

# **STORMWATER REPORT**

***FULLER FIELD  
TRACK & FIELD IMPROVEMENTS  
PHASE TWO  
NEWBURYPORT, MASSACHUSETTS***

Prepared For:  
HUNTRESS ASSOCIATES, INC.

Prepared By:  
Marchionda & Associates, LP

*February 10, 2020  
Rev. 3/6/20*

**FULLER FIELD IMPROVEMENTS – PHASE 2  
STORMWATER REPORT**

February 10, 2020  
Rev. 3/6/20

**TABLE OF CONTENTS**

NARRATIVE .....	
EXISTING CONDITIONS & SITE PREP. PLAN.....	FIGURE 1
BMP PLAN.....	FIGURE 2
APPENDICES	
STANDARD 2 (PEAK FLOW) .....	1
STANDARD 3 (RECHARGE).....	2
STANDARD 9 (LONG TERM O & M).....	3

# **STORMWATER REPORT NARRATIVE**

## ***FULLER FIELD TRACK & FIELD IMPROVEMENTS PHASE TWO***

*February 10, 2020  
Rev. 3/6/20*

### **Introduction:**

Marchionda & Associates, L.P. has completed a storm water analysis for the *Track & Field Improvement* project proposed at the Bradley Fuller Field in Newburyport, Massachusetts. The purpose of this report is to offer information on the stormwater characteristics of the site in its existing and post construction condition.

For additional information regarding the site's existing conditions and the stormwater management system reference is made to the following plans and report;

- *Fuller Field  
Track & Field Improvements – Phase Two  
Owner: Town of Newburyport, MA  
Prepared by; Huntress Associates, Inc.  
Dated; 1/20/20, Rev. 2/28/20*

### **Existing Conditions:**

The project site is located at the track and field facility within the Bradley Fuller field complex located off of Low Street. The existing running track was recently constructed to replace and reconfigure an older track. The site also includes existing multi-purpose natural grass fields, a parking area, and supporting structures such as a bathroom and storage buildings.

The site is surrounded by the frontage on Low Street to the south, residential homes to the north and west, and a senior living facility to the east. A portion of the site is located within a buffer zone to a wetland resource area. The site is not located in a designated flood hazard area.

Stormwater from the site presently flows in two main directions. Stormwater generated from the track and field area flows into existing catch basins and a closed drainage system that runs through the site and eventually into the municipal drainage system in Low St . Stormwater from the existing parking area flows to a

**March 6, 2020**

bordering vegetated wetland located along the western boundary of the site. This wetland drains to a drainage way that runs parallel with Low Street and eventually into the municipal system. Refer to the existing conditions plan in project site plan set for specific information on the existing topography and features of the site.

Soils on the site have been mapped as those typically found in the Maybid, Scantic, and Buxton Silt Loam soil series. These soils are typically made up of poorly drained silts and clays. These soils fall in the Hydrologic soil groups C & D. An on-site investigation also found layers of sands located above these soils. Information on the site's soils has been included in appendix of the report.

**Project Description:**

The project consists of the removal of the existing bituminous parking area and the construction of a new gravel parking area, grandstand, and concrete sidewalks.

This construction will result in approximately 9450 +/- s.f. of new impervious surfaces. The construction will require shallow excavation and surface preparation and will take place in areas of the site has been previously disturbed. The remaining open space will be made up of manicured grass and landscape areas.

A comprehensive stormwater management system will be constructed to mitigate the stormwater run-off generated from the new impervious surfaces. This system will be made up of stone infiltration trenches and a stormwater management area (sediment trap). To also help reduce run-off to the wetland, portions of the proposed parking area will be constructed of pervious pavement surfaces. These surfaces will make up the accessible parking area and the entrance driveway apron at the access to Low Street. Detailed information on the components of the system are included in the project's site plans.

**Project Type:**

The project will take place in areas previously disturbed. However, for purposes of stormwater management standards the project has not been considered a redevelopment project.

**LID Measures:**

When possible environmental sensitive site design and LID techniques have been used in the planning of the project. All of the proposed construction will be located in areas previously disturbed by the existing facility.

**March 6, 2020**

**Stormwater Management Standards Compliance:**

A description of how this project meets the DEP and City of Newburyport stormwater standards, along with supporting documentation, is provided herein:

**Standard 1:** *No New Untreated Stormwater Discharges*

No new point source discharges will be created. The project has been designed to recharge and contain the majority of the storm water flows within the project area.

**Standard 2:** *No Increase in the Post-Development Peak Discharge Rate*

Peak flow rates were analyzed to determine the performance of the proposed BMP's. The 2-year, 10-year, and 100-year, 24-hour Type III storm events were considered in the analysis. The contributing area of each BMP is shown in Figure 2 and described below.

AREA "A" represents the impervious area of the new grandstand and walkway that drains to the infiltration trench "BMP A".

AREA "B" represents the impervious area of the new walkway and storage building that drains to the underground infiltration trench "BMP B".

AREA "C" represents the impervious area of the new walkway that drains to the underground infiltration trench "BMP C".

AREA "D" represents the impervious area of the new walkways that drain to the stone trenches and stormwater management area (sediment trap) "BMP D".

In terms of the modeling methodology, Technical Release 55 (TR-55) was utilized to obtain weighted curve numbers (CNs) for each of the BMP subcatchment areas. Inputs for obtaining the weighted CNs were based on ground cover type and hydrologic soil groups (HSGs). For this analysis only the new impervious surfaces covering the existing grass areas were considered. TR-55 was also utilized to obtain times of concentration (TCs) for each of the subcatchment areas. Flow paths were generally broken into segments of sheet flow and shallow concentrated flow. Because of the small contributing areas and short flow path the minimum 5 minute time was used for each analysis.

**FULLER FIELD IMPROVEMENTS  
STORMWATER REPORT NARRATIVE**

March 6, 2020

CNs and TCs obtained from TR-55 were input into the *Hydraflow*<sup>®</sup> Hydrographs software package, which utilizes the National Resources Conservation Service (NRCS) method to generate and route hydrographs.

As shown in the attached modeling output and as summarized in Table 1 (below), each of the proposed BMP's will have the capacity to accept the stormwater generated by the additional impervious for of the 2, 10, & 100 year design storms:

**TABLE 1: "Peak Flows"**

BMP AREA	2-yr storm event (3.1"/24-hr)		10-yr storm event (4.7"/24-hr)		25-yr storm event (5.8"/24-hr)		100-yr storm event (8.3"/24-hr)	
	Pre-Dev (cfs)	Post Dev (cfs)	Pre-Dev (cfs)	Post Dev (cfs)	Pre-Dev (cfs)	Post Dev (cfs)	Pre-Dev (cfs)	Post Dev (cfs)
<b>A</b>	<b>0.18</b>	<b>0.0</b>	<b>0.41</b>	<b>0.21</b>	<b>0.59</b>	<b>0.51</b>	<b>1.00</b>	<b>1.21</b>
<b>B</b>	<b>0.07</b>	<b>0.0</b>	<b>0.15</b>	<b>0.0</b>	<b>0.22</b>	<b>0.0</b>	<b>0.38</b>	<b>0.0</b>
<b>C</b>	<b>0.03</b>	<b>0.0</b>	<b>0.08</b>	<b>0.0</b>	<b>0.11</b>	<b>0.0</b>	<b>0.19</b>	<b>0.0</b>
<b>D</b>	<b>0.08</b>	<b>0.0</b>	<b>0.18</b>	<b>0.0</b>	<b>0.26</b>	<b>0.0</b>	<b>0.44</b>	<b>0.16</b>

The analysis shows that there will be a slight increase from BMP Area "A" in the 100 year event. will overtop in the 100 year event. However, with the reduction of flows from the other areas the post construction condition will not cause any off site impacts in a 100 year event.

**Standard 3:** *Loss of Annual Recharge*

DEP's *Stormwater Management Handbook* prescribes an infiltration volume based on the hydrologic soil group over which impervious area will be constructed as follows:

- HSG A – 0.60 inches of runoff
- HSG B – 0.35 inches of runoff
- HSG C – 0.25 inches of runoff
- HSG D – 0.10 inches of runoff

The proposed construction will include both the creation and removal of impervious surfaces. It appears from soil mapping and on-site soil observation that the entire project area is made up of soils that are considered to be in the hydrologic soil group "C & D". Due to the poorly drained soils that presently exist at the site, the project will infiltrate stormwater volumes to the extent possible.

**March 6, 2020**

**Standard 4:** *Water Quality*

The new impervious surfaces created will be walkways and roof tops. Since these surfaces will not generate pollutant laden suspended solids there will no increase in Total Suspended Solids as a result of the project.

A *Long-Term Stormwater Operation and Maintenance Plan & Pollution Prevention Plan* (Appendix 4) has been developed for the project to comply with this requirement and the requirements of Standard 9.

**Standard 5:** *Land Uses with Higher Potential Pollutant Loads*

Not applicable – this project does not propose a land use with a higher potential pollutant load.

**Standard 6:** *Discharges within a Zone II or Interim Wellhead Protection Area*

Based on a review of Mass GIS data. The project does not lie within a Zone II or Interim Wellhead Protection Area.

**Standard 7:** *Redevelopment*

This project is not considered a redevelopment project as defined in the DEP *Stormwater Management Handbook*.

**Standard 8:** *Construction-Related Impacts*

A *Site Preparation Plan* has been developed for the project and is included as part of the Site Plans. In addition to this plan, the project is subject to the National Pollutant Discharge Elimination System (NPDES) program of the United States Environmental Protection Agency, as it will involve greater than one acre of land disturbance. As such, coverage under the NPDES *General Permit for Stormwater Discharges from Construction Activities* will be required along with a Stormwater Pollution Prevention Plan (SWPPP) prior to land disturbance.

**March 6, 2020**

**Standard 9:** *Long-Term Operation and Maintenance*

A *Long-Term Stormwater Operation and Maintenance Plan & Pollution Prevention Plan* has been developed for the project to comply with this requirement and the requirements of Standard 4. A copy of this plan has been included in the appendix of the report.

**Standard 10:** *Illicit Discharges*

DEP does not permit illicit discharges, defined by 310 CMR 10.04 as follows, to the stormwater management system:

*“Illicit discharge means a discharge that is not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean buildings without detergents.”*

Prior to the discharge of stormwater runoff to the post-construction stormwater system it shall be the project owner’s responsibility to prepare an Illicit Discharge Compliance Statement in accordance with Standard 10 certifying that no illicit discharges exist on the site.







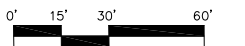
Huntress Associates, Inc.

Landscape Architecture & Land Planning

17 Tewksbury Street  
Andover, Massachusetts 01810  
978 470 8882 FAX 978 470 8890

Project:  
**FULLER FIELD  
Track & Field  
Phase Two**  
Newburyport, Massachusetts

Drawing Title:  
**Grading & Drainage  
BMP PLAN**



**Marchionda  
& Associates, L.P.**

Engineering and  
Planning Consultants

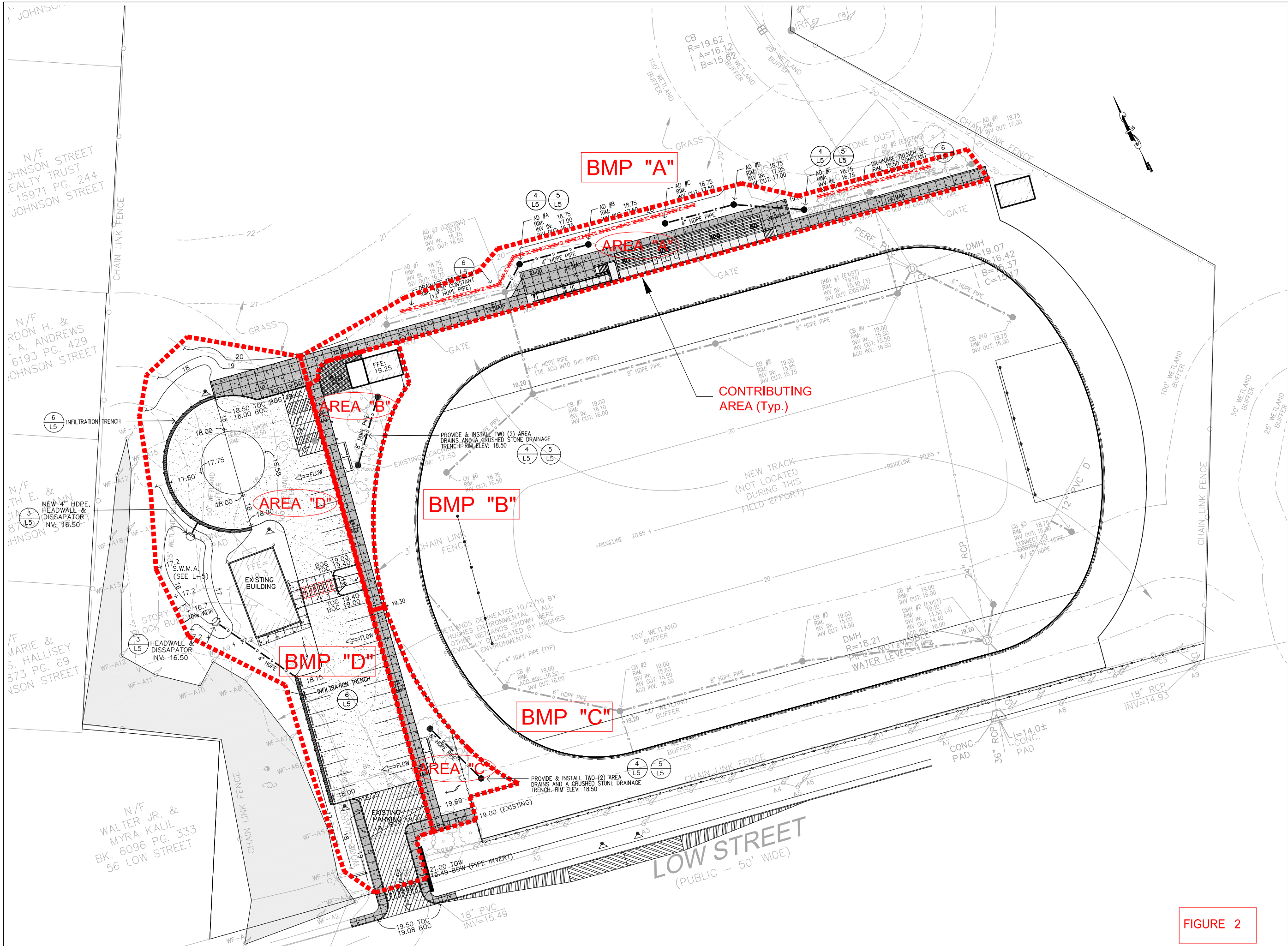
62 Montvale Avenue  
Suite 1  
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DATE: 2/28/20

...670-32 B-F Field Newburyport/HA-Fuller-CD Marchionda.DWG

M. & A. NO.: 670-32 SCALE: 1"=30'

**SHEET 1 OF 1**



**FIGURE 2**

**FULLER FIELD IMPROVEMENTS – PHASE 2  
STORMWATER REPORT**

February 10, 2020  
Rev. 3/6/20

**LIST OF APPENDICES**

Appendix 1.....	<i>Standard 2 (Peak Flow)</i>
Appendix 2.....	<i>Standard 3 (Recharge)</i>
Appendix 3.....	<i>Operation and Maintenance Plan</i>

# **APPENDIX 1**

## **Standard 2 (Peak Flow)**

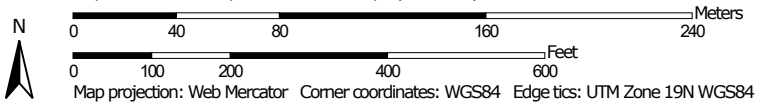
# **SOILS INFORMATION**



Hydrologic Soil Group—Essex County, Massachusetts, Northern Part



Map Scale: 1:2,930 if printed on A landscape (11" x 8.5") sheet.



## 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 1:15,800.

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

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

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

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL:  
 Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Essex County, Massachusetts, Northern Part  
 Survey Area Data: Version 15, Sep 12, 2019

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

Date(s) aerial images were photographed: Dec 31, 2009—Sep 12, 2016

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

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
12A	Maybid silt loam, 0 to 3 percent slopes	C/D	2.6	13.1%
16A	Scantic silt loam, 0 to 3 percent slopes	C/D	14.3	71.3%
228B	Buxton silt loam, 3 to 8 percent slopes	D	2.7	13.3%
602	Urban land		0.1	0.4%
719B	Suffield silt loam, 3 to 8 percent slopes	C	0.4	1.9%
<b>Totals for Area of Interest</b>			<b>20.1</b>	<b>100.0%</b>



## 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

## Essex County, Massachusetts, Northern Part

### 12A—Maybid silt loam, 0 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* vjhj  
*Mean annual precipitation:* 45 to 54 inches  
*Mean annual air temperature:* 43 to 54 degrees F  
*Frost-free period:* 145 to 240 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Maybid and similar soils:* 85 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Maybid

##### Setting

*Landform:* Depressions, depressions  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Parent material:* Soft silty and clayey glaciolacustrine deposits and/or firm silty marine deposits

##### Typical profile

*H1 - 0 to 7 inches:* silt loam  
*H2 - 7 to 19 inches:* silty clay  
*H3 - 19 to 60 inches:* silty clay

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Very poorly drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Depth to water table:* About 0 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* Frequent  
*Available water storage in profile:* Moderate (about 8.8 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 6w  
*Hydrologic Soil Group:* C/D  
*Hydric soil rating:* Yes

### **Minor Components**

#### **Scantic**

*Percent of map unit:* 12 percent

*Landform:* Depressions

*Hydric soil rating:* Yes

#### **Swansea**

*Percent of map unit:* 3 percent

*Landform:* Bogs

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: Essex County, Massachusetts, Northern Part

Survey Area Data: Version 15, Sep 12, 2019

## Essex County, Massachusetts, Northern Part

### 16A—Scantic silt loam, 0 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* vjrl  
*Elevation:* 10 to 900 feet  
*Mean annual precipitation:* 45 to 54 inches  
*Mean annual air temperature:* 43 to 54 degrees F  
*Frost-free period:* 145 to 240 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Scantic and similar soils:* 85 percent  
*Minor components:* 15 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Scantic

##### Setting

*Landform:* Drainageways, depressions  
*Landform position (two-dimensional):* Toeslope  
*Landform position (three-dimensional):* Dip  
*Down-slope shape:* Concave  
*Across-slope shape:* Concave  
*Parent material:* Soft fine-silty glaciolacustrine deposits and/or soft fine-silty glaciomarine deposits over hard fine-silty glaciolacustrine deposits and/or hard fine-silty glaciomarine deposits

##### Typical profile

*H1 - 0 to 11 inches:* silt loam  
*H2 - 11 to 26 inches:* silty clay loam  
*H3 - 26 to 60 inches:* clay

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Poorly drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Depth to water table:* About 0 to 12 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* High (about 9.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3w  
*Hydrologic Soil Group:* C/D  
*Hydric soil rating:* Yes

### **Minor Components**

#### **Maybid**

*Percent of map unit:* 10 percent

*Landform:* Depressions

*Hydric soil rating:* Yes

#### **Buxton**

*Percent of map unit:* 5 percent

*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: Essex County, Massachusetts, Northern Part

Survey Area Data: Version 15, Sep 12, 2019

## Essex County, Massachusetts, Northern Part

### 228B—Buxton silt loam, 3 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* vj37  
*Mean annual precipitation:* 45 to 54 inches  
*Mean annual air temperature:* 43 to 54 degrees F  
*Frost-free period:* 145 to 240 days  
*Farmland classification:* All areas are prime farmland

#### Map Unit Composition

*Buxton and similar soils:* 80 percent  
*Minor components:* 20 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Buxton

##### Setting

*Landform:* Valleys, valleys  
*Landform position (two-dimensional):* Footslope  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Concave  
*Parent material:* Soft fine-loamy glaciolacustrine deposits derived from mica schist over hard fine-loamy glaciolacustrine deposits derived from mica schist

##### Typical profile

*H1 - 0 to 10 inches:* silt loam  
*H2 - 10 to 30 inches:* silt loam  
*H3 - 30 to 60 inches:* silty clay

##### Properties and qualities

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Moderately well drained  
*Capacity of the most limiting layer to transmit water (Ksat):* Very low to moderately high (0.00 to 0.20 in/hr)  
*Depth to water table:* About 12 to 36 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* High (about 9.7 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 2e  
*Hydrologic Soil Group:* D  
*Hydric soil rating:* No

### **Minor Components**

#### **Suffield**

*Percent of map unit:* 15 percent

*Hydric soil rating:* No

#### **Scantic**

*Percent of map unit:* 5 percent

*Landform:* Depressions

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: Essex County, Massachusetts, Northern Part

Survey Area Data: Version 15, Sep 12, 2019

# ***GEOTECHNICAL REPORT***

**BRADLEY FULLER FIELD  
NEWBURYPORT, MASSACHUSETTS**

January 5, 2016

**GSI Project No. 215300**

***Prepared for:***

Mr. Chris Huntress  
Huntress Associates, Inc.  
17 Tewksbury Street  
Andover, MA 01810

***Prepared by:***

Geotechnical Services, Inc.  
55 North Stark Highway  
Weare, NH 03281

**Geotechnical Services Inc.**

Geotechnical Engineering ▴ Environmental Studies ▴ Materials Testing ▴ Construction Monitoring







# GEOTECHNICAL SERVICES INC.

▲ Geotechnical Engineering ▲ Environmental Studies ▲ Materials Testing ▲ Construction Monitoring ▲

January 5, 2016

Mr. Chris Huntress  
Huntress Associates, Inc.  
17 Tewksbury Street  
Andover, MA 01810

Advanced via Email: [chris@huntressassociates.com](mailto:chris@huntressassociates.com)

**RE: Geotechnical Investigation Report  
Bradley Fuller Field  
Newburyport, Massachusetts  
GSI Project No. 215300**

Dear Mr. Huntress:

Geotechnical Services, Inc. (GSI) is pleased to submit this report on the proposed design-redevelopment of the track and grass turf athletic field at the Bradley Fuller Field off of Low Street in Newburyport, MA. The report consists of the subsurface data obtained through implementation of an exploration program, evaluation of the subsurface data, a summary of our understanding of the proposed development, and the results of an assessment for earthwork design options. The content of this report is subject to the **Limitations** stated in Appendix A.

## PROJECT UNDERSTANDING

The project site is located at 89 to 107 Low Street in Newburyport, MA (See Figure 1, Project Locus). We understand that the planned redevelopment will include the renovation of both the existing grass turf field located within the limits of the track and replace and reconfigure the existing track.

## SUBSURFACE INVESTIGATION

Thirteen (13) soil probes, designated as GP-1 to GP-13, were performed at the site on December 14, 2015 by New England Boring Contractors, Inc. located in Derry, NH. The probes were conducted using a Geoprobe soil probing machine which collects continuous 5-ft long soil samples. Soil samples were collected to depths ranging from 5 to 10-ft below the existing grade. The Geoprobos were observed by the GSI engineer and the soils encountered were classified in accordance with the Burmister Classification system. The approximate locations of the Geoprobos are shown on Figures 2, Exploration Location Plan. The finalized logs for the Geoprobos are included in Appendix B. Representative portions of each sample retrieved were saved in plastic bags with identification, and delivered to the GSI Soils Laboratory. The samples were re-examined and field classifications were reviewed.

## SUBSURFACE CONDITIONS

The subsurface conditions encountered in the investigation indicate that the site is underlain by the following soil units/deposits, described in order of increasing depth:

**Topsoil:** All of the probes encountered the Topsoil layer at the ground surface. The Topsoil layer generally consists of organic silty soils. The thickness of this soil unit varies from less than 6-in in proximity to the existing track to 8 to 18-in. within the limits of the grass turf field.

**Sand Fill:** The Sand Fill was encountered with all the geoprobos immediately beneath the topsoil layer. The Sand Fill generally consists of brown fine to medium SAND with varying amounts of gravel and coarse sand. The thickness of the Filter Sand layer varies from about 12-in. (GP-6) to 38-in. (GP-13) and was about 24-in. (on average) in thickness across the project site.

**Fill:** Fill soils, consisting of gray, CLAY and fine to coarse SAND with little gravel, was encountered in GP-6 between 1.8 to 5.5-ft below the existing grade.

**Silt Deposits:** An isolated pocket of Silt was encountered in GP-9 from 2.5 to 5.5-ft below the existing grade which generally consists of brown Silt.

**Marine Deposits:** Marine Deposits were encountered in all of the geoprobes beneath the Sand Fill, Fill and Silt Deposits. The Marine Deposits generally consist of gray, CLAY with varying amounts of silt or fine to medium sand. All the geoprobes were terminated within this soil unit at depth of 5 to 10-ft below the existing grade.

**Groundwater:** Groundwater was not encountered upon completion of the probes. Groundwater levels should be expected to vary with season, precipitation, snowmelt, and other factors. As a result, groundwater levels encountered during construction may differ from those encountered in the explorations. It should be anticipated that perched groundwater above the Marine Deposits should be anticipated during construction due to seasonal groundwater conditions and weather.

## **GEOTECHNICAL DESIGN RECOMMENDATIONS**

### **General**

As a general guideline, foundation design and construction must conform to the applicable provisions of the Massachusetts Building Code, 8<sup>th</sup> Edition (Building Code).

### **Track and Grass Field Subgrades**

We anticipate that the construction of the new track and renovation of the existing grass field will involve the following; stripping off the track pavement, stripping off or amending the existing Topsoil, removing/relocating any existing utilities (irrigation, drainage pipes, electric utilities and any other utilities), grading the field to the planned rough grade, proof-rolling the subgrade and reconstructing the turf system, and construction of the re track to the planned configuration. The existing Sand Fill, Fill, Silt and Marine Deposit soils are suitable for support of the grass turf field and track provided the subgrade is prepared using the recommendation provided herein. It should be anticipated that the new track configuration will require some additional engineered fill beneath the track where the footprint of the track extends beyond the area where the geoprobe investigation was conducted where Sand Fill may not be present.

## **CONSTRUCTION CONSIDERATIONS**

### **General**

In general, all excavation work, any construction dewatering, and other construction activities should conform to the requirements of OSHA and all other applicable regulations. The site soils would typically be classified as Type C based on OSHA 29 CFR 1926.

### **Excavation**

Construction will involve clearing and grubbing of vegetation, stripping off the Topsoil and Track Asphalt, adding or cutting fill to achieve design grades (if needed), and constructing the planned turf field and track improvements. We anticipate that most of the site grading can be accomplished with conventional earth-moving equipment.

### **Construction Dewatering**

Based on the available subsurface data it is anticipated that during the general site work, no significant dewatering measures will be necessary to conduct the construction "in-the-dry." The Contractor should take measures to prevent stormwater from entering into excavated areas, and be prepared to remove ponded surface water by means of localized sumps and pumps. The Contractor should select whichever dewatering procedures may be effective to maintain dry, stable excavation bottoms.

### **Existing Utilities and Foundations of Former Structures**

Unknown and/or undocumented subsurface features, structures, and utilities may be present within the project site. The unknown structures and piping, should be anticipated during excavation work, and will need to be carefully removed to limit disturbance to underlying soil deposits and backfilled with compacted Granular Fill prior to construction of the planned field and track.

### **Preparation and Protection of Bearing Surfaces**

Final excavation should be conducted in a manner that minimizes disturbance to the subgrade soils when excavating for bearing surfaces. All final excavation and footing construction should be conducted in-the-dry. We recommend that the exposed subgrade soils be observed in the field by a geotechnical engineer to confirm the projected soil



bearing conditions. It may be necessary to over-excavate and replace weak, disturbed or otherwise unacceptable foundation bearing materials.

Following excavation to bearing grades, exposed soil surfaces should be re-compacted (proof-rolled) prior to placing engineered fill, or constructing foundations, with a minimum of four passes with a heavy vibratory roller or other heavy vibratory compaction equipment.

If subgrade protection difficulties are encountered due to surface or groundwater, various methods can be utilized:

- Leave subgrades high until immediately before forming and concreting to minimize the time the subgrade is exposed.
- Over excavate footings by 8 in. using a smooth edged bucket and backfill to the design bearing elevation using compacted Granular Fill.

Each such encounter is probably best resolved individually in the field upon observation of the subgrade conditions.

### **Compaction**

Minimum compaction requirements refer to percentages of the maximum dry density determined in accordance with ASTM D1557. Recommended compaction requirements are as follows:

<u>Location</u>	<u>Minimum Compaction Requirements</u>
Beneath the track & field	95 %
Landscaped areas	90 % nominal compaction

### **Filling and Backfilling**

Placement of compacted soil fills should not be conducted when air temperatures are low enough (approximately 30 degrees F, or below) to cause freezing of the moisture in the fill during or before placement. Fill materials should not be placed on snow, ice or uncompacted frozen soil. Compacted fill should not be placed on frozen soil. No fill should be allowed to freeze prior to compaction. At the end of each day's operations, the last lift of fill, after compaction, should be rolled by a smooth-wheeled roller to eliminate ridges of uncompacted soil.

