



HYDROLOGY AND HYDRAULICS REPORT

Tannery Bridge over Tannery Brook
Mariaville, ME

Bridge Number #3511

July 16, 2024

Prepared for:
Maine Department of Transportation

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Project Number:179450563

Hydrology and Hydraulics Report

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Hydrology and Hydraulics Report

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1 Introduction

1.1 Purpose

The Maine Department of Transportation (MEDOT) proposes replacement of Tannery Bridge over Tannery Brook on Mariaville Road in Mariaville, Maine (Project). The location of Tannery Bridge (Site) is shown at Latitude: 44° 11' 14.8" N, Longitude: 69° 04' 26.5" W in Figure 1. The purpose of this report is to present the methods and results of a hydrology and hydraulic study (the Study) for the preliminary proposed bridge replacement design. The objective of the Study is to evaluate the hydraulic performance and scour potential of the proposed bridge.



Latitude: 44° 11' 14.8" N, Longitude: 69° 04' 26.5" W

Figure 1. Location of Tannery Bridge including an overview map of the surrounding features; basemap imagery is based on publicly available imagery accessed online from Google Maps in September 2023.

1.2 Scope

The scope of the Study includes review and analysis of existing hydrologic data, developing a numerical hydraulic model of the Study reach of Tannery Brook for existing and proposed conditions, evaluating and comparing the hydraulic model results for existing and proposed conditions, and calculating stable material size for scour protection measures. This report includes descriptions of the Project, data collection and analysis, and Study findings, conclusions, and recommendations.



1.3 References

The following data sources, references, and reports pertinent to the subject bridge were available and were used as part of the Study:

1. Bridge file information provided by MEDOT, including bridge inspection reports and site photographs.
2. U.S. Geological Survey (USGS) topographic maps.
3. Information provided by MEDOT from USGS regression equations and the USGS StreamStats online software tool. (April 2022).
4. OCM Partners (2015). *Maine and Massachusetts 2015 QL1 and QL2 Lidar*.
5. Soil boring information, including the composition, distribution, and depth of materials obtained from the borings.
6. Channel cross-sections and survey obtained from MEDOT. (May 2023).
7. Federal Emergency Management Agency. (July 20, 2016). *Flood Insurance Rate Map 23009C583D*. Town of Mariaville, Maine, Hancock County. (FIRM)
8. Federal Emergency Management Agency. (July 20, 2016). *Flood Insurance Study 23009CV001A*. Hancock County, Maine. (FIS)
9. Federal Highway Administration. (September 2009). HEC-23. *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance - Third Edition*.
10. Federal Highway Administration. (April 2012). HEC-20. *Stream Stability at Highway Structures - Fourth Edition*.
11. Federal Highway Administration. (April 2012). HEC-18. *Evaluating Scour at Bridges - Fifth Edition*.
12. Maine Department of Transportation. (August 2003). *Bridge Design Guide*.

2 Project Description

2.1 Tannery Brook

Tannery Brook generally flows in a south-easterly direction and discharges into Graham Lake. According to the United States Geological Survey (USGS) StreamStats tool (ver. 4.16.1), the tributary drainage area of Tannery Brook at the approximate location of the Project Bridge is 18.7 square miles (Figure 2). Based on information obtained from StreamStats, the average basin slope is approximately 9.1 percent.



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Downstream of the Tannery Bridge the Tannery Brook is part of the FERC Project Boundary for the Ellsworth Hydroelectric Project, FERC No. 2727, which extends to the elevation 107.0 feet (ft) mean sea level contour. Based on previous work performed by Stantec, 107.0 ft mean sea level is approximately elevation 106.675 ft based on the North American Vertical Datum of 1988 (NAVD88).

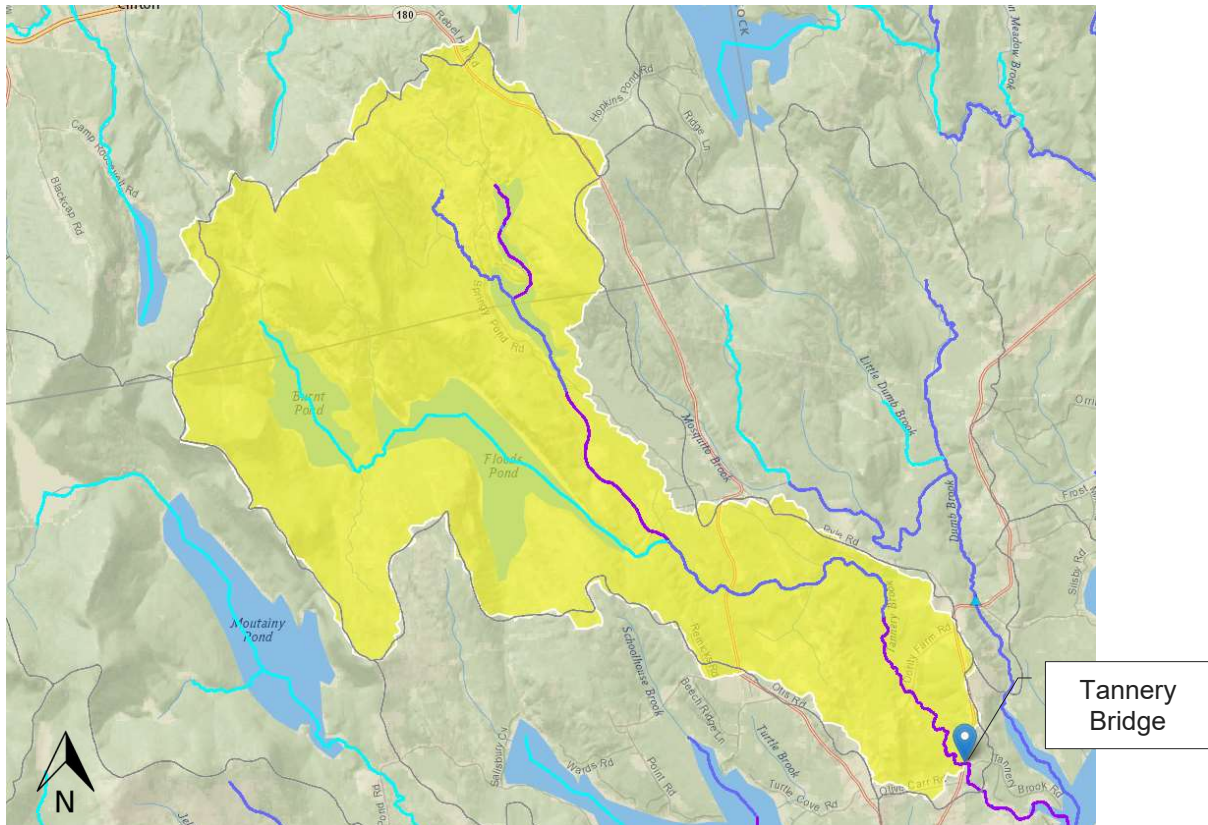


Figure 2. Approximate drainage area depicted in yellow as delineated from USGS StreamStats

2.2 Existing Structure

The existing Tannery Bridge (#3511) was built in 1937 and is a 23-ft single-span reinforced concrete slab bridge with bituminous wearing surface. Tannery Bridge carries Route 181, locally known as Mariaville Road, over Tannery Brook. The bridge has a 30-degree skew and carries two 11-ft lanes of traffic. The bridge is currently posted for 25 tons. The wingwalls were rehabilitated in 2014 and are in satisfactory condition. The bridge has a scour plan of action (POA).

Maintenance records and inspection reports indicate the following repairs have been made to the bridge:

1. The concrete railing and curb were replaced with “Maine Rail” in 1996.
2. Fascias have been rehabilitated.



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3. Wingwalls rehabilitated in 2014.
4. Grout bad scour repairs at both abutments in 2016.

The 2021 inspection report noted the following deficiencies:

1. Bottom of the slab has 75 to 100% cracking with very active efflorescence and leakage.
2. Rehabilitated fascias have minor cracking and efflorescence staining.
3. Abutments have moderate cracking with active efflorescence.
4. Rehabilitated wingwalls have no issues.
5. 2020 Dive inspection found no change in grout bags or abutments.
6. Overall condition ratings for components: Superstructure is 4 – Poor Conditions and Substructure is 5 – Fair Condition.

2.3 Proposed Structure

Several different replacement alternatives were assessed during this phase of project planning, following which, a preferred alternative was selected. The preferred alternative for the proposed structure is a 48-ft single-span steel bridge, with a hydraulic opening of 42.6 ft. The proposed span exceeds the bankfull width of 27 ft and has 3:1 slopes up to the integral abutments. Note that the design span substantially exceeds 1.2-times the bankfull width due to incorporation of two 4-ft-wide wildlife benches. Further discussion of the proposed bridge components will be discussed in the preliminary design report.

2.3.1 HABITAT CONNECTIVITY DESIGN

The proposed design address MaineDOT's Habitat Connectivity Design (HCD) requirements for aquatic organisms and wildlife benches for terrestrial organism passage. The HCD requirements for aquatic organism are addressed by maintaining the existing riffle located approximately 30 ft downstream from the bridge that currently results in backwater conditions through the bridge during typical instream flow conditions. HCD requirements for natural substrate will be accommodated by placing gravel and cobble material in the channel on armor material used to construct scour countermeasures, and wildlife benches on the margins of the channel under the bridge.

A wildlife bench is incorporated into the design of the proposed structure. The wildlife bench will facilitate wildlife movement from one side of the proposed bridge to the other during normal flow conditions in close proximity to the channel. The wildlife bench is not intended to support passage of wildlife during high-flow flood events. The wildlife bench design consists of two, 4-ft stretches of level ground between the abutments and the channel, one on each side of the channel. The hydraulic section then slopes at a 3:1 slope until tying into the existing channel bed. Each wildlife bench is set at an elevation of 110.4 ft referenced to the North American Vertical Datum of 1988 (NAVD88), which is the approximate water surface elevation during the 1.1-year flow event.



3 Engineering Methods

Hydrologic and hydraulic analyses were conducted to estimate flow speeds and water surface elevations at the proposed bridge location. The following sections briefly describe the hydrologic and hydraulic analysis methodologies.

3.1 Hydrologic Analysis

MEDOT provided Stantec with peak flow and flow duration statistics for the Study reach of Tannery Brook on April 28, 2022, which were based on USGS regression equations for the state of Maine¹. Stantec also reviewed the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) for peak flow statistics along Tannery Brook. The Site is located in an area designed by FEMA as “Area of Minimal Flood Hazard”. Peak and normal flows estimated at the Site are presented in Table 1 and

¹ Lombard and Hodgkins, 2021. Estimating Flood Magnitude and Frequency on Gaged and Ungaged Streams in Maine. SIR 2021-xxxx, USGS, Augusta, ME; 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 and Hodgkins, 2015. Peak Flow regression equations for small, ungaged streams: in Maine: Comparing Map-Based to Field-Based Variables. SIR 2015-4059, USGS, August, ME; Dudley, 2004, Estimating Monthly Stream Flows..., SIR 2004-5026; Dudley, 2013, FY2013 Progress Report – Phase 1..., USFWS QRP Project; Dudley, 2015, Regression Equations for Monthly and Annual Mean..., USGS, SIR 2015-5151.



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Table 2 below, respectively.

Table 1. Tannery Brook peak flows

Return Interval	Annual Exceedance Probability	Flow (cfs)
		MaineDOT Provided
Bankfull		324
1.1-year	90%	270
2-year	50%	490
5-year	20%	720
10-year	10%	875
25-year	4%	1085
50-year	2%	1255
100-year	1%	1415
200-year	0.50%	1580
500-year	0.20%	1800



Table 2. Tannery Brook annual (normal) flows

Normal Flow Description	Flow (cfs) MaineDOT Provided
Mean Annual Flow	44
95% Annual Exceedance	3
50% (Median) Annual Exceedance	19
5% Annual Exceedance	138

Per the MEDOT Bridge Design Guide (August 2003), the design flood for bridges is the 50-year flow event. Supporting information on the estimates of hydrology for the Study, including hydrologic computations and background information, are provided in Appendix A.

3.2 Hydraulic Analysis

The United States Army Corps of Engineers HEC-RAS software (Version 6.3.1) was used to develop a combined one-dimensional and two dimension (depth-averaged) numerical hydraulic model (Model). The Model was used to simulate water surface elevation profiles and flow speeds across a range of flows for both existing and proposed conditions. The bridge and immediately adjacent reaches of the brook were modeled using a one-dimensional domain. The downstream reach was modeled using a two-dimensional domain to address complex hydraulic conditions adjacent to an approximately 180-degree bend in the river and overtopping of the bench during high-flow conditions. The vertical datum used for the Model is NAVD88.

3.2.1 MODEL DEVELOPMENT

The spatial extents of the Model are from approximately 330 ft upstream to 600 ft downstream of the Site. Cross-sections were developed using topographic and bathymetric survey data provided by MEDOT (May 2023) and augmented with the 2013 USGS-NRCS LiDAR data. Cross-section locations in the Model are shown in Figure 3. The two-dimensional computational mesh extends approximately 550 ft downstream of the one-dimensional model extents with an average 10-foot cell size. A breakline along the centerline of a river was used to align cells with the flow direction. The low chord for the proposed bridge was raised from the existing elevation of 115.75 ft NAVD88 to 116 ft NAVD88.



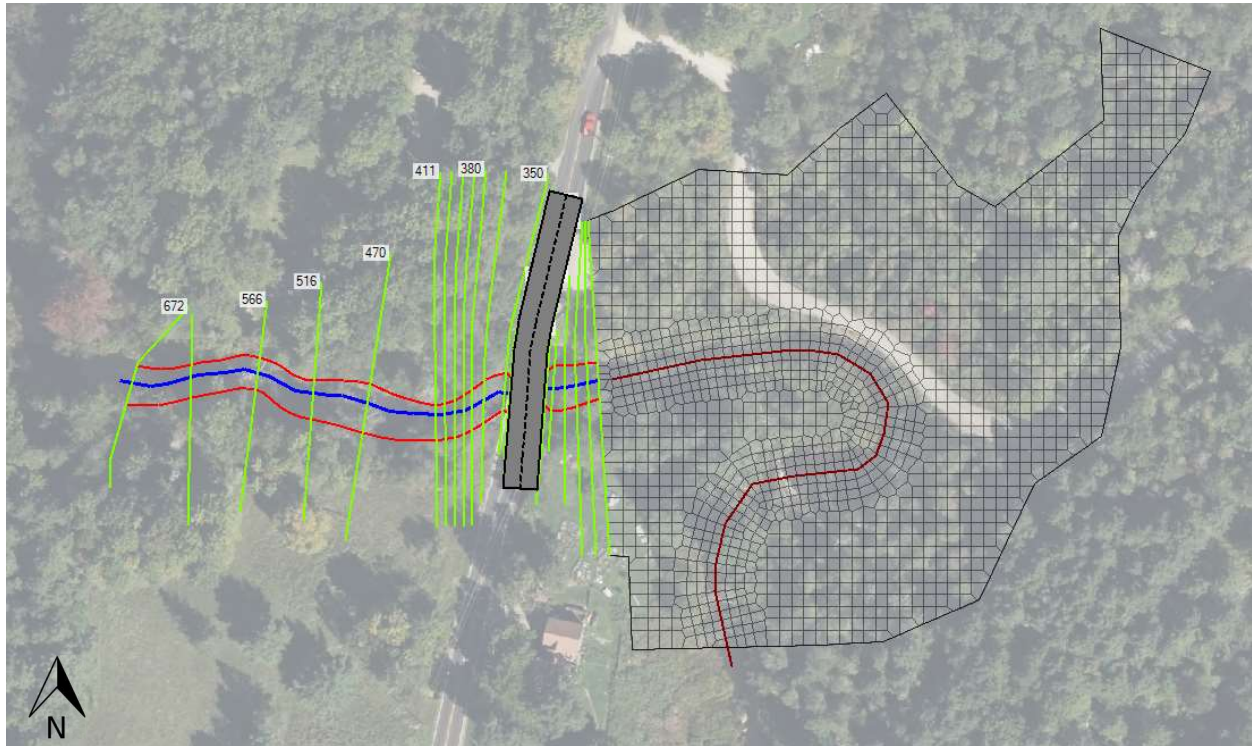


Figure 3. Existing Conditions Model cross-section locations

Channel and overbank roughness coefficients were developed based on professional judgement and review of aerial photography and terrain data (i.e., LiDAR data). Inflows used in the Model were based on the hydrologic estimates for the Site (reference Section 3.1) and defined the upstream boundary condition. A normal depth boundary condition of 0.002, based on the average channel slope, defined the downstream boundary condition. Simulations were run in unsteady-state mode with a constant inflow value and included checks on the applied downstream boundary condition to identify model sensitivity to this parameter.

3.2.2 PROPOSED CONDITIONS MODEL

The proposed conditions Model was developed by replacing the existing bridge geometry with the proposed bridge geometry. Boundary conditions and other geometric parameterizations, including cross-sections and the downstream two-dimensional computational domain, representing the upstream and downstream reaches of the brook, were not changed between the existing and proposed conditional Models.

3.3 Scour Analysis

Scour at the bridge was evaluated using the Model simulation results and information obtained from the field. Total scour at the bridge consisted of three components: (1) contraction scour due to constriction or the location of the bridge; (2) local scour; and (3) long-term aggradation or degradation of the brook channel. Local scour at the bridge was evaluated for abutment scour (there are no piers). The scour design storm is



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the 100-year event, and the scour check storm is the 500-year event based on the MEDOT Bridge Design Guide (2003).

Contraction scour was estimated based on live-bed contraction scour conditions using a representative median particle size diameter (D_{50}) for sand based on the geotechnical investigation performed by GZA GeoEnvironmental in October 2022.

Abutment scour depths at the proposed bridge were developed using Equations 8.3, 8.4, and 8.5, National Cooperative Highway Research Program (NCHRP) 24-30 Abutment Scour Approach in the Federal Highway Administration (FHWA) Hydraulic Engineering Circular No. 18 (HEC-18), "Evaluating Scour at Bridges" Fifth Edition. Abutment scour is estimated based on an amplification factor applied to the calculated contraction scour depth. Input parameters for these equations are summarized in Table 3.

Live-bed contraction scour was calculated using Equation 8.5 in HEC-18. Maximum flow depth resulting from abutment scour was calculated using Equation 8.3 in HEC-18. Abutment scour depth was calculated using Equation 8.4 in HEC-18. The abutment scour computed from the NCHRP approach is total scour at the abutment and is not added to contraction scour because it already includes contraction scour.

Stantec assessed long-term aggradation/degradation scour qualitatively based on site reconnaissance, site photos, and survey.

Table 3. Scour depth equation parameters

Parameter	Value	Units
α_A (amplification factor for live-bed conditions)	<i>calculated</i>	dimensionless
y_0 (flow depth prior to scour)	<i>from Model</i>	<i>ft</i>
y_1 (upstream flow depth)	<i>from Model</i>	<i>ft</i>
q_{2c} (unit discharge, in the constricted opening)	<i>from Model</i>	<i>ft²/s</i>
K_u	11.17	dimensionless
D_{50} (particle size with 50% finer)	2.32	mm

3.4 Stable Material Sizing

The stable material size for the proposed bridge was evaluated using the Model simulation results downstream of the subject bridge. Stable material size at the proposed bridge was developed using Equation 4.1 in the FHWA Hydraulic Engineering Circular No. 23, "Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance" Third Edition (HEC-23). Input parameters for this equation include depth of water and average flow speed ("velocity") and are summarized in



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Table 4.



Table 4. Equation 4.1 parameters

Parameter	Value	Units
S _f (safety factor)	1.1	dimensionless
C _s (stability coefficient)	0.3	dimensionless
C _v (vertical velocity distribution coefficient)	1	dimensionless
C _t (thickness coefficient)	1	dimensionless
D (depth)	<i>from Model</i>	<i>ft</i>
S _g (specific gravity of rock)	62.4	dimensionless
V (channel cross-sectional average velocity)	<i>from Model</i>	<i>ft/second (s)</i>
K ₁ (side-slope correction factor)	0.98	dimensionless
G (gravity)	32.2	ft/s ²

Equation 4.1 in HEC-23 calculates the stable D₃₀ material size; a stable D₅₀ (median) material size was calculated as follows using Equation 4.2 in HEC-23:

$$D_{50} = 1.2 D_{30}$$

4 Results

The following section presents the results from the Study, including the hydraulic analysis, scour analysis, and stable material sizing.

4.1 Hydraulic Analysis Results

Water surface elevation (WSE) and average channel flow speed (ft-per-second [fps]) simulation results from the Model for existing and proposed conditions are presented below in Table 5. Freeboard is presented based on the distance between the upstream water surface elevation at the bridge and the elevation of the bottom of the low chord (i.e., 115.75 ft NAVD88 and 116 ft NAVD88 for existing and proposed conditions, respectively). Negative freeboard values represent upstream water surface elevations at the bridge that are above the elevation of the bottom of the low chord.



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Table 5. Summary of Model results at the cross-section immediately upstream of the bridge

Return Interval	Discharge (cfs)	Existing Conditions WSE (ft, NAVD88)	Proposed Conditions WSE (ft, NAVD88)	Existing Conditions Freeboard (ft)	Proposed Conditions Freeboard (ft)	Existing Conditions Average Channel Flow Speed (fps)	Proposed Conditions Average Channel Flow Speed (fps)
1.1-yr	270	110.6	110.4	5.2	5.6	4.6	4.3
Bankfull	324	110.9	110.7	4.9	5.3	5.0	4.5
2-yr	490	111.8	111.3	4.0	4.7	5.9	5.5
5-yr	720	112.8	112.1	3.0	3.9	6.8	6.4
10-yr	875	113.4	112.5	2.4	3.5	7.3	6.8
25-yr	1085	114.2	113.1	1.6	2.9	7.8	7.4
50-yr	1255	114.8	113.6	1.0	2.4	8.2	7.8
100-yr	1415	115.4	114.0	0.3	2.0	8.4	8.2
200-yr	1580	116.6	114.4	-0.8	1.6	7.5	8.6
500-yr	1800	117.8	114.9	-2.0	1.1	6.7	9.0
95% Exceedance	3	108.6	108.6	7.1	7.4	0.1	0.1
50% Exceedance	19	108.7	108.7	7.0	7.3	0.8	0.8
5% Exceedance	138	109.7	109.6	6.1	6.4	3.3	3.3
Mean annual	44	109.0	108.9	6.8	7.1	1.6	1.6



Water surface elevations are not increased upstream of the subject bridge as a result of the proposed bridge replacement. Flow speeds are expected to increase under the 200- and 500-year events. The proposed bridge does not experience overtopping up to the 500-year event. A minimum of 2.0 ft of freeboard is maintained at the proposed bridge up to the 100-year event.

4.2 Scour Analysis Results

Combined depths of abutment and contraction scour for the simulated flood flow events are depicted in Table 6.

Table 6. Abutment and contraction scour depths

Return Interval	Scour Depth (ft)
100-yr	1.5
500-yr	2.1

Review of the existing channel profile from survey data indicates a steeper slope downstream of the bridge. Stantec estimates that up to 2 ft of long-term degradation could occur at the subject bridge based on the channel slope downstream of the bridge.

Total scour, as described in Section 3.3, estimated for the proposed bridge for the scour design and check flows are presented in Table 7.

Table 7. Total scour depths

Return Interval	Scour Depth (ft)
100-yr	3.5
500-yr	4.1

Supporting calculations for the scour analysis are provided in Appendix C.

4.3 Stable Material Sizing Results

Stable material sizes for the simulated flood flow events are presented in Table 8. The table indicates that material with a minimum D_{50} of 14-inch angular rock would be stable for the 100- and 500-year events.



Table 8. D₅₀ (median, inches) stable material size

Return Interval	D50 (inches)
100-yr	9.8
500-yr	12.8

Supporting calculations for the stable material and countermeasure analysis are provided in Appendix D. Stable material and countermeasure analysis does not include consideration for ice or woody debris loading.

5 Conclusions and Recommendations

The hydraulic and scour analysis predict that the proposed bridge crossing will not increase water surface elevations during normal and flood flow events. However, flow speeds are expected to increase during high-flow events. It is recommended that future design includes consideration for ice and woody debris loading. Scour protection countermeasures with a minimum D₅₀ of 14 inches angular rock and integration with HCD requirements should be incorporated into the final design.

Based upon the findings described in this memo, we recommend the design of the proposed bridge continue to be advanced. Bridge openings and structural components should remain as presented herein, or if revised, should be re-evaluated for hydraulic considerations.



Appendix A Hydrology



WIN:	26107.00		
Town:	Mariaville		
Route No.:	ME181		
Asset ID:	3511		
Lat:	44.70109	Long:	-68.41294

Project Name:	
Stream Name:	Tannery Brook
Bridge Name:	Tannery
Analysis by:	csh
Date:	4/28/2022

Peak Flow Calculations by USGS Regression Equations (Lombard/Hodgkins, 2021; Hodgkins, 1999 & Lombard/Hodgkins, 2015)

Enter data in blue cells only!

	km ²	mi ²	ac
A	48.43	18.70	11968.0
W	6.64	2.6	1639.6
P _c	540348	4954597	
County	Hancock		

Enter data in [mi²]

Watershed Area *DRNAREA*
Wetlands area (by NWI)

watershed centroid (E, N; UTM 19N; meters)
choose county from drop-down menu

ver. 2021 Jan 01

Worksheet prepared by:

Charles S. Hebson, PE
Environmental Office
Maine Dept. Transportation
Augusta, ME 04333-0016
207-557-1052

Charles.Hebson@maine.gov

Watershed Characteristics from StreamStats

STORNWI	13.70	NWI Wetlands %
SANDGRAVF	0.22	sand & gravel aquifer as decimal fraction of watershed A
ELEV	372	mean basin elevation (ft)
BSLDEM10M	8.9	mean basin slope (%)
COASTDIST	55.00	distance from the coast (mi)
ELEVMAX	789	maximum basin elevation (ft)
LC06WATER	9.95	percent of drainage basin land cover as open water
PRECIP	43.6	mean annual precipitation
STATSGOA	22.5	mean basin percentage of hydrological soil group A

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

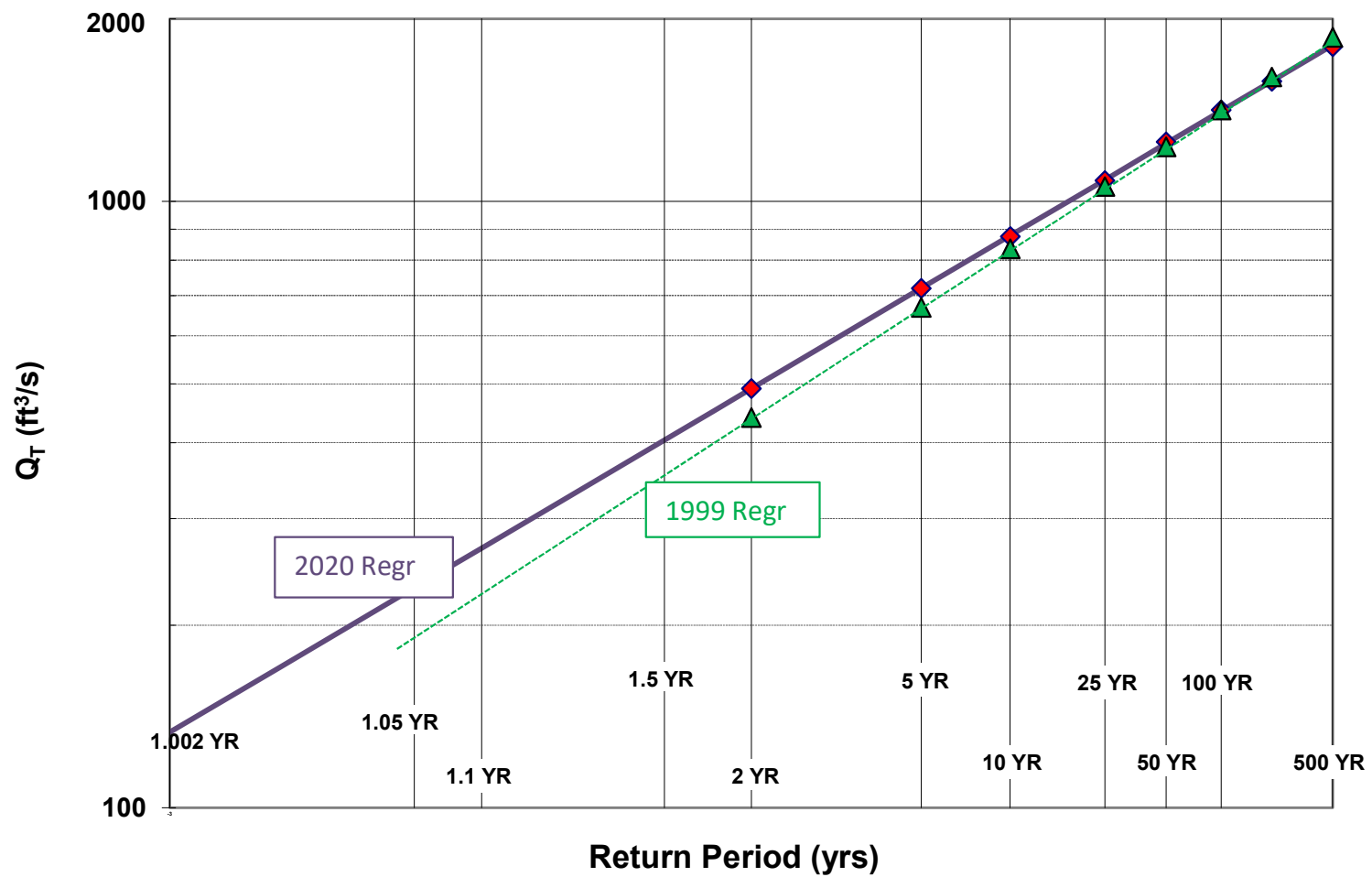
Lombard, P.J. & G.A. Hodgkins, 2021.
Estimating Flood Magnitude and Frequency on Gaged and
Ungaged Streams in Maine
SIR 2021-xxxx, USGS, Augusta, ME.

