

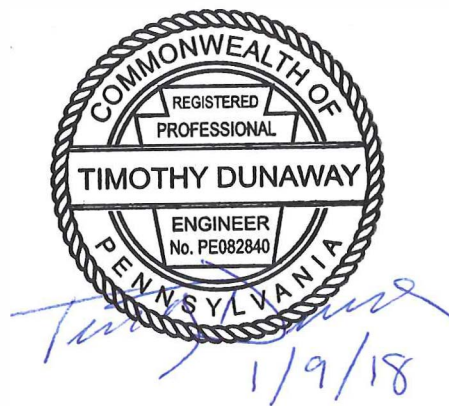


TETRA TECH

Hydrologic and Hydraulic Analysis

Floodplain Analysis Report For Shaeffer Run Toboyne Township, Perry County, Pennsylvania

Sunoco Pipeline L.P.
535 Fritztown Road
Sinking Spring, Pa 19608



January 2018

**FLOODPLAIN ANALYSIS REPORT
SHAEFFER RUN
BACK HOLLOW ROAD BRIDGE**

**TOBOYNE TOWNSHIP
PERRY COUNTY, PENNSYLVANIA**

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1.0 PROJECT OVERVIEW

1.1 INTRODUCTION

On behalf of Toboyne Township Tetra Tech, Inc. (Tetra Tech) has conducted a floodplain study at the Back Hollow Road Bridge in Toboyne Township, Perry County, Pennsylvania (Project). Toboyne Township is proposing to upgrade an existing bridge by installing 40' long permanent bridge deck on top of the existing bridge deck. The Project is located at 40.269167°, -77.549475° where Back Hollow Road crosses Shaeffer Run. This portion of Shaeffer Run is designated as a Federal Emergency Management Agency (FEMA) Zone A floodplain (no base flood elevations defined). The intent of this study is to determine base flood elevations at the proposed Project to quantify the effect of the bridge upgrade on the base flood elevations of Shaeffer Run. According to the conditions of the GP-11 Permit, the bridge may not increase water surface elevations for the 100-year flood event. Study reaches extend approximately 300 downstream of the bridge on Shaeffer Run and 500 up stream of the bridge on Shaeffer Run. A site location map is located in Appendix A.

Hydrologic and Hydraulic (H&H) calculations were completed to estimate and route the 100-year flood flow rate through Shaeffer Run. Existing conditions were modeled based on the previously existing bridge deck configuration and proposed conditions were modeled based on the upgraded bridge deck configuration.

1.2 PROJECT DESCRIPTION

The purpose of the floodplain study on Shaeffer Run is to quantify changes to the base flood elevation and velocities resulting from an upgrade to a bridge spanning Shaeffer Run. The hydraulic analysis for the Project was completed using the computer program Hydrologic Engineering Center River Analysis System (HEC-RAS), developed by the US Department of Defense, Army Corps of Engineers.

1.3 SITE INFORMATION

The project falls on the Flood Insurance Rate Map (FIRM) Panel 42099C0320D, effective June 16, 2009. This shows the 100-year floodplain for the Project site as a Zone A floodplain, having no published water surface elevations or defined floodway. Zone A floodplains were originally delineated by FEMA using non-numerically supported approximate study techniques. Therefore, Shaeffer Run in the Project area has been identified by FEMA as an area of elevated risk of flooding but no detailed study has been adopted by FEMA. Because no defined floodway exists, an assumed floodway has been incorporated into the proposed site designs, defined as 50-feet from top of bank in accordance with the Pennsylvania Department of Environmental Protection Chapter 105.1. Under Title 25, Chapter 93 of the PA Code and PA eMaps, this reach of Shaeffer Run is designated as High Quality Cold Water Fishes (HQ-CWF). There are no USGS stream gaging stations along Shaeffer Run.

2.0 DATA COLLECTION

Tetra Tech conducted limited topographic survey of the study area on December 18, 2017. Photographs were taken of the study area on December 18, 2017 (see Appendix A, A-2 Study Area Photographs). The primary intent of the field surveys was to collect stream channel information (top of bank to top of bank) for use in hydraulic modeling. Information on the previously existing and upgraded bridge decks was also collected. Additional information on site conditions outside of the stream channels was obtained from Pennsylvania Spatial Data Access (PASDA) Lidar PAMAP Program Topographic Contours (2 ft Interval) of Pennsylvania published in 2006 through the PA Department of Conservation and Natural Resources, Bureau of Topographic and Geologic Survey. The base maps for existing and proposed conditions with cross sections are shown in Figures HH-1 and HH-2, respectively (see Appendix A).

3.0 HYDROLOGY

The watershed is a steeply sloped drainage basin that consists of wooded areas, with some open land. The total contributing drainage area is approximately 5.24 square miles at the entrance of the bridge. A map showing the upstream watershed is included in Appendix B as Figure B-1. Downstream of the bridge an UNT to Shaeffer Run feeds into Shaeffer Run. This slightly increases the drainage area downstream of the bridge to be 5.48 square miles. A map showing the downstream watershed is included in Appendix B as Figure B-2. The main channel slope of Shaeffer Run within the study reach is 1.5%.

The 100-year peak stream discharge was found using USGS Pennsylvania StreamStats, a web-based geographic information systems application for use in water resources planning and management, was used to calculate peak runoff for Shaeffer Run upstream and downstream of the crossing (see Appendix B, Reports B-1 and B-2, respectively). StreamStats uses the SIR 20008-5102 regression equations for estimating stream flow statistics. From these estimates, percent total flows were calculated for the upstream reaches.

Table 1: Summary of Peak Discharge

Location	Drainage Area (square miles)	Peak Discharge (cfs)
		100-year
Shaeffer Run Upstream of Bridge	5.24	1120
Shaeffer Run Downstream of Bridge	5.48	1160

4.0 EXISTING CONDITIONS HYDRAULICS

4.1 MODEL SETUP

Hydraulic analysis for both existing and proposed conditions was performed using U.S. Army Corps of Engineers HEC-RAS computer program. HEC-RAS calculates water surface profiles for flow in natural or man-made channels. HEC-RAS has the capacity to model various obstructions such as bridges, culverts, weirs, and other structures. The program computes a wide

range of hydraulic variables for each peak discharge simulated including water surface elevation, velocity, and shear stress.

The hydraulic analysis must include a sufficient amount of stream channel data upstream and downstream from the work areas to show all potential changes in the water surface elevations. Therefore, cross sections were surveyed 500 linear feet upstream from the bridge and a 300 linear feet downstream of the bridge.

Stream cross sections were spaced approximately every 100 linear feet along the stream and incorporate the entire width of the FEMA-defined Zone A 100-year floodplain. Cross-section geometry used in the model was based on field survey obtained in December 2015 and PASDA Lidar Topographic Contours (2 ft Interval). Upon comparison of Lidar and field survey in areas of dense tree cover, it was determined that Lidar data was slightly different due to the dense vegetation. Therefore, to connect survey data to Lidar in areas of dense tree cover, elevation data was interpolated using best engineering judgement from the last field survey point (top of bank) to a Lidar contour outside areas of dense vegetation.

The Manning's "n" values estimated for this model are based on reference values published in the HEC-RAS Hydraulic Reference Manual. These values were published originally in Chow's book "Open-Channel Hydraulics" [Chow, 1959]. The selection of Manning's "n" values was based on photographs and satellite imagery of the area. The Manning's "n" value estimated for the streambed channel was 0.040 (clean, winding, some pools and shoals). Manning's "n" values for the overbanks were specified as 0.1 (heavy stand of timber, few down trees, little undergrowth with flow below and into branches).

Hydrology within the HEC-RAS model was built from 5 cross sections upstream of the crossing and 3 cross sections downstream of the crossing. Within the 857 linear foot study of Shaeffer Run, the bridge deck crosses the channel between station 2+81.07 and 2+95.59. The bridge is rectangular span with concrete piers. This bridge is included in the existing conditions HEC-RAS model, as summarized in Table 2. The upgrades to the existing bridge required minor grading of the approaching road to meet the elevated bridge deck.

Table 2: Summary of Existing Bridge Crossing Configuration

Crossing	Back Hollow Road Bridge
River Station	RS 2+81.07 (Shaeffer Run)
Structure Type	Automobile bridge
Bridge Length (ft)	38.9
Hydraulic Width (ft)	14.52
Vertical Opening (ft)	5.1
Streambed Elevation (ft)	978.42
Vertical Distance from Streambed to Top of Road (ft)	7.04
Elevation of Low Chord (ft)	983.52
Top of Road (High Chord) Elevation (ft)	985.46

The survey data reflects the proposed condition, since the bridge upgrade has already been constructed. Therefore, two (2) existing cross sections were modified from survey data to reflect the assumed previous road grade. These sections include 2+81.07 and 2+95.59 and are the only sections that are different between the existing and proposed conditions. Existing conditions were assumed at the bridge based on measurements of the existing and proposed bridge deck thickness. Existing conditions were assumed at the road based on the limits of disturbance and the location of jersey barriers that were used to add fill. No other hydraulic structures, such as bridges, culverts or dams are located near the Project that would impact the flow regime in this area.

The model was run under subcritical flow using a steady flow regime. In some cross sections there were no valid subcritical answers and critical flow was used. No error messages were reported for either the existing or proposed models. The warnings and notes generated from the model included only warnings regarding the possible need for additional cross sections due to conveyance ratios outside the limits of tolerance, significant energy losses (greater than 1.0 foot), or velocity head changes greater than 0.5 foot. These warnings and notes can safely be ignored because cross sections were placed every 100 feet and hydraulic results are found to be reasonable.

4.2 EXISTING CONDITIONS RESULTS

Table 3 summarizes the results for existing conditions at each of the modeled cross sections for the 100-year flows in Shaeffer Run. Existing site conditions are shown on Figure A-2 in Appendix A. Flood profiles and copy of the HEC-RAS summary output for existing conditions are included in Appendix C-1.

Table 3: Results of Existing Conditions Hydraulic Analysis Shaeffer Run

River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
857.28	1120.00	985.66	990.03	989.81	990.49	0.014672	5.45	205.83	170.6	0.83
755.82	1120.00	984.92	988.69		989.09	0.012955	5.08	220.51	165.53	0.78
654.16	1120.00	983.5	987.46	987.2	987.79	0.012084	4.6	243.46	201.23	0.74
530.15	1120.00	982.09	985.2	985.2	985.74	0.023377	5.89	190.07	178.22	1.01
425.51	1120.00	979.32	984.95		985	0.000972	1.85	606.86	296.58	0.23
295.59	1120.00	978.25	984.01	983.43	984.68	0.006052	7.09	268.52	164.61	0.6
281.08	Bridge									
281.07	1120.00	978.23	983.35	983.35	984.34	0.010983	8.62	215.59	135.77	0.78
181.31	1160.00	975.99	979.68		979.94	0.005324	4.08	284.56	150.94	0.52
78.5	1160.00	975.96	978.33	978.33	978.91	0.022827	6.12	189.68	165.31	1.01
0	1160.00	973.99	976.33	976.33	976.91	0.023638	6.1	190.1	171.29	1.02

5.0 PROPOSED CONDITIONS HYDRAULICS

5.1 MODEL SETUP

The model setup was the same as described for the existing conditions. The only difference between the existing and proposed conditions model is the bridge deck thickness and the modifications to sections 2+81.07 and 2+95.59 that reflect changed to the road grading. Table 4 summarized the proposed bridge configuration.

Table 4: Summary of Proposed Bridge Crossing Configuration

Crossing	Back Hollow Road Bridge
River Station	RS 2+81.07 (Shaeffer Run)
Structure Type	Automobile bridge
Bridge Length (ft)	38.9
Hydraulic Width (ft)	14.52
Vertical Opening (ft)	5.1
Streambed Elevation (ft)	978.42
Vertical Distance from Streambed to Top of Road (ft)	8.87
Elevation of Low Chord (ft)	983.52
Top of Road (High Chord) Elevation (ft)	987.29

5.2 PROPOSED CONDITIONS RESULTS

Table 5 summarizes the results for proposed conditions at each of the modeled cross sections for the 100-year flows in Shaeffer Run. In comparing the existing and proposed conditions (Table 6), the upgrade to existing bridge along Shaeffer Run results in no change in the water surface elevations for any of the cross sections. Therefore, the Project does not result in any change to the existing 100-year base flood elevation (BFE).

Proposed conditions are shown in Figure A-3 in Appendix A. Figure HH-1 shows the existing and BFE and Figure HH-2 shows the proposed BFE as modeled by HEC-RAS. The FEMA Zone A (approximate) floodplain boundary is also shown on the figures. Flood profiles and copy of the HEC-RAS summary output for proposed conditions are included in Appendix C-2.

Table 5: Results of Final Proposed Conditions Hydraulic Analysis Shaeffer Run

River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft/ft)	E.G. Slope (ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
857.28	1120	985.66	990.03	989.81	990.49	0.014672	5.45	205.83	170.6	0.83
755.82	1120	984.92	988.69		989.09	0.012955	5.08	220.51	165.53	0.78
654.16	1120	983.5	987.46	987.2	987.79	0.012084	4.6	243.46	201.23	0.74
530.15	1120	982.09	985.2	985.2	985.74	0.023377	5.89	190.07	178.22	1.01
425.51	1120	979.32	984.95		985	0.000972	1.85	606.86	296.58	0.23
295.59	1120	978.25	984.01	983.43	984.68	0.006052	7.09	268.52	164.61	0.6
281.08	Bridge									
281.07	1120	978.23	983.35	983.35	984.34	0.010983	8.62	215.59	135.77	0.78
181.31	1160	975.99	979.68		979.94	0.005324	4.08	284.56	150.94	0.52
78.5	1160	975.96	978.33	978.33	978.91	0.022827	6.12	189.68	165.31	1.01
0	1160	973.99	976.33	976.33	976.91	0.023638	6.1	190.1	171.29	1.02

Table 6: Comparison of Existing and Proposed Conditions

River Sta	W.S. Elev (ft) (Existing)	Vel Chnl (ft/s) (Existing)	W.S. Elev (ft) (Proposed)	Vel Chnl (ft/s) (Proposed)	W.S. Elev (ft) Difference	Vel Chnl (ft/s) Difference
857.28	990.03	5.45	990.03	5.45	0.00	0.00
755.82	988.69	5.08	988.69	5.08	0.00	0.00
654.16	987.46	4.6	987.46	4.60	0.00	0.00
530.15	985.2	5.89	985.20	5.89	0.00	0.00
425.51	984.95	1.85	984.95	1.85	0.00	0.00
295.59	984.01	7.09	984.01	7.09	0.00	0.00
281.08	Bridge					
281.07	983.35	8.62	983.35	8.62	0.00	0.00
181.31	979.68	4.08	979.68	4.08	0.00	0.00
78.5	978.33	6.12	978.33	6.12	0.00	0.00
0	976.33	6.1	976.33	6.10	0.00	0.00

6.0 RISK ASSESSMENT

The upgrade to the existing bridge will yield no increases (a maximum of 0.00 feet) in water surface elevations on Shaeffer Run for the 100-year storm event. The associated calculated floodplain limits do not propose a risk to current structures or dwellings.

There is no increase in velocity along Shaeffer Run, this will result in no accelerated erosion and sedimentation. Therefore, the project will not result in a threat to property or hazard of life as outlined within this report.

7.0 CONCLUSIONS

A detailed floodplain analysis of the upgrade to the existing bridge on Back Hollow Road was performed for Shaeffer Run. The study area was not part of a detailed FEMA Flood Insurance Study and is designated as a Zone A (approximate) floodplain, defined by FEMA as areas within the 100-year floodplain but do not have 100-year water surface elevations or a delineated floodway. The results of the H&H analysis indicate that the upgrade to the existing bridge crossing will not cause an increase in the 100-year water surface elevations relative to the previously existing conditions within the study reaches for the 100-year peak flow rate. Furthermore no on-site or off-site increases in flood velocities are anticipated to occur from the upgrade to the existing bridge on Back Hollow Road.

REFERENCES

1. Brunner, Gary W. *HEC-RAS River Analysis System: User's Manual*. Davis, CA: US Army Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Center, 2002. USACE, Jan. 2010. Web.
2. Chow, V.T., 1959, *Open Channel Hydraulics*, McGraw-Hill Book Company, NY.
3. EMapPA. Pennsylvania Department of Environmental Protection
<<http://www.depgis.state.pa.us/emappa/>>.
4. Federal Emergency Management Agency, Pennsylvania Department of Environmental Protection, 2006, PA Code Title 25, Chapter 93, Water Quality Standards.
5. Pennsylvania Department of Environmental Protection, 2006, PA Code Title 25, Chapter 106.
6. U.S. Army Corps of Engineers, January 2010, HEC-RAS River Analysis System, Version 4.1.0, Hydrologic Engineering Center, Davis, CA.
7. U.S. Army Corps of Engineers, January 2010, HEC-RAS River Analysis System Hydraulic Reference Manual, Version 4.1, Hydrologic Engineering Center, Davis, CA.

APPENDIX A

Site Information

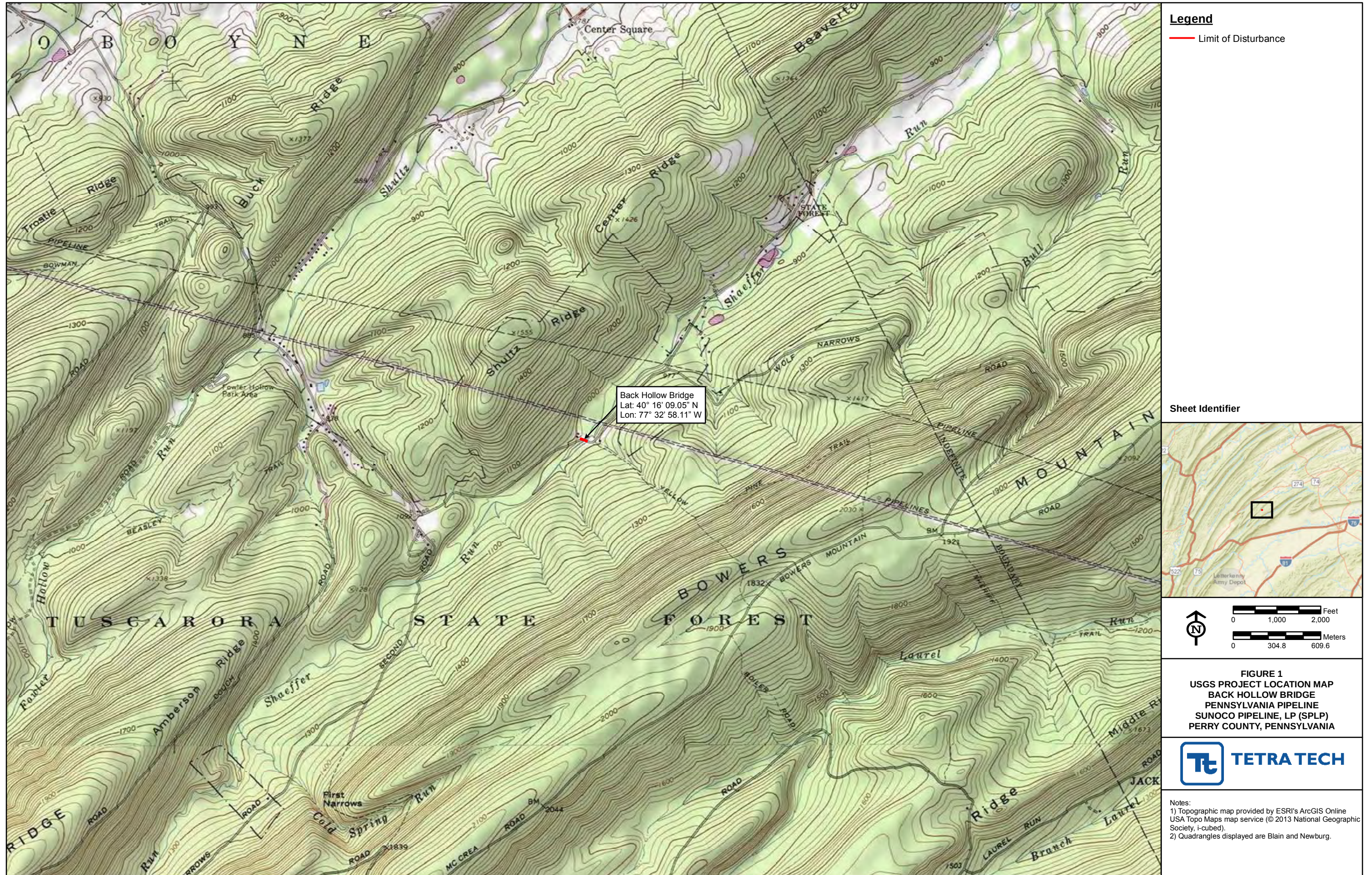
A-1 – Project Location Map

A-2 – Study Area Photographs

A-3 – Existing Conditions

A-4 – Proposed Conditions

A-1 PROJECT LOCATION MAP



A-2 STUDY AREA PHOTOGRAPHS



Photo 1 – 12/18/2017 – Looking southwest at bridge.

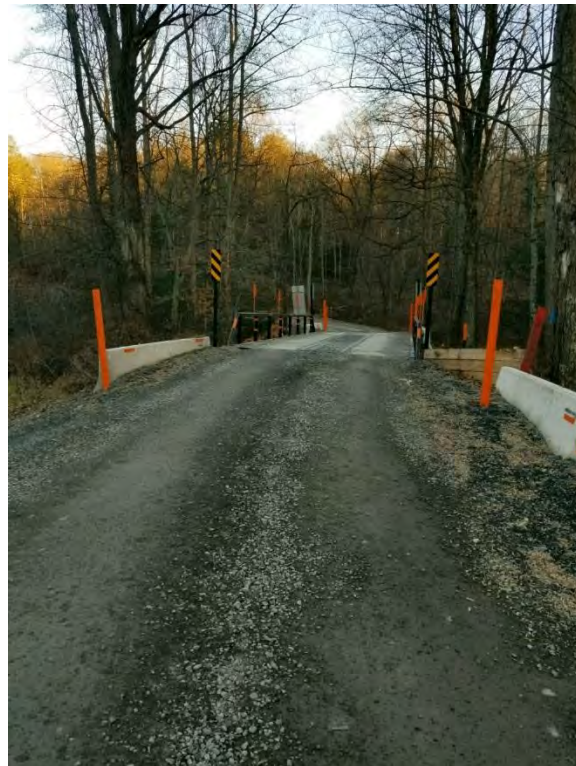


Photo 2 – 12/18/2017 – Looking east across bridge.



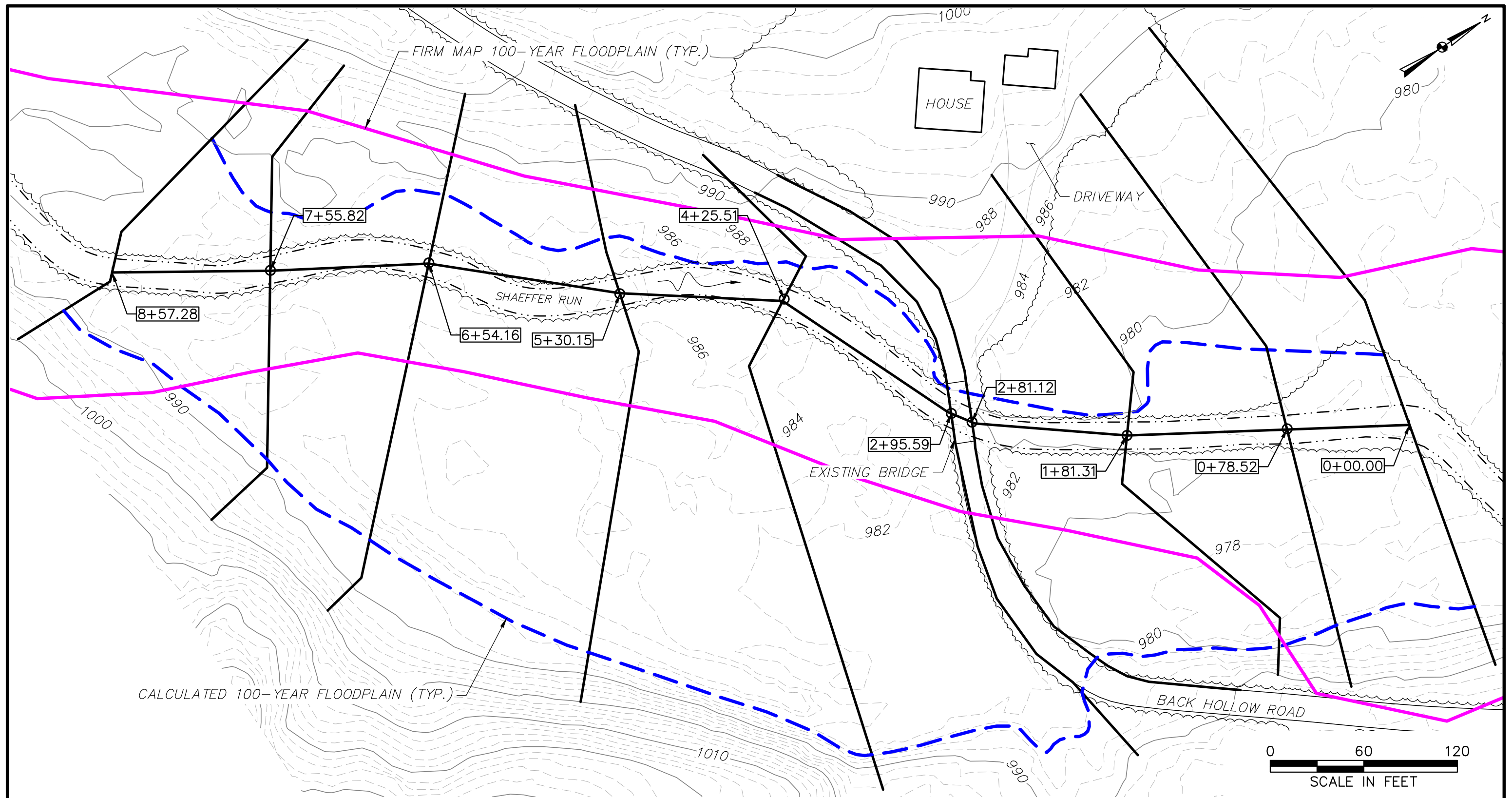
Photo 3 – 12/18/2017 – Looking west across bridge.



Photo 4 – 12/18/2017 – Looking southeast at bridge.



Photo 5 – 12/18/2017 – Looking northwest across bridge.



TETRA TECH

WWW.TETRATECH.COM

661 ANDERSEN DRIVE — FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

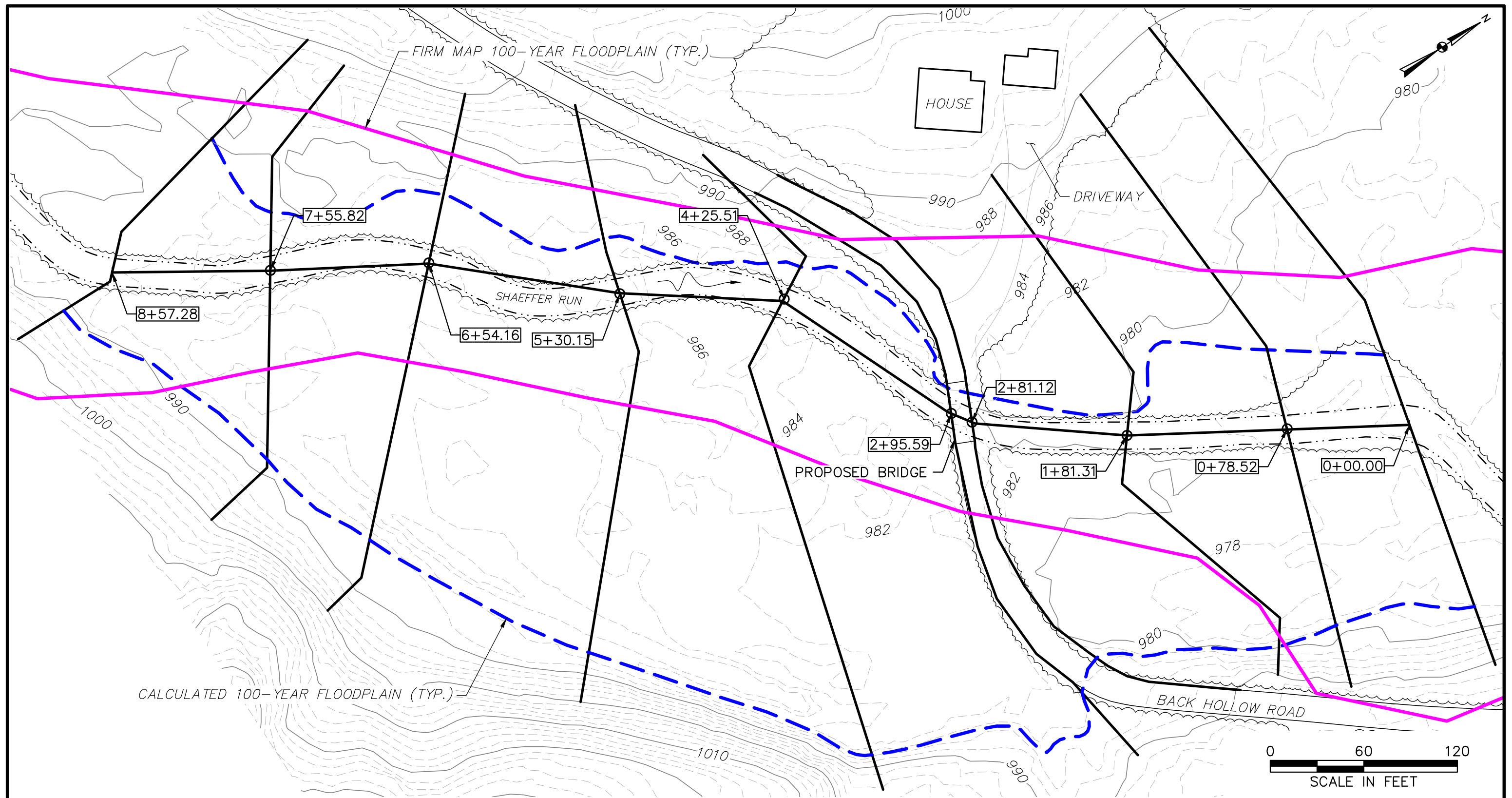
SUNOCO PIPELINE L.P.
SINKING SPRING, PENNSYLVANIA

**BACK HOLLOW BRIDGE REPAIR PROJECT
H&H SITE PLAN
EXISTING CONDITIONS**

DATE: 1/5/18
PROJECT NO.: 112IC05958
DESIGNED BY: EJR
DRAWN BY: BH
CHECKED BY: TD
SHEET: 1 OF 2

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HH-1



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PITTSBURGH, PA 15220
T: (412) 921-7090 | F: (412) 921-4040

