3.6 DRAINAGE CALCULATIONS
for
18 Wetherbee Street
Acton, MA

PREPARED FOR:

Onyx Corporation
18 Wetherbee Street
Acton, MA 01720

PREPARED BY:

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1000 Main Street
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Engineering-Planning-Surveying

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STORMWATER MANAGEMENT

The site is located at 18 Wetherbee Street in Acton, Massachusetts and is approximately 2.09 acres in size and has been previously developed. There is an existing dwelling with a gravel driveway, three sheds, a service shop, and soil stockpiles located on the site. The Natural Resource Conservation Service (N.R.C.S.) soil survey report for Middlesex County and associated soil map for Acton indicates that soils located on the site are Urban Land, Birdsall Mucky Silt Loam, and Hinckley Loamy Sand. Urban Land and Hinckley Loamy Sand are in Hydrologic Group A, whereas Birdsall Mucky Silt Loam is Hydrologic Group C/D. However, based on test pits dug on site, all soils are Hydrologic Group A.

Pre-Development

The entire site is comprised of 1 subcatchment. This subcatchment drains into Nashoba Brook. The subcatchment can be seen on the attached drainage maps.

Post-Development

The fully developed site will consist of the proposed building trade shop, paved parking area, and walkways. The post-development site has been divided into three subcatchments. Subcatchment P1 remains largely unchanged. The subcatchment drains to Nashoba Brook in the northeast part of the site. Subcatchment P2 is the building trade shop, which will be directly infiltrated via a subsurface infiltration area. Subcatchment P3 is the proposed parking which will drain to a deep sump hooded catch basin and sent to a drainage manhole fitted with a Contech CDS2015-4 unit for pretreatment. The runoff will then be infiltrated in subsurface infiltration chambers.

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 and east 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 infiltration.

The following table summarizes the peak runoff rates to the overland flow discharge points.

Discharge Summary Table

E1 Compared to P1

2-Year Storm		10-year Storm		100-year Storm	
Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)
1.079	0.689	3.088	2.256	6.402	4.968

P2

2-Year Storm		10-year Storm		100-year Storm	
Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)
0.000	0.000	0.000	0.000	0.000	0.000

P3

2-Year Storm		10-year Storm		100-year Storm	
Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)	Pre(cfs)	Post(cfs)
0.000	0.000	0.000	0.000	0.000	0.000

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 "Water Balance Calculations" showing compliance with this standard are attached.

Standard #4 Removal of 44% TSS (prior to infiltration)

This standard stipulates that when infiltration occurs in an area of rapid infiltration (greater than 2.4 inches/hour), 44% of TSS must be removed prior to discharge to the infiltration BMP.

In order to achieve 44% TSS removal for the Subsurface Infiltration Area, a Contech CDS2015-4 insert and is provided. 92% TSS removal provided. See the attached TSS removal sheet for more information.

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 require 1.0 inch of runoff from impervious areas to be treated. One proposed catch basin with a Contech CDS2015-4 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. The combination will also remove 98.4% of TSS. See "TSS Removal Calculations".

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 within a Critical Area.

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 attached and on the plan.

Standard #10 Illicit Discharges to Drainage System:

No known illicit discharges exist and none are proposed.

Design Basis

1. The rational method (Q=CIA) was used as a basis for sizing pipes. Runoff Coefficients: C=0.15 for woods, 0.20 for grass/landscaped areas, 0.76 for gravel, and 0.90 for impervious surfaces.
2. The 100-year storm was used for sizing pipes. Rainfall intensity values were taken from the U.S. Weather Bureau Technical Paper 40.
3. The United States Department of Agriculture Natural Resource Conservation Service (N.R.C.S.) TR55 methodology was used to determine offsite rates of runoff.
4. 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.
5. The hydrologic calculations were performed using the computer program: "Hydraflow Hydrographs 2007" by Intelisolve.
6. The soil types of the site were taken from the N.R.C.S. Soil Survey Map from nesoil.com.
7. Soil conditions and estimated seasonal high groundwater table were based on on-site soil evaluations.
8. The Hantoush Method was used for Mounding analysis.

Stormwater Checklist

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

Checklist for Stormwater Report

A. Introduction

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

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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

COMMONWEALTH OF MASSACHUSETTS
GEORGE
DIMAKARAKOS
CIVIL
No. 41281
REGISTERED
PROFESSIONAL ENGINEER

1/8/16

Signature and Date

Checklist

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

☒ New development

☒ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

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.

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	1.079	2	726	4,160	----	------	------	Existing
2	SCS Runoff	0.689	2	726	2,958	----	------	------	P1
3	SCS Runoff	0.493	2	724	1,659	----	------	------	P2
4	Diversion1	0.180	2	712	1,472	3	------	------	Infiltration Trench
5	Diversion2	0.313	2	724	187	3	------	------	Overflow to Galleys
6	Reservoir	0.000	2	n/a	0	12	1.09	133	Trench to Galleys
7	SCS Runoff	0.348	2	724	1,171	----	------	------	P3
8	Reservoir	0.000	2	676	0	7	1.78	294	P3, Parking to Galleys

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	3.088	2	724	9,837	----	------	------	Existing
2	SCS Runoff	2.256	2	724	7,441	----	------	------	P1
3	SCS Runoff	0.721	2	724	2,467	----	------	------	P2
4	Diversion1	0.180	2	704	2,023	3	------	------	Infiltration Trench
5	Diversion2	0.541	2	724	444	3	------	------	Overflow to Galleys
6	Reservoir	0.000	2	n/a	0	12	2.28	325	Trench to Galleys
7	SCS Runoff	0.509	2	724	1,741	----	------	------	P3
8	Reservoir	0.000	2	624	0	7	2.84	498	P3, Parking to Galleys

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	6.402	2	724	19,357	----	------	------	Existing
2	SCS Runoff	4.968	2	724	15,183	----	------	------	P1
3	SCS Runoff	1.028	2	724	3,565	----	------	------	P2
4	Diversion1	0.180	2	698	2,713	3	------	------	Infiltration Trench
5	Diversion2	0.848	2	724	851	3	------	------	Overflow to Galleys
6	Reservoir	0.000	2	n/a	0	12	4.45	655	Trench to Galleys
7	SCS Runoff	0.726	2	724	2,516	----	------	------	P3
8	Reservoir	0.000	2	556	0	7	4.50	791	P3, Parking to Galleys

Pre-Development Hydrology

Worksheet 2: Runoff curve number and runoff **SM-229**

Project: 18 Wetherbee Street By DJC Date 10/23/15

Location: Acton, MA Checked _____ Date _____

Circle one: Present | Developed Existing Site

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) Square Ft	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
Hinckley 253B A	Open Space	39			0.79	30.83
Hinckley 253B A	Impervious	98			0.40	39.50
Hinckley 253B A	Gravel	76			0.65	49.24
Hinckley 253B A	Soil Pile	72			0.25	17.93
					0.00	0.00
				Totals =	2.09	137.51

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{137.51}{2.09} = 65.77$; Use CN = 65.8

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	0.58	1.38	2.72
Runoff, Q.....	cf	4431	10483	20635

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-229

Project: 18 Wetherbee Street By DJC Date 10/23/15

Location: Acton, MA Checked _____ Date _____

Circle one: Present Developed through E1- To wetlands
Circle one: Tc Tt subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Gravel			
2. Mannings roughness coeff., n (table 3-1)			0.011			
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	0.004			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.02			0.02
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			paved			
8. Flow Length, L		ft	203			
9. Watercourse slope, s		ft/ft	0.038			
10. Average Velocity, V (figure 3-1)		ft/s	3.96			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01
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 0.04
min 6.0

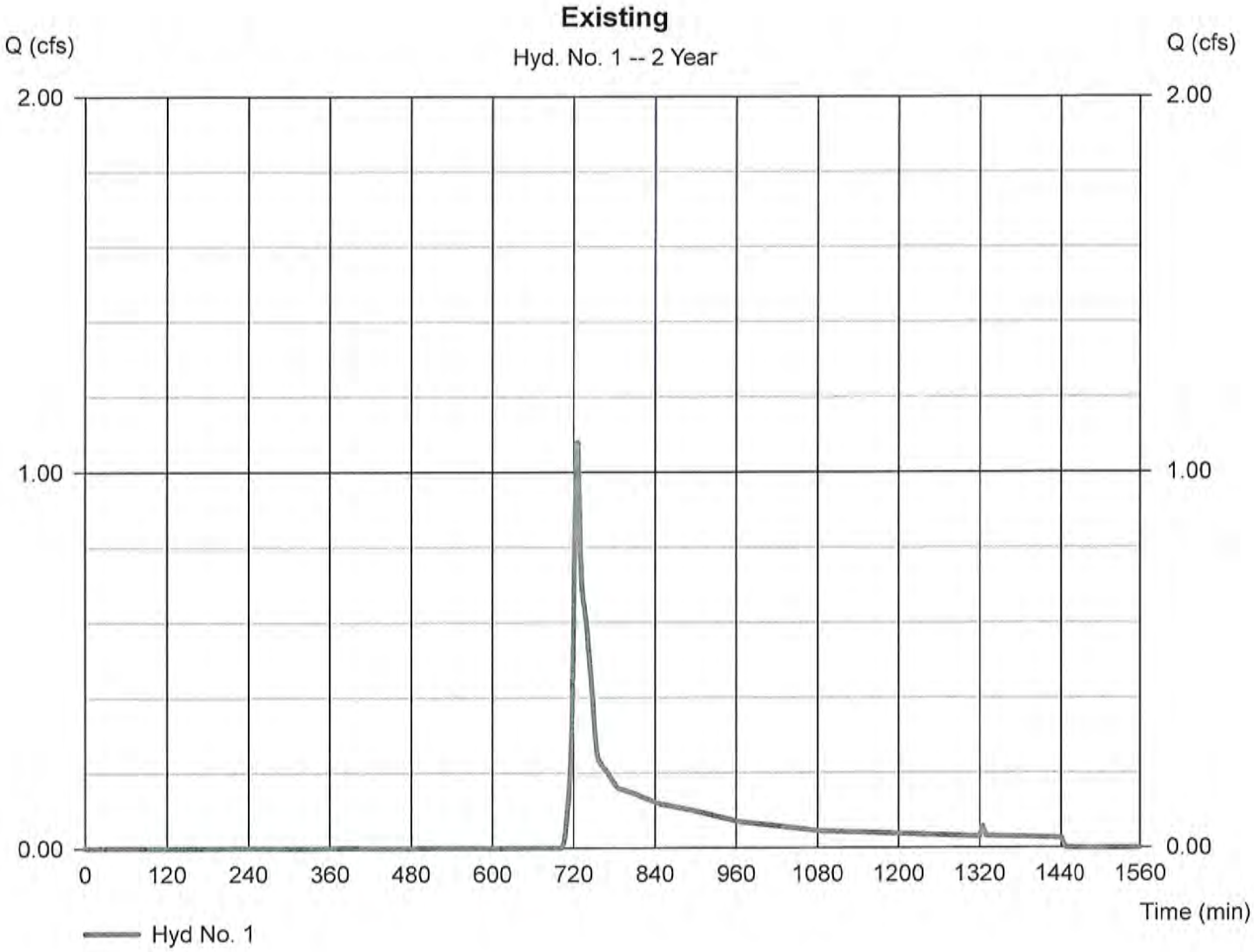
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 1.079 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 4,160 cuft
Drainage area	= 2.090 ac	Curve number	= 65.8
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



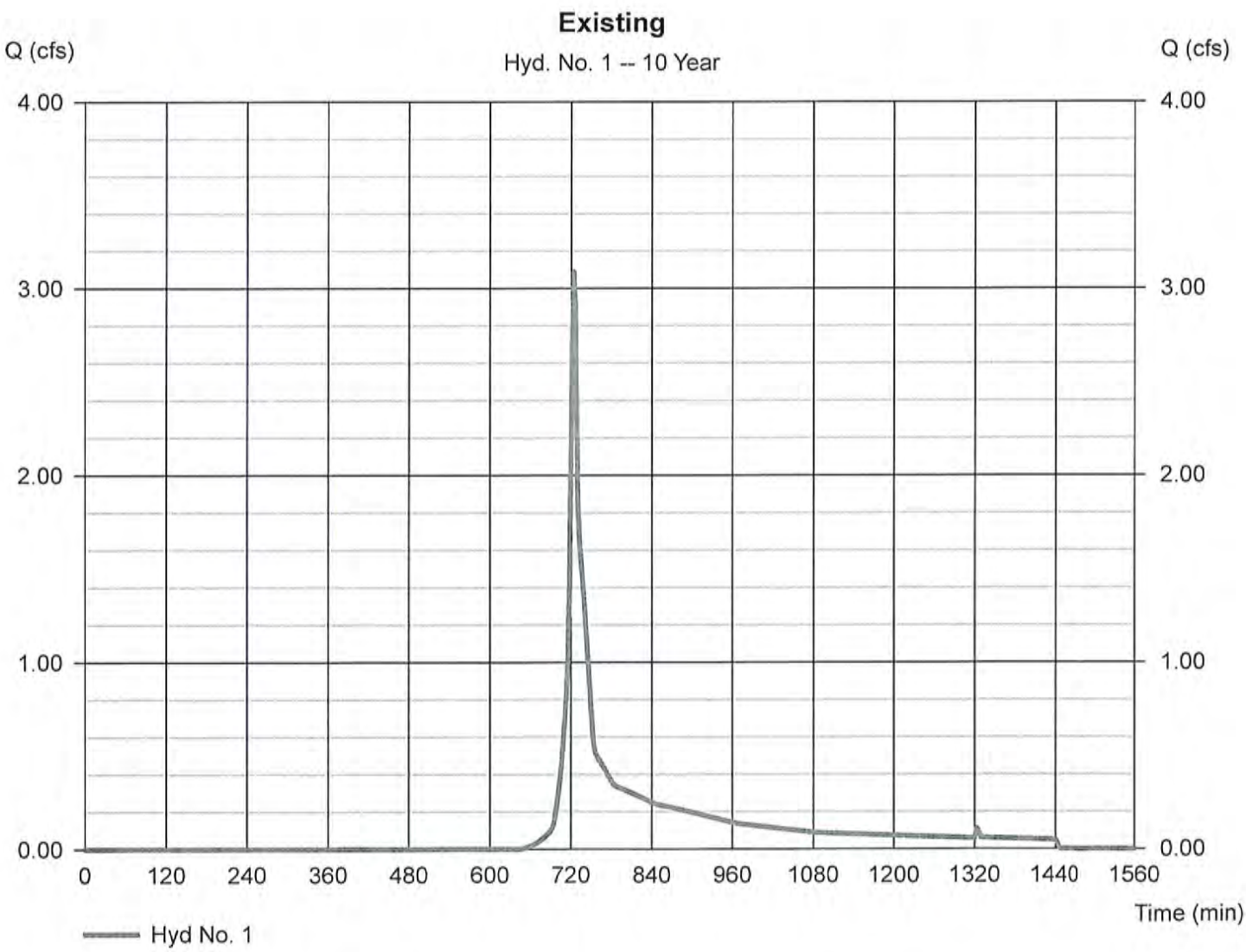
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 3.088 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 9,837 cuft
Drainage area	= 2.090 ac	Curve number	= 65.8
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



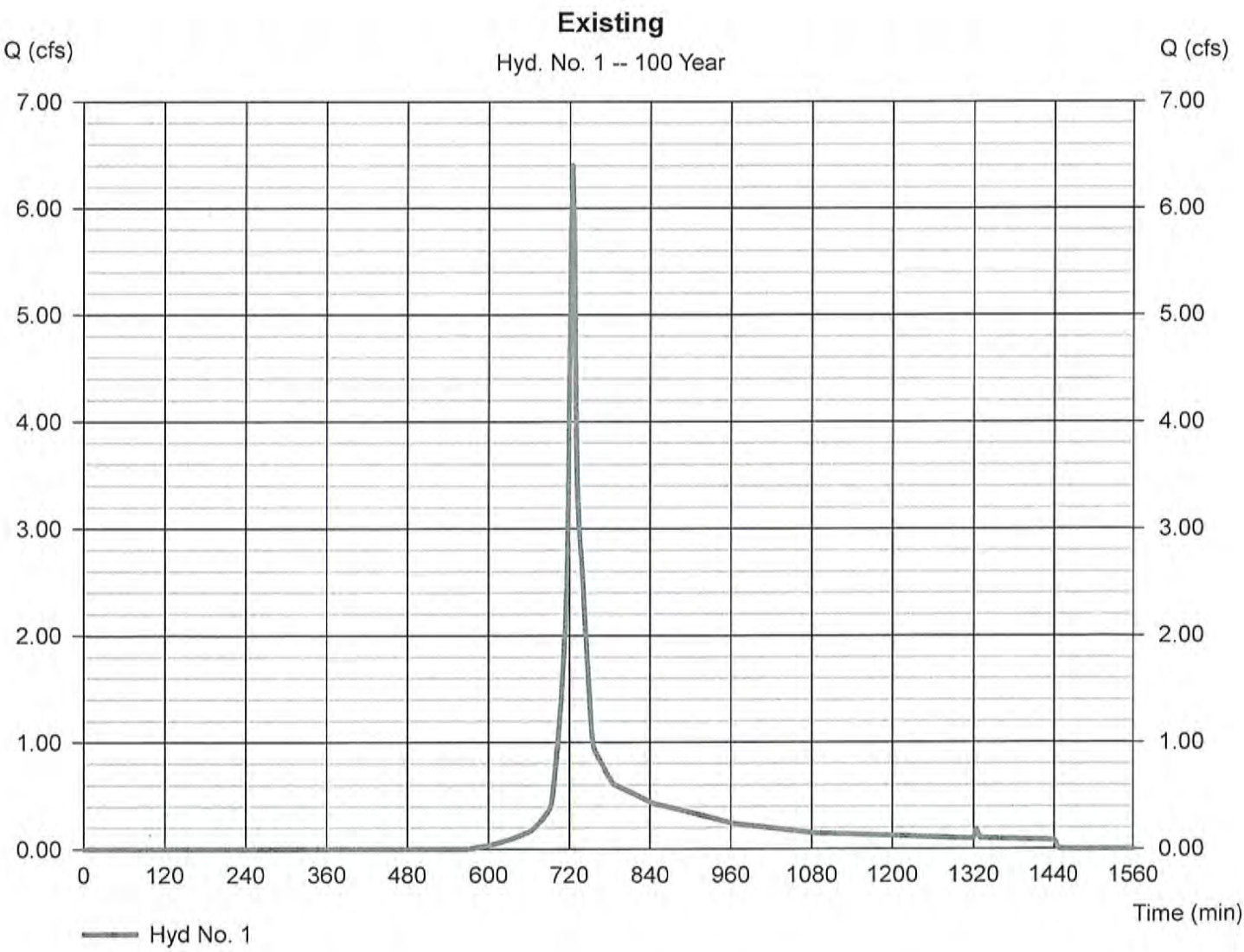
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Jan 4, 2016

Hyd. No. 1

Existing

Hydrograph type	= SCS Runoff	Peak discharge	= 6.402 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 19,357 cuft
Drainage area	= 2.090 ac	Curve number	= 65.8
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



