Limited Stormwater Hydrology Report

Under the DEP Stormwater Management Standards

Track Renovation Project
Eaglebrook School

Pine Nook Road
Deerfield, MA

April 13, 2023

Submitted To:

Town of Deerfield
Conservation Commission
8 Conway Street
South Deerfield, MA 01373

Applicant:

Allen-Chase Foundation
d/b/a Eaglebrook School
279 Pine Nook Road
Deerfield, MA 01342

Prepared By:
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COMMONWEALTH OF MASSACHUSETTS
JESSE M. MORENO
CIVIL
No. 47315
REGISTERED

Jesse Moreno, PE

Digitally signed by Jesse Moreno, PE
DN: c=US, st=Massachusetts, l=Hadley, o=ProTerra Design Group, LLC, ou=Engineer, cn=Jesse Moreno, PE, email=jmoreno@proterra-design.com
Date: 2023.04.13 16:35:03 -04'00'

Section 1

Checklist, Narrative, & Figures

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

COMMONWEALTH OF MASSACHUSETTS
JESSE M.
MORENO
CIVIL
No. 47315
REGISTERED
PROFESSIONAL ENGINEER

4-13-2023

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

The project consists of the renovation of the existing track and playing field area by changing the surface types from grass to synthetic turf. The project will meet all applicable Stormwater Standards to the maximum extent practicable.

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

The impervious surfaces of the track will be pretreated with trench drain filter inserts prior to discharge into an underground stone storage/infiltration reservoir under the proposed synthetic turf field. Outlet protection will be upgraded at the two discharge pipes for the underground reservoir. Existing and pass-through stormwater flows will be maintained at the site.

☒ 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.

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

Checklist (continued)

Standard 3: Recharge (continued)

Based on results of test pits, borings at other locations within the school property, and NRCS data, groundwater is estimated at or below elevation 322'. This allows for a 4' offset from the bottom of the stone reservoir.

☐ 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.

Trench drain filter inserts to provide min. 44% TSS removal prior to underground infiltration system. See attached efficiency testing conducted by Woodbury University.

☐ 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.

Trench drains with REM FOG or equal filter inserts will provide >44% TSS pretreatment prior to underground infiltration system. See attached efficiency testing conducted by Woodbury University.

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

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.

The TMDL for the downstream Category 5 Water is for E.coli. Stormwater runoff from the track surface will not contribute to increasing pollutants associated with the TMDL.

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.

Project is located within IWPA. The track surface is the only area considered impervious by current MassDEP standards. Pretreatment is provided for the impervious surfaces with trench drain filter inserts.

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

ProTerra
DESIGN GROUP, LLC

PROJECT OVERVIEW

The Eaglebrook School ("Applicant") proposes to complete a track renovation project encompassing the conversion of an existing grass athletic field to a synthetic turf field with sand/rubber infill. The project will be constructed on land owned by the school containing approximately 36.5 acres and will require disturbance of 2.50± acres of land within the existing track infield.

A stormwater management system is proposed to treat, collect, route, detain, infiltration, and control the release rates of stormwater generated by the existing track and proposed synthetic turf field. Outlets for the underground stone reservoir will maintain existing drainage patterns and utilize the existing stormwater network for discharge of collected runoff. Erosion control will be provided between the improvements and the wetland resource areas. A long-term pollution prevention plan has been prepared and is contained in Section 2. The site is proposed to be permitted under "New Development" seeking compliance with Standards to the maximum extent practicable.

The proposed site improvements are shown on the plans provided under separate cover entitled "*Track Renovation Project; Eaglebrook School; Pine Nook Road; Deerfield, MA*" latest edition as prepared by ProTerra Design Group, LLC (ProTerra) with Northeast Survey Consultants, PC (Northeast) and R.A.D. Sports (RAD).

TOTAL RUNOFF PEAK (CFS) FROM THE SITE
TO DESIGN POINT 1/10 (West Area of Existing Track)

Type III SCS 24-HR STORM	EXISTING (DP#1)	PROPOSED (DP#10)	DIFFERENCE
2 - YEAR	2.03	1.51	-0.52
10 – YEAR	2.94	1.62	-1.32
100 – YEAR	7.14	5.08	-2.06

REF: OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS; 2021 ORTHOPHOTO

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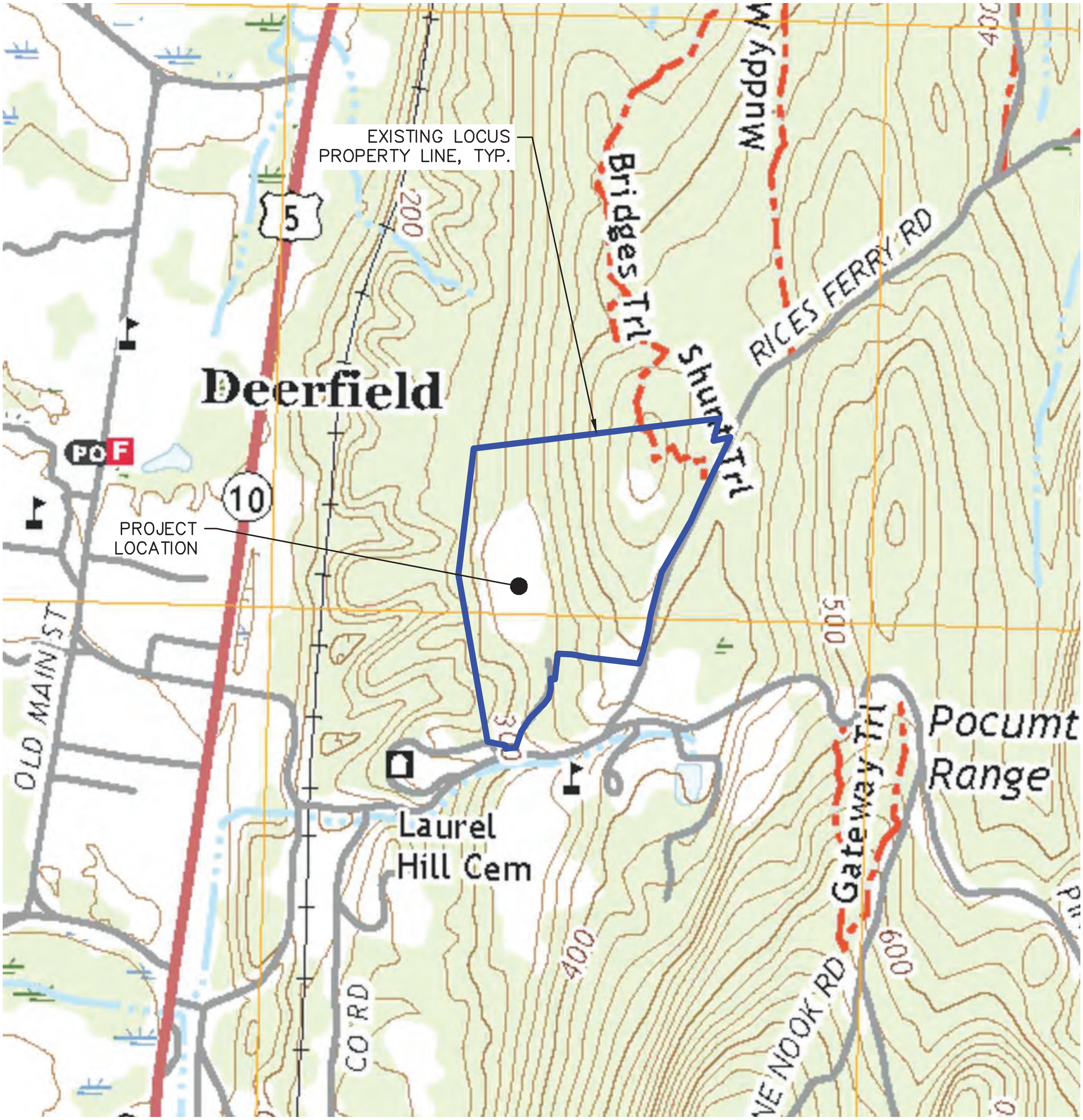
ORTHOPHOTO MAP

TRACK RENOVATION PROJECT
EAGLEBROOK SCHOOL
279 PINE NOOK ROAD
DEERFIELD, MA 01342

SCALE: 1" = 600' DATE: APRIL 13, 2023

FIG. 1



REF: UNITED STATES GEOLOGICAL SURVEY, GREENFIELD QUADRANGLE (2021)

ProTerra DESIGN GROUP, LLC 4 Bay Road Building A, Suite 200 Hadley, MA 01035 (413)320-4918	USGS TOPOGRAPHIC MAP	TRACK RENOVATION PROJECT EAGLEBROOK SCHOOL 279 PINE NOOK ROAD DEERFIELD, MA 01342 SCALE: 1" = 800' DATE: APRIL 13, 2023	FIG. 2

REF: OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS; 2021 ORTHOPHOTO
SOILS REF: NRCS (NATURAL RESOURCES CONSERVATION SERVICE) CUSTOM SOIL RESOURCE REPORT FOR FRANKLIN COUNTY, MASSACHUSETTS.

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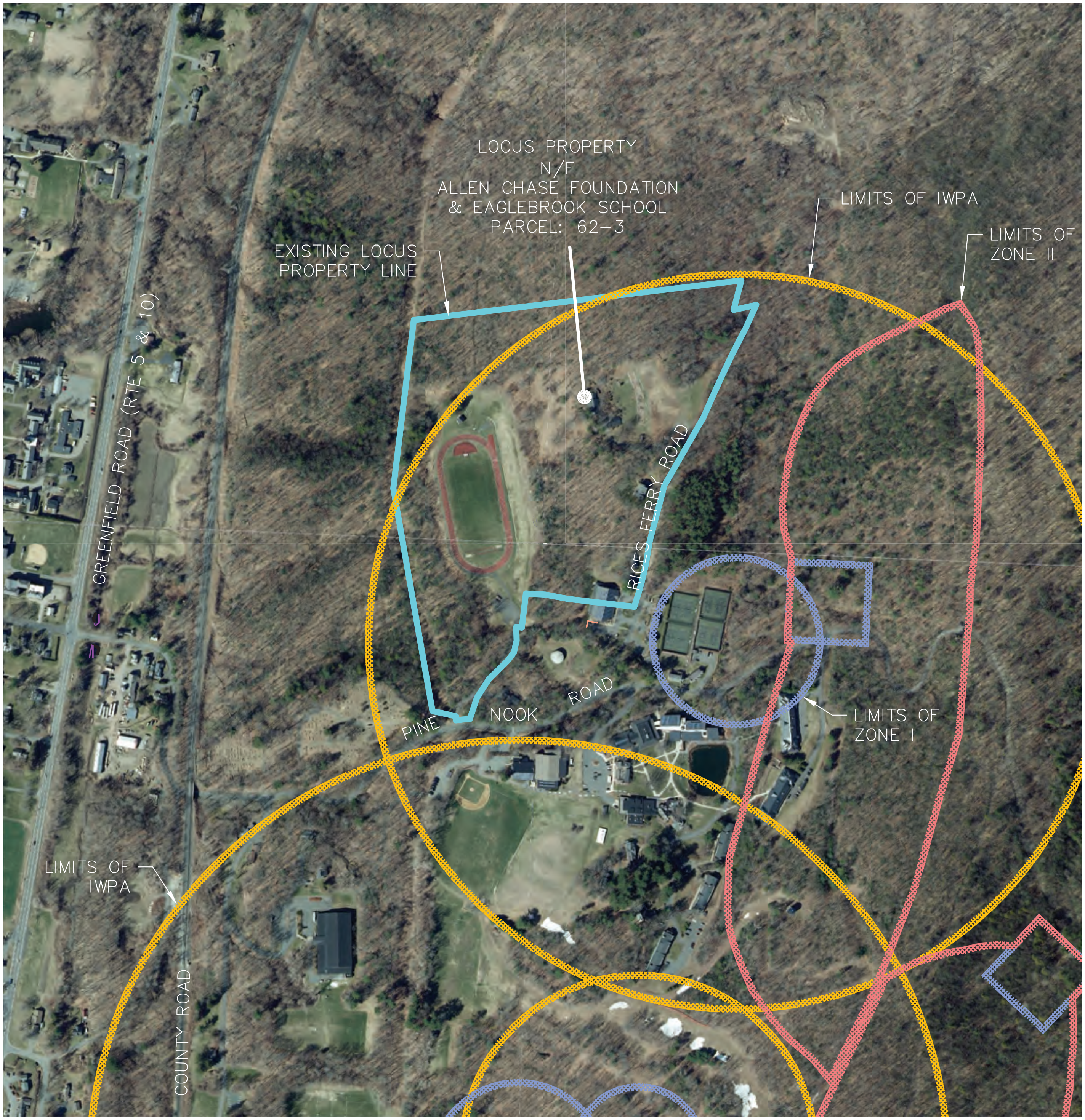
ProTerra DESIGN GROUP, LLC 4 Bay Road Building A, Suite 200 Hadley, MA 01035 (413)320–4918	SOILS MAP	TRACK RENOVATION PROJECT EAGLEBROOK SCHOOL 279 PINE NOOK ROAD DEERFIELD, MA 01342 SCALE: 1" = 400' DATE: APRIL 13, 2023	FIG. 3



REF: OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS; 2021 ORTHOPHOTO, & MASSDEP WELLHEAD PROTECTION AREAS (ZONE II, ZONE I, IWPA) NOVEMBER 2022.

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MASSDEP WELLHEAD PROTECTION AREAS

TRACK RENOVATION PROJECT
EAGLEBROOK SCHOOL
279 PINE NOOK ROAD
DEERFIELD, MA 01342

SCALE: 1" = 600'

DATE: APRIL 13, 2023

FIG. 4

Section 2

Long-Term Pollution Prevention and Operation & Maintenance Plan

April 13, 2023

RECOMMENDED LONG-TERM STORMWATER POLLUTION PREVENTION PLAN and STORMWATER OPERATION & MAINTENANCE (O&M) PLAN TO COMPLY WITH STORMWATER STANDARDS 4, 8, 9 & 10 FOR THE PROPOSED TRACK RENOVATION PROJECT

PROJECT OVERVIEW

Eaglebrook School is an independent boarding and day school for boys in grades six, seven, eight, and nine and was founded in 1922 by Howard Gibbs. Today, it educates over 250 students from 23 countries and 19 states with about 75 faculty and staff. The Eaglebrook School ("Applicant") proposes to complete a track renovation project encompassing the conversion of an existing grass athletic field to a synthetic turf field with sand/rubber infill. The project will be constructed on land owned by the school containing approximately 36.5 acres.

The project proposes a series of drainage improvements including trench drains along the edge of the existing track, underground infiltration below the synthetic turf field, and outlet protection at existing pipe discharge points.

The project will require disturbance of 2.50± acres of land on the 36.5-acre parcel. Development and completion of a Notice of Intent (NOI) and Stormwater Pollution Prevention Plan (SWPPP) associated with the EPA's National Pollutant Discharge Elimination System (NPDES) General Permit for Discharges from Construction Activities will be required. The contractor shall prepare the SWPPP for review by the Applicant and obtain the NPDES permit coverage prior to starting construction activities.

The proposed site improvements are shown on the plans provided under separate cover entitled "*Track Renovation Project; Eaglebrook School; Pine Nook Road; Deerfield, MA*" latest edition as prepared by ProTerra Design Group, LLC (ProTerra) with Northeast Survey Consultants, PC (Northeast) and R.A.D. Sports (RAD).

OWNER AND RESPONSIBLE PARTY

Land Owner:	Responsible Parties:
Allen-Chase Foundation d/b/a Eaglebrook School 279 Pine Nook Road Deerfield, MA 01342	Eaglebrook School Maintenance Department & Physical Plant 270 Pine Nook Road Deerfield, MA 01342

The Land Owner and Responsible Party are cooperative entities. The Eaglebrook School is part of a campus containing over 700 acres of land and many buildings. The facilities department will be responsible for maintenance of the track renovation improvements.

ProTerra DESIGN GROUP, LLC

CONSTRUCTION MANAGEMENT

Contractor: ________________________
Address: __________________________
____
Phone Number: ____________________

A Construction Manager, Engineer, and/or Clerk-of-the-Works with adequate knowledge and experience on projects of similar size and scope shall be employed to oversee all site work related construction. The contractor shall incorporate appropriate techniques to control sediment and erosion pollution during construction in accordance with the Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas. It is recommended that this document and any required NPDES CGP be incorporated into contracts with the site and general contractor.

Care should be taken when constructing stormwater control structures and dewatering (if required) to install foundations. Light earthmoving equipment shall be used to excavate in the vicinity of the areas of stormwater infiltration. Use of heavy-equipment causes excessive compaction of the soils resulting in reduced infiltration capacity. At no time, shall temporary settling basins be constructed in the vicinity of the proposed infiltration areas in order to prevent the soils from becoming clogged with sediment.

Dewatering activities (if required) shall be directed towards a berm and filter sack to promote infiltration into the ground. If silt-laden sediment is encountered, a frac tank or temporary sediment trap approximately 15,000-20,000 gallons in size or greater may be employed to settle pumped groundwater before discharge to the land surface for recharge.

WHAT TYPES OF CONSTRUCTION ACTIVITIES ARE REGULATED

A NPDES Clean Water Act permit is required for stormwater discharges from any construction activity disturbing:

- 1 acre or more of land, or
- Less than 1 acre of land, but that is part of a common plan of development or sale that will ultimately disturb 1 or more acres of land.

Construction activity includes earth-disturbing activities such as clearing, grading, and excavating land and other construction-related activities that could generate pollutants.

MINIMUM CONSTRUCTION & DEVELOPMENT LIMITATIONS (C&D RULE)

All NPDES permits for construction stormwater must address the minimum federal effluent limitation guidelines for the construction and development point source category (referred to as “the C&D rule”).

The C&D rule found in 40 CFR 450.21 establishes minimum NPDES effluent limitations, such as:

1. Design, install, and maintain effective erosion and sediment controls, and pollution prevention measures, to minimize the discharge of pollutants;
2. Stabilize disturbed areas immediately when construction has ceased and will not resume for more than 14 days;
3. Prohibit the dewatering discharges unless managed by appropriate controls;
4. Prohibit the discharge of:
    - Wastewater from concrete washout (unless managed by appropriate control), or washout/cleanout of stucco, paint, form release oils, other wastewater materials;
    - Fuels, oils, or other pollutants used for vehicles; and
    - Soaps or solvents to wash vehicles and equipment.

A. Erosion and Sediment Controls Operators must design, install, and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed, and maintained to:

1. Control stormwater volume and velocity to minimize soil erosion in order to minimize pollutant discharges

2. Control stormwater discharges, including both peak flowrates and total stormwater volume, to minimize channel and streambank erosion and scour in the immediate vicinity of discharge points.

3. Minimize the amount of soil exposed during construction activity;

4. Minimize the disturbance of steep slopes;

5. Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater discharge, and soil characteristics, including the range of soil particle sizes expected to be present on the site;

6. Provide and maintain natural buffers around waters of the United States, direct stormwater to vegetated areas and maximize stormwater infiltration to reduce pollutant discharges, unless infeasible;

7. Minimize soil compaction unless required where the intended function of a specific area of the site dictates that it be compacted; and

8. Unless infeasible, preserve topsoil. Preserving topsoil is not required where the intended function of a specific area of the site dictates that the topsoil be disturbed or removed.

B. Soil Stabilization Requirements: at a minimum, Contractors must initiate soil stabilization measures immediately whenever any clearing, grading, excavating or other earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. In limited circumstances, stabilization may not be required if the intended function of a specific area of the site necessitates that it remains disturbed.

C. Dewatering Requirements: Operators must minimize the discharge of pollutants from dewatering trenches and excavations. Discharges are prohibited to surface waters and must be managed by appropriate controls to infiltrate into the ground.

D. Pollution Prevention Measures: Operators must design, install, implement, and maintain effective pollution prevention measures to minimize the discharge of pollutants. At a minimum, such measures must be designed, installed, implemented, and maintained to:

1. Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters. Wash waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
2. Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on the site to precipitation and to stormwater. Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.

E. Prohibited Discharges The following discharges from C&D sites are prohibited: Wastewater from washout of concrete, unless managed by an appropriate control; Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials; Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance; and Soaps or solvents used in vehicle and equipment washing.

F. Surface Outlets When discharging from basins and impoundments, operators must utilize outlet structures that withdraw water from the surface, unless infeasible.

CONSTRUCTION PHASING

The phasing of construction for the track renovation project shall generally follow the following sequence to limit disturbed areas in each phase. Items may be completed concurrently or separately depending on their location.

- Installation of temporary erosion and sediment control measures along the perimeter of the site (i.e., inlet protection, silt fence, temporary BMP’s & sediment traps etc.)
- Installation of temporary sediment basins with diversion swales directing stormwater into the temporary basins.

- Installation of tree/protection and fencing at limit of work. Install tree trunk protection where equipment could reach nearby trees.
- Establishment of schedules for good housekeeping BMPs, locations for trash stockpile/removal, porta-potty installation, and a construction trailer as necessary
- Clearing and grubbing of vegetation within limits of work. Chip slash, trees, and branches to create mulch for use as temporary soil cover.
- Construction of temporary construction exit point
    - Installation of stabilized construction entrance
- Excavation/Fill for field sub-grade
- Installation of long-term stormwater features, piping, conveyances, etc.
- Construct outlet protection at outlets.
- Construction and stabilization of synthetic turf field area
- Installation of new track surface pavement
- Re-vegetation in disturbed areas for final stabilization
- Remove temporary BMPs that are no longer required after a good vegetative cover is established.

EROSION & SEDIMENT CONTROL PHASING

The phasing of erosion and sediment control during construction of project shall generally follow the following sequence.

- Pre-Disturbance/Site Preparation
    - Install stabilized construction entrance and temporary access
    - Install perimeter BMPs (i.e., silt fence, inlet protection)
    - Prepare stabilized staging area including concrete washout pit & dewatering basins/tanks
    - Prepare construction fencing, pedestrian, and vehicular detours
    - Limit access to areas that are not to be disturbed
    - Install tree protection and/or fencing at limit of work to protect areas not to be disturbed.
- Construction
    - Locate stockpiles in work areas upstream of temporary sediment basins and outside of tree root zones/drip lines
    - Leave disturbed area of site in a surface roughened condition when feasible
    - Close excavations as soon as possible
    - Protect and repair BMPs, as necessary
    - Perform street sweeping, as needed
    - Seed or surround stockpiles to prevent loss of material.
- Backfill and Compacting
    - Remove temporary BMPs where appropriate
    - Remove limited stored materials and equipment from the site
- Final Stabilization
    - Install synthetic turf/seed/mulch in areas of disturbance

- Remove all non-biodegradable temporary BMPs when stable

EROSION CONTROL BEST MANAGEMENT PRACTICES (BMPs)

During construction, silt-laden runoff, or discharge from dewatering operations (if necessary) will be prevented from exiting the construction area untreated. Siltation barriers consisting of a filter fabric silt fence, straw bales, stone filter berms, or silt socks will be erected in advance of construction along the down-gradient edge of all disturbed areas and maintained throughout the construction period. The control of dust and erosion during the construction period will be managed using several Best Management Practices (BMPs) described below and as shown on the erosion control plans of the referenced plan set.

Stabilized Construction Entrance

An apron constructed of coarse aggregate over a geotextile fabric or track-out control construction mat system shall cover the transition between the existing track area and the paved access driveway. The size and construction of the entrance is shown on the plan detail sheets. This entrance shall be inspected weekly and maintained throughout construction activities and removed after completion.

Storm Sewer Inlet Protection

Storm sewer inlet protection is a sediment filter or an excavated impounding area around a storm drain drop inlet or curb inlet. Its purpose is to prevent sediment from entering storm drainage systems prior to permanent stabilization of the disturbed area. This practice shall be used where the drainage area to an inlet is disturbed, it is not possible to temporarily divert the storm drain outfall into a trapping device, and watertight blocking of the inlets is not advisable. It is not to be used in place of sediment trapping devices.

Temporary Sediment Traps (During Construction)

Small depressions that have stormwater runoff directed into them for increased retention time that promotes settling out of suspended solids. Tributary drainage area shall be under 1 acre. The storage volumes should be 1,800 cubic feet per acre of tributary area. At no time, shall temporary settling basins be constructed in the vicinity of the proposed stormwater infiltration areas in order to prevent the soils from becoming clogged with sediment. Skimmers shall be employed to discharge water on the surface of the trap to limit

Silt Fence, Reinforced with Straw Bales as Required (Compost Berms & Socks can be used as alternatives)

Silt fence or silt sock is installed at the down gradient limit of work. It should be trenched into the ground 6” and staked without drooping. The woven fabric will allow the passage of stormwater while filtering out suspended solids. Straw bales give added filtering and erosion control. Every 100’ two bales or silt socks shall be placed and staked perpendicular to the fence. Straw bales shall be inert straw or salt hay type.

Dewatering

If dewatering is required, small discharges shall be directed through a settling pool or filter bag prior to discharge and infiltration into the ground. Outflow of silt-laden runoff shall not be permitted to flow directly into resource areas. Larger flows will require a well point or sump system to a settling tank/frac tank before decanting and discharge to the soil. Upon completion of site stabilization, the BMP's and conveyance systems shall be thoroughly cleaned of silt and sediment and made ready for the proposed operation. Discharge points shall be set back from the edge of the resource areas and monitored by qualified personnel to ensure no impacts to resource areas and compliance with applicable federal and state regulations. Discharges shall be free from visible floating, suspended, and settleable solids that would impair the functions of the nearby wetlands and downstream rivers.

Concrete Washout Pit

A concrete washout pit/area must be designated to receive wash water from washing of tools and concrete mixer chutes, liquid concrete waste from dump trucks, mobile batch mixers, or pump trucks. Concrete washout activities must be conducted in a manner that does not contribute pollutants to surface waters or stormwater runoff. Concrete washout areas may be lined or unlined excavated pits in the ground, commercially manufactured prefabricated washout containers, or aboveground holding areas constructed of berms, sandbags, or straw bales with a plastic liner. Although un-lined washout areas may be used, lined pits will be required to protect groundwater.

FINAL STABILIZATION

Final stabilization includes those measures taken to control pollutants in stormwater after soil disturbing activities are complete. Practices implemented to achieve final stabilization include:

- Installation of track surface, synthetic turf, and concrete pavement
- Installation of wetland seeding and loam/seed on exposed loam
- Maintenance of appropriate erosion and sediment control BMPs until final stabilization is achieved
- Removal of temporary BMPs once work is completed and final stabilization achieved

ON-GOING MAINTENANCE

The Owner / Responsible Party shall hire appropriate staff, contract with a maintenance company, or designate qualified in-house staff to complete ongoing maintenance.

LIVING DOCUMENT PROVISIONS

Due to the difficulty of identifying all sources of potential stormwater contamination and maintenance activities, this document shall be updated as necessary to reflect new procedures, technologies, or requirements. Ultimately, the Responsible Party will have the authority to implement a plan and frequency of maintenance as required.

MAINTENANCE LOG

The Owner / Responsible Party shall develop and maintain a log of inspections, maintenance, repairs, and disposal (including location of disposal) during the life of the project. Records shall be maintained for at least three years and be made available to the Massachusetts Department of Environmental Protection in accordance with the provisions of the Massachusetts Stormwater Handbook. A sample of such a maintenance log is provided.

GOOD HOUSEKEEPING PRACTICES DURING CONSTRUCTION & BEYOND

The Owner / Responsible Party shall maintain good housekeeping practices by maintaining a clean and orderly facility to prevent potential pollution sources from meeting stormwater and degrading water quality. This includes establishing protocols to reduce the possibility of mishandling materials or equipment and training employees in good housekeeping techniques.

Common areas where good housekeeping practices should be followed shall include: material storage areas, vehicle, and equipment maintenance areas, and loading areas. Good housekeeping practices must include a designated and secure location for garbage and fertilizers. A schedule for regular pickup and disposal of garbage and waste materials during construction and routine inspections of containers for leaks and structural integrity shall be developed.

After construction, no trash shall be kept on-site and shall be removed by service technicians or contractors when they leave. Portable toilets shall be installed on site and maintained throughout construction. Excess concrete and cleanout water from red-mix vehicles shall be directed towards small excavations or constructed boxes for cleanup. Catch basins and drainage conveyance systems shall not be used for this purpose.

Dust Control (Seeding and Topsoiling)

Construction traffic must enter and exit the site at the stabilized construction entrance. The purpose is to trap dust and mud that would otherwise be carried off-site by construction traffic. Large areas of soil that are denuded of vegetation and have no protection from particles being picked up and carried by wind should be protected with a temporary cover or kept under control with water or other soil adhering products to limit wind transported particles existing the site perimeter. Water trucks or other dust control agents will be used, as needed, during construction to reduce dust generated on the site that may cause off-site damage, health hazards, and traffic safety problems.

Material Storage

Areas designated for temporary materials storage shall be surrounded on the downhill side by an erosion control barrier. This area shall be inspected daily for erosion and runoff of stored materials. At the completion of construction, the area shall be stabilized with vegetation or stone product. The areas should be located away from trees to be saved including root areas and drip lines. Because of the proximity to the school, laydown and material storage areas shall be fenced or cordoned off to prevent unauthorized access.

Waste Disposal

A secure location shall be designated for waste storage. Regular pickup and disposal of materials shall be scheduled. Containers shall be inspected daily for leaks and structural integrity. Portable toilets shall be installed on site and maintained throughout construction.

Sanitary Facilities

Portable restroom facilities "sani-cans" or other means for construction and maintenance workers to use the lavatory shall be provided on site. Handwashing stations are encouraged especially during the pandemic and other times of the year where influenza and other communicable viruses can be spread.

Stockpiles

Cover all stockpiles that will remain open in excess of 7-14 days with either temporary vegetation or tarps to prevent erosion. Surround all stockpiles with barrier BMP's when not is use such as compost filter socks to prevent escaped sediment from washing away. Stockpiles should be stabilized at the end of each day.

Snow & Ice Removal

Parts of the drainage system, such as inlets, outlets, and culverts are susceptible from clogging and freezing during the winter months. To retain effectiveness of drains, snow and ice shall be removed from the inlets and outlets during cold months where ice and snow buildup may clog conveyance paths. Plowing shall not be directed towards inlets or outlets where clogging or freezing of the conveyance path may occur.

MINIMIZING EXPOSURE

The Owner / Responsible Party shall minimize exposure of potential pollutant sources from coming into contact with precipitation and being picked up by stormwater and carried into drains and surface waters. All materials shall be plainly labeled and stored in an appropriate container in an appropriate location. All activities which can generate sources of contaminants shall be contained.

LONG-TERM BMPS: MAINTENANCE

Prior to final completion and full occupancy of the development, a representative of the contractor and/or Engineer at the owner / responsible party's request shall properly instruct the user of the required maintenance responsibilities to maintain the effectiveness of the drainage system. The Owner / Responsible Party will implement the procedures and frequencies as they see fit above and beyond the minimums under their current plan and inspect the systems as needed to maintain effectiveness.

Trench Drains, In-Line Catch Basins, & Manholes

Trench drains shall be cleaned, in dry weather, when half of the sump capacity is filled or at a minimum three times per year or as required through periodic inspection. Cleaning will take place at the completion of construction or as needed depending on the frequency of major storm events (> 1" of rainfall). All in-line catch basins and manholes shall be inspected at least once annually or as dictated by the responsible party. Any obstructions, sediment, and debris that could potentially cause clogs shall be removed within the conveyance system as necessary. Inverts, grates, and filters shall be checked and replaced as necessary to maintain hydraulic effectiveness.

Synthetic Turf Field with Underground Stone Storage with Infiltration

The synthetic turf field shall be maintained per manufacturer's recommendations to ensure proper drainage through the filter media into the underground stone storage. Semi-annual cleanings shall include removal of sediment/debris accumulating on the surface and monitoring groundwater and infiltration rates to ensure proper operation of the systems. Items to note during inspections include differential settlement, cracking, break-out, clogging of outlets, and root infestation. Water levels should be checked and recorded against rainfall amounts to verify the drainage system is working properly.

Outlet Structures & Control Orifices

During the construction phases of the project, the manholes and outlet structures shall be inspected monthly to monitor the sediment accumulation and sediment removed as necessary after storm events with 1" of rainfall or greater. Thereafter, the manholes and outlet structures shall be inspected every six months or as needed during the owner's regular maintenance of the grounds. Maintenance shall include cleaning the units during dry weather. Any obstructions, sediment, and debris that could potentially cause clogs shall be removed within the stormwater conveyance system. Inverts and orifices shall be checked and replaced as necessary to maintain hydraulic effectiveness. Any screens, trash racks, or outlet protection racks shall be cleaned of debris to maintain hydraulic effectiveness.

Culvert Outlet Protection / Energy Dissipaters

During the construction phases of the project, the rip-rap outlet protection / energy dissipaters shall be inspected monthly and cleaned as necessary and/or after storms events with 1" of rainfall or greater. Thereafter, these structures shall be cleaned at least once per year or as needed during the owner's regular maintenance of the grounds. Cleanings shall include removal of vegetation, removal of excess sediment accumulation and inspection of condition of stone and energy dissipaters.

Trench Drain Filter

See attached manufacturer's recommendations for trench filter maintenance.

ProTerra
DESIGN GROUP, LLC

ANNUAL STORMWATER MAINTENANCE COST ESTIMATE

BMP	Frequency	Unit Cost	Subtotal
Trench Drains, In-Line Catch Basins, & Manholes	3 visits per year	$250	$750
Synthetic Turf Field with Underground Stone Storage with Infiltration	2 visits per year	$750	$1500
Outlet Structures & Control Orifices	2 visit per year	$500	$1000
Culvert Outlet Protection / Energy Dissipaters	1 visit per year	$500	$500
Trench Drain Filter Replacement	1 visit per year	$500	$500
		Total:	$4,250

The annual maintenance cost does not include the owner's regular maintenance of the grounds that would consist of mowing & debris pickup.

REM TRITON Filter Recommended Maintenance Procedures:

Maintenance and Inspections:

In order to ensure proper operation, REM (Revel Environmental Manufacturing, Inc.) recommends that REM Stormwater filters be serviced and maintained when debris and pollutant accumulations exceed no more than 80% of the filter's capacity. REM recommends that the filters are inspected and serviced at a minimum of three times (3X's) per seasonal cycle year. The frequency and length of duration between inspections and maintenance may fluctuate based on specific site conditions such as local weather conditions, site use, and pollutant type and loading volume.

Filter Media Replacement:

In order to ensure proper operation, REM recommends that the FOG Media, or other specified media (such as Activated Carbon, and/or Zeolite) be replaced when the outer surface of media is no more than 50% coated with contaminants. (The surface area of REM's standard FOG media is stark white in color. The media will blacken with encapsulated contaminants over time.) It is recommended that REM media packs and Bioflex be replaced a minimum of one time (1X) per seasonal cycle year. Sites with higher pollutant loading concentrations may require more frequent service and media replacement. Purchase replacement media packs from REM at (888) 526-4736 or sales@remfilters.com. Custom media configurations are available upon.

Disposal:

Captured pollutant debris and spent media must be disposed of in accordance with all Federal, State, and Local Laws and Regulations.

On-site Procedures for Triton Catch Basin Filter Inserts:

1. Secure area (proceed with traffic and pedestrian control plan).
2. Clean surface area immediately around each storm drain utilizing a stiff bristled push-broom, flat shovel or industrial vacuum.
3. Proceed with confined space procedures as necessary.
4. Remove grate or manhole cover and set aside.
5. Inspect perimeter filter flange gasket. Confirm media cartridge is secure in the filter basin.
6. Remove debris trapped in grate slot openings.
7. Utilize an industrial vacuum to remove debris from within filter basin.
8. Pressure wash media pack through the stainless steel cartridge. (Avoid discharge by utilizing an industrial vacuum to remove excess water while pressure washing).
9. Inspect media housed inside stainless steel cartridge. REM recommends replacing the filter media a minimum of once a year (see *Filter Media Replacement* above).
10. Place grate or manhole cover back on catch basin grate frame.
11. Secure dated service lock-out tag on grate lid.
12. Identify catch basin on site map for tracking and reporting.
13. Note observations, concerns or recommendation regarding specific filter on maintenance report.
14. Remove pedestrian and/or traffic control barricades.

