

## Memorandum

**To:** PPO Subcommittee

**Re:** West Papillion Creek Levee Restoration Evaluation and Regional Detention Structure WPRB5 RFP

**Date:** September 30, 2008

**From:** Amanda Grint, Water Resources Engineer

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In March 2008, HDR Engineering, Inc. completed a report titled "West Papillion Creek Levee Restoration Evaluation" (attached). This report was commissioned by Management to address the dramatic impact that recently developed floodplain mapping along the West Papillion Creek has on the City of Papillion due to the District's flood control levees no longer being effective to FEMA standards. The conclusions in the report indicate that a combination of alternatives is necessary to achieve required freeboard and certification along the West Papillion Creek levee system to provide 100 year flood protection. Regional detention structures to store flood waters upstream, raising a couple of bridges and in some areas raising portions of the levee will be necessary to provide maximum protection. One regional detention flood control structure identified in both the levee evaluation and the Papillion Creek Watershed Partnership Stage IV study as a priority site is WPRB-5, located at approximately 126<sup>th</sup> and Cornhusker Road. See attached map.

This regional detention structure provides immediate flood control benefits to the City of Papillion. The City has contracted with Tetra Tech, Inc. to review the flood study and mapping recently completed on the West Papio. Tetra Tech has reviewed the data for the flood study as well as the Levee Restoration Evaluation report and concurs with the findings. Attached is a letter from the City of Papillion expressing their strong support for the WPRB-5 project.

A Request for Engineering Proposals (RFP) has been drafted and is included with the memo. This RFP would allow the General Manager to accept professional service proposals for the planning, permitting, design and construction administration of WPRB-5. This project would expand on the conceptual design that was completed by HDR Engineering, Inc. in February 2006 in a report titled "Unnamed South Papillion Creek Tributary Detention Evaluation".

**Management recommends that the Subcommittee recommend to the Board that the General Manager be authorized to distribute the proposed Request for Proposals for professional engineering services necessary to plan, permit, design and construct the proposed flood control structure WPRB-5.**

# **West Papillion Creek Levee Restoration Evaluation**

**West Papillion  
Creek Levee  
Restoration  
Evaluation**

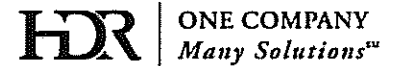
**Sarpy County  
Nebraska**

**March 2008**

**Prepared for**



**Prepared by**



## TABLE OF CONTENTS

1.0	Background and Purpose.....	1
2.0	Additional Flood Control Measures .....	2
2.1	Improvements at 66th Street Bridge .....	2
2.2	Improvements at 84th Street Bridge .....	2
3.0	Hydraulic Analysis .....	3
3.1	Scenario 1 .....	5
3.2	Scenario 2 .....	5
3.3	Scenario 3 .....	5
4.0	Estimated Opinion of Probable Construction Costs .....	5
5.0	Conclusions and Recommendations.....	10
6.0	References .....	11

## LIST OF TABLES

Table 1	Evaluation Summary of Levee Restoration Scenarios .....	4
Table 2	Length and Height of Required Levee Raise .....	4
Table 3	Scenario 1 - Summary of Estimated Probable Construction Costs.....	8
Table 4	Scenario 2 - Summary of Estimated Probable Construction Costs.....	9
Table 5	Scenario 3 - Summary of Estimated Probable Construction Costs.....	10

## LIST OF EXHIBITS

Exhibit 1	Typical Levee Raise Using a Structural Wall Up to 1 Foot Raise
Exhibit 2	Typical Levee Raise Using a Structural Wall 1- to 3-Foot Raise
Exhibit 3	Typical Levee Raise Using a Structural Wall Greater Than 3-Foot Raise
Exhibit 4	Typical Levee Raise Using Fill Material

## APPENDICES

Appendix A	Figures
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### LIST OF FIGURES

Figure 1	General Location Map
Figure 2A	66th St. Proposed Bridge Replacement Revised Floodplain Maps (1 of 2)
Figure 2B	66th St. Proposed Bridge Replacement Revised Floodplain Maps (2 of 2)
Figure 3	Scenario 1 – Raise Bridges and Levees
Figure 4	Scenario 2 – Raise Bridges and Levees with Tributary Storage
Figure 5	Scenario 3 – Raise Bridges and Levees with Tributary Storage and Upstream Storage

Appendix B	West Papillion Creek Levee Restoration – Summary of Previous Analyses Technical Memorandum
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Appendix C	Evaluation of Proposed 66th St. Bridge Replacement over West Papillion Creek Technical Memorandum
Appendix D	Hydraulic Modeling Summary of HEC-RAS Output
Appendix E	Opinion of Probable Construction Costs

## WEST PAPILLION CREEK LEVEE RESTORATION EVALUATION

### 1.0 Background and Purpose

In the lower reach of West Papillion Creek is an earthen levee system located along the banks of the main channel of West Papillion Creek. During the flood hazard remapping of the West Papillion Creek floodplain initiated in 2005, it was found that the required 3 ft of levee freeboard (4 ft near bridges) for the 1-percent annual chance event was compromised under current (2004) land use conditions. Because the freeboard requirement was not able to be met, a much wider floodplain was defined and mapped. The purpose of this evaluation is to define flood control measures to restore the levee system as being able to provide flood protection from the 1-percent annual chance event.

The levees extend from the confluence with Walnut Creek, near 96th Street, downstream to 42nd Street on the right (south) bank and on the left (north) bank from just west of 84th Street, near Adams Street, to the abandoned Chicago, Rock Island, and Pacific Railroad (CRIPRR) embankment, at approximately 44th Street. See Figure 1 in Appendix A for a general location map of the West Papillion Creek Watershed and its levees. The levee is predominately an earthen levee with several structural walls at 84th Street and at two other locations along roadways.

The earthen levees were designed to contain a 1-percent annual chance flood event (also known as the 100-year) and provide 3 ft of freeboard (levee height defined 3 ft above the 1-percent annual chance water surface elevation), in accordance with FEMA criteria. The levees were designed based on a year 2020 future land use condition; thereby, providing additional freeboard. During the flood hazard remapping of the West Papillion Creek floodplain, the freeboard requirement was not able to be met, and the floodplain was defined and mapped using the maximum water surface elevation for a "no left levee" or a "no right levee" condition creating a much larger floodplain than what is currently mapped.

Several individual evaluations were completed following the West Papillion Creek flood hazard remapping to assess specific flood control measures that may potentially restore the required levee freeboard. These analyses were summarized in a technical memorandum prepared by HDR Engineering, Inc., entitled, "West Papillion Creek Levee Restoration – Summary of Previous Analyses", dated December 13, 2006, and included with this report as Appendix B. These evaluations considered a range of alternatives including tributary detention storage, upstream regional detention storage, and bridge modifications. A conclusion of the 2006 summary document was that none of the evaluated options alone would restore the required levee freeboard and that levee raises would be required as an additional flood control measure to provide the required freeboard.

This analysis summarizes additional flood control measures that may be enacted to restore the required levee freeboard. These measures are presented as Scenarios 1, 2, and 3. The general methodology includes modeling the scenarios with U.S. Army Corps of Engineer's hydraulic modeling software, HEC-RAS, to obtain a water surface elevation (WSEL), comparing the modeled WSEL to existing levee elevations to obtain freeboard, enacting additional flood control measures such as levee and bridge raises

to meet freeboard criteria, and estimating an opinion of probable construction cost for each scenario.

## **2.0 Additional Flood Control Measures**

Additional flood control measures were identified with P-MRNRD and HDR staff and the following order was proposed to evaluate the levee freeboard using 1-percent annual chance future land use conditions:

1. Scenario 1: Raise bridges and levees, without storage
2. Scenario 2: Raise bridges and levees, with tributary detention sites (3 locations)
3. Scenario 3: Raise bridges and levees, with tributary detention sites (3 locations) and upstream dams (3 locations)

In each scenario, the levees and bridges were raised to meet the freeboard criteria. Each levee is required to maintain 3 ft of freeboard in the 1-percent annual chance event and 4 ft of freeboard 100 ft upstream and downstream of bridges. In addition, local floodplain policies require bridges to maintain 1 ft of freeboard, as measured between the WSEL and the bridge low chord, during the 1-percent annual chance event. At 66th Street and 84th Street, additional improvements were considered in addition to raising the bridge and levees to meet freeboard requirements.

### **2.1 Improvements at 66th Street Bridge**

For the West Papillion Creek flood hazard remapping project, it was found that under existing and full build-out land use conditions, the 66th Street Bridge is submerged for the 1-percent annual chance event. For the 10-percent annual chance event (10-year), the bridge is not overtopped but the low chord is submerged. In a previous technical memorandum prepared by HDR entitled, "Evaluation of Proposed 66th St. Bridge Replacement over West Papillion Creek" dated May 12, 2006, it was recommended that the 66th Street Bridge be removed and replaced with a wider and higher bridge. It was found that a span width of 265 ft and a raise of 9.2 ft were necessary to minimize hydraulic impacts.

By widening and raising the 66th Street Bridge, the base flood elevation would decrease and floodplain and floodway widths would reduce. While the required freeboard was not achieved by replacing the bridge alone, the 66th Street Bridge replacement serves as a key component in the combination of alternatives necessary to achieve the required freeboard. Appendix C includes the previous technical memorandum for the proposed 66th Street Bridge Replacement and shows the results of the revised floodplain and floodway boundaries. Replacing the 66th Street Bridge provides an incremental benefit to achieving the required freeboard.

### **2.2 Improvements at 84th Street Bridge**

As the analysis proceeded, it became clear that a bridge raise necessary to meet freeboard requirements at 84th Street would be costly. Containing the 1-percent annual chance event between the levees required a bridge raise on the order of 5.3 ft. This would require raising 84th Street (also known as Washington Street) and affect the city of Papillion's businesses along the 84th Street corridor. Transitioning the roadway grades from a new bridge deck using a vertical curve with a 3 percent slope

requires raising the roadway starting 1,000 ft to the south of the bridge (approximately Lincoln Road) and terminating 500 ft to the north of the bridge (approximately 1st Street).

Realizing the potential cost and impact of raising the 84th Street Bridge, two additional improvements were identified and incorporated into the improvements at the 84th Street Bridge to minimize the hydraulic impacts: 1) increasing the bridge span length and 2) relocating the existing grade control structure upstream. The channel geometry allowed the 84th Street bridge length to be increased from 152 ft long to 215 ft long. A grade control structure exists near the downstream face of the 84th Street Bridge and moving it approximately 2,000 ft upstream allows a reduction in the water surface elevation at the 84th Street Bridge. These two improvements are incorporated into all three scenarios.

### **3.0 Hydraulic Analysis**

Water surface elevations for the 1-percent annual chance, full build-out land use condition event as determined for the leveed reach of West Papillion Creek for the West Papillion Creek Flood Hazard Remapping Project were used as the baseline hydraulic scenario. During the flood hazard remapping evaluation, it was determined that FEMA's levee freeboard requirements were not met and, in some cases, the levees are overtopped.

A total of three hydraulic scenarios were evaluated, and, in all the scenarios, the levees and bridges were raised to match the freeboard requirements. The differences in the scenarios are in the detention projects evaluated for each scenario. Existing detention is located on Walnut Creek and Midland Creek, two tributaries located near or within the leveed reach, respectively. Scenario 1, as shown in Figure 3, does not include any additional detention. As shown in Figure 4, Scenario 2 includes the tributary detention sites previously referred to as South Papio Tributary (SPT), West Papio Tributary - West (WPT-West), and West Papio Tributary - East (WPT-East) Sites. These three tributary detention sites are also shown on a "Draft Drainage Plan" map as WP-RB5, WP-RB6, and WP-RB7 respectively. Figure 5 shows Scenario 3 components which includes both the three lower tributary detention sites and regional detention sites known as Reservoir Sites 12, 15A, and 19, as defined in the September 2004 report, "Multi-Reservoir Analysis - Papillion Creek Watershed", prepared by HDR.

The full build-out 1-percent annual chance event discharges, the range of levee raises, and the required bridge raises are summarized in Table 1. More detailed results showing the end result of the hydraulic analysis, the required bridge and levee increases for the three scenarios are contained in Appendix D.

**TABLE 1**  
**EVALUATION SUMMARY OF LEVEE RESTORATION SCENARIOS**

Levee and Bridge Raise Evaluation						
Scenario	Description	Reach	Full Build-Out 1-Percent Annual Chance Discharges (cfs) <sup>6</sup>	Required Left (North) Levee Raise <sup>1,7</sup>	Required Right (South) Levee Raise <sup>1,7</sup>	Required Bridge Raises <sup>5</sup>
1 <sup>2</sup>	Raise Bridges, Raise Levees Without SPT, WPT-West, WPT-East; Without Reservoir Sites 12, 15A, 19	D/S 48th	36,130 to 37,050	1.0 to 0.0	1.8 to 0.0	0.4 (48th)
		48th to 66th	36,400 to 36,130	3.4 to 0.7	2.8 to 1.3	8.7 (66th)
		66th to 84th	37,070 to 36,400	2.8 to 0.5	2.5 to 0.6	1.9 (72nd)
		U/S 84th	36,430 to 37,070	2.4 to 2.1	2.9 to 1.8	4.4 (84th)
2 <sup>3</sup>	Raise Bridges, Raise Levees With SPT, WPT-West, WPT-East; Without Reservoir Sites 12, 15A, 19	D/S 48th	31,920 to 32,430	0.0 to 0.0	0.7 to 0.0	0.0 (48th)
		48th to 66th	32,160 to 32,060	2.0 to 0.0	1.6 to 0.2	7.3 (66th)
		66th to 84th	32,680 to 32,160	1.3 to 0.0	1.0 to 0.0	0.4 (72nd)
		U/S 84th	32,400 to 32,680	1.9 to 0.4	2.3 to 0.4	2.6 (84th)
3 <sup>4</sup>	Raise Bridges, Raise Levees With SPT, WPT-West, WPT-East; With Reservoir Sites 12, 15A, 19	D/S 48th	29,660 to 30,510	0.0 to 0.0	0.1 to 0.0	0.0 (48th)
		48th to 66th	29,820 to 29,660	1.2 to 0.0	0.9 to 0.0	6.5 (66th)
		66th to 84th	30,310 to 29,820	0.5 to 0.0	0.2 to 0.0	0.0 (72nd)
		U/S 84th	29,790 to 30,310	0.9 to 0.0	1.4 to 0.0	1.1 (84th)

**Notes:**

1. Levee and bridge raises presented in ft.
2. Scenario 1 - Baseline conditions. Levee raises with multiple bridge modifications. Without SPT, WPT-West or WPT-East. Without Reservoir Sites 12, 15A, or 19.
3. Scenario 2 - Levee raises with multiple bridge modifications. With SPT, WPT-West or WPT-East detention sites. Without Reservoir Sites 12, 15A, or 19.
4. Scenario 3 - Levee raises with multiple bridge modifications. With SPT, WPT-West or WPT-East detention sites. With Reservoir Sites 12, 15A, or 19.
5. Bridge modifications to achieve 1 ft of freeboard above 100-year future water surface elevation.
6. Assume full build-out land use conditions.
7. Levee raises noted are necessary to obtain 3 ft of freeboard (4 ft 100 ft upstream and downstream of a bridge).

The peak discharges associated with Scenarios 2 and 3 were reflective of the flood attenuation effects of potential tributary detention and regional detention sites. The peak discharges are reduced and therefore the WSEL are reduced as more detention is considered. This in turn leads to reduced levee and bridge raises.

Table 2 categorized the total length of each levee raise by three height categories: less than 1 ft, between 1 ft and 3 ft, and greater than 3 ft.