### **CONSTRUCTION MONITORING**

It is recommended that a geotechnical engineer or technician qualified by training and experience be present during construction to:

- Confirm that soils used as fill and backfill are in accordance with the contract requirements.
- Observe and test placement and compaction of Granular Fill and other compacted fills.
- Observe preparation of field and pavement bearing surfaces.

Monitoring by experienced personnel will be important to the efficiency and integrity of the geotechnical aspects of the project construction. It is recommended that GSI be retained to provide the recommended monitoring services during construction. This will enable us to observe compliance with the design concepts, help resolve construction problems and to facilitate design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

### **PLAN REVIEW**

It is recommended that GSI be provided the opportunity to review the final plans in order to confirm that the recommendations made in this report were interpreted and implemented as intended.



**CLOSURE**

GSI appreciates the opportunity for participating in this early phase of the project, and looks forward to our continuing association during its subsequent phases towards its successful completion. In the mean time, please do not hesitate to contact us, if you have any questions on the content of this report.

Very truly yours,

**GEOTECHNICAL SERVICES, INC.**

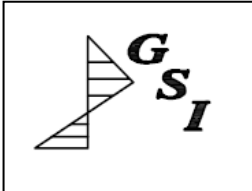
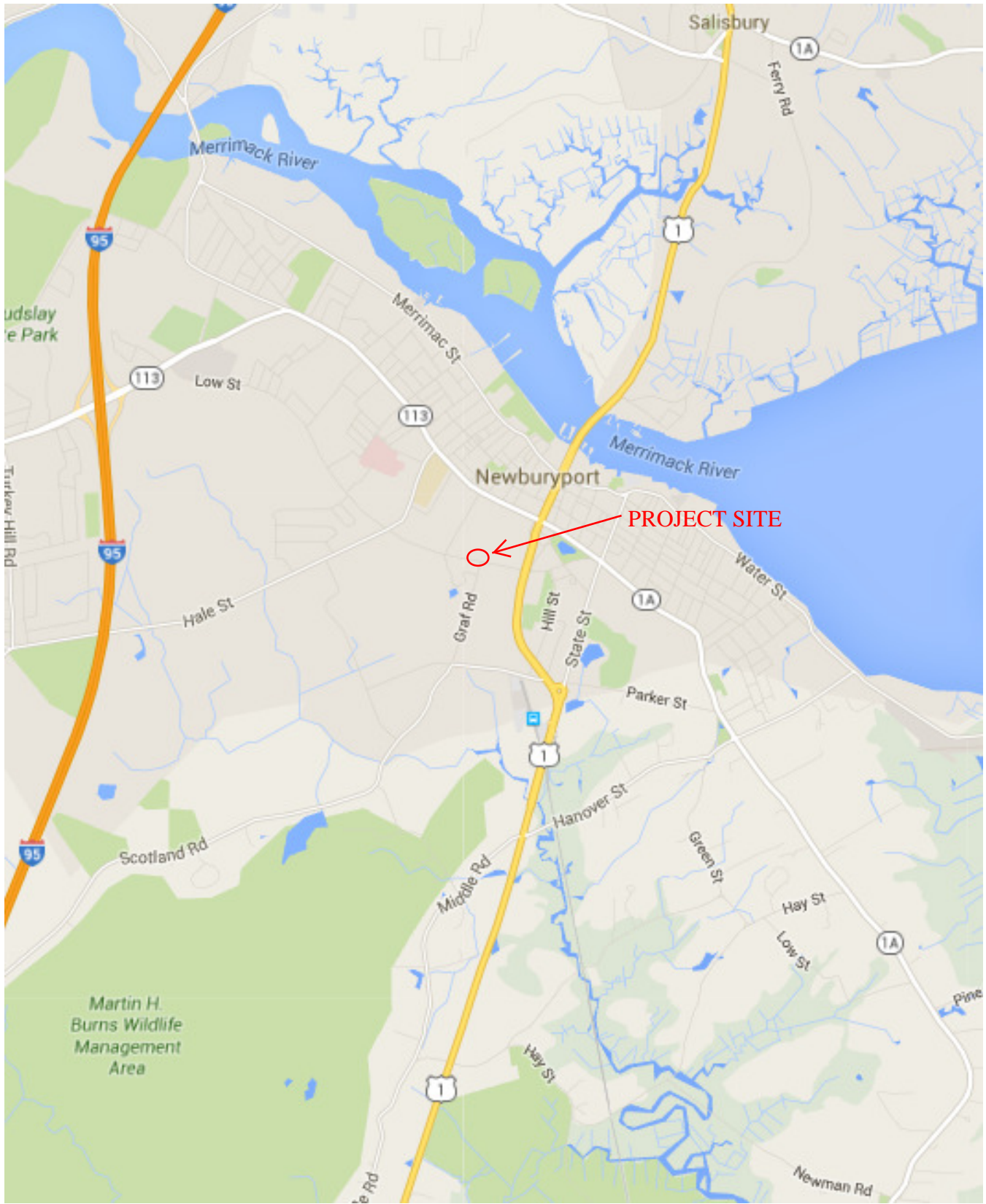


Glen V. Zola, P.E.  
*Project Manager*

Harry K. Wetherbee, P.E.  
*Principal Engineer*

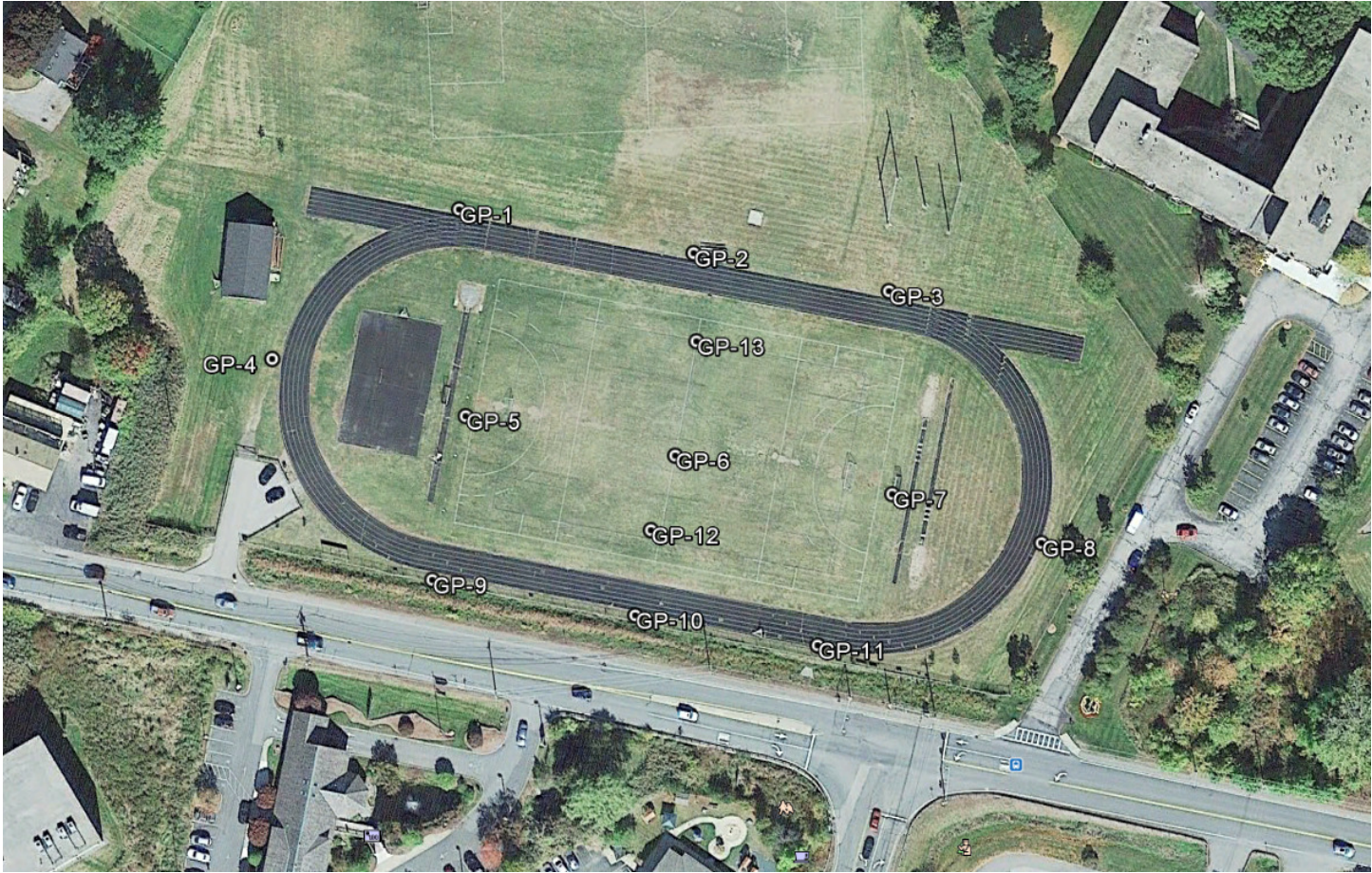
- Figure 1. Project Locus
- Figure 2. Exploration Location Plan
  
- Appendix A. Limitations
- Appendix B. Geoprobe Logs





**FIGURE 1—PROJECT LOCUS**  
**BRADLEY FULLER FIELD**  
**NEWBURYPORT, MA**  
**GSI PROJECT NO. 215300**





NOT TO SCALE

LEGEND:

○ GP-1      GEOPROBE I.D. AND APPROXIMATE LOCATION



FIGURE 2—EXPLORATION LOCATION PLAN

BRADLEY FULLER FIELD  
NEWBURYPORT, MA  
GSI PROJECT NO. 215300

**APPENDIX A**  
**LIMITATIONS**



## LIMITATIONS

### Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.
3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

### Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.
5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by Geotechnical Services, Inc.

### Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

### Use of Report

7. This report has been prepared for the exclusive use of Huntress Associates, Inc. in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.
8. This report has been prepared for this project by Geotechnical Services, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to evaluation considerations only.






**APPENDIX B**  
**GEOPROBE LOGS**



Geotechnical Services, Inc. " 55 North Stark Highway Tel. 603.529.7766 Fax. 603.529.7080 " 30 Newbury Street, Boston, MA 02116 Tel. 617.455.4248 Fax. 617.745.4308

	TEST BORING LOG	<b>Boring No.</b> <b>GP-1</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	


Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head <input type="checkbox"/> Roller Bit	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic <input type="checkbox"/> Cutting Head
Type	-	-	-	-			
Inside Diameter (in.)	-	-	-	-			
Hammer Weight (lb)	-	-	-	-			
Hammer Fall (in.)	-	-	-	-			

Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	43					0.4 Topsoil Brown, f/c SAND (wet)	
									1.7 -SAND FILL-	
									Gray CLAY  -MARINE DEPOSITS-	
5		G2	5-10	51					Gray, CLAY with occasional seams of silt	
10									Bottom of Exploration at 10-ft. No groundwater encountered.	
15										
20										
25										

Water Level Data					<b>Sample Identification</b> O = Open Ended U = Undisturbed S = Split Spoon C = Rock Core GP = Geoprobe	<b>Cohesive Soils N-Value</b> 0 to 2: Very Soft 2 to 4: Soft 4 to 8: Medium Stiff 8 to 15: Stiff 15 to 30 Very Stiff Over 30: Hard	<b>Granular Soils N-Value</b> 0 to 4: Very Loose 4 to 10: Loose 11 to 30: Medium Dense 31 to 50: Dense Over 50: Very Dense
Date	Time	Depth (ft) to:					
		Bott. of Casing	Bott. of Hole	Water			

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-2</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head	<input type="checkbox"/> Roller Bit <input type="checkbox"/> Cutting Head	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic
Type	-	-	-	-				
Inside Diameter (in.)	-	-	-	-				
Hammer Weight (lb)	-	-	-	-				
Hammer Fall (in.)	-	-	-	-				


Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	37				0.2	Topsoil Brown, f/m SAND, tr. c-sand	
								3	-SAND FILL-	
									-MARINE DEPOSITS-	
5									Bottom of Exploration at 5-ft. No groundwater encountered.	
10										
15										
20										
25										

Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value		
Date	Time	Depth (ft) to:			O = Open Ended U = Undisturbed S = Split Spoon C = Rock Core GP = Geoprobe	0 to 2: Very Soft 2 to 4: Soft 4 to 8: Medium Stiff 8 to 15: Stiff 15 to 30 Very Stiff Over 30: Hard	0 to 4: Very Loose 4 to 10: Loose 11 to 30: Medium Dense 31 to 50: Dense Over 50: Very Dense				
		Bott. of Casing	Bott. of Hole	Water							

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-2

Geotechnical Services, Inc. " 55 North Stark Highway Tel. 603.529.7766 Fax. 603.529.7080 " 30 Newbury Street, Boston, MA 02116 Tel. 617.455.4248 Fax. 617.745.4308

	TEST BORING LOG	<b>Boring No.</b> <b>GP-3</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/13/2015
Contractor	NEBC	Checked By		Finish	12/13/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck	<input type="checkbox"/> Skid	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic	
Type	-	-	-	-	<input checked="" type="checkbox"/> Track	<input type="checkbox"/> ATV		
Inside Diameter (in.)	-	-	-	-	<input type="checkbox"/> Bomb.	<input type="checkbox"/> Geophone		
Hammer Weight (lb)	-	-	-	-	<input type="checkbox"/> Tripod	<input type="checkbox"/> Other		
Hammer Fall (in.)	-	-	-	-	<input type="checkbox"/> Winch	<input type="checkbox"/> Cat Head		<input type="checkbox"/> Roller Bit


Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	41					0.3 Topsoil Brown, f/m SAND, some c-sand, tr. gravel ----- -SAND FILL- ----- 2 Gray CLAY ----- <b>-MARINE DEPOSITS-</b>  Gray, CLAY (6-in seam of br., f/c SAND from 5 to 5.5-ft.)	
5		G2	5-10	60						
10									Bottom of Exploration at 10-ft.  No groundwater encountered.	
15										
20										
25										

Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value		
Date	Time	Depth (ft) to:			O = Open Ended	U = Undisturbed	S = Split Spoon	C = Rock Core	GP = Geoprobe	0 to 2: Very Soft	0 to 4: Very Loose
		Bott. of Casing	Bott. of Hole	Water							
										4 to 8: Medium Stiff	11 to 30: Medium Dense
										8 to 15: Stiff	31 to 50: Dense
										15 to 30 Very Stiff	Over 50: Very Dense
										Over 30: Hard	

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-3

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-4</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input type="checkbox"/> Skid	<input type="checkbox"/> Safety Hammer
Type	-	-	-	-	<input checked="" type="checkbox"/> Track <input type="checkbox"/> ATV	<input type="checkbox"/> Doughnut
Inside Diameter (in.)	-	-	-	-	<input type="checkbox"/> Bomb. <input type="checkbox"/> Geophone	<input type="checkbox"/> Automatic
Hammer Weight (lb)	-	-	-	-	<input type="checkbox"/> Tripod <input type="checkbox"/> Other	
Hammer Fall (in.)	-	-	-	-	<input type="checkbox"/> Winch <input type="checkbox"/> Cat Head <input type="checkbox"/> Roller Bit <input type="checkbox"/> Cutting Head	

Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	42				0.2	Topsoil	
									Brown, f/m SAND, trace gravel, c-sand, silt	
								2.8	<b>-SAND FILL-</b>	
									Gray, CLAY	
									<b>-MARINE DEPOSITS-</b>	
5									Bottom of Exploration at 5-ft. No groundwater encountered.	
10										
15										
20										
25										


Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value											
Date	Time	Depth (ft) to:			O = Open Ended	U = Undisturbed	S = Split Spoon	C = Rock Core	GP = Geoprobe	0 to 2: Very Soft	2 to 4: Soft	4 to 8: Medium Stiff	8 to 15: Stiff	15 to 30 Very Stiff	Over 30: Hard	0 to 4: Very Loose	4 to 10: Loose	11 to 30: Medium Dense	31 to 50: Dense	Over 50: Very Dense
		Bott. of Casing	Bott. of Hole	Water																

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

GP-4

Notes:

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-5</b>
		Page 1 of 1

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck	<input type="checkbox"/> Skid	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic	
Type	-	-	-	-	<input checked="" type="checkbox"/> Track	<input type="checkbox"/> ATV		
Inside Diameter (in.)	-	-	-	-	<input type="checkbox"/> Bomb.	<input type="checkbox"/> Geophone		
Hammer Weight (lb)	-	-	-	-	<input type="checkbox"/> Tripod	<input type="checkbox"/> Other		
Hammer Fall (in.)	-	-	-	-	<input type="checkbox"/> Winch	<input type="checkbox"/> Cat Head		<input type="checkbox"/> Roller Bit


Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	48					Topsoil	
								1.5	Brown, f/m SAND, little c-sand <b>-SAND FILL-</b>	
								3.5	Gray, CLAY <b>-MARINE DEPOSITS-</b>	
5									Bottom of Exploration at 5-ft. No groundwater encountered.	
10										
15										
20										
25										

Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value											
Date	Time	Depth (ft) to:			O = Open Ended	U = Undisturbed	S = Split Spoon	C = Rock Core	GP = Geoprobe	0 to 2: Very Soft	2 to 4: Soft	4 to 8: Medium Stiff	8 to 15: Stiff	15 to 30 Very Stiff	Over 30: Hard	0 to 4: Very Loose	4 to 10: Loose	11 to 30: Medium Dense	31 to 50: Dense	Over 50: Very Dense
		Bott. of Casing	Bott. of Hole	Water																

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-5

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-6</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	


Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head	<input type="checkbox"/> Roller Bit <input type="checkbox"/> Cutting Head	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic
Type	-	-	-	-				
Inside Diameter (in.)	-	-	-	-				
Hammer Weight (lb)	-	-	-	-				
Hammer Fall (in.)	-	-	-	-				

Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	47					Topsoil 0.8 Brown, fine SAND 1.8 -SAND FILL- Gray, CLAY and f/c SAND, little gravel -FILL- 5.5 Gray, CLAY -MARINE DEPOSITS- Bottom of Exploration at 10-ft. No groundwater encountered.	
5		G2	5-10	51						
10										
15										
20										
25										

Water Level Data					<b>Sample Identification</b> O = Open Ended U = Undisturbed S = Split Spoon C = Rock Core GP = Geoprobe	<b>Cohesive Soils N-Value</b> 0 to 2: Very Soft 2 to 4: Soft 4 to 8: Medium Stiff 8 to 15: Stiff 15 to 30 Very Stiff Over 30: Hard	<b>Granular Soils N-Value</b> 0 to 4: Very Loose 4 to 10: Loose 11 to 30: Medium Dense 31 to 50: Dense Over 50: Very Dense
Date	Time	Depth (ft) to:					
		Bott. of Casing	Bott. of Hole	Water			

Notes: Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%) **GP-6**

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-7</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck	<input type="checkbox"/> Skid	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic	
Type	-	-	-	-	<input checked="" type="checkbox"/> Track	<input type="checkbox"/> ATV		
Inside Diameter (in.)	-	-	-	-	<input type="checkbox"/> Bomb.	<input type="checkbox"/> Geophone		
Hammer Weight (lb)	-	-	-	-	<input type="checkbox"/> Tripod	<input type="checkbox"/> Other		
Hammer Fall (in.)	-	-	-	-	<input type="checkbox"/> Winch	<input type="checkbox"/> Cat Head		<input type="checkbox"/> Roller Bit

Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	39					0.8 Topsoil Brown, f/m SAND, little gravel, c-sand, tr. silt	
									-SAND FILL-	
									-MARINE DEPOSITS-	
5									Bottom of Exploration at 5-ft. No groundwater encountered.	
10										
15										
20										
25										


Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value											
Date	Time	Depth (ft) to:			O = Open Ended	U = Undisturbed	S = Split Spoon	C = Rock Core	GP = Geoprobe	0 to 2: Very Soft	2 to 4: Soft	4 to 8: Medium Stiff	8 to 15: Stiff	15 to 30 Very Stiff	Over 30: Hard	0 to 4: Very Loose	4 to 10: Loose	11 to 30: Medium Dense	31 to 50: Dense	Over 50: Very Dense
		Bott. of Casing	Bott. of Hole	Water																

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-7



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	TEST BORING LOG	<b>Boring No.</b> <b>GP-8</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head	<input type="checkbox"/> Roller Bit <input type="checkbox"/> Cutting Head	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic
Type	-	-	-	-				
Inside Diameter (in.)	-	-	-	-				
Hammer Weight (lb)	-	-	-	-				
Hammer Fall (in.)	-	-	-	-				


Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	36				0.4	Topsoil Brown, f/m SAND, some c-sand, tr. gravel <b>-SAND FILL-</b>	
5		G2	5-10	58				2.2	Gray, CLAY little to trace f/m sand <b>-MARINE DEPOSITS-</b> Gray, CLAY little to trace f/m sand	
10									Bottom of Exploration at 10-ft. No groundwater encountered.	
15										
20										
25										

Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value		
Date	Time	Depth (ft) to:			O = Open Ended U = Undisturbed S = Split Spoon C = Rock Core GP = Geoprobe	0 to 2: Very Soft 2 to 4: Soft 4 to 8: Medium Stiff 8 to 15: Stiff 15 to 30 Very Stiff Over 30: Hard	0 to 4: Very Loose 4 to 10: Loose 11 to 30: Medium Dense 31 to 50: Dense Over 50: Very Dense				
		Bott. of Casing	Bott. of Hole	Water							

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-8

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-9</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck	<input type="checkbox"/> Skid	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic
Type	-	-	-	-	<input checked="" type="checkbox"/> Track	<input type="checkbox"/> ATV	
Inside Diameter (in.)	-	-	-	-	<input type="checkbox"/> Bomb.	<input type="checkbox"/> Geophone	
Hammer Weight (lb)	-	-	-	-	<input type="checkbox"/> Tripod	<input type="checkbox"/> Other	
Hammer Fall (in.)	-	-	-	-	<input type="checkbox"/> Winch	<input type="checkbox"/> Cat Head	
					<input type="checkbox"/> Roller Bit	<input type="checkbox"/> Cutting Head	


Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	39					0.3 Topsoil Brown, f/m SAND, tr. gravel, coarse sand <b>-SAND FILL-</b>	
									2.5 Brown, SILT <b>-SILT DEPOSITS-</b>	
5		G2	5-10	58					5.5 Gray, CLAY <b>-MARINE DEPOSITS-</b>	
10									Bottom of Exploration at 10-ft. No groundwater encountered.	
15										
20										
25										

Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value	
Date	Time	Depth (ft) to:			O = Open Ended	U = Undisturbed	0 to 2: Very Soft	0 to 4: Very Loose		
		Bott. of Casing	Bott. of Hole	Water					2 to 4: Soft	4 to 10: Loose
					S = Split Spoon	4 to 8: Medium Stiff	11 to 30: Medium Dense			
					C = Rock Core	8 to 15: Stiff	31 to 50: Dense			
					GP = Geoprobe	15 to 30 Very Stiff	Over 50: Very Dense			
						Over 30: Hard				

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-9

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-10</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head <input type="checkbox"/> Roller Bit	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic <input type="checkbox"/> Cutting Head
Type	-	-	-	-			
Inside Diameter (in.)	-	-	-	-			
Hammer Weight (lb)	-	-	-	-			
Hammer Fall (in.)	-	-	-	-			


Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	40					0.3 Topsoil	
									Brown, f/m SAND, little c-sand <b>-SAND FILL-</b>	
									3.1 Gray CLAY <b>-MARINE DEPOSITS-</b>	
5									Bottom of Exploration at 5-ft. No groundwater encountered.	
10										
15										
20										
25										

Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value		
Date	Time	Depth (ft) to:			O = Open Ended U = Undisturbed S = Split Spoon C = Rock Core GP = Geoprobe	0 to 2: Very Soft 2 to 4: Soft 4 to 8: Medium Stiff 8 to 15: Stiff 15 to 30 Very Stiff Over 30: Hard	0 to 4: Very Loose 4 to 10: Loose 11 to 30: Medium Dense 31 to 50: Dense Over 50: Very Dense				
		Bott. of Casing	Bott. of Hole	Water							

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: **GP-10**

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-11</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	


Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head	<input type="checkbox"/> Roller Bit <input type="checkbox"/> Cutting Head	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic
Type	-	-	-	-				
Inside Diameter (in.)	-	-	-	-				
Hammer Weight (lb)	-	-	-	-				
Hammer Fall (in.)	-	-	-	-				

Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	34				0.3	Topsoil Brown, f/m SAND, little coarse sand, tr. gravel <b>-SAND FILL-</b>	
								2.8	Gray CLAY  <b>-MARINE DEPOSITS-</b> Gray, CLAY with seams of silt (wet from 5 to 6-ft below grade)	
5		G2	5-10	53						
10									Bottom of Exploration at 10-ft. No groundwater encountered.	
15										
20										
25										

Water Level Data					<b>Sample Identification</b> O = Open Ended U = Undisturbed S = Split Spoon C = Rock Core GP = Geoprobe	<b>Cohesive Soils N-Value</b> 0 to 2: Very Soft 2 to 4: Soft 4 to 8: Medium Stiff 8 to 15: Stiff 15 to 30 Very Stiff Over 30: Hard	<b>Granular Soils N-Value</b> 0 to 4: Very Loose 4 to 10: Loose 11 to 30: Medium Dense 31 to 50: Dense Over 50: Very Dense
Date	Time	Depth (ft) to:					
		Bott. of Casing	Bott. of Hole	Water			

Notes: Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%) **GP-11**

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-12</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head <input type="checkbox"/> Roller Bit	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic <input type="checkbox"/> Cutting Head
Type	-	-	-	-			
Inside Diameter (in.)	-	-	-	-			
Hammer Weight (lb)	-	-	-	-			
Hammer Fall (in.)	-	-	-	-			


Depth (ft)	Casing (Blows/ft)	Sample Data						Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)		
0		G1	0-5	46				0.7 Topsoil Brown, f/m SAND	
								-SAND FILL-	
								3.8 Gray CLAY	
								-MARINE DEPOSITS-	
5								Bottom of Exploration at 5-ft. No groundwater encountered.	
10									
15									
20									
25									

Water Level Data					Sample Identification		Cohesive Soils N-Value		Granular Soils N-Value											
Date	Time	Depth (ft) to:			O = Open Ended	U = Undisturbed	S = Split Spoon	C = Rock Core	GP = Geoprobe	0 to 2: Very Soft	2 to 4: Soft	4 to 8: Medium Stiff	8 to 15: Stiff	15 to 30 Very Stiff	Over 30: Hard	0 to 4: Very Loose	4 to 10: Loose	11 to 30: Medium Dense	31 to 50: Dense	Over 50: Very Dense
		Bott. of Casing	Bott. of Hole	Water																

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-12

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	TEST BORING LOG	<b>Boring No.</b> <b>GP-13</b>
		<b>Page 1 of 1</b>

Project	Bradley Fuller Field	Project No.	215300	Elevation	N/A
Location	Newburyport, MA	Inspector	G. Zoladz	Datum	See Plan
Client	Huntress Associates	Project Manager	G. Zoladz	Start	12/14/2015
Contractor	NEBC	Checked By		Finish	12/14/2015
Driller	C. Downing	Drill Rig	Geoprobe	Model	

Item:	Auger	Casing	Sampler	Core Barrel	<input type="checkbox"/> Truck <input checked="" type="checkbox"/> Track <input type="checkbox"/> Bomb. <input type="checkbox"/> Tripod <input type="checkbox"/> Winch	<input type="checkbox"/> Skid <input type="checkbox"/> ATV <input type="checkbox"/> Geophone <input type="checkbox"/> Other <input type="checkbox"/> Cat Head	<input type="checkbox"/> Roller Bit <input type="checkbox"/> Cutting Head	<b>Hammer Type:</b> <input type="checkbox"/> Safety Hammer <input type="checkbox"/> Doughnut <input type="checkbox"/> Automatic
Type	-	-	-	-				
Inside Diameter (in.)	-	-	-	-				
Hammer Weight (lb)	-	-	-	-				
Hammer Fall (in.)	-	-	-	-				

Depth (ft)	Casing (Blows/ft)	Sample Data							Stratum Change (ft)	Soil-Rock Visual Classification and Description (Soils - Burmister System) (Rock - U.S. Corps of Engineers System)
		No.	Depth (ft)	Rec. (in.)	SPT (Blows/6-in.)	Rock RQD (%)	PID Rdg. (ppm)			
0		G1	0-5	47					0.7 Topsoil Brown, f/m SAND	
									-SAND FILL-	
									3.9 Gray CLAY	
									-MARINE DEPOSITS-	
5									Bottom of Exploration at 5-ft. No groundwater encountered.	
10										
15										
20										
25										

Water Level Data					Sample Identification O = Open Ended U = Undisturbed S = Split Spoon C = Rock Core GP = Geoprobe	Cohesive Soils N-Value 0 to 2: Very Soft 2 to 4: Soft 4 to 8: Medium Stiff 8 to 15: Stiff 15 to 30 Very Stiff Over 30: Hard	Granular Soils N-Value 0 to 4: Very Loose 4 to 10: Loose 11 to 30: Medium Dense 31 to 50: Dense Over 50: Very Dense
Date	Time	Depth (ft) to:					
		Bott. of Casing	Bott. of Hole	Water			

