.74 cfs 55,310 cf

Link SP2: STUDY POINT #2 Inflow=7.59 cfs 26,414 cf
Primary=7.59 cfs 26,414 cf

Total Runoff Area = 293,017 sf Runoff Volume = 123,190 cf Average Runoff Depth = 5.05"
63.25% Pervious = 185,334 sf 36.75% Impervious = 107,683 sf

Summary for Subcatchment B-1A: Subcat B-1A

Runoff = 1.12 cfs @ 12.08 hrs, Volume= 4,058 cf, Depth= 8.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
4,811	98	Roofs, HSG A
1,064	98	Roofs, HSG C
5,875	98	Weighted Average
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-1B: Subcat B-1B

Runoff = 1.05 cfs @ 12.08 hrs, Volume= 3,821 cf, Depth= 8.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
4,214	98	Roofs, HSG A
1,316	98	Roofs, HSG C
5,530	98	Weighted Average
5,530		100.00% Impervious Area

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

Summary for Subcatchment B-2A: Subcat B-2A

Runoff = 1.12 cfs @ 12.08 hrs, Volume= 4,058 cf, Depth= 8.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
5,875	98	Roofs, HSG A
5,875		100.00% Impervious Area

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

Summary for Subcatchment B-2B: Subcat B-2B

Runoff = 1.05 cfs @ 12.08 hrs, Volume= 3,821 cf, Depth= 8.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
5,530	98	Roofs, HSG A
5,530		100.00% Impervious Area

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

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.66 cfs @ 12.13 hrs, Volume= 2,383 cf, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
2,665	39	>75% Grass cover, Good, HSG A
1,275	61	>75% Grass cover, Good, HSG B
2,735	74	>75% Grass cover, Good, HSG C
38	98	Paved parking, HSG B
3,940	30	Woods, Good, HSG A
942	70	Woods, Good, HSG C
11,595	49	Weighted Average
11,556		99.67% Pervious Area
38		0.33% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	50	0.1400	0.14		**Sheet Flow, A TO B** Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		**Shallow Concentrated Flow, B TO C** Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		**Shallow Concentrated Flow, C TO D** Paved Kv= 20.3 fps
8.0	424	Total			

Summary for Subcatchment P-2B: Subcat P-2B

Runoff = 7.59 cfs @ 12.13 hrs, Volume= 26,414 cf, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
8,707	39	>75% Grass cover, Good, HSG A
28,468	74	>75% Grass cover, Good, HSG C
189	98	Paved parking, HSG A
1,137	98	Paved parking, HSG C
5,524	30	Woods, Good, HSG A
29,228	70	Woods, Good, HSG C
73,254	65	Weighted Average
71,928		98.19% Pervious Area
1,325		1.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0300	0.12		**Sheet Flow, A TO B** Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		**Shallow Concentrated Flow, C TO D** Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		**Shallow Concentrated Flow, D TO E** Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 1.15 cfs @ 12.09 hrs, Volume= 3,685 cf, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
5,544	39	>75% Grass cover, Good, HSG A
4,374	98	Paved parking, HSG A
3,612	30	Woods, Good, HSG A
13,530	56	Weighted Average
9,155		67.67% Pervious Area
4,374		32.33% Impervious Area

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

Summary for Subcatchment P-3B: Subcat P-3B

Runoff = 0.91 cfs @ 12.09 hrs, Volume= 2,854 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
3,755	39	>75% Grass cover, Good, HSG A
3,556	98	Paved parking, HSG A
7,310	68	Weighted Average
3,755		51.36% Pervious Area
3,556		48.64% Impervious Area

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

Summary for Subcatchment P-3C: Subcat P-3C

Runoff = 1.08 cfs @ 12.09 hrs, Volume= 3,366 cf, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
4,381	39	>75% Grass cover, Good, HSG A
4,243	98	Paved parking, HSG A
8,624	68	Weighted Average
4,381		50.80% Pervious Area
4,243		49.20% Impervious Area

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

Summary for Subcatchment P-3D: Subcat P-3D

Runoff = 1.25 cfs @ 12.09 hrs, Volume= 3,912 cf, Depth= 4.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
4,537	39	>75% Grass cover, Good, HSG A
4,998	98	Paved parking, HSG A
9,535	70	Weighted Average
4,537		47.58% Pervious Area
4,998		52.42% Impervious Area

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

Summary for Subcatchment P-3E: Subcat P-3E

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 3,068 cf, Depth= 5.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
2,771	39	>75% Grass cover, Good, HSG A
4,044	98	Paved parking, HSG A
6,815	74	Weighted Average
2,771		40.66% Pervious Area
4,044		59.34% Impervious Area

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

Summary for Subcatchment P-3F: Subcat P-3F

Runoff = 1.56 cfs @ 12.09 hrs, Volume= 5,114 cf, Depth= 6.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
1,772	39	>75% Grass cover, Good, HSG A
7,192	98	Paved parking, HSG A
8,965	86	Weighted Average
1,772		19.77% Pervious Area
7,192		80.23% Impervious Area

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 4.35 cfs @ 12.09 hrs, Volume= 13,607 cf, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
6,551	39	>75% Grass cover, Good, HSG A
20,031	74	>75% Grass cover, Good, HSG C
5,797	98	Paved parking, HSG C
32,379	71	Weighted Average
26,582		82.10% Pervious Area
5,797		17.90% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Assumed**
5.0	0	Total, Increased to minimum Tc = 6.0 min			

Summary for Subcatchment P-5A: Subcat P-5A

Runoff = 1.91 cfs @ 12.09 hrs, Volume= 6,313 cf, Depth= 7.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
547	39	>75% Grass cover, Good, HSG A
88	61	>75% Grass cover, Good, HSG B
3,077	74	>75% Grass cover, Good, HSG C
646	98	Paved parking, HSG A
1,804	98	Paved parking, HSG B
4,528	98	Paved parking, HSG C
10,690	88	Weighted Average
3,712		34.72% Pervious Area
6,978		65.28% Impervious Area

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

Summary for Subcatchment P-5B: flow to wqu3

Runoff = 0.93 cfs @ 12.08 hrs, Volume= 3,215 cf, Depth= 7.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
366	39	>75% Grass cover, Good, HSG A
109	74	>75% Grass cover, Good, HSG C
655	98	Paved parking, HSG A
3,712	98	Paved parking, HSG B
175	98	Paved parking, HSG C
5,018	93	Weighted Average
475		9.47% Pervious Area
4,543		90.53% Impervious Area

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

Summary for Subcatchment P-5C: flow to wqu4

Runoff = 0.57 cfs @ 12.09 hrs, Volume= 1,869 cf, Depth= 6.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
738	39	>75% Grass cover, Good, HSG A
1,556	98	Paved parking, HSG A
1,041	98	Paved parking, HSG B
3,335	85	Weighted Average
738		22.14% Pervious Area
2,597		77.86% Impervious Area

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

Summary for Subcatchment P-5D: Subcat P-5D

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,549 cf, Depth= 3.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
3,781	39	>75% Grass cover, Good, HSG A
1,712	98	Paved parking, HSG A
5,493	57	Weighted Average
3,781		68.84% Pervious Area
1,712		31.16% Impervious Area

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

Summary for Subcatchment P-5E: flow to wqu5

Runoff = 1.21 cfs @ 12.08 hrs, Volume= 4,232 cf, Depth= 7.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
323	39	>75% Grass cover, Good, HSG A
5,991	98	Paved parking, HSG A
91	98	Paved parking, HSG B
6,404	95	Weighted Average
323		5.04% Pervious Area
6,081		94.96% Impervious Area

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

Summary for Subcatchment P-5F: flow to wqu6

Runoff = 0.71 cfs @ 12.08 hrs, Volume= 2,410 cf, Depth= 7.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
478	39	>75% Grass cover, Good, HSG A
3,405	98	Paved parking, HSG A
3,883	91	Weighted Average
478		12.31% Pervious Area
3,405		87.69% Impervious Area

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

Summary for Subcatchment P-5G: Subcat P-5G

Runoff = 0.61 cfs @ 12.08 hrs, Volume= 2,070 cf, Depth= 7.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
418	39	>75% Grass cover, Good, HSG A
2,696	98	Paved parking, HSG A
220	98	Paved parking, HSG B
3,335	91	Weighted Average
418		12.55% Pervious Area
2,917		87.45% Impervious Area

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

Summary for Subcatchment P-5H: Subcat P-5H

Runoff = 0.86 cfs @ 12.09 hrs, Volume= 2,700 cf, Depth= 4.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
3,639	39	>75% Grass cover, Good, HSG A
820	61	>75% Grass cover, Good, HSG B
1,190	98	Paved parking, HSG A
1,838	98	Paved parking, HSG B
7,488	65	Weighted Average
4,459		59.55% Pervious Area
3,029		40.45% Impervious Area

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

Summary for Subcatchment P-6: Subcat P-6

Runoff = 0.08 cfs @ 12.08 hrs, Volume= 293 cf, Depth= 8.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
424	98	Paved parking, HSG B
424		100.00% Impervious Area

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

Summary for Subcatchment P-7: Subcat P-7

Runoff = 3.83 cfs @ 12.13 hrs, Volume= 13,457 cf, Depth= 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
10,690	39	>75% Grass cover, Good, HSG A
545	61	>75% Grass cover, Good, HSG B
410	74	>75% Grass cover, Good, HSG C
13,964	98	Paved parking, HSG A
2,140	98	Paved parking, HSG B
119	98	Paved parking, HSG C
1,373	98	Roofs, HSG A
29,242	75	Weighted Average
11,646		39.82% Pervious Area
17,597		60.18% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	50	0.0160	0.13		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		**Sheet Flow, C-D** Smooth surfaces n= 0.011 P2= 3.10"
9.4	178	Total			

Summary for Subcatchment P-8: Subcat P-8

Runoff = 0.83 cfs @ 12.47 hrs, Volume= 4,920 cf, Depth= 2.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=8.53"

Area (sf)	CN	Description
11,113	39	>75% Grass cover, Good, HSG A
11,753	61	>75% Grass cover, Good, HSG B
22	98	Paved parking, HSG B
22,888	50	Weighted Average
22,866		99.90% Pervious Area
22		0.10% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.7	50	0.0200	0.15		**Sheet Flow, A TO B** Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		**Shallow Concentrated Flow, B TO C** Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

Summary for Reach 1R: Reach

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

Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 3.89" for 100-year event
Inflow = 7.66 cfs @ 12.14 hrs, Volume= 27,414 cf
Outflow = 7.66 cfs @ 12.14 hrs, Volume= 27,414 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Summary for Pond 1P: Collection Pond

Inflow Area = 29,242 sf, 60.18% Impervious, Inflow Depth = 5.52" for 100-year event
Inflow = 3.83 cfs @ 12.13 hrs, Volume= 13,457 cf
Outflow = 3.54 cfs @ 12.18 hrs, Volume= 12,902 cf, Atten= 8%, Lag= 2.6 min
Primary = 3.54 cfs @ 12.18 hrs, Volume= 12,902 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 171.20' @ 12.18 hrs Surf.Area= 1,830 sf Storage= 1,265 cf
Flood Elev= 172.00' Surf.Area= 7,699 sf Storage= 4,823 cf

Plug-Flow detention time= 41.8 min calculated for 12,902 cf (96% of inflow)
Center-of-Mass det. time= 18.2 min (832.9 - 814.7)

Volume	Invert	Avail.Storage	Storage Description
#1	169.00'	4,823 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
169.00	58	127.0	0	0	58
170.00	507	161.0	245	245	850
171.00	1,011	179.0	745	990	1,366
172.00	7,699	640.0	3,833	4,823	31,414

Device	Routing	Invert	Outlet Devices
#1	Primary	170.50'	**120.0 deg x 1.0' long Sharp-Crested Vee/Trap Weir** Cv= 2.48 (C= 3.10)

Primary OutFlow Max=3.50 cfs @ 12.18 hrs HW=171.19' TW=0.00' (Dynamic Tailwater)
↑—**1=Sharp-Crested Vee/Trap Weir** (Weir Controls 3.50 cfs @ 2.30 fps)

