
EXPEDITED RECONNAISSANCE STUDY

Section 905(b) (WRDA 1986) Analysis

Des Moines and Raccoon Rivers, Des Moines, Iowa

CEMVR-PM-MF (16 November 1998)

1. STUDY AUTHORITY: The Des Moines and Raccoon Rivers Study is being carried out under the Corps of Engineers' General Investigations (GI) Program. The study was initiated pursuant to the provision of funds in the Energy & Water Development Appropriations Act, 1998. The study was authorized by Section 216 of the 1970 Flood Control Act, which reads:

“The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significant changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest.”

The study received \$100,000 in Federal Fiscal Year 1998 and 1999 funds to complete the reconnaissance phase.

2. STUDY PURPOSE: The city of Des Moines, located in Polk County, Iowa, has several rivers and waterways that traverse the city, including the Des Moines River, Raccoon River, Walnut Creek, Fourmile Creek, and numerous small tributaries. The areas adjacent to these streams frequently sustain substantial flood damages. During the Great Flood of 1993, Polk County suffered more than \$152 million in flood damages, mostly in the Des Moines metropolitan area. In addition, Des Moines was without water service for more than a week, causing the closure of most of the businesses and industry in the city. More than 3,000 properties were inundated.

The purpose of this reconnaissance study is to evaluate the potential for Federal interest in studying improvements to alleviate flooding and other water resource problems in Des Moines. The 905(b) Analysis determines whether the planning process should proceed into the more detailed feasibility phase based on a preliminary appraisal of Federal interest, estimated costs, potential benefits, and possible environmental impacts of various alternatives. The reconnaissance study will result in the development of a Project Study

Plan (PSP) and the negotiation of a Feasibility Cost Sharing Agreement (FCSA) with the city of Des Moines for the next phase of the study.

3. LOCATION OF PROJECT/CONGRESSIONAL DISTRICT:

a. The study area (see Figure 1) is the city of Des Moines, Iowa and includes portions of the Des Moines River, the Raccoon River, and several tributary streams. Des Moines is located in central Iowa at the confluence of the Des Moines and Raccoon Rivers. The 1990 population of Des Moines was 193,189.

b. The study area is located in Iowa's 4th Congressional District which is represented by Congressman Greg Ganske. Iowa's Senators are Charles E. Grassley and Thomas R. Harkin.

4. DISCUSSION OF PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS: Several reports have been completed concerning investigations of flood problems in the Des Moines River Basin. Some of these studies and reports have resulted in the construction of flood control projects as discussed below. The impacts of these flood reduction projects were considered in this 905(b) Analysis.

a. Prior Studies and Reports:

(1) *Review of Reports for Flood Control and Related Purposes on the Des Moines River, Iowa and Minnesota*, U.S. Army Corps of Engineers, Rock Island District, December 1966 - This report considers the advisability of providing improvements for flood control and related purposes in the Des Moines River Basin upstream of the city of Des Moines. Three projects were recommended: 1) a reservoir on Walnut Creek; 2) local flood protection works along the Raccoon River and Walnut Creek in West Des Moines and Des Moines; and 3) local flood protection works along Fourmile Creek in Des Moines.

(2) *Des Moines River Flood Plain Information, Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, April 1970 - This report evaluates the flood situation along the Des Moines River flood plain starting from Center Street Dam in the city of Des Moines to the downstream side of the Saylorville Dam in Polk County, Iowa.

(3) *Detailed Project Report for Flood Control under Section 205 of the 1948 Flood Control Act, as Amended, Fourmile Creek in Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, May 1975 - This report recommended that no structural improvements or further studies be performed .

(4) *Feasibility Study for Flood Damage Reduction and Related Purposes, Des Moines River Basin, Iowa and Minnesota*, U.S. Army Corps of Engineers, Rock Island District, June, 1975 - This study recommended constructing a project providing Standard Project Flood (SPF) protection for West Des Moines and a portion of Des Moines. The Final Environmental Statement was completed in June 1977.

