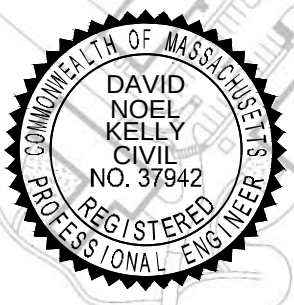
STORMWATER MANAGEMENT REPORT

WALDEN CENTER FOR EDUCATION AND RESEARCH, INC.
518 PLEASANT STREET
FRAMINGHAM, MA

MARCH 31, 2014



David Noel Kelly
2014.04.01
12:19:27 -04'00'

PREPARED FOR:

WALDEN CENTER FOR EDUCATION AND RESEARCH, INC.
9 HOPE AVENUE, SUITE 500
WALTHAM, MA 02453

PREPARED BY:

KELLY ENGINEERING GROUP, INC.
CIVIL ENGINEERING CONSULTANTS
0 CAMPANELLI DRIVE BRAINTREE MA 02184
PHONE: 781 843 4333 FAX: 781 843 0028

TABLE OF CONTENTS

INTRODUCTION

The purpose of this report is to analyze the pre-development and post-development drainage conditions for the proposed project and to demonstrate that the project will have no negative impacts on the surrounding properties and resource areas. The design incorporates many low impact development and best management practices recommended by the Massachusetts Stormwater Management Handbook.

EXISTING SITE

The site is located on 518 Pleasant Street in Framingham, MA. The site is currently occupied by The Marist Fathers of Boston, a religious organization. The existing site contains approximately 27.7 acres and is bordered by Pleasant Street, Temple Street, Massachusetts Turnpike Route 90, and abutting properties.

Currently runoff from the site splits into four drainage areas. Area 1 flows to a depression located to the west of the property. Area 2 flows to the south of the site to wetland line B. Area 3 flows to the south of the site toward Massachusetts Turnpike. Area 4 flows to the east of the site to wetland line A. See Existing Drainage Exhibit in **Attachment A.**

PROPOSED SITE

The proposed project will entail constructing 2 Dormitories, an Aftercare building, and a Center for Education and Research along with associated parking, utilities, and a stormwater management system for the

entire site. The proposed project will result in approximately 2.4 acres of new impervious area.

A stormwater management system has been designed to comply with Massachusetts Department of Environmental Protection Standards for stormwater management.

The Stormwater management system will incorporate many Best Management Practices (BMPs), which will include multiple biofilter swales with pea stone diaphragms, infiltration basins, proprietary water quality devices, subsurface recharge chambers, and an operations and maintenance program designed to treat, recharge, and detain all of the runoff generated from the proposed development of the site.

See Proposed Conditions Drainage Exhibit in **Attachment B**.

STORMWATER MANAGEMENT STANDARDS

The following is a discussion of the Massachusetts Stormwater Management Standards

STANDARD 1: NO NEW UNTREATED DISCHARGES

The proposed project has been designed for no new untreated discharges from the site. The proposed pavement areas will be treated by proprietary water quality devices or biofilter swales.

STANDARD 2: PEAK RATE ATTENUATION

Existing and developed sites were modeled using Hydraflow Hydrographs 10 computer program by AutoCAD Civil 3D 2013. This computer software uses the TR55/TR20 tabular method of computing peak flows, hydrograph addition, and pond routing. The curve numbers for the existing conditions analysis were determined using soil survey maps which show Group B

soils. For the purposes of the proposed conditions analysis, a conservative estimate of time of concentration of 6 minutes was assumed for watersheds to stormwater management systems.

As can be seen from the summary chart below, the peak flows from the design storm on the site will be reduced as a result of this project. Peak flow mitigation will be provided within the infiltration basins.

The entire TR55 analysis is included in **Attachment A** (existing conditions) **and B** (proposed conditions) of this report.

Peak Runoff Chart – Area 1

Storm (yr, inches)	**Existing** (cfs)	**Proposed** (cfs)	**Difference** (cfs)
2, 3.1	0.881	0.784	-0.097
10, 4.5	2.794	2.631	-0.163
25, 5.3	4.135	4.105	-0.030
50, 5.9	5.224	5.217	-0.007
100, 6.5	6.363	6.360	-0.003

Peak Runoff Chart – Area 2

Storm (yr, inches)	**Existing** (cfs)	**Proposed** (cfs)	**Difference** (cfs)
2, 3.1	3.386	0	-3.386
10, 4.5	8.908	1.866	-7.042
25, 5.3	12.58	4.292	-8.288
50, 5.9	15.53	7.233	-8.297
100, 6.5	18.57	10.40	-8.17

Peak Runoff Chart – Area 3

Storm (yr, inches)	**Existing** (cfs)	**Proposed** (cfs)	**Difference** (cfs)
2, 3.1	1.580	0.007	-1.573
10, 4.5	4.795	0.567	-4.228
25, 5.3	7.035	1.833	-5.202
50, 5.9	8.83	3.14	-5.69
100, 6.5	10.72	4.57	-6.15

Peak Runoff Chart – Area 4

Storm (yr, inches)	**Existing** (cfs)	**Proposed** (cfs)	**Difference** (cfs)
2, 3.1	2.503	1.987	-0.516
10, 4.5	8.643	7.283	-1.36
25, 5.3	13.09	11.17	-1.92
50, 5.9	16.70	14.50	-2.20
100, 6.5	20.50	18.97	-1.53

Peak Runoff Chart – Total Site Runoff

Storm (yr, inches)	**Existing** (cfs)	**Proposed** (cfs)	**Difference** (cfs)
2, 3.1	8.255	2.761	-5.494
10, 4.5	25.03	11.16	-13.87
25, 5.3	36.67	20.35	-16.32
50, 5.9	46.00	28.15	-17.85
100, 6.5	55.89	36.82	-19.07

STANDARD 3: RECHARGE

The project site contains Group B soils according to the NRCS soil maps. The required recharge for Group B soils is 0.35". The dedicated recharge volume has been provided in the 4 infiltration basins. All runoff to be recharged will receive greater than 80% TSS removal.

The provided recharge volumes for the infiltration basins were calculated using Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2013 Version 10.

Infiltration basin locations were chosen based on existing topography. The 4 infiltration basins were sited where the topography is low and to minimize disturbance to existing woodlands.

See **ATTACHMENT C** for detailed calculations.

STANDARD 4: STORMWATER QUALITY

Stormwater runoff from the site will be enhanced by means of a number of Best Management Practices (BMP's), which have been designed to comply with the DEP Stormwater Management Guidelines. In order to achieve a Total Suspended Solids (TSS) removal rate of 80%, the following BMP's will be incorporated:

- Pavement sweeping and maintenance program
- Water quality proprietary devices
- Pea stone diaphragms
- Biofilter swales
- Infiltration basins

The total TSS removal is expected to be greater than 80%. See TSS Removal in **Attachment D**.

STANDARD 5: Land Uses with Higher Potential Pollutant Loads (LUHPPL's)

The proposed project is not considered a land use with higher potential pollutant loads. The proposed use is not an industrial use and is not subject to a NPDES Multi-Sector General Permit.

STANDARD 6: CRITICAL AREAS

The site is not in an active public water supply, surface water protection area, nor groundwater protection area, and is not in an area of critical environmental concern.

STANDARD 7: REDEVELOPMENT

The proposed project constitutes both redevelopment and new development.

STANDARD 8: CONSTRUCTION PERIOD POLLUTION PREVENTION AND EROSION CONTROL

A construction phasing plan will be established when a site contractor is consulted. At that time a construction phasing plan and the associated Stormwater Pollution Prevention Plan will be prepared and submitted to the Town of Framingham and the EPA.

STANDARD 9: OPERATIONS AND MAINTENANCE PLAN

The Stormwater Management System Operation and Maintenance Plan and Long Term Pollution Prevention Plan, Operations and Maintenance Log, and BMP Location Map are provided in **Attachment D.**

STANDARD 10: ILLICIT DISCHARGES

An Illicit Discharge Statement is attached and can be found it the Table of Contents. The Long Term Pollution Prevention Plan can be found in **Attachment D.**

CONCLUSION

An extensive stormwater management system has been designed for the project. The stormwater management system has been designed to comply with current (DEP) standards and will incorporate a number of Best Management Practices ("BMP's") that will ensure that the runoff will be treated prior to leaving the site.

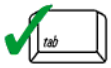
The construction of the stormwater management system will ensure that stormwater runoff from this site will be of high quality and that there will be no adverse impacts on surrounding properties or resource areas.

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.

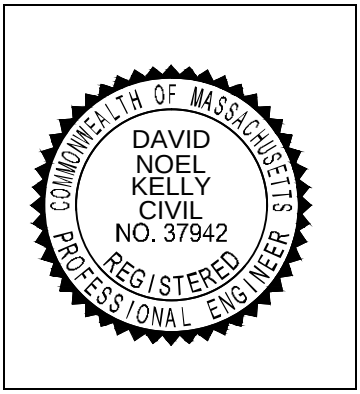
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



David Noel Kelly
2014.04.01 12:20:02 -04'00'

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

ILLICIT DISCHARGE STATEMENT

This statement has been prepared to comply with Stormwater Management Standard #10 as referenced in the Massachusetts Stormwater Handbook, Volume One, Chapter One, Page 25. This handbook has been issued by the Massachusetts Department of Environmental Protection for compliance with revised Regulations for Wetlands 310 CMR 10.00.

As detailed in the Site Development Plans accompanying this application this project will not involve any illicit discharge to the stormwater management system. Furthermore, to the best of my knowledge there are no illicit discharges to the stormwater management system of the existing site.

Owner and Responsible Party for Operating and Managing the site:

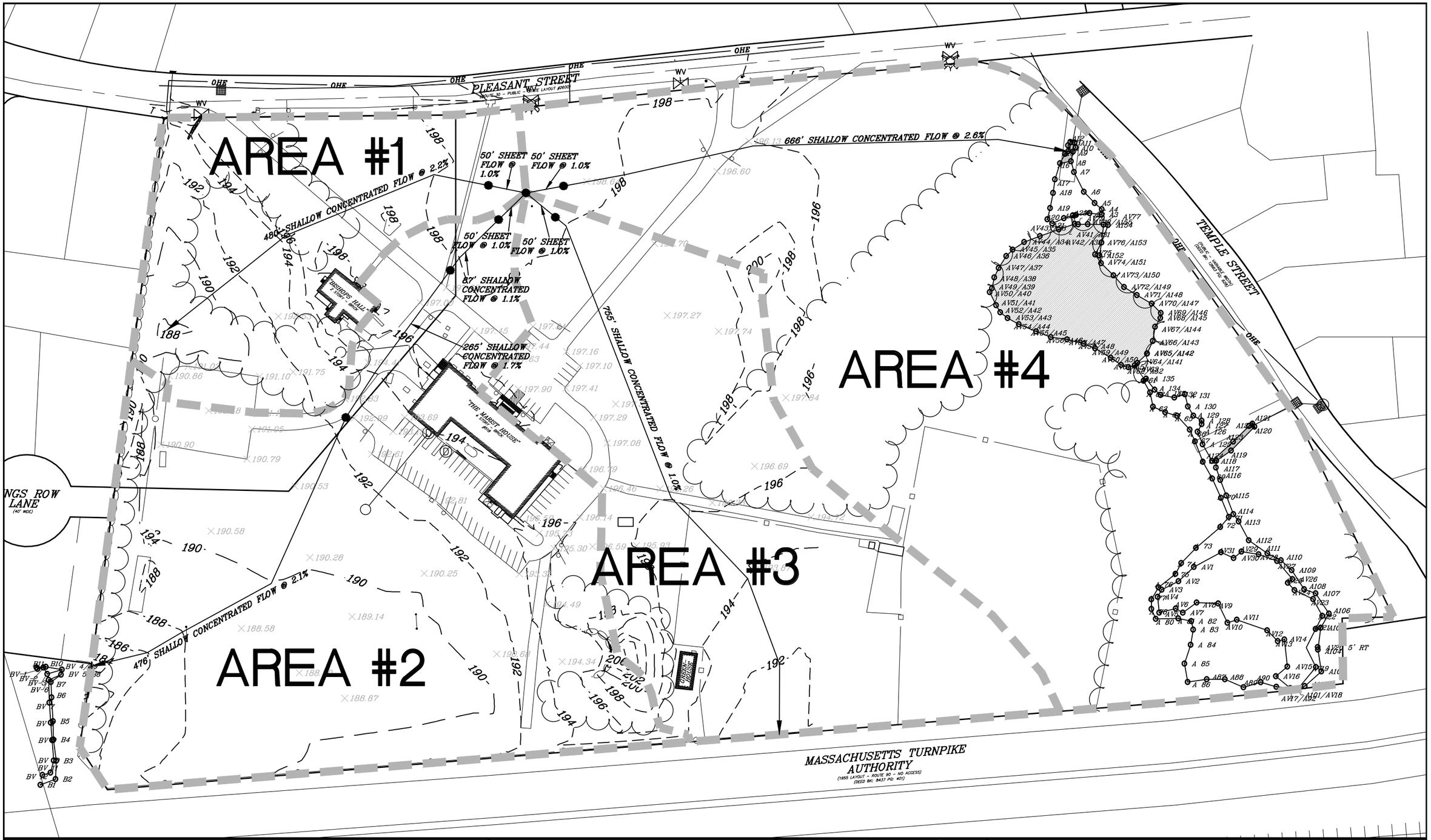
Walden Center for Education and Research, Inc.
9 Hope Avenue, Suite 500
Waltham, MA 02453
781-647-6700

Brandon Li for Stuart Koman — 4/1/14

Stuart Koman — Date

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment A
Existing Conditions



WALDEN CENTER FOR EDUCATION AND RESEARCH, INC. 518 PLEASANT ST. FRAMINGHAM, MA	SCALE: 1"= 120' DATE: 03/31/14 2013-025-EXDR00	EXISTING DRAINAGE EXHIBIT	KELLY ENGINEERING GROUP, INC. CIVIL ENGINEERING CONSULTANTS 0 CAMPANELLI DRIVE · BRAINTREE MA · 02184 PHONE: 781 843 4333 FAX: 781 843 0028

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Existing Conditions - Area 1**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	CN	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	46510	2558050
Impervious		98	15014	1471372
Green	Hydrologic Group B; Good Condition	61	74967	4572987
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	136491.00	8602409
		Acres =	3.1334022	

CN or C (weighted) = total product/total area = **63.0**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Existing Conditions - Area 2**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	12114	666270
Impervious		98	60148	5894504
Green	Hydrologic Group B; Good Condition	61	286957	1.8E+07
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	359219.00	2.4E+07
		Acres =	8.24653352	

CN or C (weighted) = total product/total area = **67.0**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Existing Conditions - Area 3**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	CN	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	22315	1227325
Impervious		98	21506	2107588
Green	Hydrologic Group B; Good Condition	61	210832	1.3E+07
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	254653.00	1.6E+07
		Acres =	5.84602847	

CN or C (weighted) = total product/total area = **63.6**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Existing Conditions - Area 4**

Circle One: **Pre** or Post

Runoff Curve Number (CN):

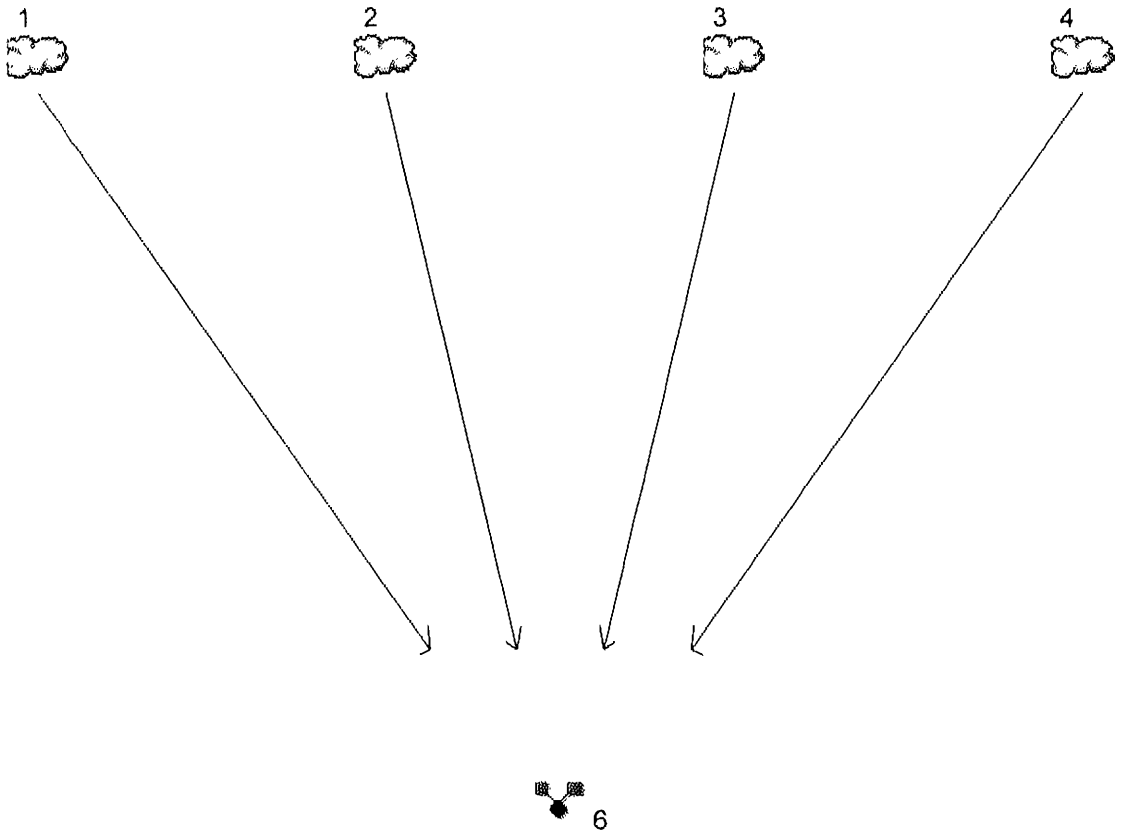
Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	197052	1.1E+07
Impervious		98	8581	840938
Green	Hydrologic Group B; Good Condition	61	231685	1.4E+07
Pond	Hydrologic Group D; Good Condition	77	24172	1861244
Wetlands	Hydrologic Group D; Good Condition	77	38603	2972431
		Totals =	500093.00	3.1E+07
		Acres =	11.4805556	

CN or C (weighted) = total product/total area = **61.3**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd.	Origin	Description
1	SCS Runoff	Area #1
2	SCS Runoff	Area #2
3	SCS Runoff	Area #3
4	SCS Runoff	Area #4
6	Combine	Total Site Runoff

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	0.881	-------	-------	2.794	4.135	5.224	6.363	Area #1
2	SCS Runoff	------	-------	3.386	-------	-------	8.908	12.58	15.53	18.57	Area #2
3	SCS Runoff	------	-------	1.580	-------	-------	4.795	7.035	8.830	10.72	Area #3
4	SCS Runoff	------	-------	2.503	-------	-------	8.643	13.09	16.70	20.50	Area #4
6	Combine	1, 2, 3, 4,	-------	8.255	-------	-------	25.03	36.67	46.00	55.89	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.881	2	740	5,401	------	------	------	Area #1
2	SCS Runoff	3.386	2	740	19,366	------	------	------	Area #2
3	SCS Runoff	1.580	2	746	10,408	------	------	------	Area #3
4	SCS Runoff	2.503	2	746	17,566	------	------	------	Area #4
6	Combine	8.255	2	744	52,740	1, 2, 3, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.794	2	736	13,659	------	------	------	Area #1
2	SCS Runoff	8.908	2	738	44,619	------	------	------	Area #2
3	SCS Runoff	4.795	2	740	25,923	------	------	------	Area #3
4	SCS Runoff	8.643	2	740	46,546	------	------	------	Area #4
6	Combine	25.03	2	738	130,747	1, 2, 3, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	4.135	2	734	19,340	------	------	------	Area #1
2	SCS Runoff	12.58	2	736	61,420	------	------	------	Area #2
3	SCS Runoff	7.035	2	740	36,538	------	------	------	Area #3
4	SCS Runoff	13.09	2	738	66,798	------	------	------	Area #4
6	Combine	36.67	2	738	184,095	1, 2, 3, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	5.224	2	734	23,938	------	------	------	Area #1
2	SCS Runoff	15.53	2	736	74,829	------	------	------	Area #2
3	SCS Runoff	8.830	2	740	45,111	------	------	------	Area #3
4	SCS Runoff	16.70	2	738	83,299	------	------	------	Area #4
6	Combine	46.00	2	738	227,178	1, 2, 3, 4,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	6.363	2	734	28,774	------	------	------	Area #1
2	SCS Runoff	18.57	2	736	88,800	------	------	------	Area #2
3	SCS Runoff	10.72	2	738	54,114	------	------	------	Area #3
4	SCS Runoff	20.50	2	736	100,729	------	------	------	Area #4
6	Combine	55.89	2	736	272,418	1, 2, 3, 4,	------	------	Total Site Runoff

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	17.4950	4.2000	0.6438	--------
3	0.0000	0.0000	0.0000	--------
5	40.8144	10.8000	0.7755	--------
10	45.6810	10.9000	0.7723	--------
25	106.0698	18.5000	0.9101	--------
50	44.6078	10.9000	0.6858	--------
100	47.7883	11.3000	0.6734	--------

File name: Boston IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.19	3.17	2.61	2.25	1.99	1.80	1.65	1.53	1.42	1.34	1.26	1.20
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.80	3.88	3.28	2.86	2.55	2.30	2.10	1.94	1.80	1.69	1.59	1.50
10	5.39	4.37	3.70	3.23	2.88	2.60	2.38	2.20	2.04	1.91	1.80	1.70
25	5.99	5.03	4.34	3.82	3.42	3.10	2.84	2.61	2.43	2.26	2.12	2.00
50	6.69	5.55	4.79	4.24	3.83	3.50	3.23	3.01	2.82	2.66	2.52	2.40
100	7.29	6.09	5.29	4.70	4.25	3.90	3.61	3.37	3.17	2.99	2.84	2.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

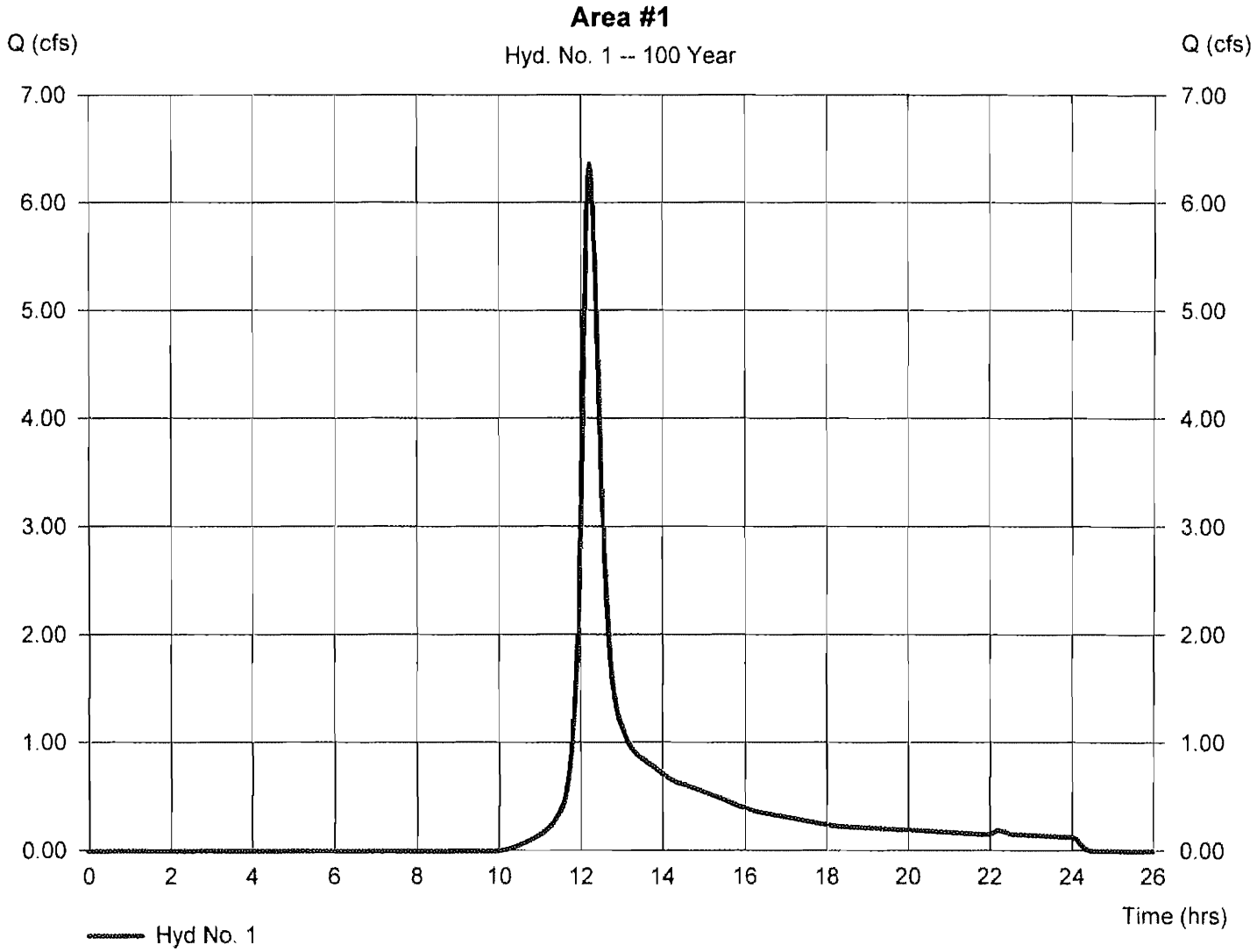
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.50	3.10	0.00	3.30	4.50	5.30	5.90	6.50
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	2.75	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	2.75	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	2.80	0.00	0.00	0.00	0.00

Hydrograph Report

Hyd. No. 1

Area #1

Hydrograph type	= SCS Runoff	Peak discharge	= 6.363 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 28,774 cuft
Drainage area	= 3.130 ac	Curve number	= 63
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.60 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 1

Area #1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 480.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 3.34**	**+**	**0.00**	**+**	**0.00**	**=**	**3.34**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