Trace (0 to 5%), Little (10 to 20%), Some (20 to 35%), And (35 to 50%)

Notes: GP-13

# **CURVE NUMBER COMPUTATIONS**

# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>JBS</b>	Date <b>2/10/20</b>
Location <b>NEWBURYPORT, MA</b>	Checked	Date

Check one:  Present  Developed **AREA "A"**

## 1. Runoff curve number

Soil name and hydrologic group <small>(appendix A)</small>	Cover description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
	<b>IMPERVIOUS</b>	<b>98</b>			<b>0.16</b>	

<sup>1/</sup> Use only one CN source per line

Totals ➡ **0.16**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ; Use CN ➡ **98**

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			
(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)			



# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>J.P.S.</b>	Date <b>2/10/20</b>
Location <b>NEWBURYPORT, MA</b>	Checked	Date

Check one:  Present  Developed **AREA "B"**

## 1. Runoff curve number

Soil name and hydrologic group <small>(appendix A)</small>	Cover description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
	<b>IMPERVIOUS</b>	<b>98</b>			<b>0.06</b>	

<sup>1/</sup> Use only one CN source per line

Totals ➡ **0.06**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ; Use CN ➡

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			
(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)			

# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>J.B.</b>	Date <b>2/10/20</b>
Location <b>NEWBURYPORT, MA</b>	Checked	Date

Check one:  Present  Developed **AREA "C"**

## 1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description  (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
	<b>IMPERVIOUS</b>	<b>98</b>			<b>.03</b>	

<sup>1/</sup> Use only one CN source per line

Totals ➡ **0.03**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ; Use CN ➡ **98**

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>J.B.</b>	Date <b>2/10/20</b>
Location <b>NEWSBURYPORT, MA</b>	Checked	Date

Check one:  Present  Developed **AREA "D"**

## 1. Runoff curve number

Soil name and hydrologic group <small>(appendix A)</small>	Cover description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
	<b>IMPERVIOUS</b>	<b>98</b>			<b>0.07</b>	

<sup>1/</sup> Use only one CN source per line

Totals ➡ **0.07**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ; Use CN ➡ **98**

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

# Worksheet 2: Runoff curve number and runoff

Project: <b>FULLER FIELD (PHASE 2)</b>	By: <b>JBS</b>	Date: <b>2/10/20</b>
Location: <b>NEWBURYPORT, MA</b>	Checked:	Date:

Check one:  Present  Developed

## 1. Runoff curve number

Soil name and hydrologic group <small>(appendix A)</small>	Cover description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		

<sup>1/</sup> Use only one CN source per line

**Totals** ➡

--	--

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ;

**Use CN** ➡

--

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			
(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)			

# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>JTB</b>	Date <b>2/10/20</b>
Location <b>NEWSBURYPORT, MA</b>	Checked	Date <b>3/6/20</b>

Check one:  Present    Developed      **AREA "A"**

## 1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description  (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
<b>C</b>	<b>OPEN SPACE (WOOD)</b>	<b>74</b>			<b>0.16</b>	

<sup>1/</sup> Use only one CN source per line

Totals ➡ **0.16**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ;

Use CN ➡ **74**

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>JRS</b>	Date <b>2/10/20</b>
Location <b>NEWSBURYPORT, MA</b>	Checked	Date <b>3/6/20</b>

Check one:  Present  Developed **"AREA B"**

## 1. Runoff curve number

Soil name and hydrologic group <small>(appendix A)</small>	Cover description <small>(cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
<b>C</b>	<b>OPEN SPACE</b>	<b>74</b>			<b>0.06</b>	

<sup>1/</sup> Use only one CN source per line

Totals ➡ **0.06**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ; Use CN ➡ **74**

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>JTB</b>	Date <b>2/10/20</b>
Location <b>NEWBURYPORT, MA</b>	Checked	Date <b>3/6/20</b>

Check one:  Present  Developed **"AREA C"**

## 1. Runoff curve number

Soil name and hydrologic group <small>(appendix A)</small>	Cover description  <small>(cover type, treatment, and hydrologic condition; percent impervious, unconnected/connected impervious area ratio)</small>	CN <sup>1/</sup>			Area <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
<b>C</b>	<b>OPEN SPACE</b>	<b>74</b>			<b>0.03</b>	

<sup>1/</sup> Use only one CN source per line

Totals ➡ **0.03**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ; Use CN ➡ **74**

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)

# Worksheet 2: Runoff curve number and runoff

Project <b>FULLER FIELD (PHASE 2)</b>	By <b>JBS</b>	Date <b>2/10/20</b>
Location <b>NEWBURYPORT, MA</b>	Checked	Date <b>3/6/20</b>

Check one:  Present  Developed **"AREA D"**

## 1. Runoff curve number

Soil name and hydrologic group (appendix A)	Cover description  (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN <sup>1/</sup>			Area  <input checked="" type="checkbox"/> acres <input type="checkbox"/> mi <sup>2</sup> <input type="checkbox"/> %	Product of CN x area
		Table 2-2	Figure 2-3	Figure 2-4		
<b>C</b>	<b>OPEN SPACE</b>	<b>74</b>			<b>0.07</b>	

<sup>1/</sup> Use only one CN source per line Totals ➡ **0.07**

CN (weighted) =  $\frac{\text{total product}}{\text{total area}}$  = \_\_\_\_\_ = \_\_\_\_\_ ; Use CN ➡ **74**

## 2. Runoff

	Storm #1	Storm #2	Storm #3
Frequency ..... yr			
Rainfall, P (24-hour) ..... in			
Runoff, Q ..... in			

(Use P and CN with table 2-1, figure 2-1, or equation 2-3 and 2-4)



# HYDROGRAPHS

# Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.2

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	-----	-----	0.179	-----	-----	0.411	0.587	-----	1.004	AREA A (Pre)
2	SCS Runoff	-----	-----	0.498	-----	-----	0.761	0.941	-----	1.349	AREA A (Post)
3	SCS Runoff	-----	-----	0.067	-----	-----	0.154	0.220	-----	0.377	AREA B (Pre)
4	SCS Runoff	-----	-----	0.187	-----	-----	0.285	0.353	-----	0.506	AREA B (Post)
5	SCS Runoff	-----	-----	0.034	-----	-----	0.077	0.110	-----	0.188	AREA C (Pre)
6	SCS Runoff	-----	-----	0.093	-----	-----	0.143	0.176	-----	0.253	AREA C (Post)
7	SCS Runoff	-----	-----	0.078	-----	-----	0.180	0.257	-----	0.439	AREA D (Pre)
8	SCS Runoff	-----	-----	0.218	-----	-----	0.333	0.412	-----	0.590	AREA D (Post)
9	Reservoir	2	-----	0.000	-----	-----	0.207	0.512	-----	1.205	BMP - A (Outflow)
10	Reservoir	4	-----	0.000	-----	-----	0.000	0.000	-----	0.000	BMP - B (Outflow)
11	Reservoir	6	-----	0.000	-----	-----	0.000	0.000	-----	0.000	BMP - C (Outflow)
12	Reservoir	8	-----	0.000	-----	-----	0.000	0.000	-----	0.161	BMP - D (Outflow)

# Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	SCS Runoff	0.179	1	725	582	----	-----	-----	AREA A (Pre)	
2	SCS Runoff	0.498	1	724	1,718	----	-----	-----	AREA A (Post)	
3	SCS Runoff	0.067	1	725	218	----	-----	-----	AREA B (Pre)	
4	SCS Runoff	0.187	1	724	644	----	-----	-----	AREA B (Post)	
5	SCS Runoff	0.034	1	725	109	----	-----	-----	AREA C (Pre)	
6	SCS Runoff	0.093	1	724	322	----	-----	-----	AREA C (Post)	
7	SCS Runoff	0.078	1	725	255	----	-----	-----	AREA D (Pre)	
8	SCS Runoff	0.218	1	724	751	----	-----	-----	AREA D (Post)	
9	Reservoir	0.000	1	345	0	2	18.75	1,465	BMP - A (Outflow)	
10	Reservoir	0.000	1	n/a	0	4	18.31	644	BMP - B (Outflow)	
11	Reservoir	0.000	1	n/a	0	6	18.14	322	BMP - C (Outflow)	
12	Reservoir	0.000	1	735	0	8	16.35	536	BMP - D (Outflow)	
hydro.gpw					Return Period: 2 Year			Monday, Mar 9, 2020		

# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

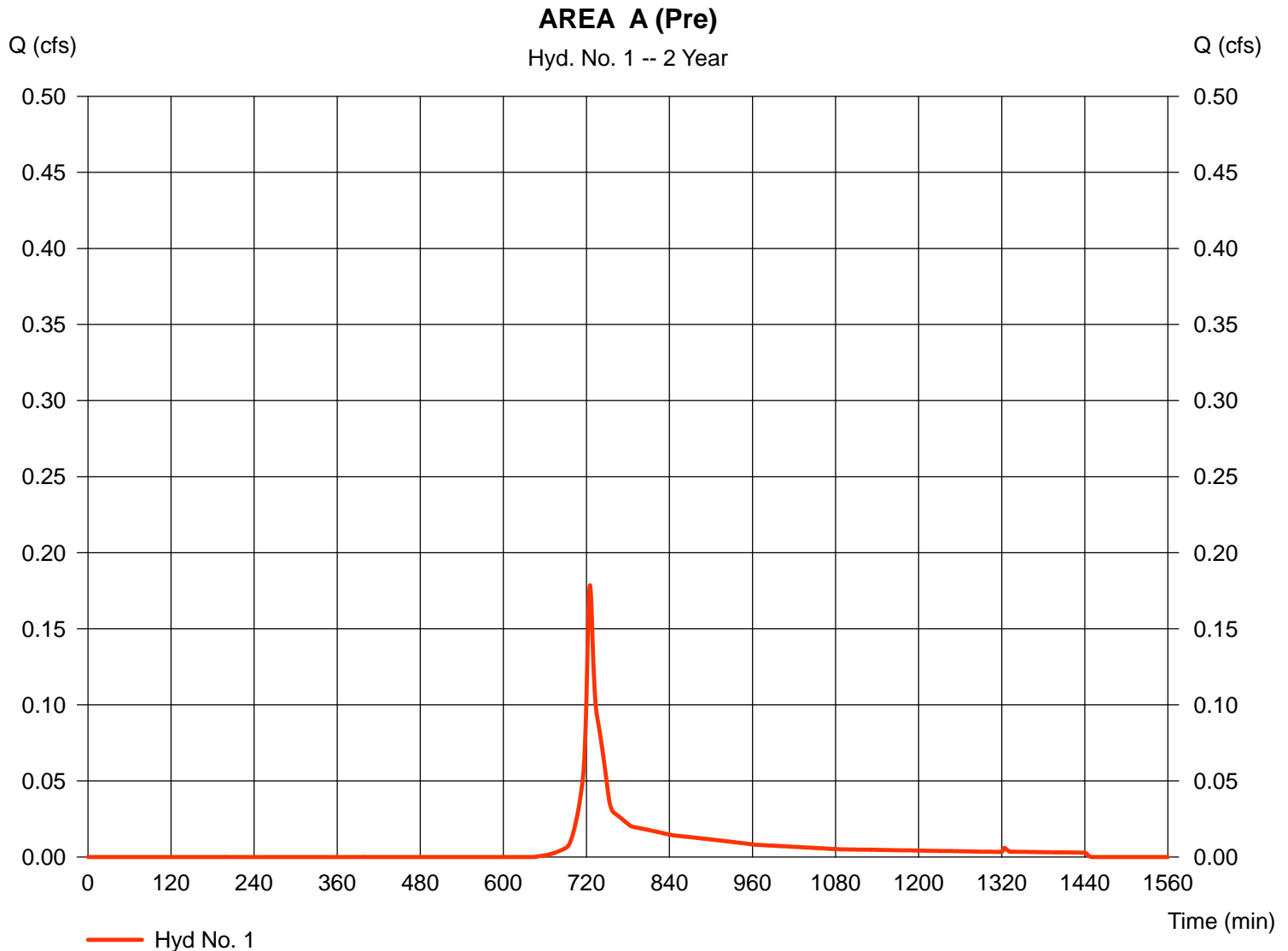
Monday, Mar 9, 2020

## Hyd. No. 1

AREA A (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.160 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.179 cfs  
Time to peak = 725 min  
Hyd. volume = 582 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

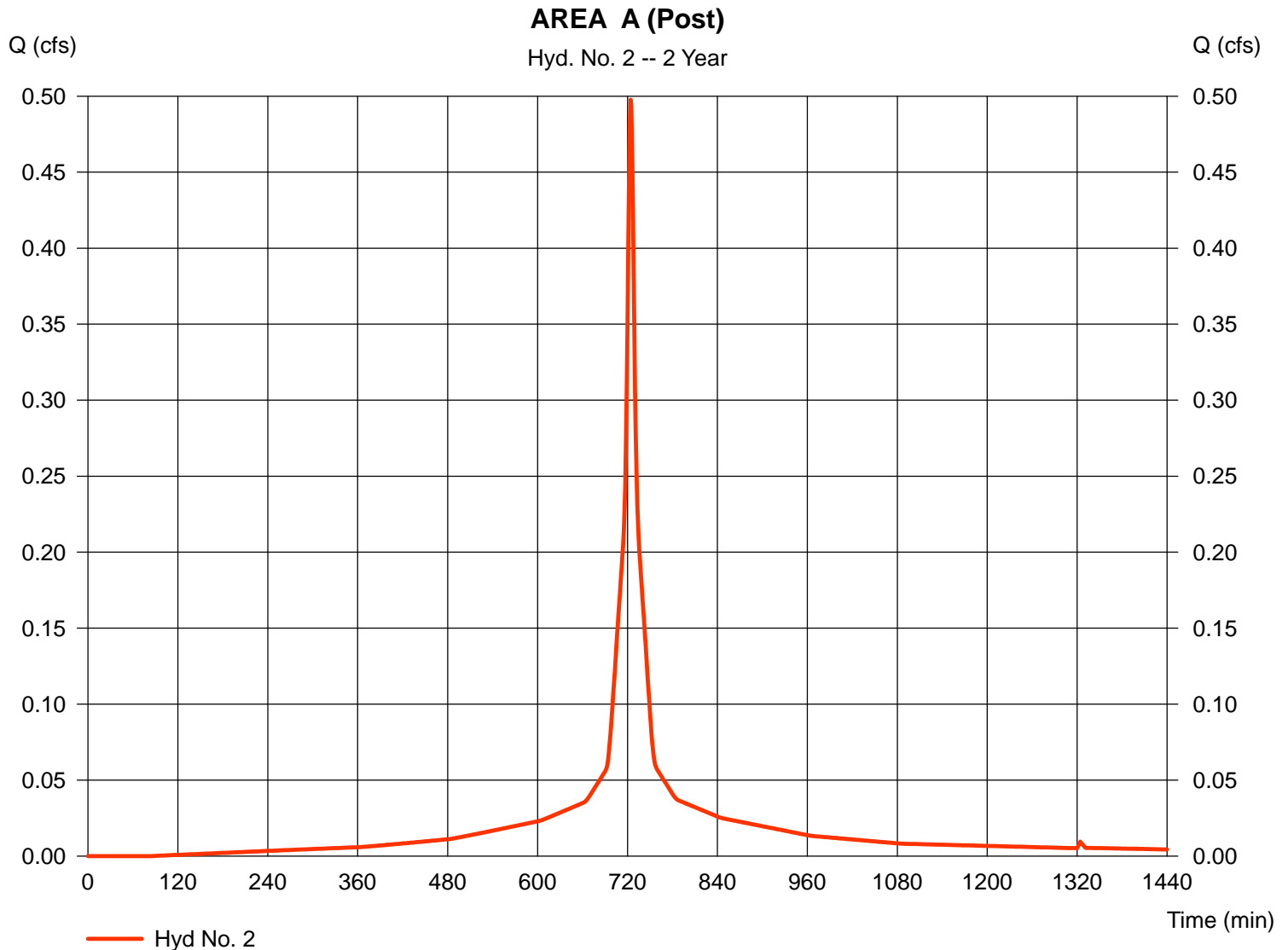
Monday, Mar 9, 2020

## Hyd. No. 2

AREA A (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.160 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.498 cfs  
Time to peak = 724 min  
Hyd. volume = 1,718 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

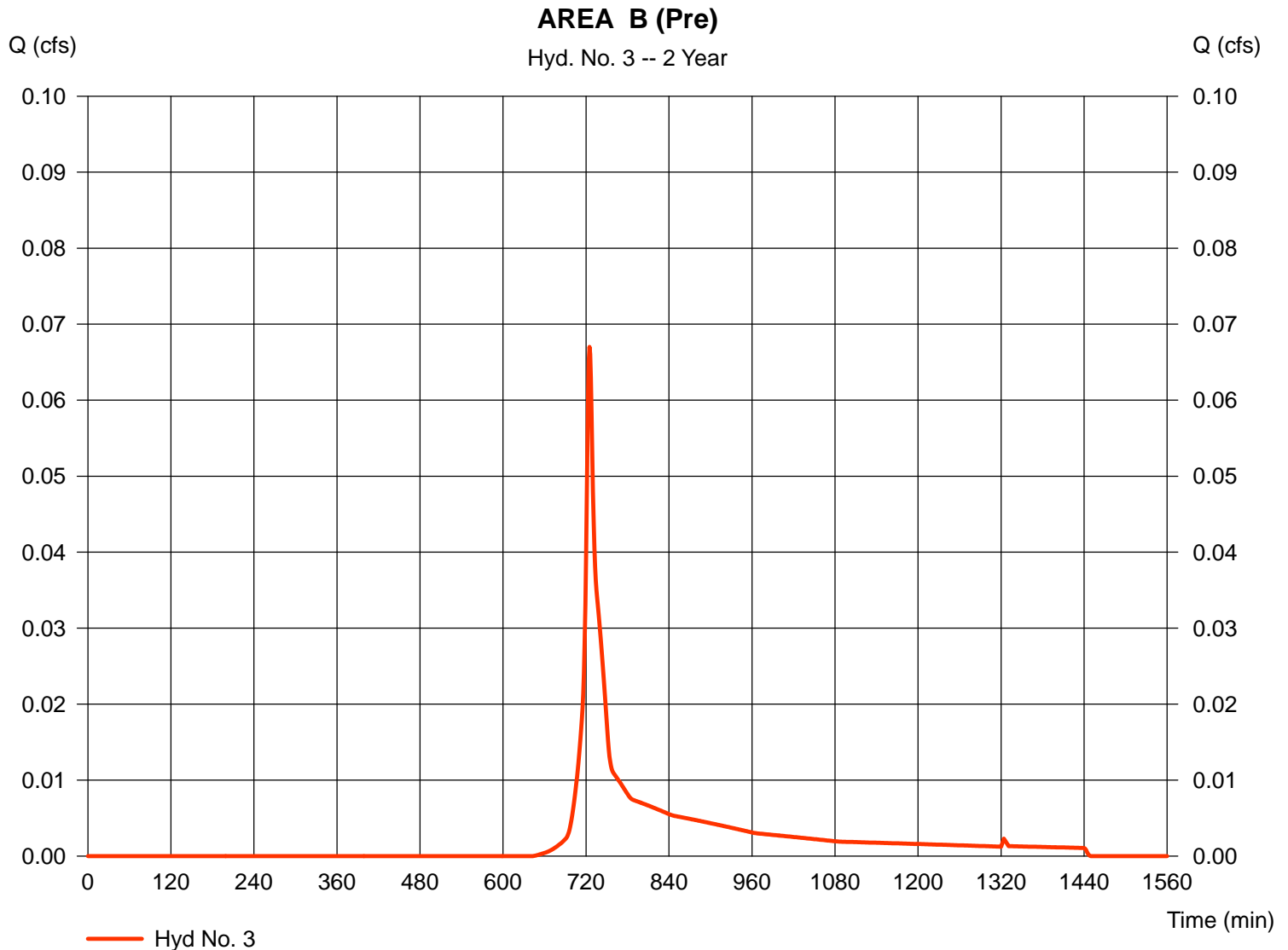
Monday, Mar 9, 2020

## Hyd. No. 3

AREA B (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.060 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.067 cfs  
Time to peak = 725 min  
Hyd. volume = 218 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

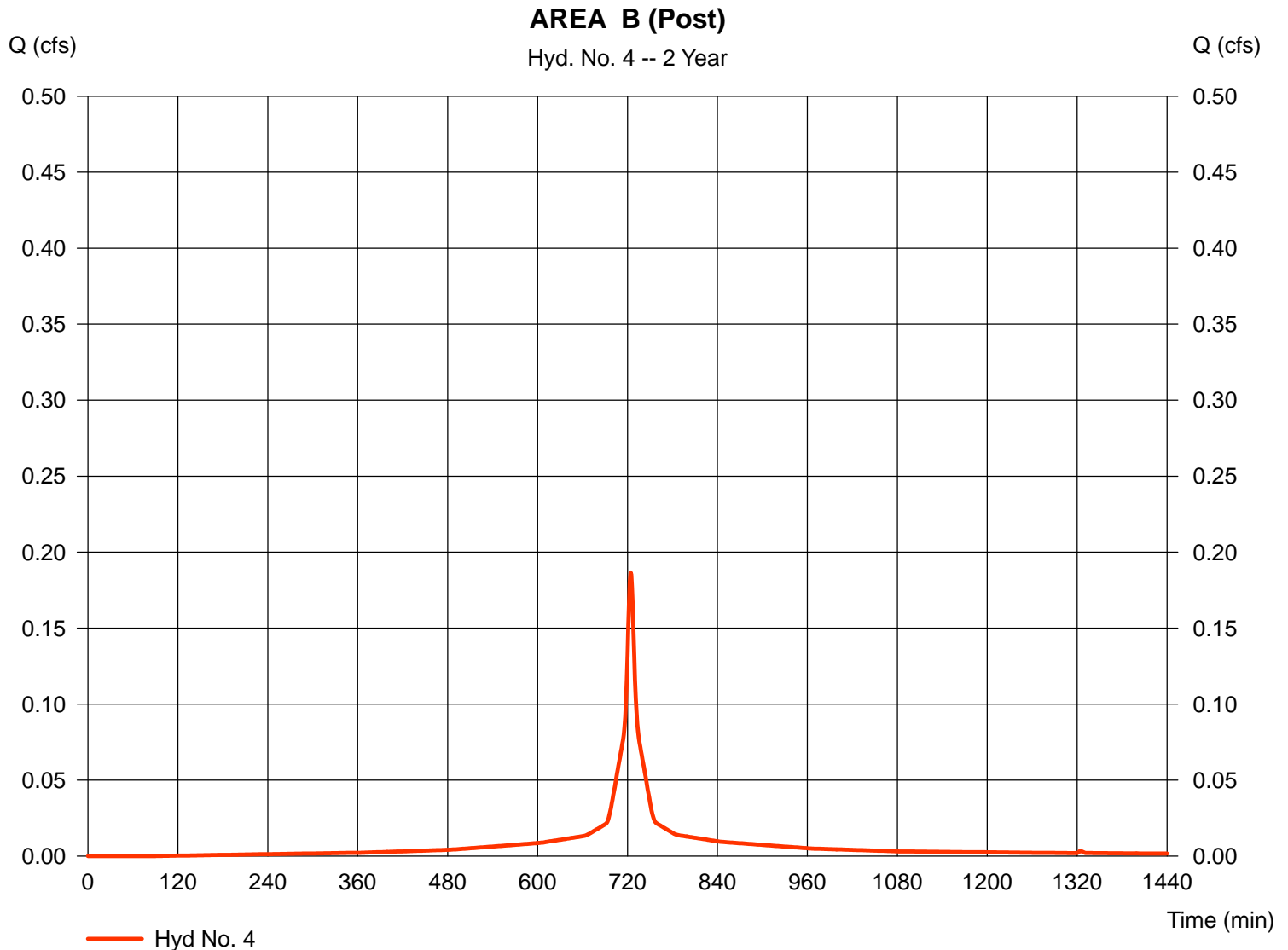
Monday, Mar 9, 2020

## Hyd. No. 4

AREA B (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.060 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.187 cfs  
Time to peak = 724 min  
Hyd. volume = 644 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

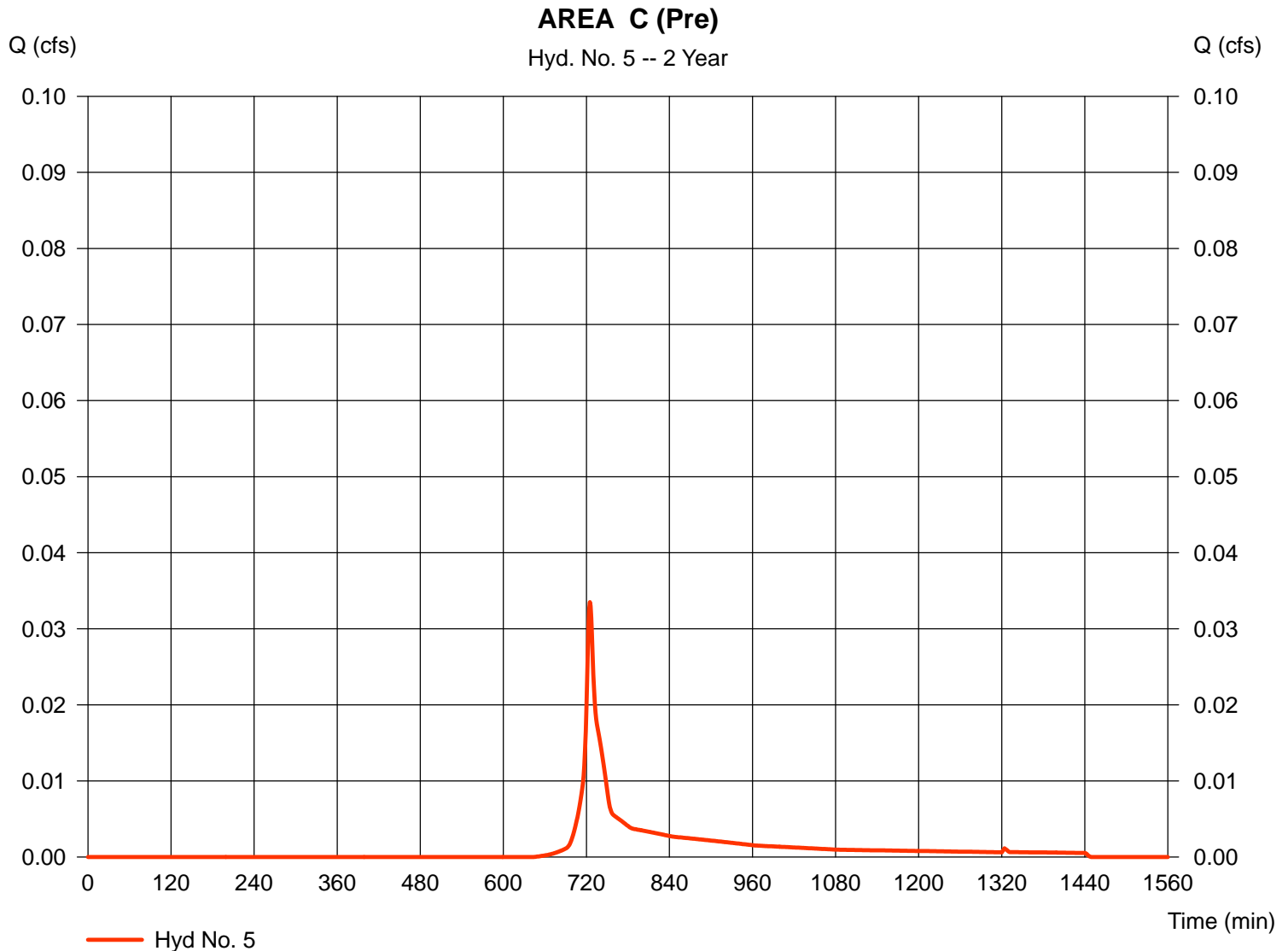
Monday, Mar 9, 2020

## Hyd. No. 5

AREA C (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.030 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.034 cfs  
Time to peak = 725 min  
Hyd. volume = 109 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