SUNOCO PIPELINE L.P.
SINKING SPRING, PENNSYLVANIA

**BACK HOLLOW BRIDGE REPAIR PROJECT
H&H SITE PLAN
PROPOSED CONDITIONS**

DATE: 1/5/18
PROJECT NO.: 112IC05958
DESIGNED BY: EJR
DRAWN BY: BH
CHECKED BY: TD
SHEET: 2 OF 2

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HH-2

APPENDIX B

Hydrologic Analysis Documentation

B-1 – Shaeffer Run Upstream StreamStats Drainage Area Map & Report

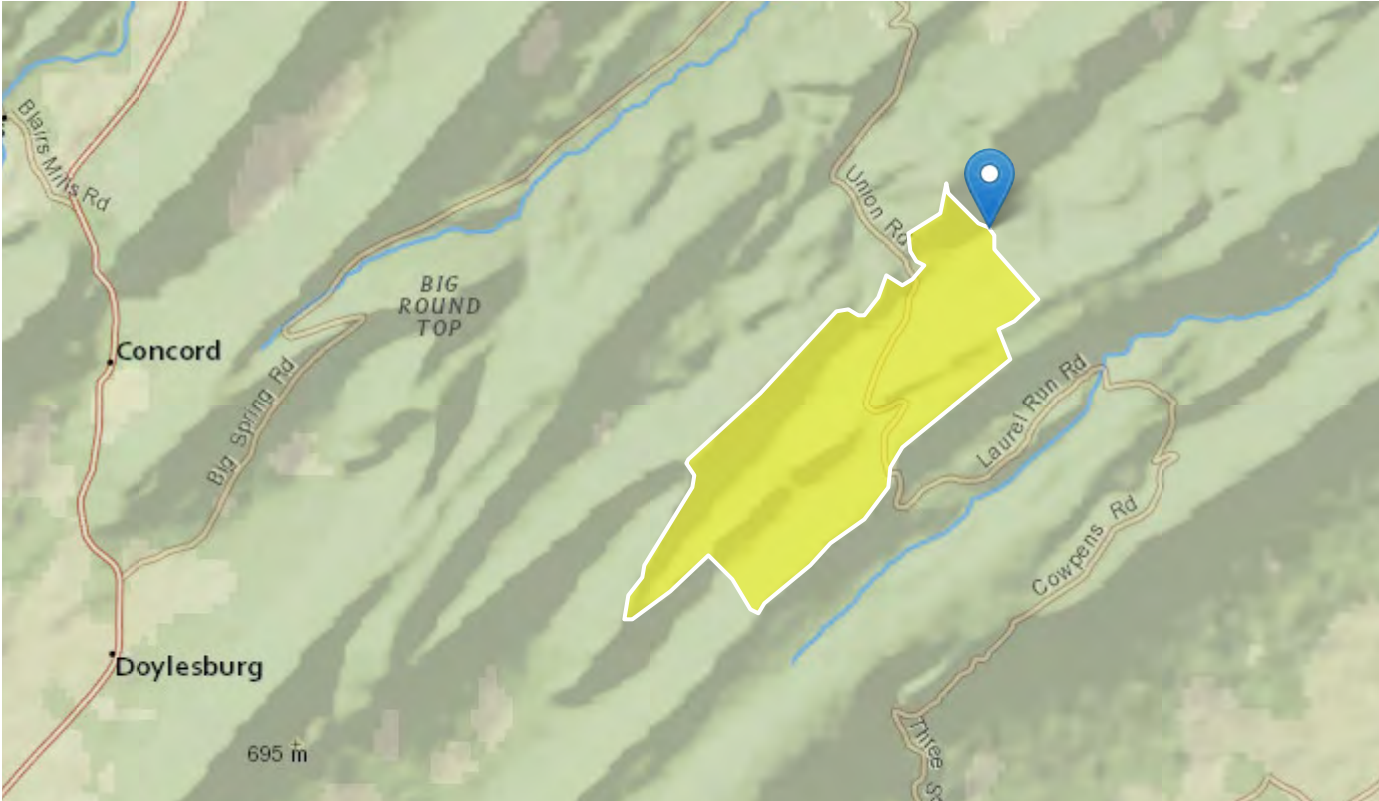
B-2 – Shaeffer Run Downstream StreamStats Drainage Area Map & Report

B-3– FEMA Effective FIRM Map

B-1 SHAEFFER RUN UPSTREAM STREAMSTATS DRAINAGE AREA MAP & REPORT

StreamStats Report

Region ID: PA
Workspace ID: PA20171228130554588000
Clicked Point (Latitude, Longitude): 40.26916, -77.54949
Time: 2017-12-28 08:05:49 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	5.24	square miles
ELEV	Mean Basin Elevation	1604.9	feet
CARBON	Percentage of area of carbonate rock	0	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0	percent
PRECIP	Mean Annual Precipitation	42	inches
STRDEN	Stream Density -- total length of streams divided by drainage area	1.97	miles per square mile
ROCKDEP	Depth to rock	4.3	feet
FOREST	Percentage of area covered by forest	100	percent
URBAN	Percentage of basin with urban development	0	percent

Peak-Flow Statistics Parameters [100 Percent (5.22 square miles) Peak Flow Region 3]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.24	square miles	1.44	1610
ELEV	Mean Basin Elevation	1604.9	feet	457	2150
CARBON	Percent Carbonate	0	percent	0	99
STORAGE	Percent Storage	0	percent	0	22.6

Peak-Flow Statistics Flow Report [100 Percent (5.22 square miles) Peak Flow Region 3]

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

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	262	ft^3/s	31	31	3
5 Year Peak Flood	444	ft^3/s	28	28	5
10 Year Peak Flood	586	ft^3/s	28	28	7
50 Year Peak Flood	947	ft^3/s	31	31	11
100 Year Peak Flood	1120	ft^3/s	36	36	11
500 Year Peak Flood	1590	ft^3/s	43	43	11

Peak-Flow Statistics Citations

Roland, M.A., and Stuckey, M.H.,2008, Regression equations for estimating flood flows at selected recurrence intervals for ungaged streams in Pennsylvania: U.S. Geological Survey Scientific Investigations Report 2008-5102, 57p. (<http://pubs.usgs.gov/sir/2008/5102/>)

Low-Flow Statistics Parameters [Low Flow Region 2]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.24	square miles	4.93	1280
PRECIP	Mean Annual Precipitation	42	inches	35	50.4
STRDEN	Stream Density	1.97	miles per square mile	0.51	3.1
ROCKDEP	Depth to Rock	4.3	feet	3.32	5.65
CARBON	Percent Carbonate	0	percent	0	99

Low-Flow Statistics Flow Report [Low Flow Region 2]

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

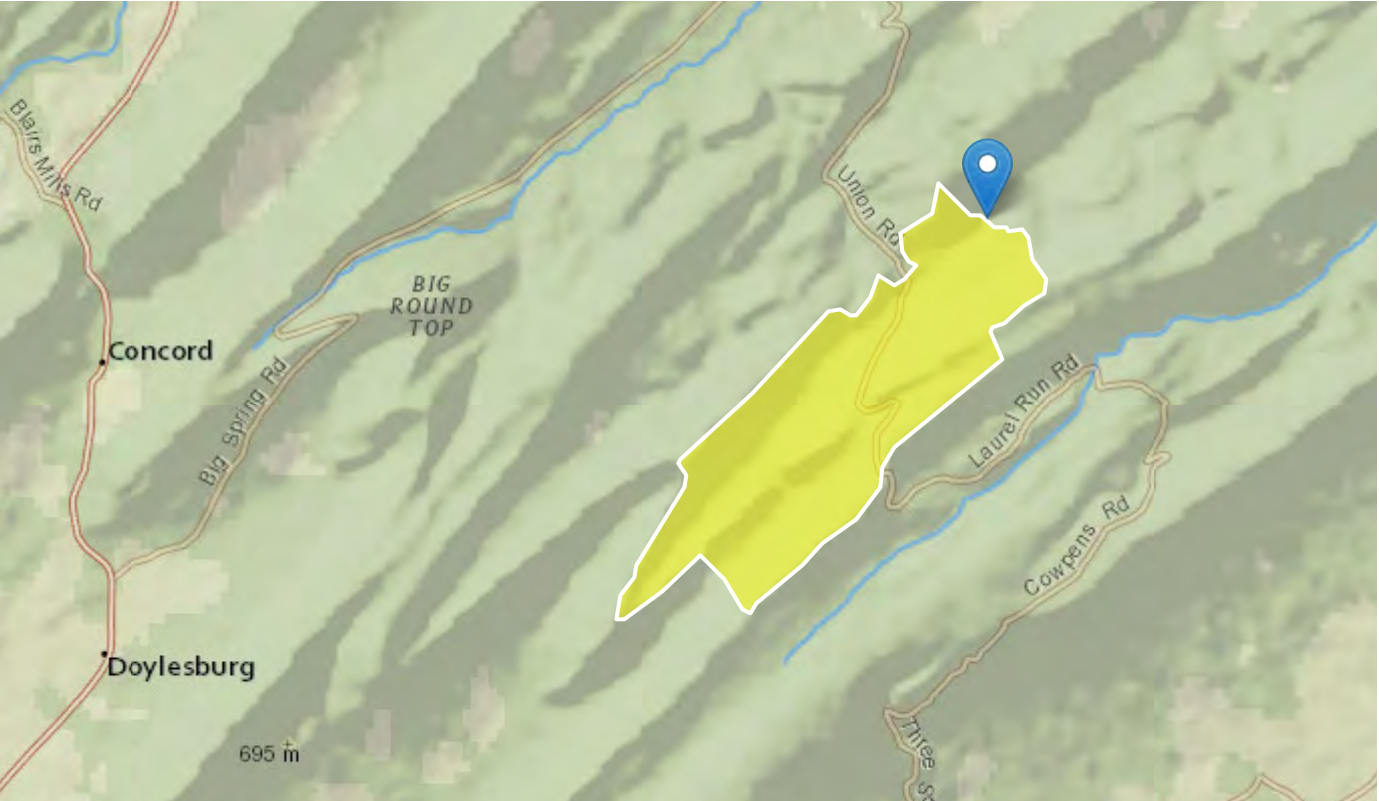
Statistic	Value	Unit	SE	SEp
7 Day 2 Year Low Flow	0.459	ft^3/s	38	38
30 Day 2 Year Low Flow	0.648	ft^3/s	33	33
7 Day 10 Year Low Flow	0.189	ft^3/s	51	51
30 Day 10 Year Low Flow	0.268	ft^3/s	46	46
90 Day 10 Year Low Flow	0.448	ft^3/s	36	36

Low-Flow Statistics Citations

B-2 SHAEFFER RUN DOWNSTREAM STREAMSTATS DRAINAGE AREA MAP & REPORT

StreamStats Report

Region ID: PA
Workspace ID: PA20180103200222181000
Clicked Point (Latitude, Longitude): 40.27028, -77.54841
Time: 2018-01-03 15:02:14 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	5.48	square miles
ELEV	Mean Basin Elevation	1592.7	feet
CARBON	Percentage of area of carbonate rock	0	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0	percent
PRECIP	Mean Annual Precipitation	41	inches
STRDEN	Stream Density -- total length of streams divided by drainage area	2	miles per square mile
ROCKDEP	Depth to rock	4.3	feet
FOREST	Percentage of area covered by forest	100	percent
URBAN	Percentage of basin with urban development	0	percent

Peak-Flow Statistics Parameters [100 Percent (5.47 square miles) Peak Flow Region 3]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.48	square miles	1.44	1610
ELEV	Mean Basin Elevation	1592.7	feet	457	2150
CARBON	Percent Carbonate	0	percent	0	99
STORAGE	Percent Storage	0	percent	0	22.6

Peak-Flow Statistics Flow Report [100 Percent (5.47 square miles) Peak Flow Region 3]

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

Statistic	Value	Unit	SE	SEp	Equiv. Yrs.
2 Year Peak Flood	272	ft^3/s	31	31	3
5 Year Peak Flood	462	ft^3/s	28	28	5
10 Year Peak Flood	609	ft^3/s	28	28	7
50 Year Peak Flood	984	ft^3/s	31	31	11
100 Year Peak Flood	1160	ft^3/s	36	36	11
500 Year Peak Flood	1650	ft^3/s	43	43	11

Peak-Flow Statistics Citations

Roland, M.A., and Stuckey, M.H.,2008, Regression equations for estimating flood flows at selected recurrence intervals for ungaged streams in Pennsylvania: U.S. Geological Survey Scientific Investigations Report 2008-5102, 57p. (<http://pubs.usgs.gov/sir/2008/5102/>)

Low-Flow Statistics Parameters [Low Flow Region 2]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	5.48	square miles	4.93	1280
PRECIP	Mean Annual Precipitation	41	inches	35	50.4
STRDEN	Stream Density	2	miles per square mile	0.51	3.1
ROCKDEP	Depth to Rock	4.3	feet	3.32	5.65
CARBON	Percent Carbonate	0	percent	0	99

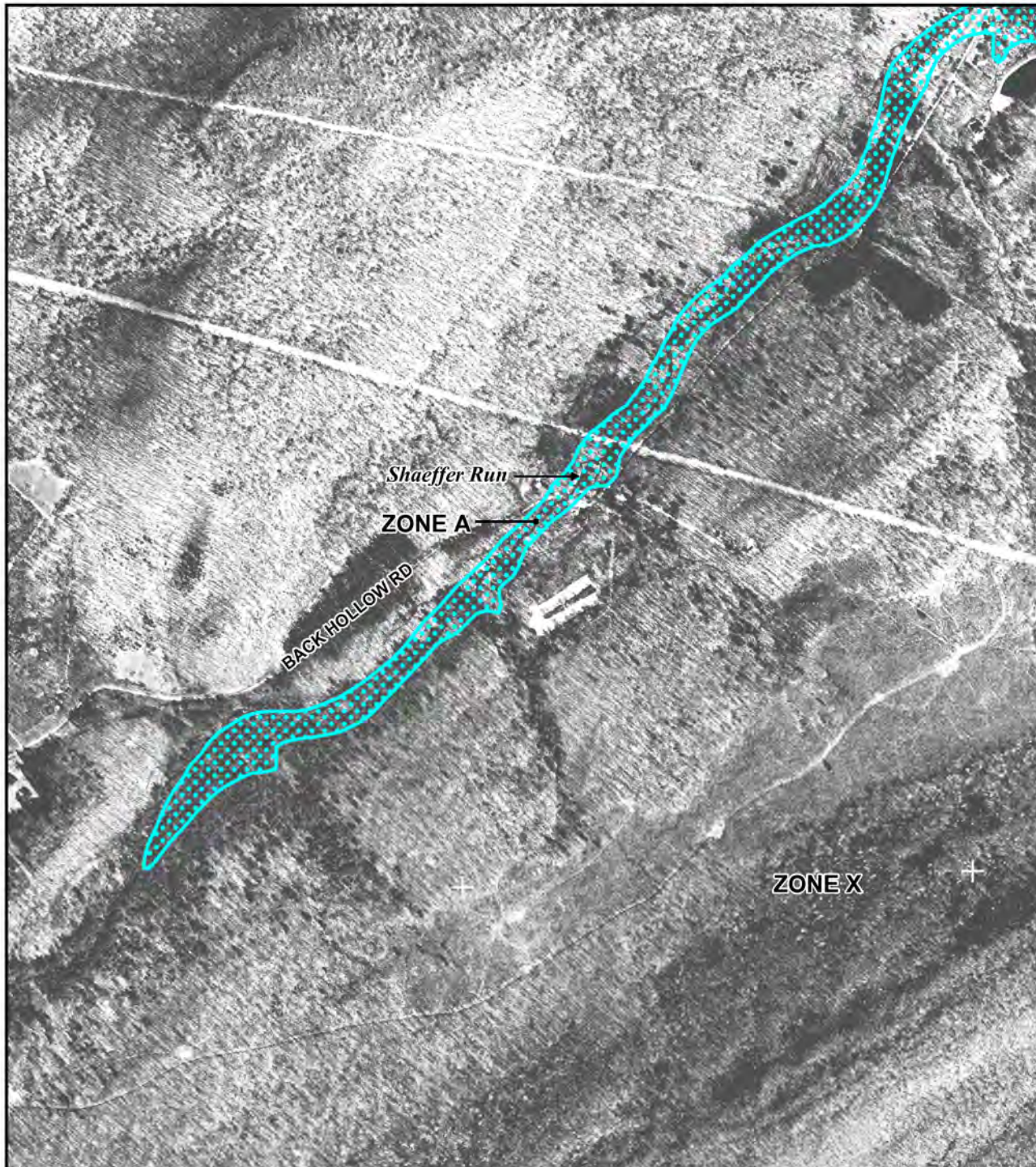
Low-Flow Statistics Flow Report [Low Flow Region 2]

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

Statistic	Value	Unit	SE	SEp
7 Day 2 Year Low Flow	0.434	ft^3/s	38	38
30 Day 2 Year Low Flow	0.616	ft^3/s	33	33
7 Day 10 Year Low Flow	0.179	ft^3/s	51	51
30 Day 10 Year Low Flow	0.254	ft^3/s	46	46
90 Day 10 Year Low Flow	0.43	ft^3/s	36	36

Low-Flow Statistics Citations

B-3 FEMA EFFECTIVE FIRM MAP



MAP SCALE 1" = 1000'

500 0 1000 2000
FEET

0 300 600
METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0320D

FIRM

FLOOD INSURANCE RATE MAP

PERRY COUNTY,
PENNSYLVANIA
(ALL JURISDICTIONS)

PANEL 320 OF 505

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
JACKSON, TOWNSHIP OF	421952	0320	D
TOBOYNE, TOWNSHIP OF	421959	0320	D

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



MAP NUMBER
42099C0320D

EFFECTIVE DATE
JUNE 16, 2009

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX C

Hydraulic Analysis Documentation

C-1 – HEC-RAS Existing Conditions Model Data

C-2 – HEC-RAS Proposed Conditions Model Data

C-1 HEC-RAS EXISTING CONDITIONS MODEL DATA

Bridge.rep

HEC-RAS HEC-RAS 5.0.3 September 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```

