

Stormwater Management Report

Site Plan

171 VFW Drive

Rockland, Massachusetts

June 6, 2024

Prepared for:

Rockland Station LLC

171 VFW Drive

Rockland, MA 02370

Prepared by:

Zenith Consulting Engineers, LLC

3 Main Street

Lakeville, MA 02347

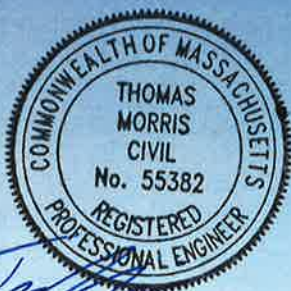


TABLE OF CONTENTS

NARRATIVE

DRAINAGE SUMMARY

SOIL REPORT

ILLICIT DISCHARGE STATEMENT

DEP STORMWATER CHECKLIST

GRATE ANALYSIS & PIPE DESIGN CALCULATIONS

FIRST DEFENSE UNIT SIZING CALCULATIONS

MOUNDING REPORT

HYDROCAD OUTPUT

Pre-Development Calculations

2 Year Storm

10 Year Storm

25 Year Storm

100 Year Storm

Post-Development Calculations

2 Year Storm

10 Year Storm

25 Year Storm

100 Year Storm

OPERATIONS AND MAINTENANCE PLAN

NARRATIVE

STORMWATER NARRATIVE

Site Plan – 171 VFW Drive Rockland, Massachusetts

The site is located at 171 VFW Drive and 216 Pleasant Street. The site is used by a landscaping supply company with a sales/showroom building and outdoor storage areas. The entire site drains west toward a stream which crosses VFW Drive. The on-site soils are all classified as Urban Fill which does not have a hydrologic soil group. Looking at surrounding upland areas and soil conditions witnessed in test pits performed on-site (see soil logs on plan set) it has been determined that the site should be considered to be within hydrologic soil group A.

The proposed work on the site includes the permitting of an accessory building which will be used for storage of items which are currently stored outside on the site. Construction will also consist of the necessary supporting infrastructure including pavement for access, drainage structures and utility connections.

The storm drainage system has been designed to not create an increase in the rate of storm water runoff when compared to existing conditions. In addition, the project's design will not reduce the quality of the runoff discharging from the site. The collection and treatment systems will be in the form of deep sump catch basins, First Defense water quality units and a subsurface chamber drain field. Hydrologic computations were performed in order to model the rate of flow of stormwater from the site under both existing and proposed conditions for the 2, 10, 25, and 100-year storms. For post-development the runoff from the project site is zero because the drainage field has been sized to capture and infiltrate the runoff from the proposed improvements up to at least the 100-year storm.

1.0 STORM WATER COLLECTION SYSTEM

The runoff from the site will run through a treatment train on the site. Runoff will be collected from the impervious area with catch basins. The catch basins will be precast concrete. This runoff will then be routed through one of the two First Defense water quality units prior to discharge to the drainage field.

The catch basins will have a four-foot-deep sump for sediment settlement and will be equipped with a hood on the outlet to prevent discharge of floating debris and other substances. The collected runoff will be conveyed through smooth interior walled HDPE piping with corrugated exterior walls. The corrugated exterior of the piping provides for exceptional strength and bearing capacity. The smooth interior walls of the piping provide a smoothness that exceeds that of concrete pipe, thus providing increased hydraulic capacity. The piping is designed to provide self cleansing velocities in large storm events to remain essentially maintenance free throughout its life.

The proposed treatment train will provide removal of Total Suspended Solids (TSS) prior to the stormwater chambers designed to control runoff up to, and including, the 100-year storm event. The infiltration system has been designed to meet the requirement for recharge and to handle more than the 100-year design storm event.

2.0 STORM WATER MANAGEMENT FACILITIES

Current Department of Environmental Protection Policies require that the peak runoff rate after development is not more than peak runoff rate prior to development for the 2 and 10 year 24-hour storm events. Additionally, it is required that the storm water management system be evaluated for the 100-year storm projections. The town of Rockland further requires analysis of the 25-year storm.

Hydrologic modeling has been conducted for the design of the infiltration area to determine appropriate sizing and infiltration characteristics. HydroCAD Version 10.00 was utilized to perform this hydrologic and hydraulic modeling. The 2, 10, 25, and 100-year design storms were evaluated. The hydrologic and hydraulic modeling established that the stormwater management system will effectively attenuate the full range of design storms. That is, the peak rate of flow after development will be equal to or less than under existing conditions. The drainage summary provided with this document tabulates the projected runoff rates when the site is subjected to the design storm events. The complete hydrologic and hydraulic computational output is presented in this document.

2.1 LOW IMPACT DEVELOPMENT (LID) CONSIDERATIONS

The Massachusetts Stormwater Handbook encourages the use of Low Impact Development (LID) techniques by offering design credits for their implementation. No credits are sought or required for this project and, therefore, no LID techniques are required. Nevertheless, the project design incorporates LID techniques by proposing no impacts to wetlands and the minimum amount of pavement required to provide safe vehicular access to and around the site for all vehicle types.

3.0 WATER QUALITY CONSIDERATIONS

On November 18, 1996, The Massachusetts Department of Environmental Protection (MADEP) issued the Storm Water Management Policy. The goal of this policy is to improve water quality and address flooding problems, which are sometimes caused by development projects, by the implementation of performance standards for storm water management. These standards were issued as guidelines with the possibility that in several years, after review by design engineers, they might be implemented as regulations. The project was designed to meet and exceed all relevant standards established in the policy. The following sections describe how each of these standards will be achieved on this project by incorporating Best Management Practices into the design. In January, 2008, the revised policy was issued.

3.1 UNTREATED STORM WATER - Standard 1

Standard 1 recommends that no new storm water conveyance, such as storm drain outfalls, discharge untreated storm water directly to wetlands or waterways of the Commonwealth. Flows from woods, fields, and other undeveloped areas are to be considered uncontaminated, however, runoff from paved road surfaces should receive treatment prior to discharge.

In designing this project, provisions have been made so that the runoff from all proposed paved surfaces will receive proper treatment prior to discharge. All the proposed improvements will be located and graded such that runoff from the pavement will be directed to a series of BMP structures. Runoff from these areas will be collected and conveyed to the water quality measures through deep sump catch basins and subsurface piping. This collected runoff will receive treatment utilizing the proposed Best Management Practice (BMP) measures as further described under the discussions for Standards 2 through 9. Through the collection and treatment of all runoff from paved areas, DEP Standard 1 is satisfied.

3.2 POST DEVELOPMENT PEAK DISCHARGE RATES - Standard 2

Standard 2 prescribes that storm water management systems be implemented in order to ensure that post-development peak rates of discharge do not exceed existing rates of runoff for standard 2-year and 10-year design storms. In addition, the pre and post peak rates for the 100-year storm must be evaluated to assure that there will not be increased off-site flooding. In addition, the town of Rockland requires this project to evaluate the 25-year storm event. Hydrologic calculations have been conducted in designing the storm water control measures to ensure that this standard is satisfied.

HydroCAD version 10.00, a computer aided design program, was selected for modeling the hydrology and hydraulics of storm water runoff for the site and its contributing drainage area. This program utilizes the latest techniques to predict the consequences of any given storm event and to verify that the drainage system is adequate to meet the performance standards for the area under consideration. The HydroCAD computer model uses TR-20 and TR-55 methodologies to generate runoff hydrographs and perform hydraulic routings through the modeled project.

Runoff hydrographs were generated for each subcatchment area. For post-development, all paved areas, roof areas and lawn areas were considered in determining composite runoff curve numbers for each subcatchment. For pre-development, all subcatchments were evaluated in their existing condition. As described in the narrative of this report, the soils within the development area of this project are hydrologic soils group A.

In evaluating the same areas under pre and post development conditions, a direct comparison can be made as to the net increase or decrease in runoff rates attributable to altered land uses. The Drainage Summary table included in this report presents a summary of the hydrologic modeling conducted for this project. As presented in this table, the drainage system successfully moderates the flow for the full range of design storms and this standard is met by both state and town requirements.

3.3 RECHARGE TO GROUNDWATER - STANDARD 3

The loss of annual recharge to groundwater will be minimized through the infiltration of runoff from the proposed pavement and roof areas. The annual recharge from the post development site will approximate the annual recharge from the pre-development conditions based on an assessment of soil types. Standard 3 of the DEP Stormwater Policy prescribes that the storm water runoff volume to be recharged to groundwater should be determined using existing soil.

As described in the narrative of this report, the soils within the development area of this project are hydrologic soils group A. The DEP Stormwater Policy requires that a certain volume of runoff be infiltrated to groundwater based on the type of soil present and the amount of impervious area being generated by the proposed development.

SOIL GROUP	A	B	C	D
DEPTH FACTOR	0.6 inch	0.35 inch	0.25 inch	0.1 inch

The proposed amount of impervious area over A soils is 84,725 sf. A small portion of the proposed pavement is not directed to the proposed infiltration system so an area adjustment must be made. The required volume of recharge is:

$$(84,725 \text{ sf} \times 0.6 \text{ in}) \times (84,725 \text{ sf} / 83,365 \text{ sf}) = 4,305 \text{ cf}$$

The volume provided within the proposed chamber field is 18,294 cf. (see HydroCAD calculations) thus, this criterion is satisfied.

3.4 REMOVAL OF 80% OF TOTAL SUSPENDED SOLIDS - Standard 4

The required water quality volume is determined by multiplying the proposed impervious area by a water quality depth. In this case the water depth is 1" due to infiltration greater than 2.4 inches/hour and being located within an ORW.

$$\text{Water Quality Volume} = 84,725 \text{ sf} \times 1 \text{ in} = 7,060 \text{ cf}$$

As stated in the Standard 3 compliance, the area provided within the proposed chamber field is 18,294 cf. thus, this criterion is satisfied.

The proposed stormwater BMP's have been designed in order to meet the objectives of removing 80% of the average annual load of total suspended solids. In this case the BMP's must also provide 44% removal of the average annual load of total suspended solids prior to reaching the infiltration BMP due to infiltration greater than 2.4 inches/hour and being located within an ORW.

PRE-TREATMENT

A BMP	B TSS Removal Rate	C Starting TSS Load ⁽¹⁾	D Amount Removed (BxC)	E Remaining Load (C-D)
Deep-Sump, Hooded Catch Basin	25% ⁽²⁾	1.00	0.25	0.75
First Defense HC 4ft Diameter	50% ⁽³⁾	0.75	0.375	0.375
TOTAL TSS REMOVAL			0.625 x 100 = 62.5% Removal	

TREATMENT

A BMP	B TSS Removal Rate	C Starting TSS Load ⁽¹⁾	D Amount Removed (BxC)	E Remaining Load (C-D)
Deep-Sump, Hooded Catch Basin	25% ⁽²⁾	1.00	0.25	0.75
Chamber Field w/ Pre-Treatment (First Defense)	80% ⁽²⁾	0.75	0.60	0.15
TOTAL TSS REMOVAL			0.85 x 100 = 85% Removal	

(1) Equals remaining load from previous BMP (E)

(2) TSS Removal Rates As Published in the DEP Storm Water Policy Handbook (3/97)

(3) TSS Removal Rate as verified by NJCAT in February 2016, rev. May 2021)

3.5 USES WITH HIGHER POTENTIAL POLLUTANT LOADS - Standard 5

The DEP Storm Water Management Policy - Standard 5 requires that storm water discharges with higher potential pollutant loads, such as gas stations, be provided with specific BMP's. The use of infiltration practices for these discharges prior to pretreatment is prohibited. This development is not considered a use with a higher potential pollutant load. As such, this standard is satisfied.

It should be noted that a Source Control and Pollution Prevention Plan are included in the Operations and Maintenance Plan.

3.6 STORM WATER DISCHARGES TO CRITICAL AREAS - Standard 6

Standard 6 of the DEP Storm water Policy seeks to protect critical areas. Critical areas are specifically designated Outstanding Resource Waters (ORW's) such as shell fish beds, swimming beaches, cold water fisheries and recharge areas for public water supplies. Such areas require the use of specific BMP's. This project is partially located within an ORW. This requires a few considerations for the drainage design;

- BMP's must be chosen from the recommended list provided in Volume 1 Chapter 1 of the Stormwater Handbook. Deep sump catch basins and proprietary separators (First Defense unit) are recommended for pretreatment and subsurface structures (chamber field) is recommended for infiltration.
- The 1" water quality depth must be used to determine the required water quality volume (see Standard 4 above).
- 44% TSS removal must be met prior to infiltration. This has been met by the proposal of deep sump catch basins and a First Defense water quality unit prior to discharge to the proposed chamber field (see Standard 4 above).

Meeting the requirements listed above means that the standard has been met.

3.7 REDEVELOPMENT OF PREVIOUSLY DEVELOPED SITES - Standard 7

Standard 7 applies to sites which have been previously developed and are being redeveloped. Diminished performance of BMP's is allowed in these areas. Although the project site is previously developed, this project proposes an increase in impervious area versus the existing condition and does not meet the requirements of a re-development.

3.8 EROSION AND SEDIMENT CONTROL -Standard 8

Erosion and sediment control measures have been developed for this project and are included in the construction set of drawings. These plans show the proposed locations for erosion control devices. The following supplemental provisions are also a part of this plan.

Erosion and Sedimentation Control measures which are proposed to be implemented during construction include the installation of silt sacks and silt sock.

- Erosion control devices such as silt fence, haybales and silt socks shall be inspected after every major rainfall runoff event (over 1½" depth of precipitation). All damaged or misaligned devices shall be immediately repaired. Silt shall be immediately removed from all areas of the silt fence when depth of accumulation exceeds 4 inches.
- Sumps and out falls shall be inspected after every major rainfall runoff event (over 1½" depth of precipitation). Silt shall be immediately removed from all sumps where the depth of accumulation exceeds 9 inches.)
- All exposed construction areas will be stabilized upon completion in order to minimize the time that these areas are unstabilized.

With the full impact of the measures presented on the Erosion and Sedimentation Control Plans, along with the provisions stipulated above, Standard 8 will be satisfied.

3.9 OPERATIONS AND MAINTENANCE PLAN - Standard 9

Standard 9 of the DEP Storm Water Policy prescribes the adoption of a formal operation and maintenance plan to ensure that the storm water management systems function properly as designed. The proposed Operations and Maintenance Plan is attached in an appendix to this report. The plan includes Stormwater operations and Maintenance procedures, Construction Period Pollution Control measures and a Source Control and Pollution Prevention Plan.

DRAINAGE SUMMARY

Site Plan
171 VFW Drive
Rockland, Massachusetts

Drainage Summary

FLOW TO PLEASANT STREET:

Storm Event	Pre-Dev Rate $Q_{\max}(\text{cfs})$	Post-Dev Rate $Q_{\max}(\text{cfs})$
2-Year (3.35")	0.88	0.00
10-Year (5.09")	1.73	0.00
25-Year (6.18")	2.28	0.00
100-Year (7.86")	3.15	0.00

FLOW WEST TOWARD STREAM:

Storm Event	Pre-Dev Rate $Q_{\max}(\text{cfs})$	Post-Dev Rate $Q_{\max}(\text{cfs})$
2-Year (3.35")	2.67	0.00
10-Year (5.09")	5.48	0.00
25-Year (6.18")	7.33	0.00
100-Year (7.86")	10.23	0.00

The pre-development areas are eliminated in the post-development state because the area is directed to the proposed drainage system which is sized to infiltrate up to at least the 100-year storm.

SOIL REPORT



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 **Plymouth County, Massachusetts**



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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.

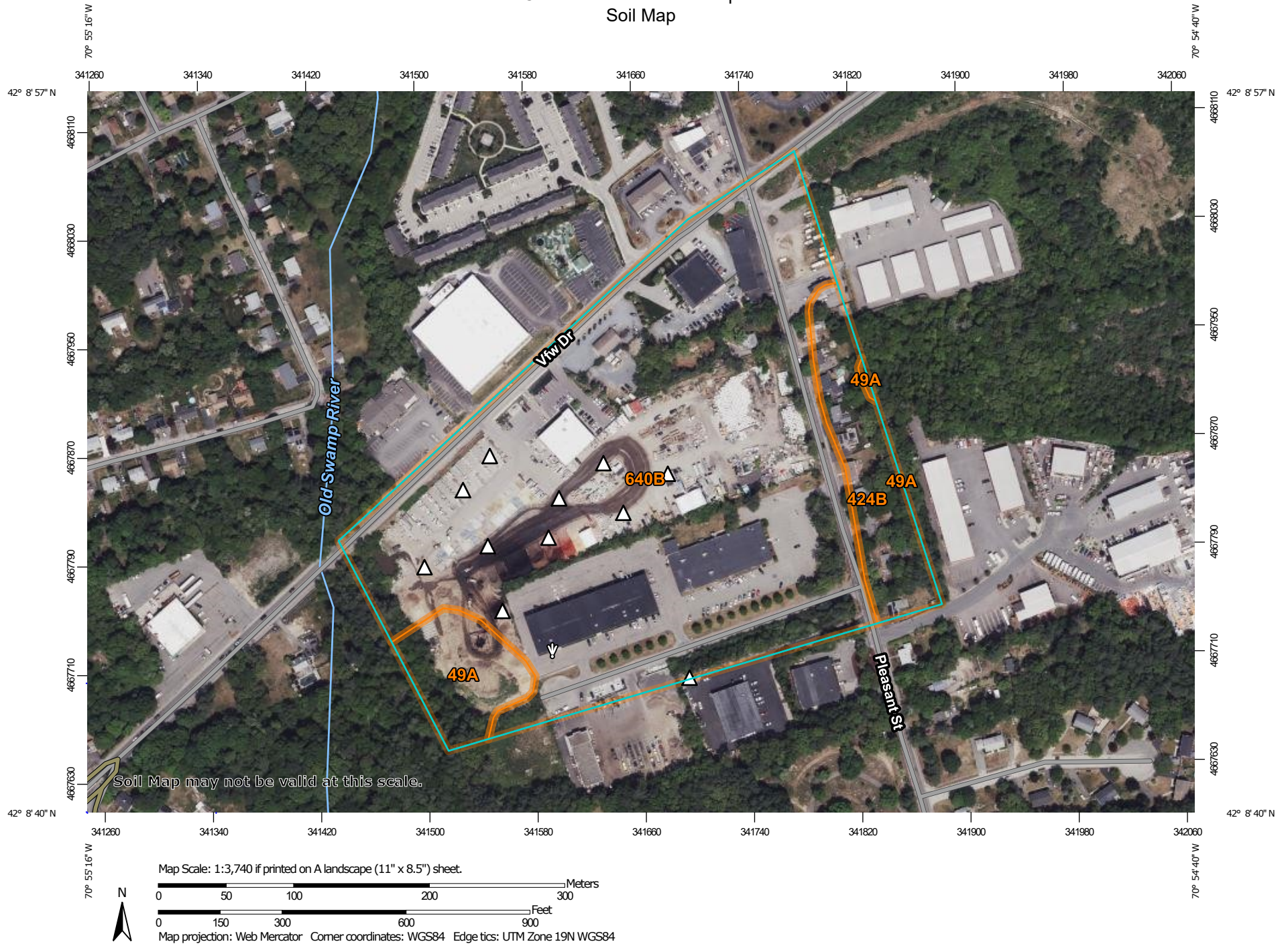
Contents

Preface	2
Soil Map	5
Soil Map.....	6
Legend.....	7
Map Unit Legend.....	8
Map Unit Descriptions.....	8
Plymouth County, Massachusetts.....	10
49A—Norwell mucky fine sandy loam, 0 to 3 percent slopes, extremely stony.....	10
424B—Canton very fine sandy loam, 3 to 8 percent slopes, extremely bouldery.....	11
640B—Urban land, till substratum, 0 to 8 percent slopes.....	13
Soil Information for All Uses	14
Soil Properties and Qualities.....	14
Soil Qualities and Features.....	14
Hydrologic Soil Group.....	14

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



Custom Soil Resource Report

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 1:12,000.

