

PATUXENT GREENS

GREENVIEW DR AND CLUBHOUSE BLVD

FLOODPLAIN STUDY

PREPARED FOR:

CS PATUXENT GREENS, LLC
6290 MONTROSE ROAD
ROCKVILLE, MD 20852
TEL: (301) 692-4000

PREPARED BY:

RODGERS CONSULTING, INC.
1101 MERCANTILE LANE, SUITE 280
LARGO, MARYLAND 20774
TEL: (301) 948-4700

RCI No. 1262A

OCTOBER 2017

PROFESSIONAL CERTIFICATION

"I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 32113, EXPIRATION DATE: SEPTEMBER 15, 2019."



A. Introduction

Patuxent Greens Golf Course is located at 14415 Greenview Drive in Laurel, Maryland. The site is located near the intersection of Greenview Drive and Clubhouse Boulevard. The project proposed 450 dwelling units comprised of a mixture of single-family detached and attached houses grouped in eight pods or land bays of various sizes. FEMA has conducted an existing study that maps the whole site in the 100-year floodplain. The purpose of this floodplain study is to explain how floodplain area filled on site is compensated for, demonstrate the hydrologic and hydraulic methods and tools used to perform these floodplain computations, and ultimately demonstrate the new limits of the 100-year floodplain based on the proposed conditions of the site after the development.

B. Site Information

The site is 191.75 acres and is recorded as Amenity Area Patuxent Greens Golf Course on Plat No. 126059 in the Prince George's County Records and is zoned PUD-E within the municipal limits of the City of Laurel. The property is bordered by single-family detached and multifamily dwelling units to the west, forest to the south, the Patuxent River to the east, and City property to the northeast. The property has an 18-hole golf course, a clubhouse, pro-shop, maintenance sheds, parking lot, paved golf cart trails, driving range, and irrigation ponds. The site is generally flat with rolling hills, berms, and sand bunkers within the golf area. Earthen berms are located along the Patuxent River and Bear Branch edges to keep flood waters from entering the site. Several interconnected water hazards exist through the middle of the site, which will remain, that drain south to a pond that regulated water level with a large pumping station. The site contains emergent wetlands, non-tidal vegetated wetland buffers, and irrigation ponds. About 2,800 feet of Bear Branch runs through the northeastern part of the site. The property ultimately is part of the Upper Patuxent River watershed.

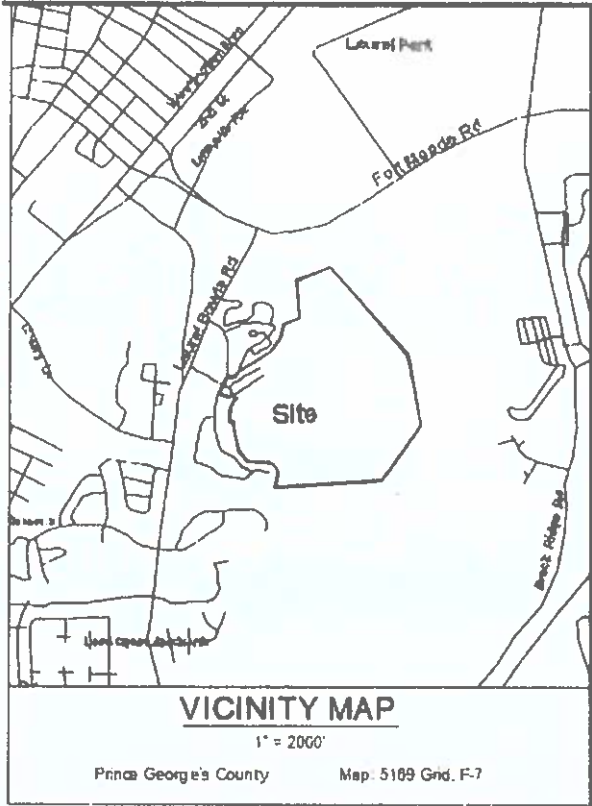
C. Compensatory Storage Methodology

In order to calculate the volume required for compensatory storage, an existing surface was prepared using Joyce Engineering Corporation's existing contours for the site. The cross sections were digitized in from FEMA's FIRM maps and assigned elevations from the calculated Hec-Ras output. Then, a floodplain surface was prepared utilizing the proposed water surface elevations. A comparison volume surface was used to determine the volume of storage available between the existing ground and the 100-year floodplain. At this point it was assumed that the entire site would be brought above the floodplain elevations. The volume of this surface represents the on-site floodplain fill and was determined to be 579,295 CY (see appendix D for calculations). A compensatory cut area was graded on the site bordering the Bear Branch and Patuxent River to make up the volume filled in the floodplain. To find the volume of cut provided in this area a new proposed surface was prepared that included the graded compensatory area. A comparison volume surface was used between this surface and the existing surface to find the volume of cut storage. This volume provided in this cut is 582,796 CY, therefore the on-site fill is accounted for in this compensatory area (see appendix D for calculations).

