CONNORSTONE ENGINEERING, INC.
10 SOUTHWEST CUTOFF, SUITE #7
NORTHBOROUGH, MASSACHUSETTS 01532
TEL: (508) 393-9727 • FAX: (508) 393-5242

Town of Ashland Planning Board
101 Main Street, 2nd Floor,
Ashland, MA 01721

May 11, 2016

Subject: **0 Megunko Road**
Site Plan Review Comments

Dear Members of the Board:

On behalf of the applicant (Ashland Landscape Supply, LLC), Connorstone Engineering, Inc, is transmitting revised plans and documentation for 0 Megunko Road. The enclosed plans and documents have been revised based peer review comments from PSC in a letter dated April 22, 2016. Specific responses to each of the review comments are provided below.

General Regulations (§5.0)
Z1. The plans have been revised to label 27 spaces along Megunko Road.
Z2. Item Addressed.
Z3-6. Site landscaping to be reviewed by the Board.
Z7. A Site Alteration Permit Application was previously submitted.
Z8. Conditions to be discussed with the Board.

Photovoltaic Installation Overlay District (§8.3)
Not applicable.

Site Plan Review (§9.4)
P1. An turning analysis was previously submitted. A copy has been included with this letter.
P2. Site landscaping to be reviewed by the Board.
P3. The color, lettering, etc. of the sign would be reviewed by the Building Inspector.
P4. Lighting has been reviewed and approved by the Design Review Board.
P5. Item Addressed.
P6. Updated Architectural Plans to be provided to the Board by the Owner.

Building Design (§9.4.7)
BD1. Updated Architectural Plans to be provided to the Board by the Owner.
BD2. Item Addressed.

Traffic (§9.4.8)
T1. To be determine by Board.

Stormwater Management (Chapter 343)
SW1. Additional test pits have been performed on-site to determine groundwater elevations and suitability for the proposed stormwater management design. As requested, at least Five test pits have been performed in each of the infiltration locations. The results are shown on the site plans (sheet 2).

SW2. Drainage calculations had been previously submitted. An updated copy has been attached with this letter.
SW3. Item Addressed.
SW4. The content required under §7.6.16 had been provided on the plans and within the Stormwater Report.

- 7.6.16(b)(11) Seasonal high groundwater elevations have been provided in the locations of the stormwater systems.
- 7.6.16(b)(13)(c) A description of the drywells has been provided in the Stormwater report and timing was provided in the sequencing notes.
- 7.6.16(c)(11) The stormwater report and analysis have verified there will be a net decrease in both the peak rate of runoff and the volume of runoff leaving the site for all storms including the 8.15 inch 100-year storm.

SW5. Item Addressed. The applicant does not have the right to work within the drainage swale, and the inlet is off-site.
SW6. Documentation to show compliance with General Criteria was provided in the previously submitted Stormwater Report.

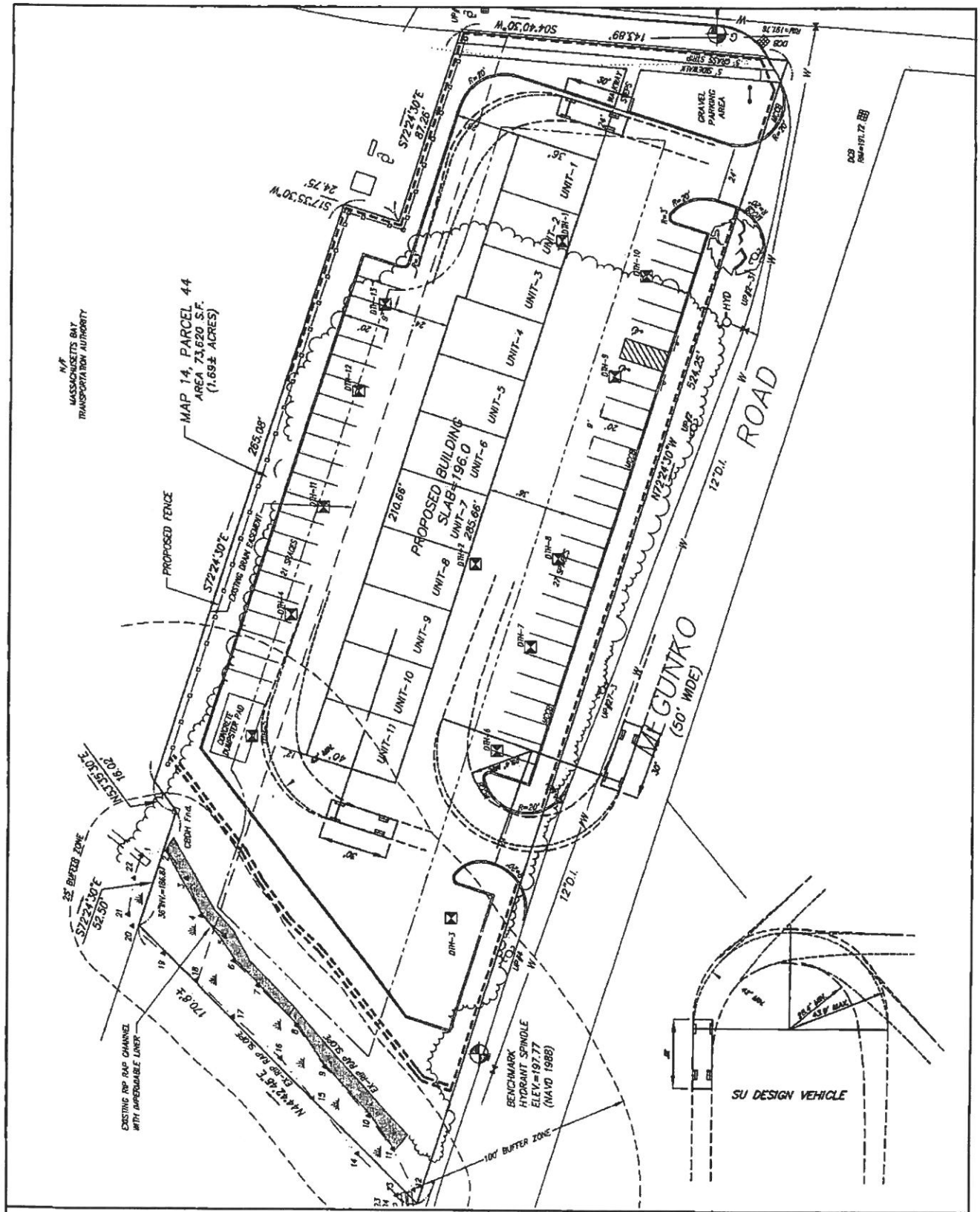
- 8.1.1.4: As noted above, the stormwater report and analysis have verified there will be a net decrease in both the peak rate of runoff and the volume of runoff leaving the site for all storms including the 8.15 inch 100-year storm.
- 8.1.1.5: An analysis of the recharge requirements was previously provided in the Stormwater Report. The analysis has been updated to the new limit of pavement. The recharge provided far exceeds the minimum required values (approximately 8 times the minimum required value).

SW7. The snow storage area was removed from the buffer area.
SW8. Item Addressed.

If you have any questions related to this project or the materials submitted, please contact our office at 508-393-9727.

Sincerely,
Connorstone Engineering, Inc.

Vito Colonna, P.E.



TURNING TEMPLATE EXHIBIT
MEGUNKO ROAD
ASHLAND, MA
SCALE 1"=60'

CONNORSTONE ENGINEERING
CONSULTING CIVIL ENGINEERS
AND LAND SURVEYORS
10 SOUTHWEST CUTOFF, SUITE 7
NORTHBOROUGH, MASSACHUSETTS 01532

STORMWATER REPORT & DOCUMENTATION

Megunko Road
Ashland, Massachusetts

January 22, 2016
(Revised 5/10/2016)

Prepared by:
Connorstone Engineering, Inc.
10 Southwest Cutoff, Suite 7
Northborough, MA

The purpose of this analysis is to design a Stormwater Management System in accordance with the Ashland Stormwater Management Bylaw and the Massachusetts Stormwater Standards. This report provides a summary of the Stormwater Management System, and required documentation to verify compliance with the Standards.

Project Narrative:

Location: The subject site consists of a 1.69 acre parcel of land located at the corner of Megunko road and Cherry Street shown as Assessors Map 14, Parcel 44 Under the existing conditions, the site is partially developed as a gravel parking lot along Cherry Street. The remaining area is undeveloped and wooded. Site zoning includes the Industrial zoning district, Photovoltaic Overlay, and Add 'A' Overlay.

Existing Conditions: The existing topography is generally flat with a gradual slope away from a high point near the center of the site. The center portion of the site appears to have been filled several years ago. Regulated wetland resources areas are located along the westerly property line and include an intermittent stream with bordering vegetated wetlands. The wetland has a drainage area of approximately 0.3 sq. miles and is not shown on the USGS mapping. The Natural Heritage and Endangered Species Program (NHESP) have not identified any areas on-site as lying within the reported Priority or Estimated Habitat Areas.

Soils: The Natural Resource Conservation Service has mapped the soils on site as Freetown and Udorthents (developed urban land). Freetown soils have a mixed hydrologic soil group as B / D. If a soil is assigned to a dual hydrologic group (B/D), the first letter is for drained areas and the second is for undrained areas. Soils in their natural condition are group D. The existing conditions include areas of natural grade, and areas that appear to have been filled. Areas of fill have been designated as Group B, and areas in the natural condition are designated as Group D.

Proposed Project: The proposed plan includes construction of an 11,100 sq ft. +/- building containing 11 units for contractor garages/offices. The work also includes a paved driveway, 48 parking spaces; drainage and stormwater structures; utility connections; and required site work. Site access will include two curb cuts off Megunko Road, which will allow circulation throughout the site. The additional traffic generated from the proposed project is minimal, and would not have an impact on Megunko Road, Cherry Street, or the surrounding area.

The proposed building will be serviced by the municipal water and sewer systems. The water connection has been proposed off the existing water main in Cherry Street. Each unit will have an individual service and shutoff. The closest public sewer main is located at the corner of Cherry Street and Park Road. A sewer main will be extended approximately 200 feet down Cherry Street, ending

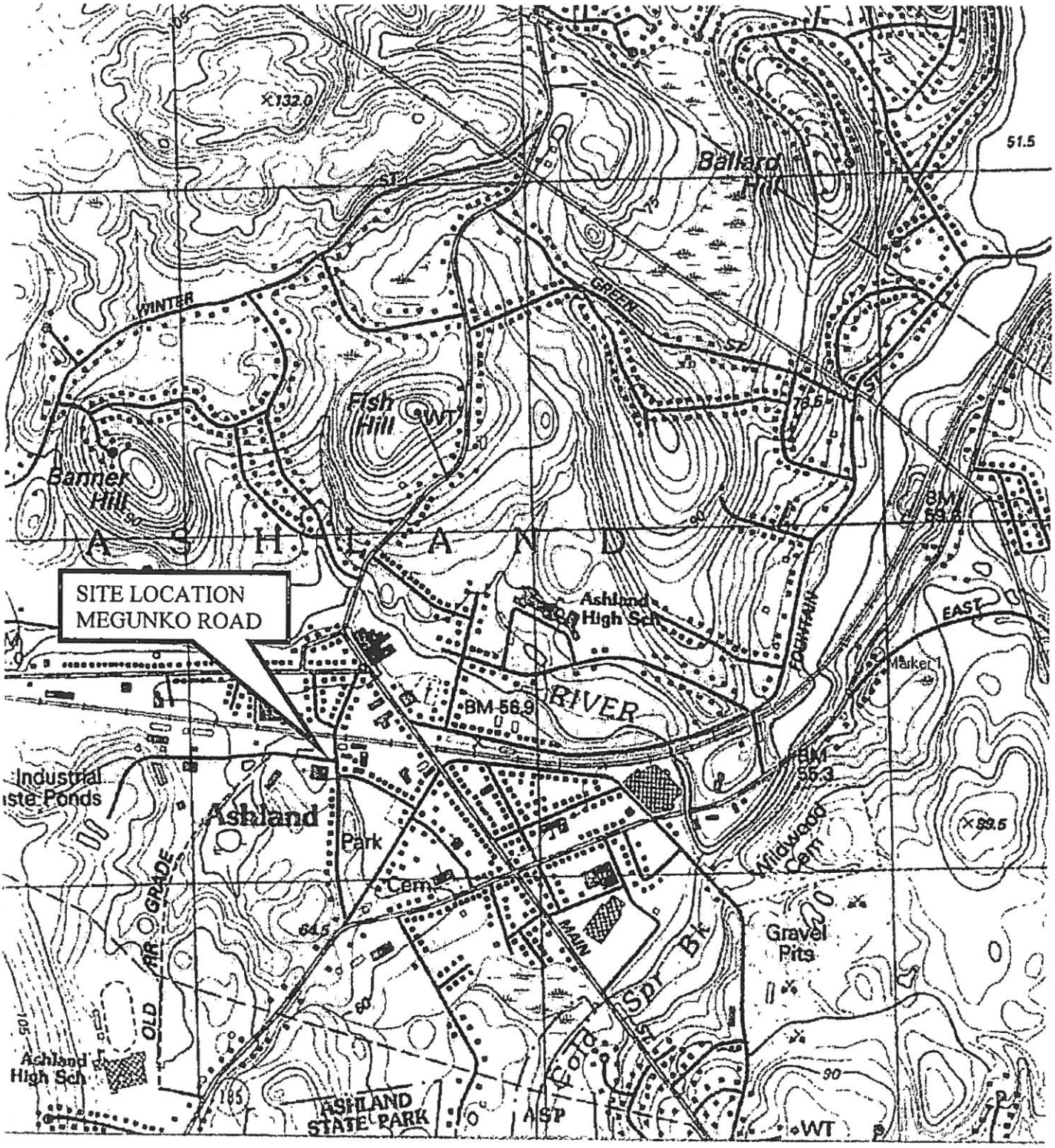
with a manhole located in front of the proposed building. Each of the units will have a separate sewer service. Floor drains within the units will be connected to an oil/gas trap prior to connection to the sewer system.

The overall project will result in 50,320 square feet of impervious area and require a disturbance area of approximately 65,000 square feet. The proposed building and limit of work has been designed to maintain an undisturbed buffer of at least 25 feet around the on-site wetlands.

The proposed stormwater management system has been designed in compliance with the MassDEP Stormwater Standards and the Ashland Stormwater Bylaw. The proposed system will collect runoff from the paved surfaces and provide treatment, recharge, and detention though subsurface infiltration beds. The beds have been set at least two feet above seasonal high groundwater and ledge.

A detailed description and supporting calculations for each of the standards have been provided in this report.

USGS LOCUS MAP



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.

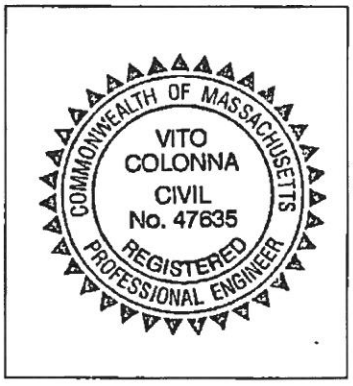
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



5/10/16
Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

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.

MA D.E.P. STORMWATER STANDARDS

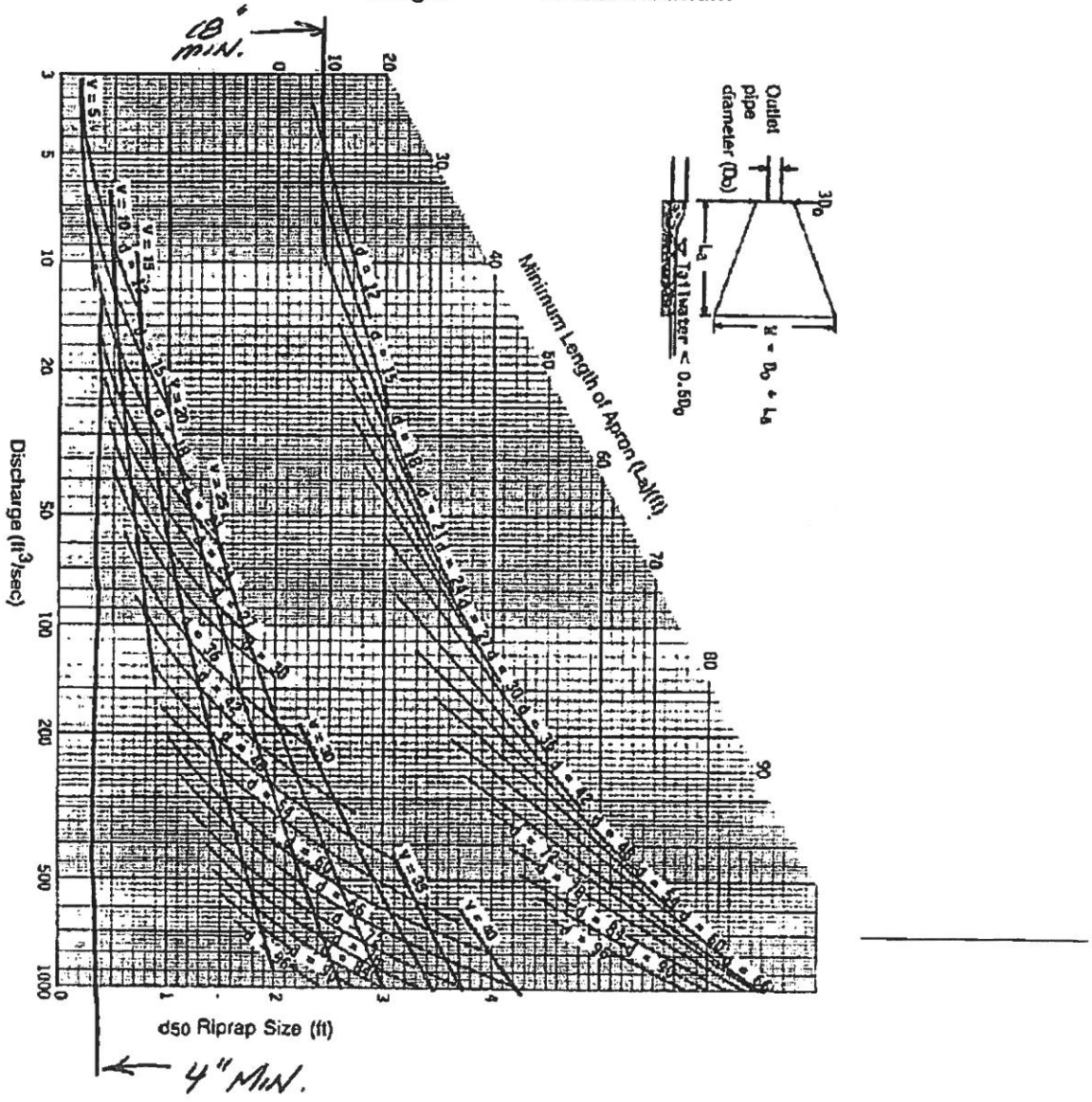
Standard 1: No New Untreated Discharges

1. There are no new untreated discharges to any wetland resource area. The discharge locations within the buffer zone are treated stormwater.

