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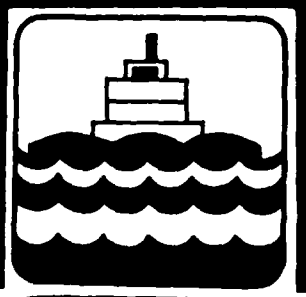

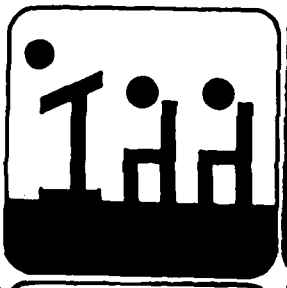

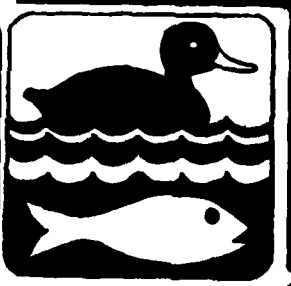

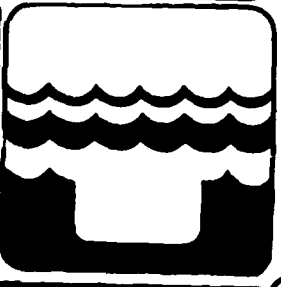

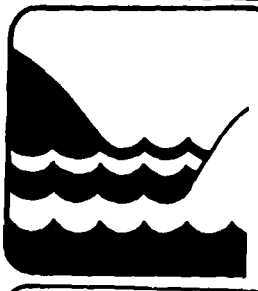

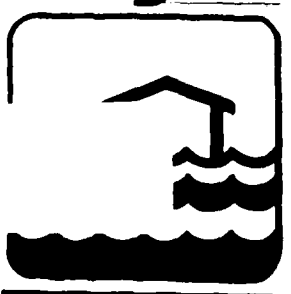

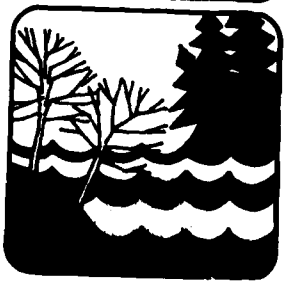

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GREAT I

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The Great I study covers the Upper Mississippi River from Minneapolis/St. Paul, Minnesota to Lock and Dam 10 at Guttenberg, Iowa. The main report describes Great I study organization, the study area, presents findings, conclusions and recommendations of the Great I Team; and provides a guide for implementation of the recommendations.

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VOLUME 1 MAIN REPORT

TECHNICAL APPENDIXES

VOLUME 2
- A. FLOODPLAIN MANAGEMENT
- B. DREDGED MATERIAL USES
- C. DREDGING REQUIREMENTS

VOLUME 3
- D. MATERIAL AND EQUIPMENT NEEDS
- E. COMMERCIAL TRANSPORTATION

VOLUME 4
- F. WATER QUALITY
- G. SEDIMENT AND EROSION

VOLUME 5
- H. FISH AND WILDLIFE

VOLUME 6
- I. RECREATION

VOLUME 7
- J. PUBLIC PARTICIPATION
- K. PLAN FORMULATION

VOLUME 8
- L. CHANNEL MAINTENANCE
  - PART I - NARRATIVE
  - PART II - POOL PLANS AND SITE DESCRIPTIONS - MINNESOTA RIVER, ST. CROIX RIVER, ST. ANTHONY FALLS, AND POOLS 1 AND 2
  - PART III - POOL PLANS AND SITE DESCRIPTIONS - POOLS 3 AND 4
  - PART IV - POOL PLANS AND SITE DESCRIPTIONS - POOLS 5, 5A, 6, AND 7
  - PART V - POOL PLANS AND SITE DESCRIPTIONS - POOLS 8, 9, AND 10

VOLUME 9
- M. ENVIRONMENTAL IMPACT STATEMENT

Preface

The GREAT I final report consists of nine volumes as identified on the outline in each of the report documents. The nine volumes include four documents that provide distinct types of information about our work or our products. Each document is directed at a different audience. The following is to help you determine which segment of the report will be of value to you.

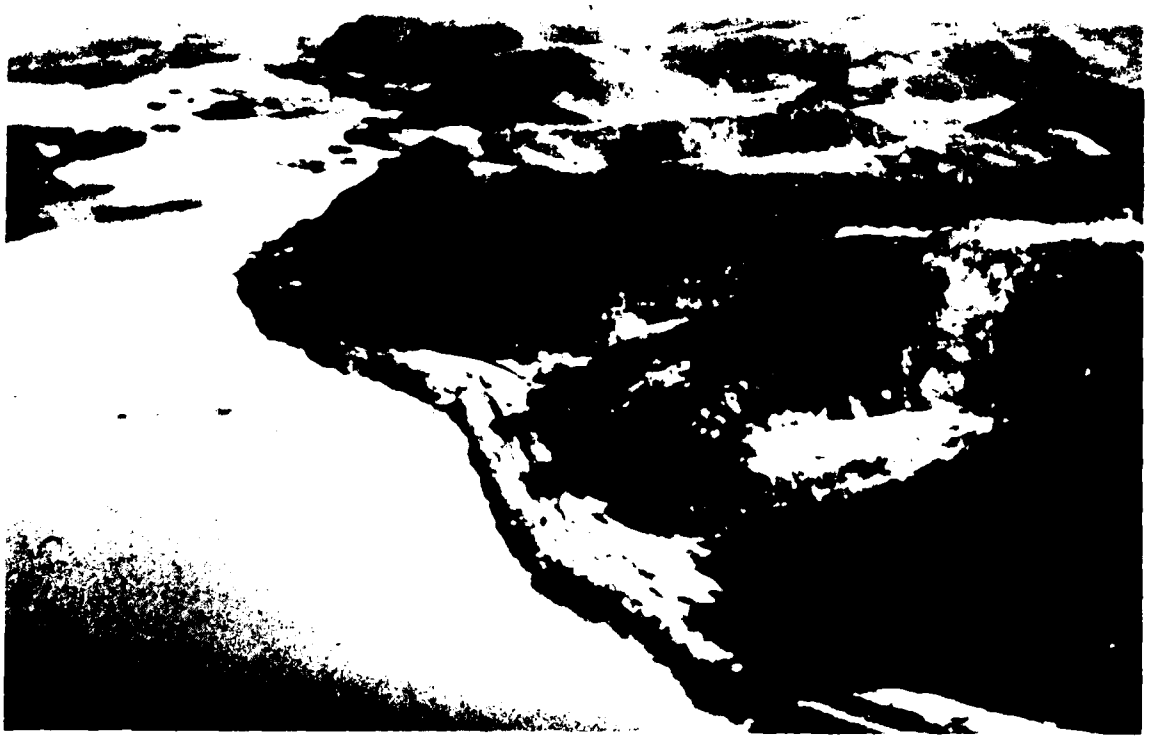
The Main Report (Volume 1) is the most comprehensive description of our efforts and results and provides sufficient information for most analyses of the GREAT I program and proposals. It provides background on the Upper Mississippi River and the GREAT I Study. It also describes the study process; presents the findings, conclusions, and recommendations of the GREAT I Team; and provides a guide for implementation of the recommended actions.

The Work Group Appendixes (Volumes 2-7) provide a large volume of the background information which led to the conclusions and recommendations of the final report. These are reports of the GREAT I Team's 11 technical work groups. They are products of the individual work groups and do not necessarily reflect the views of the GREAT I Team. However, much of the data and assumptions used in developing the recommendations found in the Main Report can be found in the 11 Work Group Appendixes. The appendixes also contain descriptions of the research, special studies, and pilot projects conducted by GREAT I. Many of the work group reports refer to unpublished technical appendixes or contractor reports. Information on these can be obtained through the agency that chaired the particular work group or the Corps of Engineers, St. Paul District Office. Although not indicated on the outline, there was limited printing of Part II of the Fish and Wildlife Work Group Appendix. It is available upon request to those whose direct work on the river might benefit from some of the details contained in this section.

The Channel Maintenance Plan (Volume 8) provides substantial detail on how the navigation channel within the GREAT I area should be maintained and how GREAT I developed this plan. Major emphasis is given to proper placement of dredged material and analysis of cost differences between dredged material placement methods. A summary of this section is contained in the Main Report. The detail contained in Volume 8 is primarily for those involved first-hand with implementing the plan. Therefore, only the narrative, part I, is inclosed with the complete set of GREAT I documents. Parts II through V are available upon request.

The Environmental Impact Statement is included with the GREAT I final report as a supportive document. However, the EIS was prepared by the Corps of Engineers with the assistance of other agencies and is not officially a product of the GREAT I Team. The EIS provides a detailed analysis of the probable impacts of the GREAT I Channel Maintenance Plan. The detail is considered adequate to describe the impacts of implementing the plan. In addition, general information is provided describing other programs and projects recommended by GREAT I to manage much broader aspects of the river. Supplemental details will be required before those items can be implemented.

In addition to the nine volumes discussed above, the GREAT I Team has prepared an Executive Summary titled, "A Public Trust." This summary provides sufficient detail of the GREAT I program to generally explain our objectives, our work, and our products. It should draw attention to the entirety of the program, highlight those items the GREAT I Team considered most important, and direct interested individuals to details in the Main Report.



"As I looked I felt how hopeless art was to convey the soul of such a scene as this and as the poet wishes for the pencil of the artist so did I for the power of descrip(ti)on to tell of the thousand thoughts fast crowding each other from my mind." Captain Meriwether Lewis, Lewis & Clark Expedition

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"Men travel far to see a city, but few seem curious about a river. Every river has, nevertheless, its individuality, its great silent interest. Every river has, moreover, its influence over the people who pass their lives within sight of its waters." H. S. Merriman, The Sowers, Ch. 2

INTRODUCTION

CHAPTER I

CHAPTER I

INTRODUCTION

INTRODUCTION TO THE RIVER

The Mississippi River is the most productive river in the world. The 1.5-million-square-mile drainage basin, which includes all or part of 31 States and a small portion of Canada, produces nearly 75 percent of our gross national product. Besides being one of the greatest food-producing areas in the world, the region has vast oil and gas fields and deposits of salt and sulfur. The productivity of the river, however, goes well beyond economic goods and gross national product. It includes migrating birds such as ducks, geese, swans, egrets, and herons; wildlife such as muskrat, beaver, mink, and otter; and a diversity of fish species such as catfish, carp, northern pike, largemouth bass, and bluegills.

The Mississippi River is probably the best known and most loved river in North America. We are all aware of the important role it played in the development of our country. La Salle, Marquette, Joliet, and other early explorers who used the river are familiar to all of us. We also share an understanding of early life on the Mississippi River from the writings of Mark Twain and other authors of the romantic steamboat era. Those days are kept alive today by the stern-wheeler Delta Queen and by preservation and restoration at many of the riverbank towns.

Although we all have some common views of the Mississippi River, we also have very different views as the river changes character dramatically from one region to another. From its origin in Minnesota's

Lake Itasca to St. Anthony Falls at Minneapolis, Minnesota, it drops about 700 feet in 513 miles flowing through swamps, lakes, and pine forests. The only navigation on this portion of the river is by canoe and other small boats that have to portage around 12 dams.

From the Twin Cities (Minneapolis-St. Paul) to Cairo, Illinois, the Corps of Engineers maintains a 9-foot deep channel for commercial navigation. Above St. Louis, Missouri, modern towboats push barges loaded with grain, coal, and other commodities through the 29 locks and dams necessary to make this reach of the river navigable. From St. Louis to Cairo the river is navigable without the need for locks and dams. Much of the river from the Twin Cities to Cairo is characterized by high bluffs, rolling hills, extensive wetlands, neat prairie farms, forested islands, and magnificent scenery. Industry, which depends on the river for delivery of raw materials or shipment of finished products, flourishes in communities along the river. The Missouri River, which is longer and muddier than the Mississippi River, and the Illinois River, which carries commerce to and from the Great Lakes port of Chicago, Illinois, both join the Mississippi River in this reach.

From Cairo, where the Ohio River joins the Mississippi River, on downstream to New Orleans, Louisiana, the Corps of Engineers maintains a 12-foot navigation channel without the need for locks and dams. The river flows nearly 1,000 miles from Cairo to the sea in giant loops within its 15-mile-wide meander belt. The fertile bottomlands in this reach have been cleared for cotton, sugar cane, and rice. The river is lined by 30-foot-high levees which form a "wall" twice as long as

the Great Wall of China. The river bottom and riverbanks are also stabilized to prevent the river from shifting and destroying man's investments.

The study conducted by GREAT (Great River Environmental Action Team) is concerned with that reach of the Mississippi River from Cairo upstream to Minneapolis. This reach of the river, commonly referred to as the Upper Mississippi River, is maintained for commercial navigation by periodic channel dredging and, above St. Louis, by locks and dams. The Great River Study was further broken down into three separate study areas. This report was prepared by the GREAT I Team which was responsible for study of the river from the head of navigation at Minneapolis downstream to lock and dam 10 at Guttenberg, Iowa.

The Mississippi River has had a major influence on the settlement and growth of the Upper Midwest in the GREAT I area. It has influenced who we are and why we are here. Our lives today have been shaped, in part, by our relationship with this great river, and the river will undoubtedly continue to play a role in our future. We have also shaped the river to serve our needs and will continue to shape the river in the future to meet our needs and satisfy our desires.

Much of the economic productivity of the basin originates within the GREAT I area. The primary commodity moving downriver from this area is grain from the farms of North and South Dakota, Minnesota, Wisconsin, and Iowa. We depend on the river to bring us much of our coal and petroleum products which provide energy for our industries and homes. We use the river to dilute our wastes, provide freshwater supplies, and supply cooling water for electrical production and industrial use.

The GREAT I portion of the river is one of the most productive areas in the Nation for wildlife and fish. Fish and wildlife habitat is abundant; much of it was enhanced by the construction of the commercial navigation system. Much of the area has been set aside as an internationally significant wildlife refuge.

While we want the river to continue to meet our economic needs, we also want it to continue to spawn game fish and maintain the lush marshes and other habitat for egrets, ducks, geese, and eagles. We want to enjoy the beauty of the river by building homes on its banks, yet we are upset when our homes get flooded in the spring, and we often insist on constraining the river more and more by building dikes to protect us. We see the river as a natural playground for recreation boating for the millions of people that live within easy access of the river, but we are disturbed when others crowd us out of the "secluded spot" we have grown to love or when we see recreation pressures infringing on valuable wildlife habitat.

Each year, tributary streams bring millions of cubic yards of material into the river. The river in turn distributes the sand and silt to the main channel, backwater areas, and floodplain lands. To maintain a channel for commercial navigation, the Corps of Engineers removes the accumulated sediment from the main channel and places it on adjacent wetlands and floodplain areas.

Man has influenced the river and has been influenced by the river since the beginning of our history in this area. It would be difficult to imagine the river without our impacts, some of which could be considered positive or negative depending on your own value systems. We have used the river to enhance our standard of living and provide us with recreational opportunities. Although previous actions have enhanced fish and wildlife habitat, we are realizing we may be on the threshold of irreversible deterioration. The

greatest need appears to be for intelligent and rational management of this resource that is so important to our lives.

The Great River Study is one effort at dealing with this need. The GREAT I Team has attempted to address the complex problems of management, preservation, and enhancement in our area of responsibility. Because the river offers us so much we hope our efforts contribute to action to preserve and enhance this system.

"For decades there has been raging on that great river, the greatest river of our country, a dispute between those who represent different wholly legitimate values of that river. Some represent fish and wildlife, and that is certainly a legitimate interest. Some represent recreation and that is certainly a legitimate interest. Some represent transportation.

The truth is that now there is anarchy on that river and it is dog eat dog. The result is needless damage, needless bitterness and unresolved disputes..." Walter F. Mondale, Statement to the Subcommittee on Water Resources, 1976, regarding Lock and Dam #26.

INTRODUCTION TO THE REPORT

This report describes the GREAT I study organization, the study area, the study process, problems addressed, accomplishments, and final conclusions and recommendations resulting from the study. It also includes a guide to implementing the recommendations.

The Upper Mississippi River system is just that - a system. It is not easily divided into individual components. Chapter III discusses the total system and the interrelationship of its parts. For purposes of study management and report presentation, the problems, tasks, conclusions, and recommendations are grouped into three broad categories, as follows:

Natural Resources
Human Resources
River System Management

Where appropriate within these major categories, information is presented under the following subcategories:

CHANNEL MAINTENANCE

SEDIMENT AND EROSION CONTROL

WATER QUALITY

FISH AND WILDLIFE RESOURCES

AESTHETICS

COMMERCIAL TRANSPORTATION

RECREATION

FLOODPLAIN MANAGEMENT

CULTURAL RESOURCES

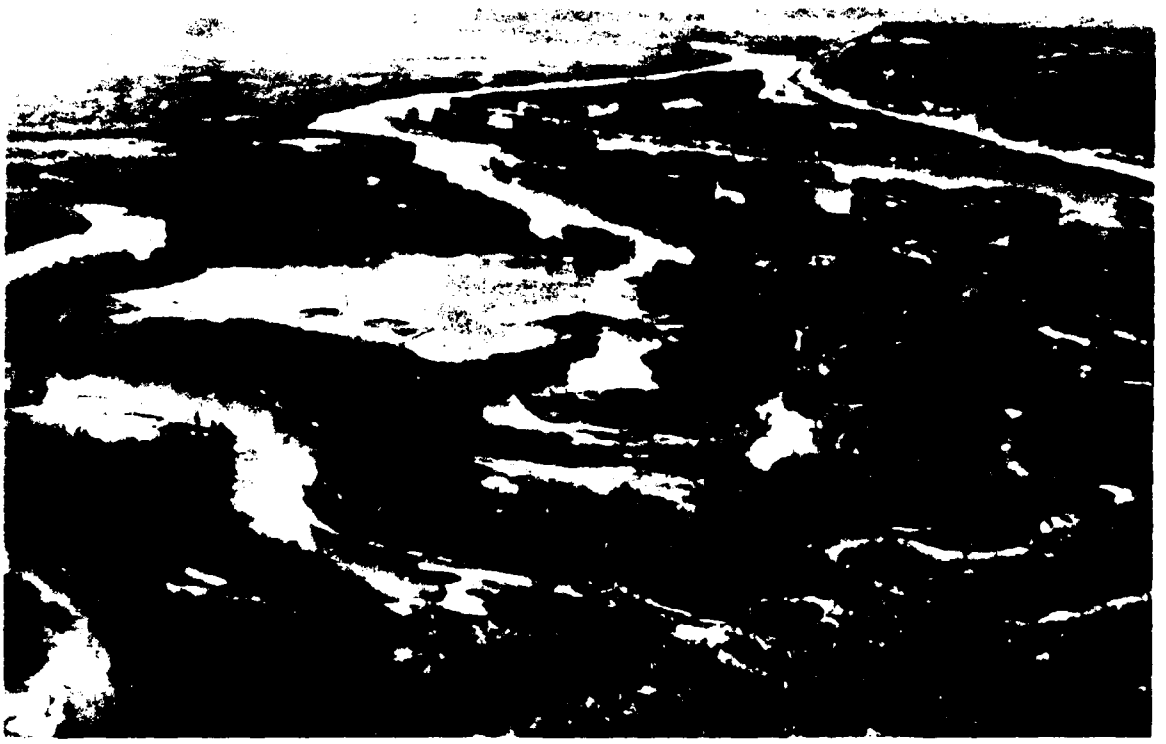
PUBLIC PARTICIPATION

These 10 major management areas make up the total system. When addressed together, they represent components of a "total river resource". The symbols shown next to these subcategories are used through the report. Where appropriate, other subcategories are also discussed without use of symbols.

In preparing this report, the GREAT I Team used information gathered by the work groups. Each work group prepared its own report. These reports are published as appendixes to this report and are referred to where appropriate. Those who wish to gain a further understanding of the study process, tasks, conclusions, and recommendations should review the appropriate appendixes and other reports noted in this document. Finally, in accordance with the requirements of the National Environmental Policy Act and other rules and regulations, a programmatic Environmental Impact Statement has been prepared and is an appendix to this report.

"...I think we should remember that in order to have such a healthy barge system we must have a healthy natural river system.

The river cannot be considered apart from its entire ecosystem, which includes its floodplains and its wetlands." Mrs. Raye-Page, The Wilderness Society, Statement to the Subcommittee on Water Resources, 1976



BACKGROUND OF THE STUDY

CHAPTER II

CHAPTER II

BACKGROUND OF THE STUDY

INTRODUCTION

For many years, conservation organizations, commercial fishermen, biologists, and sportsmen have expressed deep concern over the environmental impacts of the methods used to operate and maintain the navigation waterway system of the Upper Mississippi River. Their concerns were directed to the U.S. Army Corps of Engineers, the agency assigned to carry out the navigation mandate for Congress. Under the shadow of a lawsuit initiated against the Corps by the State of Wisconsin in 1973, the Corps St. Paul and Rock Island Districts accelerated preparation of environmental impact statements in accordance with the National Environmental Policy Act of 1969. The statements described the effects of the operation and maintenance program on the Upper Mississippi River. These documents revealed that sediment from uplands and stream banks, as well as current methods of channel maintenance (especially dredging and placement of dredged material), were damaging the fragile backwaters, marshes, and sloughs for which the river is famous. The environmental impact statement also revealed that little information was available on many other components of the river. The lack of information would make it almost impossible for government agencies or Congress to evaluate alternative means to manage the river in a more balanced way without considerable additional study.

As a result of growing congressional and public interest in the Upper Mississippi River management problems, the North Central Division Engineer of the Corps of Engineers and the North Central Regional Director of the U.S. Fish and Wildlife Service announced in September 1974 the establishment of a partnership team. The team would work out a long-range management strategy for the multi-purpose use of the river. This move soon led to organization of a broad-based Federal-State task force. The Upper Mississippi River Basin Commission had established a special Dredged Spoil Disposal Practices Committee several months before to begin laying the groundwork for a cooperative effort. This committee was composed of delegates representing the five principal river basin States and five key resource-oriented Federal agencies. Thus, what finally became known as GREAT was established in October 1974 as a working partnership of Federal agencies, States, and the public under the auspices of the Upper Mississippi River Basin Commission.

The Team established in 1974 studied the Upper Mississippi River from Minneapolis/St. Paul to lock and dam 10 at Guttenberg. This team is called GREAT I. GREAT II was organized in 1976 and studied the river from Guttenberg to Saverton, Missouri. GREAT III was organized in 1977 and was responsible for the Mississippi River from Saverton to the mouth of the Ohio River.

The remainder of this chapter describes the scope of the GREAT I study; authority under which the study was carried out; organization of the Team; planing process; and relationship of the study to programs, plans, and studies of other organizations.

SCOPE OF THE STUDY

The scope of the GREAT I study was initially defined by the Upper Mississippi River Basin Commission in October 1974. GREAT was directed to develop a river system management strategy incorporating total river resource requirements. To that end, the Commission adopted the following objectives:

* Develop ways to significantly reduce the volume of dredged material removed for the navigation project.
* Open backwater areas that have been deprived of necessary freshwater flow as a result of navigation maintenance activity.
* Ensure necessary capability to maintain the total river resources on the Upper Mississippi River in an environmentally sound manner.
* Contain or stabilize all floodplain dredged material placement sites to benefit the river resource.
* Assure that all navigation project authorizations include fish, wildlife, and recreation as project purposes.
* Develop physical and biological base-line data to identify factors controlling the river system.
* Identify sites that can be developed to provide for fish and wildlife habitat irretrievably lost to water development projects.
* Identify and develop ways to use dredged material as a valuable resource for productive uses.
* Implement programs to provide for present and projected recreation demands on the river system.
* Strive to comply with Federal and State water quality standards.
* Strive to comply with Federal and State floodplain management standards.
* Develop procedures for ensuring an appropriate level of public participation.