Ret Pd T (yr)	I24	Q _T (ft ³ /s)		Q _T (ft ³ /s) Design
		1999 / 2015	2021	
1.1			268	270
2	2.91	440	491	490
5	3.57	669	719	720
10	4.11	836	875	875
25	4.87	1058	1083	1085
50	5.44	1230	1253	1255
100	6.03	1415	1415	1415
200	6.66	1603	1578	1580
500	7.54	1865	1800	1800

Instructions:

Enter values in blue cells only, watershed data from StreamStats
Copy I24 values from Stream Stats
Use results under "Design"
Check against gage data and FEMA studies if available
Questions? Check with ENV / Hydrology Section

Log-Normal Probability Plot



WIN:	26107.00
Town:	Mariaville
Route No.:	ME181
Asset ID:	3511
Lat:	44.70109
Long:	-68.41294

Project Name:	0
Stream Name:	Tannery Brook
Bridge Name:	Tannery
Analysis by:	csh
Date:	4/28/2022

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

MAINE MONTHLY MEDIAN FLOWS and HYDRAULIC GEOMETRY BY USGS REGRESSION EQUATIONS (2004, 2013, 2015)

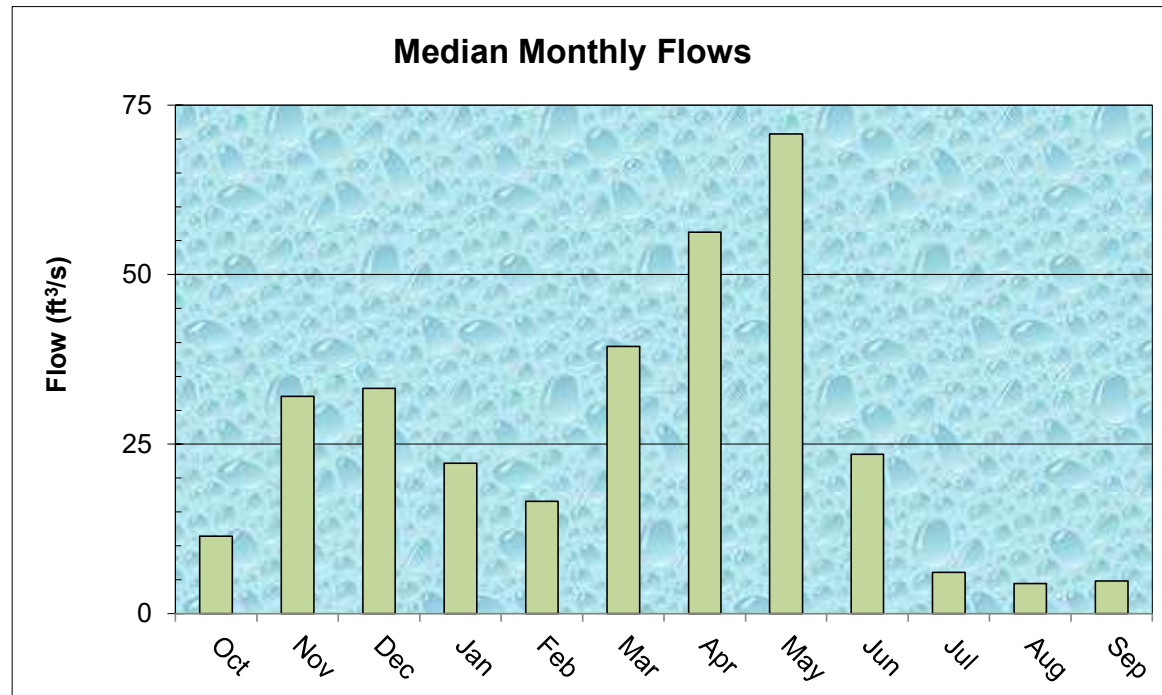
Value	Variable	Explanation
18.70	A	Area (mi ²)
540348.3	P _c	Watershed centroid (E,N; UTM; Zone 19; meters)
54.38	DIST	Distance from Coastal reference line (mi)
43.6	pptA	Mean Annual Precipitation (inches)
0.00	SG	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q _{median} (ft ³ /s)	(m ³ /s)
Jan	22.15	0.6278
Feb	16.56	0.4692
Mar	39.39	1.1162
Apr	56.23	1.5934
May	70.77	2.0056
Jun	23.49	0.6657
Jul	6.06	0.1718
Aug	4.40	0.1247
Sep	4.81	0.1364
Oct	11.42	0.3236
Nov	32.06	0.9085
Dec	33.19	0.9405

Q _{bf}	112.4
ann avg	43.9
ann med	23.9
Q _{1.002}	133.2
Q _{1.01}	170.9
Q _{1.05}	230.6
Q _{bf}	239.7

assume v = 4ft/s

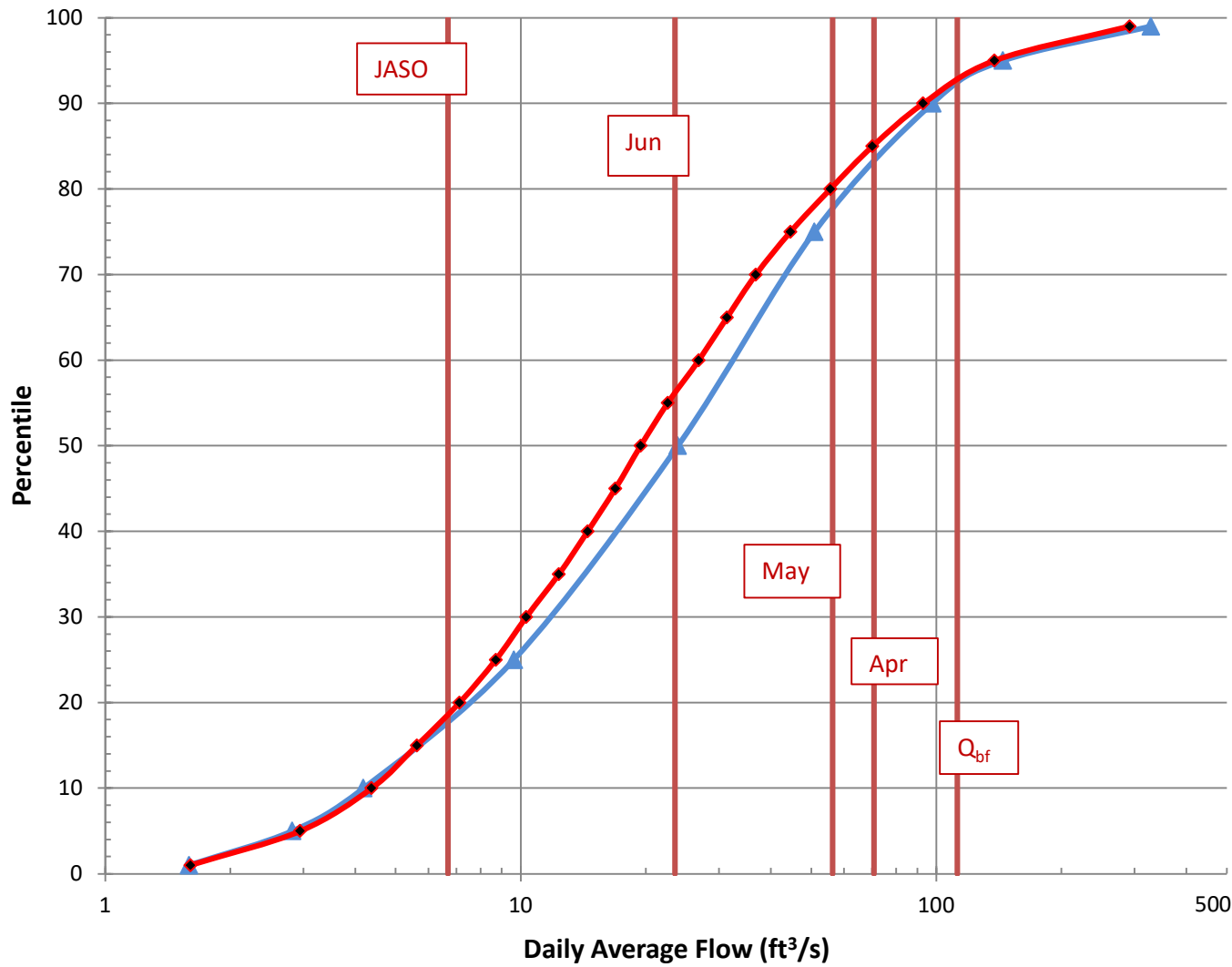
W _{bf}	37.3	estimated bankfull width (ft)
d _{bf}	1.6	estimated bankfull depth (ft)
A _{bf}	56.5	estimated bankfull flow area (ft ²)



References

- Dudley, 2013. FY2013 Progress Report - Phase 1 ..., USFWS QRP Project
- Dudley, 2004. Estimating Monthly Streamflows ..., SIR 2004-5026
- Dudley, 2015. Regression Equations for Monthly & Annual Mean..., USGS SIR 2015-5151

Daily Average Flow Distribution



Daily Avg Flow Dist

$A_{ws} = (mi^2)$ 18.7

$Q (ft^3/s)$

Pctl	Median	84 th pctl
1.00E-06	0.00	0.00
1	1.60	2.84
5	2.94	4.74
10	4.37	6.57
15	5.62	8.21
20	7.12	9.95
25	8.71	11.67
30	10.30	13.29
35	12.34	15.19
40	14.47	17.47
45	16.87	19.75
50	19.42	23.32
55	22.56	27.14
60	26.79	31.86
65	31.34	37.12
70	36.76	43.30
75	44.57	52.07
80	55.58	62.17
85	70.13	79.67
90	92.90	106.98
95	137.87	166.37
99	291.55	383.83

Q_{bf} 112.4

$Q_{1.002}$ 133.2

$Q_{1.1}$ 268.2

Q_2 491.2

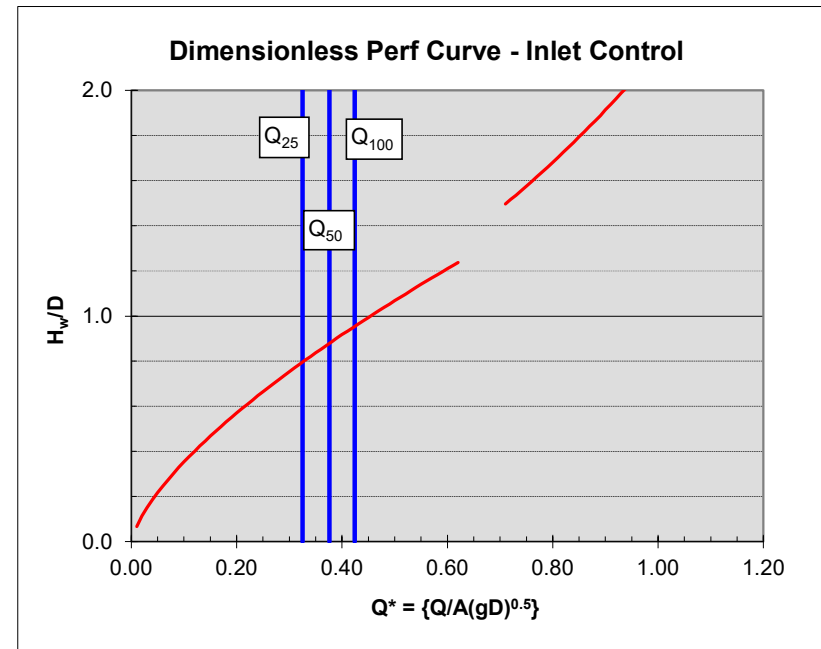
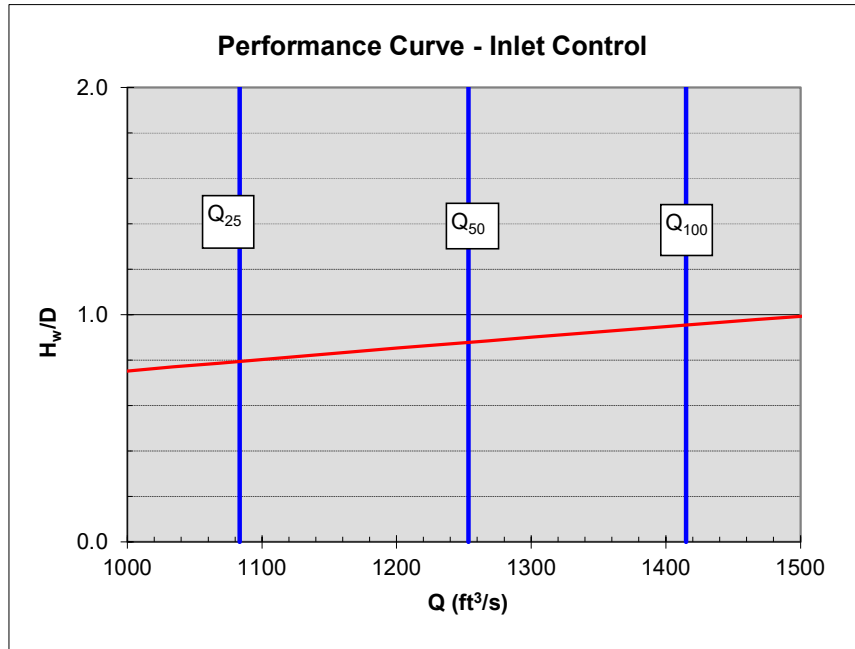
NOTE: This page is for preliminary sizing only.
Final design should be done with HY8 or HDS-5

Note: culvert dimensions are for open flow area; adjust for lost capacity due to embedding / backfilling (min {2' / 25% rise} embedment)
Finish analysis with HY-8

Preliminary Culvert Sizing - Round & Box Culverts

Shape:	Box			
Inlet Type:	Box 0 ww			
D or R (ft)	6 diam / rise	Q ₂₅	1083.4	trial D / R = 14.2
w (ft)	40 box span	Q ₅₀	1253.3	
Slope (ft/ft)	0.02	Q ₁₀₀	1415.1	trial w: BFW = 37.3
A (ft ²)	240.00			
g (ft/s ²)	32.2			

Choose shape and inlet type by pull-down menu in green cells



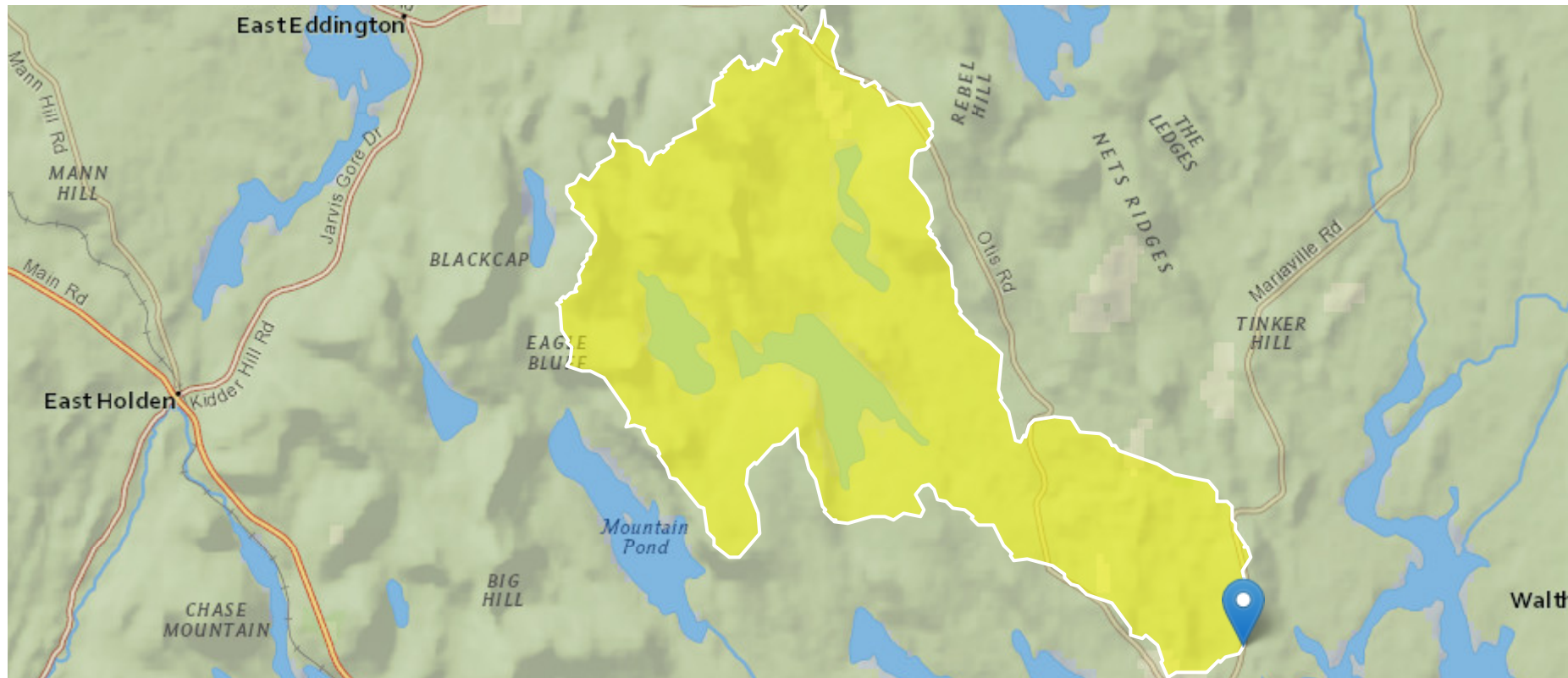
Mariaville 26107 Br #3511 ME181 @ Tannery Brook

Region ID: ME

Workspace ID: ME20220428191627016000

Clicked Point (Latitude, Longitude): 44.70122, -68.41290

Time: 2022-04-28 15:16:50 -0400



Basin Characteristics

Parameter Code

Parameter Description

Value

Unit

Parameter Code	Parameter Description	Value	Unit
BSLDEM10M	Mean basin slope computed from 10 m DEM	8.9	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	540348.3	meters
CENTROIDY	Basin centroid vertical (y) location in state plane units	4954597.48	meters
COASTDIST	Shortest distance from the coastline to the basin centroid	55	miles
DRNAREA	Area that drains to a point on a stream	18.71	square miles
ELEV	Mean Basin Elevation	372.4	feet
ELEVMAX	Maximum basin elevation	788.8	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	6.03	inches
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	4.11	inches
I24H200Y	Maximum 24-hour precipitation that occurs on average once in 200 years	6.66	inches
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	4.87	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	2.91	inches
I24H500Y	Maximum 24-hour precipitation that occurs on average once in 500 years	7.54	inches
I24H50Y	Maximum 24-hour precipitation that occurs on average once in 50 years	5.44	inches
I24H5Y	Maximum 24-hour precipitation that occurs on average once in 5 years	3.57	inches
LC06WATER	Percent of open water, class 11, from NLCD 2006	9.95	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	1.74	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.32	percent
PRDEC FEB90	Basin average mean precipitation for December to February from PRISM 1961-1990	10.8	inches
PRECIP	Mean Annual Precipitation	43.6	inches

Parameter Code	Parameter Description	Value	Unit
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0.216	dimensionless
SANDGRAVAP	Percentage of land surface underlain by sand and gravel aquifers	21.63	percent
STATSGOA	Percentage of area of Hydrologic Soil Type A from STATSGO	22.5	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	14.211	percent
STORNWI	Percentage of storage (combined water bodies and wetlands) from the National Wetlands Inventory	13.73	percent

Peak-Flow Statistics Parameters [Statewide multiparameter peakflows SIR 2020 5092]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.71	square miles	0.26	5680
I24H2Y	24 Hour 2 Year Precipitation	2.91	inches	1.92	4.17
STORAGE	Percent Storage	14.211	percent	0	29.4
I24H5Y	24 Hour 5 Year Precipitation	3.57	inches	2.48	5.38
I24H10Y	24 Hour 10 Year Precipitation	4.11	inches	2.84	6.38
I24H25Y	24 Hour 25 Year Precipitation	4.87	inches	3.3	7.75
I24H50Y	24 Hour 50 Year Precipitation	5.44	inches	3.65	8.79
I24H100Y	24 Hour 100 Year Precipitation	6.03	inches	3.99	9.88
I24H200Y	24 Hour 200 Year Precipitation	6.66	inches	5.26	11.1
I24H500Y	24 Hour 500 Year Precipitation	7.54	inches	5.95	13.1

Peak-Flow Statistics Flow Report [Statewide multiparameter peakflows SIR 2020 5092]

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

Statistic	Value	Unit	PII	Plu	ASEp
50-percent AEP flood	479	ft ³ /s	258	888	39.1
20-percent AEP flood	700	ft ³ /s	383	1280	38.1
10-percent AEP flood	855	ft ³ /s	462	1580	38.9
4-percent AEP flood	1060	ft ³ /s	566	1980	39.9
2-percent AEP flood	1220	ft ³ /s	641	2320	39.7
1-percent AEP flood	1380	ft ³ /s	730	2610	40.7
0.5-percent AEP flood	1540	ft ³ /s	788	3010	42.8
0.2-percent AEP flood	1760	ft ³ /s	889	3480	43.8

Peak-Flow Statistics Citations

Lombard, P.J., and Hodgkins, G.A., 2020, Estimating flood magnitude and frequency on gaged and ungaged streams in Maine: U.S. Geological Survey Scientific Investigations Report 2020–5092, 56 p. (<https://doi.org/10.3133/sir20205092>)

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

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.71	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.216	dimensionless	0	0.212
ELEV	Mean Basin Elevation	372.4	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	1.59	ft ³ /s
5 Percent Duration	2.82	ft ³ /s
10 Percent Duration	4.18	ft ³ /s
25 Percent Duration	9.63	ft ³ /s
50 Percent Duration	23.9	ft ³ /s
75 Percent Duration	50.9	ft ³ /s
90 Percent Duration	97.8	ft ³ /s
95 Percent Duration	145	ft ³ /s
99 Percent Duration	329	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	18.71	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0.216	dimensionless	0	0.212
ELEV	Mean Basin Elevation	372.4	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	43.9	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>)

Bankfull Statistics Parameters [Central and Coastal Bankfull 2004 5042]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.71	square miles	2.92	298

Bankfull Statistics Parameters [Appalachian Highlands D Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.71	square miles	0.07722	940.1535

Bankfull Statistics Parameters [New England P Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.71	square miles	3.799224	138.999861

Bankfull Statistics Parameters [USA Bieger 2015]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	18.71	square miles	0.07722	59927.7393

Bankfull Statistics Flow Report [Central and Coastal Bankfull 2004 5042]

Statistic	Value	Unit
Bankfull Streamflow	112	ft ³ /s
Bankfull Width	35.2	ft
Bankfull Depth	1.61	ft
Bankfull Area	56.5	ft ²

Bankfull Statistics Flow Report [Appalachian Highlands D Bieger 2015]

Statistic	Value	Unit
Bieger_D_channel_width	51.2	ft
Bieger_D_channel_depth	2.6	ft
Bieger_D_channel_cross_sectional_area	136	ft ²

Bankfull Statistics Flow Report [New England P Bieger 2015]

Statistic	Value	Unit
Bieger_P_channel_width	57.4	ft
Bieger_P_channel_depth	2.62	ft
Bieger_P_channel_cross_sectional_area	154	ft ²

Bankfull Statistics Flow Report [USA Bieger 2015]

Statistic	Value	Unit
Bieger_USA_channel_width	34.7	ft
Bieger_USA_channel_depth	2.25	ft
Bieger_USA_channel_cross_sectional_area	83.1	ft ²

Bankfull Statistics Flow Report [Area-Averaged]

Statistic	Value	Unit
Bankfull Streamflow	112	ft ³ /s
Bankfull Width	35.2	ft
Bankfull Depth	1.61	ft
Bankfull Area	56.5	ft ²
Bieger_D_channel_width	51.2	ft
Bieger_D_channel_depth	2.6	ft
Bieger_D_channel_cross_sectional_area	136	ft ²
Bieger_P_channel_width	57.4	ft
Bieger_P_channel_depth	2.62	ft
Bieger_P_channel_cross_sectional_area	154	ft ²
Bieger_USA_channel_width	34.7	ft
Bieger_USA_channel_depth	2.25	ft
Bieger_USA_channel_cross_sectional_area	83.1	ft ²

Bankfull Statistics Citations

Dudley, R.W.,2004, Hydraulic-Geometry Relations for Rivers in Coastal and Central Maine: U.S. Geological Survey Scientific Investigations Report 2004-5042, 30 p (<http://pubs.usgs.gov/sir/2004/5042/pdf/sir2004-5042.pdf>)

Bieger, Katrin; Rathjens, Hendrik; Allen, Peter M.; and Arnold, Jeffrey G.,2015, Development and Evaluation of Bankfull Hydraulic Geometry Relationships for the Physiographic Regions of the United States, Publications from USDA-ARS / UNL Faculty, 17p. (https://digitalcommons.unl.edu/usdaarsfacpub/1515?utm_source=digitalcommons.unl.edu%2Fusdaarsfacpub%2F1515&utm_medium=PDF&utm_campaign=PDFCoverPages)

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Application Version: 4.8.1

StreamStats Services Version: 1.2.22

NSS Services Version: 2.1.2

To:	Denver Small MaineDOT	From:	Abigail Dempsey Stantec
File:	WIN 26107.00	Date:	February 7, 2023

Reference: Mariaville, Tannery Bridge #3511 – Route 181 over Tannery Brook

This memorandum was developed to document Stantec's work to determine the Federal Energy Regulatory Commission (FERC) Project Boundary for the Ellsworth Hydroelectric Project as it relates to the July 19, 2022, scope of work for the Tannery Bridge #3511 bridge replacement project in Mariaville, Maine.

Stantec is requesting input from MaineDOT on the methodology described in this memorandum to convert mean sea level (msl) to the North American Vertical Datum of (NAVD88).

The November 2018 FERC Draft Environmental Assessment for Hydropower License Ellsworth Hydroelectric Project Docket No. P-2727-092 Maine identifies the project boundary for the Ellsworth Hydroelectric Project as the land up to a contour elevation of 107.0 feet (ft) mean sea level on, in, and upstream from Graham Lake.

Stantec reviewed the recorded datums for three National Oceanic and Atmospheric Administration (NOAA) tide gages:

1. Station 8413320 Bar Harbor, ME
2. Station 8411060 Cutler Farris Wharf, ME
3. Station 8418150 Portland, ME

The locations of the gages are shown in Figure 1.

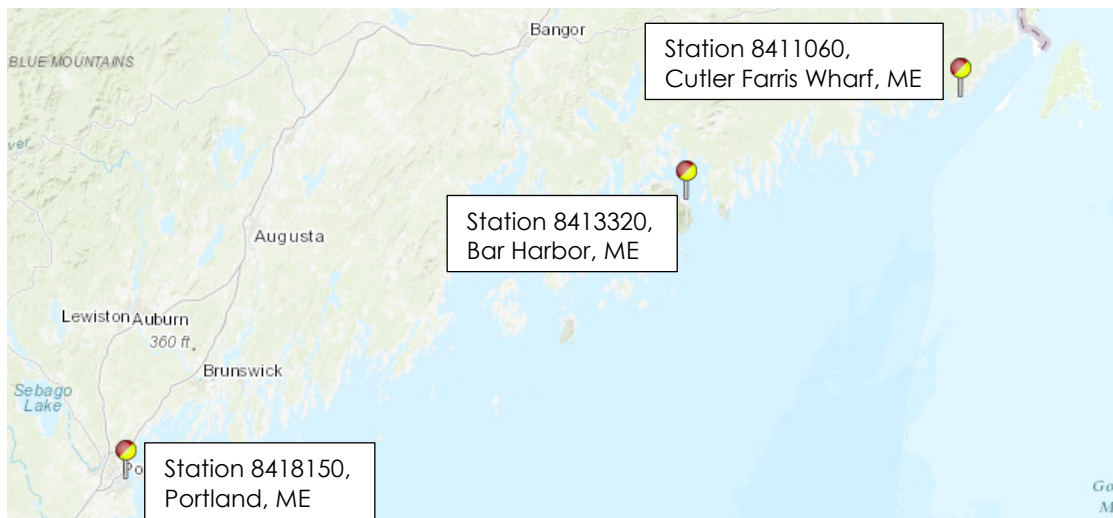


Figure 1: Location of the NOAA Tide Gages

Reference: Mariaville, Tannery Bridge #3511 – Route 181 over Tannery Brook

The Bar Harbor gage is closest to Graham Lake; however, the station page did not reference the NAVD88 datum. Therefore, Stantec used the Cutler Farris Wharf and Portland gages to determine the conversion between msl to NAVD88.

Stantec assumed the conversion from msl to NAVD88 would be the average of the conversions from msl to NAVD88 at the Cutler Farris Wharf and Portland locations. Therefore, the conversion from msl to NAVD88 at Graham Lake would be:

$$\text{Mean Sea Level} - 0.325 \text{ feet} = \text{NAVD88}$$

Based on the referenced conversion, the FERC boundary corresponds to Elevation 106.675 ft NAVD88.

Topographic and bathymetric survey provided to Stantec by MaineDOT is in the NAVD88 vertical datum. A portion of the associated contour lines are shown in Figure 2.

