BURNHAM BRIDGE OVER COBBOSSEECONTEE STREAM

WEST GARDINER / LITCHFIELD, MAINE

FINAL
HYDROLOGIC AND HYDRAULIC REPORT

November 2017

PREPARED FOR

MaineDOT
16 State House Station
August, ME 04333

PREPARED BY

HNTB Corporation
4507 North Front Street
Suite 300
Harrisburg, PA 17110

HNTB

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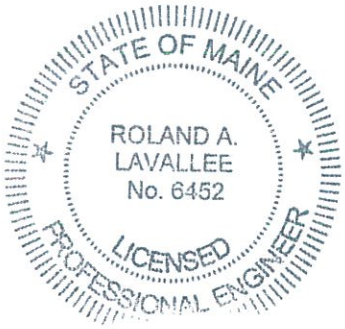


Roland Lavallee 11/09/17

Roland Lavallee, P.E., P.L.S.

Prepared For:
Maine Department of Transportation
16 State House Station
Augusta, ME 04333

Prepared By:
HNTB Corporation
4507 North Front Street, Suite 300
Harrisburg, PA 17110

The following is the final report of the hydrologic and hydraulic analysis of the existing and proposed bridges at Burnham Bridge (Bridge No. 2112) over Cobbosseecontee Stream between Litchfield and West Gardiner in Kennebec County, ME.

1.0 Introduction

The Burnham Bridge crosses over the Cobbosseecontee Stream approximately 0.60 miles upstream of Pleasant Pond. The bridge carries Pond Road from West Gardiner across the stream to Plains Road in Litchfield. In addition, Burnham Bridge is approximately 5.50 miles upstream of the dams in Gardiner that control Pleasant Pond.

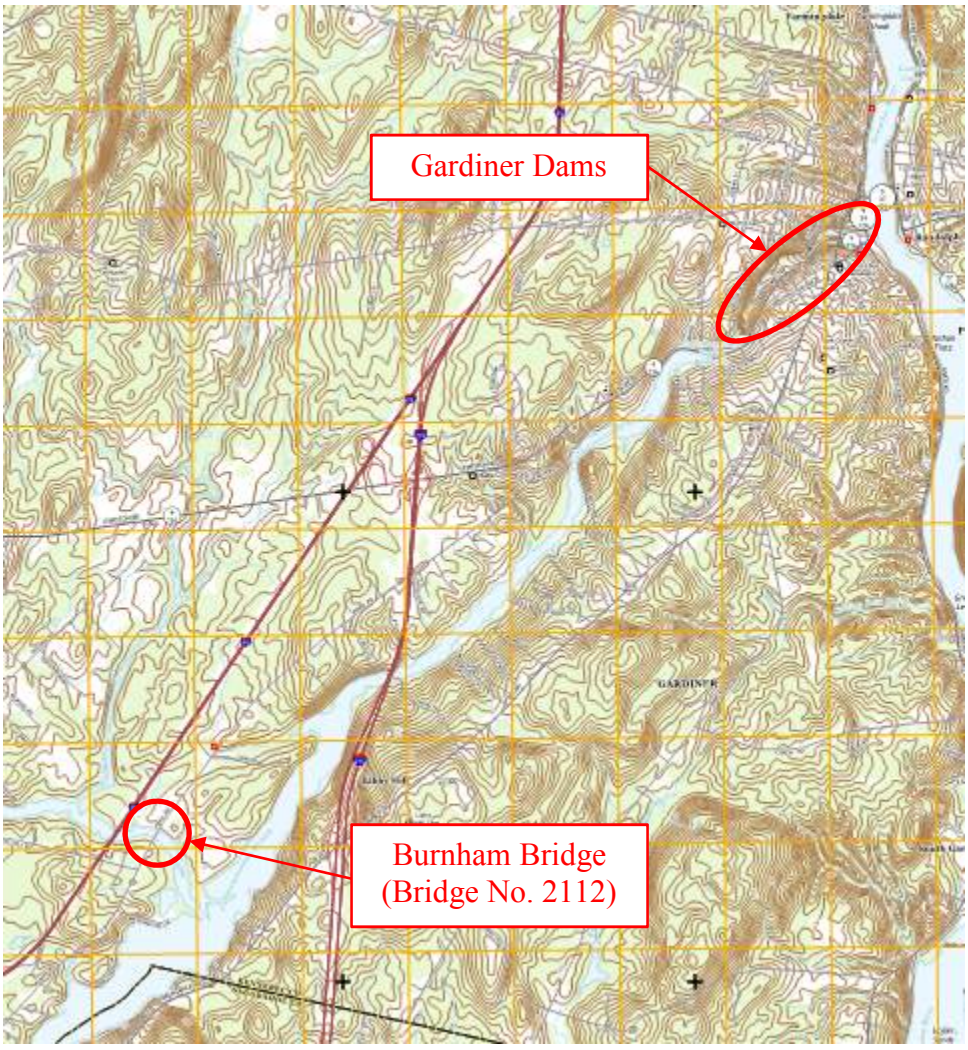


Figure 1 – Project Location Map (USGS Quadrangle – Gardiner, ME)

Burnham Bridge is just downstream of the I-95 bridge. There are no structures downstream of Burnham Bridge on this branch of Cobbosseecontee Stream.

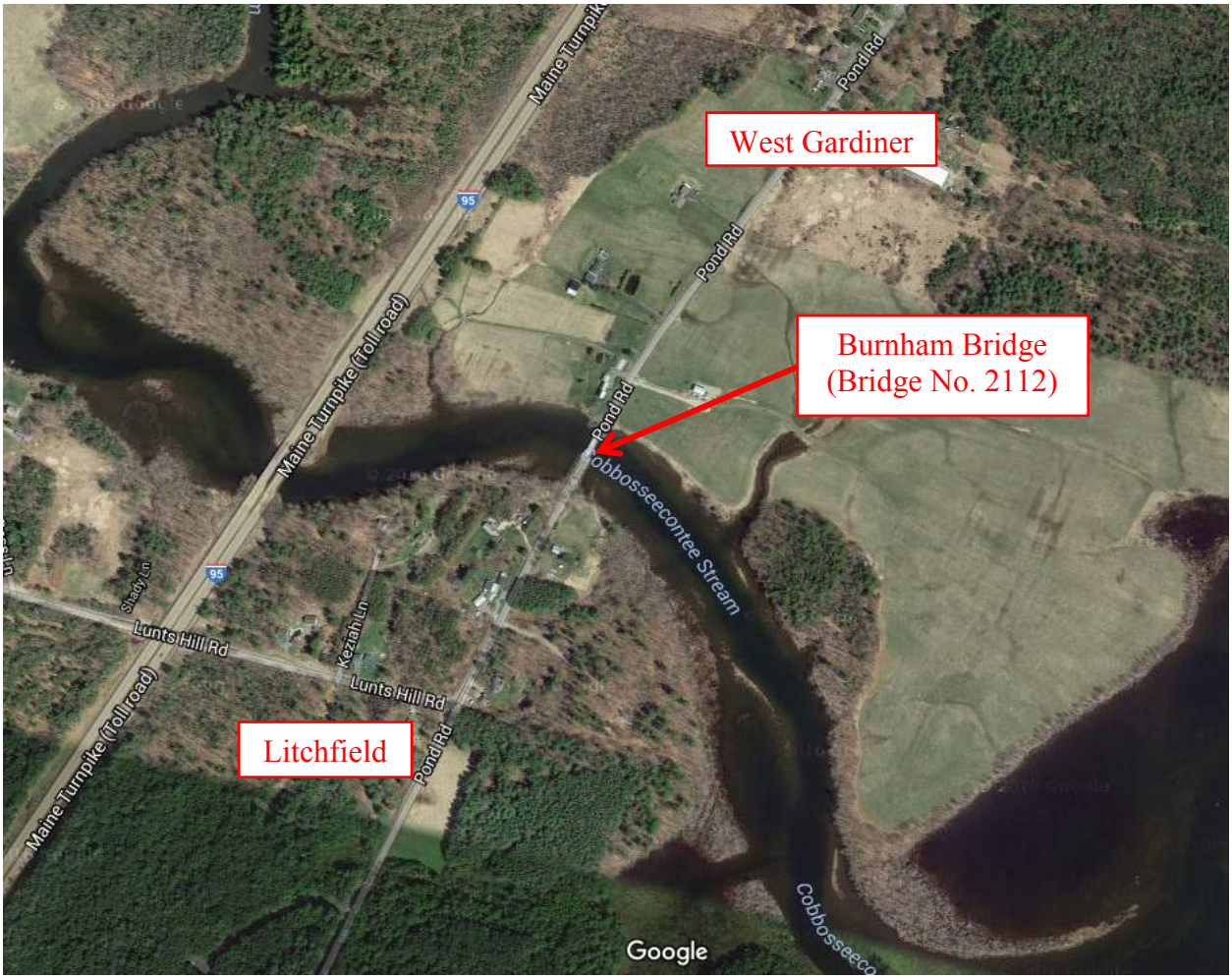


Figure 2 – Aerial image showing project site

2.0 Existing Data Review

- On April 13, 2016, HNTB conducted a site visit at the bridge. Photographs are provided in **Appendix A**.
- USGS Gage record, Gage Number 01049500, Cobbosseecontee Stream in Gardiner, Maine. The gage was located downstream of the project bridge location. The project's water shed is 184 square miles while the gage watershed is 217 square miles. The gage has been in use for 112 years.
- FEMA Flood Insurance Rate Map (see **Appendix B**). Kennebec County, ME. June 16, 2011. The FEMA flood insurance rate map shows the project in Zone AE. Zone AE means that base flood elevations have been determined. The base flood elevation shown on the FIRM is an elevation of 139 downstream and upstream of the project bridge. The flood profile provided in the FEMA Flood Insurance Study indicated that the water

surface elevation of the 100-year event was approximately 139.5 upstream of the bridge and 138.7 downstream of the bridge.

3.0 Hydrology

MaineDOT provided a hydrology report of the Cobbosseecontee Stream at the location of the bridge replacement. A stream gage (USGS Stream Gage number 01049500) exists on the Cobbosseecontee Stream downstream of the project in the town of Gardiner. The drainage area to the stream gage is approximately 217 square miles. The drainage area at the location of the bridge replacement project is 184 square miles. The flows were calculated from the stream gage using the USGS PeakFQ program. The flows were then transposed to the project site. The flows can be found in **Table 1**. The hydrology report from MaineDOT can be found in **Appendix C**.

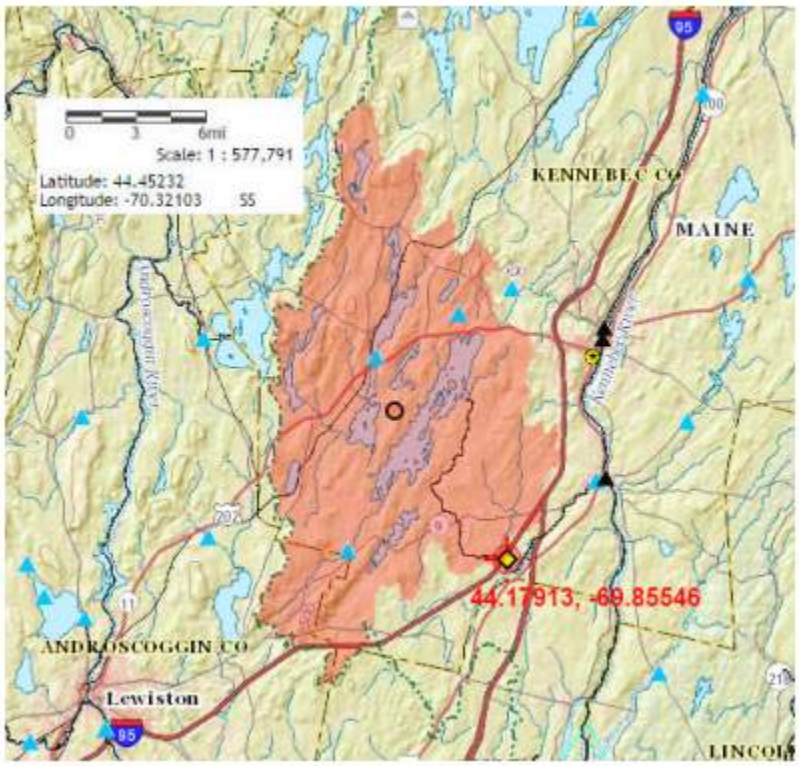


Figure 3 – Watershed above Burnham Bridge over Cobbosseecontee Stream

In addition to the flows provided by MaineDOT, flows were also provided in the FEMA Flood-Insurance Study (FIS). The FEMA FIS flows were also based off of USGS Stream gage number 01049500. The flows were transposed based on the relationship of the drainage area to the bridge and the drainage area to the stream gage downstream. The flows from the FEMA FIS are also provided in **Table 1**.

Table 1: Flood Information
(For calculations see **Appendix C**)

Year Storm	USGS Stream Gage 01049500 (cfs)	**USGS Stream Gage Flows at Bridge (cfs)**	FEMA FIS Flows (cfs)
Drainage Area	217 sq. mi.	**184 sq. mi.**	186 sq. mi
$Q_{1.01}$	563	**486**	---
$Q_{1.05}$	1122	**969**	---
Q_2	2204	**1912**	---
Q_5	3020	**2633**	----
Q_{10}	3531	**3086**	3400
Q_{25}	4148	**3635**	---
Q_{50}	4588	**4028**	4660
Q_{100}	5012	**4407**	5180
Q_{500}	5959	**5257**	6500

The analysis was completed using both the peak flows provided by MaineDOT from the USGS stream gage as well as the FEMA Flows. The flows shown in **bold** were used in the hydraulic analysis at Burnham Bridge over Cobbosseecontee Stream. These flows were compared to what has been observed at the project location. As can be seen in the photographs provided in **Appendix A,** there is no clear high water mark present at the site. However, the existing structure shows evidence that the steel beams of the existing structure have been inundated by showing rust. The model shows that the existing structure is under pressure flow for all storm events greater than the 5-year storm. Therefore, these flows were accepted as valid for the analysis.

4.0 Hydraulic Analysis

Hydraulic calculations for the existing and proposed conditions along Cobbosseecontee Stream were performed using the U.S. Army Corps of Engineers' software HEC-RAS, version 4.1. HEC-RAS supports one-dimensional, steady flow, water surface profiles calculations. Cross-sections were cut from survey gathered for this project.

The existing bridge was constructed is 1935 and reconstructed in 1951. The bridge is a two-span structure with a total length of approximately 95 feet from abutment to abutment. The existing structure features a timber crib pier that is approximately nine (9) feet wide and has a triangular nose with a 90-degree angle. Therefore, the coefficient of drag (Cd) for the momentum equation in low flow scenarios is 1.6. The low chord elevation of the existing bridge is 137.9 feet. The existing structure has a hydraulic opening of approximately 1100 square feet.

The MaineDOT Bridge Design Guide states that bridges that are not major riverine bridges shall have a depth of 2 feet minimum of freeboard over the 50-year storm event. In order to meet this requirement at Burnham Bridge, the profile of the roadway was raised to be able to raise the low chord of the proposed structure. The profile of the roadway has been raised by approximately three feet. The proposed bridge has a clear span of 102 feet from abutment to abutment with no

piers. The structure will feature integral abutments with sloping embankments. The low chord of the proposed structure has been raised from existing conditions to 139.94 feet. The proposed structure offers approximately 1475 square feet of hydraulic opening, which equates to a 34% increase over the existing condition.

The HEC-RAS model was run assuming a downstream water surface elevation. This was done due to the fact that Cobbosseecontee Stream is controlled by a dam in the town of Gardiner. The downstream water surface elevations for the 10-, 50-, 100-, and 500-year events were found using the FEMA FIS and the flood profile. The water surface elevations for the other events were estimated from USGS mapping and the FEMA FIS.

The model was run using "subcritical" flow due to the Froude numbers at all cross-sections below 1.0. The model covers approximately 550 feet of Cobbosseecontee Stream with approximately 250 feet downstream of the bridge and 300 feet upstream of the bridge. Cross-sections were set approximately 25 feet apart from each other beginning at the downstream end of the model and moving upstream.

Manning's n numbers were found in the FEMA FIS for Cobbosseecontee Stream. The n-value for the channel was 0.035 and the n-value for the overbanks was 0.05. Ineffective flow areas were set upstream and downstream of the bridge based on contraction and expansion.

The analysis found that the existing structure is under pressure flow for all events greater than the 5-year event; however, the bridge is not overtopped by any storm event. All storm events are forced through the opening within the structure.

The proposed project raises the profile of the roadway to increase the clearance between the water surface and the low chord of the structure. The proposed structure is not under pressure-flow and offers 1.13 feet of clearance between the 50-year water surface elevation and the low chord of the bridge. As a result of the proposed bridge replacement, the water surface elevation for all storm events has been decreased. In addition, the velocities have decreased slightly as well.

Table 2 provides a summary of the hydraulic analysis of existing and proposed conditions at the Burnham Bridge over Cobbosseecontee Stream. This summary is based on the USGS stream gage flows provided by MaineDOT.

Table 2: Hydraulic Analysis Summary

Summary of Hydraulic Data – Burnham Bridge over Cobbosseecontee Stream	Existing Bridge	Proposed Bridge
Low Chord	137.9	139.94
Floodplain width at Q100, ft	434.66	419.43
Width at Banks, ft	96.52	96.52
Headwater at Upstream face of bridge, Q25, ft	138.86	138.71
Headwater at Upstream face of bridge, Q50, ft	138.99	138.81
Headwater at Upstream face of bridge, Q100, ft	139.24	139.01
Discharge Velocity at Q25, fps	2.53	2.50
Discharge Velocity at Q50, fps	2.78	2.75
Discharge Velocity at Q100, fps	2.98	2.96
Ordinary High Water Elevation (Q1.1) (US face), ft	137.15	137.11
Discharge Velocity at Q1.1, fps	0.78	0.77
Clearance at Q25, ft	0.00	1.23
Clearance at Q50, ft	0.00	1.13
Clearance at Q100, ft	0.00	0.93
Bridge Opening Area, ft^2	1099.76	1474.76
Flow area at Q100, ft^2	1641.71	1626.18

The FEMA FIRM indicated the project was in a detailed study area. The model was obtained from FEMA and was found to be a USGS E431 Backwater model. There was no date given on the data obtained from FEMA but FEMA confirmed that no new hydrologic or hydraulic model had been completed. The area of the bridge was located in the data but the streambed elevations and the 50-year water surface elevations were approximately 20 feet and 12 feet higher respectively than what is found in the FEMA FIS and the survey gathered for this project. After reviewing the FEMA data, it was determined that this difference in streambed and water surface elevations was too great and the data could not be used as part of this analysis. An excerpt from the FEMA data showing the project location is provided in **Appendix D**.

Table 3: Hydraulic Analysis Summary (FEMA Flows)

Summary of Hydraulic Data – Burnham Bridge over Cobbosseecontee Stream	Existing Bridge	Proposed Bridge
Low Chord	137.9	139.94
Floodplain width at Q100, ft	419.62	419.58
Width at Banks, ft	96.52	96.52
Headwater at Upstream face of bridge, Q50, ft	138.96	138.72
Headwater at Upstream face of bridge, Q100, ft	139.33	139.02
Discharge Velocity at Q50, ft	3.22	3.21
Discharge Velocity at Q100, fps	3.48	3.48
Clearance at Q50, ft	0.00	1.22
Clearance at Q100, ft	0.00	0.92
Bridge Opening Area, ft^2	1099.76	1474.76
Flow area at Q100, ft^2	1553.90	1626.93

Note: FEMA did not provide a 25-year flow in the FIS. Flow would be required to be estimated and therefore not included.

The HEC-RAS model was reviewed for errors, warnings, and notes. There were several notes produced by HEC-RAS for the existing and proposed models about multiple critical depths found at several cross-sections. While there were no errors produced, some warnings stated there might be need for more cross-sections. These warnings were reviewed and were deemed acceptable for this analysis. HEC-RAS outputs including cross-sections and profiles are provided for existing conditions in **Appendix E** and proposed conditions in **Appendix F**.

5.0 Scour Analysis

A scour analysis was performed based on equations from FHWA publication HEC-18 (Fifth Edition). The 100-year and 500-year events were analyzed for scour at the proposed Burnham Bridge crossing. The D_{50} of the streambed material was found during geotechnical testing. The D_{50} of the material was found to be 1.558 mm or 0.0051 feet. This number was used to determine whether clear water or live bed scour analysis was to be performed. At Burnham Bridge, contraction scour was required to be calculated. In addition, local scour was calculated per HEC-18 for the near and far abutments.

Boring logs indicated that bedrock was found approximately two to three feet below the streambed elevation. Calculations indicate scour depths of 17.5 feet or greater. However, the scour calculations do not take the presence of bedrock into account. Since the bedrock is shallow, the bridge foundations will be driven into the bedrock. The abutments are concrete integral abutments supported on h-piles that will be driven to bedrock. Driving the h-piles into the bedrock will protect the abutments against scour. However, riprap will be placed at the abutments for additional protection.

The total scour depths can be found in Table 4 and the scour analysis can be found in the **Appendix G**.

Table 4: Scour Depths

	100 - year storm	
	Near Abutment	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00
Contraction/Expansion Scour (ft) *	1.89	1.89
Local Scour (ft)	16.04	15.61
Pressure Flow Scour (ft)	---	---
TOTAL SCOUR (ft)	***17.93***	***17.50***

	500-year storm	
	Near Abutment	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00
Contraction/Expansion Scour (ft) *	2.59	2.59
Local Scour (ft)	17.78	17.11
Pressure Flow Scour (ft)	---	---
TOTAL SCOUR (ft)	***20.36***	***19.70***

** If calculated y_s returns negative answer, the scour depth equals zero*

6.0 Summary

In summary, the existing Burnham Bridge over the Cobbosseecontee Stream in Kennebec County is proposed to be replaced. The low chord of the existing structure is at 137.9 feet and constricts the water flow at Q50 (Elev. 138.99) and Q100 (Elev. 139.24). The existing structure offers approximately 1100 square feet of hydraulic opening.

The profile of the roadway is proposed to be raised from existing conditions to provide greater clearance between the low chord of the structure and the 50-year event. The low chord of the proposed structure has been raised to 139.94 feet. Raising the low chord and lengthening the spans of the structure has increased the hydraulic opening to approximately 1475 square feet, which results in unrestricted water flows.

The proposed structure will decrease the water surface elevations for all storm events. In addition, the raised profile allows for approximately 1.13 feet of clearance between the low chord of the structure and the 50-year water surface elevations.

Appendix Contents

APPENDIX A

Site Photographs

Photo 1 – Cobbosseecontee Stream – Looking Upstream

Photo 2 – Cobbosseecontee Stream – Looking Downstream

Photo 3 – Pond Road – South Approach

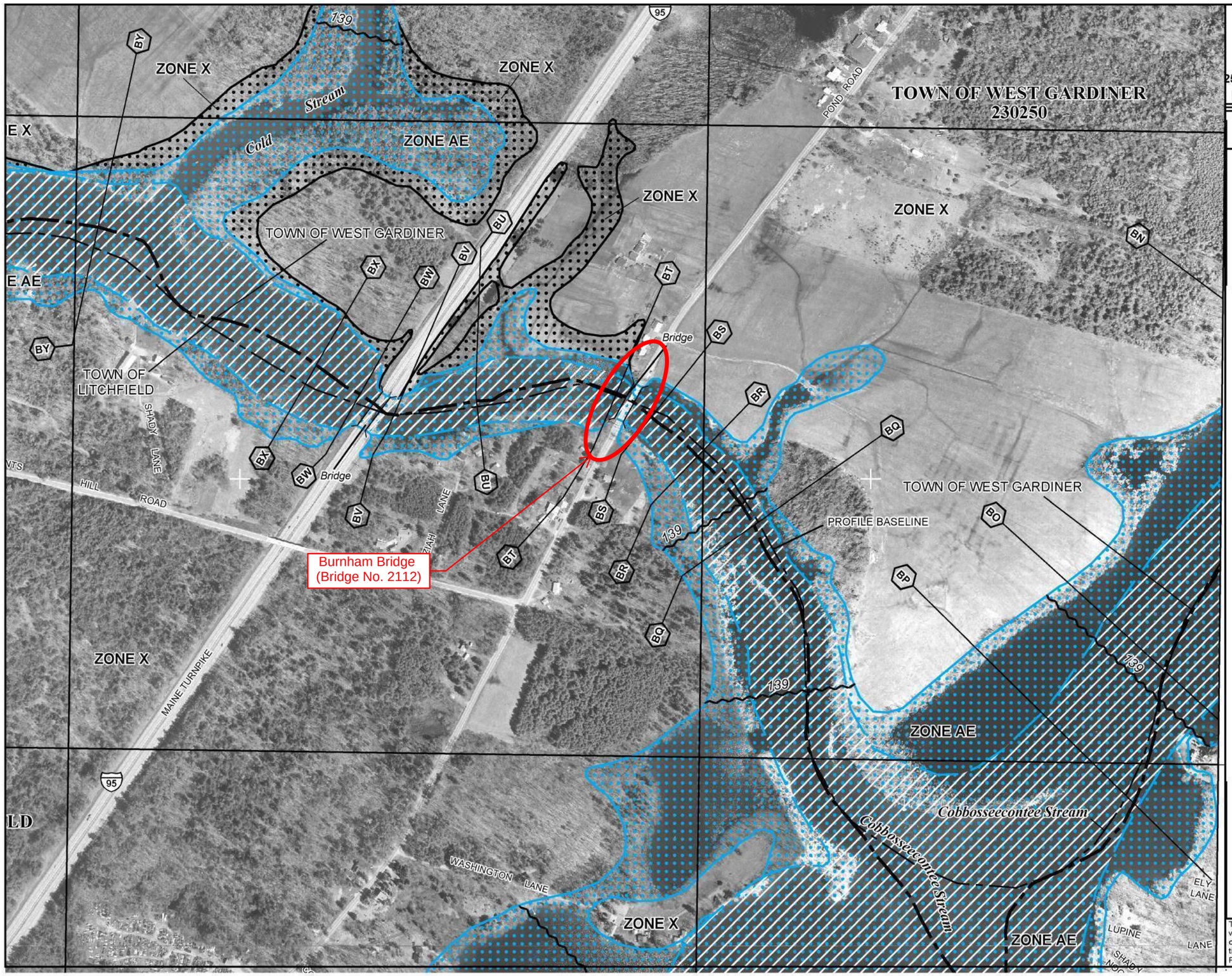
Photo 4 – Pond Road – North Approach

Photo 5 – Burnham Bridge – Upstream Face of Bridge

Photo 6 – Burnham Bridge – Downstream Face of Bridge

APPENDIX B

FEMA FIRM



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0661D

FIRM

FLOOD INSURANCE RATE MAP

KENNEBEC COUNTY, MAINE
(ALL JURISDICTIONS)

PANEL 661 OF 775
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GARDINER, CITY OF	230068	0661	D
LITCHFIELD, TOWN OF	230238	0661	D
WEST GARDINER, TOWN OF	230250	0661	D

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
23011C0661D
EFFECTIVE DATE
JUNE 16, 2011

Federal Emergency Management Agency

APPENDIX C

MaineDOT Hydrology

Environmental Office – Hydrology Section
16 State House Station
Augusta ME 04333-0016
207.557.1052
Charles.Hebson@maine.gov

Maine Department of Transportation

Memo

To: Leanne Timberlake

From: Charles Hebson

CC:

Date: 2016 February 18

Re: 18954 West Gardiner – Litchfield Burnham Bridge #2112, Hydrology Report

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The project bridge is located on Cobbosseecontee Stream, upstream of a USGS streamflow gage (# 01049500) in Gardiner; the project watershed is 184 mi^2 while the gage watershed is 217 mi^2 (Hodgkins, 1999, p. 14). The river is regulated, meaning gage-based estimates are preferred over regression estimates. Fortunately, the gage record length is 112 years and the gage and project watersheds close enough in size to permit simple area scaling of the gage peak flow estimates (Hodgkins, 1999, p. 31). The scaled estimates are calculated as

$$Q_{Tb} = (A_b/A_g)^a \times Q_{Tg}$$

Where Q_T is the design flow of return period T, A is the watershed area, and a is an exponent that varies with T; subscripts "b" and "g" refer to bridge and gage, respectively. The annual maximum flows at the Gardiner gage are shown in Figure 1.

The project watershed is shown in Figure 2. Peak flow estimates according to Bulletin 17B methods were calculated from the gage data using the USGS program PeakFQ (Flynn et al, 2006). Full output (with some reformatting) is given in the Appendix. Summary output for return periods of interest is given in Table 1.

Figure 1. Annual Maximum Peak Flows, Gage 01049500

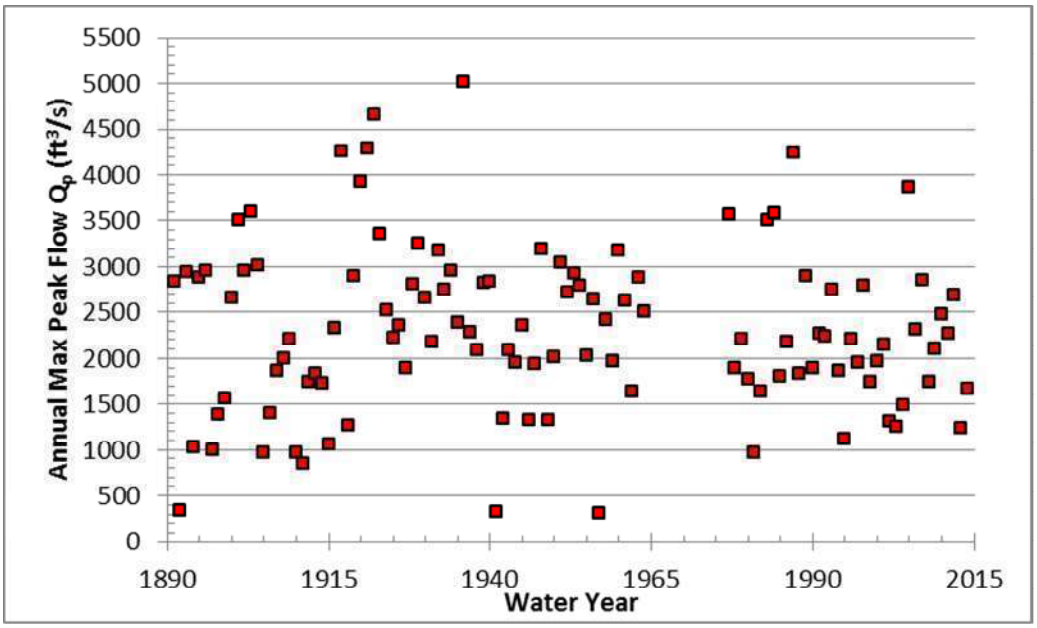
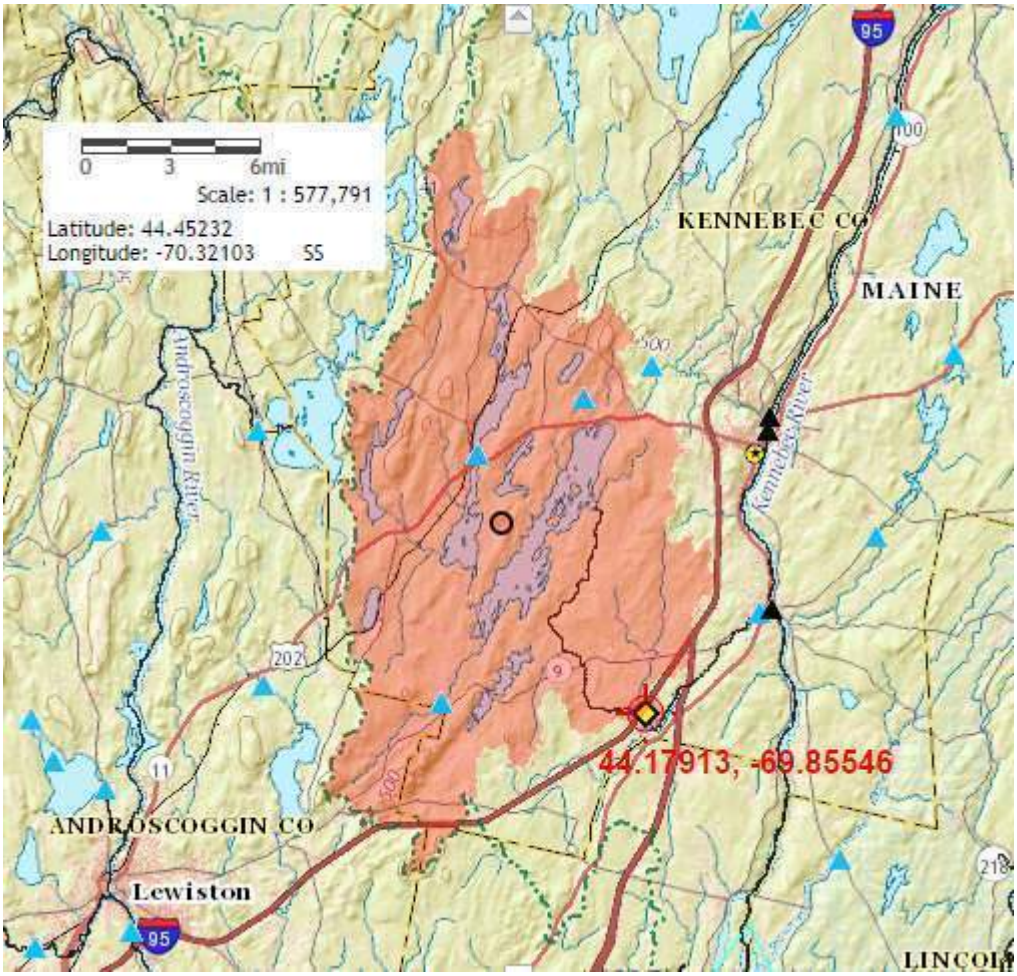


Table 1: Summary of Design Peak Flows for Burnham Bridge

Return Period (years)	Exceedance Probability	Gage Peak Flow Q_{Tg} (ft^3/s)	Exponent a	Bridge Peak Flow Q_{Tb} (ft^3/s)
1.01	0.99	563	0.855	486
1.05	0.95	1122	0.852	969
2	0.5	2204	0.825	1912
5	0.2	3020	0.797	2633
10	0.1	3531	0.783	3086
25	0.04	4148	0.767	3635
50	0.02	4588	0.757	4028
100	0.01	5012	0.748	4407
500	0.002	5959	0.729	5257

Note: design flow Q_T at bridge $Q_{Tb} = (A_b/A_g)^a \times Q_{Tg} = 0.848^a \times Q_{Tg}$

Figure 1. Burnham Bridge Watershed



References

Flynn, K.M., Kirby, W.H., and Hummel, P.R., 2006, User's manual for program PeakFQ, Annual Flood Frequency Analysis Using Bulletin 17B Guidelines: U.S. Geological Survey Techniques and Methods Book 4, Chapter B4, 42 pgs.

Hodgkins, G., 1999. Estimating the Magnitude of Peak Flows for Streams inMaine for Selected Recurrence Intervals, WRIR 99-4008, U.S. Geological Survey, Augusta, ME.

Appendix:

Output for Cobbosseecontee Stream - Gardiner Gage #01049500

from

USGS Program PeakFQ

--- PROCESSING OPTIONS ---

Plot option = Graphics device
Basin char output = None
Print option = Yes
Debug print = No
Input peaks listing = Long
Input peaks format = WATSTORE peak file

Input files used:
peaks (ascii) - C:\ProgFils\PeakFQ\data\COBB-PEAK-Q.TXT
specifications - C:\ProgFils\PeakFQ\data\PKFQWPSF.TMP
Output file(s):
main - C:\ProgFils\PeakFQ\data\COBB-PEAK-Q.PRT

Station - 01049500 Cobbosseecontee Stream at Gardiner, Maine

I N P U T D A T A S U M M A R Y

Number of peaks in record	=	112
Peaks not used in analysis	=	0
Systematic peaks in analysis	=	112
Historic peaks in analysis	=	0
Beginning Year	=	1891
Ending Year	=	2014
Historical Period Length	=	0
Generalized skew	=	0.029
Standard error	=	0.297
Mean Square error	=	0.088
Skew option	=	WEIGHTED
Gage base discharge	=	0.0
User supplied high outlier threshold	=	--
User supplied PILF (LO) criterion	=	--
Plotting position parameter	=	0.00
Type of analysis		BULL.17B
PILF (LO) Test Method		GBT
Perception Thresholds	=	Not Applicable
Interval Data	=	Not Applicable
Area	=	217 sq mi

********* NOTICE -- Preliminary machine computations. *********
********* User responsible for assessment and interpretation. *********

WCF134I-NO SYSTEMATIC PEAKS WERE BELOW GAGE BASE. 0.0
WCF198I-LOW OUTLIERS BELOW FLOOD BASE WERE DROPPED. 3 470.9
WCF163I-NO HIGH OUTLIERS OR HISTORIC PEAKS EXCEEDED HHBASE. 6998.1

Kendall's Tau Parameters

	TAU	P-VALUE	MEDIAN SLOPE	No. of PEAKS
SYSTEMATIC RECORD	-0.049	0.449	-1.801	112

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	3.3208	0.2121	-1.572
BULL.17B ESTIMATE	470.9	0.9732	3.3369	0.1681	-0.225

BULL.17B ESTIMATE OF MSE OF AT-SITE SKEW 0.0680

ANNUAL FREQUENCY CURVE -- DISCHARGES AT SELECTED EXCEEDANCE PROBABILITIES

ANNUAL EXCEEDANCE PROBABILITY	BULL.17B ESTIMATE	SYSTEMATIC RECORD	<-- FOR BULLETIN 17B ESTIMATES --> VARIANCE OF EST.	95% CONFIDENCE INTERVALS LOWER	UPPER
0.9950		301.3	--	--	--
0.9900		403.1	--	--	--
0.9500	1122.	803.8	----	1012.0	1225.0
0.9000	1312.	1093.	----	1200.0	1416.0
0.8000	1576.	1502.	----	1463.0	1684.0
0.6667	1861.	1920.	----	1744.0	1979.0
0.5000	2204.	2365.	----	2075.0	2342.0
0.4292	2360.	2543.	----	2222.0	2512.0
0.2000	3020.	3124.	----	2825.0	3255.0
0.1000	3531.	3413.	----	3275.0	3854.0
0.0400	4148.	3630.	----	3805.0	4595.0
0.0200	4588.	3725.	----	4176.0	5134.0
0.0100	5012.	3786.	----	4531.0	5661.0
0.0050	5426.	3825.	----	4872.0	6180.0
0.0020	5959.	3856.	----	5309.0	6858.0

I N P U T D A T A L I S T I N G

Water Year	Peak Flow	Water Year	Peak Flow	Water Year	Peak Flow
1891	2830	1929	3250	1979	2200
1892	336	1930	2660	1980	1780
1893	2940	1931	2170	1981	972
1894	1020	1932	3180	1982	1640
1895	2880	1933	2740	1983	3510
1896	2960	1934	2960	1984	3580
1897	1000	1935	2390	1985	1800
1898	1380	1936	5020	1986	2170
1899	1570	1937	2280	1987	4240
1900	2650	1938	2080	1988	1840
1901	3510	1939	2820	1989	2890
1902	2960	1940	2840	1990	1900
1903	3600	1941	318	1991	2260
1904	3020	1942	1340	1992	2230
1905	968	1943	2080	1993	2740
1906	1400	1944	1950	1994	1870
1907	1860	1945	2350	1995	1110
1908	2000	1946	1320	1996	2200
1909	2200	1947	1940	1997	1950
1910	968	1948	3200	1998	2790
1911	840	1949	1320	1999	1740
1912	1740	1950	2010	2000	1970
1913	1830	1951	3040	2001	2140
1914	1730	1952	2710	2002	1310
1915	1050	1953	2920	2003	1250
1916	2320	1954	2790	2004	1490
1917	4250	1955	2030	2005	3870
1918	1260	1956	2640	2006	2310
1919	2890	1957	302	2007	2850
1920	3930	1958	2420	2008	1750
1921	4290	1959	1960	2009	2100
1922	4660	1960	3180	2010	2470
1923	3350	1961	2620	2011	2260
1924	2520	1962	1640	2012	2690
1925	2220	1963	2880	2013	1240
1926	2350	1964	2500	2014	1670
1927	1890	1977	3560		
1928	2810	1978	1890		

Note: all values flagged as “K” to denote regulated river.

