
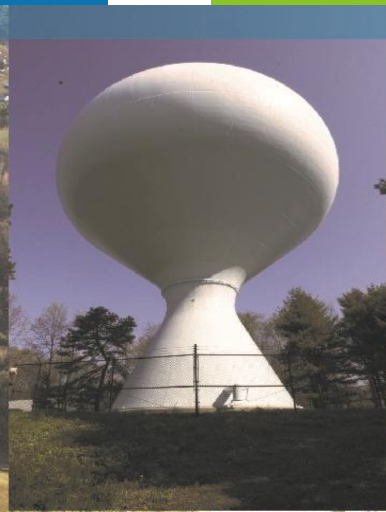
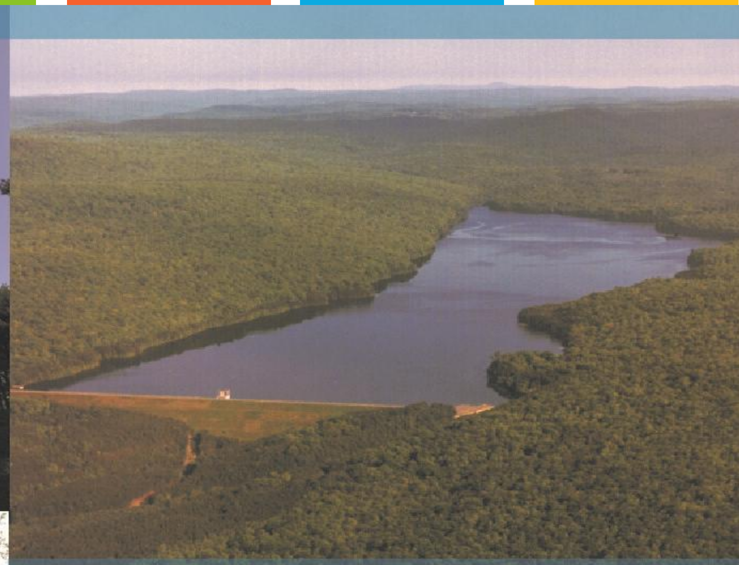


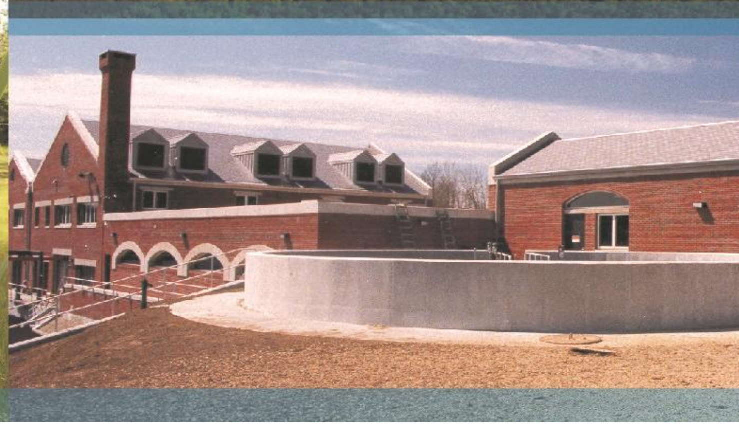

Lake Hiawatha Drainage and Water Main Replacement
Bellingham, MA

STORMWATER MANAGEMENT REPORT

Town of Bellingham

November 2025

Tighe&Bond

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CONTENTS

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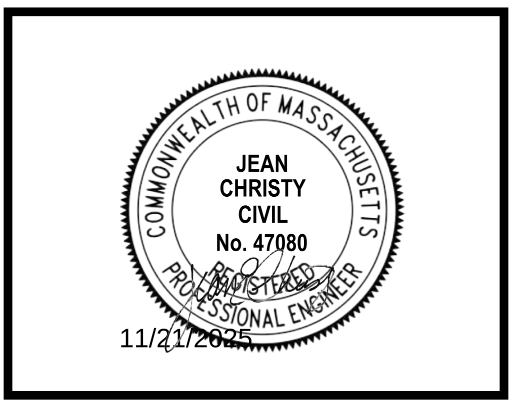
SECTION 1

Section 1
Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the computations, published and site-specific soil information, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan, the Long-term Post-Construction Operation and Maintenance Plan 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, provided in Appendix A, 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 ____________ 11/21/2025

Signature, Date

SECTION 2

Section 2
Project Description

2.1 Project Introduction

On behalf of the Town of Bellingham (the "Applicant"), Tighe & Bond has prepared the following Stormwater Management Report to support local permitting efforts for the Lake Hiawatha Drainage and Water Main Replacement Project located in Bellingham, Massachusetts.

The proposed project is located in Bellingham, Massachusetts near Lake Hiawatha on Lakeshore Drive, Bernier Lane, and Indian Run Road (the Site). Currently, the Site and its surrounding area consists mainly of private residential properties and town-owned parcels. The town-owned parcel between Indian Run Road and Lakeshore Drive includes a stream conveying storm runoff from a larger upstream watershed to Lake Hiawatha. During intense rain events, the capacity of the receiving catch basin and downstream infrastructure is inundated, impacting both public and private properties. The proposed project includes updates to existing stormwater management infrastructure for flood mitigation and water quality improvement in the Lake Hiawatha area, as well as water main improvement work. The existing 6-inch asbestos concrete (AC) water main along Lakeshore Drive is proposed to be replaced with an 8-inch diameter ductile iron water main to the Blackstone Town line (approximately 2,500 linear feet). Because the existing water main is asbestos concrete, the proposed design will lay the new ductile iron water main in parallel to the existing water main to minimize asbestos concrete disturbance; therefore, the existing water main will be abandoned in place. The proposed connection between existing 6-inch CLCI (Cast Iron Cemented Line) water mains in Indian Run Road will extend approximately 250 feet between approximately 46 Indian Run Road and 56 Indian Run Road. The existing 2-inch water line in Bernier Lane will be replaced with a 6-inch ductile iron main.

A United States Geological Survey (USGS) Site Locus figure, Priority Resource figure, and Orthophotograph of the Site are provided in Appendix B as Figures 1-3 (respectively). Project plans are provided separately.

2.2 Existing Conditions

The Site is located within the Suburban Zoning District. Currently, the Site consists of residential properties with landscaping. The Site consists of moderate sloping topography, with the entire area pitched down toward Lake Hiawatha. Land surrounding the Site is occupied by residential properties and some commercial and general use offices, as well as Lake Hiawatha, which is considered an Open Water zone by MassDEP.

The Natural Resources Conservation Service (NRCS) soil data was obtained through the Web Soil Survey portal on the United States Department of Agriculture (USDA) NRCS website. The areas surrounding the Site were queried for soil types according to the record soil survey maps maintained by NRCS. Soils within the project area, as published in the USDA Soil Survey for Norfolk and Suffolk Counties, Version 21, dated September 5, 2025, include the Montauk and Woodbridge associations. The NRCS Soils Mapping is provided in Appendix C. The hydrologic soil group (HSG) and further description for each soil association is presented in Table 2.1 below.

Table 2.1
Soil Descriptions

Soil Map Designation	Soil Name	Hydrologic Soil Group (HSG)
302B	Montauk fine sandy loam, 0 to 8 percent slopes, extremely stony	C
302C	Montauk fine sandy loam, 8 to 15 percent slopes, extremely stony	C
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D

The hydrologic soil group designation (HSG) for this soil type is listed C. The HSG rating for soil types is 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. Soils designated as HSG C have a slow infiltration rate due to layers of finer texture soils. The dual-designation assignment of C/D represent soils in drained and undrained areas. For purposes of this report, any wetland within the dual-designation area was represented as HSG D, while the remainder of the soil grouping was represented as HSG C based on the first letter of the dual-designation. The NRCS Soils Mapping is provided in Appendix C.

Under existing conditions, minimally treated stormwater runoff from the project area flows downgradient toward Lake Hiawatha. Existing available data suggests that stormwater infrastructure exists within Partridge Trail and Buffy Road, which captures runoff from the southern portion of the contributing drainage area via a series of catch basins outletting to two detention ponds within the subcatchment area. Two 21-inch culverts currently convey water beneath Buffy Road in the direction of Lake Hiawatha. Four existing catch basins on Lakeshore Drive collect runoff from the road and the stream on the Town-owned parcel. A series of 12-inch concrete pipes convey runoff to an outfall on Lake Hiawatha, where water is discharged to the lake on private property.

The runoff curve numbers (CN) used in the calculation of the composite CN for each drainage area are based on the values provided in TR-55, Urban Hydrology for Small Watersheds. RCN values vary depending on the type of ground cover and soil HSG. Existing Conditions Drainage Areas were delineated based on topography and stormwater discharge location. A summary of the existing conditions runoff curve numbers and drainage areas are provided in the HydroCAD report in Appendix D. An Existing Conditions Drainage Area Map is provided as Figure 4 in Appendix B.

2.3 Floodplain Management

The Federal Emergency Management Agency's Flood Insurance Rate Map (FIRM) Community Panel Number 25021C0311F, effective July 8, 2025 shows the majority of the Site outside of any floodways or floodplains, as attached in Appendix B. A small portion of the end of Bernier Lane is identified as being within a Zone A, with no base flood elevation assigned.

2.4 Proposed Improvements

The proposed drainage improvements include replacing the existing drainage system within Lakeshore Drive to address flooding concerns in the area and treat stormwater runoff quality before discharge to Lake Hiawatha. Flow from an unnamed stream is proposed to be captured through a new 18-inch pipe at an existing headwall along Indian Run Road, from which water will be conveyed down through Lakeshore Drive through a series of drainage manholes. Stormwater runoff from within Lakeshore Drive will be captured through deep-sump, hooded catch basins, and flows will combine within Lakeshore Drive before they are conveyed down Bernier Lane for water quality treatment. This design has been prepared in accordance with recommendations in the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook.

Proposed conditions drainage areas were delineated based on topography and stormwater discharge location. A summary of the proposed conditions runoff curve numbers and drainage areas are provided in the HydroCAD report in Appendix D. A Proposed Conditions Drainage Area Map is provided as Figure 5 in Appendix B.

The proposed stormwater management system treats the quality of stormwater discharge from the Site. The system includes best management practices (BMPs) such as deep-sump hooded catch basins, and a proprietary stormwater treatment unit. A brief description of the proposed Best Management Practices incorporated into the stormwater management system are as follows:

> <u>Deep-Sump, Hooded Catch Basins:</u> Catch basins proposed for the project collect stormwater runoff from Lakeshore Drive and the stream running through the town-owned parcel, and are connected to the project's stormwater collection system. The deep-sump and hooded outlet provide runoff an opportunity to separate from solids and floatable pollutants prior to discharge and are used as a pretreatment device throughout the project.
>
> <u>Proprietary Treatment Devices:</u> Structural stormwater treatment devices, proposed as Stormceptor STC 900, are designed to mechanically separate pollutants from stormwater flows through centrifugal force and vortex separation. One unit is proposed within Bernier Lane, prior to the proposed outfall to Lake Hiawatha. The unit has been sized in accordance with guidance provided by MassDEP to ensure proper sediment removal efficiencies.

2.5 Method of Hydrology and Hydraulic Analysis

The following storm drainage design criteria were used for all hydrologic and hydraulic analyses:

1. Piped storm drainage system and the outlets are designed for a 25-year storm event.
2. Minimum time of concentration = 6 minutes.
3. For SCS peak flow calculations, Curve Number were as follows:
    a. Impervious (Pavement/Roof Areas) = 98
    b. ½ Acre Lots (HSG C) = 80
    c. ¼ Acre Lots (HSG C) = 83
    d. 1 Acre Lots (HSG C) =79

   e. 50-75% Grass Cover, Fair (HSG C) = 79
   f. >75% Grass Cover, Fair (HSG C) = 74
   g. Woods, Good (HSG C) = 70
4. Minimum diameter pipes, excluding roof leaders, underdrains and foundation drains = 12 inches
5. Minimum pipe slope = 0.5 percent
6. Watershed areas delineated using polylines in AutoCAD Civil 3D 2021.
7. Comparative hydrology analyzed using Hydro CAD Stormwater Modeling software Version 10.2-4c.

A hydrologic analysis of the pre-development and post-development site was performed to determine the impacts of the proposed project to peak discharge rates and stormwater runoff volumes. HydroCAD Release 10.00-20 is a hydrology and hydraulics software using Technical Release (TR) 20 and TR-55 methodologies for the determination of stormwater runoff quantities. The HydroCAD Report for both pre- and post-development conditions for the 2-, 10-, 25-, and 100-year storm events is provided in Appendix D. Table 2.2 below presents the design rainfall depths for the 2, 10, 25, and 100-year storms, as provided by the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service.

Table 2.2
Design Rainfall Depths

Storm Event	Rainfall Depth (inches)
2-Year	3.38
10-Year	5.23
25-Year	6.38
100-Year	8.16

The proposed storm drain collection system was analyzed to ensure that the pipe capacities proposed can accommodate the 25-year storm event, as well as meeting minimum and maximum flow velocity. Results of that analysis are provided in Appendix D. Supporting flow calculations for the 25-year storm event are provided separately in Appendix D, reflecting a rainfall depth of 6.38 inches.

SECTION 3

Section 3
Regulatory Compliance

The project is required to comply with the ten MassDEP Massachusetts Stormwater Standards (Standards) under the Massachusetts Wetlands Protection Act and the Town of Bellingham Chapter 247- Wetland Regulation Bylaw. The Massachusetts Stormwater Checklist is provided in Appendix A.

3.1 LID Measures

MassDEP allows for reductions in structural stormwater Best Management Practice (BMP) requirements for water quantity and quality when certain criteria are met. The proposed project includes environmentally sensitive site design and low impact development techniques; however, the applicant is not requesting credit for LID measures.

3.2 Standard 1: No New Untreated Discharges

The project will not result in any new stormwater conveyance discharging untreated stormwater directly to the Waters of the Commonwealth. Further documentation pertaining to stormwater treatment is provided in Section 3.5.

It is not anticipated that erosive stormwater velocities will be encountered post-construction subsequently causing erosion and siltation to Waters of the Commonwealth. All discharges have been designed to meet the thresholds identified in Volume 3 of the Massachusetts Stormwater Handbook.

Table 3.1
Stormwater Discharge Velocities

Discharge Location	2-year Storm Event (cfs)	2-Year Storm Event Velocity (fps)	Maximum Permissible Velocity (fps)[1]
18” outfall	9.9	4.4	3.0

[1] Maximum Permissible Velocity is based on Table 2.3.1 of Volume 3 of the MassDEP Stormwater Handbook for slopes greater than 10%.

All outfalls will be equipped with stone outlet protection as shown on the Site Plans to ensure that no scour occurs. These devices are designed based on the anticipated flow from each outfall to dissipate energy and reduce the opportunity for erosion to develop.

3.3 Standard 2: Peak Discharge Rate Attenuation

Although the proposed project alters existing drainage patterns, infiltration and detention are not proposed as stormwater management features for the project. Peak discharge rates are generally maintained under proposed conditions as compared to existing conditions through minimal impervious cover reduction, with no new impervious area proposed. Runoff is collected by deep-sump, hooded catch basins and conveyed to an outfall at Lake Hiawatha down Bernier Lane. Table 3.2 presents the results of the pre-development stormwater runoff analysis versus the post-development stormwater runoff analysis, previously described in Section 2.4, for project.

Table 3.2
Peak Discharge Rate Comparison

		2-Year Storm Event (cfs)	10-Year Storm Event (cfs)	100-Year Storm Event (cfs)
Design Point 1	Existing	9.9	19.3	34.9
	Proposed	9.9	19.3	34.9

Table 3.2 indicates that existing peak discharge rate for the project at the Design Point is maintained for all storm events.

3.4 Standard 3: Groundwater Recharge

The project is considered a redevelopment, therefore, compliance with Standard 3 is to the maximum extent practicable. The project includes a slight reduction in impervious area, and due to limited available space within the right-of-way and shallow groundwater, recharge is not included as part of this project.

3.5 Standard 4: Water Quality

Standard 4 of the Massachusetts Stormwater Standards addresses stormwater quality requirements. This standard requires that new stormwater management systems be designed to achieve an 80% Total Suspended Solids (TSS) removal rate prior to discharge. MassDEP has published presumed removal rates for each of the BMPs featured in their design guidelines. Additionally, this standard addresses the required volume of stormwater runoff that is to be treated by the BMPs, as well as components of a long-term source control and pollution prevention plan. The project is considered a redevelopment and therefore complies with Standard 4 to the maximum extent practicable.

Treatment for stormwater runoff is provided through deep sump hooded catch basins and a Stormceptor STC 900 unit. The TSS pretreatment removal of this train is 63%. Refer to Appendix D for TSS removal calculations.

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

The proposed use is not considered a LUHPPL. Therefore, compliance with the additional requirements of Standard 5 is not required.

3.7 Standard 6: Critical Areas

The Site discharges stormwater runoff to Lake Hiawatha. Lake Hiawatha is not listed as impaired in the Massachusetts Year 2022 Integrated List of Waters.

Although the project does not discharge to impaired waters, the proposed BMPs will increase water quality in stormwater runoff discharging to Lake Hiawatha as compared to existing conditions. Refer to Section 3.5 for additional information on TSS pretreatment removal efficiencies.

Other Critical Areas, as defined in the Massachusetts Stormwater Handbook, are shown on Figure 2 in Appendix B.

3.8 Standard 7: Redevelopment Projects

The project is considered a redevelopment; therefore, the project has been designed to comply to the maximum extent practicable with Standards 2, 3, and 4. The project has been designed to fully comply with the remaining Standards.

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

A construction period Soil Erosion and Sediment Control Plan (SESCP) is provided in Appendix E. The SESCP presents the minimum soil erosion a sediment control practices to be used during construction. General soil erosion and sedimentation control BMPs are indicated on the Site Plans.

3.10 Standard 9: Long-Term Operation and Maintenance Plan

A Long-Term Stormwater Operations and Maintenance Plan is included in Appendix F of this report. The O&M plan indicates the responsible parties for the project, routine and non-routine maintenance tasks and inspection criteria. The O&M Plan also provides guidance on long-term pollution prevention practices for the project.

3.11 Standard 10: Prohibition of Illicit Discharges

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents. A signed Illicit Discharge Statement will be provided prior to construction.

3.12 Local Regulations

Section 7.9 of the Bellingham Planning Board Procedural Rules outlines performance standards for redevelopment projects within the Town, as listed below.

1) Stormwater management systems on redevelopment sites shall be designed to meet an average annual pollutant removal equivalent to 80% of the average annual postconstruction load of Total Suspended Solids (TSS) related to the total post-construction impervious area on the Site. Average annual pollutant removal requirements shall be achieved through one of the following methods:

a. Installing stormwater BMPs that meet the pollutant removal percentages required based on calculations developed consistent with EPA Region 1's BMP Accounting and Tracking Tool or other BMP performance evaluation tool provided by EPA Region 1, where available.

b. Retaining the volume of runoff equivalent to, or greater than, 0.8 inch multiplied by the total post-construction impervious surface area on the redeveloped site, or

c. Meeting a combination of retention and treatment that achieves the above standards.

This requirement is met to the maximum extent practicable. The aim of the proposed project is to improve storm drainage access and discharge quality in the Lakeshore Drive and Bernier Lane area. With the majority of the project taking place within the public right-of-way, there is limited space for runoff retention and infiltration. Although the performance standard is not fully met, the proposed project presents an improvement over existing conditions through the installation of deep-sump, hooded catch basins and a water quality unit. Through these practices, a TSS pretreatment removal rate of 63% is achieved for runoff from the subcatchment prior to discharge to Lake Hiawatha. Additionally, the project proposes a small reduction in impervious cover as part of the drainage improvement and repaving work.

2) Unless specifically exempt from Section 7 of these Rules, Post-Construction Stormwater Management Plan for New Developments and Redevelopments, redevelopment activities that are exclusively limited to maintenance and improvement of existing roadways (including… improving existing drainage systems and repaving projects) shall improve existing conditions where feasible and are exempt from Section 7.9.2(E) and may be exempt from certain Massachusetts Stormwater Standards.

   The proposed project is limited to improvements to the existing drainage and water distribution systems, as well as roadway repaving. As such, it meets the requirements of Section 7.9 of the Bellingham Planning Board Procedural Rules to the maximum extent practicable, while providing water quality and drainage infrastructure access improvements, as outlined herein.

\\Tighebond.com\data\Data\Projects\B\B0852 Bellingham MS4 Engineering\009 Lake Hiawatha Drainage Design\Stormwater\Narrative\B0852-009 Stormwater Management Report.docx

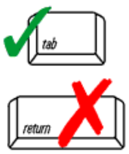
APPENDIX A

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

COMMONWEALTH OF MASSACHUSETTS
JEAN
CHRISTY
CIVIL
No. 47080
REGISTERED
PROFESSIONAL ENGINEER
11/21/2025

Jean E. Christy 11/21/2025
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 (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

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

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

☐ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist (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 (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 (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 (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.

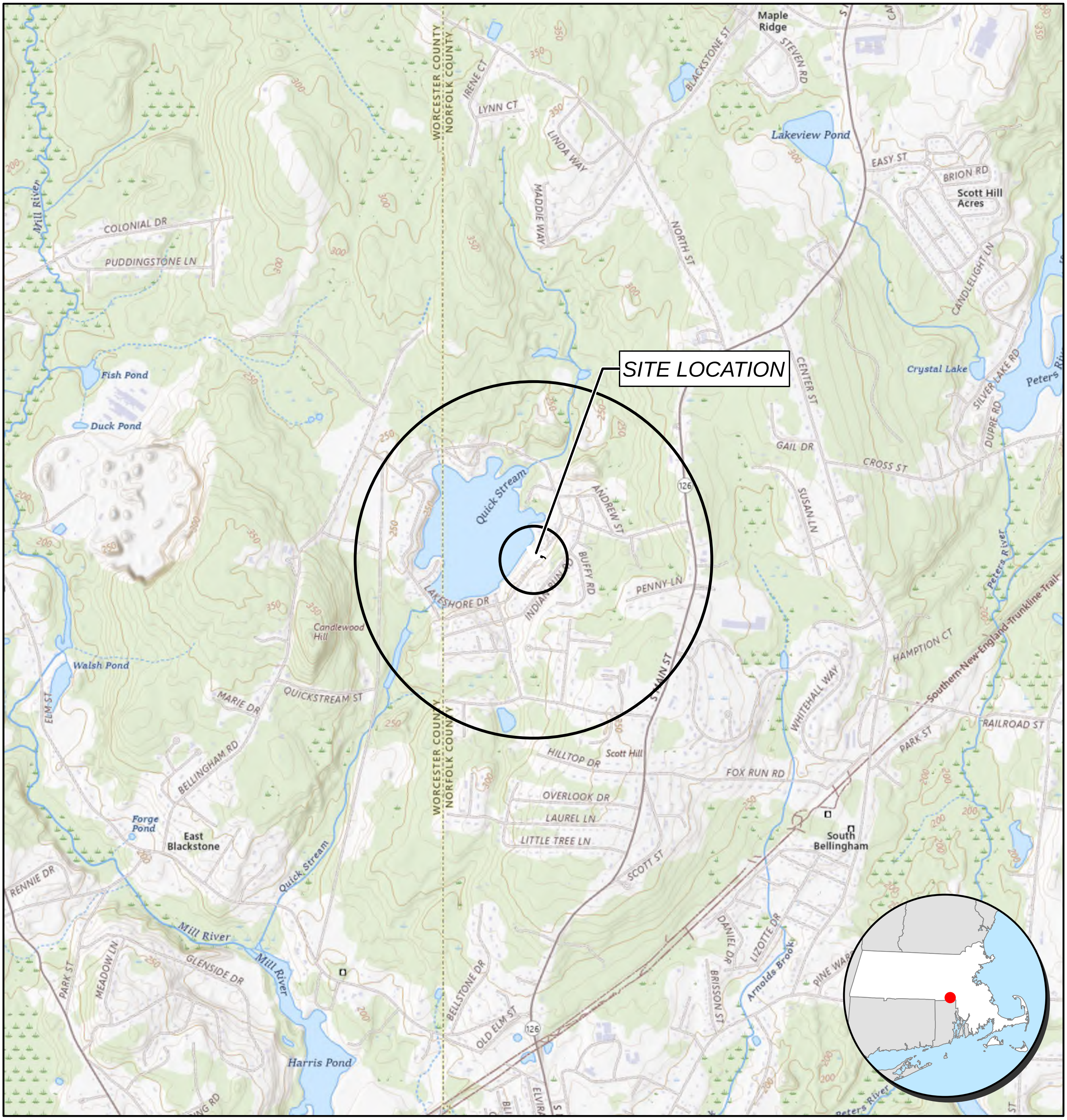
Standard 10: Prohibition of Illicit Discharges

- ☐ 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.

APPENDIX B

FIGURE 1
SITE LOCATION
November 2025

Lake Hiawatha
Drainage and Water Main Replacement Project
Bellingham, Massachusetts



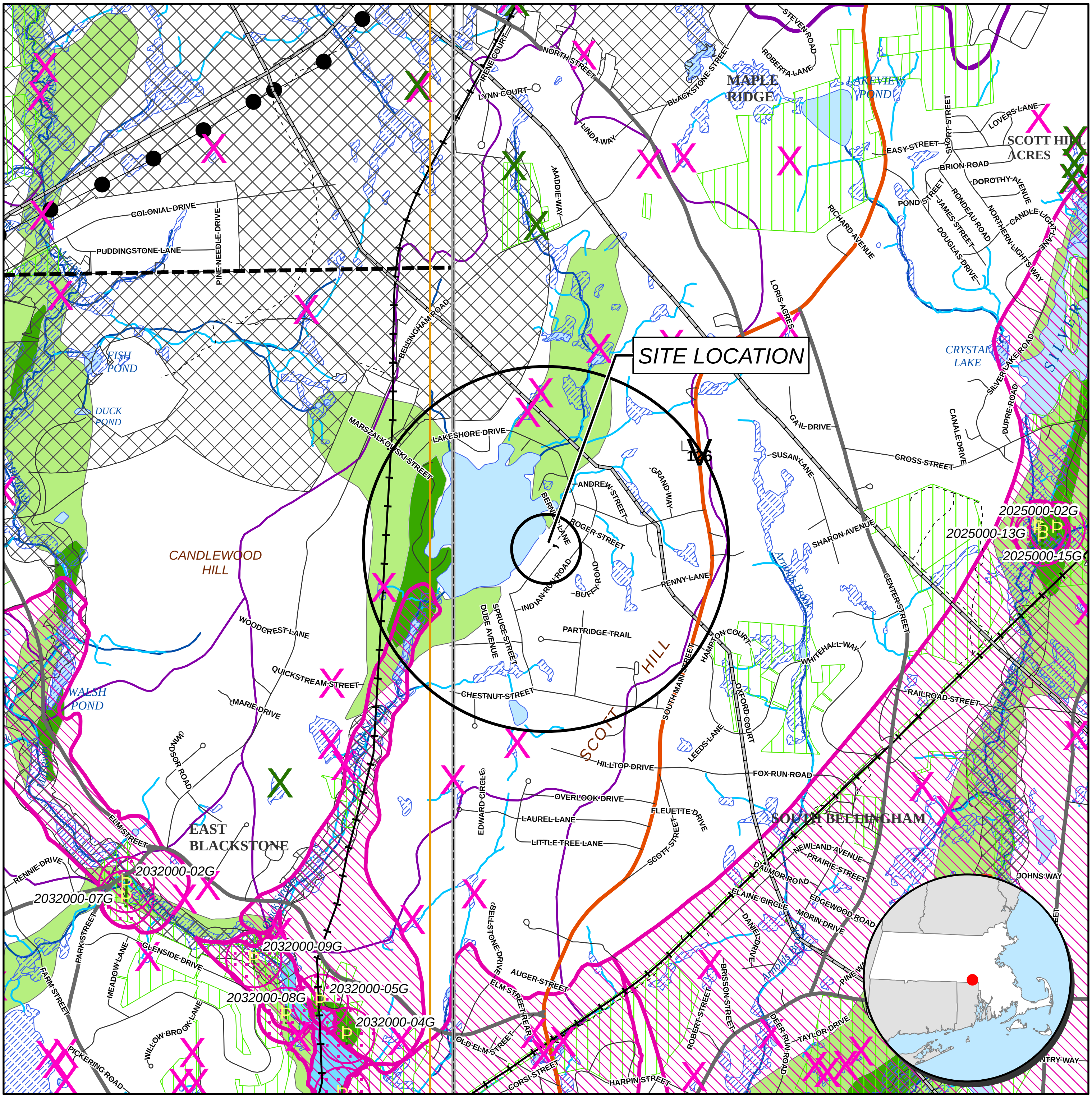
Tighe&Bond

Based on USGS The National Map Topo Basemap.
Contour Interval Equals 10 Feet.
Circles indicate 500-foot and half-mile radii.