Summary for Pond 3P: Collection Pond

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Verify GW w/ TP

Inflow Area = 32,379 sf, 17.90% Impervious, Inflow Depth = 5.04" for 100-year event
Inflow = 4.35 cfs @ 12.09 hrs, Volume= 13,607 cf
Outflow = 4.08 cfs @ 12.12 hrs, Volume= 12,183 cf, Atten= 6%, Lag= 1.9 min
Discarded = 0.03 cfs @ 12.12 hrs, Volume= 2,591 cf
Primary = 4.05 cfs @ 12.12 hrs, Volume= 9,591 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 174.97' @ 12.12 hrs Surf.Area= 1,265 sf Storage= 3,078 cf

Plug-Flow detention time= 169.7 min calculated for 12,169 cf (89% of inflow)
Center-of-Mass det. time= 120.4 min (940.3 - 819.9)

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,117 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	299	79.0	0	0	299
172.00	567	99.0	426	426	596
175.00	1,274	137.0	2,691	3,117	1,393

Device	Routing	Invert	Outlet Devices
#1	Discarded	171.00'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'
#2	Device 3	174.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	172.50'	**15.0" Round Culvert** L= 100.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.50' / 171.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Discarded OutFlow Max=0.03 cfs @ 12.12 hrs HW=174.97' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=4.05 cfs @ 12.12 hrs HW=174.97' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 4.05 cfs of 6.34 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 4.05 cfs @ 3.30 fps)

Summary for Pond cb1: cb

Inflow Area = 13,530 sf, 32.33% Impervious, Inflow Depth = 3.27" for 100-year event
Inflow = 1.15 cfs @ 12.09 hrs, Volume= 3,685 cf
Outflow = 1.15 cfs @ 12.09 hrs, Volume= 3,685 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.15 cfs @ 12.09 hrs, Volume= 3,685 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 185.06' @ 12.10 hrs
Flood Elev= 187.67'

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	**12.0" Round Culvert** L= 65.0' Ke= 0.500 Inlet / Outlet Invert= 184.40' / 183.75' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.05 cfs @ 12.09 hrs HW=185.05' TW=184.62' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 1.05 cfs @ 2.77 fps)

Summary for Pond dmh-10: dmh

Inflow Area = 7,488 sf, 40.45% Impervious, Inflow Depth = 4.33" for 100-year event
Inflow = 0.86 cfs @ 12.09 hrs, Volume= 2,700 cf
Outflow = 0.86 cfs @ 12.09 hrs, Volume= 2,700 cf, Atten= 0%, Lag= 0.0 min
Primary = 0.86 cfs @ 12.09 hrs, Volume= 2,700 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 173.23' @ 12.26 hrs
Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	**12.0" Round Culvert** L= 71.0' Ke= 0.500 Inlet / Outlet Invert= 171.30' / 170.85' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=172.66' TW=172.83' (Dynamic Tailwater)
└**1=Culvert** (Controls 0.00 cfs)

Summary for Pond dmh1: dmh

Inflow Area = 20,840 sf, 38.05% Impervious, Inflow Depth = 3.76" for 100-year event
Inflow = 2.06 cfs @ 12.09 hrs, Volume= 6,538 cf
Outflow = 2.06 cfs @ 12.09 hrs, Volume= 6,538 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.06 cfs @ 12.09 hrs, Volume= 6,538 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 184.64' @ 12.10 hrs
Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	**12.0" Round Culvert** L= 62.0' Ke= 0.500 Inlet / Outlet Invert= 183.65' / 183.03' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.01 cfs @ 12.09 hrs HW=184.62' TW=184.11' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 2.01 cfs @ 3.29 fps)

Summary for Pond dmh2: dmh

Inflow Area = 29,464 sf, 41.31% Impervious, Inflow Depth = 4.03" for 100-year event
Inflow = 3.14 cfs @ 12.09 hrs, Volume= 9,905 cf
Outflow = 3.14 cfs @ 12.09 hrs, Volume= 9,905 cf, Atten= 0%, Lag= 0.0 min
Primary = 3.14 cfs @ 12.09 hrs, Volume= 9,905 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 184.14' @ 12.10 hrs
Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	**12.0" Round Culvert** L= 73.0' Ke= 0.500 Inlet / Outlet Invert= 182.93' / 182.20' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.95 cfs @ 12.09 hrs HW=184.11' TW=183.29' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 2.95 cfs @ 4.01 fps)

Summary for Pond dmh3: dmh

Inflow Area = 38,999 sf, 44.03% Impervious, Inflow Depth = 4.25" for 100-year event
Inflow = 4.39 cfs @ 12.09 hrs, Volume= 13,817 cf
Outflow = 4.39 cfs @ 12.09 hrs, Volume= 13,817 cf, Atten= 0%, Lag= 0.0 min
Primary = 4.39 cfs @ 12.09 hrs, Volume= 13,817 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 183.32' @ 12.09 hrs
Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	**15.0" Round Culvert** L= 66.0' Ke= 0.500 Inlet / Outlet Invert= 181.95' / 181.29' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=4.30 cfs @ 12.09 hrs HW=183.29' TW=182.61' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 4.30 cfs @ 4.06 fps)

Summary for Pond dmh4: dmh

[80] Warning: Exceeded Pond dmh3 by 0.38' @ 24.16 hrs (0.53 cfs 283 cf)

Inflow Area = 45,814 sf, 46.31% Impervious, Inflow Depth = 4.42" for 100-year event
Inflow = 5.37 cfs @ 12.09 hrs, Volume= 16,885 cf
Outflow = 5.37 cfs @ 12.09 hrs, Volume= 16,885 cf, Atten= 0%, Lag= 0.0 min
Primary = 5.37 cfs @ 12.09 hrs, Volume= 16,885 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 182.98' @ 12.83 hrs
Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	**15.0" Round Culvert** L= 55.0' Ke= 0.500 Inlet / Outlet Invert= 181.19' / 180.64' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=5.26 cfs @ 12.09 hrs HW=182.61' TW=181.18' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 5.26 cfs @ 4.28 fps)

Summary for Pond IS1: Infiltration #1

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

Bottom of system placed above existing grade

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[80] Warning: Exceeded Pond wqu1 by 2.48' @ 24.12 hrs (17.26 cfs 117,691 cf)

Inflow Area =	66,528 sf,	60.36% Impervious,	Inflow Depth =	5.43"	for 100-year event
Inflow =	9.17 cfs @	12.09 hrs,	Volume=	30,109 cf	
Outflow =	1.07 cfs @	12.80 hrs,	Volume=	20,746 cf,	Atten= 88%, Lag= 43.0 min
Discarded =	0.13 cfs @	12.80 hrs,	Volume=	13,132 cf	
Primary =	0.94 cfs @	12.80 hrs,	Volume=	7,614 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 182.97' @ 12.80 hrs Surf.Area= 4,094 sf Storage= 15,612 cf

Plug-Flow detention time= 425.8 min calculated for 20,746 cf (69% of inflow)
Center-of-Mass det. time= 326.5 min (1,123.9 - 797.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	177.50'	4,569 cf	**44.50'W x 92.00'L x 5.50'H Field A** 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	**CMP Round 60** x 24 Inside #1 Effective Size= 60.0"W x 60.0"H => 19.63 sf x 20.00'L = 392.7 cf Overall Size= 60.0"W x 60.0"H x 20.00'L 24 Chambers in 6 Rows 42.50' Header x 19.63 sf x 2 = 1,669.0 cf Inside
		15,663 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	182.40'	**12.0" Round Culvert** L= 82.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 182.40' / 178.31' S= 0.0499 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Discarded	177.50'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.13 cfs @ 12.80 hrs HW=182.97' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.94 cfs @ 12.80 hrs HW=182.97' TW=172.44' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 0.94 cfs @ 2.03 fps)

Summary for Pond IS2: Infiltration #2

Soil type 307C (sandy loam) Rawls infiltration rate = 1.02 inches per hour

TP-1 GW @ 36" = El. 168.70

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[80] Warning: Exceeded Pond wqu2 by 0.64' @ 24.28 hrs (1.73 cfs 4,416 cf)
[80] Warning: Exceeded Pond wqu7 by 0.74' @ 24.20 hrs (1.33 cfs 4,673 cf)

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 3.86" for 100-year event
Inflow = 9.40 cfs @ 12.09 hrs, Volume= 39,613 cf
Outflow = 4.87 cfs @ 12.23 hrs, Volume= 39,613 cf, Atten= 48%, Lag= 8.6 min
Discarded = 0.19 cfs @ 12.23 hrs, Volume= 14,394 cf
Primary = 4.68 cfs @ 12.23 hrs, Volume= 25,219 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 173.18' @ 12.23 hrs Surf.Area= 6,176 sf Storage= 9,759 cf

Plug-Flow detention time= 114.4 min calculated for 39,569 cf (100% of inflow)
Center-of-Mass det. time= 114.7 min (907.5 - 792.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	170.70'	3,753 cf	**16.00'W x 386.00'L x 2.50'H Field A** 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	**CMP Round 24** x 95 Inside #1 Effective Size= 24.0"W x 24.0"H => 3.14 sf x 20.00'L = 62.8 cf Overall Size= 24.0"W x 24.0"H x 20.00'L 95 Chambers in 5 Rows 14.00' Header x 3.14 sf x 2 = 88.0 cf Inside
		9,810 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	171.55'	**15.0" Round Culvert** L= 9.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 171.55' / 171.25' S= 0.0333 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Discarded	170.70'	**1.020 in/hr Exfiltration over Wetted area** Phase-In= 0.01'

Discarded OutFlow Max=0.19 cfs @ 12.23 hrs HW=173.18' (Free Discharge)
2=Exfiltration (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=4.67 cfs @ 12.23 hrs HW=173.18' TW=0.00' (Dynamic Tailwater)
1=Culvert (Inlet Controls 4.67 cfs @ 3.80 fps)

Summary for Pond wqu1: dmh

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=12)
[80] Warning: Exceeded Pond dmh4 by 1.08' @ 24.40 hrs (3.83 cfs 7,116 cf)

Inflow Area = 54,779 sf, 51.86% Impervious, Inflow Depth = 4.82" for 100-year event
Inflow = 6.93 cfs @ 12.09 hrs, Volume= 21,999 cf
Outflow = 6.93 cfs @ 12.09 hrs, Volume= 21,992 cf, Atten= 0%, Lag= 0.0 min
Primary = 6.93 cfs @ 12.09 hrs, Volume= 21,992 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2

Peak Elev= 182.97' @ 12.80 hrs
Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	**24.0" Round Culvert** L= 26.0' Ke= 0.500 Inlet / Outlet Invert= 179.89' / 179.63' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=6.84 cfs @ 12.09 hrs HW=181.18' TW=180.33' (Dynamic Tailwater)
↑**1=Culvert** (Barrel Controls 6.84 cfs @ 4.53 fps)

Summary for Pond wqu2: dmh

Inflow Area = 77,218 sf, 61.04% Impervious, Inflow Depth = 2.16" for 100-year event
Inflow = 1.91 cfs @ 12.09 hrs, Volume= 13,927 cf
Outflow = 1.91 cfs @ 12.09 hrs, Volume= 13,927 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.91 cfs @ 12.09 hrs, Volume= 13,927 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 173.18' @ 12.23 hrs
Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	**24.0" Round Culvert** L= 7.0' Ke= 0.500 Inlet / Outlet Invert= 170.84' / 170.70' S= 0.0200 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf

Primary OutFlow Max=1.91 cfs @ 12.09 hrs HW=172.67' TW=172.65' (Dynamic Tailwater)
↑**1=Culvert** (Outlet Controls 1.91 cfs @ 0.83 fps)

Summary for Pond wqu7: dmh

[80] Warning: Exceeded Pond dmh-10 by 0.22' @ 12.12 hrs (1.55 cfs 1,228 cf)

Inflow Area = 10,823 sf, 54.93% Impervious, Inflow Depth = 5.29" for 100-year event
Inflow = 1.47 cfs @ 12.09 hrs, Volume= 4,770 cf
Outflow = 1.47 cfs @ 12.09 hrs, Volume= 4,770 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.47 cfs @ 12.09 hrs, Volume= 4,770 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 173.23' @ 12.22 hrs
Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	**12.0" Round Culvert** L= 8.0' Ke= 0.500 Inlet / Outlet Invert= 170.75' / 170.70' S= 0.0063 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.45 cfs @ 12.09 hrs HW=172.81' TW=172.67' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 1.45 cfs @ 1.84 fps)

