WIN. 23234.01
US 2/MAIN STREET (MATTAWAMKEAG BRIDGE) OVER MATTAWAMKEAG RIVER

MATTAWAMKEAG, MAINE

FINAL
HYDROLOGIC AND HYDRAULIC REPORT

July 2020

PREPARED FOR

MaineDOT
16 State House Station
Augusta, ME 04333

PREPARED BY

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HNTB

MATTAWAMKEAG BRIDGE (US 2) OVER MATTAWAMKEAG RIVER
WIN 23234.01

Mattawamkeag, Maine

Final Hydrologic and Hydraulic Report
July 2020

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STATE OF MAINE
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The following is a final report of the hydrologic and hydraulic analysis of the existing and proposed bridges at Mattawamkeag Bridge (Bridge No. 2522) over Mattawamkeag River in the town of Mattawamkeag in Penobscot County, Maine.

1.0 Introduction

The Mattawamkeag Bridge carries US Route 2 (N Main St) over the Mattawamkeag River. The existing bridge is a multi-span concrete tee beam bridge. The existing bridge was built in 1928 and reconstructed in 1963. The bridge serves approximately 2008 cars per day (2014). The bridge is located approximately 2,185 feet (0.45 miles) upstream of the confluence with Penobscot River.

The bridge spans over the Mattawamkeag River with a total length of approximately 357 feet from abutment to abutment and contains seven spans and six piers with a maximum span length of 47 feet. The existing structure features concrete abutments and piers. The existing structure runs perpendicular to the Mattawamkeag River. The low chord elevation (at the southern abutment) of the existing bridge is 204.90 feet at the center of the of the structure, with an average low chord of 205.45 feet. The existing structure has a hydraulic opening of approximately 6009 square feet.

The proposed structure is being constructed predominantly on the same alignment as the existing bridge. The proposed structure is a three-span bridge with a total span length of 387' from abutment to abutment. The proposed structure will also feature traditional abutments with sloping embankments. The proposed profile of the approach roadway is proposed to be raised by 0.5 feet on the southern side of the structure and approximately 0.59 feet on the northern side of the structure. The proposed structure will be perched with a vertical grade of 3.77% from the southern approach and a vertical grade of 3.46% from the northern roadway approach. The low chord elevation is proposed to be 204.30 feet at the southern abutment, a slight decrease of 0.60 feet from the existing structure. Although the lowest point is slightly reduced the average low chord of the proposed structure is 206.43 feet an increase of nearly a foot (0.98’) The proposed bridge provides a hydraulic opening of 7237 square feet. The increase in hydraulic area is due to the increased span length and increased average low chord elevation.

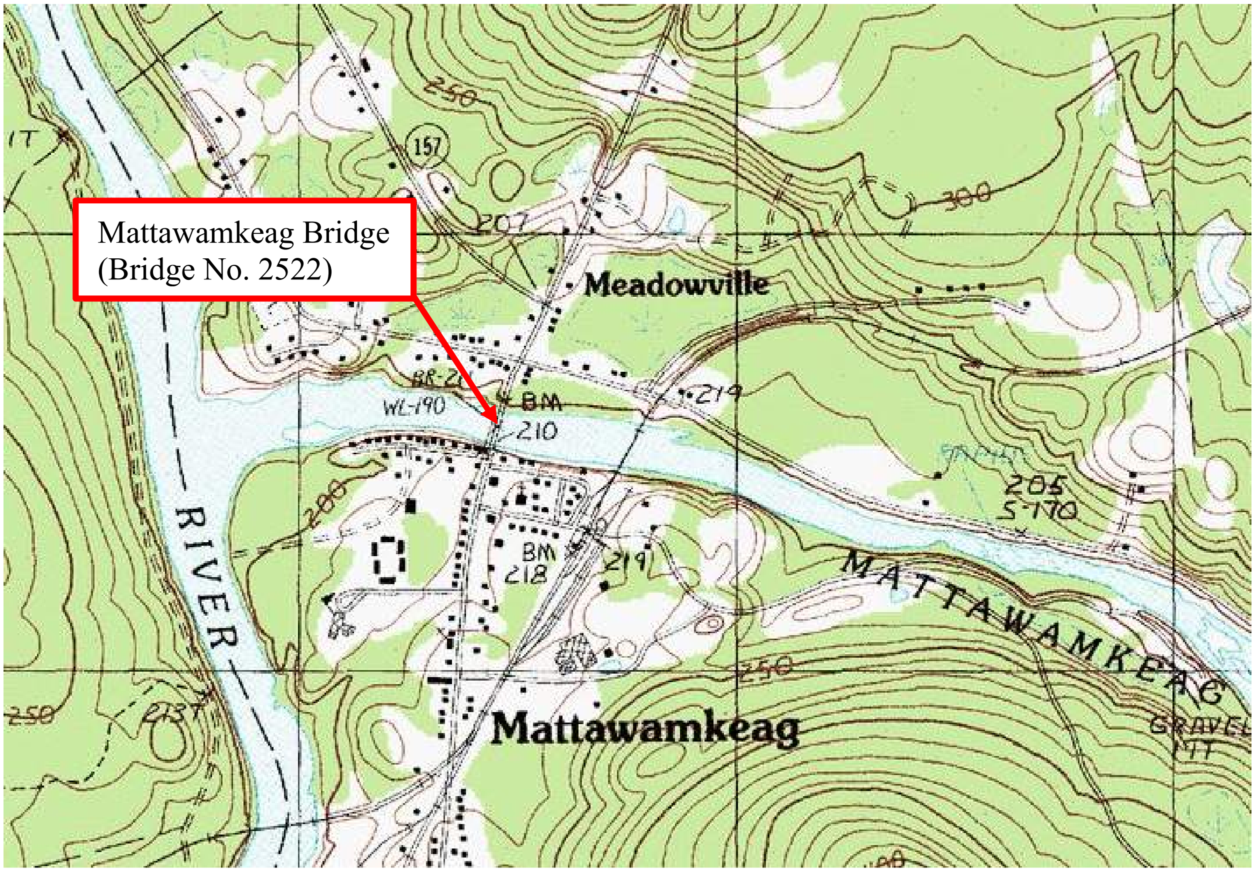


Figure 1 – Project Location Map (USGS Quadrangle – Mattawamkeag, ME)

The nearest bridge upstream from Mattawamkeag Bridge is a three-span rail bridge. The rail bridge is approximately 1,000 feet upstream. Approximately 2,185 feet downstream from Mattawamkeag Bridge is the Penobscot River. The Mattawamkeag Bridge gets backwater effects from the Penobscot River on its downstream side as displayed in the FEMA profile located in the **Appendix D.**

Figure 2 – Aerial image showing project site

2.0 Existing Data Review

- Site Photographs are provided in **Appendix A**.
- The FEMA Flood Insurance Rate Map (Effective May 4, 1988) has been provided in Appendix B. The map indicated that the project is in Zone AE with base flood elevations having been determined. The map also indicates the project is located within a floodway. The 100-year flood elevations downstream of the bridge are shown to be 201.5 feet and upstream is 201.7 feet.
- There is a USGS stream gage (#01030500) located approximately 4 miles upstream from the project site. The stream gage has a watershed area of 1418 sq. miles which is slightly smaller than the project watershed of 1508 sq. miles. The gage has 114 years of record through 2016 and has the largest recorded flow occurred in 1923 at 48,777 cfs. The project drainage area can be found in **Figure 3** of the report.
- Flows were calculated for Mattawamkeag River by adjusting the gage values for the difference in the project and gage watershed areas.

3.0 Hydrology

The peak flows recommended for design were based on the upstream USGS stream gage and adjusted to account for the difference in drainage area between the project area and the stream gage. Because the length of record is so long the regression estimates have little to no effect on the final site peak flow estimates. The final site area-weighted analysis provided flows that were slightly higher than the flows published in the FEMA Flood Insurance Study (FIS), however the difference is less than 5% for the 100-year flood event. These are the flows to be used for the hydraulic analysis at Mattawamkeag Bridge.

The calculated flows as well as the flows published in the FEMA Flood Insurance Study have been provided in **Table 1**. The hydrology report can be found in **Appendix C**.

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

Year Storm	**Calculated Flows (cfs)**	**FEMA FIS (cfs)**
Drainage Area	**1508 sq. mi.**	**1507 sq. mi.**
$Q_{1.1}$	**12,073**	---
Q_2	**17,407**	---
Q_5	**22,354**	---
Q_{10}	**25,554**	---
Q_{25}	**29,566**	---
Q_{50}	**32,533**	---
Q_{100}	**35,478**	**34,000**
Q_{500}	**42,421**	---

As mentioned earlier, the calculated flows by were used in the hydraulic analysis of Mattawamkeag Bridge. The hydrology report can be found in **Appendix C.**

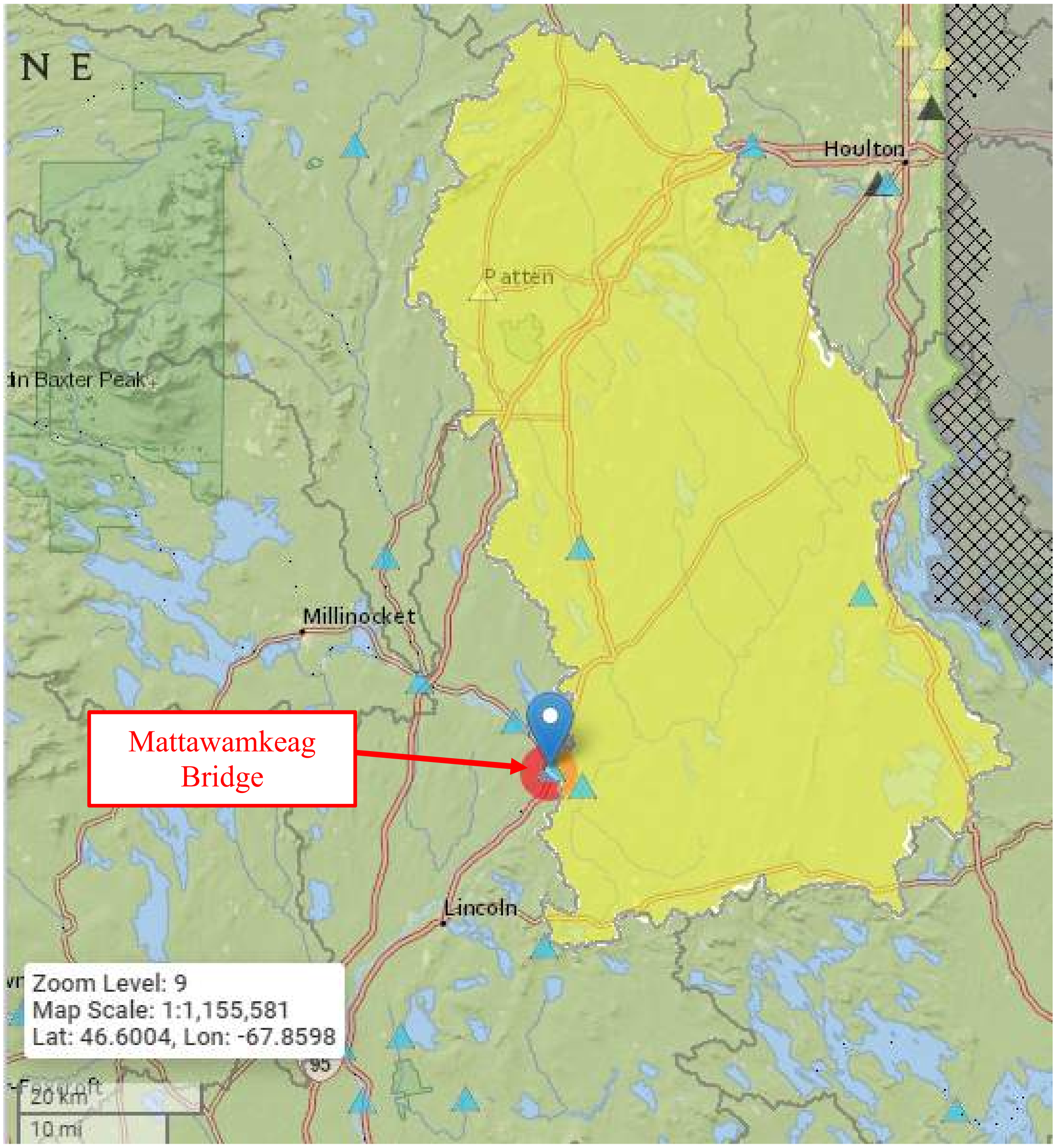


Figure 3 – Watershed above Mattawamkeag Bridge over Mattawamkeag River

4.0 Hydraulic Analysis

Hydraulic calculations for the existing and proposed conditions along the Mattawamkeag River were performed using the U.S. Army Corps of Engineers' software HEC-RAS, version 5.0.3 HEC-RAS supports one-dimensional, steady flow, water surface profiles calculations. Cross-sections were cut from survey gathered for this project.

The downstream boundary condition for the HEC-RAS model was set for one profile at a time, while the upstream boundary was set for all of the profiles based upon survey and iterations. The downstream boundary conditions for all events except for the 100-yr storm were set to a normal slope of 0.00065 ft/ft. The normal slope was derived from project survey and alternative iterations resulting in the normal slope of 0.00065 ft/ft. The downstream water surface for the 100-year storm event was pulled from the FEMA flood profile provided in the FEMA FIS report. With the known water surface elevation (201.5), the existing conditions analysis returned water surface elevations for the FEMA 100-yr flood event of 201.96 feet upstream of the bridge and 201.49 feet downstream of the bridge. The difference between the upstream water surface elevation for the HEC-RAS model and the known water surface elevation (201.95') from the FEMA FIS report water surface profile (201.7') is approximately 0.26 feet or about 3 inches. The difference between the downstream elevations in the model (201.49') and the FEMA FIS report profile (201.5') is 0.01 feet. Therefore, the boundary conditions have been deemed valid for this analysis.

The FEMA FIS report identified that the majority of flooding events for the Mattawamkeag River occur in the spring months due to the combination of heavy rains and snowmelt, and less frequently, hurricanes later in the year. Multiple floods of record were noted in the FEMA FIS report that caused significant flooding and in turn damage to bridges and other structures. The largest of these storms occurred in 1923 which the FEMA report estimates to be the 120-yr event. However, when comparing the flow (obtained from stream gage records) from this storm event to the peak flow values of the hydrology report, the 1923 flow is noticeably higher than the flows obtained from the Bulletin 17B method peak flow estimates. Due to the abnormality of this peak flow the 1923 Flood was not included for analysis in the model.

The model was run using "subcritical" flow due to Froude numbers are all below 1.0 for all cross sections along the reach. The model was run in "subcritical" flow in order to ensure that the model uses the downstream boundary conditions set by the FEMA FIS flood profiles and normal depth discussed above. The model covers approximately 140 feet upstream and downstream (280' total) of the existing structure.

The FEMA FIS also provided values for the Manning's n-values along the Mattawamkeag River. The values provided in the FIS were 0.030 to 0.035 for the channel and 0.05 for the overbank areas. These values were reviewed against the survey data, photographs and aerial images of the project area. It was determined that the appropriate Manning's n-values for the channel are 0.035 downstream and upstream of the bridge. The overbank areas throughout the project were set to 0.05. Additionally, due the proximity of houses within the floodplain, obstructions were used in the model to better analyze what impact the storm event may have on the surrounding area.

Ineffective flow areas were set upstream and downstream of the bridge based on contraction and expansion from the existing and proposed bridge in both existing and proposed models. These ineffective flow areas were set to the elevation of the low spot to the west of the bridge and to the roadway elevation on the east side of the bridge. Once these elevations are overtopped, the flow will become effective and the ineffective flow areas turn off.

The existing structure has a hydraulic opening of 6009 square feet. The existing model is run utilizing the energy and momentum equations for the low flow conditions. The high flow method was set to energy flow which indicates that the flood is running without any impact from the bridge structure low chord or roadway. The low flow method is also run under "momentum" due to the presence of piers in the model, however the HEC-RAS output resulted in only a valid answer using the energy equation. A coefficient of drag, C_D, was set for 1.60 for the pier shape (triangular nose, 90-degree angle).

The proposed structure is being constructed on the same alignment as the existing bridge and has a proposed hydraulic opening of 7237 square feet. The proposed model is run utilizing the energy and momentum equations for the low flow conditions as it was done for the existing conditions. The high flow method was set to energy flow which indicates that the flood is running without any impact from the bridge structure low chord or roadway. The proposed structure does include two piers with triangular noses with a given C_D (used in momentum equation) of 1.60, the same as the existing piers.

The Bridge Design Guide (BDG) states that bridges that are major riverine bridges must provide a minimum of 4 feet of freeboard over the 50-year event. In the proposed condition, the bridge provides 3.08 feet of clearance (Elev.=201.85') to the low chord (Elev.=204.30') of the structure and 5.16' of clearance from the 50-yr storm to the average low chord elevation (206.43') of the proposed structure. The proposed structure also passes the 500-yr storm (Elev.=202.82').

The proposed structure is able to pass all design storms due to the increase in span length and raised average low chord. These changes will safely pass all design storms as well as limit impacts to the surrounding area. As a result of the proposed structure (increased span length and increased profile), the water surface elevations upstream and downstream of the structure have been decreased for the all storm events.

Note that the proposed structure does show a small increase in velocity for all storm events upstream (and a few storm events downstream) of the structure, but these increases are minimal (0.08 ft/s maximum increase) and will not adversely impact any adjacent property owners upstream or downstream of the proposed structure.

Table 2 provides a summary of the hydraulic analysis of existing and proposed conditions at the Mattawamkeag Bridge over the Mattawamkeag River.

Table 2: Hydraulic Analysis Summary

Summary of Hydraulic Data-Mattawamkeag Bridge (US2/Main St) over the Mattawamkeag River	Existing Bridge	Proposed Bridge
Low Chord	204.90	204.30
Average Low Chord	205.45	206.43
Floodplain width at FEMA Q100, ft	491.13	494.69
Floodplain width at Q100, ft	491.68	495.08
Floodplain width at Q500, ft	507.28	509.43
Width at Banks, ft	291.93	291.93
Headwater at Upstream face of bridge, Q10, ft	199.47	199.33
Headwater at Upstream face of bridge, Q25, ft	200.61	200.44
Headwater at Upstream face of bridge, Q50, ft	201.40	201.22
Headwater at Upstream face of bridge, FEMA Q100, ft	201.96	201.82
Headwater at Upstream face of bridge, Q100, ft	202.00	201.85
Headwater at Upstream face of bridge, Q500, ft	202.99	202.82
Discharge Velocity at Q10, fps	5.30	5.32
Discharge Velocity at Q25, fps	5.68	5.70
Discharge Velocity at Q50, fps	5.94	5.97
Discharge Velocity at FEMA Q100, fps	6.01	6.00
Discharge Velocity at Q100, fps	6.25	6.25
Discharge Velocity at Q500, fps	7.06	7.06
Ordinary High Water Elevation (Q1.1) (US face), ft	194.78	194.73
Discharge Velocity at Q1.1, fps	3.66	3.68
Clearance at Q10, ft	5.43	4.97
Clearance at Q25, ft	4.29	3.86
Clearance at Q50, ft	3.50	3.08
Clearance at FEMA Q100, ft	2.94	2.48
Clearance at Q100, ft	2.90	2.45
Clearance at Q500, ft	1.91	1.48
Bridge Opening Area, ft^2	6008.75	7236.95
Flow area at FEMA Q100, ft^2	6076.60	6185.95
Flow area at Q100, ft^2	6093.28	6198.32
Flow area at Q500, ft^2	6458.12	6580.08

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 a need for more cross-sections. These warnings were reviewed and it was deemed that additional cross-sections were not needed for the 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 Mattawamkeag Bridge crossing. The D_{50} of the streambed material was measured to be approximately 12 mm or 0.03936 feet. This D_{50} was used to determine whether clear water or live bed scour analysis was to be performed. At the Mattawamkeag Bridge, live bed scour was required to be calculated. In addition, local scour was calculated per HEC-18 for the near and far abutments as well as the piers. From the scour analysis it was found that there was no live bed scour at the proposed project site, only local scour at the near and far abutments and piers.

The total scour depths can be found in **Table 3** and the scour analysis can be found in **Appendix G**.

Table 3: Scour Depths

	100 - year storm		
	Near Abutment	Pier	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00	0.00
Contraction/Expansion Scour (ft)	0.00	0.00	0.00
Local Scour (ft)	9.91	13.21	12.65
Pressure Flow Scour (ft)	0.00	0.00	0.00
TOTAL SCOUR (ft)	***9.91***	***13.21***	***12.65***

	500-year storm		
	Near Abutment	Pier	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00	0.00
Contraction/Expansion Scour (ft)	0.00	0.00	0.00
Local Scour (ft)	10.79	14.01	14.04
Pressure Flow Scour (ft)	0.00	0.00	0.00
TOTAL SCOUR (ft)	***10.79***	***14.01***	***14.04***

Note that local scour is known to be conservative and the calculations do not account for any proposed scour protection such as riprap.

6.0 Summary

In summary, the existing Mattawamkeag Bridge over Mattawamkeag River in Penobscot County is proposed to be replaced. The low chord of the existing structure is at 204.90 feet and no storm events (including the 500-yr storm event) impact the low chord of the structure. The existing structure offers approximately 6009 square feet of hydraulic opening.

The proposed bridge is designed to be on the existing alignment, while raising the average low chord elevation and lengthening the spans. The span length from abutment to abutment is proposed to be 387’ total while also reducing the number of piers from six to two. Increasing the span and raising the average low chord elevation increases the hydraulic opening to 7237 square feet. The structure passes all storm events and provides greater than 3 feet of freeboard (to the lowest point of the low chord at the southern abutment) from the 50-yr storm event and greater than 1 foot of freeboard from the 500-yr storm event.

The proposed structure and revised profile will improve the hydraulic conditions at the Mattawamkeag Bridge over Mattawamkeag River.

Appendix Contents

APPENDIX A

Site Photographs

Photo 1 – Eastern View of Existing Structure– Looking Downstream

Photo 2 – Western View of Existing Structure – Looking Upstream

Photo 3 – Main St/US 2– Looking North

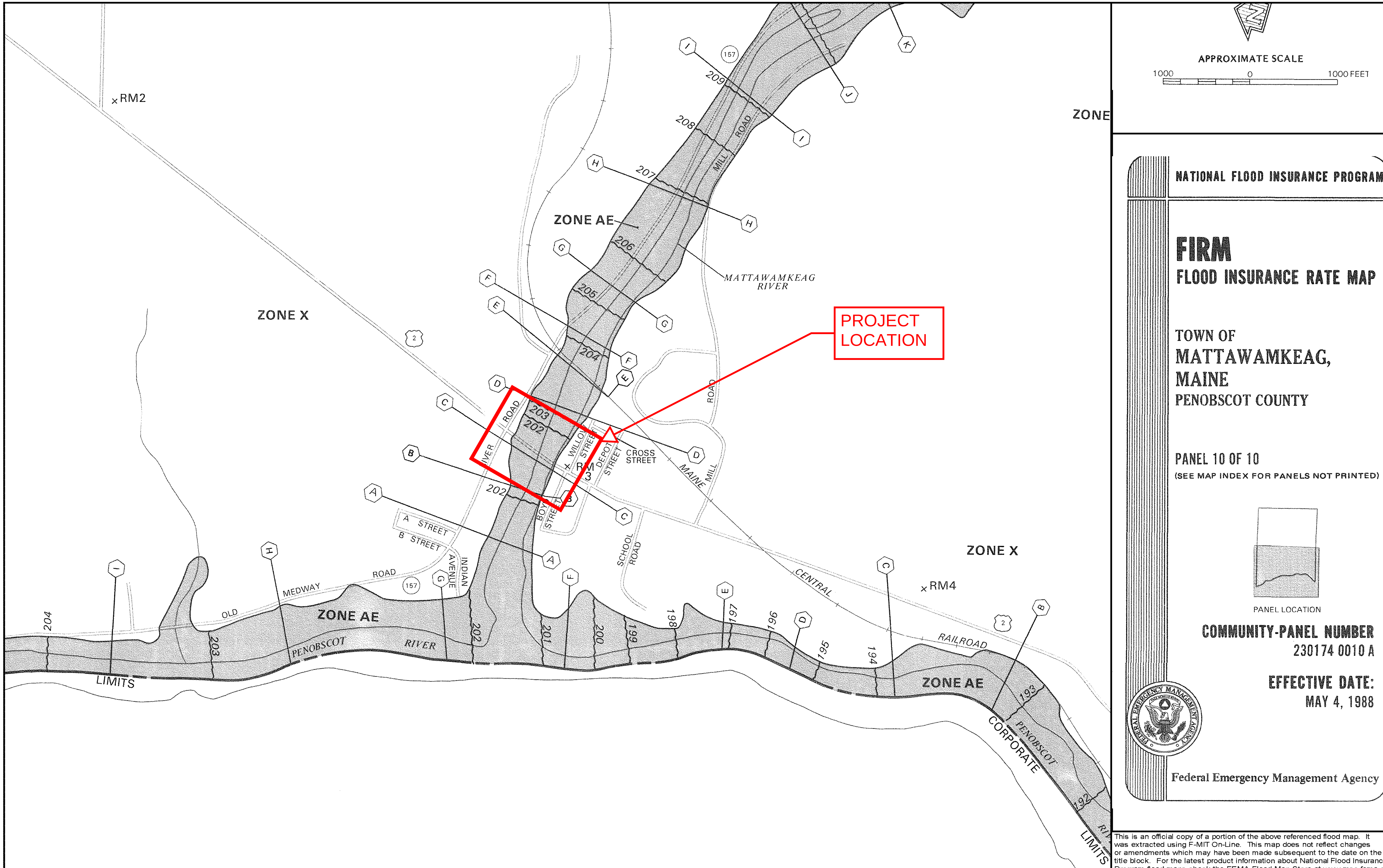
Photo 4 – Main St/ US 2 – Looking South

Photo 5 – View of the Downstream Side of Mattawamkeag River – Looking West

Photo 6 – View of the Upstream Side of Mattawamkeag River – Looking East

APPENDIX B

FEMA FIRM


APPROXIMATE SCALE
1000
0
1000 FEET
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
TOWN OF
MATTAWAMKEAG, MAINE
PENOBSCOT COUNTY
PANEL 10 OF 10
(SEE MAP INDEX FOR PANELS NOT PRINTED)
PANEL LOCATION
COMMUNITY-PANEL NUMBER
230174 0010 A
EFFECTIVE DATE:
MAY 4, 1988
Federal Emergency Management Agency
PROJECT LOCATION
ZONE X
ZONE AE
ZONE
MATTAWAMKEAG RIVER
PENOBSCOT RIVER
CORPORATE LIMITS
LIMITS
RM2
RM3
RM4
MILL ROAD
MAINE MILL ROAD
CENTRAL RAILROAD
OLD MEDWAY ROAD
A STREET
B STREET
INDIAN AVENUE
SCHOOL ROAD
CROSS STREET
DEPOT STREET
WILLOW STREET
BOYD STREET
RIVER ROAD
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX C

Hydrology Report

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: Brian Nichols

From: Charles Hebson

CC:

Date: 2017 September 18

Re: 23234 Mattawamkeag Bridge #2522 – Hydrology Report

Mattawamkeag Bridge carries US-2 over the Mattawamkeag River in Mattawamkeag, just upstream of the confluence with the Penobscot River. The project location and watershed are show in Figure 1. The final recommended design hydrology is summarized in Table 1 under "USGS Gage 17B Est." and Figure 2 (curve Scale-Adj 17B) below. There is a USGS gage (#01030500 Mattawamkeag River near Mattawamkeag, Maine) just upstream of the project with 114 years of record through 2016. The gage watershed (A_g = 1418 mi^2) is slightly smaller than the project watershed (A_{ws} = 1508 mi^2); all gage flows have been adjusted for the difference in watershed areas. Because the record length is so long, regression estimates are not used in the final recommended design values and the gage flows should serve as basis for design. The regression estimates are only reported for the sake of completeness. The Weibull plotting positions for the ranked gage flows are also reported. Since they agree so closely with the Bulletin 17B method estimates (as calculated with the USGS program PeakFQ), the 17B estimates are recommended for design. The area-adjusted maximum of record can be used as a check flow.

Discussion

MaineDOT design hydrology for larger structures is ordinarily calculated with statewide peak flow regression equations (Hodgkins, 1999). When the structure is on a gaged river, the regression and gage estimates are combined according to Hodgkins (1999). For long gage record lengths and for gages near the project site, the site regression estimates have relatively little effect on the final site estimates; the final site estimates mostly reflect area-weighted adjustments of the gage values. Since the Mattawamkeag gage record is so long (114 years), the regression estimates will not be used in developing design peak flow estimates. The only adjustments to the gage values will be for the difference between the project and gage watershed areas.