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: Plymouth County, Massachusetts
Survey Area Data: Version 16, Sep 10, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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
49A	Norwell mucky fine sandy loam, 0 to 3 percent slopes, extremely stony	1.6	6.2%
424B	Canton very fine sandy loam, 3 to 8 percent slopes, extremely bouldery	2.4	8.9%
640B	Urban land, till substratum, 0 to 8 percent slopes	22.6	84.9%
Totals for Area of Interest		26.6	100.0%

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

Custom Soil Resource Report

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.

Plymouth County, Massachusetts

49A—Norwell mucky fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: bd1w

Elevation: 10 to 400 feet

Mean annual precipitation: 41 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Norwell, extremely stony, and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norwell, Extremely Stony

Setting

Landform: Drainageways, depressions

Landform position (two-dimensional): Footslope, toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Sandy supraglacial meltout till over coarse-loamy lodgment till

Typical profile

Oe - 0 to 4 inches: moderately decomposed plant material

A - 4 to 8 inches: mucky fine sandy loam

Bg1 - 8 to 14 inches: gravelly sandy loam

Bg2 - 14 to 19 inches: loamy fine sand

Cdg - 19 to 29 inches: gravelly coarse sandy loam

Cd - 29 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 3 percent

Surface area covered with cobbles, stones or boulders: 9.0 percent

Depth to restrictive feature: 12 to 20 inches to densic material

Drainage class: Poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low
(0.00 to 0.14 in/hr)

Depth to water table: About 0 to 12 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Available water supply, 0 to 60 inches: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Ecological site: F144AY041MA - Very Wet Till Depressions

Hydric soil rating: Yes

Minor Components

Scituate, very stony

Percent of map unit: 5 percent
Landform: Drumlins, ridges
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluvium
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Mattapoisett, extremely stony

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Brockton, extremely stony

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Ridgebury, extremely stony

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

424B—Canton very fine sandy loam, 3 to 8 percent slopes, extremely bouldery

Map Unit Setting

National map unit symbol: 9y4s
Elevation: 30 to 400 feet
Mean annual precipitation: 41 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Canton, extremely bouldery, and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton, Extremely Bouldery

Setting

Landform: Ridges, hills, till plains

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Interfluve

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Coarse-loamy eolian deposits over sandy and gravelly supraglacial meltout till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

Oe - 1 to 2 inches: moderately decomposed plant material

A - 2 to 3 inches: very fine sandy loam

E - 3 to 4 inches: very fine sandy loam

Bw1 - 4 to 5 inches: very fine sandy loam

Bw2 - 5 to 15 inches: very fine sandy loam

Bw3 - 15 to 24 inches: fine sandy loam

BC - 24 to 28 inches: gravelly loamy sand

2C1 - 28 to 49 inches: gravelly coarse sand

2C2 - 49 to 73 inches: gravelly loamy coarse sand

Properties and qualities

Slope: 3 to 8 percent

Surface area covered with cobbles, stones or boulders: 7.5 percent

Depth to restrictive feature: 20 to 36 inches to strongly contrasting textural stratification

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Gloucester, extremely bouldery

Percent of map unit: 5 percent

Landform: Ground moraines, hills

Landform position (two-dimensional): Summit, shoulder

Landform position (three-dimensional): Interfluve

Custom Soil Resource Report

Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Newfields, extremely stony

Percent of map unit: 5 percent
Landform: Till plains, hills, moraines
Landform position (two-dimensional): Shoulder, footslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Montauk, very stony

Percent of map unit: 5 percent
Landform: Ground moraines, drumlins, till plains
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Barnstable, extremely bouldery

Percent of map unit: 5 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

640B—Urban land, till substratum, 0 to 8 percent slopes

Map Unit Composition

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

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 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.

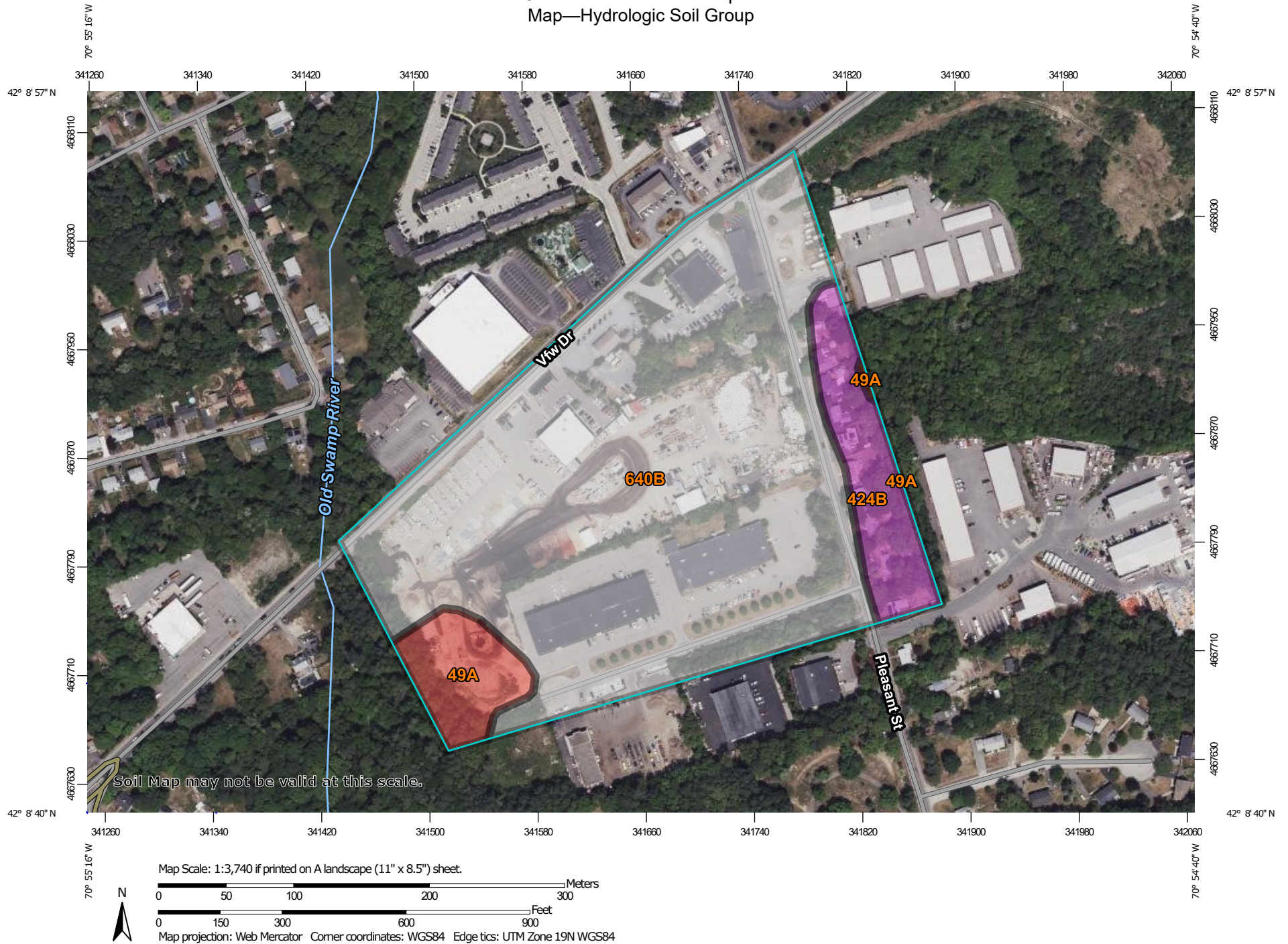
Custom Soil Resource Report

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



Custom Soil Resource Report

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 1:12,000.

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: Plymouth County, Massachusetts
Survey Area Data: Version 16, Sep 10, 2023

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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
49A	Norwell mucky fine sandy loam, 0 to 3 percent slopes, extremely stony	D	1.6	6.2%
424B	Canton very fine sandy loam, 3 to 8 percent slopes, extremely bouldery	A	2.4	8.9%
640B	Urban land, till substratum, 0 to 8 percent slopes		22.6	84.9%
Totals for Area of Interest			26.6	100.0%

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

ILLICIT DISCHARGE STATEMENT



3 Main Street Lakeville, MA 02347
(508) 947-4208 - www.zcellc.com

- Civil Engineering
- Septic Design (Title 5)
- Septic Inspections (Title 5)
- Commercial and Industrial Site Plans
- Chapter 91 Permitting

ILLICIT DISCHARGE STATEMENT (STANDARD #10)

RE: 171 VFW Drive Rockland, MA

Standard 10 of the Massachusetts Stormwater Handbook prohibits illicit discharges to stormwater management systems. The following is an illicit discharge compliance statement based on existing conditions and design conditions for the proposed project.

EXISTING CONDITIONS

The existing site is used by a landscaping supply company with a sales/showroom building and outdoor storage areas. Based on all the information available to the undersigned, and therefore, to the best of my knowledge, there are no current illicit discharges to the storm drainage system. If during construction, an illicit discharge is discovered, it shall be removed immediately.

PROPOSED DESIGN

The proposed project design does not include any illicit discharges. There are no points in the proposed storm drainage system where illicit discharges are likely to occur.

I hereby certify that the preceding is accurate.

Representative of Rockland Station LLC.

DEP STORMWATER CHECKLIST



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

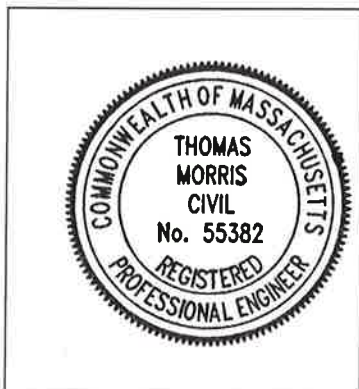
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Thomas Morris 6-6-24

Signature and Date

Checklist

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

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

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

- ☒ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☒ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
 - ☐ Credit 1
 - ☐ Credit 2
 - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☒ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- ☒ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☐ Static
 - ☒ Simple Dynamic
 - ☐ Dynamic Field¹
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- ☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☒ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☐ is near or to other critical areas
 - ☒ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
 - ☐ Redevelopment Project
 - ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☒ Description and delineation of public safety features;
 - ☒ Estimated operation and maintenance budget; and
 - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☒ An Illicit Discharge Compliance Statement is attached;
- ☐ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

GRATE ANALYSIS & PIPE DESIGN CALCULATIONS

Input Values

SINGLE GRATE

K Values for grate R-3405-A with a transverse gutter slope of 2%	
LONGITUDINAL SLOPE (%)	K
1	19.00
1.5	20.75
2	22.50
2.5	23.75
3	25.00
3.5	26.25
4	27.50
4.5	28.75
5	30.00
5.5	31.25
6	32.50

DOUBLE GRATE

K Values for grate R-3403F-A with a transverse gutter slope of 2%	
LONGITUDINAL SLOPE (%)	K
1	22.80
1.5	25.55
2	28.30
2.5	29.55
3	30.80
3.5	32.05
4	33.30
4.5	34.55
5	35.80
5.5	37.05
6	38.30

ROADWAY PROPERTIES

Roughness Coefficient of Bituminous Asphalt	0.016
Transverse Slope	0.02

Geometric Values for grate R-3405-A

Square Dimention (in.)	23.6
Free Area (sq. ft.)	1.3

STORM EVENT

100	Year
-----	------

GUTTER DEPTH OF FLOW

$$D = \left(\frac{QN}{0.56Z\sqrt{S}} \right)^{\frac{3}{8}}$$

Q = Channel flow (cfs)
 Z = Reciprocal of transverse slope (ft/ft)
 S = Longitudinal Slope
 N = Roughness Coefficient
 D = Depth (ft)

GUTTER CAPACITY OF GRATE

$$Q = KD^{\frac{5}{3}}$$

Q = Grate capacity (cfs)
 K = Grate coef. from "Inlet Grate Capacities Manual"
 D = Depth of flow in feet (from previous equation)

ORIFICE FLOW EQUATION

$$Q = .6A\sqrt{2gh}$$

Q = Capacity (cfs)
 A = Free open area (sq. ft.)
 g = Acceleration of Gravity (32.2 ft/s²)
 h = Head (ft.)

WEIR EQUATION

$$Q = 3.3P(h)^{\frac{3}{2}}$$

Q = Capacity (cfs)
 P = Perimeter (ft.)
 h = Head (ft.)

CATCH BASINS IN DEPRESSIONS - 100 YEAR STORM

STRUCTURE	CONTRIBUTING FLOW (cfs)	CARRYOVER FLOW (cfs)	TOTAL FLOW (cfs)	SIDES ON CURB	(S)INGLE OR (D)OUBLE	P (ft)	DESIGN HEAD OVER GRATE (ft)	ORIFICE		WEIR		MAX CAPACITY (cfs)	ACTUAL DEPTH (ft)	OVERFLOW (cfs)	OVERFLOW TO
								Q _{MAX} (cfs)	H (ft)	Q _{MAX} (cfs)	H (ft)				
PIPE NETWORK TO BASIN 1															
CB-1	2.62	0.00	2.62	1	S	5.9	0.5	4.43	0.17	6.89	0.26	4.43 cfs	0.17 ft.	0.00	CB-2
CB-2	3.17	0.00	3.17	0	S	7.9	0.5	4.43	0.26	9.19	0.25	4.43 cfs	0.26 ft.	0.00	-
CB-3	2.62	0.00	2.62	1	S	5.9	0.5	4.43	0.17	6.89	0.26	4.43 cfs	0.17 ft.	0.00	CB-4
CB-4	0.82	0.00	0.82	1	S	5.9	0.5	4.43	0.02	6.89	0.12	4.43 cfs	0.02 ft.	0.00	-
TRENCH	0.25	0.00	0.25	1	S	5.9	0.5	4.43	0.00	6.89	0.05	4.43 cfs	0.00 ft.	0.00	CB-2

RATIONAL METHOD OF FLOWS TOWARD INLET GRATES - 100 YEAR STORM									
FROM	UNPAVED AREA	UNPAVED COEFFICIENT	PAVE/ROOF AREA	PAVE/ROOF COEFFICIENT	AREA ACRES	WEIGHTED COEFFICIENT	TOC MIN.	i	Q cfs
PIPE NETWORK TO CHAMBER FIELD									
CB-1	5070	0.20	11355	0.90	0.38	0.68	6	10.1	2.62
CB-2	3840	0.20	14255	0.90	0.42	0.75	6	10.1	3.17
CB-3	740	0.20	12310	0.90	0.30	0.86	6	10.1	2.62
CB-4	1090	0.20	3685	0.90	0.11	0.74	6	10.1	0.82
TRENCH	0	0.20	1170	0.90	0.03	0.90	6	10.1	0.25
DMH-1	0	0.20	20500	0.90	0.47	0.90	6	10.1	4.30
DMH-2	0	0.20	20500	0.90	0.47	0.90	6	10.1	4.30

Flow to DMH-1 and DMH-3 added from roof leaders.

OPEN CHANNEL FLOW CAPACITIES								
FROM	TO	PIPE DIA.	FROM INVERT	TO INVERT	PIPE LENGTH	SLOPE FT./FT.	N VALUE	Q FULL cfs
PIPE NETWORK TO CHAMBER FIELD (NORTH SIDE)								
CB-1	DMH-1	12	142.30	141.00	141	0.009	0.012	3.72
TRENCH	DMH-1	8	141.80	141.00	53	0.015	0.012	1.61
DMH-1	DMH-2	15	140.90	140.50	36	0.011	0.012	7.40
CB-2	DMH-2	12	140.80	140.50	33	0.009	0.012	3.69
DMH-2	FIELD	18	140.50	140.00	50	0.010	0.012	11.41
PIPE NETWORK TO CHAMBER FIELD (SOUTH SIDE)								
CB-3	DMH-3	12	142.00	140.20	164	0.011	0.012	4.05
CB-4	DMH-3	12	140.50	140.20	13	0.023	0.012	5.88
DMH-3	FIELD	12	140.20	140.00	5	0.040	0.012	7.74

ZENITH CONSULTING ENGINEERS, LLC
CIVIL ENGINEERING

3 MAIN STREET
LAKEVILLE, MA 02347
TEL: (508) 947-4208

Pipe Design Calculations

PROJECT 171 VFW Dr Rockland

INLET GRATE AND PIPE ANALYSIS - 100 YEAR STORM

CALCULATED BY: TEM

DATE

CHECKED BY:

DATE

LOCATION		GRATE ANALYSIS							PIPE ANALYSIS							CHECK?
FROM	TO	(S)ag or (G)utter	FLOW TO	GRATE	OVER-	DEPT	FLOW TO	PIPE	PIPE	LNTH	SLOPE	Q	Q	V	V	
			GRATE	CAPACITY	FLOW	H OF	PIPE	SIZE	FT.	FT./FT.	CAPACITY	ACTUAL	FULL	ACTUAL		
PIPE NETWORK TO CHAMBER FIELD (NORTH SIDE)																
CB-1	DMH-1	S	2.62	4.43	0.00	2.1"	2.62	12	141	0.009	3.72	2.62	4.73	5.02	OK	
TRENCH	DMH-1	S	0.25	4.43	0.00	0.0"	0.25	8	53	0.015	1.61	0.25	4.62	3.35	OK	
DMH-1	DMH-2						7.16	15	36	0.011	7.40	7.16	6.03	6.72	OK	
CB-2	DMH-2	S	3.17	4.43	0.00	3.1"	3.17	12	33	0.009	3.69	3.17	4.70	5.19	OK	
DMH-2	FIELD						10.33	18	50	0.010	11.41	10.33	6.46	7.17	OK	
PIPE NETWORK TO CHAMBER FIELD (SOUTH SIDE)																
CB-3	DMH-3	S	2.62	4.43	0.00	2.1"	2.62	12	164	0.011	4.05	2.62	5.16	5.42	OK	
CB-4	DMH-3	S	0.82	4.43	0.00	0.2"	0.82	12	13	0.023	5.88	0.82	7.49	5.05	OK	
DMH-3	FIELD						7.74	12	5	0.040	7.74	7.74	9.86	10.99	OK	

Flow to DMH-1 and DMH-3 added from roof leaders.

