

manayunk, pa

ISLAND **venice one**

Flood Hazard Analysis

J. Richard Weggel, PhD., P.E.

Second Supplementary Report; March 5, 2007

First Supplementary Report; April 23, 2006

Flood Hazard Report; January 14, 2000

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**FLOOD HAZARD ANALYSIS FOR PROPOSED DEVELOPMENT ON VENICE
ISLAND, MANAYUNK, PHILADELPHIA, PA
SECOND SUPPLEMENTARY REPORT**

prepared for

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by

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3 March 2007

INTRODUCTION

This report is the second supplementary report to an original flood analysis report entitled "Flood Hazard Analysis for Proposed Development on Venice Island, Manayunk, Philadelphia, PA," (Weggel, 2000)¹. The first supplementary report (Weggel, 2006) was prepared to address changes to the proposed Venice Island Apartments between Green Lane and Leverington Street, and to the proposed Waterford Apartments at Cotton Street (referred to as "Cotton Street Landing" in the original report). The original report describes existing conditions at the condominium site as well as the calibration of the HEC-RAS model. In that calibration, four additional cross-sections were added to the Schuylkill River model to better describe conditions at the various development sites. In the original report the effect of three proposed developments on flood elevations in the Schuylkill River was investigated. The first supplementary report addressed flood level changes resulting from modifications to the proposed Venice Island Apartments and Waterford Apartments. This second supplementary report addresses further changes to proposed conditions at the Venice Island Apartments - since renamed the Venice Island Condominiums.

A flood hazard analysis for the Schuylkill River was made by the US Army Corps of Engineers for the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program. The analysis was made using HEC-2, a computer model, developed by the Corps of Engineers' Hydrologic Engineering Center (HEC), which computes backwater profiles for river reaches given characteristic cross-sections spaced along the river and information on obstructions such as bridges, culverts, etc. A FEMA Flood Insurance Study (FIS) for the Schuylkill River in Montgomery County was issued in December 1996 (FEMA, 1996)

Table 1, reproduced from the original report, presents the water levels at selected locations along the Schuylkill River for the 100-year flood. (The 100-year flood is defined as the flood with a probability of 0.01 of occurring in any one year.) Table 2 presents the flood discharges for various return periods developed by the Corps of Engineers' for Schuylkill River floods in the reach adjacent to Venice Island.

PROPOSED DEVELOPMENT

For the original analysis, four cross-sections were added to the cross-sections used by the Corps of Engineers in their analysis. Cross-section 73055 was added to characterize hydraulic conditions at the Waterford Apartments site. Cross-sections 74810 and 75370 were added to better define hydraulic characteristics at the Venice Island Apartments site. (Cross-section 75710 was added to characterize hydraulic conditions at the 4601 Flat Rock Road site which has not been modified from the original analysis and is not considered herein.)

¹ Cited references are listed in the section of the report entitled REFERENCES.

The Venice Island Condominium development extends from Green Lane to Leverington Avenue and includes river cross-sections 74545, 74810, 75059 and 75370. Entrance to the apartment complex is from Leverington Avenue. The 4.0 acre site extends across Venice Island and is about 1,250 feet long. Hydraulic changes to cross-sections 74545, 74810, 75059 and 75370 include the addition of the support columns for the buildings, stairwells and elevator shafts.

Table 1 Water Surface Elevations of the 100-Year Flood on Schuylkill River in the Vicinity of Venice Island, Manayunk, Philadelphia, PA (FEMA, 1996).

Distance from Confluence with Delaware River	100-Year Flood Elevation (ft above NGVD datum)	100-Year Flood Elevation (ft above City datum*)
66,301	37.2	31.4
69,030	40.6	34.8
71,537	42.1	36.3
73,395	43.6	37.8
76,046	45.0	39.2
78,239	45.8	40.0
79,960	46.4	40.6
81,813	51.6	45.8**

* City of Philadelphia Datum = NGVD datum – 5.76 feet.

** Upstream of Flat Rock Dam.

Table 2 Magnitude of Floods with Given Return Periods, Venice Island Reach of Schuylkill River Upstream of Wissahickon Creek.

Return Period of Flood Discharge (yrs)	Flood Discharge (ft ³ /s)
10	62,900
50	93,700
100	109,000
500	146,000

PRE-DEVELOPMENT ANALYSIS

The pre-development analysis of existing conditions has been described in the original report (Weggel, 2000).

POST-DEVELOPMENT REANALYSIS

Cross-sections 74545, 74810, 75059 and 75370 go through the Venice Island Condominium site. The location of the cross-sections relative to the proposed developments is shown in Figure 1 (taken from Figure 3 of the original report).

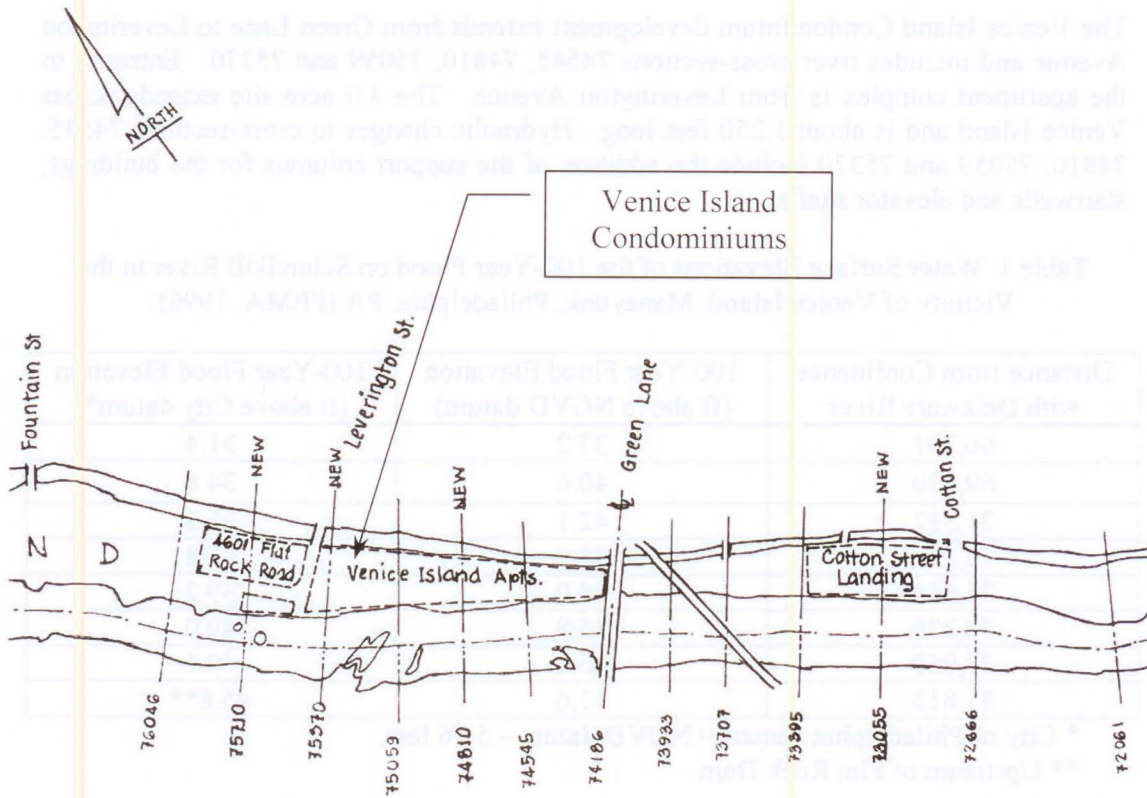


Figure 1 Location of Schuylkill River Sections vis-à-vis Venice Island Condominiums

Venice Island Condominiums

Pre-development conditions for cross-sections 74545 and 75370 were the same as the conditions used by the Corps of Engineers in their FEMA study. Cross-section 74810 was added. At cross-section 75059 the existing Arroyo Grill was added to the Corps' cross-section to describe pre-development conditions. For revised post-development conditions, supporting columns, stairwells and elevator shafts were included in the cross-sections. Cross-section 75059 passes through the former Arroyo Grill. Original and revised post-development conditions at cross-sections 74545 and 74810 are shown in Figures 2 and 3 respectively. Original and revised post-development conditions at cross-sections 75059 and 75370 are shown in Figures 4 and 5.

REVISED SECTION 74545

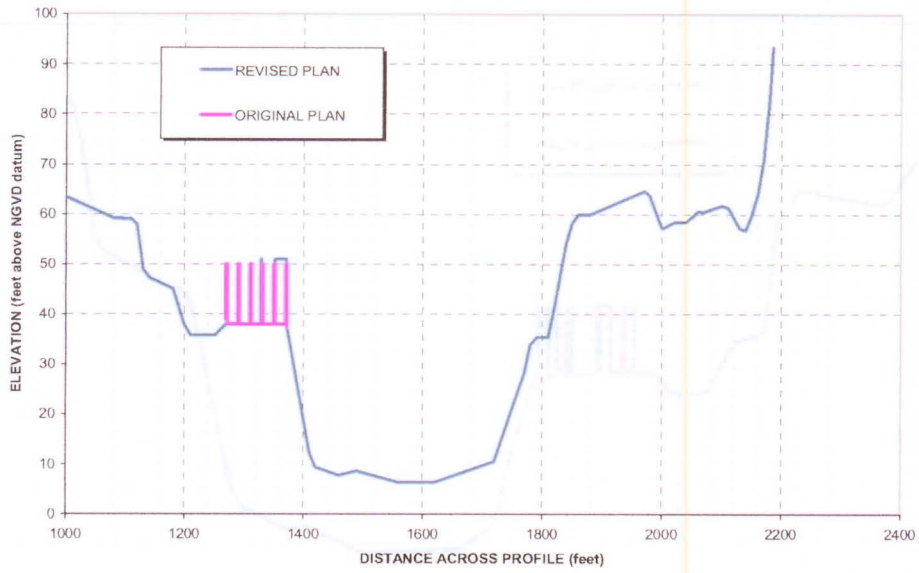


Figure 2 Cross-Section 74545, Vicinity of Proposed Venice Island Condominium Development

REVISED SECTION 74810

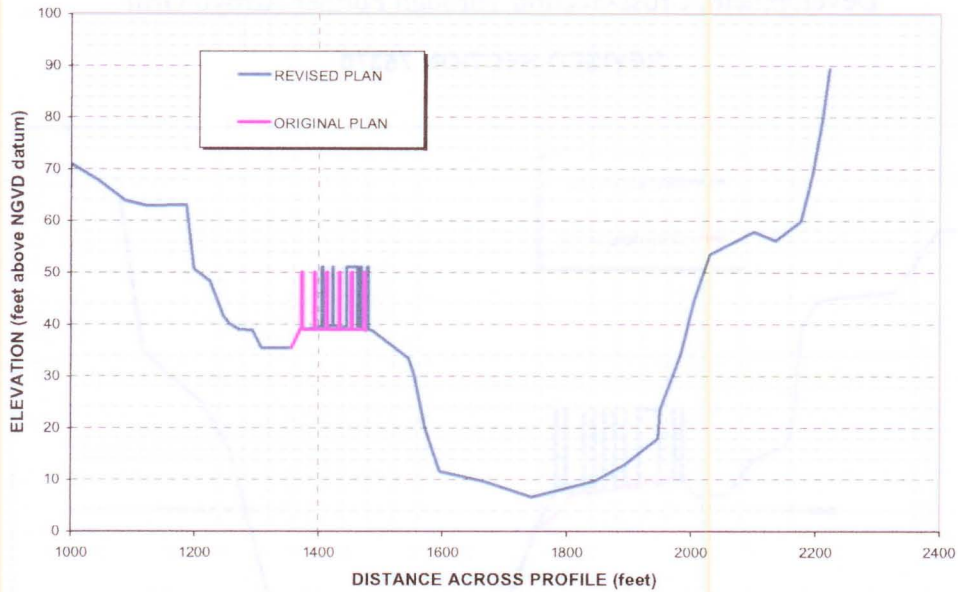


Figure 3 Cross-Section 74810, Vicinity of Proposed Venice Island Condominium Development

REVISED SECTION 75059

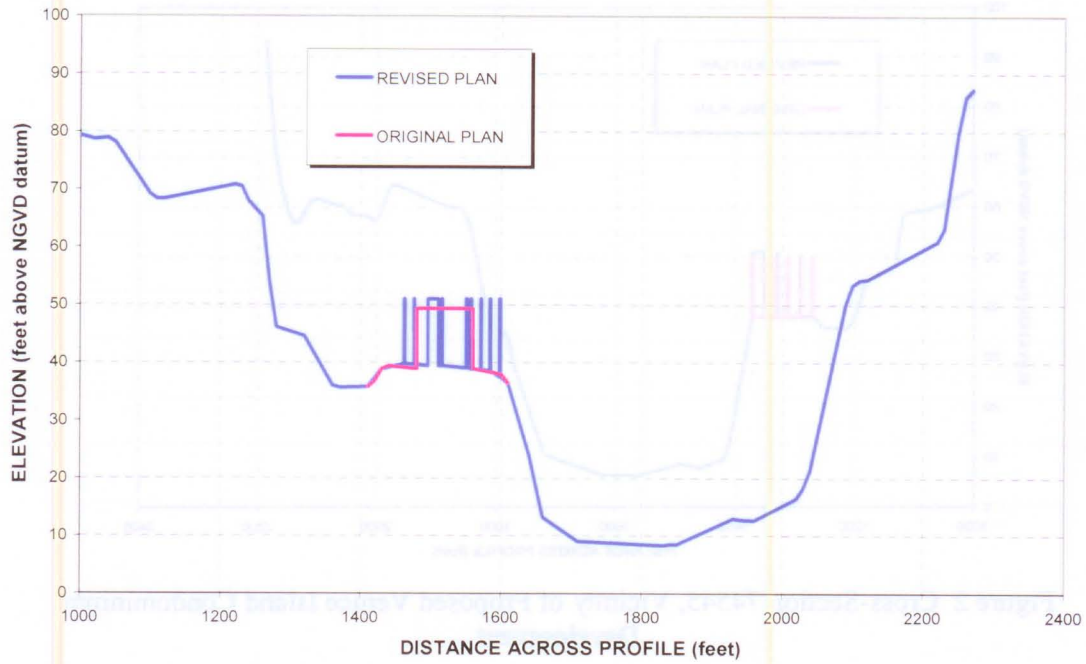


Figure 4 Cross-Section 75059, Vicinity of Proposed Venice Island Condominium Development, Cross-Section Through Former Arroyo Grill

REVISED SECTION 75370

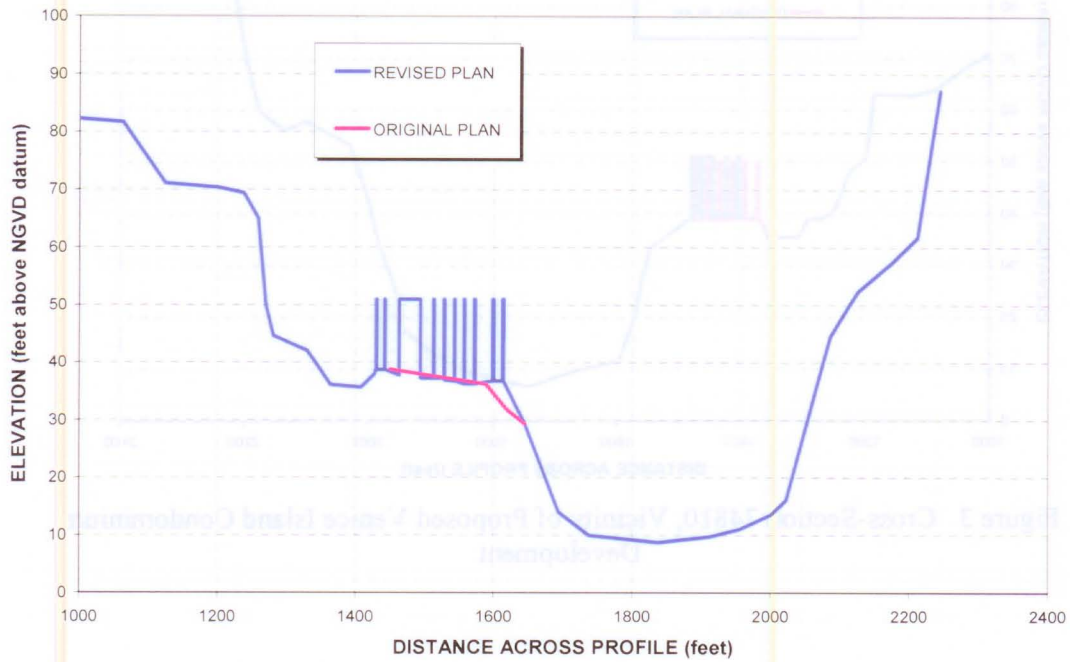


Figure 5 Cross-Section 75370, Upstream Portion of Venice Island Condominium Site.

SUMMARY & CONCLUSIONS

HEC-RAS was rerun to calculate water surface elevations for the 100-year Schuylkill River flood discharge of 109,000 ft³/s along the Venice Island reach of the river. The model was run for revised post-development conditions and compared with pre-development conditions as presented in the original report (Weggel, 2000). The results of the two computer runs for the revised development plan and the pre-development plan are shown in Figure 6. Both pre-development and revised post-development conditions are shown in the figure. The revised post-development water levels lie below the pre-development levels. (The solid blue line on Figure 6, representing the revised post-development condition, lies below the dashed green line; hence, flood levels will be lower following the proposed development. The HEC-RAS output water level profile for pre-development conditions is shown separately in Figure 7 while the revised post-development water level profile is shown in Figure 8. Revised post-development cross-sections along with the 100-year water levels are shown in Figures A1 through A8 in Appendix A, "Pre- and Revised Post-Development Cross-Sections Showing HEC-RAS-Calculated 100-Year Flood Water Levels in the Vicinity of the Proposed Venice Island Condominiums."

The analysis indicates that the proposed revisions to development at the Venice Island Condominiums will not result in any significant change in the 100-year flood levels on the Schuylkill River. In fact, local water levels will be lower following development.

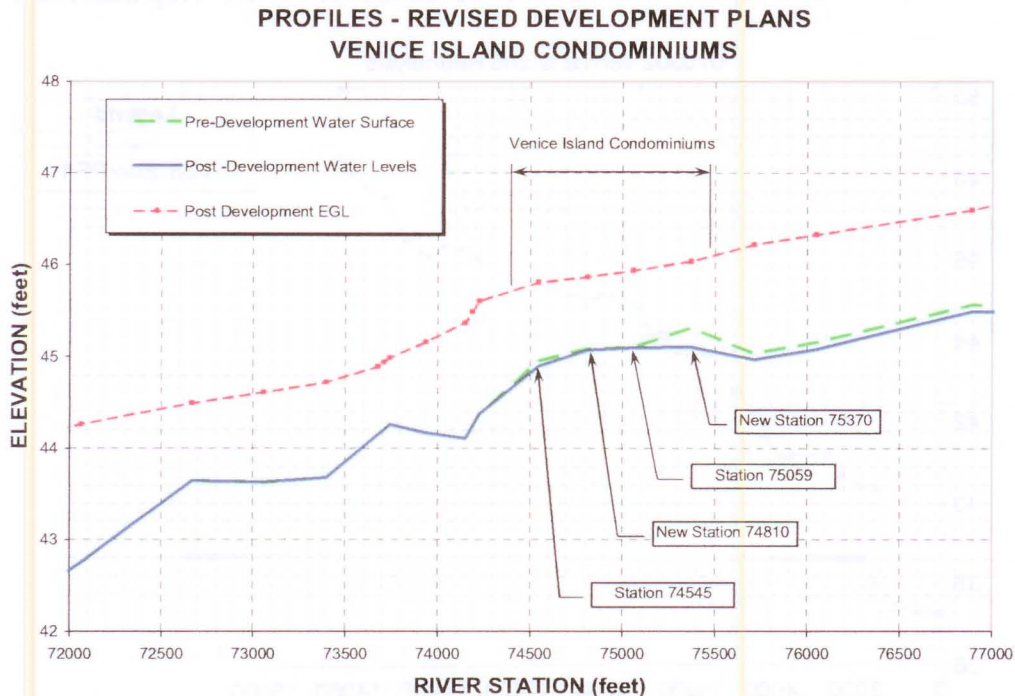


Figure 6 Comparison of Pre- and Post-Development Water Surface Profiles, Venice Island, Manayunk, Philadelphia, PA.