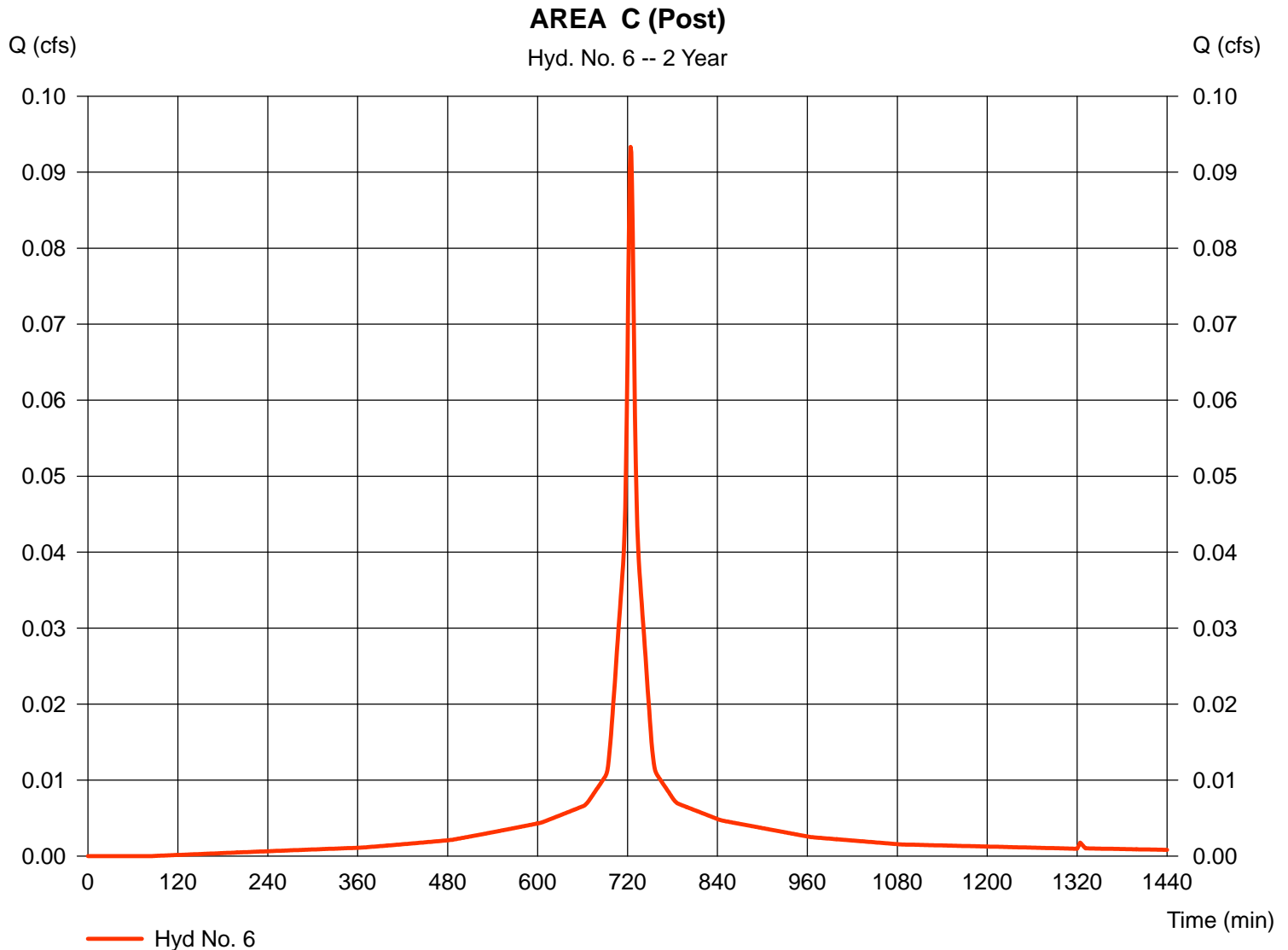
Monday, Mar 9, 2020

## Hyd. No. 6

AREA C (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.030 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.093 cfs  
Time to peak = 724 min  
Hyd. volume = 322 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

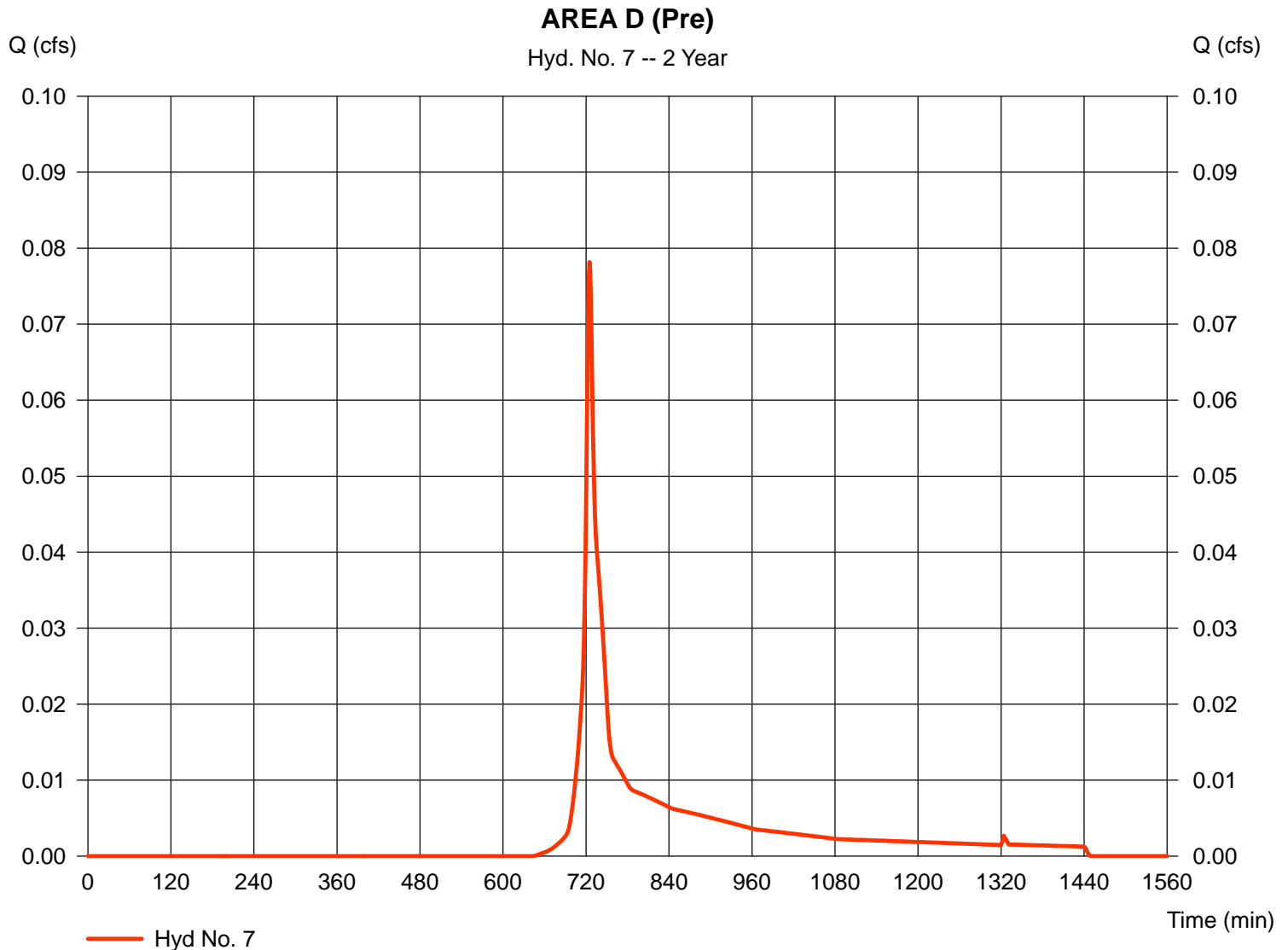
Monday, Mar 9, 2020

## Hyd. No. 7

AREA D (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.070 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.078 cfs  
Time to peak = 725 min  
Hyd. volume = 255 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

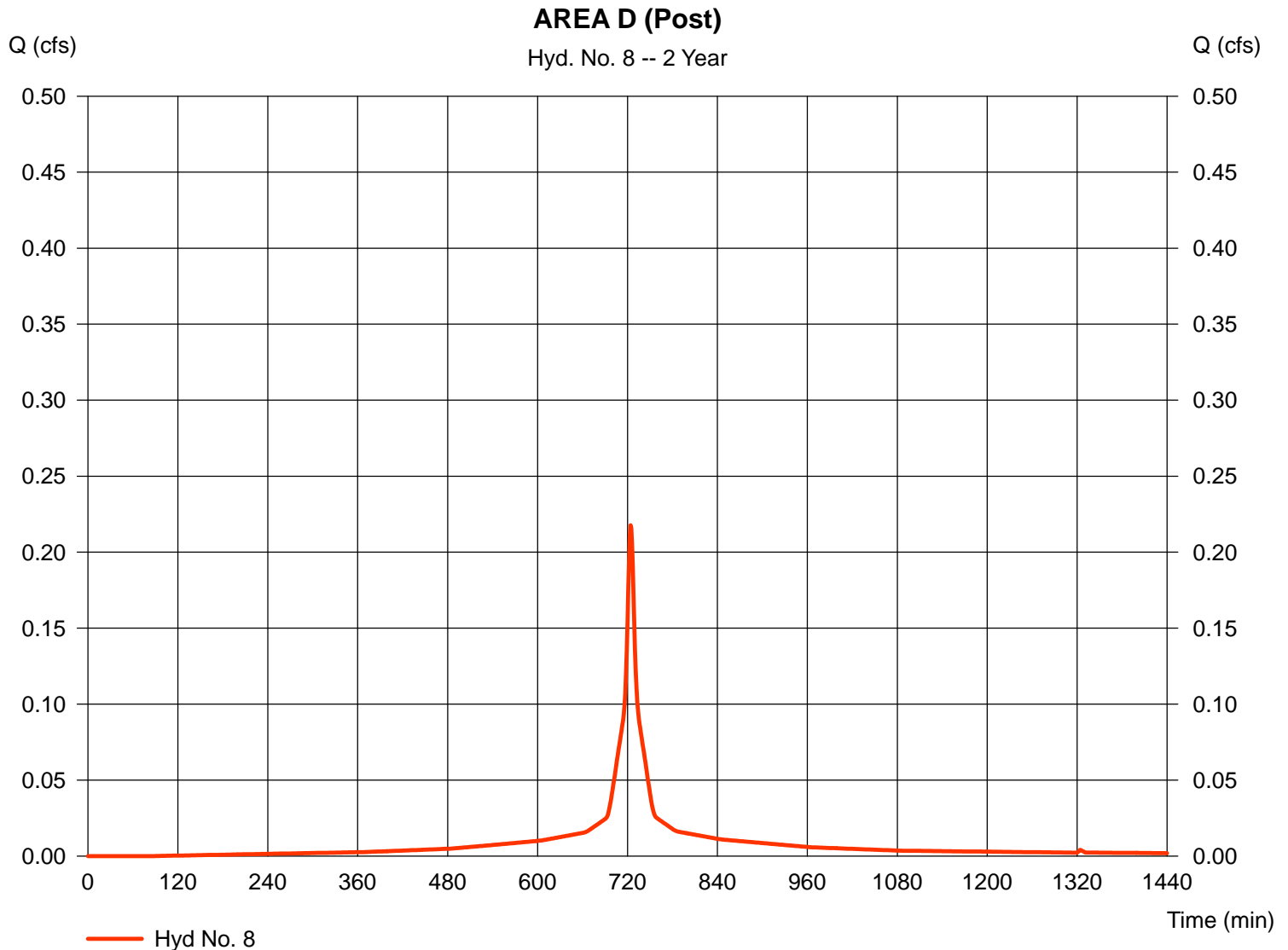
Monday, Mar 9, 2020

## Hyd. No. 8

AREA D (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 2 yrs  
Time interval = 1 min  
Drainage area = 0.070 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 3.10 in  
Storm duration = 24 hrs

Peak discharge = 0.218 cfs  
Time to peak = 724 min  
Hyd. volume = 751 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

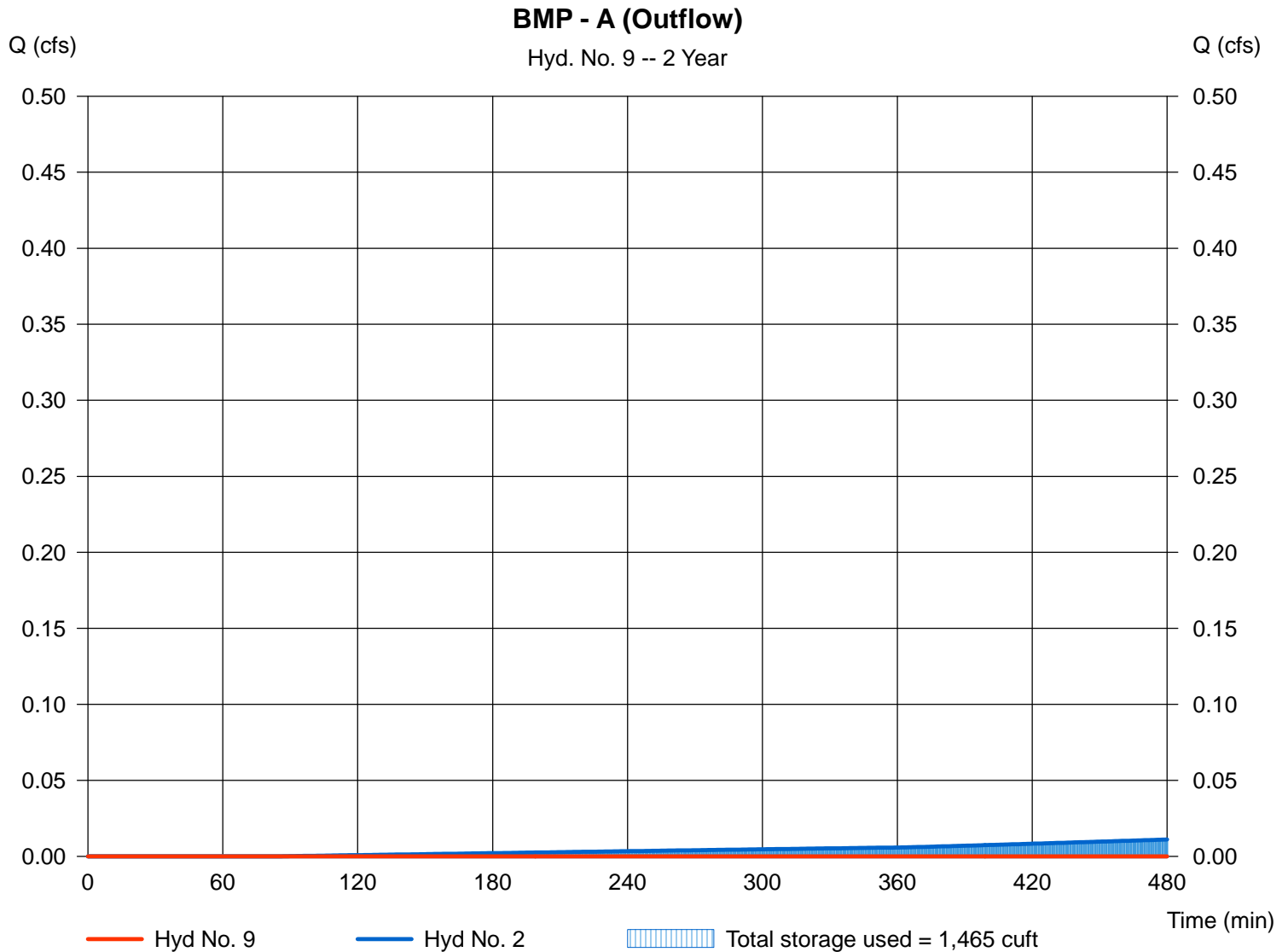
## Hyd. No. 9

### BMP - A (Outflow)

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Time interval = 1 min  
Inflow hyd. No. = 2 - AREA A (Post)  
Reservoir name = BMP - A (Trench)

Peak discharge = 0.000 cfs  
Time to peak = 345 min  
Hyd. volume = 0 cuft  
Max. Elevation = 18.75 ft  
Max. Storage = 1,465 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

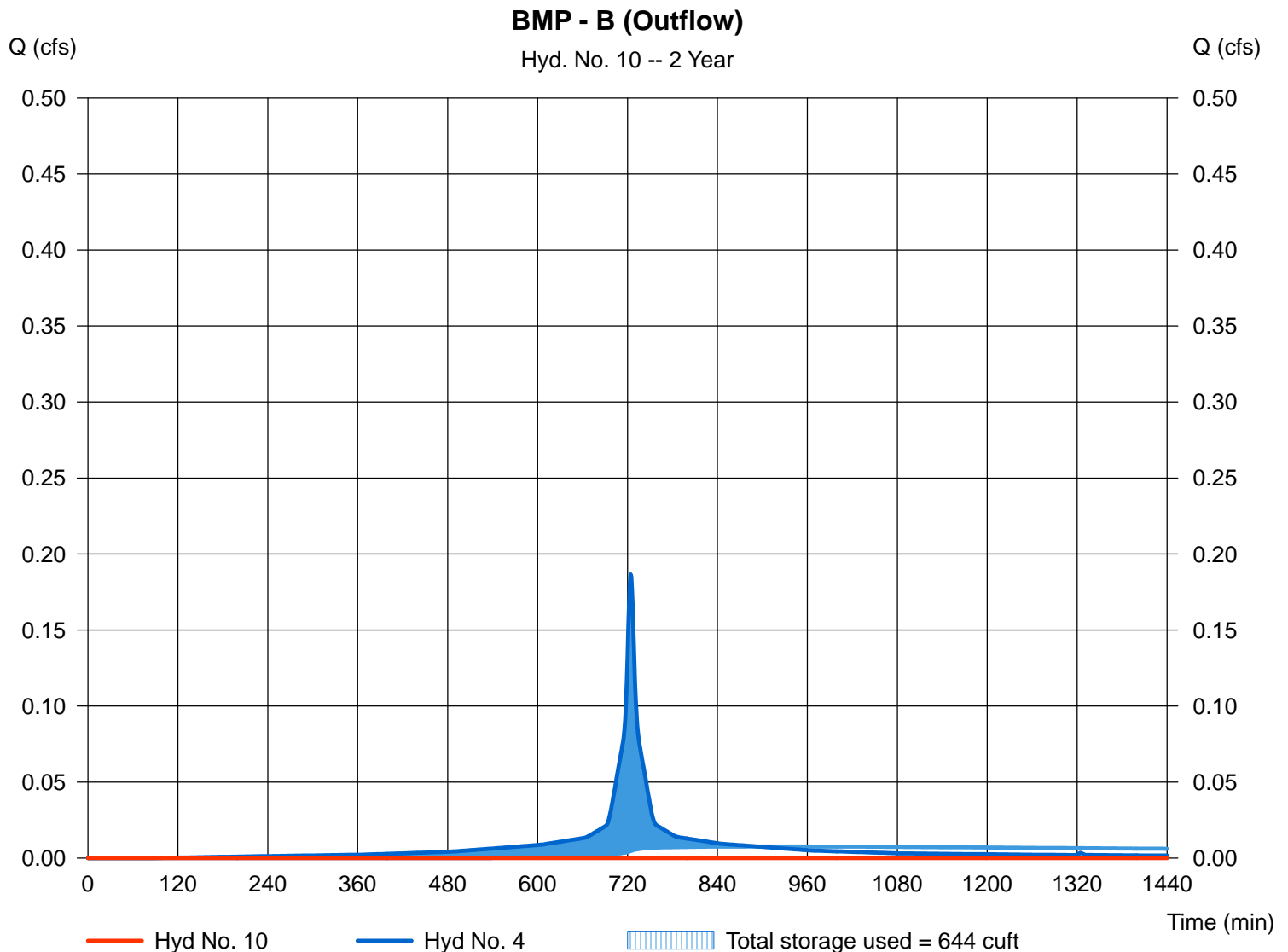
## Hyd. No. 10

BMP - B (Outflow)

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Time interval = 1 min  
Inflow hyd. No. = 4 - AREA B (Post)  
Reservoir name = BMP - B (Trench)

Peak discharge = 0.000 cfs  
Time to peak = n/a  
Hyd. volume = 0 cuft  
Max. Elevation = 18.31 ft  
Max. Storage = 644 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

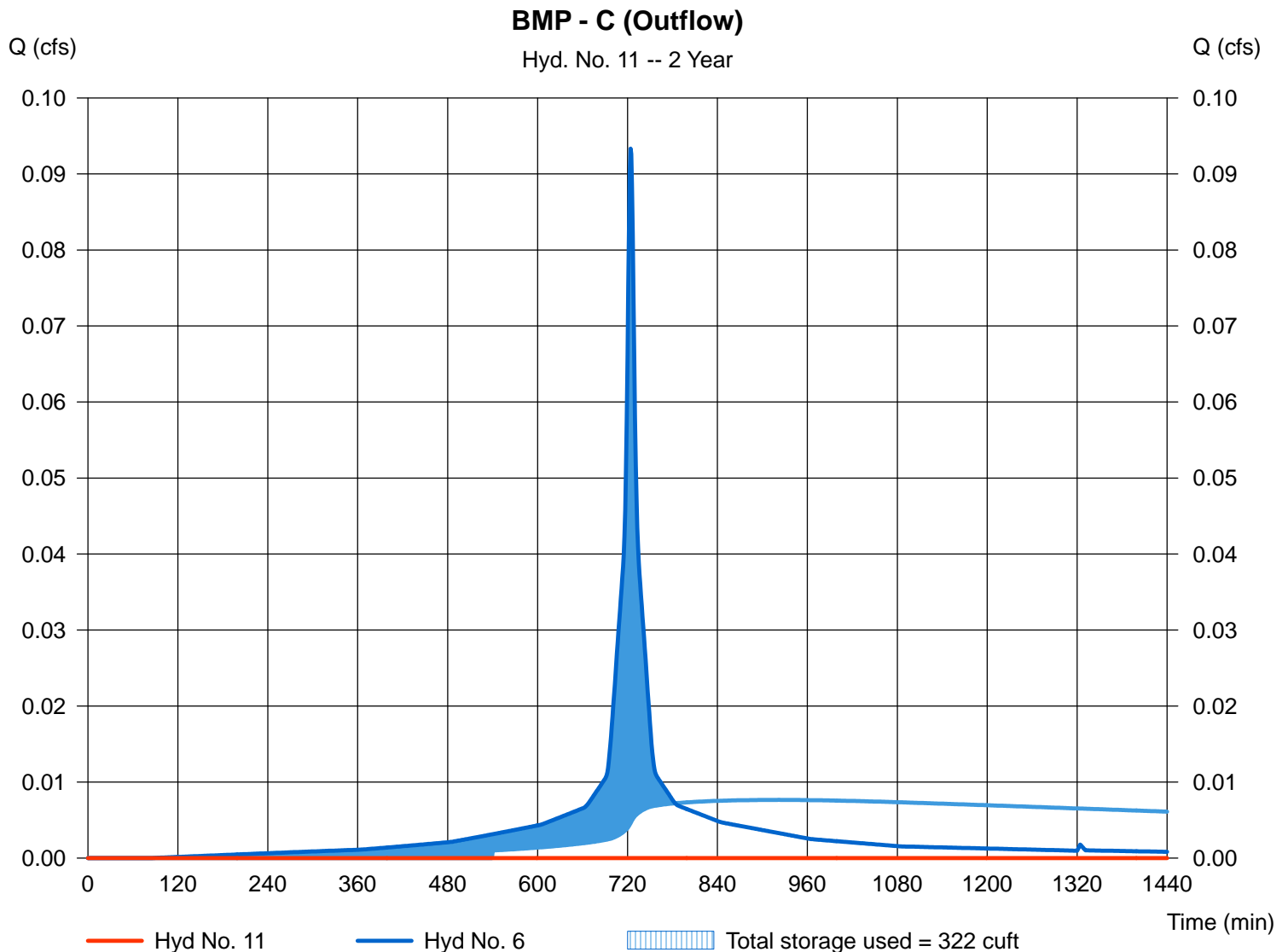
## Hyd. No. 11

BMP - C (Outflow)

Hydrograph type = Reservoir  
Storm frequency = 2 yrs  
Time interval = 1 min  
Inflow hyd. No. = 6 - AREA C (Post)  
Reservoir name = BMP - C (Trench)

Peak discharge = 0.000 cfs  
Time to peak = n/a  
Hyd. volume = 0 cuft  
Max. Elevation = 18.14 ft  
Max. Storage = 322 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

## Hyd. No. 12

BMP - D (Outflow)

Hydrograph type = Reservoir

Storm frequency = 2 yrs

Time interval = 1 min

Inflow hyd. No. = 8 - AREA D (Post)

Reservoir name = BMP - D (SWMA)

Peak discharge = 0.000 cfs

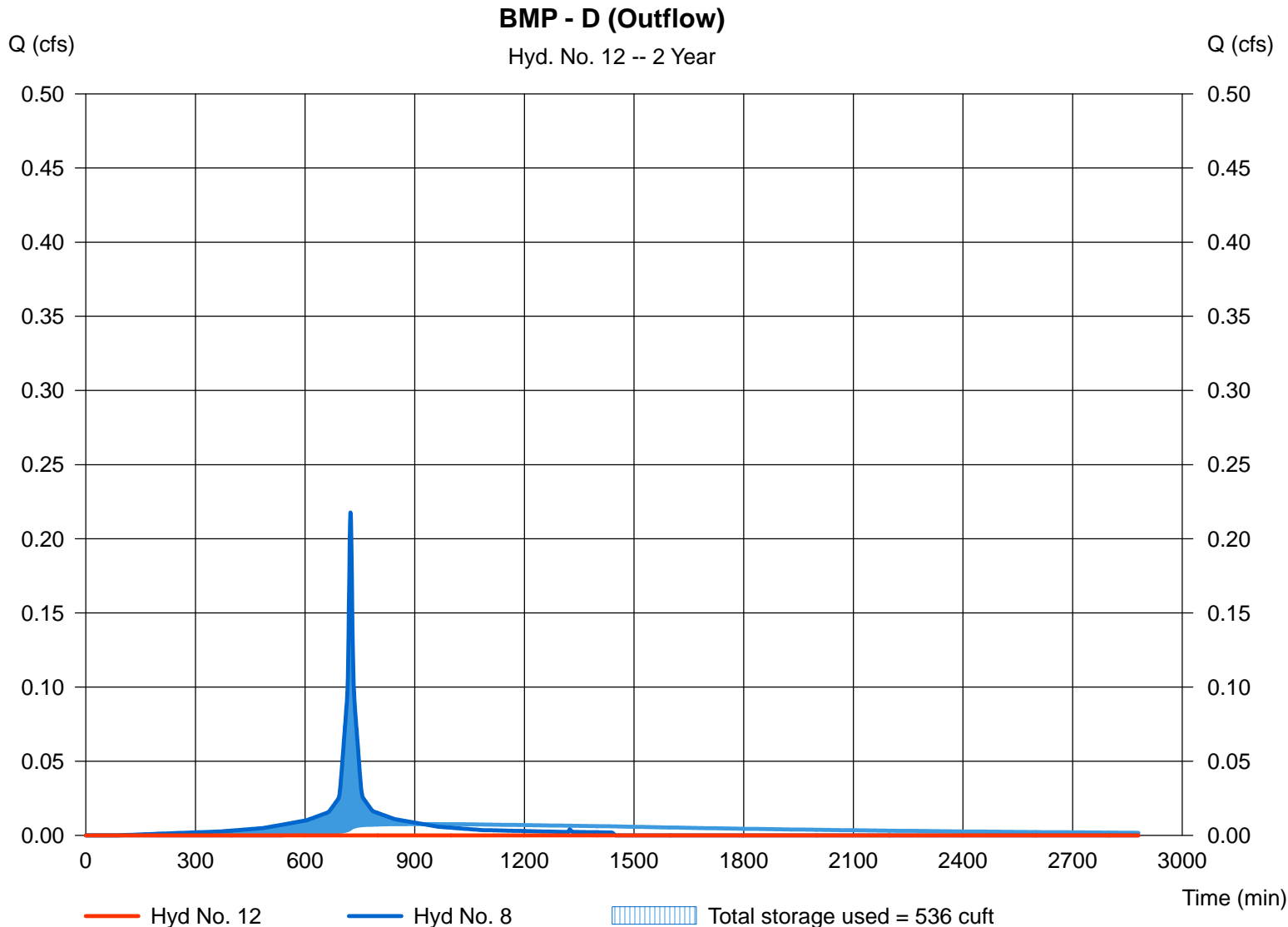
Time to peak = 735 min

Hyd. volume = 0 cuft

Max. Elevation = 16.35 ft

Max. Storage = 536 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	SCS Runoff	0.411	1	725	1,274	----	-----	-----	AREA A (Pre)	
2	SCS Runoff	0.761	1	724	2,674	----	-----	-----	AREA A (Post)	
3	SCS Runoff	0.154	1	725	478	----	-----	-----	AREA B (Pre)	
4	SCS Runoff	0.285	1	724	1,003	----	-----	-----	AREA B (Post)	
5	SCS Runoff	0.077	1	725	239	----	-----	-----	AREA C (Pre)	
6	SCS Runoff	0.143	1	724	501	----	-----	-----	AREA C (Post)	
7	SCS Runoff	0.180	1	725	557	----	-----	-----	AREA D (Pre)	
8	SCS Runoff	0.333	1	724	1,170	----	-----	-----	AREA D (Post)	
9	Reservoir	0.207	1	744	921	2	18.76	1,541	BMP - A (Outflow)	
10	Reservoir	0.000	1	n/a	0	4	18.50	1,003	BMP - B (Outflow)	
11	Reservoir	0.000	1	n/a	0	6	18.23	501	BMP - C (Outflow)	
12	Reservoir	0.000	1	718	0	8	16.53	834	BMP - D (Outflow)	
hydro.gpw					Return Period: 10 Year			Monday, Mar 9, 2020		