Summary for Link SP1: STUDY POINT #1

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth = 3.02" for 100-year event
Inflow = 12.74 cfs @ 12.16 hrs, Volume= 55,310 cf
Primary = 12.74 cfs @ 12.16 hrs, Volume= 55,310 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Summary for Link SP2: STUDY POINT #2

Inflow Area = 73,254 sf, 1.81% Impervious, Inflow Depth = 4.33" for 100-year event
Inflow = 7.59 cfs @ 12.13 hrs, Volume= 26,414 cf
Primary = 7.59 cfs @ 12.13 hrs, Volume= 26,414 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs

Section 5.0

APPENDIX

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.370 degrees West
Latitude	42.249 degrees North
Elevation	0 feet
Date/Time	Mon, 17 Aug 2020 11:52:03 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.44	0.54	0.71	0.89	1.12	**1yr**	0.77	1.06	1.30	1.65	2.09	2.66	2.89	**1yr**	2.36	2.78	3.25	3.90	4.57	**1yr**
2yr	0.35	0.54	0.67	0.89	1.12	1.41	**2yr**	0.97	1.29	1.63	2.04	2.55	3.19	3.51	**2yr**	2.83	3.37	3.88	4.62	5.24	**2yr**
5yr	0.42	0.65	0.82	1.10	1.40	1.78	**5yr**	1.21	1.62	2.07	2.59	3.23	4.02	4.47	**5yr**	3.55	4.30	4.93	5.85	6.53	**5yr**
10yr	0.48	0.75	0.94	1.28	1.67	2.14	**10yr**	1.44	1.91	2.48	3.11	3.86	4.78	5.38	**10yr**	4.23	5.17	5.92	7.00	7.72	**10yr**
25yr	0.57	0.90	1.15	1.58	2.10	2.70	**25yr**	1.81	2.39	3.15	3.95	4.89	6.01	6.87	**25yr**	5.32	6.60	7.55	8.87	9.64	**25yr**
50yr	0.64	1.03	1.32	1.86	2.50	3.25	**50yr**	2.16	2.83	3.80	4.76	5.87	7.16	8.27	**50yr**	6.34	7.95	9.07	10.61	11.41	**50yr**
100yr	0.74	1.19	1.54	2.18	2.98	3.90	**100yr**	2.57	3.36	4.57	5.71	7.02	8.53	9.96	**100yr**	7.55	9.58	10.91	12.70	13.51	**100yr**
200yr	0.86	1.39	1.81	2.58	3.56	4.67	**200yr**	3.07	3.98	5.48	6.84	8.40	10.17	12.00	**200yr**	9.00	11.54	13.12	15.21	16.00	**200yr**
500yr	1.03	1.69	2.21	3.21	4.50	5.95	**500yr**	3.89	4.99	6.99	8.72	10.66	12.85	15.37	**500yr**	11.37	14.78	16.75	19.32	20.02	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.35	0.43	0.58	0.71	0.91	**1yr**	0.61	0.89	1.03	1.41	1.83	2.28	2.48	**1yr**	2.02	2.38	2.96	3.33	3.97	**1yr**
2yr	0.34	0.52	0.65	0.87	1.08	1.27	**2yr**	0.93	1.24	1.45	1.92	2.46	3.06	3.35	**2yr**	2.71	3.22	3.69	4.49	5.09	**2yr**
5yr	0.38	0.59	0.73	1.00	1.27	1.52	**5yr**	1.10	1.48	1.73	2.26	2.89	3.59	4.00	**5yr**	3.18	3.84	4.44	5.45	6.06	**5yr**
10yr	0.42	0.65	0.80	1.12	1.45	1.73	**10yr**	1.25	1.69	1.94	2.55	3.24	4.05	4.56	**10yr**	3.58	4.38	5.08	6.18	6.92	**10yr**

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
25yr	0.48	0.73	0.91	1.30	1.71	2.04	**25yr**	1.48	2.00	2.30	3.02	3.80	4.76	5.44	**25yr**	4.21	5.23	6.10	7.41	8.24	**25yr**
50yr	0.53	0.80	1.00	1.44	1.94	2.32	**50yr**	1.67	2.26	2.60	3.41	4.27	5.37	6.22	**50yr**	4.76	5.99	7.00	8.46	9.40	**50yr**
100yr	0.58	0.88	1.10	1.59	2.18	2.63	**100yr**	1.88	2.57	2.94	3.78	4.82	6.10	7.15	**100yr**	5.40	6.87	8.04	9.68	10.73	**100yr**
200yr	0.63	0.95	1.21	1.75	2.44	2.99	**200yr**	2.10	2.92	3.33	4.27	5.43	6.92	8.20	**200yr**	6.13	7.88	9.26	11.09	12.24	**200yr**
500yr	0.71	1.06	1.36	1.98	2.81	3.54	**500yr**	2.43	3.46	3.92	5.01	6.38	8.22	9.91	**500yr**	7.27	9.53	11.16	13.28	14.62	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.49	0.60	0.81	1.00	1.19	**1yr**	0.86	1.17	1.36	1.79	2.31	3.01	3.22	**1yr**	2.66	3.10	3.51	4.22	5.20	**1yr**
2yr	0.37	0.57	0.70	0.95	1.17	1.37	**2yr**	1.01	1.34	1.58	2.06	2.65	3.37	3.72	**2yr**	2.99	3.58	4.08	4.82	5.43	**2yr**
5yr	0.46	0.71	0.89	1.22	1.55	1.81	**5yr**	1.33	1.77	2.06	2.66	3.36	4.49	4.96	**5yr**	3.97	4.77	5.42	6.29	7.02	**5yr**
10yr	0.56	0.86	1.06	1.49	1.92	2.24	**10yr**	1.66	2.19	2.56	3.22	4.04	5.55	6.22	**10yr**	4.91	5.98	6.78	7.75	8.54	**10yr**
25yr	0.72	1.10	1.37	1.95	2.57	2.97	**25yr**	2.22	2.90	3.38	4.16	5.18	7.39	8.39	**25yr**	6.54	8.07	9.10	10.19	11.05	**25yr**
50yr	0.88	1.33	1.66	2.38	3.21	3.67	**50yr**	2.77	3.59	4.18	5.05	6.23	9.16	10.52	**50yr**	8.11	10.11	11.36	12.55	13.45	**50yr**
100yr	1.07	1.62	2.03	2.93	4.02	4.56	**100yr**	3.47	4.46	5.17	6.25	7.51	11.37	13.14	**100yr**	10.07	12.64	14.18	15.47	16.37	**100yr**
200yr	1.31	1.97	2.49	3.61	5.04	5.65	**200yr**	4.35	5.53	6.40	7.61	9.04	14.11	16.44	**200yr**	12.49	15.81	17.69	19.06	19.93	**200yr**
500yr	1.73	2.57	3.31	4.80	6.83	7.50	**500yr**	5.89	7.33	8.50	9.90	11.56	18.72	22.10	**500yr**	16.57	21.25	23.70	25.15	25.82	**500yr**

Powered by ACIS
Northeast Regional Climate Center

National Flood Hazard Layer FIRMette

FEMA

71°22'28"W 42°15'8"N

71°21'50"W 42°14'41"N

Feet
0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 — Cross Sections with 1% Annual Chance
- 17.5 — Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/27/2020 at 1:02 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

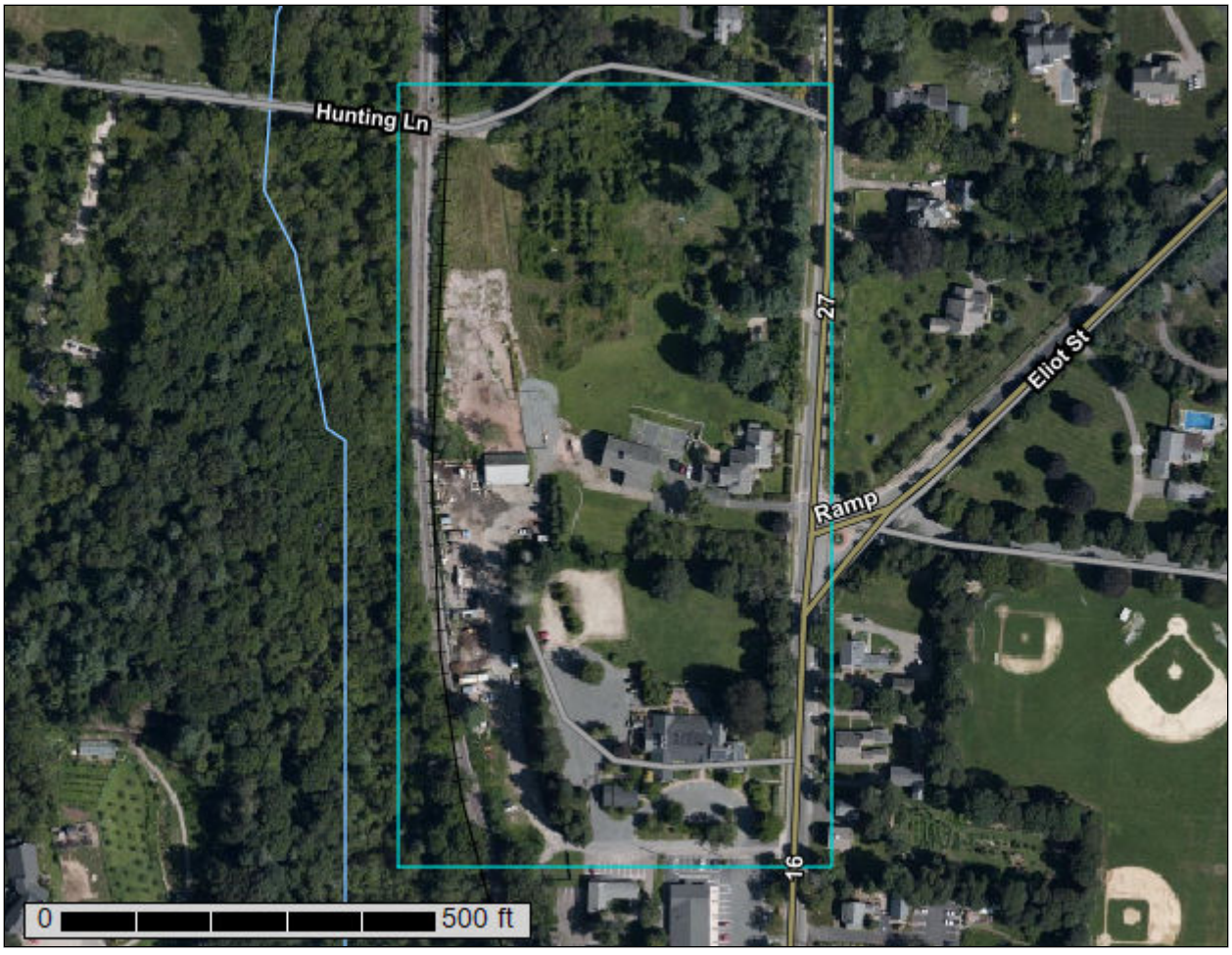
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Middlesex County, Massachusetts