Post-Development Hydrology

Worksheet 2: Runoff curve number and runoff SM-229

Project: 18 Wetherbee Street By DJC Date 10/23/15

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] P1

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) [Square Ft]	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
Hinckley 253B A	Open Space	39			0.86	33.53
Hinckley 253B A	Impervious	98			0.40	39.20
Hinckley 253B A	Gravel	76			0.54	41.25
					0.00	0.00
					0.00	0.00
				Totals =	1.80	113.98

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{113.98}{1.80} = 63.24$; Use CN = 63.2

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	0.48	1.22	2.48
Runoff, Q.....	cf	3168	7963	16240

D-2 (210-VI-TR-55, Second Ed., June 1986)

Worksheet 3: Time of Concentration (Tc) or travel time (Tt) SM-229

Project: 18 Wetherbee Street By DJC Date 10/23/15

Location: Acton, MA Checked _____ Date _____

Circle one: Present | Developed | through P1- To wetlands

Circle one: Tc | Tt | subarea _____

Sheet flow (Applicable to Tc only)		Segment ID	A-B			
1. Surface Description (table 3-1)			Gravel			
2. Mannings roughness coeff., n (table 3-1)			0.011			
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	0.004			
6. Tt = 0.007 (nL)^0.8 / (P2^0.5 s^0.4)	Compute Tt	hr	0.02			0.02
Shallow concentrated Flow		Segment ID	B-C			
7. Surface Description (paved or unpaved)			Paved			
8. Flow Length, L		ft	203			
9. Watercourse slope, s		ft/ft	0.038			
10. Average Velocity, V (figure 3-1)		ft/s	3.96			
11. Tt = L / 3600V	Compute Tt	hr	0.01			0.01
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 0.04

min 6.0

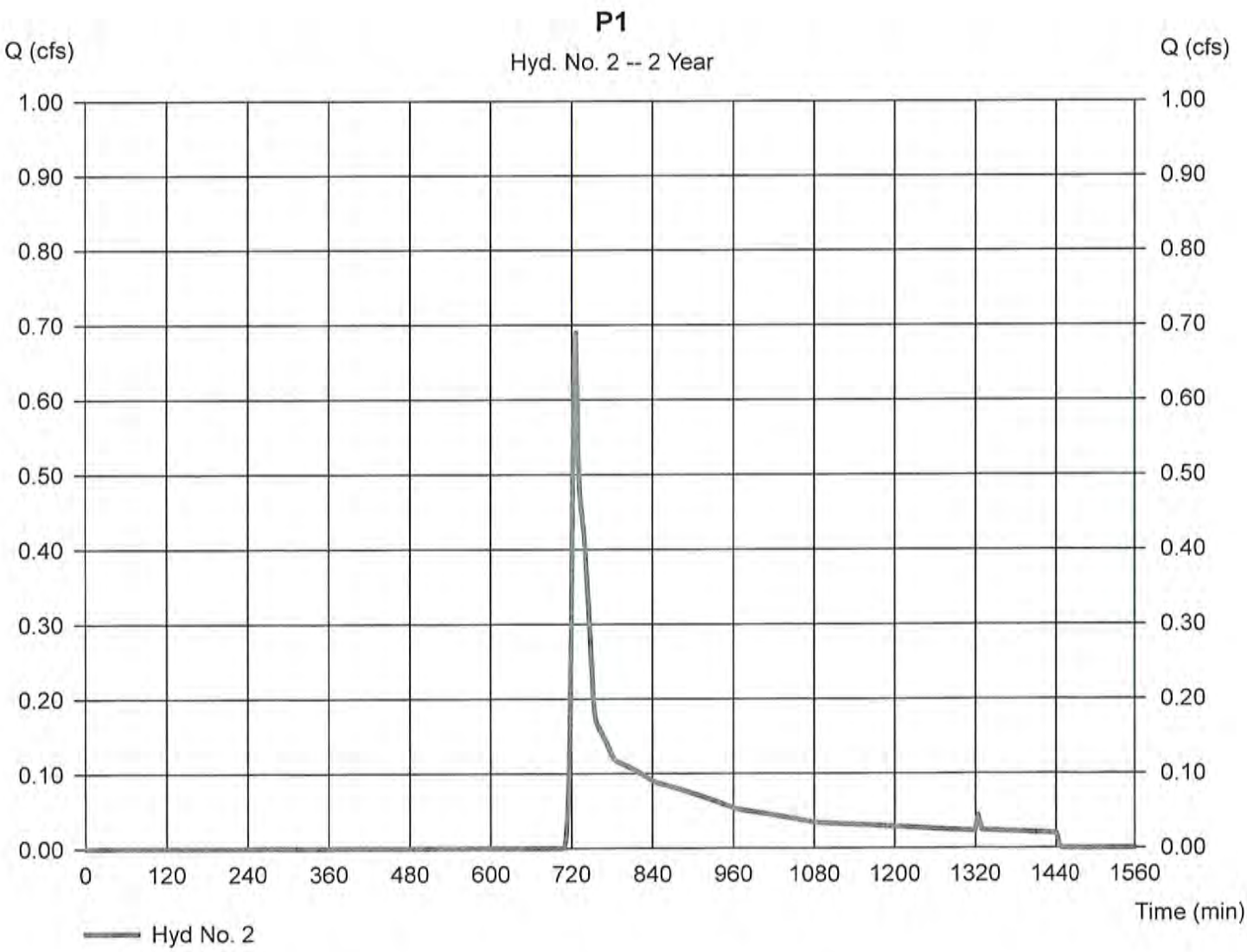
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 2

P1

Hydrograph type	= SCS Runoff	Peak discharge	= 0.689 cfs
Storm frequency	= 2 yrs	Time to peak	= 726 min
Time interval	= 2 min	Hyd. volume	= 2,958 cuft
Drainage area	= 1.800 ac	Curve number	= 63.2
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



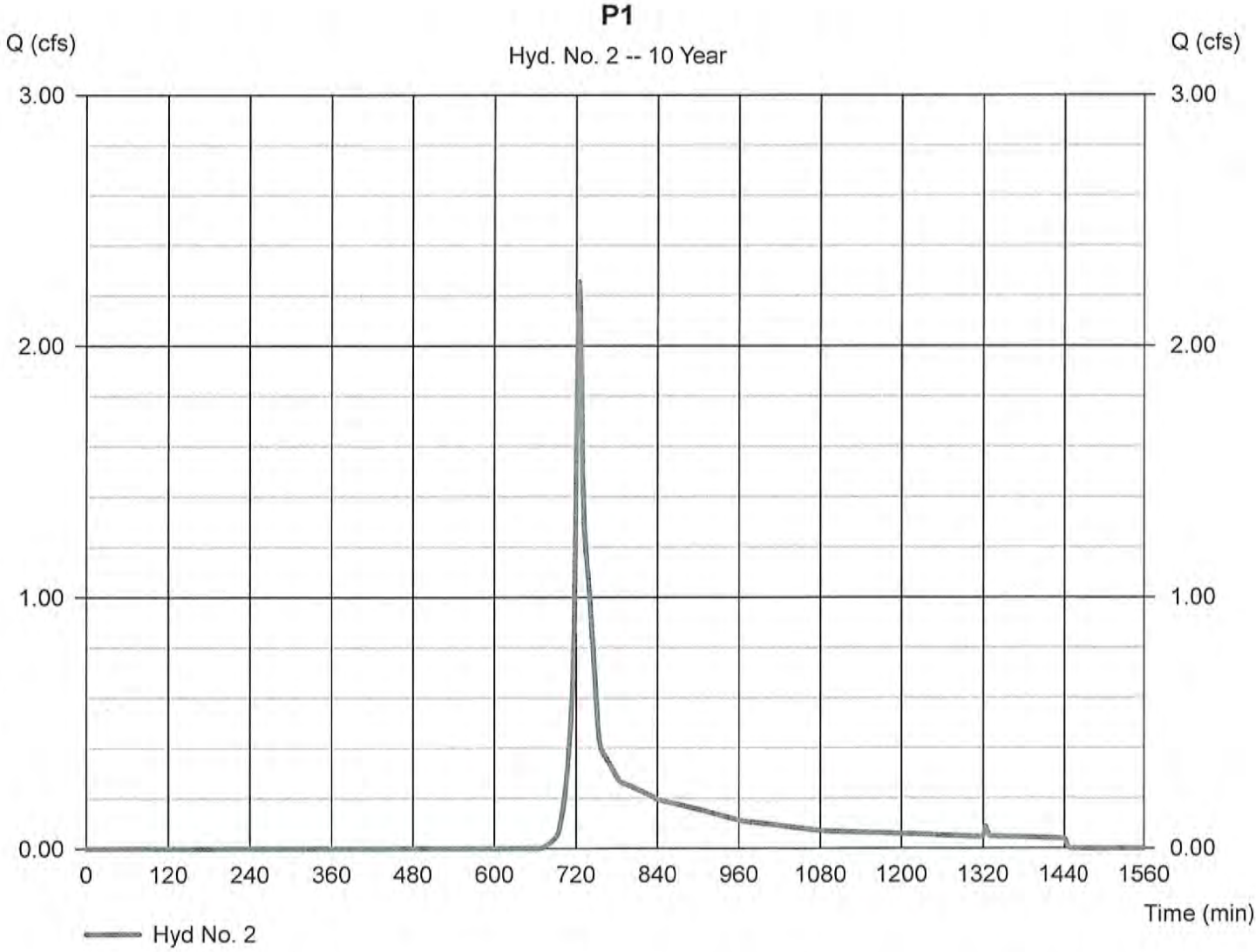
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 2

P1

Hydrograph type	= SCS Runoff	Peak discharge	= 2.256 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 7,441 cuft
Drainage area	= 1.800 ac	Curve number	= 63.2
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



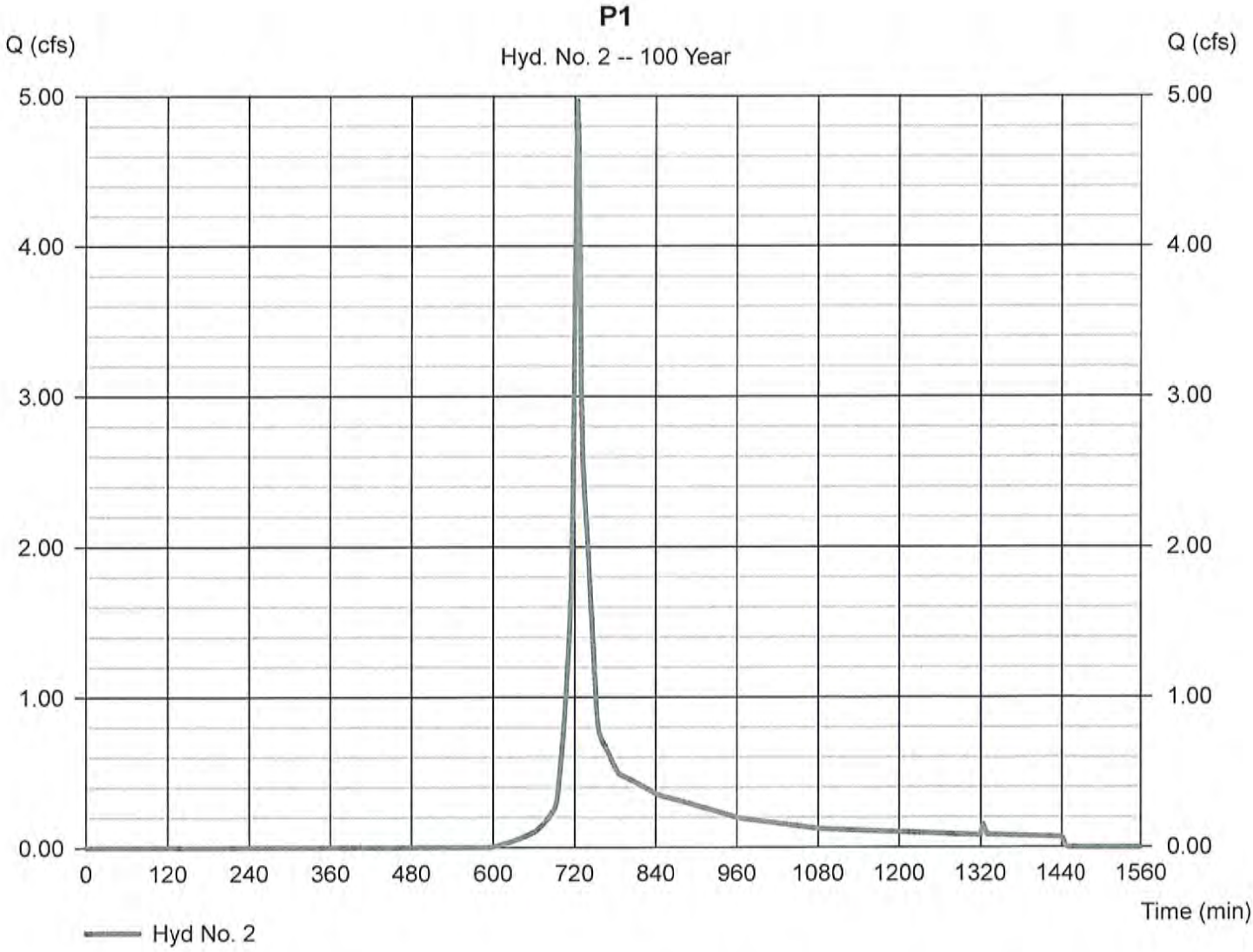
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 2

P1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.968 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 15,183 cuft
Drainage area	= 1.800 ac	Curve number	= 63.2
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



Worksheet 2: Runoff curve number and runoff SM-229

Project: 18 Wetherbee Street By DJC Date 10/23/15

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] P2- Proposed Building Trade Shop

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) [Square Ft]	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
Hinckley 253B A	Open Space	39			0.00	0.00
Hinckley 253B A	Impervious	98			0.17	16.87
Hinckley 253B A	Gravel	76			0.00	0.00
					0.00	0.00
					0.00	0.00
				Totals =	0.17	16.87

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{16.87}{0.17} =$ 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	1792	2665	3851

D-2 (210-VI-TR-55, Second Ed., June 1986)

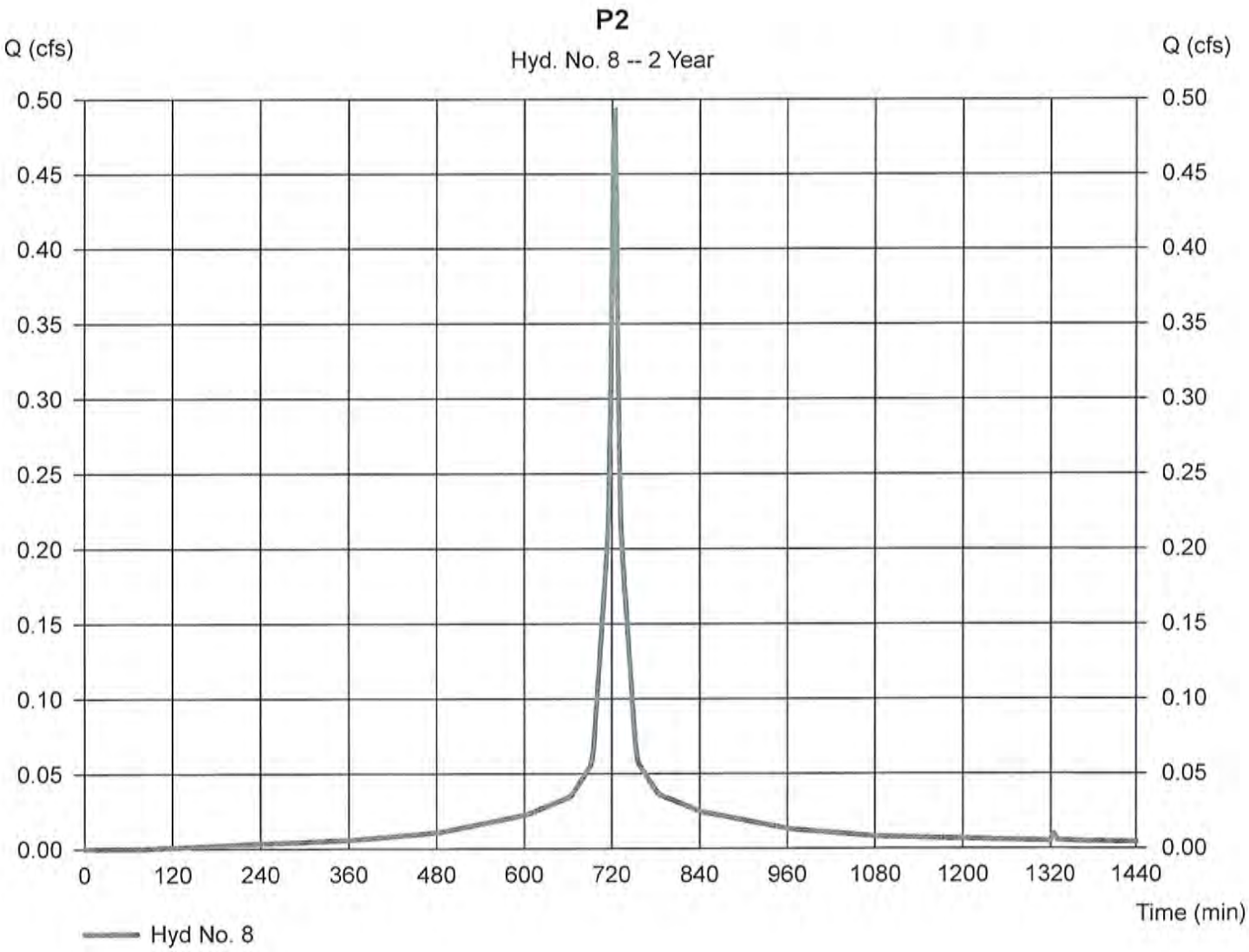
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 — Thursday, Jan 7, 2016

Hyd. No. 8

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.493 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,659 cuft
Drainage area	= 0.170 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