2. Stormwater discharge outlets have been protected with riprap aprons or spillways. Riprap sizing shall be MassHighway Standard 'Modified Rock Fill' having an 8" minus stone size.

Stormwater Discharge Velocity: (100 year NOAA 14) 18" FE: Q= 3.0 cfs / V= 5.9 fps (18-inch)

Riprap sizing: Use: Riprap Size = 4-inch minimum D_{50}
Length= 10 foot minimum



Standard 2: Peak Rate Attenuation

An analysis was performed to determine the peak rate of stormwater runoff leaving the site, and design a stormwater management system in accordance with the Massachusetts Department of Environmental Protection Stormwater Management Standard 2. The pre- and post-development stormwater runoff has been analyzed using HydroCAD 9.10, which is a stormwater modeling computer program utilizing a collection of techniques for the generation and routing of hydrographs, including Soil Conservation Service (SCS) Technical Release No. 20 (TR-20) and SCS Technical Release 55 (TR-55), *Urban Hydrology for Small Watersheds.*

Rainfall depths for the design storms were taken from the "United States Department of Commerce, Weather Bureau, Technical Paper 40 (TP-40), *Rainfall frequency Atlas of the United States.*" Based upon discussion at the Conservation Commission hearing, the site was also evaluated for the NOAA Atlas 14 rainfall values. This publication is still being reviewed by the MassDEP, and current guidance recommends the use of TP-40 for the interim. The rainfall depths used in the calculations are listed below:

2 year	3.20	
10 year	4.70	
100 year	7.00	From TP-40
100 year	8.15	From NOAA Atlas 14

Two analysis point was utilized for the existing and proposed conditions:

Analysis Point A	West - Wetland at Westerly Property Line
Analysis Point B	East - Cherry Street Drainage System

Existing conditions were compared to proposed conditions to ensure that the proposed design will not increase the rate of runoff from the site and/or result in downstream impacts. A summary of the results is as follows:

Table 1 – Peak Rate of Runoff

Analysis Point	2-Year Storm Existing (Proposed)	10-Year Storm Existing (Proposed)	100-Year TP-40 Existing (Proposed)	100-Year Atlas 14 Existing (Proposed)
A Wetland	0.7 cfs (0.3 cfs)	1.6 cfs (0.7 cfs)	3.3 cfs (1.9 cfs)	4.3 cfs (3.9 cfs)
B Cherry Street	0.6 cfs (0.1 cfs)	1.3 cfs (0.3 cfs)	2.5 cfs (0.7 cfs)	3.2 cfs (1.0 cfs)

Table 2: Volume of Runoff

Analysis Point	2-Year Storm Existing (Proposed)	10-Year Storm Existing (Proposed)	100-Year TP-40 Existing (Proposed)	100-Year Atlas Existing (Proposed)
A Wetland	0.1 acre-ft (0.0 acre-ft)	0.2 acre-ft (0.1 acre-ft)	0.3 acre-ft (0.1 acre-ft)	0.4 acre-ft (0.2 acre-ft)
B Cherry Street	0.1 acre-ft (0.0 acre-ft)	0.1 acre-ft (0.0 acre-ft)	0.2 acre-ft (0.0 acre-ft)	0.3 acre ft (0.1 acre-ft)

Standard 3: Stormwater Recharge

The previous report had indicated the recharge was not proposed due to the soil conditions and potential risk of future contamination. Additional information has been provided by the project L.S.P. indicating recharge will be allowed and is acceptable on the subject site. Additional soil test pits were performed to verify soil texture and depth to groundwater.

The proposed Stormwater management system has been designed to provide recharge of stormwater in excess of that required by Standard 3. Recharge has been provided through the proposed subsurface infiltration beds.

Required Recharge Volume:

Post development increased impervious area = 44,700 S.F.
Onsite hydrologic soil group = B/D
Assume all as HSG B for Conservative estimate: 0.35 inches of runoff
Required Volume = 44,700 S.F. x 0.35 = 1,304 Cubic Feet

Proposed Recharge Volume: (Static Method)

Volume within Infiltration System -1 = 5,700 C.F.
Volume within Infiltration System -2 = 3,900 C.F.
Total = 9,600 Cubic Feet

Separation to Groundwater

Soil testing performed in the location of the stormwater basins have shown seasonal high groundwater to be greater than 2 feet below the bottom of systems.

Draw down Time (maximum 72 hours allowable):

Infiltration System 1 – (5,700 cubic feet) / (1.02 in/hr * 1/12 * 8,550 sq. ft.) = 8 hours
Infiltration System 2 – (3,900 cubic feet) / (1.02 in/hr * 1/12 * 5,936 sq. ft.) = 8 hours

Mounding Analysis

Per the Massachusetts Stormwater Handbook a mounding analysis was performed utilizing the Hantush method. The application rate was based upon the treatment or recharge volume (whichever was greater), and the hydraulic conductivity was based upon the Rawles Rate associated with the soil texture as determined from on-site soil testing. The attached analysis verifies the resulting groundwater mound will not break out onto the ground surface and will drain within 72 hours.

Standard 4: Water Quality

The proposed project has been designed to provide a minimum 80% removal of the annual post construction load of total suspended solids prior to discharge to resource areas. A recommended long-term pollution prevention plan is provided as part of the attached Operation and Maintenance Plan.

Per MassDEP's Stormwater Handbook, infiltration systems remove 80% of the average annual Total Suspended Solids, avg. 55% TN, and avg. 55%TP.

Infiltration System 1

Required WQV: (0.5 in / 12 in/ft) * (30,320 s.f.) = 1,263 C.F.
Provided WQV: Available volume below outlet = 5,700 C.F

Infiltration System 2

Required WQV: (0.5 in / 12 in/ft) * 20,000 s.f.) = 833 C.F.
Provided WQV: Available volume below outlet = 3,900 C.F

Standard 5: Land Uses With Higher pollutant Loads

Not applicable - The proposed use is not classified as a land use with higher pollutant loads.

Standard 6: Critical Areas

Not applicable – the site does not contain and critical areas.

Standard 7: Redevelopment

Not applicable

Standard 8: Construction Period Controls

1. A Construction Period Pollution Prevention / Erosion Control measures have been provided on the site plans along with a typical sequencing plan.

2. The project is greater than 1 acre of disturbance and is covered by the NPDES General Construction Permit. A copy of the SWPPP has been attached with this report.

Standard 9: Operation and Maintenance Plan

A recommended Operation and Maintenance Plan has been provided with this report.

Standard 10: Illicit Discharges

Based upon site observations, no illicit discharges have been observed on the site. Illicit discharges are prohibited. The proposed building will be connected to the municipal sewer system.

DRYWELL STORAGE TABLES AND MOUNDING CALCULATIONS

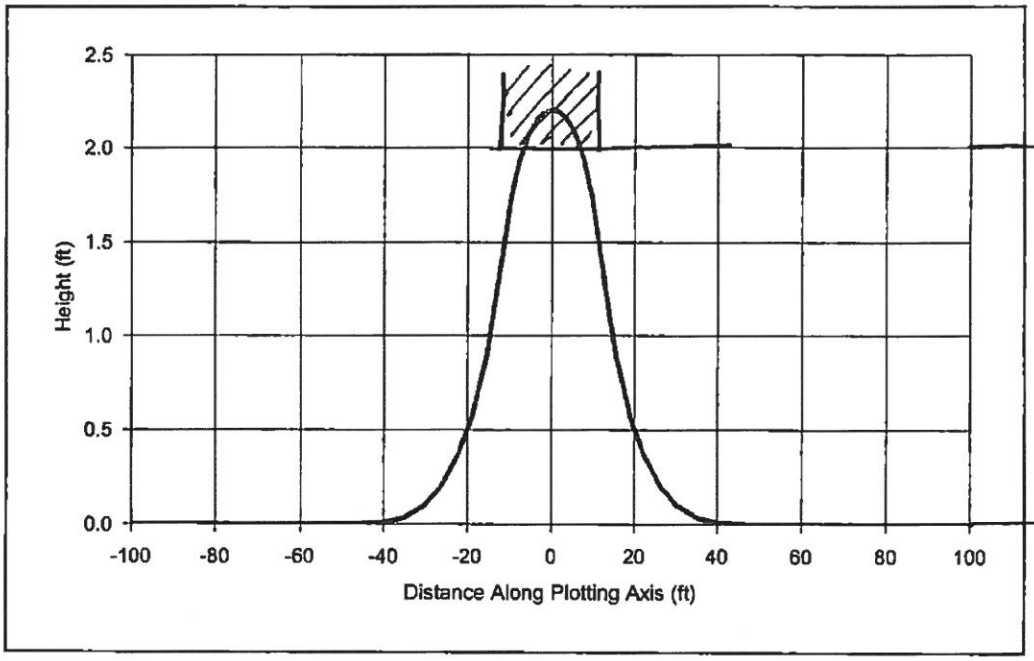
Stage-Area-Storage for Pond 1P: Infiltration System - 1

Elevation (feet)	Wetted (sq-ft)	Storage (cubic-feet)
191.50	8,550	0
191.60	8,623	342
191.70	8,697	684
191.80	8,770	1,026
191.90	8,844	1,368
192.00	8,917	1,710
192.10	8,990	2,087
192.20	9,064	2,488
192.30	9,137	2,901
192.40	9,211	3,322
192.50	9,284	3,747
192.60	9,357	4,171
192.70	9,431	4,592
192.80	9,504	5,006
192.90	9,578	5,407
193.00	9,651	5,783
193.10	9,724	6,127
193.20	9,798	6,470
193.30	9,871	6,813
193.40	9,945	7,156
193.50	**10,018**	7,500
193.60	10,018	7,501
193.70	10,018	7,502
193.80	10,018	7,504
193.90	10,018	7,505
194.00	10,018	7,506
194.10	10,018	7,507
194.20	10,018	7,509
194.30	10,018	7,510
194.40	10,018	7,511
194.50	10,018	7,512
194.60	10,018	7,514
194.70	10,018	7,515
194.80	10,018	7,516
194.90	10,018	7,517
195.00	10,018	7,519
195.10	10,018	7,520
195.20	10,018	7,521
195.30	10,018	7,522
195.40	10,018	7,524
195.50	10,018	7,525
195.60	10,018	7,526
195.70	10,018	7,527
195.80	10,018	7,529
195.90	10,018	7,530
196.00	10,018	7,531
196.10	10,018	7,532
196.20	10,018	7,534
196.30	10,018	7,535
196.40	10,018	7,536
196.50	10,018	7,537
196.60	10,018	7,539
196.70	10,018	7,540
196.80	10,018	7,541
196.90	10,018	7,542
197.00	10,018	7,544
197.10	10,018	7,545
197.20	10,018	7,546
197.30	10,018	7,547
197.40	10,018	7,549
197.50	10,018	7,550
197.60	10,018	7,551
197.70	10,018	7,553
197.80	10,018	7,554
197.90	10,018	7,555
198.00	10,018	**7,556**

overflow @ 193.0

INFILTRATION SYSTEM - 1

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



BOTTOM SYSTEM = 191.5

ESH+GW = 189.5

COMPANY: csei

PROJECT: Megunko

ANALYST: vc

DATE: 5/11/2016 TIME: 2:09:12 PM

INPUT PARAMETERS

Application rate: 0.676 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.25
Hydraulic conductivity: 2.04 ft/day
Initial saturated thickness: 10 ft
Length of application area: 342 ft
Width of application area: 25 ft
No constant head boundary used
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 12.5 ft
positive Y: 0 ft
Total volume applied: 5779.8 c.ft ✓

R VOLUME ✓

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-100	0	-100	0
-84.1	0	-84	0
-68.2	0	-68	0
-52.3	0	-52	0
-39.8	0	-40	0.01
-30.1	0	-30	0.1
-22.2	0	-22	0.38
-15.5	0	-15	0.89
-9.7	0	-10	1.74
-5.8	0	-6	2.06
-3.2	0	-3	2.16
0	0	0	2.2
3.2	0	3	2.16
5.8	0	6	2.06
9.7	0	10	1.74
15.5	0	15	0.89
22.2	0	22	0.38
30.1	0	30	0.1
39.8	0	40	0.01
52.3	0	52	0
68.2	0	68	0
84.1	0	84	0
100	0	100	0

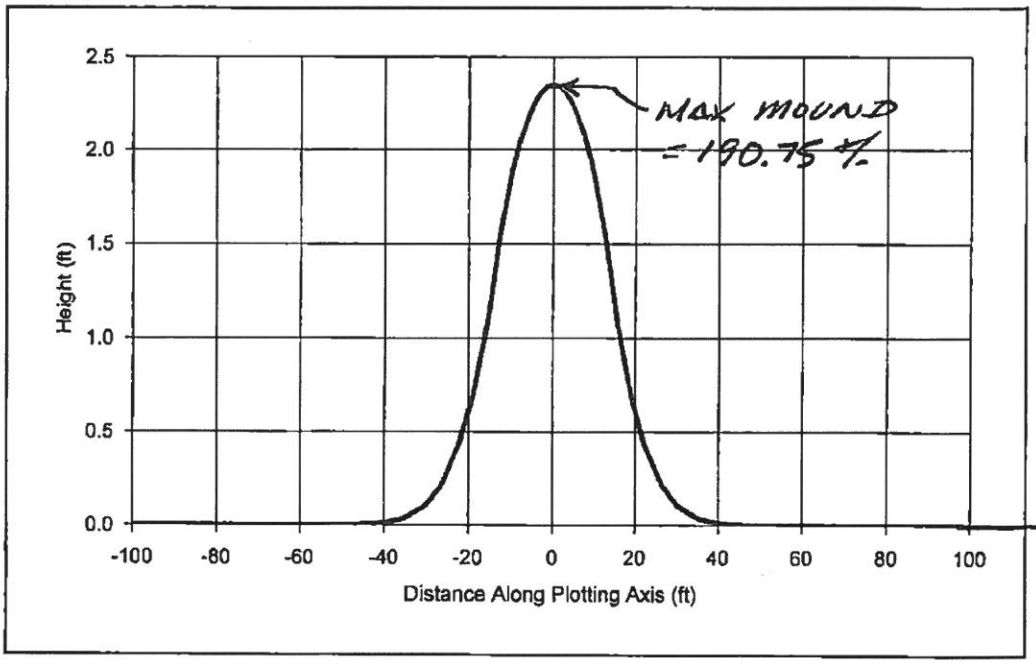
Stage-Area-Storage for Pond 2P: Infiltration System - 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
191.50	**5,936**	0
191.60	5,936	237
191.70	5,936	475
191.80	5,936	712
191.90	5,936	950
192.00	5,936	1,187
192.10	5,936	1,446
192.20	5,936	1,721
192.30	5,936	2,003
192.40	5,936	2,290
192.50	5,936	2,579
192.60	5,936	2,867
192.70	5,936	3,154
192.80	5,936	3,436
192.90	5,936	3,711
193.00	5,936	3,970
193.10	5,936	4,209
193.20	5,936	4,447
193.30	5,936	4,686
193.40	5,936	4,925
193.50	5,936	5,163
193.60	5,936	5,165
193.70	5,936	5,166
193.80	5,936	5,167
193.90	5,936	5,169
194.00	5,936	5,170
194.10	5,936	5,171
194.20	5,936	5,172
194.30	5,936	5,174
194.40	5,936	5,175
194.50	5,936	5,176
194.60	5,936	5,177
194.70	5,936	5,179
194.80	5,936	5,180
194.90	5,936	5,181
195.00	5,936	5,182
195.10	5,936	5,184
195.20	5,936	5,185
195.30	5,936	5,186
195.40	5,936	5,187
195.50	5,936	5,189
195.60	5,936	5,190
195.70	5,936	5,191
195.80	5,936	5,192
195.90	5,936	5,194
196.00	5,936	5,195
196.10	5,936	5,196
196.20	5,936	5,197
196.30	5,936	5,199
196.40	5,936	5,200
196.50	5,936	5,201
196.60	5,936	5,202
196.70	5,936	5,204
196.80	5,936	5,205
196.90	5,936	5,206
197.00	5,936	5,207
197.10	5,936	5,209
197.20	5,936	5,210
197.30	5,936	5,211
197.40	5,936	5,212
197.50	5,936	5,214
197.60	5,936	5,215
197.70	5,936	5,216
197.80	5,936	5,218
197.90	5,936	5,219
198.00	5,936	**5,220**

overflow @ 193.0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)

BOTTOM SYSTEM = 191.5



COMPANY: csei

PROJECT: Megunko

ANALYST: vc

DATE: 5/11/2016 TIME: 2:22:33 PM

INPUT PARAMETERS

Application rate: 0.669 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.25
Hydraulic conductivity: 2.04 ft/day
Initial saturated thickness: 10 ft
Length of application area: 212 ft
Width of application area: 28 ft
No constant head boundary used
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 14 ft
positive Y: 0 ft
Total volume applied: 3971.184 c.ft ✓

R VOLUME ✓

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-100	0	-100	0
-84.1	0	-84	0
-68.2	0	-68	0
-52.3	0	-52	0
-39.8	0	-40	0.01
-30.1	0	-30	0.11
-22.2	0	-22	0.44
-15.5	0	-15	1.1
-9.7	0	-10	1.89
-5.8	0	-6	2.19
-3.2	0	-3	2.31
0	0	0	2.35
3.2	0	3	2.31
5.8	0	6	2.19
9.7	0	10	1.89
15.5	0	15	1.1
22.2	0	22	0.44
30.1	0	30	0.11
39.8	0	40	0.01
52.3	0	52	0
68.2	0	68	0
84.1	0	84	0
100	0	100	0

STORMWATER DRAINAGE SYSTEM DESIGN

The street drainage system has been designed from calculations based upon the 25-year design storm to ensure capacity to convey stormwater.

Storm intensities were determined from exhibit 8-14 "*Intensity – Duration – Frequency Curve for Worcester, MA*" from the MassHighway Design Manual. The resulting analysis was performed using the Rational Method of determining peak storm flows. All storm sewer pipe sizes were determined using Manning's Equation for pipes flowing full.

The following table presents the hydraulic calculations performed for sizing the site drainage system. The structure references refer to those as shown on the site plan submitted with this report.