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS (17B ESTIMATES)

WATER YEAR	RANKED Q	EX PROB	RETURN PERIOD	WATER YEAR	RANKED Q	EX PROB	RETURN PERIOD	WATER YEAR	RANKED Q	EX PROB	RETURN PERIOD
1936	5020	0.0088	113.6	2012	2690	0.3451	2.9	1978	1890	0.6814	1.5
1922	4660	0.0177	56.5	1930	2660	0.354	2.8	1994	1870	0.6903	1.4
1921	4290	0.0265	37.7	1900	2650	0.3628	2.8	1907	1860	0.6991	1.4
1917	4250	0.0354	28.2	1956	2640	0.3717	2.7	1988	1840	0.708	1.4
1987	4240	0.0442	22.6	1961	2620	0.3805	2.6	1913	1830	0.7168	1.4
1920	3930	0.0531	18.8	1924	2520	0.3894	2.6	1985	1800	0.7257	1.4
2005	3870	0.0619	16.2	1964	2500	0.3982	2.5	1980	1780	0.7345	1.4
1903	3600	0.0708	14.1	2010	2470	0.4071	2.5	2008	1750	0.7434	1.3
1984	3580	0.0796	12.6	1958	2420	0.4159	2.4	1912	1740	0.7522	1.3
1977	3560	0.0885	11.3	1935	2390	0.4248	2.4	1999	1740	0.7611	1.3
1901	3510	0.0973	10.3	1926	2350	0.4336	2.3	1914	1730	0.7699	1.3
1983	3510	0.1062	9.4	1945	2350	0.4425	2.3	2014	1670	0.7788	1.3
1923	3350	0.115	8.7	1916	2320	0.4513	2.2	1962	1640	0.7876	1.3
1929	3250	0.1239	8.1	2006	2310	0.4602	2.2	1982	1640	0.7965	1.3
1948	3200	0.1327	7.5	1937	2280	0.469	2.1	1899	1570	0.8053	1.2
1932	3180	0.1416	7.1	1991	2260	0.4779	2.1	2004	1490	0.8142	1.2
1960	3180	0.1504	6.6	2011	2260	0.4867	2.1	1906	1400	0.823	1.2
1951	3040	0.1593	6.3	1992	2230	0.4956	2.0	1898	1380	0.8319	1.2
1904	3020	0.1681	5.9	1925	2220	0.5044	2.0	1942	1340	0.8407	1.2
1896	2960	0.177	5.6	1909	2200	0.5133	1.9	1946	1320	0.8496	1.2
1902	2960	0.1858	5.4	1979	2200	0.5221	1.9	1949	1320	0.8584	1.2
1934	2960	0.1947	5.1	1996	2200	0.531	1.9	2002	1310	0.8673	1.2
1893	2940	0.2035	4.9	1931	2170	0.5398	1.9	1918	1260	0.8761	1.1
1953	2920	0.2124	4.7	1986	2170	0.5487	1.8	2003	1250	0.885	1.1
1919	2890	0.2212	4.5	2001	2140	0.5575	1.8	2013	1240	0.8938	1.1
1989	2890	0.2301	4.3	2009	2100	0.5664	1.8	1995	1110	0.9027	1.1
1895	2880	0.2389	4.2	1938	2080	0.5752	1.7	1915	1050	0.9115	1.1
1963	2880	0.2478	4.0	1943	2080	0.5841	1.7	1894	1020	0.9204	1.1
2007	2850	0.2566	3.9	1955	2030	0.5929	1.7	1897	1000	0.9292	1.1
1940	2840	0.2655	3.8	1950	2010	0.6018	1.7	1981	972	0.9381	1.1
1891	2830	0.2743	3.6	1908	2000	0.6106	1.6	1905	968	0.9469	1.1
1939	2820	0.2832	3.5	2000	1970	0.6195	1.6	1910	968	0.9558	1.0
1928	2810	0.292	3.4	1959	1960	0.6283	1.6	1911	840	0.9646	1.0
1954	2790	0.3009	3.3	1944	1950	0.6372	1.6	1892	336	0.9735	1.0
1998	2790	0.3097	3.2	1997	1950	0.646	1.5	1941	318	0.9823	1.0
1933	2740	0.3186	3.1	1947	1940	0.6549	1.5	1957	302	0.9912	1.0
1993	2740	0.3274	3.1	1990	1900	0.6637	1.5				
1952	2710	0.3363	3.0	1927	1890	0.6726	1.5				

End PeakFQ analysis.
  Stations processed :   1
  Number of errors   :   0
  Stations skipped   :   0
  Station years   :   112

Data records may have been ignored for the stations listed below.
(Card type must be Y, Z, N, H, I, 2, 3, 4, or *.)
(2, 4, and * records are ignored.)

 For the station below, the following records were ignored:

 FINISHED PROCESSING STATION: 01049500   USGS Cobbosseecontee Stream at Gar

 For the station below, the following records were ignored:

 FINISHED PROCESSING STATION:

APPENDIX D

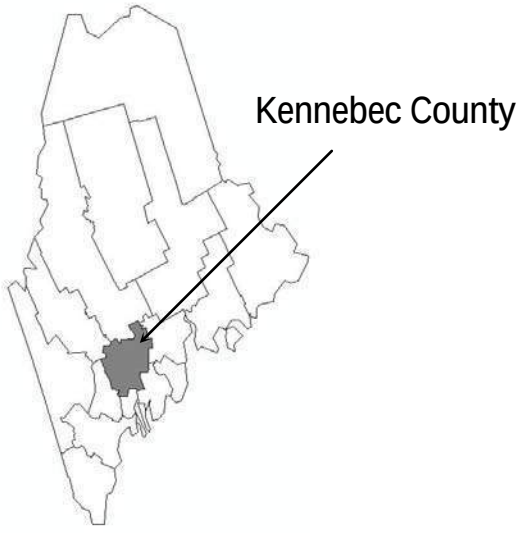
FEMA Information

FLOOD INSURANCE STUDY

KENNEBEC COUNTY, MAINE
(ALL JURISDICTIONS)

Volume 1 of 2

COMMUNITY NAME	COMMUNITY NUMBER
ALBION, TOWN OF	230231
AUGUSTA, CITY OF	230067
BELGRADE, TOWN OF	230232
BENTON, TOWN OF	230233
CHELSEA, TOWN OF	230234
CHINA, TOWN OF	230235
CLINTON, TOWN OF	230236
FARMINGDALE, TOWN OF	230164
FAYETTE, TOWN OF	230237
GARDINER, CITY OF	230068
HALLOWELL, CITY OF	230069
LITCHFIELD, TOWN OF	230238
MANCHESTER, TOWN OF	230239
MONMOUTH, TOWN OF	230240
MT VERNON, TOWN OF	230241
OAKLAND, TOWN OF	230242
PITTSTON, TOWN OF	230243
RANDOLPH, TOWN OF	230244
READFIELD, TOWN OF	230245
ROME, TOWN OF	230246
SIDNEY, TOWN OF	230247
UNITY, TOWNSHIP OF	230602
VASSALBORO, TOWN OF	230248
VIENNA, TOWN OF	230249
WATERVILLE, CITY OF	230070
WAYNE, TOWN OF	230188
WEST GARDINER, TOWN OF	230250
WINDSOR, TOWN OF	230251
WINSLOW, TOWN OF	230071
WINTHROP, TOWN OF	230072



Effective Date: June 16, 2011

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
23011CV001A

Chelsea, Town of – cont'd:	90-E-3266, Project Order No. 2. This work was completed in August 1992.
China, Town of:	The hydrologic and hydraulic analyses for the June 5, 1989 FIS were prepared by USGS for FEMA, under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 20. This work was completed in January 1988.
Clinton, Town of:	The hydrologic and hydraulic analyses for the May 3, 1990 FIS were prepared USGS for FEMA, under Inter-Agency Agreement No. EMW-85-E-1823, Project Order No. 20. This work was completed in March 1988. The hydrologic and hydraulic analyses for the Kennebec and Sebasticook Rivers were previously performed by the SCS.
Farmingdale, Town of:	In the March 1980, original FIS, the hydrologic and hydraulic analyses for the Kennebec River were prepared by the USGS, Water Resources Division, for FEMA, under Inter-Agency Agreement No. IAA-H-9-77, Project Order No. 6. This work was completed in January 1978. For the May 2, 1994, revised FIS, the hydrologic and hydraulic analyses for the Kennebec River were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-90-E-266, Project Order No. 2. This work was completed in August 1992.
Gardiner, City of:	Kennebec River and Cobbosseecontee Stream were prepared by the USGS, Water Resources Division, for the FIA, under Inter-Agency Agreement No.IAA-H-9-77, Project Order No. 6. This work was completed in January 1978. For the July 18, 1994, revised FIS, the hydrologic and hydraulic analyses for the Kennebec River were prepared by the USGS for FEMA, under Inter-Agency Agreement No. EMW-90-E-3266, Project Order No. 2. This work was completed in August 1992.

TABLE 2 –FLOODING SOURCES STUDIED BY DETAILED METHODS - continued

Flooding Source Name	Description of Study Reaches
Cobbosseecontee Stream	From the outlet of Cobboseecontee Lake in the Town of Manchester through the Town of West Gardner to the West Gardiner-Manchester corporate boundary.
	From Pleasant Pond in the Town of Litchfield to the upstream corporate limits.
Cochnewagon Lake	For the entire shoreline.
Dexter Pond	For the entire shoreline.
Eastern River	From the downstream Pittston corporate limits to a point approximately 50 feet upstream of State Route 194.
Echo Lake	For its entire shoreline within the Town of Readfield.
Great Pond	For its entire shoreline.
Kennebec River	For its entire length within Kennebec County.
Little Cobbosseecontee Lake	For its entire shoreline.
Long Pond	For its entire shoreline within the Towns of Belgrade and Rome.
Lovejoy Pond	For its entire shoreline within the Towns of Readfield and Wayne.
Lower Narrows Pond	For its entire shoreline.
Maranacook Lake	For its entire shoreline.
Meadow Brook	From a point approximately 4,180 feet downstream of Dirigo Road to approximately 50 feet upstream of Dirigo Road in the Town of China.
Messalonskee Lake (Snow Pond)	For its entire shoreline.

by applying a USGS regression equation (Reference 20). The flow of the West Branch Sheepscot River was changed just upstream of the first major tributary from the downstream limit of detailed study. This adjustment was made on the basis of the ratio of the change in drainage area. The primary source of data for China Lake was 17 annual maximum lake elevations from records furnished by the Kennebec Water District.

The Cobbosseecontee Stream Basin is composed of over 20 lakes and ponds. Many of the communities in Kennebec County are within this basin, including Gardiner, Litchfield, Manchester, Monmouth, West Gardiner, and Winthrop. The largest of these lakes (in downstream order) and their capacities in million cubic feet are as follows: Torsey Lake--441, Maranacook Lake--2,000; Annabessacook Lake--1,070, and Cobbosseecontee Lake--6,810. Although these lakes are not regulated as storage reservoirs, they do have a considerable dampening influence on peak flows downstream.

The analysis of Cobbosseecontee Lake in Litchfield, Manchester, Monmouth, West Gardiner, and Winthrop was based on a normal-Pearson Type III distribution of annual peak elevation data (Reference 23). The principal source of data for Cobbosseecontee Lake was the record of lake elevations maintained by the Gardiner Water District for the period 1947-1975. In September 1975, the USGS established a gaging station (no. 01049000) on Cobbosseecontee Lake at East Winthrop, Maine. These records and historic recordings of the 1936 peak elevation also were included in the analysis.

The principal sources of data for Cobbosseecontee Stream in Gardiner, Litchfield, Manchester, and West Gardiner are records published by the USGS. These records were published for USGS gaging station No. 01049500 on Cobbosseecontee Stream at Gardiner for the period from 1890 to 1964 (74 years of record). These data were collected at the Gardiner Water District dam operated by the Gardiner Water District. In 1976, the USGS re-established the gaging operation on Cobbosseecontee Stream. In the 1977 edition of Water Resources Data for Maine, these records were again published for USGS gaging station No. 01049500 (Reference 19). The value of the 1-percent-annual-chance peak discharge at the gaging station was obtained from a log-Pearson Type III distribution of annual peak flow data, according to the instruction in Water Resources Council Bulletin No. 17 (Reference 23). A significant flood event occurred during 1973 when no gaging station was in operation. The peak flow for this event was approximated using the flow over dam method (Reference 24). The peak was then included in the log-Pearson Type III distribution. Due to the difference in the drainage area of Cobbosseecontee Stream from Gardiner (217 square miles) to the Litchfield-West Gardiner corporate limits (140 square miles) and to the Manchester-West Gardiner Town line (139 square miles), decreases in discharge were required to make the peak flow representative of Litchfield, Manchester, and West Gardiner. These decreases were based on drainage area adjustments and information contained in USGS Open-File Report 75-292 (Reference 20).

Discharges on Messalonksee Stream in Waterville were generated from the SCS Technical Release No. 20 hydrologic evaluation model (Reference 25). This information was checked against historic data provided by the USGS, the Maine Department of Transportation, and the Central Maine Power Company.

In the Town of Wayne, flood elevations for Berry, Dexter, and Wilson Ponds were taken from the precountywide FIS for the Town of Winthrop (Reference 26). In the Winthrop study, flood discharges were related to elevations at the Wilson Pond outlet dam using USGS regression techniques (References 20 and 27). It was assumed that the dam on Wilson Pond controlled flood elevations for both Dexter and Berry Ponds as well. Field analyses made during the April 1987 flood proved this was not correct and 1-percent-annual-chance flood elevations for Dexter and Berry Ponds needed to be recomputed. Resultant 1-percent-annual-chance flood discharges are 510 feet per cubic second for Berry Pond, 570 feet per cubic second for Dexter Pond, and 930 feet per cubic second for Wilson Pond. The 1-percent-annual-chance flood elevation for Wilson Pond determined in the Winthrop study is still valid. This elevation was used in this study as the 1-percent-annual-chance flood elevation for Wilson Pond and the starting-water elevation in Dexter and Berry Ponds (Reference 28). Flood discharges were routed from Wilson Pond upstream through the bridges that separate both Dexter and Berry Ponds. The bridges and appropriate cross-sections were surveyed by the USGS.

The 1-percent-annual-chance flood of Lovejoy Pond in the Town of Wayne was taken from the precountywide FIS for the Town of Readfield (Reference 29). In the Readfield study, flood discharges were computed using regression equations developed by the USGS (Reference 20). The resultant 1-percent-annual-chance flood discharge of 1,400 feet per cubic second was routed over the outlet dam to determine the flood elevation (Reference 27).

Countywide Analyses

No new hydrologic analyses were performed in Kennebec County. Peak discharge-drainage area relationships for flooding sources in Kennebec County are shown in Table 6, “Summary of Discharges”. For the Kennebec River, only the drainage area-peak discharge relationships for free-flow events are shown.

TABLE 6 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
BOND BROOK					
At Confluence with Kennebec River	21.3	1,390	2,310	2,800	4,210
At first crossing of Bond Brook Road	17.2	1,110	1,830	2,230	3,360
Upstream of Confluence of Stone Brook	13.7	898	1,500	1,820	2,760
COBBOSSEECONTEE STREAM					
At Confluence with Kennebec River	219	3,850	5,290	5,910	7,380
At inlet to Pleasant Pond near the Sagadahoc-Kennebec County limits	213	3,850	5,290	5,910	7,380
Gardiner- West Gardiner corporate limits	212	3,850	5,290	5,910	7,380
At Pond Road	186	3,400	4,660	5,180	6,500
At the Litchfield-West Gardiner upstream corporate limits	140	*	*	4,140	*
At Collins Mill Road	140	2,710	3,740	4,140	5,200
At West Gardiner-Manchester corporate limits	139	2,710	3,740	4,140	5,200
At Confluence with Cobbosseecontee Lake	131	2,570	3,540	3,920	4,930
EASTERN RIVER					
Downstream from Confluence of Kimball Brook	19.2	*	*	2,250	*
Upstream from Confluence of Kimball Brook	16.5	*	*	1,960	*
KENNEBEC RIVER					
At the Lincoln-Kennebec County limits	5,822	*	*	233,000	*

*Data not computed

TABLE 7 – SUMMARY OF STILLWATER ELEVATIONS – (continued)

FLOODING SOURCE AND LOCATION	ELEVATION (FEET NAVD) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
MARANACOOK LAKE				
Town of Readfield	214.1	214.5	214.7	215
Town of Winthrop	214.1	214.5	214.7	215
MESSALONSKEE LAKE				
Entire shoreline within the Town of Belgrade	*	*	237.1	*
Entire shoreline within the Town of Oakland	*	*	237.1	*
Entire shoreline within the Town of Sidney	*	*	237.1	*
PLEASANT POND				
Town of Litchfield	*	*	138.7	*
PICKEREL POND				
Town of Wayne	*	*	288.6	*
POCASSET LAKE				
Entire shoreline within the Town of Wayne	*	*	288.6	*
SALMON LAKE				
Entire shoreline within the Town of Belgrade	*	*	278.6	*
Entire shoreline within the Town of Oakland	*	*	278.6	*
SAND POND				
Town of Litchfield	*	*	177.7	*
Town of Monmouth	176.8	177.4	177.7	178.2
THREE CORNERED POND				
City of Augusta	195.5	196.1	196.4	196.9

*Data not computed

Cross section data for the below-water sections were obtained from field surveys. Cross sections were located at close intervals above and below bridges, culverts, and dams in order to compute the significant backwater effects of these structures. In addition, cross sections were taken between hydraulic controls whenever warranted by topographic changes.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM (Exhibit 2).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals.

For each community within Kennebec County that has a previously printed FIS report, the hydraulic analyses described in those reports have been compiled and are summarized below.

Precountywide Analyses

All cross sections, bridges and culverts were surveyed to obtain elevation data, structural data, and structural geometry. Cross sections were selected immediately below changes in stream configuration. Roughness coefficients (Manning's "n") were determined by field inspection at each cross section using a step-by-step procedure. Where feasible, transposed cross sections were used to reduce the number of surveyed cross sections. Transposed cross sections are surveyed sections which can be transferred either upstream or downstream to represent a location which is similar in valley shape.

All elevations from the precountywide analyses were referenced from National Geodetic Vertical Datum of 1929 (NGVD), but were converted to North American Vertical Datum of 1988 for this countywide FIS. Refer to Section 3.4 Vertical Datum for more information about the conversion factor.

For the 17.1 mile length of the Kennebec River that stretches across the Towns of Farmingdale, Chelsea, Clinton, Pittston, and Randolph, and the Cities of Augusta, Gardiner, and Hallowell, water-surface elevations of floods of the selected recurrence intervals were computed using the USGS E431 and J635 step-backwater computer programs (References 30 and 31). The starting water-surface elevation for the Kennebec River was determined by using the 1-percent-annual-chance coastal flood elevation on the Lower Kennebec River at Merrymeeting Bay, which was taken from the precountywide FIS for the City of Bath (Reference 32). That elevation was inserted into the WSPRO models used to prepare the precountywide FISs for the downstream communities of Bowdoinham, Dresden, Pittston, and Richmond; the models were calibrated to the

Benton (described above). Water-surface elevations of floods of the selected recurrence interval for the Sebasticook River were taken from profiles developed using a USGS step-backwater computer program model (Reference 28). The step-backwater model for the Sebasticook River was checked using water level information obtained during the 1987 flood. Flood elevations observed during the 1987 flood are shown on the Sebasticook River profile at critical points throughout the entire length of the river within the Town of Clinton. The 1987 flood was the most severe since systematic collection of data was begun in October 1928 at the USGS stream gage near Pittsfield (Reference 46).

Cross sections for the Sebasticook River in Winslow were obtained from aerial photographs flown in November 1984 at a scale of 1:14,400 (Reference 58). The below-water sections were obtained from field surveys. Water-surface elevations of floods of the selected recurrence intervals for the Sebasticook River were computed using the SCS WSP-2 computer program (Reference 59). Starting water-surface elevations for the Sebasticook River were started from a given slope at its confluence with the Kennebec River.

The water-surface elevations for Cobbosseecontee Stream in Gardiner, Litchfield, Manchester, and West Gardiner were taken from profiles developed using the USGS E431 step-backwater computer program (References 30, 31, 41, 47, 48 and 49). The computations for the Manchester, Gardiner, and West Gardiner studies were performed as part of the analyses of 17.6 miles of Cobbosseecontee Stream. The computed backwater elevations of the Kennebec River at the mouth of Cobbosseecontee Stream were the source of the starting water-surface elevations used for the profiles on Cobbosseecontee Stream in Gardiner. These profiles were compared with historical flood marks. In Litchfield, the starting water-surface elevations for Cobbosseecontee Stream were taken from historical flood information and a rating curve developed by applying the flow over dam method at the Gardiner Water District Dam located 4.7 miles downstream from the Litchfield-West Gardiner corporate limits. The same was done in West Gardiner, where the Gardiner Water District Dam is located 0.8 mile downstream from the West Gardiner-Gardiner town boundary (Reference 24). The profiles were calibrated using historical flood information available from local landowners. In Manchester, the profiles were determined for Cobbosseecontee Stream from its mouth to the outlet of Cobbosseecontee Lake. The starting elevations used for the Manchester profile determinations were computed using historical flood information and a stage-discharge relation developed for Collins Mill Dam, located in West Gardiner, 1.1 miles downstream of the Manchester corporate limits. To determine the stage-discharge relationship for this dam, USGS personnel surveyed the dam and took current-meter measurements. This rating was extended on the basis of the stand flow-over-dam formulae, specifically the Francis Formula ($Q = CLH\ 3/2$), where Q is the discharge being studied, C is the coefficient of discharge, L is the length of the dam perpendicular to the direction of the flow, and H is the head on the dam (Reference 50). The coefficient of discharge (C) was also determined using the tables and graphs in U.S. Geological Survey Techniques of Water-Resources Investigations Book 3 which lists "C"

Roughness factors (Manning's "n" values) used in the hydraulic computations are shown in Table 9. Table 9, "Manning's "n" values", shows the channel and overbank "n" values for the streams studied by detailed methods:

TABLE 9 – MANNING'S "n" VALUES

Flooding Source	Channel "N"	Overbanks
Bond Brook (Augusta)	0.035 - 0.090	0.050 - 0.100
Cobbosseecontee Stream (Gardiner)	0.030 - 0.052	0.040 - 0.100
Cobbosseecontee Stream (Litchfield, West Gardiner)	0.035 - 0.045	0.045 - 0.090
Cobbosseecontee Stream (Manchester)	0.035 - 0.040	0.035 - 0.085
Eastern River (Pittston)	0.035 - 0.045	0.080 - 0.100
Kennebec River (Augusta, Chelsea, Farmingdale, Gardiner, Hallowell)	0.027 - 0.050	0.050 - 0.100
Kennebec River (Benton)	0.012 - 0.040	0.028 - 0.095
Kennebec River (Pittston)	0.025	0.055 - 0.085
Kennebec River (Randolph)	0.030 - 0.060	0.045 - 0.110
Kennebec River (Sidney)	0.029 - 0.040	0.060 - 0.075
Kennebec River (Waterville)	0.015 - 0.065	0.00 - 0.080
Kennebec River (Winslow)	0.029 - 0.040	0.060 - 0.075
Meadow Brook (China)	0.040 - 0.080	0.090 - 0.125
Messalonskee Stream (Waterville)	0.040 - 0.056	0.00 - 0.085
Sebasticook River (Benton)	0.040 - 0.070	0.060 - 0.090
Sebasticook River (Clinton)	0.030 -0.050	0.060 - 0.090
Sebasticook River (Winslow)	0.020 - 0.035	0.040 - 0.090
Togus Stream (Chelsea)	0.035 - 0.045	0.060 - 0.090
Togus Stream (Pittston)	0.030 - 0.060	0.045 - 0.110
West Branch Sheepscot River (China)	0.040 - 0.080	0.090 - 0.125

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD). With the completion of the North American Vertical Datum of 1988 (NAVD), many FIS reports and FIRMs are now prepared using NAVD as the referenced vertical datum.

Flood elevations shown in this FIS report and on the FIRM are referenced to the NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. This can be done by applying a standard conversion factor. The Flood Profiles, and Base (1-percent-annual-chance) Flood Elevations (BFEs) in the precountywide FIS reports, are in NGVD. These were converted to NAVD by applying the conversion factor of -0.6 feet to each detailed study stream in the effective FIS reports (**NGVD – 0.6 ft. = NAVD**). It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities. For information regarding conversion between the NGVD 29 and NAVD 88, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

Temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

The BFEs shown on the FIRM represent whole-foot rounded values. For example, a BFE of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD 29 should apply the stated conversion factor to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

To obtain current elevation, description, and/or location information for benchmarks shown on this map, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1-percent-annual-chance floodplain data, which may include a combination of the following: 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations; delineations of the 1- and 0.2-percent-annual-chance floodplains; and a 1-percent-annual-chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
BC	16950	385	5310	1.1	138.4	138.4	138.4	0.0
BD	17850	350	5490	1.1	138.4	138.4	138.4	0.0
BE	19070	550	7250	0.8	138.4	138.4	138.4	0.0
BF	19890	385	7660	0.8	138.4	138.4	138.4	0.0
BG	21430	450	6410	0.9	138.4	138.4	138.4	0.0
BH	22350	410	6720	0.9	138.4	138.4	138.4	0.0
BI	22790	140	2490	2.4	138.4	138.4	138.4	0.0
BJ	23100	370	7330	0.8	138.7	138.7	138.7	0.0
BK	23630	250	4950	1.2	138.7	138.7	138.7	0.0
BL	24910	640	7170	0.8	138.7	138.7	138.7	0.0
BM	28250	510	5290	1.1	138.7	138.7	138.7	0.0
BN	29310	560	5590	1.1	138.7	138.7	138.7	0.0
BO	31080	720	8880	0.7	138.7	138.7	138.7	0.0
BP	31730	700	15600	0.4	138.7	138.7	138.7	0.0
BQ	35100	430	3900	1.3	138.7	138.7	138.7	0.0
BR	35510	250	3760	1.4	138.7	138.7	138.7	0.0
BS	35840	250	3740	1.4	138.7	138.7	138.7	0.0
BT	35990	355	3500	1.5	139.3	139.3	139.4	0.1
BU	36770	280	4020	1.3	139.3	139.3	139.4	0.1
BV	37190	*	3490	1.5	139.3	139.3	139.4	0.1
BW	37460	*	2940	1.8	139.4	139.4	139.4	0.0
BX	37720	*	3740	1.4	139.4	139.4	139.4	0.0
BY	39120	*	6100	0.9	139.4	139.4	139.5	0.1
BZ	40210	*	8060	0.6	139.4	139.4	139.5	0.1
CA	41410	470	6470	0.8	139.4	139.4	139.5	0.1
CB	42600	395	3970	1.3	139.4	139.4	139.5	0.1
CC	43700	460	7640	0.7	139.5	139.5	139.5	0.0

[1] FEET ABOVE CONFLUENCE WITH KENNEBEC RIVER

* FLOODWAY COINCIDENT WITH CHANNEL BANKS

TABLE 10

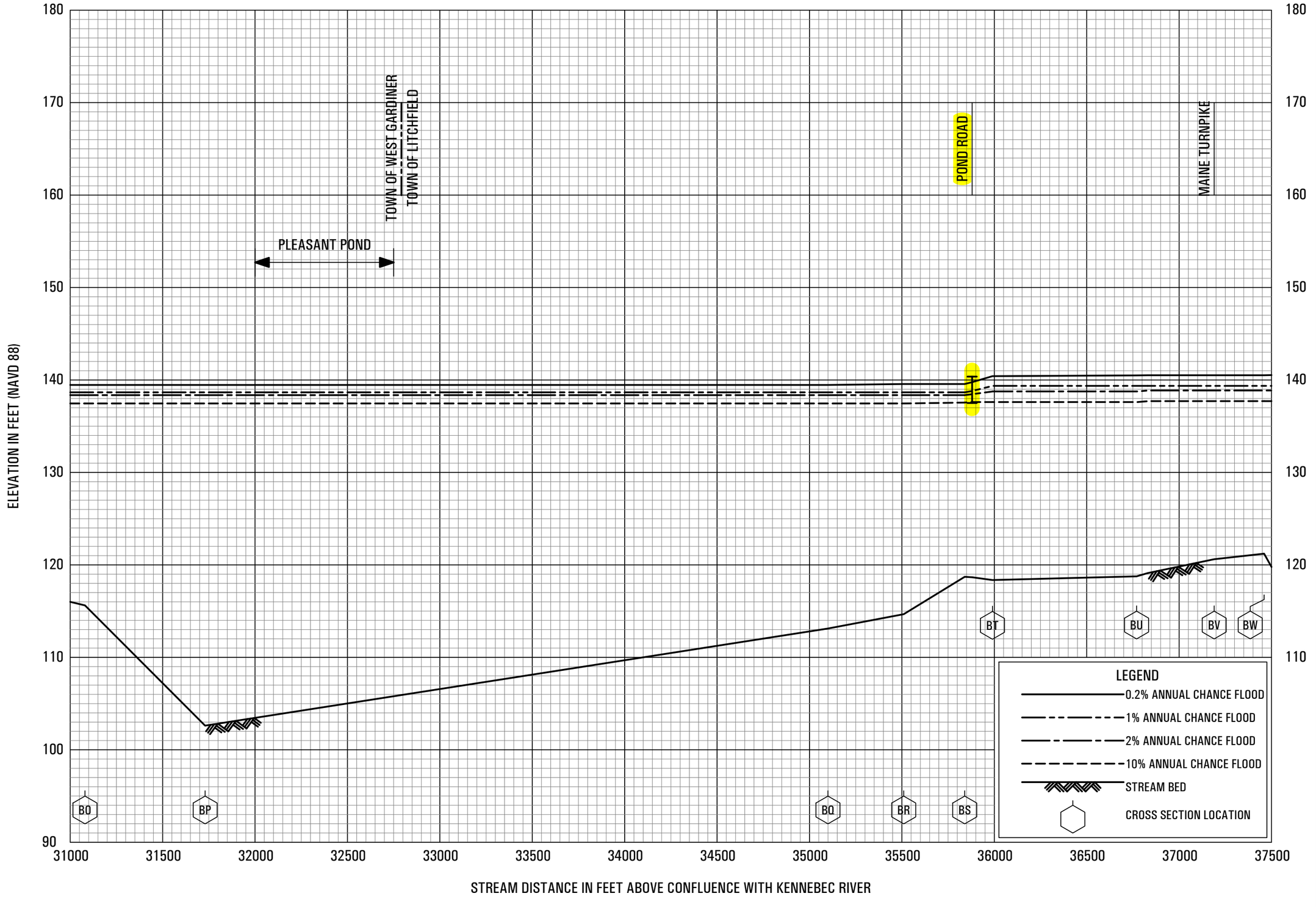
FEDERAL EMERGENCY MANAGEMENT AGENCY

KENNEBEC COUNTY, ME

(ALL JURISDICTIONS)

FLOODWAY DATA

COBBOSSEECONTEE STREAM



FLOOD PROFILES

COBBOSSEECONTEE STREAM

FEDERAL EMERGENCY MANAGEMENT AGENCY

KENNEBEC COUNTY, ME

(ALL JURISDICTIONS)

09P

Excerpt from data received from FEMA showing the project area.

X

Q500

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                USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT=  93
          NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

 ================================================================================
 WATER-SURFACE PROFILE FOR: COBSY STREAM CROSS SECTIONS UJ TO VJ     SECT. 10
 PAGE  3 OF  3
 ================================================================================
 SECID AT DISTANCE/ LENGTH/DISCHARGE/  AREA  /CONVEYANCE/ ALPHA/  LEW  /  REW
   WS ELEV /    HV  /    HF  /    HE  /    EG  /     V  /    FN  /   ACC    *10*
 ********************************************************************************
 VJ    AT   61860 /   290 /  6500. / 22472. / 4429694. / 1.17 /   55. / 1906.
    143.93 /  0.00 /  0.00 /  0.00 / 143.84 /  0.29 /  0.01 / -0.000  *XS*
 --------------------------------------------------------------------------------

                                END OF THIS PROFILE
```

X

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 17
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

*** INPUT CARD PRINTOUT ***

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 9 20002 16603 HOR      220  550
 9 20003 16700 HOR      230  570
 9 20004 16800 HOR      290  590
 9 20005 16900 HOR      190  700
 9 20006 17000 HOR      220 1040
 9 20007 17100 HOR      190 1190
 9 20008 17200 HOR      160  820
 9 20009 17300 HOR      198 1198
 9 20010 17500 HOR      366 1266
 9 20011 17600 HOR      458  538
 9 20012 17700 HOR      282  842
 9 20013 17800 HOR      230  670
 9 20014 17900 HOR      234  584
 9 20015 18000 HOR      217  507
 9 20016 18100 HOR      480  890
 9 20017 18300 HOR      910 1160
 9 20018 18400 HOR     1117 1417
 9 20019 18500 HOR      328  718
 9 20020 18600 HOR      407 1017
 9 20021 18700 HOR      387 1167
 9 20022 18800 HOR      195 1085
 9 20023 18900 HOR      130 1180
 9 20024 19000 HOR      378 1628
 9 20025 19100 HOR      211 1711
 9 20026 19200 HOR      418 1786
 9 20027       END
```

Input to Floodway analysis

X

Floodway Profile

WATER-SURFACE PROFILE FOR: COBSY STREAM CROSS SECTIONS UJ TO VJ SECT. 10
PAGE 1 OF 3
*** FLOODWAY ANALYSIS ***

SECID AT DISTANCE/ WS ELEV	LENGTH/DISCHARGE/ HV	HE	AREA / HE	CONVEYANCE/ EG	ALPHA/ V	LEW / FN	REW / ACC	
UJ AT 50550 / 140.19	0 / 0.03	5180.	3940.	753110. / 140.22	1.00 / 1.31	220. / 0.07	550.	*IS*
UK AT 50910 / 140.21	360 / 0.02	5180. / 0.01	4616. / 0.0	952435. / 140.23	1.00 / 1.12	230. / 0.05	570. / -0.000	*XS*
AL UL AT 51180 / 140.21	270 / 0.01	5180. / 0.00	5998. / 0.0	1584266. / 140.22	1.00 / 0.86	290. / 0.03	590. / -0.013	*XS*
********** BEGIN BRIDGE ANALYSIS **********								
IUL AT 51180 / 138.80	/ 0.42	5180. / ***3.**	994. / (0.082)	138174. / 5.21	1.00 / 0.28	0. /	94.	*BO*
NO ROAD OVERFLOW								*RG*
AM UM AT 51400 / 140.22	220 / 0.01	5180. / 0.00	6573. / 0.02	1322937. / 140.23	1.00 / 0.79	190. / 0.04	700. / -0.011	*AS*
M = **** / E = **** / K* = **** / 140.86		6899. / 0.01		1431914. / 140.87	1.00 / 0.75	190. / 0.04	700.	*AS*
********** END BRIDGE ANALYSIS **********								
UN AT 51850 / 140.86	450 / 0.00	5180. / 0.00	15475. / 0.0	2981080. / 140.86	1.06 / 0.33	220. / 0.02	1840. / -0.010	*XS*
AN UO AT 52310 / 140.86	460 / 0.00	5180. / 0.00	14224. / 0.00	3078927. / 140.86	1.00 / 0.36	190. / 0.02	1190. / -0.001	*XS*
UP AT 52950 / 140.86	640 / 0.01	5180. / 0.00	7632. / 0.00	1434435. / 140.87	1.00 / 0.68	160. / 0.04	820. / -0.001	*XS*
AO UR AT 53760 / 140.86	810 / 0.00	5180. / 0.01	12235. / 0.0	2408098. / 140.86	1.00 / 0.42	128. / 0.02	1198. / -0.011	*XS*
US AT 54850 / 140.86	1090 / 0.00	5180. / 0.01	11110. / 0.00	2188507. / 140.86	1.00 / 0.47	166. / 0.02	1266. / -0.005	*XS*
AP UT AT 55230 / 140.78	380 / 0.19	5180. / 0.02	1480. / 0.09	309876. / 140.97	1.00 / 3.50	458. / 0.14	538. / -0.000	*XS*
********** BEGIN BRIDGE ANALYSIS **********								
UUT AT 55240 / 139.80	/ 1.03	4985. / ***3.**	612. / (-.001)	78680. / 8.14	1.00 / 0.39	0. /	45.	*BO*
ROAD OVERFLOW (CFS) / LEFT 89. / RIGHT 94. /								*RG*

X
Floodway Profile.

