Stormwater Management Report

For

37 Mohegan Road

Map D-2 Parcel 133
Acton, MA

March 25, 2016

Stamski And McNary, Inc.
Engineering - Planning – Surveying
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Acton, MA 01720

SM-5443

File: 5443-Stormwater Report Cover.doc

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Checklist for Stormwater Report

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

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

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

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.

Narrative

STORMWATER MANAGEMENT

The site is located at 37 Mohegan Road in Acton, Massachusetts and is approximately 3.32 acres in size and has been previously developed. There is an existing dwelling with a paved driveway and a barn located on the site. The Natural Resource Conservation Service (N.R.C.S.) soil survey report for Middlesex County indicates that soils located on the site are Canton-Charlton-Urban land complex and Narragansett silt loam which are in Hydrologic Group A.

Pre-Development

The existing site is comprised of a single subcatchment. Subcatchment E-1 contains the existing dwelling, a barn, the existing paved driveway, lawn, and wooded areas. This subcatchment drains to the Bordering Vegetated Wetland on-site. The subcatchment can be seen on the attached drainage maps. Drainage from Mohegan Road currently flows down the driveway and into the wetlands on-site.

Post-Development

The fully developed site will consist of the existing dwelling, a proposed dwelling, and a proposed road. The post-development site remains as a single subcatchment. A portion of the existing driveway will be removed and much of the proposed road will be treated and infiltrated on-site. An additional catch basin will be added to the Mohegan Road right of way to direct runoff from the Mohegan Road cul-de-sac to the wetlands on-site.

This project would qualify as a "Redevelopment Project" as defined by the Stormwater Management Standards but all standards have been met. The following describes the drainage system and the projects compliance with the Stormwater Management Standards.

Standard #1 Untreated direct discharge of Stormwater:

No new direct discharges of untreated stormwater are proposed. The overland discharge to the north will remain and any additional runoff will be treated and infiltrated.

Standard #2 Post-Development Peak Discharge:

The Stormwater Management Policy requires that peak discharge rates for the 2-year and 10-year storm events not be increased from pre-development conditions. Furthermore, the 100-year storm event will not increase flooding impacts offsite. Attenuation of peak discharge rates will be accomplished by using subsurface infiltration. The following table summarizes the peak runoff rates to the overland flow discharge points.

Discharge Summary Table

E1 Compared to P-1

2-Year Storm		10-year Storm		100-year Storm	
Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)
0.068	0.065	0.637	0.581	2.210	1.991

Detailed Calculations are attached.

Standard #3 Recharge to Groundwater:

This standard prescribes the stormwater volume that must be recharged to groundwater based on the existing site soil conditions. The Natural Resources Conservation Service (N.R.C.S.) Middlesex Soil Survey map indicates that the site contains soils in Hydrologic Group A. The Stormwater Management Policy requires 0.6 inches of runoff over the total impervious area to be recharged in areas with the respective soil groups. Furthermore the town's regulations require that the annual water budget is balanced to preserve groundwater supply. Detailed "Recharge Volume Calculations" and "Water Balance Calculations" showing compliance with this standard are attached.

Standard #4 80% TSS Removal:

According to the guidelines provided in the Stormwater Management Standards 80% Total Suspended Solids (TSS) removal is required for the total increase in impervious area associated with the project. This standard requires 1.0 inches of runoff from impervious surfaces to be treated when not in a critical area. Town Standards also require 1.0 inch of runoff from impervious areas to be treated. The proposed catch basin with Hydroflow Hydroguard insert and subsurface infiltration structures will treat the water quality volume of 1.0 inch over the proposed impervious area. See "Water Quality Volume Calculation" attached. A TMDL for phosphorus is present in the Assabet River. The use of infiltration will remove 40-70% of total phosphorus and is consistent with the TMDL.

Standard #5 Higher Potential Pollutant Loads:

The site is not considered to have a "Higher Potential Pollutant Load" as defined in the Stormwater Management Policy.

Standard #6 Protection of Critical Areas:

The site is not located within a Critical Area as defined in the Stormwater Management Policy.

Standard #7 Redevelopment Projects:

Although the existing site is developed and has been disturbed, the project has been designed to meet new construction standards. This standard would require that the Stormwater Management Standards be met to the extent practicable. The project has been designed to meet all of the standards.

Standard #8 Erosion/Sediment Control:

Erosion and sediment controls are incorporated into the project design to prevent erosion, control sediment movement, and stabilize exposed and disturbed soils during construction. Temporary erosion and sedimentation controls during construction include minimizing areas of exposed soil, directing and controlling runoff, and rapidly stabilizing exposed areas. Soils left exposed for extended periods will be mulched and seeded for temporary vegetative cover. Following construction, exposed areas will be permanently vegetated with appropriate ground cover. Erosion and sedimentation control measures will be maintained throughout all phases of construction. Inspections will be made regularly and after rainfalls exceeding 0.5 inches in a 24-hour period during construction. The contractor will be required to inspect erosion and sedimentation control measures at the end of each workday, when precipitation is forecasted, and after each rainfall. All measures will be inspected prior to each weekend. The contractor will replace and repair any malfunctioning or damaged control measures including vegetative stabilization. Long term erosion and sedimentation control will be realized using the Best Management Practices described previously. Areas where soils have been disturbed will be loamed and vegetated with lawn, trees, and shrubs.

Standard #9 Operation and Maintenance Plan:

An Operation and Maintenance plan has been prepared and is shown on the plan set.

Standard #10 Illicit Discharges to Drainage System:

No known illicit discharges exist and none are proposed.

Design Basis

1. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
2. The twenty-four hour rainfall, taken from N.R.C.S. publications, is 6.4 inches for the 100-year storm, 4.5 inches for the 10-year storm, and 3.1 inches for the 2-year storm event.
3. The hydrologic calculations were performed using the computer program: "Hydraflow Hydrographs 2007" by Intelisolve.
4. The soil types of the site were taken from the N.R.C.S. Soil Survey Map for Middlesex County.
5. Soil conditions and estimated seasonal high groundwater table were based on on-site soil evaluations.
6. The Natural Resources Conservation Service (N.R.C.S.) soil survey indicated the presence of Canton-Charlton-Urban land complex and Narragansett silt loam. These soil groups rate as Hydrologic Group A.

Pre-Development Hydrology

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.068	2	750	988	----	------	------	Sub. E-1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.637	2	734	3,854	----	------	------	Sub. E-1

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	2.210	2	730	9,734	----	------	------	Sub. E-1

Worksheet 2: Runoff curve number and runoff SM-5443

Project: 37 Mohegan Road By WJH Date 3/22/2016

Location: Acton, MA Checked _____ Date _____

Circle one: [Present] Developed Subcatchment E-1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious-Pavement	98			0.39	38.51
A	Open Space - Good Condition	39			1.25	48.63
A	Woods - Good Condition	30			0.07	2.06
Totals =					1.71	89.20

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{89.20}{1.71}$ = 52.21 ; Use CN = [52.2]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.15	0.60	1.52
Runoff, Q.....	cf	959	3738	9436

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-5443

Project: 37 Mohegan Road By WJH Date 3/22/2016

Location: Acton, MA Checked _____ Date _____

Circle one: Present / Developed Circle one: Tc / Tt through subarea Subcatchment E-1

Sheet flow (Applicable to Tc only)		Segment ID	A-B	B-C		
1. Surface Description (table 3-1)			Woods	Grass		
2. Mannings roughness coeff., n (table 3-1)			0.6	0.24		
3. Flow length, L (total L <= 300 ft)		ft	10	40		
4. Two-yr 24-hr rainfall, P2		in	3.1	3.1		
5. Land Slope, s		ft/ft	0.06	0.03		
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.05	0.10		0.15
Shallow concentrated Flow		Segment ID	C-D			
7. Surface Description (paved or unpaved)			UNPAVED			
8. Flow Length, L		ft	225			
9. Watercourse slope, s		ft/ft	0.053			
10. Average Velocity, V (figure 3-1)		ft/s	3.71			
11. Tt = L / 3600V	Compute Tt	hr	0.02			0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.17
min 10.0

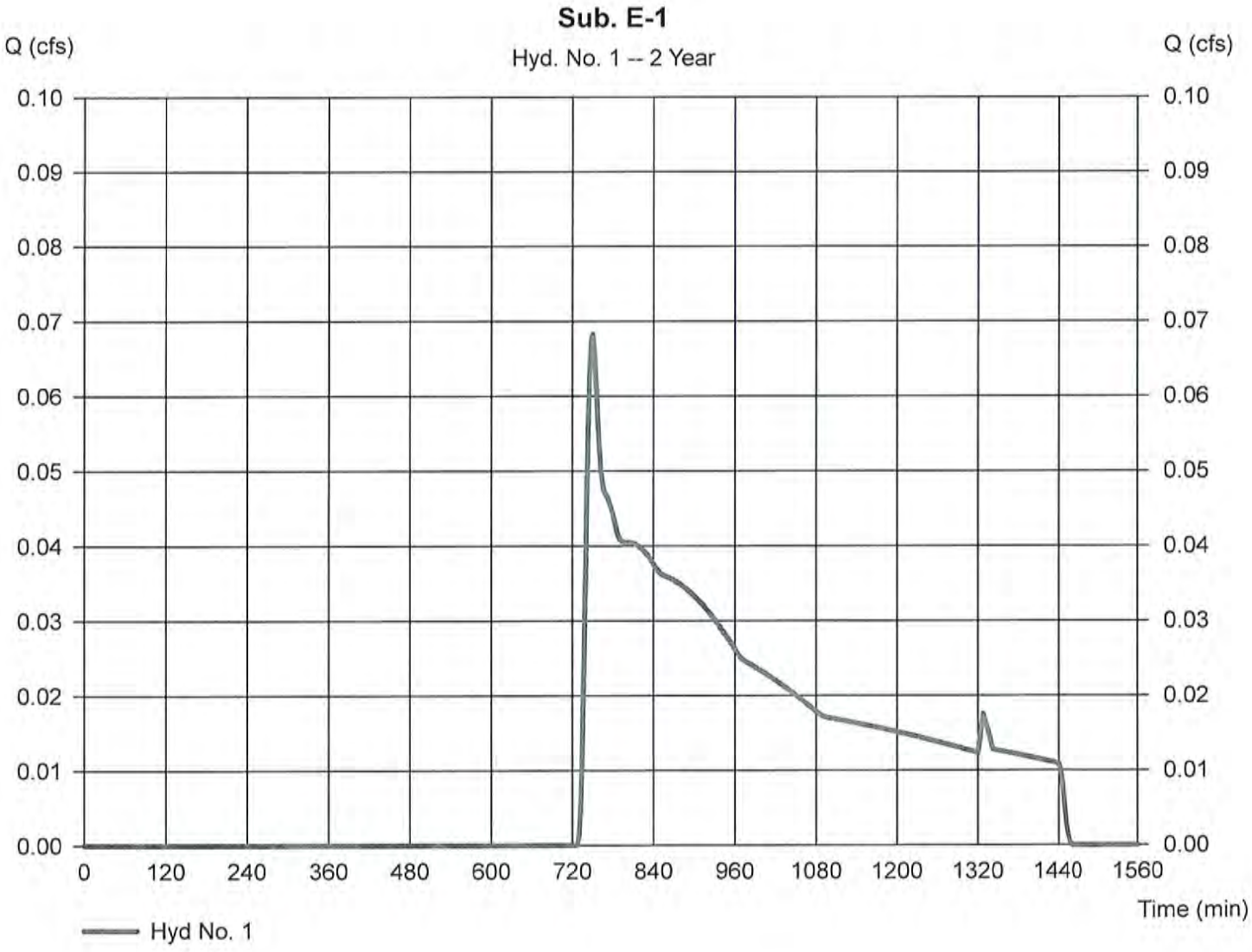
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Mar 22, 2016

Hyd. No. 1

Sub. E-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.068 cfs
Storm frequency	= 2 yrs	Time to peak	= 750 min
Time interval	= 2 min	Hyd. volume	= 988 cuft
Drainage area	= 1.710 ac	Curve number	= 52.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



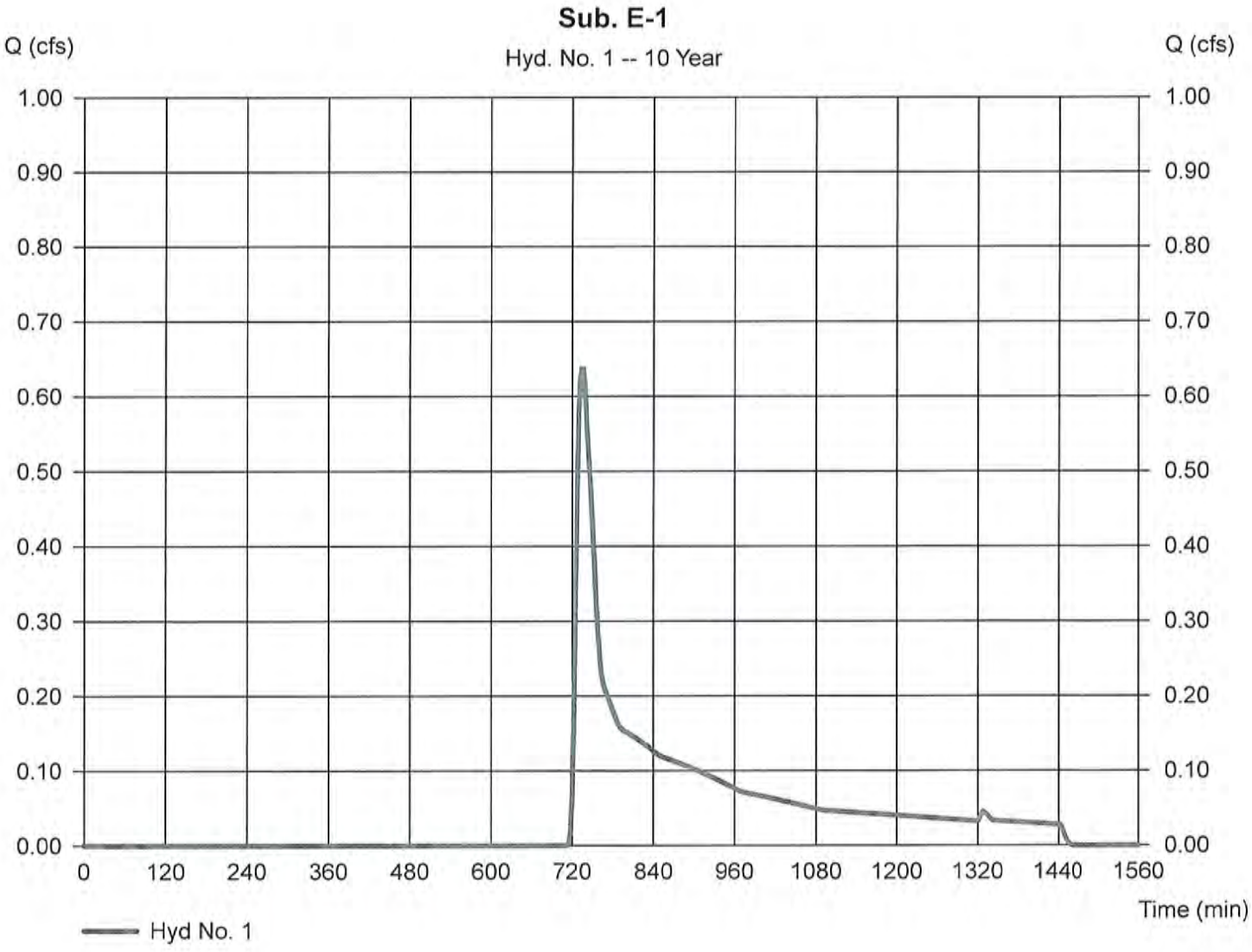
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Mar 22, 2016

Hyd. No. 1

Sub. E-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.637 cfs
Storm frequency	= 10 yrs	Time to peak	= 734 min
Time interval	= 2 min	Hyd. volume	= 3,854 cuft
Drainage area	= 1.710 ac	Curve number	= 52.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



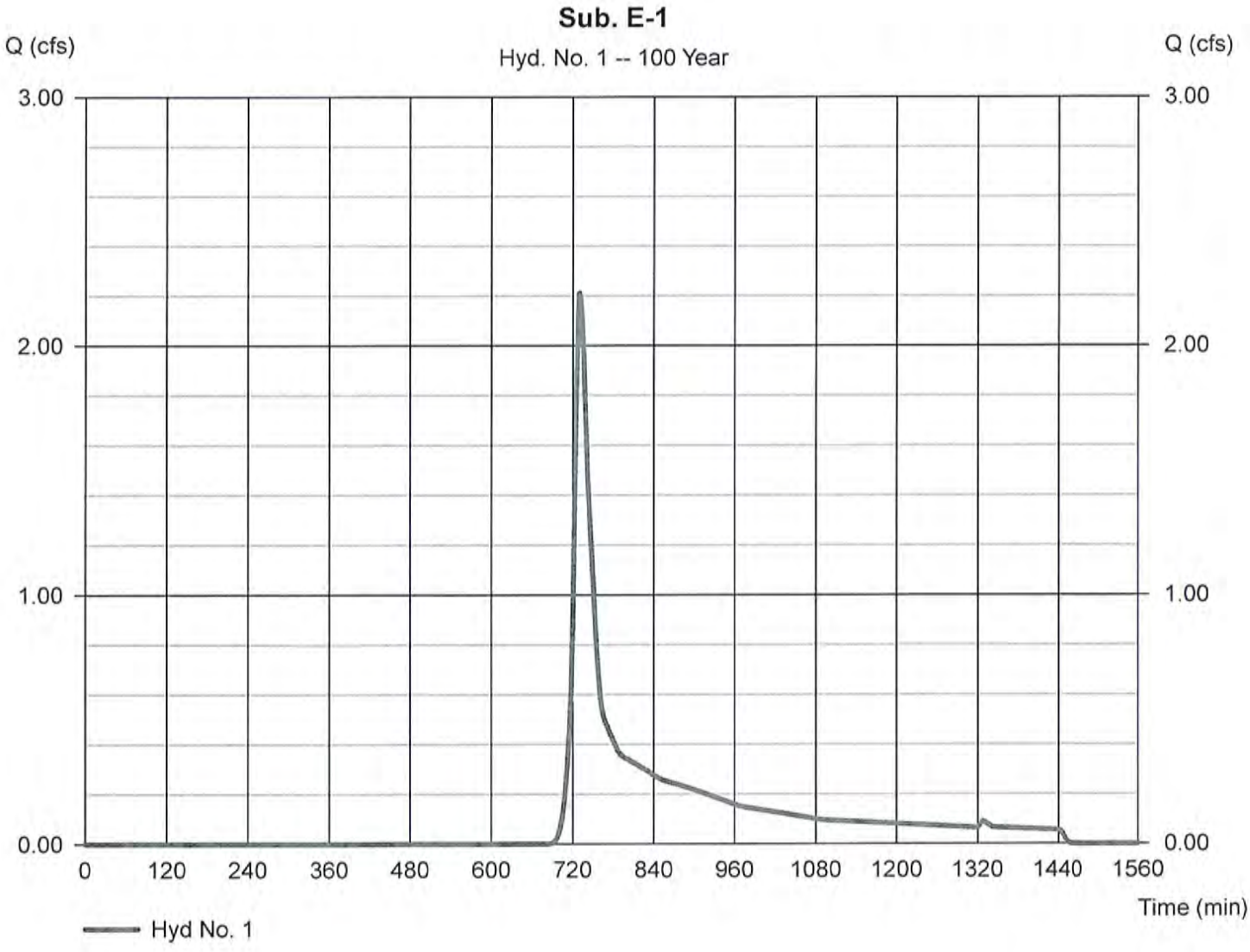
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Tuesday, Mar 22, 2016

Hyd. No. 1

Sub. E-1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.210 cfs
Storm frequency	= 100 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 9,734 cuft
Drainage area	= 1.710 ac	Curve number	= 52.2
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Post-Development Hydrology

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.065	2	746	824	----	------	------	Sub. P-1
3	SCS Runoff	0.051	2	732	343	----	------	------	Area to CB-1
4	Reservoir	0.000	2	784	0	3	215.01	5.05	Subsurface Inf.
6	SCS Runoff	0.145	2	724	488	----	------	------	Roof Runoff
7	Reservoir	0.000	2	686	0	6	215.39	70.9	Roof Drywell

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.581	2	730	3,115	----	------	------	Sub. P-1
3	SCS Runoff	0.239	2	728	977	----	------	------	Area to CB-1
4	Reservoir	0.000	2	830	0	3	215.43	145	Subsurface Inf.
6	SCS Runoff	0.212	2	724	726	----	------	------	Roof Runoff
7	Reservoir	0.000	2	696	0	6	215.79	140	Roof Drywell

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	1.991	2	728	7,765	----	------	------	Sub. P-1
3	SCS Runoff	0.588	2	726	2,133	----	------	------	Area to CB-1
4	Reservoir	0.000	2	696	0	3	217.16	542	Subsurface Inf.
6	SCS Runoff	0.302	2	724	1,048	----	------	------	Roof Runoff
7	Reservoir	0.000	2	1210	0	6	216.57	238	Roof Drywell

Worksheet 2: Runoff curve number and runoff SM-5443

Project: 37 Mohegan Road By WJH Date 3/22/2016

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] Subcatchment P-1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious-Pavement	98			0.32	31.14
A	Open Space - Good Condition	39			1.05	41.05
A	Woods - Good Condition	30			0.00	0.00
Totals =					1.37	72.19

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{72.19}{1.37} = 52.68$; Use CN = [52.7]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.17	0.63	1.56
Runoff, Q.....	cf	822	3112	7760

(210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) **SM-5443**

Project: 37 Mohegan Road By WJH Date 3/22/2016

Location: Acton, MA Checked _____ Date _____

Circle one: Present | Developed
Circle one: Tc | Tt through subarea Subcatchment P-1

