HANCOCK ASSOCIATES

Stormwater Report
In Support of

Site Plan Review Filing
for
93 Tenney Street
(Map 15, Lot 136)
Georgetown, MA

Prepared By:
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#24618

Prepared For:
DCD Development, LLC

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Introduction

DCD Development, LLC proposes to construct a 11,700 sf commercial building with parking on 93 Tenney Street in Georgetown, MA. Associated site improvements will include paved vehicular and pedestrian areas, landscaped areas, utility services, and a stormwater management system. In the existing condition, the project area consists of a vacant undeveloped lot that is wooded and overgrown. The project area consists of 2.58 acres and is bounded by the Industrial B zone to the north, south, east and west. The Residential B zone is to the southeast of the project area. Elevations on site range from approximately El. 13 at the southwest corner of the property to EL. 148 at the southeast corner.

The project will result in an increase in impervious area, therefore this project is considered a development. The proposed stormwater management system was designed to meet the Stormwater Management Standards described in the Massachusetts Stormwater Handbook. The following report describes the system's compliance with these standards.

Standard 1: No New Untreated Discharges

The Massachusetts Stormwater Handbook states that no new stormwater conveyances may discharge untreated stormwater directly to or cause erosions in wetlands or waters of the Commonwealth. The project includes new stormwater conveyances that will be treated at the onsite drainage system.

Standard 2: Peak Rate Attenuation

The Massachusetts Stormwater Handbook states that stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. A summary of the existing and proposed discharge rates follows. The proposed condition discharge rates of runoff are at or below the existing rates to the same discharge points. Please see the attached "Existing Drainage Areas" and "Proposed Drainage Areas" figures (Appendix III) and Hydrocad output (Appendix IV) for more information.

For the purpose of these calculations the following assumptions were made:

- The project related areas at 91 and 93 Tenney Street were used to delineate watershed boundaries.
- The same total watershed area of the drainage areas is used to compare the existing and proposed conditions.
- The Natural Resources Conservation Service (NRCS) Web Soil Survey of Essex County defines soils in the project area as 651, Udorthents, smoothed (Hydrologic Soil Group A) and 421D Canton fine sandy loam, 15 to 25 percent slopes, very stony (Hydrologic Soil Group A). On site soil testing results show that surficial soils are considered to be Loamy Sand, Hydrologic Soil Group A. Please see the attached NRCS Web Soil Survey summary (Appendix II).

Two drainage area have been modeled to represent the existing condition:

- Drainage Area 1S consists of woods, brush and pond. Stormwater runoff from this area drains to the existing pond. From the pond, runoff follows the path labeled 2R to reach the outfall labeled 4R as shown in the model.
- Drainage Area 3S consists of brush with some woods. Stormwater runoff from this area flows over-land to the outfall labeled 4R. This runoff is modeled by a series of reaches, shown as 2

In the proposed condition a stormwater management system will collect and treat stormwater runoff from the project site. This system will include a subsurface system of chambers. Four drainage areas have been modeled to represent the proposed condition:

- Drainage Area S10 consists of woods, brush and pond. Stormwater runoff from this area drains to the existing pond. From the pond, runoff follows the path (20R to 21R to 22R) to reach the outfall labeled 40R as shown in the model.
- Drainage Area S30 will consist of a paved driveway and roof. Stormwater runoff will drain to 40R via a subsurface chamber system and a network of pipes.
- Drainage Area S31 consist of brush and woods. Stormwater runoff from this area flows over-land to the outfall labeled 40R.
- Drainage Area S32 will consist of brush, woods, grass, and pavement. Stormwater runoff flows offsite toward Tenney Street.

The following table compares the peak rates of runoff under the existing and proposed conditions:

Discharge Point		**2-Year Storm** (3.2" Rainfall Depth)		**10-Year Storm** (4.6" Rainfall Depth)		**25-Year Storm** (5.5" Rainfall Depth)		**100-Year Storm** (6.6" Rainfall Depth)	
		Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
4R/40R	Peak Rate (cfs)	0.0	0.00	0.3	0.2	0.9	0.7	3.0	2.8
	Volume (cf)	334	301	2,168	2,110	5,013	4,463	14,803	13,002

cfs - Cubic Feet per Second

Standard 3: Recharge

The Massachusetts Stormwater Handbook states that loss of annual recharge to groundwater shall be eliminated or minimized. In the existing condition the site consists of brush, forest, and ponds. In the proposed conditions a recharge volume equal to 9,162 cubic feet will be provided in the subsurface system of chambers.

Subsurface exploration has shown the soil present to be sand which is Hydrological Soil Group A. The target depth factor for Group A is 0.6 inches.

Required Recharge Volume (Rv) = Target Depth Factor * Impervious Area
= 0.6 in * 29,850 sf
= 1,493 cf

Adjusted Min. Storage Volume = (Total Impervious Area/impervious area to recharge facility) * Rv
= (29,850 sf / 29187 sf) * 1,493 cf
= 1,527 cf (<9,162 cf provided)

The Massachusetts Stormwater Handbook states that the recharge volume must drain within 72 hours. Observations in test pits performed on-site indicate that the soil that the chamber system will be installed upon is loamy sand. The following "drawdown" calculation assumes a Rawl's Rate of 2.41 inches per hour, corresponding to texture class "Loamy Sand".

Drawdown Time = Storage Volume / (Rawl's Rate * Bottom Area)
= 1,527 cf / (2.41 in/hr * 4,096 sf) = 1.86 Hours
Since the drawdown time of 1.86 hours is less than 72 hours, the requirement is met.

Standard 4: Water Quality

The Massachusetts Stormwater Handbook states that systems shall be designed to remove 80% of the average annual post-development construction load of Total Suspended Solids (TSS). The treatment BMP's have been sized to provide at least 80% TSS removal and measures will be taken for long-term pollution prevention.

Stormwater runoff from the proposed driveway will drain to an infiltration basin via catch basins. The infiltration basin, consisting of Brentwood Stormtank Chambers along with the catch basins will provide 85% TSS Removal.

Water Quality Treatment Volume is as show:
Impervious Surface Area, A = 29,850 sf
Water Quality Volume, WQV = 1.0 Inches
WQV= 1.0 in * 29,850 sf = **2,487.5 cf**

The water quality treatment train for stormwater runoff from the outdoor vehicular paved areas is as follows:

BMP	TSS Removal Rate	Starting TSS Load	Amount Removed	Remaining Load
Catch Basins with Deep Sumps and Hoods	0.25	1	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
Total TSS Removal				0.85

The runoff from sub catchment 32S is considered to be *de minimis*.

Weighted Average Percent:
Weighted avg. % = $[(Area_1 * TSS\%)+(Area_n * TSS\%)]/ (Area_1 + Area_n)$
= [(110,555 sf * 85%)+(8,355*0%)]/118,910 sf = **80%**

Standard 5: Land Uses with Higher Potential Pollutant Loads

The proposed project is not considered a Land Use with Higher Potential Pollutant Loads. Therefore, this standard is not applicable.

Standard 6: Critical Areas

The proposed project is not in a critical area. Therefore, this standard is not applicable.

Standard 7: Redevelopment

The proposed project is not considered a redevelopment. All standards are applicable.

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

Best management practices (BMP) for erosion and sedimentation control are staked straw bales, filter fences, wattles, hydro seeding, and phased development. Many stormwater BMP technologies (e.g., infiltration technologies) are not designed to handle the high concentrations of sediments typically found in construction runoff and must be protected from construction-related sediment loadings. Construction BMP's **must** be maintained. In developing the proposed project certain measures will be implemented to minimize impacts erosion and sedimentation could have on surrounding areas. This section addresses items that involve proper construction techniques, close surveillance of workmanship, and immediate response to emergency situations. The developer must be prepared to provide whatever reasonable measures are necessary to protect the environment during construction and to stabilize all disturbed areas as soon as construction ends.