August 14, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

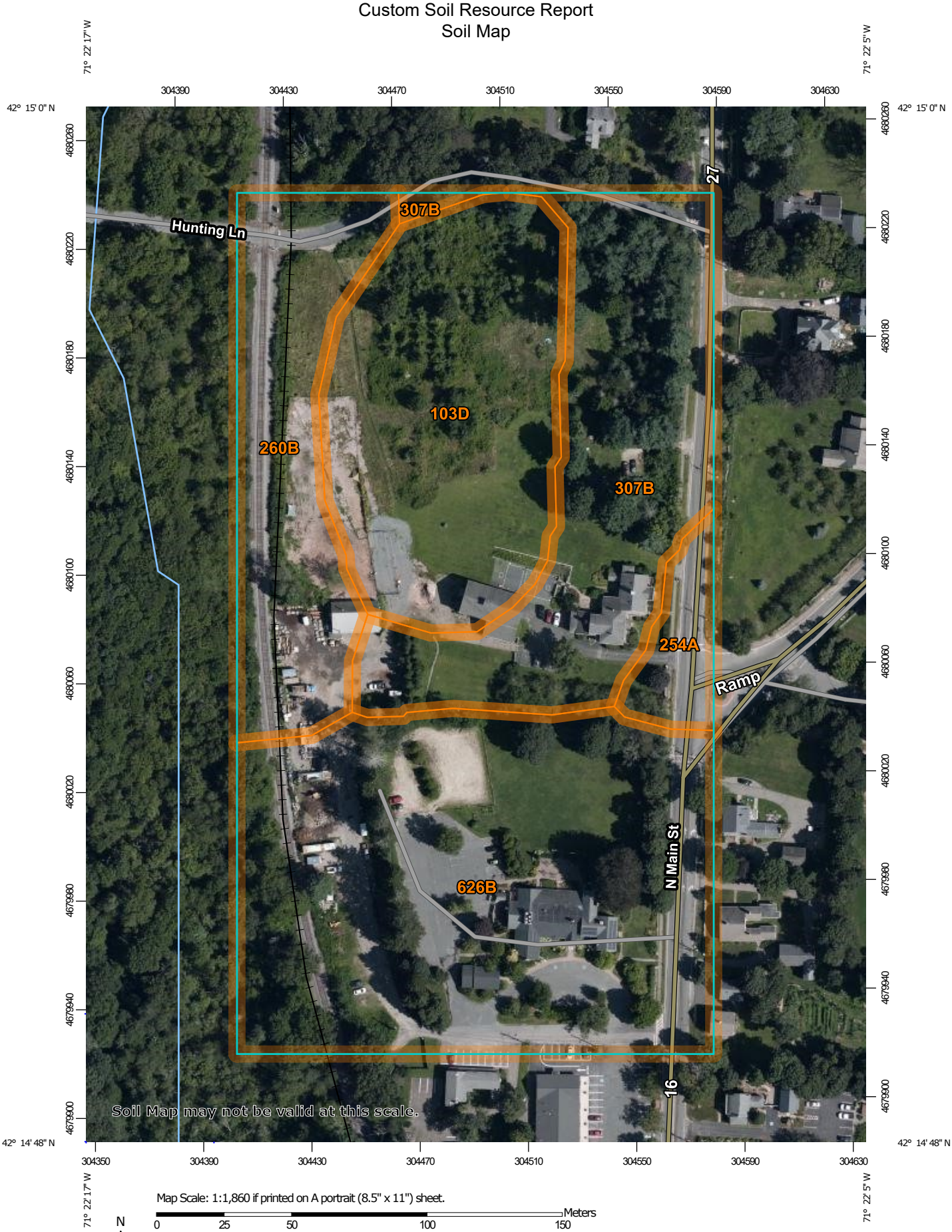
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



Map Scale: 1:1,860 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Jul 28, 2019—Aug 15, 2019

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
103D	Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes	3.0	21.7%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	0.4	3.1%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	2.0	14.5%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	3.0	21.8%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	5.4	38.8%
Totals for Area of Interest		**13.9**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

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

Middlesex County, Massachusetts

103D—Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: 98yf
Elevation: 0 to 1,560 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton and similar soils: 50 percent
Hollis and similar soils: 25 percent
Rock outcrop: 15 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton

Setting

Landform: Drumlins, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over friable loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 5 inches: fine sandy loam
H2 - 5 to 22 inches: sandy loam
H3 - 22 to 65 inches: gravelly sandy loam

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Description of Hollis

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till over granite and gneiss

Typical profile

H1 - 0 to 2 inches: fine sandy loam
H2 - 2 to 14 inches: fine sandy loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Granite and gneiss

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

Minor Components

Narragansett

Percent of map unit: 2 percent
Landform: Ridges, hills

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Nose slope, head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Woodbridge

Percent of map unit: 2 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, shoulder, toeslope
Landform position (three-dimensional): Head slope, base slope, nose slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Canton

Percent of map unit: 2 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Head slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 2 percent

254A—Merrimac fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyqr
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent

Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Moraines, outwash terraces, outwash plains, kames, eskers
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Outwash plains, eskers, kames, deltas

Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 3 percent
Landform: Outwash plains, outwash terraces, stream terraces, kames, eskers, moraines
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Landform: Outwash terraces, deltas, dunes, outwash plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9915
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: fine sandy loam
H2 - 8 to 20 inches: fine sandy loam
H3 - 20 to 27 inches: loamy sand
H4 - 27 to 65 inches: stratified gravelly coarse sand to sand

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Plains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wareham

Percent of map unit: 4 percent
Landform: Terraces, deltas, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Windsor

Percent of map unit: 2 percent
Landform: Flats, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

307B—Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w675
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Paxton, Extremely Stony

Setting

Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex, linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, extremely stony
Percent of map unit: 10 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Charlton, extremely stony
Percent of map unit: 5 percent
Landform: Hills
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury, extremely stony
Percent of map unit: 4 percent
Landform: Drainageways, drumlins, hills, ground moraines, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, extremely stony
Percent of map unit: 1 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting
National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Eskers, moraines, outwash terraces, outwash plains, kames
Landform position (two-dimensional): Backslope, footslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water capacity: Very low (about 0.0 inches)

Interpretive groups

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

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Dunes, outwash terraces, deltas, outwash plains
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Eskers, kames, deltas, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

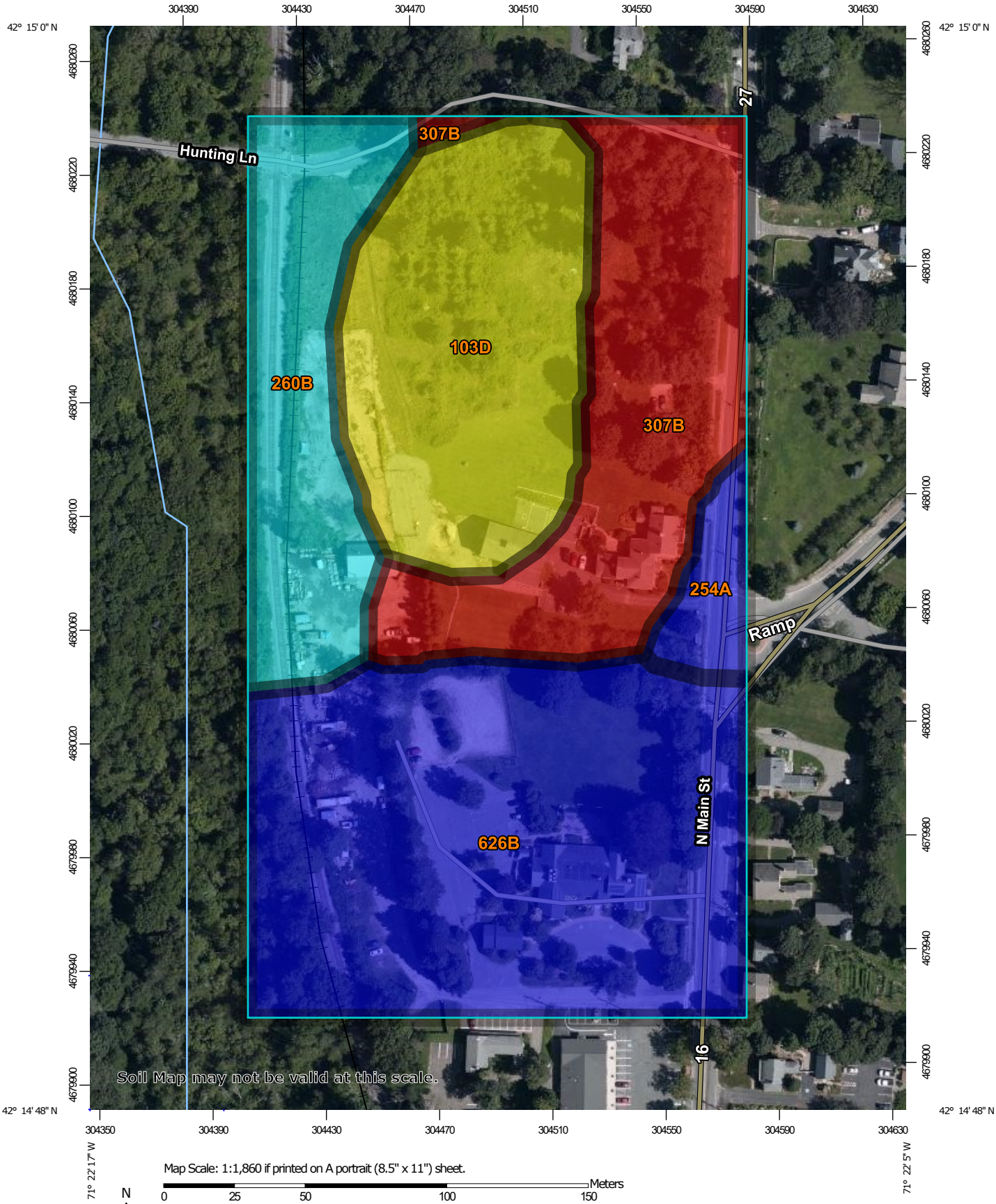
Saturated Hydraulic Conductivity (Ksat)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Map—Saturated Hydraulic Conductivity (Ksat)



MAP LEGEND

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

Soils

Soil Rating Polygons
- <= 2.9993
- > 2.9993 and <= 23.2900
- > 23.2900 and <= 79.9793
- > 79.9793 and <= 100.0000
- Not rated or not available

Soil Rating Lines
- <= 2.9993
- > 2.9993 and <= 23.2900
- > 23.2900 and <= 79.9793
- > 79.9793 and <= 100.0000
- Not rated or not available

Soil Rating Points
- <= 2.9993
- > 2.9993 and <= 23.2900
- > 23.2900 and <= 79.9793
- > 79.9793 and <= 100.0000
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Jul 28, 2019—Aug 15, 2019

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

Table—Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
103D	Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes	23.2900	3.0	21.7%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	100.0000	0.4	3.1%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	79.9793	2.0	14.5%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	2.9993	3.0	21.8%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	100.0000	5.4	38.8%
Totals for Area of Interest			**13.9**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 12

Bottom Depth: 90

Units of Measure: Inches

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

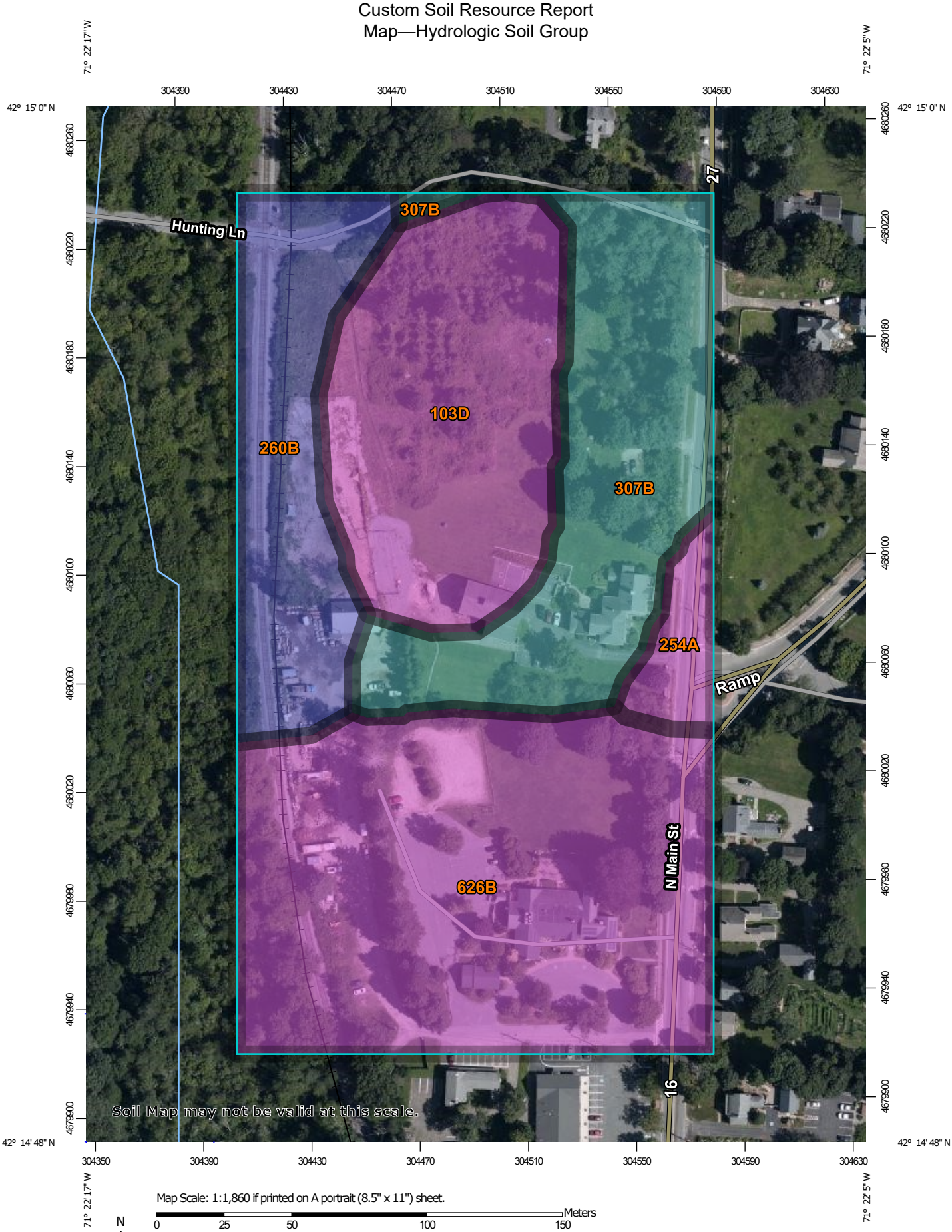
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Map Scale: 1:1,860 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Jul 28, 2019—Aug 15, 2019

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
103D	Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes	A	3.0	21.7%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	0.4	3.1%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	2.0	14.5%
307B	Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony	C	3.0	21.8%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	5.4	38.8%
Totals for Area of Interest			**13.9**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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ALLEN & MAJOR ASSOCIATES, INC.