**TABLE 2**  
**LENGTH AND HEIGHT OF REQUIRED LEVEE RAISE**

Required Levee Raises			
Height (ft)	Length (ft)		
	Scenario 1	Scenario 2	Scenario 3
Levee Raise Less Than 1 ft	11,090	16,821	7,540
Levee Raise Between 1 and 3 ft	34,524	5,648	622
Levee Raise Greater Than 3 ft	622	-	-
<b>Total Length</b>	<b>46,200</b>	<b>22,500</b>	<b>8,200</b>
<b>Percentage of Levee to be Raised</b>	<b>99%</b>	<b>49%</b>	<b>18%</b>

**Note:**

Total levee length is 46,300 ft.



### **3.1 Scenario 1**

As can be seen from the summary in Table 1, Scenario 1 has the largest required levee raise, with a maximum raise of 3.4 ft on the left bank and 2.9 ft on the right bank. Four bridge raises are required to achieve the necessary 1 ft of freeboard ranging from 8.7 ft at 66th Street to 0.4 ft at 48<sup>th</sup> Street. From Table 2, Scenario 1 includes raising 99 percent of the levied reach as shown in Figure 2.

### **3.2 Scenario 2**

The reduction in peak discharge due to tributary detention basins SPT, WPT-West, and WPT-East, is shown in Figure 3, is clearly seen in Scenario 2, as the largest required levee raise is 2.0 ft on the left bank and 2.3 ft on the right bank. Only three bridge raises are required to achieve the necessary 1 ft of freeboard at each bridge ranging from 7.3 ft at 66th Street to 0.4 ft at 72nd Street. No bridge raise is required at 48th Street. The reduction in required total length of levee raise is halved, as can be viewed in Table 2.

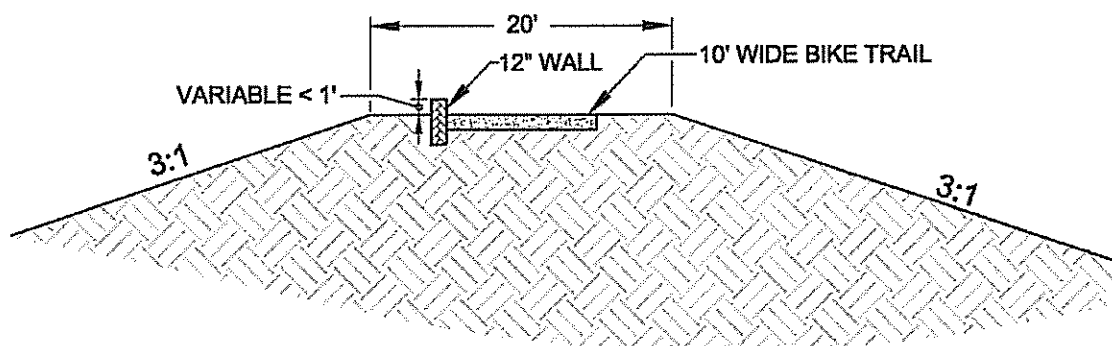
### **3.3 Scenario 3**

Finally, the reduction in peak discharge due to the combination of tributary detention basins SPT, WPT-West, and WPT-East and proposed Reservoir Sites 12, 15A, and 19 is clearly seen in the summary of Scenario 3, as the largest required levee raise is 1.2 ft on the left bank and 1.4 ft on the right bank. As shown on Figure 4, only two bridge raises are required to achieve the necessary 1 ft of freeboard at each bridge ranging from 6.5 ft at 66th Street to 1.1 ft at 84th Street. No bridge raises are necessary at 48th or 72nd Streets. The reduction in the total length of required levee raise is reduced dramatically, as only 18-percent of the total levee in the reach must be raised as inferred from Table 2.

## **4.0 Estimated Opinion of Probable Construction Costs**

Estimates of probable construction costs were calculated for the three different scenarios.

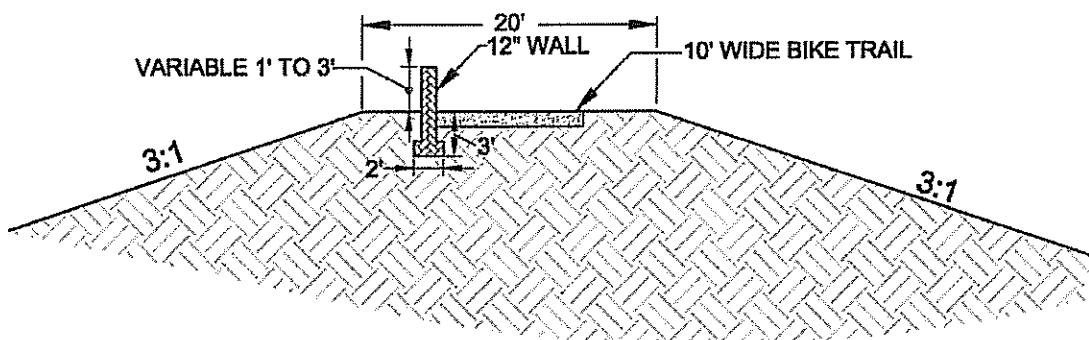
The quantity and cost of levee raises included two raise options. The first was construction of a floodwall, in which three typical sections, depending on the height of the required raise, were developed. Schematics of the three typical sections are shown as Exhibits 1, 2, and 3. Exhibit 1 was for a levee raise less than 1 ft, Exhibit 2 was for a raise between 1 ft and 3 ft, and Exhibit 3 was for a levee raise greater than 3 ft. Each successive floodwall section is higher than the last and thus has higher requirements for structural stability. The unit cost per linear foot associated with a floodwall raise is \$37, \$120, and \$875 for Wall Sections 1, 2, and 3, respectively.



### TYPICAL LEVEE RAISE - WALL UP TO ONE FOOT

SCALE = 1:10

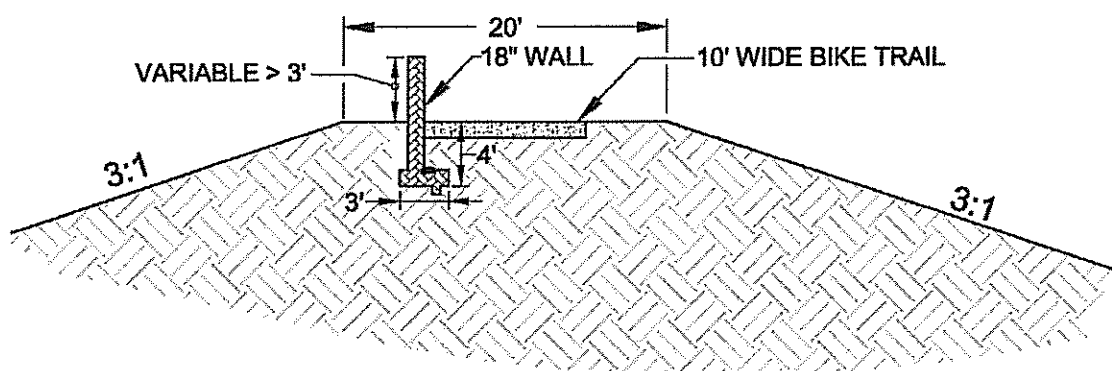
EXHIBIT 1. TYPICAL LEVEE RAISE USING A STRUCTURAL WALL UP TO 1 FOOT RAISE



### TYPICAL LEVEE RAISE - WALL ONE TO THREE FEET

SCALE = 1:10

EXHIBIT 2. TYPICAL LEVEE RAISE USING A STRUCTURAL WALL 1- TO 3-FOOT RAISE

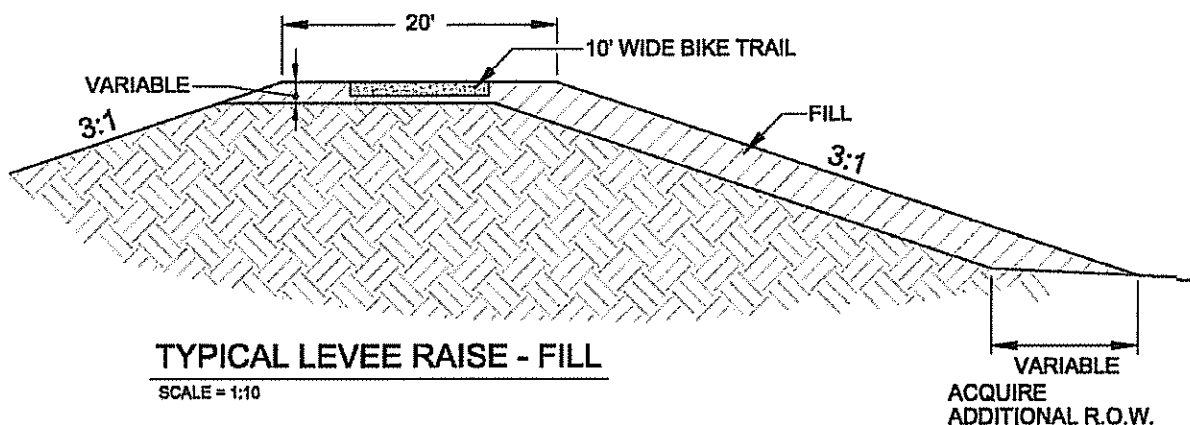


### TYPICAL LEVEE RAISE - WALL GREATER THAN THREE FEET

SCALE = 1:10

EXHIBIT 3. TYPICAL LEVEE RAISE USING A STRUCTURAL WALL GREATER THAN 3-FOOT RAISE

The second levee raise option considered was the addition of fill to the existing levees and purchase of additional right-of-way (ROW) at the base of the levee to provide for slope stability. A schematic of a fill section is shown as Exhibit 4. This option had a unit cost per linear foot of levee of \$31, \$45, and \$87 for fill sections 1, 2, and 3, respectively, including purchase of ROW.



### TYPICAL LEVEE RAISE - FILL

SCALE = 1:10

EXHIBIT 4. TYPICAL LEVEE RAISE USING FILL MATERIAL

Further estimates of probable construction costs include an item to remove and rebuild the trail in conjunction with the levee raise, modification of interior drainage structures, seeding, mulching, and erosion control, and an estimate for bridge raises. Contingencies were included for quantity and unit cost adjustments, costs related to administrative, legal, and engineering services given the approximate nature of the conceptual designs.

Bridge raises include demolition of the old bridge, building a new bridge, and raising the roadway to meet the new bridge deck height. If the total bridge raise was less than 1 ft in height, a hydraulic bridge jack may be used to achieve the desired height. A detailed structural integrity analyses would be required to evaluate any bridge raised by using hydraulic jacks. The roadway raise includes concrete pavement, embankment, drainage, seeding, mulching, erosion protection, guard rails, and utility relocation.

Costs were also included for each of the tributary detention and regional reservoir structures. The probable construction costs were developed in previous reports. Land acquisition costs are a significant portion of the cost and they are broken out between land and construction costs. The cost estimates also include contingencies for administrative, legal, and engineering services.

Tables 3, 4, and 5 summarize the estimated probable construction costs associated with Scenarios 1, 2, and 3. Detailed cost estimates, including unit costs and quantities for the scenarios, are contained in Appendix E.

**TABLE 3**  
**SCENARIO 1 - SUMMARY OF ESTIMATED PROBABLE CONSTRUCTION COSTS**

Item	Flood Wall Total Cost	Structural Fill Total Cost
1. Levee Raise	\$4,850,000	\$1,561,000
2. ROW Acquisition	\$0	\$393,000
3. Remove & Rebuild Trail	\$1,100,000	\$1,100,000
4. Modification to Interior Drainage Structures	\$728,000	\$728,000
5. Seeding, Mulching, & Erosion Control	\$60,000	\$60,000
6. Bridge Replacements	\$8,320,000	\$8,320,000
Subtotal Levee and Bridge Raises	\$15,058,000	\$12,162,000
40% Contingency	\$6,023,000	\$4,865,000
6% Engineering	\$1,265,000	\$1,022,000
10% Administration/Legal	\$2,108,000	\$1,703,000
Totals for Scenario 1	\$24,454,000	\$19,752,000

*Notes:*

*Cost estimate do not include the potential impacts to property and businesses along 84th Street.*

*Costs are based on a base year of 2007.*

**TABLE 4**  
**SCENARIO 2 - SUMMARY OF ESTIMATED PROBABLE CONSTRUCTION COSTS**

Item	Flood Wall Total Cost	Structural Fill Total Cost
1. Levee Raise	\$1,150,000	\$371,000
2. ROW Acquisition	\$0	\$90,887
3. Remove & Rebuild Trail	\$440,000	\$440,000
4. Modification to Interior Drainage Structures	\$173,000	\$173,000
5. Seeding, Mulching, & Erosion Control	\$30,000	\$30,000
6. Bridge Replacements	\$6,181,000	\$6,181,000
Subtotal Levee and Bridge Raises	\$7,974,000	\$7,286,000
40% Contingency	\$3,190,000	\$2,914,000
6% Engineering	\$670,000	\$612,000
10% Administration/Legal	\$1,116,000	\$1,020,000
Total Levee and Bridge Raises	\$12,950,000	\$11,832,000
Tributary Detention Structures		
7. SPT	\$20,000,000	\$20,000,000
8. WPT - West	\$8,200,000	\$8,200,000
9. WPT - East	\$3,700,000	\$3,700,000
Total Detention Structures	\$31,900,000	\$31,900,000
Totals for Scenario 2	\$44,850,000	\$43,732,000

**Notes:**

Cost estimate do not include the potential impacts to property and businesses along 84th Street.  
Costs are based on a base year of 2007

**TABLE 5**  
**SCENARIO 3 - SUMMARY OF ESTIMATED PROBABLE CONSTRUCTION COSTS**

Item	Flood Wall Total Cost	Structural Fill Total Cost
1. Levee Raise	\$250,000	\$64,000
2. ROW Acquisition	\$0	\$15,000
3. Remove & Rebuild Trail	\$154,000	\$154,000
4. Modification to Interior Drainage Structures	\$38,000	\$38,000
5. Seeding, Mulching, & Erosion Control	\$12,000	\$12,000
6. Bridge Replacements	\$5,000,000	\$5,000,000
Subtotal Levee and Bridge Raises	\$5,454,000	\$5,283,000
40% Contingency	\$2,182,000	\$2,113,000
6% Engineering	\$458,000	\$444,000
10% Administration/Legal	\$764,000	\$740,000
Total Levee and Bridge Raises	\$8,858,000	\$8,580,000
Tributary Detention Structures		
7. SPT-Total	\$20,000,000	\$20,000,000
8. WPT - West - Total	\$8,200,000	\$8,200,000
9. WPT - East - Total	\$3,700,000	\$3,700,000
Total Tributary Detention Structures	\$31,900,000	\$31,900,000
Regional Reservoir Structures		
10. Reservoir Site 12 - Total	\$16,340,000	\$16,340,000
11. Reservoir Site 15A - Total	\$40,800,000	\$40,800,000
12. Reservoir Site 19 - Total	\$21,680,000	\$21,680,000
Total Regional Reservoir Structures	\$78,820,000	\$78,820,000
Totals for Scenario 3	\$119,578,000	\$119,300,000

**Notes:**

Cost estimate do not include the potential impacts to property and businesses along 84th Street.

Costs are based on a base year of 2007.

## 5.0 Conclusions and Recommendations

Scenario 1 has the lowest estimated probable construction cost. Scenarios 2 and 3 are affected significantly by the cost of land acquisition for detention structures and reservoir sites. Land acquisition costs for detention sites are 51 percent of the total

Scenario 2 costs. In Scenario 3, land costs for the detention and dam sites are 68 percent of the total.

