ENGINEERING

PLANNING

SURVEYING

A HYDRAULIC ANALYSIS

OF THE
PROPOSED

EAST BRANCH TRIBUTARY B BRIDGE AT PHEASANT POINT

FOR

DOMINION PROPERTIES
1714 DEER TRACK TRAIL
ST. LOUIS, MO 63131
(314) 965-5565

AS A PART OF THE

PHEASANT POINT APARTMENT COMPLEX

BAX PROJECT NO.: 95-7218B

MARCH 1999
REVISED DECEMBER 1999

BAX ENGINEERING CO., INC.
1052 South Cloverleaf Drive
St. Peters, MO 63376-6445
314-928-5552
FAX 314-928-1718

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PURPOSE

Dominion Properties, Inc. is planning the development of an apartment complex, Pheasant Point Apartments, in the city limits of O'Fallon, Missouri. The proposed complex is located on Pheasant Meadow Drive (which was completed in Phase I of the overall development of the project) on the east side of Highway K (see Figure 1 for a location map). To access the development, Pheasant Meadow Drive will be extended across East Branch Tributary B, which empties into Dardenne Creek approximately one-half mile downstream.

Access to Pheasant Point Apartments will require a bridge to cross East Branch Tributary B. At the crossing, the proposed bridge and associated roadway must traverse approximately 500 feet of the 100-year floodway and 950 feet of the 100-year floodplain, as established by the Federal Emergency Management Agency (FEMA) Study dated August 2, 1996. Since a single bridge span length of 500 feet or more is not economically feasible, construction within the 100-year floodway is proposed.

In March 1999, a hydraulic study was completed and a report was prepared which documented the results of the study. The study was approved by the City of O'Fallon on April 27, 1999 (see Appendix A). As a stipulation to the approval of the study, the City requested that the U.S. Army Corps of Engineers be contacted for their determination as to any required mitigation associated with the proposed channel improvements. Based upon this request, Dominion Properties contracted with SCI Engineering to investigate the site for wetlands and make recommendations. SCI Engineering found wetlands adjacent to the watercourse and, after coordination with the U.S. Army Corps of Engineers and the Missouri Department of Natural Resources, recommended that the channel improvements be limited to approximately 200 feet upstream and downstream of the proposed bridge for a total length of 400 feet.

Given the findings and recommendation from the wetlands investigation, Bax Engineering revised the hydraulic analysis for the proposed bridge crossing and channel improvements. The purpose of this report is to document the revised hydraulic study. The goal of the analysis was to determine the minimum length bridge with associated channel improvements which satisfies the City of O'Fallon's requirements and preserves the wetlands in accordance with the recommendations of the U.S. Army Corps of Engineers and the Missouri Department of Natural Resources.

SCOPE

In performing the hydraulic analysis presented herein, Bax Engineering completed the following tasks:

1) Obtained the Federal Emergency Management Agency (FEMA) data including flowrates, flood elevations, and floodway & floodplain limits for the study area.
2) Contacted Baker Civil (repository for FEMA) and the U.S. Army Corps of Engineers for pertinent existing conditions model data.
3) Performed a wetlands investigation (performed by SCI Engineering)

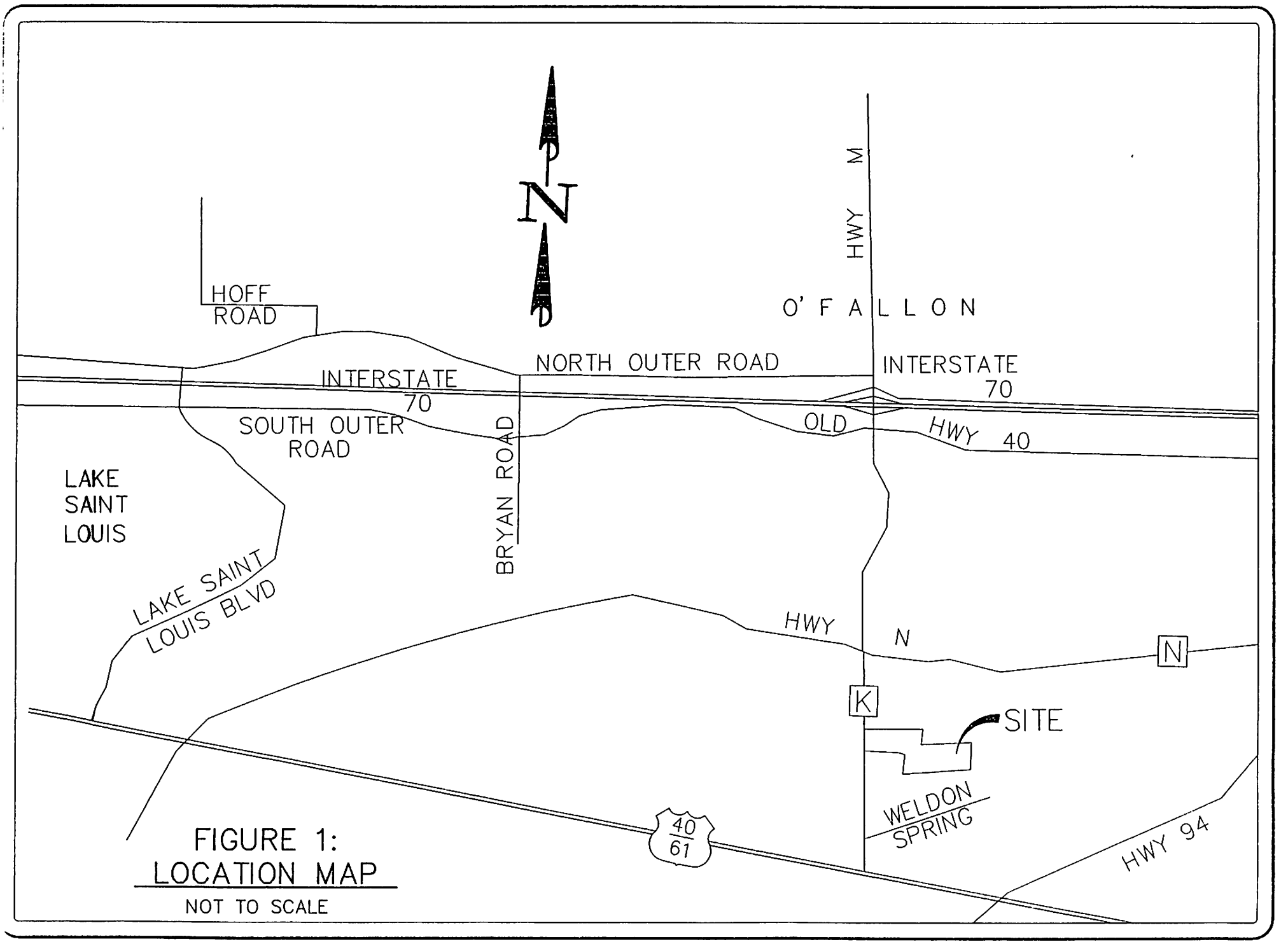


FIGURE 1:
LOCATION MAP

NOT TO SCALE

4) Created and calibrated a HEC-RAS computer model for existing conditions.
5) Created a HEC-RAS computer model for the proposed bridge and roadway.
6) Summarized the results of this analysis in a report.

EXISTING CONDITIONS HEC-RAS MODEL

Federal Emergency Management Agency (FEMA) Flood Data

From the study sponsored by FEMA, the 100-Year Flood Zone, 100-Year peak discharge, 100-Year water surface elevations, and stream bed slope were obtained. The 100-Year Flood Zone is shown in Appendix B. The 100-Year peak discharge is 7,195 cubic feet per second. It is assumed that the peak discharge does not vary within the model limits. The water surface elevations are shown in Appendix B. The stream bed slope is estimated to be 19.5 feet per mile (0.37%).

Previously Completed Existing Conditions Model Data

On June 24, 1998, Bax Engineering contacted Baker Civil for information on the flood study for East Branch Tributary B. On July 1, 1998, a letter received from Baker Civil stated that no input data was available for the study area. The letter recommended that the U.S. Army Corps of Engineers, St. Louis District, should be contacted.

Bax Engineering contacted Mr. Ron Diekmann of the U.S. Army Corps of Engineers, St. Louis District, for input data for the study area. Mr. Diekmann stated that no information was available for East Branch Tributary B. Therefore, no input data from the previously conducted hydraulic analysis of the study area was obtained.

Cross Section Data

Since input data from the hydraulic study that generated the results published in the FEMA information was not available, the cross section data for the existing conditions model was established from available resources. The cross section station and elevation data was taken from topographics generated from aerial photography performed by SURDEX Corporation dated July 3, 1998. Based on a field review, the Manning's n values were estimated using values published in "Open-Channel Hydraulics" by Chow. See attached Appendix C which depicts existing elevation data.

Model Calibration and Summary of Results

Using the available data, a HEC-RAS computer model was created and calibrated to the existing conditions. The Bax existing conditions model and FEMA study 100-Year flood profiles appear to agree to within an acceptable margin of error. The results of the Bax existing conditions model are summarized in Table 1. The existing conditions model input, output, and cross section plots are contained in Appendix C.

Table 1: 100-Year Water Surface Elevations for the FEMA Model and the Calibrated Existing Conditions Model

Cross Section Location		100-Yr. Water Surface Elevation		
River Mile	River Station	FEMA Model (Estimated)	Bax Existing Conditions Model	Absolute Error
0.600	3168	482.30	482.29	-0.01
0.582	3075	482.00	482.11	+0.11
0.549	2900	482.00	481.99	-0.01
0.526	2775	482.00	481.91	-0.09
0.492	2600	481.95	481.73	-0.22
0.473	2500	481.90	481.67	-0.23
0.440	2325	481.75	481.45	-0.30
0.388	2050	481.60	481.29	-0.31
0.322	1700	481.20	481.15	-0.05
0.303	1600	481.10 [A]	481.10 [A]	0.00

Note: [A] Starting water surface elevation.

PROPOSED CONDITIONS HEC-RAS MODEL

Several HEC-RAS computer models were developed to determine a bridge length and associated channel improvements to satisfy the requirements of the City of O'Fallon, the U.S. Army Corps of Engineers, and the Missouri Department of Natural Resources. The requirements, as understood, are no rise if considering fill within the floodway only or less than one foot of rise when considering the combined fill within the floodway and floodway fringe (floodplain). This study considers all fill proposed, and, therefore, a rise of less than one foot is required as approved by the City. Furthermore, the study assumes the floodway fringe downstream is filled. Thus, the starting water surface elevation used is that which corresponds to elevation resulting from full encroachment to the floodway downstream (in this case, the elevation is 0.8 feet higher than the 100-year base flood elevation).

In an effort to accommodate all of the parties involved in this project, Bax Engineering developed a proposed bridge and grading plan which provides a compromise solution which attempts to satisfy requirements the City of O'Fallon and the U.S. Army Corps of Engineers. The solution presented utilizes a bridge with a length of 140 feet and channel improvements with a total length of approximately 520 feet that produces an anticipated flood profile less than one foot higher than the 100-year base flood profile.

As stated previously, SCI Engineering in coordination with the U.S. Army Corps of Engineers and the Missouri Department of Natural Resources restricted the channel improvements to 200 feet upstream and downstream of the proposed bridge. The channel

improvements utilized will necessitate channel grading approximately 220 feet upstream and approximately 300 feet downstream. This grading results in a total length of bank disturbance of approximately 520 feet.

As previously stated, the proposed design does indicate an increase in the base flood profile. However, the Federal Emergency Management Agency and the City of O'Fallon allows for an increase of up to one foot when the floodplain is filled to the limits of the floodway. The design produces an anticipated flood profile that is less than one foot higher than the base flood elevation as the result of the combined effects of fill in the floodplain and floodway. The property in the floodplain that is not proposed to be filled will be placed in a permanent drainage easement to ensure no future development. This scenario protects the upstream property owners from future flood hazard and preserves the concept of a floodway with floodplain development. The proposed 100-year water surface elevations and the increase above the existing conditions elevations are summarized in the Table 2. The HEC-RAS input, output, and cross section plots for the proposed conditions are contained in Appendix D.

Table 2: 100-Year Water Surface Elevations for the Bax Existing Conditions Model and the Proposed Conditions Model

Cross Section Location		**100-Yr. Water Surface Elevation**		
River Mile	**River Station**	**Bax Existing Conditions Model**	**Bax Proposed Conditions Model**	**W.S.E. Change**
0.600	3168	482.29	482.68	+0.39
0.582	3075	482.11	482.49	+0.38
0.549	2900	481.99	482.64	+0.65
0.526	2775	481.91	482.63	+0.72
0.492	2600	481.73	482.35	+0.62
BRIDGE				
0.473	2500	481.67	482.22	+0.55
0.440	2325	481.45	482.20	+0.75
0.421	2225	---	482.12	---
0.388	2050	481.29	482.15	+0.86
0.322	1700	481.15	482.07	+0.92
0.379	1600	481.10 [A]	481.90 [B]	+0.80

Notes: [A] Starting water surface elevation for flood profile without encroachment
[B] Starting water surface elevation for flood profile with encroachment to floodway limits

CONCLUSIONS

The proposed Pheasant Point Apartments bridge and channel improvements will require construction within the 100-Year floodway. Consequently, the anticipated flood profile produces an increase above the base flood elevations but does not exceed a one foot rise which would result from the floodplain being filled to the floodway limits. Additionally, since a permanent drainage easement will be provided that will prevent all future fill in the floodplain within the property limits, and the estimated flood profile increase is less than one foot, the flood hazard associated with this project will be reduced somewhat. Furthermore, in an effort to satisfy the concerns of the U.S. Army Corps of Engineers, channel improvements have been designed to minimize the length of bank disturbance to approximately 520 feet.

APPENDIX A

CITY OF O'FALLON LETTER OF APPROVAL

100 NORTH MAIN STREET
O'FALLON, MISSOURI 63366
636.240.2000
FACSIMILE 636.978.4144

April 27, 1999

Sean Martin
Bax Engineering
1052 South Cloverleaf Drive
St. Peters, MO 63376

RE: Pheasant Point Apartments Hydraulic Analysis

Dear Mr. Martin:

The hydraulic analysis for Pheasant Point Apartments has been reviewed and approved. The study shows the proposed changes will cause no rise in the 100-year stormwater levels in any off-site property. In conjunction with this approval, please contact the Federal Emergency Management Agency (FEMA) for a Letter of Map Revision (LOMR) based on your study and provide the City with a copy of this submittal. Also, contact the U.S. Army Corps of Engineers for their determination as to any required mitigation and forward a copy of all necessary approvals to the City.

If you have any further questions, please call me at 240-2000.

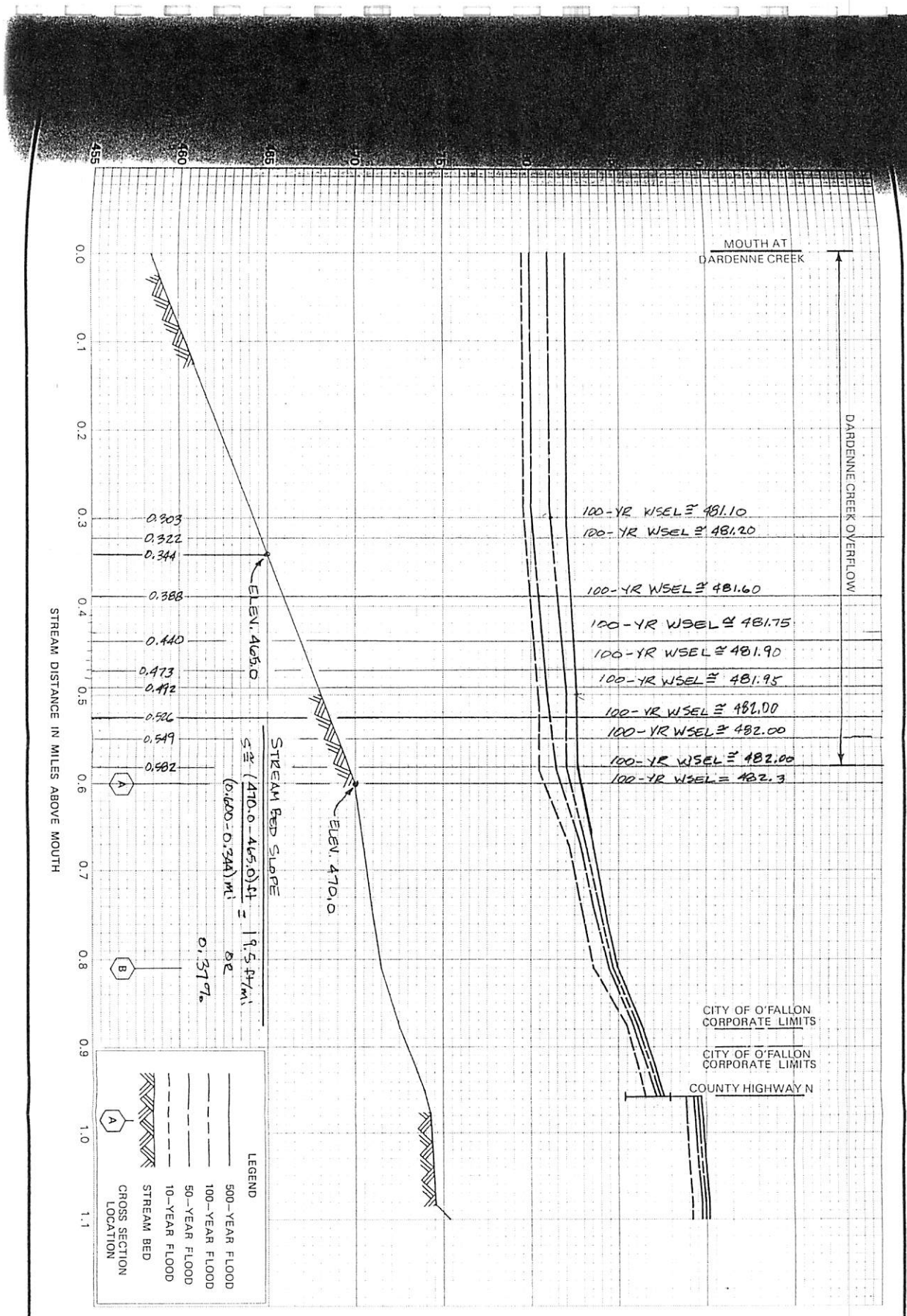
Sincerely,

Chris Linneman, E.I.T.
Engineer III

cc P. Banger, D. Woods, J. Heitkamp, T. Criswell, File thru F. Godwin

APPENDIX B

FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD DATA



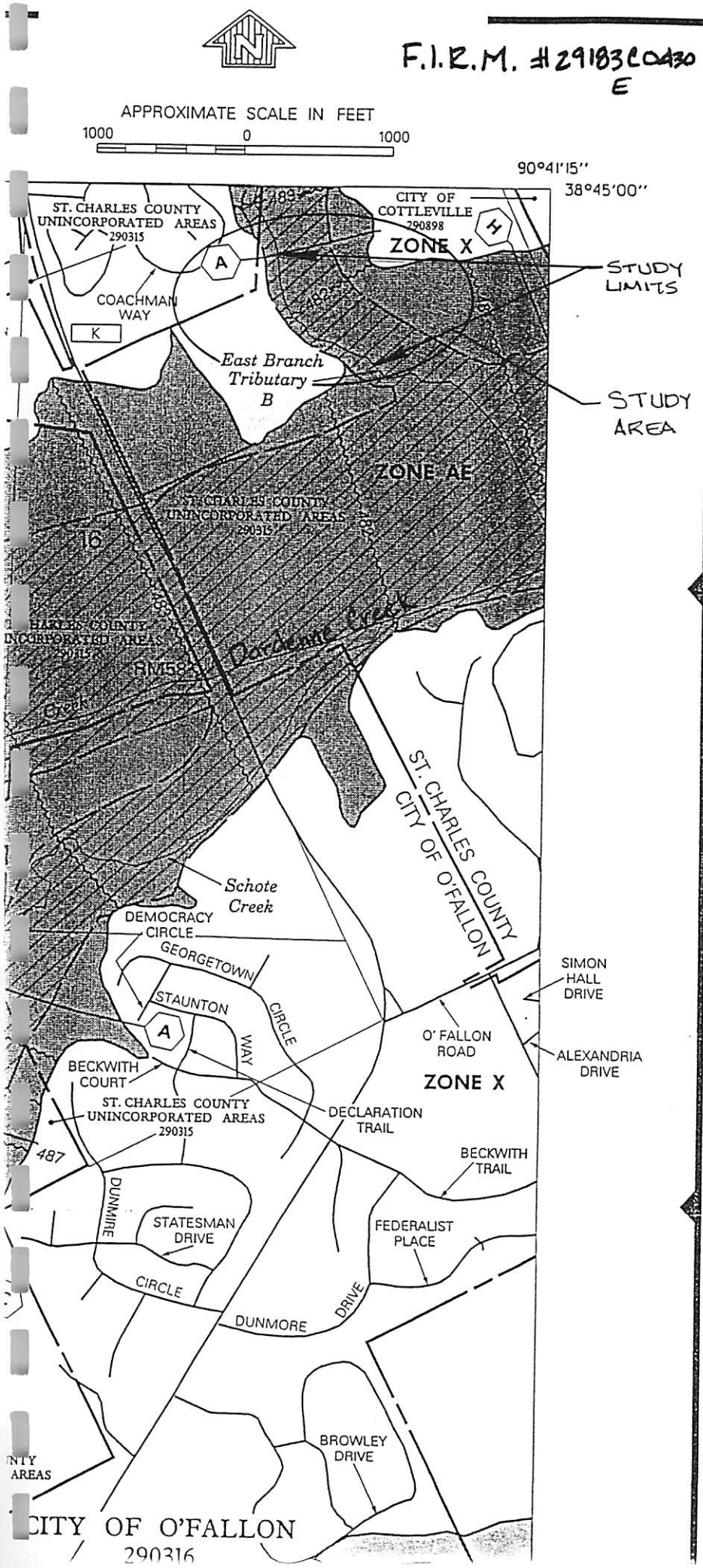
FEDERAL EMERGENCY MANAGEMENT AGENCY

ST. CHARLES COUNTY, MO
AND INCORPORATED AREAS

FLOOD PROFILES

EAST BRANCH TRIBUTARY B

F.I.R.M. #29183C0430 E



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100–YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be protected from 100–year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500–year flood; areas of 100–year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100–year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500–year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 — Elevation Reference Mark

M2 — River Mile

97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of Special Flood Hazard (100–year flood) include Zones A, AE, AH, AO, A99, V, and VE.

