ATTACHMENT B
Project Abutters

Attachment to Chapter 91 Waterways License Application
Transmittal No. X266755

Bruce Freeman Rail Trail over Assabet River – Bridge Construction and Transportation Improvements
Concord, Massachusetts
Project File No. 605189 – MassDEP Transmittal X266755

C.7. Project Abutters

Mary J. Tully
3 Riverside Ave.
Concord, MA 01742

Thomas F. Gardner and
Pamela J. Gardner
72 Cottage Street
Concord, MA 01742

Shirley R. Rohan
5B Cottage Street (property address)
182 Old Marlboro Road (mailing address)
Concord, MA 01742

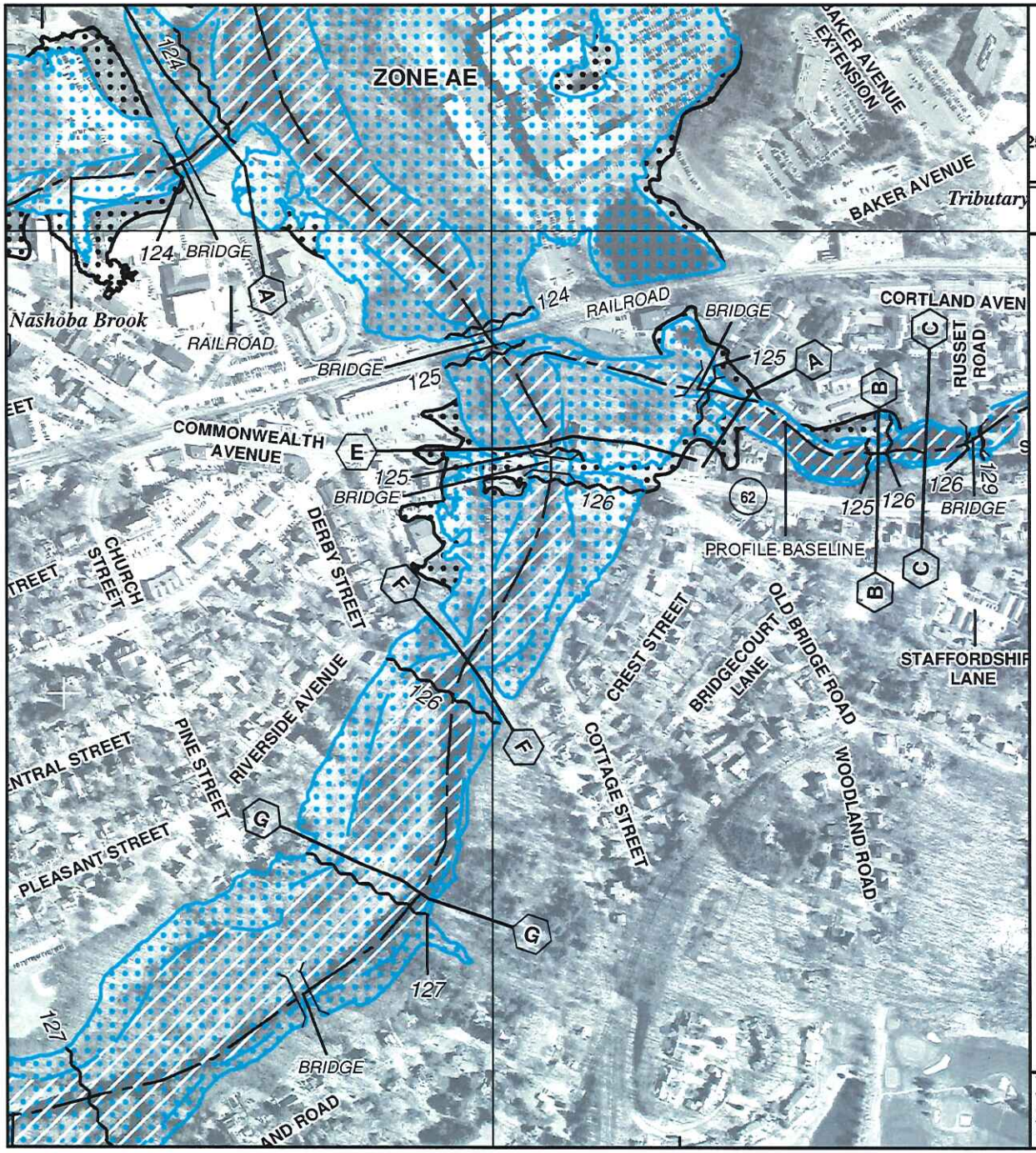
Jerome L. Robertson and
Nancy A. Robertson
3A Westgate Park (property address)
140 Adams Road (mailing address)
Concord, MA 01742

Digi LLC
2B Upland Road (property address)
144 Sudbury Road (mailing address)
Concord, MA 01742

Kevin P. Hurley
MHSN Realty Trust
51 Derby Street (property address)
1489 Main Street
Concord, MA 01742

Town of Concord, MA
Dept of Natural Resources
141 Keyes Road
Concord, MA 01742

ATTACHMENT C
FEMA Flood Map



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0359F

FIRM

FLOOD INSURANCE RATE MAP

MIDDLESEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 359 OF 656

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CONCORD, TOWN OF	250189	0359	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
25017C0359F

MAP REVISED
JULY 7, 2014

Federal Emergency Management Agency

ATTACHMENT D
Mass DEP Bureau of Waste Site Cleanup MCP Numerical Ranking System Map

MassDEP - Bureau of Waste Site Cleanup

Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

Site Information:
BRUCE FREEMAN RAIL TRAIL; ASSABET RIVER CROSSING
3 RIVERSIDE AVE CONCORD, MA

NAD83 UTM Meters:
4703020mN , 303395mE (Zone: 19)
May 12, 2015

The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at: http://www.mass.gov/mgis/.

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection

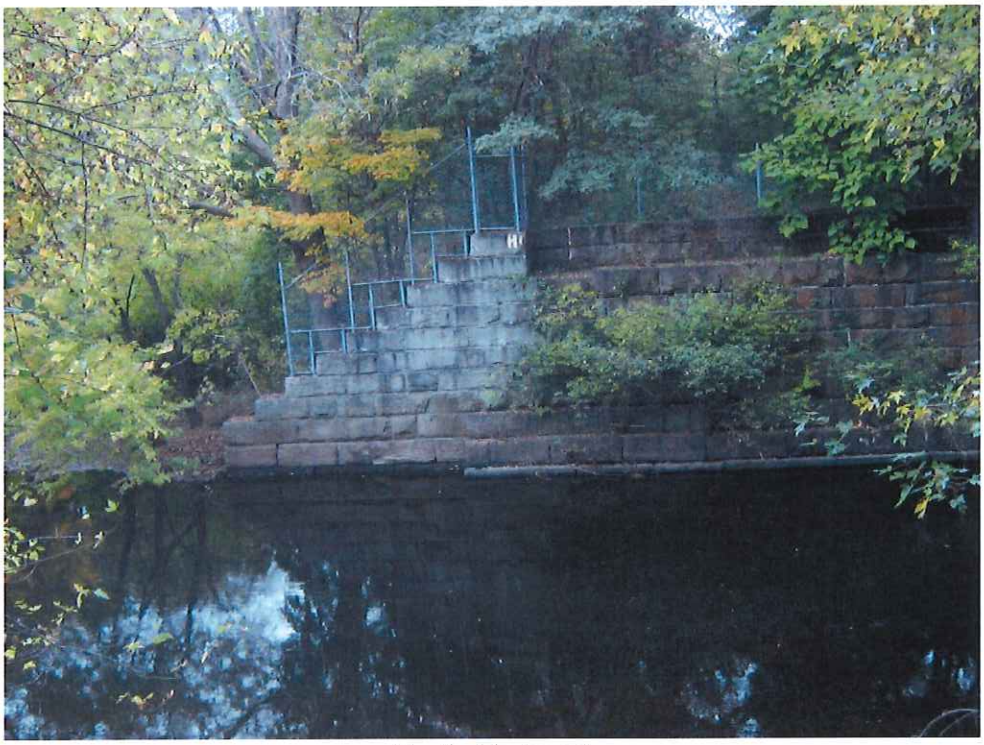
Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail
Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct
Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam
Aquifers: Medium Yield, High Yield, EPA Sole Source
Non Potential Drinking Water Source Area: Medium, High (Yield)

PWS Protection Areas: Zone II, IWPA, Zone A
Hydrography: Open Water, PWS Reservoir, Tidal Flat
Wetlands: Freshwater, Saltwater, Cranberry Bog
FEMA 100yr Floodplain; Protected Open Space; ACEC
Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential
Solid Waste Landfill; PWS: Com.GW,SW, Emerg., Non-Com.

ATTACHMENT E
Site Photographs

North Approach

South Approach



North Abutment

South Abutment

Historic Photo of Train Crossing the Assabet River

ATTACHMENT F
Hydraulic Study

HEC-RAS ANALYSIS

Bruce Freeman Rail Trail (Phase 2C)
Concord, Massachusetts
MassDOT Project #605189

PREPARED BY:

Nover-Armstrong Associates, Inc.
124 Main Street, Unit 2GG
Carver, Massachusetts 02330

PREPARED FOR:

Greenman-Pedersen, Inc.
181 Ballardvale Street, Suite 202
Wilmington, Massachusetts 01887

SUBMITTED TO:

MassDOT – Highway Division
10 Park Plaza
Boston, MA 02116

March 2015

NOVER-ARMSTRONG ASSOCIATES, INC.
GPI Greenman - Pedersen, Inc.

MassDOT – Highway Division
Bruce Freeman Rail Trail
Acton, Massachusetts
HEC-RAS ANALYSIS
March 2015

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Appendix C – Excerpts from Middlesex County FIS
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- **Nashoba Brook (Lower)**

1.0 – EXECUTIVE SUMMARY

1.1 Purpose

This study was undertaken to evaluate the impact of the **Bruce Freeman Rail Trail (BFRT)** Phase 2C project on 100-Year flood elevations of the **Nashoba Brook.**

1.2 Scope

HEC-RAS hydraulic analyses were performed at the location where project development activities are anticipated to be within National Flood Insurance Program (NFIP) regulatory floodway.

MassDOT's review of the 25% Design Plans had identified regulatory floodway encroachment of the low chord of the proposed **Bridge No. C-19-032** as illustrated on Flood Profile 378P in the Middlesex County 2014 FIS.

1.2 Results

The analyses demonstrate that there is "no-rise" in the Base Flood Elevation (BFE) as a result of the project. The BFE at the location of Bridge No. C-19-032 is controlled by the backwater from the Assabet River. **The Post Project hydraulic model found no increase in the regulatory BFE for Bridge No. C-19-032.**

The Middlesex Floodway Data Table 12 indicates a Nashoba Brook BFE (without consideration of the backwater effect of the Assabet River) to be approximately 7.0 feet below the regulatory BFE and approximately 2.5 feet below the low-chord of the bridge. No change to the bridge's low chord, abutments, or to existing channel bed of Nashoba Brook are proposed.

2.0 - PROJECT DESCRIPTION

The Massachusetts Department of Transportation (MassDOT) Highway Division, in conjunction with the Town of Concord proposes to construct a multi-use recreational trail along the former **Lowell Secondary Track** of the Old Colony Railroad right-of-way. The project involves the construction of the Bruce Freeman Rail Trail (BFRT) - Phase 2C from the Acton town line south through West Concord Center to the Sudbury town line, a distance of approximately 3 miles.

MassDOT had identified potential low chord floodway encroachment for Bridge No. C-19-032 from the 25% Design Plans. The existing bridge consists of a three span built-up deck girder bridge supported on granite block abutments. **No change to the existing steel beams that constitute the low-chord is being proposed. The existing stone masonry abutments are also to remain unchanged. Further, no change is proposed to the existing channel bed of the Nashoba Brook.** The existing deck will be cleared of vegetation and the rails, ties, and ballast to make deck repairs if necessary and to install a waterproofing membrane. Spalled concrete on the underside of the deck will be repaired. A 14 foot wide trail will be constructed on the west side of the bridge consisting of 3" HMA surface over borrow gravel. The remaining width of the bridge will serve as a rest area surfaced with textured concrete overlay over gravel to match the height of the trail.

3.0 - DATA COLLECTION

FEMA was contacted to obtain all Flood insurance study information available. A number of existing HEC-2 computer models were provided by FEMA. The hydraulic models date back to the early 1980's. A list and copies of the information received is found in Appendix D.

4.0 – ENGINEERING METHODS

4.1 – Duplicate Effective Model

The HEC-2 models obtained from FEMA were compared to the Middlesex County 2014 FIS Table 8 – Summary of Discharges, Table 12 -Floodway Data, Panel 378 - Floodway Profiles and the Flood Insurance Rate Map Number 25017C0358F. The comparison found the 2014 FIS Table 12 cross section distances above the confluence with Assabet River matched the existing HEC-2 model cross section distances. The 2014 FIS Base Flood Elevations (BFEs) - With Floodway & Without Floodway also matched the HEC-2 model when the HEC-2 model elevations were converted to NAVD.

The Nashoba Brook discharges used in the HEC-2 analyses did not match the discharges in Table 8 of the 2014 FIS at the location of the confluence of Fort Pond Brook, the last entry in the Table. The HEC-2 flow at Bridge C-19-032 is almost double. This is to be expected as the Fort Pond Brook adds an additional 24.6 acres of drainage area to Nashoba Brook. This additional Fort Pond Brook drainage area as well as additional area tributary to Nashoba Brook between the confluence of Fort Pond Brook and the location of Bridge No. C-19-032 would result in an increase in the discharge rate. A summary of these drainage areas and discharge rates are tabled below.

The HEC-2 flow data and cross section data was then inputted into HEC-RAS Version 4.1 to develop a Duplicate Effective Model based using the HEC-2 NGVD elevations. Bridge deck information for Bridge No. C-19-032) was not found in the HEC-2 data. Instead, Bridge No. C-19-032 and the bridge at Commonwealth Avenue were modeled as stream cross sections but using contraction and expansion coefficients typical of bridge locations. This simplified approach was probably due to the fact that the BFEs without consideration of backwater effects from Assabet River were considerably lower than the low chord of both bridges.

Using the estimated downstream energy slope found in the HEC-2 model for the downstream boundary condition, the upstream water surface elevation profiles of the Duplicate Effective HEC-RAS model was found to be within 0.1 feet of the existing FIS elevations when converted to NAVD. No modifications to either Manning's "n" or the cross sectional ineffective area were necessary.

Summary of Drainage Areas and Peak Discharges					
Flooding Source and Location	Drainage Area (sq. miles)	Peak Discharges (cfs) 10-Percent	2-Percent	1-Percent	0.2 Percent
Fort Pond Brook at confluence with Nashoba Brook	24.6	570	850	975	1,250
Nashoba Brook at confluence of Fort Pond Brook	20.3	450	710	845	1,140
Nashoba Brook from Warners Pond Dam to confluence with Assabet River	46.8[1]	780[2]	1095[2]	1600[2]	1750[2]

[1] Area from Massachusetts StreamStats
[2] Discharge Rates from existing HEC-2 Effective Model

4.2 – Existing Conditions / Corrected Effective Model

An Existing Conditions / Corrected Effective Model was made by incorporating the actual bridge deck, abutment and pier data for Bridge No, C-19-032 into the Duplicate Effective Model. A low chord elevation of 120.75 NAVD based on a recent field survey was used for the bridge in the Corrected Effective Model. A slightly higher low chord elevation of 121.4 NAVD is illustrated on Panel 378 – Floodway Profiles in the 2014 FIS. The existing top of the bridge deck was inputted using the proposed BFRT profile which is slightly higher than the existing ground but thought to more closely represent the former top of rail elevation. Abutment geometry was taken from Figure 9.1.2, dated April 15, 2014 in the Bridge Type Selection Worksheet. New bounding bridge cross sections for the bridge necessary for the HEC-RAS model were also added.

As a result of inserting the actual bridge data for Bridge No. C-19-032, the BFEs (without consideration of backwater effects from Assabet River) rose approximately 6" – 8" in this reach of Nashoba Brook, with slightly higher increases at the bridge itself. The corrected BFEs at the location of Bridge C-19-032 (118.2 ± NAVD) are still below the surveyed 120.75 NAVD low chord elevation and obviously well below the Regulatory BFE.

4.3 – Proposed Conditions / Post Project Model

As no changes to the bridge's low chord, abutments, or to existing channel bed of Nashoba Brook are proposed, the Proposed Conditions Model is the same as the Existing Conditions Model. The calculated BFEs are then the same as the Existing Conditions Model and well below the Regulatory Base Flood Elevation of 123.8 NAVD that is due to the effects of backwater from the Assabet River.

5.0 - CONCLUSIONS

The proposed Bruce Freeman Rail Trail Project – Phase 2C will not result in a rise in the Regulatory Base Flood Elevation of Nashoba Brook.

5.1 Bridge No. C-19-032

The Post Project Model found no increase in the Regulatory BFE for Bridge C-19-032. A review of the material obtained from FEMA determined that the bridge deck, abutment and pier data were not incorporated in the Current Effective Model. An Existing Conditions / Corrected Effective Model was developed to incorporate the bridge geometry. The BFE of the Corrected Effective Model increased slightly from the Current Effective Model but was found to be less than the Regulatory Base Flood Elevation that is controlled by the backwater effects from the Assabet River.