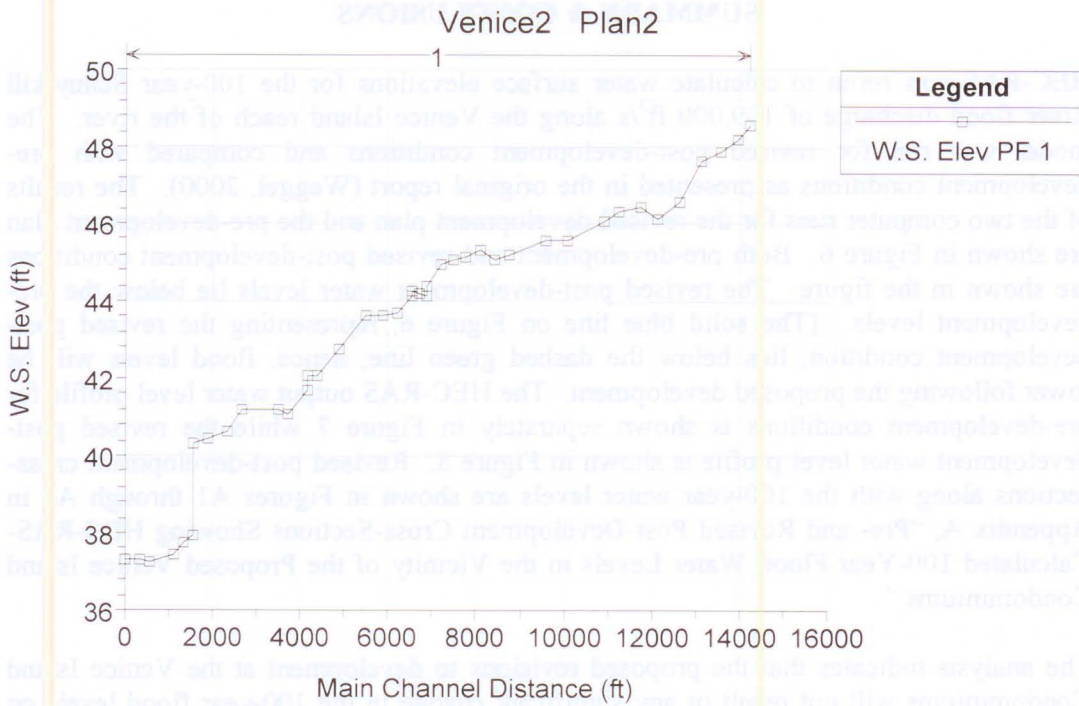


Figure 7 HEC-RAS Output, Water Surface Elevations for Pre-Development Plan.

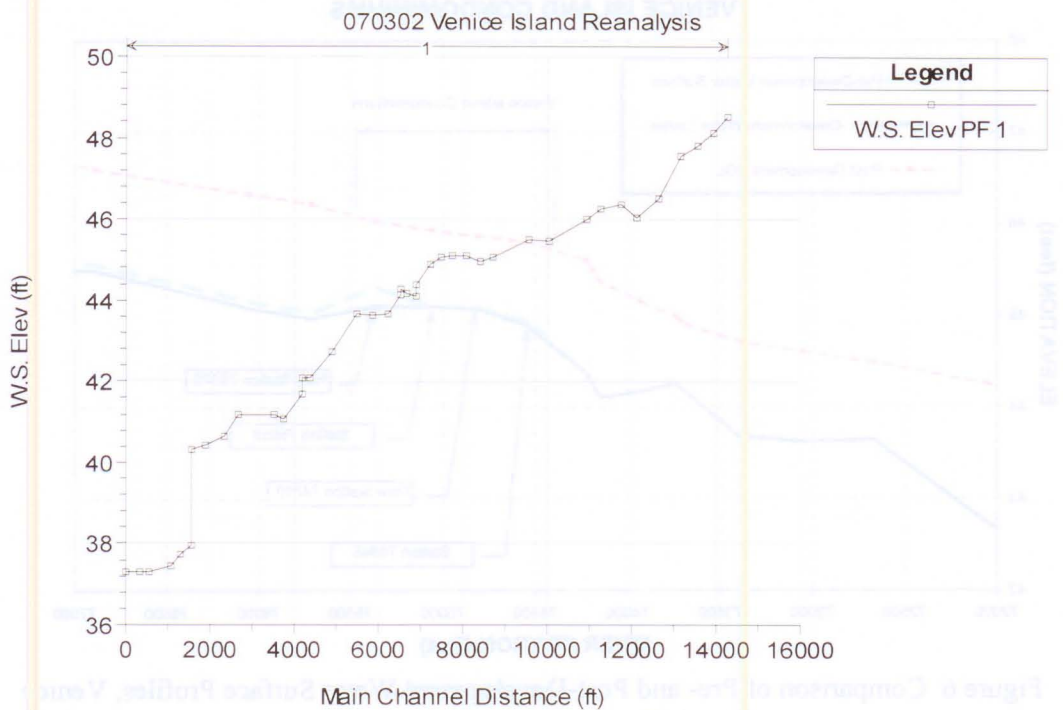


Figure 8 HEC-RAS Output, Water Surface Elevations for Revised Post-Development Plan.

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Corps of Engineers (1998b) "HEC-RAS River Analysis System – Hydraulic Reference Manual," Version 2.2, US Army Corps of Engineers Hydrologic Engineering Center, Davis, CA, September 1998.

Corps of Engineers (1998c) "HEC-RAS River Analysis System – Applications Guide," Version 2.2, US Army Corps of Engineers Hydrologic Engineering Center, Davis, CA, September 1998.

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Weggel, J. Richard (2006) "Supplement to Flood Hazard Analysis for Proposed Development on Venice Island, Manayunk, Philadelphia, PA," prepared for Smyth, Boles Associates, Inc., 2400 Chestnut Street, Philadelphia, PA 19104, 23 April 2006.

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Corps of Engineers (1998b) HEC-RAS River Analysis System - Hydraulic Reference Manual, Version 2.1, US Army Corps of Engineers Hydrologic Engineering Center, Davis, CA September 1998.

Corps of Engineers (1998c) HEC-RAS River Analysis System - Application Guide, Version 2.1, US Army Corps of Engineers Hydrologic Engineering Center, Davis, CA September 1998.

FEMA (1996) Flood Insurance Study, Montgomery County, Pennsylvania, Federal Emergency Management Agency, December 19, 1996.

APPENDIX A

Pre- and Revised Post-Development Cross-Sections Showing HEC-RAS-Calculated 100-Year Flood Water Levels in the Vicinity of the Proposed Venice Island Condominiums.

Wegiel, J. Richard (2006) Supplement to Flood Hazard Analysis for Proposed Development on Venice Island, Montgomery, Philadelphia, PA, prepared for Smart Boat Associates, Inc., 2400 Chestnut Street, Philadelphia, PA 19104, 23 April 2006.

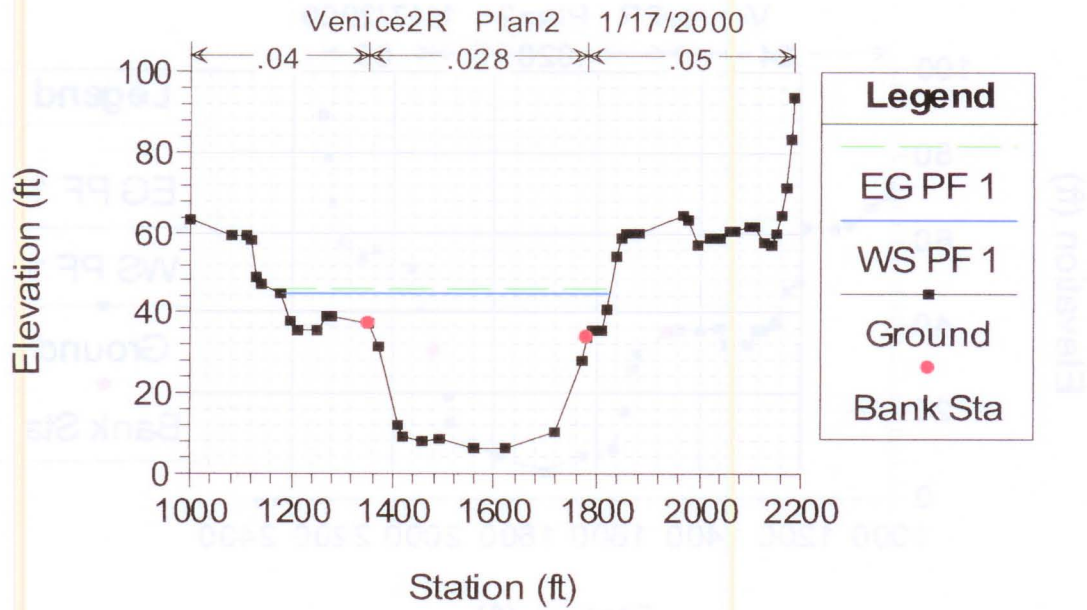


Figure A1 HEC-RAS Output, Cross-Section 74545, Pre-Development Conditions.

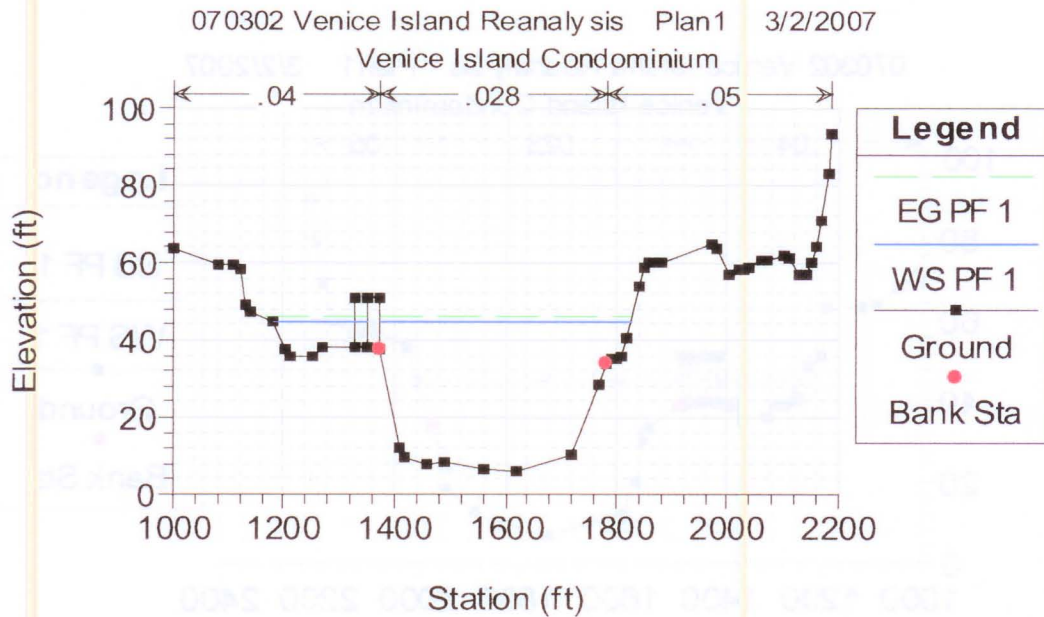


Figure A2 HEC-RAS Output, Cross-Section 74545, Post-Development Conditions.

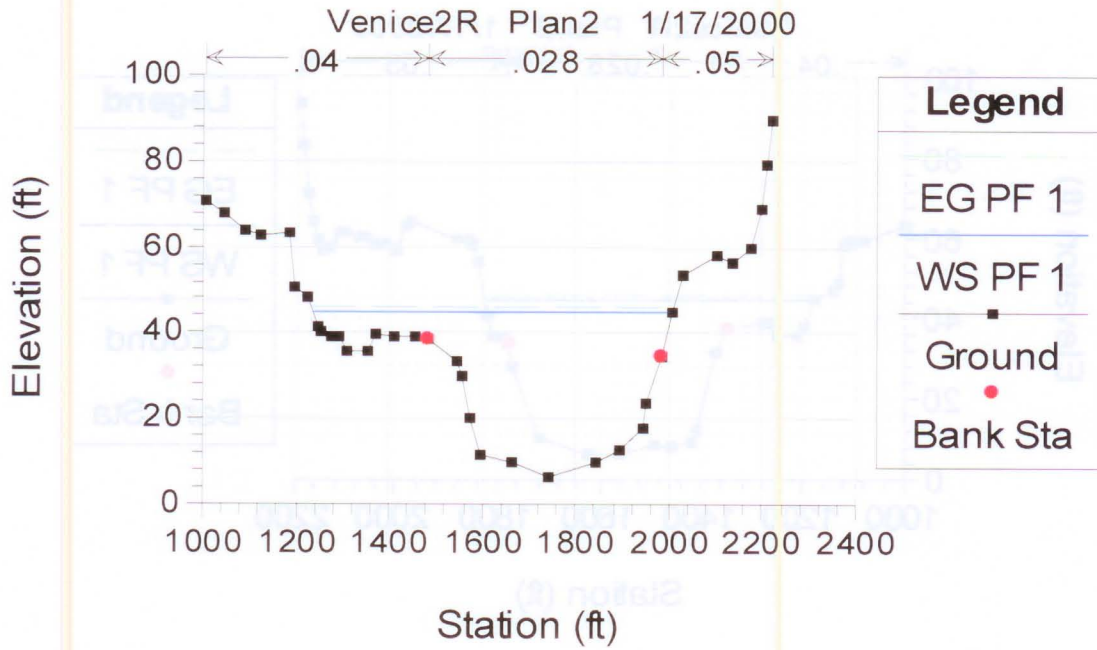


Figure A3 HEC-RAS Output, Cross-Section 74810, Pre-Development Conditions.

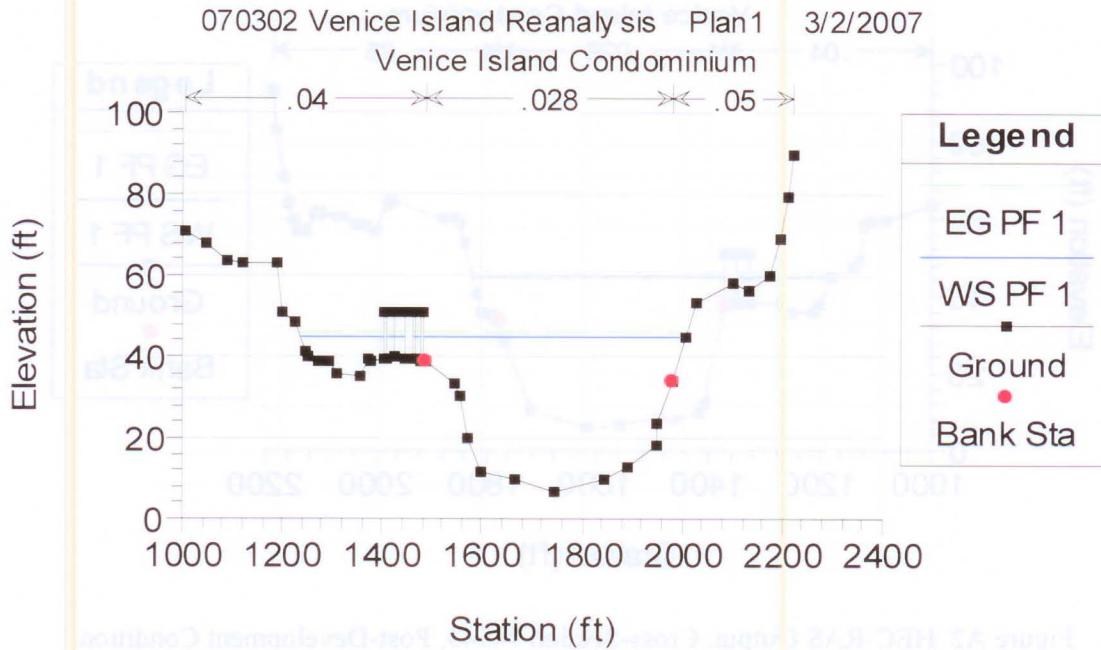


Figure A4 HEC-RAS Output, Cross-Section 74810, Post-Development Conditions.

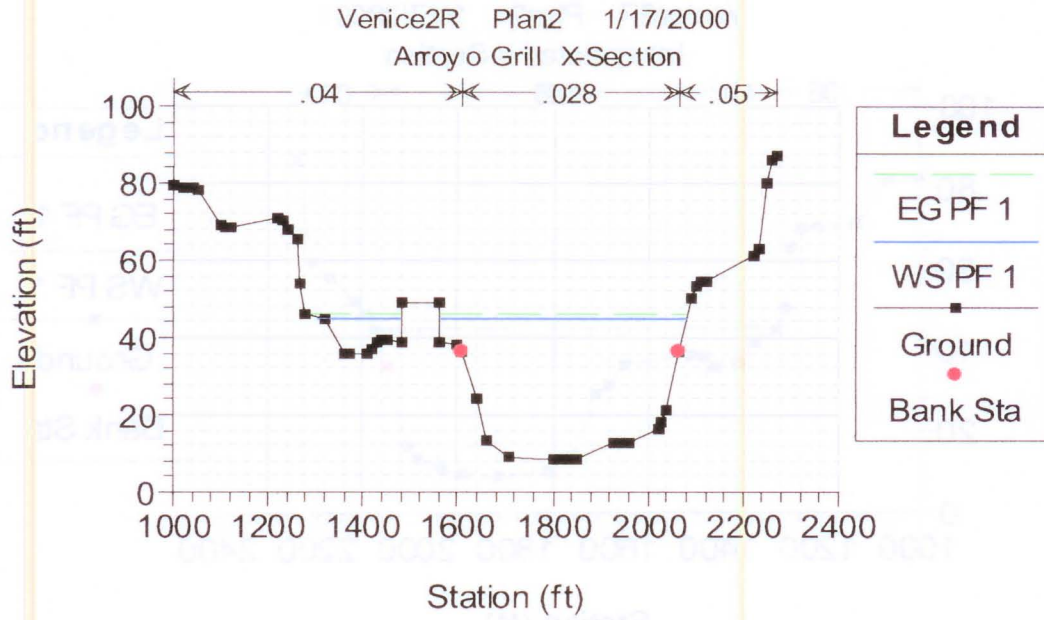


Figure A5 HEC-RAS Output, Cross-Section 75059, Pre-Development Conditions.

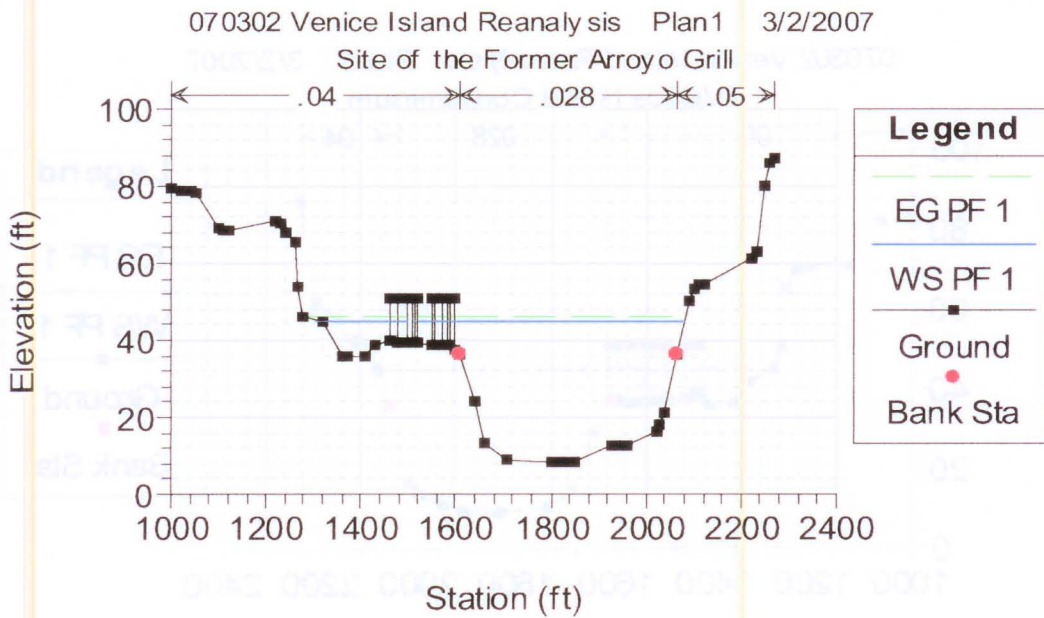


Figure A6 HEC-RAS Output, Cross-Section 75059, Post-Development Conditions.

