DETAILED PROJECT REPORT
WITH ENVIRONMENTAL ASSESSMENT

SECTION 205 FLOOD DAMAGE REDUCTION STUDY

MAD CREEK
MUSCATINE, MUSCATINE COUNTY, IOWA

APPENDIX B
ECONOMIC ANALYSIS

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APPENDIX B
ECONOMIC ANALYSIS

1. INTRODUCTION

This appendix describes the economic analysis of project alternatives for providing flood damage reduction measures for the City of Muscatine, Iowa. Current damages are caused primarily by high flows of Geneva Creek, Mad Creek, and the Mississippi River. The five major sections of this appendix summarize the Detailed Project Report analysis conducted by the Rock Island District, U.S. Army Corps of Engineers.

Following the introductory section, the second section describes the general characteristics of the study area and summarizes historical flooding. The third section presents the procedures used to quantify flood damages and the potential benefits which would accrue to a flood damage reduction project. The fourth section presents the benefit and cost analysis for the recommended plan. The fifth section summarizes the non-Federal financial analysis. Throughout this analysis, price levels are stated as of June 2002, with the required Federal discount rate of 6-1/8 percent for water resources project being used to amortize costs for comparison with annualized benefits.

2. CHARACTERISTICS OF THE STUDY AREA

a. General. The City of Muscatine is located on the right bank of the Mississippi River in Muscatine County, Iowa. The City of Muscatine has an estimated year 2000 population of 23,100. Table B-1 depicts historical population trends. The city is served by major state and Federal highway, railway and waterway systems. The interstate highway system and major airline transportation are also within close proximity.

Table B-1. Muscatine, Iowa, population trends

Year	1950	1960	1970	1980	1990	2000
Population	19,041	19,813	22,405	23,467	22,881	23,100

b. Study Area. As shown on Figure 1 of the main report, the study area is the floodplain impacted by Geneva Creek, Mad Creek, and the Mississippi River (at the confluence with Mad Creek). Separate reaches are delineated on Figure 2. The study area is centrally located within the City of Muscatine. The area is predominantly industrial and commercial, with a few residential and public properties. Table B-3 lists numbers of properties by category. Reaches 1 and 4 are

geographically identical, but impacted by independent Mad Creek and Mississippi River flows, respectively. Reach 2 is impacted by Mad Creek flows, and Reach 3 is impacted by Geneva Creek flows.

The following types of properties are included in the area to be protected: office furnishings manufacturing, auto and cycle repair and service, taverns, energy services, retail furniture, chiropractic services, freight services, door/awning services, button manufacturing, and public roads and sewers. The study area exhibits fairly dense usage. Significant growth trends are not apparent.

Table B-2. Study area properties by category

Type	Reaches 1 & 4	Reach 2	Reach 3	Areas Outside of Reaches
Commercial	13	5		13
Industrial	2		1	
Residential				7
Public				1

c. Labor Force Data. As shown in Table B-2, 1990 data indicate that the Muscatine area labor force is concentrated in the manufacturing, retail trade, and service industries. Median household income was $40,800 for the Muscatine area, compared to $35,400 for the State of Iowa.

Table B-3. Muscatine County, Iowa, labor force
2000 projected statistics (Woods & Poole Economics, Inc.)

Employment Category	2000 Labor Force	Percent Distribution
Construction & Mining	1,080	4.0
Manufacturing	8,910	33.0
Wholesale & Retail Trade	4,710	17.4
Service Industries	6,090	22.5
Finance, Insurance, Real Estate	840	3.1
Transportation & Utilities	990	3.7
Farm and Farm Services	1,130	4.2
Other	3,270	12.1
Total	27,020	100.0

d. Historical Flooding. Mad Creek, Geneva Creek, and the Mississippi River have experienced significant flooding in the past several decades. Mad Creek and Geneva Creek are ungaged streams, which had serious recent flash flooding in 1990 and 1993. The Mississippi River has had severe recent flooding in 1993, 1997, and 2001 (see Appendix A, Table A-1). The existing levees protecting Reach 1 (& 4) and Reach 3 prevented significant damages from occurring during the flood events. Seepage pumping, sandbagging, and levee patrol costs were incurred during these events.