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

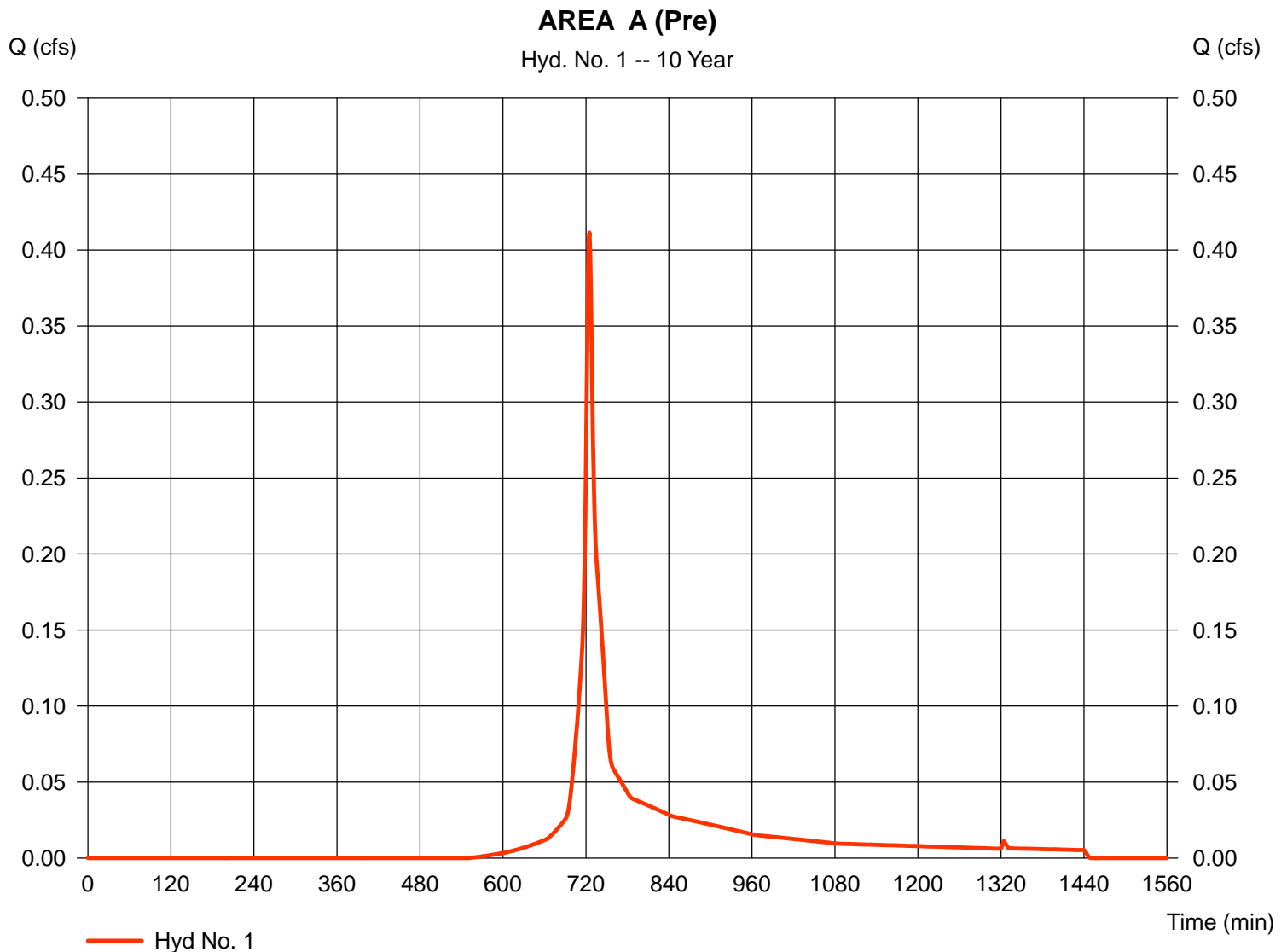
Monday, Mar 9, 2020

## Hyd. No. 1

AREA A (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.160 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.411 cfs  
Time to peak = 725 min  
Hyd. volume = 1,274 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

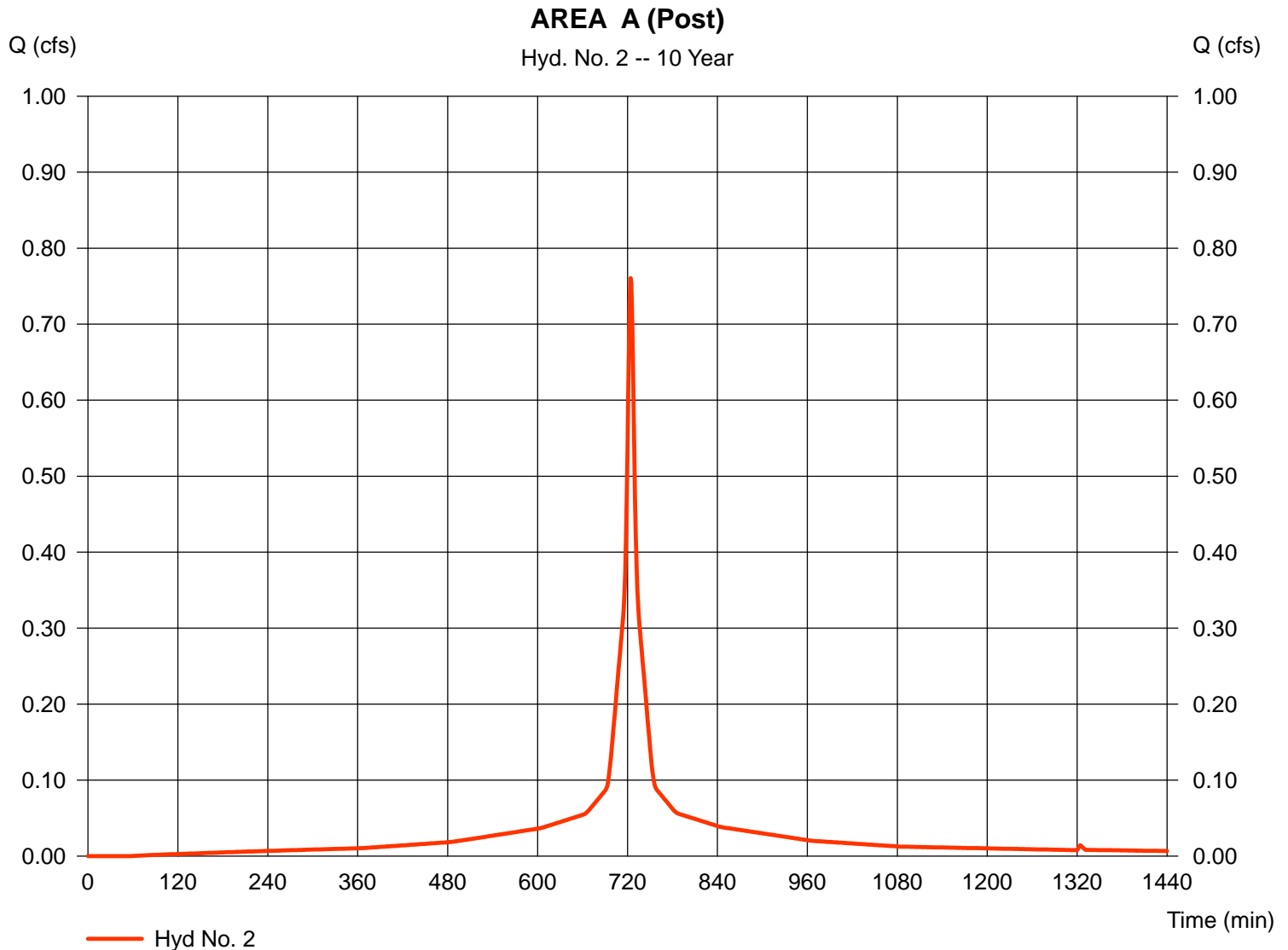
Monday, Mar 9, 2020

## Hyd. No. 2

AREA A (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.160 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.761 cfs  
Time to peak = 724 min  
Hyd. volume = 2,674 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

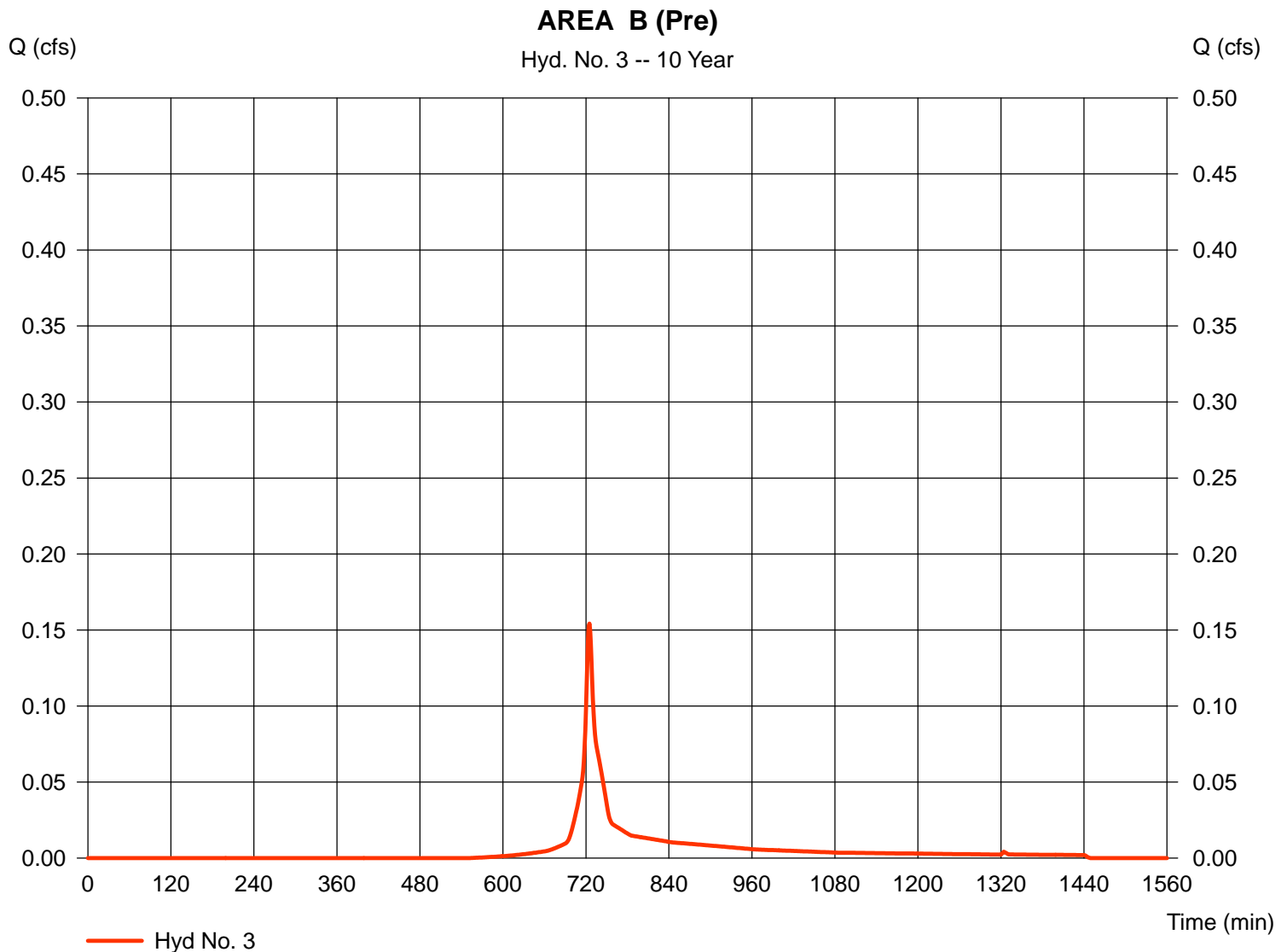
Monday, Mar 9, 2020

## Hyd. No. 3

AREA B (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.060 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.154 cfs  
Time to peak = 725 min  
Hyd. volume = 478 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

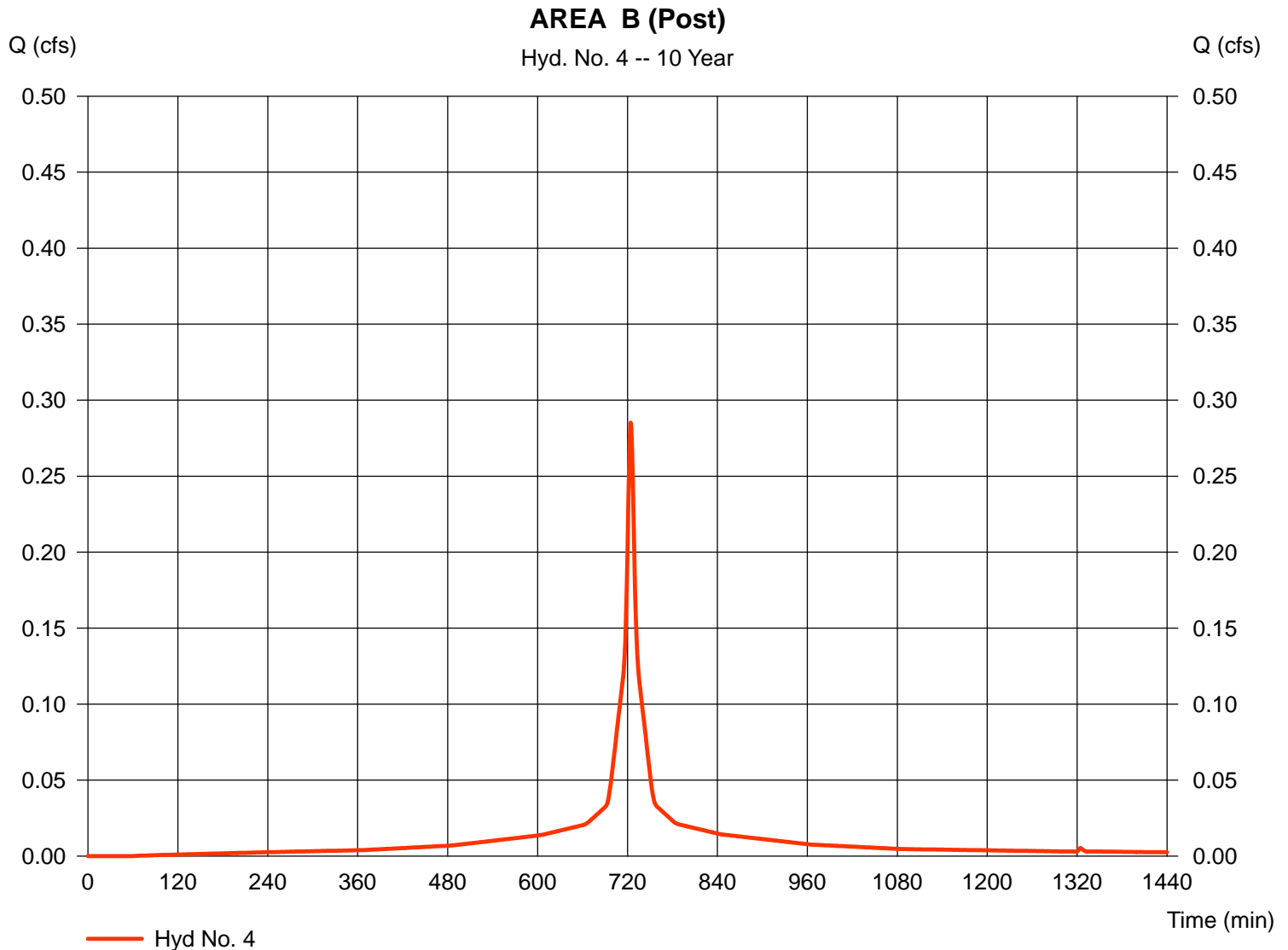
Monday, Mar 9, 2020

## Hyd. No. 4

AREA B (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.060 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.285 cfs  
Time to peak = 724 min  
Hyd. volume = 1,003 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

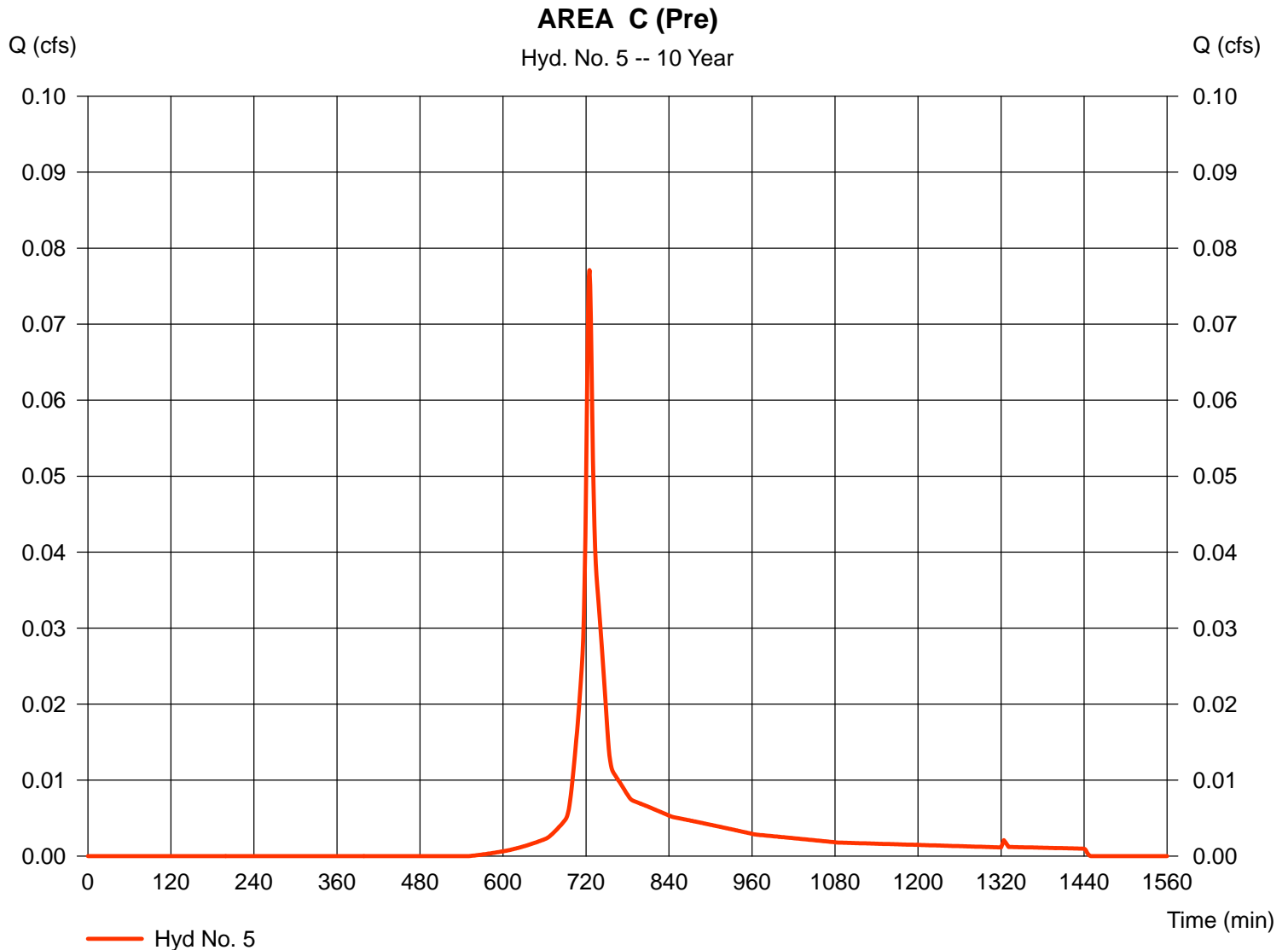
Monday, Mar 9, 2020

## Hyd. No. 5

AREA C (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.030 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.077 cfs  
Time to peak = 725 min  
Hyd. volume = 239 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

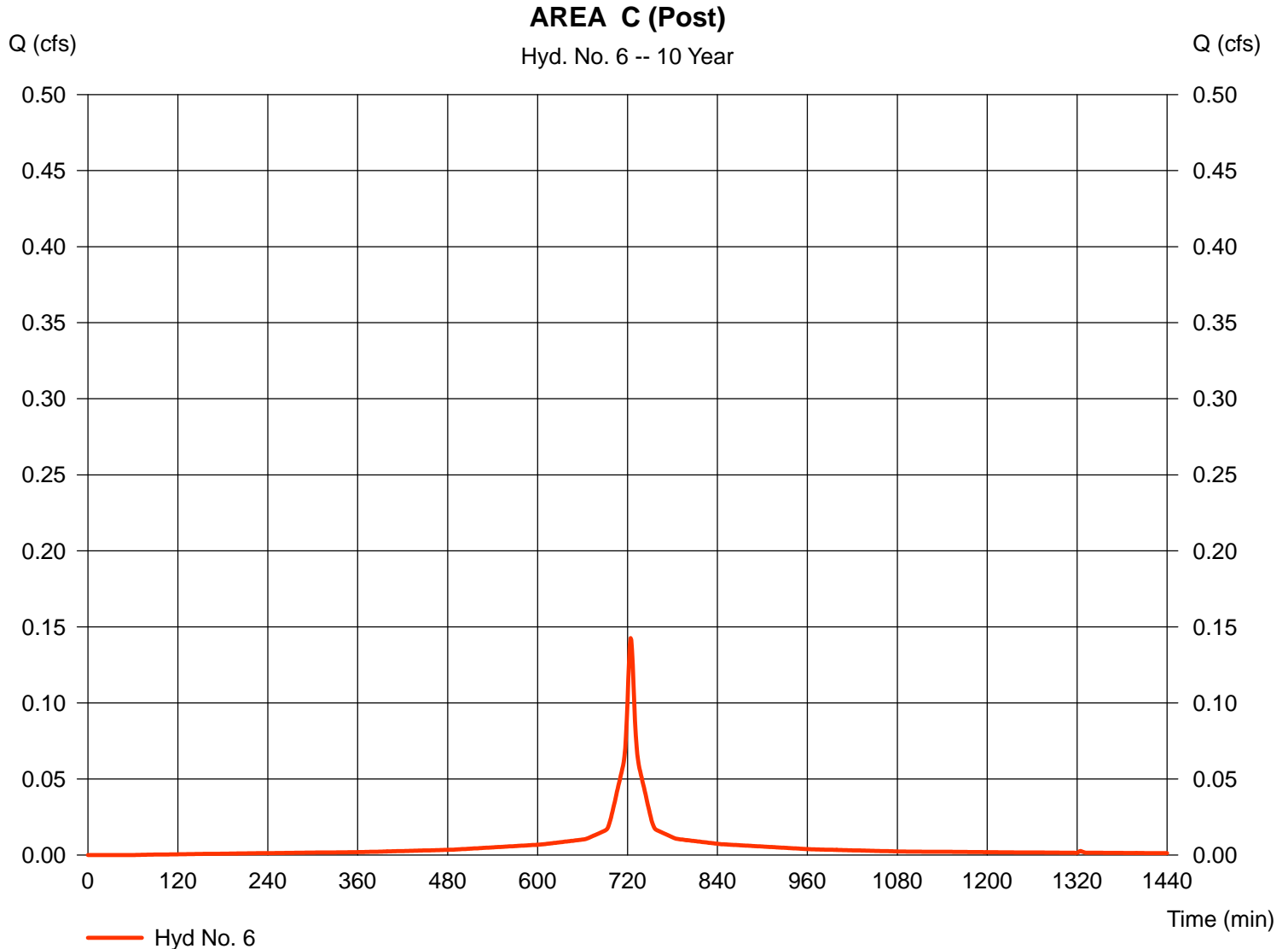
Monday, Mar 9, 2020

## Hyd. No. 6

AREA C (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.030 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.143 cfs  
Time to peak = 724 min  
Hyd. volume = 501 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

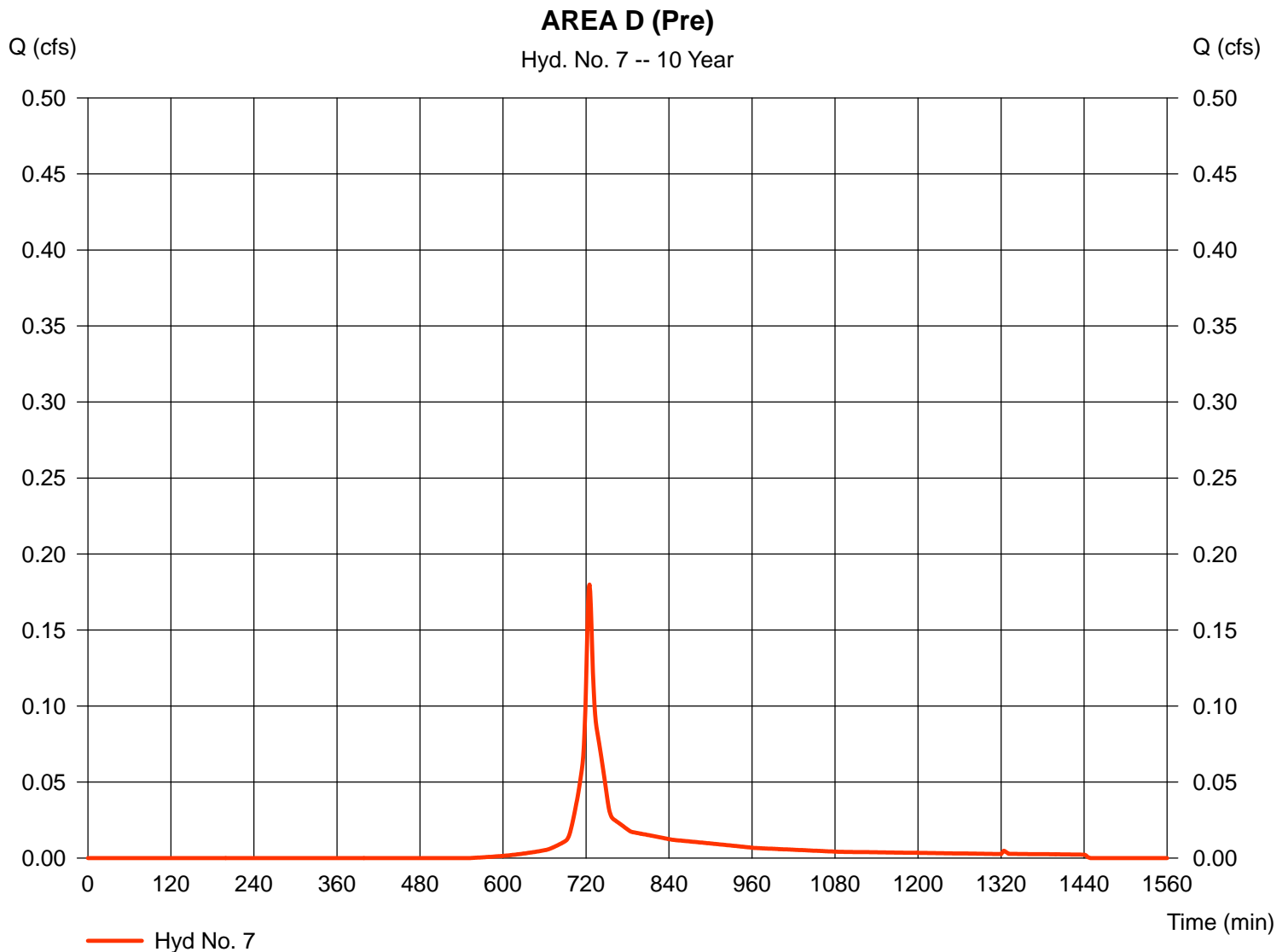
Monday, Mar 9, 2020

## Hyd. No. 7

AREA D (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.070 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.180 cfs  
Time to peak = 725 min  
Hyd. volume = 557 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

