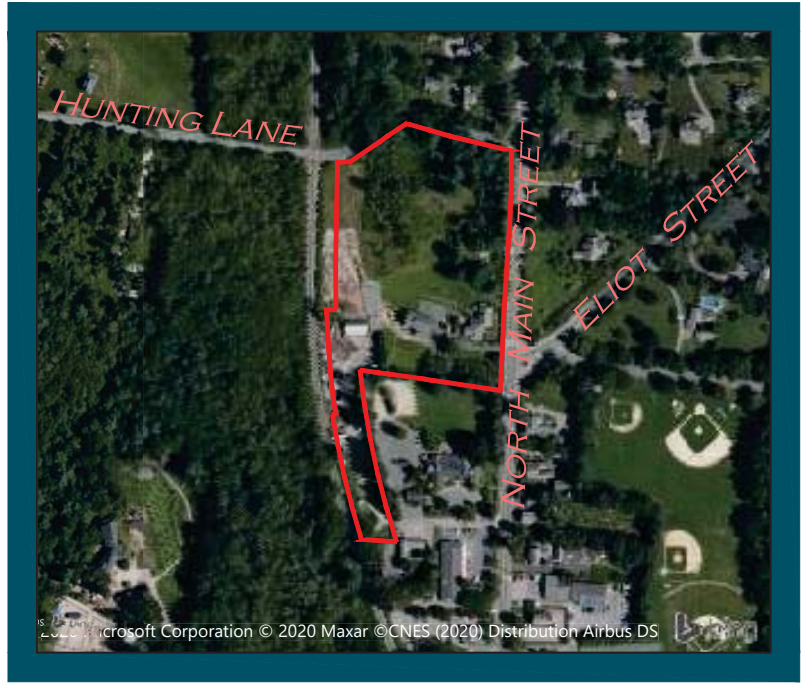




ALLEN & MAJOR  
ASSOCIATES, INC.

SITE LOCUS: 1" = 500'



## THE PINE RESIDENCES

41 NORTH MAIN STREET

SHERBORN, MASSACHUSETTS

## DRAINAGE REPORT

**DATE PREPARED:**

NOVEMBER 18, 2020

Revised: April 9, 2021

**APPLICANT:**

BARSKY ESTATE REALTY TRUST

23 HUNTING LANE

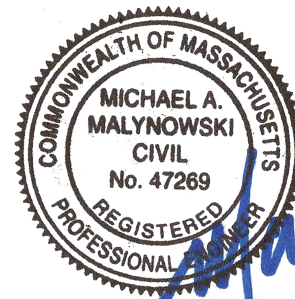
SHERBORN, MA 01770

**PREPARED BY:**

ALLEN & MAJOR ASSOCIATES, INC.

100 COMMERCE WAY, SUITE 5

WOBURN, MASSACHUSETTS 01801



Digitally signed by Michael Malynowski  
Date: 2021.04.09 12:33:04 -04'00'

# DRAINAGE REPORT

---

THE PINE RESIDENCES  
41 NORTH MAIN STREET  
SHERBORN, MA

*PROPONENT:*

BARSKY ESTATE REALTY TRUST  
23 HUNTING LANE  
SHERBORN, MA 01770

*PREPARED BY:*

ALLEN & MAJOR ASSOCIATES, INC.  
100 COMMERCE WAY  
WOBURN, MA 01888-0118

DATE ISSUED: NOVEMBER 18, 2020  
Revised April 9, 2021

A&M PROJECT #2513-01A

# ***Table of Contents***

---

- 1. NARRATIVE**
- 2. OPERATION & MAINTENANCE PLAN**
- 3. HYDROCAD WORKSHEETS.....EXISTING CONDITIONS**
- 4. HYDROCAD WORKSHEETS.....PROPOSED CONDITIONS**
- 5. APPENDIX**
- 6. WATERSHED PLANS**
- 7. PLAN SET (UNDER SEPARATE COVER)**

## **SECTION 1.0**

NARRATIVE



## ***Section 1.0     Drainage Report***

### ***Table of Contents***

<b>SECTION 1.0     DRAINAGE REPORT .....</b>	<b>1-1</b>
<b>TABLE OF CONTENTS .....</b>	<b>1-1</b>
•     INTRODUCTION .....	1-2
•     SITE CATEGORIZATION FOR STORMWATER REGULATIONS .....	1-2
•     SITE LOCATION AND ACCESS .....	1-2
•     WATERSHED .....	1-2
•     EXISTING SITE CONDITIONS .....	1-3
•     EXISTING SOIL CONDITIONS .....	1-3
•     FEMA FLOODPLAIN .....	1-4
•     DRAINAGE ANALYSIS METHODOLOGY .....	1-4
•     PEAK RATE OF RUNOFF .....	1-4
•     MA DEP STORMWATER PERFORMANCE STANDARDS .....	1-5

## **DRAINAGE REPORT**

*The Pine Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
April 8, 2021*

### **• 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.

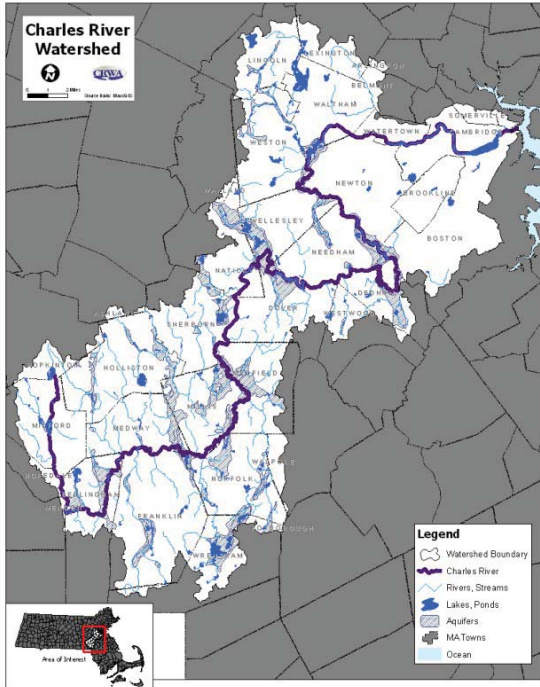
## DRAINAGE REPORT

*The Pine Residences*  
Sherborn, MA

*A&M Project # 2513-01A*  
*April 8, 2021*

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 18% 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

## DRAINAGE REPORT

*The Pine Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
April 8, 2021*

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	2.72	4.19	5.83
Proposed Flow (CFS)	0.44	1.83	3.98	5.63
<b>Decrease (CFS)</b>	<b>0.01</b>	<b>0.89</b>	<b>0.21</b>	<b>0.20</b>

## DRAINAGE REPORT

The Pine Residences  
Sherborn, MA

A&M Project # 2513-01A  
April 8, 2021

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
<b>Decrease (CFS)</b>	<b>0.01</b>	<b>0.03</b>	<b>0.04</b>	<b>0.08</b>

### • 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
- Bioretention/Filtration basins
- 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.

## DRAINAGE REPORT

The Pine Residences  
Sherborn, MA

A&M Project # 2513-01A  
April 8, 2021

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
<b>Change in impervious area</b>	<b>= 71,885± square feet</b>

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

$$\begin{aligned}\text{Recharge Volume (Rv)} &= (F) \times (\text{Impervious Area}) \\ &= (0.60 \text{ inches}) \times (1/12 \text{ inches/ft}) \times (82,213 \text{ square feet}) \quad (\text{A Soils}) \\ &+ (0.35 \text{ inches}) \times (1/12 \text{ inches/ft}) \times (11,333 \text{ square feet}) \quad (\text{B Soils}) \\ &+ (0.25 \text{ inches}) \times (1/12 \text{ inches/ft}) \times (14,136 \text{ square feet}) \quad (\text{C Soils}) \\ &= \mathbf{4,736 \text{ cubic feet}}\end{aligned}$$

Recharge Provided	=14,649 ft <sup>3</sup> (IS #1)	(See Appendix)
	+ 3,571 ft <sup>3</sup> (IS #2)	
	<b>18,220 ft<sup>3</sup></b>	

$$18,220 \text{ ft}^3 > 4,736 \text{ ft}^3 \text{ Required}$$

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.*



## DRAINAGE REPORT

The Pine Residences  
Sherborn, MA

A&M Project # 2513-01A  
April 8, 2021

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.

## DRAINAGE REPORT

The Pine Residences  
Sherborn, MA

A&M Project # 2513-01A  
April 8, 2021

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***

### ***Table of Contents***

<b>SECTION 2.0    OPERATION &amp; MAINTENANCE PLAN .....</b>	<b>2-1</b>
<b>TABLE OF CONTENTS .....</b>	<b>2-1</b>
• INTRODUCTION.....	2-2
• NOTIFICATION PROCEDURES FOR CHANGE OF RESPONSIBILITY FOR O&M.....	2-2
• CONTACT INFORMATION.....	2-2
• CONSTRUCTION PERIOD.....	2-3
LONG TERM POLLUTION PREVENTION PLAN .....	2-4
o HOUSEKEEPING .....	2-4
o STORING OF MATERIALS AND WASTE PRODUCTS .....	2-4
o VEHICLE WASHING .....	2-4
o SPILL PREVENTION AND RESPONSE .....	2-4
o MAINTENANCE OF LAWNS, GARDENS, AND OTHER LANDSCAPED AREAS .....	2-5
o STORAGE AND USE OF HERBICIDES AND PESTICIDES .....	2-6
o PET WASTE MANAGEMENT.....	2-8
o OPERATIONS AND MANAGEMENT OF SEPTIC SYSTEMS.....	2-8
o MANAGEMENT OF DEICING CHEMICALS AND SNOW .....	2-8
• LONG TERM MAINTENANCE PLAN – FACILITIES DESCRIPTION.....	2-8
• INSPECTION AND MAINTENANCE FREQUENCY AND CORRECTIVE MEASURES.....	2-10
• SUPPLEMENTAL INFORMATION.....	2-10

## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

### **• 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 or 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

## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

### **• 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 demolition 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 dams 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.

## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

### **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 in 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.

## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

### **○ 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.

## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A*

*November 18, 2020*

*Revised: April 9, 2021*

### ▪ **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 15<sup>th</sup> depending on lawn growth.
3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
4. Do not remove grass clippings after mowing.
5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

#### ◆ **Shrubs**

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

#### ◆ **Trees**

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

#### ◆ **Invasive Species**

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

### ○ **STORAGE AND USE OF HERBICIDES AND PESTICIDES**

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

## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

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.



## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

### **○ 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 de-icing agents. Sodium chloride as a de-icing agent should not be utilized.

### **• 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

---

**DRAINAGE REPORT**

---

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

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.

**Rain Guardians (curb inlet pretreatment devices)**

Removal of trash, debris, sediment

Inspect twice annually and after rainfall events exceeding 2.5" in a 24 hour period. Remove trash, debris sediment when encountered

**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.

**Bioretention System**

Systems should be inspected at least twice annually, and following any rainfall event exceeding 2.5 inches in a 24 hour period, with maintenance or rehabilitation conducted as warranted by such inspection.

Trash and debris should be removed at each inspection.

At least once annually, system should be inspected for drawdown time. If bioretention system does not drain within 72-hours following a rainfall event, then a qualified professional should assess the condition of the facility to determine measures required to restore filtration function, including but not limited to removal of accumulated sediments or reconstruction of the filter media.

Vegetation should be inspected at least annually, and maintained in healthy condition, including pruning, removal and replacement of dead or diseased vegetation, and removal of invasive species.

**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.

## **DRAINAGE REPORT**

*The Pines Residences  
Sherborn, MA*

*A&M Project # 2513-01A  
November 18, 2020  
Revised: April 9, 2021*

### **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.

### **Gabion Style Level Spreaders**

The base of the level spreader should be inspected annually for scouring and erosion. Woody vegetation surrounding the base of the level spreader should be removed during annual inspections.

Inspect the level spreader clean out annually for sediment build up. If any is found, remove using a vacuum truck or shop vac.

### **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 driveways and roadways with high-efficiency regenerative air-vacuum	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.	\$1,500/Sweeping	Semi-annually (Spring & Fall)	\$3,000		
		Maintain information that confirms that all street sweepings have been disposed in accordance with state and local requirements					
Deep Sump CB's	Inspect frames and grates. Empty sumps using a vacuum-truck.	Inspected and cleaned 4 times per year.	\$500/CB	CBs - quarterly			
		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					
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.	\$4,000	Semi-annually (Spring & Fall)			
		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					
Underground Infiltration Systems	Remove trash/debris	Twice a year	\$500	Semi-annually (Spring & Fall)			
	Check for sediment and outlet clogging						
		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					
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	\$500 allowance	Annually			
		Check sediment build-up on a yearly basis and clean as needed using hand methods					
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.<sup>1</sup> 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

---

<sup>1</sup> 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.<sup>2</sup> 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.

## REFERENCES

- California Department of Transportation, 2004, BMP Retrofit Pilot Program, Final Report, Report ID CTSW – RT – 1 – 050,  
[http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/\\_pdfs/new\\_technology/CTSW-RT-01-050.pdf#xml=http://dap1.dot.ca.gov/cgi-bin/texis/webinator/search/pdfhi.txt?query=mosquito&db=db&pr=www&prox=page&rorder=500&rprox=500&rdfreq=500&rwfreq=500&rlead=500&sufs=0&order=r&cq=&id=4673373b7](http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-01-050.pdf#xml=http://dap1.dot.ca.gov/cgi-bin/texis/webinator/search/pdfhi.txt?query=mosquito&db=db&pr=www&prox=page&rorder=500&rprox=500&rdfreq=500&rwfreq=500&rlead=500&sufs=0&order=r&cq=&id=4673373b7)  
Appendix E: Vector Monitoring and Abatement,  
[http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/\\_pdfs/new\\_technology/](http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/)  
California Department of Transportation, 2001, Final Vector Report, Caltrans BMP Retrofit Project Sites, Districts 7 and 11,  
[http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/\\_pdfs/new\\_technology/CTSW-RT-01-050/AppendixE/01\\_FinalVectorReport.pdf](http://www.dot.ca.gov/hq/env/stormwater/special/newsetup/_pdfs/new_technology/CTSW-RT-01-050/AppendixE/01_FinalVectorReport.pdf)  
Currier, Brian, and Moeller, Glenn, 2000, Lessons Learned: The CALTRANS Storm Water Best Management Practice Retrofit Pilot Study, prepared by the California State University Sacramento and University of California Davis for the California Department of Transportation,  
<http://www.owp.csus.edu/research/papers/papers/PP015.pdf>  
Massachusetts Department of Environmental Protection, 2001, West Nile Virus, Application of Pesticides to Wetland Resource Areas and Buffer Zones and Public Water systems, Guideline No. BRPG01-02, <http://www.mass.gov/dep/water/wnvpolicy.doc>  
O'Meara, G.F., 2003, Mosquitoes Associated With Stormwater Detention/Retention Areas, ENY627, University of Florida, Institute of Food and Agricultural Sciences Extension,  
<http://edis.ifas.ufl.edu/mg338>  
Taylor, Scott M., and Currier, Brian, 1999, A Wet Pond as a Storm Water Runoff BMP – Case Study, presented at Department of Environmental Resources Engineering, Humboldt State University, Arcata, California <http://www.owp.csus.edu/research/papers/papers/PP004.pdf>  
U.S. EPA, 2005, Stormwater Structures and Mosquitoes, EPA 833-F-05-003,  
[http://www.epa.gov/npdes/pubs/sw\\_wnv.pdf](http://www.epa.gov/npdes/pubs/sw_wnv.pdf)  
U.S. EPA, 2003, Do Stormwater Retention Ponds Contribute to Mosquito Problems, Nonpoint source News-Notes, Issue No. 71, <http://notes.tetratex.com/newsnotes.nsf/0/143f7fa99c3ea25485256d0100618bc9?OpenDocument>  
Virginia Department of Conservation and Recreation, 2003, Vector Control, Mosquitoes and Stormwater Management, Stormwater Management Technical Bulletin No. 8,  
[http://www.dcr.virginia.gov/soil\\_&\\_water/documents/tecbltn8.pdf](http://www.dcr.virginia.gov/soil_&_water/documents/tecbltn8.pdf)  
Wallace, John R., Stormwater Management and Mosquito Ecology, Stormwater Magazine, March/April 2007, [http://www.gradingandexcavation.com/sw\\_0703\\_management.html](http://www.gradingandexcavation.com/sw_0703_management.html)

---

<sup>2</sup> *Bacillus thuringiensis 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.<sup>3</sup> 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.<sup>4</sup>

---

<sup>3</sup> 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.

<sup>4</sup> 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.<sup>5</sup> 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.

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

## CDS<sup>®</sup> Inspection and Maintenance Guide

---





## 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 allow 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 whether 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 system 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](http://www.contechstormwater.com).
- Site-specific design support is available from our engineers.

©2010 CONTECH Stormwater Solutions

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](http://contech-cpi.com) or call 800.338.1122

Nothing in this catalog should be construed as an expressed warranty or an implied warranty of merchantability or fitness for any particular purpose. See the CONTECH standard quotation or acknowledgement for applicable warranties and other terms and conditions of sale.

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; 7,517,450 related foreign patents or other patents pending.

## CDS Inspection & Maintenance Log

CDS Model: \_\_\_\_\_ Location: \_\_\_\_\_

[illegible]

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.



**Stormceptor<sup>®</sup> STC**  
**Owner's Manual**





## Table of Contents

<b>TITLE .....</b>	<b>SECTION</b>
Stormceptor Overview .....	1
Stormceptor Operation and Components .....	2
Stormceptor Identification .....	3
Stormceptor Inspection and Maintenance .....	4
<i>Recommended Stormceptor Inspection Procedure</i>	
<i>Recommended Stormceptor Maintenance Procedure</i>	
Contact Information .....	5

---

For patent information, go to [www.ContechES.com/ip](http://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.

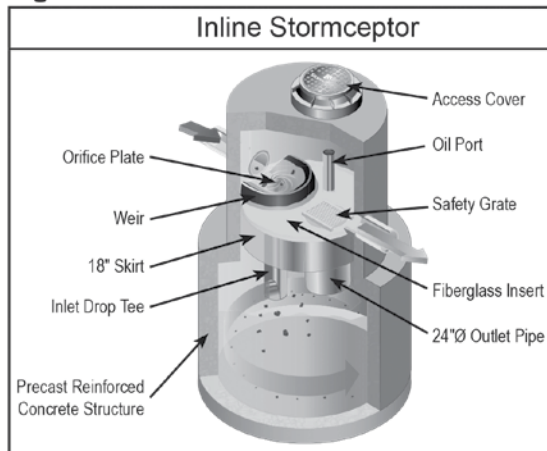
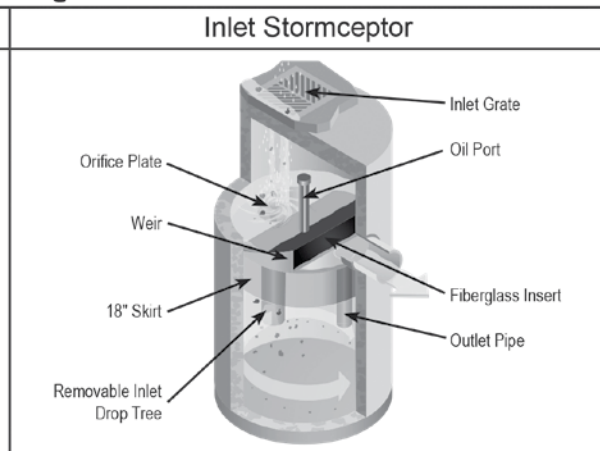


Figure 2.



## 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.

<b>Table 1. Stormceptor Dimensions - Insert to Base of Structure</b>	
<b>STC Model</b>	<b>Insert to Base (in.)</b>
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.

<b>Table 2. Storage Capacities</b>		
<b>STC Model</b>	<b>Hydrocarbon Storage Capacity (gal)</b>	<b>Sediment Capacity (ft³)</b>
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.

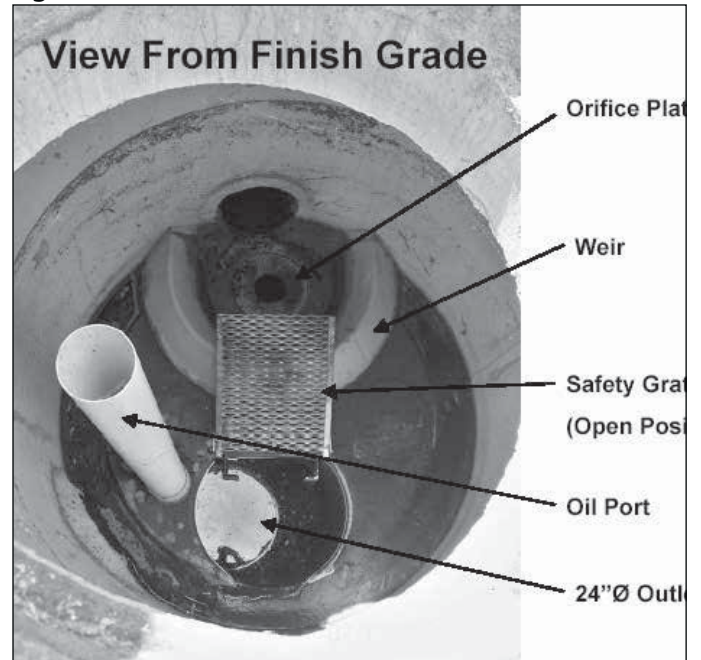
***Figure 3.***



### ***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 4.***

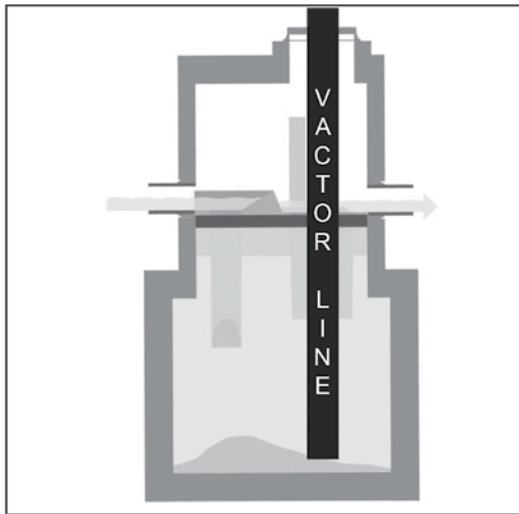


### **Recommended Stormceptor Maintenance Procedure**

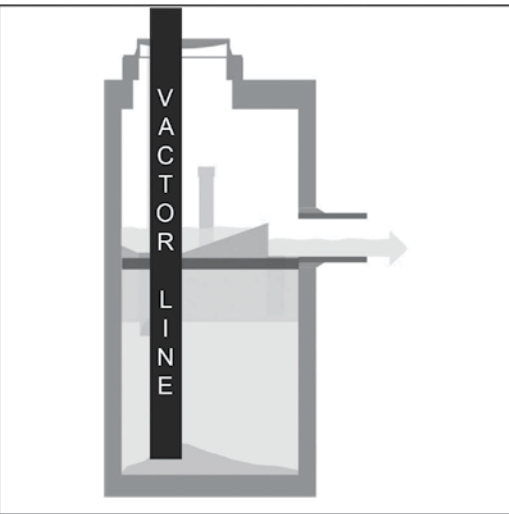
Maintenance of Stormceptor is performed using a vacuum truck. No entry into the unit is required for maintenance. **DO NOT ENTER THE STORMCEPTOR CHAMBER** unless you have the proper personal safety equipment, have been trained and are qualified to enter a confined space, as identified by local Occupational 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.