It is also very important to note that there are significant additional benefits in Scenarios 2 and 3 that have not been accounted for in this analysis. This includes flood control on creeks upstream from the reach considered in this analysis, as well as recreational benefits, increase in property values, water quality improvements, stream stabilization, and wildlife habitat.

Scenario 1 has a major bridge raise in an urban area (84th Street). The estimated probable construction cost developed for the bridge raise included the cost of bridge demolition, bridge construction, grade control relocation, raising the roadway embankment to the new bridge deck location, erosion control, intersection raises, and utility relocation. The impact to business and land owners was not quantified. This is difficult to estimate without further detailed impact analysis, including the cost of acquiring and relocating businesses and property along the 84th Street corridor.

It is possible to build a long-span arch bridge to avoid the need to raise the 84th Street Bridge approach roadway and still have enough freeboard to meet the 1-ft requirement. A long-span arch bridge would have a significantly more expensive estimated probable construction cost than the bridge that was estimated in the current analysis. An estimate of this type of bridge is beyond the scope of this document but would be necessary to analyze the full implications of enacting Scenario 1.

The final conclusion is that a combination of alternatives is necessary to achieve the required freeboard along the West Papillion Creek levee system. These alternatives include raising bridges, raising levees, and constructing upstream regional detention and tributary detention. Not one alternative alone can achieve the required freeboard, but each alternative collectively can provide an incremental benefit toward increasing levee freeboard and reducing flood risk.

## **6.0 References**

HDR (2006). "West Papillion Creek Levee Restoration – Summary of Previous Analyses," December 13, 2006.

HDR (2004), "Multi-Reservoir Analysis - Papillion Creek Watershed," September 2004.

HDR (2006), "Evaluation of Proposed 66th St. Bridge Replacement over West Papillion Creek," May 12, 2006.

HDR (2007), "Dam Site 15A, Revised Conceptual Design Evaluation, Final Conceptual Design Report," May 2007.

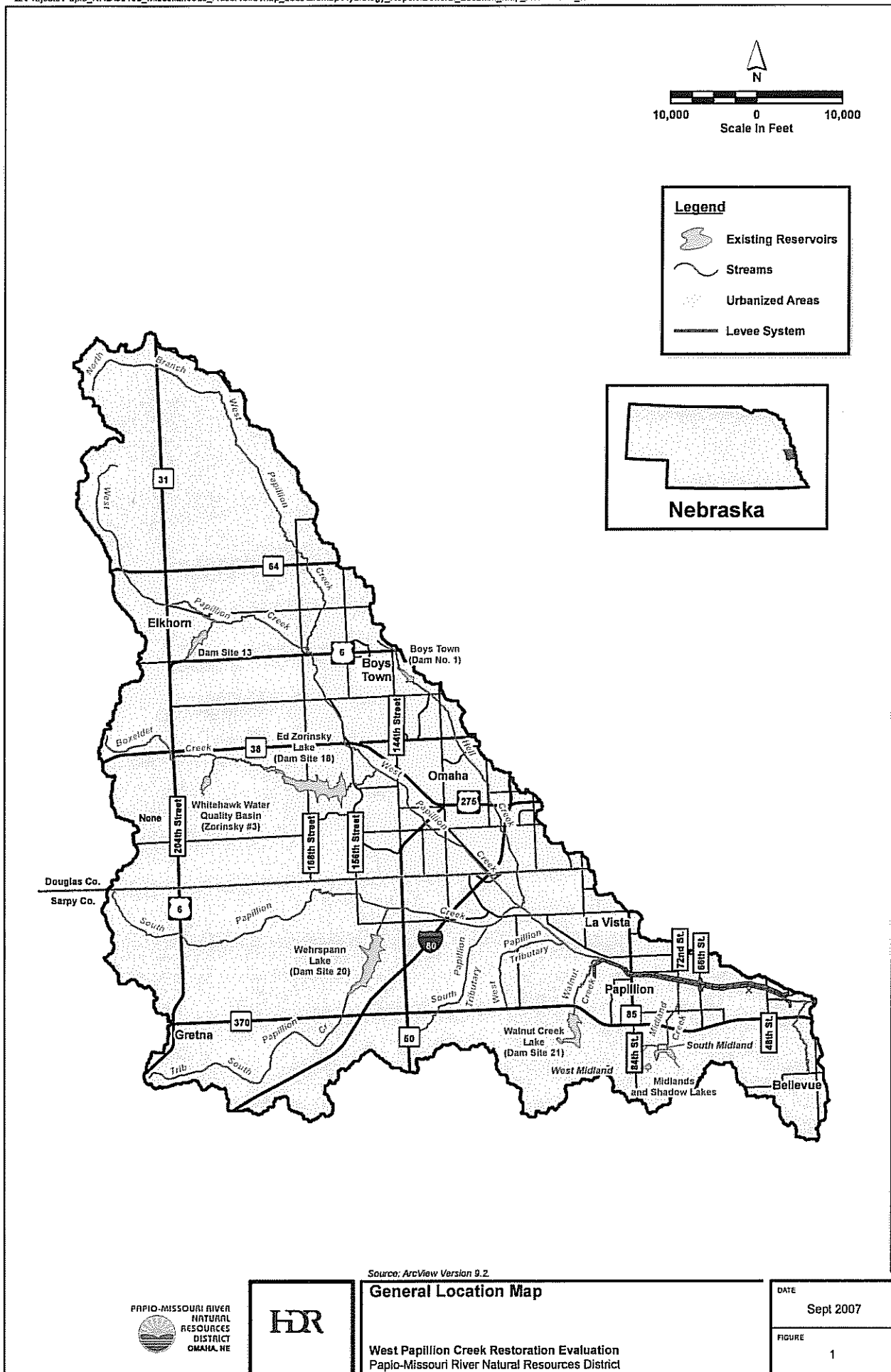
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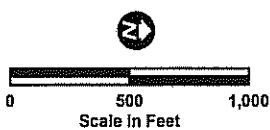
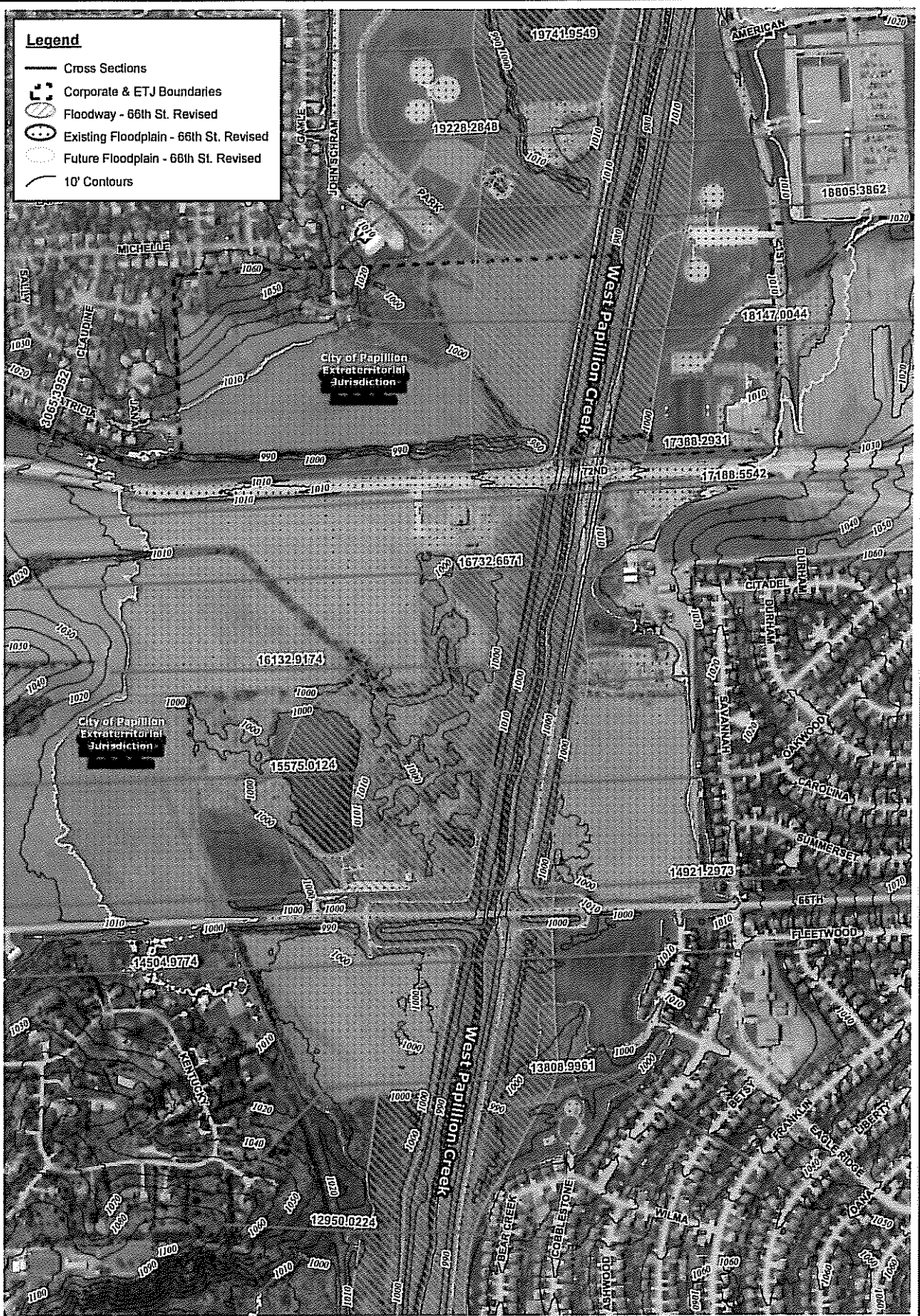


## Appendix A

### Figures

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HDR

**66th St. Proposed Bridge Replacement  
Revised Floodplain Mapping (1 of 2)**



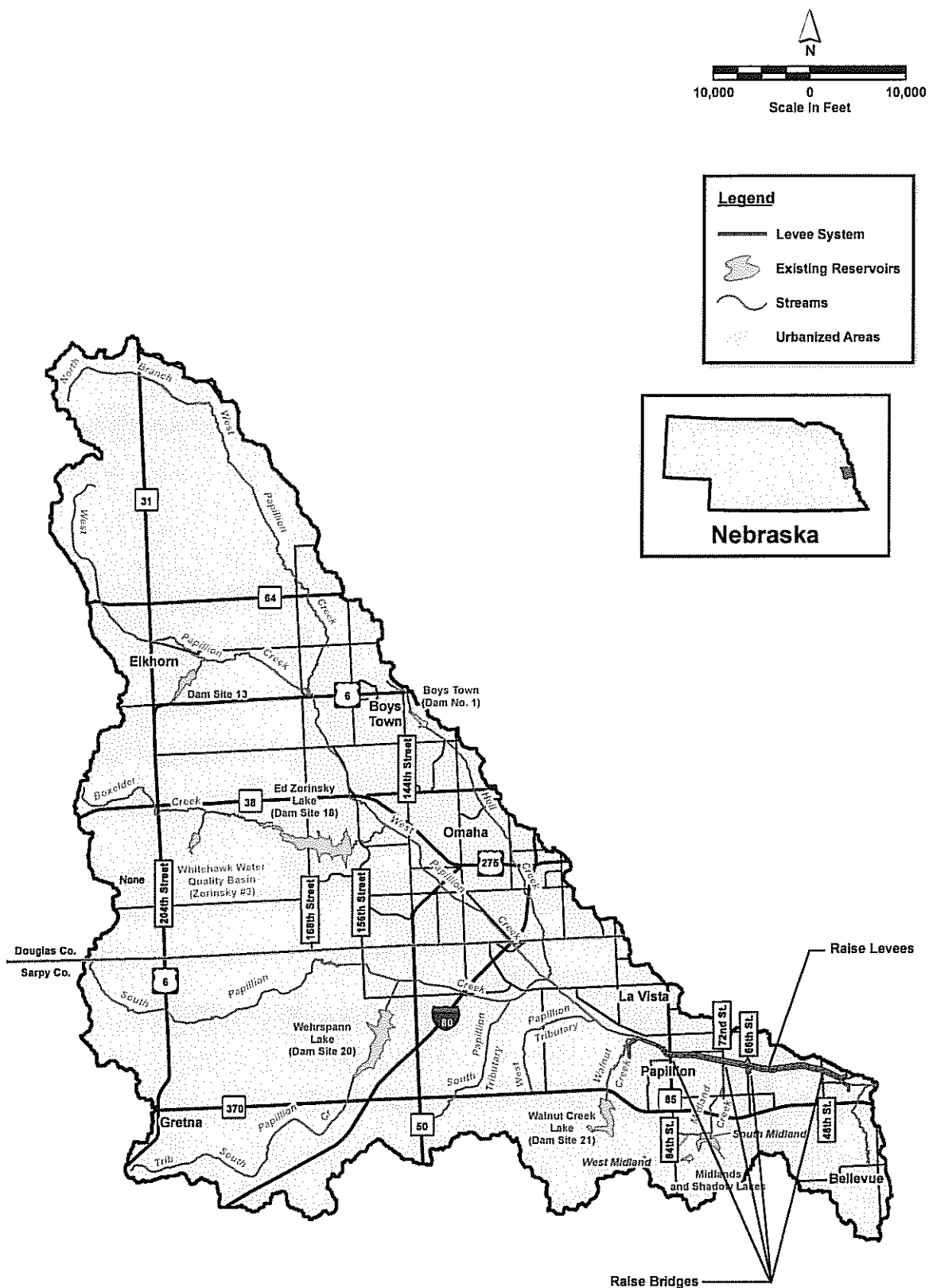
**DRAFT**

DATE May 2006

FIGURE 2A







Source: ArcView Version 9.2

### Scenario 1 - Raise Bridges and Levees

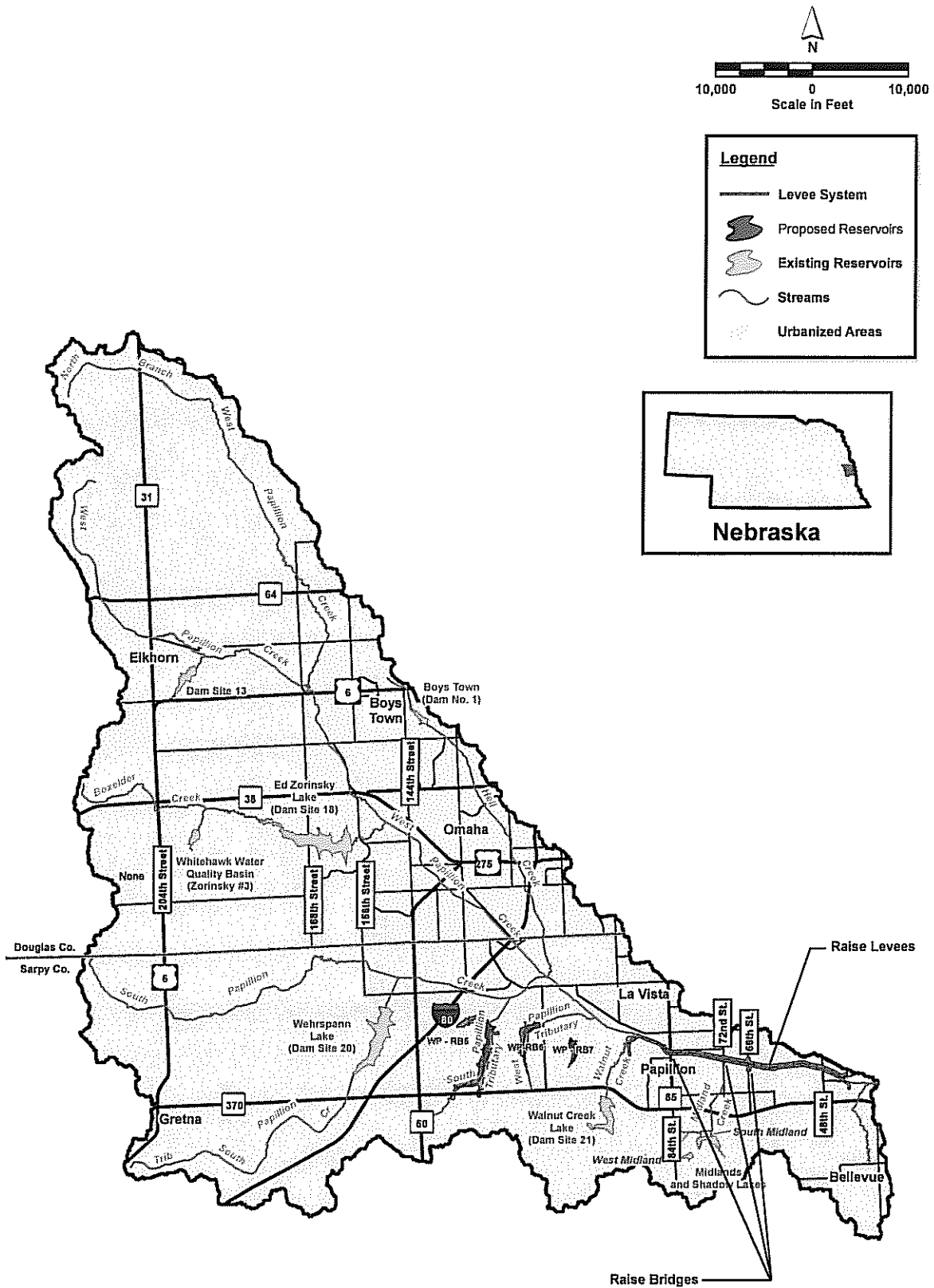
West Papillion Creek Restoration Evaluation  
Papio-Missouri River Natural Resources District



HDR

DATE  
Sept 2007

FIGURE  
3



Source: ArcView Version 9.2.