3. METHODOLOGY

a. General Conditions. This study area was evaluated under the Corps of Engineers' requirements for "Risk and Uncertainty" analysis.

Portions of the project study area are currently protected by a Federal levee/floodwall system. The area has been analyzed as a 4-reach study. Table B-4 lists reaches, affecting streams, top-of-levee elevations, and alternatives analyzed.

Table B-4. Reach alternatives analyzed

Reach	Affecting Stream	Top-of-Levee Elevation (existing)	Alternatives Analyzed
1	Mad Creek	559.4	1-, 2-, 3-foot levee raise; Upstream dams; Dams and levee raise; Channel work & levee raise
4	Mississippi	559.5	1-, 2-, 3-foot raise
2	Mad Creek	560.5	1-foot raise Upstream dams; Dams and levee raise
3	Geneva Creek	572.4	Positive closures Upstream dams; Dams and closures
Areas Outside Reaches	Geneva Creek & Mad Creek	No-levee areas	Upstream dams

b. Flood Damage Data Collection. Structure and content values and depth-damage estimates were collected for all properties in the study area. For industrial, commercial, and public properties, on-site interviews were used to determine damageable values and depth-damage relationships for affected properties (to include structural and content damages, emergency preparedness, and cleanup costs). Ground and floor elevations were determined from property records and topographic mapping. The Mad Creek Reach 1 (Mississippi Reach 4) area contains a large, well-maintained manufacturing facility in addition to the many other occupants. This manufacturer has a very significant investment in plant, inventory, and equipment at this location. The equipment for manufacture and assembly is generally located on the ground floor of several building sites and is permanently placed. It is not mobile and could not be removed during a flood threat. Inventory is stored at varying heights in several buildings and is at risk during flood threats. Therefore, it is assumed that any breach or overtopping of the existing levee during flooding would cause immediate and severe damage to this industrial facility, as well as other levee district occupants. Information from study area occupants was used to estimate the range of potential damages resulting from an overtopping flood event.

For residential structures, ground and floor elevations, structure type, age, size (square footage), condition and repair/replacement values were estimated from field survey. Using this information and the Rock Island District's standard residential depth-damage computer program, elevation-damage relationships were estimated for the residential properties.

c. <u>Risk and Uncertainty</u>. Tables B-5 through B-8 present mean damage estimates and standard deviation of damage by category for various flood elevations. The accepted approach with limited data and funding was used to arrive at standard deviations of stage/damage relationships (reference IWR Risk/Uncertainty guidance). Total mean damage and standard deviation information was then entered to the Hydraulic Engineering Center - Flood Damage Assessment (HEC-FDA) computer model for risk and uncertainty. The HEC-FDA model was then run, sampling various hydraulic and economic variables, resulting in existing and proposed levee-height reliability statistics and annual damage/benefit information.

Table B-5. Reach 1/4 (two independent stream flows)

Elevation (NGVD)	Approx. Freq.	Industrial/ Commercial	Standard Deviation
Mad Creek Reach 1 (Miss. Reach 4) Existing Damages by Category ($000's)			
559.0	.0033	0	0
560.0	.0027	69,270	18,680
561.0	.0023	74,680	18,670
562.0	.0020	80,090	18,450
563.0	.0017	85,190	18,340
564.0	.0015	90,970	18,530
Mississippi Reach 4 (Mad Creek Reach 1) Existing Damages by Category ($000's)			
559.0	.004	0	0
560.0	.0028	69,270	18,680
561.0	.0015	74,680	18,670
562.0	.0008	80,090	18,450
563.0	.0005	85,190	18,340
564.0	.0002	90,970	18,530

Table B-6. Reach 2 existing damages by category ($000's)

