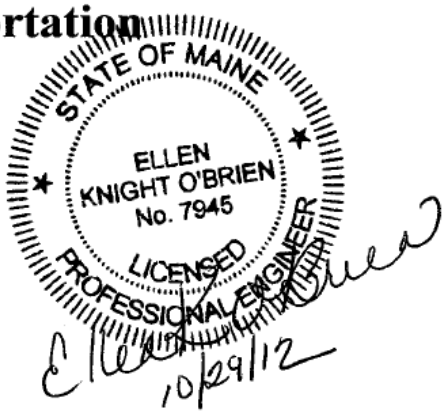
Bass Harbor Bridge
Route 102, Tremont, Maine

Preliminary Hydrology, Hydraulics and Scour Report

Northstar Hydro, Inc. for
VHB, Inc. and Maine Dept. of Transportation
October, 2012

Maine DOT WIN # 19305.00
Bridge # 6336



Introduction:

This preliminary design report describes hydrologic and hydraulic analyses performed at the site of the Bass Harbor Bridge in Tremont. This site is affected by both freshwater flows from the upland drainage area and by daily and storm tides that cycle in and out of Bass Harbor Marsh. This bridge site is subject to rapid flows in both directions as the tide causes the current to reverse direction twice each day. The existing bridge is a 15' clear span on granite abutments.

Goals for Preliminary Design include:

- Determine flood elevations for existing and proposed bridge options
- Evaluate rate of flow through bridge under normal and flood tides
- Evaluate impacts of freshwater flows
- Evaluate impact of existing and proposed bridges on upstream (marsh) flood elevations during coastal storms
- Evaluate scour potential based

Review of Existing Data:

Data reviewed and results of the review of existing data review for preliminary design are described below.

1. Project datum: When working in a tidal area, many different reference elevations are available. The datum for this project is NAVD 1988. The difference between NAVD and NGVD 1929 is 0.663' at this location (subtract 0.663' from NGVD to get NAVD elevation). The following table summarizes relationships between various tidal based elevations at this site. (Ref. 6)

T I D A L D A T U M S

Tidal datums at BAR HARBOR, FRENCHMAN BAY:

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

HIGHEST OBSERVED WATER LEVEL (02/07/1978)		= 4.941 (10.2' NAVD)
MEAN HIGHER HIGH WATER	MHHW	= 3.466 (5.4' NAVD)
MEAN HIGH WATER	MHW	= 3.336 (5.0' NAVD)
North American Vertical Datum	NAVD88	= 1.821 (0.0' NAVD)
MEAN SEA LEVEL	MSL	= 1.728
MEAN TIDE LEVEL	MTL	= 1.726
MEAN LOW WATER	MLW	= 0.116 (-5.6'NAVD)
MEAN LOWER LOW WATER	MLLW	= 0.000(-6.0' NAVD)
LOWEST OBSERVED WATER LEVEL (03/21/2007)		= -0.887

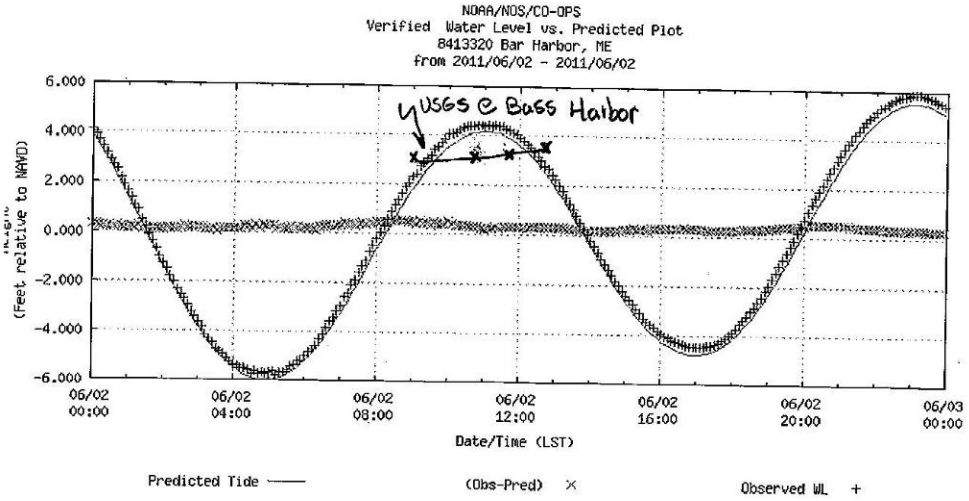
2. The USGS installed a gage (Rref. 7) at Bass Harbor Bridge site in association with a study on nitrates in Bass Harbor Marsh (Ref. 8). The gage is located on the "upstream" or marsh side of the bridge.

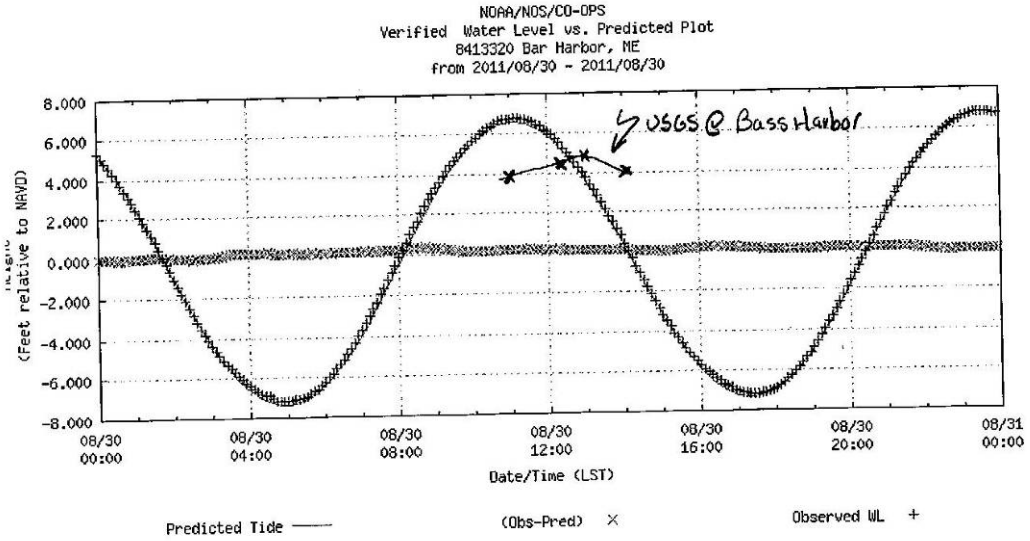
Gage data is available at the following link.

http://waterdata.usgs.gov/nwis/nwisman/?site_no=010228955&agency_cd=USGS

Measurements of streamflow through the bridge and water levels were collected in the summers of 2011 and 2012. In addition, USGS furnished information on measured stream flows at several elevations. These measured flows and water levels are included in the appendix.

Water level measurements indicate that inside the bridge, tides tend to be lower than outside of the bridge, never reaching the high tide level that is reached in unrestricted tidal zones. Water level begins to drop in the marsh after high tide has begun to recede in the open ocean, and never falls below approximately NAVD 0.0 due to the elevation of the rock sill in the bridge section. The following two sketches show data measured at Bass Harbor plotted over the NOAA tide curve at Bar Harbor for June 2, 2011 and August 30, 2011 when USGS measured water levels and flows at the site.





3. FEMA Flood Insurance Study of Tremont (Ref. 2). The FEMA Flood Insurance Study for Tremont was completed in 1990. The 100-year flood elevation on both the ocean and marsh side of the bridge is 10.7' NGVD, or 10.0' NAVD. The 50-year flood elevation is listed as 10.3' NGVD, 9.6' NAVD. Selected pages from the FIS report and the Flood Insurance Rate map are included in the appendix.

4. USACOE tidal profiles (Ref. 4). In February of 2012, the U. S. Army Corps of Engineers re-evaluated the tidal stage-frequency relationship at every tide gage on the East Coast. A report summarizing the tidal flood profiles that resulted from this analysis was published in a full report. Selected pages from the report are included in the appendix. For Bar Harbor, the following table summarizes the flood frequency elevations (ft, NAVD):

Frequency	Elevation, ft, NAVD
Mean Annual	8.12
10-percent	8.53
2-percent	8.98
1-percent	9.17
0.2 percent	9.58

5. NOAA Tide Data: the National Oceanic and Atmospheric Administration (NOAA) publishes tide predictions and tide records. The nearest tidal recording station for Bass Harbor is at Bar Harbor (Ref. 7). Records and predictions for this station can be retrieved at:

http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=8413320%20Bar%20Harbor,%20ME&type=Tide%20Data

NOAA also predicts tides at a series of locations, including Bass Harbor (Ref. 7). Predicted tides can be accessed at the following site.

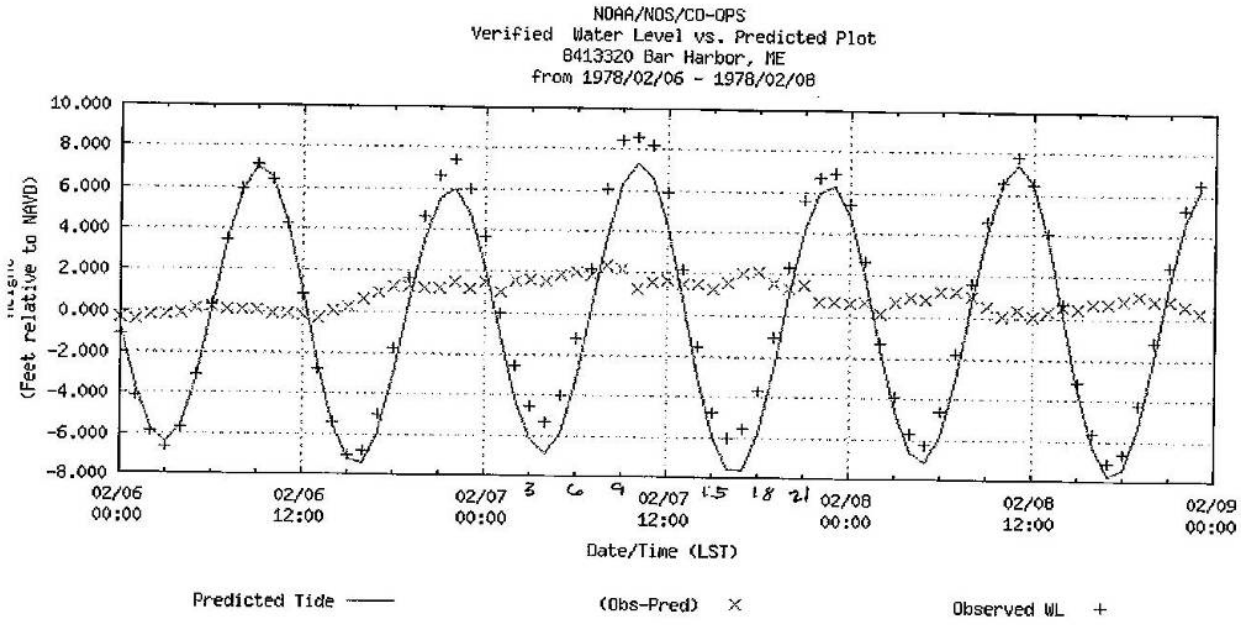
http://tidesandcurrents.noaa.gov/tide_predictions.shtml?gid=17

6. Air photos: The following photo is from ESRI's on-line database and was produced using ArcGIS (ref. 1).

7. Topographic Maps: the USGS topographic map was also used, in ArcGIS format.

8. MDOT bridge file information including inspection reports, photographs and plans of past and existing bridges.

9. Historical Flood Information: Historical data on flooding at Bass Harbor was collected from NOAA data, USGS data, the FEMA Flood Study and the ACOE profiles listed above. The highest recorded water level at Bar Harbor is 10.2' NAVD on February 7, 1978. The predicted and recorded water levels during this storm of record are shown below.



Hydrologic Analysis:

Hydrologic analysis at this site included evaluation of both the potential for tidal flooding and riverine flooding. Combinations of various levels of tides and freshwater flows occurring simultaneously were considered. Normal daily tide data was also considered since flow occurs in two directions twice every day. The interaction of tides and freshwater flows was based on normal tides, flood tides and flood flows in the stream.

Freshwater flows were developed by Maine DOT using the USGS Regional formula for flood prediction with the following results:

Frequency	Flow, cfs
1.1-yr	71
10-yr	245
25-yr	307
50-yr	354
100-yr	405
500-yr	526

FEMA Flood elevations were used for the Oceanside tide levels at Bass Harbor. The following peak tide elevations were used:

Frequency	Elevation, ft, NAVD
1.1-yr (MHHW)	5.4
10-yr	8.9
50-yr	9.7
100-yr	10.0
500-yr	10.8

Tides are modeled as a changing water level boundary. Tides fluctuate from high to low and back on an approximate 7 hour cycle from high to low, 13 hours from high to high. To accurately model site conditions, a smooth tide curve simulating tide elevations was developed for each of the peak elevations listed above. Annual high tide data was simulated using a high tide day during 2012, with a peak of 5.4' and the 1978 recorded hydrograph that had elevated flood levels over a two day period.

The following combinations of tide and freshwater flows were modeled:

Tide	Freshwater Flow
MHHW	Q 50 and Q100
MHHW	Mean daily flow
1978 Storm	Q 1.1-yr
100- and 50-year	Q 1.1-yr

Because the 1978 storm has a recorded flood hydrograph rather than a simulated hydrograph, this storm was used for the majority of evaluations. This storm hydrograph was applied to existing and proposed conditions for most model runs.

Hydraulic Analysis:

Goals of the preliminary hydraulic analysis include:

- Preliminary assessment of bridge impacts on flood elevations. Note that a key goal is to assure that Bass Harbor Marsh is not negatively impacted by the new bridge, and to assure that flood elevations upstream (inland) of the bridge are not raised. While the FEMA 100-year elevation is listed as 10.0, model results and flow evaluations indicate that it is more likely that the 100-year tidal elevation inside of the bridge is much lower.
- Preliminary flow velocity studies for scour analyses.
- Flood elevation for the 25-, 50- and 100-year floods.

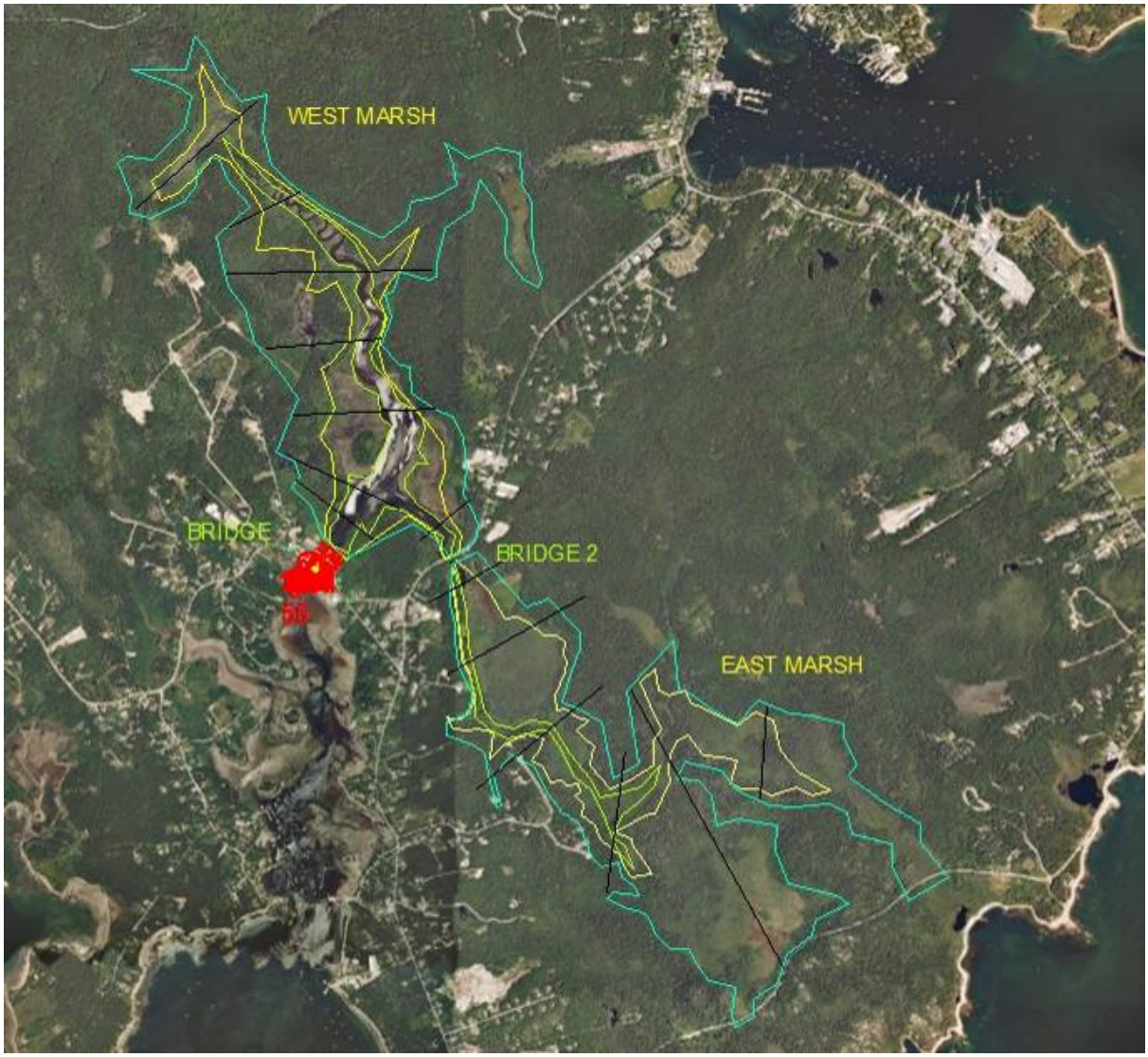
Flow model HECRAS was used to evaluate different bridge geometries and different tide and flow combinations. The model was run in both steady and unsteady modes to evaluate bridge rating curves and flow under changing tidal conditions. Verification of model results was also conducted using USGS measured flow and elevation data and "hand calculation" of flow through the existing bridge into the marsh.

The HECRAS model was compiled using data from the following sources:

- MDOT project survey, imported to GIS format
- Existing bridge plans, MDOT, June 1924
- Proposed bridge geometries, and construction phase options furnished by VHB
- USGS topographic map in ArcGIS format
- Tide and flow data as described under hydrology

The model was compiled as three reaches with a series of cross sections to represent the marsh areas. Cross sections at the bridge were based on project survey, as shown in the first photograph below. The marsh area was modeled based on USGS topographic map data. The marsh area model is shown in the second photograph following. Marsh areas at several elevations were measured using ArcGIS and sections were also compiled based on the ArcGIS base map.

Approximate marsh areas are outlined, showing the MHHW, 10’ and 20’ contours. Cross sections are shown in black. The bridge sections are red, compressed in this view



The following bridge geometries were simulated:

1. Existing bridge, 15’ span, 8.6’ opening.
2. Proposed bridge 15’ span
3. 16’ Conspan
4. 15’ span with cofferdam insert for 11’ total width
5. 8’ box and round culvert inserts for construction.

Modeled bridge sections are included in the appendix.

Because HECRAS model routines vary somewhat from bridge to culvert, all existing and proposed options were modeled as bridges, not culverts. Construction options were modeled as a span for the cofferdam, culverts for the 8' option.

The following table summarizes results of both steady and unsteady flow models, showing elevation in marsh for various combinations of oceanside tide elevation and streamflow.

Bass Harbor Bridge, Tremont

Tide Frequency	Streamflow	Maximum Elevation, NAVD			
		Oceanside	Existing Marsh side	Proposed 15' span Marsh side	Proposed 16' Con-span Marsh side
1.1-yr or MHHW	1.1-yr = 70 cfs	5.4	4.5	4.5	4.5
1.1-yr or MHHW	mean daily = 10 cfs	5.4	3.4	3.4	3.5
1.1-yr or MHHW	50-yr = 354 cfs	5.4	5.9	5.9	5.9
1.1-yr or MHHW	100-yr = 405 cfs	5.4	6.1	6.1	6.1
1.1-yr or MHHW					
50-yr	1.1-yr = 70 cfs	9.7	6	6	6
100-yr	1.1-yr = 70 cfs	10	6.1	6.1	6.1
Storm of Record, 1978	1.1-yr = 70 cfs	10.2	6.1	6.1	6.1

The model was also tested for larger bridges, such as an 18' span. The model indicated that marsh flood elevations would be increased by a wider span as more tidal flood flow could enter the marsh during an ocean storm.

Model results were also checked with a calculation comparing computed bridge flows and potential storage within the marsh. Estimated storage areas within the two marsh areas are summarized below. The marsh would fill as the tide rises, but only by the amount that the bridge area would allow to flow through the bridge opening during the 6 hour incoming tide.

Storage in Marsh	**West Marsh**		**East Marsh**		**total**	
Elev, NAVD	Area, acres	Acre-ft, cum	Area, acres	Acre-ft, cum	Area, acres	Acre-ft, cum
0	30	0	10	0	40	0
4	77	175	23	55	100	230
10	206	713	180	407	386	1120
20	464	1810	503	1509	967	3318

The following table summarizes computations for the 1978 storm showing the marsh filling as flow comes through the bridge from the ocean. This calculation estimated a marsh elevation of 6.0 feet, whereas HECRAS estimated 6.1' NAVD, suggesting that both modeling methods are providing valid results (HECRAS and storage/elevation/flow calculations).

Existing Bridge 1978 storm w/ 1.1 year stream flows

Tide Elev	Flow Est based on rating curve, cfs	cumulative inflow per hour, ft3	acre ft	Approx marsh elevation, ft, NAVD	HECRAS, elevation ft, NAVD
-2.67	0				
-0.26	25	90000	2.07		
1.94	90	504000	11.57		
3.4	225	1638000	37.60	0.5	
3.95	300	3528000	80.99	1	
3.36	225	5418000	124.38	1.5	
1.86	90	6552000	150.41	2	
-0.36	25	6966000	159.92		
-2.38	0	7056000	161.98		
-3.67	0				
-4.18	0				
-2.4	0				
-1	0				
2.91	180	648000	14.88	0.2	
5.3	450	2916000	66.94	0.5	
8.3	900	7776000	178.51	2	
10	1110	15012000	344.63	4.2	
8.3	900	22248000	510.74	6	6.1
5.9	600	27648000	634.71	7	
2.2	90	30132000	691.74		
-1.5	0	30456000	699.17		

Finally, the model was used to estimate the impacts of various construction phase options where the bridge area would be further constricted by either a coffer dam or a culvert insert. For this analysis, a high spring tide (MHHW) was used coupled with mean daily flow (MDOT hydrology computations) of 10 cfs. This represents typical summer daily fluctuations. The model indicates that an 11' cofferdam could lower daily high tide levels in the marsh by about 0.1'- 0.2', whereas an 8' culvert insert could cause as much as 0.5' difference for every high tide.

The following table summarizes model results for construction phase options. The model indicated high tide levels may be affected, but low tide levels would not change for these options.

Bass Harbor Bridge. Tide Elevations, Construction Phase.

Construction Phase, Normal Tides, Mean daily flows	Ocean-side Elevation	Marsh-side Elevation
Existing Bridge	5.4	3.4
Proposed 15'	5.4	3.4
11' cofferdam	5.4	3.17
8' box	5.4	2.9
8' round	5.4	2.9

Scour Considerations:

Preliminary design geotechnical and design information indicates that foundations will rest on bedrock, so scour computations were not performed. For final design, rock quality vs. potential velocity and scour should be rechecked, once the final bridge configuration is determined.

Maximum modeled velocities for the 1978 storm for existing and proposed options are summarized below. With high velocities such as these, rock quality should be checked for final design. Experience indicates that excavating to competent rock typically mirrors the depth that rock scour could occur.

Maximum Velocity	**upstream in bridge**	**downstream in bridge**
	fps	fps
Existing Conditions	13.6	9.6
15' Span	13.2	9.8
16' Con-span	12.9	9.8

6.0 References

1. ESRI ArcMap Version 9.3.1. 2009, ArcView License

2. Federal Emergency Management Agency. Flood Insurance Study, Town of Tremont. 1990
3. Maine Dept. of Transportation. Bridge Design Manual. August, 2003.
4. U.S. Army Corps of Engineers. Updated Tidal Flood Profiles for the New England Coastline. February, 2012

5. U.S. Army Corps of Engineers, Hydrologic Engineering Center. HEC-RAS River Analysis System. Version 4.10 January, 2010. Davis, CA

6. U. S. Department of Commerce. NOAA Tide Gage Data, Bar Harbor. http://tidesandcurrents.noaa.gov/data_menu.shtml?stn=8413320%20Bar%20Harbor,%20ME&type=Tide%20Data

7. United States Department of the Interior, Geological Survey. Gage at Tremont/Bass Harbor. http://waterdata.usgs.gov/nwis/nwisman/?site_no=010228955&agency_cd=USGS

8. U. S. Department of the Interior, Geological Survey. Denitrification Rates in Marsh Soils and Hydrologic and water Quality Data for Northeast Creek and Bass Harbor Marsh Watersheds, Mount Desert Island, Maine. OFR 2011-125

9. U.S. Dept. of Transportation, FHWA, HEC-18. Evaluating Scour at Bridges. April, 2012

10. U.S. Dept. of Transportation, FHWA, HEC-25. Tidal Hydrology, Hydraulics and Scour at Bridges, April, 2004. First Edition

U. S. Dept. of the Interior, Geological Survey, with Maine Dept. of Transportation. Estimating the Magnitude and Frequency of Peak Flows for Streams in Maine for Selected Recurrence Intervals. Water Resources Investigations Report 99-4008.

Appendix

1. USGS Gage Data at Bass Harbor
2. USGS and NOAA tide and flow data
3. Flow measurements by USGS at Bass Harbor Bridge
4. FEMA Flood Insurance Study
5. ACOE tidal flood profiles .pdf
6. MDOT Streamflow Calculations
7. HECRAS bridge cross sections
8. HECRAS output
    - 8-1 Rating curve at Bass Harbor Bridge, HECRAS vs USGS measured
    - 8-2 Rating Curves for each bridge (HECRAS)
    - 8-3 Maximum water levels for each bridge
    - 8-4 Data summary for each time step, 1978 storm
    - 8-5 Normal Tide model runs for each bridge
    - 8-6 Flood Flows at each bridge coupled with mean annual tides

APPENDIX 1

USGS Gage Data at Bass Harbor

National Water Information System: Web Interface

USGS 010228955 Outlet Bass Hbr Marsh at Rt 102 at Tremont, Maine

Available data for this site SUMMARY OF ALL AVAILABLE DATA GO

Stream: Tidal stream Site

DESCRIPTION:

Latitude 44°15'10.49", Longitude 68°20'57.12" NAD83
Hancock County, Maine, Hydrologic Unit 01050002
Drainage area: 8.403 square miles
Contributing drainage area: 8.403 square miles,
Datum of gage: 8.07 feet above NAVD88.

AVAILABLE DATA:

Data Type	Begin Date	End Date	Count
Current / Historical Observations (availability statement)	2012-06-26	2012-10-03	
Field measurements	2011-06-01	2011-08-30	69
Field/Lab water-quality samples	2011-05-26	2011-10-05	134
Additional Data Sources	**Begin Date**	**End Date**	**Count**
Annual Water-Data Report (pdf) **offsite**	2011	2011	1

OPERATION:

Record for this site is maintained by the USGS Maine Water Science Center
Email questions about this site to Maine Water Science Center Water-Data Inquiries

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APPENDIX 2

USGS and NOAA Tide and Flow Data

USGS
science for a changing world

USGS Home
Contact USGS
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National Water Information System: Web Interface

USGS Water Resources

Data Category: Surface Water | Geographic Area: United States | GO

News - updated September 2012

Streamflow Measurements for the Nation

USGS 010228955 Outlet Bass Hbr Marsh at Rt 102 at Tremont, Maine

Available data for this site | Surface-water: Field measurements | GO

Hancock County, Maine
Hydrologic Unit Code 01050002
Latitude 44°15'10.49", Longitude 68°20'57.12" NAD83
Drainage area 8.403 square miles
Contributing drainage area 8.403 square miles
Gage datum 8.07 feet above NAVD88

Output formats

- HTML table with channel data
- HTML table without channel data
- Tab-separated data with channel data
- Tab-separated data without channel data
- Graph of data
- Reselect output format

Meas. Number	Date	Time	Time Datum	Measurement Used?	Who	Measuring Agency	Stream flow (ft^3/s)	Gage Height (ft)	Rating No.	Shift Adj. (ft)	% Diff.	GH Change (ft)	Meas. Duration (hr)	Meas. Rated	Control	Flow Adjust. Code
69	2011-08-30	14:30:49	EDT	Yes	ns	USGS	279	12.13	001		2.2		0.06	UNSP	UNSP	UNSP
68	2011-08-30	14:23	EDT	Yes	ns	USGS	274	12.10	001		1.5		0.20	UNSP	UNSP	UNSP
67	2011-08-30	14:06:18	EDT	Yes	ns	USGS	263	12.20	001		-2.2		0.08	UNSP	UNSP	UNSP
66	2011-08-30	14:02	EDT	Yes	ns	USGS	260	12.26	001		2.8		0.06	UNSP	UNSP	UNSP
65	2011-08-30	13:58:17	EDT	Yes	ns	USGS	246	12.33	001		4.2		0.06	UNSP	UNSP	UNSP
64	2011-08-30	13:54:35	EDT	Yes	ns	USGS	226	12.37	001		2.3		0.06	UNSP	UNSP	UNSP
63	2011-08-30	13:51:06	EDT	Yes	ns	USGS	205	12.46	001		6.8		0.05	UNSP	UNSP	UNSP
62	2011-08-30	13:48:37	EDT	Yes	ns	USGS	184	12.50	001		8.2		0.03	UNSP	UNSP	UNSP
61	2011-08-30	13:01:31	EDT	Yes	ns	USGS	-411	12.69	001		2.2		0.06	UNSP	UNSP	UNSP
60	2011-08-30	12:56:09	EDT	Yes	ns	USGS	-428	12.68	001		4.6		0.12	UNSP	UNSP	UNSP
59	2011-08-30	12:51:44	EDT	Yes	ns	USGS	-436	12.67	001		3.1		0.03	UNSP	UNSP	UNSP
58	2011-08-30	12:50:05	EDT	Yes	ns	USGS	-469	12.65	001		6.8		0.03	UNSP	UNSP	UNSP
57	2011-08-30	12:48:19	EDT	Yes	ns	USGS	-476	12.61	001		3.3		0.03	UNSP	UNSP	UNSP
56	2011-08-30	12:43:41	EDT	Yes	ns	USGS	-479	12.60	001		0.4		0.12	UNSP	UNSP	UNSP
55	2011-08-30	12:39:13	EDT	Yes	ns	USGS	-506	12.56	001		4.5		0.03	UNSP	UNSP	UNSP
54	2011-08-30	12:34:46	EDT	Yes	ns	USGS	-460	12.54	001		-4.4		0.11	UNSP	UNSP	UNSP
53	2011-08-30	12:29:44	EDT	Yes	ns	USGS	-466	12.51	001		-4.5		0.05	UNSP	UNSP	UNSP
52	2011-08-30	12:26:16	EDT	Yes	ns	USGS	-501	12.49	001		2.0		0.05	UNSP	UNSP	UNSP
51	2011-08-30	12:22:49	EDT	Yes	ns	USGS	-513	12.47	001		-0.8		0.05	UNSP	UNSP	UNSP
50	2011-08-30	12:16:06	EDT	No												
49	2011-08-30	12:13:30	EDT	Yes	ns	USGS	-477	12.40	001		-3.8		0.06	UNSP	UNSP	UNSP
48	2011-08-30	12:10:58	EDT	Yes	ns	USGS	-502	12.38	001		-0.4		0.02	UNSP	UNSP	UNSP
47	2011-08-30	11:54:36	EDT	Yes	ns	USGS	-491	12.28	001		0.2		0.08	UNSP	UNSP	UNSP
46	2011-08-30	11:50:39	EDT	Yes	ns	USGS	-496	12.27	001		-0.6		0.05	UNSP	UNSP	UNSP
45	2011-08-30	11:46:06	EDT	Yes	ns	USGS	-484	12.23	001		0.2		0.10	UNSP	UNSP	UNSP
44	2011-08-30	11:42:15	EDT	Yes	ns	USGS	-472	12.21	001		-3.7		0.02	UNSP	UNSP	UNSP
43	2011-08-30	11:39:44	EDT	Yes	NS	USGS	-494	12.18	001		1.6		0.06	UNSP	UNSP	UNSP
42	2011-08-30	11:36:26	EDT	Yes	ns	USGS	-465	12.16	001		-1.7		0.05	UNSP	UNSP	UNSP
41	2011-08-30	11:28:34	EDT	Yes	ns	USGS	-460	12.08	001		1.8		0.21	UNSP	UNSP	UNSP
40	2011-08-30	11:20:29	EDT	Yes	ns	USGS	-472	12.01	001		4.4		0.06	UNSP	UNSP	UNSP
39	2011-08-30	11:17:33	EDT	Yes	ns	USGS	-415	11.97	001		-3.7		0.03	UNSP	UNSP	UNSP
38	2011-08-30	11:04:04	EDT	No												
37	2011-06-02	13:07:43	EDT	Yes	ns	USGS	-68.0	11.46	001		-13.2		0.06	UNSP	UNSP	UNSP
36	2011-06-02	13:04:35	EDT	Yes	ns	USGS	-97.0	11.47	001		-11.8		0.02	UNSP	UNSP	UNSP
35	2011-06-02	13:03:07	EDT	Yes	ns	USGS	-122	11.45	001		-7.6		0.03	UNSP	UNSP	UNSP
34	2011-06-02	13:00:17	EDT	Yes	ns	USGS	-141	11.48	001		-5.4		0.06	UNSP	UNSP	UNSP
33	2011-06-02	12:56:30	EDT	Yes	ns	USGS	-159	11.45	001		1.9		0.06	UNSP	UNSP	UNSP
32	2011-06-02	12:54:01	EDT	Yes	ns	USGS	-175	11.42	001		6.1		0.02	UNSP		UNSP
31	2011-06-02	12:52:37	EDT	Yes	ns	USGS	-186	11.50	001		1.6		0.02	UNSP	UNSP	UNSP
30	2011-06-02	12:41:35	EDT	Yes	ns	USGS	-163	11.38	001		3.8		0.16	UNSP	UNSP	UNSP
29	2011-06-02	11:46:57	EDT	Yes	ns	USGS	-197	11.05	001		-9.6		0.13	UNSP	UNSP	UNSP
28	2011-06-02	11:38:56	EDT	Yes	ns	USGS	-215	11.08	001		-4.4		0.13	UNSP	UNSP	UNSP
27	2011-06-02	11:33:38	EDT	Yes	ns	USGS	-183	10.96	001		-3.7		0.04	UNSP	UNSP	UNSP
26	2011-06-02	11:26:40	EDT	Yes	ns	USGS	-181	10.91	001		-6.7		0.19	UNSP	UNSP	UNSP
25	2011-06-02	11:06:55	EDT	Yes	ns	USGS	-191	10.84	001		-2.6		0.03	UNSP	UNSP	UNSP
24	2011-06-02	11:05:30	EDT	Yes	ns	USGS	-189	10.91	001		1.6		0.01	UNSP	UNSP	UNSP
23	2011-06-02	11:03:57	EDT	Yes	ns	USGS	-167	10.96	001		2.5		0.03	UNSP	UNSP	UNSP

22	2011-06-02 10:58:29	EDT	Yes	ns	USGS	-155	10.91	001	2.6	0.14	UNSP	UNSP	UNSP
21	2011-06-02 10:51:31	EDT	Yes	ns	USGS	-128	10.93	001	-4.5	0.07	UNSP	UNSP	UNSP
20	2011-06-02 10:47:59	EDT	Yes	ns	USGS	-119	10.91	001	-4.8	0.04	UNSP	UNSP	UNSP
19	2011-06-02 10:45:22	EDT	Yes	ns	USGS	-132	10.90	001	0.8	0.04	UNSP	UNSP	UNSP
18	2011-06-02 10:42:41	EDT	Yes	ns	USGS	-137	10.88	001	-0.7	0.05	UNSP	UNSP	UNSP
17	2011-06-02 10:37:44	EDT	Yes	ns	USGS	-109	10.84	001	-6.8	0.05	UNSP	UNSP	UNSP
16	2011-06-02 10:35:01	EDT	Yes	ns	USGS	-97.0	10.84	001	-8.5	0.04	UNSP	UNSP	UNSP
15	2011-06-02 10:25:38	EDT	Yes	ns	USGS	-68.0	10.84	001	-5.0	0.02	UNSP	UNSP	UNSP
14	2011-06-02 10:24:01	EDT	Yes	ns	USGS	-39.0	10.84	001	-22.8	0.03	UNSP	UNSP	UNSP
13	2011-06-02 10:22:28	EDT	Yes	ns	USGS	-34.0	10.83	001	-23.8	0.02	UNSP	UNSP	UNSP
12	2011-06-02 10:19:57	EDT	Yes	ns	USGS	-8.50	10.85	001	-62.9	0.02	UNSP	UNSP	UNSP
11	2011-06-02 10:18:44	EDT	Yes	ns	USGS	22.4	10.81	001	1393	0.02	UNSP	UNSP	UNSP
10	2011-06-02 10:15:06	EDT	Yes	ns	USGS	40.0	10.78	001	15.6	0.10	UNSP	UNSP	UNSP
9	2011-06-02 10:11:30	EDT	Yes	ns	USGS	55.0	10.75	001	11.6	0.02	UNSP	UNSP	UNSP
8	2011-06-02 10:09:03	EDT	Yes	ns	USGS	61.0	10.72	001	-1.0	0.04	UNSP	UNSP	UNSP
7	2011-06-02 10:05:33	EDT	Yes	ns	USGS	71.0	10.67	001	-2.3	0.07	UNSP	UNSP	UNSP
6	2011-06-02 10:02:23	EDT	Yes	ns	USGS	73.0	10.67	001	-6.8	0.03	UNSP	UNSP	UNSP
5	2011-06-02 10:00:19	EDT	Yes	ns	USGS	79.0	10.63	001	-9.1	0.03	UNSP	UNSP	UNSP
4	2011-06-02 09:55:56	EDT	Yes	ns	USGS	85.0	10.62	001	-5.9	0.11	UNSP	UNSP	UNSP
3	2011-06-02 09:01:30	EDT	Yes	ns	USGS	93.0	10.70	001	-6.7	0.25	UNSP	UNSP	UNSP
2	2011-06-01 16:26	EDT	Yes	ns	USGS	90.3	10.68	001	-7.5	0.20	UNSP	UNSP	UNSP
1	2011-06-01 15:22:01	EDT	Yes	ns	USGS	98.0	10.75	001	-9.3	0.23	UNSP	UNSP	UNSP

Questions about sites/data?
Feedback on this web site
Automated retrievals
Help

Data Tips
Explanation of terms
Subscribe for system changes
News

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U.S. Department of the Interior | U.S. Geological Survey
Title: Surface Water for USA: Streamflow Measurements
URL: http://waterdata.usgs.gov/nwis/measurements?