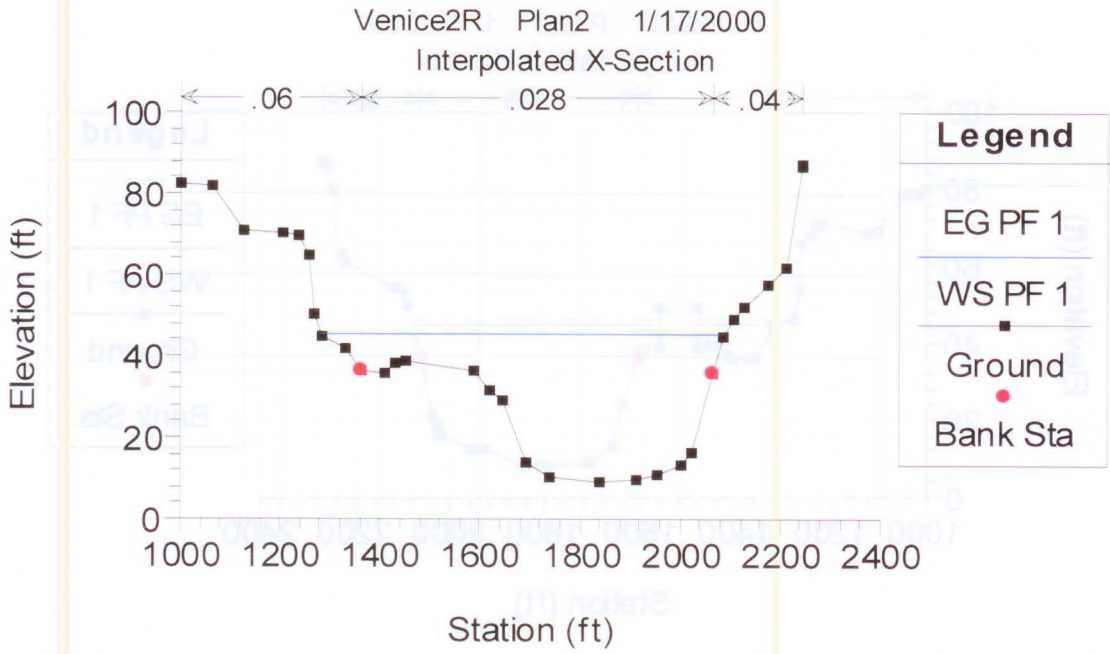


Figure A7 HEC-RAS Output, Cross-Section 75370, Pre-Development Conditions.

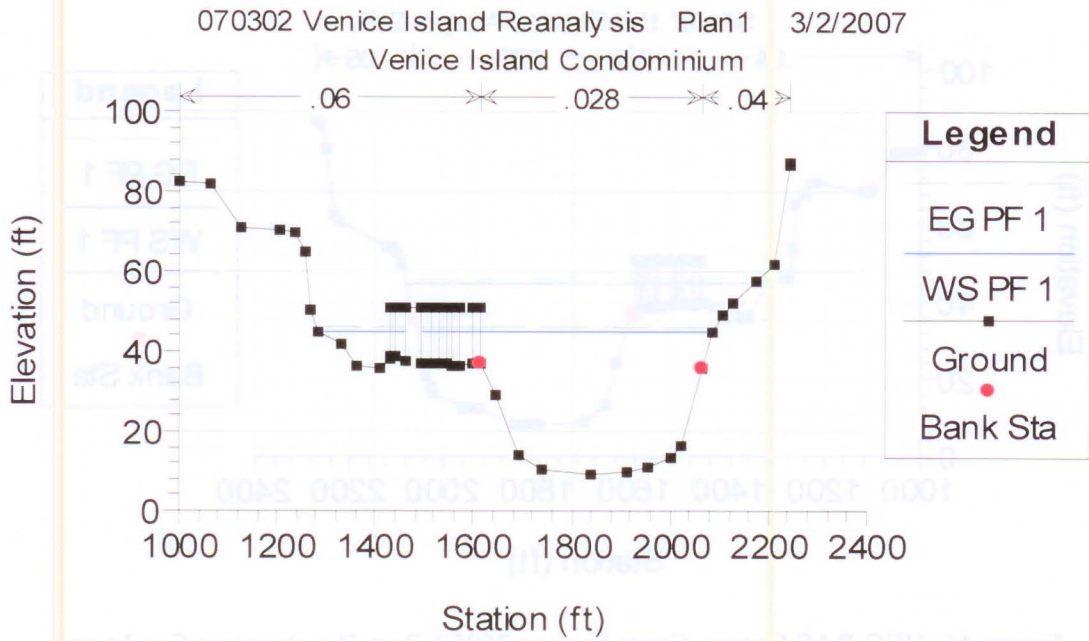


Figure A8 HEC-RAS Output, Cross-Section 75370, Post-Development Conditions.

INTRODUCTION

**SUPPLEMENT TO
FLOOD HAZARD ANALYSIS FOR PROPOSED DEVELOPMENT ON VENICE
ISLAND, MANAYUNK, PHILADELPHIA, PA**

prepared for

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by

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23 April 2006

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INTRODUCTION

This report is a supplement to an original flood analysis report entitled "Flood Hazard Analysis for Proposed Development on Venice Island, Manayunk, Philadelphia, PA," (Weggel, 2000). It has been prepared to address changes to the proposed development made since preparation of the original report. Specifically, changes have been proposed to the Venice Island Apartments between Green Lane and Leverington Street, and to the Waterford Apartments at Cotton Street (referred to as "Cotton Street Landing in the original report). The original report describes existing conditions at the two apartment sites as well as the calibration of the HEC-RAS model. In that calibration, four additional cross-sections were added to the Schuylkill River model to better describe conditions at the development sites. In the original report the effect of three proposed developments on flood elevations in the Schuylkill River was investigated. This supplemental report addresses flood level changes resulting from changes at only two of those developments, the Venice Island Apartments and the Waterford Apartments.

A flood hazard analysis for the Schuylkill River was made by the US Army Corps of Engineers for the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program. The analysis was made using HEC-2, a computer model, developed by the Corps of Engineers' Hydrologic Engineering Center (HEC), which computes backwater profiles for river reaches given characteristic cross-sections spaced along the river and information on obstructions such as bridges, culverts, etc. A FEMA Flood Insurance Study (FIS) for the Schuylkill River in Montgomery County was issued in December 1996 (FEMA, 1996)¹.

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PROPOSED DEVELOPMENT

For the original analysis, four cross-sections were added to the cross-sections used by the Corps of Engineers in their analysis. Cross-section 73055 was added to characterize hydraulic conditions at the Waterford Apartments site. Cross-sections 74810 and 75370 were added to better define hydraulic characteristics at the Venice Island Apartments site. (Cross-section 75710 was added to characterize hydraulic conditions at the 4601 Flat Rock Road site which has not been modified from the original analysis and is not considered herein.)

The Waterford Apartments development extends about 650 feet westward along Venice Island from Cotton Street. The ground level is dedicated to parking so that the apartments are raised above the 100-year flood level. However, stairwells, an elevator

¹ Cited references are listed in the section of the report entitled REFERENCES.

shaft and enclosed pool area at ground level are in the flood plain. Cross-section 73055 extends through the site where the former Connelly Container mill building existed.

The Venice Island Apartment development extends from Green Lane to Leverington Avenue and includes river cross-sections 74545, 74810, 75059 and 75370. Entrance to the apartment complex is from Leverington Avenue. The 4.0 acre site extends across Venice Island and is about 1,250 feet long. Hydraulic changes to cross-sections 74545 and 74810 include the addition of the support columns for the buildings, stairwells and two elevator shafts.

Table 1 Water Surface Elevations of the 100-Year Flood on Schuylkill River in the Vicinity of Venice Island, Manayunk, Philadelphia, PA (FEMA, 1996).

Distance from Confluence with Delaware River	100-Year Flood Elevation (ft above NGVD datum)	100-Year Flood Elevation (ft above City datum*)
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78,239	45.8	40.0
79,960	46.4	40.6
81,813	51.6	45.8**

* City of Philadelphia Datum = NGVD datum – 5.76 feet.

** Upstream of Flat Rock Dam.

Table 2 Magnitude of Floods with Given Return Periods, Venice Island Reach of Schuylkill River Upstream of Wissahickon Creek.

Return Period of Flood Discharge (yrs)	Flood Discharge (ft ³ /s)
10	62,900
50	93,700
100	109,000
500	146,000

PRE-DEVELOPMENT ANALYSIS

The pre-development analysis of existing conditions has been described in the original report (Weggel, 2000).

POST-DEVELOPMENT REANALYSIS

Cross-sections 72666, 73055 and 73395 pertain to the Cotton Street Landing site. (72666 is just downstream, 73395 is just upstream and 73055 goes through the middle of the Waterford Apartment site.) Cross-sections 74545, 74810, 75059 and 75370 go through the Venice Island Apartments site. The location of the cross-sections relative to the proposed developments is shown in Figure 1 (taken from Figure 3 of the original report).

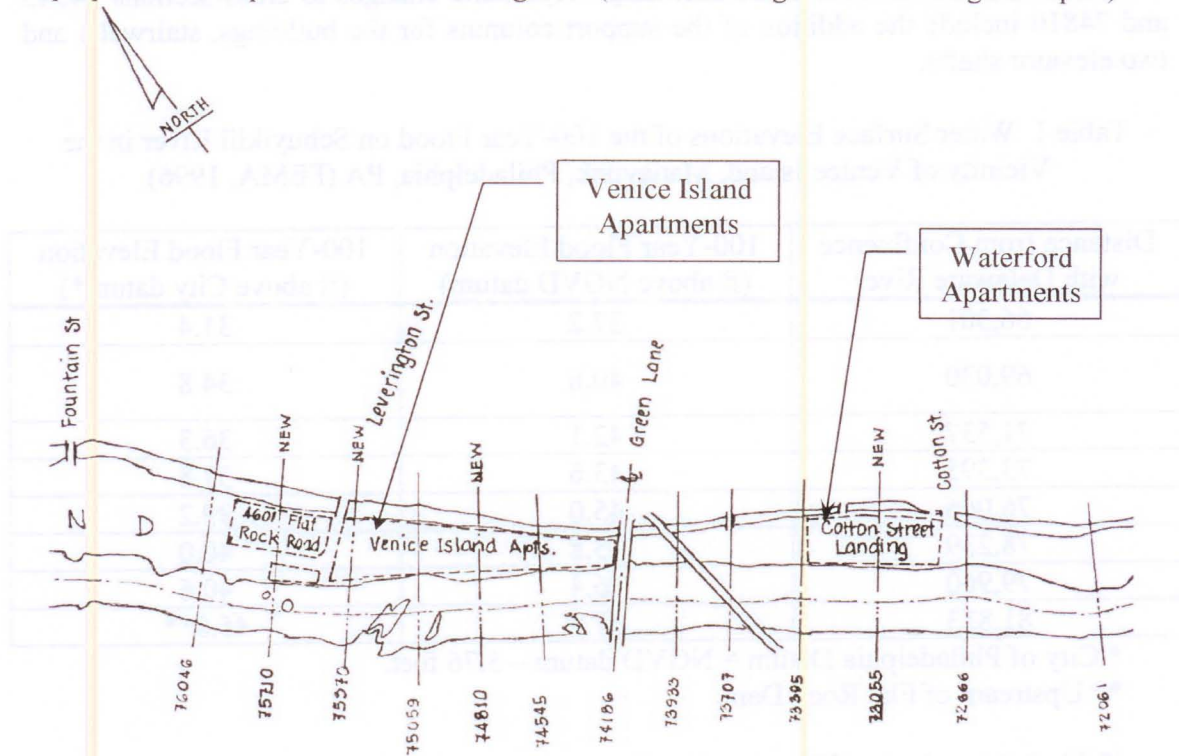


Figure 1 Location of Schuylkill River Sections vis-à-vis Venice Island Apartments and Waterford Apartments (Cotton Street Landing)

Waterford Apartments (Cotton Street Landing)

Cross-section 73055 passes through the middle of the proposed Waterford Apartments site. The Connelly Container mill building was included in the cross-section to describe pre-development conditions. Post-development conditions at 73055 show the Connelly mill demolished and replaced by row of columns, stairwells and elevator shaft for the proposed apartment building. Figure 2 shows the 73055 cross-section with both the original and revised post-development conditions.

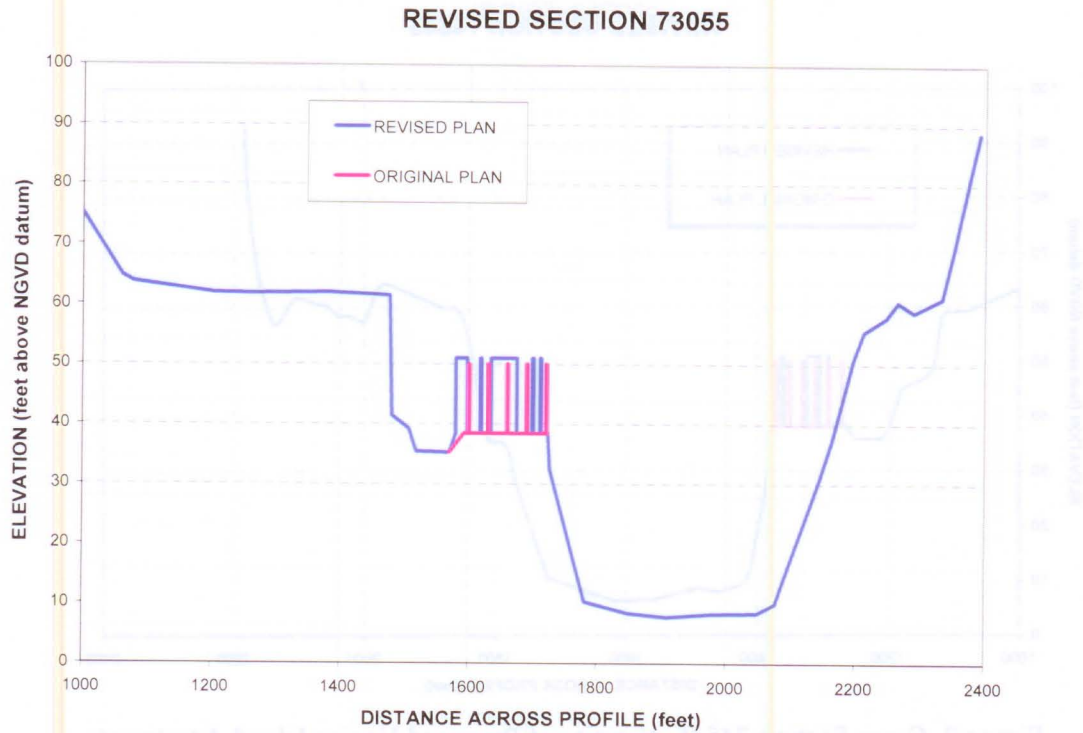


Figure 2 Cross-Section 73055, Vicinity of Proposed Waterford Apartments Site, Cross-Section through Connelly Container Mill.

Venice Island Apartments

Pre-development conditions for cross-sections 74545 and 75370 were the same as the conditions used by the Corps of Engineers in their FEMA study. Cross-section 74810 was added. At cross-section 75059 the existing Arroyo Grill was added to the Corps' cross-section to describe pre-development conditions. For revised post-development conditions, supporting columns, stairwells, elevator shafts and an enclosed swimming pool area were included in cross-sections 74545 and 74810. Cross-section 75059 passes through the former Arroyo Grill. Original and revised post-development conditions at cross-sections 74545 and 74810 are shown in Figures 3 and 4 respectively. Original and revised post-development conditions at cross-sections 75059 and 75370 are shown in Figures 5 and 6.

REVISED SECTION 74545

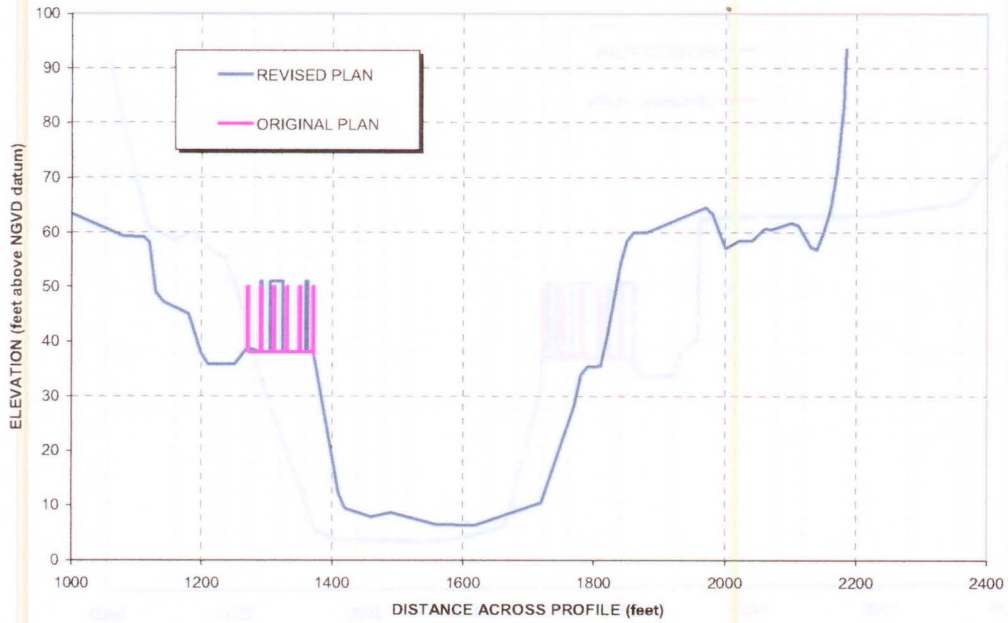


Figure 3 Cross-Section 74545, Vicinity of Proposed Venice Island Apartments Development

REVISED SECTION 74810

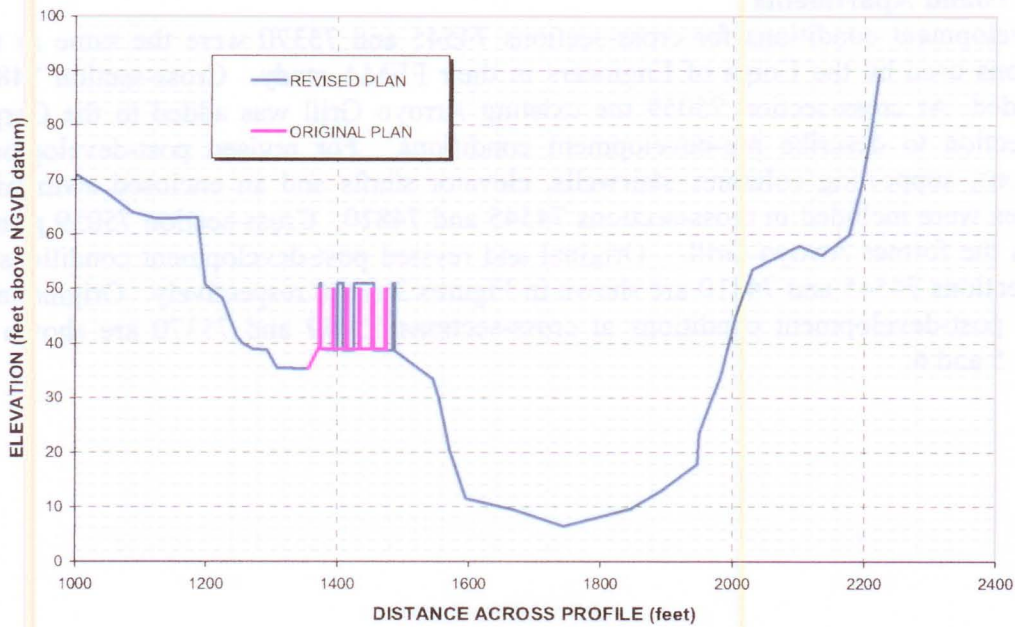


Figure 4 Cross-Section 74810, Vicinity of Proposed Venice Island Apartments Development