Elevation (NGVD)	Approx. Freq.	Commercial	Standard Deviation
560.0	.004	0	0
561.0	.0032	110	28
562.0	.0027	162	37
563.0	.002	209	45
564.0	.0017	242	49

Table B-7. Reach 3 existing damages by category ($000's)

Elevation (NGVD)	Approx. Freq.	Industrial	Standard Deviation
572.0	.0013	0	0
573.0	.001	53,330	13,333

Table B-8. Area outside of reaches existing damages by category ($000's)

Approx. Freq.	Residential	Commercial	Public
.5	0	0	0
.1	14	17	13
.02	35	219	58
.01	60	472	76
.002	111	974	242

(1) <u>Existing Condition Annual Damages and Benefits</u>. Average annual damages are the expected value of flood losses for any given year. The calculation for existing condition average annual damages, under the Hydraulic Engineering Center - Flood Damage Assessment (HEC-FDA) model involves using Monte Carlo simulation for computing expected annual flood damages (mean damage obtained by integrating the damage exceedance probability curve for the study area). Uncertain parameters (error distributions around the mean) such as flow-frequency, flow-stage, and stage-damage are sampled when a simulated overtopping event occurs. HEC-FDA output includes best estimate (mean) of expected annual damage and a distribution of possible values about the mean.

That portion of annual damages which can be prevented by construction of a project are the benefits accruing to the project. Residual (with-project) damages are damages that could occur due to the possibility of flood events that would overtop the proposed levee improvement.

Table B-9 lists annual damages and benefits information for the existing condition and alternatives considered.

Table B-9. Annual damages and benefits by alternative

Existing Condition	Geneva	Annual Damages Mad	Annual Damages Miss.	Total Annual Damage
Reach 1/4		469,500	349,300	818,800
Reach 2		1,500		1,500
Reach 3	11,200			11,200
Outside Specific Reaches	200	44,000		44,200

With-Project Conditions	Geneva	Annual Benefits Mad	Annual Benefits Miss.	Total Annual Benefits
A. Mad Creek/Geneva Creek Levee Raises				
A-1. Mad Creek Levee Raise - Reach 1				
A-1-a. One-foot raise		121,200		**121,200**
A-1-b. Two-foot raise		265,200		**265,200**
A-1-c. Three-foot raise		397,400		**397,400**
A-2. Mad Creek Railroad Raise - Reach 2		300		**300**
A-3. Geneva Creek Closures - Reach 3	11,100			**11,100**
B. Dams (.01 design) Mad & Geneva Creek				**456,100**
Reach 1		409,700		
Reach 2		1,200		
Reach 3	11,200			
Outside Specific Reaches		34,000		
C. Dams (.01) and 1-ft Levee Raise				
C-1. Dams and Reach 1 raise		454,100		**500,500**
Reach 2 benefit		1,200		
Reach 3 benefit	11,200			
Outside Specific Reaches		34,000		
C-2. Dams and Reach 2 raise		1,400		**456,300**
Reach 1 benefit		409,700		
Reach 3 benefit	11,200			
Outside Specific Reaches		34,000		
C-3. Dams and Reach 3 Closures	11,200			**456,100**
Reach 1 benefit		409,700		
Reach 2 benefit		1,200		
Outside Specific Reaches		34,000		
D. Improve Mad Channel w/Mad/Miss Raise Reach 1/4				
D-1. 1-foot raise		441,800	239,300	**691,600**
D-2. 2-foot raise		466,200	346,300	**823,000**
D-3. 3-foot raise		469,300	348,700	**828,500**
Reach 2 benefit for all D plans		700		
Outside Specific Reaches		9,800		

(2) Future Condition. The existing project-protected floodplain along Mad Creek, Geneva Creek, and the Mississippi River is densely developed, with significant growth not being apparent. The unprotected areas of the floodplain are regulated, so that at-risk structures are not expected to increase. Therefore, future economic conditions are not expected to change significantly.