FIRST DEFENSE UNIT SIZING CALCULATIONS



3 Main Street Lakeville, MA 02347
(508) 947-4208 - www.zcellc.com

- Civil Engineering
- Septic Design (Title 5)
- Septic Inspections (Title 5)
- Commercial and Industrial Site Plans
- Chapter 91 Permitting

FIRST DEFENSE UNIT SIZING CALCULATIONS

RE: Accessory Building at 171 VFW Drive Rockland, MA

These calculations follow the Mass DEP “Standard Method to Convert Required Water Quality Volume to a Discharge Rate for Sizing Flow Based Manufactured Proprietary Stormwater Treatment Practices”.

Flow rate (Q) is found with the following equation:

$$Q_1 = (q_u) (A) (WQV)$$

Where:

Q_1 = flow rate associated with the first ½ inch of runoff

q_u = the unit peak discharge (csm/in)

Value determined from table in document referenced above based on T_c

A = contributing impervious drainage area (square miles)

WQV = water quality volume (½ inch in this case)

FLOW TO PROPOSED DMH-2

$q_u = 774$ csm/in ($T_c = 6$ min.)

A = 47,280 s.f.

$$Q_1 = (774 \text{ csm/in}) (47,280 \text{ s.f.}) (1 \text{ in}) / (27,878,400 \text{ s.f. per square mile}) = \underline{\underline{1.31 \text{ cfs}}}$$

Per our 100-year Pipe Calculations the peak flow rate is **10.33 cfs**

FLOW TO PROPOSED DMH-3

$q_u = 774$ csm/in ($T_c = 6$ min.)

A = 36,495 s.f.

$$Q_{0.5} = (774 \text{ csm/in}) (36,495 \text{ s.f.}) (1 \text{ in}) / (27,878,400 \text{ s.f. per square mile}) = \underline{\underline{1.01 \text{ cfs}}}$$

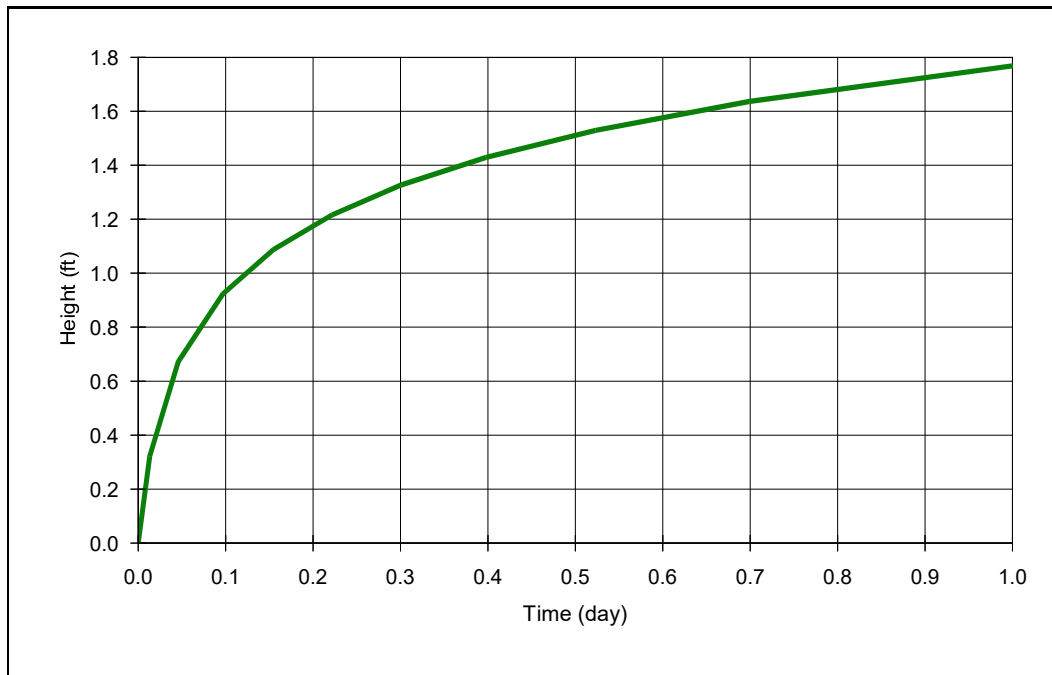
Per our 100-year Pipe Calculations the peak flow rate is **7.74 cfs**

FIRST DEFENSE UNITS PROVIDED

A 4' diameter First Defense unit (model FDHC-3) shall be used after each of the two catch basins. The FDHC-4 is capable of treating up to **1.50 cfs** (per NJCAT Technology Verification) and has a peak online flow rate of **18 cfs** (per manufacturer specifications) and is therefore more than adequate for each case above.

MOUNDING REPORT

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: Zenith Consulting Engineers

PROJECT: 171 VFW Dr Rockland - Chamber Field

ANALYST: Tom Morris, P.E., S.E.

DATE: 6/3/2024 TIME: 8:53:03 AM

INPUT PARAMETERS

Application rate: 6 c.ft/day/sq. ft

Duration of application: 1 day

Total simulation time: 1 day

Fillable porosity: 0.2

Hydraulic conductivity: 500 ft/day

Initial saturated thickness: 20 ft

Length of application area: 108 ft

Width of application area: 72.17 ft

No constant head boundary used

Groundwater mounding @

X coordinate: 0 ft

Y coordinate: 0 ft

Total volume applied: 46766.16 cft

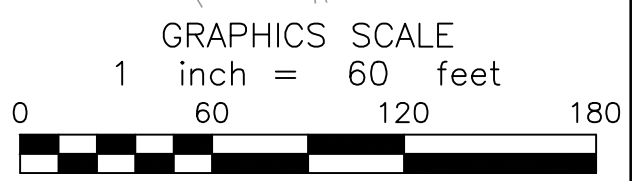
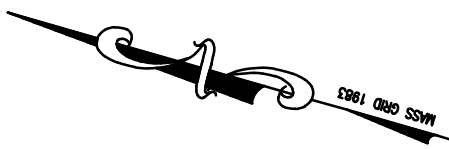
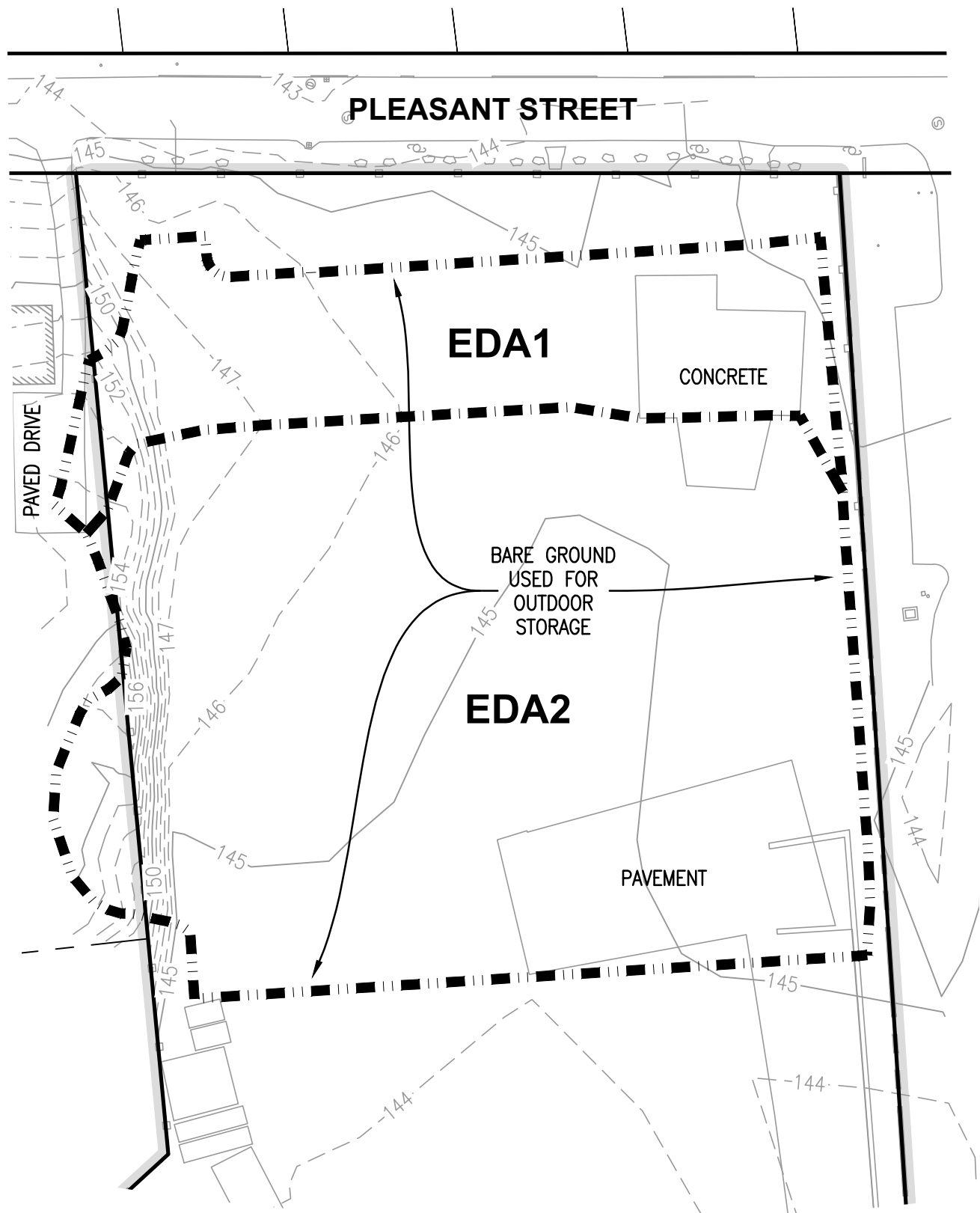
MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.32
0	0.67
0.1	0.92
0.2	1.09
0.2	1.22
0.3	1.33
0.4	1.43
0.5	1.53
0.7	1.64
1	1.77

PRE-DEVELOPMENT CALCULATIONS

2 Year 3.35"
10 Year 5.09"
25 Year 6.18"
100 Year 7.86"

PRE-DEVELOPMENT DRAINAGE PLAN

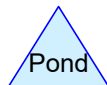
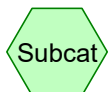




Flow West Toward
Stream



Flow to Pleasant St



Routing Diagram for Pre-Development

Prepared by Zenith Consulting Engineers LLC, Printed 6/4/2024
HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Pre-Development

Type III 24-hr 2 yr Rainfall=3.35"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA1: Flow to Pleasant St Runoff Area=21,605 sf 18.24% Impervious Runoff Depth=1.52"
Tc=6.0 min CN=80 Runoff=0.88 cfs 0.063 af

Subcatchment EDA2: Flow West Toward Runoff Area=72,915 sf 13.22% Impervious Runoff Depth=1.38"
Tc=6.0 min CN=78 Runoff=2.67 cfs 0.193 af

Total Runoff Area = 2.170 ac Runoff Volume = 0.256 af Average Runoff Depth = 1.41"
85.63% Pervious = 1.858 ac 14.37% Impervious = 0.312 ac

Pre-Development

Type III 24-hr 2 yr Rainfall=3.35"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 3

Summary for Subcatchment EDA1: Flow to Pleasant St

Runoff = 0.88 cfs @ 12.09 hrs, Volume= 0.063 af, Depth= 1.52"

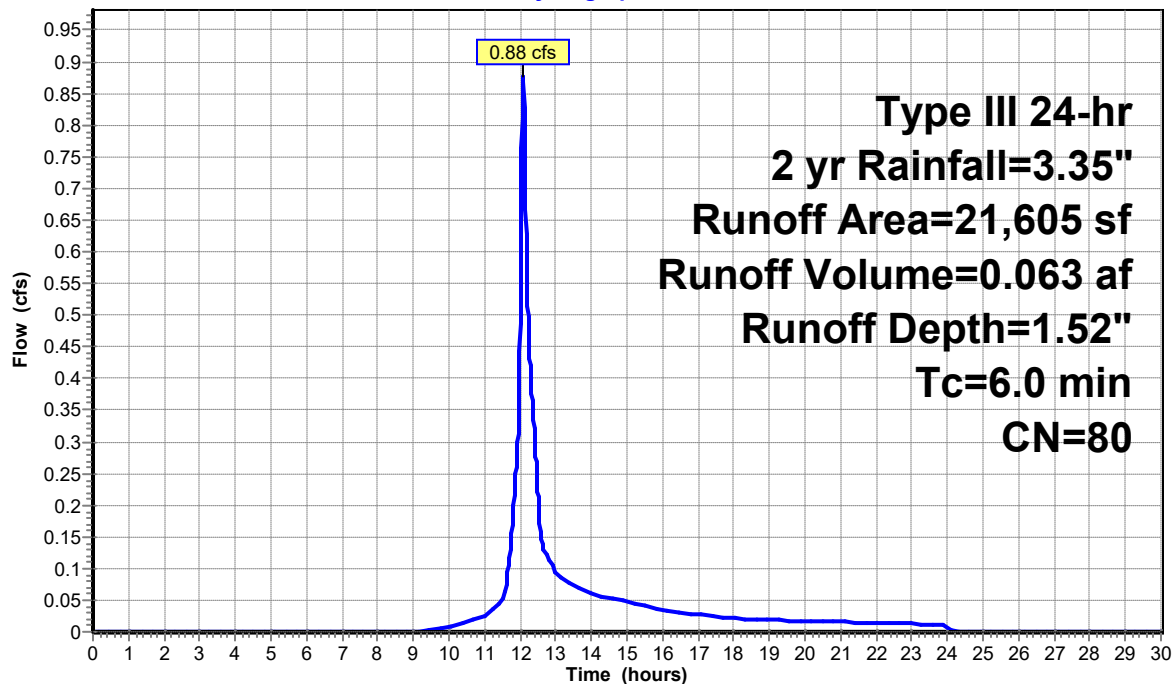
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.35"

	Area (sf)	CN	Description
*	3,940	98	Impervious
	500	39	>75% Grass cover, Good, HSG A
	17,165	77	Fallow, bare soil, HSG A
	21,605	80	Weighted Average
	17,665		81.76% Pervious Area
	3,940		18.24% Impervious Area

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

Subcatchment EDA1: Flow to Pleasant St

Hydrograph



Runoff

Pre-Development

Type III 24-hr 2 yr Rainfall=3.35"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 4

Summary for Subcatchment EDA2: Flow West Toward Stream

Runoff = 2.67 cfs @ 12.09 hrs, Volume= 0.193 af, Depth= 1.38"

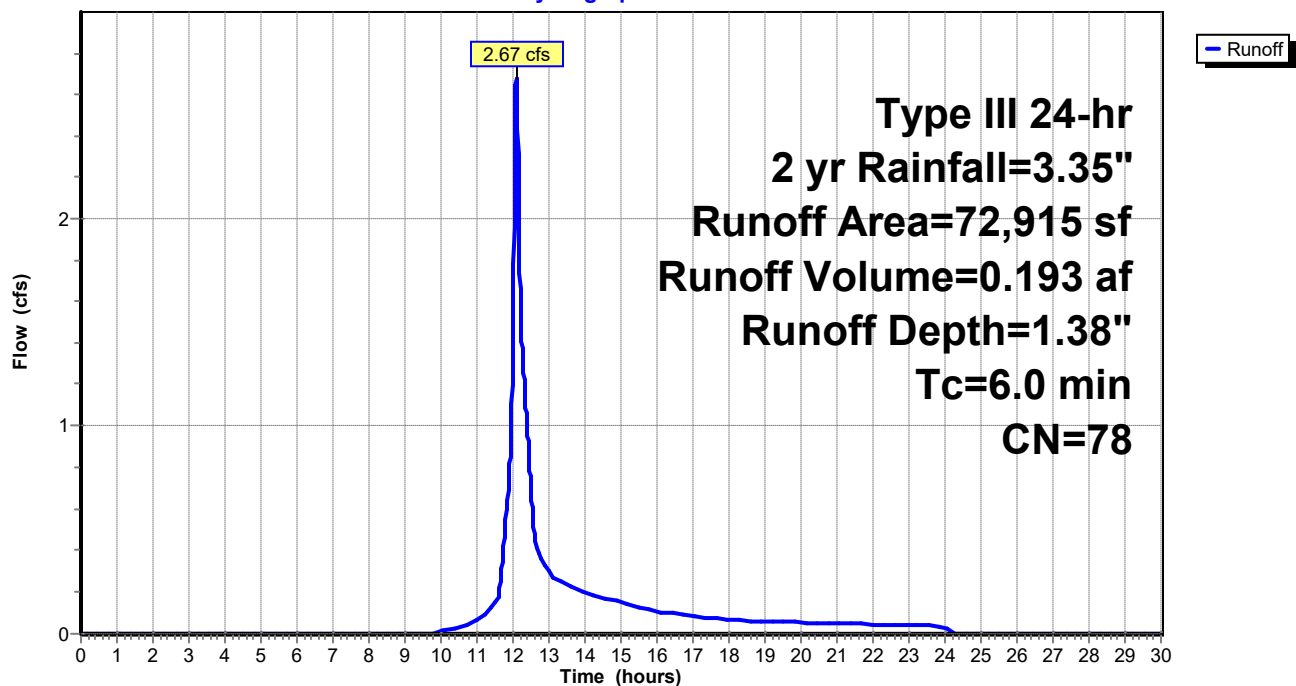
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.35"