(5) *Review of Completed Project at Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, September 1978 - This study investigated the feasibility of providing additional interior drainage facilities and determined that none of the alternatives considered was economically justified.

(6) *Flood Insurance Study, City of Des Moines, Iowa*, Federal Emergency Management Administration (FEMA), August 1980 - This report contains flood profiles and discharge-frequency information.

(7) *Flood Insurance Study, City of Des Moines, Iowa*, FEMA, February 1985 - This is a revision of the 1980 flood insurance study and encompasses a greater level of detail than the original report.

(8) *Reconnaissance Study for Section 205 Flood Control Project, Raccoon River, Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, May 1986 - This study identified three feasible flood damage reduction alternatives and recommended a detailed project study for the vicinity of Valley and Fleur Drives.

(9) *Definite Project Report, Section 205 Flood Control Project, Raccoon River, Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, May 1988 - The recommended plan consisted of a 100-year levee to protect the mixed residential, commercial, and light industrial area located near Waterworks Park and Gray's Lake.

(10) *Reconnaissance Report, Section 205 Flood Damage Reduction Project, Des Moines River, Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, December 1988 - This report assessed flood damage reduction alternatives in the Birdland Park area and indicated that a project was not economically justified.

(11) *General Reevaluation Report for Flood Control Project, Raccoon River and Walnut Creek, West Des Moines - Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, July 1989 - This report studied several levels of protection and recommended a plan to provide 100-year level of levee protection along the north bank of the Raccoon River and the west bank of Jordan Creek.

(12) *Letter Report for Increased Levee Height, Raccoon River and Walnut Creek, West Des Moines and Des Moines, Iowa*, U.S. Army Corps of Engineers, Rock Island District, March 1994 - Recommended revising the local flood protection project to incorporate updated Raccoon River flow-frequency values based on the flows experienced during the Great Flood of 1993.

b. Existing Water Projects:

(1) Des Moines River at Des Moines, Iowa - This local flood protection project included additions and improvements to a system of levees and floodwalls protecting Des Moines' central business district. The project was completed in 1971.

(2) Des Moines River, Saylorville Lake - This Des Moines River reservoir lies approximately 6 miles upstream of Des Moines. It was completed in 1975 as a flood control project for the city of Des Moines and other communities along the Des Moines River.

(3) Raccoon River, Section 205, Des Moines, Iowa - This nearly completed Local Flood Protection Project is located in the vicinity of Valley and Fleur Drives and consists of improvements and additions to the existing levee system. Stage I of the project was substantially completed in 1995. Stage II, a railroad closure under Fleur Drive, is to be completed in 1999.

(4) Raccoon River and Walnut Creek, West Des Moines and Des Moines, Iowa - This project provides local flood protection to portions of West Des Moines and Des Moines from flooding along the Raccoon River, Walnut Creek and Jordan Creek. The project includes new levees, floodwalls, closure structures and pumping plants. The project was substantially completed in 1997.

5. PLAN FORMULATION: Rock Island District personnel met with city representatives on April 14, 1998, to discuss the city's flooding and water resource problems and gather relevant information. The District and city representatives performed a field inspection of the city's flood protection system to gather additional information. During the inspection, the group identified numerous potential projects and discussed potential alternatives.

The Corps of Engineers' Hydrologic Engineering Center (HEC) provided draft revised regulated flow-frequency curve information on the Des Moines River below Saylorville Dam as part of a Rock Island District hydrologic modeling effort. The new flow-frequency data indicate that Des Moines River flow estimates are larger than those developed in the 1988 Flood Insurance Study (FIS) for Des Moines (see Table 1). Although the 100-year discharge at 2nd Avenue has not substantially increased, the profile has increased due to the higher discharges in the river downstream of the Raccoon River. These new flow data were used to develop preliminary revised flood profiles and to estimate revised inundation areas and flood damages for flood events of varying frequencies. Flood damage reduction alternatives were developed based on this information and input from the city. The preliminary revised 100-year flood profile at 2nd Avenue is 2 to 3 feet higher than that in the 1988 FIS.