Project No.	2513-01A	**Sheet**	1 of 2
Project Description	The Pines Residences		
	Sherborn, MA		
Calculated By	SM	**Date**	11/18/20
Checked By		**Date**	

Drawdown within 72 hours Analysis for Static Method

Infiltration System #1

Infiltration Rate: 1.02 inches/hour *(From table 2.3.3: Rawls, Brakensiek, Saxton, 1982)*

Volume Provide for Infiltration: 14,649 cf

Basin bottom area: 4,094 sf (92 x 44.5)

Time $_{drawdown}$ = (Required Recharge Volume in cubic feet as determined by the Static Method)(1/Design Infiltration Rate in inches per hour)(conversion for inches to feet)(1/bottom area in feet)

Time $_{drawdown}$ = (14,649 cf) (1 / 1.02 in/hr) (1ft/12 in.) (1 / 4,094 sf)

= 42.10 hours

Drawdown within 72 hours Analysis for Static Method

Infiltration System #2

Infiltration Rate: 1.02 inches/hour *(From table 2.3.3: Rawls, Brakensiek, Saxton, 1982)*

Volume Provide for Infiltration: 3,571 cf

Basin bottom area: 6,176 sf (386 x 16.0)

Time $_{drawdown}$ = (Required Recharge Volume in cubic feet as determined by the Static Method)(1/Design Infiltration Rate in inches per hour)(conversion for inches to feet)(1/bottom area in feet)

Time $_{drawdown}$ = (3,571 cf) (1 / 1.02 in/hr) (1ft/12 in.) (1 / 6,176 sf)

= 6.80 hours

Stage-Area-Storage for Pond IS1: Infiltration #1

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
177.50	4,094	0	178.56	4,383	2,766
177.52	4,099	34	178.58	4,389	2,826
177.54	4,105	71	178.60	4,394	2,887
177.56	4,110	113	178.62	4,400	2,948
177.58	4,116	154	178.64	4,405	3,009
177.60	4,121	195	178.66	4,411	3,070
177.62	4,127	238	178.68	4,416	3,132
177.64	4,132	282	178.70	4,422	3,194
177.66	4,138	326	178.72	4,427	3,255
177.68	4,143	371	178.74	4,433	3,317
177.70	4,149	417	178.76	4,438	3,379
177.72	4,154	463	178.78	4,443	3,442
177.74	4,160	510	178.80	4,449	3,504
177.76	4,165	558	178.82	4,454	3,567
177.78	4,170	606	178.84	4,460	3,629
177.80	4,176	654	178.86	4,465	3,692
177.82	4,181	703	178.88	4,471	3,755
177.84	4,187	753	178.90	4,476	3,818
177.86	4,192	803	178.92	4,482	3,882
177.88	4,198	854	178.94	4,487	3,945
177.90	4,203	905	178.96	4,493	4,008
177.92	4,209	956	178.98	4,498	4,072
177.94	4,214	1,008	179.00	4,504	4,136
177.96	4,220	1,060	179.02	4,509	4,200
177.98	4,225	1,112	179.04	4,514	4,264
178.00	4,231	1,165	179.06	4,520	4,328
178.02	4,236	1,218	179.08	4,525	4,392
178.04	4,241	1,272	179.10	4,531	4,456
178.06	4,247	1,326	179.12	4,536	4,521
178.08	4,252	1,380	179.14	4,542	4,585
178.10	4,258	1,435	179.16	4,547	4,650
178.12	4,263	1,490	179.18	4,553	4,715
178.14	4,269	1,545	179.20	4,558	4,780
178.16	4,274	1,601	179.22	4,564	4,844
178.18	4,280	1,657	179.24	4,569	4,909
178.20	4,285	1,713	179.26	4,574	4,975
178.22	4,291	1,769	179.28	4,580	5,040
178.24	4,296	1,826	179.30	4,585	5,105
178.26	4,301	1,883	179.32	4,591	5,170
178.28	4,307	1,940	179.34	4,596	5,236
178.30	4,312	1,998	179.36	4,602	5,301
178.32	4,318	2,055	179.38	4,607	5,367
178.34	4,323	2,113	179.40	4,613	5,432
178.36	4,329	2,171	179.42	4,618	5,498
178.38	4,334	2,230	179.44	4,624	5,564
178.40	4,340	2,289	179.46	4,629	5,630
178.42	4,345	2,347	179.48	4,635	5,696
178.44	4,351	2,407	179.50	4,640	5,762
178.46	4,356	2,466	179.52	4,645	5,828
178.48	4,362	2,526	179.54	4,651	5,894
178.50	4,367	2,585	179.56	4,656	5,960
178.52	4,372	2,645	179.58	4,662	6,026
178.54	4,378	2,705	179.60	4,667	6,092

Stage-Area-Storage for Pond IS1: Infiltration #1 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
179.62	4,673	6,158	180.68	4,962	9,674
179.64	4,678	6,225	180.70	4,968	9,739
179.66	4,684	6,291	180.72	4,973	9,805
179.68	4,689	6,357	180.74	4,979	9,870
179.70	4,695	6,424	180.76	4,984	9,935
179.72	4,700	6,490	180.78	4,989	10,000
179.74	4,706	6,556	180.80	4,995	10,065
179.76	4,711	6,623	180.82	5,000	10,130
179.78	4,716	6,689	180.84	5,006	10,194
179.80	4,722	6,756	180.86	5,011	10,259
179.82	4,727	6,823	180.88	5,017	10,323
179.84	4,733	6,889	180.90	5,022	10,388
179.86	4,738	6,956	180.92	5,028	10,452
179.88	4,744	7,022	180.94	5,033	10,516
179.90	4,749	7,089	180.96	5,039	10,580
179.92	4,755	7,156	180.98	5,044	10,644
179.94	4,760	7,222	181.00	5,050	10,708
179.96	4,766	7,289	181.02	5,055	10,772
179.98	4,771	7,355	181.04	5,060	10,836
180.00	4,777	7,422	181.06	5,066	10,899
180.02	4,782	7,489	181.08	5,071	10,963
180.04	4,787	7,555	181.10	5,077	11,026
180.06	4,793	7,622	181.12	5,082	11,089
180.08	4,798	7,689	181.14	5,088	11,152
180.10	4,804	7,755	181.16	5,093	11,215
180.12	4,809	7,822	181.18	5,099	11,278
180.14	4,815	7,889	181.20	5,104	11,340
180.16	4,820	7,955	181.22	5,110	11,403
180.18	4,826	8,022	181.24	5,115	11,465
180.20	4,831	8,088	181.26	5,120	11,527
180.22	4,837	8,155	181.28	5,126	11,589
180.24	4,842	8,221	181.30	5,131	11,651
180.26	4,847	8,288	181.32	5,137	11,712
180.28	4,853	8,354	181.34	5,142	11,774
180.30	4,858	8,421	181.36	5,148	11,835
180.32	4,864	8,487	181.38	5,153	11,896
180.34	4,869	8,553	181.40	5,159	11,957
180.36	4,875	8,620	181.42	5,164	12,018
180.38	4,880	8,686	181.44	5,170	12,078
180.40	4,886	8,752	181.46	5,175	12,139
180.42	4,891	8,818	181.48	5,181	12,199
180.44	4,897	8,885	181.50	5,186	12,259
180.46	4,902	8,951	181.52	5,191	12,319
180.48	4,908	9,017	181.54	5,197	12,378
180.50	4,913	9,083	181.56	5,202	12,438
180.52	4,918	9,149	181.58	5,208	12,497
180.54	4,924	9,215	181.60	5,213	12,556
180.56	4,929	9,280	181.62	5,219	12,614
180.58	4,935	9,346	181.64	5,224	12,673
180.60	4,940	9,412	181.66	5,230	12,731
180.62	4,946	9,477	181.68	5,235	12,789
180.64	4,951	9,543	181.70	5,241	12,847
180.66	4,957	9,609	181.72	5,246	12,904

Stage-Area-Storage for Pond IS1: Infiltration #1 (continued)

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
181.74	5,252	12,961
181.76	5,257	13,018
181.78	5,262	13,075
181.80	5,268	13,132
181.82	5,273	13,188
181.84	5,279	13,243
181.86	5,284	13,299
181.88	5,290	13,354
181.90	5,295	13,409
181.92	5,301	13,464
181.94	5,306	13,518
181.96	5,312	13,572
181.98	5,317	13,626
182.00	5,323	13,679
182.02	5,328	13,732
182.04	5,333	13,784
182.06	5,339	13,837
182.08	5,344	13,888
182.10	5,350	13,940
182.12	5,355	13,991
182.14	5,361	14,041
182.16	5,366	14,091
182.18	5,372	14,141
182.20	5,377	14,190
182.22	5,383	14,239
182.24	5,388	14,287
182.26	5,393	14,334
182.28	5,399	14,381
182.30	5,404	14,427
182.32	5,410	14,473
182.34	5,415	14,518
182.36	5,421	14,562
182.38	5,426	14,606
182.40	5,432	14,649
182.42	5,437	14,690
182.44	5,443	14,731
182.46	5,448	14,771
182.48	5,454	14,807
182.50	5,459	14,844
182.52	5,464	14,877
182.54	5,470	14,910
182.56	5,475	14,943
182.58	5,481	14,975
182.60	5,486	15,008
182.62	5,492	15,041
182.64	5,497	15,074
182.66	5,503	15,106
182.68	5,508	15,139
182.70	5,514	15,172
182.72	5,519	15,205
182.74	5,525	15,237
182.76	5,530	15,270
182.78	5,535	15,303
182.80	5,541	15,336
182.82	5,546	15,368
182.84	5,552	15,401
182.86	5,557	15,434
182.88	5,563	15,467
182.90	5,568	15,499
182.92	5,574	15,532
182.94	5,579	15,565
182.96	5,585	15,598
182.98	5,590	15,630
183.00	**5,596**	**15,663**
183.02	5,596	15,663
183.04	5,596	15,663
183.06	5,596	15,663
183.08	5,596	15,663
183.10	5,596	15,663
183.12	5,596	15,663
183.14	5,596	15,663
183.16	5,596	15,663
183.18	5,596	15,663
183.20	5,596	15,663
183.22	5,596	15,663
183.24	5,596	15,663
183.26	5,596	15,663
183.28	5,596	15,663
183.30	5,596	15,663
183.32	5,596	15,663
183.34	5,596	15,663
183.36	5,596	15,663
183.38	5,596	15,663
183.40	5,596	15,663