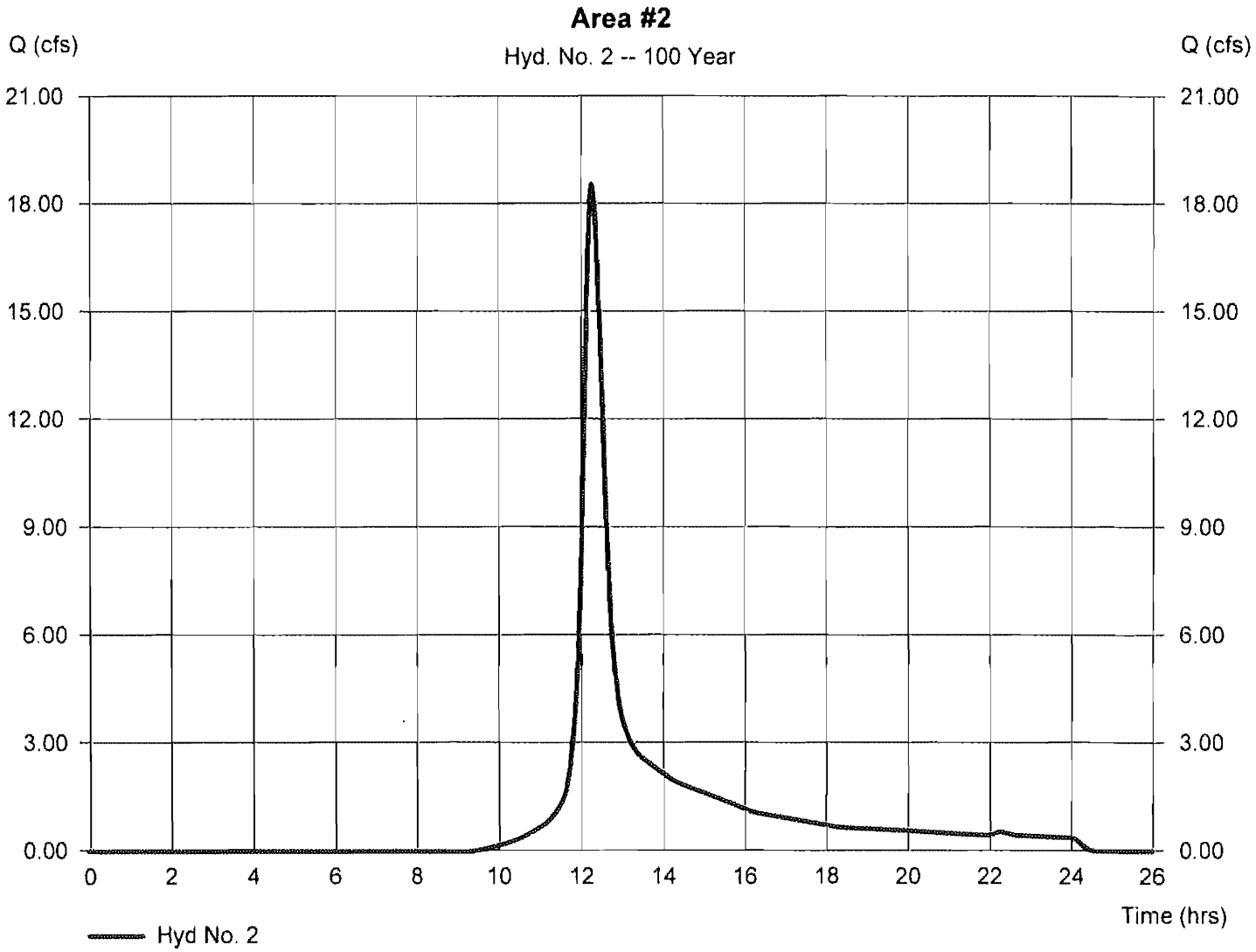
Total Travel Time, Tc ..... 19.60 min

Hydrograph Report

Hyd. No. 2

Area #2

Hydrograph type	= SCS Runoff	Peak discharge	= 18.57 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 88,800 cuft
Drainage area	= 8.250 ac	Curve number	= 67
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 22.20 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 2

Area #2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 87.00		265.00		476.00		
Watercourse slope (%)	= 1.10		1.70		2.10		
Surface description	= Unpaved		Paved		Unpaved		
Average velocity (ft/s)	=1.69		2.65		2.34		
Travel Time (min)	**= 0.86**	**+**	**1.67**	**+**	**3.39**	**=**	**5.92**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

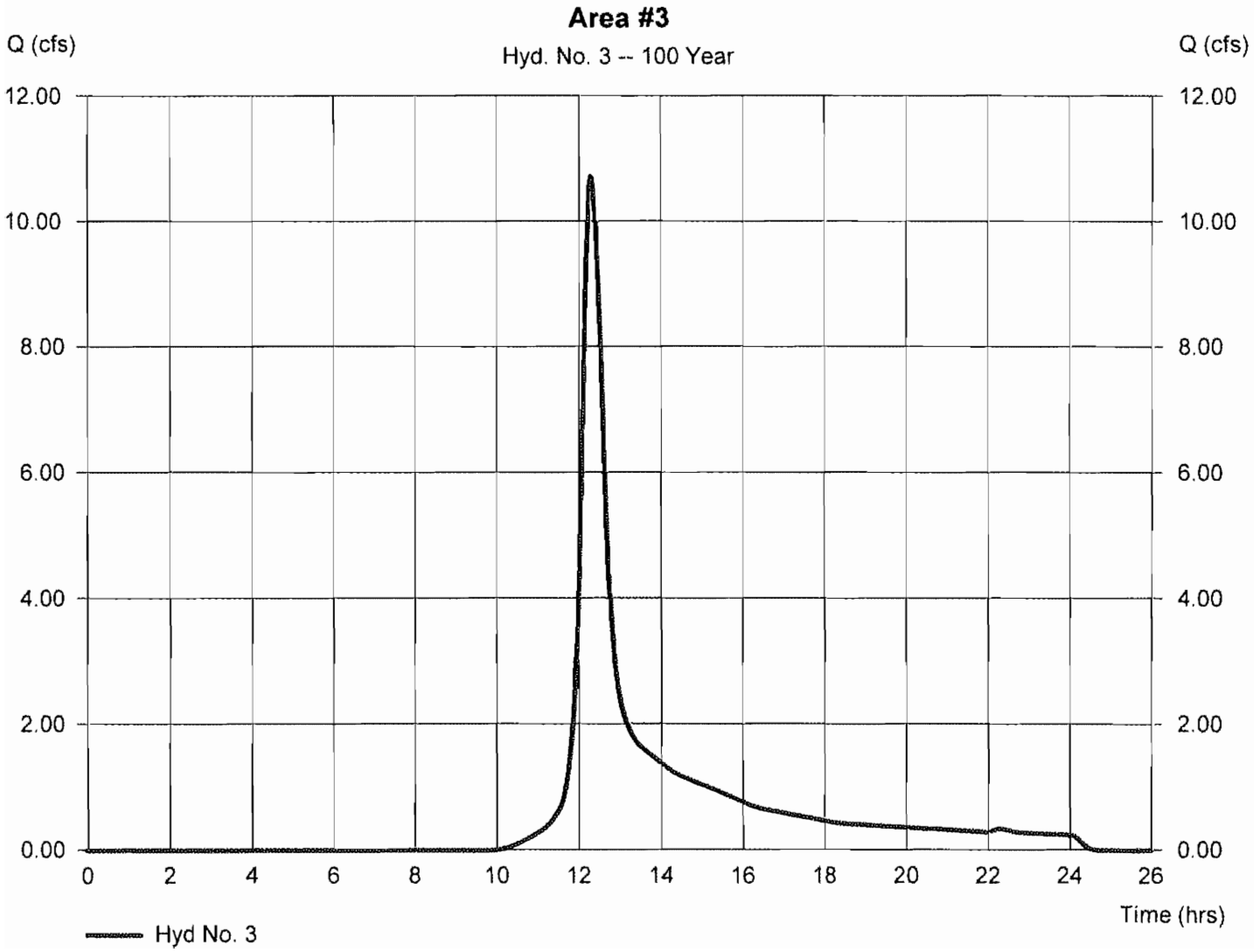
Total Travel Time, Tc ..... 22.20 min

Hydrograph Report

Hyd. No. 3

Area #3

Hydrograph type	= SCS Runoff	Peak discharge	= 10.72 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 54,114 cuft
Drainage area	= 5.850 ac	Curve number	= 63.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 24.10 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 3

Area #3

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 755.00		0.00		0.00		
Watercourse slope (%)	= 1.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61		0.00		0.00		
Travel Time (min)	**= 7.80**	**+**	**0.00**	**+**	**0.00**	**=**	**7.80**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

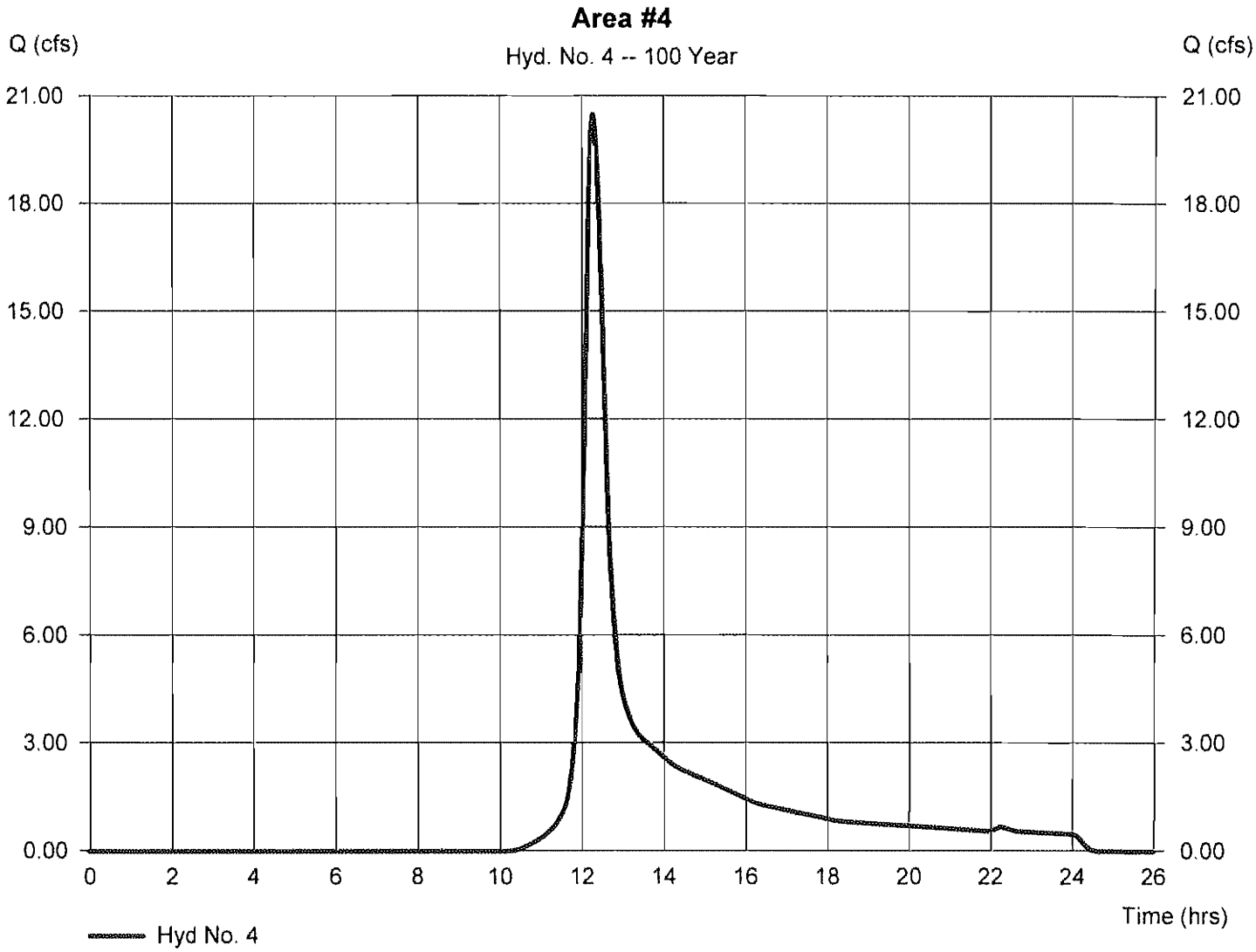
Total Travel Time, Tc ..... 24.10 min

Hydrograph Report

Hyd. No. 4

Area #4

Hydrograph type	= SCS Runoff	Peak discharge	= 20.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 100,729 cuft
Drainage area	= 11.480 ac	Curve number	= 61.3
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.50 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 4

Area #4

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 666.00		0.00		0.00		
Watercourse slope (%)	= 2.60		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.60		0.00		0.00		
Travel Time (min)	**= 4.27**	**+**	**0.00**	**+**	**0.00**	**=**	**4.27**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

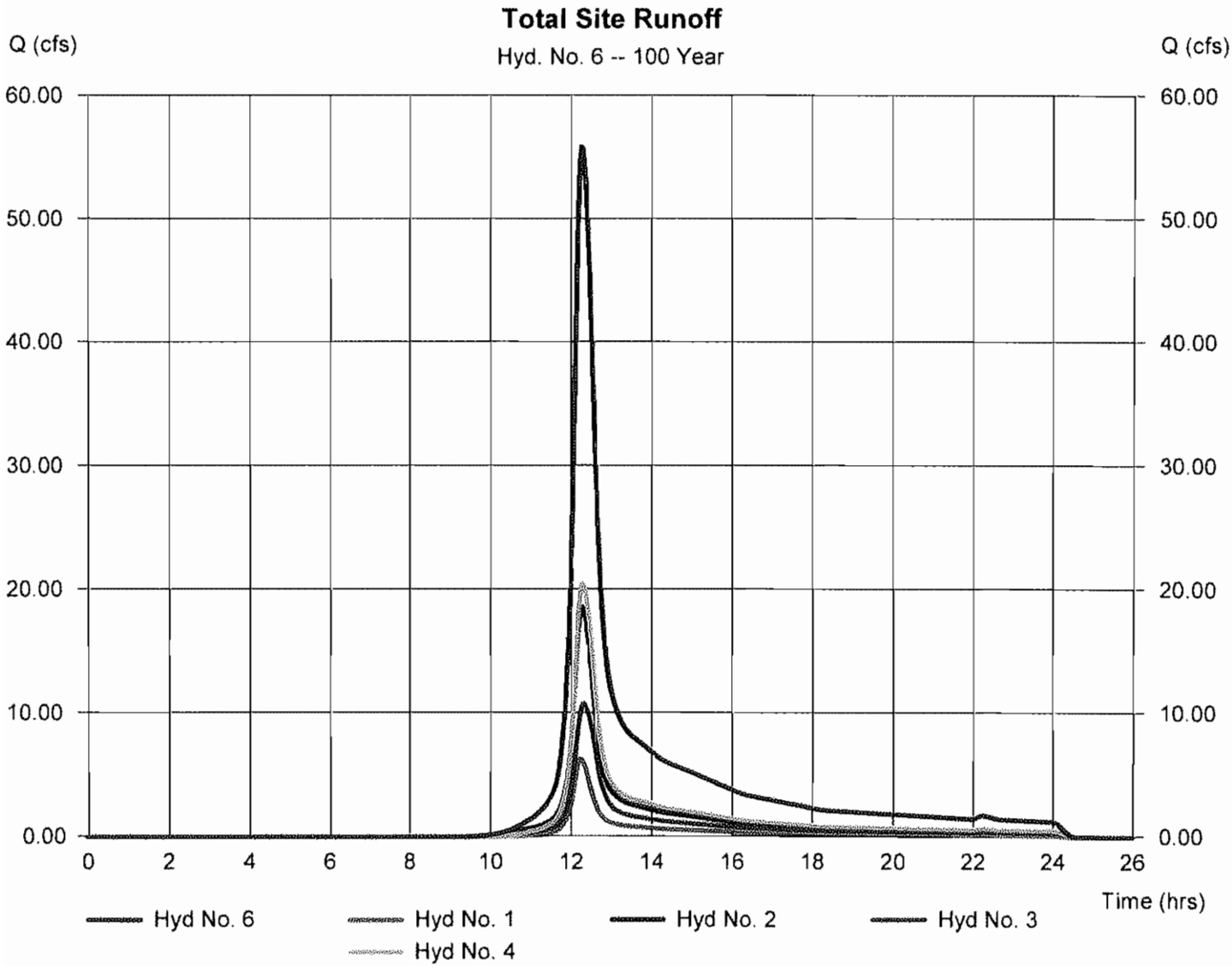
Total Travel Time, Tc ..... **20.50 min**

Hydrograph Report

Hyd. No. 6

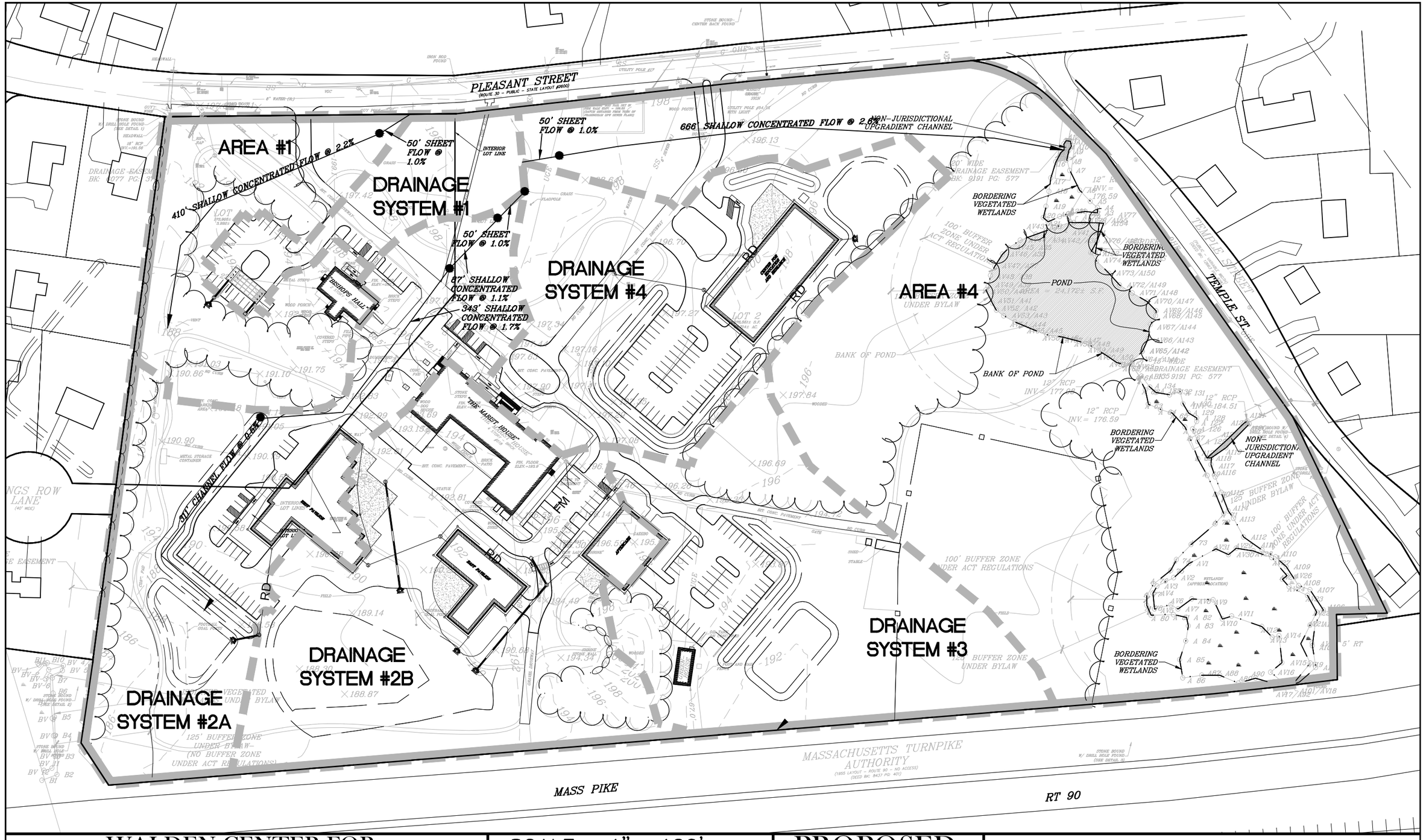
Total Site Runoff

Hydrograph type	= Combine	Peak discharge	= 55.89 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 272,418 cuft
Inflow hyds.	= 1, 2, 3, 4	Contrib. drain. area	= 28.710 ac



KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment B
Proposed Conditions



WALDEN CENTER FOR EDUCATION AND RESEARCH, INC.
518 PLEASANT ST.
FRAMINGHAM, MA

SCALE: 1"= 120'

DATE: 03/31/14

2013-025-PRDR00

PROPOSED DRAINAGE EXHIBIT

KELLY ENGINEERING GROUP, INC.
CIVIL ENGINEERING CONSULTANTS
0 CAMPANELLI DRIVE · BRAINTREE MA · 02184
PHONE: 781 843 4333 FAX: 781 843 0028

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Proposed Conditions - To Drainage System #1**

Circle One: Pre or **Post**

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	0	0
Impervious		98	14430	1414140
Roof		98	0	0
Green	Hydrologic Group B; Good Condition	61	28783	1755763
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	43213.00	3169903
		Acres =	0.992034	

CN or C (weighted) = total product/total area = **73.4**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Proposed Conditions - To Area #1**

Circle One: Pre or **Post**

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	44731	2460205
Impervious		98	3482	341236
Roof		98	3146	308308
Green	Hydrologic Group B; Good Condition	61	41919	2557059
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	93278.00	5666808
		Acres =	2.1413682	

CN or C (weighted) = total product/total area = **60.8**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Proposed Conditions - To Drainage System #2A**

Circle One: Pre or **Post**

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	7926	435930
Impervious		98	33227	3256246
Roof		98	12626	1237348
Green	Hydrologic Group B; Good Condition	61	116456	7103816
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	170235.00	1.2E+07
		Acres =	3.9080579	

CN or C (weighted) = total product/total area = **70.7**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Proposed Conditions - To Drainage System #2B**

Circle One: Pre or **Post**

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	8681	477455
Impervious		98	32606	3195388
Roof		98	27305	2675890
Green	Hydrologic Group B, Good Condition	61	129328	7889008
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	197920.00	1.4E+07
		Acres =	4.543618	

CN or C (weighted) = total product/total area = **71.9**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Proposed Conditions - To Drainage System #3**

Circle One: Pre or **Post**

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	22427	1233485
Impervious		98	26419	2589062
Roof		98	1093	107114
Green	Hydrologic Group B; Good Condition	61	106598	6502478
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D; Good Condition	77	0	0
		Totals =	156537.00	1E+07
		Acres =	3.593595	

CN or C (weighted) = total product/total area = **66.6**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Proposed Conditions - To Drainage System #4**

Circle One: Pre or **Post**

Runoff Curve Number (CN):

Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	0	0
Impervious		98	38439	3767022
Roof		98	13125	1286250
Green	Hydrologic Group B; Good Condition	61	87630	5345430
Pond	Hydrologic Group D; Good Condition	77	0	0
Wetlands	Hydrologic Group D, Good Condition	77	0	0
		Totals =	139194.00	1E+07
		Acres =	3.1954545	

CN or C (weighted) = total product/total area = **74.7**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Runoff Curve Number and Runoff

Name: Walden Behavioral Care **By:** SHK **Date:** 03/27/14
Location : 518 Pleasant St, Framingham, MA
Description: **Proposed Conditions - To Area #4**

Circle One: Pre or **Post**

Runoff Curve Number (CN):

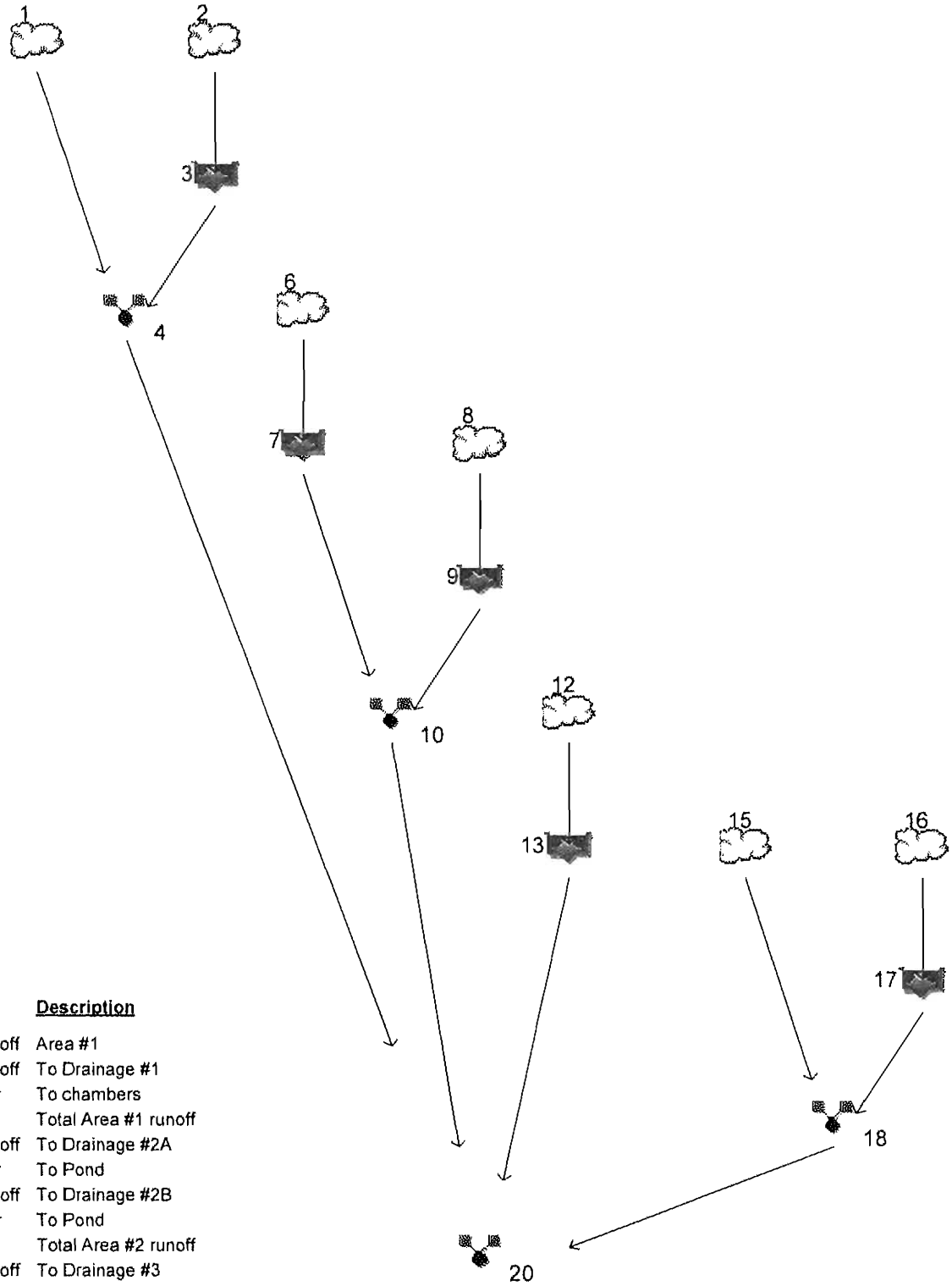
Surface Description	Soil Name; hydrologic group; hydrologic condition	**CN**	s.f.	Product of CN x Area
Woods	Hydrologic Group B; Good Condition	55	239357	1.3E+07
Impervious		98	4333	424634
Roof		8	0	0
Green	Hydrologic Group B; Good Condition	61	143613	8760393
Pond	Hydrologic Group D; Good Condition	77	24172	1861244
Wetlands	Hydrologic Group D; Good Condition	77	38603	2972431
		Totals =	450078.00	2.7E+07
		Acres =	10.332369	