<b>Table 3. Recommended Sediment Depths Indicating Maintenance</b>	
<b>STC Model</b>	<b>Maintenance Sediment Depth (in)</b>
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

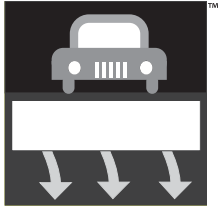
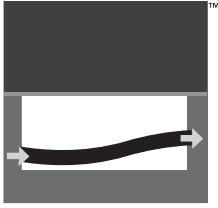
- Drawings and specifications are available at [www.ContechES.com](http://www.ContechES.com).
- Site-specific design support is available from our engineers.

©2019 Contech Engineered Solutions LLC, a QUIKRETE Company

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](http://www.ContechES.com) or call 800.338.1122

NOTHING IN THIS CATALOG SHOULD BE CONSTRUED AS A WARRANTY. APPLICATIONS SUGGESTED HEREIN ARE DESCRIBED ONLY TO HELP READERS MAKE THEIR OWN EVALUATIONS AND DECISIONS, AND ARE NEITHER GUARANTEES NOR WARRANTIES OF SUITABILITY FOR ANY APPLICATION. CONTECH MAKES NO WARRANTY WHATSOEVER, EXPRESS OR IMPLIED, RELATED TO THE APPLICATIONS, MATERIALS, COATINGS, OR PRODUCTS DISCUSSED HEREIN. ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND ALL IMPLIED WARRANTIES OF FITNESS FOR ANY PARTICULAR PURPOSE ARE DISCLAIMED BY CONTECH. SEE CONTECH'S CONDITIONS OF SALE (AVAILABLE AT [WWW.CONTECHES.COM/COS](http://WWW.CONTECHES.COM/COS)) FOR MORE INFORMATION.





# URBANGREEN™



## CMP Detention and Infiltration Inspection and Maintenance Guide





# 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

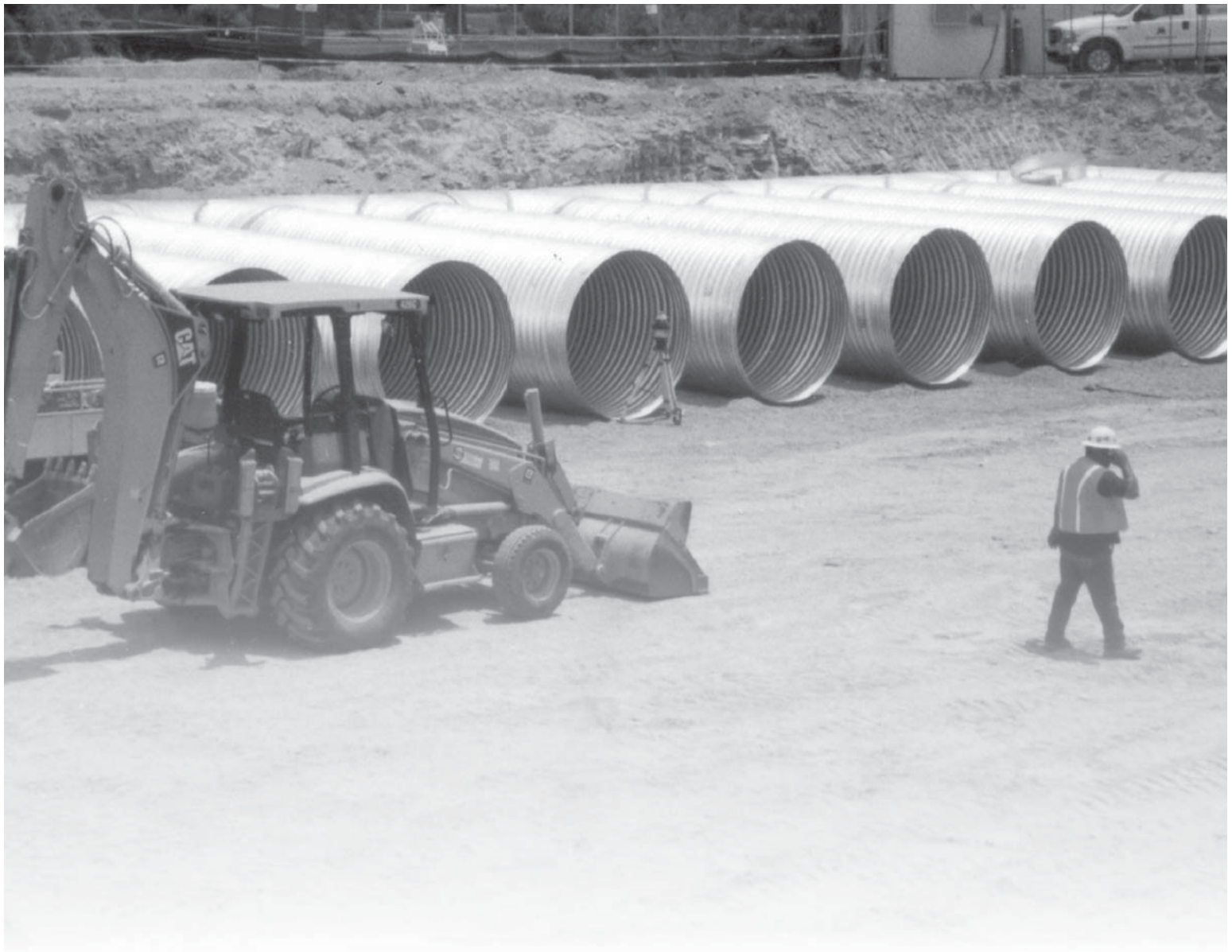
Maintaining an underground detention or retention system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

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

[illegible]



## **CONTECH®** ENGINEERED SOLUTIONS

©2012 CONTECH ENGINEERED SOLUTIONS, LLC.  
800-338-1122  
[www.ContechES.com](http://www.ContechES.com)

All Rights Reserved. Printed in the USA.

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](http://ContechES.com) or call 800.338.1122

NOTHING IN THIS CATALOG SHOULD BE CONSTRUED AS AN EXPRESSED WARRANTY OR AN IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. SEE THE CONTECH STANDARD CONDITIONS OF SALE (VIEWABLE AT [WWW.CONTECHES.COM/COS](http://WWW.CONTECHES.COM/COS)) FOR MORE INFORMATION.

### **Support**

- Drawings and specifications are available at [contechstormwater.com](http://contechstormwater.com).
- Site-specific design support is available from our engineers.

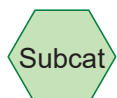
ug\_cmp\_design guide 06/12



## **SECTION 3.0**

HYROCAD WORKSHEETS.....EXISTING CONDITIONS

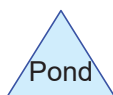




Subcat



Reach



Pond



Link

**Routing Diagram for 2513-01A - Existing HydroCAD**  
 Prepared by Allen & Major Associates, Inc., Printed 4/9/2021  
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

## 2513-01A - Existing HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 4/9/2021

Page 2

### 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)
<b>293,017</b>	<b>57</b>	<b>TOTAL AREA</b>

## 2513-01A - Existing HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 4/9/2021

Page 3

### 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	
<b>293,017</b>		<b>TOTAL AREA</b>

## 2513-01A - Existing HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 4/9/2021

Page 4

### 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	ED1	167.19	166.69	50.0	0.0100	0.012	12.0	0.0	0.0

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 5

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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**Pond ED1: Existing Depression**

Peak Elev=167.52' Storage=20 cf Inflow=0.45 cfs 4,421 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 ' Outflow=0.45 cfs 4,417 cf

**Link SP1: STUDY POINT #1**

Inflow=0.45 cfs 4,432 cf  
Primary=0.45 cfs 4,432 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**

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 6

**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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		<b>Shallow Concentrated Flow, C TO D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b> Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b> Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 7

**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		<b>Sheet Flow, A TO B</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		<b>Shallow Concentrated Flow, B TO C</b>
					Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		<b>Shallow Concentrated Flow, C TO D</b>
					Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		<b>Shallow Concentrated Flow, D TO E</b>
					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		<b>Sheet Flow, A TO B</b>
					Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

**Summary for Pond ED1: Existing Depression**

Inflow Area = 191,886 sf, 17.58% Impervious, Inflow Depth = 0.28" for 2-year event  
 Inflow = 0.45 cfs @ 12.37 hrs, Volume= 4,421 cf  
 Outflow = 0.45 cfs @ 12.38 hrs, Volume= 4,417 cf, Atten= 0%, Lag= 0.5 min  
 Primary = 0.45 cfs @ 12.38 hrs, Volume= 4,417 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 167.52' @ 12.38 hrs Surf.Area= 70 sf Storage= 20 cf  
 Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf



**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 8

Plug-Flow detention time= 1.8 min calculated for 4,417 cf (100% of inflow)

Center-of-Mass det. time= 1.1 min ( 955.5 - 954.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.45 cfs @ 12.38 hrs HW=167.52' (Free Discharge)↑ **1=Culvert** (Inlet Controls 0.45 cfs @ 1.96 fps)**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 @ 12.38 hrs, Volume= 4,432 cf  
 Primary = 0.45 cfs @ 12.38 hrs, Volume= 4,432 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

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 9

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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**Pond ED1: Existing Depression**

Peak Elev=168.21' Storage=141 cf Inflow=2.85 cfs 14,877 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 '/' Outflow=2.72 cfs 14,873 cf

**Link SP1: STUDY POINT #1**

Inflow=2.72 cfs 15,374 cf  
Primary=2.72 cfs 15,374 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**

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 10

**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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		<b>Shallow Concentrated Flow, C TO D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b> Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b> Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 11

**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		<b>Sheet Flow, A TO B</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		<b>Shallow Concentrated Flow, B TO C</b>
					Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		<b>Shallow Concentrated Flow, C TO D</b>
					Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		<b>Shallow Concentrated Flow, D TO E</b>
					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		<b>Sheet Flow, A TO B</b>
					Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

**Summary for Pond ED1: Existing Depression**

Inflow Area = 191,886 sf, 17.58% Impervious, Inflow Depth = 0.93" for 10-year event  
 Inflow = 2.85 cfs @ 12.14 hrs, Volume= 14,877 cf  
 Outflow = 2.72 cfs @ 12.18 hrs, Volume= 14,873 cf, Atten= 5%, Lag= 2.3 min  
 Primary = 2.72 cfs @ 12.18 hrs, Volume= 14,873 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 168.21' @ 12.18 hrs Surf.Area= 526 sf Storage= 141 cf  
 Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 12

Plug-Flow detention time= 1.1 min calculated for 14,873 cf (100% of inflow)

Center-of-Mass det. time= 0.7 min ( 900.4 - 899.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=2.70 cfs @ 12.18 hrs HW=168.20' (Free Discharge)↑ **1=Culvert** (Inlet Controls 2.70 cfs @ 3.44 fps)**Summary for Link SP1: STUDY POINT #1**

Inflow Area = 218,982 sf, 15.40% Impervious, Inflow Depth = 0.84" for 10-year event  
 Inflow = 2.72 cfs @ 12.18 hrs, Volume= 15,374 cf  
 Primary = 2.72 cfs @ 12.18 hrs, Volume= 15,374 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

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 13

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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**Pond ED1: Existing Depression**

Peak Elev=168.85' Storage=1,175 cf Inflow=5.71 cfs 25,621 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 '/' Outflow=4.04 cfs 25,617 cf

**Link SP1: STUDY POINT #1**

Inflow=4.19 cfs 26,881 cf  
Primary=4.19 cfs 26,881 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**



**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 14

**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		<b>Sheet Flow, A TO B</b>
					Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		<b>Shallow Concentrated Flow, C TO D</b>
					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		<b>Sheet Flow, A TO B</b>
					Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b>
					Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b>
					Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 15

**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		<b>Sheet Flow, A TO B</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		<b>Shallow Concentrated Flow, B TO C</b>
					Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		<b>Shallow Concentrated Flow, C TO D</b>
					Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		<b>Shallow Concentrated Flow, D TO E</b>
					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		<b>Sheet Flow, A TO B</b>
					Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

**Summary for Pond ED1: Existing Depression**

Inflow Area = 191,886 sf, 17.58% Impervious, Inflow Depth = 1.60" for 25-year event

Inflow = 5.71 cfs @ 12.13 hrs, Volume= 25,621 cf

Outflow = 4.04 cfs @ 12.30 hrs, Volume= 25,617 cf, Atten= 29%, Lag= 9.8 min

Primary = 4.04 cfs @ 12.30 hrs, Volume= 25,617 cf

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

Peak Elev= 168.85' @ 12.30 hrs Surf.Area= 3,013 sf Storage= 1,175 cf

Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 16

Plug-Flow detention time= 1.9 min calculated for 25,617 cf (100% of inflow)

Center-of-Mass det. time= 1.6 min ( 882.1 - 880.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 '/ Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=4.03 cfs @ 12.30 hrs HW=168.85' (Free Discharge)↑ **1=Culvert** (Barrel Controls 4.03 cfs @ 5.13 fps)**Summary for Link SP1: STUDY POINT #1**

Inflow Area = 218,982 sf, 15.40% Impervious, Inflow Depth = 1.47" for 25-year event  
 Inflow = 4.19 cfs @ 12.30 hrs, Volume= 26,881 cf  
 Primary = 4.19 cfs @ 12.30 hrs, Volume= 26,881 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

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 17

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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**SubcatchmentE-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

**Pond ED1: Existing Depression**

Peak Elev=169.76' Storage=7,803 cf Inflow=12.75 cfs 52,261 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 '/' Outflow=5.39 cfs 52,257 cf

**Link SP1: STUDY POINT #1**

Inflow=5.83 cfs 55,856 cf  
Primary=5.83 cfs 55,856 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**

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 18

**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		<b>Sheet Flow, A TO B</b>
					Grass: Dense n= 0.240 P2= 3.10"
1.4	260	0.2000	3.13		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
1.3	120	0.0100	1.50		<b>Shallow Concentrated Flow, C TO D</b>
					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		<b>Sheet Flow, A TO B</b>
					Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b>
					Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b>
					Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 19

**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		<b>Sheet Flow, A TO B</b>
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.4	50	0.1800	2.12		<b>Shallow Concentrated Flow, B TO C</b>
					Woodland Kv= 5.0 fps
0.7	133	0.2000	3.13		<b>Shallow Concentrated Flow, C TO D</b>
					Short Grass Pasture Kv= 7.0 fps
0.3	75	0.0500	4.54		<b>Shallow Concentrated Flow, D TO E</b>
					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		<b>Sheet Flow, A TO B</b>
					Grass: Short n= 0.150 P2= 3.10"
24.6	800	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b>
					Short Grass Pasture Kv= 7.0 fps
32.5	850	Total			

**Summary for Pond ED1: Existing Depression**

Inflow Area = 191,886 sf, 17.58% Impervious, Inflow Depth = 3.27" for 100-year event

Inflow = 12.75 cfs @ 12.13 hrs, Volume= 52,261 cf

Outflow = 5.39 cfs @ 12.53 hrs, Volume= 52,257 cf, Atten= 58%, Lag= 24.0 min

Primary = 5.39 cfs @ 12.53 hrs, Volume= 52,257 cf

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

Peak Elev= 169.76' @ 12.53 hrs Surf.Area= 13,119 sf Storage= 7,803 cf

Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf



**2513-01A - Existing HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 20

Plug-Flow detention time= 8.7 min calculated for 52,257 cf (100% of inflow)

Center-of-Mass det. time= 8.4 min ( 866.6 - 858.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=5.39 cfs @ 12.53 hrs HW=169.76' (Free Discharge)↑**1=Culvert** (Barrel Controls 5.39 cfs @ 6.86 fps)**Summary for Link SP1: STUDY POINT #1**

Inflow Area = 218,982 sf, 15.40% Impervious, Inflow Depth = 3.06" for 100-year event  
 Inflow = 5.83 cfs @ 12.35 hrs, Volume= 55,856 cf  
 Primary = 5.83 cfs @ 12.35 hrs, Volume= 55,856 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**

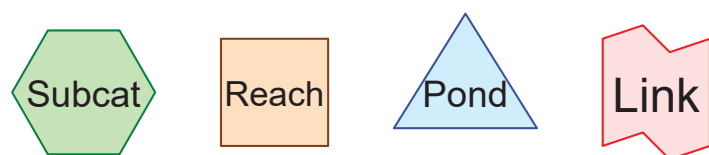
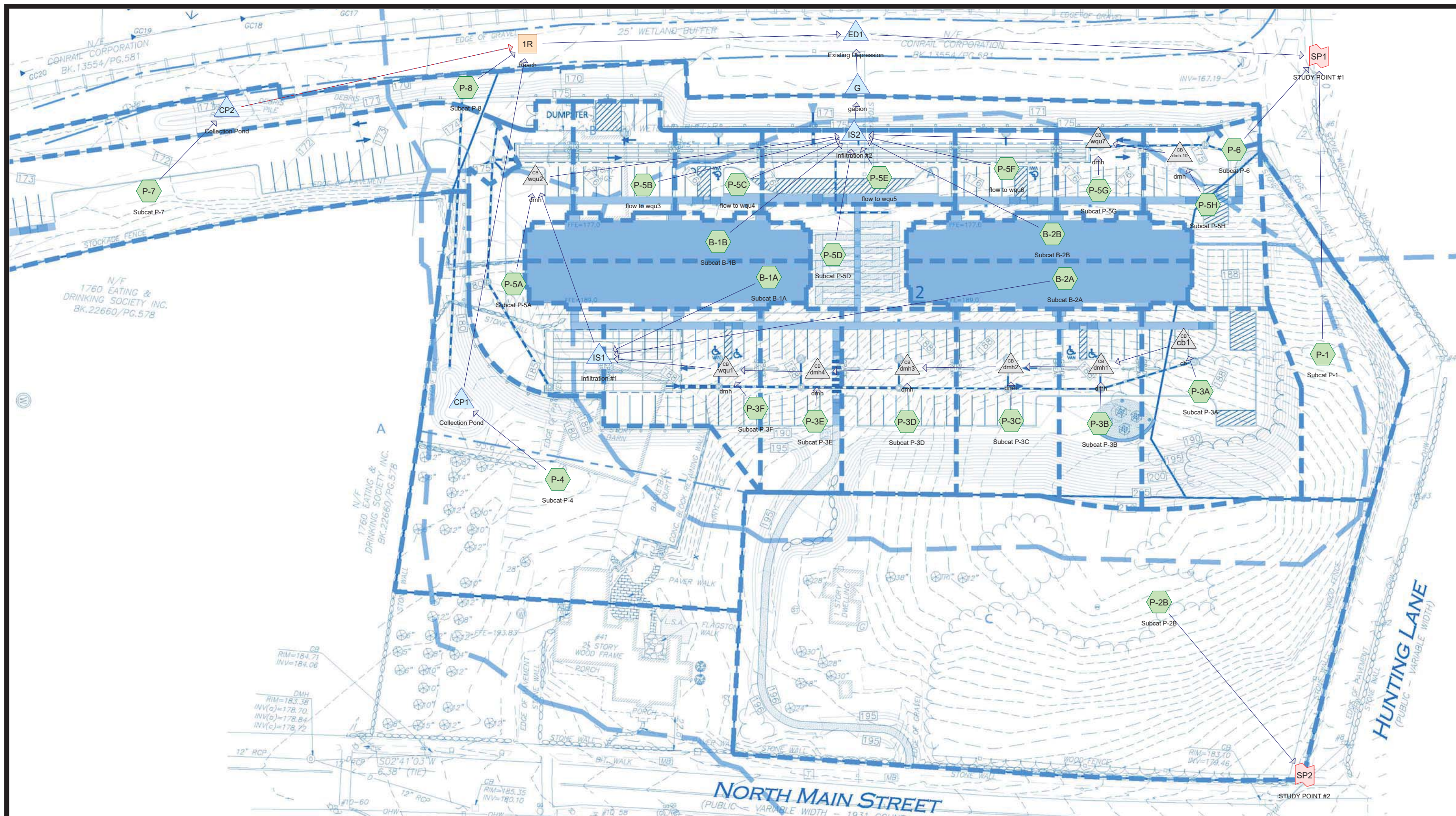
Inflow Area = 74,035 sf, 2.79% Impervious, Inflow Depth = 4.33" for 100-year event  
 Inflow = 7.67 cfs @ 12.13 hrs, Volume= 26,696 cf  
 Primary = 7.67 cfs @ 12.13 hrs, Volume= 26,696 cf, Atten= 0%, Lag= 0.0 min

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

## **SECTION 4.0**

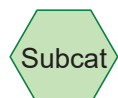
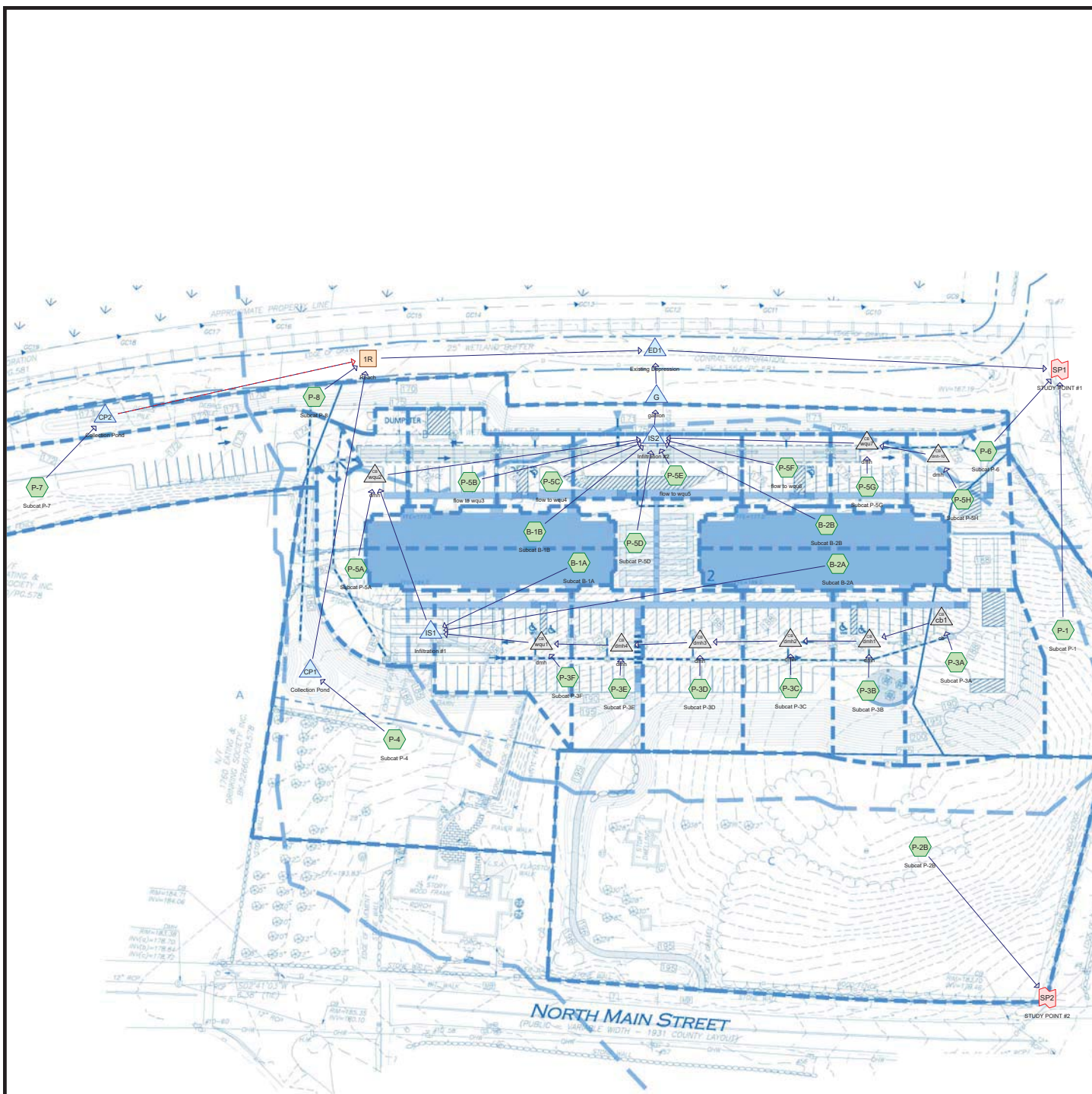
HYROCAD WORKSHEETS.....PROPOSED CONDITIONS





