



**US Army Corps  
of Engineers** ®  
St Paul District

# FARGO-MOORHEAD METROPOLITAN AREA RECONNAISSANCE STUDY

**Section 905(b) Analysis  
(Water Resources Development Act (WRDA) of 1986)**

**North Dakota and Minnesota**

March 2008  
Revised April 2008





**DEPARTMENT OF THE ARMY**  
MISSISSIPPI VALLEY DIVISION, CORPS OF ENGINEERS  
P.O. BOX 80  
VICKSBURG, MISSISSIPPI 39181-0080

REPLY TO  
ATTENTION OF:

CEMVD-PD-SP

APR 8 2008

MEMORANDUM FOR Commander, St. Paul District, ATTN: CEMVP-PM-A

SUBJECT: Reconnaissance Study, Fargo-Moorhead Metropolitan Area,  
North Dakota and Minnesota

1. Reference memorandum, CEMVP-PM-A, 13 March 2008, subject as above (encl).
2. The Mississippi Valley Division (CEMVD) has reviewed the revised report. In accordance with memorandum, CECW-MVD, 3 May 2004, subject: Delegation of Approval Authority for Section 905(b) Reports, CEMVD approves the Section 905(b) analysis for the Fargo-Moorhead Metropolitan Area, North Dakota and Minnesota.
3. As you negotiate the scope, schedule and budget for the feasibility study, the following guidance should be applied and comments considered:
  - a. The City of Moorhead, Minnesota, should be made fully aware that the upcoming feasibility study may not result in a recommendation for Federal implementation of a project.
  - b. Non-structural flood risk management measures should be fully addressed in the feasibility study.
  - c. EC 1105-2-407 requires that all planning models must be certified. Since the study will primarily address flood risk management, the National Flood Risk Management Planning Center of Expertise (FRM-PCX) should be contacted regarding certification of any planning models used for the studies.
  - d. EC 1105-2-408 requires that Review Plans be prepared and included in the Project Management Plan for the study. Since this study primarily addresses flood risk management, the FRM-PCX must concur in the Review Plan, the Review Plan must be approved by the MVD Commander, and then posted on the MVP, FRM-PCX, and HQ website.
  - e. Flood damage and levee/floodwall elevations should be referenced to their correct geodetic vertical datum (ex. 893.0 feet NGVD29).

CEMVD-PD-SP

SUBJECT: Reconnaissance Study, Fargo-Moorhead Metropolitan Area,  
North Dakota and Minnesota

f. Supporting H&H data (frequency profiles and frequency curves) used in the economic analysis should be included in the report.

g. Alternative plans that apply to a subset of the study area, e.g., Fargo only, must consider adverse impacts on other areas in the study area.

h. Mitigation may be needed for riparian forest impacts.

i. Cultural analysis will require further evaluation.

j. The authority includes "flood control, water supply, waste water management, and allied purposes." It does not specifically include environmental restoration. Paragraph 8.c. should be qualified by adding "within the extent allowed by allied project purposes and authority." The last sentence in paragraph 5.d.3. should include at the end "and project authority."

4. Point of contact is Robert Petersen, CEMVD-PD-SP, (601) 634-5286.



Encl

CHARLES B. BARTON  
Chief, St. Louis, Rock Island, St. Paul  
District Support Team

CF:  
CECW-MVD (w/copy of 905(b) analysis)

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ATTACHMENT A: Sponsor Letter of Intent

**FARGO-MOORHEAD METROPOLITAN AREA  
NORTH DAKOTA AND MINNESOTA  
RECONNAISSANCE STUDY**  
**Section 905(b) (Water Resources Development Act (WRDA) of 1986) Analysis**

**1. STUDY AUTHORITY**

This Section 905(b) (WRDA) Analysis was authorized by a September 30, 1974, Resolution of the Senate Committee on Public Works:

RESOLVED BY THE COMMITTEE ON PUBLIC WORKS OF THE UNITED STATES SENATE, That the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review reports on the Red River of the North Drainage Basin, Minnesota, South Dakota and North Dakota, submitted in House Document Numbered 185, 81st Congress, 1st Session, and prior reports, with a view to determining if the recommendations contained therein should be modified at this time, with particular reference to flood control, water supply, waste water management and allied purposes.

The Fargo-Moorhead metropolitan area was included in the Red River Basin Reconnaissance Study approved on September 19, 2002, but the level of detail in that report was insufficient to recommend a feasibility study specifically for measures in Fargo, North Dakota, and Moorhead, Minnesota. Supplemental study activities in the study area began in June 2007.

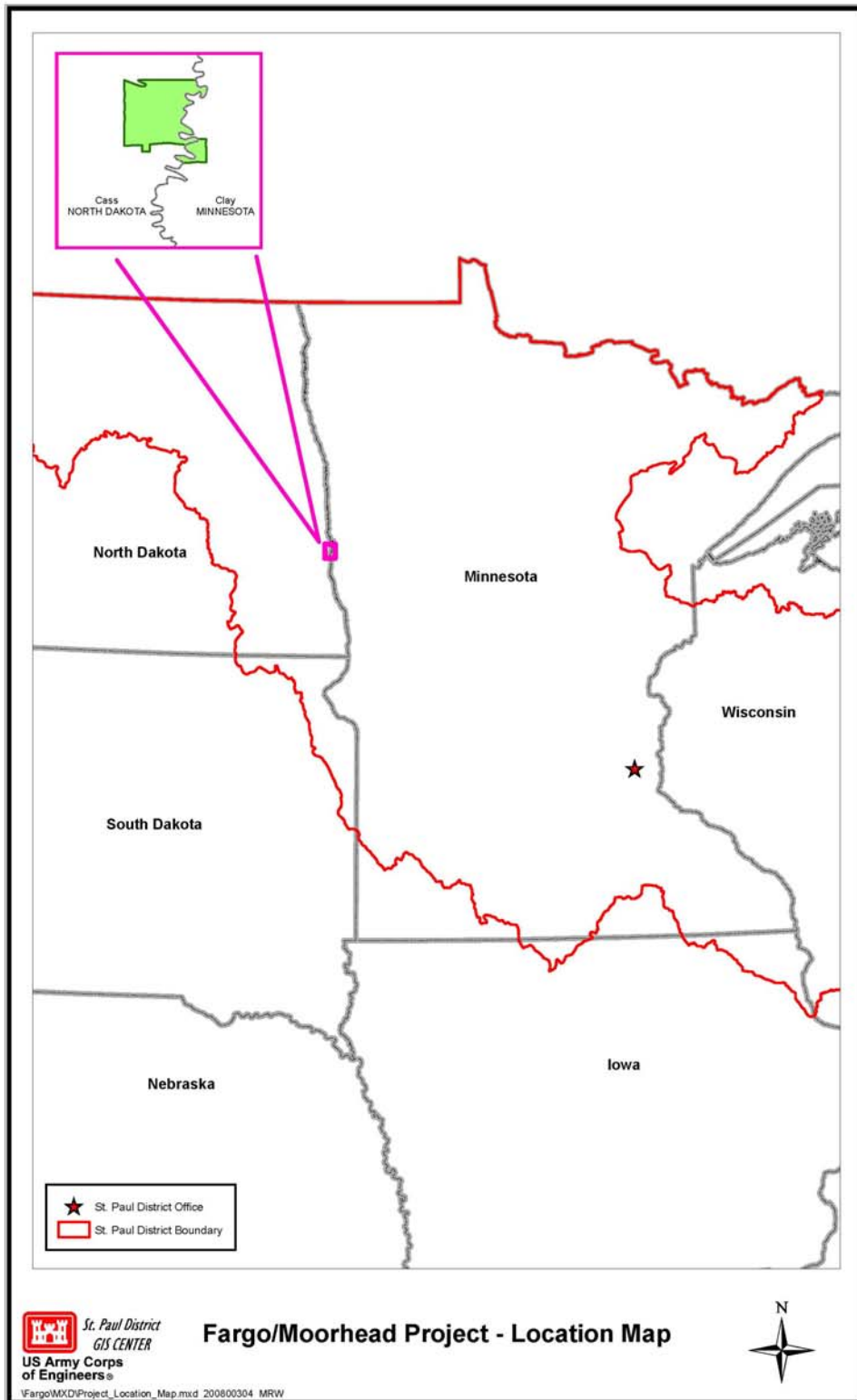
**2. STUDY PURPOSE**

The purpose of this reconnaissance study is to evaluate the potential for Federal interest in implementing solutions to flooding, ecosystem degradation, and other related water resource problems and opportunities in the vicinity of the Fargo-Moorhead metropolitan area. The reconnaissance report documents water resource problems in the study area and the determination as to whether the problems warrant additional Federal study. To recommend more detailed feasibility studies, the reconnaissance effort must also identify non-Federal partners willing to participate financially.

**3. LOCATION OF STUDY, NON-FEDERAL SPONSOR AND CONGRESSIONAL DISTRICTS**

The study area is the Fargo-Moorhead metropolitan area and communities in the vicinity. Fargo-Moorhead is located on the Red River of the North, but the Wild Rice, Sheyenne, Maple and Rush Rivers in North Dakota and the Buffalo River in Minnesota also cross the study area. Figure 1 shows the study area.