REVISED SECTION 75059

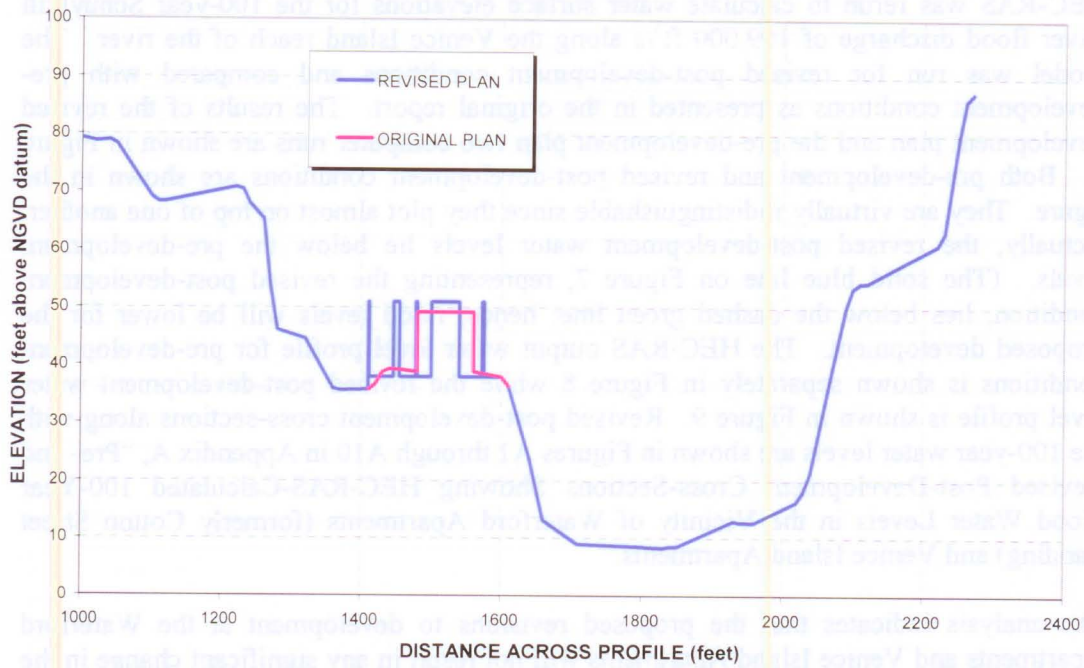


Figure 5 Cross-Section 75059, Vicinity of Proposed Venice Island Apartments Development, Cross-Section Through Former Arroyo Grill

REVISED SECTION 75370

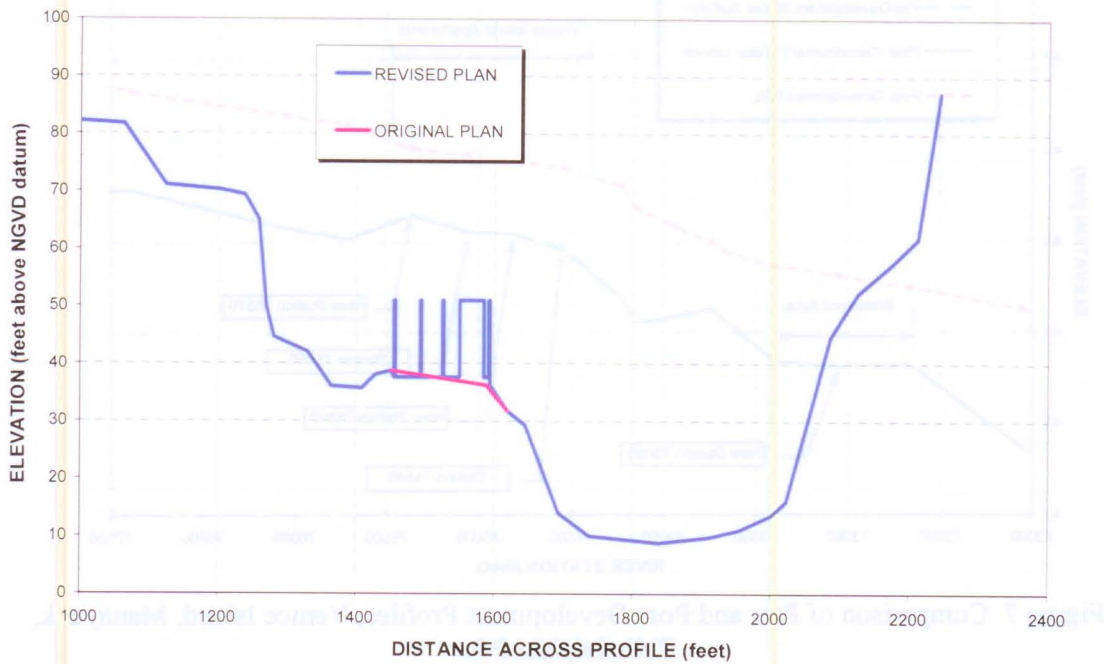


Figure 6 Cross-Section 75370, Upstream Portion of Venice Island Apartments Site.

SUMMARY & CONCLUSIONS

HEC-RAS was rerun to calculate water surface elevations for the 100-year Schuylkill River flood discharge of 109,000 ft³/s along the Venice Island reach of the river. The model was run for revised post-development conditions and compared with pre-development conditions as presented in the original report. The results of the revised development plan and the pre-development plan two computer runs are shown in Figure 7. Both pre-development and revised post-development conditions are shown in the figure. They are virtually indistinguishable since they plot almost on top of one another. Actually, the revised post-development water levels lie below the pre-development levels. (The solid blue line on Figure 7, representing the revised post-development condition, lies below the dashed green line; hence, flood levels will be lower for the proposed development. The HEC-RAS output water level profile for pre-development conditions is shown separately in Figure 8 while the revised post-development water level profile is shown in Figure 9. Revised post-development cross-sections along with the 100-year water levels are shown in Figures A1 through A10 in Appendix A, "Pre- and Revised Post-Development Cross-Sections Showing HEC-RAS-Calculated 100-Year Flood Water Levels in the Vicinity of Waterford Apartments (formerly Cotton Street Landing) and Venice Island Apartments."

The analysis indicates that the proposed revisions to development at the Waterford Apartments and Venice Island Apartments will not result in any significant change in the 100-year flood levels on the Schuylkill River. In fact, local water levels will be lower.

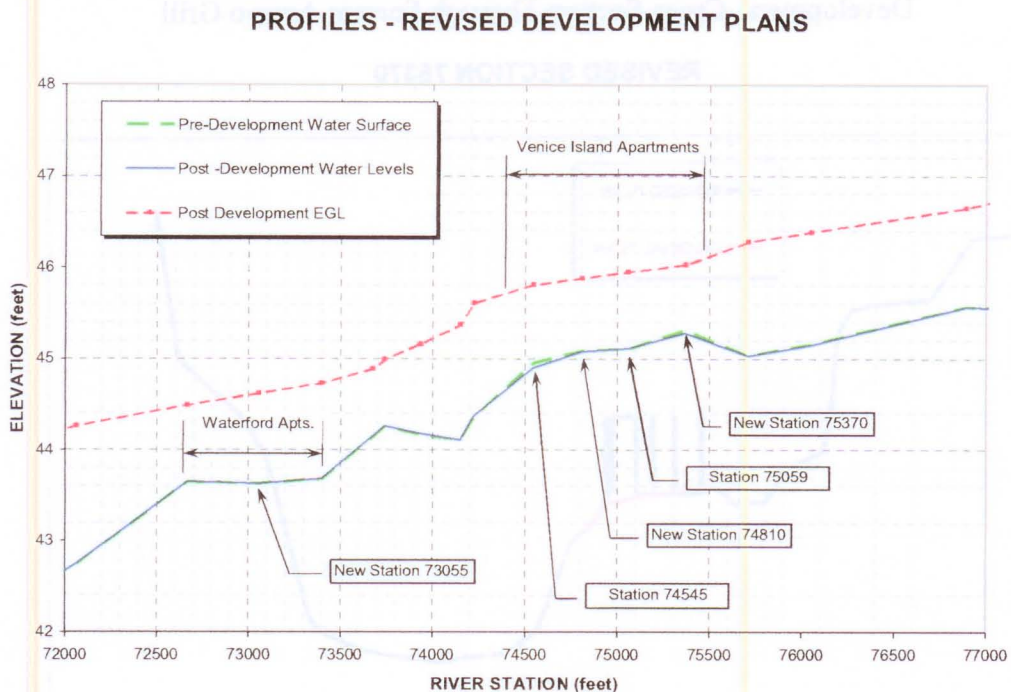


Figure 7 Comparison of Pre- and Post-Development Profiles, Venice Island, Manayunk, Philadelphia, PA.

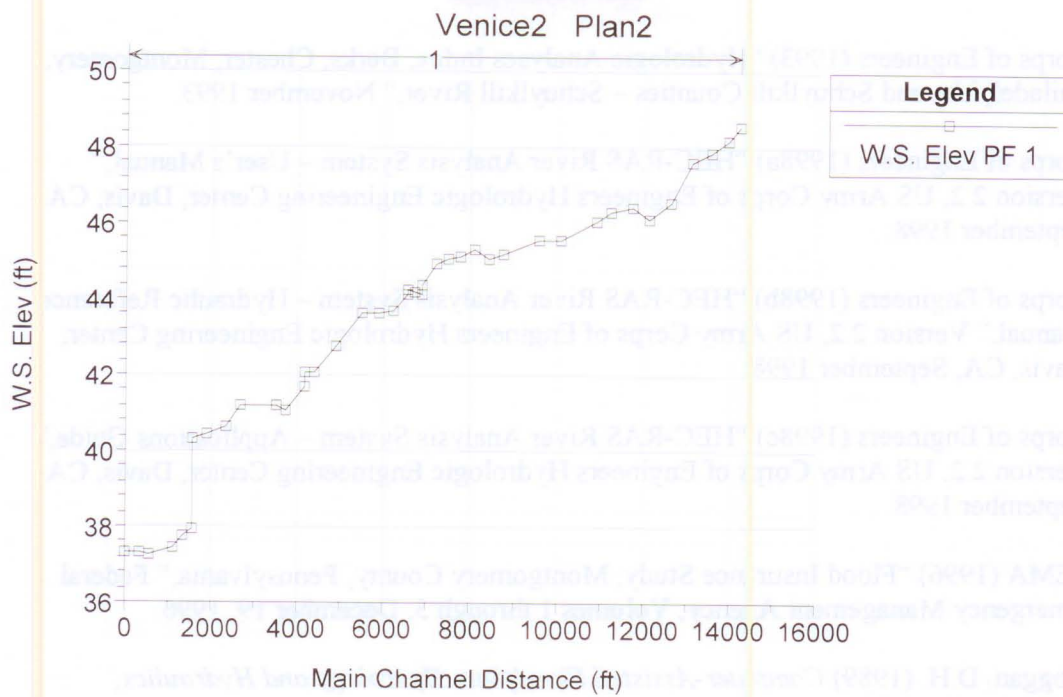


Figure 8 HEC-RAS Output, Water Surface Elevations for Pre-Development Plan.

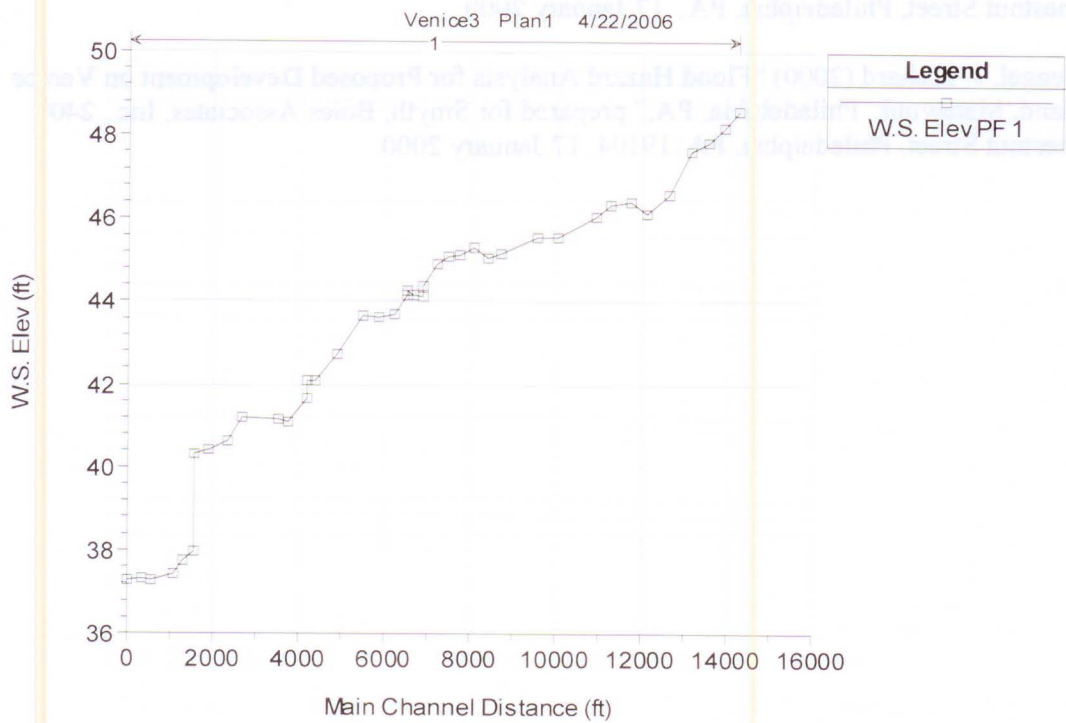
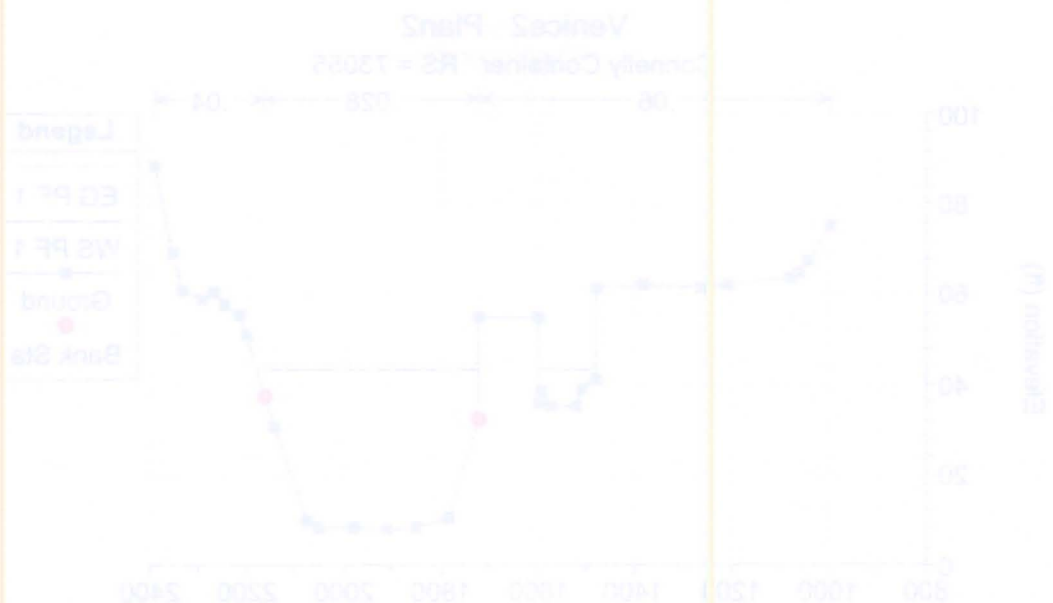


Figure 9 HEC-RAS Output, Water Surface Elevations for Revised Post-Development Plan.

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APPENDIX A

Pre- and Revised Post-Development Cross-Sections Showing HEC-RAS-Calculated 100-Year Flood Water Levels in the Vicinity of Waterford Apartments (formerly Cotton Street Landing) and Venice Island Apartments.

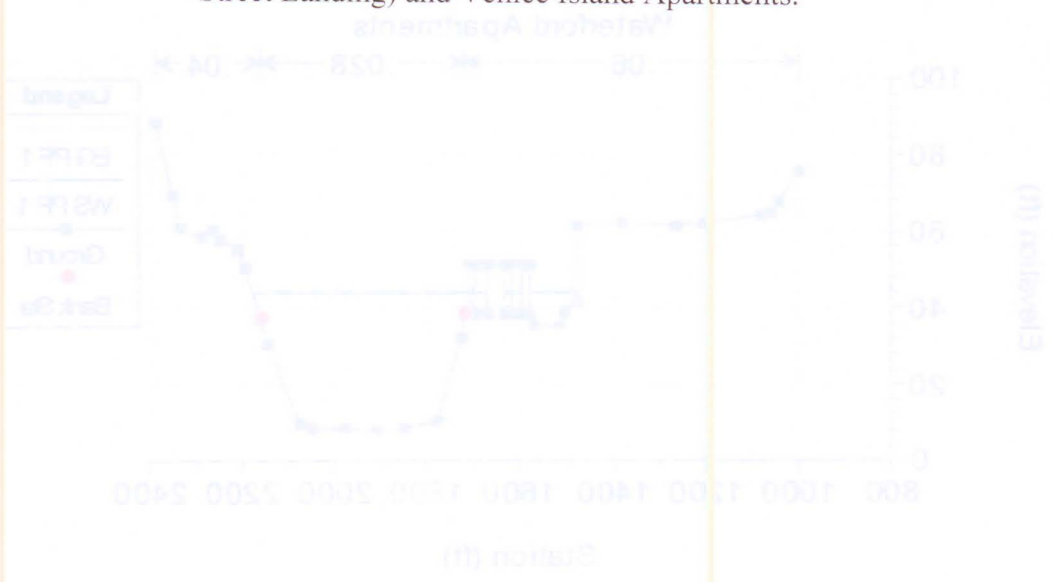


Figure A2 HEC-RAS Output Cross-section T3027 Post-Development Conditions

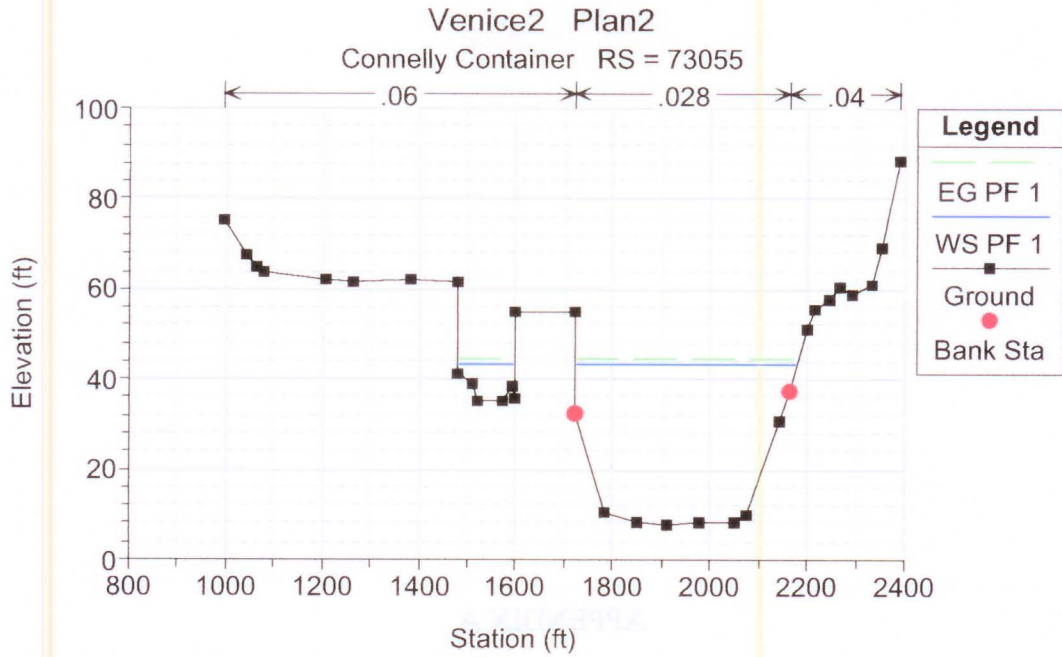


Figure A1 HEC-RAS Output, Cross-Section 73055, Pre-Development Conditions.