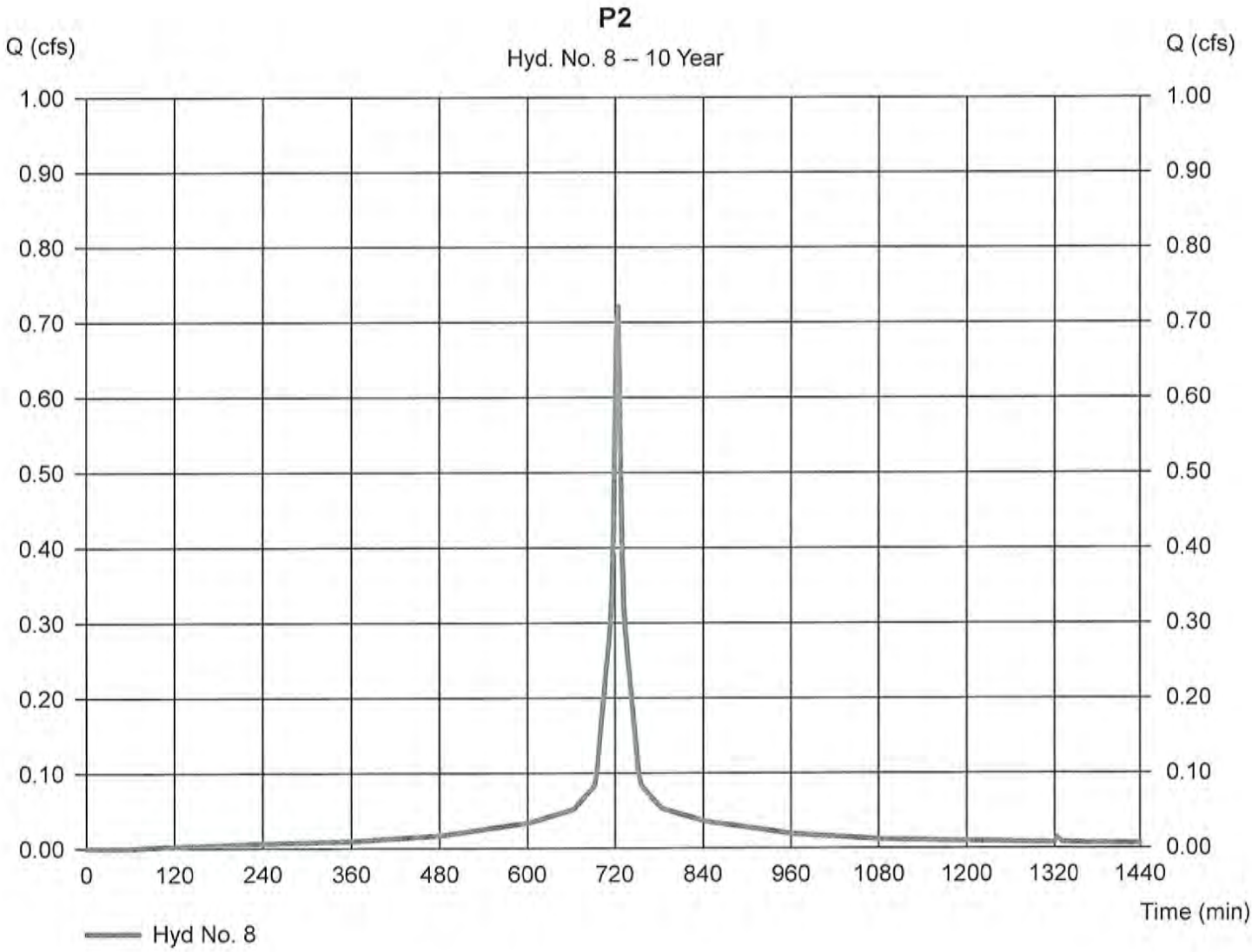
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 8

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 0.721 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,467 cuft
Drainage area	= 0.170 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



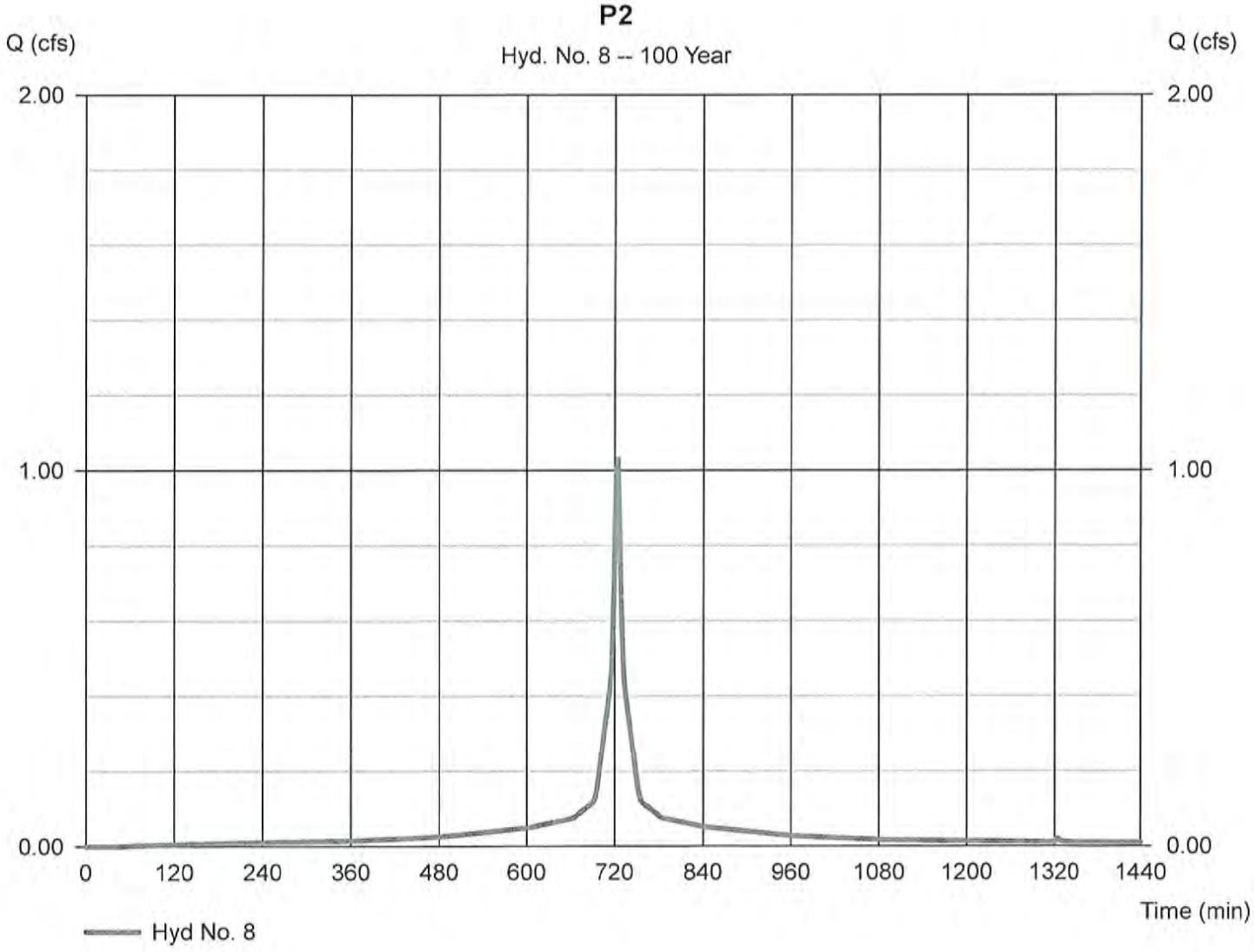
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 8

P2

Hydrograph type	= SCS Runoff	Peak discharge	= 1.028 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 3,565 cuft
Drainage area	= 0.170 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



Infiltration Trench Calculation

Project: 18 Wetherbee Street by: DJC Date: 1/7/2016

Location: Acton, MA checked: Date:

Infiltration Trench Sizing

Length:	188	ft	
Depth:	2	ft	
Width:	3	ft	
Bottom Area:	564	SF	
Sidewall Area:	388	SF	One side only
Total Area:	952	SF	
Infiltration Rate:	8.27	in/hr	
	0.000191	ft/sec	
Q=	0.182	CFS	

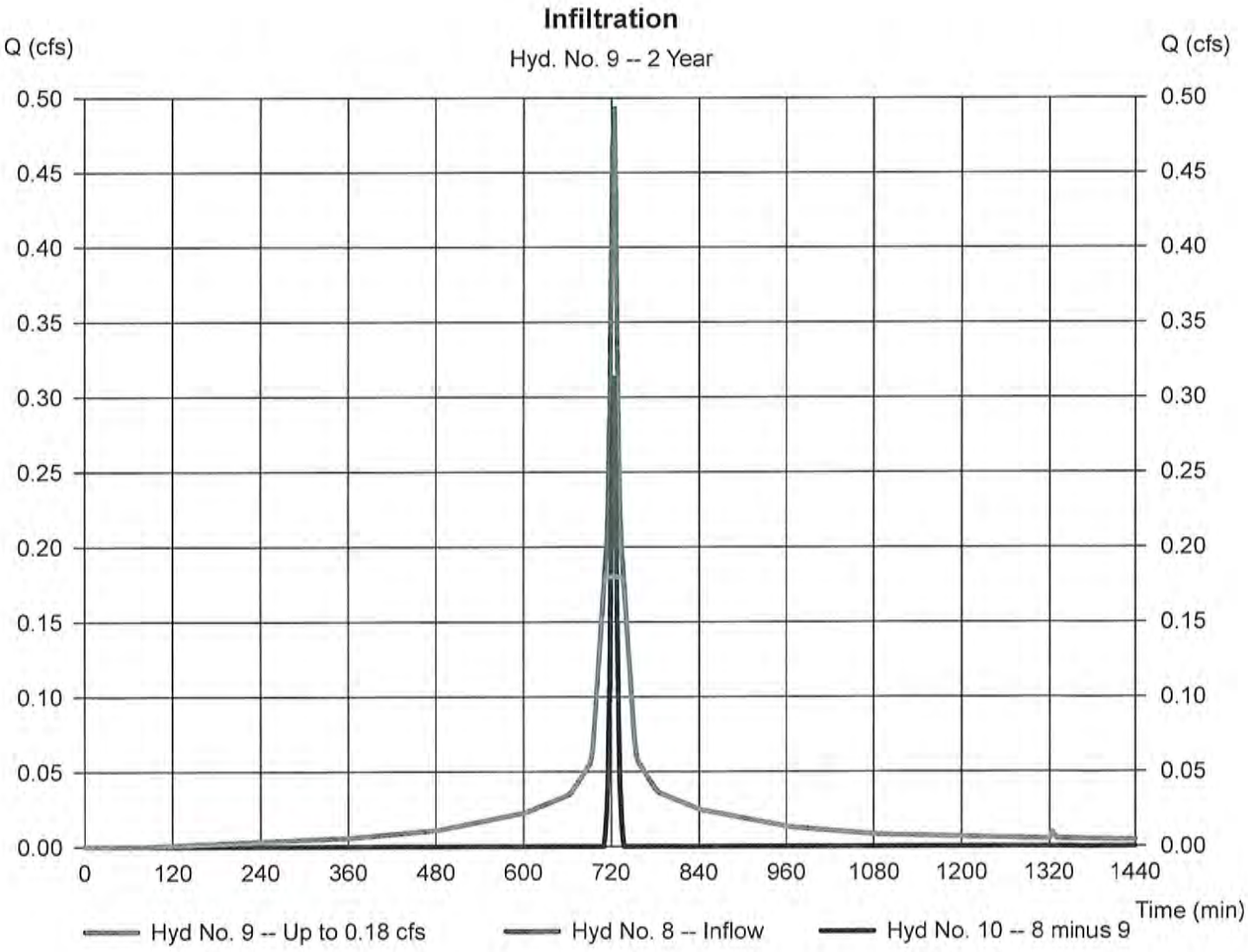
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 9

Infiltration

Hydrograph type	= Diversion1	Peak discharge	= 0.180 cfs
Storm frequency	= 2 yrs	Time to peak	= 712 min
Time interval	= 2 min	Hyd. volume	= 1,472 cuft
Inflow hydrograph	= 8 - P2	2nd diverted hyd.	= 10
Diversion method	= Constant Q	Constant Q	= 0.18 cfs



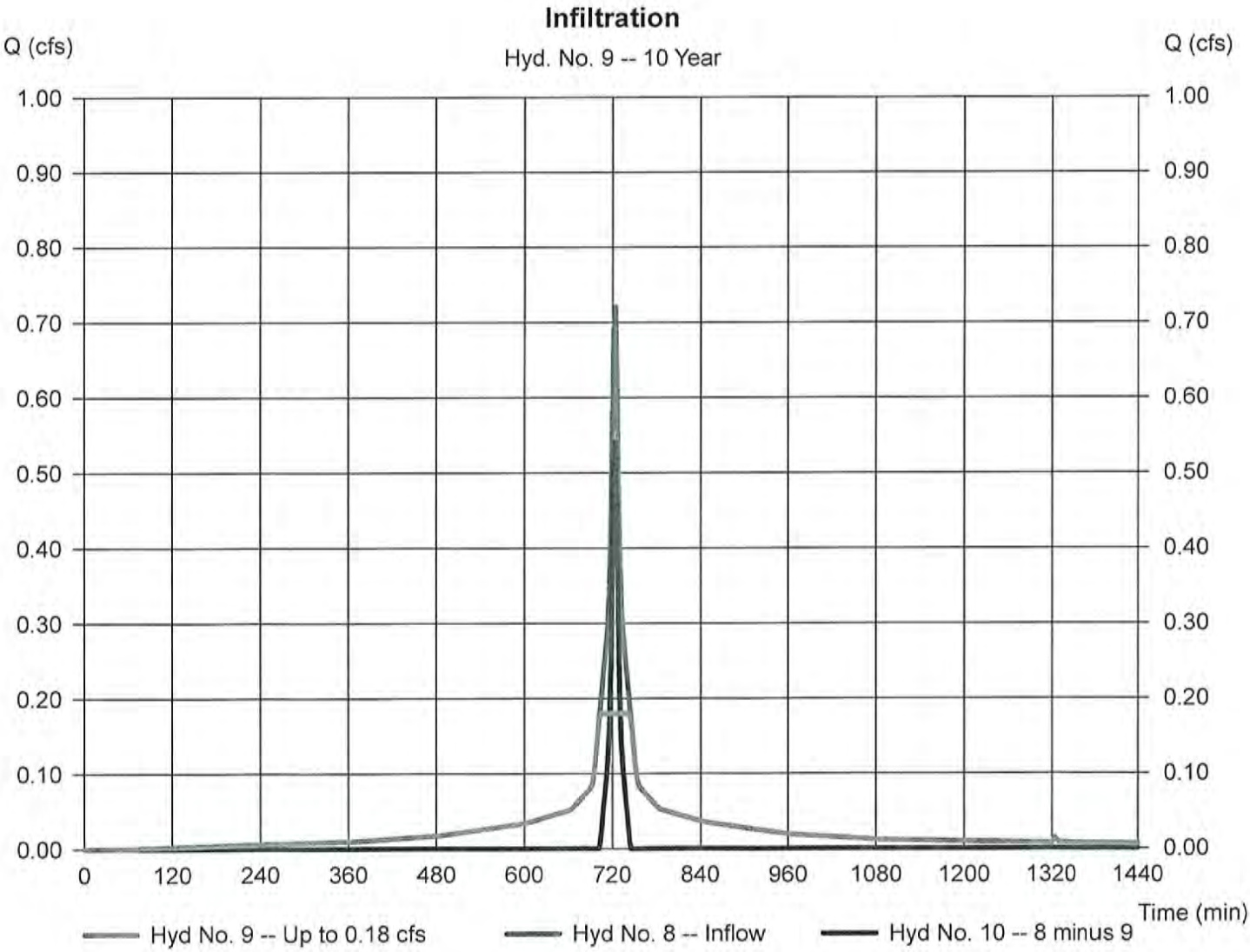
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 9

Infiltration

Hydrograph type	= Diversion1	Peak discharge	= 0.180 cfs
Storm frequency	= 10 yrs	Time to peak	= 704 min
Time interval	= 2 min	Hyd. volume	= 2,023 cuft
Inflow hydrograph	= 8 - P2	2nd diverted hyd.	= 10
Diversion method	= Constant Q	Constant Q	= 0.18 cfs



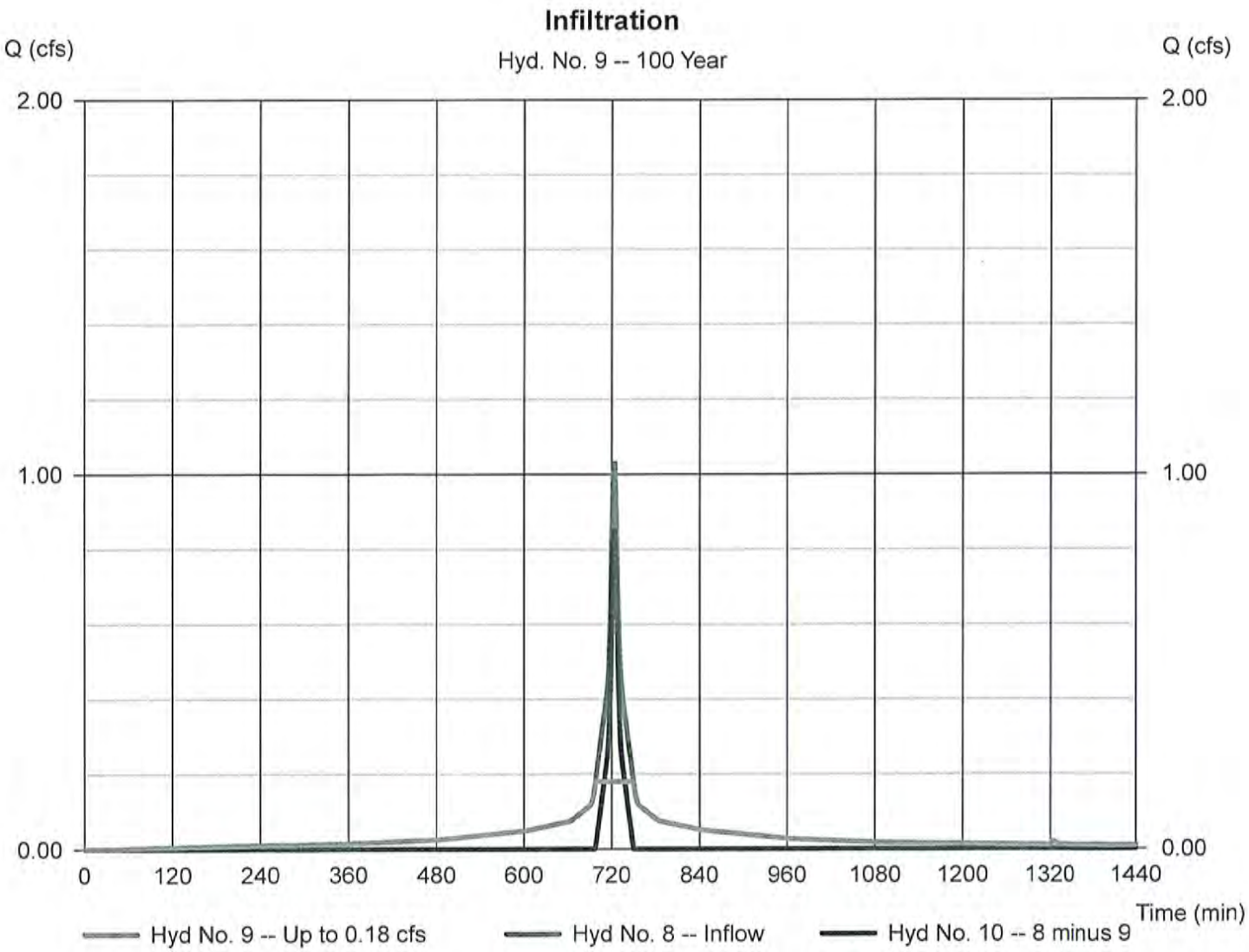
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 9

Infiltration

Hydrograph type	= Diversion1	Peak discharge	= 0.180 cfs
Storm frequency	= 100 yrs	Time to peak	= 698 min
Time interval	= 2 min	Hyd. volume	= 2,713 cuft
Inflow hydrograph	= 8 - P2	2nd diverted hyd.	= 10
Diversion method	= Constant Q	Constant Q	= 0.18 cfs