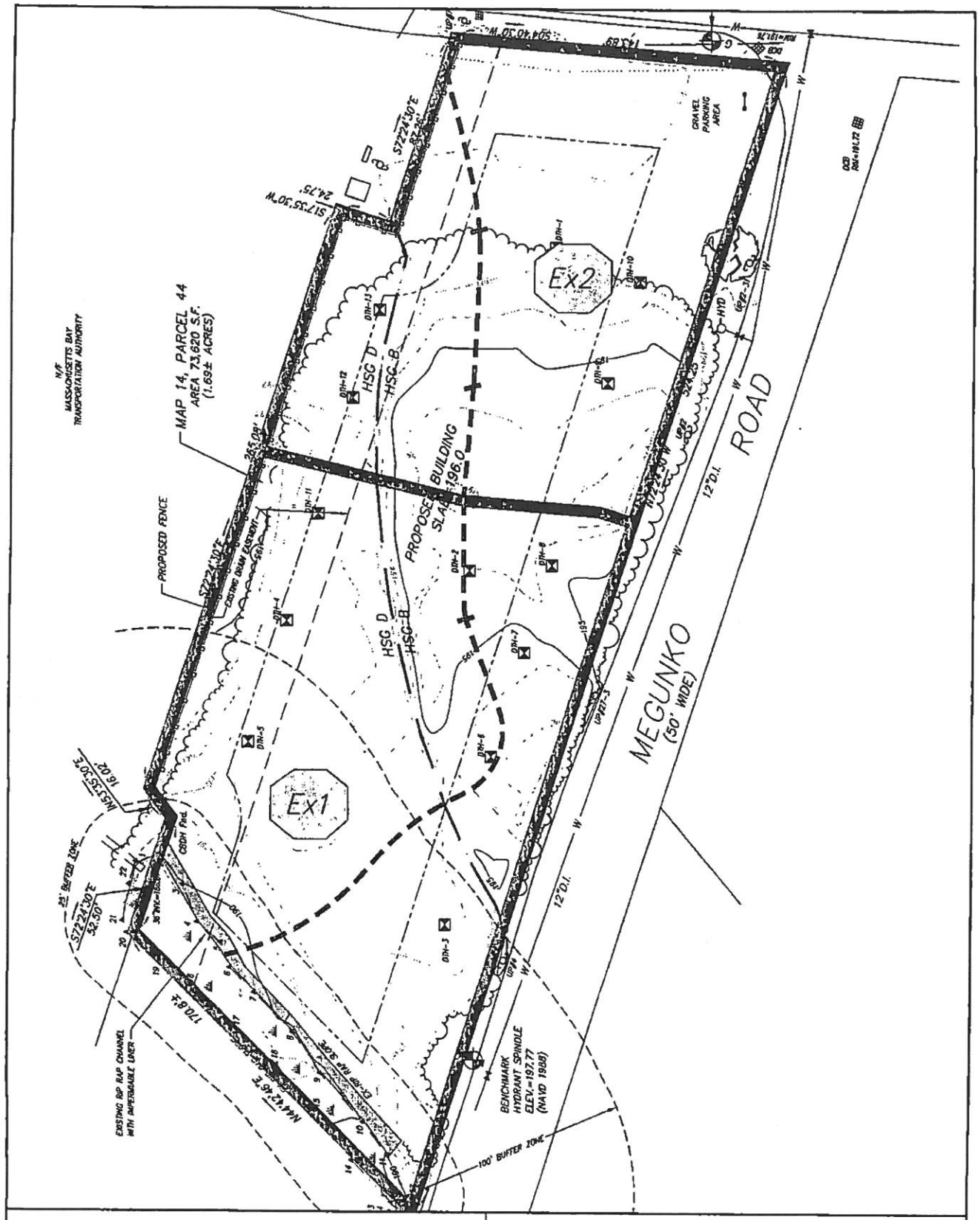
DRAIN PIPE SIZING CALCULATIONS

PROJECT Megunko Road LOCATION 0 Megunko Road, Ashland, MA BY: VC n= 0.012
Ashland SHEET 1 OF 1 DATE: rev 5/10/2016 RETURN PERIOD 25 YEAR

Line		Area	C	CA	Ci	Tc	rain	Inlet flow Q	Pipe flow Qd	Pipe Size	Pipe Length	Slope	flowing full		Rim (feet)		Inv. El.	
FROM	TO	ac				min.	in/hr	cfs	cfs	in	ft	ft/ft	Qf	Vf	Upper	Lower	Upper	Lower
Trench Drain	CB-3	0.06	0.95	0.06	1.1	5.0	6.5	0.41	0.41	8	15	0.010	1.31	3.8	193.75	194.75	192.50	192.35
CB-3	DMH-2	0.09	0.95	0.14	1.1	5.0	6.5	1.02	1.02	8	18	0.008	1.20	3.4	194.75	195.20	192.25	192.10
CB-2	INF-1	0.16	0.95	0.15	1.1	5.0	6.5	1.09	1.09	8	5	0.050	2.93	8.4	194.75	—	192.25	192.00
CB-1	INF-1	0.14	0.95	0.13	1.1	5.0	6.5	0.95	0.95	8	5	0.050	2.93	8.4	194.75	—	192.25	192.00
CB-7	INF-1	0.13	0.95	0.12	1.1	5.0	6.5	0.88	0.88	8	8	0.031	2.31	6.6	194.75	—	192.25	192.00
DMH-1	DMH-5	FROM HYDROCAD							0.00	12	48	0.010	3.94	5.0	195.30	195.35	192.50	192.00
CB-6	DMH-4	0.10	0.95	0.10	1.1	5.0	6.5	0.68	0.68	8	45	0.008	1.15	3.3	194.75	195.40	192.35	192.00
CB-5	INF-2	0.15	0.95	0.14	1.1	5.0	6.5	1.02	1.02	8	6	0.042	2.67	7.7	194.75	—	192.25	192.00
CB-4	INF-2	0.16	0.95	0.15	1.1	5.0	6.5	1.09	1.09	8	6	0.042	2.67	7.7	194.75	—	192.25	192.00
CB-4	DMH--3	0.07	0.95	0.07	1.1	5.0	6.5	0.48	0.48	8	4	0.063	3.27	9.4	194.75	—	192.25	192.00
DMH-3	DMH-5	FROM HYDROCAD							0.00	12	46	0.011	4.03	5.1	194.90	195.35	192.50	192.00
DMH-5	18" HW	FROM HYDROCAD							0.00	18	5	0.020	16.10	9.1	195.35	—	191.85	191.75

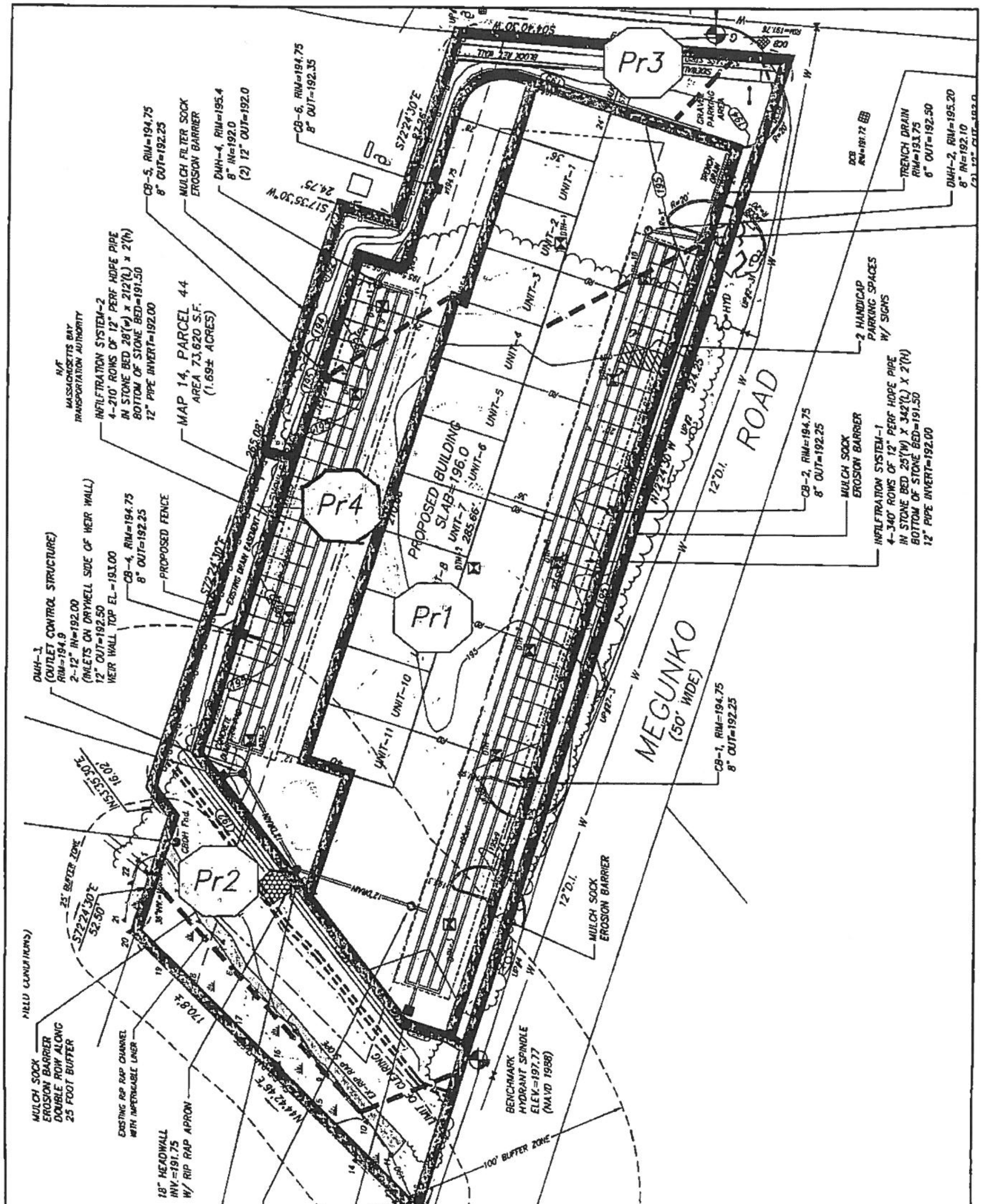
HYDROCAD CALCULATIONS

2 Year, 10 Year, 100 Year & NOAA Atlas 14 Storm Event
Calculation Sheets



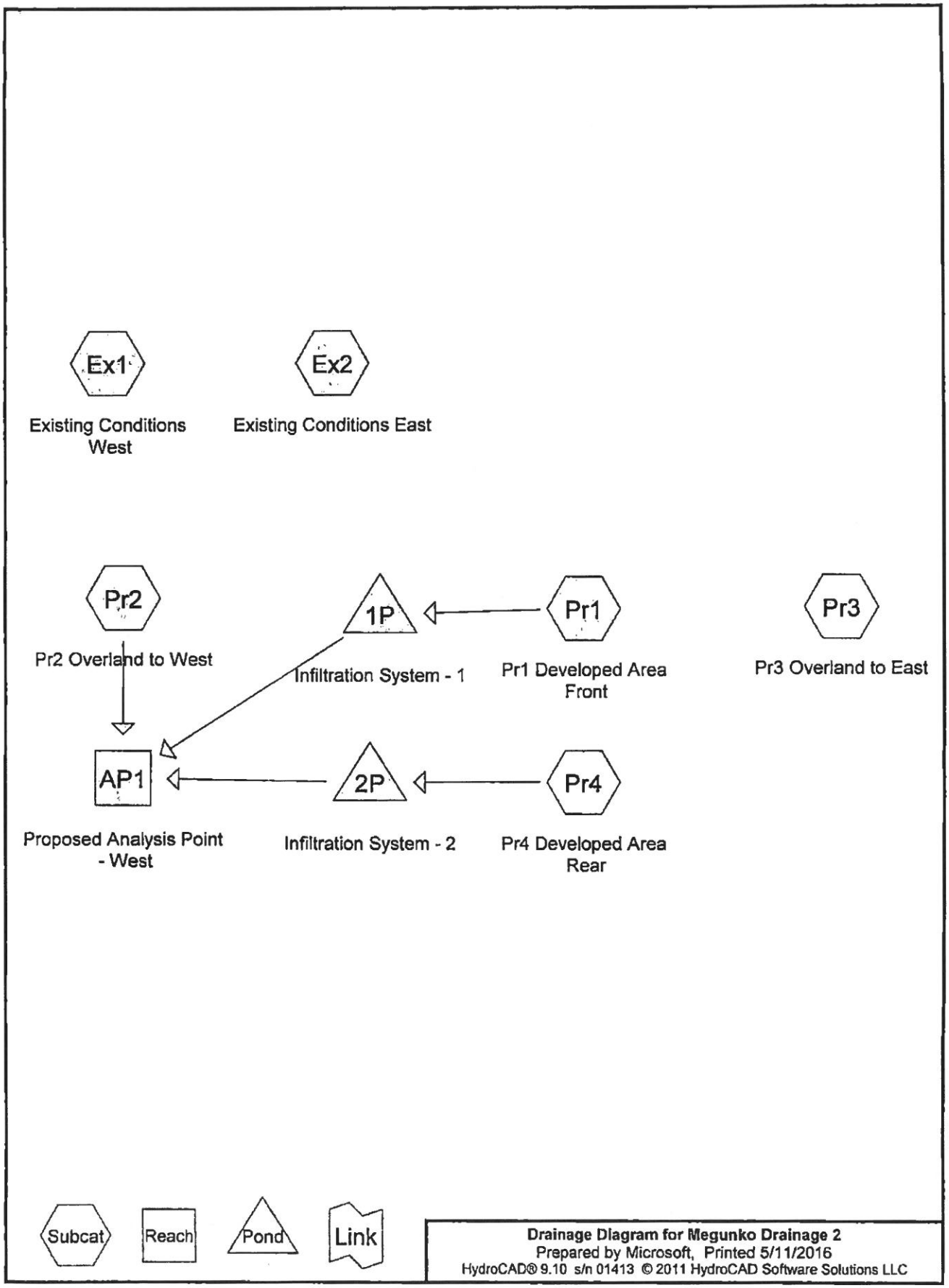
EXISTING DRAINAGE AREAS
MEGUNKO ROAD
ASHLAND, MA
SCALE 1"=60'

CONNORSTONE ENGINEERING
CONSULTING CIVIL ENGINEERS
AND LAND SURVEYORS
10 SOUTHWEST CUTOFF, SUITE 7
NORTHBOROUGH, MASSACHUSETTS 01532



PROPOSED DRAINAGE AREAS
MEGUNKO ROAD
ASHLAND, MA
SCALE 1"=60'

CONNORSTONE ENGINEERING
CONSULTING CIVIL ENGINEERS
AND LAND SURVEYORS
10 SOUTHWEST CUTOFF, SUITE 7
NORTHBOROUGH, MASSACHUSETTS 01532


Ex1
Existing Conditions West
Ex2
Existing Conditions East
Pr2
Pr2 Overland to West
1P
Infiltration System - 1
Pr1
Pr1 Developed Area Front
Pr3
Pr3 Overland to East
AP1
Proposed Analysis Point - West
2P
Infiltration System - 2
Pr4
Pr4 Developed Area Rear
Subcat
Reach
Pond
Link
Drainage Diagram for Megunko Drainage 2
Prepared by Microsoft, Printed 5/11/2016
HydroCAD® 9.10 s/n 01413 © 2011 HydroCAD Software Solutions LLC

Summary for Subcatchment Ex1: Existing Conditions West

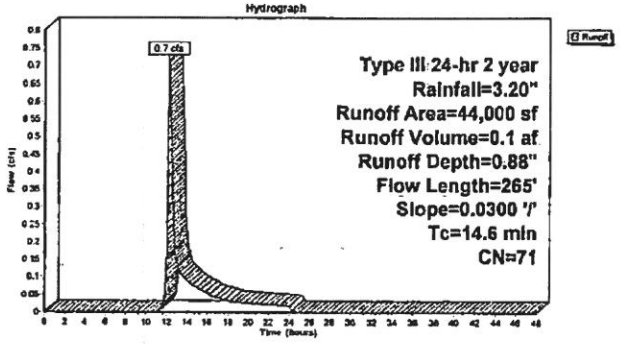
Runoff = 0.7 cfs @ 12.22 hrs, Volume= 0.1 af, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
13,000	55	Woods, Good, HSG B
31,000	77	Woods, Good, HSG D
44,000	71	Weighted Average
44,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	215	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.6	265	Total			

Subcatchment Ex1: Existing Conditions West



Summary for Subcatchment Ex2: Existing Conditions East

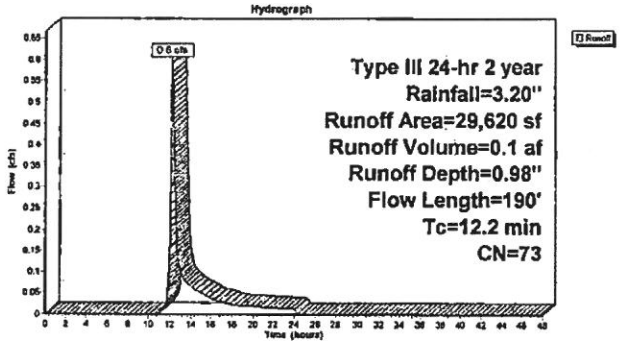
Runoff = 0.6 cfs @ 12.18 hrs, Volume= 0.1 af, Depth= 0.96"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
4,500	77	Woods, Good, HSG D
11,120	55	Woods, Good, HSG B
14,000	85	Gravel roads, HSG B
29,620	73	Weighted Average
29,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	70	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.5	70	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
12.2	190	Total			

Subcatchment Ex2: Existing Conditions East



Summary for Subcatchment Pr1: Pr1 Developed Area Front

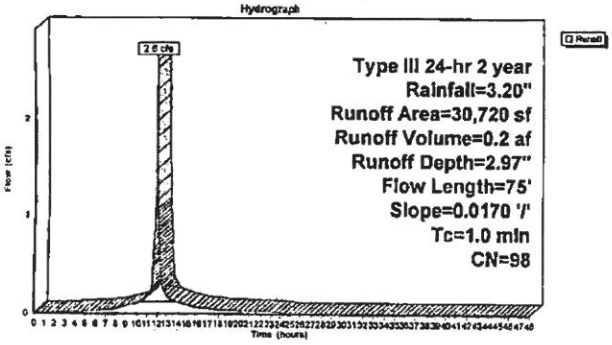
Runoff = 2.6 cfs @ 12.01 hrs, Volume= 0.2 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
* 30,320	98	Paved parking and Roofs
400	61	>75% Grass cover, Good, HSG B
30,720	98	Weighted Average
400		1.30% Pervious Area
30,320		98.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	75	0.0170	1.22		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr1: Pr1 Developed Area Front



