STORMWATER MANAGEMENT REPORT

for:

Knox Trail Council, BSA
Training and Service Center
1300 Edgell Road
Framingham, Massachusetts

Project Proponent:

Knox Trail Council, BSA
490 Union Avenue
Framingham, MA 01702

July 2016

7-14-16
Taylor B. Smith, EIT

COMMONWEALTH OF MASSACHUSETTS
MICHAEL J. SCOTT
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CIVIL ENGINEERS SURVEYORS LANDSCAPE ARCHITECTS PLANNERS

WATERMAN DESIGN ASSOCIATES, INC.
31 East Main Street • Westborough, MA 01581

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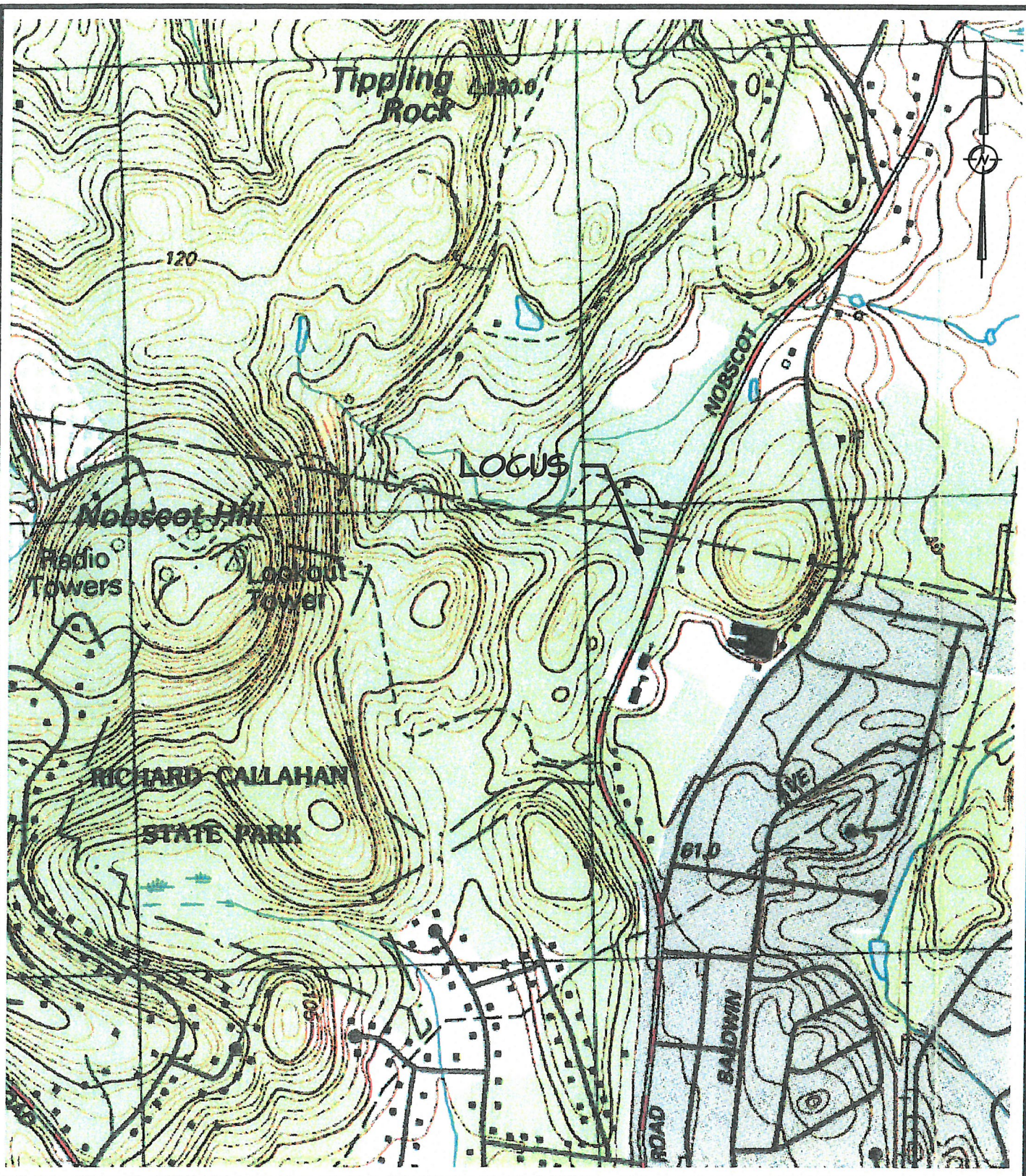

PREPARED BY:

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TITLE: USGS LOCUS

BSA Service Center & Knox Trail
Training Center
Shrewsbury, MA

OWNER/APPLICANT:

KNOX TRAIL COUNCIL, BSA
490 Union Ave.
Framingham, MA

DATE:	07/07/16	*FILE NO.:*	1014600	*SCALE:*	1" = 1000'
JOB NO.:	1014.00	*DWG NO.:*	1014602A	*DRAWN BY:*	TBS

PURPOSE

Hydrologic, hydraulic, and water quality calculations have been performed as part of the Site Plan Review Application for the Knox Trail Council of the Boy Scouts' of America (BSA) development of a proposed training center located in Framingham, MA. The calculations were performed to design stormwater collection and attenuation facilities for the site and to demonstrate that the project will meet the standards of the Town of Framingham and the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Regulations.

This report describes the existing project site, the proposed project, and analyses performed to develop a stormwater management system that will protect public safety and convenience and minimize environmental impacts.

PROJECT SITE

The subject Site contains approximately 2.3 acres of the BSA's 118± acre northerly parcel on Edgell Road and is located along the west side of Edgell Road, just south of the Sudbury town line. The Site consists of primarily undeveloped woodland. The Site contains some gravel foot and vehicle paths and a gravel overflow parking area as well as a small existing structure associated with the BSA campground that stretches across their Framingham and Sudbury properties. There are no existing dedicated stormwater management or collection systems on Site, and there are no wetland resources on or within 200' of the Site. The Site generally drains from the west to east (toward Edgell and Nobscot Roads) and elevations at the Site range from 230 to 200 (elevations refer to NAVD 88). While the Site is roughly 2.3 acres, it is part of a far larger watershed on the BSA land that drains to Edgell and Nobscot Roads.

United States Department of Agriculture Natural Resources Conservation Service (NRCS) mapping identifies the soils of the subject Site as Narragansett-Hollis rock outcrop (Hydrologic Soil Group A; HSG A), Windsor loamy sand (HSG A), and Broadbrook very fine sand (HSG D). Soil testing was performed in March and June of 2016 by Waterman Design Associates, Inc. and we observed well drained, medium to coarse sand with the characteristics of Hydrologic Soil Group A, HSG A. Limited areas at the northeastern corner of the Site exhibited shallow depths to refusal (presumably bedrock), with characteristics of HSG D. Please refer to the attached Existing Hydrology Plan for soil type delineations and testing locations.