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Grass			
2. Mannings roughness coeff., n (table 3-1)			0.24			
3. Flow length, L (total L <= 300 ft)		ft	50			
4. Two-yr 24-hr rainfall, P2		in	3.1			
5. Land Slope, s		ft/ft	0.03			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.12			0.12
Shallow concentrated Flow		Segment ID	B-C	C-D		
7. Surface Description (paved or unpaved)			UNPAVED	PAVED		
8. Flow Length, L		ft	91	124		
9. Watercourse slope, s		ft/ft	0.025	0.045		
10. Average Velocity, V (figure 3-1)		ft/s	2.55	4.31		
11. Tt = L / 3600V	Compute Tt	hr	0.01	0.01		0.02
Channel flow		Segment ID				
12. Cross sectional flow area, a		sf				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r=a/wp	Compute r	ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. V = 1.49 r^2/3 s^1/2 / n	Compute V	ft/s				
18. Flow length, L		ft				
19. Tt = L / 3600V	Compute Tt	hr				0

20. Watershed or subarea Tc or Tt (add Tt in steps 6, 11, and 19) hr 0.14
min 8.2

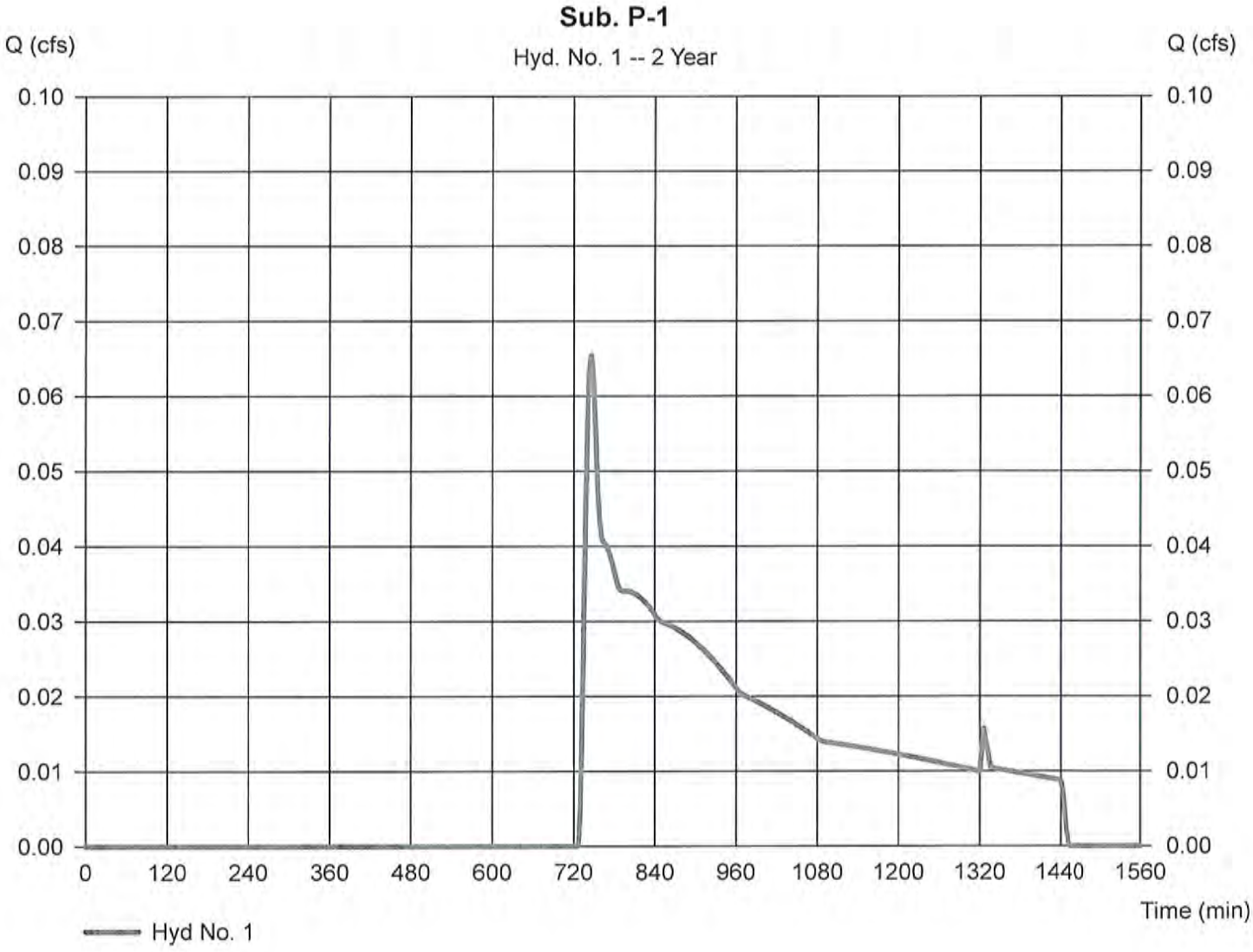
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 1

Sub. P-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.065 cfs
Storm frequency	= 2 yrs	Time to peak	= 746 min
Time interval	= 2 min	Hyd. volume	= 824 cuft
Drainage area	= 1.370 ac	Curve number	= 52.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.20 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



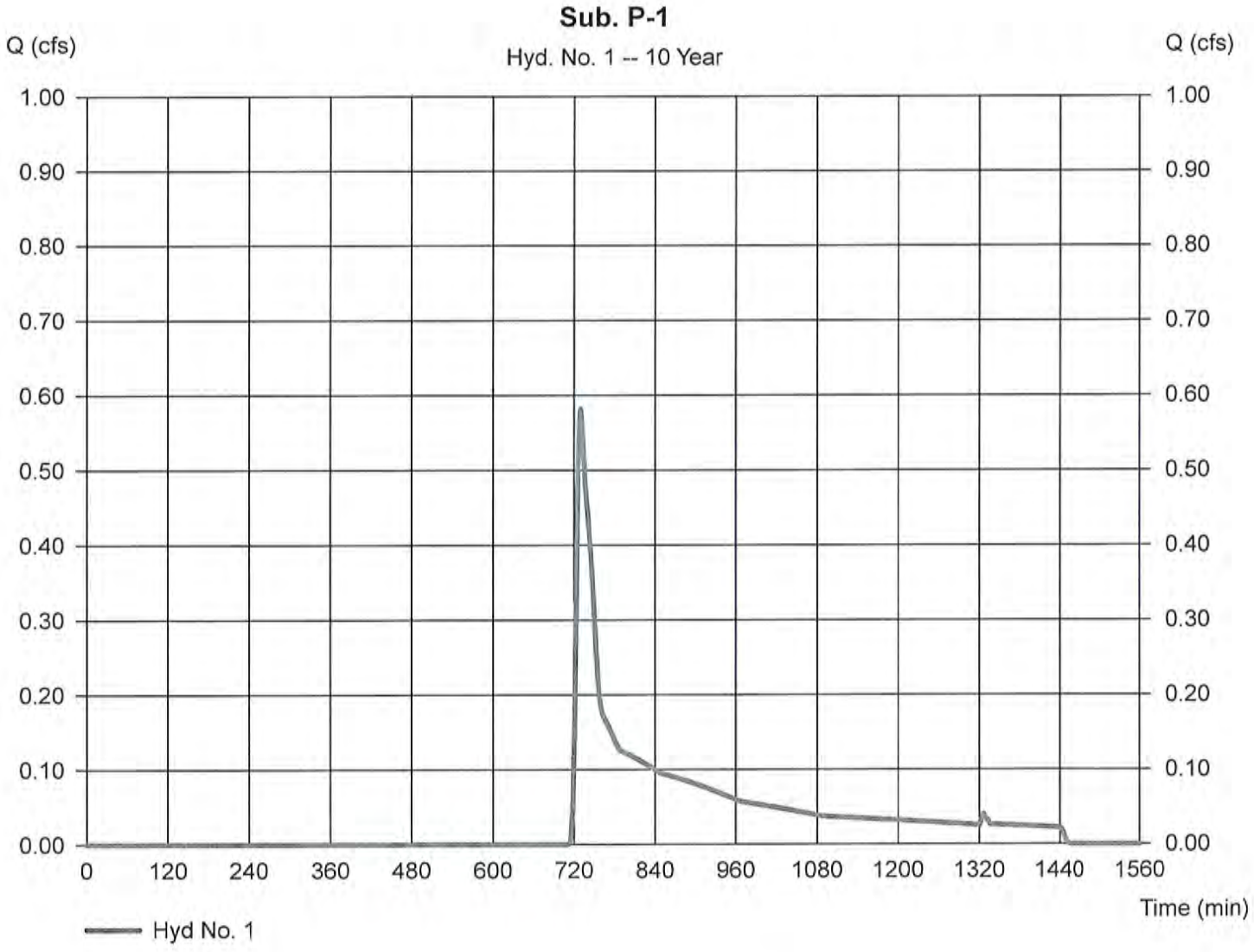
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 1

Sub. P-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.581 cfs
Storm frequency	= 10 yrs	Time to peak	= 730 min
Time interval	= 2 min	Hyd. volume	= 3,115 cuft
Drainage area	= 1.370 ac	Curve number	= 52.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.20 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



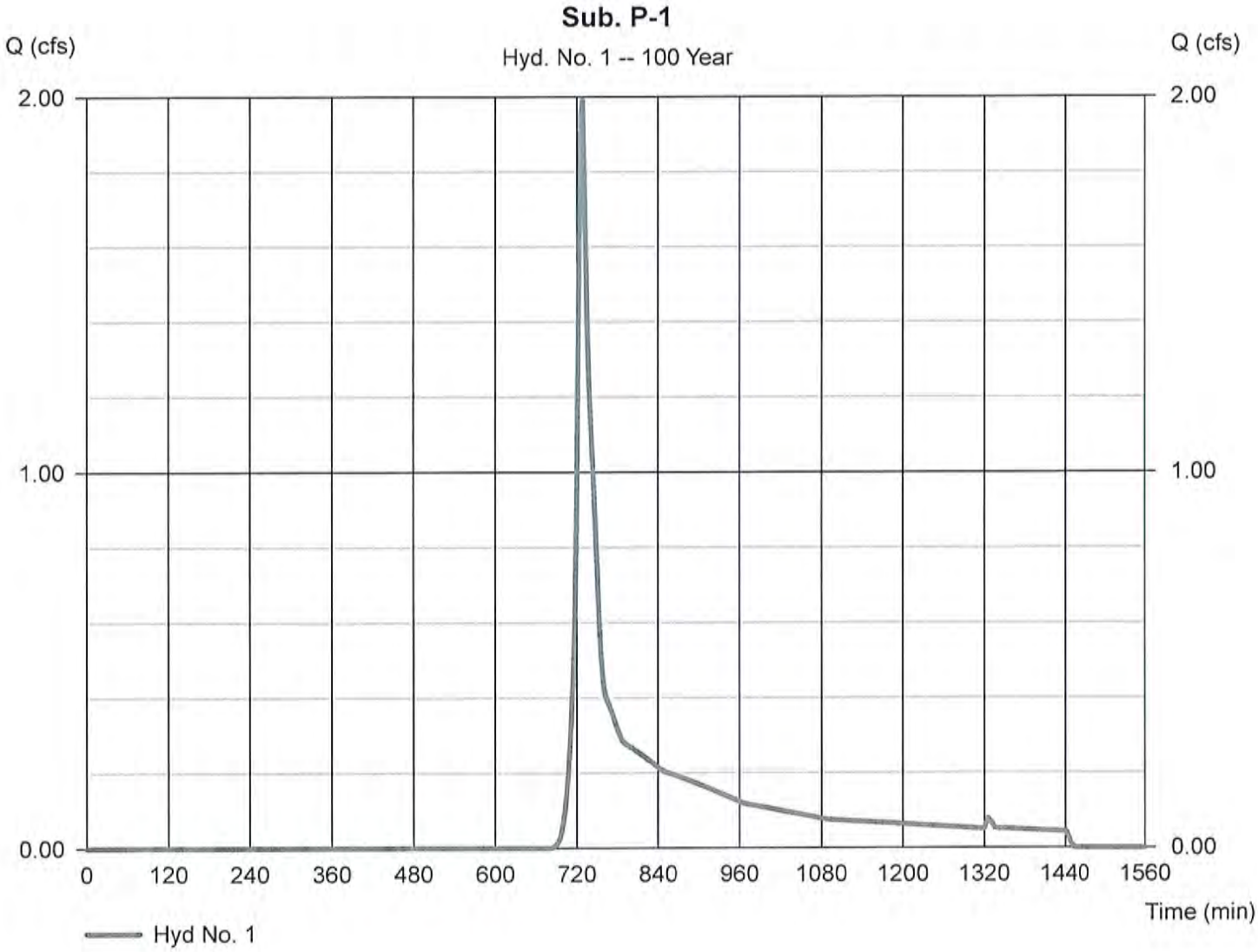
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 1

Sub. P-1

Hydrograph type	= SCS Runoff	Peak discharge	= 1.991 cfs
Storm frequency	= 100 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 7,765 cuft
Drainage area	= 1.370 ac	Curve number	= 52.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.20 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Worksheet 2: Runoff curve number and runoff SM-5443

Project: 37 Mohegan Road By WJH Date 3/22/2016

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] Post Runoff to CB-1

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
-	Impervious-Pavement	98			0.10	9.39
A	Open Space - Good Condition	39			0.19	7.31
Totals =					0.28	16.71

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{16.71}{0.28} = 58.95$; Use CN = [59.0]

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.....	yr	2	10	100
Rainfall, P (24-hour).....	in	3.1	4.5	6.4
Runoff, Q..... (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	0.34	0.96	2.09
Runoff, Q.....	cf	346	987	2155

(210-VI-TR-55, Second Ed., June 1986)

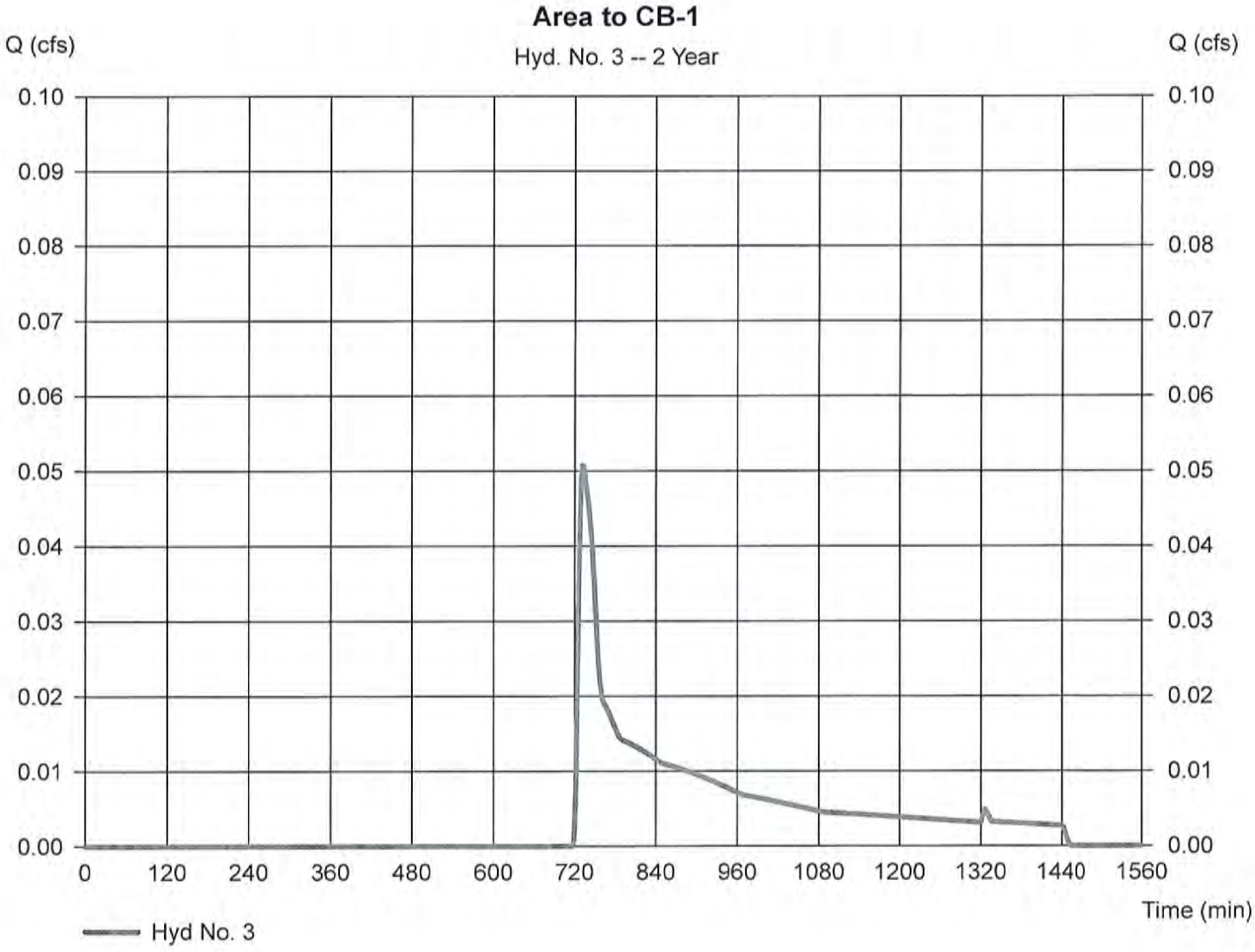
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 3

Area to CB-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.051 cfs
Storm frequency	= 2 yrs	Time to peak	= 732 min
Time interval	= 2 min	Hyd. volume	= 343 cuft
Drainage area	= 0.280 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.20 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



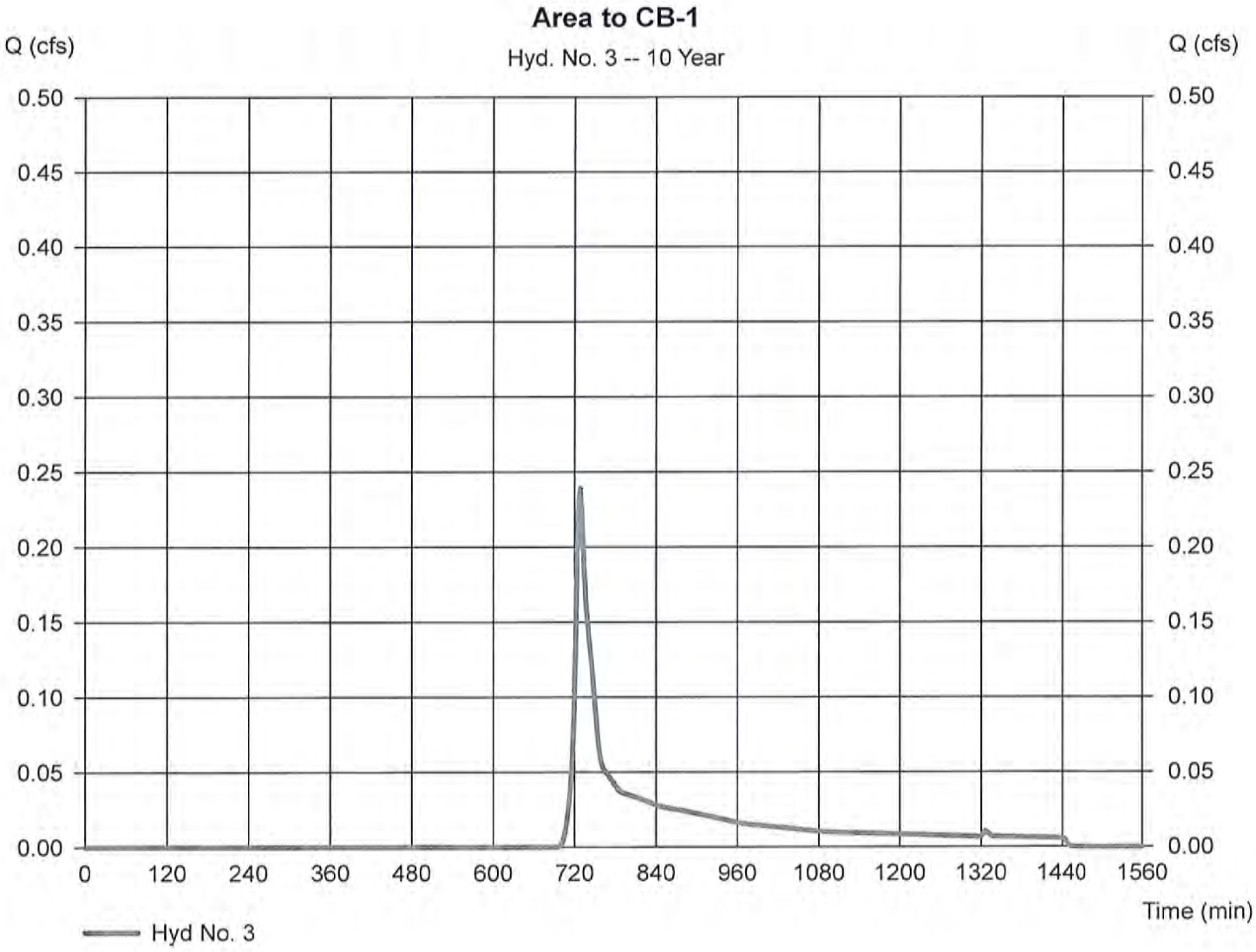
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 3

Area to CB-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.239 cfs
Storm frequency	= 10 yrs	Time to peak	= 728 min
Time interval	= 2 min	Hyd. volume	= 977 cuft
Drainage area	= 0.280 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.20 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