Page Contact Information: Maine Water Data Support Team
Page Last Modified: 2012-10-24 11:29:49 EDT
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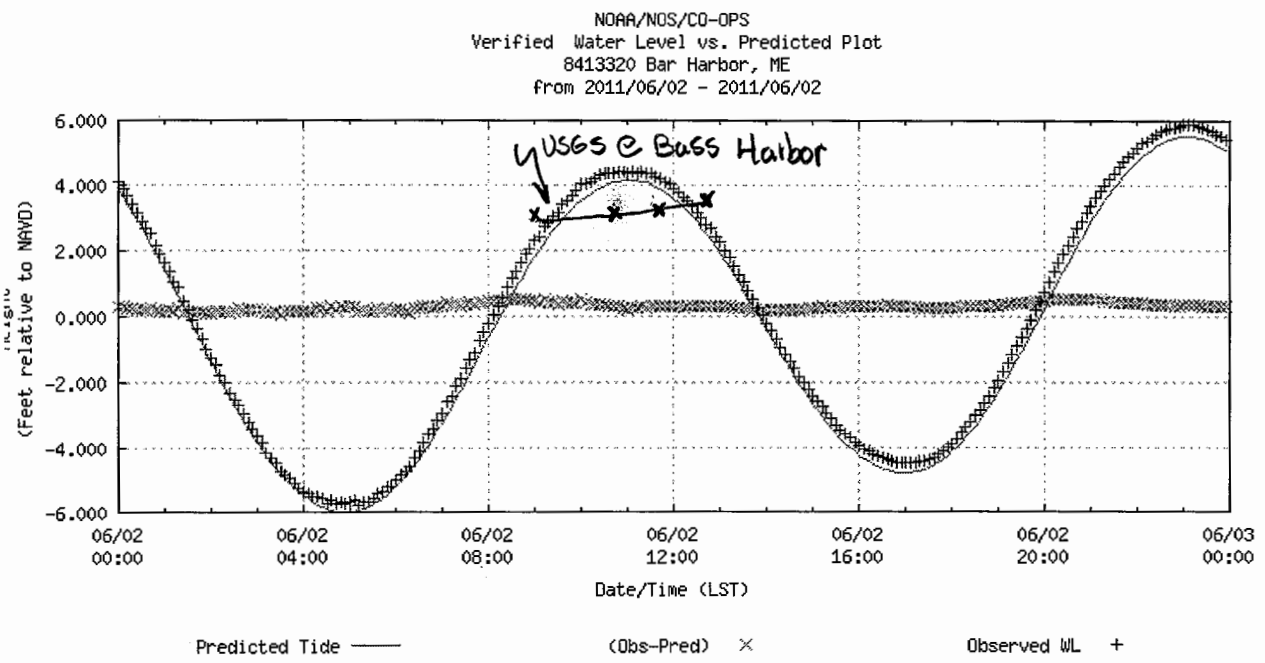
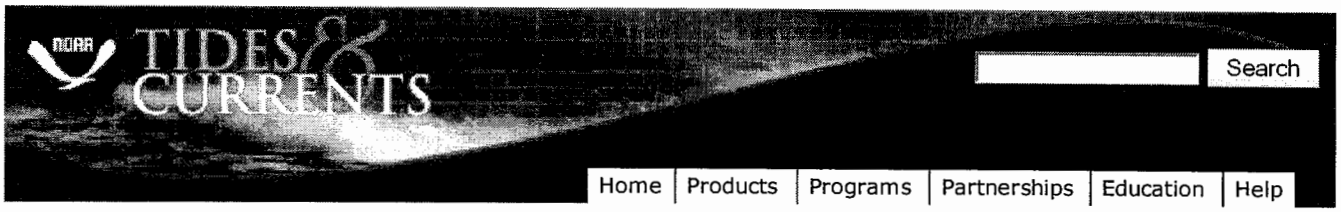

NOAA/NOS/CO-OPS
Verified Water Level vs. Predicted Plot
8413320 Bar Harbor, ME
from 2011/06/02 - 2011/06/02
USGS @ Bass Harbor
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
(Feet relative to NAVD)
06/02 00:00
06/02 04:00
06/02 08:00
06/02 12:00
06/02 16:00
06/02 20:00
06/03 00:00
Date/Time (LST)
Predicted Tide
(Obs-Pred)
Observed WL



Station Home Page
Station Information
Tide / Water Level Data
Tide Predictions
Current Data
Meteorological Observations
Conductivity
PORTS
Operational Forecast System
Bench Mark Sheets
Datums
Harmonic Constituents
Sea Level Trends
Measurement Specifications

ɔor, ME

: 8413320

Bar Harbor, ME: Data Inventory

Page Help

Historic Tide Data

ʻide Data

	Date	Time	Pred 6 1 Feet	Vrfy 6 1 Feet
	NAVD	LST	100.00	100.00
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	:		-7.36	-7.19
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8413320	20110830	00:12	4.84	4.81
8413320	20110830	00:18	4.59	4.56
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8413320	20110830	00:48	3.13	3.12
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8413320	20110830	01:36	0.38	0.43
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8413320	20110830 19:24	-3.72	-3.60
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8413320	20110830 19:36	-3.07	-2.94
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8413320	20110830 22:42	6.28	6.24
8413320	20110830 22:48	6.41	6.38
8413320	20110830 22:54	6.52	6.49
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8413320	20110830 23:18	6.79	6.79
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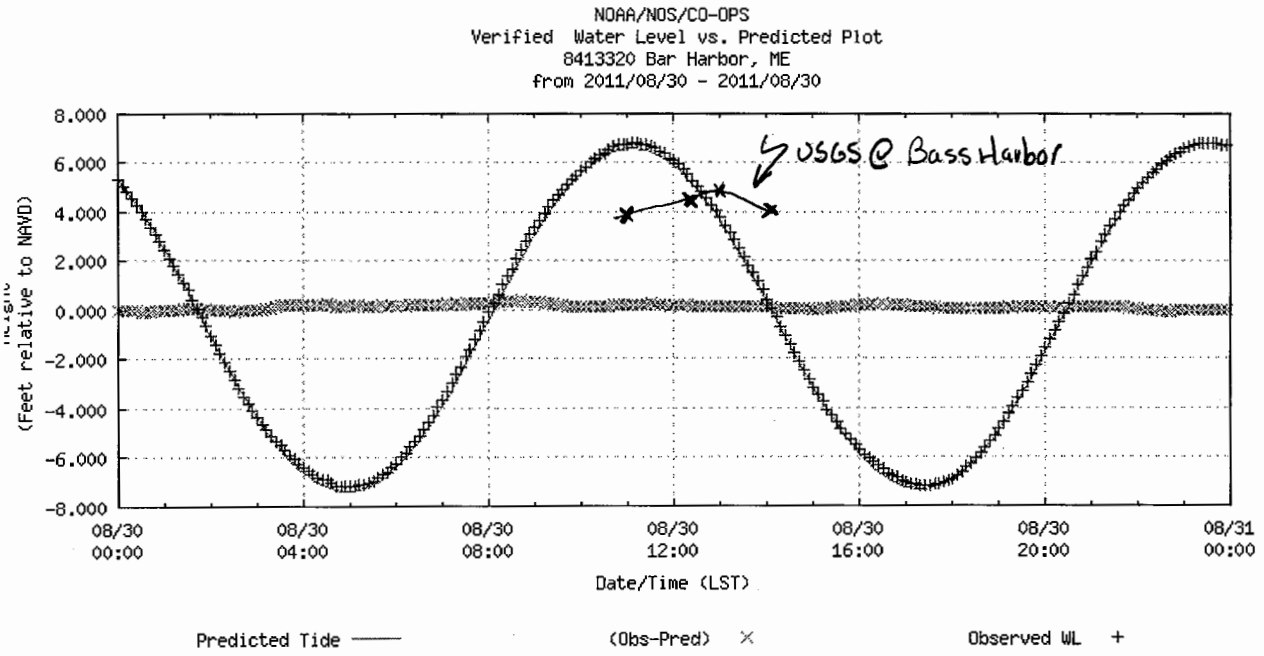
8413320	20110830 23:48	6.74	6.75
8413320	20110830 23:54	6.68	6.71

Begin Date: Aug 30 2011 **End Date:** Aug 30 2011 **Interval:** Six minute WL **Datum:** NAVD

Data Units: (•) **Feet** ( ) **Meters**

Time Zone: ( ) **Local (LST/LDT)** ( ) **GMT** (•) **LST**

View Plot View Data Reset


NOAA/NOS/CO-OPS
Verified Water Level vs. Predicted Plot
8413320 Bar Harbor, ME
from 2011/08/30 - 2011/08/30
USGS @ Bass Harbor
(Feet relative to NAVD)
8.000
6.000
4.000
2.000
0.000
-2.000
-4.000
-6.000
-8.000
08/30 00:00
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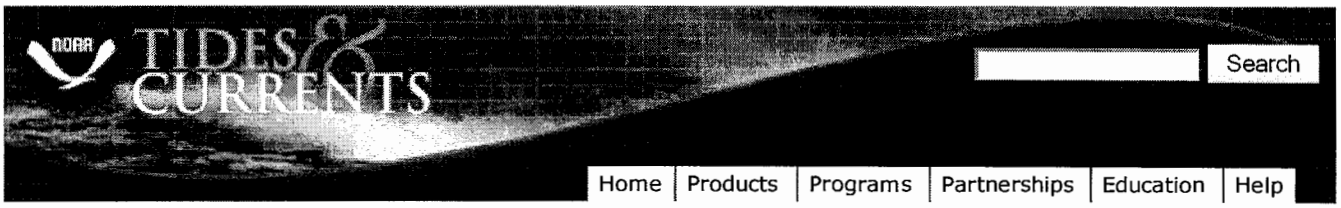
08/30 08:00
08/30 12:00
08/30 16:00
08/30 20:00
08/31 00:00
Date/Time (LST)
Predicted Tide
(Obs-Pred)
Observed WL



Station Home Page
Station Information
Tide / Water Level Data
Tide Predictions
Current Data
Meteorological Observations
Conductivity
PORTS
Operational Forecast System
Bench Mark Sheets
Datums
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Sea Level Trends
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ɔor, ME

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Bar Harbor, ME: Data Inventory

Page Help

Historic Tide Data

ide Data

	Date	Time	Pred 6 1 Feet	Vrfy 6 1 Feet
NAVD		LST	100.00	100.00
:			5.52	5.89
:			-6.00	-5.79
8413320	20110602	00:00	3.82	4.11
8413320	20110602	00:06	3.62	3.91
8413320	20110602	00:12	3.41	3.68
8413320	20110602	00:18	3.19	3.43
8413320	20110602	00:24	2.96	3.15
8413320	20110602	00:30	2.73	2.92
8413320	20110602	00:36	2.48	2.68
8413320	20110602	00:42	2.23	2.50
8413320	20110602	00:48	1.97	2.17
8413320	20110602	00:54	1.71	1.87
8413320	20110602	01:00	1.44	1.61
8413320	20110602	01:06	1.16	1.38
8413320	20110602	01:12	0.89	1.03
8413320	20110602	01:18	0.61	0.87
8413320	20110602	01:24	0.32	0.45
8413320	20110602	01:30	0.04	0.21
8413320	20110602	01:36	-0.24	-0.09
8413320	20110602	01:42	-0.52	-0.38
8413320	20110602	01:48	-0.81	-0.67
8413320	20110602	01:54	-1.09	-0.98
8413320	20110602	02:00	-1.36	-1.27
8413320	20110602	02:06	-1.64	-1.48
8413320	20110602	02:12	-1.91	-1.77
8413320	20110602	02:18	-2.18	-2.02
8413320	20110602	02:24	-2.43	-2.30
8413320	20110602	02:30	-2.69	-2.53
8413320	20110602	02:36	-2.94	-2.69
8413320	20110602	02:42	-3.18	-2.97
8413320	20110602	02:48	-3.41	-3.20
8413320	20110602	02:54	-3.64	-3.43
8413320	20110602	03:00	-3.85	-3.64
8413320	20110602	03:06	-4.06	-3.83
8413320	20110602	03:12	-4.27	-4.16
8413320	20110602	03:18	-4.46	-4.34
8413320	20110602	03:24	-4.64	-4.47
8413320	20110602	03:30	-4.81	-4.74
8413320	20110602	03:36	-4.97	-4.83
8413320	20110602	03:42	-5.12	-4.97
8413320	20110602	03:48	-5.26	-5.11
8413320	20110602	03:54	-5.38	-5.24
8413320	20110602	04:00	-5.50	-5.35
8413320	20110602	04:06	-5.60	-5.42
8413320	20110602	04:12	-5.70	-5.54
8413320	20110602	04:18	-5.78	-5.54
8413320	20110602	04:24	-5.85	-5.57
8413320	20110602	04:30	-5.91	-5.76
8413320	20110602	04:36	-5.95	-5.62
8413320	20110602	04:42	-5.98	-5.76
8413320	20110602	04:48	-6.00	-5.71

8413320	20110602	04:54	-6.00	-5.75
8413320	20110602	05:00	-6.00	-5.68
8413320	20110602	05:06	-5.98	-5.64
8413320	20110602	05:12	-5.94	-5.79
8413320	20110602	05:18	-5.90	-5.68
8413320	20110602	05:24	-5.84	-5.70
8413320	20110602	05:30	-5.76	-5.59
8413320	20110602	05:36	-5.68	-5.44
8413320	20110602	05:42	-5.58	-5.37
8413320	20110602	05:48	-5.47	-5.22
8413320	20110602	05:54	-5.34	-5.20
8413320	20110602	06:00	-5.20	-5.01
8413320	20110602	06:06	-5.06	-4.85
8413320	20110602	06:12	-4.90	-4.72
8413320	20110602	06:18	-4.72	-4.59
8413320	20110602	06:24	-4.54	-4.29
8413320	20110602	06:30	-4.35	-4.10
8413320	20110602	06:36	-4.14	-3.82
8413320	20110602	06:42	-3.93	-3.60
8413320	20110602	06:48	-3.71	-3.43
8413320	20110602	06:54	-3.48	-3.15
8413320	20110602	07:00	-3.24	-2.94
8413320	20110602	07:06	-3.00	-2.59
8413320	20110602	07:12	-2.75	-2.40
8413320	20110602	07:18	-2.50	-2.12
8413320	20110602	07:24	-2.24	-1.90
8413320	20110602	07:30	-1.98	-1.59
8413320	20110602	07:36	-1.72	-1.31
8413320	20110602	07:42	-1.45	-1.10
8413320	20110602	07:48	-1.18	-0.74
8413320	20110602	07:54	-0.92	-0.49
8413320	20110602	08:00	-0.65	-0.19
8413320	20110602	08:06	-0.39	0.07
8413320	20110602	08:12	-0.13	0.32
8413320	20110602	08:18	0.13	0.60
8413320	20110602	08:24	0.39	0.91
8413320	20110602	08:30	0.64	1.18
8413320	20110602	08:36	0.89	1.39
8413320	20110602	08:42	1.13	1.64
8413320	20110602	08:48	1.36	1.87
8413320	20110602	08:54	1.59	2.05
8413320	20110602	09:00	1.81	2.29
8413320	20110602	09:06	2.02	2.44
8413320	20110602	09:12	2.22	2.73
8413320	20110602	09:18	2.42	2.86
8413320	20110602	09:24	2.61	3.03
8413320	20110602	09:30	2.79	3.18
8413320	20110602	09:36	2.95	3.41
8413320	20110602	09:42	3.11	3.54
8413320	20110602	09:48	3.26	3.69
8413320	20110602	09:54	3.40	3.84
8413320	20110602	10:00	3.52	4.03
8413320	20110602	10:06	3.64	4.07
8413320	20110602	10:12	3.74	4.11
8413320	20110602	10:18	3.84	4.23
8413320	20110602	10:24	3.92	4.29
8413320	20110602	10:30	3.99	4.36
8413320	20110602	10:36	4.05	4.37
8413320	20110602	10:42	4.09	4.38
8413320	20110602	10:48	4.13	4.43
8413320	20110602	10:54	4.15	4.41
8413320	20110602	11:00	4.16	4.39
8413320	20110602	11:06	4.16	4.41
8413320	20110602	11:12	4.14	4.38
8413320	20110602	11:18	4.12	4.41
8413320	20110602	11:24	4.08	4.35
8413320	20110602	11:30	4.03	4.35
8413320	20110602	11:36	3.96	4.27
8413320	20110602	11:42	3.89	4.21
8413320	20110602	11:48	3.80	4.11
8413320	20110602	11:54	3.70	4.03

8413320	20110602	12:00	3.59	3.90
8413320	20110602	12:06	3.47	3.79
8413320	20110602	12:12	3.33	3.61
8413320	20110602	12:18	3.19	3.53
8413320	20110602	12:24	3.03	3.35
8413320	20110602	12:30	2.87	3.17
8413320	20110602	12:36	2.70	3.01
8413320	20110602	12:42	2.51	2.81
8413320	20110602	12:48	2.32	2.66
8413320	20110602	12:54	2.12	2.43
8413320	20110602	13:00	1.91	2.24
8413320	20110602	13:06	1.70	1.99
8413320	20110602	13:12	1.48	1.80
8413320	20110602	13:18	1.26	1.54
8413320	20110602	13:24	1.03	1.27
8413320	20110602	13:30	0.79	1.03
8413320	20110602	13:36	0.55	0.79
8413320	20110602	13:42	0.31	0.53
8413320	20110602	13:48	0.08	0.26
8413320	20110602	13:54	-0.17	0.04
8413320	20110602	14:00	-0.41	-0.20
8413320	20110602	14:06	-0.65	-0.43
8413320	20110602	14:12	-0.89	-0.69
8413320	20110602	14:18	-1.13	-0.93
8413320	20110602	14:24	-1.36	-1.15
8413320	20110602	14:30	-1.59	-1.37
8413320	20110602	14:36	-1.81	-1.60
8413320	20110602	14:42	-2.04	-1.82
8413320	20110602	14:48	-2.25	-2.02
8413320	20110602	14:54	-2.46	-2.19
8413320	20110602	15:00	-2.66	-2.40
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8413320	20110602	15:12	-3.05	-2.76
8413320	20110602	15:18	-3.23	-2.96
8413320	20110602	15:24	-3.40	-3.12
8413320	20110602	15:30	-3.57	-3.33
8413320	20110602	15:36	-3.72	-3.45
8413320	20110602	15:42	-3.87	-3.58
8413320	20110602	15:48	-4.00	-3.71
8413320	20110602	15:54	-4.13	-3.82
8413320	20110602	16:00	-4.24	-3.94
8413320	20110602	16:06	-4.35	-4.03
8413320	20110602	16:12	-4.44	-4.13
8413320	20110602	16:18	-4.52	-4.19
8413320	20110602	16:24	-4.60	-4.26
8413320	20110602	16:30	-4.66	-4.33
8413320	20110602	16:36	-4.71	-4.36
8413320	20110602	16:42	-4.74	-4.41
8413320	20110602	16:48	-4.77	-4.46
8413320	20110602	16:54	-4.78	-4.48
8413320	20110602	17:00	-4.79	-4.48
8413320	20110602	17:06	-4.78	-4.46
8413320	20110602	17:12	-4.75	-4.46
8413320	20110602	17:18	-4.72	-4.44
8413320	20110602	17:24	-4.67	-4.40
8413320	20110602	17:30	-4.61	-4.35
8413320	20110602	17:36	-4.54	-4.29
8413320	20110602	17:42	-4.46	-4.22
8413320	20110602	17:48	-4.36	-4.11
8413320	20110602	17:54	-4.25	-3.98
8413320	20110602	18:00	-4.13	-3.89
8413320	20110602	18:06	-4.00	-3.72
8413320	20110602	18:12	-3.85	-3.55
8413320	20110602	18:18	-3.69	-3.38
8413320	20110602	18:24	-3.53	-3.20
8413320	20110602	18:30	-3.35	-3.01
8413320	20110602	18:36	-3.16	-2.83
8413320	20110602	18:42	-2.96	-2.62
8413320	20110602	18:48	-2.75	-2.41
8413320	20110602	18:54	-2.53	-2.18
8413320	20110602	19:00	-2.31	-1.97

8413320	20110602 19:06	-2.07	-1.70
8413320	20110602 19:12	-1.83	-1.44
8413320	20110602 19:18	-1.58	-1.17
8413320	20110602 19:24	-1.33	-0.92
8413320	20110602 19:30	-1.07	-0.64
8413320	20110602 19:36	-0.80	-0.38
8413320	20110602 19:42	-0.54	-0.10
8413320	20110602 19:48	-0.27	0.20
8413320	20110602 19:54	0.00	0.49
8413320	20110602 20:00	0.28	0.75
8413320	20110602 20:06	0.55	1.05
8413320	20110602 20:12	0.82	1.35
8413320	20110602 20:18	1.09	1.61
8413320	20110602 20:24	1.36	1.89
8413320	20110602 20:30	1.62	2.16
8413320	20110602 20:36	1.89	2.43
8413320	20110602 20:42	2.14	2.67
8413320	20110602 20:48	2.39	2.92
8413320	20110602 20:54	2.64	3.14
8413320	20110602 21:00	2.87	3.37
8413320	20110602 21:06	3.11	3.61
8413320	20110602 21:12	3.33	3.83
8413320	20110602 21:18	3.54	4.01
8413320	20110602 21:24	3.75	4.20
8413320	20110602 21:30	3.94	4.38
8413320	20110602 21:36	4.13	4.57
8413320	20110602 21:42	4.30	4.72
8413320	20110602 21:48	4.47	4.88
8413320	20110602 21:54	4.62	5.02
8413320	20110602 22:00	4.76	5.17
8413320	20110602 22:06	4.90	5.30
8413320	20110602 22:12	5.01	5.39
8413320	20110602 22:18	5.12	5.49
8413320	20110602 22:24	5.21	5.57
8413320	20110602 22:30	5.30	5.66
8413320	20110602 22:36	5.36	5.73
8413320	20110602 22:42	5.42	5.78
8413320	20110602 22:48	5.47	5.81
8413320	20110602 22:54	5.50	5.84
8413320	20110602 23:00	5.52	5.87
8413320	20110602 23:06	5.52	5.89
8413320	20110602 23:12	5.51	5.88
8413320	20110602 23:18	5.49	5.85
8413320	20110602 23:24	5.45	5.79
8413320	20110602 23:30	5.40	5.73
8413320	20110602 23:36	5.34	5.68
8413320	20110602 23:42	5.27	5.60
8413320	20110602 23:48	5.18	5.50
8413320	20110602 23:54	5.08	5.41

Begin Date: Jun 2 2011 **End Date:** Jun 2 2011 **Interval:** Six minute WL **Datum:** NAVD **Data Units:** Feet / Meters **Time Zone:** Local (LST/LDT) / GMT / LST

View Plot View Data Reset

APPENDIX 3

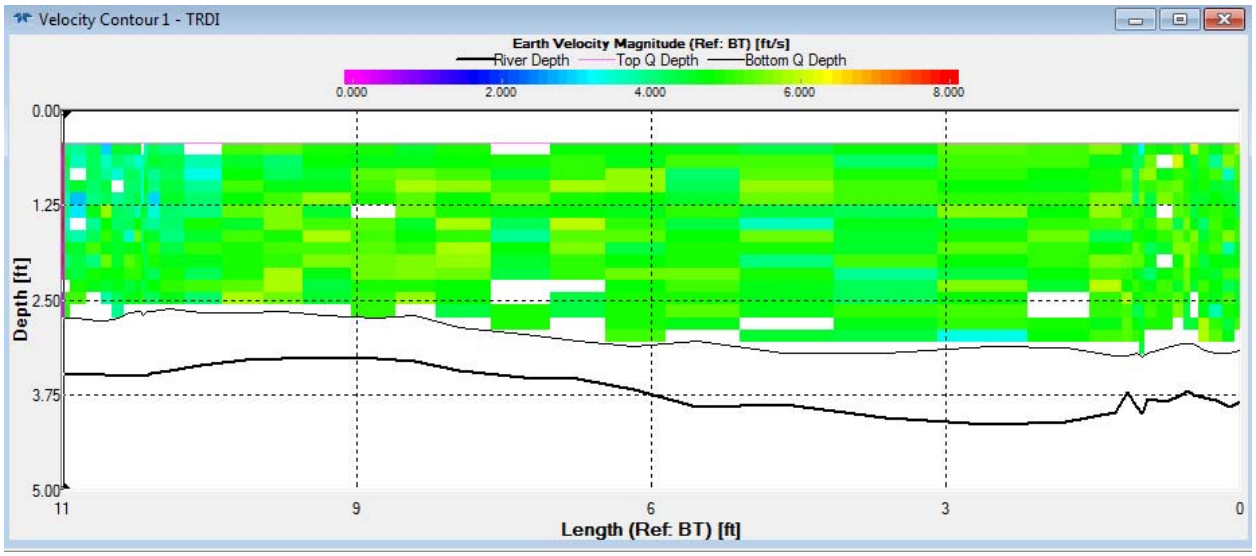
Flow Measurements by USGS at Bass Harbor Bridge

Appendix Insert # 3. Tremont Preliminary Design H/H Report

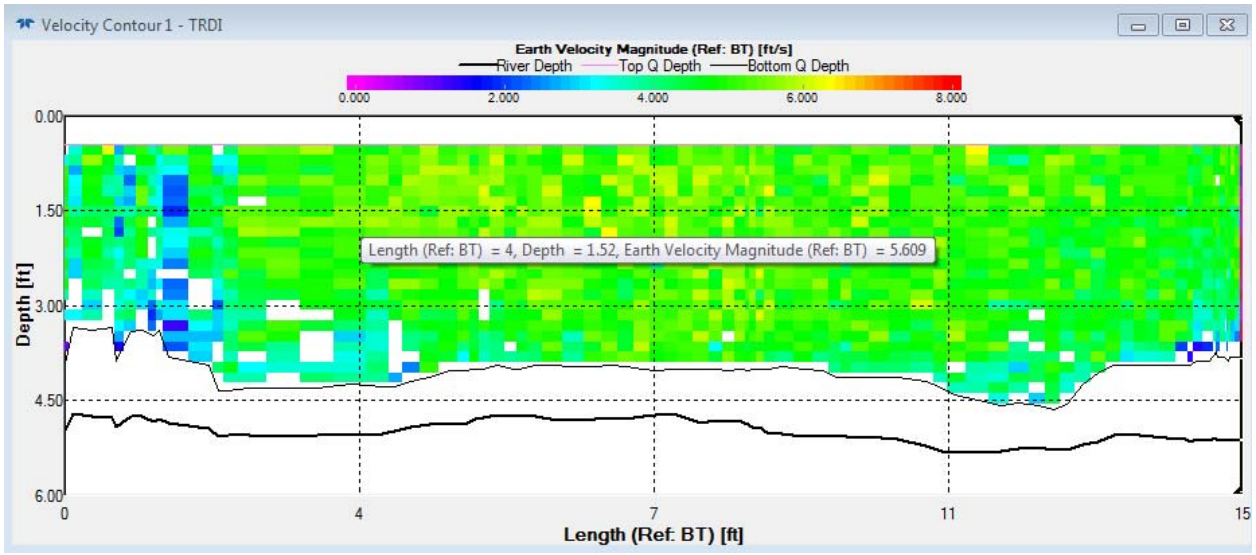
Flow Data at Bass Harbor Marsh
Furnished by USGS
Flow measurements as described below.

Outflow is approx. 15’ downstream from DS face of bridge
Inflow (neg. flows) are approx. 5’ upstream from the DS face of bridge (this is under the bridge)

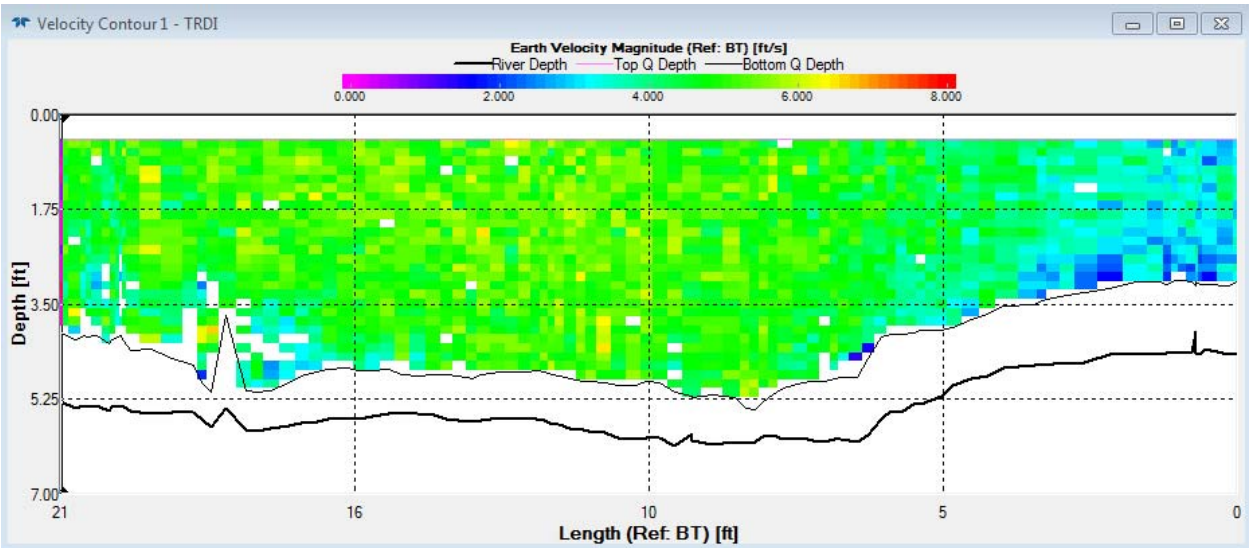
205 CFS into marsh (-205 cfs)



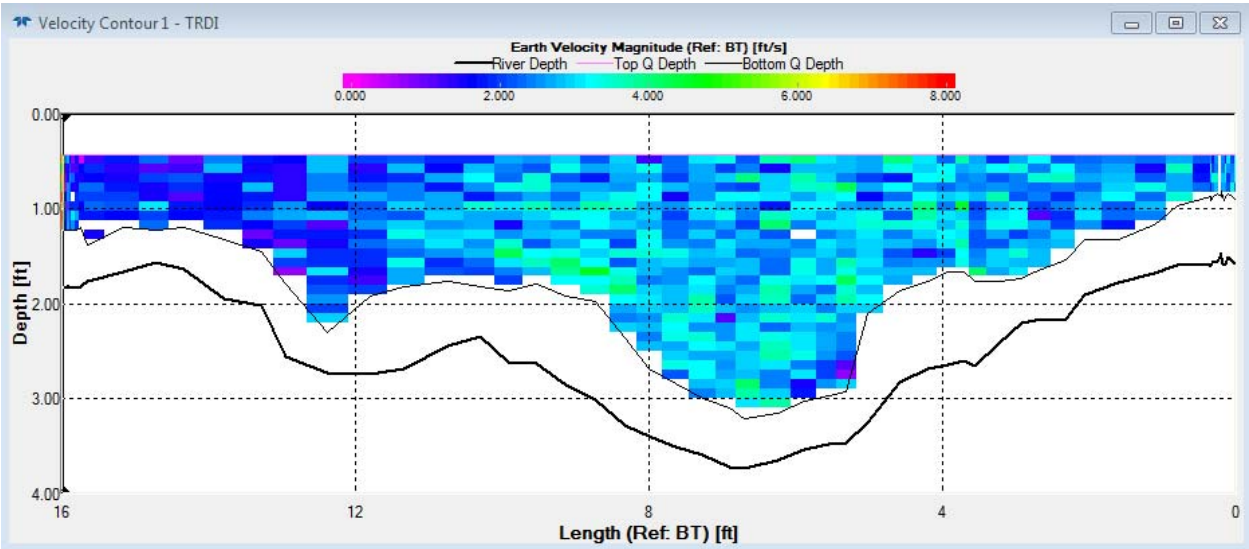
314 CFS into marsh (-314 cfs)



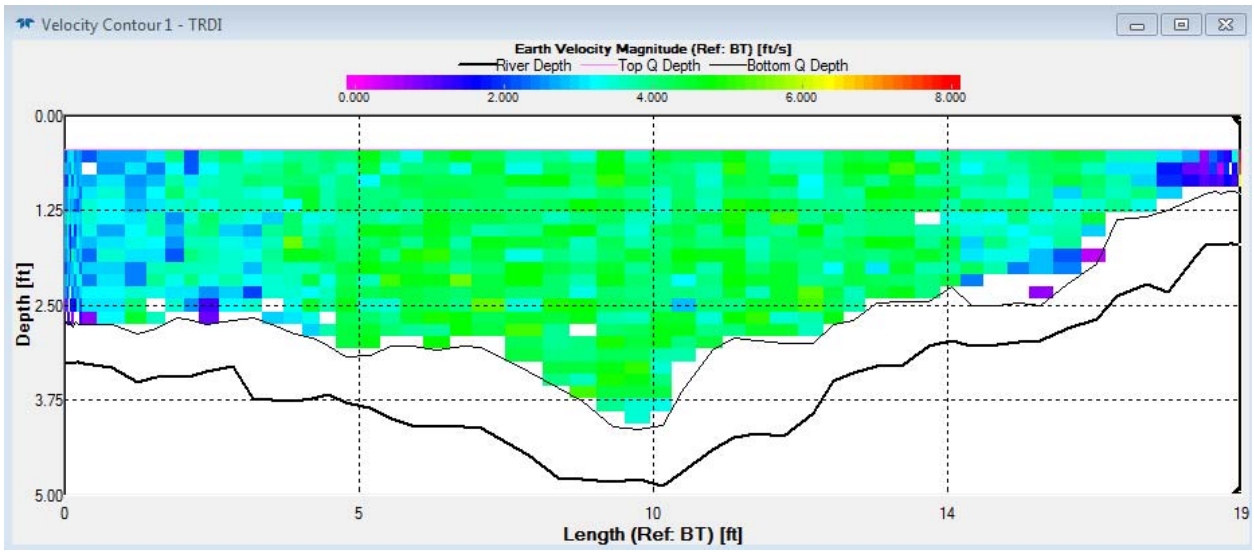
451 CFS into marsh (-451 cfs)



91 cfs out of marsh (91 cfs)

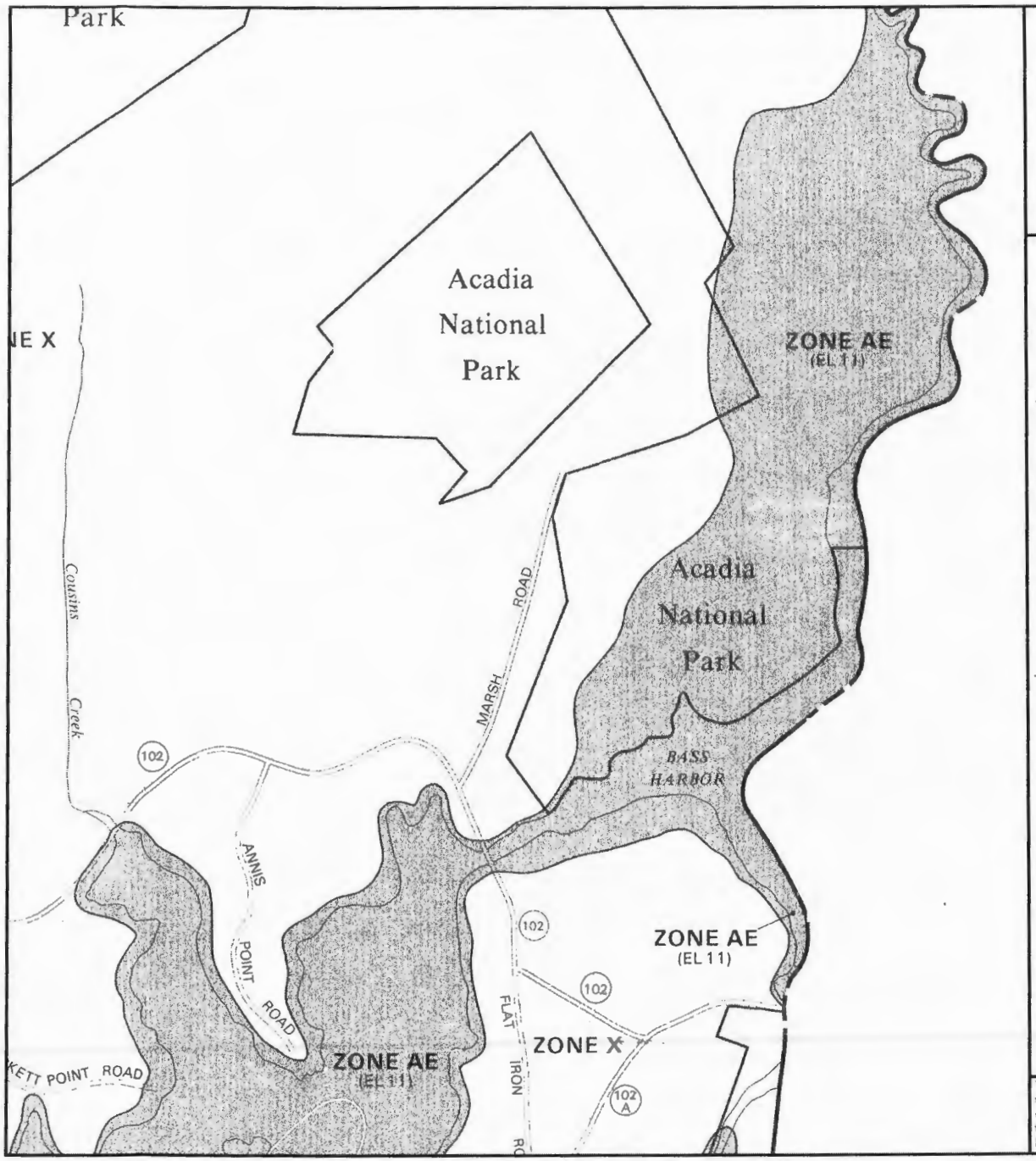


250 cfs out of marsh (250 cfs)


Velocity Contour 1 - TRDI
Earth Velocity Magnitude (Ref: BT) [ft/s]
River Depth
Top Q Depth
Bottom Q Depth
0.000
2.000
4.000
6.000
8.000
0.00
1.25
2.50
3.75
5.00
Depth [ft]
0
5
10
14
19
Length (Ref: BT) [ft]

APPENDIX 4

FEMA Flood Insurance Study



APPROXIMATE SCALE

1000 0 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

TOWN OF
TREMONT, MAINE
HANCOCK COUNTY

PANEL 15 OF 20
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
230298 0015 B

EFFECTIVE DATE:
AUGUST 2, 1990

Federal Emergency Management Agency

TABLE 3 - TRANSECT DATA - continued

Flooding Source	Stillwater Elevation 10-Year	50-Year	100-Year	500-Year	Zone	Base Flood Elevation (Feet NGVD)*
ATLANTIC OCEAN (continued)						
Transect 6	9.6	10.4	10.7	11.5	VE	14
Transect 7	9.6	10.4	10.7	11.5	VE	13-14
					AE	11-13
Transect 8	9.6	10.4	10.7	11.5	VE	13-15
					AE	11-13
Transect 9	9.6	10.4	10.7	11.5	VE	13-14
					AE	11-13
Transect 10	9.6	10.4	10.7	11.5	VE	18
Transect 11	9.6	10.4	10.7	11.5	VE	13-18
					AE	11-13
Transect 12	9.6	10.4	10.7	11.5	VE	13-26
					AE	11-13
Transect 13	9.6	10.4	10.7	11.5	VE	16

*Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 2).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For tidal areas without wave action, the 100- and 500-year floodplain boundaries have been delineated using topographic maps at a scale of 1:24,000 with contour intervals of 10 and 20 feet and 6 meters (Reference 6). For the tidal areas with wave action, the flood boundaries were

TABLE 2 - TRANSECT DESCRIPTIONS - continued

Transect	Location	Elevation (Feet NGVD) Stillwater 100-year	Maximum Wave Elevation[1] 100-Year
No. 10	From a point approximately 2,000 feet northwest of Lopaus Point to Lopaus Point	10.7	18[2]
No. 11	From Lopaus Point to Bass Harbor Head	10.7	18[2]
No. 12	From Bass Harbor Head to southern corporate limits	10.7	26[2]
No. 13	Great Gott Island and Little Gott Island	10.7	16[3]

[1]Due to map scale limitations, the maximum wave elevation may not be shown on the FIRM
[2]Maximum wave runup elevation
[3]Maximum wave height elevation

Along each transect, wave envelope elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The computer program produces a maximum wave runup elevation that defines the inland extent of flooding (Reference 3). Wave envelopes are constructed for each transect by extending the maximum wave runup elevation seaward to its intersection with the wave profile determined by the NAS wave height analyses (Reference 4). Between transects, elevations were interpolated using the topographic maps, land-use and land-cover data, and engineering judgment to determine the areal extent of flooding. The results of the calculations are accurate until local topography, vegetation, or cultural development within the community undergo any major changes. The results of this analysis are summarized in Table 3.