Pre-Construction

1. The contractor shall have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials shall include, but are not limited to straw bales, silt fence, wattles and crushed stone.
2. The contractor is responsible for erosion control on site and shall utilize erosion control measures where needed, regardless of whether the measures are specified on the plan or in the order of conditions.

Preliminary Site Work

1. Excavated materials should be stockpiled, separating the topsoil for future use on the site. Erosion control shall be utilized along the down slope side of the piles and side slopes shall not exceed 2:1.
2. If intense rainfall is anticipated, the installation of supplemental straw bale dikes, silt fences, or armored dikes shall be considered.
3. Unsuitable excavated material shall be removed from the site.
4. Construction entrance shall be installed.
5. Existing catchbasins shall be protected with silt sacks.

Ongoing Site Work

1. Erosion control measures shall be regularly inspected and replaced as needed.
2. dewatering shall be done in a manner so as not to transmit silt, sand or particulate matter to the receiving water or existing drainage system.

Landscaping

1. Landscaping shall occur as soon as possible to provide permanent stabilization of disturbed surfaces.
2. If the season or adverse weather conditions do not allow the establishment of vegetation, temporary mulching with straw, wood chips weighted with snow fence or branches, or other methods shall be provided.
3. A minimum of 4 inches of topsoil shall be placed and its surface smoothed to the specified grades.
4. The use of herbicides is strongly discouraged.
5. Hydro seeding is encouraged for steep slopes. Application rates on slopes greater than 3:1 shall have a minimum seeding rate of 5-lbs/1000 SF. A latex or fiber tackifier shall be used on these slopes at a minimum rate of 50 lbs. of tackifier per 500 gallons of water used.

Standard 9: Operations and Maintenance Plan

The information provided herein is intended to provide the base information for operation and maintenance of the site in perpetuity subject to updates and revisions as required at a future date. As such all future property owners must be notified in writing of the this plan and be provided with a copy of this plan, a complete set of the design drawings and/or a completed as-built plan showing all the drainage features as they were constructed, which are considered part of this document. Please see the attached Operations and Maintenance Log (Appendix VII).

Stormwater management system owner: DCD Development, LLC
The party responsible for operation and maintenance: DCD Development, LLC

Preliminary Stormwater Operation and Maintenance Budget
Quarterly Inspection and Maintenance x $2,000 per visit = $8,000 annually

Illicit Discharge - Practices to Minimize Storm Water Contamination

- All waste materials will be collected and stored in a securely lidded metal dumpster.
- All trash and debris from the site will be deposited in the dumpster. The dumpster will be emptied on a regular schedule prior to being over full.
- All personnel will be instructed regarding the correct procedure for waste disposal.
- Good housekeeping and spill control practices will be followed to minimize storm water contamination from petroleum products, paints, and cleaning products.
- All site vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage.
- Spill kits will be provided with any activity that could provide contamination.
- All paint containers and curing compounds will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewers, but will be properly disposed according to the manufacturer's instructions.
- All spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm sewers will be reported to the Massachusetts Department of Environmental Protection Northeast Regional Office at 1-888-304-1133.

Deep Sump Hooded Catch Basins and Area Drains
Inspect deep sump catch basins four times per year including the end of the foliage and snow removal seasons. Sediments must also be removed four times per year or when the depth of deposits is greater than or equal to one half the depth of the sump. Vacuum trucks are to be used to remove trapped sediment and supernatant.

Although catch basin debris often contains concentrations of oil and hazardous materials such as petroleum hydrocarbons and metals, MassDEP classifies them as solid waste. Any contaminated materials must be evaluated in accordance with the Hazardous Waste Regulations, 310 CMR 30.00, and handled as hazardous waste. MassDEP regulations prohibit landfills from accepting materials that contain free draining liquids.

Infiltration BMP
The infiltration BMP (subsurface chamber system) shall be inspected after every major storm for the first few months to ensure it is stabilized and functioning properly. If necessary, corrective action shall be taken until the system functions properly. Inspectors should note how long water remains standing in the inspection port after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging. Thereafter, inspect the infiltration BMP at least twice per year.

Roof Drain Leaders

Routine roof inspections shall be performed two times per year. The roof shall be kept clean and free of debris, and the roof drainage systems shall be kept clear. Gutters and downspouts shall be cleaned at least twice per year, or more frequently as necessary.

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of stormwater management practices. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings.

Initial Post-Construction Inspection

During the initial period of vegetation establishment pruning and weeding are required twice in first year by contractor or owner. Any dead vegetation/plantings found after the first year will be replaced. Proper mulching is mandatory and regular watering may be required initially to ensure proper establishment of new vegetation.

Long-Term Maintenance

The planted areas shall be inspected on a semi-annual basis and any litter removed. Weeds and invasive plant species shall be removed by hand. Maintain planted areas adjacent to pavement to prevent soil washout. Immediately clean any soil deposits on pavement. Leaf litter and other detritus shall be removed twice per year. If needed to maintain aesthetic appearance, perennial plantings may be trimmed at the end of the growing season.

Trees and shrubs shall be inspected twice per year to evaluate health and attended to as necessary. Seeded ground cover or grass areas shall not receive mulching. Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming. Plant alternative mixtures of grass species in the event of unsuccessful establishment. The grass vegetation should not be cut to a height less than four inches.

Pesticide/Herbicide Usage

No pesticides are to be used unless a single spot treatment is required for a specific control application.

Standard 10: Prohibition of Illicit Discharges

Illicit Discharge Compliance Statement

To the best of my knowledge no illicit discharges currently exist on the site and no future illicit discharge will be allowed, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease.

_____

Signed by Owner *Date*

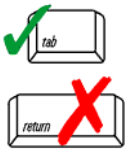
Appendix I. Stormwater Checklist

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.

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[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

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.

Appendix II. NRCS Soils Map

Map Scale: 1:2,500 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

- Canton fine sandy loam, 0 to 8 percent slopes, very stony
- Canton fine sandy loam, 15 to 25 percent slopes, very stony
- Canton fine sandy loam, 8 to 15 percent slopes, very stony
- Deerfield loamy fine sand, 0 to 3 percent slopes
- Montauk fine sandy loam, 8 to 15 percent slopes, very stony
- Paxton fine sandy loam, 15 to 25 percent slopes, very stony
- Paxton fine sandy loam, 8 to 15 percent slopes, very stony
- Udorthents, smoothed
- Not rated or not available

Soil Rating Lines

- Canton fine sandy loam, 0 to 8 percent slopes, very stony
- Canton fine sandy loam, 15 to 25 percent slopes, very stony
- Canton fine sandy loam, 8 to 15 percent slopes, very stony
- Deerfield loamy fine sand, 0 to 3 percent slopes
- Montauk fine sandy loam, 8 to 15 percent slopes, very stony
- Paxton fine sandy loam, 15 to 25 percent slopes, very stony
- Paxton fine sandy loam, 8 to 15 percent slopes, very stony
- Udorthents, smoothed
- Not rated or not available

Soil Rating Points

- Canton fine sandy loam, 0 to 8 percent slopes, very stony
- Canton fine sandy loam, 15 to 25 percent slopes, very stony
- Canton fine sandy loam, 8 to 15 percent slopes, very stony
- Deerfield loamy fine sand, 0 to 3 percent slopes
- Montauk fine sandy loam, 8 to 15 percent slopes, very stony
- Paxton fine sandy loam, 15 to 25 percent slopes, very stony
- Paxton fine sandy loam, 8 to 15 percent slopes, very stony
- Udorthents, smoothed
- 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 1:15,800.