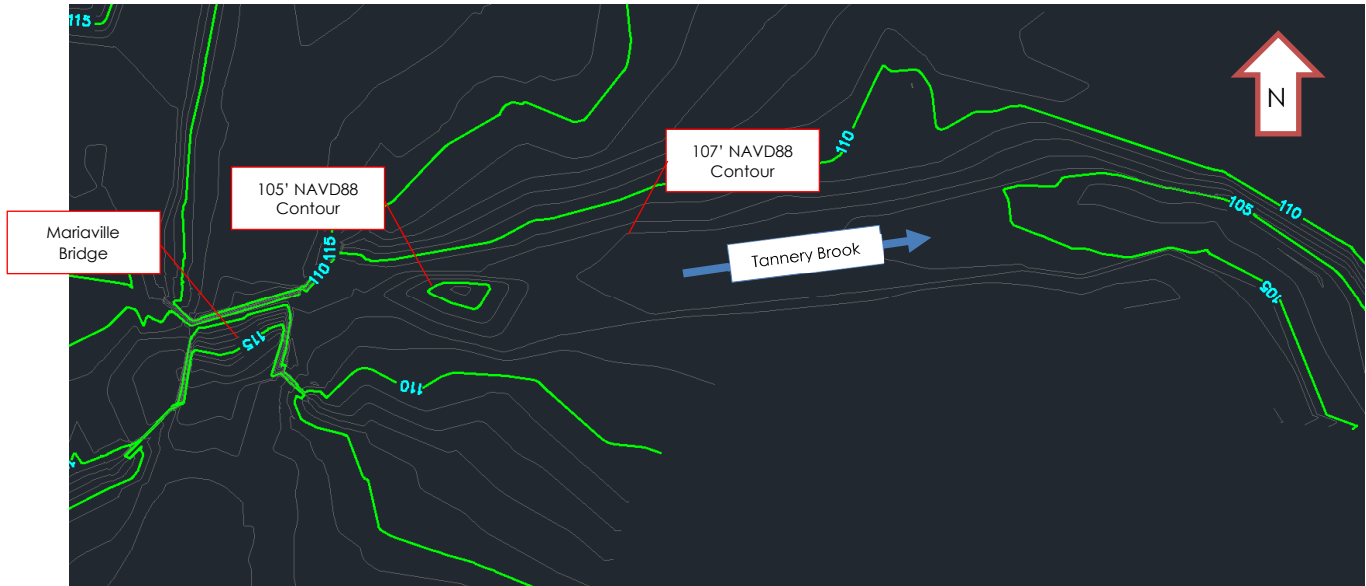


Figure 2: Mariaville 1-foot Contours in Feet NAVD88

Review of the survey data developed by MaineDOT suggests that the channel invert is at the approximate elevation of the FERC boundary downstream from the bridge and that the project bridge is upstream from the FERC boundary on Tannery Brook. As a result Stantec recommends that MaineDOT notify the FERC project owner/operator that:

1. MaineDOT is evaluating replacement of the subject bridge,
2. Stantec identified the FERC project boundary to be Elevation 107.0 ft msl which corresponds to Elevation 106.675 ft NAVD88 based on the conversion described in this memorandum, and
3. Survey data provided by MaineDOT indicates that the FERC boundary is located downstream from the project bridge.



February 7, 2023
Denver Small
Page 3 of 3

Reference: Mariaville, Tannery Bridge #3511 – Route 181 over Tannery Brook

Stantec recommends that MaineDOT request that the FERC owner/operator acknowledge receipt of the memo from MaineDOT and that the FERC owner/operator respond to MaineDOT if they do not agree with the information in the memo.

Stantec Consulting Services Inc.

A handwritten signature in black ink that reads "Abigail Dempsey". The signature is written in a cursive, flowing style.

Abigail Dempsey
Water Resources Engineer

Phone: 413-387-4478
abigail.dempsey@stantec.com

Attachment: NOAA Tide Gage Datum Pages
Exhibit 10 – FERC Draft Environmental Assessment

c. Michael Chelminski; Sarah Williams



Home (/) / Products (products.html) / Datums (stations.html?type=Datums) / 8411060 Cutler Farris Wharf, ME Favorite Stations

Station Info

Tides/Water Levels

Meteorological Obs. (/met.html?id=8411060)

Phys. Oceanography (/physocean.html?id=8411060)

OFS (/ofs/ofs_station.html?stname=Cutler Farris Wharf&ofs=gom&stnid=8411060&subdomain=0)

Datums for 8411060, Cutler Farris Wharf ME

NOTICE: All data values are relative to the MSL.

Elevations on Mean Sea Level

Station: 8411060, Cutler Farris Wharf, ME

Status: Accepted (Dec 9 2019)

Units: Feet

Control Station: 8413320 Bar Harbor, ME

T.M.: 0

Epoch: (/datum_options.html#NTDE) 1983-2001

Datum: MSL

Datum	Value	Description
MHHW (/datum_options.html#MHHW)	7.37	Mean Higher-High Water
MHW (/datum_options.html#MHW)	6.92	Mean High Water
MTL (/datum_options.html#MTL)	0.06	Mean Tide Level
MSL (/datum_options.html#MSL)	0.00	Mean Sea Level
DTL (/datum_options.html#DTL)	0.09	Mean Diurnal Tide Level
MLW (/datum_options.html#MLW)	-6.79	Mean Low Water
MLLW (/datum_options.html#MLLW)	-7.19	Mean Lower-Low Water
NAVD88 (/datum_options.html)	0.33	North American Vertical Datum of 1988
STND (/datum_options.html#STND)	-12.66	Station Datum
GT (/datum_options.html#GT)	14.56	Great Diurnal Range
MN (/datum_options.html#MN)	13.71	Mean Range of Tide
DHQ (/datum_options.html#DHQ)	0.45	Mean Diurnal High Water Inequality
DLQ (/datum_options.html#DLQ)	0.40	Mean Diurnal Low Water Inequality

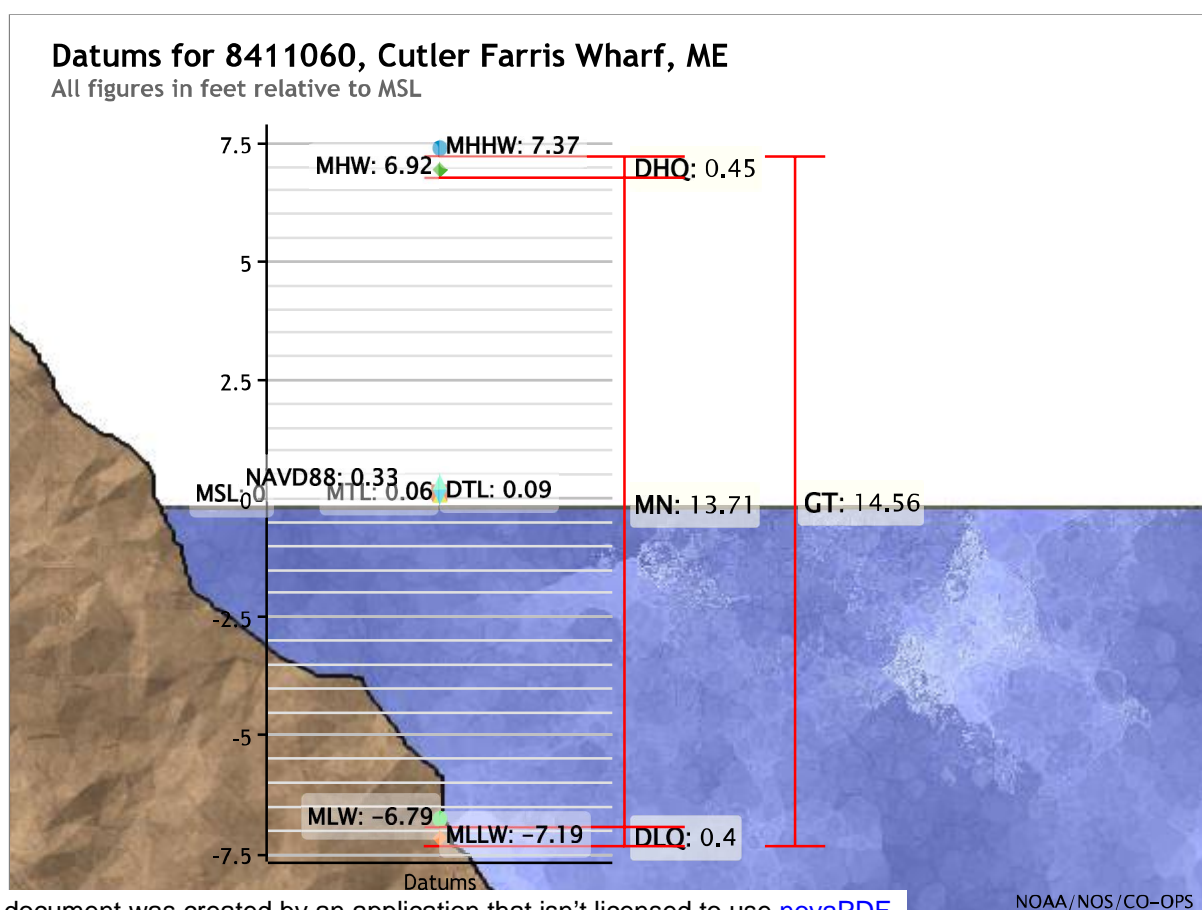
Datum	Value	Description
HWI (/datum_options.html#HWI)	3.25	Greenwich High Water Interval (in hours)
LWI (/datum_options.html#LWI)	9.51	Greenwich Low Water Interval (in hours)
Max Tide (/datum_options.html#MAXTIDE)	11.22	Highest Observed Tide
Max Tide Date & Time (/datum_options.html#MAXTIDEDT)	01/04/2018 17:18	Highest Observed Tide Date & Time
Min Tide (/datum_options.html#MINTIDE)	-10.29	Lowest Observed Tide
Min Tide Date & Time (/datum_options.html#MINTIDEDT)	01/30/2014 21:12	Lowest Observed Tide Date & Time
HAT (/datum_options.html#HAT)	10.16	Highest Astronomical Tide
HAT Date & Time	11/15/2016 15:42	HAT Date and Time
LAT (/datum_options.html#LAT)	-9.82	Lowest Astronomical Tide
LAT Date & Time	04/09/2016 10:48	LAT Date and Time

Tidal Datum Analysis Periods

07/01/2011 - 06/30/2012

07/01/2013 - 06/30/2014

07/01/2015 - 06/30/2017



Showing datums for

8411060 Cutler Farris Wharf, ...

Datum

MSL

Data Units Feet

Meters

Epoch Present (1983-2001)

Superseded (1960-1978)

Submit

Show nearby stations

Products available at 8411060 Cutler Farris Wharf, ME

TIDES/WATER LEVELS

[Water Levels \(/waterlevels.html?id=8411060\)](/waterlevels.html?id=8411060)

[NOAA Tide Predictions \(/noaatidepredictions.html?id=8411060\)](/noaatidepredictions.html?id=8411060)

[Harmonic Constituents \(/harcon.html?id=8411060\)](/harcon.html?id=8411060)

[Sea Level Trends](#)

[Datums \(/datums.html?id=8411060\)](/datums.html?id=8411060)

[Bench Mark Sheets \(/benchmarks.html?id=8411060\)](/benchmarks.html?id=8411060)

[Extreme Water Levels \(/est/est_station.shtml?stnid=8411060\)](/est/est_station.shtml?stnid=8411060)

[Reports \(/reports.html?id=8411060\)](/reports.html?id=8411060)

METEOROLOGICAL/OTHER

[Meteorological Observations \(/met.html?id=8411060\)](/met.html?id=8411060)

[Water Temp/Conductivity](#)

PORTS®

This station is not a member of PORTS®

OPERATIONAL FORECAST SYSTEMS

[Gulf of Maine \(/ofs/gomofs/gomofs.html\)](/ofs/gomofs/gomofs.html)

[OFS product page for Cutler Farris Wharf](#)

INFORMATION

[Data Inventory \(/inventory.html?id=8411060\)](/inventory.html?id=8411060)

[Measurement Specifications \(/measure.html\)](/measure.html)

Website Owner: Center for Operational Oceanographic Products and Services

National Oceanic and Atmospheric Administration (<http://www.noaa.gov>)

National Ocean Service (<http://oceanservice.noaa.gov>)

[Privacy Policy \(/privacy.html\)](/privacy.html)

[Disclaimer \(/disclaimers.html\)](/disclaimers.html)

[Take Our Survey \(/survey.html\)](/survey.html)

[Freedom of Information Act \(https://www.noaa.gov/foia-freedom-of-information-act\)](https://www.noaa.gov/foia-freedom-of-information-act)

[Contact Us \(/contact.html\)](/contact.html)



Home (/) / Products ([products.html](#)) / Datums ([stations.html?type=Datums](#)) / 8418150 Portland, ME Favorite Stations

Station Info

Tides/Water Levels

Meteorological Obs. ([/met.html?id=8418150](#))

Phys. Oceanography ([/physocean.html?id=8418150](#))

OFS ([/ofs/ofs_station.html?stname=Portland&ofs=gom&stnid=8418150&subdomain=0](#))

Datums for 8418150, Portland ME

NOTICE: All data values are relative to the MSL.

Elevations on Mean Sea Level

Station: 8418150, Portland, ME

Status: Accepted (Apr 17 2003)

Units: Feet

Control Station:

T.M.: 0

Epoch: ([/datum_options.html#NTDE](#)) 1983-2001

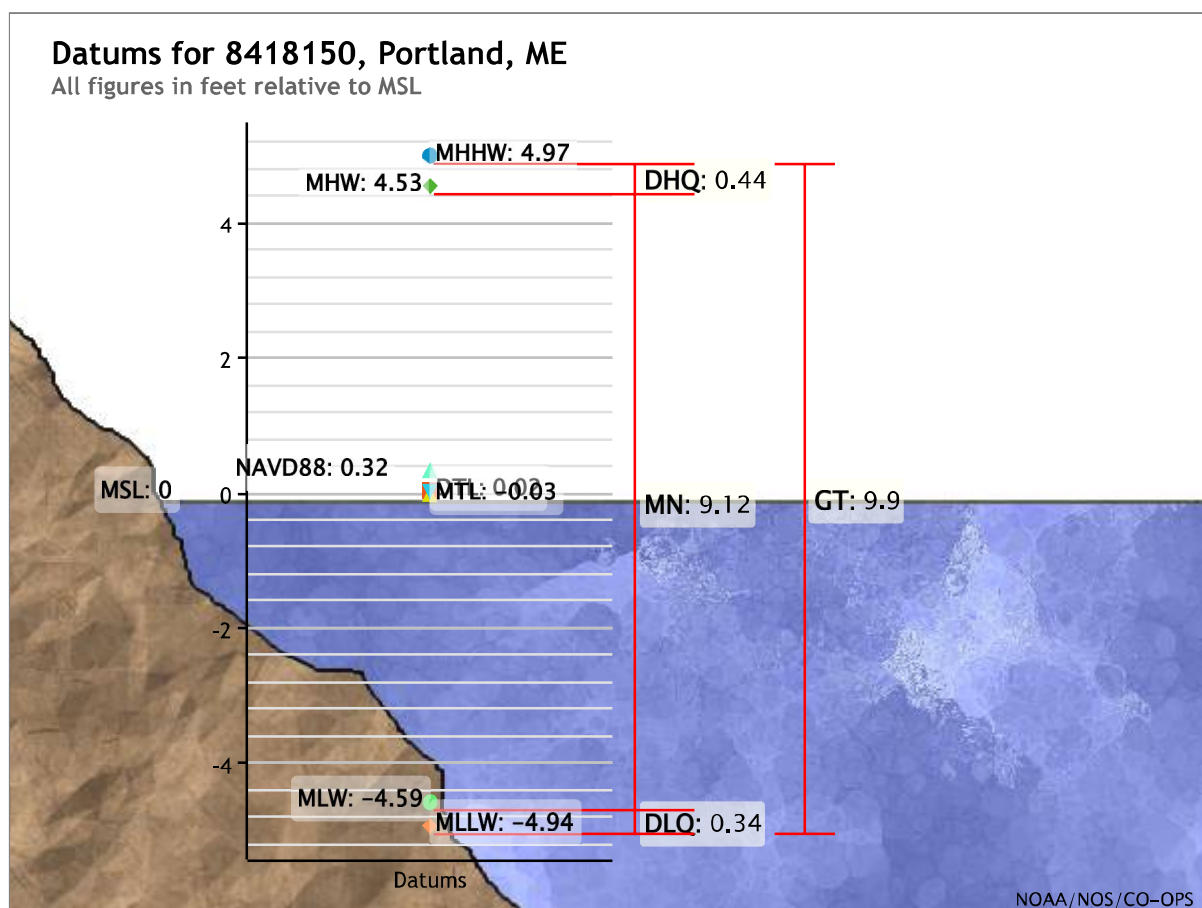
Datum: MSL

Datum	Value	Description
MHHW (/datum_options.html#MHHW)	4.97	Mean Higher-High Water
MHW (/datum_options.html#MHW)	4.53	Mean High Water
MTL (/datum_options.html#MTL)	-0.03	Mean Tide Level
MSL (/datum_options.html#MSL)	0.00	Mean Sea Level
DTL (/datum_options.html#DTL)	0.02	Mean Diurnal Tide Level
MLW (/datum_options.html#MLW)	-4.59	Mean Low Water
MLLW (/datum_options.html#MLLW)	-4.94	Mean Lower-Low Water
NAVD88 (/datum_options.html)	0.32	North American Vertical Datum of 1988
STND (/datum_options.html#STND)	-13.49	Station Datum
GT (/datum_options.html#GT)	9.90	Great Diurnal Range
MN (/datum_options.html#MN)	9.12	Mean Range of Tide
DHQ (/datum_options.html#DHQ)	0.44	Mean Diurnal High Water Inequality
DLQ (/datum_options.html#DLQ)	0.34	Mean Diurnal Low Water Inequality

Datum	Value	Description
HWI (/datum_options.html#HWI)	3.59	Greenwich High Water Interval (in hours)
LWI (/datum_options.html#LWI)	9.75	Greenwich Low Water Interval (in hours)
Max Tide (/datum_options.html#MAXTIDE)	9.19	Highest Observed Tide
Max Tide Date & Time (/datum_options.html#MAXTIDEDT)	02/07/1978 10:30	Highest Observed Tide Date & Time
Min Tide (/datum_options.html#MINTIDE)	-8.39	Lowest Observed Tide
Min Tide Date & Time (/datum_options.html#MINTIDEDT)	11/30/1955 17:18	Lowest Observed Tide Date & Time
HAT (/datum_options.html#HAT)	7.03	Highest Astronomical Tide
HAT Date & Time	05/19/2034 04:06	HAT Date and Time
LAT (/datum_options.html#LAT)	-7.06	Lowest Astronomical Tide
LAT Date & Time	01/14/2036 22:42	LAT Date and Time

Tidal Datum Analysis Periods

01/01/1983 - 12/31/2001



Showing datums for

8418150 Portland, ME

Datum

MSL

Data Units Feet

Meters

Epoch Present (1983-2001)

Superseded (1960-1978)

Submit

Show nearby stations

Products available at 8418150 Portland, ME

TIDES/WATER LEVELS

[Water Levels \(/waterlevels.html?id=8418150\)](/waterlevels.html?id=8418150)

[NOAA Tide Predictions \(/noaatidepredictions.html?id=8418150\)](/noaatidepredictions.html?id=8418150)

[Harmonic Constituents \(/harcon.html?id=8418150\)](/harcon.html?id=8418150)

[Sea Level Trends \(/sltrends/sltrends_station.shtml?id=8418150\)](/sltrends/sltrends_station.shtml?id=8418150)

[Datums \(/datums.html?id=8418150\)](/datums.html?id=8418150)

[Bench Mark Sheets \(/benchmarks.html?id=8418150\)](/benchmarks.html?id=8418150)

[Extreme Water Levels \(/est/est_station.shtml?stnid=8418150\)](/est/est_station.shtml?stnid=8418150)

[Reports \(/reports.html?id=8418150\)](/reports.html?id=8418150)

METEOROLOGICAL/OTHER

[Meteorological Observations \(/met.html?id=8418150\)](/met.html?id=8418150)

[Water Temp/Conductivity](#)

PORTS®

This station is not a member of PORTS®

OPERATIONAL FORECAST SYSTEMS

[Gulf of Maine \(/ofs/gomofs/gomofs.html\)](/ofs/gomofs/gomofs.html)

[OFS product page for Portland](#)

INFORMATION

[Station Home Page \(/stationhome.html?id=8418150\)](/stationhome.html?id=8418150)

[Data Inventory \(/inventory.html?id=8418150\)](/inventory.html?id=8418150)

[Measurement Specifications \(/measure.html\)](/measure.html)

Website Owner: Center for Operational Oceanographic Products and Services

National Oceanic and Atmospheric Administration (<http://www.noaa.gov>)

National Ocean Service (<http://oceanservice.noaa.gov>)

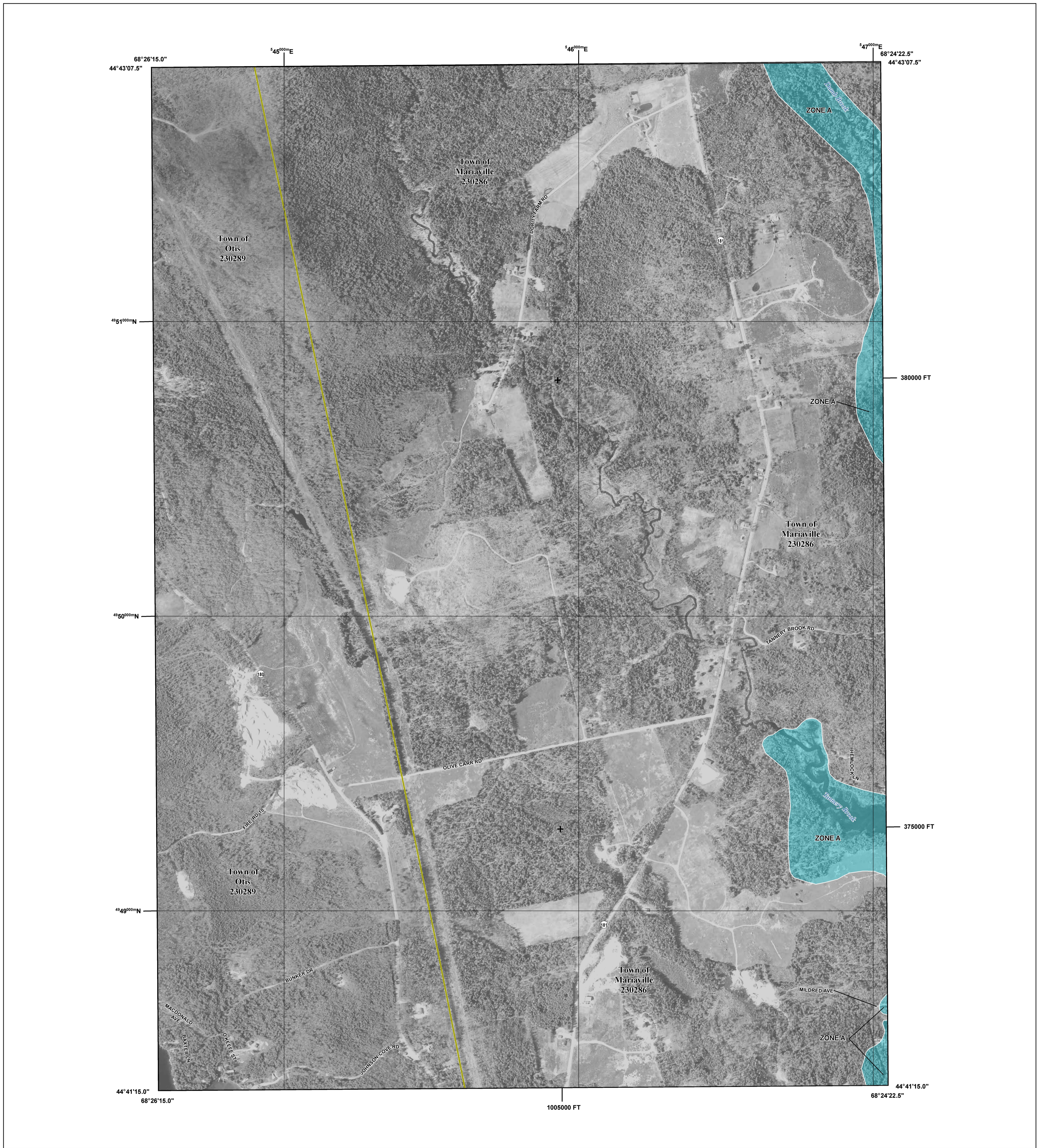
Privacy Policy (</privacy.html>)

Disclaimer (</disclaimers.html>)

Take Our Survey (</survey.html>)

Freedom of Information Act (<https://www.noaa.gov/foia-freedom-of-information-act>)

Contact Us (</contact.html>)



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT [HTTP://MSC.FEMA.GOV](http://MSC.FEMA.GOV)

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99 With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
		0.2 % Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
OTHER AREAS OF FLOOD HAZARD		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee See Notes. Zone X
OTHER AREAS		NO SCREEN Areas of Minimal Flood Hazard Zone X
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert or Storm Sewer Accredited or Provisionally Accredited Levee, Dike, or Floodwall
		Non-accredited Levee, Dike or Floodwall
		18.2 Cross Sections with 1% Annual Chance Water Surface Elevations (BFE)
		17.5
		Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
OTHER FEATURES		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary

NOTES TO USERS

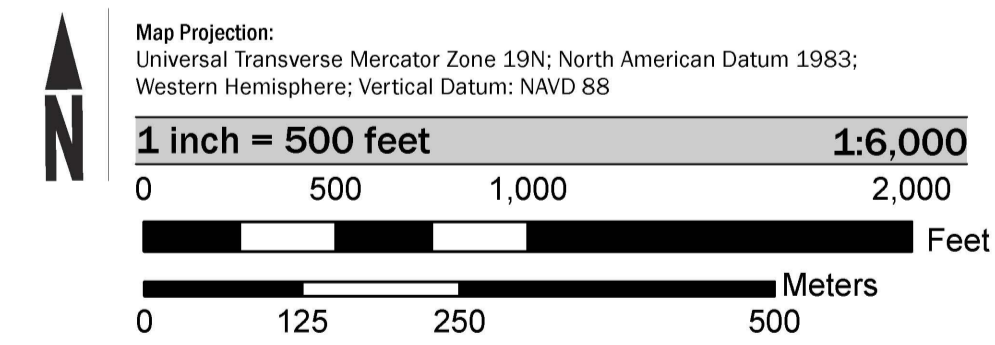
For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM index. These may be ordered directly from the Map Service Center at the number listed above. For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

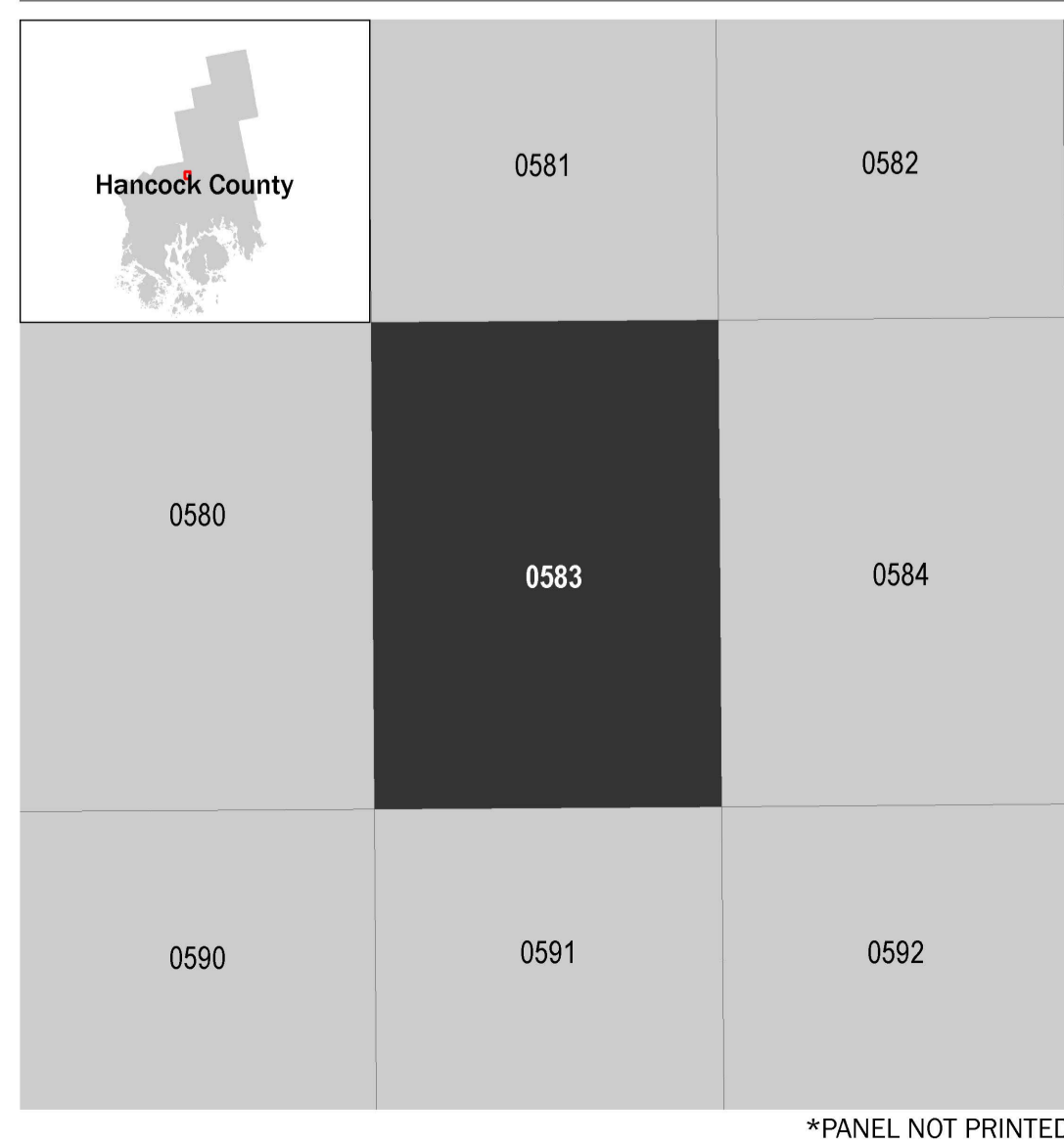
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-639-6620.

BASE MAP INFORMATION: Base map information shown on the FIRM was derived from digital orthophotography by Maine Office of GIS (MEGIS). Orthorectification was produced at a scale of 1:600 and dated August 2012 (MEGIS, 2012). Orthorectification was also acquired between 2003-2005 at a resolution of 1 and 2-ft cell size (MEGIS, 2003-2005).