TABLE 3 - TRANSECT DATA

Flooding Source	Stillwater Elevation 10-Year	50-Year	100-Year	500-Year	Zone	Base Flood Elevation (Feet NGVD)*
ATLANTIC OCEAN						
Transect 1	9.6	10.4	10.7	11.5	VE	15
					AE	11-13
Transect 2	9.6	10.4	10.7	11.5	VE	17
Transect 3	9.6	10.4	10.7	11.5	VE	14
Transect 4	9.6	10.4	10.7	11.5	VE	13-15
					AE	11-13
Transect 5	9.6	10.4	10.7	11.5	VE	13-19
					AE	11-13

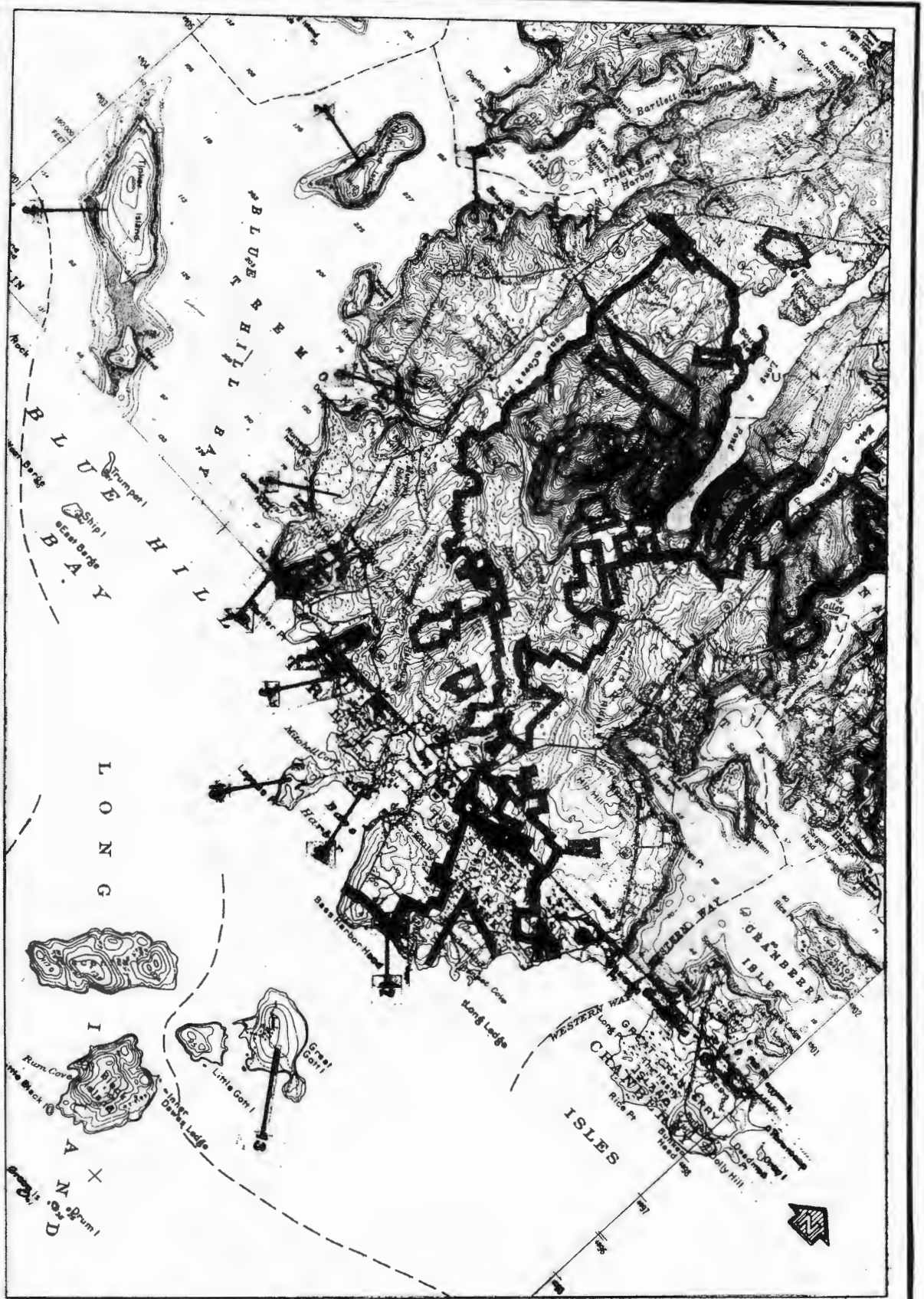


FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF TREMONT, ME
(HANCOCK CO.)

APPROXIMATE SCALE
0 1 2 3 MILES

TRANSECT LOCATION MAP

APPENDIX 5

ACOE Tidal Flood Profiles

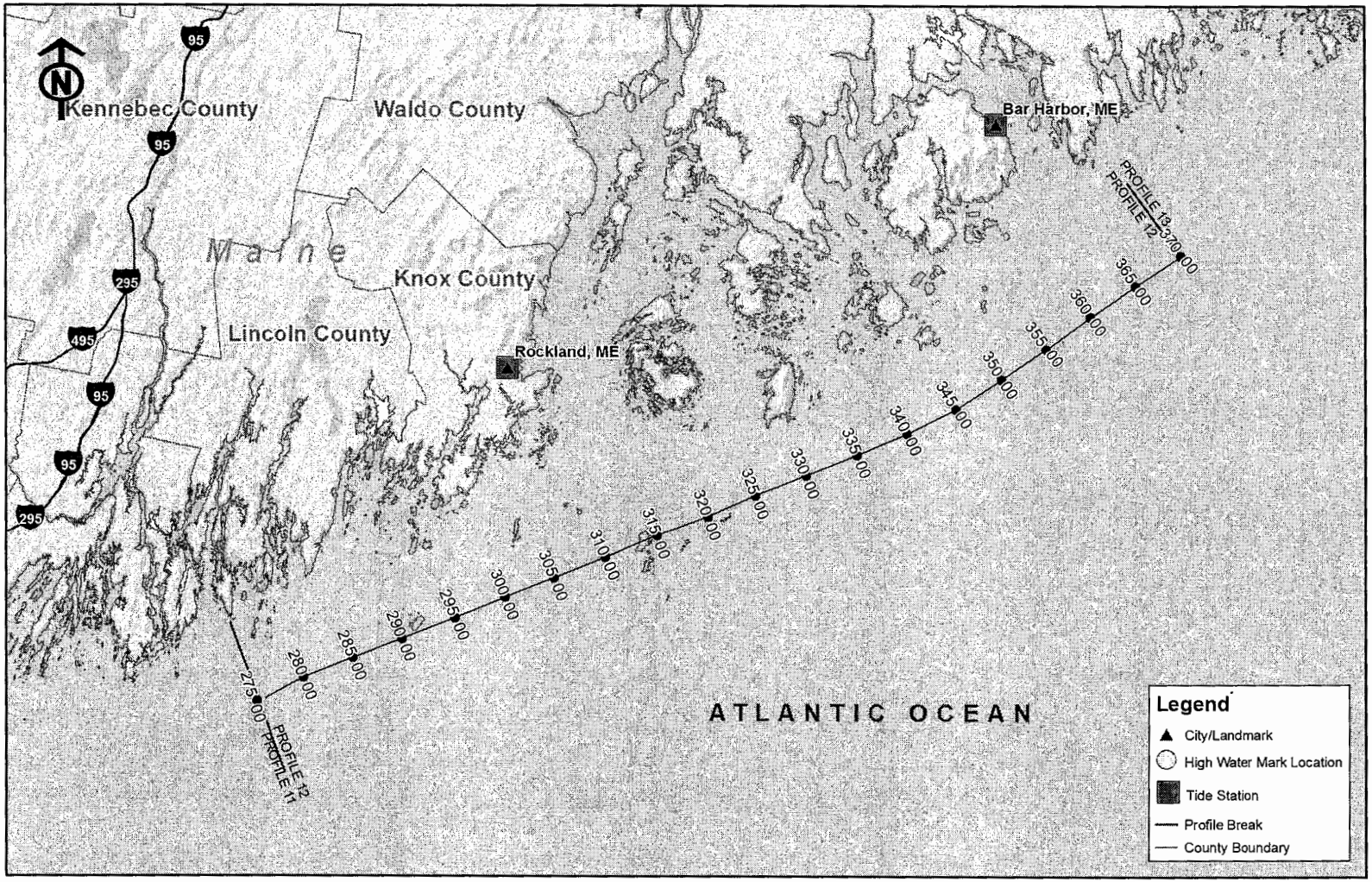


Figure B14. Base Map for Profile 12 from mile 275 to mile 370

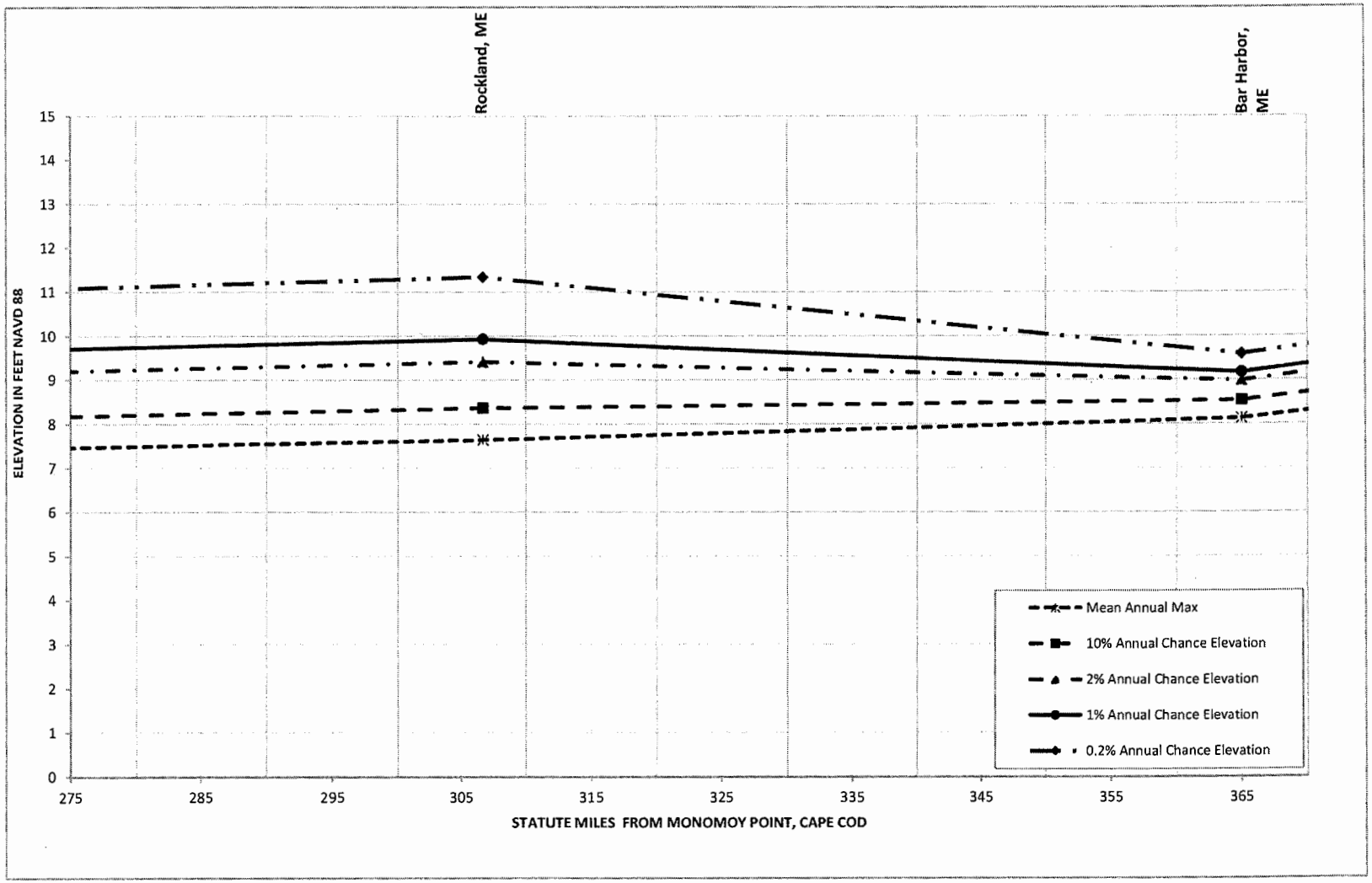


Figure C14. Tidal Flood Profile 12 from mile 275 to mile 370

Table 3. The mean annual and x-percent-annual-chance flood elevations in feet (NAVD), as estimated from the Wakeby distribution.

Station (Region)	Mean annual elevation in feet (NAVD)	10-percent elevation in feet (NAVD)	2-percent elevation in feet (NAVD)	1-percent elevation in feet (NAVD)	0.2-percent elevation in feet (NAVD)
Eastport (5)	13.04	13.70	14.42	14.72	15.39
Cutler (5)	9.76	10.25	10.79	11.02	11.52
Bar Harbor (5)	8.12	8.53	8.98	9.17	9.58
Portland (4)	7.32	8.01	9.01	9.51	10.85
Seavey Island (4)	7.30	7.99	8.98	9.48	10.83
Boston (4)	7.72	8.45	9.51	10.04	11.46
Woods Hole (3)	3.40	4.24	6.60	8.36	15.78
New Bedford (3)	4.83	6.01	9.36	11.86	22.39
Newport (3)	4.28	5.33	8.30	10.52	19.85
Providence (3)	5.61	6.98	10.88	13.79	26.02
New London (3)	3.83	4.76	7.42	9.40	17.74
Bridgeport (2)	6.30	7.79	9.33	9.95	11.30
Stamford (2)	6.86	8.49	10.17	10.85	12.32
Montauk (2)	3.70	4.57	5.48	5.84	6.63
Port Jefferson (2)	6.20	7.67	9.18	9.80	11.12
Willets Point (2)	7.22	8.93	10.70	11.41	12.96
New Rochelle (2)	6.60	8.17	9.79	10.44	11.85
The Battery (1)	4.97	5.87	6.92	7.36	8.38
Bergen Point (1)	5.11	6.04	7.11	7.57	8.62

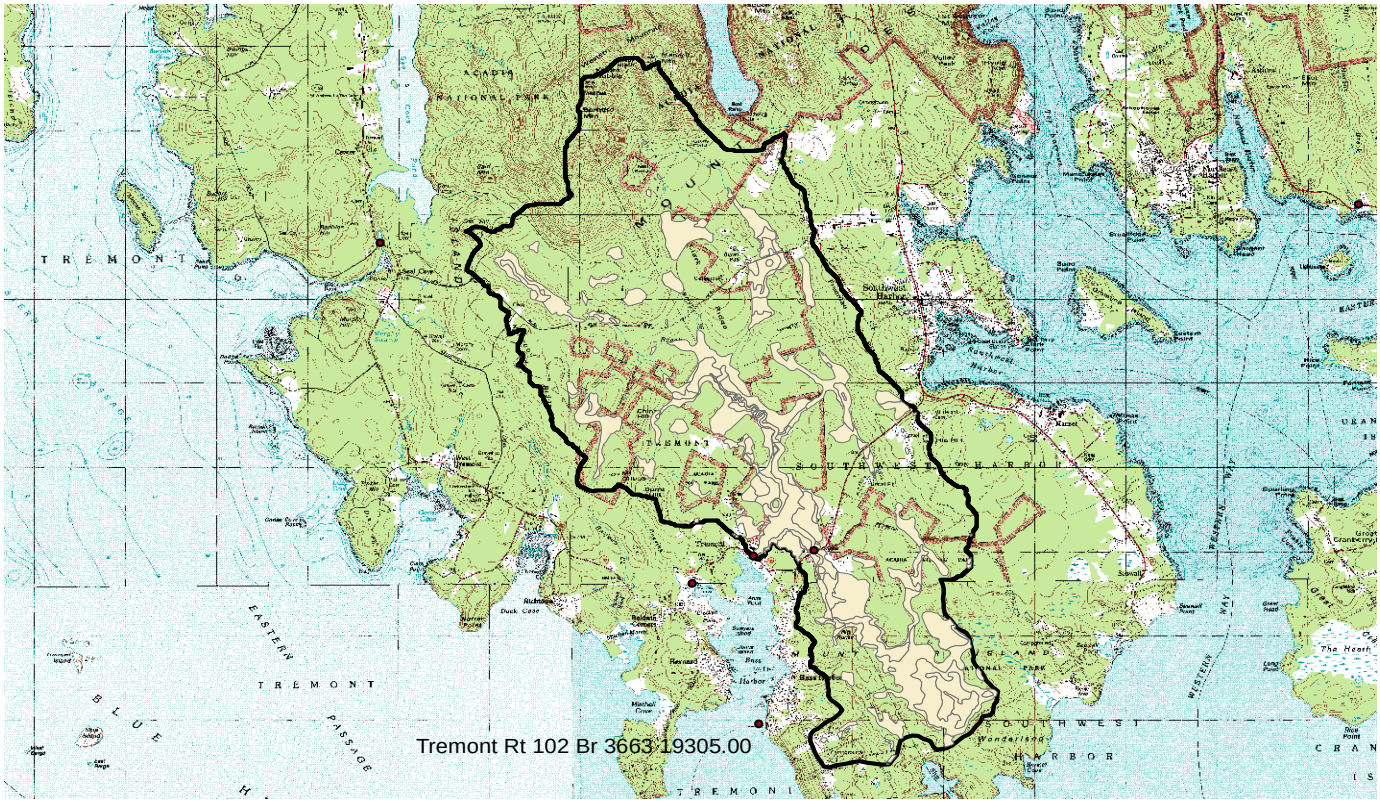
Table 4. Ratios of the x-percent chance flood to the mean annual elevation for the five homogeneous regions.

Region	10-percent	2-percent	1-percent	0.2-percent
1	1.18	1.39	1.48	1.69
2	1.24	1.48	1.58	1.80
3	1.24	1.94	2.46	4.64
4	1.09	1.23	1.30	1.48
5	1.05	1.11	1.13	1.18

For example, the 1-percent-annual-chance elevation for New London in Region 3 is obtained by multiplying the mean annual elevation of 3.827 feet by 2.46 to obtain a 1-percent-annual-chance elevation of 9.41 feet (NAVD), as shown in Table 3. Estimates for other x-percent elevations were made through the same process.

APPENDIX 6

MDOT Streamflow Calculations


Tremont Rt 102 Br 3663 19305.00

Project Name:	Tremont	**PIN:**	19305.00
Stream Name:	Marshall Brook	**Town:**	Tremont
Bridge Name:	Clark Bridge	**Bridge No.**	3663
Route No.	102	**USGS Quad:**	
Analysis by:	AWM	**Date:**	1/11/2012

Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999)

Enter data in blue cells only!

	km²	mi²	ac	
A	22.31	8.61	5512.0	Watershed Area
W	5.00	1.93	1235.8	Wetlands area (by NWI)
P_c	552140	4901831		watershed centroid (E, N; UTM 19N; meters)
County	Hancock			*choose county from drop-down menu*
pptA	45.2			mean annual precipitation (inches; by look-up)
SG	0.00			sand & gravel aquifer as decimal fraction of watershed A

Enter data in [mi²]

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

A (km²)	22.31	**Conf Lvl**	0.67
W (%)	22.42		

Ret Pd T (yr)	Peak Flow Estimate Lower	Q_T (m³/s)	Upper	Q_T (ft³/s)
1.1		2.01		70.9
2	2.68	3.79	5.35	133.8
5	3.98	5.63	7.96	198.8
10	4.85	6.94	9.94	245.1
25	5.97	8.68	12.63	306.6
50	6.80	10.01	14.75	353.6
100	7.68	11.46	17.09	404.7
500	9.65	14.88	22.96	525.5

Reference:

Hodgkins, G., 1999.
Estimating the magnitude of peak flows for streams in Maine for selected recurrence intervals
Water-Resources Investigations Report 99-4008
US Geological Survey, Augusta, Maine

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

Equation Coefficients

b	a	w
1.075	0.848	-0.0266
1.952	0.820	-0.0288
2.674	0.806	-0.0300
3.740	0.790	-0.0312
4.637	0.780	-0.0320
5.629	0.771	-0.0326
8.283	0.754	-0.0340

Error Bounds Calcs

x_o								
1	1.34843143	22.42					Conf Lvl	0.67
1.34843143							α	0.33
22.42							$t_{(\alpha/2,67)}$	0.981

Error Multiplier Matrices $(X^T\Lambda^{-1}X)^{-1}$

						Sampling Err SE_S^2	Est Model Var SE_M^2	SE_P	Lower Limit	Upper Limit
2-yr										
5.81E-03	-1.50E-03	-1.05E-04	0.001437	-0.000784	0.000100967	0.0026	0.0206	0.152	2.685	5.347
-1.50E-03	6.05E-04	-4.40E-06								
-1.05E-04	-4.40E-06	9.45E-06								
5-yr										
6.57E-03	-1.69E-03	-1.24E-04	0.001513	-0.000891	9.5639E-05	0.0025	0.0211	0.153	3.980	7.964
-1.69E-03	6.69E-04	-4.39E-06								
-1.24E-04	-4.39E-06	1.01E-05								
10-yr										
7.49E-03	-1.93E-03	-1.24E-04	0.002117	-0.00102	0.000114025	0.0033	0.0220	0.159	4.846	9.942
-1.93E-03	7.47E-04	-4.52E-06								
-1.24E-04	-4.52E-06	1.09E-05								
25-yr										
8.89E-03	-2.28E-03	-1.41E-04	0.002656	-0.001217	0.000127199	0.0039	0.0236	0.166	5.971	12.626
-2.28E-03	8.68E-04	-4.87E-06								
-1.41E-04	-4.87E-06	1.22E-05								
50-yr										
1.00E-02	-2.57E-03	-1.55E-04	0.003086	-0.001377	0.00013838	0.0043	0.0250	0.171	6.801	14.745
-2.57E-03	9.68E-04	-5.20E-06								
-1.55E-04	-5.20E-06	1.34E-05								
100-yr										
1.12E-02	-2.86E-03	-1.69E-04	0.003527	-0.001541	0.000150044	0.0048	0.0265	0.177	7.684	17.094
-2.86E-03	1.07E-03	-5.57E-06								
-1.69E-04	-5.57E-06	1.46E-05								
500-yr										
1.41E-02	-3.59E-03	-2.06E-04	0.004588	-0.001948	0.000180934	0.0060	0.0308	0.192	9.646	22.958
-3.59E-03	1.33E-03	-6.66E-06								
-2.06E-04	-6.66E-06	1.77E-05								

μ (log)	0.58
s (log)	2.064E-01

Flood Frequency Curve

			Log-Normal Distn					
Ret Pd T	Cum Prob F	Q_T (m3/s usgs)	norm std var z	log (Q m3/s)	Q (m^3/s)	Q (ft^3/s)	log (Q ft3/s)	Q_T (ft3/s usgs)
1.001	0.001		-3.091	-0.06	0.87	30.77	1.49	
1.002	0.002		-2.879	-0.02	0.96	34.03	1.53	
1.010	0.010		-2.330	0.10	1.25	44.17	1.65	
1.050	0.048		-1.668	0.23	1.71	60.50	1.78	
1.100	0.091		-1.335	0.30	2.01	70.88	1.85	
1.250	0.200		-0.842	0.40	2.54	89.62	1.95	
1.500	0.333		-0.431	0.49	3.09	108.95	2.04	
1.750	0.429		-0.180	0.54	3.48	122.74	2.09	
2	0.500	3.79	0.000	0.58	3.79	133.70	2.13	133.70
5	0.800	5.63	0.842	0.75	5.65	199.47	2.30	198.67
6.300	0.841		1.000	0.78	6.09	215.04	2.33	
10	0.900	6.94	1.282	0.84	6.97	245.87	2.39	244.93
20	0.950		1.645	0.92	8.28	292.22	2.47	
25	0.960	8.68	1.751	0.94	8.71	307.29	2.49	306.39
50	0.980	10.01	2.054	1.00	10.06	354.91	2.55	353.36
100	0.990	11.46	2.326	1.06	11.45	404.01	2.61	404.41
200	0.995		2.576	1.11	12.89	454.87	2.66	
500	0.998	14.88	2.878	1.17	14.88	525.17	2.72	525.13
1000	0.999		3.090	1.22	16.46	580.88	2.76	

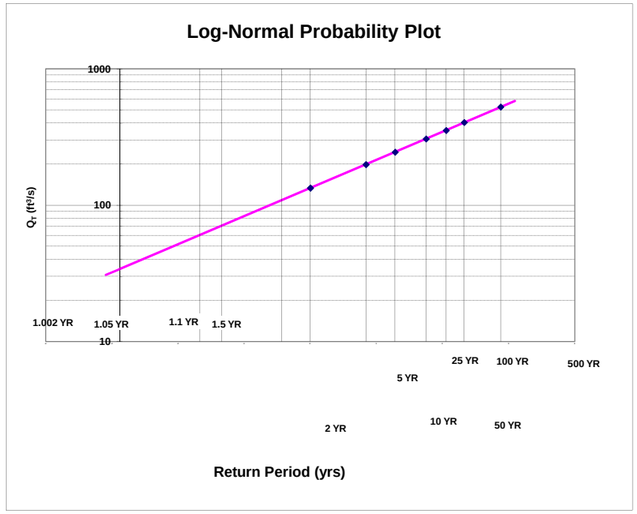
Adjust Q_T Vertical Plot Scale to Contain FF Curve

"right click" QT scale and set min, max scale values

	Min $Q_{1.002}$	Max Q_{500}
Q	34.03	525.17
log(Q)	1.53	2.72
scale Q	***10.00***	***1000.00***

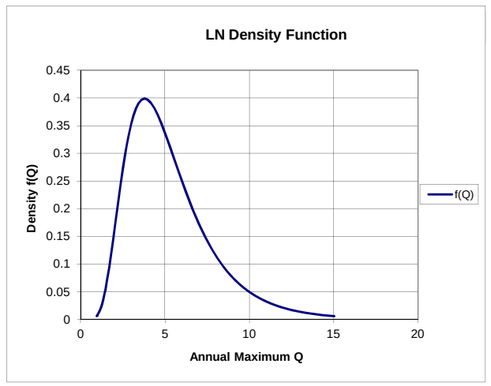
Log Normal Density Curve

z_p	log(Q)	Q	f
-2.9	-0.020	0.95	0.00595
-2.8	0.001	1.00	0.00792
-2.7	0.021	1.05	0.01042
-2.6	0.042	1.10	0.01358
-2.5	0.062	1.15	0.01753
-2.4	0.083	1.21	0.02239
-2.3	0.104	1.27	0.02833
-2.2	0.124	1.33	0.03547
-2.1	0.145	1.40	0.04398
-2	0.166	1.46	0.05399
-1.9	0.186	1.54	0.06562
-1.8	0.207	1.61	0.07895
-1.7	0.228	1.69	0.09405
-1.6	0.248	1.77	0.11092
-1.5	0.269	1.86	0.12952
-1.4	0.290	1.95	0.14973
-1.3	0.310	2.04	0.17137
-1.2	0.331	2.14	0.19419
-1.1	0.351	2.25	0.21785
-1	0.372	2.36	0.24197
-0.9	0.393	2.47	0.26609
-0.8	0.413	2.59	0.28969
-0.7	0.434	2.72	0.31225
-0.6	0.455	2.85	0.33322
-0.5	0.475	2.99	0.35207
-0.4	0.496	3.13	0.36827
-0.3	0.517	3.29	0.38139
-0.2	0.537	3.45	0.39104
-0.1	0.558	3.61	0.39695
0	0.579	3.79	0.39894
0.1	0.599	3.97	0.39695
0.2	0.620	4.17	0.39104
0.3	0.640	4.37	0.38139
0.4	0.661	4.58	0.36827
0.5	0.682	4.81	0.35207
0.6	0.702	5.04	0.33322
0.7	0.723	5.28	0.31225
0.8	0.744	5.54	0.28969
0.9	0.764	5.81	0.26609
1	0.785	6.09	0.24197
1.1	0.806	6.39	0.21785
1.2	0.826	6.70	0.19419
1.3	0.847	7.03	0.17137
1.4	0.868	7.37	0.14973
1.5	0.888	7.73	0.12952
1.6	0.909	8.11	0.11092
1.7	0.929	8.50	0.09405
1.8	0.950	8.91	0.07895
1.9	0.971	9.35	0.06562
2	0.991	9.80	0.05399
2.1	1.012	10.28	0.04398
2.2	1.033	10.78	0.03547
2.3	1.053	11.31	0.02833
2.4	1.074	11.86	0.02239
2.5	1.095	12.43	0.01753
2.6	1.115	13.04	0.01358
2.7	1.136	13.67	0.01042
2.8	1.157	14.34	0.00792
2.9	1.177	15.04	0.00595



Ret Pd Grid Lines

Q	1.002	1.05	1.1	1.5	2 yr	5 yr	10 yr	20 yr	25 yr	50 yr	100 yr	500 yr
10.00	-2.879	-1.668	-1.335	-0.431	0.000	0.842	1.282	1.645	1.751	2.054	2.326	2.878
1000	-2.879	-1.668	-1.335	-0.431	0.000	0.842	1.282	1.645	1.751	2.054	2.326	2.878



Project Name:	Tremont	**PIN:**	19305.00
Stream Name:	Marshall Brook	**Town:**	Tremont
Bridge Name:	Clark Bridge	**Bridge No.**	3987
Route No.	102	**USGS Quad:**	
Analysis by:	AWM	**Date:**	1/11/2012

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

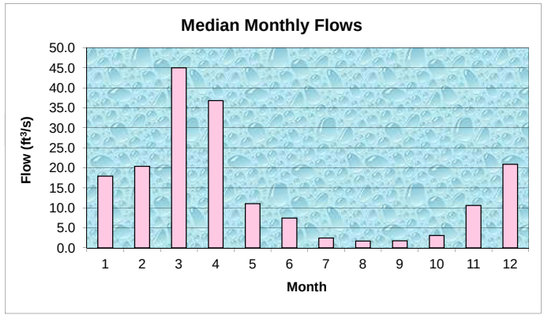
MAINE MONTHLY MEDIAN FLOWS BY USGS REGRESSION EQUATIONS (2004)

Value	Variable	Explanation
8.613	*A*	Area (mi^2)
552140 4901831	P_c	Watershed centroid (E,N; UTM; Zone 19; meters)
22.53	*DIST*	Distance from Coastal reference line (mi)
45.2	*pptA*	Mean Annual Precipitation (inches)
0.00	*SG*	Sand & Gravel Aquifer (decimal fraction of watershed area)

Worksheet prepared by:
Charles S. Hebson, PE
Chief Hydrologist
Maine Dept. Transportation
Augusta, ME 04333-0016
207-624-3073
Charles.Hebson@maine.gov

Eqn Form: $Q = cA^aDIST^d10^{(pptA)p}10^{(SG)s}$

	Month	Q_{median} (ft3/s)	(m^3/s)
1	Jan	**17.95**	0.5087
2	Feb	**20.41**	0.5783
3	Mar	**45.02**	1.2757
4	Apr	**36.82**	1.0435
5	May	**11.03**	0.3126
6	Jun	**7.45**	0.2110
7	Jul	**2.49**	0.0706
8	Aug	**1.70**	0.0480
9	Sep	**1.78**	0.0504
10	Oct	**3.10**	0.0879
11	Nov	**10.62**	0.3008
12	Dec	**20.91**	0.5925
	Q_{bf}	**49.8**	
	ann avg	**17.7**	
	ann med	**9.2**	
	$Q_{1.002}$	**34.0**	
	$Q_{1.01}$	44.2	
	$Q_{1.05}$	60.5	
	W_{bf}	23.3	
	d_{bf}	1.8	
	Q_{bf}	170.0 assume v = 4ft/s	



Regression Equation Coefficients

	c	a	d	p	s
Jan	20.710	1.036	-0.762	0	0
Feb	36.540	1.017	-0.890	0	0
Mar	183.700	0.999	-1.142	0	0
Apr	0.227	1.010	0	0.028	0
May	0.262	1.070	0.461	0	0
Jun	0.734	1.076	0	0	0
Jul	0.210	1.149	0	0	1.02
Aug	0.152	1.120	0	0	1.31
Sep	0.169	1.093	0	0	1.25
Oct	0.307	1.074	0	0	1.11
Nov	1.222	1.004	0	0	0
Dec	12.000	1.000	-0.513	0	0
bf	5.190	1.050			
ann avg	1.151	0.991	0.023		
ann med	0.239	1.006	0.057		
	7.620	0.520			
	0.594	0.340			

DIST Calculations (distance from watershed centroid to reference line in Gulf of Maine)

Reference Line Endpoints (UTM, Zone 19, NAD83,meters)

	x	y	Long	Lat
P_1	336321.28	4734992.89	71.0W	42.75N
P_2	775853.73	4988911.83	65.5W	45.0N
P_C	552140.00	4901831.00		

tan(β)	0.578	β	0.524 rad
tan(α)	0.773	α	0.658 rad
		θ	0.134 rad

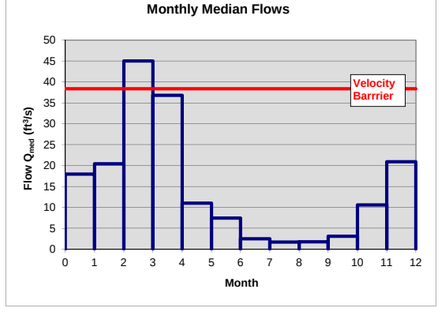
P_{1C} 272786.9 meters
P_{PC} 36505.3 meters = 22.53 miles

Annual Precip by County

Androscoggin	45.3	
Aroostook C	36.1	Presque Isle
Aroostook N	36.1	Ft Kent
Aroostook S	39.0	Houlton
Cumberland NW	43.4	NW of SR 11
Cumberland SE	44.4	SE of SR 11
Franklin	45.6	
Hancock	45.2	
Kennebec	41.7	
Knox	46.1	
Lincoln	46.1	
Oxford E	43.0	E of SR 26
Oxford W	43.8	W of SR 26
Penobscot N	41.5	N of Can-Atl RR
Penobscot S	39.5	S of Can-Atl RR
Piscataquis N	38.5	N of Can-Atl RR
Piscataquis S	41.0	S of Can-Atl RR
Sagadahoc	45.3	
Somerset N	37.3	N of Can-Atl RR
Somerset S	39.5	S of Can-Atl RR
Waldo	47.2	
Washington	44.2	
York	46.7	

Line Graph

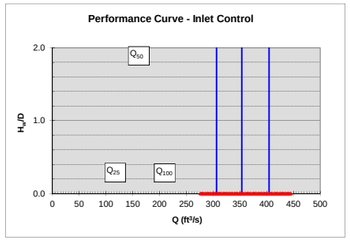
	X - Month	Y - Qmed	Velo Barrier	
Month Index	0			
1 Jan	0	0	0	38.35
2 Feb	0	17.95	12	38.35
3 Mar	1	17.95		
4 Apr	1	0		
5 May	1	0		
6 Jun	1	20.41		
7 Jul	2	20.41		
8 Aug	2	0		
9 Sep	2	0		
10 Oct	2	45.02		
11 Nov	3	45.02		
12 Dec	3	0		
	3	0		
	3	36.82		
	4	36.82		
	4	0		
	4	0		
	4	11.03		
	5	11.03		
	5	0		
	5	0		
	5	7.45		
	6	7.45		
	6	0		
	6	0		
	6	2.49		
	7	2.49		
	7	0		
	7	0		
	7	1.70		
	8	1.70		
	8	0		
	8	0		
	8	1.78		
	9	1.78		
	9	0		
	9	0		
	9	3.10		
	10	3.10		
	10	0		
	10	0		
	10	10.62		
	11	10.62		
	11	0		
	11	0		
	11	20.91		
	12	20.91		
	12	0		

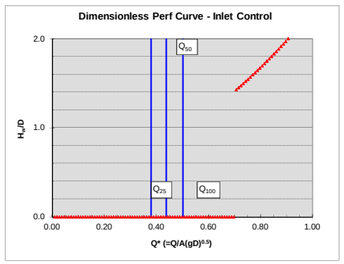


NOTE: ***This page is for preliminary sizing only.***
Final design should be done with HY8 or HDS-5

Preliminary Culvert Sizing - Round Pipes

Type:	Circ CMP Proj	Q_{25}	306.6		
D (ft)	8	Q_{50}	353.6	trial D =	7.92
w (ft)	-99 *box width*	Q_{100}	404.7		
Slope (ft/ft)	0.02				
A (ft^2)	50.27				
g	32.2				





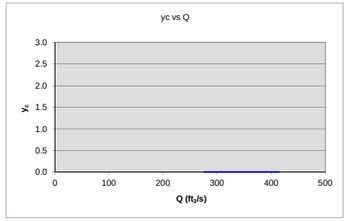
	K	M	c	Y	shape factor
Box 30-75 ww	0.026	1	0.0347	0.81	
Box 90-15 ww	0.026	1	0.0347	0.81	
Circ CMP Proj	0.034	1.5	0.0553	0.54	
Circ RCP Proj	0.0045	2	0.0317	0.69	
Circ CMP Proj	0.034	1.5	0.0553	0.54	(dim'less coef)

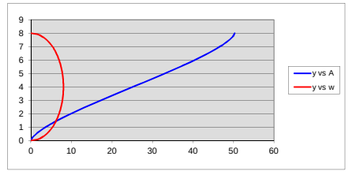
	Nat	Log	
Qmin	275.92	2.441	$AD^{0.5}$
Qmax	445.14	2.648	142.17
NQ	100	100	
ΔQ	1.71	0.002	