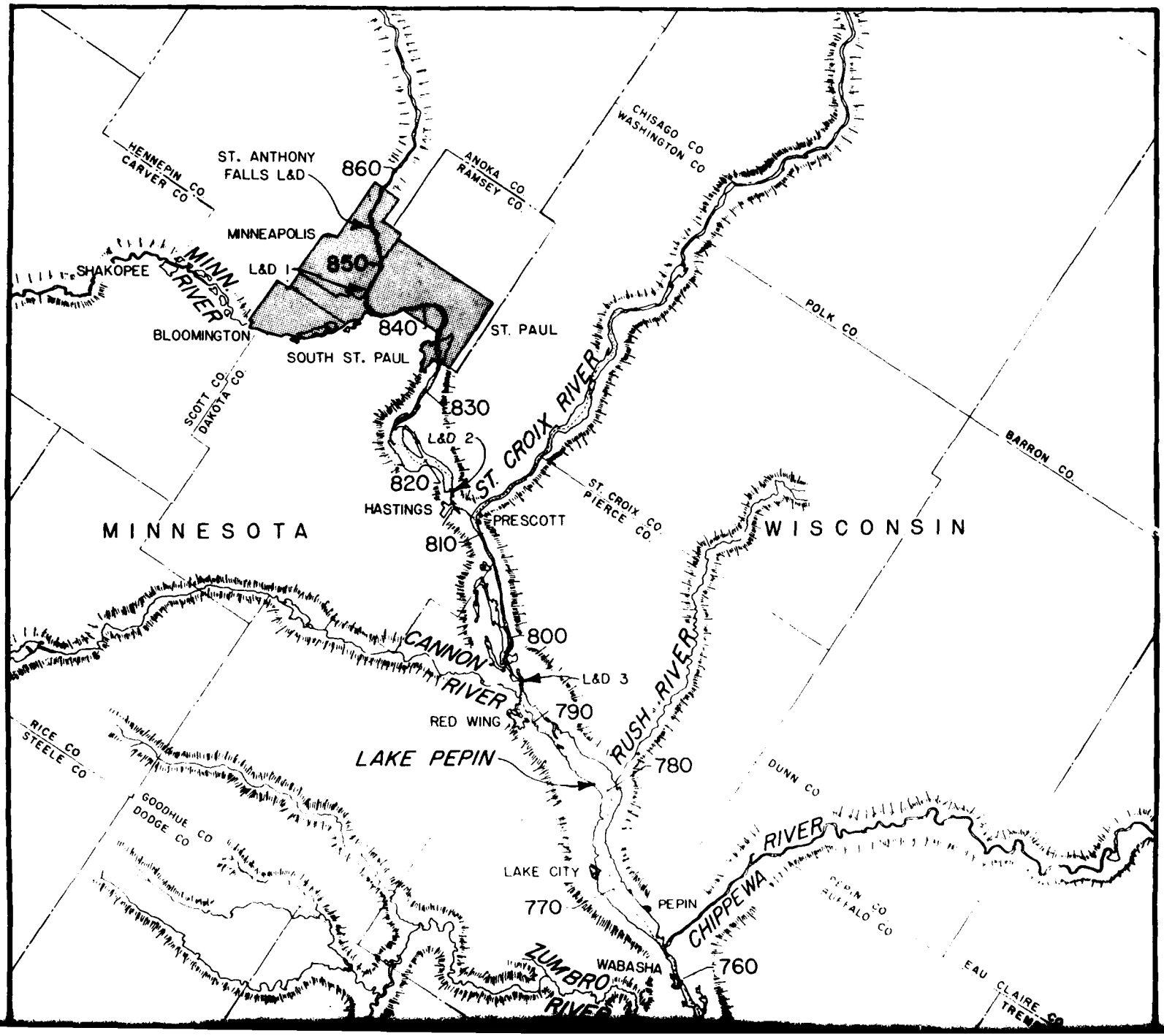
Subsequent guidance from the Upper Mississippi River Basin Commission led to the refinement of the scope of the GREAT I study (see the Plan Formulation Work Group Appendix). The primary objectives of the study became the development of a detailed site-specific channel maintenance plan and recommendations for the management of the river system and its interrelated components within the river corridor.

The GREAT I study addressed management problems within the study area. The problems of upland and tributary stream erosion were included because of their impact on channel maintenance and nearly all other resource components.

STUDY AREA

The GREAT I study area is shown on figure 1. The area covers the reach of the Mississippi River from the head of navigation at Minneapolis (Cairo river mile 857.6) to Guttenberg (Cairo river mile 614). The lower 24.5 miles of the St. Croix River, lower 14.7 miles of the Minnesota River, and lower 1.4 miles of the Black River are also included. The main channel and the floodplains adjacent to the channel constitute the primary study area. Significant tributaries and their watersheds were also studied in terms of their sediment and erosion problems.

The following counties which border the Mississippi River are in and adjacent to the study area.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CARVER CO
ANOKA CO
RAMSEY CO
CHISAGO CO
WASHINGTON CO
MINNEAPOLIS
850
SHAKOPEE
MINN. RIVER
L&D 1
BLOOMINGTON
840
ST. PAUL
SOUTH ST. PAUL
POLK CO
SCOTT CO
DAKOTA CO
830
L&D 2
ST. CROIX RIVER
820
BARRON CO
ST. CROIX CO
PIERCE CO
HASTINGS
PRESCOTT
MINNESOTA
WISCONSIN
810
800
CANNON RIVER
L&D 3
RUSH RIVER
790
RED WING
RICE CO
STEELE CO
LAKE PEPIN
780
DUNN CO
GOODHUE CO
DODGE CO
CHIPPEWA RIVER
LAKE CITY
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PEPIN
PEPIN CO
BUFFALO CO
ZUMBRO RIVER
WABASHA
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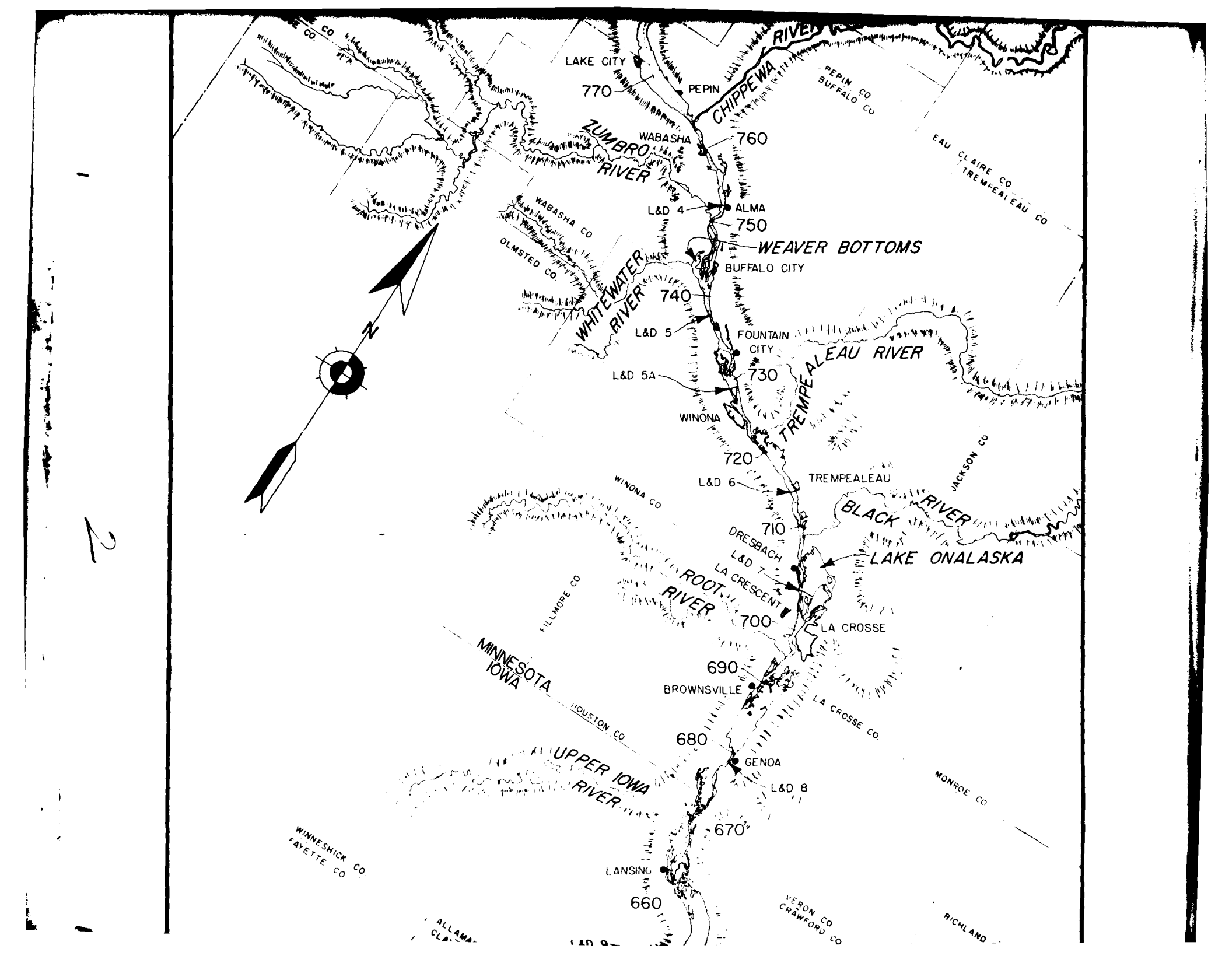
LAKE CITY
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ALMA
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WEAVER BOTTOMS
BUFFALO CITY
WHITEWATER RIVER
740
L&D 5
FOUNTAIN CITY
TREMPEALEAU RIVER
L&D 5A
730
WINONA
720
L&D 6
TREMPEALEAU
BLACK RIVER
710
DRESBACH
L&D 7
LAKE ONALASKA
LA CRESCENT
ROOT RIVER
700
LA CROSSE
690
MINNESOTA
IOWA
BROWNSVILLE
680
GENOA
L&D 8
UPPER IOWA RIVER
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LANSING
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PEPIN CO
BUFFALO CO
EAU CLAIRE CO
TREMPEALEAU CO
WABASHA CO
OLMSTED CO
WINONA CO
JACKSON CO
FILLMORE CO
HOUSTON CO
LA CROSSE CO
MONROE CO
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FAYETTE CO
VERON CO
CRAWFORD CO
RICHLAND
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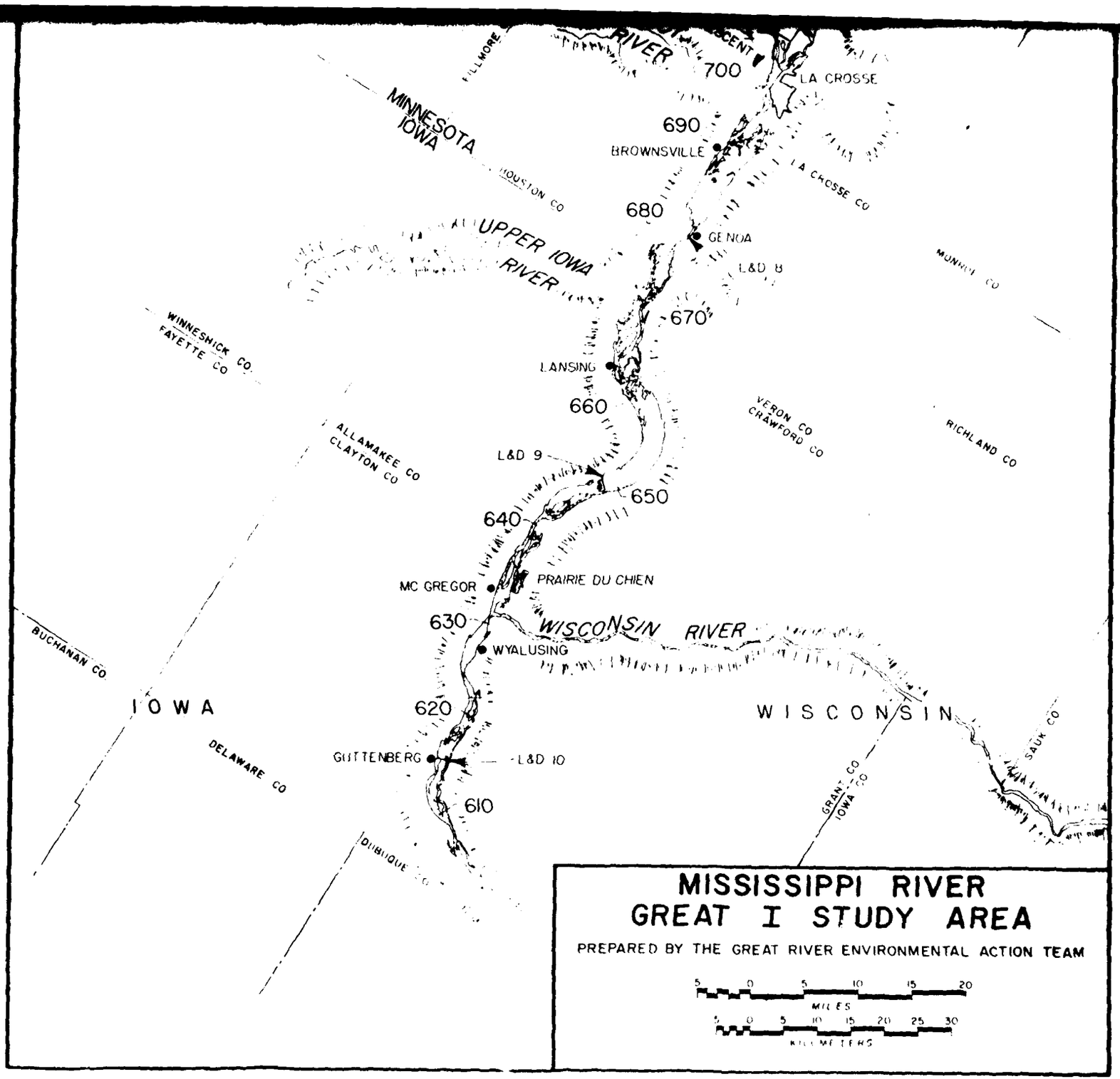
MINNESOTA
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CLAYTON CO
BUCHANAN CO
DELAWARE CO
DUBUQUE CO
IOWA
WISCONSIN
WISCONSIN RIVER
VERON CO
CRAWFORD CO
RICHLAND CO
GRANT CO
IOWA CO
SAUK CO
LA CROSSE CO
MUNROE CO
BROWNSVILLE
GENOA
L&D 8
LANSING
L&D 9
MC GREGOR
PRAIRIE DU CHIEN
WYALUSING
GUTTENBERG
L&D 10
700
690
680
670
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650
640
630
620
610
MISSISSIPPI RIVER
GREAT I STUDY AREA
PREPARED BY THE GREAT RIVER ENVIRONMENTAL ACTION TEAM
MILES
KILOMETERS

Figure 1

Iowa

Allamakee	Clayton

Minnesota

Dakota	Scott
Goodhue	Wabasha
Hennepin	Washington
Houston	Winona
Ramsey	

Wisconsin

Buffalo	Pierce
Crawford	St. Croix
Grant	Trempealeau
La Crosse	Vernon
Pepin	

AUTHORITY

In early 1974, then U.S. Representatives Albert Quie (Minnesota) and Vernon Thomson (Wisconsin) joined in supporting the testimony presented to Congress by the Minnesota-Wisconsin Boundary Area Commission. The Commission asked for an add-on appropriation of $1 million to the budget of the St. Paul District of the Corps for fiscal year 1975 (July 1974 through June 1975) to conduct further studies of channel maintenance impacts and pilot studies of alternative dredging techniques. The House of Representatives approved the request in June 1974. In August, the Senate objected to the add-on, contending that the recommended studies and experiments would duplicate the work already programmed by Congress in the $30 million Dredged Material Research Program under way through the Corps Waterways Experiment Station at Vicksburg, Mississippi. House proponents pointed out that the nationwide study heavily emphasized coastal zone, estuarine, Great Lakes, and deepwater port dredging and that the unique problems of river dredging and dredged material placement would not be meaningfully analyzed. Senate conferees agreed and accepted an add-on of $375,000 for special studies and field tests on the Upper Mississippi River between the mouth of the Missouri River and Minneapolis. The Corps reported this amount as its capability for such activities in the St. Paul District portion of the river for fiscal year 1975.

After working for 2 years with Corps of Engineers operation and maintenance funds, the GREAT study was authorized by Congress in Section 117 of the Water Resources Development Act of 1976. The section reads:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to investigate and study, in cooperation with interested States and Federal agencies, through the Upper Mississippi River Basin Commission the development of a river system management plan in the format of the 'Great River Study' for the Mississippi River from the mouth of the Ohio River to the head of navigation at Minneapolis, incorporating total river resource requirements, including, but not limited to, navigation, the effects of increased barge traffic, fish and wildlife, recreation, watershed management, and water quality at an estimated cost of $9,100,000."

STUDY ORGANIZATION

GREAT I was composed of representatives from the following States and Federal agencies:

State of Iowa
State of Minnesota
State of Wisconsin
U.S. Department of Agriculture - Soil Conservation Service
U.S. Department of the Army - Corps of Engineers
U.S. Environmental Protection Agency
U.S. Department of the Interior - Fish and Wildlife Service
U.S. Department of Transportation - Coast Guard
Minnesota-Wisconsin Boundary Area Commission (nonvoting)
Upper Mississippi River Conservation Committee (nonvoting)

GREAT I ORGANIZATION

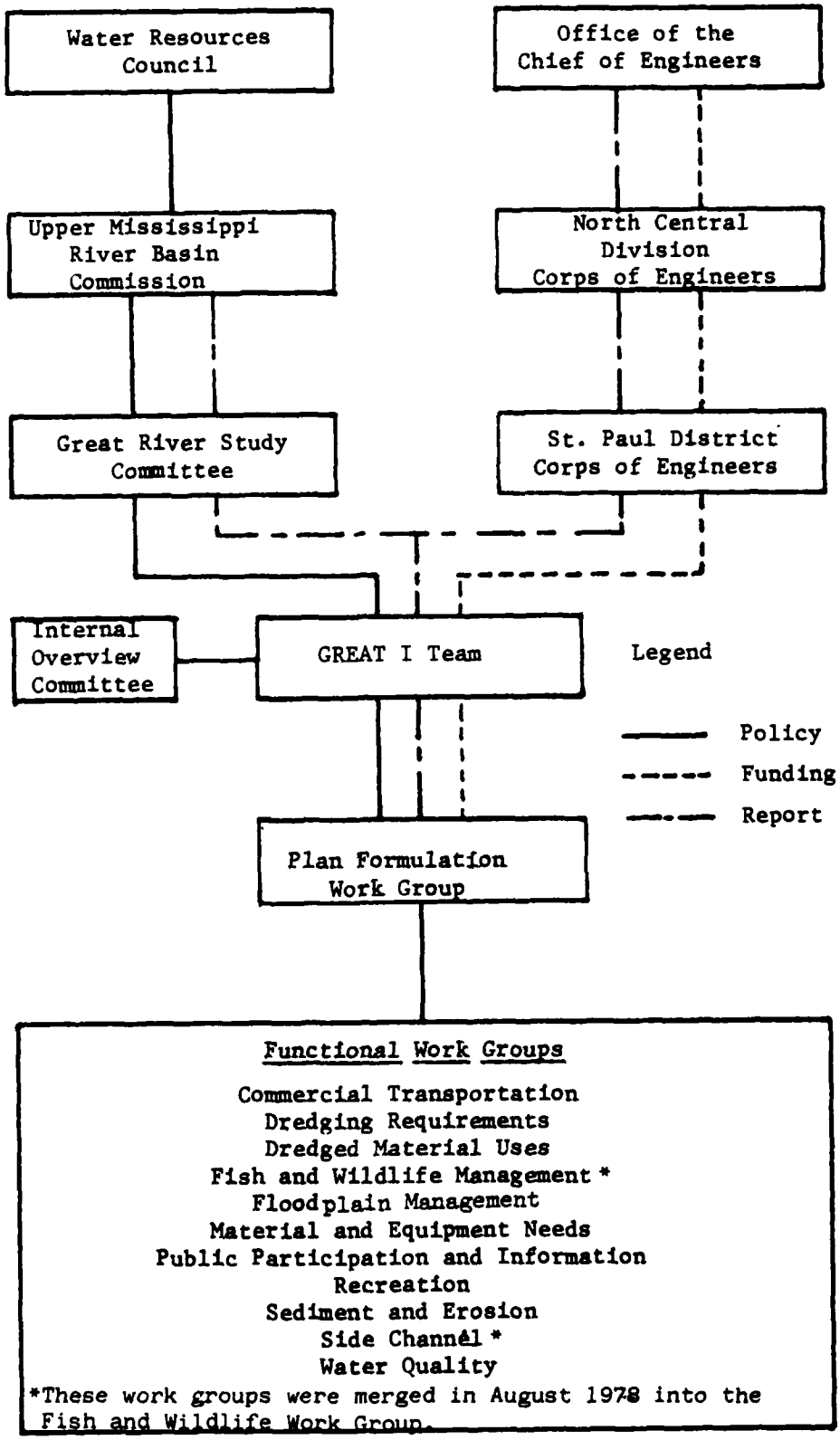


Figure 2

An organization chart for GREAT I is shown on figure 2. Exhibit 1 of this report contains letters of endorsement or qualification from member States and agencies.

The Corps of Engineers chain of command is shown on figure 2 because Congress provided study funding through the Corps and, in Section 117 of the Water Resources Development Act of 1976, required the Chief of Engineers to report the results of the study. Section 117 also directed that the study be made "through the Upper Mississippi River Basin Commission". Since GREAT I was formed in 1974, several committees of the Basin Commission have provided policy guidance and direction. The Great River Study Committee was the last to serve that function.

In the GREAT I area, the Great River Study was managed by the GREAT I Team. The equal partnership Team had one voting member from each State and Federal agency involved. The representatives of the Corps of Engineers and Fish and Wildlife Service - the agencies with major management responsibility on the river - served as co-chairmen. They conducted Team meetings and guided the ongoing studies as directed by the Team. Representatives of the Minnesota-Wisconsin Boundary Area Commission and the Upper Mississippi River Conservation Committee were nonvoting members of the Team. The Team operated under the bylaws of the Upper Mississippi River Basin Commission which require that attempts should be made to settle all issues unanimously. However, if all members could not agree, an issue could be decided by a majority vote of Federal agency caucus and a majority vote of State caucus.

The IOC (Internal Overview Committee) functioned as an advisory board to the Team. It consisted of representatives of the three States, a representative of the Minnesota-Wisconsin Boundary Area Commission, and the two Team co-chairmen. One of its duties was to recommend how GREAT I funds should be spent to best accomplish the study objectives.

PLANNING PROCESS

The planning process for the study provided an interagency, interdisciplinary approach for analyzing problems and needs, establishing specific subobjectives and work group tasks from the general objectives, and developing and evaluating conclusions and recommendations. The Team's basic philosophy was that total resource management plans require interdisciplinary planning to address the broad range of complex issues involved, including economic, environmental, and social consequences of plan implementation.

This report was prepared in accordance with the National Environmental Policy Act and the principles and standards for planning water and related land resources as required by the Water Resources Planning Act of 1965. These guidelines include those published by the Water Resources Council in the Federal Register (Volume 38, No. 174, Part III, 19 September 1973) and appropriate guidelines from the various participating Federal agencies. A description of the Team's interpretation of these guidelines is contained in the Plan Formulation Work Group Appendix. The principles and standards were also applied in developing the channel maintenance plan and were used in a limited way to analyze recommendations made for management activities related to other components of the resource. (See Plan Formulation Work Group Appendix.)

The GREAT I study and report also complied to the extent practical with Corps of Engineers planning procedures and report format. Because the final report is submitted to the Upper Mississippi River Basin Commission, the participat-

ing States and Federal agencies, and a diverse public, some flexibility in format and style was exercised. In addition, the uniqueness of a resource management study with multiagency participation necessitated a certain flexibility of planning procedures and format for the study.

The planning process adopted by the Team is explained in detail in the Plan Formulation Work Group Appendix.

STUDIES AND PLANS OF OTHERS

A number of other studies and agency authorities have addressed components of a "total river resource management plan". Among these are the Twin Cities and Main Stem Level B studies of the Upper Mississippi River Basin Commission, Corps of Engineers recreation master planning, Corps of Engineers flood damage reduction studies and authorities, Fish and Wildlife Service refuge management programs, and State water quality planning functions. In addition to these studies and authorities, efforts are under way in GREAT II and III. Also, the congressional legislation which authorized construction of locks and dam 26 (Public Law 95-502) requires the Upper Mississippi River Basin Commission to prepare a master plan for the Upper Mississippi River navigation system.

Careful coordination between the GREAT I study and the studies of others has avoided duplication of efforts. Brief summaries of some of these other studies follow.

LEVEL B STUDIES

The Level B planning approach focuses primarily on major problems, needs, and issues requiring solutions within the next 15 to 25 years. While the GREAT and Level B studies have identified similar problems to be addressed, careful coordination has prevented duplication of efforts between the two. Level B studies have been particularly oriented toward identification of sediment sources, evaluation of current land use planning approaches, and improvement of recreational boating safety. A major goal of both the Level B and GREAT studies is to coordinate Federal, State, and local interests to reconcile existing policy and program differences.

RECREATION MASTER PLANNING

The existing Corps of Engineers Recreation Master Plan is oriented toward land use zoning. Several areas were addressed including fish and wildlife, forestry, and recreation. The Corps proposes to revise the master plan based on the recommendations of GREAT.

Pleasure boating is a favorite recreational pastime.

The revised recreation master plan will address management of a broader range of public use resources than exclusively land use zoning. One particular issue to be examined is the question of future management of U.S. Government-owned lands for which the Corps holds title but management responsibility has been given to the Fish and Wildlife Service or, through a leasing arrangement, to other entities.

Water Quality Studies

Present responsibility for maintaining and improving water quality in the GREAT I study area rests with the three States (Minnesota, Wisconsin, and Iowa), the U.S. Environmental Protection Agency, and many local units of government, particularly the Metropolitan Waste Control Commission of the Minneapolis-St. Paul area. The Minnesota Pollution Control Agency, Wisconsin Department of Natural Resources, and the Iowa Department of Environmental Quality are charged with implementation of the Clean Water Act (Federal Water Pollution Control Act as amended by Public Law 92-500 and other laws) and associated Federal regulations.

Under section 303(e) of the Clean Water Act, the States have initiated the continuing planning process to develop plans for all basins in the States. Section 208 provides for an intensive study, either through designation of local agencies or through State activity. These plans, plus those prepared locally through facilities planning grants, provided a base for some of GREAT's recommendations.

Upper Mississippi River Wild Life and Fish Refuge Planning

Planning for the Upper Mississippi River Wild Life and Fish Refuge has progressed through a number of phases. Site specific management and development plans were formulated on a district (one- or two-pool area) basis in the 1940's and 1950's. Recreation plans were developed through a cooperative program in the 1950's and 1960's. These plans suggested zoning areas for various types of use.

In 1968, a concept-type master plan was developed for the refuge. The plan established goals and objectives for future management and provided general guidance for physical improvements and biological management. In the early 1970's, site specific development plans were developed for the districts within the framework of the concept plan.

With the beginning of the Bicentennial Land Heritage Program in the early 1970's, work was initiated on a comprehensive master plan for the refuge. GREAT provided assistance in the development of the plan by examining the feasibility of a computerized Geographic Information System (GIS). The planning effort is continuing and will result in a plan for the refuge within the framework of the Upper Mississippi River Basin Commission's Master Plan (see next paragraph).