Appendix A - Bridge No. C-19-032 HEC-RAS Analysis

HEC-RAS ANALYSIS – Bridge No. C-19-032

The Bruce Freeman Rail Trail (BFRT) – Phase 2C at the location of Bridge N0. C-19-032 is proposed to be a 14 foot wide trail constructed on the west side of the bridge consisting of 3" HMA surface over borrow gravel. The remaining width of the bridge will serve as a rest area surfaced with textured concrete overlay over gravel to match the height of the trail. The existing deck will be cleared of vegetation and the rails, ties, and ballast to make deck repairs if necessary and to install a waterproofing membrane. The existing bridge consists of a three span built-up deck girder bridge supported on granite block abutments. No change to the existing steel beams that constitute the low-chord is being proposed. Further, no change is proposed to the existing channel bed of the Nashoba Brook or to the stone masonry abutments.

Bridge No. C-19-032 spans the Nashoba Brook at a location approximately 300 feet above the confluence with Assabet River. The November 29, 1983 HEC-2 computer run used a Base Flood (100-Year) Discharge of 1600 CFS at the bridge location and Massachusetts Streamstats estimated a drainage area of 46.8 square miles. The Bridge runs between the BFRT Stations 138+53 $\pm$ and 139+22 $\pm$. The bounding Middlesex County Flood Insurance Study (FIS) cross sections in the Floodway Data, Floodway Profiles, and Flood Insurance Rate Maps are A and B with River Stations of 160 and 930. The HEC-RAS Existing Conditions / Corrected Effective Model estimated Base Flood Velocities of 5.35 ft/s and 7.55 ft/s at cross sections A & B.

MassDOT had identified potential low chord floodway encroachment for Bridge No. C-19-032 from the 25% Design Plans. The 2014 FIS Floodway Profile Panel 378P indicates that the existing low chord of the Bridge is 121.4 NAVD 88 and the Regulatory BFE at the location of the Bridge is 123.8 NAVD. The BFE however, is a result of backwater effects from the Assabet River and the BFE at the bridge computed without the effects of the backwater are more than 2.5 feet lower the low chord of the bridge. Recent field survey work established the actual low chord elevation as 120.75 NAVD. This elevation as well as bridge deck, abutment and pier data was incorporated into an Existing Corrected Effective Model that was used as the Existing Conditions Model. Examination of the 1983 HEC-2 data provided by FEMA had found that the bridge deck data for Bridge C-19-032 was not included in the current Effective Model.

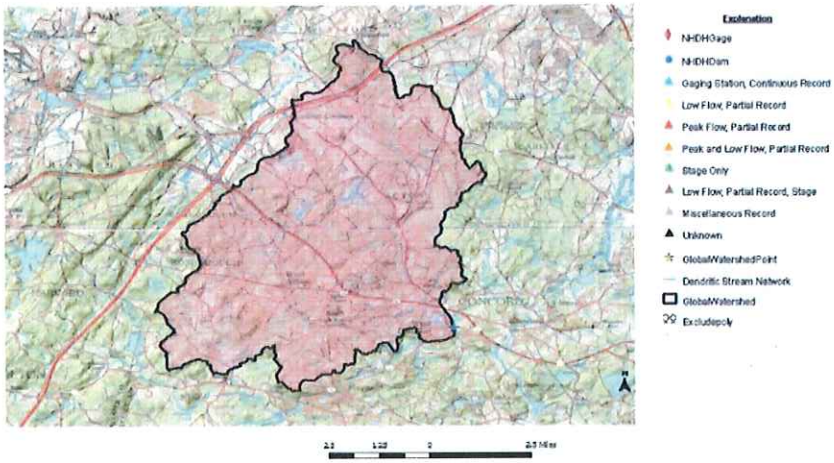
The 1983 HEC-2 data was first inputted into HEC-RAS with no changes. The computed HEC-RAS Flood Profile closely matched the HEC-2 Base Flood Profile. The actual bridge data for Bridge No. C-19-032 was then incorporated to create a Duplicate Effective Model. The BFEs (without consideration of backwater effects from Assabet River) rose approximately 0.2 feet just upstream of the bridge and 0.01 feet at the upper cross section in this lower reach of Nashoba Brook. The corrected BFEs at the location of Bridge C-19-032 (118.2 $\pm$ NAVD) were found to be below the surveyed 120.75 NAVD low chord elevation. As there are no proposed changes to the existing low chord, bridge abutments or stream channel, the proposed bridge deck improvements to construct the BFRT Phase 2C will not change the Base Flood Profile.

A Lower Nashoba Brook 100 Year Profile summary table of the computed BFEs for the Duplicate Effective HEC-RAS Model and the Existing Condition / Corrected Effective Model is provided for comparison to the 1983 HEC-2 data and the 2014 FIS Base Flood Elevations (BFEs). The BFEs were computed using NGVD. The conversation factor of -0.8 feet is used to convert NGVD to NAVD. Additional information is found in the expanded HEC-RAS Report located in this Appendix.

USGS Massachusetts StreamStats

StreamStats Print Page

Nashoba Brook



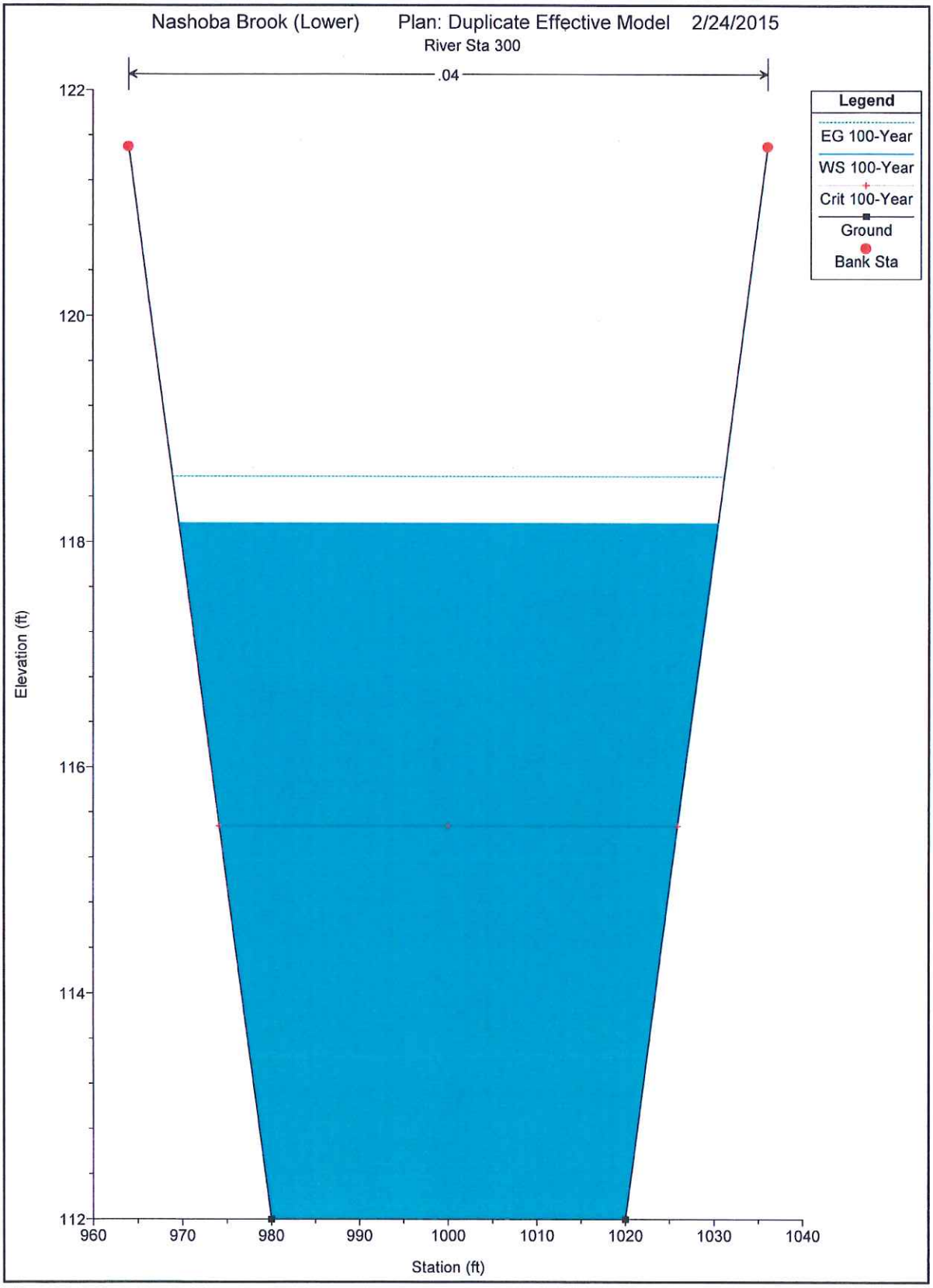
Date: Fri Mar 20 2015 09:19:02 Mountain Daylight Time
Site Location: Massachusetts
NAD27 Latitude: 42.4595 (42 27 34)
NAD27 Longitude: -71.3938 (-71 23 38)
NAD83 Latitude: 42.4596 (42 27 35)
NAD83 Longitude: -71.3933 (-71 23 36)
ReachCode: 01070005000063
Measure: 3.99
Drainage Area: 46.8 mi2
Percent Urban: 28.6 %
Percent Impervious: 9.21 %

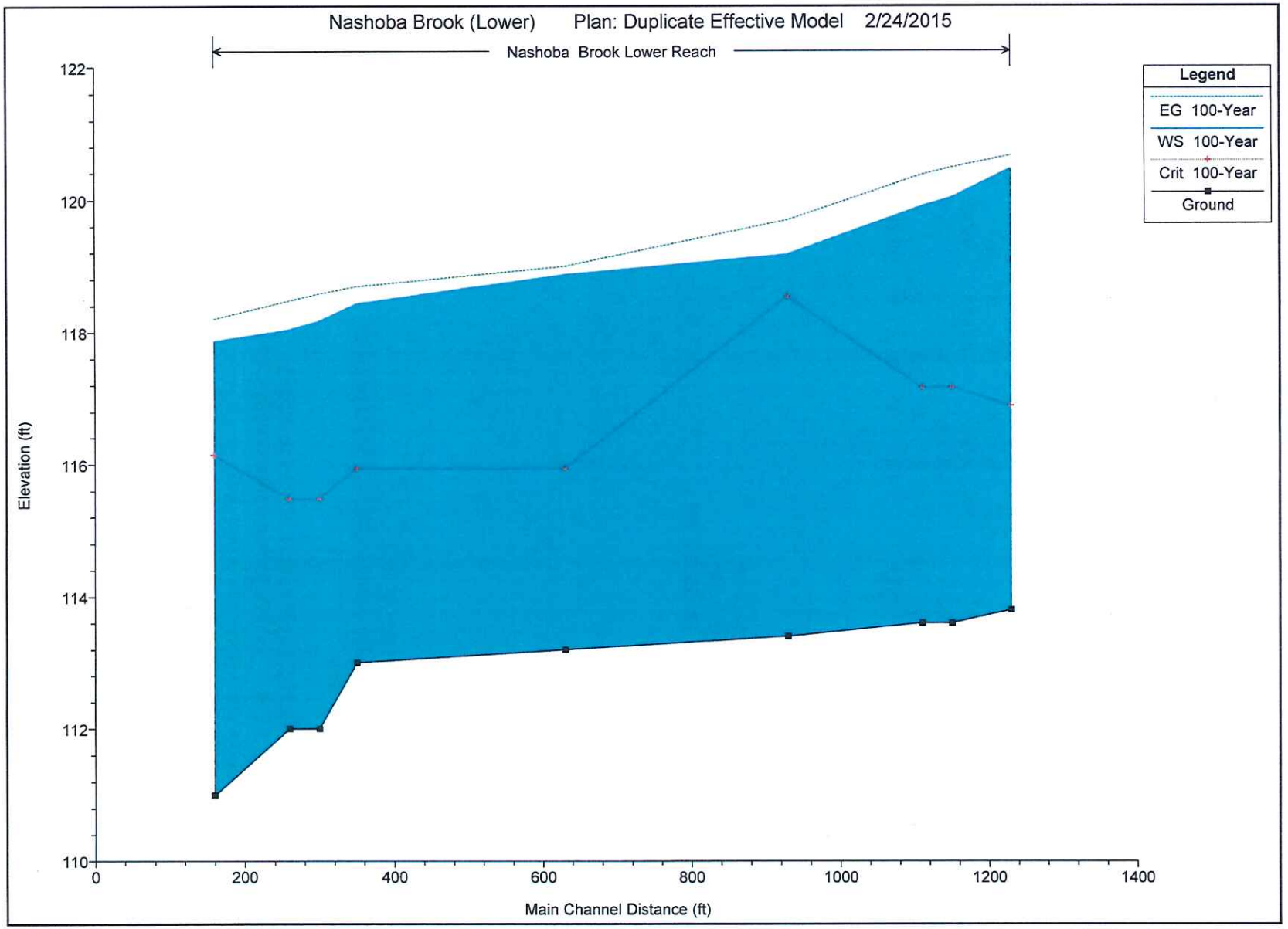
Lower Nashoba Brook – 100 Year Profile								
Cross Section	HEC-2 2014 FIS Label	2014 FIS WS NAVD	HEC-2 WS NGVD / NAVD		Duplicate Effective HEC-RAS WS NGVD / NAVD		Corrected Effective HEC-RAS WS NGVD / NAVD	
160	A	117.0	117.8	117.0	117.86	117.06	117.86	117.06
255							118.05	117.25
260		-	118.0	117.2	118.04	117.24	-	-
300		-	118.1	117.3	118.17	117.37	-	-
305							118.35	117.55
350		-	118.4	117.6	118.43	117.63	118.54	117.74
630		-	118.9	118.1	118.86	118.06	118.95	118.15
930	B	118.3	119.1	118.3	119.16	118.36	119.23	118.43
1110		-	119.8	119.0	119.89	119.09	119.90	119.10
1150		-	120.0	119.2	120.02	119.22	120.03	119.23
1230		-	120.4	119.6	120.45	119.65	120.46	119.66

HEC-RAS River: Nashoba Brook Reach: Lower Reach Profile: 100-Year

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Lower Reach	160	100-Year	Duplicate	1600.00	111.00	117.86	116.14	118.20	0.002004	5.27	546.33	197.66	0.38
Lower Reach	160	100-Year	Corrected Du	1600.00	111.00	117.86	116.14	118.20	0.002004	5.27	546.33	197.66	0.38
Lower Reach	255	100-Year	Corrected Du	1600.00	112.00	118.05	115.44	118.44	0.002237	5.02	319.03	62.00	0.39
Lower Reach	260	100-Year	Duplicate	1600.00	112.00	118.04	115.48	118.47	0.002520	5.28	303.15	60.35	0.42
Lower Reach	300	100-Year	Duplicate	1600.00	112.00	118.17	115.48	118.58	0.002346	5.15	310.66	60.77	0.40
Lower Reach	305	100-Year	Corrected Du	1600.00	112.00	118.35	115.44	118.70	0.001878	4.74	337.42	62.00	0.36
Lower Reach	350	100-Year	Duplicate	1600.00	113.00	118.43	115.94	118.69	0.001510	4.16	438.06	113.17	0.33
Lower Reach	350	100-Year	Corrected Du	1600.00	113.00	118.54	115.94	118.79	0.001393	4.06	451.02	113.89	0.32
Lower Reach	630	100-Year	Duplicate	1600.00	113.20	118.86	115.93	118.99	0.000777	3.03	675.95	201.73	0.24
Lower Reach	630	100-Year	Corrected Du	1600.00	113.20	118.95	115.93	119.07	0.000731	2.97	693.39	205.37	0.23
Lower Reach	930	100-Year	Duplicate	1600.00	113.40	119.16	118.53	119.69	0.005671	7.33	448.76	179.99	0.57
Lower Reach	930	100-Year	Corrected Du	1600.00	113.40	119.23	118.53	119.73	0.005316	7.15	461.04	181.02	0.55
Lower Reach	1110	100-Year	Duplicate	1600.00	113.60	119.89	117.16	120.36	0.002557	5.52	289.70	52.10	0.41
Lower Reach	1110	100-Year	Corrected Du	1600.00	113.60	119.90	117.16	120.37	0.002541	5.51	290.31	52.12	0.41
Lower Reach	1150	100-Year	Duplicate	1600.00	113.60	120.02	117.16	120.47	0.002390	5.40	296.36	52.34	0.40
Lower Reach	1150	100-Year	Corrected Du	1600.00	113.60	120.03	117.16	120.48	0.002376	5.39	296.90	52.36	0.40
Lower Reach	1230	100-Year	Duplicate	1600.00	113.80	120.45	116.88	120.66	0.000879	3.66	478.74	96.09	0.26
Lower Reach	1230	100-Year	Corrected Du	1600.00	113.80	120.46	116.88	120.66	0.000874	3.65	479.56	96.15	0.26