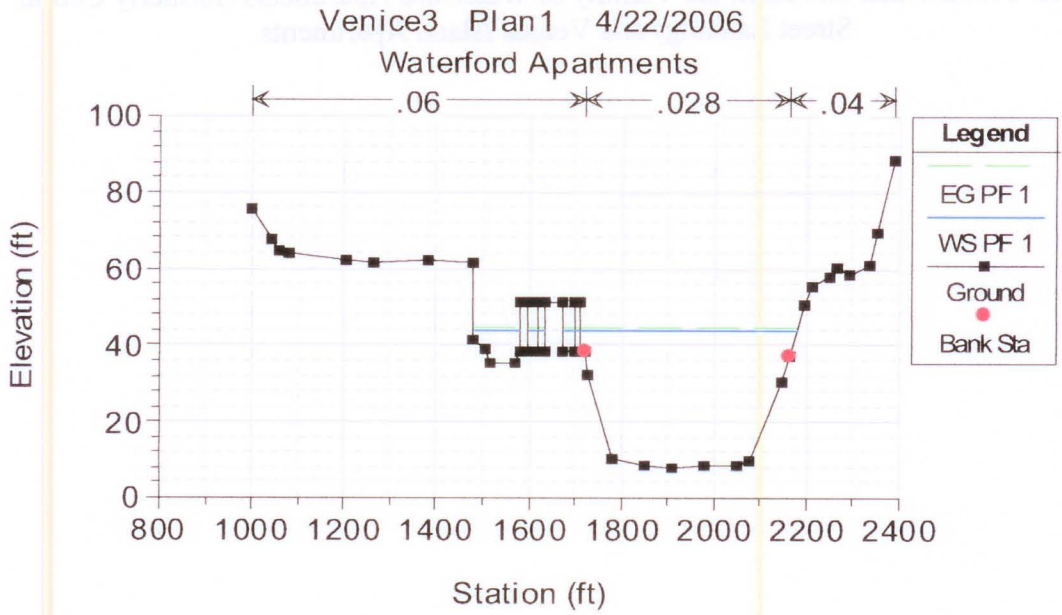


Figure A2 HEC-RAS Output, Cross-Section 73055, Post-Development Conditions.

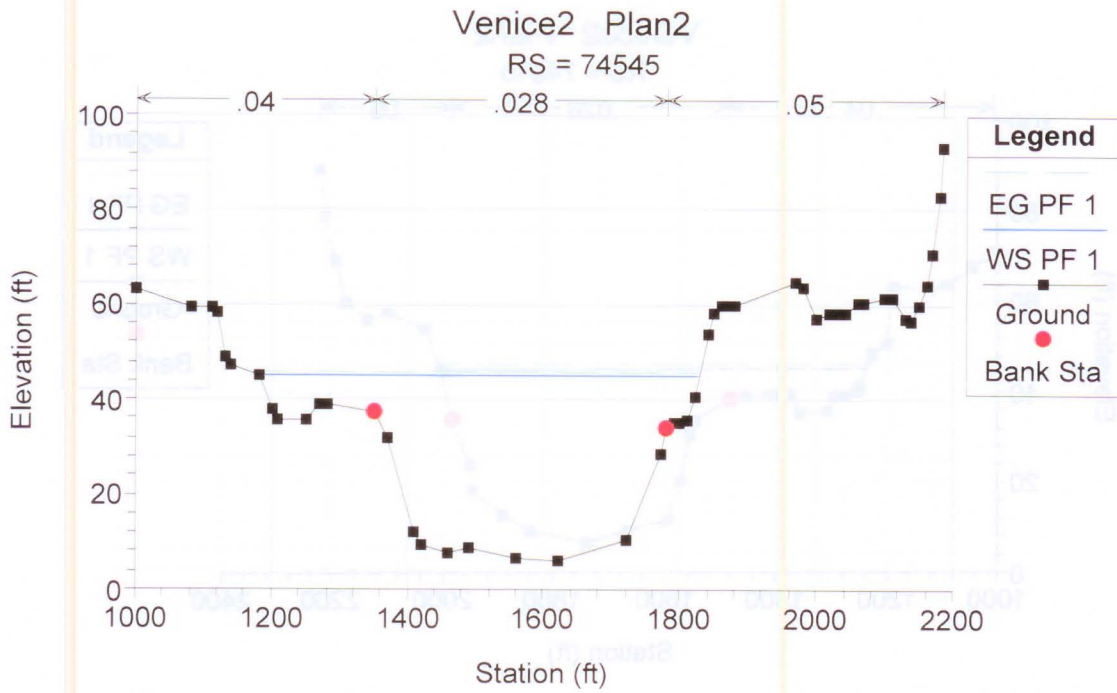


Figure A3 HEC-RAS Output, Cross-Section 74545, Pre-Development Conditions.

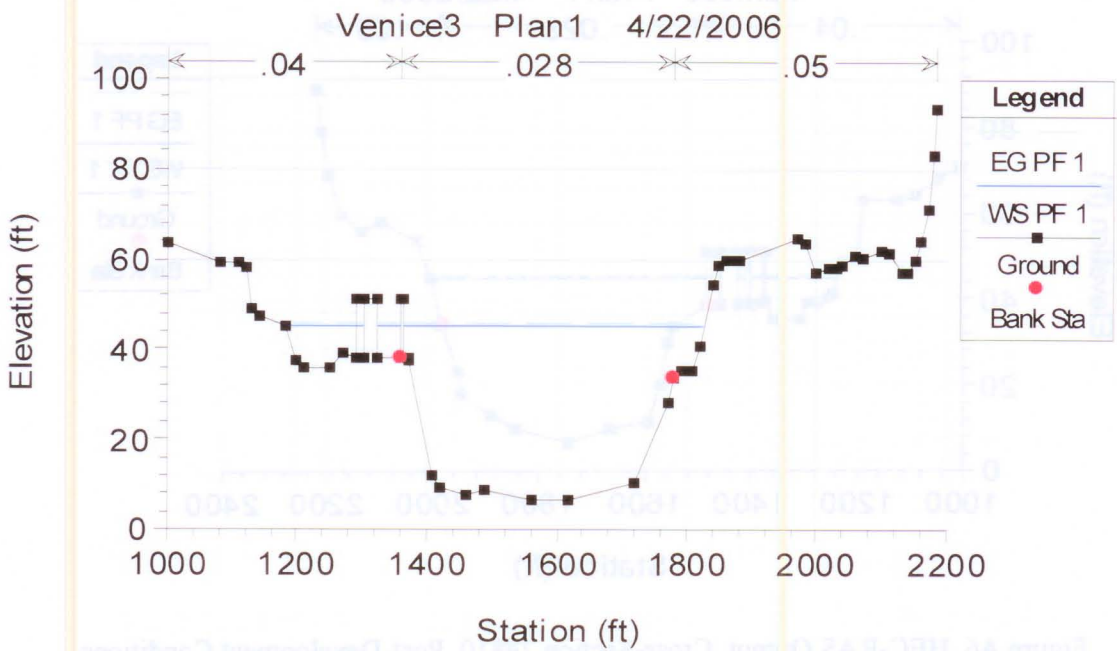


Figure A4 HEC-RAS Output, Cross-Section 74545, Post-Development Conditions.

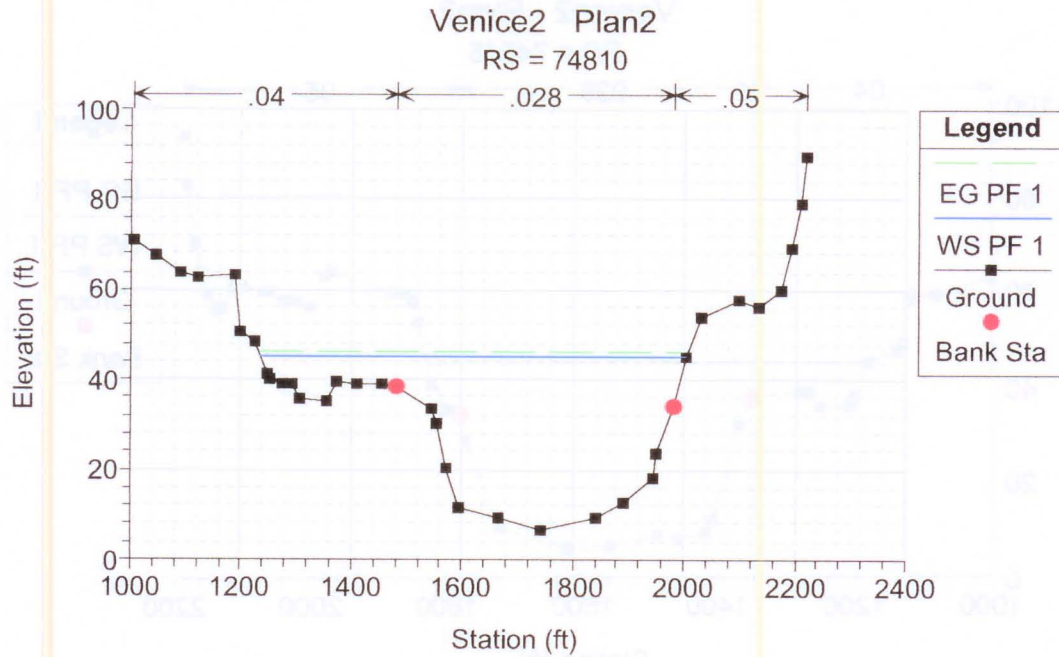


Figure A5 HEC-RAS Output, Cross-Section 74810, Pre-Development Conditions.

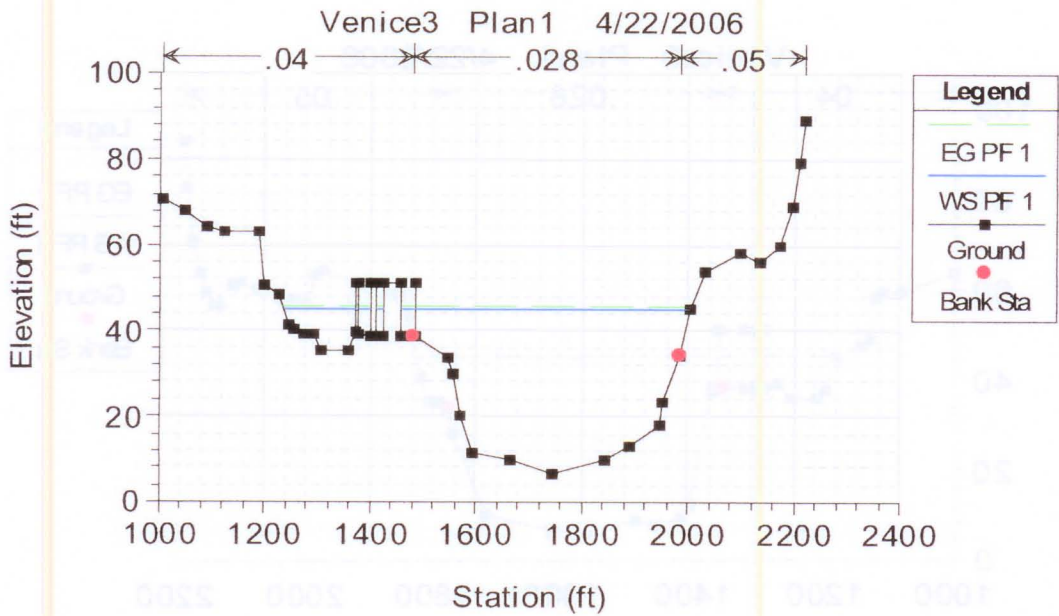


Figure A6 HEC-RAS Output, Cross-Section 74810, Post-Development Conditions.

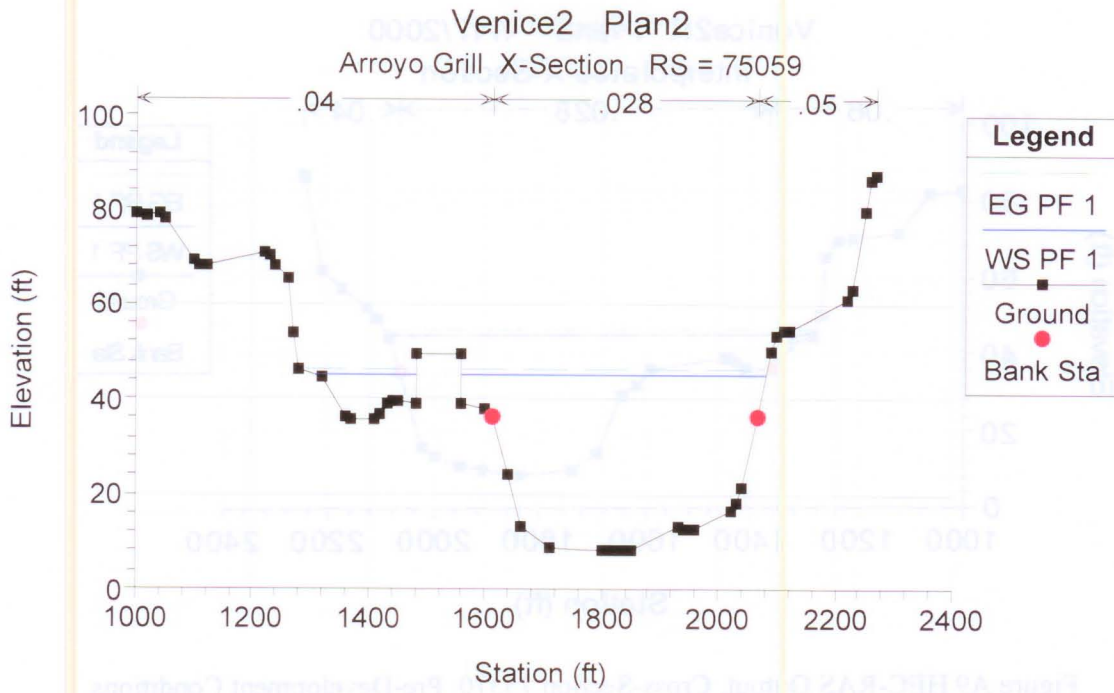


Figure A7 HEC-RAS Output, Cross-Section 75059, Pre-Development Conditions.

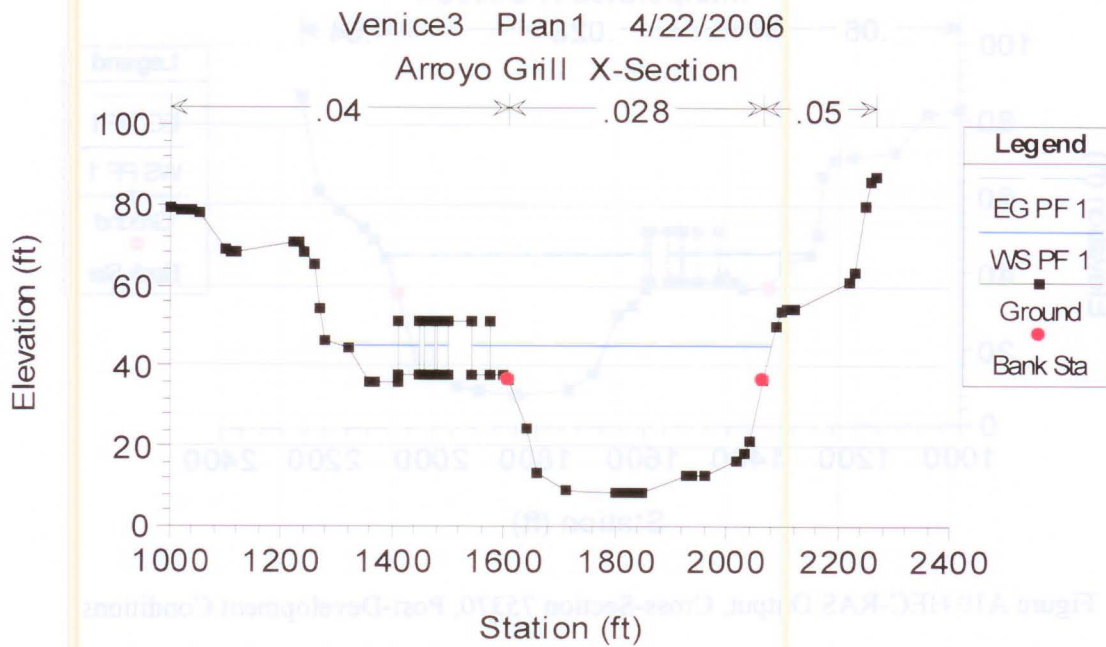


Figure A8 HEC-RAS Output, Cross-Section 75059, Post-Development Conditions.

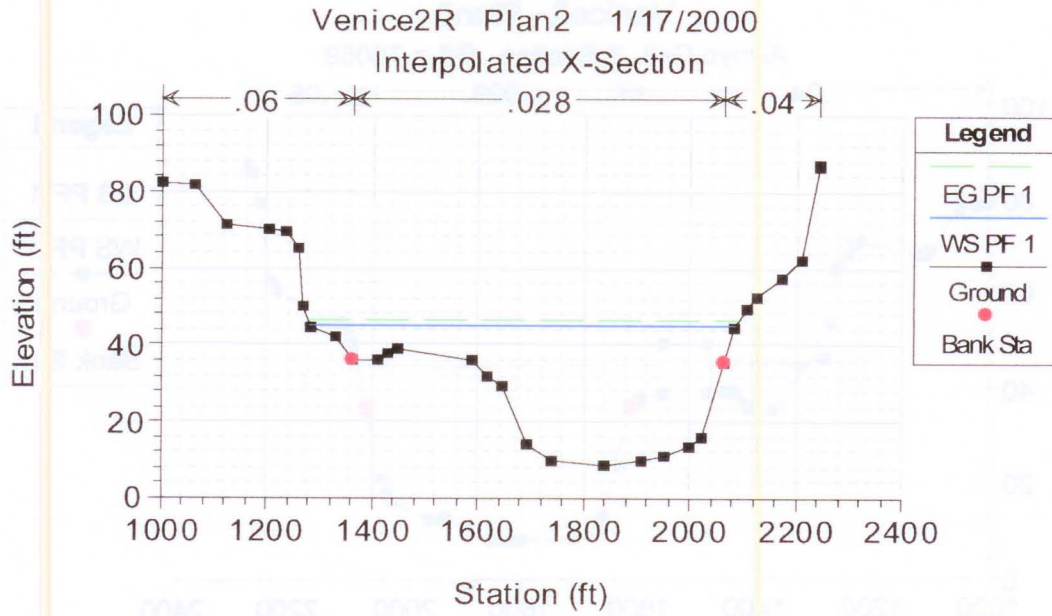


Figure A9 HEC-RAS Output, Cross-Section 75370, Pre-Development Conditions.