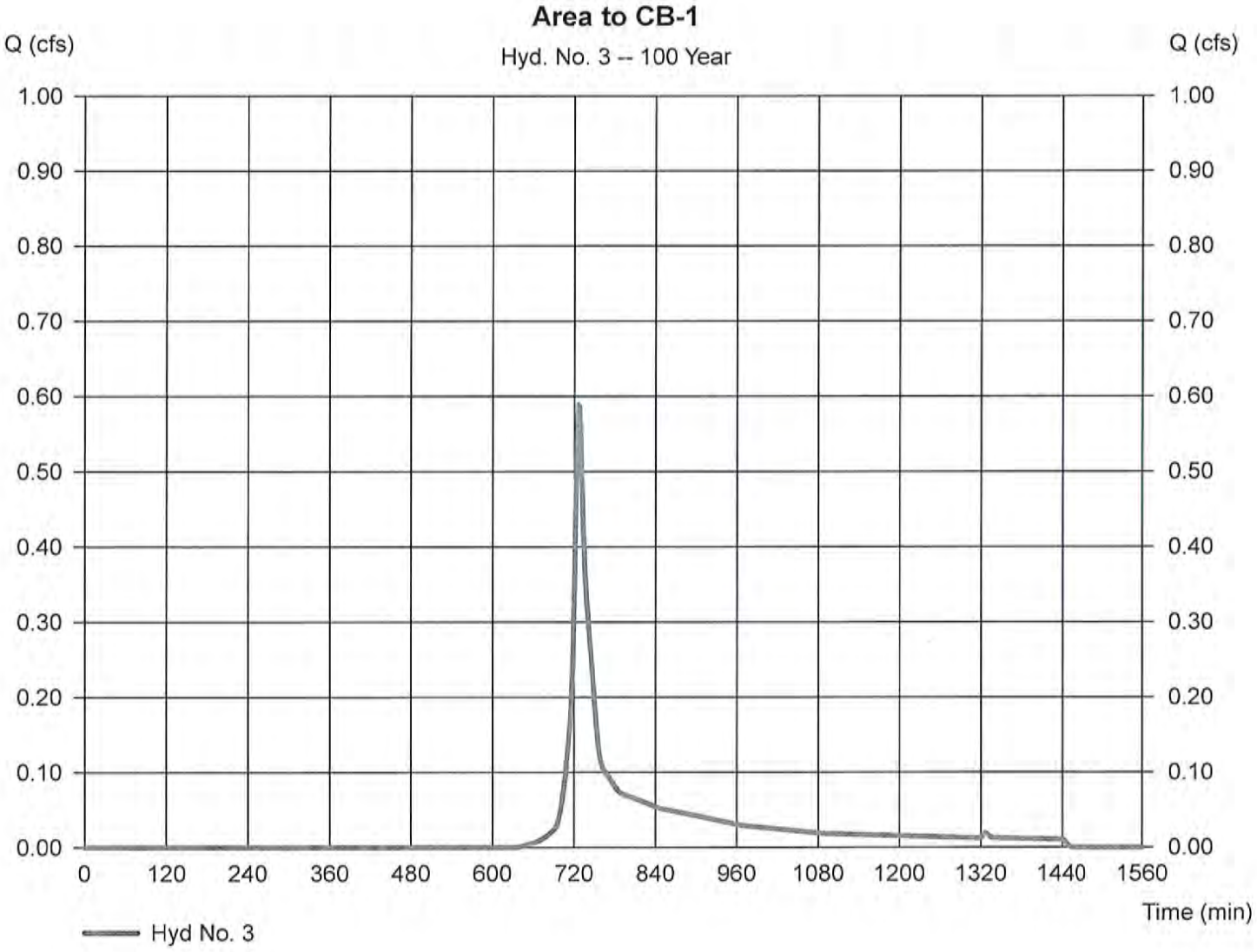
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 3

Area to CB-1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.588 cfs
Storm frequency	= 100 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 2,133 cuft
Drainage area	= 0.280 ac	Curve number	= 59
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 8.20 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

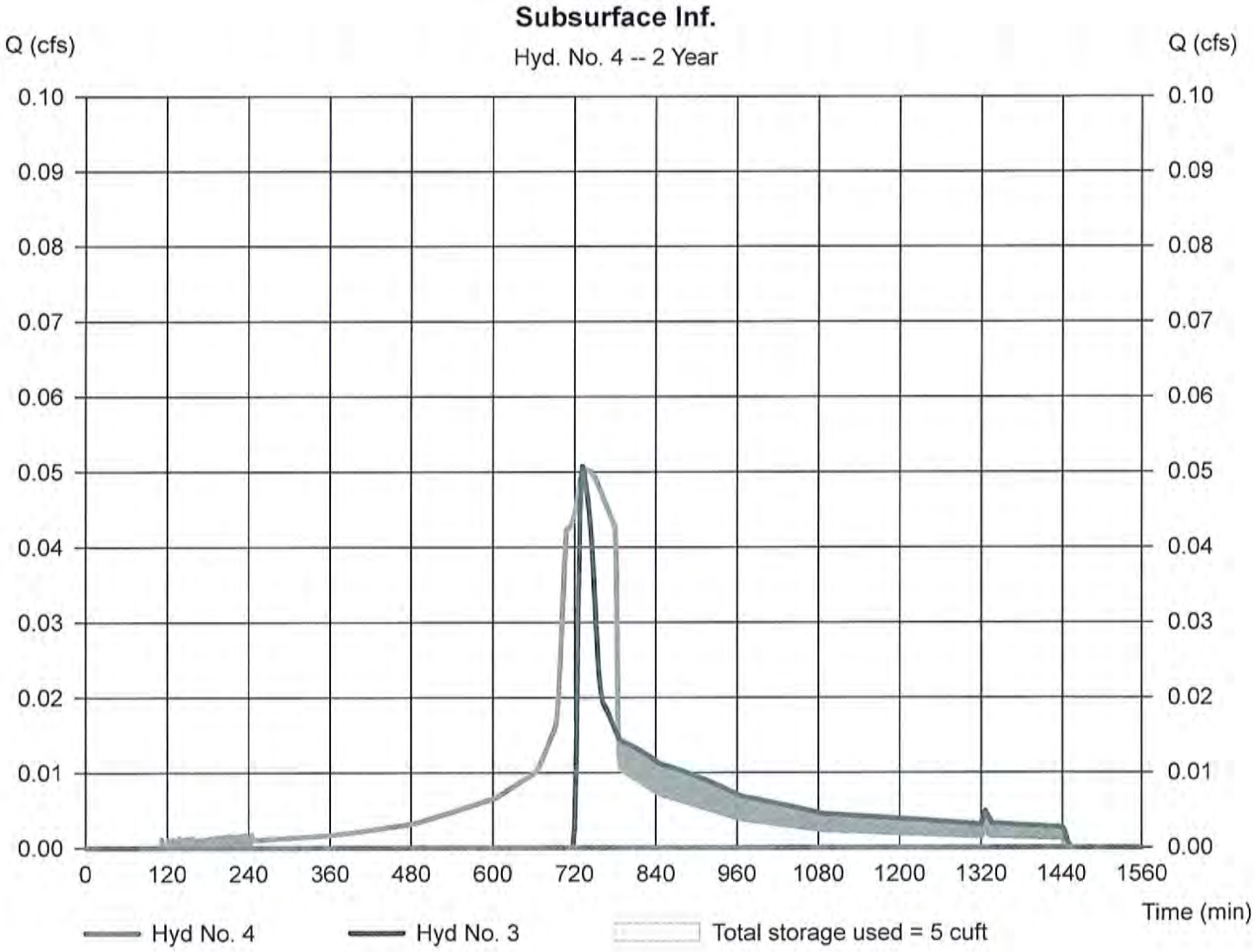
Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 4

Subsurface Inf.

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 784 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Area to CB-1	Max. Elevation	= 215.01 ft
Reservoir name	= Subsurface Infiltration	Max. Storage	= 5 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

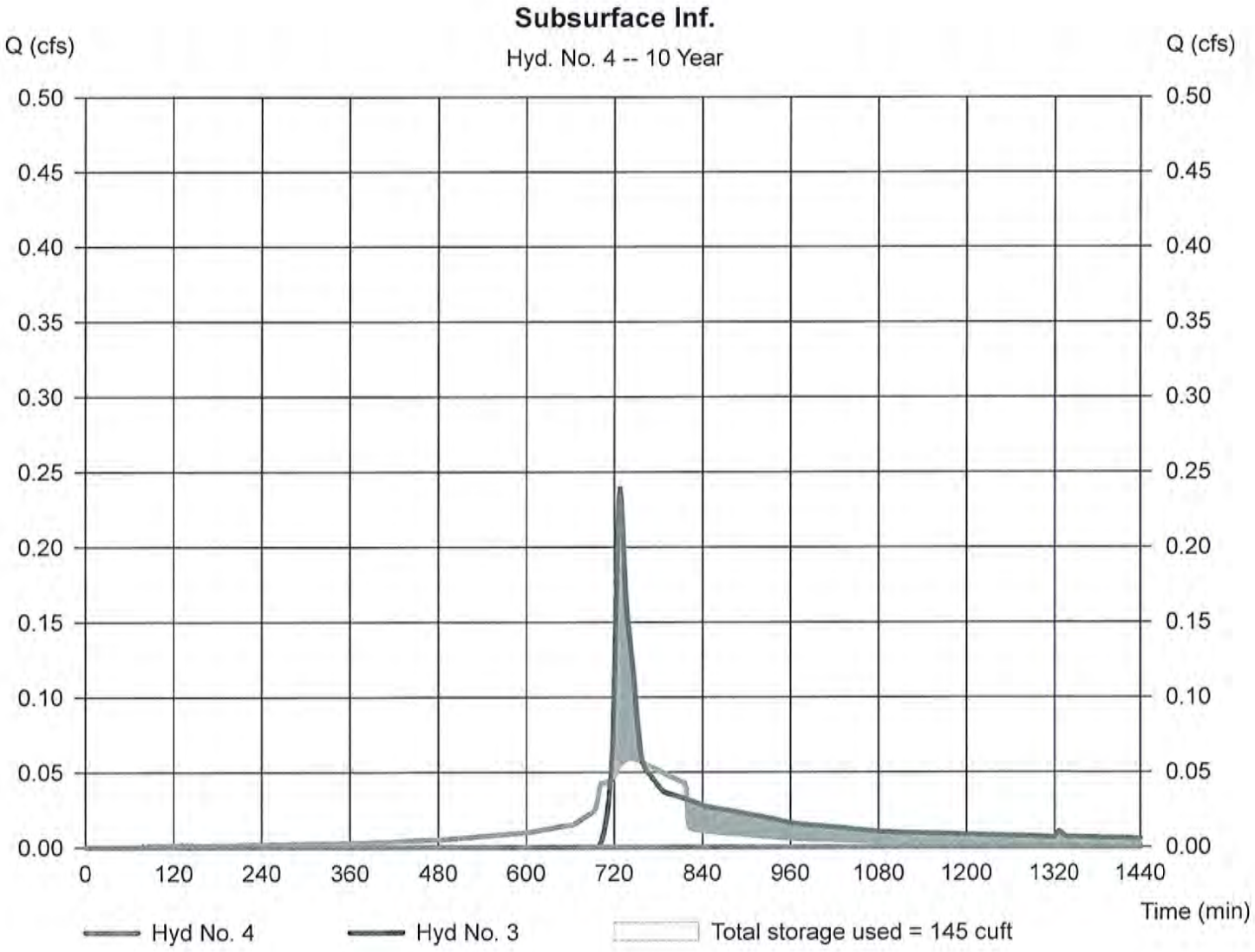
Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 4

Subsurface Inf.

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 830 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Area to CB-1	Max. Elevation	= 215.43 ft
Reservoir name	= Subsurface Infiltration	Max. Storage	= 145 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

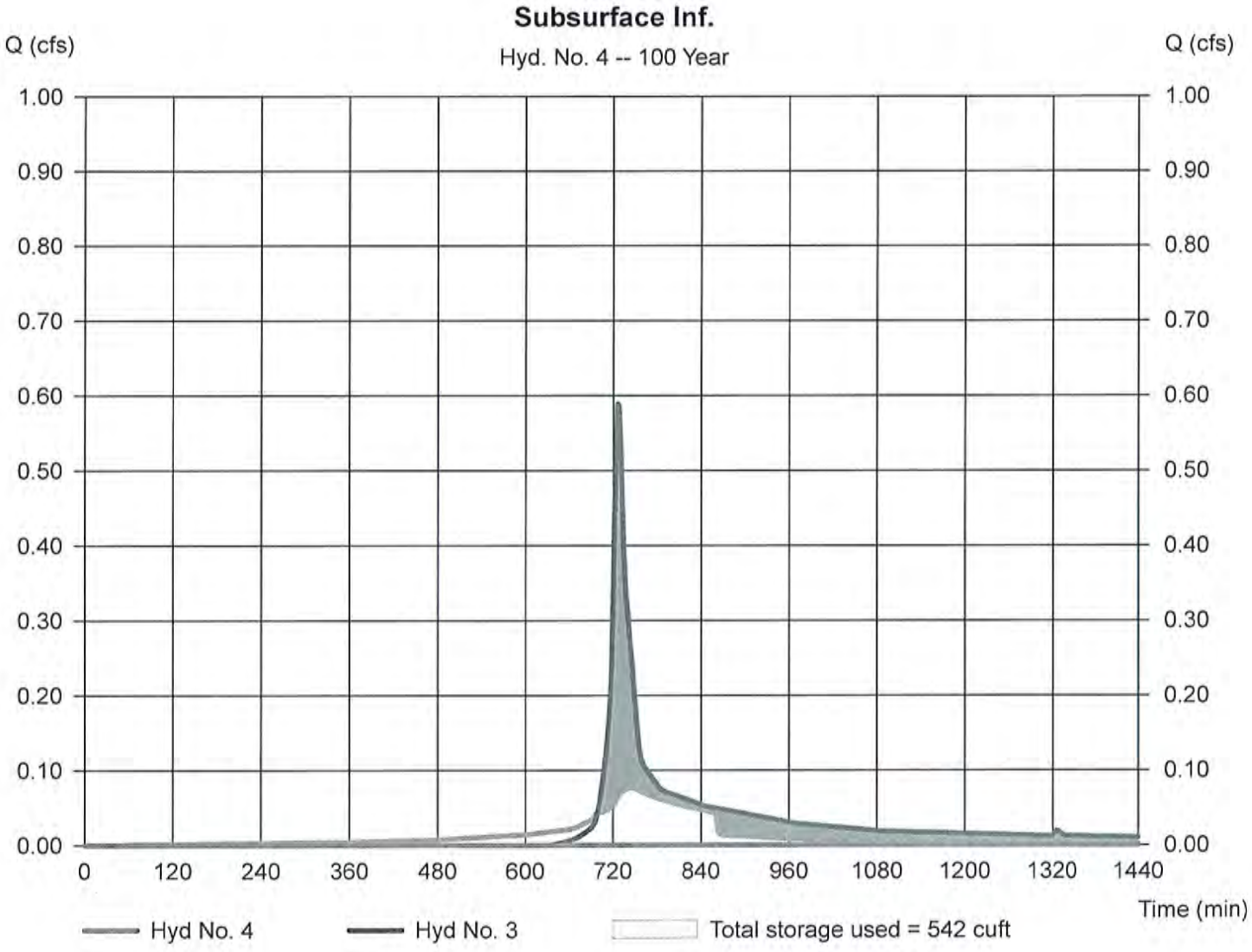
Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 4

Subsurface Inf.

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 696 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Area to CB-1	Max. Elevation	= 217.16 ft
Reservoir name	= Subsurface Infiltration	Max. Storage	= 542 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Pond No. 1 - Subsurface Infiltration

Pond Data

UG Chambers - Invert elev. = 215.00 ft, Rise x Span = 1.33 x 2.83 ft, Barrel Len = 21.36 ft, No. Barrels = 5, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 215.00 ft, Width = 3.83 ft, Height = 2.33 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	215.00	n/a	0	0
0.23	215.23	n/a	80	80
0.47	215.47	n/a	79	159
0.70	215.70	n/a	76	235
0.93	215.93	n/a	71	306
1.17	216.17	n/a	64	370
1.40	216.40	n/a	48	418
1.63	216.63	n/a	38	456
1.86	216.86	n/a	38	495
2.10	217.10	n/a	38	533
2.33	217.33	n/a	38	571

Culvert / Orifice Structures

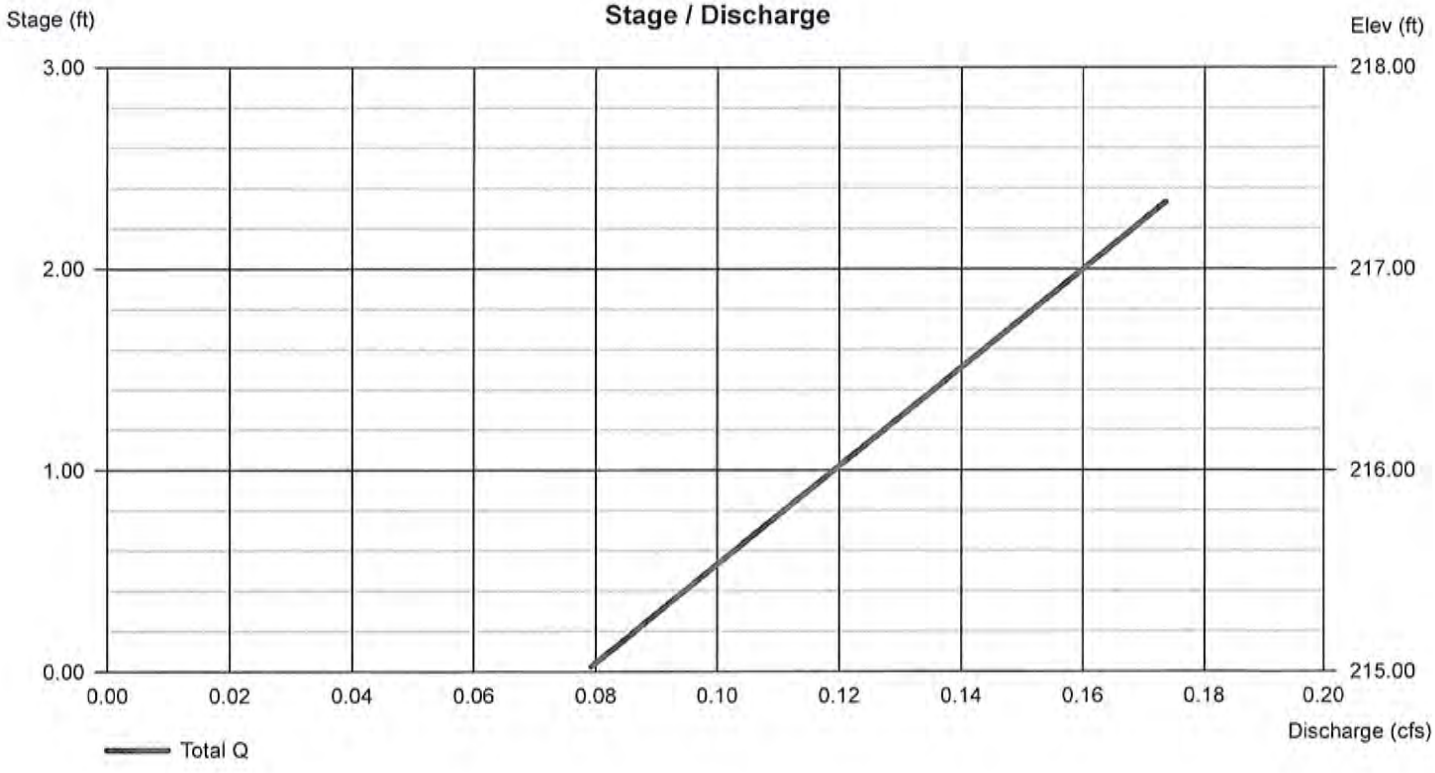
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Worksheet 2: Runoff curve number and runoff SM-5443

Project: 37 Mohegan Road By WJH Date 3/22/2016

Location: Acton, MA Checked ______ Date ______

Circle one: Present [Developed] Lot 1 Roof Runoff

1. Runoff curve number (CN)

Soil name and hydrologic group (appendix A)	Cover description (cover type, treatment, and hydrologic condition: percent impervious: unconnected/connected impervious area ratio)	CN 1/			Area	Product of CN x Area
		Table 2-2	Fig. 2-3	Fig. 2-4	Acres	
-	Impervious-Roof	98			0.05	5.37
				Totals =	0.05	5.37

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}}$ = $\frac{5.37}{0.05}$ = 98.00 ; Use CN = 98.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency.......................................	yr	2	10	100
Rainfall, P (24-hour)........................	in	3.1	4.5	6.4
Runoff, Q.. (Use P and CN with table 2-1, fig. 2-1,) or eqs. 2-3 and 2-4.)	in	2.87	4.26	6.16
Runoff, Q..	cf	570	848	1225

(210-VI-TR-55, Second Ed., June 1986)

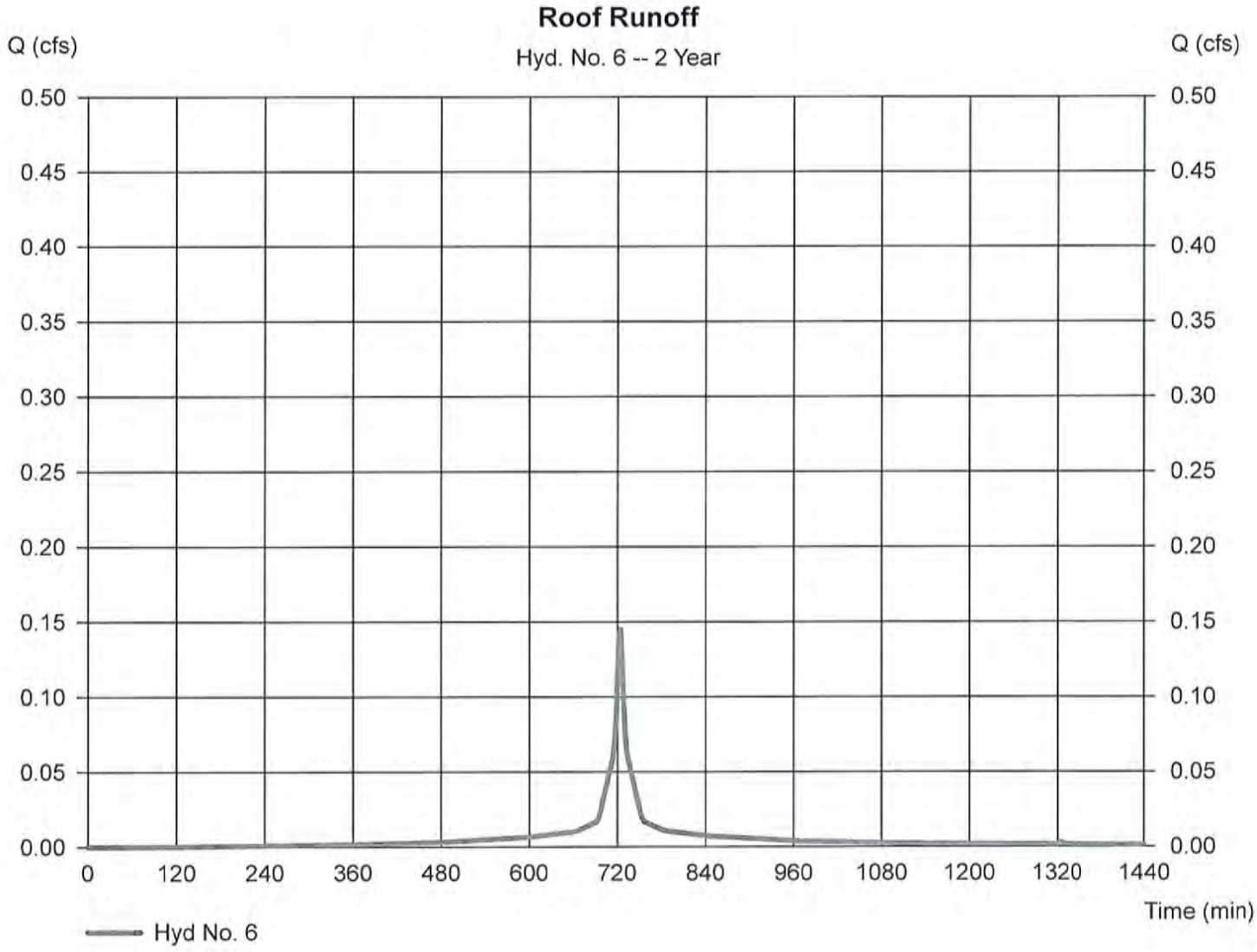
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 6

