Stormwater Report

Town of Littleton
Littleton Tennis and Whitcomb Field Improvements

Littleton Middle School
55 Russell Street
Littleton, MA, 01460

Applicant:
Town of Littleton
37 Shattuck Street
Littleton, MA 01460

Owner:
Town of Littleton School Department
PO Box 1305
Littleton, MA 01460

Submitted To:
Town of Littleton
Planning Board
37 Shattuck Street
Littleton, MA 01460

Civil Engineer/ Landscape Architect:
Activitas, Inc.
70 Milton Street
Dedham, MA 02026
(781) 355-7040

Surveyor:
LandTech Consultants
515 Groton Road
Westford, MA 01886
(978)692-6100

February 19, 2025

Site Locus Map

55 Russell Street

Littleton, MA

1 inch = 556 Feet

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February 13, 2025

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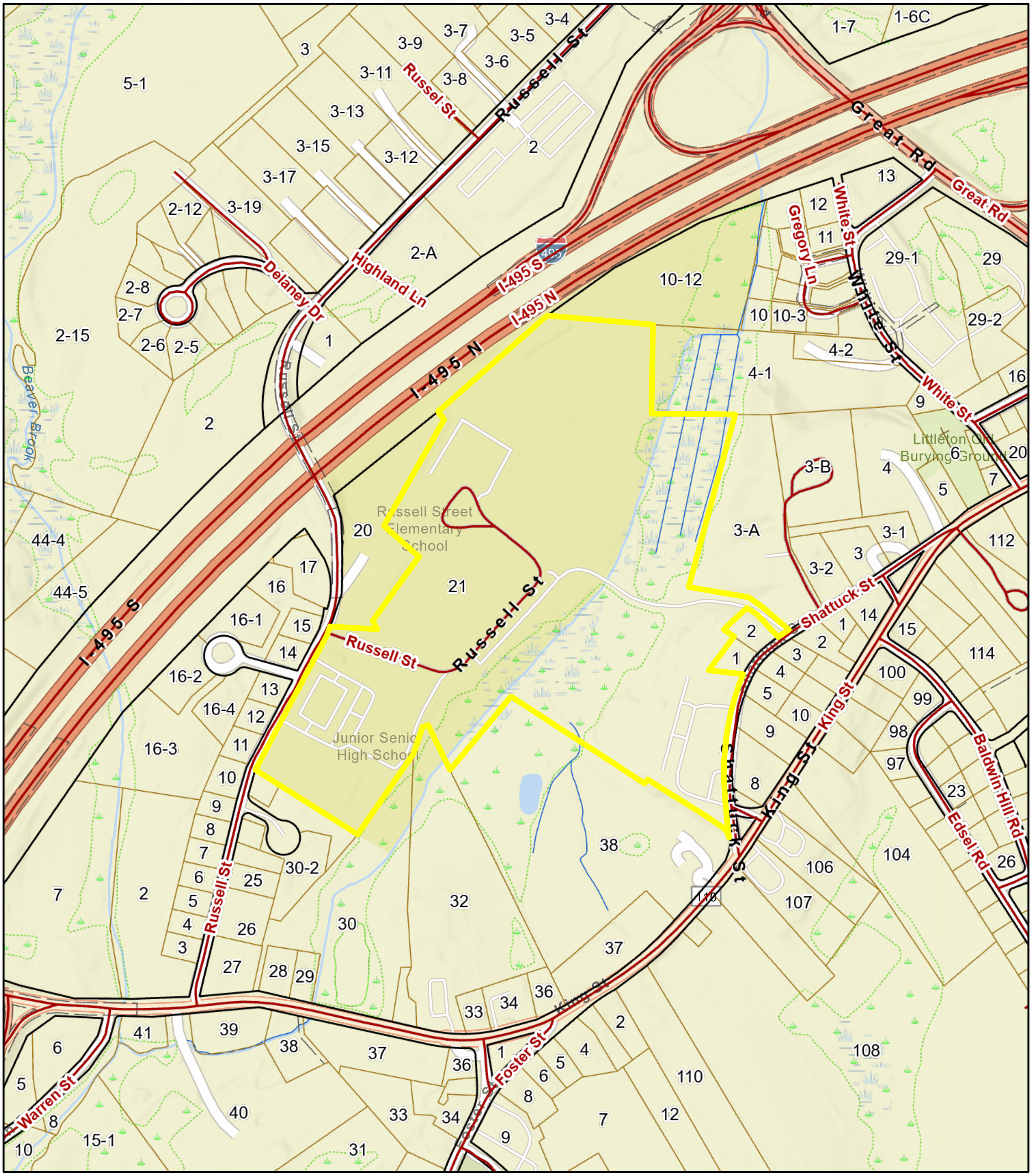

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Massachusetts Stormwater Report Checklist

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

02/19/25
Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

- ☐ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

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Project Overview

The Town of Littleton is proposing to construct a tennis facility on the south side of the Littleton Middle School property. The proposed project will include construction of a 4-court tennis battery, chain link perimeter fencing, and accessible walkways to provide access to the courts from the existing parking area.

Compliance with Stormwater Standards

The Town of Littleton requires that projects be designed to meet the Massachusetts Stormwater Standards for new development. The proposed project is considered new development under the Stormwater Standards. The project has been designed in accordance with the "Massachusetts Stormwater Handbook".

LID Measures

Key features of Low Impact Development (LID) stormwater management systems include implementing practices that maintain a site's existing hydrology, using decentralized practices to manage stormwater close to the source of generation, and maximizing onsite infiltration to reduce runoff and landscape watering requirements.

The following LID techniques Best Management Practices are specified in the proposed development program to mitigate the increase in stormwater runoff from the site.
BMPs Used:

- No disturbance to any Wetland Resource Areas
- Minimizing disturbance to existing trees and shrubs

Standard 1: No New Untreated Discharges

The MA Stormwater Handbook requires that projects demonstrate that there are no new untreated discharges and that new discharges will not cause erosion or scour to downstream wetlands or water of the Commonwealth.

Computations and strategies shown for Standards 4 through 6 in this report demonstrate that there will be no new untreated discharges from the site.

Standard 2: Peak Rate Attenuation

Standard 2 requires that stormwater management systems be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates for the 2-yr, 10-yr, and 100-yr storm events. The following section outlines the procedure for determining the peak rates and volumes for the existing condition as well as the methods for attenuating the peak flows and volumes in the proposed condition.

2.1 Methodology

2.1.1 Hydrologic Model Description

The drainage analysis was performed using the Soil Conservation Service (SCS) TR-55 and TR-20 methodologies and the computer program HydroCAD 10.20-5c by HydroCAD Software Solutions, LLC.

2.1.2 Soil Conditions

The National Resources Conservation Service (NRCS) soil report identifies the majority of soils within the area of analysis as Hinckley loamy sand and Merrimac-Urban Land Complex as noted in Table 1. Both of these soils have Hydrologic Soil Group A. Test pits performed in association with the ongoing groundwater monitoring on the Middle School property found soils consistent with the soil maps. NRCS soil report and the test pit logs on and near the project area can be found in the Attachments section of this report.