	Area (sf)	CN	Description
*	9,640	98	Impervious
	2,500	39	>75% Grass cover, Good, HSG A
	60,775	77	Fallow, bare soil, HSG A
	72,915	78	Weighted Average
	63,275		86.78% Pervious Area
	9,640		13.22% Impervious Area

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

Subcatchment EDA2: Flow West Toward Stream

Hydrograph



Pre-Development

Type III 24-hr 10 yr Rainfall=5.09"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 5

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA1: Flow to Pleasant St Runoff Area=21,605 sf 18.24% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=80 Runoff=1.73 cfs 0.123 af

Subcatchment EDA2: Flow West Toward Runoff Area=72,915 sf 13.22% Impervious Runoff Depth=2.79"
Tc=6.0 min CN=78 Runoff=5.48 cfs 0.389 af

Total Runoff Area = 2.170 ac Runoff Volume = 0.512 af Average Runoff Depth = 2.83"
85.63% Pervious = 1.858 ac 14.37% Impervious = 0.312 ac

Pre-Development

Type III 24-hr 10 yr Rainfall=5.09"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 6

Summary for Subcatchment EDA1: Flow to Pleasant St

Runoff = 1.73 cfs @ 12.09 hrs, Volume= 0.123 af, Depth= 2.97"

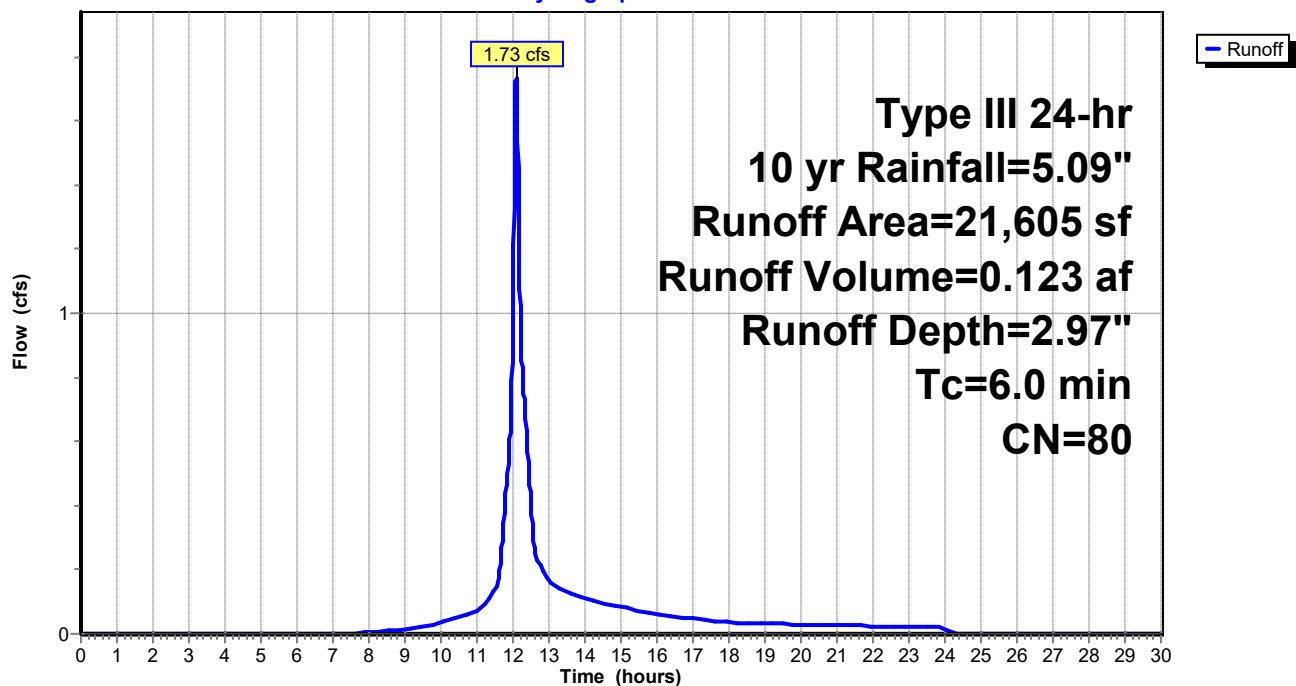
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.09"

	Area (sf)	CN	Description
*	3,940	98	Impervious
	500	39	>75% Grass cover, Good, HSG A
	17,165	77	Fallow, bare soil, HSG A
	21,605	80	Weighted Average
	17,665		81.76% Pervious Area
	3,940		18.24% Impervious Area

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

Subcatchment EDA1: Flow to Pleasant St

Hydrograph



Pre-Development

Type III 24-hr 10 yr Rainfall=5.09"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 7

Summary for Subcatchment EDA2: Flow West Toward Stream

Runoff = 5.48 cfs @ 12.09 hrs, Volume= 0.389 af, Depth= 2.79"

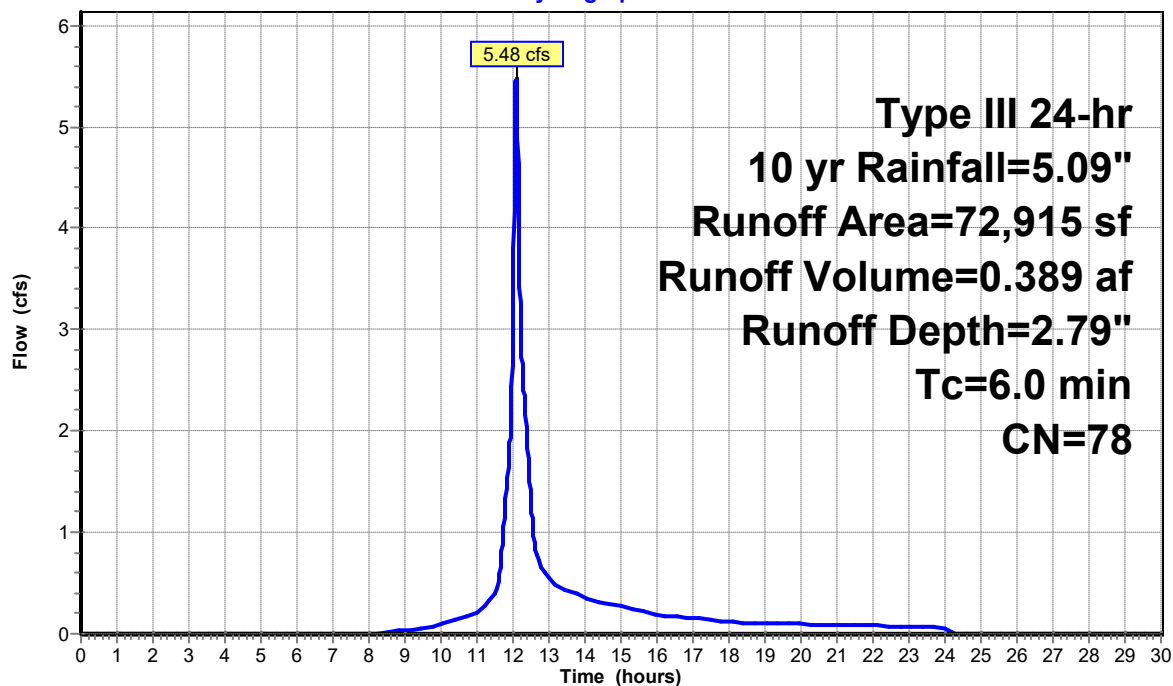
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.09"

	Area (sf)	CN	Description
*	9,640	98	Impervious
	2,500	39	>75% Grass cover, Good, HSG A
	60,775	77	Fallow, bare soil, HSG A
	72,915	78	Weighted Average
	63,275		86.78% Pervious Area
	9,640		13.22% Impervious Area

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

Subcatchment EDA2: Flow West Toward Stream

Hydrograph



Pre-Development

Type III 24-hr 25 yr Rainfall=6.18"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 8

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA1: Flow to Pleasant St Runoff Area=21,605 sf 18.24% Impervious Runoff Depth=3.94"
Tc=6.0 min CN=80 Runoff=2.28 cfs 0.163 af

Subcatchment EDA2: Flow West Toward Runoff Area=72,915 sf 13.22% Impervious Runoff Depth=3.74"
Tc=6.0 min CN=78 Runoff=7.33 cfs 0.521 af

Total Runoff Area = 2.170 ac Runoff Volume = 0.684 af Average Runoff Depth = 3.79"
85.63% Pervious = 1.858 ac 14.37% Impervious = 0.312 ac

Pre-Development

Type III 24-hr 25 yr Rainfall=6.18"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 9

Summary for Subcatchment EDA1: Flow to Pleasant St

Runoff = 2.28 cfs @ 12.09 hrs, Volume= 0.163 af, Depth= 3.94"

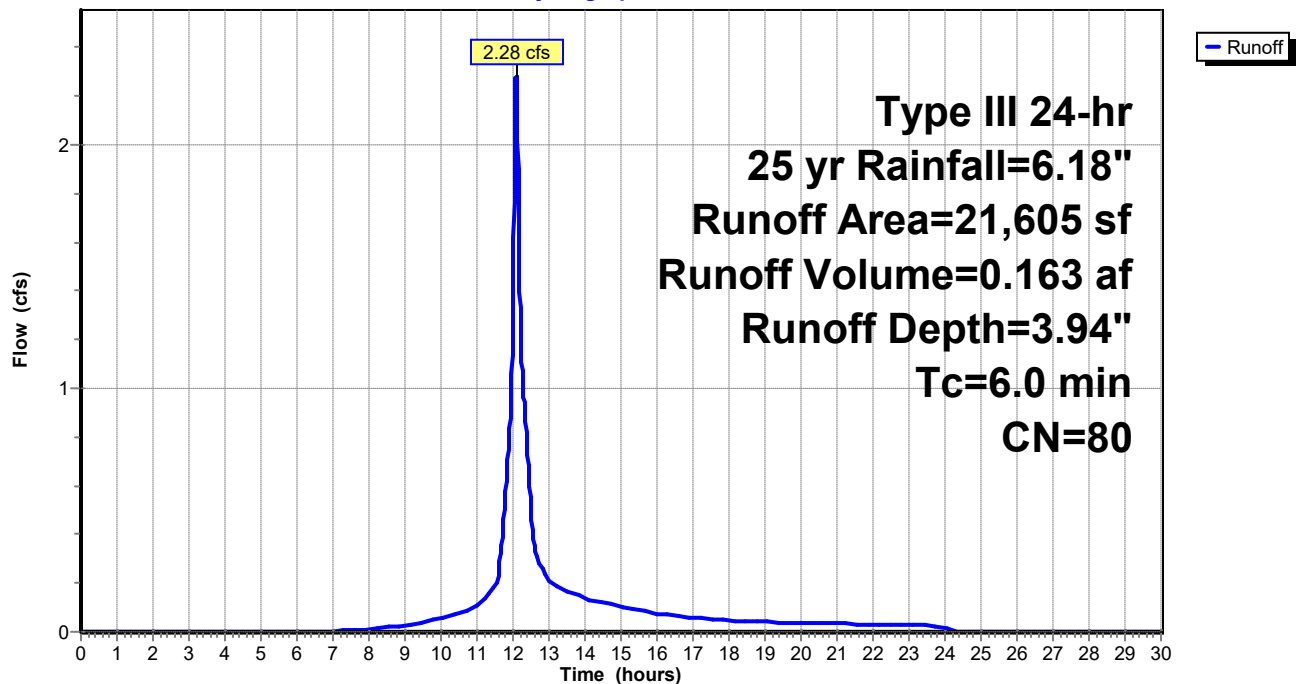
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=6.18"

	Area (sf)	CN	Description
*	3,940	98	Impervious
	500	39	>75% Grass cover, Good, HSG A
	17,165	77	Fallow, bare soil, HSG A
	21,605	80	Weighted Average
	17,665		81.76% Pervious Area
	3,940		18.24% Impervious Area

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

Subcatchment EDA1: Flow to Pleasant St

Hydrograph



Pre-Development

Type III 24-hr 25 yr Rainfall=6.18"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 10

Summary for Subcatchment EDA2: Flow West Toward Stream

Runoff = 7.33 cfs @ 12.09 hrs, Volume= 0.521 af, Depth= 3.74"

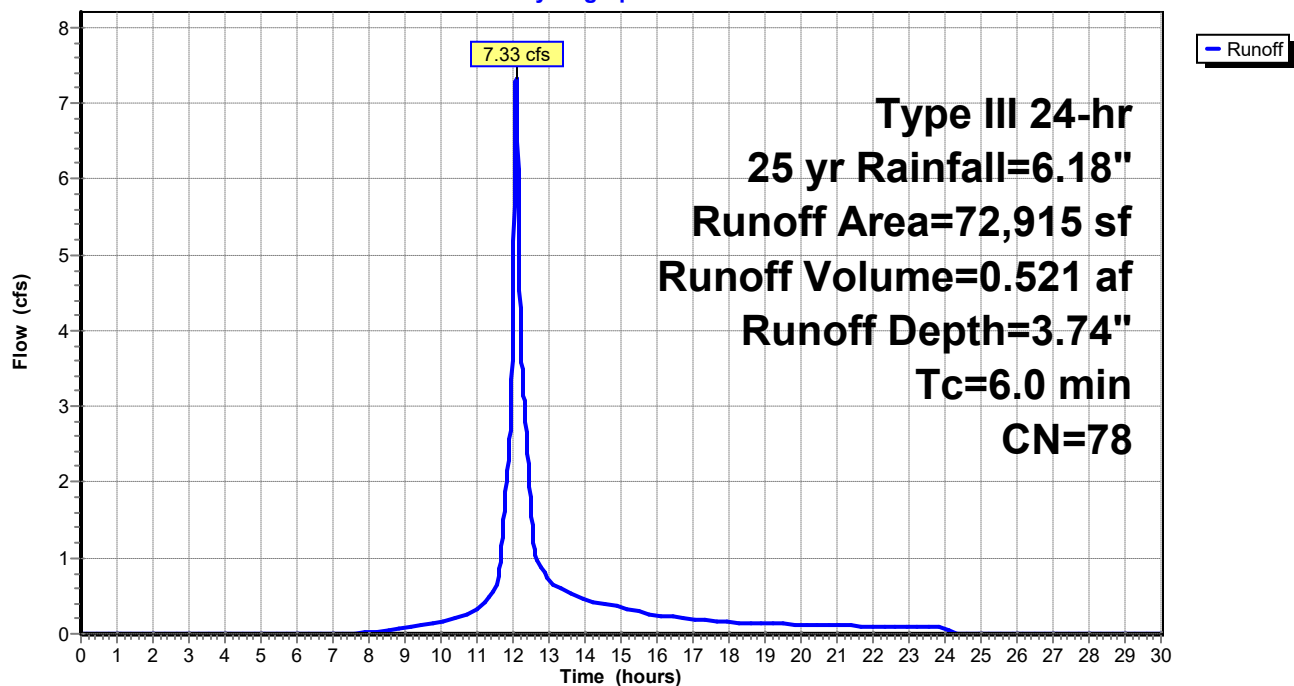
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=6.18"

	Area (sf)	CN	Description
*	9,640	98	Impervious
	2,500	39	>75% Grass cover, Good, HSG A
	60,775	77	Fallow, bare soil, HSG A
	72,915	78	Weighted Average
	63,275		86.78% Pervious Area
	9,640		13.22% Impervious Area

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

Subcatchment EDA2: Flow West Toward Stream

Hydrograph



Pre-Development

Type III 24-hr 100 yr Rainfall=7.86"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 11

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EDA1: Flow to Pleasant St Runoff Area=21,605 sf 18.24% Impervious Runoff Depth=5.49"
Tc=6.0 min CN=80 Runoff=3.15 cfs 0.227 af

Subcatchment EDA2: Flow West Toward Runoff Area=72,915 sf 13.22% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=78 Runoff=10.23 cfs 0.734 af

Total Runoff Area = 2.170 ac Runoff Volume = 0.961 af Average Runoff Depth = 5.31"
85.63% Pervious = 1.858 ac 14.37% Impervious = 0.312 ac

Pre-Development

Type III 24-hr 100 yr Rainfall=7.86"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 12

Summary for Subcatchment EDA1: Flow to Pleasant St

Runoff = 3.15 cfs @ 12.09 hrs, Volume= 0.227 af, Depth= 5.49"

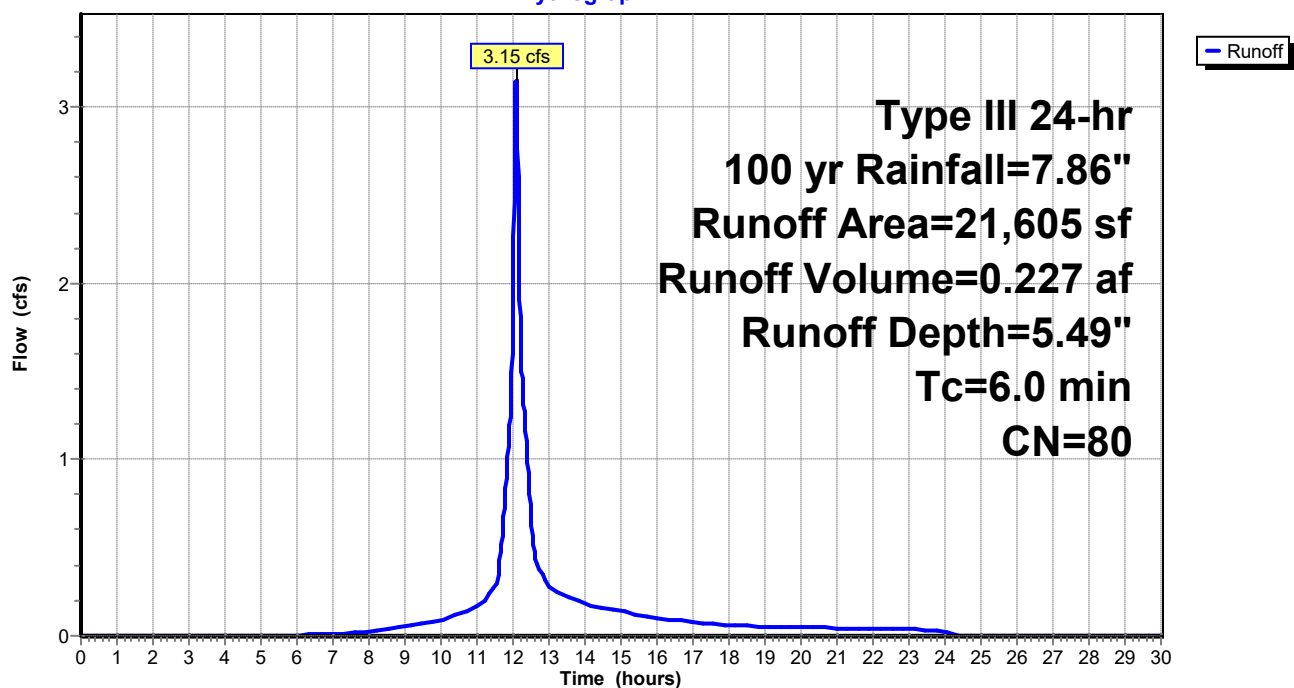
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=7.86"