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 26
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

WATER-SURFACE PROFILE FOR: COBSY STREAM CROSS SECTIONS UJ TO VJ SECT. 10
PAGE 2 OF 3
*** FLOODWAY ANALYSIS ***

SECID AT DISTANCE/ LENGTH/DISCHARGE/ AREA /CONVEYANCE/ ALPHA/ LEW / REW WS ELEV / HV / HF / HE / EG / V / FN / ACC *ID*	
UU AT 55410 / 180 / 5180. / 10623. / 2864299. / 1.08 / 282. / 842.	AQ
140.97 / 0.00 / 0.01 / 0.0 / 140.98 / 0.49 / 0.02 / -0.000 *AS*	
M = **** / E = **** / K* = **** / 11414. / 3212943. / 1.07 / 287. / 842.	
142.39 / 0.00 / / 142.39 / 0.45 / 0.02 / *AS*	
========== END BRIDGE ANALYSIS ==========	
UV AT 55810 / 400 / 5180. / 9374. / 2640561. / 1.00 / 230. / 670.	
142.39 / 0.00 / 0.00 / 0.00 / 142.39 / 0.55 / 0.02 / -0.001 *XS*	
UW AT 56140 / 330 / 5180. / 5938. / 1407536. / 1.00 / 234. / 584.	
142.39 / 0.01 / 0.00 / 0.00 / 142.40 / 0.87 / 0.04 / 0.001 *XS*	
UX AT 56420 / 280 / 5180. / 3932. / 812151. / 1.00 / 217. / 507.	AR
142.39 / 0.03 / 0.01 / 0.01 / 142.41 / 1.32 / 0.06 / 0.001 *XS*	
UY AT 56750 / 330 / 5180. / 5854. / 1249619. / 1.00 / 480. / 890.	
142.41 / 0.01 / 0.01 / 0.0 / 142.42 / 0.88 / 0.04 / 0.000 *XS*	
VA AT 57470 / 720 / 5180. / 5936. / 876796. / 1.00 / 910. / 1160.	
142.41 / 0.03 / 0.02 / 0.01 / 142.44 / 1.32 / 0.06 / -0.010 *XS*	
VB AT 57710 / 240 / 5180. / 4541. / 1029140. / 1.01 / 1117. / 1417.	AS
142.41 / 0.02 / 0.01 / 0.0 / 142.43 / 1.14 / 0.05 / -0.014 *XS*	
VC AT 58010 / 300 / 5180. / 5033. / 892034. / 1.00 / 328. / 718.	
142.41 / 0.02 / 0.01 / 0.0 / 142.43 / 1.03 / 0.05 / -0.013 *XS*	
VD AT 58200 / 190 / 5130. / 8613. / 1837809. / 1.00 / 407. / 1017.	
142.41 / 0.01 / 0.00 / 0.0 / 142.42 / 0.60 / 0.03 / -0.014 *XS*	
VE AT 58730 / 530 / 5180. / 10458. / 2169307. / 1.00 / 387. / 1167.	AT
142.41 / 0.00 / 0.00 / 0.0 / 142.41 / 0.50 / 0.02 / -0.005 *XS*	
VF AT 59470 / 740 / 5180. / 12284. / 2602369. / 1.00 / 195. / 1085.	
142.41 / 0.00 / 0.00 / 0.0 / 142.41 / 0.42 / 0.02 / -0.005 *XS*	
VG AT 60330 / 860 / 5180. / 13273. / 2668896. / 1.00 / 130. / 1180.	
142.41 / 0.00 / 0.00 / 0.0 / 142.41 / 0.39 / 0.02 / -0.004 *XS*	
VH AT 60990 / 660 / 5180. / 17627. / 3797611. / 1.00 / 378. / 1628.	AU
142.41 / 0.00 / 0.00 / 0.0 / 142.41 / 0.29 / 0.01 / -0.003 *XS*	
VI AT 61570 / 580 / 5190. / 20054. / 4205930. / 1.00 / 211. / 1711.	
142.41 / 0.00 / 0.00 / 0.0 / 142.41 / 0.26 / 0.01 / -0.001 *XS*	

WATER-SURFACE PROFILE FOR: CORSY STREAM CROSS SECTIONS UJ TO VJ SECT. 10
PAGE 3 OF 3
*** FLOODWAY ANALYSIS ***

SECID AT DISTANCE / LENGTH / DISCHARGE / AREA / CONVEYANCE / ALPHA / LEW / REW								
	WS ELEV /	HV /	HF /	HE /	EG /	V /	FN /	ACC *ID*
VJ AT 61860 /	290 /	5180. /	17456. /	3545522. /	1.00 /	418. /	1788.	
	142.41 /	0.00 /	0.00 /	0.00 /	142.41 /	0.30 /	0.01 /	-0.000 *XS*

END OF THIS PROFILE

WATER-SURFACE PROFILE FOR: CORSY STREAM CROSS SECTIONS UJ TO VJ SECT. 10
PAGE 3 OF 3
*** FLOODWAY ANALYSIS ***

SECID AT DISTANCE / LENGTH / DISCHARGE / AREA / CONVEYANCE / ALPHA / LEW / REW								
	WS ELEV /	HV /	HF /	HE /	EG /	V /	FN /	ACC *ID*
VJ AT 61860 /	290 /	5180. /	17456. /	3545522. /	1.00 /	418. /	1788.	
	142.41 /	0.00 /	0.00 /	0.00 /	142.41 /	0.30 /	0.01 /	-0.000 *XS*

END OF THIS PROFILE

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                    USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT=    1
                  NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

                              *** INPUT CARD PRINTOUT ***

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   1 25600 GODYS STREAM CROSS SECTIONS XV TO YU     SECT. 12 26  4 02 90 12
   2 25601  14960  15050  15070  15130
   3 25602 XW      1  26  3  139   78740  1  3
   4 25603 BO2710   3740   4140   5200
   5 25604      32  1 1518   48  1 1501   65  1 1474   79  1 1443   90  1 1420
   5 25605      98  2 1390  101  2 1386  109  2 1389  124  2 1380  139  2 1378
   5 25606     154  2 1381  168  2 1372  193  2 1362  198  2 1373  200  2 1374
   5 25607     204  3 1390  217  3 1406  233  3 1414  251  3 1426  270  3 1450
   5 25608     286  3 1466  305  3 1500  321  3 1508  337  3 1509  350  3 1515
   5 25609     363  3 1520
   6 25610  0  1 080 080  0  1 035 035  0  1 065 065
   3 25700 XM      0  29  3  139   78860  1  3
   5 25701      34  1 1540   47  1 1504   69  1 1448   83  1 1414  100  2 1390
   5 25702     104  2 1376  111  2 1377  125  2 1377  139  2 1381  153  2 1374
   5 25703     162  2 1375  168  2 1372  182  2 1382  195  2 1387  197  3 1390
   5 25704     210  3 1409  226  3 1420  247  3 1429  263  3 1438  277  3 1458
   5 25705     290  3 1467  311  3 1492  330  3 1503  344  3 1504  365  3 1503
   5 25706     378  3 1504  392  3 1504  411  3 1508  440  3 1525
   6 25707  0  1 080 080  0  1 035 035  0  1 065 065
   3 25800 XX      0  19  3  139   79090  1  3
   5 25801      95  1 1522  117  1 1485  139  1 1457  160  1 1426  177  1 1401
   5 25802     190  2 1390  193  2 1386  208  2 1363  229  2 1355  251  2 1351
   5 25803     272  2 1357  288  2 1349  310  2 1370  331  2 1374  338  2 1383
   5 25804     340  3 1390  354  3 1421  369  3 1453  398  3 1517
   6 25805  0  1 080 080  0  1 035 035  0  1 065 065
   3 25900 XY      0  26  3  139   79390  1  3
   5 25901     183  1 1524  228  1 1399  248  1 1393  266  2 1390  274  2 1379
   5 25902     286  2 1344  315  2 1333  343  2 1325  372  2 1318  400  2 1319
   5 25903     428  2 1322  457  2 1343  469  2 1379  472  3 1390  483  3 1414
   5 25904     515  3 1416  551  3 1421  587  3 1449  631  3 1461  677  3 1475
   5 25905     723  3 1481  768  3 1484  813  3 1476  858  3 1472  902  3 1459
   5 25906     970  3 1530
   6 25907  0  1 080 080  0  1 035 035  0  1 065 065
   3 26000 XZ      0  24  3  139   79620  1  3
   5 26001 BP 138  1 1530  182  1 1423  203  2 1390  216  2 1372  245  2 1353
   5 26002     303  2 1343  360  2 1349  418  2 1362  476  2 1349  533  2 1342
   5 26003     591  2 1345  620  2 1379  632  3 1390  662  3 1414  695  3 1425
   5 26004     739  3 1422  783  3 1400  827  3 1396  872  3 1393  916  3 1393
   5 26005     960  3 1401 1004  3 1410 1036  3 1448 1078  3 1516
   6 26006  0  1 080 080  0  1 035 035  0  1 070 070
   3 26100 YA      0  22  3  139   79860  1  3
   5 26101      35  1 1555   77  1 1536  107  1 1501  147  1 1468  168  1 1405
   5 26102     188  2 1390  225  2 1383  274  2 1359  375  2 1347  477  2 1349
   5 26103     578  2 1343  679  2 1336  692  2 1335  884  2 1334  931  2 1383
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*** INPUT CARD PRINTOUT ***

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  5 26105    1129  3 1510 1181  3 1559
  6 26106  0  1 080 080  0  1 035 035  0  1 075 075
  3 26200 YB    0  25  3  139    80400  1  3
  5 26201      45  1 1549   85  1 1492  132  1 1456  162  1 1417  198  1 1392
  5 26202     214  2 1390  288  2 1395  361  2 1385  508  2 1385  656  2 1341
  5 26203     803  2 1345  950  2 1352 1098  2 1392 1245  2 1393 1318  2 1395
  5 26204    1392  3 1390 1424  3 1399 1469  3 1409 1514  3 1428 1543  3 1442
  5 26205    1570  3 1455 1593  3 1464 1633  3 1493 1664  3 1525 1694  3 1536
  6 26206  0  1 080 080  0  1 035 035  0  1 075 075
  3 26300 YC    0  32  3  139    80890  1  3
  5 26301      0  1 1518   51  1 1485   94  1 1482  143  1 1474  186  1 1462
  5 26302    234  1 1460  257  1 1450  308  1 1460  357  1 1471  410  1 1484
  5 26303    457  1 1455  498  1 1451  543  1 1417  559  1 1403  578  2 1390
  5 26404    622  2 1388  667  2 1380  756  2 1383  849  2 1302  933  2 1238
  5 26405   1022  2 1233 1110  2 1238 1199  2 1301 1244  2 1393 1288  3 1390
  5 26406   1316  3 1410 1346  3 1420 1378  3 1443 1408  3 1461 1468  3 1491
  5 26407   1490  3 1518 1532  3 1526
  6 26408  0  1 075 075  0  1 035 035  0  1 075 075
  3 26400 YBQ   0  27  3  139    81170  1  3
  **SEQUENCE**
  5 26401      0  1 1536   31  1 1517   63  1 1494   98  1 1475  142  1 1462
  5 26402    186  1 1462  231  1 1412  258  1 1409  295  2 1392  296  2 1374
  5 26403    319  2 1361  364  2 1355  409  2 1377  455  2 1393  501  2 1378
  5 26404    546  2 1357  591  2 1358  614  2 1372  621  3 1392  637  3 1397
  5 26405    665  3 1419  690  3 1445  719  3 1478  761  3 1490  805  3 1508
  5 26406    850  3 1525  894  3 1553
  6 26407  0  1 075 075  0  1 035 035  0  1 075 075
  3 26500 YE    0  26  3  139    81410  1  3
  5 26501     66  1 1540   95  1 1510  123  1 1491  173  1 1483  208  1 1475
  5 26502    237  1 1455  270  1 1433  302  1 1429  324  1 1422  339  1 1410
  5 26503    355  2 1394  367  2 1377  379  2 1352  403  2 1342  427  2 1352
  5 26504    451  2 1382  476  2 1392  500  2 1377  524  2 1382  536  2 1392
  5 26505    548  3 1394  567  3 1415  598  3 1426  640  3 1475  683  3 1502
  5 26506    725  3 1538
  6 26507  0  1 075 075  0  1 035 035  0  1 075 075
  3 26600 YF    0  29  3  139    81600  1  3
  5 26601     66  1 1556   96  1 1539  128  1 1518  160  1 1502  181  1 1501
  5 26602    215  1 1481  247  1 1468  278  1 1424  298  2 1397  319  2 1352
  5 26603    330  2 1312  362  2 1292  394  2 1302  426  2 1292  459  2 1312
  5 26604    491  2 1332  523  2 1352  539  2 1382  555  3 1397  574  3 1422
  5 26605    597  3 1428  620  3 1439  639  3 1451  673  3 1489  707  3 1500
  5 26606    739  3 1507  767  3 1527  791  3 1536  813  3 1551
  6 26607  0  1 080 080  0  1 035 035  0  1 080 080
  3 26700 YB    0  27  3  139    81880  1  3
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BR

*** INPUT CARD PRINTOUT ***

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 5 26702    101  1 1470  125  1 1443  145  1 1426  169  2 1400  181  2 1382
 5 26703    192  2 1362  215  2 1342  238  2 1322  261  2 1312  285  2 1342
 5 26704    308  2 1362  331  2 1367  342  2 1377  354  3 1400  377  3 1423
 5 26705    400  3 1470  419  3 1499  439  3 1525  457  3 1541  475  3 1555
 5 26706    492  3 1568  508  3 1575
 6 26707  0  1 075 075  0  1 035 035  0  1 075 075
 3 26800 YH   0 35 3 140   82050  1 3
 5 26801      0  1 1608   19  1 1582   40  1 1577   64  1 1560   87  1 1547
 5 26802    108  1 1530  132  1 1498  154  1 1479  176  1 1464  198  1 1441
 5 26803    212  1 1423  221  2 1410  226  2 1384  232  2 1374  242  2 1372
 5 26804    253  2 1367  263  2 1364  274  2 1382  285  2 1379  295  2 1384
 5 26805    301  2 1390  306  3 1410  322  3 1441  339  3 1452  356  3 1463
 5 26806    378  3 1481  400  3 1479  425  3 1471  443  3 1493  463  3 1510
 5 26807    484  3 1557  502  3 1570  520  3 1577  534  3 1589  543  3 1595
 6 26808  0  1 075 075  0  1 040 040  0  1 075 075
 3 26900 YI   0 30 3 140   82290  1 3
 5 26901     40  1 1618   59  1 1573   74  1 1546   89  1 1529  102  1 1517
 5 26902    120  1 1500  135  1 1488  147  1 1481  165  1 1471  179  1 1456
 5 26903    189  1 1444  202  2 1420  208  2 1390  215  2 1390  227  2 1389
 5 26904    240  2 1387  252  2 1388  265  2 1390  278  2 1390  290  2 1394
 5 26905    297  2 1397  301  3 1420  313  3 1454  329  3 1489  350  3 1515
 5 26906    369  3 1529  389  3 1536  407  3 1550  423  3 1561  437  3 1572
 6 26907  0  1 075 075  0  1 040 040  0  1 075 075
 3 27000 YJ   0 30 3 143   82490  1 3
 5 27001      0  1 1612   21  1 1596   37  1 1581   57  1 1553   77  1 1518
 5 27002    103  1 1499  127  1 1487  143  1 1471  162  1 1453  179  1 1448
 5 27003    191  1 1448  204  1 1448  217  2 1431  222  2 1403  226  2 1394
 5 27004    235  2 1389  245  2 1385  254  2 1392  263  2 1384  273  2 1384
 5 27005    282  2 1397  286  2 1392  291  3 1431  308  3 1451  323  3 1468
 5 27006    338  3 1492  363  3 1526  378  3 1546  396  3 1592  413  3 1616
 6 27007  0  1 075 075  0  1 040 040  0  1 075 075
 3 27100 YK   0 25 3 142   82760  1 3
 5 27101 BS   0  1 1577   20  1 1567   36  1 1556   51  1 1538   68  1 1526
 5 27102     83  1 1510   97  1 1477  108  1 1455  121  1 1446  138  2 1440
 5 27103    146  2 1403  154  2 1385  170  2 1375  185  2 1370  201  2 1383
 5 27104    217  2 1365  232  2 1375  248  2 1387  256  2 1373  264  3 1440
 5 27105    280  3 1464  297  3 1505  316  3 1528  334  3 1575  352  3 1624
 6 27106  0  1 075 075  0  1 040 040  0  1 075 075
 3 27200 YL   0 36 3 145   82910  1 3
 5 27201 BT   0  1 1583   12  1 1573   24  1 1564   35  1 1560   47  1 1550
 5 27202     60  1 1537   77  1 1524   91  1 1507  102  1 1491  112  1 1474
 5 27203    122  1 1469  129  2 1460  132  2 1412  135  2 1405  141  2 1405
 5 27204    148  2 1405  154  2 1415  160  2 1405  167  2 1399  173  2 1389
 5 27205    176  2 1399  179  3 1460  191  3 1483  204  3 1492  219  3 1487
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*** INPUT CARD PRINTOUT ***

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                1         2         3         4         5         6         7         8
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    5 27206      232  3 1478  244  3 1478  258  3 1491  270  3 1507  284  3 1530
    5 27207      295  3 1547  307  3 1572  316  3 1582  329  3 1596  339  3 1622
    5 27208      347  3 1628
    6 27209  0 1 075 075  0 1 040 040  0 1 075 075
    3 27300 XR     0  32  3  145    83090  1  3
    5 27301 BU     0  1 1640   11  1 1614   22  1 1598   33  1 1593   46  1 1586
    5 27302       62  1 1562   79  1 1550   92  1 1534  104  1 1520  123  1 1503
    5 27303      136  1 1489  144  1 1481  154  2 1470  159  2 1427  163  2 1426
    5 27304      172  2 1425  182  2 1426  191  2 1423  200  2 1421  210  2 1417
    5 27305      219  2 1421  223  2 1428  228  3 1470  241  3 1487  262  3 1505
    5 27306      280  3 1516  296  3 1521  312  3 1531  327  3 1540  342  3 1548
    5 27307      360  3 1560  373  3 1569
    6 27308  0 1 075 075  0 1 040 040  0 1 075 075
    3 27400 XS     0  31  3  147    83210  1  3
    5 27401 BV     0  1 1648   15  1 1620   29  1 1585   45  1 1566   61  1 1549
    5 27402       77  1 1532   90  1 1523  106  1 1514  118  1 1502  128  1 1487
    5 27403      142  1 1485  159  2 1480  164  2 1461  170  2 1458  181  2 1456
    5 27404      191  2 1454  202  2 1460  213  2 1458  223  2 1448  234  2 1461
    5 27405      240  2 1465  245  3 1480  261  3 1502  276  3 1520  292  3 1537
    5 27406      309  3 1538  324  3 1556  342  3 1574  358  3 1592  374  3 1605
    5 27407      389  3 1618
    6 27408  0 1 080 080  0 1 040 040  0 1 080 080
    3 27500 XR     0  33  3  150    83420  1  3
    5 27501 BW     0  1 1647   13  1 1628   27  1 1589   44  1 1571   66  1 1560
    5 27502       88  1 1551  101  1 1544  114  1 1538  129  1 1534  140  1 1528
    5 27503      155  1 1516  166  1 1505  181  1 1503  202  2 1500  208  2 1487
    5 27504      214  2 1485  226  2 1483  238  2 1479  250  2 1479  261  2 1483
    5 27505      273  2 1479  285  2 1479  291  2 1477  297  3 1500  312  3 1514
    5 27506      327  3 1528  343  3 1555  359  3 1561  376  3 1570  392  3 1593
    5 27507      406  3 1634  420  3 1651  431  3 1676
    6 27508  0 1 080 080  0 1 040 040  0 1 080 080
    3 27600 XR     0  30  3  152    83610  1  3
    5 27601 BX     0  1 1683   16  1 1656   30  1 1645   46  1 1633   58  1 1632
    5 27602       76  1 1608   93  1 1576  107  1 1564  124  1 1546  145  1 1546
    5 27603      159  1 1546  171  1 1546  187  1 1540  205  2 1530  211  2 1517
    5 27604      217  2 1515  229  2 1512  241  2 1509  253  2 1505  264  2 1508
    5 27605      276  2 1506  288  2 1502  294  2 1503  299  3 1520  310  3 1550
    5 27606      324  3 1596  338  3 1626  351  3 1717  364  3 1745  379  3 1760
    6 27607  0 1 075 075  0 1 040 040  0 1 075 075
    3 27700 XR     0  32  3  153    83780  1  3
    5 27701 BY     0  1 1685   16  1 1680   31  1 1667   42  1 1652   59  1 1638
    5 27702       74  1 1629   89  1 1616  103  1 1600  117  1 1600  129  1 1603
    5 27703      140  1 1599  157  1 1579  169  1 1567  183  1 1546  199  2 1545
    5 27704      202  2 1519  205  2 1515  212  2 1514  219  2 1512  225  2 1507
    5 27705      231  2 1509  238  2 1511  245  2 1505  248  2 1510  251  3 1535
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*** INPUT CARD PRINTOUT ***

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5 27706      262  3 1575  276  3 1610  291  3 1628  305  3 1651  322  3 1665
5 27707      336  3 1681  348  3 1690
6 27708  0   1 075 075   0  1 040 040   0  1 075 075
3 27800 YR     0  34  3 158   84210  1  3
5 27801 BZ     0   1 1711   11  1 1700   24  1 1680   38  1 1668   50  1 1661
5 27802       64  1 1651   74  1 1642   84  1 1627   95  1 1604  106  1 1584
5 27803      112  1 1581  121  1 1581  130  1 1602  139  1 1612  149  1 1611
5 27804      157  1 1593  166  2 1580  171  2 1563  176  2 1555  185  2 1554
5 27805      195  2 1553  204  2 1551  214  2 1551  224  2 1553  233  2 1545
5 27806      238  2 1556  243  3 1580  252  3 1594  262  3 1625  274  3 1654
5 27807      286  3 1659  303  3 1730  315  3 1759  332  3 1776
6 27808  0   1 070 070   0  1 040 040   0  1 070 070
3 27900 MS     0  34  3 158   84540  1  3
5 27901 CA     0   1 1703   15  1 1674   26  1 1667   39  1 1652   53  1 1645
5 27902       65  1 1633   77  1 1610   90  1 1592  101  1 1583  112  1 1582
5 27903      126  2 1580  133  2 1547  141  2 1526  156  2 1515  170  2 1517
5 27904      185  2 1521  200  2 1515  214  2 1521  229  2 1533  237  2 1539
5 27905      244  3 1580  261  3 1596  274  3 1598  289  3 1607  307  3 1619
5 27906      321  3 1629  335  3 1641  346  3 1652  367  3 1650  379  3 1665
5 27907      393  3 1674  407  3 1707  419  3 1728  428  3 1742
6 27908  0   1 070 070   0  1 040 040   0  1 075 075
3 28000 MT     0  41  3 158   84930  1  3
5 28001 CB     0   1 1684   22  1 1672   64  1 1650  110  1 1625  151  1 1618
5 28002       161  1 1603  177  1 1603  202  1 1609  249  1 1617  298  1 1625
5 28003       343  1 1633  391  1 1638  437  1 1646  485  1 1646  532  1 1636
5 28004       579  1 1639  626  1 1639  673  1 1641  721  1 1643  767  1 1650
5 28005       814  1 1640  861  1 1626  888  1 1583  910  1 1582  945  2 1581
5 28006       967  2 1580  978  2 1563  989  2 1531 1011  2 1461 1033  2 1489
5 28007      1055  2 1479 1076  2 1491 1098  2 1499 1120  2 1526 1131  2 1559
5 28008      1142  3 1580 1169  3 1593 1193  3 1611 1225  3 1651 1257  3 1700
5 28009      1291  3 1764
6 28010  0   1 070 070   0  1 040 040   0  1 075 075
3 28100 YU     0  23  3 158   85760  1  3
5 28101        0   1 1730   33  1 1710   81  1 1661  128  1 1590  147  1 1583
5 28102      177  2 1582  201  2 1551  226  2 1505  274  2 1498  323  2 1498
5 28103      371  2 1501  420  2 1509  469  2 1519  517  2 1524  542  2 1553
5 28104      566  3 1582  587  3 1587  615  3 1603  662  3 1663  710  3 1668
5 28105      758  3 1669  791  3 1672  815  3 1686
6 28106  0   1 070 070   0  1 040 040   0  1 070 070
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WATER-SURFACE PROFILE FOR: COBYS STREAM CROSS SECTIONS XV TO YU SECT= 12
PAGE 1 OF 2

SECID	AT	DISTANCE / WS ELEV	LENGTH / HV	DISCHARGE / HF	AREA / HE	CONVEYANCE / EG	ALPHA / V	LEW / FN	REW / ACC	
XV	AT	78740 / 149.60	0 / 0.04	2710. /	2073. /	334870. / 149.64	1.59 / 1.31	51. / 0.09	303.	*IS*
XW	AT	78860 / 149.60	120 / 0.05	2710. / 0.01	2090. / 0.00	314389. / 149.65	1.74 / 1.30	50. / 0.10	310. / -0.007	*XS*
XX	AT	79090 / 149.63	230 / 0.02	2710. / 0.01	2719. / 0.0	527041. / 149.66	1.41 / 1.00	110. / 0.06	389. / -0.000	*XS*
XY	AT	79390 / 149.63	300 / 0.01	2710. / 0.00	5606. / 0.0	1041821. / 149.64	1.88 / 0.48	193. / 0.03	938. / -0.019	*XS*
XZ	AT	79620 / 149.63	230 / 0.00	2710. / 0.00	10161. / 0.0	1894245. / 149.64	1.52 / 0.27	152. / 0.02	1066. / -0.006	*XS*
YA	AT	79860 / 149.63	240 / 0.00	2710. / 0.00	12534. / 0.0	2993814. / 149.63	1.12 / 0.22	113. / 0.01	1035. / -0.001	*XS*
YB	AT	80400 / 149.63	540 / 0.00	2710. / 0.00	16804. / 0.0	3430931. / 149.63	1.18 / 0.16	82. / 0.01	1636. / -0.001	*XS*
YC	AT	80090 / 149.63	490 / 0.00	2710. / 0.00	16091. / 0.00	4060218. / 149.63	1.34 / 0.17	33. / 0.01	1456. / -0.000	*XS*
YD	AT	81170 / 149.63	280 / 0.00	2710. / 0.00	5955. / 0.00	1056396. / 149.64	1.54 / 0.46	60. / 0.03	776. / 0.002	*XS*
YE	AT	81410 / 149.63	240 / 0.01	2710. / 0.00	4044. / 0.00	635015. / 149.65	1.82 / 0.67	115. / 0.05	674. / 0.001	*XS*
YF	AT	81600 / 149.63	190 / 0.01	2710. / 0.00	5576. / 0.0	1310304. / 149.64	1.38 / 0.49	189. / 0.02	696. / -0.009	*XS*
YG	AT	81880 / 149.63	280 / 0.01	2710. / 0.00	3404. / 0.00	726289. / 149.65	1.38 / 0.78	71. / 0.04	417. / 0.002	*XS*
YH	AT	82050 / 149.61	170 / 0.07	2710. / 0.01	1763. / 0.03	225671. / 149.68	1.91 / 1.54	134. / 0.12	447. / -0.000	*XS*
YI	AT	82290 / 149.55	240 / 0.08	2710. / 0.04	1384. / 0.01	198263. / 149.73	1.42 / 1.96	124. / 0.13	335. / -0.000	*XS*
YJ	AT	82490 / 149.68	200 / 0.12	2710. / 0.05	1327. / 0.02	159350. / 149.79	1.79 / 2.04	107. / 0.16	341. / -0.000	*XS*

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Q10

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 15
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

WATER-SURFACE PROFILE FOR: COBYS STREAM CROSS SECTIONS XV TO YU SECT. 12
PAGE 2 OF 2

SECID	AT DISTANCE / WS ELEV	LENGTH/DISCHARGE / HV	/ HF	/ HE	AREA / EG	/ CONVEYANCE / V	/ ALPHA / FN	/ LEW / ACC	/ REW *ID*
BS XK	AT 82760 / 149.79	270 / 0.05	/ 2710. / 0.04	/ 1756. / 0.0	/ 286938. / 149.84	1.25 / 1.54	/ 88. / 0.09	/ 296. / -0.000	*XS*
BT XL	AT 82910 / 149.86	150 / 0.47	/ 2710. / 0.06	/ 616. / 0.21	/ 69750. / 150.10	1.57 / 4.40	/ 98. / 0.34	/ 262. / -0.000	*XS*
BU XM	AT 83090 / 149.99	180 / 0.36	/ 2710. / 0.25	/ 624. / 0.0	/ 76469. / 150.35	1.22 / 4.35	/ 126. / 0.32	/ 256. / -0.000	*XS*
BV XN	AT 83210 / 150.11	120 / 0.74	/ 2710. / 0.31	/ 442. / 0.19	/ 37378. / 150.85	1.21 / 6.13	/ 119. / 0.60	/ 260. / -0.001	*XS*
BW XO	AT 83420 / 151.50	210 / 1.04	/ 2710. / 1.55	/ 373. / 0.15	/ 26600. / 152.54	1.26 / 7.27	/ 158. / 0.81	/ 313. / -0.014	*XS*
BX XP	AT 83610 / ~~152.04~~	190 / 1.55	/ 2710. / 2.59	/ 278. / 0.26	/ 20263. / 155.39	1.05 / 9.75	/ 190. / 1.04	/ 304. / 0.006	*XS*
BY XQ	AT 83780 / 156.07	170 / 1.58	/ 2710. / 2.25	/ 299. / 0.02	/ 27442. / 157.65	1.24 / 9.05	/ 173. / 0.83	/ 258. / 0.001	*XS*
BZ XR	AT 84210 / 159.97	430 / 0.83	/ 2710. / 3.15	/ 413. / 0.0	/ 36512. / 160.80	1.24 / 6.56	/ 97. / 0.62	/ 254. / 0.001	*XS*
CA XS	AT 84540 / 161.12	330 / 0.10	/ 2710. / 0.42	/ 1180. / 0.0	/ 157336. / 161.23	1.26 / 2.30	/ 76. / 0.16	/ 295. / 0.000	*XS*
CB XT	AT 84950 / 161.25	410 / 0.03	/ 2710. / 0.06	/ 2237. / 0.0	/ 327926. / 161.28	1.26 / 1.21	/ 155. / 0.08	/ 1194. / 0.000	*XS*
YU	AT 85760 / 161.30	810 / 0.01	/ 2710. / 0.03	/ 3992. / 0.0	/ 632896. / 161.31	1.10 / 0.48	/ 113. / 0.04	/ 623. / -0.000	*XS*

END OF THIS PROFILE

assume WSC
YP- 154.1

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 17
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

WATER-SURFACE PROFILE FOR: COBYS STREAM CROSS SECTIONS XV TO YU SECT. 12
PAGE 1 OF 2

SECID	AT	DISTANCE	LENGTH	DISCHARGE	AREA	CONVEYANCE	ALPHA	LEW	REN	
	WS ELEV	HV	HF	HE	EG	V	FN	ACC		*ID*
XV	AT	78740	0	3740.	2306.	381690.	1.66	44.	315.	
	150.50	0.07			150.57	1.62	0.11			*IS*
XW	AT	78860	120	3740.	2348.	349111.	1.99	47.	397.	
	150.50	0.08	0.01	0.01	150.58	1.59	0.12	-0.007		*XS*
XX	AT	79090	230	3740.	2981.	594547.	1.45	105.	393.	
	150.56	0.04	0.02	0.0	150.59	1.25	0.07	-0.000		*XS*
XY	AT	79390	300	3740.	6324.	1182451.	1.95	190.	947.	
	150.59	0.01	0.01	0.0	150.60	0.59	0.04	-0.000		*XS*
XZ	AT	79620	230	3740.	11039.	2134375.	1.53	148.	1072.	
	150.59	0.00	0.00	0.0	150.59	0.34	0.02	-0.009		*XS*
YA	AT	79860	240	3740.	13489.	3332303.	1.13	103.	1119.	
	150.59	0.00	0.00	0.0	150.59	0.28	0.01	-0.002		*XS*
YB	AT	80400	540	3740.	18296.	3903692.	1.19	75.	1645.	
	150.59	0.00	0.00	0.0	150.59	0.20	0.01	-0.001		*XS*
YC	AT	80890	490	3740.	17464.	4459123.	1.38	19.	1471.	
	150.59	0.00	0.00	0.00	150.59	0.21	0.01	-0.000		*XS*
YD	AT	81170	280	3740.	6657.	1210177.	1.59	46.	800.	
	150.59	0.01	0.00	0.00	150.60	0.56	0.04	0.003		*XS*
YE	AT	81410	240	3740.	4591.	735758.	1.89	101.	688.	
	150.59	0.02	0.00	0.01	150.61	0.81	0.06	0.002		*XS*
YF	AT	81600	190	3740.	6093.	1439742.	1.46	152.	734.	
	150.59	0.01	0.00	0.0	150.60	0.61	0.03	-0.013		*XS*
YG	AT	81880	280	3740.	3823.	814644.	1.43	60.	424.	
	150.59	0.02	0.00	0.01	150.61	0.98	0.05	0.003		*XS*
YH	AT	82050	170	3740.	2068.	267406.	2.01	126.	458.	
	150.56	0.10	0.01	0.04	150.66	1.81	0.14	-0.000		*XS*
YI	AT	82290	240	3740.	1594.	233653.	1.90	114.	343.	
	150.60	0.13	0.05	0.01	150.73	2.35	0.16	-0.000		*XS*
YJ	AT	82490	200	3740.	1564.	191334.	1.88	93.	349.	
	150.64	0.17	0.06	0.02	150.81	2.39	0.19	-0.000		*XS*

X

BS

WATER-SURFACE PROFILE FOR: CUBYS STREAM CROSS SECTIONS XY TO YU SECT. 12
PAGE 2 OF 2

SECID	AT	DISTANCE/ WS ELEV	LENGTH/ HV	DISCHARGE/ HF	AREA / HE	/CONVEYANCE/ EG	ALPHA/ V	LEW / FN	REW / ACC	*ID*
BS	AT	82760. / 150.80	270 / 0.07	3740. / 0.06	1968. / 0.0	333472. / 150.87	1.29 / 1.90	84. / 0.11	299. / -0.000	*XS*
BT	AT	82910. / 150.89	150 / 0.63	3740. / 0.07	779. / 0.28	87117. / 151.22	1.76 / 4.80	92. / 0.38	269. / -0.000	*XS*
BU	AT	83090. / 151.03	180 / 0.49	3740. / 0.30	770. / 0.0	97180. / 151.52	1.34 / 4.85	115. / 0.35	271. / -0.000	*XS*
BV	AT	83210. / 151.17	120 / 0.83	3740. / 0.31	602. / 0.17	55792. / 152.00	1.38 / 6.22	108. / 0.58	269. / -0.000	*XS*
BW	AT	83420. / 152.33	210 / 1.14	3740. / 1.32	511. / 0.16	40004. / 153.47	1.37 / 7.32	146. / 0.77	322. / 0.001	*XS*
BX	AT	83610. / ~~154.34~~	190 / 2.09	3740. / 2.49	339. / 0.47	26719. / 156.43	1.10 / 11.04	178. / 1.12	306. / 0.001	*XS*
BY	AT	83780. / 156.82	170 / 2.13	3740. / 2.50	366. / 0.02	35632. / 158.95	1.31 / 10.22	68. / 0.90	260. / 0.000	*XS*
BZ	AT	84210. / 161.11	430 / 0.90	3740. / 3.06	575. / 0.0	55184. / 162.01	1.38 / 6.50	92. / 0.59	258. / 0.003	*XS*
CA	AT	84540. / 162.29	330 / 0.14	3740. / 0.42	1449. / 0.0	200414. / 162.43	1.36 / 2.58	70. / 0.18	312. / 0.000	*XS*
CB	AT	84950. / 162.46	410 / 0.04	3740. / 0.07	2780. / 0.0	407923. / 162.50	1.44 / 1.35	112. / 0.09	1204. / 0.000	*XS*
YU	AT	85760. / 162.52	810 / 0.01	3740. / 0.04	4625. / 0.0	780346. / 162.53	1.13 / 0.81	105. / 0.05	632. / -0.000	*XS*

END OF THIS PROFILE

Assume WSC
YP- 155.2

X

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 20
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

Q100

WATER-SURFACE PROFILE FOR: COBYS STREAM CROSS SECTIONS XV TO YU SECT. 12
PAGE 1 OF 2

SECID	AT	DISTANCE/ WS ELEV	LENGTH/ HV	DISCHARGE/ HF	AREA / HE	CONVEYANCE/ EG	ALPHA/ V	LEW / FN	KEW / ACC	*ID*
XV	AT	78740 / 150.70	0 / 0.08	4140. /	2361. /	392211. / 150.78	1.68 / 1.75	42. / 0.12/	319.	*IS*
XW	AT	78860 / 150.70	120 / 0.09	4140. / 0.01	2419. / 0.01	360017. / 150.79	2.01 / 1.71	46. / 0.13	406. / -0.009	*XS*
XX	AT	79090 / 150.77	230 / 0.04	4140. / 0.02	3042. / 0.0	610378. / 150.81	1.45 / 1.36	104. / 0.08	394. / -0.000	*XS*
XY	AT	79390 / 150.80	300 / 0.01	4140. / 0.01	6487. / 0.0	1215567. / 150.82	1.96 / 0.64	189. / 0.04	949. / -0.000	*XS*
XZ	AT	79620 / 150.80	230 / 0.00	4140. / 0.00	11238. / 0.0	2190114. / 150.81	1.53 / 0.37	147. / 0.02	1073. / -0.011	*XS*
YA	AT	79860 / 150.80	240 / 0.00	4140. / 0.00	13708. / 0.0	3410882. / 150.81	1.14 / 0.30	101. / 0.01	1124. / -0.002	*XS*
YB	AT	80400 / 150.80	540 / 0.00	4140. / 0.00	18634. / 0.0	4013604. / 150.81	1.19 / 0.22	74. / 0.01	1648. / -0.001	*XS*
YC	AT	80890 / 150.80	490 / 0.00	4140. / 0.00	17777. / 0.00	4551660. / 150.81	1.39 / 0.23	15. / 0.01	1475. / -0.000	*XS*
XD	AT	81170 / 150.80	280 / 0.01	4140. / 0.00	6820. / 0.00	1246296. / 150.81	1.61 / 0.61	43. / 0.04	805. / 0.003	*XS*
YE	AT	81410 / 150.80	240 / 0.02	4140. / 0.00	4718. / 0.01	759638. / 150.83	1.90 / 0.88	98. / 0.06	690. / 0.002	*XS*
YF	AT	81600 / 150.80	190 / 0.01	4140. / 0.00	6220. / 0.0	1471160. / 150.81	1.48 / 0.67	148. / 0.03	740. / -0.016	*XS*
YG	AT	81880 / 150.80	280 / 0.03	4140. / 0.00	3902. / 0.01	835249. / 150.83	1.44 / 1.06	57. / 0.06	426. / 0.004	*XS*
YH	AT	82050 / 150.77	170 / 0.12	4140. / 0.01	2138. / 0.05	277288. / 150.89	2.02 / 1.94	125. / 0.15	460. / -0.000	*XS*
YI	AT	82290 / 150.82	240 / 0.15	4140. / 0.06	1644. / 0.02	242119. / 150.97	1.51 / 2.52	111. / 0.17	344. / -0.000	*XS*
YJ	AT	82490 / 150.87	200 / 0.19	4140. / 0.07	1621. / 0.02	199207. / 151.06	1.90 / 2.55	90. / 0.20	350. / -0.000	*XS*