A	50.26548
d	8
r	4

n	Q	log(Q)	$Q/AD^{0.5}$	Hw/D	Hw	Transition	Submerged	Unsubmerged Q^2/g	y_c	Ac	Hc	H_w/D	Hw
1	275.92	2.441	1.94	#NAME?			0.75	2364.425	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
2	277.63	2.443	1.95	#NAME?			0.75	2393.808	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
3	279.34	2.445	1.96	#NAME?			0.75	2423.373	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
4	281.05	2.447	1.98	#NAME?			0.76	2453.119	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
5	282.76	2.449	1.99	#NAME?			0.76	2483.047	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6	284.47	2.451	2.00	#NAME?			0.76	2513.156	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7	286.18	2.453	2.01	#NAME?			0.76	2543.447	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
8	287.89	2.455	2.02	#NAME?			0.77	2573.919	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
9	289.60	2.458	2.04	#NAME?			0.77	2604.573	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
10	291.31	2.460	2.05	#NAME?			0.77	2635.408	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
11	**293.02**	**2.462**	**2.06**	**#NAME?**			**0.77**	**2666.425**	**#NAME?**	**#NAME?**	**#NAME?**	**#NAME?**	**#NAME?**
12	294.73	2.464	2.07	#NAME?			0.78	2697.623	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
13	296.44	2.466	2.09	#NAME?			0.78	2729.002	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
14	298.14	2.468	2.10	#NAME?			0.78	2760.563	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
15	299.85	2.470	2.11	#NAME?			0.79	2792.306	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
16	301.56	2.472	2.12	#NAME?			0.79	2824.229	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
17	303.27	2.474	2.13	#NAME?			0.79	2856.335	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
18	304.98	2.476	2.15	#NAME?			0.79	2888.621	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
19	306.69	2.479	2.16	#NAME?			0.80	2921.090	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
20	308.40	2.481	2.17	#NAME?			0.80	2953.739	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
21	310.11	2.483	2.18	#NAME?			0.80	2986.570	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
22	311.82	2.485	2.19	#NAME?			0.81	3019.583	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
23	313.53	2.487	2.21	#NAME?			0.81	3052.777	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
24	315.24	2.489	2.22	#NAME?			0.81	3086.152	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
25	316.95	2.491	2.23	#NAME?			0.81	3119.709	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
26	318.66	2.493	2.24	#NAME?			0.82	3153.448	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
27	320.36	2.495	2.25	#NAME?			0.82	3187.367	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
28	322.07	2.497	2.27	#NAME?			0.82	3221.469	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
29	323.78	2.500	2.28	#NAME?			0.83	3255.752	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
30	325.49	2.502	2.29	#NAME?			0.83	3290.216	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
31	327.20	2.504	2.30	#NAME?			0.83	3324.861	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
32	328.91	2.506	2.31	#NAME?			0.84	3359.688	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
33	330.62	2.508	2.33	#NAME?			0.84	3394.697	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
34	332.33	2.510	2.34	#NAME?			0.84	3429.887	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
35	334.04	2.512	2.35	#NAME?			0.85	3465.258	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
36	335.75	2.514	2.36	#NAME?			0.85	3500.811	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
37	337.46	2.516	2.37	#NAME?			0.85	3536.546	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
38	339.17	2.518	2.39	#NAME?			0.85	3572.461	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
39	340.87	2.521	2.40	#NAME?			0.86	3608.559	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
40	342.58	2.523	2.41	#NAME?			0.86	3644.837	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
41	344.29	2.525	2.42	#NAME?			0.86	3681.298	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
42	346.00	2.527	2.43	#NAME?			0.87	3717.939	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
43	347.71	2.529	2.45	#NAME?			0.87	3754.762	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
44	349.42	2.531	2.46	#NAME?			0.87	3791.767	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
45	351.13	2.533	2.47	#NAME?			0.88	3828.953	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
46	352.84	2.535	2.48	#NAME?			0.88	3866.320	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
47	354.55	2.537	2.49	#NAME?			0.88	3903.869	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
48	356.26	2.539	2.51	#NAME?			0.89	3941.599	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
49	357.97	2.541	2.52	#NAME?			0.89	3979.511	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
50	359.68	2.544	2.53	#NAME?			0.89	4017.605	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
51	361.39	2.546	2.54	#NAME?			0.90	4055.879	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
52	363.09	2.548	2.55	#NAME?			0.90	4094.335	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
53	364.80	2.550	2.57	#NAME?			0.90	4132.973	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
54	366.51	2.552	2.58	#NAME?			0.91	4171.792	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
55	368.22	2.554	2.59	#NAME?			0.91	4210.793	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
56	369.93	2.556	2.60	#NAME?			0.91	4249.975	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
57	371.64	2.558	2.61	#NAME?			0.92	4289.338	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
58	373.35	2.560	2.63	#NAME?			0.92	4328.883	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
59	375.06	2.562	2.64	#NAME?			0.92	4368.609	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
60	376.77	2.565	2.65	#NAME?			0.93	4408.517	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
61	378.48	2.567	2.66	#NAME?			0.93	4448.606	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
62	380.19	2.569	2.67	#NAME?			0.94	4488.877	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
63	381.90	2.571	2.69	#NAME?			0.94	4529.329	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
64	383.60	2.573	2.70	#NAME?			0.94	4569.963	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
65	385.31	2.575	2.71	#NAME?			0.95	4610.778	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
66	387.02	2.577	2.72	#NAME?			0.95	4651.774	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
67	388.73	2.579	2.73	#NAME?			0.95	4692.952	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
68	390.44	2.581	2.75	#NAME?			0.96	4734.312	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
69	392.15	2.583	2.76	#NAME?			0.96	4775.852	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
70	393.86	2.586	2.77	#NAME?			0.96	4817.575	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
71	395.57	2.588	2.78	#NAME?			0.97	4859.478	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
72	397.28	2.590	2.79	#NAME?			0.97	4901.564	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
73	398.99	2.592	2.81	#NAME?			0.98	4943.830	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
74	400.70	2.594	2.82	#NAME?			0.98	4986.279	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
75	402.41	2.596	2.83	#NAME?			0.98	5028.908	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
76	404.12	2.598	2.84	#NAME?			0.99	5071.719	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
77	405.82	2.600	2.85	#NAME?			0.99	5114.712	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
78	407.53	2.602	2.87	#NAME?			0.99	5157.886	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
79	409.24	2.604	2.88	#NAME?			1.00	5201.241	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
80	410.95	2.607	2.89	#NAME?			1.00	5244.778	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
81	412.66	2.609	2.90	#NAME?			1.01	5288.496	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
82	414.37	2.611	2.91	#NAME?			1.01	5332.396	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
83	416.08	2.613	2.93	#NAME?			1.01	5376.477	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
84	417.79	2.615	2.94	#NAME?			1.02	5420.740	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
85	419.50	2.617	2.95	#NAME?			1.02	5465.184	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
86	421.21	2.619	2.96	#NAME?			1.03	5509.809	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
87	422.92	2.621	2.97	#NAME?			1.03	5554.616	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
88	424.63	2.623	2.99	#NAME?			1.03	5599.605	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
89	426.34	2.625	3.00	#NAME?			1.04	5644.775	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
90	428.04	2.628	3.01	#NAME?			1.04	5690.126	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
91	429.75	2.630	3.02	#NAME?			1.05	5735.659	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
92	431.46	2.632	3.03	#NAME?			1.05	5781.373	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
93	433.17	2.634	3.05	#NAME?			1.05	5827.269	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
94	434.88	2.636	3.06	#NAME?			1.06	5873.346	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
95	436.59	2.638	3.07	#NAME?			1.06	5919.605	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
96	438.30	2.640	3.08	#NAME?			1.07	5966.045	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
97	440.01	2.642	3.09	#NAME?			1.07	6012.667	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
98	441.72	2.644	3.11	#NAME?			1.07	6059.470	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
99	443.43	2.646	3.12	#NAME?			1.08	6106.454	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
100	445.14	2.648	3.13	#NAME?			1.08	6153.620	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?

	y	y*	A#	A(y)	b(y)	A3/b
0	0	0	0	0	0.000	0
1	0.08	0.01	0.0851	0.0851	1.592	3.868E-04
2	0.16	0.02	0.2399	0.2399	2.240	6.164E-03
3	0.24	0.03	0.4394	0.4394	2.729	3.108E-02
4	0.32	0.04	0.6744	0.6744	3.135	9.784E-02
5	0.4	0.05	0.9396	0.9396	3.487	2.379E-01
6	0.48	0.06	1.2313	1.2313	3.800	4.913E-01
7	0.56	0.07	1.5468	1.5468	4.082	9.065E-01
8	0.64	0.08	1.8838	1.8838	4.341	1.540E+00
9	0.72	0.09	2.2408	2.2408	4.579	2.457E+00
10	0.8	0.1	2.6160	2.6160	4.800	3.730E+00
11	**0.88**	**0.11**	**3.0084**	**3.0084**	**5.006**	**5.438E+00**
12	0.96	0.12	3.4167	3.4167	5.199	7.671E+00
13	1.04	0.13	3.8400	3.8400	5.381	1.052E+01
14	1.12	0.14	4.2773	4.2773	5.552	1.410E+01
15	1.2	0.15	4.7280	4.7280	5.713	1.850E+01
16	1.28	0.16	5.1912	5.1912	5.866	2.385E+01
17	1.36	0.17	5.6663	5.6663	6.010	3.027E+01
18	1.44	0.18	6.1526	6.1526	6.147	3.789E+01
19	1.52	0.19	6.6496	6.6496	6.277	4.684E+01
20	1.6	0.2	7.1567	7.1567	6.400	5.727E+01
21	1.68	0.21	7.6734	7.6734	6.517	6.933E+01
22	1.76	0.22	8.1993	8.1993	6.628	8.317E+01
23	1.84	0.23	8.7338	8.7338	6.733	9.894E+01
24	1.92	0.24	9.2765	9.2765	6.833	1.168E+02
25	2	0.25	9.8270	9.8270	6.928	1.370E+02
26	2.08	0.26	10.3848	10.3848	7.018	1.596E+02
27	2.16	0.27	10.9497	10.9497	7.103	1.848E+02
28	2.24	0.28	11.5213	11.5213	7.184	2.129E+02
29	2.32	0.29	12.0991	12.0991	7.260	2.440E+02
30	2.4	0.3	12.6828	12.6828	7.332	2.782E+02
31	2.48	0.31	13.2721	13.2721	7.400	3.159E+02
32	2.56	0.32	13.8666	13.8666	7.464	3.572E+02
33	2.64	0.33	14.4662	14.4662	7.523	4.024E+02
34	2.72	0.34	15.0703	15.0703	7.579	4.516E+02
35	2.8	0.35	15.6788	15.6788	7.632	5.050E+02
36	2.88	0.36	16.2912	16.2912	7.680	5.630E+02
37	2.96	0.37	16.9075	16.9075	7.725	6.257E+02
38	3.04	0.38	17.5271	17.5271	7.766	6.933E+02
39	3.12	0.39	18.1500	18.1500	7.804	7.661E+02
40	3.2	0.4	18.7757	18.7757	7.838	8.444E+02
41	3.28	0.41	19.4040	19.4040	7.869	9.284E+02
42	3.36	0.42	20.0347	20.0347	7.897	1.018E+03
43	3.44	0.43	20.6674	20.6674	7.921	1.114E+03
44	3.52	0.44	21.3020	21.3020	7.942	1.217E+03
45	3.6	0.45	21.9381	21.9381	7.960	1.326E+03
46	3.68	0.46	22.5755	22.5755	7.974	1.443E+03
47	3.76	0.47	23.2139	23.2139	7.986	1.567E+03
48	3.84	0.48	23.8531	23.8531	7.994	1.698E+03
49	3.92	0.49	24.4928	24.4928	7.998	1.837E+03
50	4	0.5	25.1327	25.1327	8.000	1.984E+03
51	4.08	0.51	25.7727	25.7727	7.998	2.140E+03
52	4.16	0.52	26.4124	26.4124	7.994	2.305E+03
53	4.24	0.53	27.0516	27.0516	7.986	2.479E+03
54	4.32	0.54	27.6900	27.6900	7.974	2.662E+03
55	4.4	0.55	28.3274	28.3274	7.960	2.856E+03
56	4.48	0.56	28.9635	28.9635	7.942	3.059E+03
57	4.56	0.57	29.5981	29.5981	7.921	3.273E+03
58	4.64	0.58	30.2308	30.2308	7.897	3.499E+03
59	4.72	0.59	30.8615	30.8615	7.869	3.735E+03
60	4.8	0.6	31.4898	31.4898	7.838	3.984E+03
61	4.88	0.61	32.1155	32.1155	7.804	4.245E+03
62	4.96	0.62	32.7384	32.7384	7.766	4.518E+03
63	5.04	0.63	33.3580	33.3580	7.725	4.805E+03
64	5.12	0.64	33.9742	33.9742	7.680	5.106E+03
65	5.2	0.65	34.5867	34.5867	7.632	5.421E+03
66	5.28	0.66	35.1952	35.1952	7.579	5.752E+03
67	5.36	0.67	35.7993	35.7993	7.523	6.098E+03
68	5.44	0.68	36.3988	36.3988	7.464	6.461E+03
69	5.52	0.69	36.9934	36.9934	7.400	6.841E+03
70	5.6	0.7	37.5827	37.5827	7.332	7.240E+03
71	5.68	0.71	38.1664	38.1664	7.260	7.658E+03
72	5.76	0.72	38.7442	38.7442	7.184	8.096E+03
73	5.84	0.73	39.3157	39.3157	7.103	8.555E+03
74	5.92	0.74	39.8806	39.8806	7.018	9.038E+03
75	6	0.75	40.4385	40.4385	6.928	9.545E+03
76	6.08	0.76	40.9890	40.9890	6.833	1.008E+04
77	6.16	0.77	41.5317	41.5317	6.733	1.064E+04
78	6.24	0.78	42.0662	42.0662	6.628	1.123E+04
79	6.32	0.79	42.5920	42.5920	6.517	1.186E+04
80	6.4	0.8	43.1088	43.1088	6.400	1.252E+04
81	6.48	0.81	43.6159	43.6159	6.277	1.322E+04
82	6.56	0.82	44.1129	44.1129	6.147	1.396E+04
83	6.64	0.83	44.5992	44.5992	6.010	1.476E+04
84	6.72	0.84	45.0743	45.0743	5.866	1.561E+04
85	6.8	0.85	45.5375	45.5375	5.713	1.653E+04
86	6.88	0.86	45.9882	45.9882	5.552	1.752E+04
87	6.96	0.87	46.4255	46.4255	5.381	1.860E+04
88	7.04	0.88	46.8488	46.8488	5.199	1.978E+04
89	7.12	0.89	47.2571	47.2571	5.006	2.108E+04
90	7.2	0.9	47.6495	47.6495	4.800	2.254E+04
91	7.28	0.91	48.0247	48.0247	4.579	2.419E+04
92	7.36	0.92	48.3816	48.3816	4.341	2.609E+04
93	7.44	0.93	48.7187	48.7187	4.082	2.833E+04
94	7.52	0.94	49.0342	49.0342	3.800	3.103E+04
95	7.6	0.95	49.3259	49.3259	3.487	3.442E+04
96	7.68	0.96	49.5911	49.5911	3.135	3.890E+04
97	7.76	0.97	49.8261	49.8261	2.729	4.532E+04
98	7.84	0.98	50.0256	50.0256	2.240	5.589E+04
99	7.92	0.99	50.1804	50.1804	1.592	7.937E+04
100	8	1	50.2655	50.2655	0.000	



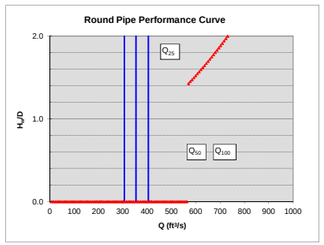


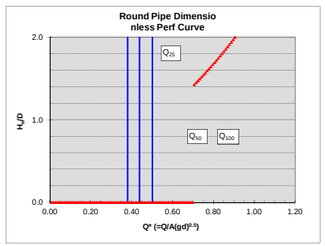
Grid Lines

	Q25	Q50	Q100		
0	306.6	353.6	404.7	353.6	0
3	306.6	353.6	404.7	353.6	0

Preliminary Culvert Sizing - Round Pipes

			Q	Q*
Type:	Circ CMP Proj	Q_{25}	306.6	0.380
D (ft)	8	Q_{50}	353.6	0.438
w (ft)	-99 box width	Q_{100}	404.7	0.502
Slope (ft/ft)	0.02			
A (ft2)	50.27			
g	32.2			





Grid Lines

	Q25	Q50	Q100
0	306.6	353.6	404.7
3	306.6	353.6	404.7

	K	M	c	Y	shape factor
Box 30-75 ww	0.026	1	0.0347	0.81	
Box 90-15 ww	0.026	1	0.0347	0.81	
Circ CMP Proj	0.034	1.5	0.0553	0.54	0.785
Circ RCP Proj	0.0045	2	0.0317	0.69	0.785
Circ CMP Proj	0.45959	1.5	1.78066	0.54	0.785

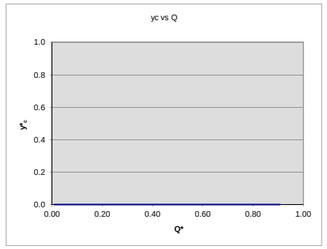
Limits				
unsub Q* <	0.617	0	0.4	0.4	0.5
sub Q* >	0.705	3	0.4	0.4	0.5
target Hw/D	0.9 for Q50				
Q*(Hw/D)	0.450				

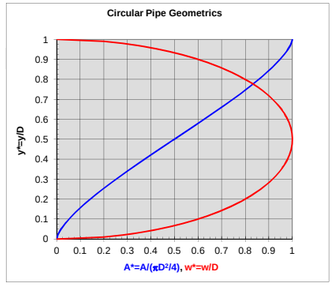
	Nat	Log
Qmin	10.00	1.000
Qmax	1000.00	3.000
NQ	100	100
ΔQ	10	0.020

$A(gD)^{0.5}$ 806.76

Q*min 0
Q*max 0.906

d 8
r 4





				Transition	Submerged	Unsubmerged				
n	Q	log(Q)	$Q^* = Q/A(gD)^{0.5}$	H_u/D	$H_u^* = H_u/D$	Q^{*2}	y^*_n	A^*_n	$H_c^*=H_c/D$	$H_u^*=H_u/D$
1	7.31	1.000	0.01	#NAME?	0.54	0.000	#NAME?	#NAME?	#NAME?	#NAME?
2	14.61	1.020	0.02	#NAME?	0.54	0.000	#NAME?	#NAME?	#NAME?	#NAME?
3	21.92	1.040	0.03	#NAME?	0.54	0.001	#NAME?	#NAME?	#NAME?	#NAME?
4	29.22	1.061	0.04	#NAME?	0.54	0.001	#NAME?	#NAME?	#NAME?	#NAME?
5	36.53	1.081	0.05	#NAME?	0.54	0.002	#NAME?	#NAME?	#NAME?	#NAME?
6	43.83	1.101	0.05	#NAME?	0.55	0.003	#NAME?	#NAME?	#NAME?	#NAME?
7	51.14	1.121	0.06	#NAME?	0.55	0.004	#NAME?	#NAME?	#NAME?	#NAME?
8	58.45	1.141	0.07	#NAME?	0.55	0.005	#NAME?	#NAME?	#NAME?	#NAME?
9	65.75	1.162	0.08	#NAME?	0.55	0.007	#NAME?	#NAME?	#NAME?	#NAME?
10	73.06	1.182	0.09	#NAME?	0.55	0.008	#NAME?	#NAME?	#NAME?	#NAME?
11	80.36	1.202	0.10	#NAME?	0.56	0.010	#NAME?	#NAME?	#NAME?	#NAME?
12	87.67	1.222	0.11	#NAME?	0.56	0.012	#NAME?	#NAME?	#NAME?	#NAME?
13	94.97	1.242	0.12	#NAME?	0.56	0.014	#NAME?	#NAME?	#NAME?	#NAME?
14	102.28	1.263	0.13	#NAME?	0.57	0.016	#NAME?	#NAME?	#NAME?	#NAME?
15	109.58	1.283	0.14	#NAME?	0.57	0.018	#NAME?	#NAME?	#NAME?	#NAME?
16	116.89	1.303	0.14	#NAME?	0.58	0.021	#NAME?	#NAME?	#NAME?	#NAME?
17	124.20	1.323	0.15	#NAME?	0.58	0.024	#NAME?	#NAME?	#NAME?	#NAME?
18	131.50	1.343	0.16	#NAME?	0.59	0.027	#NAME?	#NAME?	#NAME?	#NAME?
19	138.81	1.364	0.17	#NAME?	0.59	0.030	#NAME?	#NAME?	#NAME?	#NAME?
20	146.11	1.384	0.18	#NAME?	0.60	0.033	#NAME?	#NAME?	#NAME?	#NAME?
21	153.42	1.404	0.19	#NAME?	0.60	0.036	#NAME?	#NAME?	#NAME?	#NAME?
22	160.72	1.424	0.20	#NAME?	0.61	0.040	#NAME?	#NAME?	#NAME?	#NAME?
23	168.03	1.444	0.21	#NAME?	0.62	0.043	#NAME?	#NAME?	#NAME?	#NAME?
24	175.34	1.465	0.22	#NAME?	0.62	0.047	#NAME?	#NAME?	#NAME?	#NAME?
25	182.64	1.485	0.23	#NAME?	0.63	0.051	#NAME?	#NAME?	#NAME?	#NAME?
26	189.95	1.505	0.24	#NAME?	0.64	0.055	#NAME?	#NAME?	#NAME?	#NAME?
27	197.25	1.525	0.24	#NAME?	0.65	0.060	#NAME?	#NAME?	#NAME?	#NAME?
28	204.56	1.545	0.25	#NAME?	0.65	0.064	#NAME?	#NAME?	#NAME?	#NAME?
29	211.86	1.566	0.26	#NAME?	0.66	0.069	#NAME?	#NAME?	#NAME?	#NAME?
30	219.17	1.586	0.27	#NAME?	0.67	0.074	#NAME?	#NAME?	#NAME?	#NAME?
31	226.47	1.606	0.28	#NAME?	0.68	0.079	#NAME?	#NAME?	#NAME?	#NAME?
32	233.78	1.626	0.29	#NAME?	0.69	0.084	#NAME?	#NAME?	#NAME?	#NAME?
33	241.09	1.646	0.30	#NAME?	0.70	0.089	#NAME?	#NAME?	#NAME?	#NAME?
34	248.39	1.667	0.31	#NAME?	0.71	0.095	#NAME?	#NAME?	#NAME?	#NAME?
35	255.70	1.687	0.32	#NAME?	0.72	0.100	#NAME?	#NAME?	#NAME?	#NAME?
36	263.00	1.707	0.33	#NAME?	0.73	0.106	#NAME?	#NAME?	#NAME?	#NAME?
37	270.31	1.727	0.34	#NAME?	0.74	0.112	#NAME?	#NAME?	#NAME?	#NAME?
38	277.61	1.747	0.34	#NAME?	0.75	0.118	#NAME?	#NAME?	#NAME?	#NAME?
39	284.92	1.768	0.35	#NAME?	0.76	0.125	#NAME?	#NAME?	#NAME?	#NAME?
40	292.23	1.788	0.36	#NAME?	0.77	0.131	#NAME?	#NAME?	#NAME?	#NAME?
41	299.53	1.808	0.37	#NAME?	0.79	0.138	#NAME?	#NAME?	#NAME?	#NAME?
42	306.84	1.828	0.38	#NAME?	0.80	0.145	#NAME?	#NAME?	#NAME?	#NAME?
43	314.14	1.848	0.39	#NAME?	0.81	0.152	#NAME?	#NAME?	#NAME?	#NAME?
44	321.45	1.869	0.40	#NAME?	0.82	0.159	#NAME?	#NAME?	#NAME?	#NAME?
45	328.75	1.889	0.41	#NAME?	0.84	0.166	#NAME?	#NAME?	#NAME?	#NAME?
46	336.06	1.909	0.42	#NAME?	0.85	0.174	#NAME?	#NAME?	#NAME?	#NAME?
47	343.37	1.929	0.43	#NAME?	0.86	0.181	#NAME?	#NAME?	#NAME?	#NAME?
48	350.67	1.949	0.43	#NAME?	0.88	0.189	#NAME?	#NAME?	#NAME?	#NAME?
49	357.98	1.970	0.44	#NAME?	0.89	0.197	#NAME?	#NAME?	#NAME?	#NAME?
50	365.28	1.990	0.45	#NAME?	0.90	0.205	#NAME?	#NAME?	#NAME?	#NAME?
51	372.59	2.010	0.46	#NAME?	0.92	0.213	#NAME?	#NAME?	#NAME?	#NAME?
52	379.89	2.030	0.47	#NAME?	0.93	0.222	#NAME?	#NAME?	#NAME?	#NAME?
53	387.20	2.051	0.48	#NAME?	0.95	0.230	#NAME?	#NAME?	#NAME?	#NAME?
54	394.50	2.071	0.49	#NAME?	0.97	0.239	#NAME?	#NAME?	#NAME?	#NAME?
55	401.81	2.091	0.50	#NAME?	0.98	0.248	#NAME?	#NAME?	#NAME?	#NAME?
56	409.12	2.111	0.51	#NAME?	1.00	0.257	#NAME?	#NAME?	#NAME?	#NAME?
57	416.42	2.131	0.52	#NAME?	1.01	0.266	#NAME?	#NAME?	#NAME?	#NAME?
58	423.73	2.152	0.53	#NAME?	1.03	0.276	#NAME?	#NAME?	#NAME?	#NAME?
59	431.03	2.172	0.53	#NAME?	1.05	0.285	#NAME?	#NAME?	#NAME?	#NAME?
60	438.34	2.192	0.54	#NAME?	1.07	0.295	#NAME?	#NAME?	#NAME?	#NAME?
61	445.64	2.212	0.55	#NAME?	1.08	0.305	#NAME?	#NAME?	#NAME?	#NAME?
62	452.95	2.232	0.56	#NAME?	1.10	0.315	#NAME?	#NAME?	#NAME?	#NAME?
63	460.26	2.253	0.57	#NAME?	1.12	0.325	#NAME?	#NAME?	#NAME?	#NAME?
64	467.56	2.273	0.58	#NAME?	1.14	0.336	#NAME?	#NAME?	#NAME?	#NAME?
65	474.87	2.293	0.59	#NAME?	1.16	0.346	#NAME?	#NAME?	#NAME?	#NAME?
66	482.17	2.313	0.60	#NAME?	1.18	0.357	#NAME?	#NAME?	#NAME?	#NAME?
67	489.48	2.333	0.61	#NAME?	1.20	0.368	#NAME?	#NAME?	#NAME?	#NAME?
68	496.78	2.354	0.62	#NAME?	1.21	0.379	#NAME?	#NAME?	#NAME?	#NAME?
69	504.09	2.374	0.62		1.24	0.390	#NAME?	#NAME?	#NAME?	#NAME?
70	511.40	2.394	0.63		1.26	0.402	#NAME?	#NAME?	#NAME?	#NAME?
71	518.70	2.414	0.64		1.28	0.413	#NAME?	#NAME?	#NAME?	#NAME?
72	526.01	2.434	0.65		1.30	0.425	#NAME?	#NAME?	#NAME?	#NAME?
73	533.31	2.455	0.66		1.32	0.437	#NAME?	#NAME?	#NAME?	#NAME?
74	540.62	2.475	0.67		1.34	0.449	#NAME?	#NAME?	#NAME?	#NAME?
75	547.92	2.495	0.68		1.36	0.461	#NAME?	#NAME?	#NAME?	#NAME?
76	555.23	2.515	0.69		1.38	0.474	#NAME?	#NAME?	#NAME?	#NAME?
77	562.53	2.535	0.70		1.41	0.486	#NAME?	#NAME?	#NAME?	#NAME?
78	569.84	2.556	0.71	1.43	1.43	0.499	#NAME?	#NAME?	#NAME?	#NAME?
79	577.15	2.576	0.72	1.45	1.45	0.512	#NAME?	#NAME?	#NAME?	#NAME?
80	584.45	2.596	0.72	1.47	1.47	0.525	#NAME?	#NAME?	#NAME?	#NAME?
81	591.76	2.616	0.73	1.50	1.50	0.538	#NAME?	#NAME?	#NAME?	#NAME?
82	599.06	2.636	0.74	1.52	1.52	0.551	#NAME?	#NAME?	#NAME?	#NAME?
83	606.37	2.657	0.75	1.55	1.55	0.565	#NAME?	#NAME?	#NAME?	#NAME?
84	613.67	2.677	0.76	1.57	1.57	0.579	#NAME?	#NAME?	#NAME?	#NAME?
85	620.98	2.697	0.77	1.59	1.59	0.592	#NAME?	#NAME?	#NAME?	#NAME?
86	628.29	2.717	0.78	1.62	1.62	0.606	#NAME?	#NAME?	#NAME?	#NAME?
87	635.59	2.737	0.79	1.65	1.65	0.621	#NAME?	#NAME?	#NAME?	#NAME?
88	642.90	2.758	0.80	1.67	1.67	0.635	#NAME?	#NAME?	#NAME?	#NAME?
89	650.20	2.778	0.81	1.70	1.70	0.650	#NAME?	#NAME?	#NAME?	#NAME?
90	657.51	2.798	0.82	1.72	1.72	0.664	#NAME?	#NAME?	#NAME?	#NAME?
91	664.81	2.818	0.82	1.75	1.75	0.679	#NAME?	#NAME?	#NAME?	#NAME?
92	672.12	2.838	0.83	1.78	1.78	0.694	#NAME?	#NAME?	#NAME?	#NAME?
93	679.42	2.859	0.84	1.80	1.80	0.709	#NAME?	#NAME?	#NAME?	#NAME?
94	686.73	2.879	0.85	1.83	1.83	0.725	#NAME?	#NAME?	#NAME?	#NAME?
95	694.04	2.899	0.86	1.86	1.86	0.740	#NAME?	#NAME?	#NAME?	#NAME?
96	701.34	2.919	0.87	1.89	1.89	0.756	#NAME?	#NAME?	#NAME?	#NAME?
97	708.65	2.939	0.88	1.91	1.91	0.772	#NAME?	#NAME?	#NAME?	#NAME?
98	715.95	2.960	0.89	1.94	1.94	0.788	#NAME?	#NAME?	#NAME?	#NAME?
99	723.26	2.980	0.90	1.97	1.97	0.804	#NAME?	#NAME?	#NAME?	#NAME?
100	730.56	3.000	0.91	2.00	2.00	0.820	#NAME?	#NAME?	#NAME?	#NAME?

Round Pipe Critical Flow

	y*	A*(y*)	w*(y*)	$(s/4)*A^{*2}/w^*$	d_H
0	0	0	0.000	0	0
1	0.01	0.0017	0.199	1.914E-08	0.009
2	0.02	0.0048	0.280	3.050E-07	0.017
3	0.03	0.0087	0.341	1.538E-06	0.026
4	0.04	0.0134	0.392	4.840E-06	0.034
5	0.05	0.0187	0.436	1.177E-05	0.043
6	0.06	0.0245	0.475	2.431E-05	0.052
7	0.07	0.0308	0.510	4.485E-05	0.060
8	0.08	0.0375	0.543	7.620E-05	0.069
9	0.09	0.0446	0.572	1.216E-04	0.078
10	0.1	0.0520	0.600	1.845E-04	0.087
11	0.11	0.0598	0.626	2.691E-04	0.096
12	0.12	0.0680	0.650	3.795E-04	0.105
13	0.13	0.0764	0.673	5.206E-04	0.114
14	0.14	0.0851	0.694	6.974E-04	0.123
15	0.15	0.0941	0.714	9.152E-04	0.132
16	0.16	0.1033	0.733	1.180E-03	0.141
17	0.17	0.1127	0.751	1.498E-03	0.150
18	0.18	0.1224	0.768	1.874E-03	0.159
19	0.19	0.1323	0.785	2.317E-03	0.169
20	0.2	0.1424	0.800	2.834E-03	0.178
21	0.21	0.1527	0.815	3.430E-03	0.187
22	0.22	0.1631	0.828	4.115E-03	0.197
23	0.23	0.1738	0.842	4.895E-03	0.206
24	0.24	0.1845	0.854	5.779E-03	0.216
25	0.25	0.1955	0.866	6.777E-03	0.226
26	0.26	0.2066	0.877	7.895E-03	0.236
27	0.27	0.2178	0.888	9.144E-03	0.245
28	0.28	0.2292	0.898	1.053E-02	0.255
29	0.29	0.2407	0.908	1.207E-02	0.265
30	0.3	0.2523	0.917	1.377E-02	0.275
31	0.31	0.2640	0.925	1.563E-02	0.285
32	0.32	0.2759	0.933	1.767E-02	0.296
33	0.33	0.2878	0.940	1.991E-02	0.306
34	0.34	0.2998	0.947	2.234E-02	0.316
35	0.35	0.3119	0.954	2.499E-02	0.327
36	0.36	0.3241	0.960	2.785E-02	0.338
37	0.37	0.3364	0.966	3.095E-02	0.348
38	0.38	0.3487	0.971	3.430E-02	0.359
39	0.39	0.3611	0.975	3.790E-02	0.370
40	0.4	0.3735	0.980	4.178E-02	0.381
41	0.41	0.3860	0.984	4.593E-02	0.392
42	0.42	0.3986	0.987	5.038E-02	0.404
43	0.43	0.4112	0.990	5.514E-02	0.415
44	0.44	0.4238	0.993	6.021E-02	0.427
45	0.45	0.4364	0.995	6.562E-02	0.439
46	0.46	0.4491	0.997	7.138E-02	0.451
47	0.47	0.4618	0.998	7.750E-02	0.463
48	0.48	0.4745	0.999	8.400E-02	0.475
49	0.49	0.4873	1.000	9.088E-02	0.487
50	0.5	0.5000	1.000	9.817E-02	0.500
51	0.51	0.5127	1.000	1.059E-01	0.513
52	0.52	0.5255	0.999	1.140E-01	0.526
53	0.53	0.5382	0.998	1.226E-01	0.539
54	0.54	0.5509	0.997	1.317E-01	0.553
55	0.55	0.5636	0.995	1.413E-01	0.566
56	0.56	0.5762	0.993	1.514E-01	0.580
57	0.57	0.5888	0.990	1.619E-01	0.595
58	0.58	0.6014	0.987	1.731E-01	0.609
59	0.59	0.6140	0.984	1.848E-01	0.624
60	0.6	0.6265	0.980	1.971E-01	0.639
61	0.61	0.6389	0.975	2.100E-01	0.655
62	0.62	0.6513	0.971	2.235E-01	0.671
63	0.63	0.6636	0.966	2.377E-01	0.687
64	0.64	0.6759	0.960	2.526E-01	0.704
65	0.65	0.6881	0.954	2.682E-01	0.721
66	0.66	0.7002	0.947	2.846E-01	0.739
67	0.67	0.7122	0.940	3.017E-01	0.757
68	0.68	0.7241	0.933	3.197E-01	0.776
69	0.69	0.7360	0.925	3.385E-01	0.796
70	0.7	0.7477	0.917	3.582E-01	0.816
71	0.71	0.7593	0.908	3.788E-01	0.837
72	0.72	0.7708	0.898	4.005E-01	0.858
73	0.73	0.7822	0.888	4.233E-01	0.881
74	0.74	0.7934	0.877	4.471E-01	0.904
75	0.75	0.8045	0.866	4.722E-01	0.929
76	0.76	0.8155	0.854	4.986E-01	0.955
77	0.77	0.8262	0.842	5.264E-01	0.982
78	0.78	0.8369	0.828	5.556E-01	1.010
79	0.79	0.8473	0.815	5.866E-01	1.040
80	0.8	0.8576	0.800	6.193E-01	1.072
81	0.81	0.8677	0.785	6.540E-01	1.106
82	0.82	0.8776	0.768	6.909E-01	1.142
83	0.83	0.8873	0.751	7.302E-01	1.181
84	0.84	0.8967	0.733	7.724E-01	1.223
85	0.85	0.9059	0.714	8.177E-01	1.269
86	0.86	0.9149	0.694	8.667E-01	1.318
87	0.87	0.9236	0.673	9.200E-01	1.373
88	0.88	0.9320	0.650	9.784E-01	1.434
89	0.89	0.9402	0.626	1.043E+00	1.502
90	0.9	0.9480	0.600	1.115E+00	1.580
91	0.91	0.9554	0.572	1.197E+00	1.669
92	0.92	0.9625	0.543	1.291E+00	1.774
93	0.93	0.9692	0.510	1.401E+00	1.899
94	0.94	0.9755	0.475	1.535E+00	2.054
95	0.95	0.9813	0.436	1.703E+00	2.251
96	0.96	0.9866	0.392	1.924E+00	2.517
97	0.97	0.9913	0.341	2.242E+00	2.905
98	0.98	0.9952	0.280	2.765E+00	3.554
99	0.99	0.9983	0.199	3.927E+00	5.017
100	1	1.0000	0.000		

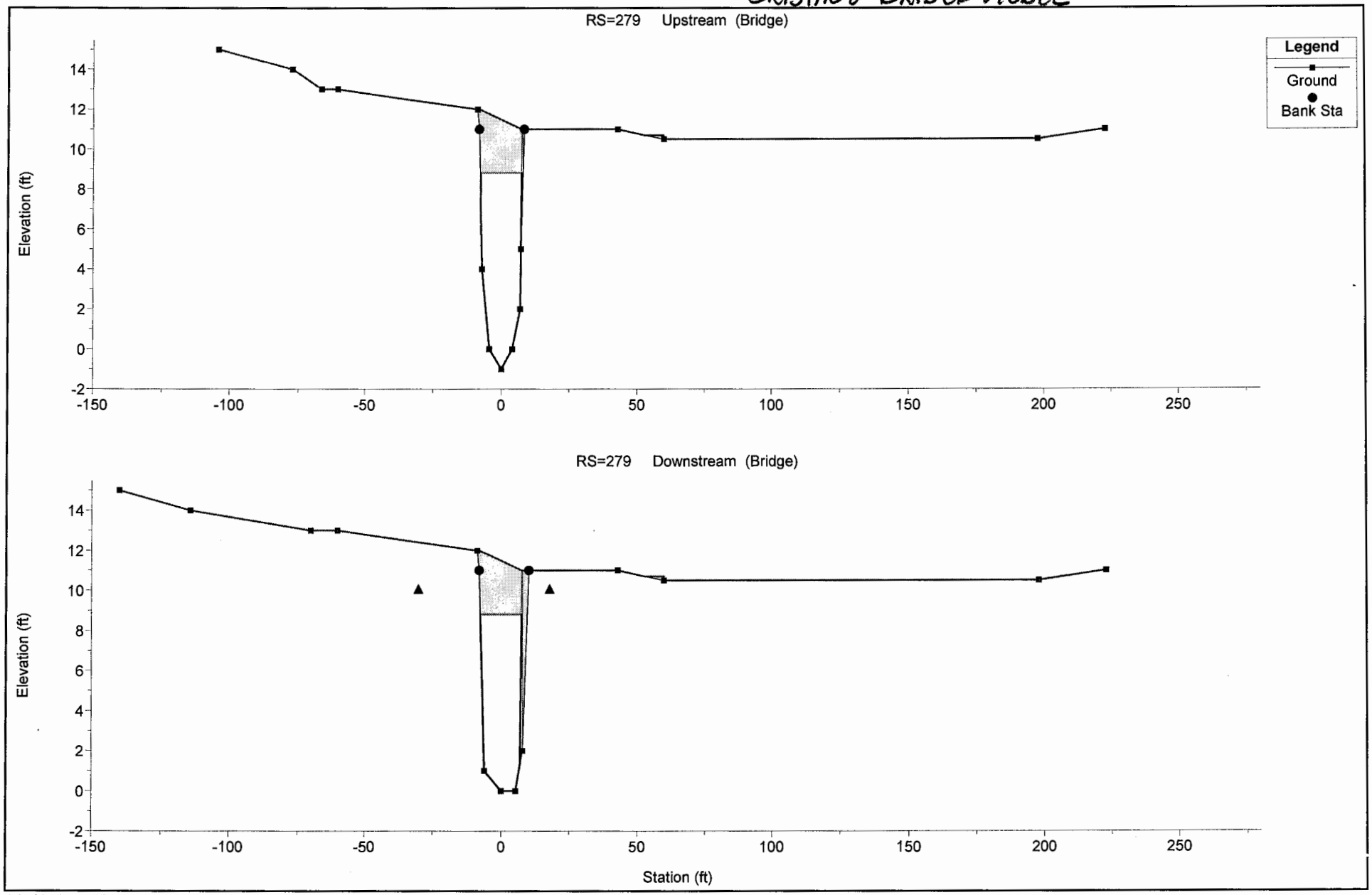
Box Culvert Critical Flow

y*	$A^*(y^*)$	$w^*(y^*)$	t^*A^{*2}/w^*	d^*_H
0	0.000	0.785	0.000	0.000
0.01	0.010	0.785	0.000	0.013
0.02	0.020	0.785	0.000	0.025
0.03	0.030	0.785	0.000	0.038
0.04	0.040	0.785	0.000	0.051
0.05	0.050	0.785	0.000	0.064
0.06	0.060	0.785	0.000	0.076
0.07	0.070	0.785	0.000	0.089
0.08	0.080	0.785	0.001	0.102
0.09	0.090	0.785	0.001	0.115
0.1	0.100	0.785	0.001	0.127
0.11	0.110	0.785	0.001	0.140
0.12	0.120	0.785	0.002	0.153
0.13	0.130	0.785	0.002	0.166
0.14	0.140	0.785	0.003	0.178
0.15	0.150	0.785	0.003	0.191
0.16	0.160	0.785	0.004	0.204
0.17	0.170	0.785	0.005	0.216
0.18	0.180	0.785	0.006	0.229
0.19	0.190	0.785	0.007	0.242
0.2	0.200	0.785	0.008	0.255
0.21	0.210	0.785	0.009	0.267
0.22	0.220	0.785	0.011	0.280
0.23	0.230	0.785	0.012	0.293
0.24	0.240	0.785	0.014	0.306
0.25	0.250	0.785	0.016	0.318
0.26	0.260	0.785	0.018	0.331
0.27	0.270	0.785	0.020	0.344
0.28	0.280	0.785	0.022	0.357
0.29	0.290	0.785	0.024	0.369
0.3	0.300	0.785	0.027	0.382
0.31	0.310	0.785	0.030	0.395
0.32	0.320	0.785	0.033	0.407
0.33	0.330	0.785	0.036	0.420
0.34	0.340	0.785	0.039	0.433
0.35	0.350	0.785	0.043	0.446
0.36	0.360	0.785	0.047	0.458
0.37	0.370	0.785	0.051	0.471
0.38	0.380	0.785	0.055	0.484
0.39	0.390	0.785	0.059	0.497
0.4	0.400	0.785	0.064	0.509
0.41	0.410	0.785	0.069	0.522
0.42	0.420	0.785	0.074	0.535
0.43	0.430	0.785	0.080	0.547
0.44	0.440	0.785	0.085	0.560
0.45	0.450	0.785	0.091	0.573
0.46	0.460	0.785	0.097	0.586
0.47	0.470	0.785	0.104	0.598
0.48	0.480	0.785	0.111	0.611
0.49	0.490	0.785	0.118	0.624
0.5	0.500	0.785	0.125	0.637
0.51	0.510	0.785	0.133	0.649
0.52	0.520	0.785	0.141	0.662
0.53	0.530	0.785	0.149	0.675
0.54	0.540	0.785	0.157	0.688
0.55	0.550	0.785	0.166	0.700
0.56	0.560	0.785	0.176	0.713
0.57	0.570	0.785	0.185	0.726
0.58	0.580	0.785	0.195	0.738
0.59	0.590	0.785	0.205	0.751
0.6	0.600	0.785	0.216	0.764
0.61	0.610	0.785	0.227	0.777
0.62	0.620	0.785	0.238	0.789
0.63	0.630	0.785	0.250	0.802
0.64	0.640	0.785	0.262	0.815
0.65	0.650	0.785	0.275	0.828
0.66	0.660	0.785	0.287	0.840
0.67	0.670	0.785	0.301	0.853
0.68	0.680	0.785	0.314	0.866
0.69	0.690	0.785	0.329	0.879
0.7	0.700	0.785	0.343	0.891
0.71	0.710	0.785	0.358	0.904
0.72	0.720	0.785	0.373	0.917
0.73	0.730	0.785	0.389	0.929
0.74	0.740	0.785	0.405	0.942
0.75	0.750	0.785	0.422	0.955
0.76	0.760	0.785	0.439	0.968
0.77	0.770	0.785	0.457	0.980
0.78	0.780	0.785	0.475	0.993
0.79	0.790	0.785	0.493	1.006
0.8	0.800	0.785	0.512	1.019
0.81	0.810	0.785	0.531	1.031
0.82	0.820	0.785	0.551	1.044
0.83	0.830	0.785	0.572	1.057
0.84	0.840	0.785	0.593	1.070
0.85	0.850	0.785	0.614	1.082
0.86	0.860	0.785	0.636	1.095
0.87	0.870	0.785	0.659	1.108
0.88	0.880	0.785	0.681	1.120
0.89	0.890	0.785	0.705	1.133
0.9	0.900	0.785	0.729	1.146
0.91	0.910	0.785	0.754	1.159
0.92	0.920	0.785	0.779	1.171
0.93	0.930	0.785	0.804	1.184
0.94	0.940	0.785	0.831	1.197
0.95	0.950	0.785	0.857	1.210
0.96	0.960	0.785	0.885	1.222
0.97	0.970	0.785	0.913	1.235
0.98	0.980	0.785	0.941	1.248
0.99	0.990	0.785	0.970	1.261
1	1.000	0.785	1.000	1.273