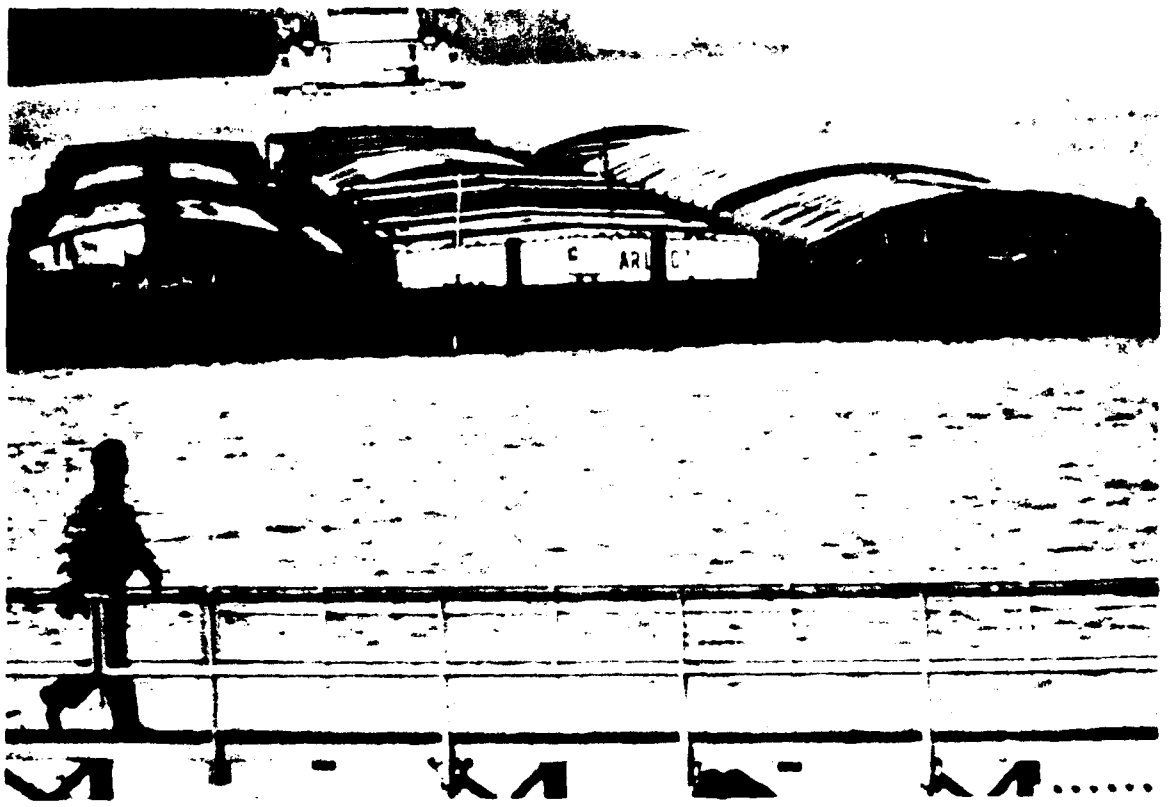
Upper Mississippi River Basin Commission Comprehensive Master Plan

Following initiation of the GREAT study, Congress charged the Upper Mississippi River Basin Commission with developing a master plan for the Upper Mississippi River system. This plan is to guide management and development decisions especially as they concern management of the navigation system (Upper Mississippi, Illinois, and Kaskaskia Rivers). The plan will also address environmental quality and resource management policies and programs. The objectives of the master plan therefore closely relate to, and expand upon, those of GREAT. Congress

Many fish species can be found in backwater areas.

required incorporation of GREAT findings into the master plan. The Basin Commission and, more specifically, its Great River Study Committee are charged with guiding both efforts. The GREAT study should make a significant contribution to the master plan.

"It is this wilderness world that speaks most eloquently of the essence of the river, of its timelessness in an age that rushes in confusion, toward a future we cannot know. In the river's woods and sandy banks and islands, its still backwaters and rippling eddies, in the simple unconquerable power of its mile-wide tide, we find something we can know and in comprehending that, perhaps we can understand something more of ourselves." T. H. Watkins, M & Twain's Mississippi



BACKGROUND OF

THE UPPER MISSISSIPPI RIVER SYSTEM

CHAPTER III

CHAPTER III

BACKGROUND OF THE UPPER MISSISSIPPI RIVER SYSTEM

INTRODUCTION

Even a cursory review of existing information reveals that "the river" is a complex resource. It means many things to many people. To call it a "resource" implies that it is something which man can draw on to satisfy his needs and desires. It, in fact, is a complex resource that serves multiple functions; it has many uses, and it has many users.

The river is first and foremost the main artery of a large watershed. The main stem corridor (floodplain) of the Upper Mississippi River, the focus of the GREAT I study, exists because of geologic and hydrologic forces interacting throughout the entire watershed. The main stem in the GREAT I area receives water and waterborne sediment from about 51 million acres of land. Alterations in the topography, land use, or land cover in this area (either as a result of natural or man-made activities) affect the main stem.

The Chippewa River is a major tributary of the Mississippi River.

Modification to one component of the resource in the main stem corridor will probably directly modify many or all other components of the resource in the main stem corridor. Any description of the Upper Mississippi River must begin with this fundamental understanding; the Upper Mississippi River is an ecosystem comprising natural and man-made inorganic features and all life forms, including man.

A second fundamental understanding that must preface a description of the system is that all life forms in the system, including man, are interdependent. This interdependency encompasses the nonliving (soil, water, air) as well as the living (plants, animals, man) elements in the system.

A third and final fundamental concept is that man is the only species in the ecosystem with the capability to significantly alter the natural environment to maintain and enhance his own existence. This capability (which is expanding as technology expands) has resulted in man's singular ability to rapidly alter the ecosystem to enhance his own needs and desires (quality of life). The health of the entire system, then, depends on man exercising this capability with responsibility.

The principal features of the system can be classified as either natural, human, or management related. The principal natural features are its climate, topography, geology and soils, stream and streamflow characteristics, water quality, air quality, and flora and fauna. The principal human features are man himself (population) and the physical alterations made by man: shoreland development (homes and commercial and industrial development), commercial transportation facilities

(locks, dams, terminals, highways, and railroads), recreation facilities, and cultural/archeological features. The principal management features include dredging of the river to maintain commercial navigation, operation of lands set aside for fish and wildlife, farming practices and streambank erosion control to reduce sediment, and public involvement. This chapter discusses these features in a general way and on a pool-by-pool basis for the study area.

Many cities owe their growth and importance to the Mississippi River.

NATURAL RESOURCES

CLIMATE

The Upper Mississippi River watershed, of which the study area is a part, is an area of great temperature extremes. Because it is in the center of the continent, it is not subject to the moderating influence of large bodies of water. The lows occur in January and February, and highs occur in July and August. The summer high has reached 108° F. Winter lows have reached -30° F or less.

Average annual precipitation is about 30 inches. However, it varies from 20 inches in the western prairie belt to more than 36 inches in the northeast humid area. About 80 percent of the precipitation falls as rain from April through October. The rest falls as snow and sleet from November through March. Winter moisture accumulates and can cause excessive runoff in the spring when coupled with a fast warm-up.

Summer winds bring tropical air to the region. The winter winds are predominantly from the northwest and bring the severe winter weather for which the region is noted.

TOPOGRAPHY

The source of the Mississippi River is Lake Itasca in Minnesota. From there, the river flows 2,400 miles south to the Gulf of Mexico. The headwaters area is composed of many lakes which reduce peak flows. Below St. Anthony Falls in Minneapolis, the river is constrained in a narrow channel flanked by high limestone and sandstone bluffs. At Fort Snelling, Minnesota, the Minnesota River joins the Mississippi River. Below this point, the river valley widens and spreads out into a wide floodplain at St. Paul. The St. Croix River enters the Mississippi River at Prescott, Wisconsin. Above Lake City, Minnesota, the Mississippi River enters Lake Pepin, a 22-mile-long natural river lake. The downstream end of Lake Pepin is the delta formed by the Chippewa River - the largest contributor of sediment to the

Mississippi River system in this area. Below Lake Pepin, the river flows through a wide valley flanked by steep, wooded rock bluffs, some as high as 600 feet. The Wisconsin River, the largest tributary in the GREAT I area, enters the Mississippi River below Prairie du Chien, Wisconsin, near La Crosse, Wisconsin.

The difference in elevation of the Mississippi River in the 200 miles between pool 11 at Guttenberg and pool 2 at St. Paul is about 80 feet. Thus, the average slope of the river is about 0.4 foot per mile. Between St. Paul and the pool above St. Anthony Falls, the river drops over 100 feet in about 7 miles. The water surface above St. Anthony Falls is as narrow as 600 feet contrasted to a width of 5 miles at Lake Onalaska.

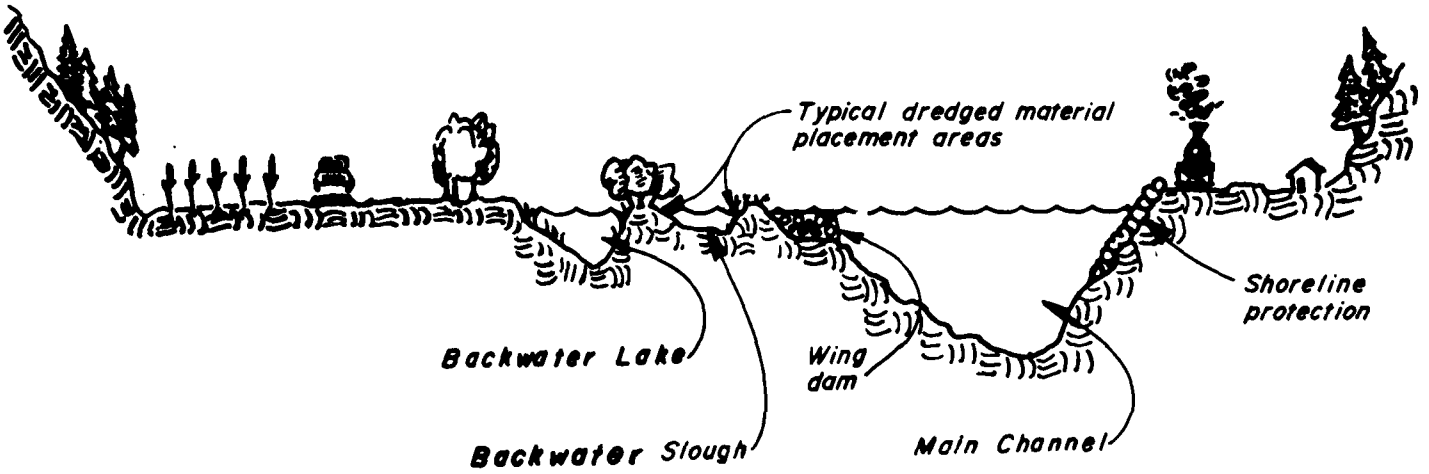
A more detailed description of pool features is contained in the individual pool descriptions.

Geology and Soils

The Upper Mississippi River valley was substantially influenced by the Pleistocene geologic age. During this period, glaciers covered all of Canada and advanced and retreated in the Mississippi River area at least four times. The last period is known as the Wisconsin Glaciation. Drift from this era covers Wisconsin, northern Iowa, and Minnesota except for scattered areas in southeast Minnesota and southwest Wisconsin.

During much of this period, a flow much greater than the present flow passed through the Mississippi River valley, causing substantial erosion and cutting the present deep valley.

Bluffs with vertical drops over 350 feet are common.



TYPICAL FLOODPLAIN CROSS SECTION

As the flow lessened, sediments composed mainly of sand and gravel filled parts of the channel. Continued deposition and erosion, influenced by the recent construction of the lock and dam system, have formed the present land areas.

Stream and Streamflow Characteristics

The upper reaches of the river above Minneapolis have a fairly steady flow because the river is fed by numerous lakes and six headwaters reservoirs. The navigable section of the river (below Minneapolis) is a series of regulated pools created by low dams built primarily in the 1930's. The dams were designed to maintain water levels for navigation and have no effect on flood flows. When flooding occurs, the gates of the dams are opened and the river flows freely. A law designed to protect fish and wildlife values limits the allowable drawdown of the pools.

At St. Paul, the river reached its maximum recorded peak flow in 1965 with a flow of 171,000 cfs (cubic feet per second). The previous peak was 125,000 cfs in 1952. The flood stage at St. Paul was 4 feet higher in 1965 than in 1952. The following table summarizes high, low, and mean discharge for St. Paul and other location

TABLE 1

Upper Mississippi River Surface Water Flows

Station	Period of record	Drainage area (sq. mi.)	Discharge (cfs) Mean	Maximum	Minimum
St. Paul, Minnesota	1872-1978	36,800	10,500	171,000	632
Prescott, Wisconsin	1928-1978	44,800	16,200	228,000	1,380
Winona, Minnesota	1928-1978	59,200	26,160	268,000	2,250
McGregor, Iowa	1936-1978	67,500	35,500	276,000	6,200

The GREAT I portion of the Mississippi River has many tributary rivers and streams. The major tributaries are listed in the following table.

TABLE 2

Major Tributaries and Drainage Areas

River or Drainage Area	Area (sq. mi.)
Headwaters(1)	19,680
Minnesota River	16,550
St. Croix River	7,650
Cannon River	1,440
Chippewa River	9,480
Zumbro River	1,380
Black River	2,250
Root River	1,660
Wisconsin River	11,700
Upper Iowa River	511

(1) Area above St. Anthony Falls in Minneapolis.

WATER QUALITY

Because of the large population and physical size of the Twin Cities metropolitan area, the portion of the river just downstream of this area continues to experience serious pollution problems. Minor problems in other segments of the river can be attributed mainly to agricultural runoff and localized domestic waste. To provide a picture of water quality conditions within the Upper Mississippi River basin, the navigable portions are discussed in more detail below. Information has been drawn from several sources (Iowa Department of Environmental Quality, 1975; Minnesota Pollution Control Agency, 1977, 1978; Wisconsin Department of Natural Resources, 1978; U.S. Geological Survey, 1977). Also see the Water Quality Work Group Appendix for more information.

MISSISSIPPI RIVER

Because of intensive municipal and industrial use and additional nonpoint source runoff, the portion of the river from the Metropolitan Wastewater Treatment Plant to locks and dam 2 at Hastings, Minnesota, has been assigned a lower use classification than other areas of the basin. The Minnesota Pollution Control Agency is evaluating this classification for pool 2 and may upgrade the rating. The present classification does not support primary body contact recreation or use for public water supply. Water quality improves significantly after the river passes locks and dam 2 and joins the St. Croix River.

Fecal coliforms, which indicate human pollution and the potential presence of disease-causing organisms, are exceedingly high in and just downstream of the metropolitan area. Occasional violations of the fecal coliform standard continue between locks and dams 2 and 10, but levels are generally below 100/100 ml (100 per 100 milliliters).

Water pollution is still a major problem.

Dissolved oxygen, which is extremely important for aquatic life, does not usually fall below 7.0 ppm (parts per million) above where the Mississippi River enters the metropolitan area. Levels in the metropolitan area are lower, but climb back above 7.0 ppm by locks and dam 2 and generally are high in the lower portion of the river.

Nutrient concentrations are also affected substantially by the metropolitan area. Turbidity and suspended solids levels are extremely variable and greatly influenced by seasonal discharge rates and tributary inflow.

Heavy metals often exceed standards in localized areas of the river and are extremely important contaminants in light of their potential for bioaccumulation and synergistic effects.

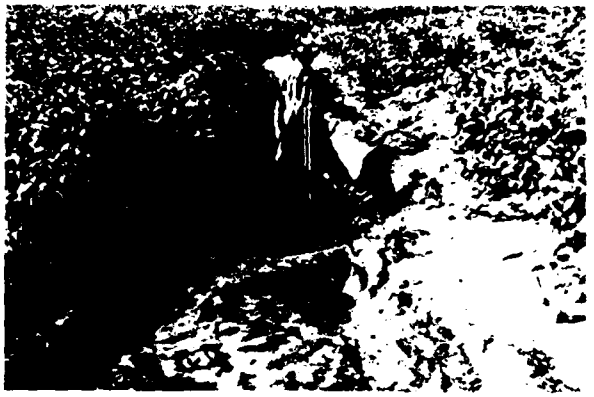
PCB's (polychlorinated biphenyls) and other organics are a problem in some segments. PCB levels in fish have exceeded the 2-ppm Food and Drug Administration action level in the metropolitan area and as far downstream as Lake Pepin (Minnesota-Wisconsin PCB Interagency Task Force, 1976).

MINNESOTA RIVER

The potential for nonpoint source pollution from agricultural runoff is higher than for pollution from other sources in the Minnesota River. Several municipalities and a variety of industries also discharge waste into the 15-mile navigable portion of the lower Minnesota River.

Fecal coliform levels are usually low during most of the year. Dissolved oxygen levels are generally high.

Turbidity and suspended solids standards are frequently exceeded during spring, summer, and fall.



Upland erosion causes siltation and pollution of streams and rivers.

The Minnesota River contributes substantial loads of suspended solids to the Mississippi River where the two rivers join in Minneapolis. Nutrient concentrations fluctuate rather widely during the year.

Heavy metals, pesticides, and PCB's usually remain within State standards. Specific conductance and hardness are extremely high during much of the year and occasionally exceed State standards.

ST. CROIX RIVER

The lower St. Croix River is characterized by water of relatively high quality. Municipal and industrial sources of pollution are minimal, but agricultural activity can contribute nonpoint source pollutants.

Fecal coliform levels rarely exceed the 200/100-ml State standard. Dissolved oxygen levels average approximately 9 mg/l (milligrams per liter).

Turbidity and suspended solids are typically low. Nutrient concentrations are moderately low and present no serious problems. Heavy metals do not exceed State standards except for rare isolated instances during the year.

AIR QUALITY

The quality of the air in the Upper Mississippi River study area is generally good. Air quality problems are significant only on a localized basis principally in large urban areas such as the Twin Cities metropolitan area and to a lesser extent at localized sites in Red Wing and Winona, Minnesota; Alma, La Crosse, and Genoa, Wisconsin; and Lansing, Iowa, where grain terminals, power plants, or heavy manufacturing facilities exist. At these locations the respective States monitor air quality. (In some cases, monitoring is performed through the local units of government.)

A unique feature of the river valley is the bluffs which rise over 500 feet, in some cases, above the floodplain on both sides. As a result, the urban areas in the valley are subject to periodic air inversions during which warm air in the valley is trapped under a layer of colder air. During such events, air quality problems are the most severe. In some cases, as at Alma, power plants have built smokestacks which rise above the bluff tops, thus dissipating emissions above the areas affected by inversions.

GREAT has not studied this aspect of the resource and readers desiring more information should contact the individual State resource agencies.

Flora and Fauna

The Upper Mississippi River provides diverse habitats that support an abundance of plant, fish, and wildlife resources. In addition to local topographic diversity, other factors contribute to the diversity of species present. Southern climatic influences extend up the river valley, allowing southern species, primarily plants, to extend their ranges northward. The valley is in the transition zone between the deciduous forests to the east and the prairie to the west. This creates a diversity of habitats that attracts species from both biomes.

The backwater areas of the river are valuable for fish and wildlife habitat.

The river bottomlands are a maze of timbered islands, marshes, sloughs, slough grass meadows, ponds, and winding backwater channels with large open pools above the dams. Along the river valley are precipitous hills covered with mixed hardwoods and cedar. Numerous limestone outcroppings rim much of the valley from Red Wing to near Clinton, Iowa.

The Upper Mississippi River valley has international significance as a major migration route for birds and is a vital habitat for many forms of resident wildlife. In 1924, the Upper Mississippi River Wild Life and Fish Refuge was established between Wabasha, Minnesota, and Rock Island, Illinois. Major parts of pools 4 through 10 were included. The refuge, located in the heart of the valley, lists 270 species of birds, 50 species of mammals, 123 species of fish, and 35 species of reptiles and amphibians known to occur within its boundaries. The area's rich and varied fish and wildlife resources have long been a vital element in the support, happiness, and prosperity of millions of people. More details on the fish and wildlife resources of the individual pools are presented in the pool descriptions later in this chapter and in the Fish and Wildlife Work Group Appendix. A discussion of State and Federal endangered species is also presented in the Fish and Wildlife Work Group Appendix.

Human Resources

Area Population and Income

The population in the area within 30 miles of the river is about 2.2 million. Heavy concentrations of population are at Minneapolis, St. Paul, Winona, and La Crosse. Populations of communities along the river are given in table 3.

TABLE 3

Population of Selected Communities along the Mississippi River[1]

Community	Population 1970	Population 1977 estimate
Minnesota		
Minneapolis-St. Paul metropolitan area[2]	1,874,600	1,998,000
Winona	26,438	25,278
Hastings	12,195	16,227
Red Wing	12,834	14,111
Stillwater	10,191	16,208
Wisconsin		
La Crosse	50,286	47,844
Prairie du Chien	5,540	5,928
Fountain City	1,017	1,054
Iowa		
Guttenberg	2,177	2,085
Lansing	1,227	1,300

(1) SOURCE: U.S. Bureau of the Census.
(2) SOURCE: Metropolitan Council.

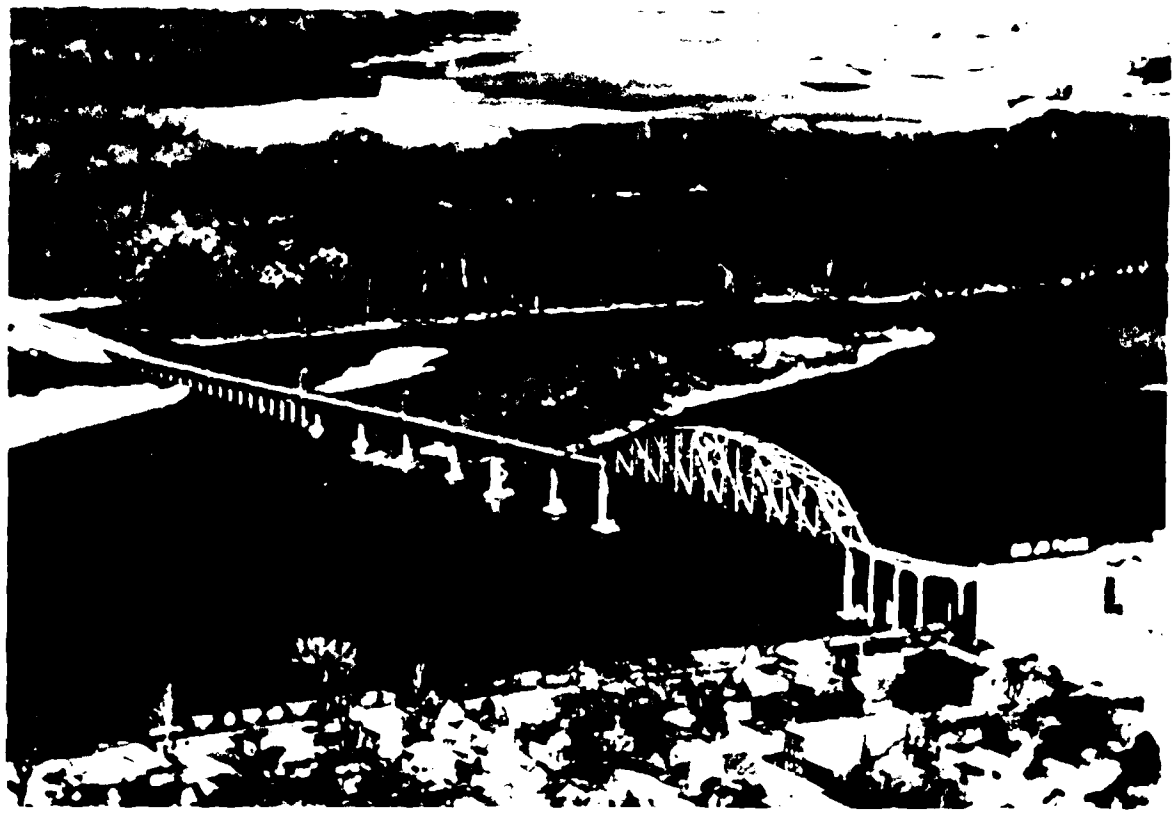
Per capita income in the St. Paul-Minneapolis metropolitan area was $9,756 in April 1980. Nearly 23 percent of employment was in manufacturing and nearly 27 percent was in wholesale/retail trade. The area is served by 10 railroads and is well-situated as a Midwest distribution and manufacturing center for commodities of every description.

In the greater La Crosse area in 1978, 24 percent of employment was in manufacturing and nearly 23 percent was in wholesale and retail enterprises. The per capita income in this area was $5,922 in 1979.

SHORELAND DEVELOPMENT

The presence of man on and along the shores of the river has significantly changed the resource. Railroad beds and highways line the floodplain on both sides for most of the stretch of the river in the GREAT I study area. This has limited access to the river in many areas, and in fact has resulted in a dike system of sorts that affects flood flows, limits access by humans, and affects the natural topography. In some areas, such as the Minnesota side of the St. Croix River, railbeds have been abandoned and the land will either revert to private ownership or become part of a riverside trail system.

Human habitation has also resulted in the establishment and growth of numerous communities with their complement of homes and commercial, industrial, and recreational facilities. Many communities have seen their river frontage dominated in the past with factories and river-related industry. In the early 1900's, the river's edge was the logical place for heavy industry because the river provided low cost transportation and a readily



Many communities depend on bridges over the river.

available means of carrying away effluent. With the advent of State water quality regulations and local floodplain and shoreland zoning regulations, riverside industry has had to terminate this direct dumping of effluent and route it through treatment plants.