Figure 1: Fargo-Moorhead location



The non-Federal sponsors for the feasibility phase of the study are the cities of Fargo and Moorhead.

The study area is located in the At Large Congressional District of North Dakota (Congressman Earl Pomeroy – D) and Minnesota’s Seventh Congressional District (Congressman Collin Peterson – D).

#### **4. PRIOR REPORTS AND EXISTING PROJECTS**

##### **a. Reports**

Since the 1940s, the Corps of Engineers and others have prepared numerous reports on the Red River of the North basin. The following reports contain the most relevant information for the current effort:

1. House Document 185, 81st Congress, 1st Session, dated May 24, 1948. This report proposed a comprehensive plan for the Red River of the North basin. The plan included channel improvements, levees and floodwalls in Fargo and Moorhead. Other components of the plan included the Orwell Reservoir on the Ottertail River in Minnesota; channel improvements on the lower Sheyenne, Maple and Rush Rivers in North Dakota; channel improvements on the Mustinka, Ottertail, Wild Rice, Marsh and Sand Hill Rivers in Minnesota; channel improvements along the Bois de Sioux and upper Red Rivers near Wahpeton, North Dakota/Breckenridge, Minnesota; and local flood protection works on the Red River in Grand Forks, North Dakota/East Grand Forks, Minnesota. The study found that channel improvements along the lower 31.6 miles of the Wild Rice River in North Dakota were economically justified, but the majority of affected local interests did not support the project, so it was not recommended. The report specifically recommended no further investigations in the Buffalo River basin and several other basins in Minnesota.

2. Section 205, Flood Control Reconnaissance Report, Red River of the North at Fargo, North Dakota, Corps of Engineers, May 1967. This study evaluated the potential to build a portion of the levee in Fargo that had been approved as part of the 1948 comprehensive plan but was later omitted from the constructed project. The study concluded that the proposed project was not economically feasible and did not warrant further Federal involvement at that time.

3. Fargo-Moorhead Urban Study, Corps of Engineers, May 1985. This study was a cooperative Federal, State and local planning effort aimed at developing viable solutions to water and related land resource problems, needs and concerns for 1980 to 2030. The study area encompassed 13 townships in Cass County, North Dakota, and Clay County, Minnesota. The study addressed water supply, water conservation, flood risk management, energy conservation and water resources data management. The study evaluated the potential to construct levees, floodwalls and channel modifications in Fargo and Moorhead. The report concluded that extremely long levees or floodwalls would be required to ring the urban areas to provide adequate protection from larger floods, and the costs would greatly exceed the damages prevented. Therefore, Federal participation in Fargo and Moorhead

flood risk management projects was not recommended. However, the report did support further studies for flood control in Harwood and Rivertree Park, North Dakota.

4. “Living with the Red,” International Joint Commission, November 2000. In June 1997, following record-setting flooding on the Red River of the North, the governments of Canada and the United States asked the International Joint Commission (IJC) to examine and report on the causes and effects of damaging floods in the Red River basin, and to make recommendations on means to reduce, mitigate and prevent harm from future flooding.” The IJC established the International Red River Basin Task Force to undertake the necessary studies. The task force produced its report in April 2000. The IJC’s report, entitled “Living with the Red,” was completed in November 2000. These reports included discussion of the flooding in the Fargo-Moorhead area. The report cited hydraulic and hydrologic analyses conducted after the 1997 flood that indicated flood risks in the Fargo-Moorhead area were likely greater than previously thought. The report supported a basin-wide flood mitigation approach including reduction in flows, strengthening of existing protection structures, and use of other techniques. The report recommended that Federal, State and local governments should “expedite the study of flood risk potential and implement plans for flood protection measures for the Fargo-Moorhead area.”

5. Reconnaissance Study, Red River Basin, Minnesota, North Dakota, South Dakota, Corps of Engineers, September 2001. This study, supported by supplemental information, was approved in October 2002. The study recommended three initial feasibility studies to be followed by additional studies throughout the basin. Only the initial three studies were approved in 2002. The additional proposed studies would be considered for approval on the basis of additional 905(b) analyses. The Fargo-Moorhead and Upstream feasibility study, currently underway, was one of the initial studies recommended and approved in the reconnaissance study.

6. Final Environmental Impact Statement (FEIS) for the Red River Valley Water Supply Project, U.S. Department of the Interior, Bureau of Reclamation, December 21, 2007. The purpose of the proposed project is to meet the comprehensive water quality and quantity needs of the Red River Valley through the year 2050. The needs were identified as municipal, rural and industrial water; water quality; aquatic environment; recreation; and water conservation measures. The preferred alternative would import water to the Red River basin from the Missouri River via the Garrison Diversion and the Sheyenne River.

7. Fargo-Moorhead Downtown Framework Plan Update, Fargo-Moorhead Council of Governments, City of Fargo, and City of Moorhead, June 2007. This report builds upon earlier planning efforts in both Fargo and Moorhead. Many of the concepts presented depend on implementation of effective flood risk management strategies.

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b. Current Studies

The following studies are being conducted:

1. Fargo-Moorhead and Upstream Feasibility Study, Corps of Engineers. The study began in August 2004. The study area is the entire headwaters of the Red River of the North upstream (south) of the Fargo-Moorhead metropolitan area. The major tributaries are the Mustinka, Bois de Sioux, and Ottetail Rivers in Minnesota and the Wild Rice River in North Dakota. The study is evaluating alternatives that would restore wetland habitat and reduce flood damages. The major underlying assumption is that a system of surface water storage sites upstream of Fargo-Moorhead would reduce flood stages and flood damages downstream. It is also assumed that water storage could be accomplished in ways that would restore aquatic ecosystems and increase habitat for wildlife. Phase 1 analyses, completed in June 2005, showed that distributed flood storage could provide significant economic benefits, but additional study of environmental benefits is needed to justify a Federal project. The North Dakota State Water Commission and the city of Moorhead are jointly sponsoring the study. Additional cost-share partners include the Southeast Cass Water Resource District; Richland County Water Resource District; Red River Joint Water Resource District; city of Fargo; Buffalo-Red River Watershed District; Bois de Sioux Watershed District; Minnesota Department of Natural Resources; Minnesota Board of Water and Soil Resources; Minnesota Pollution Control Agency; South Dakota Department of Game, Fish, and Parks; and Red River Basin Commission.

2. Fargo Southside Flood Control Project, City of Fargo, North Dakota. Since the 1997 flood, the city of Fargo and the Southeast Cass County Water Resource District have been planning for a flood risk management project to protect developments in the area south of Fargo and north and west of the Wild Rice River up to 4 miles south of its confluence with the Red River. Several alternatives have been explored, including combinations of levees, diversion channels, channel modifications, and flood storage.

3. Oakport Township, Minnesota. The Buffalo-Red River Watershed District is working on a flood risk management reduction project for Oakport Township. The project would be designed to protect areas of town to a level equal to the 1997 flood plus 3 feet. The watershed district is still finalizing levee alignments for two ring levees on either side of Oakport Coulee. The project would also include buying some homes that cannot be protected by the levee system. A Corps of Engineers study performed under the Section 205 Continuing Authority was terminated in December 2002 after it was determined that national economic benefits were insufficient to support further Federal efforts.

4. Flood Insurance Study Update, Federal Emergency Management Agency (FEMA). FEMA is updating the flood insurance maps for the Fargo-Moorhead area. As a result of recent flood events and revised hydrologic and hydraulic modeling, FEMA is likely to increase the 1-percent-chance flood elevation on the order of 1 foot above the current administratively determined elevation.

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c. Existing Water Resource Projects

1. The Lake Traverse project, including White Rock Dam and Reservation Dam, provides flood storage at the headwaters of the Bois de Sioux and Red River of the North. The project was authorized by the 1936 Flood Control Act, and construction was completed in 1948. The project is operated by the Corps of Engineers, St. Paul District.

2. Baldhill Dam and Lake Ashtabula provide water storage for flood control and water supply on the Sheyenne River. The project was authorized by the 1944 Flood Control Act, and construction was originally completed in 1951. The dam was modified in 2004 to raise the flood control pool by 5 feet. (The pool raise was part of the Sheyenne River project.)

3. The Orwell Dam provides water storage for flood control and water supply on the Ottertail River. The dam was included in the Corps' 1947 comprehensive plan for the Red River basin and authorized by the Flood Control Acts of 1948 and 1950. Construction of the dam was completed in 1953; it provides 8,600 acre-feet of storage.

4. Fargo levees: The Corps participated in a permanent flood control project completed in Fargo in 1963. The project was recommended in the Corps' 1947 comprehensive plan for the Red River basin and authorized by the Flood Control Acts of 1948 and 1950. The project included four channel cutoffs, the Midtown Dam, and a 3,500-foot levee east of Fourth Street South between First Avenue South and Tenth Avenue South. The top of levee is at approximately a 40.0-foot stage. The city later extended the levee south to Thirteenth Avenue. Fargo has several other publicly and privately owned sections of levee throughout the city. The current line of protection has top elevations that vary from a stage of 30 feet to 42 feet, but several reaches are at or below 37 feet. (Note: the proposed new FEMA 1-percent-chance flood stage is expected to be approximately 39.3 feet.)