X      X  XXXXXX      XXXX      XXXX      XX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
XXXXXXXX XXXX      X      XXX XXXX      XXXXXX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X      X      X      X      X
X      X  XXXXXX      XXXX      X      X      X      XXXXX

```

PROJECT DATA

Project Title: Bridge
Project File : Bridge.prj
Run Date and Time: 1/9/2018 5:20:55 PM

Project in English units

Project Description:
Perry County Bridge

PLAN DATA

Plan Title: Plan 02
Plan File : C:\Users\ej.regula\Desktop\Bridge\Existing\Bridge.p02

Geometry Title: UPDATED
Geometry File : C:\Users\ej.regula\Desktop\Bridge\Existing\Bridge.g02

Flow Title : FLOW
Flow File : C:\Users\ej.regula\Desktop\Bridge\Existing\Bridge.f01

Plan Summary Information:

Number of: Cross Sections	=	10	Multiple Openings	=	0
Culverts	=	0	Inline Structures	=	0
Bridges	=	1	Lateral Structures	=	0

Computational Information

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

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Bridge.rep

FLOW DATA

Flow Title: FLOW

Flow File : C:\Users\ej.regula\Desktop\Bridge\Existing\Bridge.f01

Flow Data (cfs)

River	Reach	RS	PF 1
River 1	Reach 1	857.28	1120
River 1	Reach 1	181.31	1160

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
River 1	Reach 1	PF 1	Critical
Critical			

GEOMETRY DATA

Geometry Title: UPDATED

Geometry File : C:\Users\ej.regula\Desktop\Bridge\Existing\Bridge.g02

CROSS SECTION

RIVER: River 1

REACH: Reach 1 RS: 857.28

INPUT

Description:

Station	Elevation	Data	num=	88						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	1000	3.42	999.09	8.03	998	8.51	997.9	11.82	997.18	
14.71	996	23.24	994.34	24.54	994	31.97	992.24	32.23	992.21	
32.37	992.19	33.41	992	36.18	991.68	36.54	991.64	40.99	991.16	
43.3	990.93	45.16	990.81	47.44	990.72	49.21	990.64	56.49	990	
57.31	990	61.75	990	64.78	990	66.14	990	66.61	990	
74.57	990	76.02	990.04	76.06	990.07	83.44	990.15	83.77	990.15	
88.82	990	89.46	990	89.92	990	91.27	989.9	92.51	989.8	
94.25	989.61	100	989.08	100.97	988.99	104.14	988.96	107.14	988.94	
107.35	988.97	108.9	989	110.88	988.9	113.36	988.75	116.17	988.67	
118.9	988.71	121.97	988.76	122.31	988.83	123.74	988.92	126.98	989.19	
128	989.3	135.89	989.56	135.92	989.56	137.36	989.61	139.86	989.6	
140.37	989.6	141.06	989.63	141.3	989.65	141.57	989.7	142.22	989.7	
142.44	989.69	142.52	989.65	143.64	989.6	144.36	989.58	144.71	989.58	
148.18	989.59	152.11	989.47	155.48	989.42	166.85	989.13	170.28	989.1	
171.45	989.07	183.29	988.62	183.56	988.61	192.32	989.28	198.97	988.47	
206.02	988.79	211.7	988.64	214.01	986.89	224.12	986.23	234.74	985.66	
234.95	985.85	239.39	990.176	240.4	991.16	246.41	992.19	252.86	993.52	
264.59	997.63	271.88	999.42	273.63	999.73					

Manning's	n Values		num=	3	
Sta	n Val	Sta	n Val	Sta	n Val

Page 2

Bridge.rep

0	.1	83.44	.04	239.39	.1		
Bank Sta: Left	Right		Lengths: Left	Channel	Right	Coeff Contr.	Expan.
83.44	239.39		100.46	100.46	100.46	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	990.49	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.46	Wt. n-Val.	0.100	0.040
W.S. Elev (ft)	990.03	Reach Len. (ft)	100.46	100.46
100.46				
Crit W.S. (ft)	989.81	Flow Area (sq ft)	0.48	205.35
E.G. Slope (ft/ft)	0.014672	Area (sq ft)	0.48	205.35
Q Total (cfs)	1120.00	Flow (cfs)	0.07	1119.93
Top Width (ft)	170.60	Top Width (ft)	19.31	151.28
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	0.15	5.45
Max Chl Dpth (ft)	4.37	Hydr. Depth (ft)	0.02	1.36
Conv. Total (cfs)	9246.3	Conv. (cfs)	0.6	9245.7
Length Wtd. (ft)	100.46	Wetted Per. (ft)	19.31	153.89
Min Ch El (ft)	985.66	Shear (lb/sq ft)	0.02	1.22
Alpha	1.00	Stream Power (lb/ft s)	0.00	6.67
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	0.00	5.09
0.36				
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	3.27
0.36				

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1 RS: 755.82

INPUT

Description:

Station Elevation Data		num=	92						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	998	4.23	996.75	11.1	996	13.62	995.34	14.01	995.31
14.86	995.18	16.42	995.49	18.19	995.68	18.22	995.68	18.27	995.68
18.34	995.68	20.41	995.56	20.78	995.53	21.93	995.43	27.94	994.31
28.15	994.27	29.1	994.17	30.06	994	31.77	993.75	32.09	993.7
32.38	993.66	32.63	993.63	42.02	992.49	45.33	992.07	45.84	992
46.8	991.88	51.5	991.28	51.93	991.23	52.99	991.13	60.79	990.47
64.08	990.68	65.94	990.6	68.04	990.51	74.28	990	74.33	990

Bridge.rep									
81.9	989.72	100.14	988.64	109.94	988.71	114.83	987.88	119.7	986.96
119.75	986.95	121.69	985.28	121.84	985.34	132.97	984.92	139.91	985.36
144.09	986.28	145.4	987.182	145.44	987.21	147.79	987.83	150.47	987.59
163.13	985.62	171.21	986	174.53	987.24	174.77	987.39	175.78	988
177.79	988	179.19	988	189.15	988	195.52	988	200	988
206.56	988	209.49	988	214.45	988	217.46	988	218.12	988
219.63	988	220.37	988	238.35	988	239.39	987.92	240.27	987.71
241.04	987.7	250.94	987.81	253.09	987.87	258.53	987.97	258.58	988
260.82	988	265.43	988.36	268.14	988.65	273.74	989.34	278.7	989.942
279.18	990	289.83	991.54	292.91	992	294.8	992.4	300	993.492
302.42	994	307.4	995.29	310.16	996	311.27	996.39	315.9	998
319.01	998.91	322.55	1000						

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val
0	.1	81.9	.04
		278.7	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	81.9	278.7		101.66	101.66		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	989.09	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.40	Wt. n-Val.		0.040
W.S. Elev (ft)	988.69	Reach Len. (ft)	101.66	101.66
101.66				
Crit W.S. (ft)		Flow Area (sq ft)		220.51
E.G. Slope (ft/ft)	0.012955	Area (sq ft)		220.51
Q Total (cfs)	1120.00	Flow (cfs)		1120.00
Top Width (ft)	165.53	Top Width (ft)		165.53
Vel Total (ft/s)	5.08	Avg. Vel. (ft/s)		5.08
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)		1.33
Conv. Total (cfs)	9840.0	Conv. (cfs)		9840.0
Length Wtd. (ft)	101.66	Wetted Per. (ft)		167.49
Min Ch El (ft)	984.92	Shear (lb/sq ft)		1.06
Alpha	1.00	Stream Power (lb/ft s)		5.41
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)		4.60
0.36				
C & E Loss (ft)	0.02	Cum SA (acres)		2.90
0.36				

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

Bridge.rep

RIVER: River 1
REACH: Reach 1

RS: 654.16

INPUT

Description:

Station Elevation Data		num=		117					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1000.05	.01	1000.04	.13	1000	.29	999.94	5.29	998
8.81	996.51	10.02	996	10.61	995.75	14.73	994	15.43	993.74
20.88	992	24.04	991.02	27.56	990	32.8	989.36	38.42	988.72
39.25	988.63	42.52	988.31	42.83	988.33	43.17	988.34	43.17	988.53
43.62	988.63	45.48	988.92	47.67	989.46	48.13	989.61	48.34	989.6
50.72	990	50.79	990	51.03	990	58.1	988.7	59.03	988.3
59.69	988	76.35	986.58	87.27	986.89	93.03	986.94	97.17	986.26
97.2	986.194	98.02	984.4	98.33	984.35	109.38	983.5	119.99	984.24
120.5	984.64	124.69	986.56	124.7	986.56	130.35	986.65	135.58	986.44
145.69	986.14	149.98	986	151.43	986	154.15	986	154.96	986
158.84	986	160.14	986.05	168.84	986.4	172.99	986.57	182.27	986.51
192.51	986.43	192.89	986.41	194.28	986.39	195.72	986.38	196.13	986.29
196.94	986.32	197.95	986.36	198.84	986.34	200	986.319	201.09	986.3
201.64	986.28	202.24	986.24	202.35	986.21	202.45	986.21	203.78	986.23
204.08	986.24	204.84	986.26	204.9	986.29	205	986.34	205.93	986.39
206.6	986.42	207.42	986.56	212.63	986.53	214.31	986.53	215.2	986.54
219.22	986.6	238.19	986.92	243.44	987.03	247.48	987.21	250.33	987.36
264.04	988	264.28	988	268.54	988	268.55	988	268.57	987.99
276.67	986	277.22	986	277.86	986	278.64	986	279.07	986
280.11	986	283.8	986.96	287.06	988	296.87	988.55	300	988.713
305.3	988.99	309.04	989.22	314.58	989.48	317.11	989.58	324.74	990
327.79	990.88	328.72	991.13	329.2	991.27	331.62	992	334.82	993.04
337.74	994	340.1	995.47	341.06	996	342.85	997.2	344.17	998
345.94	999.06	347.24	1000						

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	50.79	.04	317.11	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	50.79	317.11		124.01	124.01		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	987.79	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.33	Wt. n-Val.		0.040
W.S. Elev (ft)	987.46	Reach Len. (ft)	124.01	124.01
124.01				
Crit W.S. (ft)	987.20	Flow Area (sq ft)		243.46
E.G. Slope (ft/ft)	0.012084	Area (sq ft)		243.46
Q Total (cfs)	1120.00	Flow (cfs)		1120.00
Top Width (ft)	201.23	Top Width (ft)		201.23
Vel Total (ft/s)	4.60	Avg. Vel. (ft/s)		4.60
Max Chl Dpth (ft)	3.96	Hydr. Depth (ft)		1.21
Conv. Total (cfs)	10188.5	Conv. (cfs)		10188.5

Length Wtd. (ft)	124.01	Bridge.rep	
Min Ch El (ft)	983.50	Wetted Per. (ft)	203.61
Alpha	1.00	Shear (lb/sq ft)	0.90
Frctn Loss (ft)	2.03	Stream Power (lb/ft s)	4.15
0.36		Cum Volume (acre-ft)	4.06
C & E Loss (ft)	0.02	Cum SA (acres)	2.47
0.36			

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1 RS: 530.15

INPUT

Description:

Station	Elevation	Data	num=	97						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta
0	996.17	1.01	996	2.83	995.65	12.86	994	14.01	993.79	
25.07	992	35.46	990.14	36.15	990	38.35	989.69	49.64	988	
73.47	986.05	73.91	986.01	73.96	986.01	74.05	986	74.22	985.99	
81.59	985.55	91.28	984.93	91.34	984.94	101.53	984.52	103.27	984.66	
107.23	984.58	110.1	984.433	110.16	984.43	112.89	983.02	118.63	983.09	
125.38	982.09	132.48	982.87	133.03	983.67	134.23	985.03	134.3	985.039	
138.28	985.57	149.13	985.33	158.93	984.77	171.33	986	175.88	986	
179.29	986	189.48	986	190.55	986	195.48	986	197.72	986	
200	985.707	205.82	984.96	208.12	984.72	212.3	984.46	217.43	984.26	
218.46	984.21	219.76	984.18	221.23	984.16	224.45	984.23	229.6	984.03	
230.03	984	230.5	984	233.1	984	246.35	983.99	248.36	983.99	
251.07	983.99	262.38	984	265.36	984	266.83	984	270.2	984	
280.65	984	288.87	984	293.52	984	300	984	302.9	984	
303.55	984	304.03	984	307	984.15	307.59	984.18	309.57	984.33	
317.76	984.92	333.2	986	334.55	986.17	338.14	986.02	340.71	986.03	
341.31	986.03	341.59	986.03	348.15	986	349.24	985.73	356.02	985.57	
361.76	985.47	362.7	985.91	363.01	986	366.39	987.34	368.06	988	
368.72	988.26	372.86	990	374.73	991.01	376.56	992	378.58	993.24	
379.65	994	382.23	995.72	382.69	996	383.05	996.16	387.16	998	
389.18	998.85	390.98	1000							

Manning's n	Values	num=	3
Sta	n Val	Sta	n Val
0	.1	73.47	.04
		334.55	.1

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	73.47	334.55		104.64	104.64	104.64		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	985.74	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.54	Wt. n-Val.		0.040

W.S. Elev (ft)	985.20	Bridge.rep	
104.64		Reach Len. (ft)	104.64 104.64
Crit W.S. (ft)	985.20	Flow Area (sq ft)	190.07
E.G. Slope (ft/ft)	0.023377	Area (sq ft)	190.07
Q Total (cfs)	1120.00	Flow (cfs)	1120.00
Top Width (ft)	178.22	Top Width (ft)	178.22
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)	5.89
Max Chl Dpth (ft)	3.11	Hydr. Depth (ft)	1.07
Conv. Total (cfs)	7325.3	Conv. (cfs)	7325.3
Length Wtd. (ft)	104.64	Wetted Per. (ft)	179.88
Min Ch El (ft)	982.09	Shear (lb/sq ft)	1.54
Alpha	1.00	Stream Power (lb/ft s)	9.09
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)	3.44
0.36		Cum SA (acres)	1.93
C & E Loss (ft)	0.15		
0.36			

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical

depth for the water surface and continued on with the calculations.

Warning: Divided flow computed for this cross-section.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than

1.4. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: River 1

REACH: Reach 1

RS: 425.51

INPUT

Description:

Station	Elevation	Data	num=	127						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	991.94	2.37	991.63	5.35	991.32	7.41	991.12	10.81	991.05	
15.87	990.83	21.21	990.75	31.87	990.47	41.73	990	43.21	989.89	
43.39	989.89	44.43	989.84	44.47	989.84	45.22	989.79	71.2	988	
92.53	986.99	104.67	983.73	111.5	983.172	111.53	983.17	112.14	982.1	
112.16	981.21	117.87	979.32	124.58	980.72	126.9	981.12	129.4	983.945	
129.44	983.99	156.92	984.11	159.3	984.07	160.9	984.02	161.18	984	
171.96	984	173.46	984	175.13	984	181.1	985.2	181.25	985.26	
182.75	985.42	183.75	985.51	184.62	985.53	186.3	985.68	186.37	985.68	
186.43	985.68	186.47	985.68	186.63	985.68	188.92	985.58	189.27	985.54	
189.58	985.3	190.94	985.17	193.96	985.15	200	985.307	203.22	985.39	
206.97	985.57	208.36	985.62	208.68	985.61	210.18	985.49	210.93	985.47	

Bridge.rep									
219.6	984.57	221.5	984.38	222.29	984.26	234.62	984	234.71	984
235.12	984	241.07	984	246.52	984	247.49	984	248.15	984
249.42	984.19	252.57	984.49	254.88	984.66	260.53	984.37	267.03	984.01
272.15	984	272.36	984	272.85	984	273.23	984	275.63	984
278.73	983.93	279.39	983.86	281.1	983.61	287.71	982.66	291.05	982
291.81	982	300	982	309.9	982	312.4	982	315.43	982
356.34	982	359.33	982	363.21	982.02	364.62	982.02	367.39	982.01
369.63	982	370.28	982	370.98	982	375.35	982	380.96	982.01
385.12	982.01	385.58	982.01	389.01	982	394.38	982	399.02	982
400.14	982.9	400.89	982.93	411.98	982.33	413.07	982.2	413.44	982.13
413.58	982	416.4	982	427.66	982	428.56	982	428.57	982
428.58	982.01	431.39	984	433.44	985.32	434.19	985.84	434.42	986
436.66	987.52	437.2	987.87	437.42	988	437.84	988.21	438.86	988.71
441.16	990	441.85	990.29	446.43	992	448.67	992.56	449.69	992.75
454.77	994	456.6	994.3						

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val
 0 .1 92.53 .04 434.19 .1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 92.53 434.19 127.57 127.57 127.57 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	985.00	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.05	Wt. n-Val.		0.040
W.S. Elev (ft)	984.95	Reach Len. (ft)	127.57	127.57
127.57		Flow Area (sq ft)		606.86
Crit W.S. (ft)		Area (sq ft)		606.86
E.G. Slope (ft/ft)	0.000972	Flow (cfs)		1120.00
Q Total (cfs)	1120.00	Top Width (ft)		296.58
Top Width (ft)	296.58	Avg. Vel. (ft/s)		1.85
Vel Total (ft/s)	1.85	Hydr. Depth (ft)		2.05
Max Chl Dpth (ft)	5.63	Conv. (cfs)		35923.0
Conv. Total (cfs)	35923.0	Wetted Per. (ft)		301.69
Length Wtd. (ft)	127.57	Shear (lb/sq ft)		0.12
Min Ch El (ft)	979.32	Stream Power (lb/ft s)		0.23
Alpha	1.00	Cum Volume (acre-ft)		2.48
Frctn Loss (ft)	0.25	Cum SA (acres)		1.36
0.36				
C & E Loss (ft)	0.06			
0.36				

Warning: Divided flow computed for this cross-section.
 Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Bridge.rep

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1

RS: 295.59

INPUT

Description:

Station Elevation Data		num= 24		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.109	22.8	988.842	58.61	986.991	93.44	985.552	126.28	985.05		
153.09	985.962	182.53	985.89	184	985.52	189.71	979.297	199.43	978.423		
208.6	978.247	218.2	984.759	221.5	984.93	251.5	985.19	288.82	982.968		
324.43	982.436	368.03	982.957	397.69	983.799	425.05	984.656	429.27	984.802		
443.1	986	448.91	987.786	457.04	990	460.26	990.687				

Manning's n Values		num= 3		Sta n Val		Sta n Val	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.1	182.53	.04	221.5	.1		

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	182.53	221.5		14.52	14.52	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	984.68	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.68	Wt. n-Val.		0.040
0.100				
W.S. Elev (ft)	984.01	Reach Len. (ft)	0.10	0.10
0.10				
Crit W.S. (ft)	983.43	Flow Area (sq ft)		136.64
131.88				
E.G. Slope (ft/ft)	0.006052	Area (sq ft)		136.64
131.88				
Q Total (cfs)	1120.00	Flow (cfs)		968.38
151.62				
Top Width (ft)	164.61	Top Width (ft)		31.70
132.91				
Vel Total (ft/s)	4.17	Avg. Vel. (ft/s)		7.09
1.15				
Max Chl Dpth (ft)	5.76	Hydr. Depth (ft)		4.31
0.99				
Conv. Total (cfs)	14396.7	Conv. (cfs)		12447.7
1949.0				
Length Wtd. (ft)	0.10	Wetted Per. (ft)		35.58
132.96				
Min Ch El (ft)	978.25	Shear (lb/sq ft)		1.45
0.37				
Alpha	2.51	Stream Power (lb/ft s)		10.28
0.43				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		1.39
0.17				
C & E Loss (ft)	0.02	Cum SA (acres)		0.88
0.16				

Bridge.rep

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

BRIDGE

RIVER: River 1
REACH: Reach 1 RS: 281.08

INPUT

Description:

Distance from Upstream XS = .1
Deck/Roadway Width = 13
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates

num= 3			
Sta	Hi	Cord	Lo Cord
182.53	985.892	983.952	204.53 985.462 983.522
221.38	984.932	982.992	

Upstream Bridge Cross Section Data

Station Elevation Data num= 24									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.109	22.8	988.842	58.61	986.991	93.44	985.552	126.28	985.05
153.09	985.962	182.53	985.89	184	985.52	189.71	979.297	199.43	978.423
208.6	978.247	218.2	984.759	221.5	984.93	251.5	985.19	288.82	982.968
324.43	982.436	368.03	982.957	397.69	983.799	425.05	984.656	429.27	984.802
443.1	986	448.91	987.786	457.04	990	460.26	990.687		

Manning's n Values

num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	182.53	.04	221.5	.1

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	182.53	221.5	.1	.3	

Downstream Deck/Roadway Coordinates

num= 3			
Sta	Hi	Cord	Lo Cord
190.04	985.892	983.952	204.53 985.462 983.522
228.95	984.932	982.992	

Downstream Bridge Cross Section Data

Station Elevation Data num= 32									
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.138	6.82	989.301	52.05	987.025	87.65	985.628	128.65	985.01
156.96	986.251	183.72	985.873	190.04	985.873	192	985.873	208.34	978.899
216.9	978.233	226.1	978.873	228	984.89	228.95	984.89	233.19	984.89
257.67	985.259	293.08	983.035	327.89	981.868	360.29	982.016	388.82	982.898
403.11	984.078	417.18	984.935	429.01	985.497	431.43	985.364	437.84	986
449.38	986.476	462.11	987.842	471.95	988.489	479	988.811	481.11	988.837
490.01	990.234	490.59	990.254						

Manning's n Values

num= 3					
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	190.04	.04	228.95	.1

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	190.04	228.95	.1	.3	

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98

	Bridge.rep
Elevation at which weir flow begins	=
Energy head used in spillway design	=
Spillway height used in design	=
Weir crest shape	= Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters

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

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	984.68	Element	Inside BR US
Inside BR DS			
W.S. US. (ft)	984.01	E.G. Elev (ft)	984.66
984.42		W.S. Elev (ft)	984.06
Q Total (cfs)	1120.00	Crit W.S. (ft)	983.59
983.98		Max Chl Dpth (ft)	5.81
Q Bridge (cfs)	862.82	Vel Total (ft/s)	4.28
983.49		Flow Area (sq ft)	261.80
Q Weir (cfs)		Froude # Chl	0.46
5.74		Specif Force (cu ft)	630.62
Weir Sta Lft (ft)		Hydr Depth (ft)	1.93
3.89		W.P. Total (ft)	199.80
Weir Sta Rgt (ft)		Conv. Total (cfs)	9133.3
288.16		Top Width (ft)	135.44
Weir Submerg		Frctn Loss (ft)	0.19
0.39		C & E Loss (ft)	0.05
Weir Max Depth (ft)		Shear Total (lb/sq ft)	1.23
633.10		Power Total (lb/ft s)	5.26
Min El Weir Flow (ft)	982.45		
2.33			
Min El Prs (ft)	983.89		
188.86			
Delta EG (ft)	0.34		
9272.6			
Delta WS (ft)	0.66		
123.80			
BR Open Area (sq ft)	111.65		
0.02			
BR Open Vel (ft/s)	7.73		
0.06			
BR Sluice Coef			
1.39			
BR Sel Method	Energy only		
5.40			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross

Bridge.rep

sections.

CROSS SECTION

RIVER: River 1

REACH: Reach 1

RS: 281.07

INPUT

Description:

Station Elevation Data		num= 32		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.138	6.82	989.301	52.05	987.025	87.65	985.628	128.65	985.01		
156.96	986.251	183.72	985.873	190.04	985.873	192	985.873	208.34	978.899		
216.9	978.233	226.1	978.873	228	984.89	228.95	984.89	233.19	984.89		
257.67	985.259	293.08	983.035	327.89	981.868	360.29	982.016	388.82	982.898		
403.11	984.078	417.18	984.935	429.01	985.497	431.43	985.364	437.84	986		
449.38	986.476	462.11	987.842	471.95	988.489	479	988.811	481.11	988.837		
490.01	990.234	490.59	990.254								

Manning's n Values

num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	190.04	.04	228.95	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	190.04	228.95		99.76	99.76	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	984.34	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.99	Wt. n-Val.		0.040
0.100				
W.S. Elev (ft)	983.35	Reach Len. (ft)	99.76	99.76
99.76				
Crit W.S. (ft)	983.35	Flow Area (sq ft)		111.40
104.19				
E.G. Slope (ft/ft)	0.010983	Area (sq ft)		111.40
104.19				
Q Total (cfs)	1120.00	Flow (cfs)		959.83
160.17				
Top Width (ft)	135.77	Top Width (ft)		29.60
106.17				
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)		8.62
1.54				
Max Chl Dpth (ft)	5.12	Hydr. Depth (ft)		3.76
0.98				
Conv. Total (cfs)	10686.9	Conv. (cfs)		9158.6
1528.3				
Length Wtd. (ft)	99.76	Wetted Per. (ft)		33.83
106.24				
Min Ch El (ft)	978.23	Shear (lb/sq ft)		2.26
0.67				
Alpha	2.37	Stream Power (lb/ft s)		19.45
1.03				
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)		1.36
0.12				
C & E Loss (ft)	0.22	Cum SA (acres)		0.88
0.12				

Bridge.rep

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: River 1
REACH: Reach 1 RS: 181.31

INPUT

Description:

Station Elevation Data		num= 66		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990	18.54	988	34.39	986.62	40.61	986	44.38	985.62		
60.01	984	71.44	983.15	90.49	982	117.94	980.72	127.87	980.36		
132.59	980.19	133.9	980.15	145.38	980.02	147.57	980	155.66	979.89		
159.11	979.64	170.14	979.56	182.11	979.95	185.38	979.85	185.4	979.826		
187.69	977.07	194.65	976.66	200	976.994	201.69	977.1	202.1	978.789		
202.11	978.83	206.76	979.54	215.86	980.31	226.26	980.04	238.72	980.42		
249.52	980.31	256.78	980	268.99	979.58	273.61	979.37	281.62	979.04		
289.67	978.58	300	978.039	300.75	978	317.13	977.34	329.93	976.95		
345.22	976.54	353.11	976.29	360.56	976.03	361.67	976	363.08	976		
364.61	975.99	364.96	975.99	365.22	975.99	367.58	976	373.99	977.78		
374.61	977.93	374.77	978	375.11	978.15	379.53	980	383.49	981.67		
384.17	982	384.3	982.1	387.45	984	387.47	984.01	387.58	984.09		
389.91	985.49	390.8	986	391.82	986.61	393.97	988	395.14	988.91		
397.09	990										

Manning's n Values		num= 3		Sta n Val		Sta n Val	
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.1	127.87	.04	379.53	.1		

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	127.87	379.53		102.79	102.79	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	979.94	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.26	Wt. n-Val.		0.040
W.S. Elev (ft)	979.68	Reach Len. (ft)	102.79	102.79
102.79				
Crit W.S. (ft)		Flow Area (sq ft)		284.56
E.G. Slope (ft/ft)	0.005324	Area (sq ft)		284.56

Bridge.rep

Q Total (cfs)	1160.00	Flow (cfs)	1160.00
Top Width (ft)	150.94	Top Width (ft)	150.94
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)	4.08
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)	1.89
Conv. Total (cfs)	15897.1	Conv. (cfs)	15897.1
Length Wtd. (ft)	102.79	Wetted Per. (ft)	154.30
Min Ch El (ft)	975.99	Shear (lb/sq ft)	0.61
Alpha	1.00	Stream Power (lb/ft s)	2.50
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)	0.90
C & E Loss (ft)	0.03	Cum SA (acres)	0.68

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1 RS: 78.5

INPUT

Description:

Station Elevation		Data		num=		98					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990	6.89	989.46	7.54	989.42	9.84	989.29	23.68	988.42		
29.23	988	31.39	987.81	50.63	986	53.53	985.79	55.12	985.66		
55.52	985.71	55.84	985.73	57.29	985.67	62.13	985.43	90.26	984		
91.95	983.78	92.52	983.7	93.24	983.7	111.74	982.02	111.92	982.02		
112.14	982.02	117.02	982.02	129.85	982.01	133.66	982	134.03	982		
152.75	980.63	161.83	980	168.47	979.53	171.6	979.58	173.16	979.67		
174.41	979.66	177.79	979.51	178.61	979.5	183.82	979.43	186.1	979.38		
191.91	979.2	200	978.947	200.21	978.94	200.42	978.93	217.78	978.34		
223.22	978.3	233.54	978.21	244.69	978.02	244.7	978.013	246.37	976.83		
255.59	976.48	266.6	976.21	271.8	977.973	271.82	977.98	280.78	978		
289.69	978	294.8	978	300	978.09	308.13	978.23	308.44	978.25		
313.01	978.27	315.93	978.24	321.13	978.1	323.09	978.02	323.54	978		
324.46	977.79	326.34	977.29	331.32	976	335.99	975.96	336.82	975.96		
337.63	975.96	340.08	975.98	343.83	976	348.18	976.01	352.95	976.02		
357.63	976.01	358.37	976.01	361.42	976	362.64	976	362.97	976		