SCALE



PANEL LOCATOR



National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

HANCOCK COUNTY, ME
 All Jurisdictions

PANEL **0583** of 1552

Panel Contains:

COMMUNITY	NUMBER	PANEL SUFFIX
MARIAVILLE, TOWN OF	230286	0583 D
OTIS, TOWN OF	230289	0583 D

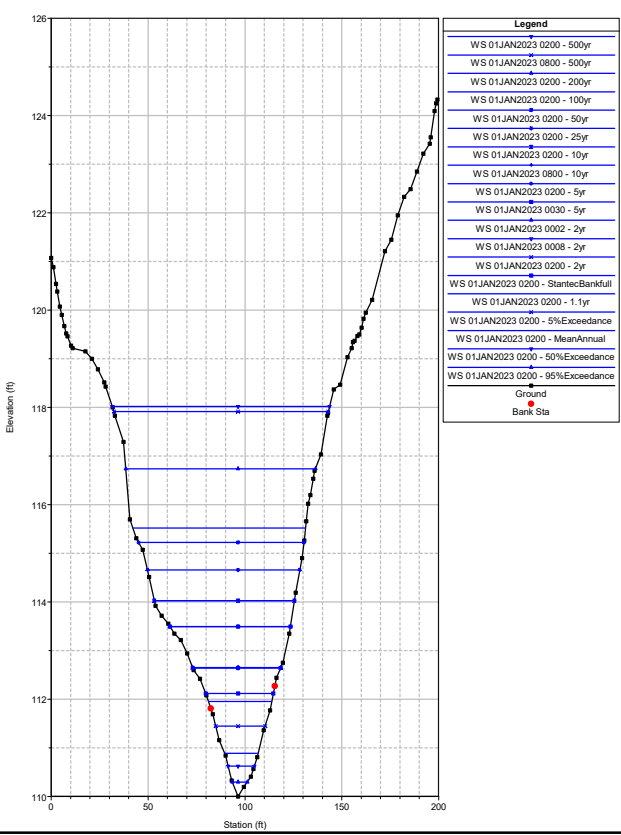
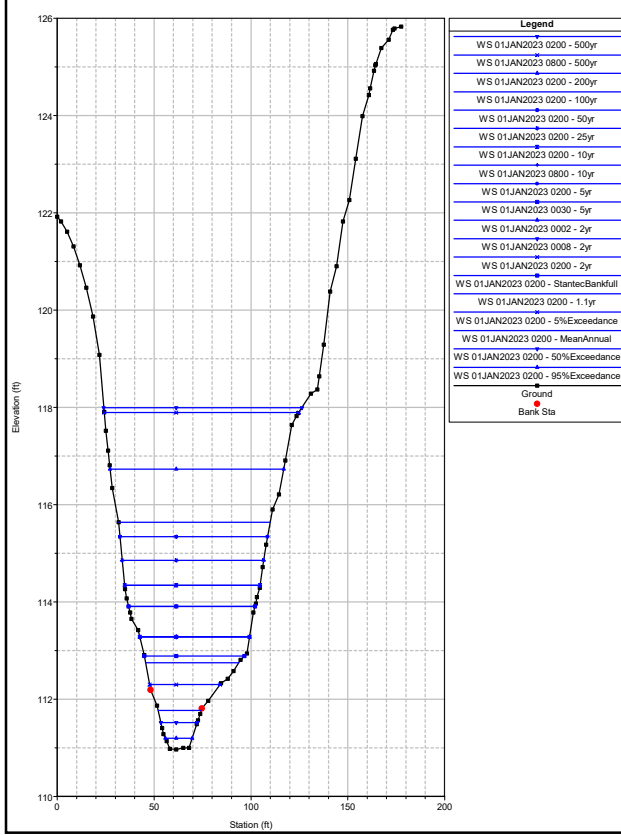
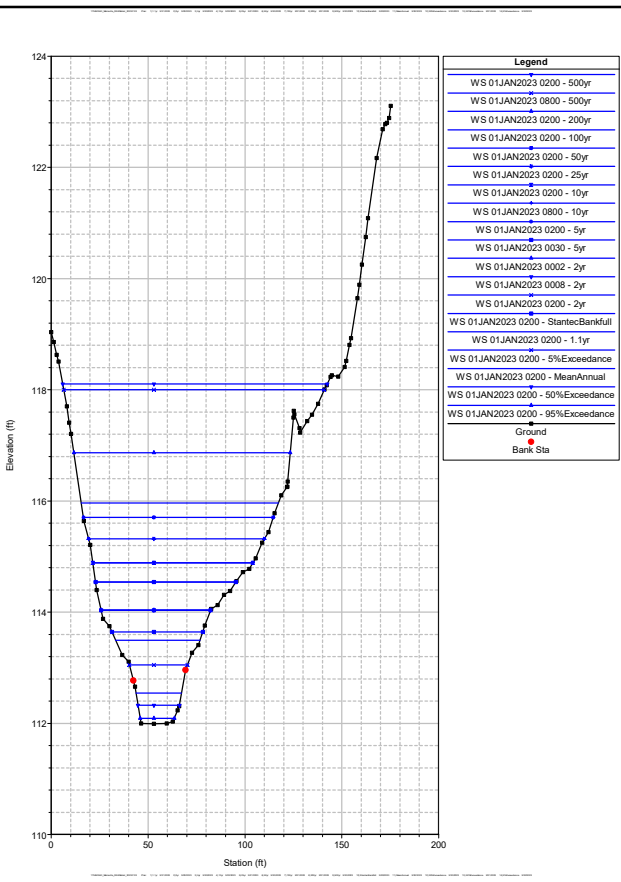
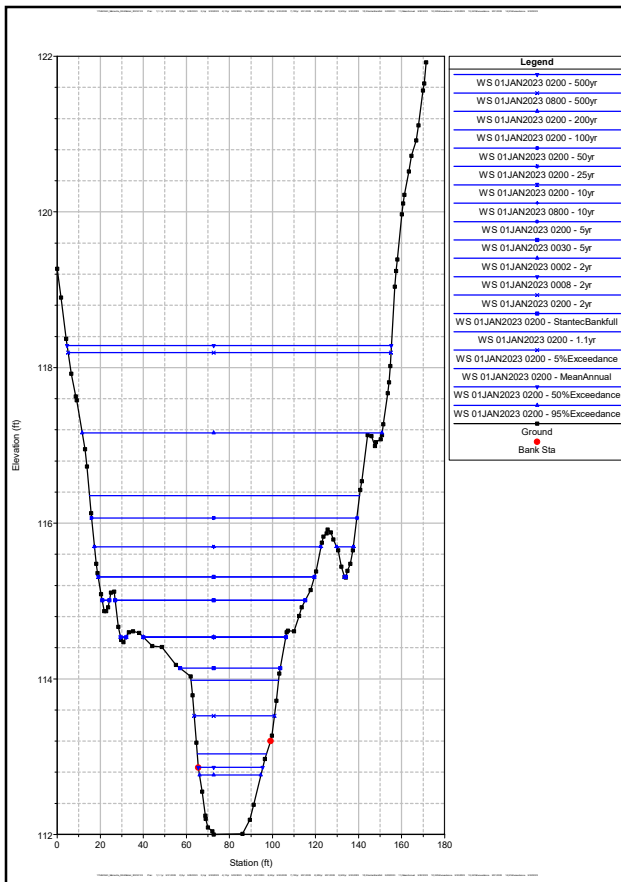
VERSION NUMBER
2.3.2.1

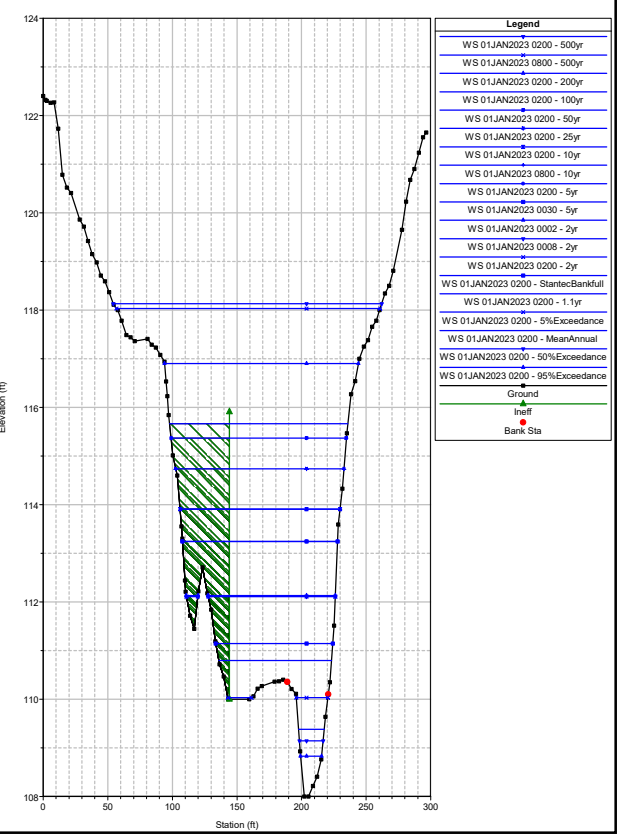
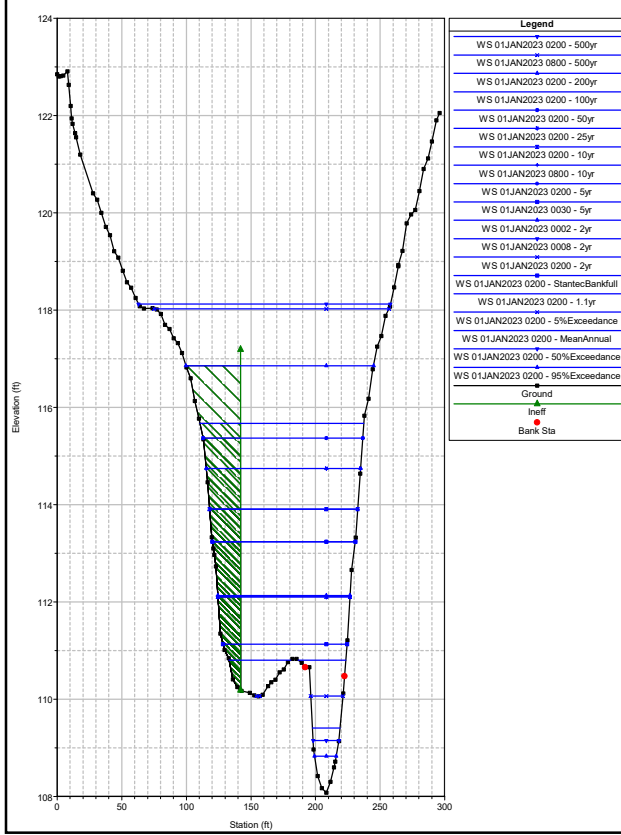
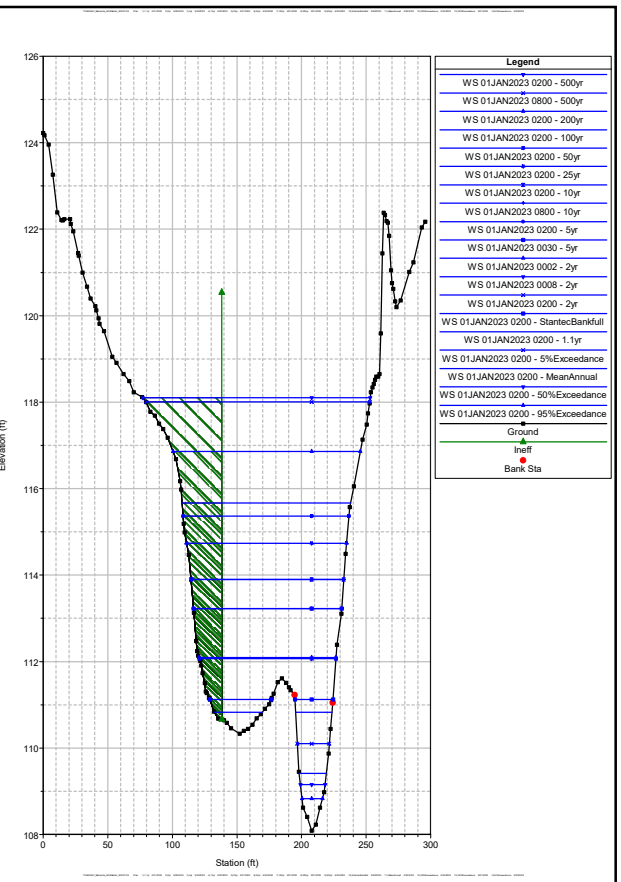
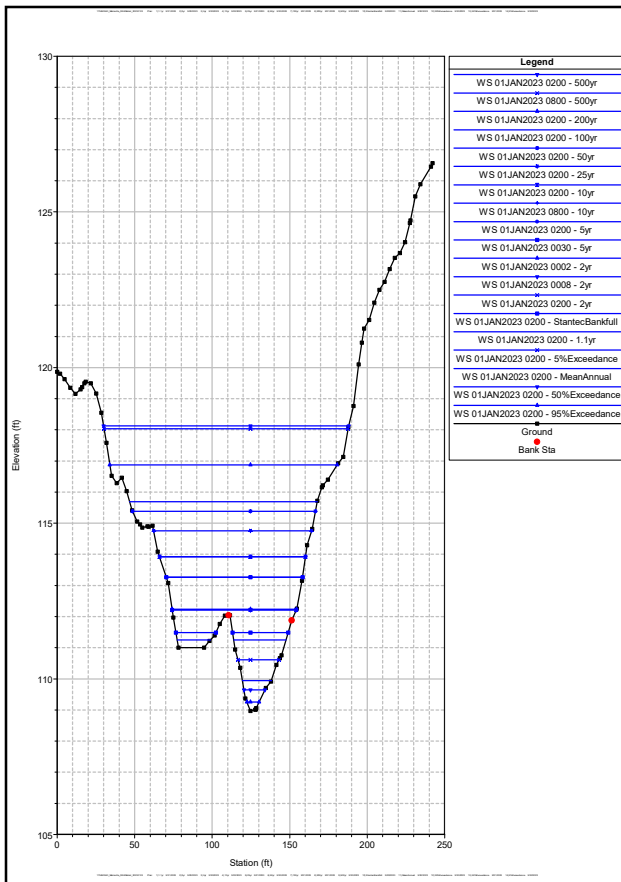
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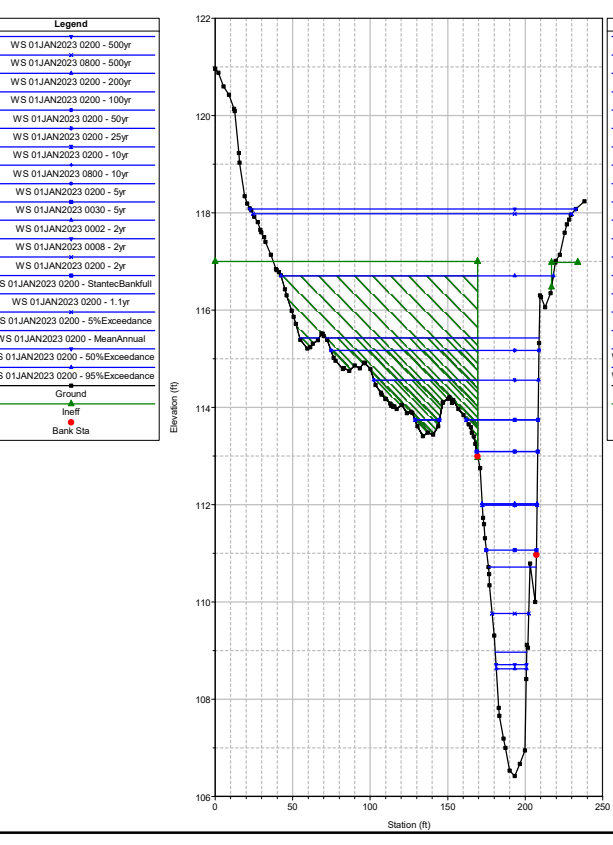
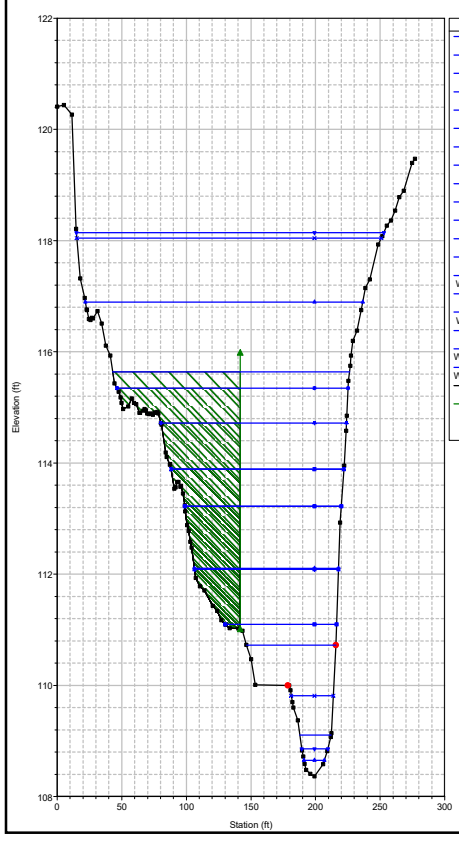
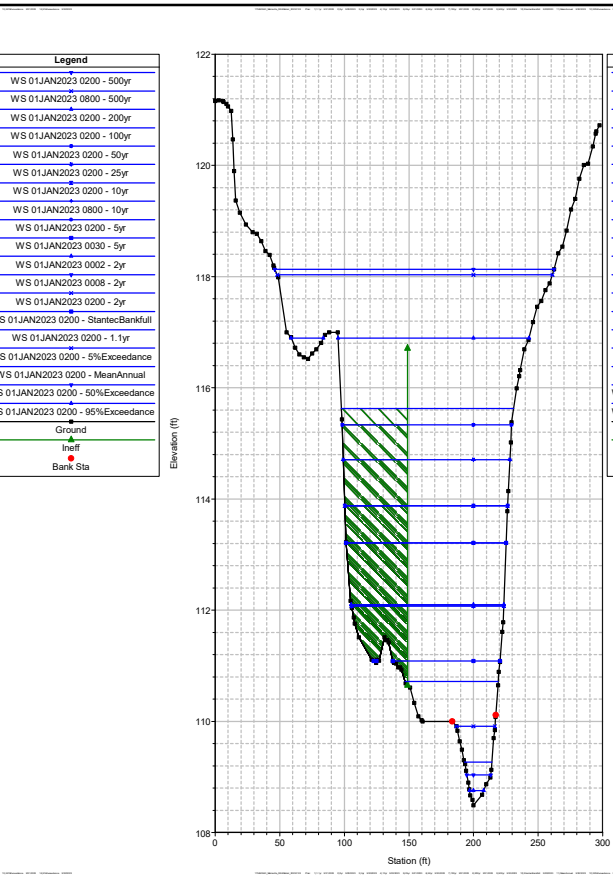
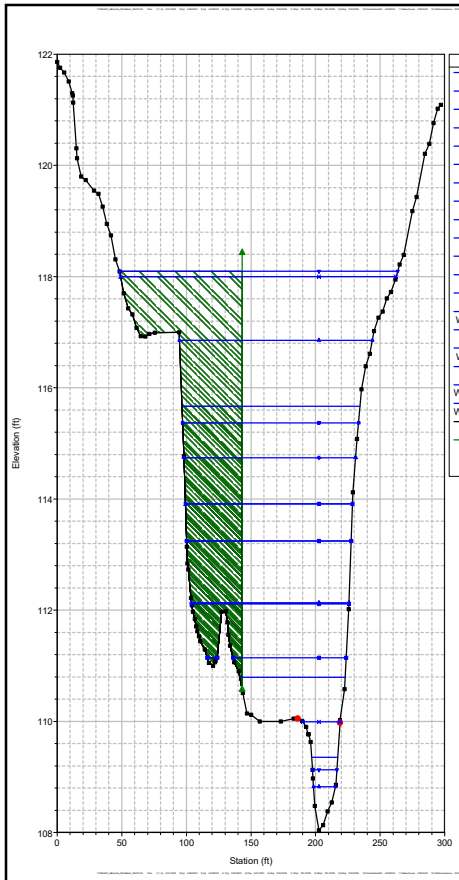
EFFECTIVE DATE
July 20, 2016

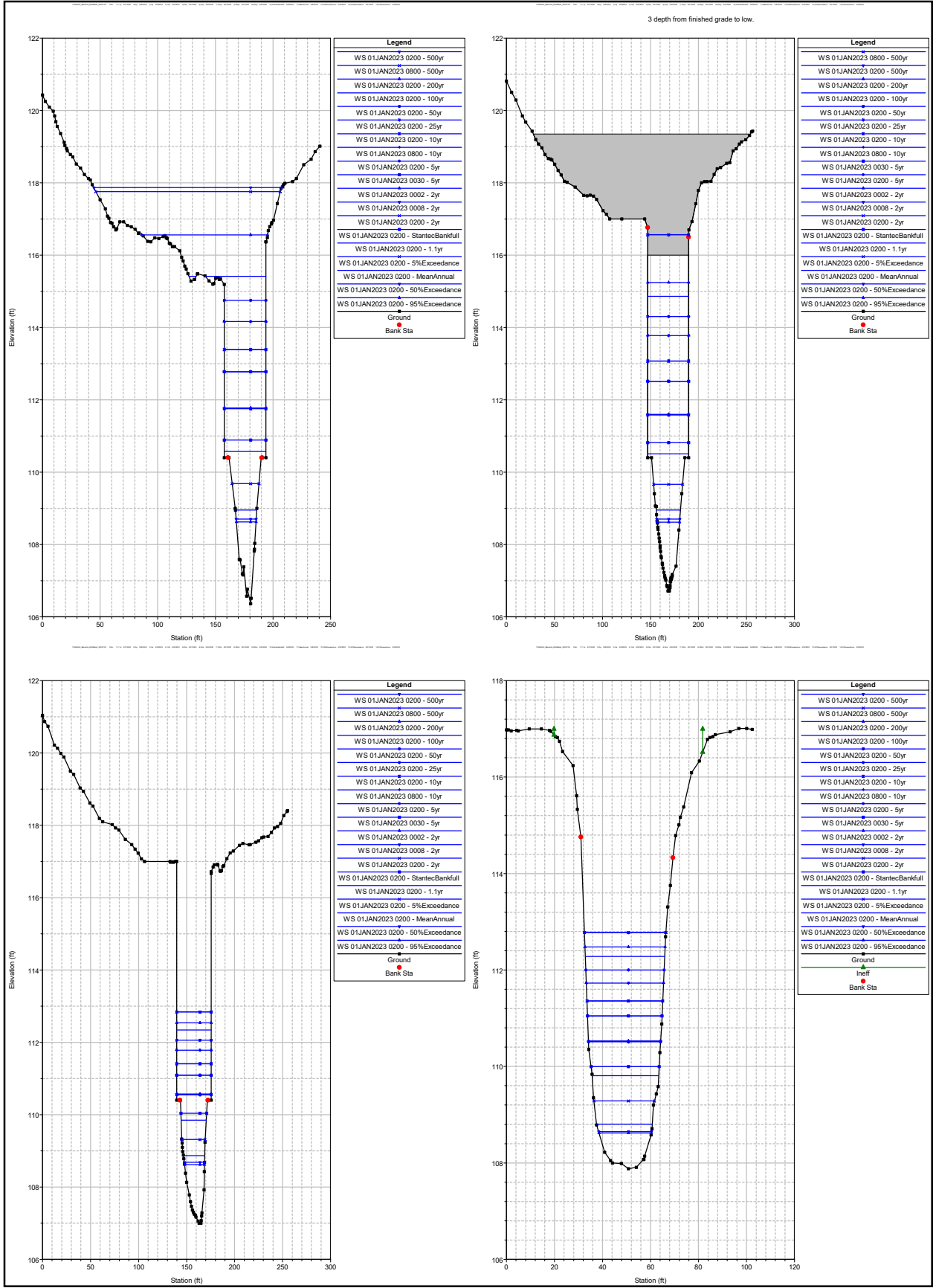
Appendix B Hydraulic Analysis Output

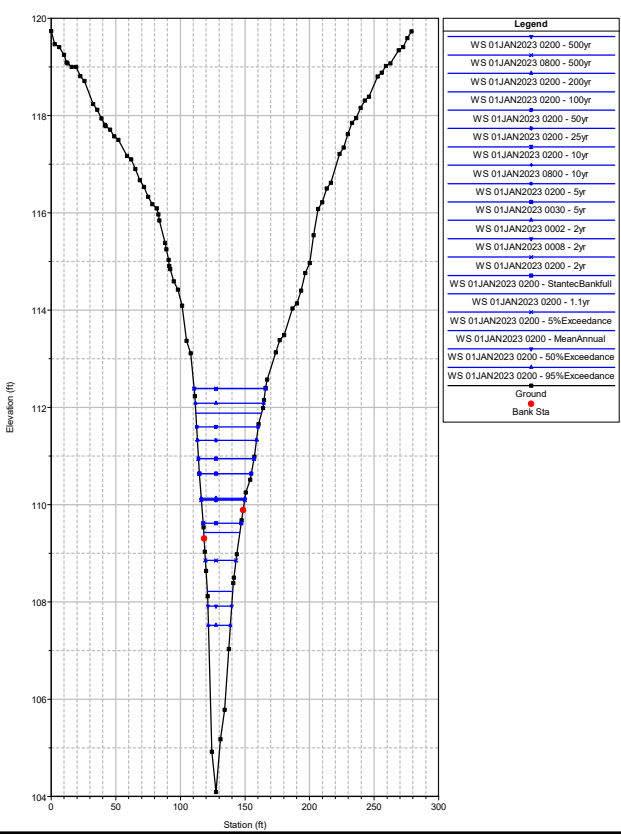
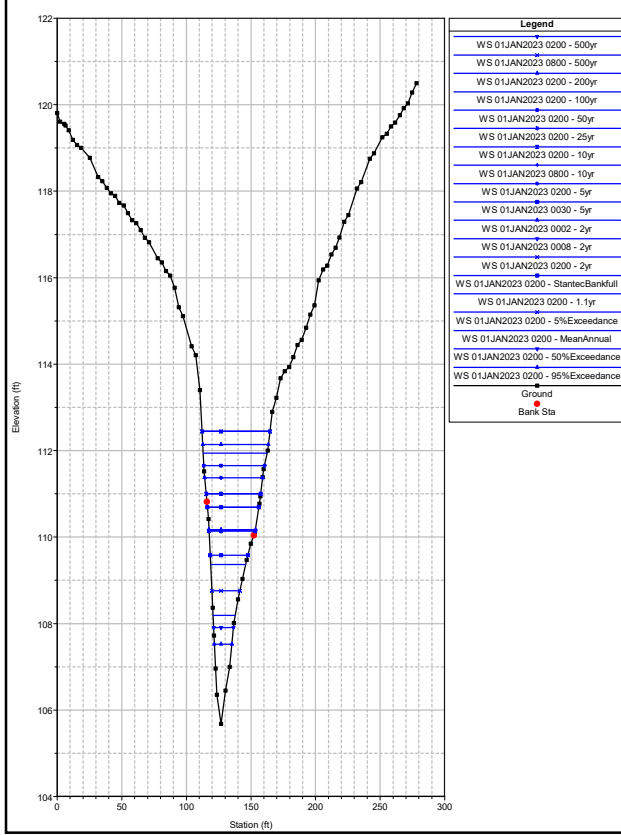
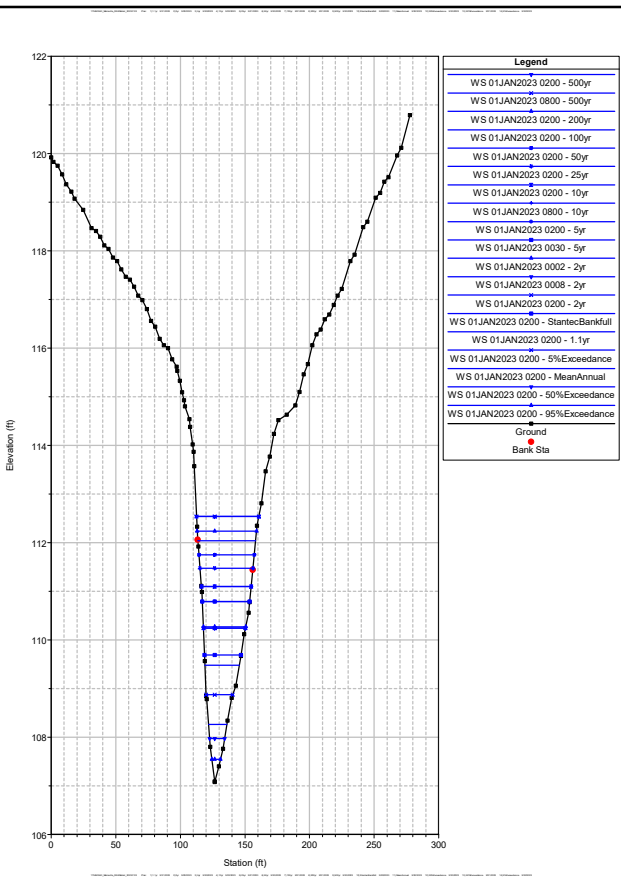
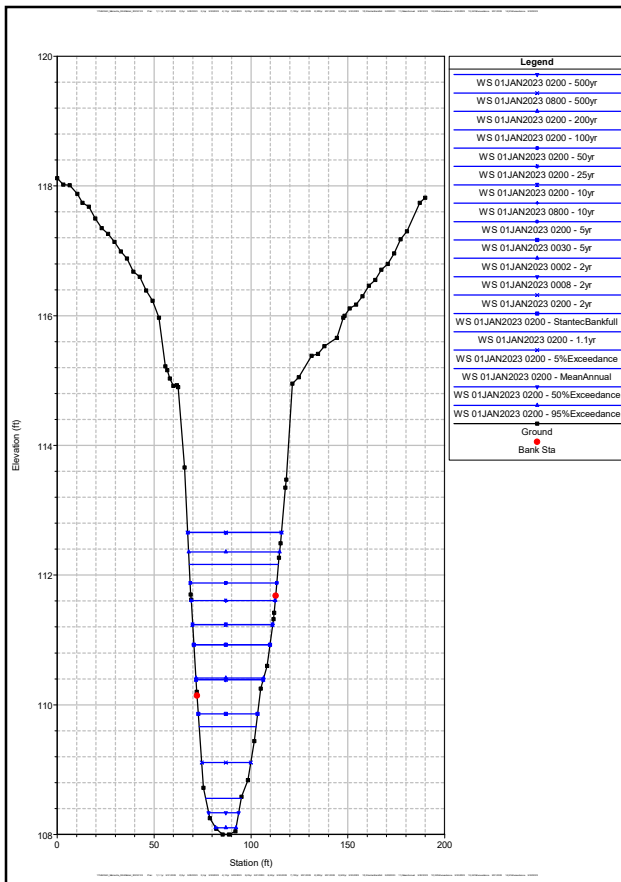