The Site falls within an area of Priority Habitat of Rare Species and Estimated Habitat of Rare Wildlife as shown on Massachusetts Natural Heritage Atlas, 13th Edition, Effective October 1, 2008. No portion of the subject site contains Special Flood Hazard Area (i.e., 100-year flood zone), as shown on the NFIP Flood Insurance Rate Map for Middlesex County, Massachusetts (Map Number 25017C0502F and 25017C0504F, Effective Date July 7, 2014).

The attached Existing Hydrology Plan shows the project design points and contributing drainage areas with existing cover types. The analyzed design points are at the Framingham Town line (northerly extent) and at Edgell Road (southern limits). These limits include areas of the 118 acre BSA parcel that eventually drain to the road across BSA property.

PROPOSED PROJECT

The project proponent, Knox Trail Council of the BSA, proposes to construct two buildings, with vehicular parking spaces, delivery/loading space, and site appurtenances that will serve as an office and training facility.

Runoff from the parking areas and buildings will be directed to flow into infiltration basins while runoff from the loading area will be directed to an existing grass/wooded area on the BSA property. Runoff will infiltrate and runoff in excess of the 100-year design storm will be directed to toward the existing drainage swale along Edgell Road, which then flows back onto the BSA property in Sudbury just north of the Town line. Controlled outflow will be discharged to upland areas at a rate equal to or less than existing conditions for the 2-, 10-, and 100-year, 24-hour design storms.

Low Impact Development (LID) Considerations:

> The overall site development is itself a low impact development. The proposed development area on the 118± acre parcel is less than 3 acres. The project has been designed to comply with the Town of Framingham's Zoning Bylaw and retains large tracts of undeveloped woodlands by confining the developed land to a fraction of the overall BSA property within Framingham.

STORMWATER MANAGEMENT STANDARDS

STANDARD #1 – NO NEW UNTREATED DISCHARGES

The stormwater collection system has been designed so that stormwater runoff from the parking areas are treated using deep sump catch basins feeding infiltration basins near Edgell Road. Runoff from the loading area will travel overland several hundred feet via existing grassed swales, woodland, and gravel parking areas before reaching any wetland resource areas and eventually flowing under Nobscot Road in Sudbury, well north of the site.

STANDARD #2 – PEAK RATE ATTENUATION

METHODOLOGY

United States Soil Conservation Service, "Urban Hydrology for Small Watersheds, Technical Release Number 55" (TR-55) methods (HydroCAD 10.00) were utilized to develop runoff hydrographs for watershed areas affected by the proposed development. Existing and proposed runoff hydrographs were developed for the 2-, 10-, and 100-year, 24-hour rainfall events for the purpose of developing a stormwater management system that will limit post-development peak runoff rates to pre-development levels.

The proposed stormwater management system has been designed to meet the requirements of the Town of Framingham and the MassDEP Stormwater Management Standards. The project will limit peak rates of runoff from the site and will infiltrate runoff to approximate existing groundwater recharge.

ANALYSIS SUMMARY

In order to assess the impact of the proposed development on peak runoff rates onto down-gradient properties, hydrologic calculations were performed for each of three design storms at the two design points. The calculations refer to runoff quantities at the final design points, being the town line (northerly boundary) and Edgell Road (southerly limit).

Calculations of peak runoff rates for existing and proposed site conditions are included and summarized in Table I for comparison of peak runoff rates for the design point for the three design storms. A proposed hydrology plan is provided showing the various sub-watersheds draining to the proposed stormwater management facilities. Stormwater runoff from the overland areas not

tributary to the stormwater management facilities will drain by sheet flow or shallow concentrated flow along the existing flow patterns to the design points.

Table I demonstrates that the proposed stormwater management system will be effective in limiting peak rates of runoff from the subject property to approximate pre-development levels.

TABLE I: EXISTING AND PROPOSED PEAK RUNOFF

DRAINAGE AREA	DESIGN STORM EVENT / PEAK RUNOFF (cfs)		
	2-Year	10-Year	100-Year
Existing South (E1S)	0.0	0.0	0.1
Proposed South (P1S)	0.0	0.0	0.1
Existing North (E2S)	0.0	1.2	18.6
Proposed North (P2L)	0.0	1.2	18.5

TABLE II: EXISTING AND PROPOSED RUNOFF VOLUMES

DRAINAGE AREA	DESIGN STORM EVENT / RUNOFF Volume (CF)		
	2-Year	10-Year	100-Year
Existing South (E1S)	0	12	3,249
Proposed South (P1S)	0	11	3,047
Existing North (E2S)	0	32,738	172,318
Proposed North (P2L)	0	31,524	170,647

STANDARD #3 – STORMWATER RECHARGE

Groundwater recharge is provided within the infiltration system. Test pits have been performed in areas where infiltration is proposed. The soils across the site and within areas of proposed infiltration facilities were well drained, medium to coarse sand with the characteristics of Hydrologic Soil Group A, (HSG A) soils. Using the Rawls Rates for Loamy Sand, an exfiltration rate of 2.4 in/hr was used in our hydrologic models for the infiltration basins. The Static Method was used in sizing the infiltration basins.

The table below provides a summary of the attached groundwater recharge calculations. Calculations are based on HSG A and HSG D, with the required volume of groundwater recharge is equal to 0.6" and 0.1" over the proposed impervious area respectively. Storage is provided below the outlet invert of the infiltration basins.

REQUIRED (CF)	AVAILABLE* (CF)
2,171	5,117

* storage below outlet invert

CAPTURE AREA ADJUSTMENT

Total Impervious Area = 45,550 sf
Rv (0.5") = 45,550 sf x 0.5 / 12 = 1,898 CF
Impervious Area Draining to Infiltration Facilities = 36,862 sf
Ratio = 45,550 / 36,862 = 1.24
*Adjusted Required Infiltration Volume (Rv) = 1.24 x 1,898 CF = 2,345 CF

ADJUSTED REQUIRED (CF)	PROVIDED* (CF)
2,345	4,554

* 2-year runoff volume

DRAWDOWN CALCULATIONS

$$Time = \frac{Rv}{(K)(BottomArea)}$$

Rv = Storage Volume (cubic feet)
K = Saturated Hydraulic Conductivity (inches per hour)

$$Time = \frac{2{,}345cf}{(2.40in/hr)(1ft/12in)(591sf)}$$

Time = 20 hours < 72 hours required (see appendix for actual HydroCAD basin drawdown times)

STANDARD #4 – WATER QUALITY

Water quality measures are designed to provide a minimum of 80% Total Suspended Solids (TSS) removal, and to treat 0.5 inch of runoff (from non-roof impervious areas). The water quality volume is achieved by providing a static storage volume below the outlet in the infiltration basins.

REQUIRED (CF)	PROVIDED (CF)
1,280	5,117

Over 80% TSS removal is provided through the use of one basic treatment train: deep-sump catch basin and infiltration basin. Please refer to the attached Water Quality and TSS Removal calculations.