Roof Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 0.145 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 488 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 3.10 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



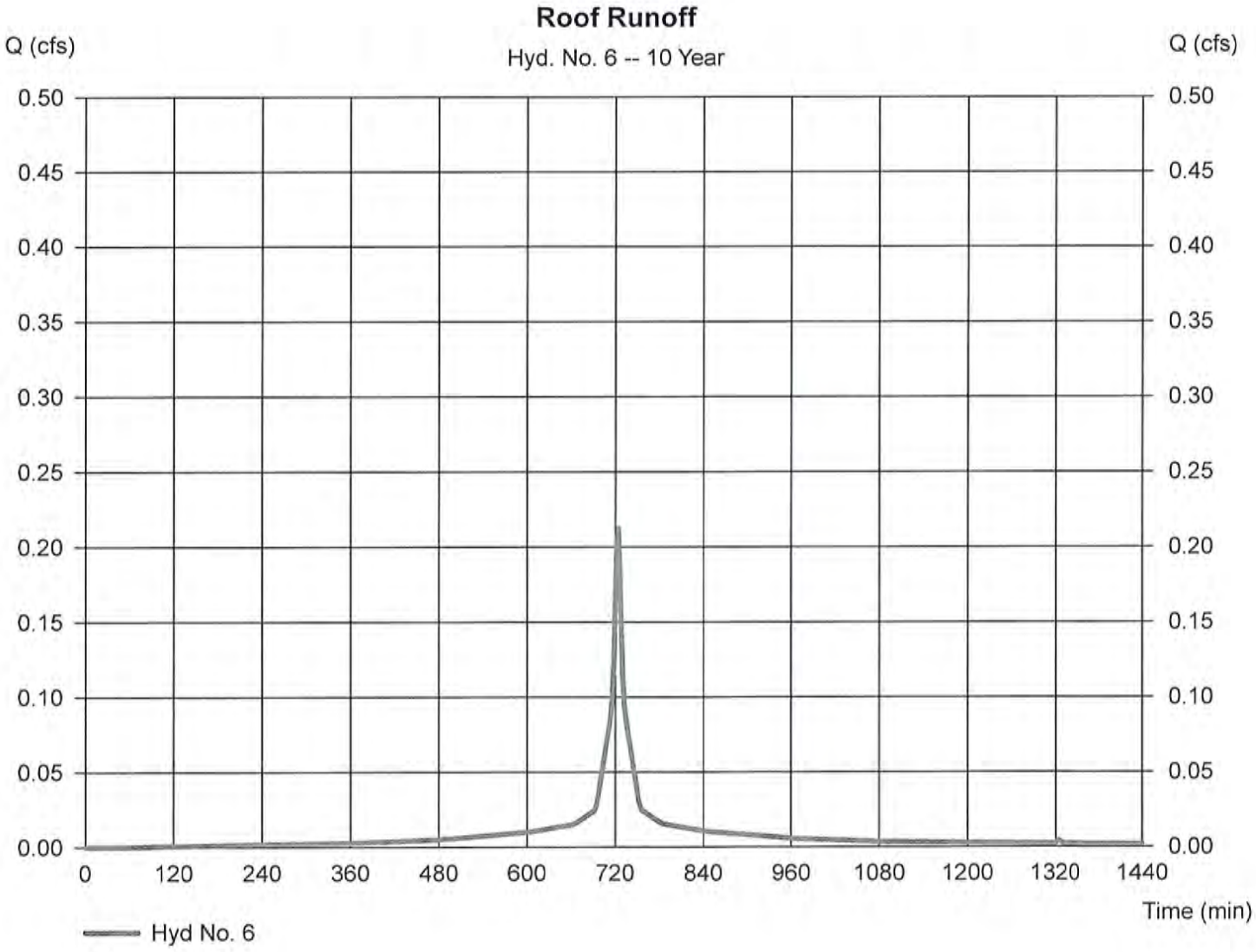
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 6

Roof Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 0.212 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 726 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 4.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



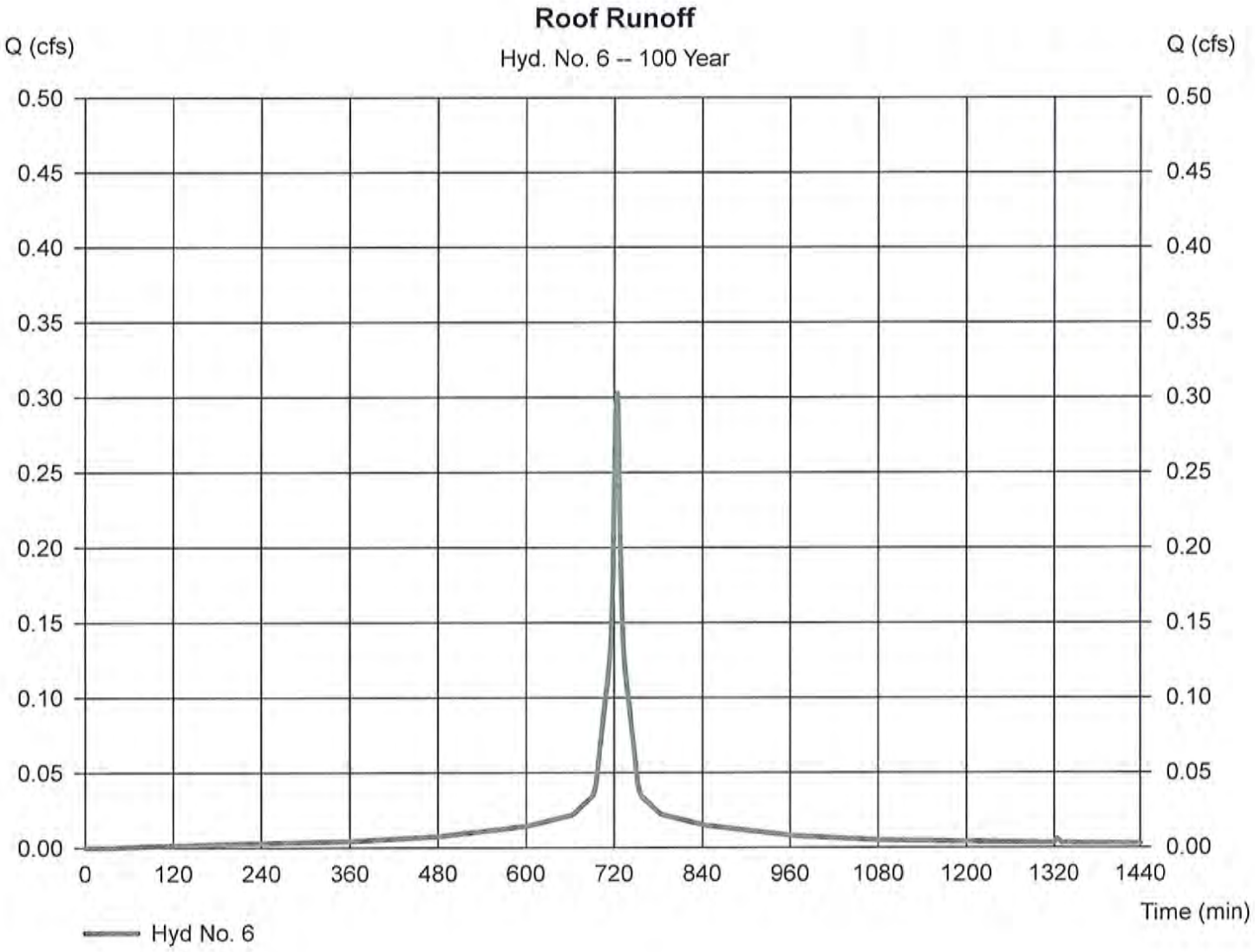
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 6

Roof Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 0.302 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,048 cuft
Drainage area	= 0.050 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.40 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

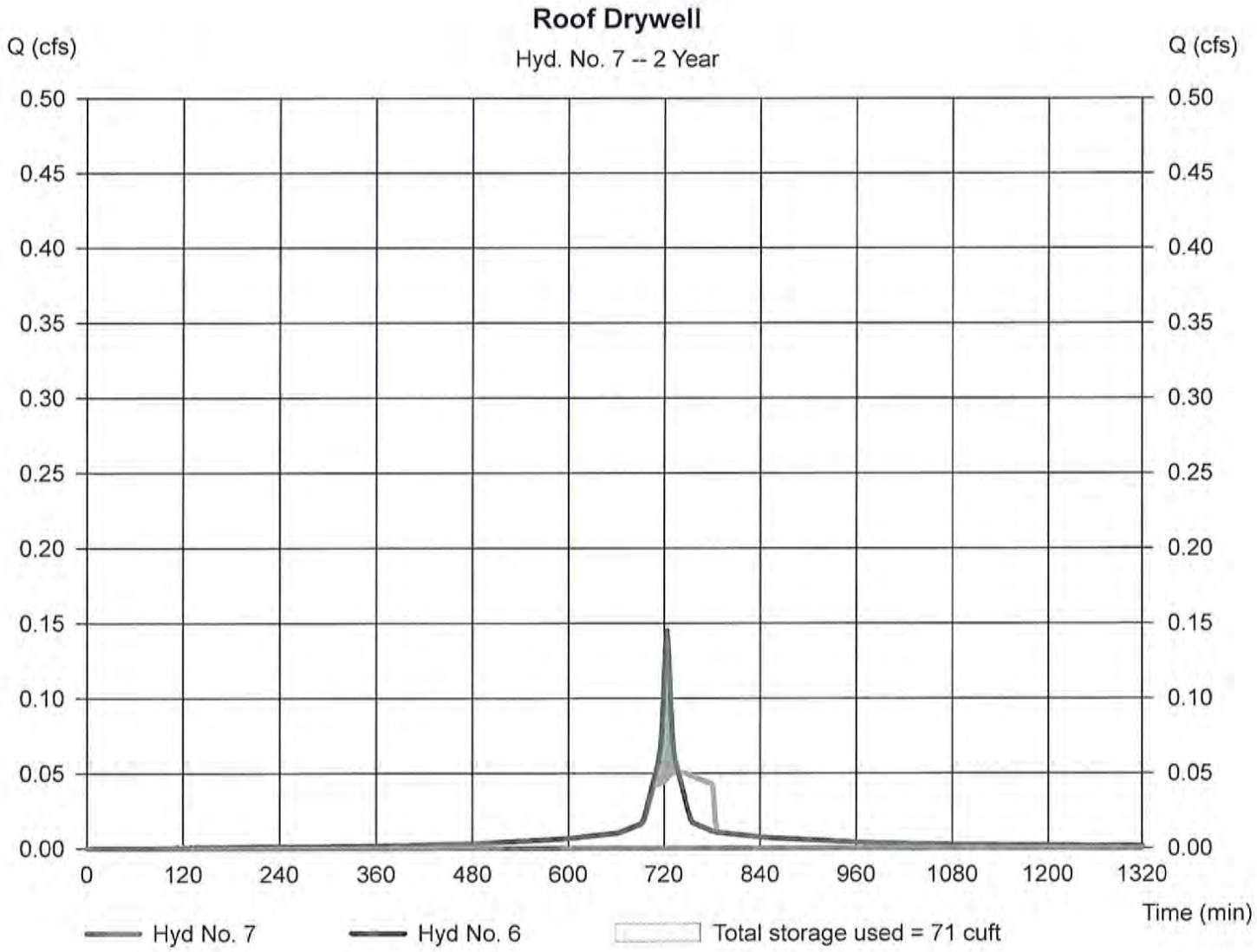
Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 7

Roof Drywell

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 686 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 6 - Roof Runoff	Max. Elevation	= 215.39 ft
Reservoir name	= Roof Drywell	Max. Storage	= 71 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

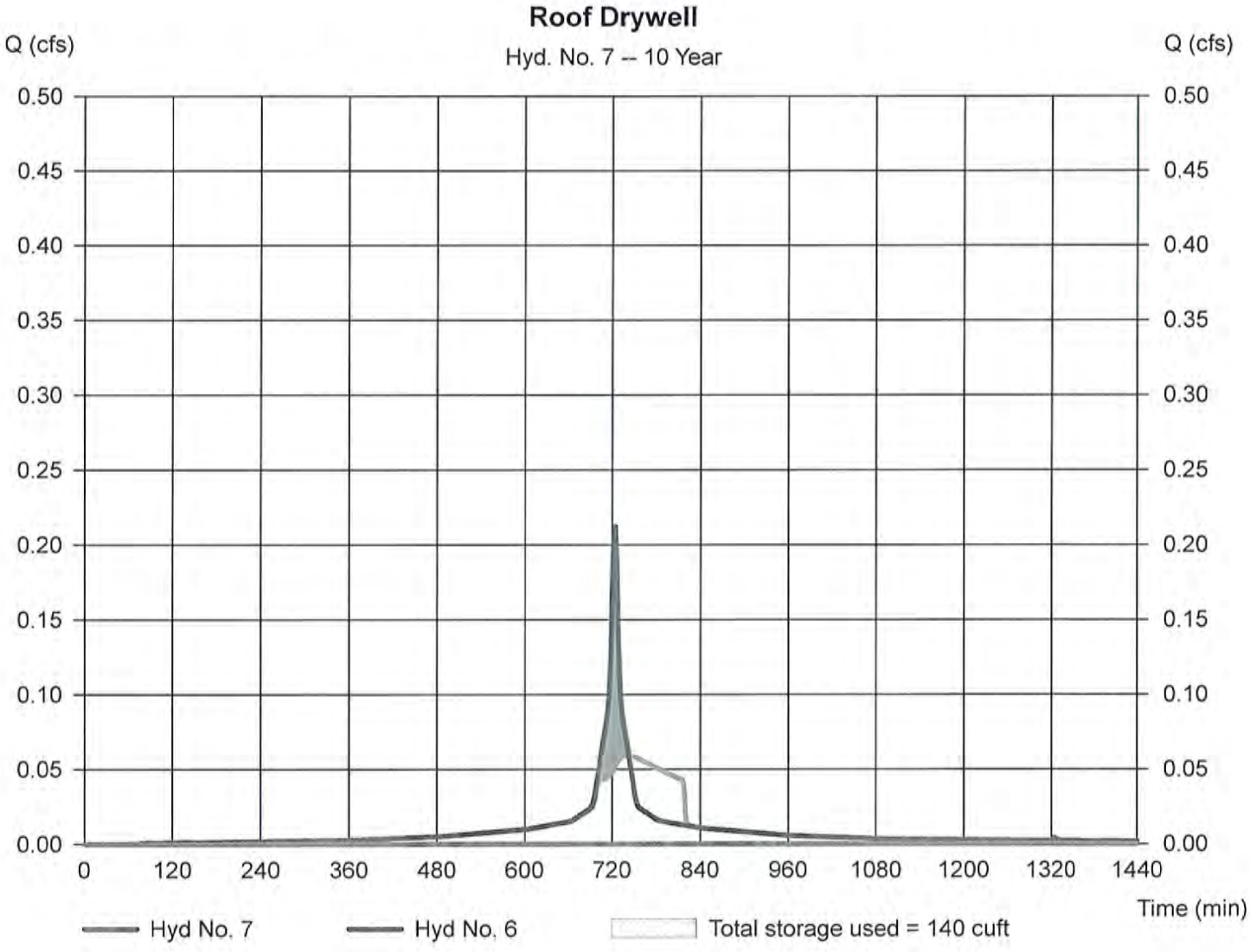
Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 7

Roof Drywell

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 696 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 6 - Roof Runoff	Max. Elevation	= 215.79 ft
Reservoir name	= Roof Drywell	Max. Storage	= 140 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

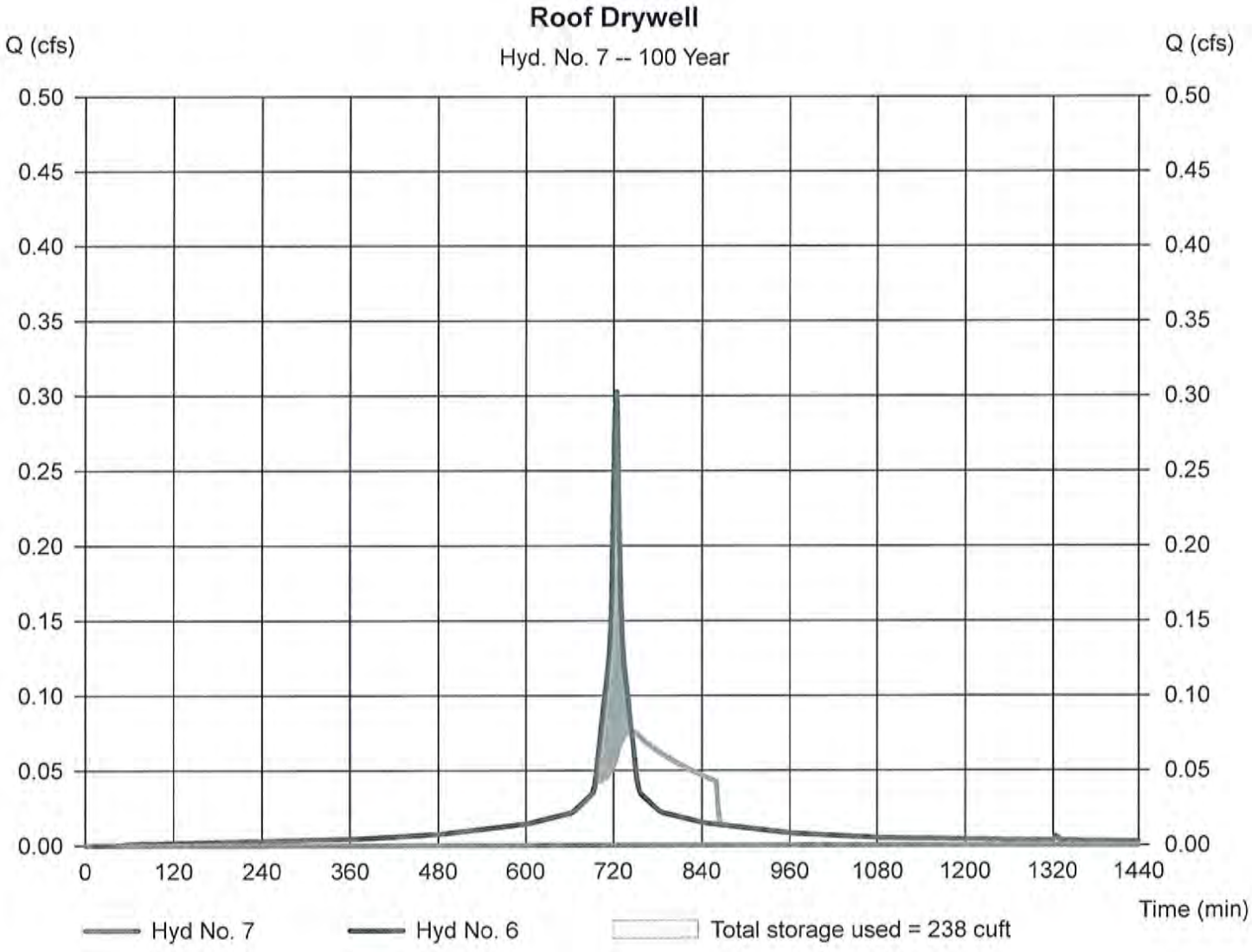
Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Hyd. No. 7

Roof Drywell

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 1210 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 6 - Roof Runoff	Max. Elevation	= 216.57 ft
Reservoir name	= Roof Drywell	Max. Storage	= 238 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Mar 28, 2016

Pond No. 2 - Roof Drywell

Pond Data

UG Chambers - Invert elev. = 215.00 ft, Rise x Span = 1.33 x 2.83 ft, Barrel Len = 28.48 ft, No. Barrels = 2, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 215.00 ft, Width = 3.83 ft, Height = 2.33 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	215.00	n/a	0	0
0.23	215.23	n/a	43	43
0.47	215.47	n/a	42	85
0.70	215.70	n/a	41	125
0.93	215.93	n/a	38	163
1.17	216.17	n/a	34	198
1.40	216.40	n/a	26	223
1.63	216.63	n/a	20	243
1.86	216.86	n/a	20	264
2.10	217.10	n/a	20	284
2.33	217.33	n/a	20	304

Culvert / Orifice Structures

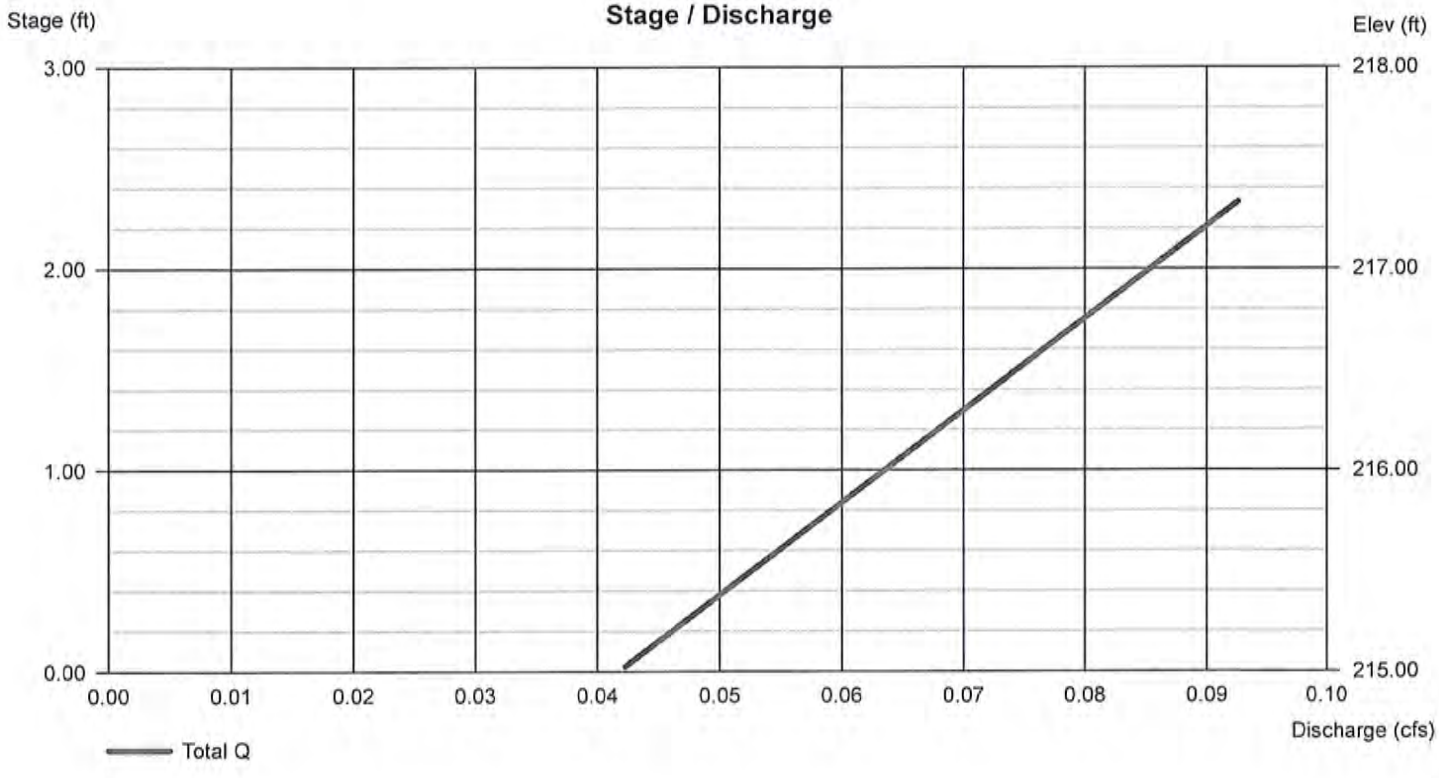
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 8.270 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Recharge Volume Calculations

Recharge Volume Calculations

Job: SM-5443

Calculated by: WJH
Date: 3/22/2016

Subsurface Infiltration Structure 1

Soils: Narragansett Silt Loam
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.10 acres
4,175 s.f.