4. BENEFIT-COST ANALYSIS

a. General. Construction and operation and maintenance costs detailed in this report are in June 2002 price levels. Interest during construction and annualized costs are computed using a 6-1/8 percent rate as mandated for Federal water resources projects. A 50-year project life has been used for the period of analysis. Tables B-10 and B-11 summarize the calculations for interest during construction and annual charges for Alternative D-2, Channel Improvements with 2-Foot Levee Raise for Mad Creek and Mississippi River (Reach 1, 4).

Table B-10. Interest during construction ($000's)
Plan D-2, channel improvements with 2-foot levee raise
(6-1/8% discount rate)

Year	Project Expenditures ($000's) Federal	Project Expenditures ($000's) Non-Federal	Time to Base Year (Period)	Interest Factor of $1 Deposited to Base Year	Accumulated Interest to Base Year ($000's) Federal	Accumulated Interest to Base Year ($000's) Non-Federal	Accumulated Interest to Base Year ($000's) Total
1	1,119.7	602.8	3	.09472	106.0	57.0	163.0
2	1,119.6	602.9	1	.0306	34.3	18.6	52.9
Totals	2,239.3	1,205.7			140.3	75.6	215.9

Table B-11. Summary of annual charges ($)
Plan D-2, channel improvements with 2-foot levee raise
(6-1/8%, 50-year evaluation period)

Description	Federal	Non-Federal	Total
Estimated Construction Cost	2,239,300	1,205,700	3,445,000
Interest During Construction	140,300	75,600	215,900
Total Economic Costs	2,379,600	1,281,300	3,660,900
Interest and Amortization (.06455)	153,600	82,700	236,300
Operation and Maintenance	0	4,100	4,100
Total Annual Charges	153,600	86,800	240,400

b. Economic Summary. Table B-12 presents a summary economic analysis for the alternatives considered. As indicated, NED (National Economic Development) benefits are maximized with Alternative D-2, Channel Improvements with 2-Foot Levee Raise for Mad Creek and Mississippi River (Reach 1, 4). This alternative provides net NED benefits of $582,600 and a benefit-to-cost ratio of 3.4 to 1.0.

Table B-12
Costs and benefits by alternative
(June 2002 prices, 6-1/8% discount rate, 50-year evaluation period)

Alternative	Total Annual Benefits	Project Cost Estimate	Interest During Const.	Total First Costs	Annual First Costs	Annual O & M Costs	Total Annual Costs	Benefit Cost Ratio
A. Mad Creek/Geneva Creek Levee Raises								
A-1. Mad Creek Levee Raise - Reach 1								
a. 1-foot raise	121,200	1,775,000	111,241	1,886,241	121,764	0	121,764	0.995
b. 2-foot raise	265,200	2,088,000	130,857	2,218,857	143,236	0	143,236	1.85
c. 3-foot raise	397,400	2,817,000	176,545	2,993,545	193,245	0	193,245	2.06
A-2. Mad Creek Railroad Raise - Reach 2	300	1,207,000	36,964	1,243,964	80,303	0	80,303	0.00
A-3. Geneva Creek Closures - Reach 3	11,100	721,000	22,081	743,081	47,969	0	47,969	0.23
B. Dams (.01 design) Mad & Geneva Creek	456,100	8,042,000	772,402	8,814,402	569,005	15,665	584,670	0.78
C. Dams (.01) and 1-ft Levee Raise								
C-1. Dams and Reach 1 raise	500,500	9,655,000	927,324	10,582,324	683,131	15,665	698,796	0.72
C-2. Dams and Reach 2 raise	456,300	9,036,000	867,872	9,903,872	639,334	15,665	654,999	0.70
C-3. Dams and Reach 3 Closures	456,100	8,552,000	821,385	9,373,385	605,089	15,665	620,754	0.73
D. Improve Mad Channel w/Mad/Miss Raise Reach 1/4								
D-1. 1-foot raise	691,600	3,255,000	203,995	3,458,995	223,292	4,070	227,362	3.04
D-2. 2-foot raise	823,000	3,445,000	215,902	3,660,902	236,326	4,100	240,426	3.42
D-3. 3-foot raise	828,500	4,242,000	265,851	4,507,851	291,000	4,150	295,150	2.81

Notes:
1. D-1, D-2, D-3 Levee Raise alternatives have O & M costs for siltation removal and temporary tie-off construction.
2. Dam alternatives cost estimates include $15,700 for access road construction.
3. Interest During Construction was calculated for mid-year expenditure and appropriate construction period.