STANDARD #5 – LAND USES WITH HIGHER POTENTIAL POLLUTANT LOADS (LUHPPLS)

The proposed project is not considered a land use with Higher Potential Pollutant Loads therefore, Standard #5 is not applicable.

STANDARD #6 – CRITICAL AREAS

The proposed project is not discharging near or to a Critical Area therefore, Standard #6 is not applicable.

STANDARD #7 – REDEVELOPMENT PROJECT

The proposed project not considered a redevelopment project therefore, Standard #7 is not applicable.

STANDARD #8 – CONSTRUCTION POLLUTION PREVENTION AND EROSION AND SEDIMENTATION CONTROL

As the total project area is over one acre, a Notice of Intent (NOI) must be filed with the US EPA and a Stormwater Pollution Prevention Plan (SWPPP) shall be retained on-site during construction. A SWPPP must be developed in accordance with the current MA Construction General Permit (CGP).

STANDARD #9 – OPERATION AND MAINTENANCE PLAN

The attached Operation and Maintenance Plan describes the requisite long-term operation and maintenance of all on-site stormwater Best Management Practices (BMPs) and hydraulic drainage system. The Operation and Maintenance Plan also describes source control for the prevention of pollution to also serve as the Long Term Pollution Prevention Plan (LTPPP).

STANDARD #10 – PROHIBITION OF ILLICIT DISCHARGES

There are no known and no proposed illicit discharges on the site.

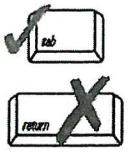
MASSACHUSETTS STORMWATER REPORT CHECKLIST (Follows as Pages 6A – 6H)

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.

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

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.

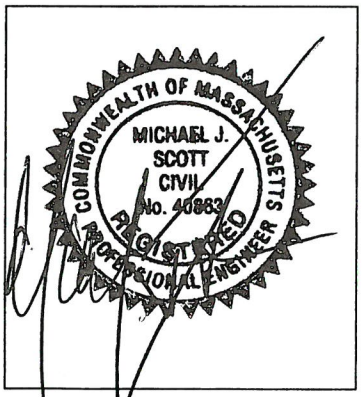
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



7-14-16

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

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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.

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Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☐ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic 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 for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

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Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☐ The BMP is sized (and calculations provided) based on:

☒ The ½" or 1" Water Quality Volume or

☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

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Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☐ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

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Checklist for Stormwater Report

Checklist (continued)

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

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☐ Name of the stormwater management system owners;
- ☐ Party responsible for operation and maintenance;
- ☐ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☐ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☒ An Illicit Discharge Compliance Statement is attached;

☐ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

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STORMWATER MANAGEMENT SYSTEM
OPERATION AND MAINTENANCE PLAN
LONG TERM POLLUTION PREVENTION PLAN

BSA Knox Trail Council Facilities
1300 Edgell Road
Framingham, MA

July 2016

PREPARED FOR:

Knox Trail Council of BSA
490 Union Avenue
Framingham, Massachusetts

RESPONSIBILITY:

Knox Trail Council, or its assigns, will be responsible for implementation of the Operation and Maintenance Plan for the stormwater management system and Long Term Pollution Prevention Plan for Knox Trail Council Facilities and for any corrective action required.

SITE CONDITIONS:

The stormwater management system for the site includes catch basins and infiltration basins.

DEEP SUMP CATCH BASIN AND LEACHING CATCH BASIN:

1. Catch basins shall be inspected four (4) times per year and cleaned whenever depth of sediment is greater than twenty-four (24) inches.

2. All sediments and hydrocarbons shall be properly handled and disposed in accordance with local, state, and federal guidelines and regulations.

INFILTRATION BASINS:

1. The basin(s) shall be inspected for accumulated sediment at least twice per year and sediment shall be removed when depth is 12 inches or at least once every 10 years.

2. Basins shall be inspected at least twice per year and immediately following large storm events to determine if the basins are functioning as intended. Inspections should be conducted during wet weather to determine if the basins are meeting the targeted detention times (24 hour average detention time). The basins shall be checked for slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sedimentation. Any necessary repairs shall be made immediately.

3. During the first few months following construction, the basins shall be inspected to ensure that the proposed vegetation becomes adequately established.

4. At least twice during the growing season, the basin, side slopes, and embankments shall be mowed and accumulated trash and debris removed.

5. To maintain the dense growth of vegetation, periodic reseeding shall be performed.

6. Basins shall not be used for snow removal and yard waste disposal.

7. Outlet control structures, headwalls, and riprap aprons or riprap stilling basins shall be checked a minimum of once per year for evidence of clogging or flow restrictions and cleared as necessary. Any debris or accumulated sediments which could hinder flows shall be removed and disposed.

SPILL CONTAINMENT:

1. In the event of a reportable spill, the Owner or its representative shall also be responsible for closing the cut-off valve in a timely manner and notifying the appropriate authorities of the spill. In the event that spill materials enter the stormwater management basin, the Owner shall be responsible for spill removal and restoration of the basin to its original condition in accordance with all applicable local and state regulations.

LAWN/LANDSCAPE MAINTENANCE:

1. Apply pesticides and fertilizers properly; at the proper time of year and at proper application rates to ensure absorption.

2. Limit lawn watering: chose drought-tolerant landscaping and grasses, and use mulch and compost to retain moisture.

3. Under no circumstance shall the stormwater management system be used for yard waste and landscape debris.

DEICING:

1. The use and loading rates for application of deicing salts should be limited to the minimum required to maintain safe vehicular and pedestrian travel.

2. Alternative materials such as sand or gravel, calcium chloride, and calcium magnesium acetate should be considered in areas adjacent stormwater management facilities and resource areas.

3. Deicing materials shall be covered to prevent loss and migration.

4. Deicing storage areas shall be located outside the 100-year floodplain.

5. Under no circumstance shall the stormwater management system or resource areas be used for storage of deicing materials.

SNOW MANAGEMENT:

1. Snow shall be stockpiled in pervious areas as indicated on the plans where it can slowly infiltrate. Under no circumstance shall the stormwater management system be used for snow storage.

2. Avoid dumping/piling snow over catch basins or in drainage channels to prevent blockages and localized flooding of the drainage system.

3. The Owner shall be responsible to manage snow storage on-site and to ensure that snow is not stockpiled in the basins.

4. Sediments deposited from the snow storage areas shall be removed every spring.

SWEEPING OF PAVED SURFACES:

1. All paved surfaces on-site including driveways, loading areas, and parking areas shall be swept at least once annually to remove accumulations of sand, silt, leaves, and other debris.

2. Sweeping should occur in March/April after snowmelt has occurred and thaw has begun. Sweepings shall be disposed of at an appropriate location away from resource areas (wetlands or waterways) and stormwater management facilities.

EXISTING HYDROLOGY

Subcat Reach Pond Link

Routing Diagram for 1014 Existing
Prepared by Waterman Design Associates, Inc.