5. Moorhead levees: There are no federally constructed levees in Moorhead. The Corps proposed an 1,800-foot-long levee in the 1947 comprehensive plan for the Red River basin. It was authorized by the Flood Control Acts of 1948 and 1950, but the city declined to participate in the project. The city has built four small levees and several lift stations and control structures on storm water lines that can be closed or operated during high-water events. The city has also installed valves on the sanitary sewer lines at several individual flood-prone residences to prevent floodwater from inundating the system. The city also builds emergency levees when necessary.

6. The Sheyenne River project was authorized by the 1986 Water Resources Development Act. The project originally included four components: a 5-foot raise of the Baldhill Dam flood control pool; a dam to provide approximately 35,000 acre-feet of storage on the Maple River; a 7.5-mile flood diversion channel from Horace to West Fargo, North Dakota; and a 6.7-mile flood diversion channel at West Fargo. The Southeast Cass Water Resource District and the St. Paul District, Corps of Engineers, signed cost share agreements for the West Fargo Diversion project in 1988 and the Horace to West Fargo Diversion in 1990. The projects were essentially completed in 1993 and 1994. A pump station was added

to the West Fargo project in 2003 and emergency generators were provided in 2007. The Maple River dam was deauthorized in 2002 for Federal participation, and the Southeast Cass Water Resource District completed the project without Federal assistance in 2007. These projects protect the cities of Horace and West Fargo and the west side of Fargo from Sheyenne River flooding. From Horace to West Fargo, the system is designed for a 1-percent-chance event plus 2 feet. At West Fargo, the channel and left bank levee contain the 1-percent-chance event plus 2 feet, and the right bank levee is higher, providing the city with protection from the Standard Project Flood plus 3 feet.

7. A Section 208 (1954 Flood Control Act) clearing and snagging project was completed in Fargo-Moorhead in 1991 to remove trees affected by Dutch elm disease. Dead and dying trees were removed along a 9.7-mile reach of the Red River of the North.

8. Three Section 14 (1946 Flood Control Act) emergency streambank protection projects were completed in Fargo between 2001 and 2003. Erosion from the Red River of the North occurred at three separate project locations. At Reach A, erosion along 4,100 feet of riverbank threatened a levee near 37<sup>th</sup> Avenue. At Reach B, erosion along a 950-foot reach threatened Kandi Lane and North Broadway and utilities located beneath them. At Reach C, erosion along a 1,900-foot reach threatened Elm Street between 13<sup>th</sup> and 17<sup>th</sup> Avenues North and the utilities located beneath it. The erosion progressed to within 50 feet of the roadway. The projects involved shaping the banks and placing rockfill or granular fill and riprap along the eroded areas.

9. Two Section 206 (1996 Water Resource Development Act) aquatic ecosystem restoration projects were implemented to improve fish passage over two dams on the Red River within the metropolitan area. Rock slope fishways were constructed at the 12<sup>th</sup> Avenue North Dam and the 32<sup>nd</sup> Avenue South Dam in 2002 and 2004, respectively. A similar fishway was constructed at the Midtown Dam in 1998 without Corps construction assistance.

10. A Section 205 (1948 Flood Control Act) small flood control project is planned for Fargo's Ridgewood neighborhood. The project will tie into a reconstructed floodwall at the Department of Veterans Affairs hospital; the floodwall is under construction.

## **5. PLAN FORMULATION**

### **a. Introduction**

During a study, six planning steps that are set forth in the Water Resource Council's Principles and Guidelines are repeated to focus the planning effort and eventually to select and recommend a plan for authorization:

1. Specify problems and opportunities.
2. Inventory and forecast conditions.
3. Formulate alternative plans.
4. Evaluate effects of alternative plans.
5. Compare alternative plans.
6. Select recommended plan.

The iterations of the planning steps typically differ in the emphasis that is placed on each of the steps. In the early iterations, those conducted during the reconnaissance phase, the step of specifying problems and opportunities is emphasized. That is not to say, however, that the other steps are ignored because the initial screening of preliminary plans that results from the other steps is very important to the scoping of the follow-on feasibility phase studies. The subparagraphs that follow present the results of the initial iterations of the planning steps that were conducted during the reconnaissance phase. This information will be refined in future iterations of the planning steps that will be accomplished during the feasibility phase.

b. Study Area Description

1. General. Fargo and Moorhead are on the west and east banks, respectively, of the Red River of the North approximately 453 river miles south of the mouth of the river at Lake Winnipeg in Manitoba, Canada. The drainage area of the Red River of the North above the U.S. Geological Survey gaging station at Fargo is approximately 6,800 square miles, of which about 2,175 square miles do not contribute to runoff.

2. Red River Basin. The Red River of the North flows generally northward in the fertile Red River Valley, forming a meandering border between North Dakota and Minnesota. The river valley is the bed of the former glacial Lake Agassiz. At its maximum extent, Lake Agassiz was about 700 miles long, 200 miles wide, and 650 feet deep. The Red River of the North drains into Lake Winnipeg, which is a remnant of Lake Agassiz. The characteristic fertile soil and exceptionally flat topography in this area are a result of its glacial history. At Fargo-Moorhead, the river bottomland is very narrow, generally 1,000 to 2,500 feet, and the adjacent terrain rises only 25 to 30 feet before becoming part of a plain that slopes toward the river at an average of 3 to 7 feet per mile. The north-south axis of the river valley bed has a gradient of about 1½ feet per mile. As a result of meandering, the river at Fargo-Moorhead has a channel gradient of about 1/2 foot per mile. The annual mean flow of the Red River of the North at Fargo-Moorhead for the period of record (1901 to the present) averages approximately 677 cubic feet per second (cfs). The channel capacity of the Red River of the North in the Fargo-Moorhead area is about 7,000 cfs.

3. Climate. The study area is in a region classified as a subhumid to humid continental climate with cold winters and moderately warm summers. Rapid changes in daily weather patterns are common. Frequent passage of weather fronts and high and low pressure systems result in a wide variety of weather. The average temperature between November and March is below 32° F, resulting in an average of 185 days per year at or below 32°F. The average temperature of the warmest month, July, is 71.1°F. The annual average normal temperature of 41.2°F reflects the northern location of the study area. On an annual basis, the prevailing wind at Fargo is from the north and northwest. The average annual

precipitation in the Fargo area is about 19.5 inches. Nearly three-fourths of the annual precipitation occurs between April and September, with the remainder occurring during the winter. The average annual snowfall is about 50 inches.

4. Demographics. Fargo is ranked as the largest city in North Dakota according to the 2000 Census information. Moorhead is directly across the Red River from Fargo. The 2000 population of Fargo, the county seat of Cass County, is 90,599. Cass County's 2000 population totaled 123,138. The 2000 population of Moorhead, the county seat of Clay County, is 32,177. Clay County's 2000 population totaled 51,229. Fargo and Moorhead are both growing communities and function as a health, educational, cultural, and commercial center serving southeastern North Dakota and west-central Minnesota.

c. National Objectives

1. The national or Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Contributions to National Economic Development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

2. The Corps has added a second national objective for Ecosystem Restoration in response to legislation and administration policy. This objective is to contribute to the nation's ecosystems through ecosystem restoration, with contributions measured by changes in the amounts and values of habitat.

3. The Water Resource Council's Principles and Guidelines include two additional accounts that must be assessed in plan formulation: regional economic development and other social effects. While these accounts are not strictly considered "national objectives," they may be used to identify locally preferred plans and plans that are in the national interest for reasons other than NED or Ecosystem Restoration.

d. Problems and Opportunities

1. Input was received through coordination with stakeholders and potential sponsors in the study area. In June 2007, Corps representatives gathered existing information and conducted a workshop with several stakeholders, including representatives of the following jurisdictions:

North Dakota

Fargo  
West Fargo  
Cass County  
Southeast Cass Water Resource District  
North Dakota State Water Commission

Minnesota

Moorhead  
Oakport Township  
Buffalo-Red River Watershed District

## 2. Flood problems and opportunities

(a) The primary problem identified by stakeholders was flooding. Average annual flood damages in the Fargo-Moorhead metropolitan area are estimated at more than \$22 million (Fargo-Moorhead and Upstream Feasibility Study, Phase 1 report, Corps of Engineers, September 2005). The Fargo-Moorhead metropolitan area has a relatively high risk of flooding. The highest river stages usually occur as a result of spring snowmelt, but summer rainfall events have also caused significant flood damages. The Red River of the North has exceeded the National Weather Service flood stage of 17 feet in 49 of the past 105 years, and every year from 1993 through 2007. The study area is between the Wild Rice River, the Sheyenne River, and the Red River of the North; interbasin flows complicate the hydrology of the region and contribute to extensive flooding.

(b) Fargo and Moorhead have become accustomed to dealing with flooding. Sufficient time is usually available to prepare for flood fighting because winter snowfall can be monitored to predict unusual spring runoff. Both communities have well documented standard operating procedures for flood fights. Both communities avoided major flood damages in the historic flood of 1997 by either raising existing levees or building temporary barriers. Since the 1997 flood, both communities have implemented mitigation measures, including acquisition of almost 100 floodplain homes, raising and stabilizing existing levees, installing permanent pump stations, and improving storm sewer lift stations and the sanitary sewer system. Although emergency measures have been very successful, they may also contribute to an unwarranted sense of security that does not reflect the true flood risk in the area.