G. Conclusion

The purpose of this floodplain study was to delineate the 100-year proposed floodplain impacting the Patuxent Greens site. FEMA's cross sections were utilized in providing supporting information to effectively delineate the new 100-year floodplain. The resulting hydraulic analysis and supporting information is provided in the following appendices. Overall the proposed floodplain elevations are only slightly different than FEMA's existing study. FEMA's FIRM Maps and FIS Reports used for this study are provided as supplemental information.

Patuxent Greens
Floodplain Study Report



FloodplainStudy.rep

HEC-RAS Version 4.1.0 Jan 2010
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   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   X      X
X      X  XXXXXX   XXXX     X   X      X   X      XXXXX
```

PROJECT DATA

Project Title: Floodplain Study
Project File : FloodplainStudy.prj
Run Date and Time: 10/19/2017 12:02:43 PM

Project in English units

PLAN DATA

Plan Title: Plan 02
Plan File : n:\MD-Prince Georges\Patuxent Green\documents\Technical\Floodplain
Hec-Ras\FloodplainStudy.p02

Geometry Title: Floodplain Study 2
Geometry File : n:\MD-Prince Georges\Patuxent
Green\documents\Technical\Floodplain Hec-Ras\FloodplainStudy.g02

Flow Title : flow 2
Flow File : n:\MD-Prince Georges\Patuxent
Green\documents\Technical\Floodplain Hec-Ras\FloodplainStudy.f05

Plan Summary Information:

Number of: Cross Sections	=	9	Multiple Openings	=	0
Culverts	=	0	Inline Structures	=	0
Bridges	=	0	Lateral Structures	=	0

Computational Information

FloodplainStudy.rep

RIVER: 1
 REACH: 1 RS: 7446.07

INPUT

Description: 130