LONG TERM STRUCTURAL BEST MANAGEMENT PRACTICE INSPECTION & MAINTENANCE MATRIX AFTER CONSTRUCTION

Note: BMP's shall be visually inspected and repaired by a qualified party in accordance with the following chart. Note these are minimum inspection criteria/frequencies and should be adjusted throughout the project lifespan as required to maintain effectiveness. Refer to maintenance standards for drainage facilities and structural best management practices in the "Recommended Long-Term Stormwater Pollution Prevention Plan."

Conventional & LID Best Management Practices	Recommended Minimum Inspection & Maintenance Frequency	Erosion/Scouring	Tree Growth Hazards	Differential Settlement/Seepage	Structural Damage/Obstructions	Trash & Debris	Removal of Accumulated Sediment	Slope Integrity	*Mow Vegetation/Poor Vegetation Coverage	Remove/Reset Filter Fabric & Stone As Required	Check - Remove & Replace mulch/media/stone	Remove/Reset Stone & Armor	Remove/Replace Filter Media
Trench Drains, In-Line Catch Basins, & Manholes	*3x per year*	☑		☑	☑	☑	☑						
Outlet Stucture & Control Orifices	*Semi-Annual*	☑		☑	☑	☑	☑						
Underground Detention System	*Semi-Annual*	☑	☑	☑	☑	☑	☑	☑					
Culvert Outlet Protection/Energy Dissapator	*Annually*	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	
Trench Drain Filter Replacement	*Annually*				☑								☑

Stormwater BMP Inspection and Maintenance Log

Project Name: Track Renovation Project; Eaglebrook School; Pine Nook Road; Deerfield, MA
SWPPP Contact: Eaglebrook School
Contact: ____________________
Phone: ____________________

Begin Date	End Date

Date	BMP ID#	BMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Section 3

Hydrology Model Using HydroCAD

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	72.594 degrees West
Latitude	42.541 degrees North
Elevation	0 feet
Date/Time	Wed, 18 Jan 2023 15:40:22 -0500

Extreme Precipitation Estimates

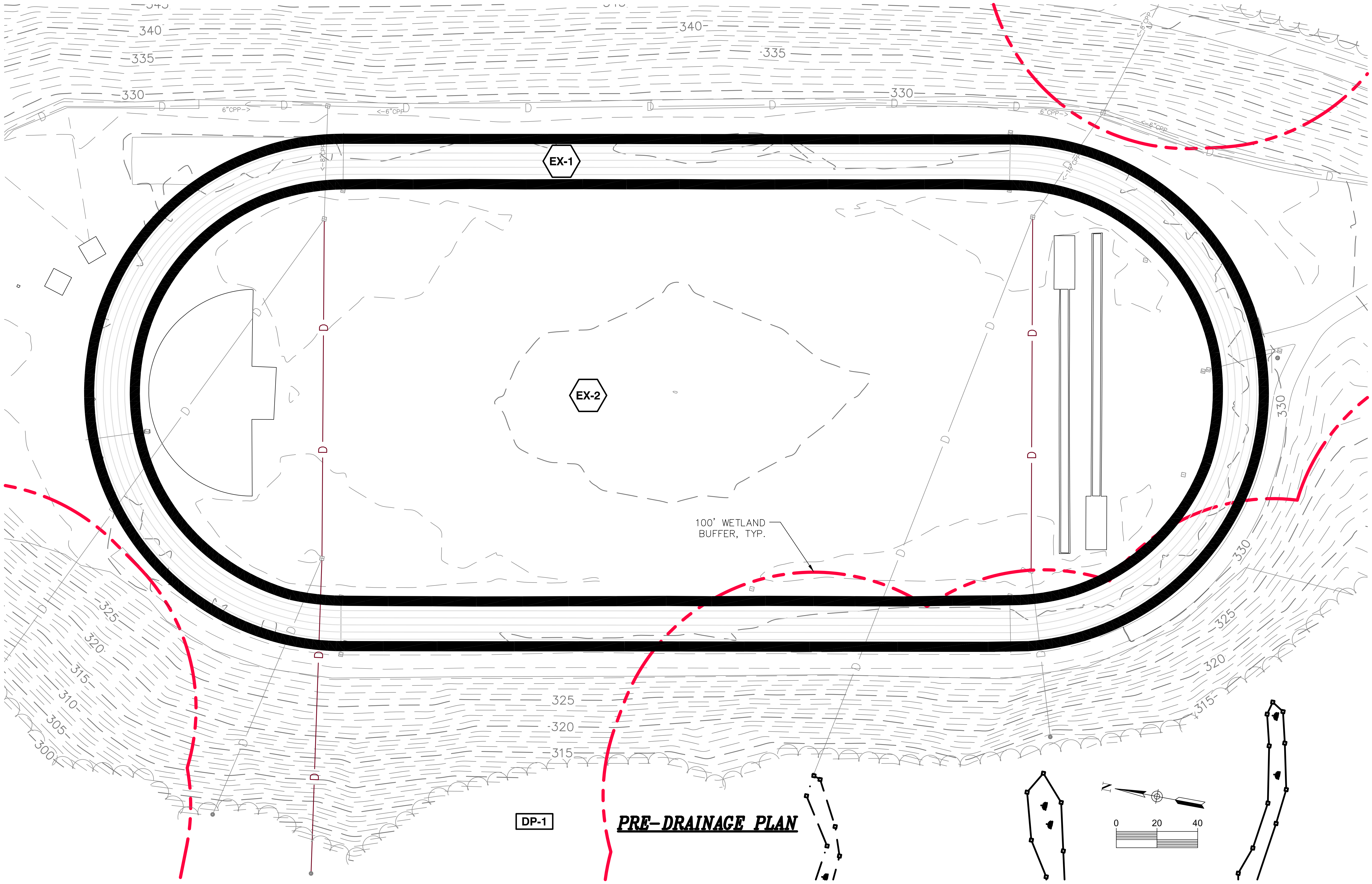
	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.29	0.44	0.55	0.72	0.89	1.12	**1yr**	0.77	1.04	1.29	1.60	1.99	2.47	2.76	**1yr**	2.19	2.66	3.07	3.71	4.31	**1yr**
2yr	0.34	0.53	0.66	0.87	1.09	1.37	**2yr**	0.94	1.24	1.58	1.96	2.42	2.99	3.34	**2yr**	2.65	3.21	3.71	4.42	5.06	**2yr**
5yr	0.41	0.64	0.80	1.07	1.37	1.73	**5yr**	1.18	1.55	1.99	2.46	3.01	3.67	4.19	**5yr**	3.25	4.03	4.68	5.44	6.20	**5yr**
10yr	0.46	0.73	0.92	1.25	1.63	2.07	**10yr**	1.41	1.83	2.38	2.93	3.56	4.29	4.98	**10yr**	3.80	4.79	5.59	6.36	7.22	**10yr**
25yr	0.56	0.88	1.12	1.55	2.05	2.61	**25yr**	1.77	2.28	3.01	3.69	4.44	5.28	6.27	**25yr**	4.67	6.03	7.06	7.84	8.85	**25yr**
50yr	0.63	1.01	1.30	1.82	2.45	3.14	**50yr**	2.11	2.69	3.62	4.40	5.25	6.18	7.47	**50yr**	5.47	7.18	8.44	9.19	10.33	**50yr**
100yr	0.72	1.17	1.50	2.14	2.92	3.75	**100yr**	2.52	3.18	4.33	5.24	6.21	7.24	8.90	**100yr**	6.41	8.56	10.09	10.77	12.05	**100yr**
200yr	0.84	1.36	1.77	2.53	3.49	4.48	**200yr**	3.01	3.77	5.16	6.23	7.33	8.48	10.62	**200yr**	7.51	10.21	12.08	12.63	14.07	**200yr**
500yr	1.02	1.67	2.18	3.16	4.41	5.69	**500yr**	3.81	4.71	6.54	7.83	9.14	10.47	13.41	**500yr**	9.27	12.90	15.32	15.61	17.28	**500yr**

Lower Confidence Limits

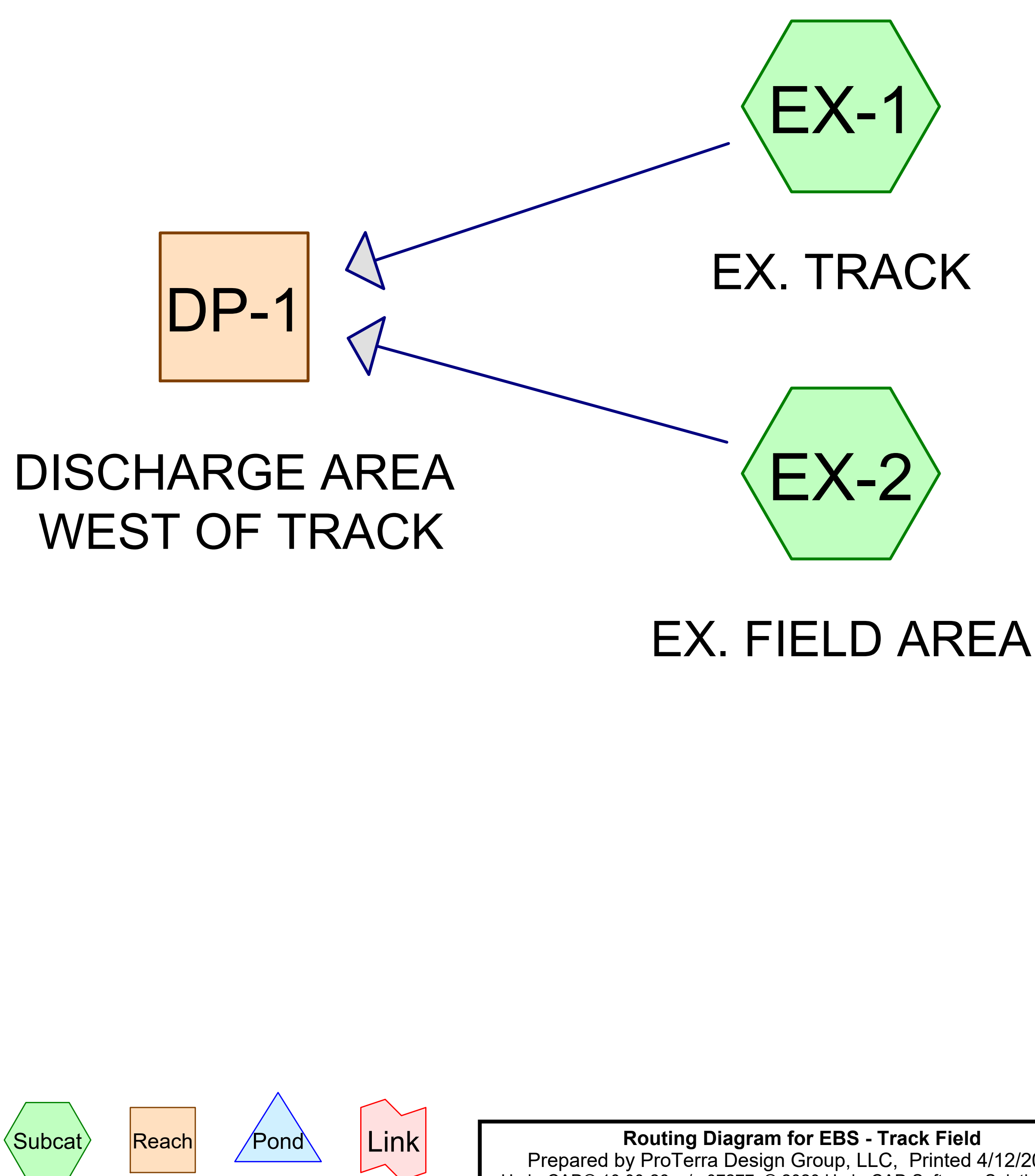
	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.35	0.43	0.58	0.71	0.85	**1yr**	0.61	0.83	1.00	1.36	1.62	2.23	2.49	**1yr**	1.98	2.39	2.61	3.21	3.71	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.23	**2yr**	0.91	1.20	1.39	1.79	2.30	2.88	3.21	**2yr**	2.55	3.09	3.58	4.24	4.89	**2yr**
5yr	0.37	0.57	0.71	0.98	1.24	1.44	**5yr**	1.07	1.41	1.63	2.11	2.65	3.33	3.84	**5yr**	2.95	3.69	4.30	5.00	5.68	**5yr**
10yr	0.41	0.63	0.78	1.10	1.42	1.59	**10yr**	1.22	1.56	1.83	2.35	2.94	3.68	4.39	**10yr**	3.26	4.23	4.94	5.63	6.36	**10yr**
25yr	0.47	0.71	0.89	1.26	1.66	1.81	**25yr**	1.44	1.77	2.16	2.70	3.36	4.25	5.26	**25yr**	3.76	5.06	5.95	6.60	7.40	**25yr**
50yr	0.52	0.78	0.98	1.40	1.89	1.99	**50yr**	1.63	1.94	2.44	2.99	3.73	4.75	6.06	**50yr**	4.21	5.82	6.89	7.47	8.30	**50yr**
100yr	0.57	0.86	1.08	1.56	2.15	2.18	**100yr**	1.85	2.13	2.78	3.31	4.13	5.33	6.99	**100yr**	4.72	6.72	7.97	8.47	9.35	**100yr**
200yr	0.63	0.96	1.21	1.75	2.44	2.38	**200yr**	2.11	2.32	3.15	3.66	4.58	5.99	8.07	**200yr**	5.30	7.76	9.28	8.11	10.54	**200yr**
500yr	0.74	1.10	1.42	2.06	2.92	2.67	**500yr**	2.52	2.61	3.74	4.18	5.23	7.03	9.81	**500yr**	6.22	9.43	11.38	9.18	12.41	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.50	0.61	0.81	1.00	1.18	**1yr**	0.86	1.15	1.34	1.72	2.15	2.71	3.03	**1yr**	2.40	2.92	3.33	4.00	4.72	**1yr**
2yr	0.36	0.56	0.68	0.93	1.14	1.35	**2yr**	0.99	1.32	1.50	1.96	2.47	3.15	3.49	**2yr**	2.78	3.36	3.88	4.69	5.28	**2yr**
5yr	0.45	0.70	0.87	1.19	1.52	1.72	**5yr**	1.31	1.68	1.95	2.47	3.09	4.06	4.60	**5yr**	3.59	4.42	5.15	5.91	6.74	**5yr**
10yr	0.55	0.84	1.04	1.45	1.88	2.09	**10yr**	1.62	2.04	2.39	2.98	3.70	5.00	5.69	**10yr**	4.42	5.47	6.37	7.16	8.13	**10yr**
25yr	0.70	1.06	1.32	1.89	2.49	2.71	**25yr**	2.15	2.65	3.11	3.86	4.69	6.50	7.52	**25yr**	5.75	7.23	8.46	9.20	10.41	**25yr**
50yr	0.85	1.29	1.60	2.30	3.10	3.30	**50yr**	2.68	3.23	3.80	4.69	5.62	7.94	9.29	**50yr**	7.03	8.94	10.46	11.11	12.54	**50yr**
100yr	1.03	1.56	1.95	2.82	3.86	4.04	**100yr**	3.33	3.95	4.65	5.70	6.73	9.69	11.48	**100yr**	8.57	11.03	12.92	13.42	15.10	**100yr**
200yr	1.25	1.88	2.38	3.44	4.80	4.94	**200yr**	4.15	4.83	5.68	6.94	8.05	11.82	14.16	**200yr**	10.46	13.62	15.94	18.44	18.16	**200yr**
500yr	1.62	2.41	3.10	4.51	6.41	6.46	**500yr**	5.53	6.32	7.42	9.01	10.21	15.37	18.71	**500yr**	13.60	17.99	21.01	24.36	23.20	**500yr**



EX-1
EX-2
100' WETLAND
BUFFER, TYP.
DP-1
PRE-DRAINAGE PLAN
340
335
330
325
320
315
310
305
300
6"CPP
N
0
20
40



Routing Diagram for EBS - Track Field
Prepared by ProTerra Design Group, LLC, Printed 4/12/2023
HydroCAD® 10.00-26 s/n 07277 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
93,812	39	>75% Grass cover, Good, HSG A (EX-2)
36,248	98	Paved track, HSG A (EX-1, EX-2)
538	76	Sand pit, HSG A (EX-2)

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
130,598	HSG A	EX-1, EX-2
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Num
93,812	0	0	0	0	93,812	>75% Grass cover, Good	
36,248	0	0	0	0	36,248	Paved track	
538	0	0	0	0	538	Sand pit	

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EX-1: EX. TRACK Runoff Area=30,576 sf 100.00% Impervious Runoff Depth=2.76"
Flow Length=22' Slope=0.0070 '/' Tc=6.0 min CN=98 Runoff=2.03 cfs 7,028 cf

Subcatchment EX-2: EX. FIELD AREA Runoff Area=100,022 sf 5.67% Impervious Runoff Depth=0.01"
Tc=6.0 min CN=43 Runoff=0.00 cfs 70 cf

Reach DP-1: DISCHARGE AREA WEST OF TRACK Inflow=2.03 cfs 7,099 cf
Outflow=2.03 cfs 7,099 cf

Summary for Subcatchment EX-1: EX. TRACK

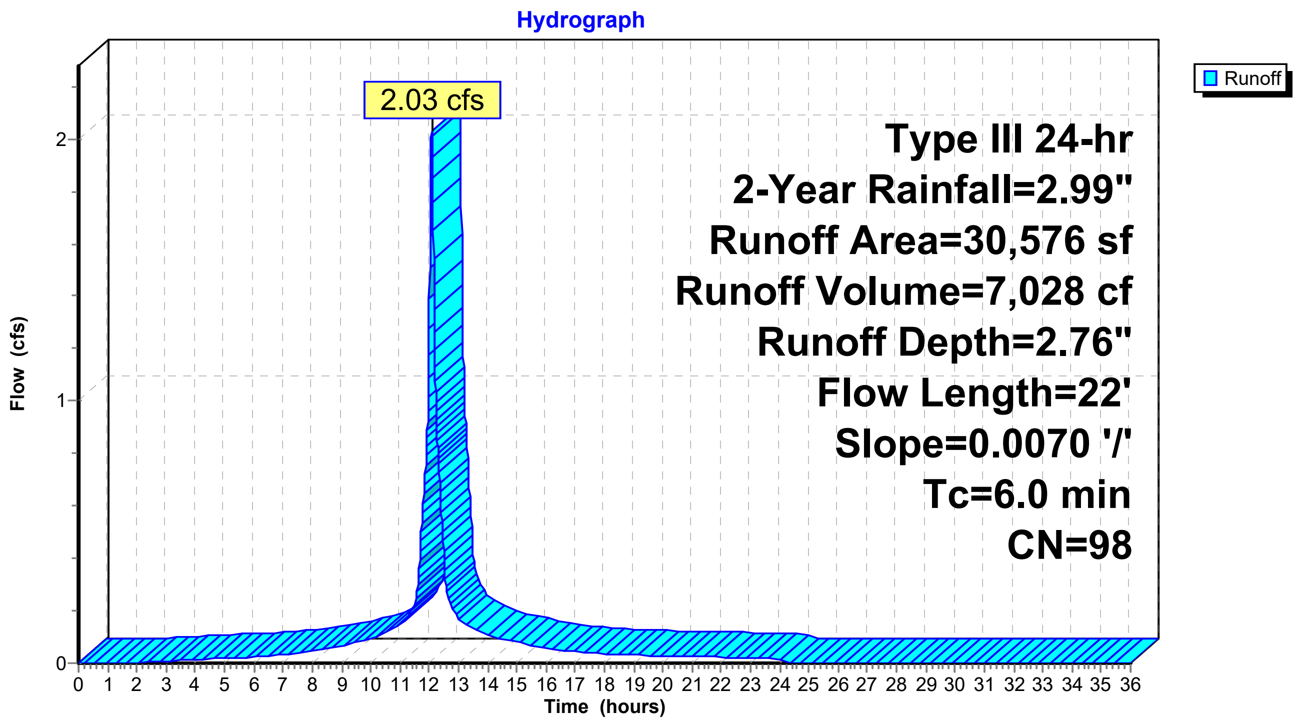
Runoff = 2.03 cfs @ 12.08 hrs, Volume= 7,028 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=2.99"

	Area (sf)	CN	Description
*	30,576	98	Paved track, HSG A
	30,576		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	22	0.0070	0.65		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.99"
0.6	22	Total,	Increased to minimum Tc = 6.0 min		

Subcatchment EX-1: EX. TRACK



Summary for Subcatchment EX-2: EX. FIELD AREA

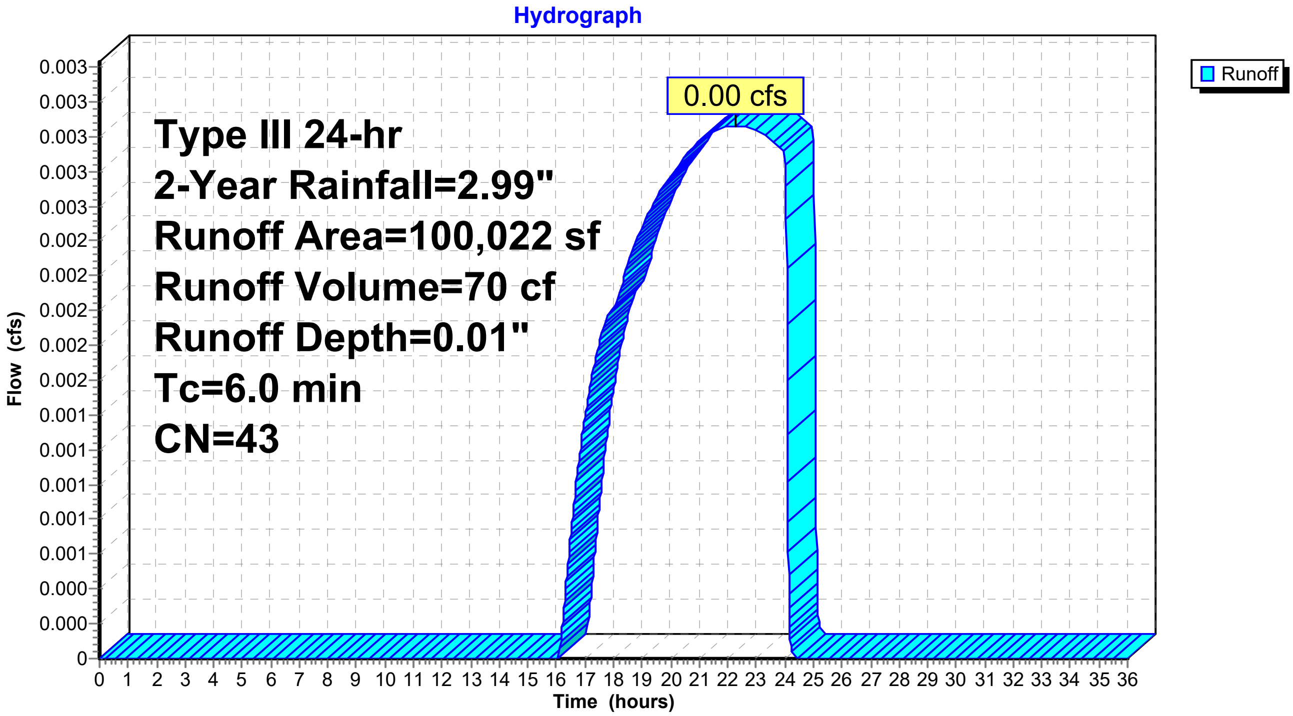
Runoff = 0.00 cfs @ 22.26 hrs, Volume= 70 cf, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=2.99"

	Area (sf)	CN	Description
	93,812	39	>75% Grass cover, Good, HSG A
*	5,672	98	Paved track, HSG A
*	538	76	Sand pit, HSG A
	100,022	43	Weighted Average
	94,350		94.33% Pervious Area
	5,672		5.67% Impervious Area

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

Subcatchment EX-2: EX. FIELD AREA

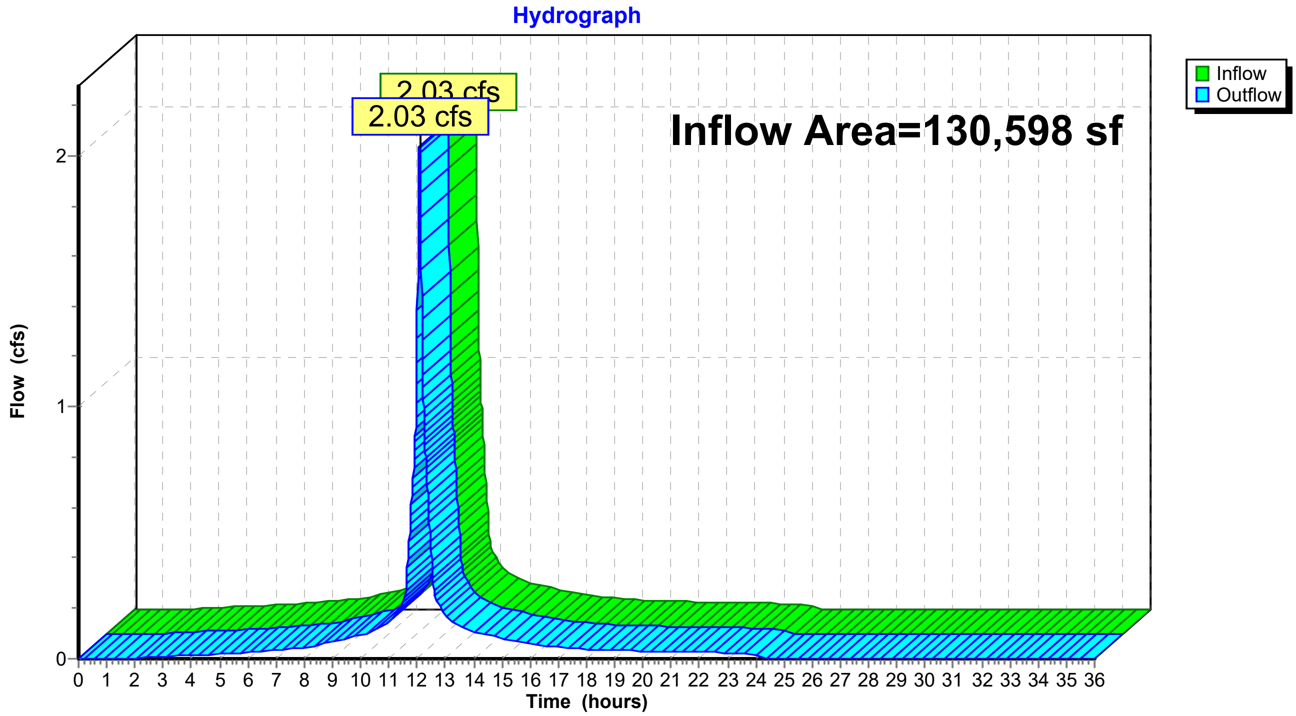


Summary for Reach DP-1: DISCHARGE AREA WEST OF TRACK

Inflow Area = 130,598 sf, 27.76% Impervious, Inflow Depth = 0.65" for 2-Year event
Inflow = 2.03 cfs @ 12.08 hrs, Volume= 7,099 cf
Outflow = 2.03 cfs @ 12.08 hrs, Volume= 7,099 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: DISCHARGE AREA WEST OF TRACK



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EX-1: EX. TRACK Runoff Area=30,576 sf 100.00% Impervious Runoff Depth=4.05"
Flow Length=22' Slope=0.0070 '/' Tc=6.0 min CN=98 Runoff=2.94 cfs 10,331 cf

Subcatchment EX-2: EX. FIELD AREA Runoff Area=100,022 sf 5.67% Impervious Runoff Depth=0.18"
Tc=6.0 min CN=43 Runoff=0.09 cfs 1,503 cf

Reach DP-1: DISCHARGE AREA WEST OF TRACK Inflow=2.94 cfs 11,834 cf
Outflow=2.94 cfs 11,834 cf

Summary for Subcatchment EX-1: EX. TRACK

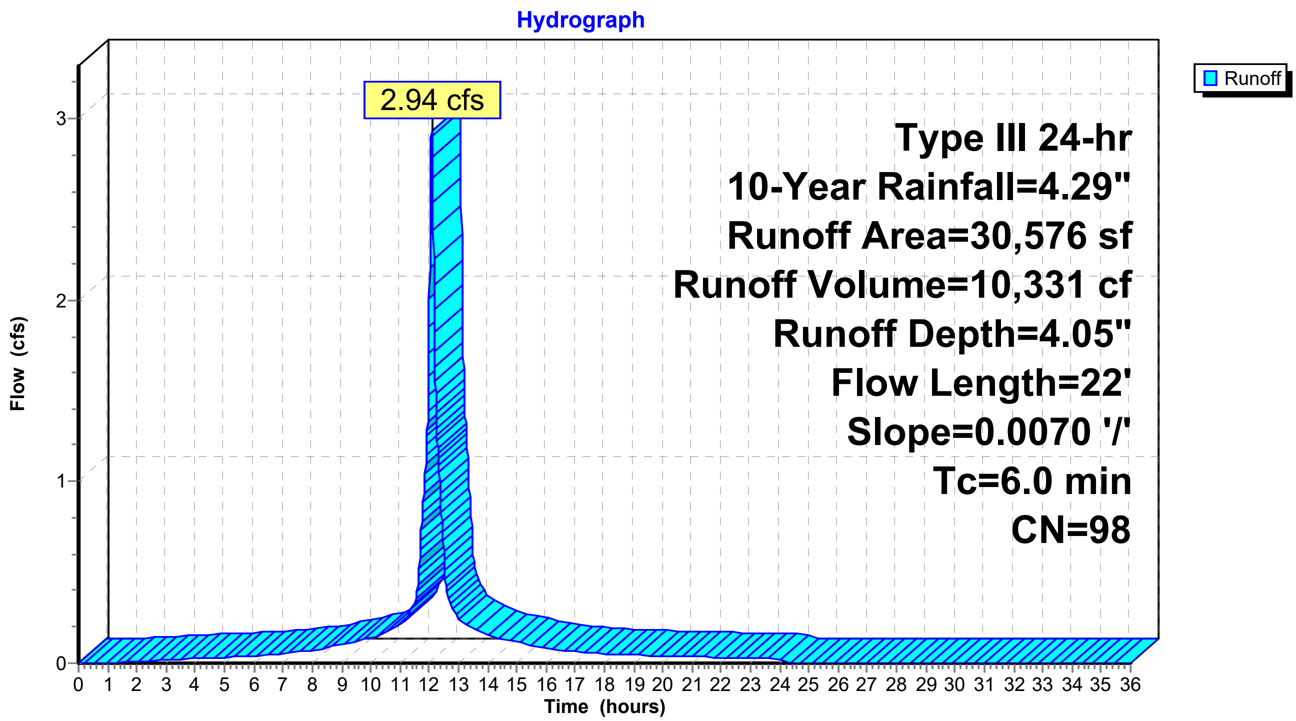
Runoff = 2.94 cfs @ 12.08 hrs, Volume= 10,331 cf, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.29"

	Area (sf)	CN	Description
*	30,576	98	Paved track, HSG A
	30,576		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	22	0.0070	0.65		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.99"
0.6	22	Total,	Increased to minimum Tc = 6.0 min		

Subcatchment EX-1: EX. TRACK



Summary for Subcatchment EX-2: EX. FIELD AREA

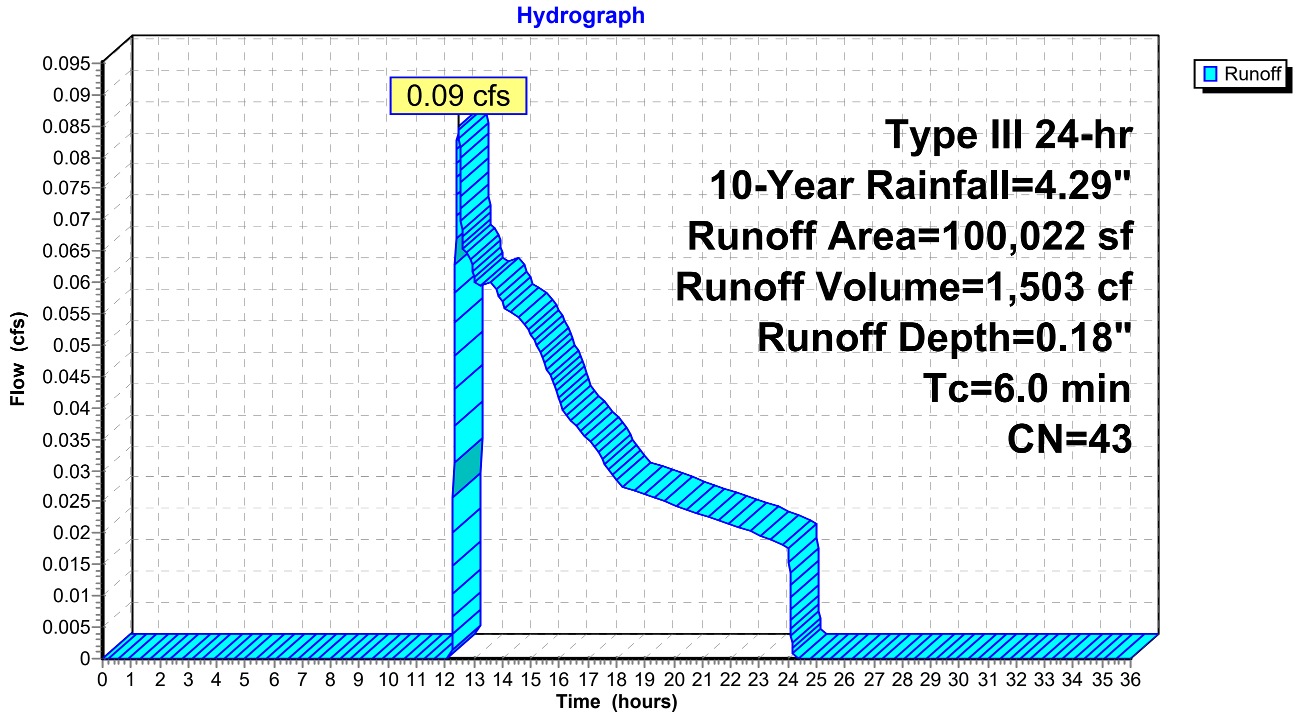
Runoff = 0.09 cfs @ 12.46 hrs, Volume= 1,503 cf, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.29"

	Area (sf)	CN	Description
	93,812	39	>75% Grass cover, Good, HSG A
*	5,672	98	Paved track, HSG A
*	538	76	Sand pit, HSG A
	100,022	43	Weighted Average
	94,350		94.33% Pervious Area
	5,672		5.67% Impervious Area