Stage-Area-Storage for Pond IS2: Infiltration #2

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
170.70	6,176	0
170.75	6,216	148
170.80	6,256	315
170.85	6,297	494
170.90	6,337	683
170.95	6,377	880
171.00	6,417	1,083
171.05	6,457	1,292
171.10	6,498	1,506
171.15	6,538	1,724
171.20	6,578	1,946
171.25	6,618	2,171
171.30	6,658	2,399
171.35	6,699	2,630
171.40	6,739	2,863
171.45	6,779	3,098
171.50	6,819	3,334
171.55	6,859	3,571
171.60	6,900	3,809
171.65	6,940	4,048
171.70	6,980	4,287
171.75	7,020	4,527
171.80	7,060	4,766
171.85	7,101	5,004
171.90	7,141	5,241
171.95	7,181	5,477
172.00	7,221	5,712
172.05	7,261	5,945
172.10	7,302	6,176
172.15	7,342	6,404
172.20	7,382	6,629
172.25	7,422	6,851
172.30	7,462	7,069
172.35	7,503	7,283
172.40	7,543	7,492
172.45	7,583	7,695
172.50	7,623	7,892
172.55	7,663	8,081
172.60	7,704	8,260
172.65	7,744	8,427
172.70	7,784	8,575
172.75	7,824	8,699
172.80	7,864	8,822
172.85	7,905	8,946
172.90	7,945	9,069
172.95	7,985	9,193
173.00	8,025	9,316
173.05	8,065	9,440
173.10	8,106	9,563
173.15	8,146	9,687
173.20	**8,186**	**9,810**

Project: The Pines Residences
Location: Sherborn, MA
Prepared For: Allen & Major Associates

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1" of runoff from the contributing impervious surface.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Procedure: Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Compute Q Rate using the following equation:

Q = (qu) (A) (WQV)

where:

Q = flow rate associated with first 1" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1" in this case)

Structure Name	Impv. (acres)	A (miles^2)	t_c (min)	t_c (hr)	WQV (in)	qu (csm/in.)	Q (cfs)
WQU1	0.65	0.0010188	6.0	0.100	1.00	774.00	0.79
WQU2	1.08	0.0016906	6.0	0.100	1.00	774.00	1.31
WQU3	0.10	0.0001625	6.0	0.100	1.00	774.00	0.13
WQU4	0.06	0.0000922	6.0	0.100	1.00	774.00	0.07
WQU5	0.14	0.0002172	6.0	0.100	1.00	774.00	0.17
WQU6	0.08	0.0001219	6.0	0.100	1.00	774.00	0.09
WQU7	0.14	0.0002125	6.0	0.100	1.00	774.00	0.16

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE PINES RESIDENCES
SHERBORN, MA

Area	**0.65 ac**	Unit Site Designation	**WQU1**
Weighted C	**0.9**	Rainfall Station #	**68**
t_c	**6 min**		
CDS Model	**2015-4**	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.01	0.01	9.3
0.04	9.5%	18.8%	0.02	0.02	9.4
0.06	8.7%	27.5%	0.04	0.04	8.6
0.08	10.1%	37.6%	0.05	0.05	9.9
0.10	7.2%	44.8%	0.06	0.06	7.0
0.12	6.0%	50.8%	0.07	0.07	5.8
0.14	6.3%	57.1%	0.08	0.08	6.1
0.16	5.6%	62.7%	0.09	0.09	5.4
0.18	4.7%	67.4%	0.11	0.11	4.5
0.20	3.6%	71.0%	0.12	0.12	3.4
0.25	8.2%	79.1%	0.15	0.15	7.6
0.50	14.9%	94.0%	0.29	0.29	12.9
0.75	3.2%	97.3%	0.44	0.44	2.6
1.00	1.2%	98.5%	0.59	0.59	0.9
1.50	0.7%	99.2%	0.88	0.88	0.4
2.00	0.8%	100.0%	1.17	1.17	0.3
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					94.3
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.5%
				Predicted Net Annual Load Removal Efficiency =	**87.8%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

CONTECH ENGINEERED SOLUTIONS

CDS TECHNOLOGIES

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD

THE PINES RESIDENCES
SHERBORN, MA

Area	1.08 ac	Unit Site Designation	WQU2
Weighted C	0.9	Rainfall Station #	68
t_c	6 min		
CDS Model	2015-4	CDS Treatment Capacity	**1.4 cfs**

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Incremental Removal (%)
0.02	9.3%	9.3%	0.02	0.02	9.3
0.04	9.5%	18.8%	0.04	0.04	9.3
0.06	8.7%	27.5%	0.06	0.06	8.5
0.08	10.1%	37.6%	0.08	0.08	9.8
0.10	7.2%	44.8%	0.10	0.10	6.9
0.12	6.0%	50.8%	0.12	0.12	5.7
0.14	6.3%	57.1%	0.14	0.14	5.9
0.16	5.6%	62.7%	0.16	0.16	5.2
0.18	4.7%	67.4%	0.18	0.18	4.3
0.20	3.6%	71.0%	0.19	0.19	3.3
0.25	8.2%	79.1%	0.24	0.24	7.3
0.50	14.9%	94.0%	0.49	0.49	11.5
0.75	3.2%	97.3%	0.73	0.73	2.1
1.00	1.2%	98.5%	0.97	0.97	0.7
1.50	0.7%	99.2%	1.46	1.40	0.2
2.00	0.8%	100.0%	1.95	1.40	0.2
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
0.00	0.0%	100.0%	0.00	0.00	0.0
					90.2
				Removal Efficiency Adjustment[2] =	6.5%
				Predicted % Annual Rainfall Treated =	93.3%
				Predicted Net Annual Load Removal Efficiency =	**83.8%**

1 - Based on 10 years of rainfall data from NCDC station 736, Blue Hill, Norfolk County, MA

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Brief Stormceptor Sizing Report - WQU3

Project Information & Location			
Project Name	The Pines Residences	**Project Number**	663904
City	Sherborn	**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/18/2020
Designer Information		**EOR Information (optional)**	
Name	Josh Stackhouse	**Name**	
Company	Contech	**Company**	
Phone #	207-219-9110	**Phone #**	
Email	joshua.stackhouse@contechllc.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU3
Target TSS Removal (%)	80
TSS Removal (%) Provided	96
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	96
STC 900	98
STC 1200	98
STC 1800	98
STC 2400	99
STC 3600	99
STC 4800	99
STC 6000	99
STC 7200	99
STC 11000	100
STC 13000	100
STC 16000	100

Stormceptor®

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A QUIKRETE® COMPANY

Sizing Details

Drainage Area	
Total Area (acres)	0.10
Imperviousness %	100.0

Rainfall	
Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	0.00000

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

OK-110

Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

Brief Stormceptor Sizing Report - WQU4

Project Information & Location			
Project Name	The Pines Residences	**Project Number**	663904
City	Sherborn	**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/18/2020
Designer Information		**EOR Information (optional)**	
Name	Josh Stackhouse	**Name**	
Company	Contech	**Company**	
Phone #	207-219-9110	**Phone #**	
Email	joshua.stackhouse@contechllc.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU4
Target TSS Removal (%)	80
TSS Removal (%) Provided	97
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	97
STC 900	99
STC 1200	99
STC 1800	99
STC 2400	99
STC 3600	99
STC 4800	100
STC 6000	100
STC 7200	100
STC 11000	100
STC 13000	100
STC 16000	100

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Sizing Details

Drainage Area	
Total Area (acres)	0.06
Imperviousness %	100.0

Rainfall	
Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

OK-110

Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

Brief Stormceptor Sizing Report - WQU5

Project Information & Location			
Project Name	The Pines Residences	**Project Number**	663904
City	Sherborn	**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/18/2020
Designer Information		**EOR Information (optional)**	
Name	Josh Stackhouse	**Name**	
Company	Contech	**Company**	
Phone #	207-219-9110	**Phone #**	
Email	joshua.stackhouse@contechllc.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU5
Target TSS Removal (%)	80
TSS Removal (%) Provided	95
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	95
STC 900	97
STC 1200	98
STC 1800	98
STC 2400	98
STC 3600	99
STC 4800	99
STC 6000	99
STC 7200	99
STC 11000	100
STC 13000	100
STC 16000	100

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Sizing Details

Drainage Area	
Total Area (acres)	0.14
Imperviousness %	100.0

Rainfall	
Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

OK-110

Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

Brief Stormceptor Sizing Report - WQU6

Project Information & Location			
Project Name	The Pines Residences	**Project Number**	663904
City	Sherborn	**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/18/2020
Designer Information		**EOR Information (optional)**	
Name	Josh Stackhouse	**Name**	
Company	Contech	**Company**	
Phone #	207-219-9110	**Phone #**	
Email	joshua.stackhouse@contechllc.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU6
Target TSS Removal (%)	80
TSS Removal (%) Provided	97
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	97
STC 900	98
STC 1200	98
STC 1800	99
STC 2400	99
STC 3600	99
STC 4800	99
STC 6000	99
STC 7200	100
STC 11000	100
STC 13000	100
STC 16000	100

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Sizing Details

Drainage Area	
Total Area (acres)	0.08
Imperviousness %	100.0

Rainfall	
Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

OK-110

Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

Brief Stormceptor Sizing Report - WQU7

Project Information & Location			
Project Name	The Pines Residences	**Project Number**	663904
City	Sherborn	**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/18/2020
Designer Information		**EOR Information (optional)**	
Name	Josh Stackhouse	**Name**	
Company	Contech	**Company**	
Phone #	207-219-9110	**Phone #**	
Email	joshua.stackhouse@contechllc.com	**Email**	

Stormwater Treatment Recommendation
The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	WQU7
Target TSS Removal (%)	80
TSS Removal (%) Provided	95
Recommended Stormceptor Model	STC 450i

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	95
STC 900	97
STC 1200	98
STC 1800	98
STC 2400	98
STC 3600	99
STC 4800	99
STC 6000	99
STC 7200	99
STC 11000	100
STC 13000	100
STC 16000	100

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Sizing Details

Drainage Area	
Total Area (acres)	0.14
Imperviousness %	100.0

Rainfall	
Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	

Up Stream Storage	
Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

OK-110

Particle Diameter (microns)	Distribution %	Specific Gravity
1.0	0.0	2.65
53.0	3.0	2.65
75.0	15.0	2.65
88.0	25.0	2.65
106.0	41.0	2.65
125.0	15.0	2.65
150.0	1.0	2.65
212.0	0.0	2.65

Notes

• Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
• Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
• For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

ALLEN & MAJOR ASSOCIATES, INC.

DRAINAGE PIPE DESIGN ANALYSIS

A&M Job No.	2513-01A
Date:	11/18/2020

Project Location:
The Pines Residences
North Main Street
Sherborn, MA

Prepared For:
Barsky Estate Realty Trust

Manning's Formula

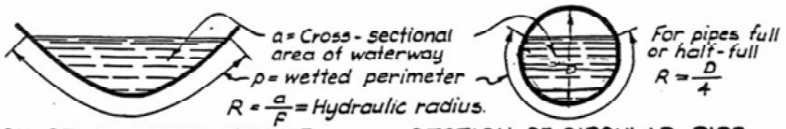
$V=1.486/n*R^{2/3}*S^{1/2}$
$Q = V*A$
(25-Year storm)

Where: V is the velocity in Ft/sec.
n is Mannings coefficient of friction
R is the Hydraulic Radius
S is the slope of the pipe