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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 17, Sep 2, 2021

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

Date(s) aerial images were photographed: Aug 13, 2020—Oct 18, 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 Name

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	Deerfield loamy fine sand, 0 to 3 percent slopes	1.0	3.6%
301C	Montauk fine sandy loam, 8 to 15 percent slopes, very stony	Montauk fine sandy loam, 8 to 15 percent slopes, very stony	2.2	7.9%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	2.6	9.4%
306D	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	Paxton fine sandy loam, 15 to 25 percent slopes, very stony	3.4	12.3%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	Canton fine sandy loam, 0 to 8 percent slopes, very stony	1.3	4.7%
421C	Canton fine sandy loam, 8 to 15 percent slopes, very stony	Canton fine sandy loam, 8 to 15 percent slopes, very stony	1.2	4.2%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	Canton fine sandy loam, 15 to 25 percent slopes, very stony	4.6	16.5%
651	Udorthents, smoothed	Udorthents, smoothed	11.6	41.4%
Totals for Area of Interest			**28.0**	**100.0%**

Description

A soil map unit is a collection of soil areas or nonsoil areas (miscellaneous areas) delineated in a soil survey. Each map unit is given a name that uniquely identifies the unit in a particular soil survey area.

Rating Options

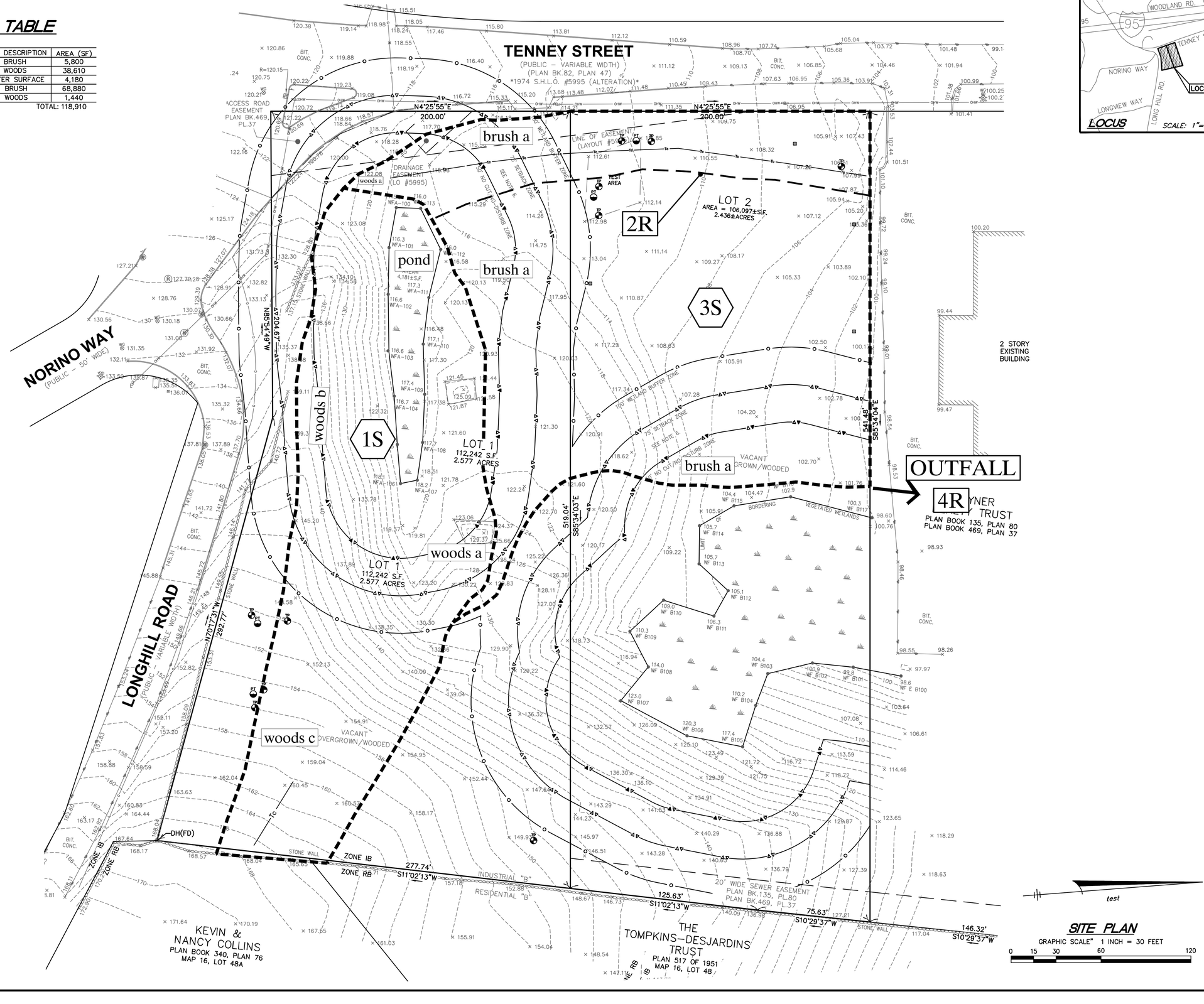
Aggregation Method: No Aggregation Necessary

Tie-break Rule: Lower

Appendix III. Existing and Proposed Drainage Figures

AREA TABLE

SUBCATCHMENT	AREA DESCRIPTION	AREA (SF)
1S	BRUSH	5,800
	WOODS	38,610
	WATER SURFACE	4,180
3S	BRUSH	68,880
	WOODS	1,440
	TOTAL: 118,910	



PERMIT SITE PLAN

93 Tenney Street
Georgetown, Massachusetts 01833

ASSESSORS:

MAP	LOT
15	136

PREPARED FOR:

DCD DEVELOPMENT LLC

53 Park Avenue
Middleton, Massachusetts 01949

HANCOCK ASSOCIATES

Civil Engineers

Land Surveyors

Wetland Scientists

185 CENTRE STREET, DANVERS, MA 01923
VOICE (978) 777–3050, FAX (978) 774–7816
WWW.HANCOCKASSOCIATES.COM

NO.	BY	APP	DATE	ISSUE/REVISION DESCRIPTION

DATE:	2/1/22	DESIGN BY:	RD/DLC
SCALE:	AS SHOWN	DRAWN BY:	MRG
APPRVD. BY:	DLC	CHECK BY:	CEW

EXISTING CONDITIONS

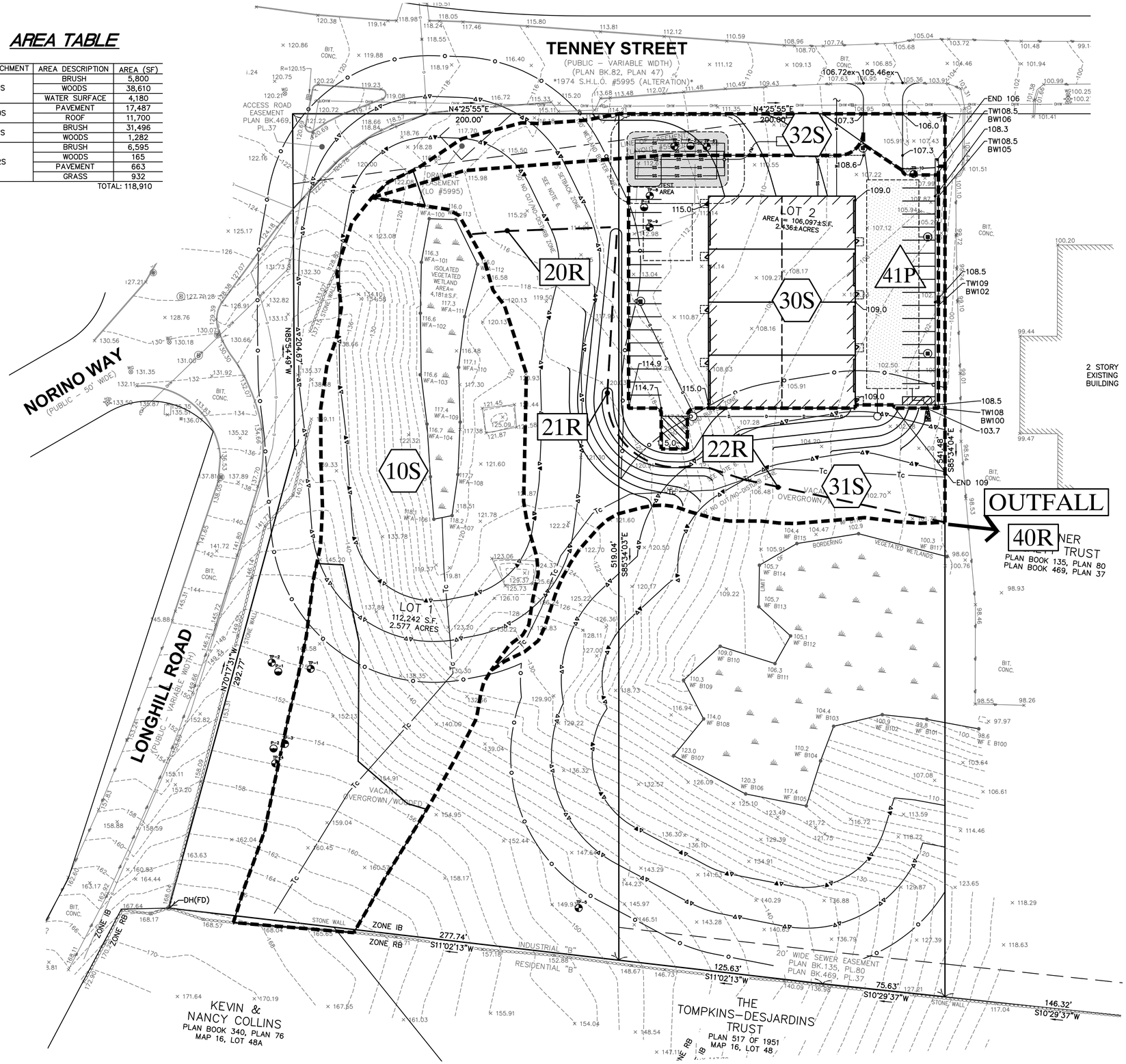
PLOT DATE: Feb 08, 2022 8:25 am
PATH: C:\Users\mgolano\Desktop\Local Work\24618 Tenney\

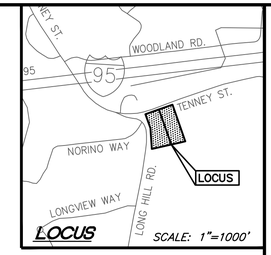
DWG:	24618 93 SP.dwg
LAYOUT:	PRE 93
SHEET:	1 OF 2
PROJECT NO.:	24618

SK1

AREA TABLE

SUBCATCHMENT	AREA DESCRIPTION	AREA (SF)
10S	BRUSH	5,800
	WOODS	38,610
	WATER SURFACE	4,180
30S	PAVEMENT	17,487
	ROOF	11,700
31S	BRUSH	31,496
	WOODS	1,282
32S	BRUSH	6,595
	WOODS	165
	PAVEMENT	663
	GRASS	932
	TOTAL:	118,910





PERMIT SITE PLAN

93 Tenney Street
Georgetown, Massachusetts 01833

ASSESSORS:

MAP	LOT
15	136

PREPARED FOR:

DCD DEVELOPMENT LLC

53 Park Avenue
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185 CENTRE STREET, DANVERS, MA 01923
VOICE (978) 777-3050, FAX (978) 774-7816
WWW.HANCOCKASSOCIATES.COM

NO.	BY	APP	DATE	ISSUE/REVISION DESCRIPTION

DATE:	2/10/22	DESIGN BY:	RD/DLC
SCALE:	AS SHOWN	DRAWN BY:	MRG
APPRVD. BY:	DLC	CHECK BY:	CEW

PROPOSED CONDITION

PLOT DATE: Feb 10, 2022 1:17 pm
PATH: C:\Users\mgalgano\Desktop\Local Work\24618 Tenney\

DWG: 24618 93 SP.dwg
LAYOUT: POST 93
SHEET: 2 OF 2

SK2

PROJECT NO.: 24618

test

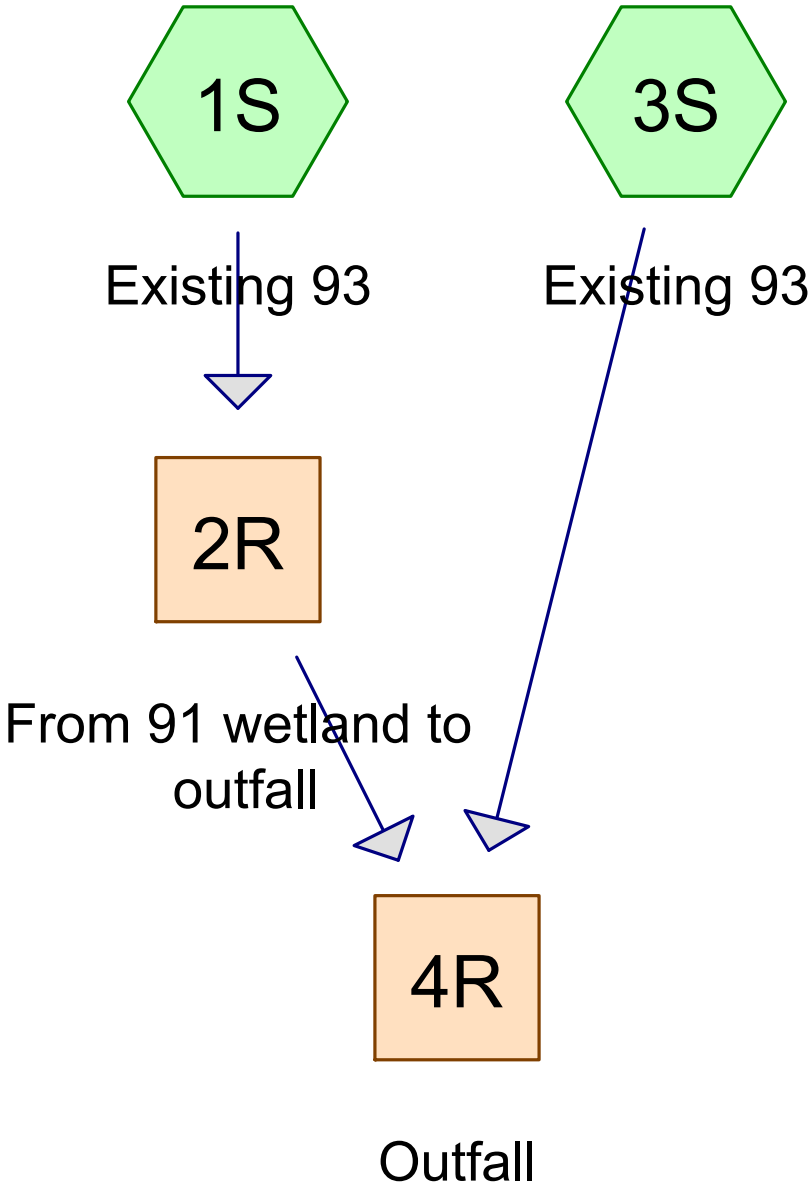
SITE PLAN

GRAPHIC SCALE" 1 INCH = 30 FEET

0 15 30 60 120

Appendix IV. Hydrocad Output

PRE-DEVELOPMENT



Subcat Reach Pond Link

Routing Diagram for 24618 93 Tenney1
Prepared by Microsoft, Printed 2/10/2022

Summary for Subcatchment 1S: Existing 93

Runoff = 0.0 cfs @ 14.63 hrs, Volume= 343 cf, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.17"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 3S: Existing 93

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.17"

Area (sf)	CN	Description
68,880	30	Brush, Good, HSG A
1,440	30	Woods, Good, HSG A
70,320	30	Weighted Average
70,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.5	270	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.9	320	Total			