HEC-RAS - Duplicate Effective Model


Nashoba Brook (Lower)
Plan: Duplicate Effective Model
2/24/2015
River Sta 300
.04
Legend
EG 100-Year
WS 100-Year
Crit 100-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
122
120
118
116
114
112
960
970
980
990
1000
1010
1020
1030
1040


Nashoba Brook (Lower) Plan: Duplicate Effective Model 2/24/2015
Nashoba Brook Lower Reach
Legend
EG 100-Year
WS 100-Year
Crit 100-Year
Ground
Elevation (ft)
122
120
118
116
114
112
110
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

Duplicate Eff Report

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Nashoba Brook (Lower)
Project File : NashobaBrook(Lowe.prj
Run Date and Time: 2/24/2015 12:55:27 PM

Project in English units

Project Description:
BFRT-Phase 2C

PLAN DATA

Plan Title: Duplicate Effective Model
Plan File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.p01

Geometry Title: Duplicate Effective Model
Geometry File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.g01

Flow Title : 10, 50, 100, 500 year Qs - Duplicate Eff
Flow File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.f01

Plan Description:
Lower Nashoba Brook

Duplicate Eff Report

Corrected Duplicate Effective Model

Plan Summary Information:

Number of:	Cross Sections	= 9	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options

Critical depth computed at all cross sections	
Conveyance Calculation Method:	At breaks in n values only
Friction Slope Method:	Average Conveyance
Computational Flow Regime:	Subcritical Flow

FLOW DATA

Flow Title: 10, 50, 100, 500 year Qs - Duplicate Eff

Flow File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.f01

Flow Data (cfs)

River	Reach	RS	10-Year	50-Year	100-Year	500-Year
Nashoba River	Lower Reach	1230	780	1095	1600	1750
Nashoba Brook	Lower Reach	1230	780	1095	1600	1750

Boundary Conditions

River	Reach	Profile	Upstream	Downstream

Nashoba Brook Lower Reach 10-Year
Normal S = 0.002
Nashoba Brook Lower Reach 50-Year
Normal S = 0.002
Nashoba Brook Lower Reach 100-Year
Normal S = 0.002
Nashoba Brook Lower Reach 500-Year
Normal S = 0.002

GEOMETRY DATA

Geometry Title: Duplicate Effective Model
Geometry File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.g01

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 1230

INPUT
Description: River Sta 1230
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	124	950	122	957	120	960	118	965	116.4
980	113.8	1020	113.8	1035	116.4	1040	118	1050	120
1060	123								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.09	965	.04	1035	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
965	1035	80	80	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 1150

INPUT

Duplicate Eff Report

Description: River Sta 1150

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
970	124	980	113.6	1020	113.6	1030	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
970	.09	970	.04	1030	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1030	40	40	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 1110

INPUT

Description: River Sta 1110

Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
970	124	980	113.6	1020	113.6	1030	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
970	.09	970	.04	1030	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1030	180	180	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 930

INPUT

Description: River Sta 930

Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
610	122	820	120	850	118	855	117	970	117
980	116	987	115.6	1000	113.4	1012	113.4	1013	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
610	.09	987	.04	1013	.09

Duplicate Eff Report

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
987	1013	300	300	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 630

INPUT
Description: River Sta 630
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
700	122	860	120	940	118	965	116	970	115.4
980	113.2	1020	113.2	1065	115.4	1100	116	1120	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
700	.09	970	.04	1065	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1065	280	280	.1	.3

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 350

INPUT
Description: River Sta 350
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
928	124	946	118	962	116	970	115.2	990	113
1030	113	1045	115.2	1050	116	1076	124		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
928	.09	970	.04	1045	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1045	50	50	.1	.3

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 300

Duplicate Eff Report

INPUT
Description: River Sta 300
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
964	121.5	980	112	1020	112	1036	121.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
964	.09	964	.04	1036	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
964	1036	40	40	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 260

INPUT
Description: River Sta 260
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
964	121.5	980	112	1020	112	1036	121.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
964	.09	964	.04	1036	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
964	1036	100	100	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 160

INPUT
Description: Located 160 feet above confluence with Assabet River
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
810	124	830	118	870	116	980	115	990	111
1010	111	1020	115	1025	116	1048	124		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

Duplicate Eff Report

810	.09	980	.04	1020	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
980	1020	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Nashoba Brook

Reach	River Sta.	n1	n2	n3
Lower Reach	1230	.09	.04	.09
Lower Reach	1150	.09	.04	.09
Lower Reach	1110	.09	.04	.09
Lower Reach	930	.09	.04	.09
Lower Reach	630	.09	.04	.09
Lower Reach	350	.09	.04	.09
Lower Reach	300	.09	.04	.09
Lower Reach	260	.09	.04	.09
Lower Reach	160	.09	.04	.09

SUMMARY OF REACH LENGTHS

River: Nashoba Brook

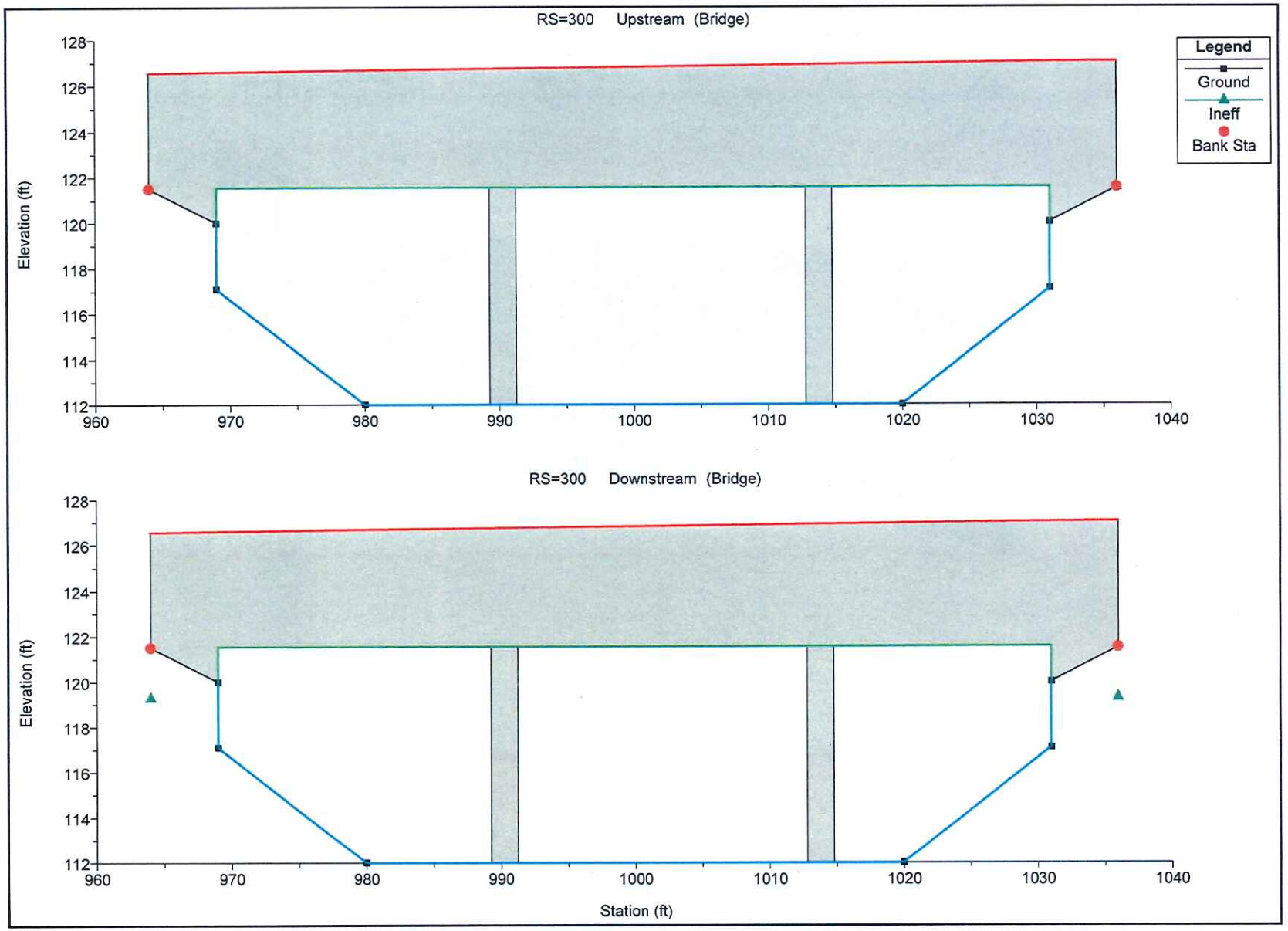
Reach	River Sta.	Left	Channel	Right
Lower Reach	1230	80	80	80
Lower Reach	1150	40	40	40
Lower Reach	1110	180	180	180
Lower Reach	930	300	300	300
Lower Reach	630	280	280	280
Lower Reach	350	50	50	50
Lower Reach	300	40	40	40
Lower Reach	260	100	100	100
Lower Reach	160	0	0	0

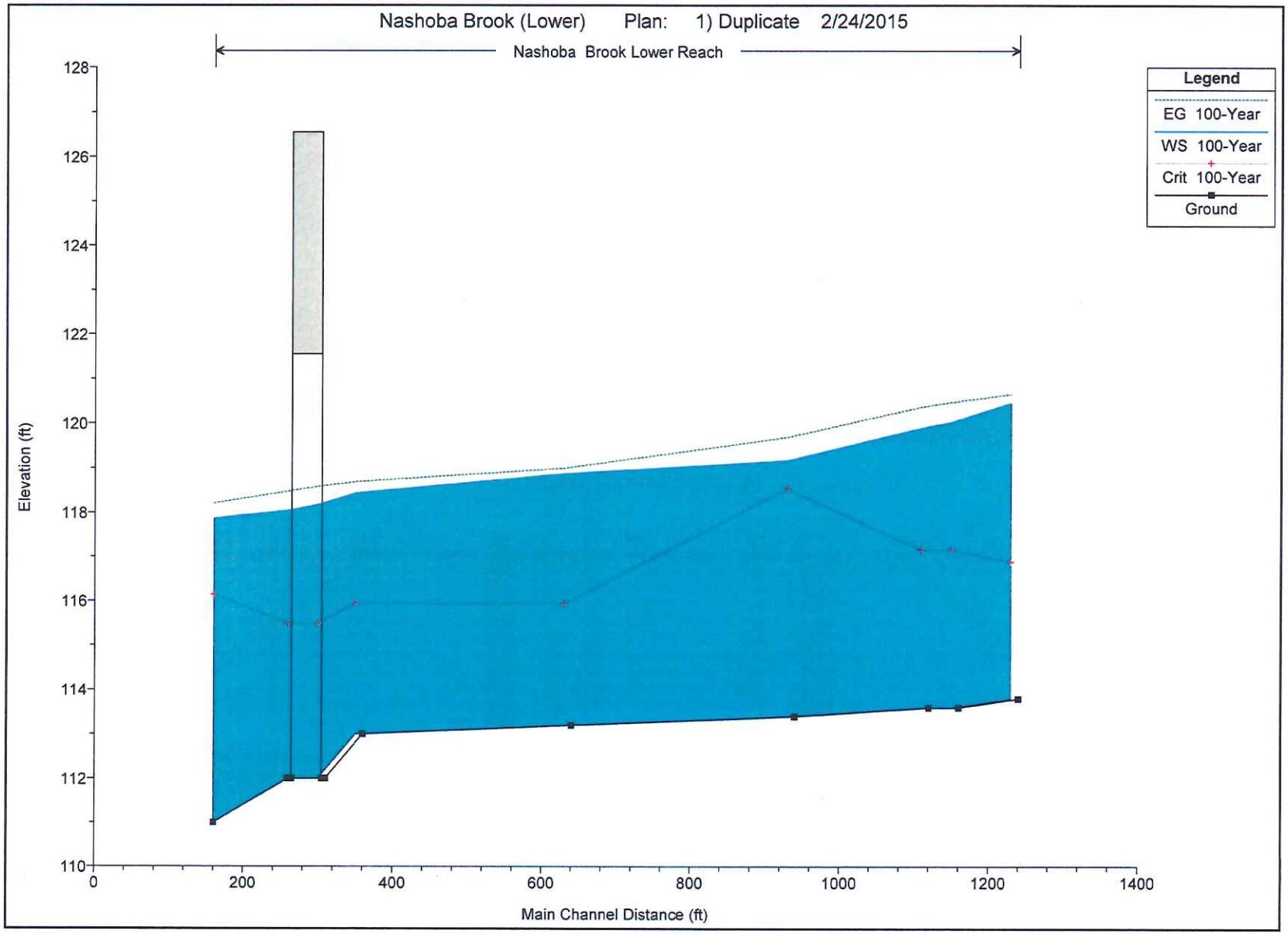
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Nashoba Brook

Duplicate Eff Report

Reach	River Sta.	Contr.	Expan.
Lower Reach	1230	.3	.5
Lower Reach	1150	.3	.5
Lower Reach	1110	.3	.5
Lower Reach	930	.3	.5
Lower Reach	630	.1	.3
Lower Reach	350	.1	.3
Lower Reach	300	.3	.5
Lower Reach	260	.3	.5
Lower Reach	160	.1	.3

HEC-RAS - Corrected Effective Model


RS=300 Upstream (Bridge)
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
128
126
124
122
120
118
116
114
112
960
970
980
990
1000
1010
1020
1030
1040
RS=300 Downstream (Bridge)
Elevation (ft)
Station (ft)


Nashoba Brook (Lower) Plan: 1) Duplicate 2/24/2015
Nashoba Brook Lower Reach
Legend
EG 100-Year
WS 100-Year
Crit 100-Year
Ground
Elevation (ft)
128
126
124
122
120
118
116
114
112
110
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

Corrected Eff Report

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X       X
X     X  X        X    X      X   X    X    X       X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Nashoba Brook (Lower)
Project File : NashobaBrook(Lowe.prj
Run Date and Time: 3/24/2015 12:50:17 PM

Project in English units

Project Description:
BFRT-Phase 2C

PLAN DATA

Plan Title: Corrected Duplicate Effective Model
Plan File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.p02

Geometry Title: Corrected Duplicate Effective Model
Geometry File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.g02

Flow Title : 10, 50, 100, 500 year Qs - Duplicate Eff
Flow File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.f01

Plan Description:
Lower Nashoba Brook

Corrected Eff Report

Corrected Duplicate Effective Model

Plan Summary Information:

Number of:	Cross Sections	= 9	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options

Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 10, 50, 100, 500 year Qs - Duplicate Eff
Flow File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.f01

Flow Data (cfs)

River	Reach	RS	10-Year	50-Year	100-Year	500-Year
Nashoba River	Lower Reach	1230	780	1095	1600	1750
Nashoba Brook	Lower Reach	1230	780	1095	1600	1750

Boundary Conditions

River	Reach	Profile	Upstream	Downstream

Corrected Eff Report

Nashoba Brook Lower Reach 10-Year
Normal S = 0.002
Nashoba Brook Lower Reach 50-Year
Normal S = 0.002
Nashoba Brook Lower Reach 100-Year
Normal S = 0.002
Nashoba Brook Lower Reach 500-Year
Normal S = 0.002

GEOMETRY DATA

Geometry Title: Corrected Duplicate Effective Model
Geometry File : z:\Projects\P2600+\P2676 GPI - BFRT\Phase 2C - Concord\HEC-RAS Calcs\NashobaBrook(Lowe.g02

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 1230

INPUT
Description: River Sta 1230
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
900	124	950	122	957	120	960	118	965	116.4
980	113.8	1020	113.8	1035	116.4	1040	118	1050	120
1060	123								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
900	.09	965	.04	1035	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
965	1035	80	80	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 1150

INPUT

Corrected Eff Report

Description: River Sta 1150
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
970	124	980	113.6	1020	113.6	1030	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
970	.09	970	.04	1030	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1030	40	40	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 1110

INPUT
Description: River Sta 1110
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
970	124	980	113.6	1020	113.6	1030	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
970	.09	970	.04	1030	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1030	180	180	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 930

INPUT
Description: River Sta 930
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
610	122	820	120	850	118	855	117	970	117
980	116	987	115.6	1000	113.4	1012	113.4	1013	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
610	.09	987	.04	1013	.09

Corrected Eff Report

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
987	1013	300	300	.3	.5

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 630

INPUT
Description: River Sta 630
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
700	122	860	120	940	118	965	116	970	115.4
980	113.2	1020	113.2	1065	115.4	1100	116	1120	124

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
700	.09	970	.04	1065	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1065	280	280	.1	.3

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 350

INPUT
Description: River Sta 350
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
928	124	946	118	962	116	970	115.2	990	113
1030	113	1045	115.2	1050	116	1076	124		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
928	.09	970	.04	1045	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
970	1045	50	50	.1	.3

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 305

Corrected Eff Report

INPUT
Description: River Sta 305
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
964	121.5	969	120	969	117.1	980	112	1020	112
1031	117.1	1031	120	1036	121.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
964	.09	964	.04	1036	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
964	1036	50	50	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
964	964	121.5	F
1036	1036	121.5	F