CN or C (weighted) = total product/total area = **60.4**

Reference: *Urban Hydrology for Small Watersheds*
Technical Release 55, Soil Conservation Service
U.S. Department of Agriculture, June 1986

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10



Legend

Hyd.	Origin	Description
1	SCS Runoff	Area #1
2	SCS Runoff	To Drainage #1
3	Reservoir	To chambers
4	Combine	Total Area #1 runoff
6	SCS Runoff	To Drainage #2A
7	Reservoir	To Pond
8	SCS Runoff	To Drainage #2B
9	Reservoir	To Pond
10	Combine	Total Area #2 runoff
12	SCS Runoff	To Drainage #3
13	Reservoir	To Pond
15	SCS Runoff	Area #4
16	SCS Runoff	To Drainage #4
17	Reservoir	To Pond
18	Combine	Total Area #4 runoff
20	Combine	Total Site Runoff

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	0.452	-------	-------	1.637	2.493	3.203	3.950	Area #1
2	SCS Runoff	------	-------	0.993	-------	-------	2.151	2.876	3.437	4.008	To Drainage #1
3	Reservoir	2	-------	0.332	-------	-------	1.013	1.731	2.158	2.608	To chambers
4	Combine	1, 3	-------	0.784	-------	-------	2.631	4.105	5.217	6.360	Total Area #1 runoff
6	SCS Runoff	------	-------	2.197	-------	-------	5.111	6.995	8.470	9.983	To Drainage #2A
7	Reservoir	6	-------	0.000	-------	-------	1.866	4.292	7.233	10.40	To Pond
8	SCS Runoff	------	-------	4.080	-------	-------	9.209	12.45	14.98	17.56	To Drainage #2B
9	Reservoir	8	-------	0.000	-------	-------	0.000	0.000	0.000	0.000	To Pond
10	Combine	7, 9	-------	0.000	-------	-------	1.866	4.292	7.233	10.40	Total Area #2 runoff
12	SCS Runoff	------	-------	2.017	-------	-------	5.555	7.888	9.737	11.65	To Drainage #3
13	Reservoir	12	-------	0.007	-------	-------	0.567	1.833	3.140	4.570	To Pond
15	SCS Runoff	------	-------	1.987	-------	-------	7.283	11.17	14.35	17.70	Area #4
16	SCS Runoff	------	-------	3.497	-------	-------	7.334	9.711	11.54	13.41	To Drainage #4
17	Reservoir	16	-------	0.000	-------	-------	0.033	0.417	1.056	2.234	To Pond
18	Combine	15, 17	-------	1.987	-------	-------	7.283	11.17	14.50	18.97	Total Area #4 runoff
20	Combine	4, 10, 13, 18,	-------	2.761	-------	-------	11.16	20.35	28.15	36.82	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	0.452	2	742	3,084	------	------	------	Area #1
2	SCS Runoff	0.993	2	724	3,175	------	------	------	To Drainage #1
3	Reservoir	0.332	2	744	1,732	2	190.12	746	To chambers
4	Combine	0.784	2	744	4,815	1, 3	------	------	Total Area #1 runoff
6	SCS Runoff	2.197	2	738	11,615	------	------	------	To Drainage #2A
7	Reservoir	0.000	2	820	0	6	188.84	7,169	To Pond
8	SCS Runoff	4.080	2	724	13,337	------	------	------	To Drainage #2B
9	Reservoir	0.000	2	744	0	8	189.22	7,090	To Pond
10	Combine	0.000	2	744	0	7, 9	------	------	Total Area #2 runoff
12	SCS Runoff	2.017	2	724	7,554	------	------	------	To Drainage #3
13	Reservoir	0.007	2	1446	12	12	192.00	7,552	To Pond
15	SCS Runoff	1.987	2	746	14,631	------	------	------	Area #4
16	SCS Runoff	3.497	2	724	11,002	------	------	------	To Drainage #4
17	Reservoir	0.000	2	774	0	16	194.70	7,357	To Pond
18	Combine	1.987	2	746	14,631	15, 17	------	------	Total Area #4 runoff
20	Combine	2.761	2	746	19,458	4, 10, 13, 18,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	1.637	2	736	8,291	------	------	------	Area #1
2	SCS Runoff	2.151	2	724	6,503	------	------	------	To Drainage #1
3	Reservoir	1.013	2	734	4,726	2	191.00	1,501	To chambers
4	Combine	2.631	2	734	13,016	1, 3	------	------	Total Area #1 runoff
6	SCS Runoff	5.111	2	736	24,913	------	------	------	To Drainage #2A
7	Reservoir	1.866	2	748	9,217	6	189.10	9,440	To Pond
8	SCS Runoff	9.209	2	724	28,010	------	------	------	To Drainage #2B
9	Reservoir	0.000	2	734	0	8	189.48	15,459	To Pond
10	Combine	1.866	2	748	9,217	7, 9	------	------	Total Area #2 runoff
12	SCS Runoff	5.555	2	724	17,552	------	------	------	To Drainage #3
13	Reservoir	0.567	2	796	10,010	12	192.13	8,497	To Pond
15	SCS Runoff	7.283	2	740	39,824	------	------	------	Area #4
16	SCS Runoff	7.334	2	724	22,072	------	------	------	To Drainage #4
17	Reservoir	0.033	2	978	244	16	195.42	14,879	To Pond
18	Combine	7.283	2	740	40,069	15, 17	------	------	Total Area #4 runoff
20	Combine	11.16	2	742	72,312	4, 10, 13, 18,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	2.493	2	736	11,948	------	------	------	Area #1
2	SCS Runoff	2.876	2	724	8,619	------	------	------	To Drainage #1
3	Reservoir	1.731	2	730	6,739	2	191.37	1,791	To chambers
4	Combine	4.105	2	732	18,686	1, 3	------	------	Total Area #1 runoff
6	SCS Runoff	6.995	2	736	33,522	------	------	------	To Drainage #2A
7	Reservoir	4.292	2	736	16,977	6	189.22	10,444	To Pond
8	SCS Runoff	12.45	2	724	37,432	------	------	------	To Drainage #2B
9	Reservoir	0.000	2	750	0	8	189.65	20,937	To Pond
10	Combine	4.292	2	736	16,977	7, 9	------	------	Total Area #2 runoff
12	SCS Runoff	7.888	2	724	24,225	------	------	------	To Drainage #3
13	Reservoir	1.833	2	750	16,683	12	192.32	9,916	To Pond
15	SCS Runoff	11.17	2	738	57,586	------	------	------	Area #4
16	SCS Runoff	9.711	2	724	29,054	------	------	------	To Drainage #4
17	Reservoir	0.417	2	830	5,457	16	195.62	16,941	To Pond
18	Combine	11.17	2	738	63,043	15, 17	------	------	Total Area #4 runoff
20	Combine	20.35	2	738	115,389	4, 10, 13, 18,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	3.203	2	734	14,933	------	------	------	Area #1
2	SCS Runoff	3.437	2	724	10,275	------	------	------	To Drainage #1
3	Reservoir	2.158	2	730	8,327	2	191.72	2,023	To chambers
4	Combine	5.217	2	732	23,260	1, 3	------	------	Total Area #1 runoff
6	SCS Runoff	8.470	2	736	40,315	------	------	------	To Drainage #2A
7	Reservoir	7.233	2	730	23,131	6	189.31	11,214	To Pond
8	SCS Runoff	14.98	2	724	44,841	------	------	------	To Drainage #2B
9	Reservoir	0.000	2	754	0	8	189.79	25,281	To Pond
10	Combine	7.233	2	730	23,131	7, 9	------	------	Total Area #2 runoff
12	SCS Runoff	9.737	2	724	29,558	------	------	------	To Drainage #3
13	Reservoir	3.140	2	744	22,016	12	192.46	10,994	To Pond
15	SCS Runoff	14.35	2	738	72,111	------	------	------	Area #4
16	SCS Runoff	11.54	2	724	34,501	------	------	------	To Drainage #4
17	Reservoir	1.056	2	768	10,195	16	195.72	18,021	To Pond
18	Combine	14.50	2	738	82,306	15, 17	------	------	Total Area #4 runoff
20	Combine	28.15	2	736	150,713	4, 10, 13, 18,	------	------	Total Site Runoff

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

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	3.950	2	734	18,091	------	------	------	Area #1
2	SCS Runoff	4.008	2	724	11,979	------	------	------	To Drainage #1
3	Reservoir	2.608	2	728	9,966	2	192.19	2,251	To chambers
4	Combine	6.360	2	732	28,057	1, 3	------	------	Total Area #1 runoff
6	SCS Runoff	9.983	2	736	47,337	------	------	------	To Drainage #2A
7	Reservoir	10.40	2	728	29,491	6	189.41	12,024	To Pond
8	SCS Runoff	17.56	2	724	52,481	------	------	------	To Drainage #2B
9	Reservoir	0.000	2	746	0	8	189.93	29,786	To Pond
10	Combine	10.40	2	728	29,491	7, 9	------	------	Total Area #2 runoff
12	SCS Runoff	11.65	2	724	35,119	------	------	------	To Drainage #3
13	Reservoir	4.570	2	740	27,576	12	192.59	12,013	To Pond
15	SCS Runoff	17.70	2	738	87,491	------	------	------	Area #4
16	SCS Runoff	13.41	2	724	40,089	------	------	------	To Drainage #4
17	Reservoir	2.234	2	750	15,213	16	195.88	19,658	To Pond
18	Combine	18.97	2	738	102,704	15, 17	------	------	Total Area #4 runoff
20	Combine	36.82	2	736	187,828	4, 10, 13, 18,	------	------	Total Site Runoff

Hydraflow Rainfall Report

Return Period (Yrs)	Intensity-Duration-Frequency Equation Coefficients (FHA)			
	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	17.4950	4.2000	0.6438	--------
3	0.0000	0.0000	0.0000	--------
5	40.8144	10.8000	0.7755	--------
10	45.6810	10.9000	0.7723	--------
25	106.0698	18.5000	0.9101	--------
50	44.6078	10.9000	0.6858	--------
100	47.7883	11.3000	0.6734	--------

File name: Boston IDF.IDF

Intensity = B / (Tc + D)^E

Return Period (Yrs)	Intensity Values (in/hr)											
	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	4.19	3.17	2.61	2.25	1.99	1.80	1.65	1.53	1.42	1.34	1.26	1.20
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	4.80	3.88	3.28	2.86	2.55	2.30	2.10	1.94	1.80	1.69	1.59	1.50
10	5.39	4.37	3.70	3.23	2.88	2.60	2.38	2.20	2.04	1.91	1.80	1.70
25	5.99	5.03	4.34	3.82	3.42	3.10	2.84	2.61	2.43	2.26	2.12	2.00
50	6.69	5.55	4.79	4.24	3.83	3.50	3.23	3.01	2.82	2.66	2.52	2.40
100	7.29	6.09	5.29	4.70	4.25	3.90	3.61	3.37	3.17	2.99	2.84	2.70

Tc = time in minutes. Values may exceed 60.

Precip. file name: Sample.pcp

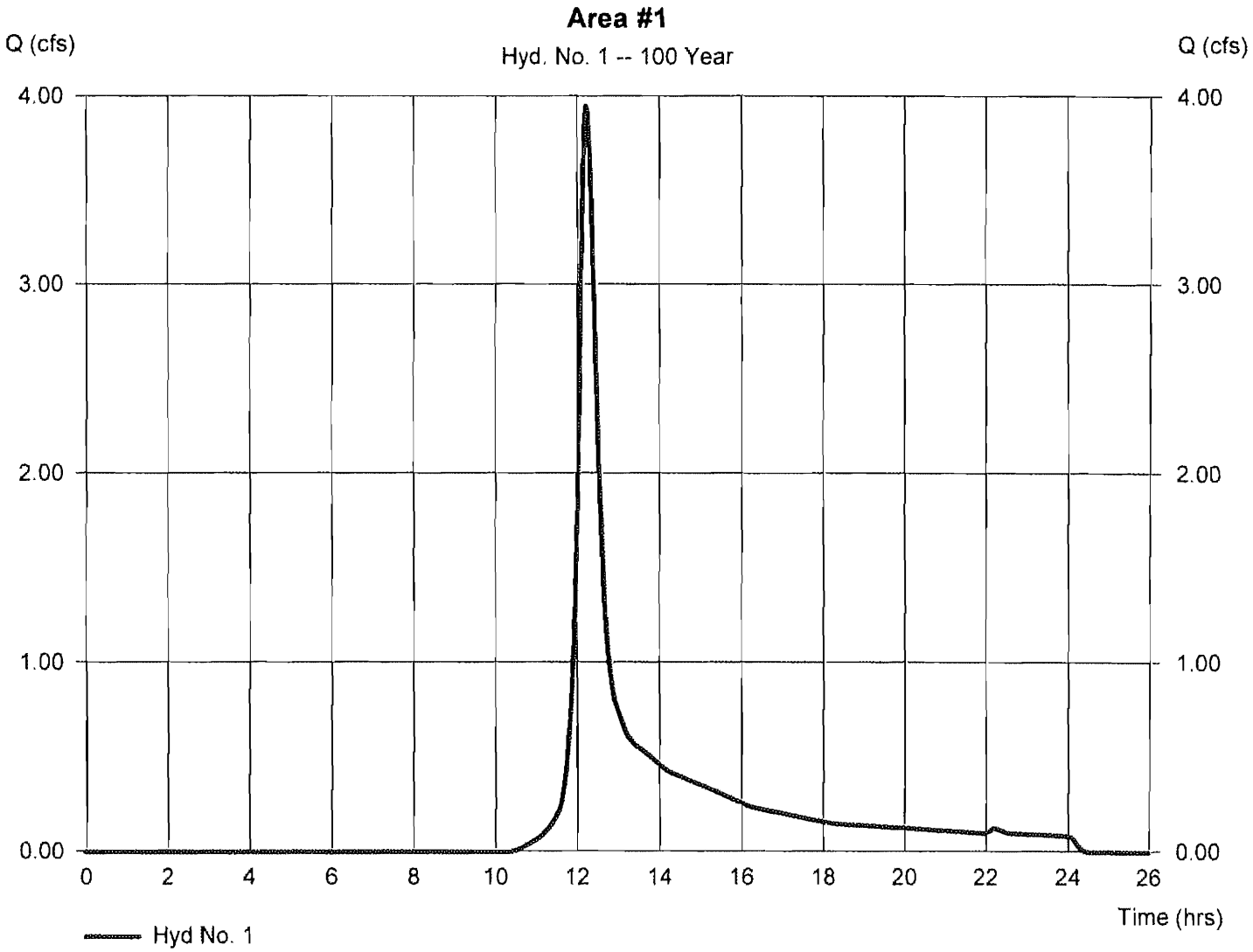
Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.50	3.10	0.00	3.30	4.50	5.30	5.90	6.50
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	2.75	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	2.75	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	2.80	0.00	0.00	0.00	0.00

Hydrograph Report

Hyd. No. 1

Area #1

Hydrograph type	= SCS Runoff	Peak discharge	= 3.950 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.23 hrs
Time interval	= 2 min	Hyd. volume	= 18,091 cuft
Drainage area	= 2.140 ac	Curve number	= 60.8
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.10 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10

Hyd. No. 1

Area #1

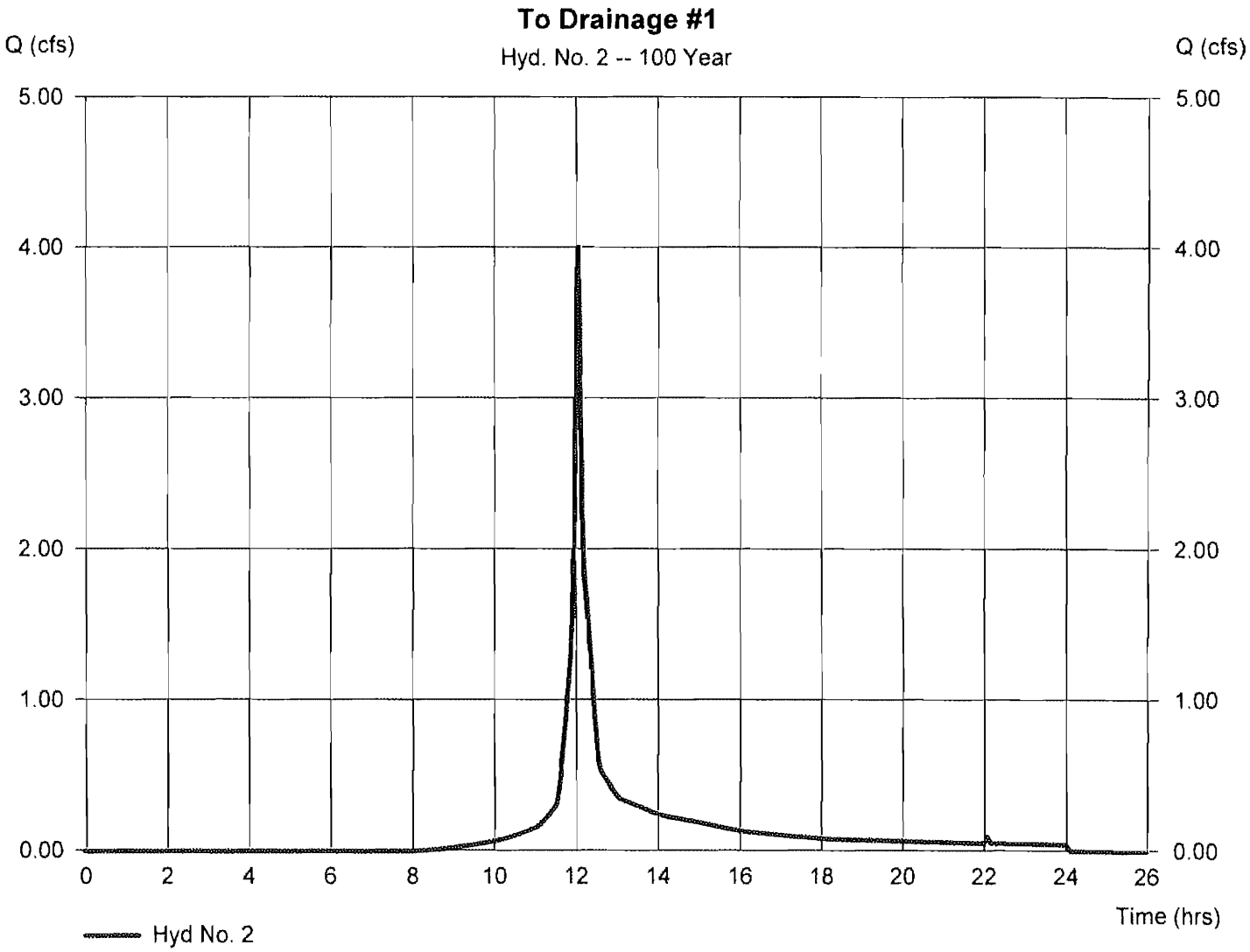
Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 410.00		0.00		0.00		
Watercourse slope (%)	= 2.20		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.39		0.00		0.00		
Travel Time (min)	**= 2.86**	**+**	**0.00**	**+**	**0.00**	**=**	**2.86**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**19.10 min**

Hydrograph Report

Hyd. No. 2

To Drainage #1

Hydrograph type	= SCS Runoff	Peak discharge	= 4.008 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 11,979 cuft
Drainage area	= 0.992 ac	Curve number	= 73.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



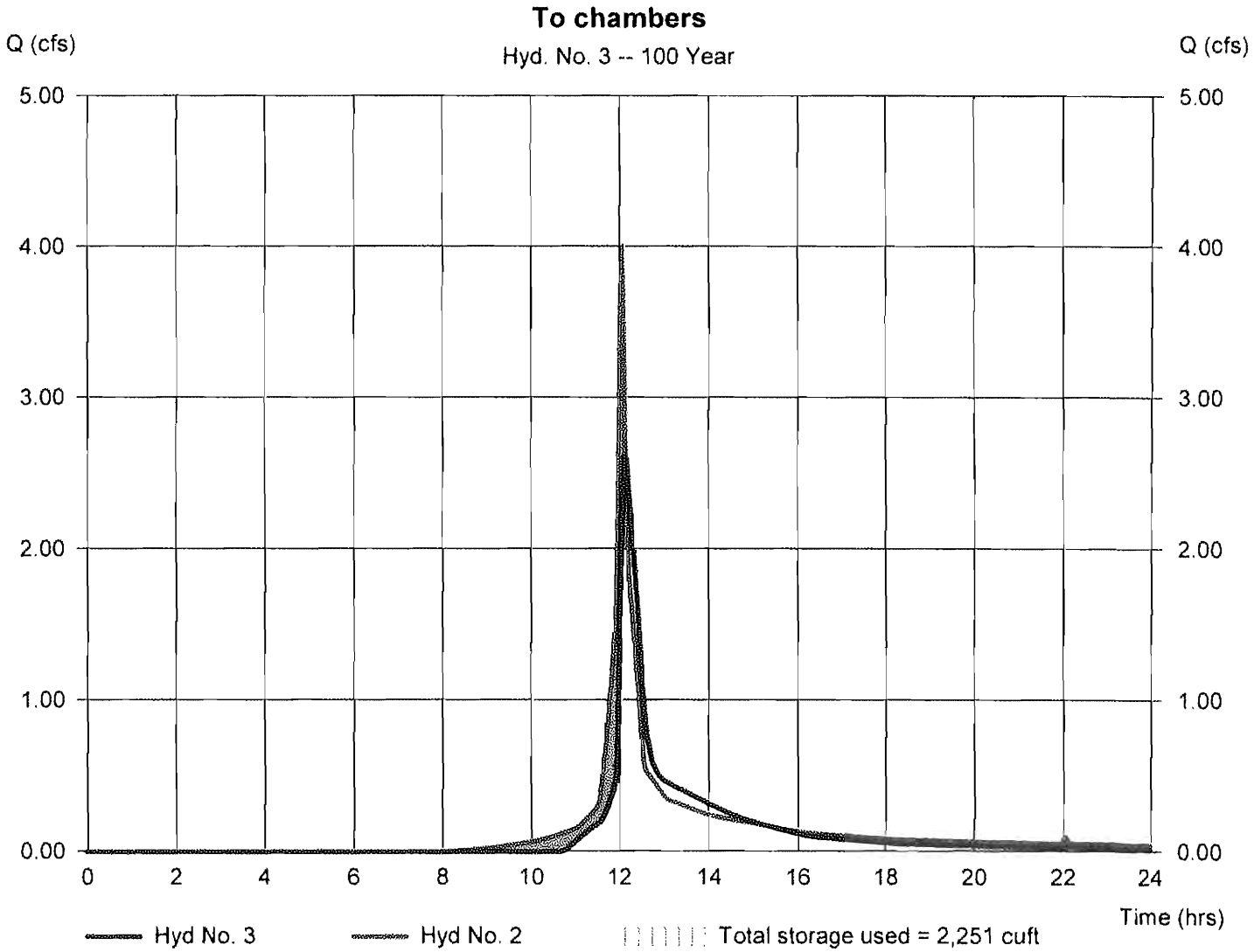
Hydrograph Report

Hyd. No. 3

To chambers

Hydrograph type	= Reservoir	Peak discharge	= 2.608 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 9,966 cuft
Inflow hyd. No.	= 2 - To Drainage #1	Max. Elevation	= 192.19 ft
Reservoir name	= Drainage #1	Max. Storage	= 2,251 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 1 - Drainage #1

Pond Data

UG Chambers -Invert elev. = 189.50 ft, Rise x Span = 2.54 x 4.33 ft, Barrel Len = 7.00 ft, No. Barrels = 28, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 189.00 ft, Width = 5.33 ft, Height = 3.54 ft, Voids = 35.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	189.00	n/a	0	0
0.35	189.35	n/a	129	129
0.71	189.71	n/a	244	374
1.06	190.06	n/a	322	696
1.42	190.42	n/a	316	1,012
1.77	190.77	n/a	306	1,318
2.12	191.12	n/a	290	1,607
2.48	191.48	n/a	267	1,874
2.83	191.83	n/a	232	2,106
3.19	192.19	n/a	160	2,266
3.54	192.54	n/a	129	2,395