N

1:24,000

0 1,000 2,000
Feet



- NHESP Certified Vernal Pool
- NHESP Potential Vernal Pool
- Non-Landfill Solid Waste Site
- Proposed Well
- Emergency Surface Water
- Community Public Water Supply - Surface Water
- Community Public Water Supply - Groundwater
- Non-Community Non-Transient Public Water Supply
- Non-Community Transient Public Water Supply
- Limited Access Highway
- Multi-Lane Highway, NOT Limited Access
- Other Numbered Route
- Major Road - Arterials and Collectors
- Minor Street or Road
- Aqueduct
- Hydrologic Connection
- Stream/Intermittent Stream
- Powerline
- Pipeline
- Track or Trail
- Railroad
- Public Surface Water Supply Protection Area (Zone A)
- DEP Approved Wellhead Protection Area (Zone I)
- DEP Approved Wellhead Protection Area (Zone II)
- DEP Interim Wellhead Protection Area (IWPA)
- Protected and Recreational Open Space
- Solid Waste Landfill
- Area of Critical Environmental Concern (ACEC)
- NHESP Priority Habitat for Rare Species
- NHESP Estimated Habitat for Rare Wildlife
- EPA Designated Sole Source Aquifer
- Major Drainage Basin
- Sub Drainage Basin
- MassDEP Inland Wetland
- MassDEP Coastal Wetland
- MassDEP Not Interpreted Wetland
- Public Surface Water Supply (PSWS)
- Water Body
- Non-Potential Drinking Water Source Area - High Yield
- Non-Potential Drinking Water Source Area - Medium Yield
- Potentially Productive Medium Yield Aquifer
- Potentially Productive High Yield Aquifer
- County Boundary
- Municipal Boundary
- USGS Quadrangle Sheet Boundary

N

1:24,000

0 1,000 2,000
Feet

Tighe&Bond

Data source: Bureau of Geographic Information (MassGIS), Commonwealth of Massachusetts, Executive Office of Technology
Circles indicate 500-foot and half-mile radii.
Data valid as of November 2025.

FIGURE 3
AERIAL
November 2025

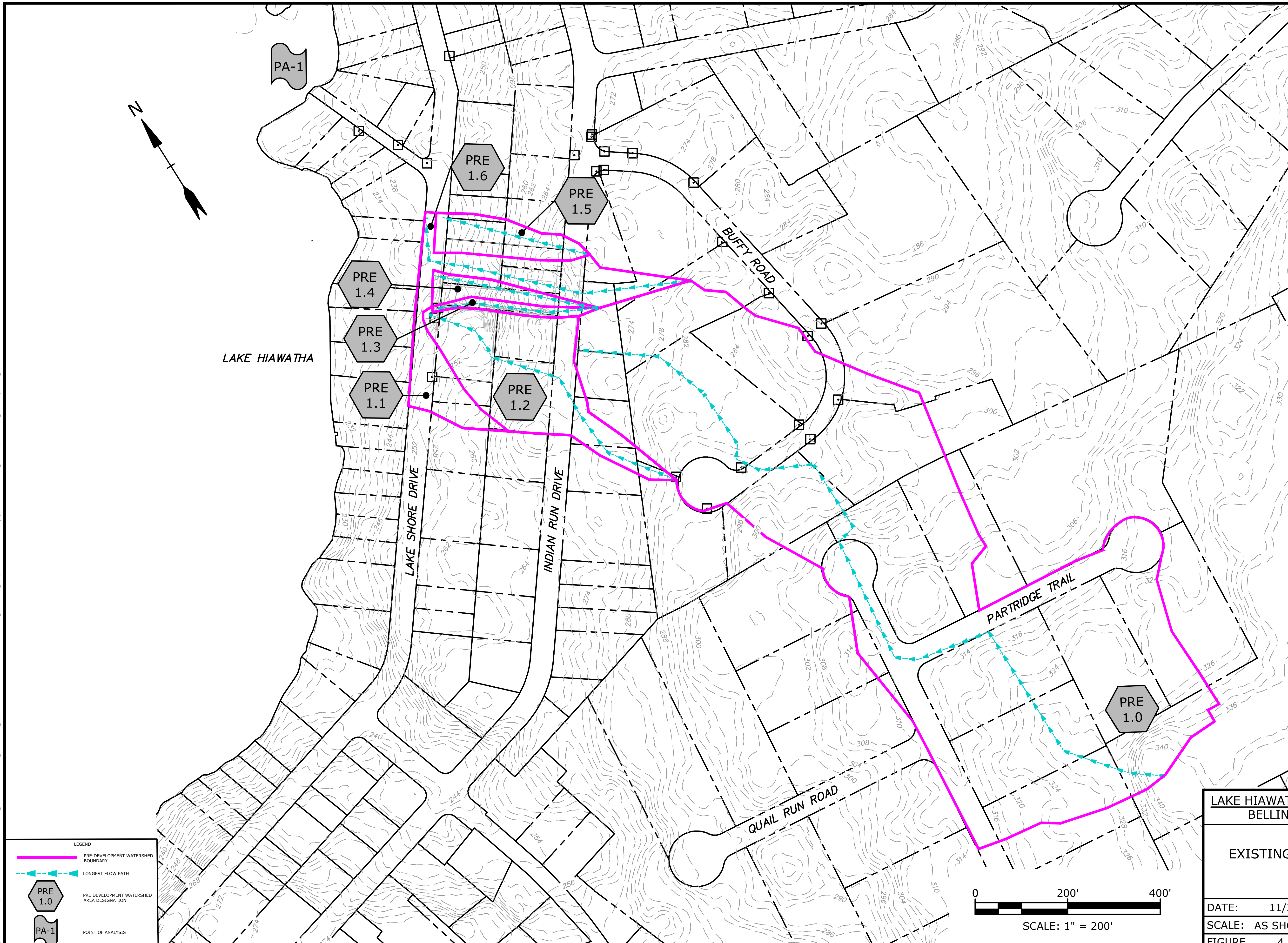
Lake Hiawatha
Drainage and Water Main Replacement Project
Bellingham, Massachusetts

Limits of Work
Municipal Boundary
Approximate Parcel Boundary

N
1:3,600
0 150 300
Feet

Tighe&Bond

Based on September 2025 Nearmap Imagery.
Approximate parcel boundaries (FY25) courtesy of MassGIS.



0 200' 400'

SCALE: 1" = 200'

LAKE HIAWATHA DRAINAGE IMPROVEMENTS
BELLINGHAM, MASSACHUSETTS

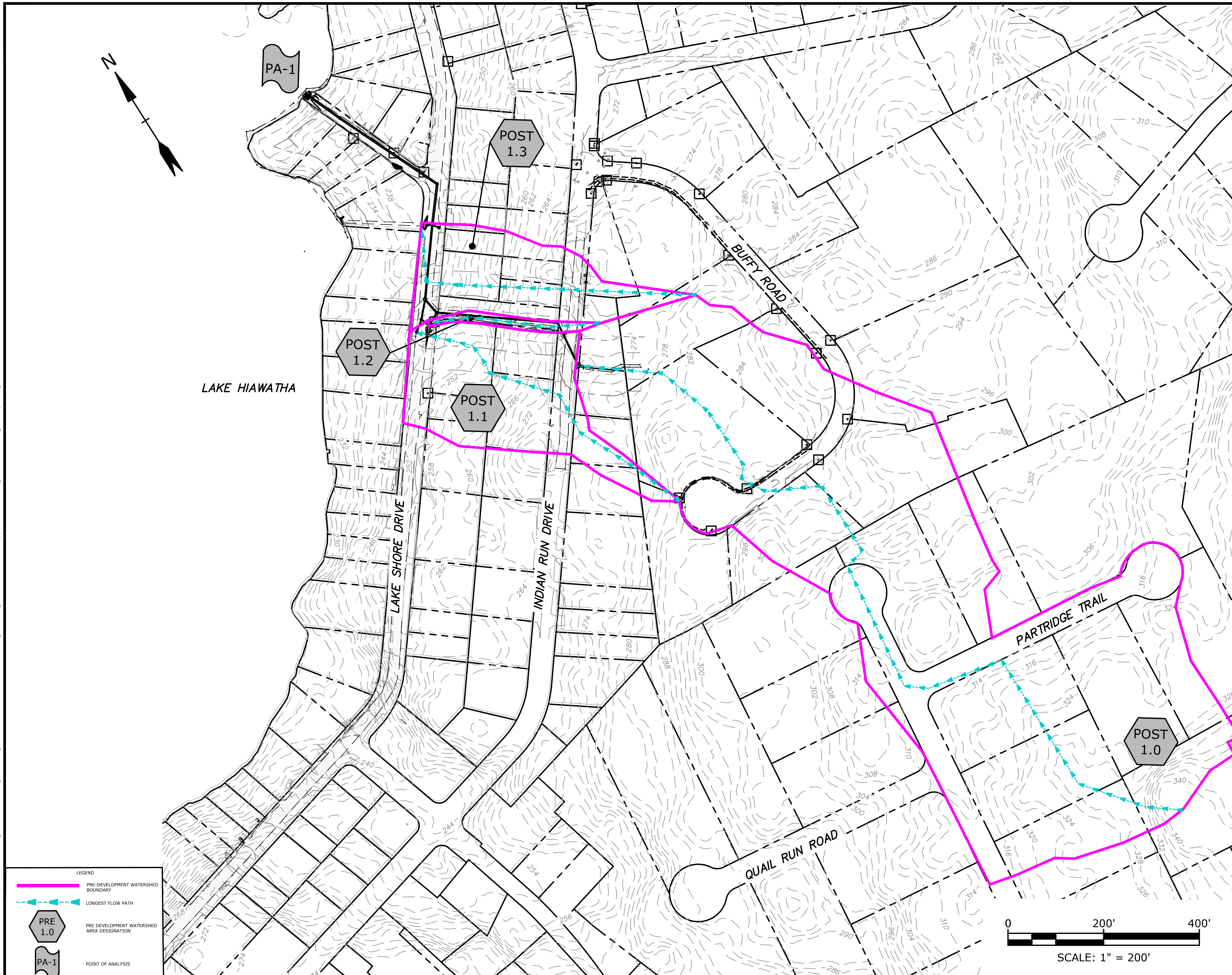
EXISTING CONDITIONS DRAINAGE FIGURE

DATE: 11/2025

SCALE: AS SHOWN

FIGURE 4

Tighe&Bond



LAKE HIAWATHA DRAINAGE IMPROVEMENTS
BELLINGHAM, MASSACHUSETTS

PROPOSED CONDITIONS DRAINAGE FIGURE

DATE: 11/2025
SCALE: AS SHOWN
FIGURE 5

Tighe&Bond

Nov 20, 2025-11:38am Plotted By: HConnolly
Tighe & Bond, Inc. J:\B\B0852 Bellingham MS4 Engineering\009 Lake Hiawatha Drainage Design\Stormwater\Appendix B - Figures\Drainage Map.dwg

National Flood Hazard Layer FIRMette

FEMA

71°29'54"W 42°3'31"N

71°29'16"W 42°3'4"N

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

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

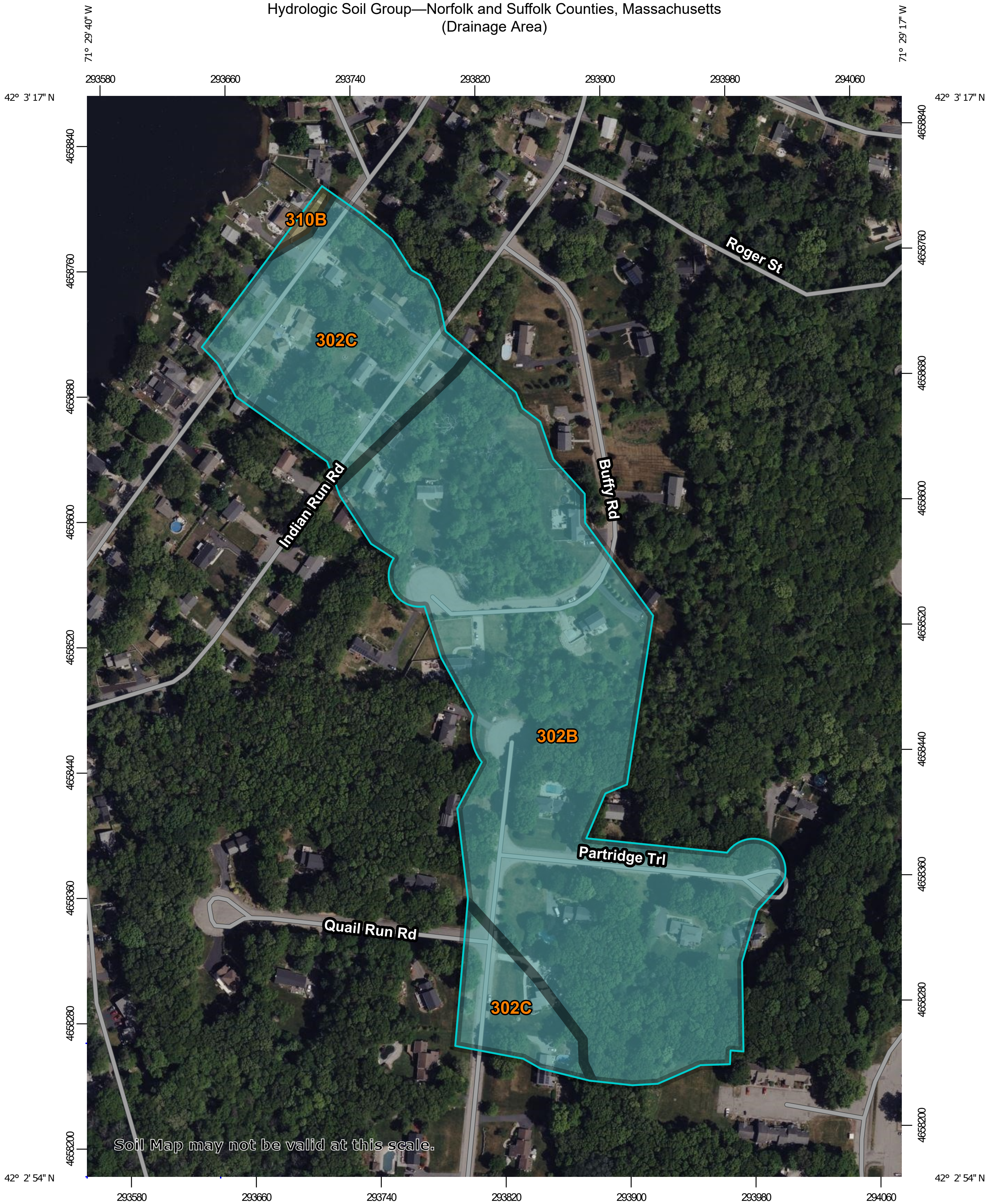
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/17/2025 at 5:14 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

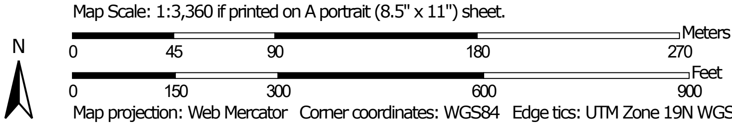
FIGURE 6

APPENDIX C

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts
(Drainage Area)



Map Scale: 1:3,360 if printed on A portrait (8.5" x 11") sheet.



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

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 21, Sep 5, 2025

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
302B	Montauk fine sandy loam, 0 to 8 percent slopes, extremely stony	C	14.1	71.9%
302C	Montauk fine sandy loam, 8 to 15 percent slopes, extremely stony	C	5.4	27.5%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	0.1	0.6%
Totals for Area of Interest			**19.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX D

Hydraulic Calculations

Tighe&Bond

Project: B0852-009
Date: 11/2025
Calculated by: TAL
Checked by: JEC

Pipe Material
Roughness Coefficient 0.013 HDPE

Upstream Structure	Downstream Structure	Anticipated Flow (cfs)*	Pipe Dia. (in)	Pipe Material	Pipe Area (sf)	Pipe Length (ft)	Upstream Invert	Downstream Invert	Pipe Slope (ft/ft)	Hydr. Radius (ft)	Full-Pipe Velocity (fps)	Full-Pipe Flow (cfs)
Headwall	DMH 10	22.20	18	HDPE	1.767	98.9	268.70	264.00	0.048	0.38	12.99	22.96
DMH 10	DMH 9	22.20	18	HDPE	1.767	84.2	262.00	258.00	0.048	0.38	12.99	22.96
DMH 9	DMH 8	22.20	18	HDPE	1.767	71.6	254.50	251.00	0.049	0.38	13.18	23.29
DMH 8	DMH 7	22.50	18	HDPE	1.767	43.5	245.00	243.00	0.046	0.38	12.78	22.58
DMH 7	DMH 6	22.50	18	HDPE	1.767	40.9	240.00	238.00	0.049	0.38	13.18	23.29
CB 3	DMH 6	0.78	12	HDPE	0.785	26.3	240.00	239.80	0.008	0.25	3.97	3.12
DMH 6	DMH 5	22.57	24	HDPE	3.142	33.9	237.80	236.20	0.047	0.50	15.69	49.28
CB 5	DMH 3	2.71	12	HDPE	0.785	23.5	238.00	237.50	0.021	0.25	6.63	5.21
CB 4	DMH 3	2.71	12	HDPE	0.785	11	238.00	237.70	0.027	0.25	7.51	5.90
DMH 3	DMH 5	5.42	15	HDPE	1.227	38.5	236.60	236.00	0.016	0.31	6.59	8.09
DMH 5	DMH 4	24.69	24	HDPE	3.142	151.2	235.60	233.50	0.014	0.50	8.51	26.73
CB 1	DMH 4	4.23	12	HDPE	0.785	6	235.00	234.80	0.033	0.25	8.30	6.52
CB 2	DMH 4	4.23	12	HDPE	0.785	10.5	235.00	234.80	0.019	0.25	6.28	4.93
DMH 4	DMH 2	25.37	30	HDPE	4.909	80	233.00	232.60	0.005	0.63	5.92	29.08
DMH 2	DMH 1	25.37	30	HDPE	4.909	163	232.50	231.00	0.009	0.63	8.04	39.45
DMH 1	WQU 1	25.37	30	HDPE	4.909	73.5	230.00	229.50	0.007	0.63	6.91	33.92
WQU 1	OUTFALL	25.37	30	HDPE	4.909	82	229.20	228.80	0.005	0.63	5.85	28.72

All flows obtained from HydroCAD modeling using NOAA Atlas 14 precipitation data. Refer to Appendix B for watershed delineation maps. Design flows are based on the 25-year storm event.

Stormceptor Sizing Calculations

Brief Stormceptor Sizing Report - Lake Hiawatha Drainage and Water Main Replacement

Project Information & Location			
Project Name	Lake Hiawatha Drainage and Water Main Replacement	**Project Number**	50718
City		**State/ Province**	Massachusetts
Country	United States of America	**Date**	11/11/2025
Designer Information		**EOR Information (optional)**	
Name	Taylor Labbe	**Name**	
Company	Tighe & Bond	**Company**	
Phone #	401-200-0318	**Phone #**	
Email	tlabbe@tighebond.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	
Target TSS Removal (%)	50
TSS Removal (%) Provided	61
Recommended Stormceptor Model	STC 900

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 450i	48
STC 900	61
STC 1200	63
STC 1800	63
STC 2400	69
STC 3600	69
STC 4800	74
STC 6000	74
STC 7200	78
STC 11000	82
STC 13000	82
STC 16000	85

Stormceptor®

CONTECH ENGINEERED SOLUTIONS

Sizing Details

Drainage Area

Drainage Area	
Total Area (acres)	19.41
Imperviousness %	32.5

Rainfall

Rainfall	
Station Name	BLUE HILL
State/Province	Massachusetts
Station ID #	0736
Years of Records	58
Latitude	42°12'44"N
Longitude	71°6'53"W

Water Quality Objective

Water Quality Objective	
TSS Removal (%)	50.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (Gal)	
Peak Conveyed Flow Rate (CFS)	
Water Quality Flow Rate (CFS)	1.97

Up Stream Storage

Storage (ac-ft)	Discharge (cfs)
0.000	0.000

Up Stream Flow Diversion

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cfs)	

Particle Size Distribution (PSD)
The selected PSD defines TSS removal

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
https://www.conteches.com/technical-guides/search?filter=1WBC0O5EYX

Standard 4 Compliance Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Pre-Treatment Train 1

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Hooded Catch Basin	25%	**1.00**	0.25	0.75
Proprietary Treatment Device	50%	0.75	0.38	0.37

Total TSS Removal = 63%

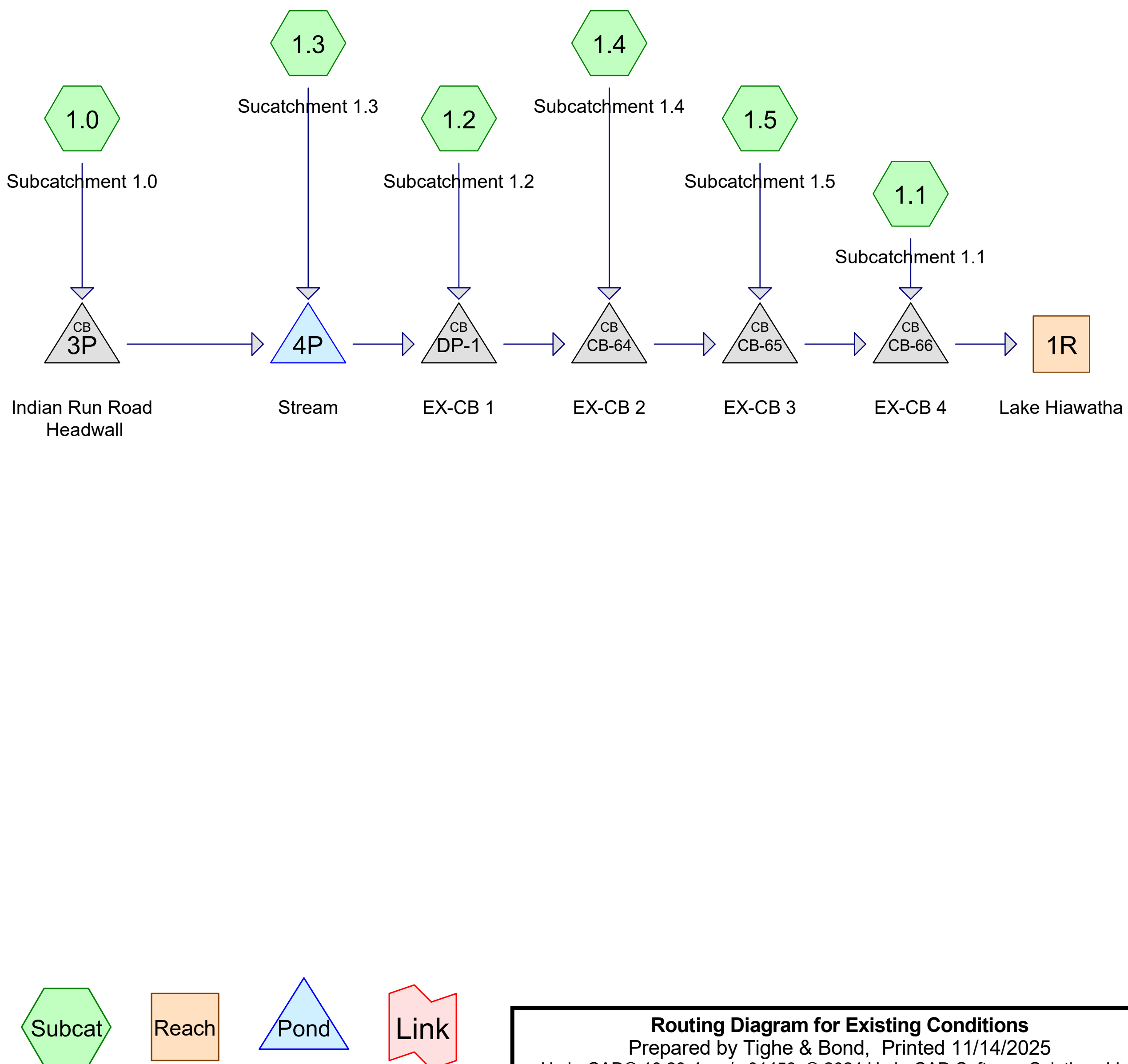
Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: B0852-022
Prepared By: TAL
Date: 11/2025

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Existing Hydrology



Routing Diagram for Existing Conditions
Prepared by Tighe & Bond, Printed 11/14/2025
HydroCAD® 10.20-4c s/n 01453 © 2024 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.38	2
2	10-Year	Type III 24-hr		Default	24.00	1	5.23	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.38	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.16	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.157	79	1 acre lots, 20% imp, HSG C (1.0)
1.374	80	1/2 acre lots, 25% imp, HSG C (1.2)
1.610	83	1/4 acre lots, 38% imp, HSG C (1.1, 1.4, 1.5)
0.166	79	50-75% Grass cover, Fair, HSG C (1.3)
2.724	98	Paved roads w/curbs & sewers, HSG C (1.0, 1.1, 1.2, 1.4, 1.5)
0.383	70	Woods, Good, HSG C (1.2, 1.5)
19.414	**82**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=1.68"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=8.54 cfs 2.143 af

Subcatchment 1.1: Subcatchment 1.1 Runoff Area=58,400 sf 49.15% Impervious Runoff Depth=1.99"
Tc=18.0 min CN=86 Runoff=2.20 cfs 0.223 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=80,241 sf 34.38% Impervious Runoff Depth=1.68"
Flow Length=947' Tc=54.0 min CN=82 Runoff=1.51 cfs 0.259 af

Subcatchment 1.3: Sucatchment 1.3 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=1.47"
Tc=6.0 min CN=79 Runoff=0.28 cfs 0.020 af

Subcatchment 1.4: Subcatchment 1.4 Runoff Area=12,432 sf 43.35% Impervious Runoff Depth=1.83"
Tc=6.0 min CN=84 Runoff=0.61 cfs 0.044 af

Subcatchment 1.5: Subcatchment 1.5 Runoff Area=22,211 sf 29.45% Impervious Runoff Depth=1.47"
Flow Length=371' Tc=6.5 min CN=79 Runoff=0.86 cfs 0.063 af

Reach 1R: Lake Hiawatha Inflow=9.87 cfs 2.751 af
Outflow=9.87 cfs 2.751 af

Pond 3P: Indian Run Road Headwall Peak Elev=272.66' Inflow=8.54 cfs 2.143 af
15.0" Round Culvert n=0.013 L=87.0' S=0.0184 '/' Outflow=8.54 cfs 2.143 af

Pond 4P: Stream Inflow=8.57 cfs 2.163 af
Primary=8.57 cfs 2.163 af

Pond CB-64: EX-CB 2 Peak Elev=284.12' Inflow=9.50 cfs 2.465 af
12.0" Round Culvert n=0.025 L=129.0' S=0.0148 '/' Outflow=9.50 cfs 2.465 af

Pond CB-65: EX-CB 3 Peak Elev=245.83' Inflow=9.58 cfs 2.528 af
12.0" Round Culvert n=0.011 L=32.0' S=0.0159 '/' Outflow=9.58 cfs 2.528 af

Pond CB-66: EX-CB 4 Peak Elev=241.41' Inflow=9.87 cfs 2.751 af
12.0" Round Culvert n=0.011 L=171.0' S=0.0391 '/' Outflow=9.87 cfs 2.751 af

Pond DP-1: EX-CB 1 Peak Elev=308.16' Inflow=9.44 cfs 2.422 af
12.0" Round Culvert n=0.025 L=76.0' S=0.0228 '/' Outflow=9.44 cfs 2.422 af

Total Runoff Area = 19.414 ac Runoff Volume = 2.751 af Average Runoff Depth = 1.70"
67.50% Pervious = 13.104 ac 32.50% Impervious = 6.310 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Depth= 1.68"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1: Subcatchment 1.1

Runoff = 2.20 cfs @ 12.25 hrs, Volume= 0.223 af, Depth= 1.99"
Routed to Pond CB-66 : EX-CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
10,507	98	Paved roads w/curbs & sewers, HSG C
47,893	83	1/4 acre lots, 38% imp, HSG C
58,400	86	Weighted Average
29,694		50.85% Pervious Area
28,706		49.15% Impervious Area

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

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 1.51 cfs @ 12.77 hrs, Volume= 0.259 af, Depth= 1.68"
Routed to Pond DP-1 : EX-CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
12,623	98	Paved roads w/curbs & sewers, HSG C
59,847	80	1/2 acre lots, 25% imp, HSG C
7,771	70	Woods, Good, HSG C
80,241	82	Weighted Average
52,656		65.62% Pervious Area
27,585		34.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
54.0	947	Total			

Summary for Subcatchment 1.3: Sucatchment 1.3

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 0.020 af, Depth= 1.47"
Routed to Pond 4P : Stream

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.4: Subcatchment 1.4

Runoff = 0.61 cfs @ 12.09 hrs, Volume= 0.044 af, Depth= 1.83"
Routed to Pond CB-64 : EX-CB 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
1,072	98	Paved roads w/curbs & sewers, HSG C
11,360	83	1/4 acre lots, 38% imp, HSG C
12,432	84	Weighted Average
7,043		56.65% Pervious Area
5,389		43.35% Impervious Area

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

Summary for Subcatchment 1.5: Subcatchment 1.5

Runoff = 0.86 cfs @ 12.10 hrs, Volume= 0.063 af, Depth= 1.47"
Routed to Pond CB-65 : EX-CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
2,402	98	Paved roads w/curbs & sewers, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
22,211	79	Weighted Average
15,671		70.55% Pervious Area
6,540		29.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.41		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.38"
5.3	261	0.1072	0.82		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.0	10	0.0352	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.5	371	Total			

Summary for Reach 1R: Lake Hiawatha

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 1.70" for 2-Year event
Inflow = 9.87 cfs @ 13.28 hrs, Volume= 2.751 af
Outflow = 9.87 cfs @ 13.28 hrs, Volume= 2.751 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Outflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Atten= 0%, Lag= 0.0 min
Primary = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Routed to Pond 4P : Stream

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 272.66' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.68'	**15.0" Round Culvert** L= 87.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.68' / 267.08' S= 0.0184 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=8.54 cfs @ 13.29 hrs HW=272.66' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 8.54 cfs @ 6.96 fps)

Summary for Pond 4P: Stream

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.57 cfs @ 13.29 hrs, Volume= 2.163 af
Primary = 8.57 cfs @ 13.29 hrs, Volume= 2.163 af, Atten= 0%, Lag= 0.0 min
Routed to Pond DP-1 : EX-CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond CB-64: EX-CB 2