Table 1: NRCS Soil Types

Map Designation	Soil Name	Soil Group
253A	Hinckley Loamy Sand	A
626B	Merrimac-Urban Land Complex	A

2.1.3 Design Storms

The analysis was performed on the 2-, 10-, and 100-year frequency rainfall events. The events were based on the 24-hour Type-III duration storms.

2.1.4 Time of Concentration

Time of Concentration (Tc) values were calculated using Average Velocities for Overland Flow, found in SCS TR-55 Urban Hydrology for Small Watersheds. The minimum Tc used was six (6) minutes as this is the minimum that HydroCAD defaults to in the calculations.

2.1.5 Curve Numbers

Curve numbers were developed for each of the different use categories and hydrologic soil group types within each sub-area. The curve numbers were based on the SCS TR-55 methodology and are included in the HydroCAD input and output found in the Attachments Section.

2.1.6 Rainfall

Rainfall data is taken from the NOAA Atlas 14, Volume 10 for the project location. The following depths were used in the HydroCAD model for the 2-, 10-, and 100-yr storm events:

Table 2: Rainfall Data

Storm Event	Rainfall Depth
2-yr	3.18"
10-yr	4.92"
100-yr	7.66"

2.2 Existing Conditions

The Littleton Tennis project limit of work is approximately 0.98 acres. The area of analysis was extended beyond the project limit of work to include a 2.94-acre area containing the entire open grassed area to the south of the Middle School building and parking area. The proposed project area is currently used by the Middle School and Town of Littleton for outdoor recreation, specifically rectangular field sports such as field hockey and soccer. In the middle of the grass area there is a ridgeline that splits the area into two subcatchment areas. Runoff from the eastern area flows overland to the existing stormwater infiltration/detention basin located to the east of the open grass area (DP-2). Stormwater within this

basin that does not infiltrate is discharged from the basin via a spillway where it is eventually tributary to Beaver Brook. Runoff from the western area flows overland to Russell Street where it is collected in a series of catch basins and ties into the Littleton stormwater drainage infrastructure (DP-1). See Pre-Development Plan Attachment (Fig. 1).

2.2.1 Existing Drainage Areas

The existing conditions of the project area contain two (2) drainage areas, Subcat 1 and Subcat 2 that flow to the two Discharge Points.

Subcat-1 is a 43,078-sf area that contains grassed areas and vegetation along the perimeter.

Subcat-2 is an 81,168-sf area that contains grassed areas, vegetation along the perimeter, and a detention/infiltration basin.

2.3 Proposed Conditions

The proposed project area contains a ridgeline southeast of the proposed walkway that splits the area into three subcatchment areas. Runoff from the eastern area flows overland to the existing stormwater infiltration/detention basin located to the east of the open grass area (DP-2). Stormwater within this basin that does not infiltrate is discharged from the basin via a spillway where it is eventually tributary to Beaver Brook. Runoff from the western area flows overland to a channel drain along the western edge of the tennis courts. The channel drain collects the water and discharges it to an infiltration/detention basin south of the proposed courts. Stormwater within this basin that does not infiltrate is discharged from the basin via an outlet control structure that connects to the existing drainage infrastructure on Russell Street.

2.3.1 Proposed Drainage Areas

The proposed conditions of the project area contain three (3) drainage areas, Subcat 10, Subcat 11, and Subcat 20 that flow to the two Discharge Points.

Subcat-10 is a 35,748-sf area that contains a four (4) court tennis battery, accessible site walkways, and a proposed infiltration/detention basin.

Subcat-11 is a 16,508-sf area that contains grassed areas and vegetation along the perimeter of the proposed tennis court battery.

Subcat-20 is a 71,990-sf area that contains grassed areas, vegetation along the perimeter, and an existing infiltration/detention basin.

Table 3: Existing & Proposed Conditions Takeoff Areas (SF)

	Impervious CN=98	Grass CN=39	Woods/Brush Good CN=30	Total Area	Weighted CN
Subcat-1	20 sf	36,439 sf	6,619 sf	43,078 sf	38
Subcat-2	65 sf	68,617 sf	12,485 sf	81,168 sf	38
EX-Total	85 sf	105,056 sf	19,104 sf	124,246 sf	38
Subcat-10	27,627 sf	8,122 sf	-	35,748 sf	
Subcat-11	142 sf	8,486 sf	7,880 sf	16,508 sf	36

Subcat-20	66 sf	60,699 sf	11,225 sf	71,990 sf	38
PR-Total	27,835 sf	77,307 sf	19,105 sf	124,246 sf	

2.4 Peak Discharge Runoff Rates

The peak flows were calculated for the 2-,10-, and 100-year storm events under the existing and proposed conditions to compare. Table 4 summarizes the rates of runoff. Please refer to the waiver request attachment in the NOI submission for more information.

Table 4: Summary of Runoff Rates (cfs)

		2 Year	10 Year	100 Year
DISCHARGE POINTS	DP-1E	0.00	0.02	0.50
	DP-1P	0.00	0.01	0.49
	DP-2E	0.00	0.04	0.93
	DP-2P	0.00	0.03	0.88

2.5 Stormwater Analysis Results

The MA Stormwater Handbook requires that stormwater management systems must be designed so that post-development peak discharge rates to do exceed pre-development peak discharge rates for the 2-yr, 10-yr, and 100-yr storm events. The Town of Littleton's Stormwater Regulations require that runoff rate does not increase for the 2-yr,10-yr, and 100-yr storm event. As shown in the HydroCAD model and summarized in Table 4 above, the rates in any of the storms are reduced under proposed conditions and therefore the project is meeting the State and Local Standards.

Standard 3: Stormwater Recharge

3.1 Stormwater Recharge

The Stormwater Standards indicate that at a minimum, the annual recharge from the post development site shall approximate the annual recharge from pre-development conditions.

Required Recharge Volume:
The proposed project will add 27,750 sf of impervious to the project site.

$$R_v = F\ x\ Impervious\ Area\ Increase$$

*F for Stormwater Standards is 0.60-inch (A-Soils)

$$R_v = (0.60in)\ x\ \left(\frac{1\ ft}{12\ in}\right) x\ (\ 27{,}750\ sf)$$

$$R_v = 1{,}387.5\ cf$$

Recharge of the runoff generated from the increase in impervious area will be provided in the underground infiltration/detention system. The Simple Dynamic Method was used to show the required volume will recharge. The HydroCAD model associated with these calculations can be found in the

Appendix. The model utilizes the 2-year storm depth that will generate a greater volume than the required recharge volume over the impervious areas (5,185 cf). The model shows that when this volume is run through the infiltration basin there is no outlet of stormwater from the system with the exception of exfiltration, meaning the full required recharge volume will recharge and therefor the standard is met.