370.71	975.97	375.48	975.99	379.79	976	383.31	977.75	383.86	978		
385.08	978.4	386.75	978.801	386.83	978.82	388.83	979.33	392.77	980		
400.56	981.32	402.31	982	403.36	982.5	407.2	984	409.12	984.74		
412.13	986	413.35	986.5	414.33	986.92	417.09	988	419.15	988.65		
423.14	990	425.13	990.77	425.42	990.85						

Manning's n Values		num=		Bridge.rep	
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	200	.04	386.75	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	200	386.75		78.52 78.52	78.52	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	978.91	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.58	Wt. n-Val.		0.040
W.S. Elev (ft)	978.33	Reach Len. (ft)	78.52	78.52
78.52				
Crit W.S. (ft)	978.33	Flow Area (sq ft)		189.68
E.G. Slope (ft/ft)	0.022827	Area (sq ft)		189.68
Q Total (cfs)	1160.00	Flow (cfs)		1160.00
Top Width (ft)	165.31	Top Width (ft)		165.31
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)		6.12
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)		1.15
Conv. Total (cfs)	7677.7	Conv. (cfs)		7677.7
Length Wtd. (ft)	78.52	Wetted Per. (ft)		166.77
Min Ch El (ft)	975.96	Shear (lb/sq ft)		1.62
Alpha	1.00	Stream Power (lb/ft s)		9.91
Frctn Loss (ft)	1.82	Cum Volume (acre-ft)		0.34
C & E Loss (ft)	0.00	Cum SA (acres)		0.30

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical

depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may

indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: River 1

REACH: Reach 1

RS: 0

INPUT

Description:

Bridge.rep									
Station Elevation Data					num= 109				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990	27.05	988.12	29.07	988	37.51	987.24	41.61	986.85
54.08	986.13	57.1	986	76.13	985.22	91.52	984.06	92.01	984
92.58	983.94	96.78	983.57	99.78	983.39	102.72	983.13	108.23	982
121.13	980.57	124.51	980	131.31	979	139.7	978	146.51	978
147.95	978	148.56	978	150.87	978	153.1	978	153.23	978
153.53	978	157.54	978.01	160.78	978.01	164.18	978.01	169.96	978.01
170.49	978.01	171.73	978.01	175.76	978.01	179.72	978.01	181.89	978.01
182.74	978.01	184.09	978.01	185.06	978.01	185.79	978.01	187.82	978.01
190.84	978.01	193.39	978.01	196.76	978.01	199.1	978.01	200	978.01
203.62	978.01	212	978	219.58	978	222.64	977.86	240.55	977.15
258	976.605	258.15	976.6	265.64	975.46	275.09	975.46	291.51	976.06
291.85	975.902	294.61	974.62	300	974.654	307.44	974.7	318.3	975.11
319.9	975.87	325.3	975.93	331.24	976.11	335.15	975.85	344.94	976
347.91	976	348.15	976	349.64	976	351.36	976	351.82	976
352.12	975.97	352.26	975.97	352.38	975.97	352.44	975.97	352.73	975.94
354.43	975.78	373.35	974	379.35	973.99	380.37	973.99	385.16	973.99
388.27	974	394.78	974.61	396.4	974.62	396.42	974.54	397.33	974.54
398.26	974.55	407.67	974.97	408.83	975.03	429.75	976	432.79	976.711
436.76	977.64	438.26	978	441.3	978.93	445.13	980	445.34	980.09
447.02	980.87	448.49	981.52	449.58	982	450.2	982.33	453.88	984
457.17	985.74	457.65	986	460.94	987.87	461.21	988	461.73	988.2
466.05	989.41	467.15	989.72	468.14	990	470.76	990.58		

Manning's n Values					num= 3				
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.1	258	.04	432.79	.1				

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	258	432.79		0	0	0		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	976.91	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.58	Wt. n-Val.		0.040
W.S. Elev (ft)	976.33	Reach Len. (ft)		
Crit W.S. (ft)	976.33	Flow Area (sq ft)		190.10
E.G. Slope (ft/ft)	0.023638	Area (sq ft)		190.10
Q Total (cfs)	1160.00	Flow (cfs)		1160.00
Top Width (ft)	171.29	Top Width (ft)		171.29
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)		6.10
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)		1.11
Conv. Total (cfs)	7544.9	Conv. (cfs)		7544.9
Length Wtd. (ft)		Wetted Per. (ft)		172.13
Min Ch El (ft)	973.99	Shear (lb/sq ft)		1.63
Alpha	1.00	Stream Power (lb/ft s)		9.94
Frctn Loss (ft)		Cum Volume (acre-ft)		

C & E Loss (ft)

Bridge.rep
Cum SA (acres)

SUMMARY OF MANNING'S N VALUES

River:River 1

Reach	River Sta.	n1	n2	n3
Reach 1	857.28	.1	.04	.1
Reach 1	755.82	.1	.04	.1
Reach 1	654.16	.1	.04	.1
Reach 1	530.15	.1	.04	.1
Reach 1	425.51	.1	.04	.1
Reach 1	295.59	.1	.04	.1
Reach 1	281.08	Bridge		
Reach 1	281.07		.1	.04
Reach 1	181.31	.1	.04	.1
Reach 1	78.5	.1	.04	.1
Reach 1	0	.1	.04	.1

SUMMARY OF REACH LENGTHS

River: River 1

Reach	River Sta.	Left	Channel	Right
Reach 1	857.28	100.46	100.46	100.46
Reach 1	755.82	101.66	101.66	101.66
Reach 1	654.16	124.01	124.01	124.01
Reach 1	530.15	104.64	104.64	104.64
Reach 1	425.51	127.57	127.57	127.57
Reach 1	295.59	14.52	14.52	14.52
Reach 1	281.08	Bridge		
Reach 1	281.07		99.76	99.76
Reach 1	181.31	102.79	102.79	102.79
Reach 1	78.5	78.52	78.52	78.52
Reach 1	0	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: River 1

Reach	River Sta.	Contr.	Expan.
Reach 1	857.28	.1	.3
Reach 1	755.82	.1	.3
Reach 1	654.16	.1	.3
Reach 1	530.15	.1	.3
Reach 1	425.51	.1	.3
Reach 1	295.59	.1	.3
Reach 1	281.08	Bridge	
Reach 1	281.07		.1

		Bridge.rep	
Reach 1	181.31	.1	.3
Reach 1	78.5	.1	.3
Reach 1	0	.1	.3

Plan: Plan 02 River 1 Reach 1 RS: 857.28 Profile: PF 1

E.G. Elev (ft)	990.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.100	0.040	
W.S. Elev (ft)	990.03	Reach Len. (ft)	100.46	100.46	100.46
Crit W.S. (ft)	989.81	Flow Area (sq ft)	0.48	205.35	
E.G. Slope (ft/ft)	0.014672	Area (sq ft)	0.48	205.35	
Q Total (cfs)	1120.00	Flow (cfs)	0.07	1119.93	
Top Width (ft)	170.60	Top Width (ft)	19.31	151.28	
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	0.15	5.45	
Max Chl Dpth (ft)	4.37	Hydr. Depth (ft)	0.02	1.36	
Conv. Total (cfs)	9246.3	Conv. (cfs)	0.6	9245.7	
Length Wtd. (ft)	100.46	Wetted Per. (ft)	19.31	153.89	
Min Ch El (ft)	985.66	Shear (lb/sq ft)	0.02	1.22	
Alpha	1.00	Stream Power (lb/ft s)	0.00	6.67	
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	0.00	5.08	0.38
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	3.27	0.39

Plan: Plan 02 River 1 Reach 1 RS: 755.82 Profile: PF 1

E.G. Elev (ft)	989.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.040	
W.S. Elev (ft)	988.69	Reach Len. (ft)	101.66	101.66	101.66
Crit W.S. (ft)		Flow Area (sq ft)		220.51	
E.G. Slope (ft/ft)	0.012955	Area (sq ft)		220.51	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	165.53	Top Width (ft)		165.53	
Vel Total (ft/s)	5.08	Avg. Vel. (ft/s)		5.08	
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)		1.33	
Conv. Total (cfs)	9840.0	Conv. (cfs)		9840.0	
Length Wtd. (ft)	101.66	Wetted Per. (ft)		167.49	
Min Ch El (ft)	984.92	Shear (lb/sq ft)		1.06	
Alpha	1.00	Stream Power (lb/ft s)		5.41	
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)		4.59	0.38
C & E Loss (ft)	0.02	Cum SA (acres)		2.90	0.39

Plan: Plan 02 River 1 Reach 1 RS: 654.16 Profile: PF 1

E.G. Elev (ft)	987.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.		0.040	
W.S. Elev (ft)	987.46	Reach Len. (ft)	124.01	124.01	124.01
Crit W.S. (ft)	987.20	Flow Area (sq ft)		243.46	
E.G. Slope (ft/ft)	0.012084	Area (sq ft)		243.46	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	201.23	Top Width (ft)		201.23	
Vel Total (ft/s)	4.60	Avg. Vel. (ft/s)		4.60	
Max Chl Dpth (ft)	3.96	Hydr. Depth (ft)		1.21	
Conv. Total (cfs)	10188.5	Conv. (cfs)		10188.5	
Length Wtd. (ft)	124.01	Wetted Per. (ft)		203.61	
Min Ch El (ft)	983.50	Shear (lb/sq ft)		0.90	
Alpha	1.00	Stream Power (lb/ft s)		4.15	
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)		4.05	0.38
C & E Loss (ft)	0.02	Cum SA (acres)		2.47	0.39

Plan: Plan 02 River 1 Reach 1 RS: 530.15 Profile: PF 1

E.G. Elev (ft)	985.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.		0.040	
W.S. Elev (ft)	985.20	Reach Len. (ft)	104.64	104.64	104.64
Crit W.S. (ft)	985.20	Flow Area (sq ft)		190.07	
E.G. Slope (ft/ft)	0.023377	Area (sq ft)		190.07	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	178.22	Top Width (ft)		178.22	
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)		5.89	
Max Chl Dpth (ft)	3.11	Hydr. Depth (ft)		1.07	
Conv. Total (cfs)	7325.3	Conv. (cfs)		7325.3	
Length Wtd. (ft)	104.64	Wetted Per. (ft)		179.88	
Min Ch El (ft)	982.09	Shear (lb/sq ft)		1.54	
Alpha	1.00	Stream Power (lb/ft s)		9.09	
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)		3.44	0.38
C & E Loss (ft)	0.15	Cum SA (acres)		1.93	0.39

Plan: Plan 02 River 1 Reach 1 RS: 425.51 Profile: PF 1

E.G. Elev (ft)	985.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.040	
W.S. Elev (ft)	984.95	Reach Len. (ft)	127.57	127.57	127.57
Crit W.S. (ft)		Flow Area (sq ft)		606.86	
E.G. Slope (ft/ft)	0.000972	Area (sq ft)		606.86	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	296.58	Top Width (ft)		296.58	
Vel Total (ft/s)	1.85	Avg. Vel. (ft/s)		1.85	
Max Chl Dpth (ft)	5.63	Hydr. Depth (ft)		2.05	
Conv. Total (cfs)	35923.0	Conv. (cfs)		35923.0	
Length Wtd. (ft)	127.57	Wetted Per. (ft)		301.69	
Min Ch El (ft)	979.32	Shear (lb/sq ft)		0.12	
Alpha	1.00	Stream Power (lb/ft s)		0.23	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)		2.48	0.36
C & E Loss (ft)	0.06	Cum SA (acres)		1.36	0.36

Plan: Plan 02 River 1 Reach 1 RS: 295.59 Profile: PF 1

E.G. Elev (ft)	984.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	984.01	Reach Len. (ft)	0.10	0.10	0.10
Crit W.S. (ft)	983.43	Flow Area (sq ft)		136.64	131.88
E.G. Slope (ft/ft)	0.006052	Area (sq ft)		136.64	131.88
Q Total (cfs)	1120.00	Flow (cfs)		968.38	151.62
Top Width (ft)	164.61	Top Width (ft)		31.70	132.91
Vel Total (ft/s)	4.17	Avg. Vel. (ft/s)		7.09	1.15
Max Chl Dpth (ft)	5.76	Hydr. Depth (ft)		4.31	0.99
Conv. Total (cfs)	14396.7	Conv. (cfs)		12447.7	1949.0
Length Wtd. (ft)	0.10	Wetted Per. (ft)		35.58	132.96
Min Ch El (ft)	978.25	Shear (lb/sq ft)		1.45	0.37
Alpha	2.51	Stream Power (lb/ft s)		10.28	0.43
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		1.39	0.17
C & E Loss (ft)	0.02	Cum SA (acres)		0.88	0.16

Plan: Plan 02 River 1 Reach 1 RS: 281.08 BR U Profile: PF 1

E.G. Elev (ft)	984.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	984.06	Reach Len. (ft)	13.00	13.00	13.00
Crit W.S. (ft)	983.59	Flow Area (sq ft)		122.95	138.86
E.G. Slope (ft/ft)	0.015038	Area (sq ft)		122.95	138.86
Q Total (cfs)	1120.00	Flow (cfs)		862.82	257.18
Top Width (ft)	135.44	Top Width (ft)			135.44
Vel Total (ft/s)	4.28	Avg. Vel. (ft/s)		7.02	1.85
Max Chl Dpth (ft)	5.81	Hydr. Depth (ft)			1.03
Conv. Total (cfs)	9133.3	Conv. (cfs)		7036.0	2097.3
Length Wtd. (ft)	13.00	Wetted Per. (ft)		64.30	135.50
Min Ch El (ft)	978.25	Shear (lb/sq ft)		1.80	0.96
Alpha	2.12	Stream Power (lb/ft s)		12.60	1.78
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)		1.39	0.17
C & E Loss (ft)	0.05	Cum SA (acres)		0.88	0.16

Plan: Plan 02 River 1 Reach 1 RS: 281.08 BR D Profile: PF 1

E.G. Elev (ft)	984.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	983.98	Reach Len. (ft)	1.42	1.42	1.42
Crit W.S. (ft)	983.49	Flow Area (sq ft)		111.65	176.50
E.G. Slope (ft/ft)	0.014589	Area (sq ft)		111.65	176.50
Q Total (cfs)	1120.00	Flow (cfs)		718.96	401.04
Top Width (ft)	123.80	Top Width (ft)			123.80
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)		6.44	2.27
Max Chl Dpth (ft)	5.74	Hydr. Depth (ft)			1.43
Conv. Total (cfs)	9272.6	Conv. (cfs)		5952.3	3320.3
Length Wtd. (ft)	1.42	Wetted Per. (ft)		64.95	123.91
Min Ch El (ft)	978.23	Shear (lb/sq ft)		1.57	1.30
Alpha	1.88	Stream Power (lb/ft s)		10.08	2.95
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		1.36	0.12
C & E Loss (ft)	0.06	Cum SA (acres)		0.88	0.13

Plan: Plan 02 River 1 Reach 1 RS: 281.07 Profile: PF 1

E.G. Elev (ft)	984.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	983.35	Reach Len. (ft)	99.76	99.76	99.76
Crit W.S. (ft)	983.35	Flow Area (sq ft)		111.40	104.19
E.G. Slope (ft/ft)	0.010983	Area (sq ft)		111.40	104.19
Q Total (cfs)	1120.00	Flow (cfs)		959.83	160.17
Top Width (ft)	135.77	Top Width (ft)		29.60	106.17
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)		8.62	1.54
Max Chl Dpth (ft)	5.12	Hydr. Depth (ft)		3.76	0.98
Conv. Total (cfs)	10686.9	Conv. (cfs)		9158.6	1528.3
Length Wtd. (ft)	99.76	Wetted Per. (ft)		33.83	106.24
Min Ch El (ft)	978.23	Shear (lb/sq ft)		2.26	0.67
Alpha	2.37	Stream Power (lb/ft s)		19.45	1.03
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)		1.36	0.12
C & E Loss (ft)	0.22	Cum SA (acres)		0.88	0.12

Plan: Plan 02 River 1 Reach 1 RS: 181.31 Profile: PF 1

E.G. Elev (ft)	979.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.040	
W.S. Elev (ft)	979.68	Reach Len. (ft)	102.79	102.79	102.79
Crit W.S. (ft)		Flow Area (sq ft)		284.56	
E.G. Slope (ft/ft)	0.005324	Area (sq ft)		284.56	
Q Total (cfs)	1160.00	Flow (cfs)		1160.00	
Top Width (ft)	150.94	Top Width (ft)		150.94	
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)		4.08	
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)		1.89	
Conv. Total (cfs)	15897.1	Conv. (cfs)		15897.1	
Length Wtd. (ft)	102.79	Wetted Per. (ft)		154.30	
Min Ch El (ft)	975.99	Shear (lb/sq ft)		0.61	
Alpha	1.00	Stream Power (lb/ft s)		2.50	
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)		0.90	
C & E Loss (ft)	0.03	Cum SA (acres)		0.68	

Plan: Plan 02 River 1 Reach 1 RS: 78.5 Profile: PF 1

E.G. Elev (ft)	978.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.040	
W.S. Elev (ft)	978.33	Reach Len. (ft)	78.52	78.52	78.52
Crit W.S. (ft)	978.33	Flow Area (sq ft)		189.68	
E.G. Slope (ft/ft)	0.022827	Area (sq ft)		189.68	
Q Total (cfs)	1160.00	Flow (cfs)		1160.00	
Top Width (ft)	165.31	Top Width (ft)		165.31	
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)		6.12	
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)		1.15	
Conv. Total (cfs)	7677.7	Conv. (cfs)		7677.7	
Length Wtd. (ft)	78.52	Wetted Per. (ft)		166.77	
Min Ch El (ft)	975.96	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		9.91	
Frctn Loss (ft)	1.82	Cum Volume (acre-ft)		0.34	
C & E Loss (ft)	0.00	Cum SA (acres)		0.30	

Plan: Plan 02 River 1 Reach 1 RS: 0 Profile: PF 1

E.G. Elev (ft)	976.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.040	
W.S. Elev (ft)	976.33	Reach Len. (ft)			
Crit W.S. (ft)	976.33	Flow Area (sq ft)		190.10	
E.G. Slope (ft/ft)	0.023638	Area (sq ft)		190.10	
Q Total (cfs)	1160.00	Flow (cfs)		1160.00	
Top Width (ft)	171.29	Top Width (ft)		171.29	
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)		6.10	
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)		1.11	
Conv. Total (cfs)	7544.9	Conv. (cfs)		7544.9	
Length Wtd. (ft)		Wetted Per. (ft)		172.13	
Min Ch El (ft)	973.99	Shear (lb/sq ft)		1.63	
Alpha	1.00	Stream Power (lb/ft s)		9.94	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Tools

Editors

River Reach

Storage Area

2D Flow Area

SA/2D Area Conn

SA/2D Area BC Lines

2D Area Break Lines

2D Area Manning Regions

Pump Station

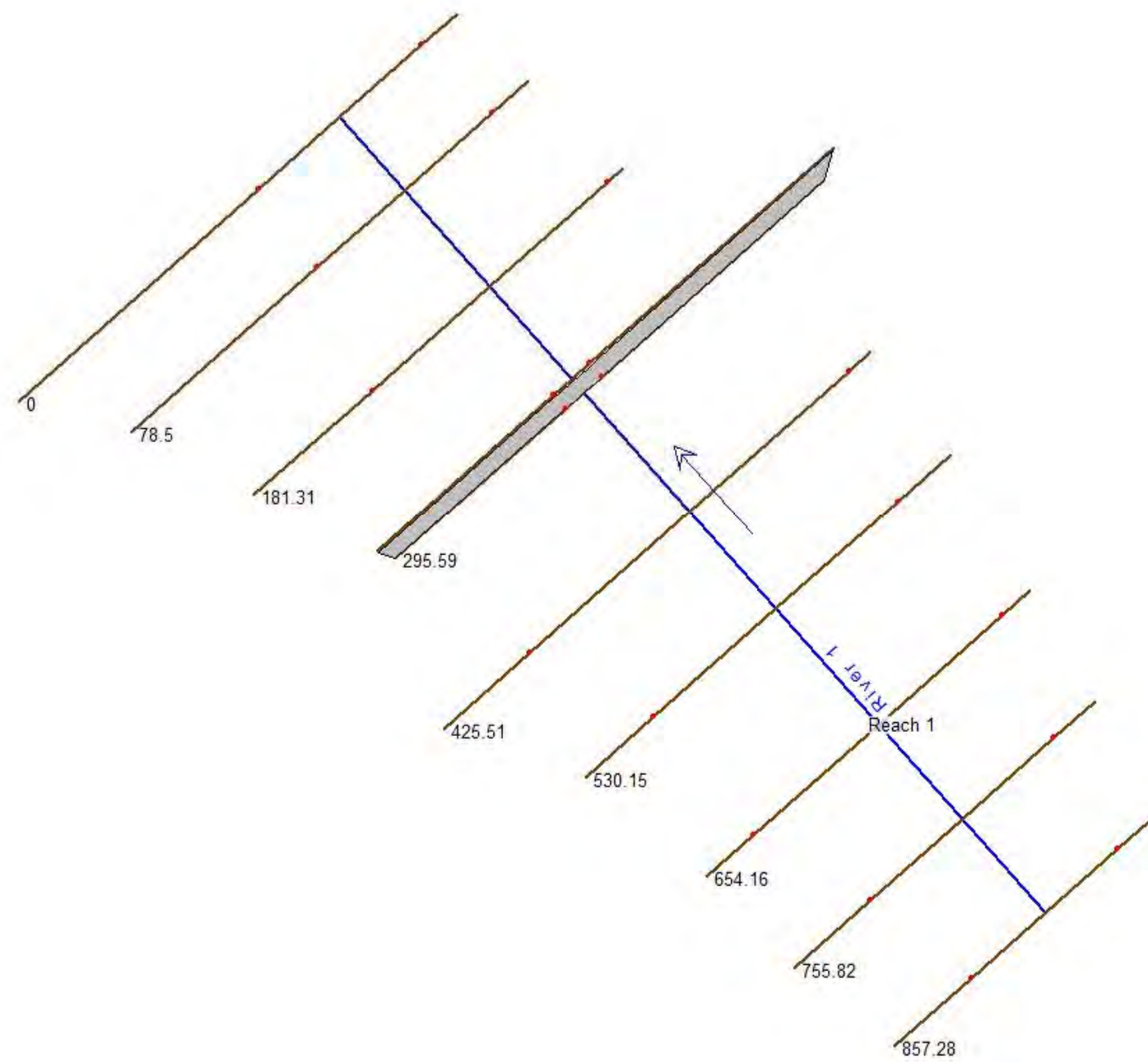
RS

Description

Plot WS extents for Profile:

(none)

- Junct.
- Cross Section
- Brdg/Culv
- Inline Structure
- Lateral Structure
- Storage Area
- 2D Flow Area
- SA/2D Area Conn
- Pump Station
- HTab Param.
- View Picture



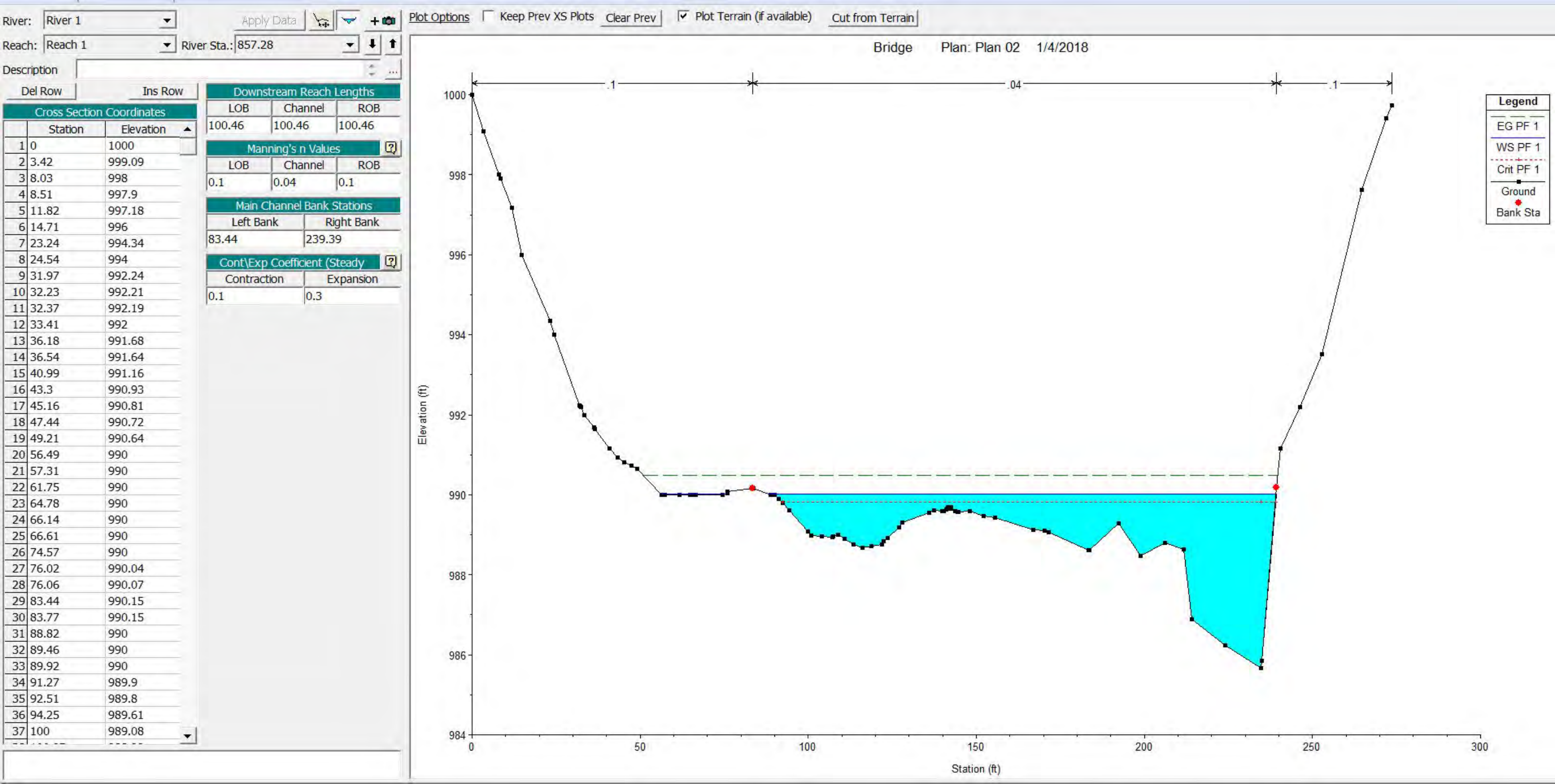
Apply Data

Add Multiple...

Add A Flow Change Location

Profile Names and Flow Rates

	River	Reach	RS	PF 1
1	River 1	Reach 1	857.28	1120
2	River 1	Reach 1	181.31	1160



River:	River 1	Apply Data			
Reach:	Reach 1	River Sta.:	755.82		
Description					

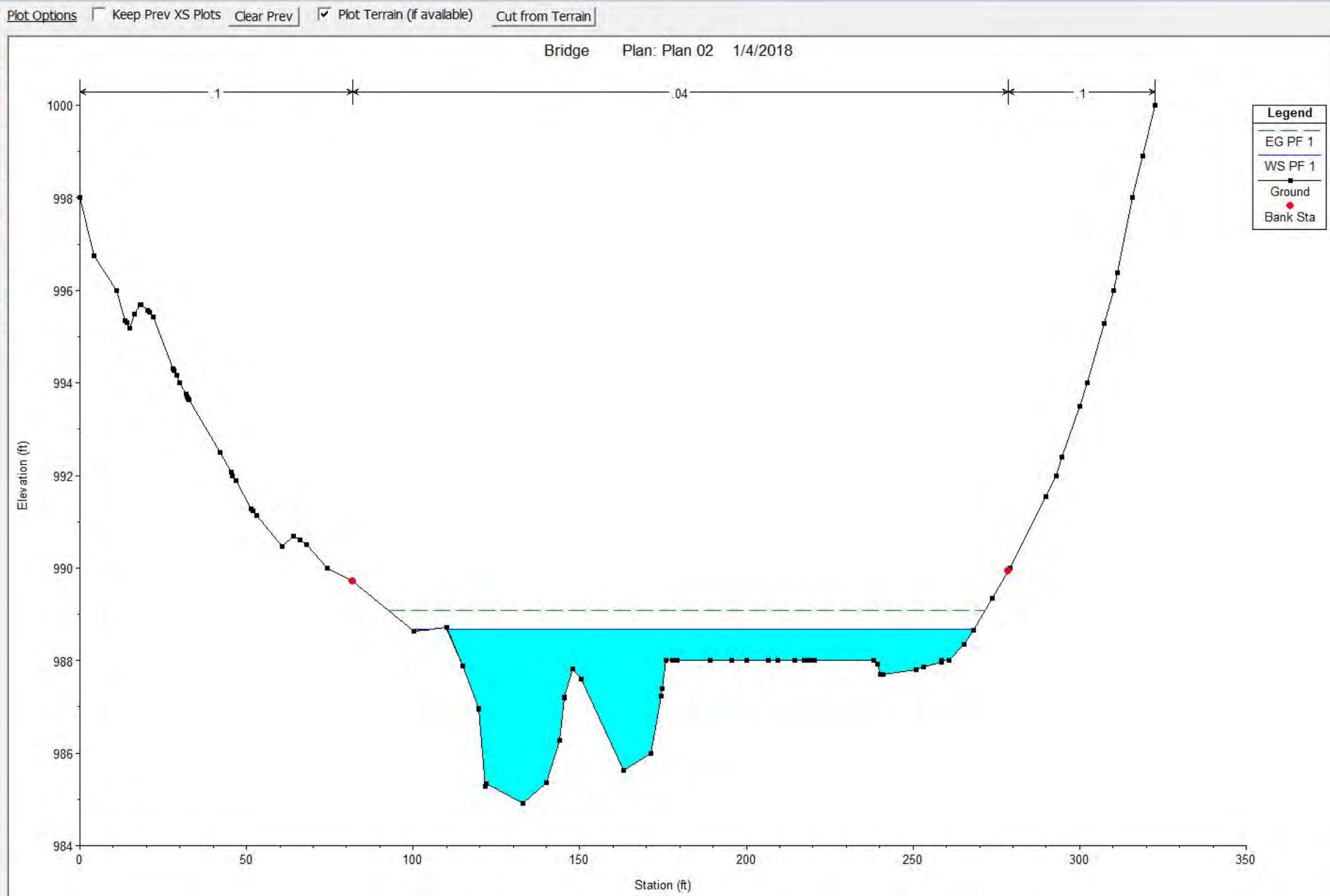
Del Row	Ins Row	Cross Section Coordinates
		Station Elevation ▲
1	0	998
2	4.23	996.75
3	11.1	996
4	13.62	995.34
5	14.01	995.31
6	14.86	995.18
7	16.42	995.49
8	18.19	995.68
9	18.22	995.68
10	18.27	995.68
11	18.34	995.68
12	20.41	995.56
13	20.78	995.53
14	21.93	995.43
15	27.94	994.31
16	28.15	994.27
17	29.1	994.17
18	30.06	994
19	31.77	993.75
20	32.09	993.7
21	32.38	993.66
22	32.63	993.63
23	42.02	992.49
24	45.33	992.07
25	45.84	992
26	46.8	991.88
27	51.5	991.28
28	51.93	991.23
29	52.99	991.13
30	60.79	990.47
31	64.08	990.68
32	65.94	990.6
33	68.04	990.51
34	74.28	990
35	74.33	990
36	81.9	989.72
37	100.14	988.64

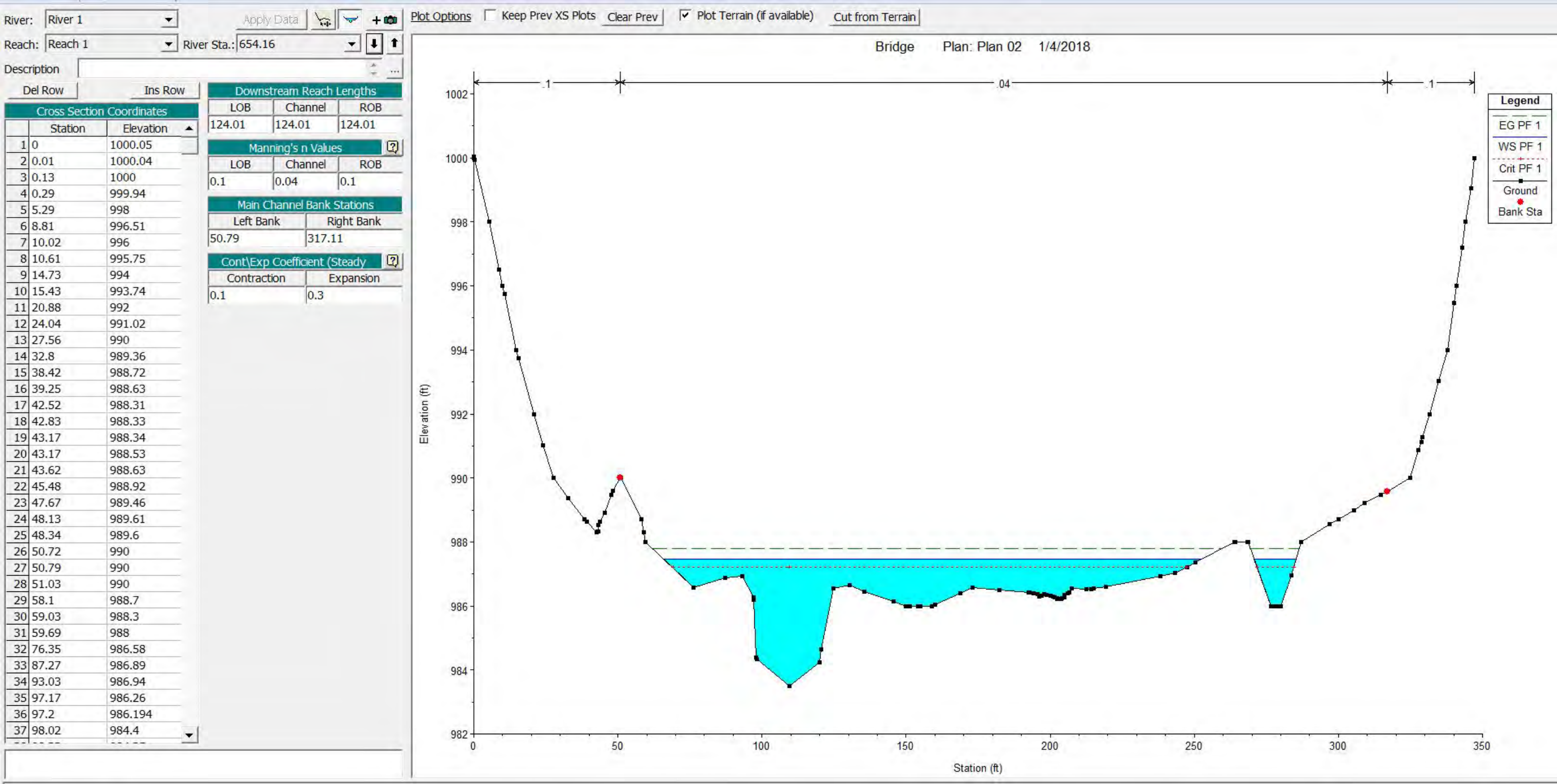
Downstream Reach Lengths		
LOB	Channel	ROB
101.66	101.66	101.66

Manning's n Values		
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations	
Left Bank	Right Bank
81.9	278.7

Cont\Exp Coefficient (Steady)	
Contraction	Expansion
0.1	0.3





Elevation (ft)

Station (ft)

Legend

EG PF 1

WS PF 1

Crit PF 1

Ground

Bank Sta

River: River 1

Apply Data

Plot Options

Keep Prev XS Plots

Clear Prev

Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 530.15

Description

Del Row

Ins Row

Cross Section Coordinates

	Station	Elevation
1	0	996.17
2	1.01	996
3	2.83	995.65
4	12.86	994
5	14.01	993.79
6	25.07	992
7	35.46	990.14
8	36.15	990
9	38.35	989.69
10	49.64	988
11	73.47	986.05
12	73.91	986.01
13	73.96	986.01
14	74.05	986
15	74.22	985.99
16	81.59	985.55
17	91.28	984.93
18	91.34	984.94
19	101.53	984.52
20	103.27	984.66
21	107.23	984.58
22	110.1	984.433
23	110.16	984.43
24	112.89	983.02
25	118.63	983.09
26	125.38	982.09
27	132.48	982.87
28	133.03	983.67
29	134.23	985.03
30	134.3	985.039
31	138.28	985.57
32	149.13	985.33
33	158.93	984.77
34	171.33	986
35	175.88	986
36	179.29	986
37	189.48	986

Downstream Reach Lengths

LOB	Channel	ROB
104.64	104.64	104.64

Manning's n Values

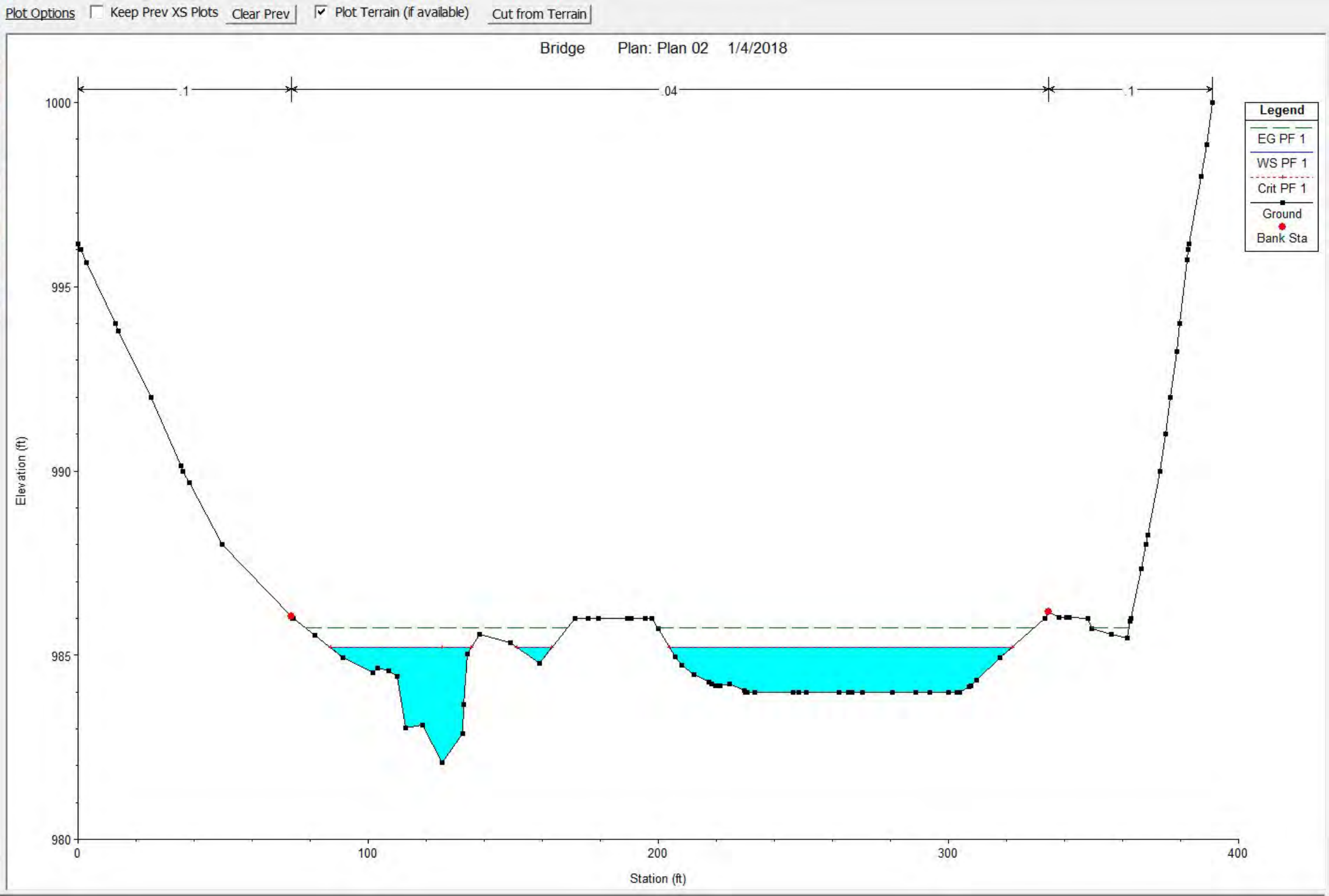
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
73.47	334.55

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



River: River 1

Apply Data

Plot Options

☐ Keep Prev XS Plots

Clear Prev

☒ Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 425.51

Description

Del Row

Ins Row

Cross Section Coordinates	
Station	Elevation
1 0	991.94
2 2.37	991.63
3 5.35	991.32
4 7.41	991.12
5 10.81	991.05
6 15.87	990.83
7 21.21	990.75
8 31.87	990.47
9 41.73	990
10 43.21	989.89
11 43.39	989.89
12 44.43	989.84
13 44.47	989.84
14 45.22	989.79
15 71.2	988
16 92.53	986.99
17 104.67	983.73
18 111.5	983.172
19 111.53	983.17
20 112.14	982.1
21 112.16	981.21
22 117.87	979.32
23 124.58	980.72
24 126.9	981.12
25 129.4	983.945
26 129.44	983.99
27 156.92	984.11
28 159.3	984.07
29 160.9	984.02
30 161.18	984
31 171.96	984
32 173.46	984
33 175.13	984
34 181.1	985.2
35 181.25	985.26
36 182.75	985.42
37 183.75	985.51

Downstream Reach Lengths

LOB	Channel	ROB
127.57	127.57	127.57

Manning's n Values

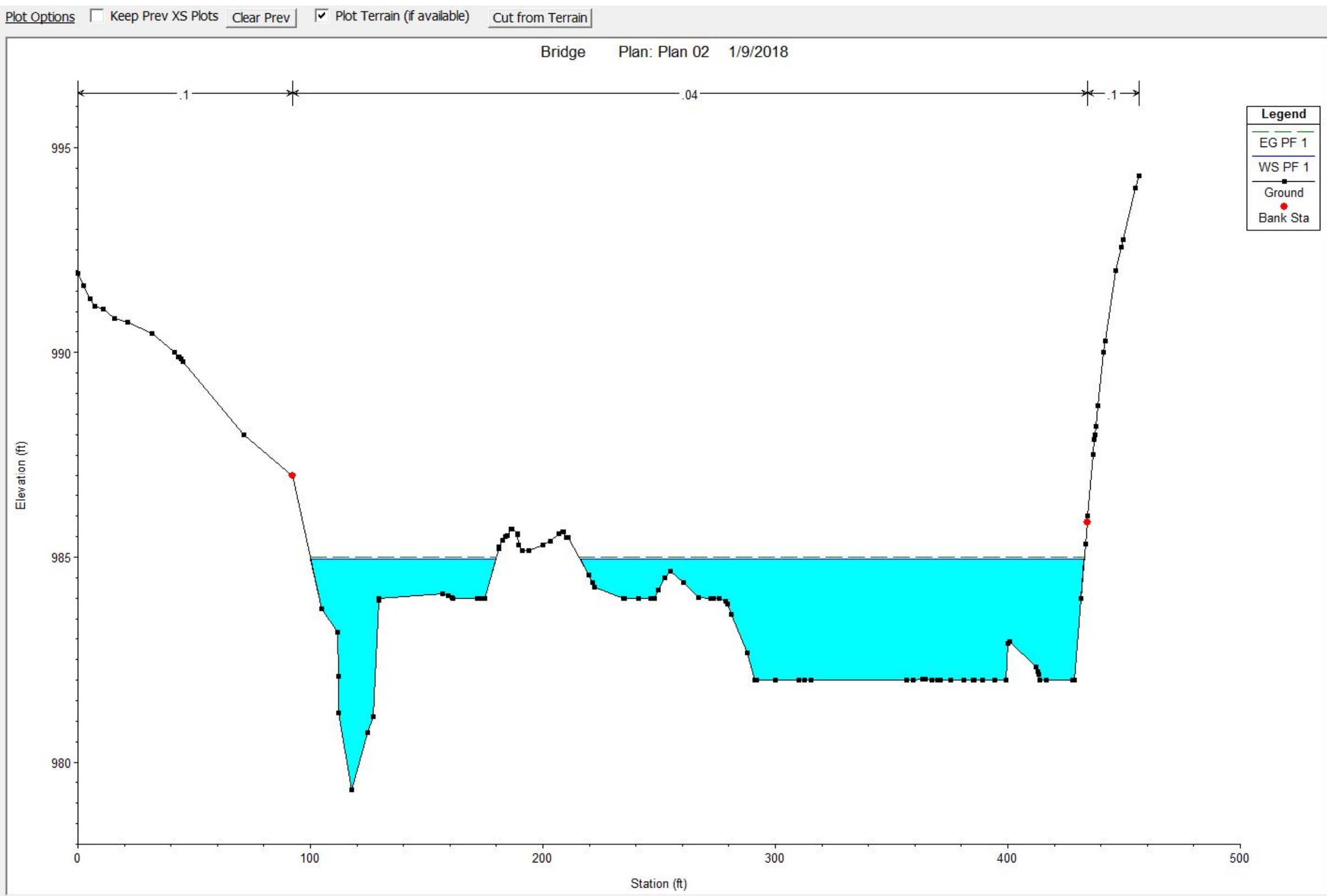
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
92.53	434.19

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



Select river for cross section editing

River: River 1

Apply Data

Reach: Reach 1

River Sta.: 295.59

Description

Del Row

Ins Row

Cross Section Coordinates

	Station	Elevation
1	0	990.109
2	22.8	988.842
3	58.61	986.991
4	93.44	985.552
5	126.28	985.05
6	153.09	985.962
7	182.53	985.89
8	184	985.52
9	189.71	979.297
10	199.43	978.423
11	208.6	978.247
12	218.2	984.759
13	221.5	984.93
14	251.5	985.19
15	288.82	982.968
16	324.43	982.436
17	368.03	982.957
18	397.69	983.799
19	425.05	984.656
20	429.27	984.802
21	443.1	986
22	448.91	987.786
23	457.04	990
24	460.26	990.687
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		

Downstream Reach Lengths

LOB	Channel	ROB
14.52	14.52	14.52

Manning's n Values

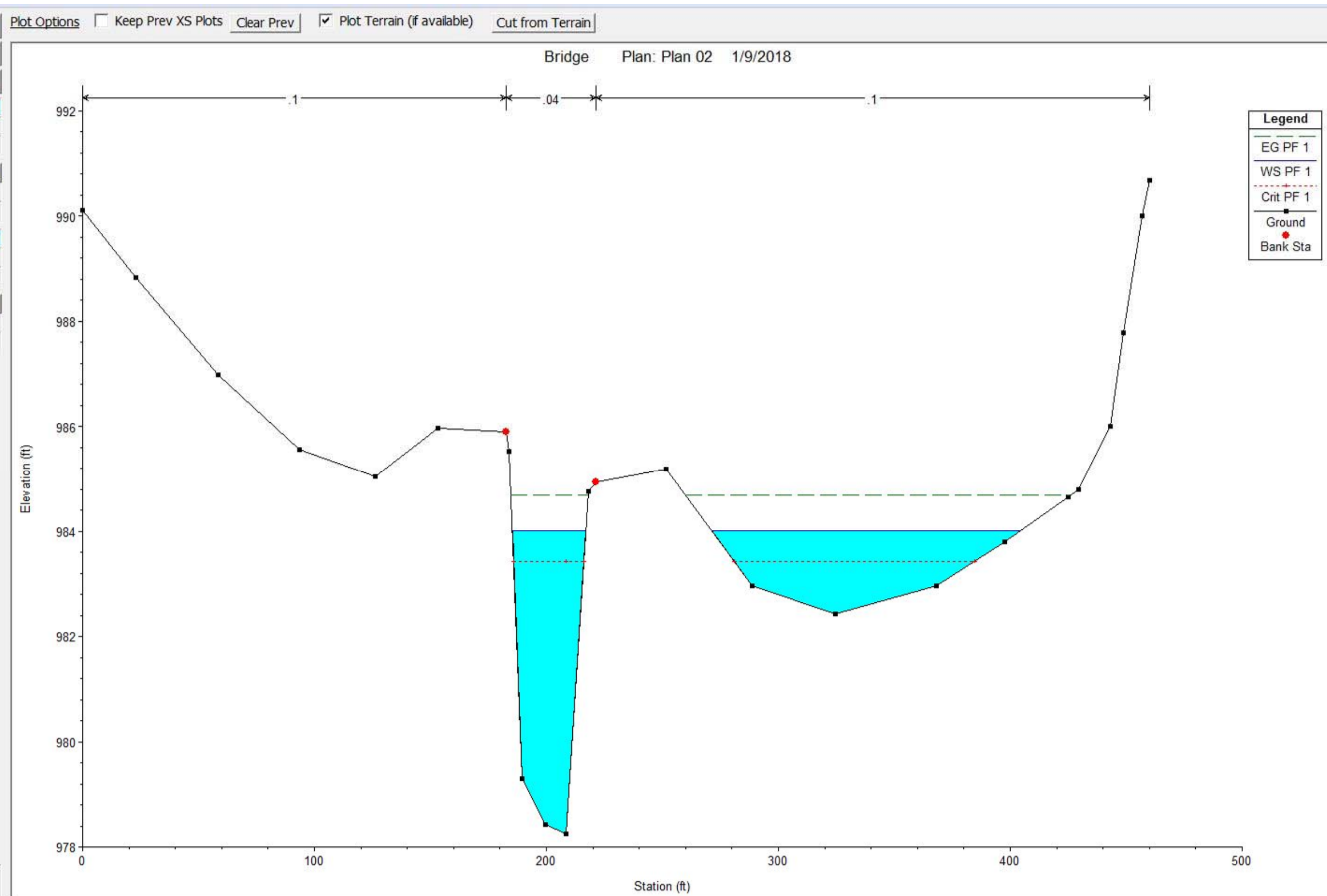
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
182.53	221.5

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



Enter to move to next downstream river station location

River: River 1

Apply Data

Reach: Reach 1

River Sta.: 281.07

Description

Del Row	Ins Row	Station	Elevation
		0	990.138
1		6.82	989.301
2		52.05	987.025
3		87.65	985.628
4		128.65	985.01
5		156.96	986.251
6		183.72	985.873
7		190.04	985.873
8		192	985.873
9		208.34	978.899
10		216.9	978.233
11		226.1	978.873
12		228	984.89
13		228.95	984.89
14		233.19	984.89
15		257.67	985.259
16		293.08	983.035
17		327.89	981.868
18		360.29	982.016
19		388.82	982.898
20		403.11	984.078
21		417.18	984.935
22		429.01	985.497
23		431.43	985.364
24		437.84	986
25		449.38	986.476
26		462.11	987.842
27		471.95	988.489
28		479	988.811
29		481.11	988.837
30		490.01	990.234
31		490.59	990.254
32			
33			
34			
35			
36			
37			

Downstream Reach Lengths

LOB	Channel	ROB
99.76	99.76	99.76

Manning's n Values

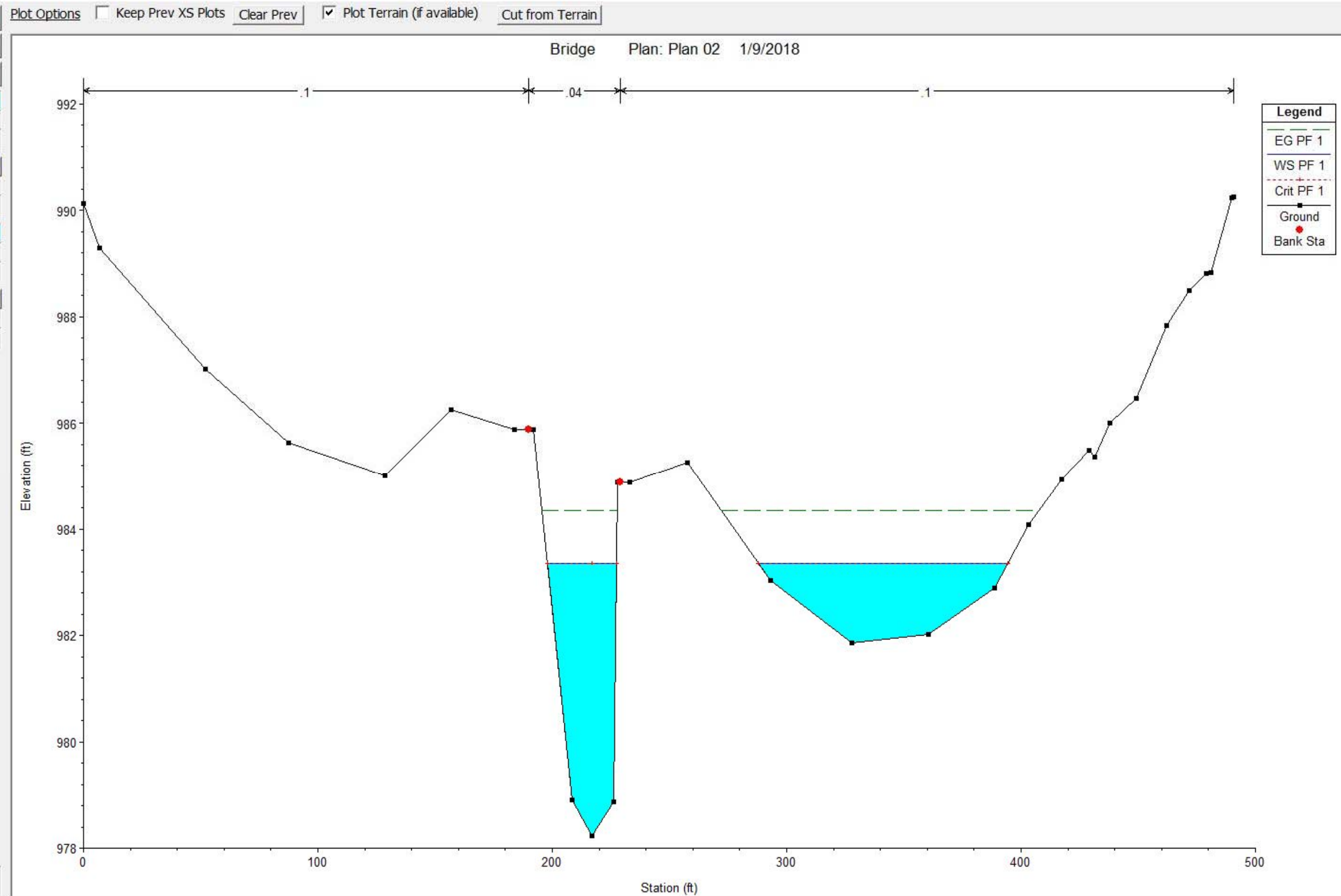
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
190.04	228.95

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



Enter to move to next downstream river station location

River: River 1

Apply Data



Plot Options

Keep Prev XS Plots

Clear Prev

☒ Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 181.31

Description

Del Row

Ins Row

Cross Section Coordinates

	Station	Elevation
1	0	990
2	18.54	988
3	34.39	986.62
4	40.61	986
5	44.38	985.62
6	60.01	984
7	71.44	983.15
8	90.49	982
9	117.94	980.72
10	127.87	980.36
11	132.59	980.19
12	133.9	980.15
13	145.38	980.02
14	147.57	980
15	155.66	979.89
16	159.11	979.64
17	170.14	979.56
18	182.11	979.95
19	185.38	979.85
20	185.4	979.826
21	187.69	977.07
22	194.65	976.66
23	200	976.994
24	201.69	977.1
25	202.1	978.789
26	202.11	978.83
27	206.76	979.54
28	215.86	980.31
29	226.26	980.04
30	238.72	980.42
31	249.52	980.31
32	256.78	980
33	268.99	979.58
34	273.61	979.37
35	281.62	979.04
36	289.67	978.58
37	300	978.039

Downstream Reach Lengths

LOB	Channel	ROB
102.79	102.79	102.79

Manning's n Values

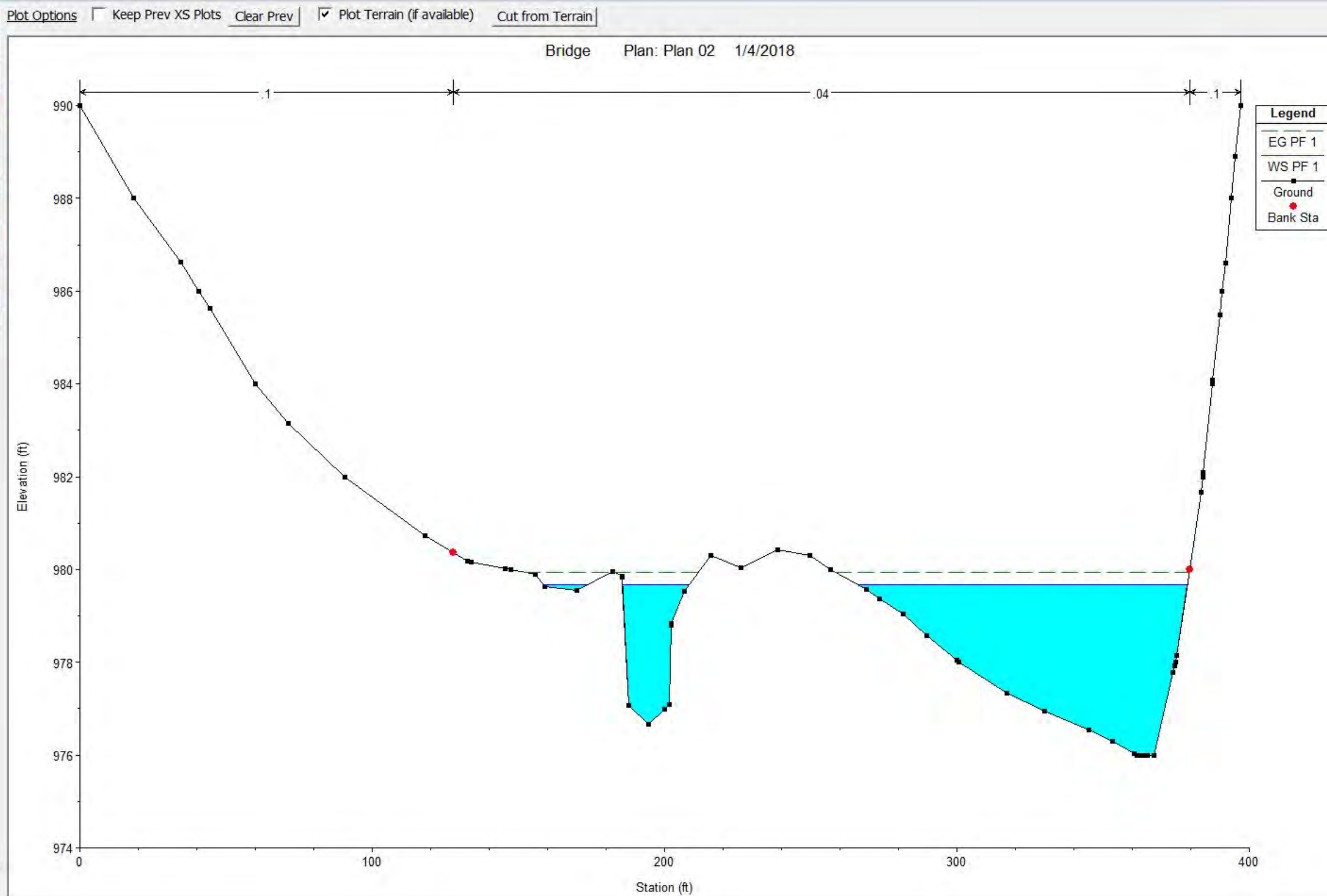
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
127.87	379.53

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



River: River 1 Apply Data Plot Options Keep Prev XS Plots Clear Prev Plot Terrain (if available) Cut from Terrain

Reach: Reach 1 River Sta.: 78.5

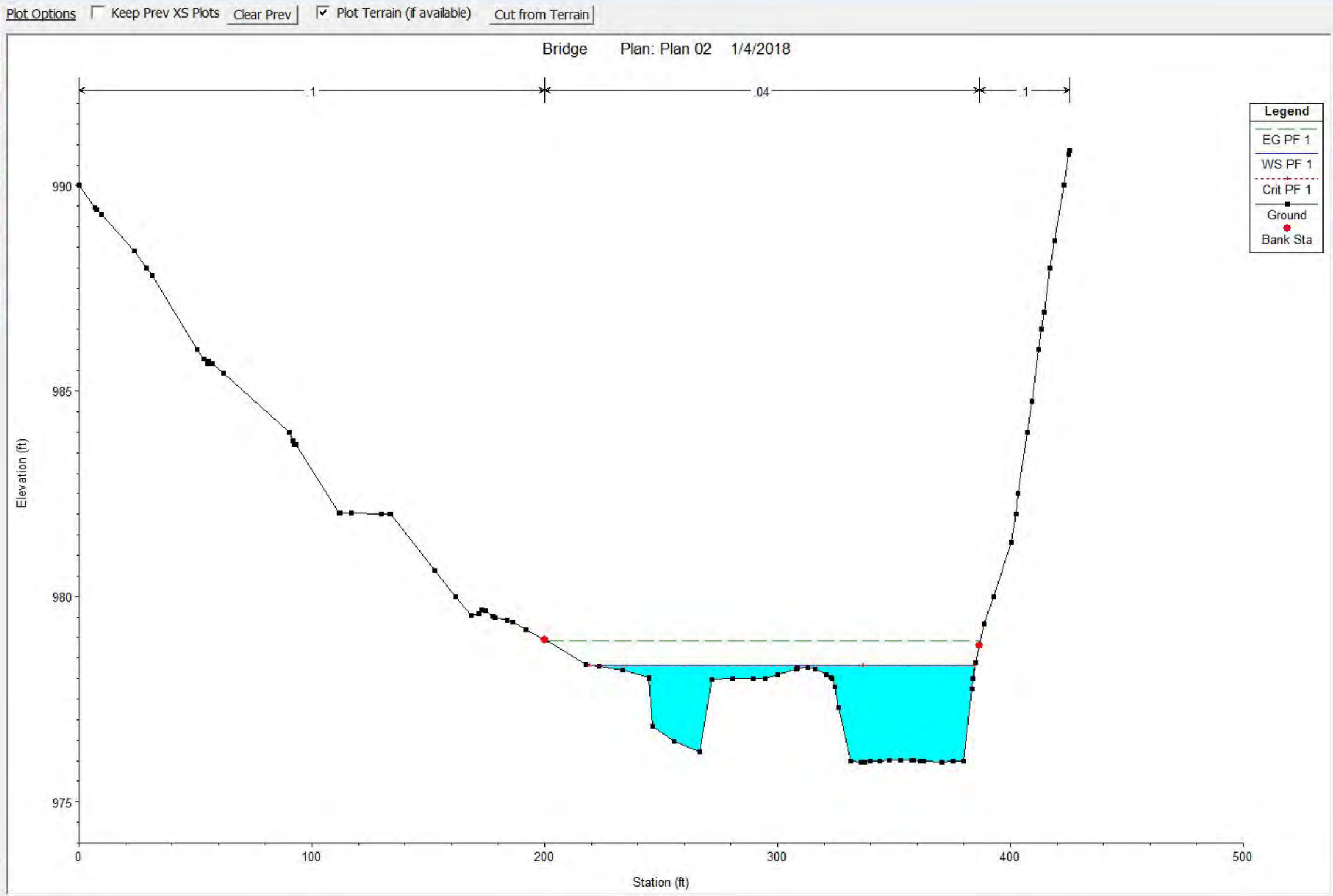
Description	
Del Row	Ins Row
Cross Section Coordinates	
Station	Elevation
1 0	990
2 6.89	989.46
3 7.54	989.42
4 9.84	989.29
5 23.68	988.42
6 29.23	988
7 31.39	987.81
8 50.63	986
9 53.53	985.79
10 55.12	985.66
11 55.52	985.71
12 55.84	985.73
13 57.29	985.67
14 62.13	985.43
15 90.26	984
16 91.95	983.78
17 92.52	983.7
18 93.24	983.7
19 111.74	982.02
20 111.92	982.02
21 112.14	982.02
22 117.02	982.02
23 129.85	982.01
24 133.66	982
25 134.03	982
26 152.75	980.63
27 161.83	980
28 168.47	979.53
29 171.6	979.58
30 173.16	979.67
31 174.41	979.66
32 177.79	979.51
33 178.61	979.5
34 183.82	979.43
35 186.1	979.38
36 191.91	979.2
37 200	978.947

Downstream Reach Lengths		
LOB	Channel	ROB
78.52	78.52	78.52

Manning's n Values		
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations	
Left Bank	Right Bank
200	386.75

Cont\Exp Coefficient (Steady)	
Contraction	Expansion
0.1	0.3



River: River 1

Apply Data

Reach: Reach 1

River Sta.: 0

Description

Del Row

Ins Row

Cross Section Coordinates	
Station	Elevation
1 0	990
2 27.05	988.12
3 29.07	988
4 37.51	987.24
5 41.61	986.85
6 54.08	986.13
7 57.1	986
8 76.13	985.22
9 91.52	984.06
10 92.01	984
11 92.58	983.94
12 96.78	983.57
13 99.78	983.39
14 102.72	983.13
15 108.23	982
16 121.13	980.57
17 124.51	980
18 131.31	979
19 139.7	978
20 146.51	978
21 147.95	978
22 148.56	978
23 150.87	978
24 153.1	978
25 153.23	978
26 153.53	978
27 157.54	978.01
28 160.78	978.01
29 164.18	978.01
30 169.96	978.01
31 170.49	978.01
32 171.73	978.01
33 175.76	978.01
34 179.72	978.01
35 181.89	978.01
36 182.74	978.01
37 184.09	978.01

Downstream Reach Lengths

LOB	Channel	ROB
0	0	0

Manning's n Values

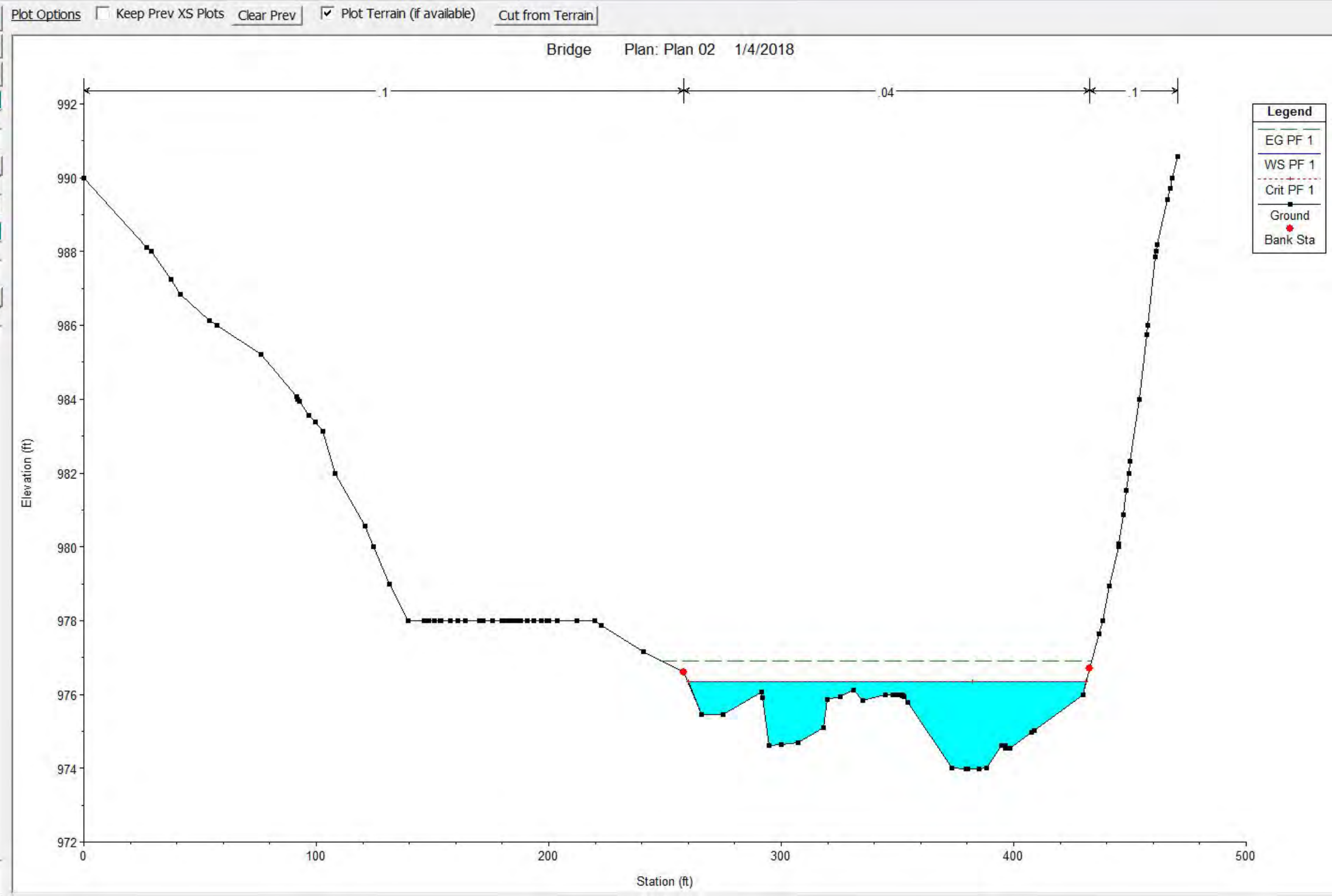
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
258	432.79

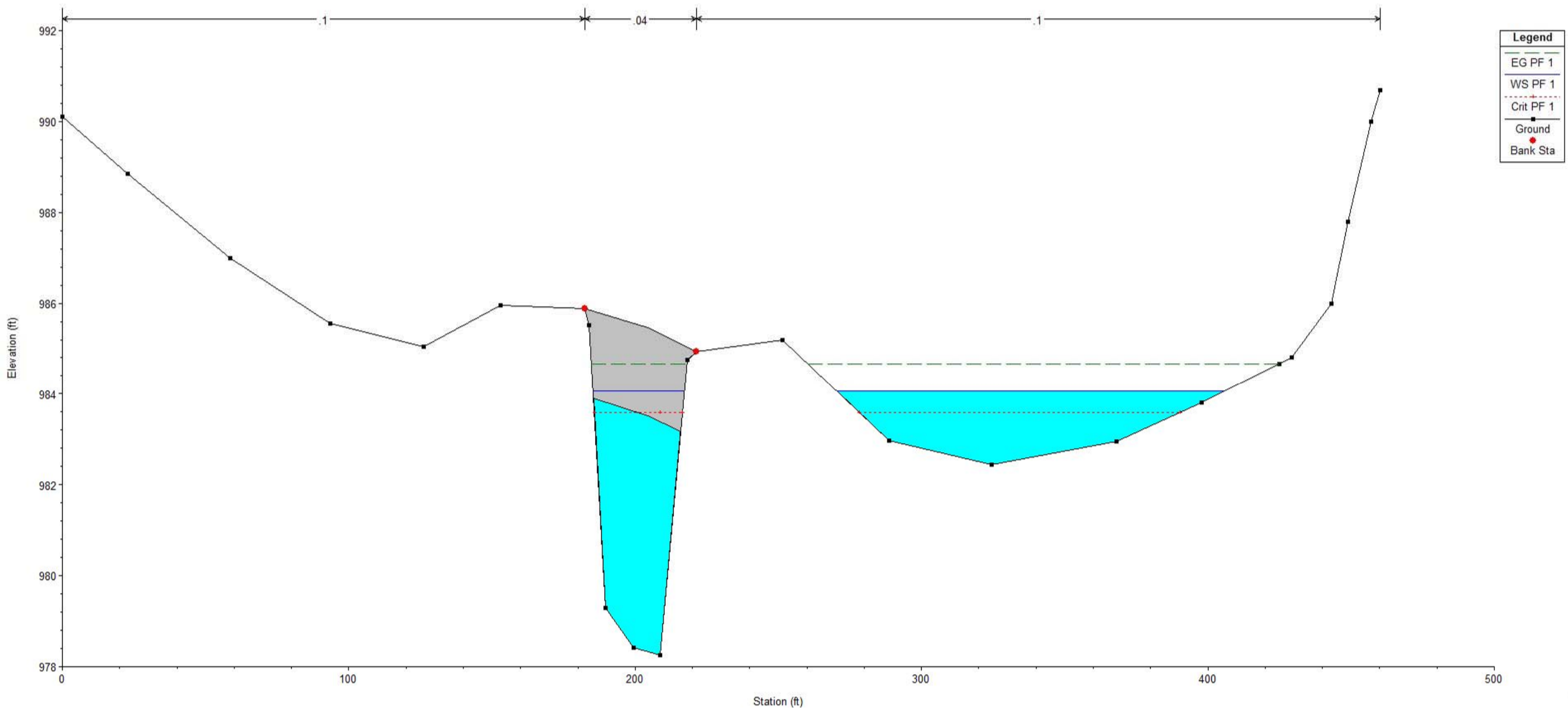
Cont\Exp Coefficient (Steady

Contraction	Expansion
0.1	0.3



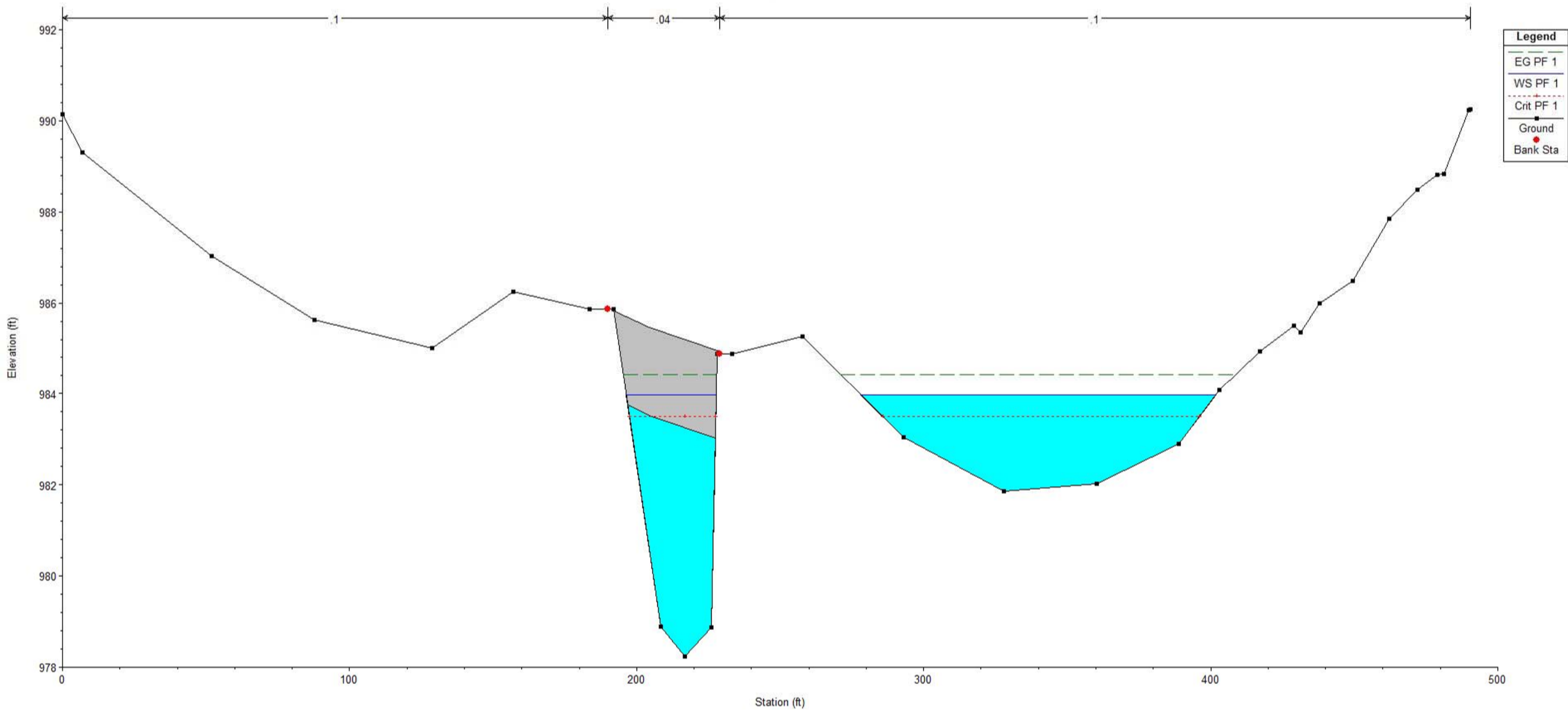
Existing Bridge Upstream

Bridge Plan: Plan 02 1/9/2018



Existing Bridge Downstream

Bridge Plan: Plan 02 1/9/2018



C-2 HEC-RAS PROPOSED CONDITIONS MODEL DATA

Bridge.rep

HEC-RAS HEC-RAS 5.0.3 September 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```

X      X  XXXXXX      XXXX      XXXX      XX      XXXX
X      X  X          X      X      X      X      X
X      X  X          X          X      X      X
XXXXXXXX XXXX      XXX XXXX      XXXXXX      XXXX
X      X  X          X          X      X          X
X      X  X          X      X      X      X      X
X      X  XXXXXX      XXXX      X      X      XXXXX