Inflow Area = 17.563 ac, 31.32% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 9.50 cfs @ 13.28 hrs, Volume= 2.465 af
Outflow = 9.50 cfs @ 13.28 hrs, Volume= 2.465 af, Atten= 0%, Lag= 0.0 min
Primary = 9.50 cfs @ 13.28 hrs, Volume= 2.465 af
Routed to Pond CB-65 : EX-CB 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 284.12' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.85'	**12.0" Round Culvert**

L= 129.0' CMP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 237.85' / 235.94' S= 0.0148 '/' Cc= 0.900
n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=9.49 cfs @ 13.28 hrs HW=284.12' TW=245.82' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 9.49 cfs @ 12.09 fps)

Summary for Pond CB-65: EX-CB 3

Inflow Area = 18.073 ac, 31.27% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 9.58 cfs @ 13.28 hrs, Volume= 2.528 af
Outflow = 9.58 cfs @ 13.28 hrs, Volume= 2.528 af, Atten= 0%, Lag= 0.0 min
Primary = 9.58 cfs @ 13.28 hrs, Volume= 2.528 af
Routed to Pond CB-66 : EX-CB 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 245.83' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.94'	**12.0" Round Culvert** L= 32.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 235.94' / 235.43' S= 0.0159 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=9.56 cfs @ 13.28 hrs HW=245.82' TW=241.41' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 9.56 cfs @ 12.17 fps)

Summary for Pond CB-66: EX-CB 4

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 1.70" for 2-Year event
Inflow = 9.87 cfs @ 13.28 hrs, Volume= 2.751 af
Outflow = 9.87 cfs @ 13.28 hrs, Volume= 2.751 af, Atten= 0%, Lag= 0.0 min
Primary = 9.87 cfs @ 13.28 hrs, Volume= 2.751 af
Routed to Reach 1R : Lake Hiawatha

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 241.41' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.73'	**12.0" Round Culvert** L= 171.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 234.73' / 228.05' S= 0.0391 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=9.86 cfs @ 13.28 hrs HW=241.40' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 9.86 cfs @ 12.56 fps)

Summary for Pond DP-1: EX-CB 1

Inflow Area = 17.278 ac, 31.12% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 9.44 cfs @ 13.28 hrs, Volume= 2.422 af
Outflow = 9.44 cfs @ 13.28 hrs, Volume= 2.422 af, Atten= 0%, Lag= 0.0 min
Primary = 9.44 cfs @ 13.28 hrs, Volume= 2.422 af
Routed to Pond CB-64 : EX-CB 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 308.16' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	239.68'	**12.0" Round Culvert** L= 76.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.68' / 237.95' S= 0.0228 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=9.43 cfs @ 13.28 hrs HW=308.10' TW=284.12' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 9.43 cfs @ 12.00 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=3.29"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=16.86 cfs 4.181 af

Subcatchment 1.1: Subcatchment 1.1 Runoff Area=58,400 sf 49.15% Impervious Runoff Depth=3.68"
Tc=18.0 min CN=86 Runoff=4.02 cfs 0.411 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=80,241 sf 34.38% Impervious Runoff Depth=3.29"
Flow Length=947' Tc=54.0 min CN=82 Runoff=2.96 cfs 0.504 af

Subcatchment 1.3: Sucatchment 1.3 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=79 Runoff=0.59 cfs 0.042 af

Subcatchment 1.4: Subcatchment 1.4 Runoff Area=12,432 sf 43.35% Impervious Runoff Depth=3.48"
Tc=6.0 min CN=84 Runoff=1.15 cfs 0.083 af

Subcatchment 1.5: Subcatchment 1.5 Runoff Area=22,211 sf 29.45% Impervious Runoff Depth=3.00"
Flow Length=371' Tc=6.5 min CN=79 Runoff=1.76 cfs 0.128 af

Reach 1R: Lake Hiawatha Inflow=19.28 cfs 5.348 af
Outflow=19.28 cfs 5.348 af

Pond 3P: Indian Run Road Headwall Peak Elev=282.36' Inflow=16.86 cfs 4.181 af
15.0" Round Culvert n=0.013 L=87.0' S=0.0184 '/' Outflow=16.86 cfs 4.181 af

Pond 4P: Stream Inflow=16.91 cfs 4.222 af
Primary=16.91 cfs 4.222 af

Pond CB-64: EX-CB 2 Peak Elev=440.99' Inflow=18.64 cfs 4.810 af
12.0" Round Culvert n=0.025 L=129.0' S=0.0148 '/' Outflow=18.64 cfs 4.810 af

Pond CB-65: EX-CB 3 Peak Elev=293.31' Inflow=18.79 cfs 4.937 af
12.0" Round Culvert n=0.011 L=32.0' S=0.0159 '/' Outflow=18.79 cfs 4.937 af

Pond CB-66: EX-CB 4 Peak Elev=276.27' Inflow=19.28 cfs 5.348 af
12.0" Round Culvert n=0.011 L=171.0' S=0.0391 '/' Outflow=19.28 cfs 5.348 af

Pond DP-1: EX-CB 1 Peak Elev=533.78' Inflow=18.55 cfs 4.727 af
12.0" Round Culvert n=0.025 L=76.0' S=0.0228 '/' Outflow=18.55 cfs 4.727 af

Total Runoff Area = 19.414 ac Runoff Volume = 5.348 af Average Runoff Depth = 3.31"
67.50% Pervious = 13.104 ac 32.50% Impervious = 6.310 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Depth= 3.29"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1: Subcatchment 1.1

Runoff = 4.02 cfs @ 12.24 hrs, Volume= 0.411 af, Depth= 3.68"
Routed to Pond CB-66 : EX-CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
10,507	98	Paved roads w/curbs & sewers, HSG C
47,893	83	1/4 acre lots, 38% imp, HSG C
58,400	86	Weighted Average
29,694		50.85% Pervious Area
28,706		49.15% Impervious Area

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

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 2.96 cfs @ 12.72 hrs, Volume= 0.504 af, Depth= 3.29"
Routed to Pond DP-1 : EX-CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
12,623	98	Paved roads w/curbs & sewers, HSG C
59,847	80	1/2 acre lots, 25% imp, HSG C
7,771	70	Woods, Good, HSG C
80,241	82	Weighted Average
52,656		65.62% Pervious Area
27,585		34.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
54.0	947	Total			

Summary for Subcatchment 1.3: Sucatchment 1.3

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af, Depth= 3.00"
Routed to Pond 4P : Stream

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.4: Subcatchment 1.4

Runoff = 1.15 cfs @ 12.09 hrs, Volume= 0.083 af, Depth= 3.48"
Routed to Pond CB-64 : EX-CB 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
1,072	98	Paved roads w/curbs & sewers, HSG C
11,360	83	1/4 acre lots, 38% imp, HSG C
12,432	84	Weighted Average
7,043		56.65% Pervious Area
5,389		43.35% Impervious Area

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

Summary for Subcatchment 1.5: Subcatchment 1.5

Runoff = 1.76 cfs @ 12.10 hrs, Volume= 0.128 af, Depth= 3.00"
Routed to Pond CB-65 : EX-CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
2,402	98	Paved roads w/curbs & sewers, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
22,211	79	Weighted Average
15,671		70.55% Pervious Area
6,540		29.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.41		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.38"
5.3	261	0.1072	0.82		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.0	10	0.0352	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.5	371	Total			

Summary for Reach 1R: Lake Hiawatha

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 3.31" for 10-Year event
Inflow = 19.28 cfs @ 13.18 hrs, Volume= 5.348 af
Outflow = 19.28 cfs @ 13.18 hrs, Volume= 5.348 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Outflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Atten= 0%, Lag= 0.0 min
Primary = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Routed to Pond 4P : Stream

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.36' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.68'	**15.0" Round Culvert** L= 87.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.68' / 267.08' S= 0.0184 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=16.85 cfs @ 13.28 hrs HW=282.36' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 16.85 cfs @ 13.73 fps)

Summary for Pond 4P: Stream

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 3.28" for 10-Year event
Inflow = 16.91 cfs @ 13.28 hrs, Volume= 4.222 af
Primary = 16.91 cfs @ 13.28 hrs, Volume= 4.222 af, Atten= 0%, Lag= 0.0 min
Routed to Pond DP-1 : EX-CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond CB-64: EX-CB 2

Inflow Area = 17.563 ac, 31.32% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 18.64 cfs @ 13.28 hrs, Volume= 4.810 af
Outflow = 18.64 cfs @ 13.28 hrs, Volume= 4.810 af, Atten= 0%, Lag= 0.0 min
Primary = 18.64 cfs @ 13.28 hrs, Volume= 4.810 af
Routed to Pond CB-65 : EX-CB 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 440.99' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.85'	**12.0" Round Culvert**

L= 129.0' CMP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 237.85' / 235.94' S= 0.0148 '/' Cc= 0.900
n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=18.64 cfs @ 13.28 hrs HW=440.93' TW=293.31' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 18.64 cfs @ 23.73 fps)

Summary for Pond CB-65: EX-CB 3

Inflow Area = 18.073 ac, 31.27% Impervious, Inflow Depth = 3.28" for 10-Year event
Inflow = 18.79 cfs @ 13.28 hrs, Volume= 4.937 af
Outflow = 18.79 cfs @ 13.28 hrs, Volume= 4.937 af, Atten= 0%, Lag= 0.0 min
Primary = 18.79 cfs @ 13.28 hrs, Volume= 4.937 af
Routed to Pond CB-66 : EX-CB 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 293.31' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.94'	**12.0" Round Culvert** L= 32.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 235.94' / 235.43' S= 0.0159 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=18.79 cfs @ 13.28 hrs HW=293.31' TW=276.25' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 18.79 cfs @ 23.92 fps)

Summary for Pond CB-66: EX-CB 4

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 3.31" for 10-Year event
Inflow = 19.28 cfs @ 13.18 hrs, Volume= 5.348 af
Outflow = 19.28 cfs @ 13.18 hrs, Volume= 5.348 af, Atten= 0%, Lag= 0.0 min
Primary = 19.28 cfs @ 13.18 hrs, Volume= 5.348 af
Routed to Reach 1R : Lake Hiawatha

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 276.27' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.73'	**12.0" Round Culvert** L= 171.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 234.73' / 228.05' S= 0.0391 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=19.28 cfs @ 13.18 hrs HW=276.27' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 19.28 cfs @ 24.55 fps)

Summary for Pond DP-1: EX-CB 1

Inflow Area = 17.278 ac, 31.12% Impervious, Inflow Depth = 3.28" for 10-Year event
Inflow = 18.55 cfs @ 13.28 hrs, Volume= 4.727 af
Outflow = 18.55 cfs @ 13.28 hrs, Volume= 4.727 af, Atten= 0%, Lag= 0.0 min
Primary = 18.55 cfs @ 13.28 hrs, Volume= 4.727 af
Routed to Pond CB-64 : EX-CB 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 533.78' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	239.68'	**12.0" Round Culvert** L= 76.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.68' / 237.95' S= 0.0228 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=18.54 cfs @ 13.28 hrs HW=533.72' TW=440.93' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 18.54 cfs @ 23.60 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=4.34"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=22.20 cfs 5.520 af

Subcatchment 1.1: Subcatchment 1.1 Runoff Area=58,400 sf 49.15% Impervious Runoff Depth=4.77"
Tc=18.0 min CN=86 Runoff=5.16 cfs 0.533 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=80,241 sf 34.38% Impervious Runoff Depth=4.34"
Flow Length=947' Tc=54.0 min CN=82 Runoff=3.89 cfs 0.666 af

Subcatchment 1.3: Sucatchment 1.3 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=4.02"
Tc=6.0 min CN=79 Runoff=0.78 cfs 0.056 af

Subcatchment 1.4: Subcatchment 1.4 Runoff Area=12,432 sf 43.35% Impervious Runoff Depth=4.55"
Tc=6.0 min CN=84 Runoff=1.50 cfs 0.108 af

Subcatchment 1.5: Subcatchment 1.5 Runoff Area=22,211 sf 29.45% Impervious Runoff Depth=4.02"
Flow Length=371' Tc=6.5 min CN=79 Runoff=2.35 cfs 0.171 af

Reach 1R: Lake Hiawatha Inflow=25.38 cfs 7.054 af
Outflow=25.38 cfs 7.054 af

Pond 3P: Indian Run Road Headwall Peak Elev=291.96' Inflow=22.20 cfs 5.520 af
15.0" Round Culvert n=0.013 L=87.0' S=0.0184 '/' Outflow=22.20 cfs 5.520 af

Pond 4P: Stream Inflow=22.27 cfs 5.576 af
Primary=22.27 cfs 5.576 af

Pond CB-64: EX-CB 2 Peak Elev=595.40' Inflow=24.52 cfs 6.350 af
12.0" Round Culvert n=0.025 L=129.0' S=0.0148 '/' Outflow=24.52 cfs 6.350 af

Pond CB-65: EX-CB 3 Peak Elev=340.30' Inflow=24.71 cfs 6.521 af
12.0" Round Culvert n=0.011 L=32.0' S=0.0159 '/' Outflow=24.71 cfs 6.521 af

Pond CB-66: EX-CB 4 Peak Elev=310.81' Inflow=25.38 cfs 7.054 af
12.0" Round Culvert n=0.011 L=171.0' S=0.0391 '/' Outflow=25.38 cfs 7.054 af

Pond DP-1: EX-CB 1 Peak Elev=756.08' Inflow=24.40 cfs 6.242 af
12.0" Round Culvert n=0.025 L=76.0' S=0.0228 '/' Outflow=24.40 cfs 6.242 af

Total Runoff Area = 19.414 ac Runoff Volume = 7.054 af Average Runoff Depth = 4.36"
67.50% Pervious = 13.104 ac 32.50% Impervious = 6.310 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Depth= 4.34"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1: Subcatchment 1.1

Runoff = 5.16 cfs @ 12.24 hrs, Volume= 0.533 af, Depth= 4.77"
Routed to Pond CB-66 : EX-CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
10,507	98	Paved roads w/curbs & sewers, HSG C
47,893	83	1/4 acre lots, 38% imp, HSG C
58,400	86	Weighted Average
29,694		50.85% Pervious Area
28,706		49.15% Impervious Area

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

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 3.89 cfs @ 12.72 hrs, Volume= 0.666 af, Depth= 4.34"
Routed to Pond DP-1 : EX-CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
12,623	98	Paved roads w/curbs & sewers, HSG C
59,847	80	1/2 acre lots, 25% imp, HSG C
7,771	70	Woods, Good, HSG C
80,241	82	Weighted Average
52,656		65.62% Pervious Area
27,585		34.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
54.0	947	Total			

Summary for Subcatchment 1.3: Sucatchment 1.3

Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 4.02"
Routed to Pond 4P : Stream

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.4: Subcatchment 1.4

Runoff = 1.50 cfs @ 12.09 hrs, Volume= 0.108 af, Depth= 4.55"
Routed to Pond CB-64 : EX-CB 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
1,072	98	Paved roads w/curbs & sewers, HSG C
11,360	83	1/4 acre lots, 38% imp, HSG C
12,432	84	Weighted Average
7,043		56.65% Pervious Area
5,389		43.35% Impervious Area

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

Summary for Subcatchment 1.5: Subcatchment 1.5

Runoff = 2.35 cfs @ 12.09 hrs, Volume= 0.171 af, Depth= 4.02"
Routed to Pond CB-65 : EX-CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
2,402	98	Paved roads w/curbs & sewers, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
22,211	79	Weighted Average
15,671		70.55% Pervious Area
6,540		29.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.41		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.38"
5.3	261	0.1072	0.82		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.0	10	0.0352	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.5	371	Total			

Summary for Reach 1R: Lake Hiawatha

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 4.36" for 25-Year event
Inflow = 25.38 cfs @ 13.18 hrs, Volume= 7.054 af
Outflow = 25.38 cfs @ 13.18 hrs, Volume= 7.054 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Outflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Atten= 0%, Lag= 0.0 min
Primary = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Routed to Pond 4P : Stream

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 291.96' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.68'	**15.0" Round Culvert** L= 87.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.68' / 267.08' S= 0.0184 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=22.20 cfs @ 13.28 hrs HW=291.95' TW=0.00' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 22.20 cfs @ 18.09 fps)

Summary for Pond 4P: Stream

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 4.33" for 25-Year event
Inflow = 22.27 cfs @ 13.28 hrs, Volume= 5.576 af
Primary = 22.27 cfs @ 13.28 hrs, Volume= 5.576 af, Atten= 0%, Lag= 0.0 min
Routed to Pond DP-1 : EX-CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond CB-64: EX-CB 2

Inflow Area = 17.563 ac, 31.32% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 24.52 cfs @ 13.28 hrs, Volume= 6.350 af
Outflow = 24.52 cfs @ 13.28 hrs, Volume= 6.350 af, Atten= 0%, Lag= 0.0 min
Primary = 24.52 cfs @ 13.28 hrs, Volume= 6.350 af
Routed to Pond CB-65 : EX-CB 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 595.40' @ 13.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.85'	**12.0" Round Culvert**

L= 129.0' CMP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 237.85' / 235.94' S= 0.0148 '/' Cc= 0.900
n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=24.51 cfs @ 13.28 hrs HW=595.32' TW=339.98' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 24.51 cfs @ 31.21 fps)

Summary for Pond CB-65: EX-CB 3

Inflow Area = 18.073 ac, 31.27% Impervious, Inflow Depth = 4.33" for 25-Year event
Inflow = 24.71 cfs @ 13.28 hrs, Volume= 6.521 af
Outflow = 24.71 cfs @ 13.28 hrs, Volume= 6.521 af, Atten= 0%, Lag= 0.0 min
Primary = 24.71 cfs @ 13.28 hrs, Volume= 6.521 af
Routed to Pond CB-66 : EX-CB 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 340.30' @ 13.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.94'	**12.0" Round Culvert** L= 32.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 235.94' / 235.43' S= 0.0159 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=24.72 cfs @ 13.28 hrs HW=339.98' TW=310.46' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 24.72 cfs @ 31.47 fps)

Summary for Pond CB-66: EX-CB 4

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 4.36" for 25-Year event
Inflow = 25.38 cfs @ 13.18 hrs, Volume= 7.054 af
Outflow = 25.38 cfs @ 13.18 hrs, Volume= 7.054 af, Atten= 0%, Lag= 0.0 min
Primary = 25.38 cfs @ 13.18 hrs, Volume= 7.054 af
Routed to Reach 1R : Lake Hiawatha

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 310.81' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.73'	**12.0" Round Culvert** L= 171.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 234.73' / 228.05' S= 0.0391 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=25.37 cfs @ 13.18 hrs HW=310.81' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 25.37 cfs @ 32.31 fps)

Summary for Pond DP-1: EX-CB 1

Inflow Area = 17.278 ac, 31.12% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 24.40 cfs @ 13.28 hrs, Volume= 6.242 af
Outflow = 24.40 cfs @ 13.28 hrs, Volume= 6.242 af, Atten= 0%, Lag= 0.0 min
Primary = 24.40 cfs @ 13.28 hrs, Volume= 6.242 af
Routed to Pond CB-64 : EX-CB 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 756.08' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	239.68'	**12.0" Round Culvert** L= 76.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.68' / 237.95' S= 0.0228 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=24.40 cfs @ 13.28 hrs HW=756.00' TW=595.33' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 24.40 cfs @ 31.06 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=6.01"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=30.56 cfs 7.650 af

Subcatchment 1.1: Subcatchment 1.1 Runoff Area=58,400 sf 49.15% Impervious Runoff Depth=6.49"
Tc=18.0 min CN=86 Runoff=6.92 cfs 0.725 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=80,241 sf 34.38% Impervious Runoff Depth=6.01"
Flow Length=947' Tc=54.0 min CN=82 Runoff=5.35 cfs 0.923 af

Subcatchment 1.3: Sucatchment 1.3 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=5.66"
Tc=6.0 min CN=79 Runoff=1.09 cfs 0.078 af

Subcatchment 1.4: Subcatchment 1.4 Runoff Area=12,432 sf 43.35% Impervious Runoff Depth=6.25"
Tc=6.0 min CN=84 Runoff=2.02 cfs 0.149 af

Subcatchment 1.5: Subcatchment 1.5 Runoff Area=22,211 sf 29.45% Impervious Runoff Depth=5.66"
Flow Length=371' Tc=6.5 min CN=79 Runoff=3.28 cfs 0.240 af

Reach 1R: Lake Hiawatha Inflow=34.89 cfs 9.765 af
Outflow=34.89 cfs 9.765 af

Pond 3P: Indian Run Road Headwall Peak Elev=312.21' Inflow=30.56 cfs 7.650 af
15.0" Round Culvert n=0.013 L=87.0' S=0.0184 '/' Outflow=30.56 cfs 7.650 af

Pond 4P: Stream Inflow=30.64 cfs 7.728 af
Primary=30.64 cfs 7.728 af

Pond CB-64: EX-CB 2 Peak Elev=922.87' Inflow=33.74 cfs 8.800 af
12.0" Round Culvert n=0.025 L=129.0' S=0.0148 '/' Outflow=33.74 cfs 8.800 af

Pond CB-65: EX-CB 3 Peak Elev=439.49' Inflow=34.01 cfs 9.040 af
12.0" Round Culvert n=0.011 L=32.0' S=0.0159 '/' Outflow=34.01 cfs 9.040 af

Pond CB-66: EX-CB 4 Peak Elev=383.63' Inflow=34.89 cfs 9.765 af
12.0" Round Culvert n=0.011 L=171.0' S=0.0391 '/' Outflow=34.89 cfs 9.765 af

Pond DP-1: EX-CB 1 Peak Elev=1,227.07' Inflow=33.58 cfs 8.651 af
12.0" Round Culvert n=0.025 L=76.0' S=0.0228 '/' Outflow=33.58 cfs 8.651 af

Total Runoff Area = 19.414 ac Runoff Volume = 9.765 af Average Runoff Depth = 6.04"
67.50% Pervious = 13.104 ac 32.50% Impervious = 6.310 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Depth= 6.01"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1: Subcatchment 1.1

Runoff = 6.92 cfs @ 12.24 hrs, Volume= 0.725 af, Depth= 6.49"
Routed to Pond CB-66 : EX-CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
10,507	98	Paved roads w/curbs & sewers, HSG C
47,893	83	1/4 acre lots, 38% imp, HSG C
58,400	86	Weighted Average
29,694		50.85% Pervious Area
28,706		49.15% Impervious Area

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

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 5.35 cfs @ 12.72 hrs, Volume= 0.923 af, Depth= 6.01"
Routed to Pond DP-1 : EX-CB 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
12,623	98	Paved roads w/curbs & sewers, HSG C
59,847	80	1/2 acre lots, 25% imp, HSG C
7,771	70	Woods, Good, HSG C
80,241	82	Weighted Average
52,656		65.62% Pervious Area
27,585		34.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
31.5	100	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
54.0	947	Total			

Summary for Subcatchment 1.3: Sucatchment 1.3

Runoff = 1.09 cfs @ 12.09 hrs, Volume= 0.078 af, Depth= 5.66"
Routed to Pond 4P : Stream

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.4: Subcatchment 1.4

Runoff = 2.02 cfs @ 12.09 hrs, Volume= 0.149 af, Depth= 6.25"
Routed to Pond CB-64 : EX-CB 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
1,072	98	Paved roads w/curbs & sewers, HSG C
11,360	83	1/4 acre lots, 38% imp, HSG C
12,432	84	Weighted Average
7,043		56.65% Pervious Area
5,389		43.35% Impervious Area

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

Summary for Subcatchment 1.5: Subcatchment 1.5

Runoff = 3.28 cfs @ 12.09 hrs, Volume= 0.240 af, Depth= 5.66"
Routed to Pond CB-65 : EX-CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
2,402	98	Paved roads w/curbs & sewers, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
22,211	79	Weighted Average
15,671		70.55% Pervious Area
6,540		29.45% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0200	1.41		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.38"
5.3	261	0.1072	0.82		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.0	10	0.0352	3.81		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
6.5	371	Total			

Summary for Reach 1R: Lake Hiawatha

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 6.04" for 100-Year event
Inflow = 34.89 cfs @ 13.17 hrs, Volume= 9.765 af
Outflow = 34.89 cfs @ 13.17 hrs, Volume= 9.765 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Outflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Atten= 0%, Lag= 0.0 min
Primary = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Routed to Pond 4P : Stream

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 312.21' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.68'	**15.0" Round Culvert** L= 87.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.68' / 267.08' S= 0.0184 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=30.55 cfs @ 13.28 hrs HW=312.20' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 30.55 cfs @ 24.90 fps)

Summary for Pond 4P: Stream

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.64 cfs @ 13.28 hrs, Volume= 7.728 af
Primary = 30.64 cfs @ 13.28 hrs, Volume= 7.728 af, Atten= 0%, Lag= 0.0 min
Routed to Pond DP-1 : EX-CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond CB-64: EX-CB 2

Inflow Area = 17.563 ac, 31.32% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 33.74 cfs @ 13.18 hrs, Volume= 8.800 af
Outflow = 33.74 cfs @ 13.18 hrs, Volume= 8.800 af, Atten= 0%, Lag= 0.0 min
Primary = 33.74 cfs @ 13.18 hrs, Volume= 8.800 af
Routed to Pond CB-65 : EX-CB 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 922.87' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.85'	**12.0" Round Culvert**

L= 129.0' CMP, projecting, no headwall, Ke= 0.900
Inlet / Outlet Invert= 237.85' / 235.94' S= 0.0148 '/' Cc= 0.900
n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=33.73 cfs @ 13.18 hrs HW=922.74' TW=439.45' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 33.73 cfs @ 42.94 fps)

Summary for Pond CB-65: EX-CB 3

Inflow Area = 18.073 ac, 31.27% Impervious, Inflow Depth = 6.00" for 100-Year event
Inflow = 34.01 cfs @ 13.18 hrs, Volume= 9.040 af
Outflow = 34.01 cfs @ 13.18 hrs, Volume= 9.040 af, Atten= 0%, Lag= 0.0 min
Primary = 34.01 cfs @ 13.18 hrs, Volume= 9.040 af
Routed to Pond CB-66 : EX-CB 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 439.49' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.94'	**12.0" Round Culvert** L= 32.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 235.94' / 235.43' S= 0.0159 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=34.00 cfs @ 13.18 hrs HW=439.43' TW=383.58' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 34.00 cfs @ 43.29 fps)

Summary for Pond CB-66: EX-CB 4

Inflow Area = 19.414 ac, 32.50% Impervious, Inflow Depth = 6.04" for 100-Year event
Inflow = 34.89 cfs @ 13.17 hrs, Volume= 9.765 af
Outflow = 34.89 cfs @ 13.17 hrs, Volume= 9.765 af, Atten= 0%, Lag= 0.0 min
Primary = 34.89 cfs @ 13.17 hrs, Volume= 9.765 af
Routed to Reach 1R : Lake Hiawatha

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 383.63' @ 13.17 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	234.73'	**12.0" Round Culvert** L= 171.0' RCP, groove end projecting, Ke= 0.200 Inlet / Outlet Invert= 234.73' / 228.05' S= 0.0391 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 0.79 sf

Primary OutFlow Max=34.89 cfs @ 13.17 hrs HW=383.59' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 34.89 cfs @ 44.42 fps)

Summary for Pond DP-1: EX-CB 1

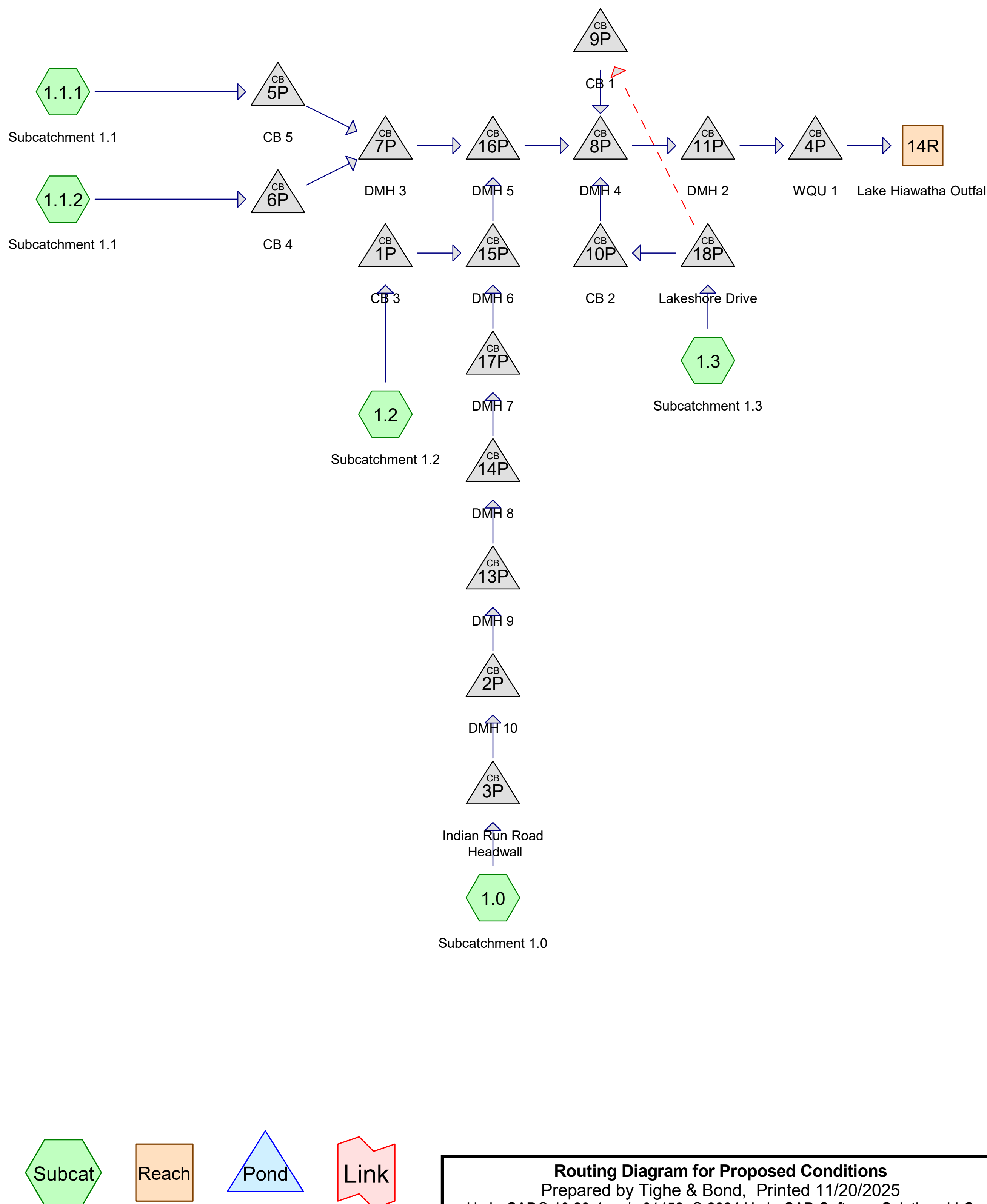
Inflow Area = 17.278 ac, 31.12% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 33.58 cfs @ 13.18 hrs, Volume= 8.651 af
Outflow = 33.58 cfs @ 13.18 hrs, Volume= 8.651 af, Atten= 0%, Lag= 0.0 min
Primary = 33.58 cfs @ 13.18 hrs, Volume= 8.651 af
Routed to Pond CB-64 : EX-CB 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 1,227.07' @ 13.19 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	239.68'	**12.0" Round Culvert** L= 76.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 239.68' / 237.95' S= 0.0228 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 0.79 sf