TABLE 1 - SUMMARY OF DISCHARGES (Continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
TRIBUTARY A					
at mouth	6.08	5,980	8,220	9,360	10,570
at Dingledine Road	1.85	1,980	2,970	3,400	4,390
about 0.14 mile upstream of Gregory Lane	0.12	200	290	330	425
TRIBUTARY NO. 3					
at mouth	0.70	630	950	1,090	1,390
TRIBUTARY NO. 4					
at mouth	1.69	1,620	2,480	2,860	3,740
at St. Peters Road	1.56	1,205	1,830	2,100	2,730
about 0.14 mile upstream of Woodstream Drive	1.04	1,100	1,670	1,920	2,490
EAST BRANCH TRIBUTARY B					
about 0.60 mile upstream of mouth	4.43	4,535	6,375	7,195	8,050
downstream of confluence of West Branch Tributary B	3.95	4,590	6,255	6,990	7,740
upstream of confluence of West Branch Tributary B	1.61	2,390	3,245	3,620	3,965
about 0.3 mile upstream of confluence of West Branch Tributary B	1.06	1,670	2,270	2,540	2,800
at County Highway K	0.55	740	1,005	1,120	1,230
WEST BRANCH TRIBUTARY B					
at mouth	2.19	1,460	2,350	2,810	3,810
about 0.69 mile upstream of mouth	1.82	1,345	2,180	2,605	3,520
about 1.26 miles upstream of mouth	1.16	840	1,340	1,605	2,170
about 2.02 miles upstream of mouth	0.59	505	830	990	1,360

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
EAST BRANCH TRIBUTARY B								
A	0.600	465	1820	4.0	482.3	482.3	483.3	1.0
B	0.808	345	1314	5.4	484.7	484.7	485.6	0.9
C	1.264	250	991	3.2	492.6	492.6	493.3	0.7
D	1.453	247	755	3.4	498.9	498.9	499.6	0.7
E	1.718	57	323	5.5	506.5	506.5	507.2	0.7
WEST BRANCH TRIBUTARY B								
A	0.284	250	981	2.9	493.8	493.8	494.8	1.0
B	0.691	75	345	7.5	499.7	499.7	500.7	1.0
C	1.256	79	246	6.5	513.8	513.8	514.5	0.7
D	1.746	54	249	4.0	533.9	533.9	533.9	0.0
E	2.017	27	92	10.7	548.0	548.0	548.0	0.0
TRIBUTARY A								
A	0.30	895	3201	2.9	469.7	463.5[2]	464.5	1.0
B	0.90	479	1993	4.3	470.8	470.8	471.6	0.8
C	1.80	253	1234	4.2	483.0	483.0	483.2	0.2
D	2.67	73	309	8.8	497.4	497.4	497.4	0.0
E	2.80	297	767	3.5	502.9	502.9	503.5	0.6
TRIBUTARY NO. 1								
A	4.2	281	1316	1.6	461.0	453.8[2]	454.8	1.0

[1]MILES ABOVE MOUTH
[2]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM DARDENNE CREEK

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

ST. CHARLES COUNTY, MO
AND INCORPORATED AREAS

FLOODWAY DATA

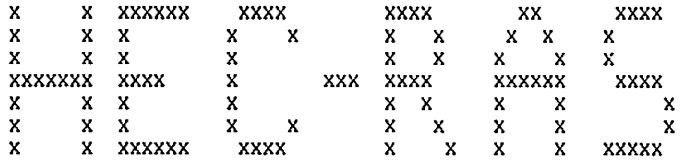
EAST BRANCH TRIBUTARY B–WEST BRANCH TRIBUTARY B–TRIBUTARY A–TRIBUTARY NO. 1

APPENDIX C

EXISTING CONDITIONS HEC-RAS MODEL

- INPUT
- OUTPUT
- CROSS SECTION PLOTS

HEC-RAS Version 2.0 April 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104



PROJECT DATA
Project Title: 7218b-Pheasant Point Bridge-REV11/08/99
Project File : 7218b-rv.prj
Run Date and Time: 11/29/99 8:07:42 AM

Project in English units

PLAN DATA

Plan Title: BAX EXISTING CONDITIONS MODEL
Plan File : c:\hec\ras\data\7218re~1\7218b-rv.p17

Geometry Title: BAX EXISTING CONDITIONS GEOMETRY
Geometry File : c:\hec\ras\data\7218re~1\7218b-rv.g15

Flow Title : 100-YR FLOW DATA
Flow File : c:\hec\ras\data\7218re~1\7218b-rv.f01

Plan Summary Information:
Number of: Cross Sections = 10 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 100-YR FLOW DATA
Flow File : c:\hec\ras\data\7218re~1\7218b-rv.f01

Flow Data (cfs)

River	Reach	RS	100-YR
E. Branch Trib.	Pheasant Point	3168	7195

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
E. Branch Trib.	Pheasant Point	100-YR		Known WS = 481.1

GEOMETRY DATA

Geometry Title: BAX EXISTING CONDITIONS GEOMETRY
Geometry File : c:\hec\ras\data\7218re~1\7218b-rv.g15

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 3168

INPUT
Description: Upstream Control Section - FEMA Section "A"
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	31.8	484	70.6	482	149.3	480	192.6	479.6
302	479.6	520	478.7	593.1	480	632.2	480	671.6	478
703.5	476	705.6	474	707.6	472	709.5	470	725.7	470
730	472	734.1	474	738.2	476	745.3	478	754.1	480
767.2	482	785	484	798.9	486				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	632.2	.04	734.1	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
632.2	754.1	85	93	65	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.030	0.042	0.050
E.G. Elev (ft)	482.46	Reach Len. (ft)	85.00	93.00	65.00
Crit W.S. (ft)		Flow Area (sq ft)	1496.19	736.45	17.35
E.G. Slope (ft/ft)	0.001006	Area (sq ft)	1496.19	736.45	17.35
Q Total (cfs)	7195.00	Flow (cfs)	4485.39	2692.27	17.33
Top Width (ft)	704.95	Top Width (ft)	567.32	121.90	15.72
Vel Total (ft/s)	3.20	Avg. Vel. (ft/s)	3.00	3.66	1.00
Max Chl Dpth (ft)	12.29	Hydr. Depth (ft)	2.64	6.04	1.10
Conv. Total (cfs)	226901.1	Conv. (cfs)	141451.1	84903.4	546.7
Length Wtd. (ft)	87.93	Wetted Per. (ft)	567.37	126.37	15.89
Min Ch El (ft)	470.00	Shear (lb/sq ft)	0.17	0.37	0.07
Alpha	1.04	Stream Power (lb/ft s)	0.50	1.34	0.07
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	49.71	21.51	20.77
C & E Loss (ft)	0.01	Cum SA (acres)	19.69	2.72	6.56

Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 3075

INPUT
Description: RIVER MILE 0.582
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	22	484.1	41.62	484	68.2	482	97.49	480
142.6	479.1	195.9	479	269.4	479.4	520	479.7	521.5	480
545.6	480.5	606.9	480.7	693.6	480	696.5	478	699.5	476
702.5	474	705.6	472	708.7	470	709.2	469.65	726.5	469.65
727.4	470	732.6	472	737.8	474	743.1	476	747.8	478
752.6	480	757.4	482	775.4	484	795.2	486		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	693.6	.04	737.8	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
693.6	752.6	125	175	190	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
W.S. Elev (ft)	482.11	Element			
Vel Head (ft)	0.24	Wt. n-Val.	0.030	0.043	0.050
E.G. Elev (ft)	482.35	Reach Len. (ft)	125.00	175.00	190.00
Crit W.S. (ft)		Flow Area (sq ft)	1461.23	523.01	5.39
E.G. Slope (ft/ft)	0.001278	Area (sq ft)	1461.23	523.01	5.39
Q Total (cfs)	7195.00	Flow (cfs)	4547.17	2642.62	5.21
Top Width (ft)	691.70	Top Width (ft)	626.89	59.00	5.81
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)	3.11	5.05	0.97
Max Chl Dpth (ft)	12.46	Hydr. Depth (ft)	2.33	8.86	0.93
Conv. Total (cfs)	201301.6	Conv. (cfs)	127220.7	73935.1	145.9
Length Wtd. (ft)	141.63	Wetted Per. (ft)	627.01	64.10	6.21
Min Ch El (ft)	469.65	Shear (lb/sq ft)	0.19	0.65	0.07
Alpha	1.19	Stream Power (lb/ft s)	0.58	3.29	0.07
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	46.82	20.16	20.76
C & E Loss (ft)	0.02	Cum SA (acres)	18.53	2.53	6.54

Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2900

INPUT
Description: RIVER MILE 0.549
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	21.8	484.8	41.9	484	59.9	482	76.4	480
99.1	479	148.9	478.9	170.6	478.7	226.3	478.6	288.6	478.9
333	478.9	407.1	479	456.9	479.3	512	479.4	549.1	479.5
593.1	480	633.2	480.6	685.1	480	691.3	478	702.6	476
705.6	474	708.5	472	711.3	470	712.7	469	724	469
726	470	730.1	472	734.1	474	738.1	476	742.2	478
746.2	480	755.4	482	767.6	484	785.8	486		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	685.1	.04	746.2	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
685.1	746.2	100	125	145	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	481.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.030	0.040	0.050
E.G. Elev (ft)	482.18	Reach Len. (ft)	100.00	125.00	145.00
Crit W.S. (ft)		Flow Area (sq ft)	1679.10	483.40	9.11
E.G. Slope (ft/ft)	0.000992	Area (sq ft)	1679.10	483.40	9.11
Q Total (cfs)	7195.00	Flow (cfs)	5061.05	2125.58	8.37
Top Width (ft)	695.37	Top Width (ft)	625.12	61.10	9.15
Vel Total (ft/s)	3.31	Avg. Vel. (ft/s)	3.01	4.40	0.92
Max Chl Dpth (ft)	12.99	Hydr. Depth (ft)	2.69	7.91	1.00
Conv. Total (cfs)	228425.9	Conv. (cfs)	160677.5	67482.6	265.7
Length Wtd. (ft)	107.74	Wetted Per. (ft)	625.27	66.36	9.37
Min Ch El (ft)	469.00	Shear (lb/sq ft)	0.17	0.45	0.06
Alpha	1.10	Stream Power (lb/ft s)	0.50	1.98	0.06
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	42.32	18.14	20.73
C & E Loss (ft)	0.01	Cum SA (acres)	16.73	2.29	6.51

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2775

INPUT
Description: RIVER MILE 0.526
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	18.7	485.8	34.9	484	51.8	482	67.7	480
90	478.6	136.9	478.7	201	478.5	258.5	478.8	328	479.1
417.8	479.4	490	479.1	537.6	479.5	598.9	479.6	639.1	480
654.2	480	660.9	478	670.7	476	684.7	474	688.4	472
692.7	470	695.8	468.55	702.8	468.55	706.9	470	712.5	472
717.8	474	723.1	476	728.3	478	745.9	480	788.5	482
811.7	484	828.9	486						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	654.2	.04	788.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
654.2	788.5	150	175	185	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
W.S. Elev (ft)	481.91	Element			
Vel Head (ft)	0.15	Wt. n-Val.	0.030	0.040	
E.G. Elev (ft)	482.06	Reach Len. (ft)	150.00	175.00	185.00
Crit W.S. (ft)		Flow Area (sq ft)	1646.69	689.77	
E.G. Slope (ft/ft)	0.000937	Area (sq ft)	1646.69	689.77	
Q Total (cfs)	7195.00	Flow (cfs)	4882.69	2312.31	
Top Width (ft)	734.18	Top Width (ft)	601.71	132.46	
Vel Total (ft/s)	3.08	Avg. Vel. (ft/s)	2.97	3.35	
Max Chl Dpth (ft)	13.36	Hydr. Depth (ft)	2.74	5.21	
Conv. Total (cfs)	235100.9	Conv. (cfs)	159544.9	75556.0	
Length Wtd. (ft)	156.58	Wetted Per. (ft)	601.88	136.22	
Min Ch El (ft)	468.55	Shear (lb/sq ft)	0.16	0.30	
Alpha	1.01	Stream Power (lb/ft s)	0.47	0.99	
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	38.50	16.46	20.71
C & E Loss (ft)	0.00	Cum SA (acres)	15.32	2.01	6.49

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2600

INPUT
Description: RIVER MILE 0.492
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	14.3	484	28.7	482	43.2	480	92.3	478.6
131.9	478.2	260.1	478.4	305.1	478.7	319.4	478	371.6	478.6
433.6	479.1	513.4	479.1	595	479.1	638.8	480	653.3	480
655.6	478	657.2	476	658.8	474	660.5	472	662.1	470
663.8	467.89	672.1	467.89	675.9	470	679.5	472	683.1	474
686.7	476	690.3	478	693.9	480	697.5	482	734.7	484
746.1	486								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	653.3	.04	686.7	.05	734.7	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
653.3	697.5	80	100	100	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	481.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.030	0.042	
E.G. Elev (ft)	481.91	Reach Len. (ft)	80.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)	1796.17	365.67	
E.G. Slope (ft/ft)	0.001006	Area (sq ft)	1796.17	365.67	
Q Total (cfs)	7195.00	Flow (cfs)	5717.11	1477.89	
Top Width (ft)	666.36	Top Width (ft)	622.65	43.71	
Vel Total (ft/s)	3.33	Avg. Vel. (ft/s)	3.18	4.04	
Max Chl Dpth (ft)	13.84	Hydr. Depth (ft)	2.88	8.36	
Conv. Total (cfs)	226847.5	Conv. (cfs)	180251.8	46595.7	
Length Wtd. (ft)	83.93	Wetted Per. (ft)	622.82	52.87	
Min Ch El (ft)	467.89	Shear (lb/sq ft)	0.18	0.43	
Alpha	1.03	Stream Power (lb/ft s)	0.58	1.76	
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	32.57	14.34	20.71
C & E Loss (ft)	0.01	Cum SA (acres)	13.22	1.66	6.49

Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2500

INPUT
Description: RIVER MILE 0.473
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
5.4	486	18.1	484	30	482	43.9	480	104.3	478.3
147.8	478.4	215.4	478.1	292.5	478.1	348	478.2	402.3	478.3
463.1	478.3	555.5	478.6	607.9	480	650	480.3	662.8	480.4
695.7	480	697.7	478	699.6	476	701.6	474	703.6	472
705.5	470	707.9	467.52	716.2	467.52	719.8	470	722.7	472
725.5	474	728.4	476	731.2	478	733.8	480	736.4	482
743.2	484	756.8	486						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
5.4	.03	650	.05	701.6	.04	725.5	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
695.7	733.8	100	175	185	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	481.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.030	0.044	0.050
E.G. Elev (ft)	481.82	Reach Len. (ft)	100.00	175.00	185.00
Crit W.S. (ft)		Flow Area (sq ft)	1947.88	354.55	1.81
E.G. Slope (ft/ft)	0.000868	Area (sq ft)	1947.88	354.55	1.81
Q Total (cfs)	7195.00	Flow (cfs)	5845.92	1347.88	1.20
Top Width (ft)	703.65	Top Width (ft)	663.39	38.10	2.17
Vel Total (ft/s)	3.12	Avg. Vel. (ft/s)	3.00	3.80	0.66
Max Chl Dpth (ft)	14.15	Hydr. Depth (ft)	2.94	9.31	0.83
Conv. Total (cfs)	244255.5	Conv. (cfs)	198457.0	45757.8	40.7
Length Wtd. (ft)	115.78	Wetted Per. (ft)	663.55	47.33	2.73
Min Ch El (ft)	467.52	Shear (lb/sq ft)	0.16	0.41	0.04
Alpha	1.03	Stream Power (lb/ft s)	0.48	1.54	0.02
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	29.13	13.51	20.71
C & E Loss (ft)	0.01	Cum SA (acres)	12.04	1.56	6.49

Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2325

INPUT
Description: RIVER MILE 0.440
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	11.9	484	24	482	39.7	480	70	478.5
108.9	478.3	183.7	478.2	237.1	478.3	322.9	479.2	401.2	479.6
477.4	479.4	542.2	479.3	598.8	479.7	646	479.3	685.2	480
719.3	480	721.1	478	722.7	476	724.4	474	726	472
727.7	470	730.4	466.88	736.9	466.88	741.4	470	744.3	472
747.2	474	750.1	476	753	478	755.8	480	758.7	482
761.5	484	767	486						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	685.2	.05	724.4	.04	747.2	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
719.3	755.8	205	275	275	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	481.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.030	0.044	0.050
E.G. Elev (ft)	481.68	Reach Len. (ft)	205.00	275.00	275.00
Crit W.S. (ft)		Flow Area (sq ft)	1604.02	335.49	1.53
E.G. Slope (ft/ft)	0.001585	Area (sq ft)	1604.02	335.49	1.53
Q Total (cfs)	7195.00	Flow (cfs)	5517.10	1676.62	1.28
Top Width (ft)	729.60	Top Width (ft)	690.99	36.50	2.10
Vel Total (ft/s)	3.71	Avg. Vel. (ft/s)	3.44	5.00	0.84
Max Chl Dpth (ft)	14.57	Hydr. Depth (ft)	2.32	9.19	0.73
Conv. Total (cfs)	180749.6	Conv. (cfs)	138598.0	42119.4	32.2
Length Wtd. (ft)	224.53	Wetted Per. (ft)	691.14	46.70	2.56
Min Ch El (ft)	466.88	Shear (lb/sq ft)	0.23	0.71	0.06
Alpha	1.08	Stream Power (lb/ft s)	0.79	3.55	0.05
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	25.06	12.13	20.70
C & E Loss (ft)	0.03	Cum SA (acres)	10.48	1.41	6.48

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.
Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2050

INPUT
Description: RIVER MILE 0.388
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	12.4	484	31.3	482	52.7	480.4	71.1	480
108.9	479	157	478.6	238.2	478.2	347.6	478.8	395.5	479.4
444.8	479.1	498.7	478.7	555	479	604.1	478.3	684.1	478.5
737.2	478.7	813	478	827.7	476	834.5	474	841.2	472
847.9	470	851.2	465.86	859.9	465.86	867.8	470	871.6	472
875.5	474	879.4	476	883.3	478	905	478.4	945.2	479.5
1014.4	480	1048.7	482	1062.1	484	1078.5	486		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	813	.05	841.2	.04	871.6	.05	905	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
813	883.3	270	350	355	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
900	1078.5	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	481.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.030	0.046	0.050
E.G. Elev (ft)	481.42	Reach Len. (ft)	270.00	350.00	355.00
Crit W.S. (ft)	479.80	Flow Area (sq ft)	1951.01	626.90	52.38
E.G. Slope (ft/ft)	0.000733	Area (sq ft)	1951.01	626.90	281.99
Q Total (cfs)	7195.00	Flow (cfs)	4854.06	2250.63	90.30
Top Width (ft)	995.73	Top Width (ft)	772.21	70.30	153.23
Vel Total (ft/s)	2.74	Avg. Vel. (ft/s)	2.49	3.59	1.72
Max Chl Dpth (ft)	15.43	Hydr. Depth (ft)	2.53	8.92	3.14
Conv. Total (cfs)	265693.8	Conv. (cfs)	179248.8	83110.4	3334.6
Length Wtd. (ft)	305.02	Wetted Per. (ft)	772.28	76.26	16.70
Min Ch El (ft)	465.86	Shear (lb/sq ft)	0.12	0.38	0.14
Alpha	1.10	Stream Power (lb/ft s)	0.29	1.35	0.25
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	16.69	9.09	19.81
C & E Loss (ft)	0.01	Cum SA (acres)	7.04	1.08	5.99

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 1700

INPUT
Description: RIVER MILE 0.322
Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	13.9	484	33.5	482	58.9	480	103.3	478.4
128.6	478.2	209.9	478.2	256.5	479.1	321.9	478.4	378	478.7
426.3	478.1	501.3	478.1	553.3	478.7	615.9	479.3	687.1	479.5
741.6	479.9	806.5	479.5	825	478.2	851.9	478	855.6	476
859.2	474	862.9	472	867.4	470	873	468	879.3	466
883.8	464.57	892	464.57	895.8	466	901.1	468	906.2	470
911.6	472	916.9	474	922.2	476	930	476.2	977.1	477.7
1212.1	477.7	1830	477.7	1835.1	486				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	825	.05	873	.04	901.1	.05	930	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
851.9	977.1	115	100	90	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
1080	1835.1	486

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
W.S. Elev (ft)	481.15	Element			
Vel Head (ft)	0.09	Wt. n-Val.	0.031	0.041	0.030
E.G. Elev (ft)	481.24	Reach Len. (ft)	115.00	100.00	90.00
Crit W.S. (ft)	477.30	Flow Area (sq ft)	1889.94	1043.26	355.29
E.G. Slope (ft/ft)	0.000414	Area (sq ft)	1889.94	1043.26	2948.49
Q Total (cfs)	7195.00	Flow (cfs)	3293.85	3082.97	818.19
Top Width (ft)	1787.86	Top Width (ft)	807.64	125.20	855.02
Vel Total (ft/s)	2.19	Avg. Vel. (ft/s)	1.74	2.96	2.30
Max Chl Dpth (ft)	16.58	Hydr. Depth (ft)	2.34	8.33	3.45
Conv. Total (cfs)	353513.5	Conv. (cfs)	161837.3	151476.1	40200.1
Length Wtd. (ft)	105.29	Wetted Per. (ft)	807.79	130.15	102.90
Min Ch El (ft)	464.57	Shear (lb/sq ft)	0.06	0.21	0.09
Alpha	1.20	Stream Power (lb/ft s)	0.11	0.61	0.21
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	4.79	2.38	6.64
C & E Loss (ft)	0.00	Cum SA (acres)	2.14	0.29	1.88

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Manning's n values were composited to a single value in the main channel.
Note - Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 1600

INPUT
Description: RIVER MILE 0.303
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	13.8	484	31	482	49.5	480	107.9	478.4
150	478.4	150	478.1	201.7	478.2	251.4	479.1	320.3	479.3
369.1	478.7	432.4	478.2	555	479.3	598.4	478.9	653	479.6
696.2	479.8	749.1	479.2	793.3	479.7	830	478.7	854.4	478
859.6	476	864.8	474	870	472	875.2	470	880.4	468
885.6	466	890.3	464.2	899.5	464.2	903	466	906.9	468
910.9	470	914.8	472	918.9	474	922.9	476	940	476.4
982.1	477.5	1270.1	477.5	1948	477.5	1953	486		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	830	.05	880.4	.04	906.9	.05	940	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
854.4	982.1	0	0	0	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
1100	1953	486

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
W.S. Elev (ft)	481.10	Element			
Vel Head (ft)	0.09	Wt. n-Val.	0.031	0.042	0.030
E.G. Elev (ft)	481.19	Reach Len. (ft)			
Crit W.S. (ft)	478.59	Flow Area (sq ft)	1736.44	1029.50	424.44
E.G. Slope (ft/ft)	0.000471	Area (sq ft)	1736.44	1029.50	3481.06
Q Total (cfs)	7195.00	Flow (cfs)	3035.48	3088.40	1071.13
Top Width (ft)	1910.79	Top Width (ft)	815.08	127.70	968.02
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	1.75	3.00	2.52
Max Chl Dpth (ft)	16.90	Hydr. Depth (ft)	2.13	8.06	3.60
Conv. Total (cfs)	331703.3	Conv. (cfs)	139941.3	142381.1	49381.0
Length Wtd. (ft)		Wetted Per. (ft)	815.51	133.09	117.90
Min Ch El (ft)	464.20	Shear (lb/sq ft)	0.06	0.23	0.11
Alpha	1.20	Stream Power (lb/ft s)	0.11	0.68	0.27
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Manning's n values were composited to a single value in the main channel.