Mattawamkeag Bridge is located in Mattawamkeag and carries US-2 over the Mattawamkeag River. The watershed map is shown in Figure 2. The ungaged watershed area at the bridge (A_u) is 1508 mi^2 with 18.2% wetlands as determined by StreamStats (U.S. Geological Survey, 2012).

For this project, there is a gage (#01030500) on the Mattawamkeag River approximately 4 miles upstream of the project bridge, just upstream of Gordon Falls and downstream of Little Gordon Brook. The time series for annual maximum flows is shown in Figure 3. The maximum of record in 1923 is noticeably larger than the other flows in the series. The gage flood frequency analysis as executed with PeakFQ is shown in Figure 4. Again, the maximum of record appears to be outside the regular behavior of the rest of the data set. Both of these graphs show gage data unadjusted for the project watershed area.

The project watershed (1508 mi^2) is 1.063 times larger than the gage watershed area A_g (1418 mi^2). Thus we can expect the project design hydrology to be just a bit larger than the gage data. Adjustment for the difference between gage (A_g) and ungaged project (A_u) watershed areas is

$Q_u = Q_g(A_u/A_g)^a$

where a = exponent from simple area-only regression equations (Hodgkins, 1999); see also Figure 5.

This relation shows that are adjustment is not a simple linear scaling. Since a < 1, linear scaling by area would produce a larger, more conservative adjusted flow.

As noted, the gage record is so long (114 years, 1903 - 2016) that the regression estimates add little or nothing to estimates based on gage data alone and so have been excluded from the final determination of peak flow estimates for design.

References:

Hodgkins, 1999. Estimating the Magnitude of Peak Flows for Stream in Maine for Selected Recurrence Intervals, US Geological Survey, *WRIR 99-4408*.

Flynn, K., W.H. Kirby, & P.R. Hummel, 2006. User's Manual for Program PeakFQ, Annual Flood Frequency Analysis Using Bulletin 17B Guidelines. US Geological Survey, *Techniques & Methods 4-B4*.

U.S. Geological Survey, 2012. The StreamStats program, online at https://streamstatsags.cr.usgs.gov/streamstats/

Table 1. Design Hydrology Summary

Area (mi^2)			1508	1418	
NWI (%)			18.23	--	
Return Period T	**Exceedance Prob P_{ex}**	**Area exponent "a"**	**Site Regression Q_r**	***** USGS Gage 17B Est. Q_g *****	**Empirical Weibull PP**
1.005	0.995	0.860		***7798***	
1.01	0.990	0.860	6373	***9087***	7079
1.05	0.952	0.856	7936	***10928***	10695
1.1	0.909	0.852	8863	***12073***	11266
1.5	0.667	0.836	11961	***15356***	15472
2	0.500	0.825	13796	***17407***	17828
5	0.200	0.797	18235	***22354***	21945
10	0.100	0.783	21097	***25554***	25092
25	0.040	0.767	24646	***29566***	27899
50	0.020	0.757	27034	***32533***	29471
100	0.010	0.748	29827	***35478***	44959
500	0.002	0.729	35813	***42421***	
Max of Record - 1923				***48777***	*48777*

Figure 1. Mattawamkeag River at US-2 in Mattawamkeag, ME

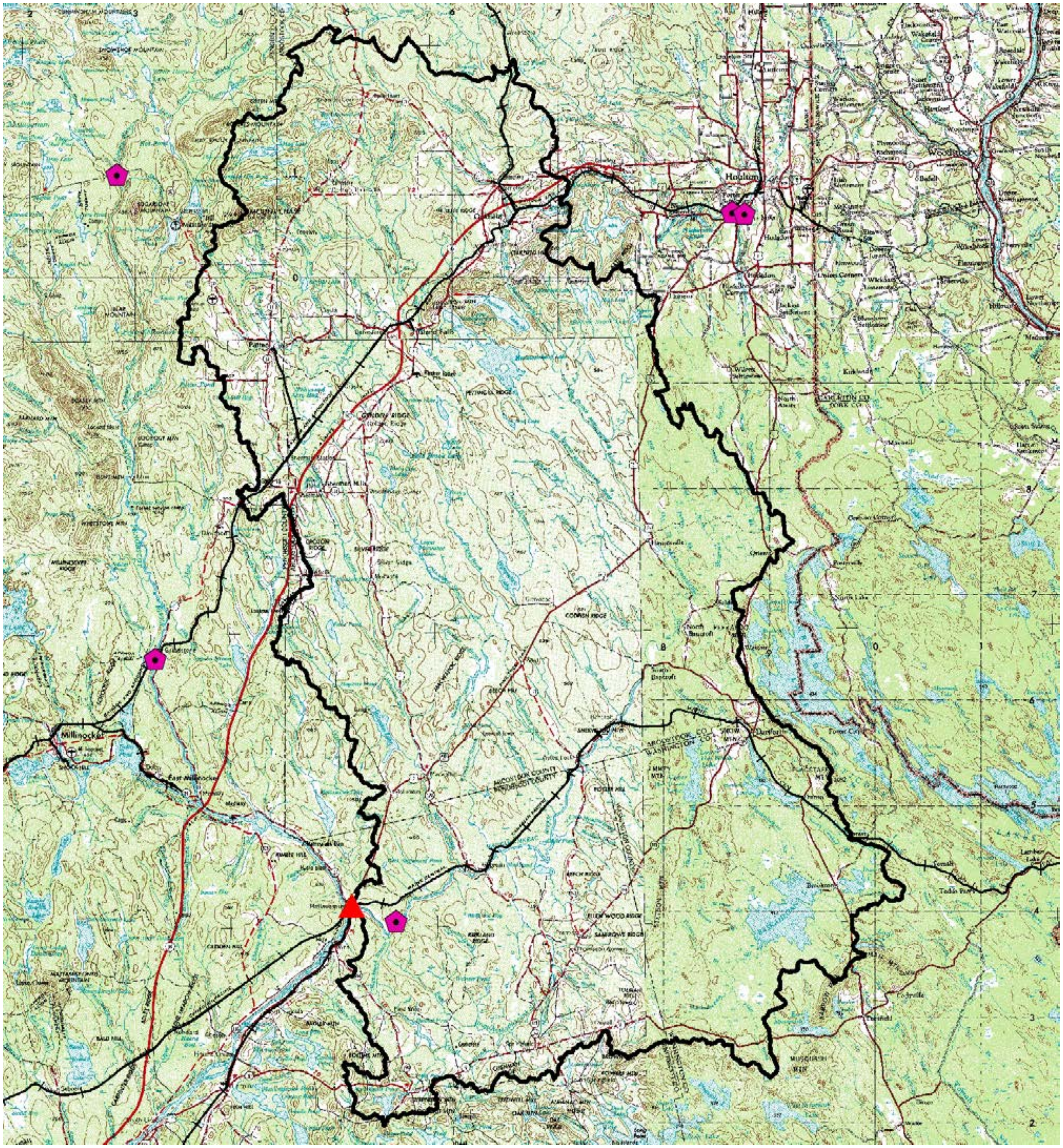


Figure 2. Probability Plot – Regression & Area-Adjusted Gage Flows

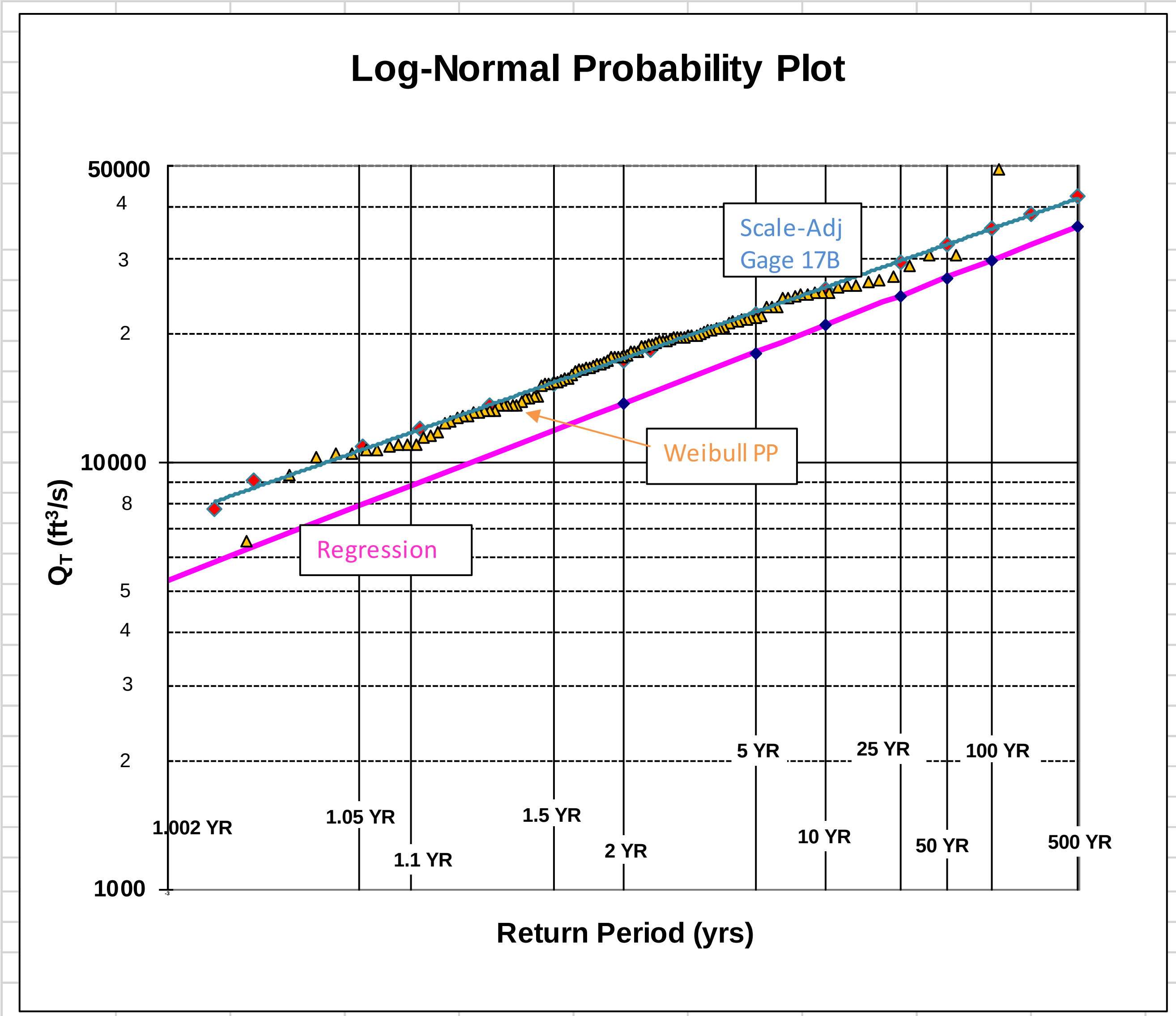


Figure 3. Annual maximum flows at Mattawamkeag gage (not adjusted for area)

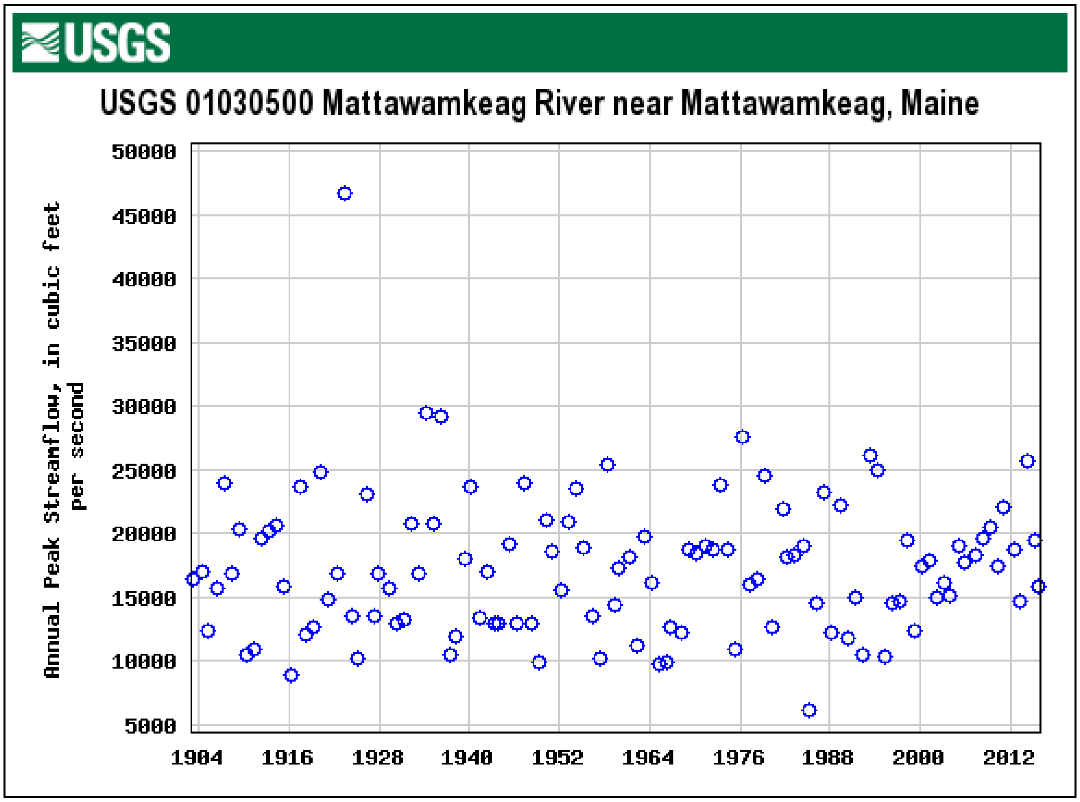


Figure 4. Results of gage peak flow analysis from PeakFQ (not adjusted for area)

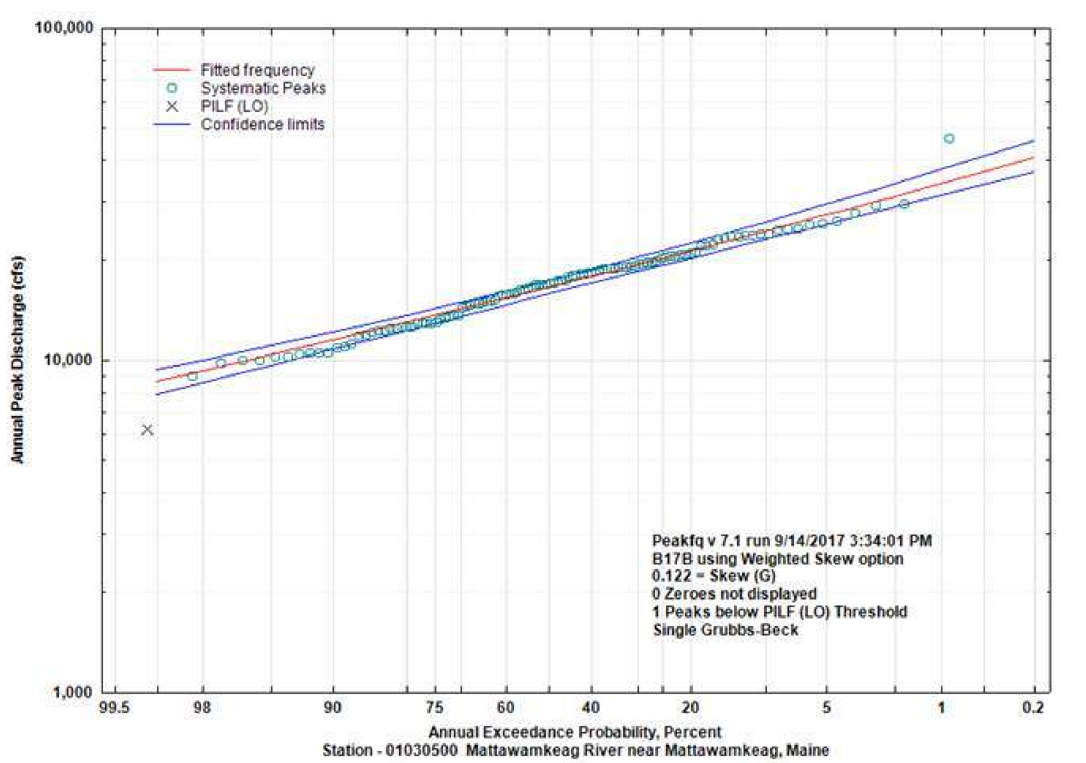
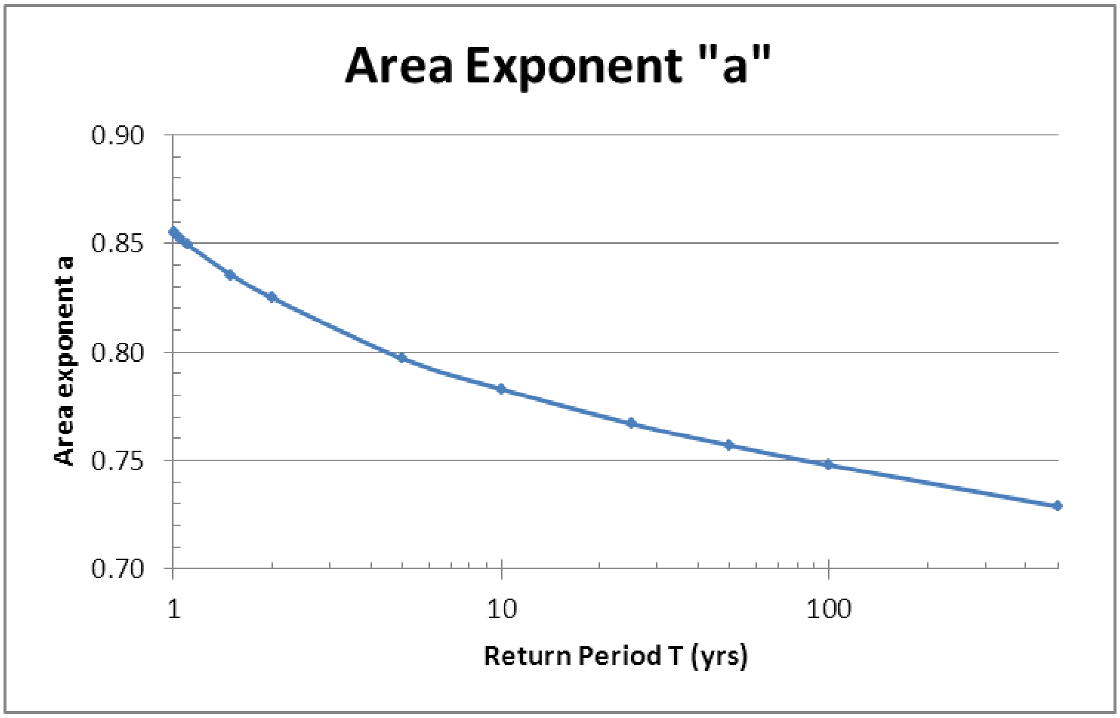


Figure 5. Area Exponent "a" for Watershed Area Scaling of Gage Peak Flow Estimates



Appendix A:

Edited Output for Mattawamkeag River Gage - Mattawamkeag from USGS Program PeakFQ

```
Program PeakFq           U. S. GEOLOGICAL SURVEY            Seq.002.000
Version 7.1        Annual peak flow frequency analysis      Run Date / Time
3/14/2014                                                   09/14/2017 15:33

                      --- PROCESSING OPTIONS ---

                   Plot option         = None
                   Basin char output   = WATSTORE
                   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\MATTA-PEAK-Q.TXT
                      specifications - C:\ProgFils\PeakFQ\data\PKFQWPSF.TMP
                   Output file(s):
                      main - C:\ProgFils\PeakFQ\data\MATTA-PEAK-Q.PRT
                      bcd  - C:\ProgFils\PeakFQ\data\MATTA-PEAK-Q.BCD
```

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

Number of peaks in record	=	114
Peaks not used in analysis	=	0
Systematic peaks in analysis	=	114
Historic peaks in analysis	=	0
Beginning Year	=	1903
Ending Year	=	2016
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

********* 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.	1	6487.4
WCF162I-SYSTEMATIC PEAKS EXCEEDED HIGH-OUTLIER CRITERION.	1	42230.3

Kendall's Tau Parameters

	TAU	P-VALUE	MEDIAN SLOPE	No. of PEAKS
SYSTEMATIC RECORD	0.053	0.408	13.592	114

ANNUAL FREQUENCY CURVE PARAMETERS -- LOG-PEARSON TYPE III

	FLOOD BASE		LOGARITHMIC		
	DISCHARGE	EXCEEDANCE PROBABILITY	MEAN	STANDARD DEVIATION	SKEW
SYSTEMATIC RECORD	0.0	1.0000	4.2190	0.1330	-0.059
BULL.17B ESTIMATE	6487.4	0.9912	4.2213	0.1278	0.122

BULL.17B ESTIMATE OF MSE OF AT-SITE SKEW 0.0550

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		7398.	--	--	--
0.9900	8621.	8015.	----	7848.0	9321.0
0.9500	10370.	9956.	----	9615.0	11050.0
0.9000	11460.	11160.	----	10730.0	12140.0
0.8000	12970.	12810.	----	12260.0	13640.0
0.6667	14590.	14550.	----	13890.0	15290.0
0.5000	16550.	16610.	----	15810.0	17320.0
0.4292	17440.	17540.	----	16670.0	18270.0
0.2000	21290.	21450.	----	20240.0	22510.0
0.1000	24360.	24470.	----	23000.0	26040.0
0.0400	28210.	28130.	----	26360.0	30570.0
0.0200	31060.	30760.	----	28810.0	33990.0
0.0100	33890.	33320.	----	31210.0	37450.0
0.0050	36750.	35840.	----	33610.0	40960.0
0.0020	40570.	39120.	----	36790.0	45720.0

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

Water Year	Peak Value	Water Year	Peak Value	Water Year	Peak Value	Water Year	Peak Value	Water Year	Peak Value
1903	16400	1926	23100	1949	9950	1972	18800	1995	10400
1904	17000	1927	13500	1950	21100	1973	23800	1996	14500
1905	12400	1928	16900	1951	18600	1974	18800	1997	14700
1906	15700	1929	15700	1952	15500	1975	11000	1998	19400
1907	24000	1930	13000	1953	20900	1976	27600	1999	12400
1908	16800	1931	13200	1954	23500	1977	16000	2000	17400
1909	20400	1932	20700	1955	18900	1978	16500	2001	17900
1910	10500	1933	16800	1956	13600	1979	24600	2002	15000
1911	10900	1934	29400	1957	10200	1980	12600	2003	16200
1912	19600	1935	20800	1958	25400	1981	22000	2004	15200
1913	20200	1936	29200	1959	14400	1982	18100	2005	19100
1914	20600	1937	10500	1960	17300	1983	18300	2006	17800
1915	15800	1938	11900	1961	18200	1984	19000	2007	18300
1916	8920	1939	18000	1962	11200	1985	6190	2008	19600
1917	23700	1940	23600	1963	19800	1986	14600	2009	20500
1918	12100	1941	13400	1964	16200	1987	23300	2010	17400
1919	12600	1942	17000	1965	9790	1988	12200	2011	22100
1920	24800	1943	12900	1966	9930	1989	22200	2012	18700
1921	14900	1944	12900	1967	12600	1990	11800	2013	14700
1922	16900	1945	19200	1968	12200	1991	15000	2014	25700
1923	46600	1946	12900	1969	18700	1992	10500	2015	19400
1924	13600	1947	23900	1970	18400	1993	26100	2016	15900
1925	10200	1948	12900	1971	19000	1994	24900		

EMPIRICAL FREQUENCY CURVES -- WEIBULL PLOTTING POSITIONS

Note: Systematic Record = 17B Estimate

Water Year	Ranked Discharge	Systematic Record	Water Year	Ranked Discharge	Systematic Record
1923	46600	0.0087	1922	16900	0.5043
1934	29400	0.0174	1928	16900	0.513
1936	29200	0.0261	1908	16800	0.5217
1976	27600	0.0348	1933	16800	0.5304
1993	26100	0.0435	1978	16500	0.5391
2014	25700	0.0522	1903	16400	0.5478
1958	25400	0.0609	1964	16200	0.5565
1994	24900	0.0696	2003	16200	0.5652
1920	24800	0.0783	1977	16000	0.5739
1979	24600	0.087	2016	15900	0.5826
1907	24000	0.0957	1915	15800	0.5913
1947	23900	0.1043	1906	15700	0.6
1973	23800	0.113	1929	15700	0.6087
1917	23700	0.1217	1952	15500	0.6174
1940	23600	0.1304	2004	15200	0.6261
1954	23500	0.1391	1991	15000	0.6348
1987	23300	0.1478	2002	15000	0.6435
1926	23100	0.1565	1921	14900	0.6522
1989	22200	0.1652	1997	14700	0.6609
2011	22100	0.1739	2013	14700	0.6696
1981	22000	0.1826	1986	14600	0.6783
1950	21100	0.1913	1996	14500	0.687
1953	20900	0.2	1959	14400	0.6957
1935	20800	0.2087	1924	13600	0.7043
1932	20700	0.2174	1956	13600	0.713
1914	20600	0.2261	1927	13500	0.7217
2009	20500	0.2348	1941	13400	0.7304
1909	20400	0.2435	1931	13200	0.7391
1913	20200	0.2522	1930	13000	0.7478
1963	19800	0.2609	1943	12900	0.7565
1912	19600	0.2696	1944	12900	0.7652
2008	19600	0.2783	1946	12900	0.7739
1998	19400	0.287	1948	12900	0.7826
2015	19400	0.2957	1919	12600	0.7913
1945	19200	0.3043	1967	12600	0.8

2005	19100	0.313	1980	12600	0.8087
1971	19000	0.3217	1905	12400	0.8174
1984	19000	0.3304	1999	12400	0.8261
1955	18900	0.3391	1968	12200	0.8348
1972	18800	0.3478	1988	12200	0.8435
1974	18800	0.3565	1918	12100	0.8522
1969	18700	0.3652	1938	11900	0.8609
2012	18700	0.3739	1990	11800	0.8696
1951	18600	0.3826	1962	11200	0.8783
1970	18400	0.3913	1975	11000	0.887
1983	18300	0.4	1911	10900	0.8957
2007	18300	0.4087	1910	10500	0.9043
1961	18200	0.4174	1937	10500	0.913
1982	18100	0.4261	1992	10500	0.9217
1939	18000	0.4348	1995	10400	0.9304
2001	17900	0.4435	1925	10200	0.9391
2006	17800	0.4522	1957	10200	0.9478
2000	17400	0.4609	1949	9950	0.9565
2010	17400	0.4696	1966	9930	0.9652
1960	17300	0.4783	1965	9790	0.9739
1904	17000	0.487	1916	8920	0.9826
1942	17000	0.4957	1985	6190	0.9913

End PeakFQ analysis.