3.2 Drawdown Time

The MA Stormwater Handbook requires that recharge volume have a drawdown time of 72 hours or less. The time required to dewater a recharge system may be estimated by the following equation:

$$Time_{drawdown} = \frac{V_{RS}}{(K)\ x\ \left(\frac{1ft}{12in}\right) x\ (A_R)}$$

$$V_{RS} = Volume\ of\ recharge\ storage\ system\ (cf)$$

$$K = Rawls\ Rate\ \left(\frac{in}{hr}\right)$$

$$A_R = Surface\ area\ of\ recharge\ system\ (sf)$$

The drawdown time of the entire underground detention system (assuming full capacity) is calculated as the following:

$$Time_{drawdown} = \frac{8{,}210\ cf}{\left(\frac{2.41\ in}{hr}\right) x\ \left(\frac{1\ ft}{12\ in}\right) x\ (1{,}434\ sf)}$$

$$Time_{drawdown} = 28.5\ hours$$

The drawdown time of 28.5 hours for Pond-1P and the drawdown time for the infiltration trench at the north end of the courts are under the 72-hour maximum and therefore this standard is met.

Standard 4: Required Water Quality Volumes

Stormwater management standards will be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). The MA Stormwater Handbook states that this standard is met when:

1. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained.

2. Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and

3. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook

The MA Stormwater Handbook does not provide guidance in differentiating between a typical development between a typical development project which would likely have roadways, driveways, and parking lots, which generate greater amounts of TSS and a landscape project like this which is renovating paved playing courts and installing accessible pedestrian walkways that will not be treated in the winter.

The Town of Littleton does not anticipate treating the tennis courts or adjacent walkways in this project and any vehicle use on these surfaces will be limited to maintenance vehicles which will be infrequent. In consideration of the impervious surface type and use, runoff from these surfaces already meet the intent of Standard 4. Standard 4 is therefore met without additional treatment of runoff required.

A long-term pollution prevention plan is required to identify practices taken for source control and pollution prevention. This information has been provided as a part of the Operation and Maintenance Plan and can be found in the Attachments Section.

Standard 5: Land Uses with Higher Potential Pollutant Loads

This project is not considered a land use with Higher Potential Pollutant loads therefore Standard 5 is not applicable to this project.

Standard 6: Critical Areas

Runoff from this project does not discharge to any critical areas and therefore is not subject to additional treatment required by Standard 6.

Standard 7: Redevelopment

For the purposes of the Stormwater Management Standards, redevelopment projects are defined to include development, rehabilitation, and expansion on previously developed sites provided the redevelopment results in no net increase in impervious area. The project proposed a net increase in impervious area on site. As such, the project has been designed in full compliance with the Massachusetts Stormwater Standards.

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

Construction period pollution prevention and erosion and sedimentation control will be implemented at the project site to control construction related impacts during construction and land disturbance activities. Refer to the Site Preparation Plan for location of erosion and sediment controls.

Standard 9: Operation and Maintenance Plan

The proposed project is owned by the Town of Littleton. Stormwater structures and other stormwater best management practices should be maintained as directed in the Operations and Maintenance Plan. An Operation and Maintenance Plan has been included as an addendum.

Standard 10: Prohibition of Illicit Discharges

Illicit Discharge Compliance Statement

"Per the requirements of Standard 10 of the Massachusetts Stormwater Management Standards it shall be stated that No Illicit Discharges exist at Littleton Middle School Tennis and Whitcomb Field located at 55 Russell Street, Littleton, Massachusetts."

Attachments:

NRCS Soil Report/Test Pit Logs
Pre-Development Plan
Post-Development Plan

HydroCAD Report
Operation & Maintenance Plan
Construction Pollution Prevention Plan & Erosion and Sediment Control Plan

NRCS Soil Report/Test Pit Logs

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Middlesex County, Massachusetts

February 11, 2025


71° 29' 23" W
71° 28' 45" W
42° 32' 57" N
42° 32' 19" N
295600
295700
295800
295900
296000
296100
296200
296300
296400
4713700
4713600
4713500
4713400
4713300
4713200
4713100
4713000
4712900
4712800
4712700
4712600
653
603
6A
262B
260B
656
51A
495
653
260B
Russell St
626B
Beaver Brook
253D
6A
626B
6A
32B
253A
626B
2a
Soil Map may not be valid at this scale.
Map Scale: 1:5,670 if printed on A portrait (8.5" x 11") sheet.
Meters
0 50 100 200 300
Feet
0 250 500 1000 1500
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 24, Aug 27, 2024

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

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

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	13.3	9.7%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	A/D	12.8	9.3%
51A	Swansea muck, 0 to 1 percent slopes	B/D	13.1	9.5%
253A	Hinckley loamy sand, 0 to 3 percent slopes	A	7.2	5.2%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	8.0	5.8%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	B	15.3	11.1%
262B	Quonset sandy loam, 3 to 8 percent slopes	A	1.8	1.3%
603	Urban land, wet substratum		3.3	2.4%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	23.7	17.2%
653	Udorthents, sandy		19.8	14.4%
656	Udorthents-Urban land complex		19.5	14.2%
Totals for Area of Interest			**137.9**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

FIGURE 4
SITE PLAN AND GROUNDWATER CONTOUR MAP

BLUE STAR MEMORIAL HIGHWAY
HIGHLAND LANE
RUSSELL STREET

LMS-7 (94.00')
94
93.5
93
92.5
LMS-12 (94.00')
LMS-1 (93.55')
TB-1
SB-1
Approximate Location of 2011 Bus Fire
LMS-5 (92.56')
LMS-4 (92.70')
SB-3 (Composite)
LMS-3 (92.71')
LMS-6 (92.64')
92.5
SB-2
LMS-8 (92.51')
LMS-11 (92.04')
SB-4
LMS-9 (92.23')
LMS-Stream/SW-1
SB-6
LMS-10 (92.14')
SB-5
LMS-2
Disposal Site Boundary Subject to RTN 2-21798

LEGEND

- Approximate Site Boundary
- Approximate Property Boundary
- Groundwater Monitoring Well
- Proposed Groundwater Monitoring Well Location
- Approximate Groundwater Contour
- Inferred Groundwater Contour
- Soil Boring Location
- Surficial Soil Sample Location (0-6")
- Surface Water Sample Location
- Disposal Site Boundary
- Approximate Groundwater Flow Direction

LOCUS MAP

N

0 50 100
Feet
1:1,500

NOTES

1. Based on MassGIS Color Orthophotography (2021)

55 Russel Street
Littleton, Massachusetts
RTN 2-21798

July 2024

Tighe&Bond

Tighe&Bond
Engineers | Environmental Specialists

Littleton Middle School PFAS Delineation
55 Russell Street, Littleton MA
Town of Littleton, MA

Boring No. **LMS-11**
Page 1 of 1
File No. L-0783-016
Checked by:

Drilling Co.: Geosearch
Foreman: Matt
T&B Rep.: M. Begag
Date Start: 06/26/23 End: 6/26/23
Location See Exploration Location Plan
GS. Elev. See Exploration Location Plan

	Casing	Sampler
Type	Geoprobe	5' liner
I.D./O.D.		2"
Hammer Wt.	N/A	N/A
Hammer Fall	N/A	N/A
Rig Make/Model	Geoprobe 7822DT	

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
Refer to Note 1				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec.(in)	Sample Depth (ft.)	PID Reading (ppm)	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/55	0-5	-	Brown, fine to coarse SAND, some Gravel, little Silt, dry	**GLACIAL TILL**		2' PVC Riser; Filter Sand 2'; Bentonite 3'; 4'
5		S-2/55	5-7	-				
			7-8	-	Brown, fine to coarse SAND, some Gravel, little Silt, wet		1	
			8-10	-	Tan, SILT, wet			2" PVC Screen; Filter Sand
10		S-3/32	10-14	-	Tan, SILT, little Gravel, little fine to coarse Sand, wet	**SILT**		14'
15					End of Boring at 14 feet BGS			
20								
25								
30								

Notes:
1. GW estimated at 7' BGS based on sample wetness

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Pre-Development Plan

EXISTING CONDITIONS WATERSHED PLAN LEGEND

PROPERTY LINE

EXISTING 1' CONTOUR — 222 —

TIME OF CONCENTRATION

FLOW ARROW

DRAINAGE ANALYSIS POINT DP-1

SUBCATCHMENT AREA EX-1

SUBCATCHMENT AREA EX-2

N/F
LITTLETON TOWN OF
55 RUSSELL STREET
BOOK –, PAGE –
PROP ID U19 21 0

CB
RIM=221.92
INV(A)=218.75
INV(B)=218.72

DCB
RIM=221.08
TOP OF HOOD=219.09

DMH
RIM=221.76
INV(A)=218.05
INV(B)=218.02
INV(C)=218.00

BITUMINOUS WALK

SITE DRIVE LIGHTING, TYP.

BIT. WALK

VGC

CCB

ROSSWALK SIGN

TTLETON MIDDLE
OOL" SIGN WITH
MESSAGE BOARD

CHAIN LINK FENCE

CB
RIM=218.03

DMH
RIM=218.12

DP-1

RUSSELL STREET

NG AHEAD SIGN

MARKER POST

CB
RIM=218.02

SHED

FES
INV=217.75

RIPRAP, TYP.

A

B

C

1

2

DP-2

N/F
WARD ANGELA L
33 RUSSELL STREET
BOOK 47022, PAGE 363
PROP ID U19 22 0

N/F
CAPELLO JASON M
31 RUSSELL STREET
BOOK 68945, PAGE 414
PROP ID U19 30 1

CONTACT DIGSAFE:
UNDERGROUND UTILITIES SHOWN ON THE PLAN ARE COMPILED FROM PLANS AND FIELD SURVEY. UTILITY LOCATIONS SHOULD BE CONSIDERED APPROXIMATE ONLY. DIGSAFE AND OR THE OTHER RESPECTIVE UTILITY COMPANIES SHALL BE CONTACTED 72 BUSINESS HOURS IN ADVANCE OF CONSTRUCTION OPERATIONS. PHONE DIGSAFE 1-888-344-7233.

0' 10' 20' 40' 60'

ACTIVITAS
landscape architecture | civil engineering
70 Milton Street | Dedham, MA 02026-2915
(781) 326-2600 | activitas.com

CONSULTANTS

SURVEY -
LANDTECH CONSULTANTS

TOWN OF LITTLETON
Littleton, Massachusetts
LITTLETON TENNIS AND WHITCOMB FIELD IMPROVEMENTS

Permitting Documents
February 19, 2025

REVISIONS:

NO.	DATE	DESCRIPTION

SCALE:	1"=20'-0"
PROJECT NO.:	24053.00
FILE:	24053.00-EX_WATERSHED_PLAN.dwg
DRAWN:	BJM
CHECKED:	JJC/HG

SEAL:

SHEET TITLE:
EXISTING CONDITIONS WATERSHED PLAN

SHEET NO:
EXWS

Post-Development Plan

PROPOSED CONDITIONS WATERSHED PLAN LEGEND

PROPERTY LINE

EXISTING 1' CONTOUR 136

TIME OF CONCENTRATION

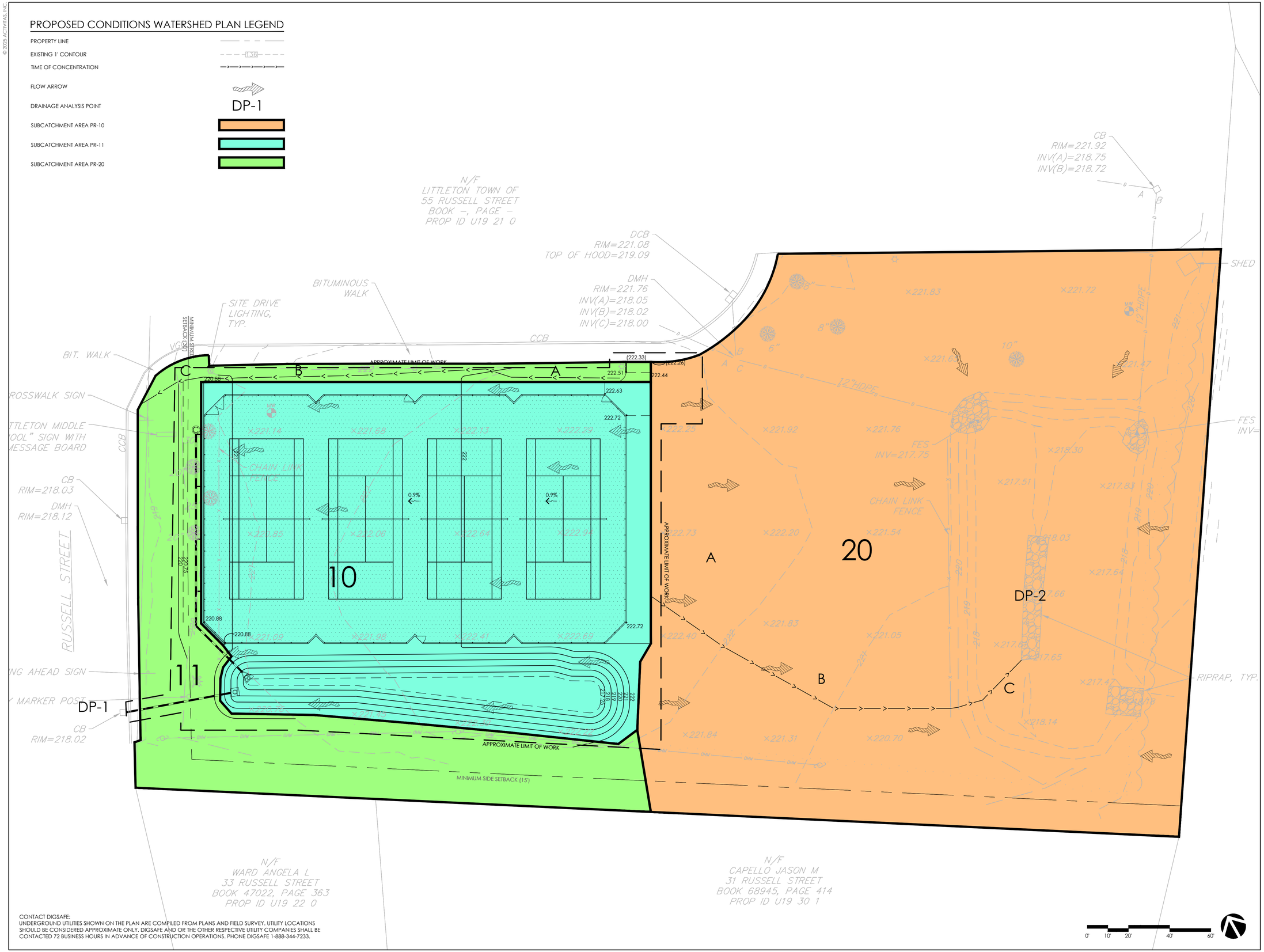
FLOW ARROW

DRAINAGE ANALYSIS POINT DP-1

SUBCATCHMENT AREA PR-10

SUBCATCHMENT AREA PR-11

SUBCATCHMENT AREA PR-20



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TOWN OF LITTLETON

Littleton, Massachusetts

LITTLETON TENNIS AND WHITCOMB FIELD IMPROVEMENTS

Permitting Documents
February 19, 2025

REVISIONS:

NO.	DATE	DESCRIPTION

SCALE:	1"=20'-0"
PROJECT NO.:	24053.00
FILE:	24053.00-PR_WATERSHED_PLAN.dwg
DRAWN:	BJM
CHECKED:	JJC/HG

SEAL:

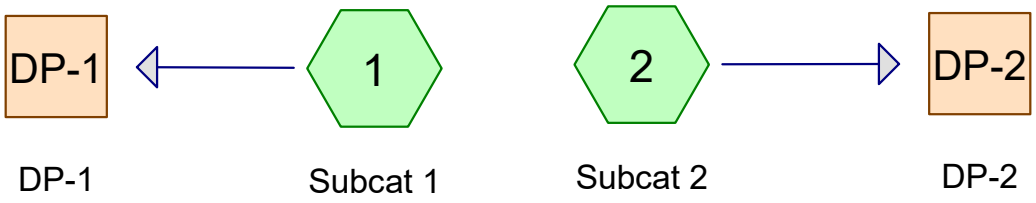
SHEET TITLE:

PROPOSED CONDITIONS WATERSHED PLAN

SHEET NO:

PRWS

HydroCAD Report



Subcat Reach Pond Link

Routing Diagram for 24053-Littleton_Tennis_Existing_Conditions
Prepared by Activitas, Inc, Printed 2/19/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.18	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.92	2
3	100-YR	Type III 24-hr		Default	24.00	1	7.66	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=43,078 sf 0.05% Impervious Runoff Depth=0.00"
Flow Length=242' Tc=10.9 min CN=38 Runoff=0.00 cfs 0 cf

Subcatchment 2: Subcat 2 Runoff Area=81,168 sf 0.08% Impervious Runoff Depth=0.00"
Flow Length=258' Tc=11.6 min CN=38 Runoff=0.00 cfs 0 cf

Reach DP-1: DP-1 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-2: DP-2 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Total Runoff Area = 124,246 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
99.93% Pervious = 124,161 sf 0.07% Impervious = 85 sf

Summary for Subcatchment 1: Subcat 1

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-1 : DP-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.18"

Area (sf)	CN	Description
36,439	39	>75% Grass cover, Good, HSG A
20	98	Paved parking, HSG A
6,619	30	Woods, Good, HSG A
43,078	38	Weighted Average
43,058		99.95% Pervious Area
20		0.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0115	0.12		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.6	56	0.0429	1.45		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
10.9	242	Total			

Summary for Subcatchment 2: Subcat 2

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-2 : DP-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.18"

Area (sf)	CN	Description
68,617	39	>75% Grass cover, Good, HSG A
65	98	Roofs, HSG A
12,485	30	Woods, Good, HSG A
81,168	38	Weighted Average
81,102		99.92% Pervious Area
65		0.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0097	0.11		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.6	165	0.0118	0.76		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.4	43	0.0786	1.96		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
11.6	258	Total			

Summary for Reach DP-1: DP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,078 sf, 0.05% Impervious, Inflow Depth = 0.00" for 2-YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: DP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81,168 sf, 0.08% Impervious, Inflow Depth = 0.00" for 2-YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=43,078 sf 0.05% Impervious Runoff Depth=0.15"
Flow Length=242' Tc=10.9 min CN=38 Runoff=0.02 cfs 548 cf

Subcatchment 2: Subcat 2 Runoff Area=81,168 sf 0.08% Impervious Runoff Depth=0.15"
Flow Length=258' Tc=11.6 min CN=38 Runoff=0.04 cfs 1,033 cf

Reach DP-1: DP-1 Inflow=0.02 cfs 548 cf
Outflow=0.02 cfs 548 cf

Reach DP-2: DP-2 Inflow=0.04 cfs 1,033 cf
Outflow=0.04 cfs 1,033 cf

Total Runoff Area = 124,246 sf Runoff Volume = 1,581 cf Average Runoff Depth = 0.15"
99.93% Pervious = 124,161 sf 0.07% Impervious = 85 sf

Summary for Subcatchment 1: Subcat 1

Runoff = 0.02 cfs @ 13.82 hrs, Volume= 548 cf, Depth= 0.15"
Routed to Reach DP-1 : DP-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.92"

Area (sf)	CN	Description
36,439	39	>75% Grass cover, Good, HSG A
20	98	Paved parking, HSG A
6,619	30	Woods, Good, HSG A
43,078	38	Weighted Average
43,058		99.95% Pervious Area
20		0.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0115	0.12		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.6	56	0.0429	1.45		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
10.9	242	Total			

Summary for Subcatchment 2: Subcat 2

Runoff = 0.04 cfs @ 13.83 hrs, Volume= 1,033 cf, Depth= 0.15"
Routed to Reach DP-2 : DP-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.92"

Area (sf)	CN	Description
68,617	39	>75% Grass cover, Good, HSG A
65	98	Roofs, HSG A
12,485	30	Woods, Good, HSG A
81,168	38	Weighted Average
81,102		99.92% Pervious Area
65		0.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0097	0.11		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.6	165	0.0118	0.76		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.4	43	0.0786	1.96		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
11.6	258	Total			