Primary OutFlow Max=33.54 cfs @ 13.18 hrs HW=1,226.52' TW=922.76' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 33.54 cfs @ 42.71 fps)

Proposed Hydrology



Routing Diagram for Proposed Conditions
Prepared by Tighe & Bond, Printed 11/20/2025
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Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.38	2
2	10-Year	Type III 24-hr		Default	24.00	1	5.23	2
3	25-Year	Type III 24-hr		Default	24.00	1	6.38	2
4	100-Year	Type III 24-hr		Default	24.00	1	8.16	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.157	79	1 acre lots, 20% imp, HSG C (1.0)
1.374	80	1/2 acre lots, 25% imp, HSG C (1.1.1, 1.1.2)
1.610	83	1/4 acre lots, 38% imp, HSG C (1.1.1, 1.1.2, 1.3)
0.166	79	50-75% Grass cover, Fair, HSG C (1.2)
2.724	98	Paved roads w/curbs & sewers, HSG C (1.0, 1.1.1, 1.1.2, 1.3)
0.383	70	Woods, Good, HSG C (1.1.1, 1.1.2, 1.3)
19.414	**82**	**TOTAL AREA**

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=1.68"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=8.54 cfs 2.143 af

Subcatchment 1.1.1: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=1.76"
Flow Length=922' Tc=47.5 min CN=83 Runoff=1.08 cfs 0.171 af

Subcatchment 1.1.2: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=1.76"
Flow Length=922' Tc=47.5 min CN=83 Runoff=1.08 cfs 0.171 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=1.47"
Tc=6.0 min CN=79 Runoff=0.28 cfs 0.020 af

Subcatchment 1.3: Subcatchment 1.3 Runoff Area=71,826 sf 41.27% Impervious Runoff Depth=1.76"
Tc=6.0 min CN=83 Runoff=3.40 cfs 0.242 af

Reach 14R: Lake Hiawatha Outfall Inflow=9.86 cfs 2.746 af
Outflow=9.86 cfs 2.746 af

Pond 1P: CB 3 Peak Elev=240.30' Inflow=0.28 cfs 0.020 af
12.0" Round Culvert n=0.013 L=26.3' S=0.0076 '/' Outflow=0.28 cfs 0.020 af

Pond 2P: DMH 10 Peak Elev=264.37' Inflow=8.54 cfs 2.143 af
18.0" Round Culvert n=0.013 L=84.0' S=0.0476 '/' Outflow=8.54 cfs 2.143 af

Pond 3P: Indian Run Road Headwall Peak Elev=271.07' Inflow=8.54 cfs 2.143 af
18.0" Round Culvert n=0.013 L=99.0' S=0.0475 '/' Outflow=8.54 cfs 2.143 af

Pond 4P: WQU 1 Peak Elev=230.75' Inflow=9.86 cfs 2.746 af
30.0" Round Culvert n=0.012 L=80.9' S=0.0049 '/' Outflow=9.86 cfs 2.746 af

Pond 5P: CB 5 Peak Elev=238.62' Inflow=1.08 cfs 0.171 af
12.0" Round Culvert n=0.013 L=23.5' S=0.0213 '/' Outflow=1.08 cfs 0.171 af

Pond 6P: CB 4 Peak Elev=238.62' Inflow=1.08 cfs 0.171 af
12.0" Round Culvert n=0.013 L=11.0' S=0.0273 '/' Outflow=1.08 cfs 0.171 af

Pond 7P: DMH 3 Peak Elev=237.46' Inflow=2.15 cfs 0.341 af
15.0" Round Culvert n=0.012 L=38.5' S=0.0156 '/' Outflow=2.15 cfs 0.341 af

Pond 8P: DMH 4 Peak Elev=234.64' Inflow=9.86 cfs 2.746 af
30.0" Round Culvert n=0.012 L=80.1' S=0.0050 '/' Outflow=9.86 cfs 2.746 af

Pond 9P: CB 1 Peak Elev=235.83' Inflow=1.70 cfs 0.121 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0333 '/' Outflow=1.70 cfs 0.121 af

Pond 10P: CB 2 Peak Elev=235.83' Inflow=1.70 cfs 0.121 af
12.0" Round Culvert n=0.013 L=10.5' S=0.0190 '/' Outflow=1.70 cfs 0.121 af

Pond 11P: DMH 2 Peak Elev=233.98' Inflow=9.86 cfs 2.746 af
30.0" Round Culvert n=0.012 L=240.7' S=0.0125 '/' Outflow=9.86 cfs 2.746 af

Pond 13P: DMH 9 Peak Elev=256.87' Inflow=8.54 cfs 2.143 af
18.0" Round Culvert n=0.013 L=72.0' S=0.0486 '/' Outflow=8.54 cfs 2.143 af

Pond 14P: DMH 8 Peak Elev=247.37' Inflow=8.54 cfs 2.143 af
18.0" Round Culvert n=0.013 L=43.5' S=0.0460 '/' Outflow=8.54 cfs 2.143 af

Pond 15P: DMH 6 Peak Elev=239.33' Inflow=8.57 cfs 2.163 af
24.0" Round Culvert n=0.013 L=34.0' S=0.0471 '/' Outflow=8.57 cfs 2.163 af

Pond 16P: DMH 5 Peak Elev=237.25' Inflow=9.57 cfs 2.505 af
24.0" Round Culvert n=0.012 L=151.2' S=0.0139 '/' Outflow=9.57 cfs 2.505 af

Pond 17P: DMH 7 Peak Elev=242.37' Inflow=8.54 cfs 2.143 af
18.0" Round Culvert n=0.013 L=41.0' S=0.0488 '/' Outflow=8.54 cfs 2.143 af

Pond 18P: Lakeshore Drive Peak Elev=238.16' Inflow=3.40 cfs 0.242 af
Primary=1.70 cfs 0.121 af Secondary=1.70 cfs 0.121 af Outflow=3.40 cfs 0.242 af

Total Runoff Area = 19.414 ac Runoff Volume = 2.746 af Average Runoff Depth = 1.70"
67.49% Pervious = 13.103 ac 32.51% Impervious = 6.311 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Depth= 1.68"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1.1: Subcatchment 1.1

Runoff = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af, Depth= 1.76"
Routed to Pond 5P : CB 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.1.2: Subcatchment 1.1

Runoff = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af, Depth= 1.76"
Routed to Pond 6P : CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 0.020 af, Depth= 1.47"
Routed to Pond 1P : CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.3: Subcatchment 1.3

Runoff = 3.40 cfs @ 12.09 hrs, Volume= 0.242 af, Depth= 1.76"
Routed to Pond 18P : Lakeshore Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.38"

Area (sf)	CN	Description
6,848	98	Paved roads w/curbs & sewers, HSG C
2,402	98	Paved roads w/curbs & sewers, HSG C
42,767	83	1/4 acre lots, 38% imp, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
71,826	83	Weighted Average
42,186		58.73% Pervious Area
29,640		41.27% Impervious Area

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

Summary for Reach 14R: Lake Hiawatha Outfall

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 1.70" for 2-Year event
Inflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af
Outflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: CB 3

Inflow Area = 0.166 ac, 0.00% Impervious, Inflow Depth = 1.47" for 2-Year event
Inflow = 0.28 cfs @ 12.09 hrs, Volume= 0.020 af
Outflow = 0.28 cfs @ 12.09 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min
Primary = 0.28 cfs @ 12.09 hrs, Volume= 0.020 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 240.30' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**12.0" Round Culvert** L= 26.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 239.80' S= 0.0076 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.28 cfs @ 12.09 hrs HW=240.30' TW=238.34' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.28 cfs @ 2.16 fps)

Summary for Pond 2P: DMH 10

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Outflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Atten= 0%, Lag= 0.0 min
Primary = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Routed to Pond 13P : DMH 9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 264.37' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	262.00'	**18.0" Round Culvert** L= 84.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 262.00' / 258.00' S= 0.0476 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.54 cfs @ 13.29 hrs HW=264.37' TW=256.87' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.54 cfs @ 4.83 fps)

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Outflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Atten= 0%, Lag= 0.0 min
Primary = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Routed to Pond 2P : DMH 10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 271.07' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.70'	**18.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.70' / 264.00' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.54 cfs @ 13.29 hrs HW=271.07' TW=264.37' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.54 cfs @ 4.83 fps)

Summary for Pond 4P: WQU 1

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 1.70" for 2-Year event
Inflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af
Outflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af, Atten= 0%, Lag= 0.0 min
Primary = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af
Routed to Reach 14R : Lake Hiawatha Outfall

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 230.75' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	229.20'	**30.0" Round Culvert** L= 80.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 229.20' / 228.80' S= 0.0049 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=9.86 cfs @ 13.28 hrs HW=230.75' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 9.86 cfs @ 4.43 fps)

Summary for Pond 5P: CB 5

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 1.76" for 2-Year event
Inflow = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af
Outflow = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.0 min
Primary = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 238.62' @ 12.66 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 23.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.50' S= 0.0213 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.08 cfs @ 12.66 hrs HW=238.62' TW=237.44' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.08 cfs @ 2.11 fps)

Summary for Pond 6P: CB 4

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 1.76" for 2-Year event
Inflow = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af
Outflow = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af, Atten= 0%, Lag= 0.0 min
Primary = 1.08 cfs @ 12.66 hrs, Volume= 0.171 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 238.62' @ 12.66 hrs
Flood Elev= 243.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 11.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.70' S= 0.0273 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.08 cfs @ 12.66 hrs HW=238.62' TW=237.44' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.08 cfs @ 2.11 fps)

Summary for Pond 7P: DMH 3

Inflow Area = 2.329 ac, 38.05% Impervious, Inflow Depth = 1.76" for 2-Year event
Inflow = 2.15 cfs @ 12.66 hrs, Volume= 0.341 af
Outflow = 2.15 cfs @ 12.66 hrs, Volume= 0.341 af, Atten= 0%, Lag= 0.0 min
Primary = 2.15 cfs @ 12.66 hrs, Volume= 0.341 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 237.46' @ 12.83 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	236.60'	**15.0" Round Culvert** L= 38.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.60' / 236.00' S= 0.0156 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=2.15 cfs @ 12.66 hrs HW=237.44' TW=236.92' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.15 cfs @ 2.46 fps)

Summary for Pond 8P: DMH 4

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 1.70" for 2-Year event
Inflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af
Outflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af, Atten= 0%, Lag= 0.0 min
Primary = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af
Routed to Pond 11P : DMH 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 234.64' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**30.0" Round Culvert** L= 80.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.00' / 232.60' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=9.86 cfs @ 13.28 hrs HW=234.64' TW=233.98' (Dynamic Tailwater)
└─**1=Culvert** (Outlet Controls 9.86 cfs @ 4.10 fps)

Summary for Pond 9P: CB 1

Inflow = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af
Outflow = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min
Primary = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.83' @ 12.09 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 6.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.70 cfs @ 12.09 hrs HW=235.83' TW=234.12' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.70 cfs @ 2.44 fps)

Summary for Pond 10P: CB 2

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 0.88" for 2-Year event
Inflow = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af
Outflow = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af, Atten= 0%, Lag= 0.0 min
Primary = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.83' @ 12.09 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 10.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0190 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.70 cfs @ 12.09 hrs HW=235.83' TW=234.12' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.70 cfs @ 2.44 fps)

Summary for Pond 11P: DMH 2

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 1.70" for 2-Year event
Inflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af
Outflow = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af, Atten= 0%, Lag= 0.0 min
Primary = 9.86 cfs @ 13.28 hrs, Volume= 2.746 af
Routed to Pond 4P : WQU 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 233.98' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	232.50'	**30.0" Round Culvert** L= 240.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.50' / 229.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=9.86 cfs @ 13.28 hrs HW=233.98' TW=230.75' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 9.86 cfs @ 3.27 fps)

Summary for Pond 13P: DMH 9

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Outflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Atten= 0%, Lag= 0.0 min
Primary = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Routed to Pond 14P : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 256.87' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**18.0" Round Culvert** L= 72.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 251.00' S= 0.0486 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.54 cfs @ 13.29 hrs HW=256.87' TW=247.37' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.54 cfs @ 4.83 fps)

Summary for Pond 14P: DMH 8

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Outflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Atten= 0%, Lag= 0.0 min
Primary = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Routed to Pond 17P : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 247.37' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	245.00'	**18.0" Round Culvert** L= 43.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 245.00' / 243.00' S= 0.0460 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.54 cfs @ 13.29 hrs HW=247.37' TW=242.37' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.54 cfs @ 4.83 fps)

Summary for Pond 15P: DMH 6

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.57 cfs @ 13.29 hrs, Volume= 2.163 af
Outflow = 8.57 cfs @ 13.29 hrs, Volume= 2.163 af, Atten= 0%, Lag= 0.0 min
Primary = 8.57 cfs @ 13.29 hrs, Volume= 2.163 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 239.33' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.80'	**24.0" Round Culvert** L= 34.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.80' / 236.20' S= 0.0471 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=8.57 cfs @ 13.29 hrs HW=239.33' TW=237.25' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.57 cfs @ 3.32 fps)

Summary for Pond 16P: DMH 5

Inflow Area = 17.765 ac, 31.69% Impervious, Inflow Depth = 1.69" for 2-Year event
Inflow = 9.57 cfs @ 13.28 hrs, Volume= 2.505 af
Outflow = 9.57 cfs @ 13.28 hrs, Volume= 2.505 af, Atten= 0%, Lag= 0.0 min
Primary = 9.57 cfs @ 13.28 hrs, Volume= 2.505 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 237.25' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.60'	**24.0" Round Culvert** L= 151.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.60' / 233.50' S= 0.0139 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=9.57 cfs @ 13.28 hrs HW=237.25' TW=234.64' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 9.57 cfs @ 3.45 fps)

Summary for Pond 17P: DMH 7

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 1.68" for 2-Year event
Inflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Outflow = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af, Atten= 0%, Lag= 0.0 min
Primary = 8.54 cfs @ 13.29 hrs, Volume= 2.143 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 242.37' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 238.00' S= 0.0488 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=8.54 cfs @ 13.29 hrs HW=242.37' TW=239.33' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.54 cfs @ 4.83 fps)

Summary for Pond 18P: Lakeshore Drive

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 1.76" for 2-Year event
Inflow = 3.40 cfs @ 12.09 hrs, Volume= 0.242 af
Outflow = 3.40 cfs @ 12.09 hrs, Volume= 0.242 af, Atten= 0%, Lag= 0.0 min
Primary = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af
Routed to Pond 10P : CB 2
Secondary = 1.70 cfs @ 12.09 hrs, Volume= 0.121 af
Routed to Pond 9P : CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 238.16' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.70 cfs @ 12.09 hrs HW=238.16' TW=235.83' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 1.70 cfs @ 1.07 fps)

Secondary OutFlow Max=1.70 cfs @ 12.09 hrs HW=238.16' TW=235.83' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 1.70 cfs @ 1.07 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=3.29"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=16.86 cfs 4.181 af

Subcatchment 1.1.1: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=3.38"
Flow Length=922' Tc=47.5 min CN=83 Runoff=2.07 cfs 0.328 af

Subcatchment 1.1.2: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=3.38"
Flow Length=922' Tc=47.5 min CN=83 Runoff=2.07 cfs 0.328 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=3.00"
Tc=6.0 min CN=79 Runoff=0.59 cfs 0.042 af

Subcatchment 1.3: Subcatchment 1.3 Runoff Area=71,826 sf 41.27% Impervious Runoff Depth=3.38"
Tc=6.0 min CN=83 Runoff=6.50 cfs 0.465 af

Reach 14R: Lake Hiawatha Outfall Inflow=19.28 cfs 5.344 af
Outflow=19.28 cfs 5.344 af

Pond 1P: CB 3 Peak Elev=241.07' Inflow=0.59 cfs 0.042 af
12.0" Round Culvert n=0.013 L=26.3' S=0.0076 '/' Outflow=0.59 cfs 0.042 af

Pond 2P: DMH 10 Peak Elev=269.05' Inflow=16.86 cfs 4.181 af
18.0" Round Culvert n=0.013 L=84.0' S=0.0476 '/' Outflow=16.86 cfs 4.181 af

Pond 3P: Indian Run Road Headwall Peak Elev=275.75' Inflow=16.86 cfs 4.181 af
18.0" Round Culvert n=0.013 L=99.0' S=0.0475 '/' Outflow=16.86 cfs 4.181 af

Pond 4P: WQU 1 Peak Elev=231.57' Inflow=19.28 cfs 5.344 af
30.0" Round Culvert n=0.012 L=80.9' S=0.0049 '/' Outflow=19.28 cfs 5.344 af

Pond 5P: CB 5 Peak Elev=239.50' Inflow=2.07 cfs 0.328 af
12.0" Round Culvert n=0.013 L=23.5' S=0.0213 '/' Outflow=2.07 cfs 0.328 af

Pond 6P: CB 4 Peak Elev=239.50' Inflow=2.07 cfs 0.328 af
12.0" Round Culvert n=0.013 L=11.0' S=0.0273 '/' Outflow=2.07 cfs 0.328 af

Pond 7P: DMH 3 Peak Elev=239.30' Inflow=4.15 cfs 0.657 af
15.0" Round Culvert n=0.012 L=38.5' S=0.0156 '/' Outflow=4.15 cfs 0.657 af

Pond 8P: DMH 4 Peak Elev=235.87' Inflow=19.28 cfs 5.344 af
30.0" Round Culvert n=0.012 L=80.1' S=0.0050 '/' Outflow=19.28 cfs 5.344 af

Pond 9P: CB 1 Peak Elev=236.69' Inflow=3.25 cfs 0.232 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0333 '/' Outflow=3.25 cfs 0.232 af

Pond 10P: CB 2 Peak Elev=236.69' Inflow=3.25 cfs 0.232 af
12.0" Round Culvert n=0.013 L=10.5' S=0.0190 '/' Outflow=3.25 cfs 0.232 af

Pond 11P: DMH 2 Peak Elev=234.80' Inflow=19.28 cfs 5.344 af
30.0" Round Culvert n=0.012 L=240.7' S=0.0125 '/' Outflow=19.28 cfs 5.344 af

Pond 13P: DMH 9 Peak Elev=261.55' Inflow=16.86 cfs 4.181 af
18.0" Round Culvert n=0.013 L=72.0' S=0.0486 '/' Outflow=16.86 cfs 4.181 af

Pond 14P: DMH 8 Peak Elev=253.65' Inflow=16.86 cfs 4.181 af
18.0" Round Culvert n=0.013 L=43.5' S=0.0460 '/' Outflow=16.86 cfs 4.181 af

Pond 15P: DMH 6 Peak Elev=241.07' Inflow=16.91 cfs 4.222 af
24.0" Round Culvert n=0.013 L=34.0' S=0.0471 '/' Outflow=16.91 cfs 4.222 af

Pond 16P: DMH 5 Peak Elev=239.06' Inflow=18.75 cfs 4.879 af
24.0" Round Culvert n=0.012 L=151.2' S=0.0139 '/' Outflow=18.75 cfs 4.879 af

Pond 17P: DMH 7 Peak Elev=247.36' Inflow=16.86 cfs 4.181 af
18.0" Round Culvert n=0.013 L=41.0' S=0.0488 '/' Outflow=16.86 cfs 4.181 af

Pond 18P: Lakeshore Drive Peak Elev=238.24' Inflow=6.50 cfs 0.465 af
Primary=3.25 cfs 0.232 af Secondary=3.25 cfs 0.232 af Outflow=6.50 cfs 0.465 af

Total Runoff Area = 19.414 ac Runoff Volume = 5.344 af Average Runoff Depth = 3.30"
67.49% Pervious = 13.103 ac 32.51% Impervious = 6.311 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Depth= 3.29"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1.1: Subcatchment 1.1

Runoff = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af, Depth= 3.38"
Routed to Pond 5P : CB 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.1.2: Subcatchment 1.1

Runoff = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af, Depth= 3.38"
Routed to Pond 6P : CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af, Depth= 3.00"
Routed to Pond 1P : CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.3: Subcatchment 1.3

Runoff = 6.50 cfs @ 12.09 hrs, Volume= 0.465 af, Depth= 3.38"
Routed to Pond 18P : Lakeshore Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.23"

Area (sf)	CN	Description
6,848	98	Paved roads w/curbs & sewers, HSG C
2,402	98	Paved roads w/curbs & sewers, HSG C
42,767	83	1/4 acre lots, 38% imp, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
71,826	83	Weighted Average
42,186		58.73% Pervious Area
29,640		41.27% Impervious Area

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

Summary for Reach 14R: Lake Hiawatha Outfall

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 3.30" for 10-Year event
Inflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af
Outflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: CB 3

Inflow Area = 0.166 ac, 0.00% Impervious, Inflow Depth = 3.00" for 10-Year event
Inflow = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af
Outflow = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min
Primary = 0.59 cfs @ 12.09 hrs, Volume= 0.042 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 241.07' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**12.0" Round Culvert** L= 26.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 239.80' S= 0.0076 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.59 cfs @ 12.09 hrs HW=240.45' TW=238.69' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.59 cfs @ 2.54 fps)

Summary for Pond 2P: DMH 10

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Outflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Atten= 0%, Lag= 0.0 min
Primary = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Routed to Pond 13P : DMH 9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 269.05' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	262.00'	**18.0" Round Culvert** L= 84.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 262.00' / 258.00' S= 0.0476 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=16.85 cfs @ 13.28 hrs HW=269.04' TW=261.54' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 16.85 cfs @ 9.54 fps)

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Outflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Atten= 0%, Lag= 0.0 min
Primary = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Routed to Pond 2P : DMH 10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 275.75' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.70'	**18.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.70' / 264.00' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=16.85 cfs @ 13.28 hrs HW=275.74' TW=269.04' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 16.85 cfs @ 9.54 fps)

Summary for Pond 4P: WQU 1

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 3.30" for 10-Year event
Inflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af
Outflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af, Atten= 0%, Lag= 0.0 min
Primary = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af
Routed to Reach 14R : Lake Hiawatha Outfall

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 231.57' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	229.20'	**30.0" Round Culvert** L= 80.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 229.20' / 228.80' S= 0.0049 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=19.28 cfs @ 13.18 hrs HW=231.57' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 19.28 cfs @ 5.16 fps)

Summary for Pond 5P: CB 5

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 3.38" for 10-Year event
Inflow = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af
Outflow = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af, Atten= 0%, Lag= 0.0 min
Primary = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 239.50' @ 12.97 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 23.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.50' S= 0.0213 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.00 cfs @ 12.62 hrs HW=239.03' TW=238.58' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.00 cfs @ 2.54 fps)

Summary for Pond 6P: CB 4

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 3.38" for 10-Year event
Inflow = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af
Outflow = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af, Atten= 0%, Lag= 0.0 min
Primary = 2.07 cfs @ 12.62 hrs, Volume= 0.328 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 239.50' @ 12.97 hrs
Flood Elev= 243.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 11.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.70' S= 0.0273 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.00 cfs @ 12.62 hrs HW=239.03' TW=238.58' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.00 cfs @ 2.54 fps)

Summary for Pond 7P: DMH 3

Inflow Area = 2.329 ac, 38.05% Impervious, Inflow Depth = 3.38" for 10-Year event
Inflow = 4.15 cfs @ 12.62 hrs, Volume= 0.657 af
Outflow = 4.15 cfs @ 12.62 hrs, Volume= 0.657 af, Atten= 0%, Lag= 0.0 min
Primary = 4.15 cfs @ 12.62 hrs, Volume= 0.657 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 239.30' @ 13.07 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	236.60'	**15.0" Round Culvert** L= 38.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.60' / 236.00' S= 0.0156 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=4.06 cfs @ 12.62 hrs HW=238.58' TW=237.82' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.06 cfs @ 3.31 fps)

Summary for Pond 8P: DMH 4

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 3.30" for 10-Year event
Inflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af
Outflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af, Atten= 0%, Lag= 0.0 min
Primary = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af
Routed to Pond 11P : DMH 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 235.87' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**30.0" Round Culvert** L= 80.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.00' / 232.60' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=19.28 cfs @ 13.18 hrs HW=235.87' TW=234.80' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 19.28 cfs @ 3.93 fps)

Summary for Pond 9P: CB 1

Inflow = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af
Outflow = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af, Atten= 0%, Lag= 0.0 min
Primary = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 236.69' @ 12.09 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 6.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.25 cfs @ 12.09 hrs HW=236.68' TW=234.76' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.25 cfs @ 4.13 fps)

Summary for Pond 10P: CB 2

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 1.69" for 10-Year event
Inflow = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af
Outflow = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af, Atten= 0%, Lag= 0.0 min
Primary = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 236.69' @ 12.09 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 10.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0190 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.25 cfs @ 12.09 hrs HW=236.68' TW=234.76' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 3.25 cfs @ 4.13 fps)

Summary for Pond 11P: DMH 2

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 3.30" for 10-Year event
Inflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af
Outflow = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af, Atten= 0%, Lag= 0.0 min
Primary = 19.28 cfs @ 13.18 hrs, Volume= 5.344 af
Routed to Pond 4P : WQU 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 234.80' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	232.50'	**30.0" Round Culvert** L= 240.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.50' / 229.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=19.28 cfs @ 13.18 hrs HW=234.80' TW=231.57' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 19.28 cfs @ 4.08 fps)

Summary for Pond 13P: DMH 9

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Outflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Atten= 0%, Lag= 0.0 min
Primary = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Routed to Pond 14P : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 261.55' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**18.0" Round Culvert** L= 72.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 251.00' S= 0.0486 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=16.85 cfs @ 13.28 hrs HW=261.54' TW=253.63' (Dynamic Tailwater)
↑—**1=Culvert** (Inlet Controls 16.85 cfs @ 9.54 fps)

Summary for Pond 14P: DMH 8

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Outflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Atten= 0%, Lag= 0.0 min
Primary = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Routed to Pond 17P : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 253.65' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	245.00'	**18.0" Round Culvert** L= 43.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 245.00' / 243.00' S= 0.0460 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=16.83 cfs @ 13.28 hrs HW=253.63' TW=247.36' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 16.83 cfs @ 9.52 fps)

Summary for Pond 15P: DMH 6

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 3.28" for 10-Year event
Inflow = 16.91 cfs @ 13.28 hrs, Volume= 4.222 af
Outflow = 16.91 cfs @ 13.28 hrs, Volume= 4.222 af, Atten= 0%, Lag= 0.0 min
Primary = 16.91 cfs @ 13.28 hrs, Volume= 4.222 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 241.07' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.80'	**24.0" Round Culvert** L= 34.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.80' / 236.20' S= 0.0471 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=16.92 cfs @ 13.28 hrs HW=241.07' TW=239.06' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 16.92 cfs @ 5.38 fps)

Summary for Pond 16P: DMH 5

Inflow Area = 17.765 ac, 31.69% Impervious, Inflow Depth = 3.30" for 10-Year event
Inflow = 18.75 cfs @ 13.18 hrs, Volume= 4.879 af
Outflow = 18.75 cfs @ 13.18 hrs, Volume= 4.879 af, Atten= 0%, Lag= 0.0 min
Primary = 18.75 cfs @ 13.18 hrs, Volume= 4.879 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 239.06' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.60'	**24.0" Round Culvert** L= 151.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.60' / 233.50' S= 0.0139 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=18.75 cfs @ 13.18 hrs HW=239.06' TW=235.87' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 18.75 cfs @ 5.97 fps)

Summary for Pond 17P: DMH 7

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 3.29" for 10-Year event
Inflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Outflow = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af, Atten= 0%, Lag= 0.0 min
Primary = 16.86 cfs @ 13.28 hrs, Volume= 4.181 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 247.36' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 238.00' S= 0.0488 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=16.85 cfs @ 13.28 hrs HW=247.36' TW=241.07' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 16.85 cfs @ 9.53 fps)

Summary for Pond 18P: Lakeshore Drive

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 3.38" for 10-Year event
Inflow = 6.50 cfs @ 12.09 hrs, Volume= 0.465 af
Outflow = 6.50 cfs @ 12.09 hrs, Volume= 0.465 af, Atten= 0%, Lag= 0.0 min
Primary = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af
Routed to Pond 10P : CB 2
Secondary = 3.25 cfs @ 12.09 hrs, Volume= 0.232 af
Routed to Pond 9P : CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 238.24' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.25 cfs @ 12.09 hrs HW=238.24' TW=236.68' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 3.25 cfs @ 1.33 fps)