APPENDIX 7

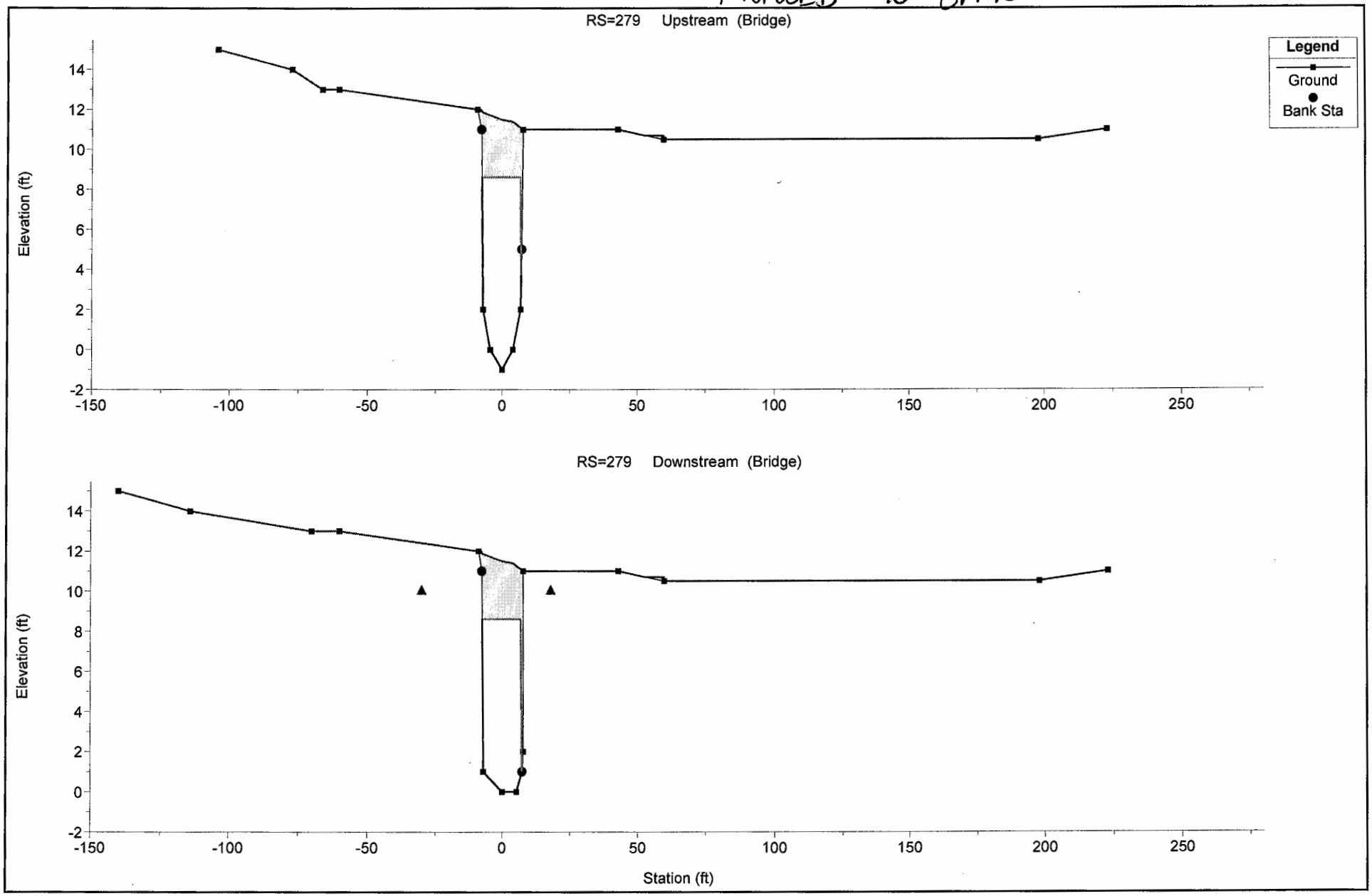
HECRAS Bridge Cross Sections

EXISTING BRIDGE MODEL



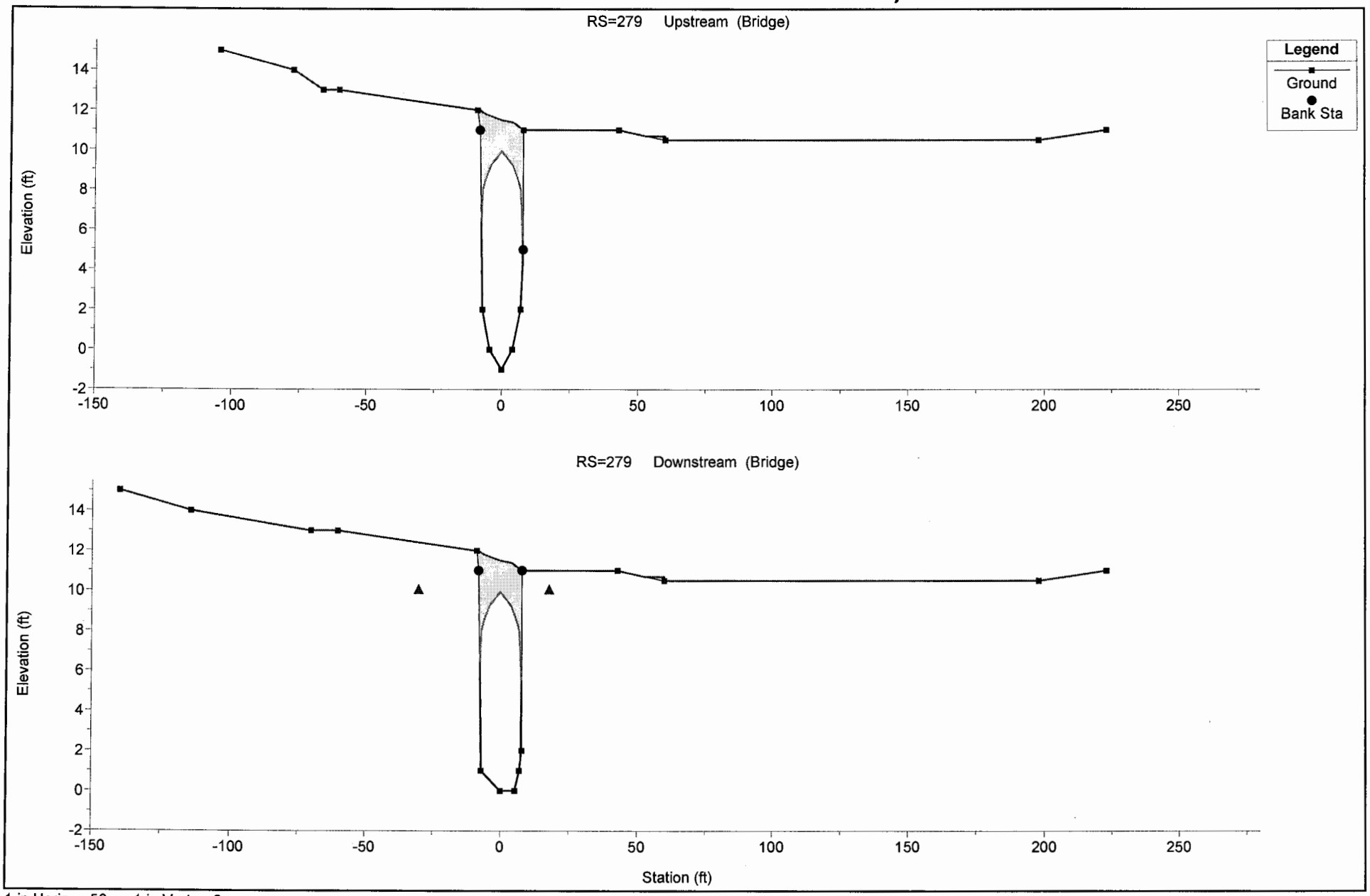
1 in Horiz. = 50 1 in Vert. = 3

PROPOSED 15' SPAN



1 in Horiz. = 50 1 in Vert. = 3

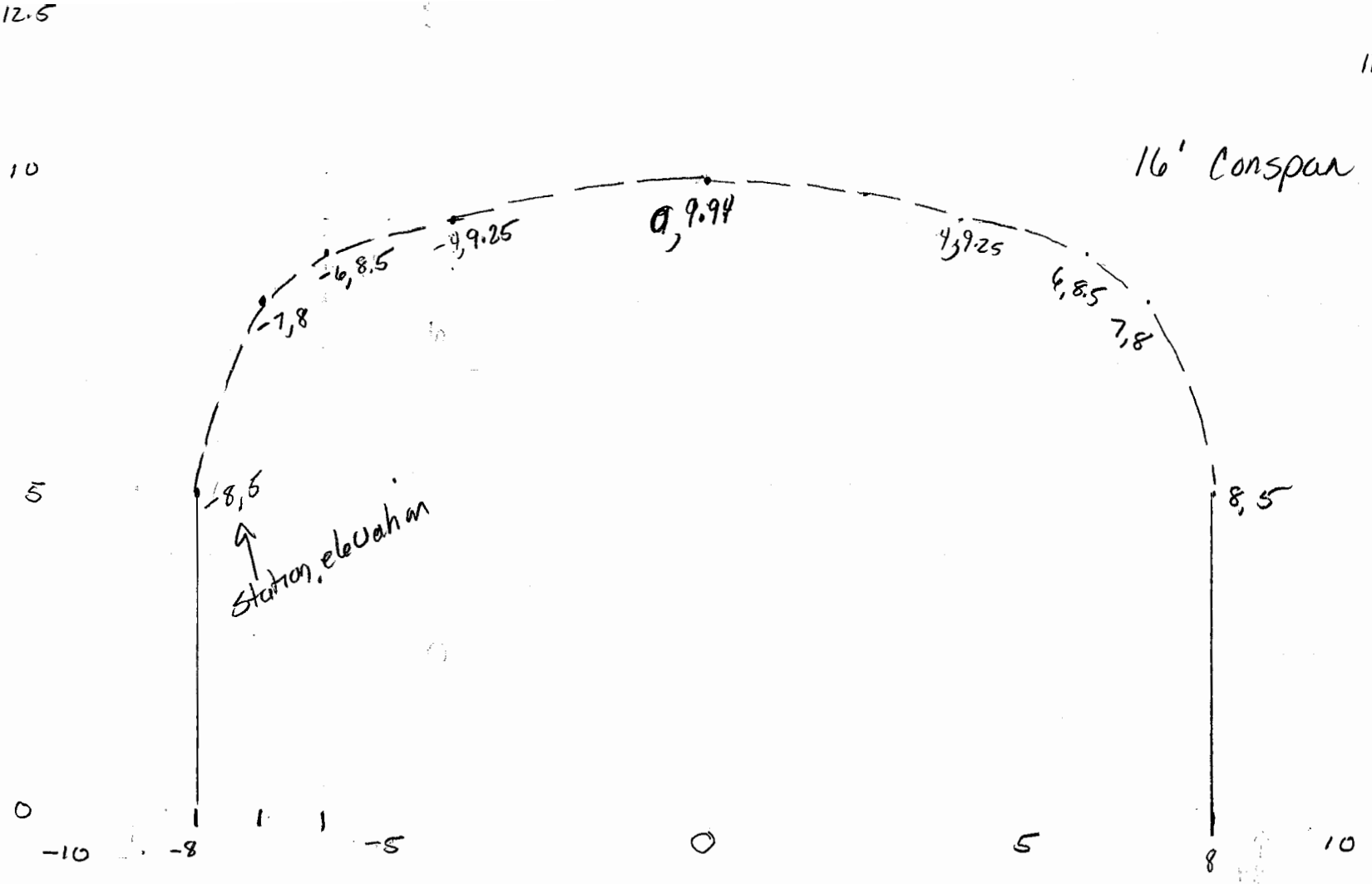
PROPOSED 16' Con-Span



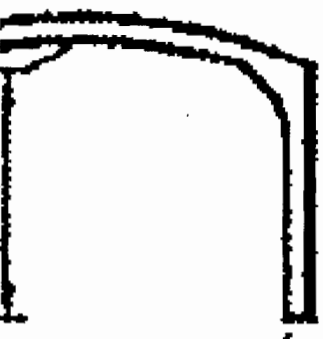
1 in Horiz. = 50 1 in Vert. = 3

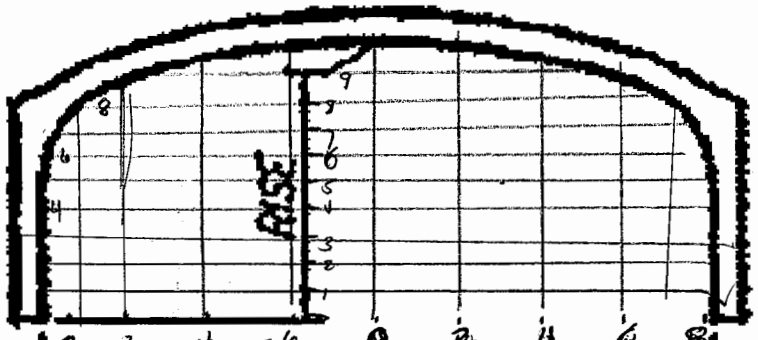
11/7/12

16' Conspan Model



CONSPAN



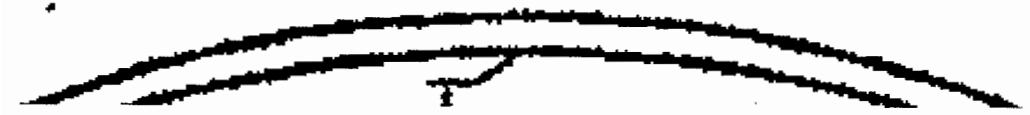


RT SPAN

YING LENGTH

INTERMEDIATE SPAN

8" LAYING LENGTH

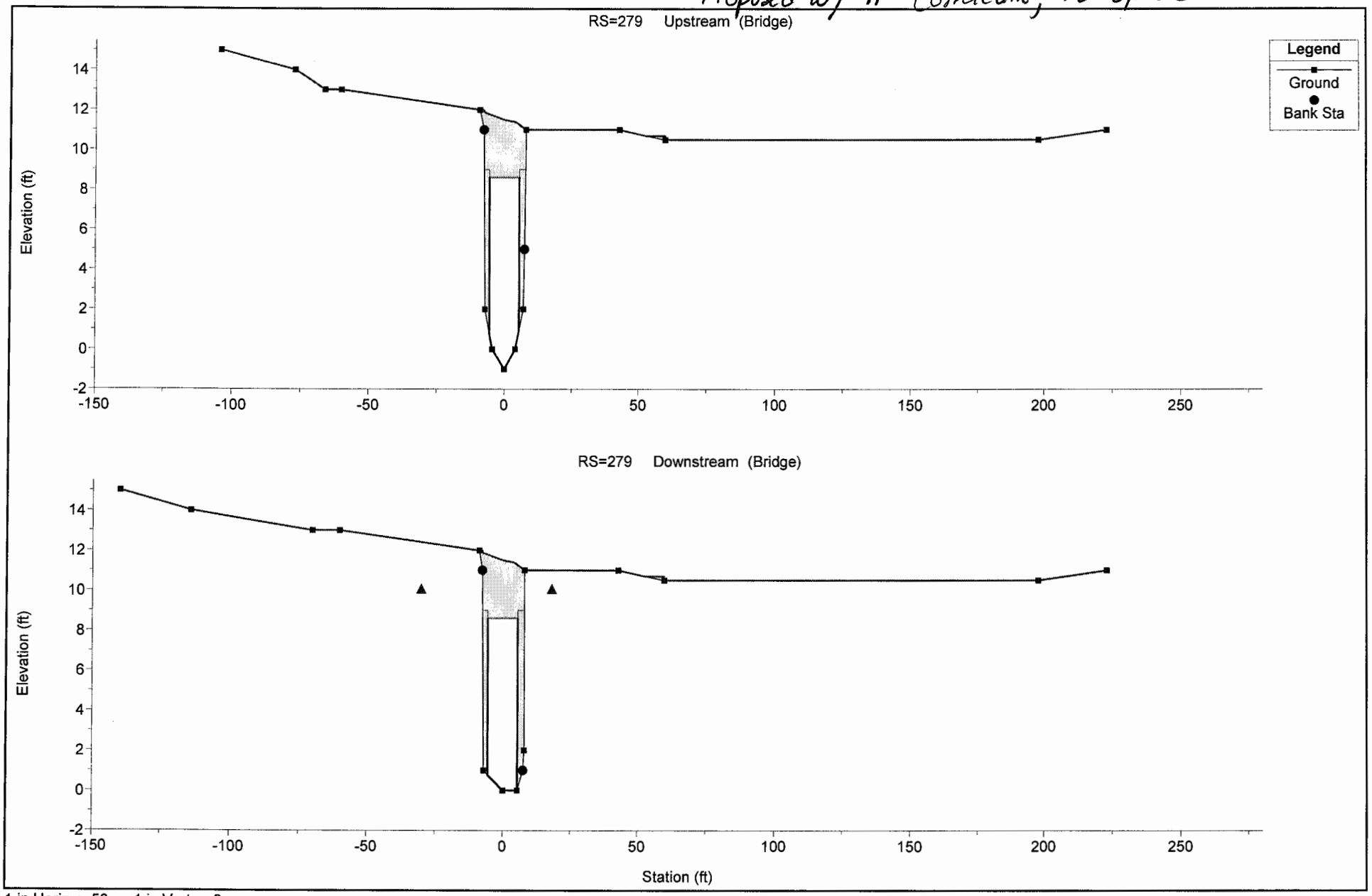


ST

WATERWAY

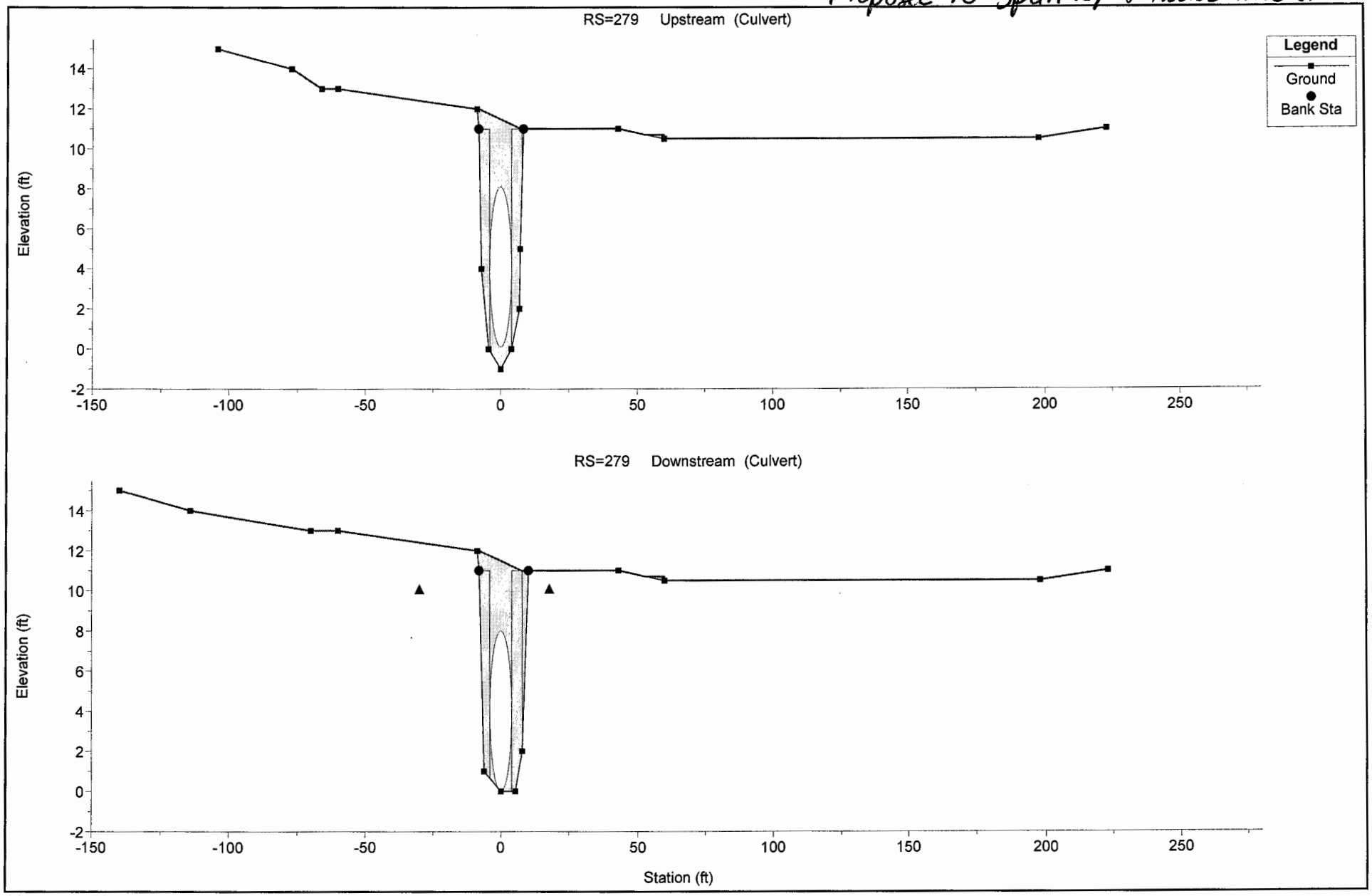
RISE (FT.)	S			
	12	14	16	2
3	30	*	*	*
4	42	50	55	6
5	54	64	71	8
6	66	78	87	10
7	78	92	103	11

Proposed w/ 11' cofferdam, 15' span



1 in Horiz. = 50 1 in Vert. = 3

Proposed 15' span w/ 8' Round INSERT

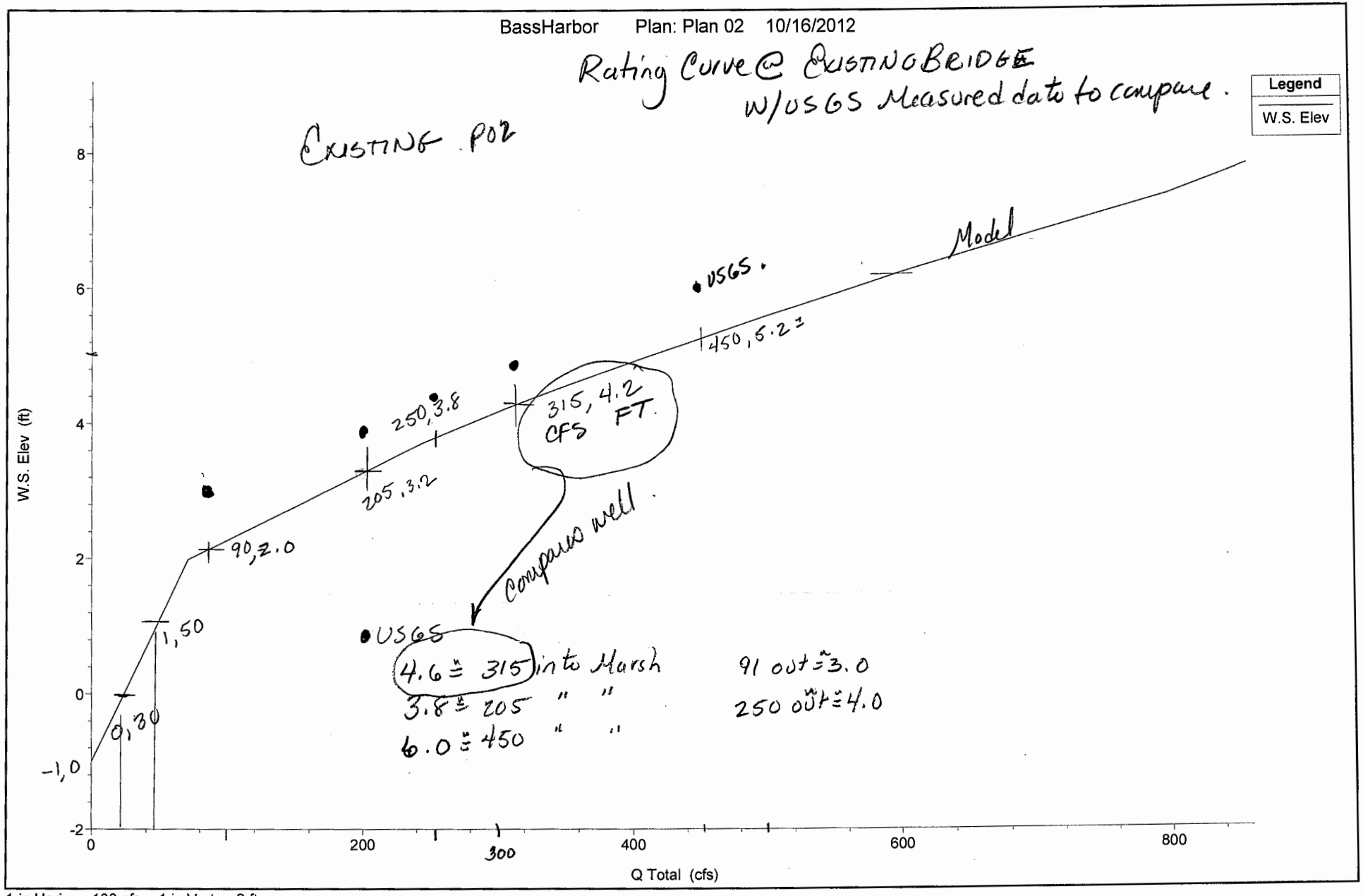


1 in Horiz. = 50 1 in Vert. = 3

APPENDIX 8-1

HECRAS Output

Rating Curve at Bass Harbor Bridge,
HECRAS vs USGS Measured



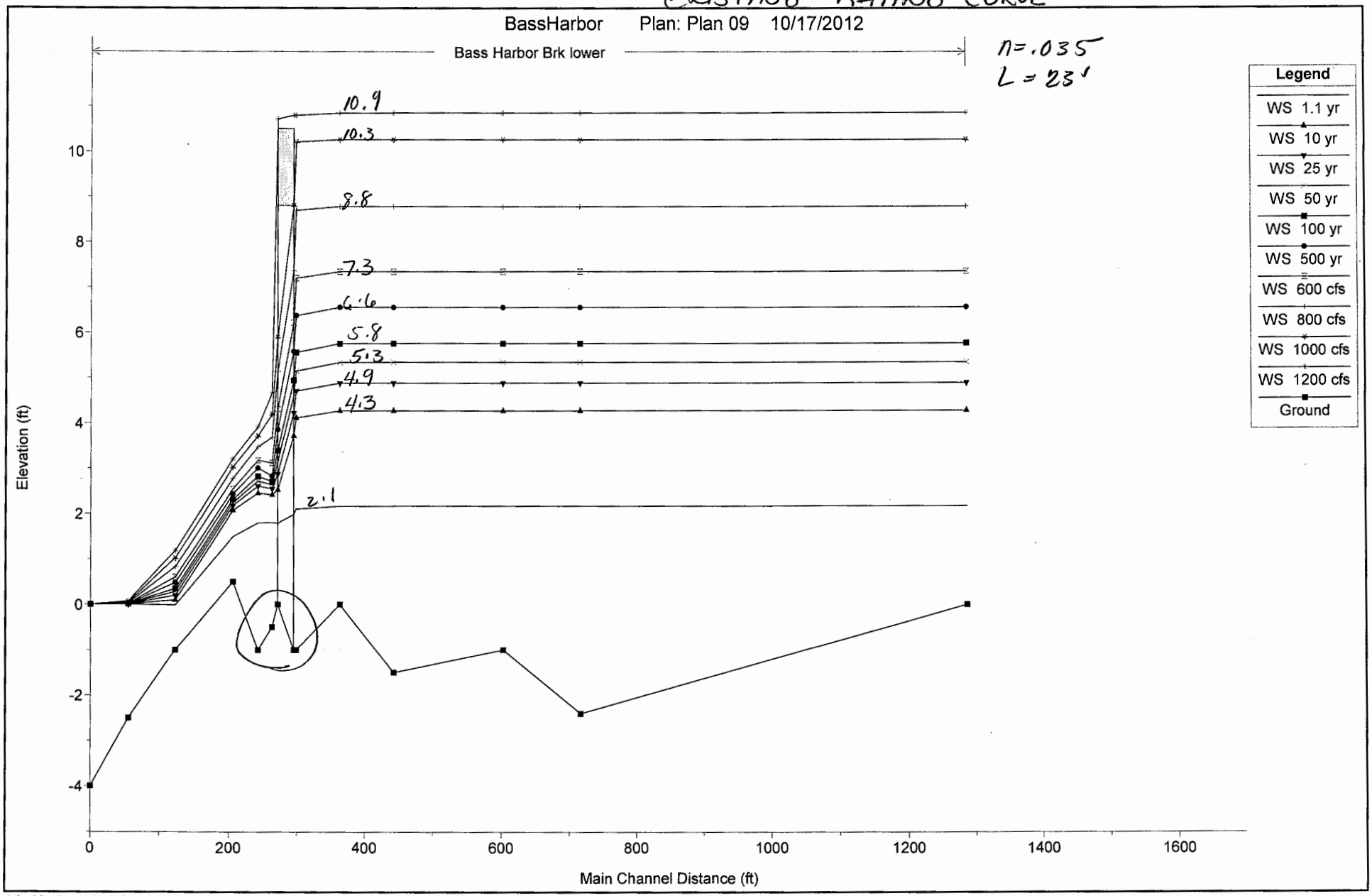
1 in Horiz. = 100 cfs 1 in Vert. = 2 ft

APPENDIX 8-2

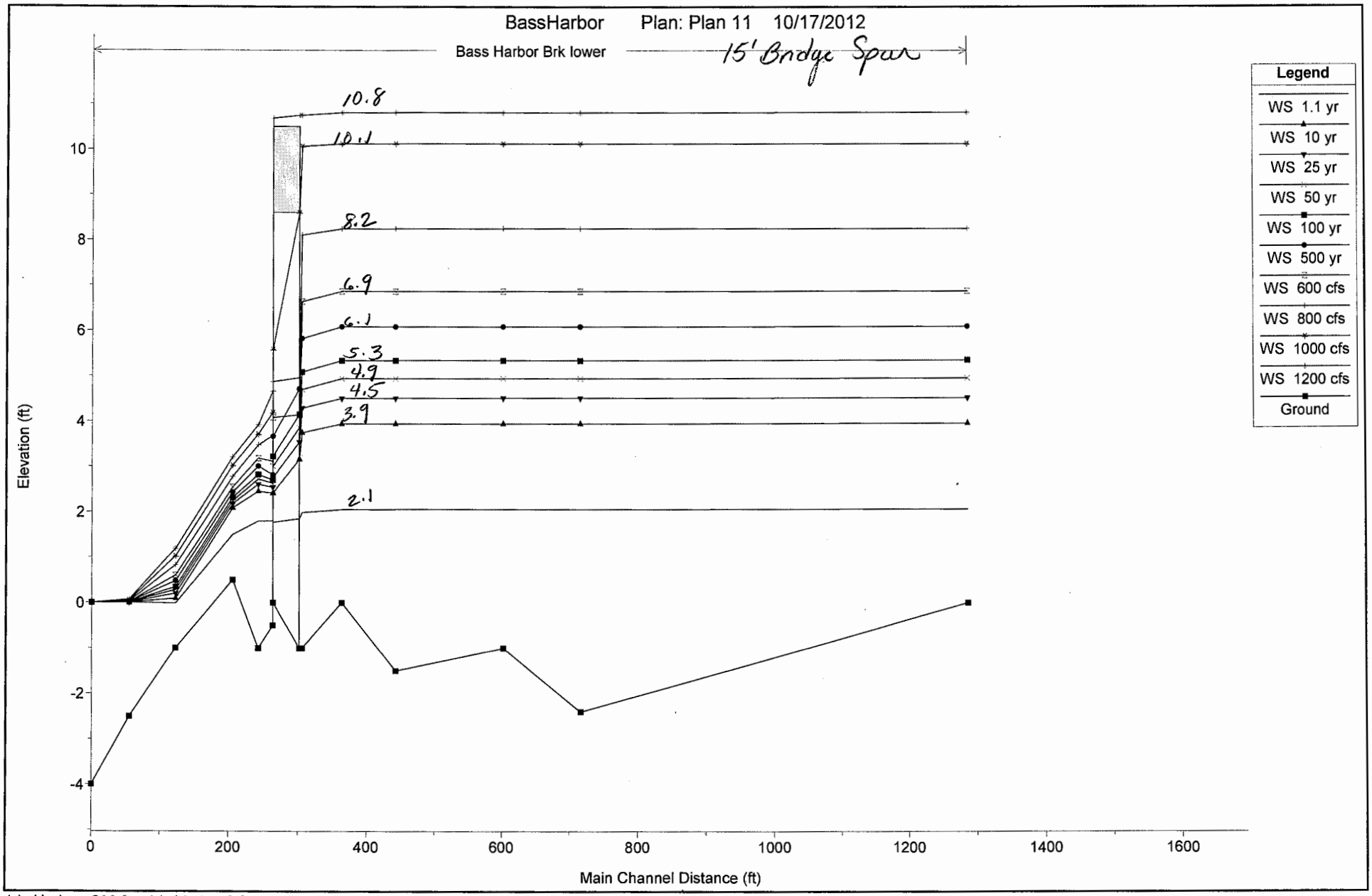
HECRAS Output

Rating Curves for Each Bridge (HECRAS)