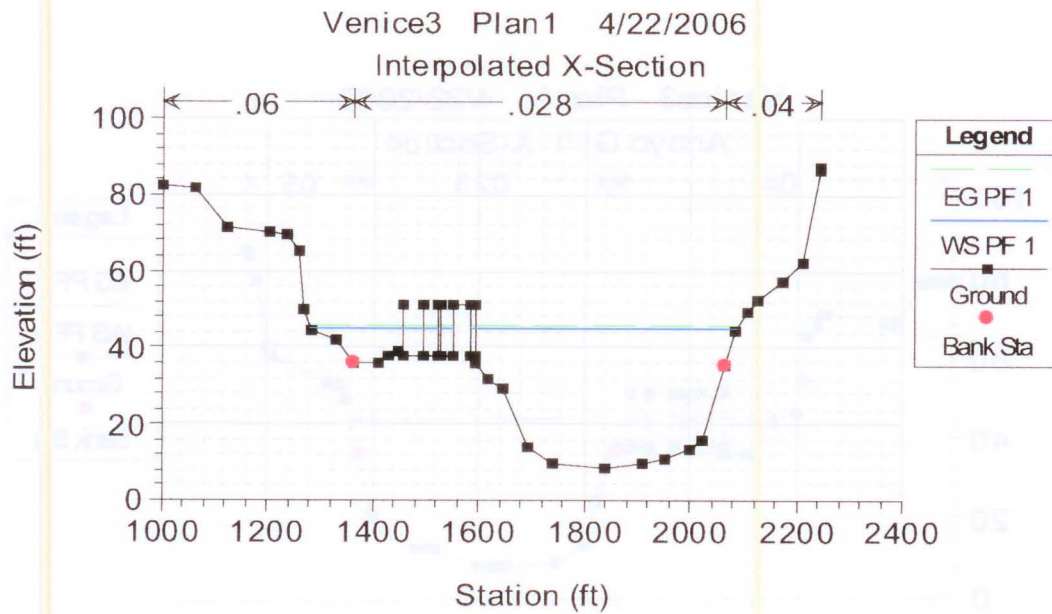


Figure A10 HEC-RAS Output, Cross-Section 75370, Post-Development Conditions.

INTRODUCTION

FLOOD HAZARD ANALYSIS FOR PROPOSED DEVELOPMENT ON VENICE ISLAND, MANAYUNK, PHILADELPHIA, PA

Prepared for

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2 June 2000

INTRODUCTION

Venice Island is a narrow, 1.7-mile-long island located between the Schuylkill River and the Manayunk Canal in the Manayunk section of Philadelphia, Pennsylvania. See Figure 1. Much of the island is within the 100-year flood plain of the Schuylkill River but it occasionally experiences flooding by lesser floods. A flood hazard analysis for the Schuylkill River was made by the US Army Corps of Engineers for the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program. The analysis was made using HEC-2, a computer model, developed by the Corps of Engineers' Hydrologic Engineering Center (HEC), which computes backwater profiles for river reaches given characteristic cross-sections spaced along the river and information on obstructions such as bridges, culverts, etc. A FEMA Flood Insurance Study (FIS) for the Schuylkill River in Montgomery County was issued in December 1996 (FEMA, 1996)¹. While this report is for Montgomery County the HEC-2 analysis it contains applies to the reach of the Schuylkill River adjacent to Venice Island and to the Manayunk Canal. The present analysis assesses the effect on flood water levels of three proposed developments on Venice Island. The developments are located at Cotton Street (Cotton Street Landing), between Green Lane and Leverington Streets (Venice Island Apartments) and at 4601 Flat Rock Road. The flooding analysis was done using the HEC-RAS River Analysis System, successor to the HEC-2 program used by the Corps of Engineers for the original analysis, and was comprised of three parts: a calibration of the HEC-RAS model to reproduce the HEC-2 results obtained in the original FEMA study, a more detailed reanalysis of existing conditions on Venice Island to determine 100-year flood levels in the vicinity of the proposed developments, and an analysis of the 100-year flood levels under the proposed post-development conditions. This report addresses the HEC-RAS model, the three aforementioned analyses, and presents conclusions regarding the effect of the proposed developments on the flood hazard on Venice Island and adjacent Manayunk.

CALIBRATION

To insure that the HEC-RAS computer model produces the same results as the HEC-2 model used by the Corps of Engineers in the original Flood Insurance Study, the HEC RAS model was calibrated against the data published by FEMA (1996). The FEMA report gives 100-year flood water levels at various locations along the Schuylkill River. The levels in the Venice Island area are summarized in Table 1. The river stations given in the table are the distance upstream from the Schuylkill River's confluence with the Delaware River. The confluence of the Wissahickon Creek and the Schuylkill is about 66,300 feet upstream from the Delaware River while the railroad bridge at the southeasterly-most end of Venice Island is about 71,331 feet upstream from the Delaware River.

Hydrologic and hydraulic data developed by the Corps of Engineers for their study were obtained from Dewberry & Davis, FEMA's flood study contractor. These data included

¹ Cited references are listed in the section of the report entitled REFERENCES.

the hydrologic analyses that established the magnitude of floods with various return frequencies for various locations on the Schuylkill River (Corps of Engineers, 1993). The flood discharge magnitudes for the reach of the Schuylkill adjacent to Venice Island are given in Table 2. The elevations given in Table 1 are based on a 100-year flood discharge of 109,000 ft³/s.



Figure 1 Location Map, Venice Island, Manayunk, Philadelphia, PA (from USGS Germantown Quadrangle)

Table 1 Water Surface Elevations of the 100-Year Flood on Schuylkill River in the Vicinity of Venice Island, Manayunk, Philadelphia, PA (FEMA, 1996).

Distance from Confluence with Delaware River	100-Year Flood Elevation (ft above NGVD datum)	100-Year Flood Elevation (ft above City datum*)
66,301	37.2	31.4
69,030	40.6	34.8
71,537	42.1	36.3
73,395	43.6	37.8
76,046	45.0	39.2
78,239	45.8	40.0
79,960	46.4	40.6
81,813	51.6	45.8**

* City of Philadelphia Datum = NGVD datum – 5.76 feet.

** Upstream of Flat Rock Dam.

Table 2 Magnitude of Floods with Given Return Periods, Venice Island Reach of Schuylkill River Upstream of Wissahickon Creek.

Return Period of Flood Discharge (yrs)	Flood Discharge (ft ³ /s)
10	62,900
50	93,700
100	109,000
500	146,000

Hydraulic data files obtained from Dewberry & Davis included both input cross-section data and output data from the original Corps study. The downstream water surface elevation for a given discharge (boundary condition for the HEC-RAS model) was determined from the 1996 FEMA report. These values are given in Table 3. The original cross-section data were imported to the HEC-RAS program and used to compute water surface elevations for the 100-year, 109,000 ft³/s discharge that were compared with the elevations presented in the FEMA report (Table 1).

Initially, the HEC-RAS results gave uniformly higher water levels than the HEC-2-based FEMA values by about 0.75 feet for the river cross-sections upstream of the railroad bridge at cross-section 68666, which is well downstream of Venice Island. The HEC-RAS-predicted energy loss through the bridge opening was greater than the HEC-2-predicted loss of the original FEMA study; consequently, the bridge characteristics were adjusted to reduce the energy loss until upstream water levels in the vicinity of Venice Island were approximately the same as the HEC-2 values. Figure 2 presents the results of

Table 3 Hydraulic Rating Curve for Schuylkill River at its Confluence with the Wissahickon Creek (downstream boundary condition for Venice Island HEC-RAS analysis).

Schuylkill River Discharge at Wissahickon Confluence (ft ³ /s)	Water Surface Elevation at Downstream Boundary of HEC-RAS Model (feet above NGVD datum)
62,900	30.1
93,700	35.8
109,000	37.3
146,000	44.0

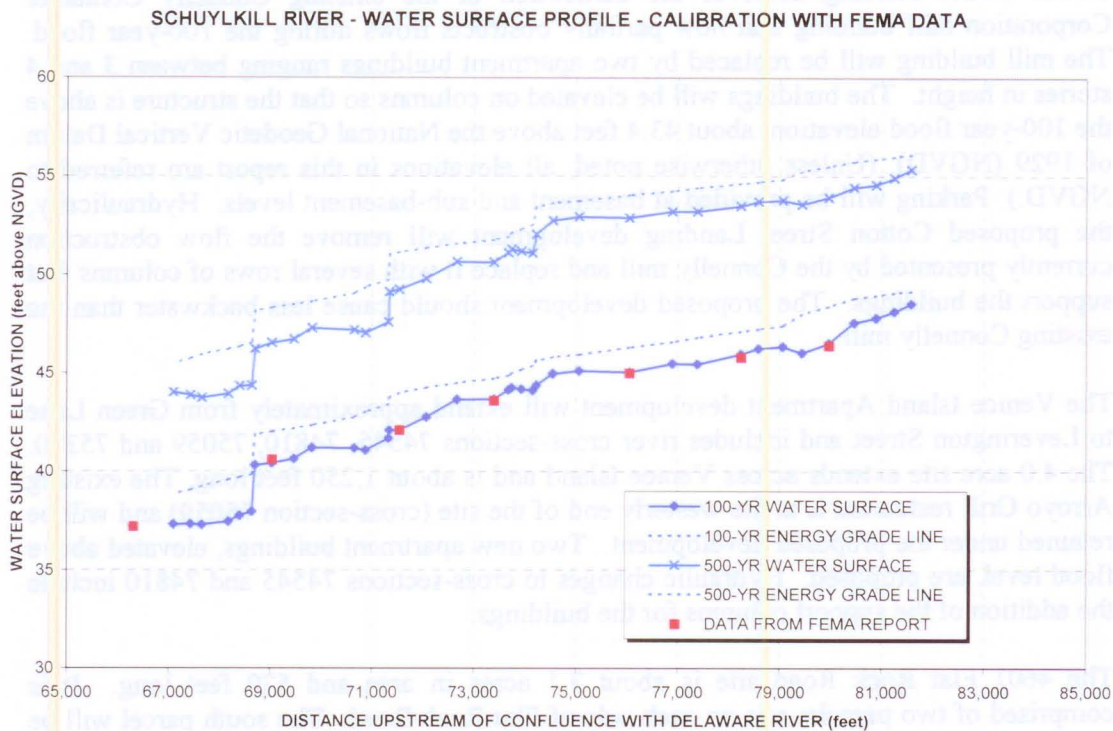


Figure 2 Calibration Run Profile – Comparison of HEC-RAS Profile of Present Study with FEMA Values for 100-Year Flood Levels

the calibration. The figure compares the water surface profile computed in the present analysis using HEC-RAS with the water levels computed using HEC-2 in the original FEMA study. The large points on the figure are the values from the FEMA study given in Table 1. The agreement is excellent constituting calibration of the HEC-RAS model. For the remainder of this study water levels are compared with the HEC-RAS-computed levels.

PROPOSED DEVELOPMENT

At present, three separate developments are proposed for Venice Island all of which are within the 100-year flood plain. Each involves the construction of apartments. The location of each site is shown on Figure 3. The figure also shows the location of four river cross-sections added for the present HEC-RAS analysis to supplement the Corps of Engineers' cross-sections. Cross-section 73055 was added to characterize hydraulic conditions at the proposed Cotton Street Landing development. Cross-sections 74810 and 75370 were added to better define hydraulic characteristics of the Venice Island Apartments development while cross-section 75710 was added to characterize hydraulic conditions at the 4601 Flat Rock Road development.

The development farthest downstream is Cotton Street Landing, located at about cross-section 73055. The 2.5-acre site extends across the island and is about 600 feet long. Cotton Street Landing involves the demolition of the existing Connelly Container Corporation mill building that now partially obstructs flows during the 100-year flood. The mill building will be replaced by two apartment buildings ranging between 3 and 4 stories in height. The buildings will be elevated on columns so that the structure is above the 100-year flood elevation, about 43.4 feet above the National Geodetic Vertical Datum of 1929 (NGVD). (Unless otherwise noted, all elevations in this report are referred to NGVD.) Parking will be provided at basement and sub-basement levels. Hydraulically, the proposed Cotton Street Landing development will remove the flow obstruction currently presented by the Connelly mill and replace it with several rows of columns that support the buildings. The proposed development should cause less backwater than the existing Connelly mill.

The Venice Island Apartment development will extend approximately from Green Lane to Leverington Street and includes river cross-sections 74545, 74810, 75059 and 75370. The 4.0 acre site extends across Venice Island and is about 1,250 feet long. The existing Arroyo Grill restaurant is at the westerly end of the site (cross-section 75059) and will be retained under the proposed development. Two new apartment buildings, elevated above flood level, are proposed. Hydraulic changes to cross-sections 74545 and 74810 include the addition of the support columns for the buildings.

The 4601 Flat Rock Road site is about 3.1 acres in area and 520 feet long. It is comprised of two parcels: one on each side of Flat Rock Road. The south parcel will be developed for parking while the north parcel will provide parking and 160 apartment units in a building ranging from 2 to 6 stories high. A portion of the former National Milling and Chemical Company building existing on the site will be demolished, but most of it will be retained, flood proofed to above the 100-year flood level and renovated to provide a lobby, resident activity rooms, building management offices and tenant storage areas. Apartments will be located on the upper floors of the renovated mill building and in a newly constructed addition. Hydraulically, the flow obstruction width presented by the renovated building will be reduced from about 160 feet to about 130 feet. The new addition will be elevated on columns to above the 100-year flood elevation.

PRE-DEVELOPMENT ANALYSIS

Pre-development conditions were modeled by adding the four new cross-sections to those used by the Corps of Engineers in their FEMA study and by modeling existing hydraulic conditions at those locations. New cross-sections were added at river sections 73055, 74810, 75370 and 75710 to better define conditions at each of the proposed development sites. Main channel conditions at the new cross-sections were obtained by interpolating between the nearest upstream and downstream cross-sections. Conditions on the Venice Island flood plain were obtained from topographic survey maps and existing condition plans. Details of the hydraulic conditions assumed at the various cross-sections are described below under POST-DEVELOPMENT ANALYSIS. Figure 4 compares 100-year flood levels for pre-development conditions, including the added cross-sections, with water levels calculated during model calibration. Small differences in water levels occur in the vicinity of the new cross-sections since their addition improves the model's resolution.. For example, the addition of cross-section 75710, which includes the existing National Milling and Chemical Co. building, results in a local lowering of the 100-year water level. Since the flow is subcritical, conservation of energy at the building cross-section results in a local velocity increase and a corresponding water level decrease. In addition, the building results in higher upstream water levels or backwater.

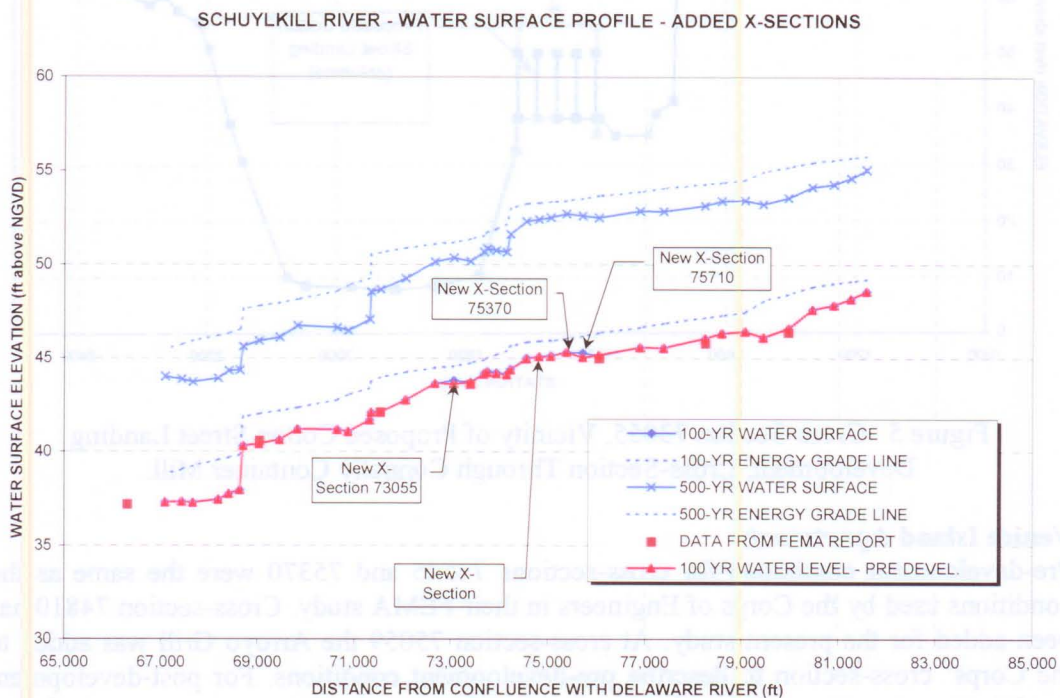


Figure 4 Comparison of Pre-Development Profile with Calibration Profile.

POST-DEVELOPMENT ANALYSIS

Cross-sections 72666, 73055 and 73395 pertain to the Cotton Street Landing site. (72666 is just downstream, 73395 is just upstream and 73055 goes through the middle of the Cotton Street Landing tract.) Cross-sections 74545, 74810, 75059 and 75370 go through

the Venice Island Apartments tract and cross-section 75710 goes through the 4601 Flat Rock Road tract. The location of the cross-sections relative to the three proposed developments is shown in Figure 3.

Cotton Street Landing

Cross-section 73055 passes through the middle of the proposed Cotton Street Landing development. The existing Connelly Container mill building was included in the cross-section to describe pre-development conditions. Post-development conditions at 73055 show the Connelly mill demolished and replaced by row of columns to support the proposed apartment building. Figure 5 shows the 73055 cross-section with both the pre- and post-development conditions assumed for the present study.

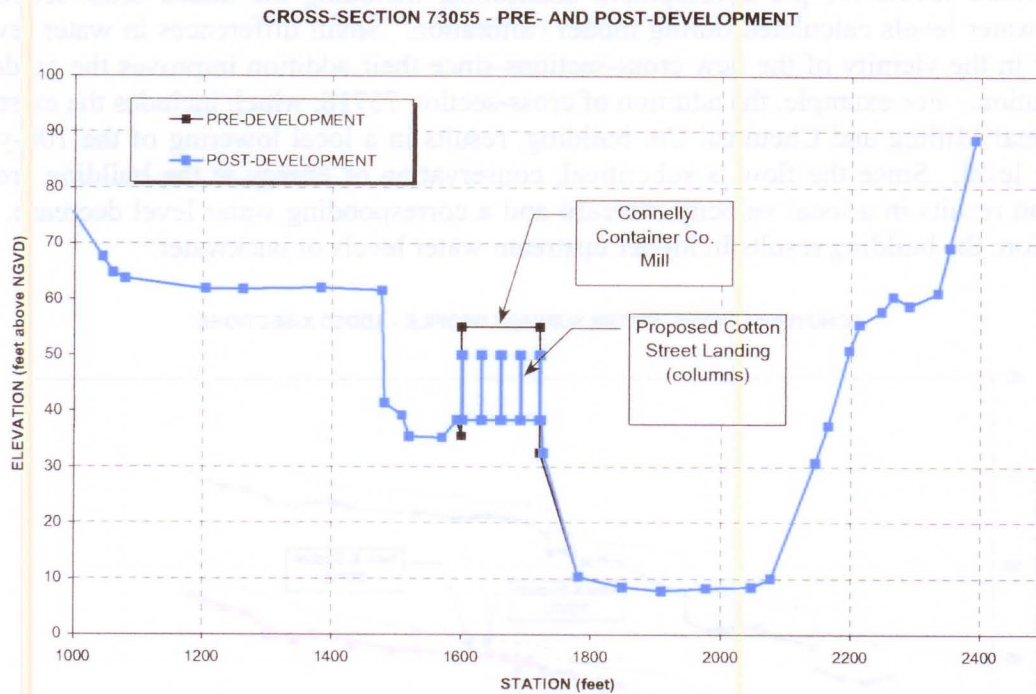


Figure 5 Cross-Section 73055, Vicinity of Proposed Cotton Street Landing Development, Cross-Section Through Connelly Container Mill.