**Routing Diagram for 2513-01A - Proposed HydroCAD\_rev1**  
 Prepared by Allen & Major Associates, Inc., Printed 4/9/2021  
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

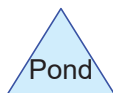




Subcat



Reach



Pond



Link

**Routing Diagram for 2513-01A - Proposed HydroCAD\_rev1**  
 Prepared by Allen & Major Associates, Inc., Printed 4/9/2021  
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 4/9/2021

Page 2

**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)
<b>293,017</b>	<b>71</b>	<b>TOTAL AREA</b>

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 4/9/2021

Page 3

**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	
<b>293,017</b>		<b>TOTAL AREA</b>



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 4/9/2021

Page 4

**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	cb1	184.40	183.75	65.0	0.0100	0.013	12.0	0.0	0.0
2	CP1	172.35	170.50	185.0	0.0100	0.012	15.0	0.0	0.0
3	CP2	170.16	169.80	187.0	0.0019	0.010	6.0	0.0	0.0
4	dmh-10	171.30	170.85	71.0	0.0063	0.013	12.0	0.0	0.0
5	dmh1	183.65	183.03	62.0	0.0100	0.013	12.0	0.0	0.0
6	dmh2	182.93	182.20	73.0	0.0100	0.013	12.0	0.0	0.0
7	dmh3	181.95	181.29	66.0	0.0100	0.013	15.0	0.0	0.0
8	dmh4	181.19	180.64	55.0	0.0100	0.013	15.0	0.0	0.0
9	ED1	167.19	166.69	50.0	0.0100	0.012	12.0	0.0	0.0
10	IS1	182.40	178.31	82.0	0.0499	0.013	12.0	0.0	0.0
11	IS2	171.55	171.25	9.0	0.0333	0.012	15.0	0.0	0.0
12	wqu1	179.89	179.63	26.0	0.0100	0.013	24.0	0.0	0.0
13	wqu2	170.84	170.70	7.0	0.0200	0.025	24.0	0.0	0.0
14	wqu7	170.75	170.70	8.0	0.0063	0.013	12.0	0.0	0.0

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 5

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentB-1A: Subcat B-1A</b>	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
<b>SubcatchmentB-1B: Subcat B-1B</b>	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
<b>SubcatchmentB-2A: Subcat B-2A</b>	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
<b>SubcatchmentB-2B: Subcat B-2B</b>	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
<b>SubcatchmentP-1: Subcat P-1</b>	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
<b>SubcatchmentP-2B: Subcat P-2B</b>	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
<b>SubcatchmentP-3A: Subcat P-3A</b>	Runoff Area=13,530 sf 32.33% Impervious Runoff Depth=0.28" Tc=6.0 min CN=56 Runoff=0.04 cfs 312 cf
<b>SubcatchmentP-3B: Subcat P-3B</b>	Runoff Area=7,310 sf 48.64% Impervious Runoff Depth=0.73" Tc=6.0 min CN=68 Runoff=0.12 cfs 443 cf
<b>SubcatchmentP-3C: Subcat P-3C</b>	Runoff Area=8,624 sf 49.20% Impervious Runoff Depth=0.73" Tc=6.0 min CN=68 Runoff=0.14 cfs 523 cf
<b>SubcatchmentP-3D: Subcat P-3D</b>	Runoff Area=9,535 sf 52.42% Impervious Runoff Depth=0.82" Tc=6.0 min CN=70 Runoff=0.19 cfs 653 cf
<b>SubcatchmentP-3E: Subcat P-3E</b>	Runoff Area=6,815 sf 59.34% Impervious Runoff Depth=1.03" Tc=6.0 min CN=74 Runoff=0.18 cfs 586 cf
<b>SubcatchmentP-3F: Subcat P-3F</b>	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
<b>SubcatchmentP-4: Subcat P-4</b>	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
<b>SubcatchmentP-5A: Subcat P-5A</b>	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
<b>SubcatchmentP-5B: flow to wqu3</b>	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
<b>SubcatchmentP-5C: flow to wqu4</b>	Runoff Area=3,335 sf 77.86% Impervious Runoff Depth=1.75" Tc=6.0 min CN=85 Runoff=0.16 cfs 486 cf
<b>SubcatchmentP-5D: Subcat P-5D</b>	Runoff Area=5,493 sf 31.16% Impervious Runoff Depth=0.31" Tc=6.0 min CN=57 Runoff=0.02 cfs 140 cf
<b>SubcatchmentP-5E: flow to wqu5</b>	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
<b>SubcatchmentP-5F: flow to wqu6</b>	Runoff Area=3,883 sf 87.69% Impervious Runoff Depth=2.25" Tc=6.0 min CN=91 Runoff=0.23 cfs 728 cf
<b>SubcatchmentP-5G: Subcat P-5G</b>	Runoff Area=3,335 sf 87.45% Impervious Runoff Depth=2.25" Tc=6.0 min CN=91 Runoff=0.20 cfs 625 cf
<b>SubcatchmentP-5H: Subcat P-5H</b>	Runoff Area=7,488 sf 40.45% Impervious Runoff Depth=0.60" Tc=6.0 min CN=65 Runoff=0.09 cfs 372 cf

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 6

**SubcatchmentP-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**SubcatchmentP-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**SubcatchmentP-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=0.43 cfs 2,889 cf  
Outflow=0.43 cfs 2,889 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 CP1: Collection Pond**Peak Elev=173.89' Storage=1,222 cf Inflow=0.68 cfs 2,353 cf  
Discarded=0.04 cfs 2,353 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 2,353 cf**Pond CP2: Collection Pond**Peak Elev=171.05' Storage=353 cf Inflow=0.72 cfs 2,649 cf  
Primary=0.43 cfs 2,647 cf Secondary=0.00 cfs 0 cf Outflow=0.43 cfs 2,647 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 ED1: Existing Depression**Peak Elev=167.51' Storage=19 cf Inflow=0.43 cfs 3,125 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 ' Outflow=0.43 cfs 3,121 cf**Pond G: gabion**Peak Elev=171.26' Storage=0 cf Inflow=0.03 cfs 237 cf  
Outflow=0.03 cfs 237 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 9,272 cf  
Discarded=0.16 cfs 9,035 cf Primary=0.03 cfs 237 cf Outflow=0.20 cfs 9,272 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 1,771 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=0.44 cfs 3,329 cf  
Primary=0.44 cfs 3,329 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**

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 7

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 8

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

**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		<b>Sheet Flow, A TO B</b> Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		<b>Shallow Concentrated Flow, B TO C</b> Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		<b>Shallow Concentrated Flow, C TO D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b> Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b> Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 9

**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"



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 10

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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 11

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

**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					<b>Direct Entry,</b>

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 12

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

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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"

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 14

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		<b>Sheet Flow, A-B</b> Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		<b>Shallow Concentrated Flow, B-C</b> Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		<b>Sheet Flow, C-D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

**Summary for Reach 1R: Reach**Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 0.41" for 2-year event  
Inflow = 0.43 cfs @ 12.34 hrs, Volume= 2,889 cf  
Outflow = 0.43 cfs @ 12.34 hrs, Volume= 2,889 cf, Atten= 0%, Lag= 0.0 min

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

**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

Peak Elev= 184.50' @ 12.31 hrs

Flood Elev= 187.67'

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 15

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	<b>12.0" Round Culvert</b> 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 CP1: Collection Pond**

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

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 =	0.04 cfs @ 15.95 hrs, Volume= 2,353 cf, Atten= 95%, Lag= 231.1 min
Discarded =	0.04 cfs @ 15.95 hrs, Volume= 2,353 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

Peak Elev= 173.89' @ 15.95 hrs Surf.Area= 1,484 sf Storage= 1,222 cf

Flood Elev= 176.00' Surf.Area= 1,788 sf Storage= 3,033 cf

Plug-Flow detention time= 385.6 min calculated for 2,353 cf (100% of inflow)

Center-of-Mass det. time= 385.5 min ( 1,257.9 - 872.4 )

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	3,033 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	1,260	166.0	0	0	1,260
175.00	1,788	185.0	3,033	3,033	1,896

Device	Routing	Invert	Outlet Devices
#1	Primary	172.35'	<b>15.0" Round Culvert</b> L= 185.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.35' / 170.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	174.50'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	173.00'	<b>1.020 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 15.95 hrs HW=173.89' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.04 cfs)**Primary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=173.00' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Passes 0.00 cfs of 1.40 cfs potential flow)↑**2=Orifice/Grate** ( Controls 0.00 cfs)**Summary for Pond CP2: 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 =	0.43 cfs @ 12.34 hrs, Volume= 2,647 cf, Atten= 41%, Lag= 11.8 min
Primary =	0.43 cfs @ 12.34 hrs, Volume= 2,647 cf
Secondary =	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

Peak Elev= 171.05' @ 12.34 hrs Surf.Area= 2,765 sf Storage= 353 cf

Flood Elev= 172.00' Surf.Area= 9,427 sf Storage= 4,118 cf

Plug-Flow detention time= 19.2 min calculated for 2,647 cf (100% of inflow)

Center-of-Mass det. time= 18.7 min ( 880.8 - 862.2 )



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 16

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,714 cf	<b>Surface Storage (Irregular)</b> Listed below (Recalc)
#2	170.66'	232 cf	<b>Soil Filter (Irregular)</b> Listed below (Recalc)
			579 cf Overall x 40.0% Voids
#3	170.16'	173 cf	<b>Underdrain (Irregular)</b> Listed below (Recalc)
			432 cf Overall x 40.0% Voids
		4,118 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	864	258.0	0	0	864
172.00	7,699	640.0	3,714	3,714	28,166

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.66	864	258.0	0	0	864
171.33	864	258.0	579	579	1,037

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.16	864	258.0	0	0	864
170.66	864	258.0	432	432	993

Device	Routing	Invert	Outlet Devices
#1	Secondary	171.50'	<b>8.0' long x 1.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	170.16'	<b>6.0" Round Culvert L= 187.0' Ke= 0.500</b> Inlet / Outlet Invert= 170.16' / 169.80' S= 0.0019 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.43 cfs @ 12.34 hrs HW=171.05' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** (Barrel Controls 0.43 cfs @ 2.17 fps)**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=170.16' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)**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

Peak Elev= 171.64' @ 13.70 hrs

Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	<b>12.0" Round Culvert L= 71.0' Ke= 0.500</b> 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=171.48' TW=171.18' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 0.08 cfs @ 1.32 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 17

Peak Elev= 183.84' @ 12.13 hrs

Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	<b>12.0" Round Culvert</b> 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

Peak Elev= 183.19' @ 12.12 hrs

Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	<b>12.0" Round Culvert</b> 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

Peak Elev= 182.27' @ 12.11 hrs

Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	<b>15.0" Round Culvert</b> 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

Peak Elev= 181.57' @ 12.11 hrs

Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	<b>15.0" Round Culvert</b> 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 ED1: Existing Depression

Inflow Area = 207,744 sf, 50.97% Impervious, Inflow Depth = 0.18" for 2-year event  
 Inflow = 0.43 cfs @ 12.34 hrs, Volume= 3,125 cf  
 Outflow = 0.43 cfs @ 12.34 hrs, Volume= 3,121 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 0.43 cfs @ 12.34 hrs, Volume= 3,121 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 167.51' @ 12.34 hrs Surf.Area= 69 sf Storage= 19 cf  
 Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf

Plug-Flow detention time= 2.5 min calculated for 3,121 cf (100% of inflow)  
 Center-of-Mass det. time= 1.3 min ( 890.5 - 889.3 )

Volume	Invert	Avail.Storage	Storage Description		
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 ' / Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=0.43 cfs @ 12.34 hrs HW=167.51' TW=0.00' (Dynamic Tailwater)

↑ **1=Culvert** (Inlet Controls 0.43 cfs @ 1.94 fps)

### Summary for Pond G: gabion

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 0.02" for 2-year event  
 Inflow = 0.03 cfs @ 13.63 hrs, Volume= 237 cf  
 Outflow = 0.03 cfs @ 13.63 hrs, Volume= 237 cf, Atten= 0%, Lag= 0.0 min  
 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  
 Peak Elev= 171.26' @ 13.63 hrs Surf.Area= 6 sf Storage= 0 cf  
 Flood Elev= 230.25' Surf.Area= 0 sf Storage= 37 cf

Plug-Flow detention time= 0.0 min calculated for 237 cf (100% of inflow)  
 Center-of-Mass det. time= 0.0 min ( 836.5 - 836.5 )

Volume	Invert	Avail.Storage	Storage Description
#1	171.25'	37 cf	<b>15.0" Round Pipe Storage</b> L= 30.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.88'	<b>3.0" Vert. 3" outlet holes X 30.00</b> C= 0.600
#2	Primary	171.25'	<b>2.0" Horiz. 2" outlet holes X 30.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.03 cfs @ 13.63 hrs HW=171.26' TW=167.36' (Dynamic Tailwater)

↑ **1=3" outlet holes** ( Controls 0.00 cfs)

↑ **2=2" outlet holes** (Weir Controls 0.03 cfs @ 0.28 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

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  
 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	<b>44.50'W x 92.00'L x 5.50'H Field A</b> 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	<b>CMP Round 60 x 24 Inside #1</b> 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'	<b>12.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 0.90" for 2-year event  
 Inflow = 2.77 cfs @ 12.09 hrs, Volume= 9,272 cf  
 Outflow = 0.20 cfs @ 13.63 hrs, Volume= 9,272 cf, Atten= 93%, Lag= 92.6 min  
 Discarded = 0.16 cfs @ 13.63 hrs, Volume= 9,035 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  
 Peak Elev= 171.64' @ 13.63 hrs Surf.Area= 6,176 sf Storage= 4,009 cf

Plug-Flow detention time= 213.9 min calculated for 9,272 cf (100% of inflow)  
 Center-of-Mass det. time= 213.8 min ( 1,008.0 - 794.2 )

Volume	Invert	Avail.Storage	Storage Description
#1A	170.70'	3,753 cf	<b>16.00'W x 386.00'L x 2.50'H Field A</b> 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	<b>CMP Round 24 x 95 Inside #1</b> 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 20

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'	<b>15.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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=171.26' (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

Peak Elev= 180.34' @ 12.10 hrs

Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	<b>24.0" Round Culvert</b> 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**

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= 1,771 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 0.56 cfs @ 12.09 hrs, Volume= 1,771 cf

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

Peak Elev= 171.64' @ 13.67 hrs

Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	<b>24.0" Round Culvert</b> 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=0.38 cfs @ 12.09 hrs HW=171.24' TW=171.17' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 0.38 cfs @ 1.30 fps)**Summary for Pond wqu7: dmh**

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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 4/9/2021

Page 21

Peak Elev= 171.64' @ 13.67 hrs

Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	<b>12.0" Round Culvert</b> 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=0.00 cfs @ 12.09 hrs HW=171.16' TW=171.18' (Dynamic Tailwater)↑**1=Culvert** ( Controls 0.00 cfs)**Summary for Link SP1: STUDY POINT #1**

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth > 0.18" for 2-year event  
Inflow = 0.44 cfs @ 12.32 hrs, Volume= 3,329 cf  
Primary = 0.44 cfs @ 12.32 hrs, Volume= 3,329 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



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 22

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentB-1A: Subcat B-1A</b>	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
<b>SubcatchmentB-1B: Subcat B-1B</b>	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
<b>SubcatchmentB-2A: Subcat B-2A</b>	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
<b>SubcatchmentB-2B: Subcat B-2B</b>	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
<b>SubcatchmentP-1: Subcat P-1</b>	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
<b>SubcatchmentP-2B: Subcat P-2B</b>	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
<b>SubcatchmentP-3A: Subcat P-3A</b>	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
<b>SubcatchmentP-3B: Subcat P-3B</b>	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
<b>SubcatchmentP-3C: Subcat P-3C</b>	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
<b>SubcatchmentP-3D: Subcat P-3D</b>	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
<b>SubcatchmentP-3E: Subcat P-3E</b>	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
<b>SubcatchmentP-3F: Subcat P-3F</b>	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
<b>SubcatchmentP-4: Subcat P-4</b>	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
<b>SubcatchmentP-5A: Subcat P-5A</b>	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
<b>SubcatchmentP-5B: flow to wqu3</b>	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
<b>SubcatchmentP-5C: flow to wqu4</b>	Runoff Area=3,335 sf 77.86% Impervious Runoff Depth=3.17" Tc=6.0 min CN=85 Runoff=0.28 cfs 880 cf
<b>SubcatchmentP-5D: Subcat P-5D</b>	Runoff Area=5,493 sf 31.16% Impervious Runoff Depth=0.99" Tc=6.0 min CN=57 Runoff=0.12 cfs 453 cf
<b>SubcatchmentP-5E: flow to wqu5</b>	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
<b>SubcatchmentP-5F: flow to wqu6</b>	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
<b>SubcatchmentP-5G: Subcat P-5G</b>	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
<b>SubcatchmentP-5H: Subcat P-5H</b>	Runoff Area=7,488 sf 40.45% Impervious Runoff Depth=1.51" Tc=6.0 min CN=65 Runoff=0.28 cfs 942 cf

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 23

**SubcatchmentP-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**SubcatchmentP-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**SubcatchmentP-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=0.90 cfs 8,034 cf  
Outflow=0.90 cfs 8,034 cf**Pond cb1: cb**Peak Elev=184.66' 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 CP1: Collection Pond**Peak Elev=174.57' Storage=2,291 cf Inflow=1.66 cfs 5,266 cf  
Discarded=0.04 cfs 3,485 cf Primary=0.24 cfs 1,346 cf Outflow=0.28 cfs 4,832 cf**Pond CP2: Collection Pond**Peak Elev=171.45' Storage=1,246 cf Inflow=1.57 cfs 5,537 cf  
Primary=0.53 cfs 5,535 cf Secondary=0.00 cfs 0 cf Outflow=0.53 cfs 5,535 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=182.55' 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 ED1: Existing Depression**Peak Elev=167.93' Storage=62 cf Inflow=1.78 cfs 12,631 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 ' Outflow=1.78 cfs 12,627 cf**Pond G: gabion**Peak Elev=171.34' Storage=1 cf Inflow=0.92 cfs 4,597 cf  
Outflow=0.92 cfs 4,597 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 15,719 cf  
Discarded=0.17 cfs 11,122 cf Primary=0.92 cfs 4,597 cf Outflow=1.09 cfs 15,719 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 3,082 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=1.83 cfs 13,325 cf  
Primary=1.83 cfs 13,325 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**

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 24

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 25

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

**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		<b>Sheet Flow, A TO B</b> Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		<b>Shallow Concentrated Flow, B TO C</b> Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		<b>Shallow Concentrated Flow, C TO D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b> Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b> Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 26

**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"

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 27

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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 28

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

**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					<b>Direct Entry,</b>

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 29

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

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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"

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 31

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		<b>Sheet Flow, A-B</b> Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		<b>Shallow Concentrated Flow, B-C</b> Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		<b>Sheet Flow, C-D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

**Summary for Reach 1R: Reach**Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 1.14" for 10-year event  
Inflow = 0.90 cfs @ 12.61 hrs, Volume= 8,034 cf  
Outflow = 0.90 cfs @ 12.61 hrs, Volume= 8,034 cf, Atten= 0%, Lag= 0.0 min

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

**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

Peak Elev= 184.66' @ 12.12 hrs

Flood Elev= 187.67'

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 32

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	<b>12.0" Round Culvert</b> 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 @ 2.37 fps)

**Summary for Pond CP1: Collection Pond**

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

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 =	0.28 cfs @ 12.62 hrs, Volume= 4,832 cf, Atten= 83%, Lag= 31.3 min
Discarded =	0.04 cfs @ 12.62 hrs, Volume= 3,485 cf
Primary =	0.24 cfs @ 12.62 hrs, Volume= 1,346 cf

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

Peak Elev= 174.57' @ 12.62 hrs Surf.Area= 1,667 sf Storage= 2,291 cf

Flood Elev= 176.00' Surf.Area= 1,788 sf Storage= 3,033 cf

Plug-Flow detention time= 420.5 min calculated for 4,826 cf (92% of inflow)

Center-of-Mass det. time= 379.5 min ( 1,226.9 - 847.5 )

Volume	Invert	Avail.Storage	Storage Description		
#1	173.00'	3,033 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	1,260	166.0	0	0	1,260
175.00	1,788	185.0	3,033	3,033	1,896

Device	Routing	Invert	Outlet Devices
#1	Primary	172.35'	<b>15.0" Round Culvert</b> L= 185.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.35' / 170.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	174.50'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	173.00'	<b>1.020 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 12.62 hrs HW=174.57' (Free Discharge)

3=Exfiltration (Exfiltration Controls 0.04 cfs)

**Primary OutFlow** Max=0.24 cfs @ 12.62 hrs HW=174.57' TW=0.00' (Dynamic Tailwater)

1=Culvert (Passes 0.24 cfs of 5.89 cfs potential flow)

2=Orifice/Grate (Weir Controls 0.24 cfs @ 0.87 fps)

**Summary for Pond CP2: 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 =	0.53 cfs @ 12.51 hrs, Volume= 5,535 cf, Atten= 66%, Lag= 22.3 min
Primary =	0.53 cfs @ 12.51 hrs, Volume= 5,535 cf
Secondary =	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

Peak Elev= 171.45' @ 12.51 hrs Surf.Area= 4,830 sf Storage= 1,246 cf

Flood Elev= 172.00' Surf.Area= 9,427 sf Storage= 4,118 cf

Plug-Flow detention time= 23.5 min calculated for 5,535 cf (100% of inflow)

Center-of-Mass det. time= 23.2 min ( 863.4 - 840.2 )

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 33

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,714 cf	<b>Surface Storage (Irregular)</b> Listed below (Recalc)
#2	170.66'	232 cf	<b>Soil Filter (Irregular)</b> Listed below (Recalc)
			579 cf Overall x 40.0% Voids
#3	170.16'	173 cf	<b>Underdrain (Irregular)</b> Listed below (Recalc)
			432 cf Overall x 40.0% Voids
		4,118 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	864	258.0	0	0	864
172.00	7,699	640.0	3,714	3,714	28,166

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.66	864	258.0	0	0	864
171.33	864	258.0	579	579	1,037

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.16	864	258.0	0	0	864
170.66	864	258.0	432	432	993

Device	Routing	Invert	Outlet Devices
#1	Secondary	171.50'	<b>8.0' long x 1.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	170.16'	<b>6.0" Round Culvert L= 187.0' Ke= 0.500</b> Inlet / Outlet Invert= 170.16' / 169.80' S= 0.0019 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.53 cfs @ 12.51 hrs HW=171.45' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** (Barrel Controls 0.53 cfs @ 2.69 fps)**Secondary OutFlow** Max=0.00 cfs @ 0.00 hrs HW=170.16' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir**( Controls 0.00 cfs)**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

Peak Elev= 172.07' @ 12.56 hrs

Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	<b>12.0" Round Culvert L= 71.0' Ke= 0.500</b> 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=0.21 cfs @ 12.10 hrs HW=171.66' TW=171.53' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 0.21 cfs @ 1.22 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



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 34

Peak Elev= 184.05' @ 12.11 hrs

Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	<b>12.0" Round Culvert</b> 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=0.56 cfs @ 12.10 hrs HW=184.05' TW=183.43' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 0.56 cfs @ 2.88 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

Peak Elev= 183.44' @ 12.10 hrs

Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	<b>12.0" Round Culvert</b> 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=182.54' (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

Peak Elev= 182.55' @ 12.11 hrs

Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	<b>15.0" Round Culvert</b> 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=1.36 cfs @ 12.10 hrs HW=182.54' TW=181.86' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 1.36 cfs @ 3.48 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