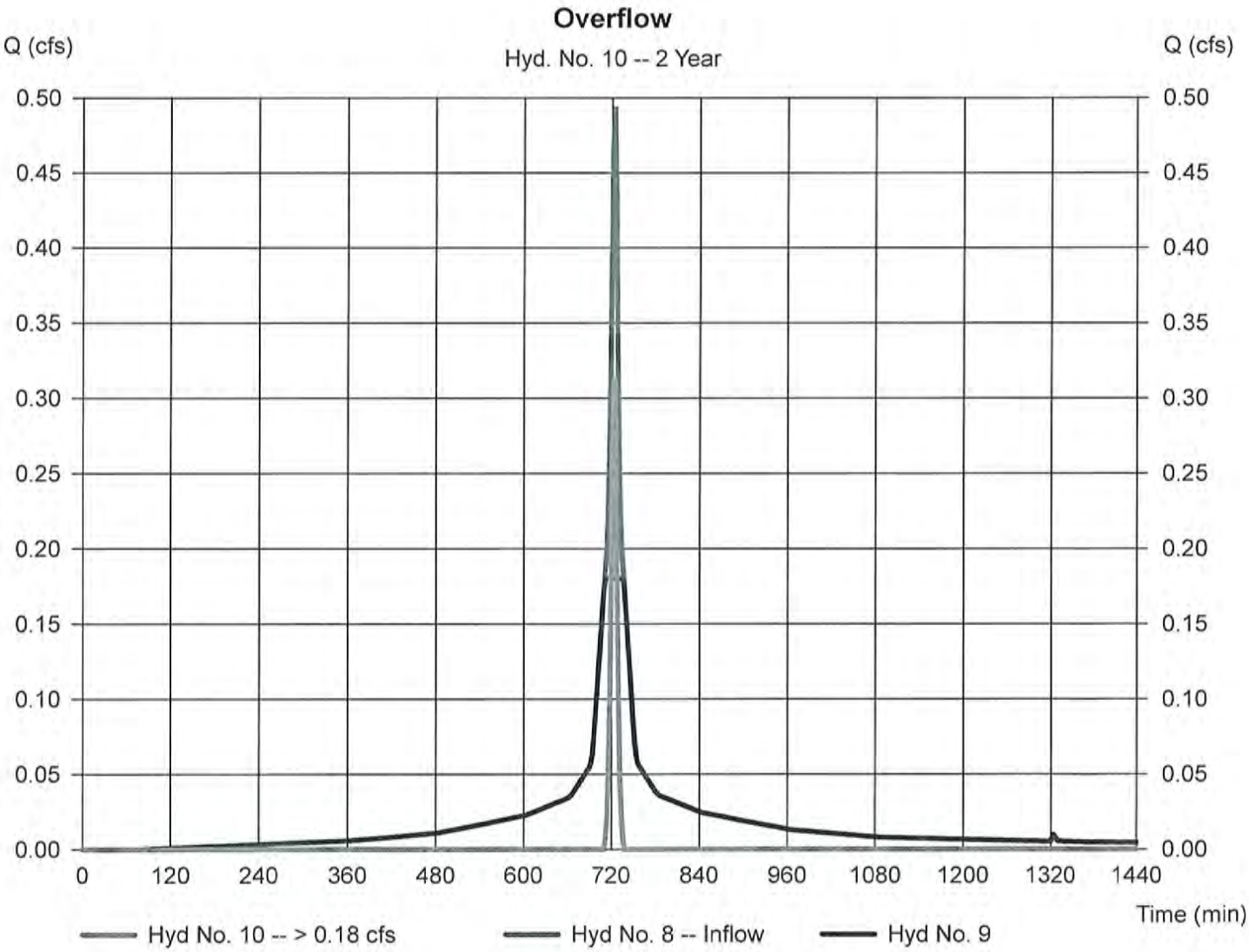
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 10

Overflow

Hydrograph type	= Diversion2	Peak discharge	= 0.313 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 187 cuft
Inflow hydrograph	= 8 - P2	2nd diverted hyd.	= 9
Diversion method	= Constant Q	Constant Q	= 0.18 cfs



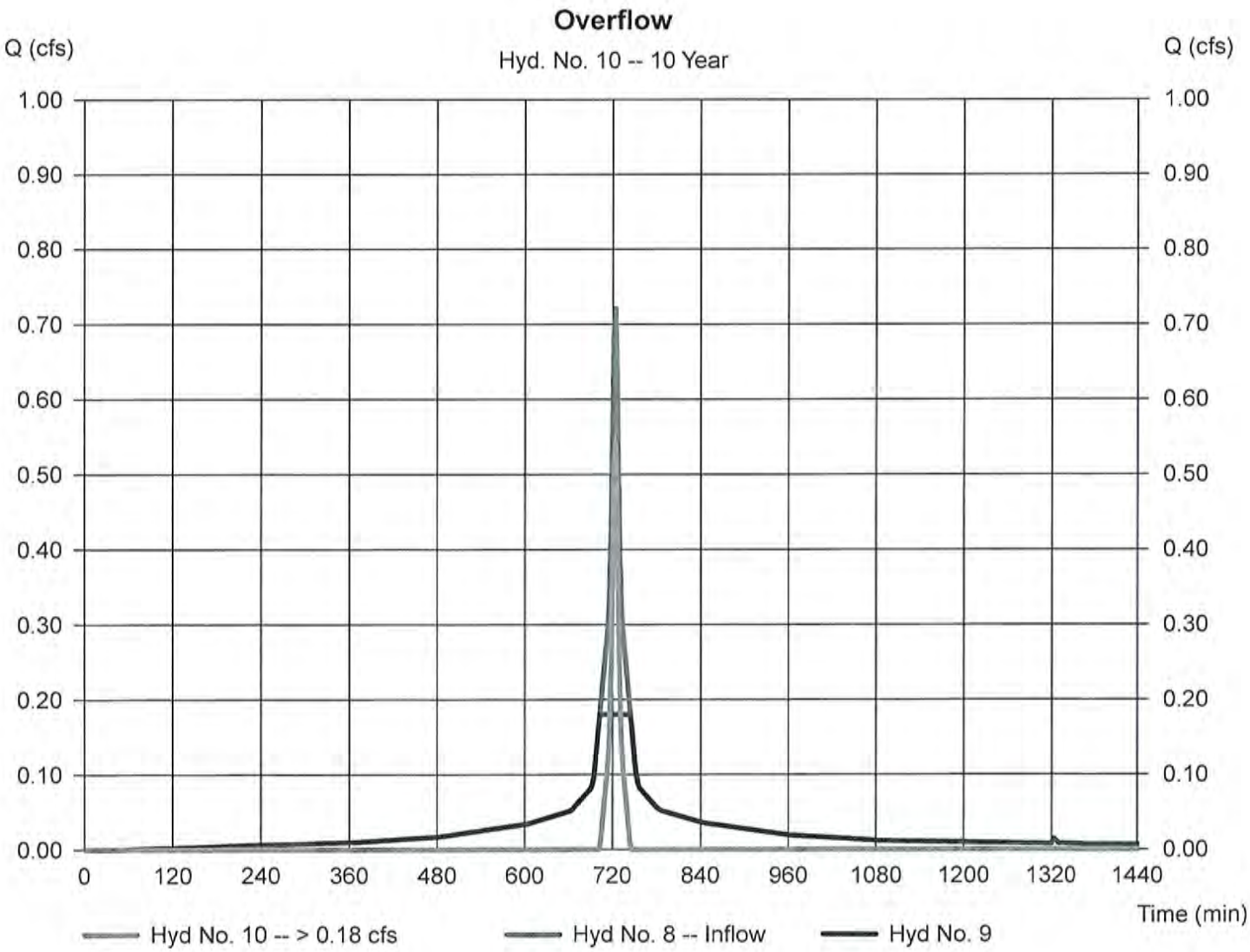
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 10

Overflow

Hydrograph type	= Diversion2	Peak discharge	= 0.541 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 444 cuft
Inflow hydrograph	= 8 - P2	2nd diverted hyd.	= 9
Diversion method	= Constant Q	Constant Q	= 0.18 cfs



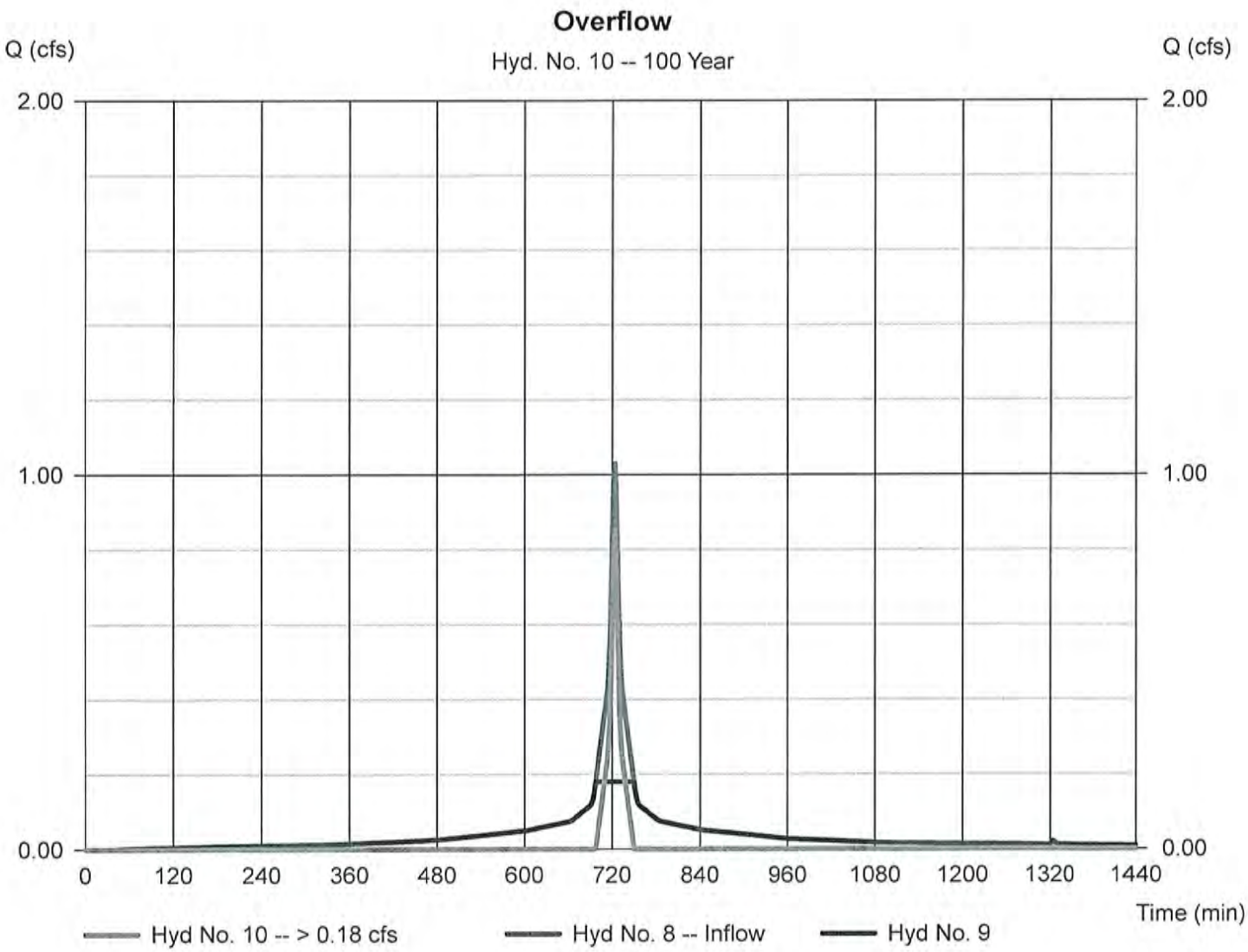
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 10

Overflow

Hydrograph type	= Diversion2	Peak discharge	= 0.848 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 851 cuft
Inflow hydrograph	= 8 - P2	2nd diverted hyd.	= 9
Diversion method	= Constant Q	Constant Q	= 0.18 cfs



Hydrograph Report

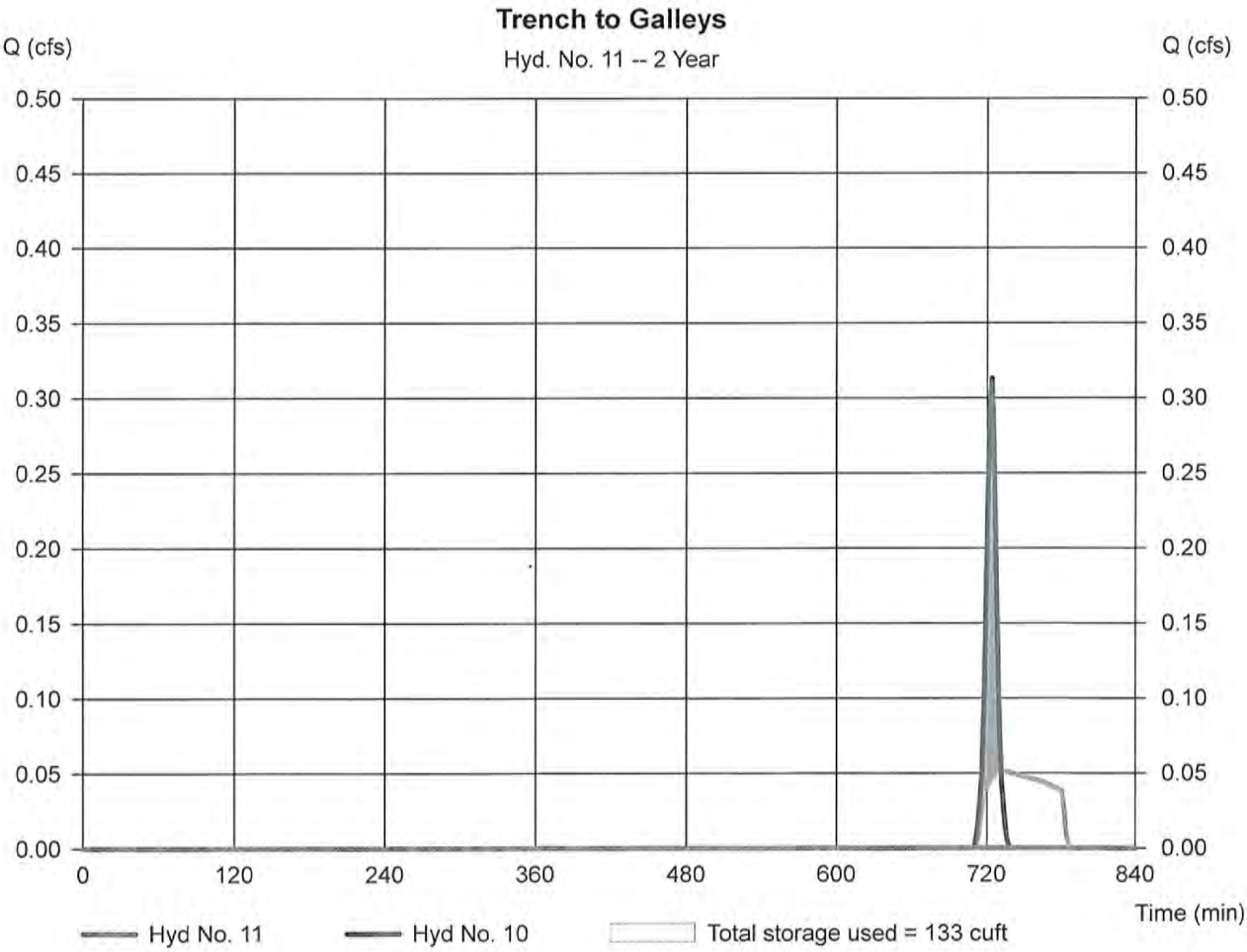
Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 11

Trench to Galleys

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 10 - Overflow	Max. Elevation	= 1.09 ft
Reservoir name	= Galley	Max. Storage	= 133 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

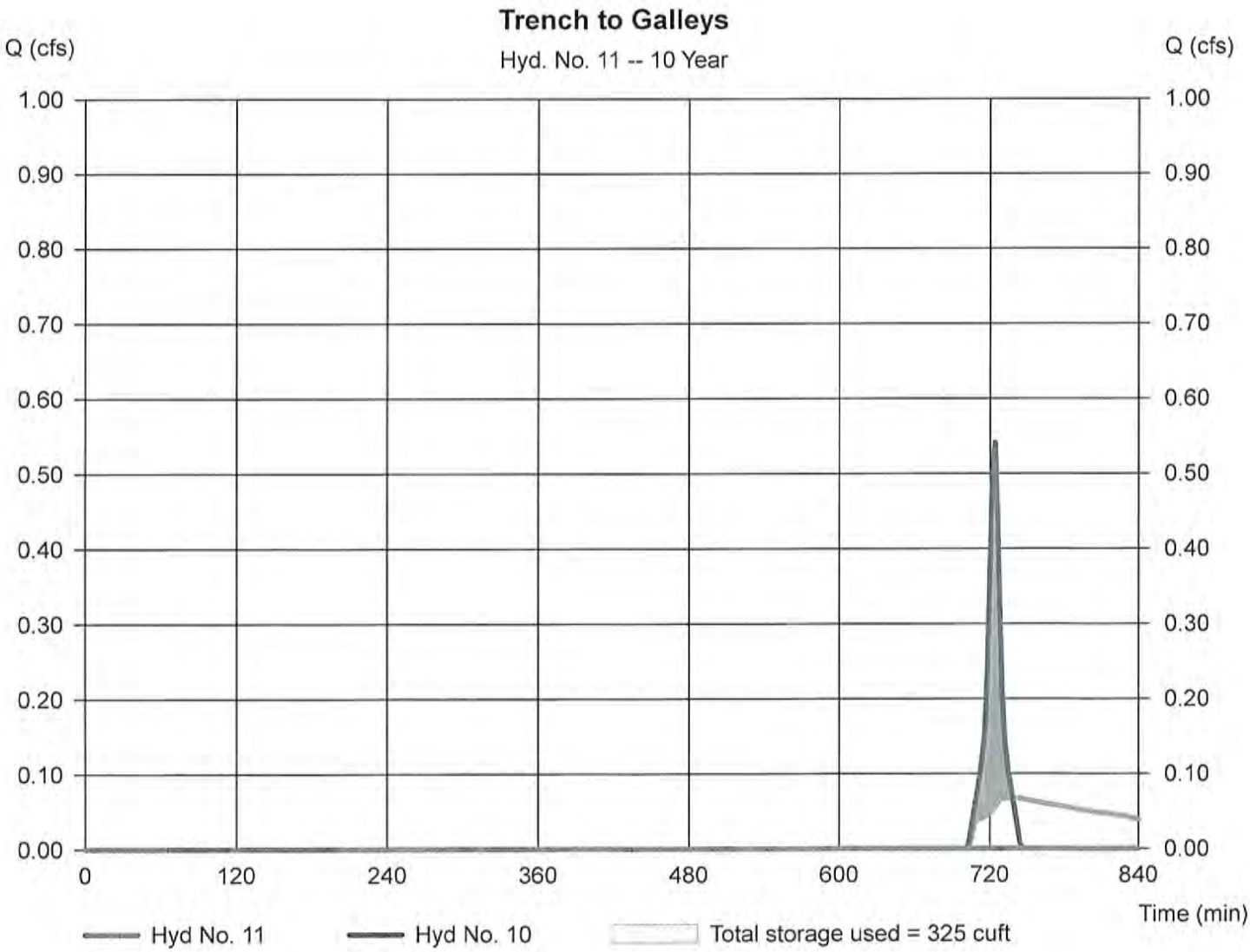
Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 11