Station Elevation Data		num=		15					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	132	130	129.916	499	124	668	124	792	126
811	126	820	124	877	124	902	126	1842	126
1958	128	1965	130.333	1970	132	2010	132	2100	140

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val
0	.05	130	.03	1965	.05

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	130	1965		1199.31	686.77 2298.46	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	128.77	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.04	Wt. n-Val.		0.030
W.S. Elev (ft)	127.73	Reach Len. (ft)	1199.31	686.77
2298.46				
Crit W.S. (ft)	127.72	Flow Area (sq ft)		3460.85
E.G. Slope (ft/ft)	0.010387	Area (sq ft)		3460.85
Q Total (cfs)	28320.00	Flow (cfs)		28320.00
Top Width (ft)	1676.48	Top Width (ft)		1676.48
Vel Total (ft/s)	8.18	Avg. Vel. (ft/s)		8.18
Max Chl Dpth (ft)	3.73	Hydr. Depth (ft)		2.06
Conv. Total (cfs)	277876.1	Conv. (cfs)		277876.1
Length Wtd. (ft)	686.77	Wetted Per. (ft)		1676.84
Min Ch El (ft)	124.00	Shear (lb/sq ft)		1.34
Alpha	1.00	Stream Power (lb/ft s)	2100.00	0.00

FloodplainStudy.rep

E.G. Slope (ft/ft)	0.001678	Area (sq ft)	7791.03
Q Total (cfs)	28320.00	Flow (cfs)	28320.00
Top Width (ft)	3247.99	Top Width (ft)	3247.99
Vel Total (ft/s)	3.63	Avg. Vel. (ft/s)	3.63
Max Chl Dpth (ft)	7.86	Hydr. Depth (ft)	2.40
Conv. Total (cfs)	691376.6	Conv. (cfs)	691376.6
Length Wtd. (ft)	1143.46	Wetted Per. (ft)	3248.83
Min Ch El (ft)	118.11	Shear (lb/sq ft)	0.25
Alpha 0.00	1.00	Stream Power (lb/ft s)	3817.00 0.00
Frctn Loss (ft)	1.68	Cum Volume (acre-ft)	1717.27
C & E Loss (ft)	0.01	Cum SA (acres)	464.46

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: 1
REACH: 1 RS: 5615.84

INPUT

Description: 126

Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	142	190	127	228	124	337	122	1035	121.75