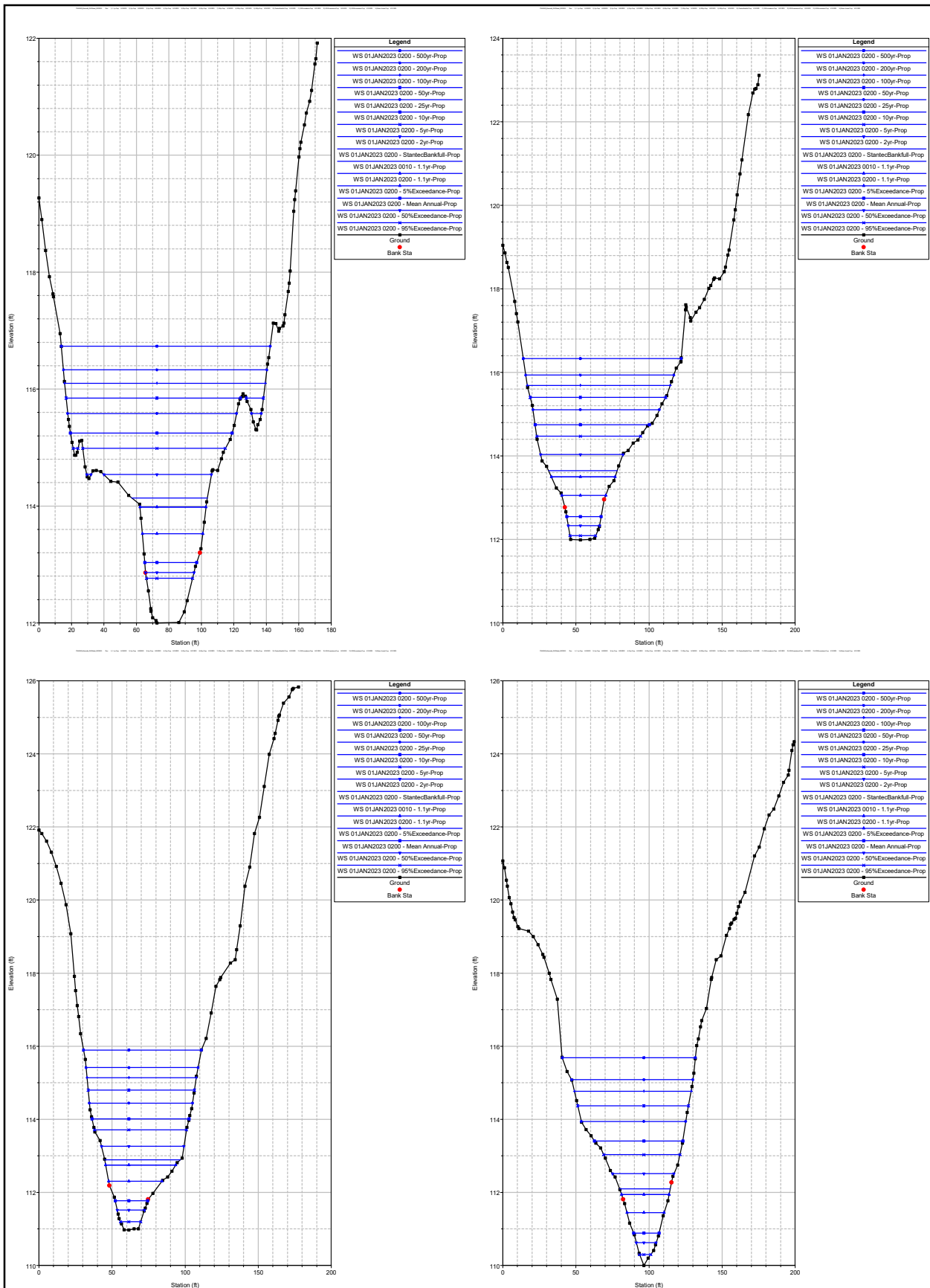


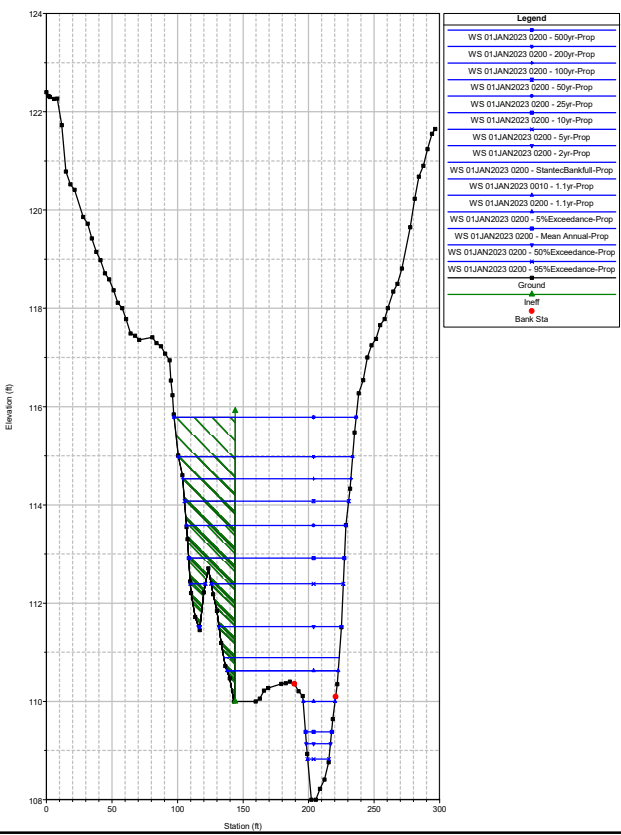
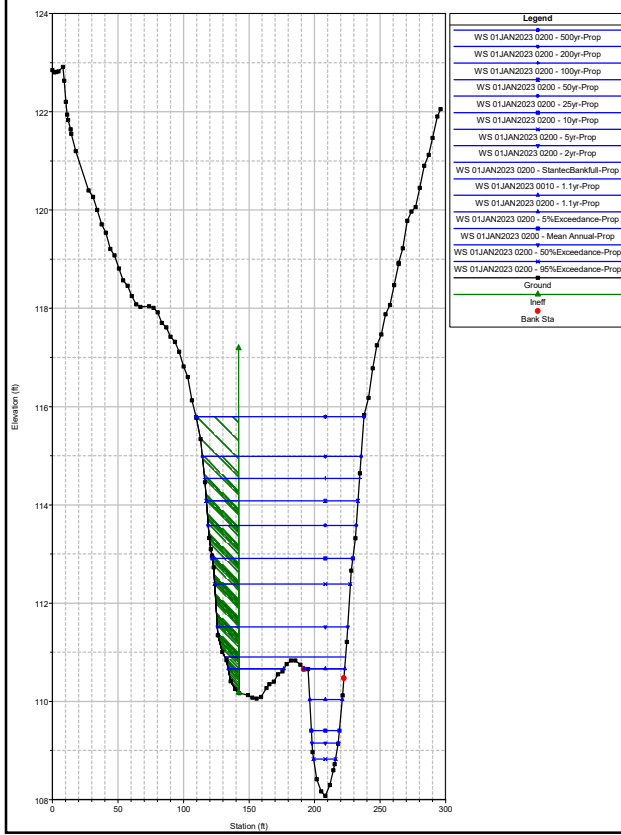
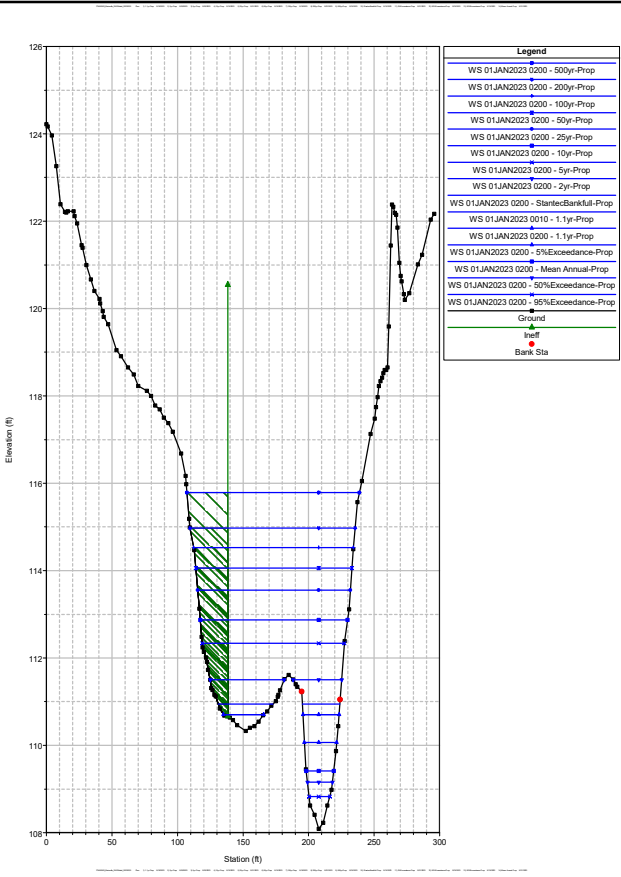
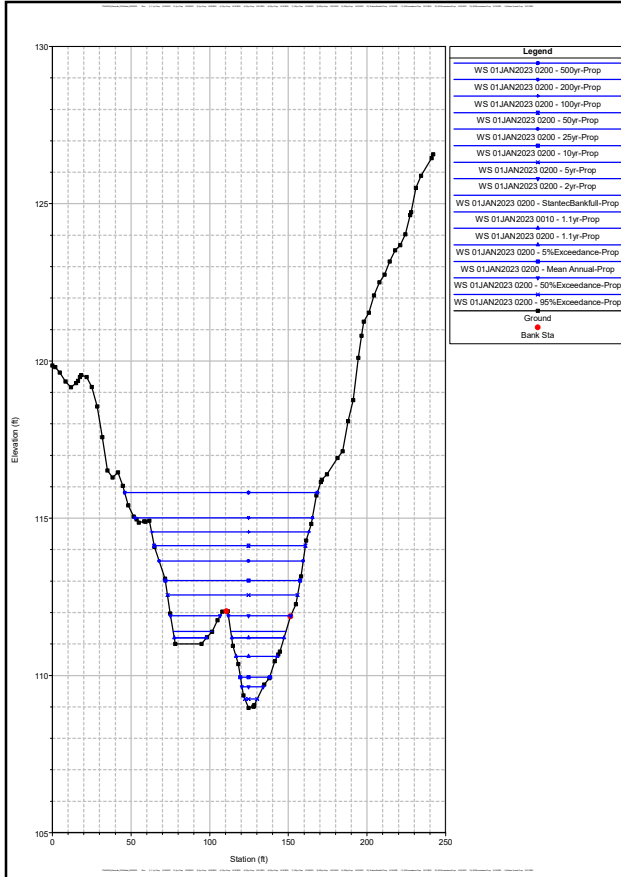


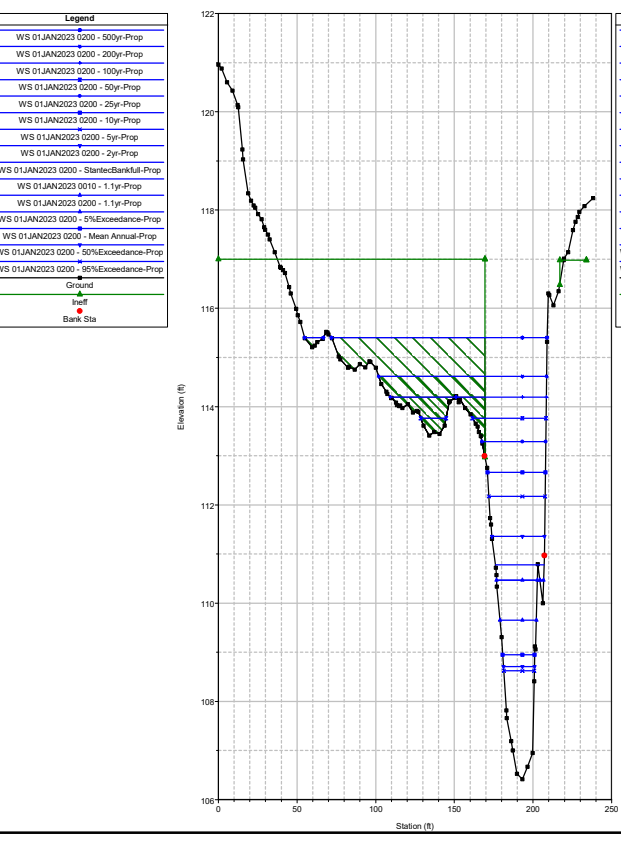
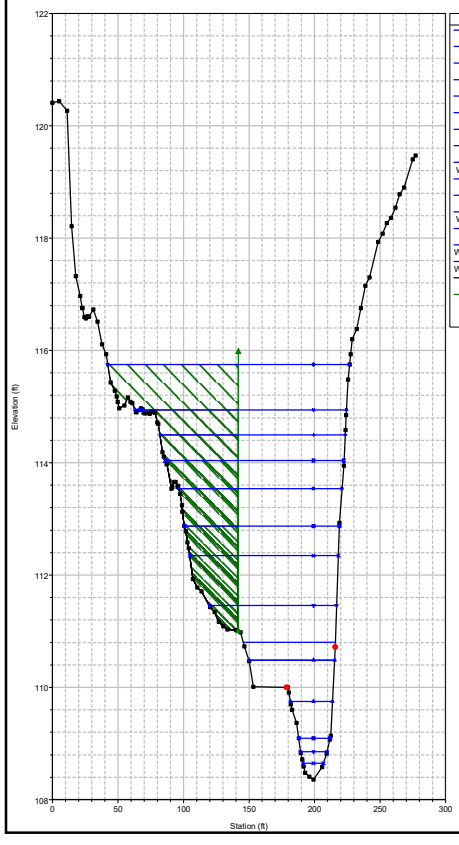
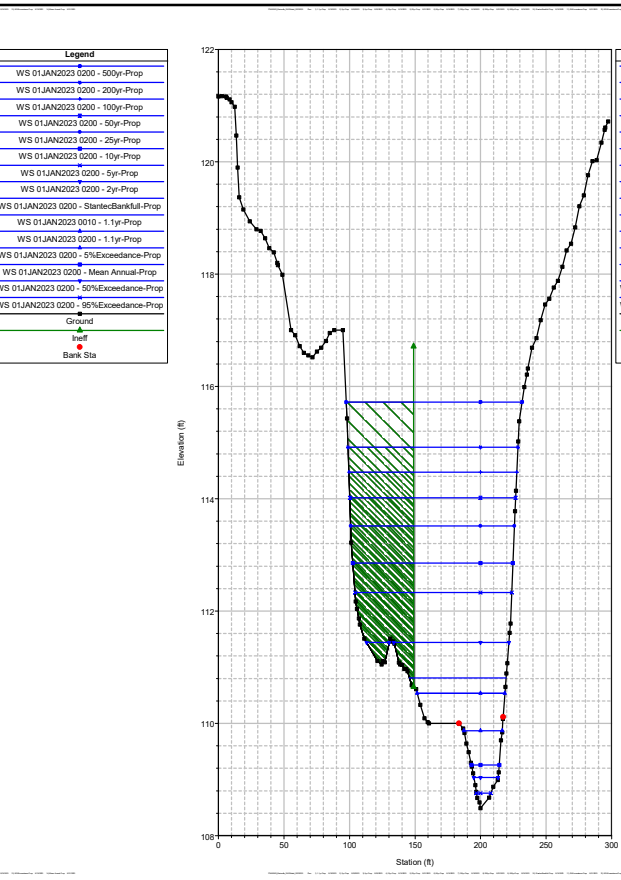
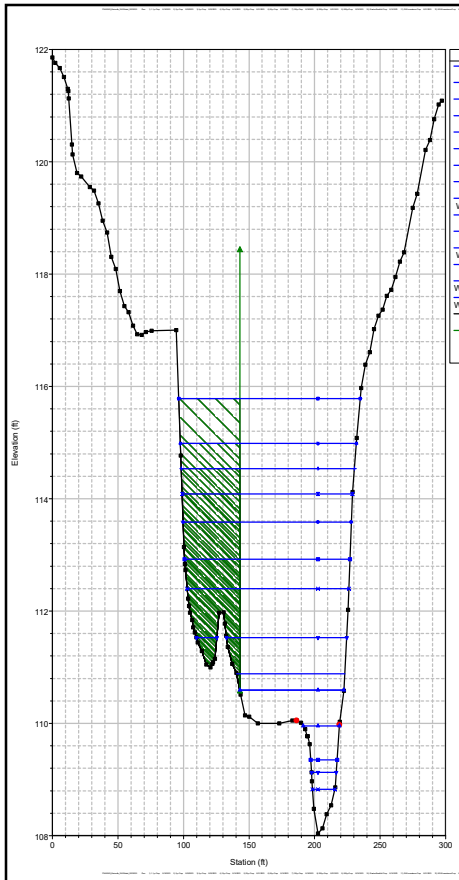


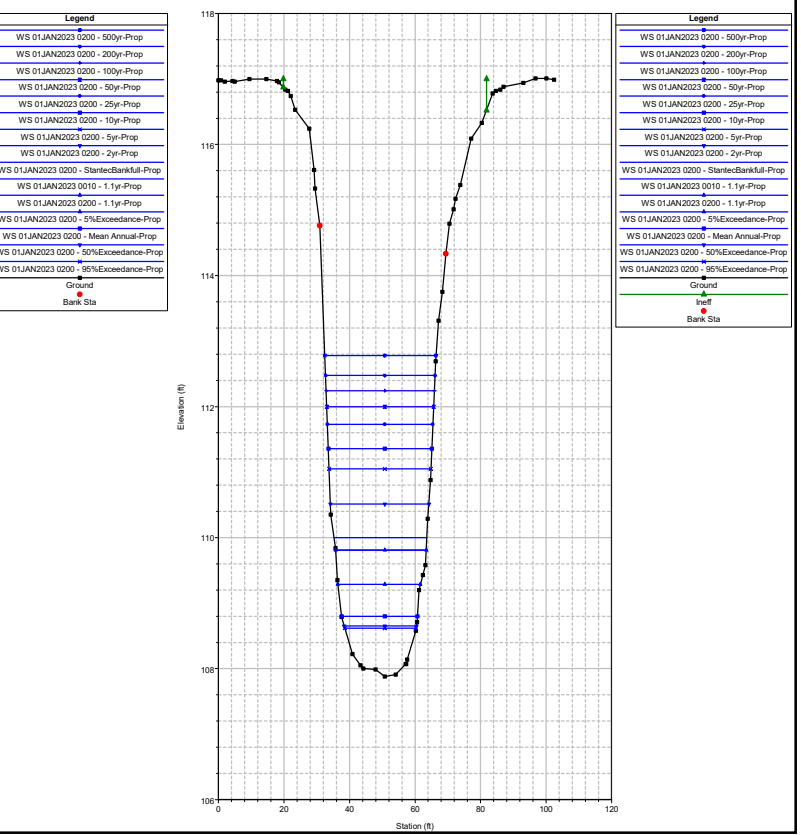
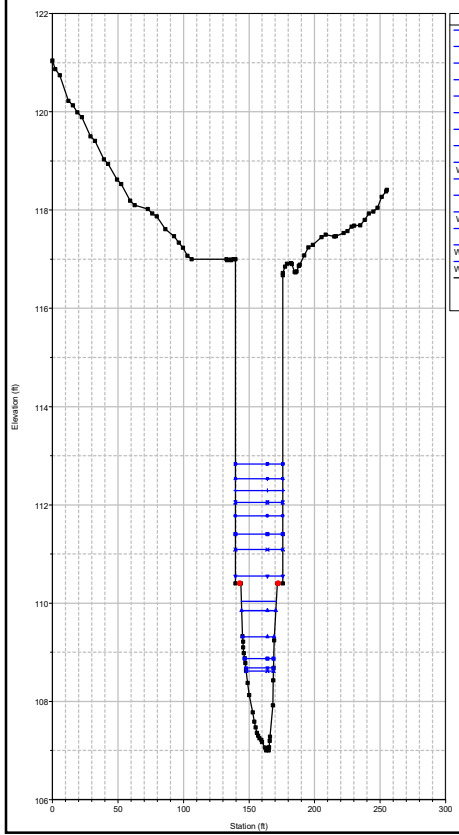
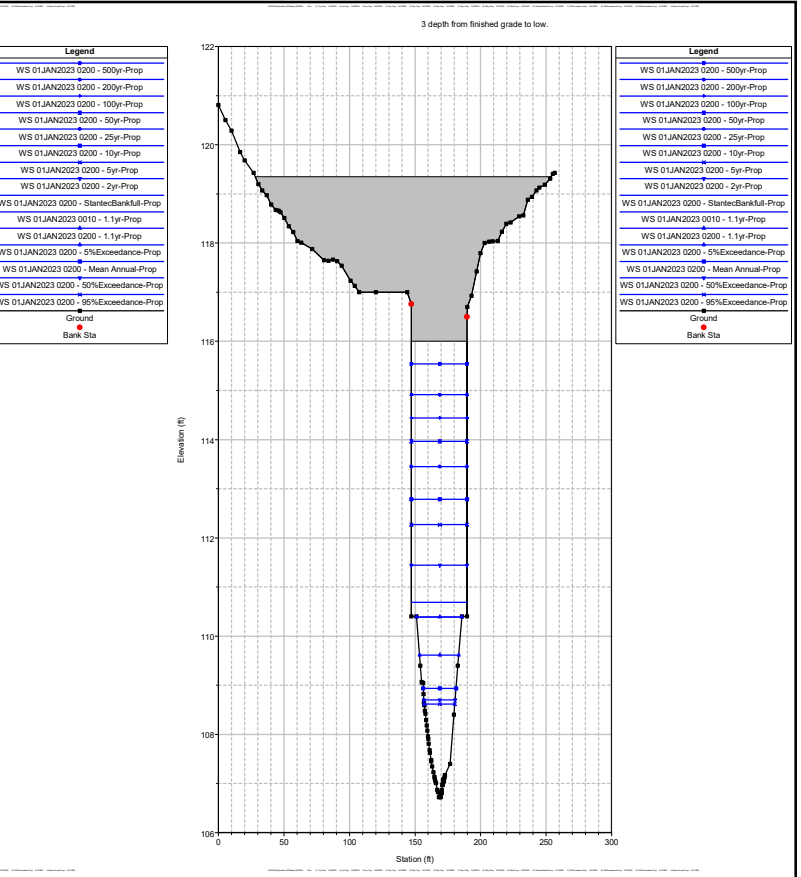
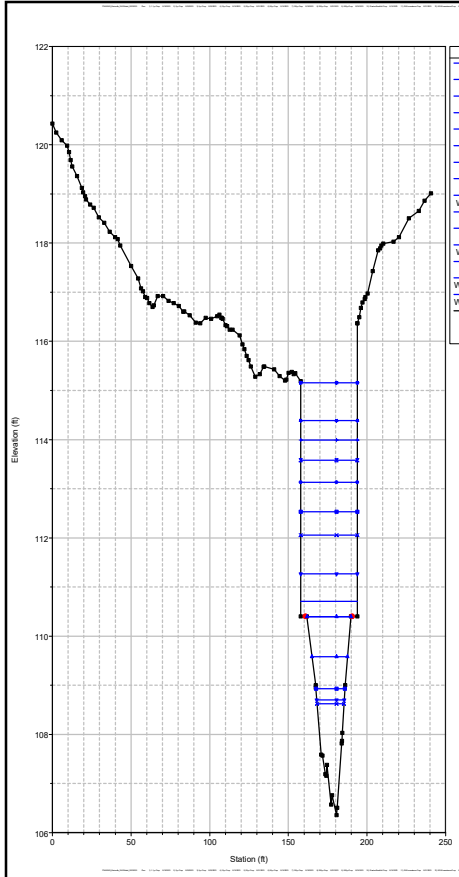












HEC-RAS River: TanneryBrook Reach: Reach1

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	672	01JAN2023 0200	1.1yr	270.00	112.00	113.98		114.32	0.004458	4.70	60.40	40.68	0.64
Reach1	672	01JAN2023 0002	2yr	490.00	112.00	114.54	114.18	115.15	0.005567	6.34	89.45	68.99	0.74
Reach1	672	01JAN2023 0030	5yr	720.00	112.00	115.01	114.86	115.82	0.005952	7.44	128.67	91.63	0.79
Reach1	672	01JAN2023 0200	10yr	875.00	112.00	115.31	115.09	116.21	0.005874	7.92	157.90	101.15	0.80
Reach1	672	01JAN2023 0200	25yr	1085.00	112.00	115.70	115.56	116.66	0.005579	8.37	199.44	113.11	0.80
Reach1	672	01JAN2023 0200	50yr	1255.00	112.00	116.07	115.78	117.02	0.004947	8.44	243.60	123.29	0.76
Reach1	672	01JAN2023 0200	100yr	1415.00	112.00	116.36		117.31	0.004627	8.57	279.57	125.50	0.75
Reach1	672	01JAN2023 0200	200yr	1580.00	112.00	117.16		117.84	0.002778	7.49	383.71	139.26	0.60
Reach1	672	01JAN2023 0200	500yr	1800.00	112.00	118.28		118.75	0.001530	6.38	547.25	150.69	0.46
Reach1	672	01JAN2023 0200	StantecBankfull	324.00	112.00	114.14		114.55	0.004800	5.16	67.00	46.48	0.67
Reach1	672	01JAN2023 0200	MeanAnnual	44.00	112.00	113.04		113.08	0.001652	1.74	25.40	32.07	0.34
Reach1	672	01JAN2023 0200	95%Exceedance	2.90	112.00	112.77		112.77	0.000023	0.17	17.21	28.44	0.04
Reach1	672	01JAN2023 0200	50%Exceedance	19.40	112.00	112.86		112.88	0.000648	0.97	20.09	29.87	0.21
Reach1	672	01JAN2023 0200	5%Exceedance	137.90	112.00	113.53		113.70	0.003344	3.30	42.61	37.26	0.52
Reach1	672	01JAN2023 0008	2yr	490.00	112.00	114.54	114.18	115.15	0.005568	6.34	89.44	68.98	0.74
Reach1	672	01JAN2023 0200	5yr	720.00	112.00	115.01	114.86	115.82	0.005952	7.44	128.67	91.63	0.79
Reach1	672	01JAN2023 0800	10yr	875.00	112.00	115.31	115.09	116.21	0.005874	7.92	157.90	101.15	0.80
Reach1	672	01JAN2023 0800	500yr	1800.00	112.00	118.19		118.68	0.001629	6.52	533.70	150.02	0.47
Reach1	672	01JAN2023 0200	2yr	490.00	112.00	114.54	114.18	115.15	0.005568	6.34	89.44	68.98	0.74
Reach1	622	01JAN2023 0200	1.1yr	270.00	111.99	113.50		113.65	0.015007	7.34	40.87	43.60	1.12
Reach1	622	01JAN2023 0002	2yr	490.01	111.99	114.04	114.30	115.26	0.014775	9.13	67.91	56.43	1.17
Reach1	622	01JAN2023 0030	5yr	720.00	111.99	114.54	114.91	115.99	0.013231	10.13	100.76	72.43	1.16
Reach1	622	01JAN2023 0200	10yr	875.00	111.99	114.88	115.20	116.37	0.011694	10.42	127.33	82.50	1.11
Reach1	622	01JAN2023 0200	25yr	1085.00	111.99	115.32	115.60	116.82	0.010061	10.66	164.99	90.67	1.06
Reach1	622	01JAN2023 0200	50yr	1255.00	111.99	115.70	115.88	117.14	0.008584	10.63	201.18	97.93	1.00
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Reach1	622	01JAN2023 0200	500yr	1800.12	111.99	118.10		118.75	0.002258	7.70	476.60	136.57	0.56
Reach1	622	01JAN2023 0200	StantecBankfull	324.00	111.99	113.64	113.82	114.58	0.014922	7.85	47.58	46.88	1.14
Reach1	622	01JAN2023 0200	MeanAnnual	44.00	111.99	112.54	112.55	112.79	0.017875	3.99	11.03	23.53	1.03
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Reach1	622	01JAN2023 0200	50%Exceedance	19.40	111.99	112.33	112.33	112.48	0.021147	3.14	6.17	21.38	1.03
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Reach1	566	01JAN2023 0200	25yr	1085.00	110.97	114.86	114.68	116.00	0.006754	9.42	180.35	73.02	0.88
Reach1	566	01JAN2023 0200	50yr	1255.00	110.97	115.34		116.43	0.005578	9.33	216.63	76.13	0.82
Reach1	566	01JAN2023 0200	100yr	1422.02	110.97	115.64		116.81	0.005508	9.72	239.33	78.18	0.82
Reach1	566	01JAN2023 0200	200yr	1580.00	110.97	116.73		117.55	0.002967	8.29	331.28	89.58	0.63
Reach1	566	01JAN2023 0200	500yr	1800.25	110.97	118.00		118.62	0.001761	7.35	451.52	102.30	0.50
Reach1	566	01JAN2023 0200	StantecBankfull	324.00	110.97	112.89	112.99	113.69	0.012178	7.36	54.61	51.58	1.04
Reach1	566	01JAN2023 0200	MeanAnnual	44.00	110.97	111.77		111.95	0.009839	3.41	12.91	22.23	0.79
Reach1	566	01JAN2023 0200	95%Exceedance	2.90	110.97	111.20		111.22	0.005511	1.17	2.48	13.85	0.49
Reach1	566	01JAN2023 0200	50%Exceedance	19.40	110.97	111.52		111.61	0.008226	2.50	7.77	18.68	0.68
Reach1	566	01JAN2023 0200	5%Exceedance	137.90	110.97	112.30	112.27	112.72	0.011220	5.19	28.63	36.47	0.92
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Reach1	566	01JAN2023 0200	5yr	720.00	110.97	113.91	113.98	115.03	0.009515	9.09	114.42	65.25	1.00
Reach1	566	01JAN2023 0800	10yr	875.00	110.97	114.34	114.31	115.46	0.007935	9.20	143.60	69.88	0.93
Reach1	566	01JAN2023 0800	500yr	1800.00	110.97	117.89		118.54	0.001858	7.47	441.15	100.40	0.51
Reach1	566	01JAN2023 0200	2yr	490.00	110.97	113.28	113.44	114.33	0.012261	8.58	76.11	56.60	1.08
Reach1	516	01JAN2023 0200	1.1yr	270.00	110.00	111.95	112.15	112.85	0.020336	7.61	35.56	32.69	1.26
Reach1	516	01JAN2023 0002	2yr	490.25	110.00	112.65	112.81	113.72	0.013325	8.32	62.40	45.61	1.10
Reach1	516	01JAN2023 0030	5yr	720.00	110.00	113.49	113.37	114.46	0.007441	8.05	107.07	62.14	0.88
Reach1	516	01JAN2023 0200	10yr	875.00	110.00	114.03	113.70	114.94	0.005602	7.91	143.26	72.35	0.79
Reach1	516	01JAN2023 0200	25yr	1085.00	110.00	114.66		115.53	0.004362	7.88	190.80	78.66	0.72
Reach1	516	01JAN2023 0200	50yr	1255.00	110.00	115.23		116.04	0.003457	7.71	237.33	85.43	0.65
Reach1	516	01JAN2023 0200	100yr	1425.98	110.00	115.52		116.41	0.003489	8.09	263.13	89.14	0.66
Reach1	516	01JAN2023 0200	200yr	1580.00	110.00	116.73		117.31	0.001760	6.71	376.77	97.89	0.49
Reach1	516	01JAN2023 0200	500yr	1800.35	110.00	118.02		118.46	0.001084	6.01	510.99	112.18	0.40
Reach1	516	01JAN2023 0200	StantecBankfull	324.00	110.00	112.12	112.32	113.09	0.018861	7.92	41.30	34.99	1.24
Reach1	516	01JAN2023 0200	MeanAnnual	44.00	110.00	110.89	110.98	111.28	0.025957	5.03	8.74	17.34	1.25
Reach1	516	01JAN2023 0200	95%Exceedance	2.90	110.00	110.30	110.32	110.40	0.035212	2.58	1.12	7.68	1.19
Reach1	516	01JAN2023 0200	50%Exceedance	19.40	110.00	110.63	110.68	110.89	0.028227	4.11	4.72	13.54	1.23
Reach1	516	01JAN2023 0200	5%Exceedance	137.90	110.00	111.45	111.62	112.12	0.023336	6.59	20.91	25.52	1.28
Reach1	516	01JAN2023 0008	2yr	490.00	110.00	112.64	112.81	113.72	0.013562	8.36	61.96	45.42	1.11
Reach1	516	01JAN2023 0200	5yr	720.00	110.00	113.49	113.37	114.46	0.007441	8.05	107.07	62.14	0.88
Reach1	516	01JAN2023 0800	10yr	875.00	110.00	114.03	113.70	114.94	0.005602	7.91	143.26	72.35	0.79
Reach1	516	01JAN2023 0800	500yr	1800.00	110.00	117.91		118.38	0.001145	6.11	499.44	110.79	0.41
Reach1	516	01JAN2023 0200	2yr	490.00	110.00	112.64	112.81	113.72	0.013564	8.36	61.96	45.41	1.11
Reach1	470	01JAN2023 0200	1.1yr	270.00	108.97	111.25	111.20	111.79	0.009920	5.93	49.81	55.26	0.91
Reach1	470	01JAN2023 0002	2yr	490.79	108.97	112.24		112.66	0.004858	5.47	116.53	80.37	0.68
Reach1	470	01JAN2023 0030	5yr	720.00	108.97	113.27		113.60	0.002328	4.98	203.26	87.98	0.50
Reach1	470	01JAN2023 0200	10yr	875.00	108.97	113.93		114.24	0.001705	4.86	263.17	94.25	0.44
Reach1	470	01JAN2023 0200	25yr	1085.00	108.97	114.76	</						