Stations processed : 1

Number of errors : 0

Stations skipped : 0

Station years : 114

FINISHED PROCESSING STATION: 01030500 USGS Mattawamkeag River near Matta

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Appendix B:

Regression Report with StreamStats Output for Mattawamkeag Bridge

WIN:	23234.00		**Project Name:**	Mattawamkeag Br 2522
Town:	Mattawamkeag		**Stream Name:**	Mattawamkeag River
Route No.	US 2		**Bridge Name:**	Mattawamkeag Bridge
Asset ID:	2522		**Analysis by:**	DFB
Lat:	45.5187	**Long:** -68.35352	**Date:**	9/11/2017

Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999 & Lombard/Hodgkins, 2015)

Enter data in blue cells only!

	km^2	mi^2	ac	*Enter data in [mi^2]*
A	3904.43	1507.50	964800.0	Watershed Area *DRNAREA*
W	711.78	274.8	175883.0	Wetlands area (by NWI)
P_c	565613	5070190		watershed centroid (E, N; UTM 19N; meters)
County	Penobscot N			*choose county from drop-down menu*
pptA	41.5			mean annual precipitation (inches; by look-up)
SG	0.02			sand & gravel aquifer as decimal fraction of watershed A

A (km^2)	3904.43	**Conf Lvl**	0.67	
W (%)	18.23			NWI Wetlands % *STORNWI*

Worksheet prepared by:
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Maine Dept. Transportation
Augusta, ME 04333-0016
207-557-1052
Charles.Hebson@maine.gov

ver. 2017 Jun. 09

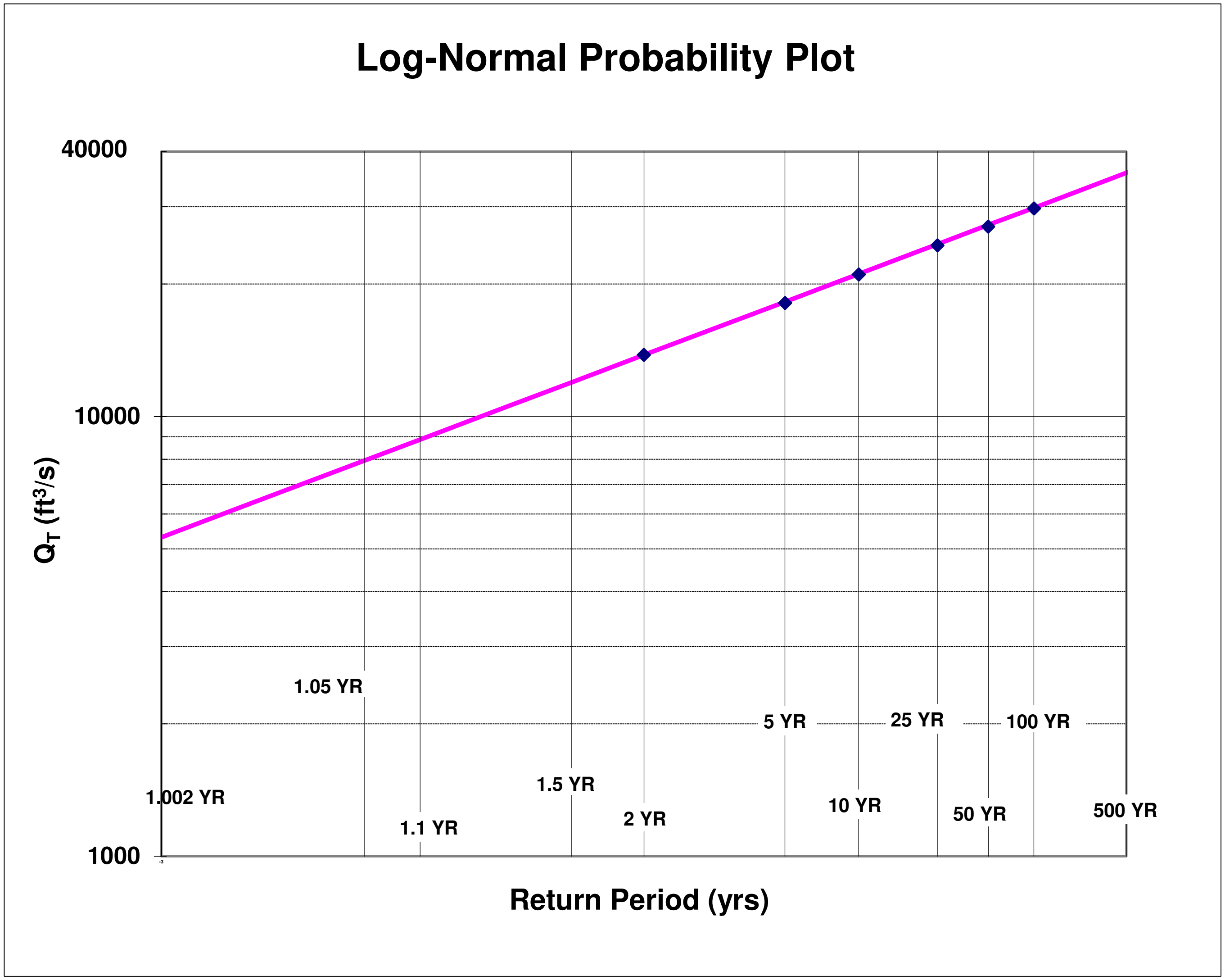
Ret Pd T (yr)	Peak Flow Estimate Lower	Q_T (m^3/s)	Upper	Q_T (ft^3/s)
1.1		251.15		8868.2
2		390.96		13804.8
5		513.49		18131.4
10		595.74		21035.6
25		694.11		24508.9
50		766.11		27051.4
100		841.83		29725.0
500		1014.85		35834.3

References:

Hodgkins, G.A., 1999.
Estimating the magnitude of peak flows for streams in Maine for selected recurrence intervals
WRIR 99-4008, USGS Augusta, ME

Lombard, P.J. & G.A. Hodgkins, 2015.
Peak flow regression equations for small, ungaged streams in Maine - Comparing map-based to field-based variables
SIR 2015-4059, USGS, Augusta, ME

$Q_T = b \times A^a \times 10^{-wW}$



Log-Normal Probability Plot
40000
10000
1000
Q_T (ft³/s)
1.002 YR
1.05 YR
1.1 YR
1.5 YR
2 YR
5 YR
10 YR
25 YR
50 YR
100 YR
500 YR
Return Period (yrs)

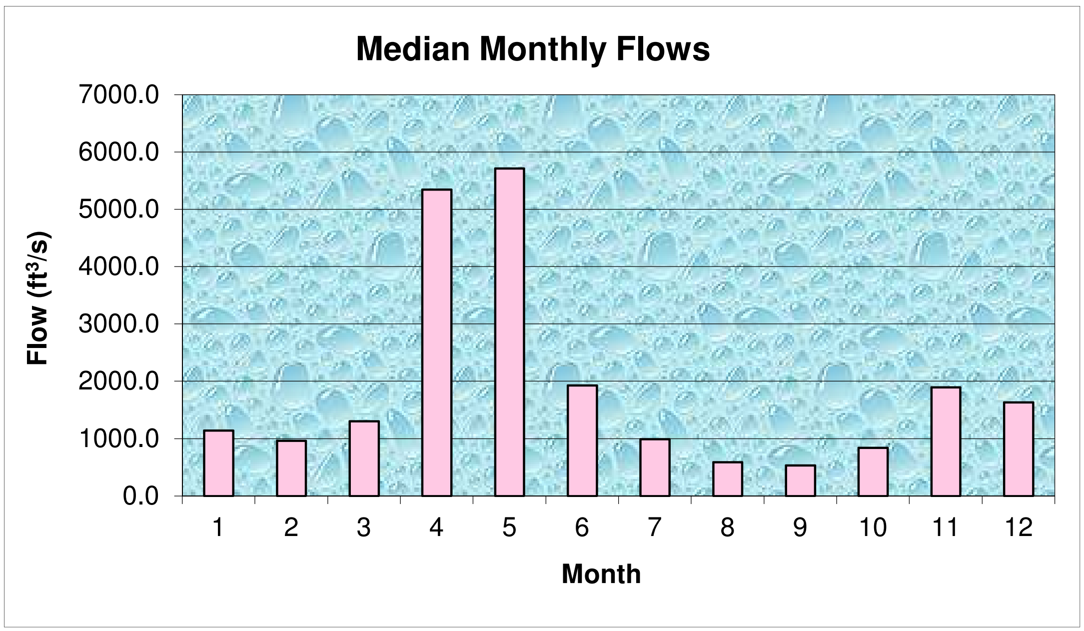
WIN:	23234.00	**Project Name:**	Mattawamkeag Br 2522
Town:	Mattawamkeag	**Stream Name:**	Mattawamkeag River
Route No.	US 2	**Bridge Name:**	Mattawamkeag Bridge
Asset ID:	2522	**Analysis by:**	DFB
Lat:	45.51871 **Long:** -68.35352	**Date:**	9/11/2017

DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED

MAINE MONTHLY MEDIAN FLOWS and HYDRAULIC GEOMETRY BY USGS REGRESSION EQUATIONS (2004, 2013)

	Value	Variable	Explanation
	1507.50	*A*	Area (mi^2)
565613.4	5070190	P_c	Watershed centroid (E,N; UTM; Zone 19; meters)
	108.36	*DIST*	Distance from Coastal reference line (mi)
	41.5	*pptA*	Mean Annual Precipitation (inches)
	0.02	*SG*	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q_{median} (ft3/s)	(m^3/s)
Jan	**1143.61**	32.4083
Feb	**963.86**	27.3146
Mar	**1304.24**	36.9604
Apr	**5346.45**	151.5110
May	**5716.30**	161.9919
Jun	**1929.75**	54.6864
Jul	**989.59**	28.0437
Aug	**587.49**	16.6487
Sep	**534.53**	15.1478
Oct	**839.26**	23.7835
Nov	**1896.89**	53.7551
Dec	**1635.11**	46.3367



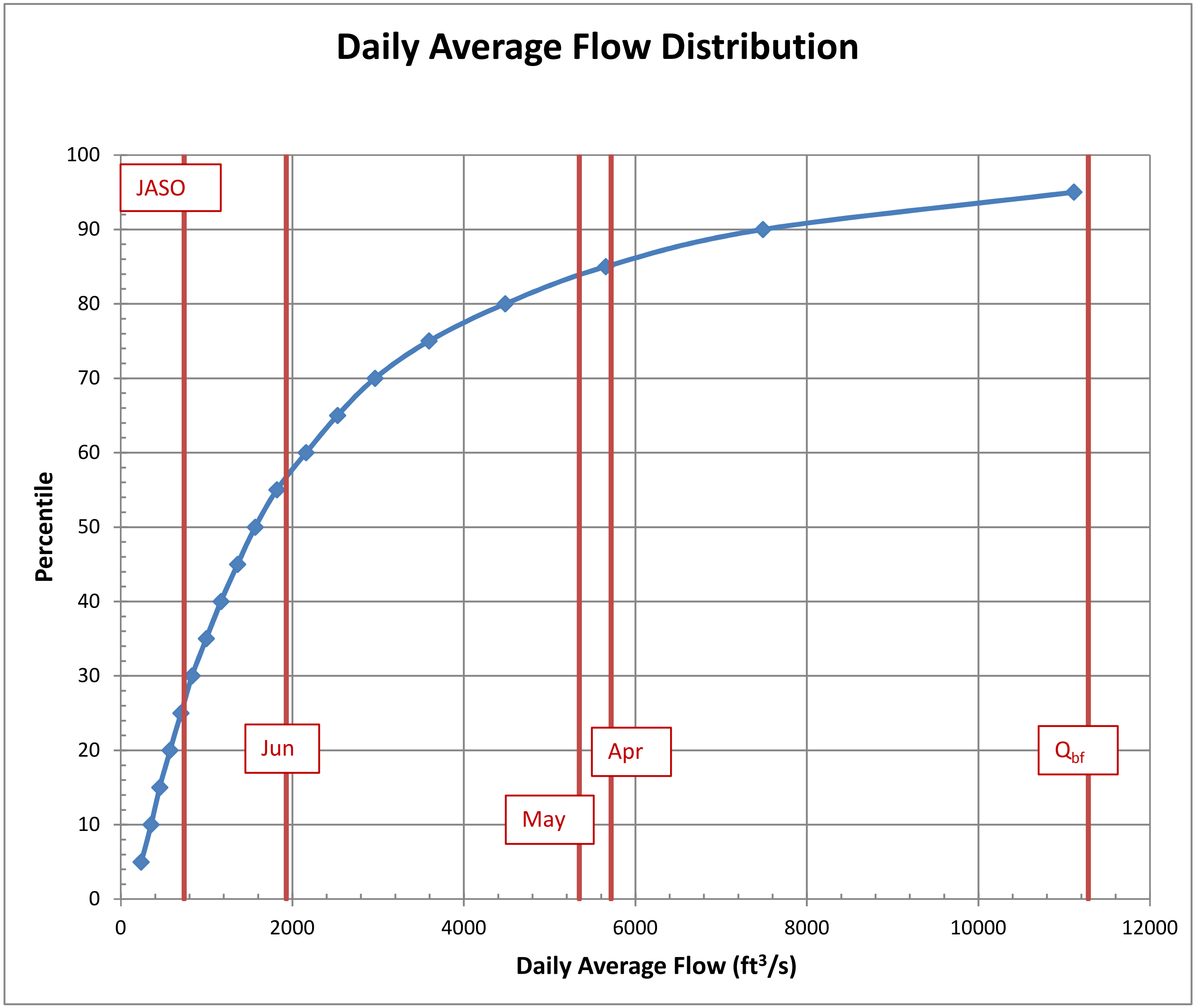
Q_{bf}	**11280.7**	
ann avg	**2814.2**	
ann med	**1469.3**	
$Q_{1.002}$	**5313.3**	
$Q_{1.01}$	**6373.1**	
$Q_{1.05}$	**7935.9**	
Q_{bf}	**7040.3**	assume v = 4ft/s

W_{bf}	**246.1**	estimated bankfull width (ft)
d_{bf}	**7.2**	estimated bankfull depth (ft)
A_{bf}	**2462.1**	estimated bankfull flow area (ft^2)

References

Dudley, R.W., 2013. FY2013 Progress Report - Phase 1 …, USFWS QRP Project

Dudley, R.W., 2004. Estimating Monthly Streamflows … , SIR 2004-5026



Daily Avg Flow Dist

A_{ws} = (mi^2) 1507.5

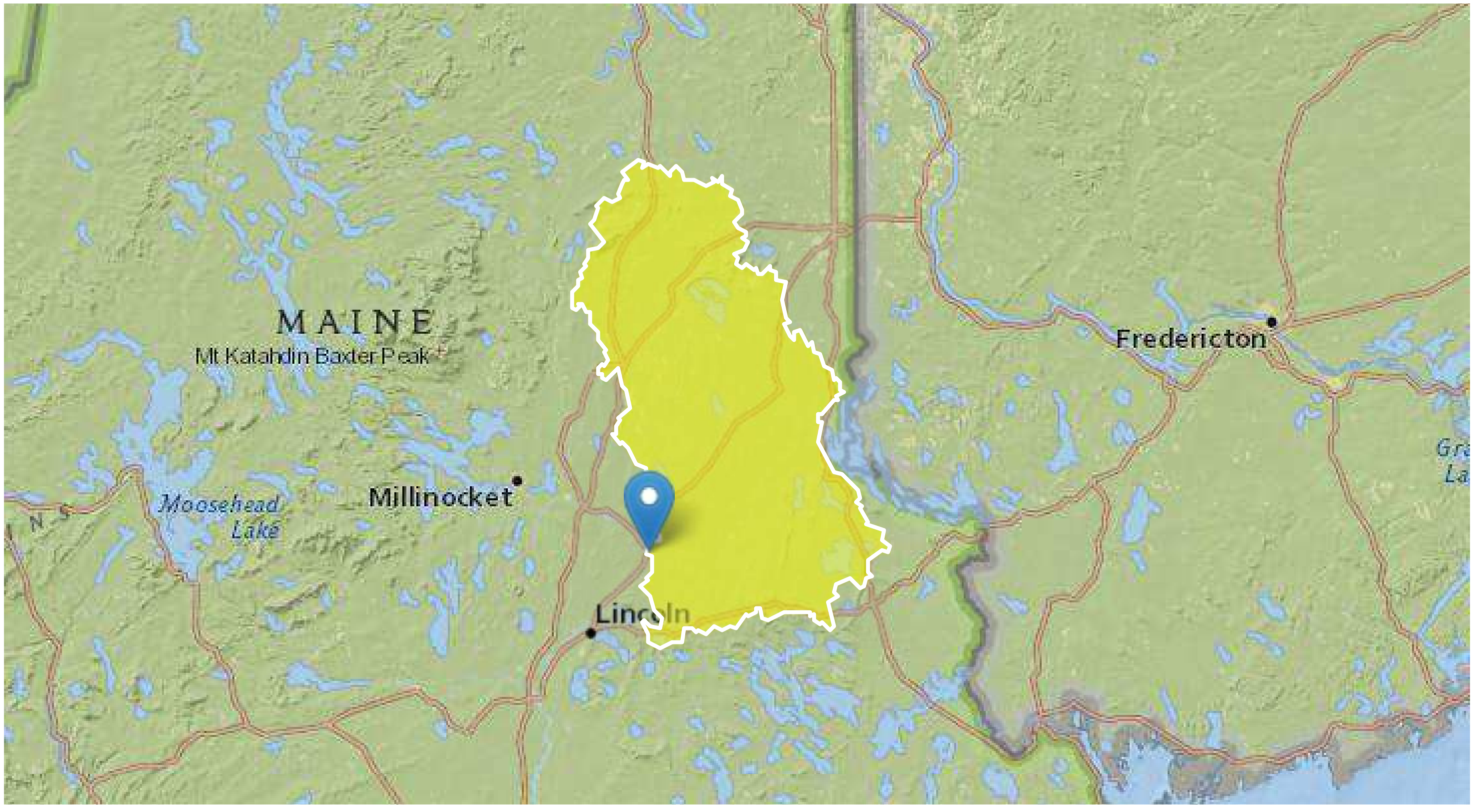
Q (ft^3/s)

Pctl	Median	84th pctl
5	237.30	381.89
10	352.46	529.96
15	453.04	661.74
20	573.74	802.50
25	701.87	940.71
30	830.57	1071.40
35	995.06	1224.51
40	1166.89	1408.18
45	1360.15	1592.21
50	1565.92	1879.74
55	1818.50	2187.83
60	2159.70	2568.20
65	2526.64	2992.04
70	2963.67	3490.78
75	3592.77	4197.82
80	4480.59	5011.96
85	5653.51	6422.79
90	7488.98	8624.42
95	11114.39	13411.69

Q_{bf}	11280.7
$Q_{1.002}$	5313.3
$Q_{1.1}$	8868.2
Q_2	13804.8

Mattawamkeag 23234 Mattawamkeag Bridge 2522

Region ID: ME
Workspace ID: ME20170911095234565000
Clicked Point (Latitude, Longitude): 45.51871, -68.35352
Time: 2017-09-11 09:53:39 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1507.5	square miles
STORNWI	Percentage of strorage (combined water bodies and wetlands) from the Nationa Wetlands Inventory	18.23	percent

Parameter Code	Parameter Description	Value	Unit
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0.021	dimensionless
ELEV	Mean Basin Elevation	555.4	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	4.56	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	565613.39	
CENTROIDY	Basin centroid vertical (y) location in state plane units	5070189.97	
COASTDIST	Shortest distance from the coastline to the basin centroid	110	miles
ELEVMAX	Maximum basin elevation	2435.7	feet
LC06WATER	Percent of open water, class 11, from NLCD 2006	2.59	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	1.84	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.24	percent
PRECIP	Mean Annual Precipitation	42.3	inches
SANDGRAVAP	Percentage of land surface underlain by sand and gravel aquifers	2.06	percent
STATSGOA	Percentage of area of Hydrologic Soil Type A from STATSGO	2.81	percent

Peak-Flow Statistics Parameters [Statewide Peak Flow Full GT 12sqmi WRI 99 4008]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1507.5	square miles	0.93	1653
STORNWI	Percentage of Storage from NWI	18.23	percent	0.7	26.7

Peak-Flow Statistics Flow Report [Statewide Peak Flow Full GT 12sqmi WRI 99 4008]

PII: Prediction Interval-Lower, Plu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PII	Plu	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	13800	ft^3/s	7650	24900	35.1	35.1	1.8
5 Year Peak Flood	18100	ft^3/s	9960	33000	36.1	36.1	2.5
10 Year Peak Flood	21000	ft^3/s	11400	38800	36.8	36.8	3.2
25 Year Peak Flood	24500	ft^3/s	13000	46400	38.6	38.6	4.1
50 Year Peak Flood	27100	ft^3/s	14000	52200	39.9	39.9	4.8

Statistic	Value	Unit	Pll	Plu	SE	SEp	Equiv. Yrs.
100 Year Peak Flood	29700	ft^3/s	15100	58600	41.2	41.2	5.4
500 Year Peak Flood	35800	ft^3/s	17200	74700	44.9	44.9	6.4

Peak-Flow Statistics Citations

Hodgkins, G. A.,1999, Estimating the Magnitude of Peak Flows for Streams in Maine for Selected Recurrence Intervals: U.S. Geological Survey Water-Resources Investigations Report 99-4008, 45 p. (http://me.water.usgs.gov/99-4008.pdf)

Low-Flow Statistics Parameters [Statewide LowFlow SIR 2004 5026]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1507.5	square miles	9.79	1418
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.021	dimensionless	0	0.455

Low-Flow Statistics Disclaimers [Statewide LowFlow SIR 2004 5026]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Low-Flow Statistics Flow Report [Statewide LowFlow SIR 2004 5026]

Statistic	Value	Unit
7 Day 10 Year Low Flow	139	ft^3/s

Low-Flow Statistics Citations

Dudley, R.W.,2004, Estimating Monthly, Annual, and Low 7-Day, 10-Year Streamflows for Ungaged Rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2004-5026, 22 p. (http://water.usgs.gov/pubs/sir/2004/5026/pdf/sir2004-5026.pdf)

Flow-Duration Statistics Parameters [Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1507.5	square miles	14.9	1419

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.021	dimensionless	0	0.212
ELEV	Mean Basin Elevation	555.4	feet	239	2120

Flow-Duration Statistics Disclaimers [Statewide Annual SIR 2015 5151]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Flow-Duration Statistics Flow Report [Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
1 Percent Duration	160	ft^3/s
5 Percent Duration	287	ft^3/s
10 Percent Duration	391	ft^3/s
25 Percent Duration	667	ft^3/s
50 Percent Duration	1390	ft^3/s
75 Percent Duration	3330	ft^3/s
90 Percent Duration	6850	ft^3/s
95 Percent Duration	10100	ft^3/s
99 Percent Duration	16600	ft^3/s

Flow-Duration Statistics Citations

Dudley, R.W.,2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015–5151, 35 p. (http://dx.doi.org/10.3133/sir20155151)

Annual Flow Statistics Parameters [Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1507.5	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.021	dimensionless	0	0.212

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
ELEV	Mean Basin Elevation	555.4	feet	239	2120

Annual Flow Statistics Disclaimers [Statewide Annual SIR 2015 5151]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors

Annual Flow Statistics Flow Report [Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
Mean Annual Flow	2730	ft^3/s

Annual Flow Statistics Citations

Dudley, R.W.,2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015–5151, 35 p. (http://dx.doi.org/10.3133/sir20155151)

APPENDIX D

FEMA Flood Insurance Study Information

approximately 115 miles. A principal physiographic feature of the central part of the basin is 5,267-foot Mt. Katadin, the state's highest peak.

The area around Mattawamkeag has moderate to gentle slopes interspersed with occasional hills. This portion of the basin can be characterized by low relief with hills generally rising 300 to 400 feet. Divides at the perimeter of the valley reach elevations of 600 feet to 800 feet (Reference 4).

The Mattawamkeag River flows in a general southern direction for 90 miles, coming from a lake region in eastern Maine. It has a drainage area of approximately 1,500 square miles. It has a total fall of 630 feet in its run to the confluence with the Penobscot. In the Town of Mattawamkeag, the river is wide and has a gentle slope (Reference 4).

The climate of Mattawamkeag is typified as humid continental, which means moderately comfortable summers with temperatures averaging between 60 degrees Fahrenheit (°F) and 70°F in July and August, and fairly cold winters when temperatures average between 11°F and 27°F in January and February. The annual-mean temperature is approximately 43°F and the average annual precipitation is approximately 44 inches, which is distributed uniformly throughout the year (Reference 5).

2.3 Principal Flood Problems

Severe flooding in Mattawamkeag is limited to the floodplains of the Penobscot and Mattawamkeag Rivers. Flooding generally occurs in the spring months from rapid runoff caused by heavy rains combined with snowmelt and, less frequently, later in the year as a result of hurricanes.

Significant flooding has occurred in Mattawamkeag in past years. Repeated damage to bridges and other important structures in the floodplains of the two rivers have occurred during such floods as those that occurred in 1923, 1936, 1940, 1973, and 1983, with recurrence intervals of 120, 35, 20, 40, and 25 years, respectively. The flood of 1936, although not as high in flow as either the 1923 or 1973 floods, resulted in considerable damage due to the ice jams. Extensive damage to property, streets, and structures occurred during these floods.

There are three gaging stations in the area. Two are located at Mattawamkeag (Station No. 01031000 and Station No. 01030000) and one is located near Mattawamkeag (Station No. 01030500).

2.4 Flood Protection Measures

The natural stream flow of the Penobscot River is altered by several hydroelectric plants and storage reservoirs located upstream from Mattawamkeag. The structure that could have the most pronounced

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross-section data for the Penobscot and Mattawamkeag Rivers were obtained from the latest USGS topographic map at a scale of 1:62,500 with a contour interval of 20 feet (Reference 9). The below-water portions of the cross sections were obtained from field surveys. All bridges were field surveyed to obtain elevation data and structural geometry.

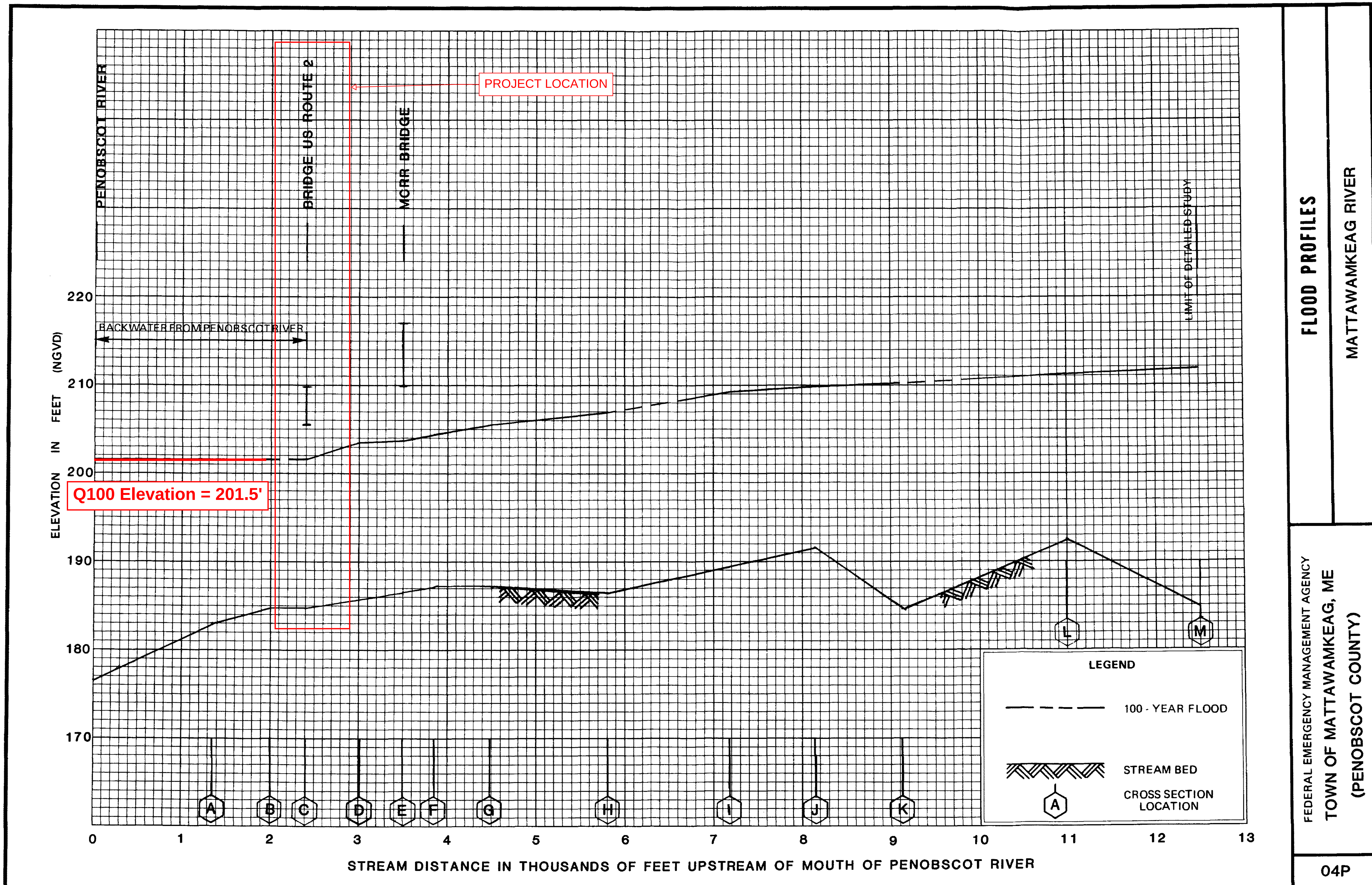
Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). Selected cross-section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

The water-surface elevations for Mattawamkeag were taken from profiles developed using a USGS step-backwater computer program model (Reference 10). Flood profiles were drawn showing computed water-surface elevations for floods of selected recurrence intervals. The starting water-surface elevations for the Penobscot River were taken from slope/area calculations. The starting water-surface elevation for the Mattawamkeag River was taken to be that associated with the 10-year flood on the Penobscot River at their confluence. The results of the water-surface computations are tabulated for selected cross sections (Table 2).

The backwater model for the Penobscot River was calibrated using profile information available for the 1936 flood at points not affected by backwater from ice (Reference 11). This calibration was possible because river conditions from 1936 to the present and the structures in the Penobscot River and their alignment have not changed appreciably. The model was also checked by comparing the simulated 100-year flood elevation to that taken from the rating curve at the USGS gaging station No. 01030000.