Summary for Subcatchment Pr2: Pr2 Overland to West

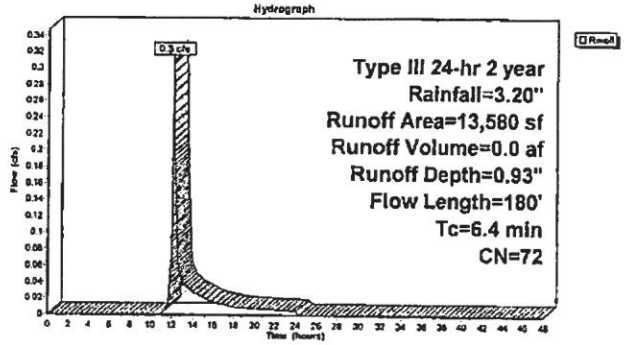
Runoff = 0.3 cfs @ 12.10 hrs, Volume= 0.0 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
9,380	77	Woods, Good, HSG D
4,200	61	>75% Grass cover, Good, HSG B
13,580	72	Weighted Average
13,580		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	40	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	140	0.0130	2.29	7.45	Trap/Vee/Rect Channel Flow, Bot.W=5.00' D=0.50' Z= 3.0 '/' Top.W=8.00' n= 0.040 Earth, cobble bottom, clean sides
6.4	180	Total			

Subcatchment Pr2: Pr2 Overland to West



Summary for Subcatchment Pr3: Pr3 Overland to East

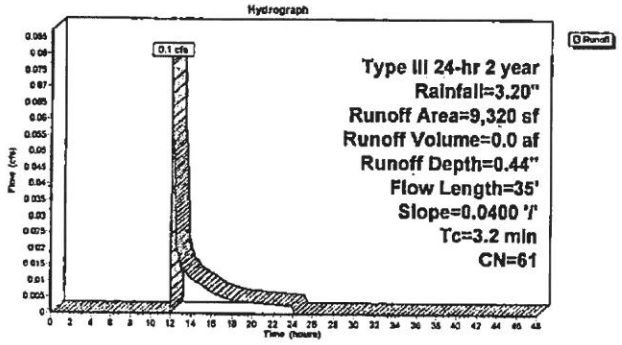
Runoff = 0.1 cfs @ 12.08 hrs, Volume= 0.0 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
9,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	35	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

Subcatchment Pr3: Pr3 Overland to East



Summary for Subcatchment Pr4: Pr4 Developed Area Rear

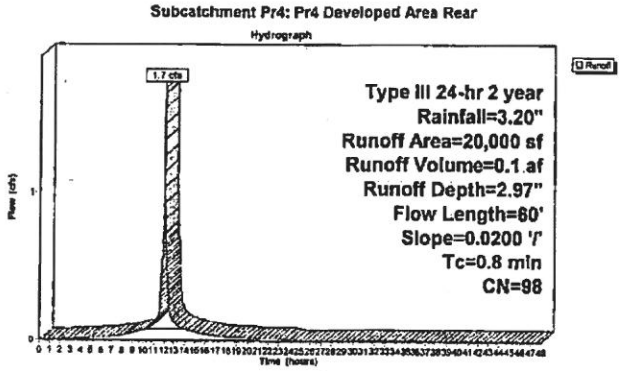
Runoff = 1.7 cfs @ 12.01 hrs, Volume= 0.1 af, Depth= 2.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 year Rainfall=3.20"

Area (sf)	CN	Description
* 20,000	98	Paved parking and Roofs
20,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	60	0.0200	1.24		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr4: Pr4 Developed Area Rear

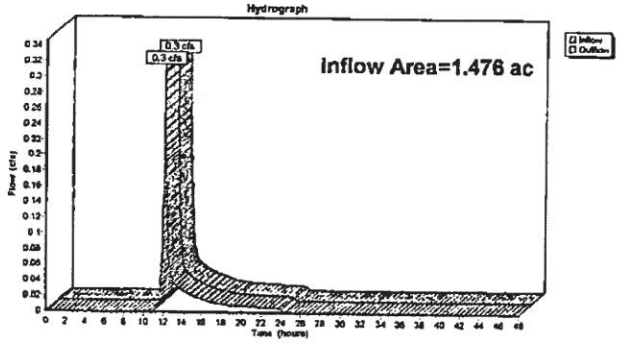


Summary for Reach AP1: Proposed Analysis Point - West

Inflow Area = 1.476 ac, 78.26% Impervious, Inflow Depth = 0.20" for 2 year event
Inflow = 0.3 cfs @ 12.10 hrs, Volume= 0.0 af
Outflow = 0.3 cfs @ 12.10 hrs, Volume= 0.0 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach AP1: Proposed Analysis Point - West



Summary for Pond 1P: Infiltration System - 1

Inflow Area = 0.705 ac, 98.70% Impervious, Inflow Depth = 2.97" for 2 year event
Inflow = 2.6 cfs @ 12.01 hrs, Volume= 0.2 af
Outflow = 0.3 cfs @ 12.51 hrs, Volume= 0.2 af, Atten= 89%, Lag= 29.5 min
Discarded = 0.3 cfs @ 12.51 hrs, Volume= 0.2 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 192.22' @ 12.51 hrs Surf.Area= 8,550 sf Storage= 2,577 cf

Plug-Flow detention time= 69.9 min calculated for 0.2 af (100% of inflow)
Center-of-Mass det. time= 69.9 min (821.7 - 751.8)

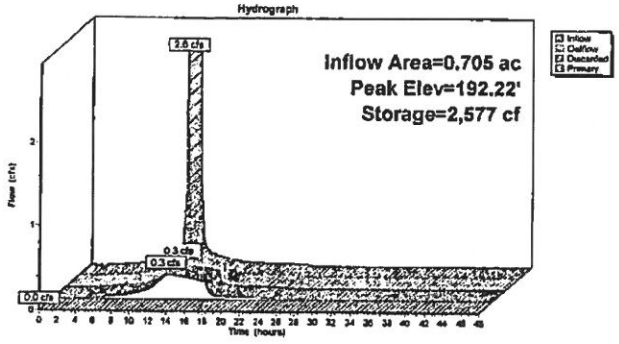
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	6,413 cf	25.00'W x 342.00'L x 2.00'H Prismatoid 17,100 cf Overall - 1,068 cf Embedded = 16,032 cf x 40.0% Voids
#2	192.00'	1,068 cf	12.0" D x 340.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00'D x 6.00'H Vertical Cone/Cylinder -Impervious
		7,556 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 189.50'
#2	Device 3	193.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.3 cfs @ 12.51 hrs HW=192.22' (Free Discharge)
└1=Exfiltration (Controls 0.3 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=191.50' (Free Discharge)
└3=Culvert (Controls 0.0 cfs)
└2=Sharp-Crested Rectangular Weir (Controls 0.0 cfs)

Pond 1P: Infiltration System - 1



Summary for Pond 2P: Infiltration System - 2

Inflow Area = 0.459 ac,100.00% Impervious, Inflow Depth = 2.97" for 2 year event
Inflow = 1.7 cfs @ 12.01 hrs, Volume= 0.1 af
Outflow = 0.2 cfs @ 12.53 hrs, Volume= 0.1 af, Atten= 90%, Lag= 31.2 min
Discarded = 0.2 cfs @ 12.53 hrs, Volume= 0.1 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 192.19' @ 12.53 hrs Surf.Area= 5,936 sf Storage= 1,698 cf

Plug-Flow detention time= 75.2 min calculated for 0.1 af (100% of inflow)
Center-of-Mass det. time= 75.2 min (826.8 - 751.6)

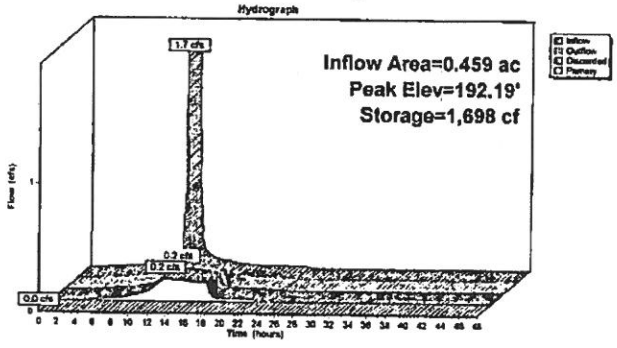
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	4,485 cf	28.00'W x 212.00'L x 2.00'H Prismatoid 11,872 cf Overall - 660 cf Embedded = 11,212 cf x 40.0% Voids
#2	192.00'	660 cf	12.0" D x 210.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00'D x 6.00'H Vertical Cone/Cylinder -Impervious
		5,220 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 188.50'
#2	Device 3	193.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.2 cfs @ 12.53 hrs HW=192.19' (Free Discharge)
└1=Exfiltration (Controls 0.2 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=191.50' (Free Discharge)
└3=Culvert (Controls 0.0 cfs)
└2=Sharp-Crested Rectangular Weir (Controls 0.0 cfs)

Pond 2P: Infiltration System - 2



Summary for Subcatchment Ex1: Existing Conditions West

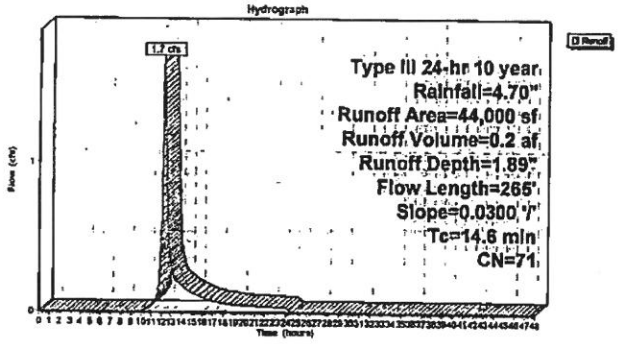
Runoff = 1.7 cfs @ 12.21 hrs, Volume= 0.2 af, Depth= 1.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
13,000	55	Woods, Good, HSG B
31,000	77	Woods, Good, HSG D
44,000	71	Weighted Average
44,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	215	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.6	265	Total			

Subcatchment Ex1: Existing Conditions West



Summary for Subcatchment Ex2: Existing Conditions East

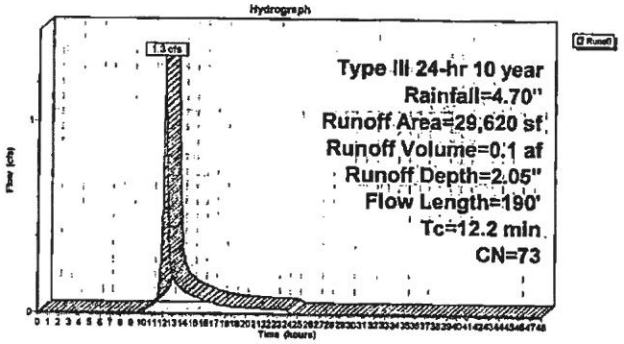
Runoff = 1.3 cfs @ 12.17 hrs, Volume= 0.1 af, Depth= 2.05"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
4,500	77	Woods, Good, HSG D
11,120	55	Woods, Good, HSG B
14,000	85	Gravel roads, HSG B
29,620	73	Weighted Average
29,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	70	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.5	70	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
12.2	190	Total			

Subcatchment Ex2: Existing Conditions East



Summary for Subcatchment Pr1: Pr1 Developed Area Front

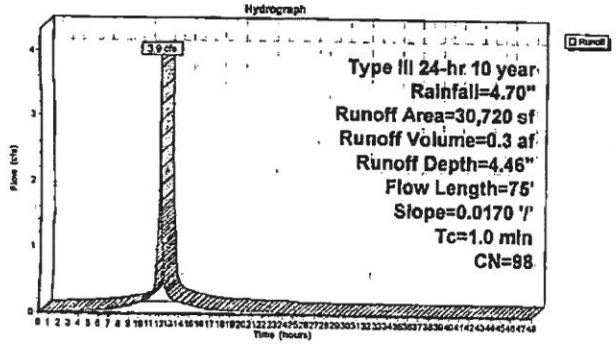
Runoff = 3.9 cfs @ 12.01 hrs, Volume= 0.3 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
30,320	98	Paved parking and Roofs
400	61	>75% Grass cover, Good, HSG B
30,720	98	Weighted Average
400		1.30% Pervious Area
30,320		98.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	75	0.0170	1.22		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr1: Pr1 Developed Area Front



Summary for Subcatchment Pr2: Pr2 Overland to West

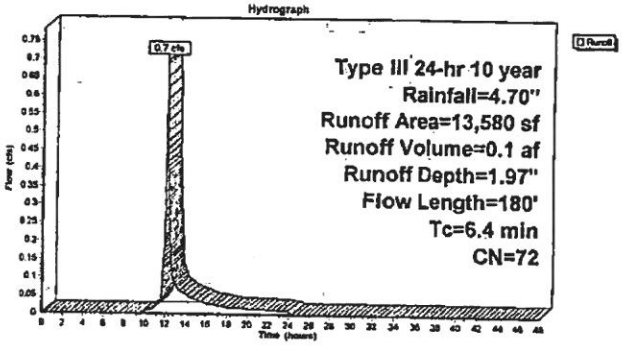
Runoff = 0.7 cfs @ 12.10 hrs, Volume= 0.1 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
9,380	77	Woods, Good, HSG D
4,200	61	>75% Grass cover, Good, HSG B
13,580	72	Weighted Average
13,580		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	40	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	140	0.0130	2.29	7.45	Trap/Vee/Rect Channel Flow, Bot.W=5.00' D=0.50' Z= 3.0 '/' Top.W=8.00' n= 0.040 Earth, cobble bottom, clean sides
6.4	180	Total			

Subcatchment Pr2: Pr2 Overland to West



Summary for Subcatchment Pr3: Pr3 Overland to East

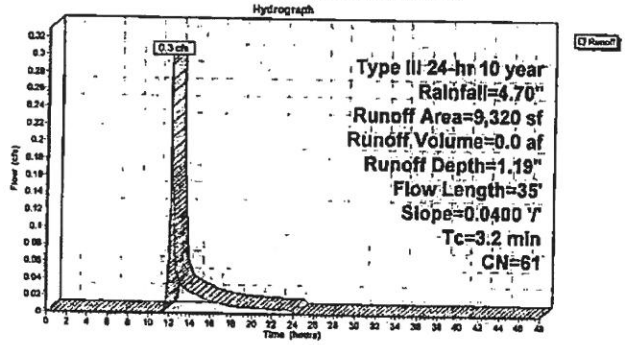
Runoff = 0.3 cfs @ 12.06 hrs, Volume= 0.0 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
9,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	35	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

Subcatchment Pr3: Pr3 Overland to East



Summary for Subcatchment Pr4: Pr4 Developed Area Rear

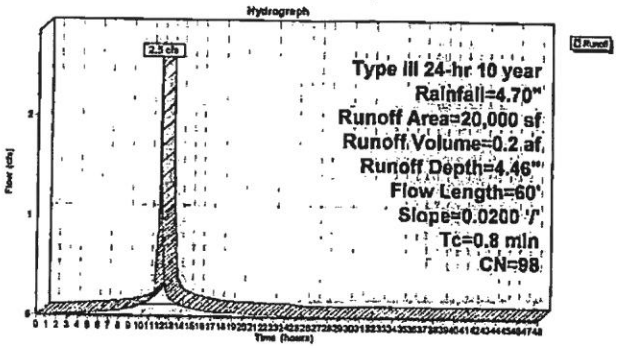
Runoff = 2.5 cfs @ 12.01 hrs, Volume= 0.2 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 year Rainfall=4.70"

Area (sf)	CN	Description
* 20,000	98	Paved parking and Roofs
20,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	60	0.0200	1.24		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr4: Pr4 Developed Area Rear

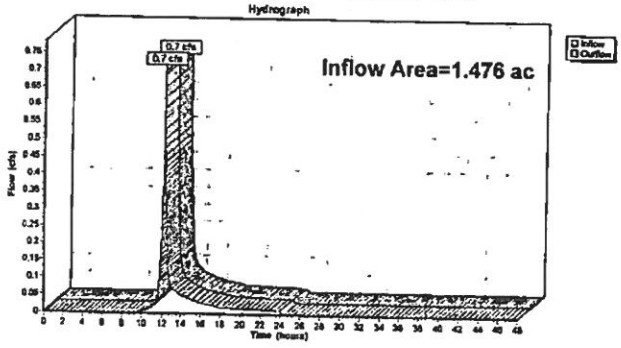


Summary for Reach AP1: Proposed Analysis Point - West

Inflow Area = 1.476 ac, 78.26% Impervious, Inflow Depth = 0.42" for 10 year event
Inflow = 0.7 cfs @ 12.10 hrs, Volume= 0.1 af
Outflow = 0.7 cfs @ 12.10 hrs, Volume= 0.1 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach AP1: Proposed Analysis Point - West



Summary for Pond 1P: Infiltration System - 1

Inflow Area = 0.705 ac, 98.70% Impervious, Inflow Depth = 4.46" for 10 year event
Inflow = 3.9 cfs @ 12.01 hrs, Volume= 0.3 af
Outflow = 0.3 cfs @ 12.70 hrs, Volume= 0.3 af, Atten= 91%, Lag= 41.4 min
Discarded = 0.3 cfs @ 12.70 hrs, Volume= 0.3 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 192.62' @ 12.70 hrs Surf.Area= 8,550 sf Storage= 4,248 cf

Plug-Flow detention time= 105.4 min calculated for 0.3 af (100% of inflow)
Center-of-Mass det. time= 105.4 min (849.8 - 744.4)

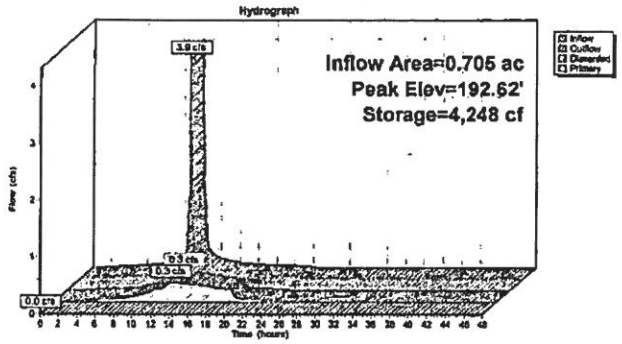
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	6,413 cf	25.00'W x 342.00'L x 2.00'H Prismatoid 17,100 cf Overall - 1,068 cf Embedded = 16,032 cf x 40.0% Voids
#2	192.00'	1,068 cf	12.0" D x 340.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00'D x 6.00'H Vertical Cone/Cylinder -Impervious
		7,556 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 189.50'
#2	Device 3	193.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.3 cfs @ 12.70 hrs HW=192.62' (Free Discharge)
└1=Exfiltration (Controls 0.3 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=191.50' (Free Discharge)
└3=Culvert (Controls 0.0 cfs)
└2=Sharp-Crested Rectangular Weir (Controls 0.0 cfs)

Pond 1P: Infiltration System - 1



Summary for Pond 2P: Infiltration System - 2

Inflow Area = 0.459 ac,100.00% Impervious, Inflow Depth = 4.46" for 10 year event
Inflow = 2.5 cfs @ 12.01 hrs, Volume= 0.2 af
Outflow = 0.2 cfs @ 12.85 hrs, Volume= 0.2 af, Atten= 92%, Lag= 50.2 min
Discarded = 0.2 cfs @ 12.85 hrs, Volume= 0.2 af
Primary = 0.0 cfs @ 0.00 hrs, Volume= 0.0 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 192.59' @ 12.85 hrs Surf.Area= 5,936 sf Storage= 2,834 cf