Peak Elev= 181.87' @ 12.10 hrs

Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	<b>15.0" Round Culvert</b> 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 ED1: Existing Depression

Inflow Area = 207,744 sf, 50.97% Impervious, Inflow Depth = 0.73" for 10-year event  
 Inflow = 1.78 cfs @ 12.57 hrs, Volume= 12,631 cf  
 Outflow = 1.78 cfs @ 12.58 hrs, Volume= 12,627 cf, Atten= 0%, Lag= 0.6 min  
 Primary = 1.78 cfs @ 12.58 hrs, Volume= 12,627 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 167.93' @ 12.58 hrs Surf.Area= 145 sf Storage= 62 cf  
 Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf

Plug-Flow detention time= 0.9 min calculated for 12,613 cf (100% of inflow)  
 Center-of-Mass det. time= 0.7 min ( 847.4 - 846.7 )

Volume	Invert	Avail.Storage	Storage Description		
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 ' / Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=1.78 cfs @ 12.58 hrs HW=167.92' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 1.78 cfs @ 4.01 fps)

### Summary for Pond G: gabion

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 0.45" for 10-year event  
 Inflow = 0.92 cfs @ 12.49 hrs, Volume= 4,597 cf  
 Outflow = 0.92 cfs @ 12.49 hrs, Volume= 4,597 cf, Atten= 0%, Lag= 0.1 min  
 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  
 Peak Elev= 171.34' @ 12.49 hrs Surf.Area= 19 sf Storage= 1 cf  
 Flood Elev= 230.25' Surf.Area= 0 sf Storage= 37 cf

Plug-Flow detention time= 0.0 min calculated for 4,592 cf (100% of inflow)  
 Center-of-Mass det. time= 0.0 min ( 804.2 - 804.2 )

Volume	Invert	Avail.Storage	Storage Description
#1	171.25'	37 cf	<b>15.0" Round Pipe Storage</b> L= 30.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.88'	<b>3.0" Vert. 3" outlet holes X 30.00</b> C= 0.600
#2	Primary	171.25'	<b>2.0" Horiz. 2" outlet holes X 30.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=0.92 cfs @ 12.49 hrs HW=171.34' TW=167.89' (Dynamic Tailwater)

↑**1=3" outlet holes** ( Controls 0.00 cfs)

↑**2=2" outlet holes** (Orifice Controls 0.92 cfs @ 1.41 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  
 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	<b>44.50'W x 92.00'L x 5.50'H Field A</b> 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	<b>CMP Round 60 x 24 Inside #1</b> 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'	<b>12.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 1.53" for 10-year event  
 Inflow = 4.68 cfs @ 12.09 hrs, Volume= 15,719 cf  
 Outflow = 1.09 cfs @ 12.49 hrs, Volume= 15,719 cf, Atten= 77%, Lag= 24.2 min  
 Discarded = 0.17 cfs @ 12.49 hrs, Volume= 11,122 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  
 Peak Elev= 172.07' @ 12.49 hrs Surf.Area= 6,176 sf Storage= 6,019 cf

Plug-Flow detention time= 179.9 min calculated for 15,701 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	<b>16.00'W x 386.00'L x 2.50'H Field A</b> 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	<b>CMP Round 24 x 95 Inside #1</b> 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 37

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'	<b>15.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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=171.34' (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

Peak Elev= 180.62' @ 12.09 hrs

Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	<b>24.0" Round Culvert</b> 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**

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= 3,082 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 0.97 cfs @ 12.09 hrs, Volume= 3,082 cf

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

Peak Elev= 172.07' @ 12.53 hrs

Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	<b>24.0" Round Culvert</b> 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=0.00 cfs @ 12.09 hrs HW=171.53' TW=171.58' (Dynamic Tailwater)↑**1=Culvert** (Controls 0.00 cfs)**Summary for Pond wqu7: dmh**

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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.78"

Printed 4/9/2021

Page 38

Peak Elev= 172.07' @ 12.53 hrs

Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	<b>12.0" Round Culvert</b> L= 8.0' Ke= 0.500 Inlet / Outlet Invert= 170.75' / 170.70' S= 0.0063 ' 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=171.51' TW=171.59' (Dynamic Tailwater)↑ **1=Culvert** ( Controls 0.00 cfs)**Summary for Link SP1: STUDY POINT #1**

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth = 0.73" for 10-year event  
 Inflow = 1.83 cfs @ 12.57 hrs, Volume= 13,325 cf  
 Primary = 1.83 cfs @ 12.57 hrs, Volume= 13,325 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 39

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentB-1A: Subcat B-1A</b>	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
<b>SubcatchmentB-1B: Subcat B-1B</b>	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
<b>SubcatchmentB-2A: Subcat B-2A</b>	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
<b>SubcatchmentB-2B: Subcat B-2B</b>	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
<b>SubcatchmentP-1: Subcat P-1</b>	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
<b>SubcatchmentP-2B: Subcat P-2B</b>	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
<b>SubcatchmentP-3A: Subcat P-3A</b>	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
<b>SubcatchmentP-3B: Subcat P-3B</b>	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
<b>SubcatchmentP-3C: Subcat P-3C</b>	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
<b>SubcatchmentP-3D: Subcat P-3D</b>	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
<b>SubcatchmentP-3E: Subcat P-3E</b>	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
<b>SubcatchmentP-3F: Subcat P-3F</b>	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
<b>SubcatchmentP-4: Subcat P-4</b>	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
<b>SubcatchmentP-5A: Subcat P-5A</b>	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
<b>SubcatchmentP-5B: flow to wqu3</b>	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
<b>SubcatchmentP-5C: flow to wqu4</b>	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
<b>SubcatchmentP-5D: Subcat P-5D</b>	Runoff Area=5,493 sf 31.16% Impervious Runoff Depth=1.68" Tc=6.0 min CN=57 Runoff=0.23 cfs 770 cf
<b>SubcatchmentP-5E: flow to wqu5</b>	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
<b>SubcatchmentP-5F: flow to wqu6</b>	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
<b>SubcatchmentP-5G: Subcat P-5G</b>	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
<b>SubcatchmentP-5H: Subcat P-5H</b>	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



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 40

**SubcatchmentP-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**SubcatchmentP-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**SubcatchmentP-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=2.51 cfs 13,869 cf  
Outflow=2.51 cfs 13,869 cf**Pond cb1: cb**Peak Elev=184.78' 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 CP1: Collection Pond**Peak Elev=174.71' Storage=2,521 cf Inflow=2.50 cfs 7,843 cf  
Discarded=0.04 cfs 3,623 cf Primary=1.21 cfs 3,663 cf Outflow=1.25 cfs 7,286 cf**Pond CP2: Collection Pond**Peak Elev=171.59' Storage=1,749 cf Inflow=2.29 cfs 8,019 cf  
Primary=0.56 cfs 7,320 cf Secondary=0.59 cfs 696 cf Outflow=1.15 cfs 8,017 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=184.21' 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=183.62' 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=182.77' 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 ED1: Existing Depression**Peak Elev=168.76' Storage=906 cf Inflow=4.54 cfs 22,537 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 ' Outflow=3.86 cfs 22,533 cf**Pond G: gabion**Peak Elev=171.67' Storage=11 cf Inflow=2.03 cfs 8,668 cf  
Outflow=2.03 cfs 8,668 cf**Pond IS1: Infiltration #1**Peak Elev=181.41' Storage=11,997 cf Inflow=5.52 cfs 18,301 cf  
Discarded=0.12 cfs 11,960 cf Primary=0.00 cfs 0 cf Outflow=0.12 cfs 11,960 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 12,650 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 4,129 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=3.98 cfs 23,777 cf  
Primary=3.98 cfs 23,777 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**

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 41

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 42

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

**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		<b>Sheet Flow, A TO B</b> Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		<b>Shallow Concentrated Flow, B TO C</b> Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		<b>Shallow Concentrated Flow, C TO D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b> Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b> Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 43

**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"

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 44

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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 45

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

**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					<b>Direct Entry,</b>

**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



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 46

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

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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"

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 48

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		<b>Sheet Flow, A-B</b> Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		<b>Shallow Concentrated Flow, B-C</b> Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		<b>Sheet Flow, C-D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

**Summary for Reach 1R: Reach**Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 1.97" for 25-year event  
Inflow = 2.51 cfs @ 12.33 hrs, Volume= 13,869 cf  
Outflow = 2.51 cfs @ 12.33 hrs, Volume= 13,869 cf, Atten= 0%, Lag= 0.0 min

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

**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

Peak Elev= 184.78' @ 12.11 hrs

Flood Elev= 187.67'

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 49

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	<b>12.0" Round Culvert</b> 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=0.49 cfs @ 12.10 hrs HW=184.78' TW=184.20' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 0.49 cfs @ 2.69 fps)**Summary for Pond CP1: Collection Pond**

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

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 =	1.25 cfs @ 12.27 hrs, Volume= 7,286 cf, Atten= 50%, Lag= 10.7 min
Discarded =	0.04 cfs @ 12.27 hrs, Volume= 3,623 cf
Primary =	1.21 cfs @ 12.27 hrs, Volume= 3,663 cf

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

Peak Elev= 174.71' @ 12.27 hrs Surf.Area= 1,705 sf Storage= 2,521 cf

Flood Elev= 176.00' Surf.Area= 1,788 sf Storage= 3,033 cf

Plug-Flow detention time= 287.8 min calculated for 7,286 cf (93% of inflow)

Center-of-Mass det. time= 251.0 min ( 1,086.8 - 835.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	173.00'	3,033 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	1,260	166.0	0	0	1,260
175.00	1,788	185.0	3,033	3,033	1,896

Device	Routing	Invert	Outlet Devices
#1	Primary	172.35'	<b>15.0" Round Culvert</b> L= 185.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.35' / 170.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	174.50'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	173.00'	<b>1.020 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 12.27 hrs HW=174.71' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.04 cfs)**Primary OutFlow** Max=1.20 cfs @ 12.27 hrs HW=174.71' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Passes 1.20 cfs of 6.14 cfs potential flow)↑**2=Orifice/Grate** (Weir Controls 1.20 cfs @ 1.49 fps)**Summary for Pond CP2: 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 =	1.15 cfs @ 12.36 hrs, Volume= 8,017 cf, Atten= 50%, Lag= 13.7 min
Primary =	0.56 cfs @ 12.36 hrs, Volume= 7,320 cf
Secondary =	0.59 cfs @ 12.36 hrs, Volume= 696 cf

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

Peak Elev= 171.59' @ 12.36 hrs Surf.Area= 5,810 sf Storage= 1,749 cf

Flood Elev= 172.00' Surf.Area= 9,427 sf Storage= 4,118 cf

Plug-Flow detention time= 24.1 min calculated for 8,017 cf (100% of inflow)

Center-of-Mass det. time= 23.8 min ( 853.3 - 829.5 )

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 50

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,714 cf	<b>Surface Storage (Irregular)</b> Listed below (Recalc)
#2	170.66'	232 cf	<b>Soil Filter (Irregular)</b> Listed below (Recalc)
			579 cf Overall x 40.0% Voids
#3	170.16'	173 cf	<b>Underdrain (Irregular)</b> Listed below (Recalc)
			432 cf Overall x 40.0% Voids
		4,118 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	864	258.0	0	0	864
172.00	7,699	640.0	3,714	3,714	28,166

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.66	864	258.0	0	0	864
171.33	864	258.0	579	579	1,037

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.16	864	258.0	0	0	864
170.66	864	258.0	432	432	993

Device	Routing	Invert	Outlet Devices
#1	Secondary	171.50'	<b>8.0' long x 1.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	170.16'	<b>6.0" Round Culvert L= 187.0' Ke= 0.500</b> Inlet / Outlet Invert= 170.16' / 169.80' S= 0.0019 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.56 cfs @ 12.36 hrs HW=171.59' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** (Barrel Controls 0.56 cfs @ 2.85 fps)**Secondary OutFlow** Max=0.59 cfs @ 12.36 hrs HW=171.59' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir**(Weir Controls 0.59 cfs @ 0.81 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

Peak Elev= 172.37' @ 12.43 hrs

Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	<b>12.0" Round Culvert L= 71.0' Ke= 0.500</b> 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=171.86' TW=171.86' (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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 51

Peak Elev= 184.21' @ 12.11 hrs

Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	<b>12.0" Round Culvert</b> 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=0.96 cfs @ 12.10 hrs HW=184.20' TW=183.61' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 0.96 cfs @ 3.15 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

Peak Elev= 183.62' @ 12.10 hrs

Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	<b>12.0" Round Culvert</b> 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=1.56 cfs @ 12.10 hrs HW=183.61' TW=182.75' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 1.56 cfs @ 3.85 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

Peak Elev= 182.77' @ 12.11 hrs

Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	<b>15.0" Round Culvert</b> 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=2.18 cfs @ 12.09 hrs HW=182.75' TW=182.08' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 2.18 cfs @ 3.74 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

Peak Elev= 182.09' @ 12.09 hrs

Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	<b>15.0" Round Culvert</b> 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 ED1: Existing Depression

Inflow Area = 207,744 sf, 50.97% Impervious, Inflow Depth = 1.30" for 25-year event  
 Inflow = 4.54 cfs @ 12.34 hrs, Volume= 22,537 cf  
 Outflow = 3.86 cfs @ 12.51 hrs, Volume= 22,533 cf, Atten= 15%, Lag= 10.1 min  
 Primary = 3.86 cfs @ 12.51 hrs, Volume= 22,533 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 168.76' @ 12.51 hrs Surf.Area= 2,507 sf Storage= 906 cf  
 Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf

Plug-Flow detention time= 1.9 min calculated for 22,533 cf (100% of inflow)  
 Center-of-Mass det. time= 1.5 min ( 833.6 - 832.2 )

Volume	Invert	Avail.Storage	Storage Description		
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=3.86 cfs @ 12.51 hrs HW=168.75' TW=0.00' (Dynamic Tailwater)

↑**1=Culvert** (Barrel Controls 3.86 cfs @ 4.91 fps)

### Summary for Pond G: gabion

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 0.84" for 25-year event  
 Inflow = 2.03 cfs @ 12.36 hrs, Volume= 8,668 cf  
 Outflow = 2.03 cfs @ 12.36 hrs, Volume= 8,668 cf, Atten= 0%, Lag= 0.2 min  
 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  
 Peak Elev= 171.67' @ 12.36 hrs Surf.Area= 35 sf Storage= 11 cf  
 Flood Elev= 230.25' Surf.Area= 0 sf Storage= 37 cf

Plug-Flow detention time= 0.0 min calculated for 8,658 cf (100% of inflow)  
 Center-of-Mass det. time= 0.0 min ( 797.2 - 797.1 )

Volume	Invert	Avail.Storage	Storage Description
#1	171.25'	37 cf	<b>15.0" Round Pipe Storage</b> L= 30.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.88'	<b>3.0" Vert. 3" outlet holes X 30.00</b> C= 0.600
#2	Primary	171.25'	<b>2.0" Horiz. 2" outlet holes X 30.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=2.03 cfs @ 12.36 hrs HW=171.67' TW=168.65' (Dynamic Tailwater)

↑**1=3" outlet holes** ( Controls 0.00 cfs)

↑**2=2" outlet holes** (Orifice Controls 2.03 cfs @ 3.11 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 = 3.30" for 25-year event  
 Inflow = 5.52 cfs @ 12.09 hrs, Volume= 18,301 cf  
 Outflow = 0.12 cfs @ 17.96 hrs, Volume= 11,960 cf, Atten= 98%, Lag= 352.5 min  
 Discarded = 0.12 cfs @ 17.96 hrs, Volume= 11,960 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  
 Peak Elev= 181.41' @ 17.96 hrs Surf.Area= 4,094 sf Storage= 11,997 cf

Plug-Flow detention time= 601.0 min calculated for 11,960 cf (65% of inflow)  
 Center-of-Mass det. time= 493.7 min ( 1,299.5 - 805.7 )

Volume	Invert	Avail.Storage	Storage Description
#1A	177.50'	4,569 cf	<b>44.50'W x 92.00'L x 5.50'H Field A</b> 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	<b>CMP Round 60 x 24 Inside #1</b> 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'	<b>12.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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

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  
 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 20,918 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	<b>16.00'W x 386.00'L x 2.50'H Field A</b> 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	<b>CMP Round 24 x 95 Inside #1</b> 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 54

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'	<b>15.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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=171.67' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 2.03 cfs @ 2.42 fps)**Summary for Pond wqu1: dmh**

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= 12,650 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 3.95 cfs @ 12.09 hrs, Volume= 12,650 cf

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

Peak Elev= 181.41' @ 18.00 hrs

Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	<b>24.0" Round Culvert</b> 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**

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= 4,129 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 1.28 cfs @ 12.09 hrs, Volume= 4,129 cf

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

Peak Elev= 172.36' @ 12.40 hrs

Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	<b>24.0" Round Culvert</b> 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=0.00 cfs @ 12.09 hrs HW=171.82' TW=171.94' (Dynamic Tailwater)↑**1=Culvert** (Controls 0.00 cfs)**Summary for Pond wqu7: dmh**

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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.01"

Printed 4/9/2021

Page 55

Peak Elev= 172.37' @ 12.39 hrs

Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	<b>12.0" Round Culvert</b> 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=0.00 cfs @ 12.09 hrs HW=171.85' TW=171.95' (Dynamic Tailwater)↑ **1=Culvert** ( Controls 0.00 cfs)**Summary for Link SP1: STUDY POINT #1**

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth = 1.30" for 25-year event  
Inflow = 3.98 cfs @ 12.48 hrs, Volume= 23,777 cf  
Primary = 3.98 cfs @ 12.48 hrs, Volume= 23,777 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 56

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

<b>SubcatchmentB-1A: Subcat B-1A</b>	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
<b>SubcatchmentB-1B: Subcat B-1B</b>	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
<b>SubcatchmentB-2A: Subcat B-2A</b>	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
<b>SubcatchmentB-2B: Subcat B-2B</b>	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
<b>SubcatchmentP-1: Subcat P-1</b>	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
<b>SubcatchmentP-2B: Subcat P-2B</b>	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
<b>SubcatchmentP-3A: Subcat P-3A</b>	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
<b>SubcatchmentP-3B: Subcat P-3B</b>	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
<b>SubcatchmentP-3C: Subcat P-3C</b>	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
<b>SubcatchmentP-3D: Subcat P-3D</b>	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
<b>SubcatchmentP-3E: Subcat P-3E</b>	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
<b>SubcatchmentP-3F: Subcat P-3F</b>	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
<b>SubcatchmentP-4: Subcat P-4</b>	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
<b>SubcatchmentP-5A: Subcat P-5A</b>	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
<b>SubcatchmentP-5B: flow to wqu3</b>	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
<b>SubcatchmentP-5C: flow to wqu4</b>	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
<b>SubcatchmentP-5D: Subcat P-5D</b>	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
<b>SubcatchmentP-5E: flow to wqu5</b>	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
<b>SubcatchmentP-5F: flow to wqu6</b>	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
<b>SubcatchmentP-5G: Subcat P-5G</b>	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
<b>SubcatchmentP-5H: Subcat P-5H</b>	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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 57

**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=6.46 cfs 27,572 cf  
Outflow=6.46 cfs 27,572 cf**Pond cb1: cb**Peak Elev=185.03' 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 CP1: Collection Pond**Peak Elev=174.95' Storage=2,949 cf Inflow=4.35 cfs 13,607 cf  
Discarded=0.04 cfs 3,809 cf Primary=3.92 cfs 9,197 cf Outflow=3.96 cfs 13,006 cf**Pond CP2: Collection Pond**Peak Elev=171.72' Storage=2,339 cf Inflow=3.83 cfs 13,457 cf  
Primary=0.59 cfs 10,307 cf Secondary=2.22 cfs 3,148 cf Outflow=2.81 cfs 13,455 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=184.60' 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=184.12' 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=183.28' 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 ED1: Existing Depression**Peak Elev=169.78' Storage=8,027 cf Inflow=11.02 cfs 52,792 cf  
12.0" Round Culvert n=0.012 L=50.0' S=0.0100 ' Outflow=5.41 cfs 52,788 cf**Pond G: gabion**Peak Elev=172.07' Storage=26 cf Inflow=4.68 cfs 25,219 cf  
Outflow=4.71 cfs 25,219 cf**Pond IS1: Infiltration #1**Peak Elev=182.97' Storage=15,612 cf Inflow=9.17 cfs 30,115 cf  
Discarded=0.13 cfs 13,133 cf Primary=0.94 cfs 7,614 cf Outflow=1.07 cfs 20,747 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 21,998 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=173.22' 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=5.63 cfs 55,464 cf  
Primary=5.63 cfs 55,464 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**



**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 58

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 59

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

**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		<b>Sheet Flow, A TO B</b> Woods: Light underbrush n= 0.400 P2= 3.10"
1.5	144	0.1000	1.58		<b>Shallow Concentrated Flow, B TO C</b> Woodland Kv= 5.0 fps
0.7	230	0.0700	5.37		<b>Shallow Concentrated Flow, C TO D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Dense n= 0.240 P2= 3.10"
0.5	57	0.0700	1.85		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
0.9	96	0.1400	1.87		<b>Shallow Concentrated Flow, C TO D</b> Woodland Kv= 5.0 fps
0.7	144	0.0500	3.35		<b>Shallow Concentrated Flow, D TO E</b> Grassed Waterway Kv= 15.0 fps
9.2	347	Total			

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 60

**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"

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 61

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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 62

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

**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					<b>Direct Entry,</b>

**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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 63

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

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>

**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					<b>Direct Entry,</b>



**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"

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 65

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		<b>Sheet Flow, A-B</b> Grass: Short n= 0.150 P2= 3.10"
2.5	82	0.0060	0.54		<b>Shallow Concentrated Flow, B-C</b> Short Grass Pasture Kv= 7.0 fps
0.6	46	0.0230	1.23		<b>Sheet Flow, C-D</b> 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		<b>Sheet Flow, A TO B</b> Grass: Short n= 0.150 P2= 3.10"
24.7	802	0.0060	0.54		<b>Shallow Concentrated Flow, B TO C</b> Short Grass Pasture Kv= 7.0 fps
30.4	852	Total			

**Summary for Reach 1R: Reach**Inflow Area = 84,510 sf, 27.71% Impervious, Inflow Depth = 3.92" for 100-year event  
Inflow = 6.46 cfs @ 12.18 hrs, Volume= 27,572 cf  
Outflow = 6.46 cfs @ 12.18 hrs, Volume= 27,572 cf, Atten= 0%, Lag= 0.0 min

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

**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

Peak Elev= 185.03' @ 12.12 hrs

Flood Elev= 187.67'

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 66

Device	Routing	Invert	Outlet Devices
#1	Primary	184.40'	<b>12.0" Round Culvert</b> 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=1.00 cfs @ 12.09 hrs HW=185.02' TW=184.56' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 1.00 cfs @ 2.82 fps)**Summary for Pond CP1: Collection Pond**

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

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 = 3.96 cfs @ 12.13 hrs, Volume= 13,006 cf, Atten= 9%, Lag= 2.4 min  
 Discarded = 0.04 cfs @ 12.13 hrs, Volume= 3,809 cf  
 Primary = 3.92 cfs @ 12.13 hrs, Volume= 9,197 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 174.95' @ 12.13 hrs Surf.Area= 1,775 sf Storage= 2,949 cf  
 Flood Elev= 176.00' Surf.Area= 1,788 sf Storage= 3,033 cf

Plug-Flow detention time= 169.5 min calculated for 12,991 cf (95% of inflow)  
 Center-of-Mass det. time= 145.7 min ( 965.6 - 819.9 )

Volume	Invert	Avail.Storage	Storage Description		
#1	173.00'	3,033 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
173.00	1,260	166.0	0	0	1,260
175.00	1,788	185.0	3,033	3,033	1,896