The 100-year flood elevation for the Penobscot River above Mattaseunk Dam was determined from information furnished by Great Northern Paper Company.

Roughness coefficients (Manning's "n" values) for the Penobscot and Mattawamkeag Rivers were estimated on the basis of the maps and field inspection at each cross section in the area studied. For the Penobscot River, the channel "n" values ranging from 0.030 to 0.035, and the overbank "n" values ranged from 0.040 to 0.075. For the Mattawamkeag, River, channel "n" values ranged from 0.030 to 0035, and the overbank "n" value was 0.050.


PROJECT LOCATION
PENOBSCOT RIVER
BRIDGE US ROUTE 2
MCRR BRIDGE
LIMIT OF DETAILED STUDY
BACKWATER FROM PENOBSCOT RIVER
Q100 Elevation = 201.5'
ELEVATION IN FEET (NGVD)
220
210
200
190
180
170
A
B
C
D
E
F
G
H
I
J
K
L
M
0
1
2
3
4
5
6
7
8
9
10
11
12
13
STREAM DISTANCE IN THOUSANDS OF FEET UPSTREAM OF MOUTH OF PENOBSCOT RIVER
LEGEND
100 - YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
MATTAWAMKEAG RIVER
FEDERAL EMERGENCY MANAGEMENT AGENCY
TOWN OF MATTAWAMKEAG, ME
(PENOBSCOT COUNTY)
04P

The principal source of flood-flow data for the flooding sources in Mattawamkeag was USGS records of peak flows for the Penobscot River at Mattawamkeag (Station No. 01030000) for the period 1941-82 and for the Mattawamkeag River near Mattawamkeag (Station No. 01030500) for the period 1934-82, and records for the Mattawamkeag River at Mattawamkeag (Station No. 01031000) for the period 1902-33. The 100-year discharge frequency relationships at the Penobscot and Mattawamkeag Rivers were determined by applying the log-Pearson Type III method to the USGS gage information (Reference 7).

The 100-year flood discharge of the Penobscot River at the upstream corporate limit of Mattawamkeag is represented by the 100-year flood discharge determined at the USGS gaging station no. 01030000.

From a correlation of the flows on the Penobscot and Mattawamkeag Rivers, it was found that the two rivers do not peak simultaneously. When the flow of the Penobscot River is at its peak, the Mattawamkeag River flows at approximately 75 percent of its peak. Based on this correlation, 100-year flood discharges for the Penobscot River below the mouth of the Mattawamkeag River were calculated to be the 100-year discharge of the Penobscot River plus 75 percent of the 100-year flood discharge from the Mattawamkeag River.

The values of the Penobscot River 100-year magnitude flow are in agreement with the flows used in the Flood Insurance Study for the Town of Lincoln downstream from Mattawamkeag (Reference 8).

The 100-year flood discharge of the Mattawamkeag River is represented by the 100-year flood discharge determined at the USGS gaging station No. 01030500 increased by a drainage area ratio to simulate flows at the mouth.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

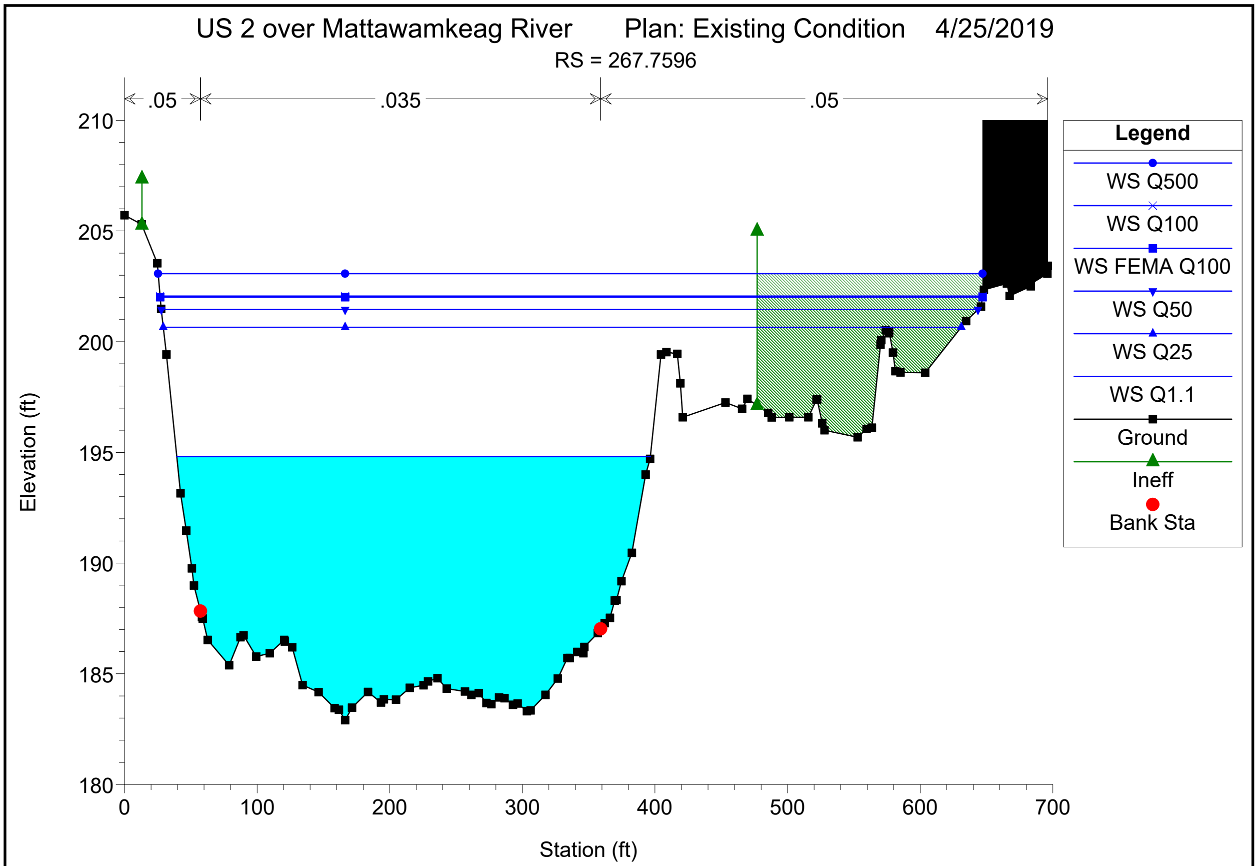
FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 100-YEAR
PENOBSCOT RIVER		
At Mattawamkeag-Winn corporate limits	4,930	94,000
Downstream of confluence of Mattawamkeag River	4,922	94,000
At USGS Gaging Station (No. 01030000)	3,356	68,000
At Medway-Mattawamkeag corporate limits	3,355	68,000
MATTAWAMKEAG RIVER		
At confluence with Penobscot River	1,507	34,000

APPENDIX E

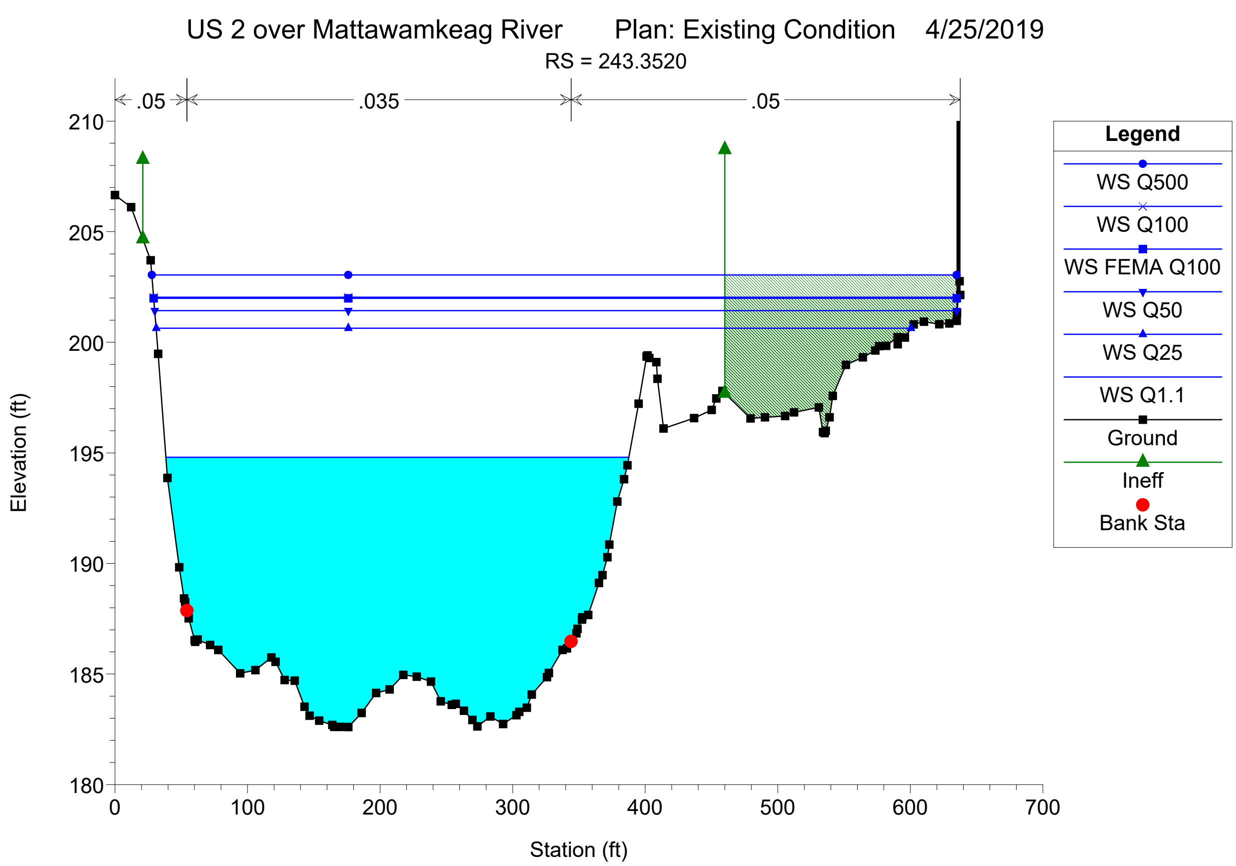
Existing HEC-RAS Analysis

HEC-RAS Plan: Ex Condition River: Stream Reach: 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)	
Reach	267.7596	Q1.1	12073.00	182.91	194.81	188.44	195.03	0.000380	3.85	3283.59	357.14	0.21
Reach	267.7596	Q25	29566.00	182.91	200.65	191.43	201.15	0.000468	5.80	5655.75	601.71	0.26
Reach	267.7596	Q50	32533.00	182.91	201.45	191.85	201.98	0.000473	6.02	6015.56	615.90	0.26
Reach	267.7596	Q100	35478.00	182.91	202.06	192.27	202.64	0.000494	6.30	6290.11	620.18	0.27
Reach	267.7596	FEMA Q100	34000.00	182.91	202.01	192.07	202.55	0.000458	6.06	6266.95	620.11	0.26
Reach	267.7596	Q500	42421.00	182.91	203.08	193.21	203.80	0.000574	7.06	6747.13	621.61	0.29
Reach	243.3520	Q1.1	12073.00	182.60	194.80	188.12	195.02	0.000357	3.83	3314.78	349.28	0.21
Reach	243.3520	Q25	29566.00	182.60	200.63	191.18	201.13	0.000459	5.84	5630.64	569.41	0.26
Reach	243.3520	Q50	32533.00	182.60	201.43	191.63	201.97	0.000467	6.08	5974.01	605.00	0.26
Reach	243.3520	Q100	35478.00	182.60	202.04	192.05	202.63	0.000489	6.37	6235.40	605.82	0.27
Reach	243.3520	FEMA Q100	34000.00	182.60	201.99	191.83	202.54	0.000454	6.13	6214.09	605.75	0.26
Reach	243.3520	Q500	42421.00	182.60	203.04	192.97	203.78	0.000572	7.15	6669.01	607.16	0.29
Reach	220.9258	Q1.1	12073.00	182.58	194.77	188.31	195.01	0.000391	3.95	3194.26	340.21	0.22
Reach	220.9258	Q25	29566.00	182.58	200.59	191.41	201.12	0.000495	6.00	5418.42	521.04	0.26
Reach	220.9258	Q50	32533.00	182.58	201.39	191.86	201.96	0.000503	6.25	5747.51	543.36	0.27
Reach	220.9258	Q100	35478.00	182.58	201.99	192.29	202.61	0.000527	6.54	5996.28	567.90	0.28
Reach	220.9258	FEMA Q100	34000.00	182.58	201.94	192.08	202.52	0.000488	6.29	5977.93	567.84	0.27
Reach	220.9258	Q500	42421.00	182.58	202.98	193.21	203.76	0.000616	7.34	6405.78	569.23	0.30
Reach	194.1222	Q1.1	12073.00	182.70	194.78	187.60	194.99	0.000315	3.71	3379.96	333.85	0.20
Reach	194.1222	Q25	29566.00	182.70	200.60	190.72	201.10	0.000434	5.78	5533.06	495.11	0.25
Reach	194.1222	Q50	32533.00	182.70	201.39	191.17	201.94	0.000445	6.04	5847.26	504.01	0.25
Reach	194.1222	Q100	35478.00	182.70	202.00	191.60	202.59	0.000469	6.34	6084.86	512.47	0.26
Reach	194.1222	FEMA Q100	34000.00	182.70	201.95	191.38	202.50	0.000435	6.09	6067.10	511.75	0.25
Reach	194.1222	Q500	42421.00	182.70	202.99	192.54	203.74	0.000555	7.14	6476.08	541.62	0.29
Reach	177.3465	Q1.1	12073.00	182.35	194.78	187.50	194.99	0.000305	3.66	3443.83	351.99	0.19
Reach	177.3465	Q25	29566.00	182.35	200.61	190.65	201.08	0.000417	5.68	5578.55	476.20	0.24
Reach	177.3465	Q50	32533.00	182.35	201.40	191.10	201.92	0.000429	5.94	5871.65	484.28	0.25
Reach	177.3465	Q100	35478.00	182.35	202.00	191.53	202.58	0.000454	6.25	6093.28	491.70	0.26
Reach	177.3465	FEMA Q100	34000.00	182.35	201.96	191.32	202.49	0.000421	6.01	6076.60	491.14	0.25
Reach	177.3465	Q500	42421.00	182.35	202.99	192.49	203.72	0.000540	7.06	6458.12	507.32	0.28
Reach	155		Bridge									
Reach	98.9674	Q1.1	12073.00	182.74	194.52	189.67	194.84	0.000683	4.60	2689.46	333.08	0.28
Reach	98.9674	Q25	29566.00	182.74	200.16	192.60	200.82	0.000723	6.64	4686.37	398.32	0.31
Reach	98.9674	Q50	32533.00	182.74	200.93	193.09	201.65	0.000727	6.90	4979.56	403.13	0.32
Reach	98.9674	Q100	35478.00	182.74	201.49	193.51	202.28	0.000760	7.23	5193.13	408.51	0.32
Reach	98.9674	FEMA Q100	34000.00	182.74	201.49	193.31	202.21	0.000698	6.93	5193.46	408.52	0.31
Reach	98.9674	Q500	42421.00	182.74	202.34	194.45	203.34	0.000901	8.16	5517.41	419.44	0.36
Reach	78.4446	Q1.1	12073.00	184.94	194.49	189.98	194.83	0.000743	4.67	2654.30	342.49	0.29
Reach	78.4446	Q25	29566.00	184.94	200.15	192.89	200.81	0.000739	6.63	4716.99	587.59	0.31
Reach	78.4446	Q50	32533.00	184.94	200.92	193.29	201.63	0.000740	6.87	5018.36	633.84	0.32
Reach	78.4446	Q100	35478.00	184.94	201.48	193.70	202.26	0.000771	7.20	5237.74	702.91	0.33
Reach	78.4446	FEMA Q100	34000.00	184.94	201.48	193.50	202.19	0.000708	6.90	5238.43	702.98	0.31
Reach	78.4446	Q500	42421.00	184.94	202.45	194.60	203.20	0.000750	7.40	7285.73	755.35	0.33
Reach	55.9663	Q1.1	12073.00	184.74	194.46	190.06	194.81	0.000788	4.76	2602.62	341.86	0.30
Reach	55.9663	Q25	29566.00	184.74	200.13	192.97	200.79	0.000751	6.63	4734.02	610.89	0.32
Reach	55.9663	Q50	32533.00	184.74	200.90	193.40	201.61	0.000750	6.88	5038.15	667.06	0.32
Reach	55.9663	Q100	35478.00	184.74	201.46	193.82	202.24	0.000780	7.19	5259.25	693.34	0.33
Reach	55.9663	FEMA Q100	34000.00	184.74	201.47	193.63	202.18	0.000716	6.89	5260.48	693.45	0.31
Reach	55.9663	Q500	42421.00	184.74	202.45	194.74	203.18	0.000739	7.31	7356.07	734.65	0.32
Reach	24.8674	Q1.1	12073.00	183.61	194.47	189.59	194.77	0.000650	4.39	2762.18	341.04	0.27
Reach	24.8674	Q25	29566.00	183.61	200.16	192.46	200.75	0.000650	6.22	4989.08	597.47	0.29
Reach	24.8674	Q50	32533.00	183.61	200.93	192.88	201.57	0.000650	6.45	5315.47	600.87	0.30
Reach	24.8674	Q100	35478.00	183.61	201.50	193.29	202.19	0.000677	6.75	5553.45	603.20	0.30
Reach	24.8674	FEMA Q100	34000.00	183.61	201.50	193.09	202.13	0.000622	6.47	5553.45	603.20	0.29
Reach	24.8674	Q500	42421.00	183.61	202.47	194.19	203.14	0.000650	6.90	7285.26	606.54	0.30



US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
RS = 267.7596
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Ineff
Bank Sta