TABLE 1
SUMMARY OF DISCHARGES

| RIVER and LOCATION | DRAINAGE AREA sq. mi. | PEAK DISCHARGES in CFS | | | |
|---|-----------------------------|------------------------|---------------|---------------|----------|
| | | 10-YEAR | 50-YEAR | 100-YEAR | 500-YEAR |
| Des Moines River at 2nd Ave (HEC study) | 6,245 | - | 30,200 | 37,400 | - |
| Des Moines River at 2 nd Ave (1988 FIS) | 6,245 | 25,000 | 33,500 | 37,000 | 46,000 |
| Des Moines River at Fourmile Cr. (HEC study) | 10,025 | - | 76,000 | 91,100 | - |
| Des Moines River at Fourmile Cr. (1988 FIS) | 10,025 | 34,000 | 47,500 | 59,000 | 91,000 |

The 2nd Avenue location listed in Table 1 is adjacent to the Birdland Park area and the Fourmile Creek location is just downstream of the Des Moines WWTP.

a. Identified Problems:

(1) Existing Conditions: The Des Moines River above the confluence with the Raccoon River has a drainage area of 6,245 square miles. Although the river is largely regulated by Saylorville Reservoir, significant storm events such as in July 1993 cause flooding in the Birdland Park and Central Place business/residential area and other areas throughout Des Moines. Existing non-Federal levees are not adequate to uniformly protect these areas from large flood events. A city council resolution and report from the city of Des Moines describing the areas prone to flooding are enclosed as Appendix A.

The Raccoon River enters the Des Moines River from the west near the Des Moines central business district and has a drainage area of 3,629 square miles. The Raccoon River has no major flood control reservoirs and therefore exhibits great fluctuations in its flows. Most developed areas along the Raccoon River will have 100-year protection by levees upon completion of the Raccoon River Section 205 Project.

Walnut Creek enters the Raccoon River approximately 6 miles upstream of the confluence with the Des Moines River and has a drainage area of 84 square miles. The recently completed Raccoon River and Walnut Creek Project provides flood protection for areas on the west bank of Walnut Creek. Areas along the east bank of Walnut Creek remain prone to frequent flooding.

While flooding impacts many portions of the city, the primary flooding threats in Des Moines are at the Des Moines Wastewater Treatment Plant (WWTP) and at the Birdland Park area along the Des Moines River.

Over 4,000 feet of the Des Moines River levee adjacent to the WWTP is eroding due to its location at the outside of a bend in the river and could fail during high flows. The existing levee is located right on the riverbank, with no buffer zone to protect the levee from erosion. The upper portion of the riverbank and levee at the WWTP is covered with riprap while the lower portions are steep and eroded. The city has installed riprap jetties to help direct the current away from the bank. Areas between the jetties are seriously eroded. The levee was constructed in 1971 as part of Red Rock Reservoir and modified in the late 1980s during reconstruction of the WWTP. This levee provides protection to numerous residences and businesses in addition to the WWTP.

Protection of the WWTP is critical to the well being of the entire metropolitan area. The WWTP serves a population of over 305,000 in the Des Moines metropolitan area and was constructed at a cost of approximately \$200 million. The WWTP treats an average of 45 million gallons per day (mgd) but experiences peak flows of up to 220 mgd. Flooding of the plant would cause the discharge of raw sewage into the Des Moines River, cause sewage to back up into homes and businesses, and endanger the health of the community.

The existing Des Moines River levee in the Birdland Park area is not adequate to protect homes, businesses, and North High School facilities from flooding such as occurred in 1993. Since 1993, the city has constructed pumping stations to handle interior drainage and has had preliminary designs prepared for levee improvements to protect this area from flooding. The 1993 flooding overtopped this levee and flooded over 50 homes, 20 businesses and the lower levels of North High School buildings. Birdland area businesses sustained estimated losses of \$7.3 million in 1993 due to flood damages.