SUMMARY OF MANNING'S N VALUES

River:E. Branch Trib.

Reach	River Sta.	n1	n2	n3	n4	n5
Pheasant Point	3168	.03	.04	.05		
Pheasant Point	3075	.03	.04	.05		
Pheasant Point	2900	.03	.04	.05		
Pheasant Point	2775	.03	.04	.05		
Pheasant Point	2600	.03	.04	.05	.03	
Pheasant Point	2500	.03	.05	.04	.05	
Pheasant Point	2325	.03	.05	.04	.05	
Pheasant Point	2050	.03	.05	.04	.05	.03
Pheasant Point	1700	.03	.05	.04	.05	.03
Pheasant Point	1600	.03	.05	.04	.05	.03

SUMMARY OF REACH LENGTHS

River: E. Branch Trib.

Reach	River Sta.	Left	Channel	Right
Pheasant Point	3168	85	93	65
Pheasant Point	3075	125	175	190
Pheasant Point	2900	100	125	145
Pheasant Point	2775	150	175	185
Pheasant Point	2600	80	100	100
Pheasant Point	2500	100	175	185
Pheasant Point	2325	205	275	275
Pheasant Point	2050	270	350	355
Pheasant Point	1700	115	100	90
Pheasant Point	1600	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: E. Branch Trib.

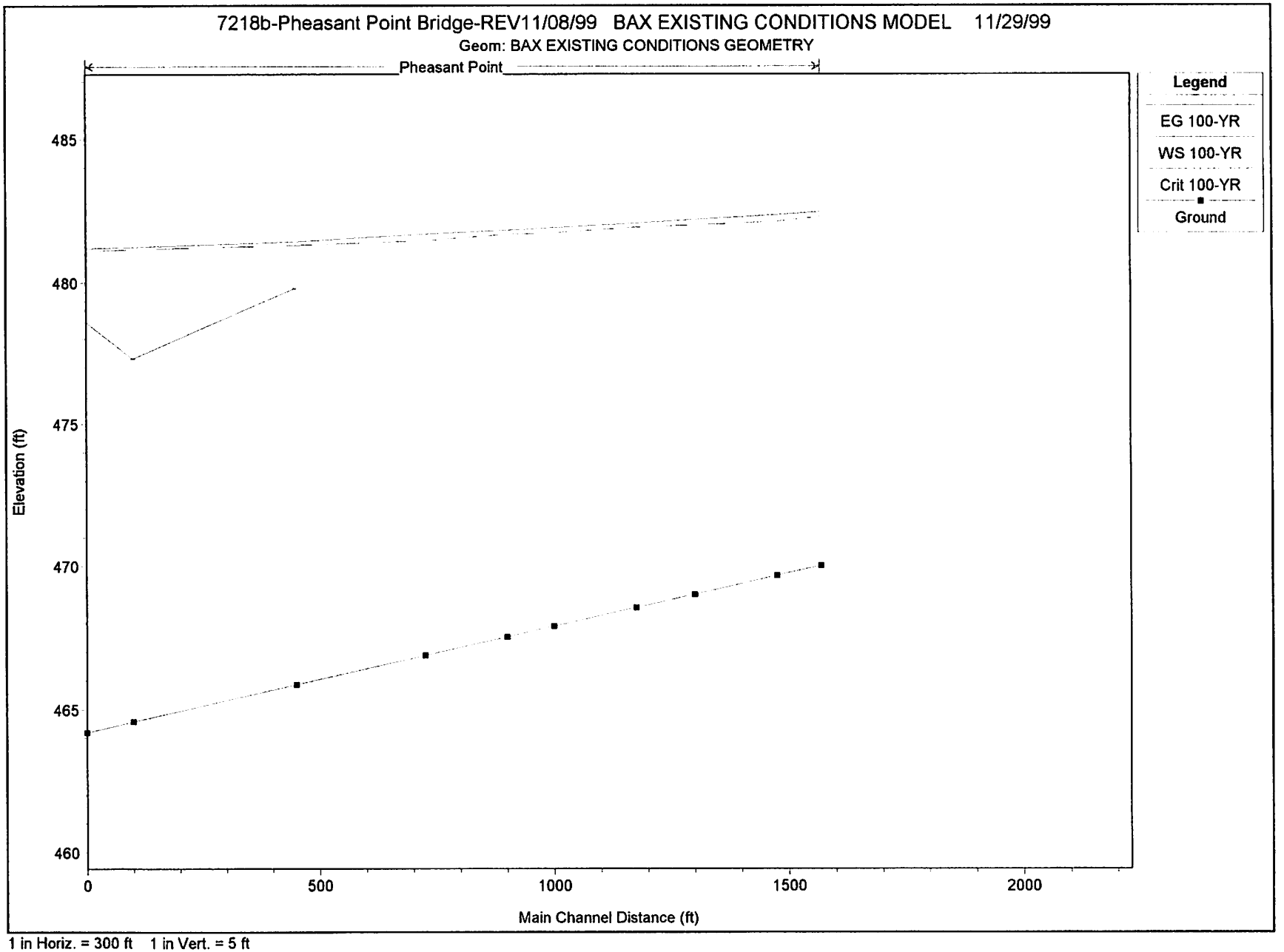
Reach	River Sta.	Contr.	Expan.
Pheasant Point	3168	.1	.3
Pheasant Point	3075	.1	.3
Pheasant Point	2900	.1	.3
Pheasant Point	2775	.1	.3
Pheasant Point	2600	.1	.3
Pheasant Point	2500	.1	.3
Pheasant Point	2325	.1	.3
Pheasant Point	2050	.1	.3
Pheasant Point	1700	.1	.3
Pheasant Point	1600	.1	.3

Profile Output Table - Standard Table 1

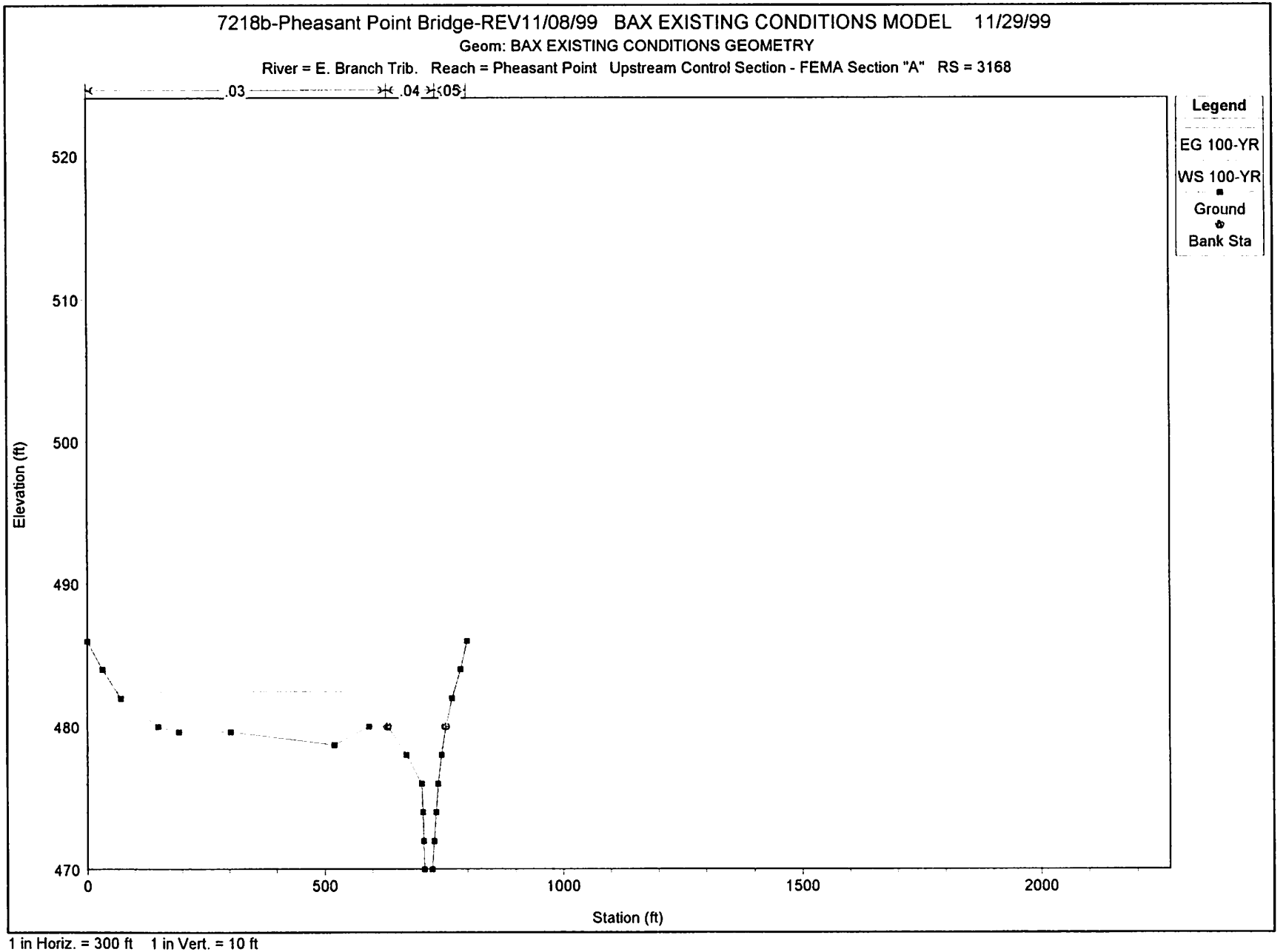
Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Pheasant Point	3168	7195.00	470.00	482.29		482.46	0.001006	3.66	2249.98	704.95	0.26
Pheasant Point	3075	7195.00	469.65	482.11		482.35	0.001278	5.05	1989.64	691.70	0.30
Pheasant Point	2900	7195.00	469.00	481.99		482.18	0.000992	4.40	2171.61	695.37	0.28
Pheasant Point	2775	7195.00	468.55	481.91		482.06	0.000937	3.35	2336.45	734.18	0.26
Pheasant Point	2600	7195.00	467.89	481.73		481.91	0.001006	4.04	2161.84	666.36	0.25
Pheasant Point	2500	7195.00	467.52	481.67		481.82	0.000868	3.80	2304.23	703.65	0.22
Pheasant Point	2325	7195.00	466.88	481.45		481.68	0.001585	5.00	1941.03	729.60	0.29
Pheasant Point	2050	7195.00	465.86	481.29	479.80	481.42	0.000733	3.59	2630.28	995.73	0.21
Pheasant Point	1700	7195.00	464.57	481.15	477.30	481.24	0.000414	2.96	3288.48	1787.86	0.18
Pheasant Point	1600	7195.00	464.20	481.10	478.59	481.19	0.000471	3.00	3190.38	1910.79	0.19

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Pheasant Point	3168	482.46	482.29	0.16	0.10	0.01	4485.39	2692.27	17.33	704.95
Pheasant Point	3075	482.35	482.11	0.24	0.16	0.02	4547.17	2642.62	5.21	691.70
Pheasant Point	2900	482.18	481.99	0.19	0.10	0.01	5061.05	2125.58	8.37	695.37
Pheasant Point	2775	482.06	481.91	0.15	0.15	0.00	4882.69	2312.31		734.18
Pheasant Point	2600	481.91	481.73	0.18	0.08	0.01	5717.11	1477.89		666.36
Pheasant Point	2500	481.82	481.67	0.16	0.13	0.01	5845.92	1347.88	1.20	703.65
Pheasant Point	2325	481.68	481.45	0.23	0.23	0.03	5517.10	1676.62	1.28	729.60
Pheasant Point	2050	481.42	481.29	0.13	0.16	0.01	4854.06	2250.63	90.30	995.73
Pheasant Point	1700	481.24	481.15	0.09	0.05	0.00	3293.85	3082.97	818.19	1787.86
Pheasant Point	1600	481.19	481.10	0.09			3035.48	3088.40	1071.13	1910.79



1 in Horiz. = 300 ft 1 in Vert. = 5 ft



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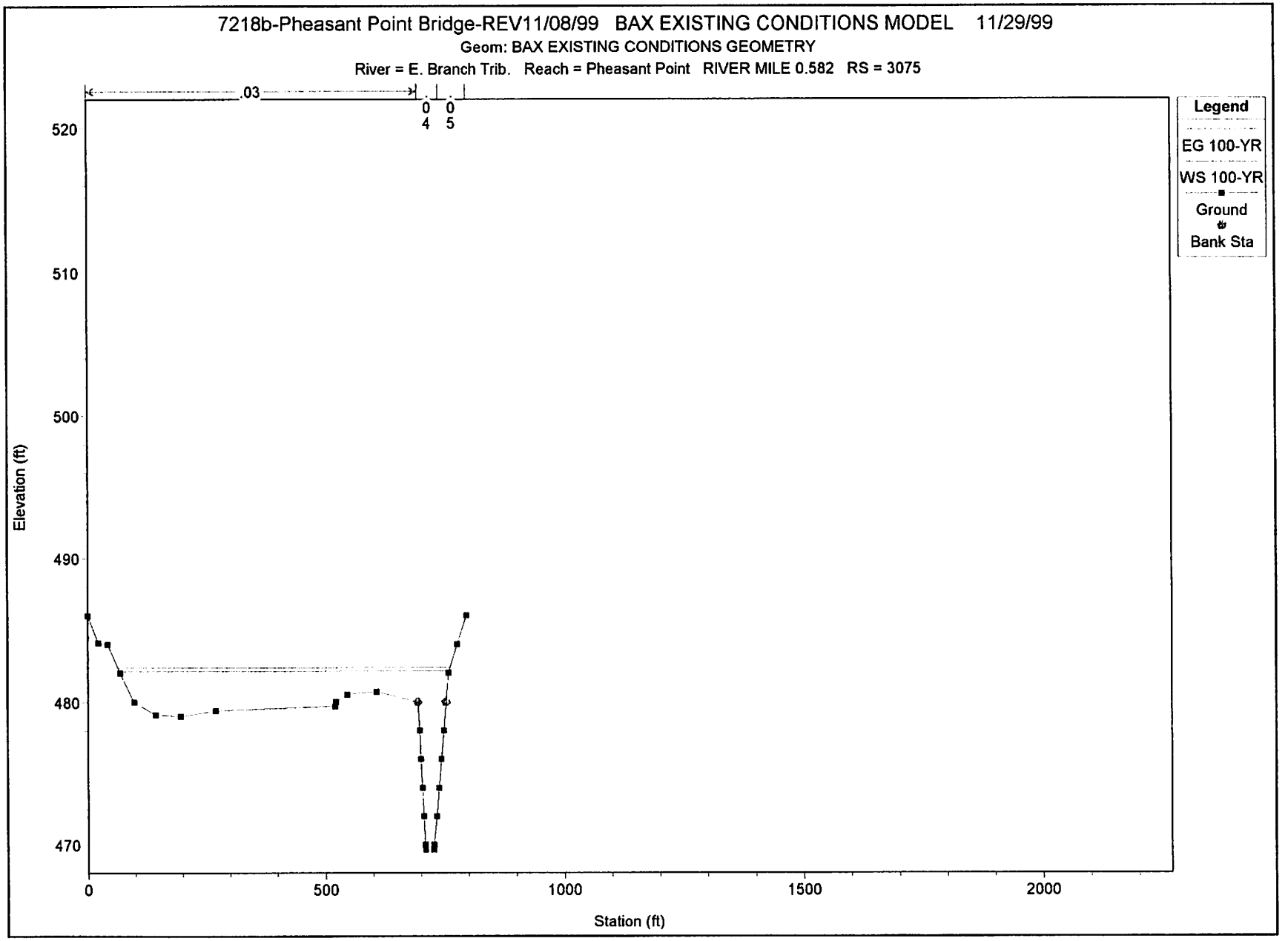
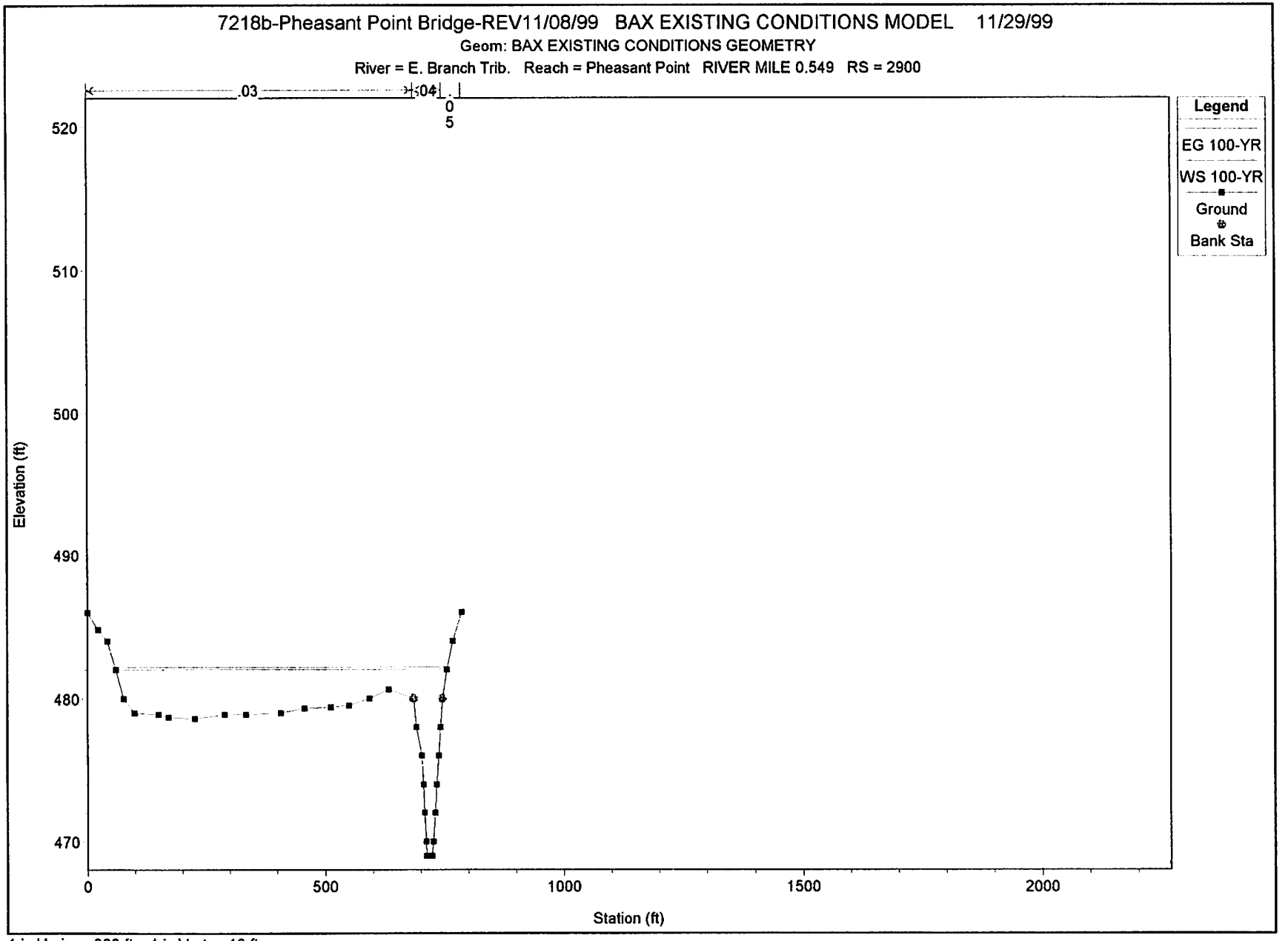