2645	122.25	3459	122	3600	117.15	3622	117.15	3624	120
3776	122	3792	126						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	190	.03	3792	.05

FloodplainStudy.rep

INPUT

Description: CG

Station Elevation Data		num= 20							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	164	345	148	430	126.952	450	122	493	120
560	120	568	122	1215	121.75	2064	122.25	2915	122
3192	120	3208	120	3390	122	3580	122	3618	117.09
3668	117.09	3677	120	3732	122	3746	126	3979	126

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.05	430	.03	3746	.05

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	430	3746		788.67	682.21	675.7	.1
							.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	123.95	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.29	Wt. n-Val.		0.030
W.S. Elev (ft)	123.65	Reach Len. (ft)	788.67	682.21
675.70				
Crit W.S. (ft)		Flow Area (sq ft)		6512.34
E.G. Slope (ft/ft)	0.003109	Area (sq ft)		6512.34
Q Total (cfs)	28320.00	Flow (cfs)		28320.00
Top Width (ft)	3294.47	Top Width (ft)		3294.47
Vel Total (ft/s)	4.35	Avg. Vel. (ft/s)		4.35
Max Chl Dpth (ft)	6.56	Hydr. Depth (ft)		1.98
Conv. Total (cfs)	507896.8	Conv. (cfs)		507896.8
Length Wtd. (ft)	682.21	Wetted Per. (ft)		3296.02
Min Ch El (ft)	117.09	Shear (lb/sq ft)		0.38
Alpha	1.00	Stream Power (lb/ft s)	3979.00	0.00
0.00				
Frctn Loss (ft)	1.18	Cum Volume (acre-ft)		1453.14

FloodplainStudy.rep			
Top Width (ft)	3504.05	Top Width (ft)	3504.05
Vel Total (ft/s)	3.11	Avg. Vel. (ft/s)	3.11
Max Chl Dpth (ft)	6.60	Hydr. Depth (ft)	2.60
Conv. Total (cfs)	852231.6	Conv. (cfs)	852231.6
Length Wtd. (ft)	1592.65	Wetted Per. (ft)	3504.56
Min Ch El (ft)	115.97	Shear (lb/sq ft)	0.18