5. FINANCIAL ANALYSIS

a. Cost Distribution. Based on current cost-sharing provisions, Federal and non-Federal costs will be distributed as shown in Table B-13.

Table B-13. Project cost distribution
Plan D-2, channel improvements with 2-foot levee raise
Muscatine, Iowa

Total Project Cost Estimate		$3,445,000
Federal Cost Estimate		2,239,250
Non-Federal Cost Estimate		1,205,750
Lands, Damages, & Relocations	$505,000	
Cash Contributions	$700,750	
Non-Federal Share Percent of Total Cost:		35%

b. Ability to Pay. Based on the provisions of Section 103 of Public Law 99-662, Muscatine, Iowa, has the ability to provide the normal share percentage of project costs. This Public Law considers the magnitude of a project benefit-to-cost ratio and the per capita income of the state and county of the non-Federal sponsor. Muscatine does not qualify for reduced cost sharing. Table B-14 summarizes the required calculation.

Table B-14. Ability to pay analysis
Plan D-2, channel improvements with 2-foot levee raise

Annual Cost	$240,400		Cost & Benefits
Annual Benefits	823,000		for Flood Control
Total Cost	$3,445,000		
Local Share	$1,205,700		
Benefit/Cost Ratio (BCR)	3.4		
Base Benefits Floor		85%	BCR multiplied by 25%
Standard Non-Federal Share		35%	

NOT QUALIFIED for reduced cost sharing, as the Benefit-to-Cost Ratio multiplied by 25%, and stated as a percentage, is greater than the standard cost-sharing percentage (based upon the benefits test per Section 103 of Public Law 99-662, and ER 1165-2-121).

c. Financial Capability. The City of Muscatine, Iowa, has the willingness and capability to finance its share of the cost of constructing this local flood protection project. The City's Statement of Financial Capability and Financing Plan are included as Attachment 1 to this appendix.

MUSCATINE

City Hall, 215 Sycamore St.
Muscatine, IA 52761-3840
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Fax (563) 264-0750

MAYOR

November 20, 2002

Colonel William J. Bayles
U.S. Army Engineer District
Clock Tower Building, P.O. Box 2004
Rock Island, Illinois 61204-2004

RE: STATEMENT OF FINANCIAL CAPABILITY, Section 205 Flood Control Project, Mad Creek, Muscatine, Iowa

Dear Colonel Bayles:

The City of Muscatine, Iowa has the legal authority to enter into the Project Cooperation Agreement and to fulfill all financial obligations for completion of the project. The City understands that the current cost estimate for the entire project is $3,445,000. Of this, the City's share is $1,205,750 ($700,750 cash and $505,000 for rights-of-way and relocation costs).

It is the City's intention to finance its share of project costs through bond issuance and the levee tax levy. These funding sources will be available to meet the City's requirements as shown on the attached schedule of Estimated Funding Requirements. Enclosed also is a copy of the City's latest Annual Financial Report for the year ended June 30, 2001. The June 30, 2002 report will be available in December.

The City of Muscatine has reviewed the Project Cooperation Agreement (PCA) and has found its provisions acceptable. The City strongly desires to proceed with this flood damage reduction project. If further information is needed, please do not hesitate to contact our office.