Trench to Galleys

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 10 - Overflow	Max. Elevation	= 2.28 ft
Reservoir name	= Galley	Max. Storage	= 325 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

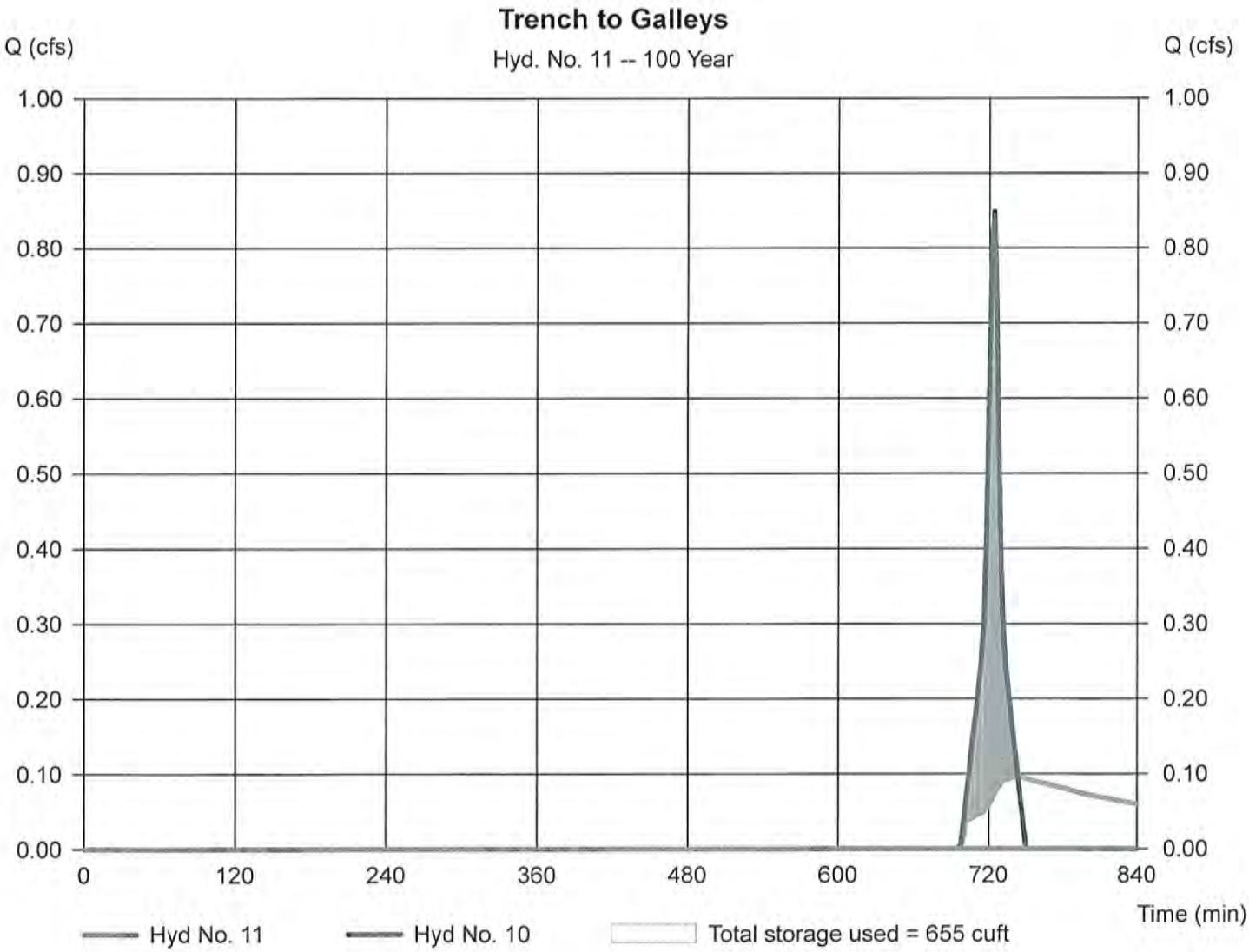
Hydraflow Hydrographs by Intelisolve v9.2 | Thursday, Jan 7, 2016

Hyd. No. 11

Trench to Galleys

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 10 - Overflow	Max. Elevation	= 4.45 ft
Reservoir name	= Galley	Max. Storage	= 655 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Thursday, Jan 7, 2016

Pond No. 1 - Galley

Pond Data

UG Chambers - Invert elev. = 0.50 ft, Rise x Span = 3.75 x 4.00 ft, Barrel Len = 3.50 ft, No. Barrels = 10, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 0.00 ft, Width = 5.50 ft, Height = 5.25 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	0.00	n/a	0	0
0.53	0.53	n/a	43	43
1.05	1.05	n/a	85	127
1.58	1.58	n/a	85	212
2.10	2.10	n/a	85	296
2.63	2.63	n/a	85	381
3.15	3.15	n/a	85	465
3.68	3.68	n/a	85	550
4.20	4.20	n/a	85	634
4.73	4.73	n/a	45	679
5.25	5.25	n/a	40	719

Culvert / Orifice Structures

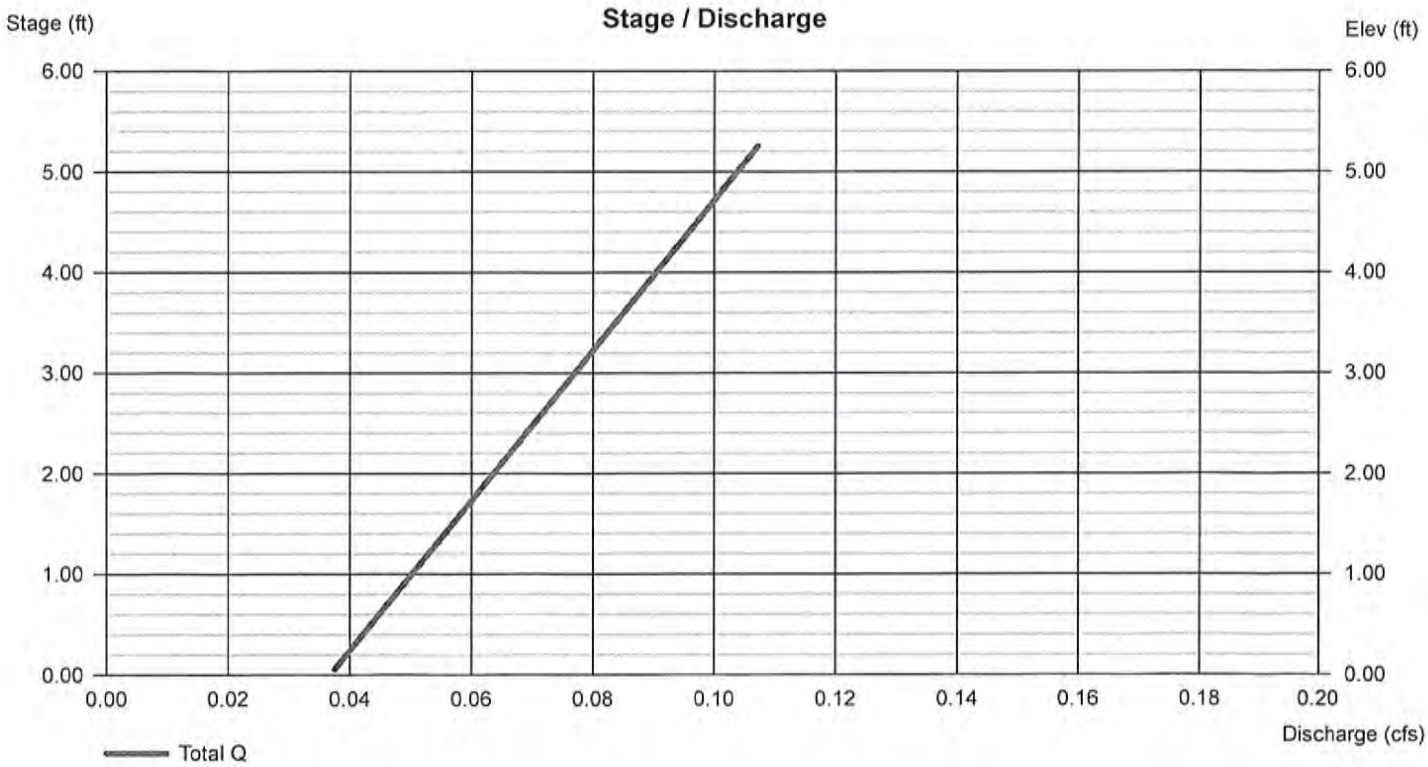
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

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-229**

Project: 18 Wetherbee Street By DJC Date 10/23/15

Location: Acton, MA Checked _____ Date _____

Circle one: Present [Developed] P3- Proposed Parking

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) [Square Ft]	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area Acres	Product of CN x Area
Hinckley 253B A	Open Space	39			0.00	0.00
Hinckley 253B A	Impervious	98			0.12	12.20
Hinckley 253B A	Gravel	76			0.00	0.00
					0.00	0.00
					0.00	0.00
				Totals =	0.12	12.20

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{12.20}{0.12} = 98.00$; 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	1296	1927	2784

D-2 (210-VI-TR-55, Second Ed., June 1986)

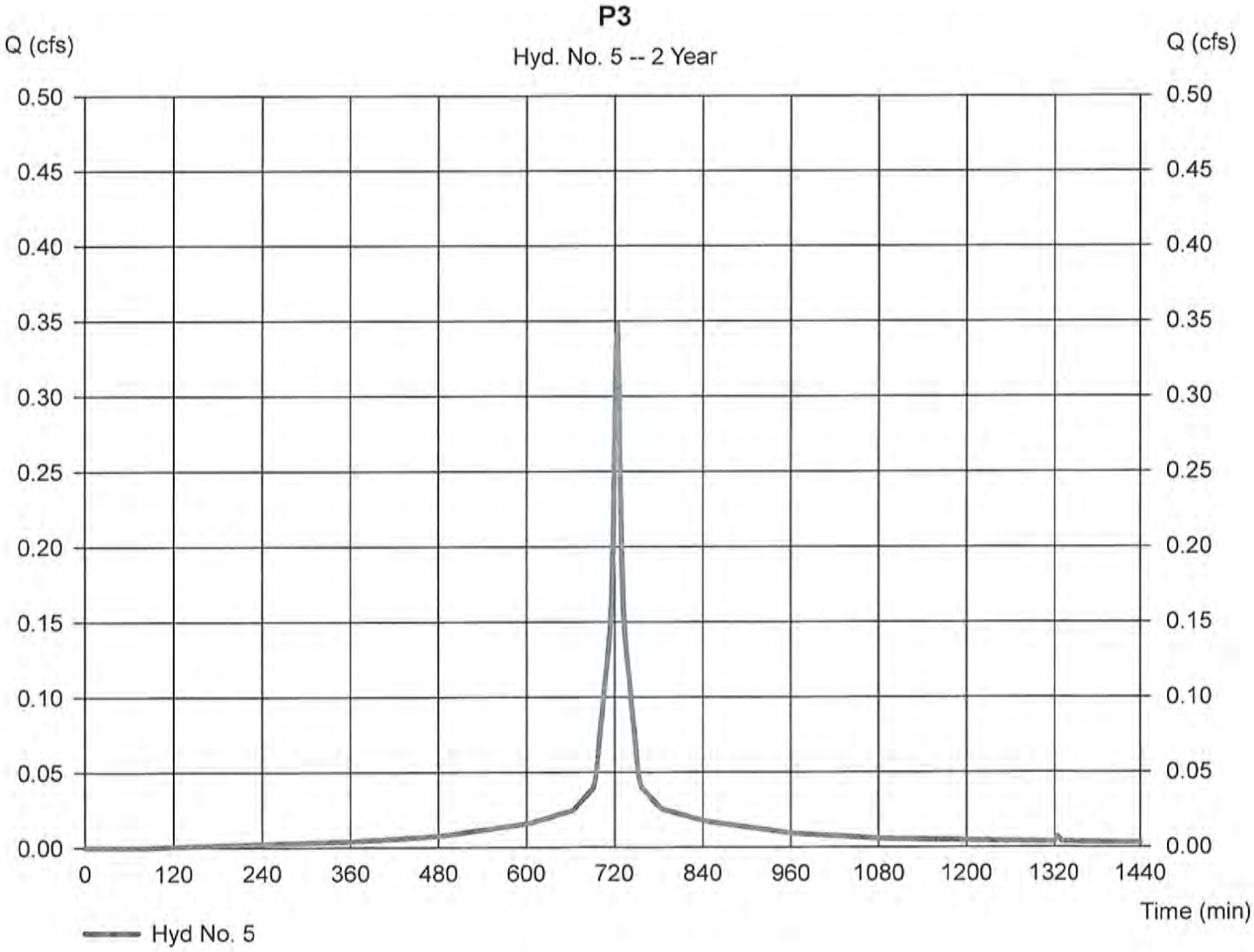
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 5

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.348 cfs
Storm frequency	= 2 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,171 cuft
Drainage area	= 0.120 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



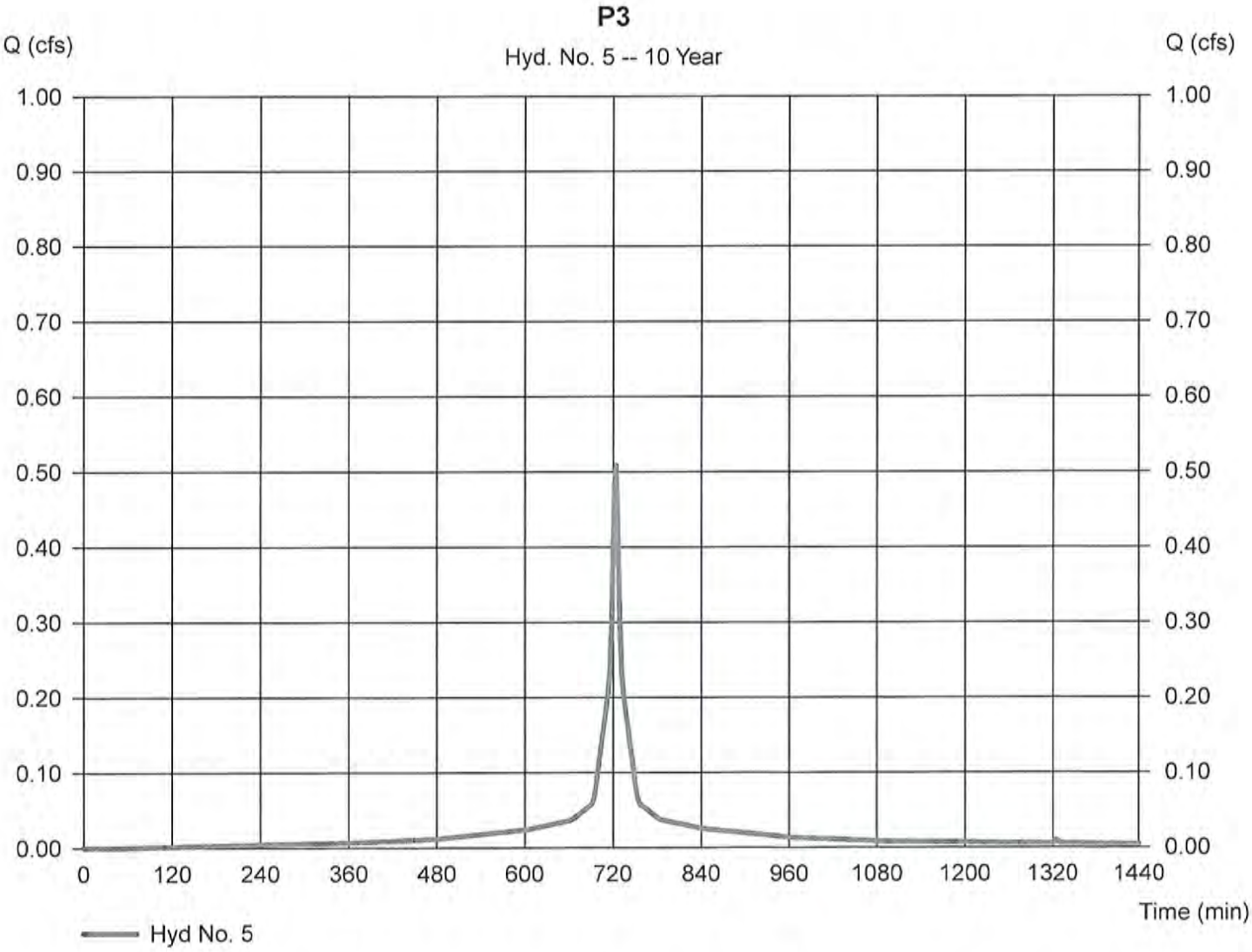
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 5

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.509 cfs
Storm frequency	= 10 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 1,741 cuft
Drainage area	= 0.120 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



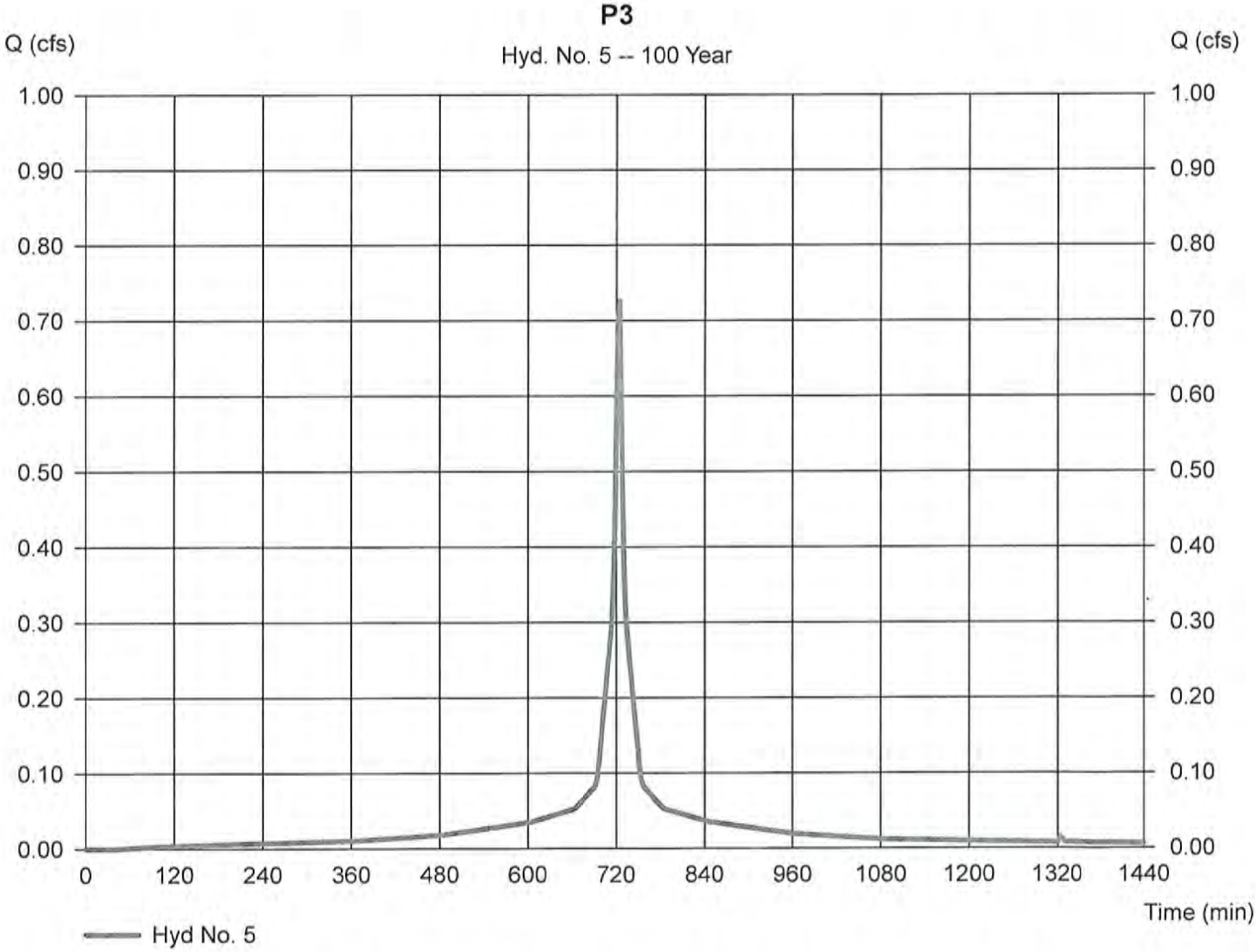
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 5