BRIDGE

RIVER: Nashoba Brook
REACH: Lower Reach RS: 300

INPUT
Description: BFRT C-19-032
Distance from Upstream XS = 5
Deck/Roadway Width = 40
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
856	125.9		956	126.5		969	126.6	121.55
1031	127	121.55	1049	127.1		1118	127.8	

Upstream Bridge Cross Section Data
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
964	121.5	969	120	969	117.1	980	112	1020	112
1031	117.1	1031	120	1036	121.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
964	.09	964	.04	1036	.09

Bank Sta: Left	Right	Coeff Contr.	Expan.
964	1036	.3	.5

Corrected Eff Report

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
964	964	121.5	F
1036	1036	121.5	F

Downstream Deck/Roadway Coordinates

num= 6

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
856	125.9		956	126.5		969	126.6	121.55
1031	127	121.55	1049	127.1		1118	127.8	

Downstream Bridge Cross Section Data

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
964	121.5	969	120	969	117.1	980	112	1020	112
1031	117.1	1031	120	1036	121.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
964	.09	964	.04	1036	.09

Bank Sta: Left	Right	Coeff Contr.	Expan.
964	1036	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
964	964	119.3	F
1036	1036	119.3	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 127.1
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 2

Pier Data
Pier Station Upstream= 990.25 Downstream= 990.25
Upstream num= 2

Width	Elev	Width	Elev
2	111	2	122

Downstream num= 2

Width	Elev	Width	Elev
2	111	2	122

Pier Data

Corrected Eff Report

Pier Station Upstream= 1013.8 Downstream= 1013.8

Upstream num= 2

Width	Elev	Width	Elev
2	111	2	122

Downstream num= 2

Width	Elev	Width	Elev
2	111	2	122

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy
Momentum Cd = 2
Yarnell KVal = 1.25

Selected Low Flow Methods = Highest Energy Answer

High Flow Method

Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters

Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION OUTPUT Profile #100-Year

E.G. Elev (ft)	118.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.		0.040	
W.S. Elev (ft)	118.17	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	115.48	Flow Area (sq ft)		310.66	
E.G. Slope (ft/ft)	0.002346	Area (sq ft)		310.66	
Q Total (cfs)	1600.00	Flow (cfs)		1600.00	
Top Width (ft)	60.77	Top Width (ft)		60.77	
Vel Total (ft/s)	5.15	Avg. Vel. (ft/s)		5.15	

Corrected Eff Report

Max Chl Dpth (ft)	6.17	Hydr. Depth (ft)			5.11
Conv. Total (cfs)	33032.0	Conv. (cfs)			33032.0
Length Wtd. (ft)	40.00	Wetted Per. (ft)			64.15
Min Ch El (ft)	112.00	Shear (lb/sq ft)			0.71
Alpha	1.00	Stream Power (lb/ft s)	1036.00		0.00
0.00					
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)		0.34	0.90
0.02					
C & E Loss (ft)	0.01	Cum SA (acres)		0.17	0.17
0.01					

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 255

INPUT
Description: River Sta 255
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
964	121.5	969	120	969	117.1	980	112	1020	112
1031	117.1	1031	120	1036	121.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
964	.09	964	.04	1036	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
964	1036	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
964	964	119.3	F
1036	1036	119.3	F

CROSS SECTION

RIVER: Nashoba Brook
REACH: Lower Reach RS: 160

INPUT

Corrected Eff Report

Description: Located 160 feet above confluence with Assabet River

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
810	124	830	118	870	116	980	115	990	111
1010	111	1020	115	1025	116	1048	124		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
810	.09	980	.04	1020	.09

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
980	1020	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Nashoba Brook

Reach	River Sta.	n1	n2	n3
Lower Reach	1230	.09	.04	.09
Lower Reach	1150	.09	.04	.09
Lower Reach	1110	.09	.04	.09
Lower Reach	930	.09	.04	.09
Lower Reach	630	.09	.04	.09
Lower Reach	350	.09	.04	.09
Lower Reach	305	.09	.04	.09
Lower Reach	300	Bridge		
Lower Reach	255	.09	.04	.09
Lower Reach	160	.09	.04	.09

SUMMARY OF REACH LENGTHS

River: Nashoba Brook

Reach	River Sta.	Left	Channel	Right
Lower Reach	1230	80	80	80
Lower Reach	1150	40	40	40
Lower Reach	1110	180	180	180
Lower Reach	930	300	300	300
Lower Reach	630	280	280	280
Lower Reach	350	50	50	50
Lower Reach	305	50	50	50

Corrected Eff Report

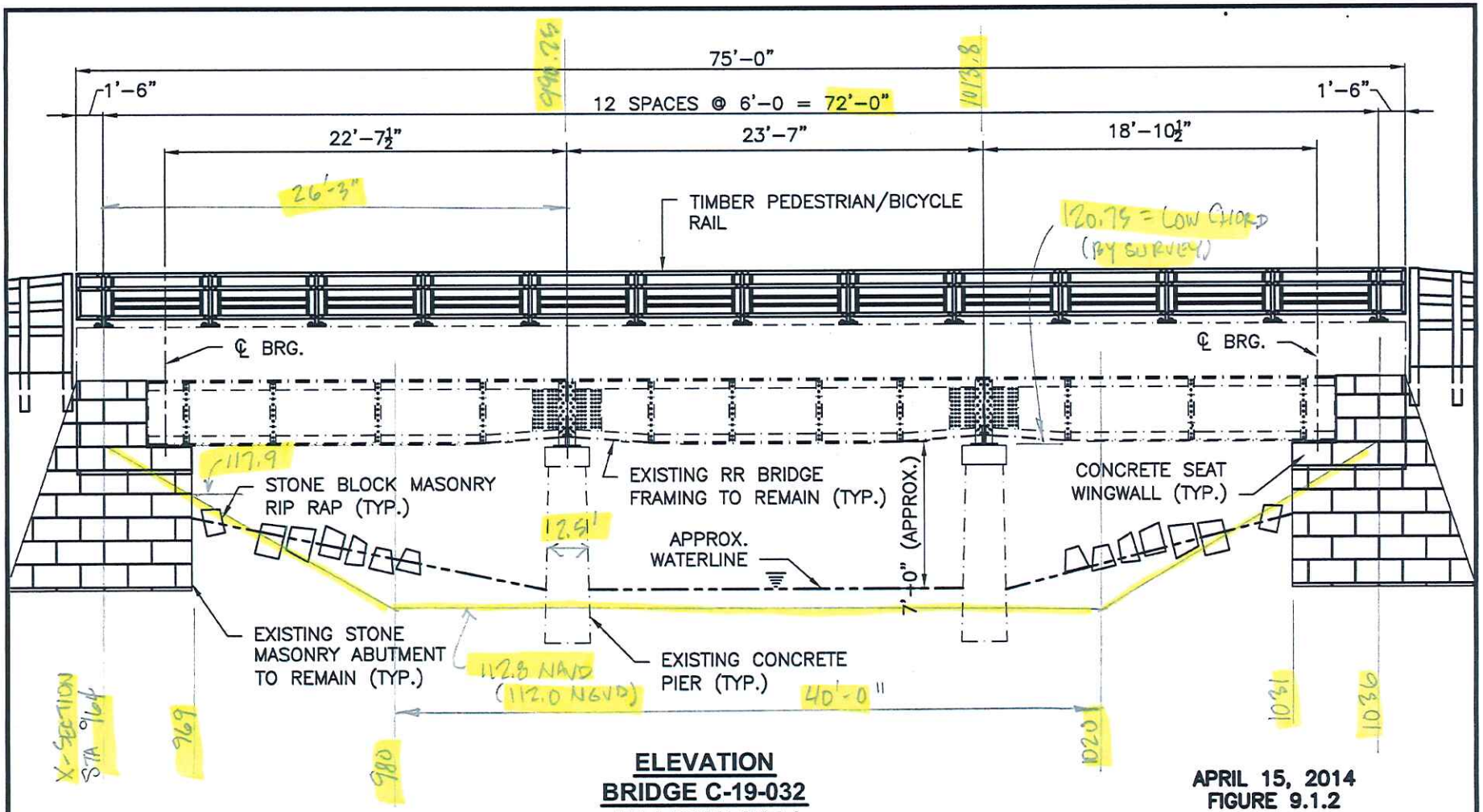
Lower Reach	300	Bridge		
Lower Reach	255	100	100	100
Lower Reach	160	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Nashoba Brook

Reach	River Sta.	Contr.	Expan.
Lower Reach	1230	.3	.5
Lower Reach	1150	.3	.5
Lower Reach	1110	.3	.5
Lower Reach	930	.3	.5
Lower Reach	630	.1	.3
Lower Reach	350	.1	.3
Lower Reach	305	.3	.5
Lower Reach	300	Bridge	
Lower Reach	255	.3	.5
Lower Reach	160	.1	.3

Appendix B – BFRT - Phase 2C Plans

Construction Plans & Profiles



ELEVATION
BRIDGE C-19-032
ALTERNATIVE 1
SCALE: ⅛" = 1'–0"

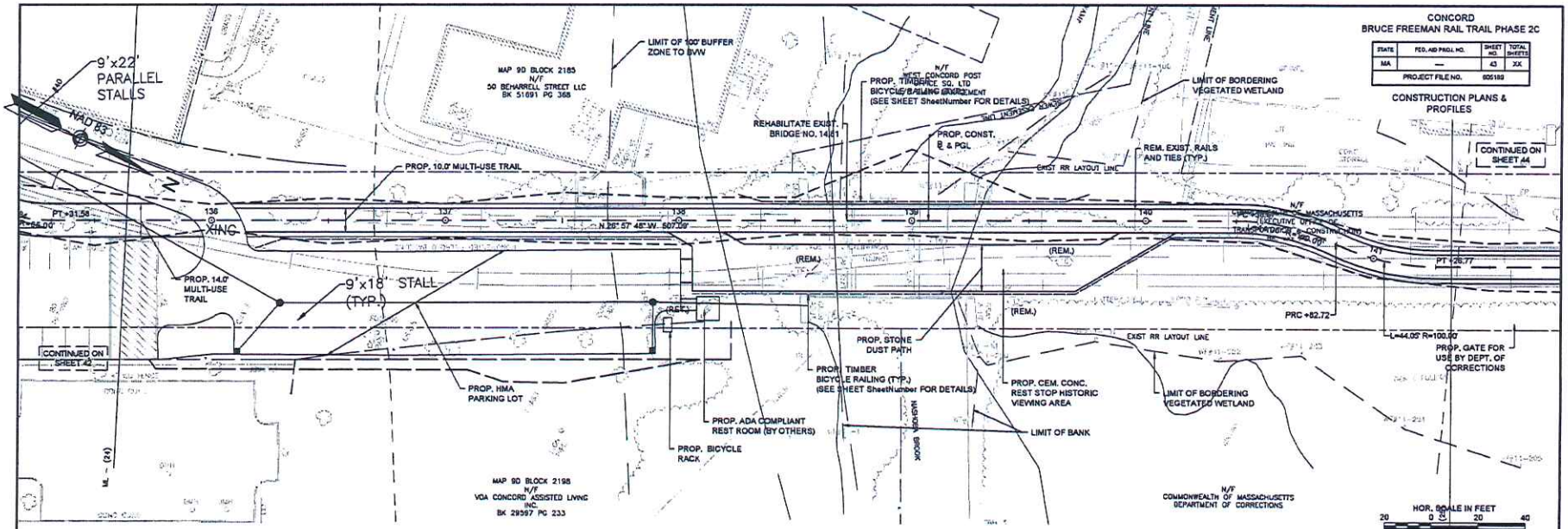
NASHOBA BROOK
RIVER STA's 260 & 300
HEC 2 FIS 11/29/83

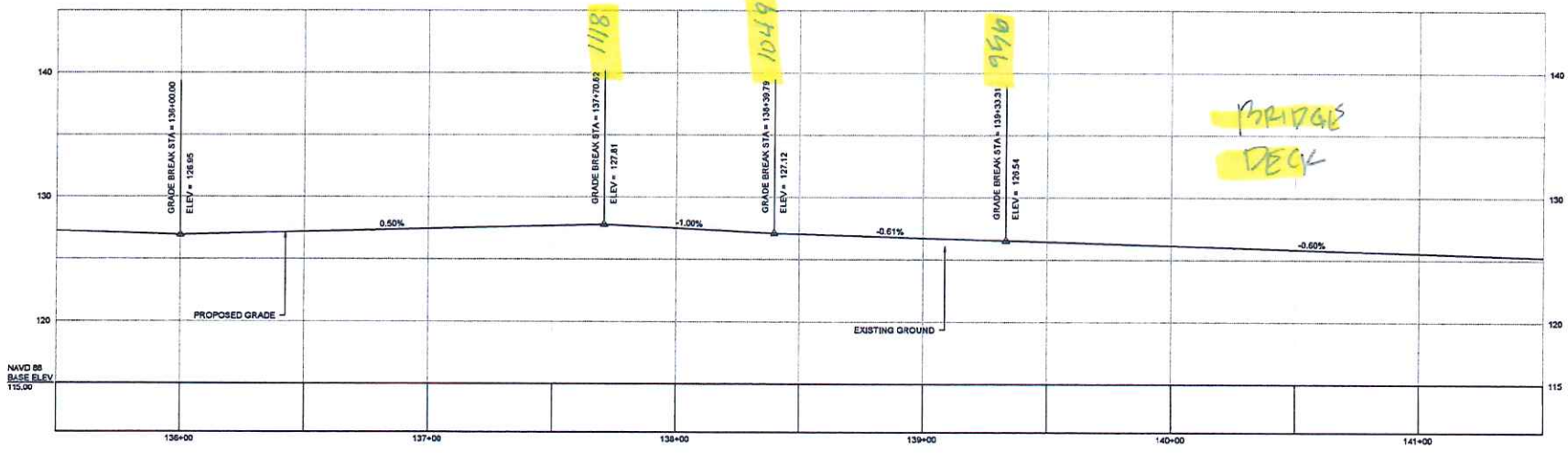
APRIL 15, 2014
FIGURE 9.1.2

BRUCE FREEMAN RAIL TRAIL
OVER NASHOBA BROOK
CONCORD, MASSACHUSETTS
BRIDGE C–19–032
BIN: A5R

Greenman-Pedersen, Inc.
GPI
181 Ballardvale Street, Suite 202, Wilmington, Ma 01887

ELEVATION – ALTERNATIVE 1


CONCORD
BRUCE FREEMAN RAIL TRAIL PHASE 2C
CONSTRUCTION PLANS & PROFILES
CONTINUED ON SHEET 44
9'x22' PARALLEL STALLS
NAD 83
PROP. 10.0' MULTI-USE TRAIL
PROP. 14.0' MULTI-USE TRAIL
9'x18' STALL (TYP.)
CONTINUED ON SHEET 43
PROP. HMA PARKING LOT
PROP. ADA COMPLIANT REST ROOM (BY OTHERS)
PROP. BICYCLE RACK
MAP 9D BLOCK 2185 N/F 50 BEHARRELL STREET LLC BK 51691 PG 365
MAP 9D BLOCK 2198 N/F VOA CONCORD ASSISTED LIVING INC. BK 29397 PG 233
LIMIT OF 100' BUFFER ZONE TO BVW
REHABILITATE EXIST. BRIDGE NO. 1401
PROP. CONST. ℄ & PGL
EXIST RR LAYOUT LINE
REM. EXIST. RAILS AND TIES (TYP.)
LIMIT OF BORDERING VEGETATED WETLAND
PROP. STONE DUST PATH
PROP. TIMBER BICYCLE RAILING (TYP.) (SEE SHEET SheetNumber FOR DETAILS)
PROP. CEM. CONC. REST STOP HISTORIC VIEWING AREA
LIMIT OF BANK
PRC +82.72
PT +26.77
L=44.05' R=100.00'
PROP. GATE FOR USE BY DEPT. OF CORRECTIONS
COMMONWEALTH OF MASSACHUSETTS DEPARTMENT OF CORRECTIONS
HOR. SCALE IN FEET
VER. SCALE IN FEET


GRADE BREAK STA = 136+00.00
ELEV = 126.65
GRADE BREAK STA = 137+70.62
ELEV = 127.81
GRADE BREAK STA = 138+39.79
ELEV = 127.12
GRADE BREAK STA = 139+33.31
ELEV = 129.54
0.50%
-1.00%
-0.61%
-0.60%
PROPOSED GRADE
EXISTING GROUND
NAVD 88
BASE ELEV
115.00
136+00
137+00
138+00
139+00
140+00
141+00
1118
1049
956
BRIDGE DECK

Appendix C – Excerpts from 2014 Middlesex County FIS

Table 8 – Summary of Discharges
Table 12 – Floodway Data
Flood Profile – Panel 378P