	Area (sf)	CN	Description
*	3,940	98	Impervious
	500	39	>75% Grass cover, Good, HSG A
	17,165	77	Fallow, bare soil, HSG A
	21,605	80	Weighted Average
	17,665		81.76% Pervious Area
	3,940		18.24% Impervious Area

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

Subcatchment EDA1: Flow to Pleasant St

Hydrograph



Pre-Development

Type III 24-hr 100 yr Rainfall=7.86"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 13

Summary for Subcatchment EDA2: Flow West Toward Stream

Runoff = 10.23 cfs @ 12.09 hrs, Volume= 0.734 af, Depth= 5.26"

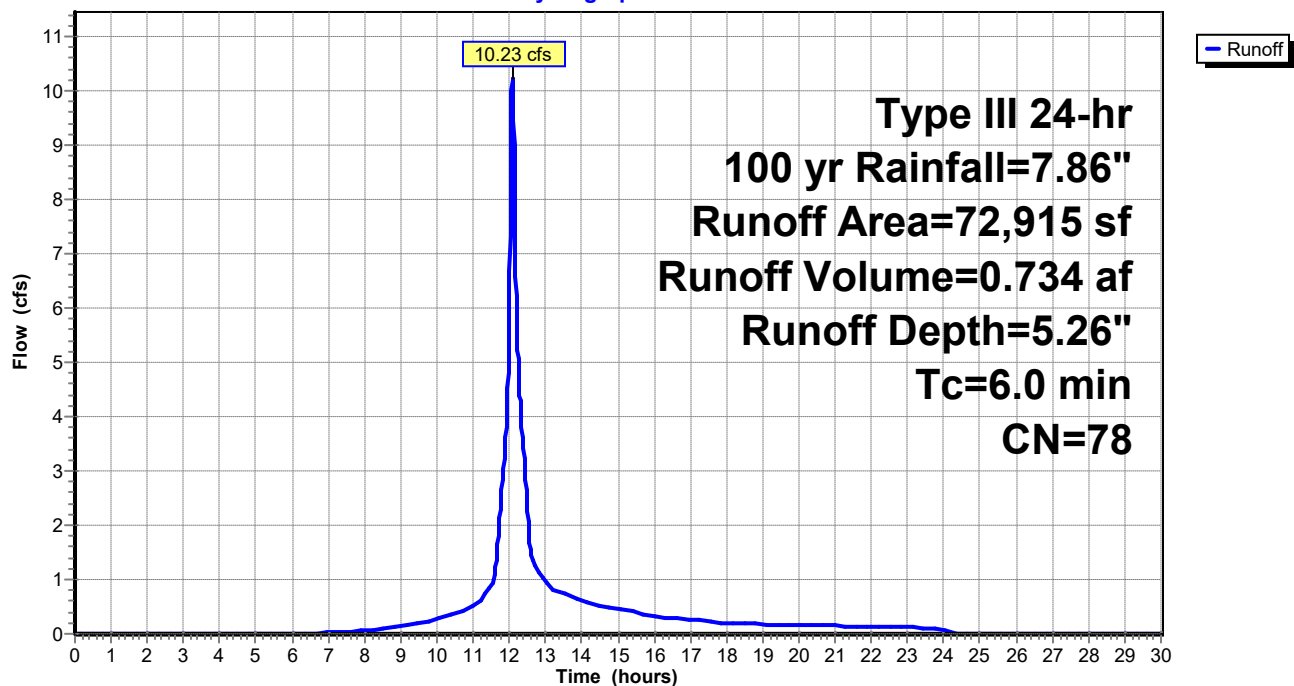
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=7.86"

	Area (sf)	CN	Description
*	9,640	98	Impervious
	2,500	39	>75% Grass cover, Good, HSG A
	60,775	77	Fallow, bare soil, HSG A
	72,915	78	Weighted Average
	63,275		86.78% Pervious Area
	9,640		13.22% Impervious Area

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

Subcatchment EDA2: Flow West Toward Stream

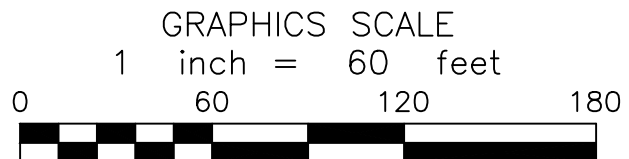
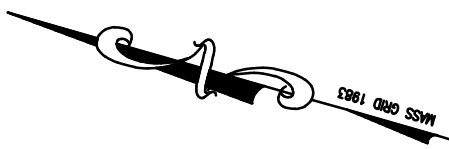
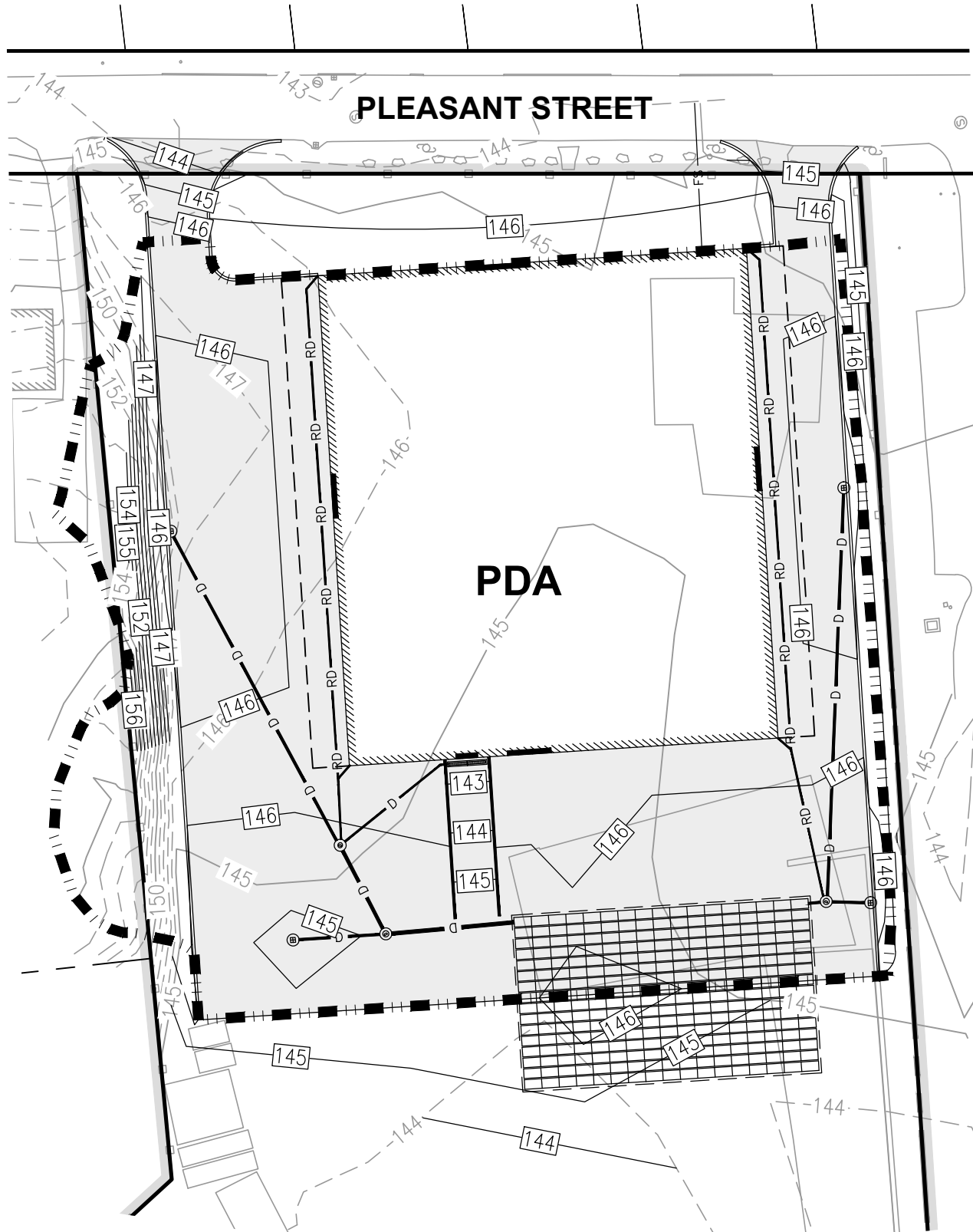
Hydrograph

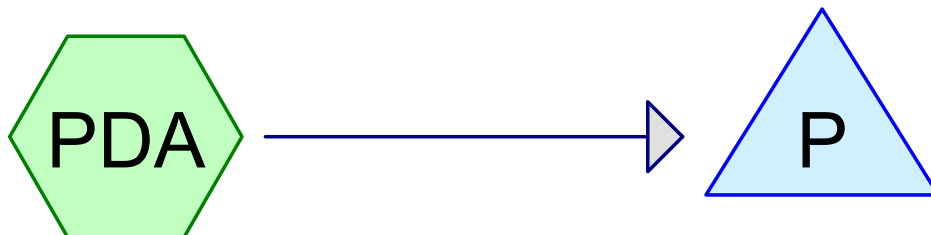


POST-DEVELOPMENT CALCULATIONS

2 Year 3.35"
10 Year 5.09"
25 Year 6.18"
100 Year 7.86"

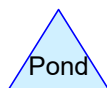
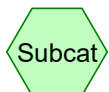
POST-DEVELOPMENT DRAINAGE PLAN





Flow to Chambers

Cultec 280HD
Chambers



Routing Diagram for Post-Development

Prepared by Zenith Consulting Engineers LLC, Printed 6/4/2024
HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Post-Development

Type III 24-hr 2 yr Rainfall=3.35"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA: Flow to Chambers

Runoff Area=94,520 sf 88.62% Impervious Runoff Depth=2.40"

Tc=6.0 min CN=91 Runoff=5.99 cfs 0.434 af

Pond P: Cultec 280HD Chambers

Peak Elev=139.82' Storage=3,496 cf Inflow=5.99 cfs 0.434 af

Outflow=1.69 cfs 0.434 af

Total Runoff Area = 2.170 ac Runoff Volume = 0.434 af Average Runoff Depth = 2.40"

11.38% Pervious = 0.247 ac 88.62% Impervious = 1.923 ac

Post-Development

Type III 24-hr 2 yr Rainfall=3.35"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 3

Summary for Subcatchment PDA: Flow to Chambers

Runoff = 5.99 cfs @ 12.09 hrs, Volume= 0.434 af, Depth= 2.40"

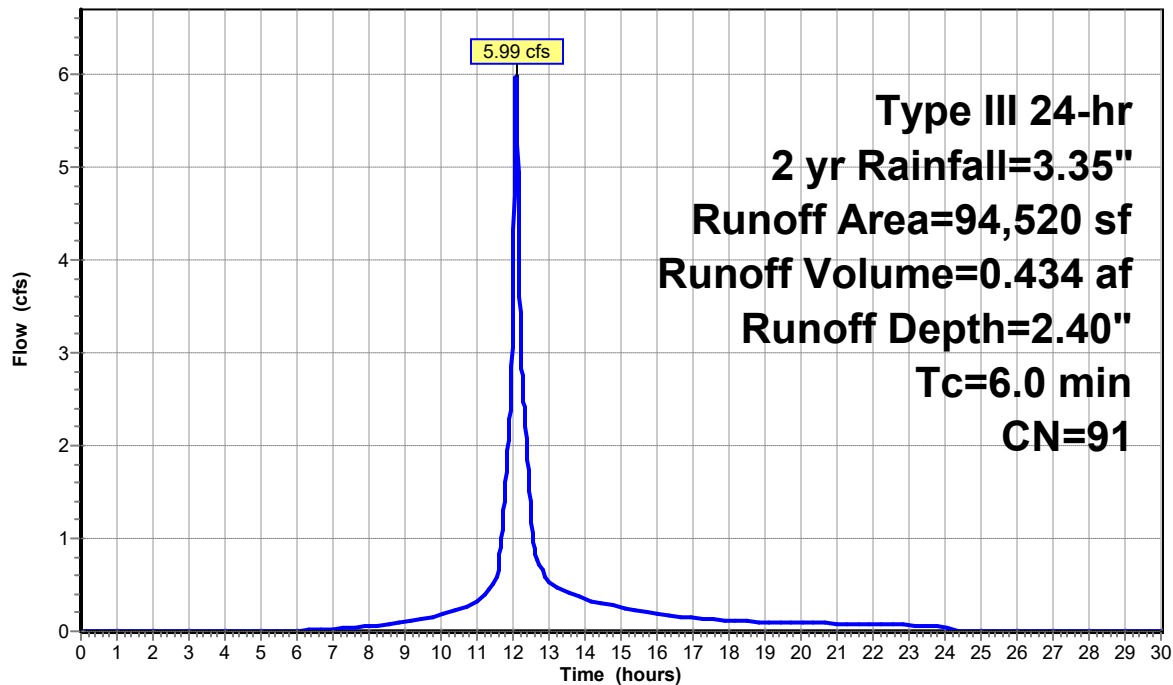
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.35"

	Area (sf)	CN	Description
*	83,760	98	Impervious (Pavement & Roof)
	10,760	39	>75% Grass cover, Good, HSG A
	94,520	91	Weighted Average
	10,760		11.38% Pervious Area
	83,760		88.62% Impervious Area

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

Subcatchment PDA: Flow to Chambers

Hydrograph



Post-Development

Type III 24-hr 2 yr Rainfall=3.35"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 4

Summary for Pond P: Cultec 280HD Chambers

Inflow Area = 2.170 ac, 88.62% Impervious, Inflow Depth = 2.40" for 2 yr event
 Inflow = 5.99 cfs @ 12.09 hrs, Volume= 0.434 af
 Outflow = 1.69 cfs @ 11.83 hrs, Volume= 0.434 af, Atten= 72%, Lag= 0.0 min
 Discarded = 1.69 cfs @ 11.83 hrs, Volume= 0.434 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Peak Elev= 139.82' @ 12.44 hrs Surf.Area= 8,804 sf Storage= 3,496 cf

Plug-Flow detention time= 10.4 min calculated for 0.434 af (100% of inflow)
 Center-of-Mass det. time= 10.4 min (811.2 - 800.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	6,636 cf	72.17'W x 122.00'L x 3.21'H Field A 28,247 cf Overall - 11,658 cf Embedded = 16,589 cf x 40.0% Voids
#2A	139.60'	11,658 cf	Cultec R-280HD x 272 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 16 rows
		18,294 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.69 cfs @ 11.83 hrs HW=139.13' (Free Discharge)↑**1=Exfiltration** (Exfiltration Controls 1.69 cfs)

Post-Development

Type III 24-hr 2 yr Rainfall=3.35"

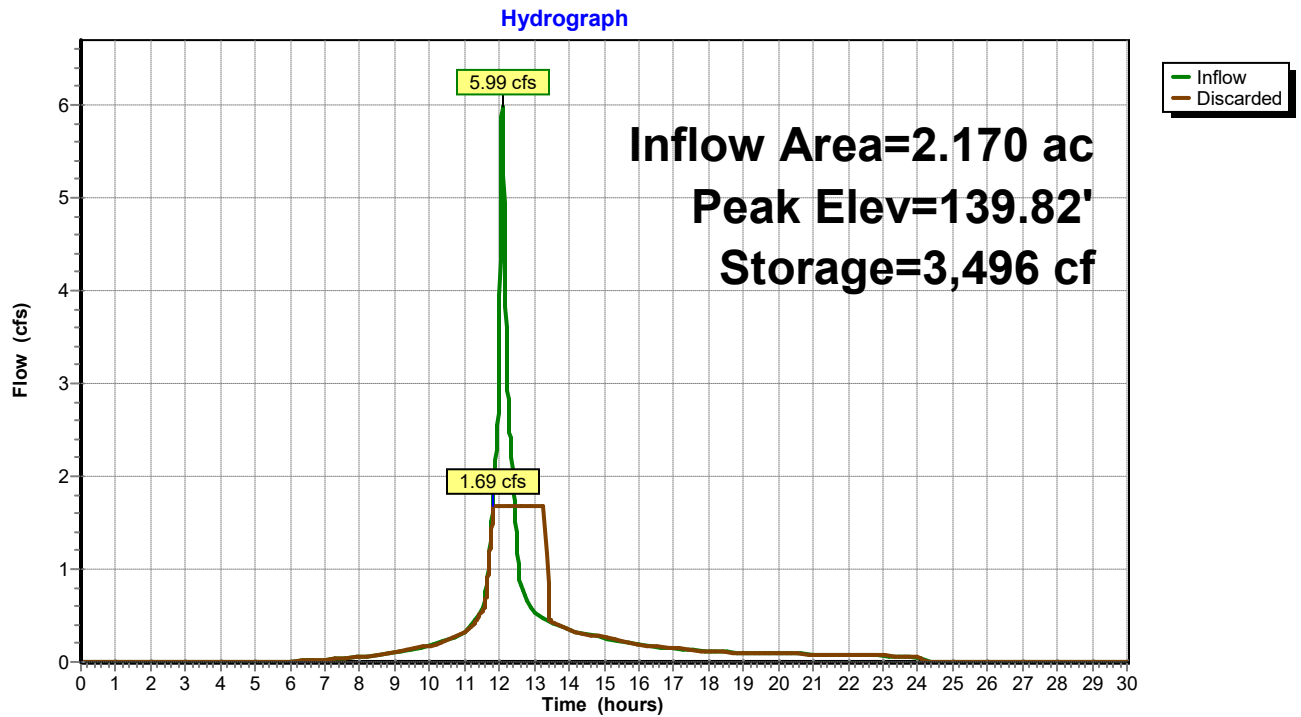
Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 5