P3

Hydrograph type	= SCS Runoff	Peak discharge	= 0.726 cfs
Storm frequency	= 100 yrs	Time to peak	= 724 min
Time interval	= 2 min	Hyd. volume	= 2,516 cuft
Drainage area	= 0.120 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

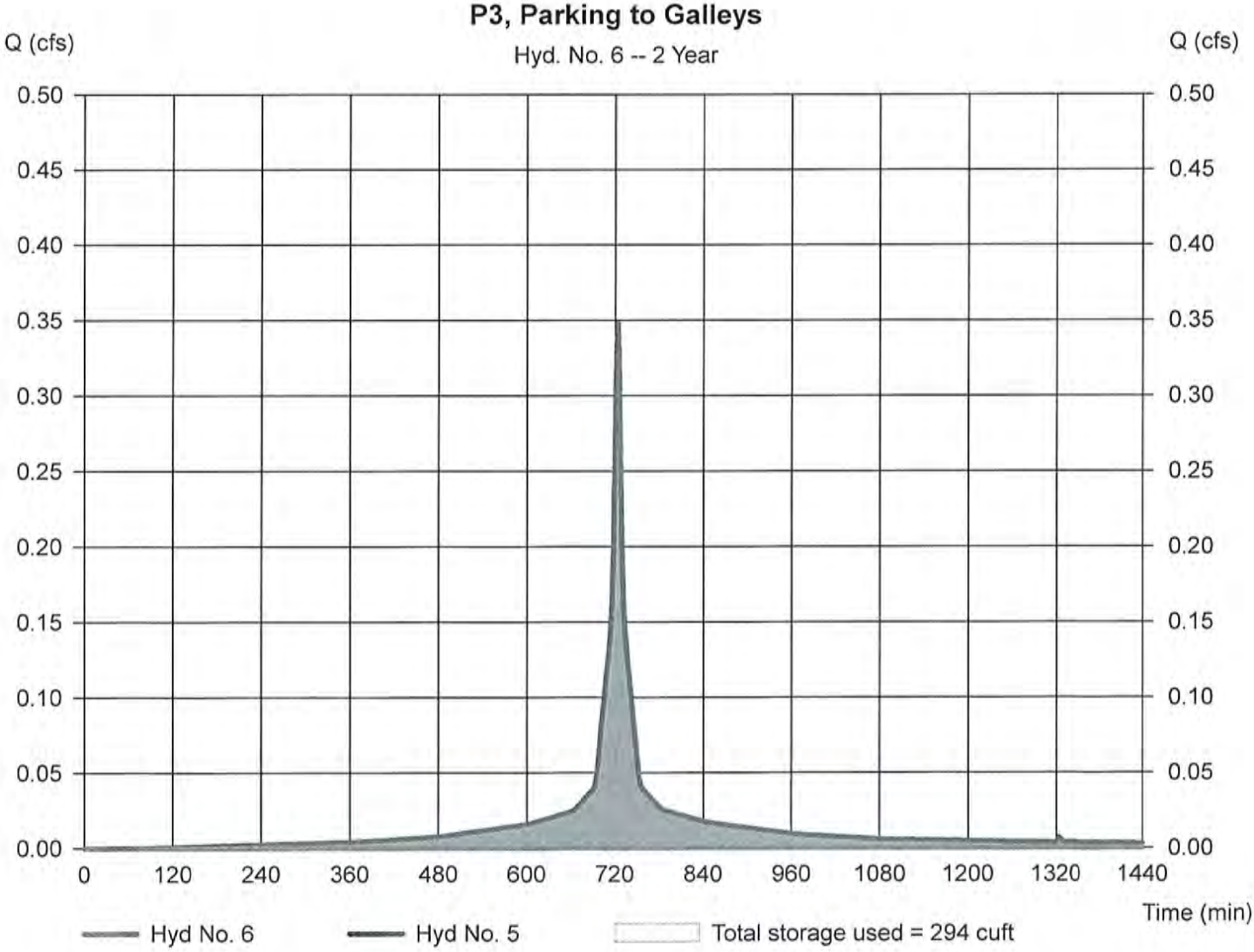
Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 6

P3, Parking to Galleys

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 676 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 5 - P3	Max. Elevation	= 1.78 ft
Reservoir name	= Galley	Max. Storage	= 294 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

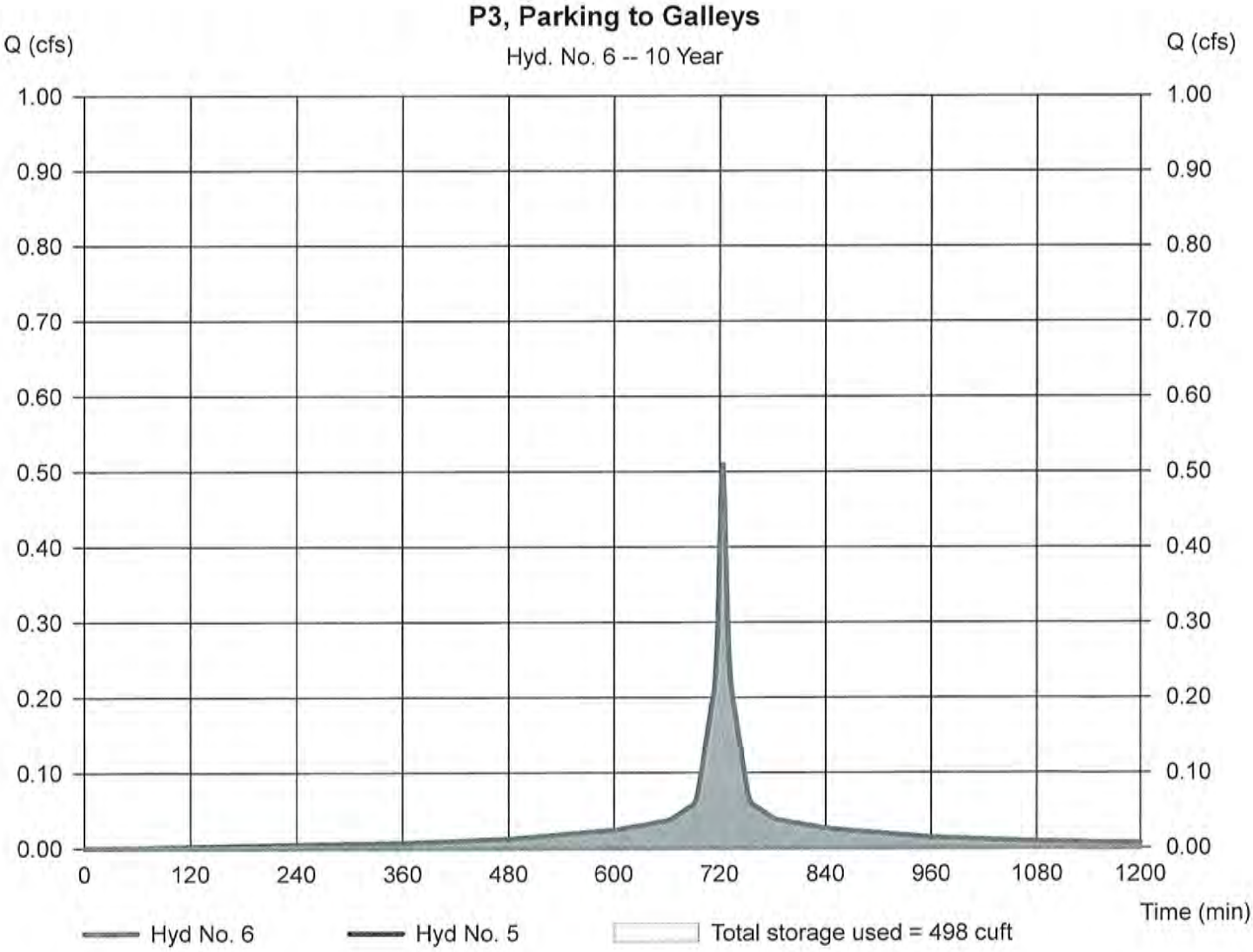
Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 6

P3, Parking to Galleys

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 624 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 5 - P3	Max. Elevation	= 2.84 ft
Reservoir name	= Galley	Max. Storage	= 498 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Hydrograph Report

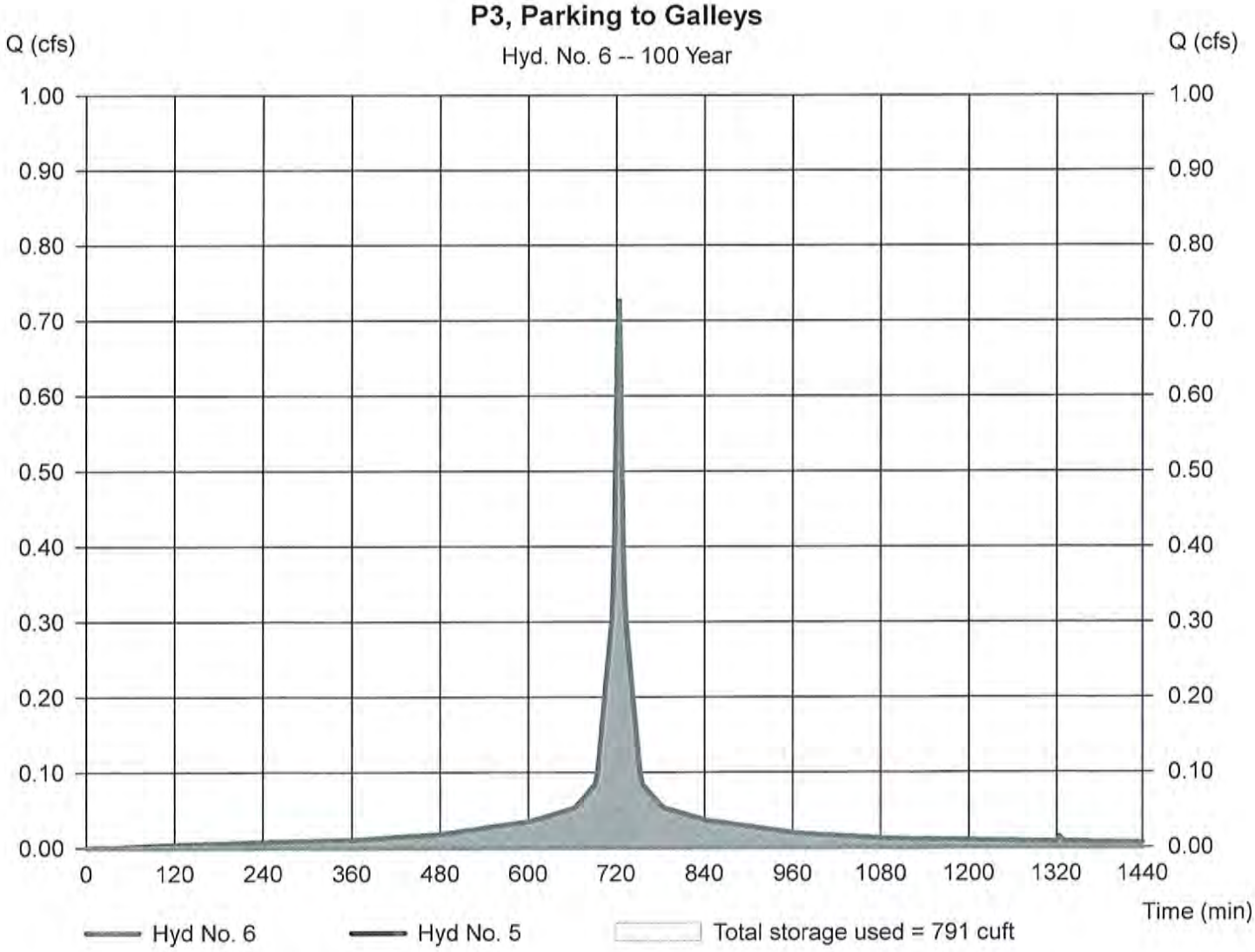
Hydraflow Hydrographs by Intelisolve v9.2 | Monday, Jan 4, 2016

Hyd. No. 6

P3, Parking to Galleys

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 556 min
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 5 - P3	Max. Elevation	= 4.50 ft
Reservoir name	= Galley	Max. Storage	= 791 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.2 — Monday, Jan 4, 2016

Pond No. 2 - Galley

Pond Data

UG Chambers - Invert elev. = 0.50 ft, Rise x Span = 3.75 x 4.00 ft, Barrel Len = 3.50 ft, No. Barrels = 12, Slope = 0.00%, Headers = No
Encasement - Invert elev. = 0.00 ft, Width = 5.50 ft, Height = 5.25 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	0.00	n/a	0	0
0.53	0.53	n/a	51	51
1.05	1.05	n/a	101	152
1.58	1.58	n/a	101	254
2.10	2.10	n/a	101	355
2.63	2.63	n/a	101	457
3.15	3.15	n/a	101	558
3.68	3.68	n/a	101	660
4.20	4.20	n/a	101	761
4.73	4.73	n/a	54	815
5.25	5.25	n/a	49	863

Culvert / Orifice Structures

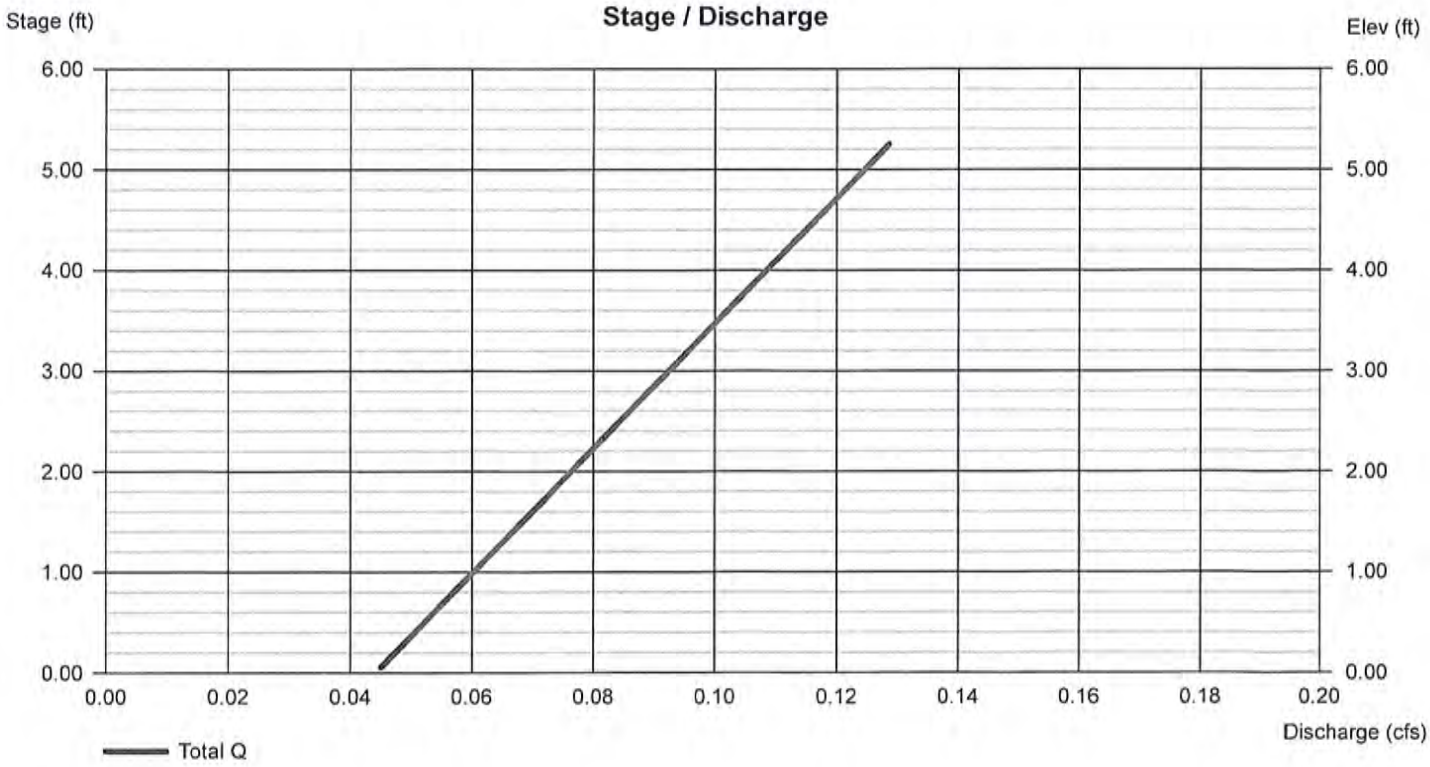
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 0.00	0.00	0.00	0.00
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

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).



Water Quality Volume Calculations

Project: 18 Wetherbee Street
Location: Acton, MA
Prepared For: Daniel Carr - Stamski & McNary, Inc.

CONTECH ENGINEERED SOLUTIONS

Purpose: To calculate the water quality flow rate (WQF) over a given site area. In this situation the WQF is derived from the first 1.0" of runoff.

Reference: Massachusetts Dept. of Environmental Protection Wetlands Program / United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	Impv. (acres)	A ($miles^2$)	t_c (min)	t_c (hr)	WQV (in)
DMH-2	0.12	0.0001875	6.0	0.100	1.00

Procedure:

Determine unit peak discharge using Figure 1 or 2. Figure 2 is in tabular form so is preferred. Using the tc, read the unit peak discharge (qu) from Figure 1 or Table in Figure 2. qu is expressed in the following units: cfs/mi^2/watershed inches (csm/in).

Structure Name	qu (csm/in.)
DMH-2	774.00

1. Compute Q Rate using the following equation:

$$Q_1 = (qu)\ (A)\ (WQV)$$

where:

Q_1 = flow fate associated with first 1.0" of runoff
qu = the unit peak discharge, in csm/in.
A = impervious surface drainage area (in square miles)
WQV = water quality volume in watershed inches (1.0" in this case)

Structure Name	Q_1 (cfs)
DMH-2	0.15

Groundwater Recharge Calculations

Recharge Volume Calculations

Job: SM-229

Calculated by: DJC
Date: 12/3/2015

P2

Soils: Hinckley Loamy Sand
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.17 acres
7,500 s.f.