Culvert / Orifice Structures

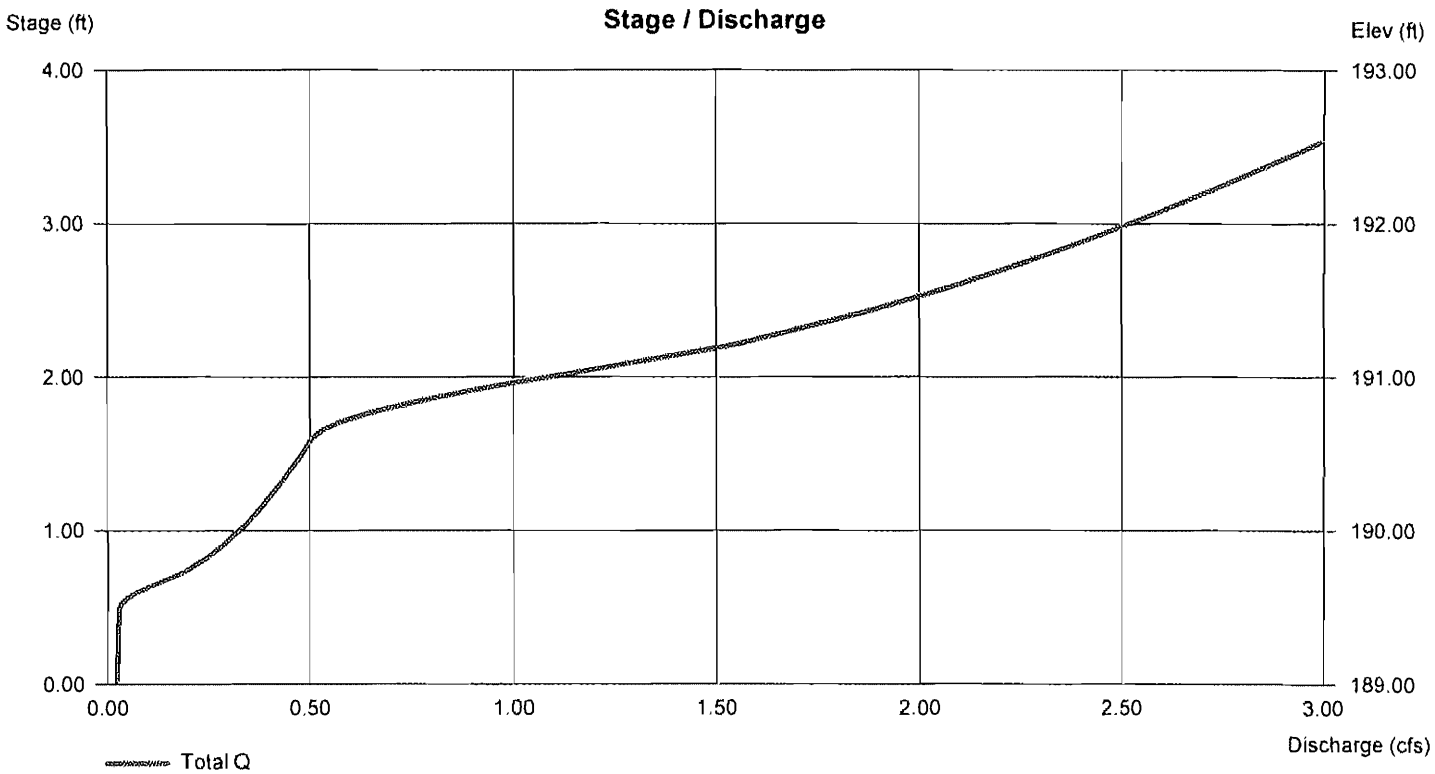
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 3.00	8.00	3.00	0.00
Span (in)	= 3.00	8.00	3.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 189.50	190.60	189.50	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	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) = 1.020 (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)

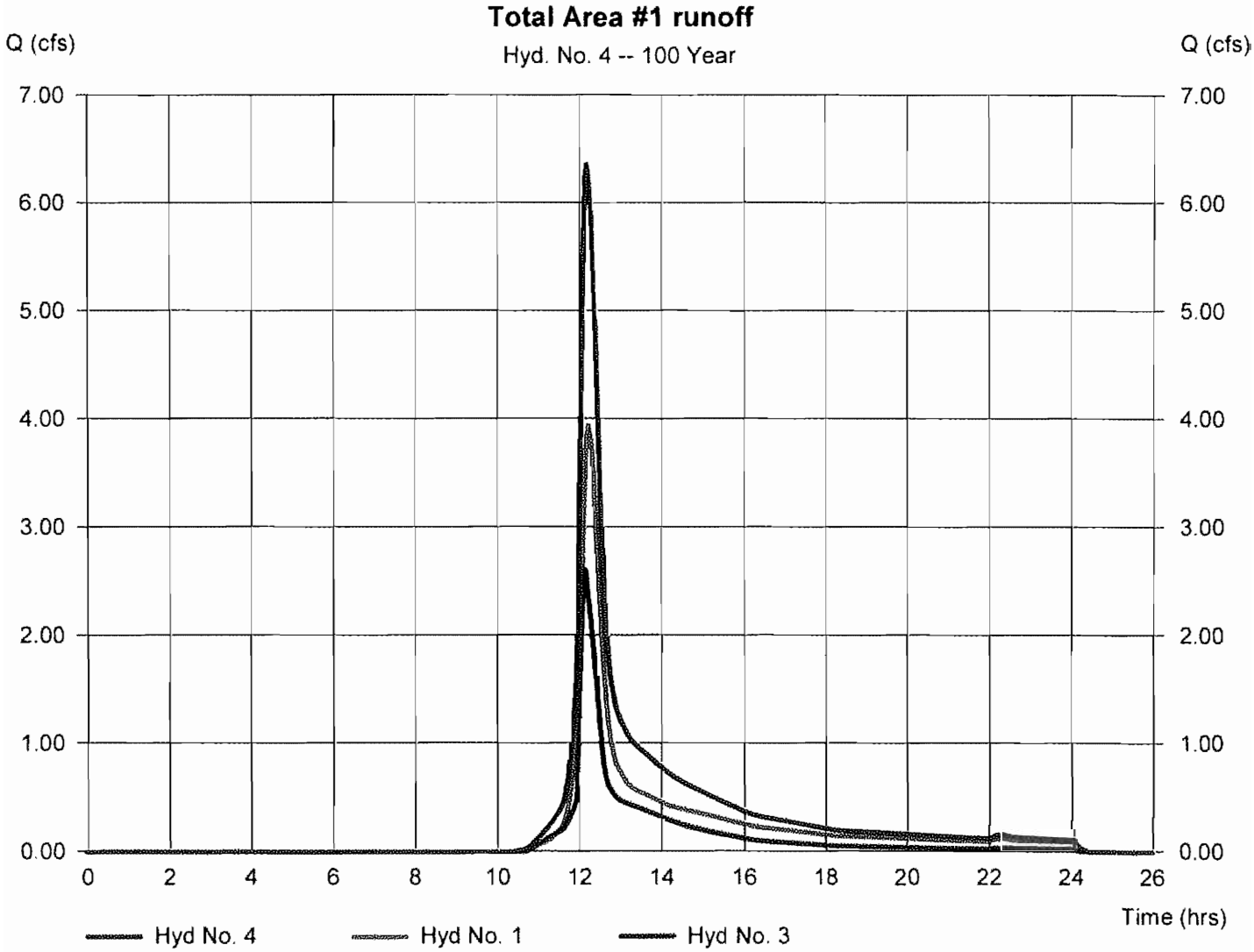


Hydrograph Report

Hyd. No. 4

Total Area #1 runoff

Hydrograph type	= Combine	Peak discharge	= 6.360 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.20 hrs
Time interval	= 2 min	Hyd. volume	= 28,057 cuft
Inflow hyds.	= 1, 3	Contrib. drain. area	= 2.140 ac

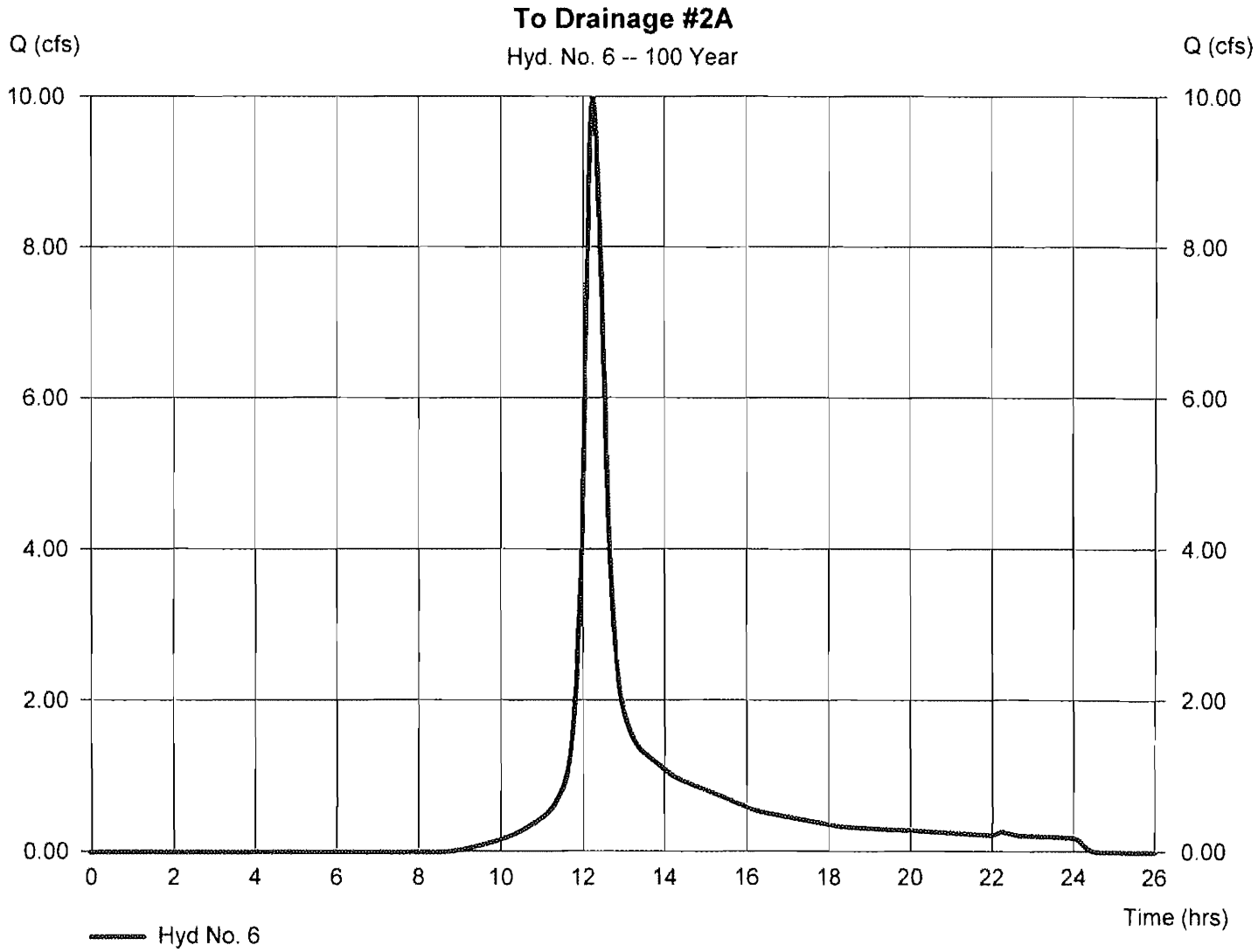


Hydrograph Report

Hyd. No. 6

To Drainage #2A

Hydrograph type	= SCS Runoff	Peak discharge	= 9.983 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 47,337 cuft
Drainage area	= 3.910 ac	Curve number	= 70.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.50 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 6

To Drainage #2A

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 87.00		343.00		0.00		
Watercourse slope (%)	= 1.10		1.70		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.69		2.65		0.00		
Travel Time (min)	**= 0.86**	**+**	**2.16**	**+**	**0.00**	**=**	**3.01**
Channel Flow							
X sectional flow area (sqft)	= 5.00		0.00		0.00		
Wetted perimeter (ft)	= 11.00		0.00		0.00		
Channel slope (%)	= 0.50		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=4.14						
			0.00				
					0.00		
Flow length (ft)	({0})311.0		0.0		0.0		
Travel Time (min)	**= 1.25**	**+**	**0.00**	**+**	**0.00**	**=**	**1.25**

Total Travel Time, Tc ..... 20.50 min

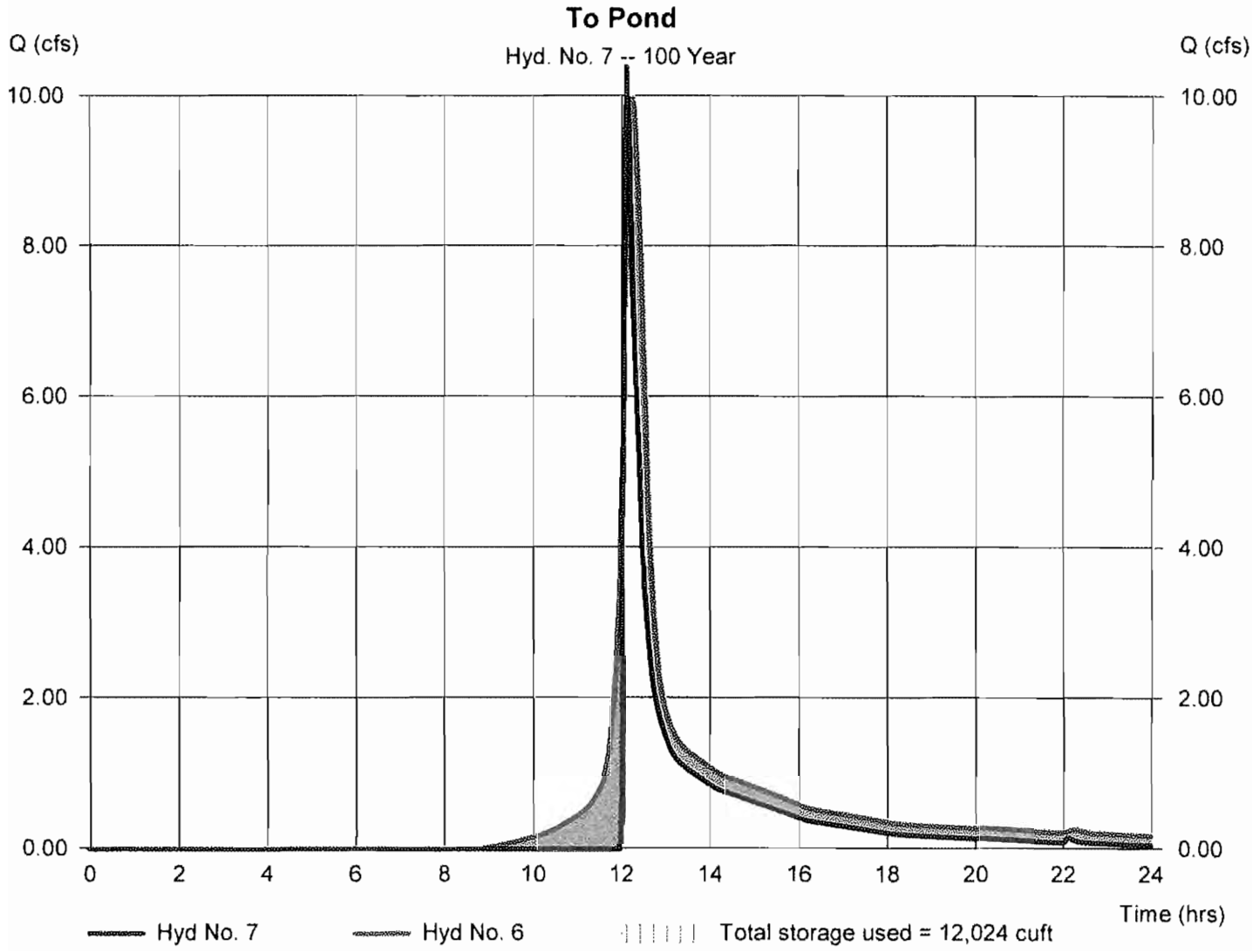
Hydrograph Report

Hyd. No. 7

To Pond

Hydrograph type	= Reservoir	Peak discharge	= 10.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 29,491 cuft
Inflow hyd. No.	= 6 - To Drainage #2A	Max. Elevation	= 189.41 ft
Reservoir name	= Pond #2A	Max. Storage	= 12,024 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 2 - Pond #2A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 188.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	188.00	7,152	0	0
2.00	189.50	10,024	17,094	17,094

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

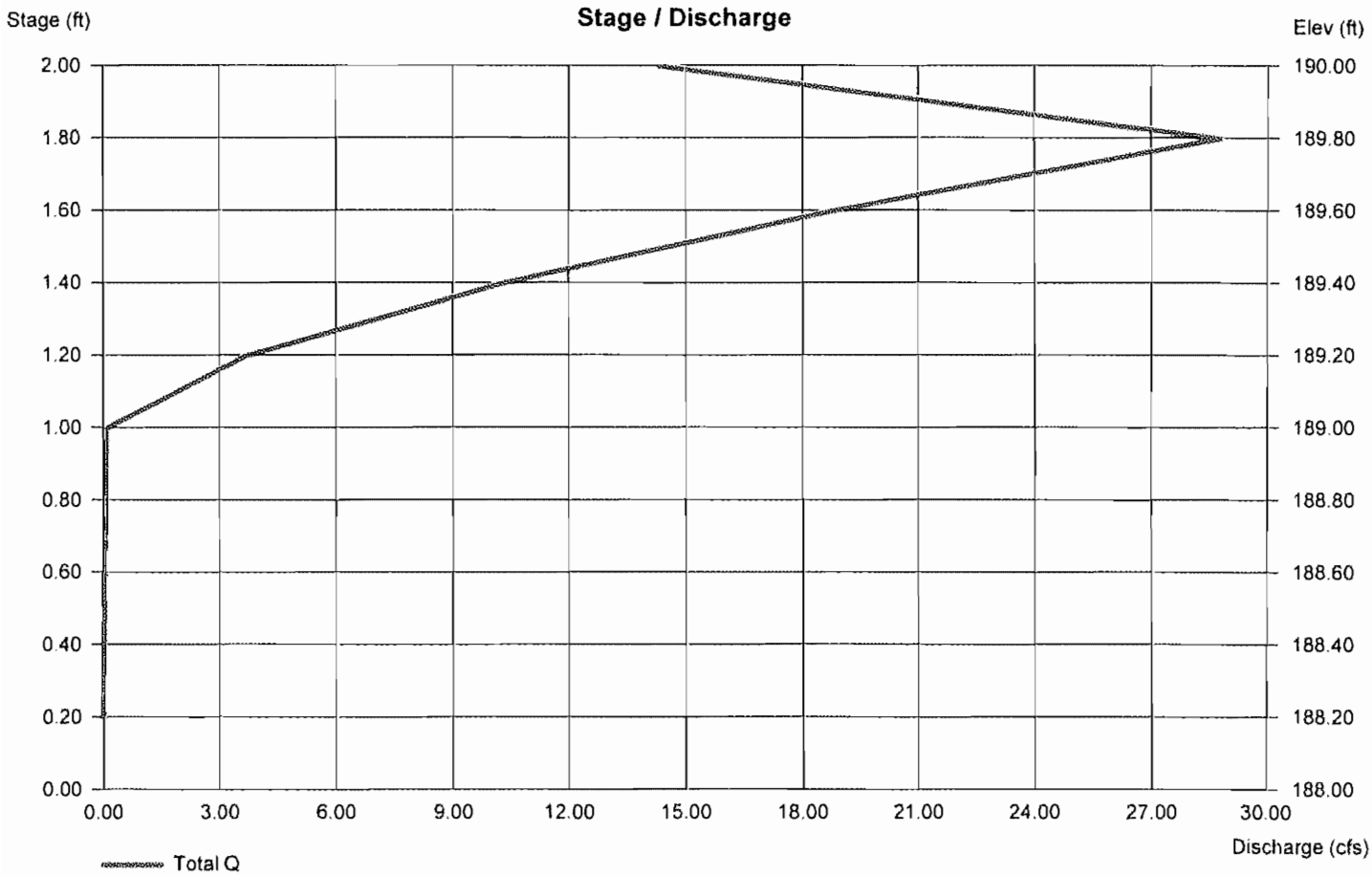
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 12.00	0.00	0.00	0.00
Crest El. (ft)	= 189.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.020 (by Contour)

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).

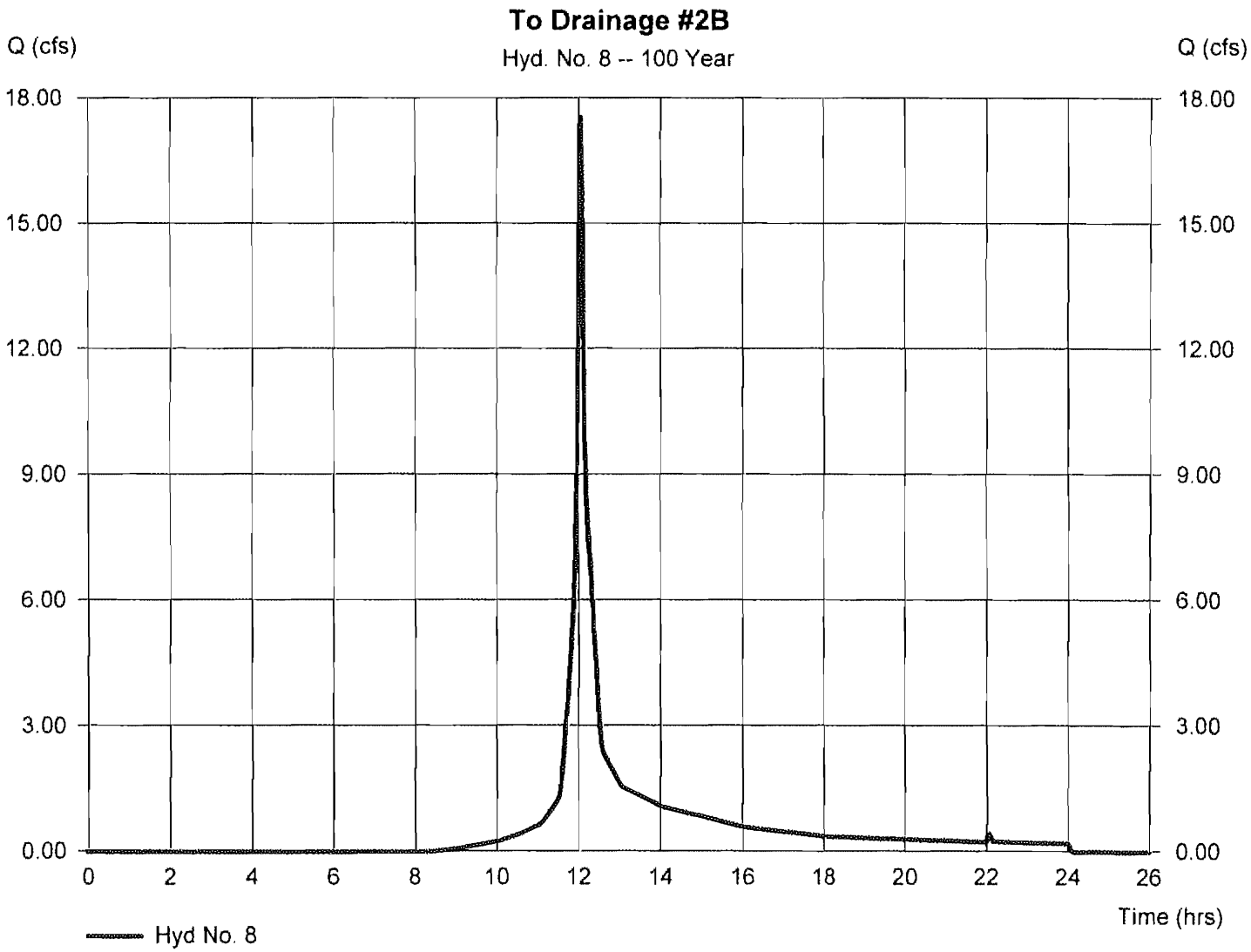


Hydrograph Report

Hyd. No. 8

To Drainage #2B

Hydrograph type	= SCS Runoff	Peak discharge	= 17.56 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 52,481 cuft
Drainage area	= 4.540 ac	Curve number	= 71.9
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



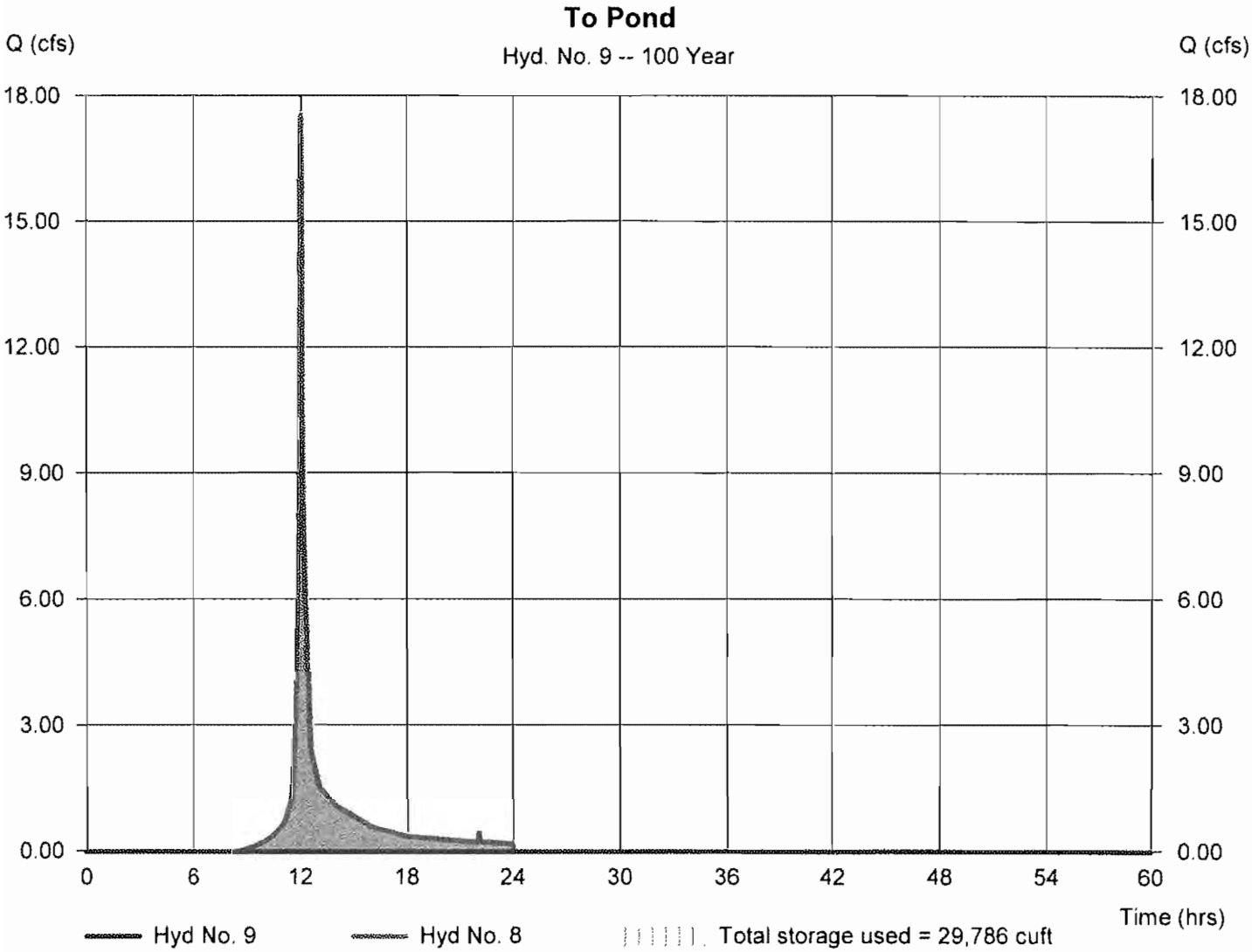
Hydrograph Report

Hyd. No. 9

To Pond

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 8 - To Drainage #2B	Max. Elevation	= 189.93 ft
Reservoir name	= Pond #2B	Max. Storage	= 29,786 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Monday, 03 / 31 / 2014