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,950	96	Gravel surface, HSG A (E2S)
2,641,859	30	Woods, Good, HSG A (E1S, E2S)
479,645	77	Woods, Good, HSG D (E2S)
23,790	43	Woods/grass comb., Fair, HSG A (E2S)
3,153,244	**37**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
2,673,599	HSG A	E1S, E2S
0	HSG B	
0	HSG C	
479,645	HSG D	E2S
0	Other	
3,153,244		**TOTAL AREA**

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1S: SOUTH Runoff Area=183,817 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=728' Tc=18.0 min CN=30 Runoff=0.0 cfs 0 cf

Subcatchment E2S: NORTH Runoff Area=2,969,427 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=1,510' Tc=24.3 min CN=38 Runoff=0.0 cfs 0 cf

Total Runoff Area = 3,153,244 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
100.00% Pervious = 3,153,244 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E1S: SOUTH

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
183,817	30	Woods, Good, HSG A
183,817		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
8.7	678	0.0670	1.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.0	728	Total			

Summary for Subcatchment E2S: NORTH

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
39,078	30	Woods, Good, HSG A
23,790	43	Woods/grass comb., Fair, HSG A
9,536	77	Woods, Good, HSG D
2,302,547	30	Woods, Good, HSG A
465,503	77	Woods, Good, HSG D
116,417	30	Woods, Good, HSG A
7,950	96	Gravel surface, HSG A
4,606	77	Woods, Good, HSG D
2,969,427	38	Weighted Average
2,969,427		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	570	0.1800	2.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.3	890	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.3	1,510	Total			

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1S: SOUTH
Runoff Area=183,817 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=728' Tc=18.0 min CN=30 Runoff=0.0 cfs 12 cf

Subcatchment E2S: NORTH
Runoff Area=2,969,427 sf 0.00% Impervious Runoff Depth=0.13"
Flow Length=1,510' Tc=24.3 min CN=38 Runoff=1.2 cfs 32,738 cf

Total Runoff Area = 3,153,244 sf Runoff Volume = 32,749 cf Average Runoff Depth = 0.12"
100.00% Pervious = 3,153,244 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E1S: SOUTH

Runoff = 0.0 cfs @ 24.04 hrs, Volume= 12 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
183,817	30	Woods, Good, HSG A
183,817		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
8.7	678	0.0670	1.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.0	728	Total			

Summary for Subcatchment E2S: NORTH

Runoff = 1.2 cfs @ 14.84 hrs, Volume= 32,738 cf, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
39,078	30	Woods, Good, HSG A
23,790	43	Woods/grass comb., Fair, HSG A
9,536	77	Woods, Good, HSG D
2,302,547	30	Woods, Good, HSG A
465,503	77	Woods, Good, HSG D
116,417	30	Woods, Good, HSG A
7,950	96	Gravel surface, HSG A
4,606	77	Woods, Good, HSG D
2,969,427	38	Weighted Average
2,969,427		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	570	0.1800	2.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.3	890	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.3	1,510	Total			

Time span=0.00-96.00 hrs, dt=0.05 hrs, 1921 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E1S: SOUTH
Runoff Area=183,817 sf 0.00% Impervious Runoff Depth=0.21"
Flow Length=728' Tc=18.0 min CN=30 Runoff=0.1 cfs 3,249 cf

Subcatchment E2S: NORTH
Runoff Area=2,969,427 sf 0.00% Impervious Runoff Depth=0.70"
Flow Length=1,510' Tc=24.3 min CN=38 Runoff=18.6 cfs 172,318 cf

Total Runoff Area = 3,153,244 sf Runoff Volume = 175,567 cf Average Runoff Depth = 0.67"
100.00% Pervious = 3,153,244 sf 0.00% Impervious = 0 sf

Summary for Subcatchment E1S: SOUTH

Runoff = 0.1 cfs @ 13.96 hrs, Volume= 3,249 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
183,817	30	Woods, Good, HSG A
183,817		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
8.7	678	0.0670	1.29		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.0	728	Total			

Summary for Subcatchment E2S: NORTH

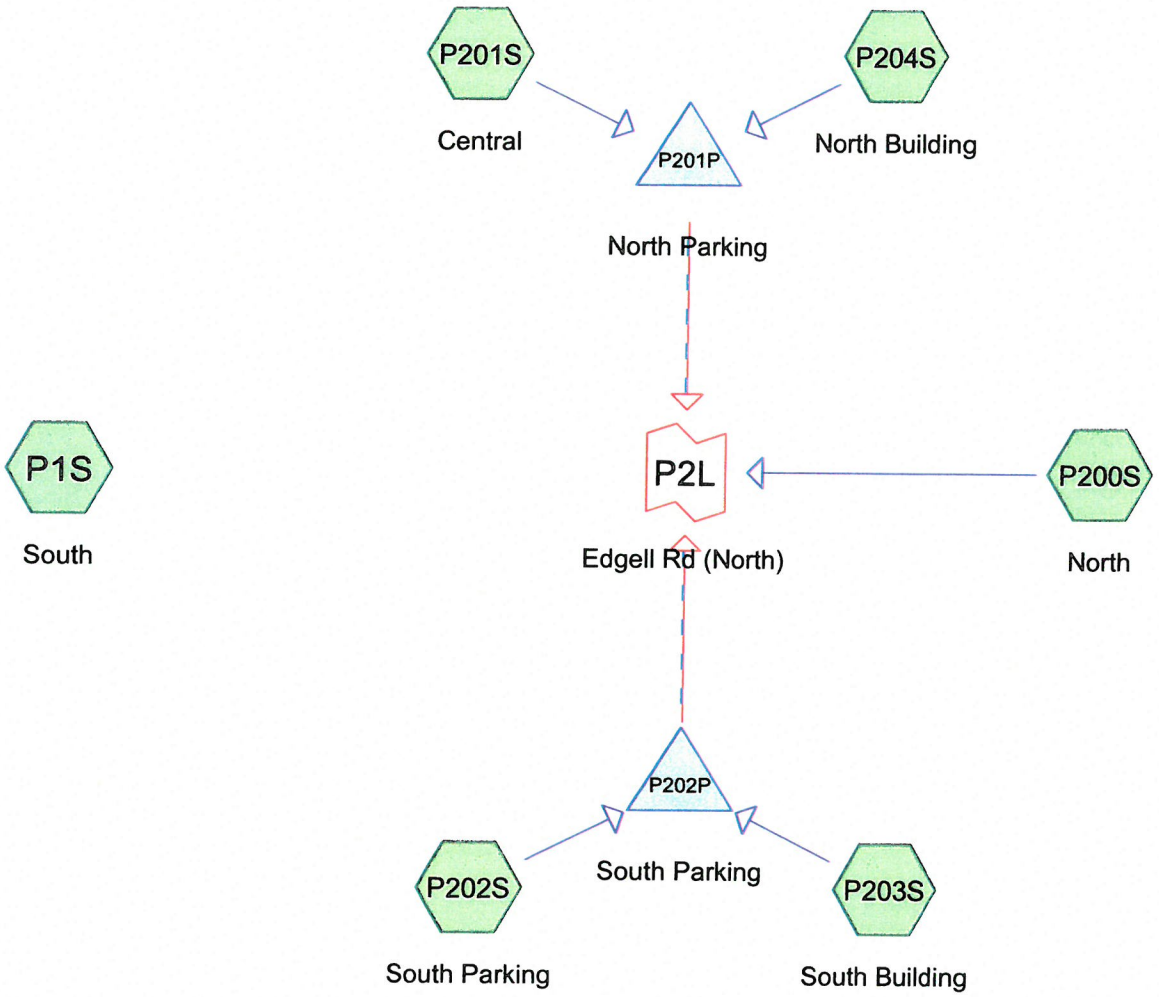
Runoff = 18.6 cfs @ 12.55 hrs, Volume= 172,318 cf, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
39,078	30	Woods, Good, HSG A
23,790	43	Woods/grass comb., Fair, HSG A
9,536	77	Woods, Good, HSG D
2,302,547	30	Woods, Good, HSG A
465,503	77	Woods, Good, HSG D
116,417	30	Woods, Good, HSG A
7,950	96	Gravel surface, HSG A
4,606	77	Woods, Good, HSG D
2,969,427	38	Weighted Average
2,969,427		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	570	0.1800	2.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
13.3	890	0.0500	1.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
24.3	1,510	Total			