## Scenario 2 - Raise Bridges and Levees with Tributary Storage

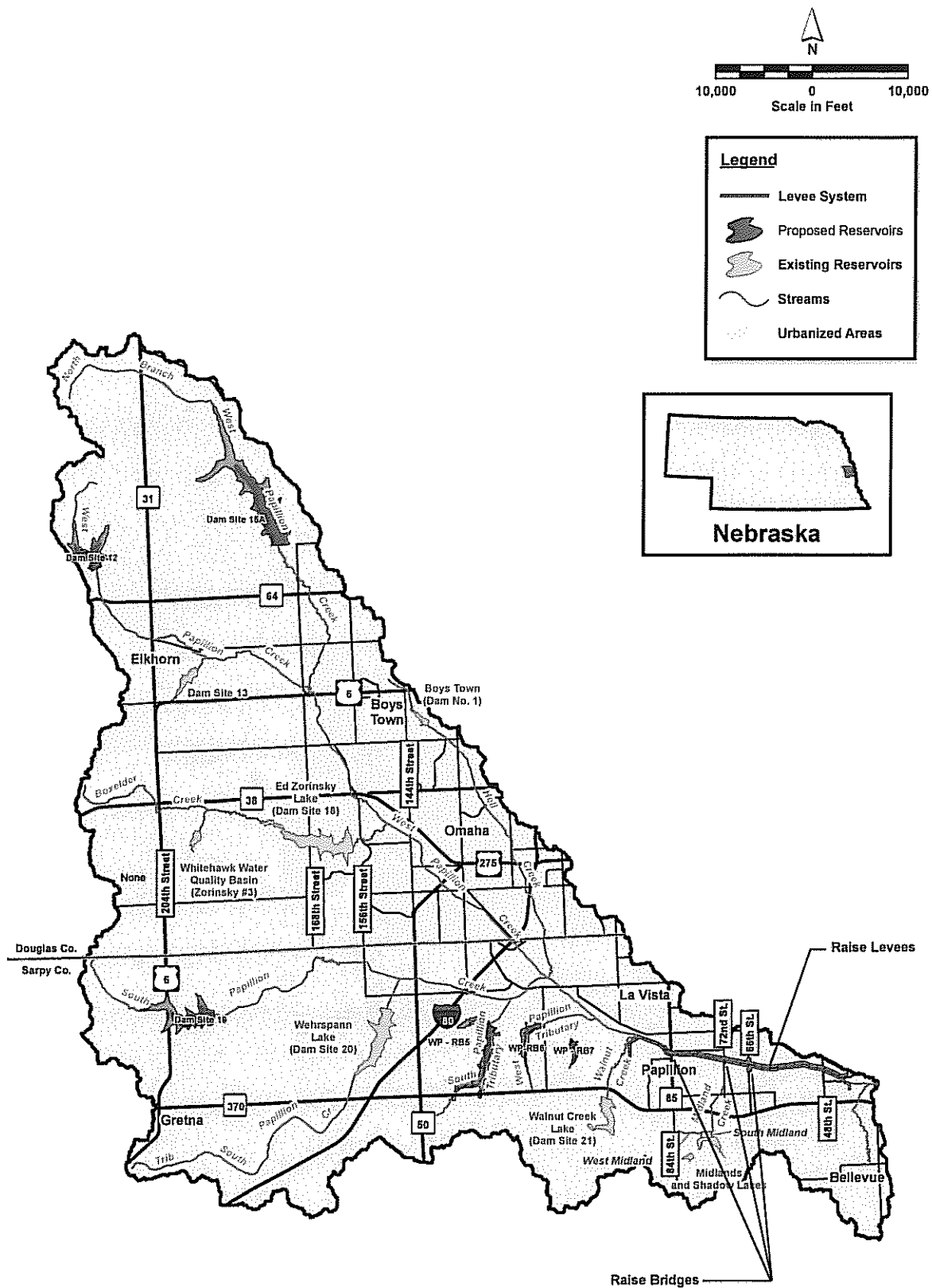
West Papillion Creek Restoration Evaluation  
Papio-Missouri River Natural Resources District



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Sept 2007

FIGURE  
4



Source: ArcView Version 9.2



### Scenario 3 - Raise Bridges and Levees with Tributary Storage and Upstream Storage

West Papillion Creek Restoration Evaluation  
Papio-Missouri River Natural Resources District

DATE  
Sept 2007

FIGURE  
5



**Appendix B**  
**West Papillion Creek Levee Restoration**  
**Summary of Previous Analyses**  
**Technical Memorandum**

To: Marlin Petermann, P.E. and Paul Woodward, CFM	
From: Paul B. Dierking, P.E.	Project: West Papillion Creek Levee Restoration
CC: File	
Date: 12/13/2006	Job No: 46839

**RE: West Papillion Creek Levee Restoration – Summary of Previous Analyses****Background and Purpose**

An earthen levee system exists on the right bank of the main channel of West Papillion Creek from Walnut Creek, near 96th St., downstream to 42nd St. and on the left bank from just west of 84th St., near Adams St., to the abandoned Chicago, Rock Island, and Pacific Railroad (CRIPRR) embankment, at approximately 44th St. This earthen levee was designed to contain the 100-yr (1-percent annual chance) event and provide 3 ft of freeboard (levee height 3 ft above 100-yr water surface elevation). During the remapping of the West Papillion Creek floodplain in 2005, it was determined that the required 3 ft of levee freeboard (4 ft near bridges) for the 1-percent annual chance event was compromised. Several individual evaluations were completed following the West Papillion Creek floodplain remapping to assess specific flood control measures that may potentially restore the required levee freeboard. This document summarizes these previous analyses, so additional flood control measures may be identified to completely restore the required levee freeboard.

**Previous Analyses**

Levee evaluations were previously performed for three different studies:

- 66<sup>th</sup> St. Bridge Replacement
- Unnamed South Papillion Creek Tributary Detention
- Unnamed West Papillion Creek Tributary Detention

It is noted that the levee evaluation performed for both the Unnamed South Papillion Creek Tributary Detention and the Unnamed West Papillion Creek Tributary Detention Evaluations was identical; the levee evaluation included both detention locations as a system. Furthermore, all of these previous analyses were performed using the future condition 1-percent annual chance discharges and the hydraulic model developed for the West Papillion Creek Floodplain Remapping Project. However, the floodplain remapping project was still ongoing at the time of these analyses, so minor variations of approximately 0.1 ft in water surface elevation (WSEL) were noted between analyses.

**66<sup>th</sup> St. Bridge Replacement**

The proposed 66<sup>th</sup> St. bridge replacement, a 265-ft bridge with a 20-ft shift of the right levee, increased levee freeboard for the future condition 1-percent annual chance event 1 to 1.5 ft between 66<sup>th</sup> St. and 72<sup>nd</sup> St. Upstream of 72<sup>nd</sup> St. levee freeboard was slightly reduced by a maximum of 0.1 ft at 72<sup>nd</sup> St. because of the difference in bridge modeling methodology; however, this minor increase in WSEL for proposed conditions has nearly converged with existing conditions at the upstream end of the leveed reach, River Station 27241.

The increase in levee freeboard from the proposed 66<sup>th</sup> St. bridge replacement provided approximately 2 to 2.5 ft of levee freeboard between 66<sup>th</sup> and 72<sup>nd</sup> St., while the levee freeboard upstream of 72<sup>nd</sup> St. remained between -0.5 and 1.5 ft. More detailed information regarding levee freeboard at individual cross section locations is available in Appendix A.

#### Unnamed South and West Papillion Creek Tributary Detention

Six different scenarios were analyzed for the Unnamed South and West Papillion Creek Tributary Detention levee evaluation. These scenarios included a baseline condition without tributary detention, without Dam Sites 12, 15A, and 19, and no bridge modifications. The remaining scenarios included combinations of tributary detention, upstream dams, and bridge modifications. The six levee evaluation scenarios and the associated freeboard for the future condition 1-percent annual chance event are illustrated in Table 1 below. More detailed information regarding levee freeboard at individual cross section locations is available in Appendix A.

**Table 1 Unnamed South and West Papillion Creek Tributary Detention Levee Evaluation Summary**

Levee Freeboard Evaluation						
Scenario	Description	Reach	Future 100-yr Discharges (cfs)	Left Bank Levee Freeboard <sup>1</sup>	Right Bank Levee Freeboard <sup>1</sup>	Bridge Raises
1	<b>Baseline</b> No SPT, WPT-West, WPT-East; Without Dam Sites 12, 15A, 19	D/S 48th	36,130 to 37,050	2.5 to 3.5	1.6 to 4.9	None
		48th to 66th	36,400 to 36,130	-0.7 to 3.6	-0.5 to 3.0	
		66th to 84th	37,070 to 36,400	0.1 to 2.5	-0.3 to 2.6	
		U/S 84th	36,430 to 37,070	0.6 to 1.9	-0.4 to 1.9	
2	<b>With SPT, WPT-West, WPT-East;</b> Without Dam Sites 12, 15A, 19	D/S 48th	31,920 to 32,430	3.5 to 4.4	2.7 to 5.5	None
		48th to 66th	32,160 to 31,920	-0.2 to 3.6	0.3 to 3.0	
		66th to 84th	32,680 to 32,160	0.8 to 2.5	1.0 to 2.6	
		U/S 84th	32,400 to 32,680	1.0 to 1.9	0.6 to 1.8	
3	<b>With SPT, WPT-West, WPT-East;</b> Without Dam Sites 12, 15A, 19; w/ multiple bridge modifications	D/S 48th	31,920 to 32,430	3.5 to 4.4	2.7 to 5.5	48th St., 66th St., 84th St.
		48th to 66th	32,160 to 32,060	2.3 to 4.6	1.6 to 3.9	
		66th to 84th	32,680 to 32,160	2.4 to 4.1	2.1 to 4.4	
		U/S 84th	32,400 to 32,680	1.7 to 4.0	1.2 to 3.9	
4	<b>With SPT, WPT-West, WPT-East;</b> With Dam Sites 12, 15A, 19	D/S 48th	29,660 to 30,510	4.1 to 4.9	3.2 to 5.7	None
		48th to 66th	29,820 to 29,660	0.4 to 5.1	1.1 to 4.5	
		66th to 84th	30,310 to 29,820	1.1 to 3.4	1.4 to 3.7	
		U/S 84th	29,790 to 30,310	1.0 to 1.5	0.6 to 1.9	
5	<b>With SPT, WPT-West, WPT-East;</b> With Dam Sites 12, 15A, 19; w/ single bridge modification	D/S 48th	29,660 to 30,510	4.1 to 4.9	3.2 to 5.7	66th St.
		48th to 66th	29,820 to 29,750	3.1 to 5.1	2.3 to 4.5	
		66th to 84th	30,310 to 29,820	1.1 to 4.9	1.4 to 5.2	
		U/S 84th	29,790 to 30,310	1.0 to 1.5	0.6 to 1.9	
6	<b>With SPT, WPT-West, WPT-East;</b> With Dam Sites 12, 15A, 19; w/ multiple bridge modifications	D/S 48th	29,660 to 30,510	4.1 to 4.9	3.2 to 5.7	66th St., 84th St.
		48th to 66th	29,820 to 29,750	3.1 to 5.1	2.3 to 4.5	
		66th to 84th	30,310 to 29,820	3.2 to 4.9	2.9 to 5.2	
		U/S 84th	29,790 to 30,310	2.6 to 4.8	2.1 to 4.7	

**Notes:**

1. Levee freeboard presented in feet. Positive values represent distance WSELs are below the respective top of levee elevations. Negative values represent height of levee overtopping assuming no reduction in flow (split flow analysis not performed).

Compared to the baseline Scenario 1 conditions, the minimum freeboard for Scenario 2, with the tributary detention structures but without Dam Sites 12, 15A, and 19, typically increased approximately 0.5 to 1.5 ft throughout the entire leveed reach. The minimum levee freeboard for

Scenario 3 was typically 1 to 3 ft greater than baseline Scenario 1 conditions throughout the entire leveed reach, and upstream of 48th St., the minimum levee freeboard for Scenario 3 was between 0.5 and 2.5 ft more than Scenario 2 conditions. Throughout the entire leveed reach, the minimum levee freeboard for Scenario 4 was typically 0.5 to 1.5 ft higher than baseline Scenario 1 conditions and up to 1.0 ft more than Scenario 2 conditions. The minimum levee freeboard for Scenario 5 was typically 0.5 to 1.5 ft higher than baseline Scenario 1 conditions throughout the entire leveed reach. Throughout the entire leveed reach, the minimum levee freeboard for Scenario 6 was typically 1.5 to 3.5 ft higher than baseline Scenario 1 conditions and between 0.5 and 1.0 ft higher than Scenario 3 conditions.

## **Additional Flood Control Measures**

Results from the previous analyses provided some background information for identifying additional flood control measures for completely restoring the levee freeboard. Potential flood control measures initially established for evaluation include:

- 66<sup>th</sup> St. bridge replacement
- 48<sup>th</sup> and 84<sup>th</sup> St. bridge replacements
- Dam Sites 12, 15A, and 19
- Unnamed South and West Papillion Creek Tributary Detention
- Additional flood control measures to be identified after initial evaluation (e.g. levee raises, concrete flood walls, off-channel storage, etc.)

The evaluation of these flood control measures will be performed in a cumulative manner; however, it was recognized that the order in which these measures are evaluated may require some preliminary evaluation and discussion. Therefore, preliminary evaluation of all bridge modifications was performed to provide additional information for identifying other flood control measures and the order they should be evaluated.