Summary for Reach 2R: From 91 wetland to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.08" for 2-yr event
Inflow = 0.0 cfs @ 14.63 hrs, Volume= 343 cf
Outflow = 0.0 cfs @ 15.05 hrs, Volume= 334 cf, Atten= 0%, Lag= 25.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.37 fps, Min. Travel Time= 13.6 min
Avg. Velocity = 0.37 fps, Avg. Travel Time= 13.6 min

Peak Storage= 10 cf @ 14.83 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 1.00' Flow Area= 30.0 sf, Capacity= 196.4 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 40.00'
Length= 300.0' Slope= 0.0350 '/'
Inlet Invert= 116.50', Outlet Invert= 106.00'

‡

Summary for Reach 4R: Outfall

Inflow Area = 118,910 sf, 3.52% Impervious, Inflow Depth > 0.03" for 2-yr event
Inflow = 0.0 cfs @ 15.05 hrs, Volume= 334 cf
Outflow = 0.0 cfs @ 15.05 hrs, Volume= 334 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Existing 93

Runoff = 0.3 cfs @ 12.15 hrs, Volume= 2,181 cf, Depth> 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 3S: Existing 93

Runoff = 0.0 cfs @ 24.00 hrs, Volume= 9 cf, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
68,880	30	Brush, Good, HSG A
1,440	30	Woods, Good, HSG A
70,320	30	Weighted Average
70,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.5	270	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.9	320	Total			

Summary for Reach 2R: From 91 wetland to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.54" for 10-yr event
Inflow = 0.3 cfs @ 12.15 hrs, Volume= 2,181 cf
Outflow = 0.3 cfs @ 12.51 hrs, Volume= 2,158 cf, Atten= 11%, Lag= 21.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.63 fps, Min. Travel Time= 7.9 min
Avg. Velocity = 0.38 fps, Avg. Travel Time= 13.1 min

Peak Storage= 135 cf @ 12.37 hrs
Average Depth at Peak Storage= 0.02'
Bank-Full Depth= 1.00' Flow Area= 30.0 sf, Capacity= 196.4 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 40.00'
Length= 300.0' Slope= 0.0350 '/'
Inlet Invert= 116.50', Outlet Invert= 106.00'

‡

Summary for Reach 4R: Outfall

Inflow Area = 118,910 sf, 3.52% Impervious, Inflow Depth > 0.22" for 10-yr event
Inflow = 0.3 cfs @ 12.51 hrs, Volume= 2,168 cf
Outflow = 0.3 cfs @ 12.51 hrs, Volume= 2,168 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Existing 93

Runoff = 1.0 cfs @ 12.13 hrs, Volume= 4,479 cf, Depth> 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.23"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 3S: Existing 93

Runoff = 0.0 cfs @ 15.37 hrs, Volume= 567 cf, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.23"

Area (sf)	CN	Description
68,880	30	Brush, Good, HSG A
1,440	30	Woods, Good, HSG A
70,320	30	Weighted Average
70,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.5	270	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.9	320	Total			

Summary for Reach 2R: From 91 wetland to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 1.11" for 25-yr event
Inflow = 1.0 cfs @ 12.13 hrs, Volume= 4,479 cf
Outflow = 0.9 cfs @ 12.30 hrs, Volume= 4,446 cf, Atten= 14%, Lag= 9.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.99 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 0.42 fps, Avg. Travel Time= 11.8 min

Peak Storage= 272 cf @ 12.21 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 30.0 sf, Capacity= 196.4 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 40.00'
Length= 300.0' Slope= 0.0350 '/'
Inlet Invert= 116.50', Outlet Invert= 106.00'

‡

Summary for Reach 4R: Outfall

Inflow Area = 118,910 sf, 3.52% Impervious, Inflow Depth > 0.51" for 25-yr event
Inflow = 0.9 cfs @ 12.30 hrs, Volume= 5,013 cf
Outflow = 0.9 cfs @ 12.30 hrs, Volume= 5,013 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Existing 93

Runoff = 3.1 cfs @ 12.12 hrs, Volume= 10,837 cf, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=9.06"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 3S: Existing 93

Runoff = 0.4 cfs @ 12.49 hrs, Volume= 4,050 cf, Depth> 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=9.06"

Area (sf)	CN	Description
68,880	30	Brush, Good, HSG A
1,440	30	Woods, Good, HSG A
70,320	30	Weighted Average
70,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.5	270	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
15.9	320	Total			

Summary for Reach 2R: From 91 wetland to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 2.68" for 100-yr event
Inflow = 3.1 cfs @ 12.12 hrs, Volume= 10,837 cf
Outflow = 2.9 cfs @ 12.21 hrs, Volume= 10,780 cf, Atten= 7%, Lag= 5.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.54 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 0.51 fps, Avg. Travel Time= 9.7 min

Peak Storage= 560 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 30.0 sf, Capacity= 196.4 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 10.0 '/' Top Width= 40.00'
Length= 300.0' Slope= 0.0350 '/'
Inlet Invert= 116.50', Outlet Invert= 106.00'

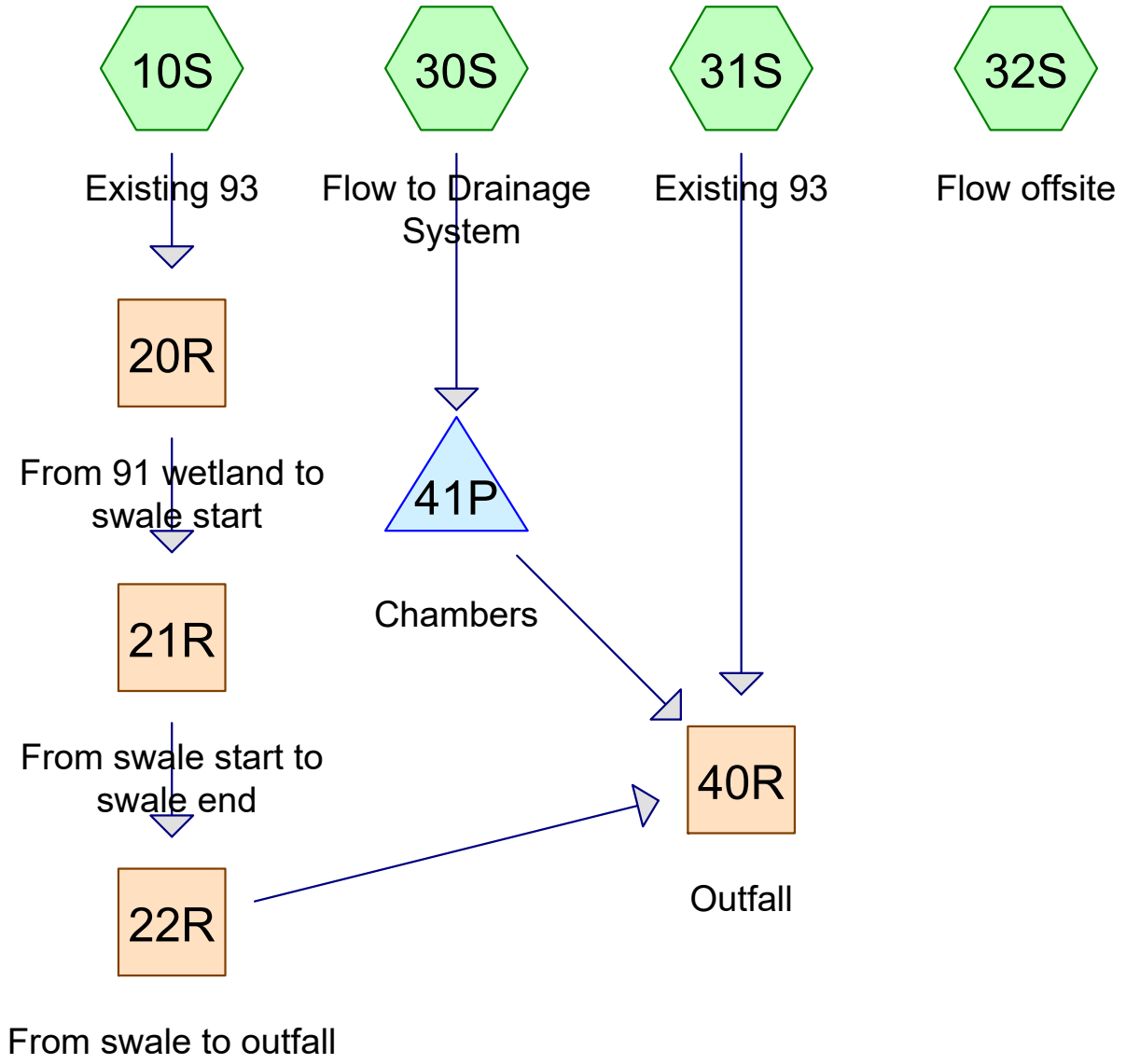
‡

Summary for Reach 4R: Outfall

Inflow Area = 118,910 sf, 3.52% Impervious, Inflow Depth > 1.50" for 100-yr event
Inflow = 3.0 cfs @ 12.22 hrs, Volume= 14,830 cf
Outflow = 3.0 cfs @ 12.22 hrs, Volume= 14,830 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