Human habitation has thus affected water quality, constrained the floodplain, and significantly altered the aesthetic character of the river valley. Most communities now have local planning and zoning programs that regulate riverfront development, floodplain encroachment, sewage treatment, and general development. Many communities, of late, have become concerned about their riverfronts. In the Twin Cities metropolitan area a "Critical Area Designation" has mandated local comprehensive planning consistent with the Metropolitan Council objectives, which call for a mixed, but regulated, use of the riverfront, incorporating industrial, commercial, residential, recreation, and open space needs. In smaller communities downstream, local units of government are attempting to restore the aesthetic and historic values of the riverfront by reestablishing parks, developing recreational access, and regulating general development. Many communities are showing a renewed interest in local historic landmarks, and attempts are evident in nearly every community to restore buildings of unique architectural construction and reestablish the old "levee parks" to their 1850's appearance.

Railroad lines and highways parallel both sides of the river.

Finally, human habitation has seen a general alteration of the appearance of the valley through construction of highway and rail bridges, power lines, and residential development on the sides and tops of the bluffs along the river. Wisconsin, Minnesota, and Iowa are examining ways to minimize the aesthetic impacts of development. In Minnesota, the Mississippi River corridor from Hastings to the Iowa border is being reviewed for potential critical area designation. Wisconsin and Iowa are looking at purchase of scenic easements, in part through the Great River Road program, as a way to encourage sound planning/development practices.

Commercial Navigation Facilities and Traffic

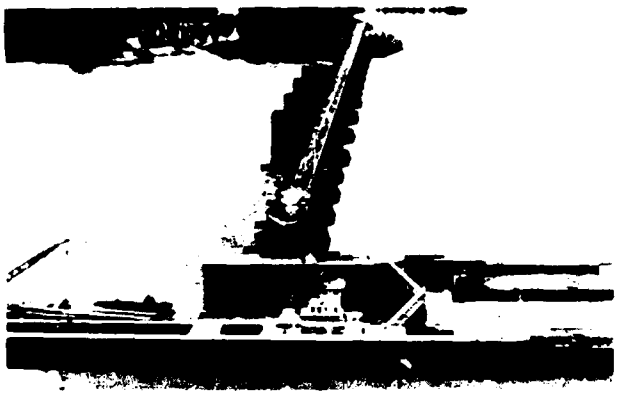
As the population and industry of the Upper Midwest grew, the need for cheap coal for power generation increased. The need for coal was complemented by the need to ship large quantities of grain south to other population centers. The barge and towboat industry was developed to meet this need.

Large grain shipments from Minneapolis began in the late 1920's. In recognition of the role of the river in the Nation's transportation network, Congress authorized the 9-foot

navigation channel in 1930. Most of the 29 locks and dams in the system were built during the 1930's. Locks and dam 1 (river mile 847.6) was built in 1917 as part of the 6-foot channel project. It was rebuilt in 1930 to accommodate 9-foot draft vessels.

The St. Anthony Falls locks and dam is the newest of the structures. The lower lock was opened in 1959; the upper lock was opened in 1963.

The construction of this system has significantly altered the natural river system, initiatlly creating hundreds of additional acres of wetlands - as well as creating a series of sediment trapping pools, which are now showing evidence of filling in.



A series of locks and dams makes water transportation possible.

The commercial river transportation system in the GREAT I area consists primarily of the 9-foot navigation channel, 13 locks, towboats, barges, fleeting areas, and terminals. By its nature, the system provides services of vital importance to the economy of the area. A 1975 study by the Upper Mississippi Waterway Association concluded that the river system handles 56 percent of the area's grain exports, 41 percent of the area's fertilizer, and 28 percent of its refined petroleum products. Additionally, about one of every three people in the Upper Mississippi River basin is served by electricity generated from barged coal. More information about the size of this industry and projections for future use are contained in the Commercial Transportation Work Group Appendix.

The rail and highway systems in the area are, from a simplistic point of view, made up of various railbeds and roadbeds, bridges, and terminals. These systems handle bulk as well as package commodities and are of vital importance to the area's economy.

Recreation Facilities and Traffic

Fish, wildlife, and other natural resources associated with the river have generated a variety of recreational pursuits. The growth of pleasure boating has increased use of islands and dredged material placement areas as picnic areas and campsites. Other recreational uses on the Mississippi River are increasing as our population increases and as other areas decline in quality.

Many private, semiprivate, and public recreation developments have been provided throughout the study area. Existing shore-based recreation facilities do not appear to be adequate to meet anticipated future needs. However, GREAT studies indicate most of the projected needs can be met by upgrading or expanding existing areas. At the same time, some river recreation conflicts with fish and wildlife resource management goals of the National Wildlife Refuge System. These conflicts need to be evaluated before recreation

facilities are upgraded or expanded. Recreational development necessary to meet the anticipated demand may not be possible as a result of other conflicting uses of the river's resources.

Detailed information on recreation facilities is contained in the pool descriptions that follow, the Recreation Work Group Appendix, and the following table.

TABLE 4

Recreation Resources in the Study Area

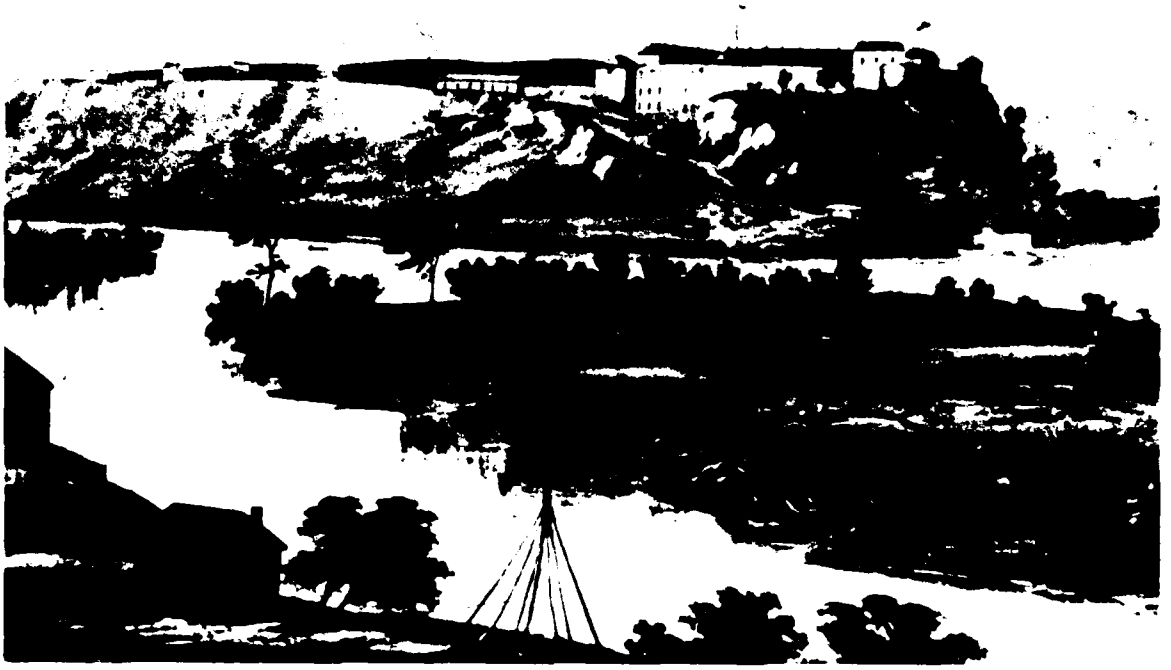
Resource	Number
Boat launching lanes	198
Boat launching parking spaces	7,815
Marina slips	5,380
Rental boats	702
Privately moored boats (not in marinas)	2,860 (1)
Boating/fishing service areas	102
Individual camping units	2,243
Group camping units	362
Picnic tables	3,690
Designated hiking trails, miles	140
Designated horseback riding trails, miles	28
Designated bicycling trails, miles	6
Designated cross-country ski trails, miles	30
Designated snowmobile trails, miles	40
Interpretive areas	6
Road access beach, acres	0.3
Fishing barge or pier	9

(1) Aerial surveys of 5 September 1976 and June 1978.

Cultural/Natural and Scientific Features

Man, over the ages, has naturally been attracted to the riverfront as a source of water; as a means of transportation of people and goods; and for the special beauty of the flowing waters, islands, and other natural features. There is ample evidence of cultural and archeological remains of past habitation in the study area. These include prehistoric village sites, petroglyphs (rock pictures), burial mounds, log cabins, and forts. Sites of significance may date from thousands of years ago to very recent times. The difficulty in identifying archeological and historic sites is not the absence of records of significant sites, but rather that records of thousands exist. Many of these records, however, are scanty at best; records are often incomplete or out of date; site locations are not accurately recorded; and, finally, public release of records is done with reluctance because of risk of robbery, despoliation, vandalism, or unauthorized investigations. Fluctuations in river levels and the lock and dam system and resultant raising of pool levels have inundated many sites, making them difficult to investigate.

As noted in the section on shoreland development, there is great interest in identifying and restoring cultural and archeological features, principally buildings constructed since the mid-1800's. For more information on the matter, the reader should refer to the Recreation Work Group Appendix and the Final Environmental Impact Statement, Operation and Maintenance of the 9-Foot Channel. (Corps of Engineers, St. Paul District, 1974.)



"Fort Snelling 1844"
Fort Snelling was the northernmost outpost of the U.S. Government on the Mississippi River. It still exists today.

RIVER SYSTEM MANAGEMENT

CHANNEL MAINTENANCE

The Corps of Engineers maintains a 9-foot channel for commercial navigation on the Mississippi River throughout the entire GREAT I study area (river mile 857.6 to river mile 614). The lower 24.5 miles of the St. Croix River, lower 14.7 miles of the Minnesota River, and lower 1.4 miles of the Black River are also maintained for commercial navigation. Since 1937, maintenance dredging has been accomplished by a 20-inch hydraulic cutterhead dredge (the William A. Thompson) and a 4-cubic-yard clamshell dredge (the Derrickbarge Hauser) with attendant plant for both primary units. The Thompson fleet includes the Boosterbarge Mullen which was acquired in 1976 and can be used to extend the placement range to about 10,000 feet. Some dredging, primarily on the Minnesota River, has been done under contract to private firms under the nationwide Industry Capability Program. Under this program, private firms can bid against the Government fleet. If the private bid is less than 25 percent above the Government bid, the work will be done by the private firm.

Dredging is required at approximately 105 locations in the GREAT I study area. These locations are referred to as dredge cuts. On the basis of data from 1956 to the present, an average of approximately 30 cuts are dredged each year. The amount of material removed and the frequency of dredging required at each cut varies. Exhibits 31 through 57 of the Final Environmental Impact Statement on Operation and Maintenance of the 9-Foot Navigation Channel present a detailed analysis of the location, volume, and frequency of dredging from 1934 to 1972. The GREAT I Channel Maintenance Appendix also discusses historic and projected future dredging volumes.

The volume of material dredged in the GREAT I area ranged from 5,445,000 cubic yards in 1938 to 205,000 cubic yards in 1977. The largest volume dredged in any of the last 10 years was 2,261,000 cubic yards in 1970. The yearly average for the last 10 years is about 1,300,000 cubic yards. The yearly average for the past 5 years (1975-1979) is about 600,000 cubic yards. Before the GREAT I study, dredging was normally accomplished to a depth of 13 feet below low-control poo'. The channel width on the Mississippi River is 300 feet except at bends where additional width is provided. The width at bends is not specified in the authorizing legislation but is based on the minimum width necessary for a tow to safely navigate the bend. The Corps of Engineers in consultation with towboat operators determines the widths to be maintained.

Efforts were made as part of the GREAT I study to reduce the volume of material dredged by reducing dredging depths and reducing widths at bends. The Dredging Requirements Work Group Appendix describes work done by GREAT I to reduce dredging volumes. Reduced-depth and reduced-width dredging can be applied safely at some locations.

Material dredged by the Thompson was traditionally placed as close as possible to the dredge cut. It was pumped to the edge of the river and placed along the shoreline or on a nearby island. Where Federal land was not available, agreement was reached with a nearby land owner who wanted the material for landfill or beach nourishment. Material dredged by the Hauser was loaded in barges which were moved to a new placement site. The material was dumped near shore and rehandled into land using the 3-cubic yard Crane barge Wade which is part of the Hauser fleet. Before the GREAT I study, material was not normally transported by barge more than 1 1/2 miles from the dredge cut.

In 1977, the St. Paul District began a program of constructing containment areas near some of the frequently used dredge cuts. Containment sites were constructed on historic placement areas by using previously placed material to construct a berm around the perimeter of the site. A controlled drop structure was placed in the berm to provide for flow of effluent water back to the river. The purpose of the containment areas was to confine hydraulically dredged material and provide retention time for effluent water. A total of 10 containment areas have been constructed in the GREAT I area.

Wildlife and Fish Management

The U.S. Fish and Wildlife Service is the primary Federal agency charged with fish and wildlife resource management on the Upper Mississippi River system in the GREAT I area. Within the study area, the Service administers the Upper Mississippi River Wild Life and Fish Refuge, Trempealeau National Wildlife Refuge, Minnesota Valley National Wildlife Refuge, and Genoa National Fish Hatchery.

The Upper Mississippi River Wild Life and Fish Refuge was established by Congress in 1924 and stretches 284 miles through the river corridor from Wabasha to Rock Island. The refuge consists of approximately 195,000 acres of wooded islands, riverbanks, sandbars, and open water marshes and is maintained to meet the following goals:

1. To provide for the nearly 365 species of wildlife indigenous to the valley (birds, mammals, fish, amphibians, and reptiles) with particular emphasis on wintering bald eagles; breeding wood ducks; all migrating waterfowl, with special concern for whistling swans and canvasback ducks; and resident furbearers.

2. To preserve intact the undiluted wildland character and natural beauty of the river with its habitat and wildlife.

3. To foster public understanding of floodplain ecology and appreciation for the fragile nature of its ecosystems through wildlife-wildlands interpretation and environmental education.

4. To provide both consumptive and nonconsumptive recreation to the extent possible with the preservation of the resources.

5. To cooperate with other agencies and private interests to promote sound management of all the resources of the river.

A concept-type master plan, developed in 1968, established the above goals and a set of objectives for future management including general guidelines for physical improvements and biological management. Work is under way on a comprehensive master plan for the refuge. Physical management of the refuge has been limited in the past because of its massive size, lack of means for making alterations, and the fact that all waters within the refuge are navigable waters of the United States. Management emphasis on the refuge has been placed on controlling uses of refuge lands and setting regulations for the taking of waterfowl and furbearers. Problems which make effective management of the Upper Mississippi River Wild Life and Fish Refuge difficult include conflicting and noncompatible uses of the resource, such as barge fleeting areas and nonwildlife related recreation; flooding; dredging and material placement operations; sedimentation of backwater areas; and degradation of water quality caused by thermal pollution from power plants, industrial and municipal discharges, and accidental spills of hazardous materials.

The Treampealeau National Wildlife Refuge is an independent facility bordering the Upper Mississippi Refuge on the Wisconsin side of the river between Winona and Trempealeau, Wisconsin. It was authorized in 1934 as a migratory bird refuge to preserve and protect the waterfowl values of the area. Only 700 acres were acquired at the time the refuge was established. However, an additional 5,700 acres which was part of the privately owned Delta Fish and Fur Farm, a unique area of bottomland marsh and hardwoods isolated from the river by a substantial dike, was recently added to the refuge. Water levels within the dike can be controlled by existing culverts. A management plan for the area has not yet been developed.

The Minnesota Valley National Wildlife Refuge extends from Fort Snelling State Park, near the confluence of the Minnesota and Mississippi Rivers, upstream to Carver Rapids near Jordan, Minnesota. The Long Meadow Lake unit of the refuge, which consists of approximately 2,100 acres, is within the GREAT I study area. The refuge was established to preserve, protect, and manage the nat-

ural resource so that existing habitat for migratory waterfowl, fish, and other wildlife species will not be lost. The refuge also provides environmental education, interpretive programs, and outdoor recreation for the nearly 2 million people in the surrounding metropolitan area. A management plan is being developed.

The Genoa National Fish Hatchery is on the Wisconsin side of the river in pool 9 at about river mile 675. The hatchery uses the river as a source of spawning and rearing stock. Fish are collected during the ebb of the spring flood. Historically, the river has not needed stocking because spawning habitat and stock have been adequate to maintain healthy populations of desirable fish. Fish from the Genoa Hatchery are distributed to research laboratories, Federal water projects, and State-managed programs throughout the country.

POOL DESCRIPTIONS

This section contains general information on each pool in the GREAT I study area. Tables 5 and 6 present the principal features of the pools and area populations. Additional detailed information may be found in the Fish and Wildlife and Recreation Work Group Appendixes.

TABLE 5

Principal Features of Pools in the GREAT I Area

Feature	Upper St. Anthony	Lower St. Anthony	Pool 1	2	3	4	5	5 a	6	7	8	9	10
Length of pool (river miles) Mississippi River	10.9	0.4	5.7	32.5	18.3	44.2	14.6	9.6	14.2	11.6	23.3	31.3	32.8
Minnesota River				25.0									
St. Croix River					33.0								
Location (river miles)	853.8-864.7	853.4-853.8	847.7-853.4	815.2-847.7 0.0-25.0(1)	796.9-815.2 0.0-25.0(2)	752.7-796.9	738.1-752.7	728.5-738.1	714.3-728.5	702.5-714.3	679.2-702.5	647.9-679.2	635.6-647.9
Elevation - flat pool (feet above mean sea level)	799.8	750.0	725.1	687.2	675.0	667.0	660.0	651.0	645.5	639.0	631.0	620.0	611.0
Water Area (acres)	974	51	546	9,652(3)	17,950(3)	35,198(4)	10,836	6,140	8,870	13,440	20,810	29,125	17,070
Primary shoreline (miles) (5)	23.1	1.5	11.6	110(3)	37.1(3)	155	50	35	55	37.1	85	90	110
Federal lands above normal flat pool (acres)		4	16	55	3,498	6,605	4,153	3,920	1,640	7,070	10,282	18,790	11,095
Administered by Corps of Engineers (acres)				55	3,430	1,769	2,044	2,670	295	2,340	3,945	6,620	2,255
Administered by the Department of the Interior (acres)					68	4,836	2,109	1,250	1,345	4,730	6,337	12,170	8,840
Total Acres Area designated as part of the National Refuge System (water & land)						11,050	13,214	6,717	1,585	16,767	24,653	40,948	18,547

(1) Minnesota River portion
(2) St. Croix River portion
(3) Mississippi River Segment
(4) Includes Lake Pepin
(5) Meandering outer perimeter limits; main and secondary channels; and main traversed sloughs adjacent to firm, high ground accessible by land.

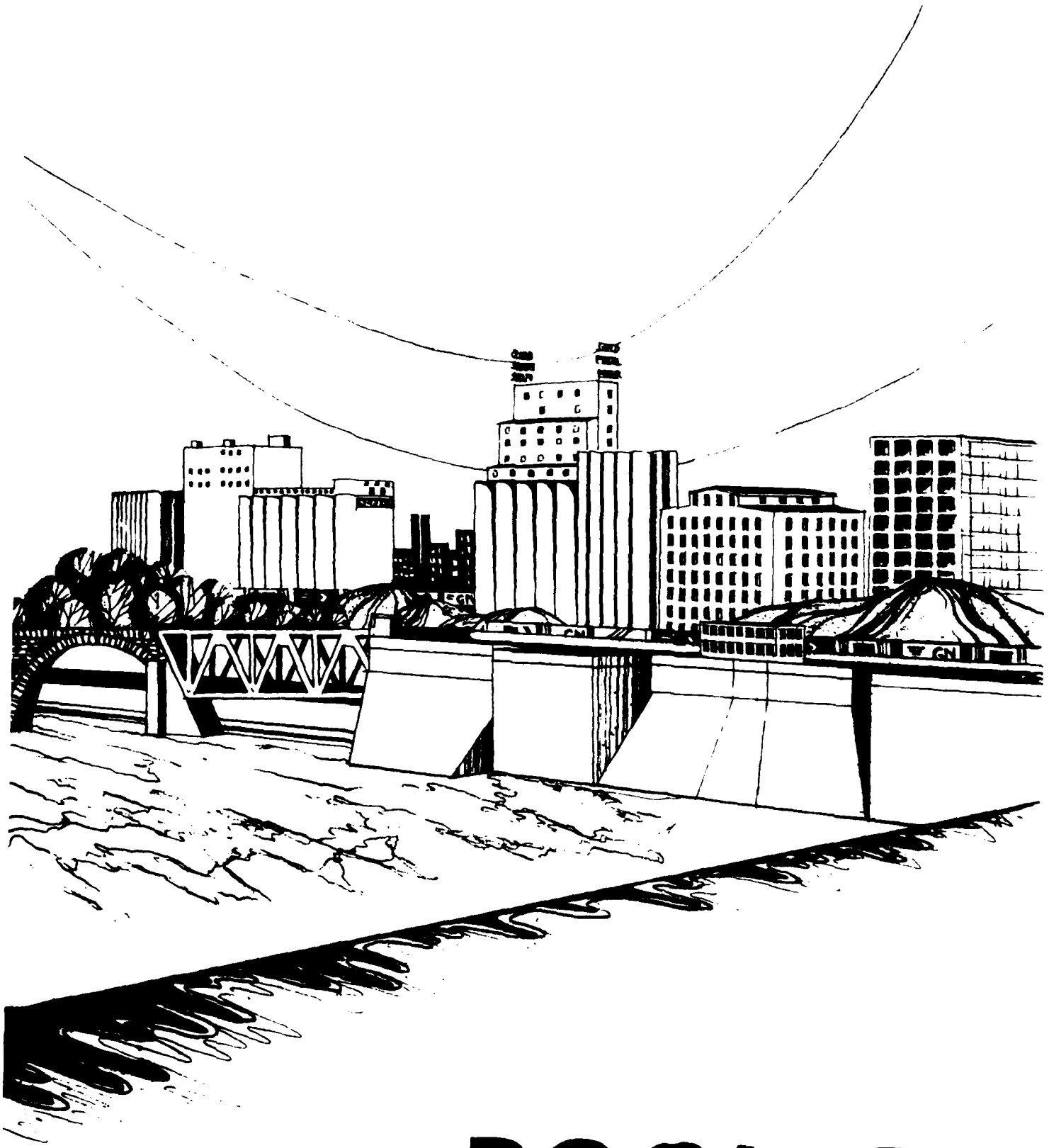
TABLE 6

Population Projections
Areas Adjacent to the Upper Mississippi River Navigation Pools

Distance from pool (miles)	Year 1975	2010	2025
St. Anthony Falls pools and pool 1			
0 to 25	1,408,730	2,250,400	1,576,280
26 to 50	671,455	1,005,085	1,169,250
Pool 2			
0 to 25	515,715	752,175	840,280
26 to 50	917,980	1,184,025	1,273,750
Pool 3			
0 to 25	72,390	128,550	153,100
26 to 50	519,445	703,680	773,690
51 to 75	1,195,559	1,433,530	1,549,115
Pool 4			
0 to 25	20,350	23,000	24,380
26 to 50	109,990	145,460	171,295
51 to 75	386,065	529,610	627,580
Pool 5			
0 to 25	58,570	68,895	75,185
26 to 50	202,605	278,945	338,010
51 to 75	263,200	341,095	391,000
Pool 5a			
0 to 25	62,375	71,930	78,630
26 to 50	245,375	331,685	399,200
51 to 75	178,760	215,595	240,705
Pool 6			
0 to 25	125,810	152,395	174,520
26 to 50	101,225	118,755	130,360
51 to 75	179,350	242,715	289,605
Pool 7			
0 to 25	124,890	152,085	174,515
26 to 50	95,310	106,795	115,445
51 to 75	139,170	163,940	181,000
Pool 8			
0 to 25	98,770	119,880	138,610
26 to 50	98,450	105,450	111,910
51 to 75	156,120	171,260	182,295
Pool 9			
0 to 25	32,365	32,010	32,535
26 to 50	135,270	157,575	177,015
51 to 75	202,480	239,870	265,045
Pool 10			
0 to 25	38,730	41,840	44,910
26 to 50	191,850	225,970	244,880
51 to 75	119,730	124,075	128,560

SOURCE: Corps of Engineers, St. Paul District; GREAT I Recreation Work Group - Public Use Projections, February 1978.

St. Anthony Falls was an invaluable source of power in the early history of Minneapolis. Water-driven flour mills and sawmills once flourished on the Mississippi River banks. Today, modern grain elevators have replaced many of the old flour mills and a lock provides for commercial navigation above the falls.



POOL 1

Upper and Lower St. Anthony Falls and Pool 1

Upper and Lower St. Anthony Falls locks and dams are at river miles 853.8 and 853.4, respectively. Both are in Minneapolis on the right (west) bank of the main channel. Locks and dam 1 is at river mile 847.7.

Upstream from locks and dam 1, pool 1 is confined to the old, narrow river channel which cuts through heavily wooded limestone and sandstone bluffs. The bluffs rise almost vertically to heights approaching 150 feet. They are covered with deciduous trees and rock outcroppings. Upstream of the Washington Avenue Bridge the bluffs begin to decrease in height. The upper limit of the flat pool created by the Upper St. Anthony Falls Dam is at river mile 865.5 near the Coon Rapids Dam.

Much industry is located along the riverbanks from the upper area of pool 1 up to river mile 857.6, the upstream limit of the 9-foot navigation channel.

Recreation Facilities - The three pools have 1 boat access with 1 launching lane, 50 parking spaces near the access, 15 picnicking units, 5 miles of hiking trails, and 5 miles of bicycling trails. Major parks in the area include North Mississippi River Park (river mile 858), St. Anthony Park (river mile 857.5), Mississippi River Park (river mile 853.5), East River Flats (river mile 852.5), West River Cave, and portions of Minnehaha Park (river miles 847 and 848).

Commercial Navigation - The 1978 Corps navigation charts indicate 18 commercial navigation facilities in the 3 pools. The St. Anthony Falls pools have two receipt, five shipment, and two receipt and shipment facilities. Pool 1 has five receipt, one shipment, and three receipt and shipment facilities.