Device	Routing	Invert	Outlet Devices
#1	Primary	172.35'	<b>15.0" Round Culvert</b> L= 185.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 172.35' / 170.50' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf
#2	Device 1	174.50'	<b>15.0" Horiz. Orifice/Grate</b> C= 0.600 Limited to weir flow at low heads
#3	Discarded	173.00'	<b>1.020 in/hr Exfiltration over Wetted area</b> Phase-In= 0.01'

**Discarded OutFlow** Max=0.04 cfs @ 12.13 hrs HW=174.95' (Free Discharge)↑**3=Exfiltration** (Exfiltration Controls 0.04 cfs)**Primary OutFlow** Max=3.85 cfs @ 12.13 hrs HW=174.95' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Passes 3.85 cfs of 6.55 cfs potential flow)↑**2=Orifice/Grate** (Weir Controls 3.85 cfs @ 2.19 fps)**Summary for Pond CP2: 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 = 2.81 cfs @ 12.24 hrs, Volume= 13,455 cf, Atten= 27%, Lag= 6.3 min  
 Primary = 0.59 cfs @ 12.24 hrs, Volume= 10,307 cf  
 Secondary = 2.22 cfs @ 12.24 hrs, Volume= 3,148 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 171.72' @ 12.24 hrs Surf.Area= 6,826 sf Storage= 2,339 cf  
 Flood Elev= 172.00' Surf.Area= 9,427 sf Storage= 4,118 cf

Plug-Flow detention time= 20.5 min calculated for 13,440 cf (100% of inflow)  
 Center-of-Mass det. time= 20.6 min ( 835.3 - 814.7 )

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 67

Volume	Invert	Avail.Storage	Storage Description
#1	171.00'	3,714 cf	<b>Surface Storage (Irregular)</b> Listed below (Recalc)
#2	170.66'	232 cf	<b>Soil Filter (Irregular)</b> Listed below (Recalc)
			579 cf Overall x 40.0% Voids
#3	170.16'	173 cf	<b>Underdrain (Irregular)</b> Listed below (Recalc)
			432 cf Overall x 40.0% Voids
4,118 cf			Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
171.00	864	258.0	0	0	864
172.00	7,699	640.0	3,714	3,714	28,166

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.66	864	258.0	0	0	864
171.33	864	258.0	579	579	1,037

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
170.16	864	258.0	0	0	864
170.66	864	258.0	432	432	993

Device	Routing	Invert	Outlet Devices
#1	Secondary	171.50'	<b>8.0' long x 1.0' breadth Broad-Crested Rectangular Weir</b> Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32
#2	Primary	170.16'	<b>6.0" Round Culvert L= 187.0' Ke= 0.500</b> Inlet / Outlet Invert= 170.16' / 169.80' S= 0.0019 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.20 sf

**Primary OutFlow** Max=0.59 cfs @ 12.24 hrs HW=171.72' TW=0.00' (Dynamic Tailwater)↑**2=Culvert** (Barrel Controls 0.59 cfs @ 2.99 fps)**Secondary OutFlow** Max=2.21 cfs @ 12.24 hrs HW=171.72' TW=0.00' (Dynamic Tailwater)↑**1=Broad-Crested Rectangular Weir**(Weir Controls 2.21 cfs @ 1.26 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

Peak Elev= 173.23' @ 12.30 hrs

Flood Elev= 174.77'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.30'	<b>12.0" Round Culvert L= 71.0' Ke= 0.500</b> 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=172.45' TW=172.59' (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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 68

Peak Elev= 184.60' @ 12.12 hrs

Flood Elev= 188.02'

Device	Routing	Invert	Outlet Devices
#1	Primary	183.65'	<b>12.0" Round Culvert</b> 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=1.77 cfs @ 12.09 hrs HW=184.56' TW=184.10' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 1.77 cfs @ 3.10 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

Peak Elev= 184.12' @ 12.09 hrs

Flood Elev= 187.95'

Device	Routing	Invert	Outlet Devices
#1	Primary	182.93'	<b>12.0" Round Culvert</b> 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=3.01 cfs @ 12.09 hrs HW=184.10' TW=183.22' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 3.01 cfs @ 4.13 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

Peak Elev= 183.28' @ 12.11 hrs

Flood Elev= 187.91'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.95'	<b>15.0" Round Culvert</b> 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=3.87 cfs @ 12.09 hrs HW=183.22' TW=182.61' (Dynamic Tailwater)↑**1=Culvert** (Outlet Controls 3.87 cfs @ 3.84 fps)**Summary for Pond dmh4: dmh**

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

Peak Elev= 182.98' @ 12.87 hrs

Flood Elev= 188.01'

Device	Routing	Invert	Outlet Devices
#1	Primary	181.19'	<b>15.0" Round Culvert</b> 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 69

**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 ED1: Existing Depression**

Inflow Area = 207,744 sf, 50.97% Impervious, Inflow Depth = 3.05" for 100-year event  
 Inflow = 11.02 cfs @ 12.19 hrs, Volume= 52,792 cf  
 Outflow = 5.41 cfs @ 12.63 hrs, Volume= 52,788 cf, Atten= 51%, Lag= 26.4 min  
 Primary = 5.41 cfs @ 12.63 hrs, Volume= 52,788 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 169.78' @ 12.63 hrs Surf.Area= 13,386 sf Storage= 8,027 cf  
 Flood Elev= 172.00' Surf.Area= 17,127 sf Storage= 11,386 cf

Plug-Flow detention time= 10.2 min calculated for 52,788 cf (100% of inflow)  
 Center-of-Mass det. time= 9.9 min ( 841.6 - 831.7 )

Volume	Invert	Avail.Storage	Storage Description		
#1	167.00'	11,386 cf	<b>Custom Stage Data (Irregular)</b> Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
167.00	13	14.0	0	0	13
168.00	162	199.4	74	74	3,163
169.00	3,862	827.5	1,605	1,679	54,493
170.00	17,127	1,025.9	9,707	11,386	83,769

Device	Routing	Invert	Outlet Devices
#1	Primary	167.19'	<b>12.0" Round Culvert</b> L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 167.19' / 166.69' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf

**Primary OutFlow** Max=5.41 cfs @ 12.63 hrs HW=169.78' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Barrel Controls 5.41 cfs @ 6.89 fps)**Summary for Pond G: gabion**

Inflow Area = 123,234 sf, 66.93% Impervious, Inflow Depth = 2.46" for 100-year event  
 Inflow = 4.68 cfs @ 12.23 hrs, Volume= 25,219 cf  
 Outflow = 4.71 cfs @ 12.21 hrs, Volume= 25,219 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 4.71 cfs @ 12.21 hrs, Volume= 25,219 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.04 hrs  
 Peak Elev= 172.07' @ 12.21 hrs Surf.Area= 36 sf Storage= 26 cf  
 Flood Elev= 230.25' Surf.Area= 0 sf Storage= 37 cf

Plug-Flow detention time= 0.1 min calculated for 25,191 cf (100% of inflow)  
 Center-of-Mass det. time= 0.1 min ( 823.9 - 823.8 )

Volume	Invert	Avail.Storage	Storage Description
#1	171.25'	37 cf	<b>15.0" Round Pipe Storage</b> L= 30.0'

Device	Routing	Invert	Outlet Devices
#1	Primary	171.88'	<b>3.0" Vert. 3" outlet holes X 30.00</b> C= 0.600
#2	Primary	171.25'	<b>2.0" Horiz. 2" outlet holes X 30.00</b> C= 0.600 Limited to weir flow at low heads

**Primary OutFlow** Max=4.67 cfs @ 12.21 hrs HW=172.07' TW=169.32' (Dynamic Tailwater)↑**1=3" outlet holes** (Orifice Controls 1.81 cfs @ 1.49 fps)↑**2=2" outlet holes** (Orifice Controls 2.86 cfs @ 4.37 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 = 5.43" for 100-year event  
 Inflow = 9.17 cfs @ 12.09 hrs, Volume= 30,115 cf  
 Outflow = 1.07 cfs @ 12.80 hrs, Volume= 20,747 cf, Atten= 88%, Lag= 43.0 min  
 Discarded = 0.13 cfs @ 12.80 hrs, Volume= 13,133 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  
 Peak Elev= 182.97' @ 12.80 hrs Surf.Area= 4,094 sf Storage= 15,612 cf

Plug-Flow detention time= 425.9 min calculated for 20,747 cf (69% of inflow)  
 Center-of-Mass det. time= 326.4 min ( 1,123.9 - 797.5 )

Volume	Invert	Avail.Storage	Storage Description
#1A	177.50'	4,569 cf	<b>44.50'W x 92.00'L x 5.50'H Field A</b> 22,517 cf Overall - 11,094 cf Embedded = 11,423 cf x 40.0% Voids
#2A	177.50'	11,094 cf	<b>CMP Round 60 x 24 Inside #1</b> 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'	<b>12.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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=172.46' (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

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  
 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	<b>16.00'W x 386.00'L x 2.50'H Field A</b> 15,440 cf Overall - 6,057 cf Embedded = 9,383 cf x 40.0% Voids
#2A	170.70'	6,057 cf	<b>CMP Round 24 x 95 Inside #1</b> 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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 71

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'	<b>15.0" Round Culvert</b> 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'	<b>1.020 in/hr Exfiltration over Wetted area</b> 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=172.07' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 4.67 cfs @ 3.80 fps)**Summary for Pond wqu1: dmh**

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= 21,998 cf, Atten= 0%, Lag= 0.0 min  
 Primary = 6.93 cfs @ 12.09 hrs, Volume= 21,998 cf

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

Peak Elev= 182.97' @ 12.84 hrs

Flood Elev= 187.83'

Device	Routing	Invert	Outlet Devices
#1	Primary	179.89'	<b>24.0" Round Culvert</b> 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=6.79 cfs @ 12.09 hrs HW=181.18' TW=180.33' (Dynamic Tailwater)↑**1=Culvert** (Barrel Controls 6.79 cfs @ 4.52 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

Peak Elev= 173.18' @ 12.27 hrs

Flood Elev= 174.93'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.84'	<b>24.0" Round Culvert</b> 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=0.00 cfs @ 12.09 hrs HW=172.44' TW=172.65' (Dynamic Tailwater)↑**1=Culvert** (Controls 0.00 cfs)**Summary for Pond wqu7: dmh**

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

**2513-01A - Proposed HydroCAD\_rev1**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.53"

Printed 4/9/2021

Page 72

Peak Elev= 173.22' @ 12.26 hrs

Flood Elev= 175.62'

Device	Routing	Invert	Outlet Devices
#1	Primary	170.75'	<b>12.0" Round Culvert</b> 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=0.00 cfs @ 12.09 hrs HW=172.58' TW=172.67' (Dynamic Tailwater)↑ **1=Culvert** ( Controls 0.00 cfs)**Summary for Link SP1: STUDY POINT #1**

Inflow Area = 219,763 sf, 48.40% Impervious, Inflow Depth = 3.03" for 100-year event  
 Inflow = 5.63 cfs @ 12.47 hrs, Volume= 55,464 cf  
 Primary = 5.63 cfs @ 12.47 hrs, Volume= 55,464 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.*

<b>Smoothing</b>	Yes
<b>State</b>	Massachusetts
<b>Location</b>	
<b>Longitude</b>	71.370 degrees West
<b>Latitude</b>	42.249 degrees North
<b>Elevation</b>	0 feet
<b>Date/Time</b>	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	
<b>1yr</b>	0.29	0.44	0.54	0.71	0.89	1.12	<b>1yr</b>	0.77	1.06	1.30	1.65	2.09	2.66	2.89	<b>1yr</b>	2.36	2.78	3.25	3.90	4.57	<b>1yr</b>
<b>2yr</b>	0.35	0.54	0.67	0.89	1.12	1.41	<b>2yr</b>	0.97	1.29	1.63	2.04	2.55	3.19	3.51	<b>2yr</b>	2.83	3.37	3.88	4.62	5.24	<b>2yr</b>
<b>5yr</b>	0.42	0.65	0.82	1.10	1.40	1.78	<b>5yr</b>	1.21	1.62	2.07	2.59	3.23	4.02	4.47	<b>5yr</b>	3.55	4.30	4.93	5.85	6.53	<b>5yr</b>
<b>10yr</b>	0.48	0.75	0.94	1.28	1.67	2.14	<b>10yr</b>	1.44	1.91	2.48	3.11	3.86	4.78	5.38	<b>10yr</b>	4.23	5.17	5.92	7.00	7.72	<b>10yr</b>
<b>25yr</b>	0.57	0.90	1.15	1.58	2.10	2.70	<b>25yr</b>	1.81	2.39	3.15	3.95	4.89	6.01	6.87	<b>25yr</b>	5.32	6.60	7.55	8.87	9.64	<b>25yr</b>
<b>50yr</b>	0.64	1.03	1.32	1.86	2.50	3.25	<b>50yr</b>	2.16	2.83	3.80	4.76	5.87	7.16	8.27	<b>50yr</b>	6.34	7.95	9.07	10.61	11.41	<b>50yr</b>
<b>100yr</b>	0.74	1.19	1.54	2.18	2.98	3.90	<b>100yr</b>	2.57	3.36	4.57	5.71	7.02	8.53	9.96	<b>100yr</b>	7.55	9.58	10.91	12.70	13.51	<b>100yr</b>
<b>200yr</b>	0.86	1.39	1.81	2.58	3.56	4.67	<b>200yr</b>	3.07	3.98	5.48	6.84	8.40	10.17	12.00	<b>200yr</b>	9.00	11.54	13.12	15.21	16.00	<b>200yr</b>
<b>500yr</b>	1.03	1.69	2.21	3.21	4.50	5.95	<b>500yr</b>	3.89	4.99	6.99	8.72	10.66	12.85	15.37	<b>500yr</b>	11.37	14.78	16.75	19.32	20.02	<b>500yr</b>

## Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.23	0.35	0.43	0.58	0.71	0.91	<b>1yr</b>	0.61	0.89	1.03	1.41	1.83	2.28	2.48	<b>1yr</b>	2.02	2.38	2.96	3.33	3.97	<b>1yr</b>
<b>2yr</b>	0.34	0.52	0.65	0.87	1.08	1.27	<b>2yr</b>	0.93	1.24	1.45	1.92	2.46	3.06	3.35	<b>2yr</b>	2.71	3.22	3.69	4.49	5.09	<b>2yr</b>
<b>5yr</b>	0.38	0.59	0.73	1.00	1.27	1.52	<b>5yr</b>	1.10	1.48	1.73	2.26	2.89	3.59	4.00	<b>5yr</b>	3.18	3.84	4.44	5.45	6.06	<b>5yr</b>
<b>10yr</b>	0.42	0.65	0.80	1.12	1.45	1.73	<b>10yr</b>	1.25	1.69	1.94	2.55	3.24	4.05	4.56	<b>10yr</b>	3.58	4.38	5.08	6.18	6.92	<b>10yr</b>

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>25yr</b>	0.48	0.73	0.91	1.30	1.71	2.04	<b>25yr</b>	1.48	2.00	2.30	3.02	3.80	4.76	5.44	<b>25yr</b>	4.21	5.23	6.10	7.41	8.24	<b>25yr</b>
<b>50yr</b>	0.53	0.80	1.00	1.44	1.94	2.32	<b>50yr</b>	1.67	2.26	2.60	3.41	4.27	5.37	6.22	<b>50yr</b>	4.76	5.99	7.00	8.46	9.40	<b>50yr</b>
<b>100yr</b>	0.58	0.88	1.10	1.59	2.18	2.63	<b>100yr</b>	1.88	2.57	2.94	3.78	4.82	6.10	7.15	<b>100yr</b>	5.40	6.87	8.04	9.68	10.73	<b>100yr</b>
<b>200yr</b>	0.63	0.95	1.21	1.75	2.44	2.99	<b>200yr</b>	2.10	2.92	3.33	4.27	5.43	6.92	8.20	<b>200yr</b>	6.13	7.88	9.26	11.09	12.24	<b>200yr</b>
<b>500yr</b>	0.71	1.06	1.36	1.98	2.81	3.54	<b>500yr</b>	2.43	3.46	3.92	5.01	6.38	8.22	9.91	<b>500yr</b>	7.27	9.53	11.16	13.28	14.62	<b>500yr</b>

## Upper Confidence Limits

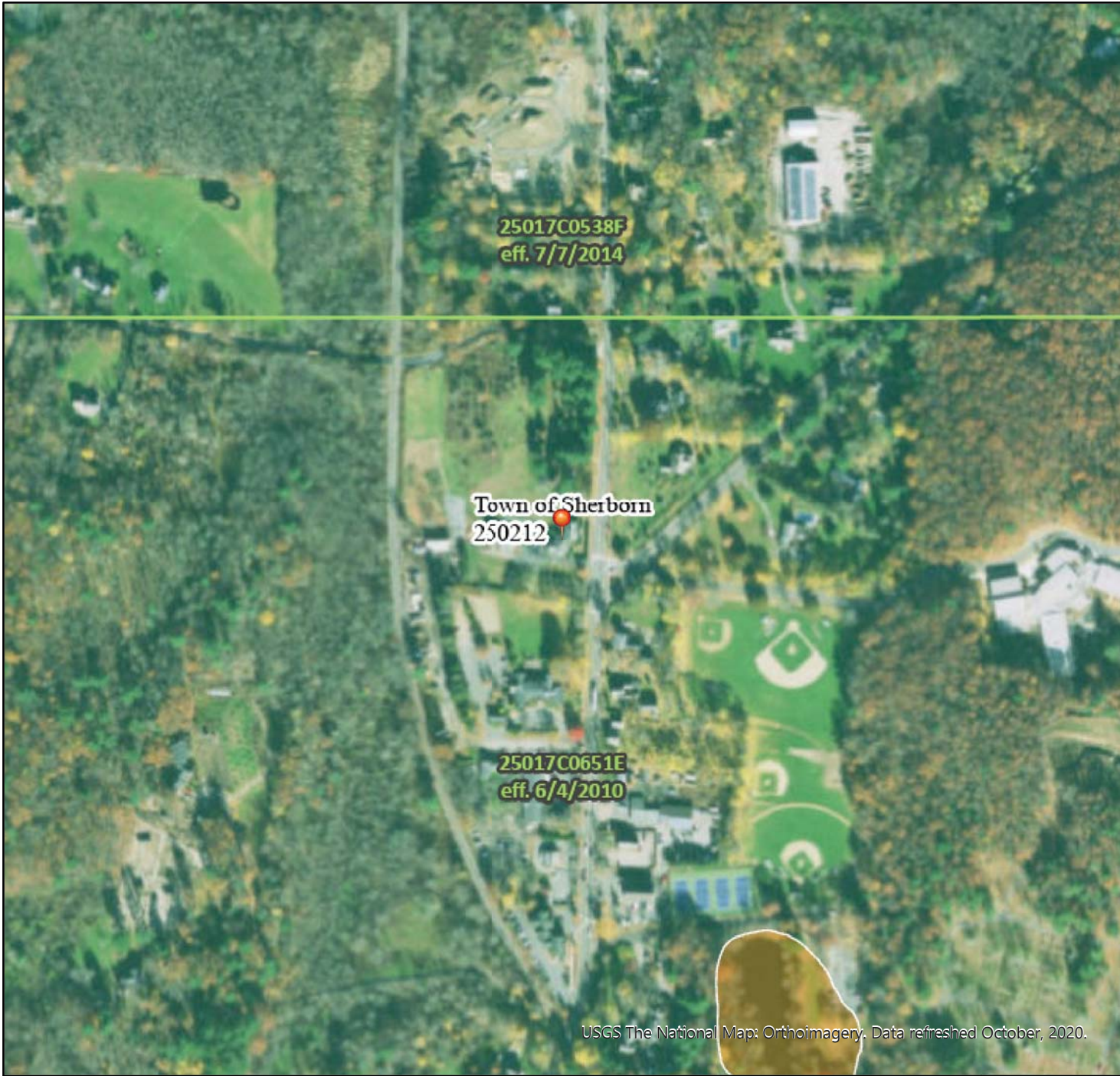
	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
<b>1yr</b>	0.32	0.49	0.60	0.81	1.00	1.19	<b>1yr</b>	0.86	1.17	1.36	1.79	2.31	3.01	3.22	<b>1yr</b>	2.66	3.10	3.51	4.22	5.20	<b>1yr</b>
<b>2yr</b>	0.37	0.57	0.70	0.95	1.17	1.37	<b>2yr</b>	1.01	1.34	1.58	2.06	2.65	3.37	3.72	<b>2yr</b>	2.99	3.58	4.08	4.82	5.43	<b>2yr</b>
<b>5yr</b>	0.46	0.71	0.89	1.22	1.55	1.81	<b>5yr</b>	1.33	1.77	2.06	2.66	3.36	4.49	4.96	<b>5yr</b>	3.97	4.77	5.42	6.29	7.02	<b>5yr</b>
<b>10yr</b>	0.56	0.86	1.06	1.49	1.92	2.24	<b>10yr</b>	1.66	2.19	2.56	3.22	4.04	5.55	6.22	<b>10yr</b>	4.91	5.98	6.78	7.75	8.54	<b>10yr</b>
<b>25yr</b>	0.72	1.10	1.37	1.95	2.57	2.97	<b>25yr</b>	2.22	2.90	3.38	4.16	5.18	7.39	8.39	<b>25yr</b>	6.54	8.07	9.10	10.19	11.05	<b>25yr</b>
<b>50yr</b>	0.88	1.33	1.66	2.38	3.21	3.67	<b>50yr</b>	2.77	3.59	4.18	5.05	6.23	9.16	10.52	<b>50yr</b>	8.11	10.11	11.36	12.55	13.45	<b>50yr</b>
<b>100yr</b>	1.07	1.62	2.03	2.93	4.02	4.56	<b>100yr</b>	3.47	4.46	5.17	6.25	7.51	11.37	13.14	<b>100yr</b>	10.07	12.64	14.18	15.47	16.37	<b>100yr</b>
<b>200yr</b>	1.31	1.97	2.49	3.61	5.04	5.65	<b>200yr</b>	4.35	5.53	6.40	7.61	9.04	14.11	16.44	<b>200yr</b>	12.49	15.81	17.69	19.06	19.93	<b>200yr</b>
<b>500yr</b>	1.73	2.57	3.31	4.80	6.83	7.50	<b>500yr</b>	5.89	7.33	8.50	9.90	11.56	18.72	22.10	<b>500yr</b>	16.57	21.25	23.70	25.15	25.82	<b>500yr</b>



# National Flood Hazard Layer FIRMMette



71°22'28"W 42°15'8"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

71°21'50"W 42°14'41"N

## 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 Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



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](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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

# Contents

---

<b>Preface</b> .....	2
<b>How Soil Surveys Are Made</b> .....	5
<b>Soil Map</b> .....	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Middlesex County, Massachusetts.....	13
103D—Charlton-Hollis-Rock outcrop complex, 15 to 25 percent slopes....	13
254A—Merrimac fine sandy loam, 0 to 3 percent slopes.....	15
260B—Sudbury fine sandy loam, 3 to 8 percent slopes.....	17
307B—Paxton fine sandy loam, 0 to 8 percent slopes, extremely stony....	19
626B—Merrimac-Urban land complex, 0 to 8 percent slopes.....	20
<b>Soil Information for All Uses</b> .....	23
Soil Properties and Qualities.....	23
Soil Physical Properties.....	23
Saturated Hydraulic Conductivity (Ksat).....	23
Soil Qualities and Features.....	26
Hydrologic Soil Group.....	27
<b>References</b> .....	31