The existing levee at Birdland Park borders residential areas, school grounds, and industrial/commercial areas. In addition to being low, the levee embankment is too narrow and the slopes too steep in some areas for structural stability and proper maintenance.

Although the 1988 Section 205 Reconnaissance Report discussed in paragraph 4.a.(10) above indicated that a project at the Birdland Park area was not economically justified, economic revisions resulting from the damages documented from 1993 flooding and the updated flood profiles will significantly increase expected annual damages and expected benefits. Construction costs will also be reduced since the city has already constructed the pumping stations for interior drainage.

(2) Expected Future Conditions (Without Project Condition): Without a project to alleviate flood damages, the city of Des Moines will likely experience flood damages at a rate similar to the past. Peak water surface elevations for flood events would remain unchanged and continue to flood a number of structures during large flood events. Significant portions of the city would remain at risk for catastrophic flooding.

Bank erosion at the WWTP levee will continue to remove up to 3 feet of levee embankment annually in some areas, threatening the structural integrity of the WWTP levee. This could ultimately result in levee failures and potentially catastrophic damages to

the city's ability to process wastewater. Failure of the WWTP levee and the resulting flooding of the WWTP would have significant adverse impacts to the environment due to the diversion of raw sewage into the Des Moines River, as well as to the Corps of Engineers' Lake Red Rock conservation pool located immediately downstream. The water supplies for the city of Ottumwa and the Cargill plant at Eddyville that are drawn from the Des Moines River downstream of Lake Red Rock would also be contaminated. Flooding of the WWTP would also cause numerous backups of sewage into basements throughout the Des Moines area. Following is a list of specific impacts that would likely result from flooding at the WWTP:

- Loss of sanitary sewer services to nearly 92,000 residences.
- Damages to the 27 operations and maintenance buildings located at the WWTP.
- Damage to pumps, motors, valves, meters, blowers, compressors, boilers and other mechanical equipment at the WWTP.
- Damage to motor controls, wiring, transformers, switchgear, and other electrical equipment at the WWTP.
- Damage to offices, machine shop, analytical chemical laboratory, tools, and maintenance equipment at the WWTP.
- Surface flooding and basement backups in residences and businesses in the Lower Four Mile, Vandalia Road, Larison Place, Jack's Plat, Lower East 18th Street, and Hawthorn Park subsystems.
- Basement backups in residences and businesses in the Jackson Street, Bell Avenue, Lower Southwest Outfall, and Frisbie Park Areas.

The Birdland Park area would also remain susceptible to flooding. The study area would likely gradually lose businesses and residents without an increase in the level of flood protection due to continued flood damages. Severe flooding would cause financial losses for businesses, possibly resulting in loss of employment for the area. Future development of businesses and improvements to residences would likely be minimal due to the threat of flooding. The North High School facilities would remain vulnerable to flood damage and resultant extended school closures.

(3) Problems and Opportunities Warranting Federal Participation: Federal participation is warranted in a feasibility study to address the problems discussed above since the proposed alternatives are consistent with Federal law, regulation, and policy. The proposed structural measures appear to be feasible for reducing flood damages in the city of Des Moines and the potential benefits are likely to exceed the costs. The feasibility study should also address environmental restoration opportunities of wildlife and aquatic habitat, reduction of maintenance costs, elimination of safety hazards, and improved interior drainage.

In addition to the problems discussed above, following is a list of other problems that have been identified in the study area but are not addressed in the 905(b) Analysis. These problems would be addressed in the subsequent feasibility study.