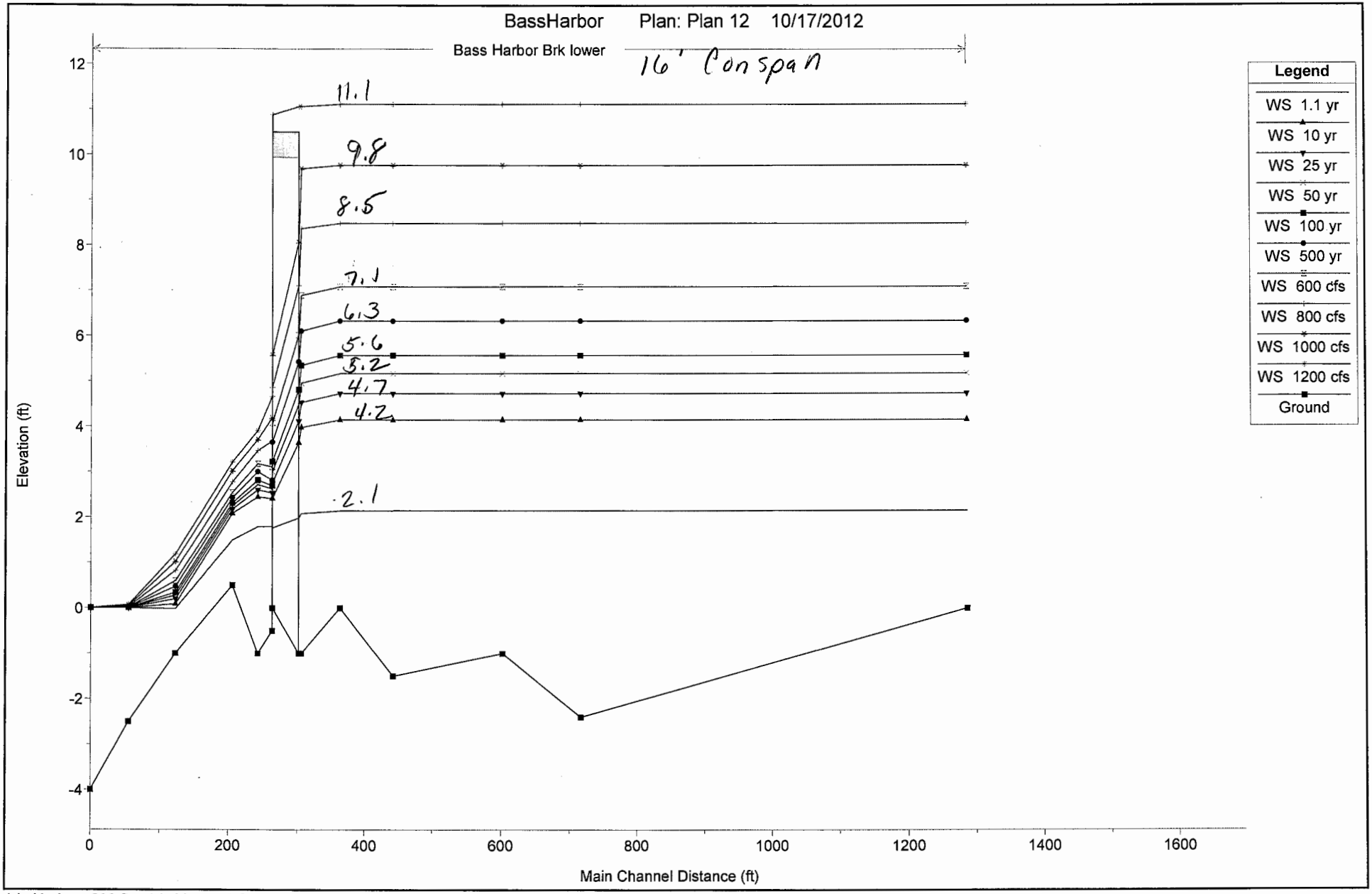
Bridge
EXISTING RATING CURVE



1 in Horiz. = 200 ft 1 in Vert. = 3 ft

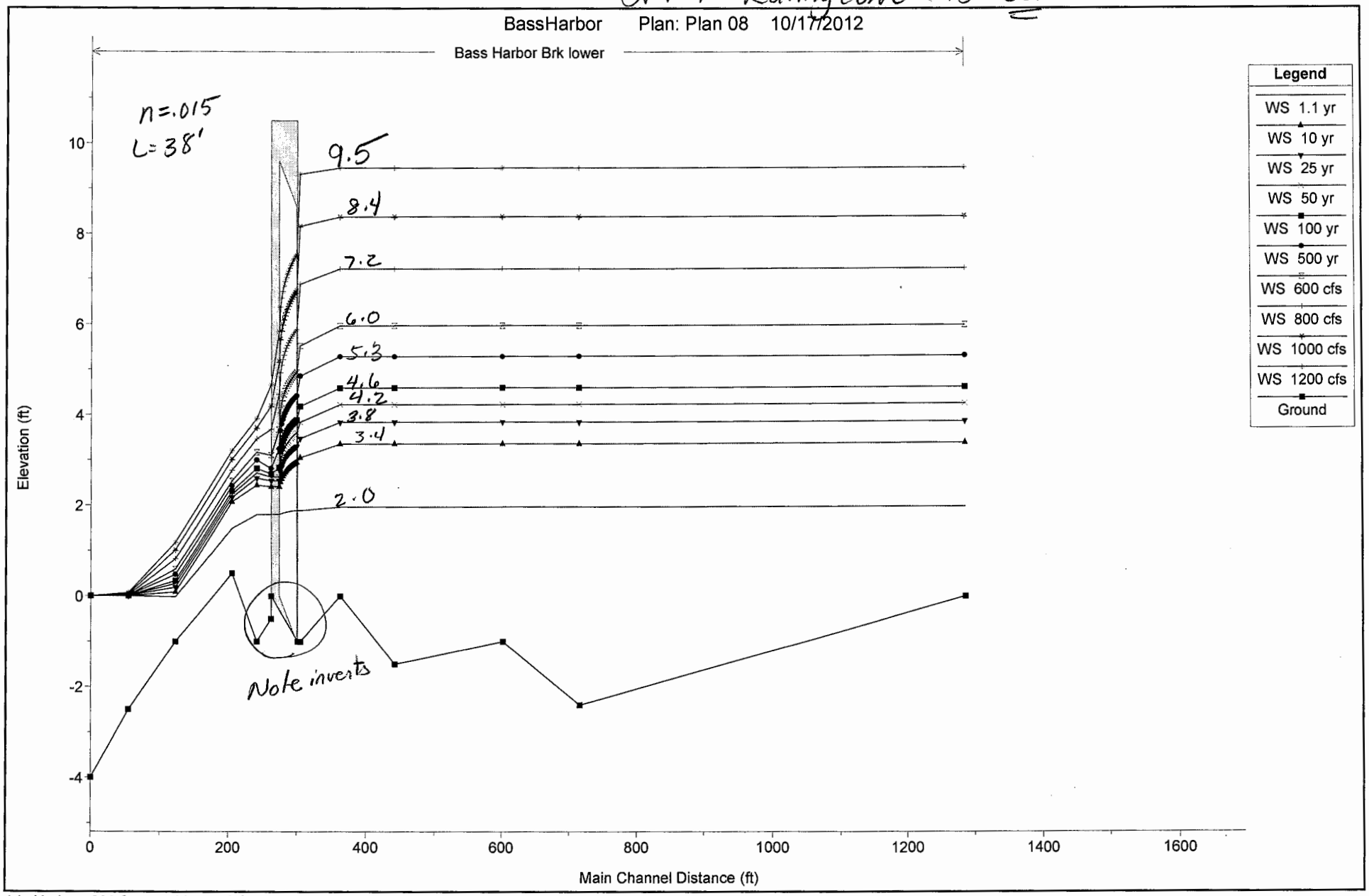


1 in Horiz. = 200 ft 1 in Vert. = 3 ft



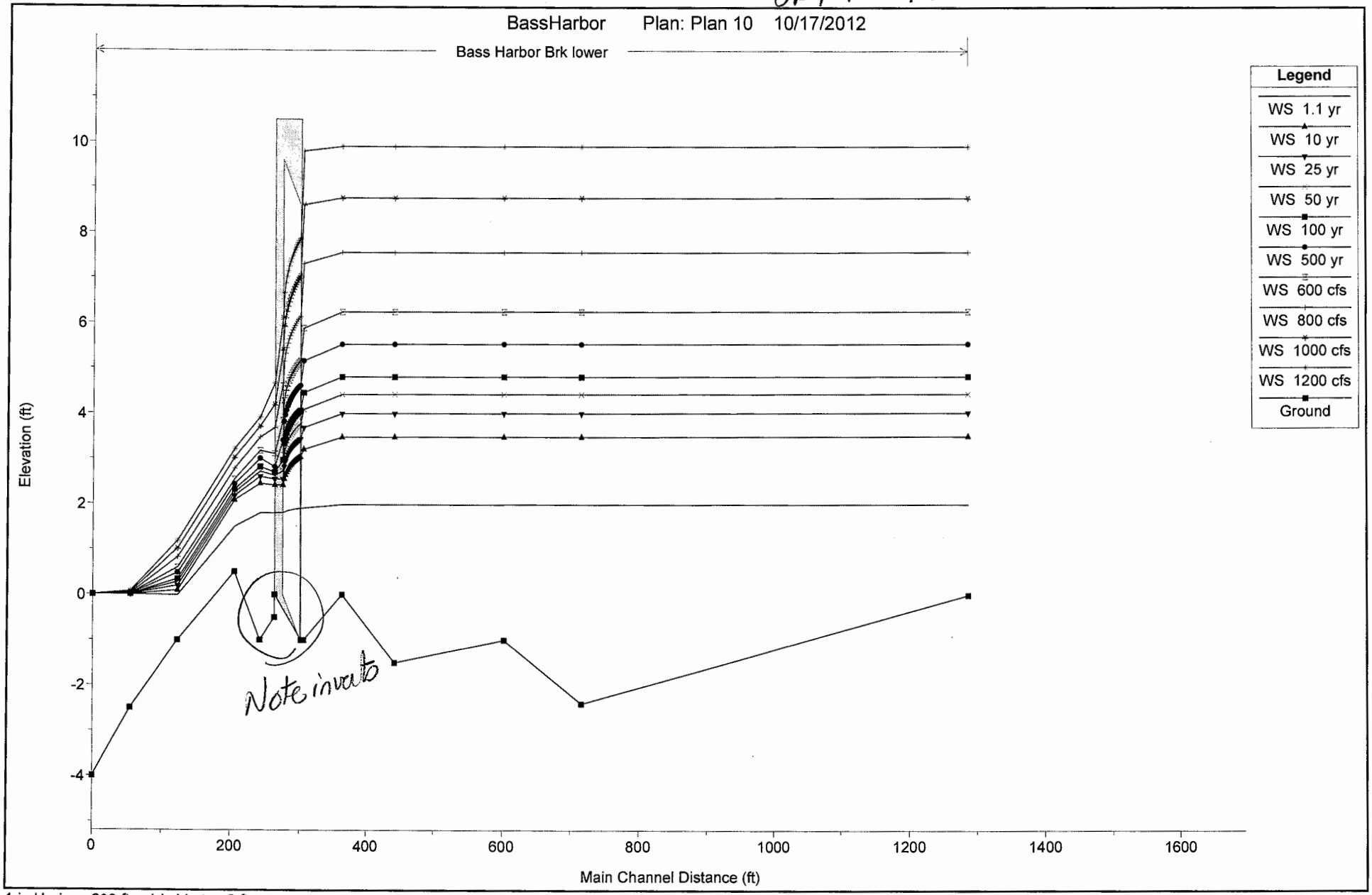
1 in Horiz. = 200 ft 1 in Vert. = 3 ft

Box Culvert
OPT 1 Rating Curve - 15' Box

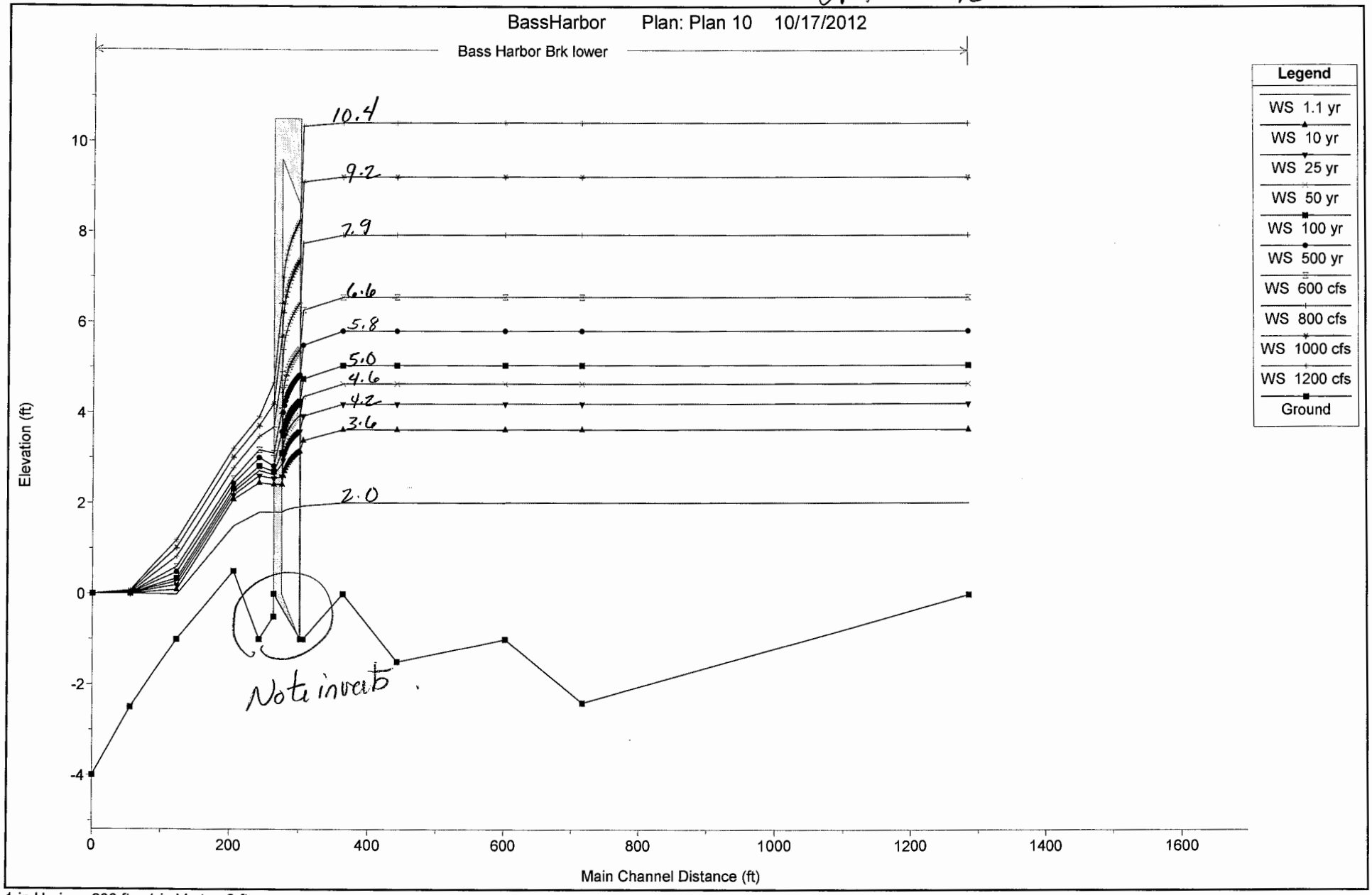


1 in Horiz. = 200 ft 1 in Vert. = 3 ft

Box Culvert
OPT 1 14



Box Culvert
OPT 1 13

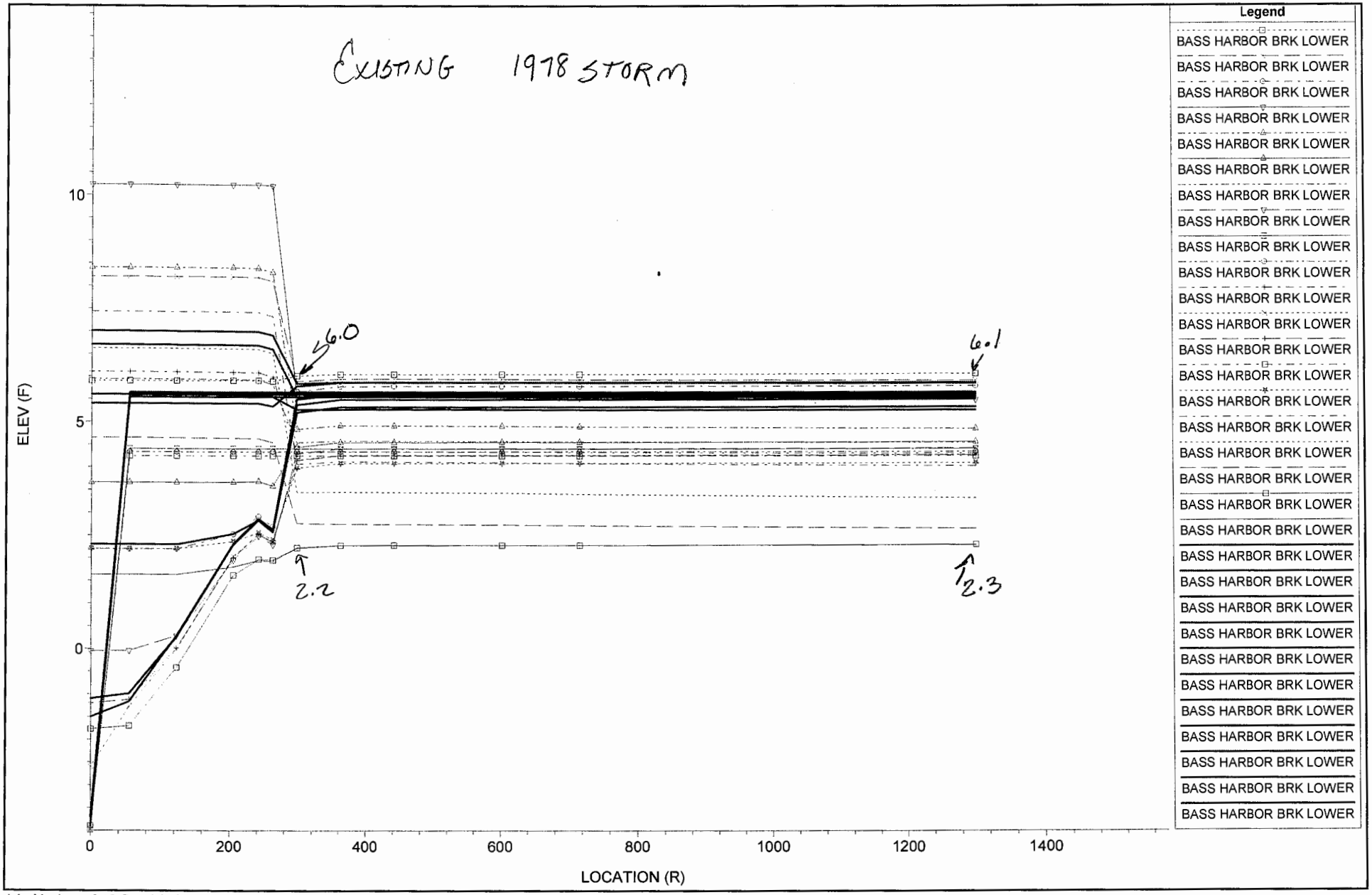


1 in Horiz. = 200 ft 1 in Vert. = 3 ft

APPENDIX 8-3

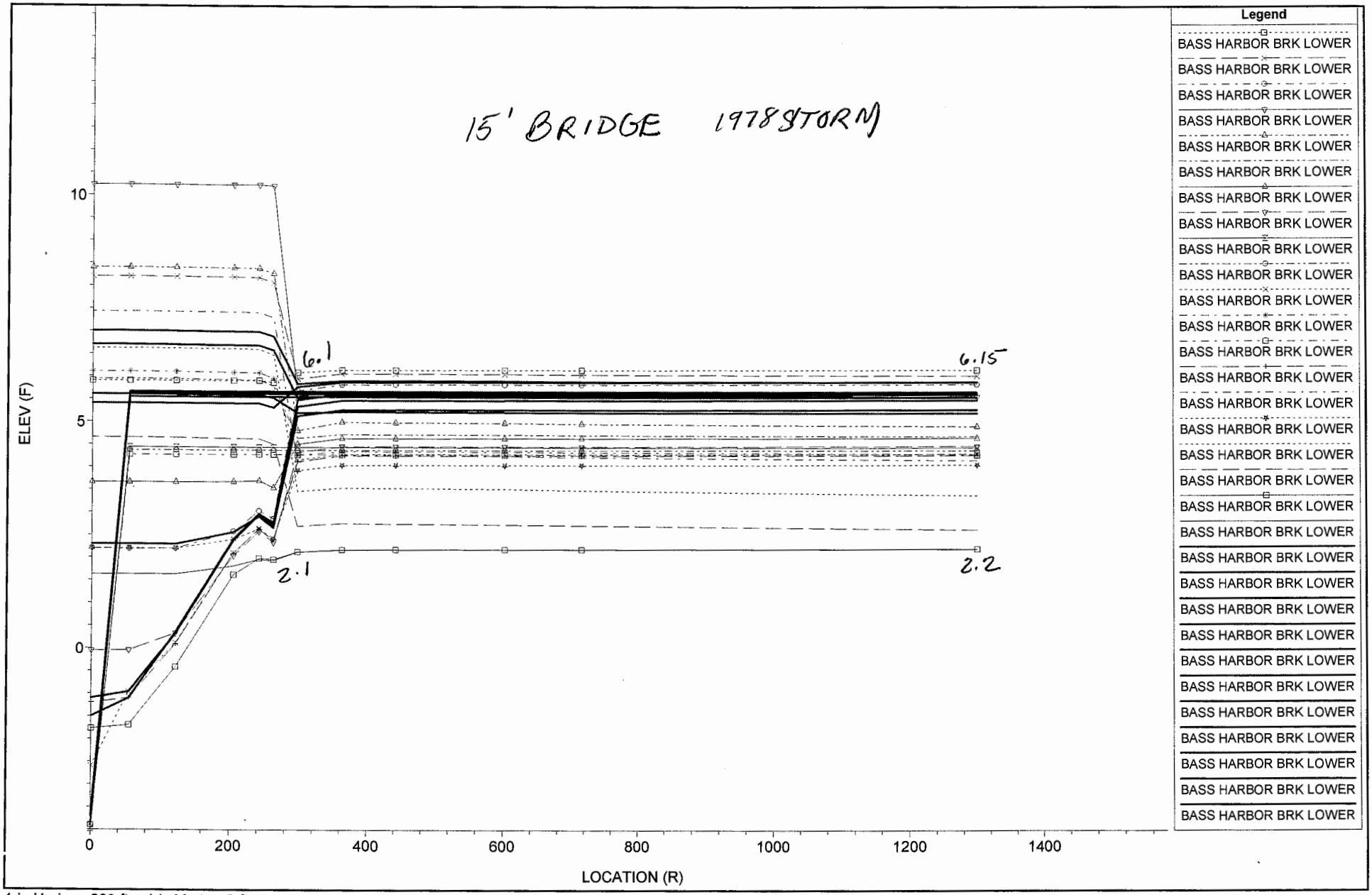
HECRAS Output

Maximum Water Levels for Each Bridge

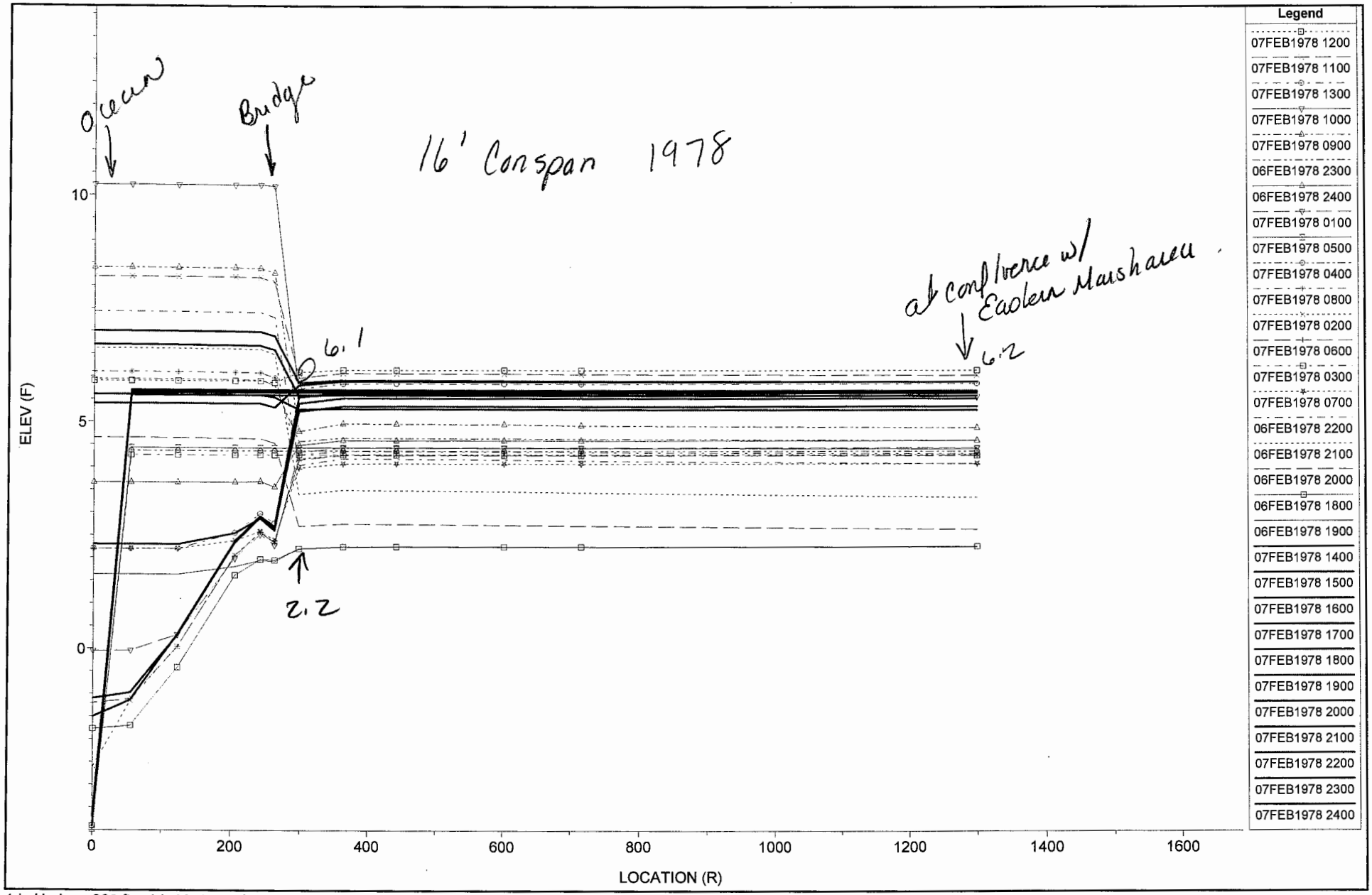


1 in Horiz. = 200 ft 1 in Vert. = 3 ft

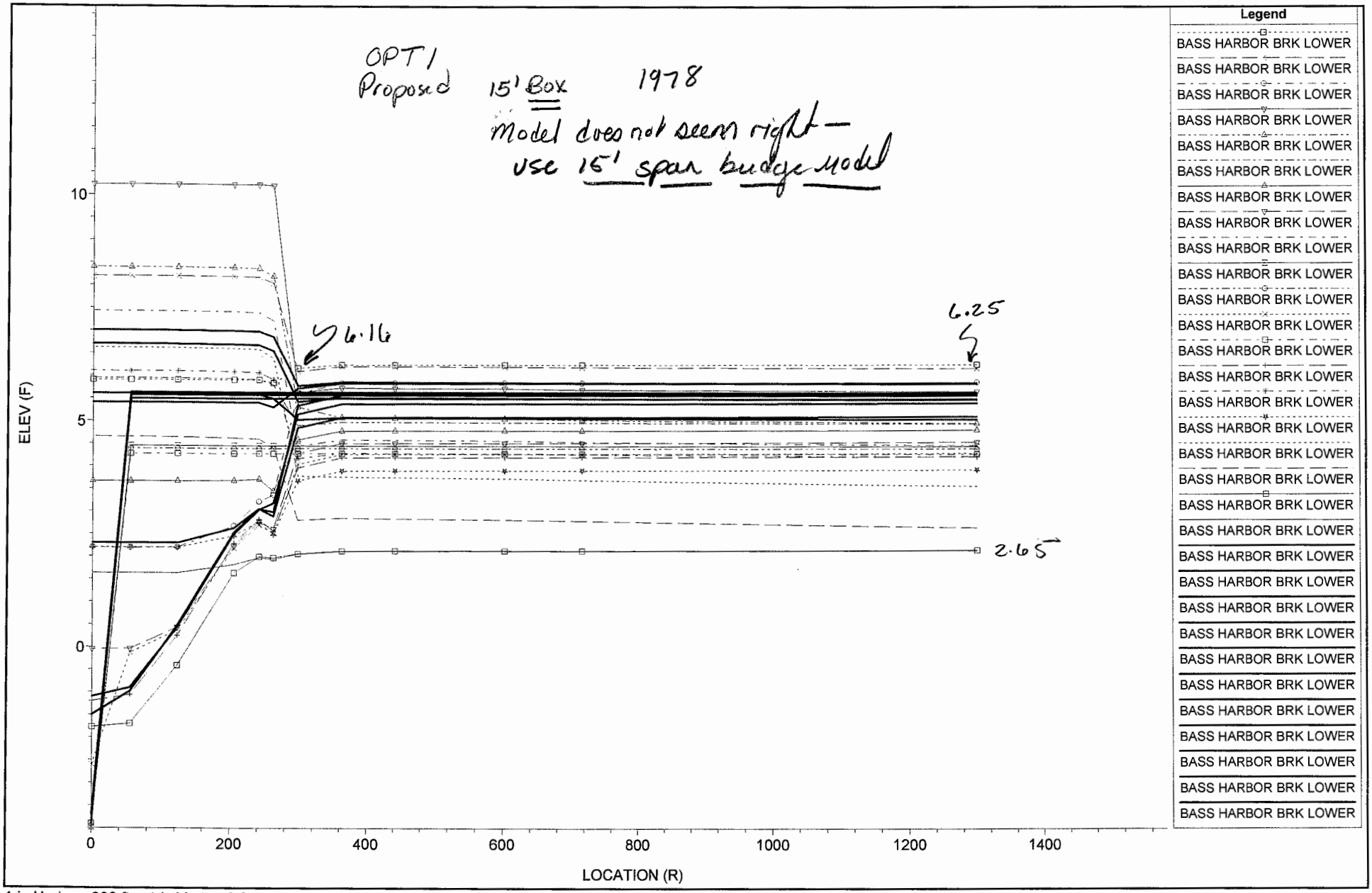
8 of 12



1 in Horiz. = 200 ft 1 in Vert. = 3 ft



1 in Horiz. = 200 ft 1 in Vert. = 3 ft



1 in Horiz. = 200 ft 1 in Vert. = 3 ft

APPENDIX 8-4

HECRAS Output

Data Summary for Each Time Step,
1978 Storm

Existing 1978

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	364	Max WS	5.92	5.92		0.00		225.79		-306.52		-0.31
lower	364	06FEB1978 1800	2.28	2.28		0.01		181.23		74.93		0.31
lower	364	06FEB1978 1900	2.27	2.27		0.01		181.19		75.61		0.31
lower	364	06FEB1978 2000	2.76	2.74		0.05		190.14		-285.48		-0.87
lower	364	06FEB1978 2100	3.47	3.45		0.05		200.85		-511.49		-1.10
lower	364	06FEB1978 2200	4.13	4.11		0.04		209.14		-610.01		-1.01
lower	364	06FEB1978 2300	4.58	4.57		0.01		213.74		-436.02		-0.62
lower	364	06FEB1978 2400	4.55	4.54		0.00		213.45		278.27		0.40
lower	364	07FEB1978 0100	4.41	4.41		0.01		212.05		264.15		0.40
lower	364	07FEB1978 0200	4.26	4.26		0.01		210.56		249.05		0.39
lower	364	07FEB1978 0300	4.12	4.11		0.01		209.15		234.96		0.39
lower	364	07FEB1978 0400	3.98	3.98		0.01		207.68		221.42		0.39
lower	364	07FEB1978 0500	3.84	3.84		0.01		205.94		208.68		0.38
lower	364	07FEB1978 0600	3.72	3.72		0.01		204.30		196.88		0.38
lower	364	07FEB1978 0700	3.60	3.60		0.01		202.76		185.99		0.37
lower	364	07FEB1978 0800	3.96	3.95		0.02		207.38		-449.06		-0.79
lower	364	07FEB1978 0900	4.67	4.65		0.03		214.55		-738.66		-1.03
lower	364	07FEB1978 1000	5.34	5.32		0.03		220.73		-990.61		-1.15
lower	364	07FEB1978 1100	5.75	5.74		0.01		224.32		-717.21		-0.75
lower	364	07FEB1978 1200	5.90	5.90		0.00		225.62		-71.10		-0.07
lower	364	07FEB1978 1300	5.63	5.63		0.00		223.33		398.77		0.43
lower	364	07FEB1978 1400	5.46	5.46		0.00		221.93		379.92		0.42
lower	364	07FEB1978 1500	5.30	5.30		0.00		220.56		361.23		0.42
lower	364	07FEB1978 1600	5.13	5.13		0.00		219.11		341.92		0.42
lower	364	07FEB1978 1700	4.97	4.97		0.00		217.67		323.76		0.41
lower	364	07FEB1978 1800	4.81	4.81		0.00		216.10		307.02		0.41
lower	364	07FEB1978 1900	4.67	4.66		0.00		214.63		291.13		0.40
lower	364	07FEB1978 2000	4.53	4.53		0.00		213.25		276.39		0.40
lower	364	07FEB1978 2100	4.63	4.63		0.01		214.28		-370.98		-0.52
lower	364	07FEB1978 2200	5.03	5.02		0.01		218.16		-519.77		-0.65
lower	364	07FEB1978 2300	5.44	5.43		0.01		221.67		-559.23		-0.63
lower	364	07FEB1978 2400	5.53	5.53		0.00		222.52		202.78		0.22
lower	299	Max WS	5.96	5.91				61.02		-247.75	-4.44	-1.93
lower	299	06FEB1978 1800	2.27	2.22	0.44			18.61		75.08		1.75
lower	299	06FEB1978 1900	2.27	2.22	0.44			18.61		75.60		1.76
lower	299	06FEB1978 2000	3.21	2.76				19.85		-286.78		-5.38
lower	299	06FEB1978 2100	4.35	3.45				21.43		-513.15		-7.61
lower	299	06FEB1978 2200	4.95	4.07				22.85		-611.40		-7.53
lower	299	06FEB1978 2300	4.89	4.54				23.94		-436.62		-4.73
lower	299	06FEB1978 2400	4.59	4.44	1.77			23.71		278.73		3.10
lower	299	07FEB1978 0100	4.44	4.30	1.69			23.39		264.42		3.05
lower	299	07FEB1978 0200	4.29	4.15	1.62			23.05		249.36		3.00
lower	299	07FEB1978 0300	4.15	4.01	1.54			22.73		235.25		2.94
lower	299	07FEB1978 0400	4.01	3.88	1.46			22.42		221.70		2.88
lower	299	07FEB1978 0500	3.87	3.75	1.38			22.11		208.94		2.83
lower	299	07FEB1978 0600	3.74	3.62	1.31			21.83		197.13		2.77
lower	299	07FEB1978 0700	3.62	3.50	1.25			21.56		186.23		2.71
lower	299	07FEB1978 0800	4.44	3.93				22.53		-450.42		-5.78
lower	299	07FEB1978 0900	5.56	4.58				24.03		-740.03		-7.94
lower	299	07FEB1978 1000	6.58	5.42				41.87		-989.39	-2.69	-8.63
lower	299	07FEB1978 1100	6.21	5.69				52.52		-711.43	-6.61	-5.83
lower	299	07FEB1978 1200	5.90	5.89				60.49		-68.96	-1.19	-0.54
lower	299	07FEB1978 1300	5.69	5.51	2.35			45.27		397.49	1.72	3.40
lower	299	07FEB1978 1400	5.52	5.35	2.25			38.75		379.66	0.61	3.38
lower	299	07FEB1978 1500	5.36	5.19	2.17			32.39		361.54	0.12	3.34
lower	299	07FEB1978 1600	5.19	5.02	2.08			25.68		342.31	0.00	3.29
lower	299	07FEB1978 1700	5.02	4.85	1.99			24.67		324.11		3.24
lower	299	07FEB1978 1800	4.86	4.70	1.91			24.31		307.35		3.20
lower	299	07FEB1978 1900	4.71	4.56	1.83			23.98		291.43		3.15
lower	299	07FEB1978 2000	4.57	4.42	1.76			23.66		276.67		3.10
lower	299	07FEB1978 2100	4.85	4.61				24.09		-371.93		-3.96
lower	299	07FEB1978 2200	5.37	4.98				24.95		-520.75		-5.06
lower	299	07FEB1978 2300	5.76	5.39				40.41		-558.98	-1.21	-4.92
lower	299	07FEB1978 2400	5.55	5.50	1.35			44.88		201.93	0.83	1.73
lower	279 BR U	Max WS	6.06	5.91				14.69		-252.20		-3.15
lower	279 BR U	06FEB1978 1800	2.22	2.10	0.85			12.82		75.08		2.82

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	279 BR U	06FEB1978 1900	2.21	2.08	0.86			12.81		75.60		2.86
lower	279 BR U	06FEB1978 2000	3.79	2.76				13.34		-286.78		-8.13
lower	279 BR U	06FEB1978 2100	5.50	3.45				13.87		-513.15		-11.51
lower	279 BR U	06FEB1978 2200	6.11	4.07				14.32		-611.40		-11.46
lower	279 BR U	06FEB1978 2300	5.36	4.54				14.42		-436.62		-7.26
lower	279 BR U	06FEB1978 2400	4.38	3.92	2.49			14.24		278.73		5.43
lower	279 BR U	07FEB1978 0100	4.30	3.87	2.40			14.20		264.42		5.23
lower	279 BR U	07FEB1978 0200	4.15	3.75	2.31			14.11		249.36		5.11
lower	279 BR U	07FEB1978 0300	4.02	3.63	2.21			14.01		235.25		4.99
lower	279 BR U	07FEB1978 0400	3.88	3.51	2.12			13.92		221.70		4.87
lower	279 BR U	07FEB1978 0500	3.75	3.40	2.04			13.84		208.94		4.75
lower	279 BR U	07FEB1978 0600	3.63	3.29	1.96			13.75		197.13		4.64
lower	279 BR U	07FEB1978 0700	3.47	3.13	1.87			13.63		186.23		4.62
lower	279 BR U	07FEB1978 0800	5.12	3.93				14.24		-450.42		-8.77
lower	279 BR U	07FEB1978 0900	6.89	4.58				14.42		-740.03		-12.19
lower	279 BR U	07FEB1978 1000	8.29	5.42				14.59		-992.08		-13.59
lower	279 BR U	07FEB1978 1100	7.05	5.69				14.65		-718.04		-9.34
lower	279 BR U	07FEB1978 1200	5.90	5.89				14.69		-70.15		-0.88
lower	279 BR U	07FEB1978 1300	5.48	4.90	3.17			14.49		399.21		6.11
lower	279 BR U	07FEB1978 1400	5.32	4.77	3.06			14.46		380.27		6.00
lower	279 BR U	07FEB1978 1500	5.17	4.63	2.97			14.43		361.66		5.89
lower	279 BR U	07FEB1978 1600	5.00	4.49	2.86			14.41		342.31		5.77
lower	279 BR U	07FEB1978 1700	4.84	4.35	2.75			14.38		324.11		5.65
lower	279 BR U	07FEB1978 1800	4.69	4.22	2.66			14.35		307.35		5.54
lower	279 BR U	07FEB1978 1900	4.55	4.09	2.56			14.32		291.43		5.42
lower	279 BR U	07FEB1978 2000	4.41	3.98	2.47			14.28		276.67		5.32
lower	279 BR U	07FEB1978 2100	5.18	4.61				14.43		-371.93		-6.09
lower	279 BR U	07FEB1978 2200	5.93	4.98				14.50		-520.75		-7.83
lower	279 BR U	07FEB1978 2300	6.32	5.39				14.59		-560.19		-7.73
lower	279 BR U	07FEB1978 2400	5.52	5.40	2.00			14.59		202.76		2.79
lower	279 BR D	Max WS	10.27	10.20						-252.20		-2.11
lower	279 BR D	06FEB1978 1800	2.12	1.93	1.32			13.43		75.08		3.52
lower	279 BR D	06FEB1978 1900	2.10	1.90	1.32			13.42		75.60		3.61
lower	279 BR D	06FEB1978 2000	4.93	4.54				14.09		-286.78		-5.01
lower	279 BR D	06FEB1978 2100	7.06	6.50				14.58		-513.15		-6.01
lower	279 BR D	06FEB1978 2200	7.93	7.31				14.78		-611.40		-6.28
lower	279 BR D	06FEB1978 2300	6.34	5.82				14.40		-436.62		-5.79
lower	279 BR D	06FEB1978 2400	4.14	3.47	2.72			13.82		278.73		6.58
lower	279 BR D	07FEB1978 0100	3.77	2.64	2.64			13.61		264.42		8.54
lower	279 BR D	07FEB1978 0200	3.64	2.55	2.55			13.59		249.36		8.39
lower	279 BR D	07FEB1978 0300	3.52	2.46	2.46			13.57		235.25		8.23
lower	279 BR D	07FEB1978 0400	3.39	2.38	2.38			13.55		221.70		8.07
lower	279 BR D	07FEB1978 0500	3.28	2.30	2.30			13.52		208.94		7.93
lower	279 BR D	07FEB1978 0600	3.16	2.22	2.22			13.51		197.13		7.78
lower	279 BR D	07FEB1978 0700	3.07	2.24	2.16			13.51		186.23		7.28
lower	279 BR D	07FEB1978 0800	6.50	5.98				14.45		-450.42		-5.79
lower	279 BR D	07FEB1978 0900	8.97	8.29				15.02		-740.03		-6.62
lower	279 BR D	07FEB1978 1000	11.27	10.20						-992.08		-8.30
lower	279 BR D	07FEB1978 1100	8.76	8.08				14.97		-718.04		-6.60
lower	279 BR D	07FEB1978 1200	5.92	5.90				14.43		-70.15		-0.91
lower	279 BR D	07FEB1978 1300	4.84	3.36	3.36			13.79		399.21		9.78
lower	279 BR D	07FEB1978 1400	4.70	3.27	3.27			13.77		380.27		9.62
lower	279 BR D	07FEB1978 1500	4.56	3.17	3.17			13.74		361.66		9.46
lower	279 BR D	07FEB1978 1600	4.41	3.07	3.07			13.72		342.31		9.30
lower	279 BR D	07FEB1978 1700	4.27	2.97	2.97			13.69		324.11		9.13
lower	279 BR D	07FEB1978 1800	4.13	2.88	2.88			13.67		307.35		8.97
lower	279 BR D	07FEB1978 1900	4.00	2.79	2.79			13.65		291.43		8.82
lower	279 BR D	07FEB1978 2000	3.88	2.71	2.71			13.63		276.67		8.68
lower	279 BR D	07FEB1978 2100	5.92	5.49				14.32		-371.93		-5.25
lower	279 BR D	07FEB1978 2200	7.14	6.58				14.60		-520.75		-6.02
lower	279 BR D	07FEB1978 2300	7.47	6.88				14.67		-560.19		-6.16
lower	279 BR D	07FEB1978 2400	5.49	5.36	2.26			14.29		202.76		2.94
lower	264	Max WS	10.22	10.20		0.00		232.20	-0.54	-546.55	-444.98	-1.48
lower	264	06FEB1978 1800	2.01	1.94		0.02		23.33		75.08		2.00
lower	264	06FEB1978 1900	1.98	1.92		0.02		23.21		75.60		2.05
lower	264	06FEB1978 2000	4.65	4.54		0.01		30.71		-286.78		-2.66