POST-DEVELOPMENT



Subcat Reach Pond Link

Routing Diagram for 24618 93 Tenney1
Prepared by Microsoft, Printed 2/10/2022

Summary for Subcatchment 10S: Existing 93

Runoff = 0.0 cfs @ 14.63 hrs, Volume= 343 cf, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.17"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 30S: Flow to Drainage System

Runoff = 2.0 cfs @ 12.09 hrs, Volume= 7,141 cf, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.17"

	Area (sf)	CN	Description
*	17,487	98	Paved parking and wall, HSG A
	11,700	98	Roofs, HSG A
	29,187	98	Weighted Average
	29,187		100.00% Impervious Area

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

Summary for Subcatchment 31S: Existing 93

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.17"

	Area (sf)	CN	Description
	13,196	30	Brush, Good, HSG A
	965	30	Woods, Good, HSG A
*	18,300	30	Brush, Good, HSG A
*	317	30	Woods, Good, HSG A
	32,778	30	Weighted Average
	32,778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.8	288	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.2	338	Total			

Summary for Subcatchment 32S: Flow offsite

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

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.17"

	Area (sf)	CN	Description
	932	39	>75% Grass cover, Good, HSG A
*	663	98	Paved parking and wall, HSG A
	6,595	30	Brush, Good, HSG A
	165	30	Woods, Good, HSG A
	8,355	36	Weighted Average
	7,692		92.06% Pervious Area
	663		7.94% Impervious Area

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

Summary for Reach 20R: From 91 wetland to swale start

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.08" for 2-yr event
Inflow = 0.0 cfs @ 14.63 hrs, Volume= 343 cf
Outflow = 0.0 cfs @ 14.77 hrs, Volume= 340 cf, Atten= 0%, Lag= 8.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.33 fps, Min. Travel Time= 4.3 min
Avg. Velocity = 0.33 fps, Avg. Travel Time= 4.3 min

Peak Storage= 3 cf @ 14.70 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 217.7 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0282 '/'
Inlet Invert= 116.50', Outlet Invert= 114.10'

‡

Summary for Reach 21R: From swale start to swale end

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.08" for 2-yr event
Inflow = 0.0 cfs @ 14.77 hrs, Volume= 340 cf
Outflow = 0.0 cfs @ 16.11 hrs, Volume= 304 cf, Atten= 3%, Lag= 80.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.07 fps, Min. Travel Time= 47.2 min
Avg. Velocity = 0.06 fps, Avg. Travel Time= 57.5 min

Peak Storage= 35 cf @ 15.33 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 3.9 cfs

5.00' x 1.00' deep channel, n= 0.240 Sheet flow over Dense Grass
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 190.0' Slope= 0.0100 '/'
Inlet Invert= 114.00', Outlet Invert= 112.10'

‡

Summary for Reach 22R: From swale to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.07" for 2-yr event
Inflow = 0.0 cfs @ 16.11 hrs, Volume= 304 cf
Outflow = 0.0 cfs @ 16.25 hrs, Volume= 301 cf, Atten= 0%, Lag= 8.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.57 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 4.2 min

Peak Storage= 3 cf @ 16.18 hrs
Average Depth at Peak Storage= 0.00'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 373.9 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 144.0' Slope= 0.0833 '/'
Inlet Invert= 112.00', Outlet Invert= 100.00'

‡

Summary for Reach 40R: Outfall

Inflow Area = 110,555 sf, 30.18% Impervious, Inflow Depth > 0.03" for 2-yr event
Inflow = 0.0 cfs @ 16.25 hrs, Volume= 301 cf
Outflow = 0.0 cfs @ 16.25 hrs, Volume= 301 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond 41P: Chambers

Inflow Area = 29,187 sf,100.00% Impervious, Inflow Depth > 2.94" for 2-yr event
Inflow = 2.0 cfs @ 12.09 hrs, Volume= 7,141 cf
Outflow = 0.2 cfs @ 11.65 hrs, Volume= 7,130 cf, Atten= 89%, Lag= 0.0 min
Discarded = 0.2 cfs @ 11.65 hrs, Volume= 7,130 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 104.63' @ 12.72 hrs Surf.Area= 4,096 sf Storage= 2,372 cf

Plug-Flow detention time= 71.6 min calculated for 7,130 cf (100% of inflow)
Center-of-Mass det. time= 70.6 min (826.8 - 756.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.00'	1,891 cf	**32.00'W x 128.00'L x 3.00'H Field A** 12,288 cf Overall - 7,560 cf Embedded = 4,728 cf x 40.0% Voids
#2A	104.00'	7,271 cf	**Brentwood StormTank 24"** x 840 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 840 Chambers in 20 Rows
#3	107.00'	205 cf	**32.00'W x 128.00'L x 0.50'H Prismatoid** 2,048 cf Overall x 10.0% Voids
		9,367 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	104.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	107.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.2 cfs @ 11.65 hrs HW=104.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.2 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=104.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Subcatchment 10S: Existing 93

Runoff = 0.3 cfs @ 12.15 hrs, Volume= 2,181 cf, Depth> 0.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.87"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 30S: Flow to Drainage System

Runoff = 3.1 cfs @ 12.09 hrs, Volume= 11,263 cf, Depth> 4.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.87"

	Area (sf)	CN	Description
*	17,487	98	Paved parking and wall, HSG A
	11,700	98	Roofs, HSG A
	29,187	98	Weighted Average
	29,187		100.00% Impervious Area

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

Summary for Subcatchment 31S: Existing 93

Runoff = 0.0 cfs @ 24.00 hrs, Volume= 4 cf, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.87"

	Area (sf)	CN	Description
	13,196	30	Brush, Good, HSG A
	965	30	Woods, Good, HSG A
*	18,300	30	Brush, Good, HSG A
*	317	30	Woods, Good, HSG A
	32,778	30	Weighted Average
	32,778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.8	288	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.2	338	Total			

Summary for Subcatchment 32S: Flow offsite

Runoff = 0.0 cfs @ 15.02 hrs, Volume= 63 cf, Depth> 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.87"

	Area (sf)	CN	Description
	932	39	>75% Grass cover, Good, HSG A
*	663	98	Paved parking and wall, HSG A
	6,595	30	Brush, Good, HSG A
	165	30	Woods, Good, HSG A
	8,355	36	Weighted Average
	7,692		92.06% Pervious Area
	663		7.94% Impervious Area

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

Summary for Reach 20R: From 91 wetland to swale start

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.54" for 10-yr event
Inflow = 0.3 cfs @ 12.15 hrs, Volume= 2,181 cf
Outflow = 0.3 cfs @ 12.27 hrs, Volume= 2,174 cf, Atten= 0%, Lag= 7.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.62 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 0.35 fps, Avg. Travel Time= 4.1 min