### Bridge Modifications

The bridges at 48<sup>th</sup>, 66<sup>th</sup>, 72<sup>nd</sup>, and 84<sup>th</sup> Streets were all modified to provide a minimum of 1 ft of freeboard (bridge low chord at least 1 ft above WSEL) for the future condition 1-percent annual chance discharge. The 66<sup>th</sup> St. bridge was modified according to the methods used in the 66<sup>th</sup> St. Bridge Replacement evaluation and the other 3 bridges were analyzed by raising the low chord until achieving a minimum of 1 ft of freeboard.

In general, levee freeboard with the four bridge modifications increased approximately 0.5 to 2.0 ft from baseline conditions, which provided levee freeboard of 1 to 3 ft between 48<sup>th</sup> and 84<sup>th</sup> St. The impact of the drop structure and bridge at 84<sup>th</sup> St. on WSELs upstream of 84<sup>th</sup> St. require additional analysis to accurately determine the levee freeboard upstream of 84<sup>th</sup> St. More detailed information regarding levee freeboard at individual cross section locations is available in Appendix A.

**Appendix C**  
**Evaluation of Proposed 66th St. Bridge Replacement**  
**over West Papillion Creek Technical Memorandum**

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To: Marlin Petermann, P.E. and Paul Woodward, CFM	
From: Paul B. Dierking, P.E.	Project: 66 <sup>th</sup> St. Bridge Replacement Evaluation
CC: File	
Date: 5/12/2006	Job No: 30166

**RE: Evaluation of Proposed 66<sup>th</sup> St. Bridge Replacement over West Papillion Creek**

## Background and Purpose

A replacement of the 66<sup>th</sup> St. bridge crossing over West Papillion Creek was evaluated for determining potential hydraulic and floodplain benefits. The existing 66<sup>th</sup> St. bridge is a 3-span, 180-ft structure with a maximum low chord elevation of approximately 1000.3 ft (NAVD 88). It is noted that an earthen levee exists on both the left (north) and right (south) banks of West Papillion Creek in the vicinity of 66<sup>th</sup> St. These levees are typically located near the left and right top of banks, respectively, providing a channel width between the left and right levee tops of approximately 300 ft. The levee elevations in the immediate vicinity of the 66<sup>th</sup> St. bridge are between 1009.0 and 1009.5 ft. Figures 1 and 2 illustrate the site location of the 66<sup>th</sup> St. bridge over West Papillion Creek.

At the time the existing 66<sup>th</sup> St. bridge was constructed, a railroad line was located parallel to and immediately north of West Papillion Creek. Therefore, the 66<sup>th</sup> St. roadway profile and the bridge over West Papillion Creek were placed at similar elevations to the railroad grade. When the levees were constructed several years later, the railroad line had been abandoned, but it was cost prohibitive to replace the 66<sup>th</sup> St. bridge and elevate the 66<sup>th</sup> St. roadway profile to match the levee elevations. Consequently, levee tiebacks were constructed on both the left and right bank levees at 66<sup>th</sup> St. to allow the 66<sup>th</sup> St. roadway profile to come up and over the levees, at elevation 1009.0 to 1009.5 ft, and then back down to the 66<sup>th</sup> St. bridge elevation, at top of road elevation 1002.0 to 1004.0.

During the remapping of the West Papillion Creek floodplain in 2005, it was determined that the required 3 ft of levee freeboard (4 ft near bridges) for the 1-percent annual chance event was compromised. Because the levee freeboard was less than 3 ft, FEMA required the floodplain and floodway to be determined using a levee failure analysis. This failure analysis includes 3 conditions: 1) no left levee, 2) no right levee and 3) with both left and right levees. The base flood elevations (BFEs) were defined and mapped using the maximum of these three elevations for each of three portions of the floodplain: 1) outside (landward) of the left levee, 2) outside (landward) of the right levee, and 3) between (riverward) the left and right levees. Furthermore, a levee condition without both left and right levees was used as the base flood, or without floodway condition, for floodway analysis.

Because a levee failure analysis was required for floodplain remapping, the levee tiebacks became a significant obstruction to overbank flows. In addition, the elevation of the 66<sup>th</sup> St. bridge road profile is approximately 6 ft below the top of levee elevation and produces a significant obstruction for flows between the levees and limits the available levee freeboard upstream of 66<sup>th</sup> St. In effort to maximize levee freeboard and minimize floodplain elevations, an evaluation was performed for a bridge replacement of 66<sup>th</sup> St. that would eliminate the levee tiebacks and provide 1 ft of freeboard between the low chord of the bridge and the future condition 1-percent annual chance BFE. The

discharges computed from the West Papillion Creek Floodplain Remapping Project (HDR, 2005 and 2006) were used for existing and future, or full build-out, conditions. Furthermore, the HEC-RAS models developed for the West Papillion Creek Floodplain Remapping Project were used for modeling the existing 66<sup>th</sup> St. and modified for modeling the proposed 66<sup>th</sup> St. bridge.

## Hydraulic Analysis

The configuration of a proposed 66<sup>th</sup> St. bridge was approximated from bridges immediately upstream and downstream from 66<sup>th</sup> St. The bridges at Raynor Parkway, 48<sup>th</sup> St., 72<sup>nd</sup> St., and 96<sup>th</sup> St. are all 3-span structures and have clear span lengths, or flow lengths (bridge length adjusted for channel skew), between 240 and 245 ft. Consequently, a 3-span 245-ft bridge was initially evaluated as the proposed replacement for 66<sup>th</sup> St. However, in an attempt to minimize hydraulic impacts of the proposed 66<sup>th</sup> St. bridge, a slightly larger bridge at 265-ft with a low chord elevation of 1008.5 ft (minimum of 1 ft of freeboard between the low chord and the future BFE) was evaluated. An estimated deck thickness of 5.5 ft was used to establish the top of road elevation at 1014 ft. The estimated deck thickness was also based on the bridges mentioned above and discussion with HDR bridge designers.

The larger 265-ft bridge also included a 20-ft landward shift of the right levee only in the vicinity of the bridge. The larger 265-ft bridge span and 20-ft landward shift of the right levee help minimize the impacts of the bridge piers on the water surface profile. This 20-ft levee shift could be incorporated when the levee tieback is removed and a levee parallel with the stream is reconstructed.

A proposed 66<sup>th</sup> St. roadway profile was approximated by minimizing the roadway elevation in the overbank areas outside the levees. A typical minimum roadway elevation above floodplain ground elevations is 3 ft. In the vicinity of the 66<sup>th</sup> St. bridge, ground elevations in the overbank areas of the floodplain are around elevation 1000 ft; therefore, the minimum proposed roadway elevation was elevation 1003 ft. This minimum roadway elevation was transitioned to the roadway elevation at the bridge, elevation 1014 ft, using vertical curves with a 3 percent slope. Moving away from the bridge, the minimum roadway elevation was maintained for approximately 400 ft in the left (north) overbank and 600 ft in the right (south) overbank before transitioning back to existing roadway elevations at a 3 percent slope.

### With Left and Right Levees

The proposed 66<sup>th</sup> St. was evaluated for the condition with both left and right levees to assess hydraulic impacts, and the results are summarized in Tables 1 and 2. Compared to a baseline condition with no 66<sup>th</sup> St. bridge, the 265-ft bridge with a 20-ft shift of the right levee minimized the hydraulic impact of the 66<sup>th</sup> St. bridge to a 0.1 ft increase in WSEL for the future condition 1-percent annual chance event at River Station 14921 located immediately upstream of 66<sup>th</sup> St. Upstream of River Station 14921, the proposed 66<sup>th</sup> St. bridge condition reduced the future condition 1-percent annual chance WSEL several tenths of a foot compared to the baseline no bridge condition. The two conditions converge at the 72<sup>nd</sup> St. bridge because this bridge operates under the same pressure flow conditions for both scenarios.

Comparing the existing 66<sup>th</sup> St. bridge condition with the proposed 66<sup>th</sup> St. bridge condition, the proposed bridge and right levee shift decreased the future condition 1-percent annual chance WSEL 1 to 1.5 ft between 66<sup>th</sup> St. and 72<sup>nd</sup> St. Upstream of 72<sup>nd</sup> St. a slight increase in WSEL of 0.1 ft occurred because of the difference in bridge modeling methodology. The 72<sup>nd</sup> St. bridge operates under pressure flow conditions for both existing and proposed conditions; however, the existing condition tailwater elevation is higher than the low chord of the bridge and creates an orifice pressure flow condition through the bridge. The proposed condition tailwater elevation is over 1 ft lower than the existing condition tailwater and is lower than the low chord, creating a less efficient sluice gate pressure flow condition. It is noted that this minor increase in WSEL for proposed



conditions has nearly converged with existing conditions at the upstream end of the leveed reach, River Station 27241.

**Table 1 66<sup>th</sup> St. Bridge Modification Effect on WSELs with Left and Right Levee**

Future Condition 1-Percent Annual Chance WSELs						
Location	River Station	Baseline (No Bridge) WSEL (ft)	Existing WSEL (ft)	Proposed WSEL (ft)	Change in WSEL (ft)	
					Proposed - Baseline	Proposed - Existing
66th St.	12950	1005.72	1005.72	1005.72	0.00	0.00
	13809	1006.24	1006.27	1006.27	0.03	0.00
	14505	1006.74	1006.79	1006.78	0.04	-0.01
	14779 BR D	--	1008.39	1006.93	--	-1.46
	14779 BR U	--	1008.39	1006.93	--	-1.46
	14921	1007.03	1008.39	1007.13	0.10	-1.26
	15575	1007.80	1008.97	1007.52	-0.28	-1.45
	16133	1008.38	1009.44	1008.13	-0.25	-1.31
	16733	1009.01	1009.96	1008.79	-0.22	-1.17
72nd St.	17189	1009.49	1010.37	1009.30	-0.19	-1.07
	17294 BR D	1009.49	1010.31	1009.30	-0.19	-1.01
	17294 BR U	1009.76	1010.55	1009.76	0.00	-0.79
	17388	1011.07	1010.97	1011.07	0.00	0.10
	18147	1011.55	1011.46	1011.55	0.00	0.09
	18805	1012.15	1012.07	1012.15	0.00	0.08
	19228	1012.47	1012.39	1012.47	0.00	0.08
	19742	1012.73	1012.65	1012.73	0.00	0.08
	20064	1013.06	1012.99	1013.06	0.00	0.07
	20522	1013.34	1013.28	1013.34	0.00	0.06
	21185	1014.13	1014.08	1014.13	0.00	0.05
	21826	1014.55	1014.49	1014.55	0.00	0.06
	22340	1014.86	1014.81	1014.86	0.00	0.05
	22819	1015.33	1015.28	1015.33	0.00	0.05
	22821	1015.19	1015.15	1015.19	0.00	0.04
	22823	1015.16	1015.11	1015.16	0.00	0.05
	22825	1015.12	1015.07	1015.12	0.00	0.05
84th St.	22827	1015.08	1015.03	1015.08	0.00	0.05
	22829	1015.04	1014.99	1015.04	0.00	0.05
	22921 BR D	1014.83	1014.80	1014.83	0.00	0.03
	22921 BR U	1014.83	1014.80	1014.83	0.00	0.03
	23035	1014.83	1014.80	1014.83	0.00	0.03
	23666	1017.15	1017.13	1017.15	0.00	0.02
	24393	1017.79	1017.78	1017.79	0.00	0.01
	24885	1018.13	1018.11	1018.13	0.00	0.02
	25302	1018.61	1018.59	1018.61	0.00	0.02
	25694	1018.87	1018.86	1018.87	0.00	0.01
	26148	1019.14	1019.13	1019.14	0.00	0.01
	26618	1019.20	1019.19	1019.20	0.00	0.01
	27241	1020.23	1020.22	1020.23	0.00	0.01

Notes:

1. Stationing begins at the confluence with Big Papillion Creek at River Station 0 and proceeds upstream in feet.

A comparison of levee freeboard was also performed for the proposed and existing 66<sup>th</sup> St. bridge conditions and is summarized in Table 2. The levee freeboard increased between 1 and 1.5 ft from 66<sup>th</sup> St. to 72<sup>nd</sup> St. As noted previously, a slight increase in WSEL of 0.1 ft occurred upstream of 72<sup>nd</sup> St. because of the difference in bridge modeling methodology. Therefore, the levee freeboard

was reduced by a maximum of 0.1 ft at 72<sup>nd</sup> St. It is noted that this minor increase in WSEL for proposed conditions has nearly converged with existing conditions at the upstream end of the leveed reach, River Station 27241, and the levee freeboard is within 0.01 ft of existing conditions.

**Table 2 66<sup>th</sup> St. Bridge Modification Effect on Levee Freeboard**

Future Condition 1-Percent Annual Chance Freeboard							
Location	River Station	Left Levee Freeboard			Right Levee Freeboard		
		Existing (ft)	Proposed (ft)	Change (ft)	Existing (ft)	Proposed (ft)	Change (ft)
66th St.	12950	1.67	1.67	0.00	0.78	0.78	0.00
	13809	1.41	1.41	0.00	0.84	0.84	0.00
	14505	0.61	0.62	0.01	1.29	1.30	0.01
	14779 BR D	-0.99	0.47	1.46	-0.31	1.15	1.46
	14779 BR U	0.75	2.21	1.46	1.06	2.52	1.46
	14921	0.75	2.01	1.26	1.06	2.32	1.26
	15575	0.58	2.03	1.45	0.81	2.26	1.45
	16133	0.76	2.07	1.31	0.99	2.30	1.31
	16733	0.88	2.05	1.17	0.61	1.78	1.17
	17189	1.42	2.49	1.07	1.54	2.61	1.07
72nd St.	17294 BR D	1.48	2.49	1.01	1.60	2.61	1.01
	17294 BR U	1.74	2.53	0.79	1.80	2.59	0.79
	17388	1.32	1.22	-0.10	1.38	1.28	-0.10
	18147	0.96	0.87	-0.09	1.00	0.91	-0.09
	18805	1.37	1.29	-0.08	0.59	0.51	-0.08
	19228	1.12	1.04	-0.08	0.71	0.63	-0.08
	19742	1.38	1.30	-0.08	0.59	0.51	-0.08
	20064	1.01	0.94	-0.07	0.44	0.37	-0.07
	20522	0.82	0.76	-0.06	0.49	0.43	-0.06
	21185	0.59	0.54	-0.05	0.10	0.05	-0.05
84th St.	21826	0.49	0.43	-0.06	0.04	-0.02	-0.06
	22340	0.40	0.35	-0.05	1.48	1.43	-0.05
	22819	0.65	0.60	-0.05	0.93	0.88	-0.05
	22821	0.78	0.74	-0.04	1.06	1.02	-0.04
	22823	0.82	0.77	-0.05	1.10	1.05	-0.05
	22825	0.86	0.81	-0.05	1.14	1.09	-0.05
	22827	0.90	0.85	-0.05	1.18	1.13	-0.05
	22829	0.94	0.89	-0.05	1.22	1.17	-0.05
	22921 BR D	1.13	1.10	-0.03	1.41	1.38	-0.03
	22921 BR U	1.56	1.53	-0.03	1.52	1.49	-0.03
	23035	1.56	1.53	-0.03	1.52	1.49	-0.03
	23666	0.06	0.04	-0.02	-0.41	-0.43	-0.02
	24393	--	--	--	-0.28	-0.29	-0.01
	24885	--	--	--	-0.23	-0.25	-0.02
	25302	--	--	--	0.00	-0.02	-0.02
	25694	--	--	--	0.24	0.23	-0.01
	26148	--	--	--	0.54	0.53	-0.01
	26618	--	--	--	0.61	0.60	-0.01
	27241	--	--	--	0.31	0.30	-0.01

Notes:

1. Stationing begins at the confluence with Big Papillion Creek at River Station 0 and proceeds upstream in feet.
2. Levee freeboard presented in feet. Positive values represent distance WSELs are below the respective top of levee elevations. Negative values represent height of levee overtopping assuming no reduction in flow (split flow analysis not performed).