Required Recharge Volume (Rv)

$$Rv = 4{,}175 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{209} \text{ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)

D (depth of infiltration facility):	2.33	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
T (time):	2	hours
Min. Area=	11	s.f.
Min. Volume= AxD=	26	C.F.
Bottom Area=	471	s.f.
# of Units=	15	
Volume Per Unit=	14.7	C.F.
Volume=	571	c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.64 Hours
0.64 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-5443

Calculated by: WJH
Date: 3/22/2016

Roof Drywell

Soils: Narragansett Silt Loam
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.05 acres
2,386 s.f.

Required Recharge Volume (Rv)

$$Rv = 2{,}386 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{119} \text{ c.f.}$$

Simple Dynamic Method
A=Rv / (D+KT)

D (depth of infiltration facility):	2.33	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
T (time):	2	hours
Min. Area=	6	s.f.
Min. Volume= AxD=	15	C.F.
Bottom Area=	264	s.f.
# of Units=	8	
Volume Per Unit=	14.7	C.F.
Volume=	317	c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.66 Hours

0.66 < 72 hours O.K.

Capture Area Adjustment Calculations

Job: SM-5443

Calculated by: WJH

Date: 3/22/2016

$$\text{Capture Area Adjustment} = \frac{\text{Total Impervious Area}}{\text{Impervious Area Directed to BMP's}}$$

Capture Area Adjustment= 3.1

Adjusted Required Recharge Volume= **649 CF**

Infiltration Structure 1 Volume= 571 CF

Roof Drywell Volume= 317 CF

Total Recharge Volume Provided= **888 CF OK**

First Flush Volume Calculations

Technical Submission for

37 Mohegan Road

Acton, MA

Prepared by
Hydroworks, LLC

3/28/2016

The water leaving the inner chamber continues into the middle chamber, again at a tangent to the wall of the structure. The water is then conveyed through an outlet baffle wall (high and low baffle). This enhances the collection of any floatables or solids not removed by the inner chamber. Water flowing through the baffles then enters the outlet chamber and is discharged into the downstream storm drain.

During high flows, the flow rate entering the inner chamber is restricted by the size of the inlet opening to the inner chamber. This restriction of flow rate into the inner chamber prevents scour and re-suspension of solids from the inner chamber during periods of high flow. This is important since fines, which are typically considered highly polluted, are conveyed during low/normal flows. The excess flow is conveyed directly into the middle chamber where it receives treatment for floatables and larger solids/debris via the baffle system. This treatment of the higher flow rates is important since trash and heavier solids are typically conveyed during periods of higher flow rates. Hydroguard is revolutionary since it incorporates low and high flow treatment in one device while maintaining separate low and high flow paths to prevent the scour and re-suspension of fines.

Figure 2 is a profile view of Hydroguard showing the flow patterns for low and high flows.

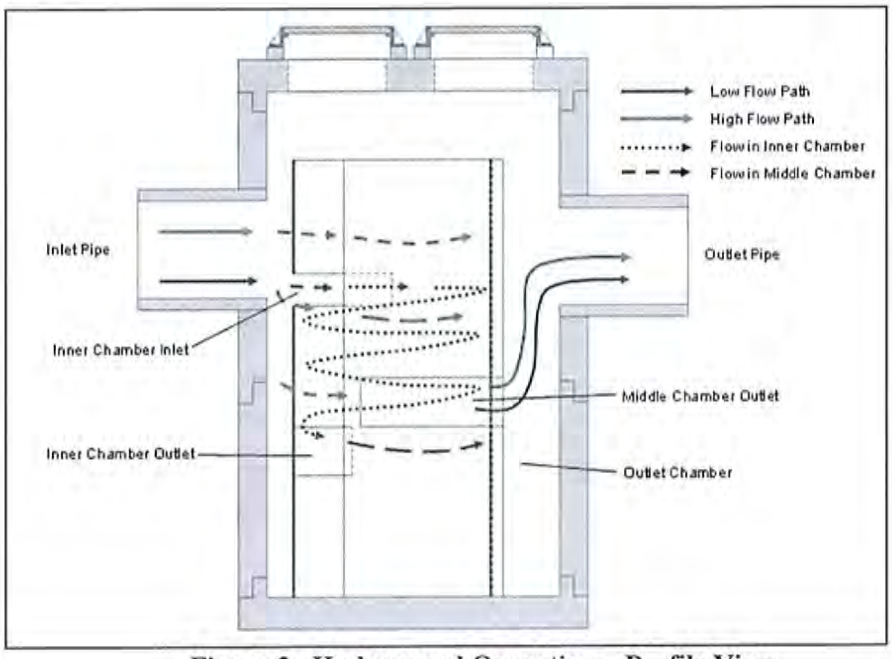


Figure 2. Hydroguard Operation – Profile View

The HG 4i is an inlet version of the HG 4 separator. There is a catch-basin grate on top of the HG 4i. Water flows directly into the inner chamber of the HG 4i through the catch-basin grate on top of the structure. The grate is oversized to allow maintenance of the entire structure. A funnel that sits under the grate on the frame directs the water into the inner chamber during normal flows and the middle chamber during high flows. Figure 3 shows the flow paths for the HG 4i separator.

The inlet funnel is sloped towards the corner inlet and hence the wall of the inner chamber. Water moves in a circular direction in the inner chamber since water enters tangentially along the wall of the inner chamber due to the sloping funnel.

Hydroworks HG Separator Dimensions and Capacities

The HG separator is manufactured in a variety of sizes from 4 ft inside diameter to 12 ft inside diameter as shown in Table 1. Larger sizes may not be available in all areas. Please check with Hydroworks to ensure availability of the larger model sizes.

Table 1. Hydroworks HG Separator Dimensions*

Model	Structure Inside Diam. (SID) (ft)	Inner Chamber (ICID) Diam. (in)	Structure Depth (ft)	Sediment/ Sinking Trash Volume (ft3)	Oil/Floating Trash Volume (ft3) [gal]	Permanent Pool Wet Volume (gal)
HG 4	4	1.1	5	35	10 [75]	470
HG 5	5	1.7	5.5	60	15 [140]	805
HG 6	6	2.6	6	90	25 [200]	1265
HG 7	7	3.6	6.5	125	40 [330]	1870
HG 8	8	4.9	7.0	175	55 [430]	2630
HG 10	10	8.2	9.0	310	145 [1115]	5285
HG 12	12	12.5	10.5	505	265 [2000]	8880

*Dimensions and Capacities are minimum values and may vary with project

Table 2 provides the treatment flow rate for each size of Hydroguard based on the NJDEP certified water quality flow rates (NJDEP, 2011). The treatment flow rate is representative of how large an area can be treated with the separator (i.e. a separator with a higher treatment rate can treat a larger drainage area).

Table 2. Water Quality Flow Treatment Rates (cfs)*

Diameter (ft)	Hydroworks Model	HG Treatment Rate (cfs)
4 ft	HG4 /HG4i	0.8
5 ft	HG5	1.25
6 ft	HG6	1.8
7 ft	HG7	2.45
8 ft	HG8	3.2
10 ft	HG10	5.0
12 ft	HG12	7.2

*NJDEP (2011)

Headloss

Any water quality system implemented in a storm drain network will create headloss in the system. In general, depending on the configuration of the by-pass, systems designed to treat high flows or all of

Table 4. Design TSS Particle Size Distribution	
Diameter (μm)	Percentage by Mass (%)
2	5
8	15
30	15
50	10
67	5
100	10
150	15
200	10
250	5
500	5
1000	5

TSS removal calculations in the sizing program are based on the Hydroguard being a completely mixed reactor vessel. The removal calculations solve a first order differential equation for the concentration of solids in the tank at any time. The first order differential equation is for continuity of mass.

$$C'V = QC_i - QC_t - r_cV$$

C' = the change in concentration of solids in the tank with time
Q = flow rate through the tank
C_i = solids concentration in the influent to the tank
C_t = solids concentration in the tank
V = tank volume
r_c = reduction in solids in the tank (laboratory performance or Cheng's equation)

Continuous simulation provides the most accurate way of estimating performance possible since it takes into account:

- The effect of flow rate (detention time) on settling
- Back to back storms
- Pollutant buildup and washoff
- Inter-event settling.

Hydroworks has developed a sizing methodology based on the Peclet Number to estimate TSS removal for particle size distributions that are different from the NJDEP distribution that was tested.

The independent laboratory testing (Alden Research Laboratory, 2008) results for TSS removal for the Hydroguard using the NJDEP particle size distribution is provided in Figure 4.

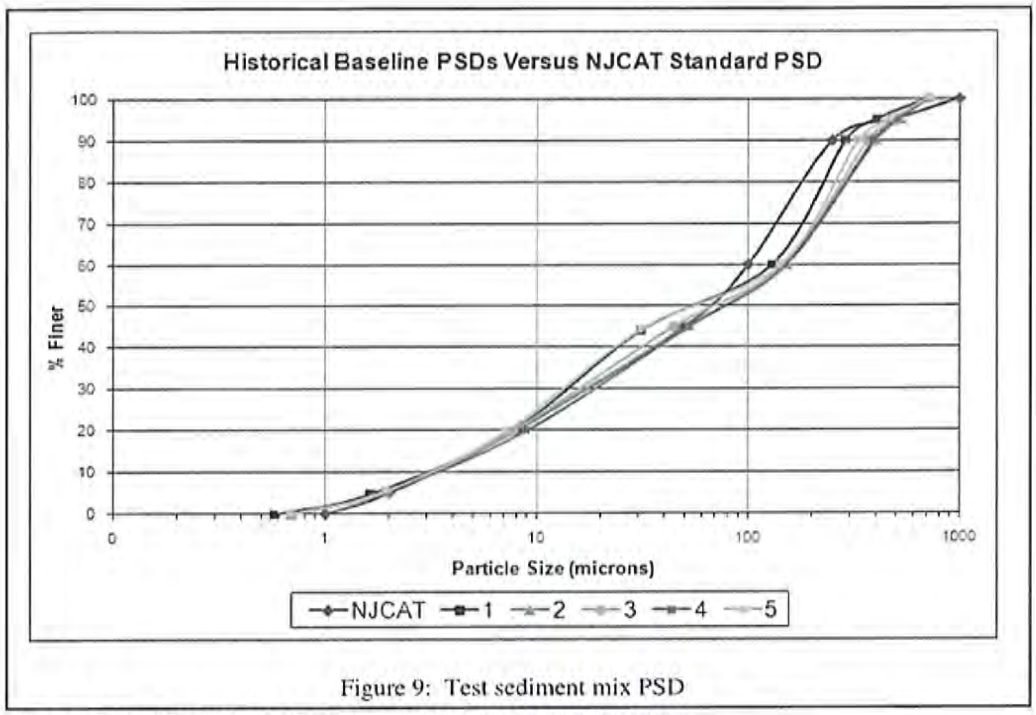


Figure 5. Independent Testing Particle Size Distribution

Hydroworks uses the Peclet Number to calculate TSS removal based on the independent laboratory testing. The Peclet number has been used as a dimensionless scaling number for sediment deposition in lakes (Dhamotharan, et. Al. 1981). Others have suggested its use for scaling of TSS removal results for hydrodynamic separators (Dhanak, 2008, Gulliver, Guo and Wu, 2008).

The Peclet number is the ratio of convection (convective settling) to diffusion (turbulence keeping particles in suspension). The Peclet number (Equation 1) varies with the size of separator, particle size of TSS, and flow rate.

$$Pe = Vs\ h\ d\ /Q \qquad \text{Equation 1}$$

Where Pe = Peclet number
Vs = settling velocity
h = depth of separator sump
d = separator diameter
Q = flow rate

A particle will be removed in the separator if the Peclet number is equal to, or greater than, the Peclet number calculated for removal of that particle based on the independent laboratory results. Based on the NJDEP PSD in Figure 5, the TSS removal in Figure 4 and the dimensions of the tested HG 6, critical Peclet Numbers can be calculated for each particle size in Figure 6 (critical Peclet number is the Peclet Number above which the particle is removed). A critical Peclet Number curve was then developed and input to the model (Figure 6).

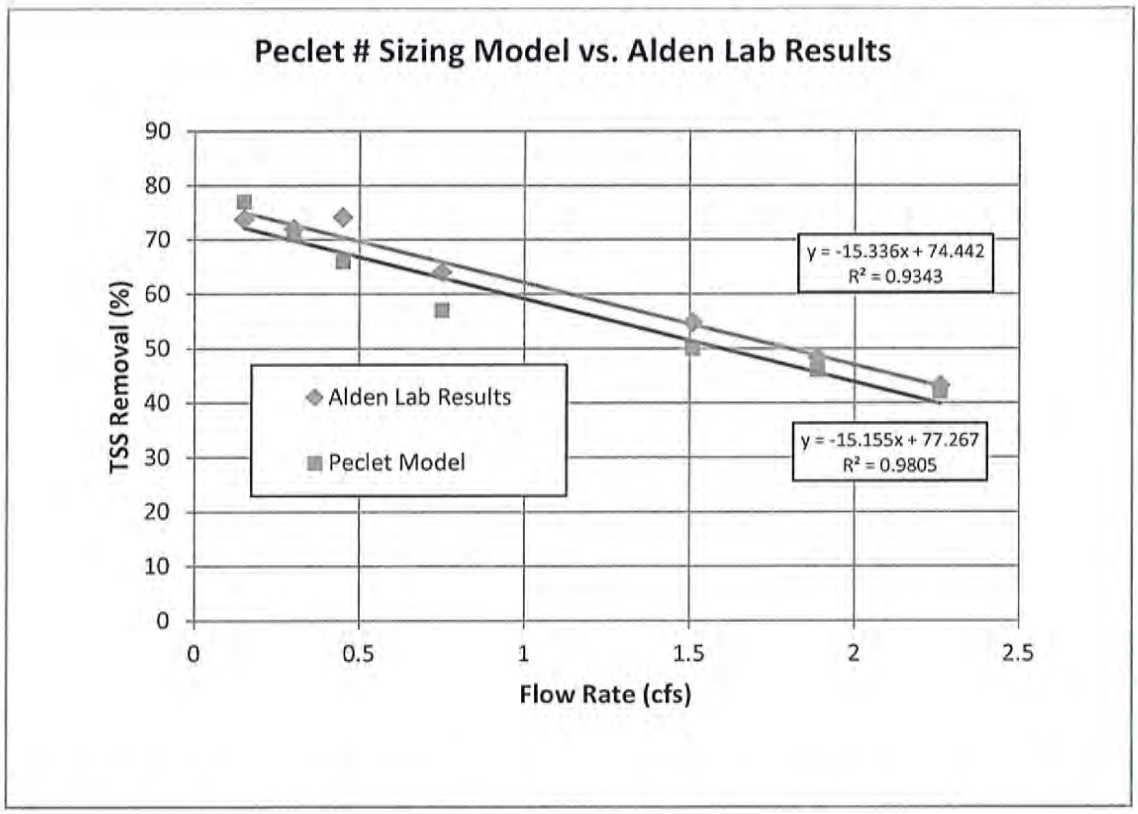


Figure 7. Independent Laboratory TSS Removal Performance versus Peclet Sizing Model

The use of the Peclet Number allows Hydroworks to size the Hydroguard based on any particle size and design storm or local hydrology.

Figure 8 provides the annual estimate of TSS removal based on the particle size distribution given in Table 4, Sterling, MA rainfall, and drainage area and imperviousness given in Table 3. The TSS removal simulation shows that the HG 4 will provide over 80% TSS removal annually.

Hydroguard has been certified by the New Jersey Department of Environmental Protection (NJDEP, 2011)

Hydroguard has been verified by the New Jersey Center for Advanced Technology (NJCAT, 2009).

Hydroworks is on the list of approved stormwater units for NJDEP and MDC.

Hydroworks Hydroguard is approved by the Wisconsin Department of Commerce, Virginia DEQ, and the City of Virginia Beach, and Montgomery County, Maryland.

Hydroguard has been used extensively throughout New England.

Over 2000 Hydroguard separators have been installed in RI, CT, MA, MD, NJ, NY, NH, QC, PA, WI, IA, IL, IN, KY, OH, ON, MN, CO, FL, VA, SC and TX since 2004.

Local Production

Hydroworks units are made at Lamarre Concrete and CSI in Hudson, NH. All of the inserts for New England are made in Andover and Groveland, MA. Accordingly the selection of Hydroworks supports the New England economy.

Summary

The HG4i separator by Hydroworks meets the WQF and TSS removal requirements for this project for Unit 1.

Please do not hesitate to call us at 888-290-7900 if you require clarification or have any questions regarding this submission. Thank you for your time and consideration of this submission.

Commonwealth of Massachusetts
OFFICE OF CONSUMER AFFAIRS AND BUSINESS REGULATION
DIVISION OF PROFESSIONAL LICENSURE
1000 Washington St, Suite 710
Boston, Massachusetts 02118-6100
BOARD OF STATE EXAMINERS OF PLUMBERS AND GASFITTERS

February 9, 2016

Hydroworks, LLC
505 Dorian Rd
Westfield
NJ, 07090 USA

You are hereby advised that on 2/3/2016 the Board took action pursuant to your application(s) for extended Product acceptance for product(s) as indicated on the attached list.

Accepted

The acceptance number(s) displayed have been granted. Please be advised, the product shall be installed in compliance with CMR 248, the Massachusetts Fuel Gas and Plumbing Code. Your extended Product acceptance is in effect for three years beginning 2/3/2016. At the expiration of the extended three year Product acceptance it will be necessary for the manufacturer to petition this Board for an additional three year extended Product acceptance. You are further advised that the preceding accetped Product are not to be construed as an endorsement of these products nor is this letter to be used or reproduced as advertisement of the products.

Tablings

If an extended Product acceptance was Tabled for 'insufficient receipt of (a specified) fee', forward the balance of the fee due directly to the Board Office at the address shown above. Additionally, if this is the only reason for the Tabling decision, you will not be required to appear before the Board again.

If an extended Product acceptance was Tabled due to the absence of a manufacturers representative ('Failure to Appear') as required, call the Board Office at (617) 727-9952 to re-schedule an appearance before the Board. Failure to reschedule within six months of the date of this correspondence will result in the application fee being forfeited and the closing of your file. Note: extended Product-approvals may not require a manufacturers representative to be present at the Board meeting. Please call the Board Office for verification.

If you have any questions regarding the extended Product acceptance decision reached by the Board, please call the Board Office at (617) 727-9952 or email the Board at cynthia.e.johnson@state.ma.us.

Very truly yours,
For the Board

Wayne E. Thomas, Executive Director
Board of State Examiners of Plumbers and Gas Fitters

http://www.mass.gov/dpl/boards/pl/
Forms available at http://www.mass.gov/dpl/boards/pl/forms.htm

UNIVERSITY OF MASSACHUSETTS
AT AMHERST
Water Resources Research Center
Blaisdell House, UMass
310 Hicks Way
Amherst, MA 01003

Massachusetts Stormwater Evaluation Project

(413) 545-5532
(413) 545-2304 FAX
www.mastep.net

MASTEP Technology Review

Technology Name: HydroGuard HG6 Hydrodynamic Separator. Hydroworks, LLC

Studies Reviewed: Verification Testing of the HydroGuard HG6 Hydrodynamic Separator Stormwater Treatment Unit. Mailloux and Humphrey, December 2008.

Date: January 29, 2009

Reviewers: Jerry Schoen

Rating: 2

Brief rationale for rating:

This laboratory study is generally well conducted and documented. Quality control data is lacking.