- Low-density residential neighborhoods in the Fourmile Creek flood plain on the city's east side experience repeated flooding. This has resulted in rundown properties and hard-to-maintain public infrastructure (roads and utilities) to service these areas.
- The north bank along the Des Moines River between E 6th Street and E 14th Street is eroding and threatening the stability of the existing levee.
- The existing non-Federal Des Moines River levee in the Central Place area is not adequate to protect homes and businesses from flooding. The city has constructed pumping stations to handle interior drainage.
- The storm water detention basins south of the Des Moines River near SE 14th Street do not drain properly and are expensive to maintain.
- The levee west of the Des Moines River at Martin Luther King Parkway is not adequate to protect homes from flooding.
- The homes and businesses along the eastern bank of Walnut Creek near Grand Avenue are subject to flooding.
- The level of flood protection throughout the city of Des Moines is variable and undefined in some areas. The city desires an assessment of their flood control facilities to determine the current levels of protection.
- The rivers are underutilized from a recreational and environmental aspect due to the degraded habitat in some locations.

As discussed in Appendix A, Des Moines has identified a number of areas requiring additional flood protection and desired projects and actions to remedy the problems. Some of these desired projects may not necessarily be in the Federal interest; however, in order to provide a comprehensive evaluation of the City's needs, the feasibility study would address and evaluate these projects and actions.

b. Alternative Plans: For the purpose of this 905(b) Analysis, only two potential projects were evaluated at the concept level for reducing the flood damages: the Wastewater Treatment Plant area and the Birdland Park area. The alternative plans for each potential project are as follows:

(1) Reducing Flood Damages at the Wastewater Treatment Plant:

Alternative A: Placing erosion protection, such as riprap, along approximately 4,000 feet of levee and riverbank to protect it from erosion. This alternative may also include increasing the height of the existing levee to provide the required functional reliability.

Alternative B: Placing improved jetties to deflect the river away from the levee. This alternative may also include increasing the height of the existing levee to provide the required functional reliability.

Alternative C: No Federal Action. Under this alternative, the Corps of Engineers would not participate in efforts to provide flood protection or environmental restoration in the study area. The existing project would remain the responsibility of the city of Des Moines. The expected future conditions with no Federal action are discussed in paragraph 5.a above.

Other alternatives, including relocating the WWTP away from the river, constructing a backup WWTP or holding area for emergency use, floodproofing WWTP facilities, replacing eroded levee material as part of an annual maintenance program, and relocating the river away from the WWTP, were not considered viable due to excessive costs, environmental impacts, and low probabilities for success.

(2) Reducing Flood Damages at the Birdland Park Area:

Alternative A: Reconstructing and replacing the existing non-Federal levee system. This alternative would involve constructing approximately 6,000 feet of levee embankments and 1,400 feet of floodwalls with appurtenant storm drain gates, street closures, and other related structures.

Alternative B: No Federal Action. Under this alternative, the Corps of Engineers would not participate in efforts to provide flood protection or environmental restoration in the study area. The existing project would remain the responsibility of the city of Des Moines. The expected future conditions with no Federal action are discussed in paragraph 5.a above.

Other alternatives, including relocating homes and businesses, increasing the channel capacity of the Des Moines River, increasing storage volume in Saylorville Reservoir, and floodproofing structures were not considered viable due to excessive costs, environmental impacts, and low probabilities for success.

c. Evaluation of Alternatives:

(1) Reducing Flood Damages at the Wastewater Treatment Plant: Preliminary analyses indicate that Alternative A can be accomplished at a total first cost of

approximately \$4,000,000. Alternative B can be accomplished at a total first cost of approximately \$5,500,000. Due to the catastrophic magnitude of the potential impacts to people and business, and for repair/recovery costs to the WWTP in the case of a levee failure, it appears that the benefits of protecting the levee from erosion will be greater than the costs of providing that protection. Major flood damage reduction benefits will accrue to protection of public facilities, uninterrupted wastewater treatment for over 305,000 people, and reduction of potential environmental and health hazards. Placement of erosion protection at the WWTP would require coordination with appropriate natural resource agencies in compliance with the National Environmental Policy Act (NEPA). Environmental impacts of this work are expected to be minimal with proper environmental practices.