# 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

## Custom Soil Resource Report

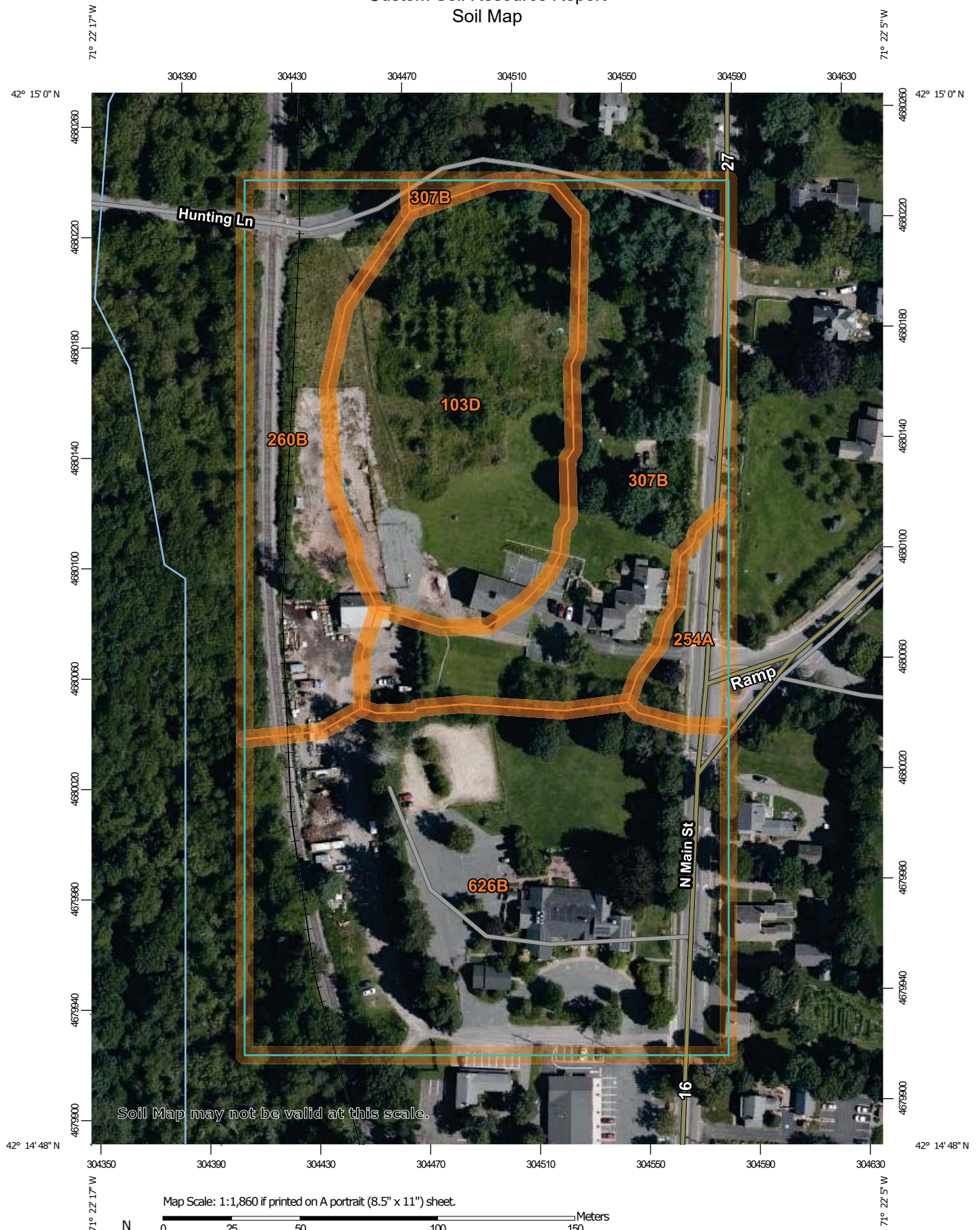
identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

# 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.

# Custom Soil Resource Report Soil Map




## 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%
<b>Totals for Area of Interest</b>		<b>13.9</b>	<b>100.0%</b>

## 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

## Custom Soil Resource Report

*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

## Custom Soil Resource Report

*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

## Custom Soil Resource Report

*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



## Custom Soil Resource Report

### 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

Custom Soil Resource Report

*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

## Custom Soil Resource Report

*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)**

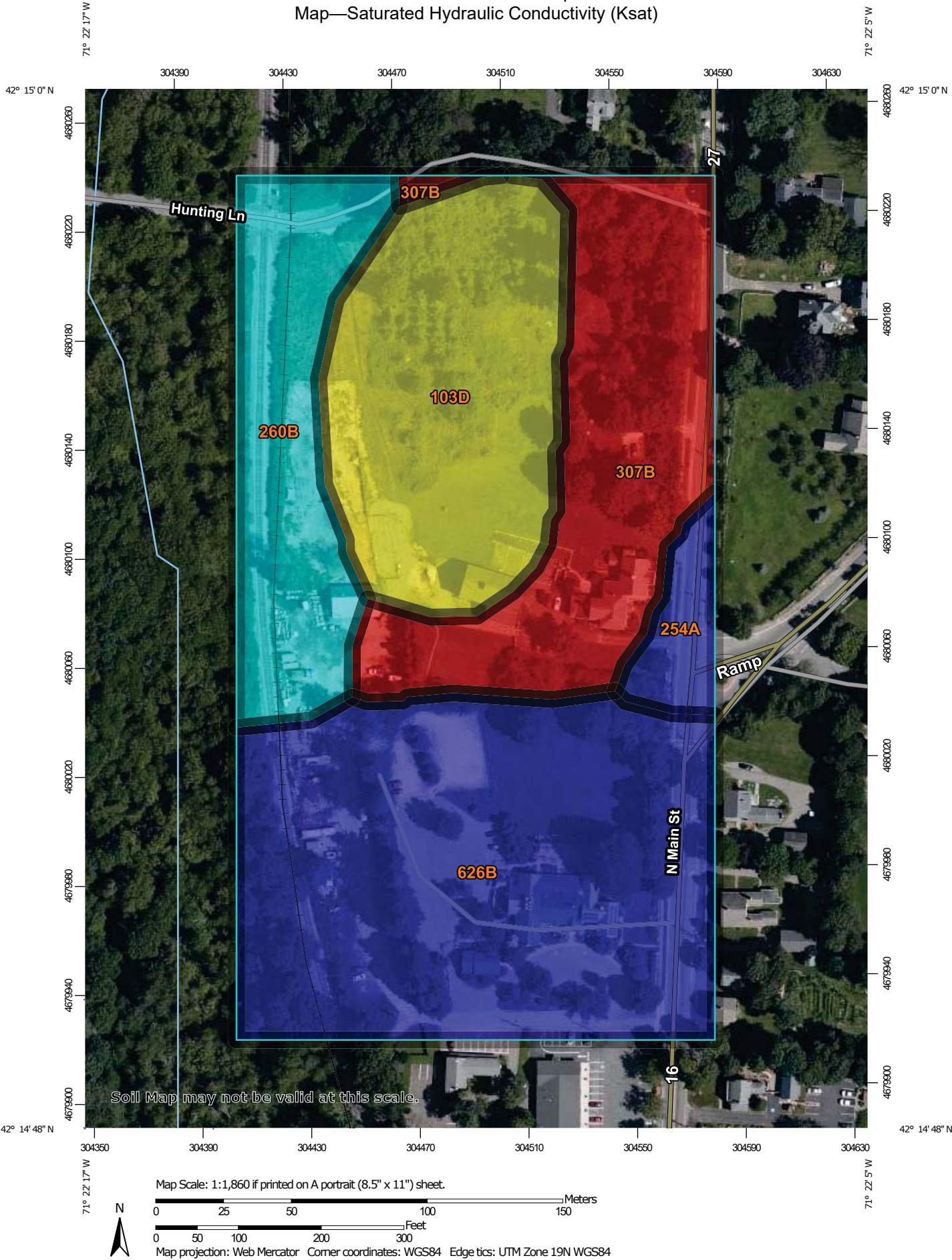
Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic 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.




Custom Soil Resource Report  
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%
<b>Totals for Area of Interest</b>			<b>13.9</b>	<b>100.0%</b>

**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.

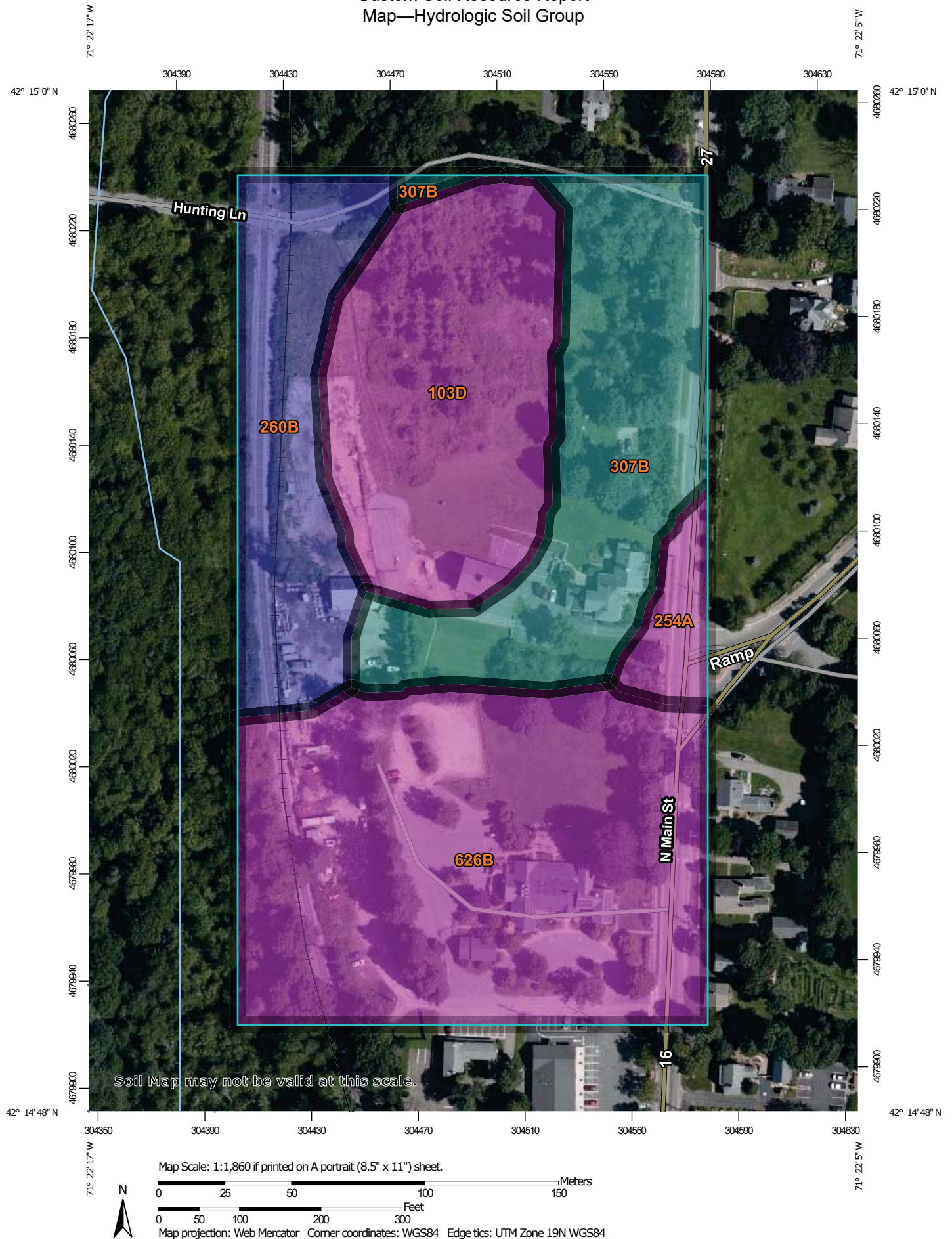
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

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.




# Custom Soil Resource Report Map—Hydrologic Soil Group






## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines


 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available


### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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%
<b>Totals for Area of Interest</b>			<b>13.9</b>	<b>100.0%</b>

**Rating Options—Hydrologic Soil Group***Aggregation Method:* Dominant Condition*Component Percent Cutoff:* None Specified*Tie-break Rule:* Higher

# References

---

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_054262](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262)
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053577](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577)
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053580](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580)
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2\\_053374](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374)
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084>

## Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2\\_054242](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242)

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. [http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2\\_053624](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624)

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs142p2\\_052290.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf)



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<sub>drawdown</sub> = (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)

$$\begin{aligned}\text{Time}_{\text{drawdown}} &= ( 14,649 \text{ cf} ) ( 1 / 1.02 \text{ in/hr} ) ( 1\text{ft}/12 \text{ in.} ) ( 1 / 4,094 \text{ sf} ) \\ &= 42.10 \text{ hours}\end{aligned}$$



Project No.	2513-01A	Sheet	2 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 #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<sub>drawdown</sub> = (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<sub>drawdown</sub> = ( 3,571 cf ) ( 1 / 1.02 in/hr ) ( 1ft/12 in. ) ( 1 / 6,176 sf )  
= 6.80 hours

**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

**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



**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

**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

**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

**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)
181.74	5,252	12,961	182.80	5,541	15,336
181.76	5,257	13,018	182.82	5,546	15,368
181.78	5,262	13,075	182.84	5,552	15,401
181.80	5,268	13,132	182.86	5,557	15,434
181.82	5,273	13,188	182.88	5,563	15,467
181.84	5,279	13,243	182.90	5,568	15,499
181.86	5,284	13,299	182.92	5,574	15,532
181.88	5,290	13,354	182.94	5,579	15,565
181.90	5,295	13,409	182.96	5,585	15,598
181.92	5,301	13,464	182.98	5,590	15,630
181.94	5,306	13,518	183.00	<b>5,596</b>	<b>15,663</b>
181.96	5,312	13,572	183.02	5,596	15,663
181.98	5,317	13,626	183.04	5,596	15,663
182.00	5,323	13,679	183.06	5,596	15,663
182.02	5,328	13,732	183.08	5,596	15,663
182.04	5,333	13,784	183.10	5,596	15,663
182.06	5,339	13,837	183.12	5,596	15,663
182.08	5,344	13,888	183.14	5,596	15,663
182.10	5,350	13,940	183.16	5,596	15,663
182.12	5,355	13,991	183.18	5,596	15,663
182.14	5,361	14,041	183.20	5,596	15,663
182.16	5,366	14,091	183.22	5,596	15,663
182.18	5,372	14,141	183.24	5,596	15,663
182.20	5,377	14,190	183.26	5,596	15,663
182.22	5,383	14,239	183.28	5,596	15,663
182.24	5,388	14,287	183.30	5,596	15,663
182.26	5,393	14,334	183.32	5,596	15,663
182.28	5,399	14,381	183.34	5,596	15,663
182.30	5,404	14,427	183.36	5,596	15,663
182.32	5,410	14,473	183.38	5,596	15,663
182.34	5,415	14,518	183.40	5,596	15,663
182.36	5,421	14,562			
182.38	5,426	14,606			
<b>182.40</b>	<b>5,432</b>	<b>14,649</b>			
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			

**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

**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
<b>171.55</b>	<b>6,859</b>	<b>3,571</b>
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	<b>8,186</b>	<b>9,810</b>



Project No.	2513-01A	Sheet	1 of 5
Project Description	The Pines Residences		
	41 North Main Street - Sherborn, MA		
Calculated By	ARM	Date	04/09/21
Checked By	MAM	Date	

- 1 The calculations provide the TSS removal rate of a stormwater management system, and they also identify the necessary volumes to meet water quality and re-charge standards.

***Treatment Train #1 - Discharge to Infiltration System #1***

<u>Stormwater Management BMP</u>	<u>TSS Removal rate</u>
Parking Lot Sweeping	5 %
Hooded catch basins	25 %
Proprietary Device (WQU1)	88 %
Average Annual Load = 1.0	
Parking Lot Sweeping	= <u>5.0</u> % Removal Rate
	95.0 % TSS Load Remains
TSS Load Remaining = 95.0 %	
Hooded catch basins	= <u>25.0</u> % Removal Rate
	71.3 % TSS Load Remains
TSS Load Remaining = 71.3 %	
Proprietary Device (WQU1)	= <u>87.8</u> % Removal Rate
	8.7 % TSS Load Remains
Percentage of TSS Remaining - Initial TSS Load = Final TSS Removal Rate	
8.69	- 100.0 = 91.3 %

For this drainage area, this system as designed will remove an estimated  
91.3 % of the annual TSS load and therefore will meet the TSS removal standard.



Project No.	2513-01A	Sheet	2 of 5
Project Description	The Pines Residences		
	41 North Main Street - Sherborn, MA		
Calculated By	ARM	Date	04/09/21
Checked By	MAM	Date	

- 1 The calculations provide the TSS removal rate of a stormwater management system, and they also identify the necessary volumes to meet water quality and re-charge standards.

***Treatment Train #2 - Discharge to Infiltration System #2 (CB7, CB8, CB9 to WQU2)***

<u>Stormwater Management BMP</u>	<u>TSS Removal rate</u>	
Parking Lot Sweeping	5 %	
Hooded catch basins	25 %	
Proprietary Device (WQU2)	84 %	
Average Annual Load	= 1.0	
Parking Lot Sweeping	= <u>5.0</u> % Removal Rate	
	95.0 % TSS Load Remains	
TSS Load Remaining	= 95.0 %	
Hooded catch basins	= <u>25.0</u> % Removal Rate	
	71.3 % TSS Load Remains	
TSS Load Remaining	= 71.3 %	
Proprietary Device (WQU2)	= <u>83.8</u> % Removal Rate	
	11.5 % TSS Load Remains	
Percentage of TSS Remaining	- Initial TSS Load	= Final TSS Removal Rate
11.54	- 100.0	= 88.5 %

For this drainage area, this system as designed will remove an estimated 88.5 % of the annual TSS load and therefore will meet the TSS removal standard.



Project No.	2513-01A	Sheet	3 of 5
Project Description	The Pines Residences		
	41 North Main Street - Sherborn, MA		
Calculated By	ARM	Date	04/09/21
Checked By	MAM	Date	

- 1 The calculations provide the TSS removal rate of a stormwater management system, and they also identify the necessary volumes to meet water quality and re-charge standards.

***Treatment Train #3 - Discharge to Infiltration System #2 (CB14, CB15, CB16 to WQU7)***

<u>Stormwater Management BMP</u>	<u>TSS Removal rate</u>	
Parking Lot Sweeping	5 %	
Hooded catch basins	25 %	
Proprietary Device (WQU2)	95 %	
Average Annual Load	= 1.0	
Parking Lot Sweeping	= <u>5.0</u> % Removal Rate	
	95.0 % TSS Load Remains	
TSS Load Remaining	= 95.0 %	
Hooded catch basins	= <u>25.0</u> % Removal Rate	
	71.3 % TSS Load Remains	
TSS Load Remaining	= 71.3 %	
Proprietary Device (WQU2)	= <u>95.0</u> % Removal Rate	
	3.6 % TSS Load Remains	
Percentage of TSS Remaining - Initial TSS Load = Final TSS Removal Rate		
3.56	- 100.0	= 96.4 %

For this drainage area, this system as designed will remove an estimated 96.4 % of the annual TSS load and therefore will meet the TSS removal standard.





Project No.	2513-01A	Sheet	4 of 5
Project Description	The Pines Residences		
	41 North Main Street - Sherborn, MA		
Calculated By	ARM	Date	04/09/21
Checked By	MAM	Date	

1 The calculations provide the TSS removal rate of a stormwater management system, and they also identify the necessary volumes to meet water quality and re-charge standards.

***Treatment Train #4 - Discharge to Infiltration System #2 (WQU4, WQU5, WQU6)***

<u>Stormwater Management BMP</u>	<u>TSS Removal rate</u>
Parking Lot Sweeping	5 %
	%
Proprietary Devices	97 %
Average Annual Load	= 1.0
Parking Lot Sweeping	= <u>5.0</u> % Removal Rate
	95.0 % TSS Load Remains
TSS Load Remaining	= 95.0 %
	= <u>0.0</u> % Removal Rate
	95.0 % TSS Load Remains
TSS Load Remaining	= 95.0 %
Proprietary Devices	= <u>97.0</u> % Removal Rate
	2.9 % TSS Load Remains
Percentage of TSS Remaining - Initial TSS Load = Final TSS Removal Rate	
2.85	- 100.0 = 97.2 %

For this drainage area, this system as designed will remove an estimated 97.2 % of the annual TSS load and therefore will meet the TSS removal standard.



Project No.	2513-01A	Sheet	5 of 5
Project Description	The Pines Residences		
	41 North Main Street - Sherborn, MA		
Calculated By	ARM	Date	04/09/21
Checked By	MAM	Date	

- 1 The calculations provide the TSS removal rate of a stormwater management system, and they also identify the necessary volumes to meet water quality and re-charge standards.

***Treatment Train #5 - Discharge to BioRetention #1 (Stormturret)***

<u>Stormwater Management BMP</u>	<u>TSS Removal rate</u>
Parking Lot Sweeping	5 %
Proprietary Devices	80 %
BioRetention Filter	80 %
Average Annual Load	= 1.0
Parking Lot Sweeping	= <u>5.0</u> % Removal Rate
	95.0 % TSS Load Remains
TSS Load Remaining	= 95.0 %
Proprietary Devices	= <u>80.0</u> % Removal Rate
	19.0 % TSS Load Remains
TSS Load Remaining	= 19.0 %
BioRetention Filter	= <u>80.0</u> % Removal Rate
	3.8 % TSS Load Remains

$$\begin{array}{rclcl} \text{Percentage of TSS Remaining} & - & \text{Initial TSS Load} & = & \text{Final TSS Removal Rate} \\ 3.80 & - & 100.0 & = & 96.2 \% \end{array}$$

For this drainage area, this system as designed will remove an estimated 96.2 % of the annual TSS load and therefore will meet the TSS removal standard.

**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  $t_c$ , read the unit peak discharge ( $q_u$ ) from Figure 1 or Table in Figure 2.  $q_u$  is expressed in the following units: cfs/mi<sup>2</sup>/watershed inches (csm/in).

Compute Q Rate using the following equation:

$$Q = (q_u) (A) (WQV)$$

where:

Q = flow rate associated with first 1" of runoff

$q_u$  = 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 <sup>2</sup> )	$t_c$ (min)	$t_c$ (hr)	WQV (in)	$q_u$ (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**  
Weighted C **0.9**  
 $t_c$  **6 min**  
CDS Model **2015-4**

Unit Site Designation **WQU1**  
Rainfall Station # **68**

CDS Treatment Capacity **1.4 cfs**

<u>Rainfall Intensity<sup>1</sup></u> (in/hr)	<u>Percent Rainfall Volume<sup>1</sup></u>	<u>Cumulative Rainfall Volume</u>	<u>Total Flowrate (cfs)</u>	<u>Treated Flowrate (cfs)</u>	<u>Incremental Removal (%)</u>
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 <sup>2</sup> =					6.5%
Predicted % Annual Rainfall Treated =					93.5%
<b>Predicted Net Annual Load Removal Efficiency =</b>					<b>87.8%</b>

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.

## CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

### THE PINES RESIDENCES SHERBORN, MA

Area **1.08 ac**  
Weighted C **0.9**  
 $t_c$  **6 min**  
CDS Model **2015-4**

Unit Site Designation **WQU2**  
Rainfall Station # **68**

CDS Treatment Capacity **1.4 cfs**

<u>Rainfall Intensity<sup>1</sup></u> (in/hr)	<u>Percent Rainfall Volume<sup>1</sup></u>	<u>Cumulative Rainfall Volume</u>	<u>Total Flowrate (cfs)</u>	<u>Treated Flowrate (cfs)</u>	<u>Incremental Removal (%)</u>
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 <sup>2</sup> =					6.5%
Predicted % Annual Rainfall Treated =					93.3%
<b>Predicted Net Annual Load Removal Efficiency =</b>					<b>83.8%</b>

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			
<b>Project Name</b>	The Pines Residences	<b>Project Number</b>	663904
<b>City</b>	Sherborn	<b>State/ Province</b>	Massachusetts
<b>Country</b>	United States of America	<b>Date</b>	11/18/2020
Designer Information		EOR Information (optional)	
<b>Name</b>	Josh Stackhouse	<b>Name</b>	
<b>Company</b>	Contech	<b>Company</b>	
<b>Phone #</b>	207-219-9110	<b>Phone #</b>	
<b>Email</b>	joshua.stackhouse@contechllc.com	<b>Email</b>	

### 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.

<b>Site Name</b>	WQU3
<b>Target TSS Removal (%)</b>	80
<b>TSS Removal (%) Provided</b>	96
<b>Recommended Stormceptor Model</b>	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



Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (acres)	0.10	TSS Removal (%)	80.0
Imperviousness %	100.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (Gal)	
Station Name	BLUE HILL	Peak Conveyed Flow Rate (CFS)	
State/Province	Massachusetts	Water Quality Flow Rate (CFS)	
Station ID #	0736	Up Stream Storage	
Years of Records	58	Storage (ac-ft)	Discharge (cfs)
Latitude	42°12'44"N	0.000	0.000
Longitude	71°6'53"W	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
<ul style="list-style-type: none"> <li>Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.</li> <li>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.</li> <li>For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.</li> </ul>

For Stormceptor Specifications and Drawings Please Visit:  
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>

## 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

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (acres)	0.06	TSS Removal (%)	80.0
Imperviousness %	100.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (Gal)	
Station Name	BLUE HILL	Peak Conveyed Flow Rate (CFS)	
State/Province	Massachusetts	Water Quality Flow Rate (CFS)	
Station ID #	0736	Up Stream Storage	
Years of Records	58	Storage (ac-ft)	Discharge (cfs)
Latitude	42°12'44"N	0.000	0.000
Longitude	71°6'53"W	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
<ul style="list-style-type: none"> <li>Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.</li> <li>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.</li> <li>For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.</li> </ul>

For Stormceptor Specifications and Drawings Please Visit:  
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>

## Brief Stormceptor Sizing Report - WQU5

Project Information & Location			
<b>Project Name</b>	The Pines Residences	<b>Project Number</b>	663904
<b>City</b>	Sherborn	<b>State/ Province</b>	Massachusetts
<b>Country</b>	United States of America	<b>Date</b>	11/18/2020
Designer Information		EOR Information (optional)	
<b>Name</b>	Josh Stackhouse	<b>Name</b>	
<b>Company</b>	Contech	<b>Company</b>	
<b>Phone #</b>	207-219-9110	<b>Phone #</b>	
<b>Email</b>	joshua.stackhouse@contechllc.com	<b>Email</b>	

### 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.

<b>Site Name</b>	WQU5
<b>Target TSS Removal (%)</b>	80
<b>TSS Removal (%) Provided</b>	95
<b>Recommended Stormceptor Model</b>	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

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (acres)	0.14	TSS Removal (%)	80.0
Imperviousness %	100.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (Gal)	
Station Name	BLUE HILL	Peak Conveyed Flow Rate (CFS)	
State/Province	Massachusetts	Water Quality Flow Rate (CFS)	
Station ID #	0736	Up Stream Storage	
Years of Records	58	Storage (ac-ft)	Discharge (cfs)
Latitude	42°12'44"N	0.000	0.000
Longitude	71°6'53"W	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
<ul style="list-style-type: none"> <li>Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.</li> <li>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.</li> <li>For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.</li> </ul>

For Stormceptor Specifications and Drawings Please Visit:  
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>

## Brief Stormceptor Sizing Report - WQU6

Project Information & Location			
<b>Project Name</b>	The Pines Residences	<b>Project Number</b>	663904
<b>City</b>	Sherborn	<b>State/ Province</b>	Massachusetts
<b>Country</b>	United States of America	<b>Date</b>	11/18/2020
Designer Information		EOR Information (optional)	
<b>Name</b>	Josh Stackhouse	<b>Name</b>	
<b>Company</b>	Contech	<b>Company</b>	
<b>Phone #</b>	207-219-9110	<b>Phone #</b>	
<b>Email</b>	joshua.stackhouse@contechllc.com	<b>Email</b>	

### 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.

<b>Site Name</b>	WQU6
<b>Target TSS Removal (%)</b>	80
<b>TSS Removal (%) Provided</b>	97
<b>Recommended Stormceptor Model</b>	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



Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (acres)	0.08	TSS Removal (%)	80.0
Imperviousness %	100.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (Gal)	
Station Name	BLUE HILL	Peak Conveyed Flow Rate (CFS)	
State/Province	Massachusetts	Water Quality Flow Rate (CFS)	
Station ID #	0736	Up Stream Storage	
Years of Records	58	Storage (ac-ft)	Discharge (cfs)
Latitude	42°12'44"N	0.000	0.000
Longitude	71°6'53"W	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
<ul style="list-style-type: none"> <li>Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.</li> <li>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.</li> <li>For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.</li> </ul>

For Stormceptor Specifications and Drawings Please Visit:  
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>

## Brief Stormceptor Sizing Report - WQU7

Project Information & Location			
<b>Project Name</b>	The Pines Residences	<b>Project Number</b>	663904
<b>City</b>	Sherborn	<b>State/ Province</b>	Massachusetts
<b>Country</b>	United States of America	<b>Date</b>	11/18/2020
Designer Information		EOR Information (optional)	
<b>Name</b>	Josh Stackhouse	<b>Name</b>	
<b>Company</b>	Contech	<b>Company</b>	
<b>Phone #</b>	207-219-9110	<b>Phone #</b>	
<b>Email</b>	joshua.stackhouse@contechllc.com	<b>Email</b>	

### 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.

<b>Site Name</b>	WQU7
<b>Target TSS Removal (%)</b>	80
<b>TSS Removal (%) Provided</b>	95
<b>Recommended Stormceptor Model</b>	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

Sizing Details			
Drainage Area		Water Quality Objective	
Total Area (acres)	0.14	TSS Removal (%)	80.0
Imperviousness %	100.0	Runoff Volume Capture (%)	
Rainfall		Oil Spill Capture Volume (Gal)	
Station Name	BLUE HILL	Peak Conveyed Flow Rate (CFS)	
State/Province	Massachusetts	Water Quality Flow Rate (CFS)	
Station ID #	0736	Up Stream Storage	
Years of Records	58	Storage (ac-ft)	Discharge (cfs)
Latitude	42°12'44"N	0.000	0.000
Longitude	71°6'53"W	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
<ul style="list-style-type: none"> <li>Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.</li> <li>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.</li> <li>For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.</li> </ul>

For Stormceptor Specifications and Drawings Please Visit:  
<https://www.conteches.com/technical-guides/search?filter=1WBC005EYX>



## DRAINAGE PIPE DESIGN ANALYSIS

Manning's Formula

$$V = 1.486/n \cdot R^{2/3} \cdot S^{1/2}$$

$$Q = V \cdot A$$

(25-Year storm)

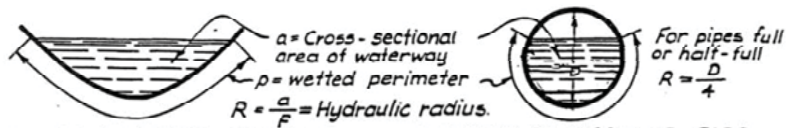
Where: V is the velocity in Ft/sec.  
n is Mannings coefficient of friction  
R is the Hydraulic Radius  
S is the slope of the pipe

$R = \text{Area} / \text{Wetted Perimeter}$

Where:  $\text{Area} = \pi \cdot (R/12)^2$   
 $\text{Wetted Perimeter} = 2 \cdot \pi \cdot R/12$

A&M Job No.	2513-01A
Date:	11/18/2020
<b>Project Location:</b> The Pines Residences North Main Street Sherborn, MA	
<b>Prepared For:</b> Barsky Estate Realty Trust	

PIPE	Q <sub>design</sub>	n	Diameter	A	Wp	R	S	Q <sub>full</sub>	Q <sub>full</sub> ≥ Q <sub>design</sub>	V <sub>full</sub>	Q <sub>d</sub> /Q <sub>f</sub>	Results	V <sub>design</sub>	2.5 ft/s ≤	V <sub>design</sub> ≤ 10 ft/s
	(cfs)		(inches)	(ft <sup>2</sup> )	(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

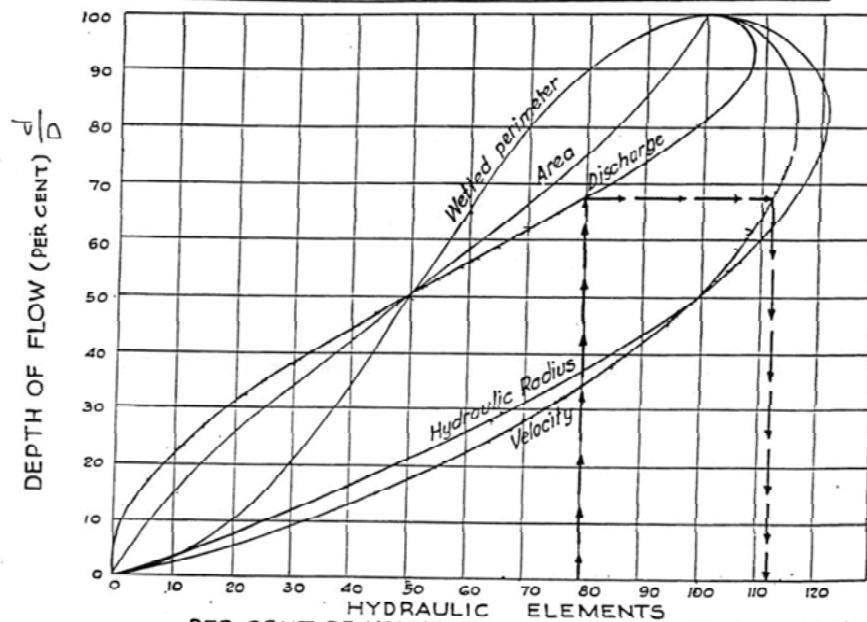
$V$  = Average or mean velocity in feet per second.

$Q = aV$  = 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-Fg.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.



#### PER CENT OF VALUE FOR FULL SECTION (APPROXIMATE)

**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.  
 $\therefore$  Percentage of full discharge =  $\frac{12}{15} = 80\%$ . Enter chart at 80% of value for full section of Hydraulic Elements, find  $V = 112.5\% \times 7 = 7.9$  ft. per sec.

#### VALUES OF HYDRAULIC ELEMENTS OF CIRCULAR SECTION FOR VARIOUS DEPTHS OF FLOW.

Figure 4-4A

## ESTIMATION FOR PHOSPHORUS REMOVAL

Existing Condition Phosphorus 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
		<b>Total</b>	<b>6.73</b>
			<b>1.62</b>

Phosphorus Reduction Requirement			
Phosphorus Reduction Requirement	=	Proposed Phosphorus Load x 18%*	
	=	1.62 x 0.18	
	=	0.29 lbs/year	
Target Phosphorus Load		1.62 - 0.29	
(Post Construction) =		<b>1.33 (Target Phosphorus Load)</b>	

\*Table F-2, Appendix F, MA MS4 General Permit

Proposed Condition Phosphorus 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
		<b>Total</b>	<b>6.73</b>
			<b>6.22</b>

Proposed Condition Phosphorus Loading Reduction				
BMP (Subcatchment)	BMP (Appendix F Category)	Total Phosphorous Load to BMP (lbs/yr)***	BMP Removal %**	Phosphorus Removed by BMPs (lbs/year)
IS #1 (P-3A - P-3F & P-1A & P-2A)	Infiltration Basin	2.17	100%	2.17
IS #2 (P-5A - P-5H & P-1B & P-2B)	Infiltration Basin	2.28	94%	2.14
Collection Pond (P-7)	Bioretention Basin	0.95	60%	0.57
Enhanced Sweeping Program Credit	-	-	-	0.098
Catch Basin Cleaning Credit	-	-	-	0.025
Urban Fertilizer Reduction	-	-	-	0.12
Note: See following pages for phosphorus removal calculations			<b>Total</b>	<b>5.12</b>

Proposed Load before reduction	-	Loading Reduction	=Actual Constructed Phosphorus Load	
Actual Constructed Phosphorus Load	6.22	-	5.12	(Target Phosphorus Load)
Actual Constructed Phosphorus Load	<b>1.10 lb/yr</b>	compared to ----->	<b>1.34</b>	<b>TARGET IS MET</b>

Percent Phosphorus Removed =	Loading Reduction / Proposed Load before reduction x 100	
<b>Percent Phosphorus Removed =</b>	<b>82%</b>	<b>&gt; 60% TARGET IS MET</b>



#### Phosphorus Calculations Per BMP

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
<b>IS #1 (P-3A - P3-F &amp; P-1A &amp; P-2A)</b>			(per BMP)	Area to Drywells	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	2.6	IN.
Open Space Soil Type B	0.12	0.00	0.00	<b>BMP Removal %**</b>	<b>100%</b>	
Open Space Soil Type C	0.21	0.00	0.00	**Table 3-15, Appendix F, MA MS4 General Permit		
Forest	0.13	0.08	0.01			
	<b>total</b>	<b>1.53</b>	<b>2.17</b>			

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
<b>IS #2 (P-5A - P-5H &amp; P-1B &amp; P-2B)</b>			(per BMP)	Area to DB-1	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	0.8	IN.
Open Space Soil Type B	0.12	0.02	0.00	<b>BMP Removal %**</b>	<b>94%</b>	
Open Space Soil Type C	0.21	0.07	0.02	**Table 3-15, Appendix F, MA MS4 General Permit		
Forest	0.13	0.00	0.00			
	<b>total</b>	<b>1.30</b>	<b>2.28</b>			

	Phosphorus Load by Land Use (lbs/ac/yr)	Area (Acres)	Proposed Phosphorus Load (lbs/yr)			
<b>Collection Pond (P-7)</b>			(per BMP)	Area to DB-1	29,241	S.F.
Multi-Family	2.32	0.40	0.94	Volume Treated	4,118	C.F.
Open Space Soil Type A	0.03	0.25	0.01	Depth of runoff treated	1.7	IN.
Open Space Soil Type B	0.12	0.01	0.00	<b>BMP Removal %**</b>	<b>60%</b>	
Open Space Soil Type C	0.21	0.01	0.00	**Table 3-18, Appendix F, MA MS4 General Permit		
Forest	0.13	0.00	0.00			
	<b>total</b>	<b>0.67</b>	<b>0.95</b>			

<b>Enhanced Sweeping Program Credit</b>						
$la_{swept} =$	0.53	acres				
$PLER_{IC-HDR} =$	2.32	lb/acre/yr (for Multi-Family)				
$PRF_{sweeping} =$	0.08	(from Table 2-4, assumed swept monthly w/ regenerative air vacuum)				
$AF =$	1.00	12 months / 12 months				
$Credit_{sweeping} = la_{swept} * PLER_{IC-HDR} * PRF_{sweeping} * AF$						
<b>Credit<sub>sweeping</sub> =</b>	<b>0.098</b>	<b>lb/yr</b>				

<b>Catch Basin Cleaning Credit</b>						
$la_{CB} =$	0.53	acres				
$PLER_{IC-HDR} =$	2.32	lb/acre/yr (for Multi-Family)				
$PRF_{CB} =$	0.02	(from Table 2-5)				
$Credit_{sweeping} = la_{CB} * PLER_{IC-HDR} * PRF_{CB}$						
<b>Credit<sub>sweeping</sub> =</b>	<b>0.025</b>	<b>lb/yr</b>				

<b>Urban Fertilizer Reduction</b>	Soil Type (Open Space, Acres)					
	B	C	D			
$Area_{each\ soil\ type} =$	1.67	0.33	1.26			
$PLER_{each\ soil\ type} =$	0.03	0.12	0.21			
<b>Reduction Factor</b>	33% (from Section 2.4, Summary of Potential BMPs for Phosphorus Reduction, Sherborn, MA)					
$Credit_{fertilizer} = Area_{each\ soil\ type} * PLER_{each\ soil\ type} * 0.33$						
<b>Credit<sub>fertilizer</sub> =</b>	<b>0.12</b>	<b>lb/yr</b>				

**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

**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

**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

**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

**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

**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)
181.74	5,252	12,961	182.80	5,541	15,336
181.76	5,257	13,018	182.82	5,546	15,368
181.78	5,262	13,075	182.84	5,552	15,401
181.80	5,268	13,132	182.86	5,557	15,434
181.82	5,273	13,188	182.88	5,563	15,467
181.84	5,279	13,243	182.90	5,568	15,499
181.86	5,284	13,299	182.92	5,574	15,532
181.88	5,290	13,354	182.94	5,579	15,565
181.90	5,295	13,409	182.96	5,585	15,598
181.92	5,301	13,464	182.98	5,590	15,630
181.94	5,306	13,518	183.00	<b>5,596</b>	<b>15,663</b>
181.96	5,312	13,572	183.02	5,596	15,663
181.98	5,317	13,626	183.04	5,596	15,663
182.00	5,323	13,679	183.06	5,596	15,663
182.02	5,328	13,732	183.08	5,596	15,663
182.04	5,333	13,784	183.10	5,596	15,663
182.06	5,339	13,837	183.12	5,596	15,663
182.08	5,344	13,888	183.14	5,596	15,663
182.10	5,350	13,940	183.16	5,596	15,663
182.12	5,355	13,991	183.18	5,596	15,663
182.14	5,361	14,041	183.20	5,596	15,663
182.16	5,366	14,091	183.22	5,596	15,663
182.18	5,372	14,141	183.24	5,596	15,663
182.20	5,377	14,190	183.26	5,596	15,663
182.22	5,383	14,239	183.28	5,596	15,663
182.24	5,388	14,287	183.30	5,596	15,663
182.26	5,393	14,334	183.32	5,596	15,663
182.28	5,399	14,381	183.34	5,596	15,663
182.30	5,404	14,427	183.36	5,596	15,663
182.32	5,410	14,473	183.38	5,596	15,663
182.34	5,415	14,518	183.40	5,596	15,663
182.36	5,421	14,562			
182.38	5,426	14,606			
<b>182.40</b>	<b>5,432</b>	<b>14,649</b>			
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			

**2513-01A - Proposed HydroCAD**

Prepared by Allen &amp; Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 2-year Rainfall=3.19"

Printed 11/18/2020

**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
<b>171.55</b>	<b>6,859</b>	<b>3,571</b>
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	<b>8,186</b>	<b>9,810</b>

**2513-01A - Proposed HydroCAD\_rev1***Type III 24-hr 100-year Rainfall=8.53"*

Prepared by Allen &amp; Major Associates, Inc.

Printed 4/9/2021

HydroCAD® 10.10-5a s/n 02947 © 2020 HydroCAD Software Solutions LLC

---

**Stage-Area-Storage for Pond CP2: Collection Pond (continued)**

Elevation (feet)	Storage (cubic-feet)
171.75	2,496
171.76	2,550
171.77	2,605
171.78	2,660
171.79	2,717
171.80	2,774
171.81	2,833
171.82	2,892
171.83	2,952
171.84	3,013
171.85	3,075
171.86	3,138
171.87	3,202
171.88	3,266
171.89	3,332
171.90	3,399
171.91	3,466
171.92	3,535
171.93	3,604
171.94	3,675
171.95	3,746
171.96	3,819
171.97	3,892
171.98	3,966
171.99	4,042
172.00	4,118



**Table 3-15: Infiltration Basin (1.02 in/hr) BMP Performance Table**

Surface Infiltration (1.02 in/hr) BMP Performance Table: Long-Term Phosphorus Load Reduction								
BMP Capacity: Depth of Runoff 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%
Cumulative Nitrogen Load Reduction	59%	77%	92%	96%	98%	100%	100%	100%

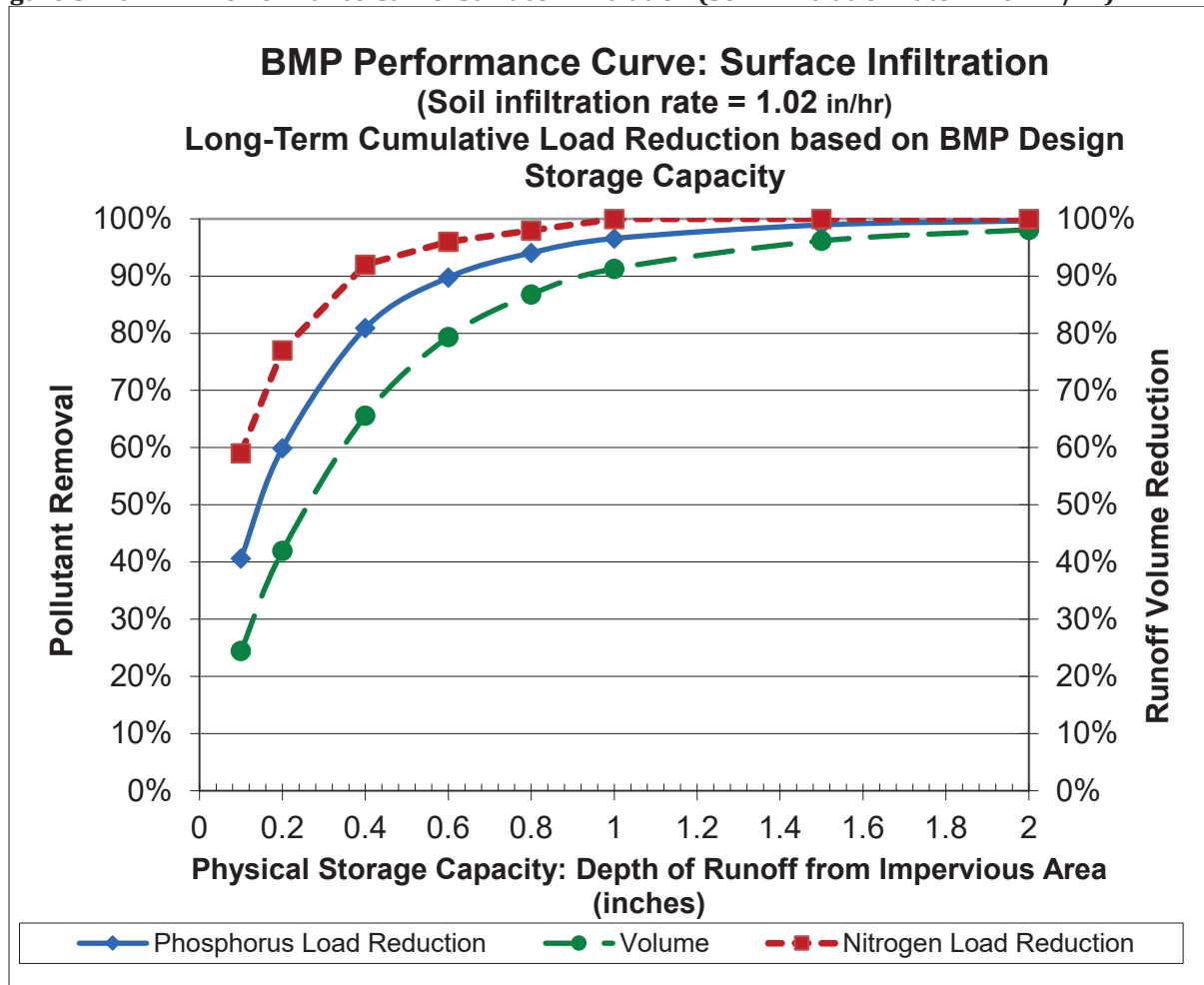
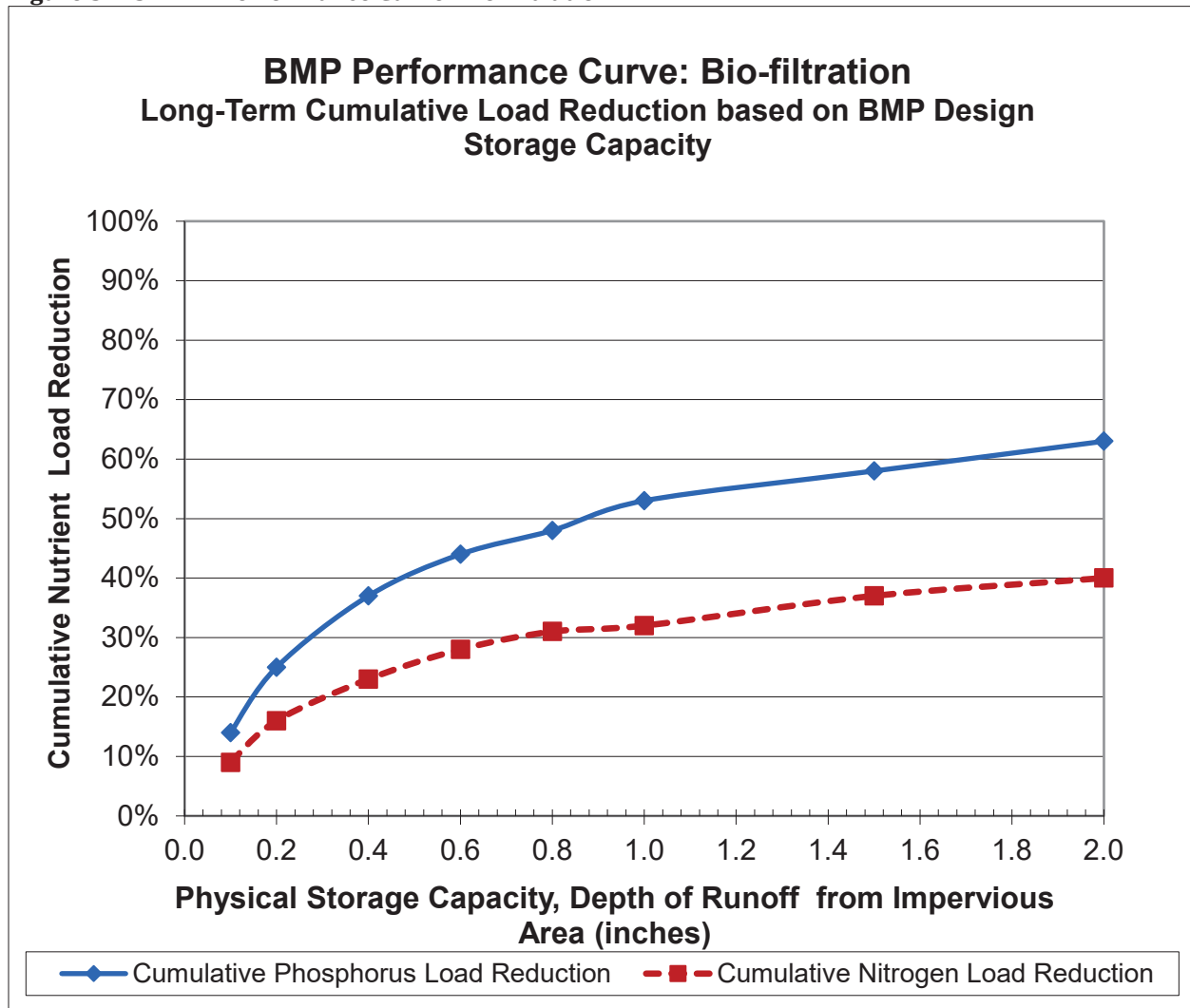
**Figure 3- 10: BMP Performance Curve: Surface Infiltration (Soil infiltration rate = 1.02 in/hr)**