PROPOSED HYDROLOGY



Subcat Reach Pond Link

Routing Diagram for 1014 Proposed
Prepared by Waterman Design Associates, Inc.

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
69,001	39	>75% Grass cover, Good, HSG A (P1S, P200S, P201S, P202S)
11,596	80	>75% Grass cover, Good, HSG D (P200S)
1,150	96	Gravel surface, HSG A (P201S)
6,465	98	Paved parking, HSG A (P202S)
14,822	98	Roofs, HSG A (P203S, P204S)
21,717	98	Unconnected pavement, HSG A (P200S, P201S)
2,546	98	Unconnected pavement, HSG D (P200S)
2,536,672	30	Woods, Good, HSG A (P1S, P200S, P201S)
465,503	77	Woods, Good, HSG D (P200S)
23,772	43	Woods/grass comb., Fair, HSG A (P200S)
3,153,244	**38**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
2,673,599	HSG A	P1S, P200S, P201S, P202S, P203S, P204S
0	HSG B	
0	HSG C	
479,645	HSG D	P200S
0	Other	
3,153,244		**TOTAL AREA**

Time span=0.00-96.00 hrs, dt=0.04 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1S: South Runoff Area=172,384 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=750' Tc=18.8 min CN=30 Runoff=0.0 cfs 0 cf

Subcatchment P200S: North Runoff Area=2,859,344 sf 0.30% Impervious Runoff Depth=0.00"
Flow Length=1,510' Tc=25.0 min CN=38 Runoff=0.0 cfs 0 cf

Subcatchment P201S: Central Runoff Area=90,002 sf 17.31% Impervious Runoff Depth=0.00"
Flow Length=902' Tc=16.8 min UI Adjusted CN=40 Runoff=0.0 cfs 20 cf

Subcatchment P202S: South Parking Runoff Area=16,692 sf 38.73% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=62 Runoff=0.1 cfs 669 cf

Subcatchment P203S: South Building Runoff Area=8,670 sf 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.6 cfs 2,144 cf

Subcatchment P204S: North Building Runoff Area=6,152 sf 100.00% Impervious Runoff Depth=2.97"
Tc=6.0 min CN=98 Runoff=0.4 cfs 1,521 cf

Pond P201P: North Parking Peak Elev=207.35' Storage=640 cf Inflow=0.4 cfs 1,541 cf
Discarded=0.1 cfs 1,541 cf Primary=0.0 cfs 0 cf Secondary=0.0 cfs 0 cf Outflow=0.1 cfs 1,541 cf

Pond P202P: South Parking Peak Elev=216.42' Storage=1,128 cf Inflow=0.7 cfs 2,813 cf
Discarded=0.1 cfs 2,813 cf Primary=0.0 cfs 0 cf Secondary=0.0 cfs 0 cf Outflow=0.1 cfs 2,813 cf

Link P2L: Edgell Rd (North) Inflow=0.0 cfs 0 cf
Primary=0.0 cfs 0 cf

Total Runoff Area = 3,153,244 sf Runoff Volume = 4,354 cf Average Runoff Depth = 0.02"
98.56% Pervious = 3,107,694 sf 1.44% Impervious = 45,550 sf

Summary for Subcatchment P1S: South

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
163,000	30	Woods, Good, HSG A
9,384	39	>75% Grass cover, Good, HSG A
172,384	30	Weighted Average
172,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
9.5	700	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	750	Total			

Summary for Subcatchment P200S: North

[45] Hint: Runoff=Zero

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
24,080	30	Woods, Good, HSG A
23,158	39	>75% Grass cover, Good, HSG A
23,772	43	Woods/grass comb., Fair, HSG A
6,142	98	Unconnected pavement, HSG A
11,596	80	>75% Grass cover, Good, HSG D
2,546	98	Unconnected pavement, HSG D
2,302,547	30	Woods, Good, HSG A
465,503	77	Woods, Good, HSG D
2,859,344	38	Weighted Average
2,850,656		99.70% Pervious Area
8,688		0.30% Impervious Area
8,688		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	570	0.1800	2.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	890	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.0	1,510	Total			

Summary for Subcatchment P201S: Central

Runoff = 0.0 cfs @ 23.99 hrs, Volume= 20 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Adj	Description
47,045	30		Woods, Good, HSG A
26,232	39		>75% Grass cover, Good, HSG A
15,575	98		Unconnected pavement, HSG A
1,150	96		Gravel surface, HSG A
90,002	45	40	Weighted Average, UI Adjusted
74,427			82.69% Pervious Area
15,575			17.31% Impervious Area
15,575			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.8	350	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	80	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	422	0.0200	3.10	2.32	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=0.30' Z= 5.0 '/' Top.W=4.00' n= 0.022 Earth, clean & straight
16.8	902	Total			

Summary for Subcatchment P202S: South Parking

Runoff = 0.1 cfs @ 12.12 hrs, Volume= 669 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
6,465	98	Paved parking, HSG A
10,227	39	>75% Grass cover, Good, HSG A
16,692	62	Weighted Average
10,227		61.27% Pervious Area
6,465		38.73% Impervious Area

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

Summary for Subcatchment P203S: South Building

Runoff = 0.6 cfs @ 12.08 hrs, Volume= 2,144 cf, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
8,670	98	Roofs, HSG A
8,670		100.00% Impervious Area

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

Summary for Subcatchment P204S: North Building

Runoff = 0.4 cfs @ 12.08 hrs, Volume= 1,521 cf, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-year Rainfall=3.20"