Pond P: Cultec 280HD Chambers



Post-Development

Type III 24-hr 10 yr Rainfall=5.09"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 6

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA: Flow to Chambers

Runoff Area=94,520 sf 88.62% Impervious Runoff Depth=4.07"

Tc=6.0 min CN=91 Runoff=9.90 cfs 0.736 af

Pond P: Cultec 280HD Chambers

Peak Elev=140.51' Storage=8,720 cf Inflow=9.90 cfs 0.736 af

Outflow=1.69 cfs 0.736 af

Total Runoff Area = 2.170 ac Runoff Volume = 0.736 af Average Runoff Depth = 4.07"

11.38% Pervious = 0.247 ac 88.62% Impervious = 1.923 ac

Post-Development

Type III 24-hr 10 yr Rainfall=5.09"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 7

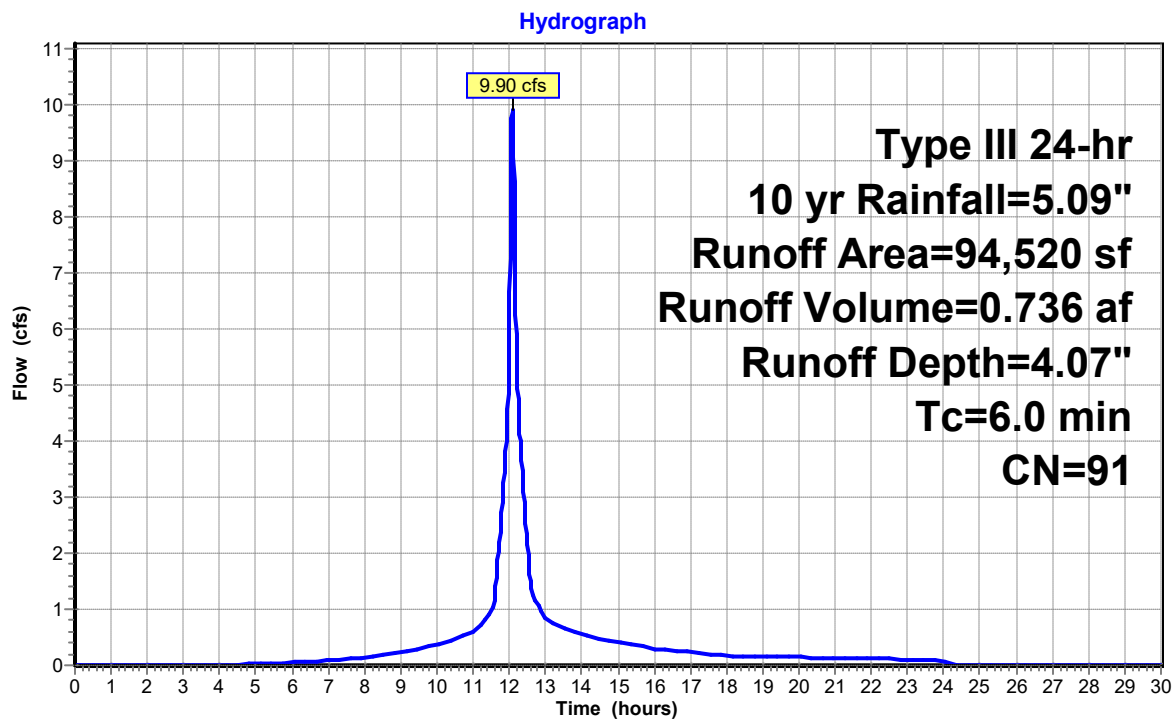
Summary for Subcatchment PDA: Flow to Chambers

Runoff = 9.90 cfs @ 12.08 hrs, Volume= 0.736 af, Depth= 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=5.09"

	Area (sf)	CN	Description
*	83,760	98	Impervious (Pavement & Roof)
	10,760	39	>75% Grass cover, Good, HSG A
	94,520	91	Weighted Average
	10,760		11.38% Pervious Area
	83,760		88.62% Impervious Area

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

Subcatchment PDA: Flow to Chambers

Post-Development

Type III 24-hr 10 yr Rainfall=5.09"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 8

Summary for Pond P: Cultec 280HD Chambers

Inflow Area = 2.170 ac, 88.62% Impervious, Inflow Depth = 4.07" for 10 yr event
 Inflow = 9.90 cfs @ 12.08 hrs, Volume= 0.736 af
 Outflow = 1.69 cfs @ 11.69 hrs, Volume= 0.736 af, Atten= 83%, Lag= 0.0 min
 Discarded = 1.69 cfs @ 11.69 hrs, Volume= 0.736 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Peak Elev= 140.51' @ 12.55 hrs Surf.Area= 8,804 sf Storage= 8,720 cf

Plug-Flow detention time= 30.0 min calculated for 0.736 af (100% of inflow)
 Center-of-Mass det. time= 30.0 min (816.2 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	6,636 cf	72.17'W x 122.00'L x 3.21'H Field A 28,247 cf Overall - 11,658 cf Embedded = 16,589 cf x 40.0% Voids
#2A	139.60'	11,658 cf	Cultec R-280HD x 272 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 16 rows
		18,294 cf	Total Available Storage

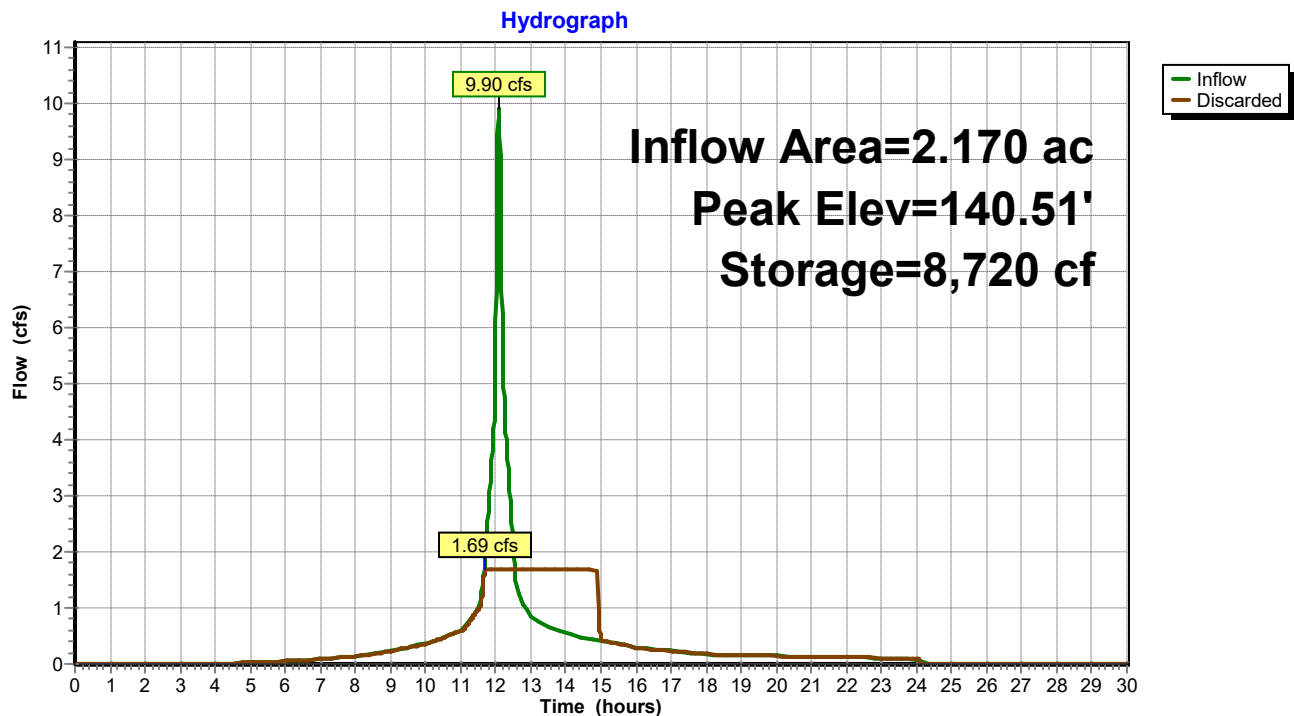
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.69 cfs @ 11.69 hrs HW=139.13' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 1.69 cfs)

Pond P: Cultec 280HD Chambers



Post-Development

Type III 24-hr 25 yr Rainfall=6.18"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 10

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA: Flow to Chambers

Runoff Area=94,520 sf 88.62% Impervious Runoff Depth=5.13"

Tc=6.0 min CN=91 Runoff=12.33 cfs 0.928 af

Pond P: Cultec 280HD Chambers

Peak Elev=141.01' Storage=12,244 cf Inflow=12.33 cfs 0.928 af

Outflow=1.69 cfs 0.928 af

Total Runoff Area = 2.170 ac Runoff Volume = 0.928 af Average Runoff Depth = 5.13"

11.38% Pervious = 0.247 ac 88.62% Impervious = 1.923 ac

Post-Development

Type III 24-hr 25 yr Rainfall=6.18"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 11

Summary for Subcatchment PDA: Flow to Chambers

Runoff = 12.33 cfs @ 12.08 hrs, Volume= 0.928 af, Depth= 5.13"

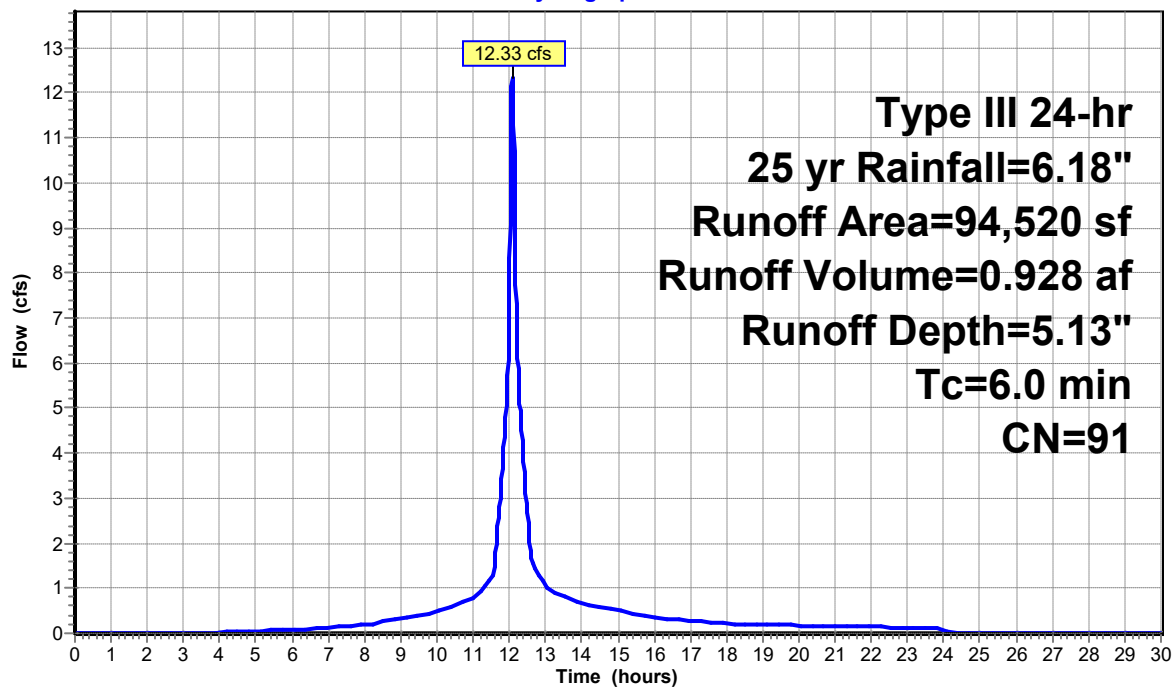
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=6.18"

	Area (sf)	CN	Description
*	83,760	98	Impervious (Pavement & Roof)
	10,760	39	>75% Grass cover, Good, HSG A
	94,520	91	Weighted Average
	10,760		11.38% Pervious Area
	83,760		88.62% Impervious Area

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

Subcatchment PDA: Flow to Chambers

Hydrograph



Runoff

Post-Development

Type III 24-hr 25 yr Rainfall=6.18"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 12

Summary for Pond P: Cultec 280HD Chambers

Inflow Area = 2.170 ac, 88.62% Impervious, Inflow Depth = 5.13" for 25 yr event
 Inflow = 12.33 cfs @ 12.08 hrs, Volume= 0.928 af
 Outflow = 1.69 cfs @ 11.63 hrs, Volume= 0.928 af, Atten= 86%, Lag= 0.0 min
 Discarded = 1.69 cfs @ 11.63 hrs, Volume= 0.928 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Peak Elev= 141.01' @ 12.60 hrs Surf.Area= 8,804 sf Storage= 12,244 cf

Plug-Flow detention time= 45.5 min calculated for 0.928 af (100% of inflow)
 Center-of-Mass det. time= 45.5 min (825.7 - 780.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	6,636 cf	72.17'W x 122.00'L x 3.21'H Field A 28,247 cf Overall - 11,658 cf Embedded = 16,589 cf x 40.0% Voids
#2A	139.60'	11,658 cf	Cultec R-280HD x 272 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 16 rows
		18,294 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.69 cfs @ 11.63 hrs HW=139.13' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 1.69 cfs)

Post-Development

Type III 24-hr 25 yr Rainfall=6.18"

Prepared by Zenith Consulting Engineers LLC

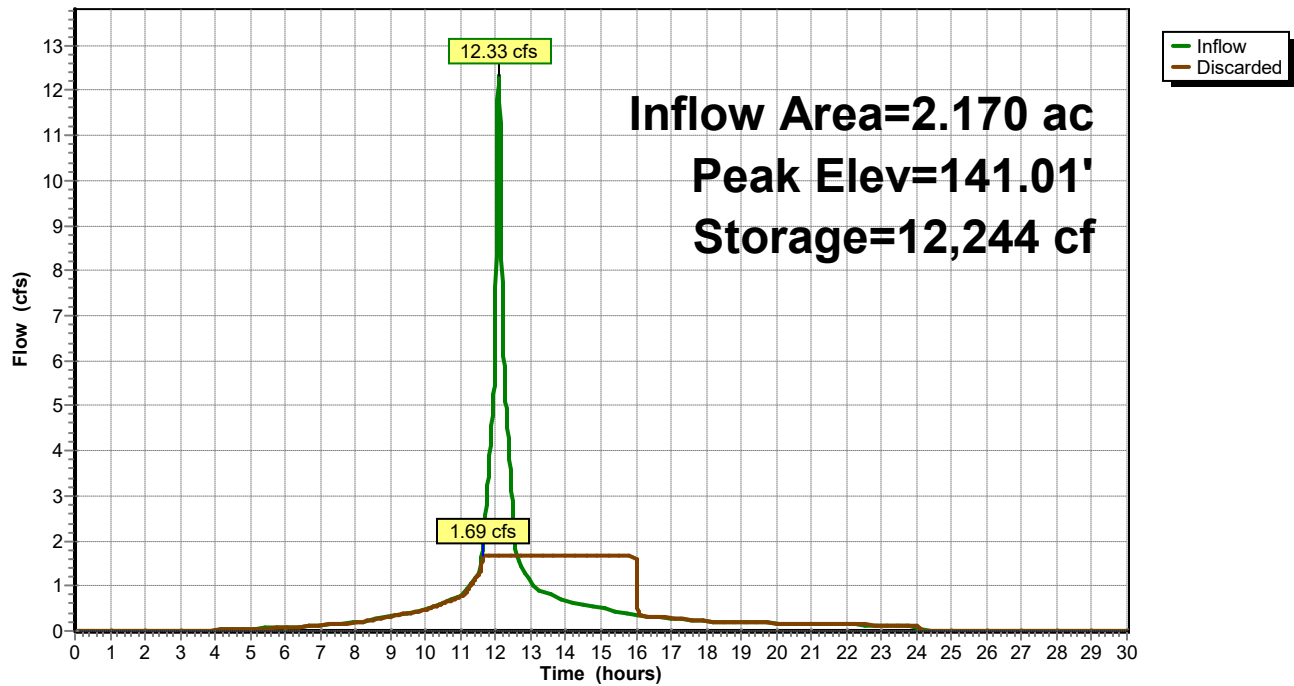
Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 13

Pond P: Cultec 280HD Chambers

Hydrograph



Post-Development

Type III 24-hr 100 yr Rainfall=7.86"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 14

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PDA: Flow to Chambers

Runoff Area=94,520 sf 88.62% Impervious Runoff Depth=6.79"

Tc=6.0 min CN=91 Runoff=16.03 cfs 1.227 af

Pond P: Cultec 280HD Chambers

Peak Elev=142.21' Storage=17,950 cf Inflow=16.03 cfs 1.227 af

Outflow=1.69 cfs 1.227 af

Total Runoff Area = 2.170 ac Runoff Volume = 1.227 af Average Runoff Depth = 6.79"

11.38% Pervious = 0.247 ac 88.62% Impervious = 1.923 ac

Post-Development

Type III 24-hr 100 yr Rainfall=7.86"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 15

Summary for Subcatchment PDA: Flow to Chambers

Runoff = 16.03 cfs @ 12.08 hrs, Volume= 1.227 af, Depth= 6.79"