Summary for Reach DP-1: DP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,078 sf, 0.05% Impervious, Inflow Depth = 0.15" for 10-YR event
Inflow = 0.02 cfs @ 13.82 hrs, Volume= 548 cf
Outflow = 0.02 cfs @ 13.82 hrs, Volume= 548 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: DP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81,168 sf, 0.08% Impervious, Inflow Depth = 0.15" for 10-YR event
Inflow = 0.04 cfs @ 13.83 hrs, Volume= 1,033 cf
Outflow = 0.04 cfs @ 13.83 hrs, Volume= 1,033 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: Subcat 1 Runoff Area=43,078 sf 0.05% Impervious Runoff Depth=0.93"
Flow Length=242' Tc=10.9 min CN=38 Runoff=0.50 cfs 3,351 cf

Subcatchment 2: Subcat 2 Runoff Area=81,168 sf 0.08% Impervious Runoff Depth=0.93"
Flow Length=258' Tc=11.6 min CN=38 Runoff=0.93 cfs 6,313 cf

Reach DP-1: DP-1 Inflow=0.50 cfs 3,351 cf
Outflow=0.50 cfs 3,351 cf

Reach DP-2: DP-2 Inflow=0.93 cfs 6,313 cf
Outflow=0.93 cfs 6,313 cf

Total Runoff Area = 124,246 sf Runoff Volume = 9,664 cf Average Runoff Depth = 0.93"
99.93% Pervious = 124,161 sf 0.07% Impervious = 85 sf

Summary for Subcatchment 1: Subcat 1

Runoff = 0.50 cfs @ 12.24 hrs, Volume= 3,351 cf, Depth= 0.93"
Routed to Reach DP-1 : DP-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.66"

Area (sf)	CN	Description
36,439	39	>75% Grass cover, Good, HSG A
20	98	Paved parking, HSG A
6,619	30	Woods, Good, HSG A
43,078	38	Weighted Average
43,058		99.95% Pervious Area
20		0.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	50	0.0115	0.12		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.6	56	0.0429	1.45		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
10.9	242	Total			

Summary for Subcatchment 2: Subcat 2

Runoff = 0.93 cfs @ 12.26 hrs, Volume= 6,313 cf, Depth= 0.93"
Routed to Reach DP-2 : DP-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.66"

Area (sf)	CN	Description
68,617	39	>75% Grass cover, Good, HSG A
65	98	Roofs, HSG A
12,485	30	Woods, Good, HSG A
81,168	38	Weighted Average
81,102		99.92% Pervious Area
65		0.08% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.6	50	0.0097	0.11		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.6	165	0.0118	0.76		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.4	43	0.0786	1.96		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
11.6	258	Total			

Summary for Reach DP-1: DP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 43,078 sf, 0.05% Impervious, Inflow Depth = 0.93" for 100-YR event
Inflow = 0.50 cfs @ 12.24 hrs, Volume= 3,351 cf
Outflow = 0.50 cfs @ 12.24 hrs, Volume= 3,351 cf, Atten= 0%, Lag= 0.0 min

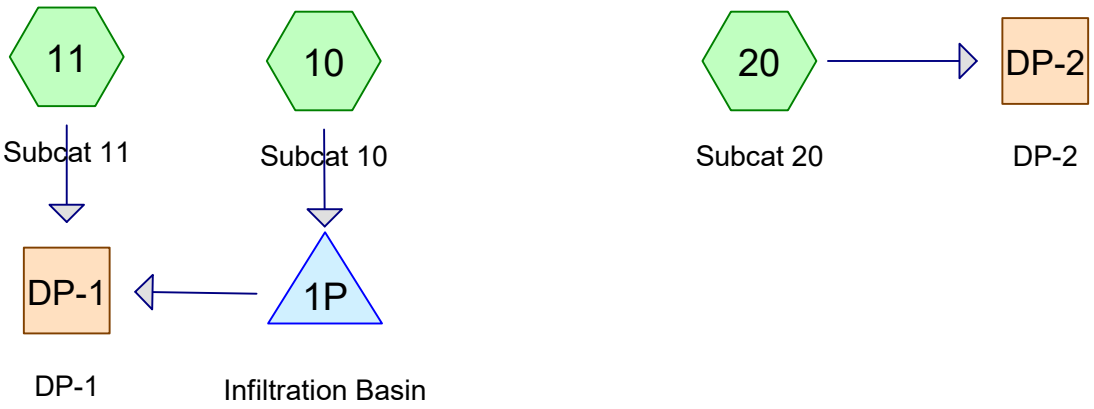
Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: DP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 81,168 sf, 0.08% Impervious, Inflow Depth = 0.93" for 100-YR event
Inflow = 0.93 cfs @ 12.26 hrs, Volume= 6,313 cf
Outflow = 0.93 cfs @ 12.26 hrs, Volume= 6,313 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs



Subcat Reach Pond Link

Routing Diagram for 24053-Littleton_Tennis_Proposed_Conditions-HG
Prepared by Activitas, Inc, Printed 2/19/2025

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-YR	Type III 24-hr		Default	24.00	1	3.18	2
2	10-YR	Type III 24-hr		Default	24.00	1	4.92	2
3	100-YR	Type III 24-hr		Default	24.00	1	7.66	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10: Subcat 10 Runoff Area=35,748 sf 77.28% Impervious Runoff Depth=1.74"
Tc=6.0 min CN=85 Runoff=1.68 cfs 5,185 cf

Subcatchment 11: Subcat 11 Runoff Area=16,508 sf 0.86% Impervious Runoff Depth=0.00"
Flow Length=235' Tc=12.3 min CN=35 Runoff=0.00 cfs 0 cf

Subcatchment 20: Subcat 20 Runoff Area=71,990 sf 0.09% Impervious Runoff Depth=0.00"
Flow Length=204' Tc=9.2 min CN=38 Runoff=0.00 cfs 0 cf

Reach DP-1: DP-1 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Reach DP-2: DP-2 Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 1P: Infiltration Basin Peak Elev=218.33' Storage=2,195 cf Inflow=1.68 cfs 5,185 cf
Discarded=0.15 cfs 5,185 cf Primary=0.00 cfs 0 cf Outflow=0.15 cfs 5,185 cf

Total Runoff Area = 124,246 sf Runoff Volume = 5,185 cf Average Runoff Depth = 0.50"
77.60% Pervious = 96,411 sf 22.40% Impervious = 27,835 sf

Summary for Subcatchment 10: Subcat 10

Runoff = 1.68 cfs @ 12.09 hrs, Volume= 5,185 cf, Depth= 1.74"
Routed to Pond 1P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.18"

Area (sf)	CN	Description
8,122	39	>75% Grass cover, Good, HSG A
27,627	98	Paved parking, HSG A
35,748	85	Weighted Average
8,122		22.72% Pervious Area
27,627		77.28% Impervious Area

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

Summary for Subcatchment 11: Subcat 11

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-1 : DP-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.18"