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

Subcatchment EX-2: EX. FIELD AREA

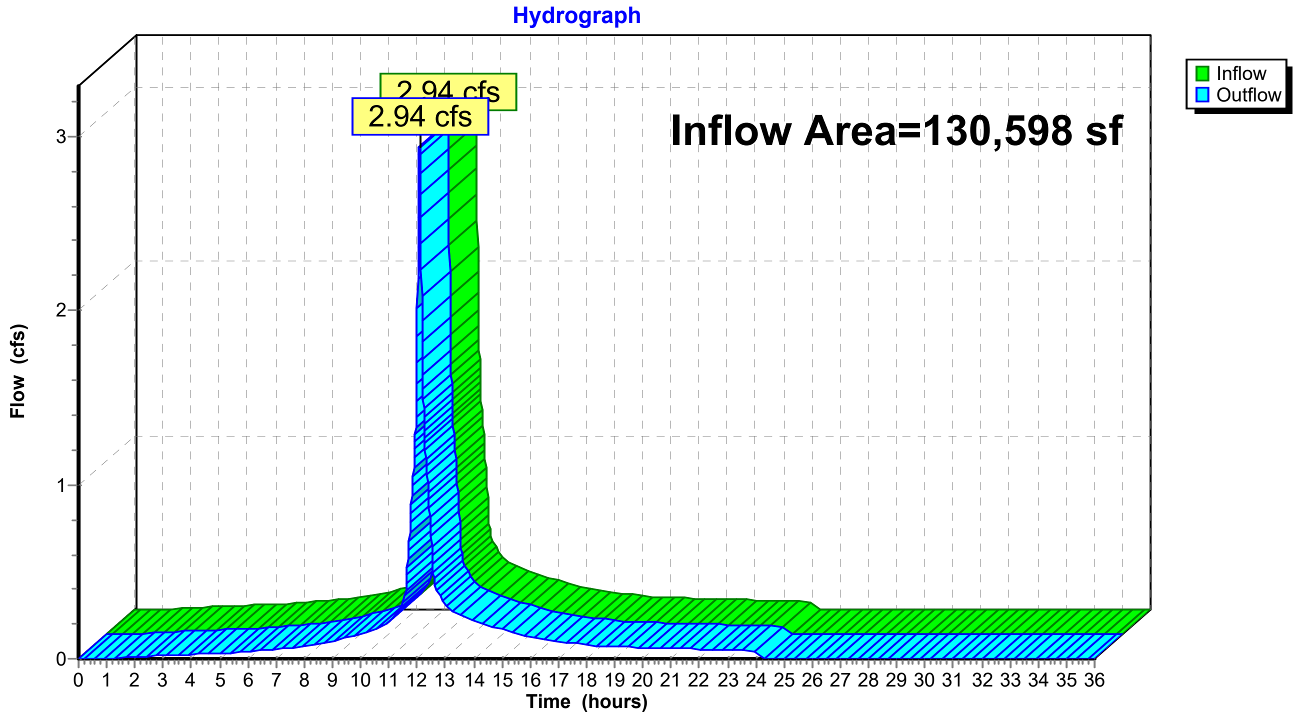


Summary for Reach DP-1: DISCHARGE AREA WEST OF TRACK

Inflow Area = 130,598 sf, 27.76% Impervious, Inflow Depth = 1.09" for 10-Year event
Inflow = 2.94 cfs @ 12.08 hrs, Volume= 11,834 cf
Outflow = 2.94 cfs @ 12.08 hrs, Volume= 11,834 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-1: DISCHARGE AREA WEST OF TRACK



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EX-1: EX. TRACK Runoff Area=30,576 sf 100.00% Impervious Runoff Depth=5.04"
Flow Length=22' Slope=0.0070 '/' Tc=6.0 min CN=98 Runoff=3.63 cfs 12,849 cf

Subcatchment EX-2: EX. FIELD AREA Runoff Area=100,022 sf 5.67% Impervious Runoff Depth=0.44"
Tc=6.0 min CN=43 Runoff=0.43 cfs 3,626 cf

Reach DP-1: DISCHARGE AREA WEST OF TRACK Inflow=3.75 cfs 16,475 cf
Outflow=3.75 cfs 16,475 cf

Summary for Subcatchment EX-1: EX. TRACK

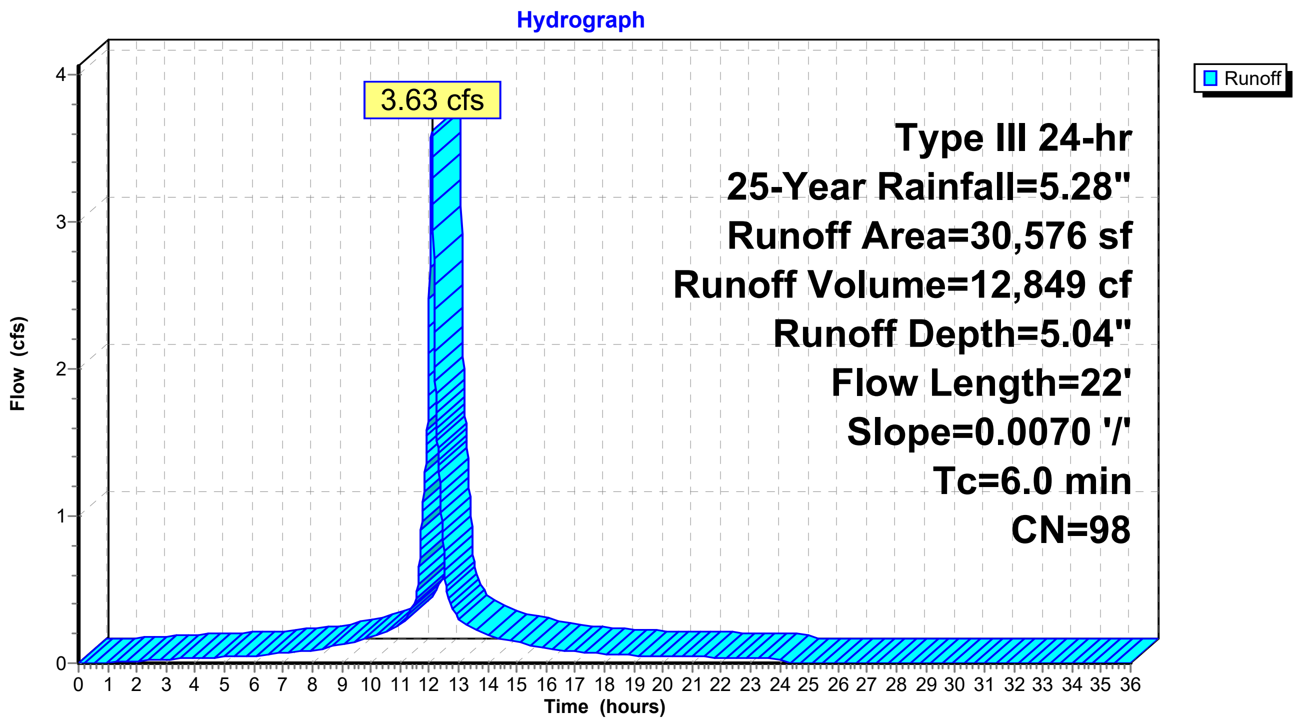
Runoff = 3.63 cfs @ 12.08 hrs, Volume= 12,849 cf, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.28"

	Area (sf)	CN	Description
*	30,576	98	Paved track, HSG A
	30,576		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	22	0.0070	0.65		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.99"
0.6	22	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX-1: EX. TRACK



Summary for Subcatchment EX-2: EX. FIELD AREA

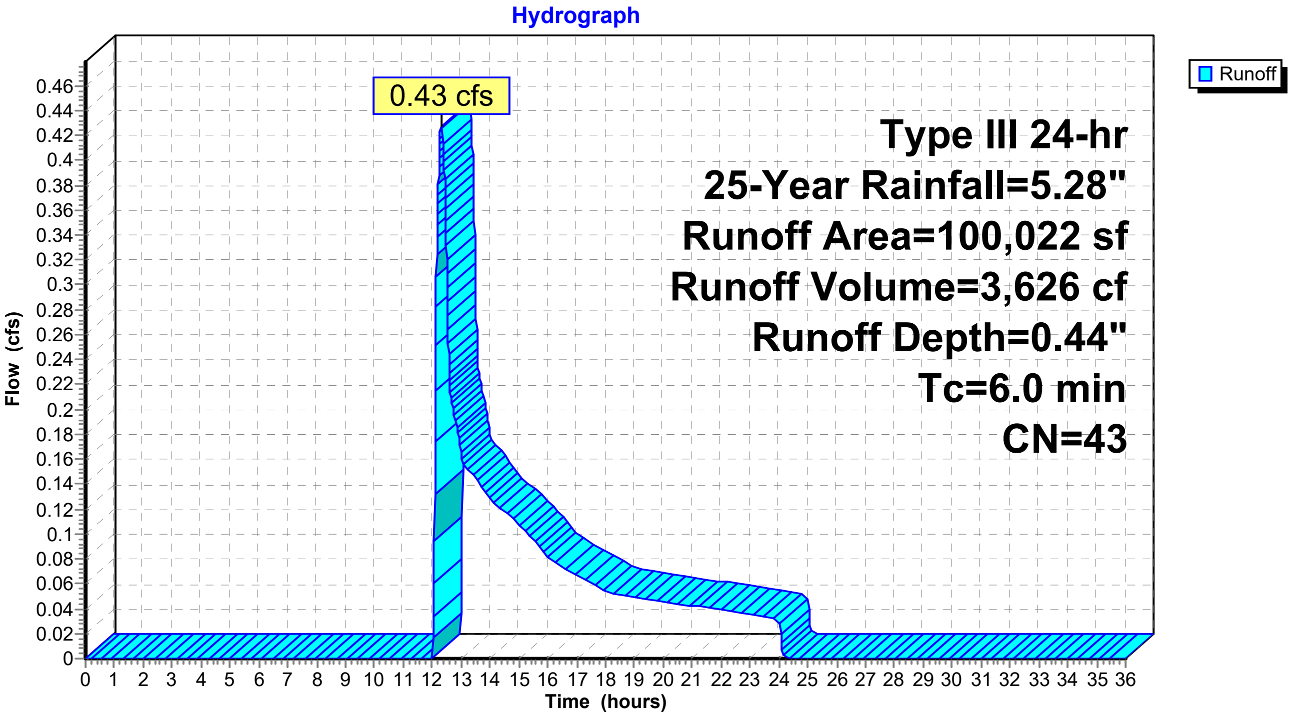
Runoff = 0.43 cfs @ 12.32 hrs, Volume= 3,626 cf, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.28"

	Area (sf)	CN	Description
	93,812	39	>75% Grass cover, Good, HSG A
*	5,672	98	Paved track, HSG A
*	538	76	Sand pit, HSG A
	100,022	43	Weighted Average
	94,350		94.33% Pervious Area
	5,672		5.67% Impervious Area

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

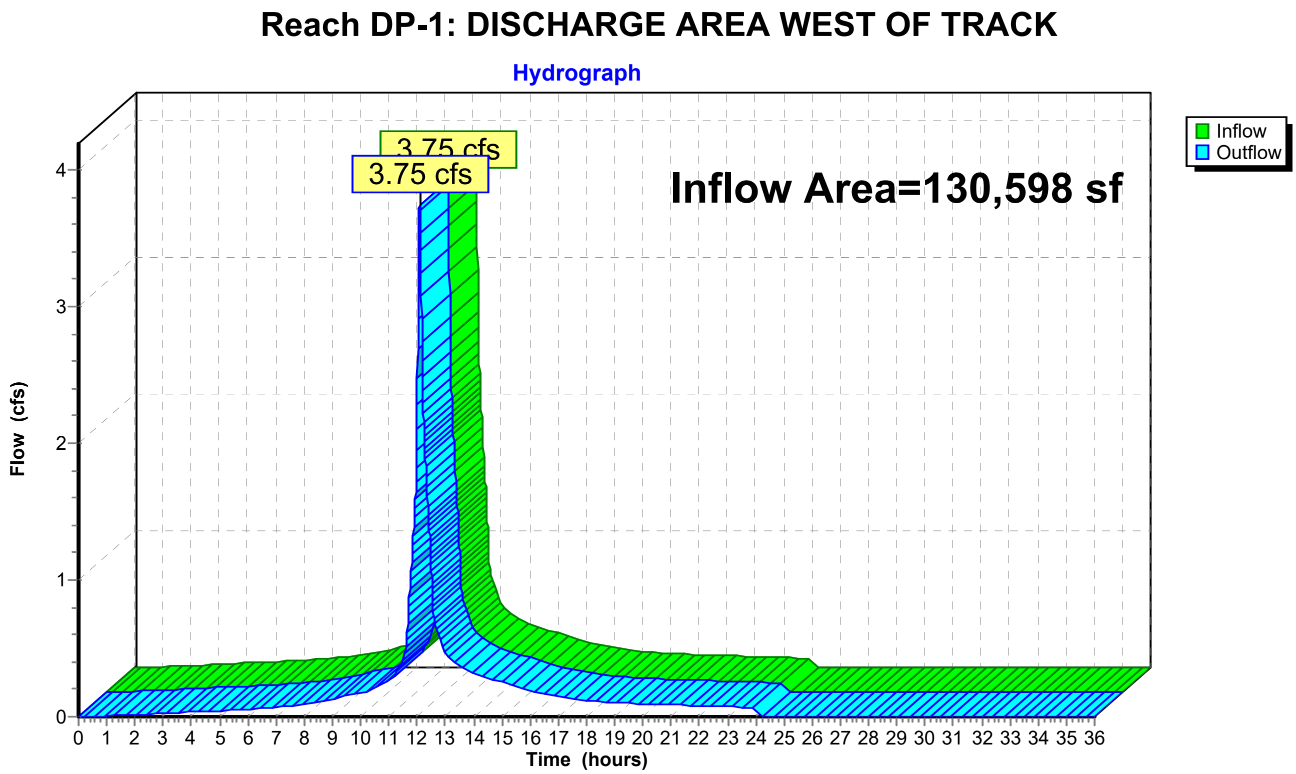
Subcatchment EX-2: EX. FIELD AREA



Summary for Reach DP-1: DISCHARGE AREA WEST OF TRACK

Inflow Area = 130,598 sf, 27.76% Impervious, Inflow Depth = 1.51" for 25-Year event
Inflow = 3.75 cfs @ 12.09 hrs, Volume= 16,475 cf
Outflow = 3.75 cfs @ 12.09 hrs, Volume= 16,475 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 EX-1: EX. TRACK Runoff Area=30,576 sf 100.00% Impervious Runoff Depth=7.00"
Flow Length=22' Slope=0.0070 '/' Tc=6.0 min CN=98 Runoff=4.99 cfs 17,838 cf

Subcatchment EX-2: EX. FIELD AREA Runoff Area=100,022 sf 5.67% Impervious Runoff Depth=1.18"
Tc=6.0 min CN=43 Runoff=2.27 cfs 9,836 cf

Reach DP-1: DISCHARGE AREA WEST OF TRACK Inflow=7.14 cfs 27,674 cf
Outflow=7.14 cfs 27,674 cf

Summary for Subcatchment EX-1: EX. TRACK

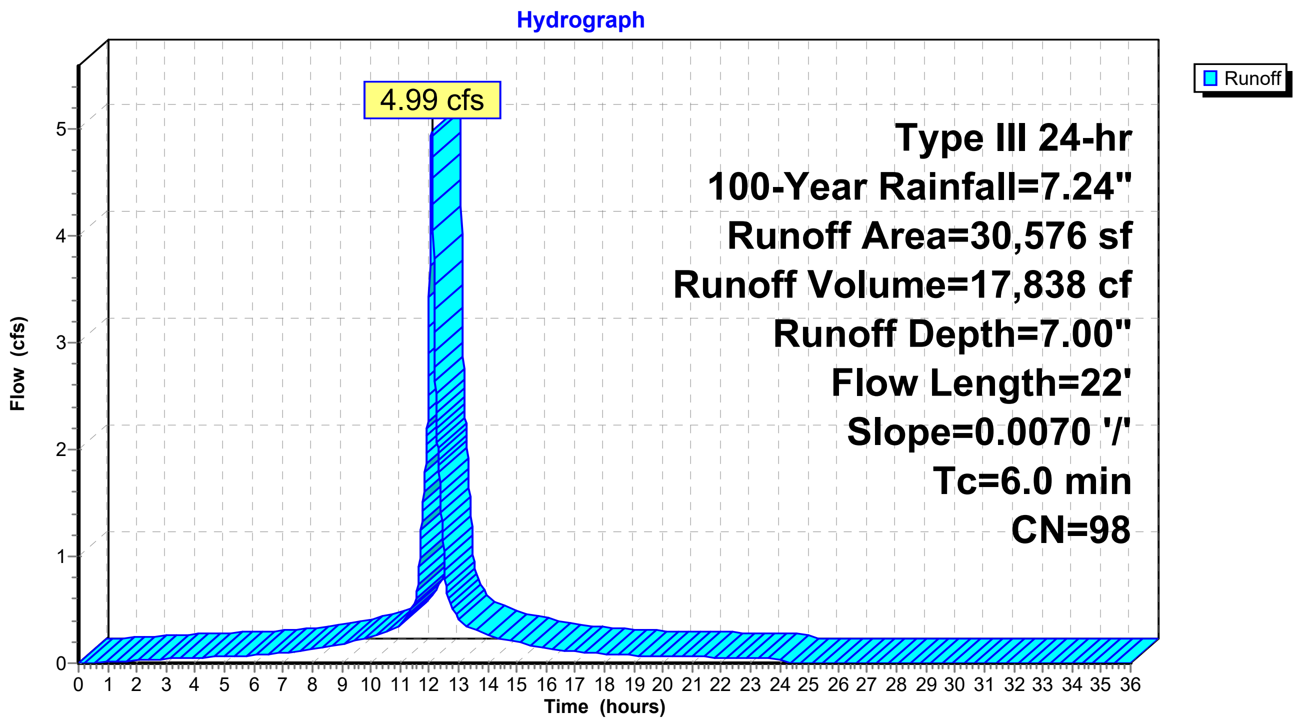
Runoff = 4.99 cfs @ 12.08 hrs, Volume= 17,838 cf, Depth= 7.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.24"

	Area (sf)	CN	Description
*	30,576	98	Paved track, HSG A
	30,576		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.6	22	0.0070	0.65		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.99"
0.6	22	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX-1: EX. TRACK



Summary for Subcatchment EX-2: EX. FIELD AREA

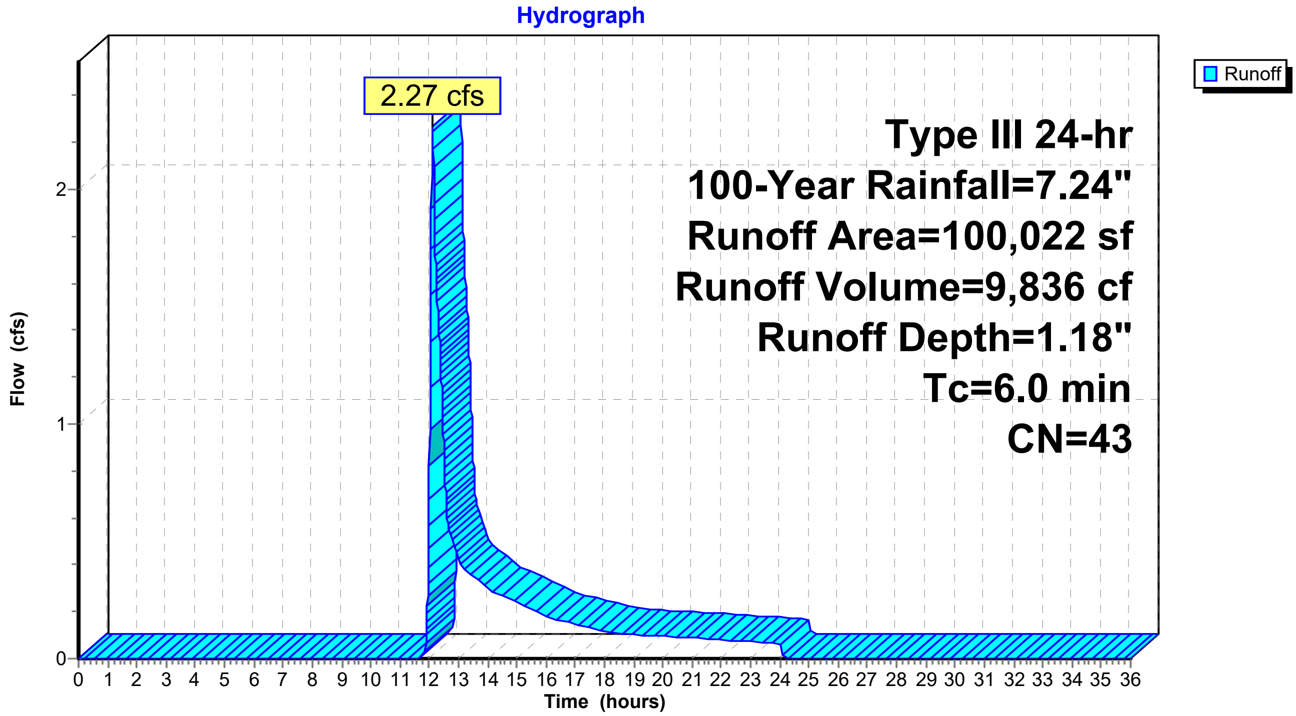
Runoff = 2.27 cfs @ 12.11 hrs, Volume= 9,836 cf, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.24"

	Area (sf)	CN	Description
	93,812	39	>75% Grass cover, Good, HSG A
*	5,672	98	Paved track, HSG A
*	538	76	Sand pit, HSG A
	100,022	43	Weighted Average
	94,350		94.33% Pervious Area
	5,672		5.67% Impervious Area

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

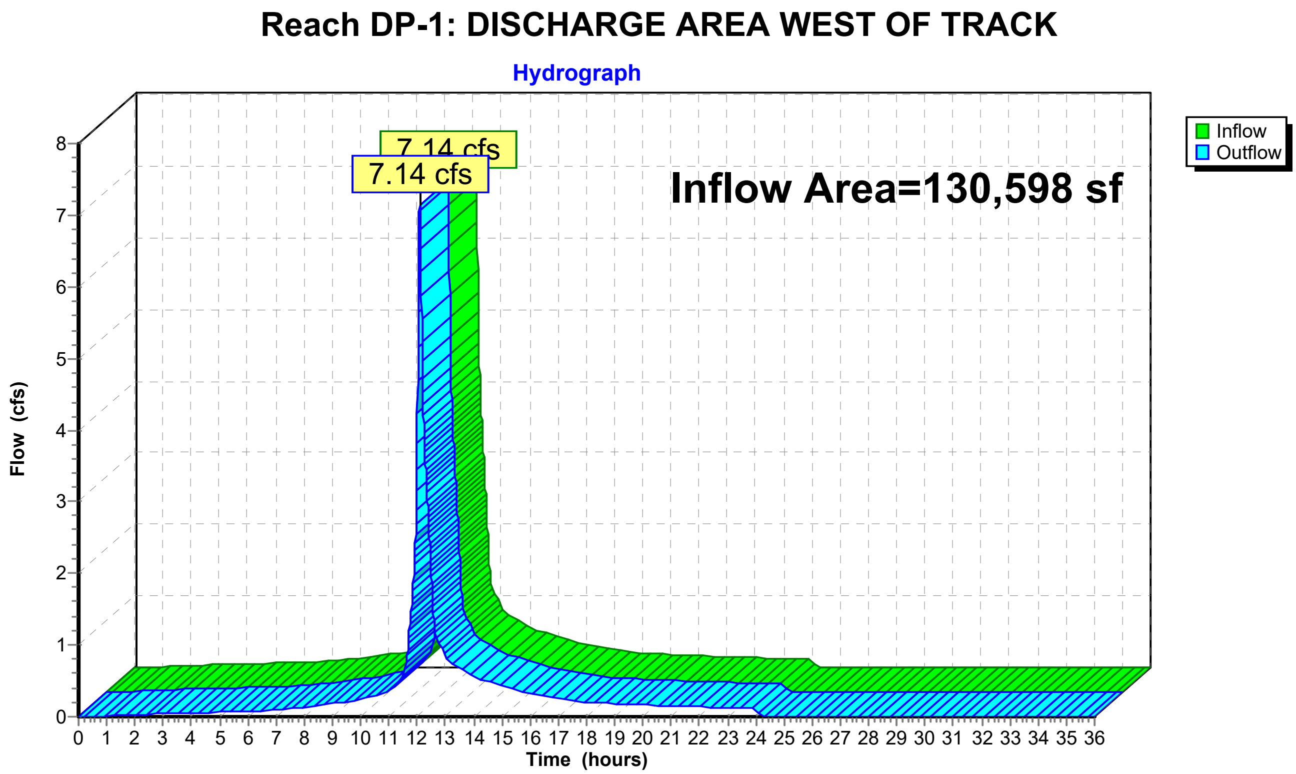
Subcatchment EX-2: EX. FIELD AREA

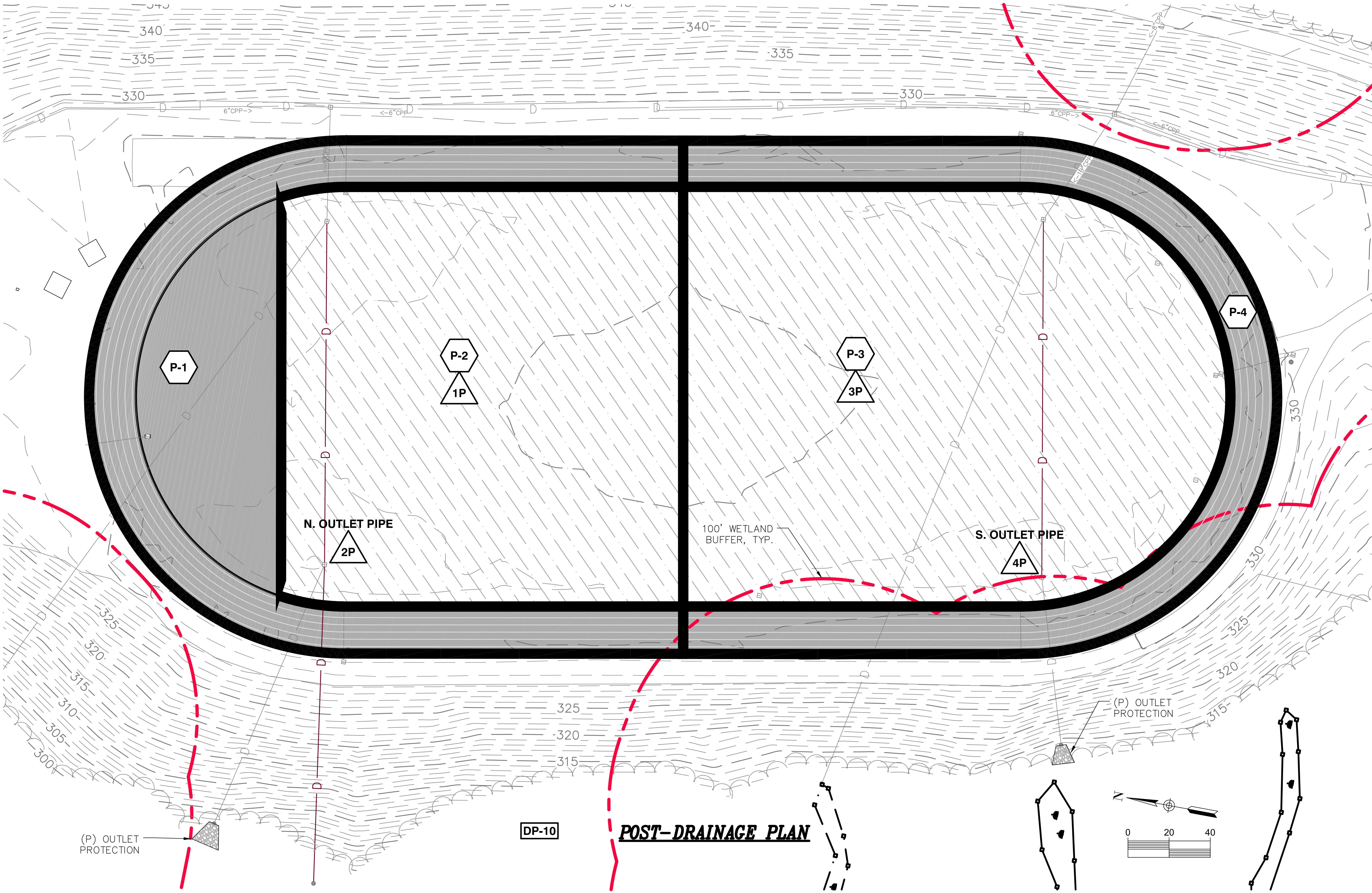


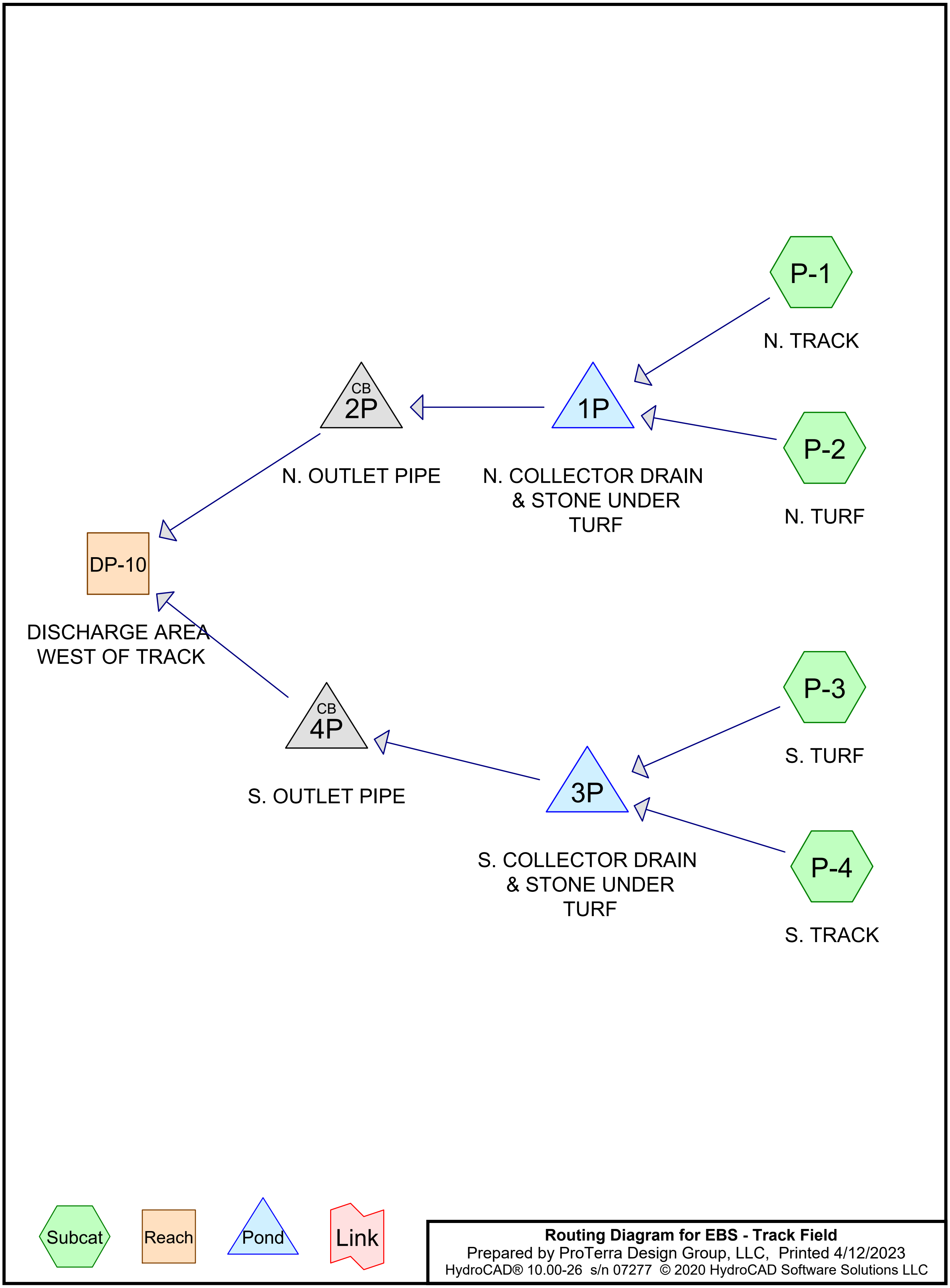
Summary for Reach DP-1: DISCHARGE AREA WEST OF TRACK

Inflow Area =	130,598 sf,	27.76% Impervious,	Inflow Depth = 2.54"	for 100-Year event
Inflow =	7.14 cfs @	12.09 hrs, Volume=	27,674 cf	
Outflow =	7.14 cfs @	12.09 hrs, Volume=	27,674 cf,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs




340
335
330
6"CPP
P-1
P-2
1P
P-3
3P
P-4
N. OUTLET PIPE
2P
100' WETLAND
BUFFER, TYP.
S. OUTLET PIPE
4P
325
320
315
310
305
300
(P) OUTLET
PROTECTION
DP-10
POST-DRAINAGE PLAN
N
0
20
40



Routing Diagram for EBS - Track Field
Prepared by ProTerra Design Group, LLC, Printed 4/12/2023
HydroCAD® 10.00-26 s/n 07277 © 2020 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
41,114	98	Paved track, HSG A (P-1, P-4)
89,484	98	Synthetic turf, HSG A (P-2, P-3)

Soil Listing (selected nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
130,598	HSG A	P-1, P-2, P-3, P-4
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	

Ground Covers (selected nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
41,114	0	0	0	0	41,114	Paved track	P-1, P-4
89,484	0	0	0	0	89,484	Synthetic turf	P-2, P-3

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P-1: N. TRACK Runoff Area=25,582 sf 100.00% Impervious Runoff Depth=2.76"
Tc=6.0 min CN=98 Runoff=1.70 cfs 5,880 cf

Subcatchment P-2: N. TURF Runoff Area=39,721 sf 100.00% Impervious Runoff Depth=2.76"
Tc=6.0 min CN=98 Runoff=2.64 cfs 9,130 cf

Subcatchment P-3: S. TURF Runoff Area=49,763 sf 100.00% Impervious Runoff Depth=2.76"
Tc=6.0 min CN=98 Runoff=3.31 cfs 11,438 cf

Subcatchment P-4: S. TRACK Runoff Area=15,532 sf 100.00% Impervious Runoff Depth=2.76"
Tc=6.0 min CN=98 Runoff=1.03 cfs 3,570 cf

Reach DP-10: DISCHARGE AREA WEST OF TRACK Inflow=1.51 cfs 15,137 cf
Outflow=1.51 cfs 15,137 cf

Pond 1P: N. COLLECTOR DRAIN & STONE Peak Elev=329.09' Storage=2,508 cf Inflow=4.34 cfs 15,010 cf
Discarded=0.97 cfs 6,351 cf Primary=1.00 cfs 8,654 cf Outflow=1.98 cfs 15,005 cf

Pond 2P: N. OUTLET PIPE Peak Elev=320.63' Inflow=1.00 cfs 8,654 cf
10.0" Round Culvert n=0.013 L=136.8' S=0.1334 '/' Outflow=1.00 cfs 8,654 cf

Pond 3P: S. COLLECTOR DRAIN & STONE Peak Elev=329.09' Storage=2,992 cf Inflow=4.34 cfs 15,009 cf
Discarded=1.22 cfs 8,500 cf Primary=0.51 cfs 6,483 cf Outflow=1.72 cfs 14,983 cf

Pond 4P: S. OUTLET PIPE Peak Elev=320.60' Inflow=0.51 cfs 6,483 cf
8.0" Round Culvert n=0.013 L=82.1' S=0.0821 '/' Outflow=0.51 cfs 6,483 cf