TARP Requirements Not Met*:

- No documentation of a Quality Assurance Project Plan, no QC data
- Sediment removal efficiency was calculated by modified mass balance method. Although this is an accurate method, TARP specifies use of TSS analysis method.

Other Comments

- Sediment removal efficiency, calculated according to the NJDEP weighted formula, was 60.3%.
- The 100% treatment flow rate for this system is 1.8 CFS.
- Sediment removal was evaluated using modified mass balance method, considered to be a particularly accurate method of evaluating sediment removal in a laboratory setting.
- Particle Size Distribution (with d50 of 70 microns) closely matched the 55% sand, 40% silt, 5% clay mix recommended by NJDEP.
- A full range of flows (25% - 125%) was tested.
- Scour test was performed. Some scour was observed at flows exceeding capacity (effluent concentrations ranged from 14 mg/l when tested with F60 sediment to 42 mg/l when tested with mix similar to NJDEP mix). Given that 75% of material resuspended was < 18 microns and that the smallest particles retained in the system were 26 microns, this test suggests that little scouring of captured materials will occur.

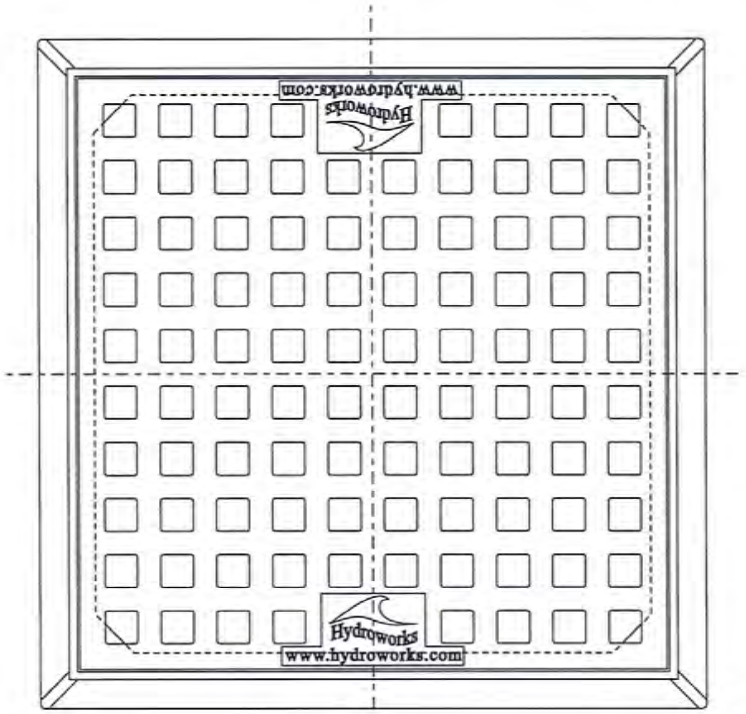
* Criteria also based on NJDEP laboratory testing guidelines.

APPENDIX 2

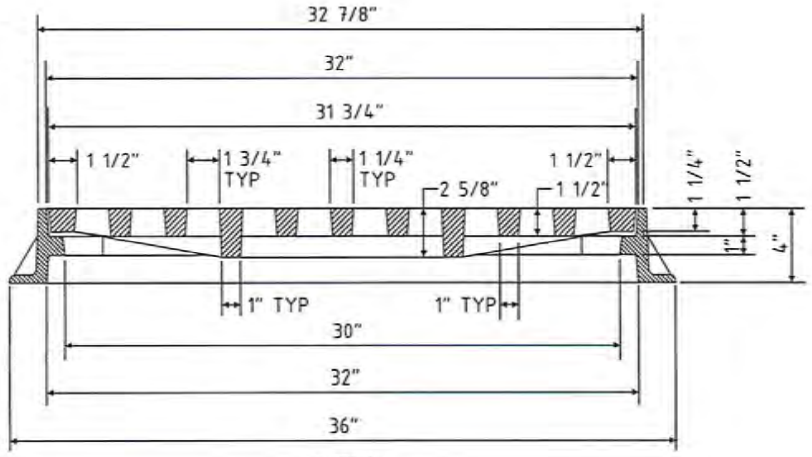
CAD Drawings

Heavy Duty Inlet Frame and Logo Grate

2816

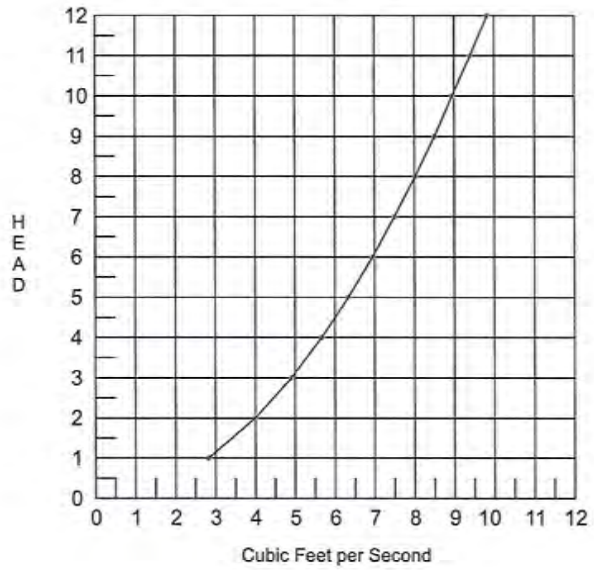


PLAN



SECTION

Rate of Flow



1" Head - 2.83 Cu.Ft. per Sec.
3" Head - 4.91 Cu.Ft. per Sec.
6" Head - 6.95 Cu.Ft. per Sec.
9" Head - 8.51 Cu.Ft. per Sec.
12" Head - 9.83 Cu.Ft. per Sec.

Notes:

1. Material: Gray Cast Iron, ASTM A48-83,Class 30B;
2. Loading HS25 Highway Loading;
3. Grate shall have 96 - 1 3/4" square hole affording a total open area of 294 Sq. In. (2.04 Sq.Ft.);
4. Logo cast on surface of grate, 180° apart;
5. Castings supplied without surface coating.

CAMPBELL FOUNDRY COMPANY
Harrison, N.J. 07029
Phone: 973-483-5480 FAX: 973-483-1843

SCALE:	APPROVED BY:	DRAWN BY: DL
DATE: 02/22/10		REV.:

Heavy Duty Inlet Frame and Logo Grate

Pattern Number: 2816

```
*************************************************
*      Storm Water Management Sizing Model      *
*                Hydroworks, LLC                *
*                 Version 4.1                   *
*                                               *
*        Continuous Simulation Program          *
*              Based on SWMM 4.4H               *
*              Hydroworks, LLC                  *
*               Graham Bryant                   *
*                2003 - 2013                    *
*************************************************

                Developed by

*************************************************
*              Hydroworks, LLC                  *
*            Metcalf & Eddy, Inc.               *
*           University of Florida               *
*       Water Resources Engineers, Inc.         *
*      (Now Camp Dresser & McKee, Inc.)         *
*              Modified SWMM 4.4                *
*************************************************

        Distributed and Maintained by

*************************************************
*                                               *
*                Hydroworks, LLC                *
*                 888-290-7900                  *
*              www.hydroworks.com               *
*                                               *
*************************************************

*************************************************
*     If any problems occur executing this      *
*     model, contact Mr. Graham Bryant at       *
*     Hydroworks, LLC by phone at 908-272-4411  *
*     or by e-mail: support@hydroworks.com      *
*************************************************

*************************************************
*     This model is based on EPA SWMM 4.4       *
*  "Nature is full of infinite causes which     *
*   have never occurred in experience" da Vinci *
*************************************************


*************************************************
* Entry made to the Rain Block                  *
* Created by the University of Florida - 1988   *
* Updated by Oregon State University, March 2000 *
```

```
     Print NCDC special codes in event summary:
     = 0, only on days with events.
     = 1, on all days with codes present.
     Codes: A = accumulated value, I = incomplete value,
            M = missing value,     O = other code present



**********************************************************
*  Precipitation output created using the Rain block   *
*  Number of precipitation stations...       1         *
**********************************************************

Location Station Number
-------- --------------
       1.     8159


STATION ID ON PRECIP. DATA INPUT FILE = 5902
REQUESTED STATION ID =     8159  CHECK TO BE SURE THEY MATCH.


$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$
Note, 15-min. data are being processed, but hourly
print-out, summaries, and statistics are based on
hourly totals only.  Data placed on interface file
are at correct 15-min. intervals.
$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

##################################################
# Entry made to the Runoff Block, last updated by #
# Oregon State University, and Camp, Dresser and  #
# McKee, Inc., March 2002.                        #
##################################################
# "And wherever water goes, amoebae go along for  #
#  the ride"                    Tom Robbins       #
##################################################


                  37 Mohegan (Unit 1)

                  Acton, MA


Snowmelt parameter - ISNOW.....................          0

Number of rain gages - NRGAG...................          1
```

```
**********************************************************
*   Processed Precipitation will be read from file     *
**********************************************************

  ##############################
  #        Data Group F1       #
  # Evaporation Rate (in/day) #
  ##############################

 JAN.  FEB.  MAR.  APR.  MAY   JUN.  JUL.  AUG.  SEP.  OCT.  NOV.  DEC.
 ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----  ----
 0.00  0.00  0.00  0.10  0.10  0.15  0.15  0.15  0.10  0.10  0.00  0.00

♠


**********************************************************
*         C H A N N E L  A N D  P I P E  D A T A        *
**********************************************************

Input   NAMEG:      Drains                              Invert  L Side   R Side  Intial     Max  Mann-    Full
equen  Channel       to      Channel  Width  Length     Slope   Slope    Slope   Depth    Depth   ings    Flow
umber    ID #       NGTO:     Type     (ft)   (ft)     (ft/ft) (ft/ft)  (ft/ft)  (ft)     (ft)    "N"   (cfs)
-----  ------------------ -------- ------ -------   ------- -------- ------- ------- ------- -----  -----
  1        201         200   Dummy     0.0     0.0    0.0000   0.0000  0.0000     0.0     0.0  0.0000 0.00E+00
♠

 ***************************************************
 *         S U B C A T C H M E N T  D A T A        *
 ***************************************************

*NOTE, SEE LATER TABLE FOR OPTIONAL SUBCATCHMENT PARAMETERS*
      SUBCATCH-  CHANNEL      WIDTH    AREA  PERCENT    SLOPE    RESISTANCE  FACTOR    DEPRES. STORAGE(IN) INFILTRATION   DECAY RATE GAGE  MAXIMUM
       MENT NO.  OR INLET      (FT)    (AC)  IMPERV.   (FT/FT)    IMPERV.     PERV.    IMPERV.    PERV.      RATE(IN/HR)     (1/SEC)    NO.  VOLUME
                                                                                                          MAXIMUM MINIMUM                      (INCHES)
 ---  --------   -------- --------- -------  -----   -------    --------  ---------   ------    ------     ----   -------  --------  ------ -------
  1       300        200    108.45     0.27  36.00    0.0200      0.015     0.250     0.020     0.200     2.50    0.40    0.00055     1    4.00000

TOTAL NUMBER OF SUBCATCHMENTS...            1
TOTAL TRIBUTARY AREA (ACRES)....         0.27
IMPERVIOUS AREA (ACRES).........         0.10
PERVIOUS AREA (ACRES)...........         0.17
TOTAL WIDTH (FEET)..............       108.45
PERCENT IMPERVIOUSNESS..........        36.00
♠
**********************************************************
*     G R O U N D W A T E R  I N P U T  D A T A    *
**********************************************************
```

Number of quality constituents.....	NQS.....	1	
Number of land uses.....	JLAND.....	1	
Standard catchbasin volume.....	CBVOL.....	4.00	cubic feet
Erosion is not simulated.....	IROS.....	0	
DRY DAYS PRIOR TO START OF STORM...	DRYDAY.....	3.00	DAYS
DRY DAYS REQUIRED TO RECHARGE CATCHBASIN CONCENTRATION TO INITIAL VALUES.....	DRYBSN.....	5.00	DAYS
DUST AND DIRT STREET SWEEPING EFFICIENCY.....	REFFDD.....	0.300	
DAY OF YEAR ON WHICH STREET SWEEPING BEGINS.....	KLNBGN.....	120	
DAY OF YEAR ON WHICH STREET SWEEPING ENDS.....	KLNEND.....	270	

```
###########################################
#     Land use data on data group J2      #
###########################################
```

AND USE LNAME)	BUILDUP EQUATION TYPE (METHOD)	FUNCTIONAL DEPENDENCE OF BUILDUP PARAMETER(JACGUT)	LIMITING BUILDUP QUANTITY (DDLIM)	BUILDUP POWER (DDPOW)	BUILDUP COEFF. (DDFACT)	CLEANING INTERVAL IN DAYS (CLFREQ)	AVAIL. FACTOR FRACTION (AVSWP)	DAYS SINCE LAST SWEEPING (DSLCL)
Urban De	EXPONENTIAL(1)	AREA(1)	2.500E+01	0.500	60.000	30.000	0.300	30.000

```
^
###############################################
#     Constituent data on data group J3       #
###############################################
```

	Total Su
Constituent units.....	mg/l
Type of units.....	0
KALC.....	2
Type of buildup calc.....	EXPONENTIAL(2)
KWASH.....	0

```
   Totals (Loads in lb or other)    2.20     1.00  0.0E+00

    ************************
    *    DATA GROUP M1     *
    ************************


TOTAL NUMBER OF PRINTED GUTTERS/INLETS...NPRNT..        1
NUMBER OF TIME STEPS BETWEEN PRINTINGS..INTERV..        0
STARTING AND STOPPING PRINTOUT DATES.....               0        0


    ************************
    *    DATA GROUP M3     *
    ************************

CHANNEL/INLET PRINT DATA GROUPS......       -200
```

```
         ****************************************
         * Rainfall from Nat. Weather Serv. file  *
         * in units of hundredths of an inch      *
         ****************************************

        37 Mohegan (Unit 1)
        Acton, MA


Rainfall Station    Sterling 2 Nnw
State/Province      Massachusetts

Rainfall Depth Summary (in)

Year     Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sep   Oct   Nov   Dec    Total

1948.    1.8   0.0   0.0   0.0   6.8   4.1   4.8   1.6   0.4   2.7   7.7   3.0    32.9
1949.    4.7   3.9   2.2   5.2   3.0   0.4   1.9   2.1   3.7   2.6   1.0   3.8    34.5
1950.    5.6   5.2   4.8   3.7   2.5   1.9   2.0   0.0   0.0   0.3   7.1   3.8    36.9
1951.    4.4   6.8   6.4   3.3   5.2   3.2   6.7   3.2   2.7   5.8   6.9   5.1    59.6
1952.    5.8   2.8   4.5   5.5   4.2   4.7   3.3   8.1   2.4   0.8   5.0   3.0    50.1
1953.    6.4   3.9   8.7   8.2   4.8   2.6   1.9   2.0   2.0   6.4   3.4   5.9    56.3
1954.    2.9   3.4   3.3   5.1   7.2   3.9   2.6   7.8   7.6   4.1   6.7   5.7    60.3
1955.    0.6   4.2   4.6   4.6   1.7   5.7   2.2  10.6   2.3  11.0   5.2   1.6    54.1
1956.    8.4   4.7   6.9   5.4   2.0   3.8   2.3   1.4   3.9   2.7   4.4   6.0    51.9
```

	(in)	(#)	(%)	(in)	(%)
	0.10	693	26.0	40.	3.5
	0.20	458	17.2	66.	5.7
	0.30	322	12.1	78.	6.8
	0.40	232	8.7	80.	6.9
	0.50	171	6.4	76.	6.7
	0.60	161	6.0	88.	7.6
	0.70	116	4.3	75.	6.5
	0.80	92	3.4	68.	6.0
	0.90	68	2.5	57.	5.0
	1.00	62	2.3	59.	5.1
	1.10	37	1.4	39.	3.4
	1.20	49	1.8	56.	4.9
	1.30	38	1.4	47.	4.1
	1.40	31	1.2	42.	3.6
	1.50	18	0.7	26.	2.3
	1.60	24	0.9	37.	3.2
	1.70	15	0.6	25.	2.1
	1.80	16	0.6	28.	2.4
	1.90	13	0.5	24.	2.1
	2.00	7	0.3	14.	1.2
>	2.00	46	1.7	124.	10.8

Total # Days with Rain 2669

```
************************************************
*      End of time step DO-loop in Runoff      *
************************************************

Final Date (Mo/Day/Year)   =                12/31/1972
Total number of time steps =                   1668762
Final Julian Date  =                           1972366
Final time of day  =                            86398. seconds.
Final time of day  =                             24.00   hours.
Final running time =                         219168.0000   hours.
Final running time =                          9132.0000    days.

************************************************
*     Extrapolation Summary for Watersheds     *
* # Steps ==> Total Number of Extrapolated Steps *
* # Calls ==> Total Number of OVERLND Calls     *
************************************************
```

Subcatch	# Steps	# Calls	Subcatch	# Steps	# Calls	Subcatch	# Steps	# Calls
300	7232299	1810285						

```
************************************************
*     Extrapolation Summary for Channel/Pipes  *
* # Steps ==> Total Number of Extrapolated Steps *
```

```
Channel/Pipe/Inlet Outflow.....                412725.       421.
Initial Storage + Inflow.....                  412725.       421.
Final Storage + Outflow.....                   412725.       421.
*******************************************
* Final Storage + Outflow + Evaporation  - *
* Watershed Runoff - Groundwater Inflow  - *
*     Initial Channel/Pipe Storage         *
*     ----------------------------------   *
*  Final Storage + Outflow  + Evaporation  *
*******************************************
Error.....                          0.000 Percent

*************************************************
*     Continuity Check for Subsurface Water     *
*************************************************

                                                 Inches over
                                       cubic feet  Subsurface Basin

Total Infiltration                             0.          0.
Total Upper Zone ET                            0.          0.
Total Lower Zone ET                            0.          0.
Total Groundwater flow                         0.          0.
Total Deep percolation                         0.          0.
Initial Subsurface Storage                 35284.         36.
Final Subsurface Storage                   35284.         36.
Upper Zone ET over Pervious Area               0.          0.
Lower Zone ET over Pervious Area               0.          0.


*****************************************
* Infiltration + Initial Storage - Final *
* Storage - Upper and Lower Zone ET -    *
* Groundwater Flow - Deep Percolation    *
* -------------------------------------- *
*     Infiltration + Initial Storage     *
*****************************************
Error .....                         0.000 Percent
```

SUMMARY STATISTICS FOR SUBCATCHMENTS

SUBCATCH-	GUTTER OR INLET	AREA	PERCENT	TOTAL SIMULATED RAINFALL	PERVIOUS AREA TOTAL RUNOFF DEPTH	PERVIOUS AREA TOTAL LOSSES	PERVIOUS AREA PEAK RUNOFF RATE	IMPERVIOUS AREA RUNOFF DEPTH	IMPERVIOUS AREA PEAK RUNOFF RATE	TOTAL SUBCATCHMENT AREA RUNOFF DEPTH	TOTAL SUBCATCHMENT AREA PEAK RUNOFF RATE	TOTAL SUBCATCHMENT AREA PEAK UNIT RUNOFF

Remaining Loads
---
 6. LOAD REMAINING ON SURFACE... 3.
 7. REMAINING IN CATCHBASINS.... 0.
 8. REMAINING IN CHANNEL/PIPES.. 0.

Removals
---
 9. STREET SWEEPING REMOVAL..... 249.
10. NET SURFACE BUILDUP (2-9)... 3602.
11. SURFACE WASHOFF..... 3598.
12. CATCHBASIN WASHOFF..... 0.
13. TOTAL WASHOFF (11+12)..... 3598.
14. LOAD FROM OTHER CONSTITUENTS 0.
15. PRECIPITATION LOAD..... 0.
15a.SUM SURFACE LOAD (13+14+15). 3598.
16. TOTAL GROUNDWATER LOAD..... 0.
16a.TOTAL I/I LOAD..... 0.
17. NET SUBCATCHMENT LOAD
    (15a-15b-15c-15d+16+16a).... 3598.
>>Removal in channel/pipes (17a, 17b):
17a.REMOVE BY BMP FRACTION..... 0.
17b.REMOVE BY 1st ORDER DECAY... 0.
18. TOTAL LOAD TO INLETS..... 3598.
19. FLOW WT'D AVE.CONCENTRATION mg/l
    (INLET LOAD/TOTAL FLOW)..... 140.

Percentages
---
20. STREET SWEEPING (9/2)..... 6.
21. SURFACE WASHOFF (11/2)..... 93.
22. NET SURFACE WASHOFF(11/10).. 100.
23. WASHOFF/SUBCAT LOAD(11/17).. 100.
24. SURFACE WASHOFF/INLET LOAD
    (11/18)..... 100.
25. CATCHBASIN WASHOFF/
    SUBCATCHMENT LOAD (12/17)... 0.
26. CATCHBASIN WASHOFF/
    INLET LOAD (12/18)..... 0.
27. OTHER CONSTITUENT LOAD/
    SUBCATCHMENT LOAD (14/17)... 0.
28. INSOLUBLE FRACTION/
    INLET LOAD (14/18)..... 0.
29. PRECIPITATION/
    SUBCATCHMENT LOAD (15/17)... 0.
30. PRECIPITATION/
    INLET LOAD (15/18)..... 0.
31. GROUNDWATER LOAD/
    SUBCATCHMENT LOAD (16/17)... 0.
32. GROUNDWATER LOAD/

HG 4	1.131	7.457	100.0	94.6
HG 5	1.405	7.457	100.0	96.2
HG 6	1.714	7.457	100.0	97.3
HG 7	2.376	7.604	100.0	97.9
HG 8	3.102	7.604	100.0	98.5
HG 9	3.776	7.604	100.0	98.8
HG 10	3.641	7.749	100.0	99.1
HG 12	3.641	7.749	100.0	99.5

```
**************************************************
*  Summary of Quantity and Quality Results at    *
*  Location        200  INFlow in cfs.            *
*  Values are instantaneous at indicated time step *
**************************************************

  37 Mohegan (Unit 1)
  Acton, MA

     Date     Time        Flow   Total Su
 Mo/Da/Year  Hr:Min        cfs    mg/l
 ----------  -------    -------  --------
Flow wtd means.....        0.001      140.
Flow wtd std devs..        0.009       66.
Maximum value......        1.372      292.
Minimum value......        0.000        0.
Total loads........      412650.     3600.
                        Cub-Ft     POUNDS

===> Runoff simulation ended normally.

===> SWMM 4.1    simulation ended normally.
     Always check output file for possible warning messages.

**************************************************
*       SWMM 4.1    Simulation Date and Time Summary  *
**************************************************
* Starting Date... March      28, 2016              *
*          Time...          13:15:18.805             *
*   Ending Date... March      28, 2016              *
*          Time...          13:15:22.906             *
*  Elapsed Time...               0.068 minutes.     *
*  Elapsed Time...               4.101 seconds.     *
**************************************************
```

Table 1 shows the MADEP water quality flow calculations

State	MA
Rain (in)	1
SCS Type	III
Area (ac)	0.27
Imp (%)	36
P (in)	1
Rv	0.37
Q (in)	1.00
CN	100
Ia	0.041
Ia/P	0.041
tc	0.10
qu	774
WQF (cfs)	0.12

For the State of MA the runoff (Q) is calculated from the impervious area as either 1" or 0.5" over the impervious area. We have assumed 1" of runoff for this project.