No Left Levee and No Right Levee

The proposed 66<sup>th</sup> St. bridge replacement was also evaluated for the remaining levee failure analysis conditions: 1) no left levee, and 2) no right levee. A comparison of the proposed 66<sup>th</sup> St. bridge with the existing 66<sup>th</sup> St. bridge for the future condition 1-percent annual chance event is presented in Table 3. The proposed 66<sup>th</sup> St. bridge condition decreases the WSELs between 1.6 and 2.7 ft from 66<sup>th</sup> St. to 72<sup>nd</sup> St. and nearly converges with the existing condition at the upstream end of the leveed reach, River Station 27241. It is noted that a slight increase in WSELs occurs downstream of 66<sup>th</sup> St. The removal of the levee tiebacks and change to the 66<sup>th</sup> St. roadway profile creates more effective flow area downstream of 66<sup>th</sup> St. As a result of the increase in flow area, the velocity decreases, thereby slightly increasing the WSELs.

**Table 3      66<sup>th</sup> St. Bridge Modification Effect on WSELs with No Left Levee and No Right Levee**

Future Condition 1-Percent Annual Chance WSELs							
Location	River Station	No Left Levee			No Right Levee		
		Existing WSEL (ft)	Proposed WSEL (ft)	Change in WSEL (ft)	Existing WSEL (ft)	Proposed WSEL (ft)	Change in WSEL (ft)
66th St.	12950	1004.69	1004.69	0.00	1005.56	1005.56	0.00
	13809	1005.88	1005.98	0.10	1006.34	1006.40	0.06
	14505	1005.92	1006.00	0.08	1006.89	1006.90	0.01
	14779 BR D	1008.44	1006.04	-2.40	1008.62	1006.97	-1.65
	14779 BR U	1008.62	1006.09	-2.53	1008.62	1006.97	-1.65
	14921	1008.62	1006.33	-2.29	1008.62	1006.85	-1.77
	15575	1009.60	1006.94	-2.66	1009.42	1007.54	-1.88
	16133	1009.74	1007.32	-2.42	1009.76	1007.87	-1.89
	16733	1009.83	1007.68	-2.15	1009.92	1008.01	-1.91
72nd St.	17189	1010.76	1008.53	-2.23	1009.88	1007.98	-1.90
	17294 BR D	1011.21	1010.72	-0.49	1010.01	1007.60	-2.41
	17294 BR U	1011.62	1010.93	-0.69	1010.12	1007.87	-2.25
	17388	1011.62	1010.93	-0.69	1010.12	1008.31	-1.81
	18147	1012.60	1012.02	-0.58	1011.07	1009.93	-1.14
	18805	1012.75	1012.20	-0.55	1011.24	1010.20	-1.04
	19228	1012.78	1012.24	-0.54	1011.40	1010.42	-0.98
	19742	1012.77	1012.24	-0.53	1011.50	1010.55	-0.95
	20064	1012.94	1012.45	-0.49	1011.52	1010.57	-0.95
	20522	1013.20	1012.75	-0.45	1011.69	1010.81	-0.88
	21185	1013.84	1013.45	-0.39	1011.94	1011.18	-0.76
	21826	1014.27	1013.92	-0.35	1012.27	1011.61	-0.66
	22340	1014.58	1014.25	-0.33	1012.51	1011.94	-0.57
	22819	1015.08	1014.79	-0.29	1012.90	1012.40	-0.50
	22821	1014.95	1014.65	-0.30	1012.70	1012.17	-0.53
	22823	1014.92	1014.62	-0.30	1012.64	1012.11	-0.53
	22825	1014.88	1014.58	-0.30	1012.58	1012.04	-0.54
84th St.	22827	1014.85	1014.54	-0.31	1012.52	1011.97	-0.55
	22829	1014.80	1014.49	-0.31	1012.44	1011.88	-0.56
	22921 BR D	1014.80	1014.56	-0.24	1014.50	1014.49	-0.01
	22921 BR U	1014.80	1014.56	-0.24	1014.50	1014.49	-0.01
	23035	1014.80	1014.56	-0.24	1014.50	1014.49	-0.01
	23666	1016.99	1016.87	-0.12	1016.68	1016.68	0.00
	24393	1017.65	1017.55	-0.10	1017.33	1017.33	0.00
	24885	1018.00	1017.90	-0.10	1017.53	1017.53	0.00
	25302	1018.49	1018.41	-0.08	1017.70	1017.70	0.00
	25694	1018.76	1018.68	-0.08	1017.99	1017.99	0.00
	26148	1019.04	1018.97	-0.07	1018.12	1018.12	0.00
	26618	1019.10	1019.03	-0.07	1018.22	1018.22	0.00

Future Condition 1-Percent Annual Chance WSELs							
Location	River Station	No Left Levee			No Right Levee		
		Existing WSEL (ft)	Proposed WSEL (ft)	Change in WSEL (ft)	Existing WSEL (ft)	Proposed WSEL (ft)	Change in WSEL (ft)
	27241	1020.15	1020.08	-0.07	1018.48	1018.48	0.00

Notes:

1. Stationing begins at the confluence with Big Papillion Creek at River Station 0 and proceeds upstream in feet.

### Floodway Modifications

As described above, considerable reductions in WSELs result with the proposed 66<sup>th</sup> St. bridge replacement. Because of these reductions, additional modeling was performed for optimizing the floodway boundaries determined in the West Papillion Creek Floodplain Remapping Project. A levee condition without both left and right levees was used as the base flood, or without floodway condition, for floodway analysis.

The future condition 1-percent annual chance event discharges were used for floodway analysis, with a maximum 1 ft surcharge. The existing condition 1-percent annual chance event discharges were then used to ensure the maximum surcharge remained less than 1 ft for existing discharge conditions. From 66<sup>th</sup> St. upstream to approximately River Station 20000 (approximately 2,500 ft upstream of 72<sup>nd</sup> St.), the floodway boundary was typically reduced 200 to 300 ft on both the left and right bank sides (total reduction of 400 to 600 ft). The revised floodway boundaries are illustrated on Figures 1 and 2.

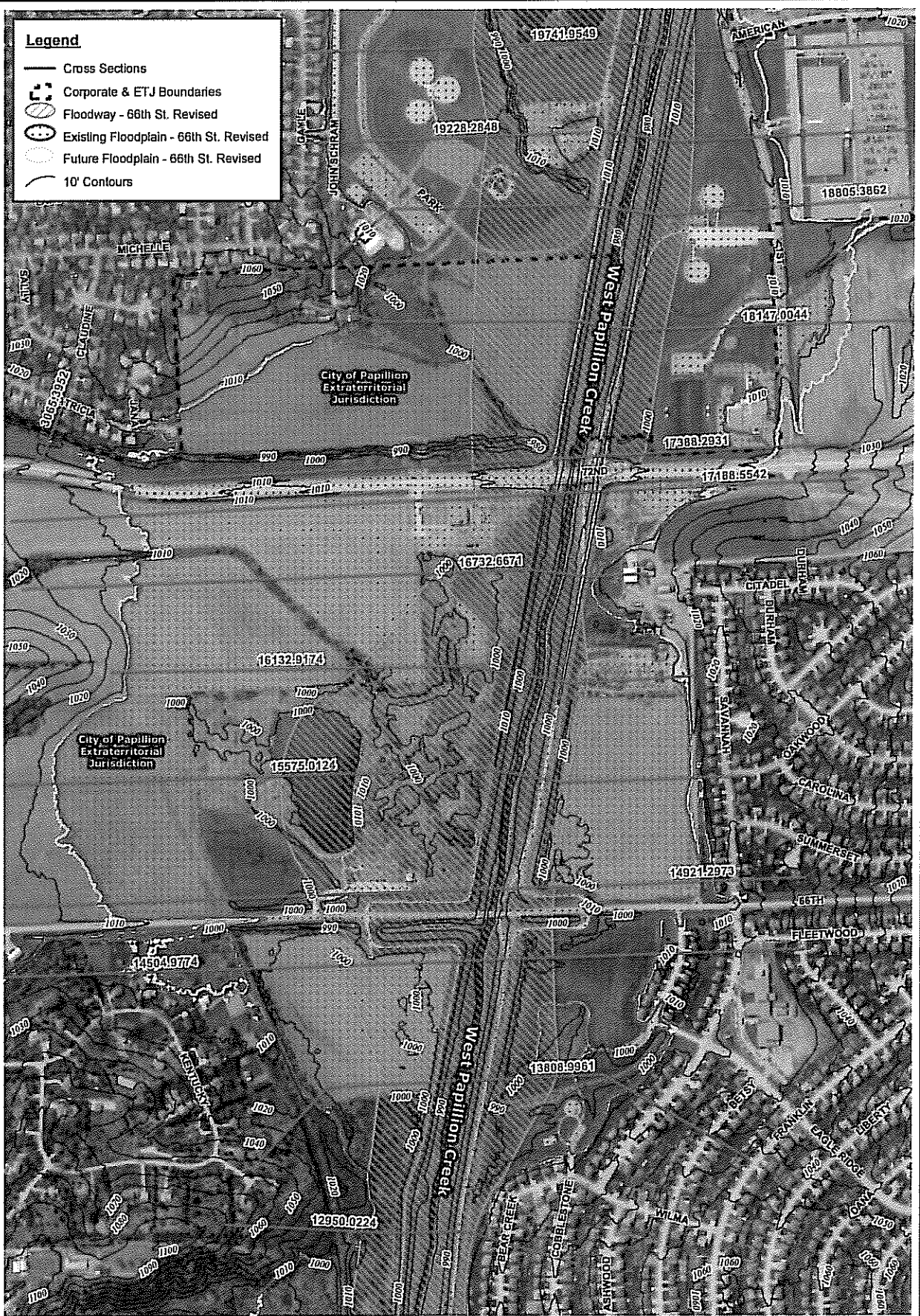
### **Floodplain Mapping**

A preliminary draft work map was produced illustrating the revised existing and future 1-percent annual chance floodplain delineations from just downstream of 66<sup>th</sup> St. to the point upstream of 84<sup>th</sup> St. where the revised WSELs converge with the baseline results. Figures 1 and 2 illustrate the revised floodplain boundaries, along with the revised floodway boundary.

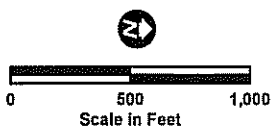
### **Summary and Conclusions**

The following list summarizes the proposed 66<sup>th</sup> St. bridge replacement evaluation:

- The existing 66<sup>th</sup> St. bridge is submerged for all 1-percent annual chance conditions evaluated.
- The proposed 66<sup>th</sup> St. bridge replacement will not provide the required 3 ft of freeboard throughout the entire leveed reach. However, the proposed 66<sup>th</sup> St. bridge replacement serves as a key component in the combination of upstream storage and conveyance improvements required to limit the areas of the leveed reach that violates the 3 ft freeboard requirement.
- The proposed 66<sup>th</sup> St. bridge replacement significantly reduces the future condition 1-percent annual chance WSELs. With both left and right levees, WSELs are decreased between 1 and 1.5 ft from 66<sup>th</sup> St. to 72<sup>nd</sup> St.
- The proposed 66<sup>th</sup> St. bridge replacement would decrease the BFEs and reduce floodway widths while the levees remain out of compliance with freeboard requirements. The WSELs outside the levees would be reduced between 1.6 and 2.7 ft between 66<sup>th</sup> and 72<sup>nd</sup> St. and between 0.3 and 1.8 ft from 72<sup>nd</sup> St. to 84<sup>th</sup> St. Floodway widths would typically be reduced a total of 400 to 600 ft from 66<sup>th</sup> St. to River Station 20000 (approximately 2,500 ft upstream of 72<sup>nd</sup> St.).



Source: MAPA 2004 Orthophotography and Topographic Data, ArcMap 9.0



HDR

# 66th St. Proposed Bridge Replacement Revised Floodplain Mapping (1 of 2)



**DRAFT**

DATE  
May 2006

FIGURE  
1





**Appendix D**  
**Hydraulic Modeling Summary of HEC-RAS Output**

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Baseline							
Station	Bridge	Existing Low Chord Elevation (ft)	Calculation	100-yr Future WSEL at u/s bridge face (ft)	Bridge Freeboard (ft)	100-yr Future WSEL at u/s cross section (ft)	Bridge Freeboard Raise (ft)
6848	48th Street	1000.63	Energy	999.41	1.59	999.65	1.35
14779	66th Street	1008.00	Energy	1006.76	1.24	1006.96	1.04
17294	72nd Street	1010.70	Energy	1009.38	1.32	1009.53	1.17
22921	84th Street	1016.80	Energy	1014.42	2.38	1014.79	2.01
Scenario 1							
6848	48th Street	1001.00	Energy	999.41	1.59	999.65	1.35
14779	66th Street	1008.00	Energy	1006.76	1.24	1006.96	1.04
17294	72nd Street	1010.70	Energy	1009.38	1.32	1009.53	1.17
22921	84th Street	1016.80	Energy	1014.42	2.38	1014.79	2.01
Scenario 2							
6848	48th Street	1000.63	Energy	998.32	2.31	998.54	2.09
14779	66th Street	1006.60	Energy	1005.38	1.22	1005.55	1.05
17294	72nd Street	1009.20	Energy	1008.00	1.20	1008.14	1.06
22921	84th Street	1015.05	Energy	1012.98	2.07	1013.32	1.73
Scenario 3							
6848	48th Street	1000.63	Energy	997.75	2.88	997.94	2.69
14779	66th Street	1005.80	Energy	1004.60	1.20	1004.75	1.05
17294	72nd Street	1008.50	Energy	1007.21	1.29	1007.34	1.16
22921	84th Street	1013.50	Energy	1012.15	1.35	1012.47	1.03

- Notes:
- Freeboard is calculated two places, at the upstream face of the bridge and at the first cross section upstream from the bridge. A minimum of 1-ft is required
  - The bridge raise is calculated by subtracting the existing low chord elevation from the proposed low chord elevation
  - If a required bridge raise is less than 1-ft a bridge jack-up will be performed instead of demolishing the old bridge and constructing a new bridge

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West Papillon Creek Levee Restoration Evaluation- June 2007  
Potential Levee Raises to Meet Required Freeboard