Summary for Subcatchment P-1: N. TRACK

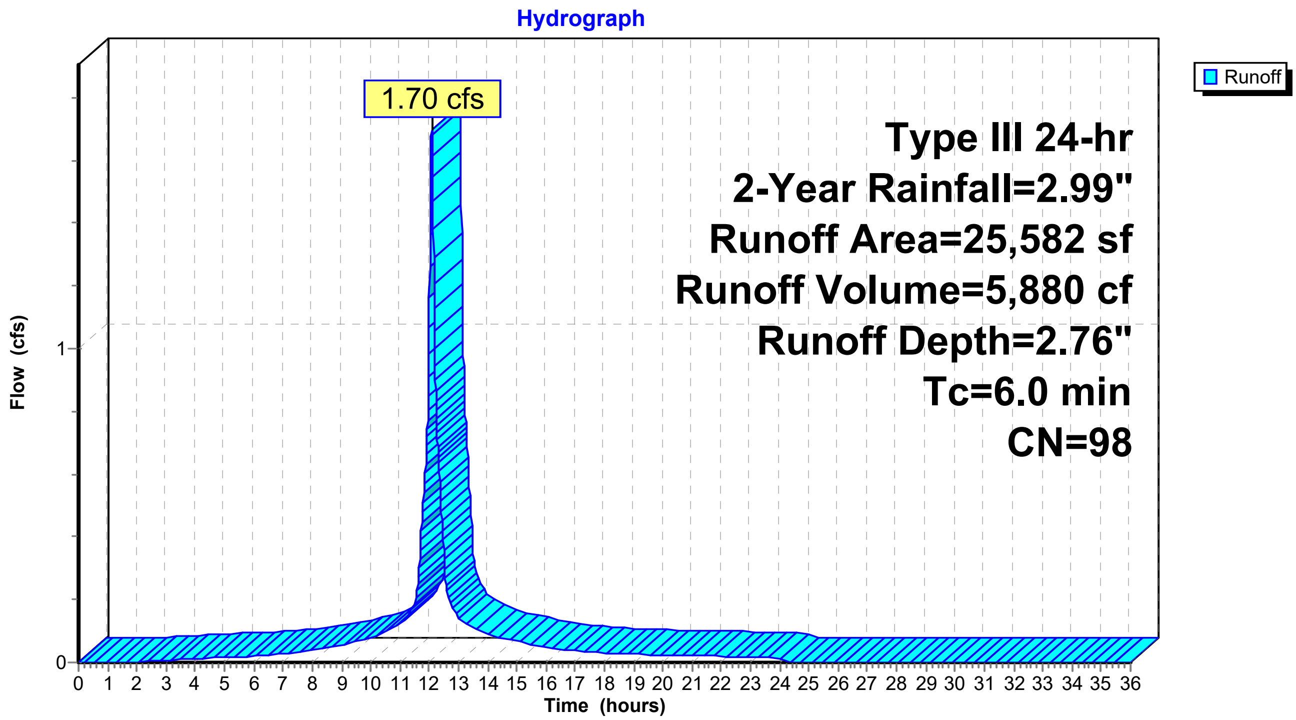
Runoff = 1.70 cfs @ 12.08 hrs, Volume= 5,880 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=2.99"

Area (sf)	CN	Description
25,582	98	Paved track, HSG A
25,582		100.00% Impervious Area

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

Subcatchment P-1: N. TRACK



Summary for Subcatchment P-2: N. TURF

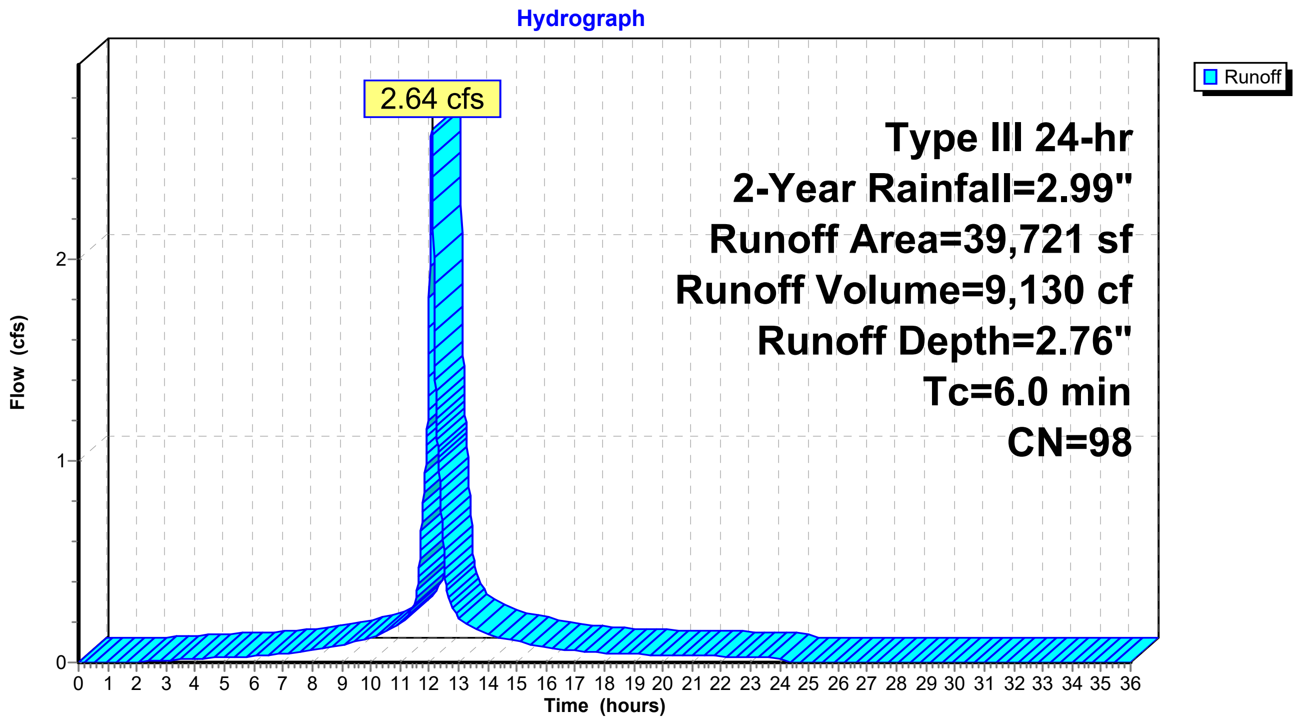
Runoff = 2.64 cfs @ 12.08 hrs, Volume= 9,130 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=2.99"

Area (sf)	CN	Description
39,721	98	Synthetic turf, HSG A
39,721		100.00% Impervious Area

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

Subcatchment P-2: N. TURF



Summary for Subcatchment P-3: S. TURF

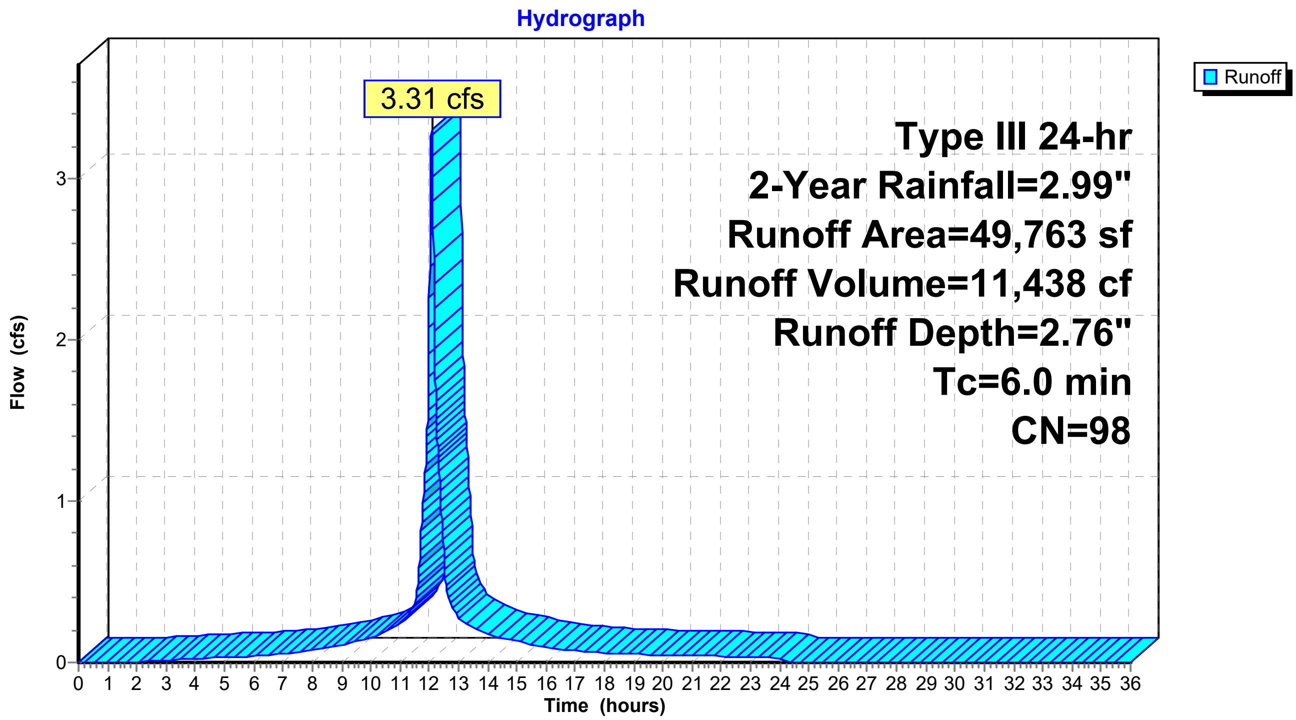
Runoff = 3.31 cfs @ 12.08 hrs, Volume= 11,438 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=2.99"

	Area (sf)	CN	Description
*	49,763	98	Synthetic turf, HSG A
	49,763		100.00% Impervious Area

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

Subcatchment P-3: S. TURF



Summary for Subcatchment P-4: S. TRACK

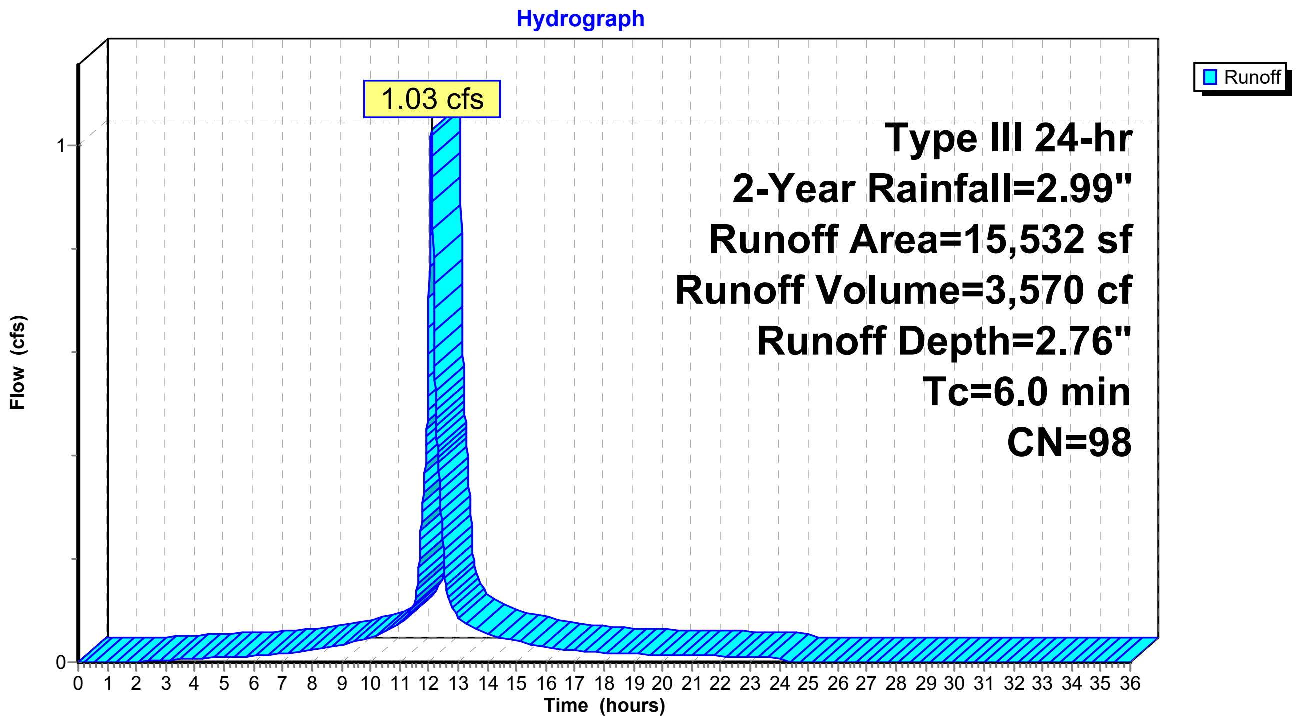
Runoff = 1.03 cfs @ 12.08 hrs, Volume= 3,570 cf, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=2.99"

Area (sf)	CN	Description
15,532	98	Paved track, HSG A
15,532		100.00% Impervious Area

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

Subcatchment P-4: S. TRACK

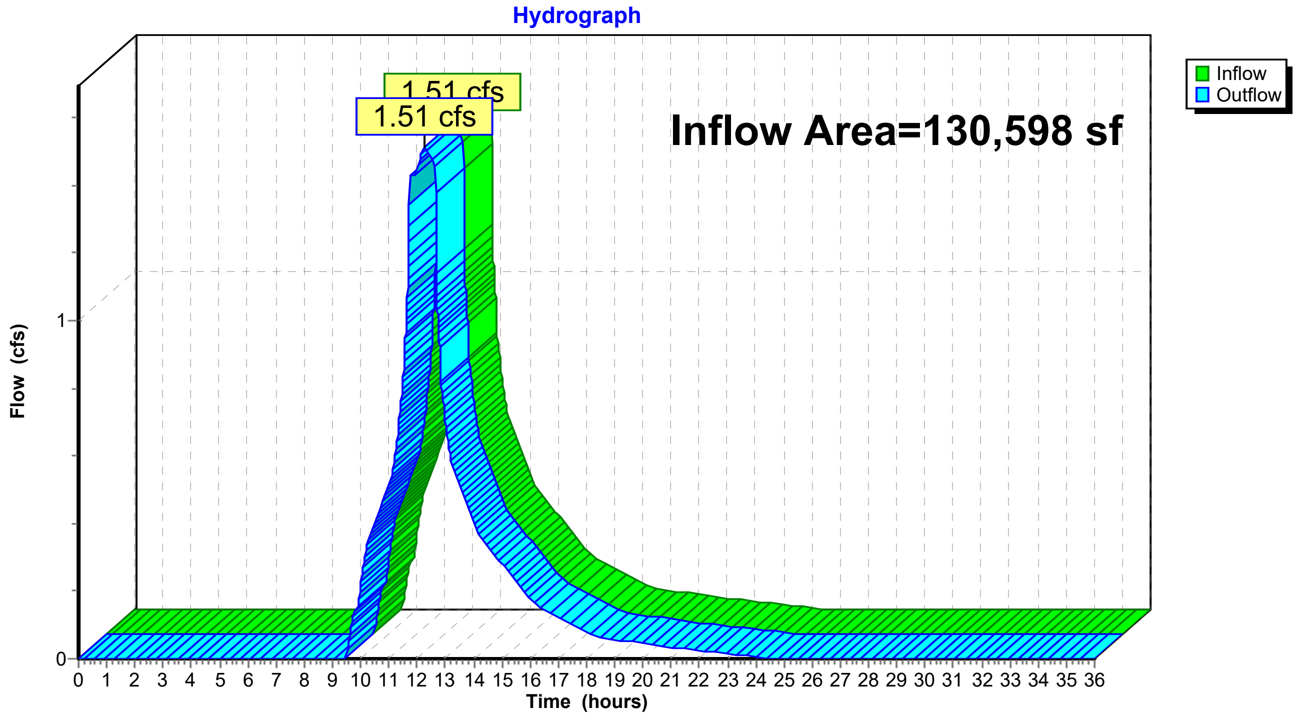


Summary for Reach DP-10: DISCHARGE AREA WEST OF TRACK

Inflow Area = 130,598 sf,100.00% Impervious, Inflow Depth = 1.39" for 2-Year event
Inflow = 1.51 cfs @ 12.26 hrs, Volume= 15,137 cf
Outflow = 1.51 cfs @ 12.26 hrs, Volume= 15,137 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-10: DISCHARGE AREA WEST OF TRACK



Summary for Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area =	65,303 sf,100.00% Impervious,	Inflow Depth = 2.76" for 2-Year event		
Inflow =	4.34 cfs @	12.08 hrs, Volume=	15,010 cf	
Outflow =	1.98 cfs @	12.25 hrs, Volume=	15,005 cf,	Atten= 54%, Lag= 10.0 min
Discarded =	0.97 cfs @	11.95 hrs, Volume=	6,351 cf	
Primary =	1.00 cfs @	12.25 hrs, Volume=	8,654 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.09' @ 12.25 hrs Surf.Area= 41,242 sf Storage= 2,508 cf

Plug-Flow detention time= 94.8 min calculated for 15,005 cf (100% of inflow)
Center-of-Mass det. time= 94.6 min (852.4 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	325.18'	649 cf	**36.0" W x 24.0" H Box Stone Storage** L= 340.0' S= 0.0050 '/' 2,040 cf Overall - 185 cf Embedded = 1,855 cf x 35.0% Voids
#2	325.68'	185 cf	**10.0" Round Pipe Storage** Inside #1 L= 340.0' S= 0.0050 '/'
#3	326.30'	325 cf	**36.0" W x 24.4" H Box Stone Storage** L= 167.0' S= 0.0040 '/' 1,019 cf Overall - 91 cf Embedded = 928 cf x 35.0% Voids
#4	326.80'	91 cf	**10.0" Round Pipe Storage** Inside #3 L= 167.0' S= 0.0040 '/'
#5	329.00'	11,539 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 32,968 cf Overall x 35.0% Voids
		12,789 cf	Total Available Storage

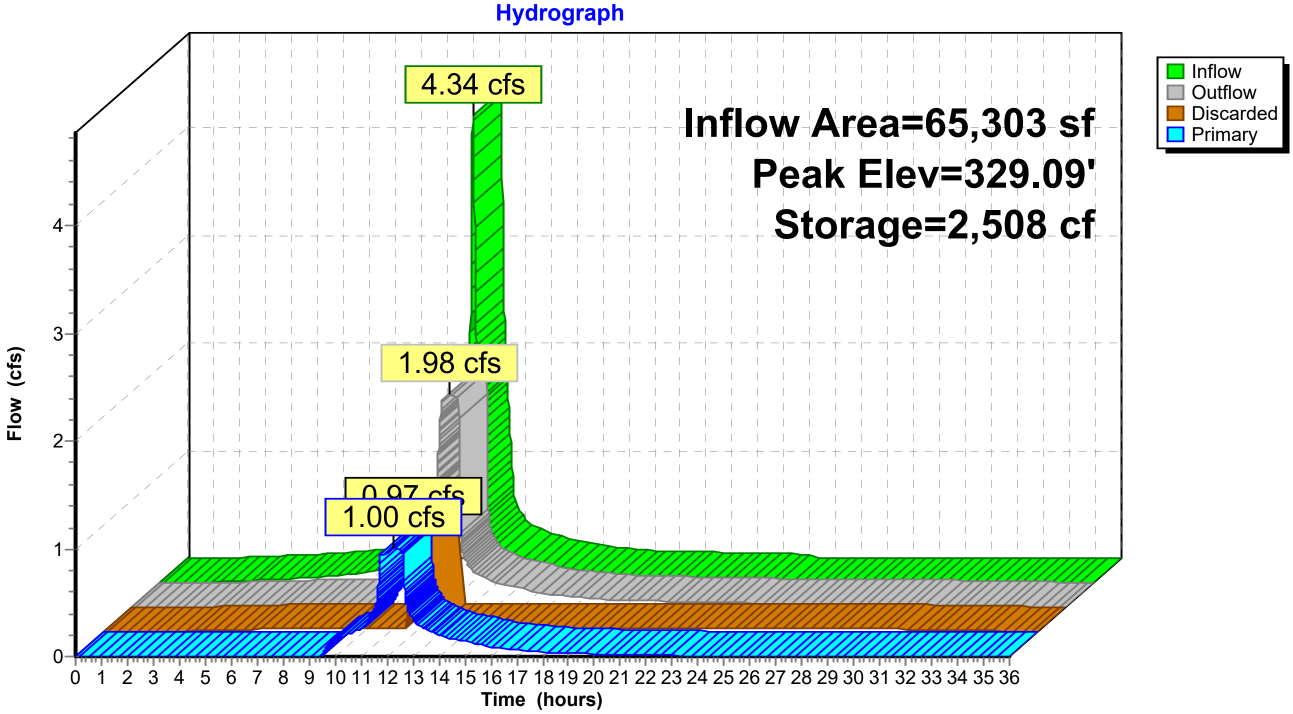
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	39,721	0	0
329.83	39,721	32,968	32,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	325.18'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.58'	**10.0" Round Culvert** L= 13.4' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.58' / 325.50' S= 0.0060 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**6.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.97 cfs @ 11.95 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.97 cfs)

Primary OutFlow Max=1.00 cfs @ 12.25 hrs HW=329.09' TW=320.63' (Dynamic Tailwater)
└─**2=Culvert** (Passes 1.00 cfs of 4.62 cfs potential flow)
  ├─**3=Orifice** (Orifice Controls 1.00 cfs @ 4.36 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF



Summary for Pond 2P: N. OUTLET PIPE

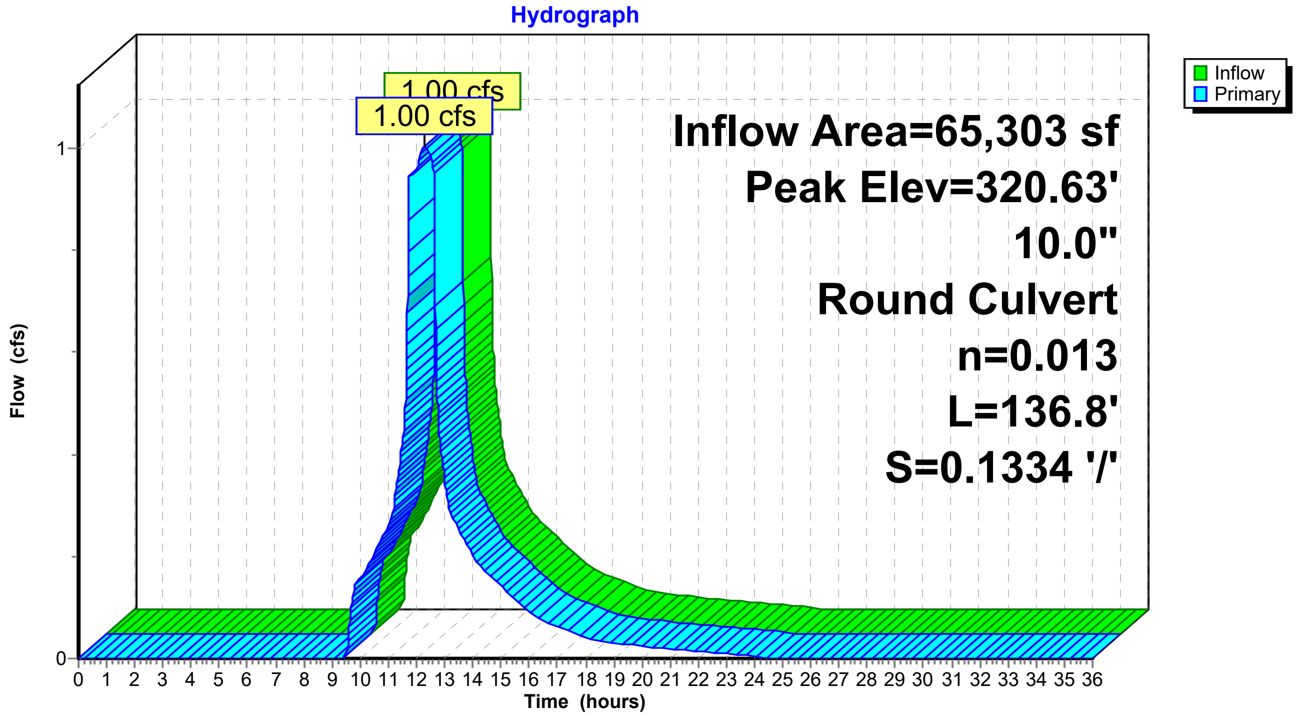
Inflow Area = 65,303 sf,100.00% Impervious, Inflow Depth = 1.59" for 2-Year event
Inflow = 1.00 cfs @ 12.25 hrs, Volume= 8,654 cf
Outflow = 1.00 cfs @ 12.25 hrs, Volume= 8,654 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.00 cfs @ 12.25 hrs, Volume= 8,654 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 320.63' @ 12.25 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.07'	**10.0" Round Culvert** L= 136.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.07' / 301.82' S= 0.1334 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=1.00 cfs @ 12.25 hrs HW=320.63' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.00 cfs @ 2.56 fps)

Pond 2P: N. OUTLET PIPE



Summary for Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area = 65,295 sf,100.00% Impervious, Inflow Depth = 2.76" for 2-Year event
Inflow = 4.34 cfs @ 12.08 hrs, Volume= 15,009 cf
Outflow = 1.72 cfs @ 12.30 hrs, Volume= 14,983 cf, Atten= 60%, Lag= 12.9 min
Discarded = 1.22 cfs @ 11.90 hrs, Volume= 8,500 cf
Primary = 0.51 cfs @ 12.30 hrs, Volume= 6,483 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.09' @ 12.30 hrs Surf.Area= 51,503 sf Storage= 2,992 cf

Plug-Flow detention time= 110.7 min calculated for 14,983 cf (100% of inflow)
Center-of-Mass det. time= 109.6 min (867.4 - 757.8)

Volume	Invert	Avail.Storage	Storage Description
#1	324.85'	781 cf	**36.0" W x 24.0" H Box Stone Storage** L= 409.0' S= 0.0050 '/' 2,454 cf Overall - 223 cf Embedded = 2,231 cf x 35.0% Voids
#2	325.35'	223 cf	**10.0" Round Pipe Storage** Inside #1 L= 409.0' S= 0.0050 '/'
#3	326.13'	329 cf	**36.0" W x 24.2" H Box Stone Storage** L= 171.0' S= 0.0050 '/' 1,035 cf Overall - 93 cf Embedded = 941 cf x 35.0% Voids
#4	326.63'	93 cf	**10.0" Round Pipe Storage** Inside #3 L= 171.0' S= 0.0050 '/'
#5	329.00'	14,456 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 41,303 cf Overall x 35.0% Voids
		15,883 cf	Total Available Storage

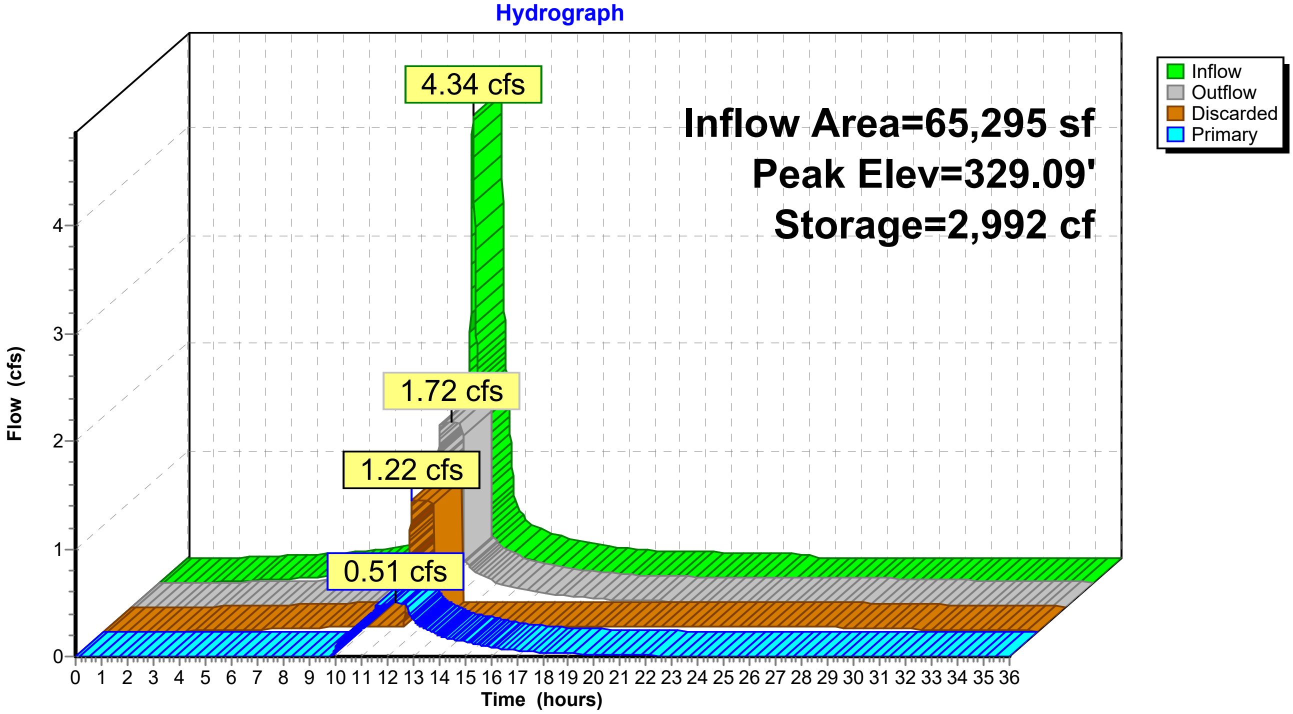
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	49,763	0	0
329.83	49,763	41,303	41,303

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.85'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.25'	**10.0" Round Culvert** L= 23.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.25' / 325.13' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**4.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=1.22 cfs @ 11.90 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.22 cfs)

Primary OutFlow Max=0.51 cfs @ 12.30 hrs HW=329.09' TW=320.60' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.51 cfs of 4.86 cfs potential flow)
  ├─**3=Orifice** (Orifice Controls 0.51 cfs @ 4.57 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF



Summary for Pond 4P: S. OUTLET PIPE

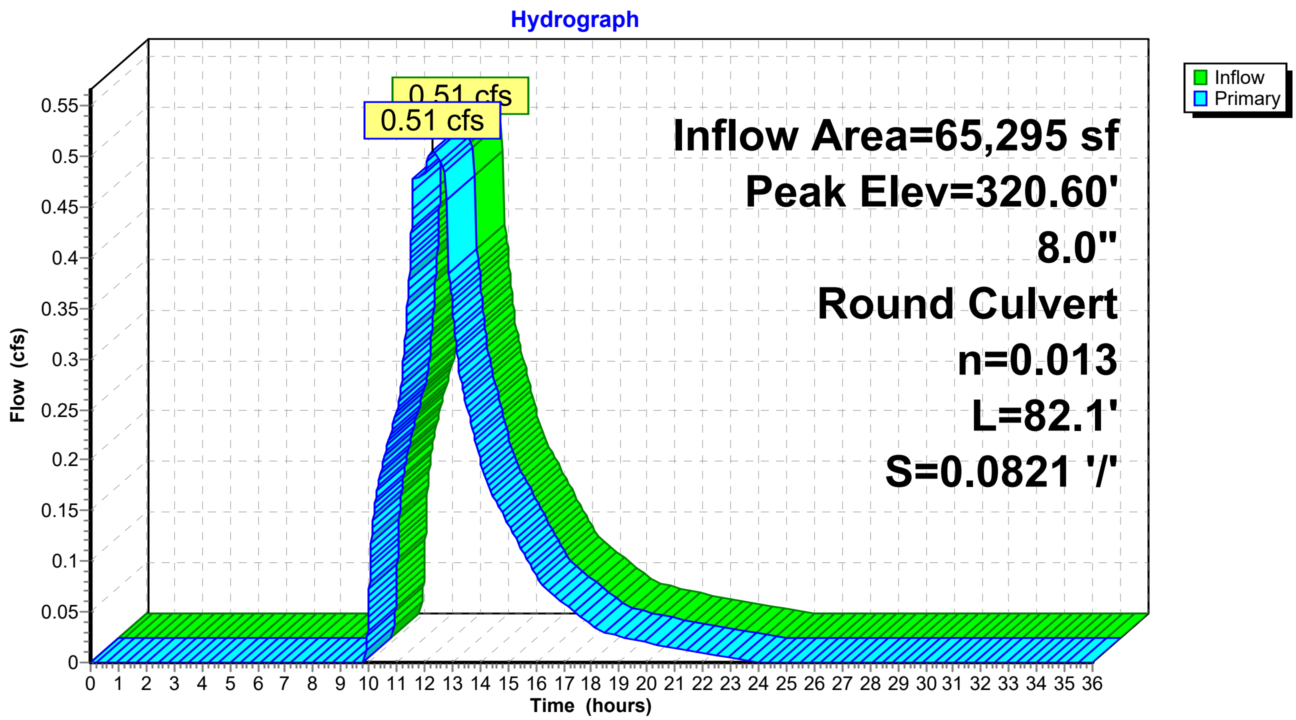
Inflow Area =	65,295 sf,100.00% Impervious,	Inflow Depth = 1.19"	for 2-Year event	
Inflow =	0.51 cfs @	12.30 hrs, Volume=	6,483 cf	
Outflow =	0.51 cfs @	12.30 hrs, Volume=	6,483 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.51 cfs @	12.30 hrs, Volume=	6,483 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 320.60' @ 12.30 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.18'	**8.0" Round Culvert** L= 82.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.18' / 313.44' S= 0.0821 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.51 cfs @ 12.30 hrs HW=320.60' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.51 cfs @ 2.20 fps)

Pond 4P: S. OUTLET PIPE



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P-1: N. TRACK Runoff Area=25,582 sf 100.00% Impervious Runoff Depth=4.05"
Tc=6.0 min CN=98 Runoff=2.46 cfs 8,643 cf

Subcatchment P-2: N. TURF Runoff Area=39,721 sf 100.00% Impervious Runoff Depth=4.05"
Tc=6.0 min CN=98 Runoff=3.82 cfs 13,421 cf

Subcatchment P-3: S. TURF Runoff Area=49,763 sf 100.00% Impervious Runoff Depth=4.05"
Tc=6.0 min CN=98 Runoff=4.78 cfs 16,813 cf

Subcatchment P-4: S. TRACK Runoff Area=15,532 sf 100.00% Impervious Runoff Depth=4.05"
Tc=6.0 min CN=98 Runoff=1.49 cfs 5,248 cf

Reach DP-10: DISCHARGE AREA WEST OF TRACK Inflow=1.62 cfs 23,832 cf
Outflow=1.62 cfs 23,832 cf

Pond 1P: N. COLLECTOR DRAIN & STONE Peak Elev=329.22' Storage=4,351 cf Inflow=6.28 cfs 22,064 cf
Discarded=0.97 cfs 8,484 cf Primary=1.08 cfs 13,572 cf Outflow=2.06 cfs 22,057 cf

Pond 2P: N. OUTLET PIPE Peak Elev=320.66' Inflow=1.08 cfs 13,572 cf
10.0" Round Culvert n=0.013 L=136.8' S=0.1334 '/' Outflow=1.08 cfs 13,572 cf

Pond 3P: S. COLLECTOR DRAIN & STONE Peak Elev=329.21' Storage=5,111 cf Inflow=6.28 cfs 22,061 cf
Discarded=1.22 cfs 11,772 cf Primary=0.54 cfs 10,260 cf Outflow=1.75 cfs 22,032 cf

Pond 4P: S. OUTLET PIPE Peak Elev=320.61' Inflow=0.54 cfs 10,260 cf
8.0" Round Culvert n=0.013 L=82.1' S=0.0821 '/' Outflow=0.54 cfs 10,260 cf