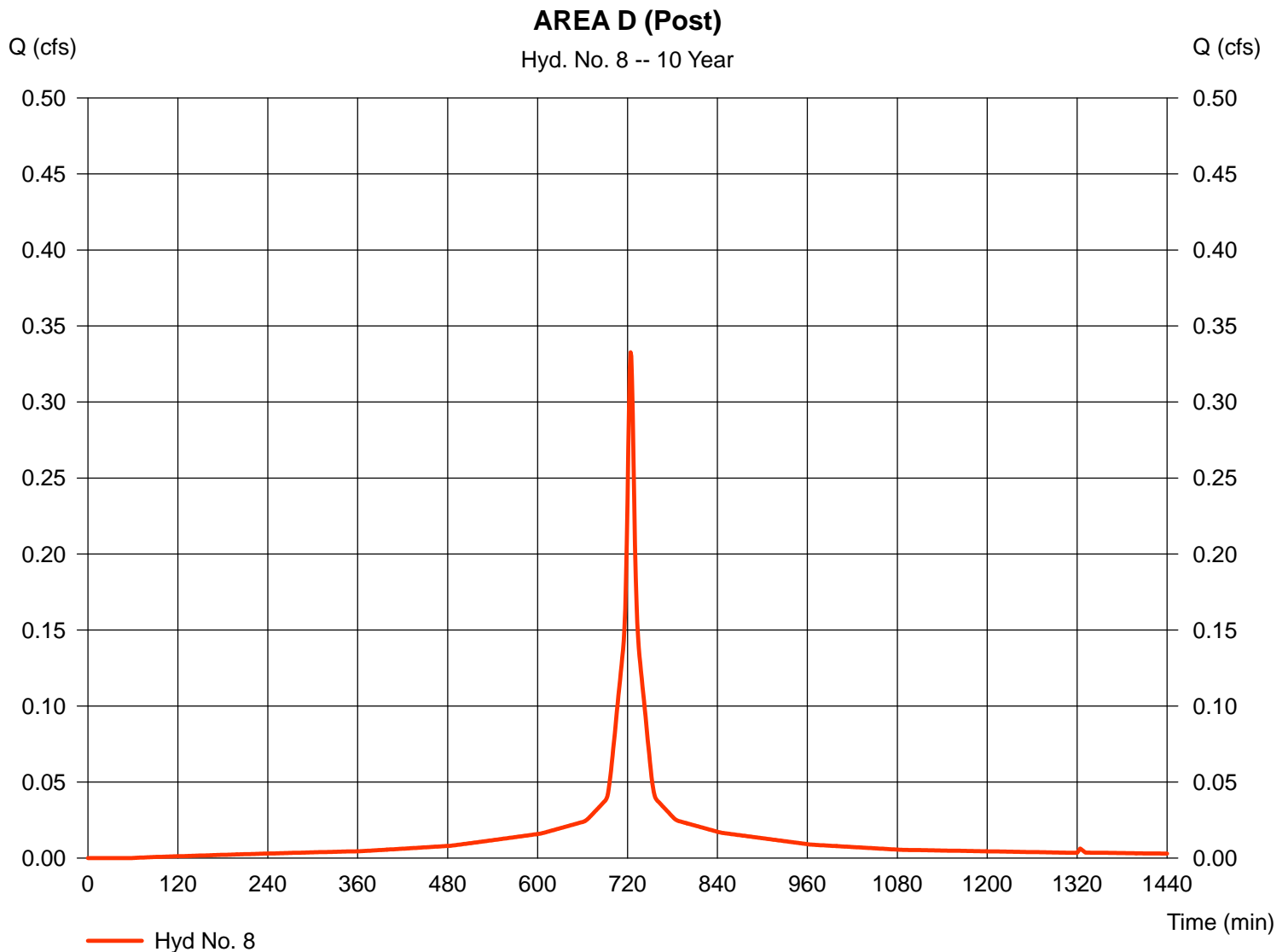
Monday, Mar 9, 2020

## Hyd. No. 8

AREA D (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 10 yrs  
Time interval = 1 min  
Drainage area = 0.070 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 4.70 in  
Storm duration = 24 hrs

Peak discharge = 0.333 cfs  
Time to peak = 724 min  
Hyd. volume = 1,170 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

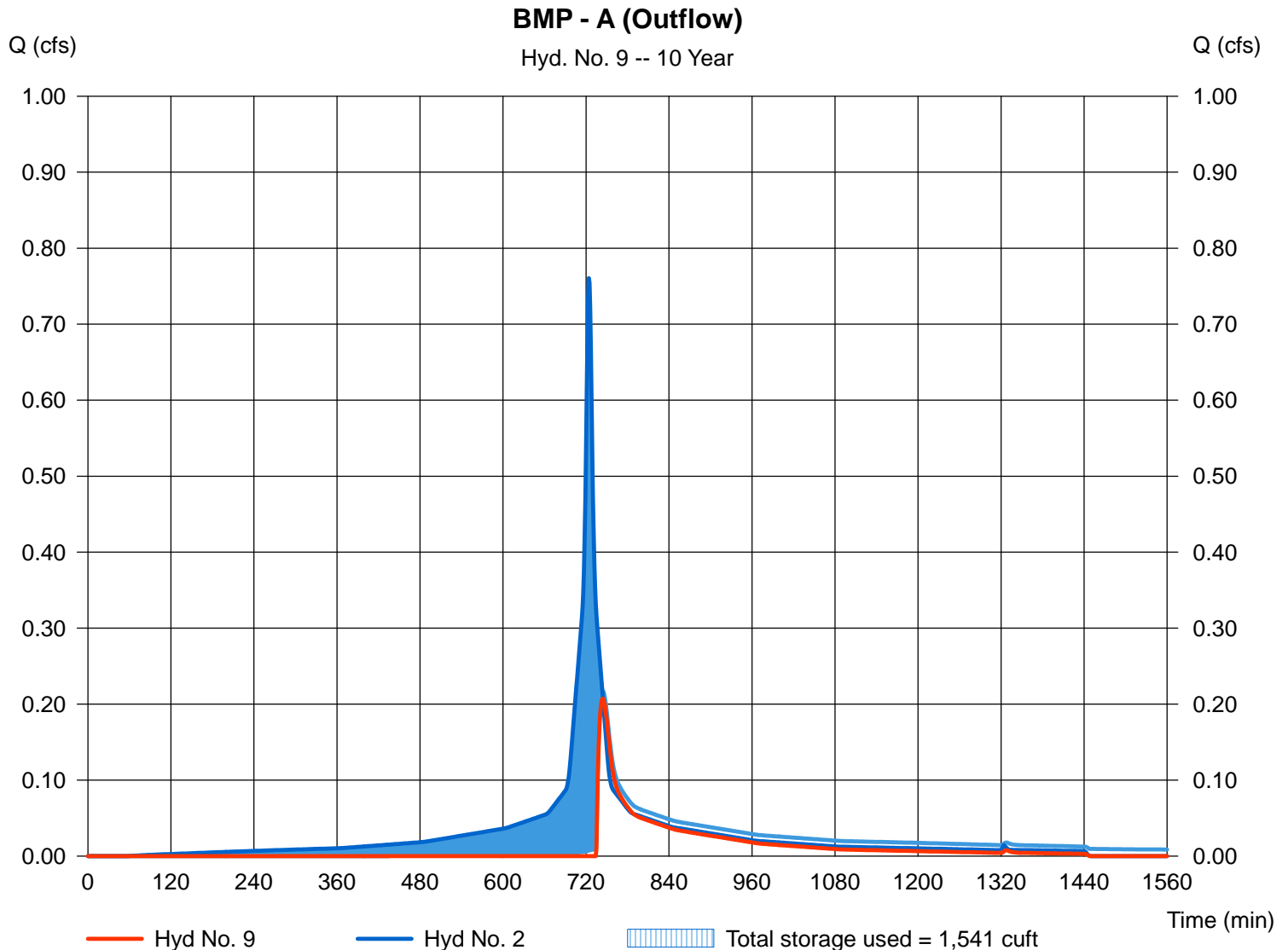
## Hyd. No. 9

BMP - A (Outflow)

Hydrograph type = Reservoir  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyd. No. = 2 - AREA A (Post)  
Reservoir name = BMP - A (Trench)

Peak discharge = 0.207 cfs  
Time to peak = 744 min  
Hyd. volume = 921 cuft  
Max. Elevation = 18.76 ft  
Max. Storage = 1,541 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

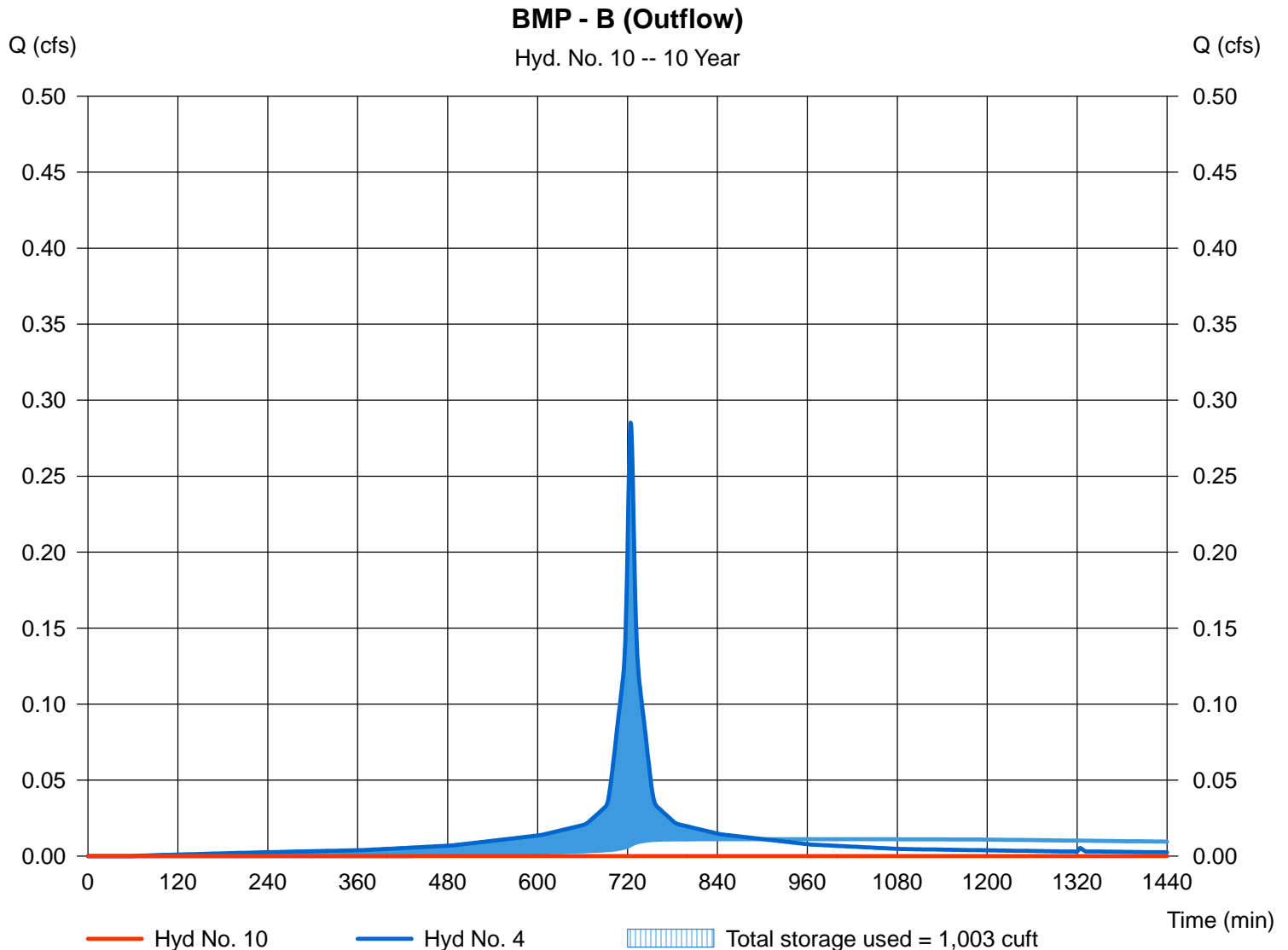
## Hyd. No. 10

BMP - B (Outflow)

Hydrograph type = Reservoir  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyd. No. = 4 - AREA B (Post)  
Reservoir name = BMP - B (Trench)

Peak discharge = 0.000 cfs  
Time to peak = n/a  
Hyd. volume = 0 cuft  
Max. Elevation = 18.50 ft  
Max. Storage = 1,003 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

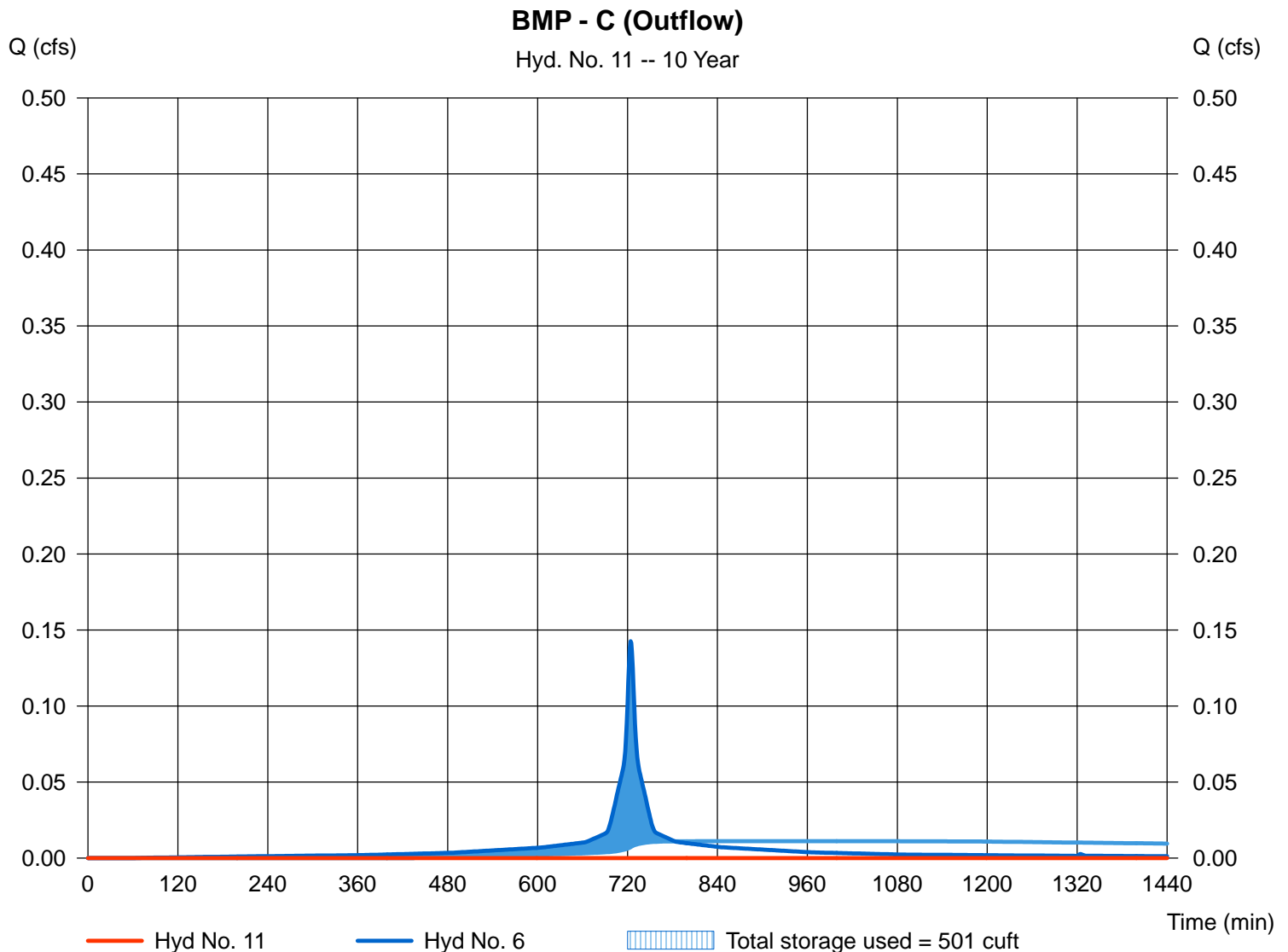
## Hyd. No. 11

BMP - C (Outflow)

Hydrograph type = Reservoir  
Storm frequency = 10 yrs  
Time interval = 1 min  
Inflow hyd. No. = 6 - AREA C (Post)  
Reservoir name = BMP - C (Trench)

Peak discharge = 0.000 cfs  
Time to peak = n/a  
Hyd. volume = 0 cuft  
Max. Elevation = 18.23 ft  
Max. Storage = 501 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

## Hyd. No. 12

BMP - D (Outflow)

Hydrograph type = Reservoir

Storm frequency = 10 yrs

Time interval = 1 min

Inflow hyd. No. = 8 - AREA D (Post)

Reservoir name = BMP - D (SWMA)

Peak discharge = 0.000 cfs

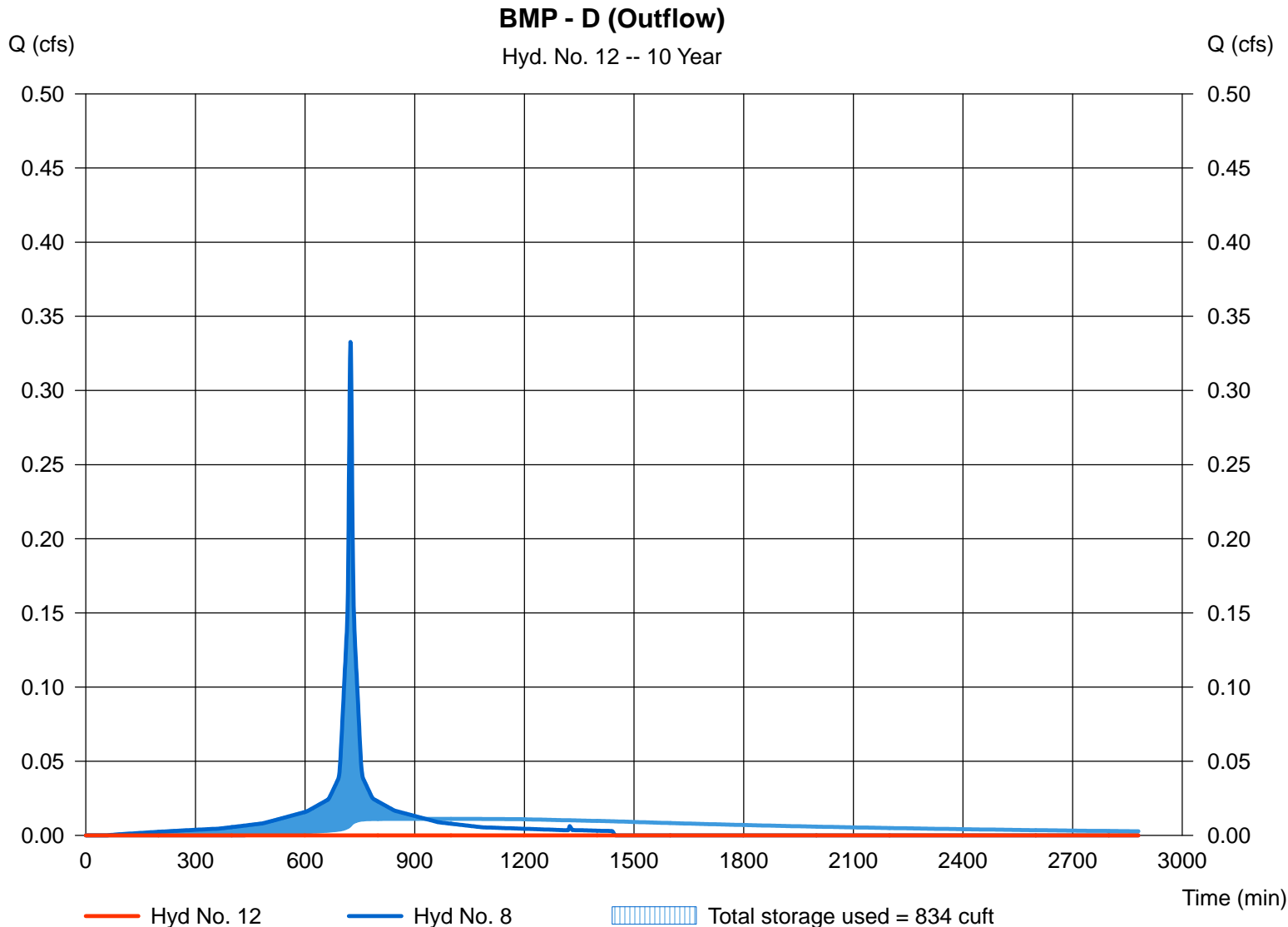
Time to peak = 718 min

Hyd. volume = 0 cuft

Max. Elevation = 16.53 ft

Max. Storage = 834 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.2

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	SCS Runoff	0.587	1	725	1,807	----	-----	-----	AREA A (Pre)	
2	SCS Runoff	0.941	1	724	3,331	----	-----	-----	AREA A (Post)	
3	SCS Runoff	0.220	1	725	678	----	-----	-----	AREA B (Pre)	
4	SCS Runoff	0.353	1	724	1,249	----	-----	-----	AREA B (Post)	
5	SCS Runoff	0.110	1	725	339	----	-----	-----	AREA C (Pre)	
6	SCS Runoff	0.176	1	724	625	----	-----	-----	AREA C (Post)	
7	SCS Runoff	0.257	1	725	791	----	-----	-----	AREA D (Pre)	
8	SCS Runoff	0.412	1	724	1,457	----	-----	-----	AREA D (Post)	
9	Reservoir	0.512	1	731	1,569	2	18.77	1,632	BMP - A (Outflow)	
10	Reservoir	0.000	1	n/a	0	4	18.64	1,249	BMP - B (Outflow)	
11	Reservoir	0.000	1	n/a	0	6	18.30	625	BMP - C (Outflow)	
12	Reservoir	0.000	1	706	0	8	16.65	1,060	BMP - D (Outflow)	
hydro.gpw					Return Period: 25 Year			Monday, Mar 9, 2020		

# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

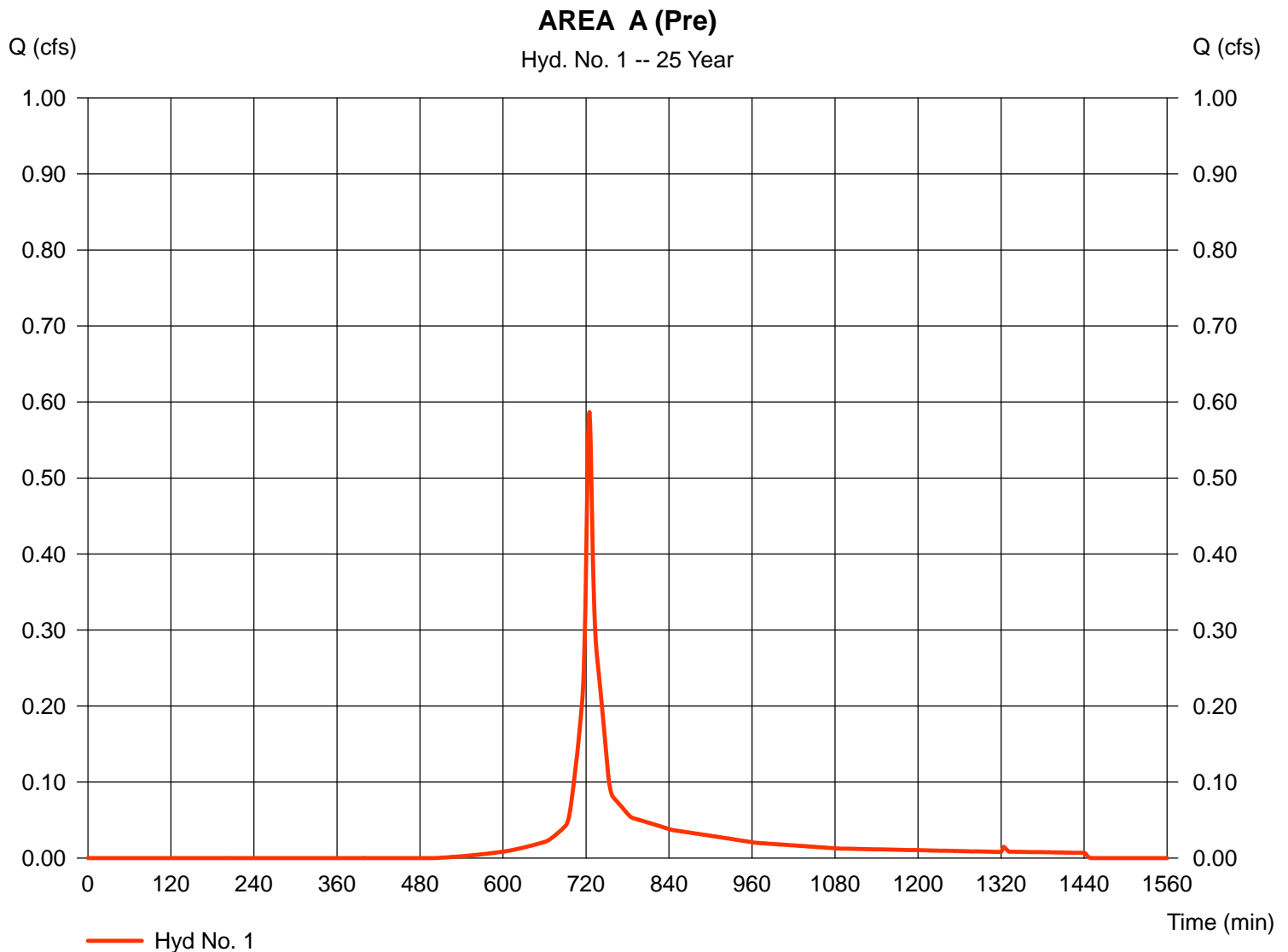
Monday, Mar 9, 2020

## Hyd. No. 1

AREA A (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.160 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.587 cfs  
Time to peak = 725 min  
Hyd. volume = 1,807 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

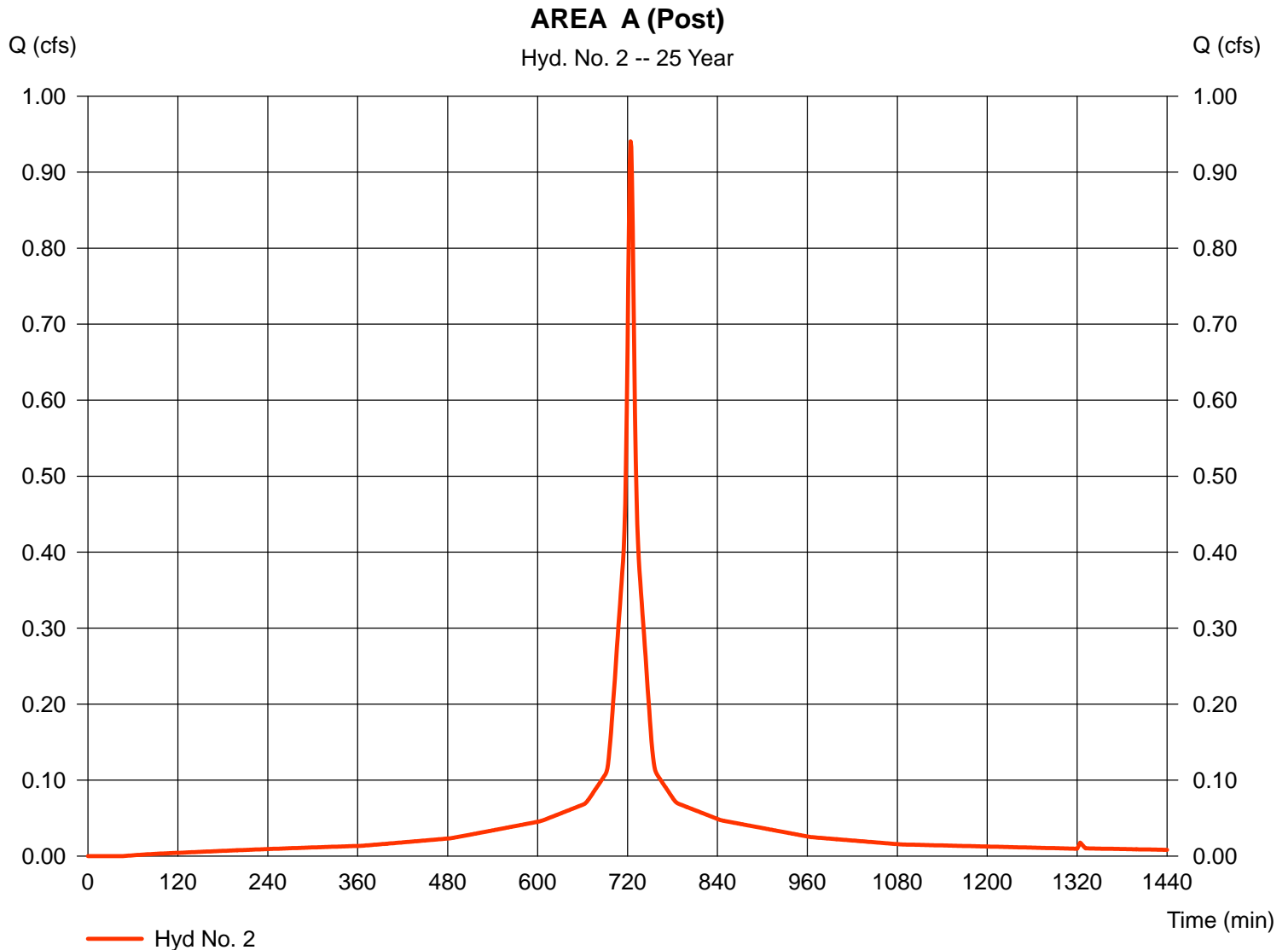
Monday, Mar 9, 2020

## Hyd. No. 2

AREA A (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.160 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.941 cfs  
Time to peak = 724 min  
Hyd. volume = 3,331 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