TABLE 8 - SUMMARY OF DISCHARGES – continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
MOWRY BROOK					
At confluence with the Sudbury Reservoir	1.6	50	70	80	110
MUD POND BROOK					
At confluence with Shawsheen River	0.3	45	80	100	175
MUDDY BROOK					
At the confluence with Heath Hen Meadow Brook	0.5	90	140	170	220
MULPUS BROOK					
At confluence with the Nashua River	15.9	720	1,740	1,950	3,440
At Townsend Road Culvert	14.0	810	1,920	2,140	3,820
MUNROE BROOK					
At Lexington/Arlington corporate limits	2.2	179	345	434	754
At Lilian Road	2.0	165	313	399	665
At Trail	1.5	130	242	302	511
At Bryant Road	1.0	100	188	238	359
MYSTIC RIVER					
At confluence with Maiden River	62.9	1,150	2,130	2,530	3,700
Downstream of confluence of Alewife Brook (Little River)	43.7	990	1,840	2,110	3,520
Upstream of confluence of Alewife Brook (Little River)	34.8	800	1,560	2,040	4,250
NAGOG BROOK					
At confluence with Nashoba Brook	2.4	70	120	155	310
At Nagog Pond outlet	1.2	12	16	18	27
NASHOBA BROOK					
At confluence of Fort Pond Brook	20.3	450	710	845	1,140
At State Route 27	11.8	410	695	840	1,340
Upstream of confluence of Butter Brook	8.7	340	590	715	1,130

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER-SURFACE ELEVATION (FEET NAVD88)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Nashoba Brook								
A	160	80	394	4.1	123.8	117.0[2]	117.7	0.7
B	930	100	339	4.7	123.8	118.3[2]	118.7	0.4
C	6,618	40	215	3.9	123.8	123.3	124.0	0.7
D	7,620	40	170	5.0	124.0	124.0	124.8	0.8
E	8,470	30	170	4.9	126.1	126.1	126.4	0.3
F	8,486	30	180	4.8	126.1	126.1	126.5	0.4
G	9,410	50	290	2.9	127.1	127.1	127.7	0.6
H	9,470	50	290	2.9	127.2	127.2	127.7	0.5
I	9,760	100	600	1.4	127.5	127.5	128.0	0.5
J	9,920	30	160	5.5	127.6	127.6	128.1	0.5
K	9,950	40	230	3.6	127.9	127.9	128.3	0.4
L	10,920	60	260	3.2	129.0	129.0	129.7	0.7
M	14,145	160	660	1.3	137.1	137.1	137.3	0.2
N	15,245	120	420	2.0	137.4	137.4	137.7	0.3
O	15,645	200	620	1.4	137.6	137.6	138.0	0.4
P	15,885	200	1,350	0.6	137.6	137.6	138.1	0.5
Q	16,655	300	2,080	0.4	137.7	137.7	138.1	0.4
R	17,135	180	730	1.2	137.7	137.7	138.2	0.5
S	17,555	320	1,270	0.7	137.8	137.8	138.3	0.5
T	17,965	50	210	4.0	137.8	137.8	138.2	0.4
U	18,445	130	740	1.1	138.1	138.1	138.7	0.6
V	18,610	30	130	6.5	138.2	138.2	138.9	0.7
W	18,765	90	290	2.9	140.6	140.6	140.8	0.2
X	19,915	110	330	2.5	141.9	141.9	142.4	0.5
Y	20,015	110	370	2.2	142.0	142.0	142.7	0.7
Z	21,015	60	310	2.7	142.9	142.9	143.7	0.8

[1] Feet above confluence with Assabet River
[2] Elevation computed without consideration of backwater effects from Assabet River

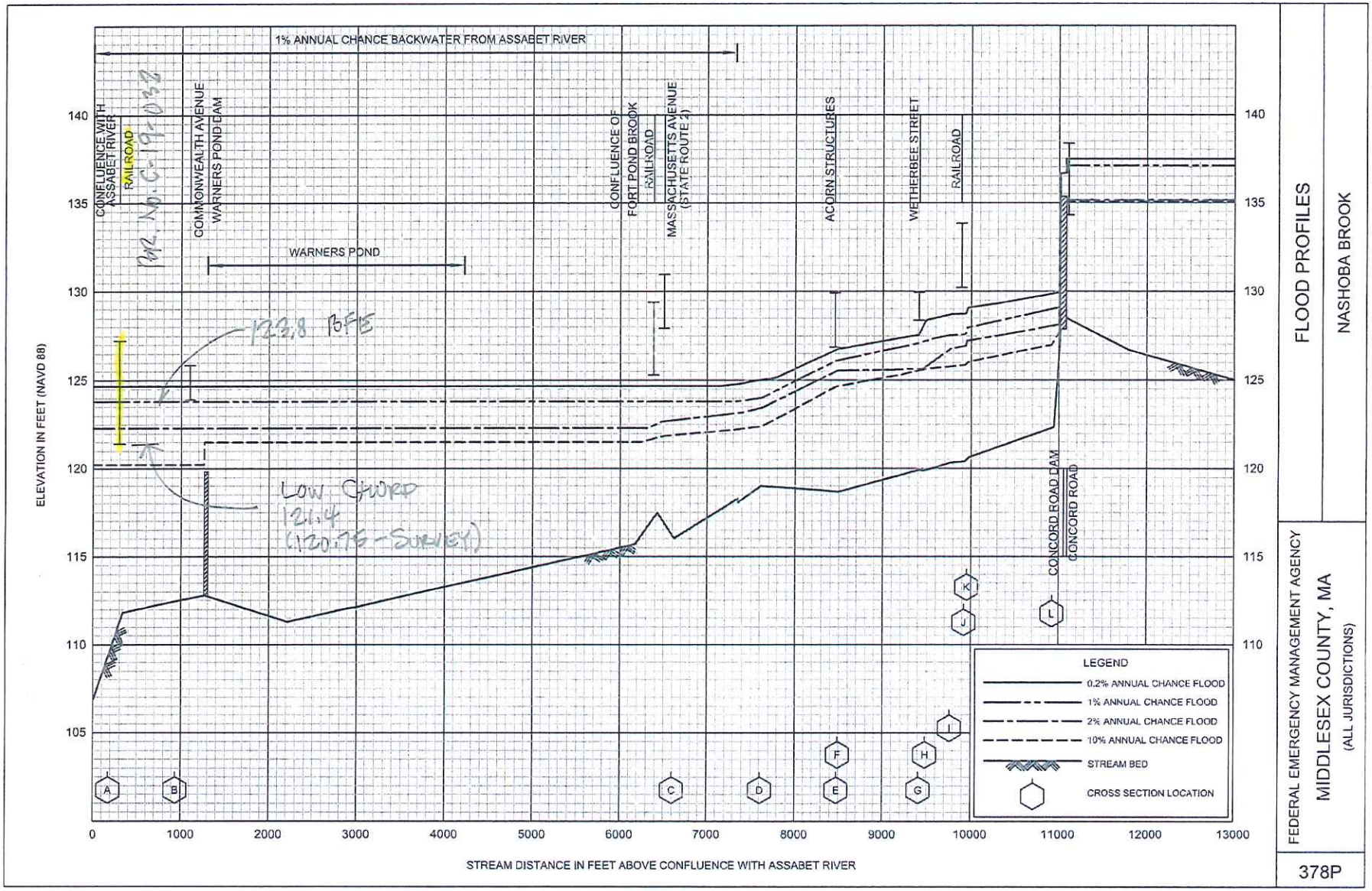
TABLE 12

FEDERAL EMERGENCY MANAGEMENT AGENCY

MIDDLESEX COUNTY, MA
(ALL JURISDICTIONS)

FLOODWAY DATA

NASHOBA BROOK



FLOOD PROFILES

NASHOBA BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MIDDLESEX COUNTY, MA

(ALL JURISDICTIONS)

378P

Appendix D – Information Received from FEMA

Nashoba Brook (Lower)

THIS RUN EXECUTED 11/29/83 11.39.25

```
**********************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APRL 1980
  ERROR CODE - 01,02,03,04
  MODIFICATION - 50,51,52,53,54, *, *, *, *, *
**********************************************************
```

Concord, MA
Nashoba Brook (Lower)
Type 1 Encroachment
-Final-

```
T1      FLOOD INSURANCE STUDY
T2      CONCORD, MASS.  10-YEAR
T3      LOWER NASHOBA BROOK  TYPE 1 ENCROACHMENT

J1  ICHECK     INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
        0.       4.        0.        0.  0.002000       0.0       0.0       0.   118.000       0.0
J2  NPROF      IPLOT     PRFVS     XSECV     XSECH     FN        ALLOC     IBW       CHNIM     ITRACE
    1.000        0.0    -1.000       0.0       0.0       0.0       0.0       0.0       0.0        0.0
J3  VARIABLE CODES FOR SUMMARY PRINTOUT
     30.000    30.000    40.000    41.000    42.000     1.000    51.000     2.000    13.000    14.000
     15.000    44.000    43.000     5.0      99.000     1.000    61.000     3.000    61.000    26.000
     72.000    72.000    21.000    44.000    43.000    28.000    99.000     0.0      200.000     0.0
GR      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
        1.0       0.0       0.0       0.0       0.0       0.0       7.000    10.000    13.000     2.100     0.0
X1    100.000     0.000   280.300   1020.000     0.0       0.0       0.0       0.0       0.0       0.0       0.0
CR    124.000   811.000   118.300   1030.000   116.000   870.000   115.000   980.000   111.000   990.000
EL    111.000  1010.000   115.000   1070.000   116.000  1025.000   124.000  1048.000     0.0       0.0
MNC     1.0       2.0       3.0       4.0       5.0       6.0       0.0       0.0       0.0       0.0
ET      1.0     964.000   103.300     1.300     0.0       1.000    10.700    13.400     2.100     0.0
X1    100.000     0.000   284.300   1020.000   109.000   100.000   100.000     0.0       0.0       0.0
CR    111.000   869.000   112.300   1030.000   112.000   1038.000  100.000   1038.000     0.0       0.0
ET      1.0     964.000   103.300     1.300     0.0       1.000    10.700    13.400     2.100     0.0
X1    100.000     0.000   284.300     0.0       40.000    40.000    40.000     1.000     0.0       0.0
ET      1.0     972.000   104.300     1.0       0.0       1.000    10.700    13.400     2.100     0.0
```

Corps Bridge No. C-19-032 (M81)

11/29/83 11.39.25

X1	350.000	9.000	970.000	1045.000	50.000	50.000	50.000	0.0	0.0	0.0
GE	124.000	926.000	110.000	946.000	116.000	962.000	115.200	970.000	113.000	990.000
GR	113.000	1030.000	115.200	1045.000	116.000	1050.000	124.000	1076.000	0.0	0.0
NC	0.0	0.0	0.0	0.100	0.300	0.0	0.0	0.0	0.0	0.0
ET	0.0	970.000	1065.000	0.0	0.0	7.600	10.600	13.600	2.100	0.0
X1	630.000	10.000	970.000	1065.000	280.000	280.000	280.000	0.0	0.0	0.0
GE	120.000	700.000	120.000	860.000	118.000	640.000	116.000	965.000	115.400	970.000
GR	113.200	880.000	113.200	1020.000	115.400	1065.000	116.000	1100.000	124.000	1120.000
ET	0.0	913.000	1013.000	0.0	0.0	7.600	10.600	13.600	2.100	0.0
X1	930.000	10.000	987.000	1013.000	300.000	300.000	300.000	0.0	0.0	0.0
GE	124.000	640.000	120.000	820.000	118.000	860.000	117.000	855.000	117.000	970.000
GR	113.200	880.000	115.200	987.000	118.400	1000.000	118.400	1012.000	124.000	1013.000
NC	0.0	0.0	0.0	0.300	0.500	0.0	0.0	0.0	0.0	0.0
ET	0.0	970.000	1030.000	0.0	0.0	7.600	10.600	13.600	2.100	0.0
X1	1110.000	4.000	970.000	1030.000	180.000	180.000	180.000	0.0	0.0	0.0
GE	124.000	970.000	11.600	980.000	118.000	1020.000	124.000	1030.000	0.0	0.0
ET	0.0	970.000	1030.000	0.0	0.0	7.600	10.600	13.600	2.100	0.0
X1	1110.000	0.0	0.0	0.0	40.000	40.000	40.000	1.000	0.0	0.0
ET	0.0	961.000	1055.500	0.0	0.0	7.600	10.600	13.600	2.100	0.0
X1	1030.000	11.000	965.000	1035.000	80.000	80.000	80.000	0.0	0.0	0.0
GE	124.000	920.000	120.000	860.000	118.000	957.000	116.000	960.000	116.400	965.000
GR	113.200	980.000	115.200	1020.000	118.400	1035.000	0.0	1045.500	120.000	1040.000
NC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

THIS RUN EXECUTED 11/29/83 11.39.32

****
HEC2 RELEASE DATED NOV 76 LPDATED APRL 1980
ERROR CORR - 01,02,03,04
MODIFICATION - 50,51,52,53,54, *, *, *, *
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

NASHOBA BROOK TYPE 1 FA

SUMMARY PRINTOUT

	SECNO	XLOB	ELTRD	ELLC	ELMIN	CWSEL	DIFWSX	CRIWS	QLOB	QCH	QROB	.01K	C
	160.000	0.0	0.0	0.0	111.00	117.85	0.0	0.0	358.35	1223.36	18.30	350.48	1600.00
	160.000	0.0	0.0	0.0	111.00	118.51	0.0	0.0	208.10	1391.90	0.0	358.14	1600.00
	260.000	100.00	0.0	0.0	112.00	116.02	0.17	0.0	0.0	1600.00	0.0	316.38	1600.00
	260.000	100.00	0.0	0.0	112.00	116.77	0.27	0.0	0.0	1600.00	0.0	390.11	1600.00
	300.000	40.00	0.0	0.0	112.00	116.14	0.13	0.0	0.0	1600.00	0.0	328.15	1600.00
	300.000	40.00	0.0	0.0	112.00	116.85	0.06	0.0	0.0	1600.00	0.0	397.63	1600.00
	350.000	50.00	0.0	0.0	113.00	118.45	0.30	0.0	47.70	1527.46	24.85	416.24	1600.00
	350.000	50.00	0.0	0.0	113.00	119.04	0.18	0.0	0.0	1600.00	0.0	449.70	1600.00
	630.000	280.00	0.0	0.0	113.20	115.87	0.43	0.0	51.74	1433.66	114.60	581.75	1600.00
	630.000	280.00	0.0	0.0	113.20	118.40	0.37	0.0	0.0	1600.00	0.0	803.67	1600.00
	930.000	300.00	0.0	0.0	113.40	119.08	0.70	0.0	641.12	958.88	0.0	207.86	1600.00
	930.000	300.00	0.0	0.0	113.40	119.51	0.10	0.0	493.03	1106.96	0.0	204.58	1600.00
	1110.000	180.00	0.0	0.0	113.60	119.83	0.76	0.0	0.0	1600.00	0.0	311.61	1600.00
	1110.000	180.00	0.0	0.0	113.60	120.48	0.67	0.0	0.0	1600.00	0.0	367.75	1600.00
	1150.000	40.00	0.0	0.0	113.60	119.96	0.13	0.0	0.0	1600.00	0.0	322.66	1600.00
	1150.000	40.00	0.0	0.0	113.60	120.67	0.09	0.0	0.0	1600.00	0.0	375.74	1600.00
	1230.001	80.00	0.0	0.0	113.60	120.91	0.45	0.0	19.05	1555.58	25.37	535.55	1600.00
	1230.000	80.00	0.0	0.0	113.60	120.96	0.34	0.0	0.0	1600.00	0.0	547.59	1600.00

NASHOBA BROOK TYPE 1 EN
SUMMARY PRINTOUT

	SECNO	CWSEL	DIFWSP	EG	DIFEG	VCH	SSTA	STENCL	STCHL	TOPWID	STCHR	STENCR	ENDST
A	160.000	117.85	0.0	118.18	0.0	5.23	833.09	0.0	980.00	197.21	1020.00	0.0	1030.30
	160.000	118.51	0.66	118.90	0.72	5.35	940.00	940.00	980.00	80.00	1020.00	1020.00	1020.00
	260.000	118.02	0.0	118.45	0.0	5.30	969.87	0.0	964.00	60.26	1036.00	0.0	1030.13
	260.000	118.77	0.76	119.10	0.65	4.59	968.59	964.00	964.00	62.82	1036.00	1036.00	1031.41
	300.000	118.85	0.71	119.17	0.61	4.53	968.47	964.00	964.00	63.07	1036.00	1036.00	1031.53
	350.000	118.45	0.0	119.70	0.0	4.13	944.66	0.0	970.00	113.29	1045.00	0.0	1057.95
	350.000	119.04	0.59	119.27	0.57	3.86	970.00	970.00	970.00	75.00	1045.00	1045.00	1045.00
	630.000	118.67	0.0	119.00	0.0	3.00	905.06	0.0	970.00	202.13	1065.00	0.0	1107.18
	630.000	119.40	0.53	119.65	0.65	3.03	970.00	970.00	970.00	95.00	1065.00	1065.00	1065.00
B	930.000	119.09	0.0	119.62	0.0	7.42	833.83	0.0	987.00	178.71	1013.00	0.0	1012.54
	930.000	119.51	0.43	120.21	0.59	7.89	913.00	913.00	987.00	99.58	1013.00	1013.00	1012.58
	1110.000	119.03	0.0	120.32	0.0	5.58	974.01	0.0	970.00	51.99	1030.00	0.0	1025.99
	1110.000	120.48	0.64	120.96	0.56	4.99	973.39	970.00	970.00	53.22	1030.00	1030.00	1026.61
	1150.000	119.96	0.0	120.43	0.0	5.45	973.88	0.0	970.00	52.24	1030.00	0.0	1026.12
	1150.000	120.57	0.60	120.94	0.52	4.92	973.30	970.00	970.00	53.39	1030.00	1030.00	1026.70
	1290.000	120.41	0.0	120.61	0.0	3.67	965.56	0.0	965.00	95.81	1035.00	0.0	1051.37
	1290.000	120.90	0.49	121.08	0.47	3.40	965.00	965.00	965.00	70.00	1035.00	1035.00	1035.00