Area (sf)	CN	Description
8,486	39	>75% Grass cover, Good, HSG A
142	98	Paved parking, HSG A
7,880	30	Woods, Good, HSG A
16,508	35	Weighted Average
16,366		99.14% Pervious Area
142		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0080	0.10		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.8	151	0.0090	0.66		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0580	1.69		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
12.3	235	Total			

Summary for Subcatchment 20: Subcat 20

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Reach DP-2 : DP-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YR Rainfall=3.18"

Area (sf)	CN	Description
60,699	39	>75% Grass cover, Good, HSG A
1	98	Paved parking, HSG A
65	98	Roofs, HSG A
11,225	30	Woods, Good, HSG A
71,990	38	Weighted Average
71,923		99.91% Pervious Area
67		0.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0134	0.12		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
2.1	111	0.0156	0.87		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.4	43	0.0570	1.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.2	204	Total			

Summary for Reach DP-1: DP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 52,256 sf, 53.14% Impervious, Inflow Depth = 0.00" for 2-YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: DP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 71,990 sf, 0.09% Impervious, Inflow Depth = 0.00" for 2-YR event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Infiltration Basin

Inflow Area = 35,748 sf, 77.28% Impervious, Inflow Depth = 1.74" for 2-YR event
Inflow = 1.68 cfs @ 12.09 hrs, Volume= 5,185 cf
Outflow = 0.15 cfs @ 13.18 hrs, Volume= 5,185 cf, Atten= 91%, Lag= 65.5 min
Discarded = 0.15 cfs @ 13.18 hrs, Volume= 5,185 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-1 : DP-1

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 218.33' @ 13.18 hrs Surf.Area= 2,634 sf Storage= 2,195 cf

Plug-Flow detention time= 154.7 min calculated for 5,183 cf (100% of inflow)

Center-of-Mass det. time= 154.7 min (981.0 - 826.4)

Volume	Invert	Avail.Storage	Storage Description
#1	217.25'	8,315 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.25	1,434	0	0
218.00	2,251	1,382	1,382
219.00	3,400	2,826	4,207
220.00	4,605	4,003	8,210
220.02	5,930	105	8,315

Device	Routing	Invert	Outlet Devices
#1	Discarded	217.25'	**2.410 in/hr Exfiltration over Surface area**
#2	Device 4	219.10'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	219.95'	**8.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	217.25'	**10.0" Round Culvert** L= 52.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 217.25' / 215.28' S= 0.0379 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.55 sf

Discarded OutFlow Max=0.15 cfs @ 13.18 hrs HW=218.33' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=217.25' (Free Discharge)
└**4=Culvert** (Controls 0.00 cfs)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10: Subcat 10 Runoff Area=35,748 sf 77.28% Impervious Runoff Depth=3.29"
Tc=6.0 min CN=85 Runoff=3.14 cfs 9,813 cf

Subcatchment 11: Subcat 11 Runoff Area=16,508 sf 0.86% Impervious Runoff Depth=0.07"
Flow Length=235' Tc=12.3 min CN=35 Runoff=0.00 cfs 101 cf

Subcatchment 20: Subcat 20 Runoff Area=71,990 sf 0.09% Impervious Runoff Depth=0.15"
Flow Length=204' Tc=9.2 min CN=38 Runoff=0.03 cfs 916 cf

Reach DP-1: DP-1 Inflow=0.01 cfs 169 cf
Outflow=0.01 cfs 169 cf

Reach DP-2: DP-2 Inflow=0.03 cfs 916 cf
Outflow=0.03 cfs 916 cf

Pond 1P: Infiltration Basin Peak Elev=219.17' Storage=4,810 cf Inflow=3.14 cfs 9,813 cf
Discarded=0.20 cfs 9,745 cf Primary=0.01 cfs 68 cf Outflow=0.21 cfs 9,813 cf

Total Runoff Area = 124,246 sf Runoff Volume = 10,831 cf Average Runoff Depth = 1.05"
77.60% Pervious = 96,411 sf 22.40% Impervious = 27,835 sf

Summary for Subcatchment 10: Subcat 10

Runoff = 3.14 cfs @ 12.09 hrs, Volume= 9,813 cf, Depth= 3.29"
Routed to Pond 1P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.92"

Area (sf)	CN	Description
8,122	39	>75% Grass cover, Good, HSG A
27,627	98	Paved parking, HSG A
35,748	85	Weighted Average
8,122		22.72% Pervious Area
27,627		77.28% Impervious Area

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

Summary for Subcatchment 11: Subcat 11

Runoff = 0.00 cfs @ 15.35 hrs, Volume= 101 cf, Depth= 0.07"
Routed to Reach DP-1 : DP-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.92"

Area (sf)	CN	Description
8,486	39	>75% Grass cover, Good, HSG A
142	98	Paved parking, HSG A
7,880	30	Woods, Good, HSG A
16,508	35	Weighted Average
16,366		99.14% Pervious Area
142		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0080	0.10		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.8	151	0.0090	0.66		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0580	1.69		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
12.3	235	Total			

Summary for Subcatchment 20: Subcat 20

Runoff = 0.03 cfs @ 13.79 hrs, Volume= 916 cf, Depth= 0.15"
Routed to Reach DP-2 : DP-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YR Rainfall=4.92"

Area (sf)	CN	Description
60,699	39	>75% Grass cover, Good, HSG A
1	98	Paved parking, HSG A
65	98	Roofs, HSG A
11,225	30	Woods, Good, HSG A
71,990	38	Weighted Average
71,923		99.91% Pervious Area
67		0.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0134	0.12		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
2.1	111	0.0156	0.87		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.4	43	0.0570	1.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.2	204	Total			

Summary for Reach DP-1: DP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 52,256 sf, 53.14% Impervious, Inflow Depth = 0.04" for 10-YR event
Inflow = 0.01 cfs @ 13.76 hrs, Volume= 169 cf
Outflow = 0.01 cfs @ 13.76 hrs, Volume= 169 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: DP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 71,990 sf, 0.09% Impervious, Inflow Depth = 0.15" for 10-YR event
Inflow = 0.03 cfs @ 13.79 hrs, Volume= 916 cf
Outflow = 0.03 cfs @ 13.79 hrs, Volume= 916 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Infiltration Basin

Inflow Area = 35,748 sf, 77.28% Impervious, Inflow Depth = 3.29" for 10-YR event
Inflow = 3.14 cfs @ 12.09 hrs, Volume= 9,813 cf
Outflow = 0.21 cfs @ 13.67 hrs, Volume= 9,813 cf, Atten= 93%, Lag= 95.0 min
Discarded = 0.20 cfs @ 13.67 hrs, Volume= 9,745 cf
Primary = 0.01 cfs @ 13.67 hrs, Volume= 68 cf
Routed to Reach DP-1 : DP-1

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 219.17' @ 13.67 hrs Surf.Area= 3,607 sf Storage= 4,810 cf