Secondary OutFlow Max=3.25 cfs @ 12.09 hrs HW=238.24' TW=236.68' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 3.25 cfs @ 1.33 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=4.34"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=22.20 cfs 5.520 af

Subcatchment 1.1.1: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=4.45"
Flow Length=922' Tc=47.5 min CN=83 Runoff=2.71 cfs 0.431 af

Subcatchment 1.1.2: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=4.45"
Flow Length=922' Tc=47.5 min CN=83 Runoff=2.71 cfs 0.431 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=4.02"
Tc=6.0 min CN=79 Runoff=0.78 cfs 0.056 af

Subcatchment 1.3: Subcatchment 1.3 Runoff Area=71,826 sf 41.27% Impervious Runoff Depth=4.45"
Tc=6.0 min CN=83 Runoff=8.47 cfs 0.611 af

Reach 14R: Lake Hiawatha Outfall Inflow=25.37 cfs 7.049 af
Outflow=25.37 cfs 7.049 af

Pond 1P: CB 3 Peak Elev=245.15' Inflow=0.78 cfs 0.056 af
12.0" Round Culvert n=0.013 L=26.3' S=0.0076 '/' Outflow=0.78 cfs 0.056 af

Pond 2P: DMH 10 Peak Elev=288.75' Inflow=22.20 cfs 5.520 af
18.0" Round Culvert n=0.013 L=84.0' S=0.0476 '/' Outflow=22.20 cfs 5.520 af

Pond 3P: Indian Run Road Headwall Peak Elev=299.61' Inflow=22.20 cfs 5.520 af
18.0" Round Culvert n=0.013 L=99.0' S=0.0475 '/' Outflow=22.20 cfs 5.520 af

Pond 4P: WQU 1 Peak Elev=232.30' Inflow=25.37 cfs 7.049 af
30.0" Round Culvert n=0.012 L=80.9' S=0.0049 '/' Outflow=25.37 cfs 7.049 af

Pond 5P: CB 5 Peak Elev=242.34' Inflow=2.71 cfs 0.431 af
12.0" Round Culvert n=0.013 L=23.5' S=0.0213 '/' Outflow=2.71 cfs 0.431 af

Pond 6P: CB 4 Peak Elev=242.34' Inflow=2.71 cfs 0.431 af
12.0" Round Culvert n=0.013 L=11.0' S=0.0273 '/' Outflow=2.71 cfs 0.431 af

Pond 7P: DMH 3 Peak Elev=242.06' Inflow=5.42 cfs 0.863 af
15.0" Round Culvert n=0.012 L=38.5' S=0.0156 '/' Outflow=5.42 cfs 0.863 af

Pond 8P: DMH 4 Peak Elev=237.45' Inflow=25.37 cfs 7.049 af
30.0" Round Culvert n=0.012 L=80.1' S=0.0050 '/' Outflow=25.37 cfs 7.049 af

Pond 9P: CB 1 Peak Elev=237.51' Inflow=4.23 cfs 0.305 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0333 '/' Outflow=4.23 cfs 0.305 af

Pond 10P: CB 2 Peak Elev=237.51' Inflow=4.23 cfs 0.305 af
12.0" Round Culvert n=0.013 L=10.5' S=0.0190 '/' Outflow=4.23 cfs 0.305 af

Pond 11P: DMH 2 Peak Elev=235.60' Inflow=25.37 cfs 7.049 af
30.0" Round Culvert n=0.012 L=240.7' S=0.0125 '/' Outflow=25.37 cfs 7.049 af

Pond 13P: DMH 9 Peak Elev=277.88' Inflow=22.20 cfs 5.520 af
18.0" Round Culvert n=0.013 L=72.0' S=0.0486 '/' Outflow=22.20 cfs 5.520 af

Pond 14P: DMH 8 Peak Elev=266.99' Inflow=22.20 cfs 5.520 af
18.0" Round Culvert n=0.013 L=43.5' S=0.0460 '/' Outflow=22.20 cfs 5.520 af

Pond 15P: DMH 6 Peak Elev=245.15' Inflow=22.27 cfs 5.576 af
24.0" Round Culvert n=0.013 L=34.0' S=0.0471 '/' Outflow=22.27 cfs 5.576 af

Pond 16P: DMH 5 Peak Elev=241.72' Inflow=24.69 cfs 6.439 af
24.0" Round Culvert n=0.012 L=151.2' S=0.0139 '/' Outflow=24.69 cfs 6.439 af

Pond 17P: DMH 7 Peak Elev=256.08' Inflow=22.20 cfs 5.520 af
18.0" Round Culvert n=0.013 L=41.0' S=0.0488 '/' Outflow=22.20 cfs 5.520 af

Pond 18P: Lakeshore Drive Peak Elev=238.29' Inflow=8.47 cfs 0.611 af
Primary=4.23 cfs 0.305 af Secondary=4.23 cfs 0.305 af Outflow=8.47 cfs 0.611 af

Total Runoff Area = 19.414 ac Runoff Volume = 7.049 af Average Runoff Depth = 4.36"
67.49% Pervious = 13.103 ac 32.51% Impervious = 6.311 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Depth= 4.34"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1.1: Subcatchment 1.1

Runoff = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af, Depth= 4.45"
Routed to Pond 5P : CB 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.1.2: Subcatchment 1.1

Runoff = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af, Depth= 4.45"
Routed to Pond 6P : CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 0.78 cfs @ 12.09 hrs, Volume= 0.056 af, Depth= 4.02"
Routed to Pond 1P : CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.3: Subcatchment 1.3

Runoff = 8.47 cfs @ 12.09 hrs, Volume= 0.611 af, Depth= 4.45"
Routed to Pond 18P : Lakeshore Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=6.38"

Area (sf)	CN	Description
6,848	98	Paved roads w/curbs & sewers, HSG C
2,402	98	Paved roads w/curbs & sewers, HSG C
42,767	83	1/4 acre lots, 38% imp, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
71,826	83	Weighted Average
42,186		58.73% Pervious Area
29,640		41.27% Impervious Area

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

Summary for Reach 14R: Lake Hiawatha Outfall

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 4.36" for 25-Year event
Inflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af
Outflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: CB 3

Inflow Area = 0.166 ac, 0.00% Impervious, Inflow Depth = 4.02" for 25-Year event
Inflow = 0.78 cfs @ 12.09 hrs, Volume= 0.056 af
Outflow = 0.78 cfs @ 12.09 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min
Primary = 0.78 cfs @ 12.09 hrs, Volume= 0.056 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 245.15' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**12.0" Round Culvert** L= 26.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 239.80' S= 0.0076 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.78 cfs @ 12.09 hrs HW=240.53' TW=238.88' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 0.78 cfs @ 2.70 fps)

Summary for Pond 2P: DMH 10

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Outflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Atten= 0%, Lag= 0.0 min
Primary = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Routed to Pond 13P : DMH 9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 288.75' @ 13.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	262.00'	**18.0" Round Culvert** L= 84.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 262.00' / 258.00' S= 0.0476 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=22.10 cfs @ 13.28 hrs HW=288.65' TW=277.82' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 22.10 cfs @ 12.51 fps)

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Outflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Atten= 0%, Lag= 0.0 min
Primary = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Routed to Pond 2P : DMH 10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 299.61' @ 13.31 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.70'	**18.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.70' / 264.00' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=22.06 cfs @ 13.28 hrs HW=299.43' TW=288.65' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 22.06 cfs @ 12.49 fps)

Summary for Pond 4P: WQU 1

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 4.36" for 25-Year event
Inflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af
Outflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af, Atten= 0%, Lag= 0.0 min
Primary = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af
Routed to Reach 14R : Lake Hiawatha Outfall

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 232.30' @ 13.17 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	229.20'	**30.0" Round Culvert** L= 80.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 229.20' / 228.80' S= 0.0049 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=25.37 cfs @ 13.17 hrs HW=232.30' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 25.37 cfs @ 5.17 fps)

Summary for Pond 5P: CB 5

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 4.45" for 25-Year event
Inflow = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af
Outflow = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min
Primary = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 242.34' @ 13.09 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 23.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.50' S= 0.0213 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.61 cfs @ 12.62 hrs HW=240.84' TW=240.08' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.61 cfs @ 3.32 fps)

Summary for Pond 6P: CB 4

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 4.45" for 25-Year event
Inflow = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af
Outflow = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af, Atten= 0%, Lag= 0.0 min
Primary = 2.71 cfs @ 12.62 hrs, Volume= 0.431 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 242.34' @ 13.09 hrs
Flood Elev= 243.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 11.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.70' S= 0.0273 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=2.61 cfs @ 12.62 hrs HW=240.84' TW=240.08' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.61 cfs @ 3.32 fps)

Summary for Pond 7P: DMH 3

Inflow Area = 2.329 ac, 38.05% Impervious, Inflow Depth = 4.45" for 25-Year event
Inflow = 5.42 cfs @ 12.62 hrs, Volume= 0.863 af
Outflow = 5.42 cfs @ 12.62 hrs, Volume= 0.863 af, Atten= 0%, Lag= 0.0 min
Primary = 5.42 cfs @ 12.62 hrs, Volume= 0.863 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 242.06' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	236.60'	**15.0" Round Culvert** L= 38.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.60' / 236.00' S= 0.0156 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=5.31 cfs @ 12.62 hrs HW=240.08' TW=238.78' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 5.31 cfs @ 4.32 fps)

Summary for Pond 8P: DMH 4

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 4.36" for 25-Year event
Inflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af
Outflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af, Atten= 0%, Lag= 0.0 min
Primary = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af
Routed to Pond 11P : DMH 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 237.45' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**30.0" Round Culvert** L= 80.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.00' / 232.60' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=25.35 cfs @ 13.17 hrs HW=237.44' TW=235.60' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 25.35 cfs @ 5.16 fps)

Summary for Pond 9P: CB 1

Inflow = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af
Outflow = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af, Atten= 0%, Lag= 0.0 min
Primary = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 237.51' @ 12.09 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 6.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.23 cfs @ 12.09 hrs HW=237.50' TW=235.16' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.23 cfs @ 5.38 fps)

Summary for Pond 10P: CB 2

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 2.22" for 25-Year event
Inflow = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af
Outflow = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af, Atten= 0%, Lag= 0.0 min
Primary = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 237.51' @ 12.09 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 10.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0190 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.23 cfs @ 12.09 hrs HW=237.50' TW=235.16' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 4.23 cfs @ 5.38 fps)

Summary for Pond 11P: DMH 2

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 4.36" for 25-Year event
Inflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af
Outflow = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af, Atten= 0%, Lag= 0.0 min
Primary = 25.37 cfs @ 13.17 hrs, Volume= 7.049 af
Routed to Pond 4P : WQU 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 235.60' @ 13.17 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	232.50'	**30.0" Round Culvert** L= 240.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.50' / 229.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=25.37 cfs @ 13.17 hrs HW=235.60' TW=232.30' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 25.37 cfs @ 5.17 fps)

Summary for Pond 13P: DMH 9

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Outflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Atten= 0%, Lag= 0.0 min
Primary = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Routed to Pond 14P : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.88' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**18.0" Round Culvert** L= 72.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 251.00' S= 0.0486 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=22.14 cfs @ 13.28 hrs HW=277.82' TW=266.96' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 22.14 cfs @ 12.53 fps)

Summary for Pond 14P: DMH 8

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Outflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Atten= 0%, Lag= 0.0 min
Primary = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Routed to Pond 17P : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 266.99' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	245.00'	**18.0" Round Culvert** L= 43.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 245.00' / 243.00' S= 0.0460 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=22.17 cfs @ 13.28 hrs HW=266.96' TW=256.07' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 22.17 cfs @ 12.55 fps)

Summary for Pond 15P: DMH 6

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 4.33" for 25-Year event
Inflow = 22.27 cfs @ 13.28 hrs, Volume= 5.576 af
Outflow = 22.27 cfs @ 13.28 hrs, Volume= 5.576 af, Atten= 0%, Lag= 0.0 min
Primary = 22.27 cfs @ 13.28 hrs, Volume= 5.576 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 245.15' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.80'	**24.0" Round Culvert** L= 34.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.80' / 236.20' S= 0.0471 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=22.29 cfs @ 13.28 hrs HW=245.15' TW=241.67' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 22.29 cfs @ 7.09 fps)

Summary for Pond 16P: DMH 5

Inflow Area = 17.765 ac, 31.69% Impervious, Inflow Depth = 4.35" for 25-Year event
Inflow = 24.69 cfs @ 13.18 hrs, Volume= 6.439 af
Outflow = 24.69 cfs @ 13.18 hrs, Volume= 6.439 af, Atten= 0%, Lag= 0.0 min
Primary = 24.69 cfs @ 13.18 hrs, Volume= 6.439 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 241.72' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.60'	**24.0" Round Culvert** L= 151.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.60' / 233.50' S= 0.0139 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=24.67 cfs @ 13.18 hrs HW=241.71' TW=237.44' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 24.67 cfs @ 7.85 fps)

Summary for Pond 17P: DMH 7

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 4.34" for 25-Year event
Inflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Outflow = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af, Atten= 0%, Lag= 0.0 min
Primary = 22.20 cfs @ 13.28 hrs, Volume= 5.520 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 256.08' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 238.00' S= 0.0488 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=22.20 cfs @ 13.28 hrs HW=256.07' TW=245.15' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 22.20 cfs @ 12.56 fps)

Summary for Pond 18P: Lakeshore Drive

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 4.45" for 25-Year event
Inflow = 8.47 cfs @ 12.09 hrs, Volume= 0.611 af
Outflow = 8.47 cfs @ 12.09 hrs, Volume= 0.611 af, Atten= 0%, Lag= 0.0 min
Primary = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af
Routed to Pond 10P : CB 2
Secondary = 4.23 cfs @ 12.09 hrs, Volume= 0.305 af
Routed to Pond 9P : CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 238.29' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=4.23 cfs @ 12.09 hrs HW=238.29' TW=237.50' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 4.23 cfs @ 1.45 fps)

Secondary OutFlow Max=4.23 cfs @ 12.09 hrs HW=238.29' TW=237.50' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 4.23 cfs @ 1.45 fps)

Time span=0.00-72.00 hrs, dt=0.01 hrs, 7201 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1.0: Subcatchment 1.0 Runoff Area=665,135 sf 31.07% Impervious Runoff Depth=6.01"
Flow Length=1,433' Tc=98.8 min CN=82 Runoff=30.56 cfs 7.650 af

Subcatchment 1.1.1: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=6.13"
Flow Length=922' Tc=47.5 min CN=83 Runoff=3.70 cfs 0.595 af

Subcatchment 1.1.2: Subcatchment 1.1 Runoff Area=50,730 sf 38.05% Impervious Runoff Depth=6.13"
Flow Length=922' Tc=47.5 min CN=83 Runoff=3.70 cfs 0.595 af

Subcatchment 1.2: Subcatchment 1.2 Runoff Area=7,251 sf 0.00% Impervious Runoff Depth=5.66"
Tc=6.0 min CN=79 Runoff=1.09 cfs 0.078 af

Subcatchment 1.3: Subcatchment 1.3 Runoff Area=71,826 sf 41.27% Impervious Runoff Depth=6.13"
Tc=6.0 min CN=83 Runoff=11.52 cfs 0.842 af

Reach 14R: Lake Hiawatha Outfall Inflow=34.86 cfs 9.760 af
Outflow=34.86 cfs 9.760 af

Pond 1P: CB 3 Peak Elev=255.44' Inflow=1.09 cfs 0.078 af
12.0" Round Culvert n=0.013 L=26.3' S=0.0076 '/' Outflow=1.09 cfs 0.078 af

Pond 2P: DMH 10 Peak Elev=338.02' Inflow=30.56 cfs 7.650 af
18.0" Round Culvert n=0.013 L=84.0' S=0.0476 '/' Outflow=30.56 cfs 7.650 af

Pond 3P: Indian Run Road Headwall Peak Elev=358.59' Inflow=30.56 cfs 7.650 af
18.0" Round Culvert n=0.013 L=99.0' S=0.0475 '/' Outflow=30.56 cfs 7.650 af

Pond 4P: WQU 1 Peak Elev=233.94' Inflow=34.86 cfs 9.760 af
30.0" Round Culvert n=0.012 L=80.9' S=0.0049 '/' Outflow=34.86 cfs 9.760 af

Pond 5P: CB 5 Peak Elev=250.11' Inflow=3.70 cfs 0.595 af
12.0" Round Culvert n=0.013 L=23.5' S=0.0213 '/' Outflow=3.70 cfs 0.595 af

Pond 6P: CB 4 Peak Elev=250.11' Inflow=3.70 cfs 0.595 af
12.0" Round Culvert n=0.013 L=11.0' S=0.0273 '/' Outflow=3.70 cfs 0.595 af

Pond 7P: DMH 3 Peak Elev=249.62' Inflow=7.40 cfs 1.190 af
15.0" Round Culvert n=0.012 L=38.5' S=0.0156 '/' Outflow=7.40 cfs 1.190 af

Pond 8P: DMH 4 Peak Elev=240.92' Inflow=34.86 cfs 9.760 af
30.0" Round Culvert n=0.012 L=80.1' S=0.0050 '/' Outflow=34.86 cfs 9.760 af

Pond 9P: CB 1 Peak Elev=251.06' Inflow=11.62 cfs 0.422 af
12.0" Round Culvert n=0.013 L=6.0' S=0.0333 '/' Outflow=11.62 cfs 0.422 af

Pond 10P: CB 2 Peak Elev=250.70' Inflow=11.34 cfs 0.420 af
12.0" Round Culvert n=0.013 L=10.5' S=0.0190 '/' Outflow=11.34 cfs 0.420 af

Pond 11P: DMH 2 Peak Elev=237.43' Inflow=34.86 cfs 9.760 af
30.0" Round Culvert n=0.012 L=240.7' S=0.0125 '/' Outflow=34.86 cfs 9.760 af

Pond 13P: DMH 9 Peak Elev=317.42' Inflow=30.56 cfs 7.650 af
18.0" Round Culvert n=0.013 L=72.0' S=0.0486 '/' Outflow=30.56 cfs 7.650 af

Pond 14P: DMH 8 Peak Elev=296.79' Inflow=30.56 cfs 7.650 af
18.0" Round Culvert n=0.013 L=43.5' S=0.0460 '/' Outflow=30.56 cfs 7.650 af

Pond 15P: DMH 6 Peak Elev=255.44' Inflow=30.64 cfs 7.728 af
24.0" Round Culvert n=0.013 L=34.0' S=0.0471 '/' Outflow=30.64 cfs 7.728 af

Pond 16P: DMH 5 Peak Elev=248.99' Inflow=33.97 cfs 8.918 af
24.0" Round Culvert n=0.012 L=151.2' S=0.0139 '/' Outflow=33.97 cfs 8.918 af

Pond 17P: DMH 7 Peak Elev=276.12' Inflow=30.56 cfs 7.650 af
18.0" Round Culvert n=0.013 L=41.0' S=0.0488 '/' Outflow=30.56 cfs 7.650 af

Pond 18P: Lakeshore Drive Peak Elev=240.85' Inflow=11.52 cfs 0.842 af
Primary=11.34 cfs 0.420 af Secondary=11.62 cfs 0.422 af Outflow=11.52 cfs 0.842 af

Total Runoff Area = 19.414 ac Runoff Volume = 9.760 af Average Runoff Depth = 6.03"
67.49% Pervious = 13.103 ac 32.51% Impervious = 6.311 ac

Summary for Subcatchment 1.0: Subcatchment 1.0

Runoff = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Depth= 6.01"
Routed to Pond 3P : Indian Run Road Headwall

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
92,035	98	Paved roads w/curbs & sewers, HSG C
573,100	79	1 acre lots, 20% imp, HSG C
665,135	82	Weighted Average
458,480		68.93% Pervious Area
206,655		31.07% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
48.0	100	0.0100	0.03		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
1.6	69	0.0869	0.74		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.9	55	0.0363	0.48		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.6	76	0.1053	0.81		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.5	63	0.0096	1.99		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
9.9	145	0.0096	0.24		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.4	18	0.1111	0.83		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
15.2	288	0.0159	0.32		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.8	47	0.1702	1.03		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.7	73	0.0822	0.72		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
4.5	79	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.2	29	0.0135	2.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	40	0.0135	0.29		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
7.4	135	0.0148	0.30		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	117	0.0683	1.83		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
1.7	99	0.0202	0.99		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
98.8	1,433	Total			

Summary for Subcatchment 1.1.1: Subcatchment 1.1

Runoff = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af, Depth= 6.13"
Routed to Pond 5P : CB 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.1.2: Subcatchment 1.1

Runoff = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af, Depth= 6.13"
Routed to Pond 6P : CB 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
8,694	98	Paved roads w/curbs & sewers, HSG C
29,918	80	1/2 acre lots, 25% imp, HSG C
3,885	70	Woods, Good, HSG C
8,233	83	1/4 acre lots, 38% imp, HSG C
50,730	83	Weighted Average
31,428		61.95% Pervious Area
19,302		38.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
25.0	75	0.0286	0.05		**Sheet Flow,** Woods: Dense underbrush n= 0.800 P2= 3.38"
7.5	120	0.0114	0.27		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.8	107	0.1495	0.97		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.7	29	0.0689	0.66		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
3.1	109	0.0550	0.59		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
1.1	60	0.1333	0.91		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
2.0	50	0.0274	0.41		**Shallow Concentrated Flow,** Forest w/Heavy Litter Kv= 2.5 fps
0.1	23	0.0274	3.36		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.4	36	0.0555	1.65		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	16	0.1250	2.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
4.2	148	0.0135	0.58		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.0	72	0.0278	1.17		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.5	77	0.2597	2.55		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
47.5	922	Total			

Summary for Subcatchment 1.2: Subcatchment 1.2

Runoff = 1.09 cfs @ 12.09 hrs, Volume= 0.078 af, Depth= 5.66"
Routed to Pond 1P : CB 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
7,251	79	50-75% Grass cover, Fair, HSG C
7,251		100.00% Pervious Area

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

Summary for Subcatchment 1.3: Subcatchment 1.3

Runoff = 11.52 cfs @ 12.09 hrs, Volume= 0.842 af, Depth= 6.13"
Routed to Pond 18P : Lakeshore Drive

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.16"

Area (sf)	CN	Description
6,848	98	Paved roads w/curbs & sewers, HSG C
2,402	98	Paved roads w/curbs & sewers, HSG C
42,767	83	1/4 acre lots, 38% imp, HSG C
10,890	83	1/4 acre lots, 38% imp, HSG C
8,919	70	Woods, Good, HSG C
71,826	83	Weighted Average
42,186		58.73% Pervious Area
29,640		41.27% Impervious Area

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

Summary for Reach 14R: Lake Hiawatha Outfall

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af
Outflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: CB 3

Inflow Area = 0.166 ac, 0.00% Impervious, Inflow Depth = 5.66" for 100-Year event
Inflow = 1.09 cfs @ 12.09 hrs, Volume= 0.078 af
Outflow = 1.09 cfs @ 12.09 hrs, Volume= 0.078 af, Atten= 0%, Lag= 0.0 min
Primary = 1.09 cfs @ 12.09 hrs, Volume= 0.078 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 255.44' @ 13.22 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**12.0" Round Culvert** L= 26.3' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 239.80' S= 0.0076 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.09 cfs @ 12.09 hrs HW=240.64' TW=239.17' (Dynamic Tailwater)
└─**1=Culvert** (Barrel Controls 1.09 cfs @ 2.90 fps)

Summary for Pond 2P: DMH 10

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Outflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Atten= 0%, Lag= 0.0 min
Primary = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Routed to Pond 13P : DMH 9

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 338.02' @ 13.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	262.00'	**18.0" Round Culvert** L= 84.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 262.00' / 258.00' S= 0.0476 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=30.44 cfs @ 13.28 hrs HW=337.88' TW=317.35' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 30.44 cfs @ 17.22 fps)

Summary for Pond 3P: Indian Run Road Headwall

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Outflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Atten= 0%, Lag= 0.0 min
Primary = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Routed to Pond 2P : DMH 10

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 358.59' @ 13.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	268.70'	**18.0" Round Culvert** L= 99.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 268.70' / 264.00' S= 0.0475 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=30.40 cfs @ 13.28 hrs HW=358.36' TW=337.88' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 30.40 cfs @ 17.20 fps)

Summary for Pond 4P: WQU 1

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af
Outflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af, Atten= 0%, Lag= 0.0 min
Primary = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af
Routed to Reach 14R : Lake Hiawatha Outfall

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 233.94' @ 13.17 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	229.20'	**30.0" Round Culvert** L= 80.9' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 229.20' / 228.80' S= 0.0049 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=34.86 cfs @ 13.17 hrs HW=233.94' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 34.86 cfs @ 7.10 fps)

Summary for Pond 5P: CB 5

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af
Outflow = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af, Atten= 0%, Lag= 0.0 min
Primary = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 250.11' @ 13.10 hrs
Flood Elev= 244.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 23.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.50' S= 0.0213 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.46 cfs @ 12.62 hrs HW=245.48' TW=244.14' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.46 cfs @ 4.40 fps)

Summary for Pond 6P: CB 4

Inflow Area = 1.165 ac, 38.05% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af
Outflow = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af, Atten= 0%, Lag= 0.0 min
Primary = 3.70 cfs @ 12.62 hrs, Volume= 0.595 af
Routed to Pond 7P : DMH 3

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 250.11' @ 13.10 hrs
Flood Elev= 243.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**12.0" Round Culvert** L= 11.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 238.00' / 237.70' S= 0.0273 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=3.46 cfs @ 12.62 hrs HW=245.48' TW=244.14' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 3.46 cfs @ 4.40 fps)

Summary for Pond 7P: DMH 3

Inflow Area = 2.329 ac, 38.05% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 7.40 cfs @ 12.62 hrs, Volume= 1.190 af
Outflow = 7.40 cfs @ 12.62 hrs, Volume= 1.190 af, Atten= 0%, Lag= 0.0 min
Primary = 7.40 cfs @ 12.62 hrs, Volume= 1.190 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 249.62' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	236.60'	**15.0" Round Culvert** L= 38.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 236.60' / 236.00' S= 0.0156 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.23 sf

Primary OutFlow Max=7.11 cfs @ 12.62 hrs HW=244.14' TW=241.82' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 7.11 cfs @ 5.80 fps)

Summary for Pond 8P: DMH 4

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af
Outflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af, Atten= 0%, Lag= 0.0 min
Primary = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af
Routed to Pond 11P : DMH 2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 240.92' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	233.00'	**30.0" Round Culvert** L= 80.1' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 233.00' / 232.60' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=34.82 cfs @ 13.17 hrs HW=240.91' TW=237.43' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 34.82 cfs @ 7.09 fps)

Summary for Pond 9P: CB 1

Inflow = 11.62 cfs @ 12.09 hrs, Volume= 0.422 af
Outflow = 11.62 cfs @ 12.09 hrs, Volume= 0.422 af, Atten= 0%, Lag= 0.0 min
Primary = 11.62 cfs @ 12.09 hrs, Volume= 0.422 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 251.06' @ 12.09 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 6.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=10.89 cfs @ 12.09 hrs HW=249.58' TW=236.27' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 10.89 cfs @ 13.87 fps)

Summary for Pond 10P: CB 2

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 3.06" for 100-Year event
Inflow = 11.34 cfs @ 12.10 hrs, Volume= 0.420 af
Outflow = 11.34 cfs @ 12.10 hrs, Volume= 0.420 af, Atten= 0%, Lag= 0.0 min
Primary = 11.34 cfs @ 12.10 hrs, Volume= 0.420 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 250.70' @ 12.10 hrs
Flood Elev= 238.40'

Device	Routing	Invert	Outlet Devices
#1	Primary	235.00'	**12.0" Round Culvert** L= 10.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.00' / 234.80' S= 0.0190 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=11.33 cfs @ 12.10 hrs HW=250.70' TW=236.30' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 11.33 cfs @ 14.42 fps)

Summary for Pond 11P: DMH 2

Inflow Area = 19.414 ac, 32.51% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af
Outflow = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af, Atten= 0%, Lag= 0.0 min
Primary = 34.86 cfs @ 13.17 hrs, Volume= 9.760 af
Routed to Pond 4P : WQU 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 237.43' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	232.50'	**30.0" Round Culvert** L= 240.7' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 232.50' / 229.50' S= 0.0125 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Primary OutFlow Max=34.84 cfs @ 13.17 hrs HW=237.43' TW=233.94' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 34.84 cfs @ 7.10 fps)

Summary for Pond 13P: DMH 9

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Outflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Atten= 0%, Lag= 0.0 min
Primary = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Routed to Pond 14P : DMH 8

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 317.42' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	254.50'	**18.0" Round Culvert** L= 72.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 254.50' / 251.00' S= 0.0486 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=30.48 cfs @ 13.28 hrs HW=317.35' TW=296.76' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 30.48 cfs @ 17.25 fps)

Summary for Pond 14P: DMH 8

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Outflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Atten= 0%, Lag= 0.0 min
Primary = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Routed to Pond 17P : DMH 7

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 296.79' @ 13.29 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	245.00'	**18.0" Round Culvert** L= 43.5' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 245.00' / 243.00' S= 0.0460 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=30.52 cfs @ 13.28 hrs HW=296.76' TW=276.12' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 30.52 cfs @ 17.27 fps)

Summary for Pond 15P: DMH 6

Inflow Area = 15.436 ac, 30.73% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.64 cfs @ 13.28 hrs, Volume= 7.728 af
Outflow = 30.64 cfs @ 13.28 hrs, Volume= 7.728 af, Atten= 0%, Lag= 0.0 min
Primary = 30.64 cfs @ 13.28 hrs, Volume= 7.728 af
Routed to Pond 16P : DMH 5

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 255.44' @ 13.21 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	237.80'	**24.0" Round Culvert** L= 34.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 237.80' / 236.20' S= 0.0471 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=30.68 cfs @ 13.28 hrs HW=255.43' TW=248.83' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 30.68 cfs @ 9.77 fps)

Summary for Pond 16P: DMH 5

Inflow Area = 17.765 ac, 31.69% Impervious, Inflow Depth = 6.02" for 100-Year event
Inflow = 33.97 cfs @ 13.17 hrs, Volume= 8.918 af
Outflow = 33.97 cfs @ 13.17 hrs, Volume= 8.918 af, Atten= 0%, Lag= 0.0 min
Primary = 33.97 cfs @ 13.17 hrs, Volume= 8.918 af
Routed to Pond 8P : DMH 4

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 248.99' @ 13.18 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	235.60'	**24.0" Round Culvert** L= 151.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 235.60' / 233.50' S= 0.0139 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 3.14 sf

Primary OutFlow Max=33.93 cfs @ 13.17 hrs HW=248.98' TW=240.91' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 33.93 cfs @ 10.80 fps)

Summary for Pond 17P: DMH 7

Inflow Area = 15.269 ac, 31.07% Impervious, Inflow Depth = 6.01" for 100-Year event
Inflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Outflow = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af, Atten= 0%, Lag= 0.0 min
Primary = 30.56 cfs @ 13.28 hrs, Volume= 7.650 af
Routed to Pond 15P : DMH 6

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 276.12' @ 13.28 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	240.00'	**18.0" Round Culvert** L= 41.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 240.00' / 238.00' S= 0.0488 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Primary OutFlow Max=30.55 cfs @ 13.28 hrs HW=276.12' TW=255.43' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 30.55 cfs @ 17.29 fps)

Summary for Pond 18P: Lakeshore Drive

Inflow Area = 1.649 ac, 41.27% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 11.52 cfs @ 12.09 hrs, Volume= 0.842 af
Outflow = 11.52 cfs @ 12.09 hrs, Volume= 0.842 af, Atten= 0%, Lag= 0.0 min
Primary = 11.34 cfs @ 12.10 hrs, Volume= 0.420 af
Routed to Pond 10P : CB 2
Secondary = 11.62 cfs @ 12.09 hrs, Volume= 0.422 af
Routed to Pond 9P : CB 1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 240.85' @ 13.15 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Secondary	238.00'	**10.0' long x 18.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 12.10 hrs HW=238.56' TW=250.70' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 12.09 hrs HW=238.69' TW=249.58' (Dynamic Tailwater)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

APPENDIX E

CONSTRUCTION PERIOD SOIL EROSION AND SEDIMENT CONTROL PLAN

LAKE HIAWATHA DRAINAGE DESIGN PROJECT
BELLINGHAM, MA

November 2025

Prepared for:

TOWN OF BELLINGHAM

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Section 1
Introduction

Stormwater runoff from construction activities can have a significant impact on water quality. As stormwater flows over a construction site, it can pick up pollutants like sediment, debris, and chemicals and transport these to a nearby storm sewer system or directly to a river, lake, or coastal water. Polluted stormwater runoff can harm or kill fish and other wildlife. Sedimentation can destroy aquatic habitat, and high volumes of runoff can cause stream bank erosion. Debris can clog waterways and potentially reach the ocean where it can kill marine wildlife and impact habitat.