1 in Horiz. = 300 ft 1 in Vert. = 10 ft



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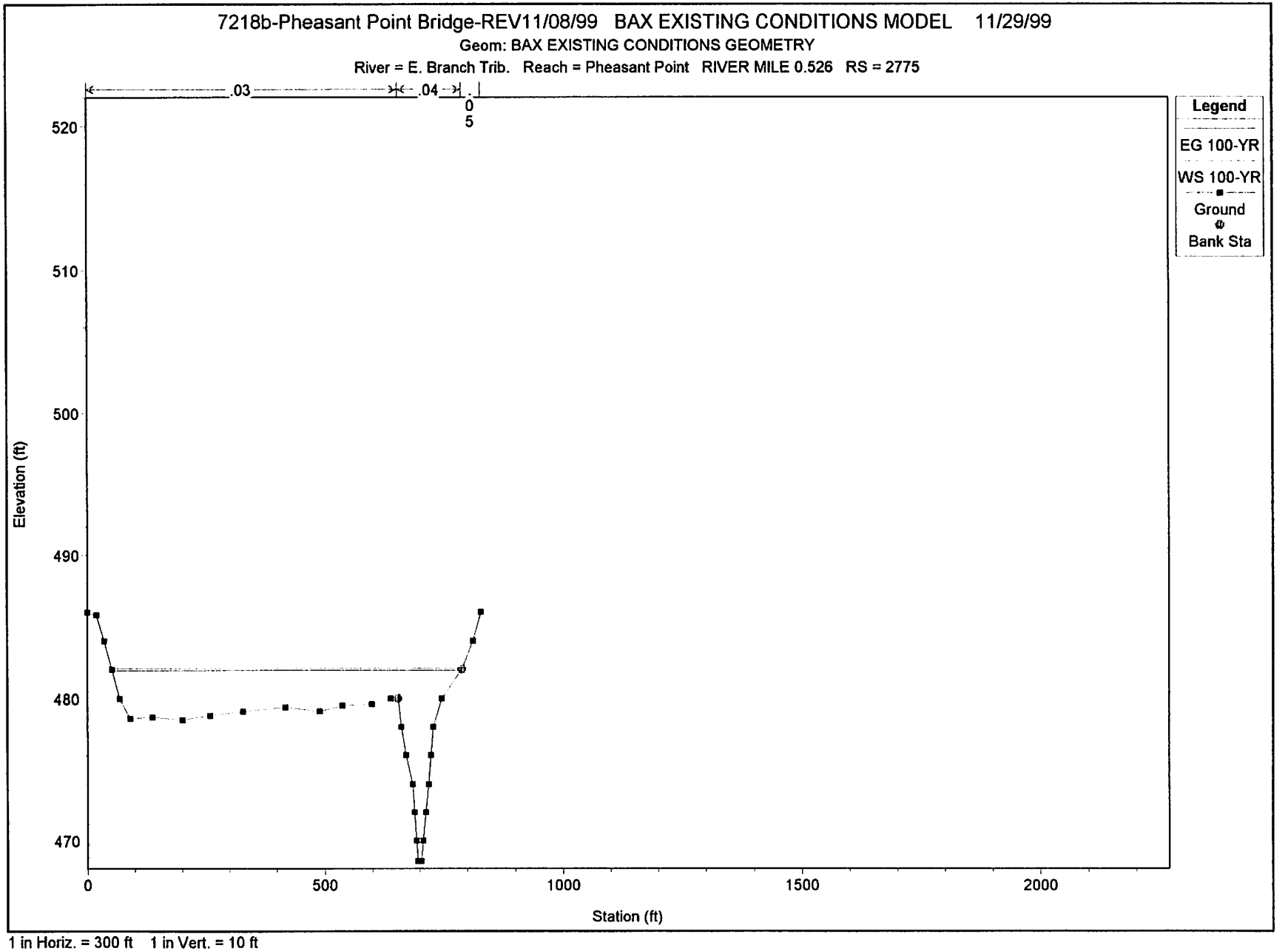
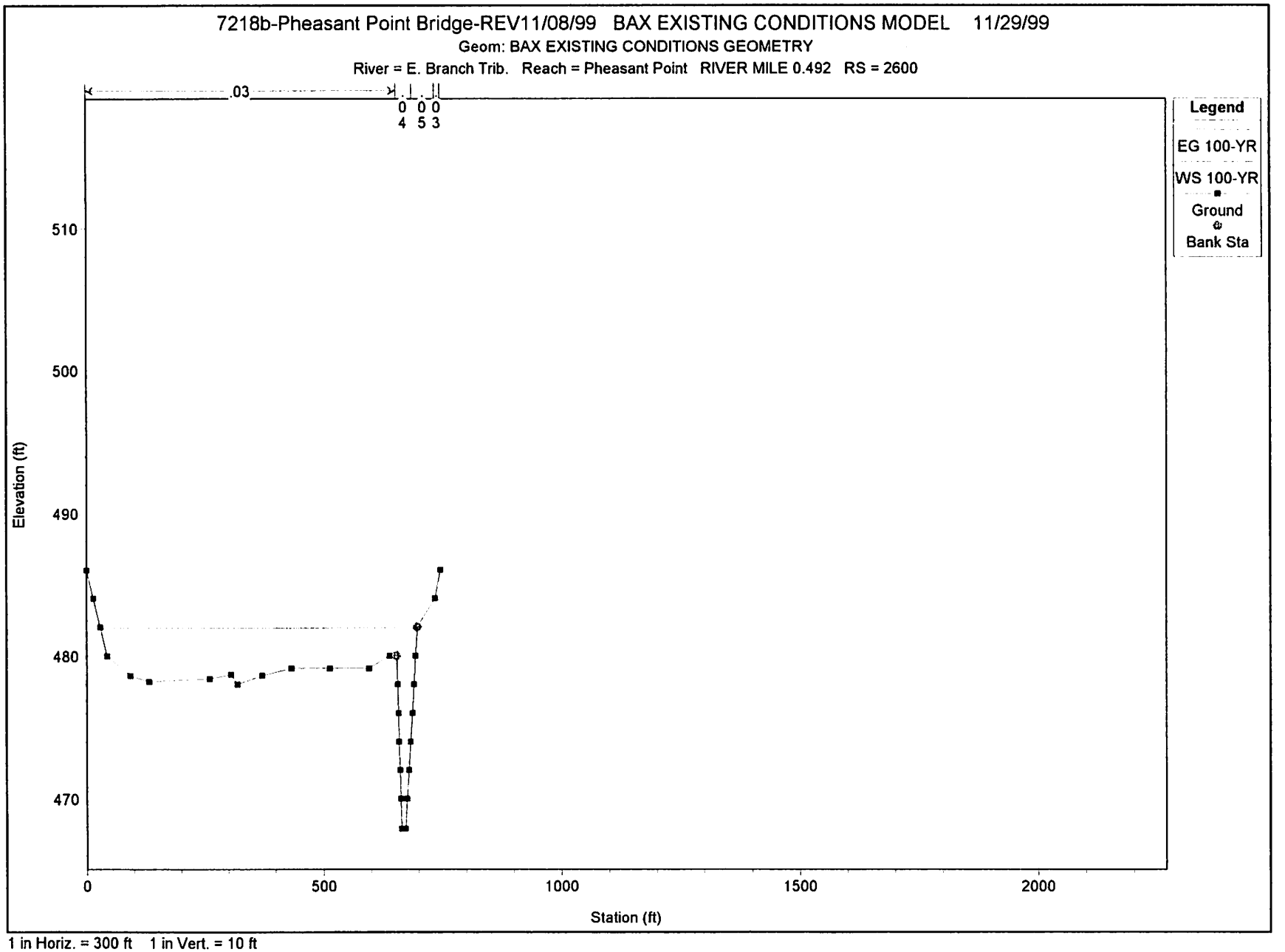


1 in Horiz. = 300 ft 1 in Vert. = 10 ft



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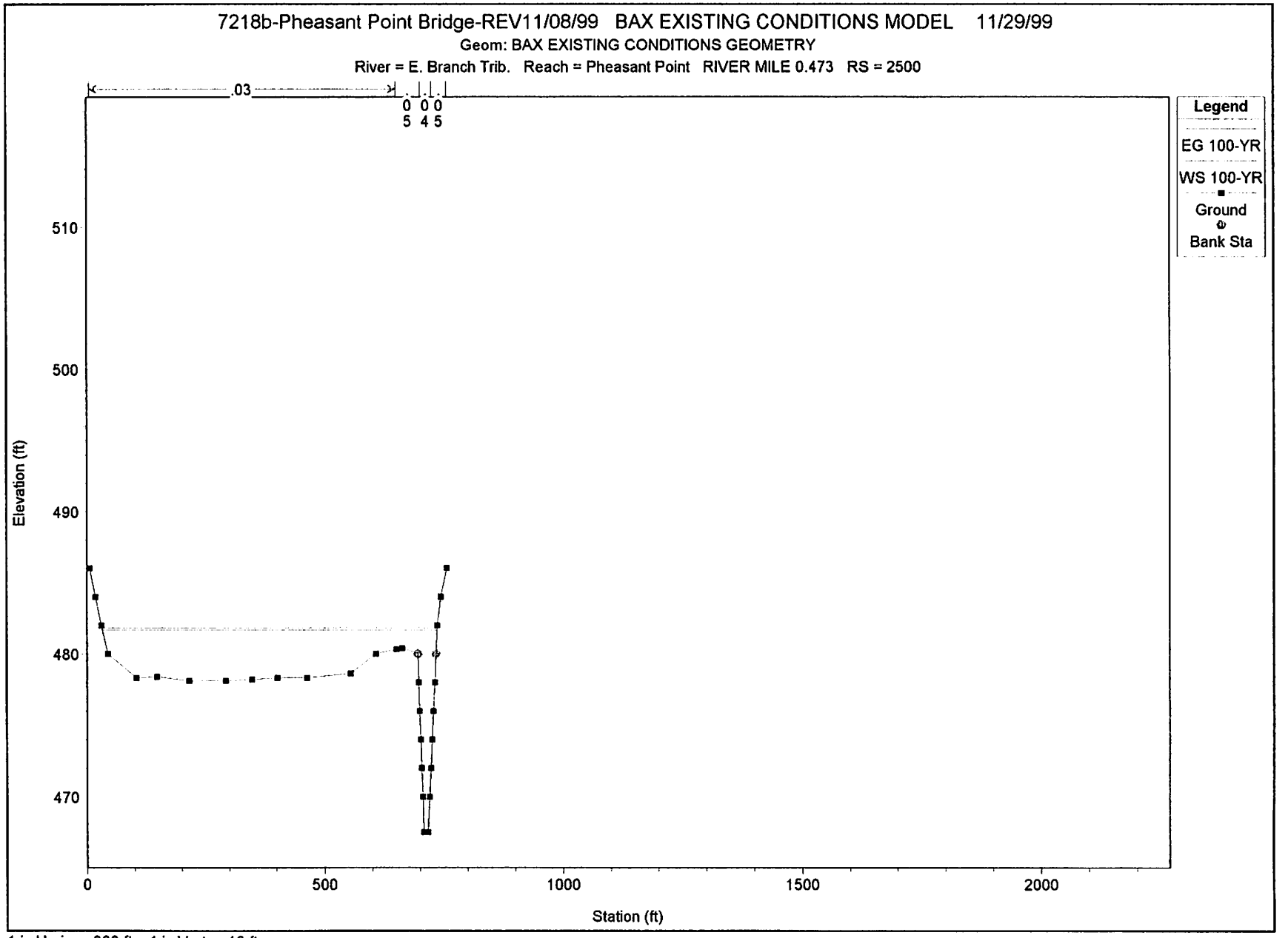
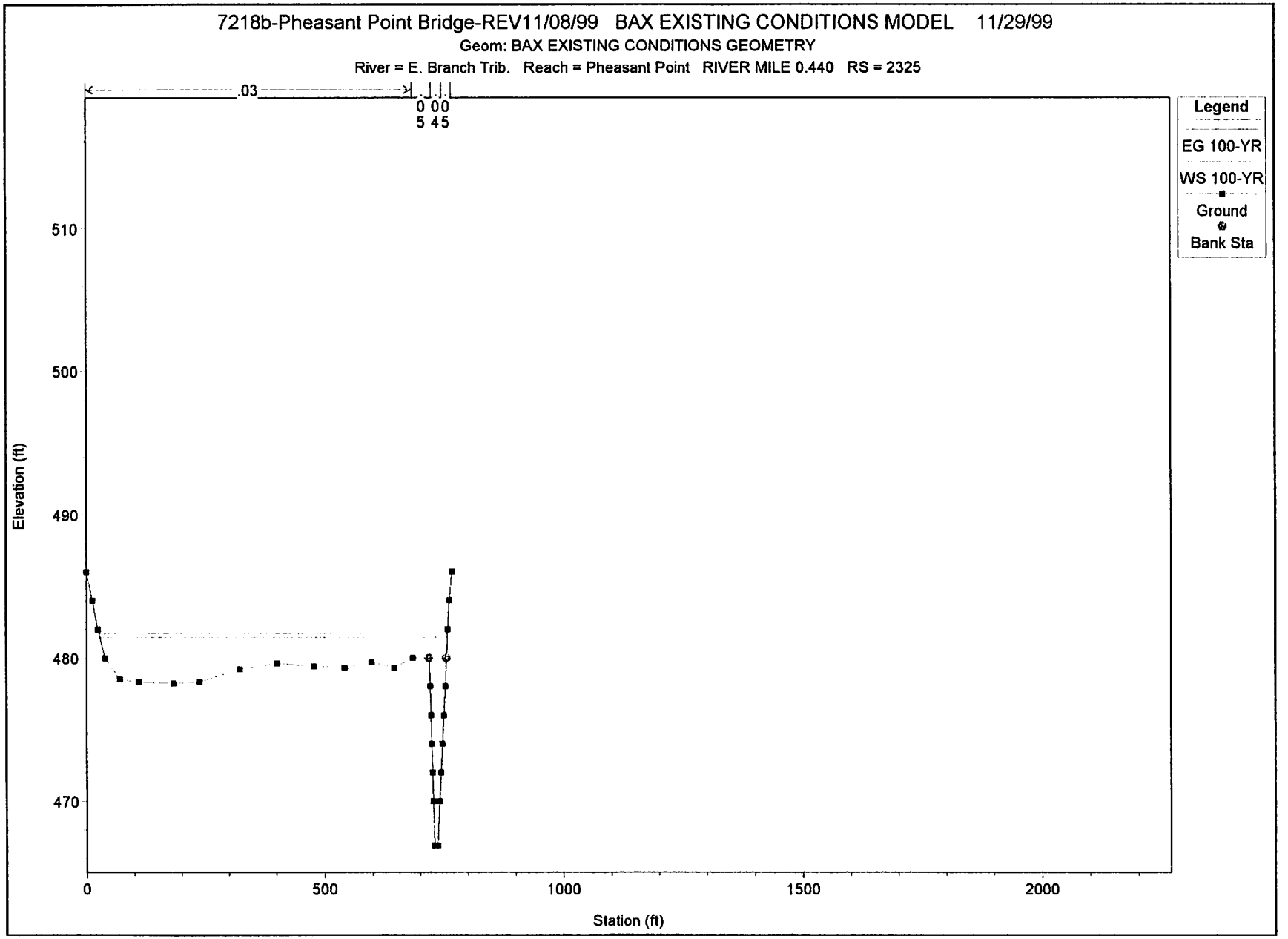
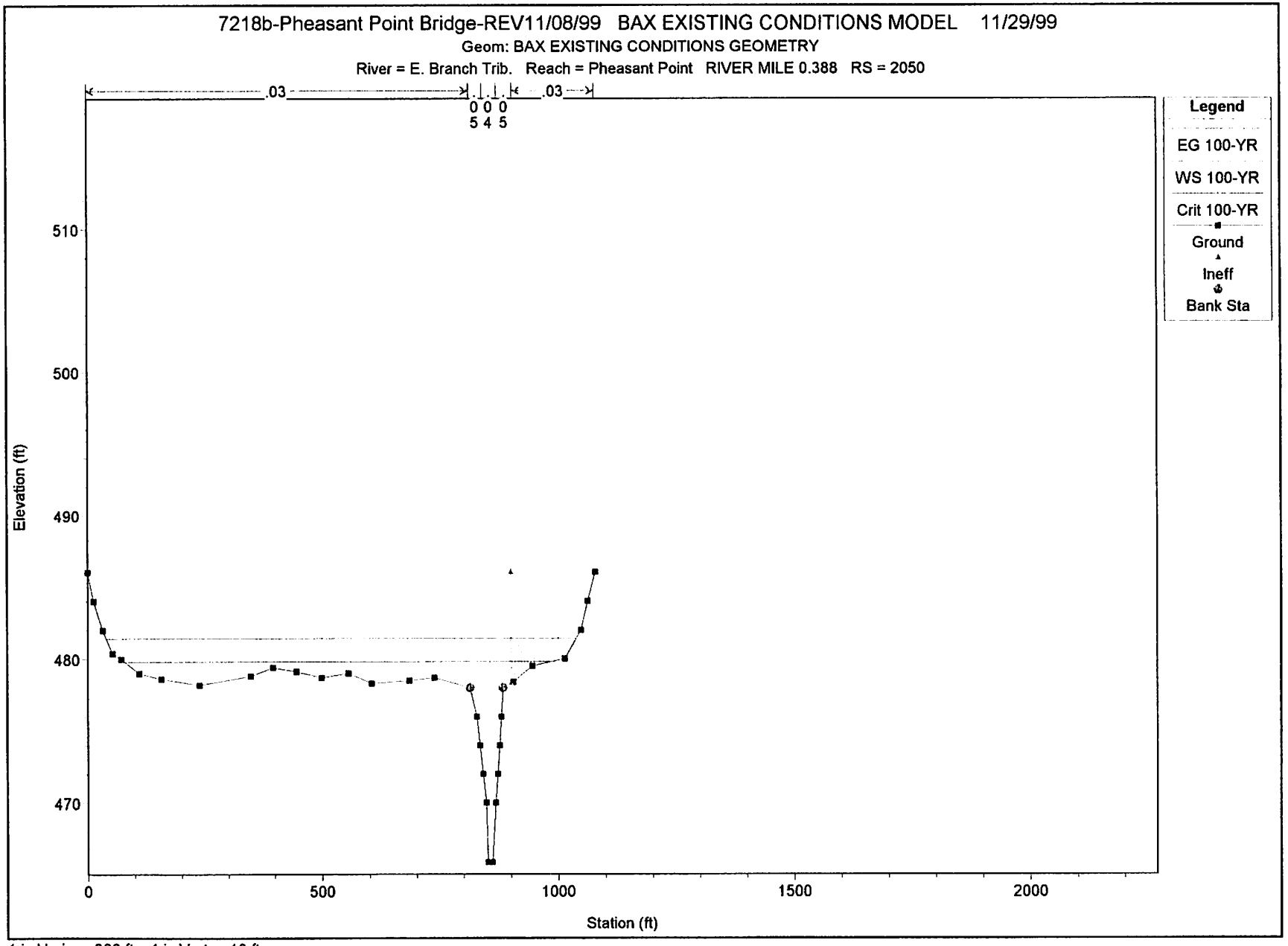


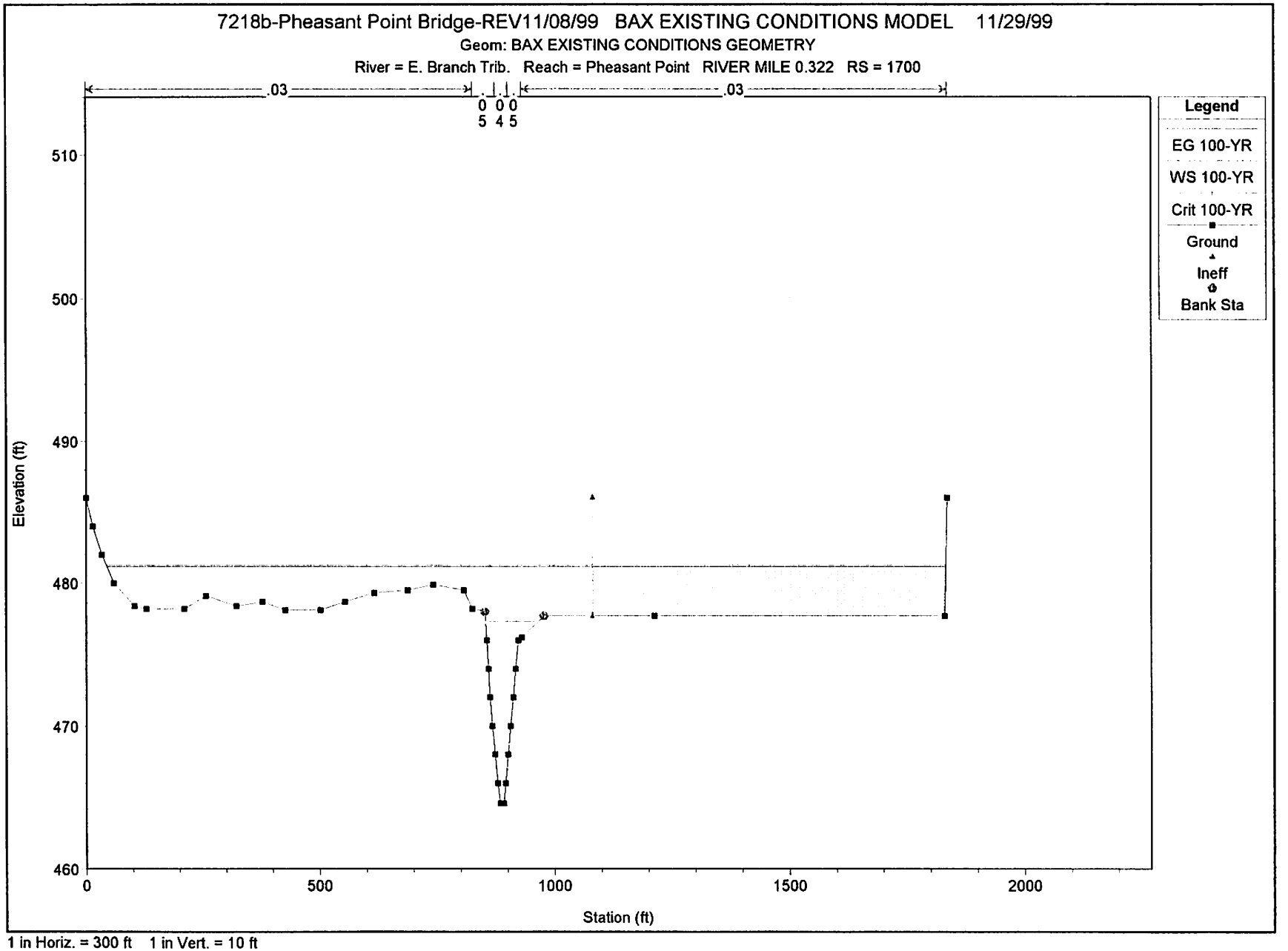
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