Cultural, Natural, and Scientific Resources - Any cultural resources along the bluffs have probably been destroyed by commercial, residential, and industrial development. Known historic sites that have survived are on top of the bluffs, well removed from the effects of water levels or human activities in and along the river.

The St. Anthony Falls Historic District and Pillsbury "A" Mill (river mile 853) are on the National Register of Historic Places. The Minnesota Historical Society also owns the Edwin H. Hewitt House (river mile 851) Bennet/McBridge House (river mile 854), and the Grain Belt Brewery (river mile 854 to 858).

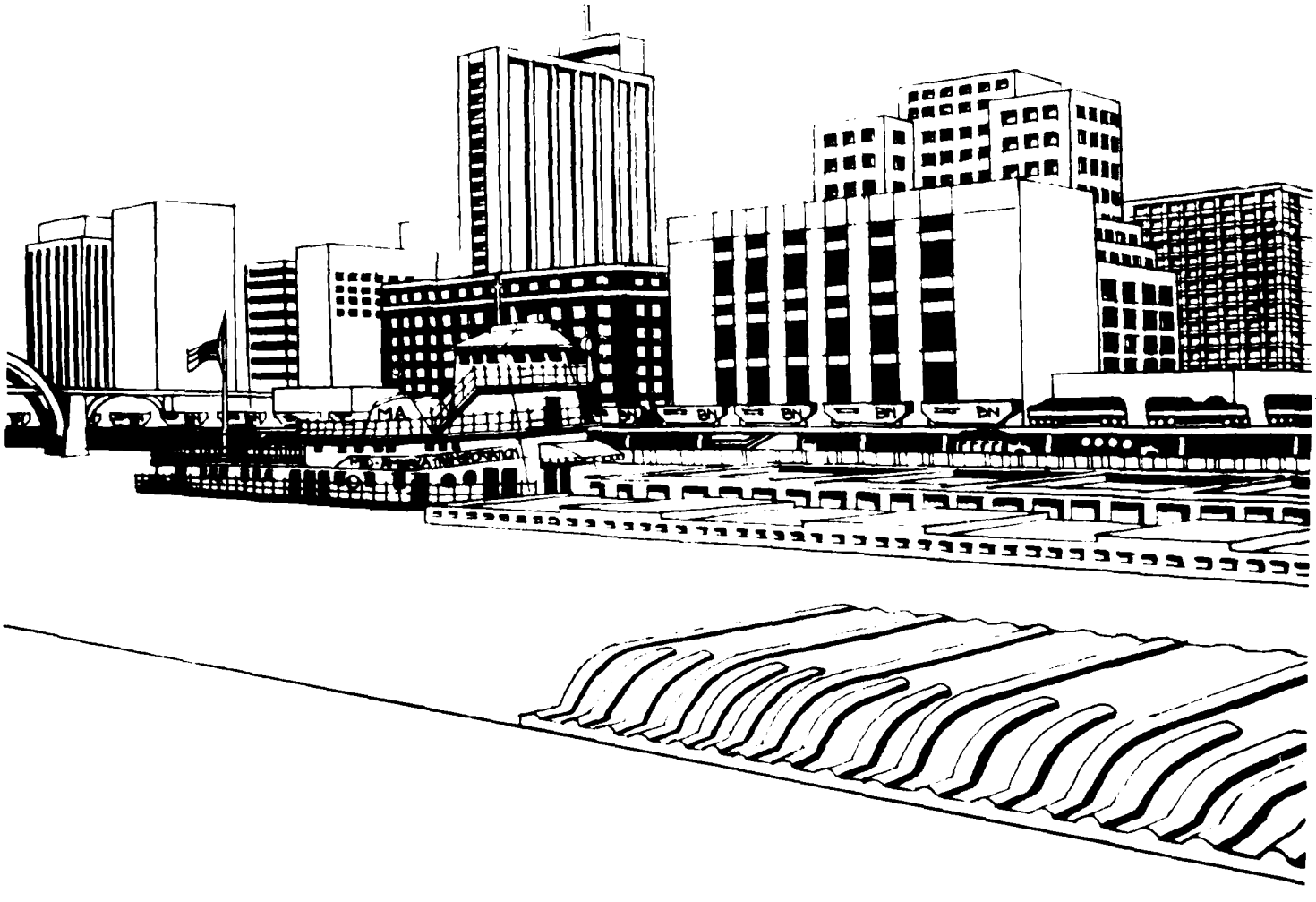
Fish and Wildlife Resources - Fish and wildlife populations are limited in the Minneapolis pools primarily because of the lack of shallow water habitat, the pools relatively small size, and industrial development along the riverbanks. Occasional short periods of poor water quality further reduce the habitat value for fish. Good habitat for small furbearers and birds still exists on the wooded bluffs along pool 1.

Bank fishing in the pools is common despite the relative lack of fish habitat. Firearm restrictions prohibit hunting in the urban areas.

Channel Maintenance - To maintain the 9-foot navigation project for commercial navigation, the Corps of Engineers dredges an average of about 50,000 cubic yards per year from the Upper St. Anthony Falls pool and about 108,000 cubic yards per year from pool 1 (based on 1964-1977 for USAF and 1956-1977 for pool 1).

Three cuts in the Upper St. Anthony Falls pool and seven in pool 1 require periodic dredging. The project above St. Anthony Falls was completed in the 1960's, about 30 years later than the rest of the system. This portion of

the system is unique because a local sponsor, the city of Minneapolis, is responsible for providing land for project needs including placement of dredged material. The material in the Upper St. Anthony Falls pool has historically been dredged by the Derrick-barge Hauser and placed at site U.01, although during high volume years the Thompson has been used at cut 3. Minneapolis uses the material for winter street sanding and other beneficial uses. Although Minneapolis is not required to provide land for placement sites in pool 1, most of the material in recent years has been dredged by the Hauser and placed at the Minneapolis Coal Dock (site 1.01) Material has also been placed along the shoreline in the gorge area. Material placed at the coal dock is used by the city and local contractors.



POOL 2

Pool 2 (Including the Minnesota River)

Description - Locks and dam 2 is at river mile 815.2 near Hastings. The main channel follows the east side of the valley at this point paralleling the Chicago, Milwaukee, St. Paul and Pacific Railroad and Burlington Northern, Inc., railroad tracks.

Upstream from the locks and dam, pool 2 spreads over the floodplain; the deeper navigable channel meanders through the valley. Near river mile 825, the pool becomes confined to the old river channel. Except for several backwater areas and connected lakes, the pool remains within the confined and progressively narrowing channel up to locks and dam 1.

From locks and dam 1 to St. Paul Park, Minnesota (river mile 829), extensive residential, institutional, and commercial developments occupy the bluff top and floodplain. Urban development from locks and dam 1 to Lilydale Minnesota, is partially screened by vegetation and high bluffs. Downstream from St. Paul Park, only occasional residential or industrial sites interrupt the floodplain and bluff slope woodlands.

Pool 2 includes 25 navigable river miles of the Minnesota River. The lower 14.7 miles are maintained for 9-foot navigation.

Recreation Facilities - Pool 2 has 11 boat accesses with a total of 11 launching lanes, 705 parking spaces next to the boat accesses, 497 marina slips, 40 rental boats, 24 camping units, and 89 picnicking units.

Commercial Navigation - The 1978 Corps navigation charts indicate 29 commercial navigation facilities in pool 2 (18 receipt, 8 shipment, and 3 receipt and shipment). The Minnesota River has nine facilities (three receipt, three shipment, and three receipt and shipment.

Cultural, Natural, and Scientific Resources - Fort Snelling is located at the confluence of the Mississippi and Minnesota Rivers. It was the State's first military post and, until 1849, the northwesternmost outpost in the Nation. Cantonment New Hope, the site of the makeshift encampment occupied by the soldiers who built Fort Snelling, is on low ground near the east end of the Mendota Bridge.

Two known archeological sites were inundated by the raising of the water level in pool 2. The sites are the Shilling site - a mound and village site on Grey Cloud Island - and the Sorg Site - a habitation site on Spring Lake.

Cultural resources along the Minnesota River include the archeological sites at river mile 7 (Kennedy site - Black Dog aboriginal Americans) and 12, 13, and 14 (aboriginal Americans) and the historic site at river mile 9.5 (Gideon Pond House). Cultural resources along the Mississippi River include the archeological sites at river miles 818, 819, 821, 822, 825, and 826 (aboriginal Americans); historical sites at river miles 818 (Nininger town site) and 825 (German Evangelical Church); and an archeological and historical site at river mile 833 (Kochendorfer House).

St. Paul developed as a banking and financial center in the early days of Minnesota and is still a prominent financial center. River traffic to St. Paul has flourished making it a major intermodal transportation center with facilities for transporting goods by truck and rail as well as by river barges.

Fish and Wildlife Resources - Fish habitat is limited but generally good in pool 2 upstream of downtown St. Paul. However, fish habitat is poor in the Minnesota River and downstream portion of pool 2 because of periodic poor water quality. Wildlife habitat is good in pool 2 in the areas of Crosby Lake, Pigs Eye Lake, and Grey Cloud Island and on the Minnesota River within the Minnesota Valley Wildlife Refuge and at Black Dog Lake.

Pigs Eye Lake in pool 2 just downstream of downtown St. Paul has a unique heron-egret rookery located at its border. This rookery is maintaining itself and contains black-crowned and great blue herons and common egrets

Fishing is good in the tail waters area of locks and dam 1 and at the outfall of Black Dog Lake (which is used as a cooling pool for a Northern States Power Company generating plant). Hunting is prohibited in the majority of pool 2 and on the Minnesota River within the study area. Use of firearms is limited near the residential areas of Bloomington, Burnsville, and St. Paul and its suburbs.

Channel Maintenance - An average of about 150,000 cubic yards of material is dredged annually from 10 dredge cuts in pool 2 (1956-1977). About 28,000 cubic yards per year has been dredged from five dredge cuts on the Minnesota River (1967-1977). The Minnesota River, like the portion of the Mississippi River above St. Anthony Falls, was added after construction of the rest of the system and has a local sponsor. Although maintained to some extent by local interests before 1967, the 9-foot channel was established by contract dredging in 1967 and 1968. Maintenance dredging on the Minnesota River has been done under contract by a hydraulic dredge or the Derrickbarge Hauser because the Thompson cannot be used with the limited bottom width of the channel (100 feet). Material has been placed on land provided by the local sponsor, the Lower Minnesota River Watershed District. Pool 2 has several unique problems for dredging and material placement. Pressure for development of riverside property makes it difficult to find suitable placement sites for cuts in downtown St. Paul (7, 8, and 9). Downstream of the Metropolitan Sewage Treatment Plant, high levels of contamination create problems for material placement. The Corps of Engineers has an agreement with the Minnesota Pollution Control Agency that requires all material dredged between downtown St. Paul and lock and dam 2 (cuts 1-8) to be contained on land. The St. Paul Barge Terminal (cut 7) is the highest volume dredging cut in the St. Paul District. Material from this cut has historically been placed on the shore near the St. Paul downtown airport (Holman Field).

The St. Croix River, a major transportation route for the late 1800's lumbering industry, enters the Mississippi River at Prescott, Wisconsin.

POOL 3

Pool 3 (Including the St. Croix River)

Description - Lock and dam 3 is at river mile 796.9, 6.1 miles above Red Wing. The lock is on the Minnesota side of the main channel.

The pool extends for 18.3 miles in the Mississippi River valley and 33 miles in the St. Croix River valley. In the St. Croix River valley, the pool is confined within the original banks of Lake St. Croix with very little lowland or floodplain area. In the Mississippi River valley below the mouth of Lake St. Croix, the pool widens and spreads over low, flat bottomlands in a generally wide floodplain.

Recreation Facilities - Pool 3 (excluding the portion in the St. Croix River) has 9 boat accesses with a total of 9 launching lanes (7 in Minnesota, 2 in Wisconsin), 216 parking spaces near the accesses, 669 marina slips (525 in Minnesota, 144 in Wisconsin), no camping units, and 21 picnicking units.

Lake Rebecca Municipal Park is the only major park in the area. The Corps and city of Hastings will begin constructing a major day use area at Lake Rebecca in 1980. The Corps maintains two areas - the Sturgeon Lake and Commissary Point Recreation Areas. Several private marinas and harbors, mainly at Prescott and Hastings, serve the area.

Most open water recreation boating occurs near the mouth of the St. Croix River and near Hastings and Diamond Bluff. Pool 3 has the third highest level of boat use.

The portion of the St. Croix River included in the 9-foot navigation project has been declared a National Scenic Riverway. Lake St. Croix is used extensively for recreation boating by local residents as well as residents of the Twin Cities metropolitan area.

Commercial Navigation - The 1978 Corps navigation charts indicate only one commercial navigation facility in this pool (for receipt of goods). However, the commercially navigable portion of the St. Croix River has two facilities, one receipt and one receipt and shipment.

Cultural, Natural, and Scientific Resources - Eight known archeological sites (seven in Minnesota and one in Wisconsin) are in the pool 3 area. Some have been affected by the activities of the Corps of Engineers. The Barton site is in Goodhue County on the southern portion of Prairie Island. The site contains possible evidence of house form, village arrangement, and artifacts from the major Mississippian culture (1000 to 1700 A.D.).

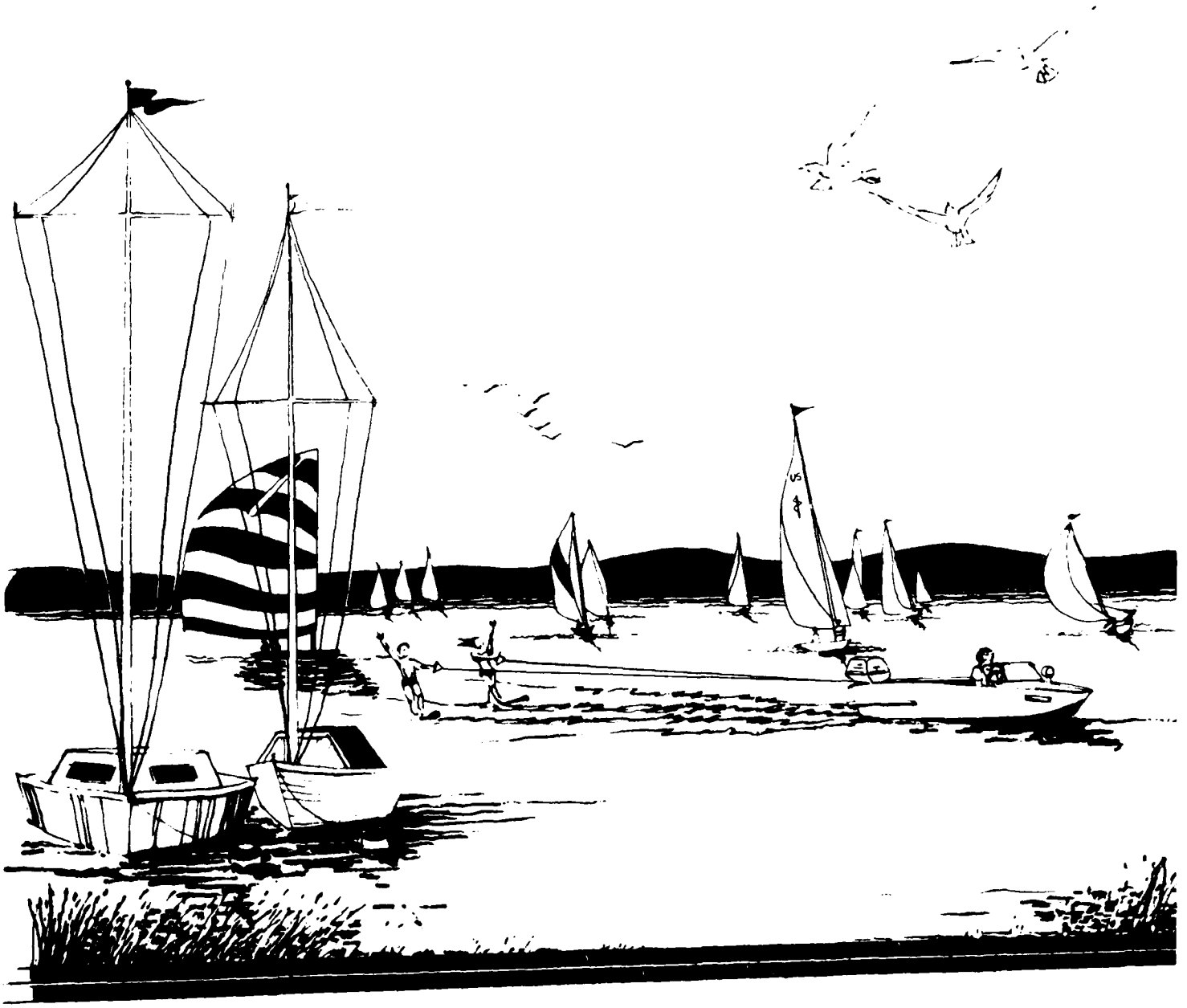
The Diamond Bluff site/Mero Mound group is at river mile 797. Both of these sites are on the National Register of Historic Places.

Fish and Wildlife Resources - Pool 3 has a small but important commercial fishery in North and Sturgeon Lakes. Sport fishing is also good through much of pool 3 and the St. Croix River and exceptional in some of the backwater lakes.

Hunting is a popular sport around pool 3. Native game birds and locally nesting waterfowl are in good supply. Bag checks by the Minnesota Department of Natural Resources indicate waterfowl harvests are comparable to the State average.

Channel Maintenance - Pool 3 has an average annual dredging volume of about 101,000 cubic yards (1956-1977) from nine dredge cuts. The St. Croix River has three dredge cuts and an average annual dredging volume of about 45,000 cubic yards. Most of the dredging in pool 3 has been done by the Thompson.

A lack of Federal land in pool 3 has made it difficult to find suitable material placement sites. A lack of suitable access sites also makes it difficult to provide material for beneficial use. Material dredged from the St. Croix River has been placed on islands near Hudson, Wisconsin; on the delta near the mouth of the Kinnickinnic River; at Lake St. Croix Beach, Minnesota; or at the Point Douglas County Park in Minnesota. In each location, the material provides sand beaches for the heavy recreation use on the lower St. Croix River.



POOL 4

Pool 4

Description - Lock and dam 4 is at Alma (river mile 752.5). Pool 4 is the longest pool and has the longest shoreline and largest water area of all the pools in the study area. Lake Pepin is part of pool 4.

This pool has been relatively little affected by channelization. The channel meanders through the alluvial fill and the multilevel terraces and lowlands formed by the glacial outwash.

The Chippewa River is the only major tributary flowing into pool 4. Smaller tributaries are the Vermillion and Cannon Rivers in Minnesota and the Buffalo River in Wisconsin.

Recreation Facilities - Pool 4 has 35 boat access areas with a total of 40 launching lanes (25 in Minnesota, 15 in Wisconsin), 1,216 parking spaces adjacent to the accesses, 1,332 marina slips (1,210 in Minnesota, 122 in Wisconsin), 692 camping units, and 381 picnicking units.

One State park - Frontenac State Park, Minnesota - is in the area. Several municipal parks provide major recreation facilities. Many private recreation developments are located throughout the pool.

Commercial Navigation - According to the 1968 Corps navigation charts, three commercial facilities (one each for receipt, shipment, and receipt and shipment) are in pool 4.

Cultural, Natural, and Scientific Resources - Wisconsin has designated Tiffany Bottoms as a State Scientific Area and Nelson-Trevino as a State Natural Area. The Chippewa River Bottoms (river miles 760 to 764) is a National Natural Landmark. Several areas are on the National Register of Historic Places.

Fish and Wildlife Resources - Pool 4 has exceptionally good and diverse habitat for both fish and wildlife. The expansive backwater areas upstream and downstream of Lake Pepin are excellent spawning, nesting, and rearing areas. Lake Pepin provides exceptional feeding and spawning areas for numerous fish species.

The riparian areas just downstream of Lake Pepin are heavily used for roosting by bald eagles and other raptors during the winter. The backwaters of the Nelson-Trevino Bottoms are one of two areas on the river where the massasauga (swamp rattlesnake) is known to exist. The Upper Mississippi River Wild Life and Fish Refuge has its northern border at the outlet of Lake Pepin.

Fishing is considered excellent in the pool, particularly the spring sport fishing for walleye in the tail waters of lock and dam 3. Trapping and waterfowl hunting are also considered excellent in the pool.

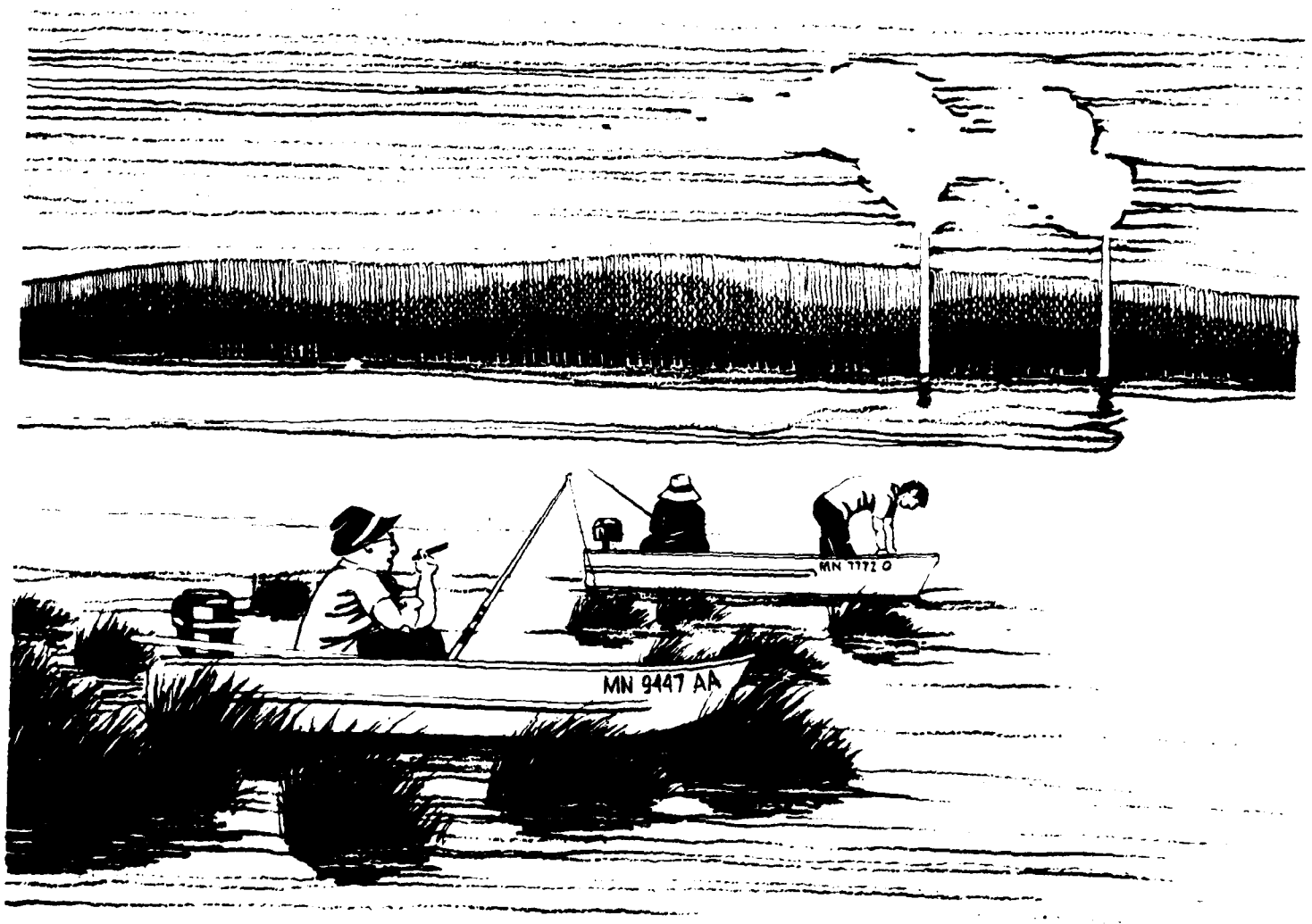
Channel Maintenance - Approximately 275,000 cubic yards of material is dredged annually from pool 4. About 55,000 cubic yards comes from six dredge cuts in upper pool 4, above and near the head of Lake Pepin. The balance of the material comes from five dredge cuts below Lake Pepin, below the mouth of the Chippewa River. The Chippewa River is the highest contributor of sediment of any of the tributaries in the GREAT I area. The cuts at and below the mouth of the Chippewa River are some of the most frequently dredged and highest volume sites. A unique problem in

Lake Pepin, unique to the Mississippi River, was created by the deposition of sediment by the Chippewa River which blocks the Mississippi River channel causing the water to back up and form a lake. Sailing is a popular recreational activity on Lake Pepin. Lake City, in the background, is known as the "birthplace of water skiing."

pool 4 is the dredging and placement of material from cut 6 which is at the upstream end of Lake Pepin. The material in this cut is a fine silt and is considered to be contaminated.

Of the 10 containment areas constructed in the GREAT I area, 4 are in lower pool 4. A containment site at Read's Landing was constructed in 1977 and 1978 and was used in 1978 and 1979. About 264,000 cubic yards of material was placed in it through 1979. In June 1979, seepage through the berm wall transported material into an adjacent backwater area. The capacity of the site was expanded after it was used in 1979 and it could be used for at least one more dredging operation. A containment site at Crats Island was used once in 1979 as was a site constructed near Teepeeota Point. A containment site constructed near Grand Escarpment was used through the 1979 dredging season.

The Mississippi River fulfills many roles. The power plants at Alma, Wisconsin, receive their cooling water from the river. On the Minnesota side, the area known as Weaver Bottoms provides prime habitat for fish and wildlife and, as a result, excellent fishing and hunting opportunities.