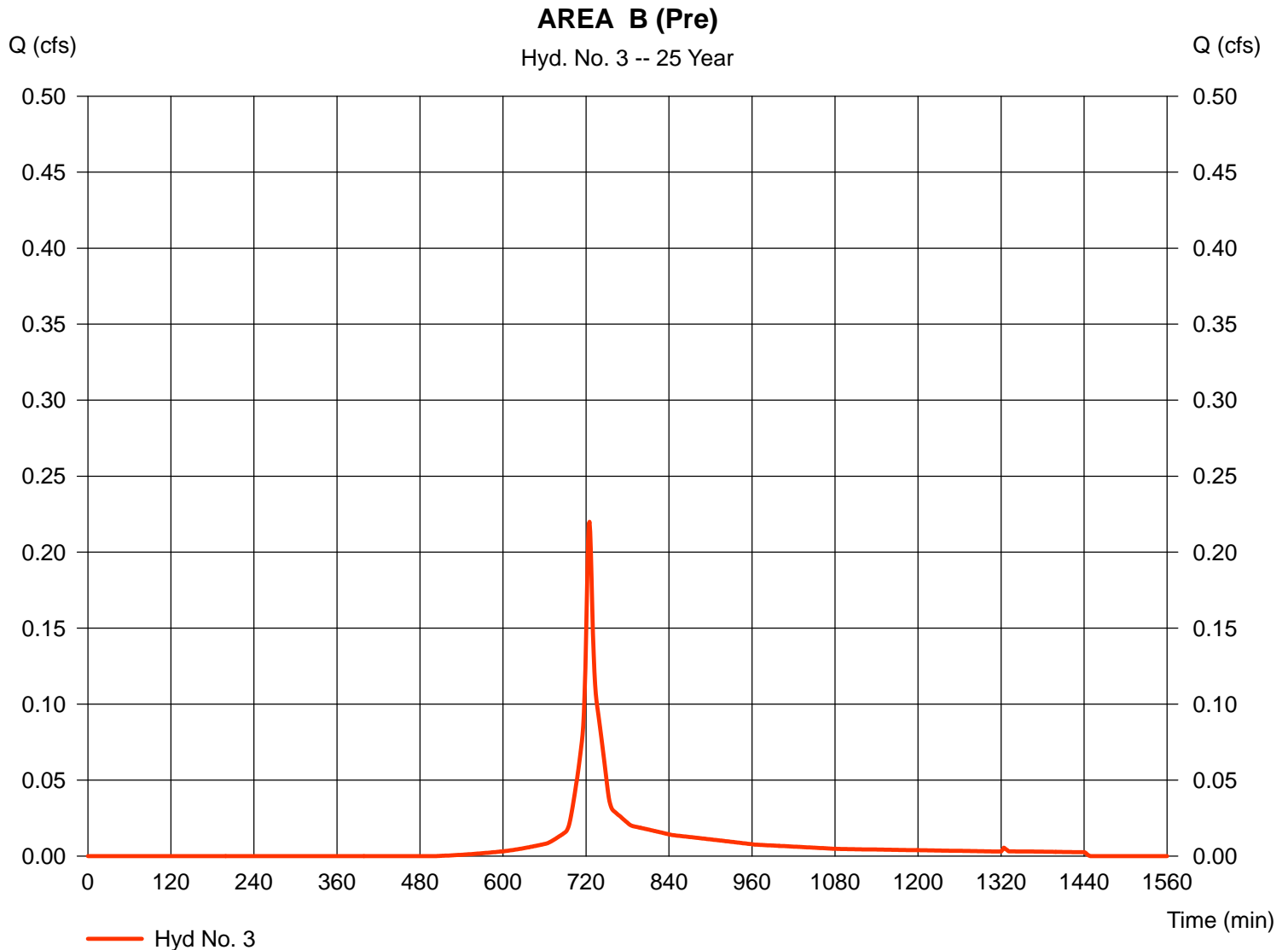
Monday, Mar 9, 2020

## Hyd. No. 3

AREA B (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.060 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.220 cfs  
Time to peak = 725 min  
Hyd. volume = 678 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484





# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

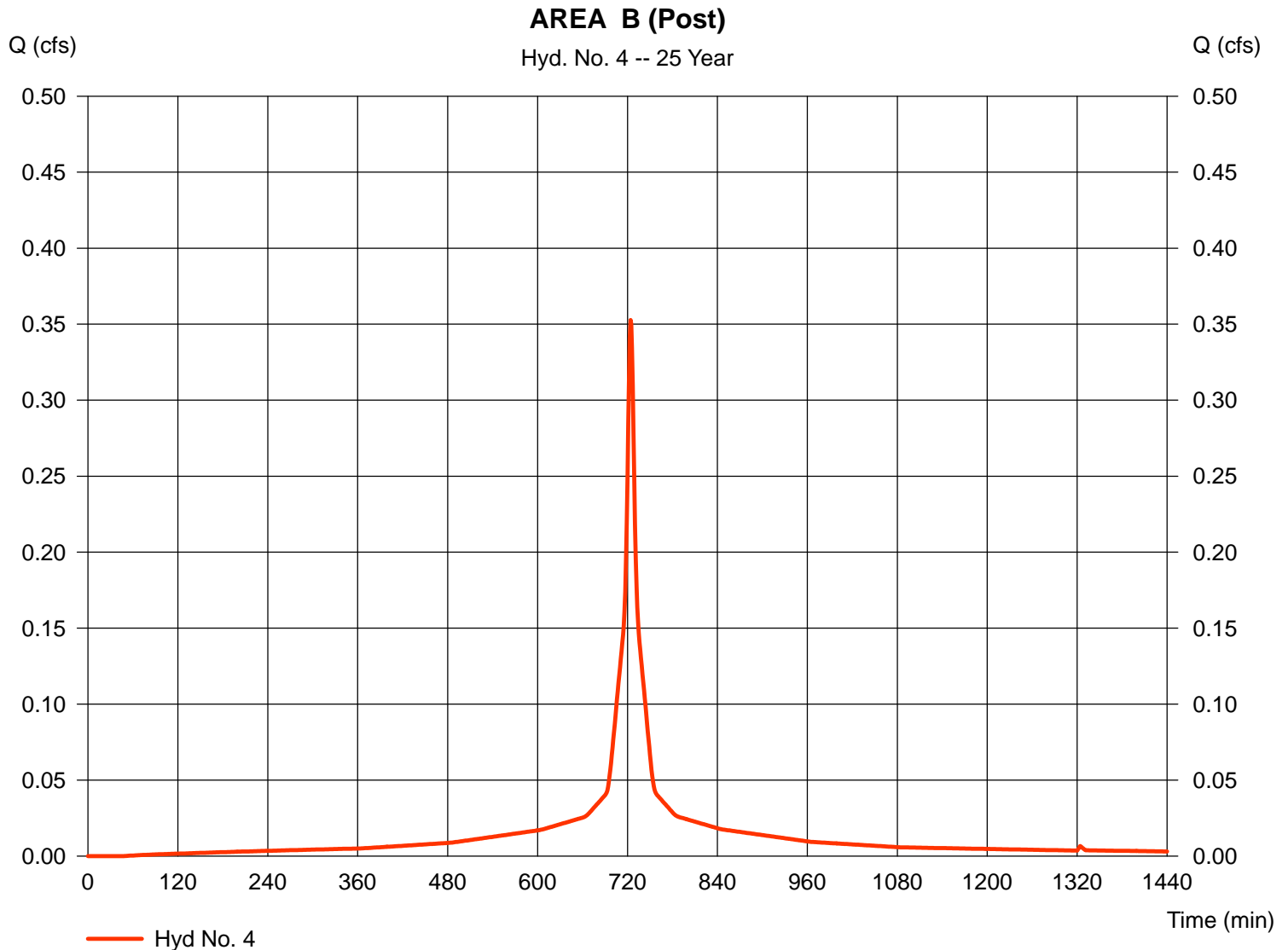
Monday, Mar 9, 2020

## Hyd. No. 4

AREA B (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.060 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.353 cfs  
Time to peak = 724 min  
Hyd. volume = 1,249 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

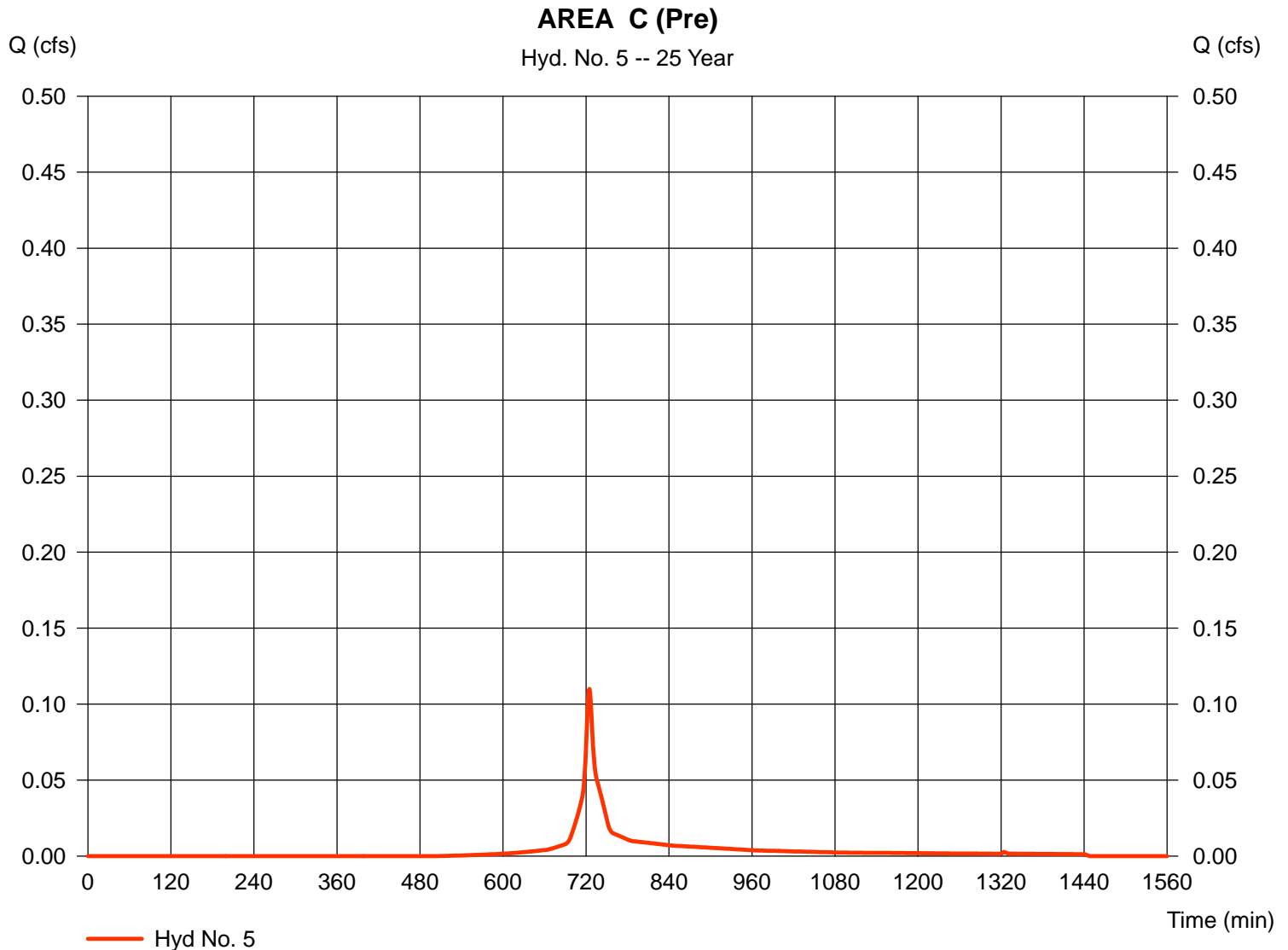
Monday, Mar 9, 2020

## Hyd. No. 5

AREA C (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.030 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.110 cfs  
Time to peak = 725 min  
Hyd. volume = 339 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

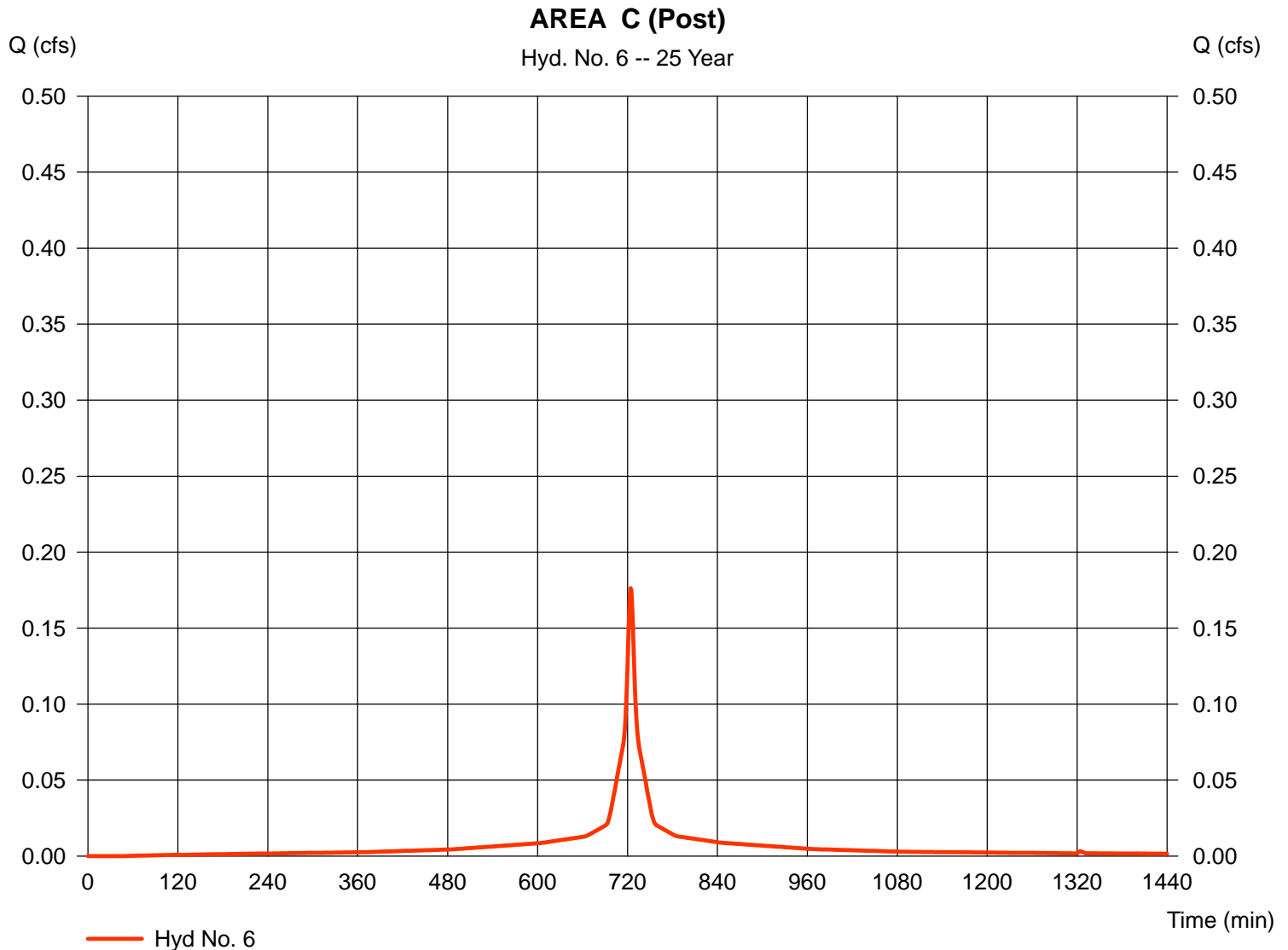
Monday, Mar 9, 2020

## Hyd. No. 6

AREA C (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.030 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.176 cfs  
Time to peak = 724 min  
Hyd. volume = 625 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

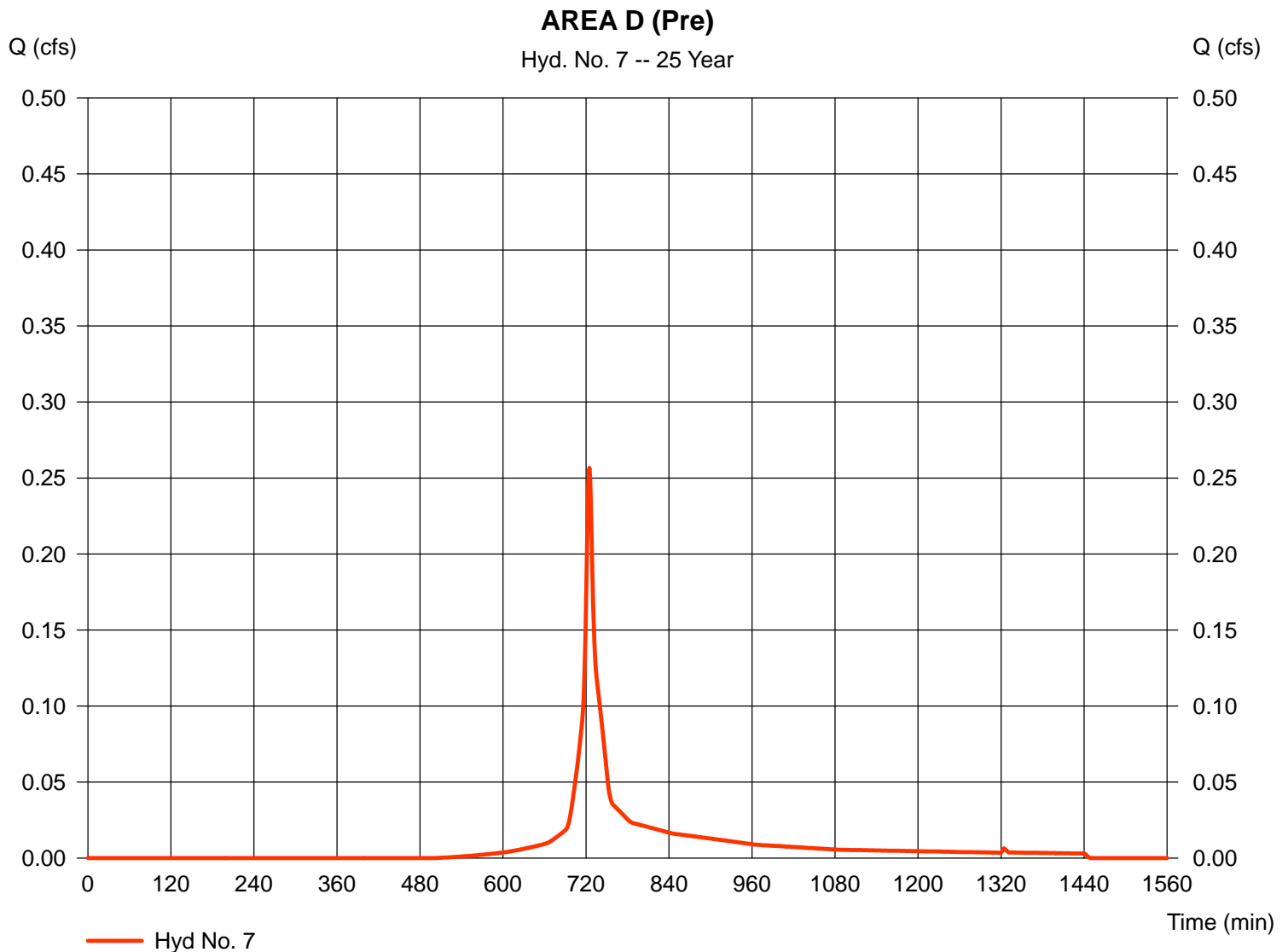
Monday, Mar 9, 2020

## Hyd. No. 7

AREA D (Pre)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.070 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.257 cfs  
Time to peak = 725 min  
Hyd. volume = 791 cuft  
Curve number = 74  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

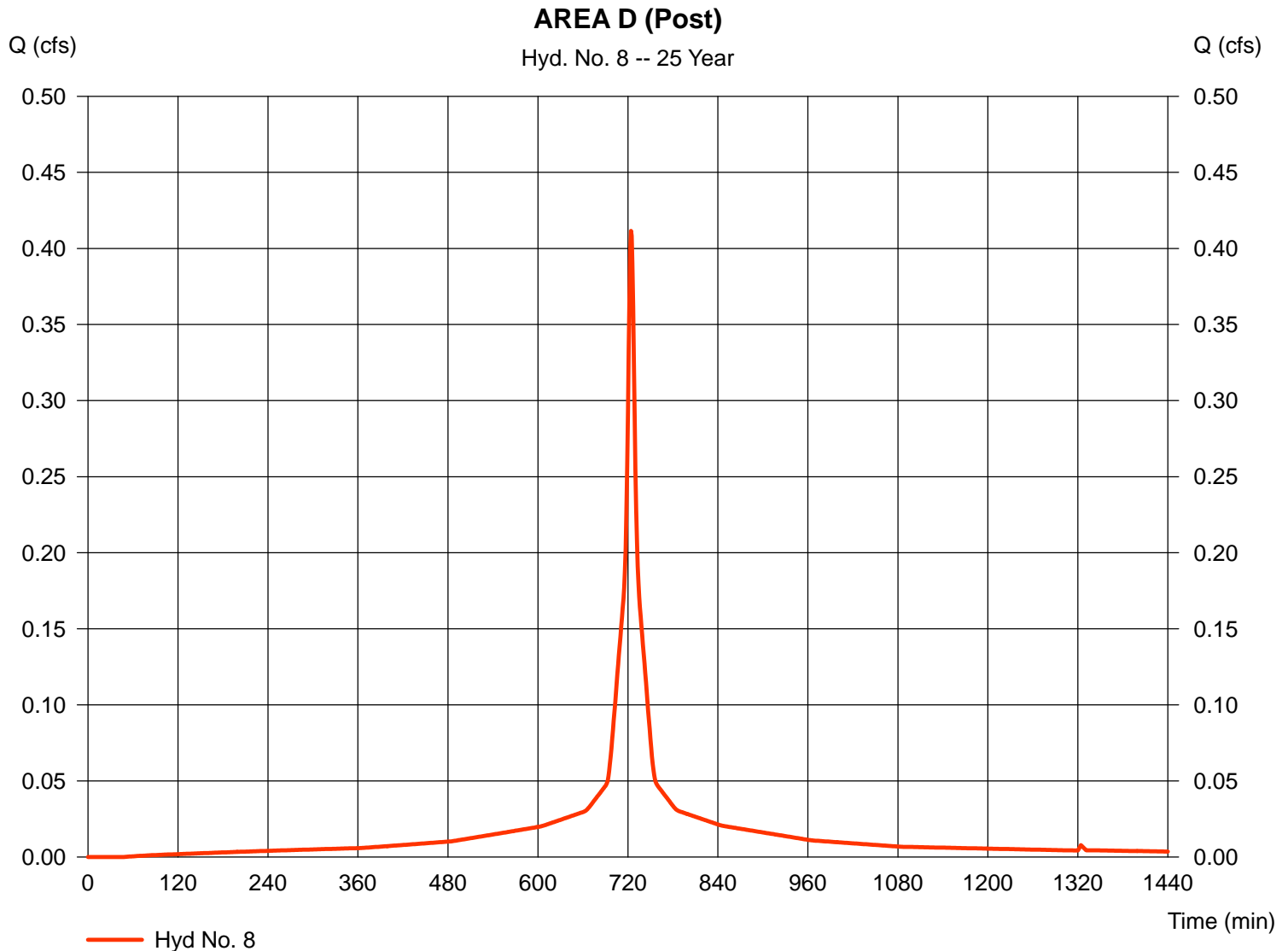
Monday, Mar 9, 2020

## Hyd. No. 8

AREA D (Post)

Hydrograph type = SCS Runoff  
Storm frequency = 25 yrs  
Time interval = 1 min  
Drainage area = 0.070 ac  
Basin Slope = 0.0 %  
Tc method = USER  
Total precip. = 5.80 in  
Storm duration = 24 hrs

Peak discharge = 0.412 cfs  
Time to peak = 724 min  
Hyd. volume = 1,457 cuft  
Curve number = 98  
Hydraulic length = 0 ft  
Time of conc. (Tc) = 6.00 min  
Distribution = Type III  
Shape factor = 484



# Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Monday, Mar 9, 2020

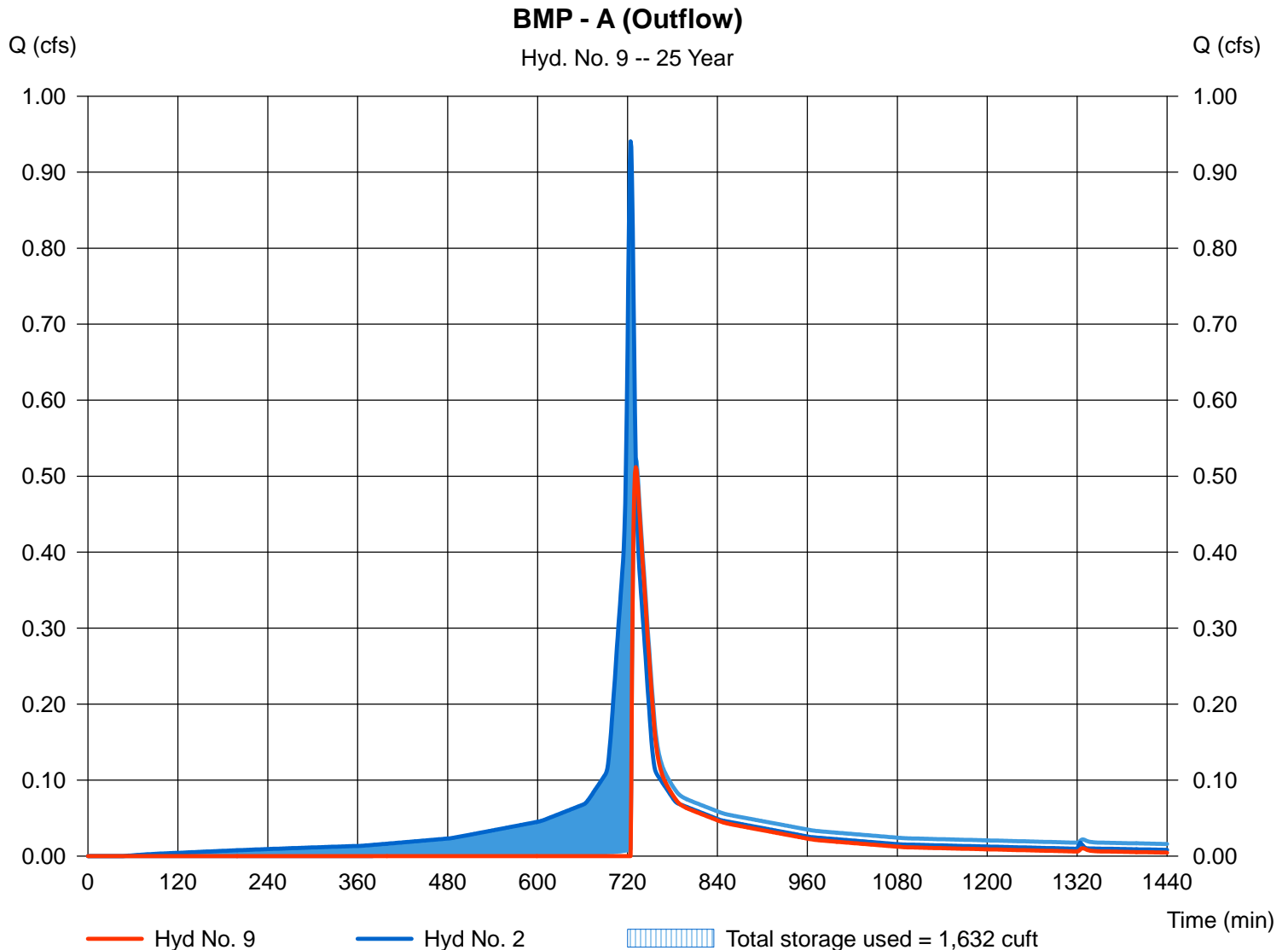
## Hyd. No. 9

BMP - A (Outflow)

Hydrograph type = Reservoir  
Storm frequency = 25 yrs  
Time interval = 1 min  
Inflow hyd. No. = 2 - AREA A (Post)  
Reservoir name = BMP - A (Trench)

Peak discharge = 0.512 cfs  
Time to peak = 731 min  
Hyd. volume = 1,569 cuft  
Max. Elevation = 18.77 ft  
Max. Storage = 1,632 cuft

Storage Indication method used. Exfiltration extracted from Outflow.