Therefore Q = 1" and A = 0.09 = 0.00014 mi^2

For 1" of runoff MADEP requires that Ia/P be 0.041.

Assuming a time of concentration of 6 min, qu becomes 774

The water quality flow is therefore:

WQF = qu A Q

WQF = 774 x 0.00014x 1

WQF = 0.12 cfs

Water Balance Calculations

Water Balance Calculations

SM-5443

Project: 37 Mohegan Road | By: WJH | Date: 3/22/2016

Location: Acton MA | Checked: | Date:

Pre-Development Recharge

CN=	52.2						
From Figure 1, infiltration=	19.5	in/year					
Drainage Area=	74,424	s.f.					
Recharge=	74,424	x	19.5	/12 in/ft	120,939	c.f./year	

Pre-Development Sewage Flow

111 Summer Street:

Total Design Flow=	440	gpd					
440	gpd x	365	days/year x	0.134	s.f./gal =	21,468	c.f./year
					Average(50%)=	10,734	c.f./year

Pre-Development Total

120,939	+	10,734	=	131,673	c.f./year	

Post-Development Recharge

CN=	55.2					
From Figure 1, infiltration=	19	in/year				
Drainage area=	74,424	s.f.				
Recharge=	74,424	x	19	/12 in/ft	117,838	c.f./year

Post-Development Sewage Flow

Total Design Flow=	1,210	gpd					
1,210	gpd x	365	days/year x	0.134	s.f./gal =	59,036	c.f./year
					Average(50%)=	29,518	c.f./year

Post-Development Subsurface Infiltration

From calculations (sheet 2): 16,676 cf

Post-Development Total

117,838	+	46,194	=	164,032	c.f./year

Post-Development	Vs.	Pre-Development
164,032	>	131,673
c.f./year		c.f./year

Overall CN Calculations

SM-5443

Project: 37 Mohegan Road | By: WJH | Date: 3/22/2016

Location: Acton MA | Checked: | Date:

Total CN

Pre				**Post**			
Subcatchment	Area	CN	Sum		Area	CN	Sum
1	1.71	52.2	89.20	1	1.37	52.7	72.19
				To CB-1	0.28	59.0	16.71
				Lot 1 Roof	0.05	98.0	5.37
Total	1.71		89.20	Total	1.71		94.27
	Overall CN:	52.2			Overall CN:	55.2	

Infiltration of Roof Runoff:

Area of roof being infiltrated for 100 year storm:	2,386	sf
Runoff from roofs (CN=98):	30.5	in/year
Total runoff from roofs being infiltrated:	6,064	cf/year

Infiltration BMP'S:

Designed for 100 year storm (6.4 in rain)

	Subcatchment Impervious Area (sf)	CN	% of Annual Runoff Infiltrated	From Graph 1 Annual Runoff (in/year)	Annual Infiltration (cf)
Subcatchment 1:	4,175	98.0	100	30.5	10,611

Annual Infiltration of Stormwater (including Roofs): 16,676 cf/year

STAMSKI AND McNARY, INC.
80 Harris Street
ACTON, MASSACHUSETTS 01720
TEL (978) 263-8585
FAX (978) 263-9883

JOB _____

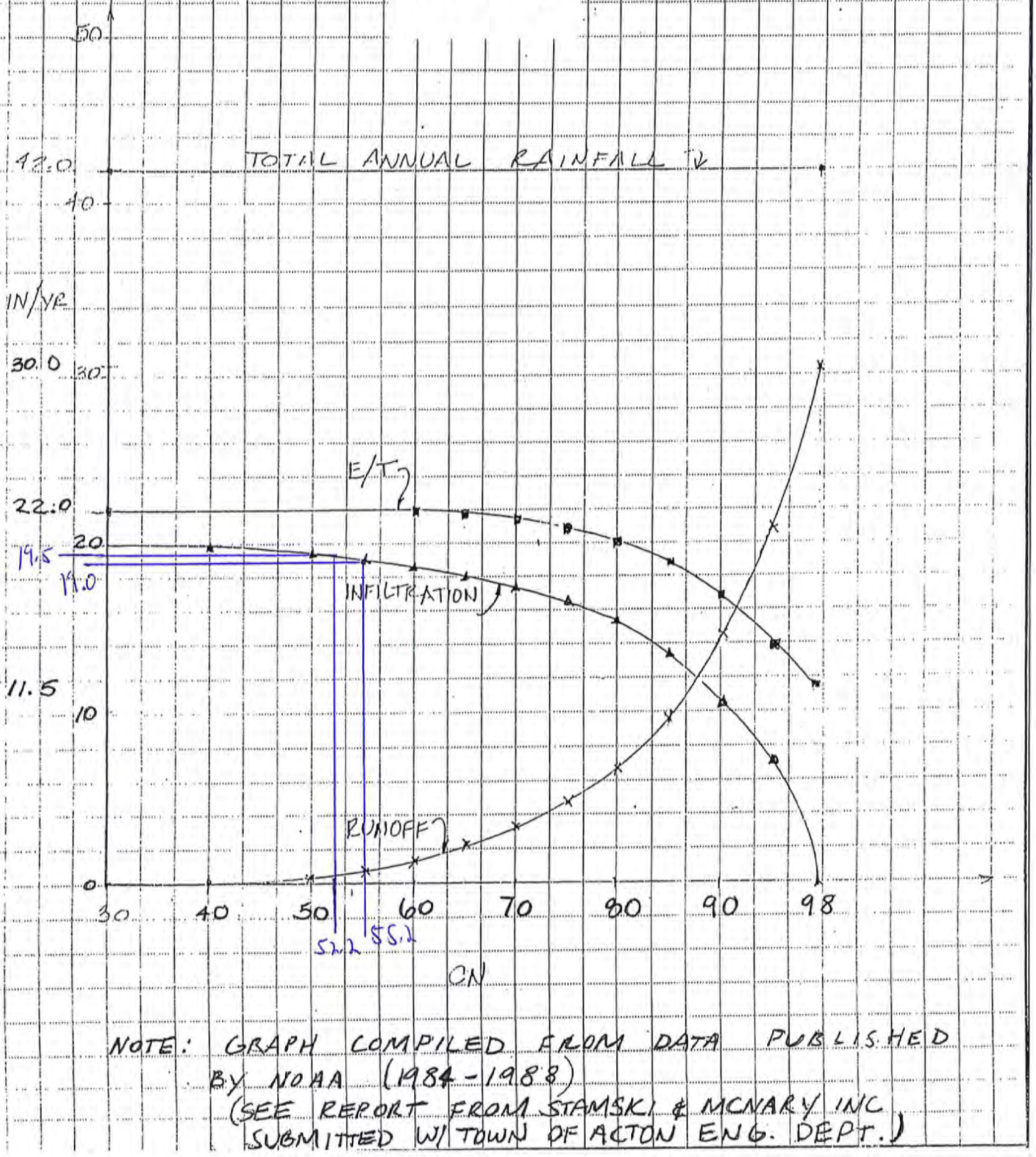
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

Figure 1



NOTE: GRAPH COMPILED FROM DATA PUBLISHED BY NOAA (1984-1988)
(SEE REPORT FROM STAMSKI & MCNARY INC. SUBMITTED W/ TOWN OF ACTON ENG. DEPT.)

Pipe Sizing Calculations

DESIGN STORM: 100 YEAR
DATE: 3/22/2016
DONE BY: WJH
FILE: 5443 RATIONAL METHOD.xlsx

STORM SEWER DESIGN

(ADS N-12)"n"= 0.010 4"-10"
(ADS N-12)"n"= 0.012 12"-36"
(ADS N-12)"n"= 0.013 42"-60"
(Cast Iron)"n"= 0.011

PROJECT: SM-5443
LOCATION: Acton, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA		TIME OF FLOW		RUNOFF COEFF. "C"	RAINFALL INTENSITY (IN/HR)	"Q" TOTAL RUNOFF (CFS)	SLOPE of PIPE (FT/FT)	DIAM (IN)	MANN. "n"	CAPACITY FULL (CFS)	VELOCITY FULL (FPS)	DESIGN FLOW				MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION	
			INCR. (ACRES)	TOTAL (ACRES)	TO UPPER END (MIN)	TIME IN SECTION (MIN)									VELOCITY (FPS)	VELOCITY HEAD (FT)	DEPTH OF FLOW (FT)	TOTAL ENERGY HEAD (FT)			UPPER END	LOWER END
CB-1	Sub. Inf.	37	0.28	0.28	10	0.15	0.44	7.6	0.94	0.010	12	0.012	3.80	4.84	3.99	0.25	0.34	0.58	0.36	0.36	215.46	215.10
CB-2	FE	28	1.11	1.11	10	0.08	0.44	7.6	3.72	0.010	12	0.012	3.85	4.91	5.59	0.49	0.79	1.28	0.28	0.28	217.50	217.22

Closed Drainage System **SM-5443**

Project: 37 Mohegan Road By WJH Date 3/22/2016

Location: Acton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs) i = rainfall intensity inches/hour

C = runoff coefficient, A = area (ac)
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

CB-1

Surface Cover	A (ac)	C	Product A x C
impervious	0.10	0.9	0.086
lands/grass	0.19	0.2	0.038
woods	0.00	0.15	0.000
sum =	0.28	sum =	0.12

C = **0.44** = total product / total area

CB-1

Surface Cover	A (ac)	C	Product A x C
impervious	0.39	0.9	0.351
lands/grass	0.61	0.2	0.122
woods	0.11	0.15	0.017
sum =	1.11	sum =	0.49

C = **0.44** = total product / total area

Inlet Grate Capacity Calculations

Inlet Grate Capacity Calculations

Job: SM-5443
Project: 37 Mohegan Road

Calculated by: WJH
Date: 3/22/2016

CAMPBELL FOUNDRY COMPANY 2816 inlet grate pass area A = 294 sq. in.
2.04 sq. ft.

$Q = (C*A* SQRT(2*g*h))*f$

C = orifice coefficient
C = 0.6 square edges
A = inlet area
A = 2.04 sq. ft.
g = gravitational constant
g = 32.2 ft/sec^2
h = head on inlet
h = 0.33 ft. (low points)
0.17 ft. (on slope)
f = clogging factor
f = 0.66

Single Grate				
Q (MAX)=	3.73	cfs (LP)	low points	LF246
Q (MAX)=	2.68	cfs (OS)	on slope	LF246
Double Grate				
Q (MAX)=	7.45	cfs (LP)	low points	LF246
Q (MAX)=	5.35	cfs (OS)	on slope	LF246

	TRIBUTARY AREA (AC)	TIME OF CONC.	100 YR INTENSITY	C	Q=CiA Q100	POSITION	Q (MAX)	single grate	double grate
CB-1	0.28	10	7.6	0.44	0.94	OS	2.68	yes	

Inlet Grate Capacity Calculations

Job: SM-5443
Project: 37 Mohegan Road

Calculated by: WJH
Date: 3/22/2016

LeBARON FOUNDRY, INC. LF246 inlet grate pass area A = 225 sq. in.
1.56 sq. ft.

$Q = (C*A* SQRT(2*g*h))*f$

C = orifice coefficient
C = 0.6 square edges
A = inlet area
A = 1.56 sq. ft.
g = gravitational constant
g = 32.2 ft/sec^2
h = head on inlet
h = 0.33 ft. (low points)
0.17 ft. (on slope)
f = clogging factor
f = 0.66

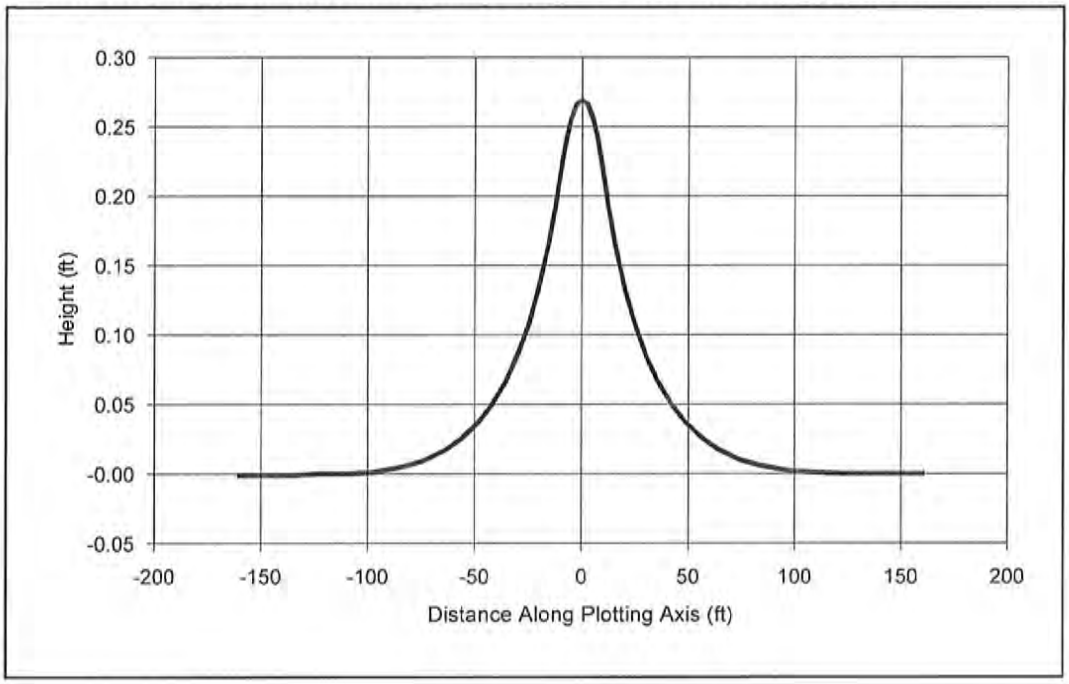
Single Grate
Q (MAX)= 2.85 cfs (LP) low points LF246
Q (MAX)= 2.04 cfs (OS) on slope LF246
Double Grate
Q (MAX)= 5.70 cfs (LP) low points LF246
Q (MAX)= 4.09 cfs (OS) on slope LF246

	TRIBUTARY AREA (AC)	TIME OF CONC.	10 YR INTENSITY	C	Q=CiA Q100	POSITION	Q (MAX)	single grate	double grate
CB-2	1.11	10	5	0.44	2.45	OS	2.85	yes	

Groundwater Mounding Analysis

Subsurface Infiltration Structure 1

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



COMPANY: Stamski and McNary, Inc.

PROJECT: SM-5443

ANALYST: William Hall

DATE: 3/28/2016 TIME: 9:06:50 AM

INPUT PARAMETERS

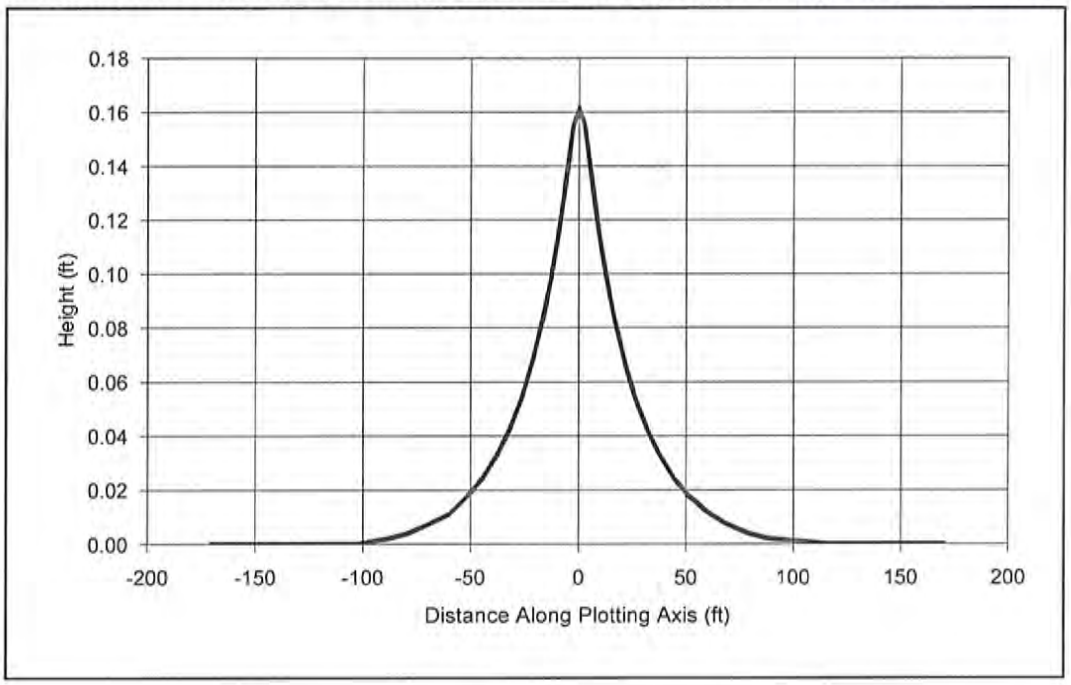
Application rate: 0.7393 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 10 ft
Length of application area: 23.36 ft
Width of application area: 20.15 ft
Constant head boundary used at: 160 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 10.1 ft
positive Y: 0 ft
Total volume applied: 347.9915 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-160	0	-160	0
-134.6	0	-135	0
-109.1	0	-109	0
-83.7	0	-84	0
-63.7	0	-64	0.02
-48.2	0	-48	0.04
-35.5	0	-35	0.07
-24.8	0	-25	0.11
-15.5	0	-16	0.16
-9.3	0	-9	0.22
-5	0	-5	0.26
0	0	0	0.27
5	0	5	0.26
9.3	0	9	0.22
15.5	0	16	0.16
24.8	0	25	0.11
35.5	0	35	0.07
48.2	0	48	0.04
63.7	0	64	0.02
83.7	0	84	0.01
109.1	0	109	0
134.6	0	135	0
160	0	160	0

ROOF DRYWELL

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



COMPANY: Stamski and McNary, Inc.

PROJECT: SM-5443

ANALYST: William Hall

DATE: 3/28/2016 TIME: 9:08:15 AM

INPUT PARAMETERS

Application rate: 0.7533 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 39 ft/day
Initial saturated thickness: 10 ft
Length of application area: 30.48 ft
Width of application area: 8.66 ft
Constant head boundary used at: 170 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 4.3 ft
positive Y: 0 ft
Total volume applied: 198.8387 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-170	0	-170	0
-143	0	-143	0
-115.9	0	-116	0
-88.9	0	-89	0
-67.6	0	-68	0.01
-51.2	0	-51	0.02
-37.7	0	-38	0.03
-26.3	0	-26	0.05
-16.5	0	-16	0.08
-9.9	0	-10	0.11
-5.4	0	-5	0.14
0	0	0	0.16
5.4	0	5	0.14
9.9	0	10	0.11
16.5	0	16	0.08
26.3	0	26	0.05
37.7	0	38	0.03
51.2	0	51	0.02
67.6	0	68	0.01
88.9	0	89	0
115.9	0	116	0
143	0	143	0
170	0	170	0

Soil Evaluation

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP 1 | 8/20/2015 (Date) | (Time) | SUN 75° (Weather)

1. Location

Ground Elevation at Surface of Hole: _____ feet | Latitude/Longitude: /

Description of Location: GRASS

2. Land Use: LAWN AREA (e.g., woodland, agricultural field, vacant lot, etc.) | Surface Stones (e.g., cobbles, stones, boulders, etc.): — | Slope (%): 2

Vegetation: GRASS | Landform: | Position on Landscape (SU, SH, BS, FS, TS):

3. Distances from: Open Water Body: — feet | Drainage Way: — feet | Wetlands: >100 feet

Property Line: 15 feet | Drinking Water Well: TOWN feet | Other: — feet

4. Parent Material: PROGLACIAL | Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No | If yes: Depth Weeping from Pit: | Depth Standing Water in Hole:

Estimated Depth to High Groundwater: _____ inches | _____ elevation

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features: Depth	Redoximorphic Features: Color	Redoximorphic Features: Percent	Soil Texture (USDA)	Coarse Fragments % by Volume: Gravel	Coarse Fragments % by Volume: Cobbles & Stones	Soil Structure	Soil Consistence (Moist)	Other
12	A + FILL		—	—	—	SL	—	—	M	F	
24	B		—	—	—	LS	—	—	M	F	
120	C	2.5Y 6/3	—	—	—	SAND	5	5C	M	VERY FRIABLE	SC
	BOULDER					FINE TO MEDIUM		5S			
						VARIGATED					

Additional Notes:

OBSERVATION PIPE INSTALLED

GWPD ZONE 3

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-2 Date: 8/20/2015 Time: _____ Weather: SUN 75°

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: _____ / _____

Description of Location: _____

2. Land Use: LAWN AREA (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Vegetation: GRASS Landform: _____ Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from: Open Water Body: — feet Drainage Way: — feet Wetlands: >100 feet

Property Line: 15 feet Drinking Water Well: TOWN feet Other: _____ feet

4. Parent Material: Proglacial Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____ inches _____ elevation

Deep Observation Hole Number: TP-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
3	A	10YR 3/2	—	—	—	SL	—	—	M	F	
12	B	10YR 5/6	—	—	—	LS	—	—	M	F	
100	C	2.5Y 10/3	—	—	—	SAND	10	5C 5S		10% Boulders	
LARGE	BOULDER					FINE TO					
	NO REFUSAL					MEDIUM GRAINED					