(c) The record-setting Red River of the North flood stage in 1997 at Fargo was 39.6 feet on the Fargo gage. The current FEMA 100-year flood stage on the Fargo gage is 38.3 feet, but the revised 100-year stage is expected to be approximately 1 foot higher. (Modeling conducted by the Corps of Engineers indicates that the actual 1-percent-chance stage could be as much as 2.5 feet higher than the current FEMA figure.) Fargo's current line of protection has top elevations that vary from a stage of 30 feet to 42 feet, but several reaches are at or below 37 feet. The Second Street area near City Hall has only a 30-foot level of protection, and emergency levees have been built there eight times since 1969. Many places along the line of protection rely on private sandbag levees during a major flood event. The city has a list of several "low elevation" properties adjacent to the river that it would like to buy to install higher flood protection; these properties are bought as they come onto the market. Newer developments in the southern part of the study area have been elevated above the anticipated floodplain elevation, but the city infrastructure (roads, sewers, etc.) is still at risk. The cities of Briarwood, Frontier and Prairie Rose, North Dakota, are also at risk of flooding from the Wild Rice and Red Rivers.

(d) The area north and northwest of Fargo is also susceptible to flooding from both the Sheyenne and Red Rivers. The West Fargo diversion of the Sheyenne River Flood Control Project, completed in 1993, prevented breakout flows from the Sheyenne River from flooding Fargo and West Fargo in 1997. Measures would be needed to

extend a line of protection from the West Fargo levee system to Interstate 29 (I-29) to provide 100-year protection from the Red River of the North.

(e) Moorhead sits on relatively higher ground compared to Fargo. Most of Moorhead's developed areas are above the 100-year flood stage, but the 500-year floodplain south of Interstate 94 (I-94) extends east almost to 20<sup>th</sup> Street South. North of I-94 the 500-year floodplain generally extends east of 14<sup>th</sup> Street. During a 100-year flood stage, it is anticipated that I-94 would be inundated, eliminating a major thoroughfare and possible evacuation route. Moorhead has no permanent Federal flood risk management project. Most of the land along the river is residential development, and private sandbag levees or other private measures provide most of the line of protection. Flooding through the sanitary sewer system is a significant concern in Moorhead, because several residences have walkout basements adjacent to the river. If these basements are flooded, water can enter the sanitary sewer and affect homes far from the surficial floodplain. Moorhead has a draft plan for a voluntary program for buyouts and assistance to build private levees/floodwalls. The city has identified properties it would like to obtain and/or target for construction, but reaction to the proposed program has been mixed. The program will be considered for the 2008 budget cycle, and the city has not yet officially adopted it. Flooding from the Buffalo River to the east of Moorhead is not a significant concern in the city. Drainage projects in this area have been improved to address any historic flooding issues.

(f) Oakport Township (population 1,689) is north of Moorhead. Oakport sustained \$3.7 million in damages in the 1997 flood. High water from the Red River of the North and Oakport Coulee damaged 150 homes and isolated 200 others. The Buffalo-Red River Watershed District is working on plans to address flooding in Oakport.

(g) Stakeholders indicated a desire to quantify and qualitatively describe the magnitude of risk that flooding poses to the Fargo-Moorhead metropolitan area using risk-based analyses similar to those being used in the New Orleans, Louisiana, area. They believe that traditional NED analyses would not capture the full magnitude of impacts to this study area such as impacts to the regional economy, social impacts and environmental effects. Base on this information, the use of a Risk Informed Decision Making (RIDM) could be used to further analyze those issues and to develop a risk based decision in the feasibility study.

### 3. Ecosystem restoration problems and opportunities

Stakeholders did not raise any environmental problems or opportunities during this reconnaissance study. The study area is largely urban or targeted for future development. Most of the riverbank is undeveloped and publicly owned; much of the riparian area is park land. Land use and development plans for the study area recognize the value of "green space" along the river and incorporate preservation and recreational use of these areas. Recent Corps projects at the three dams in the study area have improved fish passage, and streambank protection projects have reduced erosion and stabilized portions of the riverbank. Future planning efforts will look for opportunities to restore aquatic ecosystems and riparian areas consistent with Corps policy and project authority.

Figure 2: Proposed 1-percent-chance and 0.2-percent-chance flood areas - Fargo

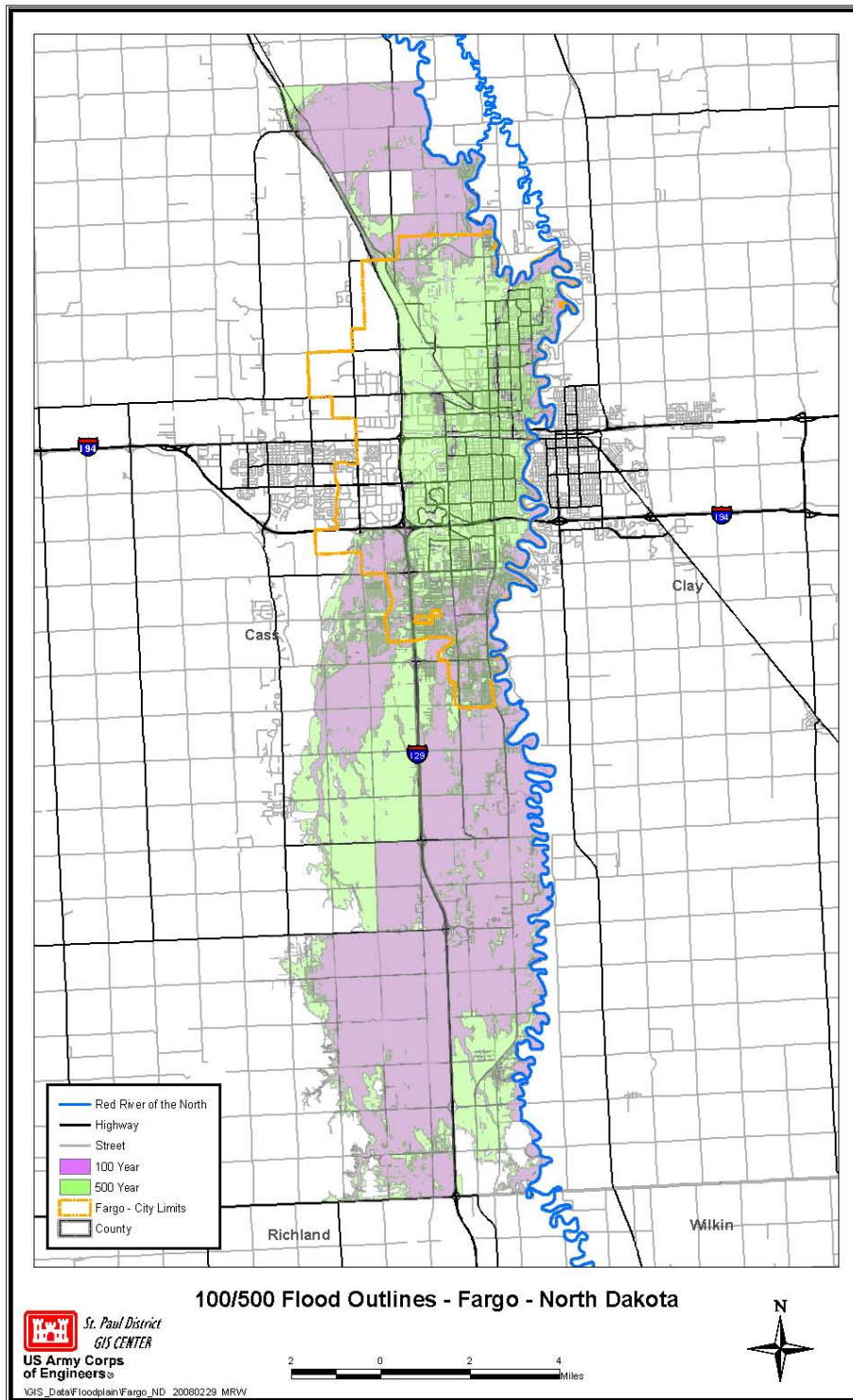
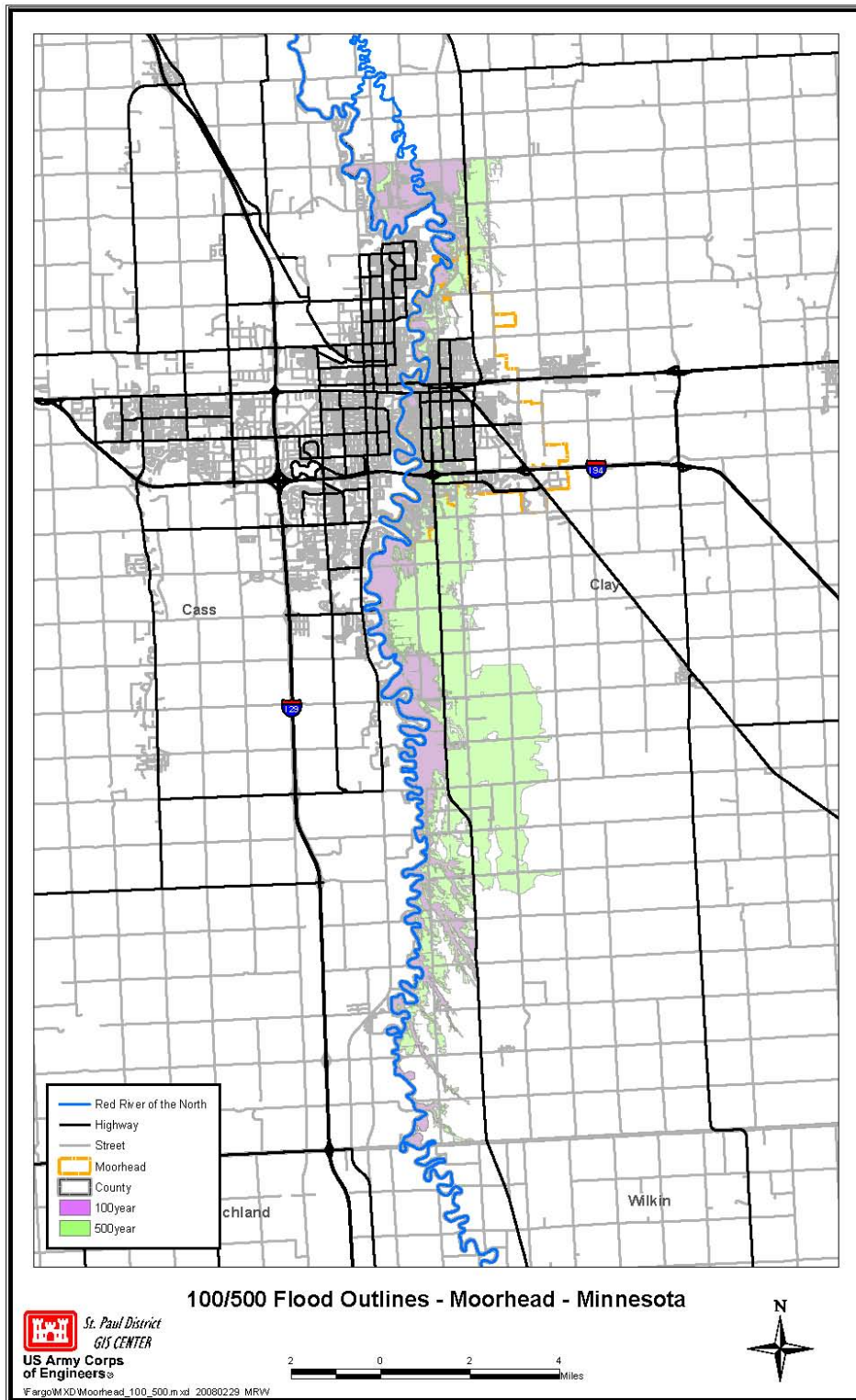