# **BMP**

# **CHARACTERISTICS**

# Pond Report

## Pond No. 1 - BMP - A (Trench)

### Pond Data

**UG Chambers** - Invert elev. = 17.00 ft, Rise x Span = 1.00 x 1.00 ft, Barrel Len = 300.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No  
**Encasement** - Invert elev. = 16.00 ft, Width = 2.00 ft, Height = 2.50 ft, Voids = 40.00%  
**Contours** - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 18.51 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	16.00	n/a	0	0
0.25	16.25	n/a	60	60
0.50	16.50	n/a	60	120
0.75	16.75	n/a	60	180
1.00	17.00	n/a	60	240
1.25	17.25	n/a	88	328
1.50	17.50	n/a	103	431
1.75	17.75	n/a	103	534
2.00	18.00	n/a	88	621
2.25	18.25	n/a	60	682
2.50	18.50	n/a	60	742
2.51	18.51	600	2	744
2.75	18.75	6,600	735	1,479
3.00	19.00	11,300	2,211	3,690

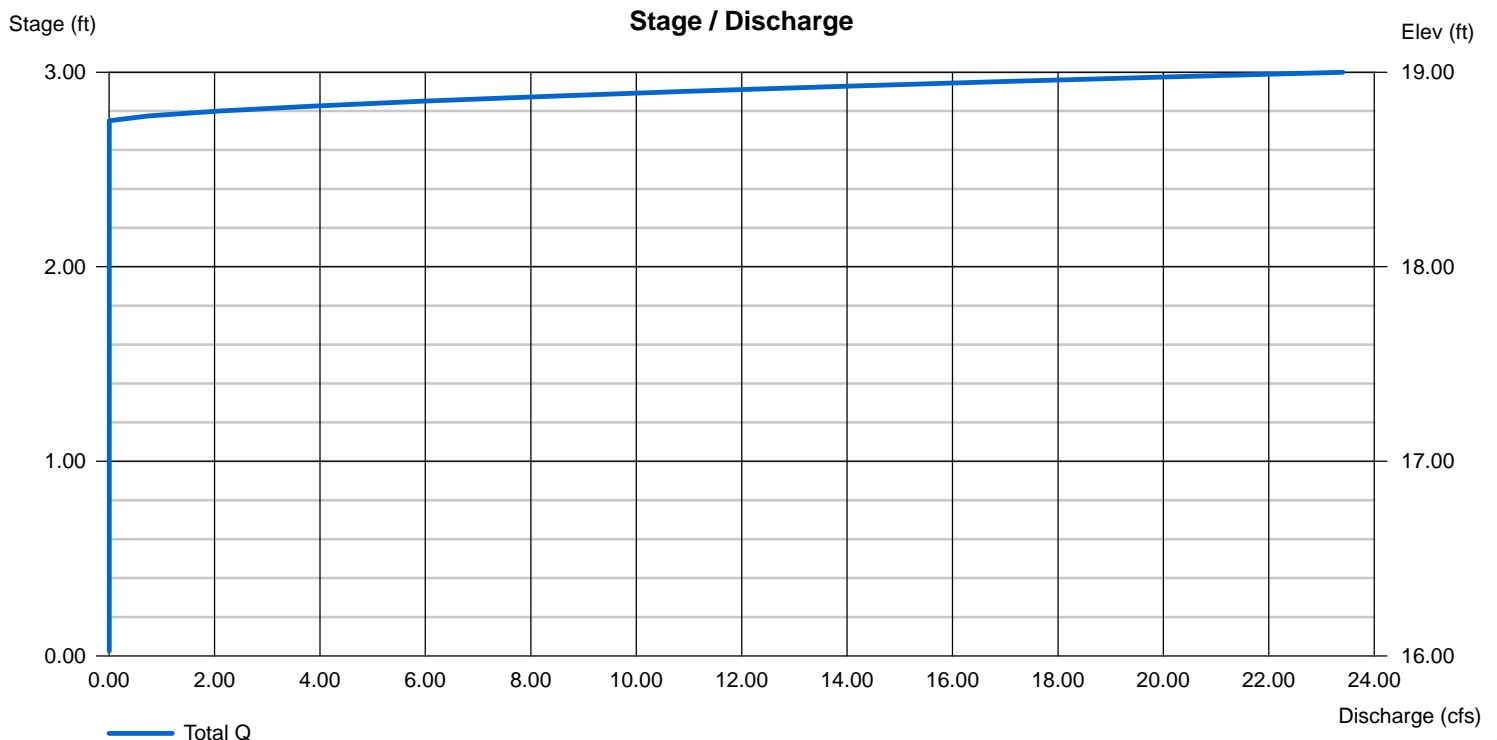
### Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
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)	= 72.00	0.00	0.00	0.00
Crest El. (ft)	= 18.75	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.270 (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

## Pond No. 2 - BMP - B (Trench)

### Pond Data

**UG Chambers** - Invert elev. = 17.00 ft, Rise x Span = 0.67 x 0.67 ft, Barrel Len = 45.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No  
**Encasement** - Invert elev. = 16.50 ft, Width = 2.50 ft, Height = 1.50 ft, Voids = 40.00%  
**Contours** - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 18.01 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	16.50	n/a	0	0
0.15	16.65	n/a	7	7
0.30	16.80	n/a	7	14
0.45	16.95	n/a	7	20
0.60	17.10	n/a	8	28
0.75	17.25	n/a	9	37
0.90	17.40	n/a	9	46
1.05	17.55	n/a	9	56
1.20	17.70	n/a	8	64
1.35	17.85	n/a	7	70
1.50	18.00	n/a	7	77
1.51	18.01	1,300	4	81
2.50	19.00	2,500	1,849	1,930
2.80	19.30	2,900	809	2,739

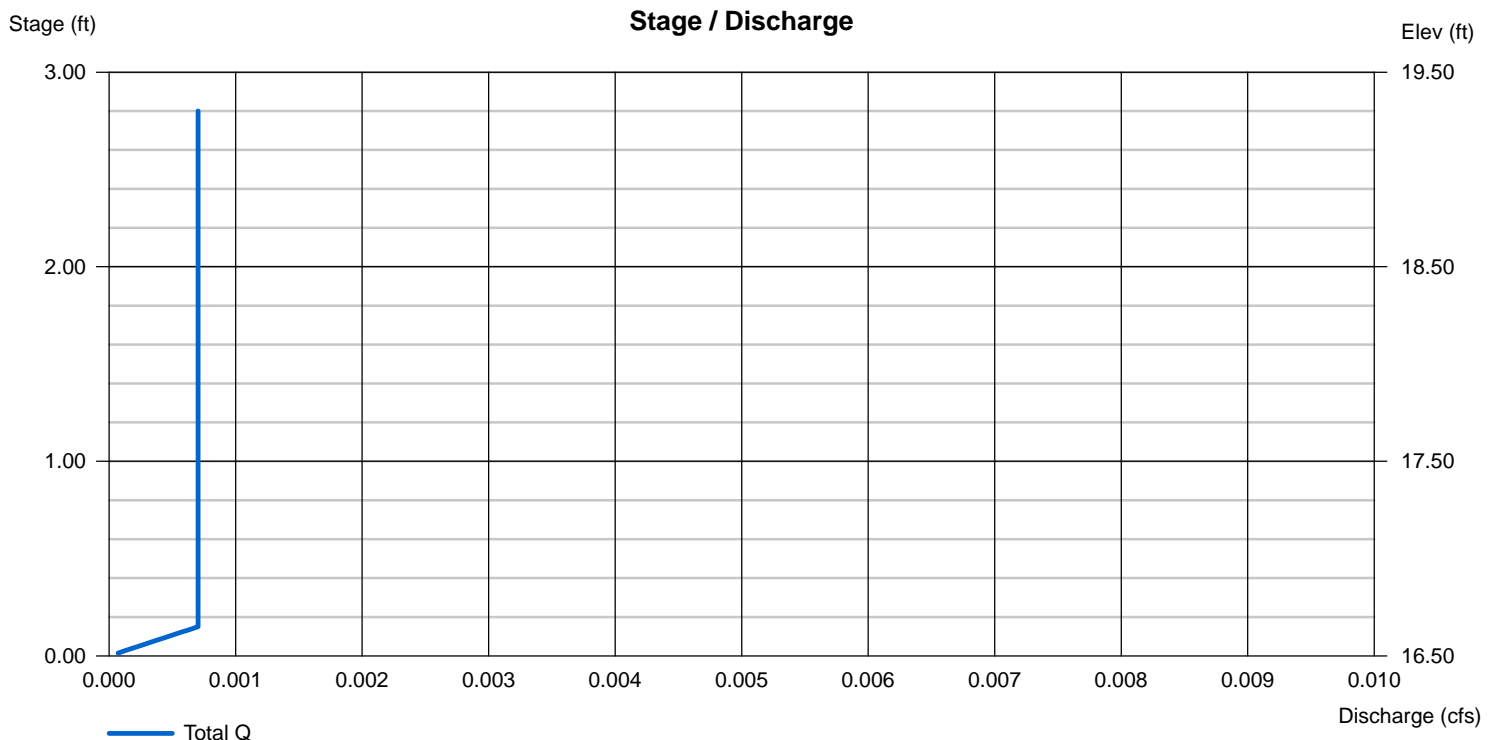
### Culvert / Orifice Structures

	[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)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 100.22	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.270 (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 by Intelisolve v9.2

Monday, Mar 9, 2020

## Pond No. 3 - BMP - C (Trench)

### Pond Data

**UG Chambers** - Invert elev. = 17.00 ft, Rise x Span = 0.67 x 0.67 ft, Barrel Len = 45.00 ft, No. Barrels = 1, Slope = 0.00%, Headers = No

**Encasement** - Invert elev. = 16.50 ft, Width = 2.50 ft, Height = 1.50 ft, Voids = 40.00%

**Contours** - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 18.01 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	16.50	n/a	0	0
0.15	16.65	n/a	7	7
0.30	16.80	n/a	7	14
0.45	16.95	n/a	7	20
0.60	17.10	n/a	8	28
0.75	17.25	n/a	9	37
0.90	17.40	n/a	9	46
1.05	17.55	n/a	9	56
1.20	17.70	n/a	8	64
1.35	17.85	n/a	7	70
1.50	18.00	n/a	7	77
1.51	18.01	1,300	4	81
2.50	19.00	2,500	1,849	1,930
2.80	19.30	2,900	809	2,739

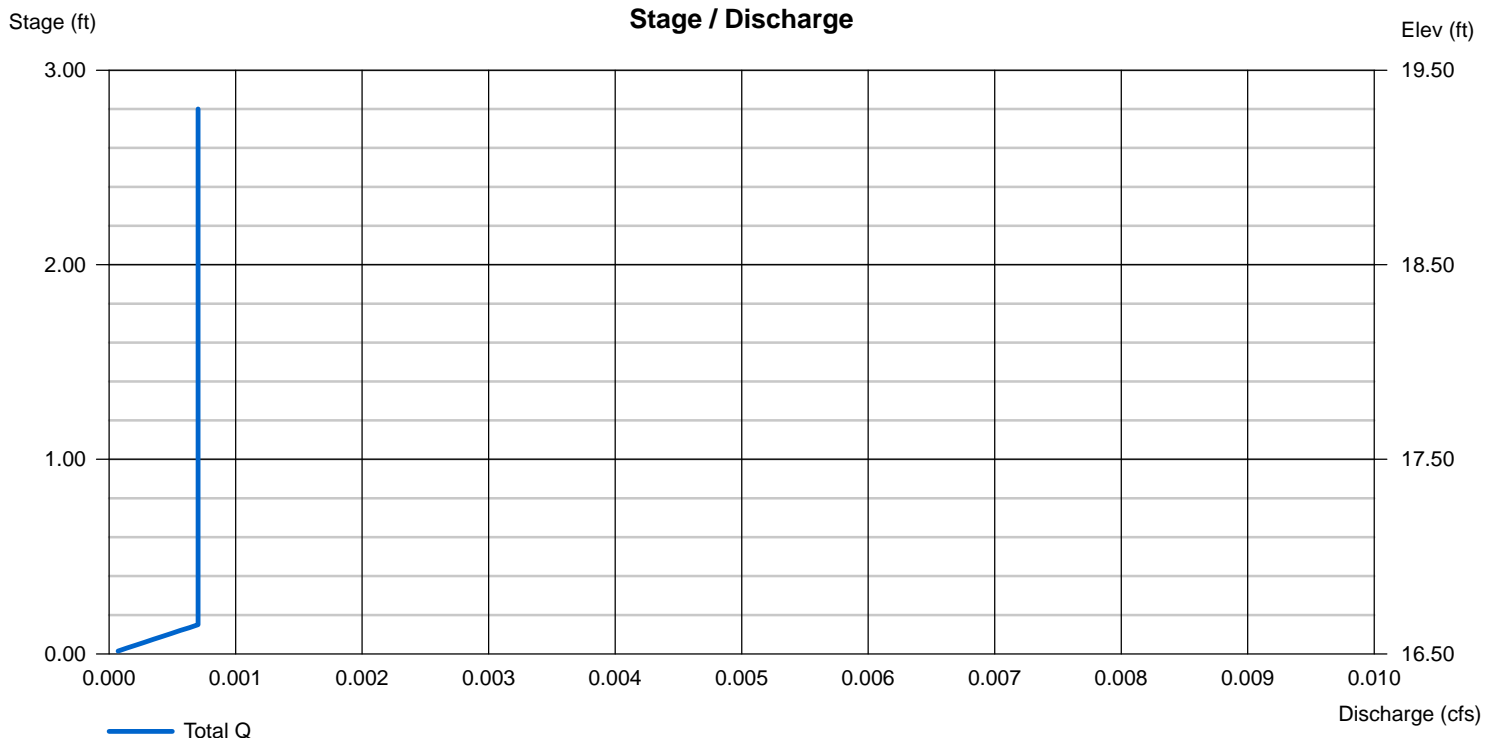
### Culvert / Orifice Structures

	[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)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 100.22	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.270 (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 by Intelisolve v9.2

Monday, Mar 9, 2020

## Pond No. 4 - BMP - D (SWMA)

### Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Beginning Elevation = 16.00 ft

### Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	16.00	1,320	0	0
0.50	16.50	1,750	765	765
1.00	17.00	2,300	1,009	1,774
1.20	17.20	2,600	490	2,264

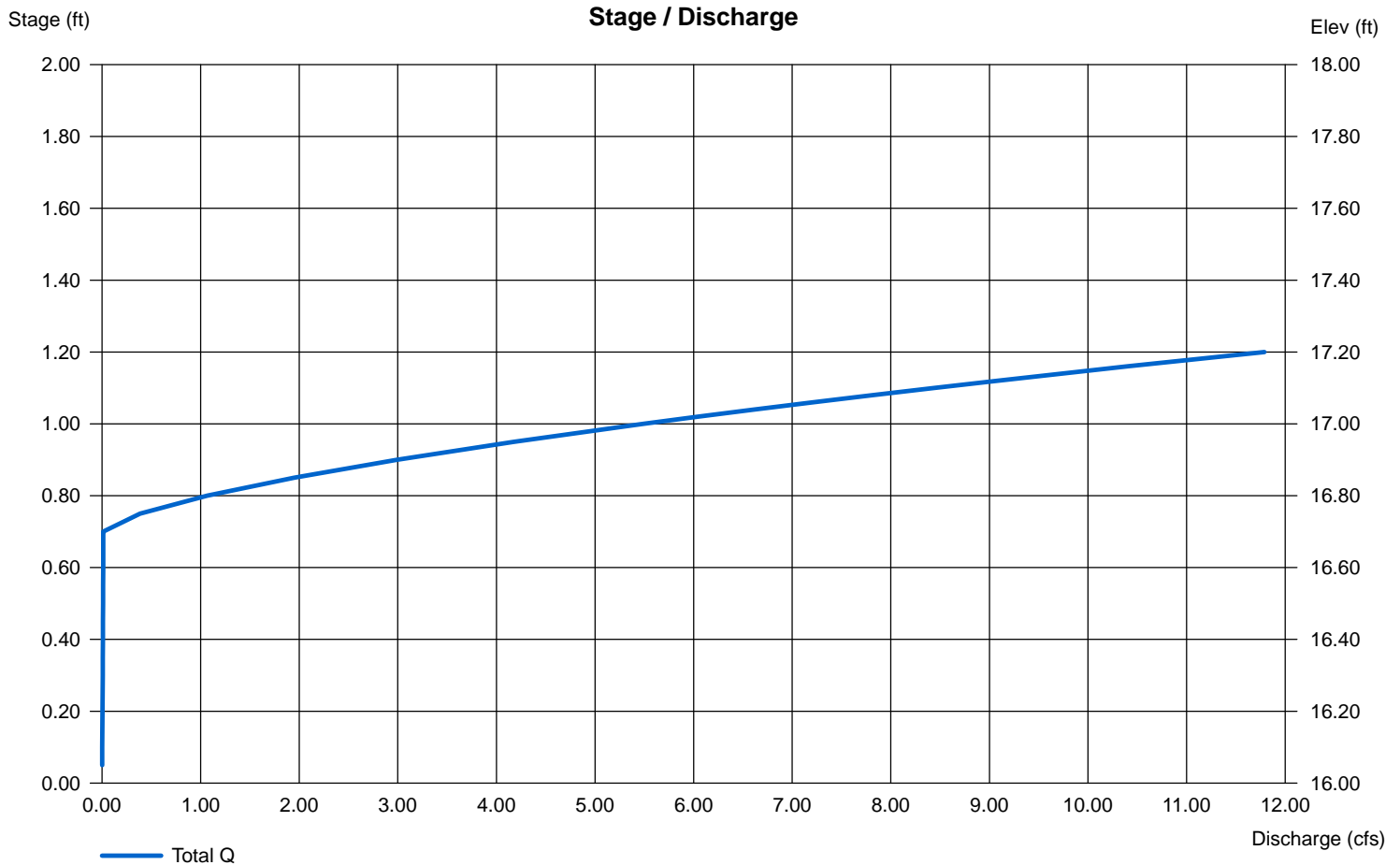
### Culvert / Orifice Structures

	[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)	= 10.00	0.00	0.00	0.00
Crest El. (ft)	= 16.70	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)	= 0.270 (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).



## **APPENDIX 2**

### **Standard 3 (Recharge)**

## STANDARD #3

- IMPERVIOUS COVER TO BE ADDED TO THE SITE:

$$\begin{array}{rcl} \text{NEW IMPERVIOUS} & = & 12,067 \text{ SF} \\ \text{EXISTING IMPERVIOUS} & = & 2,023 \text{ SF} \\ \text{TO BE REMOVED} & & \hline & & 9,444 \text{ SF} \end{array}$$

- REQUIRED VOLUME TO RECHARGE:

NOTE: BASED ON D.E.P. TARGET DEPTH FOR "C" SOILS (0.25"/SF.)

$$\text{REQ.} = 0.25"/12 \times 9,444 \text{ SF} = 197 \text{ CF}$$

VOLUME PROVIDED:

$$\begin{array}{rcl} \text{BMP "A"} & = & 1,479 \\ \text{BMP "B"} & = & 2,739 \\ \text{BMP "C"} & = & 2,789 \\ \text{BMP "D"} & = & 1,774 \end{array}$$

$$\text{TOTAL} = 8,731 \text{ CF}$$

$$8,731 \text{ CF} > 197 \text{ CF} \therefore \text{STANDARD MET}$$

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JOB 070-32 FULLERFIELD  
SHEET NO. 2 OF 3  
CALCULATED BY JB DATE 2/10/20  
CHECKED BY \_\_\_\_\_ DATE Rev. 2/20/20  
SCALE \_\_\_\_\_

## STANDARD #3 (CONT.)

### RECHARGE BMP DRAW DOWN CALCULATIONS

#### BMP "A" (TRENCH)

NOTE: ASSUME SILT LOAM RAWL'S RATE  
= 0.27 IN/HR

$$\begin{aligned} \text{TIME} &= \frac{\text{VOLUME}}{\text{RAWL'S RATE} \times \text{BASIN AREA}} \\ &= \frac{1,479 \text{ CF}}{0.27 \text{ IN/HR} \times \frac{1}{2} \times 6,600 \text{ SF}} \\ &= 10.0 \text{ HR} < 72 \text{ HOURS} \therefore \text{OK} \end{aligned}$$

#### BMP "B" (DEWELL)

NOTE: ASSUME SILT LOAM RAWL'S RATE  
= 0.27 IN/HR

$$\begin{aligned} &= \frac{2,739 \text{ CF}}{0.27 \text{ IN/HR} \times \frac{1}{2} \times 2,900 \text{ SF}} \\ &= 42.0 \text{ HRS} < 72 \text{ HOURS} \therefore \text{OK} \end{aligned}$$

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JOB 670-32 FINE FIELD  
SHEET NO. 3 OF 3  
CALCULATED BY JB DATE 2/10/20  
CHECKED BY \_\_\_\_\_ DATE REV. 2/20/20  
SCALE \_\_\_\_\_

## STANDARD # 3 (CONT.)

### BMP "C" (DRYWELL)

NOTE: ASSUME SILT LOAM RAWL'S RATE  
= 0.27 IN/HR

$$= \frac{2,739 \text{ CF}}{0.27 \text{ IN/HR} \times \frac{1}{12} \times 2,900 \text{ SF}}$$
$$= 42.0 \text{ HRS} < 72 \text{ HRS} \therefore \text{OK}$$

### BMP "D" (S.W.M.A.)

NOTE: ASSUME SILT LOAM RAWL'S RATE  
= 0.27 IN/HR

$$= \frac{1,774 \text{ CF}}{0.27 \text{ IN/HR} \times \frac{1}{12} \times 2,300 \text{ SF}}$$
$$= 34.3 \text{ HRS} < 72 \text{ HRS} \therefore \text{OK}$$

# **APPENDIX 3**

## **Operation & Maintenance Plan**



**OPERATION AND MAINTENANCE**  
**&**  
**LONG TERM POLLUTION PREVENTION PLAN**  
**FOR POST-CONSTRUCTION STORM WATER CONTROLS**

**FULLER FIELD IMPROVEMENTS (PHASE 2)**  
**NEWBURYPORT, MASSACHUSETTS**

February 10, 2020

Rev. 3/6/20

**GENERAL**

The Best Management Practices (BMPs) used in the design of the Fuller Field project were chosen for their effectiveness at reducing peak discharge, treating the required Water Quality Volume for total suspended solids (TSS), and infiltrating groundwater. Routine maintenance is required for the BMPs, as proper maintenance is essential in achieving the desired result of improved water quality. This Operations and Maintenance (O&M) and Long Term Pollution Prevention Plan (LTPPP) is intended to cover the post-construction maintenance of the permanent BMPs<sup>1</sup> and site specific pollution prevention.

**MAINTENANCE REQUIREMENTS**

Qualified personnel shall inspect all components of the stormwater management system as outlined below. To be considered “qualified”, personnel should have a working knowledge of the maintenance requirements of storm water BMP’s and must be approved by the Newburyport DPW. Qualified personnel shall be responsible for overseeing the required inspections and shall file annual reports with the town of Newburyport officials. Additionally, a copy of the Inspection/Maintenance Log, as further described herein, shall be provided to City of Newburyport officials on an annual basis.

**SUMMARY OF MAINTENANCE REQUIREMENTS**

<b>BMP</b>	<b>MIN. FREQUENCY</b>	<b>RESPONSIBLE PARTY</b>
Trash Removal	Inspect once/month Clean as necessary	TOWN OF NEWBURYPORT
Catch Basins	Inspect 4x/year Clean once/year	TOWN OF NEWBURYPORT
Infiltration Trenches	Inspect 4x/year Clean once/year	TOWN OF NEWBURYPORT
S.W.M. Area (Sediment Trap)	Inspect 4x/year Clean once/year	TOWN OF NEWBURYPORT

<sup>1</sup> Operations and maintenance of temporary erosion and sedimentation controls utilized during construction will be covered by a *Stormwater Pollution Prevention Plan* as required by the National Pollutant Discharge Elimination System program of the Environmental Protection Agency, and is not part of this O&M Plan.

**OPERATION AND MAINTENANCE AND  
LONG POLLUTION PREVENTION PLAN FOR  
POST-CONSTRUCTION STORMWATER CONTROLS  
FULLER FIELD IMPROVEMENTS**

**February 10, 2020  
Rev. 3/6/20**

**RESPONSIBILITY TO ADMINISTER O&M PLAN**

During construction, the general contractor will be responsible for maintaining the stormwater management system in accordance with this O&M Plan until such time that ownership of the project or phases thereof are turned over to the owner. The owner is then responsible for maintaining the portions of the stormwater management system under their ownership in accordance with this O&M Plan. This section below (names and signatures) shall be updated with every change in ownership and/or person(s) responsible for administering/financing the O&M of the system.

Owner(s) of the stormwater management system:

Name: \_\_\_\_\_ Name: \_\_\_\_\_

Signature: \_\_\_\_\_ Signature: \_\_\_\_\_

Person(s) responsible for financing maintenance and emergency repairs:

\_\_\_\_\_  
\_\_\_\_\_

**INSPECTION AND MAINTENANCE LOG**

A sample inspection and maintenance log to be used is attached to the end of this O&M Plan. At a minimum, any inspection and maintenance log used shall include the following items:

- Date activity performed
- Specific inspection/maintenance task
- Structural components inspected/maintained
- Staff person or contractor performing activity
- Supervisor verification of maintenance activity
- Recommended additional maintenance tasks

An Annual Report shall be submitted to the City of Newburyport to meet the requirements of the town's Stormwater Management and Erosion Control Regulations.

**OPERATION AND MAINTENANCE AND  
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**February 10, 2020  
Rev. 3/6/20**

**PROPOSED BMPS AND CORRESPONDING O&M REQUIREMENTS:**

**TRASH REMOVAL:**

The parking areas shall be inspected for litter and trash monthly as part of overall site maintenance. Any accumulated trash, litter and discarded materials in these areas shall be removed.

No disposal of materials will be permitted within the landscaped areas or wooded areas on the Site. This prohibition applies to trash, fill material, construction debris, grass clippings, collected leaves and cut branches.

**CATCH BASINS:**

The catch basins shall be inspected four times per year for build-up of sediment, oil, and/or other debris which could decrease the effectiveness of the sumps. A qualified company specializing in the cleaning of catch basins shall perform the inspection of catch basins.

Typically a dipstick tube equipped with a ball valve, such as a Sludge Judge<sup>®</sup>, is used to measure the approximate oil and sediment depth, and a vacuum truck is used to clean out the catch basin. Catch basins shall be cleaned once per year, or sooner if the depth of sediment is found to reach 12 inches. If visual inspection observes any evidence of hydrocarbons, the material shall be immediately cleaned and disposed in accordance with all applicable local, state and federal guidelines and regulations.

Frames and grates should be inspected and repaired or replaced as necessary to ensure proper operation.

**INFILTRATION TRENCHES:**

The project includes four (6) subsurface infiltration trenches. The trenches consist of a perforated pipe encased in crushed stone. Each trench should be inspected four times per year. It is important to inspect the surface stone and basins to ensure that they remain clear of any debris and sediment, which will help to ensure that trenches will continue to function efficiently for the long term.

If the inspection determines that the trench fails to fully drain within 72 hours of a storm event, the responsible party shall retain a qualified engineer to assess the reason for infiltration failure and to recommend corrective action for restoring infiltration function.

**OPERATION AND MAINTENANCE AND  
LONG POLLUTION PREVENTION PLAN FOR  
POST-CONSTRUCTION STORMWATER CONTROLS  
FULLER FIELD IMPROVEMENTS**

**February 10, 2020  
Rev. 3/6/20**

**STORMWATER MANAGEMENT AREA (SEDIMENT TRAP):**

The stormwater management system includes an above-ground stormwater sediment trap. This area shall be inspected four times per year for erosion, accumulated sediment, and debris that could affect the capacity of the pipes. Any concerns shall be addressed as soon as practicable to ensure free flow. Sediment shall be removed once it has accumulated to a depth of six (6) inches in the trap or within three (3) inches of the lowest outlet. Sediment shall be disposed in accordance with all applicable local, state and federal guidelines and regulations.

**LONG TERM POLLUTION PREVENTION:**

***MAINTENANCE OF LANDSCAPED AREAS:***

Fertilizers used for landscaping and lawn areas shall be slow release, low-nitrogen types (<5%) and shall not be used within 25 feet of a wetland resource area, and pesticides/herbicides shall not be used within 100 feet of a wetland resource area. Furthermore, the use of any fertilizers, pesticides, and herbicides shall be in accordance with the manufacturer's recommendations.

***WINTER MAINTENANCE OF WALKS AND DRIVES:***

Snow storage shall take place on pervious surfaces to the extent practicable to allow the snowmelt to filter through the soil, leaving behind sand and debris that can be removed in the springtime. Snow shall not be stockpiled in drainage collection areas or conveyance channels as this may block the system causing flooding. Furthermore, snow shall not be stored in or within 25 feet of a wetland resource area. No road salt, sodium chloride, or other deicing chemicals shall be used on paved surfaces within 25 feet of a wetland resource area.

***STORAGE OF WASTE PRODUCTS:***

Any outdoor storage of waste products shall be covered to prevent rainfall from picking up contaminants from the waste. This requirement shall include any dumpster(s) which shall have the lid(s) closed when not being loaded or unloaded.