Pond No. 3 - Pond #2B

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 189.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	189.00	20,341	0	0
1.00	190.00	45,645	32,149	32,149

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

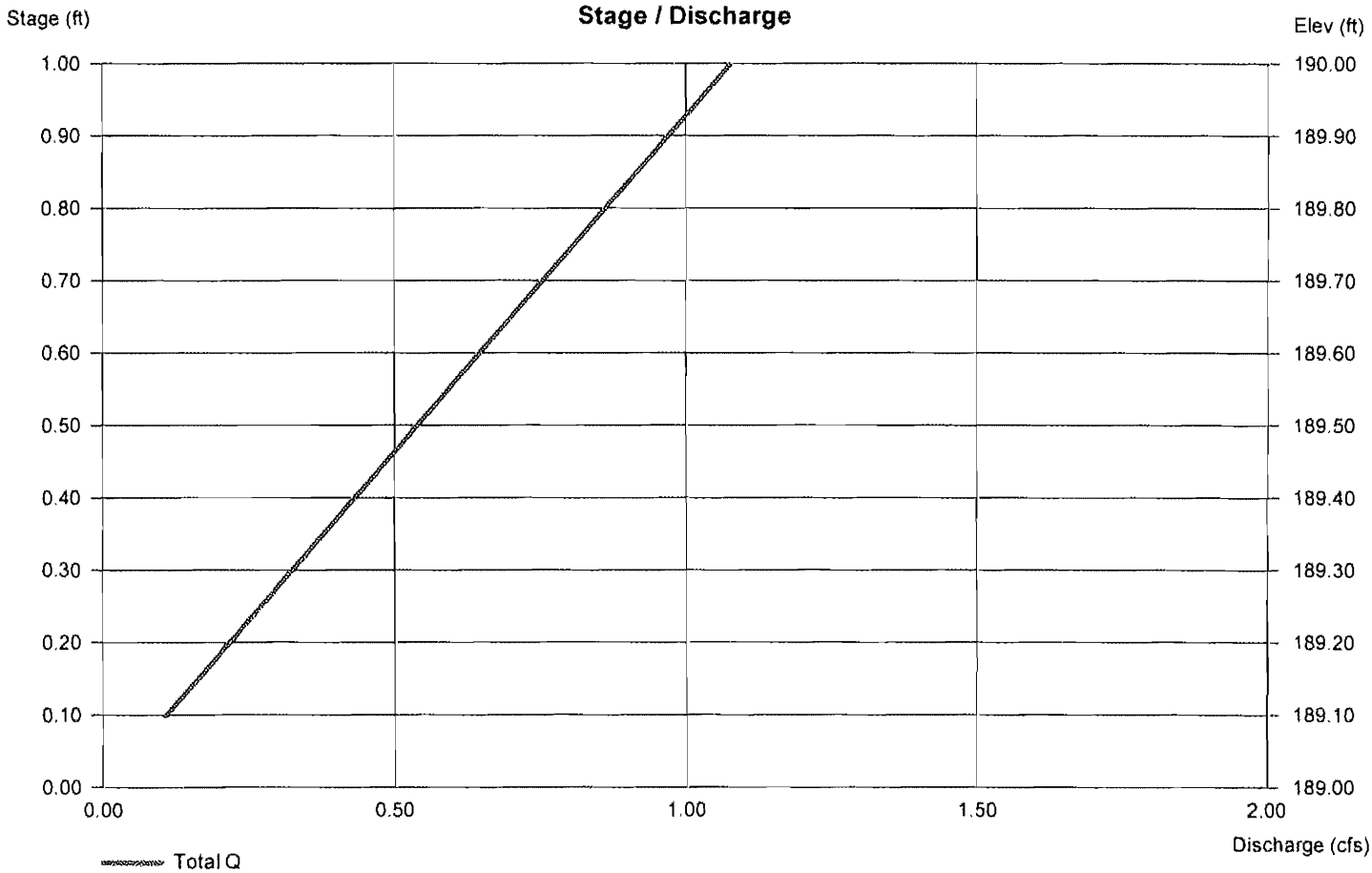
Weir Structures

	[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) = 1.020 (by Contour)

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)

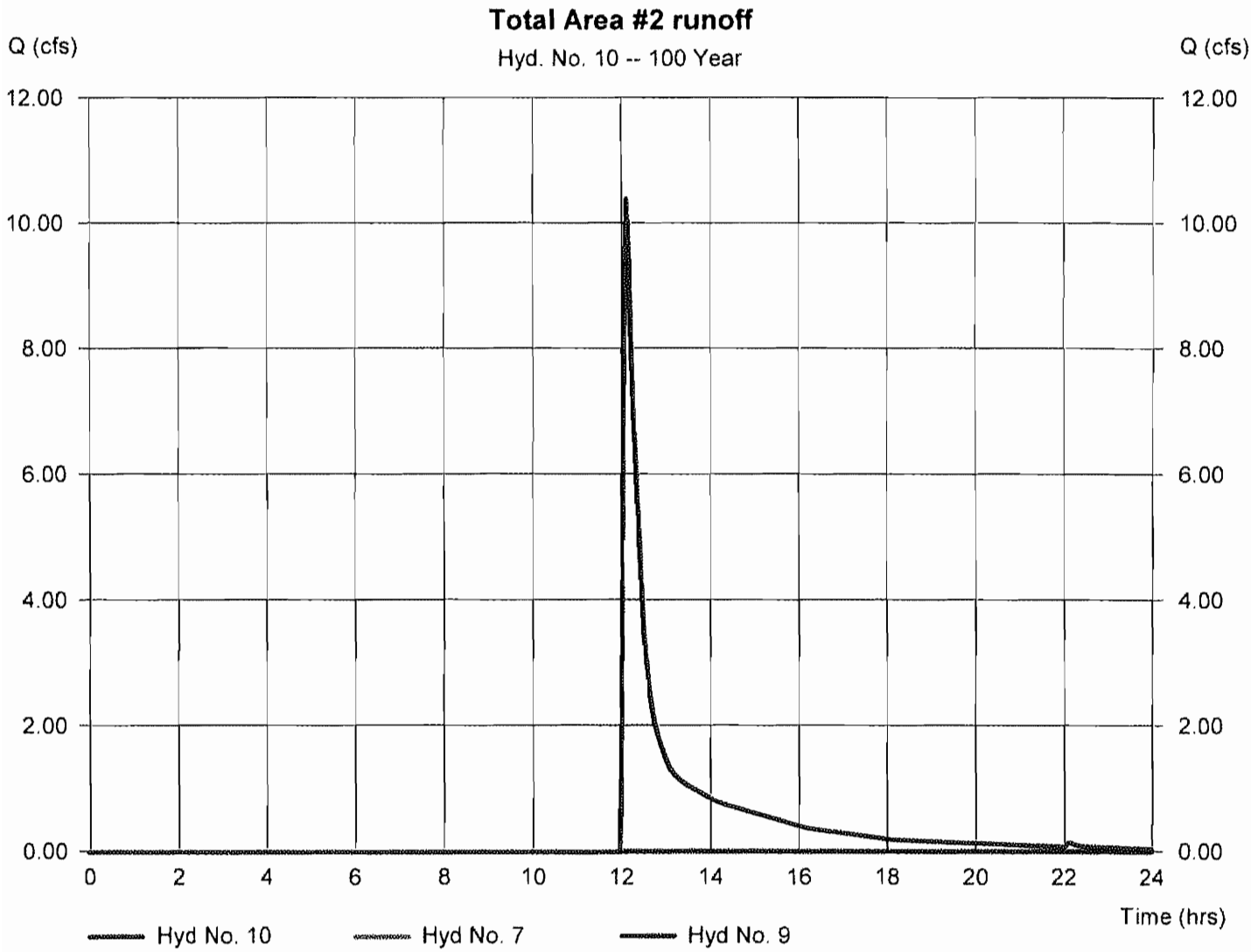


Hydrograph Report

Hyd. No. 10

Total Area #2 runoff

Hydrograph type	= Combine	Peak discharge	= 10.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.13 hrs
Time interval	= 2 min	Hyd. volume	= 29,491 cuft
Inflow hyds.	= 7, 9	Contrib. drain. area	= 0.000 ac

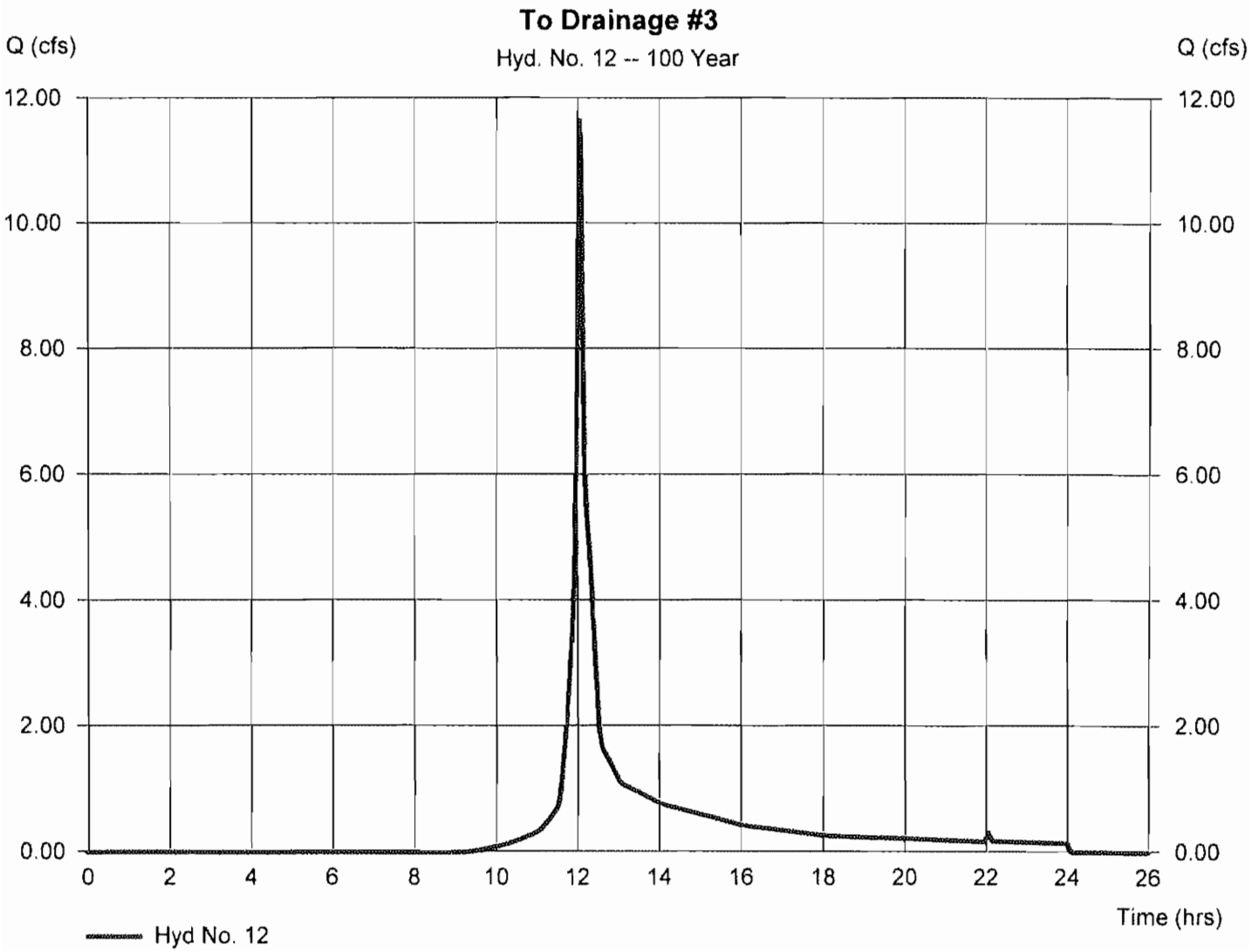


Hydrograph Report

Hyd. No. 12

To Drainage #3

Hydrograph type	= SCS Runoff	Peak discharge	= 11.65 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 35,119 cuft
Drainage area	= 3.590 ac	Curve number	= 66.6
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



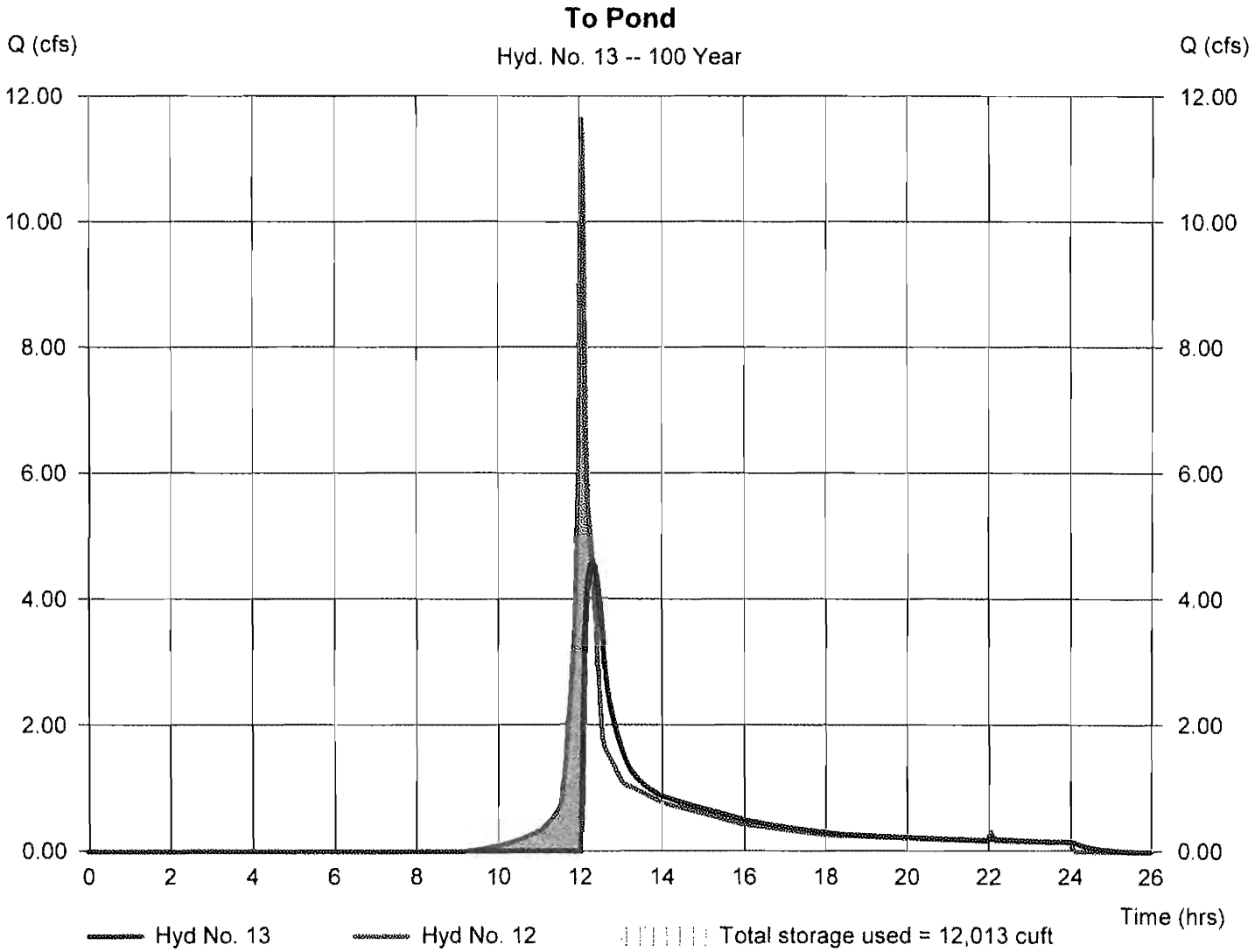
Hydrograph Report

Hyd. No. 13

To Pond

Hydrograph type	= Reservoir	Peak discharge	= 4.570 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.33 hrs
Time interval	= 2 min	Hyd. volume	= 27,576 cuft
Inflow hyd. No.	= 12 - To Drainage #3	Max. Elevation	= 192.59 ft
Reservoir name	= Pond #3	Max. Storage	= 12,013 cuft

Storage Indication method used.



Pond Report

Pond No. 4 - Pond #3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 191.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	191.00	5,903	0	0
2.00	193.00	9,308	15,081	15,081

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

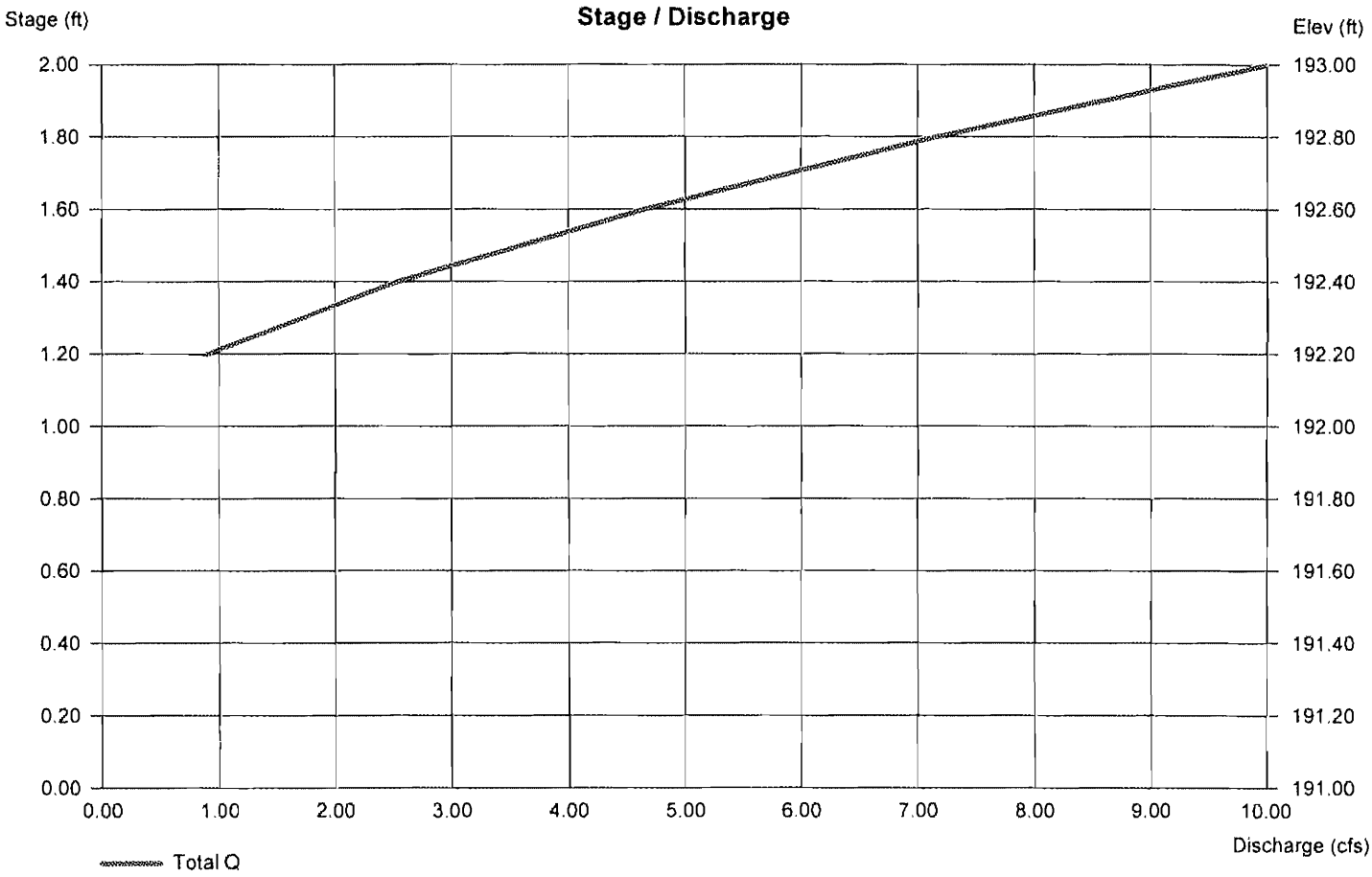
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 192.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (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).

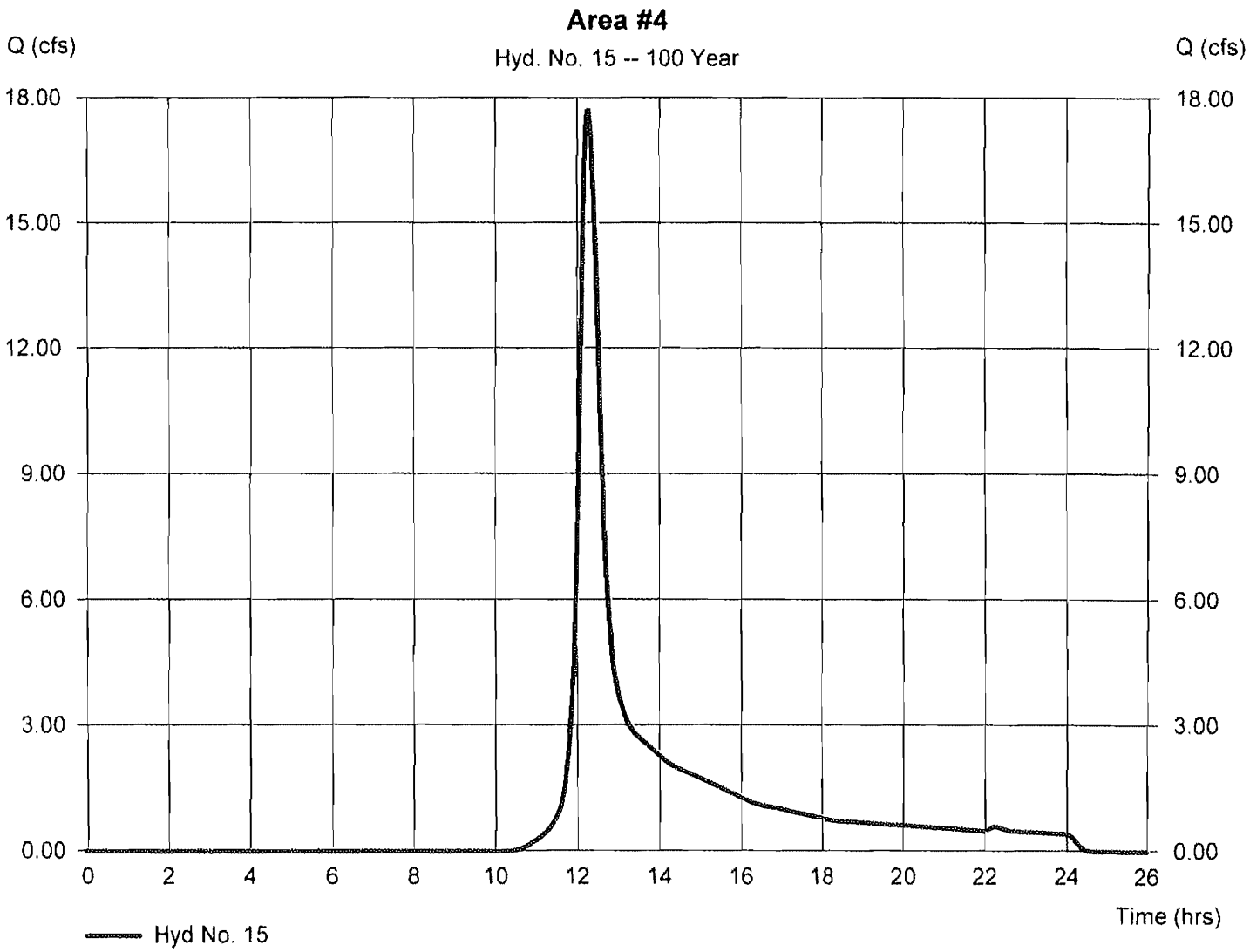


Hydrograph Report

Hyd. No. 15

Area #4

Hydrograph type	= SCS Runoff	Peak discharge	= 17.70 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 87,491 cuft
Drainage area	= 10.330 ac	Curve number	= 60.4
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.50 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 15