Plug-Flow detention time= 120.9 min calculated for 0.2 af (100% of inflow)
Center-of-Mass det. time= 120.9 min (865.1 - 744.2)

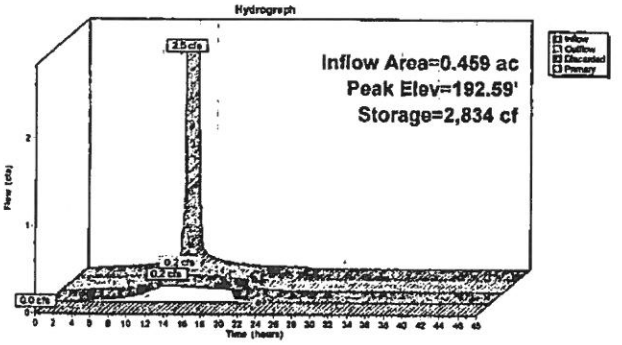
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	4,485 cf	28.00'W x 212.00'L x 2.00'H Prismatoid 11,672 cf Overall - 660 cf Embedded = 11,212 cf x 40.0% Voids
#2	192.00'	660 cf	12.0" D x 210.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00'D x 6.00'H Vertical Cone/Cylinder -Impervious
		5,220 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 188.50'
#2	Device 3	193.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.2 cfs @ 12.85 hrs HW=192.59' (Free Discharge)
└1=Exfiltration (Controls 0.2 cfs)

Primary OutFlow Max=0.0 cfs @ 0.00 hrs HW=191.50' (Free Discharge)
└3=Culvert (Controls 0.0 cfs)
└2=Sharp-Crested Rectangular Weir (Controls 0.0 cfs)

Pond 2P: Infiltration System - 2



Summary for Subcatchment Ex1: Existing Conditions West

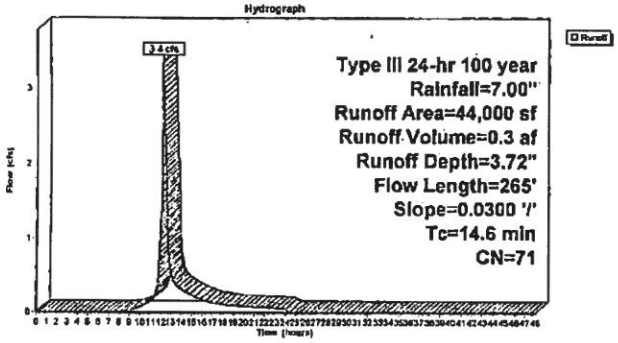
Runoff = 3.4 cfs @ 12.20 hrs, Volume= 0.3 af, Depth= 3.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (sf)	CN	Description
13,000	55	Woods, Good, HSG B
31,000	77	Woods, Good, HSG D
44,000	71	Weighted Average
44,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	215	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.6	265	Total			

Subcatchment Ex1: Existing Conditions West



Summary for Subcatchment Ex2: Existing Conditions East

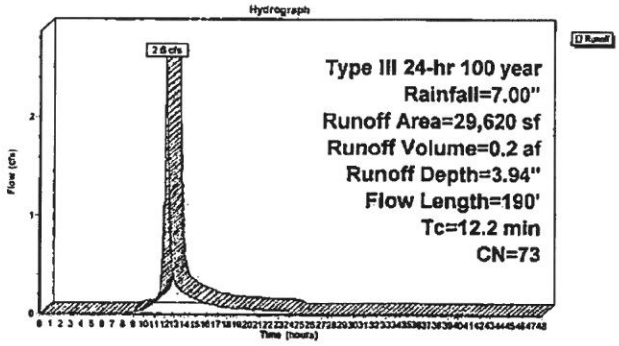
Runoff = 2.6 cfs @ 12.17 hrs, Volume= 0.2 af, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (sf)	CN	Description
4,500	77	Woods, Good, HSG D
11,120	55	Woods, Good, HSG B
14,000	85	Gravel roads, HSG B
29,620	73	Weighted Average
29,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	70	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.5	70	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
12.2	190	Total			

Subcatchment Ex2: Existing Conditions East



Summary for Subcatchment Pr1: Pr1 Developed Area Front

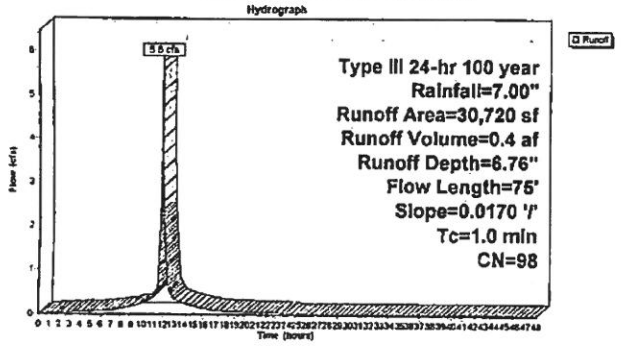
Runoff = 5.8 cfs @ 12.01 hrs, Volume= 0.4 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (sf)	CN	Description
30,320	98	Paved parking and Roofs
400	61	>75% Grass cover, Good, HSG B
30,720	98	Weighted Average
400		1.30% Pervious Area
30,320		98.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	75	0.0170	1.22		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr1: Pr1 Developed Area Front



Summary for Subcatchment Pr2: Pr2 Overland to West

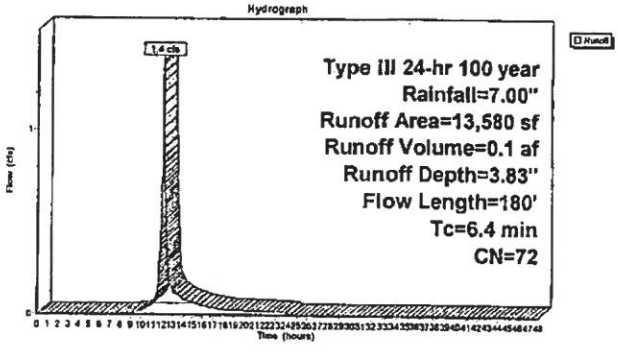
Runoff = 1.4 cfs @ 12.09 hrs, Volume= 0.1 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (sf)	CN	Description
9,380	77	Woods, Good, HSG D
4,200	61	>75% Grass cover, Good, HSG B
13,580	72	Weighted Average
13,580		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	40	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	140	0.0130	2.29	7.45	Trap/Vee/Rect Channel Flow, Bot.W=5.00' D=0.50' Z= 3.0 '/' Top.W=8.00' n= 0.040 Earth, cobble bottom, clean sides
6.4	180	Total			

Subcatchment Pr2: Pr2 Overland to West



Summary for Subcatchment Pr3: Pr3 Overland to East

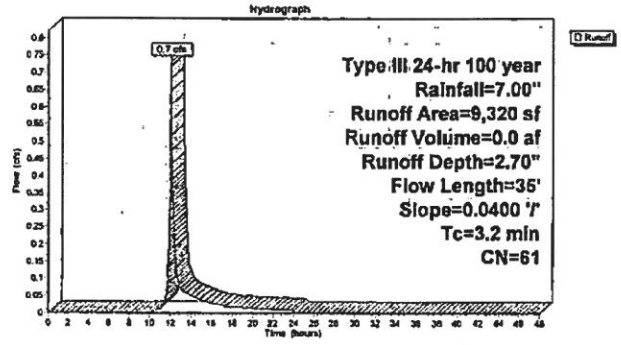
Runoff = 0.7 cfs @ 12.05 hrs, Volume= 0.0 af, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
9,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	35	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

Subcatchment Pr3: Pr3 Overland to East



Summary for Subcatchment Pr4: Pr4 Developed Area Rear

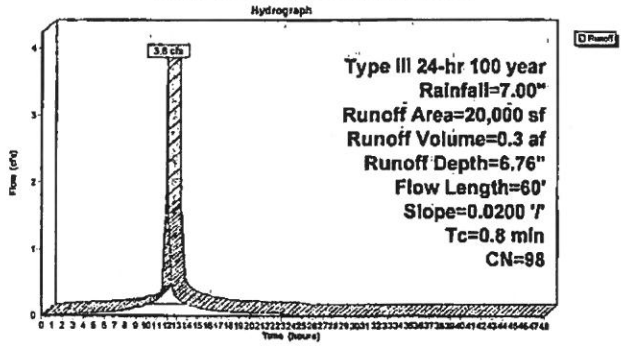
Runoff = 3.8 cfs @ 12.01 hrs, Volume= 0.3 af, Depth= 6.76"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 year Rainfall=7.00"

Area (sf)	CN	Description
* 20,000	98	Paved parking and Roofs
20,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	60	0.0200	1.24		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr4: Pr4 Developed Area Rear

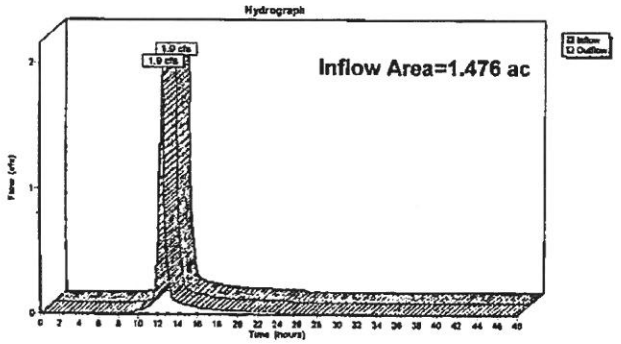


Summary for Reach AP1: Proposed Analysis Point - West

Inflow Area = 1.476 ac, 78.26% Impervious, Inflow Depth = 1.22" for 100 year event
Inflow = 1.9 cfs @ 12.35 hrs, Volume= 0.1 af
Outflow = 1.9 cfs @ 12.35 hrs, Volume= 0.1 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach AP1: Proposed Analysis Point - West



Summary for Pond 1P: Infiltration System - 1

Inflow Area = 0.705 ac, 98.70% Impervious, Inflow Depth = 6.76" for 100 year event
Inflow = 5.8 cfs @ 12.01 hrs, Volume= 0.4 af
Outflow = 1.3 cfs @ 12.36 hrs, Volume= 0.4 af, Atten= 78%, Lag= 21.0 min
Discarded = 0.4 cfs @ 12.36 hrs, Volume= 0.4 af
Primary = 0.8 cfs @ 12.36 hrs, Volume= 0.0 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 193.16' @ 12.36 hrs Surf.Area= 8,550 sf Storage= 6,335 cf

Plug-Flow detention time= 127.5 min calculated for 0.4 af (100% of inflow)
Center-of-Mass det. time= 127.4 min (865.7 - 738.3)

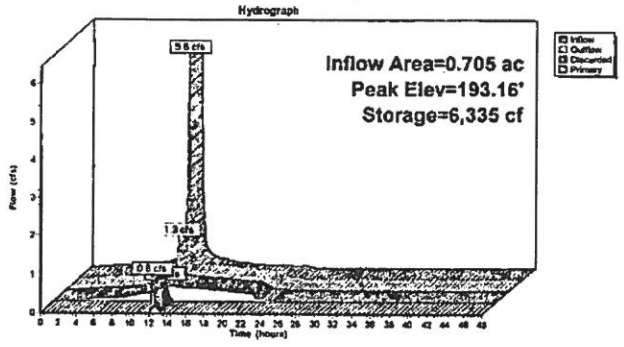
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	6,413 cf	25.00'W x 342.00'L x 2.00'H Prismatoid 17,100 cf Overall - 1,068 cf Embedded = 16,032 cf x 40.0% Voids
#2	192.00'	1,068 cf	12.0" D x 340.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00"D x 6.00'H Vertical Cone/Cylinder -Impervious
		7,556 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 189.50'
#2	Device 3	193.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.4 cfs @ 12.36 hrs HW=193.16' (Free Discharge)
└1=Exfiltration (Controls 0.4 cfs)

Primary OutFlow Max=0.8 cfs @ 12.36 hrs HW=193.16' (Free Discharge)
└3=Culvert (Passes 0.8 cfs of 1.5 cfs potential flow)
└2=Sharp-Crested Rectangular Weir (Weir Controls 0.8 cfs @ 1.31 fps)

Pond 1P: Infiltration System - 1



Summary for Pond 2P: Infiltration System - 2

Inflow Area = 0.459 ac,100.00% Impervious, Inflow Depth = 8.76" for 100 year event
Inflow = 3.8 cfs @ 12.01 hrs, Volume= 0.3 af
Outflow = 0.8 cfs @ 12.38 hrs, Volume= 0.3 af, Atten= 80%, Lag= 22.3 min
Discarded = 0.2 cfs @ 12.38 hrs, Volume= 0.2 af
Primary = 0.5 cfs @ 12.38 hrs, Volume= 0.0 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 193.12' @ 12.38 hrs Surf.Area= 5,936 sf Storage= 4,254 cf

Plug-Flow detention time= 156.3 min calculated for 0.3 af (100% of inflow)
Center-of-Mass det. time= 155.2 min (893.4 - 738.1)

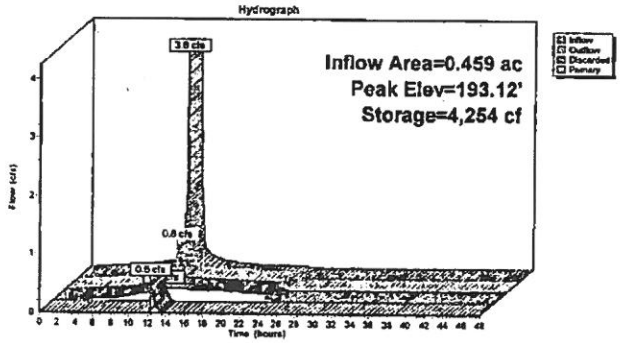
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	4,485 cf	28.00'W x 212.00'L x 2.00'H Prismatoid 11,872 cf Overall - 660 cf Embedded = 11,212 cf x 40.0% Voids
#2	192.00'	660 cf	12.0"D x 210.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00'D x 6.00'H Vertical Cone/Cylinder -Impervious
		5,220 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 188.50'
#2	Device 3	193.00'	4.0" long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.2 cfs @ 12.38 hrs HW=193.12' (Free Discharge)
└1=Exfiltration (Controls 0.2 cfs)

Primary OutFlow Max=0.5 cfs @ 12.38 hrs HW=193.12' (Free Discharge)
└3=Culvert (Passes 0.5 cfs of 1.4 cfs potential flow)
└2=Sharp-Crested Rectangular Weir (Weir Controls 0.5 cfs @ 1.13 fps)

Pond 2P: Infiltration System - 2



Summary for Subcatchment Ex1: Existing Conditions West

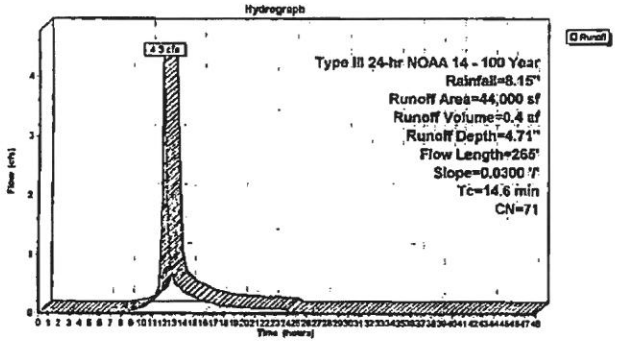
Runoff = 4.3 cfs @ 12.20 hrs, Volume= 0.4 af, Depth= 4.71"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr NOAA 14 - 100 Year Rainfall=8.15"

Area (sf)	CN	Description
13,000	55	Woods, Good, HSG B
31,000	77	Woods, Good, HSG D
44,000	71	Weighted Average
44,000		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	215	0.0300	0.87		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
14.6	265	Total			

Subcatchment Ex1: Existing Conditions West



Summary for Subcatchment Ex2: Existing Conditions East

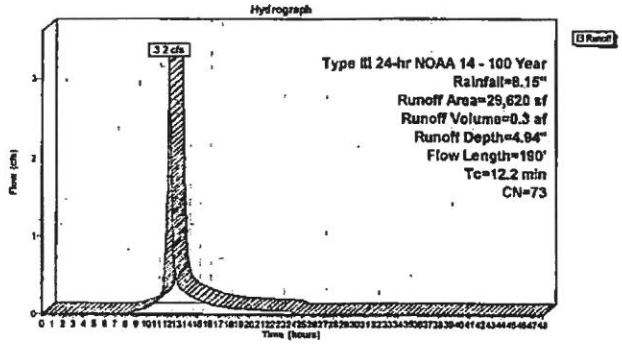
Runoff = 3.2 cfs @ 12.17 hrs, Volume= 0.3 af, Depth= 4.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr NOAA 14 - 100 Year Rainfall=8.15"

Area (sf)	CN	Description
4,500	77	Woods, Good, HSG D
11,120	55	Woods, Good, HSG B
14,000	85	Gravel roads, HSG B
29,620	73	Weighted Average
29,620		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.5	50	0.0300	0.08		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	70	0.0400	1.00		Shallow Concentrated Flow, Woodland Kv= 5.0 fps
0.5	70	0.0200	2.28		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
12.2	190	Total			

Subcatchment Ex2: Existing Conditions East



Summary for Subcatchment Pr1: Pr1 Developed Area Front

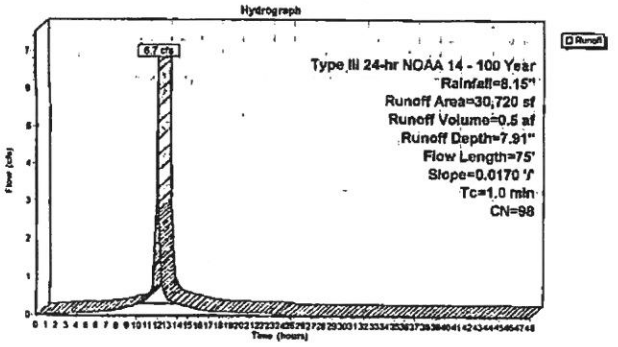
Runoff = 6.7 cfs @ 12.01 hrs, Volume= 0.5 af, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr NOAA 14 - 100 Year Rainfall=8.15"

Area (sf)	CN	Description
30,320	98	Paved parking and Roofs
400	61	>75% Grass cover, Good, HSG B
30,720	98	Weighted Average
400		1.30% Pervious Area
30,320		98.70% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	75	0.0170	1.22		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr1: Pr1 Developed Area Front