Structure Name	River Station	Required Levee Freeboard (ft)	Scenario 1 No Obstruction or Dam Size				Scenario 2 Obstruction and No Dam Size				Scenario 3 Obstruction and Dam Size			
			Bridges Raised, Levees Not Raised		Bridges Raised, Levees Raised		Bridges Raised, Levees Not Raised		Bridges Raised, Levees Raised		Bridges Raised, Levees Not Raised		Bridges Raised, Levees Raised	
			Existing Levee Elev. (ft)	Levee Freeboard (ft)	Existing Levee Elev. (ft)	Levee Freeboard (ft)	Existing Levee Elev. (ft)	Levee Freeboard (ft)	Existing Levee Elev. (ft)	Levee Freeboard (ft)	Existing Levee Elev. (ft)	Levee Freeboard (ft)	Existing Levee Elev. (ft)	Levee Freeboard (ft)
Payton Parkway	3745.506	3	998.47	4.50	998.47	4.50	998.47	4.50	998.47	4.50	998.47	4.50	998.47	4.50
	4225.893	3	999.21	4.44	999.21	4.44	999.21	4.44	999.21	4.44	999.21	4.44	999.21	4.44
	4308 BR D	4	999.21	4.42	999.21	4.42	999.21	4.42	999.21	4.42	999.21	4.42	999.21	4.42
	4361 BR U	4	999.80	3.66	999.80	3.66	999.80	3.66	999.80	3.66	999.80	3.66	999.80	3.66
	4596	3	999.59	3.23	999.59	3.23	999.59	3.23	999.59	3.23	999.59	3.23	999.59	3.23
	4871.541	3	999.59	3.23	999.59	3.23	999.59	3.23	999.59	3.23	999.59	3.23	999.59	3.23
	5479.711	3	1000.20	2.98	1000.20	2.98	1000.20	2.98	1000.20	2.98	1000.20	2.98	1000.20	2.98
	5628.091	3	1000.99	2.13	1000.99	2.13	1000.99	2.13	1000.99	2.13	1000.99	2.13	1000.99	2.13
	6442.141	3	1001.64	2.13	1001.64	2.13	1001.64	2.13	1001.64	2.13	1001.64	2.13	1001.64	2.13
	6771.071	3	1001.64	2.13	1001.64	2.13	1001.64	2.13	1001.64	2.13	1001.64	2.13	1001.64	2.13
48th St.	6845 BR D	4	1002.31	2.13	1002.31	2.13	1002.31	2.13	1002.31	2.13	1002.31	2.13	1002.31	2.13
	6845 BR U	4	1002.31	2.13	1002.31	2.13	1002.31	2.13	1002.31	2.13	1002.31	2.13	1002.31	2.13
	6952.48	4	1002.74	2.09	1002.74	2.09	1002.74	2.09	1002.74	2.09	1002.74	2.09	1002.74	2.09
	7467.792	3	1002.35	2.45	1002.35	2.45	1002.35	2.45	1002.35	2.45	1002.35	2.45	1002.35	2.45
	8049.20	3	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14
	8049.21	3	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14
	8049.22	3	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14
	8049.23	3	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14
	8049.24	3	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14
	8049.25	3	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14	1002.86	1.14
60th St.	8322.72	3	1004.21	2.24	1004.21	2.24	1004.21	2.24	1004.21	2.24	1004.21	2.24	1004.21	2.24
	8660.64	3	1004.21	2.24	1004.21	2.24	1004.21	2.24	1004.21	2.24	1004.21	2.24	1004.21	2.24
	12111.59	3	1005.07	2.03	1005.07	2.03	1005.07	2.03	1005.07	2.03	1005.07	2.03	1005.07	2.03
	12599.67	3	1005.30	2.03	1005.30	2.03	1005.30	2.03	1005.30	2.03	1005.30	2.03	1005.30	2.03
	13222.11	3	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03
	13259.65	3	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03
	13259.66	3	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03
	13259.67	3	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03
	13259.68	3	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03
	13259.69	3	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03
	13259.70	3	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03	1005.44	2.03
72nd St.	14594.07	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.08	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.09	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.10	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.11	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.12	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.13	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.14	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.15	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.16	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
	14594.17	3	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07	1007.08	1.07
84th St.	15775.01	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.02	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.03	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.04	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.05	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.06	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.07	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.08	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.09	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
	15775.10	3	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40	1010.20	2.40
84th St.	17294 BR D	4	1012.29	2.61	1012.29	2.61	1012.29	2.61	1012.29	2.61	1012.29	2.61	1012.29	2.61
	17294 BR U	4	1012.29	2.61	1012.29	2.61	1012.29	2.61	1012.29	2.61	1012.29	2.61	1012.29	2.61
	17385.29	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18147	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18555.36	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18555.37	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18555.38	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18555.39	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18555.40	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18555.41	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33
	18555.42	3	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33	1012.42	2.33

Notes: 1. Shading begins at the confidence with Big Papillon Creek at Station 0 and proceeds upstream in 1641.  
2. Cross section locations not meeting minimum freeboard requirement of 3 ft.  
3. Cross section locations within 100 ft of bridge not meeting minimum freeboard requirement of 4 ft.

\* required levee raise less than 1-ft  
\* required levee raise between 1-ft and 2-ft  
\* required levee raise greater than 2-ft

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**Appendix E**  
**Opinion of Probable Construction Costs**

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Scenario 3 - Levee Raises with Multiple Bridge Modifications and Tributary and Regional Detention Storage

Item	Flood Wall			Fill			Note
	Quantity	Unit	Unit Cost	Quantity	Unit	Unit Cost	
Levee Raise	500	CY	\$500	9,099	CY	\$7	Unit cost estimated from past, three types of wall levee raises
ROW Acquisition	0.0	acres	\$40,000	0.4	acres	\$40,000	utilized, one fill type raise utilized
Remove & Rebuild Trail	3,500	ft	\$44	3,500	ft	\$44	
Modification to Interior Drainage Structures	1	LS	\$38,000	1	LS	\$38,000	Assume 10 ft wide 8 inch thick trail
Seeding, Mulching, & Erosion Control	4	acres	\$3,000	4	acres	\$3,000	10 feet on each side of embankment levee raise
Bridge Replacement	1	LS	\$5,000,000	1	LS	\$5,000,000	2 bridge replacements and 2 roadway raises
			Subtotal			Subtotal	
			\$5,454,000			\$5,283,000	
			40% Contingency			40% Contingency	
			\$2,182,000			\$2,113,000	
			6% Engineering			6% Engineering	
			\$498,000			\$444,000	
			10% Administration/Legal			10% Administration/Legal	
			\$764,000			\$740,000	
			Subtotal			Subtotal	
			\$8,858,000			\$8,580,000	

Tributary Detention Structures

SPT-Total							
Land	1	LS		1	LS		
Construction	1	LS	\$15,500,000	1	LS	\$15,500,000	includes contingencies
WPT - West - Total			\$4,500,000			\$4,500,000	
Land	1	LS		1	LS		
Construction	1	LS	\$8,200,000	1	LS	\$8,200,000	includes contingencies
WPT - East - Total			\$8,200,000			\$8,200,000	
Land	1	LS		1	LS		
Construction	1	LS	\$3,700,000	1	LS	\$3,700,000	includes contingencies
Subtotal			\$31,900,000			\$31,900,000	
Sources: 1) Conceptual Costs from "Unnamed South Papillon Creek							
Tributary Detention Evaluation, Conceptual Design Report"							
prepared by HDR, February 2006.							
2) Conceptual Costs from "Unnamed West Papillon Creek							
Tributary Detention Evaluation, Conceptual Design Report"							
prepared by HDR, February 2006.							

Regional Detention Structures

Dam Site 12 - Total							
Land	1	LS		1	LS		
Construction	1	LS	\$10,240,000	1	LS	\$10,240,000	2004 Land Acquisition prices updated to 2007 prices
Dam Site 15A - Total			\$8,700,000			\$8,700,000	2004 Construction updated via Heavy Construction Index
Land	1	LS		1	LS		Bureau of Labor Statistics
Construction	1	LS	\$40,800,000	1	LS	\$40,800,000	2007 Cost
Dam Site 19 - Total			\$40,800,000			\$40,800,000	
Land	1	LS		1	LS		
Construction	1	LS	\$21,680,000	1	LS	\$21,680,000	2004 Land Acquisition prices updated to 2007 prices
Subtotal			\$78,820,000			\$78,820,000	2004 Construction updated via Heavy Construction Index
Sources: 1) Conceptual Costs from "Dam Site 15A, Revised Conceptual							
Design Evaluation, Final Conceptual Design Report"							
prepared by HDR, May 2007.							
2) Conceptual Costs from "Multi-Reservoir Analysis							
Papillon Creek Watershed", prepared by HDR, Sept. 2004.							
			Subtotal			Subtotal	
			\$119,578,000			\$119,578,000	
			Total			Total	
			\$119,578,000			\$119,578,000	

**West Papillion Creek Levee Restoration Evaluation  
Conceptual Probable Construction Cost Estimate - June 2007**

**Scenario 1 - Levee Raises with Multiple Bridge Modifications, No Tributary or Regional Detention Storage**

Item	Quantity	Unit	Flood Wall Unit Cost	Total Cost	Quantity	Unit	Fill Unit Cost	Total Cost	Note
Levee Raise	9,700	CY	\$500	\$4,850,000	223,000	CY	\$7	\$1,561,000	Unit cost estimated from past, three types of wall levee raises
ROW Acquisition	0.0	acres	\$40,000	\$0	9.8	acres	\$40,000	\$393,000	utilized, one fill type raise utilized
Remove & Rebuild Trail	25,000	ft	\$44	\$1,100,000	25,000	ft	\$44	\$1,100,000	Assume 10 ft wide 8 inch thick trail
Modification to Interior Drainage Structures	1	LS	\$727,500	\$727,500	1	LS	\$727,500	\$728,000	
Seeding, Mulching, & Erosion Control	20	acres	\$3,000	\$60,000	20	acres	\$3,000	\$60,000	10 feet on each side of embankment levee raise
Bridge Replacement	1	LS	\$8,320,000	\$8,320,000	1	LS	\$8,320,000	\$8,320,000	2 bridge replacements, 2 bridge raises with jacks, 4 roadway raises
			Subtotal	\$15,058,000			Subtotal	\$12,162,000	
			40% Contingency	\$6,023,000			40% Contingency	\$4,865,000	
			6% Engineering	\$1,265,000			6% Engineering	\$1,022,000	
			10% Administration/Legal	\$2,108,000			10% Administration/Legal	\$1,703,000	
			Total	\$24,454,000			Subtotal	\$19,752,000	

**Scenario 2 - Levee Raises with Multiple Bridge Modifications and Tributary Detention Storage, No Regional Detention Storage**

Item	Quantity	Unit	Flood Wall Unit Cost	Total Cost	Quantity	Unit	Fill Unit Cost	Total Cost	Note
Levee Raise	2,300	CY	\$500	\$1,150,000	53,000	CY	\$7	\$371,000	Unit cost estimated from past, three types of wall levee raises
ROW Acquisition	0.0	acres	\$40,000	\$0	2.3	acres	\$40,000	\$90,800	utilized, one fill type raise utilized
Remove & Rebuild Trail	10,000	ft	\$44	\$440,000	10,000	ft	\$44	\$440,000	Assume 10 ft wide 8 inch thick trail
Modification to Interior Drainage Structures	1	LS	\$73,000	\$73,000	1	LS	\$73,000	\$73,000	
Seeding, Mulching, & Erosion Control	10	acres	\$3,000	\$30,000	10	acres	\$3,000	\$30,000	10 feet on each side of embankment levee raise
Bridge Replacement	1	LS	\$8,181,000	\$8,181,000	1	LS	\$8,181,000	\$8,181,000	2 bridge replacements and 1 bridge raise with jacks, 3 road raises
			Subtotal	\$7,974,000			Subtotal	\$7,266,000	
			40% Contingency	\$3,190,000			40% Contingency	\$2,914,000	
			6% Engineering	\$870,000			6% Engineering	\$612,000	
			10% Administration/Legal	\$1,116,000			10% Administration/Legal	\$1,020,000	
			Subtotal	\$12,950,000			Subtotal	\$11,832,000	

**Tributary Detention Structures**

SPT-Total	1	LS		\$20,000,000	1	LS		\$20,000,000	Includes contingencies
Land	1	LS	\$15,500,000		1	LS	\$15,500,000		
Construction	1	LS	\$4,500,000		1	LS	\$4,500,000		
WPT - West - Total				\$19,500,000				\$19,500,000	Includes contingencies
Land	1	LS	\$5,500,000		1	LS	\$5,500,000		
Construction	1	LS	\$2,700,000		1	LS	\$2,700,000		
WPT - East - Total				\$8,200,000				\$8,200,000	Includes contingencies
Land	1	LS	\$1,800,000		1	LS	\$1,800,000		
Construction	1	LS	\$1,800,000		1	LS	\$1,800,000		
			Subtotal	\$31,900,000			Subtotal	\$31,900,000	
			Total	\$44,850,000			Subtotal	\$43,732,000	

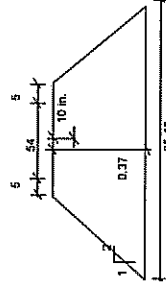
Sources: 1) Conceptual Costs from "Unnamed South Papillion Creek  
Tributary Detention Evaluation, Conceptual Design Report"  
prepared by HDR, February 2006.  
2) Conceptual Costs from "Unnamed West Papillion Creek  
Tributary Detention Evaluation, Conceptual Design Report"  
prepared by HDR, February 2006.



West Papillon Creek Levee Restoration Evaluation  
Preliminary Probable Bridge Construction Cost Estimate - June 25, 2007

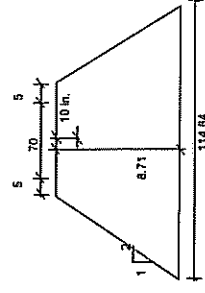
Scenario 1 - Levee Raises with Multiple Bridge Modifications, No Tributary or Regional Detention Storage

48th Street Roadway				feet			
Item	Quantity	Unit	Unit Cost	432	Unit Cost	Total Cost	
Rigid Concrete Pavement	2,712	yd	\$40.00		\$108,480		
Roadway Embankment	100	yd	\$3.00		\$300		
Drainage/Erosion Protection/Guard Rails	1	LS	\$14,250		\$14,250		
Utility Relocation		LS	\$50,000		\$50,000		
Seeding & Mulching	2.1	acre	\$25,000		\$52,500		
Subtotal 48th Street Roadway						\$194,330	



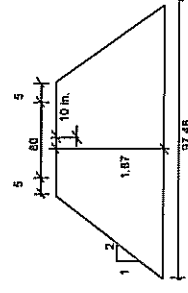
48th Street Bridge				feet			
Item	Quantity	Unit	Unit Cost	0.37	Unit Cost	Total Cost	
Bridge Deck	1	LS	\$500,000.00		\$500,000.00		
Subtotal Bridge Construction						\$500,000	
Total 48th Street Bridge Construction						\$694,330	

60th Street Roadway				feet			
Item	Quantity	Unit	Unit Cost	14.00	Unit Cost	Total Cost	
Rigid Concrete Pavement	11,200	yd	\$40.00		\$448,000		
Roadway Embankment	11,200	yd	\$3.00		\$33,600		
Drainage/Erosion Protection/Guard Rails	1	LS	\$150,000		\$150,000		
Levee Tie Back Removal	1	LS	\$20,000		\$20,000		
Utility Relocation	1	LS	\$150,000		\$150,000		
Seeding & Mulching	6.0	acre	\$25,000		\$150,000		
Subtotal 60th Street Roadway						\$852,600	



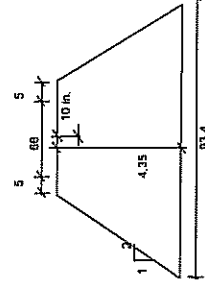
60th Street Bridge				feet			
Item	Quantity	Unit	Unit Cost	8.71	Unit Cost	Total Cost	
Bridge Deck	1	LS	\$1,200,000		\$1,200,000		
Subtotal Bridge Construction						\$1,200,000	
Total 60th Street Bridge Construction						\$1,200,000	

72nd Street Roadway				feet			
Item	Quantity	Unit	Unit Cost	10.41	Unit Cost	Total Cost	
Rigid Concrete Pavement	9,200	yd	\$40.00		\$368,000		
Roadway Embankment	1,700	yd	\$7.00		\$11,900		
Drainage/Erosion Protection/Guard Rails	1	LS	\$118,100		\$118,100		
Utility Relocation	1	LS	\$50,000		\$50,000		
Seeding & Mulching	4.8	acre	\$25,000		\$120,000		
Subtotal 72nd Street Roadway						\$668,000	