Area #4

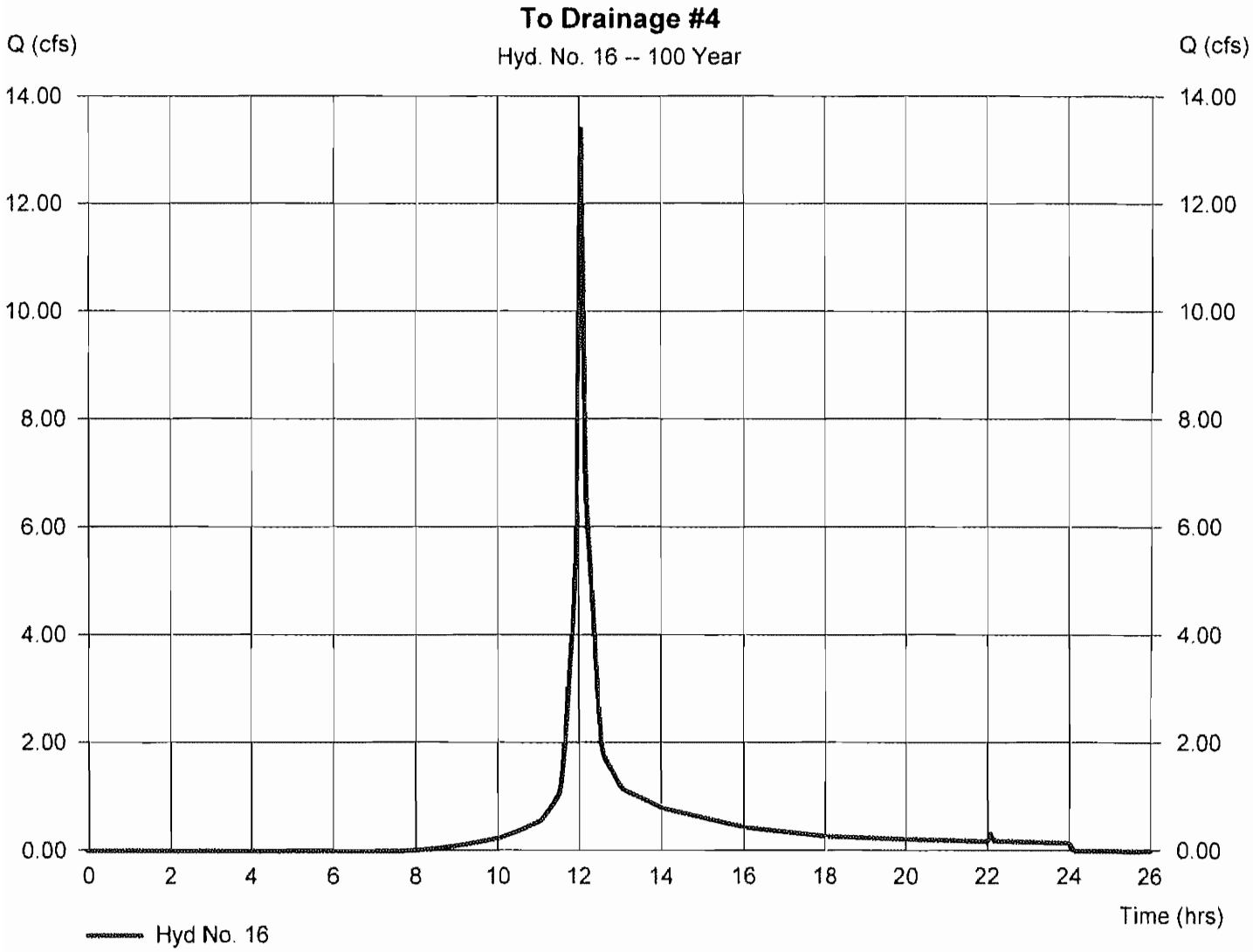
Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.400		0.011		0.011		
Flow length (ft)	= 50.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 3.20		0.00		0.00		
Land slope (%)	= 1.00		0.00		0.00		
Travel Time (min)	**= 16.27**	**+**	**0.00**	**+**	**0.00**	**=**	**16.27**
Shallow Concentrated Flow							
Flow length (ft)	= 666.00		0.00		0.00		
Watercourse slope (%)	= 2.60		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=2.60		0.00		0.00		
Travel Time (min)	**= 4.27**	**+**	**0.00**	**+**	**0.00**	**=**	**4.27**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	=0.00						
			0.00				
					0.00		
Flow length (ft)	({0})0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Total Travel Time, Tc							**20.50 min**

Hydrograph Report

Hyd. No. 16

To Drainage #4

Hydrograph type	= SCS Runoff	Peak discharge	= 13.41 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 40,089 cuft
Drainage area	= 3.200 ac	Curve number	= 74.7
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 6.00 min
Total precip.	= 6.50 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



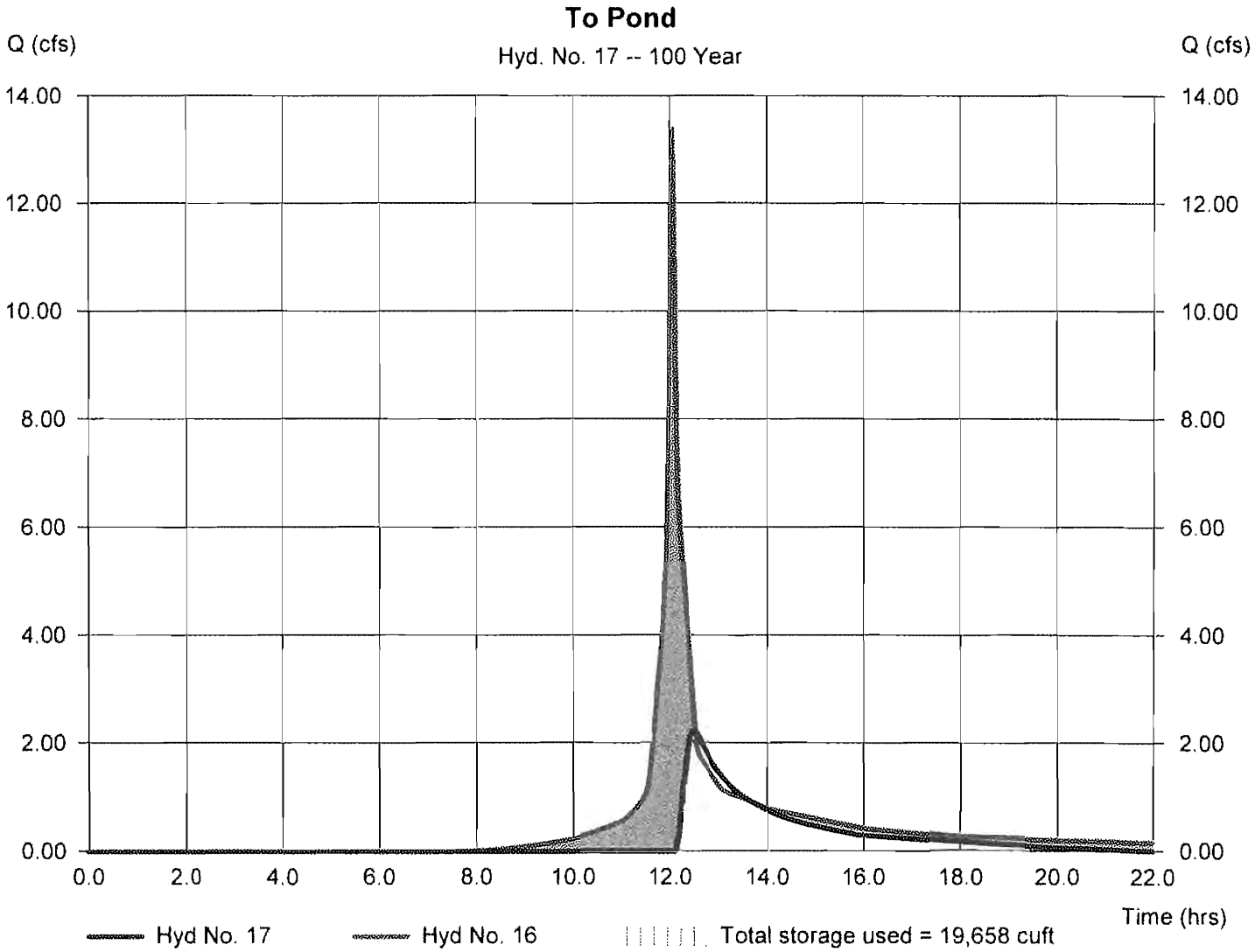
Hydrograph Report

Hyd. No. 17

To Pond

Hydrograph type	= Reservoir	Peak discharge	= 2.234 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.50 hrs
Time interval	= 2 min	Hyd. volume	= 15,213 cuft
Inflow hyd. No.	= 16 - To Drainage #4	Max. Elevation	= 195.88 ft
Reservoir name	= Pond #4	Max. Storage	= 19,658 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



Pond Report

Pond No. 5 - Pond #4

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 194.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	194.00	8,122	0	0
2.00	196.00	12,987	20,917	20,917

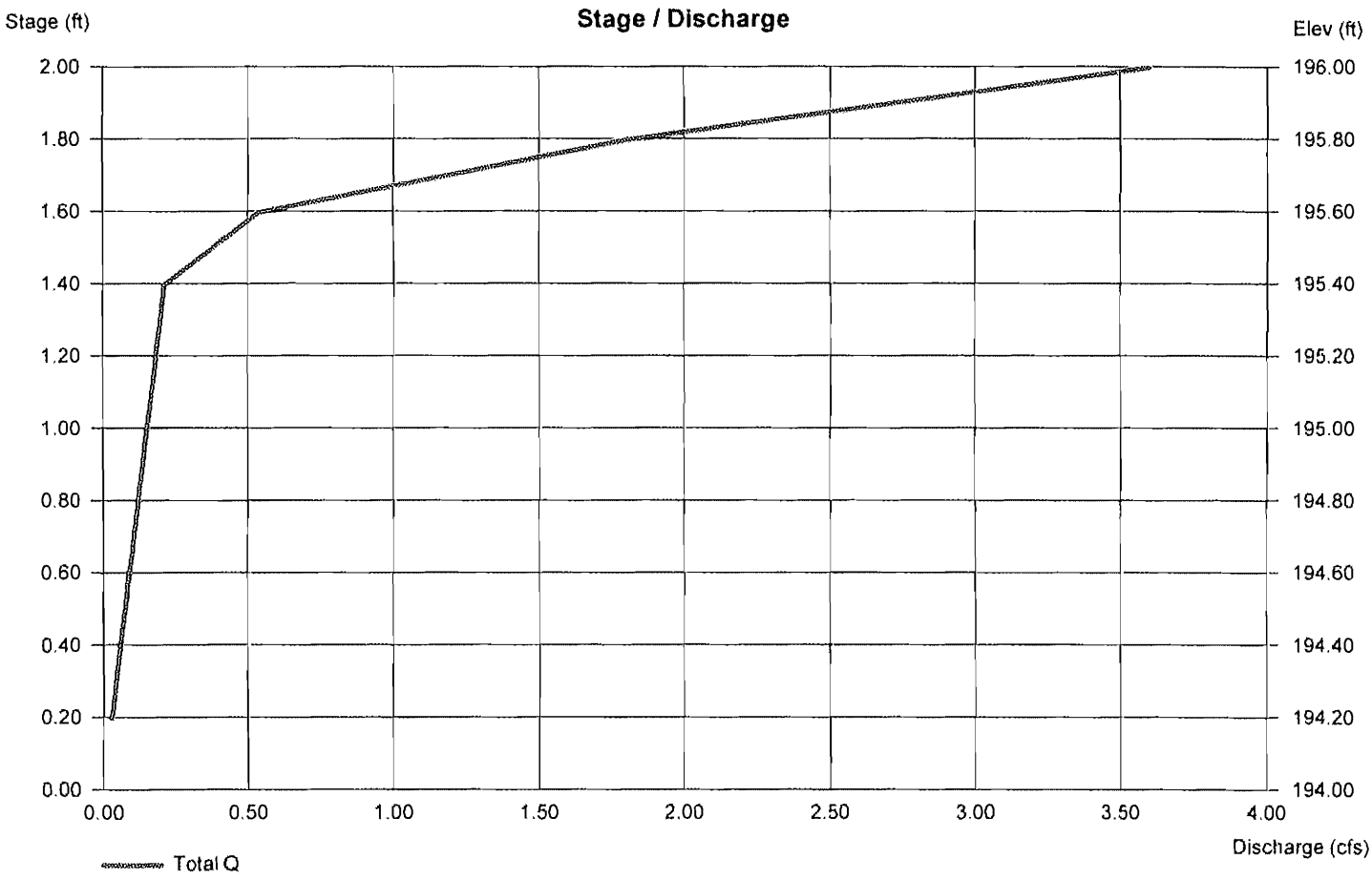
Culvert / Orifice Structures

	[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)	= 2.80	0.00	0.00	0.00
Crest El. (ft)	= 195.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 1.020 (by Contour)			
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).

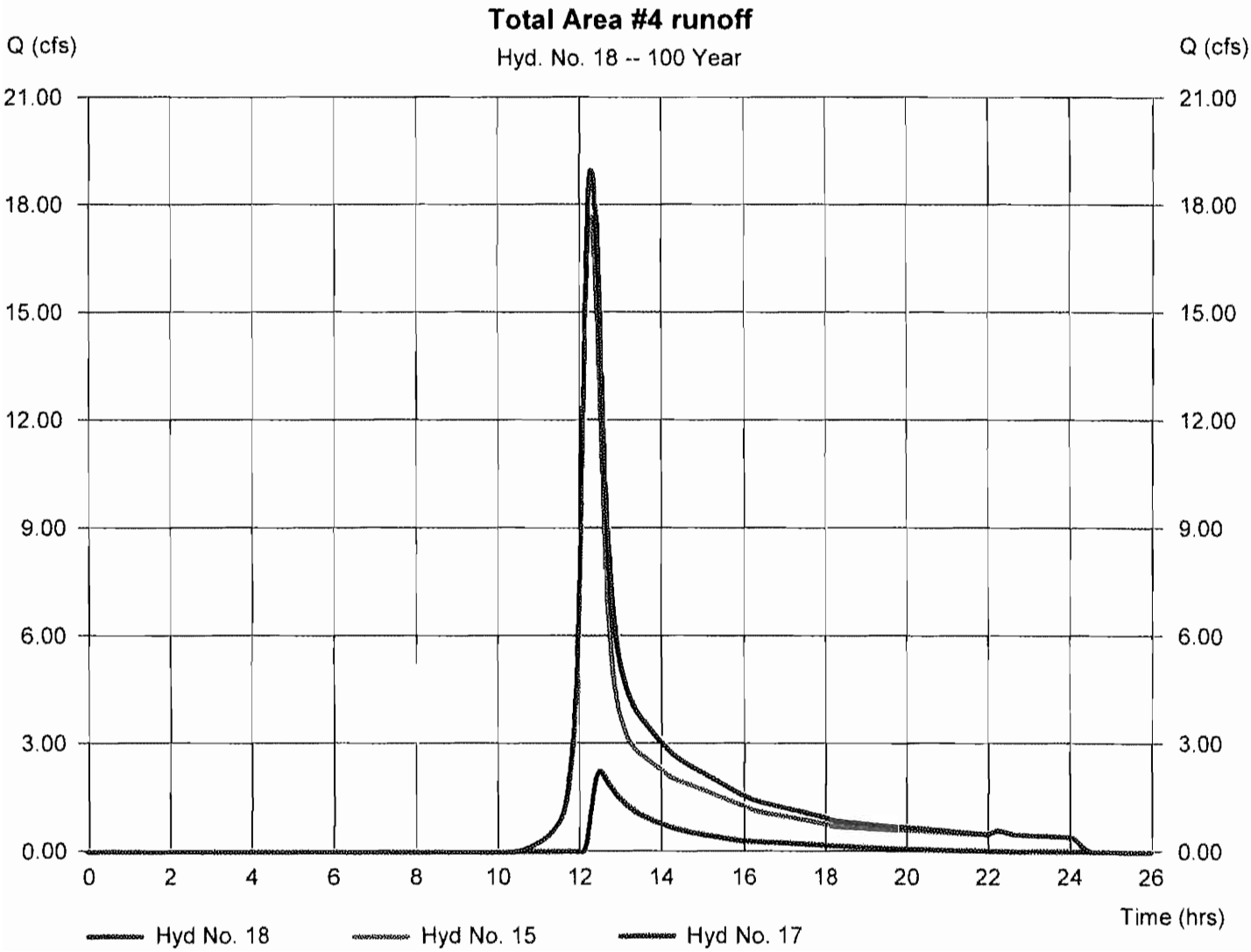


Hydrograph Report

Hyd. No. 18

Total Area #4 runoff

Hydrograph type	= Combine	Peak discharge	= 18.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 102,704 cuft
Inflow hyds.	= 15, 17	Contrib. drain. area	= 10.330 ac

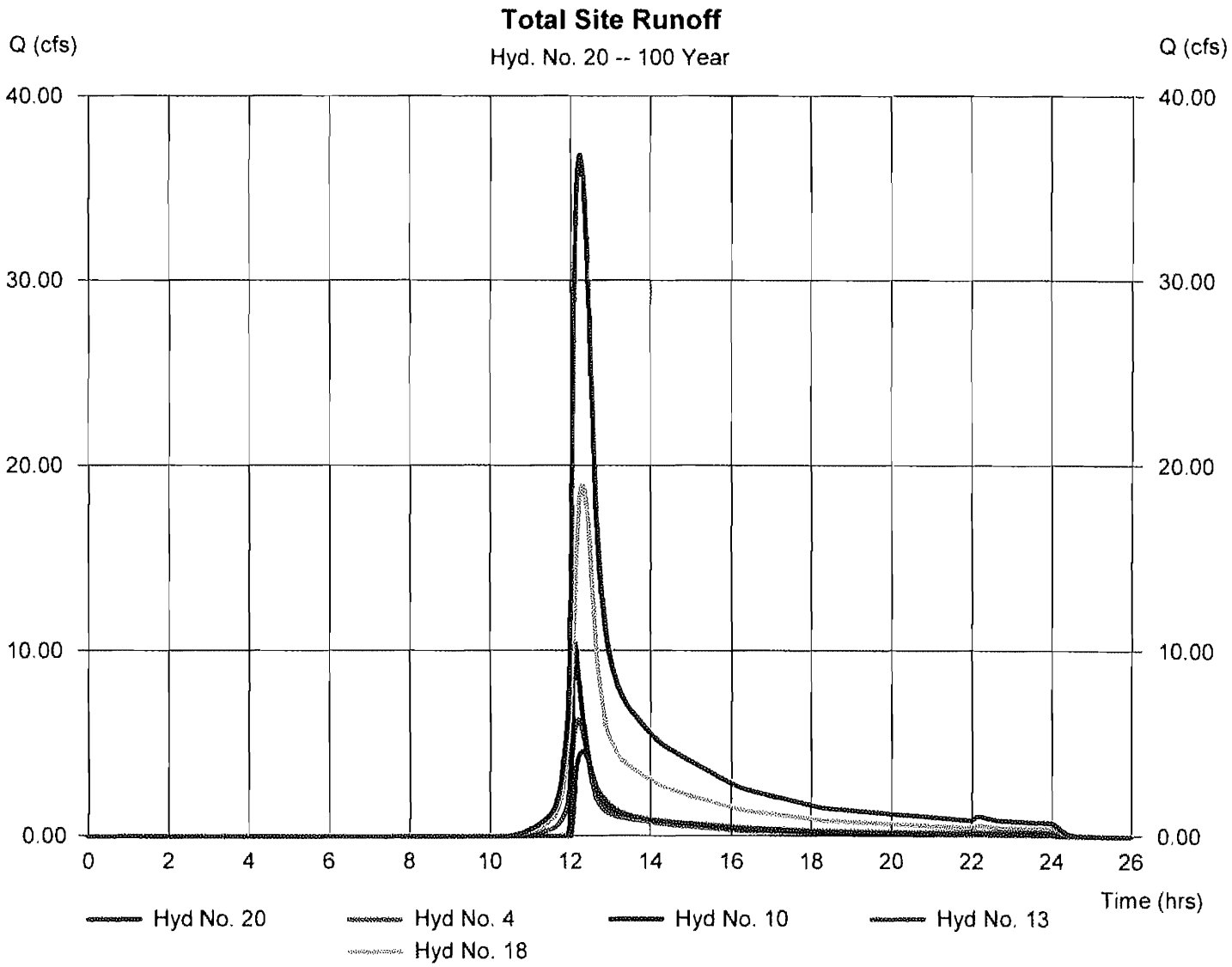


Hydrograph Report

Hyd. No. 20

Total Site Runoff

Hydrograph type	= Combine	Peak discharge	= 36.82 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 187,828 cuft
Inflow hyds.	= 4, 10, 13, 18	Contrib. drain. area	= 0.000 ac



KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment C
Infiltration Basins & Subsurface Recharge Systems

CULTEC

Stormwater and Septic Solutions

Since 1986

1-800-4-CULTEC

Manufactured at ISO 9001:2000 certified facilities

Prepared For:	Project Information:	Engineer:	Calculations Performed By:
	Walden Behavioral Care		
	518 Pleasant St.	Kelly Engineering Group, Inc.	
	Framingham	0 Campanelli Dr.	
	MA	Braintree	
		MA 02184	
	Date: (mm/dd)		

Input Given Parameters

Unit of Measure	English	
Select Model	Recharger 330XLHD	
Stone Porosity	35.0%	
Number of Header Systems	1 Header	
Stone Depth **Above** Chamber	6	inches
Stone Depth **Below** Chamber	6	inches
Workable Bed Depth	10.00	feet
Max. Bed Width	21.00	feet
Storage Volume Required	2200.00	cu. feet

Image for visual reference only.May not reflect selected model.

Chamber Specifications

Height	**30.5**	inches
Width	**52.00**	inches
Length	**8.50**	feet
Installed Length	**7.00**	feet
Bare Chamber Volume	**52.21**	cu. feet
Installed Chamber Volume	**75.88**	cu. feet
Bed Depth	**4.63**	feet
Bed Width	**20.83**	feet
Storage Volume Provided	**2336.05**	cu. feet

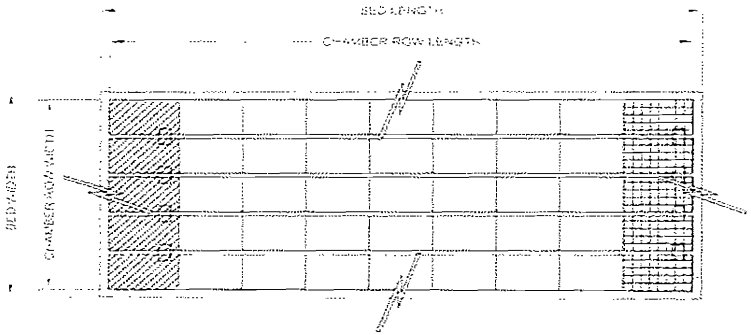
Materials List

Recharger 330XLHD Stormwater System by CULTEC, Inc.

Approx. Unit Count - not for construction	28	pieces
Actual Number of Chambers Required	**28**	pieces
Starter Chambers	**4**	pieces
Intermediate Chambers	**20**	pieces
End Chambers	**4**	pieces

HVLV FC-24	**3**	pieces
CULTEC No. 410™ Filter Fabric	**330.85**	sq. yards
CULTEC No. 20L Polyethylene Liner	**20.83**	feet
Stone	**87.62**	cu. yards
Volume of Excavation	**187.36**	cu. yards

Bed Detail



Number of Rows Wide	**4**	pieces
Number of Chambers Long	**7**	pieces
Chamber Row Width	**18.83**	feet
Chamber Row Length	**50.50**	feet
Bed Width	**20.83**	feet
Bed Length	**52.50**	feet
Bed Area Required	**1093.75**	sq. feet

Bed detail for reference only. Not project specific. Not to scale. Use CULTEC StormGenie to output project specific detail.

CULTEC, Inc.
P.O. Box 280, Brookfield, CT 06804 USA
Phone: 203-775-4416 - Fax: 203-775-1462 - **www.cultec.com**

Copyright 1996-2012 CULTEC, Inc. - All rights reserved
CULTEC SDC v. 2012-02

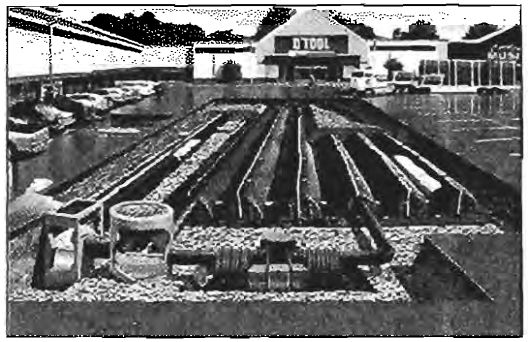
CULTEC

Stormwater and Septic Solutions
Since 1986

1-800-4-CULTEC
Manufactured at ISO 9001:2000 certified facilities

Project Name: Walden Behavioral Care **Date:** (mm/dd)

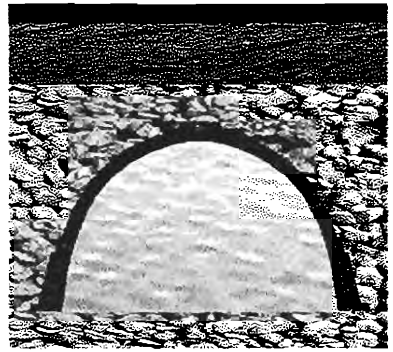
Cross Section Detail

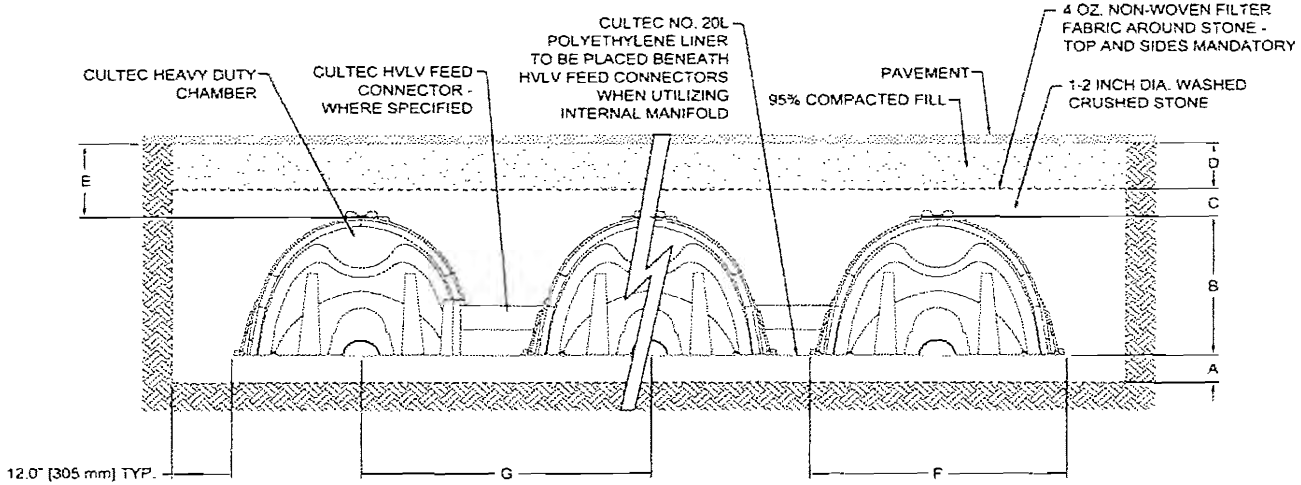


Conceptual graphic only. Not job specific.

Recharger 330XLHD

Pavement	**3**	inches
95% Compacted Fill	**10**	inches
Stone Above	**6**	inches
Chamber Height	**30.5**	inches
Stone Below	**6**	inches
Effective Depth	**42.5**	inches
Bed Depth	**55.5**	inches





A	Depth of Stone Base	**6.0**	inches
B	Chamber Height	**30.5**	inches
C	Depth of Stone Above Units	**6.0**	inches
D	Depth of 95% Compacted Fill	**10.0**	inches
E	Max. Depth of Cover Allowed Above Crown of Chamber	**12.0**	feet
F	Chamber Width	**52.0**	inches
G	Center to Center Spacing	**4.83**	feet

Breakdown of Storage Provided by Recharger 330XLHD	**Stormwater System**	
Chambers	**1506.72**	cu. feet
Feed Connectors	**1.37**	cu. feet
Stone	**827.97**	cu. feet
Total Storage Provided	**2336.05**	cu. feet

CULTEC, Inc.
P.O. Box 280, Brookfield, CT 06804 USA
Phone: 203-775-4416 · Fax: 203-775-1462 · www.cultec.com

Copyright 1996-2012 CULTEC, Inc. · All rights reserved
CULTEC SDC v. 2012-02

POND CALCULATIONS

Drainage System #1

Total impervious area = 21,058 s.f.
Existing impervious area = 15,014 s.f.
Required water quality volume = 14,430 s.f. * 0.5"/12" = **601 cu.ft.**
Note: Water quality volume provided in Contech Water Quality Device.