Area (sf)	CN	Description
6,152	98	Roofs, HSG A
6,152		100.00% Impervious Area

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

Summary for Pond P201P: North Parking

Inflow Area = 96,154 sf, 22.60% Impervious, Inflow Depth = 0.19" for 2-year event
Inflow = 0.4 cfs @ 12.08 hrs, Volume= 1,541 cf
Outflow = 0.1 cfs @ 12.70 hrs, Volume= 1,541 cf, Atten= 88%, Lag= 36.6 min
Discarded = 0.1 cfs @ 12.70 hrs, Volume= 1,541 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Peak Elev= 207.35' @ 12.70 hrs Surf.Area= 902 sf Storage= 640 cf

Plug-Flow detention time= 132.3 min calculated for 1,540 cf (100% of inflow)
Center-of-Mass det. time= 132.3 min (896.1 - 763.8)

Volume	Invert	Avail.Storage	Storage Description
#1	206.00'	6,487 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
206.00	47	0	0
208.00	1,315	1,362	1,362
210.00	3,810	5,125	6,487

Device	Routing	Invert	Outlet Devices
#1	Primary	206.00'	**12.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 206.00' / 204.00' S= 0.0392 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	206.00'	**2.400 in/hr Exfiltration over Surface area**
#3	Device 1	208.65'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	209.00'	**10.0' long x 14.0' 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) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Discarded OutFlow Max=0.1 cfs @ 12.70 hrs HW=207.35' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=206.00' (Free Discharge)
↑—**1=Culvert** (Controls 0.0 cfs)
↑—**3=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=206.00' (Free Discharge)
↑—**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond P202P: South Parking

Inflow Area =	25,362 sf, 59.68% Impervious,		Inflow Depth =	1.33"	for 2-year event
Inflow =	0.7 cfs @	12.09 hrs, Volume=	2,813 cf		
Outflow =	0.1 cfs @	13.71 hrs, Volume=	2,813 cf,	Atten= 92%,	Lag= 96.8 min
Discarded =	0.1 cfs @	13.71 hrs, Volume=	2,813 cf		
Primary =	0.0 cfs @	0.00 hrs, Volume=	0 cf		
Secondary =	0.0 cfs @	0.00 hrs, Volume=	0 cf		

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Peak Elev= 216.42' @ 13.71 hrs Surf.Area= 1,085 sf Storage= 1,128 cf

Plug-Flow detention time= 191.2 min calculated for 2,812 cf (100% of inflow)
Center-of-Mass det. time= 191.2 min (984.0 - 792.8)

Volume	Invert	Avail.Storage	Storage Description
#1	215.00'	5,604 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.00	544	0	0
216.00	887	716	716
218.00	1,834	2,721	3,437
219.00	2,500	2,167	5,604

Device	Routing	Invert	Outlet Devices
#1	Primary	215.00'	**12.0" Round Culvert** L= 63.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 215.00' / 206.30' S= 0.1381 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	215.00'	**2.400 in/hr Exfiltration over Surface area**
#3	Device 1	217.60'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	218.00'	**10.0' long x 14.0' 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) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Discarded OutFlow Max=0.1 cfs @ 13.71 hrs HW=216.42' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=215.00' (Free Discharge)
↑—**1=Culvert** (Controls 0.0 cfs)
↑—**3=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=215.00' (Free Discharge)
↑—**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link P2L: Edgell Rd (North)

Inflow Area = 2,980,860 sf, 1.53% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs

Time span=0.00-96.00 hrs, dt=0.04 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1S: South
Runoff Area=172,384 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=750' Tc=18.8 min CN=30 Runoff=0.0 cfs 11 cf

Subcatchment P200S: North
Runoff Area=2,859,344 sf 0.30% Impervious Runoff Depth=0.13"
Flow Length=1,510' Tc=25.0 min CN=38 Runoff=1.2 cfs 31,524 cf

Subcatchment P201S: Central
Runoff Area=90,002 sf 17.31% Impervious Runoff Depth=0.19"
Flow Length=902' Tc=16.8 min UI Adjusted CN=40 Runoff=0.1 cfs 1,446 cf

Subcatchment P202S: South Parking
Runoff Area=16,692 sf 38.73% Impervious Runoff Depth=1.32"
Tc=6.0 min CN=62 Runoff=0.5 cfs 1,831 cf

Subcatchment P203S: South Building
Runoff Area=8,670 sf 100.00% Impervious Runoff Depth=4.56"
Tc=6.0 min CN=98 Runoff=0.9 cfs 3,297 cf

Subcatchment P204S: North Building
Runoff Area=6,152 sf 100.00% Impervious Runoff Depth=4.56"
Tc=6.0 min CN=98 Runoff=0.7 cfs 2,340 cf

Pond P201P: North Parking
Peak Elev=207.97' Storage=1,322 cf Inflow=0.7 cfs 3,786 cf
Discarded=0.1 cfs 3,786 cf Primary=0.0 cfs 0 cf Secondary=0.0 cfs 0 cf Outflow=0.1 cfs 3,786 cf

Pond P202P: South Parking
Peak Elev=217.42' Storage=2,458 cf Inflow=1.5 cfs 5,128 cf
Discarded=0.1 cfs 5,128 cf Primary=0.0 cfs 0 cf Secondary=0.0 cfs 0 cf Outflow=0.1 cfs 5,128 cf

Link P2L: Edgell Rd (North)
Inflow=1.2 cfs 31,524 cf
Primary=1.2 cfs 31,524 cf

Total Runoff Area = 3,153,244 sf Runoff Volume = 40,449 cf Average Runoff Depth = 0.15"
98.56% Pervious = 3,107,694 sf 1.44% Impervious = 45,550 sf

Summary for Subcatchment P1S: South

Runoff = 0.0 cfs @ 24.04 hrs, Volume= 11 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
163,000	30	Woods, Good, HSG A
9,384	39	>75% Grass cover, Good, HSG A
172,384	30	Weighted Average
172,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
9.5	700	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	750	Total			

Summary for Subcatchment P200S: North

Runoff = 1.2 cfs @ 14.81 hrs, Volume= 31,524 cf, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
24,080	30	Woods, Good, HSG A
23,158	39	>75% Grass cover, Good, HSG A
23,772	43	Woods/grass comb., Fair, HSG A
6,142	98	Unconnected pavement, HSG A
11,596	80	>75% Grass cover, Good, HSG D
2,546	98	Unconnected pavement, HSG D
2,302,547	30	Woods, Good, HSG A
465,503	77	Woods, Good, HSG D
2,859,344	38	Weighted Average
2,850,656		99.70% Pervious Area
8,688		0.30% Impervious Area
8,688		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	570	0.1800	2.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	890	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.0	1,510	Total			

Summary for Subcatchment P201S: Central

Runoff = 0.1 cfs @ 12.68 hrs, Volume= 1,446 cf, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Adj	Description
47,045	30		Woods, Good, HSG A
26,232	39		>75% Grass cover, Good, HSG A
15,575	98		Unconnected pavement, HSG A
1,150	96		Gravel surface, HSG A
90,002	45	40	Weighted Average, UI Adjusted
74,427			82.69% Pervious Area
15,575			17.31% Impervious Area
15,575			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.8	350	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	80	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	422	0.0200	3.10	2.32	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=0.30' Z= 5.0 '/' Top.W=4.00' n= 0.022 Earth, clean & straight
16.8	902	Total			