Peak Storage= 45 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 217.7 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0282 '/'
Inlet Invert= 116.50', Outlet Invert= 114.10'

‡

Summary for Reach 21R: From swale start to swale end

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.54" for 10-yr event
Inflow = 0.3 cfs @ 12.27 hrs, Volume= 2,174 cf
Outflow = 0.2 cfs @ 12.81 hrs, Volume= 2,113 cf, Atten= 28%, Lag= 32.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.20 fps, Min. Travel Time= 15.8 min
Avg. Velocity = 0.11 fps, Avg. Travel Time= 29.8 min

Peak Storage= 220 cf @ 12.54 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 3.9 cfs

5.00' x 1.00' deep channel, n= 0.240 Sheet flow over Dense Grass
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 190.0' Slope= 0.0100 '/'
Inlet Invert= 114.00', Outlet Invert= 112.10'

‡

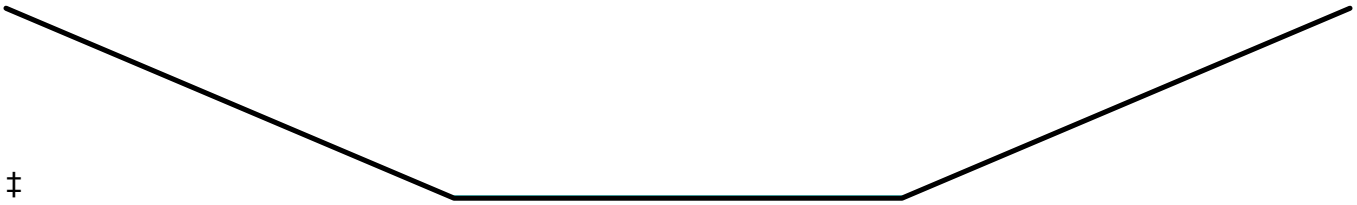
Summary for Reach 22R: From swale to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 0.52" for 10-yr event
Inflow = 0.2 cfs @ 12.81 hrs, Volume= 2,113 cf
Outflow = 0.2 cfs @ 12.89 hrs, Volume= 2,104 cf, Atten= 1%, Lag= 5.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.77 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 0.57 fps, Avg. Travel Time= 4.2 min

Peak Storage= 43 cf @ 12.84 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 373.9 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 144.0' Slope= 0.0833 '/'
Inlet Invert= 112.00', Outlet Invert= 100.00'



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Summary for Reach 40R: Outfall

Inflow Area = 110,555 sf, 30.18% Impervious, Inflow Depth > 0.23" for 10-yr event
Inflow = 0.2 cfs @ 12.89 hrs, Volume= 2,109 cf
Outflow = 0.2 cfs @ 12.89 hrs, Volume= 2,109 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond 41P: Chambers

Inflow Area = 29,187 sf,100.00% Impervious, Inflow Depth > 4.63" for 10-yr event
Inflow = 3.1 cfs @ 12.09 hrs, Volume= 11,263 cf
Outflow = 0.2 cfs @ 11.15 hrs, Volume= 11,246 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.2 cfs @ 11.15 hrs, Volume= 11,246 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 105.16' @ 13.23 hrs Surf.Area= 4,096 sf Storage= 4,361 cf

Plug-Flow detention time= 145.3 min calculated for 11,223 cf (100% of inflow)
Center-of-Mass det. time= 144.0 min (892.0 - 748.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.00'	1,891 cf	**32.00'W x 128.00'L x 3.00'H Field A** 12,288 cf Overall - 7,560 cf Embedded = 4,728 cf x 40.0% Voids
#2A	104.00'	7,271 cf	**Brentwood StormTank 24"** x 840 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 840 Chambers in 20 Rows
#3	107.00'	205 cf	**32.00'W x 128.00'L x 0.50'H Prismatoid** 2,048 cf Overall x 10.0% Voids
		9,367 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	104.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	107.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.2 cfs @ 11.15 hrs HW=104.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.2 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=104.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Subcatchment 10S: Existing 93

Runoff = 1.0 cfs @ 12.13 hrs, Volume= 4,479 cf, Depth> 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.23"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 30S: Flow to Drainage System

Runoff = 4.0 cfs @ 12.09 hrs, Volume= 14,564 cf, Depth> 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.23"

	Area (sf)	CN	Description
*	17,487	98	Paved parking and wall, HSG A
	11,700	98	Roofs, HSG A
	29,187	98	Weighted Average
	29,187		100.00% Impervious Area

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

Summary for Subcatchment 31S: Existing 93

Runoff = 0.0 cfs @ 15.37 hrs, Volume= 264 cf, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.23"

	Area (sf)	CN	Description
	13,196	30	Brush, Good, HSG A
	965	30	Woods, Good, HSG A
*	18,300	30	Brush, Good, HSG A
*	317	30	Woods, Good, HSG A
	32,778	30	Weighted Average
	32,778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.8	288	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.2	338	Total			

Summary for Subcatchment 32S: Flow offsite

Runoff = 0.0 cfs @ 12.40 hrs, Volume= 243 cf, Depth> 0.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.23"

	Area (sf)	CN	Description
	932	39	>75% Grass cover, Good, HSG A
*	663	98	Paved parking and wall, HSG A
	6,595	30	Brush, Good, HSG A
	165	30	Woods, Good, HSG A
	8,355	36	Weighted Average
	7,692		92.06% Pervious Area
	663		7.94% Impervious Area

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

Summary for Reach 20R: From 91 wetland to swale start

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 1.11" for 25-yr event
Inflow = 1.0 cfs @ 12.13 hrs, Volume= 4,479 cf
Outflow = 1.0 cfs @ 12.19 hrs, Volume= 4,469 cf, Atten= 4%, Lag= 3.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.95 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 0.39 fps, Avg. Travel Time= 3.7 min

Peak Storage= 91 cf @ 12.16 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 217.7 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0282 '/'
Inlet Invert= 116.50', Outlet Invert= 114.10'

‡

Summary for Reach 21R: From swale start to swale end

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 1.10" for 25-yr event
Inflow = 1.0 cfs @ 12.19 hrs, Volume= 4,469 cf
Outflow = 0.7 cfs @ 12.54 hrs, Volume= 4,389 cf, Atten= 29%, Lag= 21.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.29 fps, Min. Travel Time= 10.9 min
Avg. Velocity = 0.13 fps, Avg. Travel Time= 23.8 min

Peak Storage= 458 cf @ 12.36 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 3.9 cfs

5.00' x 1.00' deep channel, n= 0.240 Sheet flow over Dense Grass
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 190.0' Slope= 0.0100 '/'
Inlet Invert= 114.00', Outlet Invert= 112.10'

‡

Summary for Reach 22R: From swale to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 1.08" for 25-yr event
Inflow = 0.7 cfs @ 12.54 hrs, Volume= 4,389 cf
Outflow = 0.7 cfs @ 12.60 hrs, Volume= 4,377 cf, Atten= 1%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.15 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 0.61 fps, Avg. Travel Time= 3.9 min

Peak Storage= 87 cf @ 12.57 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 373.9 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 144.0' Slope= 0.0833 '/'
Inlet Invert= 112.00', Outlet Invert= 100.00'

‡

Summary for Reach 40R: Outfall

Inflow Area = 110,555 sf, 30.18% Impervious, Inflow Depth > 0.50" for 25-yr event
Inflow = 0.7 cfs @ 12.60 hrs, Volume= 4,642 cf
Outflow = 0.7 cfs @ 12.60 hrs, Volume= 4,642 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond 41P: Chambers

Inflow Area = 29,187 sf,100.00% Impervious, Inflow Depth > 5.99" for 25-yr event
Inflow = 4.0 cfs @ 12.09 hrs, Volume= 14,564 cf
Outflow = 0.2 cfs @ 10.55 hrs, Volume= 13,665 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.2 cfs @ 10.55 hrs, Volume= 13,665 cf
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 105.66' @ 13.87 hrs Surf.Area= 4,096 sf Storage= 6,227 cf