Standard 8 of the Massachusetts Stormwater Standards requires:

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

The following Construction Period Soil Erosion and Sediment Control Plan (SESCP) identifies the requirements to comply with Standard 8.

Section 2
Project Information

2.1 Plan Contents

This construction period erosion and sediment control plan (ESCP) was developed for the Lake Hiawatha Flash Flood Mitigation Project in Bellingham, Massachusetts. This ESCP provides permit-related information to satisfy the requirements of Standard 8 of the Massachusetts Stormwater Handbook.

2.2 Project/ Site Information

Project Name and Address

Project/Site Name:	Lake Hiawatha Drainage and Water Main Replacement Project
Project Street/Location:	Lake Shore Dr, Indian Run Road, Bernier Lane
City:	Bellingham
State:	MA
ZIP Code:	02019
County or Similar Subdivision:	Norfolk County

2.3 Nature of the Construction Activity

General Description of Project

The proposed site development involves replacing the existing drainage system within Lake Shore Drive to address flooding concerns in the area and treat stormwater runoff quality before discharge to Lake Hiawatha.

Size of Construction Project

Total area expected to be disturbed by the construction activities: 2.1 acre

The maximum area expected to be disturbed at any one time (in acres): 2.1 acre

TABLE 2-4

Pollutant-Generating Activities

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)
Site work	Soil particles and fines
Paving and construction areas	Petroleum, concrete, vehicle fluids, paints, solvents
Concrete construction	Concrete
Pavement marking	Paint
Solid waste storage	Construction debris, trash

Pollutant-Generating Activity	Pollutants or Pollutant Constituents (that could be discharged if exposed to stormwater)
Equipment use	Hydraulic Oils/fluids
Equipment use	Antifreeze/coolant
Portable toilets	Sewage
Staging areas	Sediment, gasoline, fuel oil, concrete, vehicle fluids, paints, solvents, fertilizers, adhesives, antifreeze/coolant, hydraulic oil/fluid, etc.

2.4 Sequence and Estimated Dates of Construction Activities

The following is an anticipated construction sequence identifying the major components of construction for the project.

2.4.1 Phase I

Estimated Start Date of Construction Activities for this Phase	*TBD*
Estimated End Date of Construction Activities for this Phase	*TBD*
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	*TBD*
Estimated Date(s) when Stormwater Controls will be Removed	*TBD*

2.5 Allowable Non-Stormwater Discharges

Water from non-stormwater sources are allowed when properly managed. The following identifies discharge sources anticipated with the project.

TABLE 2-5
List of Allowable Non-Stormwater Discharges Present at the Site

Type of Allowable Non-Stormwater Discharge	Likely to be Present at Your Site?	Location on Site
Discharges from emergency fire-fighting activities	☐ YES ☒ NO	
Fire hydrant flushings	☒ YES ☐ NO	At new and existing hydrants along section of replaced water main
Landscape irrigation	☐ YES ☒ NO	

Waters used to wash vehicles and equipment[1]	☐ YES ☒ NO	
Water used to control dust	☒ YES ☐ NO	Throughout site
Potable water including uncontaminated water line flushings	☒ YES ☐ NO	
External building wash down, provided soaps, solvents, and detergents are not used, and external surfaces do not contain hazardous substances (e.g. paint or caulk containing PCBs)	☐ YES ☒ NO	
Pavement wash waters[2]	☐ YES ☒ NO	
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO	
Uncontaminated, non-turbid discharges of ground water or spring water	☐ YES ☒ NO	
Foundation or footing drains[3]	☐ YES ☒ NO	
Construction dewatering water[4]	☒ YES ☐ NO	Throughout site, from excavated trenches**

[1]provided that there is no discharge of soaps, solvents, or detergents used for such purposes

[2]provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. You are prohibited from directing pavement wash waters directly into any water of the U.S., storm drain inlet, or stormwater conveyance, unless the conveyance is connected to a sediment basin, sediment trap, or similarly effective control;

[3]where flows are not contaminated with process materials sucks as solvents or contaminated ground water

[4]discharged in accordance with applicable regulations

* All treated (chlorinated) water flushed from water lines shall be disposed of by discharging to the nearest sanitary sewer or by other approved means provided in AWWA. It shall **not** be discharged to wetlands or waterways.

** **No** untreated or contaminated groundwater will be discharged to wetlands or waterways. Excess water will be discharged overland in upland areas and allowed to naturally infiltrate in well-drained soils, or discharged to wetlands or streams only after passing through filtration sacks or similar devices.

Section 3
Erosion and Sediment Controls

The Contractor must implement erosion and sediment controls in accordance with the following requirements to minimize the discharge of pollutants in stormwater from construction activities. This project also includes site specific controls and permit conditions which may take precedent and are not included in the following descriptions. The Contractor shall also comply with the requirements in the project's permits.

3.1 Perimeter Controls

Provide perimeter controls to prevent sediment from entering and compromising the adjacent storm drain system.

General

Roadways and storm drainage components adjacent to the proposed project area will be protected by a row of erosion control barriers. The erosion control barriers will consist of straw wattles or mulch-filled tubes (e.g. compost filter tubes/socks) and siltation fencing placed in a fashion that restricts the contractor(s) to the areas necessary to conduct the work and will generally define the limits of work. The locations of these barriers are shown on the project drawings.

Specific Perimeter Controls

Perimeter Control Description

- Perimeter controls include the installation of a straw wattle or mulch log barrier and siltation fence system around the perimeter of the site. Perform work in accordance with the ESCP.

Installation

- Temporary erosion control measures shall be installed prior to the start of any earth disturbing activities.
- Erosion control barriers shall not be removed until their removal is approved by the Engineer.

Maintenance Requirements

- The contractor(s) will be required to maintain a reserve supply of erosion control barriers on-site to make repairs, as necessary.
- Perimeter control shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. They shall be repaired if there are any signs of erosion or sedimentation below them, any repairs shall be made immediately. If there are signs of undercutting at the center or the edges, or impounding of large volumes of water behind them, sediment barriers shall be replaced with a temporary check dam.
- Should the fabric on a barrier decompose or become ineffective prior to the end of the expected usable life and the barrier still is necessary, the fabric shall be replaced promptly.
- Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximated 1/3 the height of the barrier.

At the conclusion of the project, the erosion control barriers will be removed and properly disposed off-site following the stabilization of disturbed areas.

3.2 Sediment Track-Out

General

It is the Contractor's responsibility to take measures to prevent tracking of sediment from the project site. It is also the Contractor's responsibility to take measures to prevent tracking of sediment from any staging and material storage area. A stone tracking pad and street sweeping apparatus shall be used as necessary to minimize the track-out of sediment onto adjacent streets, other paved areas, and sidewalks from vehicles exiting the construction site.

Specific Track-Out Controls

Track-Out Controls Description

- Stone aggregate tracking pad
- Street sweeping

Installation

- Sediment track out controls to be installed by the Contractor include a stone aggregate tracking pad with an underlying geotextile fabric. The pad shall be constructed in accordance with the ESCP.

Maintenance Requirements

- The site exit shall be maintained in a condition which will prevent tracking of sediment onto public right-of-way. When washing is required, it shall be done in an area stabilized with aggregate which drains into a sediment trapping controls.
- If sediment is tracked out from the site to the surface of off-site streets, other paved areas, and sidewalks, the Contractor shall remove the deposited sediment by the end of the same work day in which the track-out occurs.

3.3 Stockpiled Sediment or Soil

General

Temporary soil stockpiles shall be surrounded by hay bales or silt fence and shall be stabilized by covering or temporary erosion control seeding. Stockpiles are to be located as far as possible from any surface water.

Specific Stockpile Controls

Description

- Temporary stockpiles of excavated soil may be present at the site as construction progresses.

Installation

- Install a sediment barrier consisting of silt fencing or straw bales along downgradient perimeter areas of stockpiles.

- For piles that will be unused for 14 or more days, temporary stabilization with erosion control seeding shall be used if perimeter controls and/or temporary covering are not sufficient to prevent sediment migration.

Maintenance Requirements

- Do not hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.

3.4 Minimize Dust

General

The Contactor shall be responsible for the control of dust throughout the construction period. Dust control methods shall include, but be not limited to, sprinkling water or calcium chloride on exposed areas, covering loaded dump trucks leaving the site, and temporary mulching exposed soil areas. Dust control measures shall be utilized to prevent the migration of dust from the site to abutting areas.

Specific Dust Controls

Description

- Prevent dust from becoming a nuisance or hazard. During construction, excavated material and open or stripped areas are to be policed and controlled to prevent spreading of the material.
- Dust control measures shall be utilized to prevent the migration of dust from the site to abutting areas.
- Ensure that the existing equipment, facilities, and occupied space adjacent to or nearby areas of the work do not come in contact with dust or debris as a result of concrete demolition, excavation or surface preparation.

Installation

- Dust control methods shall include, but be not limited to, sprinkling water on exposed areas, using calcium chloride, covering loaded dump trucks leaving the site, and temporary mulching.
- Use a mechanical street sweeper daily.

Maintenance Requirements

- During the work on-site, daily all paved road and driveway surfaces shall be scraped and broomed free of excavated materials on a daily basis. Prior to sweeping, or as needed during the work day, the surfaces shall be hosed down or otherwise treated to eliminate active or potential dust conditions and the natural road or wearing surface shall be exposed.

3.5 Minimize the Disturbance of Steep Slopes

General

All slopes greater than 15% during the regular construction season are to have slope stabilization measures. This applies to all slopes greater than 8% after October 1st.

Specific Steep Slope Controls

- Where slopes greater than 3:1 will be created, synthetic erosion control fabric is to be utilized in these areas to prevent erosion until permanent vegetation is established.

3.6 Topsoil/Loam Areas

General

All areas not to be paved or otherwise treated shall receive 4-inch loam and seed. The salvaging of existing loam and topsoil is not anticipated due to the urban nature of the site.

Specific Topsoil/Loam Area Controls

Description

- Erosion of topsoil/ loam areas will be controlled by providing temporary and perminant grass cover.
- Where slopes greater than 3:1 will be created, synthetic erosion control fabric will be utilized to prevent erosion until permanent vegetation is established.

Installation

- Temporary vegetative cover shall be provided to stabilize the site in areas where additional construction activity will not occur for more than 14 calendar days.

Maintenance Requirements

- Seeding shall be inspected periodically and at a minimum 95% of the soil surface should be covered by vegetation. If any evidence of erosion is apparent, repairs shall be made and additional measures shall be used to prevent further erosion.
- Straw mulch, wood fiber mulch, or erosion control blankets shall be applied immediately after seeding.

3.7 Soil Compaction

General

In areas where final vegetative stabilization is proposed, the Contractor shall prevent excessive compaction by:

- Restricting vehicle and equipment use in these locations to avoid excessive soil compaction; or
- Prior to seeding or planting areas of exposed soil that have been compacted, use techniques that aerates the soils resulting in conditions that will support vegetative growth.

3.8 Storm Drain Inlets

General

Provide catch basin inlet protection as per construction drawings and specifications in all catch basins within the vicinity of the earth disturbing activities to protect the stormwater management system from high sediment loads and high velocities, while disturbance due to construction is occurring in the drainage area.

Specific Storm Drain Inlet Controls

Description

- Storm Drain Inlet Controls include the installation of Silt Sacks
- Refer to the ESCP for inlet control locations.

Installation

- Refer to manufacturer recommended specifications and instillation instructions.

Maintenance Requirements

- Silt sacks shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. They shall be repaired or replaced as needed immediately.
- Sediment deposits should be removed after each storm event. They must be cleaned when deposits reach approximated 1/3 the height of the barrier.
- The Contractor shall remove the deposited sediment and make any repairs by the end of the same work day in which the sediment is observed or by the end of the next work day if observation occurs on a non-work day.

3.9 Sediment Traps

General

Permanent sediment basins are not proposed as part of the final stormwater management system, however, temporary sediment basins or sediment traps may be used during construction to retain runoff and settle out particles prior to discharge from the site.

Specific Sediment Basin/Sediment Trap Controls

Description

- Temporary sediment basins or sediment traps may be excavations or bermed detention areas on site with stabilized discharges.

Installation

- As required due to site conditions and activities.

Maintenance Requirements

- Contractor shall periodically remove sediments and dispose of them in an appropriate location. Discharge locations shall be inspected regularly and stabilized as necessary.

3.10 Dewatering Practices

General

Dewatering is anticipated for this project. Standard dewatering measures will be employed. No untreated groundwater will be discharged to wetlands or waterways. Excess water will be discharged overland in upgradient areas and allowed to naturally infiltrate, or discharged to the drainage system only after passing through filtration sacks or similar devices.

Specific Dewatering Practices

Dewatering Practice Description

- Provide, operate and maintain adequate pumping, diversion and drainage facilities in accordance with the approved dewatering plan to maintain the excavated area sufficiently dry from groundwater and/or surface runoff so as not to adversely affect construction procedures nor cause excessive disturbance of underlying natural ground. Locate dewatering system components so that they do not interfere with construction under this or other contracts.
- Install erosion/sedimentation controls for velocity dissipation at point discharges onto non-paved surfaces.

Installation

- Install sand and gravel, or crushed stone, filters in conjunction with sumps, well points, and/or deep wells to prevent the migration of fines from the existing soil during the dewatering operation.
- Transport pumped or drained water without interference to other work, damage to pavement, other surfaces, or property. Pump water through a silt filter bag prior to discharge to grade or drainage system.
- Do not discharge water into any separated sanitary sewer system.

Maintenance Requirements

- Repair any damage resulting from the failure of the dewatering operations and any damage resulting from the failure to maintain all the areas of work in a suitable dry condition.
- Take actions necessary to ensure that dewatering discharges comply with permits applicable to the Project. Dispose of water from the trenches and excavations in such a manner as to avoid public nuisance, injury to public health or the environment, damage to public or private property, or damage to the work completed or in progress.

3.11 Site Stabilization

General

Initiate site stabilization measures immediately whenever earth-disturbing activities have permanently ceased or will be temporarily suspended on any portion of the site for more than 14 days.

Complete the stabilization activities within 14 days after the permanent or temporary cessation of earth-disturbing activities. Temporary paving of disturbed areas of existing roads should be completed at a minimum at the end of each week.

Use the following stabilization practices to protect exposed soil from erosion and prevent sediment movement.

3.11.1 Seeding

Installation

- When construction has temporarily or permanently ceased, seeding shall occur immediately in accordance with the project specifications.

Maintenance Requirements

- Periodic inspections shall occur once a week and after every rainstorm of 0.25 inches or greater until a minimum of 70% of the soil surface is covered by vegetation.

3.11.2 Mulching

Installation

- When construction has temprorarily or permanently ceased, mulching shall occur immediately, as required, for erosion control while vegetation is being established.

Maintenance Requirements

- Periodic inspections shall occur once a week and after every rainstorm 0.25 inches or greater.

3.11.3 Erosion Control Mats or Blankets

Installation

- When construction has temprorarily or permanently ceased, erosion control blanket installation shall occur immediately on slopes greater than 3:1, or as required, for erosion control while vegetation is being established.

Maintenance Requirements

- Periodic inspections shall occur once a week and after every rainstorm 0.25 inches or greater.

Section 4
Pollution Prevention Standards

A clean and orderly construction site will reduce the opportunity for pollutants to enter the stormwater runoff stream. The following identifies sources of pollution anticipated on a typical construction site and preventative measures to avoid pollution.

4.1 Potential Sources of Pollution

TABLE 4-1

Construction Site Pollutants

Pollutant-Generating Activity	Pollutants or Pollutant Constituents	Location on Site
Site work	Soil particals and fines	Where disturbance is proposed
Paving and construction areas	Petroleum, concrete, vehicle fluids, paints, solvents	Where paving and construction is proposed
Concrete construction	Concrete	Where concrete is proposed
Pavement marking	Paint	Where pavement markings are proposed
Fertilizing	Fertilizers	In areas of proposed seeding
Equipment use	Hydraulic Oils/fluids	Leaks/broken hoses from equipment
Equipment use	Antifreeze/coolant	Leaks/broken hoses from equipment
Portable toilets	Sewage	Where portable toilets are located
Staging areas	Sediment, gasoline, fuel oil, concrete, vehicle fluids, paints, solvents, fertilizers, adhesives, antifreeze/coolant, hydraulic oil/fluid, etc.	

4.2 Spill Prevention and Response

- Manufacturer's recommended methods for cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and clean up supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage areas on site. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic or metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with hazardous substances.

- Spills of toxic or hazardous material will be reported to the appropriate state or local government agency regardless of size.
- The Spill Prevention Plan will be adjusted to include measures to prevent this type of spill from recurring and how to cleanup the spill if it recurs. A description of the spill, its cause and the cleanup measures will be included.
- The site superintendent responsible for day to day operations will be the Spill Response Coordinator (SRC). The SRC is responsible for decisive actions in the event of a spill at the facility. The SRC will supervise efforts to provide immediate containment of the spill to prevent a more difficult cleanup situation. Cleanup crews will utilize proper spill cleanup materials and employ safe work practices.

4.2.1 Federal and State Spill Notification

In accordance with 310 CMR 40.0333, the SRC shall notify the Massachusetts Department of Environmental Protection (Central Region) - (508)-792-7650, the Local Emergency Planning Committee (LEPC) and any other authorities or agencies within <u>two hours</u> if an accident or other type of incident results in a release to:

- Land
    - o 10 Gallons for more Oils (PCB<500 ppm)
    - o 1 Gallon or more Oils (PCB ≥500 ppm)
- Waterways
    - o Any quantity of Oils
- Or, triggers the exposure to toxic chemical levels as listed in 301 CMR 40.1600, Revised Massachusetts Contingency Plan

The SRC shall notify the National Response Center (NRC) at **(800) 424-8802** where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with Part 2.3.3.4c and established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period.

In either event, the SRC will work with state and federal agencies to ensure that all appropriate forms and reports are submitted in a timely manner.

- Note: Trigger volumes for other chemical spills vary. Contact the DEP or a Licensed Site Professional (LSP) for specific guidance on reporting thresholds and requirements for other chemicals.

4.2.2 Local Notification

The following local agencies will be called to provide emergency assistance at the facility on the judgment of the SRC:

TABLE 4-2

Emergency Assistance Notification

Fire Department	Police Department
911 or (508) 966-1112	911 or (508) 966-1515

Hospital: Milford Regional Medical Center (508) 473-1190	Department of Public Works: (508) 966-5813

4.3 Fueling and Maintenance of Equipment or Vehicles

General

Efforts shall be made to perform equipment/vehicle fueling and maintenance off-site. If fueling and/or maintenance of equipment of vehicles is performed on site, the following pollution prevention practices must be provided.

Specific Pollution Prevention Practices

- Site contractor/project manager shall provide an onsite vehicle fueling and maintenance area that is clean and dry.
- If possible keep area covered.
- Keep a spill kit at the fueling and maintenance area.
- Vehicles shall be inspected regularly for leaks and damage.
- Use drip pans, drip cloths or absorbent pads when replacing spent fluid.

4.4 Washing of Equipment and Vehicles

General

Efforts shall be made to perform equipment/vehicle washing and maintenance off-site. If washing of equipment and vehicles is performed on site, the following pollution prevention practices must be provided to minimize the discharge of pollutants.

Specific Pollution Prevention Practices

- Site contractor/project manager shall provide a proper washing area.
- Discharges from washing areas shall be infiltrated or diverted into sanitary sewer system unless no soaps or detergents are used.
- If soaps, detergents or solvents are stored onsite over must be provided to prevent these detergents from coming into contact with rainwater.

4.5 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

4.5.1 Building Products

- Site contractor/project manager shall designate a waste collection area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a water body.
- Ensure that containers have lids so they can be covered before periods of rain, and keep containers in a covered area whenever possible.

- Schedule waste collection to prevent the containers from overfilling.
- Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.
- During the demolition phase of construction, provide extra containers and schedule more frequent pickups.
- Collect, remove, and dispose of all construction site wastes at authorized disposal areas.

4.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscaping Materials

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent materials.

4.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

- Store new and used petroleum products for vehicles in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent material.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.

4.5.4 Hazardous or Toxic Waste

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage areas should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent materials.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.
- To prevent leaks, empty and clean hazerdous waste containers before disposing of them.
- Never remove the original product label from the container because it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.

- Never mix excess products when disposing of them, unless specifically recommended by the manufacturer.

4.5.5 Construction and Domestic Waste

- All materials shall be collected and stored in securely lidded receptacles, no construction waste materials will be buried. Clean up immediately if containers overflow.

4.5.6 Sanitary Waste

- Portable sanitary units will be provided throughout the course of the project for use by the site contractor/project manager's employees. A licensed sanitary waste management contractor will regularly collect all sanitary waste from the portable units. Position portable toilets so that they are secure and will not be tipped or knocked over.

4.6 Washing of Applicators and Containers used for Paint, Concrete or Other Materials

- The contractors should be encouraged where possible, to use washout facilities at their own plant or dispatch facility from stucco, paint, concrete, form release oils, curing compounds, and other construction materials.
- If washout of these materials in done on site:
  - Direct all washwater into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.
  - Handle washout or cleanout wastes as follows:
    - Do not dump liquid wastes in the storm sewers
    - Dispose of liquid wastes in accordance with applicable regulations
    - Remove and dispose of hardened concrete waste consistent with your handling of other construction wastes in Section 5.5.
  - Attempts should be made to locate washout area as far away as possible from surface waters and storwmater inlets or conveyances, and to the extend practicable, designate areas to buse for these activities and conduct such activities only in these areas.
- Inspect washout facilities daily to detect leaks or tears and to identify when materials need to be removed.

4.7 Fertilizers

If fertilizers are to be used on site, the following requirements shall be followed:

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.

- Immediately contain and clean up any spills with absorbent materials.
- Apply at a rate and in amounts consistent with manufacturer's specifications, or document departures from the manufacturer's specifications.
- Apply at the appropriate time of year for the site, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth
- Avoid applying before heavy rains that could cause excessive nutrients to be discharged
- Never apply to frozen ground
- Never apply to stormwater conveyance channels with flowing water
- Follow all federal, state, tribal, and local requirements regarding fertilizer application.

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APPENDIX F

LONG-TERM POLLUTION PREVENTION AND STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN

Lake Hiawatha Drainage and Water Main Improvements
Bellingham, MA

November 2025

Prepared for:

Town of Bellingham

\\Tighebond.com\data\Data\Projects\B\B0852 Bellingham MS4 Engineering\009 Lake Hiawatha Drainage Design\Stormwater\Appendix F - Stormwater O&M\Long Term Pollution Prevention and Stormwater Management OM Plan.doc

Section 1
Introduction and Purpose

The following Long-Term Pollution Prevention and Stormwater Operations and Maintenance (O&M) Plan has been prepared for the stormwater management system at the proposed Lake Hiawatha Drainage and Water Main Replacement Project in Bellingham, MA. The purpose of the plan is to provide guidance and procedures for proper pollution prevention and stormwater management system maintenance following construction completion.

The proposed project has been designed in compliance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook to maintain or improve stormwater runoff quality and quantity. The stormwater management system components shall be maintained as recommended in the Massachusetts Stormwater Handbook.

Section 2
Responsible Parties

The Town of Bellingham is responsible for maintaining and servicing the proposed stormwater management facilities post construction. The property is owned by the Town. During construction, the contractor will be responsible for stormwater management system maintenance.

Property Owner:

Town of Bellingham
26 Blackstone Street
Bellingham, MA 02019

Owner Signature, date: ____

Maintenance Contact:

Jesse Riedle
26 Blackstone Street
Bellingham, MA 02019
JRiedle@BellinghamMA.org

Maintenance Contact
Signature, date: ____

Section 3
Long Term Pollution Prevention Plan

3.1 Good Housekeeping

The goal of the good housekeeping policy is to keep the site in a clean and orderly condition. A disorderly site can lead to improper materials management and can reduce the efficiency of any response to potential pollution problems.

The following good housekeeping measures will be followed at the site to aid in pollution prevention:

- Promptly clean and remove any spills or contamination from vehicles or other services.
- Perform preventative maintenance on the structural components of the stormwater system.
- Properly dispose of refuse.

3.2 Potential Sources of Pollution

The following sources of pollution are anticipated as part of the long-term use of the project.

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)
Vehicular Access	Petroleum, concrete, vehicle fluids, paints, solvents

3.3 General Spill Prevention and Response

In the event of a spill, the following procedures shall be followed by the Maintenance Contact or their authorized representative:

- Manufacturer's recommended methods for cleanup will be clearly posted and facility personnel will be made aware of the procedures and the location of the information and clean up supplies.
- Materials and equipment necessary for spill cleanup will be kept in the material storage areas at the facility. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic or metal trash containers specifically for this purpose.
- All spills will be cleaned up immediately after discovery.
- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with hazardous substances.
- Spills of toxic or hazardous material will be reported to the appropriate state or local government agency regardless of size.

- The Spill Prevention Plan will be adjusted to include measures to prevent this type of spill from recurring and how to cleanup the spill if it recurs. A description of the spill, its cause and the cleanup measures will be included.
- The Maintenance Contact is responsible for day to day operations will be the spill prevention and cleanup coordinator.

3.3.1 Federal and State Spill Notification

In accordance with 310 CMR 40.0333, the Maintenance Contact shall notify the Massachusetts Department of Environmental Protection (Central Region) – (508) 792-7650 the Local Emergency Planning Committee (LEPC) (if applicable) and any other authorities or agencies within <u>two hours</u> if an accident or other type of incident results in a release to:

- land
  - 10 Gallons for more Oils (PCB<500 ppm)
  - 1 Gallon or more Oils (PCB ≥500 ppm)
- waterways
  - Any quantity of Oils
- Or, triggers the exposure to toxic chemical levels as listed in 301 CMR 40.1600, Revised Massachusetts Contingency Plan (MPC)

The Maintenance Contact shall notify the National Response Center (NRC) at **(800) 424-8802** where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with Part 2.3.3.4c and established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302, occurs during a 24-hour period.

In either event, the Maintenance Contact will work with state and federal agencies to ensure that all appropriate forms and reports are submitted in a timely manner.

- Note: Trigger volumes for other chemical spills vary. Contact the MassDEP or a Licensed Site Professional (LSP) for specific guidance on reporting thresholds and requirements for other chemicals.

3.3.2 Local Notification

The following local agencies will be called to provide emergency assistance at the facility on the judgment of the Maintenance Contact:

Fire Department 911 or (508) 966-1112	Police Department 911 or (508) 966-1515
Hospital: Milford Regional Medical Center (508) 473-1190	Department of Public Works: (508) 966-5813

3.4 Storage, Handling, and Disposal of Materials and Wastes

The following procedures shall be followed throughout the facility when storing, handling and disposing of various materials.