Summary for Subcatchment Pr2: Pr2 Overland to West

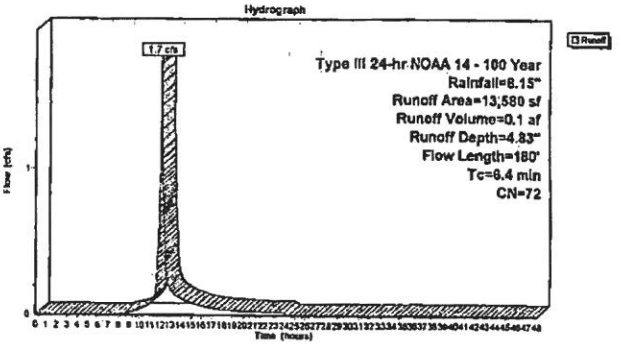
Runoff = 1.7 cfs @ 12.09 hrs, Volume= 0.1 af, Depth= 4.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr NOAA 14 - 100 Year Rainfall=8.15"

Area (sf)	CN	Description
9,380	77	Woods, Good, HSG D
4,200	61	>75% Grass cover, Good, HSG B
13,580	72	Weighted Average
13,580		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	40	0.1000	0.12		Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.20"
1.0	140	0.0130	2.29	7.45	Trap/Vee/Rect Channel Flow, Bot.W=5.00' D=0.50' Z= 3.0 '/' Top.W=8.00' n= 0.040 Earth, cobble bottom, clean sides
6.4	180	Total			

Subcatchment Pr2: Pr2 Overland to West



Summary for Subcatchment Pr3: Pr3 Overland to East

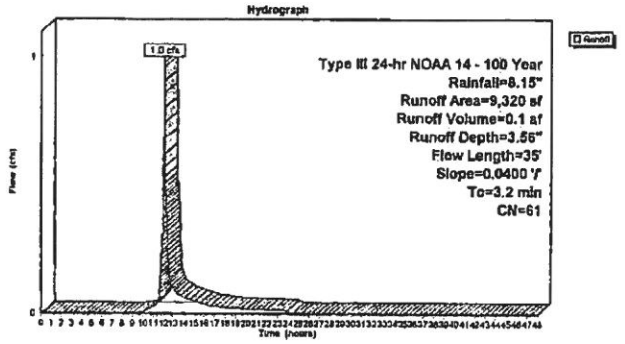
Runoff = 1.0 cfs @ 12.05 hrs, Volume= 0.1 af, Depth= 3.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr NOAA 14 - 100 Year Rainfall=8.15"

Area (sf)	CN	Description
9,320	61	>75% Grass cover, Good, HSG B
9,320		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.2	35	0.0400	0.18		Sheet Flow, Grass: Short n= 0.150 P2= 3.20"

Subcatchment Pr3: Pr3 Overland to East



Summary for Subcatchment Pr4: Pr4 Developed Area Rear

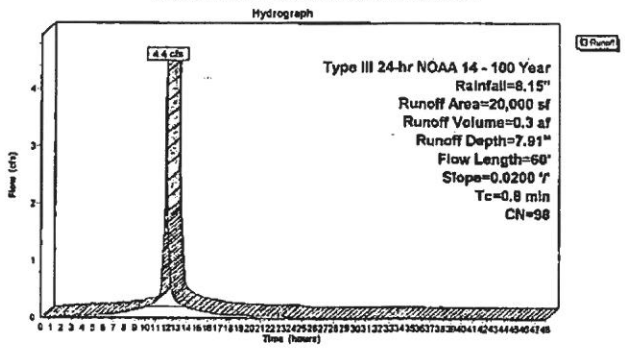
Runoff = 4.4 cfs @ 12.01 hrs, Volume= 0.3 af, Depth= 7.91"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr NOAA 14 - 100 Year Rainfall=8.15"

Area (sf)	CN	Description
* 20,000	98	Paved parking and Roofs
20,000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	60	0.0200	1.24		Sheet Flow, Smooth surfaces n= 0.011 P2= 3.20"

Subcatchment Pr4: Pr4 Developed Area Rear

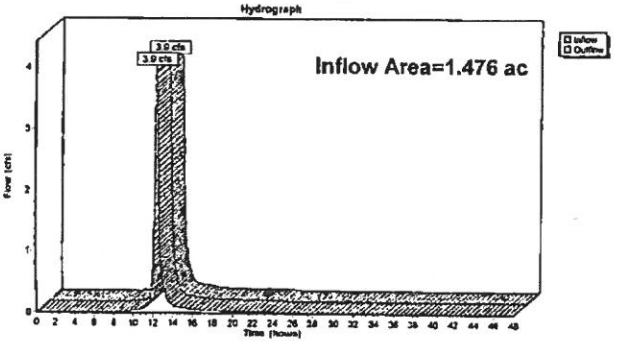


Summary for Reach AP1: Proposed Analysis Point - West

Inflow Area = 1.476 ac, 78.26% Impervious, Inflow Depth = 1.96" for NOAA 14 - 100 Year event
Inflow = 3.9 cfs @ 12.17 hrs, Volume= 0.2 af
Outflow = 3.9 cfs @ 12.17 hrs, Volume= 0.2 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach AP1: Proposed Analysis Point - West



Summary for Pond 1P: Infiltration System - 1

Inflow Area = 0.705 ac, 98.70% Impervious, Inflow Depth = 7.91" for NOAA 14 - 100 Year event
Inflow = 6.7 cfs @ 12.01 hrs, Volume= 0.5 af
Outflow = 2.1 cfs @ 12.23 hrs, Volume= 0.5 af, Atten= 68%, Lag= 13.1 min
Discarded = 0.4 cfs @ 12.23 hrs, Volume= 0.4 af
Primary = 1.7 cfs @ 12.23 hrs, Volume= 0.1 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 193.26' @ 12.23 hrs Surf.Area= 8,550 sf Storage= 6,684 cf

Plug-Flow detention time= 120.5 min calculated for 0.5 af (100% of inflow)
Center-of-Mass det. time= 120.4 min (856.8 - 736.3)

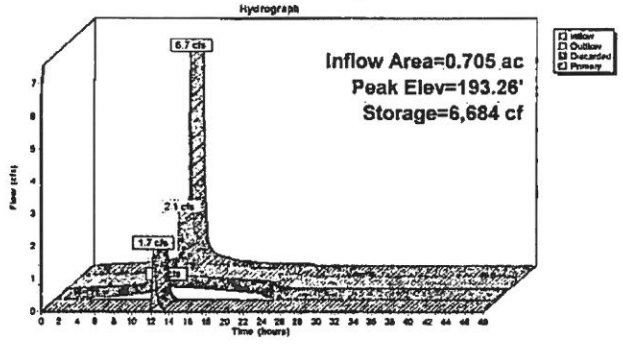
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	6,413 cf	25.00'W x 342.00'L x 2.00'H Prismatoid 17,100 cf Overall - 1,068 cf Embedded = 16,032 cf x 40.0% Voids
#2	192.00'	1,068 cf	12.0" D x 340.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00'D x 6.00'H Vertical Cone/Cylinder -Impervious
		7,556 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 189.50'
#2	Device 3	193.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.4 cfs @ 12.23 hrs HW=193.26' (Free Discharge)
└1=Exfiltration (Controls 0.4 cfs)

Primary OutFlow Max=1.7 cfs @ 12.23 hrs HW=193.26' (Free Discharge)
└3=Culvert (Passes 1.7 cfs of 1.9 cfs potential flow)
└2=Sharp-Crested Rectangular Weir (Weir Controls 1.7 cfs @ 1.67 fps)

Pond 1P: Infiltration System - 1



Summary for Pond 2P: Infiltration System - 2

Inflow Area = 0.459 ac,100.00% Impervious, Inflow Depth = 7.81" for NOAA 14 - 100 Year event
Inflow = 4.4 cfs @ 12.01 hrs, Volume= 0.3 af
Outflow = 1.4 cfs @ 12.23 hrs, Volume= 0.3 af, Atten= 69%, Lag= 13.2 min
Discarded = 0.2 cfs @ 12.23 hrs, Volume= 0.3 af
Primary = 1.2 cfs @ 12.23 hrs, Volume= 0.0 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 193.20' @ 12.23 hrs Surf.Area= 5,936 sf Storage= 4,447 cf

Plug-Flow detention time= 145.8 min calculated for 0.3 af (100% of inflow)
Center-of-Mass det. time= 145.8 min (881.9 - 736.2)

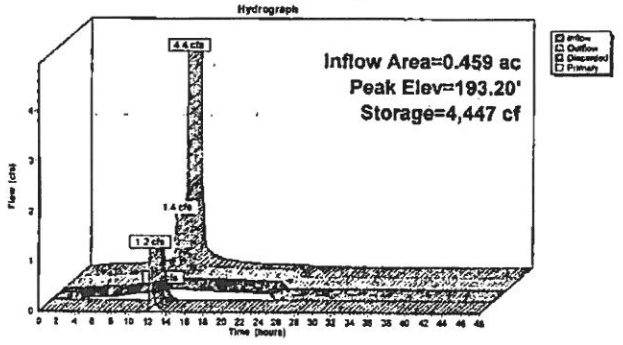
Volume	Invert	Avail.Storage	Storage Description
#1	191.50'	4,485 cf	28.00'W x 212.00'L x 2.00'H Prismatoid 11,872 cf Overall - 660 cf Embedded = 11,212 cf x 40.0% Voids
#2	192.00'	660 cf	12.0" D x 210.0'L Pipe Storage x 4 Inside #1
#3	192.00'	75 cf	4.00'D x 6.00'H Vertical Cone/Cylinder -Impervious
		5,220 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	191.50'	1.020 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 188.50'
#2	Device 3	193.00'	4.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#3	Primary	192.50'	12.0" Round Culvert L= 50.0' Ke= 0.500 Inlet / Outlet Invert= 192.50' / 192.00' S= 0.0100 '/' Cc= 0.900 n= 0.012

Discarded OutFlow Max=0.2 cfs @ 12.23 hrs HW=193.20' (Free Discharge)
└1=Exfiltration (Controls 0.2 cfs)

Primary OutFlow Max=1.2 cfs @ 12.23 hrs HW=193.20' (Free Discharge)
└3=Culvert (Passes 1.2 cfs of 1.8 cfs potential flow)
└2=Sharp-Crested Rectangular Weir (Weir Controls 1.2 cfs @ 1.46 fps)

Pond 2P: Infiltration System - 2



Stormwater Operations and Management Plan and Long-term Pollution Prevention Program

Stormwater Management System
Megunko road
Ashland, MA
January 27, 2016
Revised 5/10/2016

This Operation and Maintenance Plan has been prepared in accordance with the MA Department of Environmental Protection stormwater standards and recommendations outlined in the stormwater handbook. This plan outlines the minimum efforts necessary to ensure that the stormwater collection and treatment system and sedimentation and erosion control system for this site operates in accordance with Massachusetts Department of Environmental Protection (DEP) stormwater management policy. Efforts in addition to the minimum listed herein may be required to ensure adequate stormwater management.

This plan includes general site restrictions, routing/non-routine operation and maintenance; reporting and record keeping; and an estimated budget.

Stormwater Management System Owner & Responsible Party

Ashland Landscape Supply or Current Property Owner
10 Waverly Street
Ashland, MA
508-620-6251

Stormwater Management System Components (see approved site plans for component locations)

- Deep sump catch basins
- Drainage collection system
- Drainage system outlet
- Subsurface infiltration systems (2)

General Site Restrictions

The following conditions are imposed as part of this Plan.

- Illicit discharges into stormwater management system are perpetually prohibited.
- The use of fertilizers should be limited to slow-release, low-nitrogen fertilizers.
- Uncovered and/or uncontained road de-icing materials shall not be stored on-site.

Operation and Maintenance:

All stormwater management facilities should be inspected a minimum of two times per year, with at least one of the inspections following a storm event. Upon completion of inspection, the inspector should specify any necessary corrective actions to be taken by ownership of the facility. The items to be inspected and maintained are described in the following sections.

Based on the observed conditions, the Responsible Party shall immediately schedule the appropriate maintenance. Some minor maintenance, such as the removal of blockages, debris and saplings in the basins may be conducted at the time of the inspection. More difficult maintenance activities, requiring special equipment, will have to be scheduled, such as the removal of excessive sediment or the repair of eroded areas. All sediment must be removed at least once per year.

Catch Basins and Manholes

The actual removal of sediments and associated pollutants and trash occurs only when sumps are cleaned out; therefore, regular maintenance is required. The more frequent the cleaning, the less likely sediments will be re-suspended and subsequently discharged. Frequent cleaning also results in more volume available for future storms and enhances the overall performance.

At a minimum, deep sumps should be inspected four times per year, and cleaned whenever sediment accumulation exceeds half the sump depth (typically two feet), or at a minimum of once per year. Disposal of the accumulated sediment and hydrocarbons must be in accordance with applicable local, state, and federal guidelines and regulations. At each inspection, inspect gas trap hoods and repair as necessary. Inspect outlet pipe and remove any debris.

Clamshell buckets are typically used to remove sediment. However, vacuum trucks are preferable, because they remove more trapped sediment and supernatant than clamshells. Vacuuming is also a faster process and is less likely to damage the hood within the deep sump catch basin.

Subsurface Infiltration System

Detention structures shall be inspected after every major storm in the first few months after construction. After this initial period, the systems should be inspected at least twice annually (spring and fall). The Manhole covers should be opened and the system checked for accumulated debris and sediment. The outlet structure should be checked for sediment accumulation and structural condition of the weir wall. If sediment deposits are greater than 1 inches cleaning may be required. Drawdown time should be recorded after at least one major rain event per year. If drawdown takes longer than 72 hours, remediation may be necessary. The owner should contact a qualified engineer for recommendations.

Street Sweeping

Street sweeping of the roadway should be performed at least twice per year, preferably in the spring after the snow has melted and in the fall, prior to snowfall. Disposal of the sweepings must be in accordance with applicable local, state, and federal guidelines and regulations.

Debris Accumulation

The inspector shall check channels, inlets and outlets for both sediment and debris accumulations. Debris and sediment shall be removed at the time of the inspection, if feasible. Sediment shall not be allowed to accumulate and restrict flows. Most debris can be removed by hand or with hand tools (e.g. shovel). Some larger objects, such as fallen tree limbs, may have to be cut up before removal by hand is possible.

Vegetation

The initial vegetation inspection shall occur four (4) weeks after final stabilization of the site; vegetation shall be dense (and aesthetically acceptable on all portions of the project, including the side slopes, buffer strips and the embankments). The inspector shall determine and document: (1) whether fertilizing is required (2) the areas where grass shall be mowed, and (3) the areas which shall be protected against erosion. In addition, recently seeded areas shall be inspected for failures.

Eroded areas shall be filled and compacted, if necessary, and reseeded as soon as possible. If an area erodes twice, then a geotextile fabric is to be installed to stabilize the area to allow vegetation to be established. These maintenance activities shall take place during the planting season. Areas affected by lack of rainfall shall be watered. If a recently established vegetated area is determined to be inadequate for erosion control it shall be refertilized with microbial release, not sulfur encapsulated, fertilizer, (using half of the rate originally applied). If the stand is more than 60% damaged, it shall be reestablished, following the original preparation and seeding instructions. Areas of repeated erosion/scour problems shall be lined with riprap only after twice attempting to stabilize the area with geotextile fabric.

Pipe Inlets / Outlets

Outlet structures shall be checked for: (1) signs of seepage, (2) separation of joints, (3) cracks, breaks, or deterioration of materials, and (4) differential settlement. The outlet channel itself shall be free from obstruction (e.g., fallen trees) and bank scour, or the undermining of riprap.

Eroded areas shall be re-vegetated as described under "vegetation". In channels with repeated erosion problems, the slope may have to be cut flatter to help reduce velocities, or riprap may have to be added to protect the slope. When slope failure or settlement is apparent, damaged areas shall be filled, compacted and graded. Damaged natural areas along the outlet channel shall be filled, compacted, and reseeded, or lined with geotextile fabric, if necessary. Damaged rip rapped areas shall be replaced and supplemented.

The inspector shall ensure that there are no signs of scour around the inlets. Vegetation and riprap shall be in good condition (e.g., grass shall be dense and healthy looking; riprap shall be free from undermining and/or deterioration). Inlet structures shall be free from cracks, breaks, or deterioration of materials. If scour is evident, the damaged area shall be filled, compacted and reseeded, stabilized with a geotextile fabric, or lined with riprap in that order. If rip rapped areas have been damaged, the riprap shall be replaced or supplemented. The use of concentrated flow dissipation devices, such as level spreaders, may help to eliminate inlet scour problems.

Riprap Swales

Swales and channels should be free from obstruction and bank scour with no undermining of riprap. The spillway should show no signs of settlement, erosion, or slope failure. Damaged natural areas along the swale/channel side slopes should be filled, compacted, and reseeded. Damaged rip rapped areas should be replaced and supplemented. If displacement re-occurs, larger stone size should be utilized.

Snow Removal

Snow shall not be plowed toward the wetland areas. All catch basins shall be uncovered and functional immediately after snow plowing. The roadway has a cul-de-sac turnaround for emergency vehicle access. This area shall be kept free of snow and debris, and shall remain accessible at all times.

Reporting and Record Keeping

The responsible party will be responsible for maintaining accurate Maintenance Logs for all maintenance and inspections. The maintenance logs shall be kept on site for a minimum of three (3) years and be available for inspection by the Town municipal departments or other auditing authority, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location). This will be a perpetual requirement of the Owners. The Site Maintenance Log will be completed as described above, and at a minimum will include the following items:

- Date activity performed;
- Last rain event;
- BMP's inspected and condition;
- Specific maintenance task;
- Staff or contractor performing activity;
- Verification of maintenance activity;
- For disposal include type of material and the disposal location; and
- Recommended additional maintenance tasks.

Estimated Budget

The estimated annual budget to perform the routine scheduled maintenance is approximately $3,000 for the BMP's. This estimate does not include the repair of structures, pipes, embankments; cleaning drain lines; snow plowing; or other non-routine tasks.

Easements

None required.

Emergency Response Plan / Spill Control Practices

On-site storage of hazardous materials shall not be allowed.

In the event of an accident in the roadway or on individual lots, where a significant amount of gasoline or other petroleum product is released, the following procedure should be followed:

1. Immediately contact the following agencies:

Ashland Fire Department	(508) 881-0132
MassDEP Emergency response	(888) 304-1133

2. Provide support to agencies listed above, which may include contacting an outside contractor to provide clean-up or contacting a Licensed Site Professional (LSP) to lead the clean-up.

If the volume of spill has reached a catch basin, the structures should be cleaned by a licensed liquid waste hauler. The outlet to the drainage system should be inspected. If there is evidence of discharge from the drainage system, additional corrective actions must be taken extending to the receiving water or beyond.