```

PROJECT DATA

Project Title: Bridge
Project File : Bridge.prj
Run Date and Time: 1/9/2018 5:17:19 PM

Project in English units

Project Description:
Perry County Bridge

PLAN DATA

Plan Title: Plan 02
Plan File : C:\Users\ej.regula\Desktop\Bridge\Proposed\Bridge.p02

Geometry Title: UPDATED
Geometry File : C:\Users\ej.regula\Desktop\Bridge\Proposed\Bridge.g02

Flow Title : FLOW
Flow File : C:\Users\ej.regula\Desktop\Bridge\Proposed\Bridge.f01

Plan Summary Information:

Number of: Cross Sections	=	10	Multiple Openings	=	0
Culverts	=	0	Inline Structures	=	0
Bridges	=	1	Lateral Structures	=	0

Computational Information

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

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Bridge.rep

FLOW DATA

Flow Title: FLOW

Flow File : C:\Users\ej.regula\Desktop\Bridge\Proposed\Bridge.f01

Flow Data (cfs)

River	Reach	RS	PF 1
River 1	Reach 1	857.28	1120
River 1	Reach 1	181.31	1160

Boundary Conditions

River	Reach	Profile	Upstream
Downstream			
River 1	Reach 1	PF 1	Critical
Critical			

GEOMETRY DATA

Geometry Title: UPDATED

Geometry File : C:\Users\ej.regula\Desktop\Bridge\Proposed\Bridge.g02

CROSS SECTION

RIVER: River 1

REACH: Reach 1 RS: 857.28

INPUT

Description:

Station	Elevation	Data	num=	88						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	1000	3.42	999.09	8.03	998	8.51	997.9	11.82	997.18	
14.71	996	23.24	994.34	24.54	994	31.97	992.24	32.23	992.21	
32.37	992.19	33.41	992	36.18	991.68	36.54	991.64	40.99	991.16	
43.3	990.93	45.16	990.81	47.44	990.72	49.21	990.64	56.49	990	
57.31	990	61.75	990	64.78	990	66.14	990	66.61	990	
74.57	990	76.02	990.04	76.06	990.07	83.44	990.15	83.77	990.15	
88.82	990	89.46	990	89.92	990	91.27	989.9	92.51	989.8	
94.25	989.61	100	989.08	100.97	988.99	104.14	988.96	107.14	988.94	
107.35	988.97	108.9	989	110.88	988.9	113.36	988.75	116.17	988.67	
118.9	988.71	121.97	988.76	122.31	988.83	123.74	988.92	126.98	989.19	
128	989.3	135.89	989.56	135.92	989.56	137.36	989.61	139.86	989.6	
140.37	989.6	141.06	989.63	141.3	989.65	141.57	989.7	142.22	989.7	
142.44	989.69	142.52	989.65	143.64	989.6	144.36	989.58	144.71	989.58	
148.18	989.59	152.11	989.47	155.48	989.42	166.85	989.13	170.28	989.1	
171.45	989.07	183.29	988.62	183.56	988.61	192.32	989.28	198.97	988.47	
206.02	988.79	211.7	988.64	214.01	986.89	224.12	986.23	234.74	985.66	
234.95	985.85	239.39	990.176	240.4	991.16	246.41	992.19	252.86	993.52	
264.59	997.63	271.88	999.42	273.63	999.73					

Manning's	n Values		num=	3	
Sta	n Val	Sta	n Val	Sta	n Val

Page 2

Bridge.rep

0	.1	83.44	.04	239.39	.1		
---	----	-------	-----	--------	----	--	--

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

83.44 239.39 100.46 100.46 100.46 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	990.49	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.46	Wt. n-Val.	0.100	0.040
W.S. Elev (ft)	990.03	Reach Len. (ft)	100.46	100.46
100.46				
Crit W.S. (ft)	989.81	Flow Area (sq ft)	0.48	205.35
E.G. Slope (ft/ft)	0.014672	Area (sq ft)	0.48	205.35
Q Total (cfs)	1120.00	Flow (cfs)	0.07	1119.93
Top Width (ft)	170.60	Top Width (ft)	19.31	151.28
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	0.15	5.45
Max Chl Dpth (ft)	4.37	Hydr. Depth (ft)	0.02	1.36
Conv. Total (cfs)	9246.3	Conv. (cfs)	0.6	9245.7
Length Wtd. (ft)	100.46	Wetted Per. (ft)	19.31	153.89
Min Ch El (ft)	985.66	Shear (lb/sq ft)	0.02	1.22
Alpha	1.00	Stream Power (lb/ft s)	0.00	6.67
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	0.00	5.09
0.36				
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	3.27
0.36				

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1 RS: 755.82

INPUT

Description:

Station Elevation Data		num=	92						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	998	4.23	996.75	11.1	996	13.62	995.34	14.01	995.31
14.86	995.18	16.42	995.49	18.19	995.68	18.22	995.68	18.27	995.68
18.34	995.68	20.41	995.56	20.78	995.53	21.93	995.43	27.94	994.31
28.15	994.27	29.1	994.17	30.06	994	31.77	993.75	32.09	993.7
32.38	993.66	32.63	993.63	42.02	992.49	45.33	992.07	45.84	992
46.8	991.88	51.5	991.28	51.93	991.23	52.99	991.13	60.79	990.47
64.08	990.68	65.94	990.6	68.04	990.51	74.28	990	74.33	990

Bridge.rep									
81.9	989.72	100.14	988.64	109.94	988.71	114.83	987.88	119.7	986.96
119.75	986.95	121.69	985.28	121.84	985.34	132.97	984.92	139.91	985.36
144.09	986.28	145.4	987.182	145.44	987.21	147.79	987.83	150.47	987.59
163.13	985.62	171.21	986	174.53	987.24	174.77	987.39	175.78	988
177.79	988	179.19	988	189.15	988	195.52	988	200	988
206.56	988	209.49	988	214.45	988	217.46	988	218.12	988
219.63	988	220.37	988	238.35	988	239.39	987.92	240.27	987.71
241.04	987.7	250.94	987.81	253.09	987.87	258.53	987.97	258.58	988
260.82	988	265.43	988.36	268.14	988.65	273.74	989.34	278.7	989.942
279.18	990	289.83	991.54	292.91	992	294.8	992.4	300	993.492
302.42	994	307.4	995.29	310.16	996	311.27	996.39	315.9	998
319.01	998.91	322.55	1000						

Manning's n Values		num= 3	
Sta	n Val	Sta	n Val
0	.1	81.9	.04
		278.7	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	81.9	278.7		101.66	101.66		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	989.09	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.40	Wt. n-Val.		0.040
W.S. Elev (ft)	988.69	Reach Len. (ft)	101.66	101.66
101.66				
Crit W.S. (ft)		Flow Area (sq ft)		220.51
E.G. Slope (ft/ft)	0.012955	Area (sq ft)		220.51
Q Total (cfs)	1120.00	Flow (cfs)		1120.00
Top Width (ft)	165.53	Top Width (ft)		165.53
Vel Total (ft/s)	5.08	Avg. Vel. (ft/s)		5.08
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)		1.33
Conv. Total (cfs)	9840.0	Conv. (cfs)		9840.0
Length Wtd. (ft)	101.66	Wetted Per. (ft)		167.49
Min Ch El (ft)	984.92	Shear (lb/sq ft)		1.06
Alpha	1.00	Stream Power (lb/ft s)		5.41
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)		4.60
0.36				
C & E Loss (ft)	0.02	Cum SA (acres)		2.90
0.36				

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

Bridge.rep

RIVER: River 1
REACH: Reach 1

RS: 654.16

INPUT

Description:

Station Elevation Data		num=		117					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1000.05	.01	1000.04	.13	1000	.29	999.94	5.29	998
8.81	996.51	10.02	996	10.61	995.75	14.73	994	15.43	993.74
20.88	992	24.04	991.02	27.56	990	32.8	989.36	38.42	988.72
39.25	988.63	42.52	988.31	42.83	988.33	43.17	988.34	43.17	988.53
43.62	988.63	45.48	988.92	47.67	989.46	48.13	989.61	48.34	989.6
50.72	990	50.79	990	51.03	990	58.1	988.7	59.03	988.3
59.69	988	76.35	986.58	87.27	986.89	93.03	986.94	97.17	986.26
97.2	986.194	98.02	984.4	98.33	984.35	109.38	983.5	119.99	984.24
120.5	984.64	124.69	986.56	124.7	986.56	130.35	986.65	135.58	986.44
145.69	986.14	149.98	986	151.43	986	154.15	986	154.96	986
158.84	986	160.14	986.05	168.84	986.4	172.99	986.57	182.27	986.51
192.51	986.43	192.89	986.41	194.28	986.39	195.72	986.38	196.13	986.29
196.94	986.32	197.95	986.36	198.84	986.34	200	986.319	201.09	986.3
201.64	986.28	202.24	986.24	202.35	986.21	202.45	986.21	203.78	986.23
204.08	986.24	204.84	986.26	204.9	986.29	205	986.34	205.93	986.39
206.6	986.42	207.42	986.56	212.63	986.53	214.31	986.53	215.2	986.54
219.22	986.6	238.19	986.92	243.44	987.03	247.48	987.21	250.33	987.36
264.04	988	264.28	988	268.54	988	268.55	988	268.57	987.99
276.67	986	277.22	986	277.86	986	278.64	986	279.07	986
280.11	986	283.8	986.96	287.06	988	296.87	988.55	300	988.713
305.3	988.99	309.04	989.22	314.58	989.48	317.11	989.58	324.74	990
327.79	990.88	328.72	991.13	329.2	991.27	331.62	992	334.82	993.04
337.74	994	340.1	995.47	341.06	996	342.85	997.2	344.17	998
345.94	999.06	347.24	1000						

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	50.79	.04	317.11	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	50.79	317.11		124.01	124.01		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	987.79	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.33	Wt. n-Val.		0.040
W.S. Elev (ft)	987.46	Reach Len. (ft)	124.01	124.01
124.01				
Crit W.S. (ft)	987.20	Flow Area (sq ft)		243.46
E.G. Slope (ft/ft)	0.012084	Area (sq ft)		243.46
Q Total (cfs)	1120.00	Flow (cfs)		1120.00
Top Width (ft)	201.23	Top Width (ft)		201.23
Vel Total (ft/s)	4.60	Avg. Vel. (ft/s)		4.60
Max Chl Dpth (ft)	3.96	Hydr. Depth (ft)		1.21
Conv. Total (cfs)	10188.5	Conv. (cfs)		10188.5

Length Wtd. (ft)	124.01	Bridge.rep	
Min Ch El (ft)	983.50	Wetted Per. (ft)	203.61
Alpha	1.00	Shear (lb/sq ft)	0.90
Frctn Loss (ft)	2.03	Stream Power (lb/ft s)	4.15
0.36		Cum Volume (acre-ft)	4.06
C & E Loss (ft)	0.02	Cum SA (acres)	2.47
0.36			

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1 RS: 530.15

INPUT

Description:

Station	Elevation	Data	num=	97						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta
0	996.17	1.01	996	2.83	995.65	12.86	994	14.01	993.79	
25.07	992	35.46	990.14	36.15	990	38.35	989.69	49.64	988	
73.47	986.05	73.91	986.01	73.96	986.01	74.05	986	74.22	985.99	
81.59	985.55	91.28	984.93	91.34	984.94	101.53	984.52	103.27	984.66	
107.23	984.58	110.1	984.433	110.16	984.43	112.89	983.02	118.63	983.09	
125.38	982.09	132.48	982.87	133.03	983.67	134.23	985.03	134.3	985.039	
138.28	985.57	149.13	985.33	158.93	984.77	171.33	986	175.88	986	
179.29	986	189.48	986	190.55	986	195.48	986	197.72	986	
200	985.707	205.82	984.96	208.12	984.72	212.3	984.46	217.43	984.26	
218.46	984.21	219.76	984.18	221.23	984.16	224.45	984.23	229.6	984.03	
230.03	984	230.5	984	233.1	984	246.35	983.99	248.36	983.99	
251.07	983.99	262.38	984	265.36	984	266.83	984	270.2	984	
280.65	984	288.87	984	293.52	984	300	984	302.9	984	
303.55	984	304.03	984	307	984.15	307.59	984.18	309.57	984.33	
317.76	984.92	333.2	986	334.55	986.17	338.14	986.02	340.71	986.03	
341.31	986.03	341.59	986.03	348.15	986	349.24	985.73	356.02	985.57	
361.76	985.47	362.7	985.91	363.01	986	366.39	987.34	368.06	988	
368.72	988.26	372.86	990	374.73	991.01	376.56	992	378.58	993.24	
379.65	994	382.23	995.72	382.69	996	383.05	996.16	387.16	998	
389.18	998.85	390.98	1000							

Manning's n	Values	num=	3
Sta	n Val	Sta	n Val
0	.1	73.47	.04
		334.55	.1

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	73.47	334.55		104.64	104.64	104.64		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	985.74	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.54	Wt. n-Val.		0.040

W.S. Elev (ft)	985.20	Bridge.rep	
104.64		Reach Len. (ft)	104.64 104.64
Crit W.S. (ft)	985.20	Flow Area (sq ft)	190.07
E.G. Slope (ft/ft)	0.023377	Area (sq ft)	190.07
Q Total (cfs)	1120.00	Flow (cfs)	1120.00
Top Width (ft)	178.22	Top Width (ft)	178.22
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)	5.89
Max Chl Dpth (ft)	3.11	Hydr. Depth (ft)	1.07
Conv. Total (cfs)	7325.3	Conv. (cfs)	7325.3
Length Wtd. (ft)	104.64	Wetted Per. (ft)	179.88
Min Ch El (ft)	982.09	Shear (lb/sq ft)	1.54
Alpha	1.00	Stream Power (lb/ft s)	9.09
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)	3.44
0.36			
C & E Loss (ft)	0.15	Cum SA (acres)	1.93
0.36			

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical

depth for the water surface and continued on with the calculations.

Warning: Divided flow computed for this cross-section.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than

1.4. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: River 1

REACH: Reach 1

RS: 425.51

INPUT

Description:

Station	Elevation	Data	num=	127						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	
0	991.94	2.37	991.63	5.35	991.32	7.41	991.12	10.81	991.05	
15.87	990.83	21.21	990.75	31.87	990.47	41.73	990	43.21	989.89	
43.39	989.89	44.43	989.84	44.47	989.84	45.22	989.79	71.2	988	
92.53	986.99	104.67	983.73	111.5	983.172	111.53	983.17	112.14	982.1	
112.16	981.21	117.87	979.32	124.58	980.72	126.9	981.12	129.4	983.945	
129.44	983.99	156.92	984.11	159.3	984.07	160.9	984.02	161.18	984	
171.96	984	173.46	984	175.13	984	181.1	985.2	181.25	985.26	
182.75	985.42	183.75	985.51	184.62	985.53	186.3	985.68	186.37	985.68	
186.43	985.68	186.47	985.68	186.63	985.68	188.92	985.58	189.27	985.54	
189.58	985.3	190.94	985.17	193.96	985.15	200	985.307	203.22	985.39	
206.97	985.57	208.36	985.62	208.68	985.61	210.18	985.49	210.93	985.47	

Bridge.rep									
219.6	984.57	221.5	984.38	222.29	984.26	234.62	984	234.71	984
235.12	984	241.07	984	246.52	984	247.49	984	248.15	984
249.42	984.19	252.57	984.49	254.88	984.66	260.53	984.37	267.03	984.01
272.15	984	272.36	984	272.85	984	273.23	984	275.63	984
278.73	983.93	279.39	983.86	281.1	983.61	287.71	982.66	291.05	982
291.81	982	300	982	309.9	982	312.4	982	315.43	982
356.34	982	359.33	982	363.21	982.02	364.62	982.02	367.39	982.01
369.63	982	370.28	982	370.98	982	375.35	982	380.96	982.01
385.12	982.01	385.58	982.01	389.01	982	394.38	982	399.02	982
400.14	982.9	400.89	982.93	411.98	982.33	413.07	982.2	413.44	982.13
413.58	982	416.4	982	427.66	982	428.56	982	428.57	982
428.58	982.01	431.39	984	433.44	985.32	434.19	985.84	434.42	986
436.66	987.52	437.2	987.87	437.42	988	437.84	988.21	438.86	988.71
441.16	990	441.85	990.29	446.43	992	448.67	992.56	449.69	992.75
454.77	994	456.6	994.3						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	92.53	.04	434.19	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	92.53	434.19		127.57	127.57		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	985.00	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.05	Wt. n-Val.		0.040
W.S. Elev (ft)	984.95	Reach Len. (ft)	127.57	127.57
127.57		Flow Area (sq ft)		606.86
Crit W.S. (ft)		Area (sq ft)		606.86
E.G. Slope (ft/ft)	0.000972	Flow (cfs)		1120.00
Q Total (cfs)	1120.00	Top Width (ft)		296.58
Top Width (ft)	296.58	Avg. Vel. (ft/s)		1.85
Vel Total (ft/s)	1.85	Hydr. Depth (ft)		2.05
Max Chl Dpth (ft)	5.63	Conv. (cfs)		35923.0
Conv. Total (cfs)	35923.0	Wetted Per. (ft)		301.69
Length Wtd. (ft)	127.57	Shear (lb/sq ft)		0.12
Min Ch El (ft)	979.32	Stream Power (lb/ft s)		0.23
Alpha	1.00	Cum Volume (acre-ft)		2.48
Frctn Loss (ft)	0.25	Cum SA (acres)		1.36
0.36				
C & E Loss (ft)	0.06			
0.36				

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Bridge.rep

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1

RS: 295.59

INPUT

Description:

Station Elevation Data		num= 26		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.109	22.8	988.842	58.61	986.991	93.44	985.552	126.28	985.05		
153.09	985.962	176.03	987.233	182.53	987.347	184	985.52	189.71	979.297		
199.43	978.423	208.6	978.247	218.2	984.759	221.5	986.589	228.18	986.549		
251.5	985.19	288.82	982.968	324.43	982.436	368.03	982.957	397.69	983.799		
425.05	984.656	429.27	984.802	443.1	986	448.91	987.786	457.04	990		
460.26	990.687										

Manning's n Values

num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	182.53	.04	221.5	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	182.53	221.5		14.52	14.52	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	984.68	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.68	Wt. n-Val.		0.040
0.100				
W.S. Elev (ft)	984.01	Reach Len. (ft)	0.10	0.10
0.10				
Crit W.S. (ft)	983.43	Flow Area (sq ft)		136.64
131.88				
E.G. Slope (ft/ft)	0.006052	Area (sq ft)		136.64
131.88				
Q Total (cfs)	1120.00	Flow (cfs)		968.38
151.62				
Top Width (ft)	164.61	Top Width (ft)		31.70
132.91				
Vel Total (ft/s)	4.17	Avg. Vel. (ft/s)		7.09
1.15				
Max Chl Dpth (ft)	5.76	Hydr. Depth (ft)		4.31
0.99				
Conv. Total (cfs)	14396.7	Conv. (cfs)		12447.7
1949.0				
Length Wtd. (ft)	0.10	Wetted Per. (ft)		35.58
132.96				
Min Ch El (ft)	978.25	Shear (lb/sq ft)		1.45
0.37				
Alpha	2.51	Stream Power (lb/ft s)		10.28
0.43				
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		1.39
0.17				
C & E Loss (ft)	0.02	Cum SA (acres)		0.88
0.16				

Bridge.rep

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

BRIDGE

RIVER: River 1
REACH: Reach 1 RS: 281.08

INPUT

Description:

Distance from Upstream XS = .1
Deck/Roadway Width = 13
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates

num= 3														
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
182.53	987.347	983.952			204.53	987.1	983.522			221.38	986.59	982.992		

Upstream Bridge Cross Section Data

Station Elevation Data num= 26											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.109	22.8	988.842	58.61	986.991	93.44	985.552	126.28	985.05		
153.09	985.962	176.03	987.233	182.53	987.347	184	985.52	189.71	979.297		
199.43	978.423	208.6	978.247	218.2	984.759	221.5	986.589	228.18	986.549		
251.5	985.19	288.82	982.968	324.43	982.436	368.03	982.957	397.69	983.799		
425.05	984.656	429.27	984.802	443.1	986	448.91	987.786	457.04	990		
460.26	990.687										

Manning's n Values

num= 3							
Sta	n Val	Sta	n Val	Sta	n Val		
0	.1	182.53	.04	221.5	.1		

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	182.53	221.5	.1	.3	

Downstream Deck/Roadway Coordinates

num= 3														
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
190.04	987.722	983.952			204.53	987.292	983.522			228.95	986.762	982.992		

Downstream Bridge Cross Section Data

Station Elevation Data num= 32											
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.138	6.82	989.301	52.05	987.025	87.65	985.628	128.65	985.01		
156.96	986.251	183.72	987.393	190.04	987.703	192	985.873	208.34	978.899		
216.9	978.233	226.1	978.873	228	984.89	228.95	986.72	233.19	986.675		
257.67	985.259	293.08	983.035	327.89	981.868	360.29	982.016	388.82	982.898		
403.11	984.078	417.18	984.935	429.01	985.497	431.43	985.364	437.84	986		
449.38	986.476	462.11	987.842	471.95	988.489	479	988.811	481.11	988.837		
490.01	990.234	490.59	990.254								

Manning's n Values

num= 3							
Sta	n Val	Sta	n Val	Sta	n Val		
0	.1	190.04	.04	228.95	.1		

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	190.04	228.95	.1	.3	

Upstream Embankment side slope

=

0 horiz. to 1.0 vertical

Bridge.rep

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

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data

Energy
 Selected Low Flow Methods = Highest Energy Answer

High Flow Method
 Energy Only

Additional Bridge Parameters

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

BRIDGE OUTPUT Profile #PF 1

E.G. US. (ft)	984.68	Element	Inside BR US
Inside BR DS			
W.S. US. (ft)	984.01	E.G. Elev (ft)	984.66
984.42			
Q Total (cfs)	1120.00	W.S. Elev (ft)	984.06
983.98			
Q Bridge (cfs)	862.82	Crit W.S. (ft)	983.59
983.49			
Q Weir (cfs)		Max Chl Dpth (ft)	5.81
5.74			
Weir Sta Lft (ft)		Vel Total (ft/s)	4.28
3.89			
Weir Sta Rgt (ft)		Flow Area (sq ft)	261.80
288.16			
Weir Submerg		Froude # Chl	0.46
0.39			
Weir Max Depth (ft)		Specif Force (cu ft)	630.62
633.10			
Min El Weir Flow (ft)	982.45	Hydr Depth (ft)	1.93
2.33			
Min El Prs (ft)	983.89	W.P. Total (ft)	199.80
188.86			
Delta EG (ft)	0.34	Conv. Total (cfs)	9133.3
9272.6			
Delta WS (ft)	0.66	Top Width (ft)	135.44
123.80			
BR Open Area (sq ft)	111.65	Frctn Loss (ft)	0.19
0.02			
BR Open Vel (ft/s)	7.73	C & E Loss (ft)	0.05
0.06			
BR Sluice Coef		Shear Total (lb/sq ft)	1.23
1.39			
BR Sel Method	Energy only	Power Total (lb/ft s)	5.26
5.40			

Bridge.rep

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1
REACH: Reach 1

RS: 281.07

INPUT

Description:

Station Elevation Data		num= 32		Sta Elev		Sta Elev		Sta Elev		Sta Elev	
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990.138	6.82	989.301	52.05	987.025	87.65	985.628	128.65	985.01		
156.96	986.251	183.72	987.393	190.04	987.703	192	985.873	208.34	978.899		
216.9	978.233	226.1	978.873	228	984.89	228.95	986.72	233.19	986.675		
257.67	985.259	293.08	983.035	327.89	981.868	360.29	982.016	388.82	982.898		
403.11	984.078	417.18	984.935	429.01	985.497	431.43	985.364	437.84	986		
449.38	986.476	462.11	987.842	471.95	988.489	479	988.811	481.11	988.837		
490.01	990.234	490.59	990.254								

Manning's n Values		num= 3		Sta n Val	
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	190.04	.04	228.95	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	190.04	228.95		99.76	99.76		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	984.34	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.99	Wt. n-Val.		0.040
0.100				
W.S. Elev (ft)	983.35	Reach Len. (ft)	99.76	99.76
99.76				
Crit W.S. (ft)	983.35	Flow Area (sq ft)		111.40
104.19				
E.G. Slope (ft/ft)	0.010983	Area (sq ft)		111.40
104.19				
Q Total (cfs)	1120.00	Flow (cfs)		959.83
160.17				
Top Width (ft)	135.77	Top Width (ft)		29.60
106.17				
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)		8.62
1.54				
Max Chl Dpth (ft)	5.12	Hydr. Depth (ft)		3.76
0.98				
Conv. Total (cfs)	10686.9	Conv. (cfs)		9158.6
1528.3				
Length Wtd. (ft)	99.76	Wetted Per. (ft)		33.83
106.24				
Min Ch El (ft)	978.23	Shear (lb/sq ft)		2.26
0.67				
Alpha	2.37	Stream Power (lb/ft s)		19.45
1.03				
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)		1.36
0.12				
C & E Loss (ft)	0.22	Cum SA (acres)		0.88
0.12				

Bridge.rep

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: River 1
REACH: Reach 1 RS: 181.31

INPUT

Description:

Station Elevation Data				num=	66				
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990	18.54	988	34.39	986.62	40.61	986	44.38	985.62
60.01	984	71.44	983.15	90.49	982	117.94	980.72	127.87	980.36
132.59	980.19	133.9	980.15	145.38	980.02	147.57	980	155.66	979.89
159.11	979.64	170.14	979.56	182.11	979.95	185.38	979.85	185.4	979.826
187.69	977.07	194.65	976.66	200	976.994	201.69	977.1	202.1	978.789
202.11	978.83	206.76	979.54	215.86	980.31	226.26	980.04	238.72	980.42
249.52	980.31	256.78	980	268.99	979.58	273.61	979.37	281.62	979.04
289.67	978.58	300	978.039	300.75	978	317.13	977.34	329.93	976.95
345.22	976.54	353.11	976.29	360.56	976.03	361.67	976	363.08	976
364.61	975.99	364.96	975.99	365.22	975.99	367.58	976	373.99	977.78
374.61	977.93	374.77	978	375.11	978.15	379.53	980	383.49	981.67
384.17	982	384.3	982.1	387.45	984	387.47	984.01	387.58	984.09
389.91	985.49	390.8	986	391.82	986.61	393.97	988	395.14	988.91
397.09	990								

Manning's n Values				num=	3
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	127.87	.04	379.53	.1

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	127.87	379.53		102.79	102.79		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	979.94	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.26	Wt. n-Val.		0.040
W.S. Elev (ft)	979.68	Reach Len. (ft)	102.79	102.79
102.79				
Crit W.S. (ft)		Flow Area (sq ft)		284.56

Bridge.rep

E.G. Slope (ft/ft)	0.005324	Area (sq ft)	284.56
Q Total (cfs)	1160.00	Flow (cfs)	1160.00
Top Width (ft)	150.94	Top Width (ft)	150.94
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)	4.08
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)	1.89
Conv. Total (cfs)	15897.1	Conv. (cfs)	15897.1
Length Wtd. (ft)	102.79	Wetted Per. (ft)	154.30
Min Ch El (ft)	975.99	Shear (lb/sq ft)	0.61
Alpha	1.00	Stream Power (lb/ft s)	2.50
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)	0.90
C & E Loss (ft)	0.03	Cum SA (acres)	0.68

Warning: Divided flow computed for this cross-section.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than

1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may

indicate the need for additional cross sections.

CROSS SECTION

RIVER: River 1

REACH: Reach 1

RS: 78.5

INPUT

Description:

Station Elevation Data		num=		98					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990	6.89	989.46	7.54	989.42	9.84	989.29	23.68	988.42
29.23	988	31.39	987.81	50.63	986	53.53	985.79	55.12	985.66
55.52	985.71	55.84	985.73	57.29	985.67	62.13	985.43	90.26	984
91.95	983.78	92.52	983.7	93.24	983.7	111.74	982.02	111.92	982.02
112.14	982.02	117.02	982.02	129.85	982.01	133.66	982	134.03	982
152.75	980.63	161.83	980	168.47	979.53	171.6	979.58	173.16	979.67
174.41	979.66	177.79	979.51	178.61	979.5	183.82	979.43	186.1	979.38
191.91	979.2	200	978.947	200.21	978.94	200.42	978.93	217.78	978.34
223.22	978.3	233.54	978.21	244.69	978.02	244.7	978.013	246.37	976.83
255.59	976.48	266.6	976.21	271.8	977.973	271.82	977.98	280.78	978
289.69	978	294.8	978	300	978.09	308.13	978.23	308.44	978.25
313.01	978.27	315.93	978.24	321.13	978.1	323.09	978.02	323.54	978
324.46	977.79	326.34	977.29	331.32	976	335.99	975.96	336.82	975.96
337.63	975.96	340.08	975.98	343.83	976	348.18	976.01	352.95	976.02
357.63	976.01	358.37	976.01	361.42	976	362.64	976	362.97	976
370.71	975.97	375.48	975.99	379.79	976	383.31	977.75	383.86	978
385.08	978.4	386.75	978.801	386.83	978.82	388.83	979.33	392.77	980
400.56	981.32	402.31	982	403.36	982.5	407.2	984	409.12	984.74
412.13	986	413.35	986.5	414.33	986.92	417.09	988	419.15	988.65

Bridge.rep

423.14	990	425.13	990.77	425.42	990.85
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Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	200	.04	386.75	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

200	386.75	78.52	78.52	78.52	.1	.3
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CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	978.91	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.58	Wt. n-Val.		0.040
W.S. Elev (ft)	978.33	Reach Len. (ft)	78.52	78.52
78.52				
Crit W.S. (ft)	978.33	Flow Area (sq ft)		189.68
E.G. Slope (ft/ft)	0.022827	Area (sq ft)		189.68
Q Total (cfs)	1160.00	Flow (cfs)		1160.00
Top Width (ft)	165.31	Top Width (ft)		165.31
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)		6.12
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)		1.15
Conv. Total (cfs)	7677.7	Conv. (cfs)		7677.7
Length Wtd. (ft)	78.52	Wetted Per. (ft)		166.77
Min Ch El (ft)	975.96	Shear (lb/sq ft)		1.62
Alpha	1.00	Stream Power (lb/ft s)		9.91
Frctn Loss (ft)	1.82	Cum Volume (acre-ft)		0.34
C & E Loss (ft)	0.00	Cum SA (acres)		0.30

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: River 1
 REACH: Reach 1 RS: 0

Bridge.rep

INPUT

Description:

Station Elevation Data			num= 109								
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	990	27.05	988.12	29.07	988	37.51	987.24	41.61	986.85		
54.08	986.13	57.1	986	76.13	985.22	91.52	984.06	92.01	984		
92.58	983.94	96.78	983.57	99.78	983.39	102.72	983.13	108.23	982		
121.13	980.57	124.51	980	131.31	979	139.7	978	146.51	978		
147.95	978	148.56	978	150.87	978	153.1	978	153.23	978		
153.53	978	157.54	978.01	160.78	978.01	164.18	978.01	169.96	978.01		
170.49	978.01	171.73	978.01	175.76	978.01	179.72	978.01	181.89	978.01		
182.74	978.01	184.09	978.01	185.06	978.01	185.79	978.01	187.82	978.01		
190.84	978.01	193.39	978.01	196.76	978.01	199.1	978.01	200	978.01		
203.62	978.01	212	978	219.58	978	222.64	977.86	240.55	977.15		
258	976.605	258.15	976.6	265.64	975.46	275.09	975.46	291.51	976.06		
291.85	975.902	294.61	974.62	300	974.654	307.44	974.7	318.3	975.11		
319.9	975.87	325.3	975.93	331.24	976.11	335.15	975.85	344.94	976		
347.91	976	348.15	976	349.64	976	351.36	976	351.82	976		
352.12	975.97	352.26	975.97	352.38	975.97	352.44	975.97	352.73	975.94		
354.43	975.78	373.35	974	379.35	973.99	380.37	973.99	385.16	973.99		
388.27	974	394.78	974.61	396.4	974.62	396.42	974.54	397.33	974.54		
398.26	974.55	407.67	974.97	408.83	975.03	429.75	976	432.79	976.711		
436.76	977.64	438.26	978	441.3	978.93	445.13	980	445.34	980.09		
447.02	980.87	448.49	981.52	449.58	982	450.2	982.33	453.88	984		
457.17	985.74	457.65	986	460.94	987.87	461.21	988	461.73	988.2		
466.05	989.41	467.15	989.72	468.14	990	470.76	990.58				

Manning's n Values		num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
0	.1	258	.04	432.79	.1

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	258	432.79		0	0	0		.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	976.91	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.58	Wt. n-Val.		0.040
W.S. Elev (ft)	976.33	Reach Len. (ft)		
Crit W.S. (ft)	976.33	Flow Area (sq ft)		190.10
E.G. Slope (ft/ft)	0.023638	Area (sq ft)		190.10
Q Total (cfs)	1160.00	Flow (cfs)		1160.00
Top Width (ft)	171.29	Top Width (ft)		171.29
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)		6.10
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)		1.11
Conv. Total (cfs)	7544.9	Conv. (cfs)		7544.9
Length Wtd. (ft)		Wetted Per. (ft)		172.13
Min Ch El (ft)	973.99	Shear (lb/sq ft)		1.63
Alpha	1.00	Stream Power (lb/ft s)		9.94

Frctn Loss (ft)

Bridge.rep
Cum Volume (acre-ft)

C & E Loss (ft)

Cum SA (acres)

SUMMARY OF MANNING'S N VALUES

River: River 1

Reach	River Sta.	n1	n2	n3
Reach 1	857.28	.1	.04	.1
Reach 1	755.82	.1	.04	.1
Reach 1	654.16	.1	.04	.1
Reach 1	530.15	.1	.04	.1
Reach 1	425.51	.1	.04	.1
Reach 1	295.59	.1	.04	.1
Reach 1	281.08	Bridge		
Reach 1	281.07	.1	.04	.1
Reach 1	181.31	.1	.04	.1
Reach 1	78.5	.1	.04	.1
Reach 1	0	.1	.04	.1

SUMMARY OF REACH LENGTHS

River: River 1

Reach	River Sta.	Left	Channel	Right
Reach 1	857.28	100.46	100.46	100.46
Reach 1	755.82	101.66	101.66	101.66
Reach 1	654.16	124.01	124.01	124.01
Reach 1	530.15	104.64	104.64	104.64
Reach 1	425.51	127.57	127.57	127.57
Reach 1	295.59	14.52	14.52	14.52
Reach 1	281.08	Bridge		
Reach 1	281.07	99.76	99.76	99.76
Reach 1	181.31	102.79	102.79	102.79
Reach 1	78.5	78.52	78.52	78.52
Reach 1	0	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: River 1

Reach	River Sta.	Contr.	Expan.
Reach 1	857.28	.1	.3
Reach 1	755.82	.1	.3
Reach 1	654.16	.1	.3
Reach 1	530.15	.1	.3
Reach 1	425.51	.1	.3
Reach 1	295.59	.1	.3

		Bridge	Bridge.rep	
Reach 1	281.08			
Reach 1	281.07		.1	.3
Reach 1	181.31		.1	.3
Reach 1	78.5		.1	.3
Reach 1	0		.1	.3

Plan: Plan 02 River 1 Reach 1 RS: 857.28 Profile: PF 1

E.G. Elev (ft)	990.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.100	0.040	
W.S. Elev (ft)	990.03	Reach Len. (ft)	100.46	100.46	100.46
Crit W.S. (ft)	989.81	Flow Area (sq ft)	0.48	205.35	
E.G. Slope (ft/ft)	0.014672	Area (sq ft)	0.48	205.35	
Q Total (cfs)	1120.00	Flow (cfs)	0.07	1119.93	
Top Width (ft)	170.60	Top Width (ft)	19.31	151.28	
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	0.15	5.45	
Max Chl Dpth (ft)	4.37	Hydr. Depth (ft)	0.02	1.36	
Conv. Total (cfs)	9246.3	Conv. (cfs)	0.6	9245.7	
Length Wtd. (ft)	100.46	Wetted Per. (ft)	19.31	153.89	
Min Ch El (ft)	985.66	Shear (lb/sq ft)	0.02	1.22	
Alpha	1.00	Stream Power (lb/ft s)	0.00	6.67	
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	0.00	5.09	0.36
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	3.27	0.36

Plan: Plan 02 River 1 Reach 1 RS: 755.82 Profile: PF 1

E.G. Elev (ft)	989.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.		0.040	
W.S. Elev (ft)	988.69	Reach Len. (ft)	101.66	101.66	101.66
Crit W.S. (ft)		Flow Area (sq ft)		220.51	
E.G. Slope (ft/ft)	0.012955	Area (sq ft)		220.51	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	165.53	Top Width (ft)		165.53	
Vel Total (ft/s)	5.08	Avg. Vel. (ft/s)		5.08	
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)		1.33	
Conv. Total (cfs)	9840.0	Conv. (cfs)		9840.0	
Length Wtd. (ft)	101.66	Wetted Per. (ft)		167.49	
Min Ch El (ft)	984.92	Shear (lb/sq ft)		1.06	
Alpha	1.00	Stream Power (lb/ft s)		5.41	
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)		4.60	0.36
C & E Loss (ft)	0.02	Cum SA (acres)		2.90	0.36

Plan: Plan 02 River 1 Reach 1 RS: 654.16 Profile: PF 1

E.G. Elev (ft)	987.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.		0.040	
W.S. Elev (ft)	987.46	Reach Len. (ft)	124.01	124.01	124.01
Crit W.S. (ft)	987.20	Flow Area (sq ft)		243.46	
E.G. Slope (ft/ft)	0.012084	Area (sq ft)		243.46	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	201.23	Top Width (ft)		201.23	
Vel Total (ft/s)	4.60	Avg. Vel. (ft/s)		4.60	
Max Chl Dpth (ft)	3.96	Hydr. Depth (ft)		1.21	
Conv. Total (cfs)	10188.5	Conv. (cfs)		10188.5	
Length Wtd. (ft)	124.01	Wetted Per. (ft)		203.61	
Min Ch El (ft)	983.50	Shear (lb/sq ft)		0.90	
Alpha	1.00	Stream Power (lb/ft s)		4.15	
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)		4.06	0.36
C & E Loss (ft)	0.02	Cum SA (acres)		2.47	0.36

Plan: Plan 02 River 1 Reach 1 RS: 530.15 Profile: PF 1

E.G. Elev (ft)	985.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.		0.040	
W.S. Elev (ft)	985.20	Reach Len. (ft)	104.64	104.64	104.64
Crit W.S. (ft)	985.20	Flow Area (sq ft)		190.07	
E.G. Slope (ft/ft)	0.023377	Area (sq ft)		190.07	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	178.22	Top Width (ft)		178.22	
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)		5.89	
Max Chl Dpth (ft)	3.11	Hydr. Depth (ft)		1.07	
Conv. Total (cfs)	7325.3	Conv. (cfs)		7325.3	
Length Wtd. (ft)	104.64	Wetted Per. (ft)		179.88	
Min Ch El (ft)	982.09	Shear (lb/sq ft)		1.54	
Alpha	1.00	Stream Power (lb/ft s)		9.09	
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)		3.44	0.36
C & E Loss (ft)	0.15	Cum SA (acres)		1.93	0.36

Plan: Plan 02 River 1 Reach 1 RS: 425.51 Profile: PF 1

E.G. Elev (ft)	985.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.040	
W.S. Elev (ft)	984.95	Reach Len. (ft)	127.57	127.57	127.57
Crit W.S. (ft)		Flow Area (sq ft)		606.86	
E.G. Slope (ft/ft)	0.000972	Area (sq ft)		606.86	
Q Total (cfs)	1120.00	Flow (cfs)		1120.00	
Top Width (ft)	296.58	Top Width (ft)		296.58	
Vel Total (ft/s)	1.85	Avg. Vel. (ft/s)		1.85	
Max Chl Dpth (ft)	5.63	Hydr. Depth (ft)		2.05	
Conv. Total (cfs)	35923.0	Conv. (cfs)		35923.0	
Length Wtd. (ft)	127.57	Wetted Per. (ft)		301.69	
Min Ch El (ft)	979.32	Shear (lb/sq ft)		0.12	
Alpha	1.00	Stream Power (lb/ft s)		0.23	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)		2.48	0.36
C & E Loss (ft)	0.06	Cum SA (acres)		1.36	0.36