(2) Reducing Flood Damages at the Birdland Park Area: Preliminary analysis indicates that the proposed alternative can be accomplished at a total first cost of approximately \$3,300,000. More detailed hydrologic modeling of the Des Moines River, which includes 1993 flooding observations, indicates a greater frequency of severe flooding. This finding, linked with the magnitude of damages which occur in the Birdland Park area, indicates that structural protection solutions will likely be justified for Federal participation. Major benefit categories will include flood damage reduction to residences, commercial and industrial properties, and public school property. The annual benefits will likely well exceed \$200,000. Reconstructing and replacing the levee system at Birdland Park will require coordination with appropriate natural resource agencies in compliance with the NEPA. Environmental impacts of this levee improvement work are expected to be minimal with proper environmental practices.

The feasibility phase will include a thorough survey, investigation, and assessment of HTRW in the vicinity of the projects. Any properties with HTRW issues will be avoided if possible. During the feasibility phase, environmental design features will be incorporated into the project. Coordination with U.S. Fish and Wildlife Service, environmental groups, the Iowa Department of Natural Resources, and other State and local officials will occur to develop environmental restoration and recreational features in the design. Designs to restore aquatic habitat in the Des Moines River will be investigated. Recreational features such as trails, access points, and signing will also be investigated.

6. FEDERAL INTEREST: Flood damage reduction projects are a high priority in the Administration's budget policy. The proposed alternatives are consistent with Federal laws, regulations, and policies, and no negative environmental impacts are anticipated. The preliminary analysis indicates that the benefits of proposed flood damage reduction efforts will exceed project costs, and that they can be accomplished in a cost effective and efficient manner.

7. PRELIMINARY FINANCIAL ANALYSIS: The City Council of the City of Des Moines has indicated its willingness to serve as a local sponsor for the feasibility study. The Council has indicated by letter of intent, dated November 6, 1998, that it understands the feasibility and construction cost-sharing responsibilities and is willing to enter into

negotiations for the feasibility phase of the investigation. A copy of the letter of intent is enclosed as Appendix B.

The sponsor is aware that they will be responsible for 50% of the costs for feasibility phase studies. The sponsor is also aware that they will be responsible for all lands, easements, rights-of-way, relocations, and disposal areas for the project (LERRD), plus a cash contribution of a minimum of 5% of total project costs (after authorization of construction). In the event that LERRD costs plus 5% of total project costs do not equal at least 35% of total project costs, the sponsor is aware that they must contribute additional cash to equal 35%. The sponsor is also aware that they will be responsible for operating and maintaining the project at 100% non-Federal expense upon completion of construction.

8. RECOMMENDATIONS: Based on the results of this 905(b) Analysis, a viable and implementable plan can be developed that will meet the necessary Federal interest criteria and will be fully supported by the local sponsor. Therefore, I recommend that this 905(b) Analysis be approved and certified as a basis for developing the Project Study Plan (PSP), negotiating and finalizing the Feasibility Cost Sharing Agreement (FCSA) with the local sponsor, and proceeding to the feasibility phase of the study.

The feasibility study will employ a comprehensive approach to developing plans for flood damage reduction, environmental restoration, and related water resources improvements throughout the city of Des Moines, Iowa, with an emphasis on structural solutions in the vicinity of the Wastewater Treatment Plant and Birdland Park. The feasibility study is estimated to cost up to \$2,400,000 and is expected to be completed within 24 months of receipt of Federal and non-Federal funds. These estimates will be refined in the PSP.

9. POTENTIAL ISSUES AFFECTING INITIATION OF FEASIBILITY PHASE: There are no known issues affecting the initiation of the feasibility phase. Preliminary discussions with the sponsor indicate no issues which would preclude signing the FCSA.

10. PROJECT AREA MAP: A project area map is enclosed as Figure 1.

James V. Mudd
Colonel, U.S. Army
District Engineer

Enclosures

Figure 1 - Project Area Map
Appendix A - City of Des Moines Council Resolution 99B
and Citywide Flood Protection Report
Appendix B - Letter of Intent