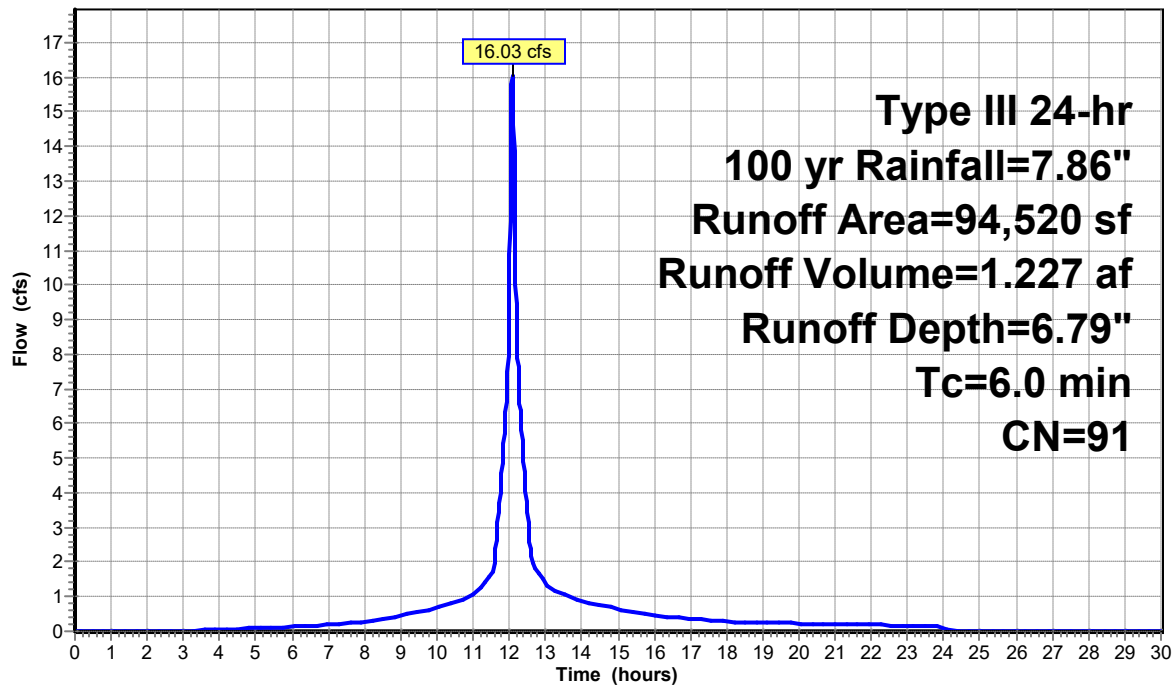
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=7.86"

	Area (sf)	CN	Description
*	83,760	98	Impervious (Pavement & Roof)
	10,760	39	>75% Grass cover, Good, HSG A
	94,520	91	Weighted Average
	10,760		11.38% Pervious Area
	83,760		88.62% Impervious Area

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

Subcatchment PDA: Flow to Chambers

Hydrograph



Runoff

Post-Development

Type III 24-hr 100 yr Rainfall=7.86"

Prepared by Zenith Consulting Engineers LLC

Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 16

Summary for Pond P: Cultec 280HD Chambers

Inflow Area = 2.170 ac, 88.62% Impervious, Inflow Depth = 6.79" for 100 yr event
 Inflow = 16.03 cfs @ 12.08 hrs, Volume= 1.227 af
 Outflow = 1.69 cfs @ 11.51 hrs, Volume= 1.227 af, Atten= 89%, Lag= 0.0 min
 Discarded = 1.69 cfs @ 11.51 hrs, Volume= 1.227 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
 Peak Elev= 142.21' @ 12.80 hrs Surf.Area= 8,804 sf Storage= 17,950 cf

Plug-Flow detention time= 72.8 min calculated for 1.227 af (100% of inflow)
 Center-of-Mass det. time= 72.8 min (845.9 - 773.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	139.10'	6,636 cf	72.17'W x 122.00'L x 3.21'H Field A 28,247 cf Overall - 11,658 cf Embedded = 16,589 cf x 40.0% Voids
#2A	139.60'	11,658 cf	Cultec R-280HD x 272 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 16 rows
		18,294 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.10'	8.270 in/hr Exfiltration over Surface area

Discarded OutFlow Max=1.69 cfs @ 11.51 hrs HW=139.13' (Free Discharge)

↑1=Exfiltration (Exfiltration Controls 1.69 cfs)

Post-Development

Type III 24-hr 100 yr Rainfall=7.86"

Prepared by Zenith Consulting Engineers LLC

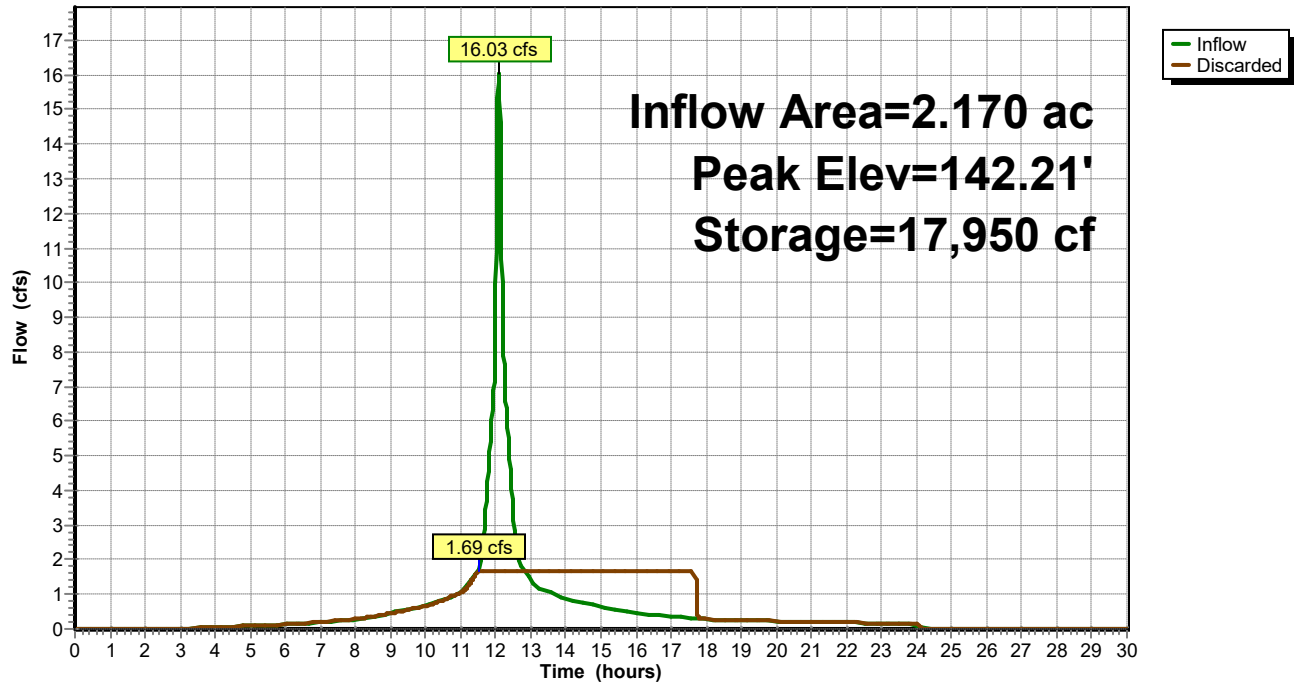
Printed 6/4/2024

HydroCAD® 10.00-16 s/n 09356 © 2015 HydroCAD Software Solutions LLC

Page 17

Pond P: Cultec 280HD Chambers

Hydrograph



OPERATIONS AND MAINTENANCE PLAN

OPERATIONS AND MAINTENANCE PLAN
171 VFW Drive Rockland, MA

The following is the proposed operation and maintenance plan for the storm water management systems at the proposed salvage yard located at 171 VFW Drive Rockland, MA. A yearly report outlining the condition and any maintenance of the proposed stormwater system shall be submitted to the town.

- Owner: Rockland Station LLC
 171 VFW Drive
 Rockland, MA 02702
- Parties responsible for Operation and Maintenance:
 Same as above

CONTENTS

1. Stormwater Management Systems Operations and Maintenance Plan
2. Construction Period Pollution Prevention Plan
3. Source Control and Long-term Pollution Prevention Plan

STORMWATER MANAGEMENT SYSTEMS
OPERATIONS AND MAINTENANCE PLAN
171 VFW Drive Rockland, MA

The storm water management facilities were designed to require little or no intervention in the operation and to require little or no maintenance once the project is built and stable vegetative cover is established. However, the drainage improvements shall be subject to the following maintenance schedule:

Catch Basins

Inspect or clean deep sump basins at least four times per year and at the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.

Clamshell buckets are typically used to remove sediment in Massachusetts. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a speedier process and is less likely to snap the cast iron hood within the deep sump catch basin.

First Defense Water Quality Units

See the attached operation and maintenance manual and log forms from the manufacturer.

Chamber Field

Measure the water depth in the inspection port at 24- and 48-hour intervals after a storm. Calculate clearance rates by dividing the drop in water level (inches) by the time elapsed (hr). Record this information to document performance. Inspect gutters and downspouts for blockages monthly and remove debris as needed.

Non-periodic Inspection

The storm water management system shall be inspected after two years of full operation by a Registered Professional Civil Engineer to confirm its adequacy. The inspection shall include an examination of all components of the system.

Annual Budget

The estimated annual budget for the O & M is \$1,000.

OPERATION AND MAINTENANCE PLAN LOG FORM

Refer to Site Plan for details on the drainage system. Use Log Form that follows as required upon completion of inspections and maintenance tasks, and file.

171 VFW Drive Rockland, MA Drainage System

STORMWATER BMP'S

STRUCTURE	DATE INSPECTED	SEDIMENT BUILDUP (YES/NO)	IF SEDIMENT BUILDUP, DATE CLEANED
CB-1			
CB-2			
CB-3			
CB-4			
DMH-1			
DMH-2 (First Defense)			
DMH-3 (First Defense)			
Trench Grate			
Chamber Field			
OTHER:			

Note: Sediment to be removed from catch basins once the depth reaches 24".

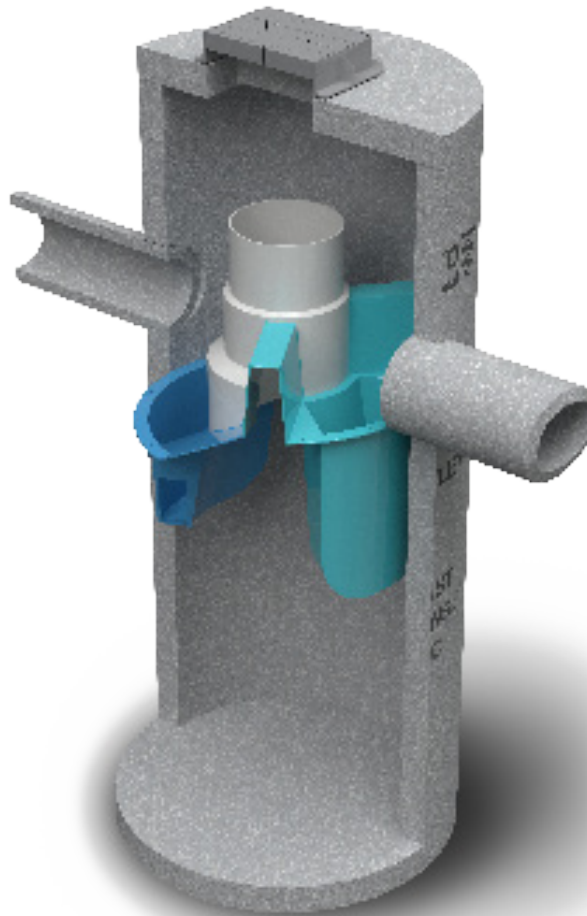
REQUIRED MAINTENANCE:

TO BE PERFORMED BY: _____

INSPECTION BY: _____

ON _____

DATE _____



Operation and Maintenance Manual

First Defense® High Capacity and First Defense® Optimum

Vortex Separator for Stormwater Treatment

Table of Contents

3	FIRST DEFENSE® BY HYDRO INTERNATIONAL - INTRODUCTION - OPERATION - POLLUTANT CAPTURE AND RETENTION
4	MODEL SIZES & CONFIGURATIONS - FIRST DEFENSE® COMPONENTS
5	MAINTENANCE - OVERVIEW - MAINTENANCE EQUIPMENT CONSIDERATIONS - DETERMINING YOUR MAINTENANCE SCHEDULE
6	MAINTENANCE PROCEDURES - INSPECTION - FLOATABLES AND SEDIMENT CLEAN OUT
8	FIRST DEFENSE® INSTALLATION LOG
9	FIRST DEFENSE® INSPECTION AND MAINTENANCE LOG

COPYRIGHT STATEMENT: The contents of this manual, including the graphics contained herein, are intended for the use of the recipient to whom the document and all associated information are directed. Hydro International plc owns the copyright of this document, which is supplied in confidence. It must not be used for any purpose other than that for which it is supplied and must not be reproduced, in whole or in part stored in a retrieval system or transmitted in any form or by any means without prior permission in writing from Hydro International plc. First Defense® is a trademarked hydrodynamic vortex separation device of Hydro International plc. A patent covering the First Defense® has been granted.

DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's First Defense®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc has a policy of continuous product development and reserves the right to amend specifications without notice.

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints.

The two product models described in this guide are the First Defense® High Capacity and the First Defense® Optimum; they are inspected and maintained identically.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig. 1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

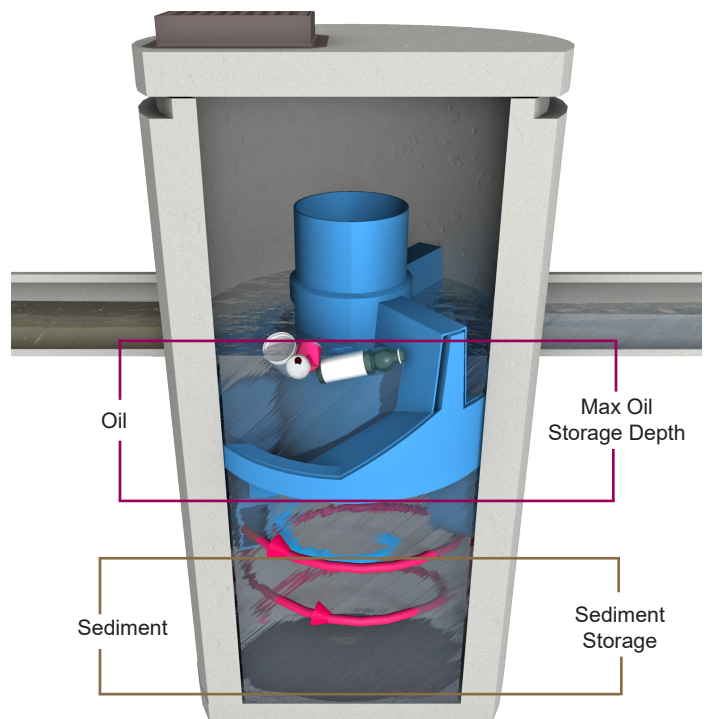


Fig. 1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components have modified geometries allowing greater design flexibility to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2). First Defense® model sizes (diameter) are shown in Table 1.

III. Maintenance

First Defense® Components

1. Built-In Bypass
2. Inlet Pipe
3. Inlet Chute
4. Floatables Draw-off Port
5. Outlet Pipe
6. Floatables Storage
7. Sediment Storage
8. Inlet Grate or Cover

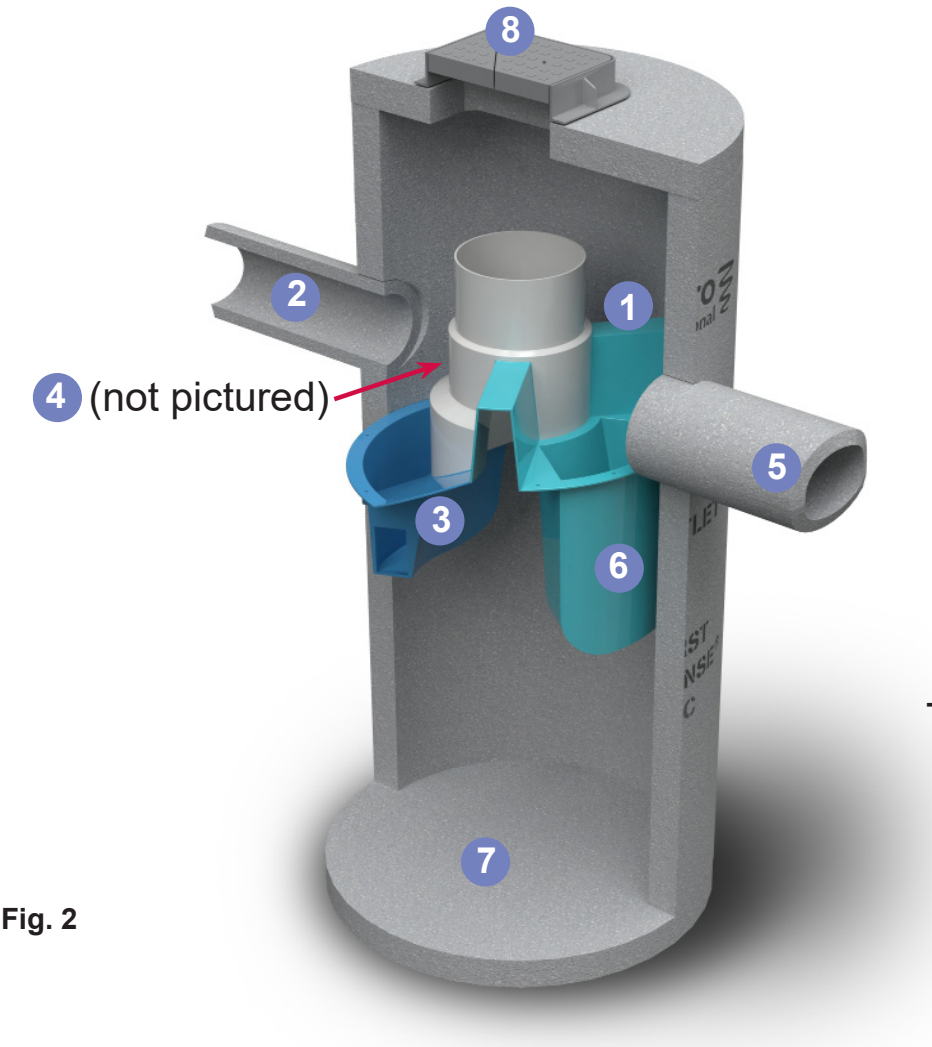


Fig. 2

Table 1

First Defense® Model Sizes
(ft / m) diameter
3 / 0.9
4 / 1.2
5 / 1.5
6 / 1.8
7 / 2.1
8 / 2.4
10 / 3.0

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense® have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

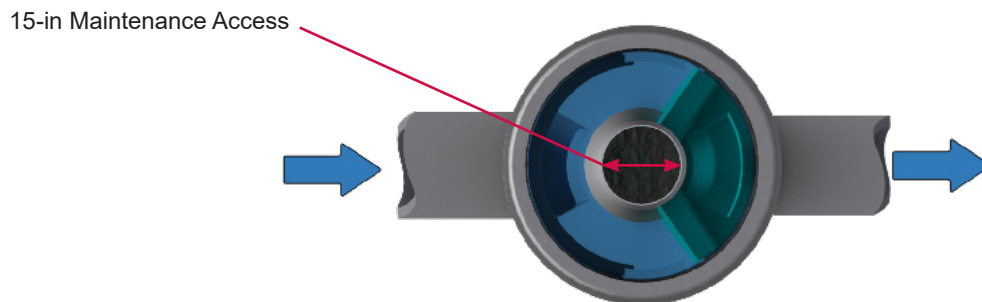


Fig.3 The central opening to the sump of the First Defense® is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / floatables removal, for First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.
6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.4).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.
- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.