Summary for Subcatchment P-1: N. TRACK

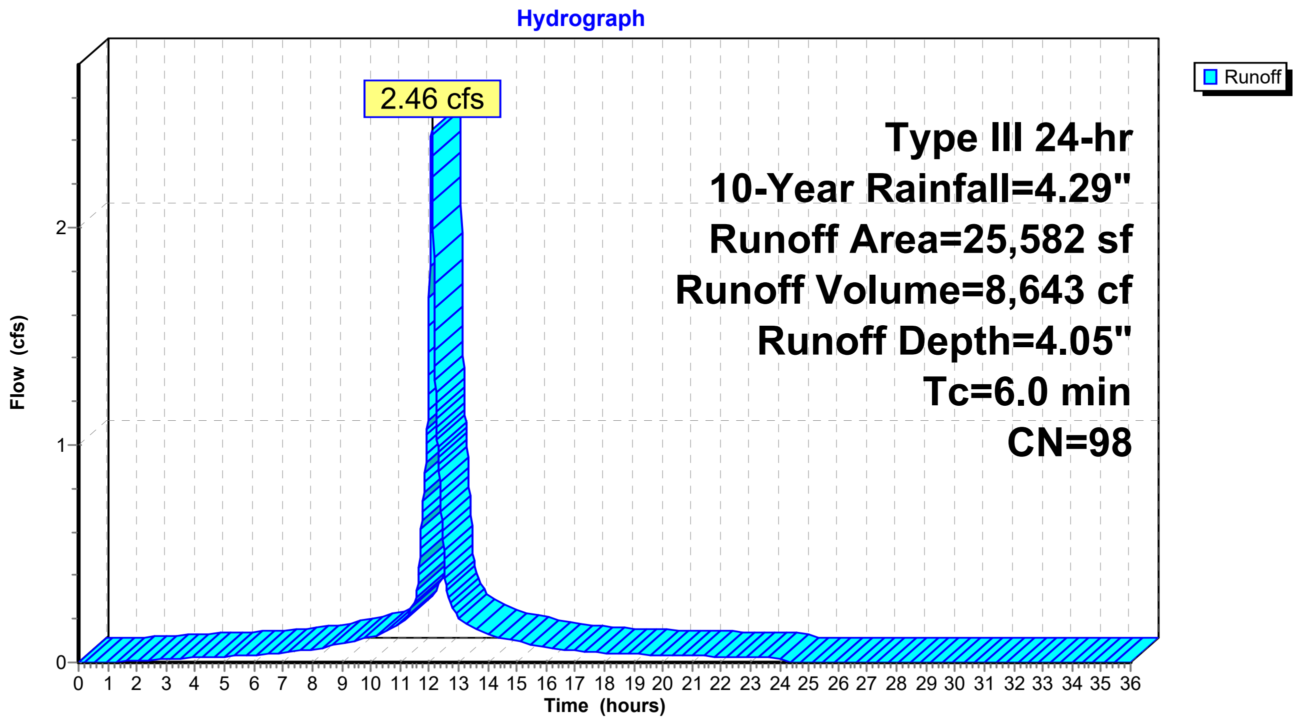
Runoff = 2.46 cfs @ 12.08 hrs, Volume= 8,643 cf, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.29"

Area (sf)	CN	Description
25,582	98	Paved track, HSG A
25,582		100.00% Impervious Area

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

Subcatchment P-1: N. TRACK



Summary for Subcatchment P-2: N. TURF

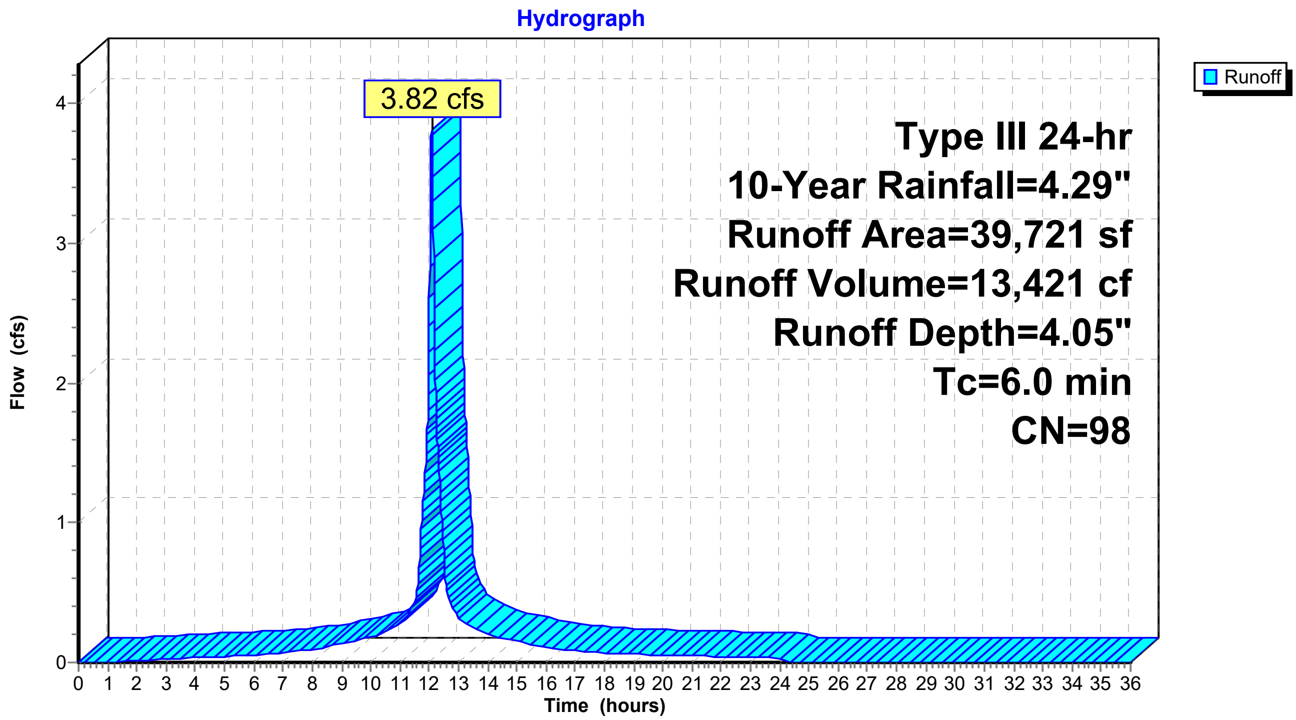
Runoff = 3.82 cfs @ 12.08 hrs, Volume= 13,421 cf, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.29"

Area (sf)	CN	Description
39,721	98	Synthetic turf, HSG A
39,721		100.00% Impervious Area

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

Subcatchment P-2: N. TURF



Summary for Subcatchment P-3: S. TURF

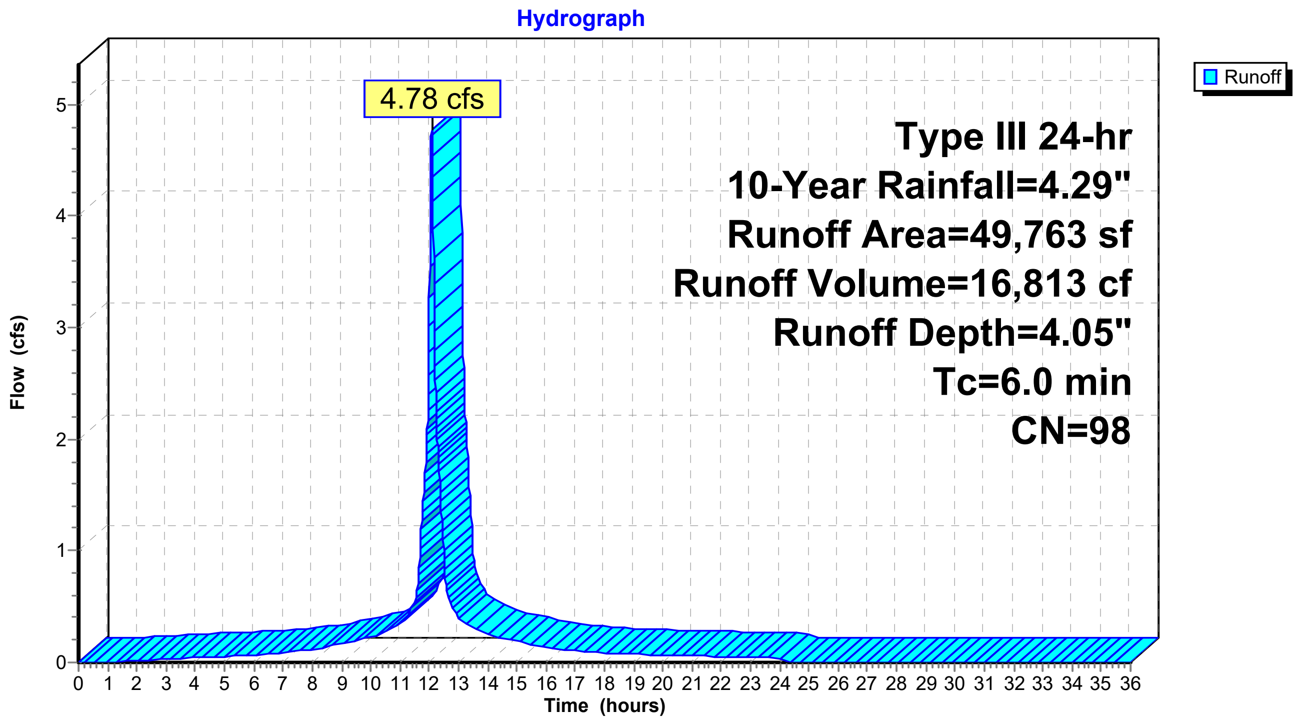
Runoff = 4.78 cfs @ 12.08 hrs, Volume= 16,813 cf, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.29"

	Area (sf)	CN	Description
*	49,763	98	Synthetic turf, HSG A
	49,763		100.00% Impervious Area

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

Subcatchment P-3: S. TURF



Summary for Subcatchment P-4: S. TRACK

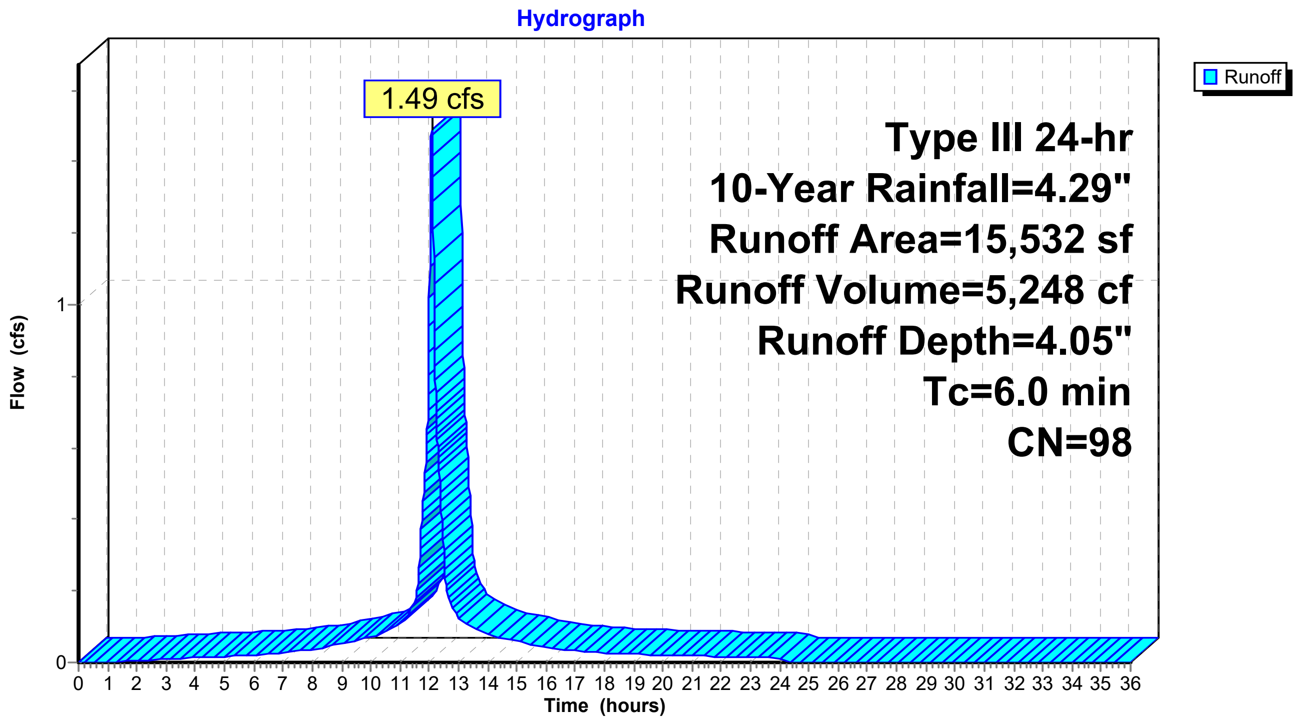
Runoff = 1.49 cfs @ 12.08 hrs, Volume= 5,248 cf, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.29"

Area (sf)	CN	Description
15,532	98	Paved track, HSG A
15,532		100.00% Impervious Area

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

Subcatchment P-4: S. TRACK

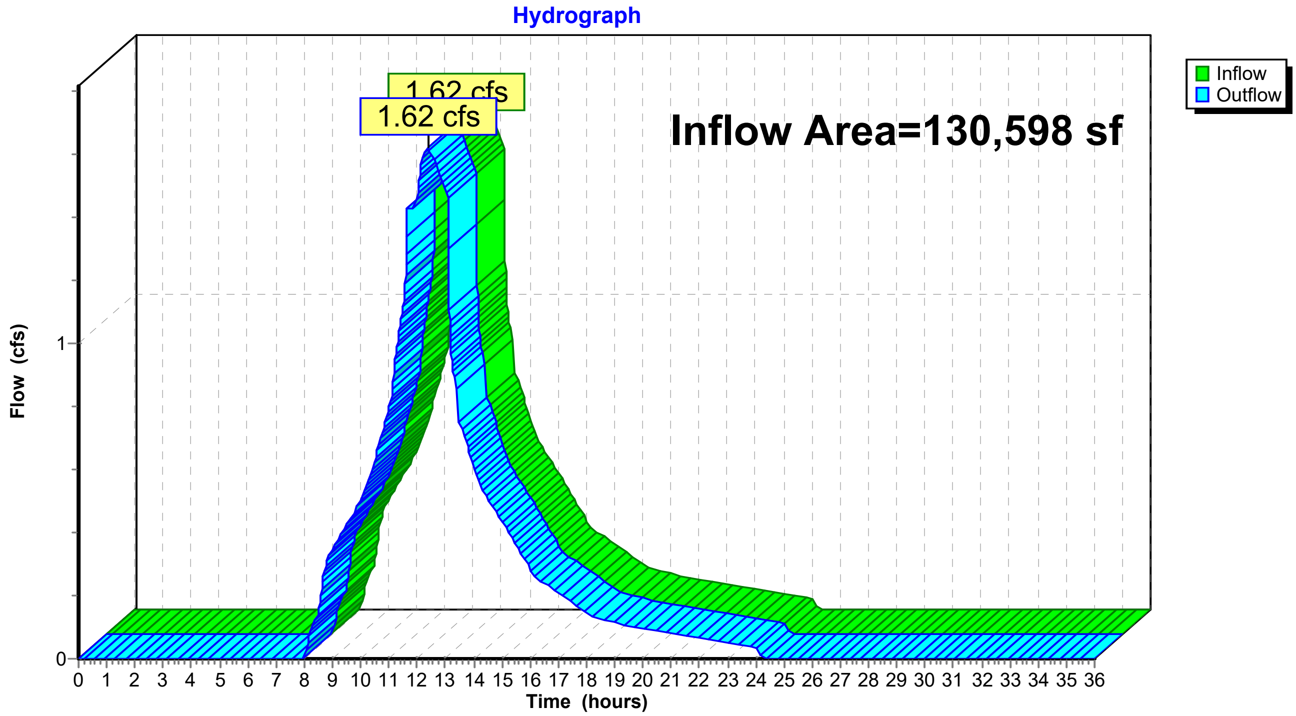


Summary for Reach DP-10: DISCHARGE AREA WEST OF TRACK

Inflow Area = 130,598 sf,100.00% Impervious, Inflow Depth = 2.19" for 10-Year event
Inflow = 1.62 cfs @ 12.37 hrs, Volume= 23,832 cf
Outflow = 1.62 cfs @ 12.37 hrs, Volume= 23,832 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-10: DISCHARGE AREA WEST OF TRACK



Summary for Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area = 65,303 sf,100.00% Impervious, Inflow Depth = 4.05" for 10-Year event
Inflow = 6.28 cfs @ 12.08 hrs, Volume= 22,064 cf
Outflow = 2.06 cfs @ 12.37 hrs, Volume= 22,057 cf, Atten= 67%, Lag= 17.0 min
Discarded = 0.97 cfs @ 11.81 hrs, Volume= 8,484 cf
Primary = 1.08 cfs @ 12.37 hrs, Volume= 13,572 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.22' @ 12.37 hrs Surf.Area= 41,242 sf Storage= 4,351 cf

Plug-Flow detention time= 74.7 min calculated for 22,051 cf (100% of inflow)
Center-of-Mass det. time= 74.7 min (825.3 - 750.7)

Volume	Invert	Avail.Storage	Storage Description
#1	325.18'	649 cf	**36.0" W x 24.0" H Box Stone Storage** L= 340.0' S= 0.0050 '/' 2,040 cf Overall - 185 cf Embedded = 1,855 cf x 35.0% Voids
#2	325.68'	185 cf	**10.0" Round Pipe Storage** Inside #1 L= 340.0' S= 0.0050 '/'
#3	326.30'	325 cf	**36.0" W x 24.4" H Box Stone Storage** L= 167.0' S= 0.0040 '/' 1,019 cf Overall - 91 cf Embedded = 928 cf x 35.0% Voids
#4	326.80'	91 cf	**10.0" Round Pipe Storage** Inside #3 L= 167.0' S= 0.0040 '/'
#5	329.00'	11,539 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 32,968 cf Overall x 35.0% Voids
		12,789 cf	Total Available Storage

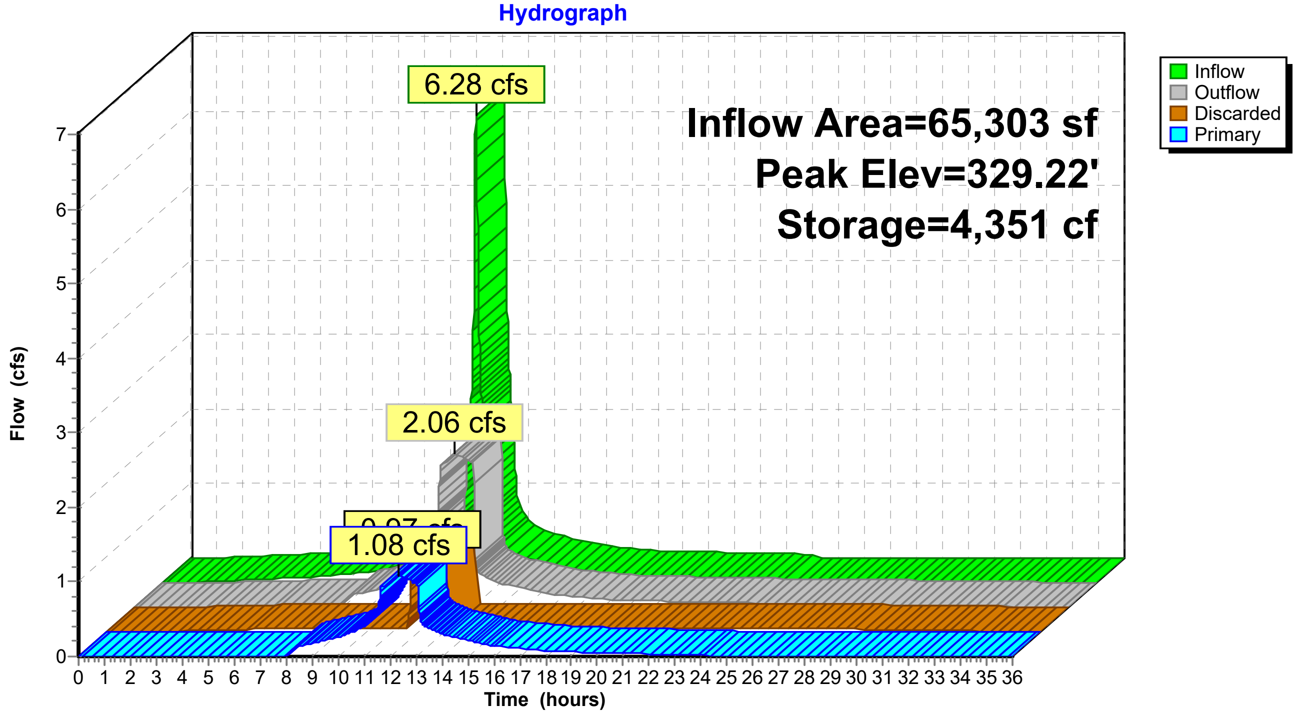
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	39,721	0	0
329.83	39,721	32,968	32,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	325.18'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.58'	**10.0" Round Culvert** L= 13.4' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.58' / 325.50' S= 0.0060 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**6.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.97 cfs @ 11.81 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.97 cfs)

Primary OutFlow Max=1.08 cfs @ 12.37 hrs HW=329.22' TW=320.66' (Dynamic Tailwater)
└─**2=Culvert** (Passes 1.08 cfs of 4.72 cfs potential flow)
  ├─**3=Orifice** (Orifice Controls 1.08 cfs @ 4.70 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.00 cfs @ 0.18 fps)

Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF



Summary for Pond 2P: N. OUTLET PIPE

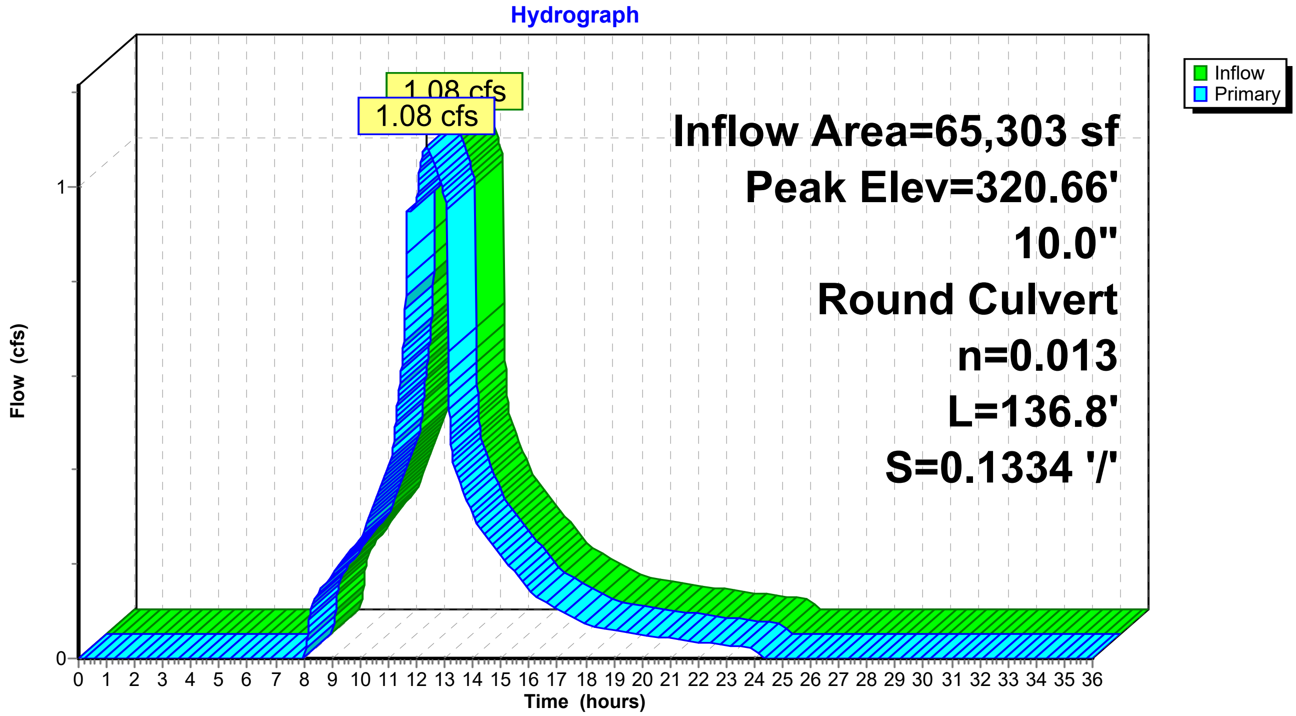
Inflow Area =	65,303 sf,100.00% Impervious,	Inflow Depth = 2.49"	for 10-Year event	
Inflow =	1.08 cfs @	12.37 hrs, Volume=	13,572 cf	
Outflow =	1.08 cfs @	12.37 hrs, Volume=	13,572 cf,	Atten= 0%, Lag= 0.0 min
Primary =	1.08 cfs @	12.37 hrs, Volume=	13,572 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 320.66' @ 12.37 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.07'	**10.0" Round Culvert** L= 136.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.07' / 301.82' S= 0.1334 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=1.08 cfs @ 12.37 hrs HW=320.66' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.08 cfs @ 2.62 fps)

Pond 2P: N. OUTLET PIPE



Summary for Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area = 65,295 sf,100.00% Impervious, Inflow Depth = 4.05" for 10-Year event
Inflow = 6.28 cfs @ 12.08 hrs, Volume= 22,061 cf
Outflow = 1.75 cfs @ 12.42 hrs, Volume= 22,032 cf, Atten= 72%, Lag= 20.2 min
Discarded = 1.22 cfs @ 11.76 hrs, Volume= 11,772 cf
Primary = 0.54 cfs @ 12.42 hrs, Volume= 10,260 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.21' @ 12.42 hrs Surf.Area= 51,503 sf Storage= 5,111 cf

Plug-Flow detention time= 88.7 min calculated for 22,032 cf (100% of inflow)
Center-of-Mass det. time= 87.8 min (838.5 - 750.7)

Volume	Invert	Avail.Storage	Storage Description
#1	324.85'	781 cf	**36.0" W x 24.0" H Box Stone Storage** L= 409.0' S= 0.0050 '/' 2,454 cf Overall - 223 cf Embedded = 2,231 cf x 35.0% Voids
#2	325.35'	223 cf	**10.0" Round Pipe Storage** Inside #1 L= 409.0' S= 0.0050 '/'
#3	326.13'	329 cf	**36.0" W x 24.2" H Box Stone Storage** L= 171.0' S= 0.0050 '/' 1,035 cf Overall - 93 cf Embedded = 941 cf x 35.0% Voids
#4	326.63'	93 cf	**10.0" Round Pipe Storage** Inside #3 L= 171.0' S= 0.0050 '/'
#5	329.00'	14,456 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 41,303 cf Overall x 35.0% Voids
		15,883 cf	Total Available Storage

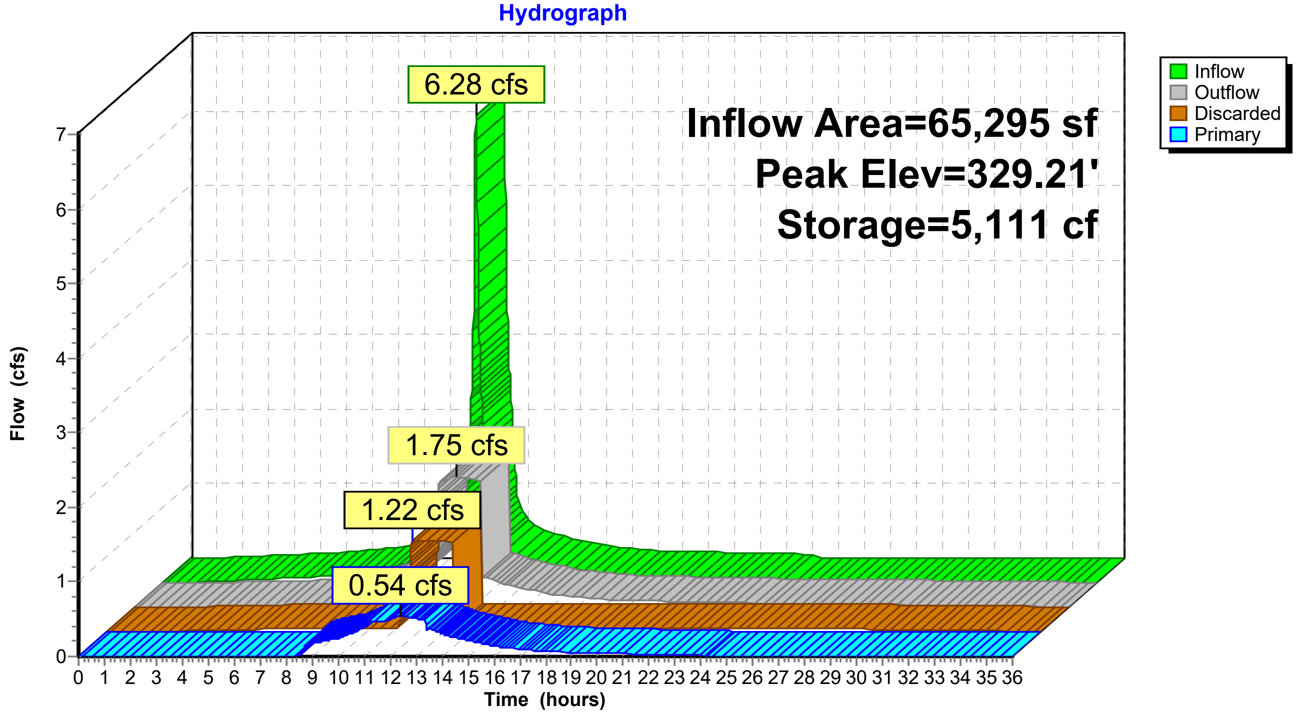
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	49,763	0	0
329.83	49,763	41,303	41,303

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.85'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.25'	**10.0" Round Culvert** L= 23.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.25' / 325.13' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**4.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=1.22 cfs @ 11.76 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.22 cfs)

Primary OutFlow Max=0.54 cfs @ 12.42 hrs HW=329.21' TW=320.61' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.54 cfs of 4.94 cfs potential flow)
  ├─**3=Orifice** (Orifice Controls 0.54 cfs @ 4.87 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF



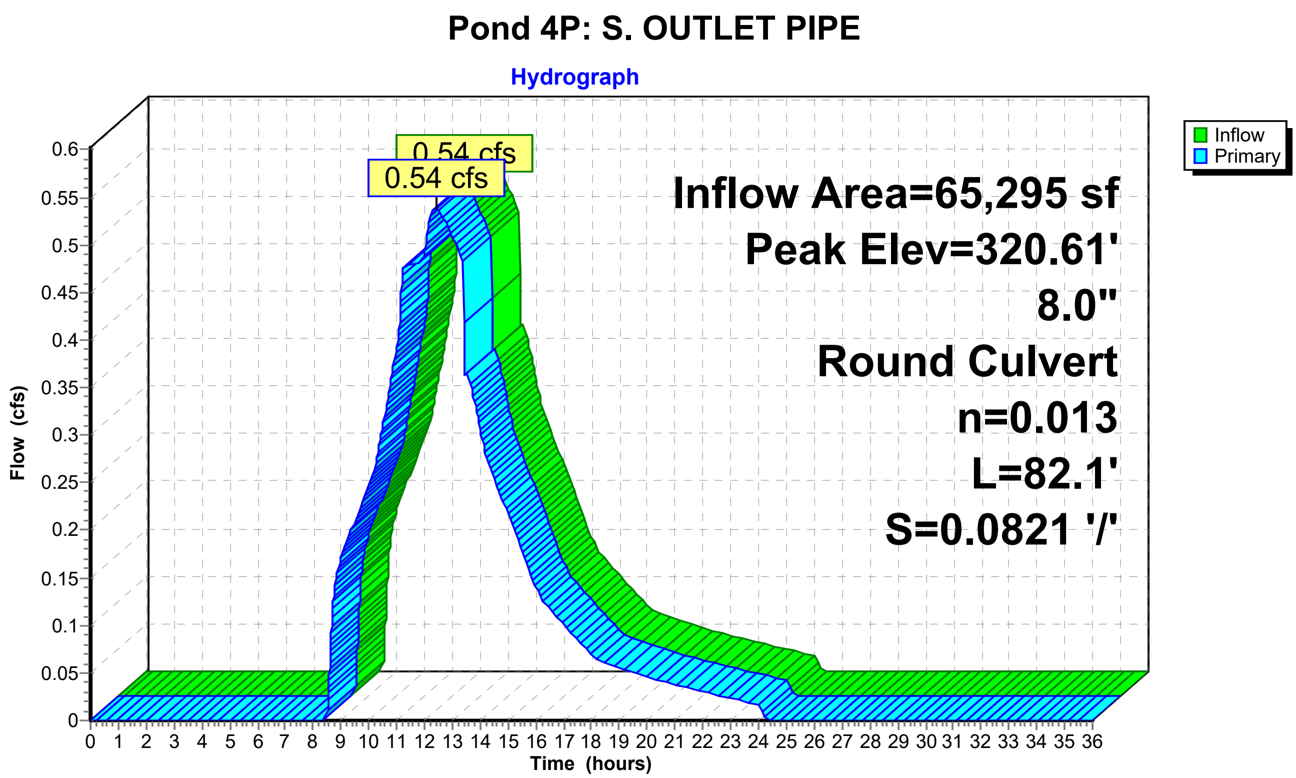
Summary for Pond 4P: S. OUTLET PIPE

Inflow Area =	65,295 sf,100.00% Impervious,	Inflow Depth = 1.89"	for 10-Year event	
Inflow =	0.54 cfs @	12.42 hrs, Volume=	10,260 cf	
Outflow =	0.54 cfs @	12.42 hrs, Volume=	10,260 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.54 cfs @	12.42 hrs, Volume=	10,260 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 320.61' @ 12.42 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.18'	**8.0" Round Culvert** L= 82.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.18' / 313.44' S= 0.0821 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.54 cfs @ 12.42 hrs HW=320.61' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.54 cfs @ 2.24 fps)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P-1: N. TRACK Runoff Area=25,582 sf 100.00% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=98 Runoff=3.04 cfs 10,750 cf

Subcatchment P-2: N. TURF Runoff Area=39,721 sf 100.00% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=98 Runoff=4.71 cfs 16,692 cf

Subcatchment P-3: S. TURF Runoff Area=49,763 sf 100.00% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=98 Runoff=5.90 cfs 20,912 cf

Subcatchment P-4: S. TRACK Runoff Area=15,532 sf 100.00% Impervious Runoff Depth=5.04"
Tc=6.0 min CN=98 Runoff=1.84 cfs 6,527 cf

Reach DP-10: DISCHARGE AREA WEST OF TRACK Inflow=2.45 cfs 31,116 cf
Outflow=2.45 cfs 31,116 cf

Pond 1P: N. COLLECTOR DRAIN & STONE Peak Elev=329.32' Storage=5,753 cf Inflow=7.75 cfs 27,442 cf
Discarded=0.97 cfs 9,695 cf Primary=1.57 cfs 17,739 cf Outflow=2.55 cfs 27,434 cf

Pond 2P: N. OUTLET PIPE Peak Elev=320.84' Inflow=1.57 cfs 17,739 cf
10.0" Round Culvert n=0.013 L=136.8' S=0.1334 '/' Outflow=1.57 cfs 17,739 cf

Pond 3P: S. COLLECTOR DRAIN & STONE Peak Elev=329.31' Storage=6,740 cf Inflow=7.75 cfs 27,439 cf
Discarded=1.22 cfs 14,032 cf Primary=0.89 cfs 13,376 cf Outflow=2.10 cfs 27,408 cf