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	264	06FEB1978 2100	6.63	6.50		0.00		141.27		-513.15		-2.86
lower	264	06FEB1978 2200	7.44	7.31		0.00		163.89		-611.40		-2.81
lower	264	06FEB1978 2300	5.95	5.82		0.00		123.82		-436.62		-2.89
lower	264	06FEB1978 2400	3.77	3.58		0.01		28.03		278.73		3.50
lower	264	07FEB1978 0100	2.81	2.29		0.08		24.41		264.42		5.77
lower	264	07FEB1978 0200	2.78	2.35		0.06		24.57		249.36		5.28
lower	264	07FEB1978 0300	2.72	2.32		0.06		24.51		235.25		5.04
lower	264	07FEB1978 0400	2.67	2.31		0.06		24.46		221.70		4.79
lower	264	07FEB1978 0500	2.61	2.29		0.05		24.42		208.94		4.56
lower	264	07FEB1978 0600	2.57	2.28		0.05		24.37		197.13		4.34
lower	264	07FEB1978 0700	2.59	2.35		0.04		24.58		186.23		3.94
lower	264	07FEB1978 0800	6.11	5.98		0.00		128.01		-450.42		-2.86
lower	264	07FEB1978 0900	8.41	8.29		0.00		194.54		-740.03		-2.80
lower	264	07FEB1978 1000	10.22	10.20		0.00		232.20	-0.54	-546.55	-444.98	-1.48
lower	264	07FEB1978 1100	8.21	8.08		0.00		188.13		-718.04		-2.82
lower	264	07FEB1978 1200	5.91	5.90		0.00		126.07		-70.15		-0.45
lower	264	07FEB1978 1300	3.47	2.65		0.09		25.41		399.21		7.30
lower	264	07FEB1978 1400	3.38	2.59		0.09		25.25		380.27		7.15
lower	264	07FEB1978 1500	3.29	2.54		0.09		25.11		361.66		6.95
lower	264	07FEB1978 1600	3.20	2.50		0.08		25.00		342.31		6.71
lower	264	07FEB1978 1700	3.11	2.46		0.08		24.89		324.11		6.48
lower	264	07FEB1978 1800	3.04	2.43		0.08		24.81		307.35		6.23
lower	264	07FEB1978 1900	2.96	2.40		0.07		24.72		291.43		6.00
lower	264	07FEB1978 2000	2.94	2.47		0.06		24.90		276.67		5.52
lower	264	07FEB1978 2100	5.60	5.49		0.00		115.58		-371.93		-2.68
lower	264	07FEB1978 2200	6.71	6.58		0.00		143.31		-520.75		-2.85
lower	264	07FEB1978 2300	7.01	6.88		0.00		150.96		-560.19		-2.85
lower	264	07FEB1978 2400	5.42	5.38		0.00		112.79		202.76		1.50
lower	243	Max WS	10.23	10.22		0.00		261.27	-1.32	-991.30	-2.16	-0.70
lower	243	06FEB1978 1800	1.98	1.96		0.06		92.31		75.50		0.90
lower	243	06FEB1978 1900	1.95	1.94		0.05		91.84		75.57		0.92
lower	243	06FEB1978 2000	4.64	4.63		0.00		136.63		-287.86		-0.92
lower	243	06FEB1978 2100	6.61	6.60		0.00		174.75		-514.52		-1.03
lower	243	06FEB1978 2200	7.42	7.41		0.00		186.50		-612.01		-1.06
lower	243	06FEB1978 2300	5.93	5.92		0.00		163.87		-435.68		-1.01
lower	243	06FEB1978 2400	3.70	3.68		0.01		118.12		279.46		1.23
lower	243	07FEB1978 0100	2.56	2.49		0.18		102.29		264.54		2.10
lower	243	07FEB1978 0200	2.59	2.53		0.14		103.02		249.36		1.93
lower	243	07FEB1978 0300	2.54	2.49		0.14		102.29		235.27		1.87
lower	243	07FEB1978 0400	2.51	2.46		0.14		101.69		221.71		1.80
lower	243	07FEB1978 0500	2.47	2.43		0.13		101.11		208.95		1.73
lower	243	07FEB1978 0600	2.44	2.40		0.13		100.53		197.18		1.66
lower	243	07FEB1978 0700	2.49	2.45		0.07		101.61		185.73		1.51
lower	243	07FEB1978 0800	6.09	6.08		0.00		166.69		-452.87		-1.01
lower	243	07FEB1978 0900	8.40	8.38		0.00		199.59		-742.04		-1.10
lower	243	07FEB1978 1000	10.23	10.22		0.00		261.27	-1.32	-991.30	-2.16	-0.70
lower	243	07FEB1978 1100	8.20	8.18		0.00		196.89		-716.36		-1.09
lower	243	07FEB1978 1200	5.91	5.91		0.00		163.67		-68.89		-0.16
lower	243	07FEB1978 1300	2.98	2.88		0.15		109.74		399.24		2.52
lower	243	07FEB1978 1400	2.92	2.83		0.17		108.75		380.32		2.47
lower	243	07FEB1978 1500	2.87	2.78		0.17		107.91		361.71		2.41
lower	243	07FEB1978 1600	2.83	2.75		0.17		107.16		342.32		2.33
lower	243	07FEB1978 1700	2.78	2.70		0.16		106.33		324.12		2.26
lower	243	07FEB1978 1800	2.74	2.66		0.16		105.63		307.36		2.19
lower	243	07FEB1978 1900	2.69	2.62		0.16		104.84		291.47		2.13
lower	243	07FEB1978 2000	2.73	2.67		0.09		105.70		276.48		1.96
lower	243	07FEB1978 2100	5.59	5.58		0.00		157.27		-373.94		-0.93
lower	243	07FEB1978 2200	6.69	6.68		0.00		175.99		-521.51		-1.03
lower	243	07FEB1978 2300	6.99	6.98		0.00		180.64		-560.41		-1.04
lower	243	07FEB1978 2400	5.41	5.40		0.00		153.85		203.90		0.53

15' Proposed 1978

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	364	Max WS	5.94	5.94		0.00		226.00		-308.14		-0.31
lower	364	06FEB1978 1800	2.25	2.25		0.01		180.66		75.39		0.32
lower	364	06FEB1978 1900	2.24	2.24		0.01		180.61		76.19		0.32
lower	364	06FEB1978 2000	2.76	2.75		0.05		190.17		-299.49		-0.91
lower	364	06FEB1978 2100	3.49	3.48		0.05		201.18		-532.11		-1.13
lower	364	06FEB1978 2200	4.17	4.15		0.03		209.53		-631.84		-1.03
lower	364	06FEB1978 2300	4.62	4.61		0.01		214.14		-454.44		-0.64
lower	364	06FEB1978 2400	4.57	4.57		0.00		213.69		295.70		0.42
lower	364	07FEB1978 0100	4.42	4.42		0.00		212.17		279.20		0.42
lower	364	07FEB1978 0200	4.26	4.26		0.01		210.59		262.40		0.41
lower	364	07FEB1978 0300	4.11	4.11		0.01		209.06		246.52		0.41
lower	364	07FEB1978 0400	3.96	3.96		0.01		207.45		231.32		0.41
lower	364	07FEB1978 0500	3.82	3.82		0.01		205.60		217.26		0.40
lower	364	07FEB1978 0600	3.68	3.68		0.01		203.85		204.24		0.40
lower	364	07FEB1978 0700	3.56	3.56		0.01		202.22		192.19		0.39
lower	364	07FEB1978 0800	3.95	3.93		0.02		207.15		-467.90		-0.83
lower	364	07FEB1978 0900	4.68	4.66		0.03		214.61		-760.58		-1.06
lower	364	07FEB1978 1000	5.35	5.33		0.03		220.83		-999.39		-1.15
lower	364	07FEB1978 1100	5.78	5.77		0.01		224.51		-739.05		-0.77
lower	364	07FEB1978 1200	5.91	5.91		0.00		225.76		-31.90		-0.03
lower	364	07FEB1978 1300	5.64	5.63		0.00		223.38		418.34		0.45
lower	364	07FEB1978 1400	5.46	5.46		0.00		221.89		397.59		0.45
lower	364	07FEB1978 1500	5.29	5.28		0.00		220.41		377.23		0.44
lower	364	07FEB1978 1600	5.11	5.10		0.00		218.89		356.48		0.44
lower	364	07FEB1978 1700	4.93	4.93		0.00		217.31		336.63		0.43
lower	364	07FEB1978 1800	4.77	4.77		0.00		215.67		317.96		0.43
lower	364	07FEB1978 1900	4.62	4.61		0.00		214.13		300.57		0.42
lower	364	07FEB1978 2000	4.47	4.47		0.00		212.69		284.88		0.42
lower	364	07FEB1978 2100	4.59	4.59		0.01		213.87		-388.54		-0.55
lower	364	07FEB1978 2200	5.00	4.99		0.01		217.94		-540.07		-0.68
lower	364	07FEB1978 2300	5.43	5.42		0.01		221.58		-580.23		-0.66
lower	364	07FEB1978 2400	5.53	5.53		0.00		222.46		211.31		0.23
lower	299	Max WS	5.96	5.93				61.83		-196.17	-3.25	-1.52
lower	299	06FEB1978 1800	2.25	2.20	0.44			18.56		75.57		1.78
lower	299	06FEB1978 1900	2.25	2.20	0.45			18.55		76.18		1.79
lower	299	06FEB1978 2000	3.21	2.69				19.70		-300.69		-5.79
lower	299	06FEB1978 2100	4.40	3.38				21.28		-533.64		-8.08
lower	299	06FEB1978 2200	4.99	4.01				22.73		-633.11		-7.92
lower	299	06FEB1978 2300	4.92	4.54				23.95		-455.01		-4.93
lower	299	06FEB1978 2400	4.63	4.47	1.86			23.77		296.01		3.27
lower	299	07FEB1978 0100	4.48	4.32	1.77			23.43		279.46		3.21
lower	299	07FEB1978 0200	4.32	4.16	1.68			23.07		262.71		3.15
lower	299	07FEB1978 0300	4.16	4.01	1.60			22.73		246.79		3.09
lower	299	07FEB1978 0400	4.01	3.86	1.52			22.39		231.59		3.02
lower	299	07FEB1978 0500	3.86	3.72	1.43			22.07		217.51		2.96
lower	299	07FEB1978 0600	3.72	3.59	1.36			21.76		204.48		2.90
lower	299	07FEB1978 0700	3.59	3.47	1.28			21.48		192.41		2.83
lower	299	07FEB1978 0800	4.43	3.85				22.34		-469.15		-6.16
lower	299	07FEB1978 0900	5.58	4.49				23.84		-761.84		-8.36
lower	299	07FEB1978 1000	6.60	5.41				41.36		-998.47	-2.19	-8.74
lower	299	07FEB1978 1100	6.22	5.65				50.87		-734.66	-5.12	-6.08
lower	299	07FEB1978 1200	5.91	5.91				61.15		-30.04	-0.48	-0.23
lower	299	07FEB1978 1300	5.72	5.52	2.43			45.70		417.09	1.66	3.56
lower	299	07FEB1978 1400	5.54	5.35	2.33			38.78		397.37	0.56	3.53
lower	299	07FEB1978 1500	5.36	5.17	2.24			31.92		377.54	0.09	3.50
lower	299	07FEB1978 1600	5.18	5.00	2.15			24.99		356.85		3.45
lower	299	07FEB1978 1700	5.00	4.82	2.05			24.60		336.96		3.40
lower	299	07FEB1978 1800	4.84	4.66	1.97			24.22		318.27		3.34
lower	299	07FEB1978 1900	4.68	4.51	1.88			23.88		300.86		3.29
lower	299	07FEB1978 2000	4.53	4.37	1.80			23.55		285.15		3.23
lower	299	07FEB1978 2100	4.81	4.54				23.93		-389.36		-4.23
lower	299	07FEB1978 2200	5.35	4.91				24.79		-540.98		-5.34
lower	299	07FEB1978 2300	5.75	5.34				38.47		-580.34	-0.78	-5.17
lower	299	07FEB1978 2400	5.55	5.49	1.40			44.67		210.57	0.74	1.81
lower	279 BR U	Max WS	6.02	5.93				14.43		-199.42		-2.40
lower	279 BR U	06FEB1978 1800	2.21	2.09	0.86			14.12		75.57		2.70

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	279 BR U	06FEB1978 1900	2.19	2.08	0.86			14.12		76.18		2.74
lower	279 BR U	06FEB1978 2000	3.75	2.69				14.25		-300.69		-8.23
lower	279 BR U	06FEB1978 2100	5.44	3.38				14.39		-533.64		-11.51
lower	279 BR U	06FEB1978 2200	6.03	4.01				14.46		-633.11		-11.40
lower	279 BR U	06FEB1978 2300	5.35	4.54				14.45		-455.01		-7.21
lower	279 BR U	06FEB1978 2400	4.42	3.97	2.50			14.46		296.01		5.39
lower	279 BR U	07FEB1978 0100	4.34	3.93	2.41			14.46		279.46		5.14
lower	279 BR U	07FEB1978 0200	4.19	3.80	2.32			14.46		262.71		5.02
lower	279 BR U	07FEB1978 0300	4.04	3.67	2.23			14.45		246.79		4.89
lower	279 BR U	07FEB1978 0400	3.89	3.54	2.14			14.43		231.59		4.76
lower	279 BR U	07FEB1978 0500	3.76	3.42	2.05			14.40		217.51		4.63
lower	279 BR U	07FEB1978 0600	3.63	3.31	1.98			14.38		204.48		4.51
lower	279 BR U	07FEB1978 0700	3.45	3.14	1.89			14.34		192.41		4.48
lower	279 BR U	07FEB1978 0800	5.06	3.85				14.46		-469.15		-8.84
lower	279 BR U	07FEB1978 0900	6.80	4.49				14.45		-761.84		-12.20
lower	279 BR U	07FEB1978 1000	8.12	5.41				14.44		-1000.66		-13.22
lower	279 BR U	07FEB1978 1100	7.01	5.65				14.43		-739.79		-9.35
lower	279 BR U	07FEB1978 1200	5.91	5.91				14.43		-30.51		-0.37
lower	279 BR U	07FEB1978 1300	5.52	4.95	3.13			14.44		418.76		6.07
lower	279 BR U	07FEB1978 1400	5.35	4.80	3.02			14.45		397.93		5.95
lower	279 BR U	07FEB1978 1500	5.19	4.66	2.93			14.45		377.63		5.82
lower	279 BR U	07FEB1978 1600	5.01	4.51	2.82			14.45		356.85		5.69
lower	279 BR U	07FEB1978 1700	4.85	4.37	2.72			14.45		336.96		5.56
lower	279 BR U	07FEB1978 1800	4.69	4.23	2.62			14.45		318.27		5.42
lower	279 BR U	07FEB1978 1900	4.53	4.10	2.53			14.45		300.86		5.30
lower	279 BR U	07FEB1978 2000	4.39	3.97	2.44			14.46		285.15		5.19
lower	279 BR U	07FEB1978 2100	5.13	4.54				14.45		-389.36		-6.17
lower	279 BR U	07FEB1978 2200	5.88	4.91				14.44		-540.98		-7.90
lower	279 BR U	07FEB1978 2300	6.28	5.34				14.44		-581.12		-7.78
lower	279 BR U	07FEB1978 2400	5.53	5.41	2.01			14.44		211.31		2.79
lower	279 BR D	Max WS	10.24	10.19						-199.42		-1.67
lower	279 BR D	06FEB1978 1800	2.08	1.91	1.26			14.43		75.57		3.27
lower	279 BR D	06FEB1978 1900	2.06	1.88	1.27			14.43		76.18		3.36
lower	279 BR D	06FEB1978 2000	4.91	4.53				14.41		-300.69		-4.94
lower	279 BR D	06FEB1978 2100	7.05	6.49				14.40		-533.64		-5.99
lower	279 BR D	06FEB1978 2200	7.92	7.31				14.39		-633.11		-6.28
lower	279 BR D	06FEB1978 2300	6.32	5.81				14.40		-455.01		-5.74
lower	279 BR D	06FEB1978 2400	4.10	3.43	2.67			14.42		296.01		6.59
lower	279 BR D	07FEB1978 0100	3.71	2.58	2.58			14.43		279.46		8.55
lower	279 BR D	07FEB1978 0200	3.58	2.49	2.49			14.43		262.71		8.36
lower	279 BR D	07FEB1978 0300	3.44	2.40	2.40			14.43		246.79		8.19
lower	279 BR D	07FEB1978 0400	3.31	2.31	2.31			14.43		231.59		8.02
lower	279 BR D	07FEB1978 0500	3.19	2.23	2.23			14.43		217.51		7.86
lower	279 BR D	07FEB1978 0600	3.07	2.15	2.15			14.43		204.48		7.71
lower	279 BR D	07FEB1978 0700	2.97	2.19	2.08			14.43		192.41		7.12
lower	279 BR D	07FEB1978 0800	6.49	5.97				14.40		-469.15		-5.75
lower	279 BR D	07FEB1978 0900	8.96	8.28				14.38		-761.84		-6.63
lower	279 BR D	07FEB1978 1000	11.29	10.19						-1000.66		-8.38
lower	279 BR D	07FEB1978 1100	8.76	8.08				14.38		-739.79		-6.61
lower	279 BR D	07FEB1978 1200	5.91	5.91				14.40		-30.51		-0.38
lower	279 BR D	07FEB1978 1300	4.77	3.28	3.28			14.42		418.76		9.77
lower	279 BR D	07FEB1978 1400	4.62	3.18	3.18			14.42		397.93		9.61
lower	279 BR D	07FEB1978 1500	4.47	3.09	3.09			14.42		377.63		9.44
lower	279 BR D	07FEB1978 1600	4.32	2.99	2.99			14.43		356.85		9.25
lower	279 BR D	07FEB1978 1700	4.17	2.88	2.88			14.43		336.96		9.10
lower	279 BR D	07FEB1978 1800	4.02	2.78	2.78			14.43		318.27		8.94
lower	279 BR D	07FEB1978 1900	3.89	2.69	2.69			14.43		300.86		8.76
lower	279 BR D	07FEB1978 2000	3.76	2.62	2.62			14.43		285.15		8.58
lower	279 BR D	07FEB1978 2100	5.91	5.49				14.41		-389.36		-5.22
lower	279 BR D	07FEB1978 2200	7.13	6.57				14.40		-540.98		-5.99
lower	279 BR D	07FEB1978 2300	7.46	6.87				14.39		-581.12		-6.14
lower	279 BR D	07FEB1978 2400	5.49	5.35	2.19			14.41		211.31		2.91
lower	264	Max WS	10.22	10.19		0.00		232.17	-0.51	-584.16	-416.00	-1.58
lower	264	06FEB1978 1800	2.01	1.94		0.02		23.33		75.57		2.01
lower	264	06FEB1978 1900	1.98	1.92		0.02		23.20		76.18		2.07
lower	264	06FEB1978 2000	4.65	4.53		0.01		30.69		-300.69		-2.79

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	264	06FEB1978 2100	6.63	6.49		0.00		141.08		-533.64		-2.98
lower	264	06FEB1978 2200	7.44	7.31		0.00		163.69		-633.11		-2.92
lower	264	06FEB1978 2300	5.95	5.81		0.01		123.61		-455.01		-3.02
lower	264	06FEB1978 2400	3.78	3.56		0.02		27.98		296.01		3.74
lower	264	07FEB1978 0100	2.86	2.28		0.08		24.38		279.46		6.14
lower	264	07FEB1978 0200	2.82	2.34		0.06		24.55		262.71		5.58
lower	264	07FEB1978 0300	2.75	2.31		0.06		24.48		246.79		5.32
lower	264	07FEB1978 0400	2.69	2.30		0.06		24.43		231.59		5.03
lower	264	07FEB1978 0500	2.64	2.28		0.05		24.39		217.51		4.77
lower	264	07FEB1978 0600	2.58	2.27		0.05		24.34		204.48		4.52
lower	264	07FEB1978 0700	2.60	2.34		0.04		24.56		192.41		4.09
lower	264	07FEB1978 0800	6.11	5.97		0.00		127.82		-469.15		-2.98
lower	264	07FEB1978 0900	8.41	8.28		0.00		194.37		-761.84		-2.89
lower	264	07FEB1978 1000	10.22	10.19		0.00		232.17	-0.51	-584.16	-416.00	-1.58
lower	264	07FEB1978 1100	8.21	8.08		0.00		187.96		-739.79		-2.91
lower	264	07FEB1978 1200	5.91	5.91		0.00		126.22		-30.51		-0.20
lower	264	07FEB1978 1300	3.56	2.67		0.09		25.49		418.76		7.56
lower	264	07FEB1978 1400	3.46	2.61		0.09		25.31		397.93		7.40
lower	264	07FEB1978 1500	3.36	2.56		0.08		25.16		377.63		7.20
lower	264	07FEB1978 1600	3.26	2.51		0.08		25.03		356.85		6.96
lower	264	07FEB1978 1700	3.17	2.47		0.08		24.90		336.96		6.72
lower	264	07FEB1978 1800	3.08	2.43		0.07		24.80		318.27		6.47
lower	264	07FEB1978 1900	2.99	2.39		0.07		24.69		300.86		6.23
lower	264	07FEB1978 2000	2.96	2.44		0.06		24.85		285.15		5.75
lower	264	07FEB1978 2100	5.61	5.49		0.00		115.38		-389.36		-2.81
lower	264	07FEB1978 2200	6.71	6.57		0.00		143.13		-540.98		-2.96
lower	264	07FEB1978 2300	7.01	6.87		0.00		150.78		-581.12		-2.96
lower	264	07FEB1978 2400	5.42	5.38		0.00		112.75		211.31		1.56
lower	243	Max WS	10.23	10.22		0.00		261.27	-1.33	-999.81	-2.18	-0.71
lower	243	06FEB1978 1800	1.98	1.97		0.06		92.37		75.94		0.90
lower	243	06FEB1978 1900	1.95	1.94		0.05		91.89		76.15		0.93
lower	243	06FEB1978 2000	4.64	4.62		0.01		136.57		-301.77		-0.97
lower	243	06FEB1978 2100	6.61	6.59		0.00		174.72		-535.00		-1.07
lower	243	06FEB1978 2200	7.42	7.41		0.00		186.47		-633.72		-1.09
lower	243	06FEB1978 2300	5.93	5.91		0.00		163.83		-454.07		-1.05
lower	243	06FEB1978 2400	3.71	3.68		0.02		118.14		296.78		1.31
lower	243	07FEB1978 0100	2.59	2.52		0.19		102.79		279.57		2.18
lower	243	07FEB1978 0200	2.62	2.56		0.15		103.66		262.72		1.99
lower	243	07FEB1978 0300	2.57	2.52		0.15		102.82		246.82		1.92
lower	243	07FEB1978 0400	2.53	2.48		0.14		102.13		231.59		1.85
lower	243	07FEB1978 0500	2.50	2.45		0.13		101.49		217.52		1.77
lower	243	07FEB1978 0600	2.46	2.41		0.13		100.85		204.53		1.71
lower	243	07FEB1978 0700	2.50	2.47		0.07		101.86		191.93		1.55
lower	243	07FEB1978 0800	6.09	6.07		0.00		166.66		-471.60		-1.05
lower	243	07FEB1978 0900	8.40	8.38		0.00		199.57		-763.84		-1.13
lower	243	07FEB1978 1000	10.23	10.22		0.00		261.27	-1.33	-999.81	-2.18	-0.71
lower	243	07FEB1978 1100	8.20	8.18		0.00		196.87		-738.11		-1.12
lower	243	07FEB1978 1200	5.91	5.91		0.00		163.73		-29.30		-0.07
lower	243	07FEB1978 1300	3.02	2.92		0.15		110.44		418.77		2.59
lower	243	07FEB1978 1400	2.96	2.86		0.18		109.38		397.98		2.54
lower	243	07FEB1978 1500	2.91	2.82		0.17		108.53		377.67		2.47
lower	243	07FEB1978 1600	2.87	2.78		0.17		107.77		356.86		2.38
lower	243	07FEB1978 1700	2.82	2.73		0.16		106.95		336.97		2.31
lower	243	07FEB1978 1800	2.77	2.69		0.16		106.14		318.28		2.23
lower	243	07FEB1978 1900	2.72	2.65		0.16		105.29		300.90		2.17
lower	243	07FEB1978 2000	2.75	2.68		0.10		105.98		284.97		2.01
lower	243	07FEB1978 2100	5.59	5.58		0.00		157.23		-391.41		-0.98
lower	243	07FEB1978 2200	6.69	6.68		0.00		175.97		-541.74		-1.07
lower	243	07FEB1978 2300	6.99	6.98		0.00		180.62		-581.34		-1.08
lower	243	07FEB1978 2400	5.41	5.40		0.00		153.86		212.47		0.55

16' Compan 1978

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	364	Max WS	6.03	6.03		0.00		227.00		-318.68		-0.31
lower	364	06FEB1978 1800	2.25	2.25		0.01		180.73		75.30		0.32
lower	364	06FEB1978 1900	2.25	2.25		0.01		180.69		75.98		0.32
lower	364	06FEB1978 2000	2.76	2.75		0.05		190.26		-302.09		-0.92
lower	364	06FEB1978 2100	3.51	3.49		0.05		201.42		-544.23		-1.14
lower	364	06FEB1978 2200	4.20	4.18		0.03		209.84		-647.83		-1.05
lower	364	06FEB1978 2300	4.65	4.64		0.01		214.43		-462.96		-0.65
lower	364	06FEB1978 2400	4.59	4.59		0.00		213.89		300.70		0.43
lower	364	07FEB1978 0100	4.44	4.43		0.00		212.33		283.40		0.42
lower	364	07FEB1978 0200	4.28	4.28		0.01		210.78		266.38		0.42
lower	364	07FEB1978 0300	4.12	4.12		0.01		209.22		249.69		0.41
lower	364	07FEB1978 0400	3.97	3.97		0.01		207.62		233.93		0.41
lower	364	07FEB1978 0500	3.83	3.83		0.01		205.75		219.04		0.40
lower	364	07FEB1978 0600	3.69	3.69		0.01		203.99		205.46		0.40
lower	364	07FEB1978 0700	3.57	3.57		0.01		202.35		192.96		0.39
lower	364	07FEB1978 0800	3.96	3.95		0.02		207.34		-477.50		-0.84
lower	364	07FEB1978 0900	4.71	4.69		0.03		214.87		-782.71		-1.08
lower	364	07FEB1978 1000	5.43	5.41		0.03		221.47		-1000.71		-1.13
lower	364	07FEB1978 1100	5.87	5.86		0.01		225.34		-759.71		-0.77
lower	364	07FEB1978 1200	5.97	5.97		0.00		226.23		174.56		0.17
lower	364	07FEB1978 1300	5.69	5.69		0.00		223.88		432.79		0.46
lower	364	07FEB1978 1400	5.51	5.51		0.00		222.34		410.58		0.45
lower	364	07FEB1978 1500	5.35	5.34		0.00		220.92		390.23		0.45
lower	364	07FEB1978 1600	5.16	5.16		0.00		219.35		367.64		0.44
lower	364	07FEB1978 1700	4.99	4.98		0.00		217.82		346.56		0.44
lower	364	07FEB1978 1800	4.82	4.81		0.00		216.14		326.76		0.43
lower	364	07FEB1978 1900	4.66	4.66		0.00		214.55		308.38		0.43
lower	364	07FEB1978 2000	4.51	4.51		0.00		213.07		291.50		0.42
lower	364	07FEB1978 2100	4.63	4.62		0.01		214.21		-395.72		-0.56
lower	364	07FEB1978 2200	5.04	5.04		0.01		218.30		-552.57		-0.69
lower	364	07FEB1978 2300	5.47	5.47		0.01		221.97		-594.49		-0.66
lower	364	07FEB1978 2400	5.56	5.56		0.00		222.75		244.29		0.27
lower	299	Max WS	6.06	6.01				65.33		-223.90	-4.61	-1.70
lower	299	06FEB1978 1800	2.25	2.20	0.44			18.57		75.46		1.77
lower	299	06FEB1978 1900	2.25	2.20	0.45			18.56		75.97		1.79
lower	299	06FEB1978 2000	3.23	2.70				19.71		-303.29		-5.83
lower	299	06FEB1978 2100	4.45	3.40				21.32		-545.80		-8.21
lower	299	06FEB1978 2200	5.05	4.04				22.80		-649.18		-8.05
lower	299	06FEB1978 2300	4.95	4.57				24.01		-463.54		-4.99
lower	299	06FEB1978 2400	4.66	4.48	1.88			23.82		301.04		3.31
lower	299	07FEB1978 0100	4.50	4.33	1.79			23.46		283.66		3.25
lower	299	07FEB1978 0200	4.34	4.18	1.70			23.11		266.70		3.19
lower	299	07FEB1978 0300	4.18	4.02	1.62			22.76		249.97		3.12
lower	299	07FEB1978 0400	4.02	3.88	1.53			22.42		234.20		3.05
lower	299	07FEB1978 0500	3.87	3.74	1.45			22.09		219.29		2.97
lower	299	07FEB1978 0600	3.73	3.60	1.37			21.79		205.70		2.90
lower	299	07FEB1978 0700	3.60	3.48	1.29			21.50		193.18		2.84
lower	299	07FEB1978 0800	4.47	3.86				22.37		-478.80		-6.27
lower	299	07FEB1978 0900	5.65	4.52				23.89		-784.02		-8.55
lower	299	07FEB1978 1000	6.61	5.45				42.75		-999.46	-2.70	-8.68
lower	299	07FEB1978 1100	6.33	5.76				55.33		-752.74	-7.77	-6.07
lower	299	07FEB1978 1200	5.98	5.95	1.19			62.76		173.41	3.05	1.34
lower	299	07FEB1978 1300	5.78	5.58	2.49			47.86		431.02	2.21	3.63
lower	299	07FEB1978 1400	5.60	5.39	2.40			40.70		410.11	0.81	3.60
lower	299	07FEB1978 1500	5.43	5.23	2.30			34.13		390.43	0.19	3.57
lower	299	07FEB1978 1600	5.24	5.05	2.20			26.86		368.01	0.00	3.52
lower	299	07FEB1978 1700	5.06	4.87	2.10			24.71		346.90		3.46
lower	299	07FEB1978 1800	4.89	4.71	2.01			24.32		327.07		3.40
lower	299	07FEB1978 1900	4.72	4.55	1.92			23.96		308.67		3.34
lower	299	07FEB1978 2000	4.57	4.40	1.83			23.63		291.78		3.28
lower	299	07FEB1978 2100	4.85	4.57				24.01		-396.62		-4.27
lower	299	07FEB1978 2200	5.40	4.95				24.88		-553.50		-5.41
lower	299	07FEB1978 2300	5.81	5.38				40.22		-594.18	-1.09	-5.24
lower	299	07FEB1978 2400	5.59	5.52	1.58			45.65		243.59	0.97	2.08
lower	279 BR U	Max WS	6.12	6.01				15.16		-228.50		-2.65
lower	279 BR U	06FEB1978 1800	2.21	2.10	0.86			14.14		75.46		2.69

HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	279 BR U	06FEB1978 1900	2.20	2.08	0.86			14.14		75.97		2.73
lower	279 BR U	06FEB1978 2000	3.76	2.70				14.40		-303.29		-8.28
lower	279 BR U	06FEB1978 2100	5.51	3.40				14.71		-545.80		-11.64
lower	279 BR U	06FEB1978 2200	6.10	4.04				14.99		-649.18		-11.51
lower	279 BR U	06FEB1978 2300	5.37	4.57				15.17		-463.54		-7.20
lower	279 BR U	06FEB1978 2400	4.43	3.97	2.53			14.96		301.04		5.44
lower	279 BR U	07FEB1978 0100	4.36	3.95	2.44			14.94		283.66		5.16
lower	279 BR U	07FEB1978 0200	4.21	3.82	2.34			14.89		266.70		5.02
lower	279 BR U	07FEB1978 0300	4.05	3.68	2.24			14.83		249.97		4.90
lower	279 BR U	07FEB1978 0400	3.91	3.56	2.15			14.78		234.20		4.76
lower	279 BR U	07FEB1978 0500	3.77	3.44	2.07			14.72		219.29		4.62
lower	279 BR U	07FEB1978 0600	3.64	3.32	1.98			14.67		205.70		4.50
lower	279 BR U	07FEB1978 0700	3.48	3.17	1.89			14.61		193.18		4.44
lower	279 BR U	07FEB1978 0800	5.09	3.86				14.90		-478.80		-8.93
lower	279 BR U	07FEB1978 0900	6.88	4.52				15.16		-784.02		-12.33
lower	279 BR U	07FEB1978 1000	8.03	5.45				15.29		-1002.16		-12.90
lower	279 BR U	07FEB1978 1100	7.08	5.76				15.22		-760.51		-9.21
lower	279 BR U	07FEB1978 1200	5.98	5.91	1.77			15.19		176.46		2.08
lower	279 BR U	07FEB1978 1300	5.58	5.00	3.20			15.23		433.22		6.10
lower	279 BR U	07FEB1978 1400	5.41	4.85	3.10			15.21		410.92		5.98
lower	279 BR U	07FEB1978 1500	5.25	4.71	3.00			15.19		390.62		5.87
lower	279 BR U	07FEB1978 1600	5.07	4.56	2.88			15.17		368.01		5.73
lower	279 BR U	07FEB1978 1700	4.90	4.41	2.77			15.14		346.90		5.60
lower	279 BR U	07FEB1978 1800	4.73	4.27	2.68			15.08		327.07		5.47
lower	279 BR U	07FEB1978 1900	4.58	4.14	2.57			15.03		308.67		5.34
lower	279 BR U	07FEB1978 2000	4.44	4.01	2.49			14.97		291.78		5.21
lower	279 BR U	07FEB1978 2100	5.16	4.57				15.17		-396.62		-6.16
lower	279 BR U	07FEB1978 2200	5.92	4.95				15.22		-553.50		-7.89
lower	279 BR U	07FEB1978 2300	6.32	5.38				15.28		-595.26		-7.76
lower	279 BR U	07FEB1978 2400	5.56	5.40	2.21			15.29		244.56		3.18
lower	279 BR D	Max WS	10.24	10.19						-228.50		-1.75
lower	279 BR D	06FEB1978 1800	2.08	1.91	1.28			14.79		75.46		3.31
lower	279 BR D	06FEB1978 1900	2.06	1.88	1.29			14.79		75.97		3.39
lower	279 BR D	06FEB1978 2000	4.90	4.53				15.16		-303.29		-4.89
lower	279 BR D	06FEB1978 2100	7.04	6.49				15.01		-545.80		-5.95
lower	279 BR D	06FEB1978 2200	7.91	7.30				14.47		-649.18		-6.26
lower	279 BR D	06FEB1978 2300	6.31	5.80				15.21		-463.54		-5.69
lower	279 BR D	06FEB1978 2400	4.11	3.42	2.72			15.00		301.04		6.64
lower	279 BR D	07FEB1978 0100	3.74	2.63	2.63			14.89		283.66		8.49
lower	279 BR D	07FEB1978 0200	3.61	2.53	2.53			14.88		266.70		8.35
lower	279 BR D	07FEB1978 0300	3.47	2.45	2.45			14.86		249.97		8.12
lower	279 BR D	07FEB1978 0400	3.34	2.36	2.36			14.85		234.20		7.97
lower	279 BR D	07FEB1978 0500	3.21	2.26	2.26			14.84		219.29		7.82
lower	279 BR D	07FEB1978 0600	3.10	2.19	2.19			14.83		205.70		7.64
lower	279 BR D	07FEB1978 0700	2.99	2.18	2.11			14.83		193.18		7.20
lower	279 BR D	07FEB1978 0800	6.47	5.97				15.17		-478.80		-5.70
lower	279 BR D	07FEB1978 0900	8.97	8.27				12.90		-784.02		-6.68
lower	279 BR D	07FEB1978 1000	11.11	10.19						-1002.16		-7.68
lower	279 BR D	07FEB1978 1100	8.75	8.07				13.72		-760.51		-6.63
lower	279 BR D	07FEB1978 1200	5.96	5.89	2.01			15.19		176.46		2.13
lower	279 BR D	07FEB1978 1300	4.84	3.35	3.35			14.99		433.22		9.78
lower	279 BR D	07FEB1978 1400	4.69	3.26	3.26			14.98		410.92		9.59
lower	279 BR D	07FEB1978 1500	4.54	3.16	3.16			14.97		390.62		9.42
lower	279 BR D	07FEB1978 1600	4.38	3.05	3.05			14.95		368.01		9.26
lower	279 BR D	07FEB1978 1700	4.23	2.95	2.95			14.94		346.90		9.06
lower	279 BR D	07FEB1978 1800	4.08	2.85	2.85			14.92		327.07		8.90
lower	279 BR D	07FEB1978 1900	3.94	2.76	2.76			14.91		308.67		8.73
lower	279 BR D	07FEB1978 2000	3.81	2.66	2.66			14.89		291.78		8.59
lower	279 BR D	07FEB1978 2100	5.90	5.48				15.29		-396.62		-5.18
lower	279 BR D	07FEB1978 2200	7.12	6.57				14.96		-553.50		-5.95
lower	279 BR D	07FEB1978 2300	7.45	6.87				14.76		-595.26		-6.11
lower	279 BR D	07FEB1978 2400	5.51	5.34	2.41			15.28		244.56		3.29
lower	264	Max WS	10.22	10.19		0.00		232.17	-0.51	-585.02	-416.63	-1.59
lower	264	06FEB1978 1800	2.01	1.94		0.02		23.32		75.46		2.01
lower	264	06FEB1978 1900	1.98	1.92		0.02		23.19		75.97		2.06
lower	264	06FEB1978 2000	4.65	4.53		0.01		30.69		-303.29		-2.82

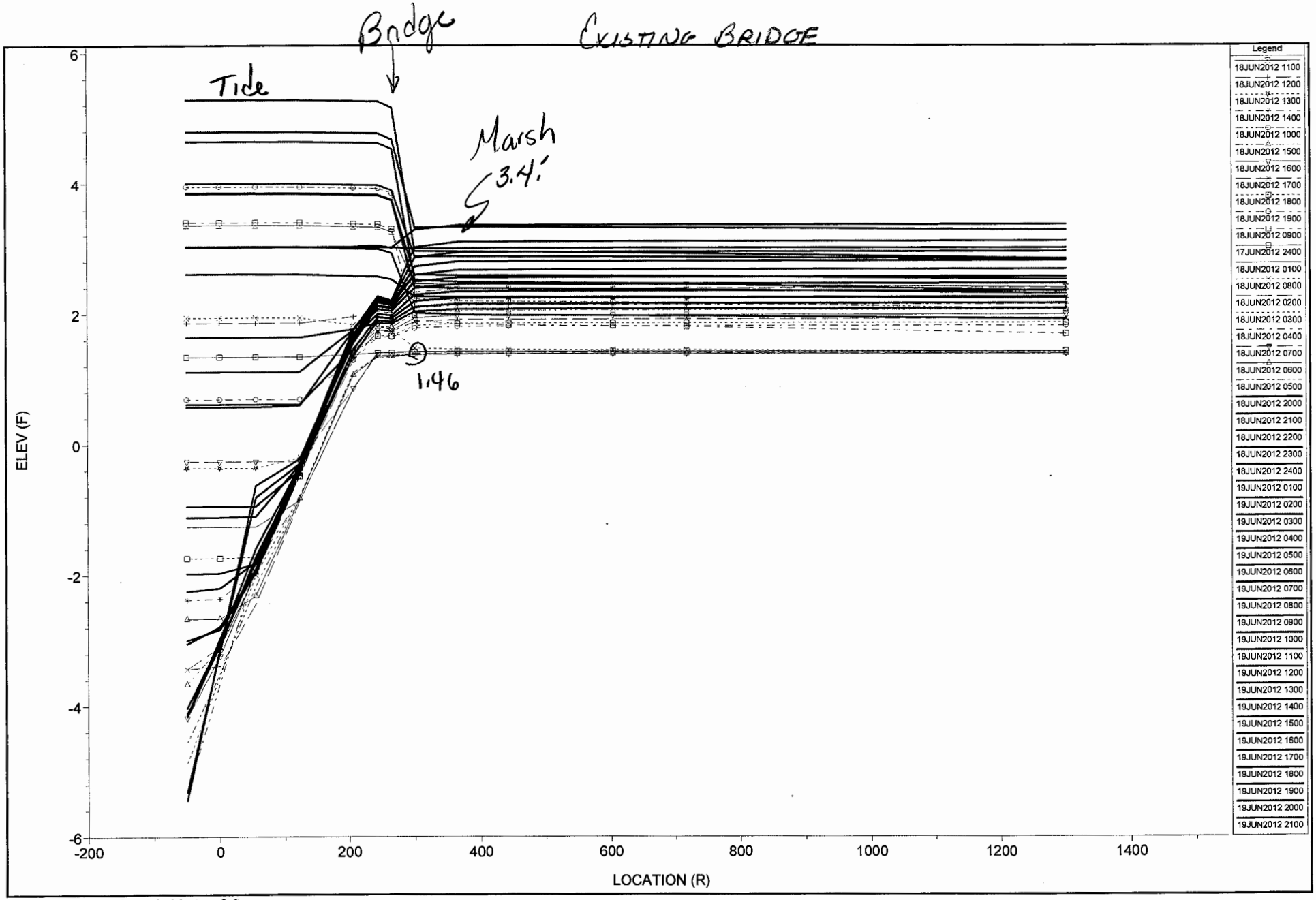
HEC-RAS Plan: Plan 23 River: Bass Harbor Brk Reach: lower (Continued)