Alpha 0.00	1.00	Stream Power (lb/ft s)	3588.00 0.00
Frctn Loss (ft)	1.65	Cum Volume (acre-ft)	1330.85
C & E Loss (ft)	0.01	Cum SA (acres)	300.50

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: 1
 REACH: 1 RS: 3069.65

INPUT

Description: 122

Station Elevation Data		num= 12							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	126	450	122	662	120	1015	118	1494	118
1542	114.69	1584	114.69	1933	117	2321	114	2452	114
2480	116	2504	122						

Manning's n Values		num= 3			
Sta	n Val	Sta	n Val	Sta	n Val
0	.05	450	.03	2504	.05

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff Contr.	Expan.
	450	2504		692.44	1771.64 2694.91	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

FloodplainStudy.rep

0	131	480	120.837	614	118	1402	116	2240	116
2765	113.5	3175	113.5	3715	122.203	4478	134.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.05	480	.03	3715	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
480	3715	211.47	629.83	638.23	.1
					.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	120.14	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.08	Wt. n-Val.		0.030
W.S. Elev (ft)	120.06	Reach Len. (ft)	211.47	629.83
638.23				
Crit W.S. (ft)		Flow Area (sq ft)		12738.93
E.G. Slope (ft/ft)	0.000302	Area (sq ft)		12738.93
Q Total (cfs)	28320.00	Flow (cfs)		28320.00
Top Width (ft)	3065.79	Top Width (ft)		3065.79
Vel Total (ft/s)	2.22	Avg. Vel. (ft/s)		2.22
Max Chl Dpth (ft)	6.56	Hydr. Depth (ft)		4.16
Conv. Total (cfs)	1630772.0	Conv. (cfs)		1630772.0
Length Wtd. (ft)	629.83	Wetted Per. (ft)		3065.87
Min Ch El (ft)	113.50	Shear (lb/sq ft)		0.08
Alpha	1.00	Stream Power (lb/ft s)	4478.00	0.00
0.00				
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)		617.76