Pond 4P: S. OUTLET PIPE Peak Elev=320.79' Inflow=0.89 cfs 13,376 cf
8.0" Round Culvert n=0.013 L=82.1' S=0.0821 '/' Outflow=0.89 cfs 13,376 cf

Summary for Subcatchment P-1: N. TRACK

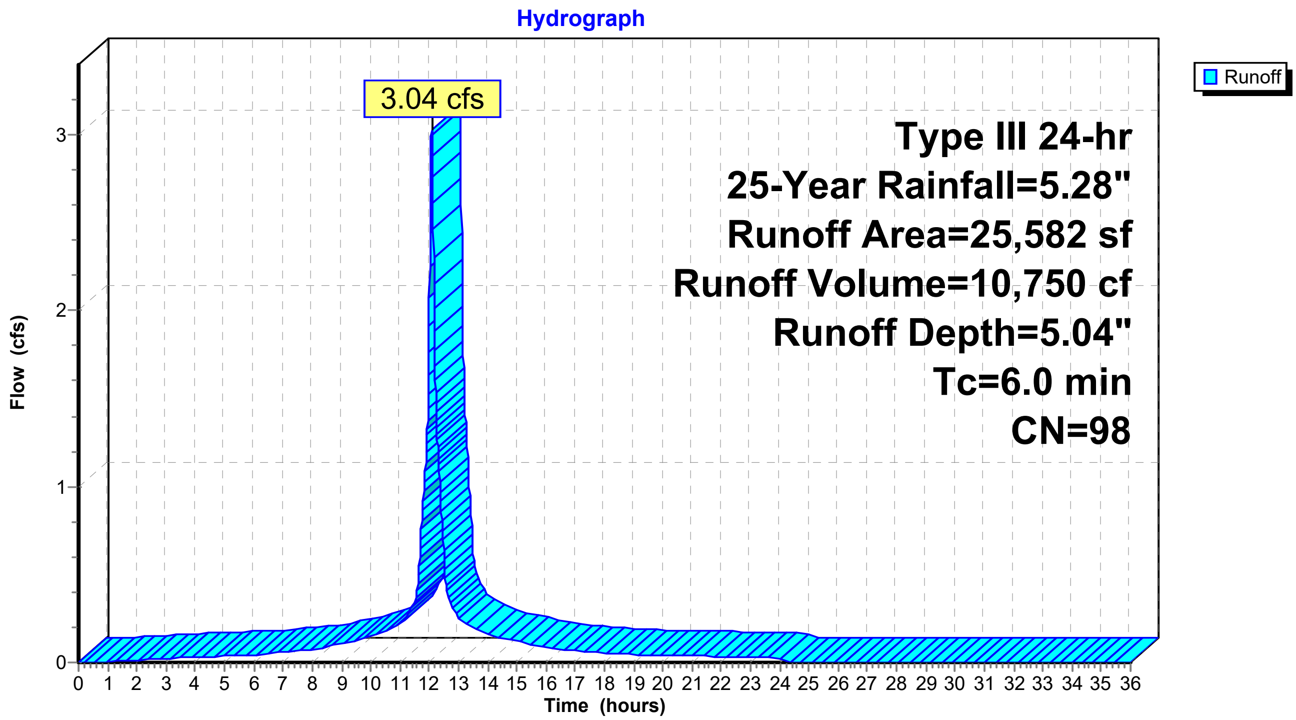
Runoff = 3.04 cfs @ 12.08 hrs, Volume= 10,750 cf, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.28"

Area (sf)	CN	Description
25,582	98	Paved track, HSG A
25,582		100.00% Impervious Area

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

Subcatchment P-1: N. TRACK



Summary for Subcatchment P-2: N. TURF

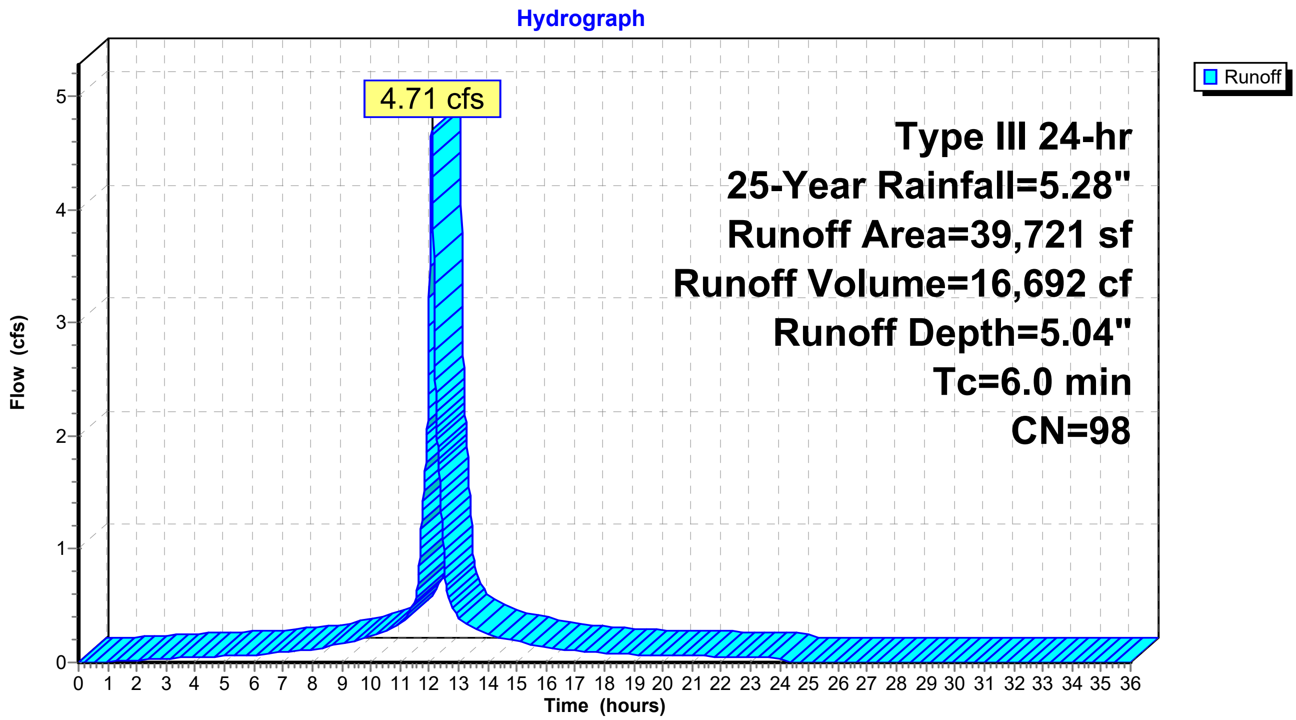
Runoff = 4.71 cfs @ 12.08 hrs, Volume= 16,692 cf, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.28"

Area (sf)	CN	Description
39,721	98	Synthetic turf, HSG A
39,721		100.00% Impervious Area

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

Subcatchment P-2: N. TURF



Summary for Subcatchment P-3: S. TURF

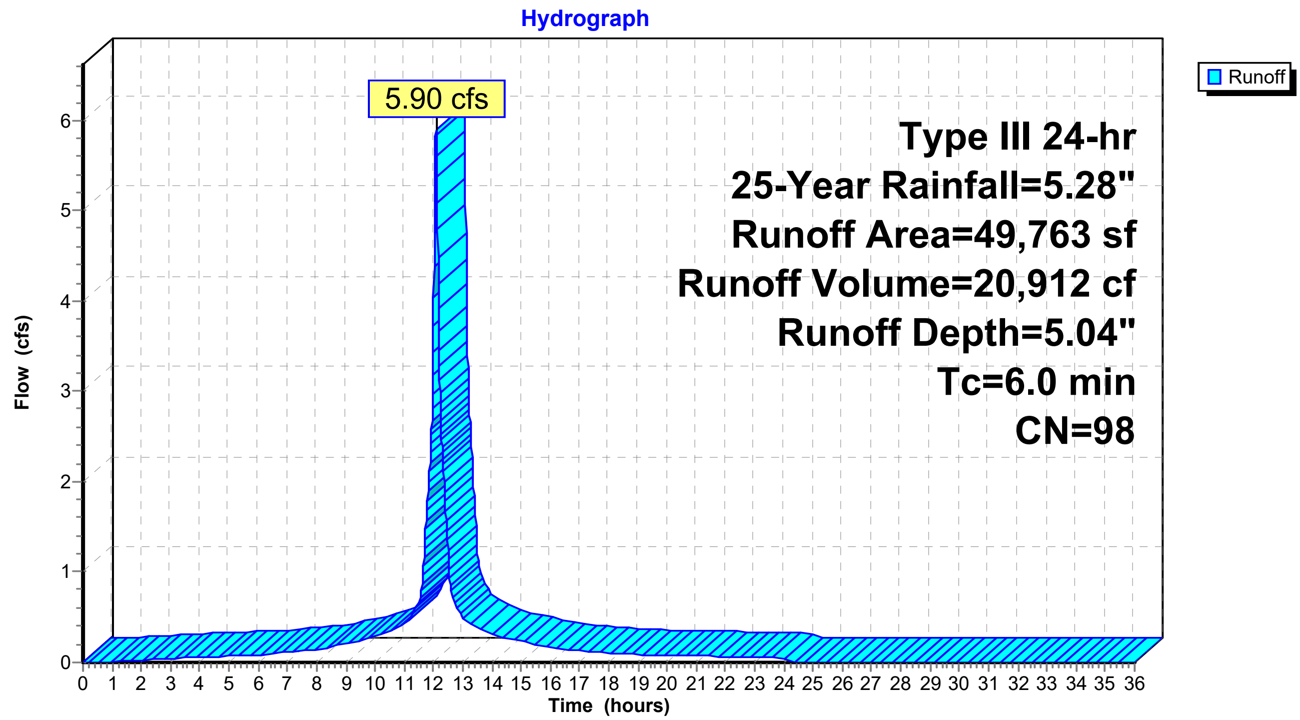
Runoff = 5.90 cfs @ 12.08 hrs, Volume= 20,912 cf, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.28"

	Area (sf)	CN	Description
*	49,763	98	Synthetic turf, HSG A
	49,763		100.00% Impervious Area

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

Subcatchment P-3: S. TURF



Summary for Subcatchment P-4: S. TRACK

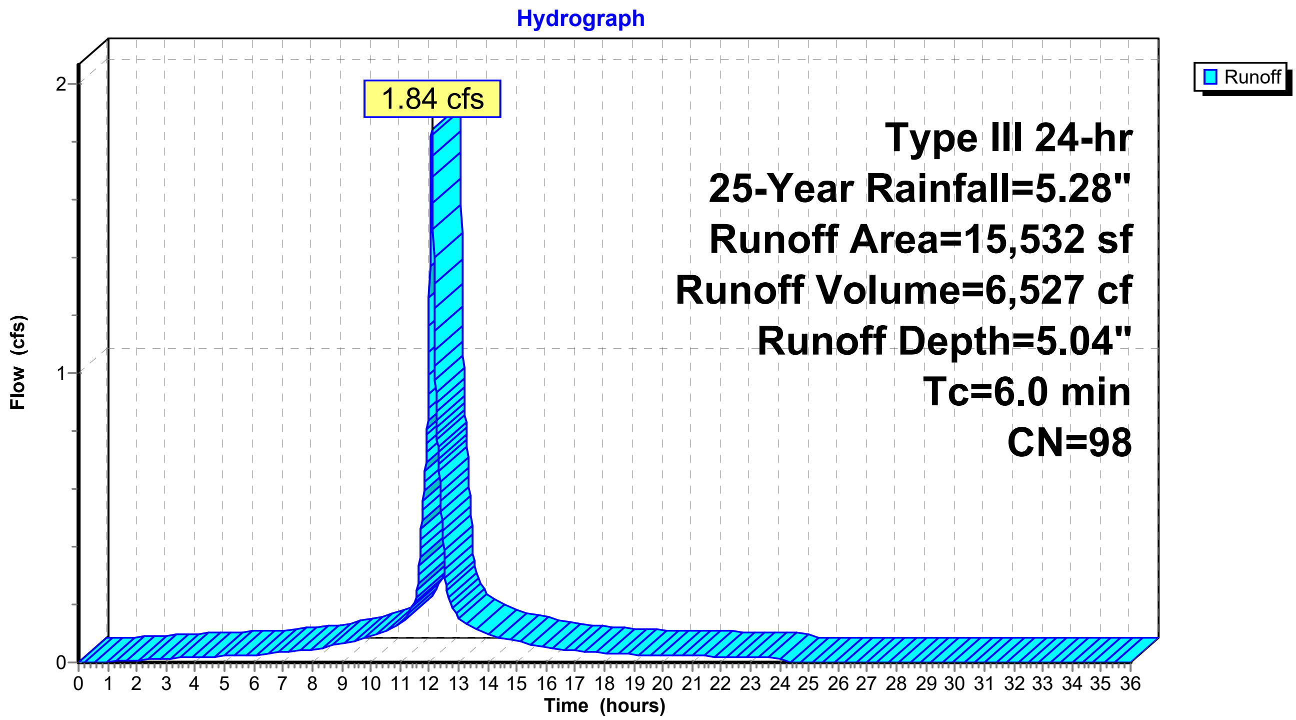
Runoff = 1.84 cfs @ 12.08 hrs, Volume= 6,527 cf, Depth= 5.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.28"

Area (sf)	CN	Description
15,532	98	Paved track, HSG A
15,532		100.00% Impervious Area

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

Subcatchment P-4: S. TRACK

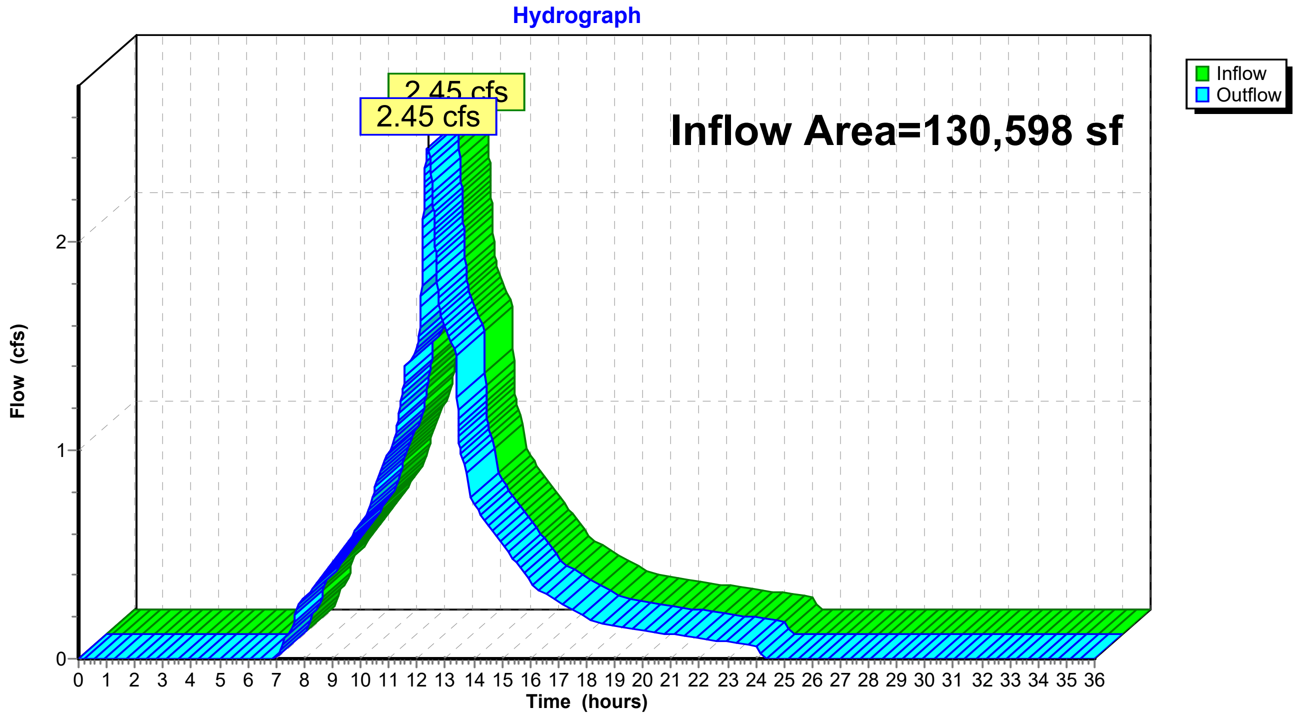


Summary for Reach DP-10: DISCHARGE AREA WEST OF TRACK

Inflow Area =	130,598 sf,100.00% Impervious,	Inflow Depth = 2.86"	for 25-Year event		
Inflow =	2.45 cfs @	12.39 hrs,	Volume=	31,116 cf	
Outflow =	2.45 cfs @	12.39 hrs,	Volume=	31,116 cf,	Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-10: DISCHARGE AREA WEST OF TRACK



Summary for Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area =	65,303 sf,100.00% Impervious,	Inflow Depth = 5.04" for 25-Year event		
Inflow =	7.75 cfs @	12.08 hrs, Volume=	27,442 cf	
Outflow =	2.55 cfs @	12.36 hrs, Volume=	27,434 cf,	Atten= 67%, Lag= 16.9 min
Discarded =	0.97 cfs @	11.74 hrs, Volume=	9,695 cf	
Primary =	1.57 cfs @	12.36 hrs, Volume=	17,739 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.32' @ 12.36 hrs Surf.Area= 41,242 sf Storage= 5,753 cf

Plug-Flow detention time= 66.5 min calculated for 27,427 cf (100% of inflow)
Center-of-Mass det. time= 66.4 min (813.6 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	325.18'	649 cf	**36.0" W x 24.0" H Box Stone Storage** L= 340.0' S= 0.0050 '/' 2,040 cf Overall - 185 cf Embedded = 1,855 cf x 35.0% Voids
#2	325.68'	185 cf	**10.0" Round Pipe Storage** Inside #1 L= 340.0' S= 0.0050 '/'
#3	326.30'	325 cf	**36.0" W x 24.4" H Box Stone Storage** L= 167.0' S= 0.0040 '/' 1,019 cf Overall - 91 cf Embedded = 928 cf x 35.0% Voids
#4	326.80'	91 cf	**10.0" Round Pipe Storage** Inside #3 L= 167.0' S= 0.0040 '/'
#5	329.00'	11,539 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 32,968 cf Overall x 35.0% Voids
		12,789 cf	Total Available Storage

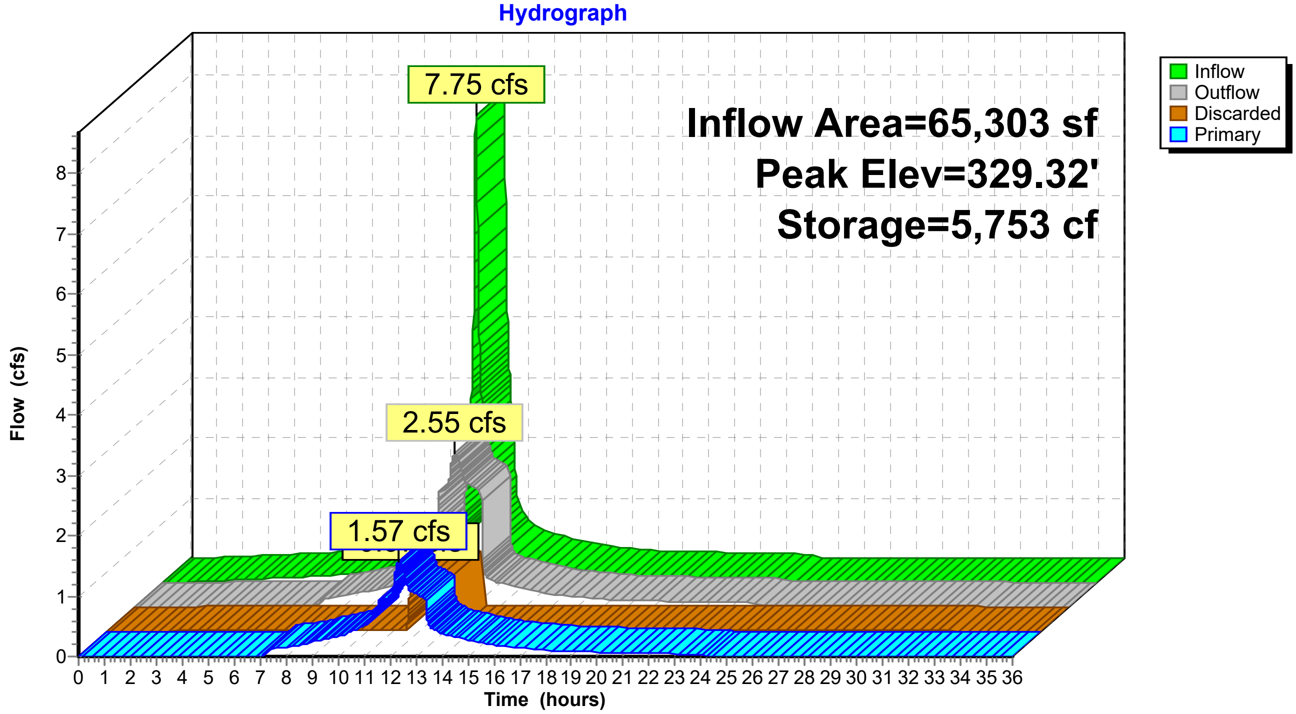
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	39,721	0	0
329.83	39,721	32,968	32,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	325.18'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.58'	**10.0" Round Culvert** L= 13.4' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.58' / 325.50' S= 0.0060 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**6.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.97 cfs @ 11.74 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.97 cfs)

Primary OutFlow Max=1.57 cfs @ 12.36 hrs HW=329.32' TW=320.84' (Dynamic Tailwater)
└─**2=Culvert** (Passes 1.57 cfs of 4.79 cfs potential flow)
  ├─**3=Orifice** (Orifice Controls 1.14 cfs @ 4.94 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.44 cfs @ 1.05 fps)

Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF



Summary for Pond 2P: N. OUTLET PIPE

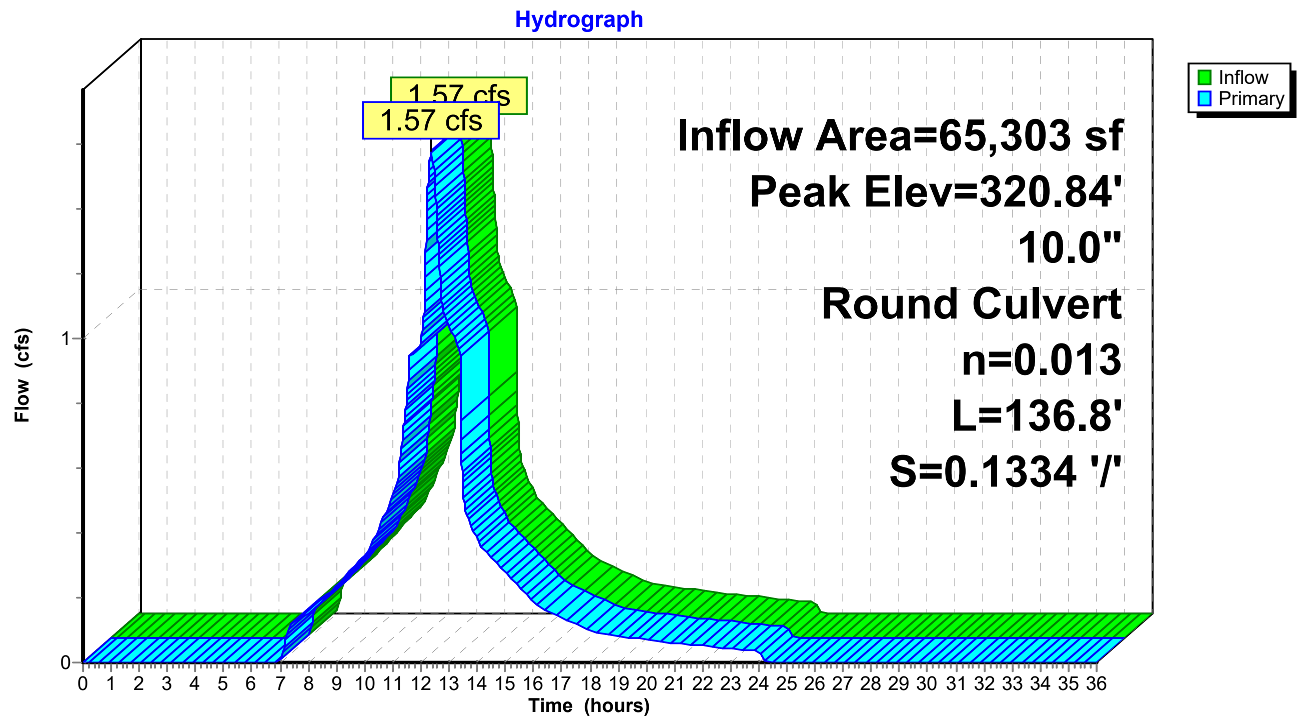
Inflow Area =	65,303 sf,100.00% Impervious,	Inflow Depth = 3.26"	for 25-Year event		
Inflow =	1.57 cfs @	12.36 hrs, Volume=	17,739 cf		
Outflow =	1.57 cfs @	12.36 hrs, Volume=	17,739 cf,	Atten= 0%,	Lag= 0.0 min
Primary =	1.57 cfs @	12.36 hrs, Volume=	17,739 cf		

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 320.84' @ 12.36 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.07'	**10.0" Round Culvert** L= 136.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.07' / 301.82' S= 0.1334 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=1.57 cfs @ 12.36 hrs HW=320.84' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.57 cfs @ 2.99 fps)

Pond 2P: N. OUTLET PIPE



Summary for Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area = 65,295 sf,100.00% Impervious, Inflow Depth = 5.04" for 25-Year event
Inflow = 7.75 cfs @ 12.08 hrs, Volume= 27,439 cf
Outflow = 2.10 cfs @ 12.43 hrs, Volume= 27,408 cf, Atten= 73%, Lag= 20.7 min
Discarded = 1.22 cfs @ 11.71 hrs, Volume= 14,032 cf
Primary = 0.89 cfs @ 12.43 hrs, Volume= 13,376 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.31' @ 12.43 hrs Surf.Area= 51,503 sf Storage= 6,740 cf

Plug-Flow detention time= 80.2 min calculated for 27,408 cf (100% of inflow)
Center-of-Mass det. time= 79.5 min (826.6 - 747.1)

Volume	Invert	Avail.Storage	Storage Description
#1	324.85'	781 cf	**36.0" W x 24.0" H Box Stone Storage** L= 409.0' S= 0.0050 '/' 2,454 cf Overall - 223 cf Embedded = 2,231 cf x 35.0% Voids
#2	325.35'	223 cf	**10.0" Round Pipe Storage** Inside #1 L= 409.0' S= 0.0050 '/'
#3	326.13'	329 cf	**36.0" W x 24.2" H Box Stone Storage** L= 171.0' S= 0.0050 '/' 1,035 cf Overall - 93 cf Embedded = 941 cf x 35.0% Voids
#4	326.63'	93 cf	**10.0" Round Pipe Storage** Inside #3 L= 171.0' S= 0.0050 '/'
#5	329.00'	14,456 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 41,303 cf Overall x 35.0% Voids
		15,883 cf	Total Available Storage

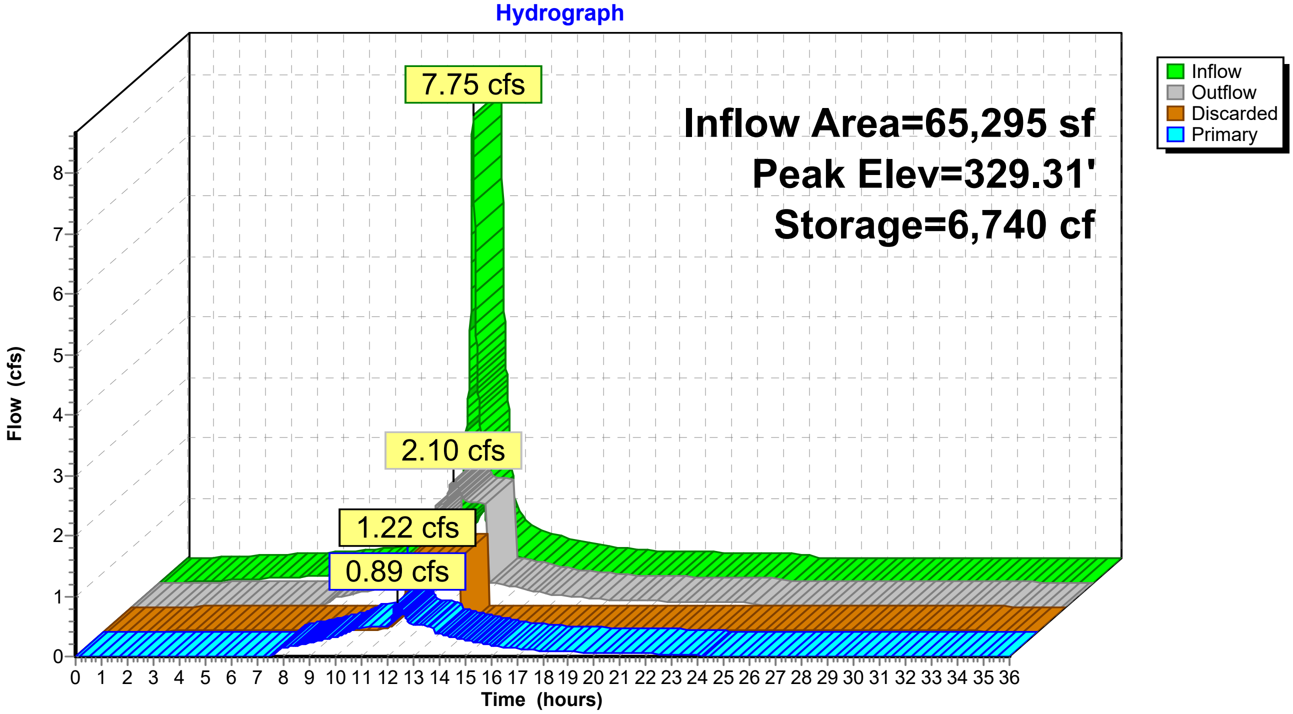
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	49,763	0	0
329.83	49,763	41,303	41,303

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.85'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.25'	**10.0" Round Culvert** L= 23.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.25' / 325.13' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**4.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=1.22 cfs @ 11.71 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.22 cfs)

Primary OutFlow Max=0.89 cfs @ 12.43 hrs HW=329.31' TW=320.79' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.89 cfs of 5.01 cfs potential flow)
  ├─**3=Orifice** (Orifice Controls 0.56 cfs @ 5.09 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 0.32 cfs @ 0.95 fps)

Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF



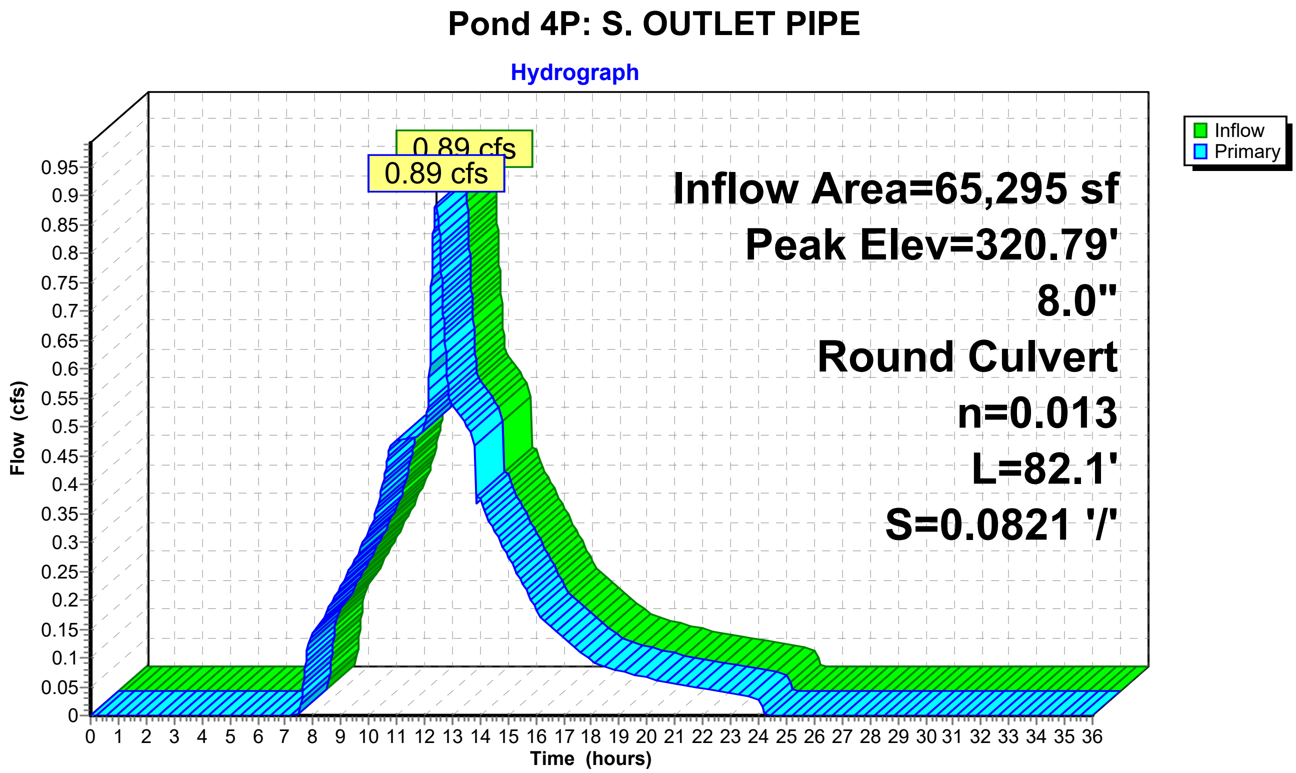
Summary for Pond 4P: S. OUTLET PIPE

Inflow Area =	65,295 sf,100.00% Impervious,	Inflow Depth = 2.46"	for 25-Year event	
Inflow =	0.89 cfs @	12.43 hrs, Volume=	13,376 cf	
Outflow =	0.89 cfs @	12.43 hrs, Volume=	13,376 cf,	Atten= 0%, Lag= 0.0 min
Primary =	0.89 cfs @	12.43 hrs, Volume=	13,376 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 320.79' @ 12.43 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.18'	**8.0" Round Culvert** L= 82.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.18' / 313.44' S= 0.0821 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=0.89 cfs @ 12.43 hrs HW=320.79' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 0.89 cfs @ 2.65 fps)



Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 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 P-1: N. TRACK Runoff Area=25,582 sf 100.00% Impervious Runoff Depth=7.00"
Tc=6.0 min CN=98 Runoff=4.17 cfs 14,924 cf

Subcatchment P-2: N. TURF Runoff Area=39,721 sf 100.00% Impervious Runoff Depth=7.00"
Tc=6.0 min CN=98 Runoff=6.48 cfs 23,173 cf

Subcatchment P-3: S. TURF Runoff Area=49,763 sf 100.00% Impervious Runoff Depth=7.00"
Tc=6.0 min CN=98 Runoff=8.12 cfs 29,031 cf

Subcatchment P-4: S. TRACK Runoff Area=15,532 sf 100.00% Impervious Runoff Depth=7.00"
Tc=6.0 min CN=98 Runoff=2.53 cfs 9,061 cf

Reach DP-10: DISCHARGE AREA WEST OF TRACK Inflow=5.08 cfs 47,351 cf
Outflow=5.08 cfs 47,351 cf

Pond 1P: N. COLLECTOR DRAIN & Peak Elev=329.49' Storage=8,047 cf Inflow=10.65 cfs 38,097 cf
Discarded=0.97 cfs 11,391 cf Primary=3.02 cfs 26,698 cf Outflow=4.00 cfs 38,089 cf