Figure 3: Proposed 1-percent-chance and 0.2-percent-chance flood areas - Moorhead



#### 4. Future without-project conditions

(a) The Fargo-Moorhead metropolitan area is expected to grow steadily in the future. Between 2000 and 2005, approximately 9,500 permits were issued to construct homes in Fargo, West Fargo and Moorhead. The Fargo-Moorhead Downtown Framework Plan Update of June 2007 projects that the metropolitan area's population will increase from 174,000 people in 2000 to more than 218,000 in 2015. Much of that development is expected in areas between the 100-year and 500-year flood elevations.

(b) Without a comprehensive flood risk management project in the area, the metropolitan region will continue to be subject to flooding and will rely on emergency responses to ensure the safety of the community. These emergency efforts will eventually be overwhelmed, and the area could experience a disaster similar to the 1997 flood in Grand Forks and East Grand Forks. A disaster of that magnitude would cause significant damage and would impact the entire region. It is expected that the average annual damages of more than \$22,000,000 will continue and increase as a result of additional development between the 100-year and 500-year flood elevations.

(c) Local projects to reduce flood risk are being planned, but implementation is uncertain without financial assistance from State and Federal sources. This includes the Southside Flood Control Project in Fargo with an initial estimated cost upwards of \$150,000,000. It is anticipated that the communities will continue to use best practices and make minor modifications to enhance their overall flood protection whenever possible. It is assumed that no projects will be implemented that will have any appreciable impact on the study area or the benefits of a possible Federal project. Additional efforts to reduce flood stages by storing water upstream are also being evaluated. Phase 1 of the Corps' Fargo-Moorhead and Upstream feasibility study determined that significant stage reductions could be obtained, but the economic benefits would not likely support Federal participation solely for flood risk management. The study is now considering the potential for ecosystem restoration and looking for synergistic solutions to both flooding and historic loss of native aquatic habitat.

#### e. Planning Objectives

The national objectives of NED and Ecosystem Restoration are general statements and not specific enough for direct use in plan formulation. The water and related land resource problems and opportunities identified in this study are stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities and represent desired positive changes in the without-project conditions. The planning objectives are specified as follows:

1. Reduce flood damages in the Fargo-Moorhead metropolitan area.
2. Restore or improve degraded riverine and riparian habitat in and along the Red River of the North, Wild Rice River (North Dakota), Sheyenne River (North Dakota), and Buffalo River (Minnesota).

f. Planning Constraints

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated. The planning constraints identified in this study are as follows:

1. Avoid increasing peak Red River flood stages.
2. Comply with the Boundary Waters Treaty of 1909 and other pertinent international agreements.

g. Measures to Address Identified Planning Objectives

A management measure is a feature or activity at a site that addresses one or more of the planning objectives. A wide variety of measures was considered. The descriptions and results of the evaluations of the measures considered in this study are presented below:

1. No Action. The Corps is required to consider the option of “No Action” as one of the alternatives to comply with the requirements of the National Environmental Policy Act (NEPA). No Action assumes that the Federal Government would implement no project to achieve the planning objectives. No Action, which is synonymous with the Without-Project Condition, forms the basis from which all other alternative plans are measured.

2. Nonstructural flood risk management measures include things such as buying and relocating flood-prone structures, flood proofing, elevating structures, employing flood warning systems, drainage controls and flood insurance. Agricultural best management practices, such as vegetative buffers and modified land use and tillage practices in the larger watershed, could be effective at reducing sediment along with improving water quality and ecosystem functions. Nonstructural measures alone would not meet the overall planning objectives. However, all of these measures should be considered for integration with structural measures to maximize effectiveness of the alternatives.

3. Structural measures include constructing large-scale reservoirs, small-scale flood storage, and levees and diversion channels to reduce peak flows or direct floodwaters away from damageable property. Several such measures have already been implemented to provide benefits to the study area, as described earlier in this report. All of these measures have the potential to reduce flood damages; however, not all are likely to be economically justified. The following structural measures were considered:

- Continue emergency measures
- Flood barriers
  - Short levee segments
  - Second-line levees
  - Continuous levee
  - Floodwalls

- Invisible floodwalls
- Gate closures
- Pump stations
- Increase conveyance
  - Diversion channels around the study area
    - In Minnesota
    - In North Dakota
  - Increased conveyance in Oakport Coulee
  - Cutoff channels (to short-cut existing meanders)
  - Dredging the river channel
  - Flattening slopes on river bank
  - Replacing bridges
- Flood storage
  - Large dams upstream
  - Distributed storage

#### h. Preliminary Plans

1. The communities in the study area have proposed several flood risk management projects. Many of the proposals would fill gaps in the existing levee system that must currently be plugged on an emergency basis. Flood storage and ecosystem restoration in the entire upper Red River watershed is being studied in the Fargo-Moorhead and Upstream feasibility study, currently underway. Because the budget for this reconnaissance study was limited, the cities of Fargo and Moorhead chose two preliminary plans to investigate for the initial screening:

- Fargo requested an initial screening of a levee and floodwall plan in the Second Street North area, from the railroad embankment near Fifth Avenue North to the water treatment plant at 13<sup>th</sup> Avenue South. The proposed line of protection includes raising the Corps levee constructed in 1961.
- Moorhead requested an initial screening of a levee and floodwall plan in the Horn Park area south of I-94.

#### 2. Preliminary economic analysis

(a) This analysis intends to determine whether there may be a Federal interest in providing flood protection at selected areas in Fargo-Moorhead. Federal interest exists at the reconnaissance study stage if a project can be found to be economically feasible. Benefits and costs are expressed in October 2007 price levels. An interest rate of 4-7/8 percent is used for annualizing project benefits and costs, and the planning period is 50 years. This analysis follows the procedures as directed in ER 1105-2-100.

(b) Fargo: The Fargo study area consists of the area generally bounded by the Red River of the North on the east; I-94 on the south; 17<sup>th</sup> Street South, 25<sup>th</sup> Street South, and 15<sup>th</sup> Street North to the west; and the Burlington Northern-Santa Fe railroad

tracks to the north. This area is divided into a north reach and a south reach by Main Avenue, which runs east-west.