Sincerely,

Richard W. O'Brien

Richard W. O'Brien
Mayor

Enclosure

Attachment 1

Mad Creek, Muscatine, IA Section 205

ESTIMATED FUNDING SCHEDULE

Fiscal Year	Total Project Impl. Cost	Non-Federal LERRD	Constr. Cash	Percent of Total	Non-Fed 5% Min. Cash	Add'l Non-Fed Cash	Total Non-Fed Cash	Federal Cash
Prior FYs	0.0	0.0	0.0	0%				0.0
2003	955.0	505.0	450.0	0%	0.0	0.0	0.0	450.0
2004	1,220.0	0.0	1,220.0	57%	97.8	300.2	398.0	822.0
2005	1,245.0	0.0	1,245.0	42%	72.9	223.8	296.7	948.3
2006	25.0	0.0	25.0	1%	1.5	4.5	6.0	19.0
Totals	3,445.0	505.0	2,940.0	100%	172.3	528.5	700.8	2,239.3

Notes:

1. Fiscal year refers to U.S. Government Fiscal Year 1 October thru 30 September
2. LERRD refers to lands, easements, relocations, rights-of-way, and damages.

MAD CREEK, MUSCATINE, IOWA
SECTION 205 LOCAL FLOOD PROTECTION PROJECT
FINANCING PLAN OUTLINE

The City of Muscatine, Iowa, non-Federal sponsor of this Local Flood Protection Project, is capable of meeting its cost-sharing obligation as required under the terms of the Project Cooperation Agreement.

Uses of Funds	Amounts	Comment
Land Acquisition	$ 505,000	Required real estate acquisition and associated costs.
Cash Contribution	700,750	Non-Federal cash requirements during construction.
Annual Operation and Maintenance	4,100	Periodic channel silt removal.

Sources of Funds		
Annual Budget Appropriations	$1,205,750	Normal budget appropriations financed from General Obligation Bond issuance and taxing authority. 1.
Annual Budget Appropriations (O&M)	4,100	

1. The City of Muscatine has ample remaining bonding capacity ($19,800,000). Bond issuances to meet financing requirements appear to pose no fiscal difficulty. The Flood Control Project portion of the Capital Improvements Program budget will be funded from General Obligation Bond issuance and taxing authority.

MUSCATINE, IOWA
LOCAL FLOOD PROTECTION PROJECT
SCHEDULE OF SOURCES AND USES OF NON-FEDERAL FUNDS

	Project Funding Sources	Estimated Cash Requirements		Year-End Funding Balance
		LERRD	Cash Contribution	
FY 2003 Funding Sources: Annual Budget Appropriations	$ 505,000	$ 505,000	0	0
FY 2004 Funding Sources: Annual Budget Appropriations	340,000	0	340,000	0
FY 2005 Funding Sources: Annual Budget Appropriations	355,750	0	355,750	0
FY 2006 Funding Sources: Annual Budget Appropriations	5,000	0	5,000	0
TOTALS	$1,205,750	$ 505,000	$ 700,750	

Credit-worthiness notes:

Based on the City Comprehensive Annual Financial Report (June 30, 2001),the following factors indicate strong capability for financing cost-sharing requirements.

1. Stable population.
2. Increasing assessed and actual property values.
3. Very strong ratio of tax collections to tax levee (consistently above 99%).
4. Significant legal debt margin (debt limit $41,900,000; outstanding debt $22,000,000)
5. Reasonable bonded debt per capita ($398).
6. Strong history of debt issue/debt service (current A-1 rating by Moody's Services).
7. Low unemployment rate (2.8%).

DISTRICT COMMANDER'S ASSESSMENT OF
NON-FEDERAL SPONSOR'S FINANCING CAPABILITY

SECTION 205 FLOOD CONTROL PROJECT
MAD CREEK, MUSCATINE, IOWA

The Financing Plan presented by the City of Muscatine, Iowa has been reviewed and is considered appropriate to participate in the construction of this Local Flood Protection Project. Based upon information received from the non-Federal sponsors, it is reasonable to expect that sufficient funds will be available to satisfy the non-Federal sponsor's financial obligations for the project.

William J. Bayles
Colonel, U.S. Army
District Engineer