Plug-Flow detention time= 264.7 min calculated for 9,813 cf (100% of inflow)
Center-of-Mass det. time= 264.6 min (1,072.8 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1	217.25'	8,315 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.25	1,434	0	0
218.00	2,251	1,382	1,382
219.00	3,400	2,826	4,207
220.00	4,605	4,003	8,210
220.02	5,930	105	8,315

Device	Routing	Invert	Outlet Devices
#1	Discarded	217.25'	**2.410 in/hr Exfiltration over Surface area**
#2	Device 4	219.10'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	219.95'	**8.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	217.25'	**10.0" Round Culvert** L= 52.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 217.25' / 215.28' S= 0.0379 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.55 sf

Discarded OutFlow Max=0.20 cfs @ 13.67 hrs HW=219.17' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.01 cfs @ 13.67 hrs HW=219.17' (Free Discharge)
└─**4=Culvert** (Passes 0.01 cfs of 2.54 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.01 cfs @ 0.91 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 10: Subcat 10 Runoff Area=35,748 sf 77.28% Impervious Runoff Depth=5.89"
Tc=6.0 min CN=85 Runoff=5.48 cfs 17,533 cf

Subcatchment 11: Subcat 11 Runoff Area=16,508 sf 0.86% Impervious Runoff Depth=0.69"
Flow Length=235' Tc=12.3 min CN=35 Runoff=0.11 cfs 951 cf

Subcatchment 20: Subcat 20 Runoff Area=71,990 sf 0.09% Impervious Runoff Depth=0.93"
Flow Length=204' Tc=9.2 min CN=38 Runoff=0.88 cfs 5,599 cf

Reach DP-1: DP-1 Inflow=0.49 cfs 5,484 cf
Outflow=0.49 cfs 5,484 cf

Reach DP-2: DP-2 Inflow=0.88 cfs 5,599 cf
Outflow=0.88 cfs 5,599 cf

Pond 1P: Infiltration Basin Peak Elev=220.01' Storage=8,284 cf Inflow=5.48 cfs 17,533 cf
Discarded=0.31 cfs 12,992 cf Primary=0.40 cfs 4,533 cf Outflow=0.71 cfs 17,525 cf

Total Runoff Area = 124,246 sf Runoff Volume = 24,084 cf Average Runoff Depth = 2.33"
77.60% Pervious = 96,411 sf 22.40% Impervious = 27,835 sf

Summary for Subcatchment 10: Subcat 10

Runoff = 5.48 cfs @ 12.09 hrs, Volume= 17,533 cf, Depth= 5.89"
Routed to Pond 1P : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.66"

Area (sf)	CN	Description
8,122	39	>75% Grass cover, Good, HSG A
27,627	98	Paved parking, HSG A
35,748	85	Weighted Average
8,122		22.72% Pervious Area
27,627		77.28% Impervious Area

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

Summary for Subcatchment 11: Subcat 11

Runoff = 0.11 cfs @ 12.40 hrs, Volume= 951 cf, Depth= 0.69"
Routed to Reach DP-1 : DP-1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.66"

Area (sf)	CN	Description
8,486	39	>75% Grass cover, Good, HSG A
142	98	Paved parking, HSG A
7,880	30	Woods, Good, HSG A
16,508	35	Weighted Average
16,366		99.14% Pervious Area
142		0.86% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0080	0.10		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
3.8	151	0.0090	0.66		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.3	34	0.0580	1.69		**Shallow Concentrated Flow, C** Short Grass Pasture Kv= 7.0 fps
12.3	235	Total			

Summary for Subcatchment 20: Subcat 20

Runoff = 0.88 cfs @ 12.19 hrs, Volume= 5,599 cf, Depth= 0.93"
Routed to Reach DP-2 : DP-2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YR Rainfall=7.66"

Area (sf)	CN	Description
60,699	39	>75% Grass cover, Good, HSG A
1	98	Paved parking, HSG A
65	98	Roofs, HSG A
11,225	30	Woods, Good, HSG A
71,990	38	Weighted Average
71,923		99.91% Pervious Area
67		0.09% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	50	0.0134	0.12		**Sheet Flow, A** Grass: Short n= 0.150 P2= 3.10"
2.1	111	0.0156	0.87		**Shallow Concentrated Flow, B** Short Grass Pasture Kv= 7.0 fps
0.4	43	0.0570	1.67		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
9.2	204	Total			

Summary for Reach DP-1: DP-1

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 52,256 sf, 53.14% Impervious, Inflow Depth = 1.26" for 100-YR event
Inflow = 0.49 cfs @ 12.54 hrs, Volume= 5,484 cf
Outflow = 0.49 cfs @ 12.54 hrs, Volume= 5,484 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Reach DP-2: DP-2

[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 71,990 sf, 0.09% Impervious, Inflow Depth = 0.93" for 100-YR event
Inflow = 0.88 cfs @ 12.19 hrs, Volume= 5,599 cf
Outflow = 0.88 cfs @ 12.19 hrs, Volume= 5,599 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: Infiltration Basin

Inflow Area = 35,748 sf, 77.28% Impervious, Inflow Depth = 5.89" for 100-YR event
Inflow = 5.48 cfs @ 12.09 hrs, Volume= 17,533 cf
Outflow = 0.71 cfs @ 12.63 hrs, Volume= 17,525 cf, Atten= 87%, Lag= 32.9 min
Discarded = 0.31 cfs @ 12.63 hrs, Volume= 12,992 cf
Primary = 0.40 cfs @ 12.63 hrs, Volume= 4,533 cf
Routed to Reach DP-1 : DP-1

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 3
Peak Elev= 220.01' @ 12.63 hrs Surf.Area= 5,567 sf Storage= 8,284 cf

Plug-Flow detention time= 235.8 min calculated for 17,519 cf (100% of inflow)
Center-of-Mass det. time= 235.5 min (1,027.5 - 792.0)

Volume	Invert	Avail.Storage	Storage Description
#1	217.25'	8,315 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
217.25	1,434	0	0
218.00	2,251	1,382	1,382
219.00	3,400	2,826	4,207
220.00	4,605	4,003	8,210
220.02	5,930	105	8,315

Device	Routing	Invert	Outlet Devices
#1	Discarded	217.25'	**2.410 in/hr Exfiltration over Surface area**
#2	Device 4	219.10'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	219.95'	**8.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	217.25'	**10.0" Round Culvert** L= 52.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 217.25' / 215.28' S= 0.0379 '/' Cc= 0.900 n= 0.020 Corrugated PE, corrugated interior, Flow Area= 0.55 sf

Discarded OutFlow Max=0.31 cfs @ 12.63 hrs HW=220.01' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=0.40 cfs @ 12.63 hrs HW=220.01' (Free Discharge)
└─**4=Culvert** (Passes 0.40 cfs of 3.18 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.36 cfs @ 4.16 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.04 cfs @ 0.82 fps)

Operations & Maintenance Plan (O&M)

(Refer to separate attachment)

Draft Construction Pollution Prevention Plan & Erosion and Sediment Control Plan (CPPP&ESCP)

(Refer to separate attachment)