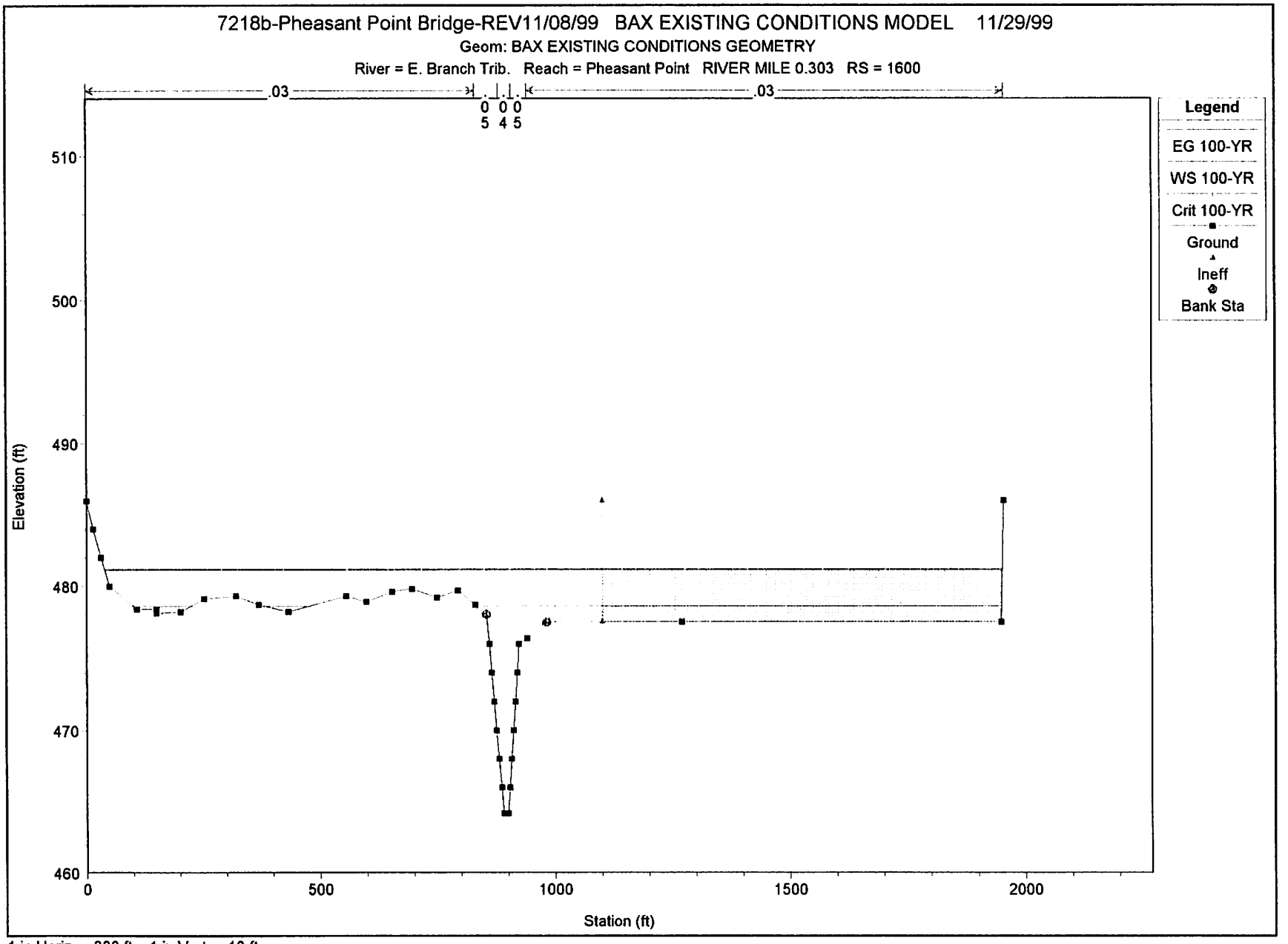
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



1 in Horiz. = 300 ft 1 in Vert. = 10 ft



1 in Horiz. = 300 ft 1 in Vert. = 10 ft



1 in Horiz. = 300 ft 1 in Vert. = 10 ft

APPENDIX D

PROPOSED CONDITIONS HEC-RAS MODEL

- INPUT
- OUTPUT
- CROSS SECTION PLOTS

HEC-RAS Version 2.0 April 1997
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
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PROJECT DATA
Project Title: 7218b-Pheasant Point Bridge-REV11/08/99
Project File : 7218b-rv.prj
Run Date and Time: 11/24/99 11:25:22 AM

Project in English units

PLAN DATA

Plan Title: 140BR-EN-CH-#5
Plan File : c:\hec\ras\data\7218re~1\7218b-rv.p45

Geometry Title: 140BR-EN-CH-#5GEO
Geometry File : c:\hec\ras\data\7218re~1\7218b-rv.g38

Flow Title : 100-YR FLOW DATA -W/ SWSEL+0.8
Flow File : c:\hec\ras\data\7218re~1\7218b-rv.f07

Plan Summary Information:
Number of: Cross Sections = 11 Mulitple Openings = 0
Culverts = 0 Inline Weirs = 0
Bridges = 1

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: 100-YR FLOW DATA -W/ SWSEL+0.8
Flow File : c:\hec\ras\data\7218re~1\7218b-rv.f07

Flow Data (cfs)

River	Reach	RS	100-YR
E. Branch Trib.	Pheasant Point	3168	7195

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
E. Branch Trib.	Pheasant Point	100-YR		Known WS = 481.9

GEOMETRY DATA

Geometry Title: 140BR-EN-CH-#5GEO
Geometry File : c:\hec\ras\data\7218re~1\7218b-rv.g38

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 3168

INPUT
Description: Upstream Control Section - FEMA Section "A"
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	31.8	484	70.6	482	149.3	480	192.6	479.6
302	479.6	520	478.7	593.1	480	632.2	480	671.6	478
703.5	476	705.6	474	707.6	472	709.5	470	725.7	470
730	472	734.1	474	738.2	476	745.3	478	754.1	480
767.2	482	785	484	798.9	486				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	632.2	.04	734.1	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
632.2	754.1	85	93	65	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.030	0.042	0.050
E.G. Elev (ft)	482.81	Reach Len. (ft)	85.00	93.00	65.00
Crit W.S. (ft)		Flow Area (sq ft)	1718.68	783.94	24.15
E.G. Slope (ft/ft)	0.000701	Area (sq ft)	1718.68	783.94	24.15
Q Total (cfs)	7195.00	Flow (cfs)	4677.88	2495.11	22.01
Top Width (ft)	715.97	Top Width (ft)	574.88	121.90	19.19
Vel Total (ft/s)	2.85	Avg. Vel. (ft/s)	2.72	3.18	0.91
Max Chl Dpth (ft)	12.68	Hydr. Depth (ft)	2.99	6.43	1.26
Conv. Total (cfs)	271706.4	Conv. (cfs)	176652.0	94223.3	831.1
Length Wtd. (ft)	87.68	Wetted Per. (ft)	574.94	126.37	19.38
Min Ch El (ft)	470.00	Shear (lb/sq ft)	0.13	0.27	0.05
Alpha	1.03	Stream Power (lb/ft s)	0.36	0.86	0.05
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	71.32	34.42	25.68
C & E Loss (ft)	0.01	Cum SA (acres)	10.71	3.50	6.61

Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 3075

INPUT
Description: RIVER MILE 0.582
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	9.6	484	15.7	482	21.7	480	26.8	479.4
95.5	479	230.5	479.5	280	479.7	409.2	479.7	414.3	480
454.6	480	457.6	478	460.5	476	463.5	474	466.6	472
469.7	470	470.2	469.65	487.5	469.65	488.4	470	493.6	472
498.9	474	504.1	476	508.9	478	513.7	480	518.5	482
536.3	484	555.9	486						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	414.3	.03	454.6	.04	498.9	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
454.6	513.7	140	175	190	.1	.3

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.025	0.043	0.050
E.G. Elev (ft)	482.73	Reach Len. (ft)	140.00	175.00	190.00
Crit W.S. (ft)		Flow Area (sq ft)	1306.13	546.11	8.26
E.G. Slope (ft/ft)	0.000913	Area (sq ft)	1306.13	546.11	8.26
Q Total (cfs)	7195.00	Flow (cfs)	4789.80	2398.51	6.70
Top Width (ft)	508.71	Top Width (ft)	440.41	59.10	9.20
Vel Total (ft/s)	3.87	Avg. Vel. (ft/s)	3.67	4.39	0.81
Max Chl Dpth (ft)	12.84	Hydr. Depth (ft)	2.97	9.24	0.90
Conv. Total (cfs)	238145.2	Conv. (cfs)	158536.1	79387.5	221.6
Length Wtd. (ft)	146.68	Wetted Per. (ft)	440.86	64.20	9.63
Min Ch El (ft)	469.65	Shear (lb/sq ft)	0.17	0.48	0.05
Alpha	1.03	Stream Power (lb/ft s)	0.62	2.13	0.04
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	68.37	33.00	25.65
C & E Loss (ft)	0.06	Cum SA (acres)	9.72	3.30	6.59

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.
Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2900

INPUT
Description: RIVER MILE 0.549
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	25.2	484	31.2	482	37.2	480	62.3	478
92.4	468	398.5	468	434.5	480	456.5	480.6	508	480
514.2	478	525.5	476	528.6	474	531.4	472	534.3	470
535.7	469	547	469	549	470	553	472	557.1	474
561.1	476	565.1	478	569.2	480	614.3	482	760.1	484
770.1	486								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	434.5	.03	508	.04	569.2	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
508	569.2	125	125	145	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	62.3	478	428.5	770.1	478

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.025	0.040	0.030
E.G. Elev (ft)	482.66	Reach Len. (ft)	125.00	125.00	145.00
Crit W.S. (ft)	470.55	Flow Area (sq ft)	5354.69	523.46	88.58
E.G. Slope (ft/ft)	0.000017	Area (sq ft)	5354.69	523.46	88.58
Q Total (cfs)	7195.00	Flow (cfs)	6864.56	312.99	17.45
Top Width (ft)	631.42	Top Width (ft)	478.71	61.20	91.51
Vel Total (ft/s)	1.21	Avg. Vel. (ft/s)	1.28	0.60	0.20
Max Chl Dpth (ft)	14.64	Hydr. Depth (ft)	11.19	8.55	0.97
Conv. Total (cfs)	1769925.0	Conv. (cfs)	1688639.0	76993.8	4292.0
Length Wtd. (ft)	125.03	Wetted Per. (ft)	482.79	66.44	91.56
Min Ch El (ft)	469.00	Shear (lb/sq ft)	0.01	0.01	0.00
Alpha	1.09	Stream Power (lb/ft s)	0.01	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	57.66	30.85	25.44
C & E Loss (ft)	0.00	Cum SA (acres)	8.24	3.06	6.37

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2775

INPUT
Description: RIVER MILE 0.526
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	487	25.4	484	31.4	482	37.4	480	68.3	478
98.4	468	393.7	468	423.7	478	448.4	479.6	487.8	480
503	480	509.7	478	519.5	476	527.8	474	534.6	472
541.5	470	544.6	468.55	551.6	468.55	555.7	470	561.3	472
566.6	474	571.9	476	577.1	478	594.7	480	615.7	482
764	484	773	486						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	423.7	.03	503	.04	594.7	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
503	615.7	175	185	.1	.3

Ineffective Flow num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
68.3	423.7	478	0	122	487	730	773	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.025	0.040	0.030
E.G. Elev (ft)	482.66	Reach Len. (ft)	175.00	175.00	185.00
Crit W.S. (ft)	468.02	Flow Area (sq ft)	5269.89	767.81	14.94
E.G. Slope (ft/ft)	0.000017	Area (sq ft)	5269.89	767.81	14.94
Q Total (cfs)	7195.00	Flow (cfs)	6747.68	445.91	1.41
Top Width (ft)	633.27	Top Width (ft)	473.50	112.70	47.07
Vel Total (ft/s)	1.19	Avg. Vel. (ft/s)	1.28	0.58	0.09
Max Chl Dpth (ft)	14.63	Hydr. Depth (ft)	11.13	6.81	0.32
Conv. Total (cfs)	1753772.0	Conv. (cfs)	1644737.0	108690.5	344.3
Length Wtd. (ft)	175.00	Wetted Per. (ft)	477.29	116.23	47.07
Min Ch El (ft)	468.55	Shear (lb/sq ft)	0.01	0.01	0.00
Alpha	1.10	Stream Power (lb/ft s)	0.01	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	42.42	29.00	25.27
C & E Loss (ft)	0.03	Cum SA (acres)	6.87	2.81	6.14

Warning - Multiple water surfaces were found that could balance the energy equation. The program selected the water surface whose main channel velocity head was the closest to the previously computed 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 - Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.
Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2600

INPUT
Description: RIVER MILE 0.492
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	484	44.3	482	50.9	480	71.3	478.1	130.2	478.2
166.7	478.7	201.1	478.6	229.1	478.6	302.4	479.2	355.7	479.2
386.1	480	390.1	480	394.1	478	398.1	476	402.1	474
406.5	472	411.4	470	417.9	468	418.3	467.89	488.9	467.89
489.2	468	494	470	499.2	472	505	474	511.2	476
517.5	478	525.7	480	535	482	564.1	484	569.7	486

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	386.1	.033	535	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
390.1	535	100	100	100	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	329	486	550	569.7	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.025	0.033	0.030
E.G. Elev (ft)	482.63	Reach Len. (ft)	45.00	45.00	45.00
Crit W.S. (ft)	474.17	Flow Area (sq ft)	177.13	1575.38	0.89
E.G. Slope (ft/ft)	0.000395	Area (sq ft)	1213.53	1575.38	0.89
Q Total (cfs)	7195.00	Flow (cfs)	421.33	6773.39	0.28
Top Width (ft)	503.56	Top Width (ft)	353.56	144.90	5.10
Vel Total (ft/s)	4.10	Avg. Vel. (ft/s)	2.38	4.30	0.31
Max Chl Dpth (ft)	14.46	Hydr. Depth (ft)	2.90	10.87	0.18
Conv. Total (cfs)	361917.3	Conv. (cfs)	21193.6	340709.9	13.8
Length Wtd. (ft)	45.00	Wetted Per. (ft)	61.11	149.66	5.11
Min Ch El (ft)	467.89	Shear (lb/sq ft)	0.07	0.26	0.00
Alpha	1.05	Stream Power (lb/ft s)	0.17	1.12	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	29.40	24.29	25.24
C & E Loss (ft)	0.03	Cum SA (acres)	5.21	2.29	6.02

BRIDGE RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2555

INPUT
Description: PHEASANT POINT BRIDGE (140' LONG)
Distance from Upstream XS = 45
Deck/Roadway Width = 30
Weir Coefficient = 2.6
Bridge Deck/Roadway Skew =
Upstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	489.15	0	378.9	489.15	484.35	518.9	487.75	483.5
1000	487.75	0						

Upstream Bridge Cross Section Data
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	484	44.3	482	50.9	480	71.3	478.1	130.2	478.2
166.7	478.7	201.1	478.6	229.1	478.6	302.4	479.2	355.7	479.2
382	484	414	468	414.56	467.72	487.74	467.72	488.3	468
516.3	482	520.3	484	524.3	486				

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.025	382	.033

Bank Sta: Left	Right	Coeff Contr.	Expan.
382	520.3	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	329	486	550	524.3	486

Downstream Deck/Roadway Coordinates
num= 4

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	489.15	0	409.7	489.15	484.35	549.7	487.75	483.5
1000	487.78	0						

Downstream Bridge Cross Section Data
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	9.5	484	89.3	482	95.9	480	219.5	479.5
314.4	480	340	481	354.7	480	398	480.4	408.9	486
412.9	484	444.9	468	445.68	467.61	518.42	467.61	519.2	468
547.2	482	555.2	486						

```
Manning's n Values          num=       2
     Sta   n Val     Sta   n Val
       0    .025   408.9    .033

Bank Sta: Left   Right    Coeff Contr.   Expan.
         408.9   555.2             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev
       0     364     486

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 =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=   448.9    Downstream=   479.7
Upstream     num=       2
    Width   Elev    Width   Elev
    1.25       0    1.25     484
Downstream     num=       2
    Width   Elev    Width   Elev
    1.25       0    1.25     484

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum               Cd   =       2
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 downstream end
       Criteria to check for pressure flow = Upstream water surface
```

BRIDGE OUTPUT Profile #100-YR
Opening : Bridge #1

E.G. US. (ft)	482.63	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	482.35	E.G. Elev (ft)	482.57	482.55
Q Total (cfs)	7195.00	W.S. Elev (ft)	482.20	482.18
Q Bridge (cfs)	7195.00	Crit W.S. (ft)	474.08	473.98
Q Weir (cfs)		Max Chl Dpth (ft)	14.48	14.57
Weir Sta Lft (ft)		Vel Total (ft/s)	4.93	4.91
Weir Sta Rgt (ft)		Flow Area (sq ft)	1460.29	1465.82
Weir Submerg		Froude # Chl	0.26	0.26
Weir Max Depth (ft)		Specif Force (cu ft)	10659.00	10742.85
Min Top Rd (ft)	487.75	Hydr Depth (ft)	11.25	11.30
Min El Prs (ft)	484.35	W.P. Total (ft)	165.62	165.77
Delta EG (ft)	0.14	Conv. Total (cfs)	280635.1	282234.0
Delta WS (ft)	0.13	Top Width (ft)	129.83	129.76
BR Open Area (sq ft)	1691.47	Frctn Loss (ft)	0.02	0.01
BR Open Vel (ft/s)	4.93	C & E Loss (ft)	0.00	0.05
Coef of Q		Shear Total (lb/sq ft)	0.36	0.36
Br Sel Mthd	Energy only	Power Total (lb/ft s)	1.78	1.76

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2500

INPUT
Description: RIVER MILE 0.473
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	9.5	484	89.3	482	95.9	480	219.5	479.5
314.4	480	340	481	354.7	480	404.4	480	432.5	470
439.5	467.52	518.1	467.52	519.1	468	543.1	480	551.1	484
558.2	486								

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.025	404.4	.033

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
404.4	543.1	110	175	190	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev
0	364	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.025	0.033	0.033
E.G. Elev (ft)	482.49	Reach Len. (ft)	110.00	175.00	190.00
Crit W.S. (ft)	473.50	Flow Area (sq ft)	89.57	1663.87	4.92
E.G. Slope (ft/ft)	0.000336	Area (sq ft)	727.44	1663.87	4.92
Q Total (cfs)	7195.00	Flow (cfs)	165.92	7025.05	4.03
Top Width (ft)	466.90	Top Width (ft)	323.76	138.70	4.43
Vel Total (ft/s)	4.09	Avg. Vel. (ft/s)	1.85	4.22	0.82
Max Chl Dpth (ft)	14.70	Hydr. Depth (ft)	2.22	12.00	1.11
Conv. Total (cfs)	392554.1	Conv. (cfs)	9052.4	383281.6	220.1
Length Wtd. (ft)	169.09	Wetted Per. (ft)	40.40	143.79	4.96
Min Ch El (ft)	467.52	Shear (lb/sq ft)	0.05	0.24	0.02
Alpha	1.04	Stream Power (lb/ft s)	0.09	1.02	0.02
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	28.56	20.81	25.24
C & E Loss (ft)	0.03	Cum SA (acres)	4.93	1.99	6.02

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2325

INPUT
Description: RIVER MILE 0.440
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	21.5	484	86.7	482	92.7	480	102.7	480
126.7	474	301.5	474	322.7	479.3	356.2	478	380.6	470
390.1	466.88	459.6	466.88	464.1	470	478.6	480	481.4	482
485.2	484	489.8	486						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	92.7	.03	356.2	.033

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
356.2	478.6	85	100	100	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
0	275	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.030	0.033	0.033
E.G. Elev (ft)	482.41	Reach Len. (ft)	85.00	100.00	100.00
Crit W.S. (ft)	473.31	Flow Area (sq ft)	453.63	1561.48	3.39
E.G. Slope (ft/ft)	0.000264	Area (sq ft)	1823.74	1561.48	3.39
Q Total (cfs)	7195.00	Flow (cfs)	1143.73	6049.00	2.27
Top Width (ft)	401.49	Top Width (ft)	275.92	122.40	3.17
Vel Total (ft/s)	3.56	Avg. Vel. (ft/s)	2.52	3.87	0.67
Max Chl Dpth (ft)	15.32	Hydr. Depth (ft)	5.59	12.76	1.07
Conv. Total (cfs)	442567.5	Conv. (cfs)	70351.3	372076.4	139.8
Length Wtd. (ft)	92.59	Wetted Per. (ft)	81.88	128.27	3.86
Min Ch El (ft)	466.88	Shear (lb/sq ft)	0.09	0.20	0.01
Alpha	1.07	Stream Power (lb/ft s)	0.23	0.78	0.01
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	25.34	14.34	25.22
C & E Loss (ft)	0.00	Cum SA (acres)	4.18	1.46	6.00

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: E. Branch Trib.
REACH: Pheasant Point RS: 2225