C & E Loss (ft)	0.01	Cum SA (acres)		99.69

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

FloodplainStudy.rep

Alpha	1.00	Stream Power (lb/ft s)	4297.00	0.00
0.00				
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)		382.45
C & E Loss (ft)	0.01	Cum SA (acres)		54.56

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: 1

REACH: 1

RS: 0

INPUT

Description: 120

Station Elevation Data	num=	9							
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev									
0 130 50 121.667 60 120 175 114 585 112									
1300 111.75 3100 112.25 3888 112 4025 122									

Manning's n Values	num=	3		
Sta n Val Sta n Val Sta n Val				
0 .05 50 .03 4025 .05				

Bank Sta: Left	Right	Coeff	Contr.	Expan.
50	4025	.1		.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	120.01	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.01	Wt. n-Val.		0.030
W.S. Elev (ft)	120.00	Reach Len. (ft)		
Crit W.S. (ft)	113.29	Flow Area (sq ft)		30068.28
E.G. Slope (ft/ft)	0.000024	Area (sq ft)		30068.28
Q Total (cfs)	28320.00	Flow (cfs)		28320.00

FloodplainStudy.rep

1	7446.07	1199.31	686.77	2298.46
1	6759.3	1148.07	1143.46	386.63
1	5615.84	365.99	271.33	164.13
1	5344.51	788.67	682.21	675.7
1	4662.30	1415.63	1592.65	1062.14
1	3069.65	692.44	1771.64	2694.91
1	1298.03	211.47	629.83	638.23
1	668.2	682.11	668	718.91
1	0			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: 1

Reach	River Sta.	Contr.	Expan.
1	7446.07	.1	.3
1	6759.3	.1	.3
1	5615.84	.1	.3
1	5344.51	.1	.3
1	4662.30	.1	.3
1	3069.65	.1	.3
1	1298.03	.1	.3
1	668.2	.1	.3
1	0	.1	.3

ERRORS WARNINGS AND NOTES

Errors Warnings and Notes for Plan : 2

River: 1 Reach: 1 RS: 7446.07 Profile: PF 1