US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
RS = 243.3520
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
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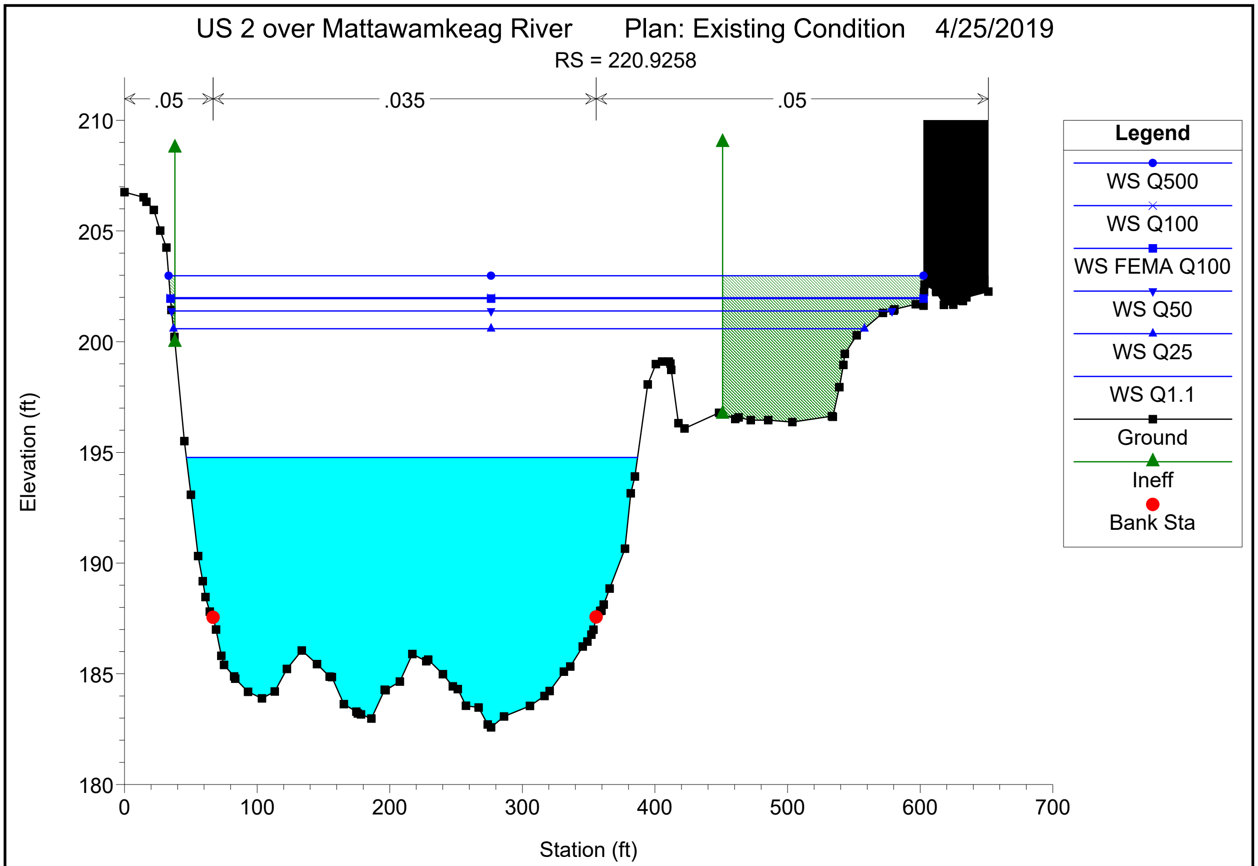
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Ineff
Bank Sta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RS = 220.9258
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
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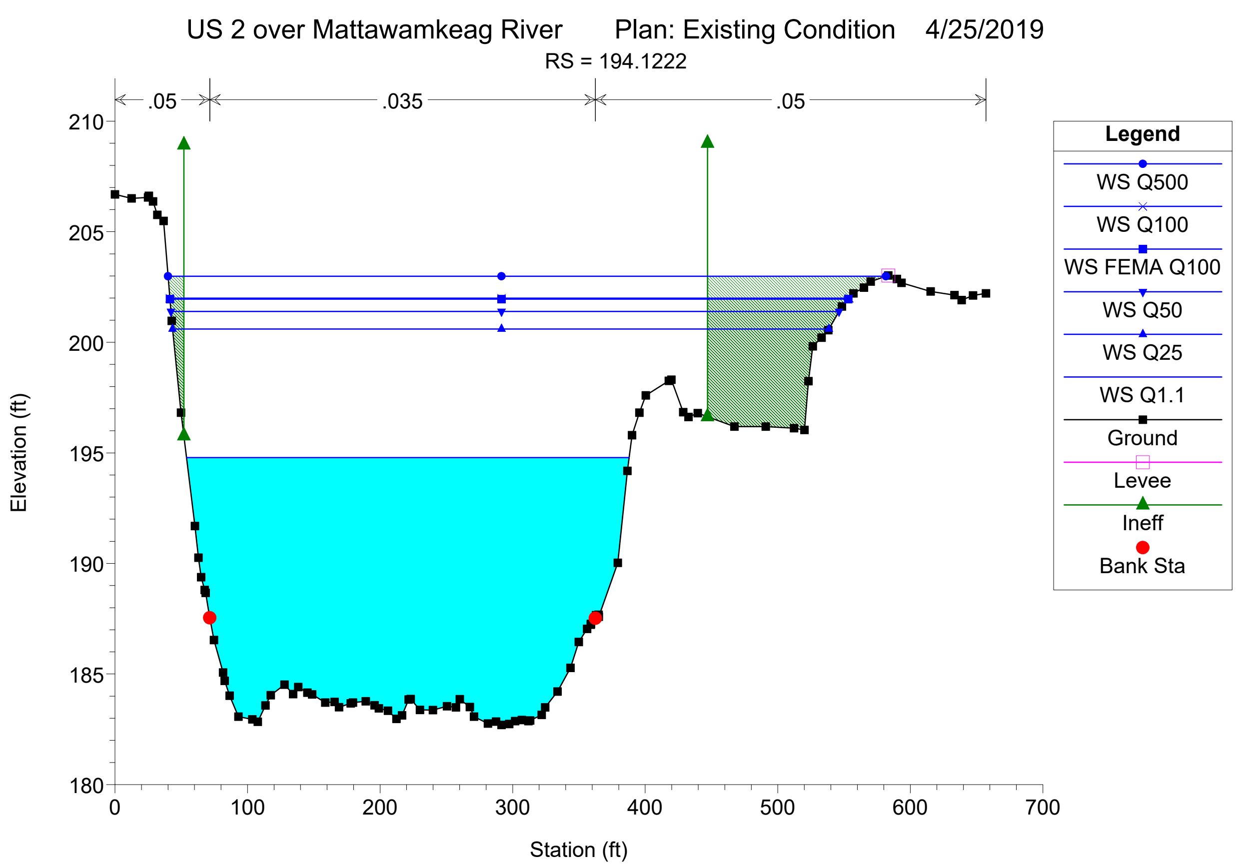
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Ineff
Bank Sta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RS = 194.1222
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.035
.05
Elevation (ft)
Station (ft)
Legend
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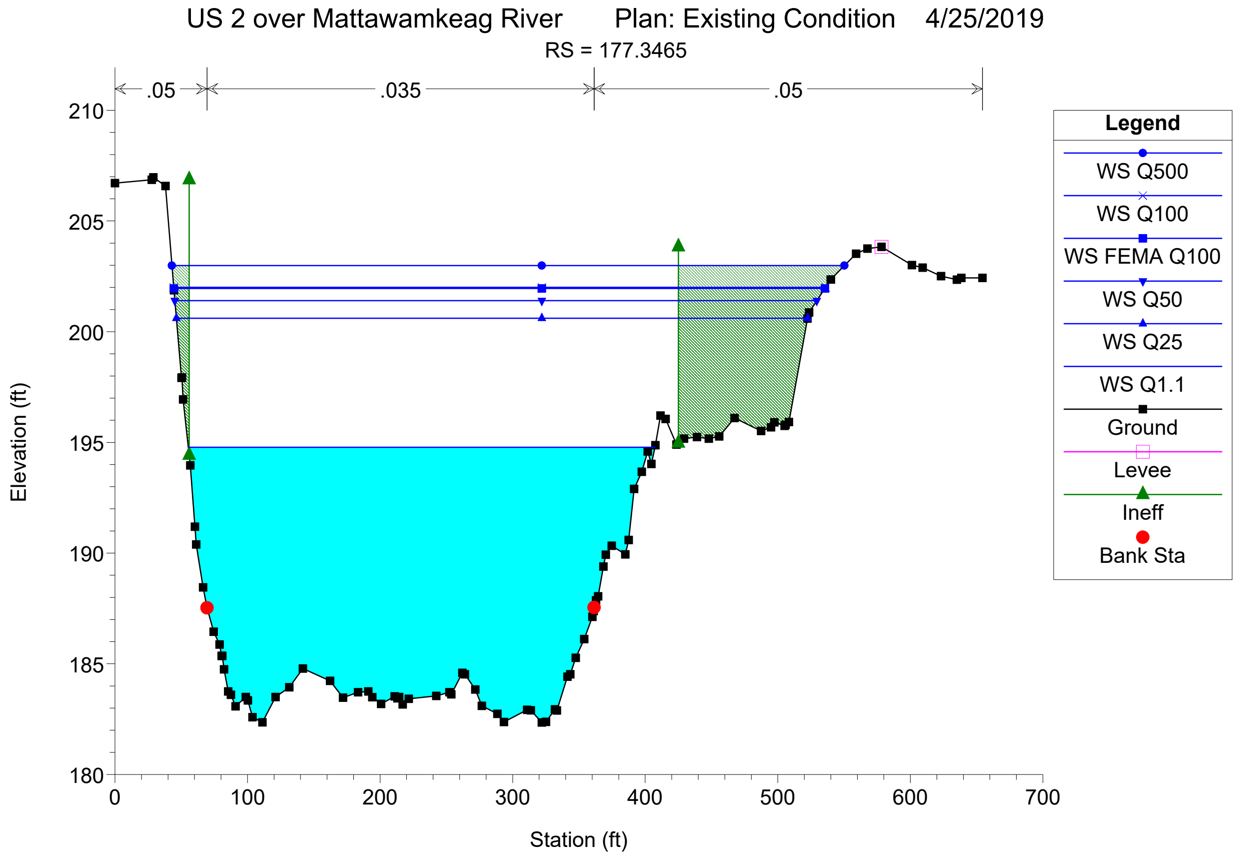
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
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.05
.035
.05
Elevation (ft)
Station (ft)
Legend
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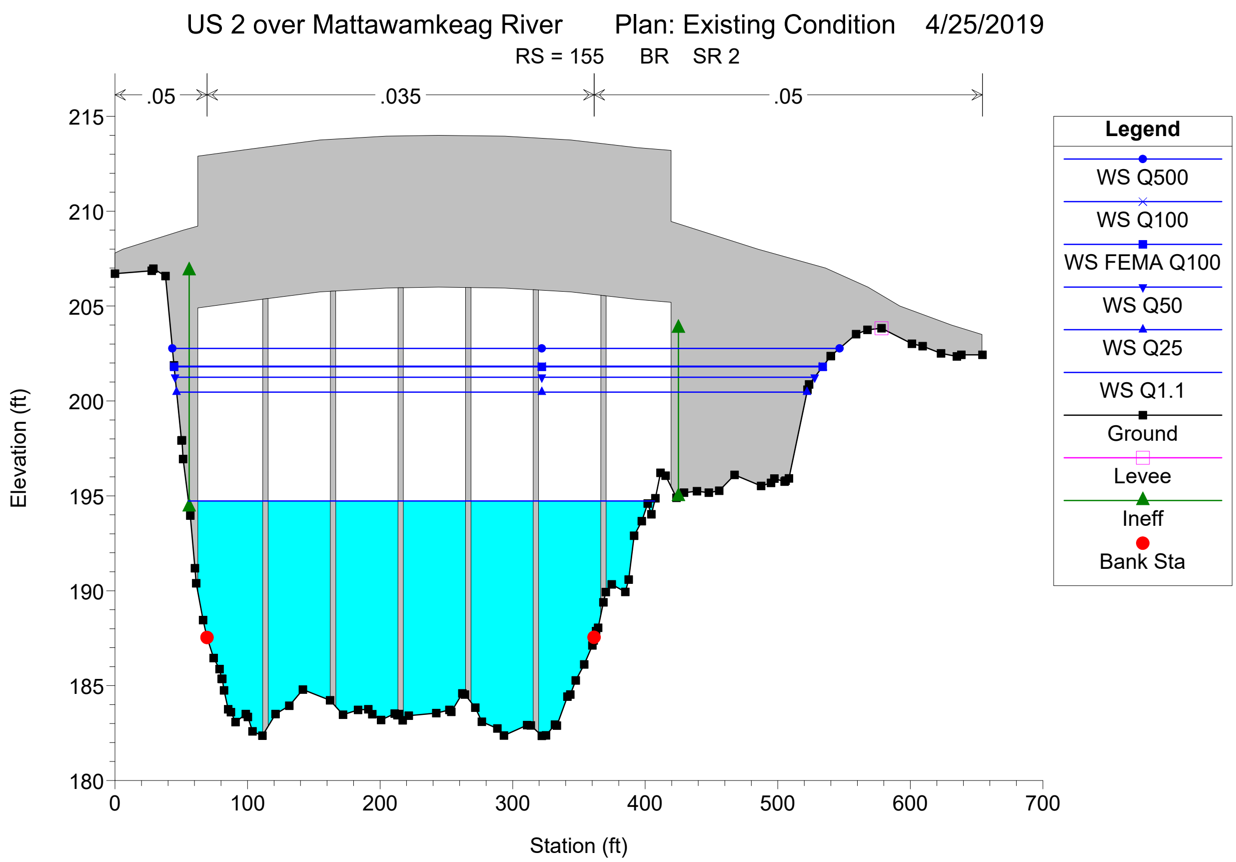
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
RS = 155 BR SR 2
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
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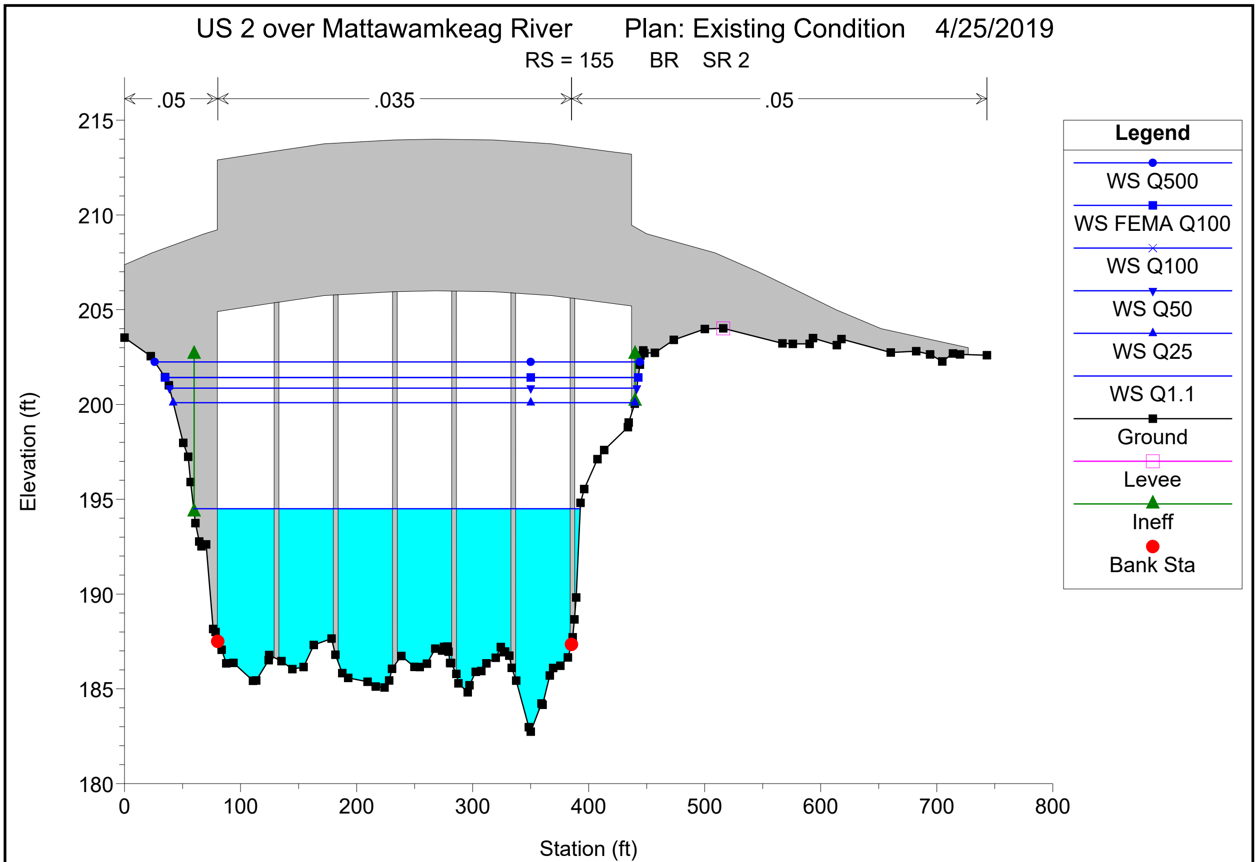
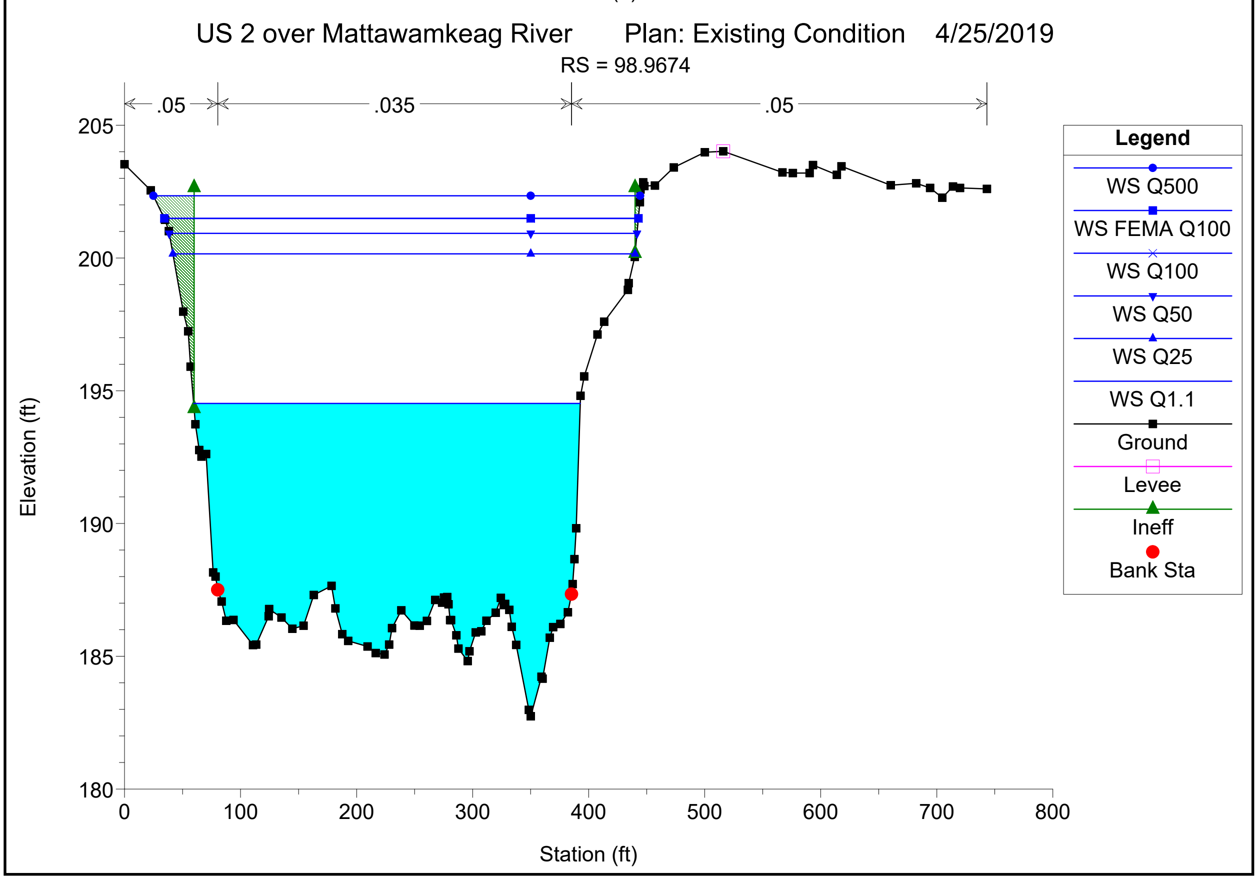
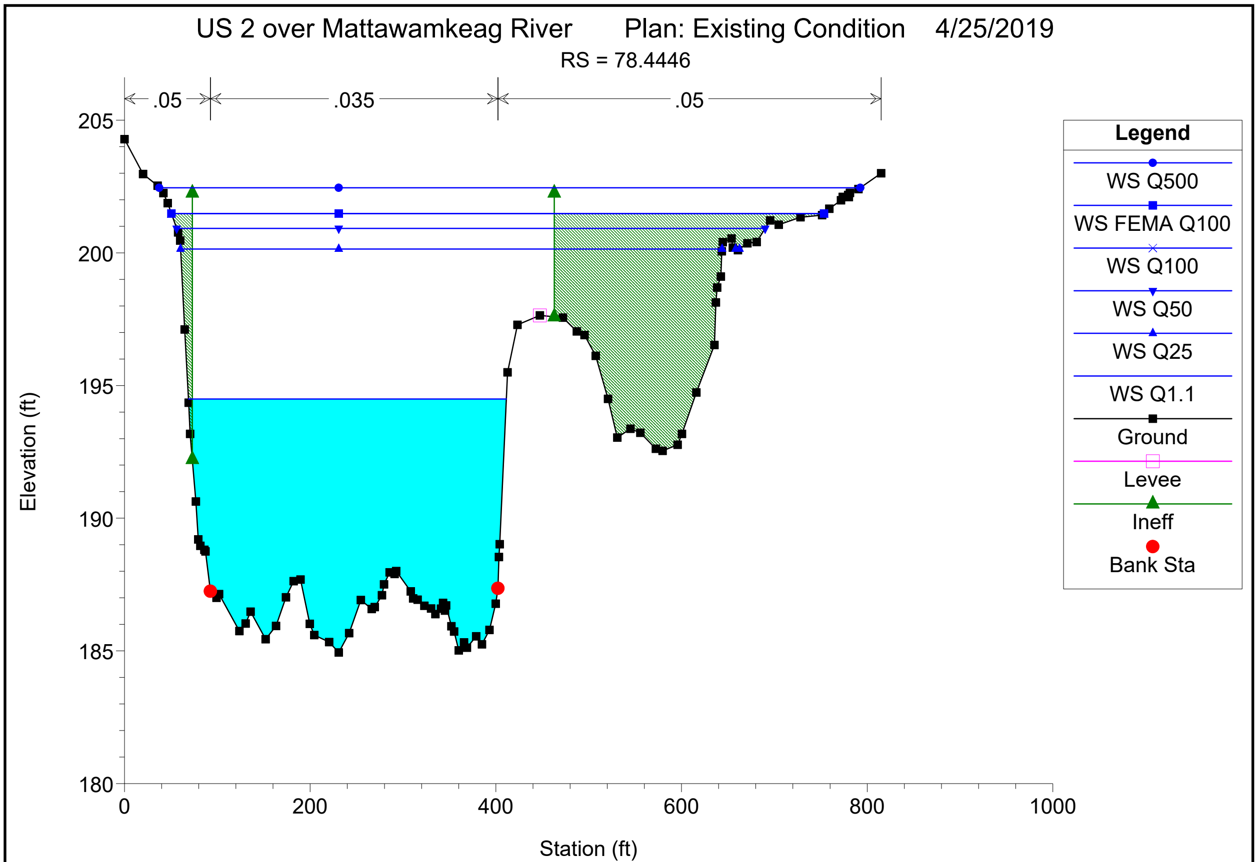
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
RS = 155 BR SR 2
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
RS = 98.9674
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
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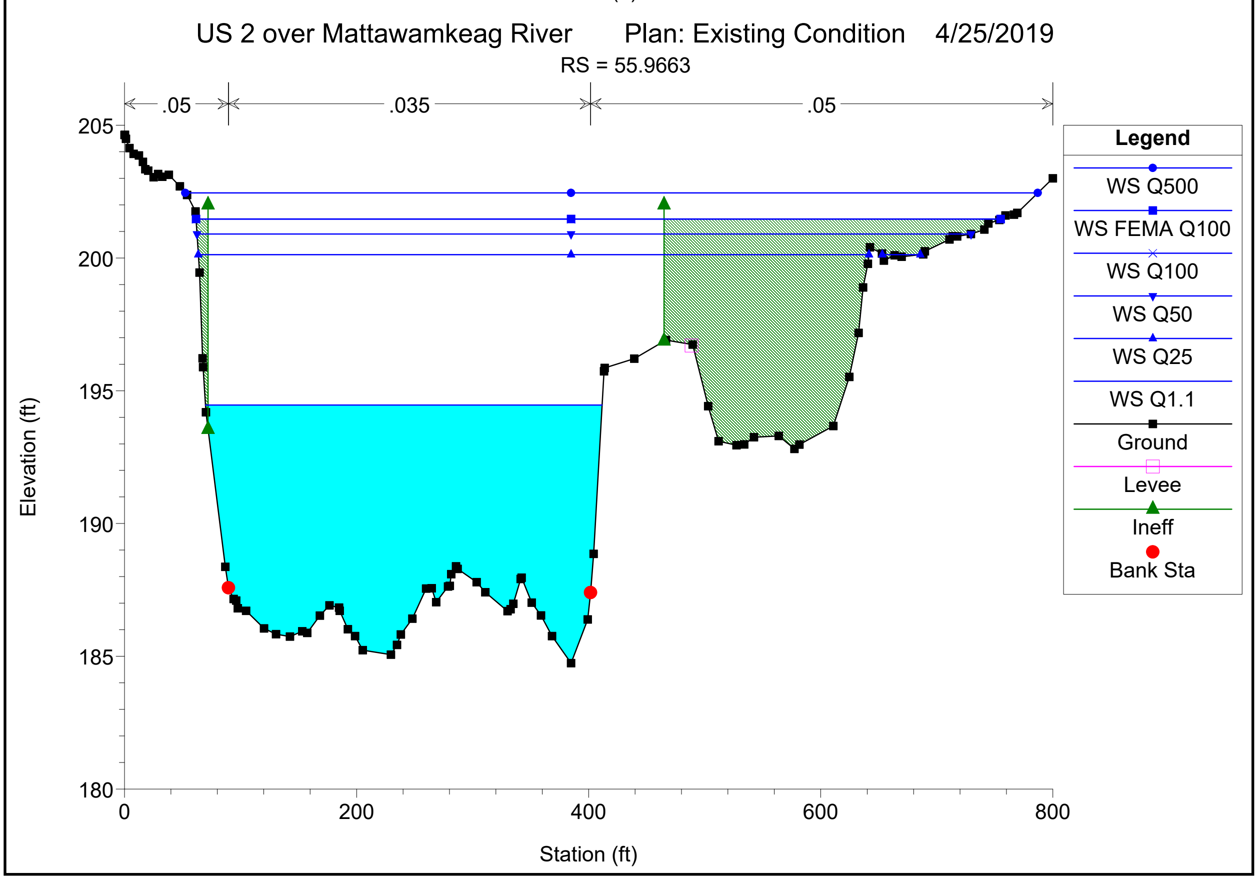
.05
.035
.05
Elevation (ft)
205
200
195
190
185
180
0
200
400
600
800
1000
Station (ft)
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
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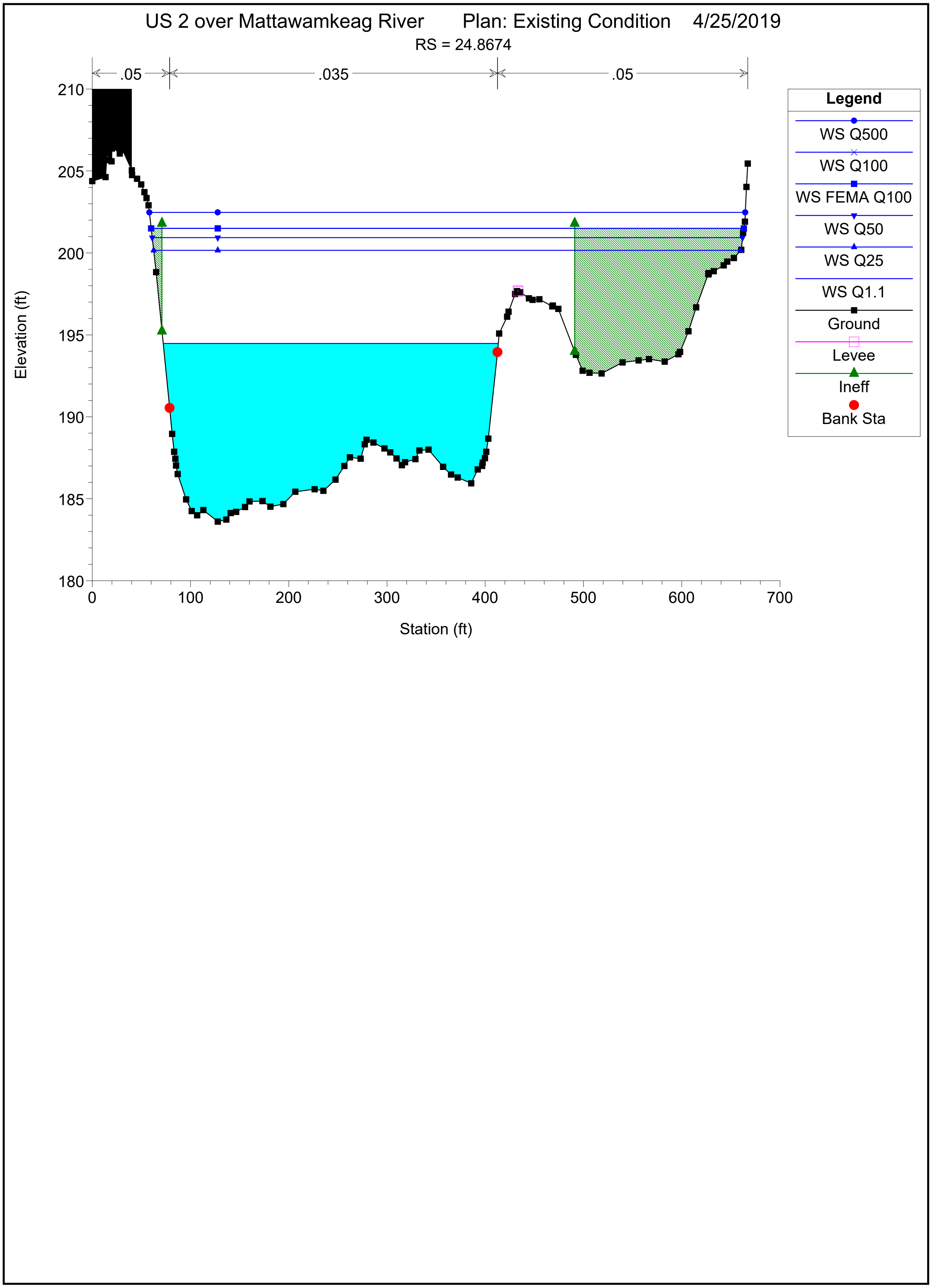
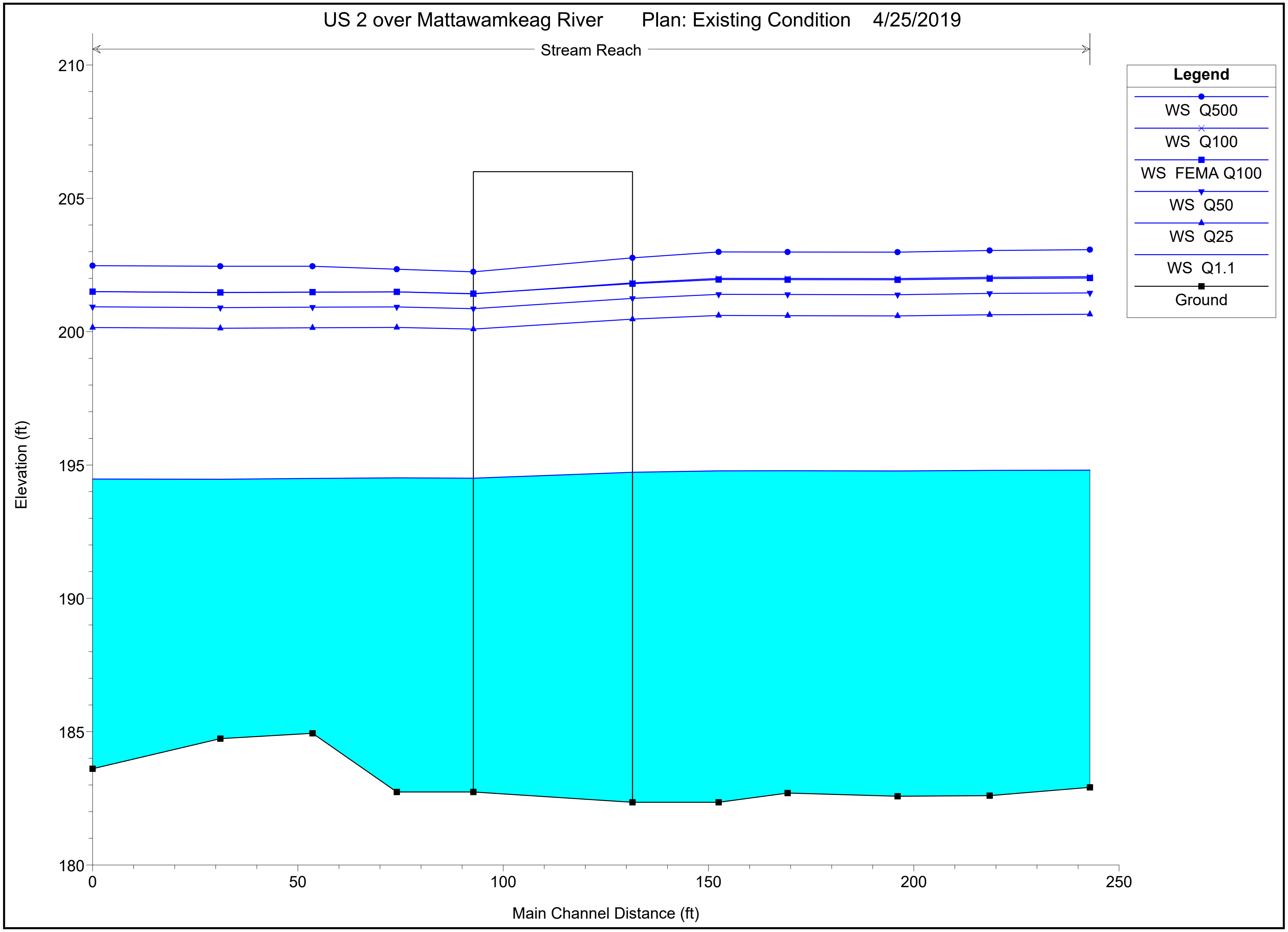
.05
.035
.05
Elevation (ft)
205
200
195
190
185
180
0
200
400
600
800
Station (ft)
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta



US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
RS = 24.8674
.05
.035
.05
Elevation (ft)
Station (ft)
210
205
200
195
190
185
180
0
100
200
300
400
500
600
700
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta

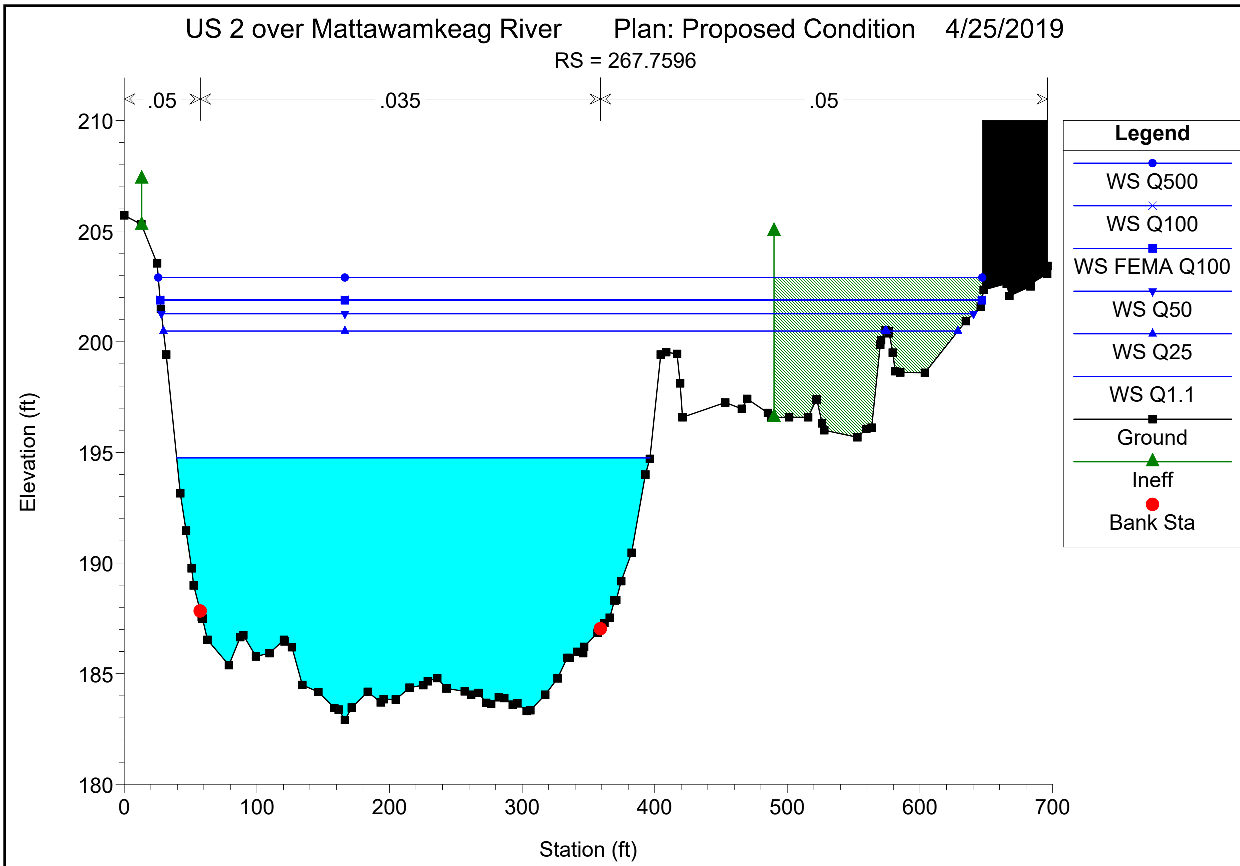

US 2 over Mattawamkeag River Plan: Existing Condition 4/25/2019
Stream Reach
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Elevation (ft)
210
205
200
195
190
185
180
0
50
100
150
200
250
Main Channel Distance (ft)