Q100

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 21
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

WATER-SURFACE PROFILE FOR: COBYS STREAM CROSS SECTIONS XV TO YU SECT. 12
PAGE 2 OF 2

SECID AT DISTANCE/ LENGTH/DISCHARGE/ AREA /CONVEYANCE/ ALPHA/ LEW / REW WS ELEV / HV / HF / HE / EG / V / FN / ACC *ID#								
YK	AT 82760 / 270 / 4140. / 2021. / 345098. / 1.30 / 83. / 301.							
	151.04 / 0.08 / 0.07 / 0.0 / 151.13 / 2.05 / 0.12 / -0.000 *XS*							
YL	AT 82910 / 150 / 4140. / 815. / 91083. / 1.79 / 90. / 271.							
151.0	150.79 / 0.72 / 0.08 / 0.32 / 151.51 / 5.08 / 0.40 / -0.015 *XS*							
BK YM	AT 83090 / 180 / 4140. / 813. / 102961. / 1.38 / 112. / 275.							
	151.29 / 0.56 / 0.33 / 0.0 / 151.85 / 5.10 / 0.37 / 0.008 *XS*							
YN	AT 83210 / 120 / 4140. / 647. / 61236. / 1.41 / 105. / 271.							
	151.45 / 0.89 / 0.33 / 0.17 / 152.34 / 6.40 / 0.59 / -0.001 *XS*							
YO	AT 83420 / 210 / 4140. / 560. / 45065. / 1.40 / 142. / 325.							
	152.60 / 1.19 / 1.30 / 0.15 / 153.80 / 7.39 / 0.77 / 0.001 *XS*							
9550mi² WSC YP- 155.4	YP AT 83610 / 190 / 4140. / 363. / 29307. / 1.13 / 173. / 307.							
	~~154.23~~ / 2.28 / 2.47 / 0.54 / 156.80 / 11.41 / 1.14 / -0.001 *XS*							
YQ	AT 83780 / 170 / 4140. / 390. / 38669. / 1.34 / 165. / 261.							
	157.08 / 2.34 / 2.57 / 0.03 / 159.42 / 10.61 / 0.93 / 0.012 *XS*							
BL YR	AT 84210 / 430 / 4140. / 645. / 63011. / 1.44 / 90. / 259.							
	161.52 / 0.92 / 3.02 / 0.0 / 162.44 / 6.42 / 0.58 / 0.000 *XS*							
BM YS	AT 84540 / 330 / 4140. / 1551. / 217167. / 1.39 / 68. / 318.							
	162.70 / 0.15 / 0.41 / 0.0 / 162.86 / 2.67 / 0.18 / 0.000 *XS*							
YT	AT 84950 / 410 / 4140. / 3014. / 440197. / 1.52 / 103. / 1207.							
	162.89 / 0.04 / 0.07 / 0.0 / 162.93 / 1.37 / 0.09 / -0.000 *XS*							
BN YU	AT 85760 / 810 / 4140. / 4855. / 836103. / 1.14 / 102. / 636.							
	162.96 / 0.01 / 0.04 / 0.0 / 162.97 / 0.85 / 0.05 / 0.000 *XS*							

END OF THIS PROFILE

Q500

WATER-SURFACE PROFILE FOR: COBYS STREAM CROSS SECTIONS XV TO YU SECT. 12
PAGE 1 OF 2

SECID	AT	DISTANCE/ WS ELEV	LENGTH/ HV	DISCHARGE/ HF	AREA / HE	CONVEYANCE/ EG	ALPHA/ V	LEN / FN	REN / ACC	*ID*
XV	AT	78740 / 151.30	0 / 0.12	5200. /	2539. /	421645. / 151.42	1.78 / 2.05	37. / 0.14	346.	*IS*
XW	AT	78860 / 151.30	120 / 0.12	5200. / 0.02	2641. / 0.00	396530. / 151.42	2.06 / 1.97	44. / 0.15	420. / -0.015	*XS*
XX	AT	79090 / 151.39	230 / 0.06	5200. / 0.02	3224. / 0.0	658497. / 151.45	1.48 / 1.61	100. / 0.09	397. / -0.000	*XS*
XY	AT	79390 / 151.44	300 / 0.02	5200. / 0.01	6973. / 0.0	1316639. / 151.46	1.99 / 0.75	186. / 0.05	955. / -0.000	*XS*
XZ	AT	79620 / 151.46	230 / 0.00	5200. / 0.00	11829. / 0.0	2358659. / 151.45	1.54 / 0.44	144. / 0.03	1077. / -0.015	*XS*
YA	AT	79860 / 151.44	240 / 0.00	5200. / 0.00	14365. / 0.0	3649692. / 151.44	1.15 / 0.36	96. / 0.02	1134. / -0.003	*XS*
YB	AT	80400 / 151.44	540 / 0.00	5200. / 0.00	19639. / 0.0	4346291. / 151.44	1.20 / 0.26	69. / 0.01	1654. / -0.002	*XS*
YC	AT	80890 / 151.44	490 / 0.00	5200. / 0.00	18712. / 0.00	4831347. / 151.44	1.42 / 0.28	6. / 0.01	1484. / -0.000	*XS*
YD	AT	81170 / 151.44	280 / 0.01	5200. / 0.00	7312. / 0.01	1356215. / 151.45	1.64 / 0.71	35. / 0.04	822. / 0.004	*XS*
YE	AT	81410 / 151.44	240 / 0.03	5200. / 0.01	5100. / 0.01	833102. / 151.47	1.94 / 1.02	91. / 0.07	697. / 0.003	*XS*
YF	AT	81600 / 151.46	190 / 0.01	5200. / 0.00	6616. / 0.0	1571343. / 151.48	1.53 / 0.79	135. / 0.04	750. / -0.000	*XS*
YG	AT	81880 / 151.46	280 / 0.04	5200. / 0.01	4148. / 0.01	899878. / 151.50	1.47 / 1.25	50. / 0.07	431. / 0.005	*XS*
YH	AT	82050 / 151.47	170 / 0.16	5200. / 0.02	2359. / 0.06	309372. / 151.57	2.06 / 2.20	120. / 0.17	465. / -0.000	*XS*
YI	AT	82290 / 151.47	240 / 0.20	5200. / 0.08	1801. / 0.02	268957. / 151.67	1.56 / 2.89	104. / 0.19	350. / -0.000	*XS*
YJ	AT	82490 / 151.54	200 / 0.25	5200. / 0.09	1801. / 0.03	224171. / 151.79	1.95 / 2.89	81. / 0.23	355. / -0.000	*XS*

Q500

WATER-SURFACE PROFILE FOR: COBYS STREAM CROSS SECTIONS XV TO YU SECT. 12
PAGE 2 OF 2

SECID	AT	DISTANCE	LENGTH	DISCHARGE	AREA	CONVEYANCE	ALPHA	LEW	REW
	WS ELEV	HV	HF	HE	EG	V	FN	ACC	*ID*
BS	AT	82760	270	5200.	2183.	380148.	1.33	76.	307.
	151.76	0.12	0.09	0.0	151.88	2.38	0.14	-0.000	*XS*
BT	AT	82910	150	5200.	944.	105719.	1.88	85.	275.
	151.99	0.89	0.10	0.39	152.38	5.51	0.44	0.014	*XS*
BU	AT	83090	180	5200.	947.	120711.	1.50	104.	295.
	152.05	0.70	0.38	0.0	152.76	5.49	0.40	0.000	*XS*
BV	AT	83210	120	5200.	787.	77905.	1.50	91.	278.
	152.24	1.02	0.35	0.16	153.26	6.61	0.59	-0.000	*XS*
BW	AT	83420	210	5200.	699.	59732.	1.49	130.	330.
	153.33	1.28	1.22	0.13	154.61	7.44	0.75	0.000	*XS*
BX	AT	83610	190	5200.	445.	36388.	1.27	120.	310.
	154.99	2.70	2.36	0.71	157.69	11.69	1.18	0.000	*XS*
BY	AT	83780	170	5200.	445.	45562.	1.39	160.	263.
	157.63	2.96	2.77	0.13	160.59	11.70	1.00	0.000	*XS*
BZ	AT	84210	430	5200.	833.	87174.	1.50	84.	262.
	162.61	0.91	2.93	0.0	163.52	6.24	0.54	0.001	*XS*
CA	AT	84540	330	5200.	1816.	261264.	1.46	61.	331.
	163.72	0.19	0.39	0.0	163.91	2.86	0.19	0.000	*XS*
CB	AT	84950	410	5200.	3690.	522348.	1.78	84.	1216.
	163.94	0.05	0.08	0.0	163.99	1.41	0.10	0.000	*XS*
YU	AT	85760	810	5200.	5430.	980213.	1.16	95.	644.
	164.02	0.02	0.04	0.0	164.03	0.96	0.05	-0.000	*XS*

END OF THIS PROFILE

Assume WSC
YP - 155.9

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 60
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

WATER-SURFACE PROFILE FOR: COOSY STREAM CROSS SECTIONS AV TO YU SELT. 12
PAGE 1 OF 2
*** FLOODWAY ANALYSIS ***

SECID	AT DISTANCE/ WS ELEV	LENGTH/DISCHARGE/ HV	HF	HE	AREA	/CONVEYANCE/ EG	V	ALPHA/ EN	LEW	KW AGG	*10*
AV	AT 78760 / 150.70 /	0 / 0.14 /	4140. /	1423. /	324398. / 150.84 /	1.05 / 2.91 /	95. / 0.15/	205.			*15*
XW	AT 78860 / 150.70 /	120 / 0.17 /	4140. / 0.02 /	1262. / 0.01 /	271162. / 150.87 /	1.04 / 3.23 /	100. / 0.16 /	206. -0.008			*XS*
XX	AT 79090 / 150.84 /	230 / 0.04 /	4140. / 0.03 /	2145. / 0.0 /	506006. / 150.90 /	1.00 / 1.89 /	190. / 0.09 /	340. -0.000			*XS*
XY	AT 79370 / 150.89 /	300 / 0.02 /	4140. / 0.01 /	3651. / 0.0 /	1030709. / 150.91 /	1.02 / 1.13 /	284. / 0.05 /	474. -0.000			*XS*
XZ	AT 79620 / 150.89 /	230 / 0.01 /	4140. / 0.00 /	6708. / 0.0 /	1967440. / 150.89 /	1.00 / 0.62 /	283. / 0.03 /	633. -0.001			*XS*
YA	AT 79860 / 150.89 /	240 / 0.00 /	4140. / 0.00 /	12552. / 0.0 /	3685830. / 150.89 /	1.01 / 0.33 /	185. / 0.01 /	315. -0.005			*XS*
YB	AT 80400 / 150.89 /	540 / 0.00 /	4140. / 0.00 /	13564. / 0.0 /	3853502. / 150.89 /	1.00 / 0.26 /	213. / 0.01 /	1393. -0.001			*XS*
YC	AT 80890 / 150.89 /	490 / 0.00 /	4140. / 0.00 /	14027. / 0.0 /	4262227. / 150.89 /	1.00 / 0.30 /	578. / 0.01 /	1.88. -0.000			*XS*
YD	AT 81170 / 150.89 /	280 / 0.01 /	4140. / 0.00 /	4582. / 0.01 /	1120109. / 150.90 /	1.01 / 0.90 /	292. / 0.04 /	622. 0.005			*XS*
YE	AT 81410 / 150.89 /	240 / 0.04 /	4140. / 0.01 /	2717. / 0.01 /	643991. / 150.92 /	1.05 / 1.52 /	350. / 0.07 /	550. 0.007			*XS*
YF	AT 81600 / 150.92 /	190 / 0.01 /	4140. / 0.00 /	4789. / 0.0 /	1411021. / 150.93 /	1.01 / 0.56 /	297. / 0.04 /	557. -0.000			*XS*
YG	AT 81880 / 150.92 /	280 / 0.03 /	4140. / 0.00 /	2985. / 0.01 /	785732. / 150.95 /	1.03 / 1.39 /	197. / 0.06 /	357. 0.005			*XS*
YH	AT 82050 / 150.84 /	170 / 0.21 /	4140. / 0.02 /	1156. / 0.09 /	227866. / 151.05 /	1.07 / 3.58 /	219. / 0.18 /	309. -0.000			*XS*
YI	AT 82240 / 150.94 /	240 / 0.20 /	4140. / 0.09 /	1176. / 0.0 /	211079. / 151.14 /	1.01 / 3.52 /	201. / 0.18 /	301. -0.000			*XS*
YJ	AT 82490 / 150.97 /	200 / 0.32 /	4140. / 0.10 /	913. / 0.06 /	164525. / 151.31 /	1.00 / 4.54 /	214. / 0.24 /	294. -0.000			*XS*

USGS STEP-BACKWATER PROGRAM - VERSION 77.180 *** PAGE COUNT= 61
NEW ENGLAND DISTRICT MODIFICATION FOR FIA TYPE 15 FLOOD INSURANCE STUDIES

WATER-SURFACE PROFILE FOR CONST STREAM CROSS SECTIONS AV TO YU SECT. 12
PAGE 2 OF 2
*** FLOODWAY ANALYSIS ***

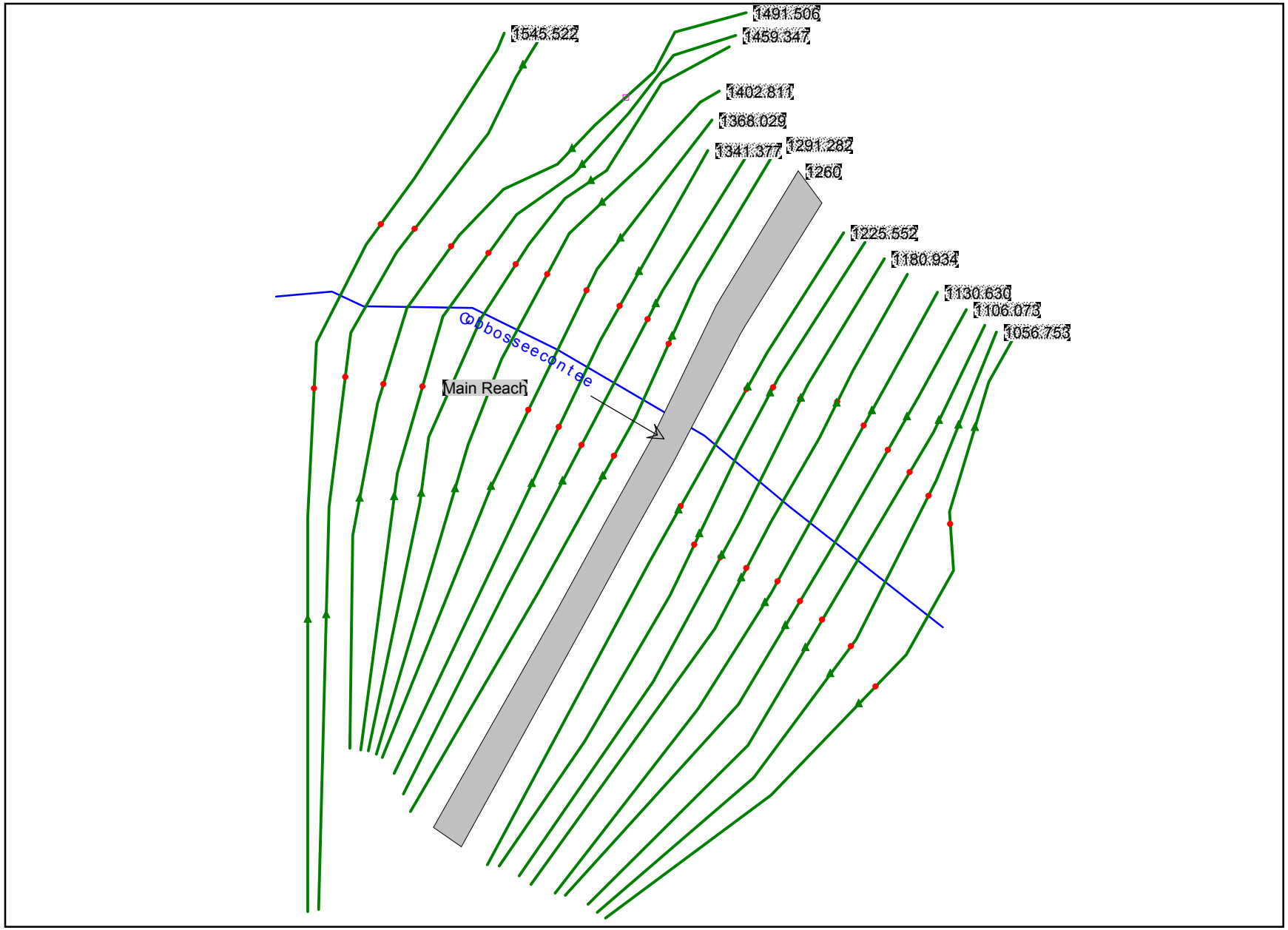
SECID	AT DISTANCE/ WS ELEV	LENGTH/DISCHARGE/ HV	AREA / HF	CONVEYANCE/ HE	ALPHA/ EG	LEW / RGW V	FR / ALL	*ID*
BS	AT 82760 / 151.30	270 / 0.10	4140. / 0.08	1679. / 0.0	335501. / 151.40	1.03 / 2.47	136. / 0.12	260. / -0.000 *XS*
BT	AT 82910 / 150.99	150 / 0.90	4140. / 0.09	940. / 0.60	86116. / 151.89	1.20 / 4.95	120. / 0.43	190. / -0.000 *XS*
BU	AT 83090 / 151.64	180 / 0.59	4140. / 0.34	652. / 0.0	105096. / 152.23	1.06 / 5.98	152. / 0.36	232. / -0.000 *XS*
BV	AT 83210 / 151.74	120 / 1.02	4140. / 0.52	521. / 0.22	81487. / 152.76	1.04 / 7.95	157. / 0.39	247. / -0.000 *XS*
BW	AT 83420 / 152.86	210 / 1.35	4140. / 1.28	434. / 0.16	45089. / 154.21	1.04 / 9.12	200. / 0.76	300. / -0.001 *XS*
BX	AT 83610 / 154.75	190 / 2.02	4140. / 2.21	382. / 0.34	32217. / 156.75	1.11 / 10.84	180. / 1.06	300. / 0.002 *XS*
BY	AT 83780 / 157.02	170 / 2.56	4140. / 2.55	320. / 0.21	25351. / 159.58	1.18 / 11.41	180. / 0.96	250. / -0.000 *XS*
BZ	AT 84210 / 161.43	430 / 1.10	4140. / 3.35	961. / 0.0	62321. / 162.93	1.03 / 8.27	165. / 0.59	245. / -0.001 *XS*
CA	AT 84560 / 163.17	330 / 0.17	4140. / 0.42	1246. / 0.0	217639. / 163.34	1.01 / 3.52	125. / 0.13	245. / -0.000 *XS*
CB	AT 84920 / 163.36	410 / 0.05	4140. / 0.08	2226. / 0.0	430379. / 163.42	1.01 / 1.88	965. / 0.09	1145. / -0.000 *XS*
YU	AT 85760 / 163.44	810 / 0.01	4140. / 0.04	4555. / 0.0	864114. / 163.45	1.00 / 0.91	176. / 0.03	366. / -0.000 *XS*

END OF THIS PROFILE

APPENDIX E

Existing HEC-RAS Analysis

Cross-Section Location Map



HEC-RAS Plan: Existing River: Cobbosseecontee Reach: Main Reach

Reach	River Sta	Profile	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)	
Main Reach	1545.522	1.1-year	969.00	111.77	137.16	115.13	137.16	0.000002	0.36	3518.83	455.98	0.02
Main Reach	1545.522	25-year	3635.00	111.77	138.95	117.93	138.97	0.000018	1.16	4159.49	509.17	0.05
Main Reach	1545.522	50-year	4028.00	111.77	139.11	118.25	139.13	0.000021	1.27	4218.10	513.18	0.05
Main Reach	1545.522	100-year	4407.00	111.77	139.37	118.55	139.39	0.000024	1.36	4315.97	519.83	0.06
Main Reach	1545.522	500-year	5257.00	111.77	140.03	119.18	140.05	0.000030	1.55	4566.30	536.59	0.06
Main Reach	1523.916	1.1-year	969.00	111.92	137.16	115.15	137.16	0.000003	0.39	3243.89	452.66	0.02
Main Reach	1523.916	25-year	3635.00	111.92	138.95	118.25	138.97	0.000023	1.25	3873.81	505.32	0.06
Main Reach	1523.916	50-year	4028.00	111.92	139.11	118.59	139.13	0.000028	1.37	3931.31	509.24	0.06
Main Reach	1523.916	100-year	4407.00	111.92	139.37	118.91	139.39	0.000031	1.47	4027.47	515.74	0.06
Main Reach	1523.916	500-year	5257.00	111.92	140.02	119.56	140.05	0.000038	1.66	4273.45	532.19	0.07
Main Reach	1491.506	1.1-year	969.00	113.09	137.16	116.86	137.16	0.000002	0.43	2871.59	465.67	0.02
Main Reach	1491.506	25-year	3635.00	113.09	138.94	120.22	138.97	0.000022	1.37	3464.06	570.65	0.06
Main Reach	1491.506	50-year	4028.00	113.09	139.10	120.59	139.13	0.000026	1.50	3515.69	575.51	0.06
Main Reach	1491.506	100-year	4407.00	113.09	139.35	120.93	139.39	0.000029	1.60	3601.84	585.30	0.06
Main Reach	1491.506	500-year	5257.00	113.09	140.01	121.65	140.05	0.000036	1.82	3818.74	618.65	0.07
Main Reach	1459.347	1.1-year	969.00	113.76	137.16	117.51	137.16	0.000003	0.45	2699.45	482.21	0.02
Main Reach	1459.347	25-year	3635.00	113.76	138.94	121.00	138.97	0.000027	1.45	3242.84	541.41	0.06
Main Reach	1459.347	50-year	4028.00	113.76	139.09	121.38	139.13	0.000032	1.59	3290.06	545.06	0.07
Main Reach	1459.347	100-year	4407.00	113.76	139.35	121.73	139.39	0.000036	1.70	3369.04	551.18	0.07
Main Reach	1459.347	500-year	5257.00	113.76	140.00	122.48	140.05	0.000044	1.93	3567.96	565.05	0.08
Main Reach	1431.576	1.1-year	969.00	114.22	137.16	118.25	137.16	0.000004	0.49	2572.33	474.13	0.02
Main Reach	1431.576	25-year	3635.00	114.22	138.93	121.87	138.96	0.000032	1.55	3072.13	514.93	0.07
Main Reach	1431.576	50-year	4028.00	114.22	139.09	122.25	139.12	0.000038	1.69	3115.44	518.37	0.07
Main Reach	1431.576	100-year	4407.00	114.22	139.34	122.60	139.39	0.000042	1.81	3188.04	524.33	0.08
Main Reach	1431.576	500-year	5257.00	114.22	139.99	123.33	140.05	0.000052	2.05	3370.99	539.75	0.08
Main Reach	1402.811	1.1-year	969.00	115.27	137.16	119.03	137.16	0.000004	0.52	2413.05	455.64	0.02
Main Reach	1402.811	25-year	3635.00	115.27	138.93	122.75	138.96	0.000037	1.66	2858.46	490.81	0.07
Main Reach	1402.811	50-year	4028.00	115.27	139.08	123.15	139.12	0.000044	1.81	2896.90	493.67	0.08
Main Reach	1402.811	100-year	4407.00	115.27	139.34	123.52	139.38	0.000049	1.94	2961.54	498.49	0.08
Main Reach	1402.811	500-year	5257.00	115.27	139.98	124.31	140.04	0.000060	2.20	3124.48	510.65	0.09
Main Reach	1368.029	1.1-year	969.00	116.46	137.16	120.31	137.16	0.000005	0.55	2167.90	433.86	0.03
Main Reach	1368.029	25-year	3635.00	116.46	138.92	123.70	138.96	0.000044	1.76	2549.79	472.85	0.08

HEC-RAS Plan: Existing River: Cobbosseecontee Reach: Main Reach (Continued)

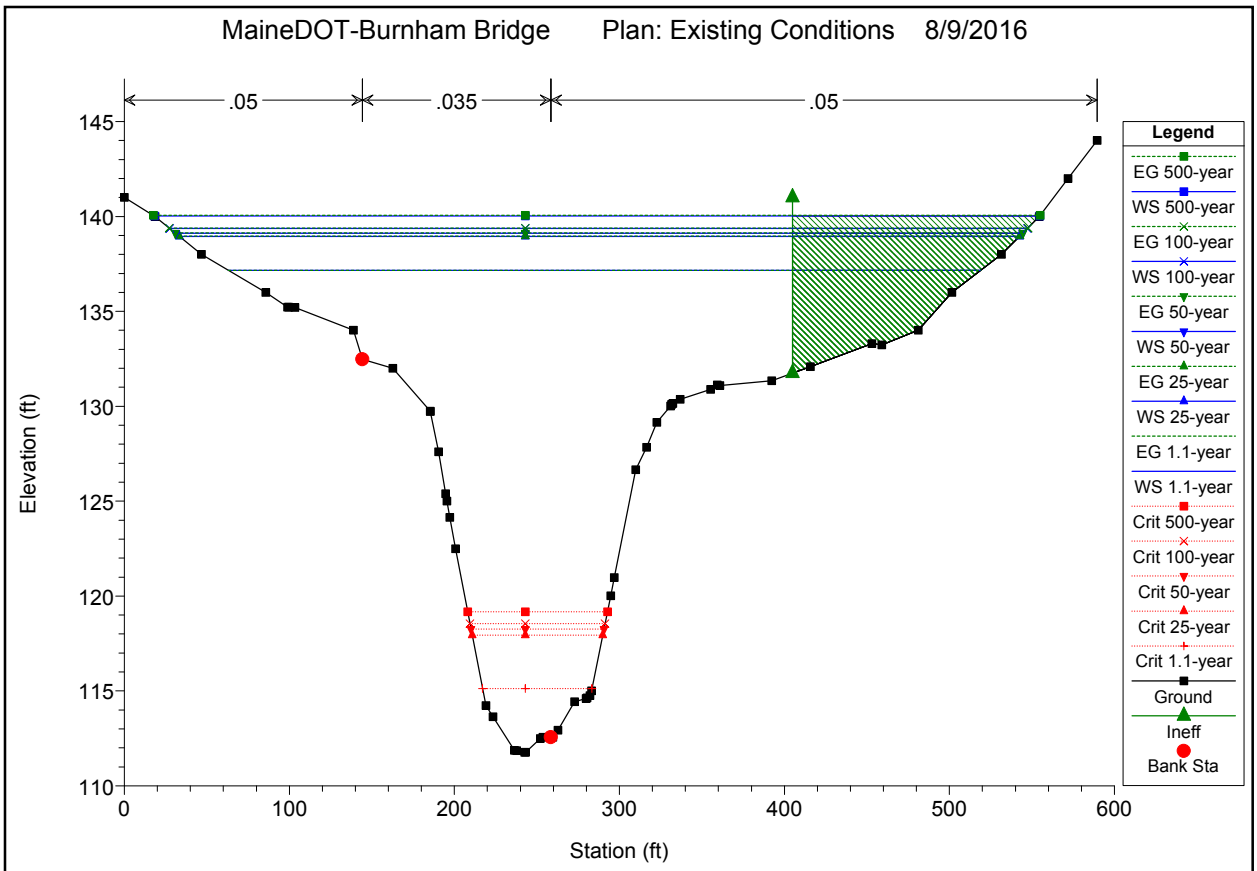
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Reach	1368.029	50-year	4028.00	116.46	139.07	124.07	139.12	0.000052	1.93	2582.52	475.61	0.08
Main Reach	1368.029	100-year	4407.00	116.46	139.33	124.41	139.38	0.000058	2.07	2637.84	480.27	0.09
Main Reach	1368.029	500-year	5257.00	116.46	139.97	125.08	140.04	0.000071	2.35	2777.38	492.02	0.10
Main Reach	1341.377	1.1-year	969.00	118.79	137.16	122.52	137.16	0.000006	0.59	1916.44	401.50	0.03
Main Reach	1341.377	25-year	3635.00	118.79	138.91	125.60	138.96	0.000055	1.91	2238.43	446.27	0.09
Main Reach	1341.377	50-year	4028.00	118.79	139.06	125.94	139.12	0.000065	2.09	2265.77	451.12	0.09
Main Reach	1341.377	100-year	4407.00	118.79	139.31	126.23	139.38	0.000073	2.25	2312.29	458.46	0.10
Main Reach	1341.377	500-year	5257.00	118.79	139.95	126.87	140.04	0.000089	2.55	2429.75	470.40	0.11
Main Reach	1317.345	1.1-year	969.00	121.59	137.16	124.54	137.16	0.000008	0.64	1664.46	388.23	0.03
Main Reach	1317.345	25-year	3635.00	121.59	138.89	127.26	138.96	0.000071	2.08	1933.64	424.99	0.10
Main Reach	1317.345	50-year	4028.00	121.59	139.04	127.55	139.11	0.000084	2.28	1956.21	428.78	0.11
Main Reach	1317.345	100-year	4407.00	121.59	139.29	127.85	139.38	0.000095	2.45	1994.98	435.32	0.11
Main Reach	1317.345	500-year	5257.00	121.59	139.92	128.45	140.03	0.000116	2.78	2092.95	451.71	0.13
Main Reach	1291.282	1.1-year	969.00	122.13	137.15	125.26	137.16	0.000012	0.78	1328.03	382.21	0.04
Main Reach	1291.282	25-year	3635.00	122.13	138.86	128.04	138.95	0.000109	2.53	1533.98	415.76	0.12
Main Reach	1291.282	50-year	4028.00	122.13	138.99	128.34	139.11	0.000130	2.78	1550.66	418.93	0.13
Main Reach	1291.282	100-year	4407.00	122.13	139.24	128.62	139.37	0.000146	2.98	1580.06	424.39	0.14
Main Reach	1291.282	500-year	5257.00	122.13	139.85	129.22	140.02	0.000179	3.40	1654.59	437.14	0.15
Main Reach	1260		Bridge									
Main Reach	1225.552	1.1-year	969.00	119.07	135.00	122.96	135.01	0.000014	0.79	1235.79	305.17	0.04
Main Reach	1225.552	25-year	3635.00	119.07	138.69	125.83	138.76	0.000077	2.25	1637.56	437.67	0.10
Main Reach	1225.552	50-year	4028.00	119.07	138.78	126.14	138.88	0.000092	2.48	1648.10	440.39	0.11
Main Reach	1225.552	100-year	4407.00	119.07	138.98	126.44	139.09	0.000106	2.68	1669.51	445.91	0.12
Main Reach	1225.552	500-year	5257.00	119.07	139.47	127.06	139.62	0.000136	3.09	1722.99	459.07	0.14
Main Reach	1206.211	1.1-year	969.00	117.17	135.00	120.61	135.01	0.000006	0.59	1637.85	328.10	0.03
Main Reach	1206.211	25-year	3635.00	117.17	138.70	123.87	138.75	0.000039	1.74	2089.06	396.85	0.07
Main Reach	1206.211	50-year	4028.00	117.17	138.80	124.14	138.86	0.000047	1.92	2101.23	398.14	0.08
Main Reach	1206.211	100-year	4407.00	117.17	139.00	124.39	139.07	0.000055	2.07	2125.53	400.72	0.09
Main Reach	1206.211	500-year	5257.00	117.17	139.50	124.92	139.59	0.000071	2.40	2186.19	421.31	0.10
Main Reach	1180.934	1.1-year	969.00	115.56	135.00	118.59	135.01	0.000004	0.48	2006.65	339.05	0.02
Main Reach	1180.934	25-year	3635.00	115.56	138.71	121.10	138.74	0.000025	1.45	2510.75	399.57	0.06

HEC-RAS Plan: Existing River: Cobbosseecontee Reach: Main Reach (Continued)

Reach	River Sta	Profile	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)	
Main Reach	1180.934	50-year	4028.00	115.56	138.81	121.38	138.85	0.000030	1.60	2524.59	401.01	0.07
Main Reach	1180.934	100-year	4407.00	115.56	139.01	121.64	139.06	0.000035	1.73	2551.94	403.85	0.07
Main Reach	1180.934	500-year	5257.00	115.56	139.51	122.18	139.58	0.000045	2.01	2620.17	410.79	0.08
Main Reach	1157.599	1.1-year	969.00	114.89	135.00	119.26	135.01	0.000004	0.48	2061.28	337.16	0.02
Main Reach	1157.599	25-year	3635.00	114.89	138.71	121.85	138.74	0.000025	1.40	2632.26	400.99	0.06
Main Reach	1157.599	50-year	4028.00	114.89	138.81	122.12	138.85	0.000030	1.55	2647.96	402.44	0.06
Main Reach	1157.599	100-year	4407.00	114.89	139.01	122.37	139.06	0.000034	1.67	2678.98	405.31	0.07
Main Reach	1157.599	500-year	5257.00	114.89	139.52	122.90	139.57	0.000044	1.94	2756.35	413.30	0.08
Main Reach	1130.630	1.1-year	969.00	118.71	135.00	121.77	135.01	0.000006	0.54	1894.60	339.95	0.03
Main Reach	1130.630	25-year	3635.00	118.71	138.71	124.02	138.74	0.000032	1.53	2524.10	404.52	0.07
Main Reach	1130.630	50-year	4028.00	118.71	138.81	124.26	138.85	0.000038	1.68	2541.24	406.19	0.07
Main Reach	1130.630	100-year	4407.00	118.71	139.01	124.49	139.06	0.000044	1.81	2575.32	409.53	0.08
Main Reach	1130.630	500-year	5257.00	118.71	139.51	124.97	139.57	0.000057	2.10	2660.37	418.22	0.09
Main Reach	1106.073	1.1-year	969.00	118.88	135.00	121.41	135.01	0.000006	0.55	1902.60	348.72	0.03
Main Reach	1106.073	25-year	3635.00	118.88	138.70	123.91	138.74	0.000032	1.53	2595.01	412.59	0.07
Main Reach	1106.073	50-year	4028.00	118.88	138.81	124.17	138.85	0.000039	1.69	2613.85	414.25	0.07
Main Reach	1106.073	100-year	4407.00	118.88	139.01	124.43	139.05	0.000044	1.82	2651.33	418.17	0.08
Main Reach	1106.073	500-year	5257.00	118.88	139.51	124.93	139.57	0.000057	2.10	2744.90	429.17	0.09
Main Reach	1083.889	1.1-year	969.00	118.84	135.00	121.75	135.01	0.000007	0.58	1852.97	357.16	0.03
Main Reach	1083.889	25-year	3635.00	118.84	138.70	124.36	138.74	0.000036	1.57	2608.06	428.13	0.07
Main Reach	1083.889	50-year	4028.00	118.84	138.80	124.65	138.85	0.000043	1.73	2628.55	430.38	0.08
Main Reach	1083.889	100-year	4407.00	118.84	139.00	124.92	139.05	0.000049	1.87	2669.40	434.52	0.08
Main Reach	1083.889	500-year	5257.00	118.84	139.50	125.48	139.57	0.000062	2.15	2771.42	444.40	0.09
Main Reach	1056.753	1.1-year	969.00	121.16	135.00	124.21	135.01	0.000011	0.66	1665.54	363.30	0.04
Main Reach	1056.753	25-year	3635.00	121.16	138.70	126.60	138.74	0.000048	1.71	2467.68	436.37	0.08
Main Reach	1056.753	50-year	4028.00	121.16	138.80	126.87	138.84	0.000058	1.88	2489.19	438.74	0.09
Main Reach	1056.753	100-year	4407.00	121.16	138.99	127.12	139.05	0.000066	2.02	2532.42	443.02	0.09
Main Reach	1056.753	500-year	5257.00	121.16	139.49	127.64	139.57	0.000082	2.31	2640.52	452.97	0.11
Main Reach	1014.494	1.1-year	969.00	120.22	135.00	122.98	135.01	0.000008	0.59	1871.66	377.44	0.03
Main Reach	1014.494	25-year	3635.00	120.22	138.70	125.78	138.73	0.000038	1.53	2763.36	457.56	0.07
Main Reach	1014.494	50-year	4028.00	120.22	138.80	126.09	138.84	0.000045	1.68	2787.46	459.62	0.08
Main Reach	1014.494	100-year	4407.00	120.22	139.00	126.38	139.05	0.000051	1.81	2835.66	463.63	0.08

HEC-RAS Plan: Existing River: Cobbosseecontee Reach: Main Reach (Continued)

Reach	River Sta	Profile	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)	
Main Reach	1014.494	500-year	5257.00	120.22	139.50	126.97	139.56	0.000064	2.07	2956.16	472.89	0.09