FLOODWAY DATA NASHOBA BROOK TYPE 1 EN
PROFILE NO. 2

	STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
A	100.000	80.	394.	4.1	118.5	117.8	0.7
	200.000	85.	348.	4.6	118.6	118.0	0.6
	300.000	63.	350.	4.5	118.6	118.1	0.5
	400.000	98.	411.	3.8	118.8	118.4	0.4
	670.000	95.	869.	3.0	119.4	118.9	0.5
B	990.000	100.	336.	4.7	119.5	119.1	0.4
	1114.000	69.	321.	5.1	120.4	119.8	0.6
	1182.000	69.	354.	4.8	120.6	120.0	0.6
	1280.000	70.	458.	3.6	120.9	120.4	0.5

ATTACHMENT G
MEPA Environmental Notification Form

Commonwealth of Massachusetts

Executive Office of Energy and Environmental Affairs
Massachusetts Environmental Policy Act (MEPA) Office

Environmental Notification Form

For Office Use Only

EEA#: _____

MEPA Analyst: _____

The information requested on this form must be completed in order to submit a document electronically for review under the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: **Bruce Freeman Rail Trail Phase 2C**		
Street Address: **The project follows the Lowell Secondary Track of the abandoned New Haven Railroad, from the Sudbury/Concord town line northwest through West Concord, ending at a point west of Commonwealth Avenue, generally south of Route 2.**		
Municipality: **Concord**	Watershed: **Sudbury-Assabet-Concord**	
Universal Transverse Mercator Coordinates: **Zone 19: 302855E, 4699655N (start) Zone 19: 302799E; 4704164N (end)**	**Latitude:42°25'27"N (start) 42°27'53"N (end) Longitude:71°23'47"W (start) 71°23'55"W (end)**	
Estimated commencement date: **3/2016**	Estimated completion date: **12/2017**	
Project Type: **Multi-Use Rail Trail**	Status of project design: **75% complete**	
Proponent: **Massachusetts Department of Transportation (MassDOT)**		
Street Address: **10 Park Plaza**		
Municipality: **Boston**	State: **MA**	Zip Code: **02116**
Name of Contact Person: **Mark Kolonoski**		
Firm/Agency: **MassDOT**	Street Address: **10 Park Plaza**	
Municipality: **Boston**	State: MA	Zip Code: **02116**
Phone: **(857) 368-8831** Fax: **(857) 368-0609**	Email: **Mark.Kolonoski@dot.state.ma.us**	

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)? ☐Yes ☒No

If this is an Expanded Environmental Notification Form (ENF) (see 301 CMR 11.05(7)) or a Notice of Project Change (NPC), are you requesting:

a Single EIR? (see 301 CMR 11.06(8))	☐Yes ☒No
a Special Review Procedure? (see 301CMR 11.09)	☐Yes ☒No
a Waiver of mandatory EIR? (see 301 CMR 11.11)	☐Yes ☒No
a Phase I Waiver? (see 301 CMR 11.11)	☐Yes ☒No

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?
301 CMR 11.03 (1)(b)2. Creation of five or more acres of impervious area.

Which State Agency Permits will the project require? **Wetlands Protection Act – Notice of Intent, Order of Conditions; Section 404 ACOE Massachusetts General Permit; Section 401 Water Quality Certification; MESA Project Review & Chapter 91 Waterways License for Water-Dependent Use.**

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:

It is anticipated that MassDOT will fund 20% of the construction costs and the Federal Highway Administration will fund the remaining 80% of the construction costs. There will be no land transfer from any agency of the Commonwealth.

Summary of Project Size & Environmental Impacts	Existing	Change	Total
LAND			
Total site acreage	**31.2 acres**		
New acres of land altered		**1.8 acres**	
Acres of impervious area	**2.8 acres**	**4.8 acres**	**7.6 acres**
Square feet of new bordering vegetated wetlands alteration		**273 sf temp**	
Square feet of new other wetland alteration		**112 sf temp LUW** **27,921 sf Riverfront Area (Previously Developed)**	
Acres of new non-water dependent use of tidelands or waterways		**N/A**	
STRUCTURES			
Gross square footage	NA	NA	NA
Number of housing units	NA	NA	NA
Maximum height (feet)	NA	NA	NA
TRANSPORTATION			
Vehicle trips per day	NA	NA	NA
Parking spaces	**0**	**40**	**40**
WASTEWATER			
Water Use (Gallons per day)	NA	NA	NA
Water withdrawal (GPD)	NA	NA	NA
Wastewater generation/treatment (GPD)	NA	NA	NA
Length of water mains (miles)	NA	NA	NA
Length of sewer mains (miles)	NA	NA	NA

Has this project been filed with MEPA before?
☒ Yes (EEA # **12109**) ☐ No

The proposed Bruce Freeman Rail Trail was the subject of MEPA review in 1999 when the Towns of Chelmsford and Westford submitted an Environmental Notification Form that described the 4.88 mile long recreational trail to be located entirely within the abandoned railroad right-of-way (ROW).

Has any project on this site been filed with MEPA before?
☒ Yes (EEA # 15196) ☐ No
The proposed Bruce Freeman Rail Trail Phase 2A was the subject of MEPA review in 2014. The BFRT Phase 2A includes a 4.88 mile segment of rail trail located in the Towns of Westford, Carlisle, and Acton.

GENERAL PROJECT INFORMATION

PROJECT DESCRIPTION:

The Bruce Freeman Rail Trail (BFRT) is a multi-use path that when completed will have a length of 25-miles through the communities of Lowell, Chelmsford, Westford, Carlisle, Acton, Concord, Sudbury, and Framingham over the abandoned Framingham & Lowell lines of the former New Haven Railroad. As of 2015, Phase I of BFRT is complete through Lowell, Chelmsford, and Westford. Phase 2A through Westford, Carlisle, and Acton is scheduled to begin construction in Spring of 2015. Phase 2B through Acton and Concord, Phase 2D through Sudbury and Framingham, and Phase 3 through Framingham are still in the preliminary design stages.

Phase 2C of the BFRT is an approximately 3.0-mile long segment of a multi-use recreational trail along the former Lowell Secondary Track of the New Haven Railroad owned by the Commonwealth of Massachusetts. The Town of Concord has authorized the design work with the understanding that improvements will be funded through federal and state aid programming under the jurisdiction of the Massachusetts Department of Transportation (MassDOT). The proposed trail will extend from the completed BFRT Phase I (Westford – Lowell Phase), the recently permitted BFRT Phase 2A (Westford, Carlisle, and Acton), and BFRT Phase 2B (0.67 mile segment in Concord) which is still in the preliminary design phase.

Describe the proposed project and its programmatic and physical elements:

The proposed Phase 2C of the BFRT begins at the Sudbury/Concord town line and runs north through West Concord, ultimately ending at a point west of Commonwealth Avenue, generally south of Route 2. Construction activities will include the following:

- Paved 8 to 10 foot wide multi-use recreational trail with one to two foot stone dust graded shoulders on either side
- Stormwater management BMPs and culvert replacement
- Reconstruction of a pedestrian underpass under Powder Mill Road
- Public access to and from Powder Mill Road to the trail
- Construction of three parking areas, to be located off Commonwealth Ave and adjacent to the existing Massachusetts Bay Transportation Authority (MBTA) Commuter Rail building.
- Trail pavement markings and signing
- Roadway pavement markings and signing at trail crossings
- Traffic calming features
- Earthwork and landscaping
- Interpretive signs
- Rest areas
- Other items incidental to the construction of the trail.

In addition to the listed items, the rail trail will include the rehabilitation and/or construction of two bridges. The 70-foot by 40-foot former railroad trestle bridge (Bridge No. C-19-032) over Nashoba Brook in West Concord will be rehabilitated to support the multi-use trail and a pedestrian rest area. An 87-foot by 16-foot prefabricated trestle bridge (Bridge No. C-19-015) will be placed on the existing concrete abutments at the Assabet River (Sta. 116+25 to 117+25). Hydraulic studies have been recently completed documenting placement of these bridge structures will not increase the base flood elevation.[1]

The existing flow patterns will not be altered with the construction of the rail trail. All existing drainage will be upgraded according to MassDOT criteria. The proposed rail trail is classified as a redevelopment project under the Stormwater Management Standards established in the Massachusetts Wetland Regulations, 310 CMR 10.00. As such, the Project is required to meet the Stormwater Management Standards to the maximum extent practicable. Several types of stormwater Best Management Practices (BMPs) are proposed to limit loss of recharge to groundwater and increase stormwater Total Suspended Soils (TSS) removal. Stormwater BMPs will include the following:

- an infiltration trench, leaching basin, and bioretention cell in the location of the parking area south of Nashoba Brook (Sta 136+00 to 138+25);
- pervious pavers for the rest areas on either side of the Nashboa Brook (approximately Sta. 138+50 and Sta. 139+50); and
- an infiltration basin with a sediment forebay at the northernmost parking lot off of Commonwealth Avenue (approximately Sta. 162+00).

SUMMARY OF IMPACTS

Wetlands

The wetland resource area boundaries along the BFRT Phase 2C were delineated in the field by Vanasse Hangen Brustlin, Inc. (VHB) and were confirmed through issuance of a Superseding Order of Resource Area Delineation (SORAD) from MassDEP Northeast Regional Office on June 26, 2008. MassDEP has extended the SORAD to June 26, 2018.

Resource areas within and adjacent to the footprint of the proposed trail include Bordering Vegetated Wetlands (BVW), Bordering Land Subject to Flooding (BLSF), Riverfront Area (RA), Bank, and Land Under Water (LUW).

Bordering Vegetated Wetlands

As described in the 2007 Abbreviated Notice of Resource Area Delineation prepared by VHB, the BVW associated with BFRT Phase 2C is divided into multiple areas within the Town of Concord that are ultimately hydraulically connected to the Assabet River, Nashoba Brook, Dugan Brook, or White's Pond.

In proximity to the southernmost portion of the proposed trail route (i.e. the segment begging at the Sudbury/Concord town boundary and continuing north to the Powder Mill Road underpass) wetland resources are largely associated with White's Pond. White's Pond can be classified as lacustrine limnetic deepwater habitat with an unconsolidated bottom. The minimum distance

1 HEC-RAS Analysis Bruce Freeman Rail Trail (Phase 2C) Concord, Massachusetts MassDOT Project #605189; Prepared by Nover-Armstrong Associates, Inc; prepared for Greenman-Pedersen, Inc.; dated March 2015.

between the boundary of the wetland defining White's Pond and the limit-of-work (LOW) is approximately 35 feet. This segment of the BFRT is also within proximity to an approximately 0.3 acre isolated kettle hole forested wetland and Certified Vernal Pool (CVP #944).

BVW and associated resources adjacent to the BFRT from Powder Mill Road to the south (Sta. 29+00) and Old Marlboro Road to the north (Sta. 103+50) are known collectively as the Jenny Dugan Swamp. BVW in this area can be characterized as palustrine forested wetland with a seasonally flooded water regime. In many locations, areas of wet meadow shrub swamp emerges within the larger forested wetland complex. The BVW in this area supports a largely native community, with the exception of the rail bed itself, which supports a large population of invasive glossy buckthorn *(Rhamnus frangula).* Dominant vegetation includes red maple *(Acer rubrum)*, American elm *(Ulmus Americana)*, and highbush blueberry *(Vaccinium corymbosum).*

In proximity to the BFRT trail crossing with the Assabet River (approximately Sta. 113+00 to 119+25), palustrine forested deciduous vegetated wetland bordering on the Assabet River lies at the toe of slope on each side of the historic rail bed. Dominant vegetation includes glossy buckthorn, jewelweed *(Impatiens capensis)*, poison ivy *(Toxicondendron radicans)*, and red maple.

BVW observed in the vicinity of the BFRT crossing of the Nashoba Brook (Sta. 137+00 to Sta. 141+50) is limited to the north of the former railroad bridge and east of the railroad ROW. The BVW is characterized as a palustrine scrub shrub deciduous wetland.

BFRT Phase 2C will result in a total of 273 sf of temporary BVW impact to accommodate work associated with the replacement of an existing 30" Reinforced Concrete Pipe (RCP) culvert and headwalls at Sta. 181+12. The headwalls will be accessed from the adjacent upland and no equipment will enter the resource area at any time. As impacts to BVW will be restored in place, all of the interests of the Act for BVW including protection of Wildlife Habitat, will be preserved. Impacts to BVW will be restored in place.

Riverfront Area

RA exists within the proposed project site in association with the Assabet River and Nashoba Brook. Since historic railroads typically followed rivers, rail trail linear projects routinely result in quantifiable impacts to Previously Developed/degraded RA. A total of 27,921 sf or 29% of the total 97,506 sf of RA within the project LOW will be impacted as a result of this public project. Of the 29%, 27,921 sf or 100% is Previously Developed RA.

In their 2007 *Technical Memorandum*[2], VHB conducted an Appendix B: Detailed Wildlife Habitat Evaluation for impacts to the RA at the Assabet River and Nashoba Brook and concluded that the proposed trail alignment within RA contained minimal habitat value.

The trail crosses the Assabet River and its associated RA at Sta. 113+14 to 119+23. The Assabet River is a designated Wild and Scenic River at the location of the crossing. Work within RA at the Assabet River includes the construction of a 12-foot by 32-foot paved pedestrian rest area and a 10 to 12-foot wide paved shared use trail. Proposed impacts to RA in proximity to the Assabet River are sensitive to the aesthetic, recreational, and ecological values of the River and its RA. The 87-foot long trestle bridge to be constructed over the Assabet will

2 *Bruce Freeman Rail Trail Technical Memorandum Concord, Massachusetts*; prepared for Town of Concord; prepared by Vanasse Hangen Brustlin, Inc.; dated December 2007.

be placed upon exiting abutments to minimize disturbance. The passive recreational trail itself will be centered upon the existing Previously Developed/degraded rail ballast. Adjacent wetlands within the RA and floodplain to the Assabet River will be preserved and protected through utilization and maintenance of erosion controls. Impacts to RA in proximity to the Assabet River total 10,454 sf, of which 10,454 sf (100%) is Previously Developed RA. Of 10,454 sf of impacts, 3,068 sf is temporary impact to be fully restored in place.

The Nashoba Brook intersects with the BFRT at Sta. 31+89 to Sta. 35+63. Work within RA at the Nashoba Brook includes the construction of a pedestrian resting area, a 10 to 12-foot wide shared use path, a paved parking area on the south side of the bridge, and slope stabilization work. Impacts to RA in proximity to the Nashoba Brook total 17,467 sf, of which 17,467 sf (100%) is Previously Developed RA. Of the 17,467 sf of impact, 3,679 sf is temporary impact to be fully restored in place.

The BFRT crosses a tributary stream to Dugan brook at Sta. 81+12. Although the unnamed tributary stream is mapped as perennial on the latest USGS topographic mapping, it was confirmed as intermittent during the ANRAD process and therefore does not possess an RA.[3]

The BFRT Phase 2C has been designed to minimize impacts to RA to the extent possible. The BFRT is centered on the existing rail ballast, containing construction impacts to the extent possible on Previously Developed land and the proposed horizontal and vertical alignments were established to minimize impacts. Since historic railroads typically followed rivers, rail trail projects routinely involve quantifiable impacts to Previously Developed/degraded RA.

Bank

Bank boundary identified and delineated within 100-feet of the ROW is associated with White Pond, Dugan Brook, Assabet River, Nashoba Brook and intermittent streams. Some Bank boundaries directly adjacent to the ROW/rail bed have been confirmed under the SORAD process. The Project as proposed will not result in any impact to Bank.

Land Under Water

Land Under Water (LUW) is located in and adjacent to the linear project locus and is generally associated with the White Pond, Dugan Brook, the Assabet River, Nashoba Brook, and intermittent streams. Some LUW boundary directly adjacent to the ROW/rail bed have been confirmed under the SORAD process.

The project as proposed results in 112 sf of temporary alteration to LUW to accommodate work associated with the replacement of an existing 30" RCP and headwalls at Sta. 181+12 (Dugan Brook). Flow within the stream will be bypassed if necessary but it is expected that permit conditions will require that culvert replacement will be conducted during low or now flow conditions. Temporary impacts will be fully restored in place. No permanent impacts to LUW are proposed.