72nd Street Bridge				feet			
Item	Quantity	Unit	Unit Cost	1.87	Unit Cost	Total Cost	
Bridge Deck	1	LS	\$1,000,000		\$1,000,000		
Subtotal Bridge Construction						\$1,000,000	
Total 72nd Street Bridge Construction						\$1,000,000	

84th Street Roadway				feet			
Item	Quantity	Unit	Unit Cost	10.30	Unit Cost	Total Cost	
Rigid Concrete Pavement	2,400	yd	\$40.00		\$96,000		
Roadway Embankment	2,400	yd	\$7.00		\$16,800		
Drainage/Erosion Protection/Guard Rails	1	LS	\$102,500		\$102,500		
Utility Relocation	1	LS	\$150,000		\$150,000		
Intersection Raze	1	LS	\$50,000		\$50,000		
Seeding & Mulching	4.7	acre	\$25,000		\$117,500		
Subtotal 84th Street Roadway						\$532,800	



84th Street Bridge				feet			
Item	Quantity	Unit	Unit Cost	4.35	Unit Cost	Total Cost	
Grade Control Moved Upstream	1	LS	\$200,000		\$200,000		
Bridge Demolition	10,000	ft	\$25.00		\$250,000		
Bridge Construction	14,100	ft	\$50.00		\$705,000		
Subtotal Bridge Construction						\$1,155,000	
Total 84th Street Bridge Construction						\$1,155,000	
Total Scenario 1 Bridge Construction						\$6,320,930	



Scenario 3 - Levee Raises with Multiple Bridge Modifications and Tributary and Regional Detention Storage

48th Street Roadway		feet	
Item	Quantity	Unit	Total Cost
Rigid Concrete Pavement	0	Yd	\$0.00
Roadway Embankment	0	Yd	\$0.00
Drainage/Retention Protection/Guard Rails	0	Ls	\$0.00
Utility Relocation	0	Ls	\$0.00
Sealing & Mastic	0	sqm	\$0.00
Subtotal 48th Street Roadway			\$0

48th Street Bridge		feet	
Item	Quantity	Unit	Total Cost
Reinforcing	0	Ls	\$0.00
Subtotal 48th Street Bridge Construction			\$0

68th Street Roadway		feet	
Item	Quantity	Unit	Total Cost
Rigid Concrete Pavement	8,913	Yd	\$40,000
Roadway Embankment	8,400	Yd	\$3,000
Drainage/Retention Protection/Guard Rails	1	Ls	\$117,600
Levee Tie back Removal	1	Ls	\$20,000
Utility Relocation	1	Ls	\$150,000
Sealing & Mastic	5.3	sqm	\$3,000
Subtotal 68th Street Roadway			\$973,600

p. 107 R.D. Means 2003: \$35/sq. yd. for 10-inch pavement  
 \$3/sq. yd.  
 \$117,600: \$117,600  
 \$20,000: \$20,000  
 \$150,000: \$150,000  
 100 feet on each side of embankment

68th Street Bridge		feet	
Item	Quantity	Unit	Total Cost
Bridge Condition and Construction	10,350	Sq. Ft.	\$1,940,000
Subtotal 68th Street Bridge Construction			\$1,940,000
Total 48th Street Bridge Construction			\$1,940,000

\$108 by 700 (\$20 per sq. ft. Reconstruction, \$25 per sq. ft. Rehabilitation)

72nd Street Roadway		feet	
Item	Quantity	Unit	Total Cost
Rigid Concrete Pavement	0	Yd	\$0.00
Roadway Embankment	0	Yd	\$0.00
Drainage/Retention Protection/Guard Rails	0	Ls	\$0.00
Utility Relocation	0	Ls	\$0.00
Sealing & Mastic	0.0	sqm	\$0.00
Subtotal 72nd Street Roadway			\$0

p. 107 R.D. Means 2003: \$35/sq. yd. for 10-inch pavement  
 \$3/sq. yd. Urban setting  
 \$117,600: \$117,600  
 \$20,000: \$20,000  
 100 feet on each side of embankment

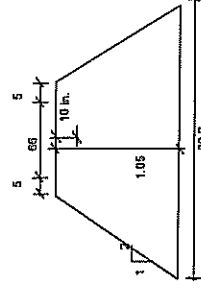
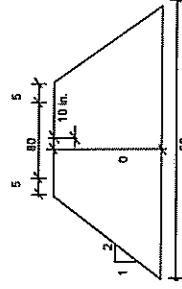
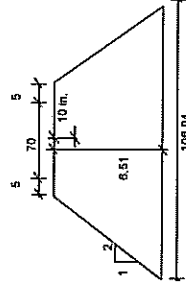
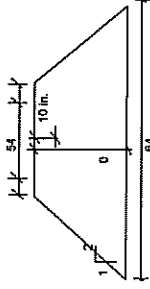
72nd Street Bridge		feet	
Item	Quantity	Unit	Total Cost
Bridge Jack up	0	Ls	\$0.00
Subtotal 72nd Street Bridge Construction			\$0
Total 72nd Street Bridge Construction			\$0

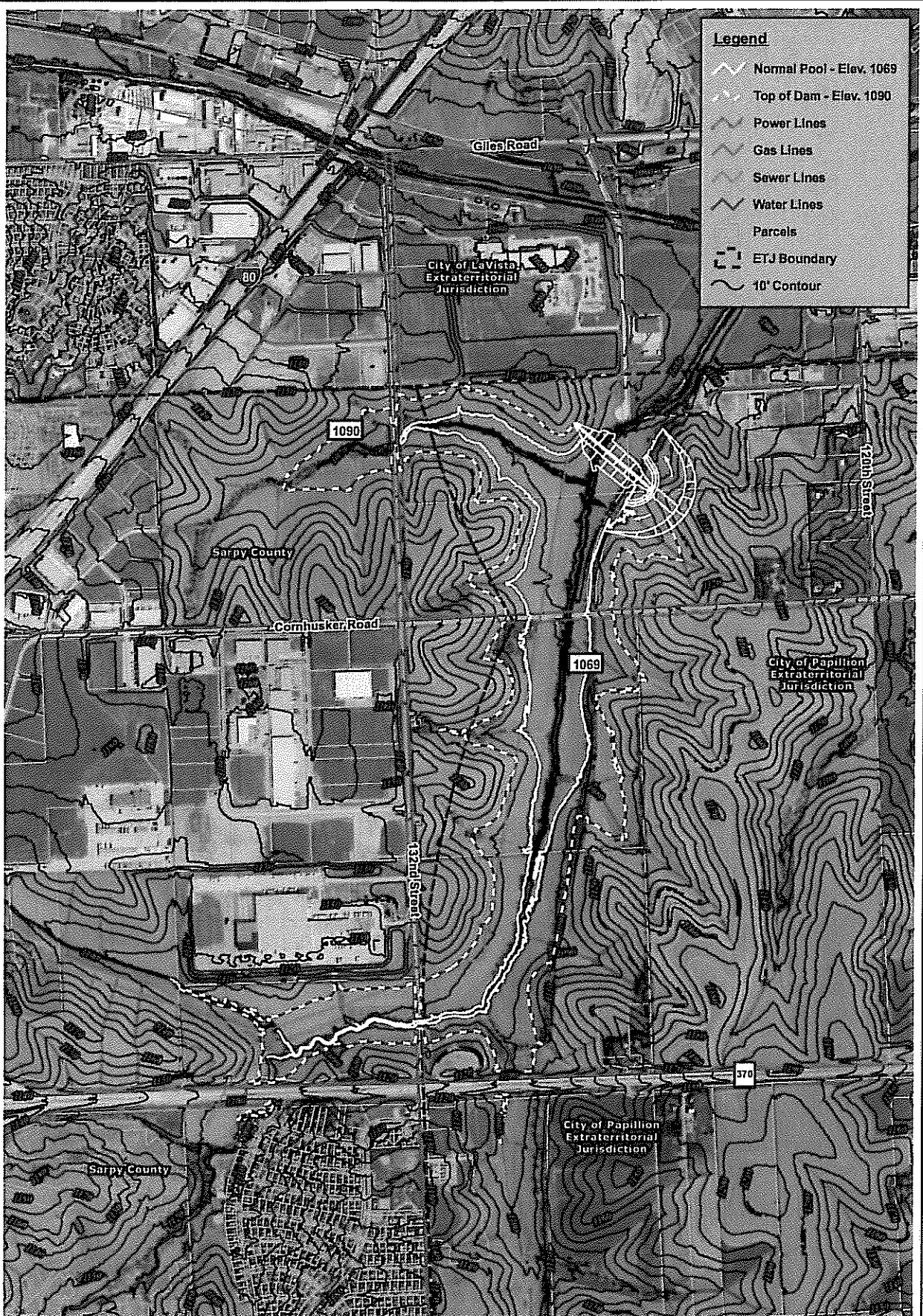
84th Street Roadway		feet	
Item	Quantity	Unit	Total Cost
Rigid Concrete Pavement	3,630	Yd	\$16,000
Roadway Embankment	400	Yd	\$1,000
Drainage/Retention Protection/Guard Rails	1	Ls	\$40,000
Utility Relocation	1	Ls	\$150,000
Sealing & Mastic	2.3	sqm	\$1,000
Subtotal 84th Street Roadway			\$178,000

p. 107 R.D. Means 2003: \$35/sq. yd. for 10-inch pavement  
 \$7/sq. yd. Urban setting  
 \$40,000: \$40,000  
 \$150,000: \$150,000  
 100 feet on each side of embankment

84th Street Bridge		feet	
Item	Quantity	Unit	Total Cost
Grate, Concrete, Metal Upstream	1	Ls	\$200,000
Bridge Demolition	10,032	Sq. Ft.	\$25,000
Bridge Construction	14,190	Sq. Ft.	\$1,400,000
Subtotal 84th Street Bridge Construction			\$1,625,000
Total 84th Street Bridge Construction			\$1,625,000
Total Scenario 3 Bridge Construction			\$4,987,100

\$12,500 \$25 per sq. ft. Reconstruction, \$15,000 \$20 per sq. ft. Reconstruction.





HDR

Source: MAPA 2004 Orthophotography and Topographic Data, ArcMap 9.0

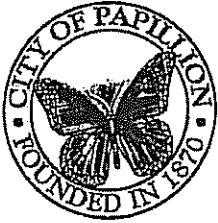
### SPT Site - Conceptual Detention Basin Layout



Unnamed South Papillion Creek Tributary Detention Evaluation  
Papio-Missouri River Natural Resources District

DATE  
February 2006

FIGURE  
1



CITY OF PAPILLION

James E. Blinn, Mayor

Dan Hoins, City Administrator

122 East Third Street  
Papillion, Nebraska 68046  
Phone 402-597-2029  
Fax 402-339-0670  
E-mail dhoins@monarch.papillion.ne.us

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October 2, 2008

Mr. John Winkler  
General Manager  
Papio-Missouri River NRD  
8901 South 154<sup>th</sup> Street  
Omaha, NE 68138

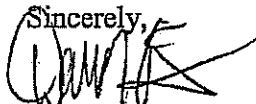
Dear John:

This letter is a follow up to previous conversations about the City of Papillion's review of the recent flood map revisions along the West Branch of the Papillion Creek and subsequent Levee Restoration Evaluation. As you are aware, we contracted with Tetra Tech to review the technical information and methodologies and have received the results from that investigation. While we will continue to assess the best mitigation projects for the City of Papillion, we believe the work performed to date is sound, given the information available.

With regards to the mitigation projects identified in the Levee Restoration report, we will also continue to monitor its effectiveness in terms of flood elevation reductions within the City of Papillion. At this time, we are most interested in prioritizing the three retention basins WRB-5, 6 and 7 proposed in the Evaluation Report, as we have been informed by our consultant that this offers the best immediate flood reduction benefits for Papillion.

We understand you are considering proceeding with the design of WRB-5 and look forward to that progress on the project and jointly implementing an overall mitigation plan to recertify the creek levees and reduce the area of floodway. Papillion agrees that WRB-5 is a key component of the overall mitigation effort and supports its implementation as a priority project. We look forward to meeting with you soon to discuss our role in this project and the overall plan.

If you have any questions, please do not hesitate to contact me.

Sincerely,  
  
Dan Hoins  
City Administrator

# Memorandum

**To:** Interested Engineering Consultants

**Re:** Request for Proposals for the Papillion Creek Watershed Regional Detention Site WPRB-5 Project Professional Services

**Date:** September 30, 2008

**From:** John Winkler, General Manager

## **Proposals Received by: October 31, 2008**

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The Papio-Missouri River Natural Resources District (PMRNRD) is requesting proposals for professional engineering services necessary to plan, permit, design and construct a flood control structure in the Papillion Creek watershed near 126<sup>th</sup> and Cornhusker Road in Papillion, Sarpy County, Nebraska (see attached map). Previous reports titled "West Papillion Creek Levee Restoration Evaluation" completed in March 2008 by HDR Engineering, Inc. and "Unnamed South Papillion Creek Tributary Detention Evaluation" dated February 2006 also by HDR Engineering, Inc. are available on the PMRNRD website, [www.papionrd.org](http://www.papionrd.org), or on cd by request. These reports concluded that a combination of alternatives such as raising bridges, raising levees and upstream regional detention are necessary to achieve the required freeboard along the West Papillion Creek levee system. The report also provides conceptual design information on the WPRB-5 structure.

If interested, the following information should be submitted with your proposal in a form of your choosing:

1. Firm name, address, telephone number and email contact information
2. Year your firm was established and any previous firm names
3. Types of services for which your firm is qualified
4. Names of principals of the firm and states in which they are registered
5. Names of personnel you would expect to utilize, including outside consultants, with experience of each and length of time in the organization
6. Specific project contact person
7. List of similar completed projects
8. General overview of your approach to the project

An Ad Hoc Subcommittee of the District's Board of Directors will be responsible for reviewing and evaluating the responses on the said requested services. Final selection of the firm to perform such services will be determined by the following timetable:

<u>Date</u>	<u>Description</u>
October 10, 2008	Mail out RFP to engineering consultants
October 31, 2008	Final date for receipt of proposals
November 6, 2008	Ad-Hoc Subcommittee meeting on the initial screening of proposals received. Three (3) firms selected for interview.
November 14, 2008	Send letter to selected firms notifying them of the interview time and date
December 4, 2008	Ad-Hoc Subcommittee Meeting to interview selected firms. Subcommittee will rank each firm by preference.
January 6, 2009	Ad-Hoc Subcommittee Meeting negotiate contract with first choice firm.
January 8, 2009	District Board of Directors adopts Subcommittee Recommendation on entering into contract with selected engineering firm.

**Interested firms should submit ten (10) copies of their proposal to the District's Omaha office, located at 8901 South 154<sup>th</sup> Street, Omaha, Nebraska 68138, no later than 4:30 PM on October 31, 2008.**

Inquiries regarding this matter may be addressed to Amanda Grint, [agrint@papionrd.org](mailto:agrint@papionrd.org) or Marlin Petermann, [mpetermann@papionrd.org](mailto:mpetermann@papionrd.org). Papio-Missouri River NRD staff may be reached by telephone at 402-444-6222.

Cc: WPRB-5 Regional Detention Structure Ad-Hoc Consultant Selection Subcommittee

David Klug, Chairperson  
Tim Fowler  
Rick Kolowski  
Rich Tesar  
Jim Thompson  
Alternate: Fred Conley