Fig.4 Floatables are removed with a vactor hose

Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- First Defense® Maintenance Log

Floatables and Sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Remove oil and floatables stored on the surface of the water with the vactor hose or with the skimmer or net
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).
6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor
7. Retract the vactor hose from the vessel.
8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.
9. Securely replace the grate or lid.

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area

NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.



First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): [3-FT] [4-FT] [5-FT] [6-FT] [7-FT] [8-FT] [10-FT]

INLET (CIRCLE ALL THAT APPLY): GRATED INLET (CATCH BASIN) INLET PIPE (FLOW THROUGH)

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200

Fax: (207) 756-6212

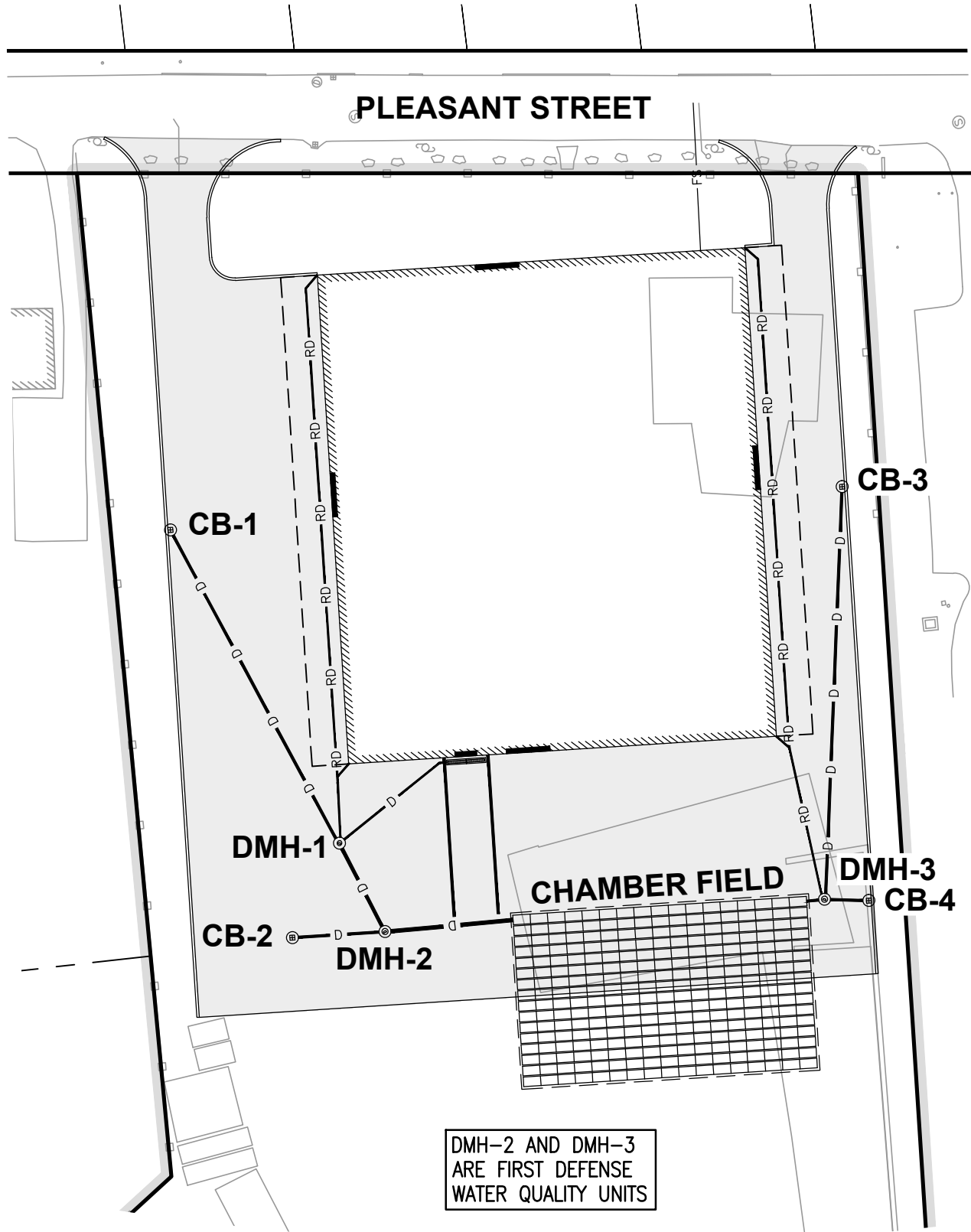
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

FD_O+M_K_2105

STORMWATER BMP LOCATION PLAN



GRAPHICS SCALE

1 inch = 60 feet



CONSTRUCTION PERIOD POLLUTION PREVENTION PLAN
171 VFW Drive Rockland, MA

1.0 INTRODUCTION

There are no wetland areas that will be directly impacted by the proposed construction, however the following erosion and sediment control program material management practices and spill control program have been developed to protect the abutting properties.

2.0 PRECONSTRUCTION MEASURES

Prior to the initiation of any construction, erosion control measures shall be installed as shown on the plans.

3.0 CONSTRUCTION PERIOD MEASURES

The following are the minimal measures required for erosion and sediment control, material handling and for spill control.

3.1 EROSION AND SEDIMENTATION CONTROL

The following measures shall be maintained throughout the site construction phase of the project.

Catch Basin Protection

The proposed catch basin shall be protected with a silt sack prior to the completion of paving. If excessive siltation is discovered to be entering the catch basin inlet, then hay bales shall also be placed around grate and catch basin within the construction/demolition area to ensure that runoff entering the catch basin has been filtered through the bales prior to discharge.

Drainage Swale Haybale Check Dams

Haybales shall also be placed across any temporary ditches constructed by the contractor during construction to limit the transport of sediment into drainage systems and waterways.

Erosion and Sediment Control - Maintenance

The project general contractor shall have primary responsibility for implementing temporary and permanent controls described in the plan and shall be responsible for assuring Contractor compliance with contract documents including all erosion and sediment control measures.

- Damaged or deteriorated items shall be repaired or replaced immediately after identification.
- The underside of haybales should be kept in close contact with the earth and reset as necessary.

- Silt Socks shall be inspected after every major rainfall runoff event (over ½" depth of precipitation) or every 14 days, whichever occurs first. All damaged or misaligned fences shall be immediately repaired. Silt shall be immediately removed from all areas of the silt fence when depth of accumulation exceeds 9 inches. Each report shall be documented.
- Sumps shall be inspected after every major rainfall runoff event (over ½" depth of precipitation) or every 14 days, whichever occurs first. Silt shall be immediately removed from all sumps where the depth of accumulation exceeds 9 inches.
- All exposed construction areas shall be stabilized upon completion in order to minimize the time that these areas are un-stabilized.

3.2 MATERIALS MANAGEMENT PRACTICES

The following are the material management practices that shall be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff. The Contractor's Superintendent shall be responsible for ensuring that these procedures are followed:

1. *Good Housekeeping*

The following good housekeeping practices shall be followed on-site during construction:

- a. An effort shall be made to store only enough products required to do the job.
- b. All materials stored on-site shall be stored in a neat, orderly manner and, if possible, under a roof or in a containment area. At a minimum, all containers shall be stored with their lids on when not in use. Drip pans shall be provided under all dispensers.
- c. Products shall be kept in their original containers with the original manufacturer's label in legible condition.
- d. Substances shall not be mixed with one another unless recommended by the manufacturer.
- e. Whenever possible, all of a product shall be used up before disposing the container.
- f. Manufacturer's recommendations for proper use and disposal shall be followed.
- g. The Contractor's Superintendent shall be responsible for daily inspections to ensure proper use and disposal of materials.

2. *Hazardous Substances*

These practices shall be used to reduce the risks associated with Hazardous Substances. Material Safety Data Sheets (MSDS's) for each product with hazardous properties that is used at the Project shall be obtained and used for the proper management of potential wastes that may result from these products. An MSDS shall be posted in the immediate area where such product is stored and/or used and another copy of each MSDS shall be

maintained in the job trailer at the Project. Each employee who must handle a Hazardous Substance shall be instructed on the use of MSDS sheets and the specific information in the applicable MSDS for the product he/she is using, particularly regarding spill control techniques.

- a. Products shall be kept in original containers with the original labels in legible condition.
- b. Original labels and MSDS's shall be procured and used for each product.
- c. If surplus product must be disposed, manufacturer's and local/state/federal required methods for proper disposal must be followed.

3. *Hazardous Waste*

It is imperative that all Hazardous Waste be properly identified and handled in accordance with all applicable Hazardous Waste Standards, including the storage, transport and disposal of the Hazardous Wastes. There are significant penalties for the improper handling of Hazardous Wastes. It is important that the Site Superintendent seeks appropriate assistance in making the determination of whether a substance or material is a Hazardous Waste. For example, Hazardous Waste may include certain Hazardous Substances, as well as pesticides, paints, paint solvents, cleaning solvents, pesticides, contaminated soils, and other materials, substances or chemicals that have been discarded (or are to be discarded) as being out-of-date, contaminated, or otherwise unusable, and can include the containers for those substances; other materials and substances can also be or become Hazardous Wastes, however. The Contractor's Superintendent is also responsible for ensuring that all site personnel are instructed as to these Hazardous Waste requirements and also that the requirements are being followed.

4. *Product Specific Practices*

The following product specific practices shall be followed on the job site:

Petroleum Products

All on-site vehicles shall be monitored for leaks and receive regular preventative maintenance to reduce the chance of leakage. Petroleum products shall be stored in tightly sealed containers which are clearly labeled. Petroleum storage tanks shall be located at minimum 100 linear feet from drainage ways, inlets and surface waters. Any petroleum storage tanks stored on-site shall be located within a containment area that is designed with an impervious surface between the tank and the ground. The secondary containment must be designed to provide a containment volume that is equal to 110% of the volume of the largest tank. Any mobile petroleum tank shall be parked in a vehicular service area surrounded by a berm that provides a containment volume that is equal to 110% of the volume of the largest tank. Containment must provide sufficient volume to contain expected precipitation and 110% volume of the largest tank. Accumulated rainwater or spills from containment areas are to be promptly pumped into a containment device and disposed properly by a licensed Hazardous Waste transporter. Drip pans shall

be provided for all dispensers. Any asphalt substances used on-site shall be applied according to the manufacturer's recommendations. The location of any fuel tanks and/or equipment storage areas must be identified on the Erosion Control Plan by the Contractor once the locations have been determined.

Fertilizers

Fertilizers shall be applied only in the minimum amounts recommended by the manufacturer. Once applied, fertilizer shall be worked in the soil to limit exposure to stormwater. The contents of any partially used bags of fertilizer shall be transferred to a sealable plastic bin to avoid spills.

Cleaning Solvents

All containers shall be tightly sealed and stored when not in use. Excess solvents shall not be discharged to the storm sewer system, but shall be properly disposed of according to manufacturer's instructions or state and federal regulations.

Concrete Wastes

Concrete trucks shall be allowed to wash out or discharge surplus concrete or drum wash water on the project site, but only in specifically designated diked and impervious washouts which have been prepared to prevent contact between the concrete wash and stormwater. Waste generated from concrete wash water shall not be allowed to flow into drainage ways, inlets, receiving waters or any location other than the designated concrete washout. Waste concrete may be poured into forms to make rip-rap or other useful concrete products. Concrete washouts shall be located at minimum 100 linear feet from drainage ways, inlets, surface waters and wetland resource areas.

The hardened residue from the concrete washout diked areas shall be disposed in the same manner as other non-hazardous construction waste materials or may be broken up and used on site as deemed appropriate by the Contractor. Maintenance of the washout is to include removal of hardened concrete. Facility shall not be filled beyond 95% capacity and shall be cleaned out once 75% full unless a new facility is constructed. The Contractor's Superintendent shall be responsible for seeing that these procedures are followed. Saw-cut Portland Cement Concrete (PCC) slurry shall not be allowed to enter storm drains or watercourses. Saw-cut residue should not be left on the surface of pavement or be allowed to flow over and off pavement. Residue from saw-cutting and grinding shall be collected by vacuum and disposed of in the concrete washout facility.

5. Solid and Construction Wastes

All waste materials shall be collected and disposed of at an appropriate solid waste disposal area.

6. Sanitary Wastes

A minimum of one portable sanitary unit shall be provided for every ten (10) workers on the site. All sanitary waste shall be collected from the portable units a minimum of one time per week by a licensed portable facility provider in complete compliance with local and state regulations.

All sanitary waste units shall be located in an area where the likelihood of the unit contributing to stormwater discharges is negligible. Additional containment BMPs must be implemented, such as gravel bags or specially designed plastic skid containers around the base, to prevent wastes from contributing to stormwater discharges.

7. Contaminated Soils

Any contaminated soils (resulting from spills of hazardous substances or oil or discovered during the course of construction) which may result from construction activities shall be contained and cleaned up immediately in accordance with the procedures given in the Material Management Plan and in accordance with applicable state and federal regulations. Contaminated soils not resulting from construction activities, or which pre-existed construction activities, but which are discovered by virtue of construction activities, should be reported in the same manner as spills, but with sufficient information to indicate that the discovery of an existing condition is being reported. If there is a release that occurs by virtue of the discovery of existing contamination, this should be reported as a spill, if it otherwise meets the requirements for a reportable spill.

SOURCE CONTROL AND LONG-TERM POLLUTION PREVENTION PLAN
171 VFW Drive Rockland, MA

1.0 INTRODUCTION

The development of the above referenced facility has been designed to provide improved stormwater quality compared to existing conditions. In order for this to continue in the long term, it is necessary to implement the following Source Control and Pollution Prevention Plan.

2.0 RESPONSIBLE PARTY

Responsible Party: Rockland Station LLC
 171 VFW Drive
 Rockland, MA 02702

3.0 SOURCE CONTROL MEASURES

The most effective means of providing clean runoff is to prevent pollutants from coming into contact with the stormwater in the first place. This involves the following:

1. Keeping de-icing agents, fertilizers, stockpiles, etc. covered at all times. If practical, all such products shall be stored indoors or off-site.
2. All landscaping, fertilization and other grounds maintenance shall be done by professional groundkeepers who are trained at how to maintain the grounds.
3. Periodic parking lot sweeping program shall be implemented. This program shall include removal of windblown debris and litter from landscaped areas.
4. A supply of speedy dry type oil absorbent material shall be kept on-site to allow for the quick cleanup of minor spills.

4.0 SPILL PREVENTION AND RESPONSE PLAN

The Property Manager, shall train all personnel in the proper handling and cleanup of spilled Hazardous Substances or Oil. No spilled Hazardous Substances or Oil shall be allowed to come in contact with stormwater discharges. If such contact occurs, the stormwater discharge shall be contained on site until appropriate measures in compliance with state and federal regulations are taken to dispose such contaminated stormwater. It shall be the responsibility of the Property Manager to be properly trained, and to train all personnel in spill prevention and cleanup procedures.

In order to prevent or minimize the potential for a spill of hazardous substances or oil to come into contact with stormwater, the following steps shall be implemented:

- a. All hazardous substances or oil (such as pesticides, petroleum products, fertilizers, detergents, chemicals, acids, paints, paint solvents, cleaning solvents, additives for soil stabilization, concrete curing compounds and additives, etc.) shall be stored in a secure location, with their lids on, preferably under cover, when not in use.
- b. The minimum practical quantity of all such materials shall be kept at the facility.
- c. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, plastic and metal trash containers, etc.) shall be provided at the site.
- d. Manufacturer's recommended methods for spill cleanup shall be clearly posted and site maintenance personnel shall be trained regarding these procedures and the location of the information and cleanup supplies.
- e. It is the Property Manager's responsibility to ensure that all hazardous waste discovered or generated at the Project site are disposed properly by a licensed hazardous material disposal company. The Property Manager is responsible for not exceeding hazardous waste storage requirements mandated by the EPA or state and local authority.

A spill contingency plan shall be implemented including the following provisions:

- Equipment necessary to quickly attend to inadvertent spills or shall be stored on-site in a secure but accessible location. Such equipment shall include:
 - 1. Safety goggles.
 - 2. Chemically resistant gloves and overshoe boots.
 - 3. Water and chemical fire extinguishers.
 - 4. Sand and shovels.
 - 5. Suitable absorbent materials.
 - 6. Storage containers.
 - 7. First aid equipment.

In the event of a spill of hazardous substances or oil, the following procedures must be followed:

- a. All measures must be taken to contain and abate the spill and to prevent the discharge of the hazardous substance or oil to stormwater or off-site. (The spill area must be kept well ventilated and personnel must wear appropriate protective clothing to prevent injury from contact with the hazardous substances.)
- b. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

- c. For spills greater than five (5) gallons of material immediately contact a Massachusetts Licensed Site Professional L.S.P. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill and proceed with prevention, containment and/or clean-up if so desired.
- d. Spills of amounts that exceed reportable quantities of certain substances specifically mentioned in federal regulations 40 CFR 110, 40 CFR 117, and 40 CFR 302 must be immediately reported to the EPA National Response Center, Telephone (800) 242-8802.

The Property Manager shall be the spill prevention and response coordinator. He shall designate the individuals who shall receive spill prevention and response training. These individuals shall each become responsible for a particular phase of prevention and response. The names of these personnel should be posted in the material storage area and in the property office.

5.0 SNOW AND ICE REMOVAL

Snow removal shall be primarily done by mechanical removal rather than chemical application. The judicious use of sand and salt without chemical additives is allowed in order to protect the safety of the public.