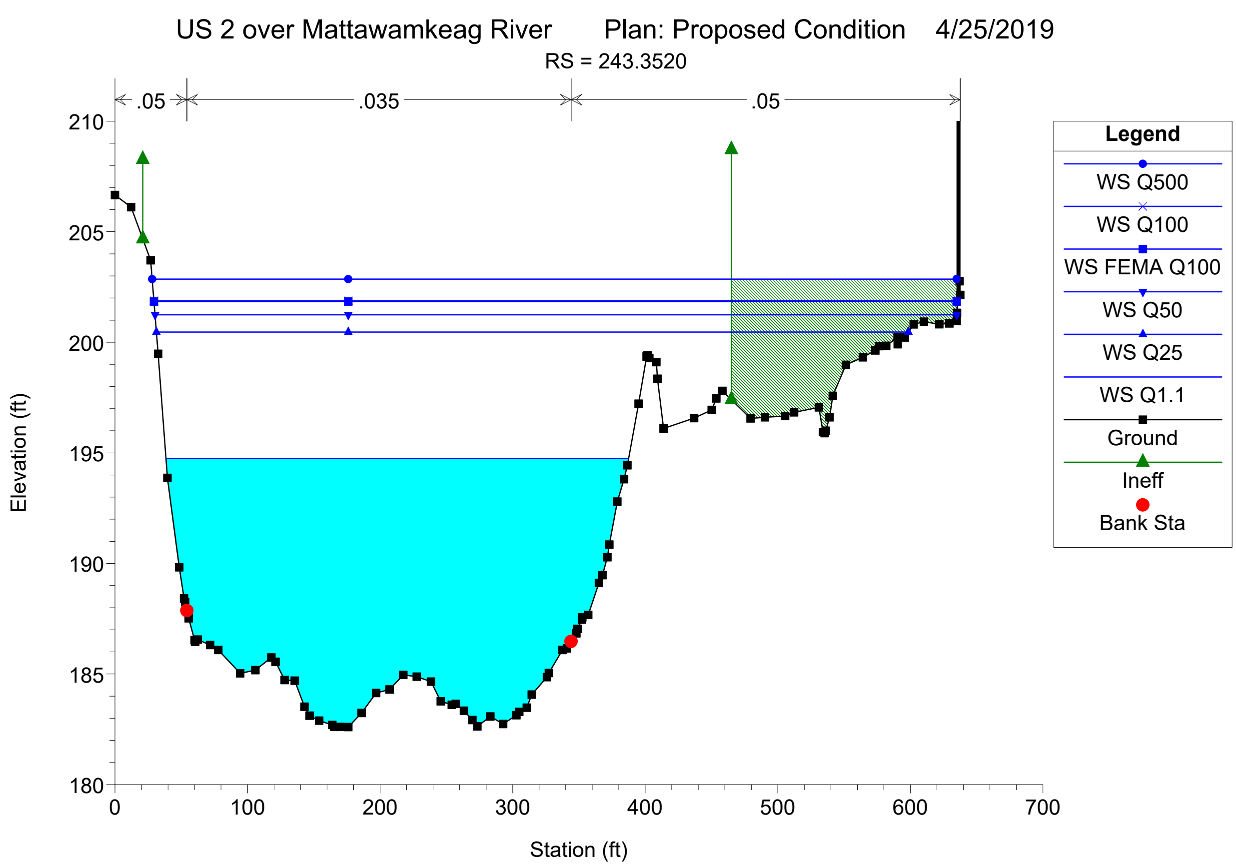
APPENDIX F

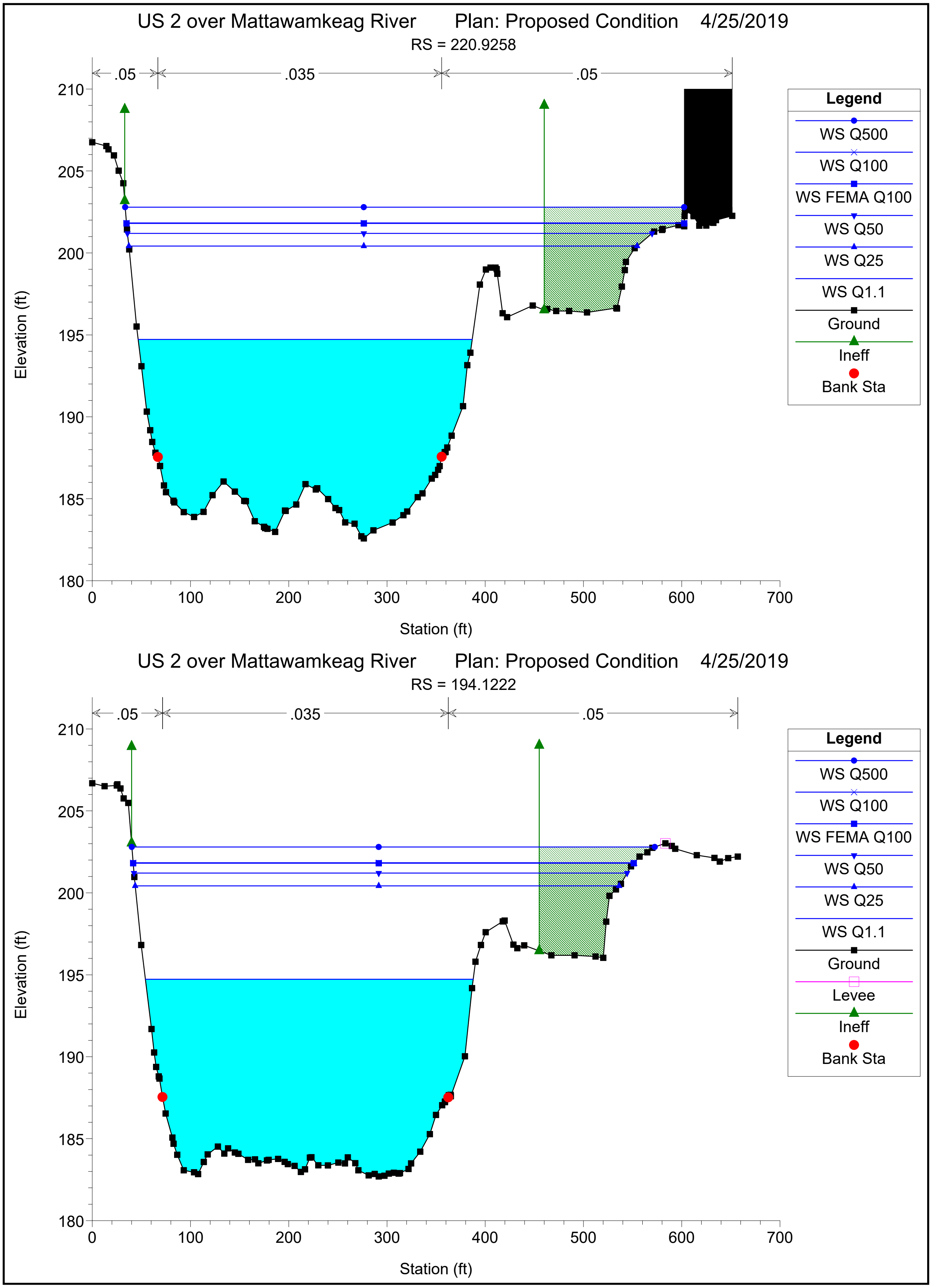
Proposed HEC-RAS Analysis

HEC-RAS Plan: Pro Condition River: Stream Reach: Reach

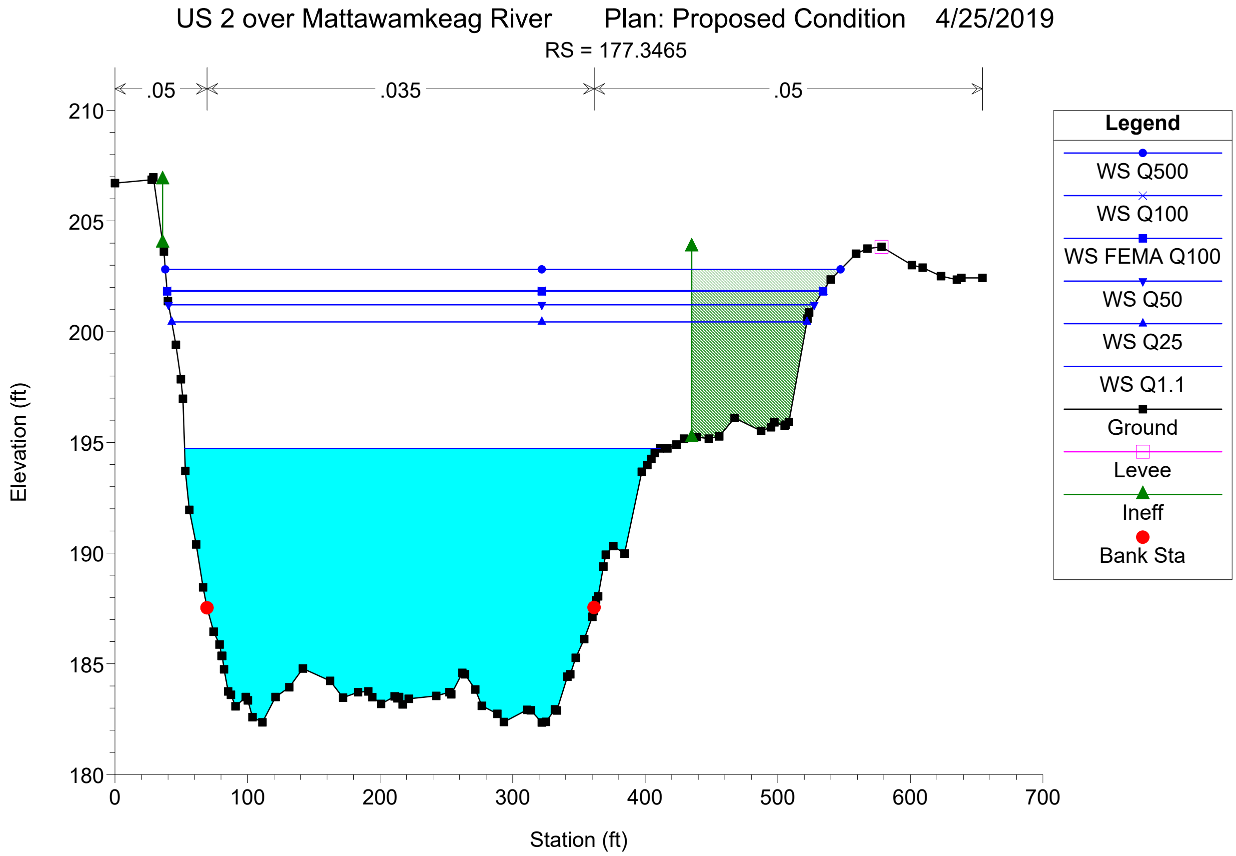
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	267.7596	Q1.1	12073.00	182.91	194.75	188.44	194.98	0.000387	3.87	3264.05	356.96	0.22
Reach	267.7596	Q25	29566.00	182.91	200.48	191.43	200.99	0.000484	5.85	5628.12	598.11	0.26
Reach	267.7596	Q50	32533.00	182.91	201.27	191.85	201.81	0.000490	6.08	5989.60	612.36	0.26
Reach	267.7596	Q100	35478.00	182.91	201.91	192.27	202.50	0.000506	6.34	6287.54	619.74	0.27
Reach	267.7596	FEMA Q100	34000.00	182.91	201.87	192.07	202.41	0.000469	6.10	6270.27	619.57	0.26
Reach	267.7596	Q500	42421.00	182.91	202.90	193.21	203.63	0.000589	7.11	6745.05	621.36	0.29
Reach	243.3520	Q1.1	12073.00	182.60	194.74	188.12	194.97	0.000364	3.86	3295.65	349.05	0.21
Reach	243.3520	Q25	29566.00	182.60	200.46	191.18	200.97	0.000477	5.91	5571.80	567.26	0.26
Reach	243.3520	Q50	32533.00	182.60	201.24	191.63	201.80	0.000486	6.16	5910.52	604.75	0.26
Reach	243.3520	Q100	35478.00	182.60	201.88	192.05	202.48	0.000505	6.43	6189.08	605.60	0.27
Reach	243.3520	FEMA Q100	34000.00	182.60	201.85	191.83	202.40	0.000467	6.18	6173.92	605.56	0.26
Reach	243.3520	Q500	42421.00	182.60	202.86	192.97	203.61	0.000592	7.22	6614.53	606.91	0.30
Reach	220.9258	Q1.1	12073.00	182.58	194.72	188.31	194.96	0.000398	3.98	3175.50	339.97	0.22
Reach	220.9258	Q25	29566.00	182.58	200.42	191.41	200.96	0.000513	6.07	5382.29	517.38	0.27
Reach	220.9258	Q50	32533.00	182.58	201.20	191.86	201.78	0.000523	6.32	5711.32	534.04	0.27
Reach	220.9258	Q100	35478.00	182.58	201.83	192.29	202.47	0.000543	6.60	5981.18	567.69	0.28
Reach	220.9258	FEMA Q100	34000.00	182.58	201.80	192.08	202.39	0.000501	6.34	5968.59	567.65	0.27
Reach	220.9258	Q500	42421.00	182.58	202.79	193.21	203.59	0.000637	7.42	6390.81	568.98	0.31
Reach	194.1222	Q1.1	12073.00	182.70	194.73	187.60	194.94	0.000320	3.72	3361.61	333.63	0.20
Reach	194.1222	Q25	29566.00	182.70	200.43	190.72	200.94	0.000450	5.84	5516.66	492.56	0.25
Reach	194.1222	Q50	32533.00	182.70	201.20	191.17	201.76	0.000462	6.10	5836.38	501.92	0.26
Reach	194.1222	Q100	35478.00	182.70	201.84	191.60	202.44	0.000482	6.39	6098.52	509.98	0.27
Reach	194.1222	FEMA Q100	34000.00	182.70	201.81	191.38	202.37	0.000446	6.14	6086.01	509.50	0.26
Reach	194.1222	Q500	42421.00	182.70	202.80	192.54	203.56	0.000572	7.20	6496.72	532.26	0.29
Reach	177.3465	Q1.1	12073.00	182.35	194.73	187.50	194.93	0.000309	3.68	3442.65	358.62	0.20
Reach	177.3465	Q25	29566.00	182.35	200.44	190.63	200.92	0.000425	5.70	5642.24	479.20	0.25
Reach	177.3465	Q50	32533.00	182.35	201.22	191.10	201.74	0.000438	5.97	5947.42	487.01	0.25
Reach	177.3465	Q100	35478.00	182.35	201.85	191.53	202.43	0.000459	6.25	6198.32	495.08	0.26
Reach	177.3465	FEMA Q100	34000.00	182.35	201.82	191.31	202.35	0.000424	6.00	6185.95	494.69	0.25
Reach	177.3465	Q500	42421.00	182.35	202.82	192.50	203.54	0.000546	7.06	6580.08	509.43	0.28
Reach	155		Bridge									
Reach	98.9674	Q1.1	12073.00	182.74	194.52	189.67	194.84	0.000683	4.60	2689.58	333.08	0.28
Reach	98.9674	Q25	29566.00	182.74	200.11	192.60	200.78	0.000731	6.67	4707.00	398.04	0.31
Reach	98.9674	Q50	32533.00	182.74	200.87	193.09	201.59	0.000736	6.93	5006.27	402.79	0.32
Reach	98.9674	Q100	35478.00	182.74	201.49	193.51	202.27	0.000759	7.23	5247.97	408.46	0.32
Reach	98.9674	FEMA Q100	34000.00	182.74	201.49	193.31	202.21	0.000697	6.92	5248.56	408.48	0.31
Reach	98.9674	Q500	42421.00	182.74	202.36	194.45	203.35	0.000895	8.14	5592.33	419.60	0.35
Reach	78.4446	Q1.1	12073.00	184.94	194.49	189.98	194.83	0.000745	4.68	2659.49	342.48	0.29
Reach	78.4446	Q25	29566.00	184.94	200.10	192.87	200.76	0.000743	6.63	4768.36	583.30	0.32
Reach	78.4446	Q50	32533.00	184.94	200.87	193.30	201.57	0.000743	6.87	5079.28	632.39	0.32
Reach	78.4446	Q100	35478.00	184.94	201.48	193.71	202.24	0.000763	7.16	5329.56	702.93	0.32
Reach	78.4446	FEMA Q100	34000.00	184.94	201.48	193.50	202.18	0.000701	6.86	5330.21	703.00	0.31
Reach	78.4446	Q500	42421.00	184.94	202.46	194.62	203.21	0.000748	7.39	7292.35	755.90	0.32
Reach	55.9663	Q1.1	12073.00	184.74	194.46	190.06	194.81	0.000789	4.76	2603.65	341.86	0.30
Reach	55.9663	Q25	29566.00	184.74	200.08	192.97	200.74	0.000757	6.65	4760.94	597.49	0.32
Reach	55.9663	Q50	32533.00	184.74	200.85	193.39	201.55	0.000756	6.89	5069.81	659.68	0.32
Reach	55.9663	Q100	35478.00	184.74	201.46	193.81	202.23	0.000776	7.18	5318.13	693.20	0.33
Reach	55.9663	FEMA Q100	34000.00	184.74	201.46	193.61	202.17	0.000712	6.87	5319.55	693.31	0.31
Reach	55.9663	Q500	42421.00	184.74	202.46	194.74	203.19	0.000737	7.30	7362.52	735.03	0.32
Reach	24.8674	Q1.1	12073.00	183.61	194.47	189.59	194.77	0.000650	4.39	2762.18	341.04	0.27
Reach	24.8674	Q25	29566.00	183.61	200.11	192.46	200.70	0.000650	6.21	5044.00	596.75	0.29
Reach	24.8674	Q50	32533.00	183.61	200.88	192.88	201.51	0.000650	6.44	5375.79	600.67	0.30
Reach	24.8674	Q100	35478.00	183.61	201.50	193.29	202.18	0.000668	6.71	5643.09	603.20	0.30
Reach	24.8674	FEMA Q100	34000.00	183.61	201.50	193.09	202.12	0.000613	6.43	5643.09	603.20	0.29
Reach	24.8674	Q500	42421.00	183.61	202.48	194.19	203.15	0.000649	6.89	7290.55	606.56	0.30


US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 267.7596
.05
.035
.05
Elevation (ft)
210
205
200
195
190
185
180
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Ineff
Bank Sta

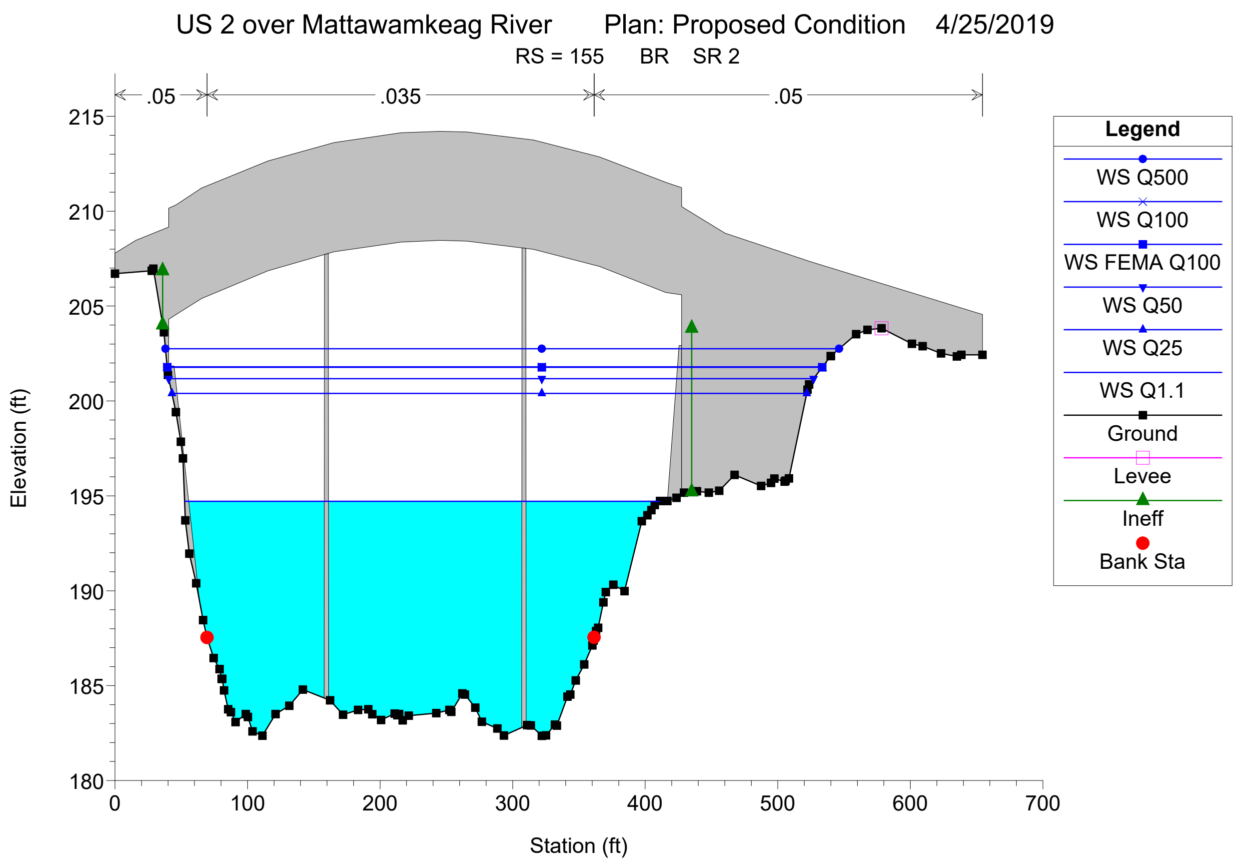

US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 243.3520
.05
.035
.05
Elevation (ft)
210
205
200
195
190
185
180
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Ineff
Bank Sta



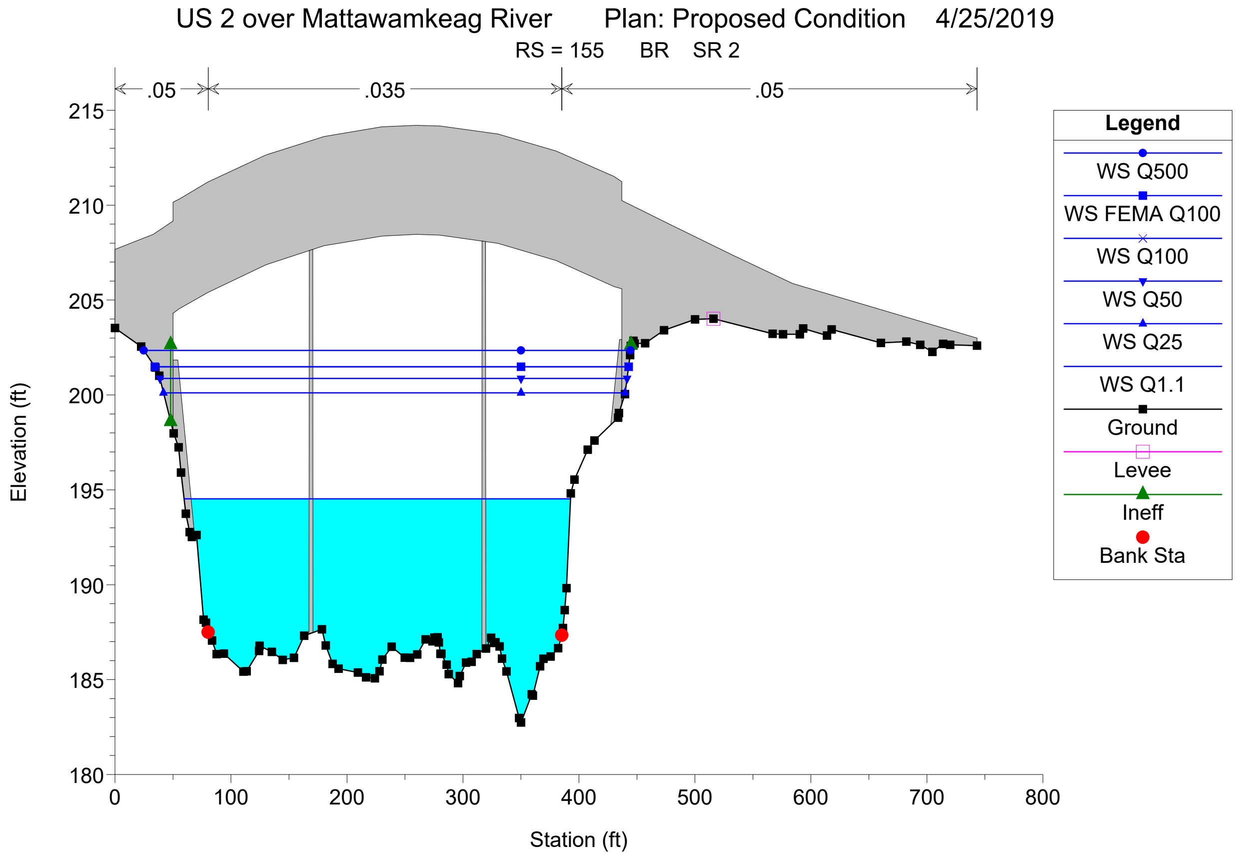
US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 220.9258
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Ineff
Bank Sta
US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 194.1222
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta

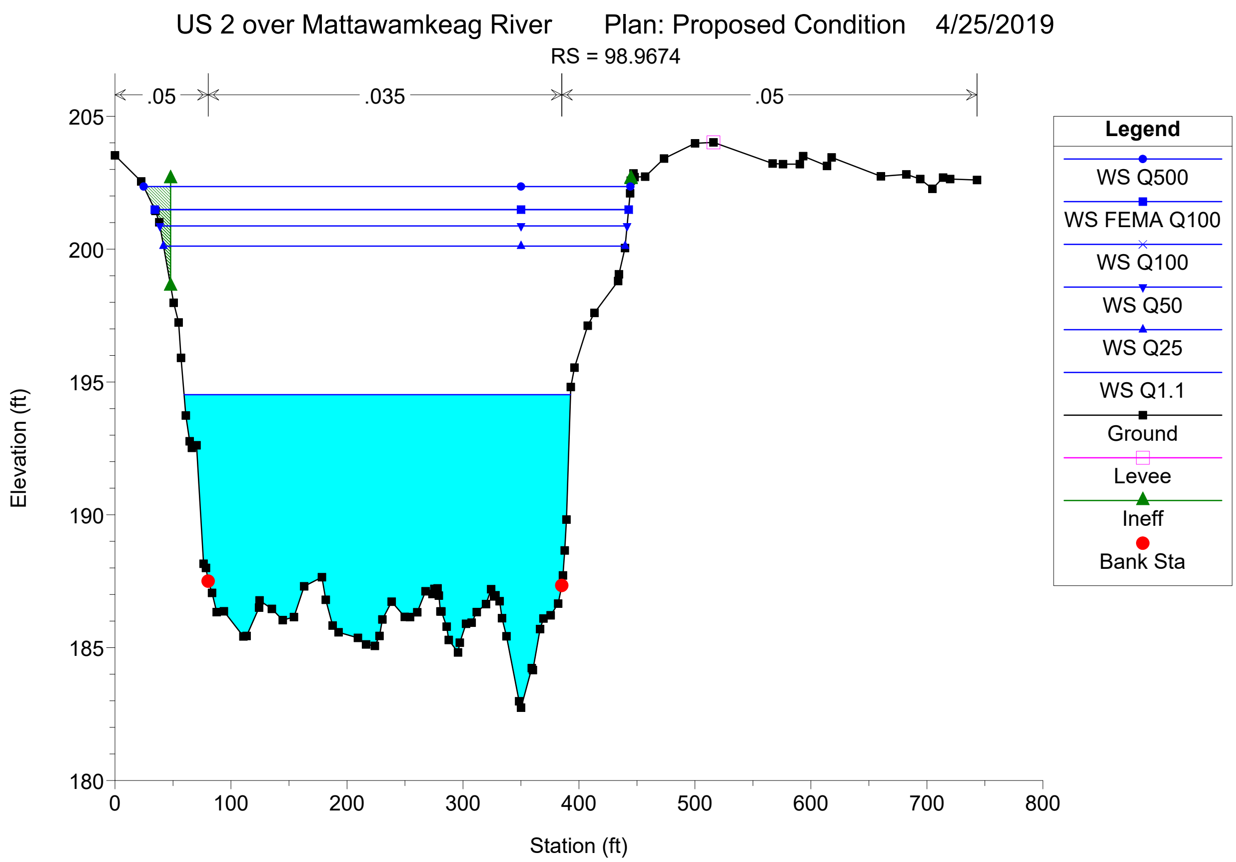


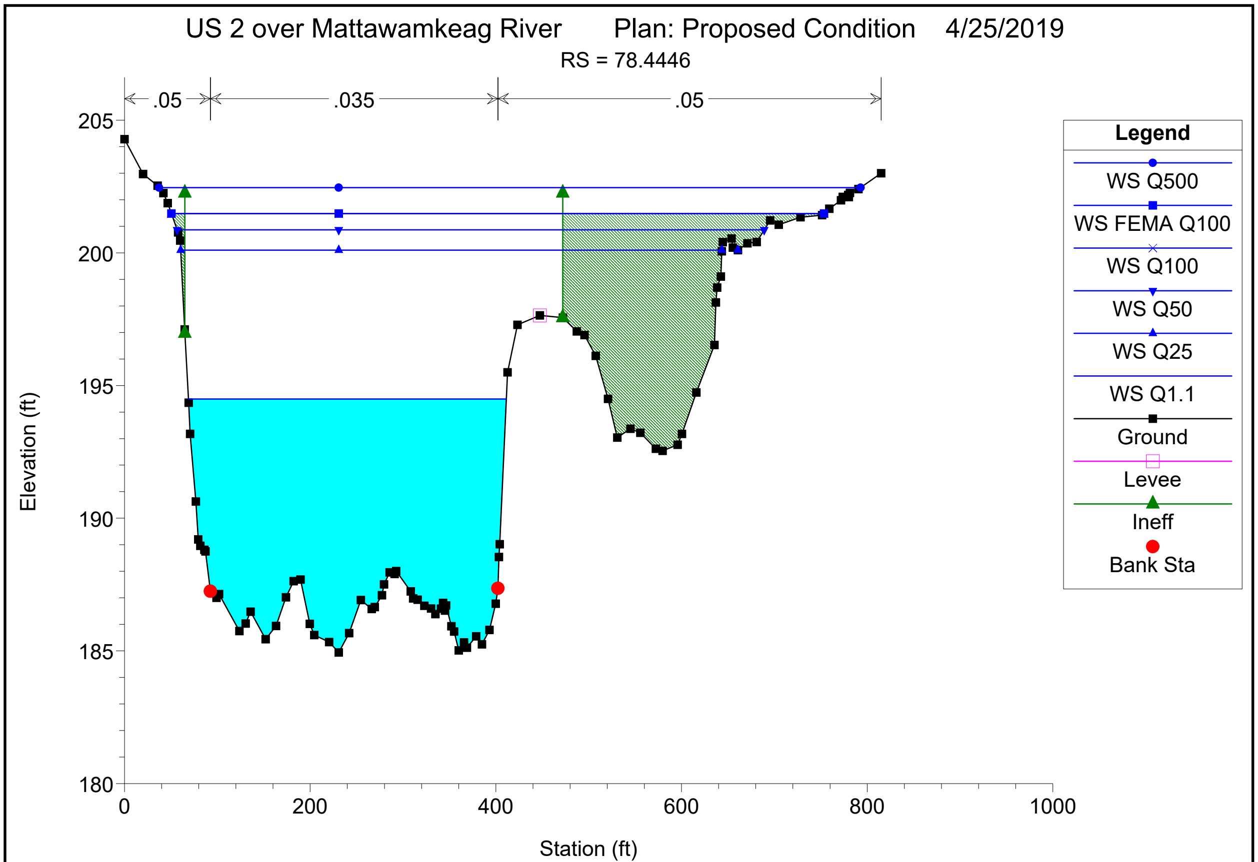
US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 177.3465
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta



US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 155 BR SR 2
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 155 BR SR 2
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 98.9674
.05
.035
.05
Elevation (ft)
Station (ft)
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 78.4446
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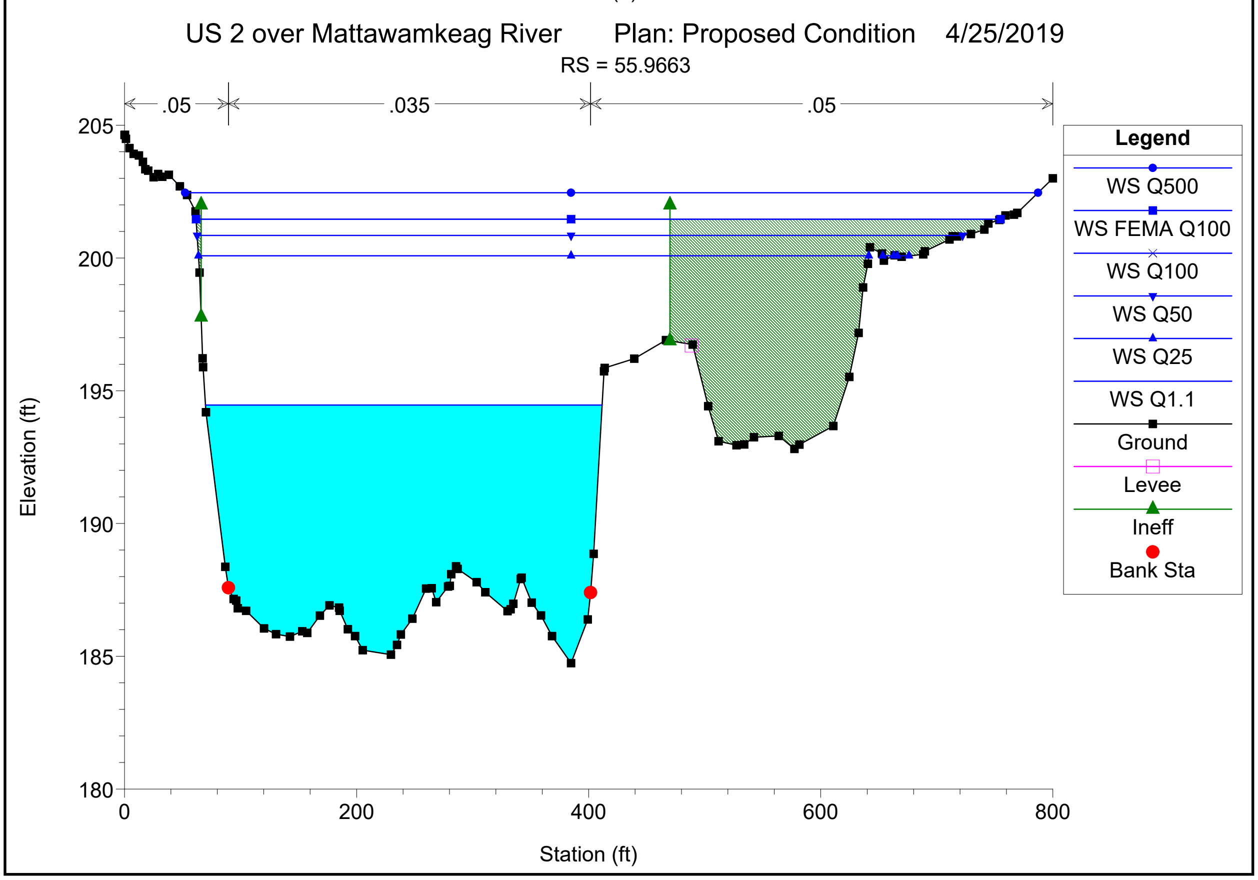
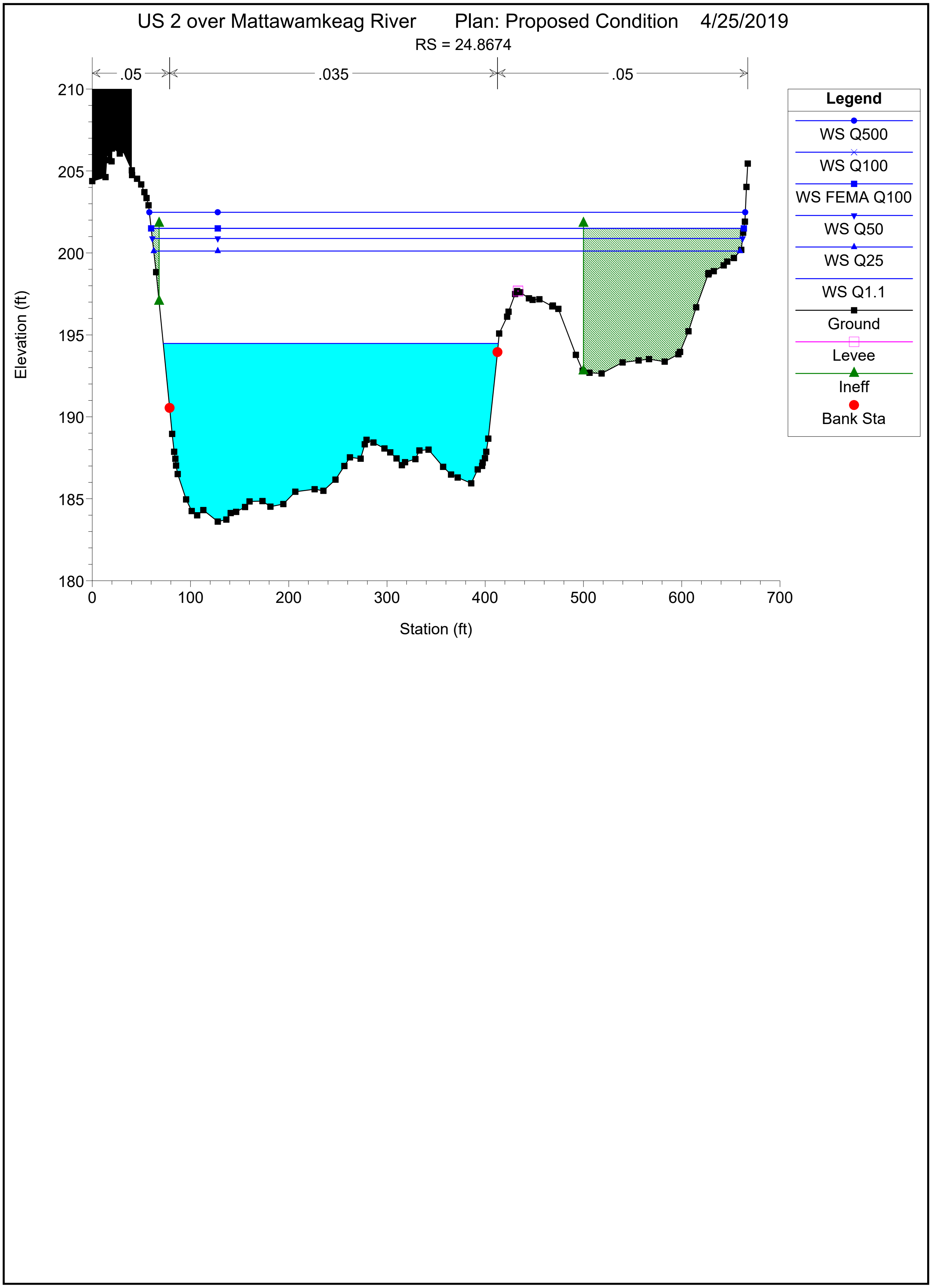
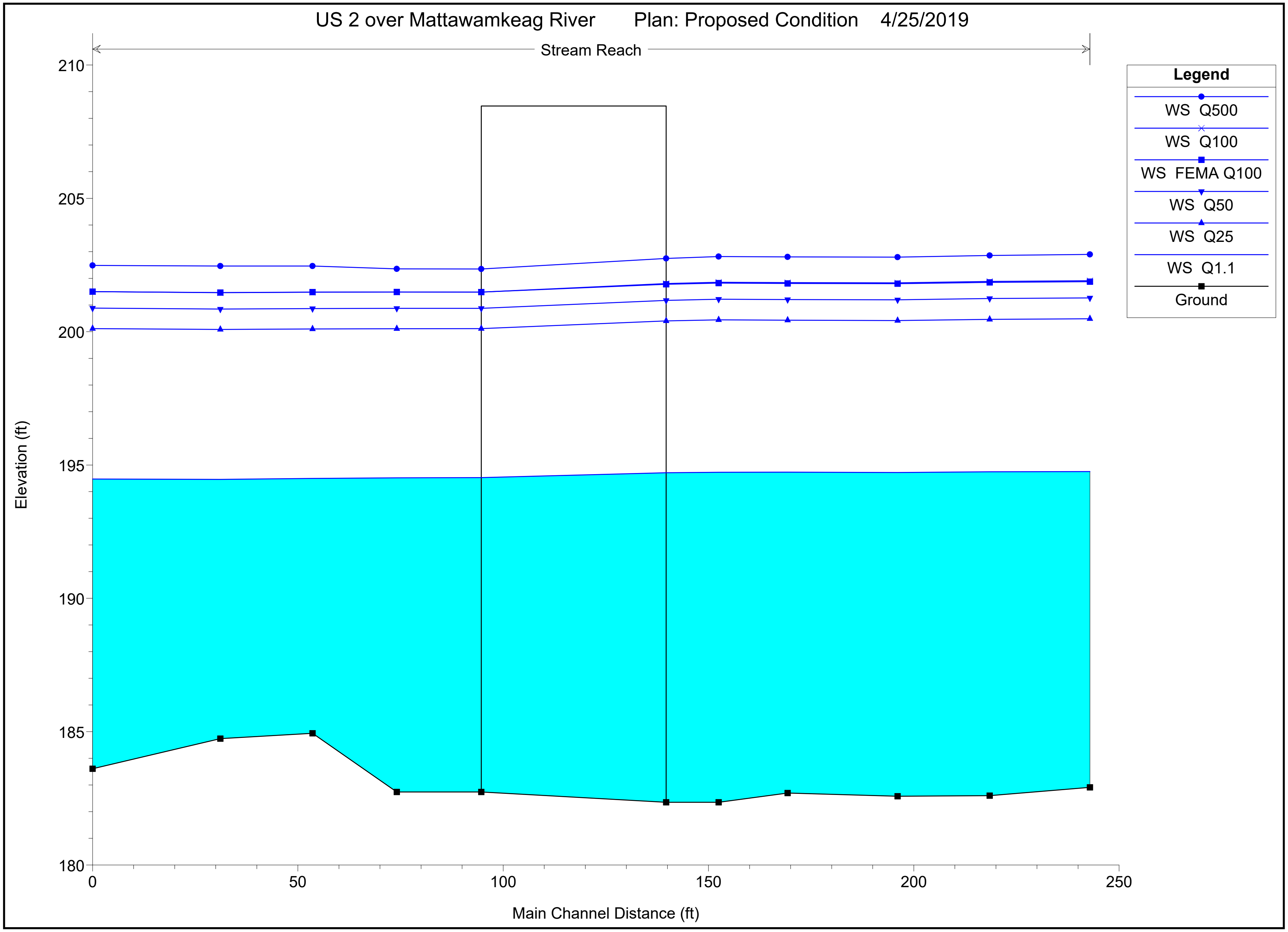
.035
.05
Elevation (ft)
Station (ft)
205
200
195
190
185
180
0
200
400
600
800
1000
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta


US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 55.9663
.05
.035
.05
Elevation (ft)
Station (ft)
205
200
195
190
185
180
0
200
400
600
800
Legend
WS Q500
WS FEMA Q100
WS Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta



US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
RS = 24.8674
.05
.035
.05
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
210
205
200
195
190
185
180
0
100
200
300
400
500
600
700



US 2 over Mattawamkeag River Plan: Proposed Condition 4/25/2019
Stream Reach
Legend
WS Q500
WS Q100
WS FEMA Q100
WS Q50
WS Q25
WS Q1.1
Ground
Elevation (ft)
210
205
200
195
190
185
180
0
50
100
150
200
250
Main Channel Distance (ft)

APPENDIX G

Scour Analysis

Scour Analysis: 100-year storm U/S face of US2 over Mattawamkeag River

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

Live Bed Vs. Clear Water

Depth of flow, y1	18.01	ft
Particle size in a mix of which 50% are smaller, D50 (m)	0.01200	m
Particle size in a mix of which 50% are smaller, D50 (ft)	0.03936	ft
Velocity of main Channel, V	6.39	ft/s
Critical Velocity, Vc	**6.15**	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	18.01	ft
Ex depth in the contracted section before scour, yo	18.11	ft
Flow in the U/S channel transporting sediment Q1	33471.89	ft^3/s
Flow in the contracted channel, Q2	33057.51	ft^3/s
Top width of U/S main channel, W1	290.82	ft
Top width of the main channel in the contracted section, W2	291.93	ft
Fall Velocity, ω	1.48	ft/s
Slope of energy grade line of main channel, S1	0.000482	ft/ft
Shear Velocity, Vα	**0.53**	
Vα/ω	**0.36**	
Exponent, k1	0.59	
Avg depth in contracted section, y2	**17.78**	
****Scour depth, ys***	**-0.33**	***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)

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

Proj. Mattawamkeag Bridge	Job No. 63738	Sheet No. 2 OF 7
Made by KAR	Checked by SPA	Backchecked by SPA
Date 4-23-2019	Date 4-25-2019	Date 4-25-2019

HNTB

Scour Analysis: 100-year storm U/S face of US2 over Mattawamkeag River

Local Scour Live Bed Scour - Pier

Flow depth directly upstream of pier, Y1	18.11	ft
Correction factor for pier nose shape, K1	1.10	
Correction factor for angle of attack of flow, K2	1.00	
Correction factor for bed condition, K3	1.10	
Correction factor for armoring by bed material size, K4	1.00	
Pier Width, a	7.00	ft
Length of Pier, L	45.00	ft
Froude Number directly upstream of pier, Fr1	**0.26**	
Mean velocity of flow directly upstream of pier, V1	6.25	ft/s
Acceleration of gravity, g	32.20	
Scour Depth, ys	**13.21**	***ft***

$$\frac{y_s}{a} = 2.0K_1K_2K_3K_4\left(\frac{y_1}{a}\right)^{0.35} {Fr_1}^{0.43}$$

(HEC-18, 5th Edition, April 2012, Equation 7.3)

Proj. Mattawamkeag Bridge	Job No. 63738	Sheet No. 3 OF 7
Made by KAR	Checked by SPA	Backchecked by SPA
Date 4-23-2019	Date 4-25-2019	Date 4-25-2019

HNTB

Scour Analysis: 100-year storm U/S face of US2 over Mattawamkeag River

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'	4.50	ft
Average depth of flow on embankment, ya	7.58	ft
Velocity on embankment, Ve	2.26	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	**0.145**	
Length of embankment projected to normal flow, L		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 **9.91** ***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'	7.00	ft
Average depth of flow on embankment, ya	9.28	ft
Velocity on embankment, Ve	2.79	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	**0.161**	
Length of embankment projected to normal flow, L		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 **12.65** ***ft***

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

Scour Analysis: 500-year storm U/S face of US2 over Mattawamkeag River

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

Live Bed Vs. Clear Water

Depth of flow, y1	18.97	ft	(HEC-18, 5th Edition, April 2012, Equation 6.1)
Particle size in a mix of which 50% are smaller, D50 (m)	0.01200	m	
Particle size in a mix of which 50% are smaller, D50 (ft)	0.03936	ft	
Velocity of main Channel, V	7.2	ft/s	
Critical Velocity, Vc	6.21	ft/s	

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	18.97	ft
Ex depth in the contracted section before scour, yo	19.07	ft
Flow in the U/S channel transporting sediment Q1	39738.76	ft^3/s
Flow in the contracted channel, Q2	39303.66	ft^3/s
Top width of U/S main channel, W1	290.82	ft
Top widthof the main channel in the contracted section, W2	291.93	ft

Fall Velocity, ω	1.48	ft/s
Slope of energy grade line of main channel, S1	0.000572	ft/ft
Shear Velocity, Vα	0.59	
Vα/ω	0.40	
Exponent, k1	0.59	
Avg depth in contracted section, y2	18.75	
****Scour depth, ys***	**-0.32**	***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)

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

Scour Analysis: 500-year storm U/S face of US2 over Mattawamkeag River

Local Scour Live Bed Scour - Pier

Flow depth directly upstream of pier, Y1	18.96	ft
Correction factor for pier nose shape, K1	1.10	
Correction factor for angle of attack of flow, K2	1.00	
Correction factor for bed condition, K3	1.10	
Correction factor for armoring by bed material size, K4	1.00	
Pier Width, a	7.00	ft
Length of Pier, L	45.00	ft
Froude Number directly upstream of pier, Fr1	**0.29**	
Mean velocity of flow directly upstream of pier, V1	7.06	ft/s
Acceleration of gravity, g	32.20	
Scour Depth, ys	**14.01**	***ft***

$$\frac{y_s}{a} = 2.0K_1K_2K_3K_4\left(\frac{y_1}{a}\right)^{0.35} Fr_1^{\ 0.43}$$

(HEC-18, 5th Edition, April 2012, Equation 7.3)

Scour Analysis: 500-year storm U/S face of US2 over Mattawamkeag River

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'	4.50	ft
Average depth of flow on embankment, ya	8.21	ft
Velocity on embankment, Ve	2.59	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	0.159	
Length of embankment projected to normal flow, L		ft

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

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

Near Abutment Scour Depth, ys **10.79** ***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'	7.00	ft
Average depth of flow on embankment, ya	10.24	ft
Velocity on embankment, Ve	3.25	ft/s
Froude Number of approach flow = $V_e/(gy_a)^{1/2}$	0.179	
Length of embankment projected to normal flow, L		ft

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

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

Far Abutment Scour Depth, ys **14.04** ***ft***

Scour Summary

	100 - year storm		
	Near Abutment	Pier	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00	0.00
Contraction/Expansion Scour (ft)	0.00	0.00	0.00
Local Scour (ft)	9.91	13.21	12.65
Pressure Flow Scour (ft)	0.00	0.00	0.00
TOTAL SCOUR (ft)	***9.91***	***13.21***	***12.65***

	500-year storm		
	Near Abutment	Pier	Far Abutment
Aggradation/ Degradation (ft)	0.00	0.00	0.00
Contraction/Expansion Scour (ft)	0.00	0.00	0.00
Local Scour (ft)	10.79	14.01	14.04
Pressure Flow Scour (ft)	0.00	0.00	0.00
TOTAL SCOUR (ft)	***10.79***	***14.01***	***14.04***

Plan: Pro Condition Stream Reach RS: 194.1222 Profile: Q100

UNCONTRACTED SECTION

E.G. Elev (ft)	202.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	201.84	Reach Len. (ft)	18.13	16.78	24.80
Crit W.S. (ft)	191.60	Flow Area (sq ft)	240.78	5237.21	620.53
E.G. Slope (ft/ft)	0.000482	Area (sq ft)	240.78	5237.21	1039.23
Q Total (cfs)	35478.00	Flow (cfs)	587.14	33471.89	1418.97
Top Width (ft)	509.98	Top Width (ft)	29.93	290.82	189.22
Vel Total (ft/s)	5.82	Avg. Vel. (ft/s)	2.44	6.39	2.29
Max Chl Dpth (ft)	19.14	Hydr. Depth (ft)	8.04	18.01	6.70
Conv. Total (cfs)	1615180.0	Conv. (cfs)	26730.4	1523850.0	64600.3
Length Wtd. (ft)	17.18	Wetted Per. (ft)	33.35	291.90	94.65
Min Ch El (ft)	182.70	Shear (lb/sq ft)	0.22	0.54	0.20
Alpha	1.15	Stream Power (lb/ft s)	0.53	3.45	0.45
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.87	18.93	3.92
C & E Loss (ft)	0.01	Cum SA (acres)	0.12	1.18	0.72

Plan: Pro Condition Stream Reach RS: 194.1222 Profile: Q500

UNCONTRACTED SECTION

E.G. Elev (ft)	203.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	202.80	Reach Len. (ft)	18.13	16.78	24.80
Crit W.S. (ft)	192.54	Flow Area (sq ft)	270.20	5516.91	709.62
E.G. Slope (ft/ft)	0.000572	Area (sq ft)	270.20	5516.91	1230.15
Q Total (cfs)	42421.00	Flow (cfs)	750.49	39738.76	1931.75
Top Width (ft)	532.26	Top Width (ft)	31.23	290.82	210.21
Vel Total (ft/s)	6.53	Avg. Vel. (ft/s)	2.78	7.20	2.72
Max Chl Dpth (ft)	20.10	Hydr. Depth (ft)	8.65	18.97	7.66
Conv. Total (cfs)	1774060.0	Conv. (cfs)	31385.7	1661888.0	80786.2
Length Wtd. (ft)	17.22	Wetted Per. (ft)	34.97	291.90	94.65
Min Ch El (ft)	182.70	Shear (lb/sq ft)	0.28	0.67	0.27
Alpha	1.15	Stream Power (lb/ft s)	0.77	4.86	0.73
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.00	20.04	4.64
C & E Loss (ft)	0.01	Cum SA (acres)	0.14	1.18	0.77

Plan: Pro Condition Stream Reach RS: 177.3465 Profile: Q100

CONTRACTED SECTION

E.G. Elev (ft)	202.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	201.85	Reach Len. (ft)	12.80	12.80	12.80
Crit W.S. (ft)	191.53	Flow Area (sq ft)	228.75	5286.84	682.73
E.G. Slope (ft/ft)	0.000459	Area (sq ft)	228.75	5286.84	1198.60
Q Total (cfs)	35478.00	Flow (cfs)	516.35	33057.51	1904.14
Top Width (ft)	495.08	Top Width (ft)	30.18	291.93	172.96
Vel Total (ft/s)	5.72	Avg. Vel. (ft/s)	2.26	6.25	2.79
Max Chl Dpth (ft)	19.50	Hydr. Depth (ft)	7.58	18.11	9.28
Conv. Total (cfs)	1655467.0	Conv. (cfs)	24093.9	1542523.0	88850.8
Length Wtd. (ft)	12.80	Wetted Per. (ft)	34.28	293.45	74.50
Min Ch El (ft)	182.35	Shear (lb/sq ft)	0.19	0.52	0.26
Alpha	1.13	Stream Power (lb/ft s)	0.43	3.23	0.73
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.78	16.90	3.28
C & E Loss (ft)	0.01	Cum SA (acres)	0.11	1.06	0.61

Plan: Pro Condition   Stream   Reach RS: 177.3465   Profile: Q500

E.G. Elev (ft)	203.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.050	0.035	0.050
W.S. Elev (ft)	202.82	Reach Len. (ft)	12.80	12.80	12.80
Crit W.S. (ft)	192.50	Flow Area (sq ft)	258.45	5568.03	753.59
E.G. Slope (ft/ft)	0.000546	Area (sq ft)	258.45	5568.03	1370.85
Q Total (cfs)	42421.00	Flow (cfs)	669.21	39303.66	2448.13
Top Width (ft)	509.43	Top Width (ft)	31.49	291.93	186.01
Vel Total (ft/s)	6.45	Avg. Vel. (ft/s)	2.59	7.06	3.25
Max Chl Dpth (ft)	20.47	Hydr. Depth (ft)	8.21	19.07	10.24
Conv. Total (cfs)	1815049.0	Conv. (cfs)	28633.2	1681669.0	104747.0
Length Wtd. (ft)	12.80	Wetted Per. (ft)	35.91	293.45	74.50
Min Ch El (ft)	182.35	Shear (lb/sq ft)	0.25	0.65	0.34
Alpha	1.13	Stream Power (lb/ft s)	0.64	4.57	1.12
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.89	17.90	3.90
C & E Loss (ft)	0.01	Cum SA (acres)	0.13	1.06	0.66

CONTRACTED SECTION

BRIDGE OUTPUT

Plan: Pro Condition Stream Reach RS: 155 Profile: Q100

E.G. US. (ft)	202.43	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	201.85	E.G. Elev (ft)	202.41	202.31
Q Total (cfs)	35478.00	W.S. Elev (ft)	201.80	201.48
Q Bridge (cfs)	35478.00	Crit W.S. (ft)	191.65	193.58
Q Weir (cfs)		Max Chl Dpth (ft)	19.45	18.74
Weir Sta Lft (ft)		Vel Total (ft/s)	5.98	7.01
Weir Sta Rgt (ft)		Flow Area (sq ft)	5928.23	5062.09
Weir Submerg		Froude # Chl	0.27	0.33
Weir Max Depth (ft)		Specif Force (cu ft)	57460.43	45696.11
Min El Weir Flow (ft)	204.57	Hydr Depth (ft)	15.88	13.62
Min El Prs (ft)	208.46	W.P. Total (ft)	454.76	439.48
Delta EG (ft)	0.16	Conv. Total (cfs)	1384702.0	1119770.0
Delta WS (ft)	0.37	Top Width (ft)	373.34	371.59
BR Open Area (sq ft)	7236.95	Frctn Loss (ft)	0.04	0.02
BR Open Vel (ft/s)	7.01	C & E Loss (ft)	0.07	0.02
BR Sluice Coef		Shear Total (lb/sq ft)	0.53	0.72
BR Sel Method	Energy only	Power Total (lb/ft s)	3.20	5.06

Plan: Pro Condition Stream Reach RS: 155 Profile: Q500

E.G. US. (ft)	203.54	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	202.82	E.G. Elev (ft)	203.52	203.40
Q Total (cfs)	42421.00	W.S. Elev (ft)	202.75	202.35
Q Bridge (cfs)	42421.00	Crit W.S. (ft)	192.64	194.53
Q Weir (cfs)		Max Chl Dpth (ft)	20.40	19.61
Weir Sta Lft (ft)		Vel Total (ft/s)	6.75	7.87
Weir Sta Rgt (ft)		Flow Area (sq ft)	6285.41	5386.86
Weir Submerg		Froude # Chl	0.29	0.36
Weir Max Depth (ft)		Specif Force (cu ft)	65624.31	52985.43
Min El Weir Flow (ft)	204.57	Hydr Depth (ft)	16.60	14.26
Min El Prs (ft)	208.46	W.P. Total (ft)	465.07	449.98
Delta EG (ft)	0.20	Conv. Total (cfs)	1503848.0	1222107.0
Delta WS (ft)	0.46	Top Width (ft)	378.61	377.81
BR Open Area (sq ft)	7236.95	Frctn Loss (ft)	0.04	0.02
BR Open Vel (ft/s)	7.87	C & E Loss (ft)	0.08	0.03
BR Sluice Coef		Shear Total (lb/sq ft)	0.67	0.90
BR Sel Method	Energy only	Power Total (lb/ft s)	4.53	7.09

D50 Fall Velocity

correctly account for the increase in transport that will occur as the result of the bed planing out (which decreases resistance to flow, increases the velocity and the transport of bed material at the bridge). That is, Laursen's equation indicates a decrease in scour for this case, whereas in reality, there would be an increase in scour depth. In addition, at flood flows, a plane bedform will usually exist upstream and through the bridge waterway, and the values of Manning n will be equal. Consequently, the n value ratio is not recommended or presented in Equation 6.2.