(1) The north reach includes damageable property consisting of 226 residential structures, 28 apartment buildings, 348 commercial/industrial properties, and 22 public property units including the civic center and city hall. The north reach does not have permanent flood protection. During flood emergencies, temporary levees are built along Second Street to protect this area from floodwaters. The low ground elevation along this reach at which flood damage is expected to start is estimated to be 893.0 (NAVD 88).

During the initial analysis completed as part of this report, it was discovered that the area that would be affected in the Fargo North Reach would be larger than initially thought because of sanitary sewer connections. The area affected, at a minimum, should have been extended up to 11<sup>th</sup> Avenue North, which is approximately six blocks north of the Burlington Northern-Santa Fe railroad tracks. This additional area would more than double the initial size of the North Reach and contains a number of residential, commercial, and public structures including a hospital. It was determined that including this additional information would exceed the costs of this study and would not influence the final recommendation. Therefore, further analysis of this reach is not included in this report. However, the information does prove useful because it points out the need to further analyze the interconnections of the sanitary sewer, the various levels of protection and how flooding in one area could affect areas of the city that perceivably lay behind a greater level of protection.

(2) The south reach encompasses an area consisting of 4,508 residential structures, 125 apartment buildings, 223 commercial properties, and 40 public property units. The south reach has areas that are lower in elevation for which a line of protection consisting of levee/floodwall has been constructed. A portion of this protection has been constructed by the Corps and the remainder by the city. Top of levee/floodwall elevation is 903.0 (NAVD 88), the level of protection assumed for the without-project condition.

Figure 4: Fargo Initial Screening Area

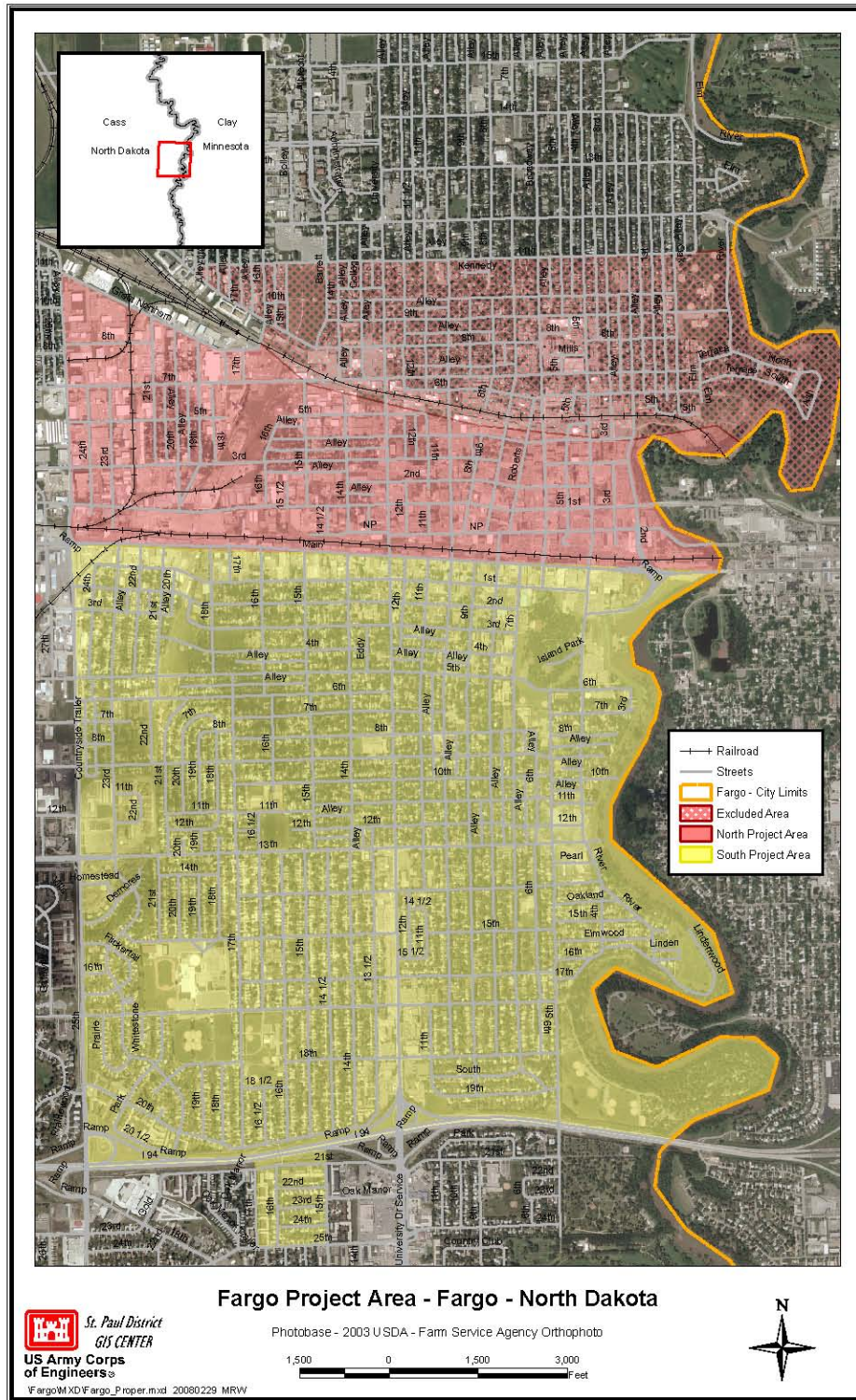


Figure 5: Moorhead Initial Screening Area



(c) Moorhead: The study area for the economic analysis consists of two neighborhoods in Moorhead on either side of I-94. The area north of I-94 is bounded by I-94, Eighth Street South, and 24<sup>th</sup> Avenue South (North Reach). The area south of I-94 is bounded by 37<sup>th</sup> Avenue South, Eighth Street South, I-94, and the Red River of the North (South Reach). The 100-year flood elevation in this area is estimated at 903.5 (NAVD 88).

(1) The North Reach includes 64 residential units and 3 commercial units. Of the residential units, 22 are adjacent to the river. The proposed project in this reach would be a non-structural solution that would provide sewer cut offs to prevent the backup of floodwaters through the sanitary sewers. The 22 residential units adjacent to the river would not receive any flood damage reduction benefit from the proposed project because they would still be exposed to the river. The remaining 42 residential units and 3 commercial units would be benefited by those non-structural measures designed to prevent backup of floodwaters through the sanitary sewer system into their basements. However, because this plan is only a non-structural plan they would not be protected from direct overland flooding.

(2) The South Reach of the Moorhead study area includes 229 residential units, 15 apartment buildings, 20 commercial units, and 2 public units. Of the residential units, eight would be bought out to allow room for the proposed levee. Structures in this reach would receive flood damage reduction benefits from the levee (top of levee set at 906.0) and from non-structural measures to prevent sewer backup into basements included in the North Reach.

(d) Metropolitan Area: The average annual flood damages in the Fargo-Moorhead metropolitan area were estimated to be more than \$22 million in 2005. If a project were able to capture all those benefits based on a 50-year period of analysis and the current interest rate of  $4 \frac{7}{8}$ , a project with a total cost of \$410 million could be justified. Although not fully analyzed in this report, it is possible that a diversion channel in combination with levees could achieve a large portion of those benefits and be in the Federal interest.

#### (e) Flood Damage/Benefit Analysis Initial Screening

(1) Separate HEC-FDA models were developed for the Fargo and Moorhead portions of the study area to calculate average annual flood damages and benefits for the proposed levee project. Detailed structure data (inventory, ground elevations, and structure values) were obtained from the cities of Fargo and Moorhead in 2005 for use in the Fargo-Moorhead and Upstream Feasibility Study (currently ongoing). These data were used for the present study. Also used from the feasibility study was a set of eight water surface profiles for flood events ranging from 2-year to 500-year recurrence intervals. From these profiles, HEC-FDA created the necessary rating curves and frequency-discharge relationships that serve as input for the calculation of average annual damage, see Table 1 for water surface profiles and Table 2 for discharge frequency information. Table 3 displays flood damage by selected flood events for the various study area reaches and damage categories. Note that the residential category includes damages for both residential structures and apartment buildings.