Pond 2P: N. OUTLET PIPE Peak Elev=321.81' Inflow=3.02 cfs 26,698 cf
10.0" Round Culvert n=0.013 L=136.8' S=0.1334 '/' Outflow=3.02 cfs 26,698 cf

Pond 3P: S. COLLECTOR DRAIN & STONE Peak Elev=329.46' Storage=9,374 cf Inflow=10.65 cfs 38,093 cf
Discarded=1.22 cfs 17,407 cf Primary=2.08 cfs 20,653 cf Outflow=3.30 cfs 38,061 cf

Pond 4P: S. OUTLET PIPE Peak Elev=322.05' Inflow=2.08 cfs 20,653 cf
8.0" Round Culvert n=0.013 L=82.1' S=0.0821 '/' Outflow=2.08 cfs 20,653 cf

Summary for Subcatchment P-1: N. TRACK

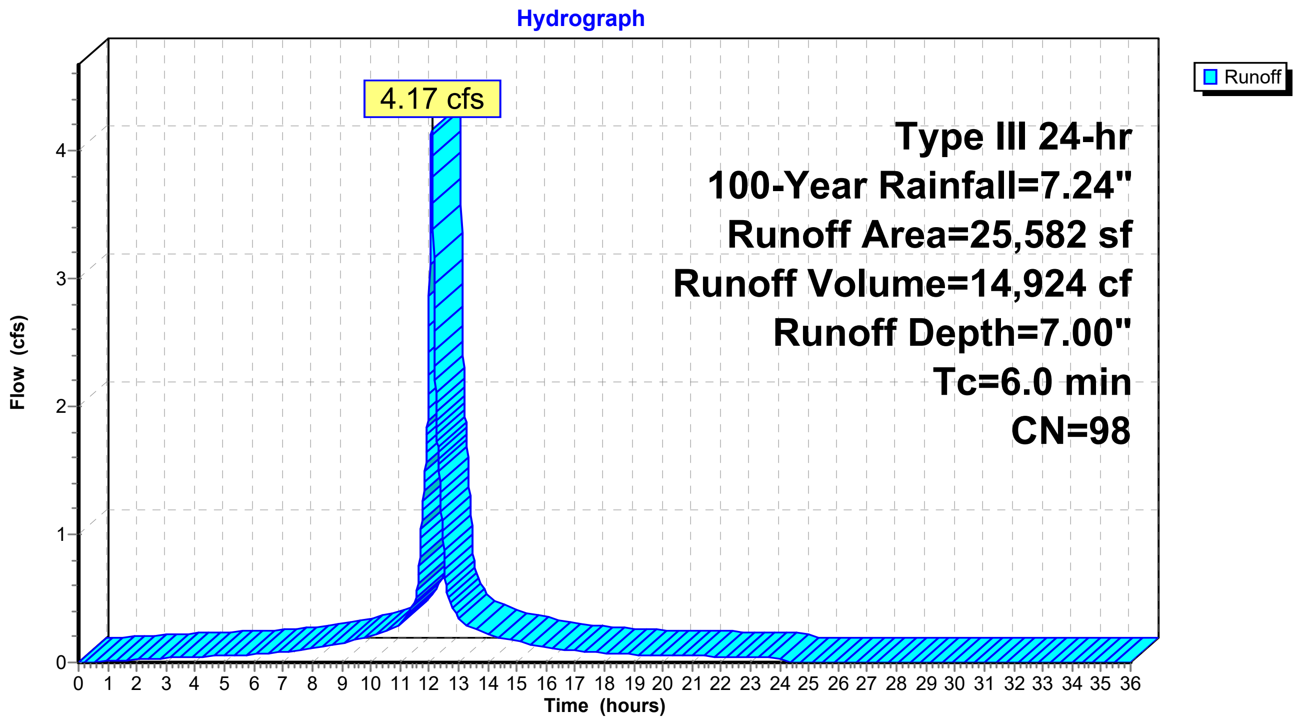
Runoff = 4.17 cfs @ 12.08 hrs, Volume= 14,924 cf, Depth= 7.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.24"

Area (sf)	CN	Description
25,582	98	Paved track, HSG A
25,582		100.00% Impervious Area

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

Subcatchment P-1: N. TRACK



Summary for Subcatchment P-2: N. TURF

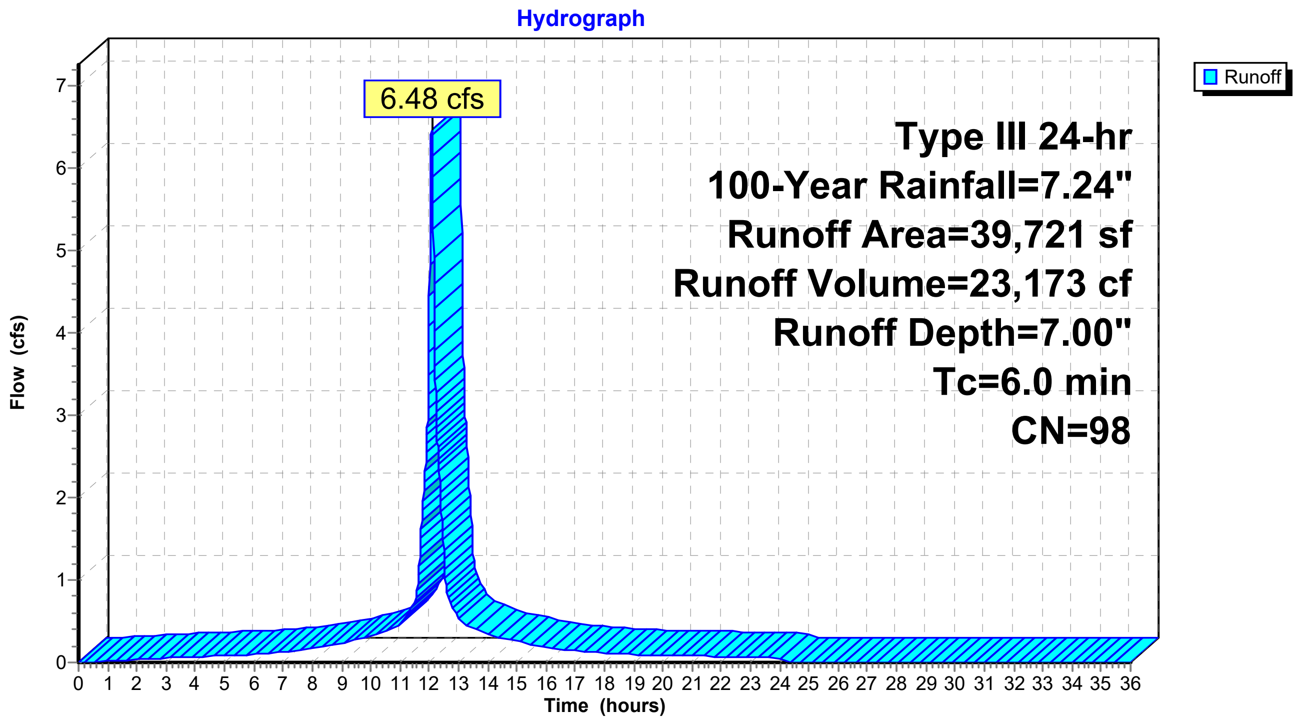
Runoff = 6.48 cfs @ 12.08 hrs, Volume= 23,173 cf, Depth= 7.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.24"

Area (sf)	CN	Description
39,721	98	Synthetic turf, HSG A
39,721		100.00% Impervious Area

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

Subcatchment P-2: N. TURF



Summary for Subcatchment P-3: S. TURF

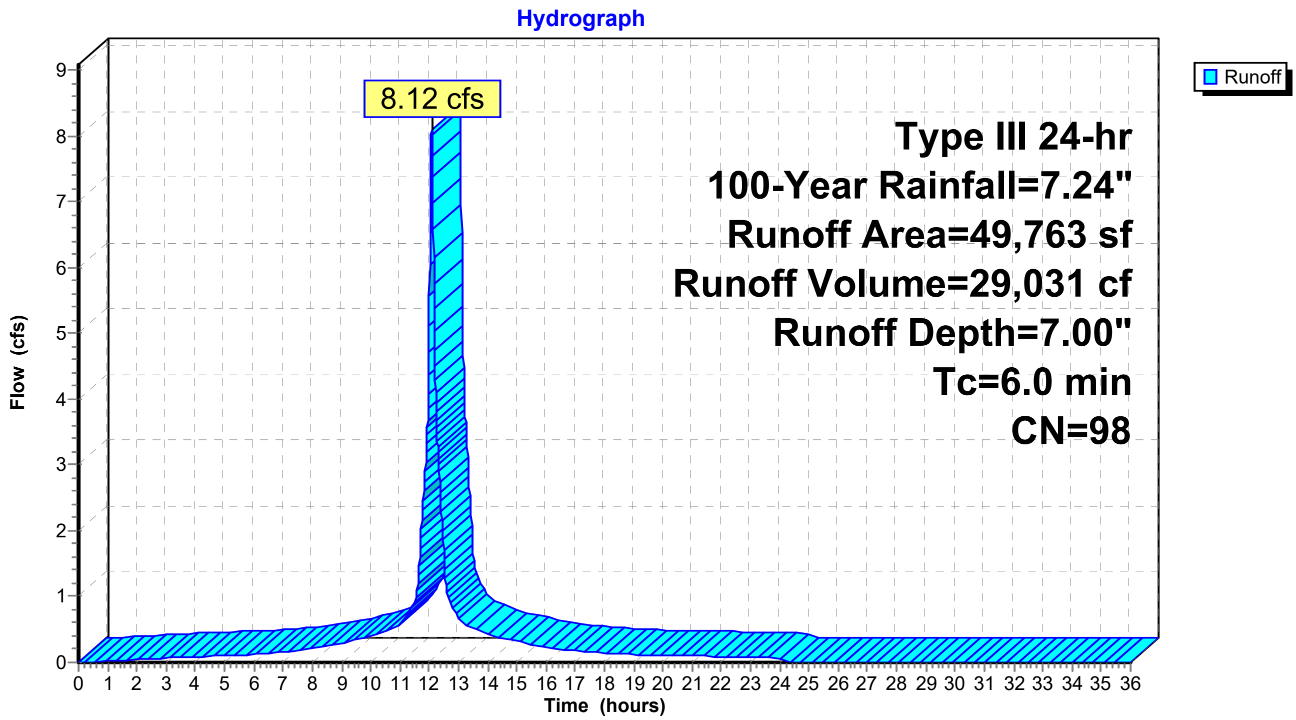
Runoff = 8.12 cfs @ 12.08 hrs, Volume= 29,031 cf, Depth= 7.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.24"

	Area (sf)	CN	Description
*	49,763	98	Synthetic turf, HSG A
	49,763		100.00% Impervious Area

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

Subcatchment P-3: S. TURF



Summary for Subcatchment P-4: S. TRACK

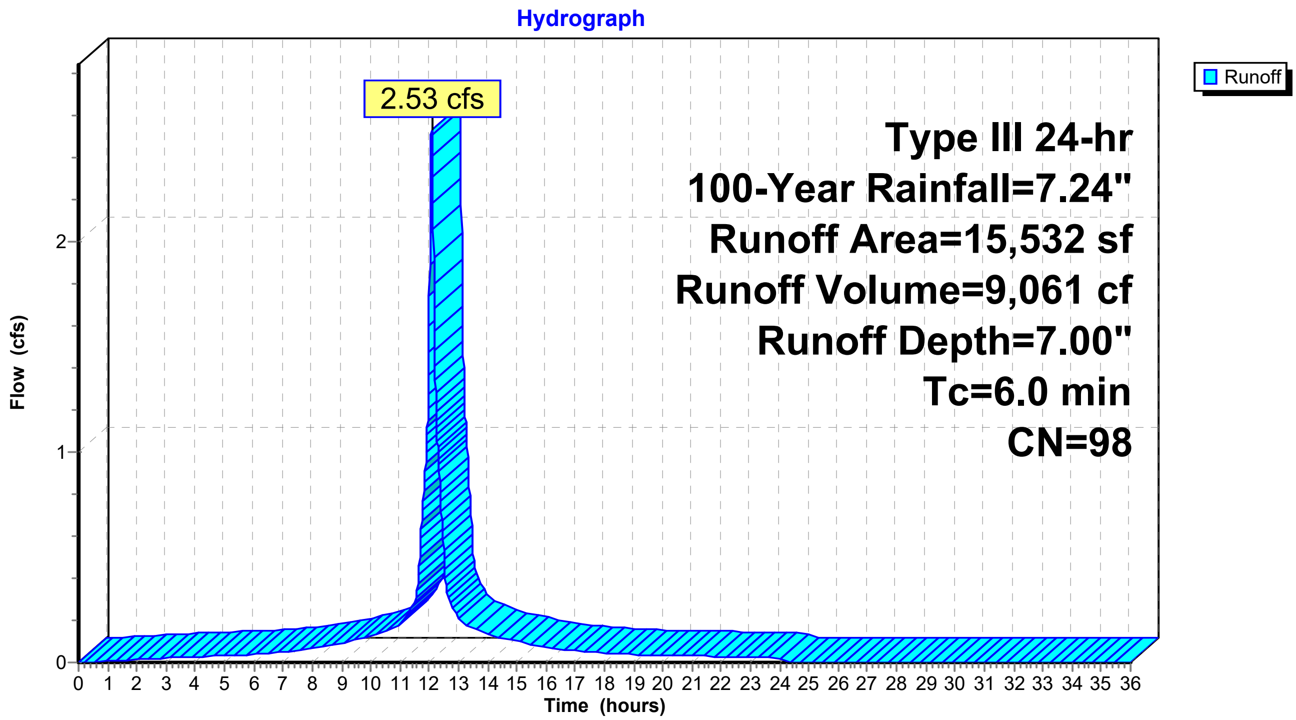
Runoff = 2.53 cfs @ 12.08 hrs, Volume= 9,061 cf, Depth= 7.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.24"

Area (sf)	CN	Description
15,532	98	Paved track, HSG A
15,532		100.00% Impervious Area

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

Subcatchment P-4: S. TRACK

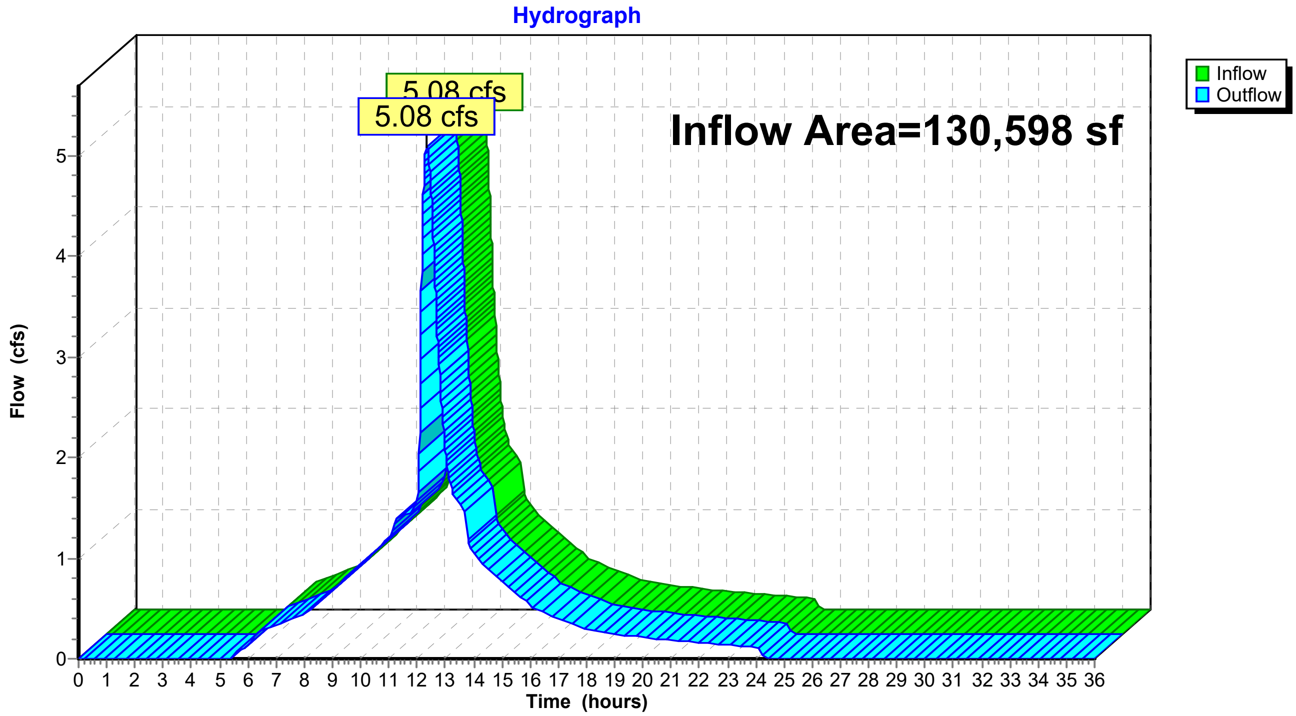


Summary for Reach DP-10: DISCHARGE AREA WEST OF TRACK

Inflow Area = 130,598 sf,100.00% Impervious, Inflow Depth = 4.35" for 100-Year event
Inflow = 5.08 cfs @ 12.35 hrs, Volume= 47,351 cf
Outflow = 5.08 cfs @ 12.35 hrs, Volume= 47,351 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Reach DP-10: DISCHARGE AREA WEST OF TRACK



Summary for Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area = 65,303 sf,100.00% Impervious, Inflow Depth = 7.00" for 100-Year event
Inflow = 10.65 cfs @ 12.08 hrs, Volume= 38,097 cf
Outflow = 4.00 cfs @ 12.32 hrs, Volume= 38,089 cf, Atten= 62%, Lag= 14.0 min
Discarded = 0.97 cfs @ 11.66 hrs, Volume= 11,391 cf
Primary = 3.02 cfs @ 12.32 hrs, Volume= 26,698 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.49' @ 12.32 hrs Surf.Area= 41,242 sf Storage= 8,047 cf

Plug-Flow detention time= 55.2 min calculated for 38,078 cf (100% of inflow)
Center-of-Mass det. time= 55.2 min (797.7 - 742.5)

Volume	Invert	Avail.Storage	Storage Description
#1	325.18'	649 cf	**36.0" W x 24.0" H Box Stone Storage** L= 340.0' S= 0.0050 '/' 2,040 cf Overall - 185 cf Embedded = 1,855 cf x 35.0% Voids
#2	325.68'	185 cf	**10.0" Round Pipe Storage** Inside #1 L= 340.0' S= 0.0050 '/'
#3	326.30'	325 cf	**36.0" W x 24.4" H Box Stone Storage** L= 167.0' S= 0.0040 '/' 1,019 cf Overall - 91 cf Embedded = 928 cf x 35.0% Voids
#4	326.80'	91 cf	**10.0" Round Pipe Storage** Inside #3 L= 167.0' S= 0.0040 '/'
#5	329.00'	11,539 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 32,968 cf Overall x 35.0% Voids
		12,789 cf	Total Available Storage

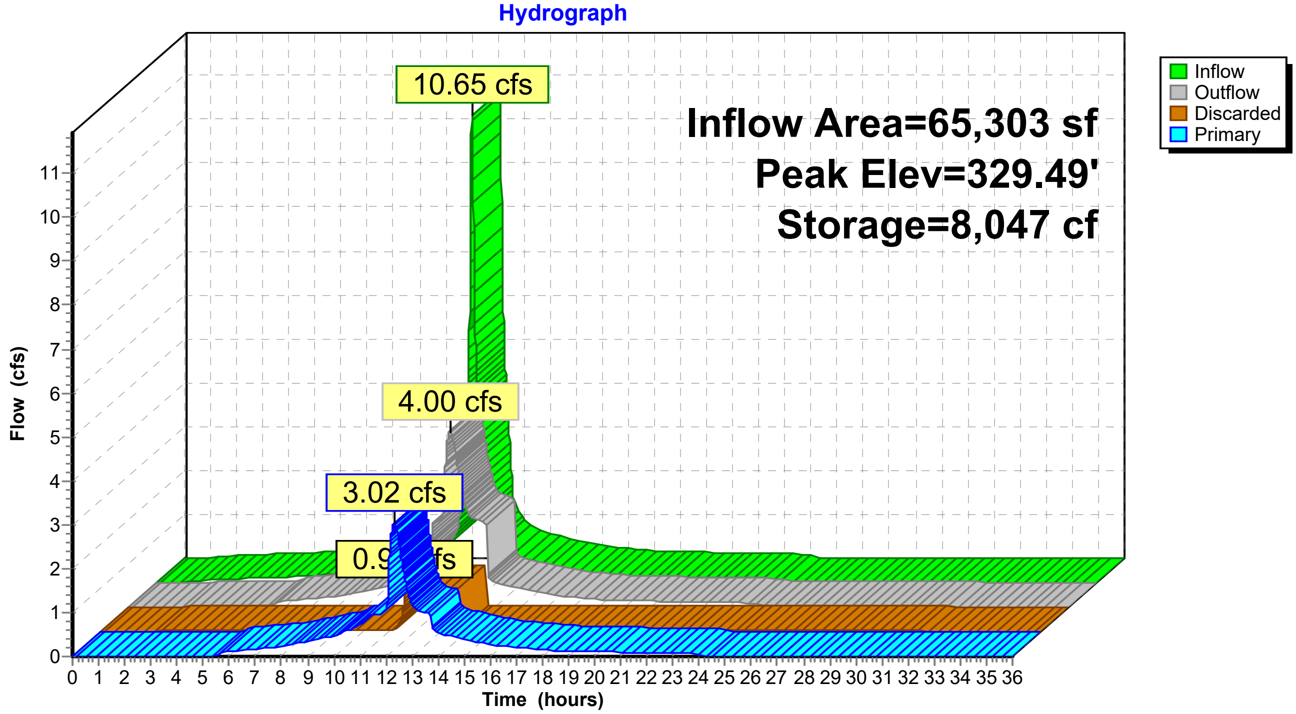
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	39,721	0	0
329.83	39,721	32,968	32,968

Device	Routing	Invert	Outlet Devices
#1	Discarded	325.18'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.58'	**10.0" Round Culvert** L= 13.4' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.58' / 325.50' S= 0.0060 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**6.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.97 cfs @ 11.66 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.97 cfs)

Primary OutFlow Max=3.02 cfs @ 12.32 hrs HW=329.49' TW=321.81' (Dynamic Tailwater)
└─**2=Culvert** (Passes 3.02 cfs of 4.91 cfs potential flow)
 ├─**3=Orifice** (Orifice Controls 1.22 cfs @ 5.31 fps)
 └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 1.80 cfs @ 1.70 fps)

Pond 1P: N. COLLECTOR DRAIN & STONE UNDER TURF



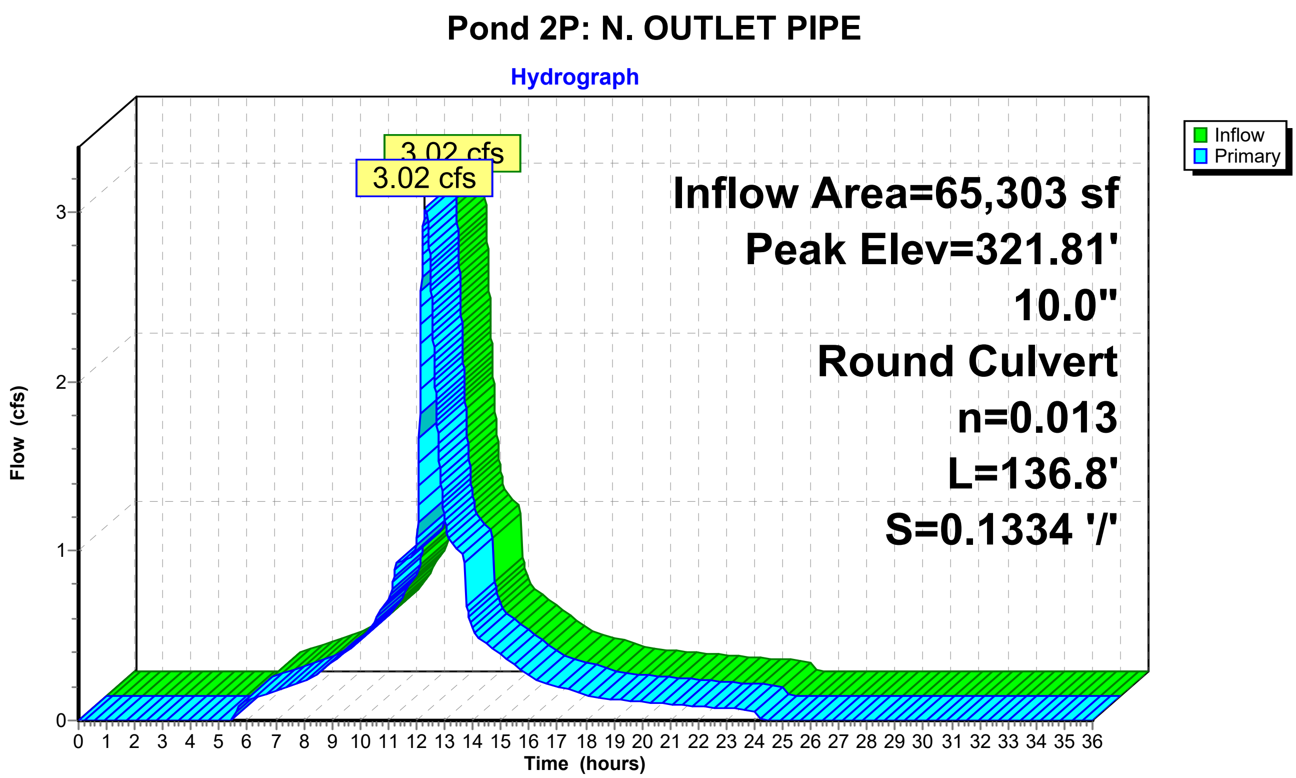
Summary for Pond 2P: N. OUTLET PIPE

Inflow Area =	65,303 sf,100.00% Impervious,	Inflow Depth = 4.91"	for 100-Year event	
Inflow =	3.02 cfs @	12.32 hrs, Volume=	26,698 cf	
Outflow =	3.02 cfs @	12.32 hrs, Volume=	26,698 cf,	Atten= 0%, Lag= 0.0 min
Primary =	3.02 cfs @	12.32 hrs, Volume=	26,698 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 321.81' @ 12.32 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.07'	**10.0" Round Culvert** L= 136.8' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.07' / 301.82' S= 0.1334 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf

Primary OutFlow Max=3.02 cfs @ 12.32 hrs HW=321.81' TW=0.00' (Dynamic Tailwater)
└**1=Culvert** (Inlet Controls 3.02 cfs @ 5.54 fps)



Summary for Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF

Inflow Area =	65,295 sf,100.00% Impervious,	Inflow Depth = 7.00" for 100-Year event			
Inflow =	10.65 cfs @	12.08 hrs,	Volume=	38,093 cf	
Outflow =	3.30 cfs @	12.39 hrs,	Volume=	38,061 cf,	Atten= 69%, Lag= 18.1 min
Discarded =	1.22 cfs @	11.63 hrs,	Volume=	17,407 cf	
Primary =	2.08 cfs @	12.39 hrs,	Volume=	20,653 cf	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 329.46' @ 12.39 hrs Surf.Area= 51,503 sf Storage= 9,374 cf

Plug-Flow detention time= 68.2 min calculated for 38,061 cf (100% of inflow)
Center-of-Mass det. time= 67.6 min (810.1 - 742.5)

Volume	Invert	Avail.Storage	Storage Description
#1	324.85'	781 cf	**36.0" W x 24.0" H Box Stone Storage** L= 409.0' S= 0.0050 '/' 2,454 cf Overall - 223 cf Embedded = 2,231 cf x 35.0% Voids
#2	325.35'	223 cf	**10.0" Round Pipe Storage** Inside #1 L= 409.0' S= 0.0050 '/'
#3	326.13'	329 cf	**36.0" W x 24.2" H Box Stone Storage** L= 171.0' S= 0.0050 '/' 1,035 cf Overall - 93 cf Embedded = 941 cf x 35.0% Voids
#4	326.63'	93 cf	**10.0" Round Pipe Storage** Inside #3 L= 171.0' S= 0.0050 '/'
#5	329.00'	14,456 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc) 41,303 cf Overall x 35.0% Voids
		15,883 cf	Total Available Storage

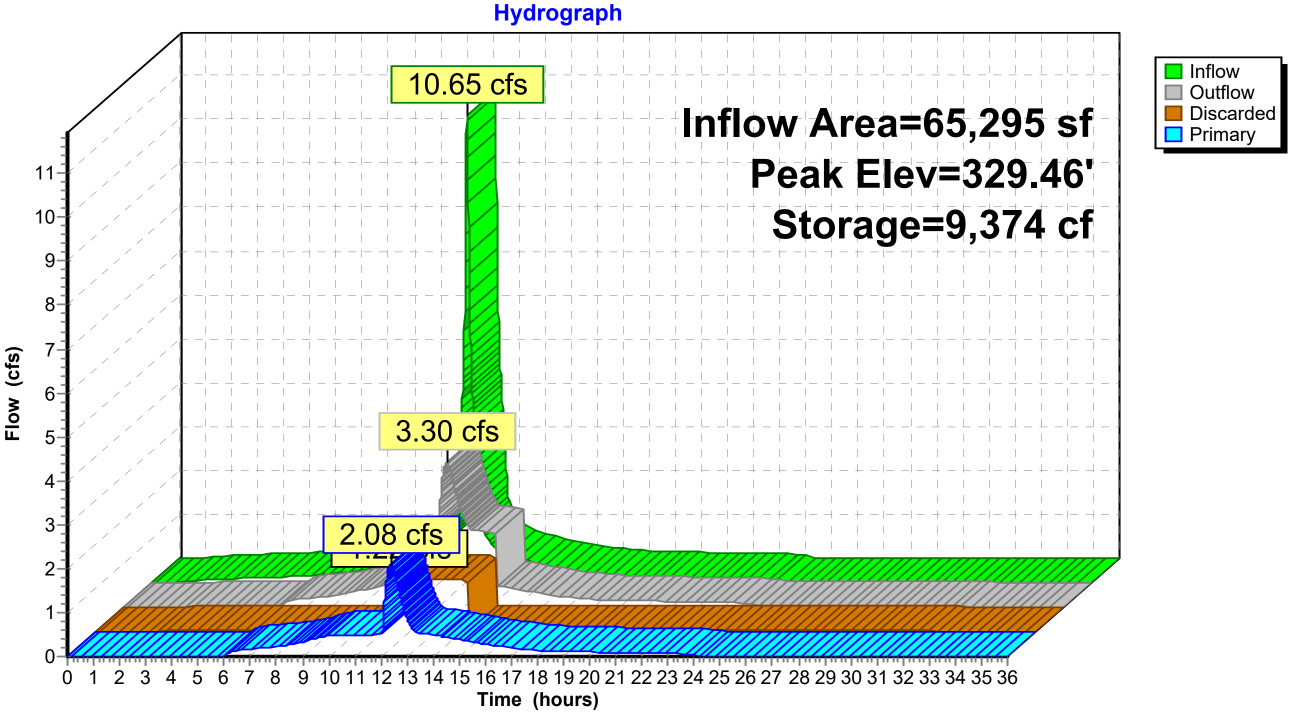
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
329.00	49,763	0	0
329.83	49,763	41,303	41,303

Device	Routing	Invert	Outlet Devices
#1	Discarded	324.85'	**1.020 in/hr Exfiltration over Surface area** Phase-In= 0.01'
#2	Primary	325.25'	**10.0" Round Culvert** L= 23.5' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 325.25' / 325.13' S= 0.0051 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	328.00'	**4.5" Vert. Orifice** C= 0.600
#4	Device 2	329.22'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=1.22 cfs @ 11.63 hrs HW=329.00' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 1.22 cfs)

Primary OutFlow Max=2.08 cfs @ 12.39 hrs HW=329.46' TW=322.05' (Dynamic Tailwater)
└─**2=Culvert** (Passes 2.08 cfs of 5.11 cfs potential flow)
  ├─**3=Orifice** (Orifice Controls 0.60 cfs @ 5.42 fps)
  └─**4=Sharp-Crested Rectangular Weir** (Weir Controls 1.48 cfs @ 1.59 fps)

Pond 3P: S. COLLECTOR DRAIN & STONE UNDER TURF



Summary for Pond 4P: S. OUTLET PIPE

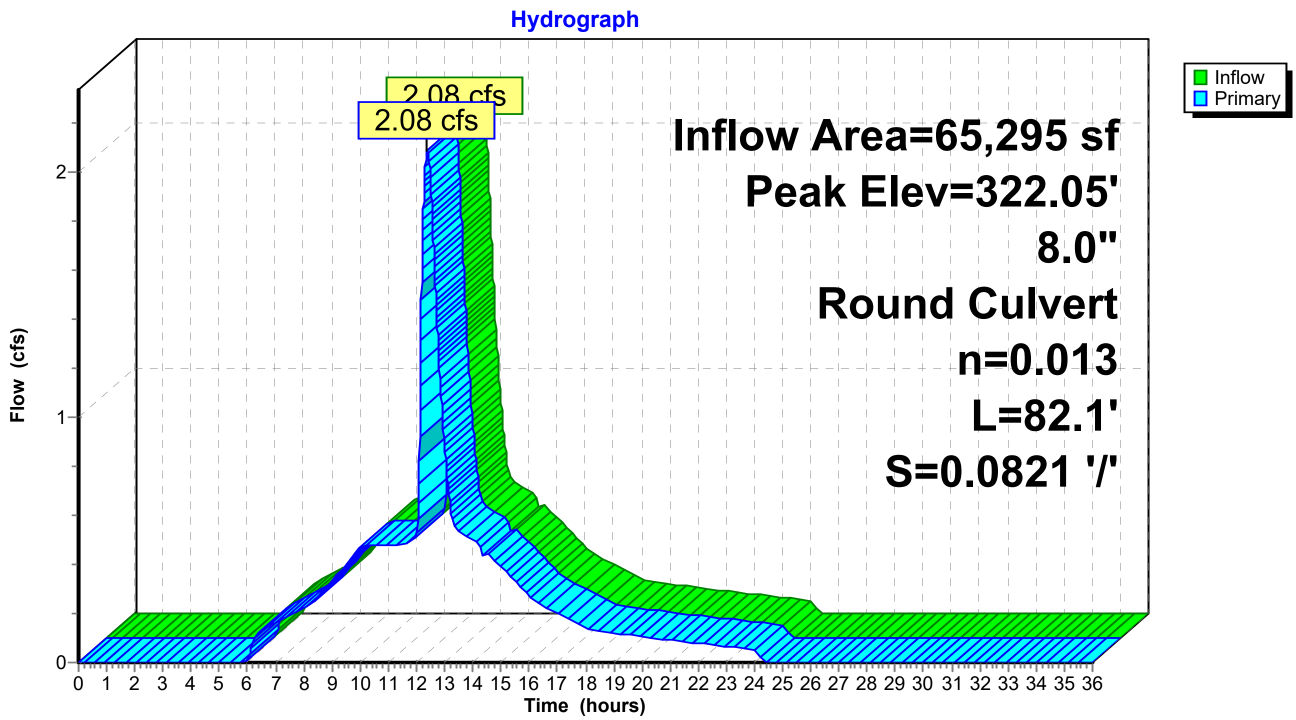
Inflow Area = 65,295 sf,100.00% Impervious, Inflow Depth = 3.80" for 100-Year event
Inflow = 2.08 cfs @ 12.39 hrs, Volume= 20,653 cf
Outflow = 2.08 cfs @ 12.39 hrs, Volume= 20,653 cf, Atten= 0%, Lag= 0.0 min
Primary = 2.08 cfs @ 12.39 hrs, Volume= 20,653 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 322.05' @ 12.39 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	320.18'	**8.0" Round Culvert** L= 82.1' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 320.18' / 313.44' S= 0.0821 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf

Primary OutFlow Max=2.08 cfs @ 12.39 hrs HW=322.05' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 2.08 cfs @ 5.97 fps)

Pond 4P: S. OUTLET PIPE



Section 4

Stormwater Management Calculations

U/G Infiltation Basin

(Recharge to Groundwater)

Rv = F * $Imperv_{(area)}$

Rv = Required Recharge Volume (CF)
F = Target Depth Factor associated with each Hydrologic Soil Group (HSG)
$Imperv_{(area)}$ = Proposed Tributary Impervious Area to Design Point

Table 2.3.2, Volume 3, Ch 1, Page 16

F =	0.60	IN (for A soils)
F =	0.35	IN (for B soils)
F =	0.25	IN (for C soils)
F =	0.10	IN (for D soils)

Project Input

Soil Group =	A		Soil Group =	B		Soil Group =	C		Soil Group =	D	
$Imperv_{(area)}$ =	41,113	SF	$Imperv_{(area)}$ =	0	SF	$Imperv_{(area)}$ =	0	SF	$Imperv_{(area)}$ =	0	SF
Rv(A)	**2055.7**	**CF**	**Rv(B)**	**0.0**	**CF**	**Rv(C)**	**0.0**	**CF**	**Rv(D)**	**0.0**	**CF**

Does all proposed impervious area drain to infiltration BMP = YES
Impervious area draining to infiltration BMP = 0 SF
Rv(Adjustment) Factor = 1.00

Volume provided in the u/g detention basin below the lowest outlet = **2282 CF**
(See HydroCAD calculations)

Adjusted Rv(Total) = 2055.7 CF

2282 > 2056 **<u>THEREFORE OK</u>**

U/G Infiltation Basin

(Water Quality Volume)

WQV = WQD * $Imperv_{(area)}$

WQV = Water Quality Volume
WQD = Water Quality Depth
$Imperv_{(area)}$ = Proposed Tributary Impervious Area to Treatment Train

WQD Based on Status of Tributary Area

WQD =	0.50	IN (for Non-Critical Areas)
WQD =	1.00	IN (for Critical Areas)

Project Input

Critical Area =	YES		
$Imperv_{(area)}$ =	41,113	SF	(Area of Track Surface Only)
WQD =	1.00	IN	
WQV =	**3426**	**CF**	

<u>U/G Infiltation Basin</u>

(Water Quality Flow)

MassDEP Standard Method to Convert WQV to a Discharge Rate

Q = (Qu) * (A) * (WQV)

WQV (0.5" or 1"):	1	IN	
CN:	98		
Tc:	0.1	HR	
Ia/P:	0.034		
Qu:	774	CSM/IN	
A:	0.00147	MI^2	(Area of Track Surface Only)
WQF (Q):	**1.14**	**CFS**	

Trench Filter Treatment Flow Rate:	0.05	CFS
Min. Filters Required for Treatment:	23	

30' O.C. Spacing of Filters Provided:	**35**	**<u>THEREFORE OK</u>**

Figure 4: for First 1-inch Runoff, Table of qu values for Ia/P Curve = 0.034, listed by tc, for Type III Storm Distribution

Tc (Hours)	qu (csm/in)
0.01	835
0.03	835
0.05	831
0.067	814
0.083	795
0.1	774
0.116	755
0.133	736
0.15	717
0.167	700
0.183	685
0.2	669
0.217	654
0.233	641
0.25	628
0.3	593
0.333	572
0.35	563
0.4	536
0.416	528
0.5	491
0.583	460
0.6	454
0.667	433
0.7	424
0.8	398
0.9	376
1	356
1.1	339
1.2	323
1.3	309
1.4	296
1.5	285
1.6	274
1.7	264
1.8	255
1.9	247
2	239
2.1	232
2.2	225
2.3	219
2.4	213
2.5	207
2.6	202

Tc (Hours)	qu (csm/in)
2.7	197
2.8	192
2.9	187
3	183
3.1	179
3.2	175
3.3	171
3.4	168
3.5	164
3.6	161
3.7	158
3.8	155
3.9	152
4	149
4.1	146
4.2	144
4.3	141
4.4	139
4.5	137
4.6	134
4.7	132
4.8	130
4.9	128
5	126
5.1	124
5.2	122
5.3	120
5.4	119
5.5	117
5.6	115
5.7	114
5.8	112
5.9	111
6	109
6.1	108
6.2	106
6.3	105
6.4	104
6.5	102
6.6	101
6.7	100
6.8	99
6.9	98
7	96

Tc (Hours)	qu (csm/in)
7.1	95
7.2	94
7.3	93
7.4	92
7.5	91
7.6	90
7.7	89
7.8	88
7.9	87
8	86
8.1	85
8.2	84
8.3	84
8.4	83
8.5	82
8.6	81
8.7	80
8.8	79
8.9	79
9	78
9.1	77
9.2	76
9.3	76
9.4	75
9.5	74
9.6	74
9.7	73
9.8	72
9.9	72
10	71

MassDEP Q Rate - Sept. 10, 2013 - Page 7

U/G Basin - Required Surface Area

$$\text{Surface Area}_{U/G\ Basin} = \frac{V}{(D + K * T / 12)}$$

V = Volume Below Lowest Orifice (CF)
D = Basin Depth (FT) below lowest outlet orifice
K = Saturated Hydraulic Conductivity, Rawls Rate (IN/HR)
T = Fill Time (HR)

V =	2282	CF	
D =	1.00	FT	
K =	1.02	IN/HR	(1982 Rawls Rate Sandy Loam)
T =	2	HR	

Surface Area$_{U/G\ Basin}$ = 1,950 SF

U/G Area Provided = 3,261 SF

U/G Basin - Drawdown Time

$$Time_{drawdown} = \frac{V}{K * \text{Basin Area}}$$

V = Total Storage Volume Below Lowest Orifice
K = Saturated Hydraulic Conductivity, Rawls Rate
Basin Area = Area of Basin at Water Surface Elevation

V =	2282	CF	
K =	1.02	IN/HR	(1982 Rawls Rate Sandy Loam)
Basin Area =	3261	SF	

$Time_{drawdown}$ = 8.2 HR

The calculation shows that the u/g basin will drawdown within the required 40 hours between storm events (assuming linear application of infiltration rate & no mounding occurs).

N. Outlet Pipe Riprap Apron Design (2P)

Apron Length

$$L_a = \frac{1.8 * Q}{D_o * 1.5} + 7 * D_o$$

$Q_{100\ (pipe\ flow)}$ =	3.02	CFS	
D_o =	0.83	FT	
TW =	0.25	FT	(Assumed)
L_a =	11	FT	

Apron Width

$W_{outlet\ end\ of\ apron} = 3 * D_o + L_a$

$W_{outlet\ end\ of\ apron}$ =	14	FT	

$W_{culvert\ end\ of\ apron} = 3 * D_o$

$W_{culvert\ end\ of\ apron}$ =	3	FT	use 5' min.

Riprap Diameter

$$D_{50} = \frac{0.02 * Q^{1.3}}{TW * D_o}$$

D_{50} =	0.40	FT	
D_{50} =	4.8	IN	**USE D_{50} = 8" min.**

S. Outlet Pipe Riprap Apron Design (4P)

Apron Length

$$L_a = \frac{1.8 * Q}{D_o * 1.5} + 7 * D_o$$

$Q_{100\ (pipe\ flow)}$ =	2.08	CFS
D_o =	0.67	FT
TW =	0.25	FT (Assumed)
L_a =	9	FT

Apron Width

$$W_{outlet\ end\ of\ apron} = 3 * D_o + L_a$$

$W_{outlet\ end\ of\ apron}$ =	11	FT

$$W_{culvert\ end\ of\ apron} = 3 * D_o$$

$W_{culvert\ end\ of\ apron}$ =	2	FT use 5' min.

Riprap Diameter

$$D_{50} = \frac{0.02 * Q^{1.3}}{TW * D_o}$$

D_{50} =	0.31	FT	
D_{50} =	3.7	IN	**USE D_{50} = 8" min.**

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Eaglebrook School - Track Renovation Project

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Subsurface Infiltration Structure	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

Total TSS Removal = 80%

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

Project: Track Renovation Project
Prepared By: BLM
Date: 4/12/2023

*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

Mass. Dept. of Environmental Protection

WOODBURY UNIVERSITY

PRETREATMENT BMP
>44% TSS

Revel Environmental Manufacturing, Inc.

2009 Storm Water Filter Efficiency Testing: Catch Basin Filter Inserts

Test Protocol

Three REM Inc. catch basin filter inserts were installed and tested at the Woodbury University parking lot in order to evaluate the filter's efficiency to remove sediments. The filters tested were REM Inc. Triton Drop Inlet Filter Inserts Model Number: TR24SR. The test equipment was constructed with two different vessels to contain water and solid media. Each vessel was piped and had valves to control a calibrated flow rate of water and solids. The slurry was delivered to the filter via 3" PVC piping.

To evaluate the effectiveness of the catch basin filter inserts we independently weighed the filters and the samples of dry media before the experiment. The combined weight of the filter and media were then taken after the delivery of the slurry and rinsing of test equipment. Measurements were taken with a calibrated digital Tylan General scale with a +/- 0.1lb accuracy. Filters were left to dry completely and this allowed us to estimate the total amount of sand collected by the filters, and consequently the filter's efficiency.

Test Date: 10/24/2009												
REM Filter Efficiency Test								Executed By:			Eugene Allevato	
TEST	Filter	Media Sample Weight		Filter Weight				Filter & Media Weight				Filter
		Pretest (Kg)	Pretest (lb)	Pretest (Kg)	Pretest (lb)	W/Sand (Kg)	W/Sand (lb)	Pre-drying (Kg)	Pre-drying (lb)	Post-drying (Kg)	Post-drying (lb)	Efficiency
1	TR24SR-1	4.6	10.1	4.4	9.6	8.9	19.7	9.6	21.2	8.4	18.6	94.42%
2	TR24SR-2	4.5	10.0	4.4	9.6	8.9	19.6	9.6	21.2	8.4	18.5	94.39%
3	TR24SR-3	4.5	10.0	4.2	9.3	8.8	19.3	9.4	20.8	8.3	18.2	94.30%
H2O flow rate: 30gal/min = 114 l/min												
Media Release rate: 5lbs/min = 2.26 Kg/min												
Media: Quikrete All Purpose Sand_No. 1152_ASTM C-33_Seive: 62microns												
Filter: TR24SR Grated Inlet Filter												

Table 1 – Efficiency of three different REM TR24SR catch basin inserts filters.

Eugene Allevato
1.818.252.5148
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7500 Glenoaks Blvd, Burbank CA 91510-7846

WOODBURY UNIVERSITY

Revel Environmental Manufacturing, Inc.

Results

Test measurements and results are tabulated in Table 1. The results were very promising and reliably indicate the removal efficiency of solid material to be above 94% as shown in figure 1.

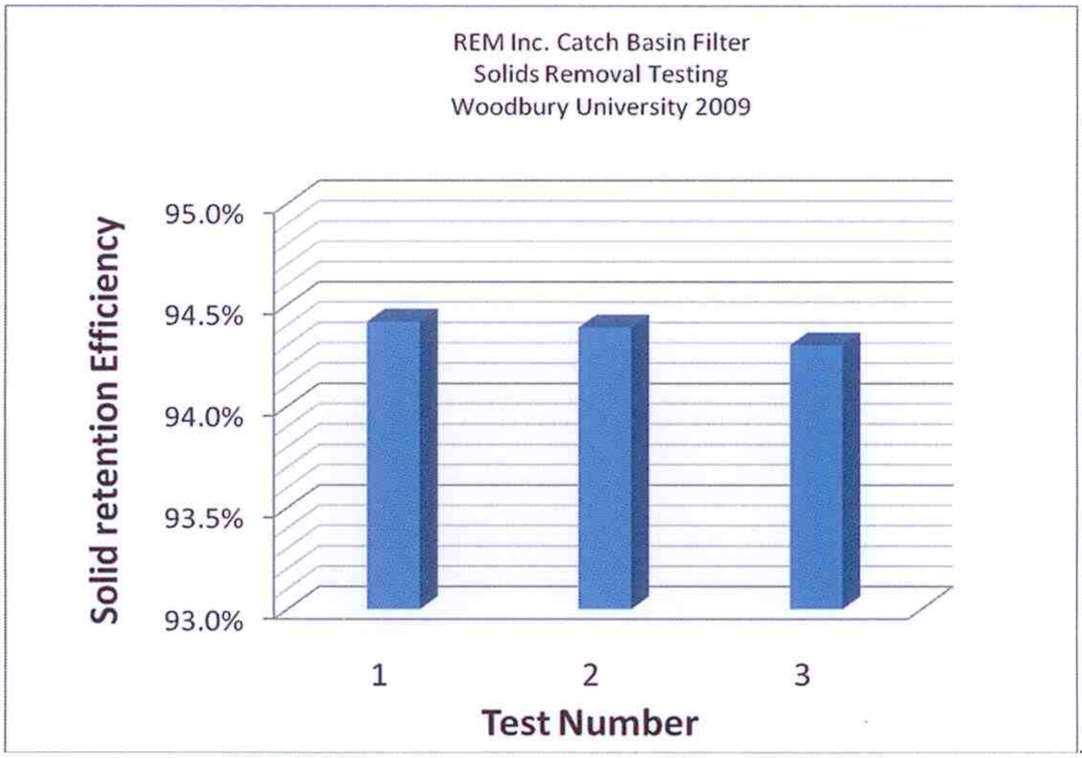

Figure 1 – Average Solids Removal Efficiency 94.37%

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Santa Ana, California 92705
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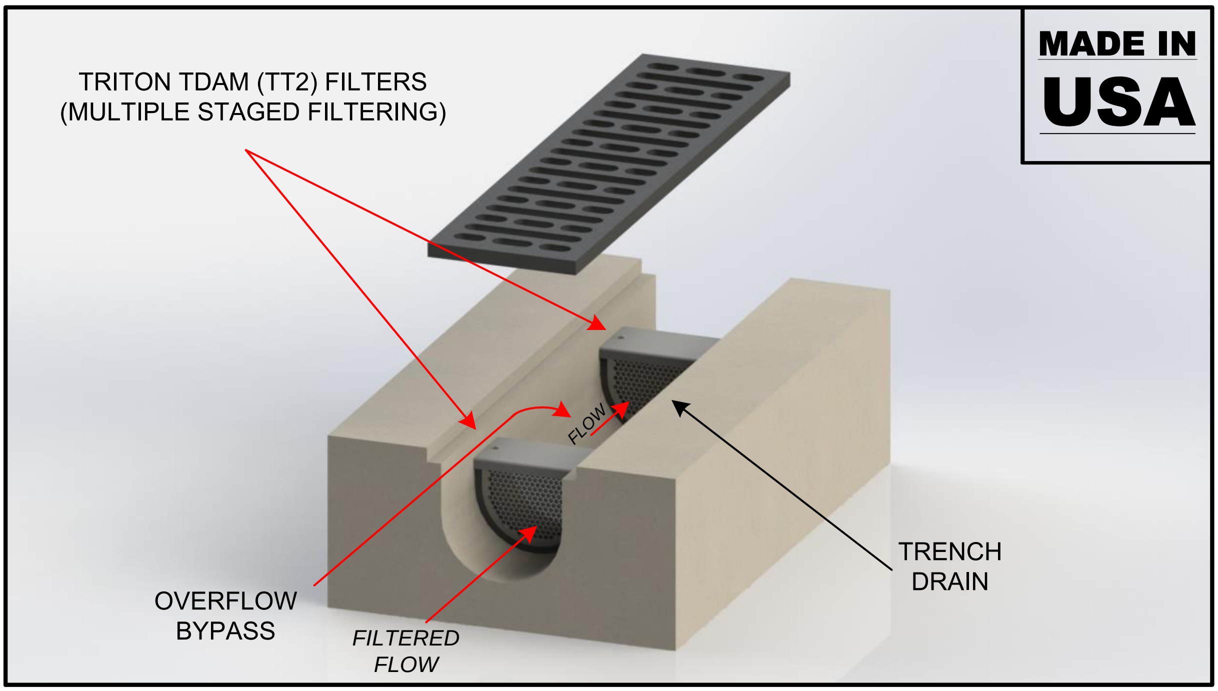
How does our technology work? (TRITON TDAM TT2 Filter™)

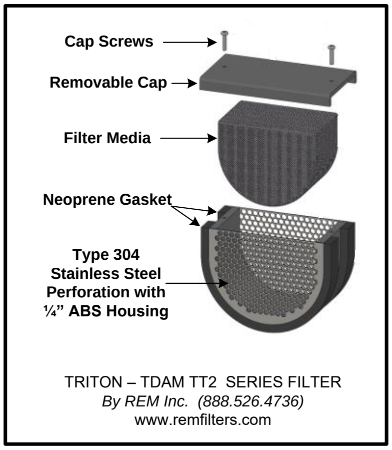
The TRITON TDAM TT2 Filter™ (Patent Pending) is an effective and economical solution to help organizations and property owners meet stormwater quality requirements and regulations. Easily installed immediately below the grate in trench drains with rounded bottoms, the REM TRITON TDAM TT2 filter utilizes a patented linear media cartridge system that effectively removes pollutants from stormwater.

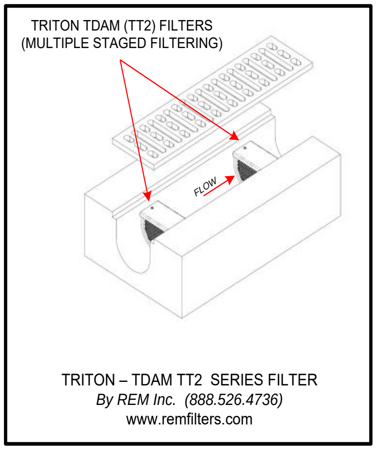


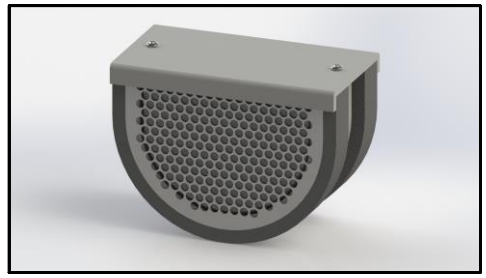
The REM TRITON TDAM TT2 gravity fed vertical cartridge system treats flow laterally through a three dimensional media pack element resulting in reduced occlusion and increased flow over a range of rainfall intensity.

The REM TRITON TDAM TT2 linear stainless steel media cartridge is installed in place on the trench drain floor allowing quick and easy removal for maintenance. The cartridge houses replaceable filter media that treats stormwater for pollutants including liquefied petroleum hydrocarbons (Fats, Oils & Grease including animal fats) and Total Suspend Solids (TSS) such as trash, sediment, silt, vegetative debris.

Media strategy can be configured to address specific discharge concerns. For instance, a common strategy for removing metals includes blending REM FOG (a high quality hydrophobic expanded perlite), AC (activated carbon, and ZEO (zeolite) media.



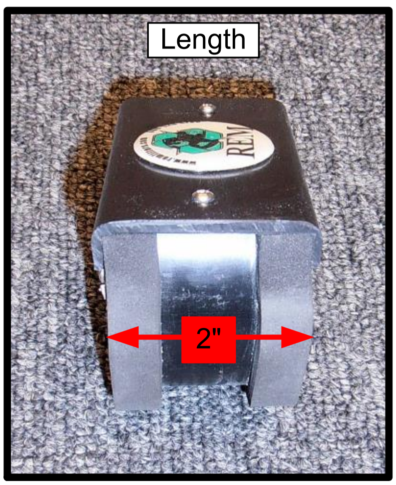


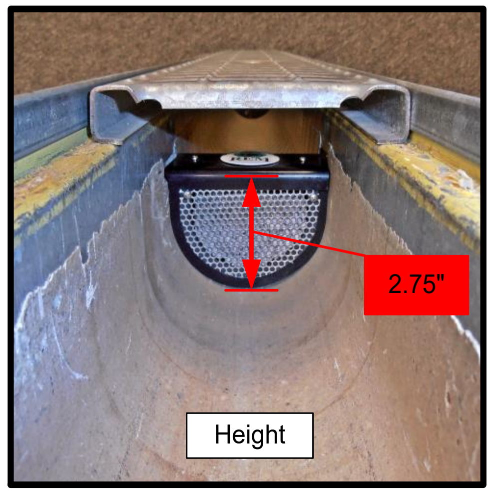


TRITON – TDAM TT2 SERIES FILTER
By REM Inc. (888.526.4736)
www.remfilters.com

REM TRITON TDAM TT2 filters offer quick and easy maintenance made available with replaceable media.

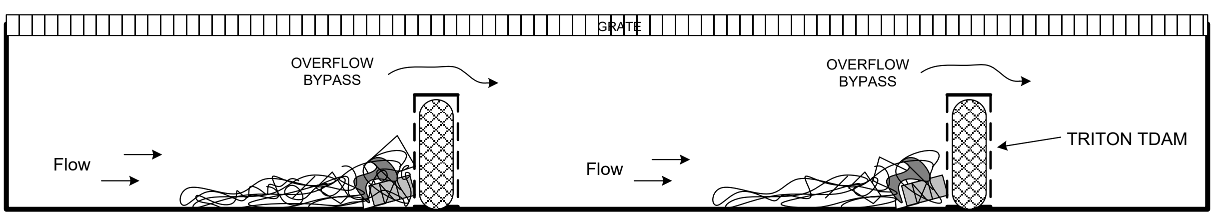
REM TRITON TDAM TT2 filters are designed for most common round bottom trench drains including Polydrains, Polycast and other polymer concrete based prefabricated sloped drains.





REM TRITON TDAM TT2 Filters are teamed in a battery series providing multiple stages of filtration effectively polishing flow. (REM recommends installing one TT2 filter every 4 to 6' along the length of the trench drain.)

REM TRITON TDAM TT2 Filters treat large volume of runoff without impeding the hydraulic capacity of the drain. TT2s are engineered with an "overflow bypass" to release water during heavy rain events exceeding filter flow-through capacity.



Section 5

Soil Data

REF: OFFICE OF GEOGRAPHIC AND ENVIRONMENTAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS; 2021 ORTHOPHOTO
TEST PITS: HAND SPADE AND AUGER BY PROTERRA DESIGN GROUP, LLC ON APRIL 10, 2023

N

ProTerra
DESIGN GROUP, LLC
4 Bay Road
Building A, Suite 200
Hadley, MA 01035 (413)320-4918

SOIL TEST PIT LOCATIONS

TRACK RENOVATION PROJECT
EAGLEBROOK SCHOOL
279 PINE NOOK ROAD
DEERFIELD, MA 01342

SCALE: 1" = 80' DATE: APRIL 13, 2023

FIG.5

Eaglebrook Track & Turf Field

- Test Pits via hand spade and auger 04-10-2023 10:00 AM, TEJ - MA Soil Evaluator, PE
- Track field was terraced in slope from original construction
- Sunny 60 deg. F, no rain last 72 hours.

TP#1 NORTHWEST CORNER OF TRACK INFIELD

0”-8” A – topsoil, grass, root structure, 10YR3/2, no gravel, Loam

8”-72” B/C - field fill, 10YR3/4 10% gravel, no water, no mottles, Loamy Sand (LS), loose structure

No water observed

TP#2 NORTHEAST CORNER OF TRACK INFIELD

Location near shallow and wide swale to existing catch basin inlet

0”-9” A – topsoil, grass, root structure, 10YR3/2, no gravel, Loam

9”-60” B/C - field fill, 10YR4/4 10% gravel, no water, no mottles, Loamy Sand (LS), loose structure

No water observed

TP#3 MID (50 YARD LINE) EAST SIDE OF INFIELD

0”-7” A – topsoil, grass, root structure, 10YR3/2, no gravel, Loam

7”-60” B/C - field fill, 10YR4/4 10% gravel, no water, no mottles, Loamy Sand (LS), loose structure

No water observed

TP#4 CENTER SOUTH GOAL BOX

0”-8” A – topsoil, grass, root structure, 10YR3/2, no gravel, Loam

8”-60” B/C - field fill, 10YR4/4 10% gravel, no water, no mottles, Loamy Sand (LS), loose structure

No water observed

@ 36” appears to be a 6” band of old topsoil

TP#5 MID WEST SIDE OF FIELD

0”-7” A – topsoil, grass, root structure, 10YR3/2, no gravel, Loam

7”-48” B/C - field fill, 10YR4/4 10% gravel, no water, no mottles, Loamy Sand (LS), loose structure

No water observed

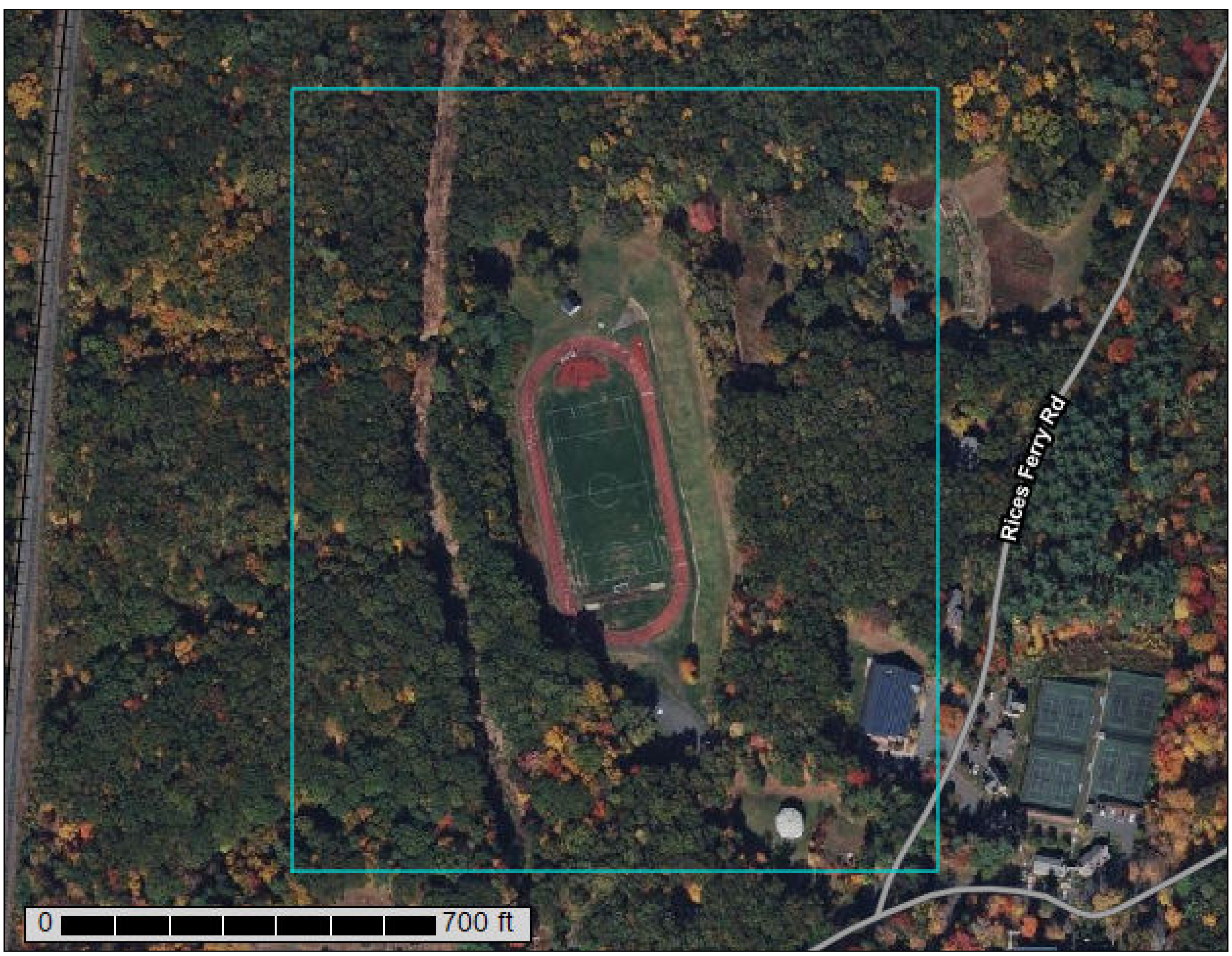
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Franklin County, Massachusetts



April 12, 2023

Soil Map

Map Scale: 1:2,840 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

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

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

Soil Survey Area: Franklin County, Massachusetts
Survey Area Data: Version 17, Sep 9, 2022

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

Date(s) aerial images were photographed: Oct 15, 2020—Oct 31, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
131B	Yalesville-Holyoke complex, 3 to 8 percent slopes, rocky	0.2	0.5%
131C	Yalesville-Holyoke complex, 8 to 15 percent slopes, rocky	1.8	4.4%
229F	Windsor and Merrimac soils, 25 to 60 percent slopes	15.6	38.6%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	3.5	8.6%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	1.2	3.1%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	4.4	10.9%
254D	Merrimac fine sandy loam, 15 to 25 percent slopes	6.1	15.0%
397D	Wethersfield very fine sandy loam, 15 to 25 percent slopes	0.7	1.7%
420D	Canton fine sandy loam, 15 to 25 percent slopes	0.7	1.8%
651	Udorthents, smoothed	5.5	13.5%
656	Udorthents-Urban land complex	0.8	1.9%
Totals for Area of Interest		**40.4**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

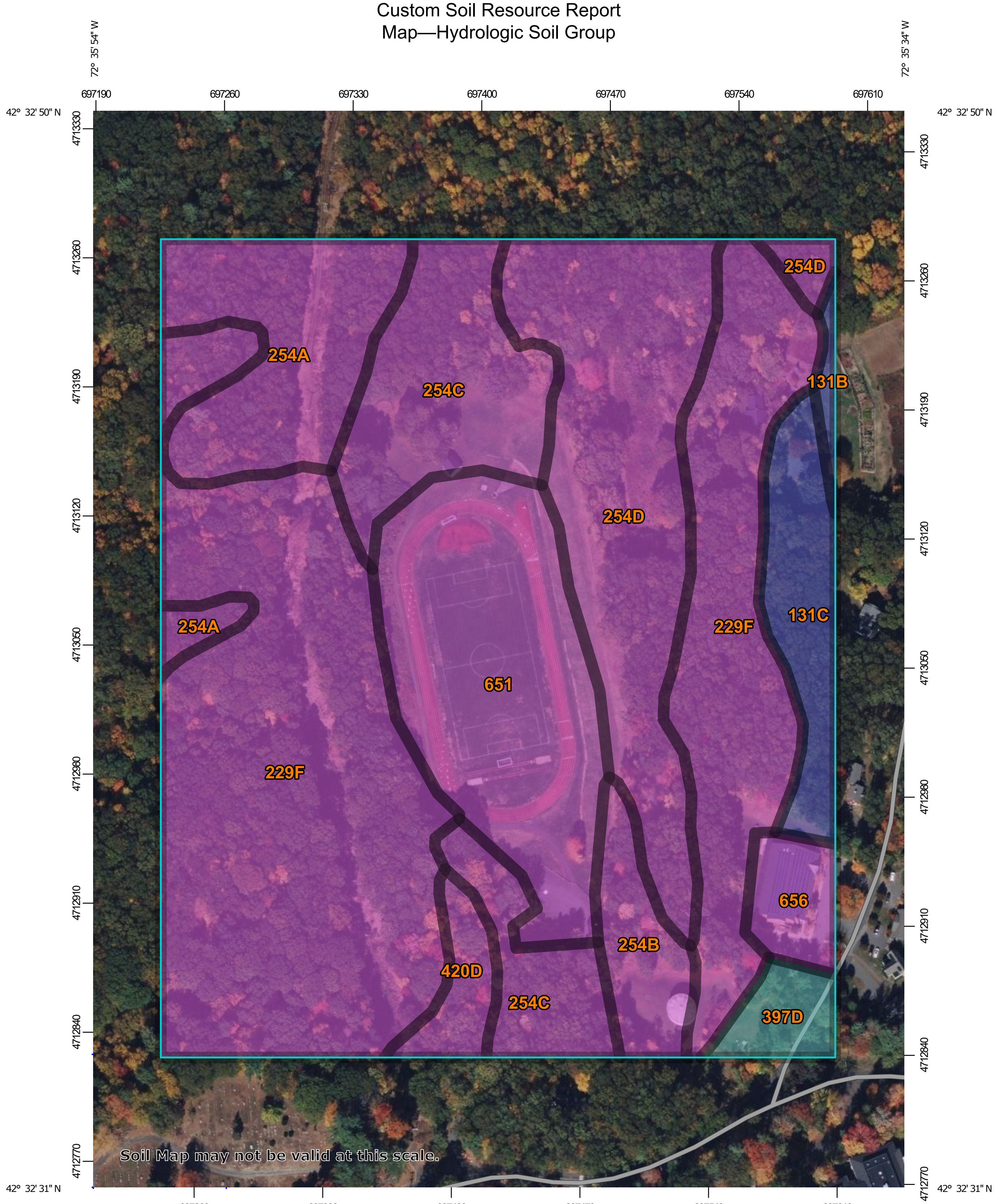
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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

Map—Hydrologic Soil Group



Map Scale: 1:2,840 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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

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Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
131B	Yalesville-Holyoke complex, 3 to 8 percent slopes, rocky	B	0.2	0.5%
131C	Yalesville-Holyoke complex, 8 to 15 percent slopes, rocky	B	1.8	4.4%
229F	Windsor and Merrimac soils, 25 to 60 percent slopes	A	15.6	38.6%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	3.5	8.6%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	1.2	3.1%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	A	4.4	10.9%
254D	Merrimac fine sandy loam, 15 to 25 percent slopes	A	6.1	15.0%
397D	Wethersfield very fine sandy loam, 15 to 25 percent slopes	C	0.7	1.7%
420D	Canton fine sandy loam, 15 to 25 percent slopes	A	0.7	1.8%
651	Udorthents, smoothed	A	5.5	13.5%
656	Udorthents-Urban land complex	A	0.8	1.9%
Totals for Area of Interest			**40.4**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Water Features

Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Map—Depth to Water Table

72° 35' 54" W
72° 35' 34" W
42° 32' 50" N
42° 32' 31" N
697190 697260 697330 697400 697470 697540 697610
4713330 4713260 4713190 4713120 4713050 4712980 4712910 4712840 4712770

Map Scale: 1:2,840 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

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

Soils

Soil Rating Polygons
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Water Features
- Streams and Canals

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Table—Depth to Water Table

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
131B	Yalesville-Holyoke complex, 3 to 8 percent slopes, rocky	>200	0.2	0.5%
131C	Yalesville-Holyoke complex, 8 to 15 percent slopes, rocky	>200	1.8	4.4%
229F	Windsor and Merrimac soils, 25 to 60 percent slopes	>200	15.6	38.6%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	>200	3.5	8.6%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	>200	1.2	3.1%
254C	Merrimac fine sandy loam, 8 to 15 percent slopes	>200	4.4	10.9%
254D	Merrimac fine sandy loam, 15 to 25 percent slopes	>200	6.1	15.0%
397D	Wethersfield very fine sandy loam, 15 to 25 percent slopes	85	0.7	1.7%
420D	Canton fine sandy loam, 15 to 25 percent slopes	>200	0.7	1.8%
651	Udorthents, smoothed	>200	5.5	13.5%
656	Udorthents-Urban land complex	>200	0.8	1.9%
Totals for Area of Interest			**40.4**	**100.0%**