HEC-RAS River: TanneryBrook Reach: Reach1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	470	01JAN2023 0200	200yr	1580.00	108.97	116.87		117.12	0.000674	4.51	608.54	146.70	0.31
Reach1	470	01JAN2023 0200	500yr	1800.47	108.97	118.13		118.32	0.000440	4.09	801.53	158.26	0.26
Reach1	470	01JAN2023 0200	StantecBankfull	324.00	108.97	111.49	111.39	112.02	0.008539	5.90	63.69	61.73	0.85
Reach1	470	01JAN2023 0200	MeanAnnual	44.00	108.97	109.95	109.93	110.21	0.014964	4.13	10.65	18.76	0.97
Reach1	470	01JAN2023 0200	95%Exceedance	2.90	108.97	109.25		109.31	0.015112	1.97	1.47	7.92	0.81
Reach1	470	01JAN2023 0200	50%Exceedance	19.40	108.97	109.64		109.82	0.014933	3.39	5.72	13.96	0.92
Reach1	470	01JAN2023 0200	5%Exceedance	137.90	108.97	110.61	110.59	111.07	0.012823	5.42	25.45	26.51	0.98
Reach1	470	01JAN2023 0008	2yr	490.00	108.97	112.22		112.65	0.005007	5.52	115.05	80.15	0.69
Reach1	470	01JAN2023 0200	5yr	720.00	108.97	113.27		113.60	0.002328	4.98	203.26	87.98	0.50
Reach1	470	01JAN2023 0800	10yr	875.00	108.97	113.93		114.24	0.001705	4.86	263.17	94.25	0.44
Reach1	470	01JAN2023 0800	500yr	1800.01	108.97	118.03		118.23	0.000463	4.16	785.82	157.52	0.26
Reach1	470	01JAN2023 0200	2yr	490.00	108.97	112.22		112.65	0.005009	5.52	115.04	80.14	0.69
Reach1	411	01JAN2023 0200	1.1yr	270.00	108.09	110.83		111.21	0.004596	5.01	62.40	65.19	0.65
Reach1	411	01JAN2023 0002	2yr	492.22	108.09	112.10		112.39	0.002129	4.71	160.74	106.19	0.48
Reach1	411	01JAN2023 0030	5yr	720.00	108.09	113.22		113.48	0.001298	4.53	262.81	114.74	0.39
Reach1	411	01JAN2023 0200	10yr	875.00	108.09	113.90		114.14	0.001067	4.54	325.80	118.31	0.36
Reach1	411	01JAN2023 0200	25yr	1085.00	108.09	114.74		114.98	0.000885	4.60	405.93	123.82	0.34
Reach1	411	01JAN2023 0200	50yr	1255.00	108.09	115.37		115.61	0.000794	4.67	467.24	128.36	0.33
Reach1	411	01JAN2023 0200	100yr	1437.79	108.09	115.67		115.95	0.000873	5.05	497.02	130.43	0.35
Reach1	411	01JAN2023 0200	200yr	1580.00	108.09	116.86		117.08	0.000566	4.54	620.28	145.03	0.29
Reach1	411	01JAN2023 0200	500yr	1800.65	108.09	118.11		118.30	0.000421	4.32	759.47	176.22	0.25
Reach1	411	01JAN2023 0200	StantecBankfull	324.00	108.09	111.12	111.50	111.50	0.004045	5.04	81.17	76.91	0.62
Reach1	411	01JAN2023 0200	MeanAnnual	44.00	108.09	109.42	109.51	109.51	0.003165	2.47	17.81	21.09	0.47
Reach1	411	01JAN2023 0200	95%Exceedance	2.90	108.09	108.83		108.83	0.002336	0.43	6.76	15.86	0.12
Reach1	411	01JAN2023 0200	50%Exceedance	19.40	108.09	109.16		109.19	0.001731	1.55	12.54	19.11	0.34
Reach1	411	01JAN2023 0200	5%Exceedance	137.90	108.09	110.10	110.36	110.36	0.004728	4.11	33.52	24.75	0.62
Reach1	411	01JAN2023 0008	2yr	490.03	108.09	112.07		112.37	0.002176	4.73	158.68	105.82	0.48
Reach1	411	01JAN2023 0200	5yr	720.00	108.09	113.22		113.48	0.001298	4.53	262.81	114.74	0.39
Reach1	411	01JAN2023 0800	10yr	875.00	108.09	113.90		114.14	0.001067	4.54	325.80	118.31	0.36
Reach1	411	01JAN2023 0800	500yr	1800.01	108.09	118.01		118.21	0.000438	4.38	748.05	173.18	0.26
Reach1	411	01JAN2023 0200	2yr	490.00	108.09	112.07		112.37	0.002177	4.73	158.66	105.82	0.48
Reach1	403.25	01JAN2023 0200	1.1yr	270.00	108.08	110.81		111.13	0.004252	4.68	74.29	84.70	0.62
Reach1	403.25	01JAN2023 0002	2yr	492.46	108.08	112.13		112.35	0.001628	4.19	184.24	102.36	0.42
Reach1	403.25	01JAN2023 0030	5yr	720.00	108.08	113.24		113.45	0.001085	4.19	280.14	110.70	0.36
Reach1	403.25	01JAN2023 0200	10yr	875.00	108.08	113.91		114.12	0.000921	4.26	340.12	114.70	0.34
Reach1	403.25	01JAN2023 0200	25yr	1085.00	108.08	114.74		114.96	0.000786	4.38	416.72	119.46	0.32
Reach1	403.25	01JAN2023 0200	50yr	1255.00	108.08	115.37		115.60	0.000716	4.48	475.38	123.65	0.31
Reach1	403.25	01JAN2023 0200	100yr	1438.72	108.08	115.67		115.93	0.000794	4.86	503.90	126.77	0.33
Reach1	403.25	01JAN2023 0200	200yr	1580.00	108.08	116.86		117.07	0.000527	4.42	621.48	145.31	0.28
Reach1	403.25	01JAN2023 0200	500yr	1800.68	108.08	118.12		118.29	0.000368	4.08	979.62	194.98	0.24
Reach1	403.25	01JAN2023 0200	StantecBankfull	324.00	108.08	111.13	111.43	111.43	0.003200	4.54	101.08	96.11	0.55
Reach1	403.25	01JAN2023 0200	MeanAnnual	44.00	108.08	109.41	109.49	109.49	0.002516	2.29	19.20	21.42	0.43
Reach1	403.25	01JAN2023 0200	95%Exceedance	2.90	108.08	108.83		108.83	0.001511	0.37	7.89	16.75	0.09
Reach1	403.25	01JAN2023 0200	50%Exceedance	19.40	108.08	109.15		109.18	0.001316	1.40	13.88	20.06	0.30
Reach1	403.25	01JAN2023 0200	5%Exceedance	137.90	108.08	110.07	110.32	110.32	0.004319	3.99	34.56	27.31	0.60
Reach1	403.25	01JAN2023 0008	2yr	490.03	108.08	112.11		112.33	0.001658	4.21	182.36	102.26	0.42
Reach1	403.25	01JAN2023 0200	5yr	720.00	108.08	113.24		113.45	0.001085	4.19	280.14	110.70	0.36
Reach1	403.25	01JAN2023 0800	10yr	875.00	108.08	113.91		114.12	0.000921	4.26	340.12	114.70	0.34
Reach1	403.25	01JAN2023 0800	500yr	1800.02	108.08	118.03		118.19	0.000369	4.05	961.27	181.79	0.24
Reach1	403.25	01JAN2023 0200	2yr	490.00	108.08	112.11		112.33	0.001658	4.21	182.33	102.26	0.42
Reach1	395.50	01JAN2023 0200	1.1yr	270.00	108.00	110.80		111.07	0.003747	4.40	84.64	87.10	0.58
Reach1	395.50	01JAN2023 0002	2yr	492.69	108.00	112.13		112.33	0.001445	3.97	192.69	107.54	0.40
Reach1	395.50	01JAN2023 0030	5yr	720.00	108.00	113.24		113.44	0.000996	4.04	284.43	120.06	0.35
Reach1	395.50	01JAN2023 0200	10yr	875.00	108.00	113.91		114.11	0.000863	4.14	340.65	123.93	0.33
Reach1	395.50	01JAN2023 0200	25yr	1085.00	108.00	114.74		114.95	0.000749	4.29	413.47	130.27	0.32
Reach1	395.50	01JAN2023 0200	50yr	1255.00	108.00	115.37		115.59	0.000689	4.41	469.56	135.65	0.31
Reach1	395.50	01JAN2023 0200	100yr	1439.63	108.00	115.66		115.93	0.000768	4.80	496.77	137.92	0.33
Reach1	395.50	01JAN2023 0200	200yr	1580.00	108.00	116.90		117.04	0.000388	3.82	832.24	150.11	0.24
Reach1	395.50	01JAN2023 0200	500yr	1800.71	108.00	118.13		118.28	0.000321	3.83	1055.44	207.84	0.22
Reach1	395.50	01JAN2023 0200	StantecBankfull	324.00	108.00	111.14	111.38	111.38	0.002697	4.20	112.29	90.53	0.51
Reach1	395.50	01JAN2023 0200	MeanAnnual	44.00	108.00	109.38	109.47	109.47	0.002441	2.33	18.88	20.00	0.42
Reach1	395.50	01JAN2023 0200	95%Exceedance	2.90	108.00	108.83		108.83	0.001104	0.33	8.75	16.29	0.08
Reach1	395.50	01JAN2023 0200	50%Exceedance	19.40	108.00	109.14		109.17	0.001090	1.36	14.22	18.42	0.27
Reach1	395.50	01JAN2023 0200	5%Exceedance	137.90	108.00	110.03	110.30	110.30	0.004791	4.14	33.82	43.01	0.63
Reach1	395.50	01JAN2023 0008	2yr	490.03	108.00	112.11		112.31	0.001468	3.98	190.89	107.09	0.40
Reach1	395.50	01JAN2023 0200	5yr	720.00	108.00	113.24		113.44	0.000996	4.04	284.43	120.06	0.35
Reach1	395.50	01JAN2023 0800	10yr	875.00	108.00	113.91		114.11	0.000863	4.14	340.65	123.93	0.33
Reach1	395.50	01JAN2023 0800	500yr	1800.02	108.00	118.03		118.18	0.000334	3.88	1035.18	204.10	0.23
Reach1	395.50	01JAN2023 0200	2yr	490.00	108.00	112.11		112.31	0.001469	3.98	190.88	107.08	0.40
Reach1	387.75	01JAN2023 0200	1.1yr	270.00	108.04	110.79		111.03	0.003247	4.13	91.89	81.58	0.54
Reach1	387.75	01JAN2023 0002	2yr	492.93	108.04	112.14		112.32	0.001297	3.79	201.24	121.85	0.38
Reach1	387.75	01JAN2023 0030	5yr	720.00	108.04	113.24		113.42	0.000910	3.88	293.83	127.29	0.33
Reach1	387.75	01JAN2023 0200	10yr	875.00	108.04	113.91		114.10	0.000792	3.99	350.40	129.32	0.32
Reach1	387.75	01JAN2023 0200	25yr	1085.00	108.04	114.74		114.94	0.000695	4.15	422.51	133.02	0.31
Reach1	387.75	01JAN2023 0200	50yr	1255.00	108.04	115.37		115.58	0.000643	4.28	478.17	136.26	0.30
Reach1	387.75	01JAN2023 0200	100yr	1440.57	108.04	115.67		115.92	0.000720	4.66	505.27	137.85	0.32
Reach1	387.75	01JAN2023 0200	200yr	1580.00	108.04	116.85		117.06	0.000486	4.27	618.28	149.40	0.27
Reach1	387.75	01JAN2023 0200	500yr	1800.74	108.04	118.10		118.29	0.000374	4.13	755.57	215.34	0.24
Reach1	387.75	01JAN2023 0200	StantecBankfull	324.00	108.04	111.14	111.35	111.35	0.002343	3.95	120.25	95.23	0.48
Reach1	387.75	01JAN2023 0200	MeanAnnual	44.00	108.04	109.35	109.45	109.45	0.002967	2.46	17.89	20.26	0.46
Reach1	387.75	01JAN2023 0200	95%Exceedance	2.90	108.04	108.83		108.83	0.001152	0.36			

HEC-RAS River: TanneryBrook Reach: Reach1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	387.75	01JAN2023 0008	2yr	490.04	108.04	112.11		112.29	0.001315	3.80	199.45	121.71	0.38
Reach1	387.75	01JAN2023 0200	5yr	720.00	108.04	113.24		113.42	0.000910	3.88	293.83	127.29	0.33
Reach1	387.75	01JAN2023 0800	10yr	875.00	108.04	113.91		114.10	0.000792	3.99	350.40	129.32	0.32
Reach1	387.75	01JAN2023 0800	500yr	1800.02	108.04	118.00		118.19	0.000389	4.19	743.70	213.26	0.25
Reach1	387.75	01JAN2023 0200	2yr	490.00	108.04	112.11		112.29	0.001315	3.80	199.43	121.70	0.38
Reach1	380	01JAN2023 0200	1.1yr	270.00	108.49	110.72		111.03	0.004767	4.65	75.71	72.13	0.65
Reach1	380	01JAN2023 0002	2yr	493.19	108.49	112.10		112.31	0.001594	4.07	175.55	118.16	0.42
Reach1	380	01JAN2023 0030	5yr	720.00	108.49	113.21		113.42	0.001075	4.13	259.43	123.83	0.36
Reach1	380	01JAN2023 0200	10yr	875.00	108.49	113.88		114.10	0.000925	4.24	310.63	125.97	0.34
Reach1	380	01JAN2023 0200	25yr	1085.00	108.49	114.71		114.94	0.000802	4.39	375.81	128.95	0.33
Reach1	380	01JAN2023 0200	50yr	1255.00	108.49	115.33		115.58	0.000737	4.52	425.67	131.17	0.32
Reach1	380	01JAN2023 0200	100yr	1441.57	108.49	115.63		115.92	0.000829	4.94	449.34	133.36	0.34
Reach1	380	01JAN2023 0200	200yr	1580.00	108.49	116.90		117.03	0.000364	3.69	840.02	172.89	0.23
Reach1	380	01JAN2023 0200	500yr	1800.77	108.49	118.13		118.27	0.000298	3.69	1085.76	216.25	0.22
Reach1	380	01JAN2023 0200	StantecBankfull	324.00	108.49	111.09		111.35	0.003183	4.36	101.57	85.26	0.55
Reach1	380	01JAN2023 0200	MeanAnnual	44.00	108.49	109.27	109.30	109.55	0.019581	4.27	10.31	21.25	1.08
Reach1	380	01JAN2023 0200	95%Exceedance	2.90	108.49	108.76		108.81	0.018080	1.83	1.58	10.96	0.85
Reach1	380	01JAN2023 0200	50%Exceedance	19.40	108.49	109.04	109.05	109.21	0.022011	3.36	5.77	18.56	1.06
Reach1	380	01JAN2023 0200	5%Exceedance	137.90	108.49	109.91	109.88	110.33	0.012649	5.15	26.79	29.93	0.96
Reach1	380	01JAN2023 0008	2yr	490.04	108.49	112.08		112.29	0.001616	4.08	173.93	117.96	0.42
Reach1	380	01JAN2023 0200	5yr	720.00	108.49	113.21		113.42	0.001075	4.13	259.43	123.83	0.36
Reach1	380	01JAN2023 0800	10yr	875.00	108.49	113.88		114.10	0.000925	4.24	310.63	125.97	0.34
Reach1	380	01JAN2023 0800	500yr	1800.01	108.49	118.03		118.17	0.000311	4.74	1064.59	213.04	0.22
Reach1	380	01JAN2023 0200	2yr	490.00	108.49	112.07		112.29	0.001617	4.08	173.91	117.95	0.42
Reach1	370.00	01JAN2023 0200	1.1yr	270.00	108.36	110.72		110.95	0.003036	3.93	85.09	69.17	0.52
Reach1	370.00	01JAN2023 0002	2yr	493.49	108.36	112.11		112.29	0.001204	3.65	187.92	115.58	0.36
Reach1	370.00	01JAN2023 0030	5yr	720.00	108.36	113.22		113.40	0.000854	3.76	273.55	121.04	0.32
Reach1	370.00	01JAN2023 0200	10yr	875.00	108.36	113.89		114.08	0.000748	3.88	326.41	133.97	0.31
Reach1	370.00	01JAN2023 0200	25yr	1085.00	108.36	114.72		114.93	0.000657	4.04	394.23	143.77	0.30
Reach1	370.00	01JAN2023 0200	50yr	1255.00	108.36	115.35		115.56	0.000609	4.16	446.06	179.04	0.29
Reach1	370.00	01JAN2023 0200	100yr	1442.94	108.36	115.64		115.90	0.000686	4.56	470.77	183.35	0.31
Reach1	370.00	01JAN2023 0200	200yr	1579.99	108.36	116.89		117.03	0.000334	3.57	945.93	214.83	0.22
Reach1	370.00	01JAN2023 0200	500yr	1800.81	108.36	118.14		118.25	0.000229	3.26	1228.87	238.07	0.19
Reach1	370.00	01JAN2023 0200	StantecBankfull	324.00	108.36	111.10		111.30	0.002178	3.79	111.80	86.17	0.46
Reach1	370.00	01JAN2023 0200	MeanAnnual	44.00	108.36	109.10		109.31	0.013516	3.62	12.15	24.28	0.90
Reach1	370.00	01JAN2023 0200	95%Exceedance	2.90	108.36	108.65		108.67	0.003711	0.99	2.94	15.76	0.40
Reach1	370.00	01JAN2023 0200	50%Exceedance	19.40	108.36	108.86		108.99	0.015230	2.91	6.67	20.26	0.89
Reach1	370.00	01JAN2023 0200	5%Exceedance	137.90	108.36	109.81		110.10	0.007667	4.28	32.24	32.64	0.76
Reach1	370.00	01JAN2023 0008	2yr	490.04	108.36	112.09		112.27	0.001217	3.65	186.30	111.42	0.36
Reach1	370.00	01JAN2023 0200	5yr	720.00	108.36	113.22		113.40	0.000854	3.76	273.55	121.04	0.32
Reach1	370.00	01JAN2023 0800	10yr	875.00	108.36	113.89		114.08	0.000748	3.88	326.41	133.97	0.31
Reach1	370.00	01JAN2023 0800	500yr	1800.01	108.36	118.05		118.15	0.000240	3.31	1205.55	235.85	0.19
Reach1	370.00	01JAN2023 0200	2yr	490.00	108.36	112.09		112.27	0.001218	3.65	186.27	111.42	0.36
Reach1	350	01JAN2023 0200	1.1yr	270.00	106.42	110.72		110.89	0.001359	3.31	81.58	30.24	0.36
Reach1	350	01JAN2023 0002	2yr	493.88	106.42	112.02		112.26	0.001339	3.96	124.83	35.38	0.37
Reach1	350	01JAN2023 0030	5yr	720.00	106.42	113.09		113.39	0.001281	4.40	164.41	39.35	0.37
Reach1	350	01JAN2023 0200	10yr	875.00	106.42	113.74		114.08	0.001181	4.64	191.76	62.09	0.37
Reach1	350	01JAN2023 0200	25yr	1085.00	106.42	114.56		114.93	0.001080	4.92	231.82	106.14	0.36
Reach1	350	01JAN2023 0200	50yr	1255.00	106.42	115.17		115.57	0.001022	5.11	262.25	134.14	0.36
Reach1	350	01JAN2023 0200	100yr	1446.80	106.42	115.43		115.92	0.001186	5.65	274.97	150.25	0.39
Reach1	350	01JAN2023 0200	200yr	1580.01	106.42	116.71		117.10	0.000769	5.12	339.33	175.65	0.32
Reach1	350	01JAN2023 0200	500yr	1800.90	106.42	118.08		118.28	0.000384	4.03	851.34	210.17	0.23
Reach1	350	01JAN2023 0200	StantecBankfull	324.00	106.42	111.06		111.25	0.001406	3.51	92.42	32.30	0.37
Reach1	350	01JAN2023 0200	MeanAnnual	44.00	106.42	108.97		108.99	0.000248	1.14	38.65	20.39	0.15
Reach1	350	01JAN2023 0200	95%Exceedance	2.90	106.42	108.62		108.62	0.000002	0.09	31.73	19.46	0.01
Reach1	350	01JAN2023 0200	50%Exceedance	19.40	106.42	108.71		108.72	0.000074	0.58	33.47	19.70	0.08
Reach1	350	01JAN2023 0200	5%Exceedance	137.90	106.42	109.76		109.86	0.000867	2.46	56.13	23.57	0.28
Reach1	350	01JAN2023 0008	2yr	490.04	106.42	112.00		112.24	0.001342	3.95	124.12	35.34	0.37
Reach1	350	01JAN2023 0200	5yr	720.00	106.42	113.09		113.39	0.001281	4.40	164.41	39.35	0.37
Reach1	350	01JAN2023 0800	10yr	875.00	106.42	113.74		114.08	0.001181	4.64	191.76	62.09	0.37
Reach1	350	01JAN2023 0800	500yr	1800.02	106.42	117.98		118.19	0.000403	4.09	830.31	205.61	0.24
Reach1	350	01JAN2023 0200	2yr	490.00	106.42	112.00		112.24	0.001342	3.95	124.11	35.33	0.37
Reach1	345	01JAN2023 0200	1.1yr	270.00	106.36	110.57	109.29	110.90	0.002472	4.61	58.51	19.74	0.47
Reach1	345	01JAN2023 0002	2yr	493.91	106.36	111.77	110.28	112.32	0.003014	5.92	83.41	21.65	0.53
Reach1	345	01JAN2023 0030	5yr	720.00	106.36	112.78	111.11	113.50	0.003270	6.81	105.74	22.95	0.56
Reach1	345	01JAN2023 0200	10yr	875.00	106.36	113.39	111.61	114.21	0.003387	7.29	120.09	23.83	0.57
Reach1	345	01JAN2023 0200	25yr	1085.00	106.36	114.17	112.22	115.11	0.003475	7.81	139.00	24.94	0.58
Reach1	345	01JAN2023 0200	50yr	1255.00	106.36	114.75	112.69	115.79	0.003546	8.15	153.92	26.06	0.59
Reach1	345	01JAN2023 0200	100yr	1447.25	106.36	115.41	113.19	116.51	0.003576	8.42	174.19	51.36	0.60
Reach1	345	01JAN2023 0200	200yr	1580.00	106.36	116.56	113.51	117.41	0.002440	7.51	258.68	109.21	0.50
Reach1	345	01JAN2023 0200	500yr	1800.92	106.36	117.87	114.03	118.47	0.001488	6.59	446.36	163.06	0.40
Reach1	345	01JAN2023 0200	StantecBankfull	324.00	106.36	110.89	109.55	111.28	0.002641	5.00	64.86	20.18	0.49
Reach1	345	01JAN2023 0200	MeanAnnual	44.00	106.36	108.95	107.70	108.99	0.000570	1.55	28.34	17.49	0.22
Reach1	345	01JAN2023 0200	95%Exceedance	2.90	106.36	108.62	106.80	108.62	0.000005	0.13	22.76	16.42	0.02
Reach1	345	01JAN2023 0200	50%Exceedance	19.40	106.36	108.71	107.33	108.72	0.000176	0.80	24.16	16.69	0.12
Reach1	345	01JAN2023 0200	5%Exceedance	137.90	106.36	109.68	108.52	109.86	0.001769	3.32	41.54	18.51	0.39
Reach1	345	01JAN2023 0008	2yr	490.04	106.36	111.76	110.26	112.30	0.003009	5.90	83.01	21.63	0.53
Reach1	345	01JAN2023 0200	5yr	720.00	106.36	112.78	111.11	113.50	0.003270	6.81	105.74	22.95	0.56
Reach1	345	01JAN2023 0800	10yr	875.00	106.36	113.39	111.61	114.21	0.003387	7.29	120.09	23.83	0.57
Reach1	345	01JAN2023 0800	500yr	1800.02	106.36	117.76	114.02	118.39	0.001585	6.73	428.26	159.94	0.42
Reach1	345	01JAN2023 0200	2yr	490.00	106.36	111.76	110.26	112.30	0.003009	5.90	83.01	21.63	0.53