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.

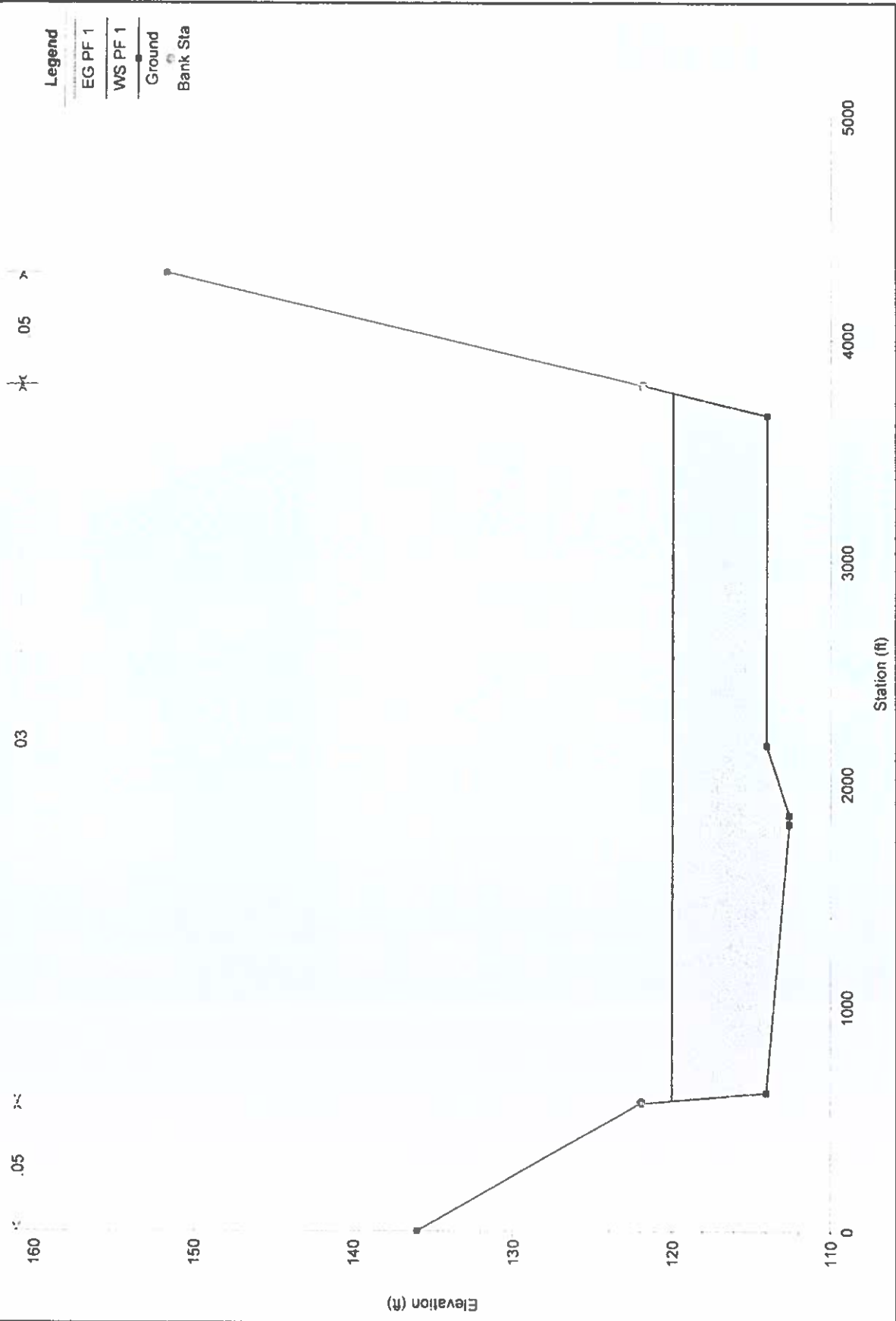
River: 1 Reach: 1 RS: 6759.3 Profile: PF 1

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

Appendix C

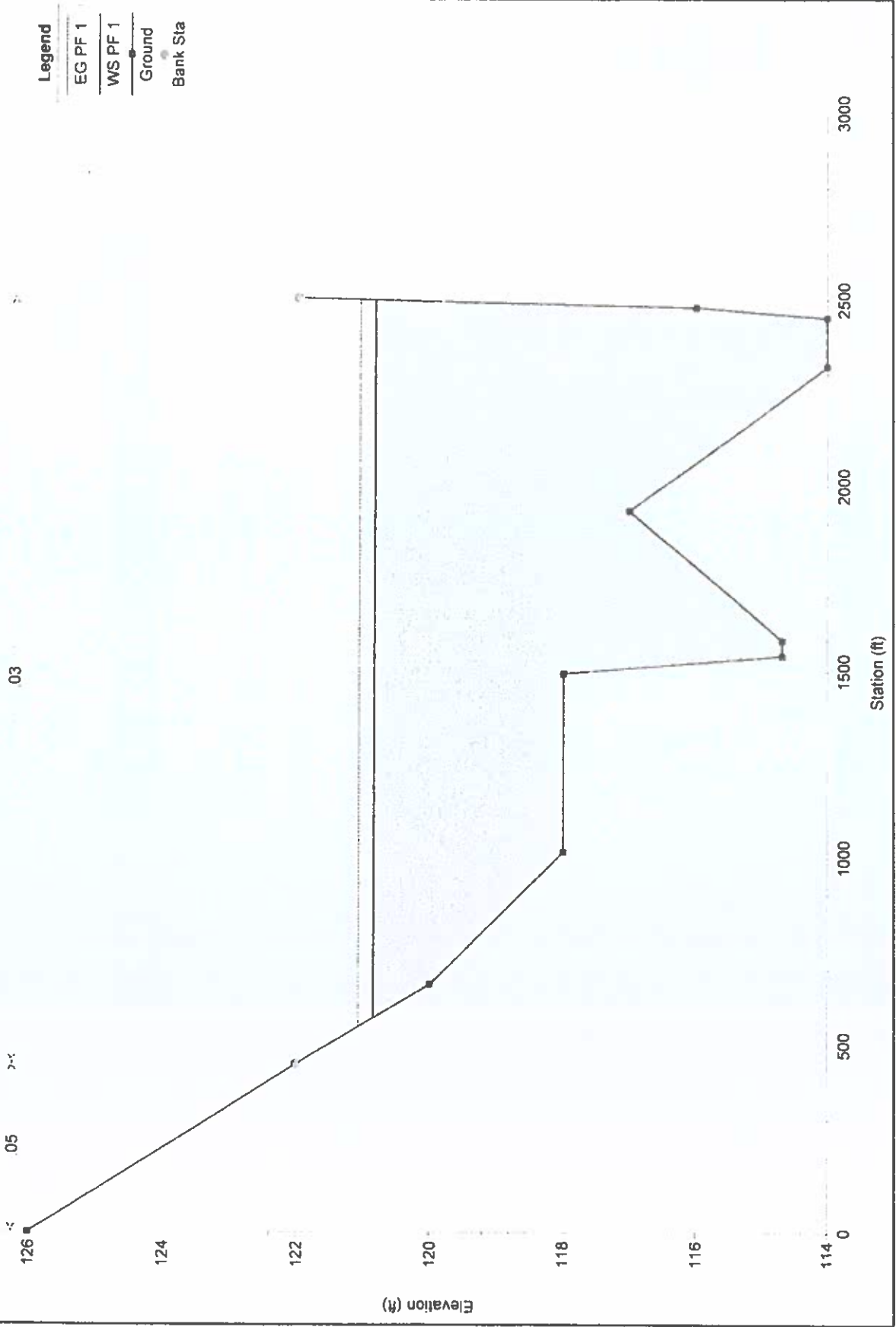
Hec-Ras Cross Sections and Summary Table

Floodplain Study Plan: Plan 02 10/19/2017
CF



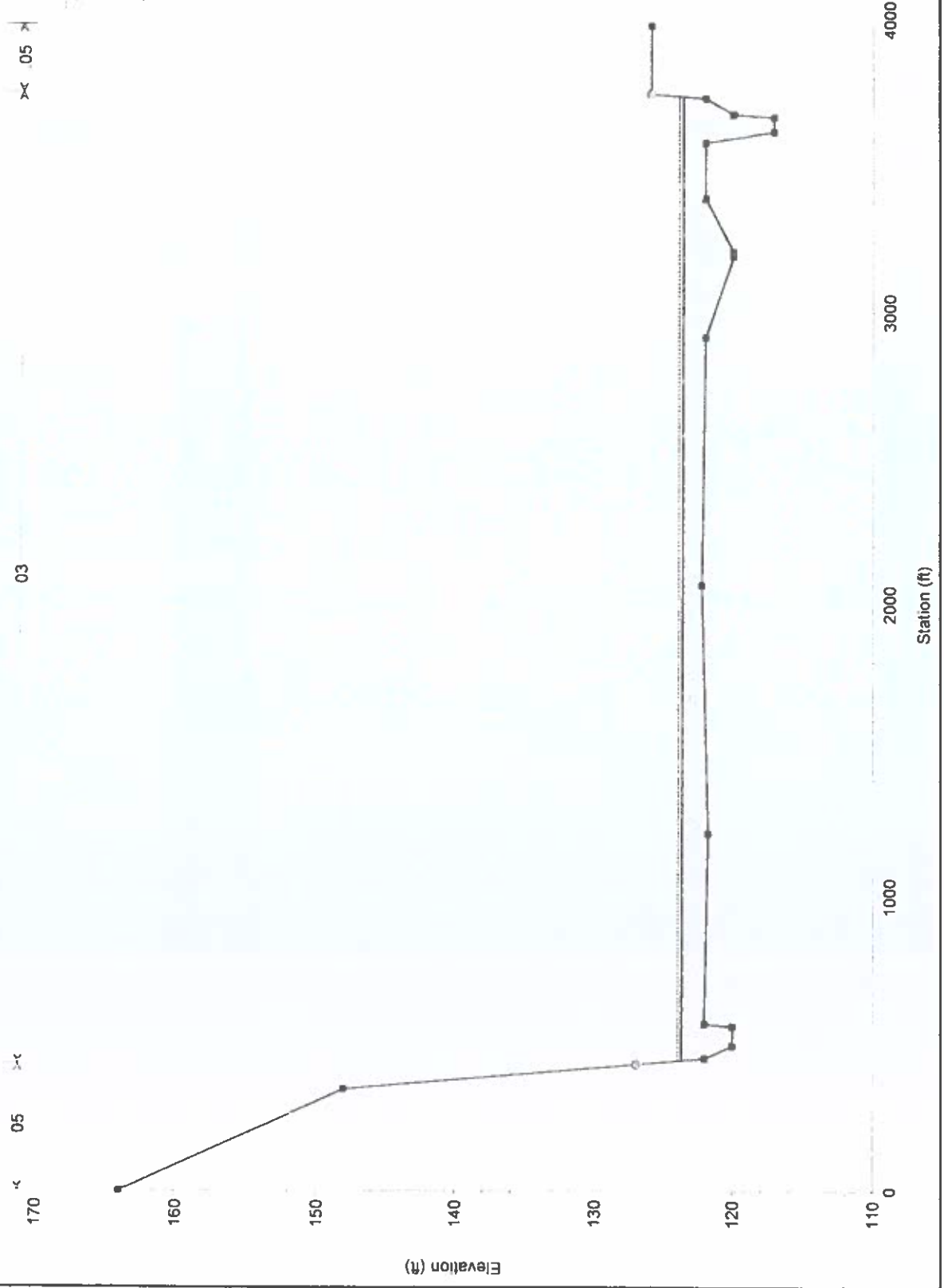
Floodplain Study Plan: Plan 02 10/19/2017

122
03



Floodplain Study Plan: Plan 02 10/19/2017

CG



Legend
EG PF 1
WS PF 1
Ground
Bank Sta

05 03 05

170 160 150 140 130 120 110 0

Elevation (ft)

0 1000 2000 3000 4000

Station (ft)

Floodplain Study Plan: Plan 02 10/19/2017

129
03

05

140

135

130

125

120

115

0

Elevation (ft)

- Legend**
- EG PF 1
 - WS PF 1
 - Ground
 - Bank Sta

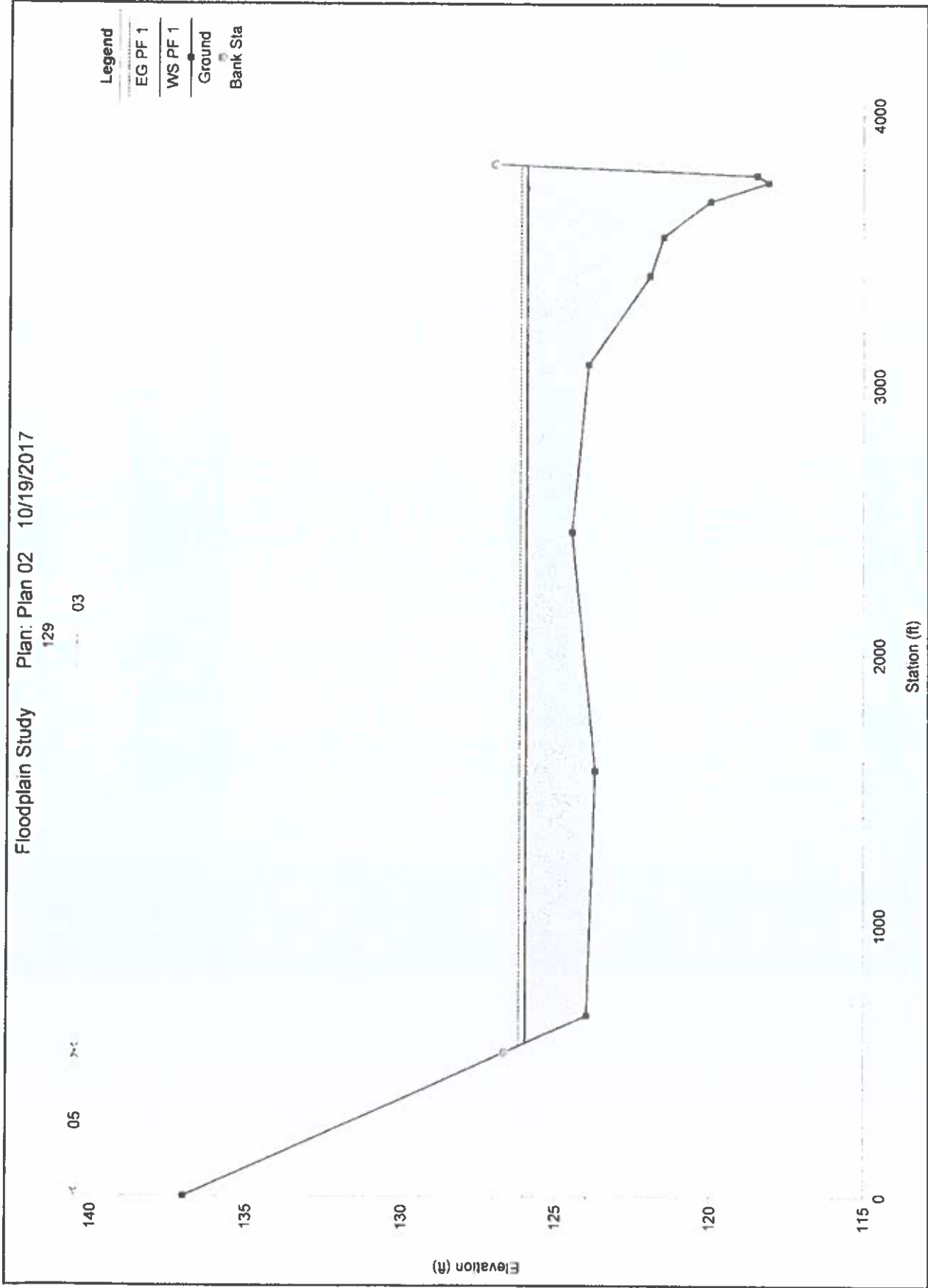
4000

3000

2000

1000

Station (ft)



HEC-RAS Plan 2 River: 1 Reach: 1 Profile: PF 1

Reach	River Sta	Profile	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
1	7446.07	PF 1	28320.00	124.00	127.73	127.72	128.77	0.010387	8.18	3460.85	1676.48	1.00	
1	6759.3	PF 1	28320.00	118.11	125.97		126.18	0.001678	3.63	7791.03	3247.99	0.41	
1	5615.84	PF 1	28320.00	117.15	124.32		124.48	0.001304	3.25	8718.81	3561.30	0.37	
1	5344.51	PF 1	28320.00	117.09	123.65		123.95	0.003109	4.35	6512.34	3294.47	0.55	
1	4662.30	PF 1	28320.00	115.97	122.57		122.72	0.001104	3.11	9104.66	3504.05	0.34	
1	3069.65	PF 1	28320.00	114.00	120.84		121.07	0.000972	3.80	7447.37	1926.65	0.34	
1	1298.03	PF 1	28320.00	113.50	120.06		120.14	0.000302	2.22	12738.93	3065.79	0.19	
1	668.2	PF 1	28320.00	112.60	120.01		120.05	0.000073	1.43	19809.88	3177.56	0.10	
1	0	PF 1	28320.00	111.75	120.00	113.29	120.01	0.000024	0.94	30068.28	3937.60	0.06	