4. W_1 and W_2 are not always easily defined. In some cases, it is acceptable to use the topwidth of the main channel to define these widths. Whether topwidth or bottom width is used, it is important to be consistent so that W_1 and W_2 refer to either bottom widths or top widths.

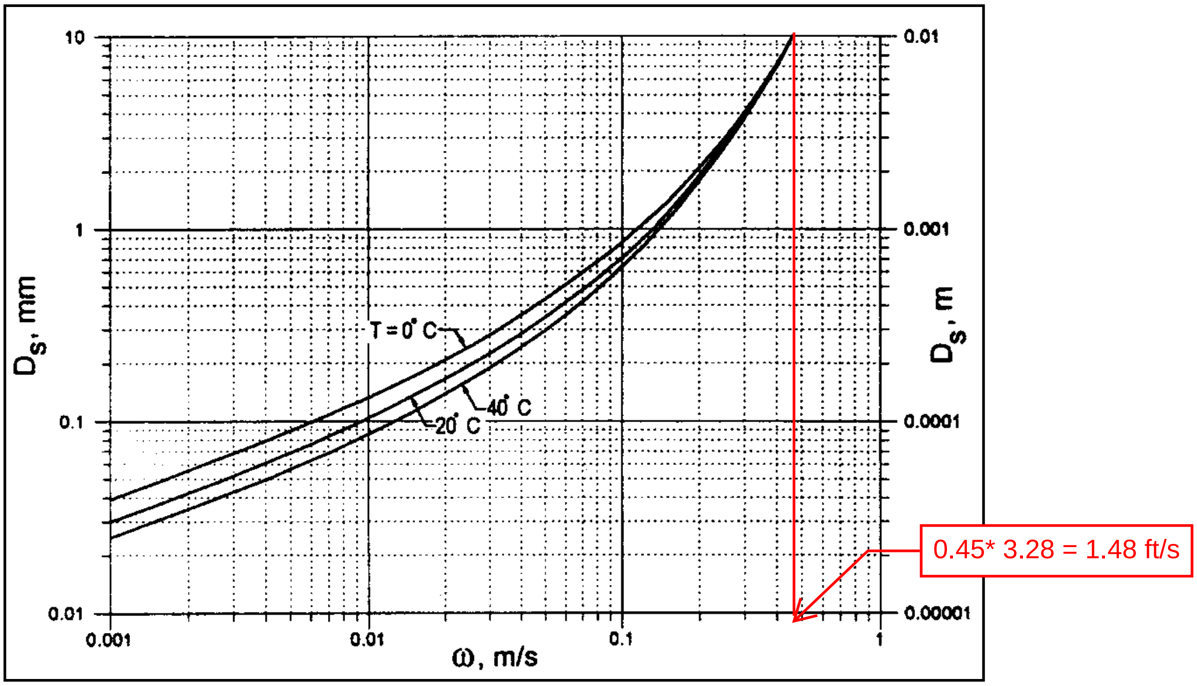


Figure 6.8. Fall velocity of sand-sized particles with specific gravity of 2.65 in metric units.

5. The average width of the bridge opening (W_2) is normally taken as the bottom width, with the width of the piers subtracted.

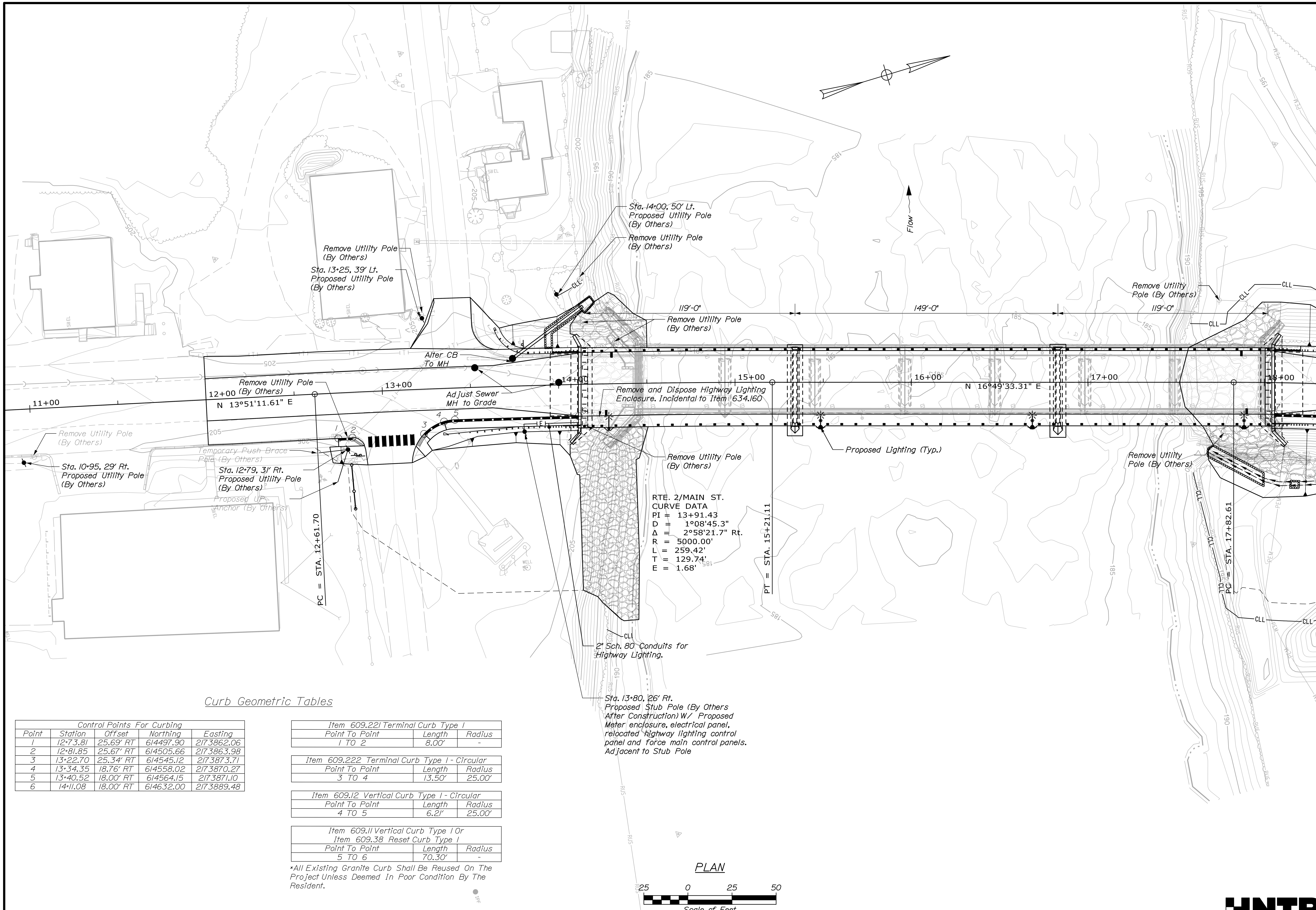
6. Laursen's equation will overestimate the depth of scour at the bridge if the bridge is located at the upstream end of a natural contraction or if the contraction is the result of the bridge abutments and piers. At this time, however, it is the best equation available.

7. In sand channel streams where the contraction scour hole is filled in on the falling stage, the y_0 depth may be approximated by y_1. Sketches or surveys through the bridge can help in determining the existing bed elevation.

8. **Scour depths with live-bed contraction scour may be limited by coarse sediments in the bed material armoring the bed. Where coarse sediments are present, it is recommended that scour depths be calculated for live-bed scour conditions using the clear-water scour equation (given in the next section) in addition to the live-bed equation, and that the smaller calculated scour depth be used.**

APPENDIX H

Drawings



Curb Geometric Tables

Control Points For Curbing				
Point	Station	Offset	Northing	Easting
1	12+73.81	25.69' RT	614497.90	2173862.06
2	12+81.85	25.67' RT	614505.66	2173863.98
3	13+22.70	25.34' RT	614545.12	2173873.71
4	13+34.35	18.76' RT	614558.02	2173870.27
5	13+40.52	18.00' RT	614564.15	2173871.10
6	14+11.08	18.00' RT	614632.00	2173889.48

Item 609.221 Terminal Curb Type I		
Point To Point	Length	Radius
1 TO 2	8.00'	-

Item 609.222 Terminal Curb Type I - Circular		
Point To Point	Length	Radius
3 TO 4	13.50'	25.00'

Item 609.12 Vertical Curb Type I - Circular		
Point To Point	Length	Radius
4 TO 5	6.21'	25.00'

Item 609.11 Vertical Curb Type I Or Item 609.38 Reset Curb Type I		
Point To Point	Length	Radius
5 TO 6	70.30'	-

*All Existing Granite Curb Shall Be Reused On The Project Unless Deemed In Poor Condition By The Resident.

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STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
2262701
WIN 023234.01
BRIDGE NO. 2522
BRIDGE PLANS

PROJ. MANAGER	Andy Lathe		
DESIGN-DETAILED	C. Helmick	P. Bishop	7/20
CHECKED-REVIEWED	L. Driscoll	A. Stephens	7/20
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

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MATTAWAMKEAG BRIDGE
MATTAWAMKEAG RIVER
MATTAWAMKEAG PENOBSCOT COUNTY

GENERAL PLAN 1

SHEET NUMBER
4
OF 69

Date: 7/9/2020
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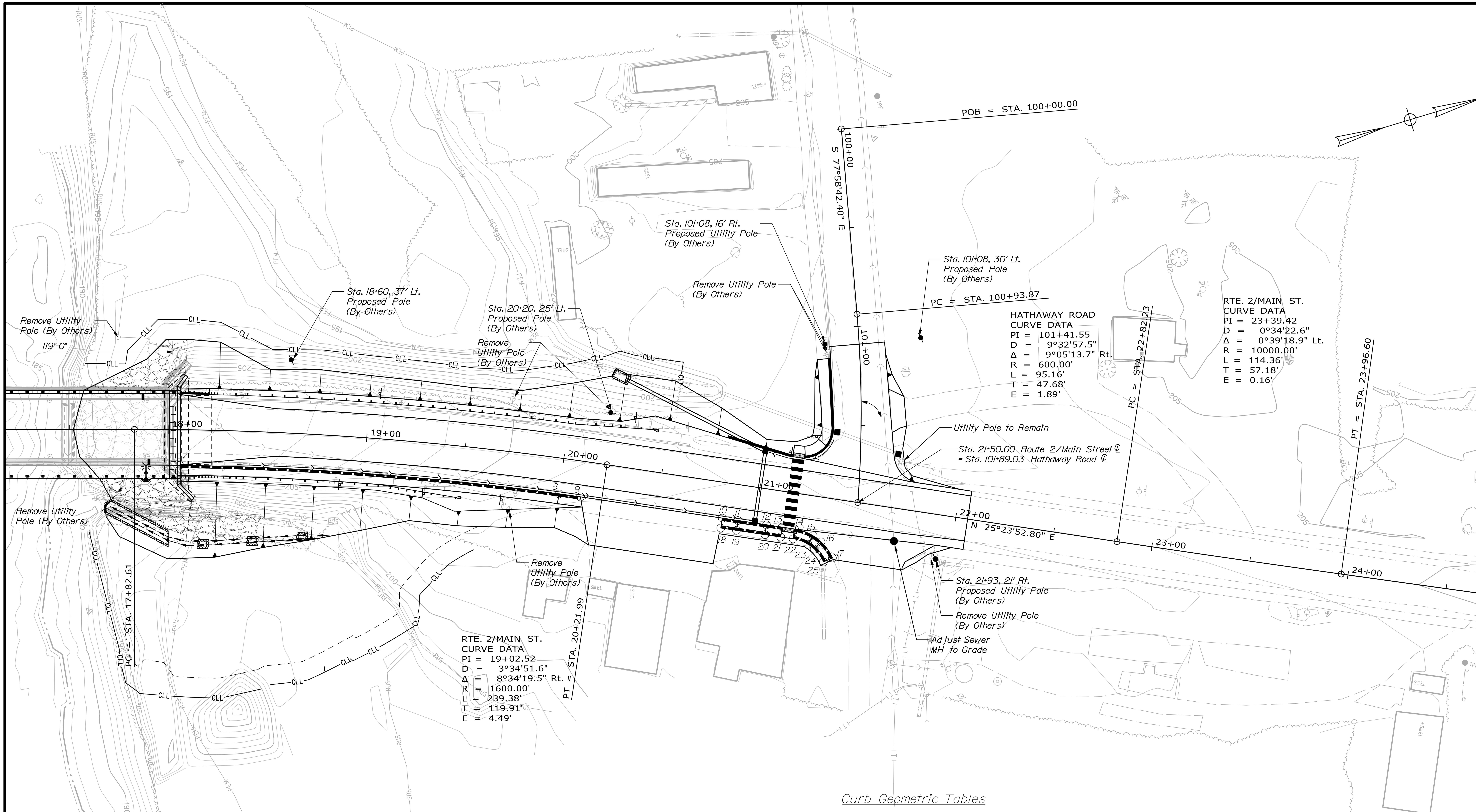

Curb Geometric Tables

Item 609.12 Vertical Curb Type I - Circular		
Point To Point	Length	Radius
15 TO 16	5.05'	25.00'
23 TO 24	4.06'	20.00'

Item 609.11 Vertical Curb Type I Or Item 609.38 Reset Curb Type I		
Point To Point	Length	Radius
7 TO 8	192.10'	1582.00'
11 TO 12	14.56'	-
19 TO 20	14.56'	-

*All Existing Granite Curb Shall Be Reused On The Project Unless Deemed In Poor Condition By The Resident.

Item 609.221 Terminal Curb Type I		
Point To Point	Length	Radius
8 TO 9	11.00'	-
10 TO 11	8.00'	-
12 TO 13	8.00'	-
18 TO 19	8.00'	-
20 TO 21	8.00'	-

Item 609.222 Terminal Curb Type I - Circular		
Point To Point	Length	Radius
14 TO 15	10.00'	25.00'
16 TO 17	10.00'	25.00'
22 TO 23	8.00'	20.00'
24 TO 25	8.00'	20.00'

PLAN

25 0 25 50
Scale of Feet

Control Points For Curbing				
Point	Station	Offset	Northing	Easting
7	18+05.74	18.00' RT	615009.44	2174002.53
8	19+99.93	18.00' RT	615188.42	2174071.71
9	20+11.05	18.00' RT	615198.40	2174076.32
10	20+83.53	18.00' RT	615263.78	2174107.33
11	20+91.53	18.00' RT	615271.01	2174110.76
12	21+06.10	18.00' RT	615284.16	2174117.00
13	21+14.10	18.00' RT	615291.39	2174120.43
14	21+20.41	18.00' RT	615297.09	2174123.14
15	21+30.17	19.99' RT	615305.06	2174129.12
16	21+34.58	22.41' RT	615308.01	2174133.20
17	21+41.49	29.56' RT	615311.18	2174142.62
18	20+83.54	23.00' RT	615261.64	2174111.85
19	20+91.54	23.00' RT	615268.87	2174115.28
20	21+06.10	23.00' RT	615282.02	2174121.53
21	21+14.10	23.00' RT	615289.25	2174124.96
22	21+20.42	23.00' RT	615294.96	2174127.66
23	21+28.20	24.58' RT	615301.31	2174132.42
24	21+31.76	26.52' RT	615303.69	2174135.71
25	21+37.28	32.25' RT	615306.22	2174143.25

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2262701

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WIN 023234.01
BRIDGE PLANS

	BY	DATE
PROJ. MANAGER	Andy Lathe	
DESIGN-DETAILED	C. Helmick	P. Bishop	7/20
CHECKED-REVIEWED	L. Driscoll	A. Stephens	7/20
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

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MATTAWAMKEAG RIVER
MATTAWAMKEAG PENOBSCOT COUNTY

GENERAL PLAN 2

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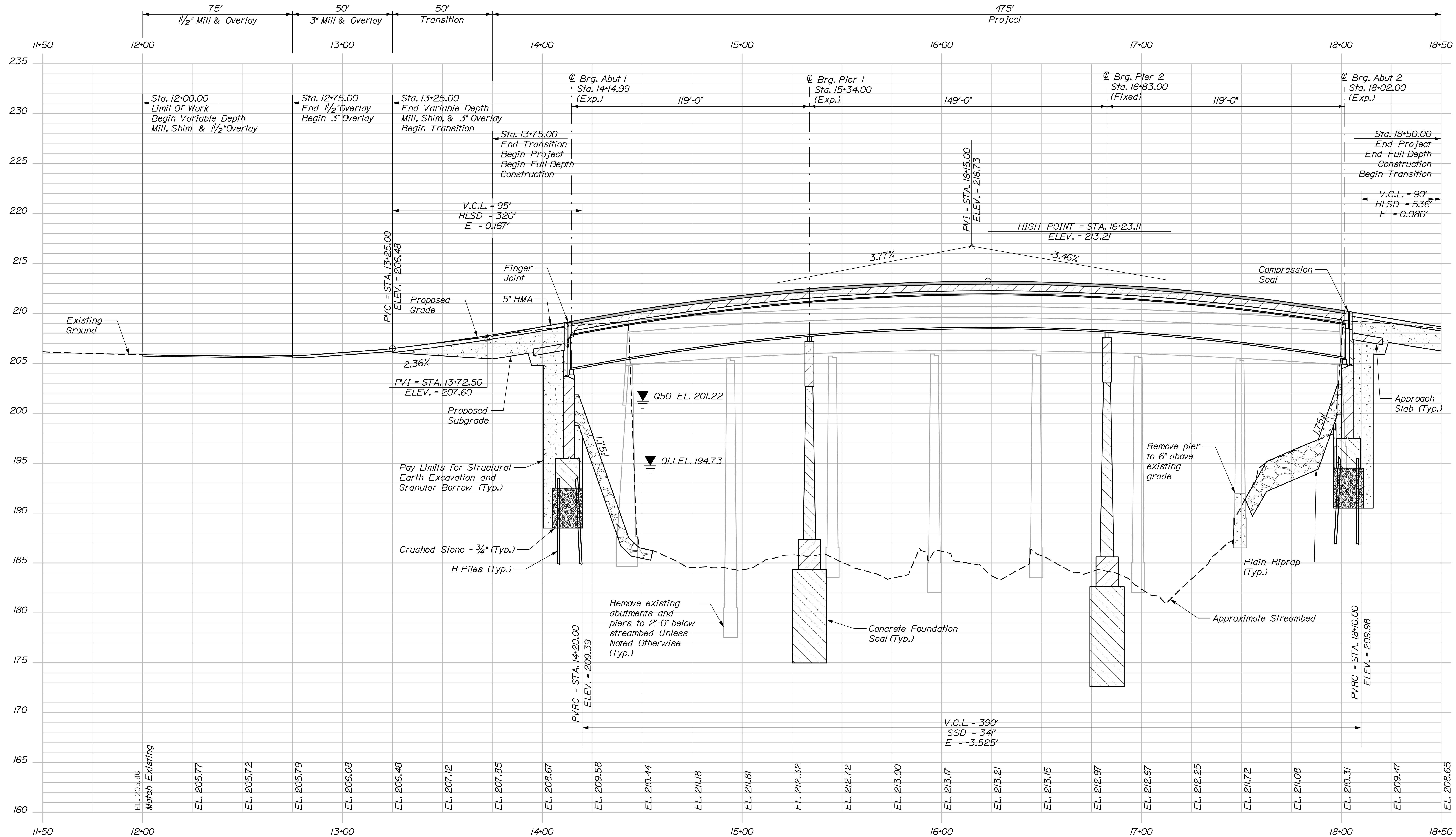

U.S. ROUTE 2/MAIN ST. PROFILE

Horiz. 25 0 25 50

Vert. 5 0 5 10

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2262701

WIN 023234.01

BRIDGE PLANS

BRIDGE NO. 2522

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P.E. NUMBER

DATE

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PROJ. MANAGER	Andy Lathe		
DESIGN-DETAILED	C. Helmick	P. Bishop	7/20
CHECKED-REVIEWED	L. Driscoll	A. Stephens	7/20
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DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

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MATTAWAMKEAG PENOBSCOT COUNTY

PROFILE 1

SHEET NUMBER

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OF 69

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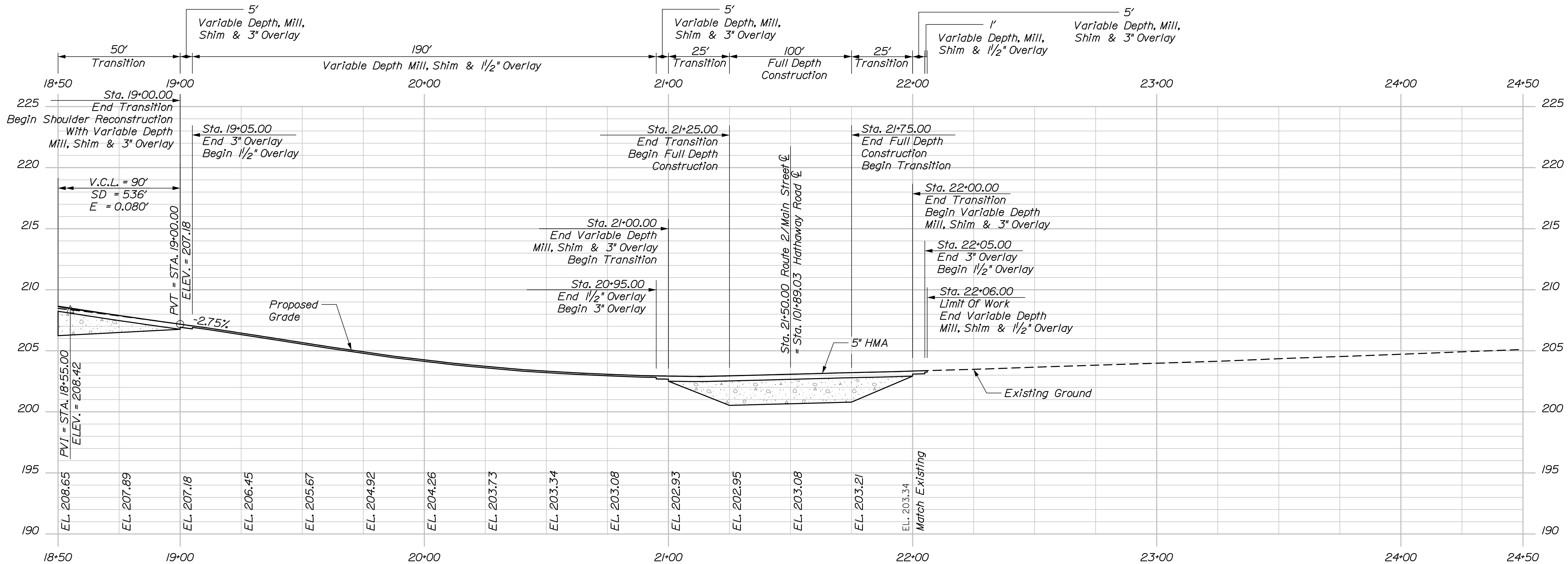
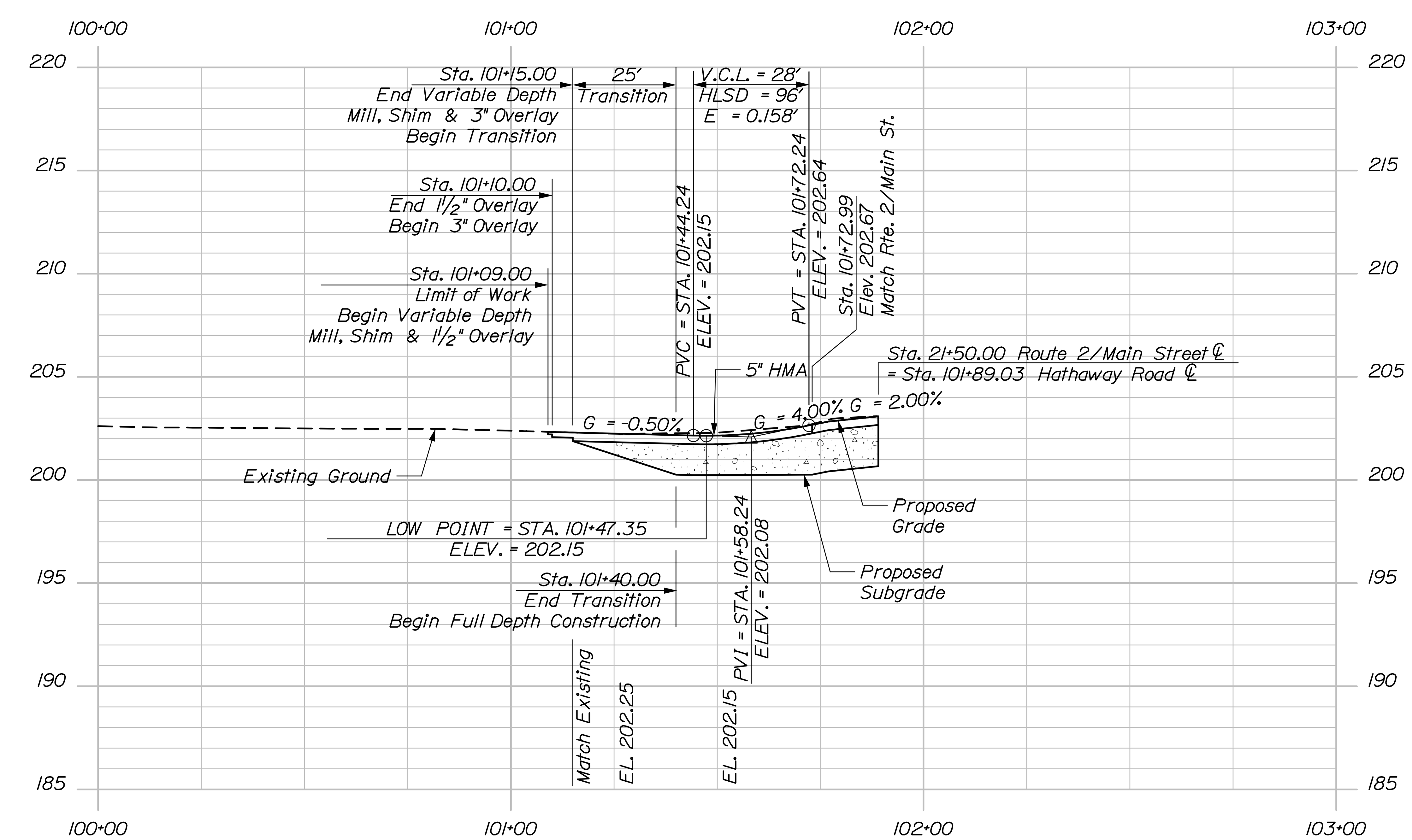


U.S. ROUTE 2/MAIN ST. PROFILE

Horiz. 25 0 25 50
Vert. 5 0 5 10
Scale of Feet



HATHAWAY ROAD PROFILE

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Scale of Feet

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STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

2262701

WIN 023234.01

BRIDGE NO. 2522

BRIDGE PLANS

		BY	DATE
PROJ. MANAGER	Andy Lathe		
DESIGN-DETAILED	C. Helmick	P. Bishop	7/20
CHECKED-REVIEWED	L. Driscoll	A. Stephens	7/20
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
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PROFILE 2

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