Plan: Plan 02 River 1 Reach 1 RS: 295.59 Profile: PF 1

E.G. Elev (ft)	984.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	984.01	Reach Len. (ft)	0.10	0.10	0.10
Crit W.S. (ft)	983.43	Flow Area (sq ft)		136.64	131.88
E.G. Slope (ft/ft)	0.006052	Area (sq ft)		136.64	131.88
Q Total (cfs)	1120.00	Flow (cfs)		968.38	151.62
Top Width (ft)	164.61	Top Width (ft)		31.70	132.91
Vel Total (ft/s)	4.17	Avg. Vel. (ft/s)		7.09	1.15
Max Chl Dpth (ft)	5.76	Hydr. Depth (ft)		4.31	0.99
Conv. Total (cfs)	14396.7	Conv. (cfs)		12447.7	1949.0
Length Wtd. (ft)	0.10	Wetted Per. (ft)		35.58	132.96
Min Ch El (ft)	978.25	Shear (lb/sq ft)		1.45	0.37
Alpha	2.51	Stream Power (lb/ft s)		10.28	0.43
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)		1.39	0.17
C & E Loss (ft)	0.02	Cum SA (acres)		0.88	0.16

Plan: Plan 02 River 1 Reach 1 RS: 281.08 BR U Profile: PF 1

E.G. Elev (ft)	984.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	984.06	Reach Len. (ft)	13.00	13.00	13.00
Crit W.S. (ft)	983.59	Flow Area (sq ft)		122.95	138.86
E.G. Slope (ft/ft)	0.015038	Area (sq ft)		122.95	138.86
Q Total (cfs)	1120.00	Flow (cfs)		862.82	257.18
Top Width (ft)	135.44	Top Width (ft)			135.44
Vel Total (ft/s)	4.28	Avg. Vel. (ft/s)		7.02	1.85
Max Chl Dpth (ft)	5.81	Hydr. Depth (ft)			1.03
Conv. Total (cfs)	9133.3	Conv. (cfs)		7036.0	2097.3
Length Wtd. (ft)	13.00	Wetted Per. (ft)		64.30	135.50
Min Ch El (ft)	978.25	Shear (lb/sq ft)		1.80	0.96
Alpha	2.12	Stream Power (lb/ft s)		12.60	1.78
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)		1.39	0.17
C & E Loss (ft)	0.05	Cum SA (acres)		0.88	0.16

Plan: Plan 02 River 1 Reach 1 RS: 281.08 BR D Profile: PF 1

E.G. Elev (ft)	984.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	983.98	Reach Len. (ft)	1.42	1.42	1.42
Crit W.S. (ft)	983.49	Flow Area (sq ft)		111.65	176.50
E.G. Slope (ft/ft)	0.014589	Area (sq ft)		111.65	176.50
Q Total (cfs)	1120.00	Flow (cfs)		718.96	401.04
Top Width (ft)	123.80	Top Width (ft)			123.80
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)		6.44	2.27
Max Chl Dpth (ft)	5.74	Hydr. Depth (ft)			1.43
Conv. Total (cfs)	9272.6	Conv. (cfs)		5952.3	3320.3
Length Wtd. (ft)	1.42	Wetted Per. (ft)		64.95	123.91
Min Ch El (ft)	978.23	Shear (lb/sq ft)		1.57	1.30
Alpha	1.88	Stream Power (lb/ft s)		10.08	2.95
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)		1.36	0.12
C & E Loss (ft)	0.06	Cum SA (acres)		0.88	0.13

Plan: Plan 02 River 1 Reach 1 RS: 281.07 Profile: PF 1

E.G. Elev (ft)	984.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.99	Wt. n-Val.		0.040	0.100
W.S. Elev (ft)	983.35	Reach Len. (ft)	99.76	99.76	99.76
Crit W.S. (ft)	983.35	Flow Area (sq ft)		111.40	104.19
E.G. Slope (ft/ft)	0.010983	Area (sq ft)		111.40	104.19
Q Total (cfs)	1120.00	Flow (cfs)		959.83	160.17
Top Width (ft)	135.77	Top Width (ft)		29.60	106.17
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)		8.62	1.54
Max Chl Dpth (ft)	5.12	Hydr. Depth (ft)		3.76	0.98
Conv. Total (cfs)	10686.9	Conv. (cfs)		9158.6	1528.3
Length Wtd. (ft)	99.76	Wetted Per. (ft)		33.83	106.24
Min Ch El (ft)	978.23	Shear (lb/sq ft)		2.26	0.67
Alpha	2.37	Stream Power (lb/ft s)		19.45	1.03
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)		1.36	0.12
C & E Loss (ft)	0.22	Cum SA (acres)		0.88	0.12

Plan: Plan 02 River 1 Reach 1 RS: 181.31 Profile: PF 1

E.G. Elev (ft)	979.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.		0.040	
W.S. Elev (ft)	979.68	Reach Len. (ft)	102.79	102.79	102.79
Crit W.S. (ft)		Flow Area (sq ft)		284.56	
E.G. Slope (ft/ft)	0.005324	Area (sq ft)		284.56	
Q Total (cfs)	1160.00	Flow (cfs)		1160.00	
Top Width (ft)	150.94	Top Width (ft)		150.94	
Vel Total (ft/s)	4.08	Avg. Vel. (ft/s)		4.08	
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)		1.89	
Conv. Total (cfs)	15897.1	Conv. (cfs)		15897.1	
Length Wtd. (ft)	102.79	Wetted Per. (ft)		154.30	
Min Ch El (ft)	975.99	Shear (lb/sq ft)		0.61	
Alpha	1.00	Stream Power (lb/ft s)		2.50	
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)		0.90	
C & E Loss (ft)	0.03	Cum SA (acres)		0.68	

Plan: Plan 02 River 1 Reach 1 RS: 78.5 Profile: PF 1

E.G. Elev (ft)	978.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.040	
W.S. Elev (ft)	978.33	Reach Len. (ft)	78.52	78.52	78.52
Crit W.S. (ft)	978.33	Flow Area (sq ft)		189.68	
E.G. Slope (ft/ft)	0.022827	Area (sq ft)		189.68	
Q Total (cfs)	1160.00	Flow (cfs)		1160.00	
Top Width (ft)	165.31	Top Width (ft)		165.31	
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)		6.12	
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)		1.15	
Conv. Total (cfs)	7677.7	Conv. (cfs)		7677.7	
Length Wtd. (ft)	78.52	Wetted Per. (ft)		166.77	
Min Ch El (ft)	975.96	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		9.91	
Frctn Loss (ft)	1.82	Cum Volume (acre-ft)		0.34	
C & E Loss (ft)	0.00	Cum SA (acres)		0.30	

Plan: Plan 02 River 1 Reach 1 RS: 0 Profile: PF 1

E.G. Elev (ft)	976.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.040	
W.S. Elev (ft)	976.33	Reach Len. (ft)			
Crit W.S. (ft)	976.33	Flow Area (sq ft)		190.10	
E.G. Slope (ft/ft)	0.023638	Area (sq ft)		190.10	
Q Total (cfs)	1160.00	Flow (cfs)		1160.00	
Top Width (ft)	171.29	Top Width (ft)		171.29	
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)		6.10	
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)		1.11	
Conv. Total (cfs)	7544.9	Conv. (cfs)		7544.9	
Length Wtd. (ft)		Wetted Per. (ft)		172.13	
Min Ch El (ft)	973.99	Shear (lb/sq ft)		1.63	
Alpha	1.00	Stream Power (lb/ft s)		9.94	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Tools

Editors

River Reach

Storage Area

2D Flow Area

SA/2D Area Conn

SA/2D Area BC Lines

2D Area Break Lines

2D Area Manning Regions

Pump Station

RS

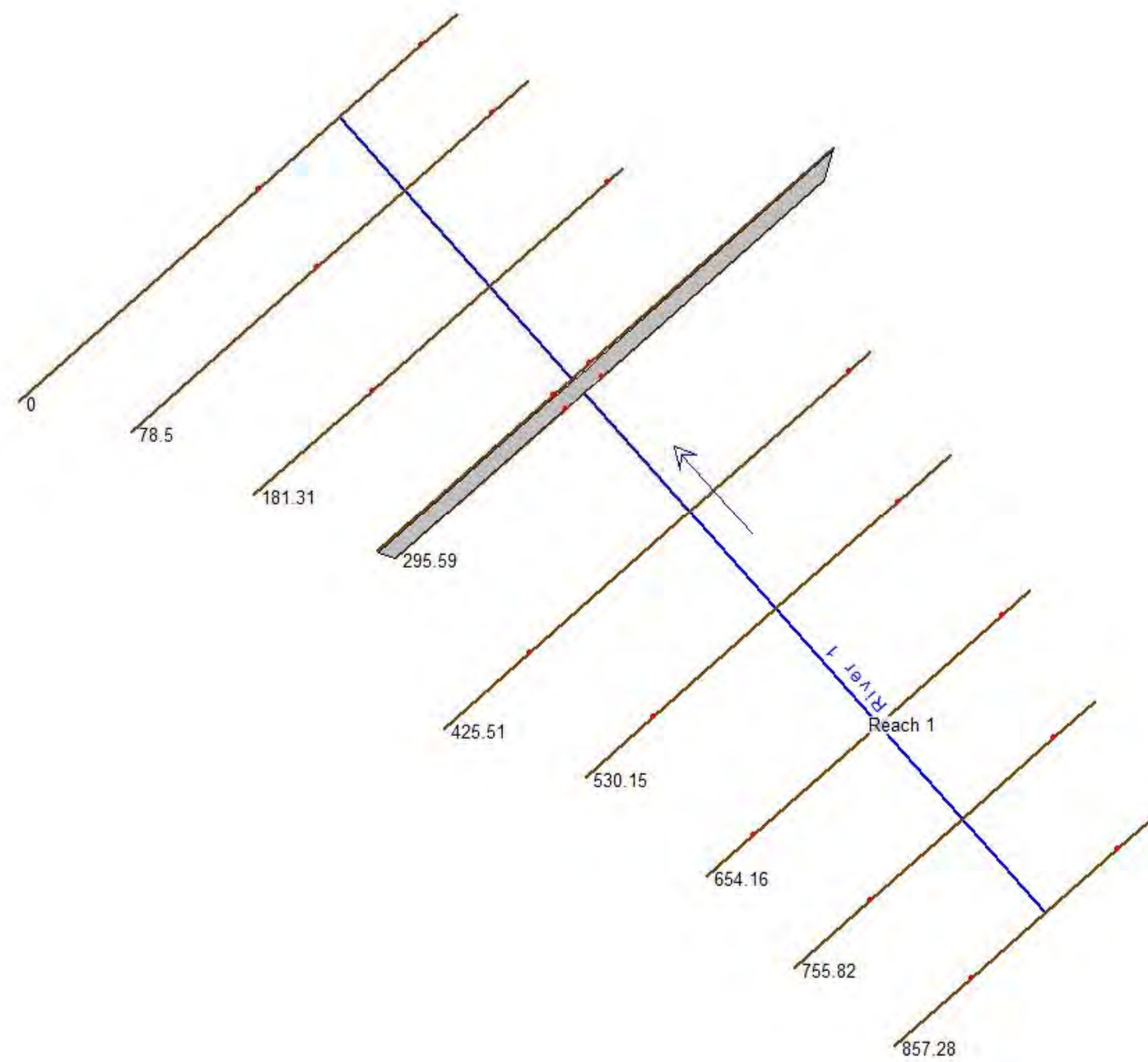
Description

Plot WS extents for Profile:

...

(none)

- Junct.
- Cross Section
- Brdg/Culv
- Inline Structure
- Lateral Structure
- Storage Area
- 2D Flow Area
- SA/2D Area Conn
- Pump Station
- HTab Param.
- View Picture



Apply Data

Add Multiple...

Add A Flow Change Location

Profile Names and Flow Rates

	River	Reach	RS	PF 1
1	River 1	Reach 1	857.28	1120
2	River 1	Reach 1	181.31	1160

River:	River 1	Apply Data			
Reach:	Reach 1	River Sta.:	857.28		
Description					

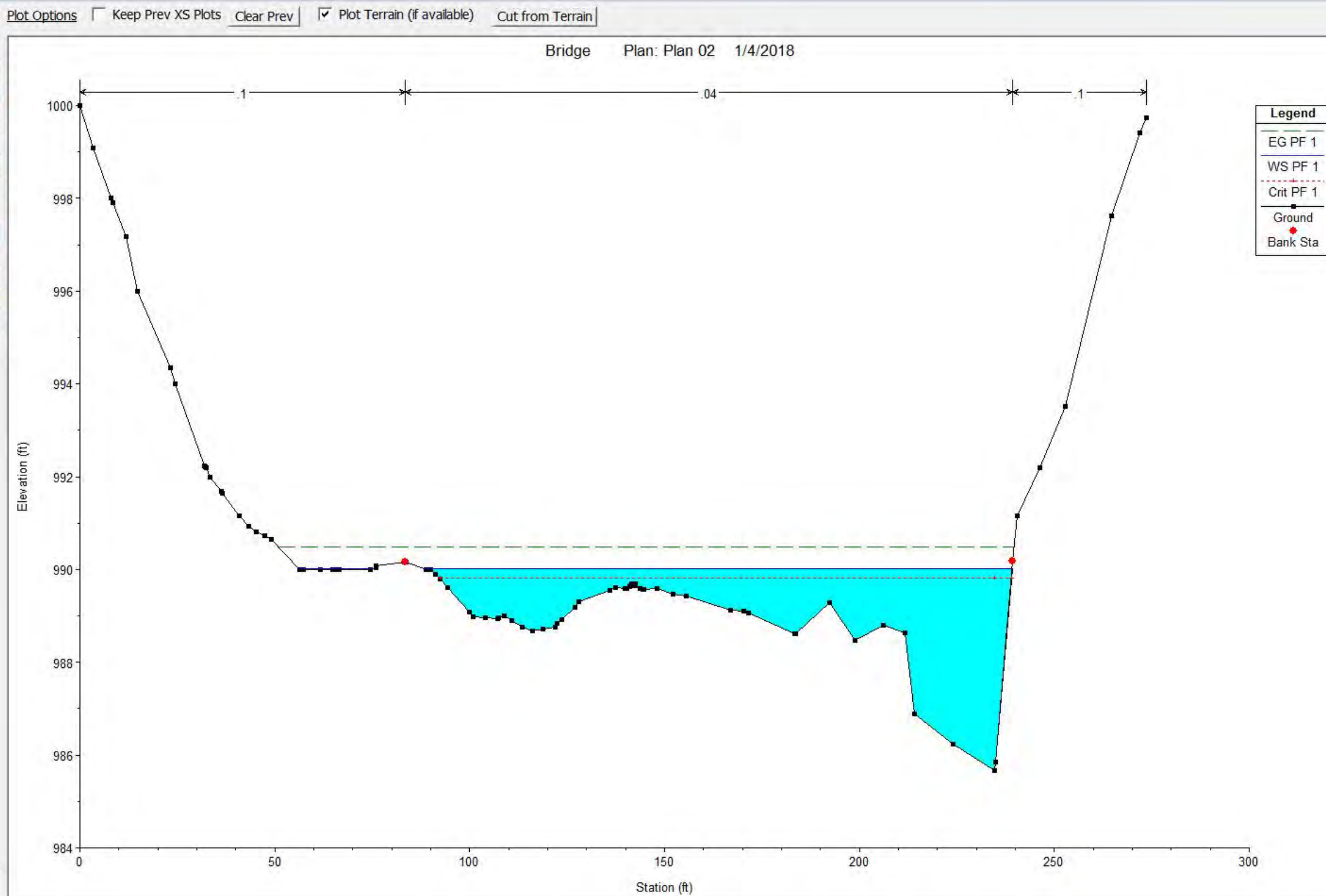
Del Row	Ins Row	Cross Section Coordinates
		Station Elevation ▲
1	0	1000
2	3.42	999.09
3	8.03	998
4	8.51	997.9
5	11.82	997.18
6	14.71	996
7	23.24	994.34
8	24.54	994
9	31.97	992.24
10	32.23	992.21
11	32.37	992.19
12	33.41	992
13	36.18	991.68
14	36.54	991.64
15	40.99	991.16
16	43.3	990.93
17	45.16	990.81
18	47.44	990.72
19	49.21	990.64
20	56.49	990
21	57.31	990
22	61.75	990
23	64.78	990
24	66.14	990
25	66.61	990
26	74.57	990
27	76.02	990.04
28	76.06	990.07
29	83.44	990.15
30	83.77	990.15
31	88.82	990
32	89.46	990
33	89.92	990
34	91.27	989.9
35	92.51	989.8
36	94.25	989.61
37	100	989.08
...	...	...

Downstream Reach Lengths		
LOB	Channel	ROB
100.46	100.46	100.46

Manning's n Values		
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations	
Left Bank	Right Bank
83.44	239.39

Cont\Exp Coefficient (Steady)	
Contraction	Expansion
0.1	0.3



River: River 1

Apply Data

Plot Options

Keep Prev XS Plots

Clear Prev

Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 755.82

Down

Up

Description

Del Row

Ins Row

Cross Section Coordinates	
Station	Elevation
1 0	998
2 4.23	996.75
3 11.1	996
4 13.62	995.34
5 14.01	995.31
6 14.86	995.18
7 16.42	995.49
8 18.19	995.68
9 18.22	995.68
10 18.27	995.68
11 18.34	995.68
12 20.41	995.56
13 20.78	995.53
14 21.93	995.43
15 27.94	994.31
16 28.15	994.27
17 29.1	994.17
18 30.06	994
19 31.77	993.75
20 32.09	993.7
21 32.38	993.66
22 32.63	993.63
23 42.02	992.49
24 45.33	992.07
25 45.84	992
26 46.8	991.88
27 51.5	991.28
28 51.93	991.23
29 52.99	991.13
30 60.79	990.47
31 64.08	990.68
32 65.94	990.6
33 68.04	990.51
34 74.28	990
35 74.33	990
36 81.9	989.72
37 100.14	988.64

Downstream Reach Lengths

LOB	Channel	ROB
101.66	101.66	101.66

Manning's n Values

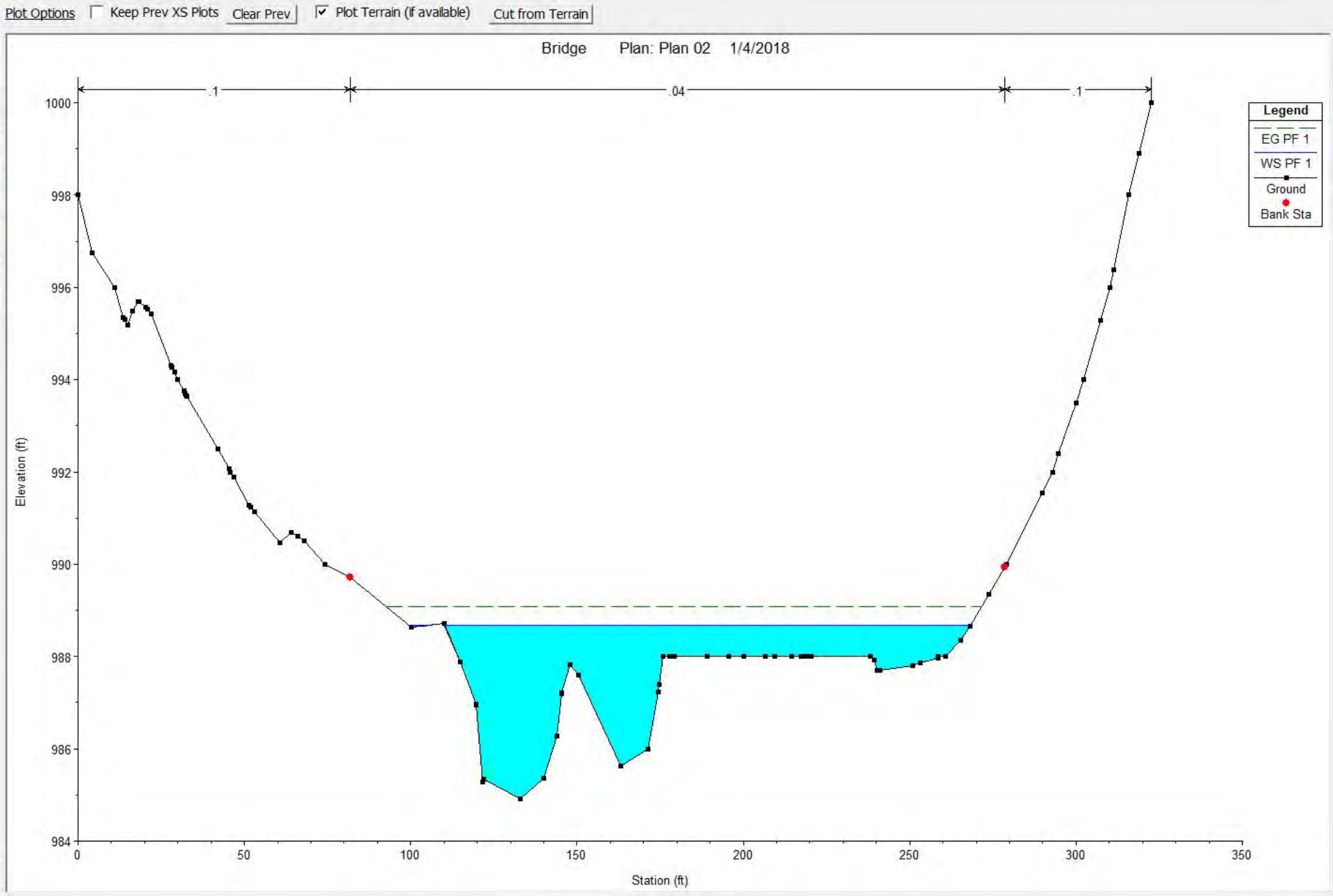
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
81.9	278.7

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



River: River 1

Apply Data

Plot Options

Keep Prev XS Plots

Clear Prev

Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 654.16

Down Arrow

Up Arrow

Description

Del Row

Ins Row

Cross Section Coordinates		
	Station	Elevation
1	0	1000.05
2	0.01	1000.04
3	0.13	1000
4	0.29	999.94
5	5.29	998
6	8.81	996.51
7	10.02	996
8	10.61	995.75
9	14.73	994
10	15.43	993.74
11	20.88	992
12	24.04	991.02
13	27.56	990
14	32.8	989.36
15	38.42	988.72
16	39.25	988.63
17	42.52	988.31
18	42.83	988.33
19	43.17	988.34
20	43.17	988.53
21	43.62	988.63
22	45.48	988.92
23	47.67	989.46
24	48.13	989.61
25	48.34	989.6
26	50.72	990
27	50.79	990
28	51.03	990
29	58.1	988.7
30	59.03	988.3
31	59.69	988
32	76.35	986.58
33	87.27	986.89
34	93.03	986.94
35	97.17	986.26
36	97.2	986.194
37	98.02	984.4

Downstream Reach Lengths

LOB	Channel	ROB
124.01	124.01	124.01

Manning's n Values

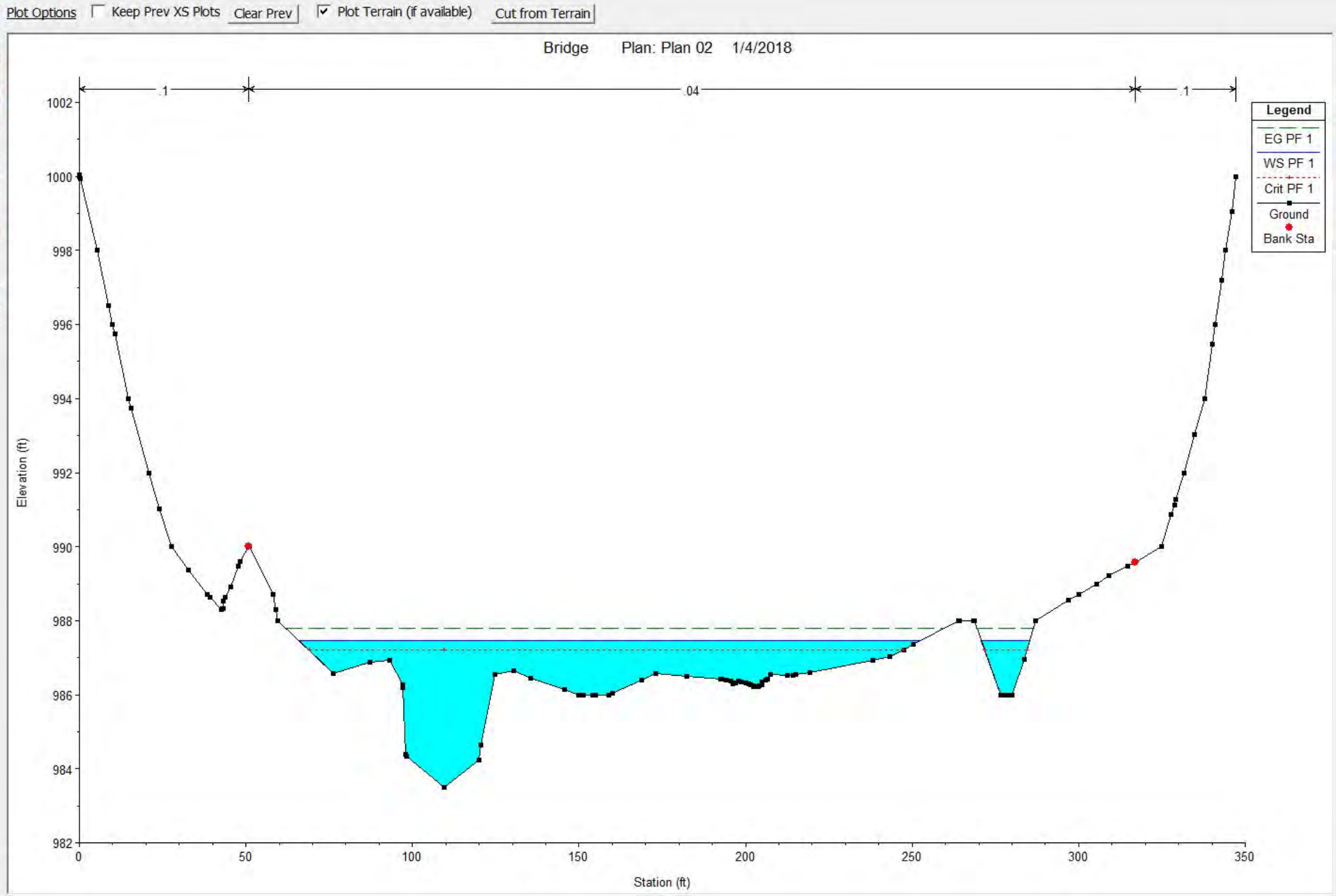
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
50.79	317.11

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



River: River 1

Apply Data

Plot Options

Keep Prev XS Plots

Clear Prev

Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 530.15

Description

Del Row

Ins Row

Cross Section Coordinates

	Station	Elevation
1	0	996.17
2	1.01	996
3	2.83	995.65
4	12.86	994
5	14.01	993.79
6	25.07	992
7	35.46	990.14
8	36.15	990
9	38.35	989.69
10	49.64	988
11	73.47	986.05
12	73.91	986.01
13	73.96	986.01
14	74.05	986
15	74.22	985.99
16	81.59	985.55
17	91.28	984.93
18	91.34	984.94
19	101.53	984.52
20	103.27	984.66
21	107.23	984.58
22	110.1	984.433
23	110.16	984.43
24	112.89	983.02
25	118.63	983.09
26	125.38	982.09
27	132.48	982.87
28	133.03	983.67
29	134.23	985.03
30	134.3	985.039
31	138.28	985.57
32	149.13	985.33
33	158.93	984.77
34	171.33	986
35	175.88	986
36	179.29	986
37	189.48	986

Downstream Reach Lengths

LOB	Channel	ROB
104.64	104.64	104.64

Manning's n Values

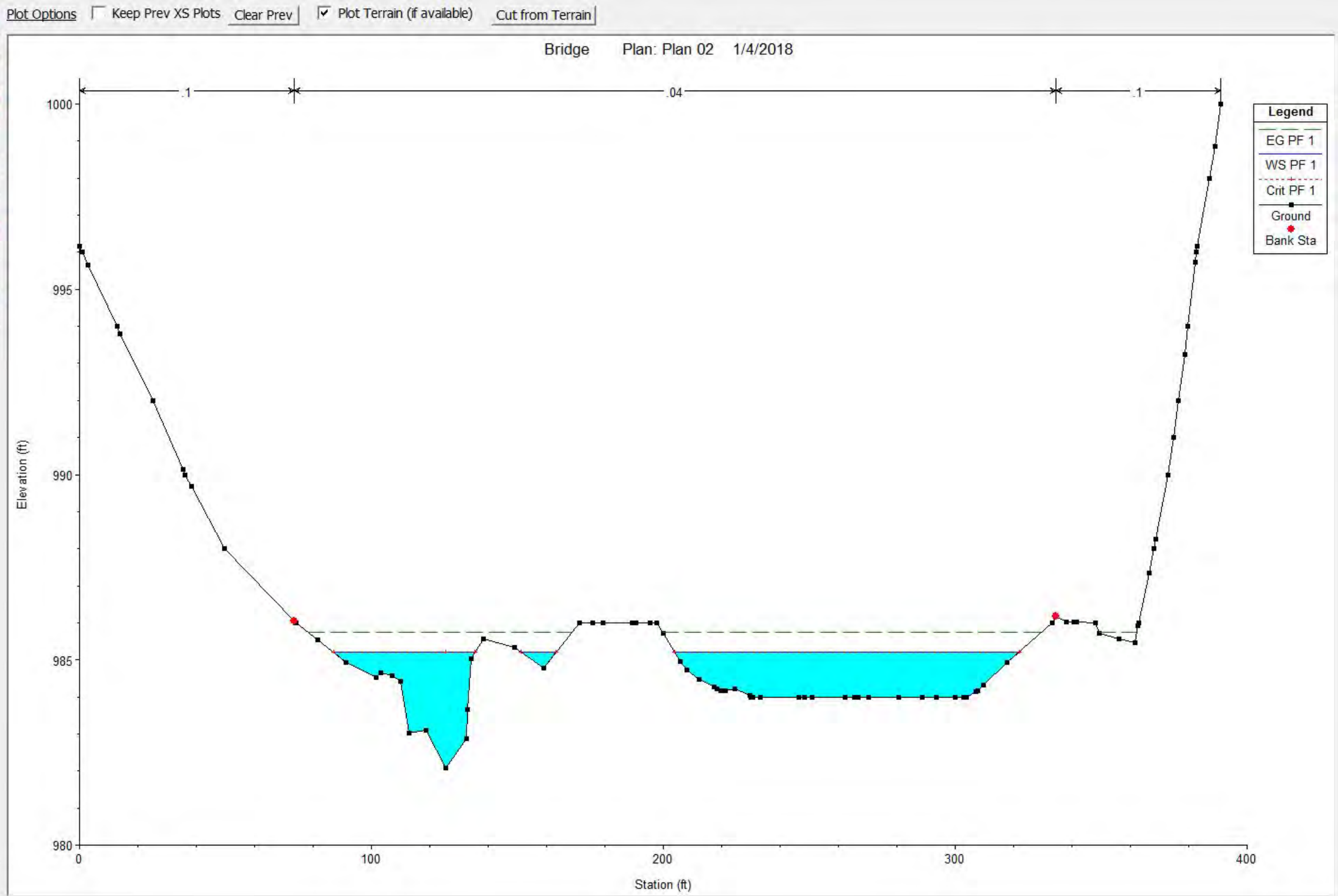
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
73.47	334.55

Cont\Exp Coefficient (Steady

Contraction	Expansion
0.1	0.3



River: River 1 Apply Data Plot Options Keep Prev XS Plots Clear Prev Plot Terrain (if available) Cut from Terrain