Comparative Floodplain Fill Surface



Comparative Floodplain Fill Statistics

Surface Properties - floodplain volume

Information | Definition | Analysis | Statistics

Statistics	Value
General	
TIN	
Volume	
Base Surface	Existing Surface 2017-10-11 from joyce aerial topo
Comparison Surface	proposed floodplain elevation
Cut Factor	1.000
Fill Factor	1.000
Cut volume (adjusted)	550.35 Cu. Yd.
Fill volume (adjusted)	579845.20 Cu. Yd.
Net volume (adjusted)	579294.84 Cu. Yd. (Fill)
Cut volume (unadjusted)	550.35 Cu. Yd.
Fill volume (unadjusted)	579845.20 Cu. Yd.
Net volume (unadjusted)	579294.84 Cu. Yd. (Fill)

← Total Fill Volume in Floodplain on Property

OK Cancel Apply Help

Appendix E

SUPPORTING PAGES
FROM
FEMA FIS REPORTS

TABLE 5 – SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES (cfs) PERCENT (%) ANNUAL CHANCE</u>			
		<u>10%</u>	<u>2%</u>	<u>1%</u>	<u>0.2%</u>
AMMENDALE BRANCH Approximately 550 feet downstream of US Route 1	2.2	1,100	1,650	1,950	3,200
ANACOSTIA RIVER Prince George's County Boundary	131.8	21,550	33,320	39,510	52,940
BALD HILL BRANCH Approximately 50 feet upstream of the confluence with Western Branch	6.09	2,048	2,612	3,113	3,865
Just downstream of Conrail	1.62	985	1,163	1,238	1,408
BARNABY RUN At the confluence with Oxon Run	4.17	2,639	3,424	3,932	5,122
BEAR BRANCH At its confluence with Crow Branch	2.43	1,218	1,704	2,053	2,669
Upstream of Contee Road	1.07	1,508	2,078	2,404	3,055
BRIER DITCH Approximately 300 feet downstream of the Kenilworth Avenue	8.09	3,310	5,070	6,020	7,690
Approximately 60 feet downstream of Kenilworth Avenue	4.23	1,970	2,930	3,430	4,310
BROAD CREEK Approximately 3,100 feet downstream of Oxon Hill Road	25.57	5,144	6,808	8,000	10,743