POOL 5

Pool 5

Description - Lock and dam 5 is at river mile 738.1, about 12.6 river miles above Winona. Pool 5 is about average in water area.

The high bluffs show signs of previous glaciation. The lowlands and floodplain consist of alluvial fill deposited in terraces by the glacial stream outwash.

For about 2 1/2 miles above the lock and dam, pool 5 is confined within a relatively narrow area between Minnesota high ground and two earth dikes. Two small tributaries - the Zumbro and Whitewater Rivers - enter the pool from Minnesota.

Recreation Facilities - Pool 5 has 11 boat accesses with a total of 12 launching lanes (5 in Minnesota, 7 in Wisconsin), 227 parking spaces adjacent to the accesses, 12 marina slips, 16 rental boats, 141 camping units, and 15 picnicking units.

Commercial Navigation - Two commercial navigation facilities are in pool 5. Both are for receipt of goods.

Cultural, Natural, and Scientific Resources - No areas in pool 5 are on the National Register. However, significant cultural resources are probably in the area.

Fish and Wildlife Resources - Pool 5 has excellent and diverse habitat for both fish and wildlife. The backwaters of the Weaver Bottoms and Belvidere Slough area provide excellent spawning, nesting, and rearing areas, although sedimentation and periodic strong water currents are causing a decline in their habitat values for fish. The sand prairie and marsh areas north of the Weaver Bottoms provide habitat for many species of rare turtles and many breeds of waterfowl.

Sport fishing and commercial fishing are considered good in pool 5. Waterfowl hunting and trapping are also good. The Weaver Bottoms is one of the few areas on the river where there is a large area closed to waterfowl hunting. Much of the pool lies within the Winona District of the Upper Mississippi River Wild Life and Fish Refuge.

Channel Maintenance - The Corps of Engineers dredges an average of about 163,000 cubic yards of material annually from eight identified dredge cuts in pool 5. Dredging has been done by the Thompson, and the dredged material placed on islands adjacent to the main channel. Weaver Bottoms, near the lower end of pool 5, has been a major concern of the GREAT I Team since early in the study.

Three containment sites have been constructed in pool 5 - above West Newton, above Fisher Island, and at Lost Island. The West Newton site was used in 1978 and 1979. The Fisher Island site was used also in 1978 and 1979. A berm stability problem was encountered in 1979 while attempting to use the Lost Island site without a discharge structure in place. The site was intentionally drained by breaching the berm on the river side to prevent a collapse of the berm in a sensitive area.

The natural beauty of the Mississippi River is unequaled. The heron and egret rookery near Fountain City, Wisconsin, is an important part of what makes the Mississippi River great.

POOL 5A

Pool 5A

Description Lock and dam 5A is 3 miles above Winona at river mile 728.5. The dam has the lowest lift (5.5 feet) of the dams in the study area. Except for pool 1 and the Lower St. Anthony Falls pool, it is the shortest. Of all the pools below pool 1, it has the least water area, overall pool area, and shoreline accessible by land.

Recreation Facilities - This pool has 7 boat accesses with a total of 10 launching lanes (6 in Minnesota, 4 in Wisconsin), 207 parking spaces next to the boat accesses, 80 marina slips, 38 rental boats, 126 camping units, and 189 picnicking units. One major park - Merrick State Park, Wisconsin - is next to the pool. Several private developments provide additional recreational facilities.

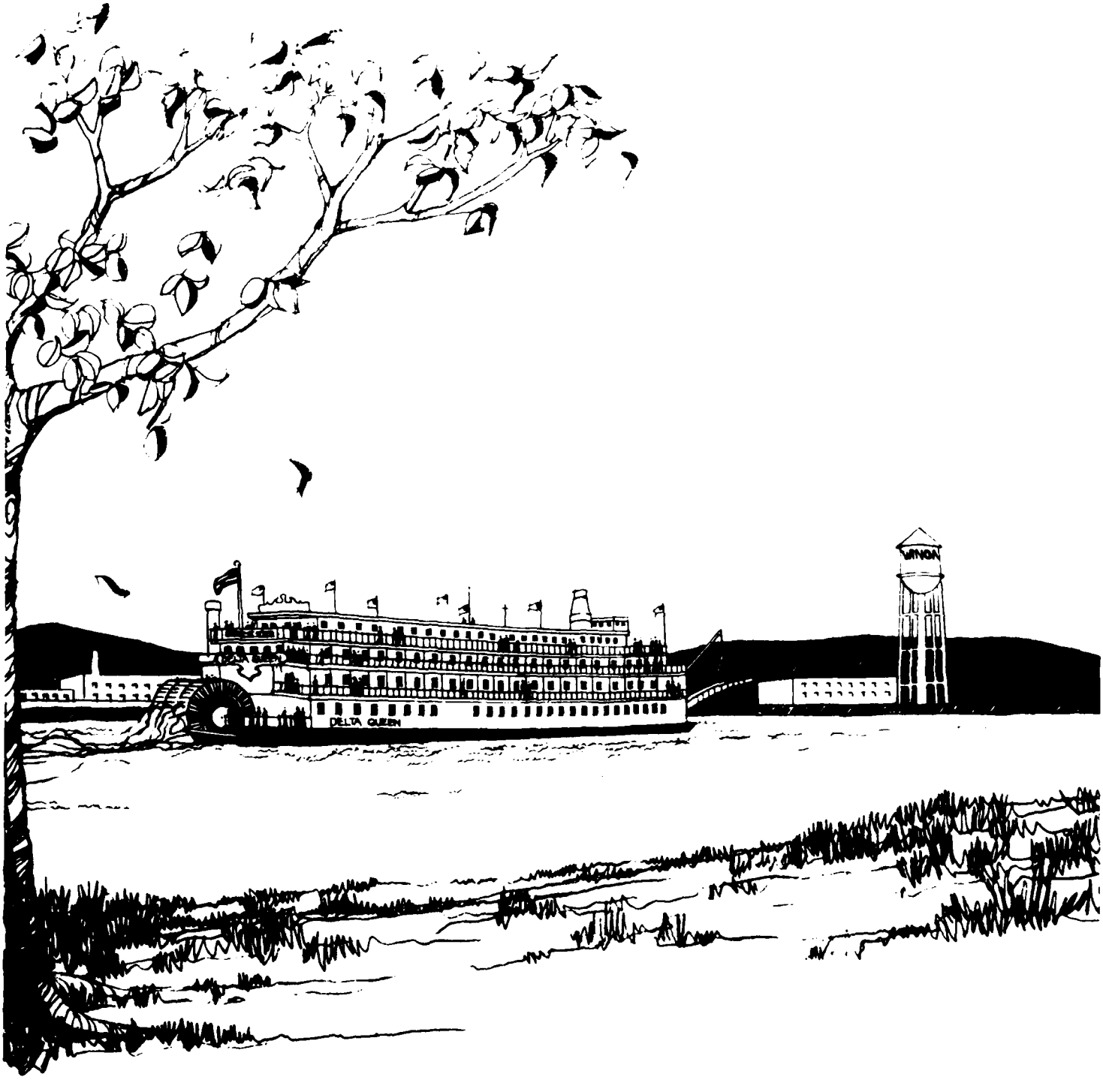
Commercial Navigation - No commercial navigation facilities are indicated for pool 5A on Corps navigation charts.

Cultural, Natural, and Scientific Resources - Two archeological sites in pool 5A are on the National Register. Both are aboriginal American sites in Minnesota. The Wisconsin Department of Natural Resources has designated one natural area - Kammeroski Rookery at river mile 734.

Fish and Wildlife Resources - Fish and wildlife habitat is generally very good in pool 5A. The Fountain City Bay area and the extensive backwater between Fountain City, Wisconsin, and Minnesota City, Minnesota, provide exceptional fishing, hunting, and trapping. A large heron and egret rookery exists in the Fountain City Bay area. Much of the pool lies within the Winona District of the Upper Mississippi River Wild Life and Fish Refuge.

Channel Maintenance - An average of about 86,000 cubic yards of material is dredged from six dredge cuts in pool 5A. Much of the material has been dredged hydraulically and placed on islands adjacent to the main channel. A containment area at Wilds Bend was used once in 1978.

Winona was once a bustling river town where paddle-wheelers would stop in the golden days of steamboating. Today the Delta Queen rekindles the memories of that bygone era, if only for a moment.



POOL 6

Pool 6

Description - Lock and dam 6 is 11.2 river miles below Winona at river mile 714.3. Between river miles 717 and 725 (Trempealeau Bay upstream to Bluff Siding), the Chicago, Burlington, and Quincy Railroad right-of-way embankment divides the pool into two large and almost equal-sized segments. The main channel is on the south side of the embankment.

The Delta Fish and Fur Farm is located on the north segment of the channel. The farm is managed to enhance the propagation of fish and wildlife for private sport fishing and hunting by permit only. Water levels are controlled independently of the main channel levels maintained by the Corps.

Recreation Facilities - Pool 6 has 11 boat accesses with a total of 12 launching lanes (9 in Minnesota, 3 in Wisconsin), 1,120 parking spaces next to the accesses, 547 marina slips, 275 camping units, and 420 picnicking units. Two major parks are adjacent to the pool - Perrot State Park (Wisconsin) and Latsch Prairie Island Park (Minnesota).

Commercial Navigation - Pool 6 has six commercial facilities for receipt, three for shipment, and one for receipt and shipment.

Cultural, Natural, and Scientific Resources - One archeological site (Vos site, Minnesota) is on the National Register. The Wisconsin Department of Natural Resources has classified three areas as natural areas - Trempealeau Mountain, Delta Fish and Fur Farm, and Mertes Slough.

Fish and Wildlife Resources - Pool 6 has good fish and wildlife habitat, but less acreage of such habitat than do most of the pools. The Straight Slough area and the area previously owned by the Delta Fish and Fur Farm are excellent fishing and trapping areas. Hunting is limited in the pool. The Trempealeau National Wildlife Refuge now includes all of the Delta Fish and Fur Farm.

Channel Maintenance - An average of about 42,000 cubic yards of material is dredged annually from six dredge cuts in pool 6. Much of the material dredged in pool 6 can be made available for beneficial use in Winona.

Lake Onalaska, near La Crosse, Wisconsin, is a major resting place for millions of migrating waterfowl each spring and fall. This area is part of the 195,000-acre Upper Mississippi River Wild Life and Fish Refuge.

POOL 7

Pool 7

Description - Lock and dam 7 is at river mile 702.5, about 4.6 miles above La Crosse. Beginning in pool 7 and extending downstream, the high bluff areas next to the river show no signs of glacial action. The lowland and floodplain between the bluffs which average over 5 miles in width in pool 7 consist of alluvial terraces deposited by glacial stream outwash.

The extreme lower end of the pool on the Wisconsin side is especially suitable for access to the water. The land is relatively level and less broken up by interspersed areas of water. The shoreline is generally not wooded except for fringe cover and is not considered desirable for extensive land-type recreation. The upper pool area is more heavily and extensively wooded and more aesthetically attractive from a "primitive" viewpoint.

Recreation Facilities - Pool 7 has 12 boat accesses with a total of 13 launching lanes (1 in Minnesota, 12 in Wisconsin), 386 parking spaces adjacent to the accesses, 46 marina slips, 112 camping units (Wisconsin), 213 picnicking units (28 in Minnesota, 185 in Wisconsin), and 4 miles of hiking trails (Wisconsin). Two major parks - O. L. Kipp State Park (Minnesota) and Louis Nelson Park (Wisconsin) - are next to the pool.

Commercial Navigation - The 1978 Corps navigation charts show no commercial navigation facilities in pool 7.

Cultural, Natural, and Scientific Resources - Four archeological sites are on the National Register. One of these sites is the Trempealeau Lakes Mound Group and Second Lake Village site in the upper segment of the pool.

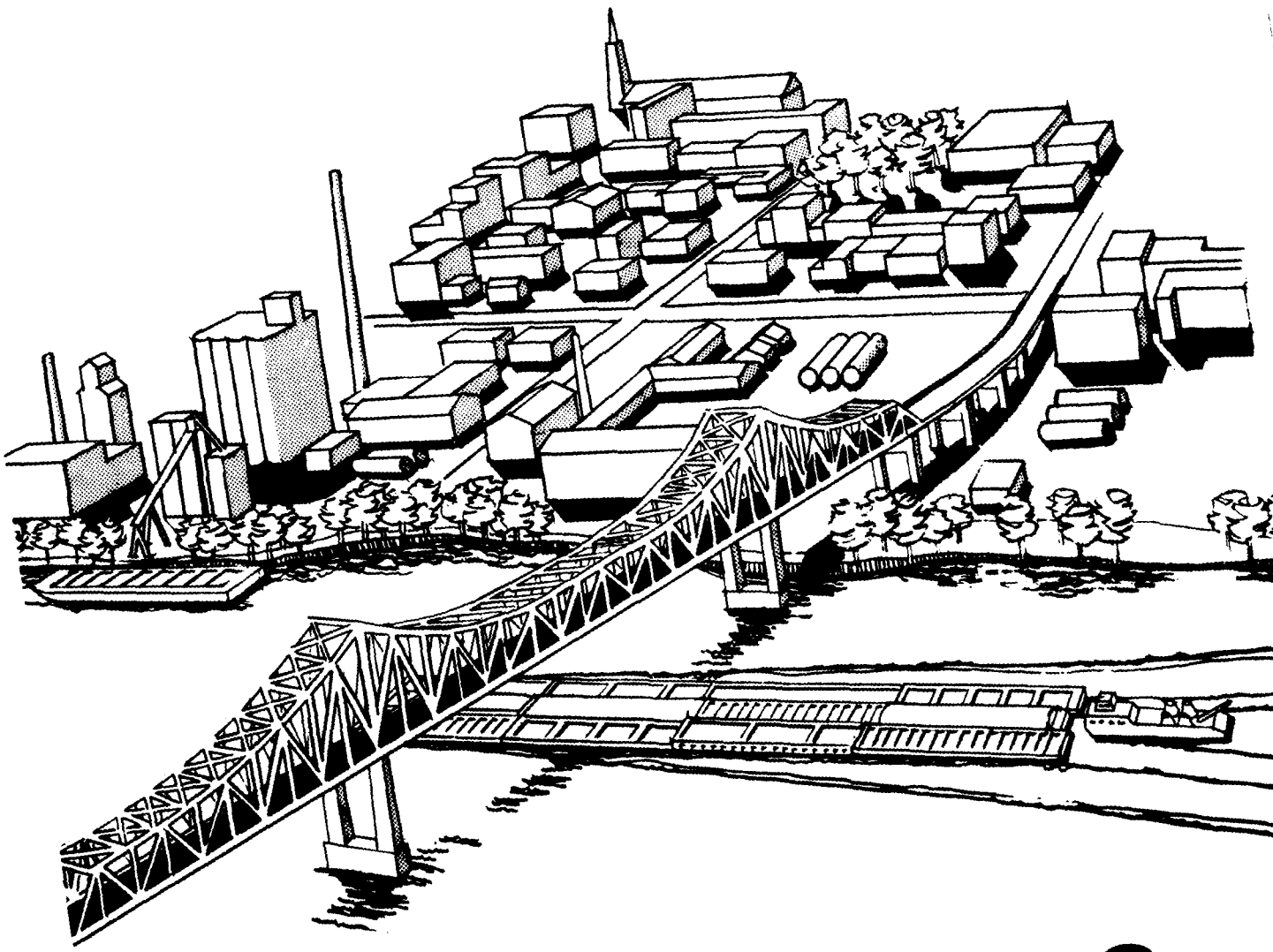
The Wisconsin Department of Natural Resources has classified two areas as natural areas - Upland Plover Nesting Site and Tank Creek.

Fish and Wildlife Resources - Pool 7 has excellent and extensive fish and wildlife habitat although sedimentation is causing decline in numerous areas. The deltas of Tank Creek, Shingle Creek, and the Black River and Lake Onalaska provide excellent hunting, fishing, and trapping. Lake Onalaska provides an exceptional resting and feeding area for migrating canvasback ducks and an outstanding habitat for sunfish. Much of the pool lies within the La Crosse District of the Upper Mississippi River Wild Life and Fish Refuge.

The massasauga is also known to exist in the Black River delta. A large area of Lake Onalaska is closed to waterfowl hunting.

Channel Maintenance - About 95,000 cubic yards of material is dredged annually from seven dredge cuts in pool 7. This is one of the most difficult pools in the GREAT I area in which to locate suitable placement sites. Material has been dredged by the Thompson and placed on islands adjacent to the main channel. In recent years, material from the Dakota and Winters Landing dredge cuts has been dredged by the Derrickbarge Hauser and barged to Dresbach to avoid wetland encroachment. A partial containment area, consisting of a berm on the back channel side, will allow for more material to be placed on Dakota Island.

The Mississippi River was an all-important transportation route in the settlement of this region. Today, cities such as La Crosse, Wisconsin, depend heavily on the river as a fluid highway for the movement of goods and materials.



POOL 8

Pool 8

Description - Lock and dam 8 is at river mile 679.2, 18.7 river miles below La Crosse. The lower pool area has one of the broader expanses of water surface that is relatively unbroken by interspersed areas of protruding land. Goose Island, located about midpool, is one of the largest St. Paul District administered land areas that is surrounded by pool water. The high bluff area through pool 8 shows no signs of glacial action. The lowlands and floodplain basically consist of alluvial fill deposited in terraces by glacial stream outwash.

Two tributaries enter the Mississippi River in pool 8. The Root River enters from Minnesota, and the La Crosse River enters from Wisconsin.

Recreation Facilities - Pool 8 has 24 boat accesses with a total of 26 launching lanes (19 in Wisconsin, 7 in Minnesota), 1,080 parking spaces near the accesses, 909 marina slips, 462 camping units (414 in Wisconsin, 48 in Minnesota), 841 picnicking units (784 in Wisconsin, 57 in Minnesota), 4 road access beach areas (3 in Wisconsin, 1 in Minnesota), and 17 miles of hiking trails (16 in Wisconsin, 1 in Minnesota).

Commercial Navigation - Three commercial navigation facilities are in pool 8 - one receipt, one shipment, and one receipt and shipment. The Black River, which is part of pool 8, has five more facilities - three shipment and two receipt and shipment.

Cultural, Natural, and Scientific Resources - No archeological sites are documented in the pool area. Wisconsin has designated a natural area - Turtle Nesting Site - at river mile 685.

Fish and Wildlife Resources - Pool 8 provides excellent fish and wildlife habitat although sedimentation is causing some decline in fish habitat. Hunting, fishing, and trapping are considered excellent throughout the extensive backwaters of the pool. Particular backwater areas provide good resting and feeding habitat for migrating canvasback ducks. Sport fishing for walleye is particularly good in the tail waters of lock and dam 7 in the spring. A heron and egret rookery exists in the delta of the Root River. Much of the pool lies within the La Crosse District of the Upper Mississippi Wild Life and Fish Refuge.

Channel Maintenance - Pool 8 has an average of about 152,000 cubic yards of material dredged annually from 10 dredge cuts. Material in pool 8 has been dredged by the Thompson and placed on nearby islands or the adjacent shoreline. A containment area was constructed above Brownsville, Minnesota; it was used once in 1978. As a pilot program under the GREAT I study, material was also transported by barge from Brownsville to Isle La Plume to meet beneficial use demands in La Crosse.

Commercial fishermen try their luck in the waters of the Mississippi River near Lansing Bend, one of the more difficult portions of the Upper Mississippi River to navigate.

POOL 9

Pool 9

Description - Lock and dam 9 is at Lynxville, Wisconsin (river mile 647.9). The total water area of pool 9 - plus the Federal above-water lands within acquisition limits - give pool 9 the largest federally managed area of any pool in the study area. Two small tributaries, the Bad Axe River from Wisconsin and Upper Iowa River from Iowa, enter the Mississippi River in pool 9.

Recreation Facilities - Pool 9 has 20 boat accesses with a total of 21 launching lanes (2 in Minnesota, 13 in Wisconsin, and 6 in Iowa), 637 parking spaces adjacent to the accesses, 216 marina slips (70 in Wisconsin and 146 in Iowa), 40 camping units (Wisconsin), 69 picnicking units (34 in Iowa and 35 in Wisconsin), and 2 miles of hiking trails (Iowa). Blackhawk Memorial County Park is the only major park in the area. Mt. Hosmer Park in Lansing provides picnic facilities and scenic overlooks of the river.

Commercial Navigation - Two commercial navigation facilities for receipt of goods are in pool 9.

Cultural, Natural, and Scientific Resources - A number of Indian mound sites are in the area. The sites include the Waukon Junction, Keller, Capoli Bluff, and Hemingway Mound Groups and the Effigy Mounds National Monument. In addition, the Iowa State Preserve Board owns the Fish Farm Mounds Preserve south of New Albin, Iowa.

Fish and Wildlife Resources - Pool 9 provides excellent fish and wildlife habitat, although sedimentation is causing a decl[illegible] in fish habitat particularly i[illegible]ansing Big Lake. Hunting, fishing, and trapping, especially commercial fishing, are considered outstanding in the pool. Particular backwater areas provide good resting and feeding habitat for migrating canvasback ducks. Lansing Big Lake, the Reno Bottoms area, and the Winneshiek Slough area are the most outstanding habitat areas in the pool. Most of the pool lies within the Lansing District of the Upper Mississippi River Wild Life and Fish Refuge.

Channel Maintenance - An average of about 120,000 cubic yards of material is dredged annually from 10 identified dredge cuts in pool 9. The material has been dredged with the Thompson and placed on nearby islands or along the adjacent shoreline. A containment area was constructed above Lansing and was used in 1978 for material from the Lansing Upper Light dredge cut.

The small river town of McGregor, Iowa, is typical of the many towns which owe their heritage and existence to the mighty Mississippi River.

POOL 10

Pool 10

Description - Lock and dam 10 is in Guttenberg at river mile 615.1. Pool 10 is the second largest pool in the St. Paul District. The valley and floodplain between the high bluffs become increasingly narrow at the lower end of the pool. The bluffs show no signs of glaciation. The lowlands and floodplain basically consist of alluvial fill deposited in terraces by the glacial stream outwash.

Recreation Facilities - Pool 10 has 30 boat accesses with a total of 37 launching lanes (18 in Wisconsin and 19 in Iowa), 1,403 parking spaces next to the accesses, 785 marina slips (218 in Wisconsin and 567 in Iowa), 130 rental boats (60 in Wisconsin and 70 in Iowa), 961 camping units (510 in Wisconsin, 451 in Iowa), 1,012 picnicking units (669 in Wisconsin and 343 in Iowa), 73 miles of hiking trails (18 in Wisconsin and 55 in Iowa), 28 miles of cross country skiing trails (Iowa), 17 miles of horseback riding trails (Iowa), and wayside stops.

Major parks and forests include Effigy Mounds National Monument, Pikes Peak State Park, and Yellow River State Forest in Iowa and Wyalusing State Park in Wisconsin.

Commercial Navigation - The Corps 1978 navigation charts indicate four commercial navigation facilities in pool 9 - one receipt, one shipment, and two receipt and shipment.

Cultural, Natural, and Scientific Resources - The pool 10 area is rich in cultural resources. It contains several of the larger, early day outposts and settlements which grew into flourishing river cities. The principal cities that developed from the early era are Prairie du Chien and Guttenberg. Preservation and restoration of historically significant structures and artifacts stimulate interest in this area.

The Villa Louis on St. Feriole Island in Prairie du Chien is on the National Register of Historic Places. It is managed by the Wisconsin Historical Society. The second Fort Crawford (river mile 634) is also on the National Register. In addition, many buildings in Prairie du Chien and McGregor and Marquette, Iowa, are historically significant.

Effigy Mounds National Monument (river mile 627) is managed by the National Park Service. It has a variety of prehistoric effigy mounds. The area features extensive interpretive facilities and hiking trails.

The Wisconsin Department of Natural Resources has three natural areas in pool 10 - Lowland Woods (river mile 621), Cliffs Woods (river mile 618), and Eagle Valley (river mile 614).

Fish and Wildlife Resources - Pool 10 provides excellent habitat for fish and wildlife. Commercial and sport fishing, hunting, and trapping are considered outstanding throughout the extensive backwaters. Harpers Slough, the Wisconsin River delta, Wyalusing Slough, and State Line Slough are all noted for their habitat.

Much of the pool lies within the Cassville District of the Upper Mississippi River Wild Life and Fish Refuge. Populations of the endangered Higgin's Eye clam are known to exist in East Channel at Prairie du Chien.

Channel Maintenance - About 70,000 cubic yards of material is dredged annually from 10 identified dredge cuts in pool 10. The material has been dredged hydraulically and placed on nearby islands or the adjacent shoreline.

"A river belongs to no man. And it belongs to every man. And no man has any right to contribute to the desecration of a river by irresponsible and abusive acts, at the expense of his neighbors and fellow American citizens, near or far removed from the stream itself." Richard J. Dorer, 1968

CONFLICTS IN THE SYSTEM

CHAPTER IV

CHAPTER IV

CONFLICTS IN THE SYSTEM

INTRODUCTION

It has already been stated that the Upper Mississippi River in this decade hosts a multiplicity of uses and users. Such has not always been the case.

The Mississippi River, before it was a wildlife refuge, a barge channel, a recreational haven, and a source of city drinking water or industrial cooling water, was a natural ecosystem. The Pleistocene Ice Age - with its alternate glacial formation and glacial melt - formed the river basin topography that we know today. At the end of the last glacier (about 14,000 years ago), the Mississippi River continued to be a natural watercourse serving the functions of movement of water and habitat for aquatic and terrestrial plants and animals.

The Mississippi River is called upon to fulfill many needs.

The arrival of the American Indians--the Sioux, Chippewas, Sac, Fox, and others--had little effect on the river as a natural system. Limited in numbers and technology, the Indians used the river for transportation, hunting and fishing. But it is unlikely they had much effect on the resource - good or bad.