Venice Island Apartments

Pre-development conditions for cross-sections 74545 and 75370 were the same as the conditions used by the Corps of Engineers in their FEMA study. Cross-section 74810 has been added for the present study. At cross-section 75059 the Arroyo Grill was added to the Corps' cross-section to describe pre-development conditions. For post-development conditions, supporting columns for the proposed Venice Island Apartments were included in cross-sections 74545 and 74810. Post-development conditions at 75059 and 75370 were the same as pre-development conditions. Cross-section 75059 passes through the Arroyo Grill. Cross-section 75370 is at the western end of the proposed development and no hydraulically significant changes are proposed to it. Pre-development and post-

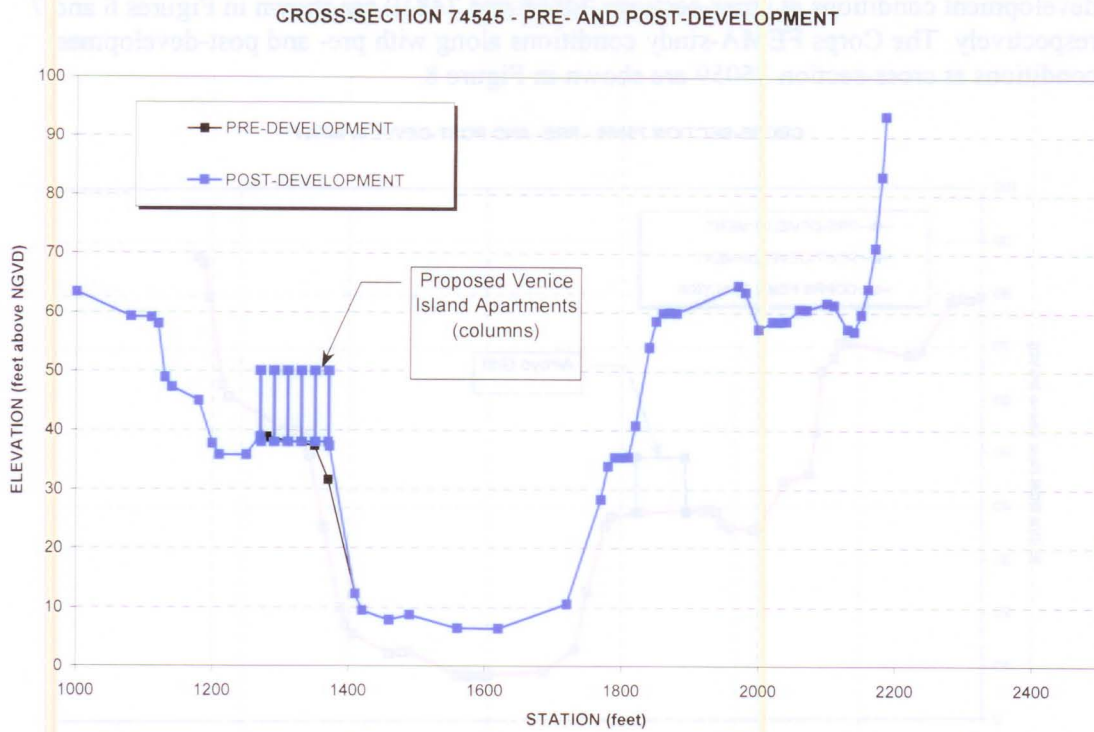


Figure 6 Cross-Section 74545, Vicinity of Proposed Venice Island Apartments Development

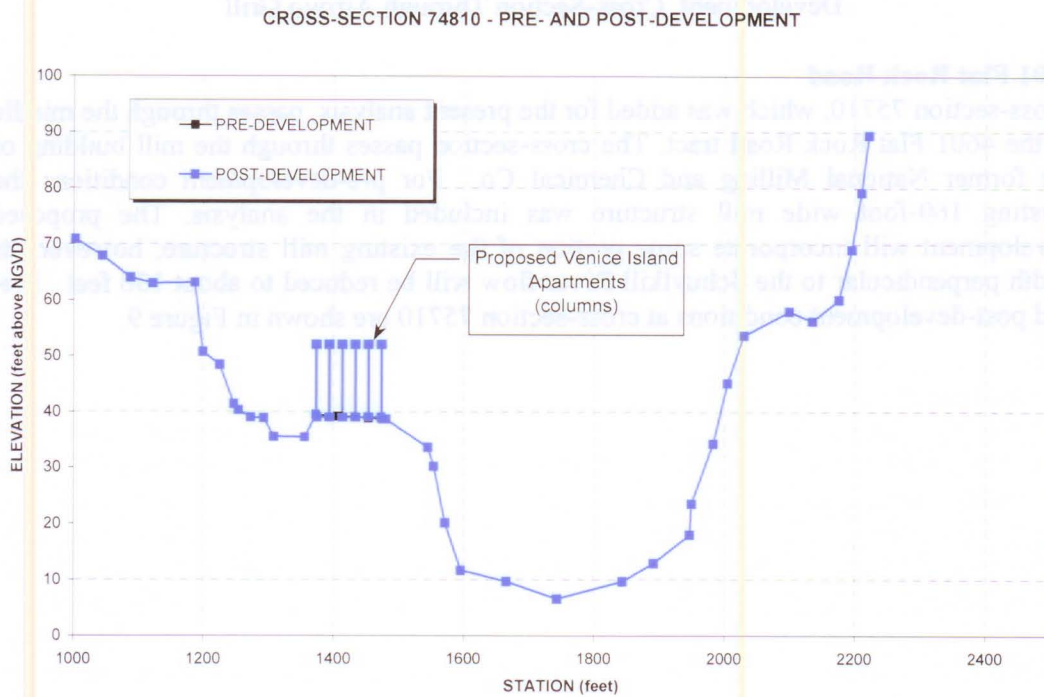


Figure 7 Cross-Section 74810, Vicinity of Proposed Venice Island Apartments Development

development conditions at cross-sections 74545 and 74810 are shown in Figures 6 and 7 respectively. The Corps FEMA-study conditions along with pre- and post-development conditions at cross-section 75059 are shown in Figure 8.

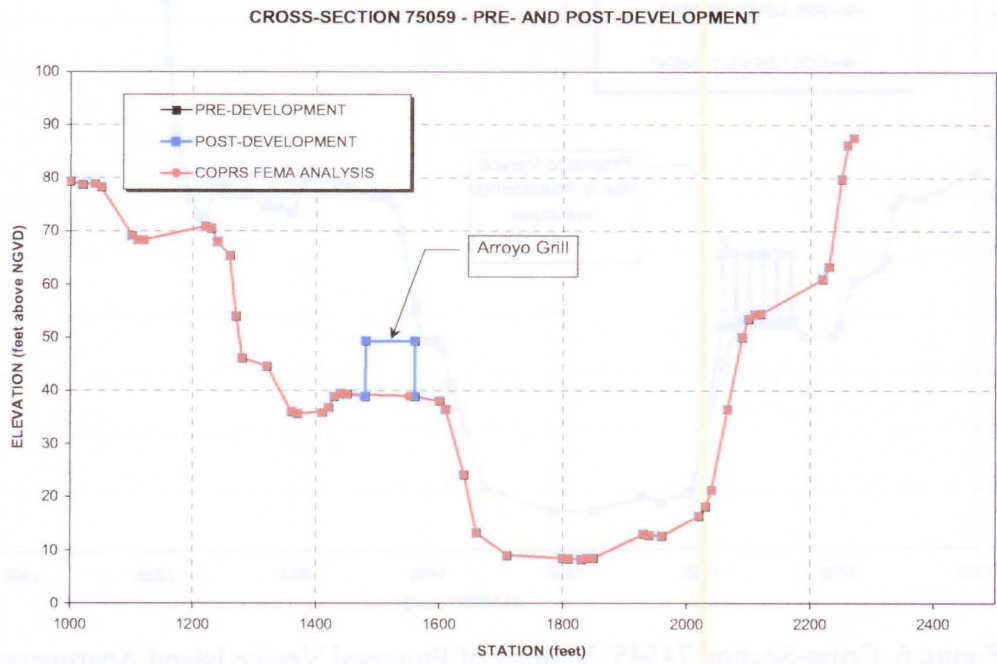


Figure 8 Cross-Section 75059, Vicinity of Proposed Venice Island Apartments Development, Cross-Section Through Arroyo Grill

4601 Flat Rock Road

Cross-section 75710, which was added for the present analysis, passes through the middle of the 4601 Flat Rock Road tract. The cross-section passes through the mill building of the former National Milling and Chemical Co. For pre-development conditions the existing 160-foot wide mill structure was included in the analysis. The proposed development will incorporate some portion of the existing mill structure; however, its width perpendicular to the Schuylkill River flow will be reduced to about 130 feet. Pre- and post-development conditions at cross-section 75710 are shown in Figure 9.

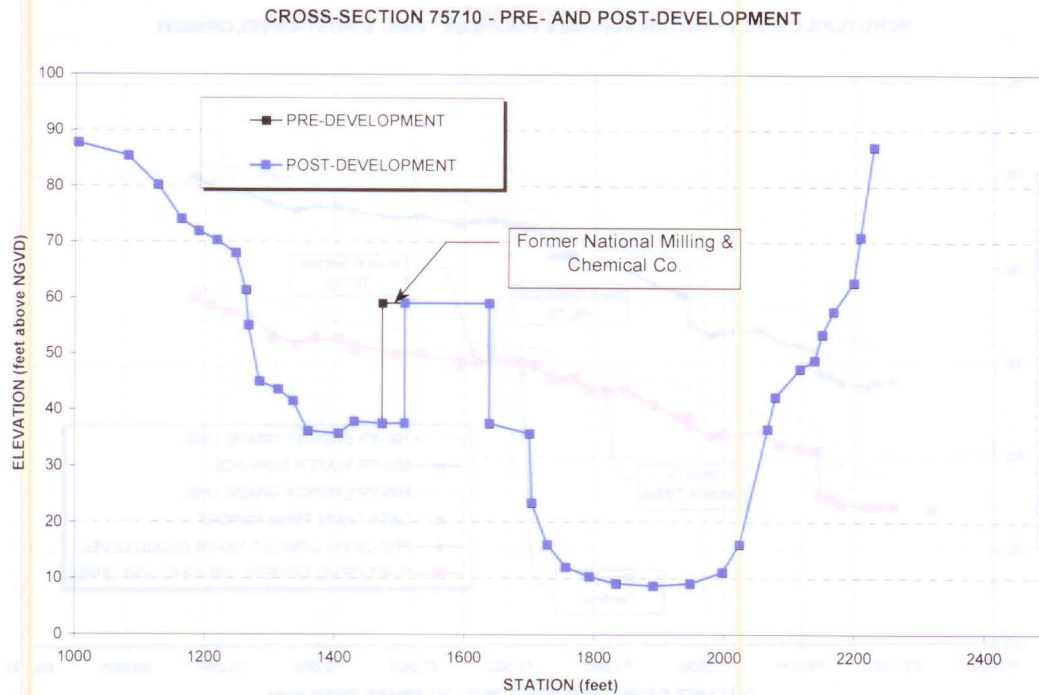


Figure 9 Cross-Section 75710, Vicinity of 4601 Flat Rock Road, Cross-Section Through Former National Milling and Chemical Company Mill Building.

SUMMARY & CONCLUSIONS

HEC-RAS was run to calculate water surface elevations for the 100-year Schuylkill River flood discharge of 109,000 ft³/s along the Venice Island reach of the river. The model was run for both pre- and post-development conditions. The results of the two computer runs are shown in Figure 10. Both pre- and post-development conditions are shown in the figure but are indistinguishable since they plot on top of one another. The HEC-RAS output water level profile for pre-development conditions is shown separately in Figure 11 while the post-development water level profile is shown in Figure 12. Pre- and post-development cross-sections along with the 100-year water levels are shown in Figures A1 through A10 in Appendix A, “Pre- and Post-Development Cross-Sections Showing HEC-RAS-Calculated 100-Year Flood Water Levels in the Vicinity of Cotton Street Landing, Venice Island Apartments and 4601 Flat Rock Road.”

The analysis indicates that the proposed developments at Cotton Street Landing, Venice Island Apartments and 4601 Flat Rock Road will not result in any change in the 100-year flood levels on the Schuylkill River.

SCHUYLKILL RIVER - WATER SURFACE PROFILES - PRE- & POST-DEVELOPMENT

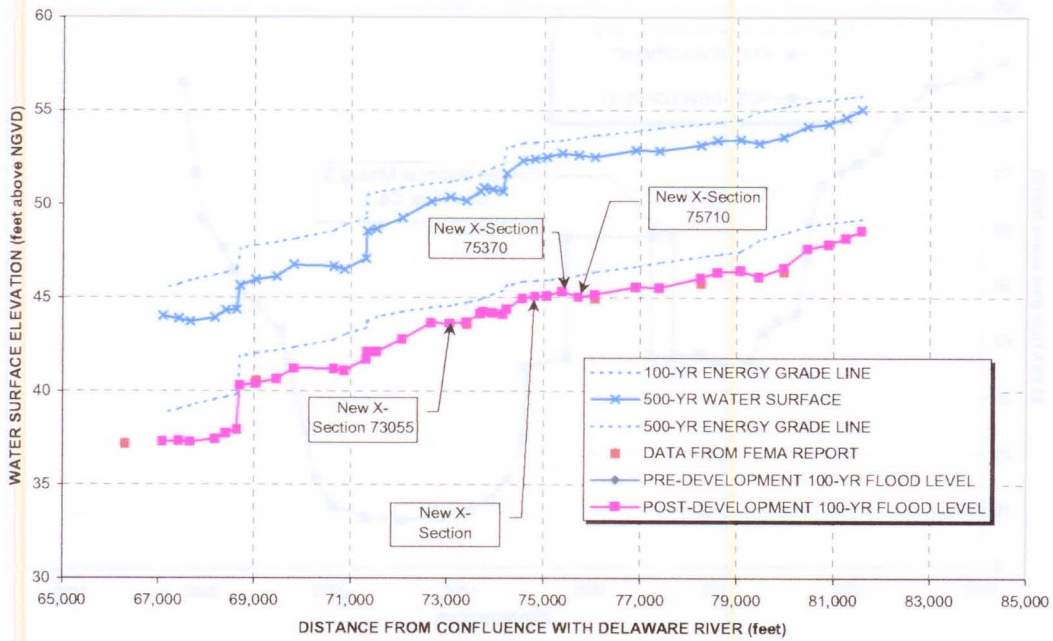


Figure 10 Comparison of Pre- and Post-Development Profiles, Venice Island, Manayunk, Philadelphia, PA.

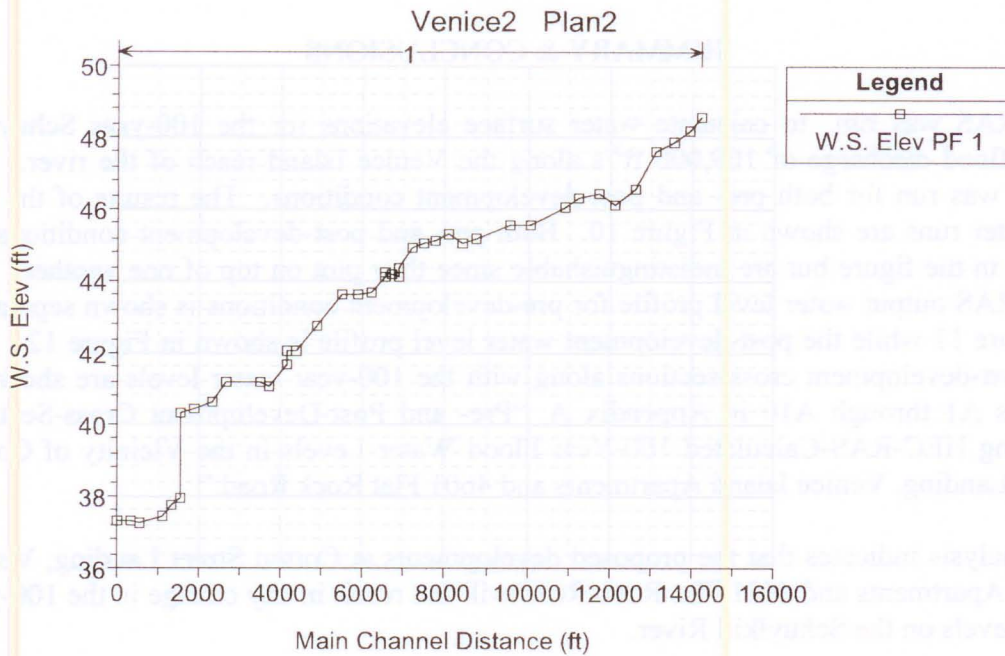


Figure 11 HEC-RAS Output, Water Surface Elevations for Post-Development Plan.

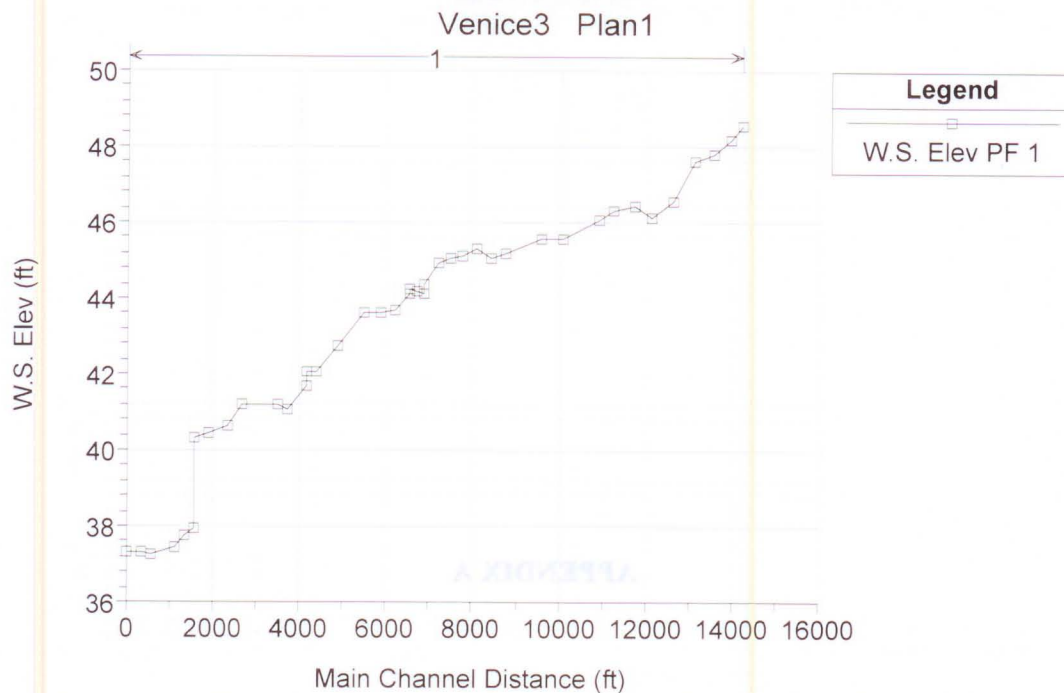


Figure 12 HEC-RAS Output, Water Surface Elevations for Post-Development Plan.

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APPENDIX A

Pre- and Post-Development Cross-Sections Showing HEC-RAS-Calculated 100-Year Flood Water Levels in the Vicinity of Cotton Street Landing, Venice Island Apartments and 4601 Flat Rock Road.