Required Recharge Volume (Rv)

$$Rv = 7{,}500 \text{ s.f.} \times \frac{0.6}{12} = \mathbf{375 \text{ c.f.}}$$

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

D (depth of infiltration facility):	5.25	ft
K (saturated hydraulic conductivity):	8.27	inches/hour
	0.6891667	feet/hour
T (time):	2	hours
A=	402	s.f.
Voids=	0.40	
Volume of Chambers=	827	
Rv=	2,224	c.f. > 375 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.24 Hours
0.24 < 72 hours O.K.

Recharge Volume Calculations

Job: SM-229

Calculated by: DJC
Date: 12/3/2015

P3

Soils: Hinckley Loamy Sand
Hydrologic Group: A
Required Recharge Volume
0.6 inches of runoff x impervious area

Impervious area: 0.12 acres
5,422 s.f.

Required Recharge Volume (Rv)

Rv = 5,422 s.f. x $\frac{0.6}{12}$ = **271 c.f.**

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

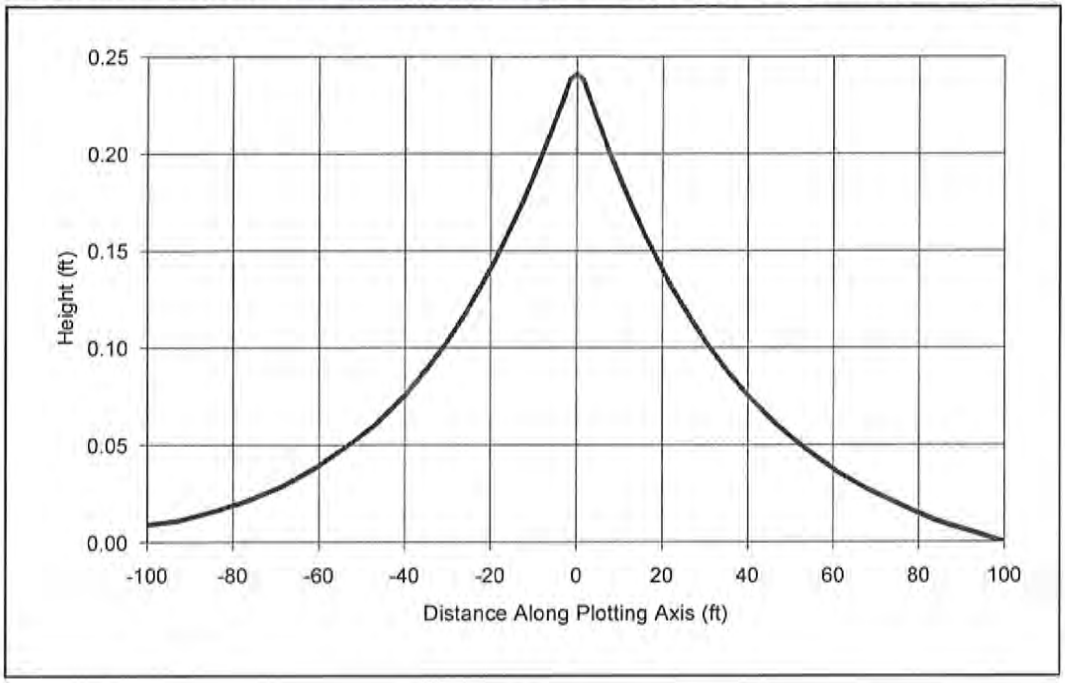
D (depth of infiltration facility): 5.25 ft
K (saturated hydraulic conductivity): 8.27 inches/hour
0.68916667 feet/hour
T (time): 2 hours
A= 270 s.f.
Voids= 0.40
Volume of Chambers= 551
Rv= 1,488 c.f. > 271 c.f.

72 Hour Drawdown
Rv/(K x Bottom Area)= 0.26 Hours
0.26 < 72 hours O.K.

Groundwater Mounding

P2

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



COMPANY: Stamski and McNary, Inc.

PROJECT: 229 Stormwater Management

ANALYST: Daniel Carr

DATE: 1/7/2016 TIME: 8:32:53 AM

INPUT PARAMETERS

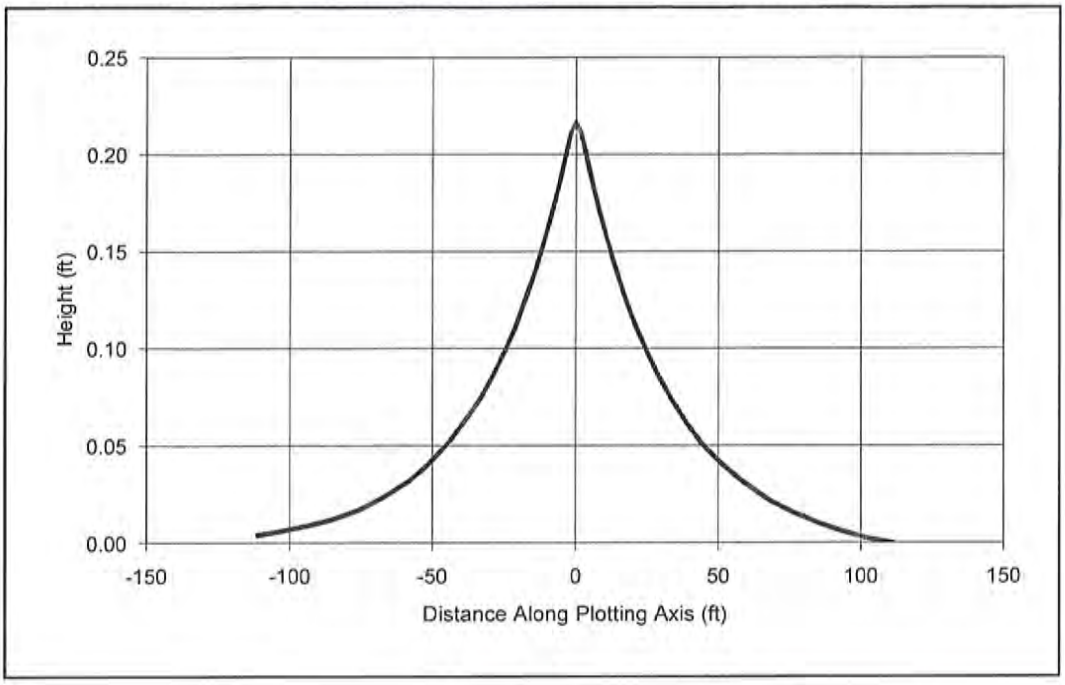
Application rate: 1.93 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 80 ft
Length of application area: 72 ft
Width of application area: 4.5 ft
Constant head boundary used at: 100 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 2.2 ft
positive Y: 0 ft
Total volume applied: 625.32 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-100	0	-100	0.01
-84.1	0	-84	0.02
-68.2	0	-68	0.03
-52.3	0	-52	0.05
-39.8	0	-40	0.08
-30.1	0	-30	0.1
-22.2	0	-22	0.13
-15.5	0	-15	0.16
-9.7	0	-10	0.19
-5.8	0	-6	0.21
-3.2	0	-3	0.23
0	0	0	0.24
3.2	0	3	0.23
5.8	0	6	0.21
9.7	0	10	0.19
15.5	0	15	0.16
22.2	0	22	0.13
30.1	0	30	0.1
39.8	0	40	0.08
52.3	0	52	0.05
68.2	0	68	0.03
84.1	0	84	0.01
100	0	100	0

P3

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



COMPANY: Stamski and McNary, Inc.

PROJECT: 229 Stormwater Management

ANALYST: Daniel Carr

DATE: 1/7/2016 TIME: 8:29:03 AM

INPUT PARAMETERS

Application rate: 2.09 c.ft/day/sq. ft
Duration of application: 1 days
Fillable porosity: 0.35
Hydraulic conductivity: 8 ft/day
Initial saturated thickness: 80 ft
Length of application area: 48 ft
Width of application area: 4.5 ft
Constant head boundary used at: 111 ft
Plotting axis from Y-Axis: 90 degrees
Edge of recharge area:
positive X: 2.2 ft
positive Y: 0 ft
Total volume applied: 451.44 c.ft

MODEL RESULTS

X (ft)	Y (ft)	Plot Axis (ft)	Mound Height (ft)
-111	0	-111	0
-93.4	0	-93	0.01
-75.7	0	-76	0.02
-58	0	-58	0.03
-44.2	0	-44	0.05
-33.4	0	-33	0.07
-24.6	0	-25	0.1
-17.2	0	-17	0.13
-10.8	0	-11	0.16
-6.4	0	-6	0.18
-3.5	0	-3	0.2
0	0	0	0.22
3.5	0	3	0.2
6.4	0	6	0.18
10.8	0	11	0.16
17.2	0	17	0.13
24.6	0	25	0.1
33.4	0	33	0.07
44.2	0	44	0.05
58	0	58	0.03
75.7	0	76	0.02
93.4	0	93	0.01
111	0	111	0

TSS Removal Calculations

INSTRUCTIONS:

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Non-automated: Mar. 4, 2008

Location: Pretreatment for Subsurface Inf. Area 2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin w/ Hood	25%	1.00	0.25	0.75
CDS 2015-4	89.7%	0.75	0.67	0.08

Total TSS Removal = 92%

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

Project: 229
Prepared By: DJC
Date: 12/11/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Subsurface Infiltration Area 2

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep Sump Catch Basin w/ Hood	25%	1.00	0.25	0.75
CDS 2015-4	89.7%	0.75	0.67	0.08
Concrete Galleys subsurface structure	80%	0.08	0.064	0.016

Total TSS Removal = 98.4%

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

Project: 229
Prepared By: DJC
Date: 12/11/2015

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

Mass. Dept. of Environmental Protection

CDS ESTIMATED NET ANNUAL TSS REDUCTION BASED ON THE RATIONAL RAINFALL METHOD

CONTECH ENGINEERED SOLUTIONS

18 WETHERBEE STREET
ACTON, MA
for SYSTEM: DMH-2

Area	0.12	acres	CDS Model	
Weighted C	0.90		2015-4	
Tc	6	minutes	CDS Treatment Capacity	
			1.4	cfs

Rainfall Intensity[1] (in/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (cfs)	Treated Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	10.2%	10.2%	0.00	0.00	97.1	9.9
0.04	9.6%	19.8%	0.00	0.00	97.0	9.4
0.06	9.4%	29.3%	0.01	0.01	96.9	9.2
0.08	7.7%	37.0%	0.01	0.01	96.8	7.5
0.10	8.6%	45.6%	0.01	0.01	96.7	8.3
0.12	6.3%	51.9%	0.01	0.01	96.6	6.1
0.14	4.7%	56.5%	0.02	0.02	96.5	4.5
0.16	4.6%	61.2%	0.02	0.02	96.4	4.5
0.18	3.5%	64.7%	0.02	0.02	96.3	3.4
0.20	4.3%	69.1%	0.02	0.02	96.2	4.2
0.25	8.0%	77.1%	0.03	0.03	95.9	7.7
0.30	5.6%	82.7%	0.03	0.03	95.6	5.3
0.35	4.4%	87.0%	0.04	0.04	95.4	4.2
0.40	2.5%	89.5%	0.04	0.04	95.1	2.4
0.45	2.5%	92.1%	0.05	0.05	94.9	2.4
0.50	1.4%	93.5%	0.05	0.05	94.6	1.3
0.75	5.0%	98.5%	0.08	0.08	93.3	4.7
1.00	1.0%	99.5%	0.11	0.11	92.0	0.9
1.50	0.0%	99.5%	0.16	0.16	89.3	0.0
2.00	0.0%	99.5%	0.22	0.22	86.7	0.0
3.00	0.5%	100.0%	0.32	0.32	81.5	0.4
						96.1
					Removal Efficiency Adjustment[2] =	6.5%
					Predicted % Annual Rainfall Treated =	93.5%
					Predicted Net Annual Load Removal Efficiency =	**89.7%**

1 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Storm Sewer Design

DESIGN STORM: 100 YEAR
DATE: **12/3/2015**
DONE BY: DJC
FILE: 229 RATIONAL METHOD

STORM SEWER DESIGN

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

PROJECT: SM-229
LOCATION: Acton, MA

FROM	TO	LENGTH (FT)	TRIBUTARY AREA INCR. (ACRES)	TRIBUTARY AREA TOTAL (ACRES)	TIME OF FLOW TO UPPER END (MIN)	TIME OF FLOW TIME IN SECTION (MIN)	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 VELOCITY (FPS)	DESIGN FLOW VELOCITY HEAD (FT)	DESIGN FLOW DEPTH OF FLOW (FT)	DESIGN FLOW TOTAL ENERGY HEAD (FT)	MANHOLE INVERT DROP (FT)	FALL IN PIPE (FT)	DRAIN INV. ELEVATION UPPER END	DRAIN INV. ELEVATION LOWER END	GROUND SURFACE UPPER END	GROUND SURFACE LOWER END	
CB-1 to DMH2	DMH2	13	0.12	0.12	10	0.08	0.90	7.6	0.82	0.005	8	0.012	0.89	2.54	2.88	0.13	0.50	0.63		0.06	126.52	126.46	129.52	130.35	CB-1 to DMH
IL DRAIN	CB1	55	0.14	0.15	10	0.20	0.90	7.6	1.05	0.012	8	0.012	1.43	4.10	4.47	0.31	0.42	0.73		0.66	126.33	125.67	129.33	130.08	IL DRAIN
ROOF TRENCH	DMH1	204	0.17	0.17	10	1.02	0.90	7.6	1.16	0.005	12	0.012	2.72	3.47	3.33	0.17	0.46	0.63		1.02	128.99	127.97	132.50	130.80	ROOF TRENC

Closed Drainage System **SM-229**

Project:	18 Wetherbee Street	By	DJC	Date	12/3/2015
Location:	Acton, MA	Checked		Date	

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

CB-1 to DMH2

Surface Cover	A (ac)	C	Product A x C
impervious	0.09	0.9	0.081
lands/grass		0.2	0
woods		0.15	0
sum =	0.09	sum =	0.081

C = **0.90** = total product / total area

Project: 18 Wetherbee Street By DJC Date 12/3/2015

Location: Acton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

Interceptor Line Drain to CB1

Surface Cover	A (ac)	C	Product A x C
impervious	0.03	0.9	0.027
lands/grass		0.2	0
woods		0.15	0
sum =	0.03	sum =	0.027

C = **0.90** = total product / total area

Project: 18 Wetherbee Street By DJC Date 12/3/2015

Location: Acton, MA Checked _____ Date _____

Rational Method

Q = peak flow rate, (cfs)

i = rainfall intensity inches/hour

C = runoff coefficient,
C = 0.90 impervious
C = 0.20 landscaped / grass
C = 0.15 woods

A = area (ac)

Roof trench to DMH1

Surface Cover	A (ac)	C	Product A x C
impervious	0.17	0.9	0.153
lands/grass		0.2	0
woods		0.15	0
sum =	0.17	sum =	0.153

C = **0.90** = total product / total area

Inlet Grate Capacity Calculations

Job: SM-229 Calculated by: DJC
Project: 18 Wetherbee Street Date: 12/3/2015

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.	100 YR INTENSITY	C	Q=CiA Q100	POSITION	Q (MAX)	single grate	double grate
CB1	0.12	6	7.6	0.75	0.59	LP	2.85	yes	

Soil Evaluation

Commonwealth of Massachusetts
City/Town of

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

A. Facility Information

John D. Durkin
Owner Name

18 Wetherbee Street
Street Address

Map/Lot #

Acton
City

MA
State

01720
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: Web Soil Survey (Source) 253B (Soil Map Unit)

Hinckley Loamy Sand, 3-8% slopes (Soil Name) N/A (Soil Limitations)

Loose sandy and gravelly glaciofluvial deposits derived from granite & gneiss (Geologic/Parent Material) Terraces, plains (Landform)

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: Year Published/Source | Publication Scale | Map Unit

4. Flood Rate Insurance Map

Above the 500-year flood boundary? ☒ Yes ☐ No Within the 100-year flood boundary? ☐ Yes ☐ No
If Yes, continue to #5.

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No MassGIS Wetland Data Layer: Wetland Type

7. Current Water Resource Conditions (USGS): 09/2015 (Month/Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:

Commonwealth of Massachusetts
City/Town of

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-1 09/15/2015 (Date) 8:30am (Time) Sunny (Weather)

1. Location

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

Description of Location: Gravel drive

2. Land Use: gravel drive (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.): — Slope (%): 1 – 5%

Vegetation: None Landform: _____ Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	>100' feet	Other	_____ feet

4. Parent Material: Alluvial 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: >60" inches _____ elevation

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-1

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			
0-4	Ap	10 YR 3/2	—	—	—	LS	—	—	M	F	
4-25	B	10YR 6/4	—	—	—	Sand	—	—	SG	Loose	
25-120	C	10 YR 4/2	—	—	—	Sand	10-15%	—	SG	Loose	

Additional Notes:

No redox, no G.W.

Commonwealth of Massachusetts
City/Town of

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-2 09/15/2015 (Date) 8:45am (Time) Sunny (Weather)

1. Location

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

Description of Location: _____

2. Land Use: Gravel drive (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.): — Slope (%): 0-3%

Vegetation: None Landform: _____ Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	>100' feet	Other	_____ feet

4. Parent Material: Alluvial 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: >120" inches _____ elevation

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

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			
0-4	A_p	10YR 3/2	—	—	—	LS	—	—	M	F	
4-32	B	10YR 6/6	—	—	—	Sand	—	—	SG	Loose	
32-120	C	2.5Y 7/3	—	—	—	Sand	10-15%	—	SG	Loose	

Additional Notes:

No redox, No G.W.

Commonwealth of Massachusetts
City/Town of

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-3 09/15/2015 (Date) 8:55am (Time) Sunny (Weather)

1. Location

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

Description of Location: Gravel drive

2. Land Use: Gravel drive (e.g., woodland, agricultural field, vacant lot, etc.) — (Surface Stones (e.g., cobbles, stones, boulders, etc.)) 0-3% (Slope (%))

None (Vegetation) _____ (Landform) _____ (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	>100' feet	Other	_____ feet

4. Parent Material: Alluvial 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: >120" inches _____ elevation

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

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			
0-4	Ap	10YR 3/2	–	–	–	LS	–	–	M	F	
4-38	Bw	10YR 6/4	–	–	–	Sand	–	–	SG	Loose	
38-120	C	2.5Y 7/3	–	–	–	Sand	10-15%	–	SG	Loose	

Additional Notes:

No redox, No G.W.

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

C. On-Site Review (continued)

Deep Observation Hole Number: TP-4 09/15/2015 (Date) 9:20 am (Time) Sunny (Weather)

1. Location

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

2. Land Use: Gravel drive (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.): — Slope (%): 0-3%

   Vegetation: none Landform: _____ Position on Landscape (SU, SH, BS, FS, _____

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	>100' feet	Other	_____ feet

4. Parent Material: Alluvial 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: >120" inches _____ elevation

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

C. On-Site Review (continued)

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			
0-4	Ap	10YR3/2	—	—	—	LS	—	—	M	F	—
4-33	Bw	10YR6/4	—	—	—	Sand	—	—	SG	Loose	—
33-120	C	10YR4/2	—	—	—	Sand	—	—	SG	Loose	—

Additional Notes:
No redox, no GW.