MAINTENANCE INSPECTION LOG FORM
Megunko Road
Ashland, MA

Contractor _____ Date _____

OPERATION	Inspected	Cleaning / Maintenance required
1. Inspect Catch Basins & Inlets	_____	_____
2. Inspect Drain Outlets	_____	_____
3. Inspect Drain lines for blockage	_____	_____
4. Inspect Infiltration System 1	_____	_____
5. Inspect Infiltration System 2	_____	_____
6. Inspect Roof Drains for blockage	_____	_____
9. Inspect Vegetation On-site	_____	_____

COMMENTS / MAINTENANCE REQUIRED: _____

Stormwater Pollution Prevention Plan

for

Megunko Road
Ashland, MA

January 27, 2016
Revised 5/10/2016

This Stormwater Pollution Prevention Pan has been prepared in accordance with the MA Department of Environmental Protection Stormwater Standards and NPDES General Construction Permit for Stormwater Discharges from Construction Activities. All work shall be in accordance with the order of conditions issued by the Local Conservation Commission.

1.1 Project Information

Project Name and Location:	Megunko Road Ashland, MA
Owner Name and Address:	Ashland Landscape Supply LLC 18 Waverly Street Ashland, MA
Site Operator:	Same as owner
Accompanying Documents:	Plans titled "Site Plan for Megunko Road, Ashland, MA" prepared by Connorstone Engineering, Inc., are to be considered a part of this document.
NDPES Tracking Number:	_____
Latitude/Longitude:	Lat: 42° 15' 36" Long: 71° 28' 07"
Project Description:	Commercial Site Plan for Contractor Garages
Estimated Dates:	Start: Summer 2016 Completion: Summer 2017
Name of Receiving Waters:	Sudbury River
Estimated Area of Disturbance:	1.5 Acres

1.2 Contact Information / Responsible Parties (complete prior to construction)

Operator(s):
Company Name: Ashland Landscape Supply
Address: 18 Waverly Street, Ashland, MA
Telephone #: 508-620-6251
Area of Control: Entire Site

Project Manager(s) or Site Supervisor(s):
Company Name: Same as Operator
Name:
Address:
Telephone #:
Area of Control: Entire Site

This SWPPP was Prepared by:
Connorstone Engineering, Inc.:
10 Southwest Cutoff
Northborough, MA 01532 / 508-393-9727

Emergency 24-Hour Contact:
Company Name: Same as Operator
Name:
Address:
Telephone #:

Subcontractors:
Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the Subcontractor Certifications/Agreement (Attached).

1.3 Existing Conditions

The subject site consists of a 1.69 acre parcel of land located at the corner of Megunko road and Cherry Street shown as Assessors Map 14, Parcel 44 Under the existing conditions, the site is partially developed as a gravel parking lot along Cherry Street. The remaining area is undeveloped and wooded. Site zoning includes the Industrial zoning district, Photovoltaic Overlay, and Add 'A' Overlay. The existing topography is generally flat with a gradual slope away from a high point near the center of the site.

1.4 Proposed Development / Nature of Construction Activities

The proposed plan includes construction of an 11,100 sq ft. +/- building containing 11 units for Contractor garages/offices. The work also includes a paved driveway, 48 parking spaces; drainage and stormwater structures; utility connections; and required site work. Site access will include two curb cuts off Megunko Road to allow circulation throughout the site. The additional traffic generated from the proposed project is minimal, and would not have an impact on Cherry Street or the surrounding area.

The proposed building will be serviced by the municipal water and sewer systems. The water connection has been proposed off the water main within Cherry Street. Each unit will have an individual service and shutoff. The closest public sewer main is located at the corner of Cherry Street and Park Road. A sewer main will be extended approximately 200 feet down Cherry Street, ending with a manhole located in front of the proposed building. Each of the units will have a separate sewer service. Floor drains within the units will be connected to an oil/gas trap prior to connection to the sewer system.

The overall project will result in 50,320 square feet of impervious area and require a disturbance area of approximately 65,000 square feet. The proposed building and limit of work has been designed to maintain an undisturbed buffer of at least 25 feet around the on-site wetlands.

The proposed stormwater management system has been designed in compliance with the MassDEP Stormwater Standards and the Ashland Stormwater Bylaw. The proposed system will collect runoff from the paved surfaces and provide treatment, detention, and recharge thought subsurface infiltration beds.

1.5 Construction Site Estimates

Total parcel area:	1.69 +/- acres
Total land disturbance:	1.5 acres
Impervious area before construction:	0.0 acres
Impervious area after construction:	1.1 acres

1.6 Sensitive Areas / Wetland Resources

Regulated wetland resources areas are located along the westerly property line and include an intermittent stream with bordering vegetated wetlands. The wetland has a drainage area of approximately 0.3 sq. miles and is not shown on the USGS mapping.

1.7 Discharge Information

The proposed site drainage will discharge to the on-site wetland system that ultimately flows to the Sudbury River. The Sudbury River is classified as Class B Warm Water. Based upon the Massachusetts year 2014 integrated list of waters this surface water is an impaired water for mercury in fish tissue, and is listed as a Category 5 water, 'Waters Requiring a TMDL.'

1.8 Endangered Species Certification

The proposed project is not located in an Estimated or Priority Habitat of Rare Wildlife as indicated on the 2008 Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)

1.9 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

- Clearing and grubbing operations
- Grading and site excavation operations
- Vehicle tracking
- Topsoil stripping and stockpiling
- Landscaping operations

Potential pollutants and sources, other than sediment, to stormwater runoff:

- Combined Staging Area—small fueling activities, minor equipment maintenance, sanitary facilities, and hazardous waste storage.
- Materials Storage Area—general building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
- Construction Activity—paving, curb/gutter installation, concrete pouring/mortar/stucco, and building construction.
- Concrete Washout Area

1.10 REQUIREMENT TO POST A NOTICE OF YOUR PERMIT COVERAGE.

The operator must post a sign or other notice conspicuously at a safe, publicly accessible location in close proximity to the project site. At a minimum, the notice must include the NPDES Permit tracking number and a contact name and phone number for obtaining additional project information. The notice must be located so that it is visible from the public road that is nearest to the active part of the construction site, and it must use a font large enough to be readily viewed from a public right-of-way.

2.1 General Construction Sequencing of Major Activities

It is assumed that under normal conditions work will proceed in accordance with the following schedule. However, the schedule is subject to change based upon field conditions and Owner input.

General hours of operation: Mon-Sat. 7:00 - 5:00 - Estimated project duration: 12 months

1. Install sediment barriers as indicated on the plans
2. Rough grade entrance off Megunko Road and install construction stone entrance. Construction stone entrance to be replaced as needed to provide adequate storage capacity for accumulated sediment storage from vehicles leaving the site.
3. Cut and remove trees. Stumps shall be left in place.
4. Prepare stockpile areas.
5. Construct temporary sediment basin at the location indicated on the plan. Stabilize slopes with loam and hydroseed.
6. Remove stumps and strip/stockpile topsoil.
8. Perform rough earthwork, place foundations, and begin building construction.
9. Drain lines, underground utilities, and structures. infiltration systems to remain off-line until binder course pavement and tributary area is stabilized. silt sacks shall be placed in all inlets until project completion.
10. Place and compact roadway gravel and install binder pavement within roadway and sidewalks.
11. Begin sweeping of all paved surfaces within the project site as necessary to prevent tracking off-site and siltation buildup in the completed drainage system.
12. Loam and seed road shoulders, drainage swales and exposed slopes.
13. After building construction is completed , complete driveway construction including final pavement, and loam and seed any remaining disturbed areas.
14. After inspection by the approving authority remove all remaining sediment control devises.

2.2 Erosion and Sediment Controls

General Conditions – Prior to initiating construction, all sedimentation and erosion control measures shall be installed as shown on the plans and detail drawings. This plan depicts the minimum required sedimentation and erosion controls. The contractor shall employ additional sedimentation and erosion control measures as necessitated by site conditions, or as directed by the owner, the owner's representative, or the conservation commission to ensure protection of all wetland resources and control sediment transport. if sedimentation plumes occur, the contractor shall stop work and install additional sedimentation control devices immediately to prevent further sedimentation.

Temporary Stabilization – Topsoil stockpiles and disturbed portions of the site where construction activity will temporarily cease for at least 14 days, shall be stabilized with a temporary seed and mulch no later than 14 days from the last construction activity in that area. The temporary seed shall be Erosion Control mix. Seeding shall be nutrient enriched hydroseed with tackifer and cellulose or other degradable fibers capable of retaining moisture.

Permanent Stabilization – Disturbed portion of the site where construction activity ceases shall be stabilized with permanent seed no later than 14 days after the last construction activity. The permanent seed mix consists of tall fescue, and annual rye. Prior to seeding, ground agricultural limestone shall be applied. Seeding shall be nutrient enriched hydroseed with tackifers and cellulose or other degradable fibers capable of retaining moisture.

Mulch Filter Mitt (Perimeter Controls) – Prior to the commencement of work, Mulch Filter Mitt (or approved equal) shall be installed along the edge of proposed development, and as indicated on the plans. Additional barriers shall be located as conditions warrant or as directed by the owner, his representatives, or the local authority. In some areas structures may have to be duplicated at regular intervals up gradient of wetlands, and it may be necessary to provide crushed stone armor to fencing when anticipated flows are expected to be heavy or fast.

Track out controls / Construction Entrance – A stabilized stone apron construction entrance shall be at all construction entrances to help prevent vehicle tracking of sediments. All vehicles shall enter and exit the sit via the stabilized construction entrance. The contractor shall inspect the construction entrance daily and after heavy use. If mud and soil clogs the voids in the crushed stone reducing the effectiveness, the pad shall be top dressed with new, clean stone. If the pad becomes completely clogged, replacement of the entire pad may be necessary. Dump trucks hauling material from the construction site will be covered with a tarpaulin.

Track out controls / Street Sweeping – Street sweeping in the vicinity of the project area shall be performed as needed until the project limits have been stabilized. All sediment tracked outside the limit of work shall be swept at the end of each working day.

Inlet Protection – All existing and proposed drainage system inlets, which may receive stormwater flow from disturbed areas, shall be provided with inlet protection (catch basin inserts). The contractor shall maintain these devices until all work is completed and all areas have been adequately stabilized.

Temporary Sediment Traps / Basins – Sediment traps and/or basins shall be constructed as shown on the approved plans and as necessitated by field conditions. The minimum volume shall be 3600 cubic feet of storage for each acre of drainage area. Sediment traps/basins should be readily accessible for maintenance and sediment removal, and should remain in operation and be properly maintained until the site area is permanently stabilized by vegetation and/or when permanent structures are in place. Remove basin after drainage area has been permanently stabilized, inspected, and approved. Before removing dam, drain water and remove sediment; place waste material in designated disposal areas. Smooth site to blend with surrounding area and stabilize.

Dust Control – Dust control measures shall be implemented and maintained properly throughout dry weather periods until all disturbed areas have been permanently stabilized. Methods for dust control shall include water sprinkling and/or other methods approved by the engineer.

Soil Stockpiles – Soil stockpiles shall be stabilized to prevent erosion along with perimeter sedimentation controls. No materials subject to erosion shall be stockpiled overnight within 100 feet of a wetland unless covered. Stockpiling of material with high fines content is not recommended unless protected from moisture.

Dewatering Operations – Dewatering operations, if required, shall discharge onto stabilized areas. All discharge water is to pass through sedimentation control devices to prevent impacts upon water bodies, bordering vegetated wetlands, drainage systems and abutting properties. No discharges from dewatering operations shall be discharged directly to the drainage system.

Snow Removal – Snow shall be plowed to the snow storage area indicated on the plans. Any excess of that which can be stored on-site shall be removed. Snow shall not be plowed into the 25-foot buffer zone to any wetland area or the stormwater basin. All catch basins shall be uncovered and functional immediately after snow plowing. The snow pile shall be placed so that it will not interfere with runoff flow.

Topsoil – Topsoil shall be stripped and stockpiled on-site for reuse, unless otherwise noted on the plans (per stockpile requirements). Materials shall be re-used on-site to the maximum extent practical. Any excess shall be properly exported off-site.

Minimize Soil Compaction – Within the limits of the infiltration galley, the use of heavy equipment shall be limited to the maximum extent practical.

Vehicle Washing – Vehicle and equipment washing, other than hose down with clean water, shall not be allowed. All wash down water shall be directed to a sediment control device (not directly to any stormwater drainage system or wetland).

The site superintendent, will select three individuals who will be responsible for inspections, maintenance and repair activities, and filling out the inspection and maintenance reports. Personnel selected for inspection and maintenance responsibilities shall be a "qualified personnel" as defined in section 4. D of the GCP. Staff shall be trained in all inspection and maintenance practices for keeping the erosion and sediment controls used onsite in good working order.

An *inspection report* will be made after each inspection. Copies of the reports shall be maintained on site. At a minimum, the inspection report must include:

- The inspection date;
- Names, titles, and qualifications of personnel making the inspection;
- Weather information for the period since the last inspection including estimate of the beginning and duration of each storm event, approximate amount of rainfall for each storm event (in inches), and whether any discharges occurred;
- Location(s) of discharges of sediment or other pollutants from the site;
- Location(s) of BMPs that need to be maintained;
- Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;
- Location(s) where additional BMPs are needed that did not exist at the time of inspection; and
- Corrective action required including implementation dates.

The inspection report must be signed in accordance with Appendix G, Section 11 of the GCP.

2.5 Staff and Training Requirements.

Prior to the commencement of earth-disturbing activities or pollutant-generating activities, whichever occurs first, you must ensure that the following personnel understand the requirements of this permit and their specific responsibilities with respect to those requirements:

- Personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls (including pollution prevention measures);
- Personnel responsible for the application and storage of treatment chemicals (if applicable);
- Personnel who are responsible for conducting inspections as required in Part 4.1.1; and
- Personnel who are responsible for taking corrective actions.

Notes: (1) If the person requiring training is a new employee, who starts after you commence earth-disturbing or pollutant-generating activities, you must ensure that this person has the proper understanding as required above prior to assuming particular responsibilities related to compliance with this permit. (2) For emergency-related construction activities, the requirement to train personnel prior to commencement of earth-disturbing activities does not apply, however, such personnel must have the required training prior to NOI submission.

The operator is responsible for ensuring that all activities on the site comply with the requirements of the permit. The operator is not required to provide or document formal training for subcontractors or other outside service providers, but you must ensure that such personnel understand any requirements of the permit that may be affected by the work they are subcontracted to perform. At a minimum, personnel must be trained to understand the following if related to the scope of their job duties (e.g., only personnel responsible for conducting inspections need to understand how to conduct inspections):

- The location of all stormwater controls on the site required by this permit, and how they are to be maintained;
- The proper procedures to follow with respect to the permit's pollution prevention requirements;
- When and how to conduct inspections, record applicable findings, and take corrective actions.

3.1 Storage, Handling, and Waste Disposal

Building Products - Shall be covered or stored inside to prevent any discharge of pollutants. Comply with all application, disposal, and registration requirements.

Pesticides, herbicides, insecticides and fertilizers - Shall be covered or stored inside to prevent any discharge of pollutants. Comply with all application, disposal, and registration requirements.

Diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals- store chemicals in water-tight containers, and provide either (1) cover (e.g., plastic sheeting or temporary roofs) to prevent these containers from coming into contact with rainwater, or (2) a similarly effective means designed to prevent the discharge of pollutants from these areas (e.g., spill kits), or provide secondary containment (e.g., spill berms, decks, spill containment pallets). Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly. Do not clean surfaces or spills by hosing the area down. Eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge

Hazardous Waste - Separate hazardous or toxic waste from construction and domestic waste. Store waste in sealed containers, which are constructed of suitable materials to prevent leakage and corrosion, and which are labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, tribal, or local requirements; iii. Store all containers that will be stored outside within appropriatelysized secondary containment (e.g., spill berms, decks, spill containment pallets) to prevent spills from being discharged, or provide a similarly effective means designed to prevent the discharge of pollutants from these areas (e.g., storing chemicals in covered area or having a spill kit available on site);

Dispose of hazardous or toxic waste in accordance with the manufacturer's recommended method of disposal and in compliance with federal, state, tribal, and local requirements. site personnel will be instructed in these practice and the individual who manages the day to day site operations, will be responsible for seeing that these procedures are followed.

Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly. Do not clean surfaces or spills by hosing the area down. Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge

Sanitary Waste – All sanitary waste will be collected from the portable units a minimum of once per week by the sanitary pumping company, licensed by the Commonwealth of Massachusetts and as required by the local regulation. Position units in a secure location where they cannot be tipped over.

Waste Materials – All waste materials will be collected and stored in a securely lidded metal dumpster rented from a licensed waster management company. The dumpster will meet all local and State solid waster management regulations. All trash and construction debris from the site will be deposited in the dumpster. The dumpster will be emptied at least twice per month or more often if necessary, and the waste will be hauled to the waste management company. On work days, clean up and dispose of waste in designated waste containers. Clean up immediately if containers overflow. No construction waste materials will be buried onsite. All personnel will be instructed regarding the correct procedure for waste disposal. Notices stating these practices will be posted in the office trailer. The individual managing the day-to-day site operations will be responsible for seeing that these procedures are followed.

3.2 Building Material Inventory for Pollution Prevention Plan

The materials or substances listed below are expected to be present onsite during construction:

- Concrete
- Petroleum based products including asphalt concrete/emulsions, fuel(s), oil, etc.
- Wood
- Fertilizers and tachifiers
- Paints (enamel, latex and oil based stains)
- Metal studs and products
- Masonry block
- Roofing shingles
- Gypsum and plaster
- Stone products

Construction equipment and maintenance materials will be stored at the combined staging area and materials storage areas. A watertight container will be used to store hand tools, small parts, and other construction materials.

3.2 Spill Prevention Material Management Practices

The following are the material management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to stormwater runoff.

Good Housekeeping – The following good housekeeping practices will be followed onsite during the construction project.

- An effort will be made to store only enough products to do the job.
- All materials stored onsite will be stored in a neat, orderly manner in this appropriate containers and, if possible, under a roof or other enclosure.
- Products will be kept in their original containers and with the original manufacturers' label.
- Substances will not be mixed with one another unless recommended by the manufactures.
- Whenever possible, all of a product will be used up before disposing of the container.
- Manufacturers' recommendation for proper use and disposal will be followed.
- The Site Superintendent will inspect daily to ensure proper use and disposal of materials.
- Hazardous Procedures – In accordance with industry standards and Applicable regulations

Product Specific Practices – The following product specific practices will be followed onsite:
Petroleum Products – Transport and delivery of fuel in approved containers only.
Fertilizers – In accordance with labeling
Paints – In accordance with labeling

Spill Control Practices – Any spills of hazardous materials shall be contained and cleaned up immediately. If appropriate, the Massachusetts Department of Environmental Protection (DEP) shall be notified. There shall, at all times when work is underway on-site, be an individual present who is trained in proper spill control practices.

In the event that hazardous material, gasoline or other petroleum is released, the following procedure should be followed:

1. Immediately contact the following agencies:
   Ashland Fire Department (508) 881-0132
   MassDEP Emergency Response (888) 304-1133

2. Provide support to agencies listed above, which may include contacting an outside contractor to provide clean-up or contacting a Licensed Site Professional (LSP) to lead the clean-up.