R=Area/Wetted Perimeter

Where: Area=Pi*(R/12)2
Wetted Perimeter=2*Pi*R/12

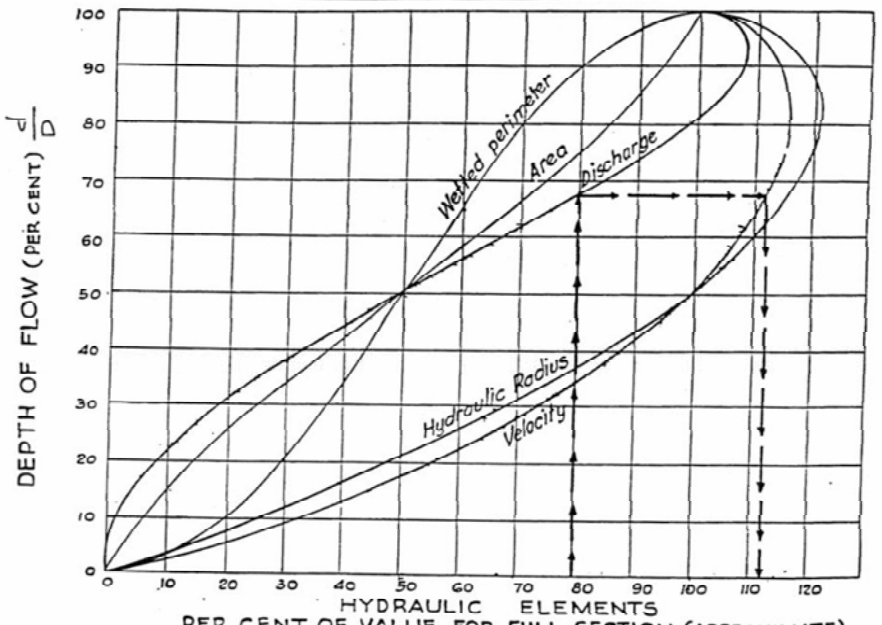
PIPE	Q_{design}	n	Diameter	A	Wp	R	S	Q_{full}	$Q_{full} \geq Q_{design}$	V_{full}	Q_d/Q_f	Results	V_{design}	2.5 ft/s ≤ V_{design} ≤ 10 ft/s
	(cfs)		(inches)	(ft^2)	(ft)	(ft)	(feet/foot)	(cfs)		(ft/s)		Fig. 4-4A	(ft/s)	
CB1 TO DMH 1	0.52	0.013	12	0.79	3.14	0.25	0.010	3.56	OK	4.54	0.15	0.68	3.08	OK
CB2 TO DMH1	0.51	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.08	0.55	4.32	OK
DMH1 TO DMH2	1.03	0.013	12	0.79	3.14	0.25	0.010	3.56	OK	4.54	0.29	0.84	3.81	OK
CB3 TO DMH2	0.60	0.013	12	0.79	3.14	0.25	0.040	7.13	OK	9.07	0.08	0.55	4.99	OK
DMH2 TO DMH3	1.62	0.013	12	0.79	3.14	0.25	0.010	3.56	OK	4.54	0.45	0.95	4.31	OK
CB4 TO DMH3	0.71	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.12	0.63	4.95	OK
DMH3 TO DMH4	2.34	0.013	15	1.23	3.93	0.31	0.010	6.46	OK	5.26	0.36	0.89	4.68	OK
CB5 TO DMH4	0.58	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.09	0.58	4.56	OK
DMH4 TO WQU1	2.92	0.013	15	1.23	3.93	0.31	0.010	6.46	OK	5.26	0.45	0.95	5.00	OK
CB6 TO WQU1	1.03	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.17	0.70	5.50	OK
WQU1 TO IS1	3.95	0.013	24	3.14	6.28	0.50	0.010	22.62	OK	7.20	0.17	0.70	5.04	OK
DMH7 TO WQU2	1.28	0.013	15	1.23	3.93	0.31	0.020	9.14	OK	7.44	0.14	0.65	4.84	OK
WQU2 TO IS2	1.28	0.013	15	1.23	3.93	0.31	0.020	9.14	OK	7.44	0.14	0.65	4.84	OK
CB10 TO IS2	0.65	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.11	0.60	4.71	OK
CB11 TO IS2	0.38	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.06	0.51	4.01	OK
CB12 TO IS2	0.84	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.14	0.65	5.11	OK
CB13 TO IS2	0.49	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.08	0.55	4.32	OK
DMH10 TO WQU7	0.46	0.013	12	0.79	3.14	0.25	0.006	2.85	OK	3.63	0.16	0.69	2.50	OK
CB14 TO WQU7	0.42	0.013	12	0.79	3.14	0.25	0.030	6.17	OK	7.86	0.07	0.53	4.16	OK
WQU7 TO IS2	0.88	0.013	12	0.79	3.14	0.25	0.006	2.85	OK	3.63	0.31	0.85	3.08	OK
AD1 TO FES2	1.23	0.013	15	1.23	3.93	0.31	0.010	6.46	OK	5.26	0.19	0.74	3.90	OK
AD3 TO IS2	0.23	0.013	12	0.79	3.14	0.25	0.016	4.53	OK	5.77	0.05	0.47	2.71	OK



SECTION OF ANY OPEN CHANNEL SECTION OF CIRCULAR PIPE

V = Average or mean velocity in feet per second.
Q = a V = Discharge of pipe or channel in cubic feet per second (c.f.s.).
n = Coefficient of roughness of pipe or channel surface, see Table A-Pg.18-68.
S = Slope of Hydraulic Gradient (water surface in open channels or pipes not under pressure, same as slope of channel or pipe invert only when flow is uniform in constant section.

HYDRAULIC ELEMENTS OF CHANNEL SECTIONS.



EXAMPLE: Given: Discharge = 12 c.f.s. through a pipe which has capacity flowing full of 15 c.f.s. at a velocity of 7.0 ft. per sec. Required to find V for Q = 12 c.f.s.
∴ Percentage of full discharge = 12/15 = 80%. Enter chart at 80% of value for full section of Hydraulic Elements, find V = 112.5% × 7 = 7.9 ft. per sec.

VALUES OF HYDRAULIC ELEMENTS OF CIRCULAR SECTION FOR VARIOUS DEPTHS OF FLOW.

Figure 4-4A

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	2513-01A	**Sheet:**	1 of 2
Project Desciprtion:	The Pines Residences, Sherborn MA		
Calculated By:	SM	**Date**:	11/18/20
Checked By:		**Date:**	

ESTIMATION FOR PHOSPHORUS REMOVAL

Existing Condition Phosphrous Loading			
Site Use	Phosphorus Load by Land Use (lbs/ac/yr) *	Area (Acres	Existing Phosphorus Load (lbs/yr)
Low Density Residential	0.30	0.82	0.25
Open Space	0.26	4.78	1.24
Forest	0.12	1.13	0.14
	Total	**6.73**	**1.62**

*Table 1-1, Appendix F, Attachment 1

Proposed Condition Phosphrous Loading			
Site Use	Phosphorus Load by Land Use (lbs/ac/yr) **	Area (Acres	Proposed Phosphorus Load (lbs/yr)
Multi-Family	2.32	2.47	5.74
Open Space Soil Type A	0.03	1.67	0.05
Open Space Soil Type B	0.12	0.33	0.04
Open Space Soil Type C	0.21	1.26	0.26
Forest	0.13	0.99	0.13
	Total	**6.73**	**6.22**

**Table 1-2, Appendix F, Attachment 1

Phosphorus Reduction Requirement					
Phosphorus Reduction Requirement	=	Proposed Phosphours Load x 16%***			
	=	6.22	x	0.16	
	=	**0.99**	**lbs/year**		

***Table F-2, Appendx F, MA MS4 General Permit

Proposed Condition Phosphrous Loading Reduction				
BMP (Subcatchment)	BMP	Total Phosphorous Load to BMP (lbs/yr) ^	BMP Removal %****	Phosphorus Removed by BMPs (lbs/year)
IS #1 (P-3A - P3-F & P-1A & P-2A)	Infiltration Basin	2.17	1.00	2.17
IS #2 (P-5A - P-5H & P-1B & P-2B)	Infiltration Basin	2.28	0.90	2.05
			Total	**4.22**

****Table 3-13, Appendx F, MA MS4 General Permit

^ See Page 2 for additional information

Percent Reduction (Phosphorus Removed / Proposed Phosphorus Load)	**67.80%**			
	4.22	**>**	**0.99**	Requirement is met

ALLEN & MAJOR
ASSOCIATES, INC.

Project No. 2513-01A **Sheet:** 2 of 2
Project Desciprtion: The Pines Residences, Sherborn MA
Calculated By: SM Date: 11/18/20
Checked By: **Date:**

Phosphorus Calculations Per BMP

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres	Proposed Phosphorus Load (lbs/yr)			
IS #1 (P-3A - P3-F & P-1A & P-2A)				Area to IS #1	66,529	S.F.
Multi-Family	2.32	0.92	2.14	Volume Treated	14,649	C.F.
Open Space Soil Type A	0.03	0.52	0.02	Depth of runoff treated	2.64	IN.
Open Space Soil Type B	0.12		0.00			
Open Space Soil Type C	0.21		0.00			
Forest	0.13	0.08	0.01			
	total	**1.53**	**2.17**			
	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres	Proposed Phosphorus Load (lbs/yr)			
IS #2 (P-5A - P-5H & P-1B & P-2B)				Area to Basin 3	56,704	S.F.
Multi-Family	2.32	0.97	2.25	Volume Treated	3,571	C.F.
Open Space Soil Type A	0.03	0.24	0.01	Depth of runoff treated	0.76	IN.
Open Space Soil Type B	0.12	0.02	0.00			
Open Space Soil Type C	0.21	0.07	0.02			
	total	**1.30**	**2.28**			

available to the public for public comment during Phase 1 Plan development. EPA encourages the permittee to post the Phase I Plan online to facilitate public involvement.

Performance Evaluation –The permittee shall evaluate the effectiveness of the PCP by tracking the phosphorus reductions achieved through implementation of structural and non-structural BMPs[6] and tracking increases resulting from development. Phosphorus reductions shall be calculated consistent with Attachment 2 to Appendix F (non-structural BMP performance) and Attachment 3 to Appendix F (structural BMP performance) for all BMPs implemented to date. Phosphorus export increases since 2005 due to development shall be calculated consistent with Attachment 1 to Appendix F. Phosphorus loading increases and reductions in unit of mass/yr shall be added or subtracted from the applicable Baseline Phosphorus Load given in Table F-2 or Table F-3 depending on the Scope of PCP chosen to estimate the yearly phosphorous export rate from the PCP Area. The permittee shall also include all information required in part I.2 of this Appendix in each performance evaluation. Performance evaluations will be included as part of each permittee's annual report as required by part 4.4 of the Permit.

Community Annual Stormwater Phosphorus Load Reduction by Permittee, Charles River Watershed

Community	Baseline Phosphorus Load, kg/yr	Stormwater Phosphorus Load Reduction Requirement kg/yr	Allowable Phosphorus Load, kg/yr	Stormwater Percent Reduction in Phosphorus Load (%)
Arlington	106	57	49	53%
Ashland	67	23	44	34%
Bellingham	947	331	616	35%
Belmont	202	86	116	42%
Brookline	1,635	789	846	48 %
Cambridge	512	263	249	51%
Dedham	805	325	480	40%
Dover	831	137	694	17%
Foxborough	2	0	2	0%
Franklin	2,344	818	1,526	35%

[6] In meeting its phosphorus reduction requirements a permittee may quantify phosphorus reductions by actions undertaken by another entity, except where those actions are credited to MassDOT or another permittee identified in Appendix F Table F-2 or F-3.