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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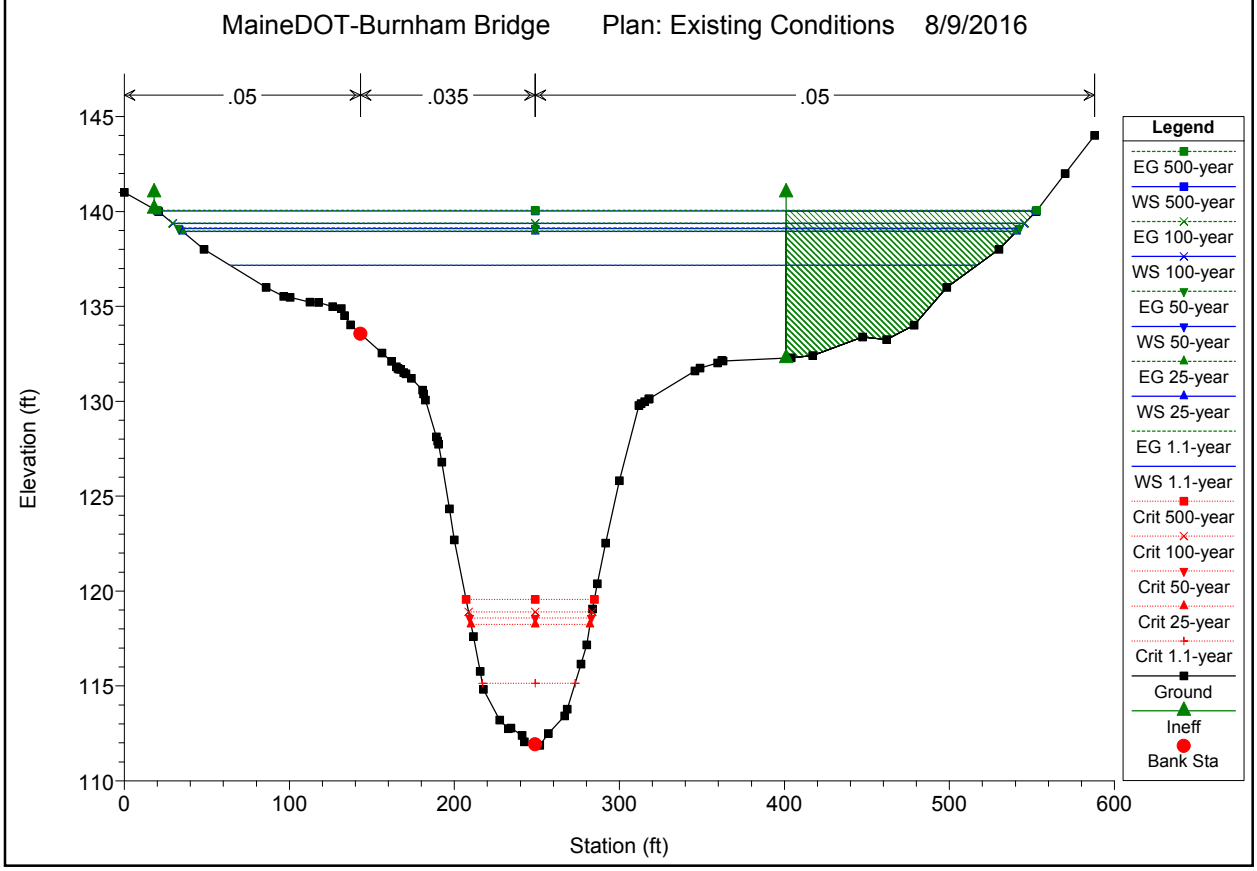
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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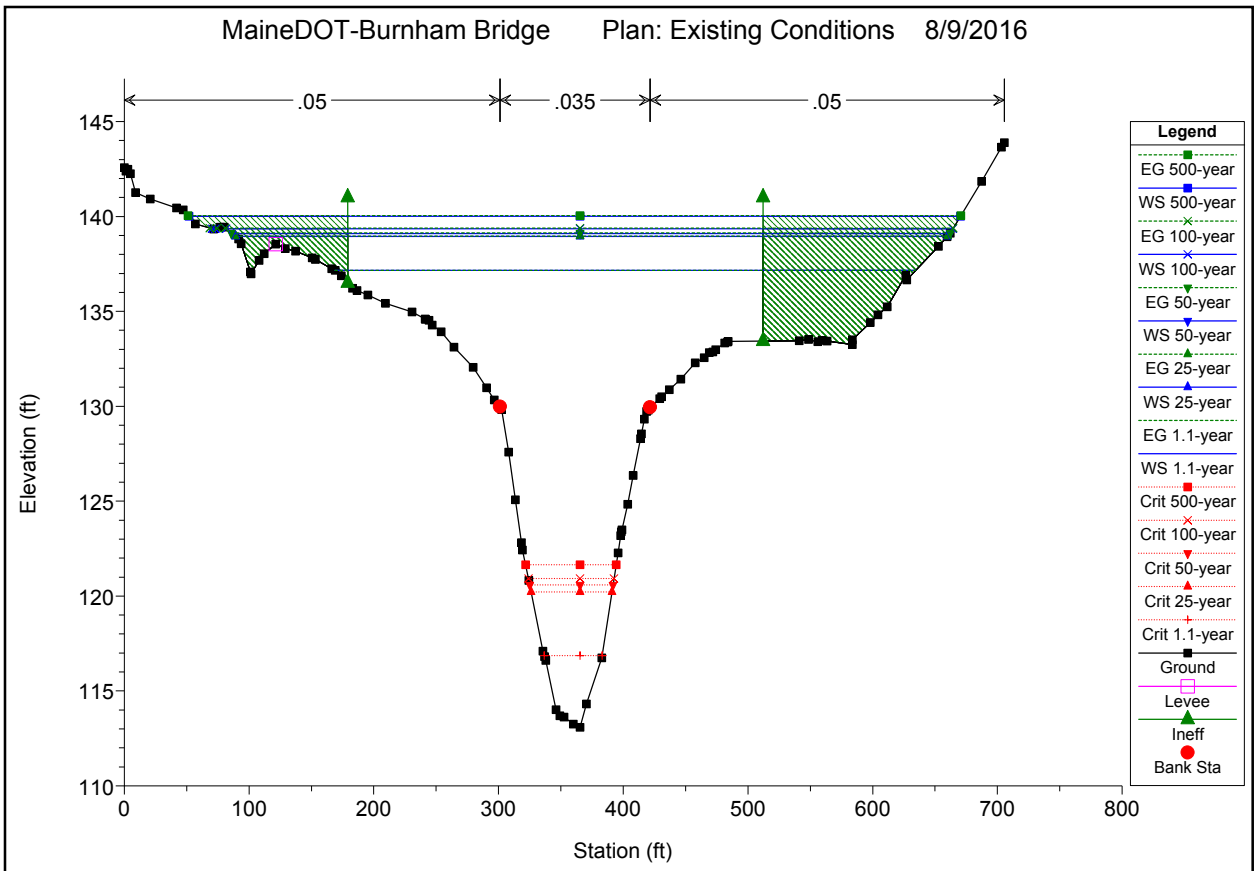
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta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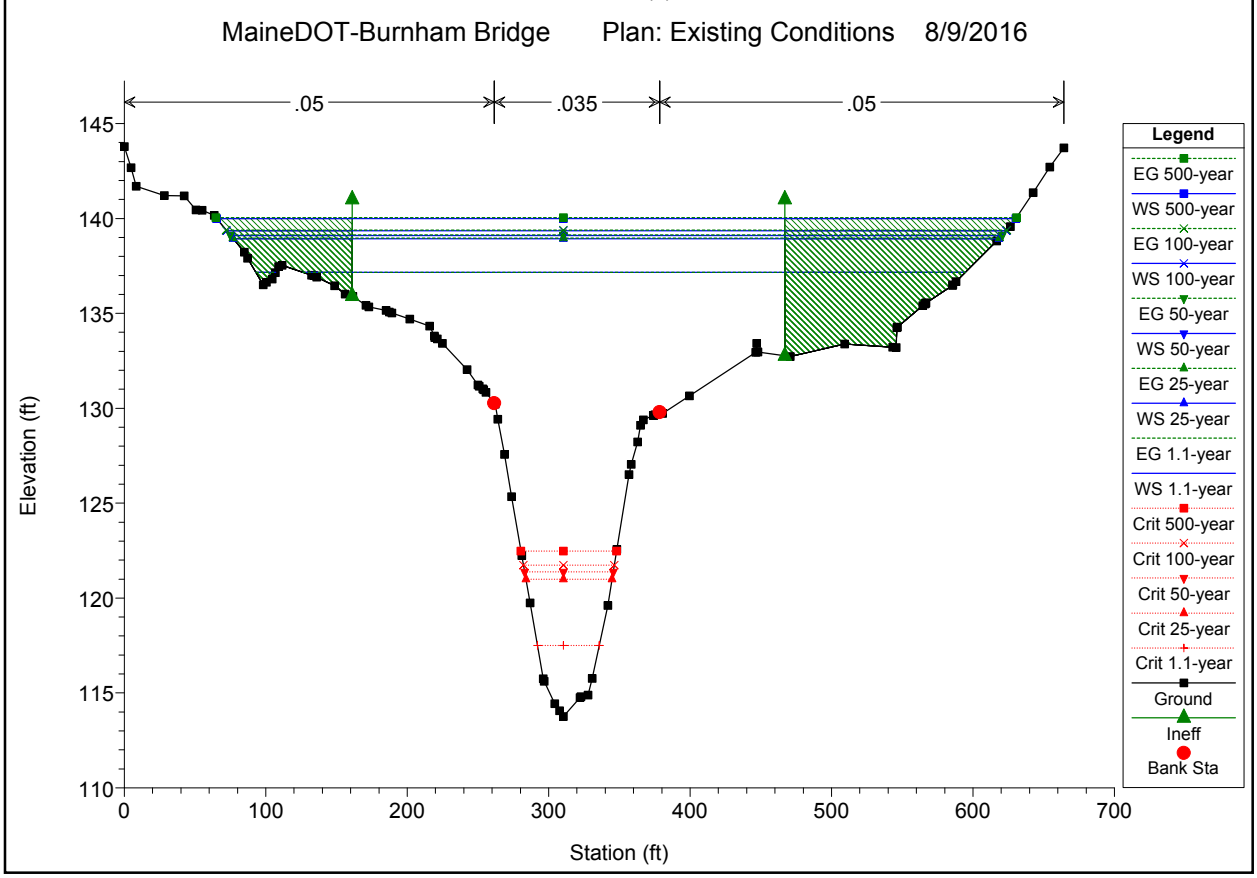
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Levee
Ineff
Bank Sta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Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
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Crit 500-year
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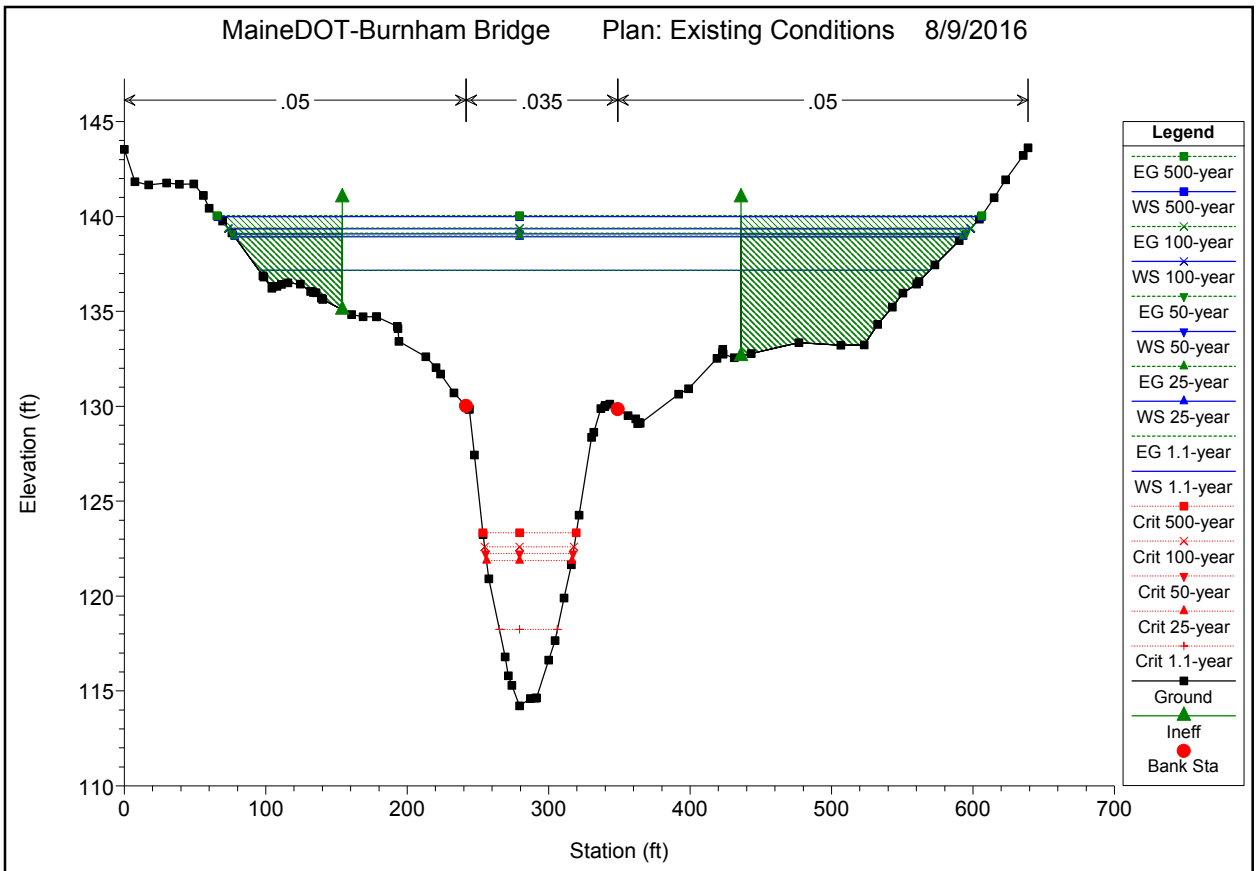
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
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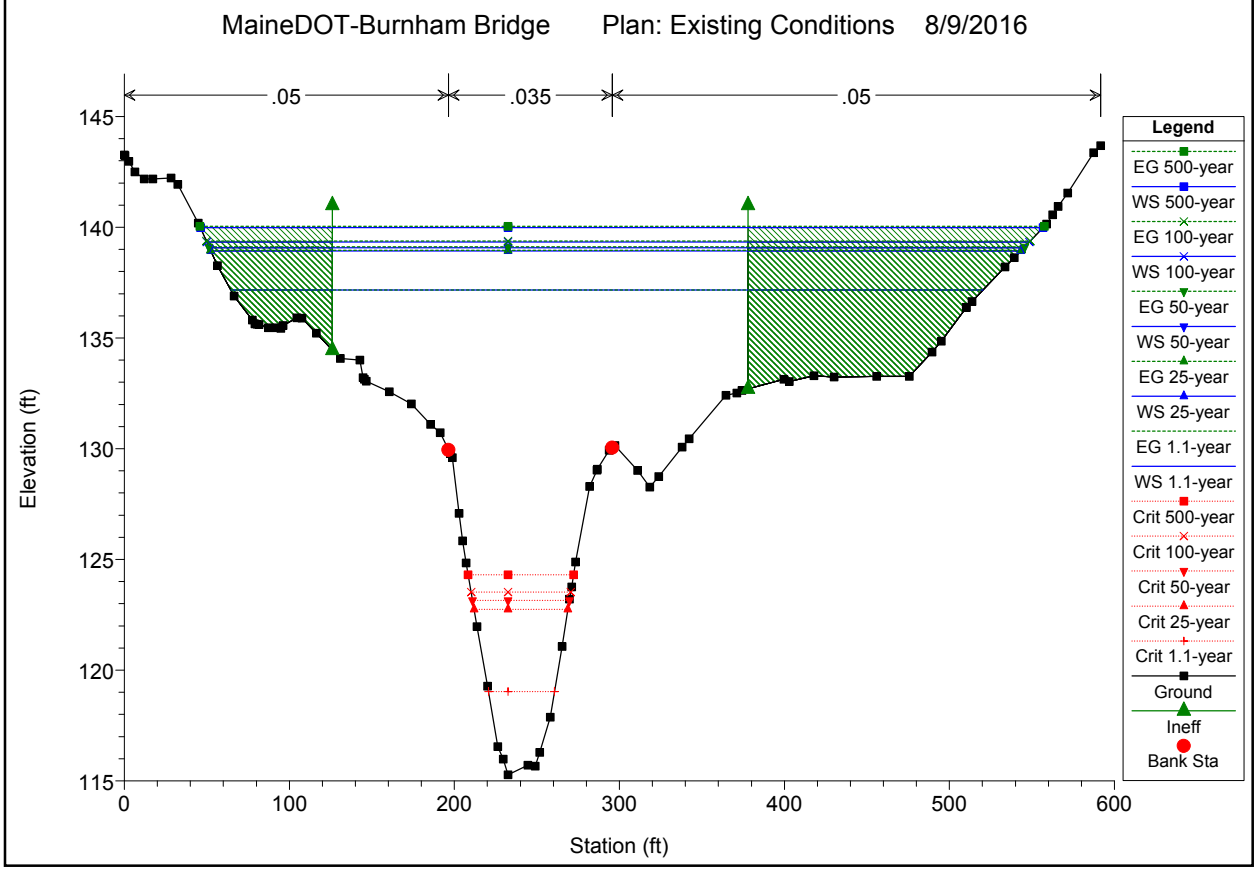
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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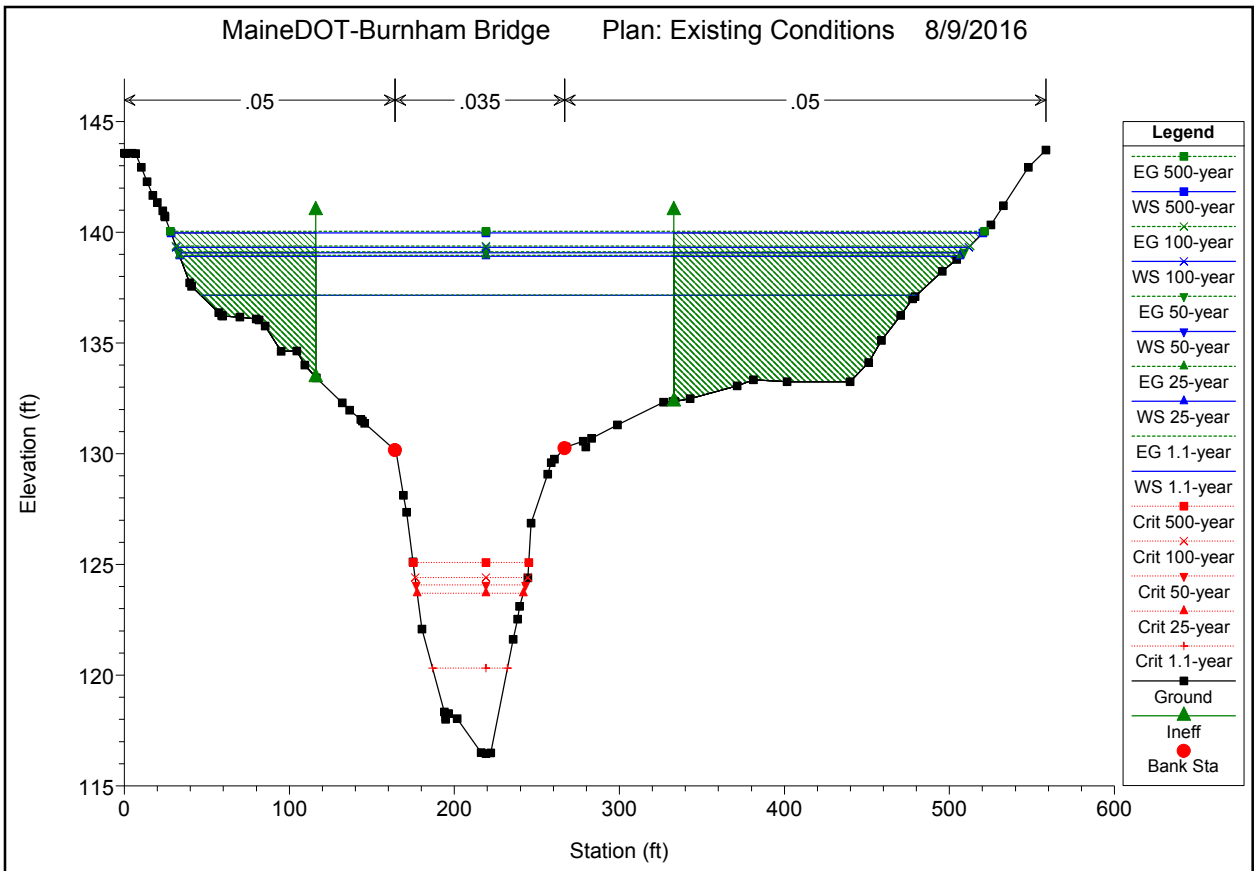
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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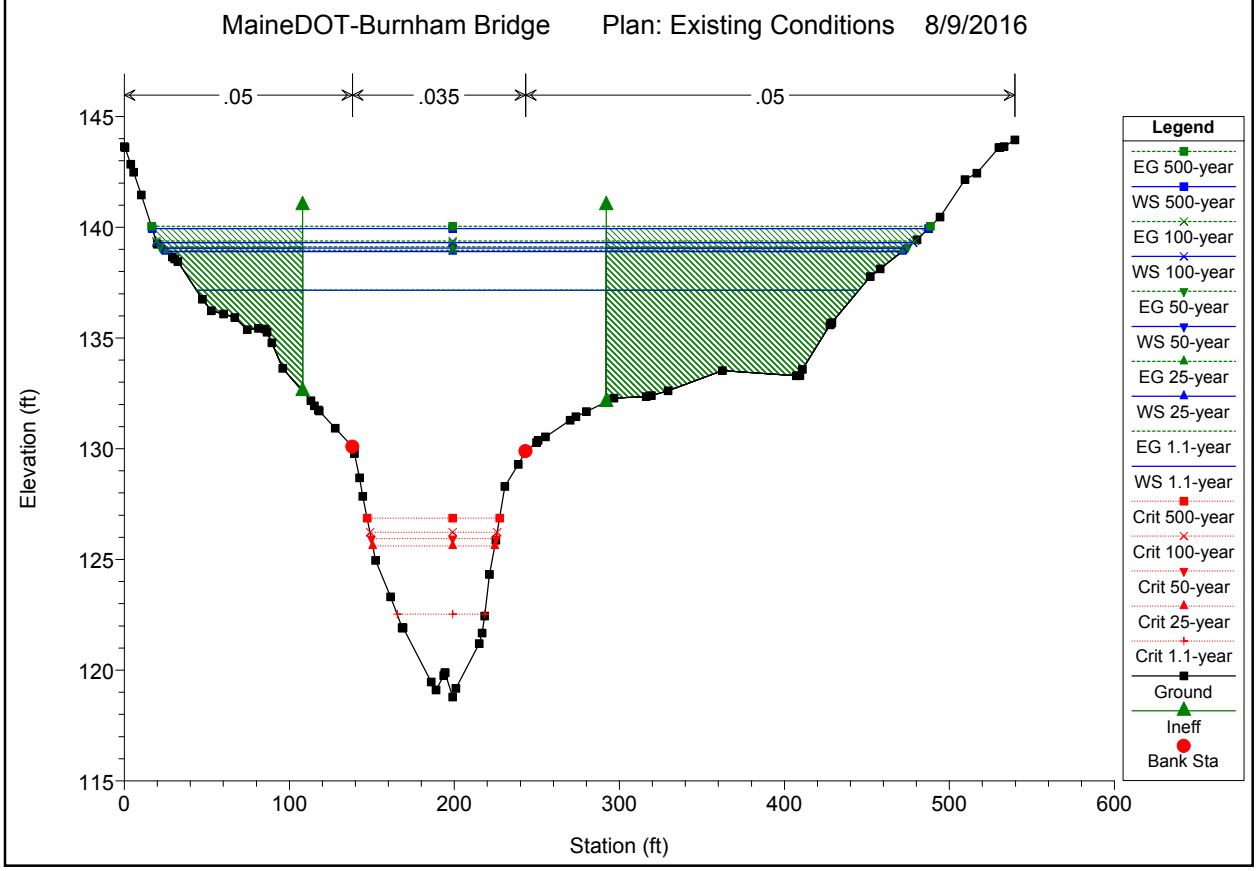
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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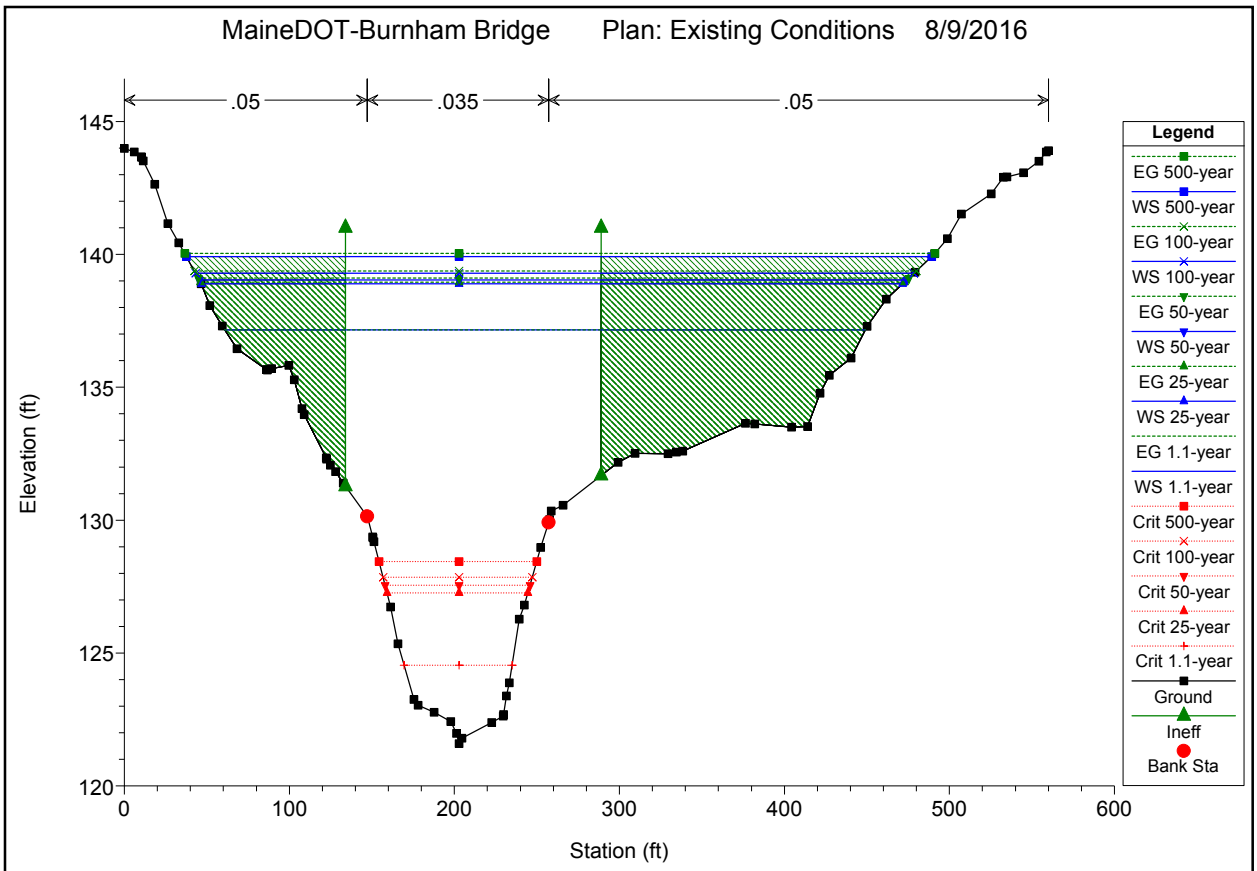
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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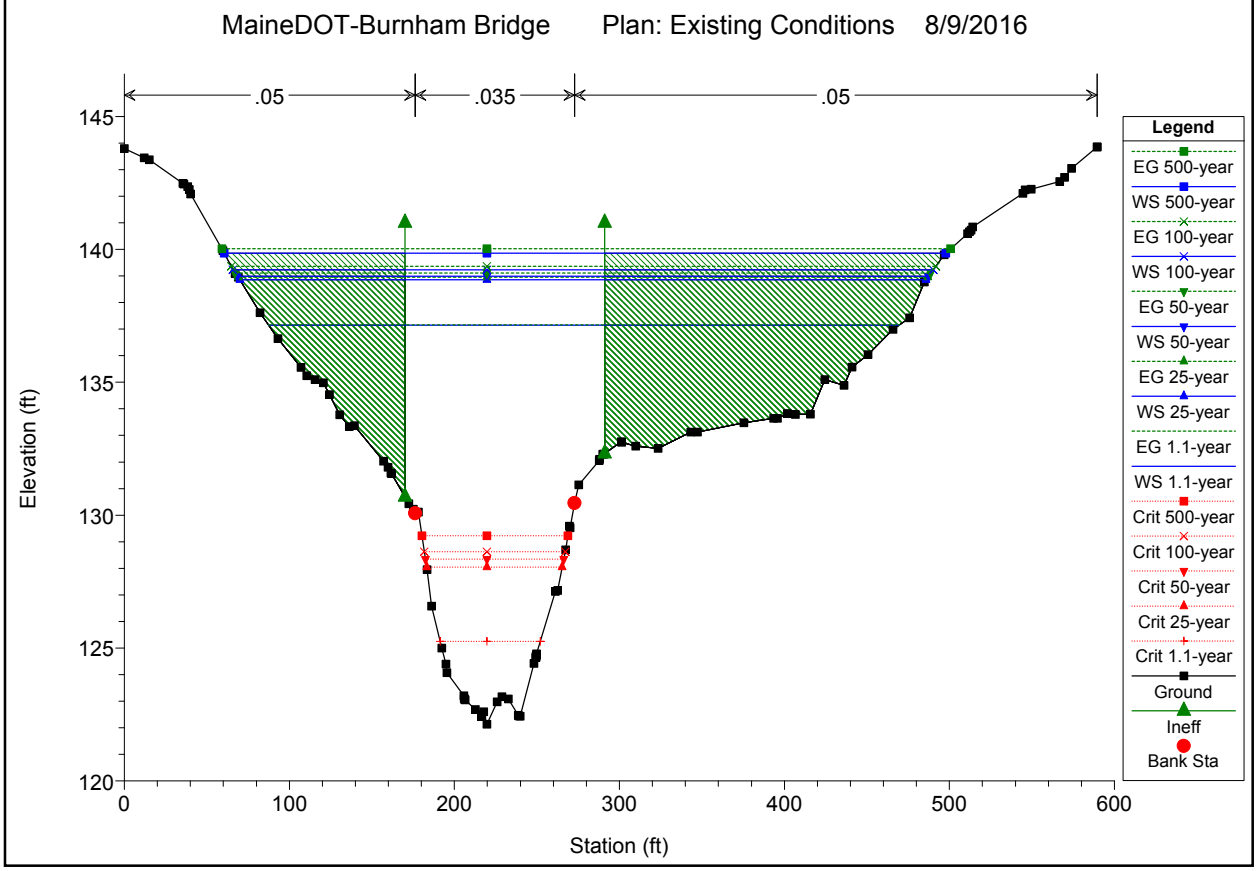
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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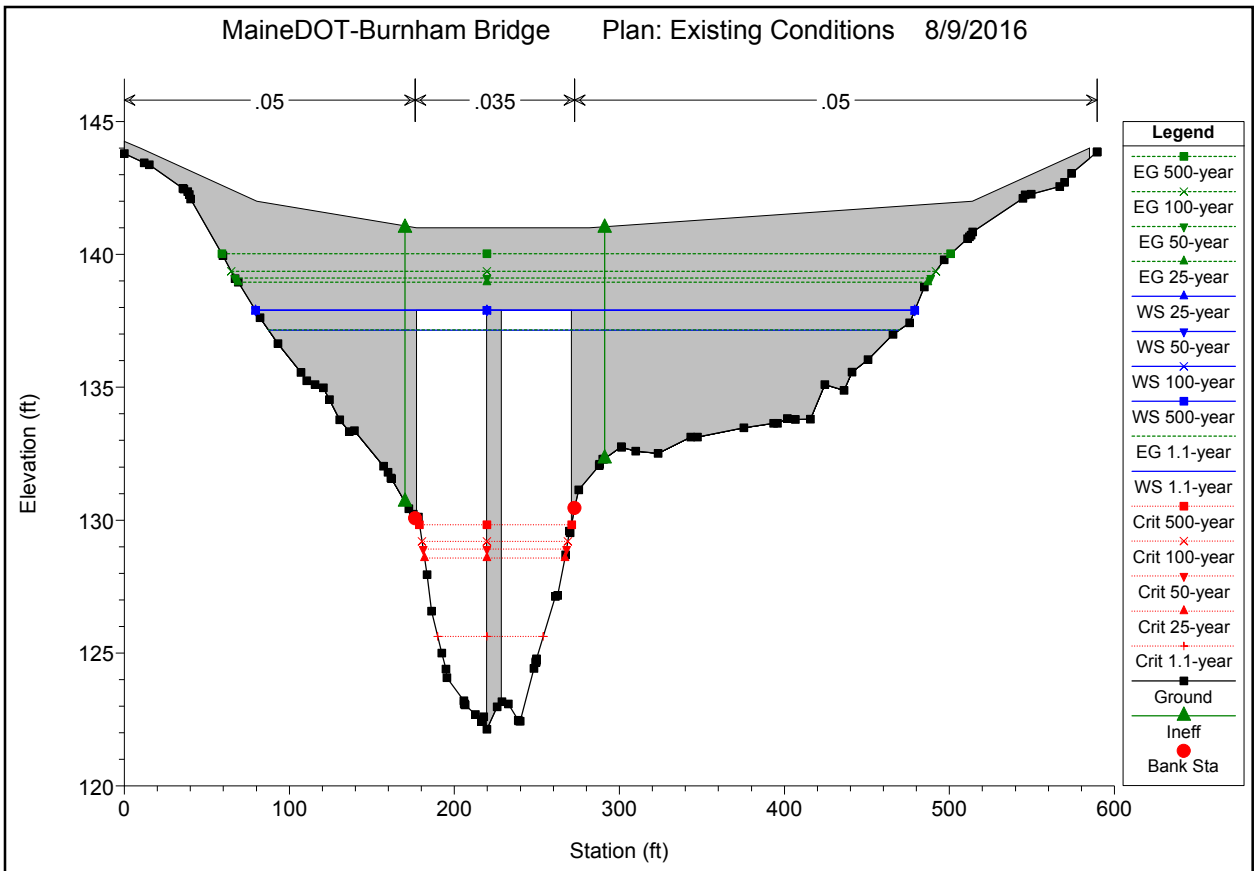
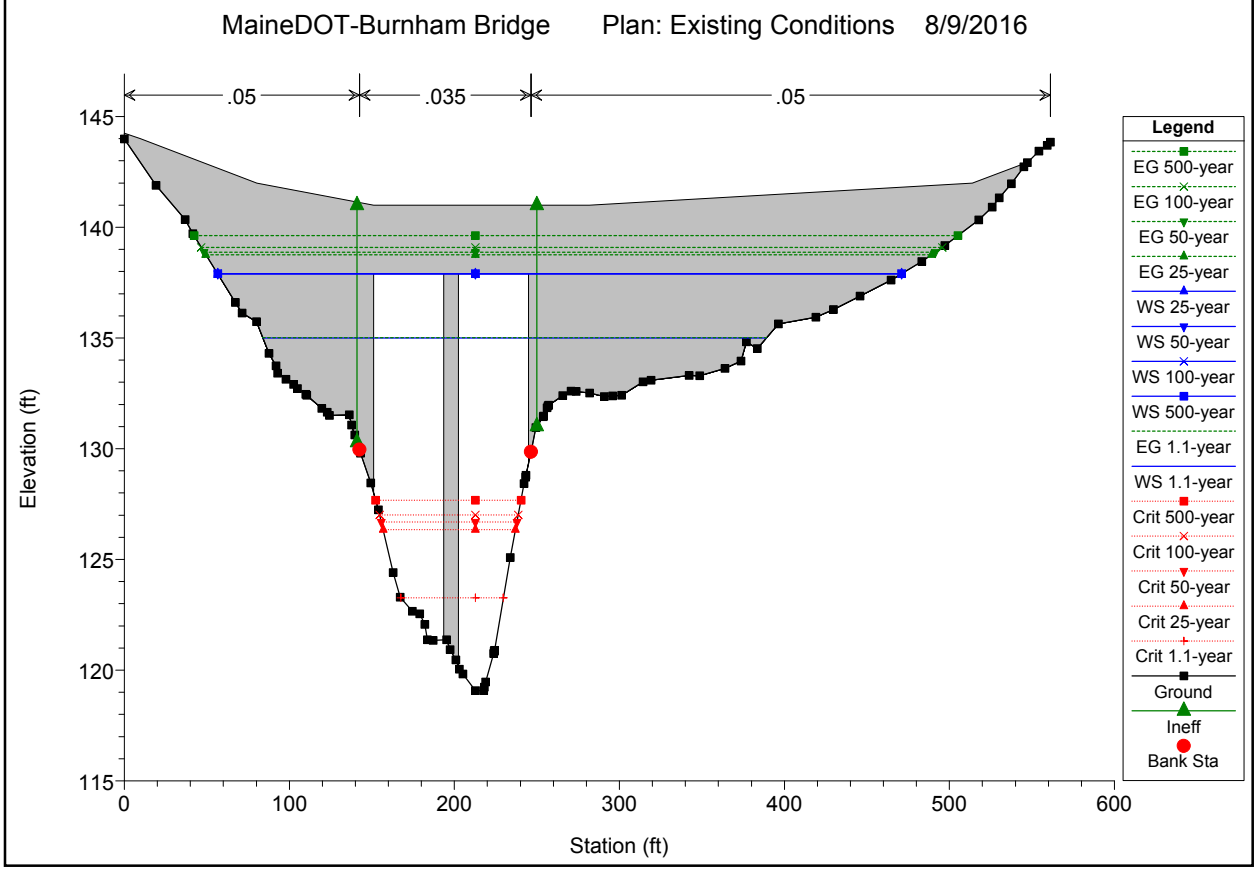
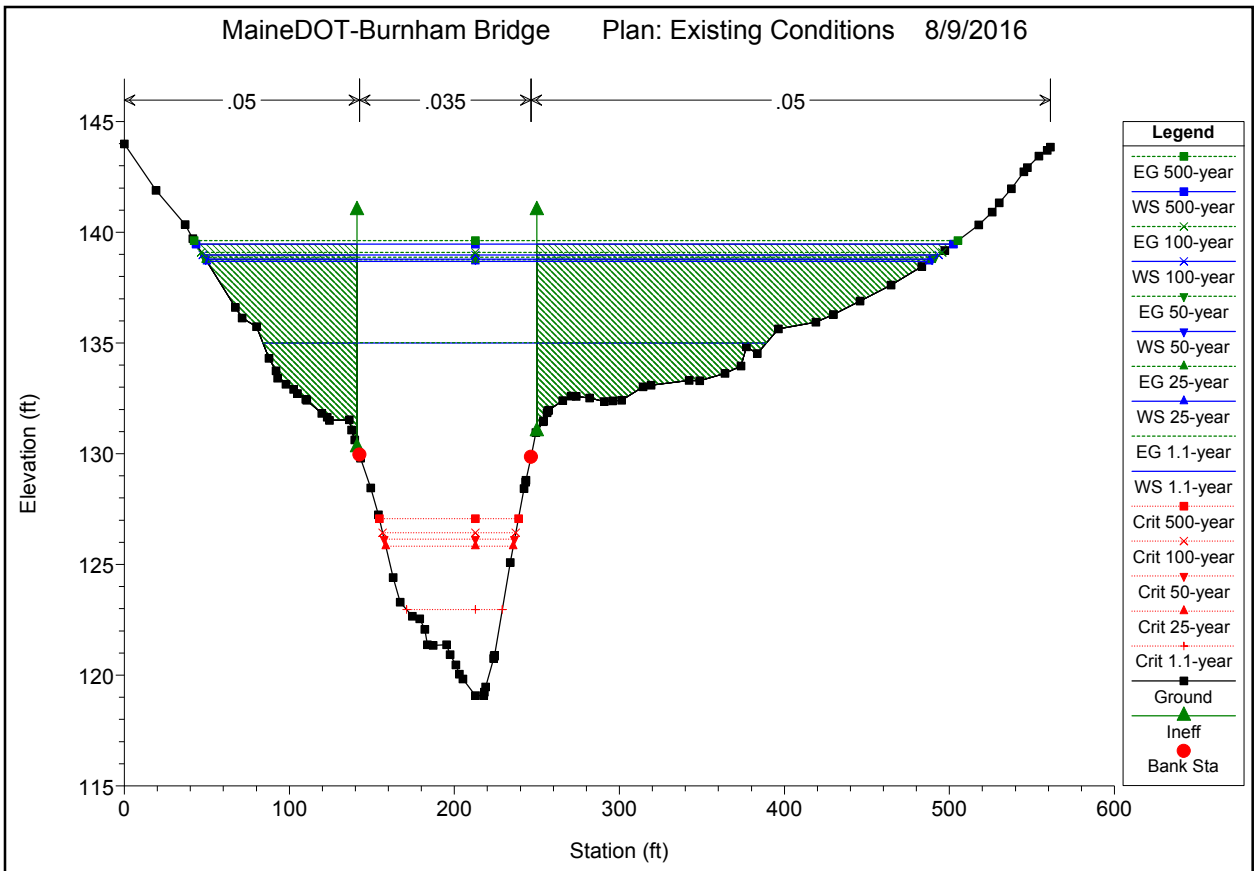
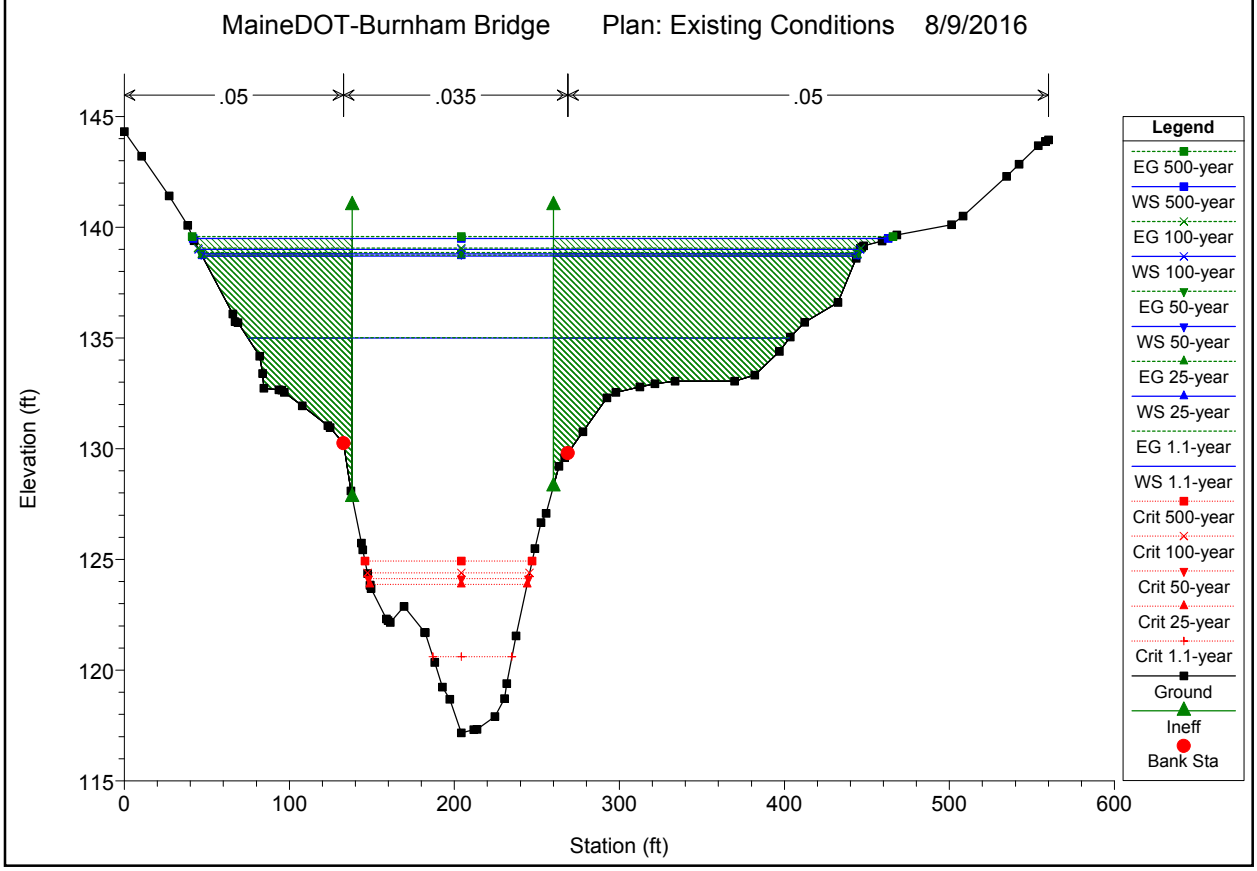
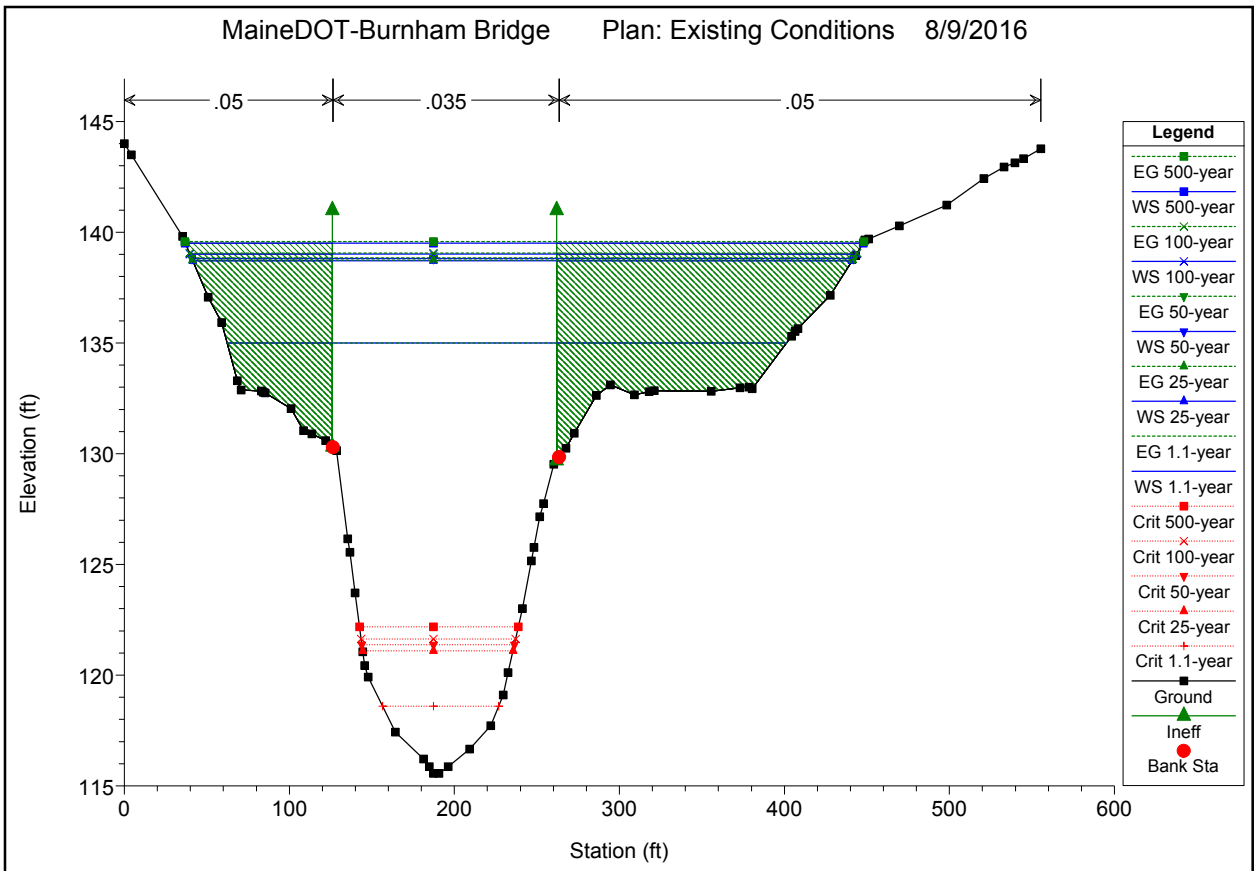
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta

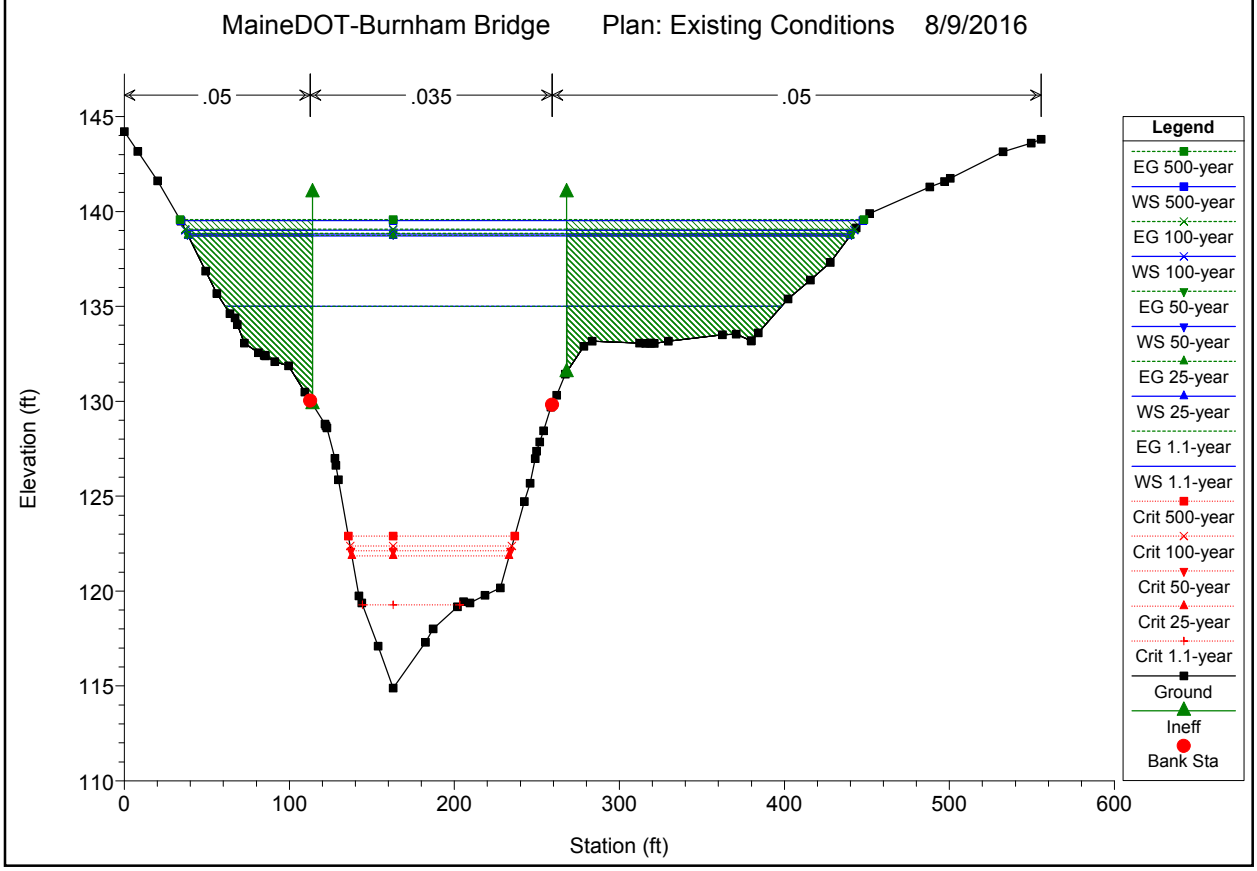

MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
EG 100-year
EG 50-year
EG 25-year
WS 25-year
WS 50-year
WS 100-year
WS 500-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
EG 100-year
EG 50-year
EG 25-year
WS 25-year
WS 50-year
WS 100-year
WS 500-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
100
200
300
400
500
600
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
100
200
300
400
500
600
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
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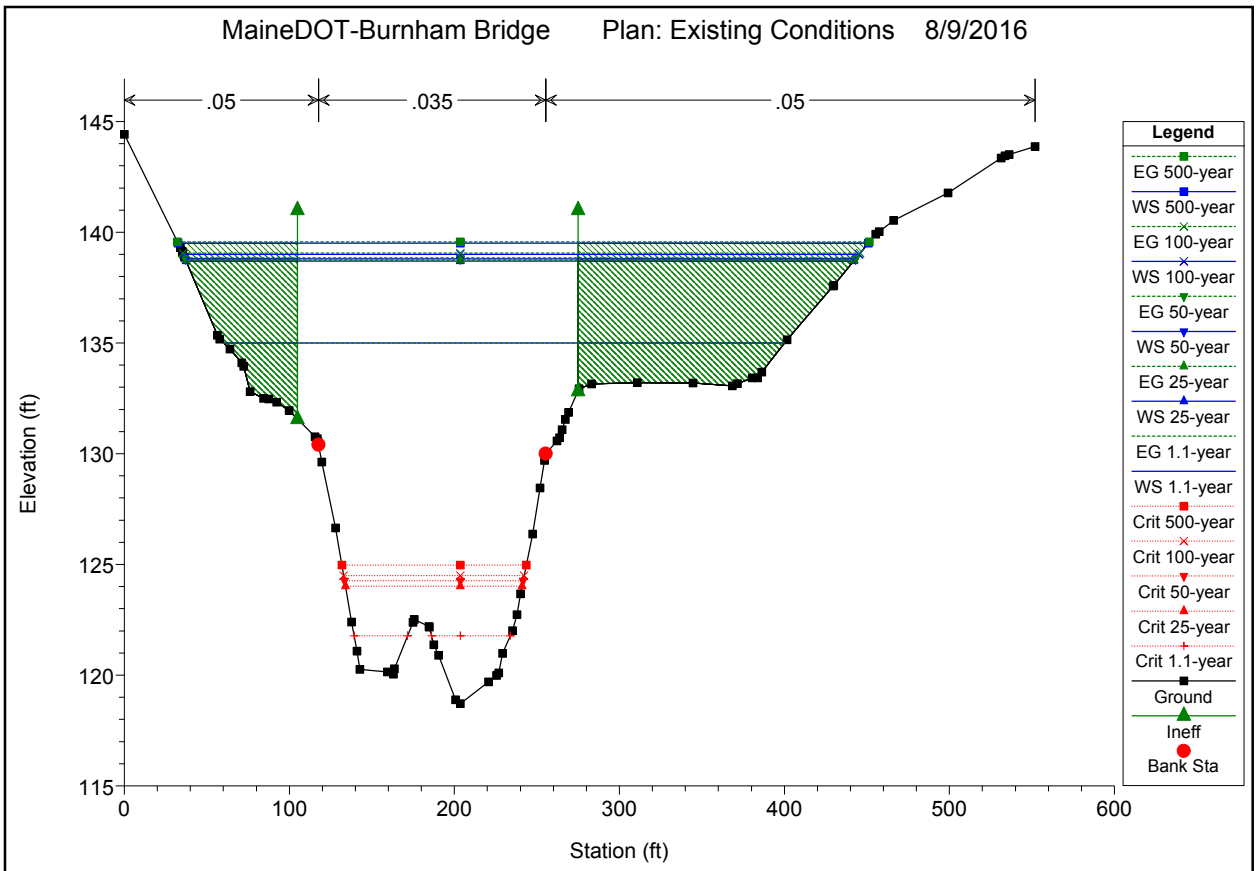
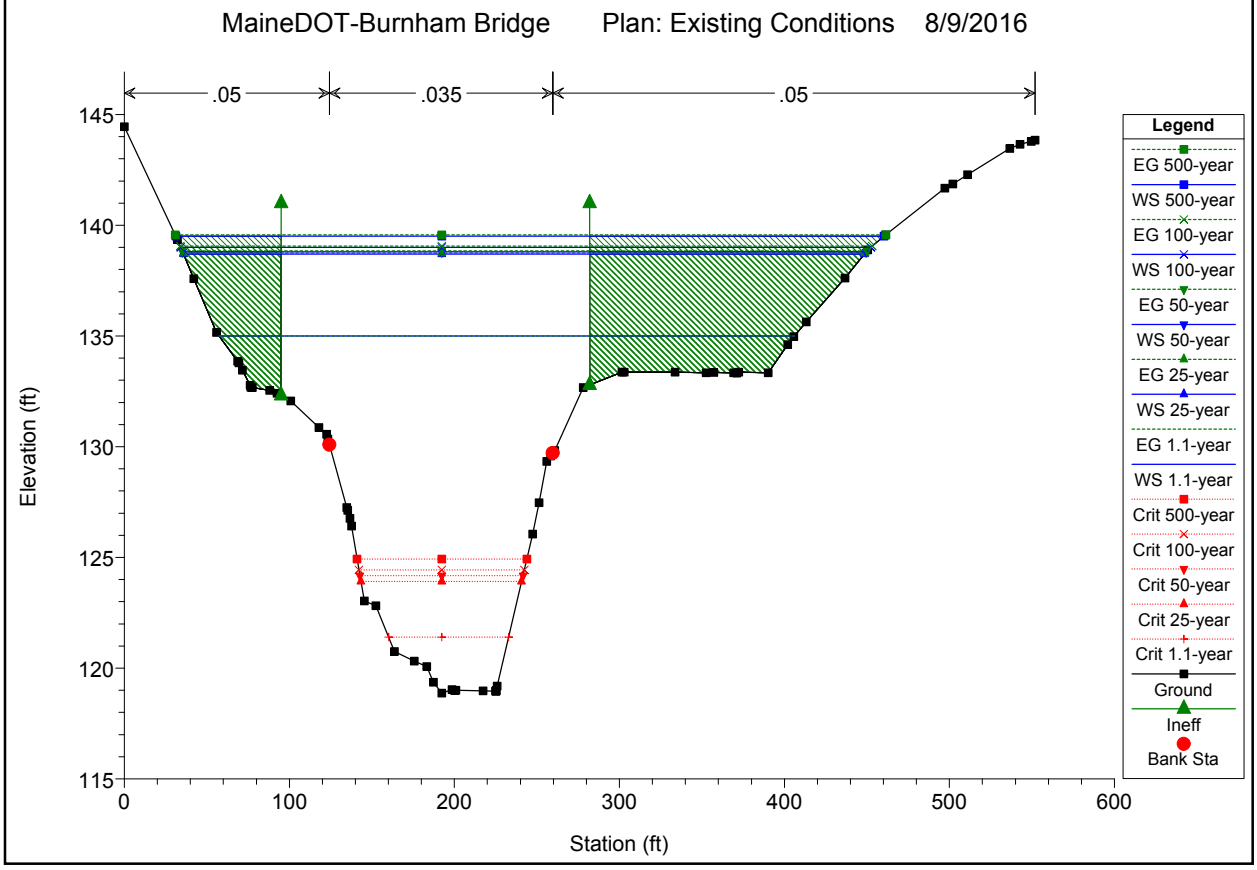
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta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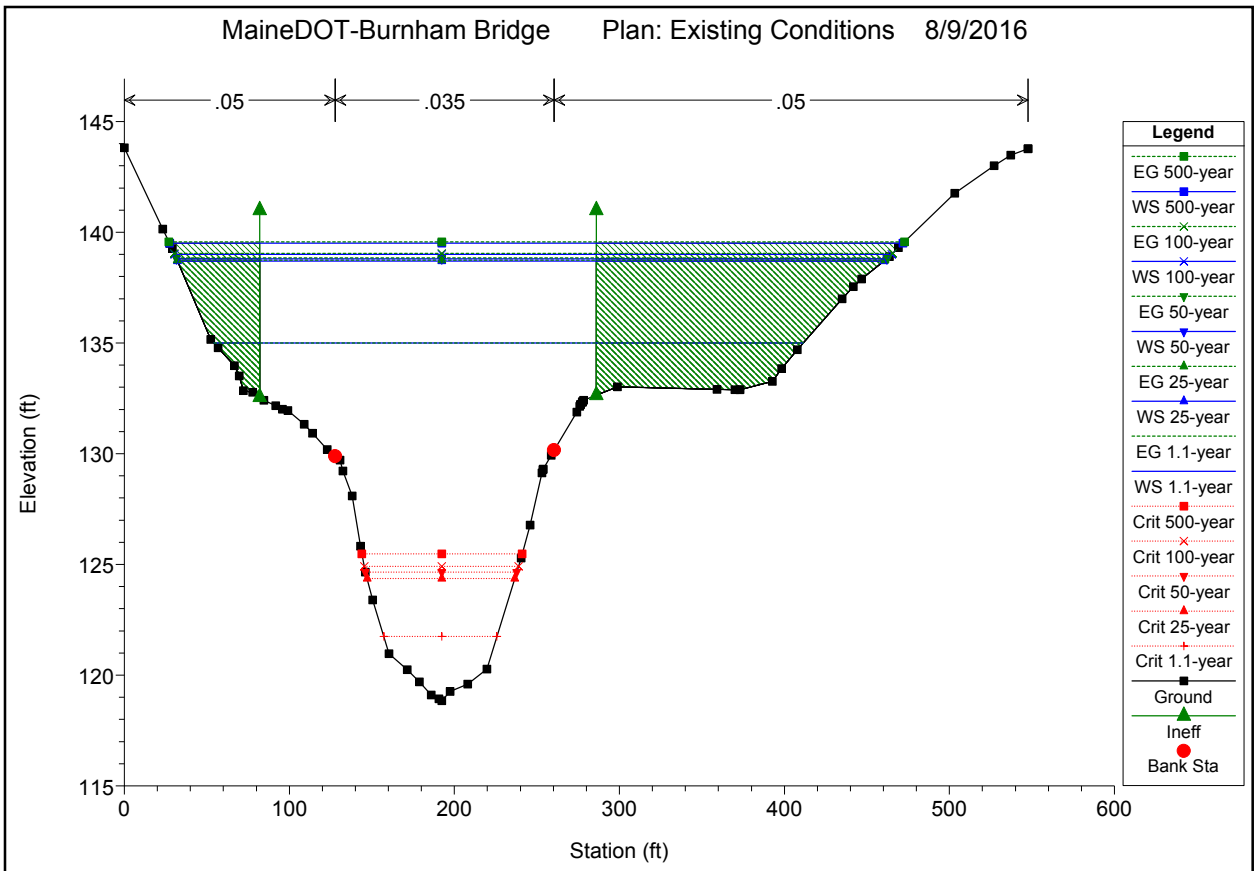
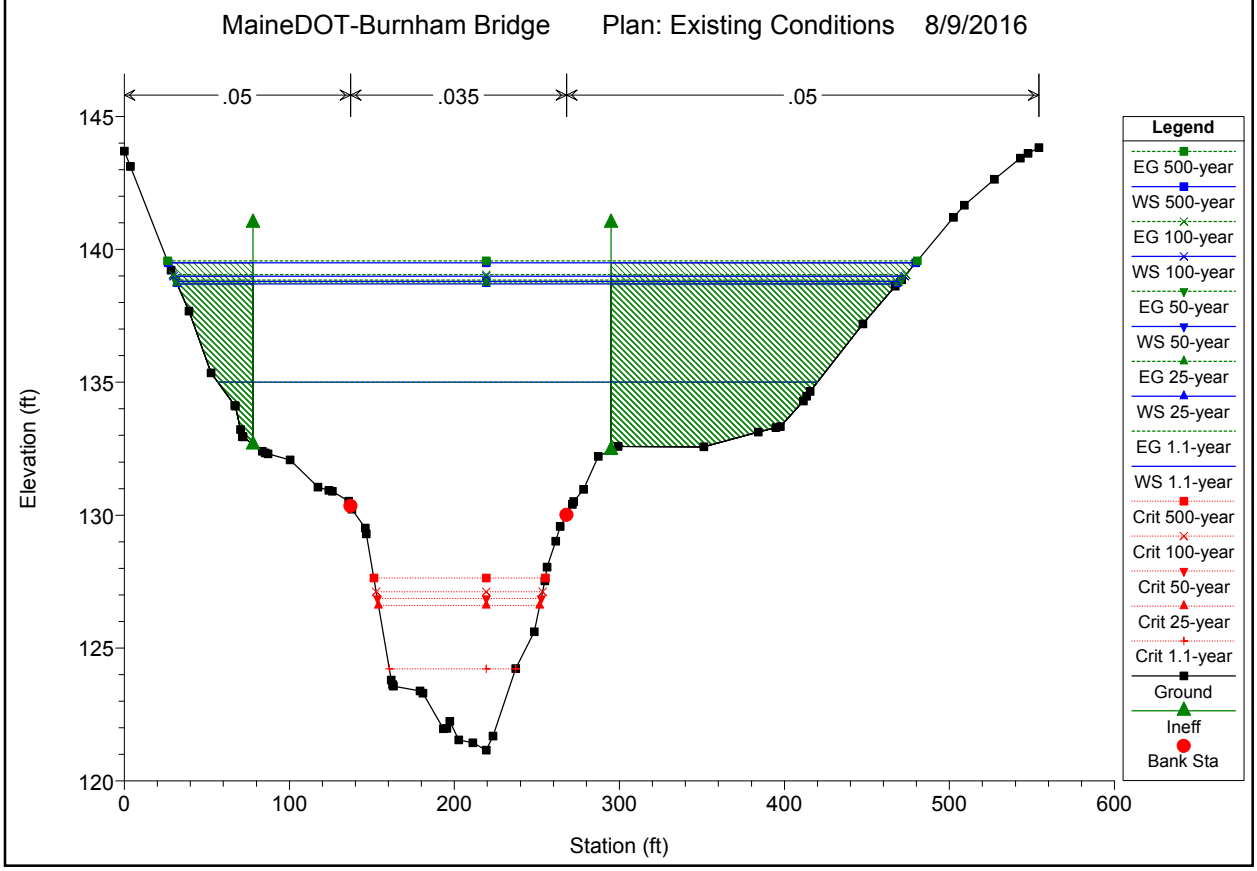
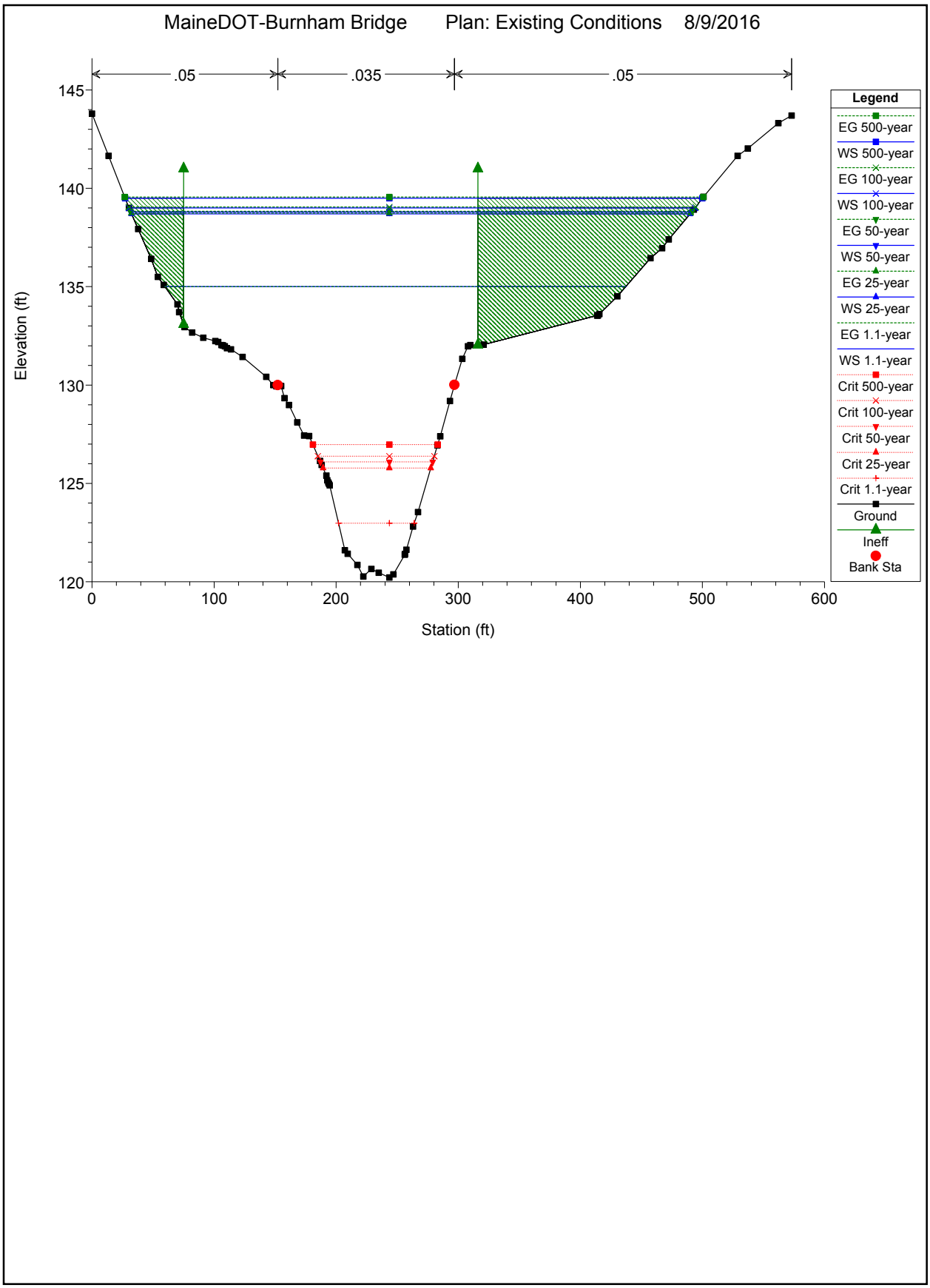
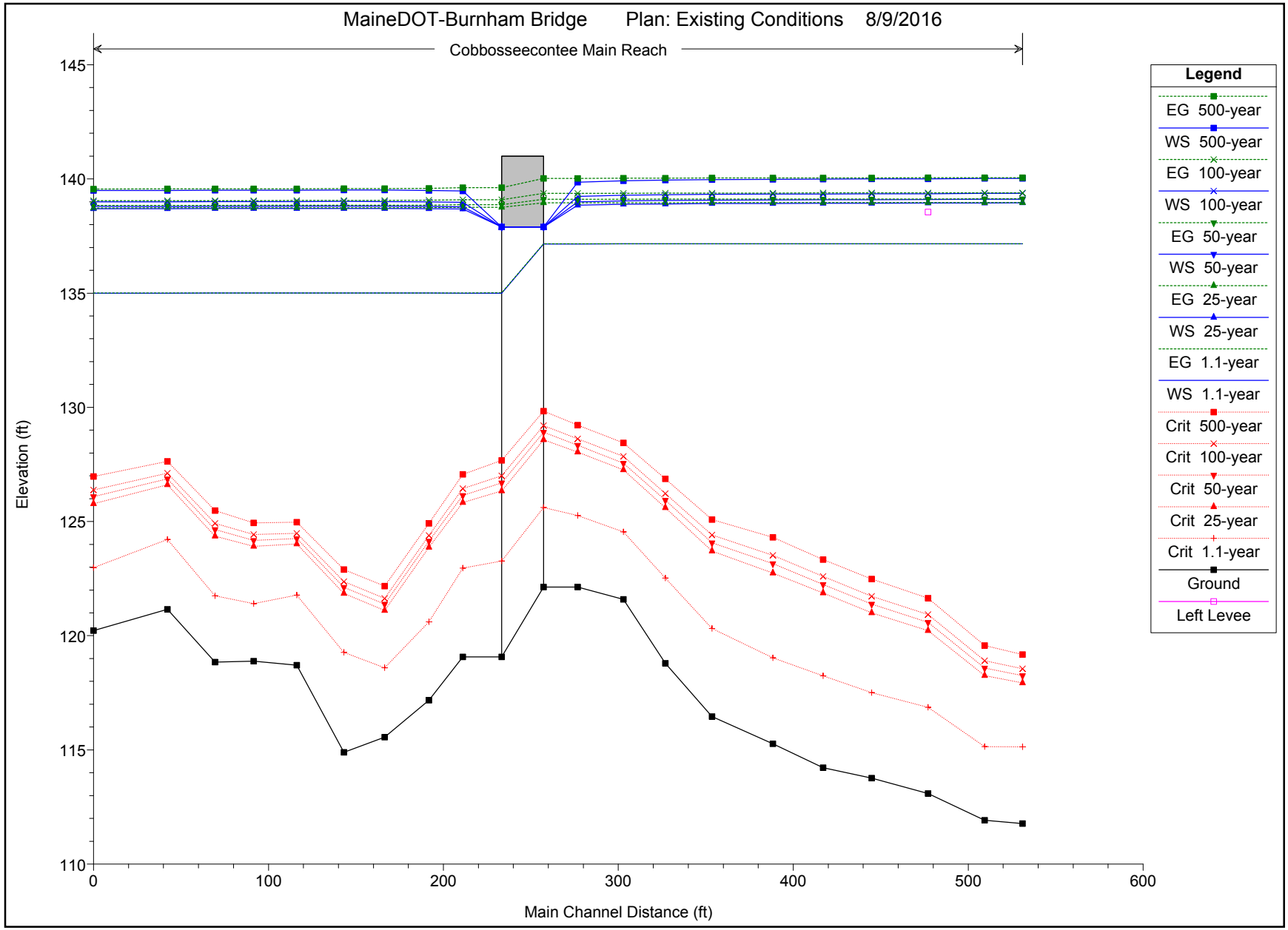
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Existing Conditions 8/9/2016
.05
.035
.05
Elevation (ft)
145
140
135
130
125
120
0
100
200
300
400
500
600
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge
Plan: Existing Conditions
8/9/2016
Cobbosseecontee Main Reach
Elevation (ft)
Main Channel Distance (ft)
145
140
135
130
125
120
115
110
0
100
200
300
400
500
600
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Left Levee

APPENDIX F

Proposed HEC-RAS Analysis

HEC-RAS Plan: Proposed River: Cobbosseecontee Reach: Main Reach

Reach	River Sta	Profile	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)	
Main Reach	1545.522	1.1-year	969.00	111.77	137.12	115.13	137.12	0.000002	0.36	3520.57	454.54	0.02
Main Reach	1545.522	25-year	3635.00	111.77	138.80	117.93	138.82	0.000019	1.17	4124.74	505.33	0.05
Main Reach	1545.522	50-year	4028.00	111.77	138.92	118.25	138.94	0.000022	1.29	4170.00	508.42	0.06
Main Reach	1545.522	100-year	4407.00	111.77	139.14	118.55	139.16	0.000025	1.38	4252.41	514.02	0.06
Main Reach	1545.522	500-year	5257.00	111.77	139.69	119.18	139.72	0.000032	1.58	4459.74	527.90	0.07
Main Reach	1523.916	1.1-year	969.00	111.92	137.12	115.15	137.12	0.000003	0.39	3244.39	451.22	0.02
Main Reach	1523.916	25-year	3635.00	111.92	138.80	118.25	138.82	0.000024	1.27	3838.47	501.56	0.06
Main Reach	1523.916	50-year	4028.00	111.92	138.92	118.59	138.94	0.000029	1.39	3882.82	504.58	0.06
Main Reach	1523.916	100-year	4407.00	111.92	139.14	118.90	139.16	0.000033	1.49	3963.75	510.05	0.07
Main Reach	1523.916	500-year	5257.00	111.92	139.68	119.56	139.71	0.000041	1.70	4167.42	523.62	0.07
Main Reach	1491.506	1.1-year	969.00	113.09	137.12	116.86	137.12	0.000002	0.43	2874.29	464.31	0.02
Main Reach	1491.506	25-year	3635.00	113.09	138.79	120.22	138.82	0.000023	1.38	3443.80	566.11	0.06
Main Reach	1491.506	50-year	4028.00	113.09	138.91	120.59	138.94	0.000027	1.52	3484.34	569.63	0.06
Main Reach	1491.506	100-year	4407.00	113.09	139.13	120.93	139.16	0.000031	1.63	3558.44	576.43	0.07
Main Reach	1491.506	500-year	5257.00	113.09	139.67	121.65	139.71	0.000039	1.86	3742.48	610.89	0.07
Main Reach	1459.347	1.1-year	969.00	113.76	137.12	117.51	137.12	0.000003	0.46	2703.37	479.36	0.02
Main Reach	1459.347	25-year	3635.00	113.76	138.79	121.00	138.82	0.000028	1.47	3223.35	537.81	0.06
Main Reach	1459.347	50-year	4028.00	113.76	138.90	121.38	138.94	0.000033	1.61	3260.20	540.63	0.07
Main Reach	1459.347	100-year	4407.00	113.76	139.12	121.74	139.16	0.000038	1.73	3327.79	545.76	0.07
Main Reach	1459.347	500-year	5257.00	113.76	139.66	122.48	139.71	0.000047	1.97	3495.72	558.20	0.08
Main Reach	1431.576	1.1-year	969.00	114.22	137.12	118.24	137.12	0.000004	0.49	2579.81	473.19	0.02
Main Reach	1431.576	25-year	3635.00	114.22	138.78	121.87	138.81	0.000033	1.56	3058.79	511.55	0.07
Main Reach	1431.576	50-year	4028.00	114.22	138.90	122.24	138.94	0.000039	1.71	3092.60	514.18	0.07
Main Reach	1431.576	100-year	4407.00	114.22	139.12	122.59	139.16	0.000044	1.84	3154.79	519.02	0.08
Main Reach	1431.576	500-year	5257.00	114.22	139.65	123.33	139.71	0.000056	2.10	3309.38	531.52	0.09
Main Reach	1402.811	1.1-year	969.00	115.27	137.12	119.03	137.12	0.000004	0.52	2429.53	454.80	0.02
Main Reach	1402.811	25-year	3635.00	115.27	138.78	122.75	138.81	0.000038	1.67	2859.07	487.97	0.07
Main Reach	1402.811	50-year	4028.00	115.27	138.89	123.15	138.94	0.000045	1.83	2889.20	490.16	0.08
Main Reach	1402.811	100-year	4407.00	115.27	139.11	123.53	139.16	0.000051	1.97	2944.87	494.20	0.08
Main Reach	1402.811	500-year	5257.00	115.27	139.64	124.31	139.71	0.000064	2.24	3083.32	504.25	0.09
Main Reach	1368.029	1.1-year	969.00	116.46	137.12	120.31	137.12	0.000005	0.55	2191.80	432.67	0.03
Main Reach	1368.029	25-year	3635.00	116.46	138.77	123.70	138.81	0.000045	1.77	2563.28	470.10	0.08