Early trappers, hunters, and traders likewise benefited from the resource but produced little in the way of "environmental impacts." Since the 1600's, change has been constant in the Upper Mississippi River valley, as witnessed by the following chronology of events:

1673: French explorers Hennepin, Marquette, and Joliet opened the Mississippi River to the Europeans.

1730: French fur traders in pirogues and bateaux followed from 1730 to 1750.

1760: Keelboats transported early settlers and military parties followed by flatboats, raft boats, and scows.

1823: The first steamboat to reach St. Paul was the "Virginia".

1830: Beginning of the fabulous days of the golden age of steamboat travel and trade on the Mississippi River.

1832: A young West Pointer, Lieutenant Robert E. Lee, prepared surveys of the rapids at Rock Island and the mouth of the Des Moines River for navigation improvement.

1878: The first comprehensive plan of improvement on the upper river, the 4 1/2-foot channel project, was authorized by Congress.

1907: A 6-foot channel was authorized. During the latter years of this project, commercial navigation almost disappeared from the upper river.

1939: The 9-foot channel opened to transportation on the Upper Mississippi River.

To date, Congress has recognized the commercial and fish and wildlife value of the resource through designation of the channel and the refuge. A study was made in the 1960's for designation of a portion of the valley as a "National Recreation Area," and the potential of the resource for "Wilderness Area Designation" has been studied. The National Recreation Area designation did not gain enough political support for congressional approval. The GREAT I Team considered the need for wilderness designation and adopted a resolution recommending that wilderness areas not be designated but that consideration be given to designating other special management areas. This resolution is included as Exhibit 2 of this report.

History has shown us that the Upper Mississippi River has undergone substantial changes in the interest of the economic development of the country. Not only has the channel been modified to accommodate vessels with greater drafts, but:

* The floodplain has been modified by dikes and levees to protect land, people, and structures from floods and by reduction of natural recharge areas as a result of covering of the landscape, particularly in urban areas.

* The water has been contaminated with human and animal wastes, cropland runoff, and chemicals of all kinds from cropland and commercial and industrial effluent.

* The natural landscape has been modified by development of man's structures of all kinds.

* Siltation in the river has been caused by erosion of streambanks and uplands - in part, natural - in part, resulting from poor grazing and farm practices.

* Railroads have 'created' a new shoreline and limited access to the river in many places.

In short, the history of the river has been one of change - change that has affected both the economy and the environment. In gross terms, the changes have, in some places, resulted in improved natural habitat (i.e., creation of new wetlands by pooling of the river behind the locks and dams), but often the changes in the basin have been to the detriment of the natural environment.

WHAT THE RIVER IS

Table 7 gives a brief description of some of the functions the river serves and shows the agencies responsible to support these functions.

The river system today can be compared to a planner's base map of a totally natural system (prehuman involvement) which has been overlaid with a series of man-made alterations - some beneficial to some parts of the environment while detrimental to others. Each alteration or "use" can benefit one aspect while harming another - nothing man or nature does to the river has "no effect". Uses can and do conflict. Depending on one's personal

TABLE 7

Functions of the Upper Mississippi River

Function	Agency responsible for management
An ecosystem for plant and animal species	U.S. Fish and Wildlife Service and State resource management agencies monitor some wildlife populations and regulate hunting and fishing.
A corridor for removal of water from the upland watershed	Corps of Engineers controls flow within limits of the lock and dam system. Local and State governments regulate floodplain development.
A navigation channel for commercial transportation of bulk commodities	Corps of Engineers operates and maintains the lock and dam system and maintains the navigation channel. U. S. Coast Guard operates and maintains the navigation aids.
A recipient of agricultural, residential, commercial, and industrial effluent	State pollution control agencies and the Environmental Protection Agency regulate municipal waste control agencies.
A recreational playground	Master planning and limited management of Federal lands by the Fish and Wildlife Service and Corps of Engineers. Coast Guard is responsible for boating safety. State and local governments manage some lands for recreational use. Much of the present use is unmanaged.
A place for human habitation and related commercial and industrial development	Local governments provide some control through land use planning, zoning, and floodplain regulations. State regulatory agencies also exercise some control. Corps of Engineers and Fish and Wildlife Service regulate development on Federal lands and in navigable waters.
An aesthetically pleasing environment for human enjoyment	Some control of visual impacts via local, State, and Federal land use controls.

values, agency mandates, or economic investment, a person, group, or agency will tend to be more concerned about one use over another and seek a management system that assures survival or enhancement of the resource for that use.

So today, the river system exists as a resource with a variety of users competing with one another for various uses.

Industries depend on the river to provide a fluid highway for movement of goods.

PROBLEM IDENTIFICATION AND REFINEMENT

For GREAT I to initiate a program of conflict resolution, the first step had to be a thorough determination of the conflicts among users - i.e., an identification of the problems that were being created or already existed as a result of our desire to have the river serve as a multipurpose resource.

The principal reason for establishing the GREAT study was concern by States and Federal agencies that Corps of Engineers traditional dredging practices were increasing flooding and adversely affecting fish, wildlife, and recreation resources. Other problems were also known and the Upper Mississippi River Basin Commission defined these problems when it set the study objectives discussed in Chapter II. On the basis of these objectives, GREAT set about identifying specific problems to address. This problem identification was one of the earliest Team efforts. The Team then determined the activities needed to address these problems and ddvelop the plans and recommendations for their resolution.

To help determine the extent and severity of the known problems and identify any additional problems, a series of public meetings was held in winter 1974-1975. From Minneapolis to Lansing, the range of public attitudes and concerns was recorded. At this stage, the proposed programs of GREAT I were adjusted to reflect these attitudes and concerns.

At each meeting, the GREAT program was explained and people were urged to express their opinions. People who live along the river and those who use it frequently indicated they believed the resource was deteriorating. They were concerned about lost beauty and degradation of the river's recreation values. Fish and wildlife and maintenance of the 9-foot navigation channel were recognized as large-scale matters that required official regulation and review. Loss of favorite fishing pools, blocking of small-boat channels by sand, and marring of the river's beauty were among the concerns expressed.

As a result of these meetings, a "Town Meeting Report" (Upper Mississippi River Basin Commission, 1975) was produced summarizing public comments, questions, and publicly identified problems. That initial report

contained 44 problem statements (as well as a number of comments and questions). On the basis of these statements and agency knowledge, the April 1975 GREAT Plan of Study was prepared. This plan of study, along with early work group deliberations, was summarized in an informational mailing to the public in fall 1975, along with a notice that the public would have another opportunity to scrutinize the early work of GREAT and suggest any problems that may have been overlooked. In October and November 1975, GREAT held another series of "Town Meetings". Following these meetings, a second "Town Meeting Report" (Upper Mississippi River Basin Commission, 1975) was prepared.

Many people have met to discuss and solve the river's problems.

This report outlined some additional problems that the public felt must be considered in creating a river resource management plan. Input from the two series of the town meetings, along with agency discussions, resulted in a list of 146 problem statements covering a broad range of concerns. The Plan Formulation Work Group Appendix lists all of the problems perceived by the public and Team members.

In March 1976, following the public meetings, the work groups were directed to develop their own list of problems based on their professional knowledge and the work group objectives identified in the plan of study.

After the work groups identified the problems, the Plan Formulation Work Group prepared guidelines (Plan Formulation Work Group Appendix) to determine the relevance of the problems to the study. These guidelines were used by the Plan Formulation Work Group to screen the problem statements and identify those that the work group felt applied to the GREAT study. This list, categorized by work group in the summer of 1976, was given a final review by the GREAT Team. The Team determined that some of the problems were being adequately addressed by others or were beyond the scope of GREAT and made appropriate changes to the list. The Team further recognized the need for a problem list for the Plan Formulation Work Group and established one.

The development of this Team-approved list did not end the problem identification efforts of GREAT (although emphasis shifted from this process at this point). Through the public participation activities, GREAT received additional requests to address certain problems. The Public Participation and Information Work Group maintained a record of these requests and transmitted them to appropriate work group personnel. This list of problem statements developed after summer 1976 is displayed in the Plan Formulation Work Group Appendix. The final list of problem statements states the problem in its final form, denotes the extent to which it was resolved as a result of the GREAT study, and discussed why the problem was not addressed by the work group or, if it was addressed, refers to the task or activity that addressed it.

PROBLEM SUMMARY

The following discussion summarizes the problem areas initially perceived and subsequently addressed in the GREAT I study. The problem areas are organized by the major problem areas of system management, natural resources, and human resources. Within these major categories are 10 subcategories:

CHANNEL MAINTENANCE

SEDIMENT AND EROSION CONTROL

WATER QUALITY

FISH AND WILDLIFE RESOURCES

AESTHETICS

COMMERCIAL TRANSPORTATION

RECREATION

FLOODPLAIN MANAGEMENT

CULTURAL RESOURCES

PUBLIC PARTICIPATION

The following matrix portrays which subcategories are discussed within each major category:

System Management	Natural Resources	Human Resources	Subcategory (Resource Components)
0	0	0	Channel Maintenance
0	0	0	Sediment and Erosion Control
0	0	0	Water Quality
0	0		Fish and Wildlife Resources
0	0	0	Aesthetics
0	0	0	Commercial Transportation
0	0	0	Recreation
0		0	Floodplain Management
0		0	Cultural Resources
0			Public Participation

A complete list of all problems that were identified by GREAT for consideration is shown in the Plan Formulation Work Group Appendix.

SYSTEM MANAGEMENT PROBLEMS

There would be few problems on the Upper Mississippi River and no need for the GREAT study were it not for the many diverse demands placed on the resource. Public agencies responsible for managing the resource have devel-

The Mississippi River valley is very extensive.

oped policies addressing narrow demand-based management objectives. The uncoordinated development of these objectives has led to conflicts in management goals. The need to resolve these conflicts through coordinated management was recognized by all team members as a problem which had to be addressed.

Of the 86 problems addressed by GREAT, 30 pertained to management needs. The overriding management problem is the one noted above--the lack of adequate coordination between agencies responsible for management. Because the river is such a complex resource and because such a multitude of State and Federal agencies have various degrees of management and enforcement authority on the river, a total river resource management approach has been impossible. Rather, individual agencies with individual mandates relating to only single-purpose problems have been managing parts of the resource with inadequate consideration of the impact on related but nonmandated parts. A prime example of this (and the problem that "created" the GREAT I study) is the problem of the negative impacts of 9-foot navigation project operation and maintenance activities on fish and wildlife resources. Historically, the Corps of Engineers' channel maintenance was limited to dredging and placement of dredged material in the most efficient manner possible, with little regard for impacts on other components of the resource. Funds were not provided for fish and wildlife habitat preservation, maintenance, or enhancement. This and other problems of primarily a management nature are discussed below by appropriate subcategory.

CHANNEL MAINTENANCE

Channel maintenance, including dredging, dredged material placement, and operation of the lock and dam system, have been regarded as a single-purpose activity. Other resource components such as fish and wildlife habitat, recreation resources, water quality, aesthetics, and cultural resources have been considered when additional funds were not required.

Various agencies have differing opinions as to the effects of dredging and dredged material placement on flood stages. Therefore, data that are acceptable to all agencies need to be developed so that all agencies can agree on the impacts and modify and align their regulations accordingly.

In the past, channel maintenance activities were detrimental to backwater areas.

SEDIMENT AND EROSION CONTROL

Control of erosion from agricultural lands under current programs considers reduction of erosion to a level compatible with continued agricultural use of the land. Current practices do not provide a long-term solution to the sedimentation problems on the river. Conservation tillage and other changes in farming practices may be neccessary to reduce erosion and sedimentation to a level that will ensure survival of the backwaters.

Streambank erosion control has been difficult to justify economically on the basis of the value of land being lost. Downstream impacts of the eroded material need to be given more consideration.

WATER QUALITY

Coordinated water quality and sediment quality data in the study area are lacking as a result of differing monitoring programs by various States and agencies. A consistent monitoring and evaluation program should be set up through interagency coordination so that impacts of a project can be agreed upon by all agencies based on consistent criteria.

FISH AND WILDLIFE RESOURCES

The Upper Mississippi River Wild Life and Fish Refuge consists of almost 200,000 acres. Planning and management of the refuge have not been coordinated with other resource uses, resulting in management conflicts among agencies.

Data gathering and interpretation regarding fish and wildlife re-

The Mississippi River valley is home to many endangered fish and wildlife species.

sources by the various States and agencies, although coordinated to some extent by the Upper Mississippi River Conservation Committee, needs to be better coordinated and made readily available for use.

AESTHETICS

This resource "value" has never been addressed by any agency as a primary objective. A uniform approach to this problem by all agencies is needed.

COMMERCIAL NAVIGATION/DEVELOPMENT

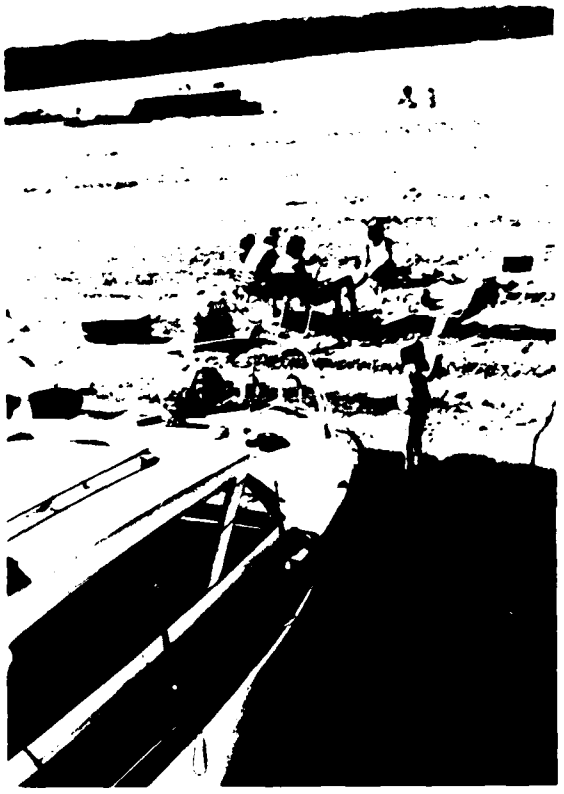
Multipurpose use of the Mississippi River, with multiple objectives and regulatory agencies at the local, State, and Federal level, poses serious problems to private industry, including commercial navigation and associated riverfront development interests. Permits for development of barge fleeting areas, terminals, and on-land water-related developments must be obtained from several agencies for just one project. This results in high development costs, uncertainty regarding development potential, and long front-end development time frames and costs. While private interests recognize the need to evaluate impacts of their developments, multipermit processes create difficulties that possibly could be minimized through more coordination among agencies at all levels.

Commercial navigation is a major activity on the river.

RECREATION

Recreational use on the Upper Mississippi River has occurred, to a great extent, without any overall management scheme. Federal, State, and local agencies have development and management capabilities, but they are not coordinated. Similarly, conflicts exist among various types of recreationalists competing for the same resources. As a result, the very aspects that draw the resource user to the river--its pristine character and abundance of fish

and wildlife--are often adversely affected. In addition, agency projects such as dredged material placement enhance and detract from this use, and, because recreation is not a project purpose, it is often not considered.



Camping and picnicking on sand beaches are popular.

FLOODPLAIN MANAGEMENT

The definition of the floodway is not consistent among agencies. This makes it difficult for State and Federal agencies to agree on what, in fact, is encroachment and what is not. Thus, management is inconsistent.

Data needs to rectify inconsistency in interpretation include mapping of the floodway and floodplain and improved topographic and hydrographic cross-section data for the floodplain

CULTURAL RESOURCES

Like recreation, cultural resources are managed jointly by the Federal government and the States without adequate coordination. The States have limited budgets and often have not given significant attention to identifying and protecting this resource. A recent Executive Order requires that all Federal agencies conduct cultural resource inventories and give more consideration to cultural resource values.

PUBLIC PARTICIPATION/INFORMATION

Individual agencies carry out their own general and project-based public participation and information efforts. Often, an individual is inundated with notices of several public participation/information events within a short time frame. The general public is often confused, if not irritated, by lack of coordination by agencies in communicating with the public.

Opportunities for the public to participate in various agency studies and project planning efforts are often not well publicized. Notification efforts to the public need to be improved.

SUMMARY

It is evident that interagency and interdisciplinary coordination of activities on the Upper Mississippi River, before GREAT, had evolved into a major problem. The solution to this problem is fundamental to addressing many related problems as further described in the next two sections.

NATURAL RESOURCE PROBLEMS

Development and modification of the Upper Mississippi River has made the river's natural resources increasingly dependent on human management for survival. Although the quality of some of the river's natural resources has improved with the development, the system is increasingly man-made. Therefore, the river is less and less able to cope on its own with threats to its natural resources.

Natural phenomena such as sedimentation, stream bank erosion, floods and drought were all part of the river ecosystem before man began to develop the river. At that time, the river was able to adjust its own channels and physical character in response to these phenomena sufficiently to maintain a rich and diverse natural resource. Development of the river has greatly reduced its means for adjusting to these physical changes. Dikes, levees, blocking dams, wing dams, and the lock and dam system have all contributed to make the river less resilient and more dependent on man to maintain its natural character.

The problem, (which led to and was emphasized by GREAT I) was that, despite the river's increased dependence on artificial management to perpetuate its natural resources, most of man's river management activities were detrimental to these resources. Not only had man's development greatly reduced the river's ability to protect itself, but man's continuing activities and developments were being accomplished with little regard for the river's natural values. The Corps of Engineers did not have adequate authority to protect the resources during its maintenance dredging activities. And neither the Fish and Wildlife Service nor the State natural resource agencies had the funds or authority to protect the resource from the many other adverse activities affecting the river.

If the river's water quality, habitat value, and aesthetic character are to survive, action is needed to change man's attitudes toward the river and agencies' authorities on the river.

Of the 86 problems addressed by GREAT, 24 are problems related to the ecological resources of the river. The general problems noted above are addressed more specifically below by appropriate subcategory.

CHANNEL MAINTENANCE

The placement of dredged material in the floodplain of the Mississippi River has adversely affected the ecosystem by directly destroying wetlands, through secondary movement of material into backwaters, and through blocking of side channels. This problem is significant because the Corps of Engineers annually dredges the river to maintain a navigation channel. Dredged material averaging in excess of 1 million cubic yards annually has been placed in the floodplain, resulting in loss of habitat or reduction of its value.

To directly reduce the impact of dredged material placement, a need was identified to determine how dredging requirements could be minimized and how placement of

materials could be better handled to minimize environmental impacts while minimizing dredging costs. To reduce the impact of dredged material placement, it was believed that there was a need to examine what types of dredging and accessory equipment may be available which would be more efficient as well as more capable of environmentally sound placement techniques.

There was some basis to believe that dredged material may have some beneficial uses. If it could be determined what these uses were and where the demand existed, dredged materials could be an asset rather than a liability. Further, beneficial use of the material may allow for justification for the likely increased costs that may result from changing past dredging practices.

Proper placement of dredged material is very important.

There was a belief that dredging and placement may have a negative impact directly on water quality of the river and thus the quality of the aquatic habitat for human use as well as for fish and wildlife. A need was identified to more clearly determine this relationship.

SEDIMENT AND EROSION CONTROL

A combined natural/man-made problem that has been identified is sedimentation. While sediment from upland and stream bank erosion has been flowing to the main stem floodplain for thousands of years, it was not a major problem before the establishment of the lock and dam system and increased erosion rates because of mechanized agricultural practices and increased urbanization. Also, the permanent pools increase sediment accumulation. Thus, sediment entering the system is filling in backwater areas. Sedimentation is not only a problem for channel maintenance, as noted earlier, but is a problem related to fish and wildlife habitat preservation.

Because it was assumed that dredged material originates in the uplands and along tributary stream banks, the belief is common that part of the solution to the problem may lie in more precise identification of where the material is coming from and how it can be controlled. Critical source areas have been identified and some erosion control measures are being recommended. Additional study is needed.

Several pilot projects were initiated to evaluate the potential for preventing backwater sedimentation by flow manipulation at the site. These projects included side channel alternatives, partial closing dams, and culverts through existing dikes. The results of these studies need to be applied to other areas.

The Corps of Engineers has initiated a program of riprap restoration along the main stem. Under this program riprap placed during construction of the lock and dam system is being restored. GREAT has provided the Corps with a priority list considering erosion potential and impact on fish and wildlife habitat.

Sedimentation of backwaters caused by dredging must be reduced.

WATER QUALITY

Concern was expressed that the quality of the water in the river (particularly the backwaters) is being affected by point source pollution from dredging and material placement operations and nonpoint pollution from upland sedimentation and is threatened by shipment of hazardous wastes. The significance of these activities must be determined and ways found to reduce the impacts on the river ecosystem.

FISH AND WILDLIFE RESOURCES

This component of the total river resource is affected by other uses of the resource. Problems associated with this element have resulted primarily from the adverse impacts of man's activities. These include channel maintenance practices, infringement on habitat from in-floodplain development, deteriorating water quality resulting from point and nonpoint source pollution and commercial and recreational navigation.

AESTHETICS

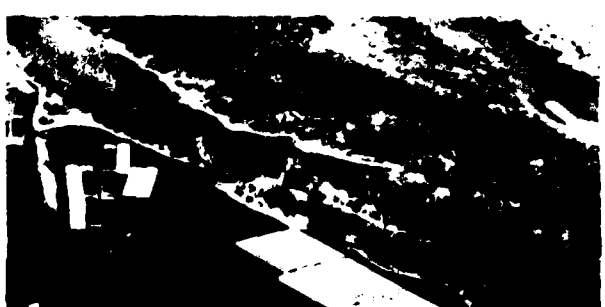
A subtle concern, expressed by many people directly and indirectly, was the need for preserving the character of the river. The beauty of the river valley, the wilderness quality of some of the backwaters, and the value of the resource in its natural state (and how this can be preserved with the presence and use of the resource by man) are problems not adequately addressed by the single-purpose management approach. The intangible "feeling of well-being" that can be felt by observing the river and recreating on it was expressed by many as an important component of the total river resource.

COMMERCIAL NAVIGATION/DEVELOPMENT

The impact of commercial navigation on the ecological resources of the river is primarily tied to the operation and maintenance

of the 9-foot navigation project. While the actual existence of tow traffic on the river is believed to have some impacts on water quality and main channel aquatic habitat, few data are available to qualify or quantify these impacts. The lock and dam system and the annual maintenance dredging required to support the commercial navigation industry have more direct impacts as noted earlier. The causal relationship between commercial navigation traffic and the ecological resources must be more clearly defined.

The development of water-related commercial/industrial facilities adjacent to the river may conflict with the ecological resource because of the need, in some cases, to alter or convert wetland habitat to upland out-of-the-floodplain land for construction of facilities. This impact is often more direct than the traffic itself and can present a conflict with other resource objectives such as fish and wildlife habitat preservation.



Barge fleeting areas are necessary and must be located in the proper areas.

Recreational fishing is popular in backwater areas.

RECREATION

Recreational use of the river may have an impact on the ecological resource insofar as heavy use of recreation areas may destroy the very resource that originally attracted the use. For example, recreational beach development may cause secondary movement of material into side channels and backwaters. The severity of this problem and the sites where this may be happening need to be identified and conflicts resolved.

Filling for development of recreational facilities adjacent to the channel but in the floodplain can destroy aquatic habitat in the same manner as commercial development. Such filling conflicts with ecological resource preservation objectives.

Recreational boat traffic on the river is believed to have some impact on water quality and aquatic habitat in backwater areas. In addition, recreational traffic has been cited as a disturbance factor to migratory birds. Little data are available to qualify or quantify these impacts.

HUMAN RESOURCES

Many of the problems man faces on the river result from conflicts among his objectives or uses. Man uses or draws from the resource in many ways. The river is a fluid highway of commerce, a recreational playground, a place to simply enjoy for what it is. Natural forces and man's multiple demands on the resource often conflict. In many cases, the same problems listed in the section on natural resources could be stated from the human resource point of view. For example, where fish and wildlife habitat preservation has been noted to be adversely affected by development of barge terminals, one could also say barge fleeting area development is hampered by those who desire to preserve the river in a wilderness-like state.

Some problems are common to both man and nature. For example, sedimentation of the river system, while posing a threat to the backwaters, also causes obstruction of the main channel commercial barge traffic.

Poor water quality threatens th. health of fish and wildlife and poses a health hazard to humans using the river for body contact recreation such as swimming and water skiing. Thus, many of the problems listed in this section are conflicts noted in the previous section, but from another point of view.

Finally, a human resource problem that is common to many components of the resource is lack of sufficient data with which to make intelligent decisions about resource use and management. Of the 86 problems addressed by GREAT, 32 are problems related to the human resources of the river. These problems noted above are addressed more specifically below by appropriate subcategory.

CHANNEL MAINTENANCE

The economy of the Upper Midwest depends, in part, on the use of the river for commercial navigation. The River and Harbor Act of 1930 mandated the Corps of Engineers to operate and maintain the 9-foot navigation project for commercial vessels. As environmental interests press for reduced dredging depths and widths and alteration of dredging techniques, the commercial navigation industry is concerned that implementation of these actions will increase the risk of channel closure and reduce vessel safety and the efficiency of tows on the river - resulting in increased costs and reduced dependability of the system.

To reduce environmental damage caused by in-floodplain placement of dredged material, some people have suggested placing dredged material in such a manner and in locations allowing the material to be used by beneficial uses such as for fill, road sanding, concrete aggregate, etc. A need was expressed to determine the feasibility of beneficial uses and to identify potential users and their locations. To do this, it is necessary to know the nature of the material, how it could be transported, and the cost involved and to determine the economic impacts on the sand and gravel companies along the river.

The 9-Foot Channel Environmental Impact Statement indicated inadequate equipment capability in the study area to carry out maintenance activities in an environmentally sound manner. Further, knowledge of equipment capability and availability in the public and private

sectors is lacking. This information is necessary to determine how environmental concerns can be met.