3.4.1 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscaping Materials

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent materials.
- Apply at a rate and in amounts consistent with manufacturer's specifications, or document departures from the manufacturer's specifications.
- Apply at the appropriate time of year for the site, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth
- Avoid applying before heavy rains that could cause excessive nutrients to be discharged
- Never apply to frozen ground
- Never apply to stormwater conveyance channels with flowing water
- Follow all federal, state, tribal, and local requirements regarding fertilizer application.

3.4.2 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

- Store new and used petroleum products for vehicles in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage area should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent material.
- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.

3.4.3 Hazardous or Toxic Waste

- Store new and used materials in a neat, orderly manner in their appropriate containers in a covered area. If storage in a covered area is not possible, the materials shall be covered with polyethylene or polypropylene sheeting to protect them from the elements.
- Storage areas should include precautions to contain any potential spills.
- Immediately contain and clean up any spills with absorbent materials.

- Have equipment available in fuel storage areas and in vehicles to contain and clean up any spills that occur.
- To prevent leaks, empty and clean hazardous waste containers before disposing of them.
- Never remove the original product label from the container because it contains important safety information. Follow the manufacturer's recommended method of disposal, which should be printed on the label.
- Never mix excess products when disposing of them, unless specifically recommended by the manufacturer.

3.4.4 Domestic Waste

- Site property manager shall designate a waste collection area on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a water body.
- Ensure that containers have lids so they can be covered before periods of rain and keep containers in a covered area whenever possible.
- Schedule waste collection to prevent the containers from overfilling.
- Clean up spills immediately. For hazardous materials, follow cleanup instructions on the package. Use an absorbent material such as sawdust or kitty litter to contain the spill.

Section 4
Stormwater Management System

The on-site stormwater management system is comprised of a series of deep-sump catch basins, manholes, inlet filters, and a Stormceptor STC7200 unit. Runoff from Lake Shore Drive is collected and piped to the proprietary water quality unit, while runoff from the stream to the south of Lake Shore Drive is collected and conveyed separately. The two flows converge at a downstream drainage manhole, where they are piped to an outfall at Lake Hiawatha.

See the attached Figure 1 in Appendix A for the location of the various described components of the Stormwater Management System.

4.1 Inspections

Inspections will be performed in accordance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook. Figure 1, provided in Appendix A, identifies the location of each BMP to be inspected and maintained as described in this Section. All inspections should be logged using the Inspection Forms provided in Section 5.

The following stormwater management system features will be evaluated during each inspection:

4.1.1 Deep-Sump, Hooded Catch Basins

Inspection Frequency: Quarterly

Special Inspection Event(s): Rainfall greater than 0.5 inches

Deep sump catch basins should be inspected at least four times per year. The Visual inspection should ascertain that the catch basin is functioning properly (i.e. no blockages or obstructions to the outlet and/or hood) and to measure the amount of solid materials that have accumulated in the sump. This can be done with a calibrated dipstick, tape measure or other measuring instrument so that the depth of deposition in the sump can be tracked. Inspections should be completed visually from the ground level. Deep sump catch basins should be cleaned four times per year or whenever the depth of the sediment is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin. Cleanings should also be conducted at the end of the foliage and snow-removal seasons. Clamshell buckets can be used to remove sediment. However, vacuum trucks will remove more trapped sediment, are more expedient, and are less likely to damage hoods on outlet pipes. Disposal of sediment removed from catch basins must be disposed of in accordance with local, state and federal requirements.

4.1.2 Proprietary Water Treatment Devices

Inspection Frequency: Per manufacturer recommendations

Special Inspection Event(s): Rainfall greater than 0.5 inches

Structural Water Quality Units (WQU) will be observed in accordance with manufacturer recommendations. Units are to be cleaned as directed by the manufacturer. Manufacturer recommended O&M requirements are provided in Appendix B.

4.1.4 Culverts and Stone End Protection (Outfalls)

Inspection Frequency: Bi-annually

Special Inspection Event(s): Rainfall greater than 0.5 inches

System outfalls should be inspected twice a year as well as after every major storm, for slope integrity, soil moisture, vegetated health, soil stability, soil compaction, soil erosion, ponding and sediment accumulation. If the rip rap has been displaced, undermined or damaged, it should be replaced immediately. The channel immediately below the outlet should be checked to see that erosion is not occurring. The downstream channel will be kept clear of obstructions, such as fallen trees, debris, leaves and sediment that could change flow patterns and/or tail water depths in pipes. Repairs must be carried out immediately to avoid additional damage to the outlet protection apron.

Section 5 Operation and Maintenance Log Form

Date: ___________________________

Person conducting Inspection: ____

Reason for Inspection (Routine / Significant Rainfall): ___________________________

Stormwater Management System Components:

Deep-Sump Hooded Catch Basins

Component inspected during this inspection ______________________________

Any Repair Necessary ____

Other Comments ____

Proprietary Water Quality Units

Component inspected during this inspection ______________________________

Any Repair Necessary ____

Other Comments ____

Other Comments ____

Outfall

Component inspected during this inspection ______________________________

Any Repair Necessary ____

Other Comments ____

Other Comments ____

Section 6
Snow Management & De-Icing

Snow removal will occur along Lake Shore Drive. Snow storage should not be in or adjacent to wetland areas nor block drainage to surface inlets (e.g. catch basins).

Applications of chemical de-icing may be applied along with sand for the roads, main entrances, stop sign areas, and sidewalks. Apply only as needed using minimum quantities. Small quantities of deicers may be mixed with sand or sprayed on hard to maintain areas.

Sweep or clean up accumulated sand, sidewalks, steps, and roads as soon as possible after the road surface clears.

Section 7
Estimated O&M Budget

The following estimated O&M Budget includes the inspections and maintenance activities previously described on an annual basis.

Maintenance Component	**Quantity**	**Frequency**	**Unit Cost**	**Annual Cost**
Street Sweeping	-	4	$250	$1,000
Catch Basin Inspection	4	4	$250	$4,000
Catch Basin Sediment Removal	4	2	$1,000	$8,000
Proprietary Treatment Devices	1	VARIES	VARIES	VARIES
Outfall	1	4	$250	$1,000
Total Annual Estimated Budget				**$14,000+**

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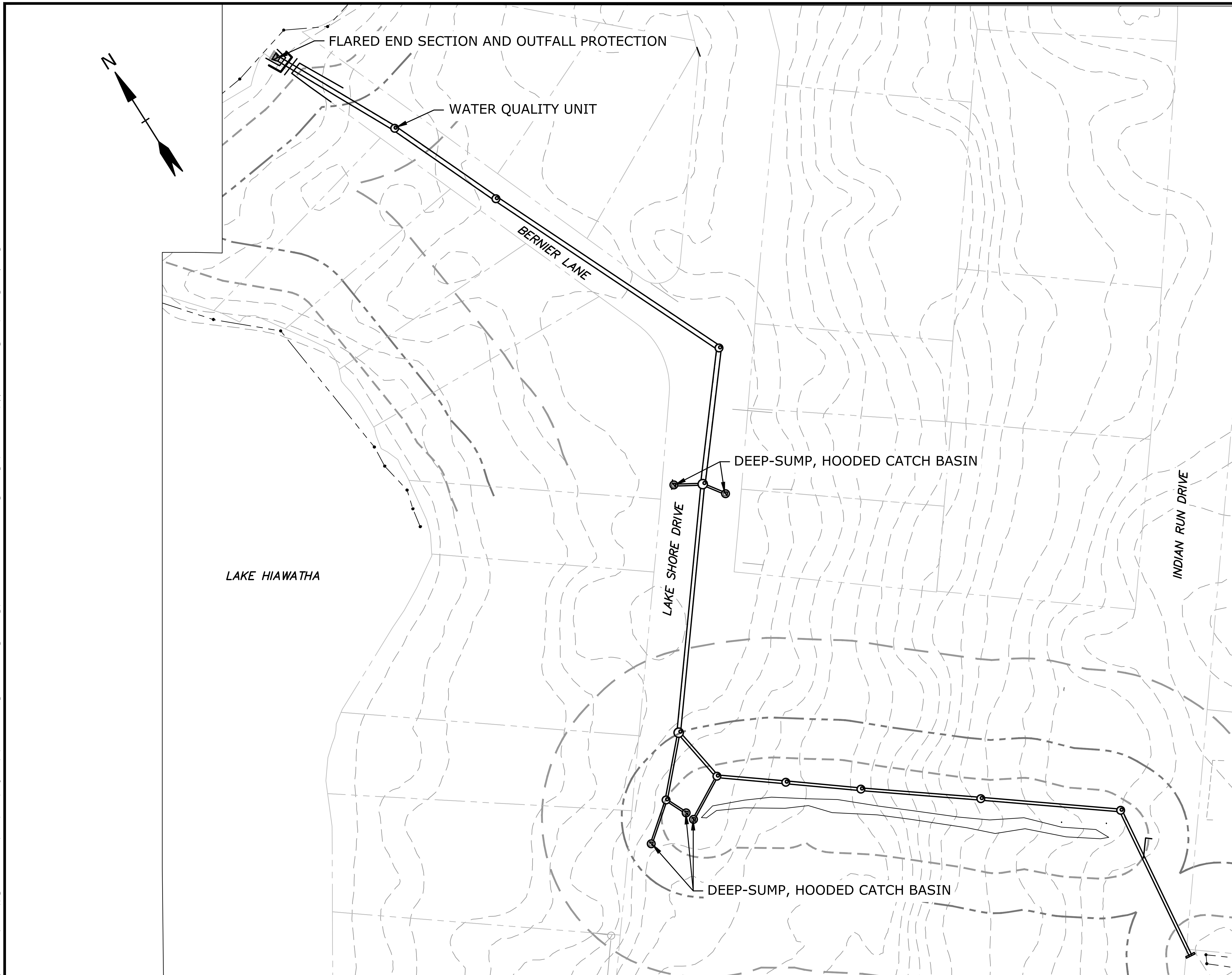

0 60' 120'

SCALE: 1" = 60'

LAKE HIAWATHA DRAINAGE IMPROVEMENTS
BELLINGHAM, MASSACHUSETTS

BMP LOCATION MAP

DATE:	11/2025
SCALE:	AS SHOWN
FIGURE	1

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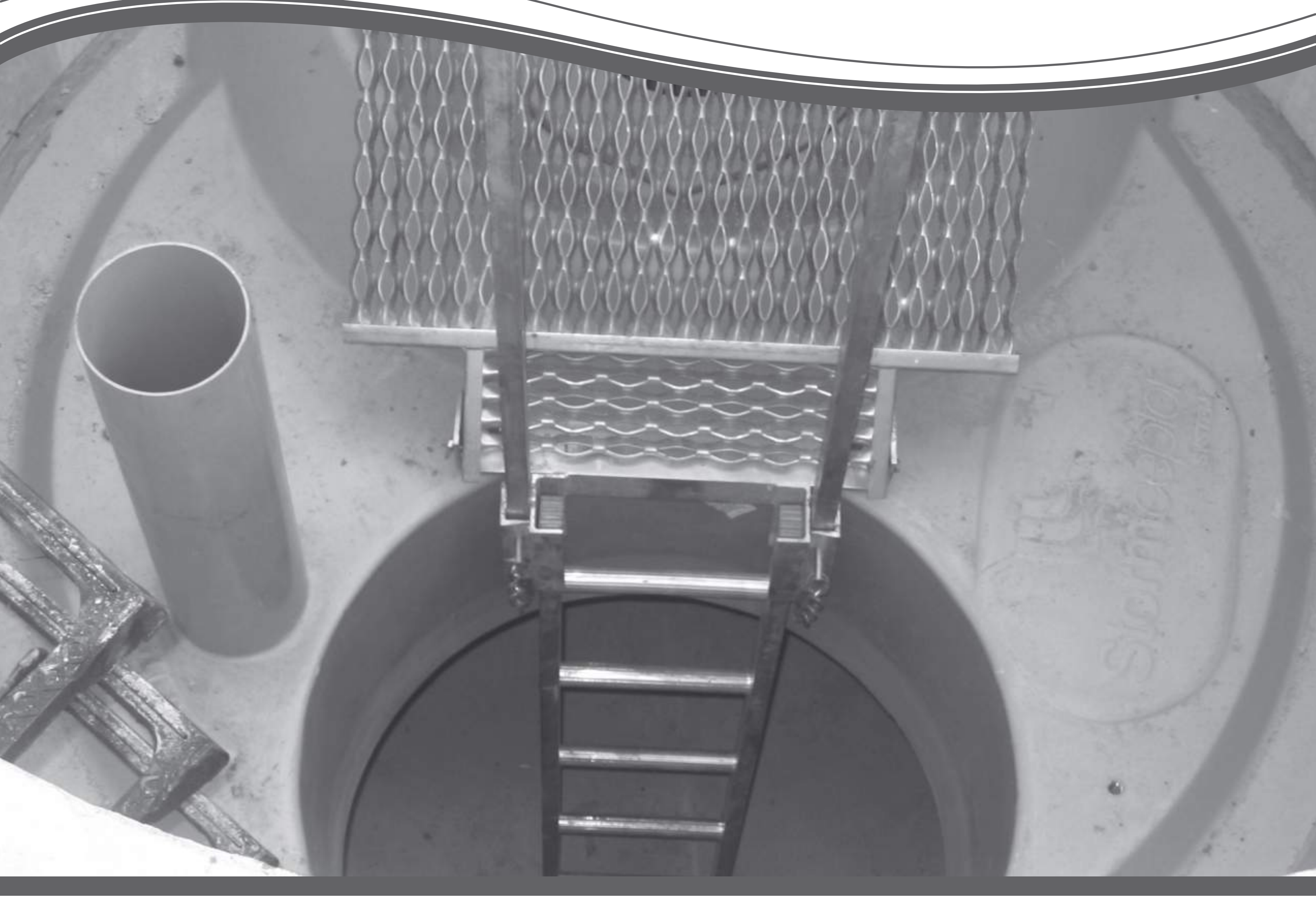
Appendix A

Stormwater BMP Location Map

Appendix B

Stormceptor O&M Requirements

Stormceptor® STC
Operation and Maintenance Guide



Stormceptor Design Notes

- Only the STC 450i is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 450i to STC 7200 may accommodate multiple inlet pipes.

Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences			
Inlet Pipe Configuration	STC 450i	STC 900 to STC 7200	STC 11000 to STC 16000
Single inlet pipe	3 in. (75 mm)	1 in. (25 mm)	3 in. (75 mm)
Multiple inlet pipes	3 in. (75 mm)	3 in. (75 mm)	Only one inlet pipe.

Maximum inlet and outlet pipe diameters:

Inlet/Outlet Configuration	Inlet Unit STC 450i	In-Line Unit STC 900 to STC 7200	Series* STC 11000 to STC 16000
Straight Through	24 inch (600 mm)	42 inch (1050 mm)	60 inch (1500 mm)
Bend (90 degrees)	18 inch (450 mm)	33 inch (825 mm)	33 inch (825 mm)

- The inlet and in-line Stormceptor units can accommodate turns to a maximum of 90 degrees.
- Minimum distance from top of grade to crown is 2 feet (0.6 m)
- Submerged conditions. A unit is submerged when the standing water elevation at the proposed location of the Stormceptor unit is greater than the outlet invert elevation during zero flow conditions. In these cases, please contact your local Stormceptor representative and provide the following information:
- Top of grade elevation
- Stormceptor inlet and outlet pipe diameters and invert elevations
- Standing water elevation
- Stormceptor head loss, K = 1.3 (for submerged condition, K = 4)

Stormceptor® STC

OPERATION AND MAINTENANCE GUIDE
Table of Content

1. About Stormceptor

The Stormceptor® STC (Standard Treatment Cell) was developed by Imbrium™ Systems to address the growing need to remove and isolate pollution from the storm drain system before it enters the environment. The Stormceptor STC targets hydrocarbons and total suspended solids (TSS) in stormwater runoff. It improves water quality by removing contaminants through the gravitational settling of fine sediments and floatation of hydrocarbons while preventing the re-suspension or scour of previously captured pollutants.

The development of the Stormceptor STC revolutionized stormwater treatment, and created an entirely new category of environmental technology. Protecting thousands of waterways around the world, the Stormceptor System has set the standard for effective stormwater treatment.

1.1. Patent Information

The Stormceptor technology is protected by the following patents:

- Australia Patent No. 693,164 • 693,164 • 707,133 • 729,096 • 779401
- Austrian Patent No. 289647
- Canadian Patent No 2,009,208 •2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending)
- China Patent No 1168439
- Denmark DK 711879
- German DE 69534021
- Indonesian Patent No 16688
- Japan Patent No 9-11476 (Pending)
- Korea 10-2000-0026101 (Pending)
- Malaysia Patent No PI9701737 (Pending)
- New Zealand Patent No 314646
- United States Patent No 4,985,148 • 5,498,331 • 5,725,760 • 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690
- Stormceptor OSR Patent Pending • Stormceptor LCS Patent Pending

2. Stormceptor Design Overview

2.1. Design Philosophy

The patented Stormceptor System has been designed to focus on the environmental objective of providing long-term pollution control. The unique and innovative Stormceptor design allows for continuous positive treatment of runoff during all rainfall events, while ensuring that all captured pollutants are retained within the system, even during intense storm events.

An integral part of the Stormceptor design is PCSWMM for Stormceptor - sizing software developed in conjunction with Computational Hydraulics Inc. (CHI) and internationally acclaimed expert, Dr. Bill James. Using local historical rainfall data and continuous simulation modeling, this software allows a Stormceptor unit to be designed for each individual site and the corresponding water quality objectives.

By using PCSWMM for Stormceptor, the Stormceptor System can be designed to remove a wide range of particles (typically from 20 to 2,000 microns), and can also be customized to remove a specific particle size distribution (PSD). The specified PSD should accurately reflect what is in the stormwater runoff to ensure the device is achieving the desired water quality objective. Since stormwater runoff contains small particles (less than 75 microns), it is important to design a treatment system to remove smaller particles in addition to coarse particles.

2.2. Benefits

The Stormceptor System removes free oil and suspended solids from stormwater, preventing spills and non-point source pollution from entering downstream lakes and rivers. The key benefits, capabilities and applications of the Stormceptor System are as follows:

- Provides continuous positive treatment during all rainfall events
- Can be designed to remove over 80% of the annual sediment load
- Removes a wide range of particles
- Can be designed to remove a specific particle size distribution (PSD)
- Captures free oil from stormwater
- Prevents scouring or re-suspension of trapped pollutants
- Pre-treatment to reduce maintenance costs for downstream treatment measures (ponds, swales, detention basins, filters)
- Groundwater recharge protection
- Spills capture and mitigation
- Simple to design and specify
- Designed to your local watershed conditions
- Small footprint to allow for easy retrofit installations
- Easy to maintain (vacuum truck)
- Multiple inlets can connect to a single unit
- Suitable as a bend structure
- Pre-engineered for traffic loading (minimum AASHTO HS-20)
- Minimal elevation drop between inlet and outlet pipes
- Small head loss
- Additional protection provided by an 18" (457 mm) fiberglass skirt below the top of the insert, for the containment of hydrocarbons in the event of a spill.

2.3. Environmental Benefit

Freshwater resources are vital to the health and welfare of their surrounding communities. There is increasing public awareness, government regulations and corporate commitment to reducing the pollution entering our waterways. A major source of this pollution originates from stormwater runoff from urban areas. Rainfall runoff carries oils, sediment and other contaminants from roads and parking lots discharging directly into our streams, lakes and coastal waterways.

The Stormceptor System is designed to isolate contaminants from getting into the natural environment. The Stormceptor technology provides protection for the environment from spills that occur at service stations and vehicle accident sites, while also removing contaminated sediment in runoff that washes from roads and parking lots.

3. Key Operation Features

3.1. Scour Prevention

A key feature of the Stormceptor System is its patented scour prevention technology. This innovation ensures pollutants are captured and retained during all rainfall events, even extreme storms. The Stormceptor System provides continuous positive treatment for all rainfall events, including intense storms. Stormceptor slows incoming runoff, controlling and reducing velocities in the lower chamber to create a non-turbulent environment that promotes free oils and floatable debris to rise and sediment to settle.

The patented scour prevention technology, the fiberglass insert, regulates flows into the lower chamber through a combination of a weir and orifice while diverting high energy flows away through the upper chamber to prevent scouring. Laboratory testing demonstrated no scouring when tested up to 125% of the unit's operating rate, with the unit loaded to 100% sediment capacity (NJDEP, 2005). Second, the depth of the lower chamber ensures the sediment storage zone is adequately separated from the path of flow in the lower chamber to prevent scouring.

3.2. Operational Hydraulic Loading Rate

Designers and regulators need to evaluate the treatment capacity and performance of manufactured stormwater treatment systems. A commonly used parameter is the "operational hydraulic loading rate" which originated as a design methodology for wastewater treatment devices.

Operational hydraulic loading rate may be calculated by dividing the flow rate into a device by its settling area. This represents the critical settling velocity that is the prime determinant to quantify the influent particle size and density captured by the device. PCSWMM for Stormceptor uses a similar parameter that is calculated by dividing the hydraulic detention time in the device by the fall distance of the sediment.

$$v_{SC} = \frac{H}{6_H} = \frac{Q}{A_S}$$

Where:

v_{SC} = critical settling velocity, ft/s (m/s)

H = tank depth, ft (m)

Ø_H = hydraulic detention time, ft/s (m/s)

Q = volumetric flow rate, ft3/s (m3/s)

A_S = surface area, ft^2 (m^2)

(Tchobanoglous, G. and Schroeder, E.D. 1987. Water Quality. Addison Wesley.)

Unlike designing typical wastewater devices, stormwater systems are designed for highly variable flow rates including intense peak flows. PCSWMM for Stormceptor incorporates all of the flows into its calculations, ensuring that the operational hydraulic loading rate is considered not only for one flow rate, but for all flows including extreme events.

3.3. Double Wall Containment

The Stormceptor System was conceived as a pollution identifier to assist with identifying illicit discharges. The fiberglass insert has a continuous skirt that lines the concrete barrel wall for a depth of 18 inches (457 mm) that provides double wall containment for hydrocarbons storage. This protective barrier ensures that toxic floatables do not migrate through the concrete wall into the surrounding soils.

4. Stormceptor Product Line

4.1. Stormceptor Models

A summary of Stormceptor models and capacities are listed in Table 1.

Table 1. Stormceptor Models

Stormceptor Model	Total Storage Volume U.S. Gal (L)	Hydrocarbon Storage Capacity U.S. Gal (L)	Maximum Sediment Capacity ft³ (L)
STC 450i	470 (1,780)	86 (330)	46 (1,302)
STC 900	952 (3,600)	251 (950)	89 (2,520)
STC 1200	1,234 (4,670)	251 (950)	127 (3,596)
STC 1800	1,833 (6,940)	251 (950)	207 (5,861)
STC 2400	2,462 (9,320)	840 (3,180)	205 (5,805)
STC 3600	3,715 (1,406)	840 (3,180)	373 (10,562)
STC 4800	5,059 (1,950)	909 (3,440)	543 (15,376)
STC 6000	6,136 (23,230)	909 (3,440)	687 (19,453)
STC 7200	7,420 (28,090)	1,059 (4,010)	839 (23,757)
STC 11000	11,194 (42,370)	2,797 (10, 590)	1,086 (30,752)
STC 13000	13,348 (50,530)	2,797 (10, 590)	1,374 (38,907)
STC 16000	15,918 (60,260)	3,055 (11, 560)	1,677 (47,487)

NOTE: Storage volumes may vary slightly from region to region. For detailed information, contact your local Stormceptor representative.

4.2. Inline Stormceptor

The Inline Stormceptor, Figure 1, is the standard design for most stormwater treatment applications. The patented Stormceptor design allows the Inline unit to maintain continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate. The Inline Stormceptor is composed of a precast concrete tank with a fiberglass insert situated at the invert of the storm sewer pipe, creating an upper chamber above the insert and a lower chamber below the insert.

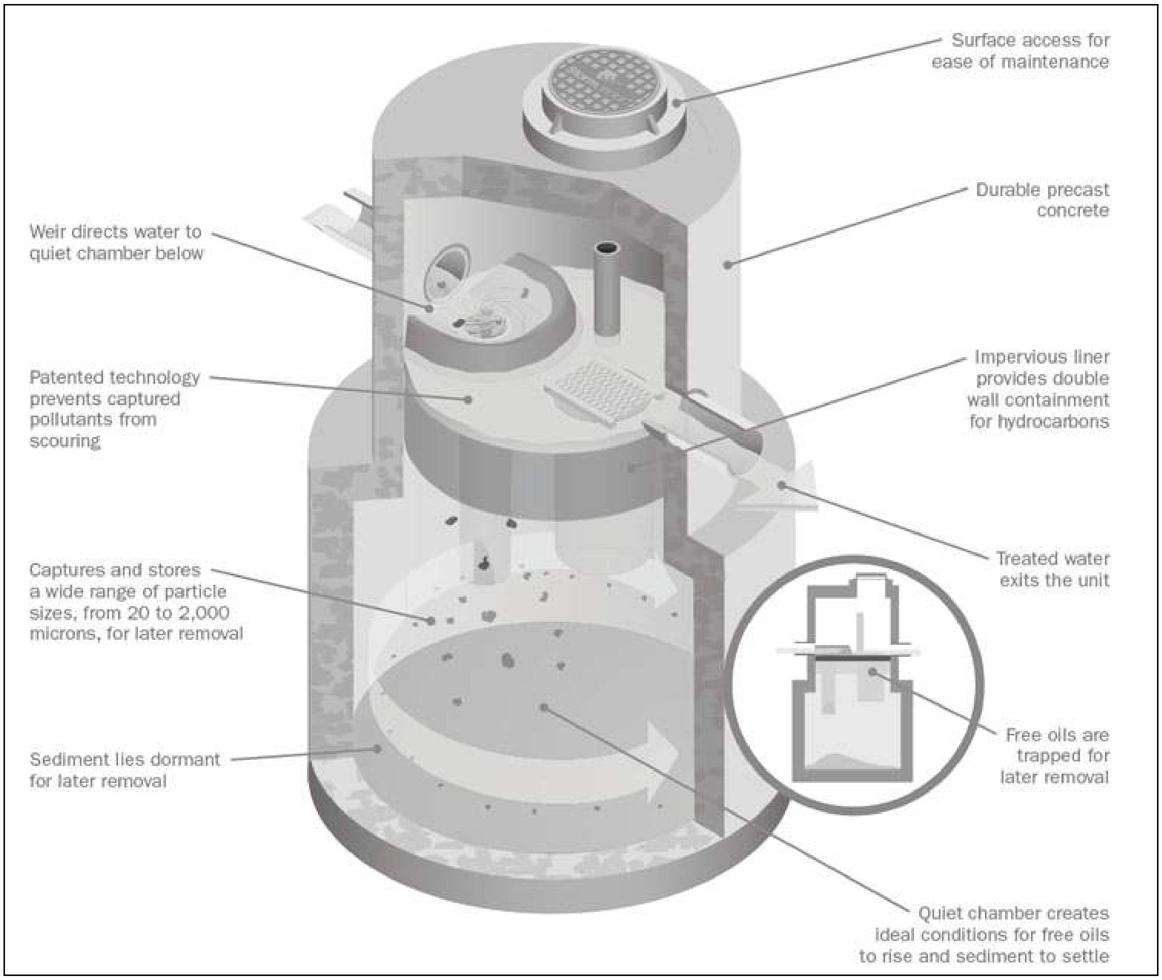


Figure 1. Inline Stormceptor

Operation

As water flows into the Stormceptor unit, it is slowed and directed to the lower chamber by a weir and drop tee. The stormwater enters the lower chamber, a non-turbulent environment, allowing free oils to rise and sediment to settle. The oil is captured underneath the fiberglass insert and shielded from exposure to the concrete walls by a fiberglass skirt. After the pollutants separate, treated water continues up a riser pipe, and exits the lower chamber on the downstream side of the weir before leaving the unit. During high flow events, the Stormceptor System's patented scour prevention technology ensures continuous pollutant removal and prevents re-suspension of previously captured pollutants.

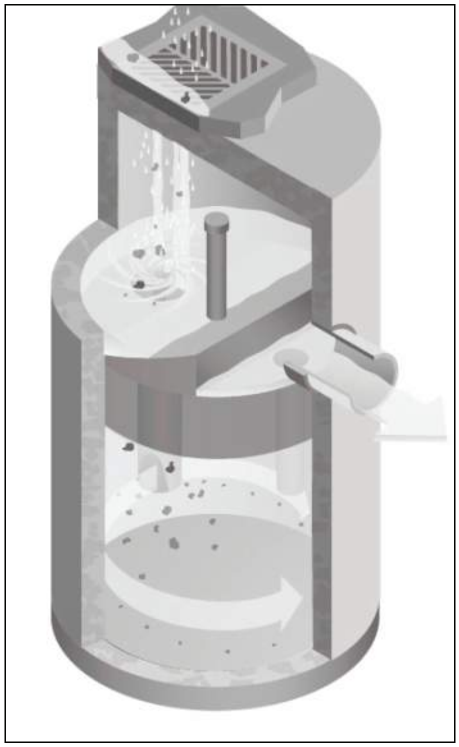


Figure 2. Inlet Stormceptor

4.3. Inlet Stormceptor

The Inlet Stormceptor System, Figure 2, was designed to provide protection for parking lots, loading bays, gas stations and other spill-prone areas. The Inlet Stormceptor is designed to remove sediment from stormwater introduced through a grated inlet, a storm sewer pipe, or both.

The Inlet Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

4.4. Series Stormceptor

Designed to treat larger drainage areas, the Series Stormceptor System, Figure 3, consists of two adjacent Stormceptor models that function in parallel. This design eliminates the need for additional structures and piping to reduce installation costs.