Summary for Subcatchment P202S: South Parking

Runoff = 0.5 cfs @ 12.10 hrs, Volume= 1,831 cf, Depth= 1.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
6,465	98	Paved parking, HSG A
10,227	39	>75% Grass cover, Good, HSG A
16,692	62	Weighted Average
10,227		61.27% Pervious Area
6,465		38.73% Impervious Area

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

Summary for Subcatchment P203S: South Building

Runoff = 0.9 cfs @ 12.08 hrs, Volume= 3,297 cf, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
8,670	98	Roofs, HSG A
8,670		100.00% Impervious Area

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

Summary for Subcatchment P204S: North Building

Runoff = 0.7 cfs @ 12.08 hrs, Volume= 2,340 cf, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-year Rainfall=4.80"

Area (sf)	CN	Description
6,152	98	Roofs, HSG A
6,152		100.00% Impervious Area

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

Summary for Pond P201P: North Parking

Inflow Area = 96,154 sf, 22.60% Impervious, Inflow Depth = 0.47" for 10-year event
Inflow = 0.7 cfs @ 12.08 hrs, Volume= 3,786 cf
Outflow = 0.1 cfs @ 15.37 hrs, Volume= 3,786 cf, Atten= 89%, Lag= 197.0 min
Discarded = 0.1 cfs @ 15.37 hrs, Volume= 3,786 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Peak Elev= 207.97' @ 15.37 hrs Surf.Area= 1,296 sf Storage= 1,322 cf

Plug-Flow detention time= 228.5 min calculated for 3,786 cf (100% of inflow)
Center-of-Mass det. time= 228.5 min (1,080.8 - 852.3)

Volume	Invert	Avail.Storage	Storage Description
#1	206.00'	6,487 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
206.00	47	0	0
208.00	1,315	1,362	1,362
210.00	3,810	5,125	6,487

Device	Routing	Invert	Outlet Devices
#1	Primary	206.00'	**12.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 206.00' / 204.00' S= 0.0392 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	206.00'	**2.400 in/hr Exfiltration over Surface area**
#3	Device 1	208.65'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	209.00'	**10.0' long x 14.0' 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) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Discarded OutFlow Max=0.1 cfs @ 15.37 hrs HW=207.97' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=206.00' (Free Discharge)
└**1=Culvert** (Controls 0.0 cfs)
└**3=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=206.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond P202P: South Parking

Inflow Area = 25,362 sf, 59.68% Impervious, Inflow Depth = 2.43" for 10-year event
Inflow = 1.5 cfs @ 12.09 hrs, Volume= 5,128 cf
Outflow = 0.1 cfs @ 14.45 hrs, Volume= 5,128 cf, Atten= 94%, Lag= 141.5 min
Discarded = 0.1 cfs @ 14.45 hrs, Volume= 5,128 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Peak Elev= 217.42' @ 14.45 hrs Surf.Area= 1,561 sf Storage= 2,458 cf

Plug-Flow detention time= 316.8 min calculated for 5,128 cf (100% of inflow)
Center-of-Mass det. time= 316.8 min (1,109.6 - 792.8)

Volume	Invert	Avail.Storage	Storage Description
#1	215.00'	5,604 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.00	544	0	0
216.00	887	716	716
218.00	1,834	2,721	3,437
219.00	2,500	2,167	5,604

Device	Routing	Invert	Outlet Devices
#1	Primary	215.00'	**12.0" Round Culvert** L= 63.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 215.00' / 206.30' S= 0.1381 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	215.00'	**2.400 in/hr Exfiltration over Surface area**
#3	Device 1	217.60'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	218.00'	**10.0' long x 14.0' 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) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Discarded OutFlow Max=0.1 cfs @ 14.45 hrs HW=217.42' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=215.00' (Free Discharge)
↑—**1=Culvert** (Controls 0.0 cfs)
↑—**3=Orifice/Grate** (Controls 0.0 cfs)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=215.00' (Free Discharge)
↑—**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link P2L: Edgell Rd (North)

Inflow Area = 2,980,860 sf, 1.53% Impervious, Inflow Depth = 0.13" for 10-year event
Inflow = 1.2 cfs @ 14.81 hrs, Volume= 31,524 cf
Primary = 1.2 cfs @ 14.81 hrs, Volume= 31,524 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs

Time span=0.00-96.00 hrs, dt=0.04 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P1S: South Runoff Area=172,384 sf 0.00% Impervious Runoff Depth=0.21"
Flow Length=750' Tc=18.8 min CN=30 Runoff=0.1 cfs 3,047 cf

Subcatchment P200S: North Runoff Area=2,859,344 sf 0.30% Impervious Runoff Depth=0.70"
Flow Length=1,510' Tc=25.0 min CN=38 Runoff=17.8 cfs 165,929 cf

Subcatchment P201S: Central Runoff Area=90,002 sf 17.31% Impervious Runoff Depth=0.84"
Flow Length=902' Tc=16.8 min UI Adjusted CN=40 Runoff=0.9 cfs 6,316 cf

Subcatchment P202S: South Parking Runoff Area=16,692 sf 38.73% Impervious Runoff Depth=2.80"
Tc=6.0 min CN=62 Runoff=1.2 cfs 3,896 cf

Subcatchment P203S: South Building Runoff Area=8,670 sf 100.00% Impervious Runoff Depth=6.76"
Tc=6.0 min CN=98 Runoff=1.4 cfs 4,885 cf

Subcatchment P204S: North Building Runoff Area=6,152 sf 100.00% Impervious Runoff Depth=6.76"
Tc=6.0 min CN=98 Runoff=1.0 cfs 3,466 cf

Pond P201P: North Parking Peak Elev=208.83' Storage=2,894 cf Inflow=1.2 cfs 9,782 cf
Discarded=0.1 cfs 7,404 cf Primary=0.4 cfs 2,378 cf Secondary=0.0 cfs 0 cf Outflow=0.5 cfs 9,782 cf

Pond P202P: South Parking Peak Elev=217.99' Storage=3,421 cf Inflow=2.6 cfs 8,781 cf
Discarded=0.1 cfs 6,441 cf Primary=0.6 cfs 2,340 cf Secondary=0.0 cfs 0 cf Outflow=0.7 cfs 8,781 cf

Link P2L: Edgell Rd (North) Inflow=18.5 cfs 170,647 cf
Primary=18.5 cfs 170,647 cf

Total Runoff Area = 3,153,244 sf Runoff Volume = 187,540 cf Average Runoff Depth = 0.71"
98.56% Pervious = 3,107,694 sf 1.44% Impervious = 45,550 sf