Required recharge volume for redevelopment = 6,044 s.f. (new impervious area) * 0.35"/12"
= **176 cu.ft.**
Provided recharge volume = 20.83' (length) * 52.5' (width) * 6" (depth) * 35% (void ratio)
= **191 cu.ft.**
Note: Recharge volume provided in stone beneath subsurface chambers.

Drain Down Time
Bottom contact area = 1,094 s.f.
Recharge rate = 1,094 s.f. * 1.02 in/hr / 12" = 93 cu.ft./hr
Drain time for recharge volume = 191 cu.ft. / 93 cu.ft./hr = **2 hours**

Drainage System #2A

Roof area = 12,626 s.f.
Other impervious area = 33,227 s.f.
Total impervious area = 45,853 s.f.
Required water quality volume = 33,227 s.f. * 0.5"/12" = **1,384 cu.ft.**

Length of 7' wide biofilter swale = 368'
Width of biofilter swale at 0.5' from flow line (side slopes 5:1) = 12'
Provided volume of biofilter swale = (7' + 12')/2 * 368' * 0.5' = **1,748 cu.ft.**

Required recharge volume for new development = 45,853 s.f. * 0.35"/12" = **1,337 cu.ft.**
Provided recharge volume @ el=188.0 to el=189.0 = **8,071 cu.ft.**

Drain Down Time
Bottom contact area = 7,152 s.f.
Recharge rate = 7,152 s.f. * 1.02 in/hr / 12" = 608 cu.ft./hr
Drain time for recharge volume = 8,071 cu.ft. / 608 cu.ft./hr = **13.3 hours**

Drainage System #2B

Roof area = 27,305 s.f.
Other impervious area = 32,606 s.f.
Total impervious area = 59,911 s.f.
Required water quality volume = 32,606 s.f. * 0.5"/12" = **1,359 cu.ft.**
Note: Water quality volume provided in Contech Water Quality Device.

Required recharge volume for new development = 59,911 s.f. * 0.35"/12" = **1,747 cu.ft.**
Provided recharge volume @ el=189.0 to el=190.0 = **32,149 cu.ft.**

Drain Down Time
Bottom contact area = 20,341 s.f.
Recharge rate = 20,341 s.f. * 1.02 in/hr / 12" = 1,729 cu.ft./hr
Drain time for recharge volume = 32,149 cu.ft. / 1,729 cu.ft./hr = **18.6 hours**

Drainage System #3

Roof area = 1,093 s.f.
Other impervious area = 26,418 s.f.
Total impervious area = 27,513 s.f.
Existing impervious area = 21,506 s.f.
Required water quality volume = 26,418 s.f. * 0.5"/12" = **1,101 cu.ft.**

Length of 7' wide biofilter swale = 235'
Width of biofilter swale at 0.5' from flow line (side slopes 5:1) = 12'
Provided volume of biofilter swale = (7' + 12')/2 * 235' * 0.5' = **1,116 cu.ft.**

Required recharge volume for new development = 27,513 s.f. * 0.35"/12" = **802 cu.ft.**
Required recharge for redevelopment = (27,513 s.f. – 21,506 s.f.) * 0.35"/12" = **175 cu.ft.**
Provided recharge volume @ el=191.0 to el=192.0 = **6,698 cu.ft.**

Drain Down Time
Bottom contact area = 5,093 s.f.
Recharge rate = 5,093 s.f. * 1.02 in/hr / 12" = 433 cu.ft./hr
Drain time for recharge volume = 6,698 cu.ft. / 433 cu.ft./hr = **15.5 hours**

Drainage System #4

Roof area = 13,125 s.f.
Other impervious area = 38,439 s.f.
Total impervious area = 49,064 s.f.
Existing impervious area = 8,581 s.f.
Required water quality volume = 49,064 s.f. * 0.5"/12" = **2,044 cu.ft.**

Paved area to Biolfilter Swale #4A = 5,519 s.f.
Required water quality volume for 5,519 s.f. = 5,519 s.f. * 0.5"/12" = 230 cu.ft.
Length of 7' wide biofilter swale 4A = 127'
Width of biofilter swale at 0.5' from flow line (side slopes 5:1) = 12'
Provided volume of biofilter swale = (7' + 12')/2 * 127' * 0.5' = **603 cu.ft.**

Paved area to Biolfilter Swale #4A = 32,920 s.f.
Required water quality volume for 32,920 s.f. = 32,920 s.f. * 0.5"/12" = 1,372 cu.ft.
Length of 7' wide biofilter swale 4B = 448'
Width of biofilter swale at 0.5' from flow line (side slopes 5:1) = 12'
Provided volume of biofilter swale = (7' + 12')/2 * 448' * 0.5' = **2,128 cu.ft.**

Required recharge volume for new development = 49,064 s.f. * 0.35"/12" = **1,431 cu.ft.**
Required recharge for redevelopment = (49,064 s.f. – 8,581 s.f.) * 0.35"/12" = **1,181 cu.ft.**
Provided recharge volume @ el=194.0 to el=195.5 = **15,705 cu.ft.**

Drain Down Time
Bottom contact area = 9,036 s.f.
Recharge rate = 9,036 s.f. * 1.02 in/hr / 12" = 768 cu.ft./hr
Drain time for recharge volume = 15,705 cu.ft. / 768 cu.ft./hr = **20.4 hours**

Pond Report

Pond No. 1 - Drainage #1

Pond Data

UG Chambers -Invert elev. = 189.50 ft, Rise x Span = 2.54 x 4.33 ft, Barrel Len = 7.00 ft, No. Barrels = 28, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 189.00 ft, Width = 5.33 ft, Height = 3.54 ft, Voids = 35.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	189.00	n/a	0	0
0.35	189.35	n/a	129	129
0.71	189.71	n/a	244	374
1.06	190.06	n/a	322	696
1.42	190.42	n/a	316	1,012
1.77	190.77	n/a	306	1,318
2.12	191.12	n/a	290	1,607
2.48	191.48	n/a	267	1,874
2.83	191.83	n/a	232	2,106
3.19	192.19	n/a	160	2,266
3.54	192.54	n/a	129	2,395

Culvert / Orifice Structures

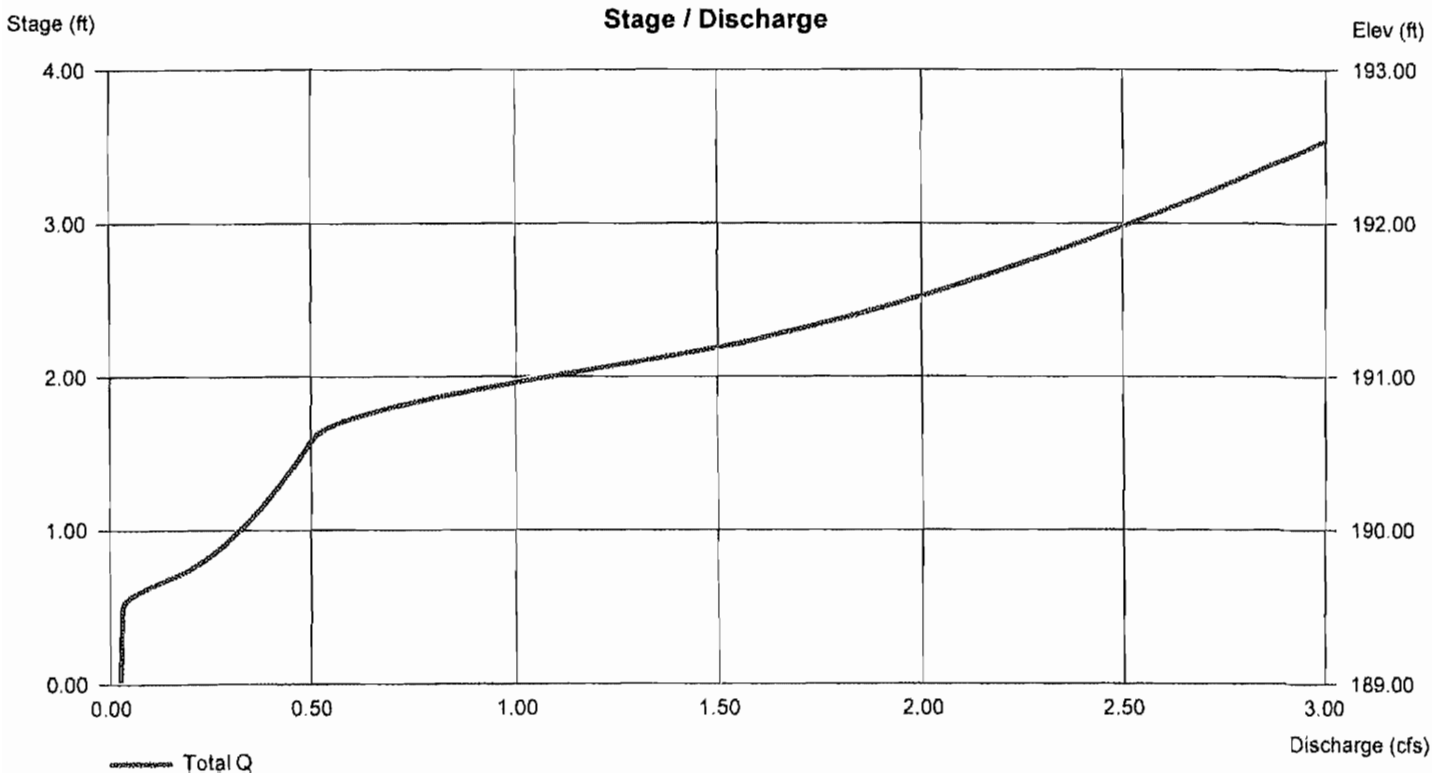
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 3.00	8.00	3.00	0.00
Span (in)	= 3.00	8.00	3.00	0.00
No. Barrels	= 1	1	1	0
Invert El. (ft)	= 189.50	190.60	189.50	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	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) = 1.020 (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).



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 Thursday, 03 / 27 / 2014

Pond No. 7 - Recharge 2A

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 188.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	188.00	7,152	0	0
1.00	189.00	9,028	8,071	8,071

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	= .000	.000	.000	n/a
Orifice Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

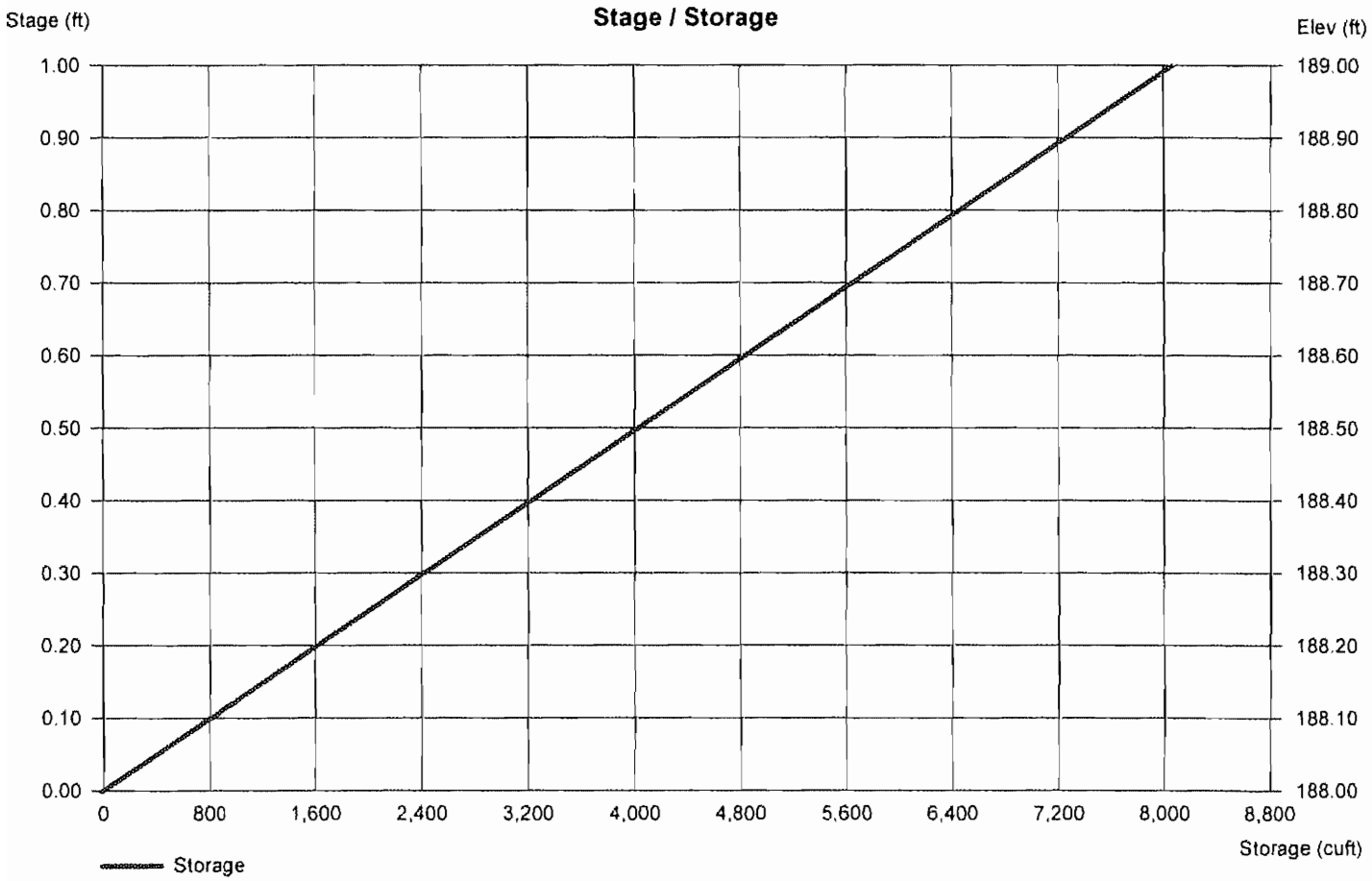
Weir Structures

	[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.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)

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).



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 — Thursday, 03 / 27 / 2014

Pond No. 3 - Pond #2B

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 189.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	189.00	20,341	0	0
1.00	190.00	45,645	32,149	32,149

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) = 1.020 (by Contour)

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)

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 — Thursday, 03 / 27 / 2014

Pond No. 8 - Recharge #3

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 191.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	191.00	5,903	0	0
1.00	192.00	7,527	6,698	6,698

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	= .000	.000	.000	n/a
Orifice Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

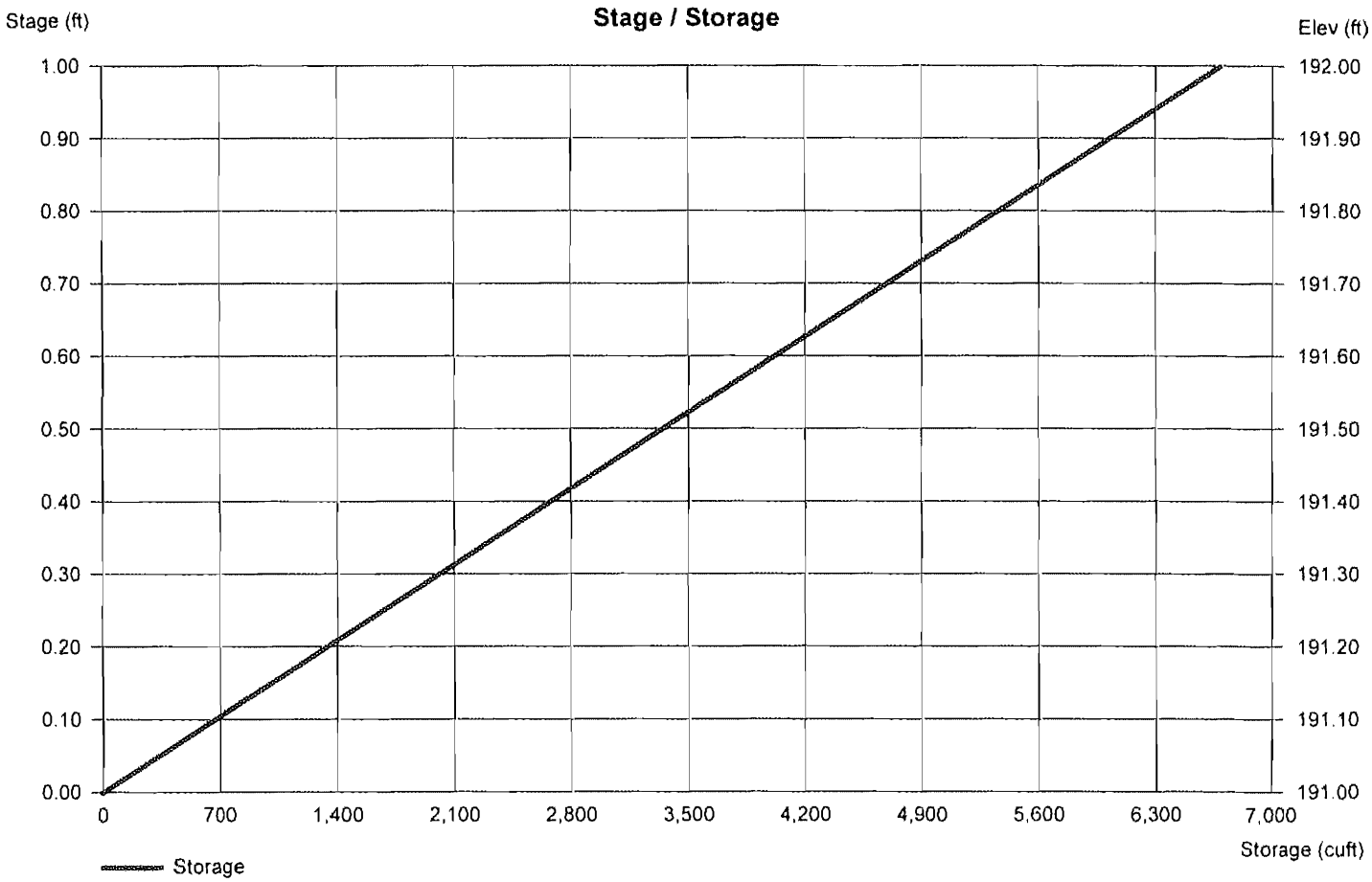
Weir Structures

	[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.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (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).



Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. v10 — Thursday, 03 / 27 / 2014

Pond No. 9 - Recharge #4

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 194.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	194.00	9,040	0	0
1.50	195.50	11,970	15,705	15,705

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	= .000	.000	.000	n/a
Orifice Coeff.	= 0.00	0.00	0.00	0.00
Multi-Stage	= n/a	No	No	No

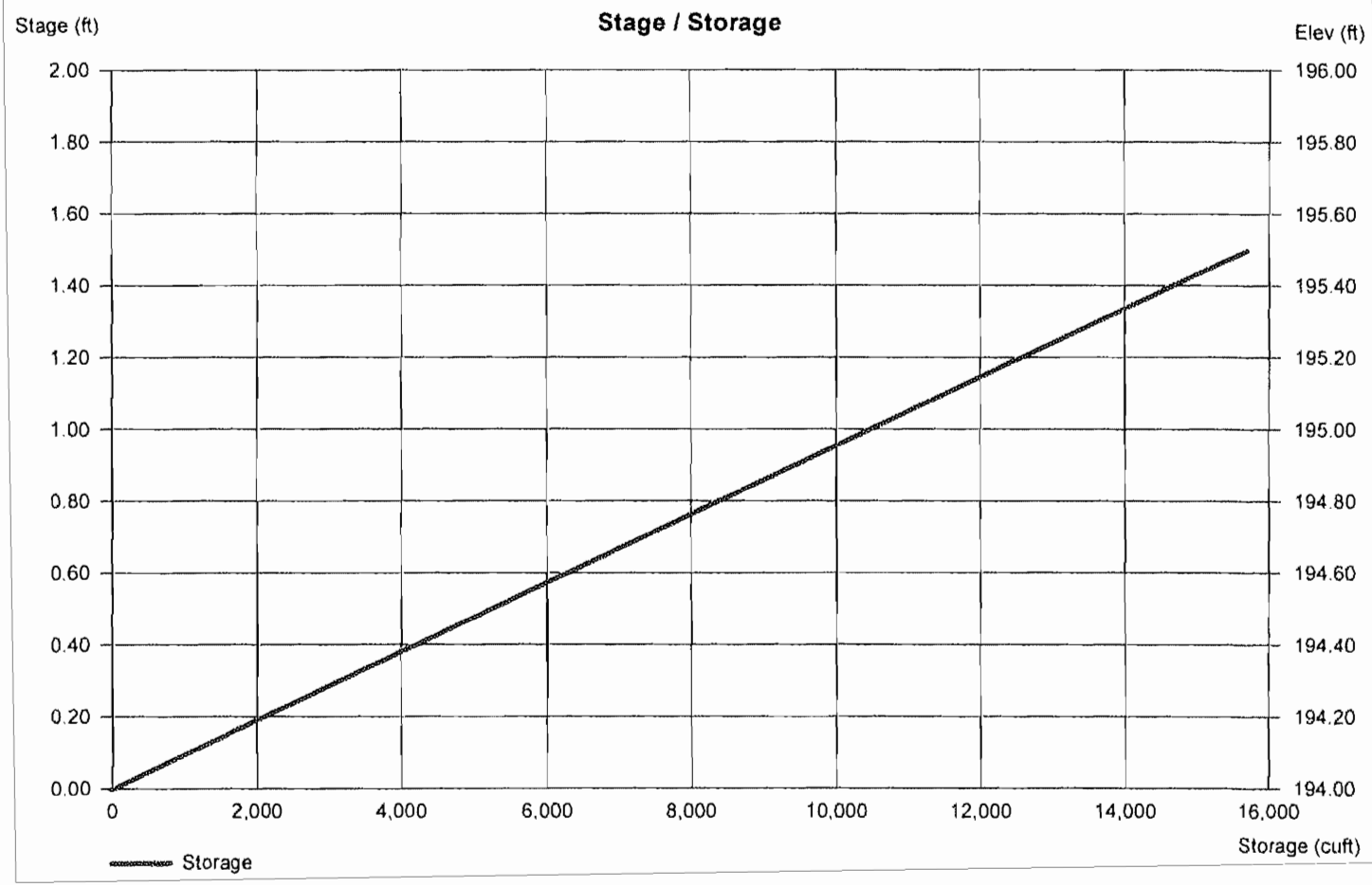
Weir Structures

	[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.	= 0.00	0.00	0.00	0.00
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (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).



KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment D
Water Quality & BMPs

INSTRUCTIONS:

Version 1, Automated: Mar. 4, 2008

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: Walden Behavioral Care - Biofilter Swale

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Street Sweeping - 5%	**0.05**	**1.00**	**0.05**	**0.95**
PEA STONE DIAPHRAGM	0.25	**0.95**	0.25	0.75
BIOFILTER SWALE	0.50		0.50	0.50
Infiltration Basin	0.80		0.80	0.80

Total TSS Removal = 80%

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

Project: 2013-035 - 518 Pleasant St.

Prepared By: Kelly Engineering Group, Inc.

Date: 3/27/2014

*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

VortSentry® HS Estimated Net Annual TSS Reduction

CONTECH ENGINEERED SOLUTIONS

WALDEN BEHAVIORAL CARE
FRAMINGHAM, MA
Model VSHS36
System EAST

Design Ratio[1] = $\frac{\text{0.33 acres x 0.9}}{\text{27 ft3}}$ **= 0.011**

Rainfall Intensity "/hr	Flow Rate cfs	Operating Rate[2] cfs/ft^3	% Total Rainfall Depth[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.02	0.01	0.00022	10.2%	98.0%	10.0%
0.04	0.01	0.00045	9.6%	98.0%	9.5%
0.06	0.02	0.00067	9.4%	98.0%	9.3%
0.08	0.02	0.00090	7.7%	98.0%	7.6%
0.10	0.03	0.00112	8.6%	98.0%	8.4%
0.12	0.04	0.00134	6.3%	98.0%	6.2%
0.14	0.04	0.00157	4.7%	98.0%	4.6%
0.16	0.05	0.00179	4.6%	98.0%	4.5%
0.18	0.05	0.00202	3.5%	98.0%	3.5%
0.20	0.06	0.00224	4.3%	98.0%	4.3%
0.25	0.07	0.00280	8.0%	98.0%	7.8%
0.30	0.09	0.00336	5.6%	98.0%	5.5%
0.35	0.10	0.00392	4.4%	98.0%	4.3%
0.40	0.12	0.00448	2.5%	98.0%	2.5%
0.45	0.13	0.00504	2.5%	98.0%	2.5%
0.50	0.15	0.00560	1.4%	98.0%	1.4%
0.75	0.22	0.00840	5.0%	97.8%	4.9%
1.00	0.30	0.01120	1.0%	93.7%	1.0%
1.50	0.45	0.01681	0.0%	88.6%	0.0%
2.00	0.59	0.02241	0.0%	73.8%	0.0%
3.00	0.89	0.03361	0.5%	46.7%	0.2%
					97.7%
				% rain falling at >0"/hr =	0.0%
				Removal Efficiency Adjustment[4] =	6.5%
				Predicted Net Annual Load Removal Efficiency =	**91.2%**

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry HS Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
2 - Operating Rate (cfs/ft^3) = Rainfall Intensity ("/hr) x Design Ratio
3 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA
4 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Calculated by: JAG	Date: 03/28/14	Checked by:	Date:

VortSentry® HS Estimated Net Annual TSS Reduction

CONTECH ENGINEERED SOLUTIONS

WALDEN BEHAVIORAL CARE
FRAMINGHAM, MA
Model VSHS36
System WEST

Design Ratio[1] = $\frac{\text{0.32 acres x 0.9}}{\text{27 ft3}}$ **= 0.011**

Rainfall Intensity "/hr	Flow Rate cfs	Operating Rate[2] cfs/ft^3	% Total Rainfall Depth[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.02	0.01	0.00022	10.2%	98.0%	10.0%
0.04	0.01	0.00043	9.6%	98.0%	9.5%
0.06	0.02	0.00065	9.4%	98.0%	9.3%
0.08	0.02	0.00087	7.7%	98.0%	7.6%
0.10	0.03	0.00109	8.6%	98.0%	8.4%
0.12	0.03	0.00130	6.3%	98.0%	6.2%
0.14	0.04	0.00152	4.7%	98.0%	4.6%
0.16	0.05	0.00174	4.6%	98.0%	4.5%
0.18	0.05	0.00196	3.5%	98.0%	3.5%
0.20	0.06	0.00217	4.3%	98.0%	4.3%
0.25	0.07	0.00272	8.0%	98.0%	7.8%
0.30	0.09	0.00326	5.6%	98.0%	5.5%
0.35	0.10	0.00380	4.4%	98.0%	4.3%
0.40	0.12	0.00435	2.5%	98.0%	2.5%
0.45	0.13	0.00489	2.5%	98.0%	2.5%
0.50	0.14	0.00543	1.4%	98.0%	1.4%
0.75	0.22	0.00815	5.0%	97.9%	4.9%
1.00	0.29	0.01086	1.0%	94.4%	1.0%
1.50	0.43	0.01630	0.0%	88.7%	0.0%
2.00	0.58	0.02173	0.0%	74.6%	0.0%
3.00	0.86	0.03259	0.5%	49.9%	0.2%
					97.7%
				% rain falling at >0"/hr =	0.0%
				Removal Efficiency Adjustment[4] =	6.5%
				Predicted Net Annual Load Removal Efficiency =	**91.2%**

1 - Design Ratio = (Total Drainage Area x Runoff Coefficient) / VortSentry HS Treatment Volume
= The Total Drainage Area and Runoff Coefficient are specified by the site engineer.