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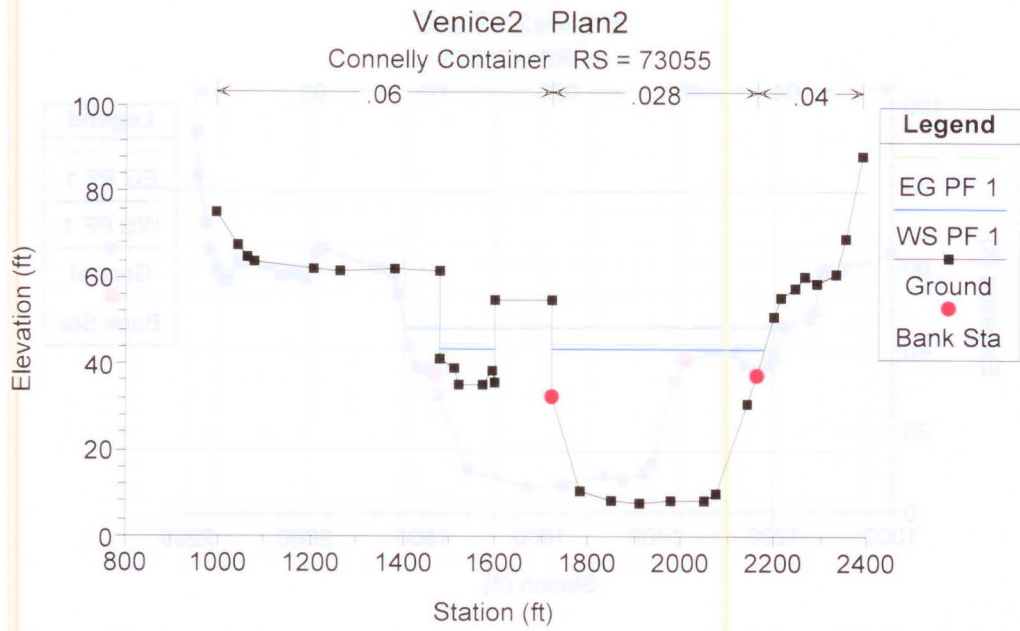


Figure A1 HEC-RAS Output, Cross-Section 73055, Pre-Development Conditions.

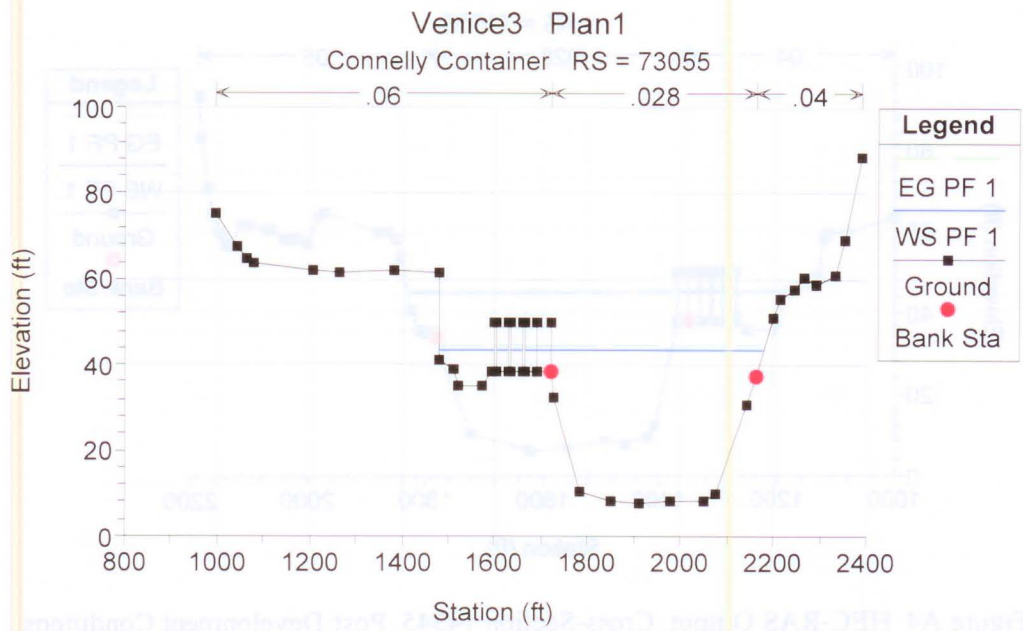


Figure A2 HEC-RAS Output, Cross-Section 73055, Post-Development Conditions.

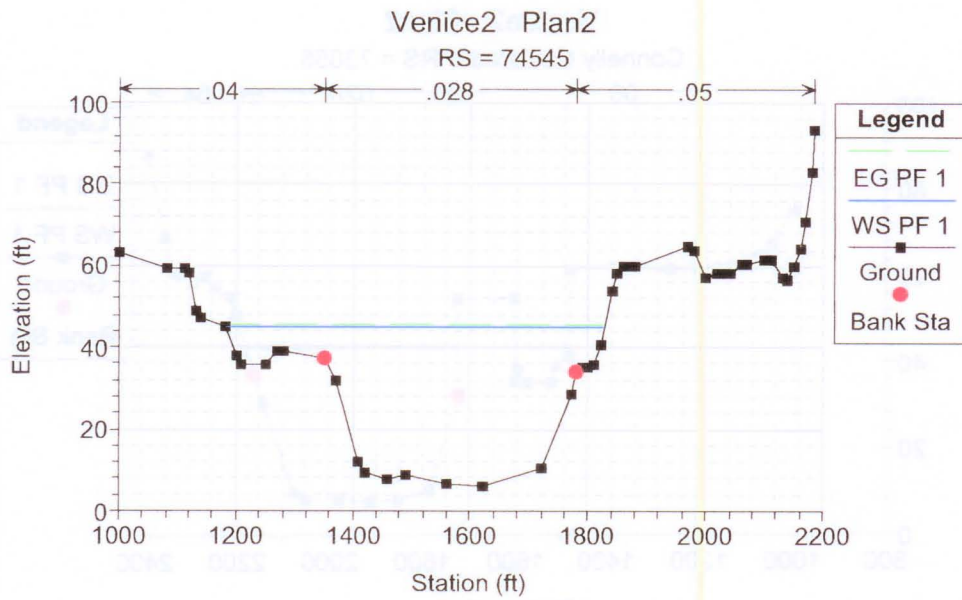


Figure A3 HEC-RAS Output, Cross-Section 74545, Pre-Development Conditions.

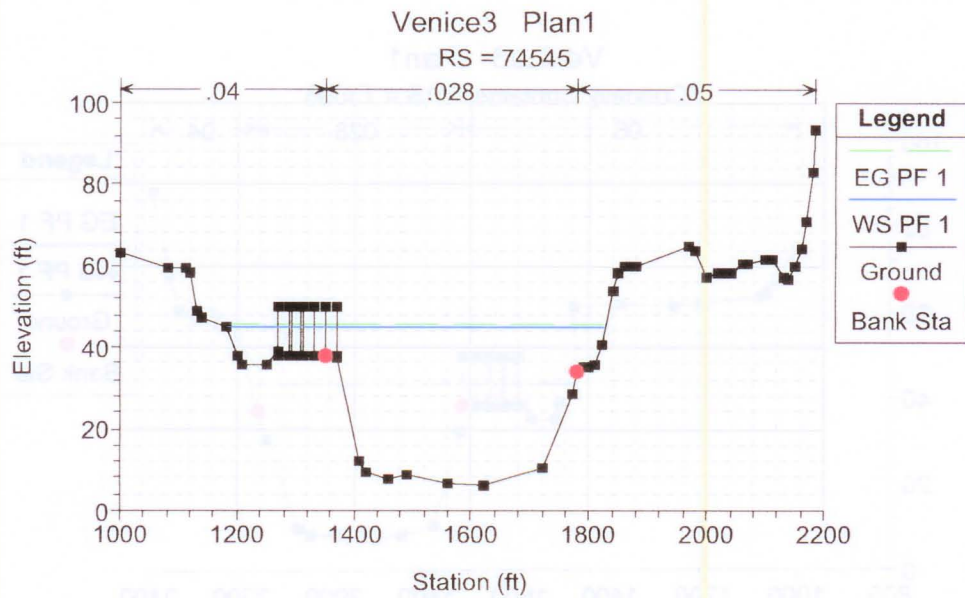


Figure A4 HEC-RAS Output, Cross-Section 74545, Post-Development Conditions.

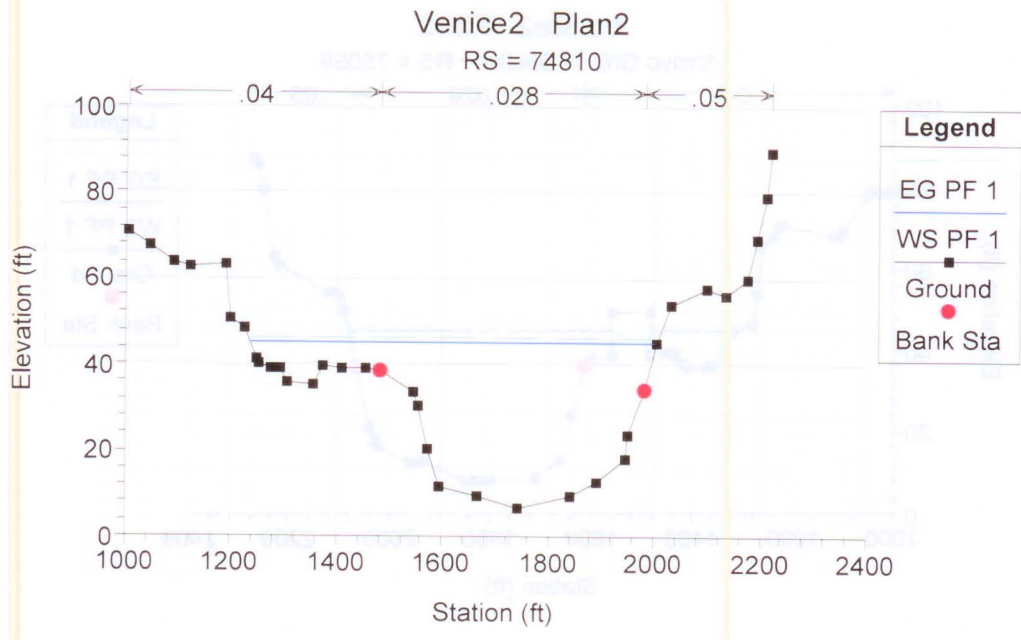


Figure A5 HEC-RAS Output, Cross-Section 74810, Pre-Development Conditions.

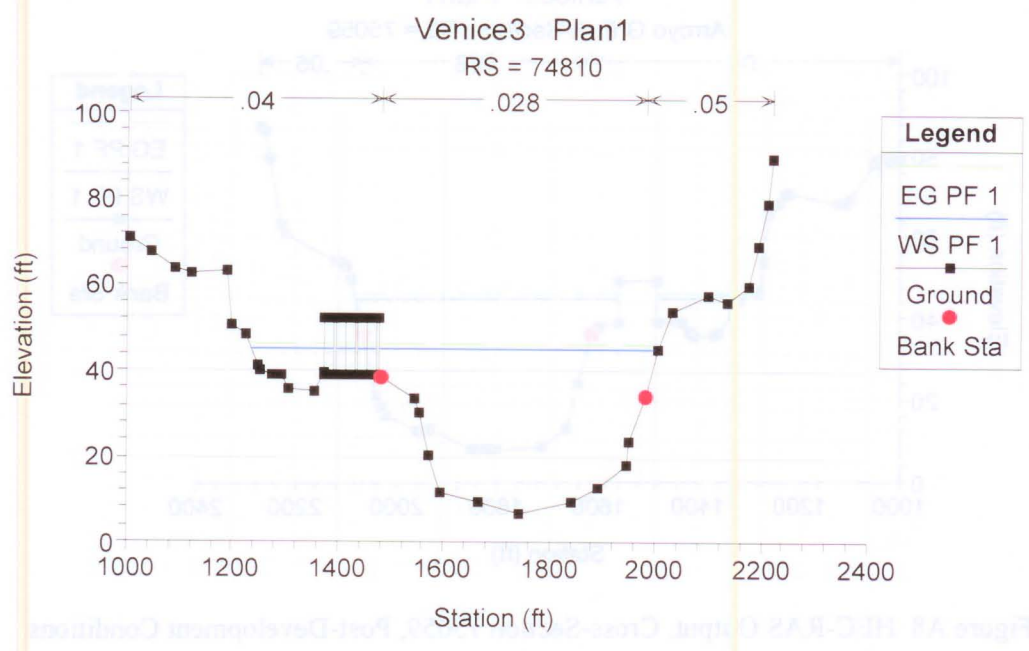


Figure A6 HEC-RAS Output, Cross-Section 74810, Post-Development Conditions.

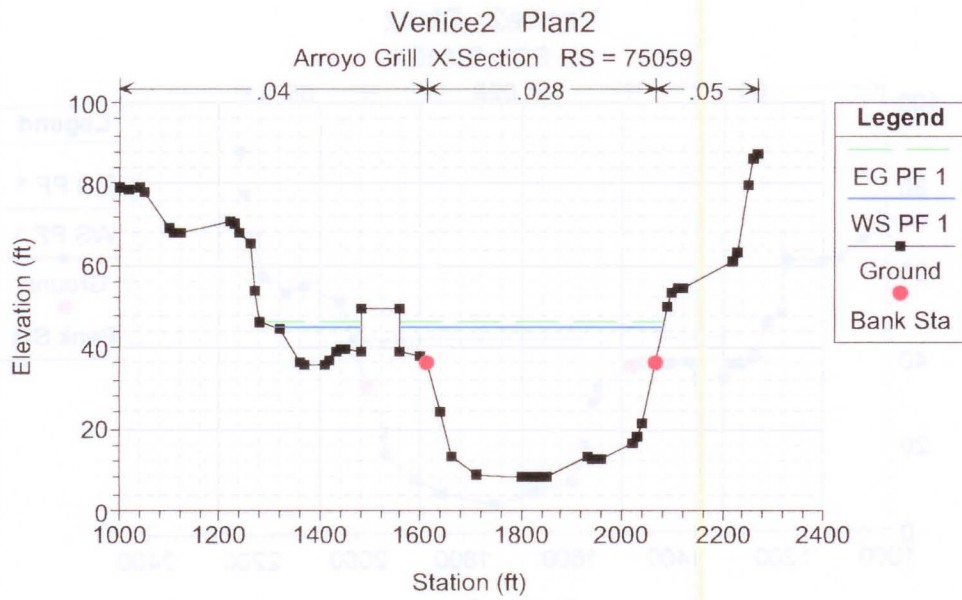


Figure A7 HEC-RAS Output, Cross-Section 75059, Pre-Development Conditions.

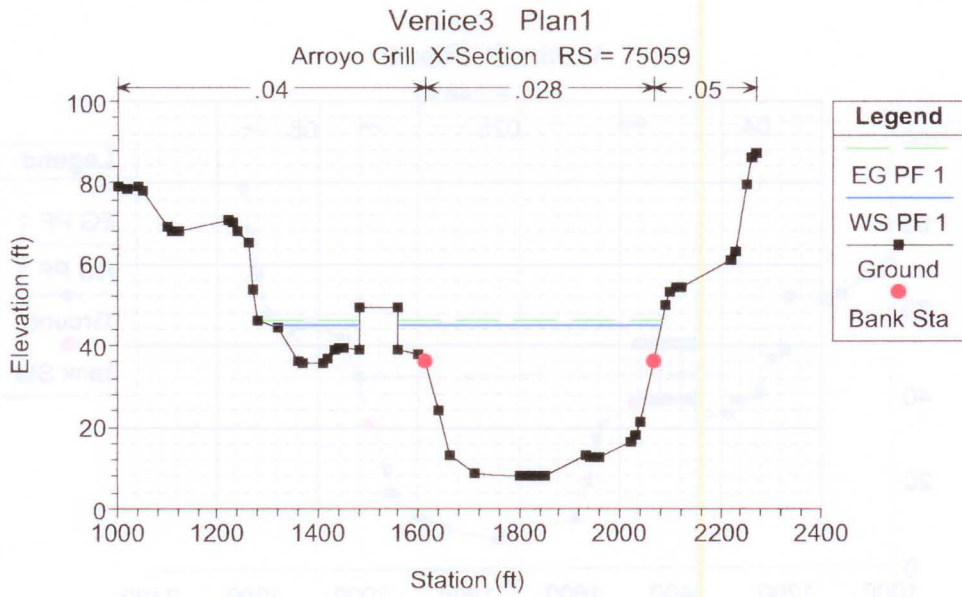


Figure A8 HEC-RAS Output, Cross-Section 75059, Post-Development Conditions.

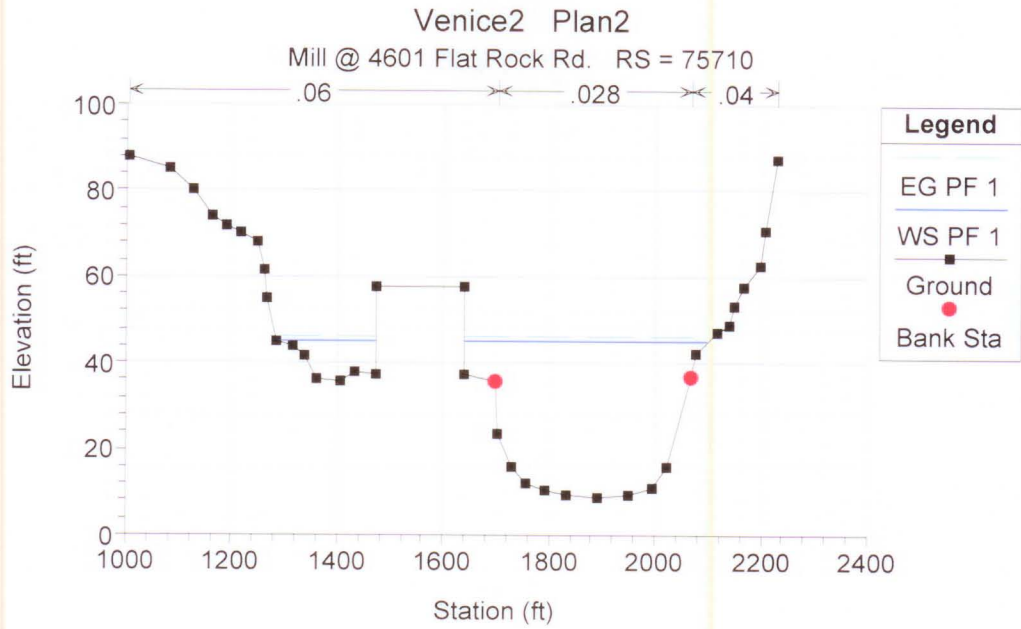


Figure A9 HEC-RAS Output, Cross-Section 75710, Pre-Development Conditions.

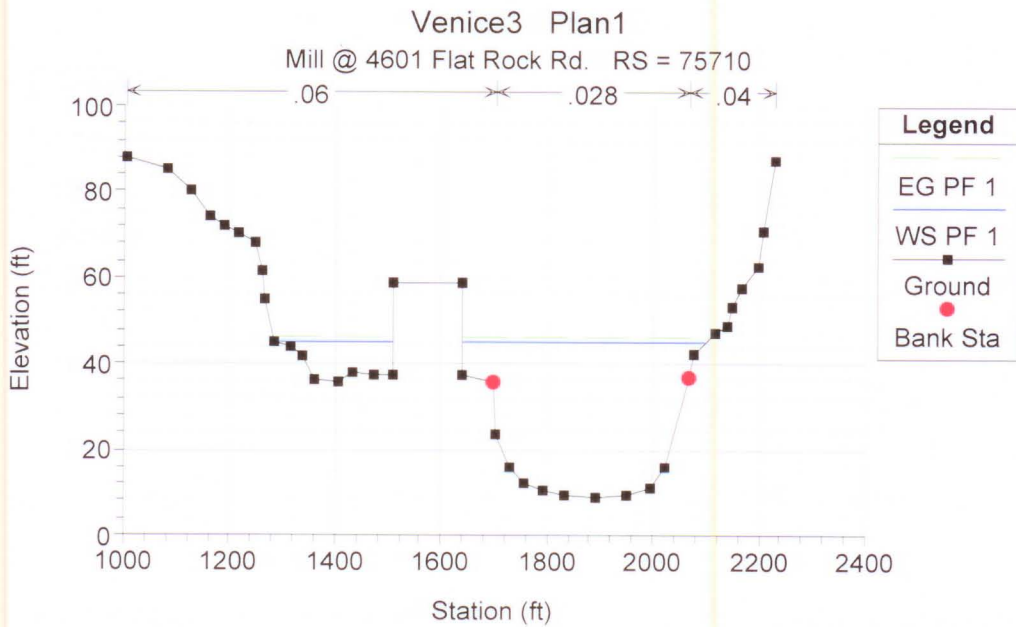


Figure A10 HEC-RAS Output, Cross-Section 75710, Post-Development Conditions.