Commonwealth of Massachusetts
City/Town of

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-5 | 09/15/15 (Date) | 10:20 am (Time) | Sunny (Weather)

1. Location

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

Description of Location: Gravel drive

2. Land Use: Gravel Drive (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.): _____ Slope (%): 0-3%

Vegetation: None Landform: _____ Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	>100' feet	Other	_____ feet

4. Parent Material: Alluvial 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: 117" (Depth Weeping from Pit) 120" (Depth Standing Water in Hole)

Estimated Depth to High Groundwater: 117" inches _____ elevation

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

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			
0-4	Ap	10YR 3/2	–	–	–	LS	–	–	M	F	–
4-38	Bw	10YR 6/4	–	–	–	Sand	–	–	SG	Loose	–
38-120	C	10YR 4/2	–	–	–	Sand	10-15%	–	SG	Loose	–

Additional Notes:

Weeping @ 117", standing @ 120"

Commonwealth of Massachusetts
City/Town of

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-6 9/15/15 (Date) 10:30am (Time) Sunny (Weather)

1. Location

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

Description of Location: Gravel Drive

2. Land Use: Gravel Drive (e.g., woodland, agricultural field, vacant lot, etc.) Surface Stones (e.g., cobbles, stones, boulders, etc.): — Slope (%): 0-3%

Vegetation: None Landform: _____ Position on Landscape (SU, SH, BS, FS, TS): _____

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	>100' feet
Property Line	>10' feet	Drinking Water Well	>100' feet	Other	_____ feet

4. Parent Material: Alluvial 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: >120" inches elevation _____

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

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			
9-0	Fill										
0-4	Ap	10YR 3/2	–	–	–	LS	–	–	M	F	
4-35	Bw	10YR 6/4	–	–	–	Sand	–	–	SG	Loose	
35-120	C	10YR 4/2	–	–	–	Sand	10-15%	–	SG	Loose	

Additional Notes:

No GW, no redox

Commonwealth of Massachusetts
City/Town of

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-7 Date: 09/15/15 Time: 10:45 Weather: Sunny

1. Location

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

Description of Location: Gravel Drive

2. Land Use: Gravel Drive (e.g., woodland, agricultural field, vacant lot, etc.) — Surface Stones (e.g., cobbles, stones, boulders, etc.) — 0 - 3% Slope (%)

None Vegetation — Landform — Position on Landscape (SU, SH, BS, FS, TS)

3. Distances from:

Open Water Body	>100' feet	Drainage Way	>100' feet	Wetlands	90' feet
Property Line	>10' feet	Drinking Water Well	>100' feet	Other	_____ feet

4. Parent Material: Alluvial 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: 106" Depth Weeping from Pit; 108" Depth Standing Water in Hole

Estimated Depth to High Groundwater: 106" inches _____ elevation

Commonwealth of Massachusetts
City/Town of

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

C. On-Site Review (continued)

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			
0-4	Ap	10 YR 3/2	–	–	–	LS	–	–	M	F	
4-28	Bw	10 YR 6/4	–	–	–	Sand	–	–	SG	Loose	
28-108	C	10 YR 4/2	–	–	–	Sand	10-15%	–	SG	Loose	

Additional Notes:

Weeping @ 106", GW @ 108"

Commonwealth of Massachusetts
City/Town of

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

D. Determination of High Groundwater Elevation

1. Method Used:

	Obs. Hole # _____	Obs. Hole # _____
☒ Depth observed standing water in observation hole	See inches	" inches
☒ Depth weeping from side of observation hole	Test inches	" inches
☐ Depth to soil redoximorphic features (mottles)	Pit inches	" inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	Logs inches	" inches

_____ Index Well Number _____ Reading Date

$S_h = S_c - [S_r \times (OW_c - OW_{max})/OW_r]$

Obs. Hole # ____ S_c ____ S_r ____ OW_c ____ OW_{max} ____ OW_r ____ S_h ____

Obs. Hole # ____ S_c ____ S_r ____ OW_c ____ OW_{max} ____ OW_r ____ S_h ____

E. Depth of Pervious Material

1. Depth of Naturally Occurring Pervious Material

   a. Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system?

   ☒ Yes ☐ No

   b. If yes, at what depth was it observed? Upper boundary: 35" inches Lower boundary: 120" inches

   c. If no, at what depth was impervious material observed? Upper boundary: — inches Lower boundary: — inches

Commonwealth of Massachusetts
City/Town of

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

F. Board of Health Witness

Evan Carloni
Name of Board of Health Witness

Acton
Board of Health

G. Soil Evaluator Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.

Daniel Carr
Signature of Soil Evaluator

09/15/2015
Date

Daniel Carr / 13801
Typed or Printed Name of Soil Evaluator / License #

2017
Expiration Date of License

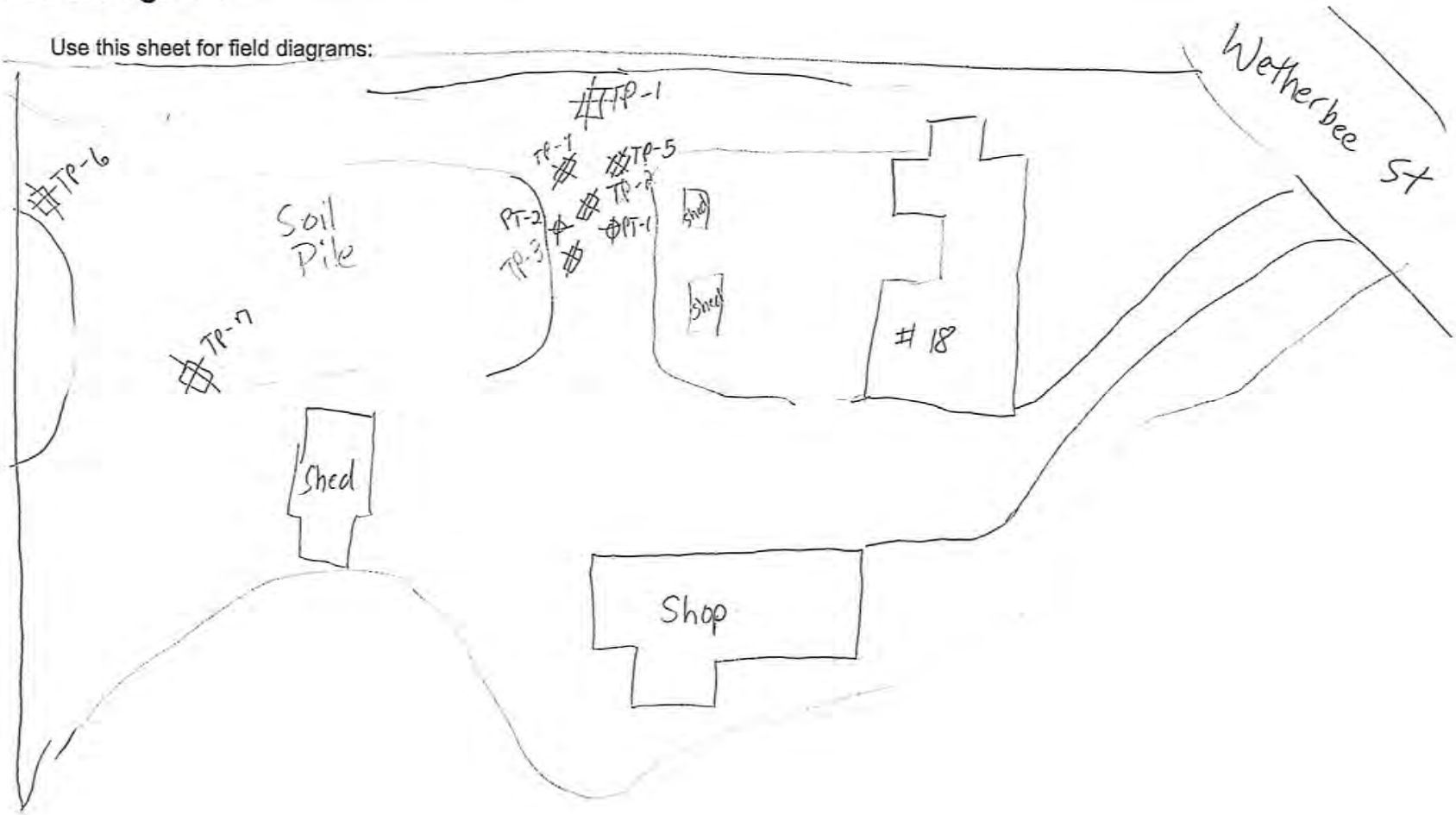
Note: In accordance with 310 CMR 15.018(2) this form must be submitted to the approving authority within 60 days of the date of field testing, and to the designer and the property owner with Percolation Test Form 12.

Commonwealth of Massachusetts
City/Town of

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

Field Diagrams

Use this sheet for field diagrams:



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

John Durkin
Owner Name

18 Wetherbee Street
Street Address or Lot #

Acton — City/Town
MA — State
01720 — Zip Code

Contact Person (if different from Owner)
Telephone Number

B. Test Results

	09/15/2015 Date, 10:15 Time	09/15/2015 Date, 10:25 Time
Observation Hole #	PT-1	PT-2
Depth of Perc	58"	51"
Start Pre-Soak	10:16	10:25
End Pre-Soak	unable	unable
Time at 12"	to presoak	to presoak
Time at 9"		
Time at 6"		
Time (9"-6")		
Rate (Min./Inch)	<2 mpi	<2 mpi
	Test Passed: ☑ Test Failed: ☐	Test Passed: ☑ Test Failed: ☐

Daniel Carr
Test Performed By:

Evan Carloni, Acton BOH
Board of Health Witness

Comments:

Operation and Maintenance Manual

Schedule for Inspection and Maintenance:

Deep Sump and Hooded Catch Basins, Manholes and Drop Inlets:
The deep sump for the catch basins shall be inspected and cleaned annually. The catch basins shall have a four foot deep sump and the water level is maintained by the discharge pipe at four feet. The discharge pipe is hidden from view by a hooded outlet. The depth of the sediment in a basin shall not exceed a depth of 18 inches as determined by probing with a stick. If the stick hits the bottom within 30 inches of the water level, more than 18 inches of sediment has accumulated and must be removed. Licensed persons should remove and dispose of the contents of the sump in accordance with applicable regulations.

Contech CDS2015-4 ProprietaryBMP : (DMH2)
Inspection and maintenance of the CDS2015-4 can be performed from the surface, without entry into the unit. Perform maintenance a minimum of twice per year. The CDS2015-4 should be cleaned once the sediment has reached a depth of 75% of the sump in the chamber.

Perform frequent inspections during the first year of installation to accurately establish the maintenance schedule.

Remove oil and sediment through the manhole cover with the use of a vacuum truck.

Disposal from the CDS2015-4 is similar to that of any other best management practice (BMP). Consult local guidelines or your CDS2015-4 area marketing manager prior to disposing the separator contents.

Drywells & Interceptor Line Drain:
Inspect the drywell and interceptor line drain after every major storm for the first few months to ensure proper stabilization and function. Thereafter, inspect and clean at least once per year. Water levels should be recorded over several days to check the drywell drainage.

Infiltration Trench:
Preventative maintenance should be performed at least twice a year, and debris should be removed from the infiltration trenches as it accumulates.

Emergency Contacts:
In the event of a hazardous materials spill on the site the following parties shall be contacted:
Fire Department: ph: 978-264-9645

Records:
The Owner shall maintain an inspection log of all elements of the storm water management plan. The owner shall maintain a maintenance log documenting the inspection and maintenance of the drainage structures under his control. A copy of the erosion control and storm water maintenance plan and inspection logs shall be kept onsite at all times

Responsibility Party:
The current Owner shall be responsible for all inspection and maintenance of the items included in the Manual.

Name: _____

Signature: _____

Date: _____

18 Wetherbee Street

Operation and Maintenance Inspection Log

Year: _____

Inspection Items:	**Frequency:**
Contech CDS 2015-4	**Two times per year**
Catch Basins	**Four times per year**
Drywells& Interceptor Line Drain	**Once per year**

Contech CDS 2015-4

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required:

Catch Basins:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Sediment Depth: _____ (Remove if depth greater than 18")
Comments:

Action Required:

Drywells:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required:

Interceptor Line Drain:

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required:

Infiltration Trench

Previous Inspection Date: _____
Inspection Date: _____
Inspector Name: _____
Comments:

Action Required:

Drainage Maps

ZONE LINE R8/4 (RESIDENCE 8/4)

TBM
NAIL IN TREE
ELEV.=134.75
(NGVD OF 1929)

N/F
COMMONWEALTH OF MASSACHUSETTS
(FORMERLY PENN CENTRAL Co.)

PARCEL A-1
14,831 S.F.±.
0.3405 AC.±

480.82'

30.00'

SB/DH FND

GRASS

GRAVEL

36" OAK

TP-1

MAN HOLE COVER
RIM=133.08'

507.15'

CHAIN LINK FENCE

ZONE LINE EAV-2 (EAST ACTON VILLAGE 2)

EXISTING BIT. CONC. DRIVE

PATIO

POOL

TP-6

TP-4

TP-2

TP-5

PT-2

PT-1

TP-3

TP-7

PILE

A

B

SHED
TBR

SHED

EXISTING
2 STORY
W/F DWELLING
#18

COBBLE STONE

STONE MASONRY RETAINING WALL

EXISTING 1,500 GALLON SEPTIC TANK (APPROXIMATE)

EXISTING 6' LEACHING PIT (APPROXIMATE)

EXISTING GRAVEL DRIVE

STONE MASONRY RETAINING WALL

EXISTING 12" WATER MAIN (APPROXIMATE)

EXISTING 2" GAS MAIN (APPROXIMATE)

WETHERBEE STREET
(1987 COUNTY LAYOUT)

L=39.92'
R=480.00'

L=58.58'
R=480.00'

NASHOBA BROOK

APPROXIMATE PROPERTY LINE "BY CENTERLINE OF BROOK"

N/F
WETHERBEE ROAD REALTY TRUST

N/F
ACTON
SPORTS
PROPERTY,
LIMITED
PARTNERSHIP

BUILDING SETBACK LINE (TYPICAL)

200' RIVERFRONT AREA

75' NO DISTURB ZONE

50' NO BUILD ZONE

100' DISTURB ZONE

FLOOD PLAIN DISTRICT LINE
(100-YEAR BASE FLOOD
ELEVATION PER FIELD SURVEY)

12" PVC PIPE
INV.=125.84'

PAVED AREA

PAVED

EXISTING SHOP

C

LOT A
91,069 S.F.±.
2.0906 AC.±

293.11'

N/F
MULLIN

ZONE LINE EAV-2

STONE MASONRY RETAINING WALL

SB/DH FND

21.18'

LEGEND:

SOIL TYPE LINE
SUBCATCHMENT DIVIDE
A B C TIME OF CONCENTRATION
253B SOIL SURVEY AREA MAP UNIT SYMBOL

SOIL TYPE LEGEND
44A BIRDSALL MUCKY SILT LOAM
253B HINCKLEY LOAMY SAND

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.

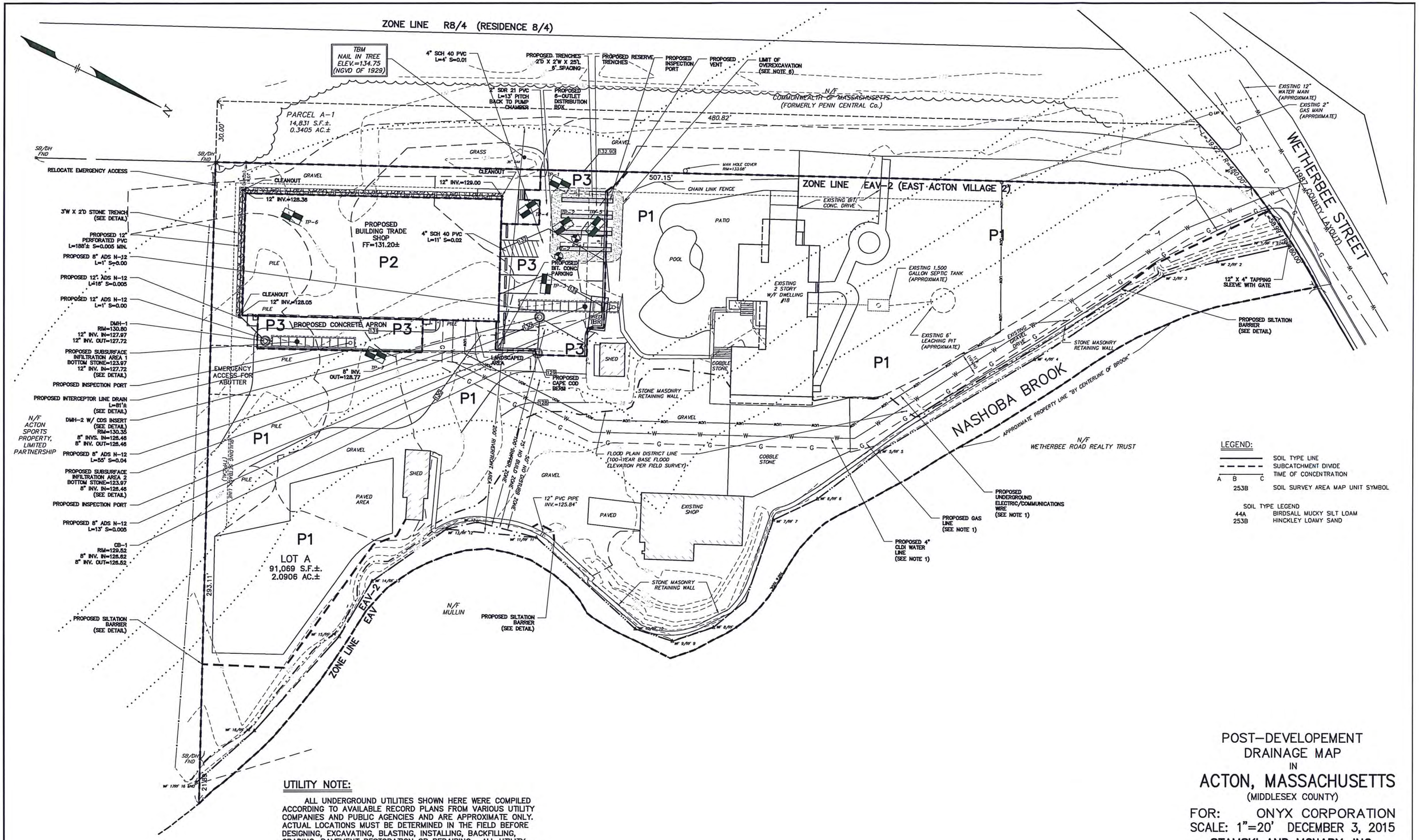
PRE-DEVELOPEMENT DRAINAGE MAP
IN
ACTON, MASSACHUSETTS
(MIDDLESEX COUNTY)

FOR: ONYX CORPORATION
SCALE: 1"=20' DECEMBER 3, 2015

STAMSKI AND MCNARY, INC.
1000 MAIN STREET ACTON, MASSACHUSETTS
ENGINEERING – PLANNING – SURVEYING

0 10 20 40 60 80 FT

229 SP.dwg 18 WETHERBEE STREET SM-229



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POST-DEVELOPEMENT DRAINAGE MAP IN ACTON, MASSACHUSETTS

(MIDDLESEX COUNTY)

FOR: ONYX CORPORATION

SCALE: 1"=20' DECEMBER 3, 2015

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