INPUT
Description: RIVER MILE 0.388
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8	486	14	484	79.2	482	85.2	480	95.2	479.9
118.8	474	360.2	474	379	478.7	418.2	478	423.3	470
423.7	466.51	431.2	466.51	437	470	443.6	474	450.3	478
457	482	461	484	475.9	486				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
8	.025	85.2	.03	418.2	.033	423.7	.04	443.6	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
418.2	450.3	175	175	165	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
8	215	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.030	0.040	0.050
E.G. Elev (ft)	482.37	Reach Len. (ft)	175.00	175.00	165.00
Crit W.S. (ft)	477.16	Flow Area (sq ft)	1434.72	352.16	14.20
E.G. Slope (ft/ft)	0.000521	Area (sq ft)	2366.14	352.16	14.20
Q Total (cfs)	7195.00	Flow (cfs)	5960.38	1220.57	14.05
Top Width (ft)	381.86	Top Width (ft)	342.82	32.10	6.93
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)	4.15	3.47	0.99
Max Chl Dpth (ft)	15.61	Hydr. Depth (ft)	7.06	10.97	2.05
Conv. Total (cfs)	315109.0	Conv. (cfs)	261038.0	53455.8	615.2
Length Wtd. (ft)	174.87	Wetted Per. (ft)	203.78	42.79	8.07
Min Ch El (ft)	466.51	Shear (lb/sq ft)	0.23	0.27	0.06
Alpha	1.02	Stream Power (lb/ft s)	0.95	0.93	0.06
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	21.25	12.14	25.20
C & E Loss (ft)	0.04	Cum SA (acres)	3.57	1.28	5.99

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 parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 2050

INPUT
Description: RIVER MILE 0.388
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	6	484	72.6	482	78.6	480	102.6	474
334	474	350	478	360	478	375.1	476	381.9	474
388.7	472	395.4	470	398.7	465.86	407.3	465.86	415.2	470
419	472	422.9	474	426.8	476	430.7	478	453	478.4
492.9	479.5	534.4	480	540.5	482	546.6	484	554	486

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	360	.04	419	.05	453	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
360	430.7	260	350	360	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	130	486	465	554	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.030	0.042	0.041
E.G. Elev (ft)	482.27	Reach Len. (ft)	260.00	350.00	360.00
Crit W.S. (ft)	476.36	Flow Area (sq ft)	1802.20	688.60	131.06
E.G. Slope (ft/ft)	0.000235	Area (sq ft)	2156.31	688.60	322.27
Q Total (cfs)	7195.00	Flow (cfs)	5395.21	1623.00	176.79
Top Width (ft)	473.31	Top Width (ft)	292.35	70.70	110.25
Vel Total (ft/s)	2.74	Avg. Vel. (ft/s)	2.99	2.36	1.35
Max Chl Dpth (ft)	16.29	Hydr. Depth (ft)	7.84	9.74	3.82
Conv. Total (cfs)	468955.4	Conv. (cfs)	351648.9	105783.5	11522.9
Length Wtd. (ft)	299.51	Wetted Per. (ft)	230.49	76.66	34.31
Min Ch El (ft)	465.86	Shear (lb/sq ft)	0.11	0.13	0.06
Alpha	1.06	Stream Power (lb/ft s)	0.34	0.31	0.08
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	12.17	10.05	24.56
C & E Loss (ft)	0.00	Cum SA (acres)	2.30	1.08	5.77

Warning - The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 1700

INPUT
Description: RIVER MILE 0.322
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	8.8	484	21.8	482	28.7	480	65.2	479.4
96.5	479.5	128.7	479.1	149.1	474	214.4	474	233.2	478.7
259.9	478	263.6	476	267.2	474	270.9	472	275.4	470
281	468	287.3	466	291.8	464.57	300	464.57	303.8	466
309.1	468	314.2	470	319.6	472	324.9	474	330.2	476
338	476.2	385.1	477.7	1238	477.7	1243.1	486		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	28.7	.03	233.2	.05	281	.04	309.1	.05
338	.03								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
259.9	385.1	120	100	85	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
480	1243.1	486

CROSS SECTION OUTPUT Profile #100-YR

W.S. Elev (ft)	482.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.031	0.041	0.030
E.G. Elev (ft)	482.19	Reach Len. (ft)	120.00	100.00	85.00
Crit W.S. (ft)	476.51	Flow Area (sq ft)	1111.97	1158.32	414.88
E.G. Slope (ft/ft)	0.000347	Area (sq ft)	1111.97	1158.32	3734.55
Q Total (cfs)	7195.00	Flow (cfs)	2811.33	3359.98	1023.68
Top Width (ft)	1219.35	Top Width (ft)	238.57	125.20	855.59
Vel Total (ft/s)	2.68	Avg. Vel. (ft/s)	2.53	2.90	2.47
Max Chl Dpth (ft)	17.50	Hydr. Depth (ft)	4.66	9.25	4.37
Conv. Total (cfs)	386159.5	Conv. (cfs)	150885.8	180332.1	54941.6
Length Wtd. (ft)	103.95	Wetted Per. (ft)	240.08	130.15	94.90
Min Ch El (ft)	464.57	Shear (lb/sq ft)	0.10	0.19	0.09
Alpha	1.02	Stream Power (lb/ft s)	0.25	0.56	0.23
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	2.41	2.63	7.80
C & E Loss (ft)	0.01	Cum SA (acres)	0.71	0.29	1.78

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 parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.
Note - Manning's n values were composited to a single value in the main channel.

CROSS SECTION RIVER: E. Branch Trib.
REACH: Pheasant Point RS: 1600

INPUT
Description: RIVER MILE 0.303
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	486	6.6	484	13.1	482	19.6	480	103.7	480
145.4	479.8	187	479.3	236.7	479.7	267.9	478.7	293	478
298.2	476	303.4	474	308.6	472	313.8	470	319	468
324.2	466	328.9	464.2	338.1	464.2	341.6	466	345.5	468
349.5	470	353.4	472	357.5	474	361.6	476	378.6	476.4
420.7	477.5	1386.6	477.5	1391.6	486				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.025	103.7	.03	267.9	.05	319	.04	345.5	.05
378.6	.03								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
293	420.7	0	0	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev
480	1391.6	486

CROSS SECTION OUTPUT Profile #100-YR

			Left OB	Channel	Right OB
W.S. Elev (ft)	481.90	Element			
Vel Head (ft)	0.22	Wt. n-Val.	0.031	0.042	0.030
E.G. Elev (ft)	482.12	Reach Len. (ft)			
Crit W.S. (ft)	477.97	Flow Area (sq ft)	639.44	1131.77	260.92
E.G. Slope (ft/ft)	0.000790	Area (sq ft)	639.44	1131.77	4255.65
Q Total (cfs)	7195.00	Flow (cfs)	1531.96	4687.49	975.55
Top Width (ft)	1375.76	Top Width (ft)	279.57	127.70	968.49
Vel Total (ft/s)	3.54	Avg. Vel. (ft/s)	2.40	4.14	3.74
Max Chl Dpth (ft)	17.70	Hydr. Depth (ft)	2.29	8.86	4.40
Conv. Total (cfs)	255935.2	Conv. (cfs)	54493.6	166740.1	34701.5
Length Wtd. (ft)		Wetted Per. (ft)	279.89	133.08	59.30
Min Ch El (ft)	464.20	Shear (lb/sq ft)	0.11	0.42	0.22
Alpha	1.14	Stream Power (lb/ft s)	0.27	1.74	0.81
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note - Manning's n values were composited to a single value in the main channel.

SUMMARY OF MANNING'S N VALUES

River:E. Branch Trib.

Reach	River Sta.	n1	n2	n3	n4	n5	n6
Pheasant Point	3168	.03	.04	.05			
Pheasant Point	3075	.025	.03	.04	.05		
Pheasant Point	2900	.025	.03	.04	.03		
Pheasant Point	2775	.025	.03	.04	.03		
Pheasant Point	2600	.025	.033	.03			
Pheasant Point	2555	Bridge					
Pheasant Point	2500	.025	.033				
Pheasant Point	2325	.025	.03	.033			
Pheasant Point	2225	.025	.03	.033	.04	.05	
Pheasant Point	2050	.03	.04	.05	.03		
Pheasant Point	1700	.025	.03	.05	.04	.05	.03
Pheasant Point	1600	.025	.03	.05	.04	.05	.03

SUMMARY OF REACH LENGTHS

River: E. Branch Trib.

Reach	River Sta.	Left	Channel	Right
Pheasant Point	3168	85	93	65
Pheasant Point	3075	140	175	190
Pheasant Point	2900	125	125	145
Pheasant Point	2775	175	175	185
Pheasant Point	2600	100	100	100
Pheasant Point	2555	Bridge		
Pheasant Point	2500	110	175	190
Pheasant Point	2325	85	100	100
Pheasant Point	2225	175	175	165
Pheasant Point	2050	260	350	360
Pheasant Point	1700	120	100	85
Pheasant Point	1600	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: E. Branch Trib.

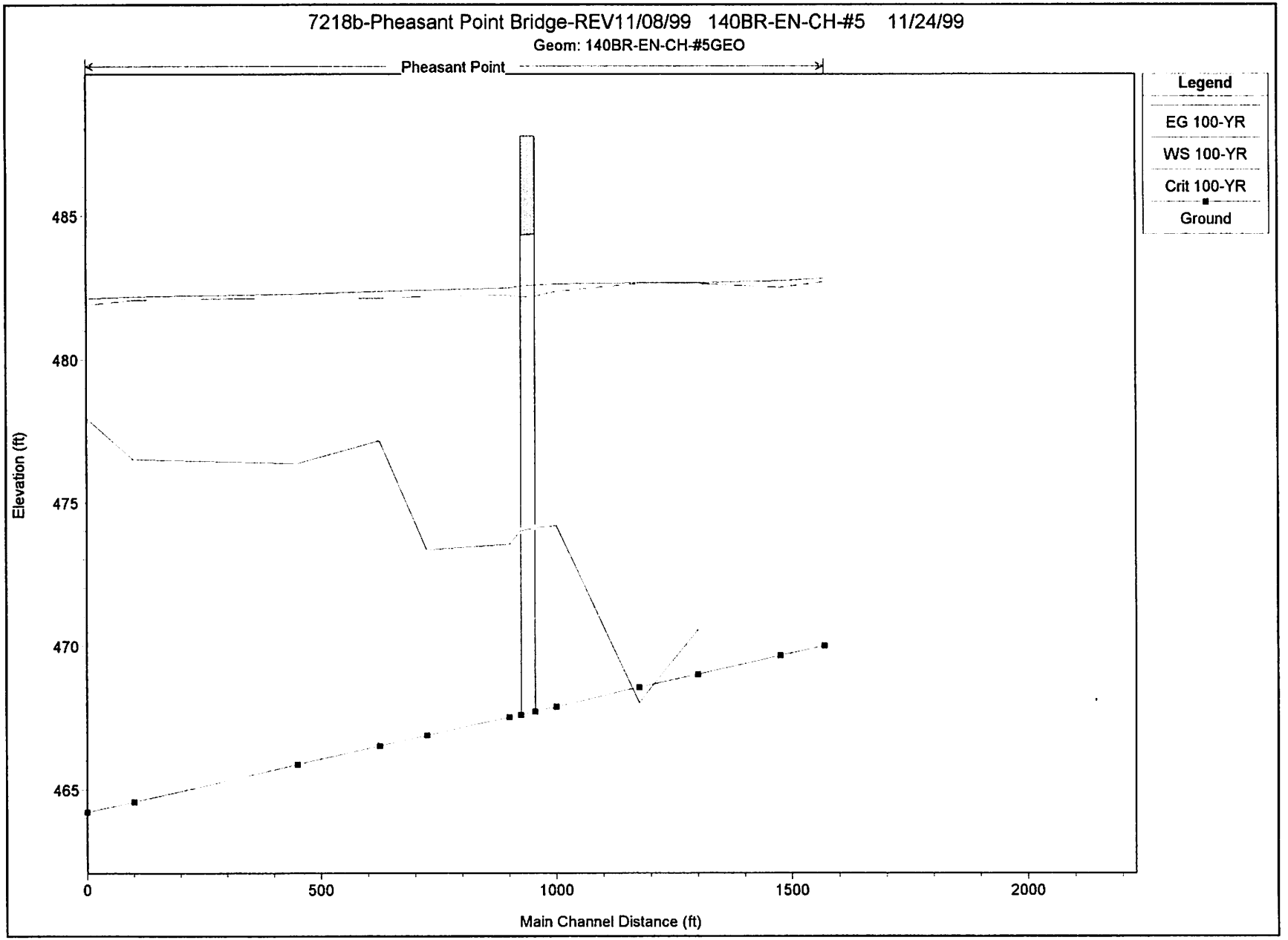
Reach	River Sta.	Contr.	Expan.
Pheasant Point	3168	.1	.3
Pheasant Point	3075	.1	.3
Pheasant Point	2900	.1	.3
Pheasant Point	2775	.1	.3
Pheasant Point	2600	.3	.5
Pheasant Point	2555	Bridge	
Pheasant Point	2500	.3	.5
Pheasant Point	2325	.1	.3
Pheasant Point	2225	.1	.3
Pheasant Point	2050	.1	.3
Pheasant Point	1700	.1	.3
Pheasant Point	1600	.1	.3

Profile Output Table - Standard Table 1

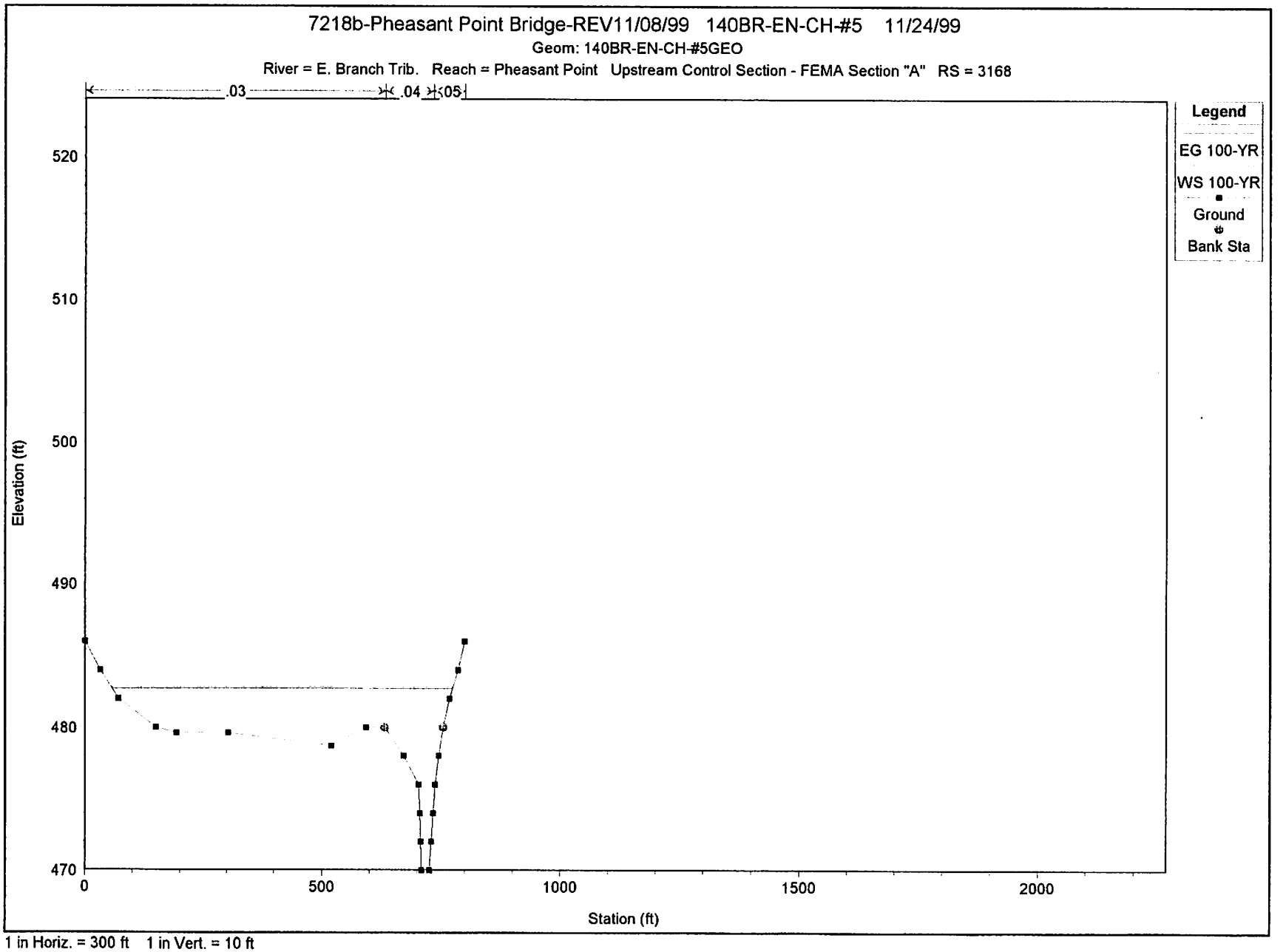
Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Pheasant Point	3168	7195.00	470.00	482.68		482.81	0.000701	3.18	2526.77	715.97	0.22
Pheasant Point	3075	7195.00	469.65	482.49		482.73	0.000913	4.39	1860.49	508.71	0.25
Pheasant Point	2900	7195.00	469.00	482.64	470.55	482.66	0.000017	0.60	5966.73	631.42	0.04
Pheasant Point	2775	7195.00	468.55	482.63	468.02	482.66	0.000017	0.58	6052.65	633.27	0.04
Pheasant Point	2600	7195.00	467.89	482.35	474.17	482.63	0.000395	4.30	1753.41	503.56	0.23
Pheasant Point	2555	Bridge									
Pheasant Point	2500	7195.00	467.52	482.22	473.50	482.49	0.000336	4.22	1758.36	466.90	0.21
Pheasant Point	2325	7195.00	466.88	482.20	473.31	482.41	0.000264	3.87	2018.50	401.49	0.19
Pheasant Point	2225	7195.00	466.51	482.12	477.16	482.37	0.000521	3.47	1801.07	381.86	0.18
Pheasant Point	2050	7195.00	465.86	482.15	476.36	482.27	0.000235	2.36	2621.86	473.31	0.13
Pheasant Point	1700	7195.00	464.57	482.07	476.51	482.19	0.000347	2.90	2685.17	1219.35	0.17
Pheasant Point	1600	7195.00	464.20	481.90	477.97	482.12	0.000790	4.14	2032.13	1375.76	0.25

Profile Output Table - Standard Table 2

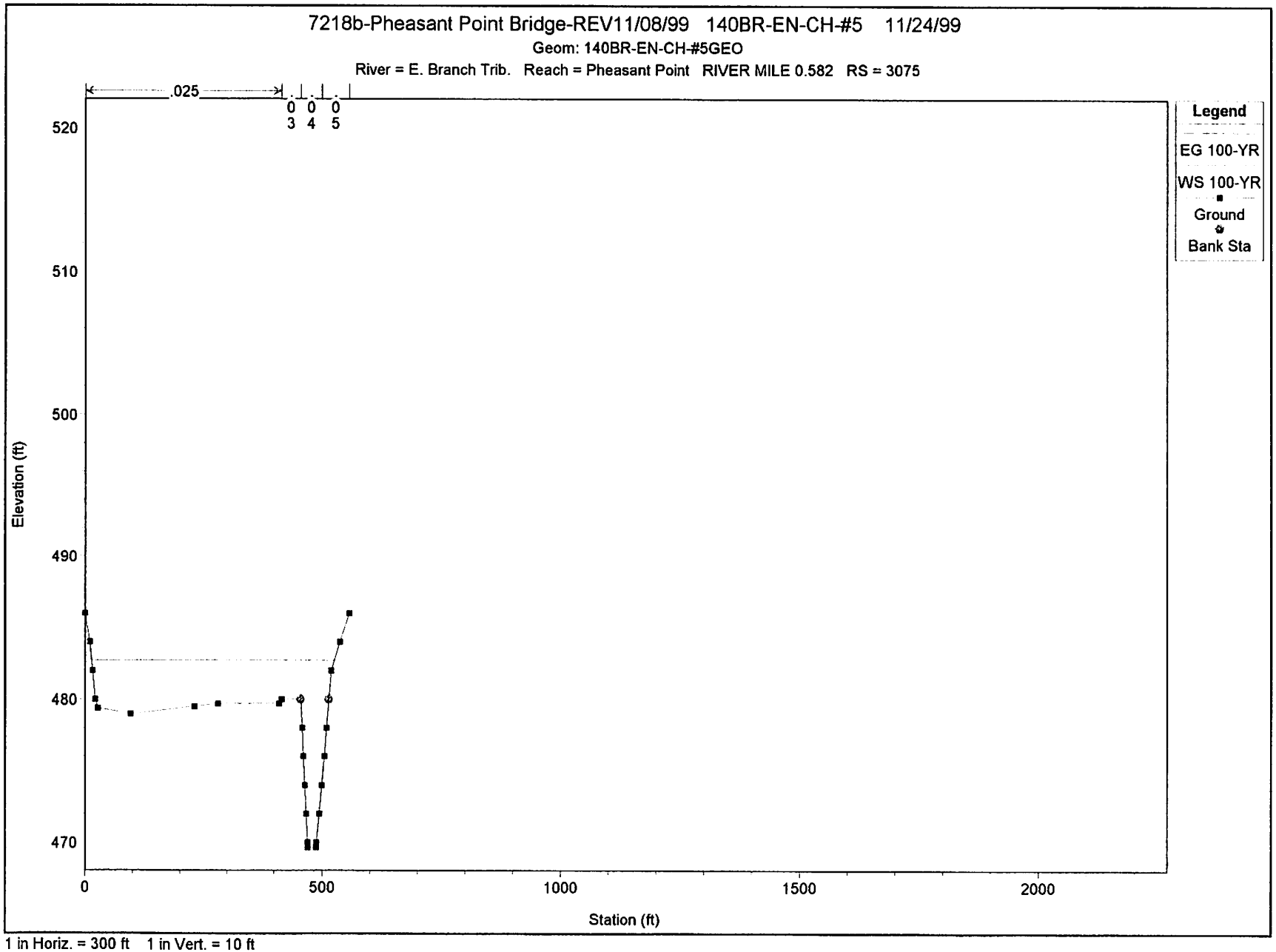
Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Pheasant Point	3168	482.81	482.68	0.13	0.07	0.01	4677.88	2495.11	22.01	715.97
Pheasant Point	3075	482.73	482.49	0.24	0.01	0.06	4789.80	2398.51	6.70	508.71
Pheasant Point	2900	482.66	482.64	0.02	0.00	0.00	6864.56	312.99	17.45	631.42
Pheasant Point	2775	482.66	482.63	0.02	0.01	0.03	6747.68	445.91	1.41	633.27
Pheasant Point	2600	482.63	482.35	0.28	0.02	0.03	421.33	6773.39	0.28	503.56
Pheasant Point	2555	Bridge								
Pheasant Point	2500	482.49	482.22	0.27	0.05	0.03	165.92	7025.05	4.03	466.90
Pheasant Point	2325	482.41	482.20	0.21	0.03	0.00	1143.73	6049.00	2.27	401.49
Pheasant Point	2225	482.37	482.12	0.25	0.06	0.04	5960.38	1220.57	14.05	381.86
Pheasant Point	2050	482.27	482.15	0.12	0.08	0.00	5395.21	1623.00	176.79	473.31
Pheasant Point	1700	482.19	482.07	0.11	0.05	0.01	2811.33	3359.98	1023.68	1219.35
Pheasant Point	1600	482.12	481.90	0.22			1531.96	4687.49	975.55	1375.76