Reach: Reach 1 River Sta.: 425.51

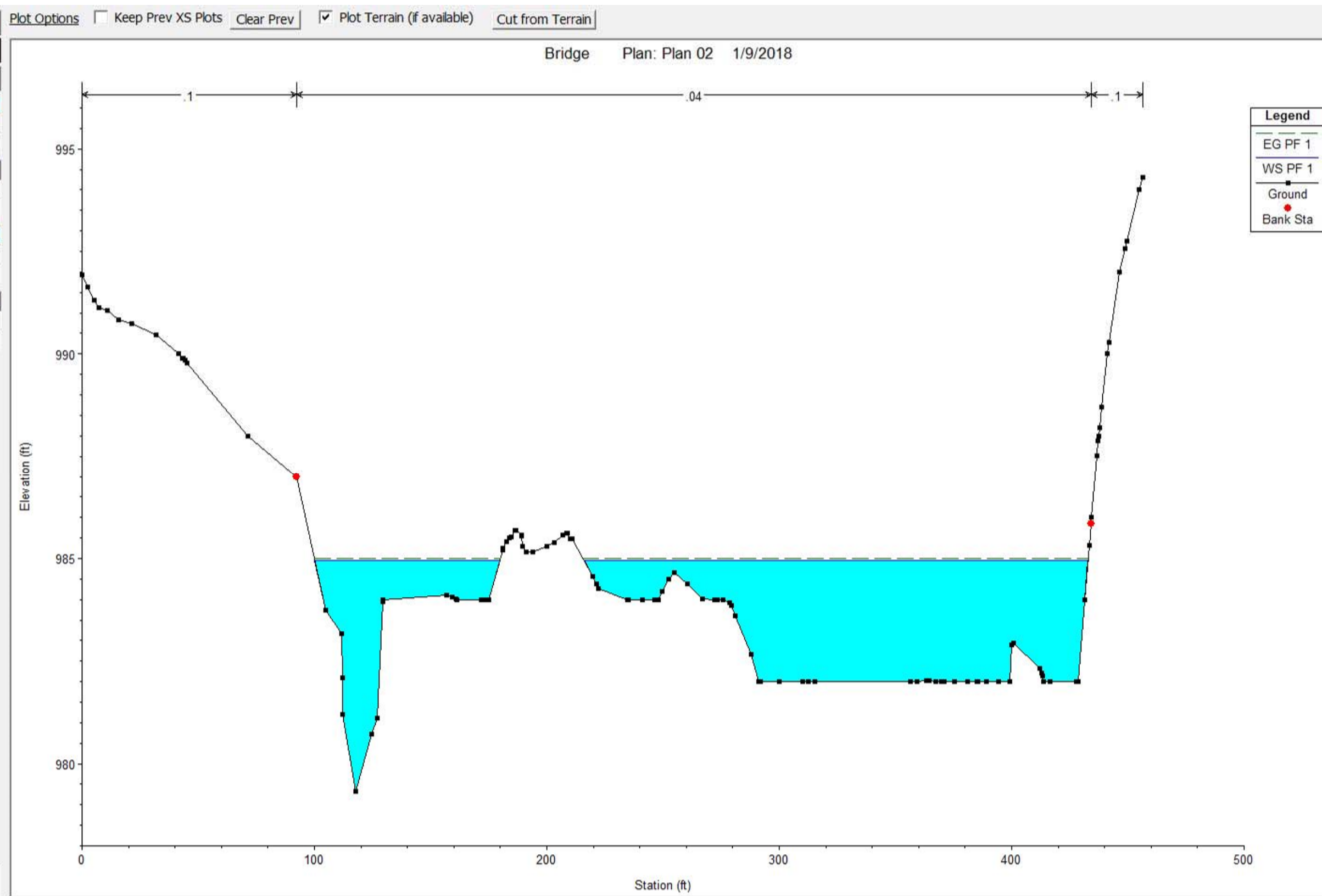
Cross Section Coordinates	
Station	Elevation
1 0	991.94
2 2.37	991.63
3 5.35	991.32
4 7.41	991.12
5 10.81	991.05
6 15.87	990.83
7 21.21	990.75
8 31.87	990.47
9 41.73	990
10 43.21	989.89
11 43.39	989.89
12 44.43	989.84
13 44.47	989.84
14 45.22	989.79
15 71.2	988
16 92.53	986.99
17 104.67	983.73
18 111.5	983.172
19 111.53	983.17
20 112.14	982.1
21 112.16	981.21
22 117.87	979.32
23 124.58	980.72
24 126.9	981.12
25 129.4	983.945
26 129.44	983.99
27 156.92	984.11
28 159.3	984.07
29 160.9	984.02
30 161.18	984
31 171.96	984
32 173.46	984
33 175.13	984
34 181.1	985.2
35 181.25	985.26
36 182.75	985.42
37 183.75	985.51

Downstream Reach Lengths		
LOB	Channel	ROB
127.57	127.57	127.57

Manning's n Values		
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations	
Left Bank	Right Bank
92.53	434.19

Cont\Exp Coefficient (Steady	
Contraction	Expansion
0.1	0.3



Enter to move to next upstream river station location

River: River 1

Apply Data

Plot Options

Keep Prev XS Plots

Clear Prev

Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 295.59

Description

Del Row

Ins Row

Downstream Reach Lengths

LOB

Channel

ROB

14.52

14.52

14.52

Manning's n Values

LOB

Channel

ROB

0.1

0.04

0.1

Main Channel Bank Stations

Left Bank

Right Bank

182.53

221.5

Cont\Exp Coefficient (Steady)

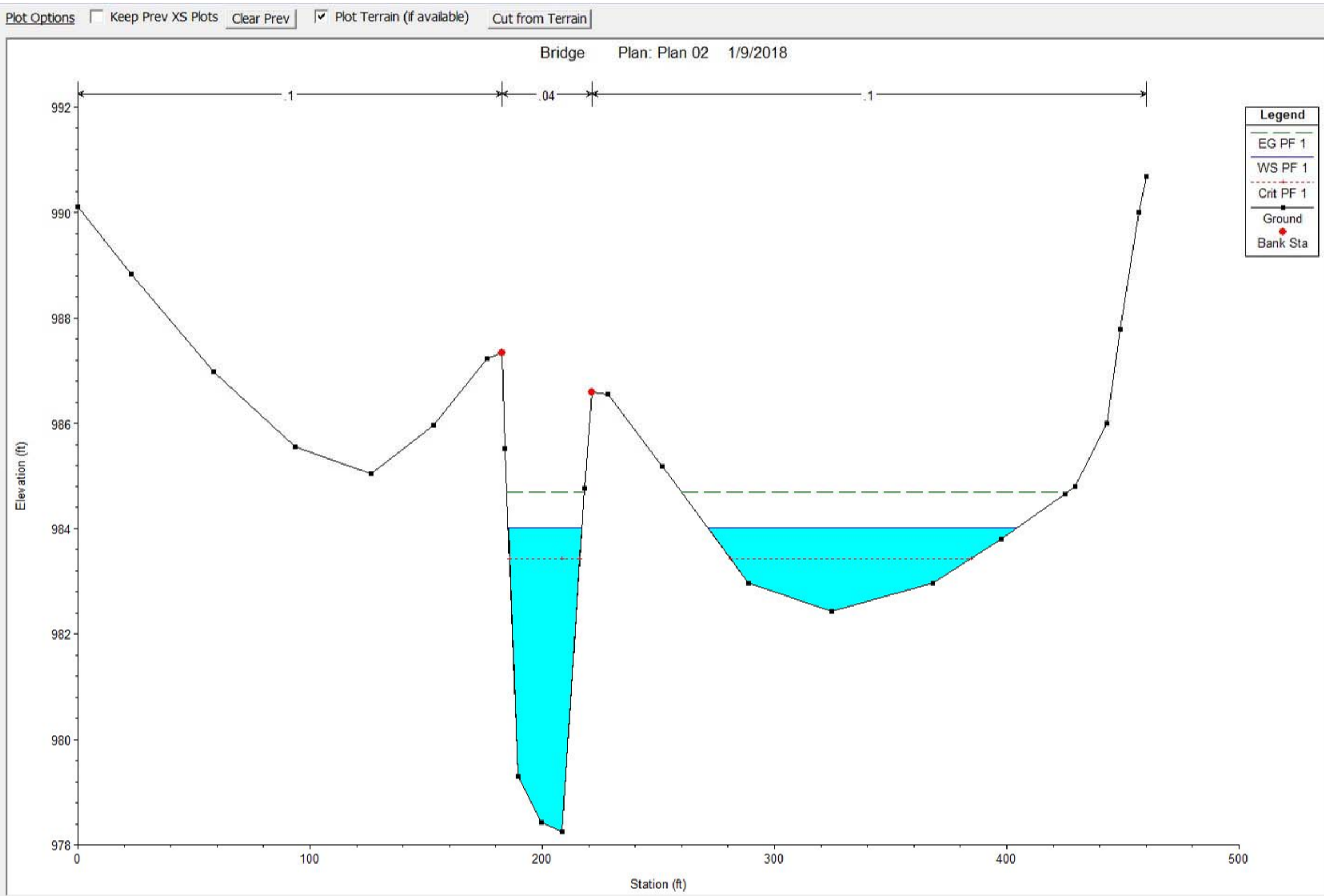
Contraction

Expansion

0.1

0.3

Cross Section Coordinates	
Station	Elevation
1 0	990.109
2 22.8	988.842
3 58.61	986.991
4 93.44	985.552
5 126.28	985.05
6 153.09	985.962
7 176.03	987.233
8 182.53	987.347
9 184	985.52
10 189.71	979.297
11 199.43	978.423
12 208.6	978.247
13 218.2	984.759
14 221.5	986.589
15 228.18	986.549
16 251.5	985.19
17 288.82	982.968
18 324.43	982.436
19 368.03	982.957
20 397.69	983.799
21 425.05	984.656
22 429.27	984.802
23 443.1	986
24 448.91	987.786
25 457.04	990
26 460.26	990.687
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	



River: River 1

Apply Data

Plot Options

☐ Keep Prev XS Plots

Clear Prev

☒ Plot Terrain (if available)

Cut from Terrain

Reach: Reach 1

River Sta.: 281.07

Description

Del Row

Ins Row

Downstream Reach Lengths

LOB	Channel	ROB
99.76	99.76	99.76

Manning's n Values

LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

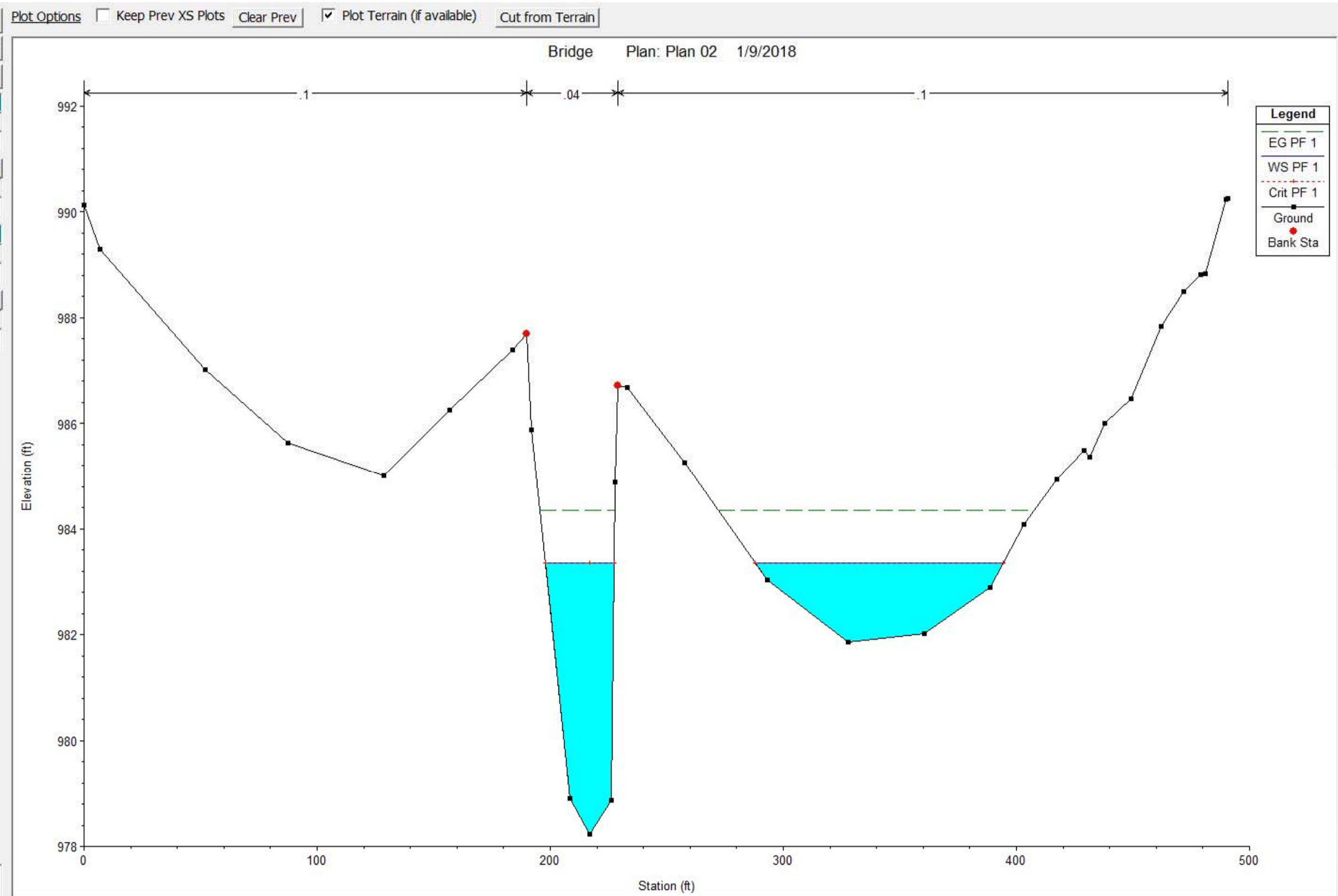
Left Bank	Right Bank
190.04	228.95

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3

Cross Section Coordinates

Station	Elevation
1 0	990.138
2 6.82	989.301
3 52.05	987.025
4 87.65	985.628
5 128.65	985.01
6 156.96	986.251
7 183.72	987.393
8 190.04	987.703
9 192	985.873
10 208.34	978.899
11 216.9	978.233
12 226.1	978.873
13 228	984.89
14 228.95	986.72
15 233.19	986.675
16 257.67	985.259
17 293.08	983.035
18 327.89	981.868
19 360.29	982.016
20 388.82	982.898
21 403.11	984.078
22 417.18	984.935
23 429.01	985.497
24 431.43	985.364
25 437.84	986
26 449.38	986.476
27 462.11	987.842
28 471.95	988.489
29 479	988.811
30 481.11	988.837
31 490.01	990.234
32 490.59	990.254
33	
34	
35	
36	
37	



River: River 1

Apply Data



Plot Options

☐ Keep Prev XS Plots

☒ Plot Terrain (if available)

Reach: Reach 1

River Sta.: 181.31

Description

Del Row

Ins Row

Cross Section Coordinates

	Station	Elevation
1	0	990
2	18.54	988
3	34.39	986.62
4	40.61	986
5	44.38	985.62
6	60.01	984
7	71.44	983.15
8	90.49	982
9	117.94	980.72
10	127.87	980.36
11	132.59	980.19
12	133.9	980.15
13	145.38	980.02
14	147.57	980
15	155.66	979.89
16	159.11	979.64
17	170.14	979.56
18	182.11	979.95
19	185.38	979.85
20	185.4	979.826
21	187.69	977.07
22	194.65	976.66
23	200	976.994
24	201.69	977.1
25	202.1	978.789
26	202.11	978.83
27	206.76	979.54
28	215.86	980.31
29	226.26	980.04
30	238.72	980.42
31	249.52	980.31
32	256.78	980
33	268.99	979.58
34	273.61	979.37
35	281.62	979.04
36	289.67	978.58
37	300	978.039

Downstream Reach Lengths

LOB	Channel	ROB
102.79	102.79	102.79

Manning's n Values

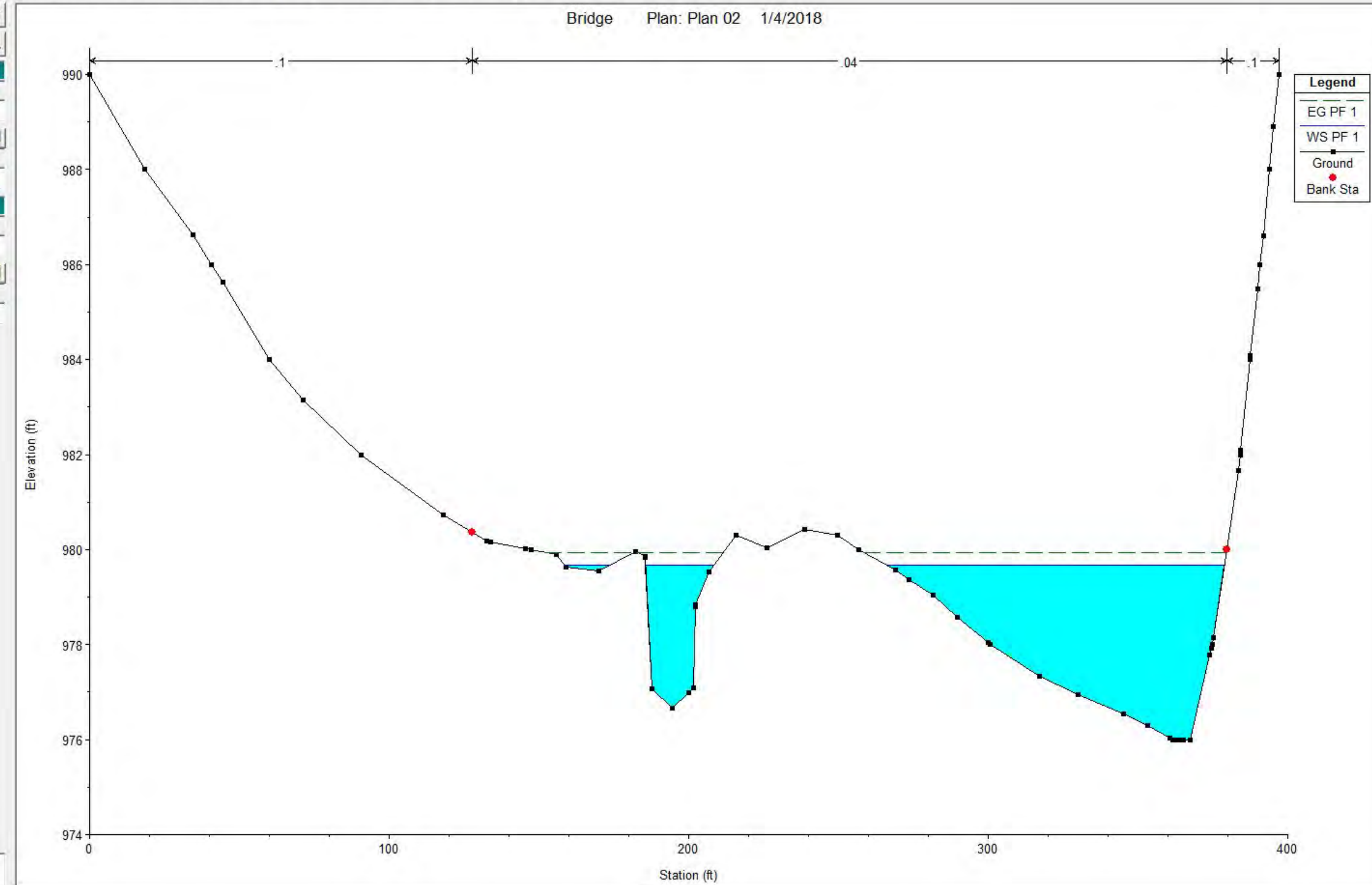
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
127.87	379.53

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



River: River 1
Reach: Reach 1
River Sta.: 78.5

Description

Del Row	Ins Row	Station	Elevation
		0	990
1		6.89	989.46
2		7.54	989.42
3		9.84	989.29
4		23.68	988.42
5		29.23	988
6		31.39	987.81
7		50.63	986
8		53.53	985.79
9		55.12	985.66
10		55.52	985.71
11		55.84	985.73
12		57.29	985.67
13		62.13	985.43
14		90.26	984
15		91.95	983.78
16		92.52	983.7
17		93.24	983.7
18		111.74	982.02
19		111.92	982.02
20		112.14	982.02
21		117.02	982.02
22		129.85	982.01
23		133.66	982
24		134.03	982
25		152.75	980.63
26		161.83	980
27		168.47	979.53
28		171.6	979.58
29		173.16	979.67
30		174.41	979.66
31		177.79	979.51
32		178.61	979.5
33		183.82	979.43
34		186.1	979.38
35		191.91	979.2
36		200	978.947

Downstream Reach Lengths

LOB	Channel	ROB
78.52	78.52	78.52

Manning's n Values

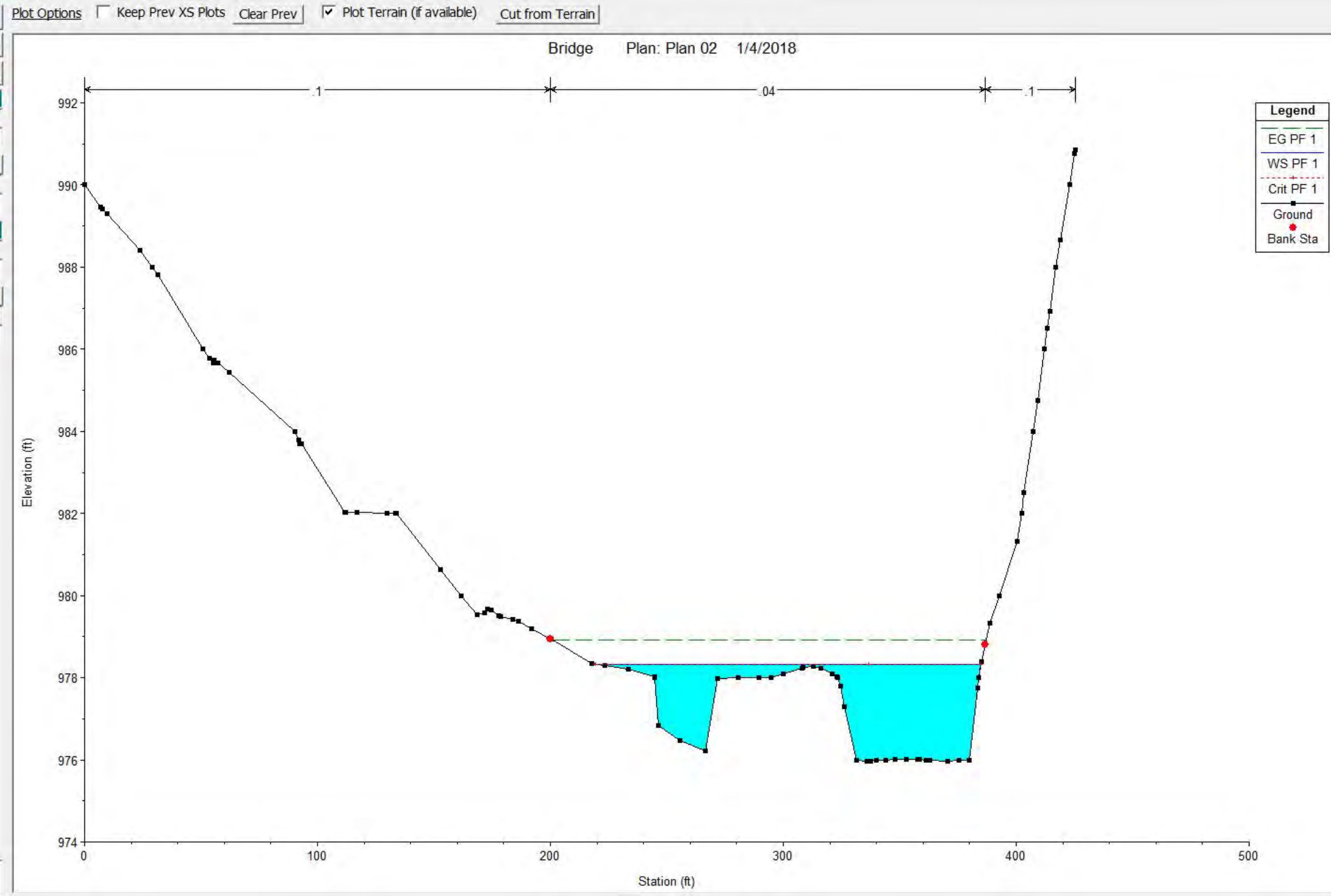
LOB	Channel	ROB
0.1	0.04	0.1

Main Channel Bank Stations

Left Bank	Right Bank
200	386.75

Cont\Exp Coefficient (Steady)

Contraction	Expansion
0.1	0.3



River:

River 1

Apply Data

Reach:

Reach 1

River Sta.: 0

Description

Del Row

Ins Row

Cross Section Coordinates	
Station	Elevation
1 0	990
2 27.05	988.12
3 29.07	988
4 37.51	987.24
5 41.61	986.85
6 54.08	986.13
7 57.1	986
8 76.13	985.22
9 91.52	984.06
10 92.01	984
11 92.58	983.94
12 96.78	983.57
13 99.78	983.39
14 102.72	983.13
15 108.23	982
16 121.13	980.57
17 124.51	980
18 131.31	979
19 139.7	978
20 146.51	978
21 147.95	978
22 148.56	978
23 150.87	978
24 153.1	978
25 153.23	978
26 153.53	978
27 157.54	978.01
28 160.78	978.01
29 164.18	978.01
30 169.96	978.01
31 170.49	978.01
32 171.73	978.01
33 175.76	978.01
34 179.72	978.01
35 181.89	978.01
36 182.74	978.01
37 184.09	978.01

Downstream Reach Lengths

LOB	Channel	ROB
0	0	0

Manning's n Values

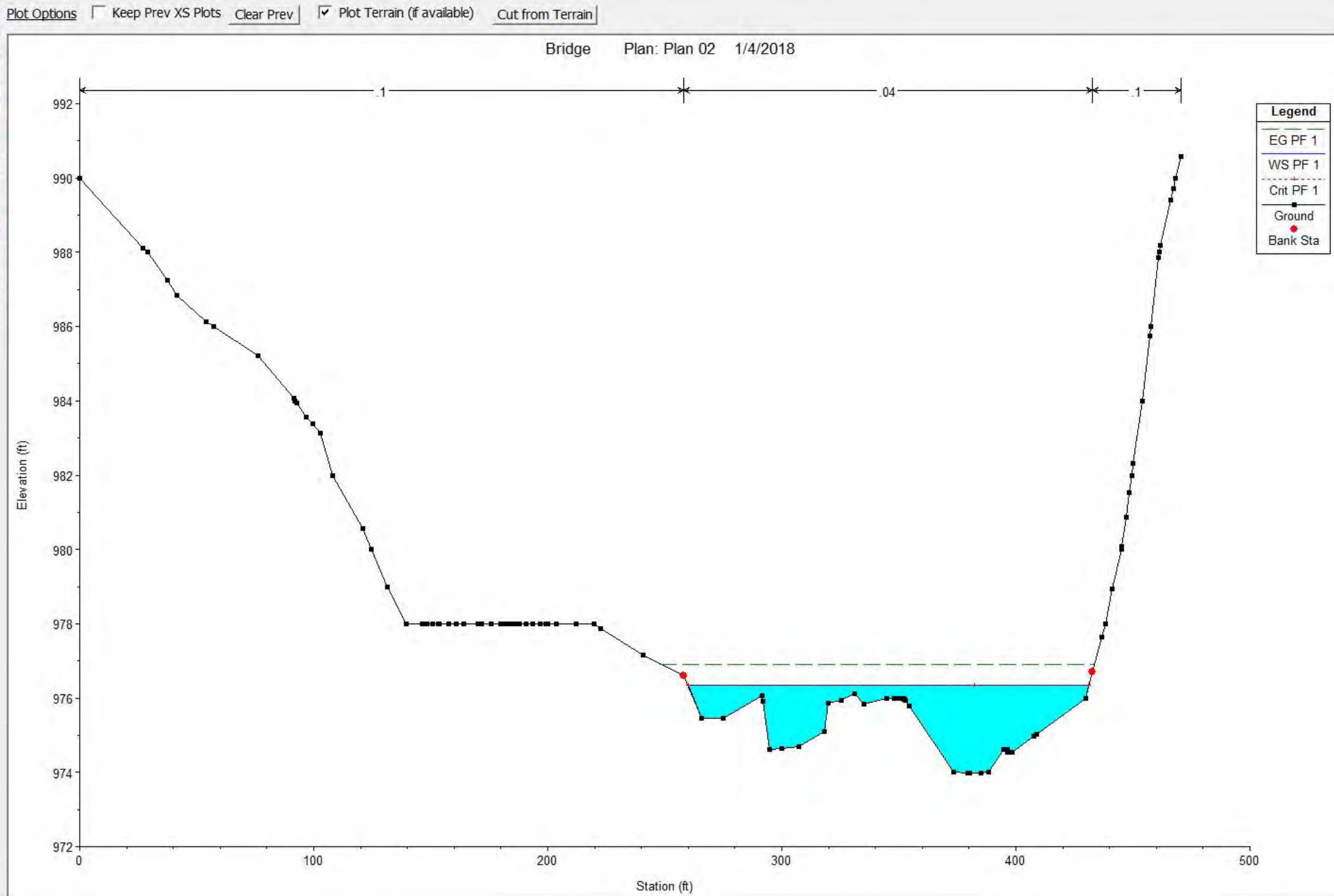
LOB	Channel	ROB
0.1	0.04	0.1

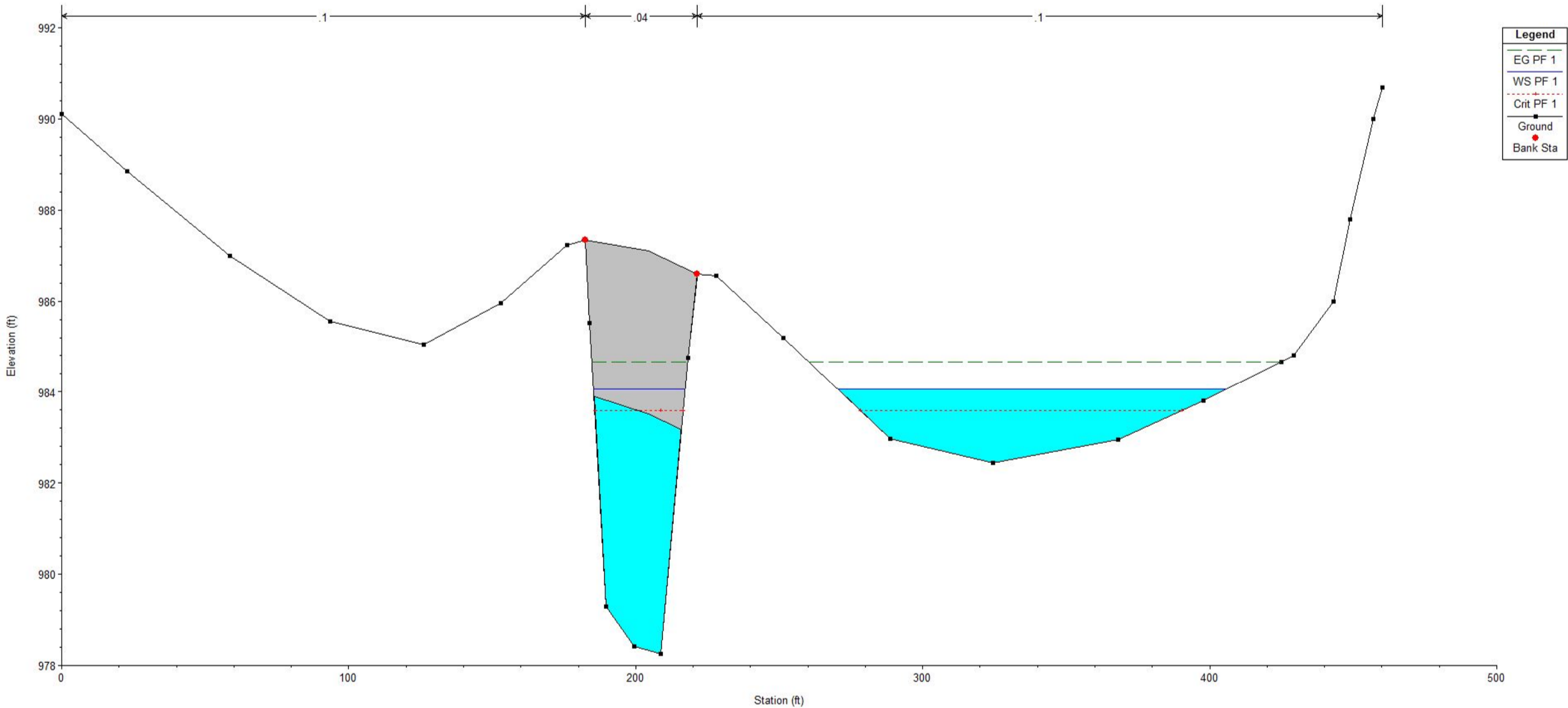
Main Channel Bank Stations

Left Bank	Right Bank
258	432.79

Cont\Exp Coefficient (Steady

Contraction	Expansion
0.1	0.3





Proposed Bridge Downstream

Bridge Plan: Plan 02 1/9/2018