Table 3-18: Bio-filtration BMP Performance Table

Bio-filtration BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%
Cumulative Nitrogen Load Reduction	9%	16%	23%	28%	31%	32%	37%	40%

Figure 3- 13: BMP Performance Curve: Bio-filtration



**(1) Enhanced Sweeping Program:** The permittee may earn a phosphorus and/or nitrogen reduction credit(s) for conducting an enhanced sweeping program of impervious surfaces. Table 2-4 below outlines the default nutrient removal factors for enhanced sweeping programs. The credit shall be calculated by using the following equations:

$$\text{Phosphorus Credit}_{P \text{ sweeping}} = IA_{\text{swept}} \times PLER_{IC\text{-land use}} \times PRF_{\text{sweeping}} \times AF \text{ (Equation 2-1)}$$

$$\text{Nitrogen Credit}_{N \text{ sweeping}} = IA_{\text{swept}} \times NLER_{IC\text{-land use}} \times NRF_{\text{sweeping}} \times AF \text{ (Equation 2-2)}$$

**Where:**

Credit <sub>sweeping</sub>	=	Amount of nutrient load removed by enhanced sweeping program (lb/year)
IA <sub>swept</sub>	=	Area of impervious surface that is swept under the enhanced sweeping program (acres)
PLER <sub>IC-land use</sub>	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
NLER <sub>IC-land use</sub>	=	Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)
PRF <sub>sweeping</sub>	=	Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).
NRF <sub>sweeping</sub>	=	Nitrogen Reduction Factor for sweeping based on sweeper type and frequency (see Table 2-4).
AF	=	Annual Frequency of sweeping. For example, if sweeping does not occur in Dec/Jan/Feb, the AF would be 9 mo./12 mo. = 0.75. For year-round sweeping, AF=1.0 <sup>1</sup>

As an alternative, the permittee may apply a credible sweeping model of the Watershed and perform continuous simulations reflecting build-up and wash-off of phosphorus or nitrogen using long-term local rainfall data.

**Table 2-4: Nutrient reduction efficiency factors for sweeping impervious areas**

<b>Frequency<sup>1</sup></b>	<b>Sweeper Technology</b>	<b>PRF<sub>sweeping</sub></b>	<b>NFR<sub>sweeping</sub></b>
2/year (spring and fall) <sup>2</sup>	Mechanical Broom	0.01	0.01
2/year (spring and fall) <sup>2</sup>	Vacuum Assisted	0.02	0.02
2/year (spring and fall) <sup>2</sup>	High-Efficiency Regenerative Air-Vacuum	0.02	0.02
Monthly	Mechanical Broom	0.03	0.03
Monthly	Vacuum Assisted	0.04	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08	0.08
Weekly	Mechanical Broom	0.05	0.06
Weekly	Vacuum Assisted	0.08	0.07
Weekly	High Efficiency Regenerative Air-Vacuum	0.10	0.10

<sup>1</sup>For full credit for monthly and weekly frequency, sweeping must be conducted year round. Otherwise, the credit should be adjusted proportionally based on the duration of the sweeping season (using AF factor).

<sup>2</sup> In order to earn credit for semi-annual sweeping the sweeping must occur in the spring following snow-melt and road sand applications to impervious surfaces and in the fall after leaf-fall and prior to the onset to the snow season.

**(2) Catch Basin Cleaning:** The permittee may earn phosphorus and/or nitrogen reduction credit(s) by removing accumulated materials from catch basins (i.e., catch basin cleaning) in the Watershed such that a minimum sump storage capacity of 50% is maintained throughout the year. The credits shall be calculated by using the following equations:

$$\text{Credit}_{P\text{ CB}} = \text{IA}_{\text{CB}} \times \text{PLER}_{\text{IC-land use}} \times \text{PRF}_{\text{CB}} \quad (\text{Equation 2-3})$$

$$\text{Credit}_{N\text{ CB}} = \text{IA}_{\text{CB}} \times \text{NLER}_{\text{IC-land use}} \times \text{NRF}_{\text{CB}} \quad (\text{Equation 2-4})$$

**Where:**

$\text{Credit}_{\text{CB}}$	=	Amount of nutrient load removed by catch basin cleaning (lb/year)
$\text{IA}_{\text{CB}}$	=	Impervious drainage area to catch basins (acres)
$\text{PLER}_{\text{IC-land use}}$	=	Phosphorus Load Export Rate for impervious cover and specified land use (lb/acre/yr) (see Table 2-1)
$\text{NLER}_{\text{IC-land use}}$	=	Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (see Table 2-2)
$\text{PRF}_{\text{CB}}$	=	Phosphorus Reduction Factor for catch basin cleaning (see Table 2-5)
$\text{NRF}_{\text{CB}}$	=	Nitrogen Reduction Factor for catch basin cleaning (See Table 2-5)

**Table 2-5: Nutrient reduction efficiency factors for semi-annual catch basin cleaning**

Frequency	Practice	$\text{PRF}_{\text{CB}}$	$\text{NRF}_{\text{CB}}$
Semi-annual	Catch Basin Cleaning	0.02	0.06

**Example 2-2: Calculation for catch basin cleaning credit ( $\text{Credit}_{\text{CB}}$ ):**



Commonwealth of Massachusetts  
City/Town of Sherborn

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: SW-1      3/11/2020      AM      Sunny, 50  
Hole #      Date      Time      Weather      Latitude      Longitude:  
1. Land Use Meadow      Grass      None  
(e.g., woodland, agricultural field, vacant lot, etc.)      Vegetation      Surface Stones (e.g., cobbles, stones, boulders, etc.)      Slope (%)  
Description of Location: \_\_\_\_\_

2. Soil Parent Material: Ablation Till      Till Ridge      Within fenced area  
Landform      Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from:      Open Water Body > 100 feet      Drainage Way > 25 feet      Wetlands > 100 feet  
Property Line > 10 feet      Drinking Water Well > 100 feet      Other \_\_\_\_\_ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No      If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No      If yes: 36" Depth Weeping from Pit      \_\_\_\_\_ Depth Standing Water in Hole

#### Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-24	Fill										
24-38	A/O	Sandy Loam									
38-49	G1	Sandy Loam	5 BG 6/1								Isolated pockets of loam
49	R										

Additional Notes:





Commonwealth of Massachusetts  
City/Town of Sherborn

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: SW-2      3/11/202      AM      Sunny, 50s      \_\_\_\_\_  
Hole #      0      Time      Weather      Latitude      Longitude:

1. Land Use: Meadow      Grass      None      2%  
(e.g., woodland, agricultural field, vacant lot, etc.)      Vegetation      Surface Stones (e.g., cobbles, stones, boulders, etc.)      Slope (%)

Description of Location: Parking area at southern portion of site.

2. Soil Parent Material: Ablation Till      \_\_\_\_\_      Grassed area near Hunter Lane  
Landform      Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body > 100 feet      Drainage Way > 25 feet      Wetlands > 100 feet  
Property Line > 10 feet      Drinking Water Well > 100 feet      Other \_\_\_\_\_ feet

4. Unsuitable  
Materials Present: ☒ Yes ☐ No      If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No      If yes: 60" Depth Weeping from Pit      \_\_\_\_\_ Depth Standing Water in Hole

#### Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-53	Fill										Trash, debris
53-106	C1	VFS/Loamy Sand	5 Y 7/2	48"					Massive	Friable	Pockets of loam, some stone and boulders
106	R										

Additional Notes:



Commonwealth of Massachusetts  
City/Town of Sherborn

## Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

### C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: SW-3      3/11/202      AM      Sunny, 50s      \_\_\_\_\_  
Hole #      0      Time      Weather      Latitude      Longitude:

1. Land Use: Meadow      Grass      None      2%  
(e.g., woodland, agricultural field, vacant lot, etc.)      Vegetation      Surface Stones (e.g., cobbles, stones, boulders, etc.)      Slope (%)

Description of Location: Parking area at southern portion of site.

2. Soil Parent Material: Ablation Till      \_\_\_\_\_      Grassed area near Hunter Lane  
Landform      Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body > 100 feet      Drainage Way > 25 feet      Wetlands > 100 feet  
Property Line > 10 feet      Drinking Water Well > 100 feet      Other \_\_\_\_\_ feet

4. Unsuitable  
Materials Present: ☒ Yes ☐ No      If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No      If yes: 60" Depth Weeping from Pit      \_\_\_\_\_ Depth Standing Water in Hole

#### Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-60	Fill										Trash, debris
60-108	C1	VFS/Loamy Sand	10 YR 7/6	60"					Massive	Friable	Pockets of loam, some stones and boulders

Additional Notes:

## **SECTION 6.0**

### **WATERSHED PLANS**

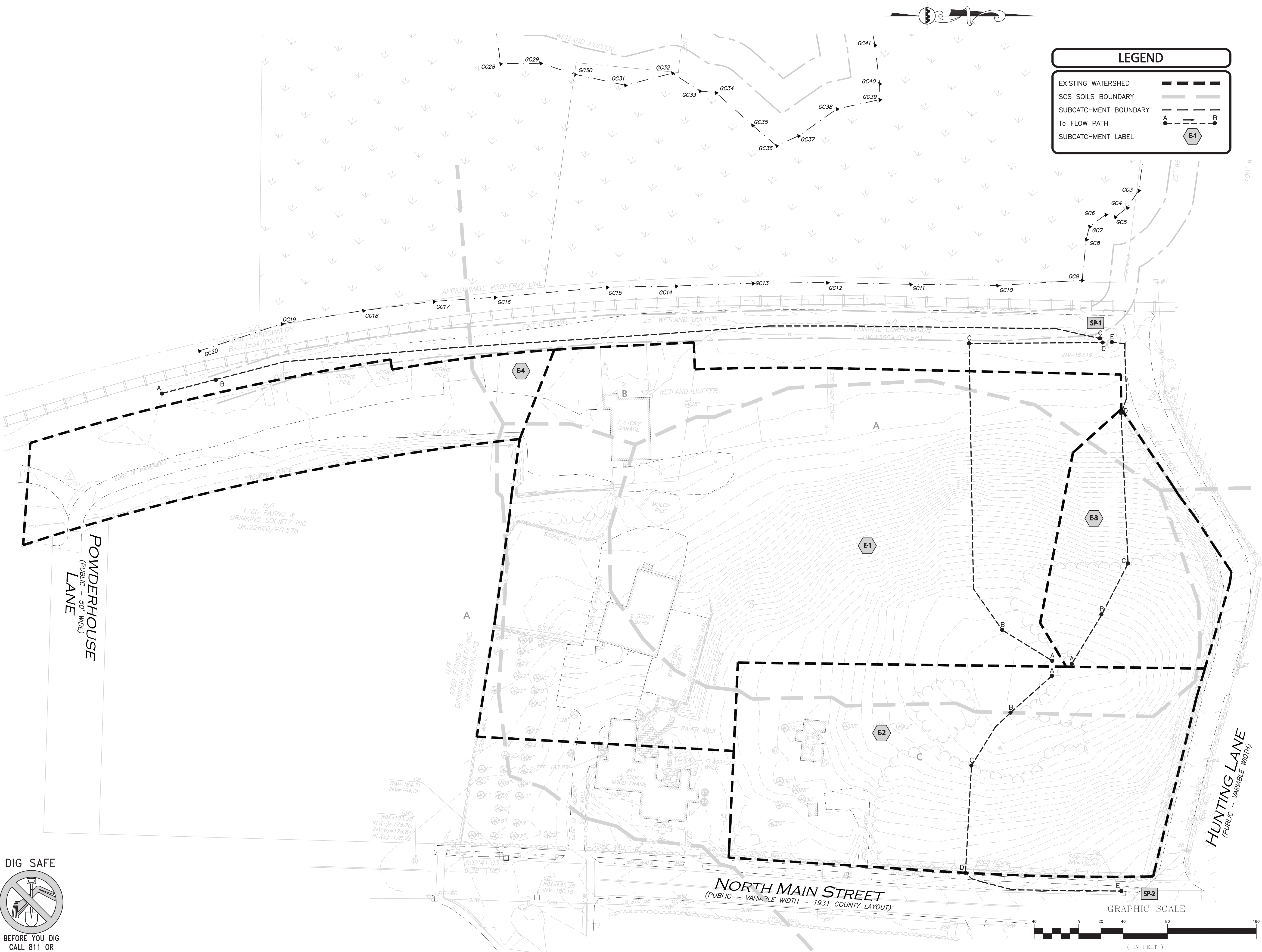


R:\PROJECTS\2513-01A\CIVIL\DRAWINGS\CURRENT\C-2513-01A\_PRE-WATERSHED.DWG

DIG SAFE



BEFORE YOU DIG  
CALL 811 OR  
1-888-DIG-SAFE  
1-888-344-7233



REV	DATE	DESCRIPTION
-----	------	-------------

APPLICANT/OWNER:		
BARKS 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:

**ALLEN & MAJOR ASSOCIATES, INC.**  
civil engineering • land surveying  
environmental consulting • landscape architecture  
www.allenmajor.com  
100 COMMERCE WAY  
WOBBURN MA 01801  
TEL: (781) 935-6889  
FAX: (781) 935-2896

WOBBURN, MA • LAKEVILLE, MA • MANCHESTER, NH

THIS DRAWING HAS BEEN PREPARED IN ELECTRONIC FORMAT. CLIENT/CUSTOMER'S REPRESENTATIVE OR CONSULTANT MAY BE PROVIDED COPIES OF DRAWINGS AND SPECIFICATIONS ON MAGNETIC MEDIA FOR HIS/HER INFORMATION AND USE FOR SPECIFIC APPLICATION TO THIS PROJECT. DUE TO THE POTENTIAL THAT THE MAGNETIC INFORMATION MAY BE MODIFIED UNINTENTIONALLY OR OTHERWISE, ALLEN & MAJOR ASSOCIATES, INC. MAY REMOVE ALL INDICATION OF THE DOCUMENT'S AUTHORSHIP ON THE MAGNETIC MEDIA. PRINTED REPRESENTATIONS OF THE DRAWINGS AND SPECIFICATIONS ISSUED SHALL BE THE ONLY RECORD COPIES OF ALLEN & MAJOR ASSOCIATES, INC.'S WORK PRODUCT.

DRAWING TITLE:	SHEET No.
----------------	-----------

PRE-WATERSHED	WS-1
---------------	------

Copyright © 2020 Allen & Major Associates, Inc.  
All Rights Reserved

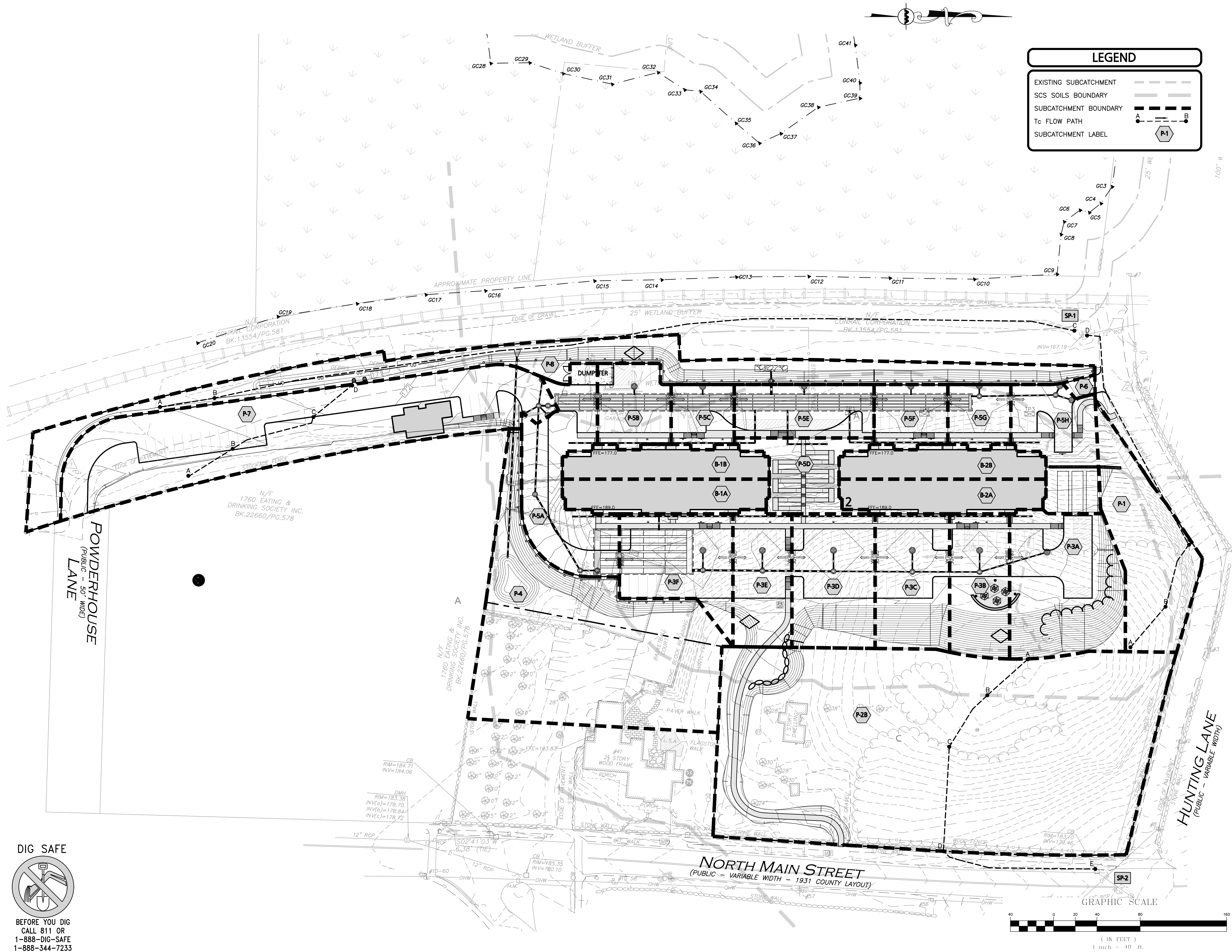


R:\PROJECTS\2513-01A\CIVIL\DRAWINGS\CURRENT\C-2513-01A\_POST-WATERSHED.DWG

DIG SAFE

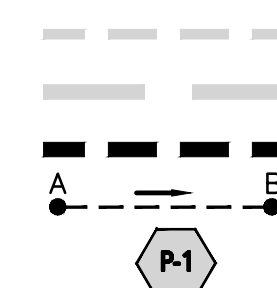


BEFORE YOU DIG  
CALL 811 OR  
1-888-DIG-SAFE  
1-888-344-7233



### LEGEND

EXISTING SUBCATCHMENT  
SCS SOILS BOUNDARY  
SUBCATCHMENT BOUNDARY  
Tc FLOW PATH  
SUBCATCHMENT LABEL



REV	DATE	DESCRIPTION
4	04-09-2021	REVS PER PEER REVIEW
3	10-01-2020	ISSUED FOR ZBA APPLICATION
2	05-21-2020	MISCELLANEOUS REVISIONS
1	01-21-2020	MISCELLANEOUS REVISIONS

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:

**ALLEN & MAJOR ASSOCIATES, INC.**  
civil engineering • land surveying  
environmental consulting • landscape architecture  
www.allenmajor.com  
100 COMMERCE WAY  
WOBBURN, MA 01801  
TEL: (781) 935-6889  
FAX: (781) 935-2896

WOBBURN, MA • LAKEVILLE, MA • MANCHESTER, NH

THIS DRAWING HAS BEEN PREPARED IN ELECTRONIC FORMAT. CLIENT/CUSTOMER'S REPRESENTATIVE OR CONSULTANT MAY BE PROVIDED COPIES OF DRAWINGS AND SPECIFICATIONS ON MAGNETIC MEDIA FOR HIS/HER INFORMATION AND USE FOR SPECIFIC APPLICATION TO THIS PROJECT. DUE TO THE POTENTIAL THAT THE MAGNETIC INFORMATION MAY BE MODIFIED UNINTENTIONALLY OR OTHERWISE, ALLEN & MAJOR ASSOCIATES, INC. MAY REMOVE ALL INDICATION OF THE DOCUMENT'S AUTHORSHIP ON THE MAGNETIC MEDIA. PRINTED REPRESENTATIONS OF THE DRAWINGS AND SPECIFICATIONS ISSUED SHALL BE THE ONLY RECORD COPIES OF ALLEN & MAJOR ASSOCIATES, INC.'S WORK PRODUCT.

DRAWING TITLE:

PRE-WATERSHED

SHEET No.

WS-1

Copyright © 2020 Allen & Major Associates, Inc.  
All Rights Reserved