HEC-RAS Plan: Proposed River: Cobbosseecontee Reach: Main Reach (Continued)

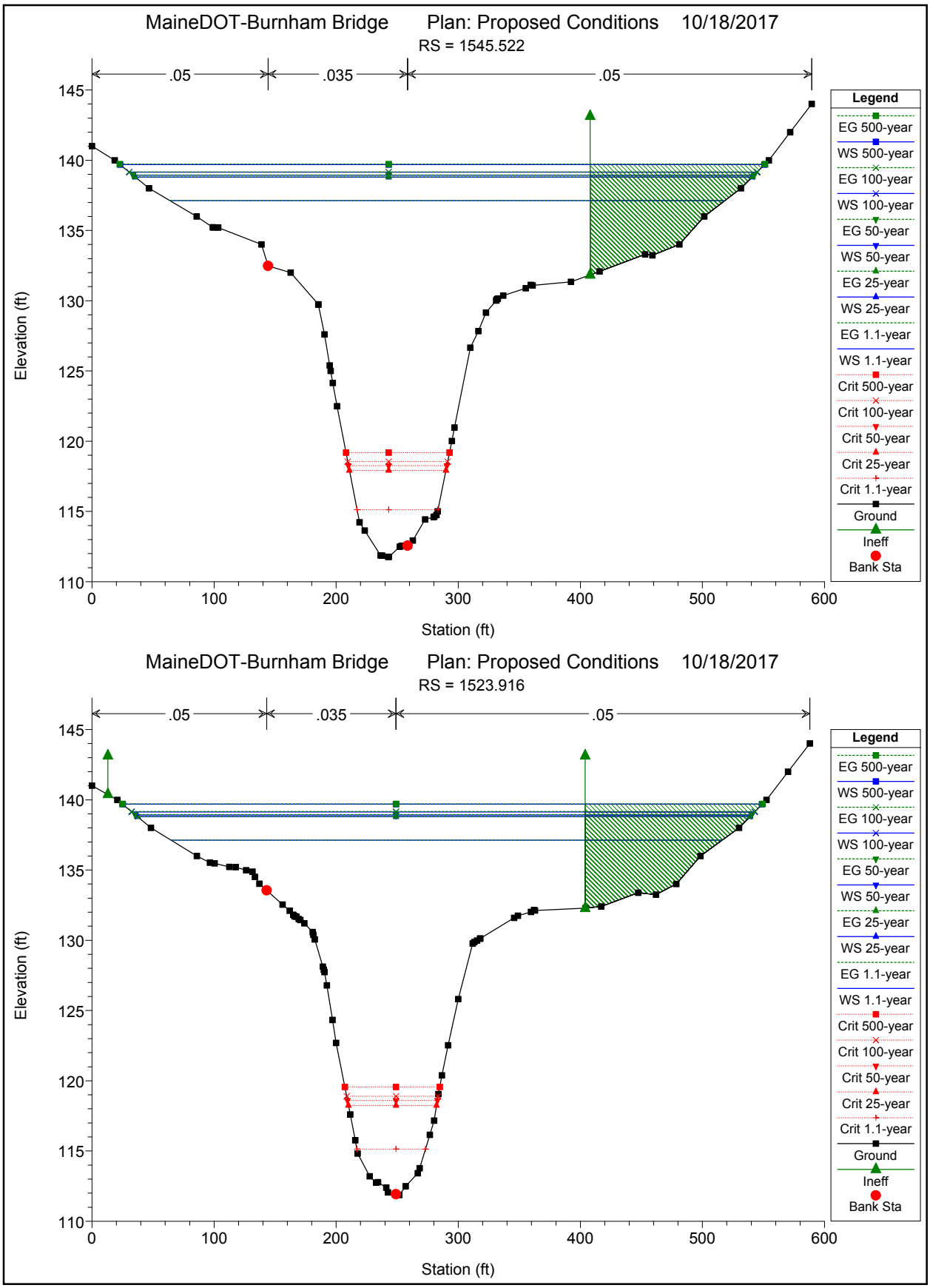
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Reach	1368.029	50-year	4028.00	116.46	138.88	124.08	138.93	0.000053	1.94	2589.06	472.20	0.08
Main Reach	1368.029	100-year	4407.00	116.46	139.10	124.42	139.15	0.000061	2.09	2637.08	476.10	0.09
Main Reach	1368.029	500-year	5257.00	116.46	139.63	125.09	139.70	0.000076	2.39	2756.53	485.80	0.10
Main Reach	1341.377	1.1-year	969.00	118.79	137.12	122.52	137.12	0.000006	0.59	1936.78	400.67	0.03
Main Reach	1341.377	25-year	3635.00	118.79	138.76	125.60	138.81	0.000056	1.92	2248.57	441.36	0.09
Main Reach	1341.377	50-year	4028.00	118.79	138.87	125.94	138.93	0.000067	2.11	2269.91	445.02	0.09
Main Reach	1341.377	100-year	4407.00	118.79	139.08	126.23	139.15	0.000076	2.27	2310.04	451.91	0.10
Main Reach	1341.377	500-year	5257.00	118.79	139.61	126.87	139.70	0.000095	2.59	2409.95	464.24	0.11
Main Reach	1317.345	1.1-year	969.00	121.59	137.12	124.54	137.12	0.000008	0.64	1696.50	387.46	0.03
Main Reach	1317.345	25-year	3635.00	121.59	138.74	127.26	138.81	0.000072	2.08	1960.33	421.47	0.10
Main Reach	1317.345	50-year	4028.00	121.59	138.85	127.55	138.93	0.000086	2.28	1978.06	424.05	0.11
Main Reach	1317.345	100-year	4407.00	121.59	139.06	127.85	139.15	0.000097	2.46	2011.84	429.38	0.11
Main Reach	1317.345	500-year	5257.00	121.59	139.58	128.45	139.69	0.000122	2.82	2096.02	442.90	0.13
Main Reach	1291.282	1.1-year	969.00	122.13	137.11	125.26	137.12	0.000012	0.77	1377.19	380.80	0.04
Main Reach	1291.282	25-year	3635.00	122.13	138.71	128.04	138.80	0.000108	2.50	1586.38	412.89	0.12
Main Reach	1291.282	50-year	4028.00	122.13	138.81	128.34	138.92	0.000130	2.75	1599.75	414.79	0.13
Main Reach	1291.282	100-year	4407.00	122.13	139.01	128.62	139.14	0.000147	2.96	1626.18	419.43	0.14
Main Reach	1291.282	500-year	5257.00	122.13	139.52	129.22	139.68	0.000185	3.40	1692.21	430.05	0.16
Main Reach	1260		Bridge									
Main Reach	1225.552	1.1-year	969.00	119.07	135.00	122.96	135.01	0.000013	0.79	1271.20	305.18	0.04
Main Reach	1225.552	25-year	3635.00	119.07	138.69	125.83	138.76	0.000074	2.21	1706.35	437.72	0.10
Main Reach	1225.552	50-year	4028.00	119.07	138.79	126.14	138.87	0.000089	2.43	1717.81	440.45	0.11
Main Reach	1225.552	100-year	4407.00	119.07	138.98	126.44	139.09	0.000102	2.63	1741.03	445.98	0.12
Main Reach	1225.552	500-year	5257.00	119.07	139.47	127.06	139.61	0.000130	3.03	1799.05	459.16	0.13
Main Reach	1206.211	1.1-year	969.00	117.17	135.00	120.61	135.01	0.000006	0.57	1692.81	328.10	0.03
Main Reach	1206.211	25-year	3635.00	117.17	138.70	123.87	138.75	0.000038	1.67	2177.51	396.87	0.07
Main Reach	1206.211	50-year	4028.00	117.17	138.80	124.14	138.85	0.000046	1.84	2190.63	398.17	0.08
Main Reach	1206.211	100-year	4407.00	117.17	139.00	124.39	139.06	0.000052	1.99	2216.77	400.75	0.09
Main Reach	1206.211	500-year	5257.00	117.17	139.50	124.92	139.58	0.000068	2.30	2282.03	421.43	0.10
Main Reach	1180.934	1.1-year	969.00	115.56	135.00	118.59	135.01	0.000004	0.48	2050.17	339.05	0.02
Main Reach	1180.934	25-year	3635.00	115.56	138.71	121.10	138.74	0.000024	1.43	2587.64	399.57	0.06

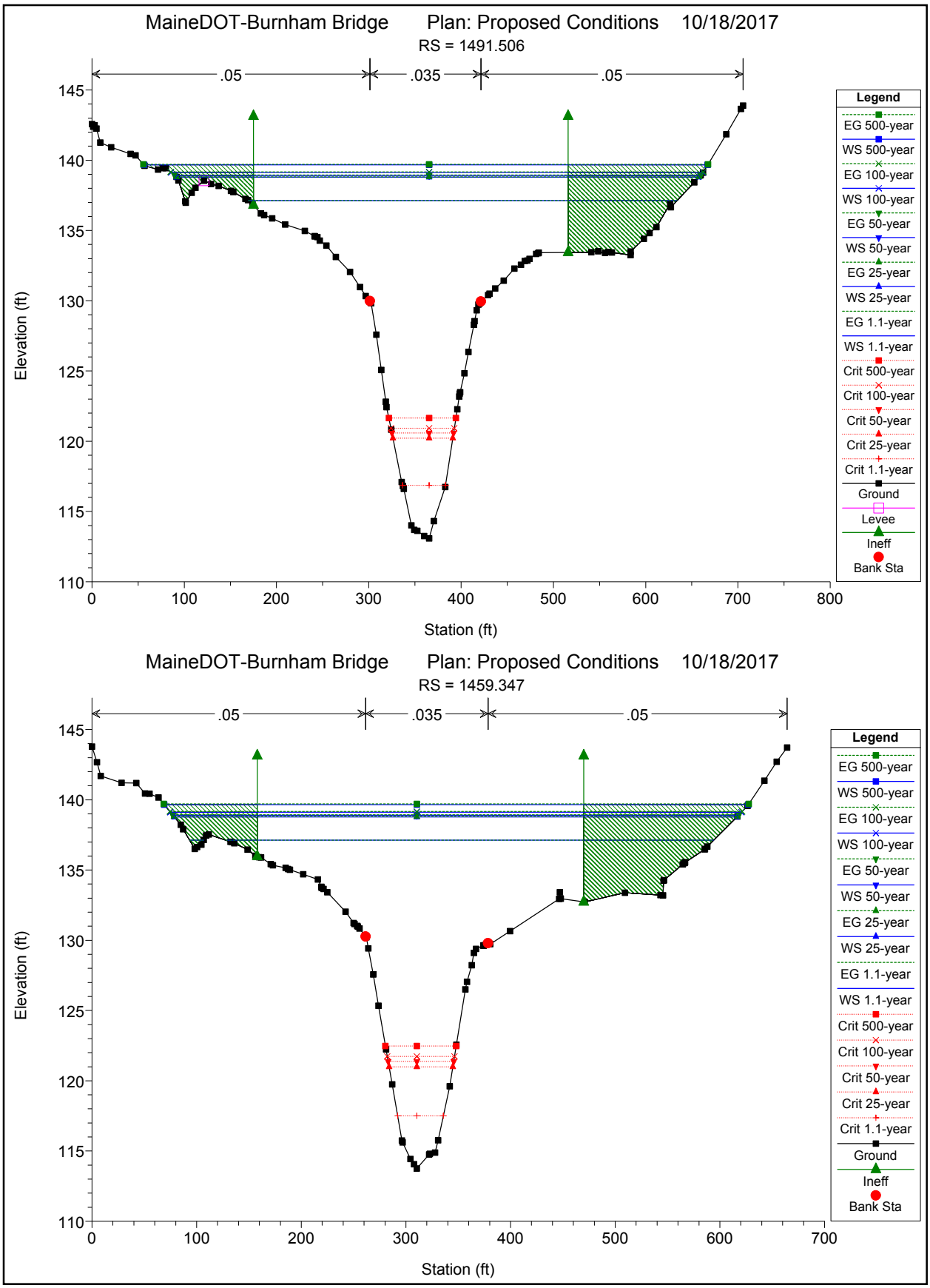
HEC-RAS Plan: Proposed River: Cobbosseecontee Reach: Main Reach (Continued)

Reach	River Sta	Profile	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)	
Main Reach	1180.934	50-year	4028.00	115.56	138.81	121.39	138.85	0.000029	1.57	2602.39	401.02	0.06
Main Reach	1180.934	100-year	4407.00	115.56	139.01	121.64	139.06	0.000034	1.70	2631.55	403.85	0.07
Main Reach	1180.934	500-year	5257.00	115.56	139.51	122.18	139.57	0.000044	1.97	2704.30	410.79	0.08
Main Reach	1157.599	1.1-year	969.00	114.89	135.00	119.27	135.01	0.000004	0.47	2088.99	337.16	0.02
Main Reach	1157.599	25-year	3635.00	114.89	138.71	121.85	138.74	0.000024	1.39	2685.88	400.99	0.06
Main Reach	1157.599	50-year	4028.00	114.89	138.81	122.12	138.85	0.000029	1.53	2702.29	402.44	0.06
Main Reach	1157.599	100-year	4407.00	114.89	139.01	122.38	139.06	0.000034	1.65	2734.70	405.30	0.07
Main Reach	1157.599	500-year	5257.00	114.89	139.52	122.90	139.57	0.000044	1.92	2815.57	413.29	0.08
Main Reach	1130.630	1.1-year	969.00	118.71	135.00	121.77	135.01	0.000005	0.53	1920.98	339.95	0.03
Main Reach	1130.630	25-year	3635.00	118.71	138.71	124.02	138.74	0.000031	1.51	2587.50	404.52	0.07
Main Reach	1130.630	50-year	4028.00	118.71	138.81	124.26	138.85	0.000038	1.66	2605.65	406.19	0.07
Main Reach	1130.630	100-year	4407.00	118.71	139.01	124.49	139.05	0.000043	1.79	2641.72	409.52	0.08
Main Reach	1130.630	500-year	5257.00	118.71	139.51	124.97	139.57	0.000055	2.07	2731.79	418.22	0.09
Main Reach	1106.073	1.1-year	969.00	118.88	135.00	121.41	135.01	0.000006	0.54	1922.10	348.72	0.03
Main Reach	1106.073	25-year	3635.00	118.88	138.70	123.91	138.74	0.000032	1.52	2644.10	412.59	0.07
Main Reach	1106.073	50-year	4028.00	118.88	138.81	124.17	138.85	0.000038	1.67	2663.74	414.25	0.07
Main Reach	1106.073	100-year	4407.00	118.88	139.01	124.43	139.05	0.000044	1.80	2702.81	418.16	0.08
Main Reach	1106.073	500-year	5257.00	118.88	139.51	124.93	139.57	0.000056	2.08	2800.37	429.16	0.09
Main Reach	1083.889	1.1-year	969.00	118.84	135.00	121.75	135.01	0.000007	0.58	1867.02	357.16	0.03
Main Reach	1083.889	25-year	3635.00	118.84	138.70	124.36	138.74	0.000035	1.56	2644.25	428.12	0.07
Main Reach	1083.889	50-year	4028.00	118.84	138.80	124.65	138.84	0.000042	1.72	2665.32	430.37	0.08
Main Reach	1083.889	100-year	4407.00	118.84	139.00	124.92	139.05	0.000048	1.85	2707.34	434.51	0.08
Main Reach	1083.889	500-year	5257.00	118.84	139.50	125.48	139.57	0.000061	2.13	2812.33	444.39	0.09
Main Reach	1056.753	1.1-year	969.00	121.16	135.00	124.21	135.01	0.000011	0.66	1684.16	363.30	0.04
Main Reach	1056.753	25-year	3635.00	121.16	138.70	126.60	138.74	0.000048	1.69	2515.90	436.37	0.08
Main Reach	1056.753	50-year	4028.00	121.16	138.80	126.87	138.84	0.000057	1.86	2538.22	438.74	0.09
Main Reach	1056.753	100-year	4407.00	121.16	138.99	127.12	139.05	0.000065	2.00	2583.04	443.02	0.09
Main Reach	1056.753	500-year	5257.00	121.16	139.49	127.64	139.56	0.000081	2.29	2695.15	452.98	0.10
Main Reach	1014.494	1.1-year	969.00	120.22	135.00	122.98	135.01	0.000008	0.58	1892.67	377.44	0.03
Main Reach	1014.494	25-year	3635.00	120.22	138.70	125.78	138.73	0.000037	1.51	2817.67	457.56	0.07
Main Reach	1014.494	50-year	4028.00	120.22	138.80	126.09	138.84	0.000044	1.66	2842.67	459.62	0.08
Main Reach	1014.494	100-year	4407.00	120.22	139.00	126.38	139.04	0.000050	1.79	2892.67	463.63	0.08

HEC-RAS Plan: Proposed River: Cobbosseecontee Reach: Main Reach (Continued)

Reach	River Sta	Profile	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)	
Main Reach	1014.494	500-year	5257.00	120.22	139.50	126.97	139.56	0.000063	2.05	3017.67	472.89	0.09


MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1545.522
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta
MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1523.916
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta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.035
.05
Elevation (ft)
Station (ft)
Legend
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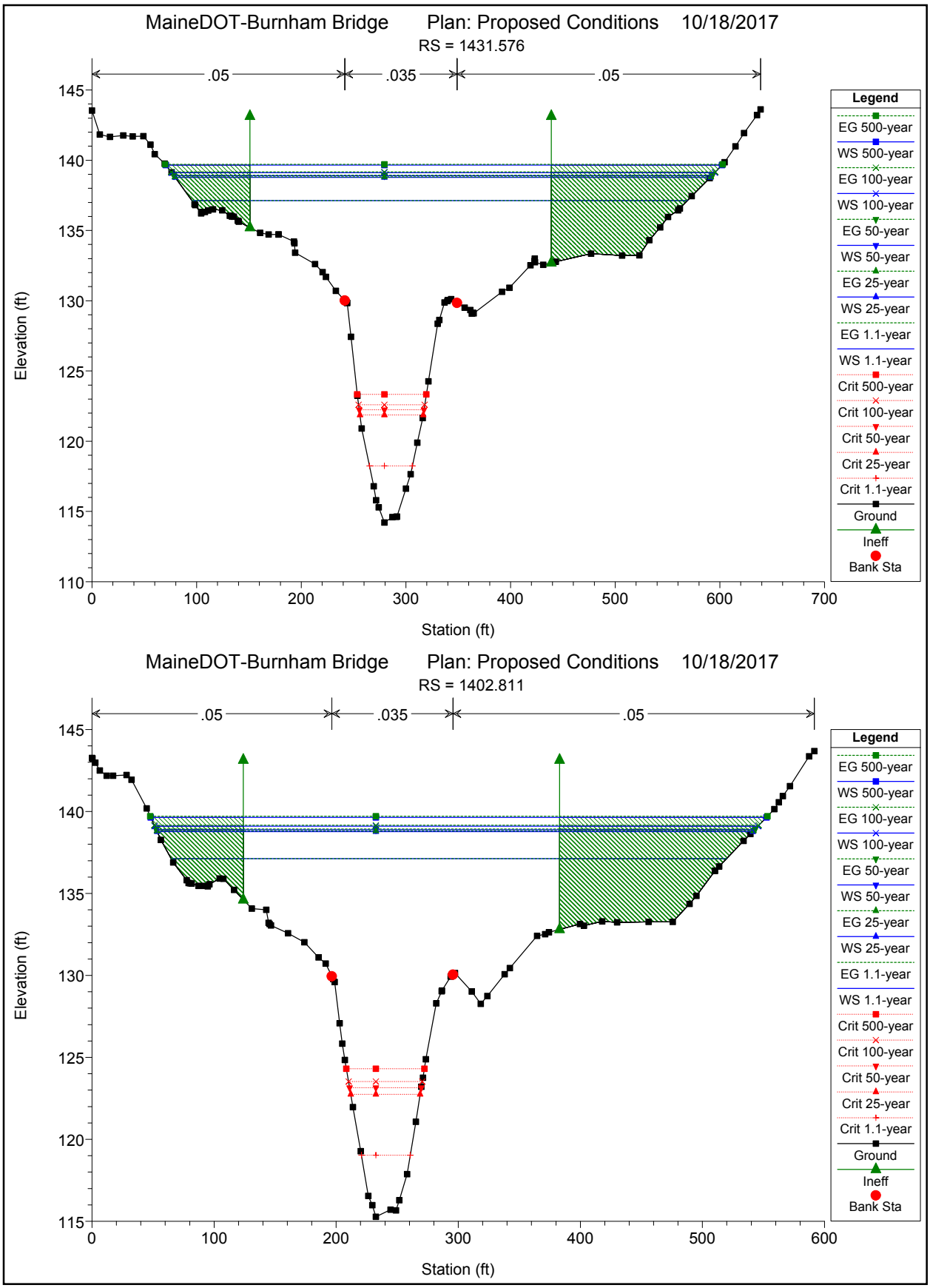
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Levee
Ineff
Bank Sta
MaineDOT-Burnham Bridge Plan: Proposed Conditions 10/18/2017
RS = 1459.347
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta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Plan: Proposed Conditions
10/18/2017
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.05
.035
.05
Elevation (ft)
Station (ft)
Legend
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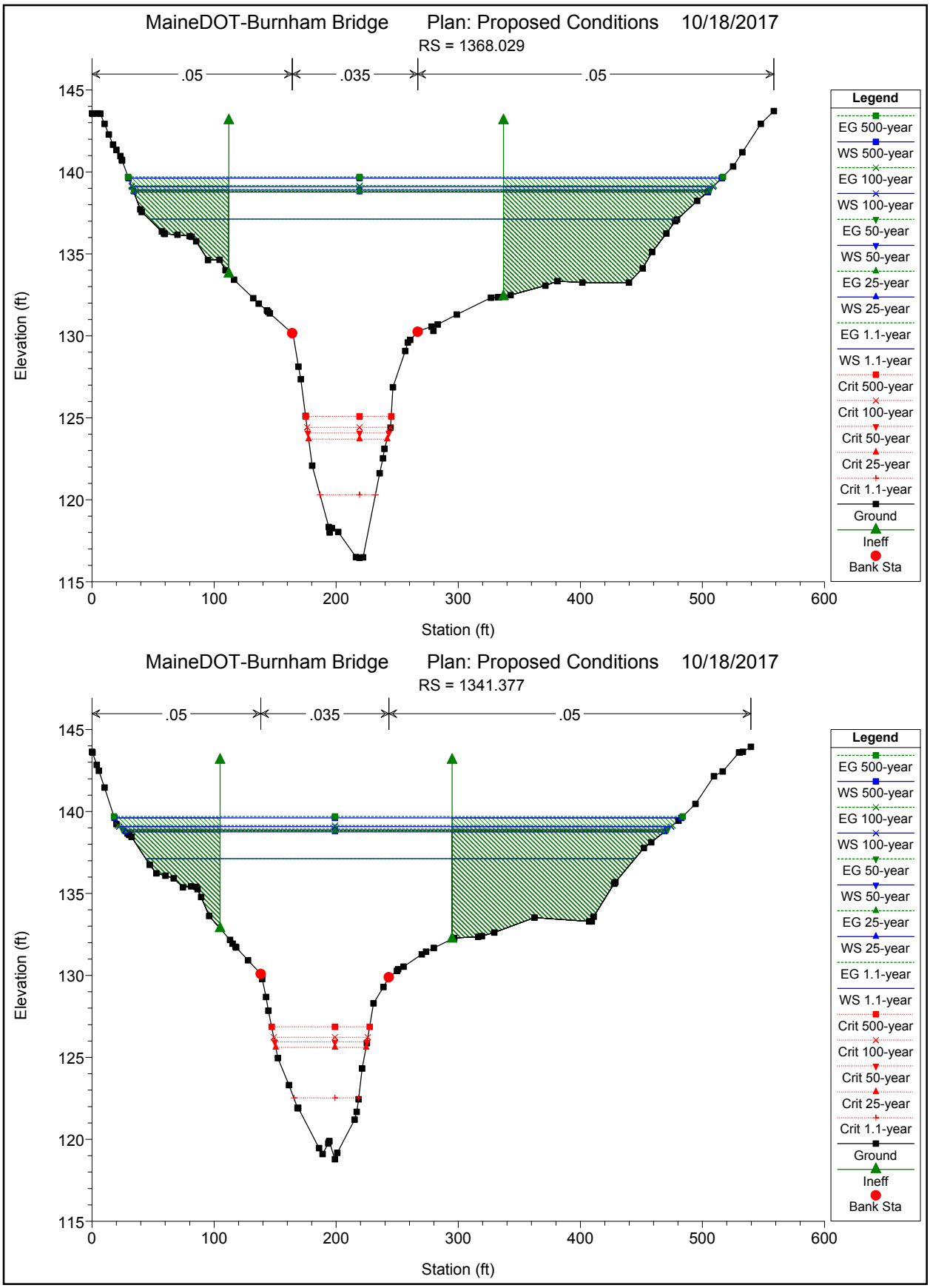
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta
MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1402.811
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta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Plan: Proposed Conditions
10/18/2017
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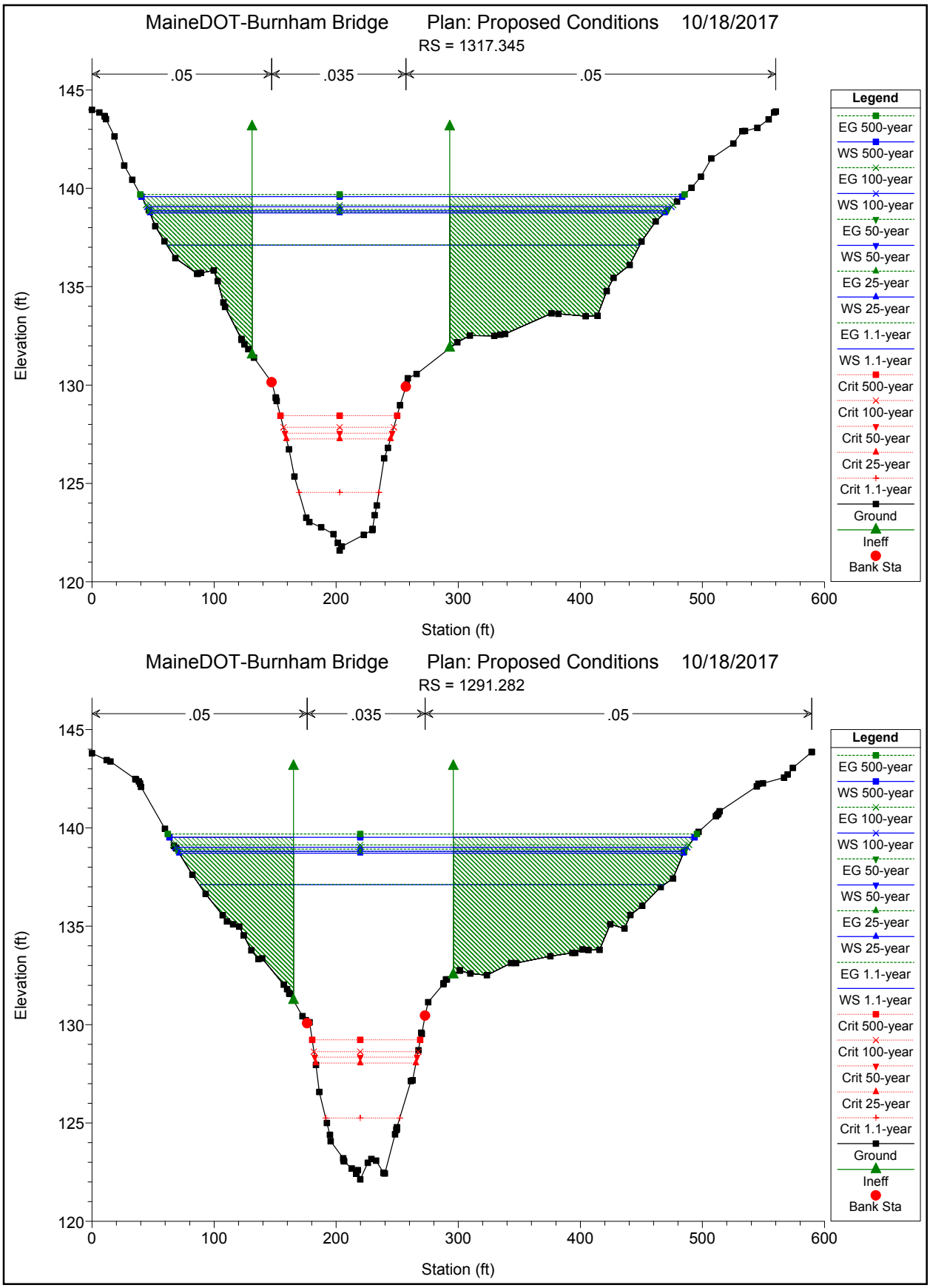
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta
MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1341.377
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta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.035
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Elevation (ft)
Station (ft)
Legend
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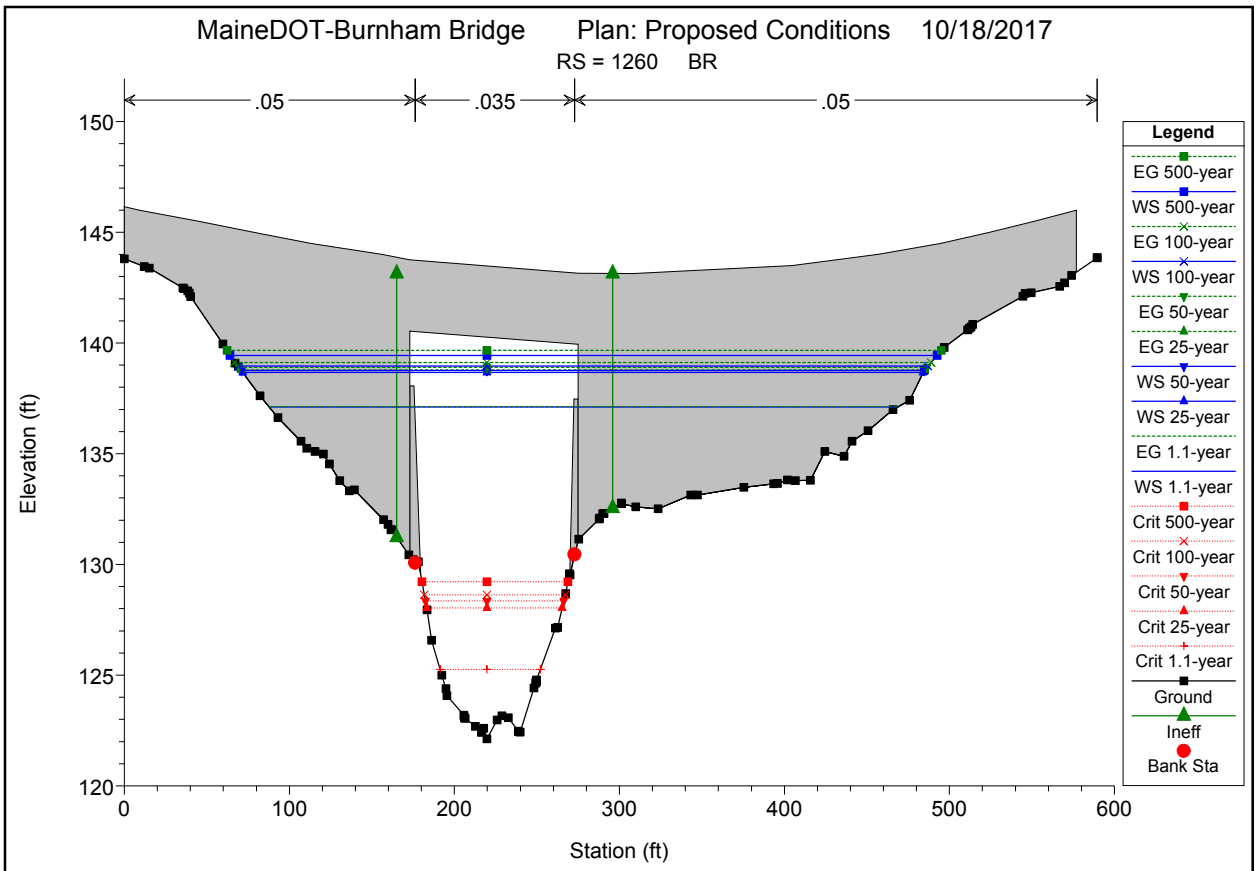
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta
MaineDOT-Burnham Bridge Plan: Proposed Conditions 10/18/2017
RS = 1291.282
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge Plan: Proposed Conditions 10/18/2017
RS = 1260 BR
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
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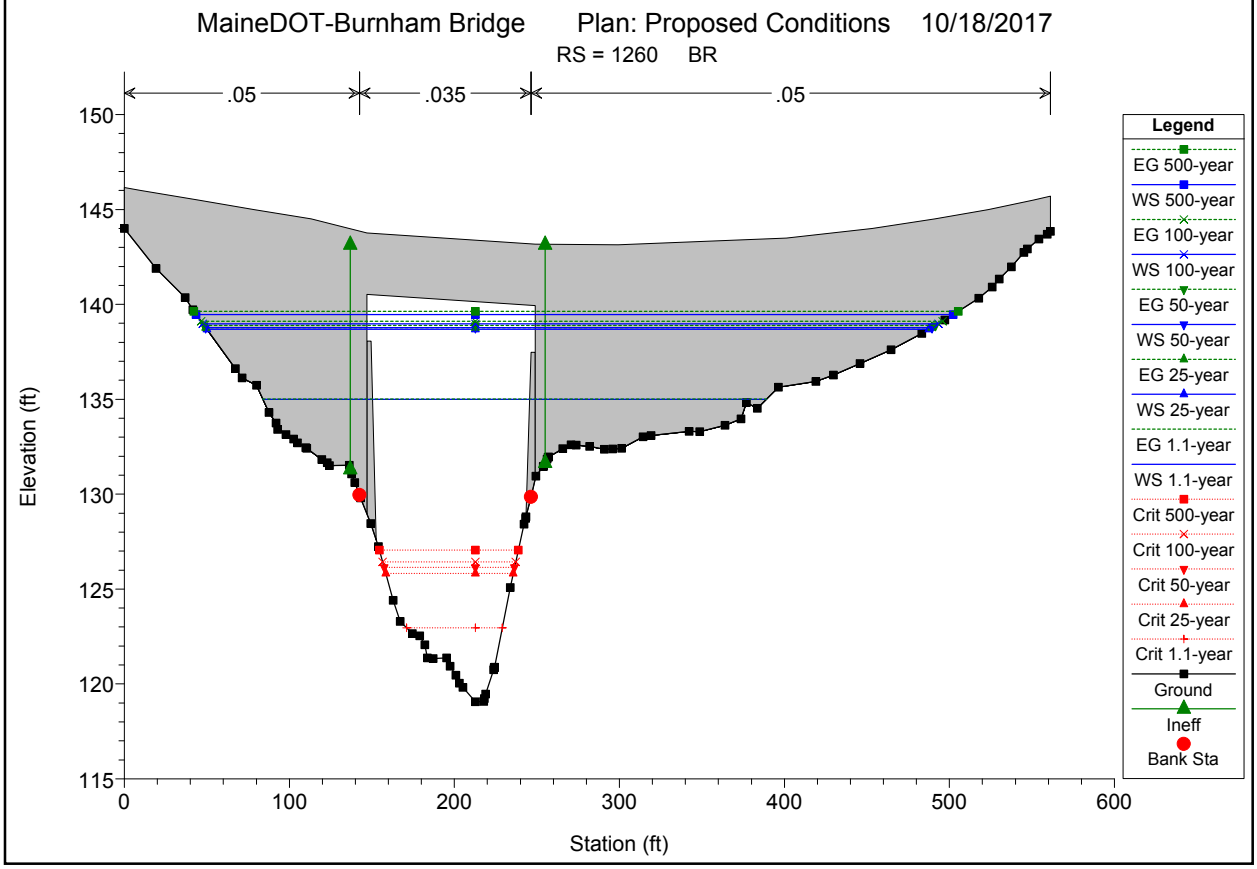
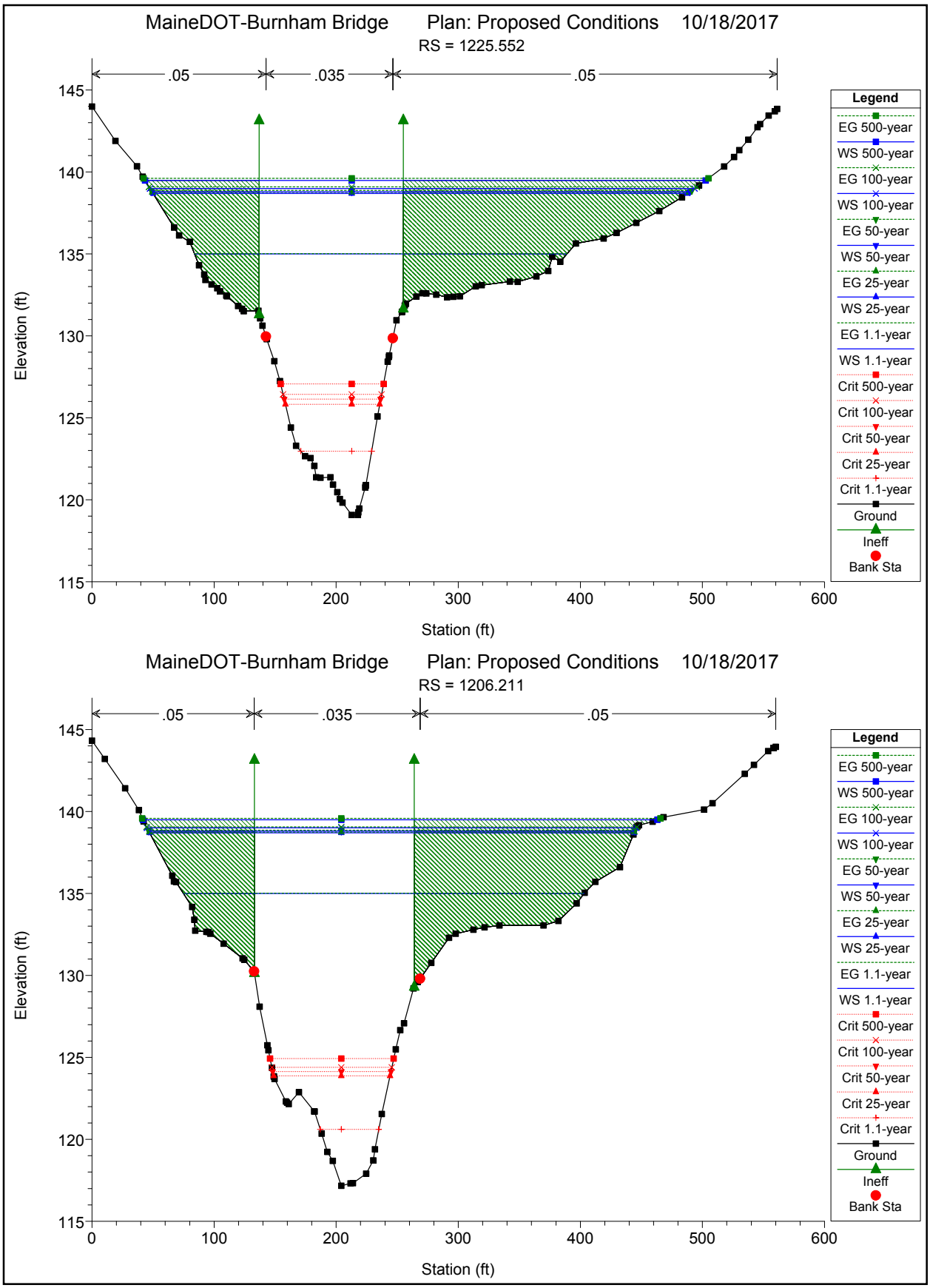
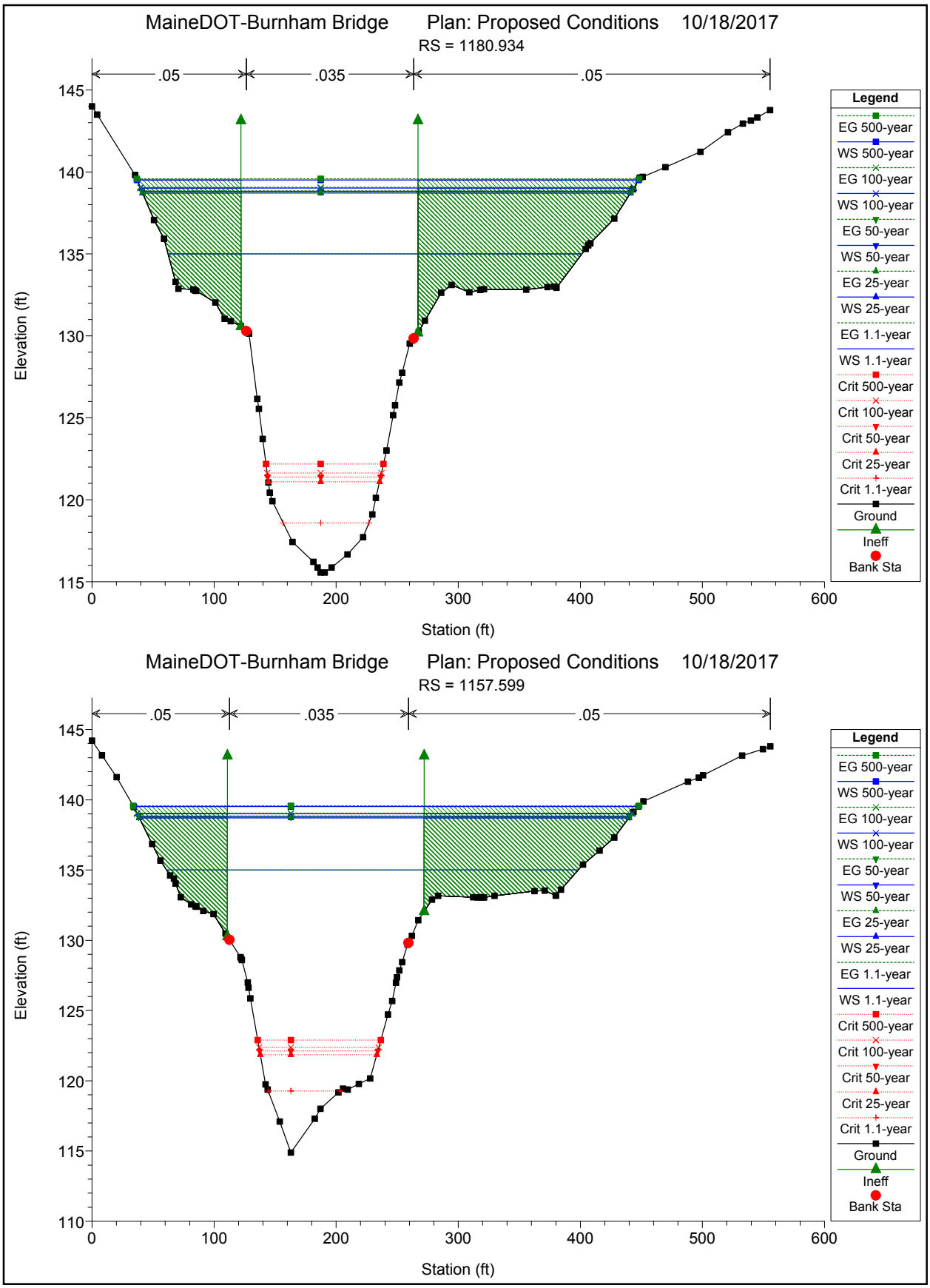
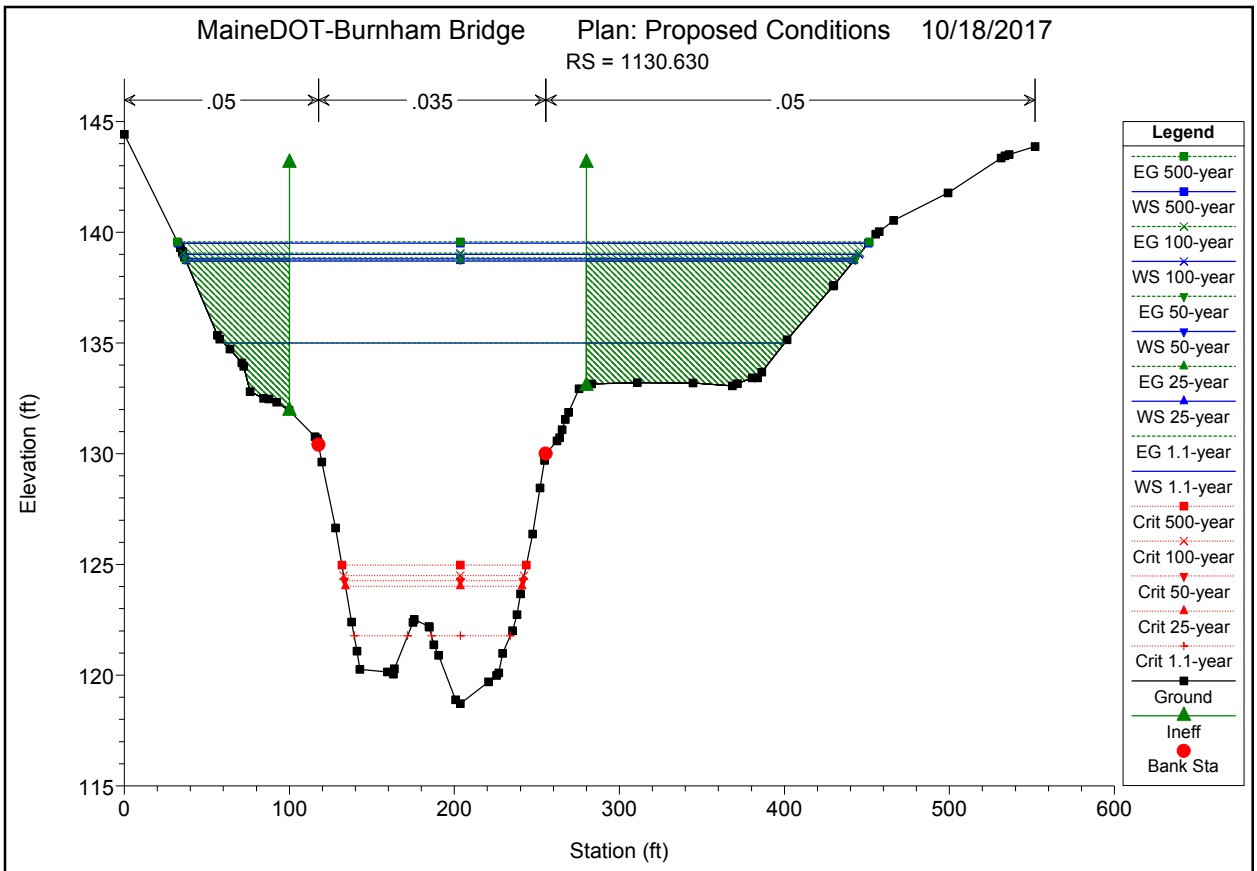
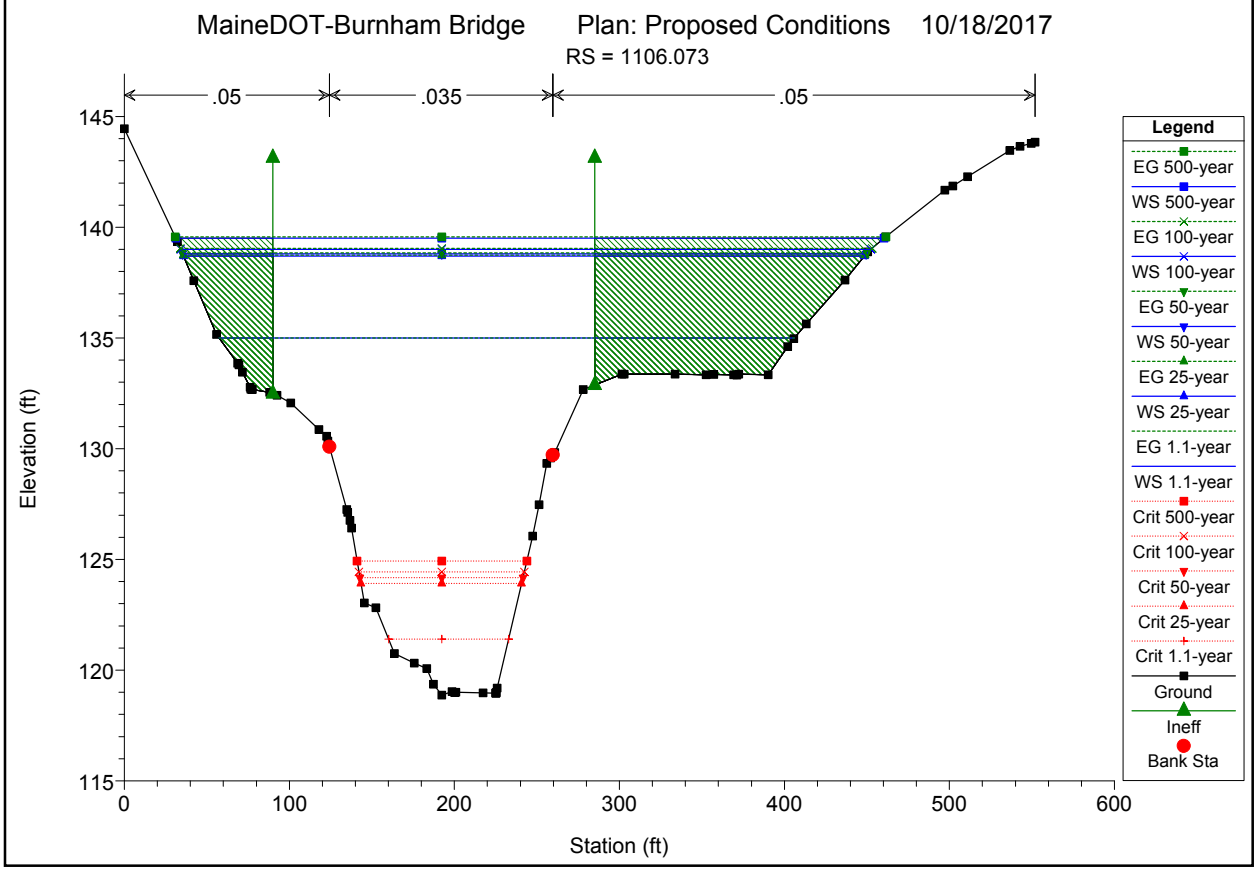
WS 500-year
EG 100-year
WS 100-year
EG 50-year
EG 25-year
WS 50-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta

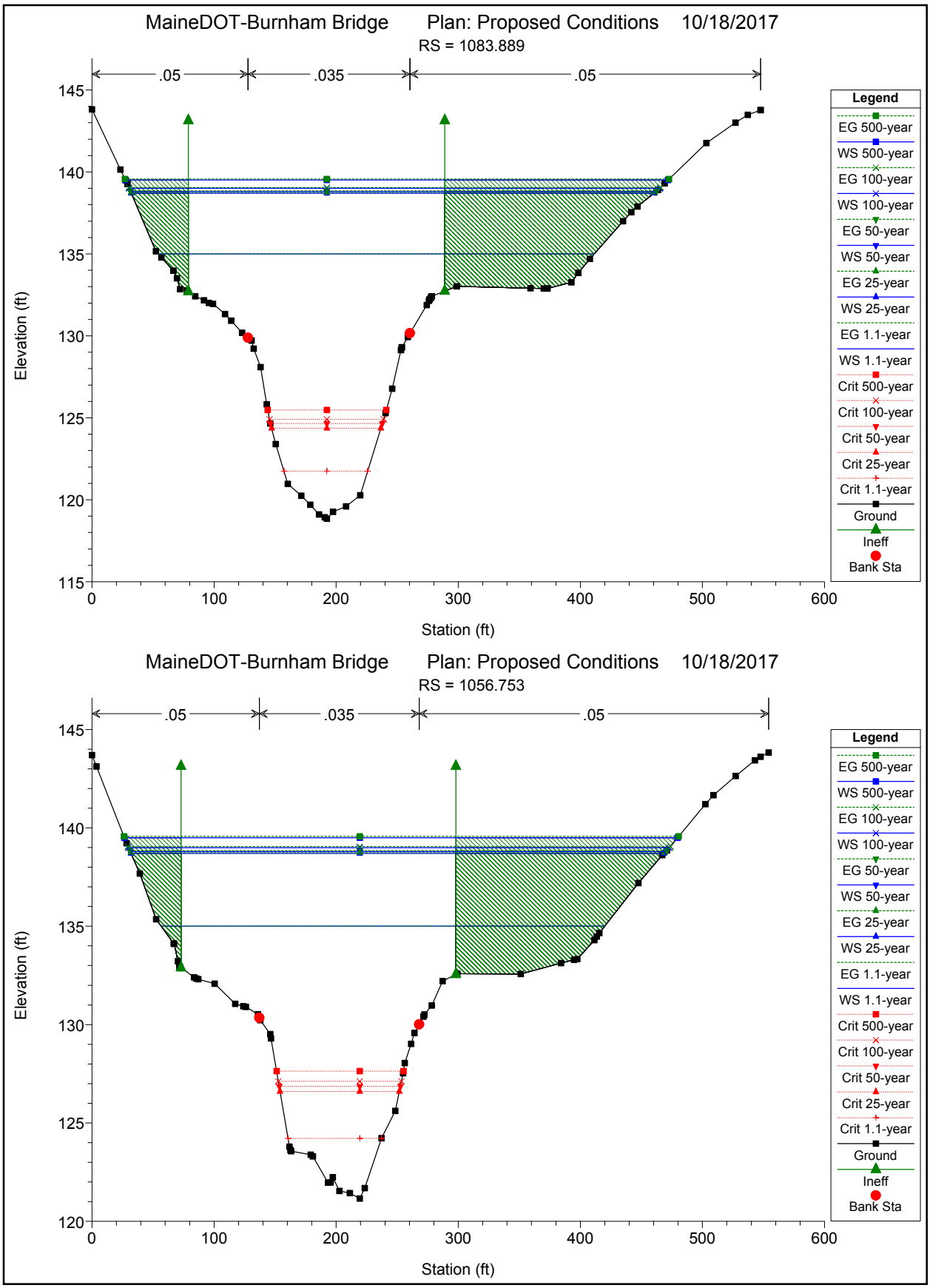

MaineDOT-Burnham Bridge Plan: Proposed Conditions 10/18/2017
RS = 1260 BR
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta

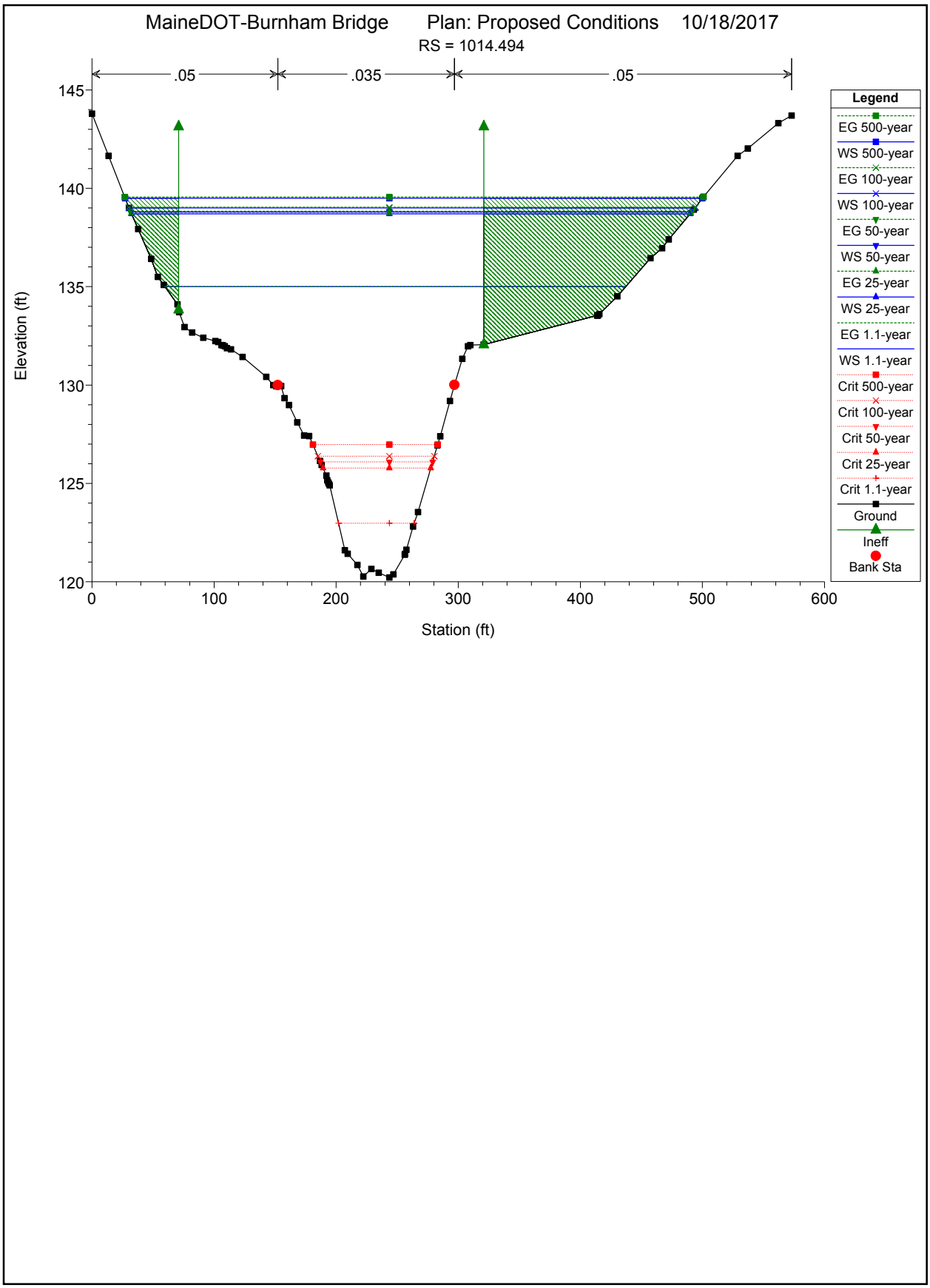

MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1225.552
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta
MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1206.211
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta

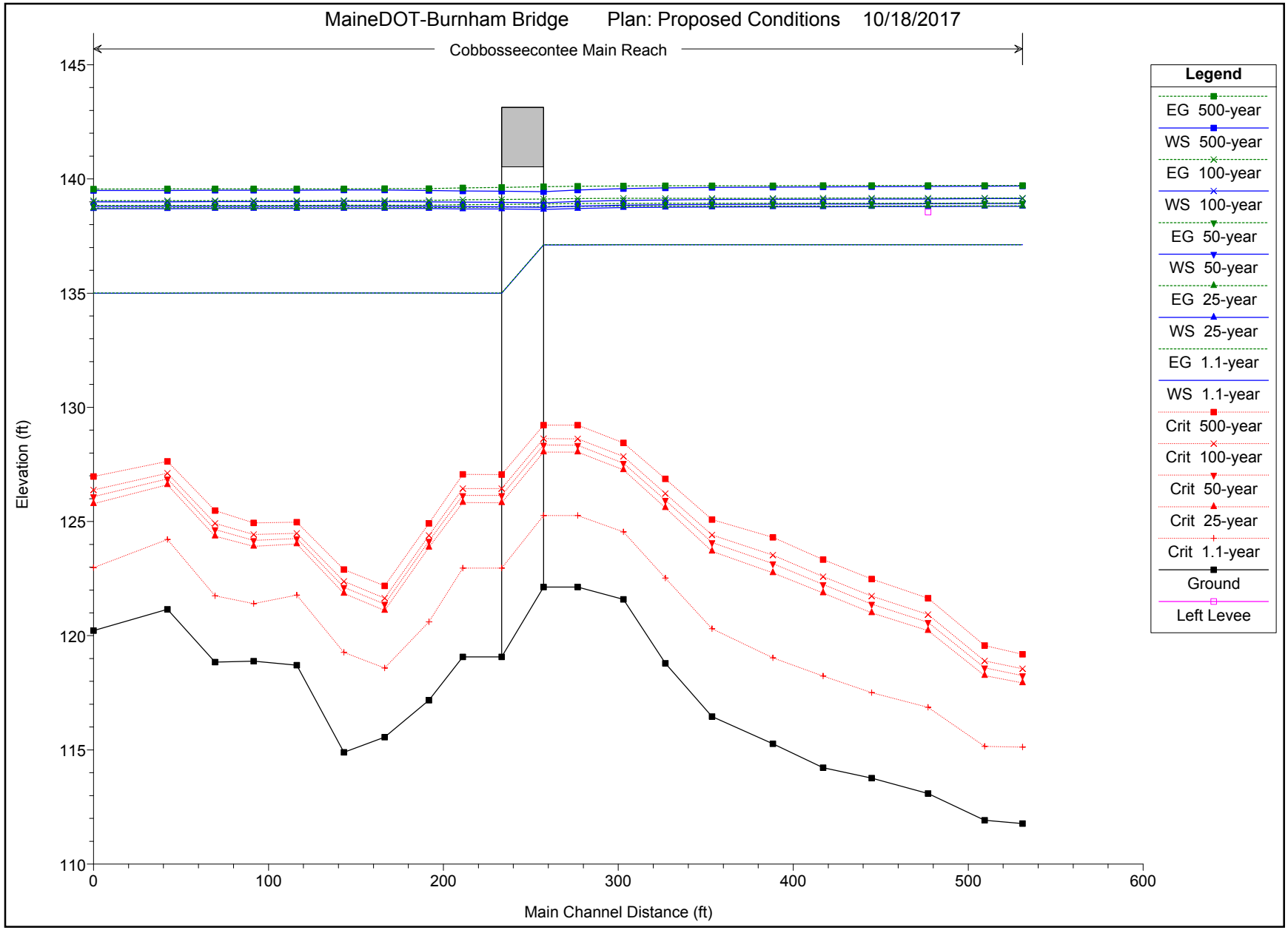

MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1180.934
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta
MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1157.599
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1130.630
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1106.073
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1083.889
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta
MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1056.753
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
RS = 1014.494
.05
.035
.05
Elevation (ft)
Station (ft)
145
140
135
130
125
120
0
100
200
300
400
500
600
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Ineff
Bank Sta


MaineDOT-Burnham Bridge
Plan: Proposed Conditions
10/18/2017
Cobbosseecontee Main Reach
Elevation (ft)
Main Channel Distance (ft)
145
140
135
130
125
120
115
110
0
100
200
300
400
500
600
Legend
EG 500-year
WS 500-year
EG 100-year
WS 100-year
EG 50-year
WS 50-year
EG 25-year
WS 25-year
EG 1.1-year
WS 1.1-year
Crit 500-year
Crit 100-year
Crit 50-year
Crit 25-year
Crit 1.1-year
Ground
Left Levee

APPENDIX G

Scour Analysis

Proj. Burnham Bridge	Job No. 63738	Sheet No. 1 OF 5
Made by SPA	Checked by CMV	Backchecked by AHR
Date 10/16/17	Date	Date

HNTB

Scour Analysis: 100-year storm U/S face of Pond Road over Cobbosseecontee Stream

Aggradation/Degradation ft

Live Bed Vs. Clear Water

Depth of flow, y1	14.13	ft
Particle size in a mix of which 50% are smaller, D50 (m)	0.00156	m
Particle size in a mix of which 50% are smaller, D50 (ft)	0.00511	ft
Velocity of main Channel, V	2.96	ft/s
Critical Velocity, Vc	2.99	ft/s

$$V_c = K_u y^{1/6} D^{1/3}$$

Ku = 11.17

(HEC-18, 5th Edition, April 2012, Equation 6.1)

Live Bed vs. Clear Water Clear Water ←Type of Contraction Scour Analysis to be completed

Live Bed Scour

Avg depth in U/S main channel, y1	14.13	ft
Ex depth in the contracted section before scour, yo	13.18	ft
Flow in the U/S channel transporting sediment Q1	4041.11	ft^3/s
Flow in the contracted channel, Q2	4407	ft^3/s
Top width of U/S main channel, W1	96.52	ft
Top width of the main channel in the contracted section, W2	92.52	ft
Fall Velocity, ω	0.59	ft/s
Slope of energy grade line of main channel, S1	0.000147	ft/ft
Shear Velocity, Vα	0.26	
Vα/ω	0.44	
Exponent, k1	0.64	
Avg depth in contracted section, y2	15.64	
***Scour depth, ys**	2.46	ft

$$V_\alpha = (g y_1 S_1)^{1/2}$$

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{\frac{6}{7}} \left(\frac{W_1}{W_2}\right)^{k_1}$$

$$y_s = y_2 - y_0$$

(HEC-18, 5th Edition, April 2012, Equations 6.2 and 6.3)

Clear Water Scour

Discharge through the bridge, Q	4407.00	
Median diameter of bed material, D50	0.00511	ft
Diameter of smallest nontrasportable particle, Dm	0.00639	
Bottom width of the contracted section, W	88.00	
Existing depth in the contracted Section, yo	13.18	
Avg depth in the contracted section after contraction scour, y2	15.07	
***Scour depth, ys**	1.89	ft

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3} W^2}\right]^{3/7}$$

$$y_s = y_2 - y_0$$

(HEC-18, 5th Edition, April 2012, Equation 6.4)

If calculated y_s returns negative answer, the scour depth equals zero

Proj.	Burnham Bridge	Job No.	63738	Sheet No.	2 OF 5
Made by	SPA	Checked by	CMV	3ackchecked by	AHR
Date	10/17/16	Date		Date	

HNTB

Scour Analysis: 100-year storm U/S face of Pond Road over Cobbosseecontee Stream

Local Scour at Abutments
Near Abutment

Coefficient for Abutment Shape, K1	0.55	
Coefficient for angle of embankment to flow, K2	1.00	
Length of active flow obstructed by embankment, L'	214.77	ft
Average depth of flow on embankment, ya	7.24	ft
Velocity on embankment, Ve	1.34	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	0.088	
Length of embankment projected to normal flow, L	330.00	ft

$$\frac{y_s}{y_a} = 2.27K_1K_2\left(\frac{L'}{y_a}\right)^{0.43}(Fr)^{0.61} + 1$$

Near Abutment Scour Depth, ys **16.04** ***ft***

(HEC-18, 5th Edition, April 2012, Equation 8.1)

Far Abutment

Coefficient for Abutment Shape, K1	0.55	
Coefficient for angle of embankment to flow, K2	1.00	
Length of active flow obstructed by embankment, L'	108.15	ft
Average depth of flow on embankment, ya	8.37	ft
Velocity on embankment, Ve	1.48	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	0.090	
Length of embankment projected to normal flow, L	175.00	ft

$$\frac{y_s}{y_a} = 2.27K_1K_2\left(\frac{L'}{y_a}\right)^{0.43}(Fr)^{0.61} + 1$$

Far Abutment Scour Depth, ys **15.61** ***ft***

(HEC-18, 5th Edition, April 2012, Equation 8.1)

Proj. Burnham Bridge	Job No. 63738	Sheet No. 3 OF 5
Made by SPA	Checked by CMV	Backchecked by AHR
Date 10/17/16	Date	Date

HNTB

Scour Analysis: 500-year storm U/S face of Pond Road over Cobbosseecontee Stream

Aggradation/Degradation | | ***ft***

Live Bed Vs. Clear Water

Depth of flow, y1	14.63	ft
Particle size in a mix of which 50% are smaller, D50 (m)	0.00156	m
Particle size in a mix of which 50% are smaller, D50 (ft)	0.00511	ft
Velocity of main Channel, V	3.4	ft/s
Critical Velocity, Vc	3.01	ft/s

$$V_c = K_u y^{1/6} D^{1/3}$$

Ku = 11.17

(HEC-18, 5th Edition, April 2012, Equation 6.1)

Live Bed vs. Clear Water | Live Bed | ←Type of Contraction Scour Analysis to be completed

Live Bed Scour

Avg depth in U/S main channel, y1	14.63	ft
Ex depth in the contracted section before scour, yo	13.66	ft
Flow in the U/S channel transporting sediment Q1	4800.89	ft^3/s
Flow in the contracted channel, Q2	5257	ft^3/s
Top width of U/S main channel, W1	96.52	ft
Top width of the main channel in the contracted section, W2	92.52	ft
Fall Velocity, ω	0.59	ft/s
Slope of energy grade line of main channel, S1	0.000185	ft/ft
Shear Velocity, Vα	0.30	
Vα/ω	0.50	
Exponent, k1	0.64	
Avg depth in contracted section, y2	16.25	
Scour depth, ys	2.59	***ft***

$$V_\alpha = (g y_1 S_1)^{1/2}$$

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{\frac{6}{7}} \left(\frac{W_1}{W_2}\right)^{k_1}$$

$$y_s = y_2 - y_0$$

(HEC-18, 5th Edition, April 2012, Equations 6.2 and 6.3)

Clear Water Scour

Discharge through the bridge, Q	5257.00	
Median diameter of bed material, D50	0.00511	ft
Diameter of smallest nontrasportable particle, Dm	0.00639	
Bottom width of the contracted section, W	88.00	
Existing depth in the contracted Section, yo	13.66	
Avg depth in the contracted section after contraction scour, y2	17.53	
Scour depth, ys	3.87	***ft***

$$y_2 = \left[\frac{K_u Q^2}{D_m^{2/3} W^2}\right]^{3/7}$$

$$y_s = y_2 - y_0$$

(HEC-18, 5th Edition, April 2012, Equation 6.4)

**** If calculated y_s returns negative answer, the scour depth equals zero***

Proj.	Burnham Bridge	Job No.	63738	Sheet No.	4 OF 5
Made by	SPA	Checked by	CMV	3ackchecked by	AHR
Date	10/17/16	Date		Date	

HNTB

Scour Analysis: 500-year storm U/S face of Pond Road over Cobbosseecontee Stream

Local Scour at Abutments
Near Abutment

Coefficient for Abutment Shape, K1	0.55	
Coefficient for angle of embankment to flow, K2	1.00	
Length of active flow obstructed by embankment, L'	220.65	ft
Average depth of flow on embankment, ya	7.75	ft
Velocity on embankment, Ve	1.58	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	0.100	
Length of embankment projected to normal flow, L	330.00	ft

$$\frac{y_s}{y_a} = 2.27K_1K_2\left(\frac{L'}{y_a}\right)^{0.43}(Fr)^{0.61} + 1$$

Near Abutment Scour Depth, ys 17.78 ***ft***

Far Abutment

Coefficient for Abutment Shape, K1	0.55	
Coefficient for angle of embankment to flow, K2	1.00	
Length of active flow obstructed by embankment, L'	112.87	ft
Average depth of flow on embankment, ya	8.88	ft
Velocity on embankment, Ve	1.73	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	0.102	
Length of embankment projected to normal flow, L	175.00	ft

$$\frac{y_s}{y_a} = 2.27K_1K_2\left(\frac{L'}{y_a}\right)^{0.43}(Fr)^{0.61} + 1$$

Far Abutment Scour Depth, ys 17.11 ***ft***

Proj.	Burnham Bridge	Job No.	63738	Sheet No.	5 OF 5
Made by	SPA	Checked by	CMV	Backchecked by	AHR
Date	10/17/16	Date		Date	

HNTB

Scour Summary

	100 - year storm	
	Near Abutment	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00
Contraction/Expansion Scour (ft) *	1.89	1.89
Local Scour (ft)	16.04	15.61
Pressure Flow Scour (ft)	---	---
TOTAL SCOUR (ft)	***17.93***	***17.50***

	500-year storm	
	Near Abutment	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00
Contraction/Expansion Scour (ft) *	2.59	2.59
Local Scour (ft)	17.78	17.11
Pressure Flow Scour (ft)	---	---
TOTAL SCOUR (ft)	***20.36***	***19.70***

** If calculated y_s returns negative answer, the scour depth equals zero*

Contracted Section

Plan: Proposed Cobbosseecontee Main Reach RS: 1260 Profile: 100-year

E.G. US. (ft)	139.14	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	139.01	E.G. Elev (ft)	139.13	139.10
Q Total (cfs)	4407.00	W.S. Elev (ft)	138.96	138.97
Q Bridge (cfs)	4407.00	Crit W.S. (ft)	128.63	126.44
Q Weir (cfs)		Max Chl Dpth (ft)	16.83	19.90
Weir Sta Lft (ft)		Vel Total (ft/s)	3.28	2.87
Weir Sta Rgt (ft)		Flow Area (sq ft)	1344.40	1536.32
Weir Submerg		Froude # Chl	0.16	0.13
Weir Max Depth (ft)		Specif Force (cu ft)	10153.19	13108.73
Min El Weir Flow (ft)	143.14	Hydr Depth (ft)	13.18	15.06
Min El Prs (ft)	140.53	W.P. Total (ft)	117.74	121.14
Delta EG (ft)	0.05	Conv. Total (cfs)	302620.7	361868.4
Delta WS (ft)	0.03	Top Width (ft)	102.00	102.00
BR Open Area (sq ft)	1474.76	Frctn Loss (ft)	0.00	0.00
BR Open Vel (ft/s)	3.28	C & E Loss (ft)	0.02	0.01
Coef of Q		Shear Total (lb/sq ft)	0.15	0.12
Br Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00

Plan: Proposed Cobbosseecontee Main Reach RS: 1260 Profile: 500-year

E.G. US. (ft)	139.68	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	139.52	E.G. Elev (ft)	139.66	139.63
Q Total (cfs)	5257.00	W.S. Elev (ft)	139.44	139.46
Q Bridge (cfs)	5257.00	Crit W.S. (ft)	129.22	127.06
Q Weir (cfs)		Max Chl Dpth (ft)	17.31	20.39
Weir Sta Lft (ft)		Vel Total (ft/s)	3.77	3.31
Weir Sta Rgt (ft)		Flow Area (sq ft)	1393.70	1586.12
Weir Submerg		Froude # Chl	0.18	0.15
Weir Max Depth (ft)		Specif Force (cu ft)	10983.55	14020.09
Min El Weir Flow (ft)	143.14	Hydr Depth (ft)	13.66	15.55
Min El Prs (ft)	140.53	W.P. Total (ft)	118.71	122.12
Delta EG (ft)	0.07	Conv. Total (cfs)	320511.3	380162.3
Delta WS (ft)	0.04	Top Width (ft)	102.00	102.00
BR Open Area (sq ft)	1474.76	Frctn Loss (ft)	0.01	0.00
BR Open Vel (ft/s)	3.77	C & E Loss (ft)	0.03	0.02
Coef of Q		Shear Total (lb/sq ft)	0.20	0.16
Br Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00

Uncontracted Section

Plan: Proposed Cobbosseecontee Main Reach RS: 1291.282 Profile: 100-year

E.G. Elev (ft)	139.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	139.01	Reach Len. (ft)	19.50	19.50	19.50
Crit W.S. (ft)	128.62	Flow Area (sq ft)	94.53	1363.73	167.92
E.G. Slope (ft/ft)	0.000147	Area (sq ft)	481.89	1363.73	1066.86
Q Total (cfs)	4407.00	Flow (cfs)	140.08	4041.11	225.82
Top Width (ft)	419.43	Top Width (ft)	108.15	96.52	214.77
Vel Total (ft/s)	2.71	Avg. Vel. (ft/s)	1.48	2.96	1.34
Max Chl Dpth (ft)	16.88	Hydr. Depth (ft)	8.37	14.13	7.24
Conv. Total (cfs)	362939.5	Conv. (cfs)	11536.1	332806.3	18597.1
Length Wtd. (ft)	19.50	Wetted Per. (ft)	11.36	98.95	23.34
Min Ch El (ft)	122.13	Shear (lb/sq ft)	0.08	0.13	0.07
Alpha	1.12	Stream Power (lb/ft s)	589.61	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	2.02	12.99	4.68
C & E Loss (ft)	0.01	Cum SA (acres)	0.38	0.81	0.94

Plan: Proposed Cobbosseecontee Main Reach RS: 1291.282 Profile: 500-year

E.G. Elev (ft)	139.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	139.52	Reach Len. (ft)	19.50	19.50	19.50
Crit W.S. (ft)	129.22	Flow Area (sq ft)	100.22	1412.38	179.61
E.G. Slope (ft/ft)	0.000185	Area (sq ft)	537.69	1412.38	1176.60
Q Total (cfs)	5257.00	Flow (cfs)	173.03	4800.89	283.08
Top Width (ft)	430.05	Top Width (ft)	112.87	96.52	220.65
Vel Total (ft/s)	3.11	Avg. Vel. (ft/s)	1.73	3.40	1.58
Max Chl Dpth (ft)	17.39	Hydr. Depth (ft)	8.88	14.63	7.75
Conv. Total (cfs)	386350.2	Conv. (cfs)	12716.7	352829.2	20804.3
Length Wtd. (ft)	19.50	Wetted Per. (ft)	11.36	98.95	23.34
Min Ch El (ft)	122.13	Shear (lb/sq ft)	0.10	0.16	0.09
Alpha	1.12	Stream Power (lb/ft s)	589.61	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	2.22	13.39	5.16
C & E Loss (ft)	0.02	Cum SA (acres)	0.40	0.81	0.98

APPENDIX H

Drawings