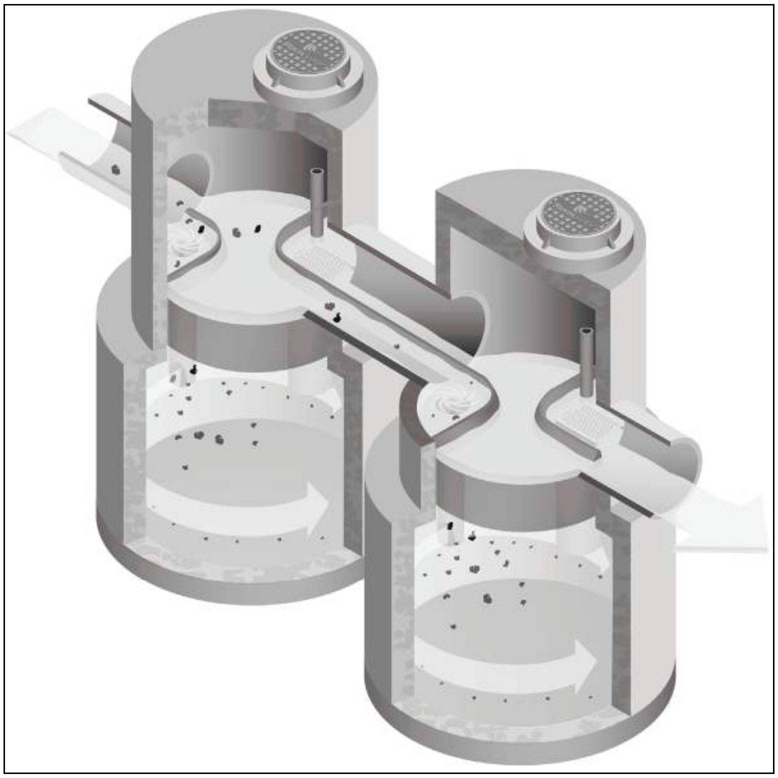


Figure 3. Series System

The Series Stormceptor design operates in the same manner as the Inline unit, providing continuous positive treatment, and ensuring that captured material is not re-suspended.

5. Sizing the Stormceptor System

The Stormceptor System is a versatile product that can be used for many different aspects of water quality improvement. While addressing these needs, there are conditions that the designer needs to be aware of in order to size the Stormceptor model to meet the demands of each individual site in an efficient and cost-effective manner.

PCSWMM for Stormceptor is the support tool used for identifying the appropriate Stormceptor model. In order to size a unit, it is recommended the user follow the seven design steps in the program. The steps are as follows:

STEP 1 – Project Details

The first step prior to sizing the Stormceptor System is to clearly identify the water quality objective for the development. It is recommended that a level of annual sediment (TSS) removal be identified and defined by a particle size distribution.

STEP 2 – Site Details

Identify the site development by the drainage area and the level of imperviousness. It is recommended that imperviousness be calculated based on the actual area of imperviousness based on paved surfaces, sidewalks and rooftops.

STEP 3 – Upstream Attenuation

The Stormceptor System is designed as a water quality device and is sometimes used in conjunction with onsite water quantity control devices such as ponds or underground detention systems. When possible, a greater benefit is typically achieved when installing a Stormceptor unit upstream of a detention facility. By placing the Stormceptor unit upstream of a detention structure, a benefit of less maintenance of the detention facility is realized.

STEP 4 – Particle Size Distribution

It is critical that the PSD be defined as part of the water quality objective. PSD is critical for the design of treatment system for a unit process of gravity settling and governs the size of a treatment system. A range of particle sizes has been provided and it is recommended that clays and silt-sized particles be considered in addition to sand and gravel-sized particles. Options and sample PSDs are provided in PCSWMM for Stormceptor. The default particle size distribution is the Fine Distribution, Table 2, option.

Table 2. Fine Distribution

Particle Size	Distribution	Specific Gravity
20	20%	1.3
60	20%	1.8
150	20%	2.2
400	20%	2.65
2000	20%	2.65

If the objective is the long-term removal of 80% of the total suspended solids on a given site, the PSD should be representative of the expected sediment on the site. For example, a system designed to remove 80% of coarse particles (greater than 75 microns) would provide relatively poor removal efficiency of finer particles that may be naturally prevalent in runoff from the site.

Since the small particle fraction contributes a disproportionately large amount of the total available particle surface area for pollutant adsorption, a system designed primarily for coarse particle capture will compromise water quality objectives.

STEP 5 – Rainfall Records

Local historical rainfall has been acquired from the U.S. National Oceanic and Atmospheric Administration, Environment Canada and regulatory agencies across North America. The rainfall data provided with PCSMM for Stormceptor provides an accurate estimation of small storm hydrology by modeling actual historical storm events including duration, intensities and peaks.

STEP 6 – Summary

At this point, the program may be executed to predict the level of TSS removal from the site. Once the simulation has completed, a table shall be generated identifying the TSS removal of each Stormceptor unit.

STEP 7 – Sizing Summary

Performance estimates of all Stormceptor units for the given site parameters will be displayed in a tabular format. The unit that meets the water quality objective, identified in Step 1, will be highlighted.

5.1. PCSWMM for Stormceptor

The Stormceptor System has been developed in conjunction with PCSWMM for Stormceptor as a technological solution to achieve water quality goals. Together, these two innovations model, simulate, predict and calculate the water quality objectives desired by a design engineer for TSS removal.

PCSWMM for Stormceptor is a proprietary sizing program which uses site specific inputs to a computer model to simulate sediment accumulation, hydrology and long-term total suspended solids removal. The model has been calibrated to field monitoring results from Stormceptor units that have been monitored in North America. The sizing methodology can be described by three processes:

1. Determination of real time hydrology
2. Buildup and wash off of TSS from impervious land areas
3. TSS transport through the Stormceptor (settling and discharge). The use of a calibrated model is the preferred method for sizing stormwater quality structures for the following reasons:
   - The hydrology of the local area is properly and accurately incorporated in the sizing (distribution of flows, flow rate ranges and peaks, back-to-back storms, inter-event times)
   - The distribution of TSS with the hydrology is properly and accurately considered in the sizing
   - Particle size distribution is properly considered in the sizing
   - The sizing can be optimized for TSS removal
   - The cost benefit of alternate TSS removal criteria can be easily assessed
   - The program assesses the performance of all Stormceptor models. Sizing may be selected based on a specific water quality outcome or based on the Maximum Extent Practicable

For more information regarding PCSWMM for Stormceptor, contact your local Stormceptor representative, or visit www.imbriumsystems.com to download a free copy of the program.

5.2. Sediment Loading Characteristics

The way in which sediment is transferred to stormwater can have a considerable effect on which type of system is implemented. On typical impervious surfaces (e.g. parking lots) sediment will build over time and wash off with the next rainfall. When rainfall patterns are examined, a short intense storm will have a higher concentration of sediment than a long slow drizzle. Together with rainfall data representing the site's typical rainfall patterns, sediment loading characteristics play a part in the correct sizing of a stormwater quality device.

Typical Sites

For standard site design of the Stormceptor System, PCSWMM for Stormceptor is utilized to accurately assess the unit's performance. As an integral part of the product's design, the program can be used to meet local requirements for total suspended solid removal. Typical installations of manufactured stormwater treatment devices would occur on areas such as paved parking lots or paved roads. These are considered "stable" surfaces which have non – erodible surfaces.

Unstable Sites

While standard sites consist of stable concrete or asphalt surfaces, sites such as gravel parking lots, or maintenance yards with stockpiles of sediment would be classified as "unstable". These types of sites do not exhibit first flush characteristics, are highly erodible and exhibit atypical sediment loading characteristics and must therefore be sized more carefully. Contact your local Stormceptor representative for assistance in selecting a proper unit sized for such unstable sites.

6. Spill Controls

When considering the removal of total petroleum hydrocarbons (TPH) from a storm sewer system there are two functions of the system: oil removal, and spill capture.

'Oil Removal' describes the capture of the minute volumes of free oil mobilized from impervious surfaces. In this instance relatively low concentrations, volumes and flow rates are considered. While the Stormceptor unit will still provide an appreciable oil removal function during higher flow events and/or with higher TPH concentrations, desired effluent limits may be exceeded under these conditions.

'Spill Capture' describes a manner of TPH removal more appropriate to recovery of a relatively high volume of a single phase deleterious liquid that is introduced to the storm sewer system over a relatively short duration. The two design criteria involved when considering this manner of introduction are overall volume and the specific gravity of the material. A standard Stormceptor unit will be able to capture and retain a maximum spill volume and a minimum specific gravity.

For spill characteristics that fall outside these limits, unit modifications are required. Contact your local Stormceptor Representative for more information.

One of the key features of the Stormceptor technology is its ability to capture and retain spills. While the standard Stormceptor System provides excellent protection for spill control, there are additional options to enhance spill protection if desired.

6.1. Oil Level Alarm

The oil level alarm is an electronic monitoring system designed to trigger a visual and audible alarm when a pre-set level of oil is reached within the lower chamber. As a standard, the oil

level alarm is designed to trigger at approximately 85% of the unit's available depth level for oil capture. The feature acts as a safeguard against spills caused by exceeding the oil storage capacity of the separator and eliminates the need for manual oil level inspection.

The oil level alarm installed on the Stormceptor insert is illustrated in Figure 4.

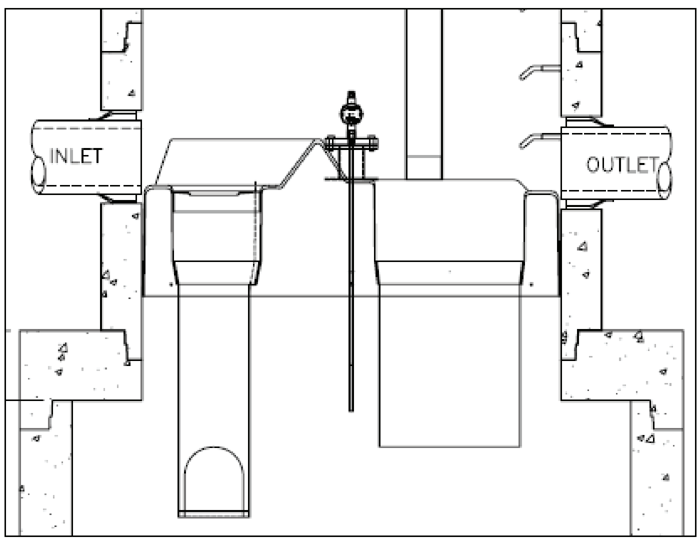


Figure 4. Oil level alarm

6.2. Increased Volume Storage Capacity

The Stormceptor unit may be modified to store a greater spill volume than is typically available. Under such a scenario, instead of installing a larger than required unit, modifications can be made to the recommended Stormceptor model to accommodate larger volumes. Contact your local Stormceptor representative for additional information and assistance for modifications.

7. Stormceptor Options

The Stormceptor System allows flexibility to incorporate to existing and new storm drainage infrastructure. The following section identifies considerations that should be reviewed when installing the system into a drainage network. For conditions that fall outside of the recommendations in this section, please contact your local Stormceptor representative for further guidance.

7.1. Installation Depth Minimum Cover

The minimum distance from the top of grade to the crown of the inlet pipe is 24 inches (600 mm). For situations that have a lower minimum distance, contact your local Stormceptor representative.

7.2. Maximum Inlet and Outlet Pipe Diameters

Maximum inlet and outlet pipe diameters are illustrated in Figure 5. Contact your local Stormceptor representative for larger pipe diameters

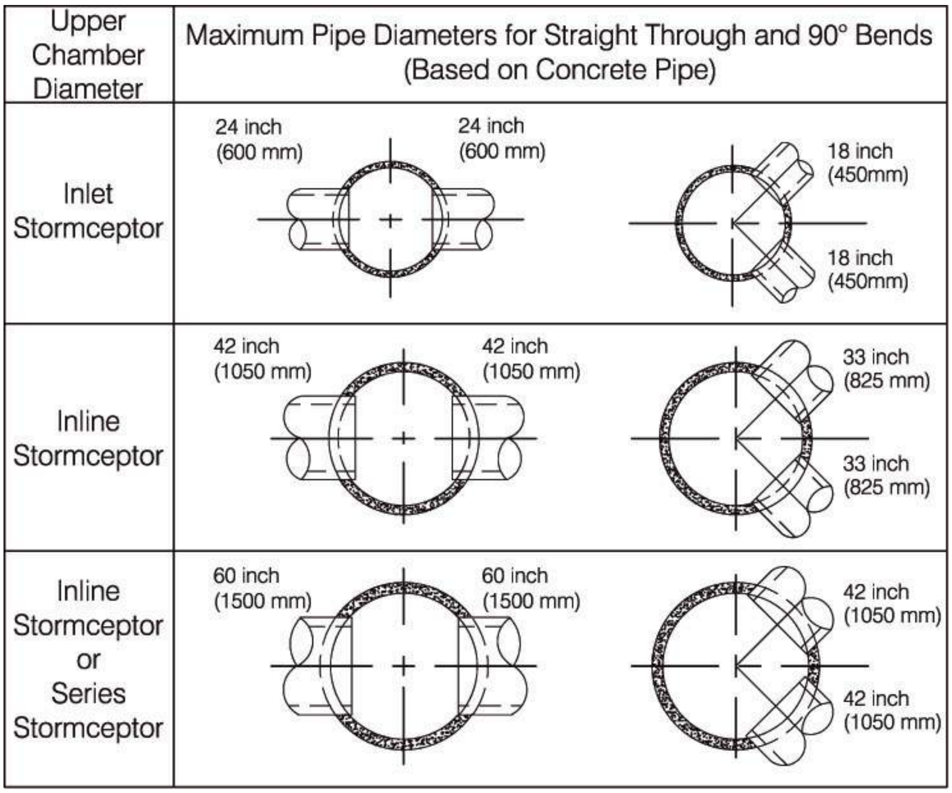


Figure 5. Maximum pipe diameters for straight through and bend applications

*The bend should only be incorporated into the second structure (downstream structure) of the Series Stormceptor System

7.3. Bends

The Stormceptor System can be used to change horizontal alignment in the storm drain network up to a maximum of 90 degrees. Figure 6 illustrates the typical bend situations of the Stormceptor System. Bends should only be applied to the second structure (downstream structure) of the Series Stormceptor System.

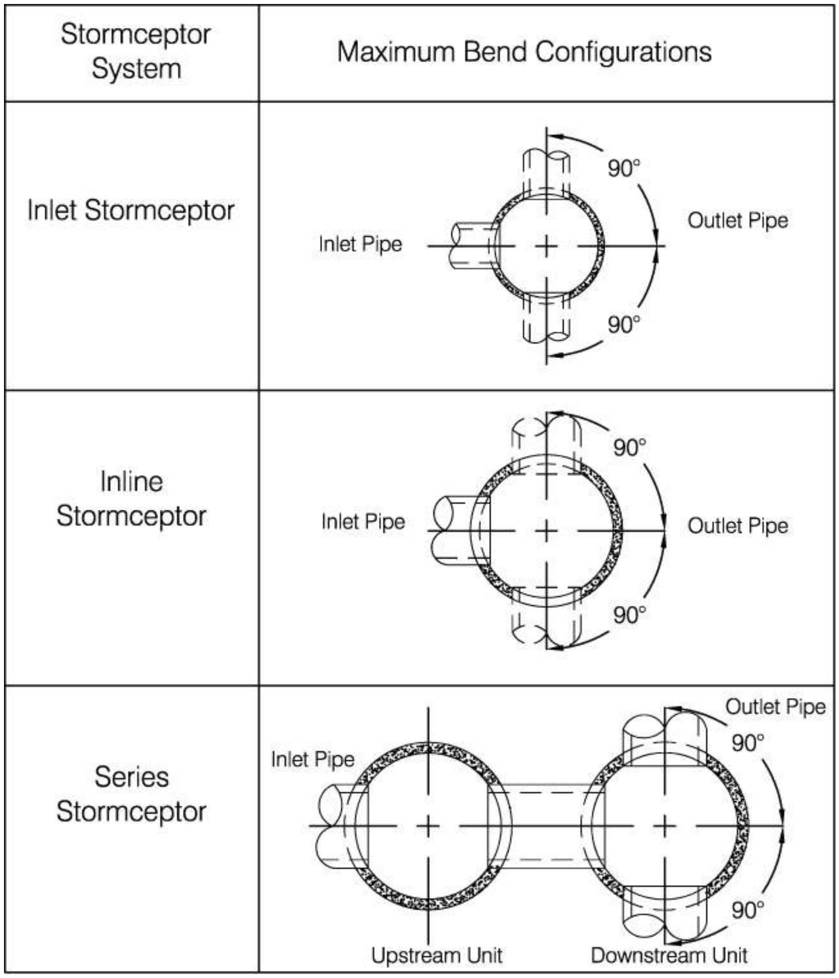


Figure 6. Maximum bend angles

7.4. Multiple Inlet Pipes

The Inlet and Inline Stormceptor System can accommodate two or more inlet pipes. The maximum number of inlet pipes that can be accommodated into a Stormceptor unit is a function of the number, alignment and diameter of the pipes and its effects on the structural integrity of the precast concrete. When multiple inlet pipes are used for new developments, each inlet pipe shall have an invert elevation 3 inches (75 mm) higher than the outlet pipe invert elevation.

7.5. Inlet/Outlet Pipe Invert Elevations

Recommended inlet and outlet pipe invert differences are listed in Table 3.

Table 3. Recommended Drops Between Inlet and Outlet Pipe Inverts

Number of Inlet Pipes	Inlet System	In-Line System	Series System
1	3 inches (75 mm)	1 inch (25 mm)	3 inches (75 mm)
>1	3 inches (75 mm)	3 inches (75 mm)	Not Applicable

7.6. Shallow Stormceptor

In cases where there may be restrictions to the depth of burial of storm sewer systems. In this situation, for selected Stormceptor models, the lower chamber components may be increased in diameter to reduce the overall depth of excavation required.

7.7. Customized Live Load

The Stormceptor system is typically designed for local highway truck loading (AASHTO HS- 20). When the project requires live loads greater than HS-20, the Stormceptor System may be customized structurally for a pre-specified live load. Contact your local Stormceptor representative for customized loading conditions.

7.8. Pre-treatment

The Stormceptor System may be sized to remove sediment and for spills control in conjunction with other stormwater BMPs to meet the water quality objective. For pretreatment applications, the Stormceptor System should be the first unit in a treatment train. The benefits of pre-treatment include the extension of the operational life (extension of maintenance frequency) of large stormwater management facilities, prevention of spills and lower total life- cycle maintenance cost.

7.9. Head loss

The head loss through the Stormceptor System is similar to a 60 degree bend at a manhole. The K value for calculating minor losses is approximately 1.3 (minor loss = k*1.3v2/2g).

However, when a Submerged modification is applied to a Stormceptor unit, the corresponding K value is 4.

7.10. Submerged

The Submerged modification, Figure 7, allows the Stormceptor System to operate in submerged or partially submerged storm sewers. This configuration can be installed on all models of the Stormceptor System by modifying the fiberglass insert. A customized weir height and a secondary drop tee are added.

Submerged instances are defined as standing water in the storm drain system during zero flow conditions. In these instances, the following information is necessary for the proper design and application of submerged modifications:

- Stormceptor top of grade elevation
- Stormceptor outlet pipe invert elevation
- Standing water elevation

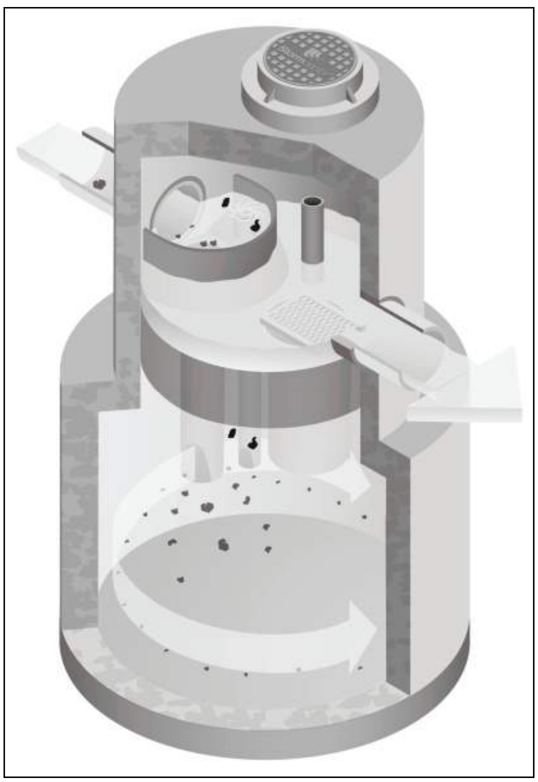


Figure 7. Submerged Stormceptor

8. Comparing Technologies

Designers have many choices available to achieve water quality goals in the treatment of stormwater runoff. Since many alternatives are available for use in stormwater quality treatment it is important to consider how to make an appropriate comparison between “approved alternatives”. The following is a guide to assist with the accurate comparison of differing technologies and performance claims.

8.1. Particle Size Distribution (PSD)

The most sensitive parameter to the design of a stormwater quality device is the selection of the design particle size. While it is recommended that the actual particle size distribution (PSD) for sites be measured prior to sizing, alternative values for particle size should be selected to represent what is likely to occur naturally on the site. A reasonable estimate of a particle size distribution likely to be found on parking lots or other impervious surfaces should consist of a wide range of particles such as 20 microns to 2,000 microns (Ontario MOE, 1994).

There is no absolute right particle size distribution or specific gravity and the user is cautioned to review the site location, characteristics, material handling practices and regulatory requirements when selecting a particle size distribution. When comparing technologies, designs using different PSDs will result in incomparable TSS removal efficiencies. The PSD of the TSS removed needs to be standard between two products to allow for an accurate comparison.

8.2. Scour Prevention

In order to accurately predict the performance of a manufactured treatment device, there must be confidence that it will perform under all conditions. Since rainfall patterns cannot be predicted, stormwater quality devices placed in storm sewer systems must be able to withstand extreme events, and ensure that all pollutants previously captured are retained in the system.

In order to have confidence in a system’s performance under extreme conditions, independent validation of scour prevention is essential when examining different technologies. Lack of independent verification of scour prevention should make a designer wary of accepting any product’s performance claims.

8.3. Hydraulics

Full scale laboratory testing has been used to confirm the hydraulics of the Stormceptor System. Results of lab testing have been used to physically design the Stormceptor System and the sewer pipes entering and leaving the unit. Key benefits of Stormceptor are:

- Low head loss (typical k value of 1.3)
- Minimal inlet/outlet invert elevation drop across the structure
- Use as a bend structure
- Accommodates multiple inlets

The adaptability of the treatment device to the storm sewer design infrastructure can affect the overall performance and cost of the site.

8.4. Hydrology

Stormwater quality treatment technologies need to perform under varying climatic conditions. These can vary from long low intensity rainfall to short duration, high intensity storms. Since a treatment device is expected to perform under all these conditions, it makes sense that any system’s design should accommodate those conditions as well.

Long-term continuous simulation evaluates the performance of a technology under the varying conditions expected in the climate of the subject site. Single, peak event design does not provide this information and is not equivalent to long-term simulation. Designers should request long-term simulation performance to ensure the technology can meet the long-term water quality objective.

9. Testing

The Stormceptor System has been the most widely monitored stormwater treatment technology in the world. Performance verification and monitoring programs are completed to the strictest standards and integrity. Since its introduction in 1990, numerous independent field tests and studies detailing the effectiveness of the Stormceptor System have been completed.

- Coventry University, UK – 97% removal of oil, 83% removal of sand and 73% removal of peat
- National Water Research Institute, Canada, - scaled testing for the development of the Stormceptor System identifying both TSS removal and scour prevention.
- New Jersey TARP Program – full scale testing of an STC 900 demonstrating 75% TSS removal of particles from 1 to 1000 microns. Scour testing completed demonstrated that the system does not scour. The New Jersey Department of Environmental Protection was followed.
- City of Indianapolis – full scale testing of an STC 900 demonstrating over 80% TSS removal of particles from 50 microns to 300 microns at 130% of the unit's operating rate. Scour testing completed demonstrated that the system does not scour.
- Westwood Massachusetts (1997), demonstrated >80% TSS removal
- Como Park (1997), demonstrated 76% TSS removal
- Ontario MOE SWAMP Program – 57% removal of 1 to 25 micron particles
- Laval Quebec – 50% removal of 1 to 25 micron particles

10. Installation

The installation of the concrete Stormceptor should conform in general to state highway, or local specifications for the installation of manholes. Selected sections of a general specification that are applicable are summarized in the following sections.

10.1. Excavation

Excavation for the installation of the Stormceptor should conform to state highway, or local specifications. Topsoil removed during the excavation for the Stormceptor should be stockpiled in designated areas and should not be mixed with subsoil or other materials.

Topsoil stockpiles and the general site preparation for the installation of the Stormceptor should conform to state highway or local specifications.

The Stormceptor should not be installed on frozen ground. Excavation should extend a minimum of 12 inches (300 mm) from the precast concrete surfaces plus an allowance for shoring and bracing where required. If the bottom of the excavation provides an unsuitable foundation additional excavation may be required.

In areas with a high water table, continuous dewatering may be required to ensure that the excavation is stable and free of water.

10.2. Backfilling

Backfill material should conform to state highway or local specifications. Backfill material should be placed in uniform layers not exceeding 12 inches (300mm) in depth and compacted to state highway or local specifications.

11. Stormceptor Construction Sequence

The concrete Stormceptor is installed in sections in the following sequence:

1. Aggregate base
2. Base slab
3. Lower chamber sections
4. Upper chamber section with fiberglass insert
5. Connect inlet and outlet pipes
6. Assembly of fiberglass insert components (drop tee, riser pipe, oil cleanout port and orifice plate
7. Remainder of upper chamber
8. Frame and access cover

The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

Adjustment of the Stormceptor can be performed by lifting the upper sections free of the excavated area, re-leveling the base and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary. Once the Stormceptor has been constructed, any lift holes must be plugged with mortar.

12. Maintenance

12.1. Health and Safety

The Stormceptor System has been designed considering safety first. It is recommended that confined space entry protocols be followed if entry to the unit is required. In addition, the fiberglass insert has the following health and safety features:

- Designed to withstand the weight of personnel
- A safety grate is located over the 24 inch (600 mm) riser pipe opening
- Ladder rungs can be provided for entry into the unit, if required

12.2. Maintenance Procedures

Maintenance of the Stormceptor system is performed using vacuum trucks. No entry into the unit is required for maintenance (in most cases). The vacuum service industry is a well- established sector of the service industry that cleans underground tanks, sewers and catch basins. Costs to clean a Stormceptor will vary based on the size of unit and transportation distances.

The need for maintenance can be determined easily by inspecting the unit from the surface. The depth of oil in the unit can be determined by inserting a dipstick in the oil inspection/cleanout port.

Similarly, the depth of sediment can be measured from the surface without entry into the Stormceptor via a dipstick tube equipped with a ball valve. This tube would be inserted through the riser pipe. Maintenance should be performed once the sediment depth exceeds the guideline values provided in the Table 4.

Table 4. Sediment Depths Indicating Required Servicing*

Particle Size	Specific Gravity
Model	Sediment Depth inches (mm)
450i	8 (200)
900	8 (200)
1200	10 (250)
1800	15 (381)
2400	12 (300)
3600	17 (430)
4800	15 (380)
6000	18 (460)
7200	15 (381)
11000	17 (380)
13000	20 (500)
16000	17 (380)
* based on 15% of the Stormceptor unit's total storage	

Although annual servicing is recommended, the frequency of maintenance may need to be increased or reduced based on local conditions (i.e. if the unit is filling up with sediment more quickly than projected, maintenance may be required semi-annually; conversely once the site has stabilized maintenance may only be required every two or three years).

Oil is removed through the oil inspection/cleanout port and sediment is removed through the riser pipe. Alternatively oil could be removed from the 24 inches (600 mm) opening if water is removed from the lower chamber to lower the oil level below the drop pipes.

The following procedures should be taken when cleaning out Stormceptor:

1. Check for oil through the oil cleanout port
2. Remove any oil separately using a small portable pump
3. Decant the water from the unit to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank
4. Remove the sludge from the bottom of the unit using the vacuum truck
5. Re-fill Stormceptor with water where required by the local jurisdiction

12.3. Submerged Stormceptor

Careful attention should be paid to maintenance of the Submerged Stormceptor System. In cases where the storm drain system is submerged, there is a requirement to plug both the inlet and outlet pipes to economically clean out the unit.

12.4. Hydrocarbon Spills

The Stormceptor is often installed in areas where the potential for spills is great. The Stormceptor System should be cleaned immediately after a spill occurs by a licensed liquid waste hauler.

12.5. Disposal

Requirements for the disposal of material from the Stormceptor System are similar to that of any other stormwater Best Management Practice (BMP) where permitted. Disposal options for the sediment may range from disposal in a sanitary trunk sewer upstream of a sewage treatment plant, to disposal in a sanitary landfill site. Petroleum waste products collected in the Stormceptor (free oil/chemical/fuel spills) should be removed by a licensed waste management company.

12.6. Oil Sheens

With a steady influx of water with high concentrations of oil, a sheen may be noticeable at the Stormceptor outlet. This may occur because a rainbow or sheen can be seen at very small oil concentrations (<10 mg/L). Stormceptor will remove over 98% of all free oil spills from storm sewer systems for dry weather or frequently occurring runoff events.

The appearance of a sheen at the outlet with high influent oil concentrations does not mean the unit is not working to this level of removal. In addition, if the influent oil is emulsified the Stormceptor will not be able to remove it. The Stormceptor is designed for free oil removal and not emulsified conditions.

SUPPORT

Drawings and specifications are available at www.ContechES.com.

Site-specific design support is available from our engineers.

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