5.0 Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____ Title: _____

Signature: _____ Date: _____

Contact information: _____

_____

SWPPP Attachments

- ***NOI and Acknowledgement Letter from EPA/State (Insert once received)***
- ***Inspection Reports***
- ***Corrective Action Log***
- ***SWPPP Amendment Log***
- ***Grading and Stabilization Activities Log***
- ***Subcontractor Certifications/Agreements***
- ***NPDES Construction General Permit***
  Download at:
  http://water.epa.gov/polwaste/npdes/stormwater/upload/cgp2012_finalpermit.pdf

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
6	Catch Basin Inlet Protection	☐Yes ☐No	☐Yes ☐No	Any Evidence of Bypass_____
7	Are all slopes and disturbed areas not actively being worked properly stabilized?	☐Yes ☐No	☐Yes ☐No	
8	Are natural resource areas protected with barriers or similar BMPs?	☐Yes ☐No	☐Yes ☐No	
9	Are discharge points and receiving waters free of any sediment deposits?	☐Yes ☐No	☐Yes ☐No	
10	Is trash/litter from work areas collected and placed in covered dumpsters?	☐Yes ☐No	☐Yes ☐No	
11	Are materials that are potential stormwater contaminants stored inside or under cover?	☐Yes ☐No	☐Yes ☐No	
12	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	☐Yes ☐No	☐Yes ☐No	
13	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	☐Yes ☐No	☐Yes ☐No	
14	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	☐Yes ☐No	☐Yes ☐No	
15	(Other)	☐Yes ☐No	☐Yes ☐No	

Non-Compliance

Describe any incidents of non-compliance not described above:

Additional Comments / Description of Current Site Work

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: _____

Signature: _____ **Date:** _____

Corrective Action Log

Project Name:
SWPPP Contact:

Inspection Date	Inspector Name(s)	Description of BMP Deficiency	Corrective Action Needed (including planned date/responsible person)	Date Action Taken/Responsible person

SWPPP Amendment Log

Project Name:
SWPPP Contact:

Amendment No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

Grading and Stabilization Activities Log

Project Name:
SWPPP Contact:

Date Grading Activity Initiated	Description of Grading Activity	Date Grading Activity Ceased (Indicate Temporary or Permanent)	Date When Stabilization Measures are Initiated	Description of Stabilization Measure and Location

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the BMPs and practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

_____

_____

Signature: _____

Title: _____

Date: _____

CONNORSTONE ENGINEERING, INC.
10 SOUTHWEST CUTOFF, SUITE #7
NORTHBOROUGH, MASSACHUSETTS 01532
TEL: (508) 393-9727 • FAX: (508) 393-5242

Town of Ashland Planning Board
101 Main Street, 2nd Floor,
Ashland, MA 01721

May 23, 2016

Subject: **0 Megunko Road**
Site Plan Review Comments

Dear Members of the Board:

Connorstone Engineering, Inc. has received updated peer review comments from PSC in a letter dated May 20, 2016. It appears the only outstanding comments related to the civil site plans is item P1 requesting a turning template for a WB-40 design vehicle rather than a SU vehicle, and item SW1 requesting a revised mounding analysis. The remaining comments are related to landscaping, lighting, signage, architectural and discussion items with the Planning Board.

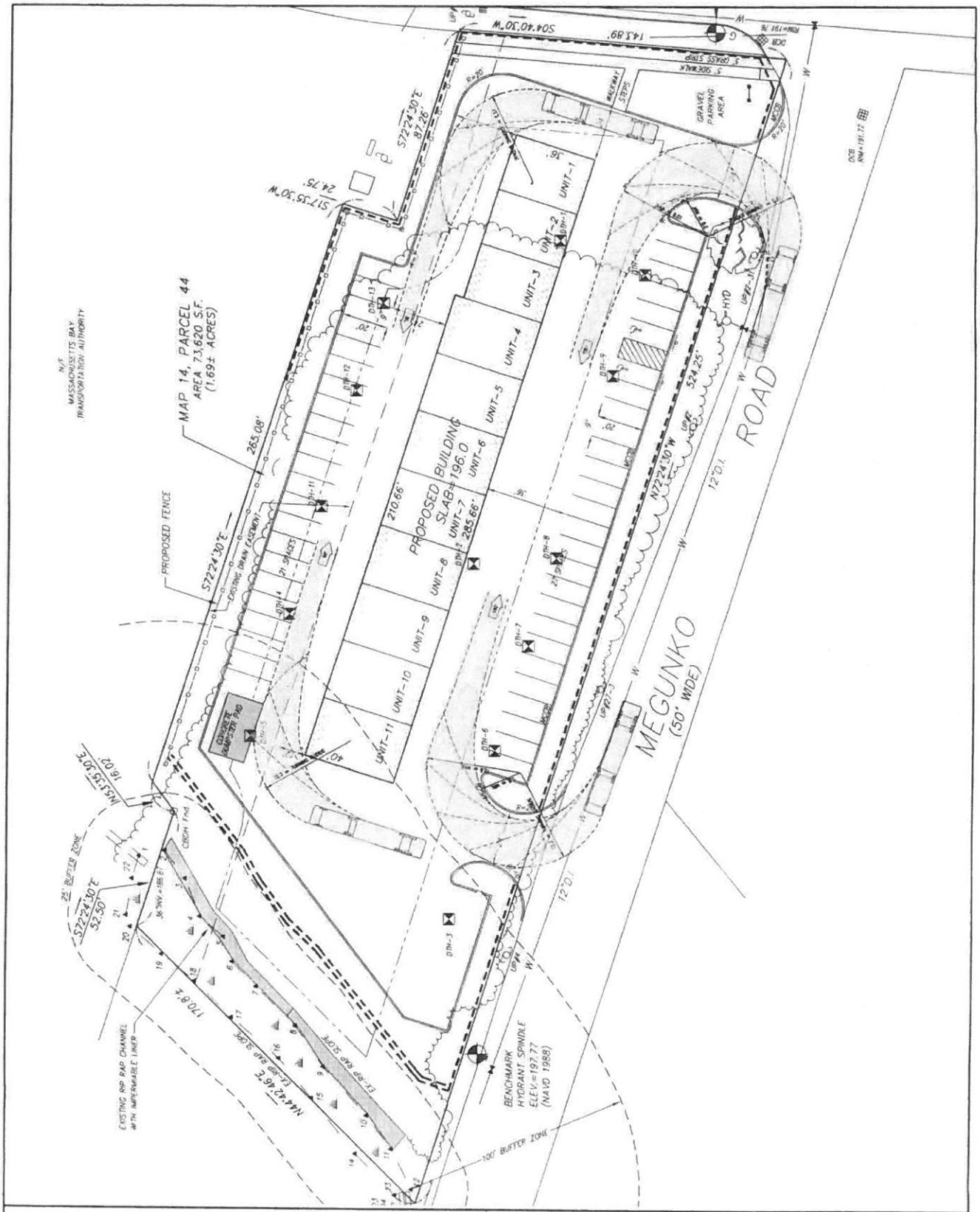
Item P1 – The comment has requested the use of a WB-40 vehicle rather than a SU vehicle. A WB-40 vehicle has a smaller turning radius than a SU vehicle and is less restrictive in the design. The attached sketch shows the requested WB-40 vehicle with adequate circulation throughout the site.

Item SW1 – The comment had requested a revised mounding analysis to account for refusal noted in the center test pits. This appeared to be a boulder in the bottom of the holes that could be removed with a larger machine, and was localized in that area. However, a revised mounding analysis has been attached assuming the entire bottom of the drywell had bedrock two feet below the system. The results verify the system would be dewatered within 72 hours after the storm.

If you have any questions related to this project or the materials submitted, please contact our office at 508-393-9727.

Sincerely,
Connorstone Engineering, Inc.

Vito Colonna, P.E.



TURNING TEMPLATE EXHIBIT
MEGUNKO ROAD
ASHLAND, MA
SCALE 1"=60'

CONNORSTONE ENGINEERING

CONSULTING CIVIL ENGINEERS
AND LAND SURVEYORS
10 SOUTHWEST CUTOFF, SUITE 7
NORTHBOROUGH, MASSACHUSETTS 01532

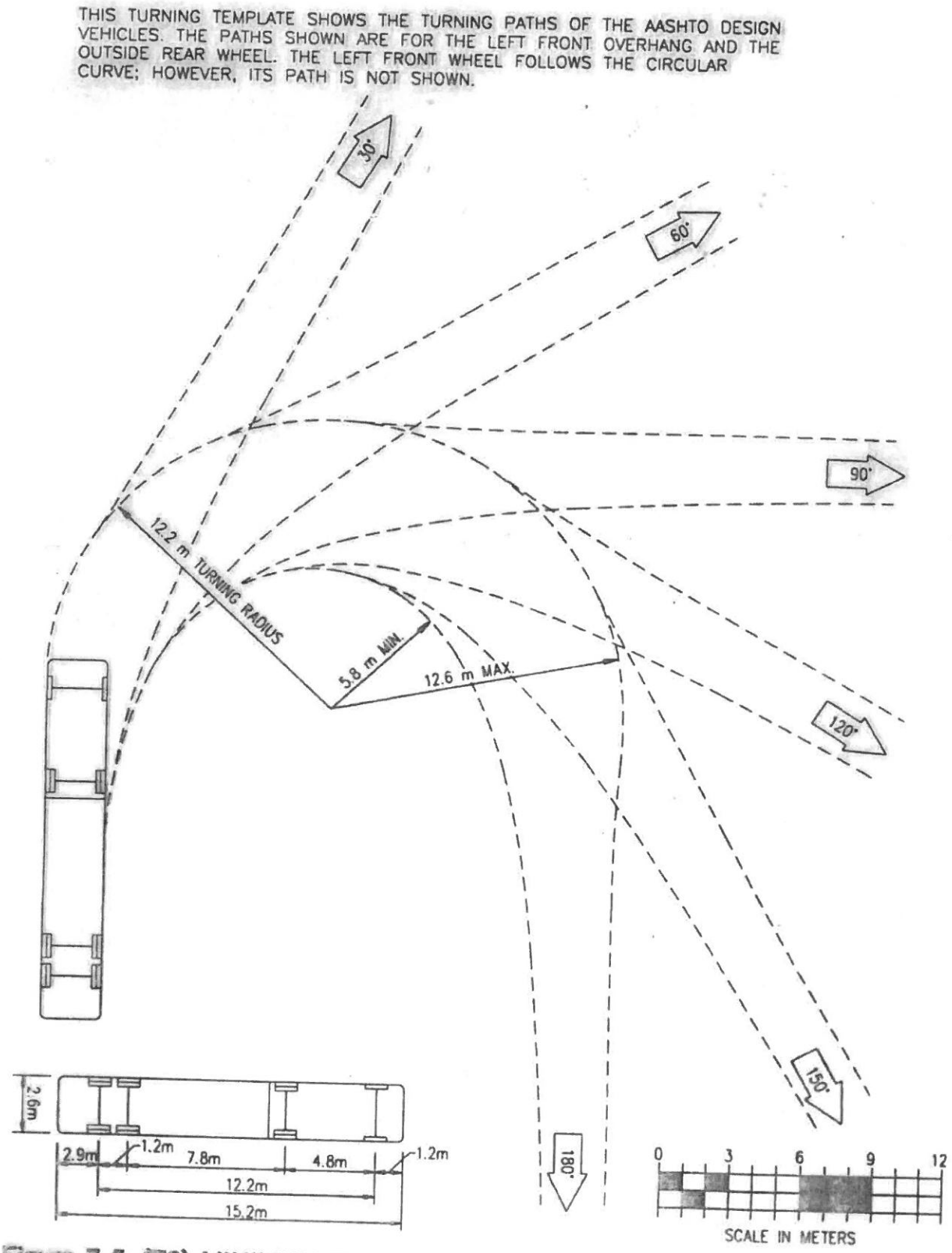
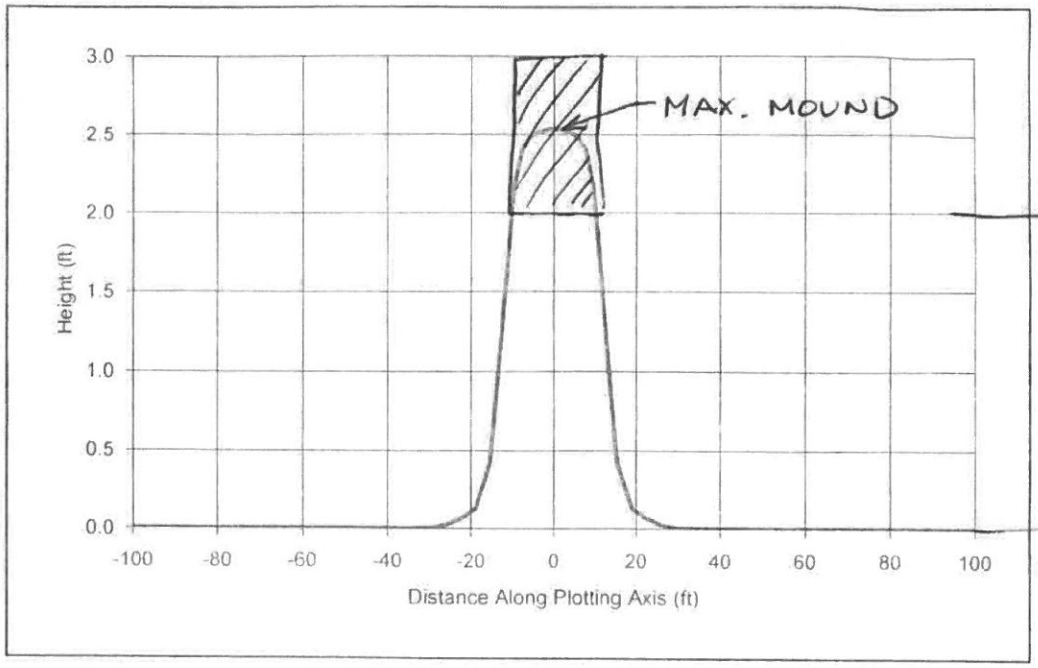


Figure 7-5. (T2) MINIMUM TURNING PATH FOR WB-12 DESIGN VEHICLE

Megunko Road, Ashland
Mounding Analysis 5/23/16

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: csei

PROJECT: Megunko

ANALYST: vc

DATE: 5/23/2016 TIME: 11:52:34 AM

INPUT PARAMETERS

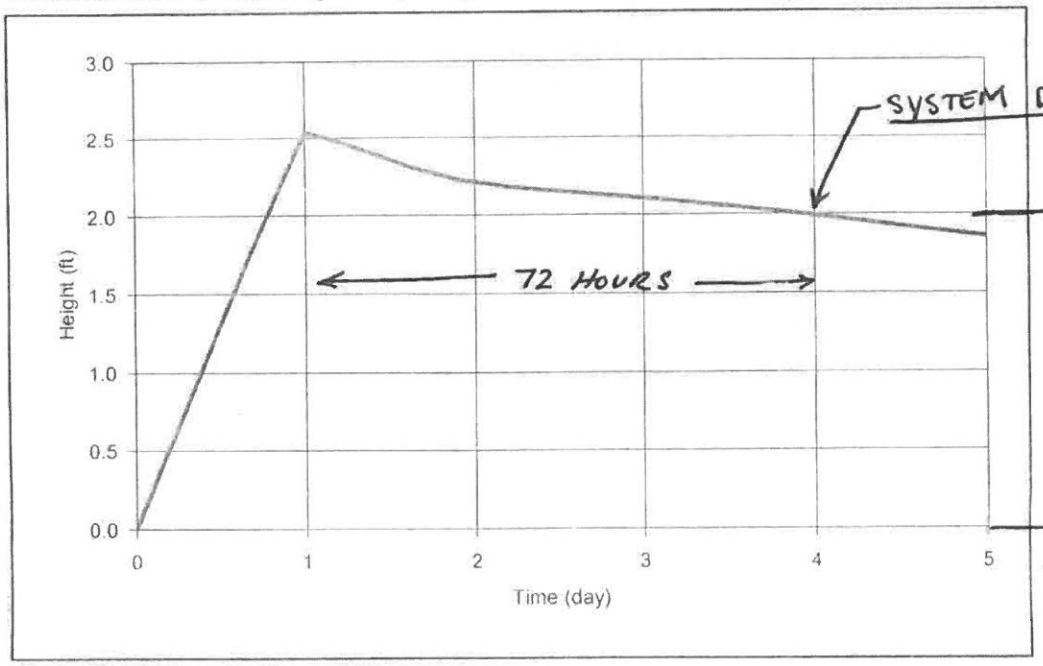
Application rate: 0.676 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.25
Hydraulic conductivity: 2.04 ft/day
Initial saturated thickness: 2 ft
Length of application area: 342 ft
Width of application area: 25 ft
No constant head boundary used
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 12.5 ft
positive Y: 0 ft
Total volume applied: 5779.8 c.ft

V OK

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-100	0	-100	0
-84.1	0	-84	0
-68.2	0	-68	0
-52.3	0	-52	0
-39.8	0	-40	0
-30.1	0	-30	0
-22.2	0	-22	0.07
-15.5	0	-15	0.42
-9.7	0	-10	2.16
-5.8	0	-6	2.48
-3.2	0	-3	2.52
0	0	0	2.54
3.2	0	3	2.52
5.8	0	6	2.48
9.7	0	10	2.16
15.5	0	15	0.42
22.2	0	22	0.07
30.1	0	30	0
39.8	0	40	0
52.3	0	52	0
68.2	0	68	0
84.1	0	84	0
100	0	100	0

Groundwater Mounding Analysis (Hantush's Method using Glover's Solution)



COMPANY: csei

PROJECT: Megunko

ANALYST: vc

DATE: 5/23/2016 TIME: 11:48:27 AM

INPUT PARAMETERS

Application rate: 0.676 c.ft/day/sq. ft
Duration of application: 1 day
Total simulation time: 5 day
Fillable porosity: 0.25
Hydraulic conductivity: 2.04 ft/day
Initial saturated thickness: 2 ft
Length of application area: 342 ft
Width of application area: 25 ft
No constant head boundary used
Groundwater mounding @
X coordinate: 0 ft
Y coordinate: 0 ft
Total volume applied: 5779.8 cft ✓ OK

MODEL RESULTS

Time (day)	Mound Height (ft)
0	0
0	0.03
0	0.12
0.1	0.25
0.2	0.4
0.2	0.58
0.3	0.78
0.4	1.04
0.5	1.36
0.7	1.81
1	2.54
1.1	2.52
1.2	2.48
1.4	2.4
1.6	2.31
1.9	2.23
2.2	2.18
2.6	2.14
3.1	2.1
3.8	2.02
5	1.86