HEC-RAS River: TanneryBrook Reach: Reach1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	315	01JAN2023 0200	1.1yr	270.00	107.00	109.85		110.27	0.004584	5.25	51.45	24.40	0.64
Reach1	315	01JAN2023 0002	2yr	493.91	107.00	110.57		111.36	0.006132	7.13	69.27	24.78	0.75
Reach1	315	01JAN2023 0030	5yr	720.00	107.00	111.09		112.28	0.007713	8.75	82.31	25.03	0.85
Reach1	315	01JAN2023 0200	10yr	875.00	107.00	111.41		112.87	0.008672	9.71	90.10	25.10	0.90
Reach1	315	01JAN2023 0200	25yr	1085.00	107.00	111.78	111.69	113.63	0.009896	10.90	99.54	25.18	0.97
Reach1	315	01JAN2023 0200	50yr	1255.00	107.00	112.06	112.09	114.22	0.010837	11.79	106.48	25.23	1.01
Reach1	315	01JAN2023 0200	100yr	1447.25	107.00	112.34	112.52	114.86	0.011858	12.72	113.74	25.29	1.06
Reach1	315	01JAN2023 0200	200yr	1580.00	107.00	112.54	112.80	115.29	0.012462	13.31	118.71	25.34	1.08
Reach1	315	01JAN2023 0200	500yr	1800.92	107.00	112.84	113.26	116.00	0.013464	14.25	126.42	25.40	1.13
Reach1	315	01JAN2023 0200	StantecBankfull	324.00	107.00	110.04		110.56	0.005048	5.78	56.10	24.50	0.67
Reach1	315	01JAN2023 0200	MeanAnnual	44.00	107.00	108.87		108.91	0.000753	1.56	28.18	22.10	0.24
Reach1	315	01JAN2023 0200	95%Exceedance	2.90	107.00	108.62		108.62	0.000006	0.13	22.87	20.68	0.02
Reach1	315	01JAN2023 0200	50%Exceedance	19.40	107.00	108.68		108.69	0.000227	0.80	24.15	20.98	0.13
Reach1	315	01JAN2023 0200	5%Exceedance	137.90	107.00	109.32		109.52	0.002937	3.57	38.61	24.08	0.50
Reach1	315	01JAN2023 0008	2yr	490.04	107.00	110.55		111.34	0.006152	7.12	68.84	24.77	0.75
Reach1	315	01JAN2023 0200	5yr	720.00	107.00	111.09		112.28	0.007713	8.75	82.31	25.03	0.85
Reach1	315	01JAN2023 0800	10yr	875.00	107.00	111.41		112.87	0.008672	9.71	90.10	25.10	0.90
Reach1	315	01JAN2023 0800	500yr	1800.02	107.00	112.84	113.26	115.99	0.013461	14.24	126.39	25.40	1.13
Reach1	315	01JAN2023 0200	2yr	490.00	107.00	110.55		111.34	0.006152	7.12	68.83	24.77	0.75
Reach1	310	01JAN2023 0200	1.1yr	270.00	107.88	109.81		110.47	0.010478	6.52	41.42	27.69	0.94
Reach1	310	01JAN2023 0002	2yr	493.56	107.88	110.53	110.49	111.51	0.010193	7.92	62.30	30.06	0.97
Reach1	310	01JAN2023 0030	5yr	720.00	107.88	111.05	111.09	112.37	0.010827	9.21	78.16	31.07	1.02
Reach1	310	01JAN2023 0200	10yr	875.00	107.88	111.36	111.46	112.90	0.011209	9.97	87.79	31.57	1.05
Reach1	310	01JAN2023 0200	25yr	1085.00	107.88	111.73	111.93	113.57	0.011742	10.89	99.62	32.18	1.09
Reach1	310	01JAN2023 0200	50yr	1255.00	107.88	112.00	112.27	114.08	0.012168	11.57	108.43	32.62	1.12
Reach1	310	01JAN2023 0200	100yr	1447.25	107.88	112.28	112.65	114.63	0.012634	12.29	117.75	33.09	1.15
Reach1	310	01JAN2023 0200	200yr	1580.00	107.88	112.48	112.90	114.99	0.012837	12.72	124.21	33.40	1.16
Reach1	310	01JAN2023 0200	500yr	1800.92	107.88	112.78	113.30	115.57	0.013231	13.41	134.33	33.95	1.19
Reach1	310	01JAN2023 0200	StantecBankfull	324.00	107.88	110.00	109.94	110.75	0.010482	6.94	46.70	28.35	0.95
Reach1	310	01JAN2023 0200	MeanAnnual	44.00	107.88	108.80		108.92	0.005375	2.80	15.74	23.14	0.60
Reach1	310	01JAN2023 0200	95%Exceedance	2.90	107.88	108.62		108.62	0.000058	0.25	11.65	21.73	0.06
Reach1	310	01JAN2023 0200	50%Exceedance	19.40	107.88	108.65		108.69	0.002183	1.57	12.36	22.02	0.37
Reach1	310	01JAN2023 0200	5%Exceedance	137.90	107.88	109.29		109.68	0.009407	5.03	27.43	25.21	0.85
Reach1	310	01JAN2023 0008	2yr	490.05	107.88	110.51	110.48	111.49	0.010316	7.93	61.77	30.03	0.98
Reach1	310	01JAN2023 0200	5yr	720.00	107.88	111.05	111.09	112.37	0.010827	9.21	78.16	31.07	1.02
Reach1	310	01JAN2023 0800	10yr	875.00	107.88	111.36	111.46	112.90	0.011209	9.97	87.79	31.57	1.05
Reach1	310	01JAN2023 0800	500yr	1800.02	107.88	112.78	113.30	115.57	0.013230	13.40	134.29	33.94	1.19
Reach1	310	01JAN2023 0200	2yr	490.00	107.88	110.51	110.48	111.49	0.010318	7.93	61.77	30.02	0.98
Reach1	300.00	01JAN2023 0200	1.1yr	270.00	108.00	109.66	109.85	110.57	0.018933	7.65	35.31	29.35	1.23
Reach1	300.00	01JAN2023 0002	2yr	492.17	108.00	110.41	110.57	111.49	0.014075	8.34	59.08	34.91	1.12
Reach1	300.00	01JAN2023 0030	5yr	720.00	108.00	110.93	111.12	112.26	0.013510	9.25	78.43	39.25	1.13
Reach1	300.00	01JAN2023 0200	10yr	875.00	108.00	111.24	111.45	112.71	0.013070	9.75	90.83	41.29	1.13
Reach1	300.00	01JAN2023 0200	25yr	1085.00	108.00	111.61	111.84	113.27	0.012619	10.37	106.54	43.35	1.14
Reach1	300.00	01JAN2023 0200	50yr	1255.00	108.00	111.88	112.12	113.70	0.012142	10.83	118.52	44.69	1.13
Reach1	300.00	01JAN2023 0200	100yr	1447.26	108.00	112.16	112.45	114.15	0.011731	11.35	131.38	46.01	1.13
Reach1	300.00	01JAN2023 0200	200yr	1580.00	108.00	112.36	112.66	114.45	0.011405	11.65	140.44	46.96	1.13
Reach1	300.00	01JAN2023 0200	500yr	1800.92	108.00	112.66	112.97	114.93	0.011064	12.15	154.76	48.40	1.13
Reach1	300.00	01JAN2023 0200	StantecBankfull	324.00	108.00	109.86	110.04	110.82	0.017252	7.86	41.22	30.61	1.19
Reach1	300.00	01JAN2023 0200	MeanAnnual	44.00	108.00	108.56	108.72	109.07	0.043551	5.75	7.66	18.41	1.57
Reach1	300.00	01JAN2023 0200	95%Exceedance	2.90	108.00	108.11	108.16	108.30	0.154964	3.55	0.82	10.49	2.25
Reach1	300.00	01JAN2023 0200	50%Exceedance	19.40	108.00	108.34	108.45	108.72	0.062718	4.95	3.92	15.51	1.74
Reach1	300.00	01JAN2023 0200	5%Exceedance	137.90	108.00	109.11	109.30	109.84	0.026282	6.85	20.13	25.35	1.36
Reach1	300.00	01JAN2023 0008	2yr	490.05	108.00	110.39	110.56	111.49	0.014400	8.40	58.39	34.69	1.13
Reach1	300.00	01JAN2023 0200	5yr	720.00	108.00	110.93	111.12	112.26	0.013510	9.25	78.43	39.25	1.13
Reach1	300.00	01JAN2023 0800	10yr	875.00	108.00	111.24	111.45	112.71	0.013070	9.75	90.83	41.29	1.13
Reach1	300.00	01JAN2023 0800	500yr	1800.02	108.00	112.66	112.97	114.93	0.011065	12.15	154.70	48.40	1.13
Reach1	300.00	01JAN2023 0200	2yr	490.00	108.00	110.39	110.56	111.49	0.014404	8.40	58.38	34.68	1.13
Reach1	290	01JAN2023 0200	1.1yr	270.00	107.08	109.48	109.67	110.44	0.018389	7.85	34.40	26.64	1.22
Reach1	290	01JAN2023 0002	2yr	488.72	107.08	110.27	110.42	111.38	0.014109	8.44	57.91	32.82	1.12
Reach1	290	01JAN2023 0030	5yr	720.00	107.08	110.79	111.01	112.18	0.014339	9.46	76.08	36.65	1.16
Reach1	290	01JAN2023 0200	10yr	875.00	107.08	111.10	111.36	112.65	0.014081	9.97	87.75	38.50	1.16
Reach1	290	01JAN2023 0200	25yr	1085.00	107.08	111.47	111.78	113.21	0.013941	10.57	102.60	41.01	1.18
Reach1	290	01JAN2023 0200	50yr	1255.00	107.08	111.75	112.08	113.63	0.013475	11.00	114.21	42.83	1.17
Reach1	290	01JAN2023 0200	100yr	1447.28	107.08	112.04	112.37	114.08	0.013183	11.47	126.77	44.79	1.18
Reach1	290	01JAN2023 0200	200yr	1580.00	107.08	112.24	112.58	114.37	0.012661	11.73	135.81	45.92	1.16
Reach1	290	01JAN2023 0200	500yr	1800.92	107.08	112.54	112.92	114.84	0.012071	12.18	150.13	48.26	1.15
Reach1	290	01JAN2023 0200	StantecBankfull	324.00	107.08	109.69	109.89	110.70	0.017083	8.05	40.22	28.31	1.19
Reach1	290	01JAN2023 0200	MeanAnnual	44.00	107.08	108.26	108.26	108.60	0.015710	4.67	9.41	14.18	1.01
Reach1	290	01JAN2023 0200	95%Exceedance	2.90	107.08	107.55		107.60	0.008658	1.77	1.64	6.83	0.64
Reach1	290	01JAN2023 0200	50%Exceedance	19.40	107.08	107.97		108.15	0.012928	3.44	5.63	11.62	0.87
Reach1	290	01JAN2023 0200	5%Exceedance	137.90	107.08	108.88	109.05	109.62	0.020939	6.92	19.92	20.62	1.24
Reach1	290	01JAN2023 0008	2yr	490.05	107.08	110.25	110.42	111.39	0.014730	8.58	57.10	32.59	1.14
Reach1	290	01JAN2023 0200	5yr	720.00	107.08	110.79	111.01	112.18	0.014339	9.46	76.08	36.65	1.16
Reach1	290	01JAN2023 0800	10yr	875.00	107.08	111.10	111.36	112.65	0.014081	9.97	87.75	38.50	1.16
Reach1	290	01JAN2023 0800	500yr	1800.01	107.08	112.54	112.92	114.84	0.012073	12.18	150.08	48.25	1.15
Reach1	290	01JAN2023 0200	2yr	490.00	107.08	110.25	110.42	111.39	0.014734	8.58	57.09	32.59	1.14
Reach1	280.50	01JAN2023 0200	1.1yr	270.00	105.68	109.37		109.82	0.005643	5.41	49.87	27.10	0.70
Reach1	280.50	01JAN2023 0002	2yr	481.60	105.68	110.17		110.81	0.006379	6.41	75.25	36.07	0.77
Reach1	280.50	01JAN2023 0030	5yr	720.00	105.68	110.69		111.61	0.007235	7.70	94.71	39.82	0.84
Reach1	280.50	01JAN2023 0200	10yr	875.00	105.68	111.00		112.08	0.007367	8.33			

HEC-RAS River: TanneryBrook Reach: Reach1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	280.50	01JAN2023 0200	100yr	1447.31	105.68	111.94	111.81	113.57	0.007715	10.30	150.31	49.55	0.93
Reach1	280.50	01JAN2023 0200	200yr	1580.00	105.68	112.14	112.04	113.88	0.007701	10.65	160.45	50.88	0.94
Reach1	280.50	01JAN2023 0200	500yr	1800.92	105.68	112.45	112.39	114.37	0.007751	11.22	176.36	52.54	0.95
Reach1	280.50	01JAN2023 0200	StantecBankfull	324.00	105.68	109.58		110.10	0.006112	5.79	55.94	29.19	0.74
Reach1	280.50	01JAN2023 0200	MeanAnnual	44.00	105.68	108.19		108.24	0.000941	1.84	23.97	17.17	0.27
Reach1	280.50	01JAN2023 0200	95%Exceedance	2.90	105.68	107.52		107.52	0.000018	0.21	13.90	13.44	0.04
Reach1	280.50	01JAN2023 0200	50%Exceedance	19.40	105.68	107.91		107.92	0.000313	1.00	19.50	15.33	0.16
Reach1	280.50	01JAN2023 0200	5%Exceedance	137.90	105.68	108.76		109.00	0.003533	3.92	35.15	21.75	0.54
Reach1	280.50	01JAN2023 0008	2yr	490.05	105.68	110.14		110.82	0.006910	6.61	74.16	35.87	0.80
Reach1	280.50	01JAN2023 0200	5yr	720.00	105.68	110.69		111.61	0.007235	7.70	94.71	39.82	0.84
Reach1	280.50	01JAN2023 0800	10yr	875.00	105.68	111.00		112.08	0.007368	8.33	107.49	42.11	0.87
Reach1	280.50	01JAN2023 0800	500yr	1800.01	105.68	112.45	112.39	114.37	0.007751	11.22	176.29	52.53	0.95
Reach1	280.50	01JAN2023 0200	2yr	490.00	105.68	110.14		110.82	0.006913	6.61	74.15	35.87	0.80
Reach1	271	01JAN2023 0200	1.1yr	270.00	104.09	109.43	107.52	109.63	0.001570	3.60	74.99	27.96	0.39
Reach1	271	01JAN2023 0002	2yr	475.52	104.09	110.13	108.54	110.51	0.002416	4.97	96.59	33.89	0.49
Reach1	271	01JAN2023 0030	5yr	720.00	104.09	110.64	109.47	111.29	0.003346	6.46	115.47	40.29	0.59
Reach1	271	01JAN2023 0200	10yr	875.00	104.09	110.95	109.92	111.75	0.003747	7.22	128.35	43.06	0.64
Reach1	271	01JAN2023 0200	25yr	1085.00	104.09	111.32	110.39	112.34	0.004234	8.14	144.83	45.73	0.69
Reach1	271	01JAN2023 0200	50yr	1255.00	104.09	111.60	110.77	112.78	0.004570	8.82	157.74	47.67	0.72
Reach1	271	01JAN2023 0200	100yr	1447.36	104.09	111.88	111.17	113.26	0.004933	9.53	171.75	50.79	0.76
Reach1	271	01JAN2023 0200	200yr	1580.00	104.09	112.08	111.41	113.58	0.005104	9.96	182.19	52.81	0.78
Reach1	271	01JAN2023 0200	500yr	1800.93	104.09	112.39	111.84	114.09	0.005395	10.64	198.71	55.33	0.81
Reach1	271	01JAN2023 0200	StantecBankfull	324.00	104.09	108.62	107.81	109.87	0.001884	4.04	80.33	29.42	0.43
Reach1	271	01JAN2023 0200	MeanAnnual	44.00	104.09	108.21	105.70	108.23	0.000133	0.95	46.36	19.59	0.11
Reach1	271	01JAN2023 0200	95%Exceedance	2.90	104.09	107.52	104.62	107.52	0.000001	0.09	33.67	17.07	0.01
Reach1	271	01JAN2023 0200	50%Exceedance	19.40	104.09	107.92	105.22	107.92	0.000037	0.48	40.72	18.45	0.06
Reach1	271	01JAN2023 0200	5%Exceedance	137.90	104.09	108.86	106.65	108.94	0.000700	2.29	60.21	23.74	0.25
Reach1	271	01JAN2023 0008	2yr	490.05	104.09	110.10	108.61	110.52	0.002650	5.18	95.57	33.63	0.52
Reach1	271	01JAN2023 0200	5yr	720.00	104.09	110.64	109.47	111.29	0.003346	6.46	115.47	40.29	0.59
Reach1	271	01JAN2023 0800	10yr	875.00	104.09	110.95	109.91	111.75	0.003747	7.22	128.35	43.06	0.64
Reach1	271	01JAN2023 0800	500yr	1800.01	104.09	112.39	111.84	114.09	0.005394	10.64	198.64	55.32	0.81
Reach1	271	01JAN2023 0200	2yr	490.00	104.09	110.10	108.61	110.52	0.002651	5.18	95.55	33.62	0.52

HEC-RAS River: TanneryBrook Reach: Reach1

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	672	01JAN2023 0010	1.1yr-Prop	270.00	112.00	113.98		114.32	0.004458	4.70	60.40	40.68	0.64
Reach1	672	01JAN2023 0200	2yr-Prop	490.00	112.00	114.54	114.18	115.15	0.005575	6.34	89.38	68.92	0.74
Reach1	672	01JAN2023 0200	5yr-Prop	720.00	112.00	114.99	114.86	115.82	0.006159	7.52	126.46	90.72	0.81
Reach1	672	01JAN2023 0200	10yr-Prop	875.00	112.00	115.25	115.09	116.20	0.006378	8.14	151.65	99.47	0.83
Reach1	672	01JAN2023 0200	25yr-Prop	1085.00	112.00	115.58	115.56	116.65	0.006421	8.77	186.44	109.89	0.85
Reach1	672	01JAN2023 0200	50yr-Prop	1255.00	112.00	115.85	115.78	116.98	0.006286	9.14	216.65	118.25	0.85
Reach1	672	01JAN2023 0200	100yr-Prop	1415.00	112.00	116.10	116.09	117.27	0.006088	9.41	247.26	123.53	0.85
Reach1	672	01JAN2023 0200	200yr-Prop	1580.00	112.00	116.33	116.29	117.54	0.005935	9.66	276.10	125.29	0.85
Reach1	672	01JAN2023 0200	500yr-Prop	1800.00	112.00	116.74	116.53	117.89	0.005176	9.62	327.72	128.61	0.80
Reach1	672	01JAN2023 0200	StantecBankfull-Prop	324.00	112.00	114.14		114.55	0.004799	5.16	67.00	46.49	0.67
Reach1	672	01JAN2023 0200	5%Exceedance-Prop	137.90	112.00	113.53		113.70	0.003344	3.30	42.61	37.26	0.52
Reach1	672	01JAN2023 0200	50%Exceedance-Prop	19.40	112.00	112.86		112.88	0.00648	0.97	20.09	29.87	0.21
Reach1	672	01JAN2023 0200	95%Exceedance-Prop	2.90	112.00	112.77		112.77	0.000023	0.17	17.21	28.44	0.04
Reach1	672	01JAN2023 0200	Mean Annual-Prop	44.00	112.00	113.04		113.08	0.001652	1.74	25.40	32.07	0.34
Reach1	672	01JAN2023 0200	1.1yr-Prop	270.00	112.00	113.98		114.32	0.004458	4.70	60.40	40.68	0.64
Reach1	622	01JAN2023 0010	1.1yr-Prop	270.00	111.99	113.50	113.65	114.32	0.014999	7.34	40.87	43.60	1.12
Reach1	622	01JAN2023 0200	2yr-Prop	490.00	111.99	114.03	114.30	115.26	0.014899	9.15	67.67	56.36	1.18
Reach1	622	01JAN2023 0200	5yr-Prop	720.00	111.99	114.48	114.91	116.04	0.014725	10.49	96.02	70.95	1.21
Reach1	622	01JAN2023 0200	10yr-Prop	875.00	111.99	114.75	115.20	116.46	0.014291	11.12	116.10	78.23	1.22
Reach1	622	01JAN2023 0200	25yr-Prop	1085.00	111.99	115.11	115.60	116.93	0.013251	11.68	145.99	86.47	1.20
Reach1	622	01JAN2023 0200	50yr-Prop	1255.00	111.99	115.40	115.88	117.27	0.012203	11.94	172.42	92.70	1.17
Reach1	622	01JAN2023 0200	100yr-Prop	1413.75	111.99	115.68	116.08	117.54	0.011117	12.05	199.43	97.69	1.13
Reach1	622	01JAN2023 0200	200yr-Prop	1580.01	111.99	115.93	116.38	117.82	0.010547	12.29	224.30	101.28	1.11
Reach1	622	01JAN2023 0200	500yr-Prop	1800.06	111.99	116.33	116.65	118.15	0.009223	12.28	265.48	108.04	1.06
Reach1	622	01JAN2023 0200	StantecBankfull-Prop	324.00	111.99	113.65	113.82	114.58	0.014915	7.85	47.59	46.88	1.14
Reach1	622	01JAN2023 0200	5%Exceedance-Prop	137.90	111.99	113.05	113.09	113.56	0.015448	5.70	24.51	30.08	1.06
Reach1	622	01JAN2023 0200	50%Exceedance-Prop	19.40	111.99	112.33	112.33	112.48	0.021147	3.14	6.17	21.38	1.03
Reach1	622	01JAN2023 0200	95%Exceedance-Prop	2.90	111.99	112.09	112.10	112.15	0.036146	1.87	1.55	17.56	1.11
Reach1	622	01JAN2023 0200	Mean Annual-Prop	44.00	111.99	112.54	112.55	112.79	0.017875	3.99	11.03	23.53	1.03
Reach1	622	01JAN2023 0200	1.1yr-Prop	270.00	111.99	113.50	113.65	114.32	0.014999	7.34	40.87	43.60	1.12
Reach1	566	01JAN2023 0010	1.1yr-Prop	270.00	110.97	112.75	112.79	113.44	0.011747	6.80	47.73	48.01	1.00
Reach1	566	01JAN2023 0200	2yr-Prop	490.00	110.97	113.26	113.44	114.34	0.012713	8.68	75.03	56.41	1.10
Reach1	566	01JAN2023 0200	5yr-Prop	720.00	110.97	113.71	113.98	115.09	0.012775	9.99	101.71	62.96	1.14
Reach1	566	01JAN2023 0200	10yr-Prop	875.01	110.97	114.01	114.31	115.52	0.012182	10.55	121.13	66.45	1.13
Reach1	566	01JAN2023 0200	25yr-Prop	1085.00	110.97	114.44	114.68	116.02	0.010818	10.97	150.48	70.48	1.09
Reach1	566	01JAN2023 0200	50yr-Prop	1255.00	110.97	114.80	114.96	116.39	0.009601	11.11	176.22	72.68	1.05
Reach1	566	01JAN2023 0200	100yr-Prop	1421.94	110.97	115.14	115.22	116.74	0.008703	11.26	201.16	74.74	1.02
Reach1	566	01JAN2023 0200	200yr-Prop	1580.00	110.97	115.42	115.45	117.07	0.008268	11.50	222.22	76.64	1.00
Reach1	566	01JAN2023 0200	500yr-Prop	1800.11	110.97	115.90	115.73	117.51	0.007121	11.49	259.89	80.58	0.95
Reach1	566	01JAN2023 0200	StantecBankfull-Prop	324.00	110.97	112.89	112.99	113.69	0.012112	7.35	54.74	51.65	1.03
Reach1	566	01JAN2023 0200	5%Exceedance-Prop	137.90	110.97	112.31	112.27	112.72	0.011200	5.19	28.65	36.48	0.92
Reach1	566	01JAN2023 0200	50%Exceedance-Prop	19.40	110.97	111.52	111.61	111.61	0.008227	2.50	7.77	18.68	0.68
Reach1	566	01JAN2023 0200	95%Exceedance-Prop	2.90	110.97	111.20	111.22	111.22	0.005512	1.17	2.48	13.85	0.49
Reach1	566	01JAN2023 0200	Mean Annual-Prop	44.00	110.97	111.77	111.77	111.95	0.009845	3.41	12.90	22.23	0.79
Reach1	566	01JAN2023 0200	1.1yr-Prop	270.00	110.97	112.75	112.79	113.44	0.011747	6.80	47.73	48.01	1.00
Reach1	516	01JAN2023 0010	1.1yr-Prop	270.00	110.00	111.94	112.15	112.86	0.020918	7.68	35.23	32.55	1.28
Reach1	516	01JAN2023 0200	2yr-Prop	490.00	110.00	112.51	112.81	113.78	0.017679	9.07	56.18	41.98	1.25
Reach1	516	01JAN2023 0200	5yr-Prop	720.00	110.00	113.04	113.37	114.54	0.014601	9.92	81.14	52.12	1.19
Reach1	516	01JAN2023 0200	10yr-Prop	875.00	110.00	113.41	113.70	114.96	0.012359	10.15	101.89	60.46	1.13
Reach1	516	01JAN2023 0200	25yr-Prop	1085.00	110.00	113.94	114.15	115.45	0.009568	10.14	136.96	71.51	1.02
Reach1	516	01JAN2023 0200	50yr-Prop	1255.00	110.00	114.37	114.43	115.81	0.007821	10.02	168.82	75.74	0.95
Reach1	516	01JAN2023 0200	100yr-Prop	1388.83	110.00	114.77	114.64	116.10	0.006400	9.74	199.76	79.84	0.87
Reach1	516	01JAN2023 0200	200yr-Prop	1580.00	110.00	115.09	114.90	116.49	0.006177	10.08	225.54	83.04	0.87
Reach1	516	01JAN2023 0200	500yr-Prop	1800.19	110.00	115.68	115.68	116.98	0.004881	9.79	277.63	90.94	0.79
Reach1	516	01JAN2023 0200	StantecBankfull-Prop	324.00	110.00	112.10	112.32	113.11	0.019921	8.06	40.52	34.66	1.27
Reach1	516	01JAN2023 0200	5%Exceedance-Prop	137.90	110.00	111.45	111.62	112.13	0.023414	6.60	20.89	25.50	1.29
Reach1	516	01JAN2023 0200	50%Exceedance-Prop	19.40	110.00	110.63	110.68	110.89	0.028227	4.11	4.72	13.54	1.23
Reach1	516	01JAN2023 0200	95%Exceedance-Prop	2.90	110.00	110.30	110.32	110.40	0.035207	2.58	1.12	7.68	1.19
Reach1	516	01JAN2023 0200	Mean Annual-Prop	44.00	110.00	110.89	110.98	111.28	0.025943	5.03	8.74	17.34	1.25
Reach1	516	01JAN2023 0200	1.1yr-Prop	270.00	110.00	111.94	112.15	112.86	0.020918	7.68	35.23	32.55	1.28
Reach1	470	01JAN2023 0010	1.1yr-Prop	270.00	108.97	111.20	111.20	111.79	0.011216	6.19	46.92	53.66	0.96
Reach1	470	01JAN2023 0200	2yr-Prop	490.00	108.97	111.50	111.82	112.55	0.008806	6.68	91.08	71.06	0.89
Reach1	470	01JAN2023 0200	5yr-Prop	720.00	108.97	112.56	112.56	113.20	0.006051	6.74	143.12	82.67	0.78
Reach1	470	01JAN2023 0200	10yr-Prop	875.00	108.97	113.02	113.02	113.62	0.004891	6.68	181.35	85.71	0.70
Reach1	470	01JAN2023 0200	25yr-Prop	1085.00	108.97	113.64	114.22	114.22	0.003506	6.60	236.43	91.51	0.63
Reach1	470	01JAN2023 0200	50yr-Prop	1255.00	108.97	114.12	114.69	114.69	0.002905	6.56	282.11	96.06	0.59
Reach1	470	01JAN2023 0200	100yr-Prop	1406.65	108.97	114.57	115.11	115.11	0.002470	6.50	325.56	100.03	0.55
Reach1	470	01JAN2023 0200	200yr-Prop	1580.00	108.97	115.01	115.58	115.58	0.002271	6.65	371.40	112.84	0.54
Reach1	470	01JAN2023 0200	500yr-Prop	1800.33	108.97	115.82	116.31	116.31	0.001649	6.28	466.85	122.51	0.47
Reach1	470	01JAN2023 0200	StantecBankfull-Prop	324.00	108.97	111.40	111.39	112.01	0.010247	6.31	58.46	59.88	0.93
Reach1	470	01JAN2023 0200	5%Exceedance-Prop	137.90	108.97	110.60	110.59	111.07	0.013231	5.49	25.13	26.31	0.99
Reach1	470	01JAN2023 0200	50%Exceedance-Prop	19.40	108.97	109.64	109.82	109.82	0.014933	3.39	5.72	13.56	0.92
Reach1	470	01JAN2023 0200	95%Exceedance-Prop	2.90	108.97	109.25	109.31	109.31	0.015111	1.97	1.47	7.92	0.81
Reach1	470	01JAN2023 0200	Mean Annual-Prop	44.00	108.97	109.95	109.93	110.21	0.014995	4.13	10.64	18.76	0.97
Reach1	470	01JAN2023 0200	1.1yr-Prop	270.00	108.97	111.20	111.20	111.79	0.011216	6.19	46.92	53.66	0.96
Reach1	411	01JAN2023 0010	1.1yr-Prop	270.00	108.09	110.70	110.31	111.15	0.005690	5.41	55.33	58.19	0.71
Reach1	411	01JAN2023 0200	2yr-Prop	490.00	108.09	111.50	111.50	112.05	0.004937	6.20	109.02	93.41	0.70
Reach1	411	01JAN2023 0200	5yr-Prop	720.00	108.09	112.34	112.84	113.24	0.003344	6.21	182.34	108.46	0.60
Reach1	411	01JAN2023 0200	10										