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-3 Date: 8/20/2015 Time: _____ Weather: SUN 75°

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /

Description of Location: _____

2. Land Use: LAWN AREA (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet; Drainage Way _____ feet; Wetlands >100 feet; Property Line _____ feet; Drinking Water Well TOWN feet; Other _____ feet

4. Parent Material: PROGLACIAL Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: _____ inches _____ elevation

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2	—	—	—	SL	—	—	M	F	
12	B	10YR 5/6	—	—	—	LS	—	—	M	F	
108	C	2.5Y 6/3	—	—	—	SAND					
						FINE TO MEDIUM		SC SS			
						VARIATED					

Additional Notes:

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-4 8/20/2015 (Date) ____ (Time) SUN 75° (Weather)

1. Location

Ground Elevation at Surface of Hole: ____ feet Latitude/Longitude: /

Description of Location: ____

2. Land Use LAWN AREA (e.g., woodland, agricultural field, vacant lot, etc.) ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%) ____

Vegetation ____ Landform ____ Position on Landscape (SU, SH, BS, FS, TS) ____

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands >100 feet

Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Parent Material: PROGLACIAL Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: ____ Depth Weeping from Pit ____ Depth Standing Water in Hole

Estimated Depth to High Groundwater: 138 -- CHECK GROUNDWATER IN NOVEMBER ZONE 3 inches elevation

Deep Observation Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
6	A	10YR 3/2	—	—	—	SL			M	F	
12	B	10YR 5/6	—	—	—	LS			M	F	
138	C	2.5Y 6/3	—	—	—	SAND			M	very	
						FINE TO				FRIABLE	
						MEDIUM					
						VARIGATED					

Additional Notes:

OBSERVATION PIPE INSTALLED

GW IN ZONE 3

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-5 Date: 8/20/2015 Time: _____ Weather: SUN 75°

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /

Description of Location: _____

2. Land Use LAWN AREA (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands >100 feet

Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Parent Material: Proglacial Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: Depth Weeping from Pit Depth Standing Water in Hole

Estimated Depth to High Groundwater: _____ inches _____ elevation

Deep Observation Hole Number: TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
4	A	10YR 3/2				SL			M	F	
12	B	10YR 5/6				LS			M	F	
120	C	2.5Y 6/3				SAND	15	10C 5S	M	VERY	
						COARSE				FRIABLE	LS

Additional Notes:

OBSERVATION PIPE INSTALLED

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-6 Date: 8/20/2015 Time: _____ Weather: SUN 75°

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /

Description of Location: _____

2. Land Use LAWN GRAVEL DRIVE AREA (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands >100 feet

Property Line 20+/- feet Drinking Water Well TNMN feet Other _____ feet

4. Parent Material: Proglacial _____ Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: Depth Weeping from Pit _____ Depth Standing Water in Hole _____

Estimated Depth to High Groundwater: SEE TEST PIT 5 +8 PVC OBS PIPE READINGS inches elevation

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
—	A	—	—	—	—	—	—	—	—	—	—
—	B	—	—	—	—	—	—	—	—	—	—
0-120	C	2.5Y 6/3	—	—	—	SAND	—	—	SG	LOOSE	
						COARSE					

Additional Notes:

GRAVEL DRIVEWAY

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-7 8/20/2015 (Date) _____ (Time) SUN 75° (Weather)

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /

Description of Location: _____

2. Land Use LAWN GRAVEL DRIVE AREA (e.g., woodland, agricultural field, vacant lot, etc.) _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%) _____

Vegetation _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Parent Material: _____ Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Estimated Depth to High Groundwater: — inches SEE OBS. PIPE TP-8 elevation

Deep Observation Hole Number: TP-7

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-120	C	2.5Y 6/3	—	—	—	SAND	15	10S 10C	SG	LOOSE	
						COARSE					

Additional Notes:

GWPD ZONE 3

REQUIRES HIGH GROUNDWATER REMOVAL NOVEMBER 1ST

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-8 Date: 8/20/2015 Time: _____ Weather: SUN 75°

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /

Description of Location: _____

2. Land Use GRAVEL DRIVE LAWN AREA (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)

Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Parent Material: _____ Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

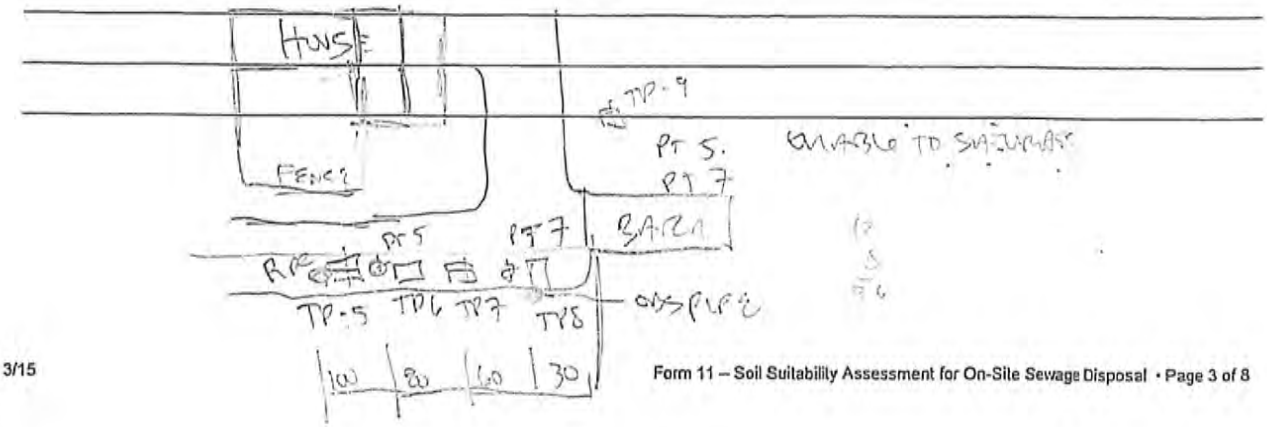
5. Groundwater Observed: ☐ Yes ☐ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Estimated Depth to High Groundwater: _____ inches _____ elevation

Deep Observation Hole Number: TP-8

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-120	C		96	5Y 5/8		COARSE SAND	15		SG	LOOSE	

Additional Notes:



Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

SM 5443 37 MOHEGAN ROAD

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-9 8/20/2015 (Date) _____ (Time) SUN 75° (Weather)

1. Location

Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: _____ / _____

Description of Location: _____

2. Land Use LAWN AREA (e.g., woodland, agricultural field, vacant lot, etc.) _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) _____ Slope (%) _____

Vegetation _____ Landform _____ Position on Landscape (SU, SH, BS, FS, TS) _____

3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands _____ feet

Property Line _____ feet Drinking Water Well _____ feet Other _____ feet

4. Parent Material: _____ Unsuitable Materials Present: ☐ Yes ☐ No

If Yes: ☐ Disturbed Soil ☑ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☐ No If yes: _____ Depth Weeping from Pit _____ Depth Standing Water in Hole

Estimated Depth to High Groundwater: 102 inches _____ elevation

Deep Observation Hole Number: TP-9

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-46	FILL	—	—	—	—	—	—	—	—	—	
46-102	C		66			SAND MEDIUM			M	VFR	
										FRIABLE	

Additional Notes:

_____

_____

_____

Commonwealth of Massachusetts
City/Town of

Percolation Test

Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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

A. Site Information

AARON & KAARIN JENNSON
Owner Name

37 MOHEGAN ROAD
Street Address or Lot #

ACTON MA
City/Town

MA
State

01720
Zip Code

Contact Person (if different from Owner)

Telephone Number

B. Test Results

	8/20/2015 Date / Time	8/20/2015 Date / Time
Observation Hole #	PT-1	PT-3
Depth of Perc	47"	53"
Start Pre-Soak	9:05	9:29
End Pre-Soak	9:20	unable to saturate
Time at 12"	9:20	
Time at 9"	9:23	
Time at 6"	9:28	
Time (9"-6")	5 min	
Rate (Min./Inch)	< 2 MPI	
	Test Passed: ☑ Test Failed: ☐	Test Passed: ☑ Test Failed: ☐

STAMSKI AND MCNARY, INC RICHARD HARRINGTON
Test Performed By:

ACTON BOH
Witnessed By:

Comments:

Commonwealth of Massachusetts
City/Town of

Percolation Test

Form 12

Percolation test results must be submitted with the Soil Suitability Assessment for On-site Sewage Disposal. DEP has provided this form for use by local Boards of Health. Other forms may be used, but the information must be substantially the same as that provided here. Before using this form, check with the local Board of Health to determine the form they use.

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

A. Site Information

AARON & KAARIN JEANSON
Owner Name

37 MOHEGAN ROAD
Street Address or Lot #

ACTON MA | MA | 01720
City/Town | State | Zip Code

Contact Person (if different from Owner) | Telephone Number

B. Test Results

	8/20/2015 Date / Time	8/20/2015 Date / Time
Observation Hole #	PT - 6	PT - 9
Depth of Perc		
Start Pre-Soak		
End Pre-Soak		
Time at 12"	24 gal unable to	24 gal unable to
Time at 9"	Saturate	Saturate
Time at 6"		
Time (9"-6")		
Rate (Min./Inch)		
Test Passed: ☑ / Test Failed: ☐	☑	☑

STAMSKI AND MCNARY, INC RICHARD HARRINGTON
Test Performed By:

ACTON BOH
Witnessed By:

Comments:

Commonwealth of Massachusetts
City/Town of ACTON

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-01 | 3/15/16 (Date) | 12:00 (Time) | 40° RAIN (Weather)

1. Location
   Ground Elevation at Surface of Hole: _____ feet Latitude/Longitude: /
   Description of Location: _____
2. Land Use: LAWN (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.) Slope (%)
   Vegetation Landform Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body _____ feet Drainage Way _____ feet Wetlands >100 feet
   Property Line _____ feet Drinking Water Well _____ feet Other _____ feet
4. Parent Material: _____ Unsuitable Materials Present: ☐ Yes ☒ No
   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☒ Yes ☐ No If yes: 84 Depth Weeping from Pit 84 Depth Standing Water in Hole
   Estimated Depth to High Groundwater: 75 inches _____ elevation
   Deep Observation Hole Number: TP-01

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
12	A	10YR 3/2	-	-	-	SL	-	-	M	F	
24	B	10YR 5/6	-	-	-	LS	-	-	M	F	
84	C	2.5Y 6/3	75	HIGH/LOW	>2	SAND	10	20	SG	LOOSE	

Additional Notes:
TEST PIT FOR DRAINAGE - WITNESSED BY BOH

Commonwealth of Massachusetts
City/Town of ACTON

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review *(minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP-02 3/15/16 (Date) ____ (Time) 40° RAIN (Weather)

1. Location

Ground Elevation at Surface of Hole: ____ feet Latitude/Longitude: /

Description of Location: ____

2. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) ____ Slope (%)

LAWN (Vegetation) ____ Landform ____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ____ feet Drainage Way ____ feet Wetlands >50 feet

Property Line ____ feet Drinking Water Well ____ feet Other ____ feet

4. Parent Material: ____ Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 72" Depth Weeping from Pit 72" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 60 inches ____ elevation

Deep Observation Hole Number: TP-02

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
8	A	10YR 3/2	-	-	-	SL	-	-	M	FR	
24	B	10YR 5/6	-	-	-	LS	-	-	M	FR	
84	C	2.5Y 6/2	60	HIGH/LOW	>2	VAR	10	20	SG	LOOSE	

Additional Notes:

TP FOR DRAINAGE - WITNESSED BY BOH

Commonwealth of Massachusetts
City/Town of ACTON
Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-03 | 3/15/16 (Date) | (Time) | 40° RAIN (Weather)

1. Location
   Ground Elevation at Surface of Hole: _____ feet | Latitude/Longitude: /
   Description of Location: _____
2. Land Use _____ (e.g., woodland, agricultural field, vacant lot, etc.) | _____ Surface Stones (e.g., cobbles, stones, boulders, etc.) | _____ Slope (%)
   LAWN Vegetation | _____ Landform | _____ Position on Landscape (SU, SH, BS, FS, TS)
3. Distances from: Open Water Body _____ feet | Drainage Way _____ feet | Wetlands 250 feet
   Property Line _____ feet | Drinking Water Well _____ feet | Other _____ feet
4. Parent Material: _____ Unsuitable Materials Present: ☐ Yes ☒ No
   If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock
5. Groundwater Observed: ☒ Yes ☐ No If yes: 72 Depth Weeping from Pit | 72 Depth Standing Water in Hole
   Estimated Depth to High Groundwater: 60 inches | _____ elevation
   Deep Observation Hole Number: _____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
8	A	10YR 3/2	-	-	-	SL	-	-	M	F	
22	B	10YR 5/6	-	-	-	LS	-	-	M	F	
78	C	2.5Y 6/3	60	HIGH/LOW	22	SAND	10	20	SG	LOOSE	

Additional Notes:
TP FOR DRAINAGE - WITNESSED BY BOH

Commonwealth of Massachusetts
City/Town of ACTON

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area*)

Deep Observation Hole Number: TP-04 | 3/15/16 (Date) | ____ (Time) | 40° RAIN (Weather)

1. Location

Ground Elevation at Surface of Hole: ____ feet | Latitude/Longitude: /

Description of Location: ____

2. Land Use ____ (e.g., woodland, agricultural field, vacant lot, etc.) | ____ Surface Stones (e.g., cobbles, stones, boulders, etc.) | ____ Slope (%)

LAWN Vegetation | ____ Landform | ____ Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from: Open Water Body ____ feet | Drainage Way ____ feet | Wetlands >10 feet

Property Line ____ feet | Drinking Water Well ____ feet | Other ____ feet

4. Parent Material: ____ Unsuitable Materials Present: ☐ Yes ☒ No

If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Impervious Layer(s) ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☒ Yes ☐ No If yes: 42 Depth Weeping from Pit | 42 Depth Standing Water in Hole

Estimated Depth to High Groundwater: 42 inches | ____ elevation

Deep Observation Hole Number: ____

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
60	COMPOST + FILL	-	-	-	-	-	-	-	-	-	

Additional Notes:

TP FOR DRAINAGE - WITNESSED BY BOH

SM-5443 LH

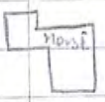
37 MORGAN RD - ACTON

3/15/16 - 45° - RAIN

OBS. PIPE READINGS:

TP-1: 9'-0" TP-5: — TP-9: 4'-0"

TP-4: 8'4" TP-8: 6'-0"



TP-4 TP-9

TP-1 TP-5 TP-8

TP-D1

A	12
B	24
C	84

ESHWT @ 75"

GW OBS @ 84"

TP D2

A	8
B	24
C	84

ESHWT @ 60"

SEEP @ 72"

TP D3

A	8
B	27
C	78

ESHWT @ 60"

GW @ 78"

BOULDERS @ BOT.

TP D4

COMPOST / FILL 60"

WEEPING @ 42"

Drainage Maps

LEGEND:

- N/F — NOW OR FORMERLY
- TREE
- TREE LINE
- DMH — DRAIN MANHOLE
- 85 — EXISTING CONTOUR
- WETLAND FLAG
- 99X9 — SPOT ELEVATION
- EDGE OF PAVEMENT
- UGW — UNDERGROUND WIRES
- UP — UTILITY POLE
- WETLANDS

UTILITY NOTE:

ALL UNDERGROUND UTILITIES SHOWN HERE WERE COMPILED ACCORDING TO AVAILABLE RECORD PLANS FROM VARIOUS UTILITY COMPANIES AND PUBLIC AGENCIES AND ARE APPROXIMATE ONLY. ACTUAL LOCATIONS MUST BE DETERMINED IN THE FIELD BEFORE DESIGNING, EXCAVATING, BLASTING, INSTALLING, BACKFILLING, GRADING, PAVEMENT RESTORATION OR REPAIRING. ALL UTILITY COMPANIES, PUBLIC AND PRIVATE, MUST BE CONTACTED INCLUDING THOSE IN CONTROL OF UTILITIES NOT SHOWN ON THIS PLAN. SEE CHAPTER 370, ACTS OF 1963 MASS. WE ASSUME NO RESPONSIBILITY FOR DAMAGES INCURRED AS A RESULT OF UTILITIES OMITTED OR INACCURATELY SHOWN. BEFORE PLANNING FUTURE CONNECTIONS THE APPROPRIATE PUBLIC UTILITY ENGINEERING DEPARTMENT MUST BE CONSULTED. DIG SAFE TELEPHONE No. 1-888-344-7233.

CHEROKEE ROAD

N/F STOCKBRIDGE FAMILY TRUST

40' EASEMENT AS SHOWN ON PLAN No. 961 OF 1950

N/F TOWN OF ACTON

N/F TOWN OF ACTON PARCEL 97

254C

N/F HALD

N/F DONOVAN

N/F ROGAN

FLOOD PLAIN CONSERVANCY DISTRICT AS SCALED FROM TOWN MAPS

EDGE OF WETLANDS AS SCALED FROM TOWN MAPS

40' EASEMENT AS SHOWN ON PLAN No. 997 OF 1962

36A

EDGE OF BORDERING VEGETATED WETLAND AS DELINEATED BY B&C ASSOCIATES, INC. AUGUST 7, 2015 ORAD FILE #085-1182

N/F TOWN OF ACTON PARCEL 137

52A

EXISTING PAVED DRIVEWAY

SUBCATCHMENT E-T

629C

50' BUFFER ZONE

75' BUFFER ZONE

100' BUFFER ZONE

APPROXIMATE LOCATION OF EXISTING WATER MAIN

N/F PROCTOR

WATER METER PIT

APPROXIMATE LOCATION OF EXISTING SOIL ABSORPTION SYSTEM

EXISTING 2 STORY W/F DWELLING #37

416B

FENCED AREA

PATIO

EXISTING PAVED DRIVEWAY

APPROXIMATE LOCATION OF EXISTING WATER SERVICE

N/F WELLINGHOFF

EXISTING BARN

MOHEGAN ROAD (PUBLIC - 40' WIDE)

N/F PAN & WANG

N/F NICHOLS

EDGE OF BORDERING VEGETATED WETLAND, AS DELINEATED BY B&C ASSOCIATES, INC. AUGUST 7, 2015 ORAD FILE #085-1182

N

PLAN 997 OF 1962

RECORD OWNER/APPLICANT

AARON B. JEANSON
KAARIN JEANSON
37 MOHEGAN ROAD
ACTON, MA

REFERENCE

SOUTH DISTRICT
DEED BOOK 64972 PAGE 465
PLAN No. 997 OF 1962
ASSESSOR'S MAP D2 PARCEL 133

ZONING DISTRICT

R-2
GWPD ZONE 3
FLOOD PLAIN DISTRICT

DATUM

N.A.V.D OF 1988.

NOTE:

THE FLOOD PLAIN IN THIS AREA DOES NOT EXTEND INTO THE UPLAND. BASE FLOOD ELEVATION = 211'

DEFINITIVE PLAN

FOR

MOHEGAN LANE

IN

ACTON, MA

PRE DEVELOPMENT DRAINAGE MAP

FOR: JEANSON
SCALE: 1"=40'
DATE: MARCH 25, 2016

STAMSKI AND McNARY, INC.
1000 MAIN STREET ACTON, MASS.
ENGINEERING - PLANNING - SURVEYING

0 10 20 40 80

SM-5443 (5443-DEFINITIVE-3.dwg)

MATCH LINE

Ⓓ

36A

FLOOD PLAIN CONSERVANCY DISTRICT AS SCALED FROM TOWN MAPS

EDGE OF WETLANDS AS SCALED FROM TOWN MAPS

40' EASEMENT AS SHOWN ON PLAN No. 997 OF 1962

EDGE OF BORDERING VEGETATED WETLAND AS DELINEATED BY B&C ASSOCIATES, INC. AUGUST 7, 2015 ORAD FILE #085-1182

N/F TOWN OF ACTON PARCEL 137

52A

EXISTING PAVED DRIVEWAY

SB-1 RIM=217.90

FE-1 INV=217.22

CB-2 RIM=220.15

PROPOSED DWELLING #39

T.C.=225.90
B.F.=217.75±
G.F.=223.50±

DECK

629C

SUBCATCHMENT P-1

50' BUFFER ZONE

75' BUFFER ZONE

100' BUFFER ZONE

APPROXIMATE LOCATION OF EXISTING SOIL ABSORPTION SYSTEM

EXISTING 2 STORY W/F DWELLING #37

416B

FENCED AREA

PATIO

EXISTING PAVED DRIVEWAY

EXISTING BARN

APPROXIMATE LOCATION OF EXISTING WATER MAIN

APPROXIMATE LOCATION OF EXISTING WATER SERVICE

WATER METER PIT

560.58' TO INTERSECTION WITH FREEDOM FARME ROAD

N/F WELLINGHOFF

N/F PAN & WANG

EDGE OF BORDERING VEGETATED WETLAND, AS DELINEATED BY B&C ASSOCIATES, INC. AUGUST 7, 2015 ORAD FILE #085-1182

PLAN 997 OF 1962

N

Ⓐ

A

B

C

LEGEND:

- N/F NOW OR FORMERLY
- TREE
- TREE LINE
- DMH DRAIN MANHOLE
- 85 EXISTING CONTOUR
- WETLAND FLAG
- 99X9 SPOT ELEVATION
- EDGE OF PAVEMENT
- UGW UNDERGROUND WIRES
- UP UTILITY POLE

UTILITY NOTE:

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RECORD OWNER/APPLICANT

AARON B. JEANSON
KAARIN JEANSON
37 MOHEGAN ROAD
ACTON, MA

ZONING DISTRICT

R-2
GWPD ZONE 3
FLOOD PLAIN DISTRICT

NOTE:

THE FLOOD PLAIN IN THIS AREA DOES NOT EXTEND INTO THE UPLAND.
BASE FLOOD ELEVATION = 211'

REFERENCE

SOUTH DISTRICT
DEED BOOK 64972 PAGE 465
PLAN No. 997 OF 1962
ASSESSOR'S MAP D2 PARCEL 133

DATUM

N.A.V.D OF 1988.

DEFINITIVE PLAN

FOR

MOHEGAN LANE

IN

ACTON, MA

POST DEVELOPMENT DRAINAGE MAP

FOR: JEANSON
SCALE: 1"=20'
DATE: MARCH 25, 2016

STAMSKI AND McNARY, INC.
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0 10 20 40 80

SM-5443 (5443-DEFINITIVE-3.dwg)