Plug-Flow detention time= 219.3 min calculated for 13,665 cf (94% of inflow)
Center-of-Mass det. time= 184.5 min (928.6 - 744.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.00'	1,891 cf	**32.00'W x 128.00'L x 3.00'H Field A** 12,288 cf Overall - 7,560 cf Embedded = 4,728 cf x 40.0% Voids
#2A	104.00'	7,271 cf	**Brentwood StormTank 24"** x 840 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 840 Chambers in 20 Rows
#3	107.00'	205 cf	**32.00'W x 128.00'L x 0.50'H Prismatoid** 2,048 cf Overall x 10.0% Voids
		9,367 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	104.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	107.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.2 cfs @ 10.55 hrs HW=104.04' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.2 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=104.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.0 cfs)

Summary for Subcatchment 10S: Existing 93

Runoff = 3.1 cfs @ 12.12 hrs, Volume= 10,837 cf, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=9.06"

Area (sf)	CN	Description
5,800	30	Brush, Good, HSG A
22,260	30	Woods, Good, HSG A
3,920	55	Woods, Good, HSG B
12,430	70	Woods, Good, HSG C
4,180	98	Water Surface, HSG A
48,590	48	Weighted Average
44,410		91.40% Pervious Area
4,180		8.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.1200	0.15		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
1.8	230	0.1830	2.14		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
7.2	280	Total			

Summary for Subcatchment 30S: Flow to Drainage System

Runoff = 5.8 cfs @ 12.09 hrs, Volume= 21,439 cf, Depth> 8.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=9.06"

	Area (sf)	CN	Description
*	17,487	98	Paved parking and wall, HSG A
	11,700	98	Roofs, HSG A
	29,187	98	Weighted Average
	29,187		100.00% Impervious Area

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

Summary for Subcatchment 31S: Existing 93

Runoff = 0.2 cfs @ 12.49 hrs, Volume= 1,887 cf, Depth> 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=9.06"

	Area (sf)	CN	Description
	13,196	30	Brush, Good, HSG A
	965	30	Woods, Good, HSG A
*	18,300	30	Brush, Good, HSG A
*	317	30	Woods, Good, HSG A
	32,778	30	Weighted Average
	32,778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.4	50	0.0150	0.07		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 4.00"
3.8	288	0.0330	1.27		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
16.2	338	Total			

Summary for Subcatchment 32S: Flow offsite

Runoff = 0.2 cfs @ 12.12 hrs, Volume= 905 cf, Depth> 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=9.06"

	Area (sf)	CN	Description
	932	39	>75% Grass cover, Good, HSG A
*	663	98	Paved parking and wall, HSG A
	6,595	30	Brush, Good, HSG A
	165	30	Woods, Good, HSG A
	8,355	36	Weighted Average
	7,692		92.06% Pervious Area
	663		7.94% Impervious Area

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

Summary for Reach 20R: From 91 wetland to swale start

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 2.68" for 100-yr event
Inflow = 3.1 cfs @ 12.12 hrs, Volume= 10,837 cf
Outflow = 3.0 cfs @ 12.15 hrs, Volume= 10,820 cf, Atten= 4%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.41 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.47 fps, Avg. Travel Time= 3.0 min

Peak Storage= 180 cf @ 12.13 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 217.7 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 85.0' Slope= 0.0282 '/'
Inlet Invert= 116.50', Outlet Invert= 114.10'

‡

Summary for Reach 21R: From swale start to swale end

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 2.67" for 100-yr event
Inflow = 3.0 cfs @ 12.15 hrs, Volume= 10,820 cf
Outflow = 2.3 cfs @ 12.36 hrs, Volume= 10,703 cf, Atten= 20%, Lag= 12.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.42 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 0.17 fps, Avg. Travel Time= 18.7 min

Peak Storage= 1,059 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.76'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 3.9 cfs

5.00' x 1.00' deep channel, n= 0.240 Sheet flow over Dense Grass
Side Slope Z-value= 3.0 '/' Top Width= 11.00'
Length= 190.0' Slope= 0.0100 '/'
Inlet Invert= 114.00', Outlet Invert= 112.10'

‡

Summary for Reach 22R: From swale to outfall

Inflow Area = 48,590 sf, 8.60% Impervious, Inflow Depth > 2.64" for 100-yr event
Inflow = 2.3 cfs @ 12.36 hrs, Volume= 10,703 cf
Outflow = 2.3 cfs @ 12.41 hrs, Volume= 10,684 cf, Atten= 2%, Lag= 2.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.81 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 0.70 fps, Avg. Travel Time= 3.4 min

Peak Storage= 184 cf @ 12.38 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 40.0 sf, Capacity= 373.9 cfs

20.00' x 1.00' deep channel, n= 0.035 Earth, dense weeds
Side Slope Z-value= 20.0 '/' Top Width= 60.00'
Length= 144.0' Slope= 0.0833 '/'
Inlet Invert= 112.00', Outlet Invert= 100.00'

‡

Summary for Reach 40R: Outfall

Inflow Area = 110,555 sf, 30.18% Impervious, Inflow Depth > 1.41" for 100-yr event
Inflow = 2.9 cfs @ 12.55 hrs, Volume= 13,000 cf
Outflow = 2.9 cfs @ 12.55 hrs, Volume= 13,000 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Pond 41P: Chambers

Inflow Area = 29,187 sf,100.00% Impervious, Inflow Depth > 8.81" for 100-yr event
Inflow = 5.8 cfs @ 12.09 hrs, Volume= 21,439 cf
Outflow = 1.3 cfs @ 12.56 hrs, Volume= 16,467 cf, Atten= 78%, Lag= 28.2 min
Discarded = 0.5 cfs @ 12.55 hrs, Volume= 16,039 cf
Primary = 0.8 cfs @ 12.56 hrs, Volume= 429 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 107.11' @ 12.56 hrs Surf.Area= 8,192 sf Storage= 9,206 cf

Plug-Flow detention time= 222.4 min calculated for 16,467 cf (77% of inflow)
Center-of-Mass det. time= 137.9 min (877.2 - 739.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	104.00'	1,891 cf	**32.00'W x 128.00'L x 3.00'H Field A** 12,288 cf Overall - 7,560 cf Embedded = 4,728 cf x 40.0% Voids
#2A	104.00'	7,271 cf	**Brentwood StormTank 24"** x 840 Inside #1 Inside= 18.0"W x 24.0"H => 2.89 sf x 3.00'L = 8.7 cf Outside= 18.0"W x 24.0"H => 3.00 sf x 3.00'L = 9.0 cf 840 Chambers in 20 Rows
#3	107.00'	205 cf	**32.00'W x 128.00'L x 0.50'H Prismatoid** 2,048 cf Overall x 10.0% Voids
		9,367 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	104.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	107.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00

2.50 3.00 3.50 4.00 4.50 5.00 5.50
Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65
2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.5 cfs @ 12.55 hrs HW=107.10' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.5 cfs)

Primary OutFlow Max=0.7 cfs @ 12.56 hrs HW=107.10' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.7 cfs @ 0.73 fps)

Appendix V. Operations and Maintenance Log

93 Tenney Street

Operation and Maintenance Log

Inspections for Year:_____

Structural Best Management Practice	Action	Date Completed	Completed By	Comments
Subsurface Stormwater Chambers – Inspect twice per year. Clean as required	Inspect			
	Inspect			
Roof Drain Leaders – Inspect/clean twice per year.	Inspect/Clean			
	Inspect/Clean			
Vegetated Areas Maintenance – Inspect twice per year. Maintain as required.	Inspect			
	Inspect			
Deep Sump Hooded Catch Basin– Inspect/clean four times per year. Clean when sump is 50% full.	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			
	Inspect/ Clean			

NOTE: See Operations and Maintenance Plan for details of inspection requirements.