Bridge work over the Assabet River will not require in-water work. Bridge rehabilitation over the Nashoba Brook will require limited in-water work consisting of boat access for the installation of a paint containment structure.

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[3] *Abbreviated Notice of Resource Area Delineation Bruce Freeman Rail Trail Concord, Massachusetts*; Prepared by Vanasse Hangen Brustlin, Inc.; prepared for Town of Concord Natural Resources Commission; dated September 5, 2007.

Bordering Land Subject to Flooding (BLSF) - FEMA 100 Year Floodplain

The July 7, 2014 FEMA Flood Insurance Rate Maps (FIRM) for the BFRT Phase 2C project limits are designated as map numbers 25017C0367F and 25017C0359F. The Base Flood Elevation (BFE) for the Nashoba Brook and the Assabet River at the location of the BFRT crossing is 123.8 and 124.0 feet NAVD, respectively. All BFRT Phase 2C work will occur above the BFE.

The FIRM maps indicate the proposed trail traversing Special Flood Hazard Areas: Zone AE and Floodway Areas in Zone AE. Zone AE are areas subject to inundation by the 1% annual chance flood (100-year flood) with the flood elevation determined. The floodway is the channel of the stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights.

The bridge work will occur entirely above the FEMA Zone AE Flood Zone BFE and therefore will not result in temporary or permanent impacts to BLSF or the placement of fill below the 100-year floodplain.

The former railroad trestle bridge over Nashoba Brook will be modified to accommodate the multi-use trail. The existing stone abutments and steel beams will remain in place. The rails, ties and ballasts will be removed to accommodate the proposed paved 12-foot trail and resting area on top of the existing crossing. Hydraulic analyses were performed to demonstrate that there is "no-rise" in the regulatory flood level at the location of the bridge replacement and the embankment modifications.[4]

Bridge work at the crossing of the BFRT with the Assabet River involves the placement of a new 87-foot by 16-foot prefabricated trestle bridge on existing concrete abutments and wing walls. The new pedestrian bridge will be located above the BFE for the area and will not result in any impacts to BLSF.

Rare Species Habitat

A small linear portion of the project is situated within Natural Heritage and Endangered Species Program (NHESP) mapped Priority Habitat of Rare Species requiring MassDOT-Highway to submit this application to NHESP for Massachusetts Endangered Species Act (321 CMR 10.00) project review. According to the 2008 public mapping, a 1,100 linear foot section of the existing rail ROW is through a NHESP Priority Habitat of Rare Species (PH 126). In 2007, during the 25% Design process, the Town of Concord commissioned VHB to evaluate the natural resources within and adjacent to the entire BFRT LOW. VHB concluded that PH126 supports two threatened plant species[5] - Engelmann's Umbrella-sedge *(Cyperus engelmannii)* and Resupinate Bladderwort *(Utricularia resupinata)*, both of which are aquatic plants. The BFRT remains in the ROW in this location and does not involve work in the nearby wetlands. Therefore, the project expects to receive a No Take determination from the NHESP.

Three mapped NHESP CVPs and three mapped potential vernal pools (PVP) exist within 100-feet of the railroad ROW. Two of three CVP (955 and 956) are located just north of Powder

4 HEC-RAS Analysis Bruce Freeman Rail Trail (Phase 2C) Concord, Massachusetts MassDOT Project #605189; Prepared by Nover-Armstrong Associates, Inc; prepared for Greenman-Pedersen, Inc.; dated March 2015.

5 *Bruce Freeman Rail Trail Technical Memorandum Concord, Massachusetts*; prepared for Town of Concord; prepared by Vanasse Hangen Brustlin, Inc.; dated December 2007.

Mill Road with the remaining CVP (944) located approximately 500 feet south of Power Mill Road. Construction protective measures, including erosion controls barriers and construction timing aimed at avoiding vernal pool species spring migration, will prevent impacts to any CVP or PVP. Work associated with Phase 2C will be limited to the buffer zones associated with the vernal pool depressions.

Alternatives Analysis

Selected Alternative: Rail Trail along the Lowell Secondary Railroad Line

The preferred alternative described in the project description portion of this ENF was selected because it avoids, minimizes, and mitigates impacts to environmental and ROW resources while achieving the purpose of the project. The alignment of Phase 2C is centered on the existing rail ballast for the purpose of utilizing previously altered land. The alignment has been re-routed in order to provide safe passage across the active MBTA Fitchburg Commuter Rail Line. This project presents an opportunity to provide continuity to the constructed and proposed phases of the BFRT while incorporating a resource-sensitive design.

Alternative B: Adjacent Lots and Other Lands Within the Municipality

There are no adjacent lots or other land within the municipality that could be reasonably obtained and would present less impact on resources within the project area. There is currently no land of adequate size and configuration available to accommodate a significant length of multi-use recreational trail and listed for sale at the time of filing. Therefore this alternative is not practicable and is not being considered.

Alternative C: On-Road Project Location

An alternative alignment was considered utilizing the existing roadway ROW within the project area. However, an on-road non-motorized multi-use passive recreational trail is not feasible while simultaneously ensuring public safety with motorized traffic. This would require significant land easements/purchases and widening of the existing roadway. For these reasons, this alternative was dismissed.

Alternative D: No Build Scenario

The no-build scenario does not fulfill the overall project purpose of providing a public passive recreational amenity by utilizing abandoned land owned by the Commonwealth.

Summarize the mitigation measures proposed to offset the impacts of the preferred alternative:

Temporary impacts to areas subject to protection, namely BVW and LUW, will be fully restored in place.

As part of the project, eroding side slopes at the Nashoba Brook bridge crossing will be stabilized by rebuilding the slope in a terraced configuration using wooden railroad ties or placement of modified rock fill. Upon slope stabilization, topsoil and seed will be placed on all exposed surfaces

Erosion and sedimentation controls will be installed and maintained where activities are proposed within 100-feet of BVW, Bank, LUW, CVP, or PVP. They will provide a LOW barrier while preventing silt and sediments from migrating into or towards the wetland resource areas. Inspectors will assess conditions and identify problems in the field during and after construction activities.

If the project is proposed to be constructed in phases, please describe each phase:

The proposed Phase 2C of the BFRT is currently designed to be constructed as a single phase within the town of Concord.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN:
Is the project within or adjacent to an Area of Critical Environmental Concern?
☐Yes (Specify_____)
☒No

RARE SPECIES:
Does the project site include Estimated and/or Priority Habitat of State-Listed Rare Species? (see http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/priority_habitat/priority_habitat_home.htm)
☒Yes (PH 126) ☐No

A small linear portion of the project is situated within NHESP-mapped Priority Habitat of Rare Species requiring MassDOT-Highway to submit this application to NHESP for Massachusetts Endangered Species Act (321 CMR 10.00) project review. According to the 2008 public mapping, a 1,100 linear foot section of the existing rail ROW is through a NHESP Priority Habitat of Rare Species (PH 126). In 2007, during the 25% Design process, the Town of Concord commissioned VHB to evaluate the natural resources within and adjacent to the entire BFRT LOW. VHB concluded that PH126 supports two threatened plant species[6] - Engelmann's Umbrella-sedge *(Cyperus engelmannii)* and Resupinate Bladderwort *(Utricularia resupinata)*, both of which are aquatic plants. The BFRT remains in the ROW in this location and does not involve work in the nearby wetlands. Therefore, the project and expects to receive a No Take determination from the NHESP.

Three mapped NHESP CVPs and three mapped potential vernal pools (PVP) exist within 100-feet of the railroad ROW. Two of three CVP (955 and 956) are located just north of Powder Mill Road with the remaining CVP (944) located approximately 500 feet south of Power Mill Road. Construction protective measures, including erosion controls barriers and construction timing aimed at avoiding vernal pool species spring migration, will prevent impacts to any CVP or PVP. Work associated with Phase 2C will be limited to the buffer zones associated with the vernal pool depressions.

HISTORICAL /ARCHAEOLOGICAL RESOURCES:
Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?

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6 *Bruce Freeman Rail Trail Technical Memorandum Concord, Massachusetts*; prepared for Town of Concord; prepared by Vanasse Hangen Brustlin, Inc.; dated December 2007.

☒Yes ☐No

A Cultural Resources Survey was completed by PAL on January 10, 2008. In the survey. PAL observed the BFRT in Concord in its entirety and found that the railroad ROW traveled through the historically valuable West Concord Village. The proposed trail was also found to be situated adjacent to MACRIS listed structures and areas including Union Station (Concord Junction Depot), White Pond, and Warners Pond. PAL estimated the MACRIS listed bridge crossings over the Assabet River and Nashoba Brook were attributed to the historic New Haven Railroad operations.

In order to accommodate the adjacent historical areas and structures, the BFRT is proposing to create a historical viewing area at the Nashoba Brook crossing and retain the overall integrity of the project area. Many features of the historic railroad identified by PAL will be protected and displayed along the route.

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources? ☐Yes (Specify_____) ☒No

WATER RESOURCES:

Is there an Outstanding Resource Water (ORW) on or within a half-mile radius of the project site? **X** Yes __No; if yes, identify the ORW and its location.

According to the information of the Massachusetts GIS website, nine NHESP Certified Vernal Pools are located within ½ of one mile of the BFRT throughout the Phase 2C project site. The certified vernal pools are depicted on the MassDEP Priority Resource GIS Figure in the Attachment.

(NOTE: Outstanding Resource Waters include Class A public water supplies, their tributaries, and bordering wetlands; active and inactive reservoirs approved by MassDEP; certain waters within Areas of Critical Environmental Concern, and certified vernal pools. Outstanding resource waters are listed in the Surface Water Quality Standards, 314 CMR 4.00.)

Are there any impaired water bodies on or within a half-mile radius of the project site? **X** Yes ___No; if yes, identify the water body and pollutant(s) causing the impairment:

The Assabet River, Segment ID: MA-82B-07, extends from the Powdermill Dam in Acton to the confluence with the Sudbury River in Concord. The Assabet River is classified as a Category 5 water. This waterbody is impaired by fecal coliform and total phosphorus.

The Nashoba Brook, Segment ID: MA-82B-14 extends from south of Route 11 in Westford to the confluence of Fort Pond Brook in Concord. This is a Category 5 waterbody impaired by low flow alterations and fish bioassessments.

Warners Pond, MA82110, is located in West Concord and is impaired by mercury in fish tissue and non-native aquatic plants.

Is the project within a medium or high stress basin, as established by the Massachusetts Water Resources Commission? **X** Yes ___No

According to the Massachusetts Stressed Basins Map (dated May 2009), the Sudbury-Assabet-Concord Basin is a medium stress basin.

STORMWATER MANAGEMENT:

The project is considered a redevelopment project and therefore, the DEP Stormwater Standards need to be met to the maximum extent practicable. As a bike path, the conditions of treatment of the runoff vary from the conditions of treatment of runoff from a roadway which is traversed by automobiles. As water flows over roadways, the water picks up dirt and dust, rubber and metal deposits from vehicle exhaust, tire wear, antifreeze and engine oil and grease that has dripped onto the pavement, discarded cups, plastic bags, cigarette butts, and other litter. Rain and snowmelt transport these pollutants directly to surface water. Road salts can also be a major pollutant. Snow runoff containing salt can produce high sodium and chloride concentrations which can cause unnecessary fish kills and changes to water chemistry. Since motorized vehicle traffic on the bike path will be restricted (other than emergency and maintenance vehicles), untreated stormwater is much less of a concern.

In general, the existing flow patterns within the project site are being maintained. All existing drainage structures within the project limits are being retained and adjusted and/or repaired if necessary. The Project will result in the creation of 210,179 sf or 4.8 acres of new impervious surface. Although the project will be increasing the impervious area by paving the proposed trail, the existing compacted railroad ballast meets the statutory definition of an impervious surface. As such, there will be minimal impact on peak discharge rates and recharge. Runoff from the impervious portion of the trail will sheet flow across adjacent pervious areas, be directed to existing and proposed swales, or be directed to proposed stormwater BMPs.

Stormwater BMPs will include the following:

- **an infiltration trench, leaching basin, and bioretention cell in the location of the parking area south of Nashoba Brook (Sta 136+00 to 138+25);**
- **pervious pavers for the rest areas on either side of the Nashboa Brook (approximately Sta. 138+50 and Sta. 139+50); and**
- **an infiltration basin with a sediment forebay at the northernmost parking lot off of Commonwealth Avenue (approximately Sta. 162+00).**

Anticipated sedimentation on the trail is limited since there will be no sanding activities. Temporary seeding and mulching may be used to minimize soil erosion and provide slope stabilization.

MASSACHUSETTS CONTINGENCY PLAN:

Has the project site been, or is it currently being, regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes ___ No **X**

Is there an Activity and Use Limitation (AUL) on any portion of the project site? Yes ___ No **X**

Are you aware of any Reportable Conditions at the property that have not yet been assigned an RTN? Yes ___ No **X**

SOLID AND HAZARDOUS WASTE:

MassDOT adopted its GreenDOT Policy Directive on June 2, 2010, with the primary goals to reduce greenhouse gas emissions, promote the healthy transportation options of walking, bicycling, and public transit, and to support smart growth development. As part of that policy, MassDOT currently uses a range of recycled materials in pavement, including recycled asphalt pavement, recycled tires, and shingles, as well as warm mix asphalt. MassDOT is working to increase the use of environmentally-friendly technologies, and continues to conduct research so that it can maximize the use of recycled materials and warm-mix asphalt paving.

Will your project disturb asbestos containing materials? Yes ___ No _X_ ;

MassDOT Highway Division's Hazardous Materials Unit reviews all projects to determine if they will encounter and/or generate waste containing asbestos. If asbestos containing materials are encountered, appropriate special conditions are provided in the project's contract, such that contractors handle and dispose of those materials appropriately and in accordance with all applicable local, state, and federal permits.

Describe anti-idling and other measures to limit emissions from construction equipment:

As stated in MassDOT's GreenDOT Policy Directive, MassDOT requires that contractors install emission control devices in all off-road vehicles. MassDOT Revised Diesel Retrofit Specification states emissions control standards must be met or technology must be used for non-road, diesel powered construction equipment in excess of 50 horsepower on all MassDOT job sites.

DESIGNATED WILD AND SCENIC RIVER:

Is this project site located wholly or partially within a defined river corridor of a federally designated Wild and Scenic River or a state designated Scenic River? Yes _X_ No ___ ;
if yes, specify name of river and designation:

The trail crosses over the Assabet River, a federally designated Wild and Scenic River.

If yes, does the project have the potential to impact any of the "outstandingly remarkable" resources of a federally Wild and Scenic River or the stated purpose of a state designated Scenic River? Yes __ No _X__; if yes, specify name of river and designation:

The wild and scenic characteristics of the Assabet River crossing with the BFRT will be retained as the LOW is contained within the existing rail ballast. Natural vegetated communities directly adjacent to the bank of the Assabet River will be protected. The placement of a new -fabricated bridge (Bridge No. C-19-015) onto existing abutments is above the BFE for the Assabet River and will not result in an impoundment.

If yes, will the project will result in any impacts to any of the designated "outstandingly remarkable" resources of the Wild and Scenic River or the stated purposes of a Scenic River.
Yes ___ No _X__

ATTACHMENTS:

1. List of all attachments to this document.

Attachment A:	ENF Distribution List
Attachment B:	Phase 2C Bruce Freeman Rail Trail Locus NHESP Estimated and Priority Habitat Figure MassDEP Priority Resource Figure
Attachment C:	Historical/Cultural Correspondence *Massachusetts Historical Commission Letter* *Letter from the Concord Historical Commission* *Concord Historical Commission Letter*
Attachment D:	Sudbury, Assabet, and Concord Wild and Scenic River Correspondence
Attachment E:	Resource Impact Chart
Attachment F:	List of municipal and federal permits and reviews required
Attachment G:	Massachusetts Department of Transportation Highway Division, Plan and Profile of Phase 2C Bruce Freeman Rail Trail, 75% Design Plans

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to **land** (see 301 CMR 11.03(1) _X_ Yes ___ No; if yes, specify each threshold:

301 CMR 11.03 (1)(b)2, Creation of five or more acres of impervious area.

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	N/A	N/A	N/A
Internal roadways	N/A	N/A	N/A
Parking and other paved areas	**2.8**	**4.8**	**7.6**
Total: Project Site Acreage	**31.2**	**2.2**	**33.4**

B. Has any part of the project site been in active agricultural use in the last five years? ___ Yes _X_ No

C. Is any part of the project site currently or proposed to be in active forestry use? ___ Yes _X_ No

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? _X_ Yes ___ No;

E Is any part of the project site currently subject to a conservation restriction,

preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes _X_ No

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes _X_ No

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? ___ Yes _X_ No

III. Consistency

A. Identify the current municipal comprehensive land use plan
Title: **Comprehensive Long Range Plan** Date: **March 2005**

B. Describe the project's consistency with that plan with regard to:
1) economic development _____
2) adequacy of infrastructure _____
3) open space impacts _____
4) compatibility with adjacent land uses_____

1) Economic Development
The Comprehensive Long Range Plan states that Concord relies heavily on tourism generated by the many historical sites located in town, including the Minuteman National Historic Park. When complete, the Bruce Freeman Rail Trail will generate more out of town visitors to Concord and will serve as another tourist attraction itself.