Station	0.2	0.1	0.04	0.02	0.01	0.004	0.002
449.0	887.6	890.2	893.1	896.6	898.8	900.4	901.9
451.0	888.4	891.1	894.0	897.7	900.1	901.9	903.8
453.0	889.7	892.5	895.5	899.6	902.4	904.6	906.8
455.0	890.5	893.3	896.3	900.5	903.3	905.5	907.7
457.0	891.1	893.9	897.0	901.2	904.0	906.2	908.5
459.0	892.1	894.9	898.1	902.4	905.2	907.2	909.4

Exceedance	Discharge	Confidence Limit Curves (standard error)			
Probability	(cfs)	-2 SD	-1 SD	+1 SD	+2 SD
0.999	3,521	3,517	3,519	3,523	3,525
0.990	3,528	3,524	3,526	3,530	3,532
0.950	3,535	3,531	3,533	3,537	3,539
0.900	3,538	3,535	3,536	3,540	3,541
0.800	3,542	3,539	3,541	3,543	3,545
0.700	3,545	3,543	3,544	3,546	3,548
0.500	3,550	3,078	3,305	3,813	4,095
0.300	6,116	4,657	5,337	7,009	8,032
0.200	8,500	6,693	7,543	9,579	10,794
0.100	11,500	9,019	10,184	12,986	14,664
0.040	16,000	10,098	12,711	10,140	25,351
0.020	24,300	13,634	18,202	32,441	43,310
0.010	31,600	16,396	22,762	43,869	60,903
0.004	41,500	19,812	28,674	60,063	86,930
0.002	57,400	24,768	37,706	87,381	133,023
0.001	77,811	30,498	48,714	124,288	198,525

<u>Fargo - South</u>	<u>25-Year</u>	<u>50-Year</u>	<u>100-Year</u>	<u>500-Year</u>
Residential	0	0	0	404,804,000
Commercial	0	0	0	34,753,500
Public	0	0	0	22,940,400
Total	0	0	0	462,497,900
<u>Moorhead – North</u>				
Residential	0	1,135,300	1,609,900	4,088,100
Commercial	0	0	0	0
Public	0	0	0	0
Total	0	1,135,300	1,609,900	4,088,100
<u>Moorhead - South</u>				
Residential	279,300	6,403,000	17,226,800	29,333,100
Commercial	10,100	230,900	621,200	1,057,800
Public	3,100	70,100	188,700	321,300
Total	292,500	6,704,000	18,036,700	30,712,200

(2) Average annual damages and benefits as evaluated by HEC-FDA are summarized in Table 4. Levels of protection assumed for the levees are 100-year plus 3 feet for the Fargo South reach and 100-year plus 1.5 feet for the Moorhead reach. Protection in Moorhead is limited by the availability of adjacent high ground.

	<u>Residential</u>	<u>Commercial</u>	<u>Public</u>	<u>Total</u>
<u>Fargo-South</u>				
Existing	\$2,111,300	\$245,600	\$162,100	\$2,519,000
With Project	1,236,400	166,000	115,800	1,518,200
Benefit	874,900	79,600	46,300	1,000,800
<u>Moorhead</u>				
Existing	452,400	14,600	4,400	471,400
With Project	228,000	10,500	3,500	242,000
Benefit	224,400	4,100	900	229,400

(f) Benefit-Cost Ratio

The Fargo South reach levee project can be constructed as a separate stand alone increment. The Moorhead project, although analyzed as separate reaches, is

intended as a single project consisting of flood damage reduction measures in both the north and south reach. Benefits, costs, and benefit-cost ratios are presented as such in Table 5 below. Results of the economic analysis show the potential for a federally justified project in Fargo-Moorhead.

It is important to recognize that with the large average annual damages to the metropolitan area it is likely that a system-wide approach will be able to deliver a better system of protection to the region. Although the analysis contained in this report only focuses on small portions of the metropolitan area, it should be understood that those portions are only one piece of the much larger system.

These evaluations provide some insight about alternative plans that warrant further evaluation, but it is important to note that the plans evaluated thus far were not optimized and that other plan combinations including different measures should be evaluated in future studies. Those other plans may be more feasible than any of the plans considered in this report; for example, a full diversion plan alternative or a diversion plan that does not require major in-town levees and associated interior flood control features could be in the Federal interest and should be carefully aligned and optimized in future detailed studies.

Table 5 - Calculation of Benefit-Cost Ratio		
	Fargo	Moorhead
	<u>South Reach</u>	<u>Horn Park</u>
Project First Costs	\$ 8,870,882	\$ 6,758,141
Int. During Const. *	<u>435,090</u>	<u>331,467</u>
Total Investment	9,305,972	7,089,608
Average Annual Costs		
Int and Amort *	499,938	380,870
O&M *	<u>44,354</u>	<u>33,791</u>
Total	544,292	414,661
Average Annual Benefits	1,000,800	229,400
Benefit-Cost Ratio	<b>1.84</b>	<b>0.55</b>
Net Benefits	456,508	(185,261)
* Note: Interest during construction assumes 2-year construction period		
: Annual O&M calculated as Project First Costs x 0.5 percent		
: Interest and amortization calculated at 4-7/8 percent over 50-year life		

### 3. Preliminary environmental and cultural analyses

(a) The Red River of the North and adjoining valley is a valuable natural resource to eastern North Dakota and northwestern Minnesota. The Red River, on its meandering northerly path to Lake Winnipeg, provides the region with fertile agricultural lands, wildlife and fisheries habitat, and a source of potable surface water. The remaining wooded riparian areas are an important wildlife and aesthetic resource. The riparian woodlands are essentially the only wooded habitat remaining in this predominantly agricultural area. Woodland was probably never very common in the prairie environment, but it is extremely important as nesting, breeding, and overwintering habitat for a number of birds, mammals, and reptiles.

(b) The project area is urban with residential, public, and commercial development. The area near the river is more natural with riparian vegetation. Riverbanks range from vegetated to eroded. The riparian zone is typical of an urban area with a mixture of trees, shrubs, and grasses. Agricultural activities, urban, and rural development, and the construction of flood risk management projects have altered the terrestrial and aquatic ecology of the area. Agricultural activities have resulted in the conversion of primarily grassland and wetland. The construction of flood risk management projects including levees, cutoffs, clearing and snagging, and erosion protection have changed many areas of the river and riparian zone and resulted in the loss of riparian woodland habitat. The fishway projects constructed at the three dams in the study area have improved fish access to various habitats needed during their life cycles.

(c) The majority of the natural resource impacts from the projects analyzed would be caused by the construction of levees and floodwalls and placement of the shore protection; some terrestrial and aquatic habitat in the project's footprint would be lost. The construction areas are predominantly urban developed and would require the removal of some trees. Project lands would be planted with trees to help offset these losses. It is not anticipated that the construction would have any long-term adverse effect on the aquatic resources of the area.

(d) The Fargo Second Street project area lies in the heart of the original town site settled in the early 1870s. Fargo's Riverfront Development Master Plan indicates that several historical and archaeological sites are in the area. We are aware of other significant cultural resources in the Fargo-Moorhead area from work on other projects. Special investigations will be required to address this issue during the feasibility study.

#### i. Conclusions from the Preliminary Screening

1. The preliminary screening indicates that at least one levee/floodwall plan considered has strong potential for implementation and the other two plans considered could possibly be justified based on new flood elevations and the additional information that would be gathered as part of further analysis. Other reaches not yet investigated will also likely be feasible. Based on this information, alternatives to address the planning objectives appear

viable, and the likelihood of a Federal project being justified in the Fargo-Moorhead Metropolitan area is strong.

2. Additional measures to reduce flood stages in the larger study area may also be warranted. The budget for this reconnaissance study did not allow consideration of such measures as diversions or other channel and bridge modifications that could reduce water surface elevations. Because the floodplain is extremely flat and highly developed in the study area, relatively infrequent flood events pose a large residual risk. It is anticipated that most of Fargo and communities upstream in North Dakota will be in the 100-year floodplain after FEMA completes its update of floodplain mapping. The lack of natural high ground and the meandering path of the river make levee-type projects expensive and less effective at reducing flood risk. In most of the study area, the land that would be needed for levee or floodwall projects is occupied by residential or commercial development. These factors make achieving significant flood risk reduction impractical using levees alone. Measures that would reduce water surface elevations to reduce damages from larger flood events less frequent than the 1-percent-chance event should be investigated. Such alternatives have the potential to benefit the entire study area.

## **6. FEDERAL INTEREST**

There is a Federal interest in conducting a feasibility study to reduce the flood risk in the Fargo-Moorhead area. Fargo is the largest urban area in North Dakota, and the metropolitan area is a major economic and social engine in the region. The Federal Government has assisted in several emergency flood fights in the study area in recent years. Based on the preliminary screening of alternatives, it appears likely that project alternatives could be developed that would be consistent with Army policies, costs, benefits, and environmental impacts.

## **7. SPONSOR INTENT**

As the non-Federal sponsors, the cities of Fargo and Moorhead will be required to provide 50 percent of the cost of the feasibility phase. The non-Federal sponsors are also aware of the cost share requirements for potential project implementation. Letters of intent from the non-Federal sponsors stating a willingness to pursue the feasibility study and to share in its cost and also indicating an understanding of the cost sharing that is required for project construction are included as Attachment A.

## **8. FEASIBILITY STUDY ASSUMPTIONS**

The following critical assumptions would provide a basis for a feasibility study:

a. The feasibility study would be conducted in two phases.

1. Phase 1 will assess the existing flood risk in the Fargo-Moorhead metropolitan area and the potential to reduce flood stages in the near future. This assessment

will include modeling efforts and updating structural inventories. The study will consider a range of alternatives including but not limited to Red River diversions around the metropolitan area, channel and structure modifications, and nonstructural measures. The initial phase will determine the potential for future stage reductions that would affect the economic analyses of other alternative plans.

2. Phase 2 will identify measures to be taken in addition to the larger plan. Measures will include but not be limited to specific levee/floodwall reaches and other structural and nonstructural measures to further reduce flood risk in the study area.