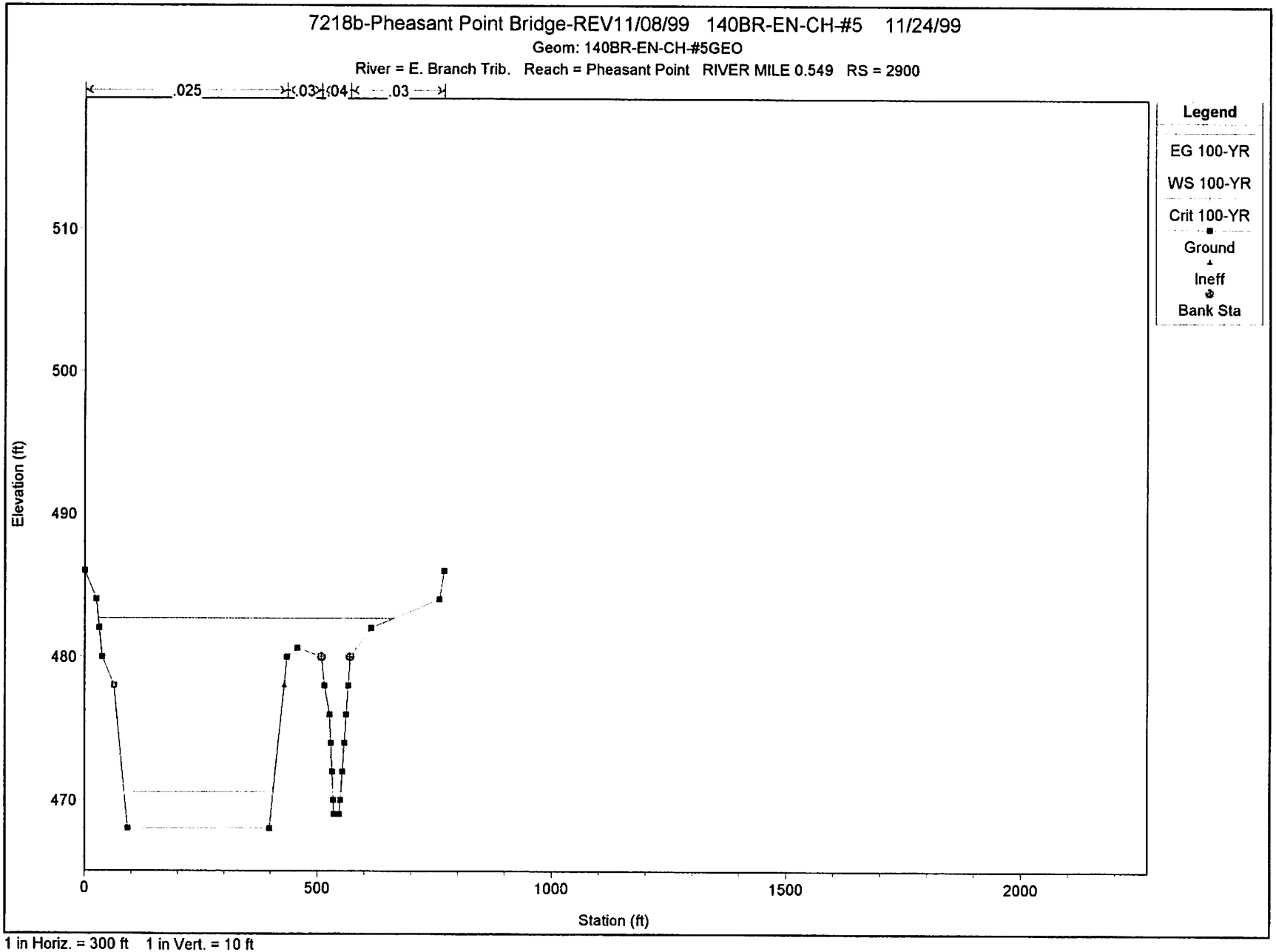
1 in Horiz. = 300 ft 1 in Vert. = 5 ft



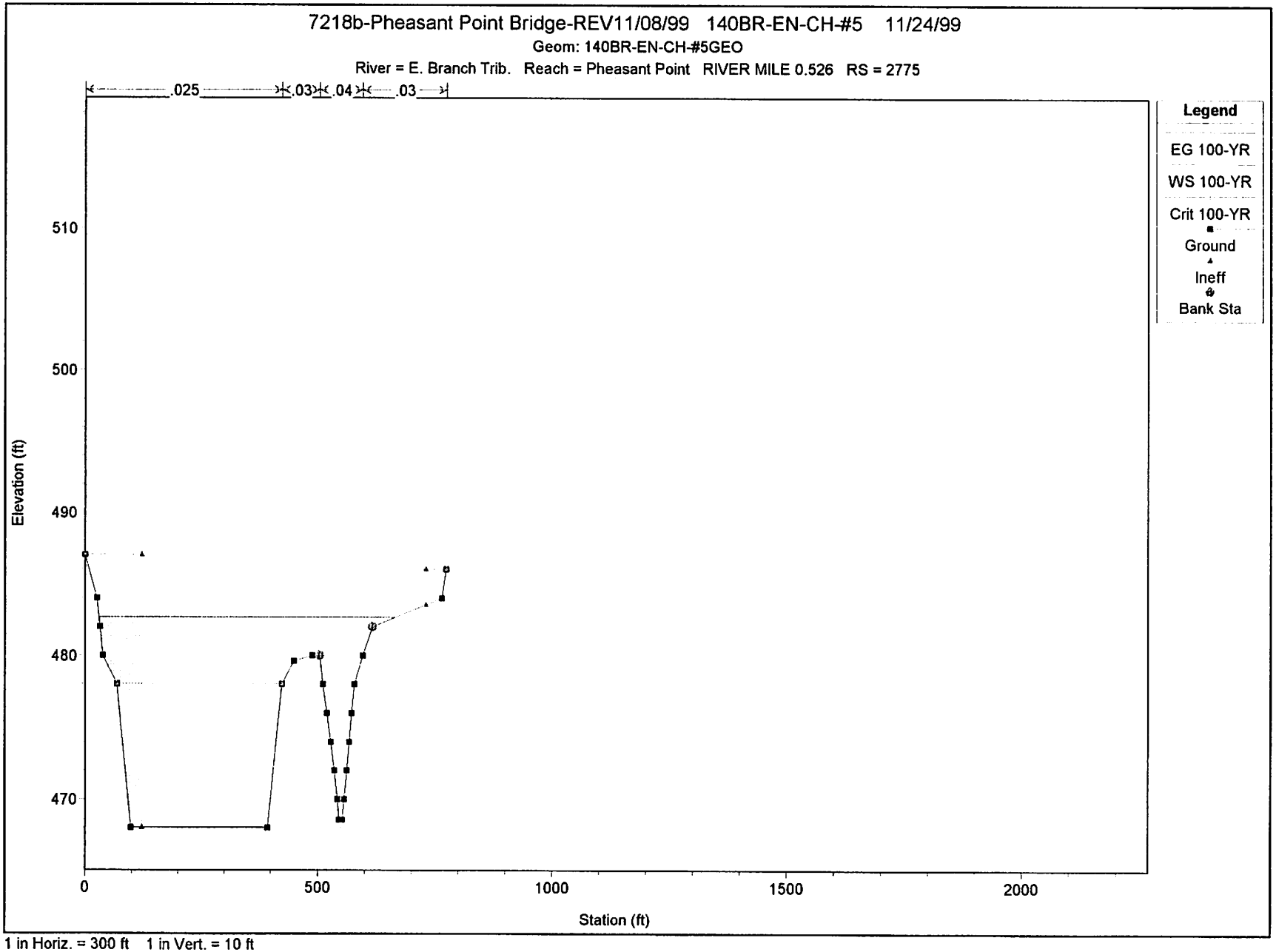
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



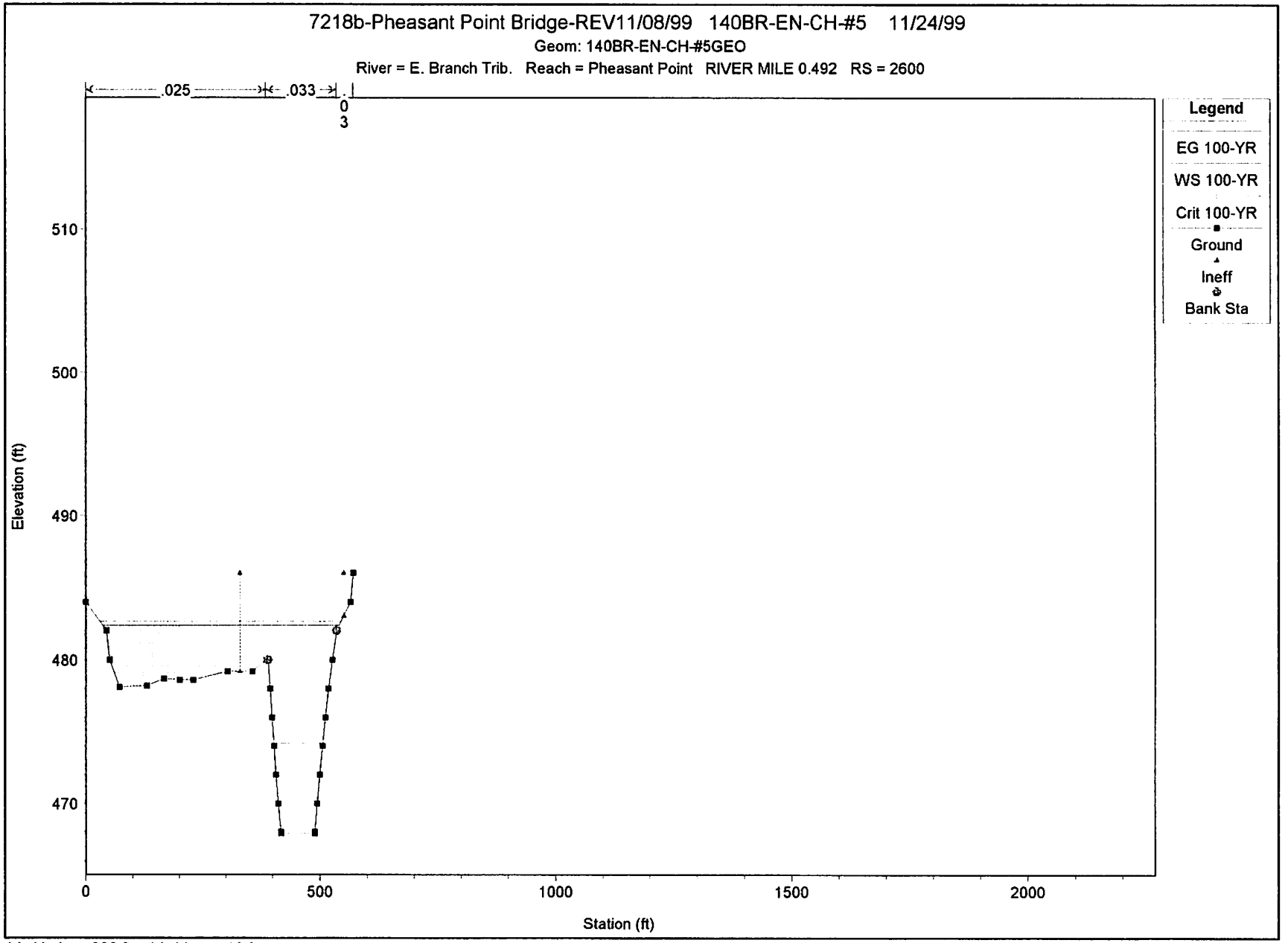
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



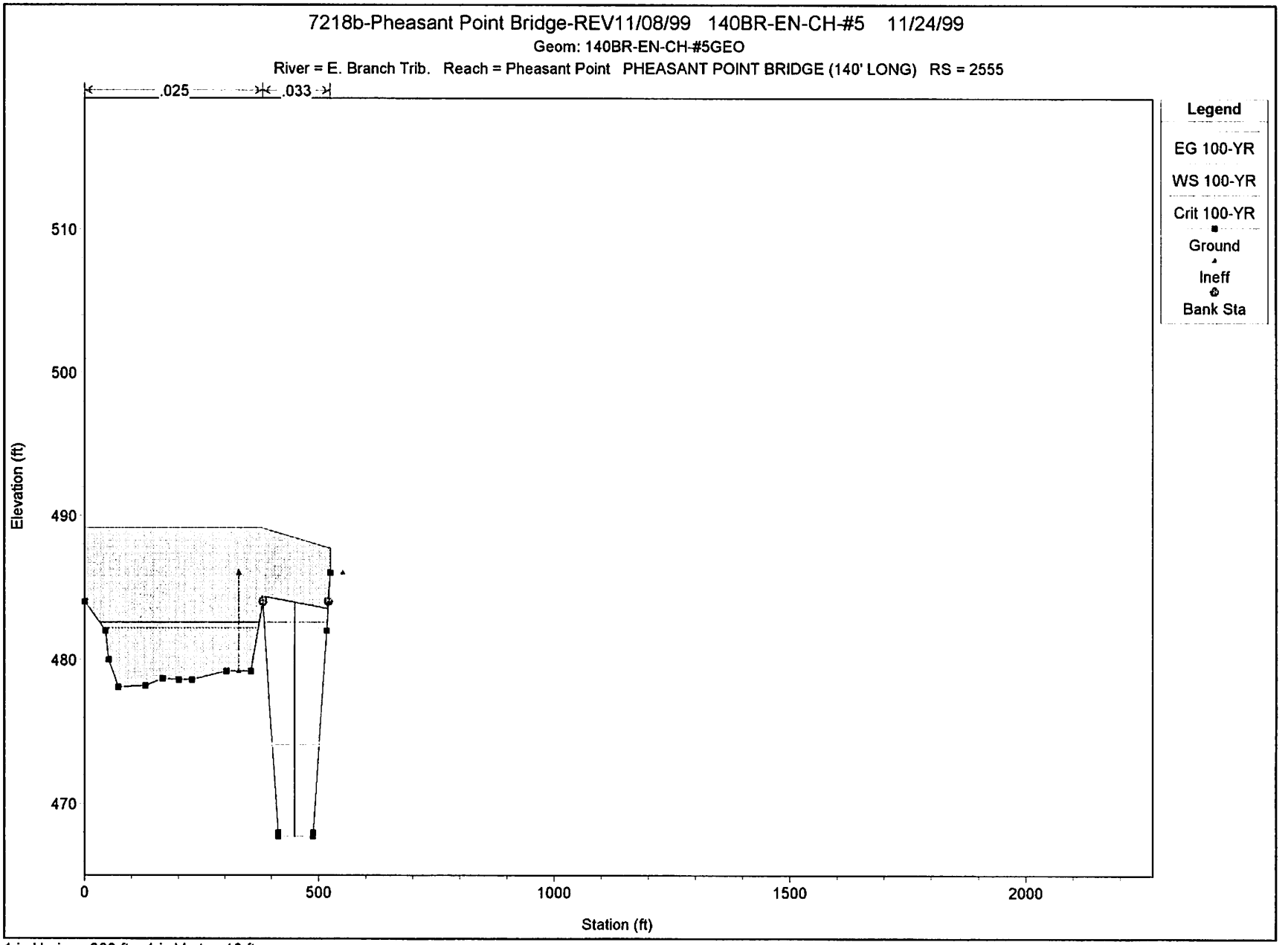
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



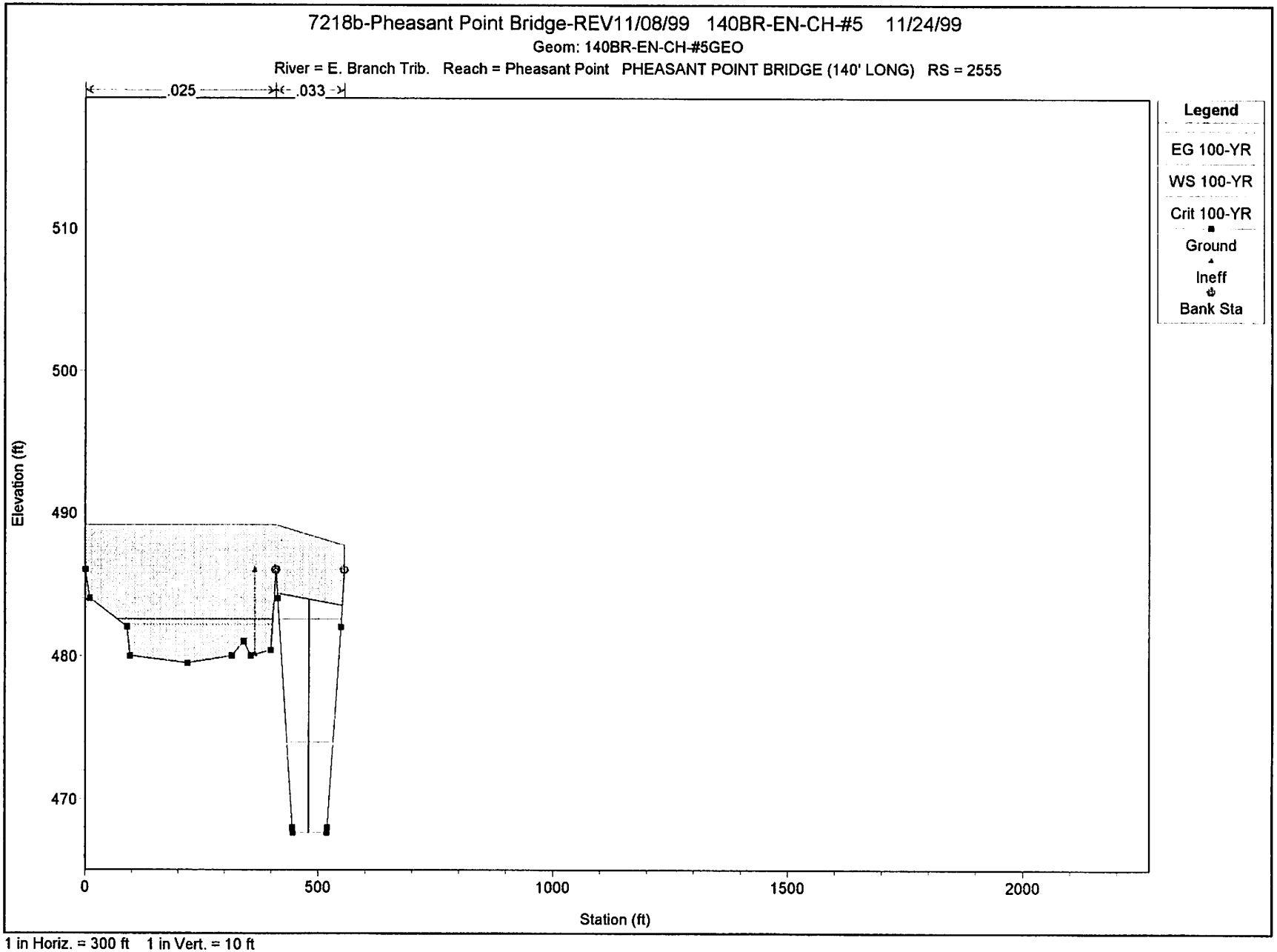
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