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	264	06FEB1978 2100	6.63	6.49		0.00		140.92		-545.80		-3.05
lower	264	06FEB1978 2200	7.44	7.30		0.00		163.48		-649.18		-3.00
lower	264	06FEB1978 2300	5.95	5.80		0.01		123.47		-463.54		-3.08
lower	264	06FEB1978 2400	3.78	3.56		0.02		27.97		301.04		3.81
lower	264	07FEB1978 0100	2.88	2.28		0.08		24.39		283.66		6.21
lower	264	07FEB1978 0200	2.84	2.35		0.06		24.57		266.70		5.65
lower	264	07FEB1978 0300	2.77	2.32		0.06		24.49		249.97		5.38
lower	264	07FEB1978 0400	2.70	2.30		0.06		24.44		234.20		5.09
lower	264	07FEB1978 0500	2.64	2.28		0.05		24.39		219.29		4.81
lower	264	07FEB1978 0600	2.59	2.27		0.05		24.35		205.70		4.55
lower	264	07FEB1978 0700	2.60	2.34		0.04		24.56		193.18		4.10
lower	264	07FEB1978 0800	6.11	5.97		0.01		127.68		-478.80		-3.05
lower	264	07FEB1978 0900	8.41	8.27		0.00		194.14		-784.02		-2.98
lower	264	07FEB1978 1000	10.22	10.19		0.00		232.17	-0.51	-585.02	-416.63	-1.59
lower	264	07FEB1978 1100	8.21	8.07		0.00		187.73		-760.51		-3.00
lower	264	07FEB1978 1200	5.93	5.91		0.00		126.09		176.46		1.14
lower	264	07FEB1978 1300	3.63	2.71		0.09		25.60		433.22		7.68
lower	264	07FEB1978 1400	3.52	2.64		0.09		25.40		410.92		7.52
lower	264	07FEB1978 1500	3.42	2.58		0.09		25.24		390.62		7.35
lower	264	07FEB1978 1600	3.32	2.53		0.08		25.09		368.01		7.10
lower	264	07FEB1978 1700	3.21	2.49		0.08		24.96		346.90		6.85
lower	264	07FEB1978 1800	3.12	2.45		0.08		24.85		327.07		6.59
lower	264	07FEB1978 1900	3.03	2.41		0.07		24.74		308.67		6.34
lower	264	07FEB1978 2000	2.98	2.45		0.06		24.86		291.78		5.87
lower	264	07FEB1978 2100	5.61	5.48		0.00		115.25		-396.62		-2.86
lower	264	07FEB1978 2200	6.71	6.57		0.00		142.97		-553.50		-3.04
lower	264	07FEB1978 2300	7.01	6.87		0.00		150.62		-595.26		-3.04
lower	264	07FEB1978 2400	5.42	5.37		0.00		112.50		244.56		1.82
lower	243	Max WS	10.23	10.22		0.00		261.27	-1.33	-1001.34	-2.19	-0.71
lower	243	06FEB1978 1800	1.98	1.97		0.06		92.36		75.84		0.90
lower	243	06FEB1978 1900	1.95	1.94		0.05		91.87		75.94		0.92
lower	243	06FEB1978 2000	4.64	4.62		0.01		136.56		-304.37		-0.98
lower	243	06FEB1978 2100	6.61	6.59		0.00		174.70		-547.16		-1.10
lower	243	06FEB1978 2200	7.42	7.40		0.00		186.46		-649.79		-1.12
lower	243	06FEB1978 2300	5.93	5.91		0.00		163.81		-462.61		-1.07
lower	243	06FEB1978 2400	3.71	3.68		0.02		118.14		301.78		1.33
lower	243	07FEB1978 0100	2.60	2.52		0.19		102.93		283.77		2.20
lower	243	07FEB1978 0200	2.63	2.57		0.15		103.85		266.71		2.01
lower	243	07FEB1978 0300	2.58	2.52		0.15		102.94		250.00		1.94
lower	243	07FEB1978 0400	2.54	2.49		0.14		102.23		234.21		1.86
lower	243	07FEB1978 0500	2.50	2.45		0.14		101.55		219.30		1.79
lower	243	07FEB1978 0600	2.46	2.42		0.13		100.90		205.75		1.71
lower	243	07FEB1978 0700	2.51	2.47		0.07		101.89		192.70		1.55
lower	243	07FEB1978 0800	6.09	6.07		0.00		166.64		-481.24		-1.07
lower	243	07FEB1978 0900	8.40	8.37		0.00		199.55		-786.01		-1.16
lower	243	07FEB1978 1000	10.23	10.22		0.00		261.27	-1.33	-1001.34	-2.19	-0.71
lower	243	07FEB1978 1100	8.19	8.17		0.00		196.85		-758.84		-1.16
lower	243	07FEB1978 1200	5.92	5.91		0.00		163.81		178.17		0.41
lower	243	07FEB1978 1300	3.05	2.94		0.16		110.89		433.25		2.65
lower	243	07FEB1978 1400	2.99	2.89		0.18		109.82		410.98		2.59
lower	243	07FEB1978 1500	2.93	2.83		0.18		108.85		390.68		2.53
lower	243	07FEB1978 1600	2.89	2.79		0.17		108.08		368.02		2.44
lower	243	07FEB1978 1700	2.84	2.76		0.17		107.35		346.91		2.35
lower	243	07FEB1978 1800	2.79	2.71		0.16		106.54		327.08		2.27
lower	243	07FEB1978 1900	2.74	2.67		0.16		105.66		308.71		2.20
lower	243	07FEB1978 2000	2.76	2.70		0.10		106.21		291.62		2.04
lower	243	07FEB1978 2100	5.59	5.58		0.00		157.21		-398.63		-0.99
lower	243	07FEB1978 2200	6.69	6.67		0.00		175.95		-554.26		-1.09
lower	243	07FEB1978 2300	6.99	6.97		0.00		180.60		-595.49		-1.11
lower	243	07FEB1978 2400	5.41	5.40		0.00		153.83		245.70		0.64

APPENDIX 8-5

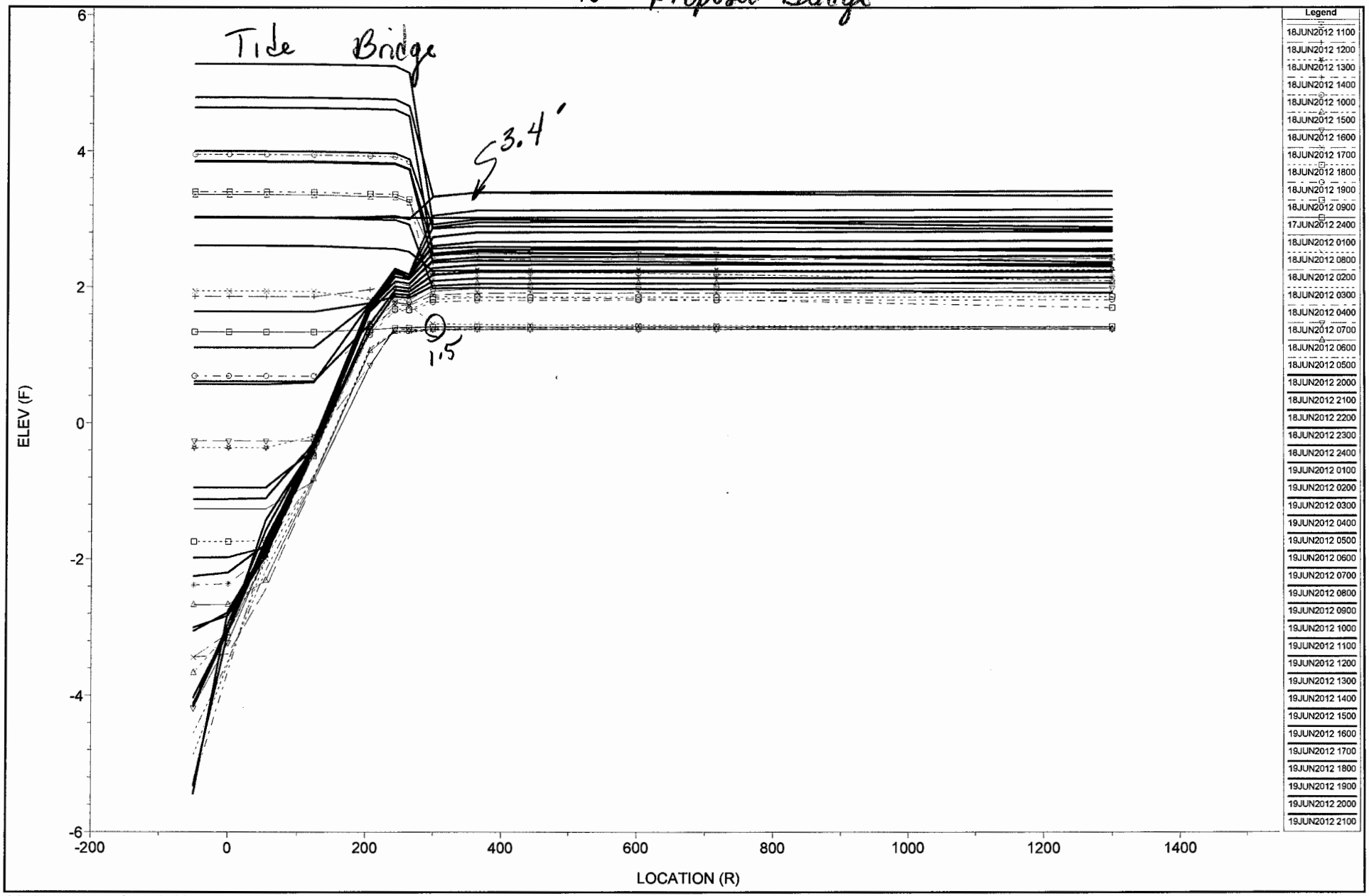
HECRAS Output

Normal Tide Model Runs for Each Bridge



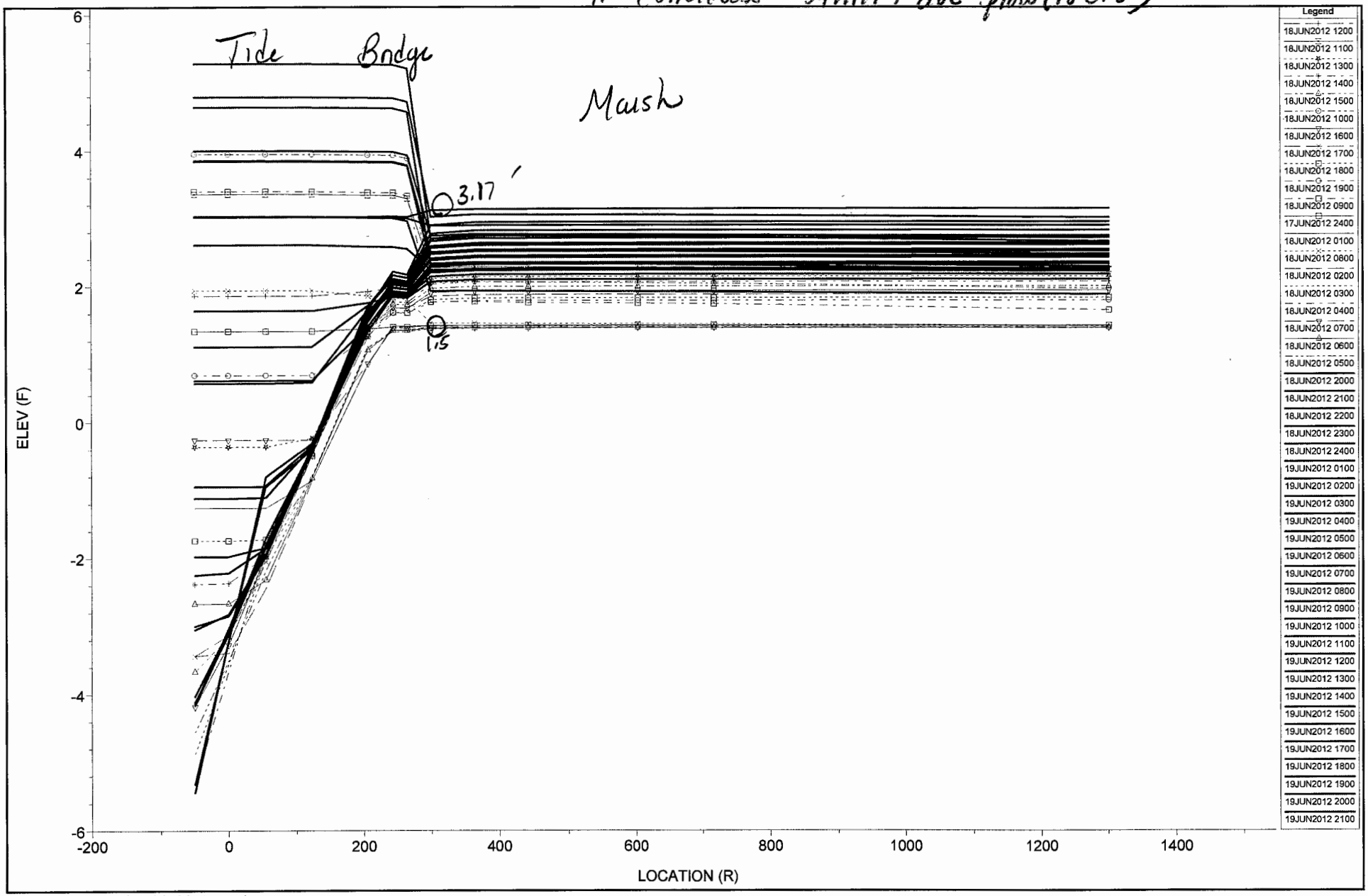
1 in Horiz. = 200 ft 1 in Vert. = 2 ft

15' Proposed Bridge



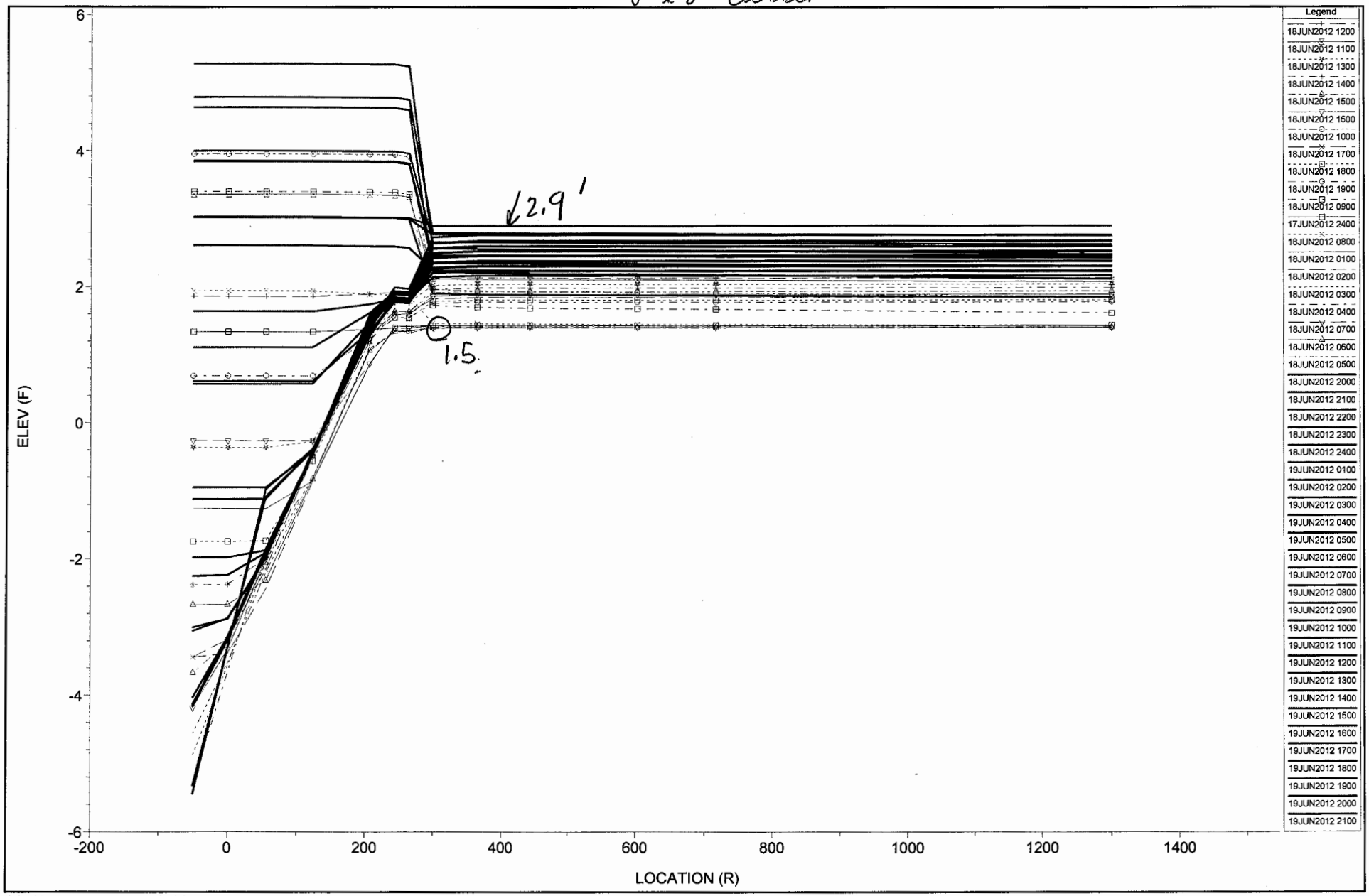
1 in Horiz. = 200 ft 1 in Vert. = 2 ft

11' cofferdam MHHT + ave flow (10 cfs)



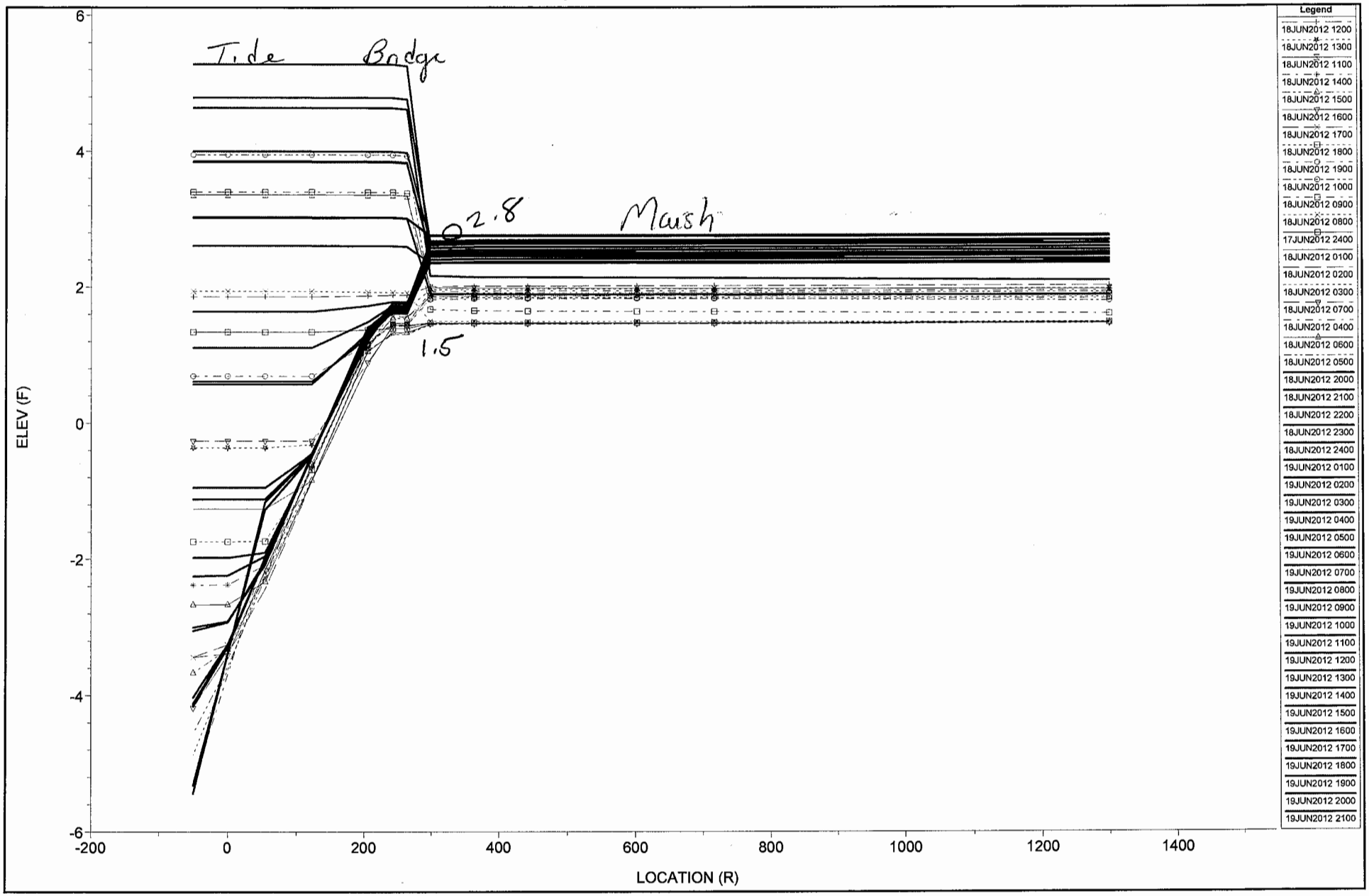
1 in Horiz. = 200 ft 1 in Vert. = 2 ft

8' x 8' culvert

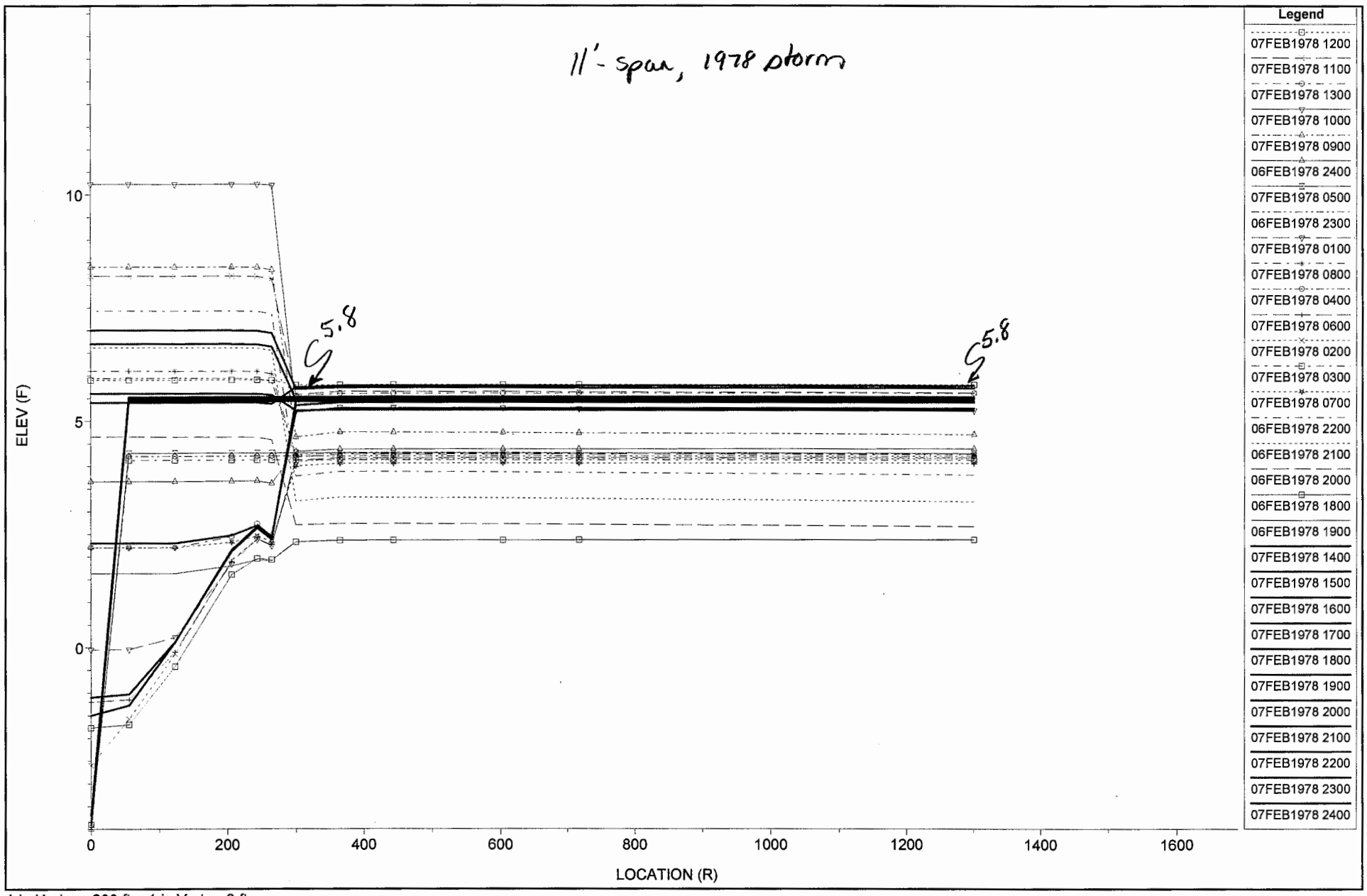


1 in Horiz. = 200 ft 1 in Vert. = 2 ft

8' Round Culvert



1 in Horiz. = 200 ft 1 in Vert. = 2 ft



1 in Horiz. = 200 ft 1 in Vert. = 3 ft

APPENDIX 8-6

HECRAS Output

Flood Flows at Each Bridge Coupled
with Mean Annual Tides

EXISTING
Q100, Tide=MHHW

Plan: Plan 15 Bass Harbor Brk lower RS: 279 Profile: PF 2

E.G. US. (ft)	6.12	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	5.98	E.G. Elev (ft)	5.95	5.82
Q Total (cfs)	405.00	W.S. Elev (ft)	5.49	5.26
Q Bridge (cfs)	405.00	Crit W.S. (ft)	3.20	3.39
Q Weir (cfs)		Max Chl Dpth (ft)	6.49	5.26
Weir Sta Lft (ft)		Vel Total (ft/s)	5.48	6.00
Weir Sta Rgt (ft)		Flow Area (sq ft)	73.91	67.47
Weir Submerg		Froude # Chl	0.43	0.49
Weir Max Depth (ft)		Specif Force (cu ft)	269.55	240.62
Min El Weir Flow (ft)	10.51	Hydr Depth (ft)	5.06	4.73
Min El Prs (ft)	8.80	W.P. Total (ft)	22.07	22.02
Delta EG (ft)	0.62	Conv. Total (cfs)	7023.2	6042.3
Delta WS (ft)	0.62	Top Width (ft)	14.61	14.26
BR Open Area (sq ft)	119.55	Frctn Loss (ft)	0.09	0.02
BR Open Vel (ft/s)	6.00	C & E Loss (ft)	0.05	0.29
Coef of Q		Shear Total (lb/sq ft)	0.70	0.86
Br Sel Method	Energy only	Power Total (lb/ft s)	-104.00	-140.00

EXISTING
Q50, Tide = MHHW

Plan: Plan 15 Bass Harbor Brk lower RS: 279 Profile: PF 1

E.G. US. (ft)	5.94	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	5.82	E.G. Elev (ft)	5.81	5.72
Q Total (cfs)	354.00	W.S. Elev (ft)	5.45	5.29
Q Bridge (cfs)	354.00	Crit W.S. (ft)	2.93	3.13
Q Weir (cfs)		Max Chl Dpth (ft)	6.45	5.29
Weir Sta Lft (ft)		Vel Total (ft/s)	4.82	5.21
Weir Sta Rgt (ft)		Flow Area (sq ft)	73.38	67.97
Weir Submerg		Froude # Chl	0.38	0.42
Weir Max Depth (ft)		Specif Force (cu ft)	251.00	224.74
Min El Weir Flow (ft)	10.51	Hydr Depth (ft)	5.03	4.76
Min El Prs (ft)	8.80	W.P. Total (ft)	22.00	22.10
Delta EG (ft)	0.46	Conv. Total (cfs)	6955.0	6103.9
Delta WS (ft)	0.45	Top Width (ft)	14.60	14.27
BR Open Area (sq ft)	119.55	Frctn Loss (ft)	0.07	0.01
BR Open Vel (ft/s)	5.21	C & E Loss (ft)	0.03	0.22
Coef of Q		Shear Total (lb/sq ft)	0.54	0.65
Br Sel Method	Energy only	Power Total (lb/ft s)	-104.00	-140.00

15' SPAN
Q50 Tide = MHHW

Plan: Plan 15 Bass Harbor Brk lower RS: 279 Profile: PF 1

E.G. US. (ft)	5.90	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	5.78	E.G. Elev (ft)	5.79	5.67
Q Total (cfs)	354.00	W.S. Elev (ft)	5.46	5.29
Q Bridge (cfs)	354.00	Crit W.S. (ft)	2.81	2.96
Q Weir (cfs)		Max Chl Dpth (ft)	6.46	5.29
Weir Sta Lft (ft)		Vel Total (ft/s)	4.63	4.93
Weir Sta Rgt (ft)		Flow Area (sq ft)	76.41	71.84
Weir Submerg		Froude # Chl	0.32	0.38
Weir Max Depth (ft)		Specif Force (cu ft)	259.39	233.91
Min El Weir Flow (ft)	10.51	Hydr Depth (ft)	5.29	4.99
Min El Prs (ft)	8.60	W.P. Total (ft)	22.55	23.35
Delta EG (ft)	0.42	Conv. Total (cfs)	7317.7	6451.3
Delta WS (ft)	0.41	Top Width (ft)	14.44	14.41
BR Open Area (sq ft)	119.42	Frctn Loss (ft)	0.10	0.00
BR Open Vel (ft/s)	4.93	C & E Loss (ft)	0.02	0.19
Coef of Q		Shear Total (lb/sq ft)	0.50	0.58
Br Sel Method	Energy only	Power Total (lb/ft s)	-104.00	-140.00

15' SPAN
Q100, Tide = MHHW

Plan: Plan 15 Bass Harbor Brk lower RS: 279 Profile: PF 2

E.G. US. (ft)	6.07	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	5.93	E.G. Elev (ft)	5.93	5.76
Q Total (cfs)	405.00	W.S. Elev (ft)	5.50	5.26
Q Bridge (cfs)	405.00	Crit W.S. (ft)	3.06	3.21
Q Weir (cfs)		Max Chl Dpth (ft)	6.50	5.26
Weir Sta Lft (ft)		Vel Total (ft/s)	5.26	5.68
Weir Sta Rgt (ft)		Flow Area (sq ft)	76.92	71.34
Weir Submerg		Froude # Chl	0.36	0.44
Weir Max Depth (ft)		Specif Force (cu ft)	277.42	248.65
Min El Weir Flow (ft)	10.51	Hydr Depth (ft)	5.33	4.95
Min El Prs (ft)	8.60	W.P. Total (ft)	22.62	23.28
Delta EG (ft)	0.57	Conv. Total (cfs)	7384.8	6389.3
Delta WS (ft)	0.56	Top Width (ft)	14.44	14.41
BR Open Area (sq ft)	119.42	Frctn Loss (ft)	0.13	0.00
BR Open Vel (ft/s)	5.68	C & E Loss (ft)	0.04	0.25
Coef of Q		Shear Total (lb/sq ft)	0.64	0.77
Br Sel Method	Energy only	Power Total (lb/ft s)	-104.00	-140.00

16' Conspan
Q50 MHHW = 5.4

Low Chord = 8.6'
- 5.4
3.2

Plan: Plan 13 Bass Harbor Brk lower RS: 279 Profile: PF 1

E.G. US. (ft)	5.87	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	5.75	E.G. Elev (ft)	5.77	5.66
Q Total (cfs)	354.00	W.S. Elev (ft)	5.45	5.30
Q Bridge (cfs)	354.00	Crit W.S. (ft)	2.82	2.98
Q Weir (cfs)		Max Chl Dpth (ft)	6.45	5.30
Weir Sta Lft (ft)		Vel Total (ft/s)	4.55	4.80
Weir Sta Rgt (ft)		Flow Area (sq ft)	77.72	73.74
Weir Submerg		Froude # Chl	0.36	0.38
Weir Max Depth (ft)		Specif Force (cu ft)	259.18	234.74
Min El Weir Flow (ft)	10.51	Hydr Depth (ft)	5.08	4.83
Min El Prs (ft)	9.94	W.P. Total (ft)	22.64	23.24
Delta EG (ft)	0.39	Conv. Total (cfs)	7508.1	6761.2
Delta WS (ft)	0.37	Top Width (ft)	15.29	15.27
BR Open Area (sq ft)	130.48	Frctn Loss (ft)	0.09	0.00
BR Open Vel (ft/s)	4.80	C & E Loss (ft)	0.02	0.18
Coef of Q		Shear Total (lb/sq ft)	0.48	0.54
Br Sel Method	Energy only	Power Total (lb/ft s)	-104.00	-140.00

16' Conspan
Q100, mHHW=5.4

Plan: Plan 13 Bass Harbor Brk lower RS: 279 Profile: PF 2

E.G. US. (ft)	6.03	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	5.88	E.G. Elev (ft)	5.89	5.74
Q Total (cfs)	405.00	W.S. Elev (ft)	5.48	5.27
Q Bridge (cfs)	405.00	Crit W.S. (ft)	3.07	3.23
Q Weir (cfs)		Max Chl Dpth (ft)	6.48	5.27
Weir Sta Lft (ft)		Vel Total (ft/s)	5.18	5.53
Weir Sta Rgt (ft)		Flow Area (sq ft)	78.18	73.24
Weir Submerg		Froude # Chl	0.36	0.44
Weir Max Depth (ft)		Specif Force (cu ft)	276.59	249.11
Min El Weir Flow (ft)	10.51	Hydr Depth (ft)	5.11	4.80
Min El Prs (ft)	9.94	W.P. Total (ft)	22.70	23.17
Delta EG (ft)	0.53	Conv. Total (cfs)	7568.0	6697.5
Delta WS (ft)	0.52	Top Width (ft)	15.29	15.27
BR Open Area (sq ft)	130.48	Frctn Loss (ft)	0.12	0.00
BR Open Vel (ft/s)	5.53	C & E Loss (ft)	0.03	0.23
Coef of Q		Shear Total (lb/sq ft)	0.62	0.72
Br Sel Method	Energy only	Power Total (lb/ft s)	-104.00	-140.00

16'
Q50, 5.4' Tide

HEC-RAS Plan: Plan 12 River: Bass Harbor Brk Reach: lower Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
lower	1300	PF 1	354.00	0.00	5.90		5.90	0.000005	0.23	1806.59	691.14	0.02
lower	717	PF 1	354.00	-2.40	5.89		5.89	0.000015	0.41	872.27	187.09	0.03
lower	603	PF 1	354.00	-1.00	5.89		5.89	0.000006	0.27	1301.33	259.85	0.02
lower	443	PF 1	354.00	-1.50	5.89		5.89	0.000009	0.34	1027.11	185.42	0.03
lower	364	PF 1	354.00	0.00	5.89		5.89	0.000013	0.36	988.73	225.53	0.03
lower	299	PF 1	354.00	-1.00	5.75	2.13	5.87	0.000772	2.83	133.39	54.79	0.24
lower	279		Bridge									
lower	264	PF 1	354.00	-0.50	5.37	2.29	5.48	0.000704	2.63	134.79	112.55	0.24
lower	243	PF 1	354.00	-1.00	5.40	1.74	5.41	0.000098	0.92	383.93	153.77	0.08
lower	206	PF 1	354.00	0.50	5.40		5.41	0.000092	0.74	477.19	157.77	0.08
lower	123	PF 1	354.00	-1.00	5.40		5.40	0.000017	0.42	837.57	185.06	0.04
lower	55	PF 1	354.00	-2.50	5.40		5.40	0.000008	0.31	1147.04	222.39	0.02
lower	0	PF 1	354.00	-4.00	5.40	-2.23	5.40	0.000001	0.15	2387.95	373.00	0.01

16' Q50 / 5.4

HEC-RAS Plan: Plan 12 River: Bass Harbor Brk Reach: lower Profile: PF 1

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	364	PF 1	5.89	5.89		0.00	0.01	225.53		354.00		0.36
lower	299	PF 1	5.87	5.75	2.13	0.00	0.10	54.79		350.54	3.46	2.83
lower	279 BR U	PF 1	5.77	5.45	2.82	0.09	0.02	15.29		354.00		4.55
lower	279 BR D	PF 1	5.66	5.30	2.98	0.00	0.18	15.27		354.00		4.80
lower	264	PF 1	5.48	5.37	2.29	0.00	0.07	112.55		354.00		2.63
lower	243	PF 1	5.41	5.40	1.74	0.00	0.00	153.77		354.00		0.92

Q50 EL = 5.4

Plan: Plan 12 Bass Harbor Brk lower RS: 279 BR U Profile: PF 1

E.G. Elev (ft)	5.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.		0.035	
W.S. Elev (ft)	5.45	Reach Len. (ft)	38.00	38.00	38.00
Crit W.S. (ft)	2.82	Flow Area (sq ft)		77.72	
E.G. Slope (ft/ft)	0.002223	Area (sq ft)		77.72	
Q Total (cfs)	354.00	Flow (cfs)		354.00	
Top Width (ft)	15.29	Top Width (ft)		15.29	
Vel Total (ft/s)	4.55	Avg. Vel. (ft/s)		4.55	
Max Chl Dpth (ft)	6.45	Hydr. Depth (ft)		5.08	
Conv. Total (cfs)	7508.1	Conv. (cfs)		7508.1	
Length Wtd. (ft)	38.00	Wetted Per. (ft)		22.64	
Min Ch El (ft)	-1.00	Shear (lb/sq ft)		0.48	
Alpha	1.00	Stream Power (lb/ft s)	223.00	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)		5.67	0.01
C & E Loss (ft)	0.02	Cum SA (acres)		1.21	0.02

Q50 MHHW = 5.4

Plan: Plan 12 Bass Harbor Brk lower RS: 279 BR D Profile: PF 1

E.G. Elev (ft)	5.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.		0.035	
W.S. Elev (ft)	5.30	Reach Len. (ft)	0.50	0.50	0.50
Crit W.S. (ft)	2.98	Flow Area (sq ft)		73.74	
E.G. Slope (ft/ft)	0.002741	Area (sq ft)		73.74	
Q Total (cfs)	354.00	Flow (cfs)		354.00	
Top Width (ft)	15.27	Top Width (ft)		15.27	
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)		4.80	
Max Chl Dpth (ft)	5.30	Hydr. Depth (ft)		4.83	
Conv. Total (cfs)	6761.2	Conv. (cfs)		6761.2	
Length Wtd. (ft)	0.50	Wetted Per. (ft)		23.24	
Min Ch El (ft)	0.00	Shear (lb/sq ft)		0.54	
Alpha	1.00	Stream Power (lb/ft s)	223.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		5.61	0.01
C & E Loss (ft)	0.18	Cum SA (acres)		1.20	0.02

16' conspan Q50, 100 MHHW = 5.4'

HEC-RAS Plan: Plan 13 River: Bass Harbor Brk Reach: lower

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
lower	364	PF 1	5.89	5.89		0.00	0.01	225.53		354.00		0.36
lower	364	PF 2	6.05	6.05		0.00	0.01	227.27		405.00		0.39
lower	299	PF 1	5.87	5.75	2.13	0.00	0.10	54.79		350.54	3.46	2.83
lower	299	PF 2	6.03	5.88	2.38	0.01	0.13	60.09		399.12	5.88	3.13
lower	279 BR U	PF 1	5.77	5.45	2.82	0.09	0.02	15.29		354.00		4.55
lower	279 BR U	PF 2	5.89	5.48	3.07	0.12	0.03	15.29		405.00		5.18
lower	279 BR D	PF 1	5.66	5.30	2.98	0.00	0.18	15.27		354.00		4.80
lower	279 BR D	PF 2	5.74	5.27	3.23	0.00	0.23	15.27		405.00		5.53
lower	264	PF 1	5.48	5.37	2.29	0.00	0.07	112.55		354.00		2.63
lower	264	PF 2	5.51	5.37	2.47	0.01	0.09	112.34		405.00		3.01
lower	243	PF 1	5.41	5.40	1.74	0.00	0.00	153.77		354.00		0.92
lower	243	PF 2	5.41	5.40	1.83	0.00	0.00	153.75		405.00		1.06