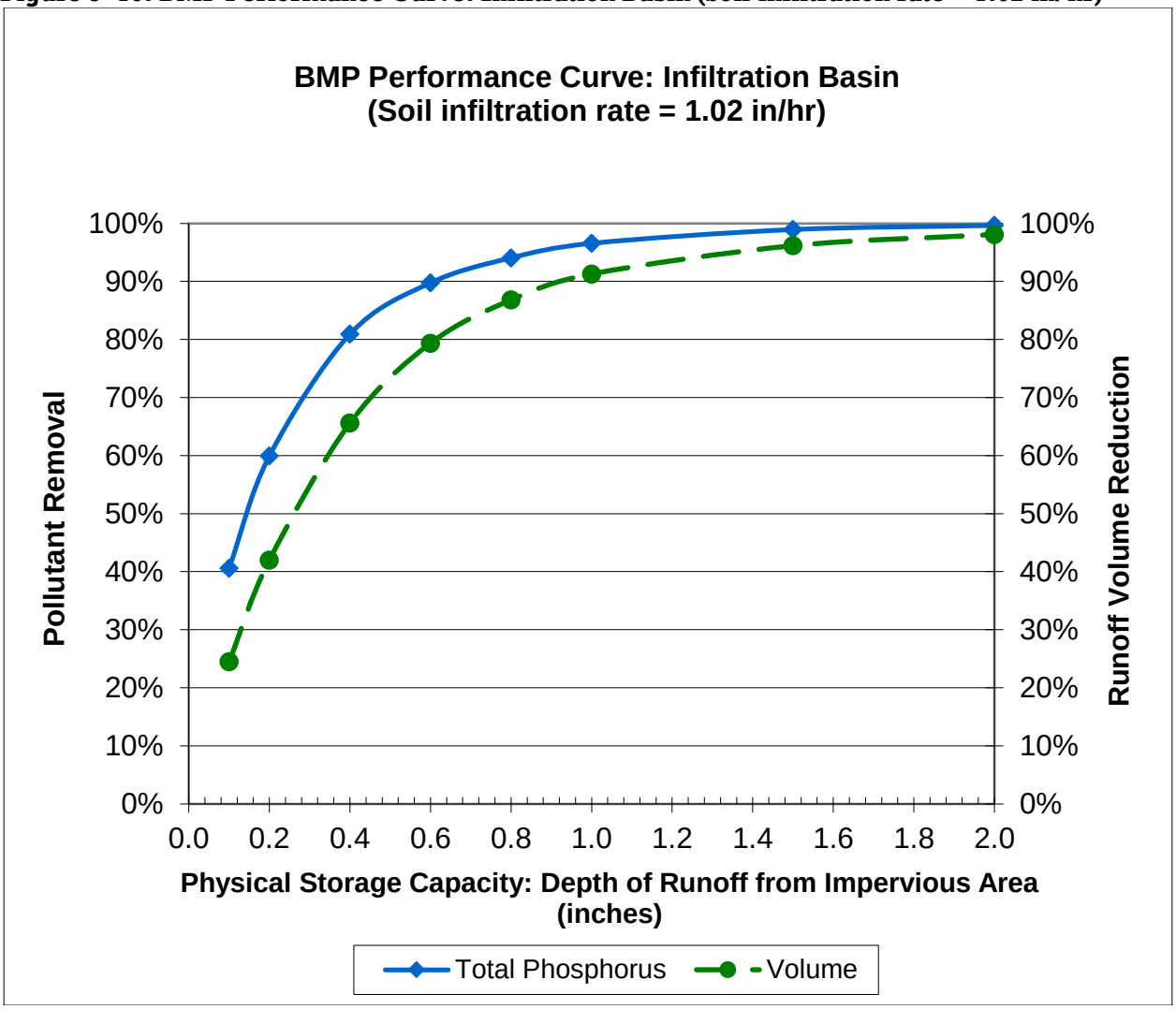
Community Annual Stormwater Phosphorus Load Reduction by Permittee, Charles River Watershed				
Community	**Baseline Phosphorus Load, kg/yr**	**Stormwater Phosphorus Load Reduction Requirement kg/yr**	**Allowable Phosphorus Load, kg/yr**	**Stormwater Percent Reduction in Phosphorus Load (%)**
Holliston	1,543	395	1,148	26%
Hopedale	107	37	70	35%
Hopkinton	292	66	226	22%
Lexington	530	194	336	37%
Lincoln	593	101	492	17%
Medfield	955	277	678	29%
Medway	1,063	314	749	30%
Mendon	29	9	20	31%
Milford	1,611	663	948	41%
Millis	969	248	721	26%
Natick	1,108	385	723	35%
Needham	1,772	796	976	45%
Newton	3,884	1,941	1,943	50%
Norfolk	1,004	232	772	23%
Somerville	646	331	315	51%
Sherborn	846	131	715	16%
Walpole	159	28	131	18%
Waltham	2,901	1,461	1,400	50%
Watertown	1,127	582	545	52%
Wayland	46	15	31	33%
Wellesley	1,431	661	770	46%
Weston	1,174	281	893	24%
Westwood	376	114	262	30%
Wrentham	618	171	447	28%
Mass-DCR	421	91	330	22%

Table F-2: Baseline Phosphorus Load, Phosphorus Reduction Requirement, Allowable Phosphorus Load and Percent Reduction in Phosphorus Load from Charles River Watershed. For use when PCP Area is chosen to be the entire community within the Charles River Watershed.

Table 3- 13: Infiltration Basin (1.02 in/hr) BMP Performance Table

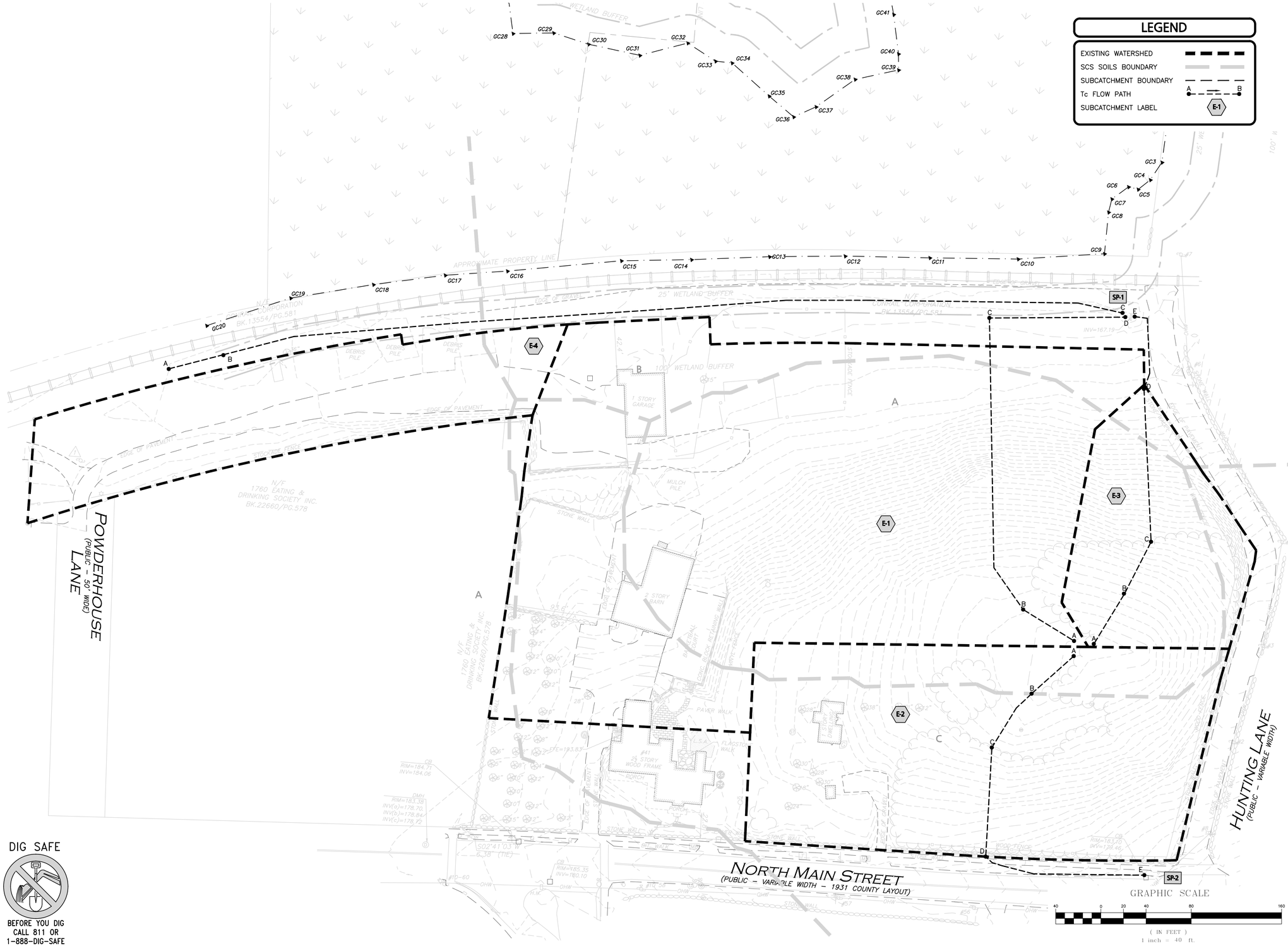
Infiltration Basin (1.02 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff Treated from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	24.5%	42.0%	65.6%	79.4%	86.8%	91.3%	96.2%	98.1%
Cumulative Phosphorus Load Reduction	41%	60%	81%	90%	94%	97%	99%	100%

Figure 3- 10: BMP Performance Curve: Infiltration Basin (Soil infiltration rate = 1.02 in/hr)



SECTION 6.0

WATERSHED PLANS



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REV	DATE	DESCRIPTION

APPLICANT\OWNER:

BARSKY ESTATE REALTY TRUST
23 HUNTING LANE
SHERBORN, MA 01770

PROJECT:

THE PINES RESIDENCES

41 NORTH MAIN STREET
SHERBORN, MA

PROJECT NO.	2513-01A	DATE:	11-18-20
SCALE:	1" = 40'	DWG. NAME:	C2513-01A
DESIGNED BY:	ARM	CHECKED BY:	MAM

PREPARED BY:

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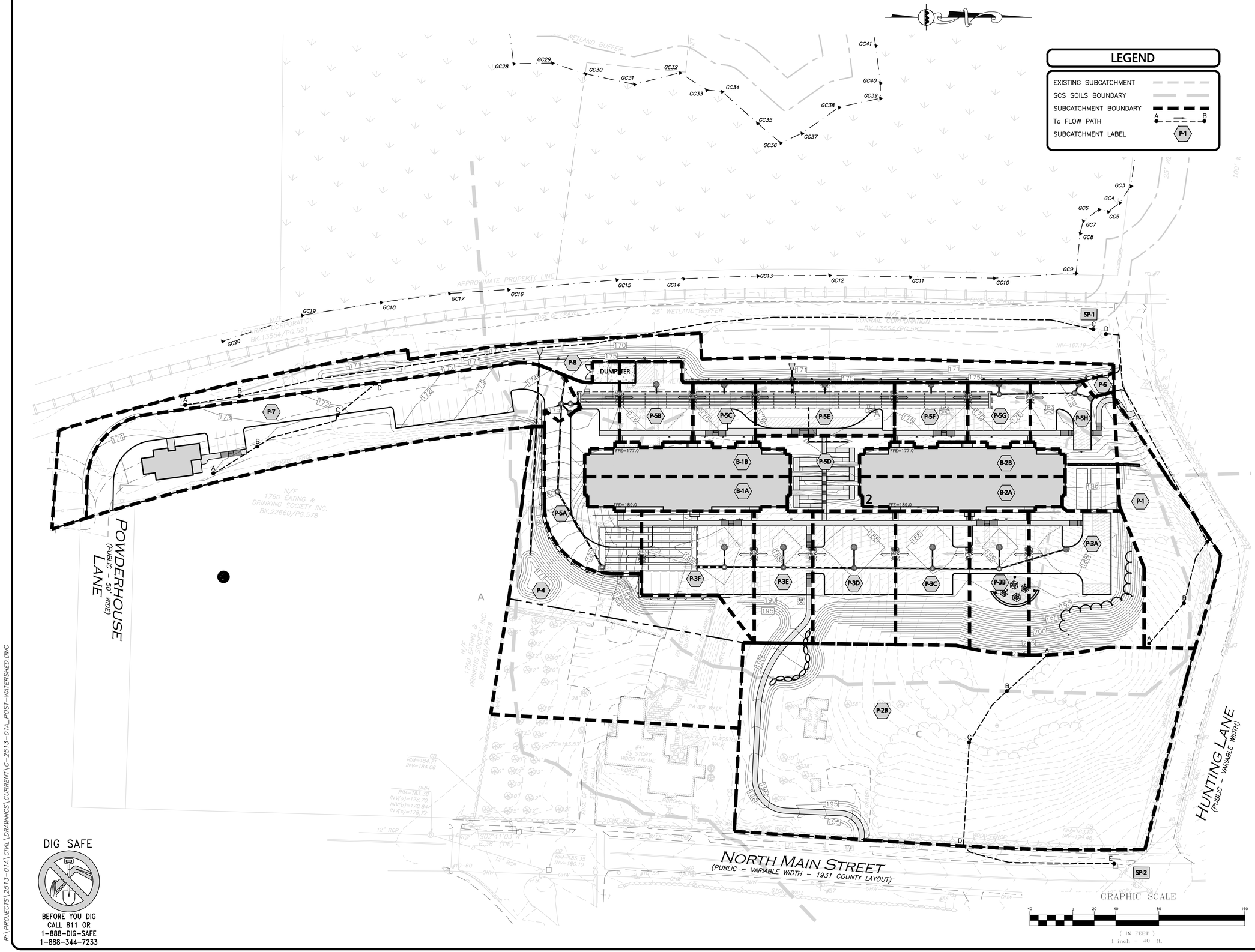

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REV	DATE	DESCRIPTION

APPLICANT\OWNER:

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23 HUNTING LANE
SHERBORN, MA 01770

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