2 - Operating Rate (cfs/ft^3) = Rainfall Intensity ("/hr) x Design Ratio

3 - Based on 10 years of hourly precipitation data from NCDC Station 770, Boston WSFO AP, Suffolk County, MA

4 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Calculated by: JAG	Date: 03/28/14	Checked by:	Date:

Project: Walden Behavioral Care
Location: Framingham, MA
Prepared For: Brandon Li (Kelly Engineering Group)

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)
East	0.33	0.0005156	5.0	0.083	1.00
West	0.32	0.0005000	5.0	0.083	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.)
East	795.00
West	795.00

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)
East	0.41
West	0.40

WALDEN CENTER FOR EDUCATION AND RESEARCH, INC. STORMWATER MANAGEMENT SYSTEM OPERATION AND MAINTENANCE PLAN & LONG-TERM POLLUTION PREVENTION PLAN

3/27/14

Prepared by:

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive
Braintree, Massachusetts 02184

OWNER:
The Marist Fathers of Boston
27 Isabella Street
Boston, MA 02116

RESPONSIBLE PARTY:
Walden Center for Education and Research, Inc.
9 Hope Avenue, Suite 500
Waltham, MA 02453

Note: If ownership of this property changes then the new owner becomes the responsible party. The Owner may assign responsibility to a tenant on the property.

Introduction

Considerable time, effort and cost has been spent in the design and construction of the stormwater management system for this development. The stormwater management system consists of a number of Best Management Practices (BMP's). These BMP's combine to ensure that storm runoff from the site will not damage the sensitive environmental resources surrounding the site. In order to ensure that these BMP's operate as designed it is very important that the procedures in this operation and maintenance plan be followed. Most of these operation procedures require observation and measurement; however, at certain times more extensive maintenance measures may be needed. The following is an itemization of each of these BMP's and their maintenance needs.

The party responsible for maintenance should contract with a maintenance organization capable of performing the more extensive measures such as pumping of catch basin sumps, etc.

BMP No. 1 – Paved Road Surface/Parking Lot Area:

- Regularly pick up and remove litter from the parking lot area, landscaped islands and perimeter landscaped areas and water quality areas.

- The paved area is to be swept a minimum of four times per year, at least once during April and again during September with a high efficiency vacuum sweeper or a regenerative air sweeper. If a mechanical sweeper is used, the paved area is to be swept a minimum of once a month.

BMP No. 2 – Biofilter Swale:

- Maintenance access must be designed as part of the grass channel. If located adjacent to a roadway, make the maintenance access at least 15 feet wide, which can also be combined with a breakdown lane along a highway or on-street parking along a residential street. When combined with on-street parking, post signs prohibiting parking when the swale is to be inspected and cleaned. Do not use travel lanes along highways and streets as the required maintenance access.

- Set the mower blades no lower than 3 to 4 inches above the ground. Do not mow beneath the depth of the design flow during the storm associated with the water quality event (e.g., if the design flow is no more than 4 inches, do not cut the grass shorter than 4 inches). Mow on an as-needed basis during the growing season so that the grass height does not exceed 6 inches.

- Inspect semi-annually the first year, and at least once a year thereafter. Inspect the grass for growth and the side slopes for signs of erosion and formation of rills and gullies. Plant an alternative grass species if the original grass cover is not successfully established. If grass growth is impaired by winter road salt or other deicer use, re-establish the grass in the spring.

- Remove accumulated trash and debris prior to mowing.

- Check on a yearly basis and clean as needed. Use hand methods (i.e., a person with a shovel) when cleaning to minimize disturbance to vegetation and underlying soils. Sediment build-up in the grass channel reduces its capacity to treat and convey the water quality even, 2-year and 10-year 24-hour storm.

BMP No. 3 – Subsurface Recharge:

- The inlet pipe and observation basin shall be inspected on a monthly basis. Any accumulated debris shall be removed.

- Inspect recharge facilities following a rainfall event greater than 2.5 inches in a 24 hour period.

- If standing water is observed for more than 48 hours following a storm event, immediately retain a qualified professional to assess whether infiltration function has been lost and develop recommended corrective actions.

BMP No.4 – Contech Water Quality Units:

- Once per month inspect the Units to ensure that it is operating correctly and to measure the sediment depth.

- When the sediment depth is within 6" of the dry weather water surface elevation, the Unit should be cleaned. This determination can be made by taking 2 measurements with a stadia rod or similar measuring device; one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. The Unit should be cleaned out if the difference between the two measurements is six inches or less.

- Cleanout of the Units shall occur during dry weather, with a vacuum truck or a "clamshell" grab. Sediment is evacuated through the manhole over the grit chamber. See Manual for required servicing and maintenance.

–CDS:

- Once per month inspect the Units to ensure that it is operating correctly and to measure the sediment depth using a "dip stick". The floatables should be removed and the sump cleaned when the sump is above 85% full. At least once a year, the unit should be pumped down and the screen carefully inspected for damage and to ensure that it is properly fastened. Ideally, the screen should be power washed for the inspection.

If any problems are encountered with the Contech Units, contact the manufacturer.

Snow Removal:

- There shall be no plowing or stock piling of snow within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Road salts and de-icing materials shall be stored on impervious pads and covered to protect from wind and precipitation.
- No de-icing materials shall be stored nor used within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- No de-icing materials shall be stored within Zone I, Zone II, Zone A, and 200 feet from a river or estuary.

Storage and Use of Chemicals:

- No pesticides, herbicides, nor insecticides shall be stored nor used within all resource areas and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Chemical storage on site shall be limited. Any chemicals that must be stored shall be stored in a secure area in accordance with Local and State regulations.

Hazardous Waste:

- Containment – In the event of a discharge or spill of oil or another hazardous material, outlets to stormwater management ponds shall be plugged so that hazardous material do not enter resource areas.
- Reporting - In the event of a discharge or spill of oil or another hazardous material, responsible facility personnel, oil spill and/or hazardous material removal organizations, federal, state, and local regulatory agencies, the Town of Hanover Department of Public Works, and the EPA National Response Center 1-800-424-8802 shall be rapidly notified.
- Hazardous Waste – All hazardous waste materials will be disposed of in the manner specified by local, state and/or federal regulations and by the manufacturer of such products.
- There shall be no illicit discharges to the stormwater management system.

Material and Waste Storage, Handling and Management:

- All waste materials will be collected and stored in a securely lidded metal dumpster from a solid waste management company licensed to do business by the state and the town. The dumpster will comply with all local and state solid waste management regulations.

Training for Long Term Pollution Prevention Plan:

- All staff or personnel involved and responsible for implementing the Stormwater Management System Operations and Maintenance Plan and the Long-Term Pollution Prevention Plan shall be properly trained as required under the DEP Stormwater Management Regulations. Training shall be documented with records kept with other stormwater maintenance records.

Vehicle Washing:

- There shall be no vehicle washing on the site.

Pet Waste Management:

- Pooper-scooper laws for pets shall be followed.
- Never dump pet waste into storm drains, catch basins, or the drainage system.
- Pet waste shall be scooped up and disposed of properly in the garbage.

Lawn and Garden activities:

- There shall be no exterior storage of fertilizers, pesticides, herbicides, or insecticides. No pesticides, herbicides, nor insecticides shall be stored nor used within any resource areas its buffers, and any area subject to the jurisdiction of local and state regulations without the prior written permission from state or local approving authority.
- Fertilizers and pesticides shall be applied properly, sparingly, and outside any resource areas and its buffers.

To reduce the impact of fertilizers, consider the following tips;

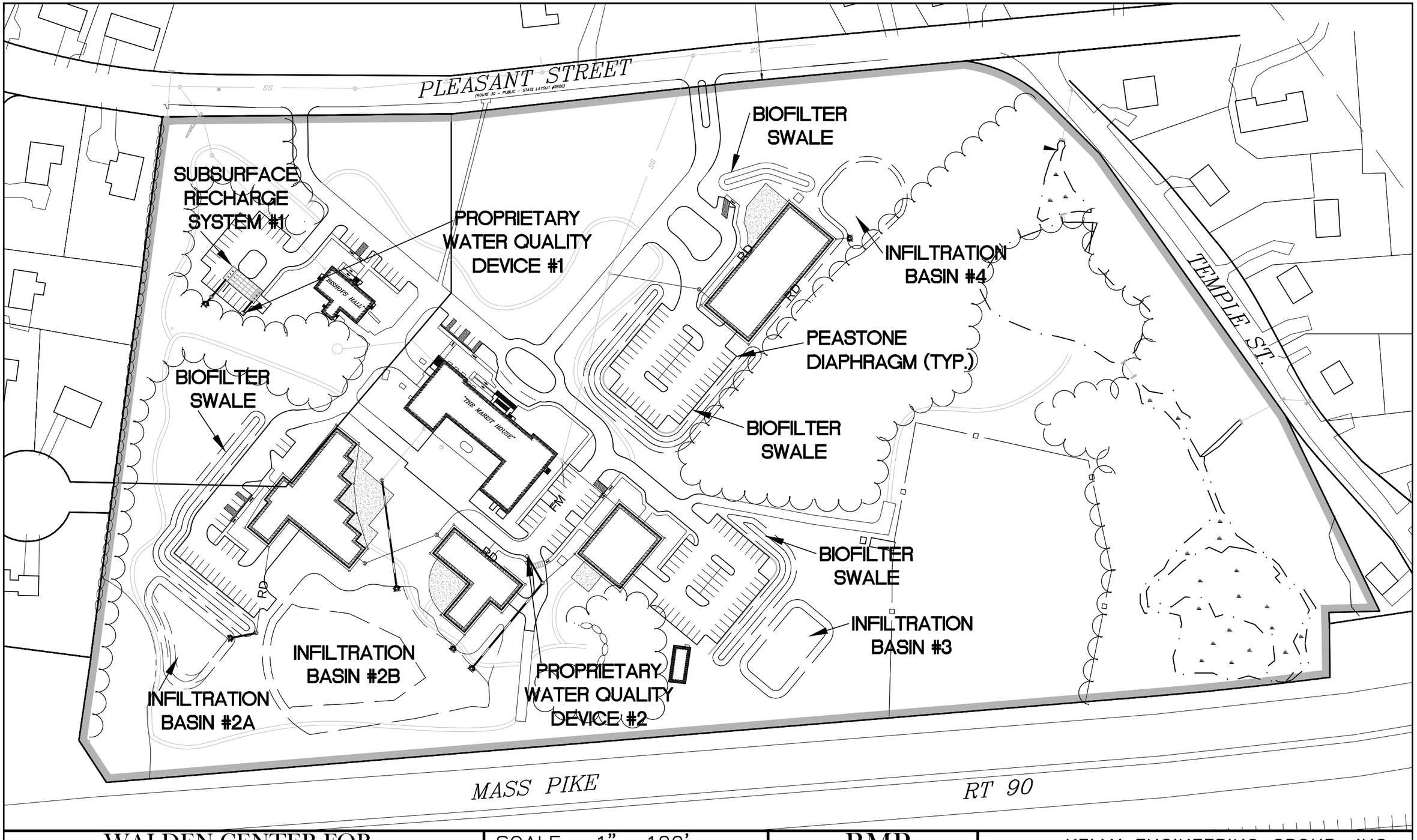
- Don't fertilize before a rain storm.
- Consider using organic fertilizers. They release nutrients more slowly.
- Test soils before applying fertilizers. Some soils may not need fertilizers. A standard soil test costs $9.00. (Call the UMass Extension Soil Testing Lab at 413-545-2311 or download a soil test order form at http://www.umass.edu/plsoils/soiltest/.)

Walden Center for Education and Research, Inc.							
PROJECT LOCATION: 518 Pleasant Street, Framingham, MA							
STORMWATER ANAGEMENT		**BEST MANAGEMENT PRACTICES - INSPECTION SCHEDULE AND EVALUATION CHECKLIST**					
Best Management Practice	Inspection Frequency (1)	Date I	Inspector	Minimum Maintenance and Key Items to Check (1)	Cleaning/Repair Needed yes__ no__ (list items)	Date of Cleaning /Repair	Perform ed By
Street Sweeping	4x per year			Vacuum sweeper			
Biofilter Swale	2x per year first year, annually thereafter			Clean by hand. Mow as needed to keep grass under 6”			
Subsurface Recharge	Monthly			Inspect inlets, remove debris, inspect after 2.5” rain event in 24 hours, contact professional if standing water is observed for 48 hours after rain event			
CDS water Quality device	4x per year			Per manufacturer Requirements			

(1) Refer to the Operation and Maintenance Plan for recommendations regarding frequency of inspections and maintenance of specific BMP's.

recommendations regarding frequency for inspection and maintenance of specific BMPs.

Stormwater Control Manager/Environmental Monitor: **Stamp/Signature**



WALDEN CENTER FOR EDUCATION AND RESEARCH, INC.
518 PLEASANT ST.
FRAMINGHAM, MA

SCALE: 1"= 120'

DATE: 03/31/14

2013-035-BMP00

BMP LOCATION MAP

KELLY ENGINEERING GROUP, INC.
CIVIL ENGINEERING CONSULTANTS
0 CAMPANELLI DRIVE · BRAINTREE MA · 02184
PHONE: 781 843 4333 FAX: 781 843 0028

KELLY ENGINEERING GROUP, INC.
Zero Campanelli Drive-Braintree-MA 02184 Phone 781 843 4333

Attachment E
Miscellaneous

Type III 24-hr Rainfall=1.29"

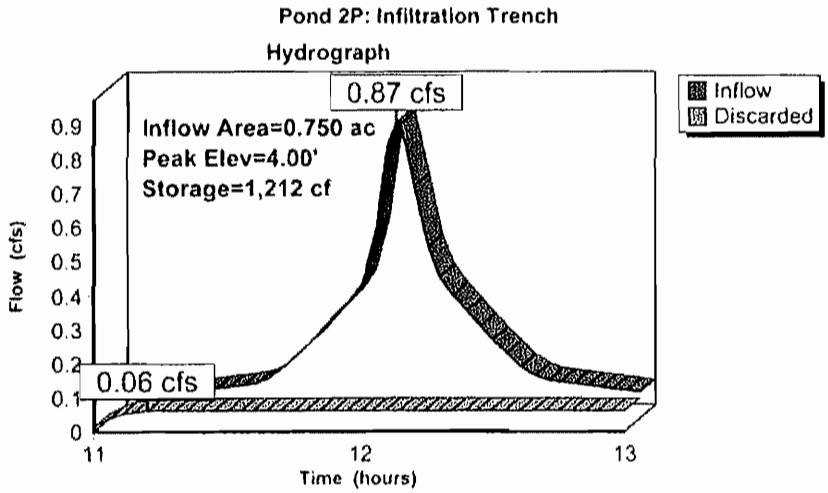


Table 2.3.3. 1982 Rawls Rates[18]

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Silt Loam	C	0.27
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

[18] Rawls, Brakensiek and Saxton, 1982

Attention must be given to ensure consistency in units. In particular, the Target Depth Factors must be converted to feet.

NRCS HYDROLOGIC SOIL TYPE	APPROX. SOIL TEXTURE	TARGET DEPTH FACTOR (F)
A	sand	**0.6-inch**
B	loam	**0.35-inch**
C	silty loam	**0.25-inch**
D	clay	**0.1-inch**

Table 2.3.2: Recharge Target Depth by Hydrologic Soil Group

When a site contains multiple Hydrologic Soil Groups, determine the *Required Recharge Volume* for each impervious area by Hydrologic Soil Group and then add the volumes together.

Example: Assume a ten (10) acre site. 5.0 acres are proposed to be developed for a retail use. A section of the entrance roadway is to be bridged over a stream that is classified as land under water. As such, the bridging is subject to the Wetlands Protection Act Regulations, and the Stormwater Management Standards apply to stormwater runoff from all proposed roads, parking areas, and rooftops. Of the 5.0 acres proposed to be developed, 2 acres of impervious surfaces are proposed atop Hydrologic Soil Group (HSG) "A" soils, 1 acre of impervious surfaces atop HSG "B" soil, 1.5 acres of impervious surfaces atop HSG "C" soil, and 0.5 acres are proposed to be landscaped area. The remaining 5.0 acres, located on HSG "A" soil, are proposed to remain forested. Determine the *Required Recharge Volume*.

Solution: The *Required Recharge Volume* is determined only for the impervious surfaces. The 5.0-acre forested area and the 0.5-acre landscaped area are not impervious areas. Although converted from forest, landscaped area is pervious area for purposes of Standard 3. Use *Equation (1)* to determine the *Required Recharge Volume* for each Hydrologic Soil Group covered by impervious area. Add together the *Required Recharge Volumes* determined for each HSG.

$Rv = F \times impervious\ area$

$Rv = [(F_{HSG\ "A"})\ (Area_1)] + [(F_{HSG\ "B"})\ (Area_2)] + [(F_{HSG\ "C"})(Area_3)] + [(F_{HSG\ "D"})(Area_4)]$ ***Equation (2)***

$Rv = [(0.6\text{-in}/12)(2\ acres)] + [(0.35\text{-in}/12)(1\ acre)] + [(0.25\text{-in}/12)(1.5\ acres)] + [(0.1\text{-in}/12)(0\ acres)]$

$Rv = 0.1605\ acre\text{-}feet$

$Rv = 0.1605\ acre\text{-}feet \times 43560\ square\ feet/acre\text{-}feet = 6{,}991\ cubic\ feet$ or $258.9\ cubic\ yards$

Hydrologic Soil Group—Middlesex County, Massachusetts
(Soil Survey Map - 518 Pleasant St. Framingham)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 13, Dec 17, 2013

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Middlesex County, Massachusetts (MA017)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
52A	Freetown muck, 0 to 1 percent slopes	A/D	7.0	22.2%
251A	Haven silt loam, 0 to 3 percent slopes	B	23.1	73.4%
416C	Narragansett silt loam, 8 to 15 percent slopes, very stony	B	0.1	0.4%
602	Urban land		1.2	3.9%
Totals for Area of Interest			**31.5**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Middlesex County, Massachusetts

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

Elevation: 0 to 1,110 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days

Map Unit Composition

Freetown and similar soils: 85 percent

Minor components: 15 percent

Description of Freetown

Setting

Landform: Marshes, bogs, kettles, depressions, depressions, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water capacity: Very high (about 19.2 inches)

Interpretive groups

Farmland classification: Farmland of unique importance
Land capability (nonirrigated): 5w
Hydrologic Soil Group: A/D

Typical profile

0 to 2 inches: Mucky peat
2 to 79 inches: Muck

Minor Components

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave

Swansea

Percent of map unit: 5 percent
Landform: Depressions, swamps, marshes, bogs, kettles

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Concave

251A—Haven silt loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 100 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Haven and similar soils: 85 percent
Minor components: 15 percent

Description of Haven

Setting

Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Farmland classification: All areas are prime farmland
Land capability (nonirrigated): 1
Hydrologic Soil Group: B

Typical profile

0 to 2 inches: Silt loam
2 to 20 inches: Silt loam
20 to 32 inches: Very fine sandy loam
32 to 65 inches: Stratified coarse sand to sand to fine sand

Minor Components

Merrimac

Percent of map unit: 9 percent
Landform: Plains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex

Scio

Percent of map unit: 5 percent
Landform: Depressions, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave

Unnamed

Percent of map unit: 1 percent

416C—Narragansett silt loam, 8 to 15 percent slopes, very stony

Map Unit Setting

Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days

Map Unit Composition

Narragansett and similar soils: 80 percent
Minor components: 20 percent

Description of Narragansett

Setting

Landform: Ground moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable silty eolian deposits and/or friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from metamorphic rock and/or friable sandy basal till derived from metamorphic rock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 35 inches to strongly contrasting textural stratification

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.4 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 6s
Hydrologic Soil Group: B

Typical profile

0 to 2 inches: Slightly decomposed plant material
2 to 7 inches: Silt loam
7 to 35 inches: Silt loam
35 to 60 inches: Very gravelly loamy sand
60 to 65 inches: Very gravelly loamy sand

Minor Components

Charlton

Percent of map unit: 10 percent
Landform: Ground moraines, drumlins
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Convex
Across-slope shape: Convex

Canton

Percent of map unit: 7 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex

Scituate

Percent of map unit: 3 percent
Landform: Hillslopes, depressions
Landform position (two-dimensional): Toeslope, summit
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Linear
Across-slope shape: Concave

602—Urban land

Map Unit Setting

Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Udorthents, loamy

Percent of map unit: 5 percent

Rock outcrop

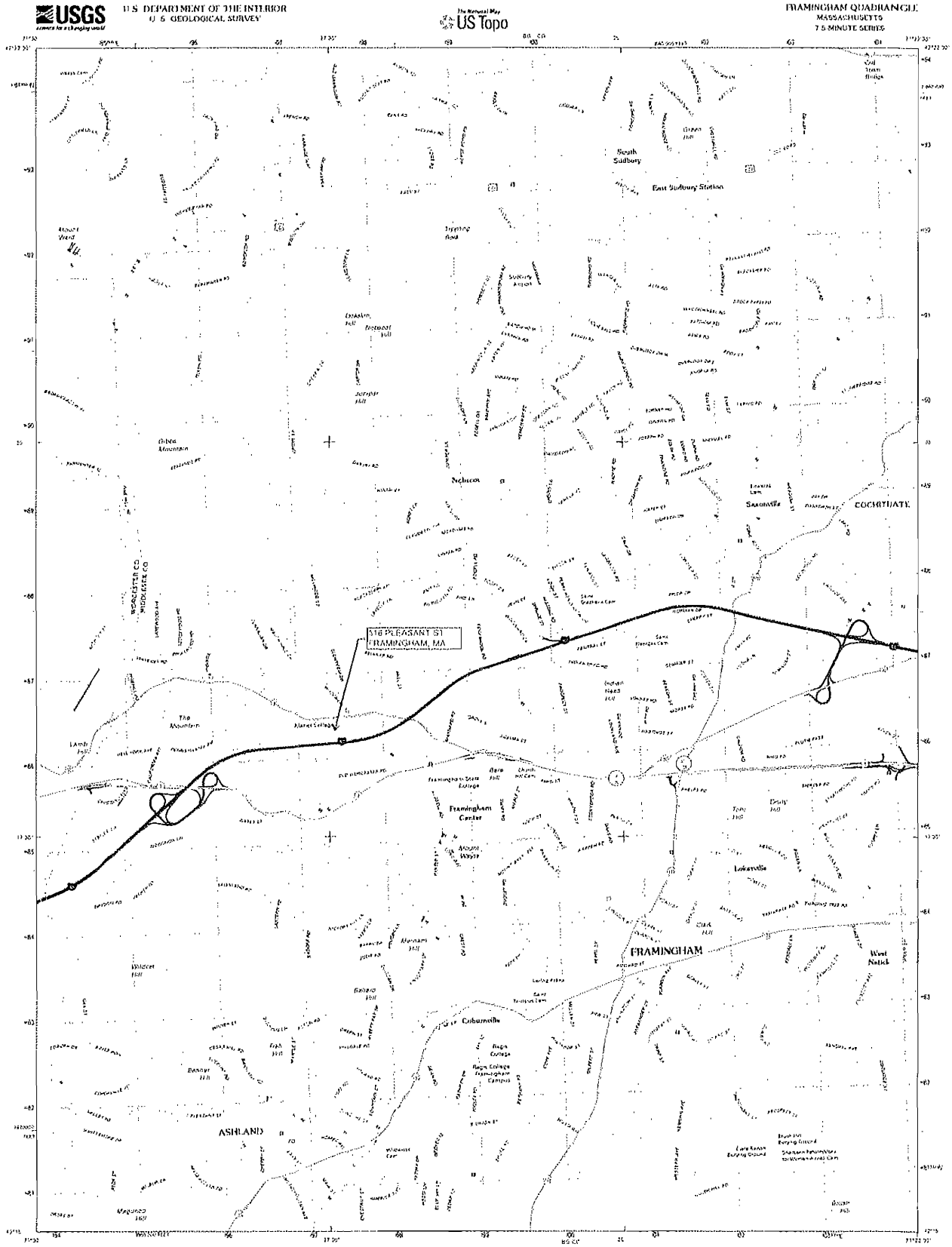
Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, wet substratum

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 13, Dec 17, 2013


USGS
science for a changing world
U S DEPARTMENT OF THE INTERIOR
U S GEOLOGICAL SURVEY
The National Map
US Topo
FRAMINGHAM QUADRANGLE
MASSACHUSETTS
7 5-MINUTE SERIES
518 PLEASANT ST
FRAMINGHAM, MA
FRAMINGHAM
ASHLAND
Nobscot
COCHITUATE
Saxonville
Framingham Center
Loksville
Columbia
South Sudbury
East Sudbury Station
West Natick
Produced by the United States Geological Survey
SCALE 1 24 000
ROAD CLASSIFICATION
FRAMINGHAM, MA
2017