HEC-RAS River: TanneryBrook Reach: Reach1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/s)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	403.25	01JAN2023 0200	StantecBankfull-Prop	324.00	108.08	110.91		111.31	0.005006	5.27	82.47	92.24	0.68
Reach1	403.25	01JAN2023 0200	5%Exceedance-Prop	137.90	108.08	110.04		110.30	0.004621	4.08	33.76	24.76	0.62
Reach1	403.25	01JAN2023 0200	50%Exceedance-Prop	19.40	108.08	109.15		109.18	0.001317	1.40	13.88	20.06	0.30
Reach1	403.25	01JAN2023 0200	95%Exceedance-Prop	2.90	108.08	108.83		108.83	0.000151	0.37	7.89	16.75	0.09
Reach1	403.25	01JAN2023 0200	Mean Annual-Prop	44.00	108.08	109.40		109.49	0.002533	2.30	19.16	21.41	0.43
Reach1	403.25	01JAN2023 0200	1.1yr-Prop	270.00	108.08	110.66		111.06	0.005788	5.16	64.27	73.65	0.71
Reach1	395.50	01JAN2023 0010	1.1yr-Prop	270.00	108.00	110.62		110.99	0.005550	5.00	71.16	84.83	0.70
Reach1	395.50	01JAN2023 0200	2yr-Prop	490.00	108.00	111.52		111.87	0.003275	5.17	142.90	94.79	0.58
Reach1	395.50	01JAN2023 0200	5yr-Prop	720.00	108.00	112.39		112.74	0.002285	5.27	214.06	112.35	0.51
Reach1	395.50	01JAN2023 0200	10yr-Prop	875.00	108.00	112.92		113.27	0.001976	5.39	257.34	118.78	0.48
Reach1	395.50	01JAN2023 0200	25yr-Prop	1085.00	108.00	113.58		113.95	0.001706	5.56	312.82	121.48	0.46
Reach1	395.50	01JAN2023 0200	50yr-Prop	1255.00	108.00	114.08		114.46	0.001566	5.71	355.45	125.23	0.45
Reach1	395.50	01JAN2023 0200	100yr-Prop	1415.26	108.00	114.53		114.93	0.001457	5.84	395.22	128.35	0.44
Reach1	395.50	01JAN2023 0200	200yr-Prop	1580.00	108.00	114.98		115.39	0.001369	5.96	434.91	132.90	0.43
Reach1	395.50	01JAN2023 0200	500yr-Prop	1800.63	108.00	115.78		116.17	0.001127	5.88	507.56	138.87	0.40
Reach1	395.50	01JAN2023 0200	StantecBankfull-Prop	324.00	108.00	110.89		111.23	0.004379	4.93	92.40	88.07	0.63
Reach1	395.50	01JAN2023 0200	5%Exceedance-Prop	137.90	108.00	110.00		110.28	0.005149	4.25	32.45	24.32	0.65
Reach1	395.50	01JAN2023 0200	50%Exceedance-Prop	19.40	108.00	109.14		109.17	0.001091	1.36	14.22	18.41	0.27
Reach1	395.50	01JAN2023 0200	95%Exceedance-Prop	2.90	108.00	108.83		108.83	0.000104	0.33	8.75	16.29	0.08
Reach1	395.50	01JAN2023 0200	Mean Annual-Prop	44.00	108.00	109.38		109.47	0.002457	2.34	18.84	19.98	0.42
Reach1	395.50	01JAN2023 0200	1.1yr-Prop	270.00	108.00	110.62		110.99	0.005550	5.00	71.16	84.83	0.70
Reach1	387.75	01JAN2023 0010	1.1yr-Prop	270.00	108.04	110.59		110.92	0.005069	4.78	76.34	79.49	0.67
Reach1	387.75	01JAN2023 0200	2yr-Prop	490.00	108.04	111.52		111.84	0.002886	4.89	151.03	107.33	0.54
Reach1	387.75	01JAN2023 0200	5yr-Prop	720.00	108.04	112.40		112.71	0.002056	5.03	222.91	123.42	0.48
Reach1	387.75	01JAN2023 0200	10yr-Prop	875.00	108.04	112.92		113.24	0.001794	5.17	266.62	126.26	0.46
Reach1	387.75	01JAN2023 0200	25yr-Prop	1085.00	108.04	113.58		113.92	0.001562	5.35	322.62	128.33	0.44
Reach1	387.75	01JAN2023 0200	50yr-Prop	1255.00	108.04	114.08		114.44	0.001437	5.50	365.33	129.86	0.43
Reach1	387.75	01JAN2023 0200	100yr-Prop	1415.31	108.04	114.54		114.91	0.001346	5.64	404.64	132.02	0.42
Reach1	387.75	01JAN2023 0200	200yr-Prop	1580.00	108.04	114.98		115.37	0.001272	5.77	443.92	134.24	0.42
Reach1	387.75	01JAN2023 0200	500yr-Prop	1800.67	108.04	115.78		116.16	0.001056	5.72	516.11	138.48	0.39
Reach1	387.75	01JAN2023 0200	StantecBankfull-Prop	324.00	108.04	110.89		111.18	0.003833	4.64	99.48	82.59	0.60
Reach1	387.75	01JAN2023 0200	5%Exceedance-Prop	137.90	108.04	109.95		110.25	0.006680	4.38	31.51	27.58	0.72
Reach1	387.75	01JAN2023 0200	50%Exceedance-Prop	19.40	108.04	109.13		109.16	0.001359	1.44	13.46	18.97	0.30
Reach1	387.75	01JAN2023 0200	95%Exceedance-Prop	2.90	108.04	108.83		108.83	0.000151	0.36	7.96	17.09	0.09
Reach1	387.75	01JAN2023 0200	Mean Annual-Prop	44.00	108.04	109.35		109.45	0.002990	2.47	17.84	20.25	0.46
Reach1	387.75	01JAN2023 0200	1.1yr-Prop	270.00	108.04	110.59		110.92	0.005069	4.78	76.34	79.49	0.67
Reach1	380	01JAN2023 0010	1.1yr-Prop	270.00	108.49	110.54	110.42	110.96	0.007446	5.35	63.15	66.91	0.79
Reach1	380	01JAN2023 0200	2yr-Prop	490.00	108.49	111.44		111.84	0.003990	5.40	127.42	105.39	0.63
Reach1	380	01JAN2023 0200	5yr-Prop	720.00	108.49	112.33		112.71	0.002585	5.45	192.83	119.60	0.54
Reach1	380	01JAN2023 0200	10yr-Prop	875.00	108.49	112.85		113.25	0.002203	5.56	232.39	122.12	0.51
Reach1	380	01JAN2023 0200	25yr-Prop	1085.00	108.49	113.52		113.93	0.001881	5.73	283.03	124.81	0.48
Reach1	380	01JAN2023 0200	50yr-Prop	1255.00	108.49	114.02		114.45	0.001714	5.88	321.65	126.45	0.47
Reach1	380	01JAN2023 0200	100yr-Prop	1415.33	108.49	114.47		114.92	0.001590	6.01	357.15	128.09	0.46
Reach1	380	01JAN2023 0200	200yr-Prop	1580.00	108.49	114.92		115.38	0.001493	6.14	392.41	129.72	0.45
Reach1	380	01JAN2023 0200	500yr-Prop	1800.70	108.49	115.72		116.17	0.001229	6.08	457.32	134.18	0.42
Reach1	380	01JAN2023 0200	StantecBankfull-Prop	324.00	108.49	110.81		111.20	0.005637	5.23	81.79	73.52	0.71
Reach1	380	01JAN2023 0200	5%Exceedance-Prop	137.90	108.49	109.87	109.88	110.32	0.014522	5.42	25.45	29.26	1.02
Reach1	380	01JAN2023 0200	50%Exceedance-Prop	19.40	108.49	109.21	109.05	109.21	0.022121	3.37	5.76	18.55	1.07
Reach1	380	01JAN2023 0200	95%Exceedance-Prop	2.90	108.49	108.76		108.81	0.018080	1.83	1.58	10.96	0.85
Reach1	380	01JAN2023 0200	Mean Annual-Prop	44.00	108.49	109.26	109.30	109.55	0.020138	4.31	10.21	21.18	1.09
Reach1	380	01JAN2023 0200	1.1yr-Prop	270.00	108.49	110.54	110.42	110.96	0.007446	5.35	63.15	66.91	0.79
Reach1	370.00	01JAN2023 0010	1.1yr-Prop	270.00	108.36	110.48		110.81	0.005051	4.65	68.93	65.35	0.66
Reach1	370.00	01JAN2023 0200	2yr-Prop	490.00	108.36	111.46		111.77	0.002786	4.75	138.81	96.97	0.53
Reach1	370.00	01JAN2023 0200	5yr-Prop	720.00	108.36	112.35		112.67	0.001961	4.89	206.15	113.38	0.47
Reach1	370.00	01JAN2023 0200	10yr-Prop	875.00	108.36	112.87		113.21	0.001713	5.04	246.57	118.19	0.45
Reach1	370.00	01JAN2023 0200	25yr-Prop	1085.00	108.36	113.54		113.89	0.001496	5.23	298.56	124.53	0.43
Reach1	370.00	01JAN2023 0200	50yr-Prop	1255.00	108.36	114.04		114.41	0.001379	5.38	338.68	136.49	0.42
Reach1	370.00	01JAN2023 0200	100yr-Prop	1415.35	108.36	114.50		114.88	0.001289	5.51	375.72	141.40	0.41
Reach1	370.00	01JAN2023 0200	200yr-Prop	1580.00	108.36	114.94		115.34	0.001217	5.64	412.48	159.20	0.41
Reach1	370.00	01JAN2023 0200	500yr-Prop	1800.75	108.36	115.75		116.13	0.001010	5.59	479.78	184.57	0.38
Reach1	370.00	01JAN2023 0200	StantecBankfull-Prop	324.00	108.36	110.80		111.10	0.003745	4.49	90.42	70.21	0.59
Reach1	370.00	01JAN2023 0200	5%Exceedance-Prop	137.90	108.36	109.75		110.07	0.009261	4.56	30.25	32.08	0.83
Reach1	370.00	01JAN2023 0200	50%Exceedance-Prop	19.40	108.36	108.86		108.99	0.015565	2.93	6.23	20.22	0.90
Reach1	370.00	01JAN2023 0200	95%Exceedance-Prop	2.90	108.36	108.65		108.67	0.003729	0.99	2.94	15.75	0.40
Reach1	370.00	01JAN2023 0200	Mean Annual-Prop	44.00	108.36	109.09		109.31	0.014525	3.71	11.85	24.07	0.93
Reach1	370.00	01JAN2023 0200	1.1yr-Prop	270.00	108.36	110.48		110.81	0.005051	4.65	68.93	65.35	0.66
Reach1	350	01JAN2023 0010	1.1yr-Prop	270.00	106.42	110.47		110.67	0.001698	3.64	74.24	28.36	0.40
Reach1	350	01JAN2023 0200	2yr-Prop	490.00	106.42	111.36		111.72	0.002409	4.80	102.12	33.53	0.48
Reach1	350	01JAN2023 0200	5yr-Prop	720.00	106.42	112.17		112.65	0.002498	5.54	130.30	35.72	0.51
Reach1	350	01JAN2023 0200	10yr-Prop	875.00	106.42	112.66		113.21	0.002506	5.93	148.09	36.81	0.52
Reach1	350	01JAN2023 0200	25yr-Prop	1085.00	106.42	113.29		113.91	0.002490	6.34	172.07	40.53	0.53
Reach1	350	01JAN2023 0200	50yr-Prop	1255.00	106.42	113.76		114.45	0.002390	6.64	190.43	62.85	0.52
Reach1	350	01JAN2023 0200	100yr-Prop	1415.35	106.42	114.19		114.93	0.002307	6.89	207.22	98.67	0.52
Reach1	350	01JAN2023 0200	200yr-Prop	1580.00	106.42	114.62		115.41	0.002238	7.14	223.75	106.76	0.52
Reach1	350	01JAN2023 0200	500yr-Prop	1800.86	106.42	115.40		116.20	0.001908	7.17	254.71	148.97	0.49
Reach1	350	01JAN2023 0200	StantecBankfull-Prop	324.00	106.42	110.78		111.01	0.001864	3.88	83.46	30.86	0.42
Reach1	350	01JAN2023 0200	5%Exceedance-Prop	137.90	106.42	109.65		109.75	0.000991	2.58	53.52	23.15	0.30
Reach1	350	01JAN2023 0200	50%Exceedance-Prop	19.40	106.42	108.71		108.71	0.000074	0.58	33.36	19.68	0.08
Reach1	350	01JAN2023 0200	95%Exceedance-Prop	2.90	106.42	108.62		108.62	0.000002	0.09	31.72	19.46	0.01
Reach1	350	01JAN2023 0200	Mean Annual-Prop	44.00	106.42	108.95		108.97	0.000256	1.15	38.20	20.33	0.15
Reach1	350	01JAN2023 0200											

HEC-RAS River: TanneryBrook Reach: Reach1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Reach1	315	01JAN2023 0010	1.1yr-Prop	270.00	107.00	109.85		110.27	0.004696	5.20	51.94	26.07	0.65
Reach1	315	01JAN2023 0200	2yr-Prop	490.00	107.00	110.55		111.28	0.006290	6.86	72.42	35.97	0.77
Reach1	315	01JAN2023 0200	5yr-Prop	720.00	107.00	111.09		112.13	0.006892	8.20	91.81	35.97	0.84
Reach1	315	01JAN2023 0200	10yr-Prop	875.00	107.00	111.40		112.65	0.007273	9.00	102.93	35.97	0.88
Reach1	315	01JAN2023 0200	25yr-Prop	1085.00	107.00	111.78	111.62	113.30	0.007755	9.98	116.36	35.97	0.92
Reach1	315	01JAN2023 0200	50yr-Prop	1255.00	107.00	112.05	111.96	113.81	0.008123	10.72	126.21	35.97	0.95
Reach1	315	01JAN2023 0200	100yr-Prop	1415.35	107.00	112.29	112.25	114.27	0.008425	11.37	134.99	35.97	0.98
Reach1	315	01JAN2023 0200	200yr-Prop	1580.00	107.00	112.53	112.56	114.73	0.008710	11.99	143.52	35.97	1.01
Reach1	315	01JAN2023 0200	500yr-Prop	1800.88	107.00	112.83	112.96	115.32	0.009047	12.77	154.40	35.97	1.04
Reach1	315	01JAN2023 0200	StantecBankfull-Prop	324.00	107.00	110.04		110.54	0.005160	5.69	56.95	26.72	0.69
Reach1	315	01JAN2023 0200	5%Exceedance-Prop	137.90	107.00	109.32		109.52	0.002952	3.57	36.62	24.22	0.50
Reach1	315	01JAN2023 0200	50%Exceedance-Prop	19.40	107.00	108.68		108.69	0.000227	0.80	24.15	20.98	0.13
Reach1	315	01JAN2023 0200	95%Exceedance-Prop	2.90	107.00	108.62		108.62	0.000006	0.13	22.87	20.68	0.02
Reach1	315	01JAN2023 0200	Mean Annual-Prop	44.00	107.00	108.87		108.91	0.000753	1.56	28.18	22.10	0.24
Reach1	315	01JAN2023 0200	1.1yr-Prop	270.00	107.00	109.85		110.27	0.004697	5.20	51.94	26.07	0.65
Reach1	310	01JAN2023 0010	1.1yr-Prop	270.00	107.88	109.81		110.47	0.010478	6.52	41.42	27.69	0.94
Reach1	310	01JAN2023 0200	2yr-Prop	490.00	107.88	110.51	110.48	111.49	0.010320	7.93	61.76	30.02	0.98
Reach1	310	01JAN2023 0200	5yr-Prop	720.00	107.88	111.05	111.09	112.37	0.010826	9.21	78.16	31.07	1.02
Reach1	310	01JAN2023 0200	10yr-Prop	875.00	107.88	111.36	111.46	112.90	0.011209	9.97	87.79	31.57	1.05
Reach1	310	01JAN2023 0200	25yr-Prop	1085.00	107.88	111.73	111.93	113.57	0.011742	10.89	99.62	32.18	1.09
Reach1	310	01JAN2023 0200	50yr-Prop	1255.00	107.88	112.00	112.27	114.08	0.012168	11.57	108.43	32.62	1.12
Reach1	310	01JAN2023 0200	100yr-Prop	1415.35	107.88	112.24	112.59	114.54	0.012514	12.16	116.38	33.02	1.14
Reach1	310	01JAN2023 0200	200yr-Prop	1580.00	107.88	112.48	112.90	114.99	0.012837	12.72	124.21	33.40	1.16
Reach1	310	01JAN2023 0200	500yr-Prop	1800.88	107.88	112.78	113.30	115.57	0.013232	13.41	134.33	33.95	1.19
Reach1	310	01JAN2023 0200	StantecBankfull-Prop	324.00	107.88	110.00	109.94	110.75	0.010482	6.94	46.70	28.35	0.95
Reach1	310	01JAN2023 0200	5%Exceedance-Prop	137.90	107.88	109.29		109.68	0.009407	5.03	27.43	25.21	0.85
Reach1	310	01JAN2023 0200	50%Exceedance-Prop	19.40	107.88	108.65		108.69	0.002183	1.57	12.36	22.02	0.37
Reach1	310	01JAN2023 0200	95%Exceedance-Prop	2.90	107.88	108.62		108.62	0.000058	0.25	11.65	21.73	0.06
Reach1	310	01JAN2023 0200	Mean Annual-Prop	44.00	107.88	108.80		108.92	0.005375	2.80	15.74	23.14	0.60
Reach1	310	01JAN2023 0200	1.1yr-Prop	270.00	107.88	109.81		110.47	0.010478	6.52	41.42	27.69	0.94
Reach1	300.00	01JAN2023 0010	1.1yr-Prop	270.00	108.00	109.66	109.85	110.57	0.018929	7.65	35.32	29.35	1.23
Reach1	300.00	01JAN2023 0200	2yr-Prop	490.00	108.00	110.39	110.56	111.49	0.014408	8.40	58.37	34.68	1.13
Reach1	300.00	01JAN2023 0200	5yr-Prop	720.00	108.00	110.93	111.12	112.26	0.013506	9.25	78.44	39.25	1.13
Reach1	300.00	01JAN2023 0200	10yr-Prop	875.00	108.00	111.24	111.45	112.71	0.013070	9.75	90.83	41.29	1.13
Reach1	300.00	01JAN2023 0200	25yr-Prop	1085.00	108.00	111.61	111.84	113.27	0.012619	10.37	106.54	43.35	1.14
Reach1	300.00	01JAN2023 0200	50yr-Prop	1255.00	108.00	111.88	112.12	113.70	0.012142	10.83	118.52	44.69	1.13
Reach1	300.00	01JAN2023 0200	100yr-Prop	1415.35	108.00	112.12	112.40	114.08	0.011727	11.24	129.50	45.82	1.13
Reach1	300.00	01JAN2023 0200	200yr-Prop	1580.00	108.00	112.36	112.66	114.45	0.011406	11.65	140.43	46.96	1.13
Reach1	300.00	01JAN2023 0200	500yr-Prop	1800.88	108.00	112.66	112.97	114.93	0.011064	12.15	154.76	48.40	1.13
Reach1	300.00	01JAN2023 0200	StantecBankfull-Prop	324.00	108.00	109.86	110.04	110.82	0.017251	7.86	41.22	30.61	1.19
Reach1	300.00	01JAN2023 0200	5%Exceedance-Prop	137.90	108.00	109.11	109.30	109.84	0.026282	6.85	20.13	25.35	1.36
Reach1	300.00	01JAN2023 0200	50%Exceedance-Prop	19.40	108.00	108.34	108.45	108.72	0.062716	4.95	3.92	15.51	1.74
Reach1	300.00	01JAN2023 0200	95%Exceedance-Prop	2.90	108.00	108.11	108.16	108.30	0.154950	3.55	0.82	10.49	2.25
Reach1	300.00	01JAN2023 0200	Mean Annual-Prop	44.00	108.00	108.56	108.72	109.07	0.043551	5.75	7.66	18.41	1.57
Reach1	300.00	01JAN2023 0200	1.1yr-Prop	270.00	108.00	109.66	109.85	110.57	0.018933	7.65	35.31	29.35	1.23
Reach1	290	01JAN2023 0010	1.1yr-Prop	270.00	107.08	109.48	109.67	110.44	0.018385	7.85	34.40	26.64	1.22
Reach1	290	01JAN2023 0200	2yr-Prop	490.00	107.08	110.25	110.42	111.39	0.014738	8.58	57.09	32.59	1.14
Reach1	290	01JAN2023 0200	5yr-Prop	720.00	107.08	110.79	111.01	112.18	0.014337	9.46	76.09	36.65	1.16
Reach1	290	01JAN2023 0200	10yr-Prop	875.00	107.08	111.10	111.36	112.65	0.014081	9.97	87.75	38.50	1.16
Reach1	290	01JAN2023 0200	25yr-Prop	1085.00	107.08	111.47	111.78	113.21	0.013941	10.57	102.60	41.01	1.18
Reach1	290	01JAN2023 0200	50yr-Prop	1255.00	107.08	111.75	112.08	113.63	0.013475	11.00	114.21	42.83	1.17
Reach1	290	01JAN2023 0200	100yr-Prop	1415.35	107.08	112.00	112.32	114.01	0.013141	11.37	124.96	44.50	1.17
Reach1	290	01JAN2023 0200	200yr-Prop	1580.00	107.08	112.24	112.58	114.37	0.012661	11.73	135.81	45.92	1.16
Reach1	290	01JAN2023 0200	500yr-Prop	1800.88	107.08	112.54	112.92	114.84	0.012072	12.18	150.13	48.26	1.15
Reach1	290	01JAN2023 0200	StantecBankfull-Prop	324.00	107.08	109.69	109.89	110.70	0.017083	8.05	40.22	28.31	1.19
Reach1	290	01JAN2023 0200	5%Exceedance-Prop	137.90	107.08	108.88	109.05	109.62	0.020939	6.92	19.92	20.62	1.24
Reach1	290	01JAN2023 0200	50%Exceedance-Prop	19.40	107.08	107.97		108.15	0.012935	3.44	5.63	11.62	0.87
Reach1	290	01JAN2023 0200	95%Exceedance-Prop	2.90	107.08	107.55		107.60	0.008657	1.77	1.64	6.83	0.64
Reach1	290	01JAN2023 0200	Mean Annual-Prop	44.00	107.08	108.26	108.26	108.60	0.015709	4.67	9.41	14.18	1.01
Reach1	290	01JAN2023 0200	1.1yr-Prop	270.00	107.08	109.48	109.67	110.44	0.018389	7.85	34.40	26.64	1.22
Reach1	280.50	01JAN2023 0010	1.1yr-Prop	270.00	105.68	109.37		109.82	0.005642	5.41	49.87	27.10	0.70
Reach1	280.50	01JAN2023 0200	2yr-Prop	490.00	105.68	110.14	110.82	110.82	0.006916	6.61	74.14	35.87	0.80
Reach1	280.50	01JAN2023 0200	5yr-Prop	720.00	105.68	110.69	111.61	111.61	0.007233	7.70	94.72	39.82	0.84
Reach1	280.50	01JAN2023 0200	10yr-Prop	875.00	105.68	111.00	112.08	112.08	0.007367	8.33	107.50	42.11	0.87
Reach1	280.50	01JAN2023 0200	25yr-Prop	1085.00	105.68	111.37	111.16	112.66	0.007491	9.11	123.71	44.68	0.89
Reach1	280.50	01JAN2023 0200	50yr-Prop	1255.00	105.68	111.65	111.48	113.10	0.007579	9.68	136.44	46.85	0.91
Reach1	280.50	01JAN2023 0200	100yr-Prop	1415.35	105.68	111.90	111.76	113.49	0.007649	10.18	148.33	49.18	0.92
Reach1	280.50	01JAN2023 0200	200yr-Prop	1580.00	105.68	112.14	112.04	113.88	0.007701	10.65	160.45	50.88	0.94
Reach1	280.50	01JAN2023 0200	500yr-Prop	1800.88	105.68	112.45	112.39	114.37	0.007751	11.22	176.36	52.54	0.95
Reach1	280.50	01JAN2023 0200	StantecBankfull-Prop	324.00	105.68	109.58		110.10	0.006112	5.79	55.94	29.19	0.74
Reach1	280.50	01JAN2023 0200	5%Exceedance-Prop	137.90	105.68	108.76		109.00	0.003533	3.92	35.15	21.75	0.54
Reach1	280.50	01JAN2023 0200	50%Exceedance-Prop	19.40	105.68	107.91		107.92	0.000313	1.00	19.50	15.33	0.16
Reach1	280.50	01JAN2023 0200	95%Exceedance-Prop	2.90	105.68	107.52		107.52	0.000018	0.21	13.90	13.44	0.04
Reach1	280.50	01JAN2023 0200	Mean Annual-Prop	44.00	105.68	108.19		108.24	0.000941	1.84	23.97	17.17	0.27
Reach1	280.50	01JAN2023 0200	1.1yr-Prop	270.00	105.68	109.37		109.82	0.005643	5.41	49.87	27.10	0.70
Reach1	271	01JAN2023 0010	1.1yr-Prop	270.00	104.09	109.43	107.52	109.63	0.001570	3.60	74.99	27.96	0.39
Reach1	271	01JAN2023 0200	2yr-Prop	490.00	104.09	110.10	108.61	110.52	0.002651	5.18	95.54	33.62	0.52
Reach1	271	01JAN2023 0200	5yr-Prop	720.00	104.09	110.64	109.47	111.29	0.003345	6.46	115.47	40.29	0.59
Reach1	271	01JAN2023 0200	10yr-Prop	875.00	104.09	110.95	1						

Appendix C Scour Analysis Calculations



SCOUR ANALYSIS - NCHRP 24-20 Abutment Approach

Live-Bed Scour Equation - HEC-18 Eqns 8.3, 8.4, 8.5, and 8.6

Bridge/Culvert Name: Tannery Bridge (Mariaville St)

Town: Mariaville, ME
 Lat: 44° 11' 14.8" N
 Long: 69° 04' 26.5" W

Storm Size: 100-Year
 HEC-RAS Proj: 179450563_Mariaville_RASmodel_20230103.prj
 HEC-RAS Geom: UTD_ProposedConditions
 HEC-RAS Xsection: 345

Notes

- (1) left bank and right bank defined from looking downstream
- (2) cross section for critical velocity is located ~ 1 bridge length upstream
- (3) bridge is located at Sta. 330 ft

$$y_{\max} = \alpha_A y_c \text{ or } y_{\max} = \alpha_B y_c$$

$$y_s = y_{\max} - y_0$$

live bed eqn

$$y_c = y_1 \left(\frac{q_{2c}}{q_1} \right)^{5/7}$$

Input:

	LOB	CHANNEL	ROB
Width Bridge section (ft)	0	42.6	0
Upstream Width (ft)	96.67	36.97	7.76
Discharge Bridge Section (cfs)		1415.35	
Upstream Discharge (cfs)	279.95	1124.71	10.68
y1	4.3	5.52	1.62
Q1 Upstream Unit Discharge (ft ² /s)	2.90	30.42	1.38
	0.01		
q2c		33.22	
ku		11.17	
D50		0.0076	
q2c/q1		0.96	
alpha a		1.2	
y0		5.69	
Output:			
yc		5.95	
y _{max}		7.14	
y _s		1.45	

SCOUR ANALYSIS - NCHRP 24-20 Abutment Approach

Live-Bed Scour Equation - HEC-18 Eqns 8.3, 8.4, 8.5, and 8.6

Bridge/Culvert Name: Tannery Bridge (Mariaville St)
 Town: Mariaville, ME
 Lat: 44° 11' 14.8" N
 Long: 69° 04' 26.5" W

Storm Size: 100-Year
 HEC-RAS Proj: 179450563_Mariaville_RASmodel_20230103.prj
 HEC-RAS Geom: UTD_ProposedConditions
 HEC-RAS Xsection: 345

Notes

- (1) left bank and right bank defined from looking downstream
- (2) cross section for critical velocity is located ~ 1 bridge length upstream
- (3) bridge is located at Sta. 330 ft

$$y_{\max} = \alpha_A y_c \text{ or } y_{\max} = \alpha_B y_c$$

$$y_s = y_{\max} - y_0$$

live bed eqn

$$y_c = y_1 \left(\frac{q_{2c}}{q_1} \right)^{5/7}$$

Input:

	LOB	CHANNEL	ROB
Width Bridge section (ft)	0	42.6	0
Upstream Width (ft)	136.46	36.97	11.14
Discharge Bridge Section (cfs)		1800.88	
Upstream Discharge (cfs)	379.44	1399.23	22.09
y1		6.77	
Q1 Upstream Unit Discharge (ft2/s)	2.78	37.85	1.98
	0.01		
q2c		42.27	
ku		11.17	
D50		0.0076	
q2c/q1		0.99	
alpha a		1.2	
y0		6.86	
Output:			
yc		7.44	
ymax		8.93	
ys		2.07	

Appendix D Stable Material Sizing Calculations



Revetment Riprap - HEC-23 Approach

Equation - HEC-23 Eqns 4.1, 4.2

Bridge/Culvert Name: Tannery Bridge
 Town: Mariaville, ME
 Lat: 44° 11' 14.8" N
 Long: 69° 04' 26.5" W

Storm Size: 100-Year
 HEC-RAS Proj: 179450563_Mariaville_RASmodel_20230103.prj
 HEC-RAS Geom: UTD_ProposedConditions
 HEC-RAS Xsection: 315

Notes

- (1) left bank and right bank defined from looking downstream
- (2) cross section for critical velocity is located immediate downstream of bridge face
- (3) bridge is located at Sta. 330 ft

Input:

y (ft)	5.29
Sf	1.1
Cs	0.3
Cv	1
Ct	1
Vavg (ft/s)	11.4
Theta	18.4
K1	0.98
Rc (ft)	0
W (ft)	35.97
Sg	2.65
g (ft/s ²)	32.2
V des (ft/s)	11.4
D30 (feet)	0.68
D50 (feet)	0.82
D50 (inches)	9.80

Revetment Riprap - HEC-23 Approach

Equation - HEC-23 Eqns 4.1, 4.2

Bridge/Culvert Name: Tannery Bridge
 Town: Mariaville, ME
 Lat: 44° 11' 14.8" N
 Long: 69° 04' 26.5" W

Storm Size: 100-Year
 HEC-RAS Proj: 179450563_Mariaville_RASmodel_20230103.prj
 HEC-RAS Geom: UTD_ProposedConditions
 HEC-RAS Xsection: 315

Notes

- (1) left bank and right bank defined from looking downstream
- (2) cross section for critical velocity is located immediate downstream of bridge face
- (3) bridge is located at Sta. 330 ft

Input:

y (ft)	5.83
Sf	1.1
Cs	0.3
Cv	1
Ct	1
Vavg (ft/s)	12.8
Theta	18.4
K1	0.98
Rc (ft)	0
W (ft)	35.97
Sg	2.65
g (ft/s ²)	32.2
V des (ft/s)	12.8
D30 (feet)	0.89
D50 (feet)	1.07
D50 (inches)	12.79