Summary for Subcatchment P1S: South

Runoff = 0.1 cfs @ 13.97 hrs, Volume= 3,047 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
163,000	30	Woods, Good, HSG A
9,384	39	>75% Grass cover, Good, HSG A
172,384	30	Weighted Average
172,384		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
9.5	700	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
18.8	750	Total			

Summary for Subcatchment P200S: North

Runoff = 17.8 cfs @ 12.56 hrs, Volume= 165,929 cf, Depth= 0.70"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
24,080	30	Woods, Good, HSG A
23,158	39	>75% Grass cover, Good, HSG A
23,772	43	Woods/grass comb., Fair, HSG A
6,142	98	Unconnected pavement, HSG A
11,596	80	>75% Grass cover, Good, HSG D
2,546	98	Unconnected pavement, HSG D
2,302,547	30	Woods, Good, HSG A
465,503	77	Woods, Good, HSG D
2,859,344	38	Weighted Average
2,850,656		99.70% Pervious Area
8,688		0.30% Impervious Area
8,688		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.5	50	0.1000	0.13		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.5	570	0.1800	2.12		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
14.0	890	0.0450	1.06		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
25.0	1,510	Total			

Summary for Subcatchment P201S: Central

Runoff = 0.9 cfs @ 12.39 hrs, Volume= 6,316 cf, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Adj	Description
47,045	30		Woods, Good, HSG A
26,232	39		>75% Grass cover, Good, HSG A
15,575	98		Unconnected pavement, HSG A
1,150	96		Gravel surface, HSG A
90,002	45	40	Weighted Average, UI Adjusted
74,427			82.69% Pervious Area
15,575			17.31% Impervious Area
15,575			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.20"
4.8	350	0.0600	1.22		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.4	80	0.0250	3.21		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
2.3	422	0.0200	3.10	2.32	**Trap/Vee/Rect Channel Flow,** Bot.W=1.00' D=0.30' Z= 5.0 '/' Top.W=4.00' n= 0.022 Earth, clean & straight
16.8	902	Total			

Summary for Subcatchment P202S: South Parking

Runoff = 1.2 cfs @ 12.09 hrs, Volume= 3,896 cf, Depth= 2.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
6,465	98	Paved parking, HSG A
10,227	39	>75% Grass cover, Good, HSG A
16,692	62	Weighted Average
10,227		61.27% Pervious Area
6,465		38.73% Impervious Area

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

Summary for Subcatchment P203S: South Building

Runoff = 1.4 cfs @ 12.08 hrs, Volume= 4,885 cf, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
8,670	98	Roofs, HSG A
8,670		100.00% Impervious Area

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

Summary for Subcatchment P204S: North Building

Runoff = 1.0 cfs @ 12.08 hrs, Volume= 3,466 cf, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-year Rainfall=7.00"

Area (sf)	CN	Description
6,152	98	Roofs, HSG A
6,152		100.00% Impervious Area

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

Summary for Pond P201P: North Parking

Inflow Area = 96,154 sf, 22.60% Impervious, Inflow Depth = 1.22" for 100-year event
Inflow = 1.2 cfs @ 12.31 hrs, Volume= 9,782 cf
Outflow = 0.5 cfs @ 12.80 hrs, Volume= 9,782 cf, Atten= 56%, Lag= 29.2 min
Discarded = 0.1 cfs @ 12.80 hrs, Volume= 7,404 cf
Primary = 0.4 cfs @ 12.80 hrs, Volume= 2,378 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Peak Elev= 208.83' @ 12.80 hrs Surf.Area= 2,356 sf Storage= 2,894 cf

Plug-Flow detention time= 225.1 min calculated for 9,778 cf (100% of inflow)
Center-of-Mass det. time= 225.3 min (1,091.9 - 866.6)

Volume	Invert	Avail.Storage	Storage Description
#1	206.00'	6,487 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
206.00	47	0	0
208.00	1,315	1,362	1,362
210.00	3,810	5,125	6,487

Device	Routing	Invert	Outlet Devices
#1	Primary	206.00'	**12.0" Round Culvert** L= 51.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 206.00' / 204.00' S= 0.0392 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	206.00'	**2.400 in/hr Exfiltration over Surface area**
#3	Device 1	208.65'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	209.00'	**10.0' long x 14.0' 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) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Discarded OutFlow Max=0.1 cfs @ 12.80 hrs HW=208.83' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.4 cfs @ 12.80 hrs HW=208.83' (Free Discharge)
↑—**1=Culvert** (Passes 0.4 cfs of 5.8 cfs potential flow)
↑—**3=Orifice/Grate** (Orifice Controls 0.4 cfs @ 2.07 fps)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=206.00' (Free Discharge)
↑—**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Pond P202P: South Parking

Inflow Area = 25,362 sf, 59.68% Impervious, Inflow Depth = 4.15" for 100-year event
Inflow = 2.6 cfs @ 12.09 hrs, Volume= 8,781 cf
Outflow = 0.7 cfs @ 12.47 hrs, Volume= 8,781 cf, Atten= 73%, Lag= 22.7 min
Discarded = 0.1 cfs @ 12.47 hrs, Volume= 6,441 cf
Primary = 0.6 cfs @ 12.47 hrs, Volume= 2,340 cf
Secondary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs
Peak Elev= 217.99' @ 12.47 hrs Surf.Area= 1,830 sf Storage= 3,421 cf

Plug-Flow detention time= 261.6 min calculated for 8,777 cf (100% of inflow)
Center-of-Mass det. time= 261.8 min (1,051.7 - 789.9)

Volume	Invert	Avail.Storage	Storage Description
#1	215.00'	5,604 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.00	544	0	0
216.00	887	716	716
218.00	1,834	2,721	3,437
219.00	2,500	2,167	5,604

Device	Routing	Invert	Outlet Devices
#1	Primary	215.00'	**12.0" Round Culvert** L= 63.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 215.00' / 206.30' S= 0.1381 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 0.79 sf
#2	Discarded	215.00'	**2.400 in/hr Exfiltration over Surface area**
#3	Device 1	217.60'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	218.00'	**10.0' long x 14.0' 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) 2.64 2.67 2.70 2.65 2.64 2.65 2.65 2.63

Discarded OutFlow Max=0.1 cfs @ 12.47 hrs HW=217.99' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 0.1 cfs)

Primary OutFlow Max=0.6 cfs @ 12.47 hrs HW=217.99' (Free Discharge)
↑**1=Culvert** (Passes 0.6 cfs of 6.0 cfs potential flow)
↑**3=Orifice/Grate** (Orifice Controls 0.6 cfs @ 3.01 fps)

Secondary OutFlow Max=0.0 cfs @ 0.00 hrs HW=215.00' (Free Discharge)
↑**4=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Link P2L: Edgell Rd (North)

Inflow Area = 2,980,860 sf, 1.53% Impervious, Inflow Depth = 0.69" for 100-year event
Inflow = 18.5 cfs @ 12.57 hrs, Volume= 170,647 cf
Primary = 18.5 cfs @ 12.57 hrs, Volume= 170,647 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-96.00 hrs, dt= 0.04 hrs