3. Sponsorship for the initial study will involve a partnership of several stakeholders representing the entire metropolitan area through third-party agreements.

b. Additional feasibility studies, either specifically authorized or under Continuing Authorities, will be used to develop specific plans as separable projects emerge from the initial study. It is likely that sponsorship of the secondary studies will be limited to jurisdictions affected by the specific project.

c. All feasibility studies will identify and address environmental opportunities that can be incorporated in the proposed plans within the extent allowed by allied project purposes and authority.

d. Feasibility study reports will meet NEPA requirements for either an environmental assessment or environmental impact statement, as appropriate and as prescribed in Engineer Regulation 200-2-2 (Procedures for Implementing NEPA).

e. Feasibility studies will be conducted in accordance with Engineer Regulation 1105-2-100 (Planning Guidance Notebook) and other pertinent guidance.

f. The schedule for feasibility efforts assumes that adequate Federal and non-Federal funds will be made available as needed. Funding shortfalls will increase study duration.

## 9. FEASIBILITY PHASE MILESTONES

It is assumed that the feasibility phase will last approximately 2.5 years and will consist of the following major milestones. Milestones may be added, removed, or modified as the development of the plan and the Project Management Plan (PMP) continues.

<u>Task</u>	<u>Milestone</u>	<u>Initial Date</u>
Recon Report Approval	CW170	14 Apr 08
Develop PMP/PRP		15 Apr 08
FCSA Submittal	CW080	21 Jul 08
FCSA Execution	CW130	01 Oct 08
Begin Feasibility Study/Scoping		01 Oct 08
Feasibility Scoping Meeting		15 Apr 09
Alternative Formulation Briefing	CW190	15 Apr 10

Civil Works Review Board		15 Sep 10
Feasibility Report Approval	CW170	15 Dec 10
Preconstruction Engineering and Design (PED)		31 Aug 10
WRDA Authorization		31 Dec 10

**10. FEASIBILITY PHASE COST ESTIMATE**

Because of the uncertainties regarding the final outcomes of the feasibility study and the potential for a justified project upward of \$400 million, the study team decided to take a phased approach to the feasibility study. Depending on the actual information gathered during the feasibility study, the costs of that study will be modified based on the information provided. It is estimated that a \$400-million project could have a feasibility cost of approximately \$21 million. Based on discussion with the non-Federal sponsors, it was determined that the feasibility study that would focus on completing the modeling efforts, data inventories, completion of the National Environmental Policy Act (NEPA) requirements, cultural coordination efforts, and development of a full range of alternatives with the assumption that the recommended construction cost would be approximately \$75 million. This \$75 million project size was chosen due to the large uncertainties associated with a feasibility study and that fact that it is not realistic to assume that the maximum project size would ultimately be constructed. Based on these assumptions the team has developed the initial cost estimate shown in table 6 below.

Table 6. Initial Feasibility Cost Estimate

Study Task	Total Cost	Corps Cost	Fargo Cost	Moorhead Cost
Public Involvement	75,000	37,500	18,750	18,750
Environmental Studies	350,000	175,000	87,500	87,500
Cultural Studies	325,000	162,500	81,250	81,250
Economic Studies	250,000	125,000	62,500	62,500
Project Management	225,000	112,500	56,250	56,250
Plan Formulation	350,000	175,000	87,500	87,500
Engineering (Total)	2,100,000	1,050,000	525,000	525,000
Survey/Mapping	150,000	75,000	37,500	37,500
GIS	125,000	62,500	31,250	31,250
Modeling (H&H)	450,000	225,000	112,500	112,500
Analysis/Design	1,375,000	687,500	343,750	343,750
Real Estate Studies	200,000	100,000	50,000	50,000
<b>Total</b>	<b>3,875,000</b>	<b>1,937,500</b>	<b>968,750</b>	<b>968,750</b>

**11. VIEWS OF OTHER RESOURCE AGENCIES**

Because of the funding and time constraints of the reconnaissance phase, only limited and informal coordination has been conducted with other resource agencies. Representatives of the North Dakota State Water Commission have expressed interest in studying alternatives

and would likely support a local non-Federal feasibility study sponsor. The U.S. Fish and Wildlife Service was not contacted during the reconnaissance study.

## **12. POTENTIAL ISSUES AFFECTING INITIATION OF FEASIBILITY PHASE**

Continuation of this study into the cost-shared feasibility phase is contingent on an executed feasibility cost share agreement (FCSA). The non-Federal sponsors have indicated their willingness and capability to fulfill their commitments under an FCSA, and no apparent issues would preclude executing an FCSA at this time. Discussions regarding the most advantageous approaches for budgeting and scheduling will take place as the PMP is developed.

## **13. PROJECT AREA MAP**

Maps of the study area are provided as Figures 1 and 2 on pages 2 and 3 of this report.

## 14. RECOMMENDATION

I recommend that this 905(b) Analysis Report be approved as a basis for proceeding with a feasibility study in the Fargo-Moorhead Metropolitan Area. The feasibility study would identify measures to reduce flood damages in the metropolitan area and recommend Federal participation in their implementation where appropriate. The initial study may identify the need for additional studies of specific alternatives that may require separate FCSAs.

Remaining tasks in the reconnaissance phase include developing a PMP and finalizing an FCSA with a non-Federal sponsor. The feasibility phase of the study would begin under the authority of the General Investigations program upon execution of an FCSA and receipt of Federal and non-Federal funds.

Indications are sufficient that cost-effective engineering solutions to water resource problems in the Fargo-Moorhead Metropolitan Area can be formulated that will result in one or more projects with benefits in excess of project costs. The potential solutions described herein are consistent with Army and budgetary policies, and the projects meet criteria for Federal participation in project implementation.

Jon L. Christensen  
Colonel, Corps of Engineers  
District Engineer



# **Attachment A**

# MOORHEAD

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## MINNESOTA

500 Center Avenue, Box 779 • Moorhead, MN 56561  
(218) 299-5166 • TDD/Relay 711  
[www.ci.moorhead.mn.us](http://www.ci.moorhead.mn.us)

March 7, 2008

Jon L. Christenson  
District Engineer  
U.S. Army Engineer District, St. Paul  
190 Fifth Street East, Suite 401  
St. Paul, Minnesota 55101-1638

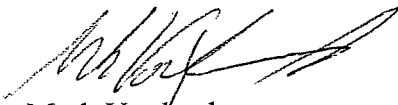
Dear Sir:

The City of Moorhead, Minnesota has reviewed the draft Fargo-Moorhead Metropolitan Area 905(b) Reconnaissance Report and is interested in participating as a non-Federal sponsor in a Corps of Engineers' feasibility study. The study should address the need for a flood damage reduction project in the Fargo-Moorhead Metropolitan Area as generally described in the reconnaissance report. We understand that all feasibility study costs will be shared between the Corps and the non-Federal sponsor on a 50/50 basis, and all or part of the non-Federal cost-share can be provided as cash or in-kind services. If the study ultimately recommends federal participation in construction of a project, we would be willing to serve as a cost-sharing sponsor for the project.

We understand that the Corps will initiate the feasibility phase of study when funds are appropriated by Congress and allocated to the St. Paul District, a Feasibility Cost Share Agreement has been executed between the Corps and the sponsor, and any initially required sponsor contribution has been provided.

We also understand that this letter constitutes an expression of intent and does not represent either a financial or contractual obligation on the part of the sponsor or the Federal government.

Sincerely,



Mark Voxland  
Mayor



Mayor Dennis R. Walaker  
200 3rd Street North  
Fargo, North Dakota 58102  
Phone (701) 241-1310  
Fax (701) 476-4136

March 10, 2008

Col. Jon L. Christenson  
District Engineer  
U.S. Army Engineer District, St. Paul  
190 Fifth Street East, Suite 401  
St. Paul, MN 55101-1638

Re: Fargo-Moorhead Flood Control Feasibility Study  
2<sup>nd</sup>/4<sup>th</sup> Street – 5<sup>th</sup> Avenue North to 14<sup>th</sup> Avenue South  
Fargo Project No. 5683

Dear Col. Christenson:

The City of Fargo, North Dakota has reviewed the draft Fargo-Moorhead Metropolitan Area 905(b) Reconnaissance Report and is interested in participating as a non-Federal sponsor in a Corps of Engineers' feasibility study. The study should address the need for a flood damage reduction project in the Fargo-Moorhead Metropolitan Area as generally described in the reconnaissance report. We understand that all feasibility study costs will be shared between the Corps and the non-Federal sponsor on a 50/50 basis, and all or part of the non-Federal cost-share can be provided as cash or in-kind services. If the study ultimately recommends federal participation in construction of a project, we would be willing to serve as a cost-sharing sponsor for the project.

We understand that the Corps will initiate the feasibility phase of study when funds are appropriated by Congress and allocated to the St. Paul District, a Feasibility Cost Share Agreement has been executed between the Corps and the sponsor, and any initially required sponsor contribution has been provided.

We also understand that this letter constitutes an expression of intent and does not represent either a financial or contractual obligation on the part of the sponsor or the Federal government.

Sincerely,

A handwritten signature in black ink, appearing to read "Dennis R. Walaker".

Dennis R. Walaker  
Mayor

DRW/jmg

C: Mark H. Bittner  
April Walker