2) Adequacy of Infrastructure
According to the Comprehensive and Long Range Plan, roadway traffic and lack of available public parking are an obstacle to Concord businesses. The rail trail will promote alternative methods of travel through the town and facilitate some relief to overloaded roadways and parking lots. The trail also falls under Goal TC-4 of the Comprehensive Long Range Plan. This goal seeks to create a system of pedestrian/bike pathways to provide a safe alternative network for moving around Concord. Phase 2C will link to the other phases of the BFRT and will provide a commuter rail connection to the West Concord station.

3) Open Space Impacts
Objective OS-3.3.2 of the Comprehensive and Long Range Plan proposes to open the Bruce Freeman Rail Trail linking Concord to Sudbury and Acton. Doing so will provide a corridor to existing open space resources in Concord and will ultimately promote use and access to designated open space.

4) Compatibility with Adjacent Land Uses
Phase 2C is consistent with the Comprehensive Long Range Plan's goal to provide an alternative network of connectivity to Concord's businesses, historical areas, and open space areas. The trail will also provide regional connectivity to the other phases of the BFRT when the project is complete.

C. Identify the current Regional Policy Plan of the applicable Regional Planning Agency (RPA)

RPA: **Metropolitan Area Planning Council**

Title: **The MetroFuture Regional Plan** Date: **May 28, 2008**

D. Describe the project's consistency with that plan with regard to:
   1) economic development _____
   2) adequacy of infrastructure _____
   3) open space impacts _____

The MetroFuture Regional Plan documents that a major goal is to double the share of trips made by biking and walking. The Plan estimates that 69% of the regions' population lives more than 1 mile from a bike path. The MetroFuture Plan will encourage "building more homes and businesses near each other along with a more extensive network of sidewalks and trails will lead to more walking and biking. The number of trips taken on foot and by bicycle will increase 68% from the year 2000 to 2030". The construction of Phase 2C of the BFRT will be consistent with these goals, which the Master Plan indicate will support regional economic development and adequacy of infrastructure as well maintaining open space and encouraging residents to enjoy the natural environmental and wildlife. As such, the construction of Phase 2C is consistent with the goals of the MetroFuture Regional Plan.

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **rare species or habitat** (see 301 CMR 11.03(2))? __ Yes __**X**__ No; if yes, specify, in quantitative terms:

Although the project is located within NHESP mapped Priority Habitat of Rare Species (PH126), it will not meet or exceed review thresholds related to rare species because disturbance will be limited to 0.5 acres and a No Take determination is anticipated from NHESP.[7]

B. Does the project require any state permits related to **rare species or habitat**? ___ Yes **X** No

Coordination with US Fish and Wildlife and NHESP is required to determine if the project requires any state permits related to rare species or habitat.

C. Does the project site fall within mapped rare species habitat (Priority or Estimated Habitat?) in the current Massachusetts Natural Heritage Atlas (attach relevant page)? __**X**__ Yes ___ No.

D. If you answered "No" to all questions A, B and C, proceed to the **Wetlands, Waterways, and Tidelands Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

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7 According to 310 CMR 11.03(2), MEPA review for State-listed species under M.G.L. c. 131A is tripped in the event of "1. Alteration of designated significant habitat 2. Greater than two acres of disturbance of designated priority habitat, as defined in 321 CMR 10.02, that results in a take of a state-listed endangered or threatened species or species of special concern".

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? __X__ Yes ___ No. If yes,

1. Have you consulted with the Division of Fisheries and Wildlife Natural Heritage and Endangered Species Program (NHESP)? __Yes __X__No; if yes, have you received a determination as to whether the project will result in the "take" of a rare species? ___ Yes ___ No; if yes, attach the letter of determination to this submission.

   The project will be concurrently submitted for to NHESP for review under the Massachusetts Endangered Species Act. According to the 2008 public mapping, a 1,100 linear foot section of the existing rail ROW is through a NHESP Priority Habitat of Rare Species (PH 126).

   Joint review of the Notices of Intent will occur and "No Take" letters are anticipated to be issued by NHESP.

2. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No

   In 2007, during the 25% Design process, the Town of Concord commissioned VHB to evaluate the natural resources within and adjacent to the entire BFRT LOW. VHB concluded that NHESP mapped habitat within the LOW supports two threatened plant species[8] - Engelmann's Umbrella-sedge *(Cyperus engelmannii)* and Resupinate Bladderwort *(Utricularia resupinata)*, both of which are aquatic plants. The BFRT remains in the ROW in this location and does not involve work in the nearby wetlands. Therefore, the project expects to receive a No Take determination from the NHESP.

3. Which rare species are known to occur within the Priority or Estimated Habitat?

   In their 2007 Technical Memorandum, VHB concluded that NHESP mapped habitat within the LOW supports two threatened plant species - Engelmann's Umbrella-sedge and Resupinate Bladderwort.

4. Has the site been surveyed for rare species in accordance with the Massachusetts Endangered Species Act? __X__ Yes ___ No

   A vegetative survey of Priority Habitat PH126 by Charles B. Quinlan, on behalf of the Town of Concord Natural Resources Commission, in 2007 and 2008 failed to document the presence of any MESA listed species.

5. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No

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8 *Bruce Freeman Rail Trail Technical Memorandum Concord, Massachusetts*; prepared for Town of Concord; prepared by Vanasse Hangen Brustlin, Inc.; dated December 2007.

The project is not within Estimated Habitat.

E. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes _X_ No; if yes, provide a summary of proposed measures to minimize and mitigate impacts to significant habitat:

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wetlands, waterways, and tidelands** (see 301 CMR 11.03(3))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits (or a local Order of Conditions) related to **wetlands, waterways, or tidelands**? _X_ Yes ___ No; if yes, specify which permit:

This project will require an Order of Conditions from the Concord Natural Resources Commission, a Section 401 General Permit issued by the Army Corps of Engineers, a Section 404 Water Quality Permit issued by the MassDEP, MESA review by NHESP, and Chapter 91 Waterways License for a Water-Dependent Use.

C. If you answered "No" to both questions A and B, proceed to the **Water Supply Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? _X_ Yes ___ No; if yes, has a Notice of Intent been filed? _X_ Yes ____ No; if yes, list the date and MassDEP file number: _____; if yes, has a local Order of Conditions been issued? ___ Yes _X_ No; Was the Order of Conditions appealed? ___ Yes ___ No. Will the project require a Variance from the Wetlands regulations? ___ Yes _X_ No.

The BFRT Phase 2C NOI has been filed simultaneously with the completion of this ENF.

B. Describe any proposed permanent or temporary impacts to wetland resource areas located on the project site:

Wetland resource areas anticipated to be impacted by this Project are BVW, LUW, and RA. No permanent or temporary impacts are proposed within BLSF or Bank.

BFRT Phase 2C will result in a total of 273 sf of temporary BVW impact to accommodate work associated with the replacement of an existing 30" Reinforced Concrete Pipe (RCP) culvert and headwalls carrying flows from the Dugan Brook. The headwalls will be accessed from the adjacent upland and no equipment will enter the resource area at any time. All temporary impacts to BVW will be restored in place.

The project as proposed results in 112 sf of temporary alteration to LUW to

accommodate work associated with the replacement of an existing 30" RCP and headwalls at Sta. 181+12 (Dugan Brook). Flow within the stream will be bypassed if necessary but it is expected that permit conditions will require that culvert replacement will be conducted during low or now flow conditions. Temporary impacts will be fully restored in place. No permanent impacts to LUW are proposed.

Bridge work over the Assabet River will not require in-water work. Bridge rehabilitation over the Nashoba Brook will require limited in-water work consisting of boat access for the installation of a paint containment structure.

Since historic railroads typically followed rivers, rail trail linear projects routinely involve impacts to Previously Developed/degraded RA. A total of 27,921sf or 29% of the total 97,506 sf of RA will be impacted as a result of this public project. Of the 29%, 27,921 sf or 100% is Previously Developed/degraded RA. For the purposes of impact quantification, the toe of slope of the rail bed in fill areas is considered the extent of Previously Developed/degraded RA within the LOW. Of the 27,921sf of impact to RA, 6,747 sf is temporary impact which will be restored in place. Disturbed land within RA immediately adjacent to the trail will be seeded with MassDOT's general restoration seed mix9 and maintained as a naturally vegetated transition zone between the trail and the surrounding forest. The naturalized shoulder will provide small wildlife shelter and food source. The area outside this grassed area that will be temporarily altered during construction will be returned to original grade, seeded, and allowed to naturally succeed.

C. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (square feet) or Length (linear feet)	Temporary or Permanent Impact?
Land Under the Ocean		
Designated Port Areas		
Coastal Beaches		
Coastal Dunes		
Barrier Beaches		
Coastal Banks		
Rocky Intertidal Shores		
Salt Marshes		
Land Under Salt Ponds		
Land Containing Shellfish		
Fish Runs		
Land Subject to Coastal Storm Flowage		
Inland Wetlands		
Bank (lf)	0	
Bordering Vegetated Wetlands	273 sf	temporary
Isolated Vegetated Wetlands	0	

9 Per MassDOT Highway Division Item 765.4 Seeding – Restoration Mix

Land under Water	112 sf	temporary
Isolated Land Subject to Flooding	0	
Bordering Land Subject to Flooding	0	
Riverfront Area	27,921 s.f Previously Developed/degraded	

D. Is any part of the project:
1. proposed as a **limited project**? **X** Yes ___ No; if yes, what is the area (in sf)? 4,977 sf
2. the construction or alteration of a **dam**? ___ Yes **X** No; if yes, describe:
3. fill or structure in a **velocity zone** or **regulatory floodway**? ___ Yes **X** No
4. dredging or disposal of dredged material? ___ Yes **X** No
5. a discharge to an **Outstanding Resource Water (ORW)** or an **Area of Critical Environmental Concern (ACEC)**? ___ Yes **X** No
6. subject to a wetlands restriction order? ___ Yes **X** No
7. located in buffer zones? **X** Yes ___ No; if yes, how much (in sf) **142,297 sf**

E. Will the project:
1. be subject to a local wetlands ordinance or bylaw? ___ Yes **X** No

The Massachusetts Department of Transportation is exempt from local bylaws under 310 CMR 10.00.

2. alter any federally-protected wetlands not regulated under state law? ___ Yes **X** No; if yes, what is the area (sf)?

III. Waterways and Tidelands Impacts and Permits

A. Does the project site contain waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? **X** Yes ___ No; if yes, is there a current Chapter 91 License or Permit affecting the project site? ___ Yes ___ No **X**

B. Does the project require a new or modified license or permit under M.G.L.c.91? **X** Yes ___ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water-dependent use? Current **0** Change **0** Total ___
If yes, how many square feet of solid fill or pile-supported structures (in sf)?

The project does not necessitate the placement of solid fill within areas subject to Chapter 91 Jurisdiction. The Project involves the placement of an 87-foot by 16-foot prefabricated trussle bridge over the Assabet River. The bridge will be placed on existing abutments. The proposed bridge design will result in a size increase of greater than ten percent over existing conditions. The increase in size trips a threshold necessitating Chapter 91 review.

C. For non-water-dependent use projects, indicate the following:
Area of filled tidelands on the site: **N/A**
Area of filled tidelands covered by buildings: **N/A**
For portions of site on filled tidelands, list ground floor uses and area of each use: **N/A**
Does the project include new non-water-dependent uses located over flowed tidelands? Yes ___ No **X**
Height of building on filled tidelands_____

Also show the following on a site plan: Mean High Water, Mean Low Water, Water-

dependent Use Zone, location of uses within buildings on tidelands, and interior and exterior areas and facilities dedicated for public use, and historic high and historic low water marks.

D. Is the project located on landlocked tidelands? ___ Yes _X_ No

E. Is the project located in an area where low groundwater levels have been identified by a municipality or by a state or federal agency as a threat to building foundations? ___Yes _X_ No

F. Is the project non-water-dependent **and** located on landlocked tidelands **or** waterways or tidelands subject to the Waterways Act **and** subject to a mandatory EIR? ___ Yes _X_ No

G. Does the project include dredging? ___ Yes _X_ No

IV. Consistency:

A. Does the project have effects on the coastal resources or uses, and/or is the project located within the Coastal Zone? ___ Yes _X_ No

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes _X_ No

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **water supply** (see 301 CMR 11.03(4))? ___ Yes _X_ No

B. Does the project require any state permits related to **water supply**? ___ Yes _X_ No

C. If you answered "No" to both questions A and B, proceed to the **Wastewater Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to **wastewater** (see 301 CMR 11.03(5))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **wastewater**? ___ Yes _X_ No; if yes, specify which permit:

D. If you answered "No" to both questions A and B, proceed to the **Transportation -- Traffic Generation Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

TRANSPORTATION SECTION (TRAFFIC GENERATION)

I. Thresholds / Permit

A. Will the project meet or exceed any review thresholds related to **traffic generation** (see 301 CMR 11.03(6))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **state-controlled roadways**? ___ Yes _X__ No; if yes, specify which permit:

A. If you answered "No" to both questions A and B, proceed to the **Roadways and Other Transportation Facilities Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

TRANSPORTATION SECTION (ROADWAYS AND OTHER TRANSPORTATION FACILITIES)

I. **Thresholds**

A. Will the project meet or exceed any review thresholds related to **roadways or other transportation facilities** (see 301 CMR 11.03(6))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **roadways or other transportation facilities**? ___ Yes _X__ No; if yes, specify which permit:

B. If you answered "No" to both questions A and B, proceed to the **Energy Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Roadways Section below.

ENERGY SECTION

I. **Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **energy** (see 301 CMR 11.03(7))? ___ Yes _X__ No

B. Does the project require any state permits related to **energy**? ___ Yes __X_ No

C. If you answered "No" to both questions A and B, proceed to the **Air Quality Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Energy Section below.

AIR QUALITY SECTION

I. **Thresholds**

A. Will the project meet or exceed any review thresholds related to **air quality** (see 301 CMR 11.03(8))? ___ Yes _X__ No

B. Does the project require any state permits related to **air quality**? ___ Yes _X__ No

D. If you answered "No" to both questions A and B, proceed to the **Solid and Hazardous Waste Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

SOLID AND HAZARDOUS WASTE SECTION

I. **Thresholds / Permits**

A. Will the project meet or exceed any review thresholds related to **solid or hazardous waste** (see 301 CMR 11.03(9))? ___ Yes _X__ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to **solid and hazardous waste**? ___ Yes _X_ No

E. If you answered "No" to both questions A and B, proceed to the **Historical and Archaeological Resources Section**. If you answered "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Have you consulted with the Massachusetts Historical Commission? _X_ Yes ___ No; if yes, attach correspondence. For project sites involving lands under water, have you consulted with the Massachusetts Board of Underwater Archaeological Resources? ____Yes ____ No; if yes, attach correspondence

The Concord Historical Commission was an integral part in the BFRT Phase 2C 25% design process. An October 21, 2008 letter from the Chair of the Concord Historical Commission stated, "...the Commission voted to support the due diligence efforts conducted to date by the Town of Concord's BFRT designer in identifying the historic resources that exist along the trail and in eliciting support from the Commission." The Massachusetts Historical Commission was forwarded this correspondence.

The MassDOT Highway Division Environmental Services will consult the Massachusetts Historical Commission and Concord Historical Commission pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470 and 36 CFR 800).

B. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? _X_ Yes ___ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes _X_ No; if yes, please describe:

The Cultural Resources Survey conducted by PAL on January 10, 2008 found that the proposed trail will be situated adjacent to the MACRIS listed Union Station (Concord Junction Depot). The historic structure will not be altered in any way during construction activities. PAL also identified the Assabet River and Nashoba Brook bridges listed under MACRIS. All efforts will be made to retain the historic integrity of these river crossings.

C. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X_ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe:

D. If you answered "No" to all parts of both questions A, B and C, proceed to the **Attachments and Certifications** Sections. If you answered "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

II. Impacts

Describe and assess the project's impacts, direct and indirect, on listed or inventoried

historical and archaeological resources:

All rail artifacts, except for the battery wells, will be retained or removed and reset. If an existing artifact poses a safety hazard, further discussion will be necessary with the rail ROW property owner - MassDOT Rail Division - to determine the disposition. The battery wells were evaluated by PAL and were determined to have low interpretive value and were noted a low preservation priority. They will be removed.

The proposed Bridge over the Assabet River will be placed on the existing stone abutments currently in place. Pre-fabricated structures will be placed on the abutments and will not alter the integrity of the historic bridges.

III. Consistency

Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources:

Effort has been made with the proposed design to avoid disturbing any rail artifacts or other significant structures. MassDOT's Cultural Resources Unit will review the proposed project in accordance with Section 106, as amended, of the National Historic Preservation Act.

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

   (Name)_____
   (Date)_____

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Signatures:

Date	Signature of Responsible Officer or Proponent	Date	Signature of person preparing NPC (if different from above)
	Name (print or type)		Name (print or type)
	Firm/Agency		Firm/Agency
	Street		Street
	Municipality/State/Zip		Municipality/State/Zip

Phone Phone