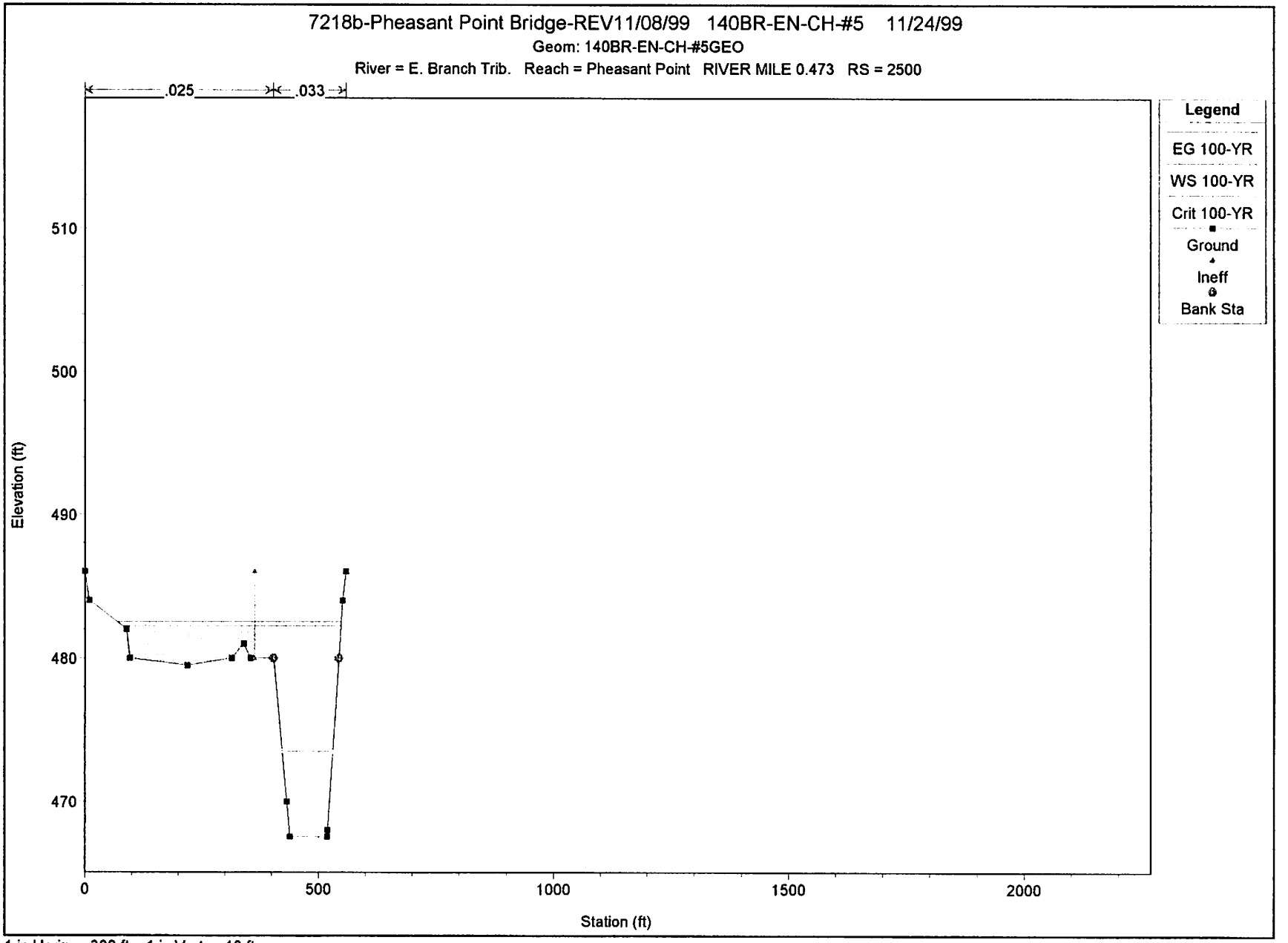
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



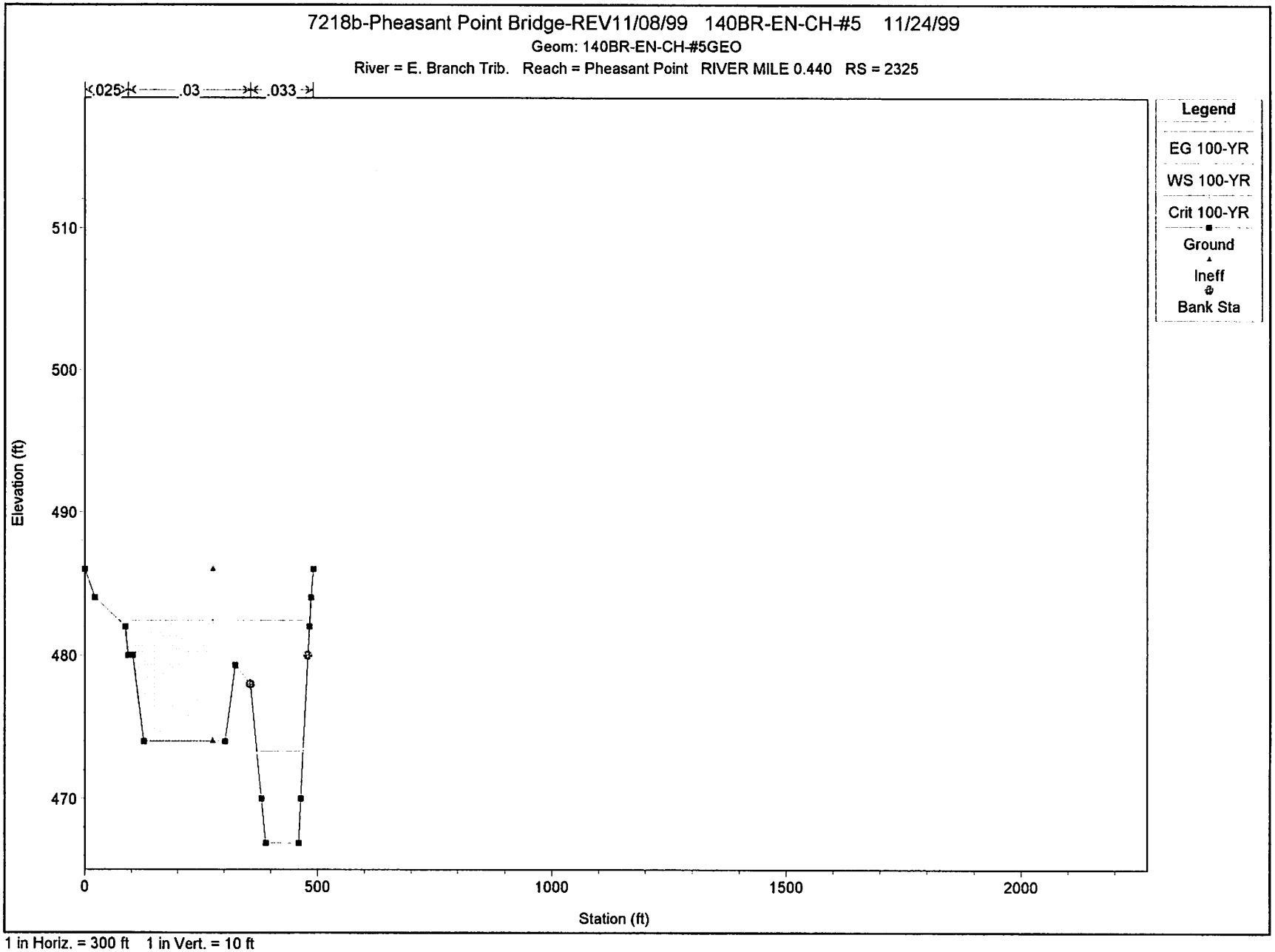
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



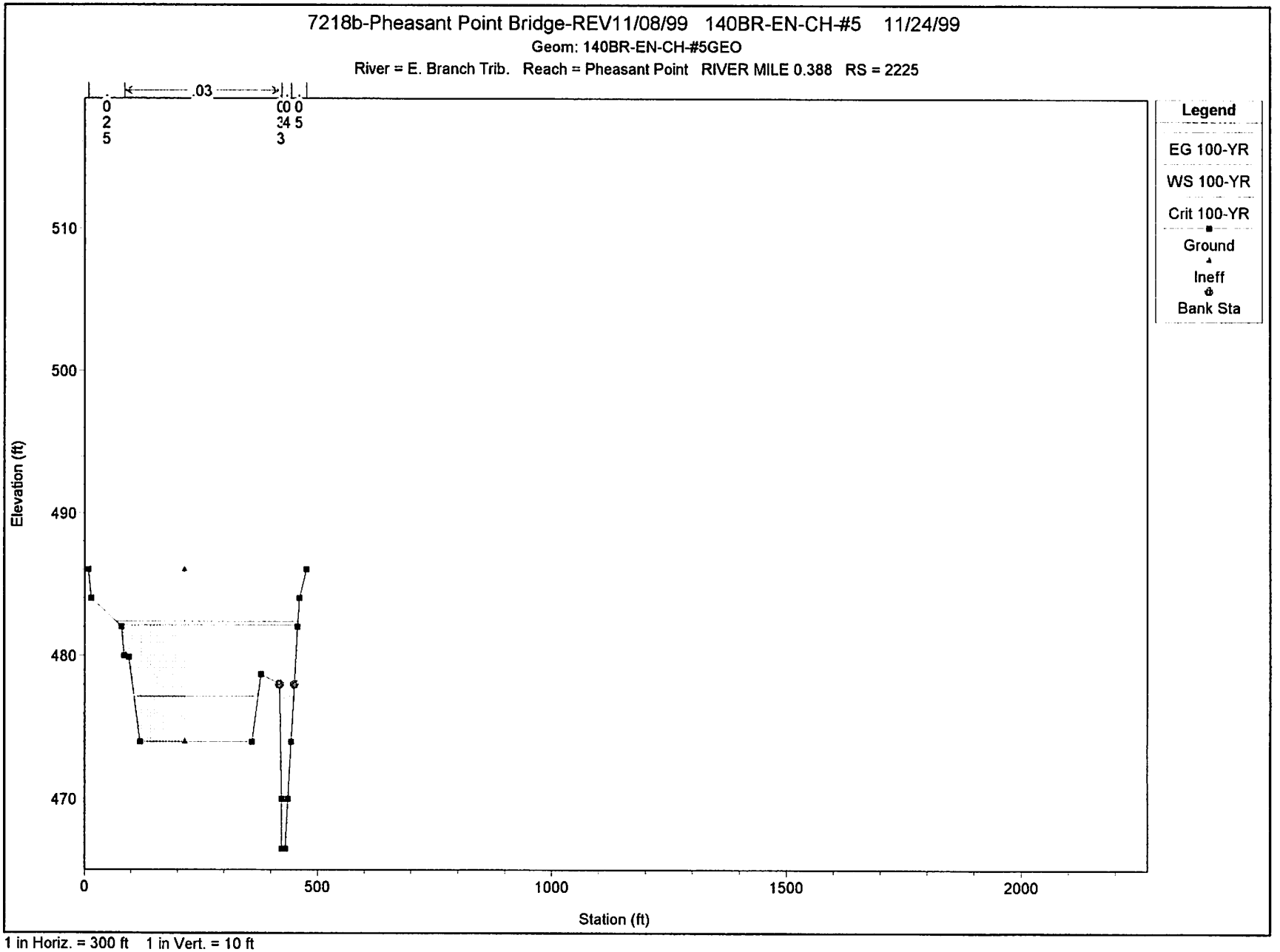
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



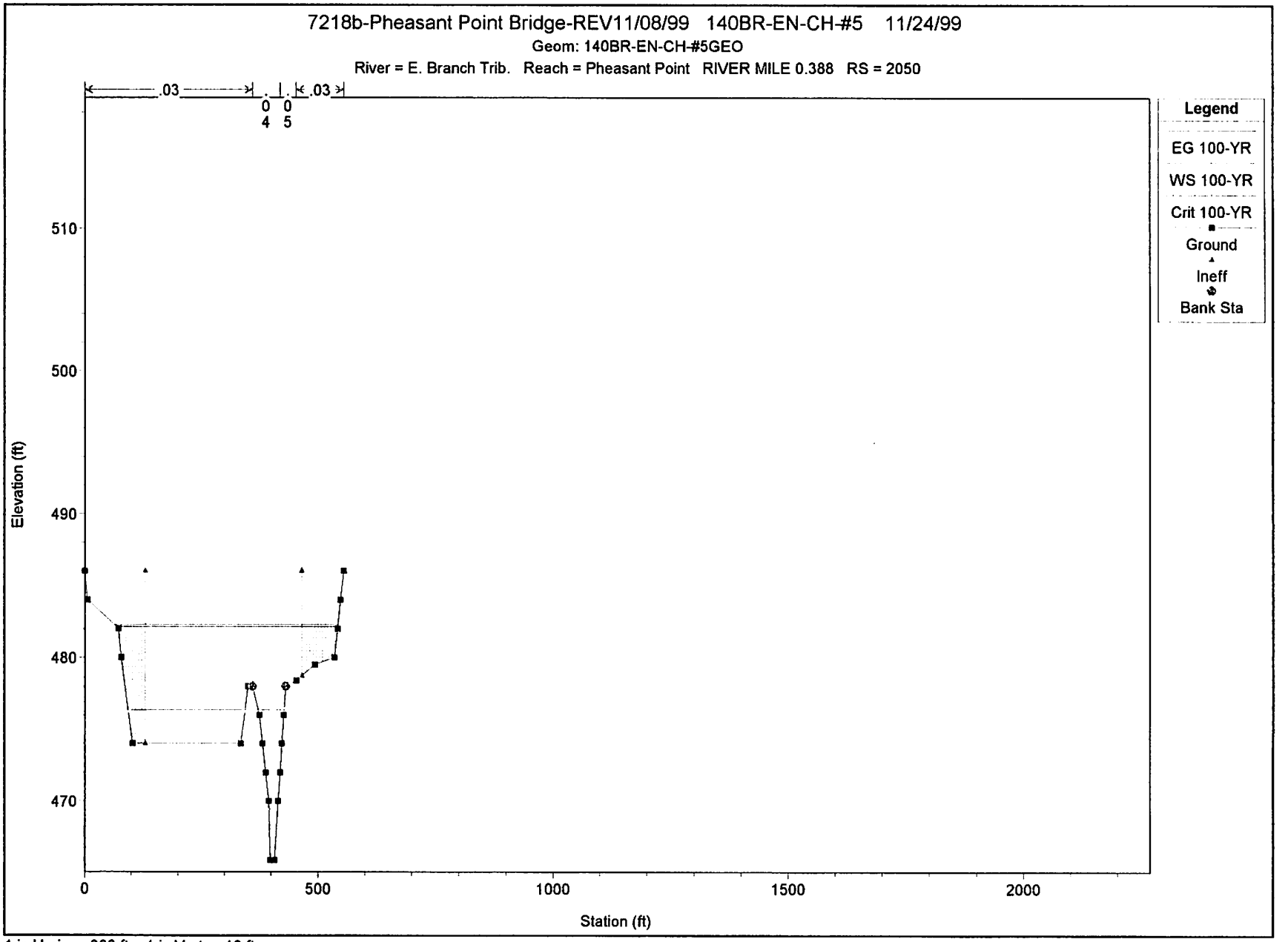
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



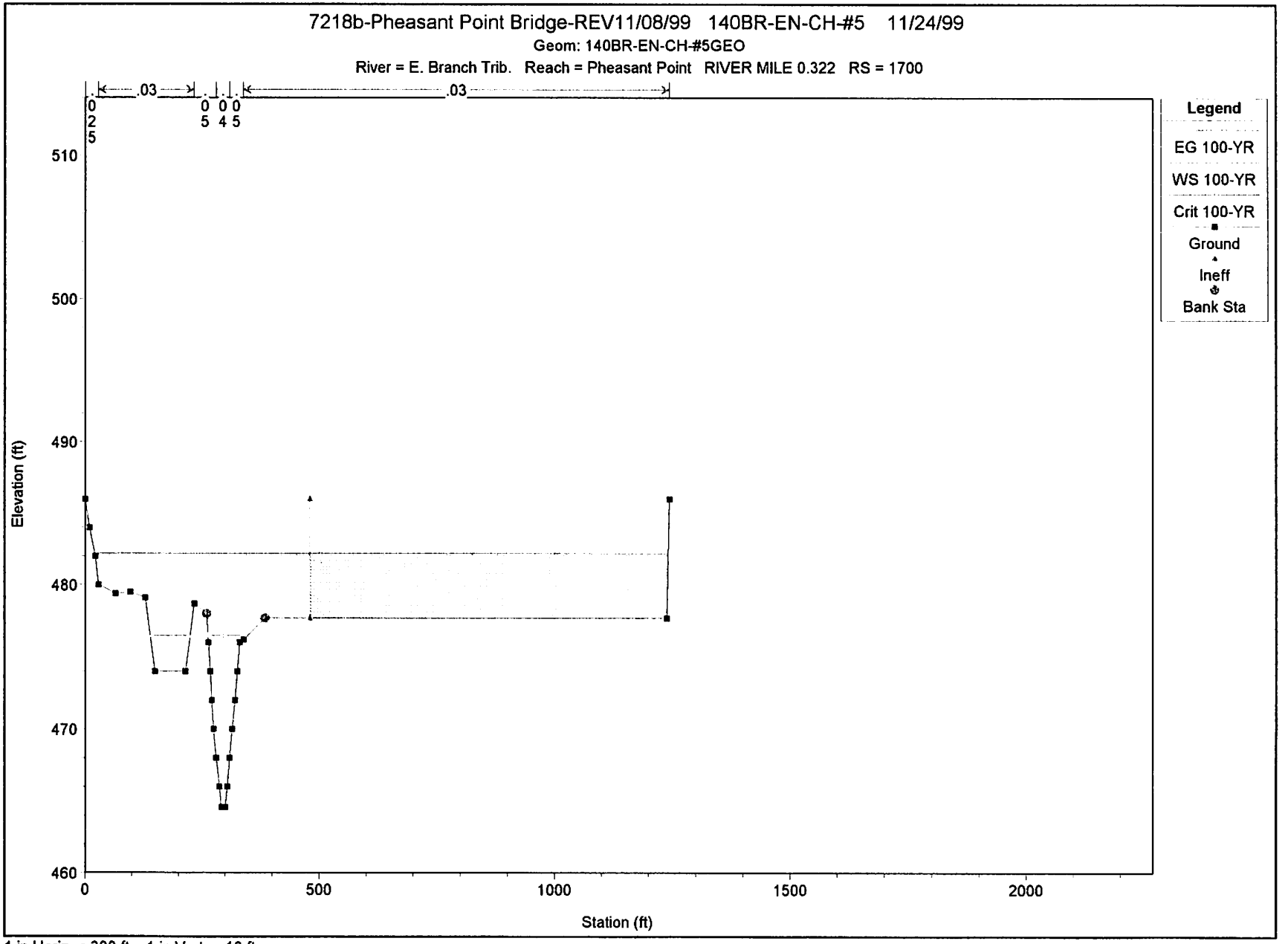
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



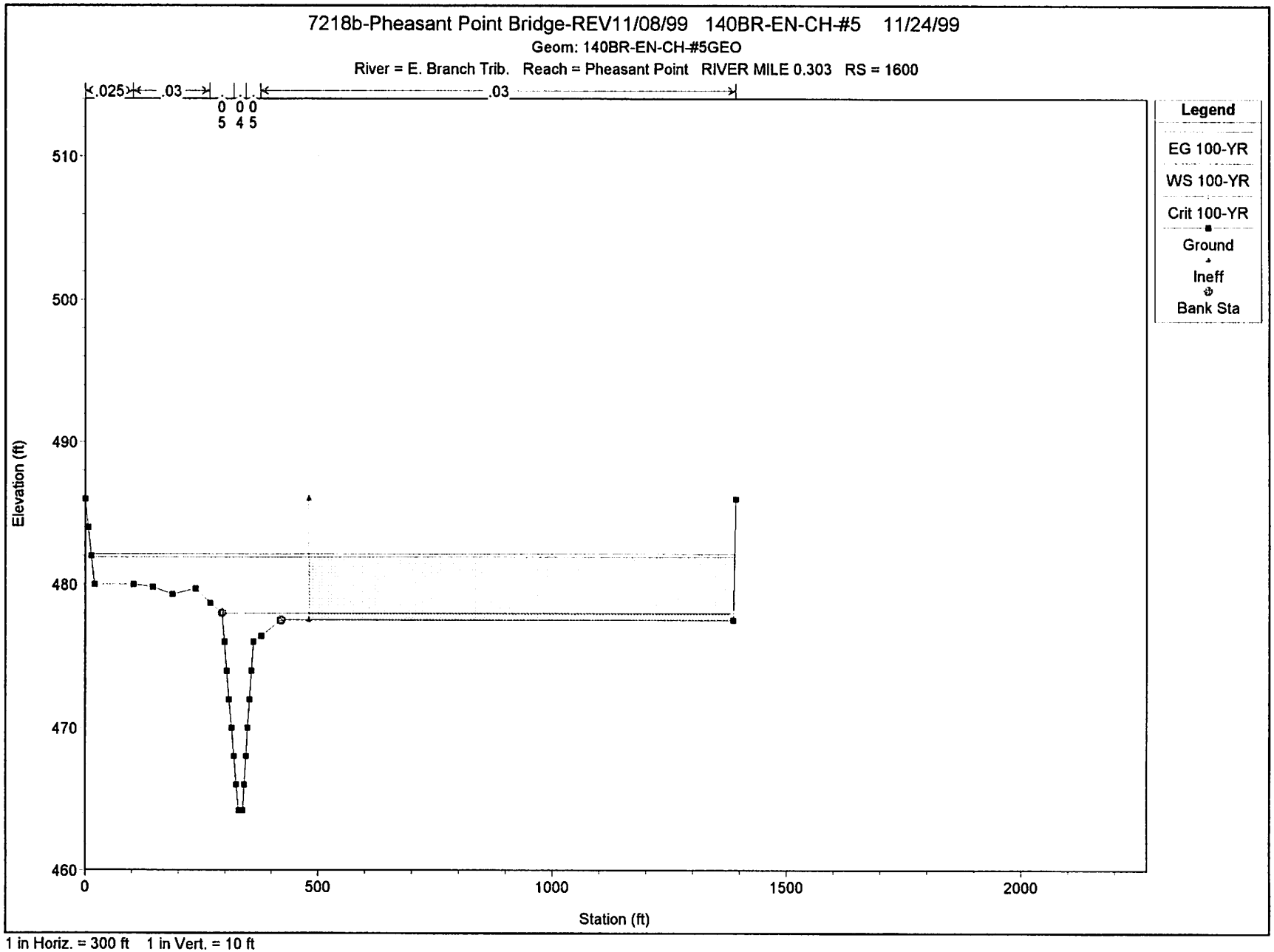
1 in Horiz. = 300 ft 1 in Vert. = 10 ft



1 in Horiz. = 300 ft 1 in Vert. = 10 ft



1 in Horiz. = 300 ft 1 in Vert. = 10 ft



1 in Horiz. = 300 ft 1 in Vert. = 10 ft

APPENDIX E

DRAWINGS

- PROPOSED PLAN & PROFILE

- PROPOSED GRADING PLAN