Recreational interests have expressed a desire to see beach enhancement become an integral part of the channel maintenance process. Existing State laws and water quality regulations prohibit placement of dredged material in the water. Locations where enhancement is desirable and the design criteria for beach enhancement must be identified. Consideration should be given to changing conflicting laws and regulations.

Important historic and archeological sites and areas funded by LAWCON funds may be affected by dredged material placement and there is a need to determine where these exist and how they may be protected.

SEDIMENT AND EROSION CONTROL

Sediment flow into the system has been accelerated by man's activities. Agricultural practices, construction, and other activities that disturb the land increase the potential for erosion and sedimentation. There is a need to find ways to slow the flow of sediment from upland areas and minimize the impacts of sedimentation on the resource.

WATER QUALITY

Like ecological resources, the quality of the water affects man's use and enjoyment of the river. Point and nonpoint pollution and the impacts of navigation need to be investigated to determine how

Barge transportation is an economical way to move bulk commodities.

water quality can be improved and maintained for man's health and enjoyment.

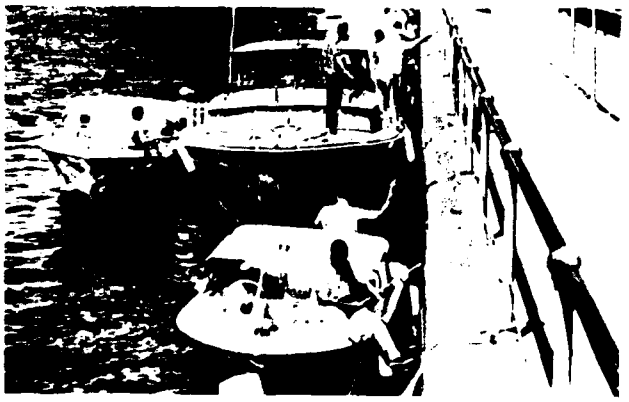
AESTHETICS

The aesthetic beauty of the valley may be negatively affected by dredged material placement. The significance of this problem and ways, if necessary, to prevent it must be identified.

COMMERCIAL NAVIGATION/DEVELOPMENT

Fleeting areas, terminals, and water-related shoreland developments are constrained as a result of environmental regulations and a complex permit process. There is a need to ensure development of needed facilities.

Recreational traffic congestion at locks and inadequate bridge clearances cause safety hazards and delays. These hazards should be reduced.



Congestion at locks and dams is partly due to increased recreational boating.

Camping on dredged material placement sites is an important recreational activity.

RECREATION

Data about the river recreationist, use patterns, user expenditures, preferences, demands, and agreement regarding appropriate uses are lacking. Further research into these matters is needed.

Boating accidents are relatively high. Ways to improve enforcement, improve boater education, and minimize hazards are needed.

CULTURAL RESOURCES

The river valley is rich in archeological and cultural resources. These resources must be identified and their significance and means of preserving them must be determined.

Further Information on Problems

The Plan Formulation Work Group Appendix lists the specific problems adopted by the work groups under the three major categories. Included are "problems" assigned to the Plan Formulation and Public Participation and Information Work Groups. These problems were established by these work groups to guide the development of their tasks related to management of the GREAT I study process and public participation/information program.

The next chapter discusses tasks that were carried out by GREAT I to address the identified problems.

"As the environment has become more polluted, a greater appreciation of the magnificent resource in the Mississippi River has developed. It is now generally accepted that the Mississippi River must be managed as a multi-purpose resource accommodating recreation and fish and wildlife needs, as well as commercial transportation needs." Statement of the Honorable Albert H. Quie before the Subcommittee on Water Resources, September 1976

GREAT I STUDY PROCESS
A MULTIAGENCY APPROACH
CHAPTER V

CHAPTER V

GREAT I STUDY PROCESS
A MULTIAGENCY APPROACH

In 1975, Major General John W. Morris, Director of Civil Works, U. S. Army Corps of Engineers, and Nathaniel P. Reed, Assistant Secretary of the U.S. Fish and Wildlife Service, U.S. Department of the Interior, issued a joint publication entitled The New Imperative: A Story of Interagency Coorperation. In their introductory letter they said:

"In GREAT, Federal and State agencies have joined in partnership to take action toward providing a better balance of uses of the upper portion of the Mississippi River. . . The partnership effort uses a coordinated approach to resource management, which is what Congress intended. . . . Through an active public involvement program, the people of the region are included in the partnership venture to restore and revitalize the river. We expect this problem-solving approach will become a national model. Interagency teamwork, extended to all areas of resource management, can make lasting contributions to meet society's needs while still preserving our natural heritage."

WORK GROUPS

Under the scope and authority noted earlier, GREAT proceeded to address the problems as summarized in Chapter IV. As an initial step, GREAT I established 11 functional work groups (see Figure 1).

Each work group was directed to accomplish study tasks as they related to the work group's functional area and objectives as directed by the team. The work groups then became the working force of the study effort and were composed of professional and technical people from various agencies and areas of expertise. The public was invited to serve, and did serve, on most of the work groups.

A Plan Formulation Work Group, composed of the Team cochairmen and the chairmen of the 11 functional work groups acted as a coordinating body and played an important role as synthesizers of study data leading to the final report. Members of the work group performed the work, or it was contracted out to private consultants and/or universities. For detailed information about these individual tasks, refer to the appropriate work group appendixes.

The major objectives of the work groups and tasks necessary to achieve those objectives and address identified problems are discussed below. The entity responsible for chairing the work group follows the work group's title. Following this general discussion of each work is a brief discussion of the specific tasks. Exhibit 3 contains a detailed list of work group activities under the three major categories - River Resource Management, Natural Resources, and Human Resources.

COMMERCIAL TRANSPORTATION WORK GROUP - COAST GUARD

The main objective of the Commercial Transportation Work Group was to determine present and future problems and needs of commercial river transportation and alternatives to meet these needs. Work group tasks were to:

- Define the existing legal and institutional framework for commercial river transportation.

- Define present and potential demand for commercial river transportation.

- Identify the capacity of the river for commercial transportation.

- Determine problems and needs of commercial river transportation including barge fleeting areas, terminals, and other support facilities.

- Delineate and evaluate commercial river transportation planning alternatives.

- Draft Commercial Transportation Work Group Appendix.

Dredged Material Uses Work Group - State of Wisconsin, Department of Natural Resources

Objectives of the Dredged Material Uses Work Group were to determine acceptable uses and placement sites for dredged material. Work group tasks were to:

- Analyze and describe constituents and properties of dredged material found in the St. Paul District.

- Determine beneficial uses for dredged material.

- Determine the market for beneficial use of dredged material

- Determine potential stockpile sites.

- Draft Dredged Material Uses Work Group Appendix.

Hydraulic dredging and placement of river sediments has created many sand beaches and islands.

Dredging Requirements Work Group - Corps of Engineers

The Dredging Requirements Work Group objective was to minimize total dredging quantities without loss of channel integrity. Major tasks were to:

- Continue study of dredging history to assist in forecasting maintenance dredging needs.

- Compile dredging requirements at individual sites as related to preceding flow conditions.

- Review channel width requirements for present, reduced, or increased tow sizes.

- Study selected sites to determine the depth and width at which the channel will stabilize under varying flow conditions.

- Perform sediment transport studies to determine shoaling and erosion characteristics in bends and crossover areas during high, normal, and low water periods and consider these data in scheduling maintenance dredging as related to seasonal flow patterns.

- Review selected sites for potential structural modifications such as wing dams, closing dams, and channel bank protection which would improve depth and width stability to decrease or change location of channel dredging.

- Review real estate ownership and pool regulation criteria within existing regulatory authority and determine the feasibility of modifying the regulations to reduce dredging requirements.

- Draft Dredging Requirements Work Group Appendix.

Fish and Wildlife Management Work Group - U.S. Fish and Wildlife Service (Later combined with Side Channel Work Group)

The primary objective of the Fish and Wildlife Management Work Group was to determine the means and make recommendations for preserving, protecting, and enhancing the fish and wildlife resources of the Upper Mississippi River. Major tasks were to:

- Devise a fish and wildlife habitat classification system.

- Inventory the fish and wildlife habitat and populations.

- Identify areas with crucial problems related to fish and wildlife management.

- Conduct in-depth investigations into identified crucial problem areas.

- Investigate possible approaches to predicting the response of the fish and wildlife resources to further alterations of the riverine environment.

- Determine the effects of channel maintenance and modification, industrial development, commercial transportation, and floodplain encroachment on the fish and wildlife resources and evaluate alternatives for alleviating adverse effects and encouraging beneficial effects.

- Draft Fish and Wildlife Management Work Group Appendix.

Portions of the Upper Mississippi River are designated as a national wildlife and fish refuge.

Floodplain Management Work Group - State of Minnesota, Department of Natural Resources

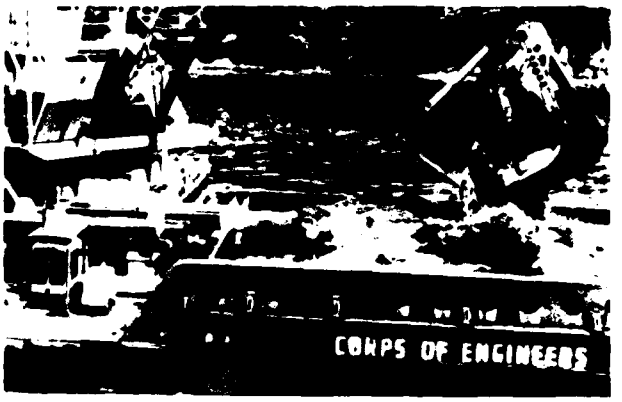
Floodplain Management Work Group objectives were to strive to comply with State floodplain management standards in dredged material placement. Work group tasks were to:

- Delineate the floodway and floodplain of the Mississippi River system from the head of navigation to Guttenberg.
- Compile and correlate State floodplain regulations, particularly with respect to floodplain encroachment stipulations.
- Establish a screening process for evaluating dredged material placement sites and floodplain development according to floodplain encroachment regulations and other floodplain management objectives.
- Draft Floodplain Management Work Group Appendix.

Material and Equipment Needs Work Group - Corps of Engineers

The primary objective of the Material and Equipment Needs Work Group was to determine equipment needs for alternative dredging methods developed by the Team. Work group tasks were to:

- Inventory all available dredging related equipment operated by the Government or private industry.
- Coordinate with Dredged Material Uses Work Group to determine equipment needs for the recommendations of that work group.
- Coordinate with Side Channel Work Group to determine equipment needs as recommended by that work group.
- Draft Material and Equipment Needs Work Group Appendix.



Dredging can be accomplished using a "clamshell" dredge.

Public Participation and Information Work Group - Private Consultant Under Contract to the Team

The Public Participation and Information Work Group was responsible for maintaining a continuous program of active public information and participation throughout the study. Work group activities were to:

- Hold town meetings in the study area.
- Sponsor public information seminars.
- Develop public information materials.
- Establish a system of community consultants or citizen advisors to help identify interested local parties, assist in scheduling public presentations, identify areas of local concern,

maintain contact with local news media, and provide local coordination of information and education programs for the study.

- Establish close coordination with local units of government with special assistance from the Minnesota-Wisconsin Boundary Area Commission.

Recreation Work Group - State of Iowa, Conservation Commission

The Recreation Work Group objectives were twofold. The short-term objective was to represent recreation interests in the process of developing recommendations for channel maintenance for the immediate navigation seasons. The long-term objective was to represent recreation interests in the process of developing a total management plan for the river corridor. Tasks to be carried out in fulfilling these objectives were to:

- Define the legal and institutional framework relating to recreation.
- Inventory existing resources. This inventory will include areas of historic and cultural significance, unique and endangered features, existing land use, physiographic features, intensity of development, and areas of potential recreation development and facility improvement.
- Estimate recreation demand, needs, and use.
- Identify recreation associated problems.
- Delineate planning alternatives.
- Draft Recreation Work Group Appendix.

Sediment and Erosion Work Group - Soil Conservation Service

The objectives of the Sediment and Erosion Work Group were to initiate studies to determine the sources of sediment damaging the river corridor, develop recommendations for sediment abatement, initiate studies for monitoring incoming sediment, and establish base-line data. Work group tasks were to:

- Identify sources of sediment causing dredging and backwater sedimentation problems.
- Determine quantities of sediment delivered directly into the Mississippi River corridor and navigation channels by tributary sources.
- Monitor rates of sedimentation and erosion within the river corridor.
- Determine the rate of sedimentation in Lake Pepin and the possible need for sediment abatement measures including placement of dredged material at the head of the lake and on the streams tributary to the lake.
- Determine rates of sedimentation to selected backwater lakes since 1959 by the cesium-137 sediment dating method.
- Determine costs for accelerated land treatment measures for the identified critical sediment source areas and identify State and Federal funding and operational programs for their execution.
- Determine types of control measures and costs for treating identified critical streambank sediment sources.

- Evaluate alternative methods or combinations of alternatives to reduce sedimentation in the Mississippi River corridor.

- Inventory and research existing data.

- Prepare base maps and illustration materials for use in the Sediment and Erosion Work Group Appendix.

- Draft Sediment and Erosion Work Group Appendix.

Stream bank erosion increases the need for dredging the main channel of the river.

Side Channel Work Group - U.S. Fish and Wildlife Service (later combined into the Fish and Wildlife Work Group)

The objective of the Side Channel Work Group was to develop the capability to predict the consequences to fish and wildlife resources of altering side channels on the backwaters of the Mississippi River. It was the intent of the work group to implement specific changes if the projects would prove beneficial. Work group tasks were to:

- Select a set of physical, chemical, and biological factors which describe and affect fish and wildlife resources of backwater areas.

- Select experimental backwater sites which represent a wide range of conditions existing in the backwaters of the river and where side channel alterations would be feasible.

- Determine conditions and fish and wildlife use in each of the experimental and control backwater areas both before and after a side channel alteration.

- Compare and correlate backwater condition and fish and wildlife use data obtained before and after side channel alterations are completed at the experimental sites.

- Determine what changes to fish and wildlife resources result when freshwater flows are altered to a wide range of backwater types by side channel modifications.

- Make recommendations as to specific side channel modifications and methods necessary.

- Draft Side Channel Work Group Appendix.

Because of similarity in objectives, the Side Channel Work Group was combined with the Fish and Wildlife Management Work Group midway through the study.

Water Quality Work Group - Environmental Protection Agency/Corps of Engineers

The primary objective of the Water Quality Work Group was to identify and evaluate the major influence dredging has on river water and sedi-

ment quality throughout the study area. To fulfill this objective, six major steps were established:

- Assemble existing water and sediment quality data.
- Conduct water and sediment quality surveys essential to a better understanding of existing water quality conditions.
- Develop a list of problem areas throughout the study area and interpret and evaluate pertinent water quality data from these sites with respect to water quality standards and criteria.
- Monitor and evaluate the effects. of dredging and navigation activities on water quality.
- Develop conclusions and recommendations pertaining to future river use activities.
- Draft Water Quality Work Group Appendix.

Plan Formulation Work Group - Study Team

The objective of the Plan Formulation Work Group was to coordinate the activities of all other work groups and direct the course of the study, incorporating the four major tasks of problem identification, formulation of alternatives, impact analysis, and evaluation. Major duties were to:

- Develop base maps.
- Update and display problems and needs.
- Develop a system to inventory and analyze existing data and data being generated through implementation of the work group plans of action.
- Identify national economic development, environmental quality, and selected plans for channel maintenance. (These plans should address channel diversions, dredging volumes, and placement locations.)
- Formulate, evaluate, and screen conceptual alternatives based on the planning and evaluation principles of national economic development and environmental quality.
- Draft Plan Formulation Work Group Appendix, channel maintenance plan, and main report.

To carry out its tasks the Plan Formulation Work Group established a number of task groups. These task groups were directed to accomplish the assigned tasks for work group review and approval. Tasks assigned were:

- Annual dredging review and recommendations.
- Mapping needs.
- Channel maintenance plan preparation.
- Principles and standards review.
- Computerized inventory and analysis.
- Planning process preparation.
- Final report writing.

Work Group Tasks

In Exhibit 3 the specific tasks of work groups are listed under the three major categories noted below:

River Resource Management Activities

These activities dealt with studying ways in which to resolve interagency management problems on the river. Foremost of these activities

was the development of a plan for future operation and maintenance of the 9-foot navigation channel that considers all resources and resource uses and is acceptable to the agencies involved. In addition, GREAT I addressed future coordination of data collection, analysis planning, and decision-making regarding the resource management on the river system.

Natural Resource Activities

Activities of the work groups that dealt with ecological resources included collection of base-line data about the resource; studies of the impacts of man's activities on the natural resources; studies of sedimentation; and pilot studies of techniques to protect, preserve, or enhance the ecological resources.

Human Resource Activities

Work group activities regarding human resources included base-line data collection on human activity needs and demands and means of reducing conflicts among human needs. Commercial navigation, recreation, and floodplain management studies were the principal areas addressed.

In general, the products of work group tasks and work group discussions were used to develop the individual work group appendixes and the conclusions and recommendations of those work groups. The Plan Formulation Work Group then reviewed the conclusions and recommendations and voted on them for inclusion in the final GREAT report. Not all recommendations approved by work groups appear in this report - only those that received approval by the GREAT I Team. The PFWG and Team also modified work group recommendations and developed additional ones where appropriate. The Plan Formulation Appendix displays the disposition of recommendations reviewed by the Plan Formulation Work Group and the GREAT I Team.

The conclusions and detailed recommendations described in the next chapters are the results of team deliberations and votes.

Commercial fishing is an important activity on the river. Fishing is done all year long.

Summary

Tasks completed by work groups are described in the work group appendixes. In addition, the Channel Maintenance Appendix describes the development of the channel maintenance plan. Finally, the Plan Formulation Work Group Appendix describes, in detail, the planning process used in GREAT I.

"It is not necessary for this essential region of the United States to suffer in order to preserve and enhance the condition of that river. It is possible for the region to prosper and for the river to be preserved." Statement of Honorable Adlai E. Stevenson to the Subcommittee on Water Resources, 1976

DISCUSSION OF FINDINGS AND CONCLUSIONS

CHAPTER VI

CHAPTER VI

DISCUSSION OF FINDINGS AND CONCLUSIONS

RIVER RESOURCE MANAGEMENT

GREAT I addressed river resource management principally from the standpoint of coordination needs, base-line data collection needs, planning procedure needs, the need for a channel maintenance plan, and the need for more uniformity in floodplain and water quality standards for the study area.

To guide future implementation of all GREAT I recommendations, an ongoing mechanism for coordination of the efforts of the involved States, Federal agencies, and the public is needed. Handing the GREAT I report to the agencies and the Federal and State administrative and legislative bodies will not result in automatic implementation. If the ultimate goal is a comprehensive plan for the total river resource, an ongoing formal process and organization must take the results of all three GREAT studies and master plan study and use that information to reach the ultimate goal. The Great River Study Committee of the Upper Mississippi River Basin Commission seems to be the logical entity to oversee the ongoing planning process leading to a total river resource management plan. To coordinate implementation of the GREAT I recommendations a cooperative agreement to continue working as a coordinating team should be worked out among the present GREAT I team members.

Through the efforts of GREAT I, much new base-line information has been obtained about many aspects of the resource. GREAT has also completed a pilot project for lower pool 4 and pool 5 called the Geographic Information System (GIS). The GIS could, with refinements, be a valuable tool for storage and synthesis of much of these data. The stored data can be used to determine areas most suitable for desired development, management, or preservation. It could be the primary tool for synthesizing GREAT I and Upper Mississippi River Basin Commission master plan study results for use in development of a total river resource management plan. Additional information on the GIS is presented in the Plan Formulation Work Group Appendix.

The development of a total river resource management plan was not accomplished by GREAT I. It did, however, make significant contributions toward that end. The most comprehensive product of GREAT was the development of an interagency and interdisciplinary plan for maintenance of the 9-foot navigation project.

The channel maintenance plan includes both a process for interagency coordination of an effort that, prior to GREAT, was principally a Corps of Engineers program, based on a single mandate - maintenance of the system for commercial navigation. The GREAT channel maintenance plan takes into account all river resources and provides for resolution of problems associated with the following areas:

a) Sediment Control Measures

GREAT identified major sources of upland, stream bank, and main stem shoreline erosion and developed recommendations for minimizing these problems. GREAT also concluded that sedimentation is a significant problem that is causing backwater and main channel filling and main channel dredging.

b) River Hydrology Control Measures

After extensive research using physical and one- and two- dimensional models of certain stretches of the river, GREAT concluded that it may be possible to reduce dredging needs by streamflow modifica-

tions using wing dams and closing dams. These techniques were used before the river was pooled by the dams and may still be viable in a pooled river. The results of preliminary work done by GREAT are positive enough to recommend ongoing investigations in this area.

c) General Guidelines

GREAT concluded that, while the operation and maintenance of the 9-foot channel and the lock and dam system have had long-term detrimental impacts on other resource areas, the economic importance of commercial navigation warrants continued authorization and study of expansion of the navigation channel. GREAT also concluded that there is a need for Congress to provide firm definition of the 9-foot channel project in relation to dredging depths.

GREAT concluded that there is a need to provide authorization and funds to the Corps of Engineers to assist the States and Fish and Wildlife Service in enhancing fish and wildlife and undertaking recreation projects. This will provide equal weight in the long-term channel maintenance program for these other resource uses.

d) Dredging Procedure and Equipment Guidelines

As a result of the GREAT I channel maintenance planning process, GREAT sees the need to obtain equipment that can dredge more efficiently in a shallow "face" and at lesser volumes per job. To meet the objectives

Diked areas are sometimes built to contain material dredged hydraulically.

of GREAT for reduced-depth dredging, transport of material to places where it can be beneficially used, and/or to out-of-floodplain or off-channel sites, and recreation and fish and wildlife enhancement projects, GREAT sees a need for acquisition or contracting for suitable equipment, such as a hydraulic backhoe and modifications to the Dubuque and Hauser.

GREAT has concluded that a reduction in dredging depths and widths is possible in site specific cases. Such reductions need to be exercised with appropriate guidelines to ensure integrity of the channel for navigation.

GREAT concluded that the Corps of Engineers should change its policy and acquire private land for placement of dredged material consistent with the GREAT I channel maintenance plan.

e) Dredged Material Placement

The Channel Maintenance Plan developed by GREAT includes a series of maps displaying specific selected placement sites for all projected cuts for the years 1985-2025 and interim guidelines for the years 1980-1984. The selection of these sites is the result of an extensive site identification and evaluation process described in the Channel Maintenance Appendix. In addition, GREAT concluded that, in the annual preseason planning process, the Corps of Engineers needed guidelines that would ensure that impacts on flood flows, water quality, recreation, and fish and wildlife would be minimized during dredging and placement. Such guidelines were developed and are contained in recommendations in Chapter VII.

f) Other Considerations

GREAT concluded that further studies related to channel maintenance are needed to determine:

* A procedure to incorporate new sites if new beneficial uses or users are identified.

* If riverine placement could be used.

* Feasibility of creating permanent beneficial use stockpile sites near population centers.

* The feasibility of stream bank erosion control, sediment traps, or low-head dams to reduce sediment inflow from the Chippewa River and other tributary streams.

* The feasibility of transporting material from existing placement sites to areas of high demand.

* The feasibility of using dredged material for soil conditioner and riprap and if there are any uses for fine organic sediments.

An analysis of legal and institutional arrangements for floodplain management revealed that the channel maintenance plan (placement sites), if implemented, would violate some State floodplain management laws and that it would be in the best interest of the total river resource to modify the laws or provide for variance where it can be shown that GREAT objectives will be achieved. No procedure exists to do this, and one needs to be established.

Although GREAT studied the impacts on water quality of hydraulic dredging in pool 2, it did not develop a definitive conclusion regarding the impacts of dredging on water quality for the entire study reach. GREAT sees a need to continue research on this matter with the goal of developing uniform standards for dredging.

NATURAL RESOURCES

GREAT addresses natural resource needs principally as they relate to

water quality improvements, improved data collection and planning for the fish and wildlife refuge, backwater and side channel management, and aesthetic protection.

Essential to improving the quality of the water in the main stem are enforcement of existing laws, regulation of transport of hazardous wastes, reduction of nonpoint source pollution (upland erosion), and a reduction of discharge from commercial and recreational craft. GREAT did not address point source pollution from cities or private industry because it felt these matters were being adequately addressed by existing programs, although GREAT recognizes that minimization of point-source discharge is crucial to the overall water quality treatment effort.

GREAT studies have shown that the pooling of the river has hastened sediment accumulation. As this sediment settles in the pools (principally in the backwaters), the character of the river is changing and much of the aquatic habitat initially formed by the pooling of the river is slowly being lost to sediment. At the same time, GREAT studies have concluded that recreational and commercial use of the river is increasing and will continue to increase. There is evidence that the quality of the water is continually being threatened. Floodplain encroachment through industrial development and dredged material placement threatens the resource. As these pressures continue to build, it will become increasingly important for the U.S. Fish and Wildlife Service to more actively manage the Upper Mississippi River Wild Life and Fish Refuge habitat.

The Mississippi River valley is a nesting area and migration route for millions of waterfowl.

Contour farming on upland areas helps reduce sedimentation in rivers and streams.

GREAT has also shown through pilot studies that backwaters can be protected or enhanced by specially designed culverts, blocking dams, and side channel openings. These types of projects should be used in the future management of natural resources.

GREAT has concluded that this future management must include several elements as listed in the next chapter. Among the needs that must be addressed are:

* Development of refuge objectives, strategies, procedures, and physical management activities.
* Improved mapping, inventories, data collection, and synthesis through computer technology.
* Continued identification, evaluation, and implementation of backwater restoration methodology.
* Increased funding for projects for fish and wildlife enhancement and recreation development.
* Increased authority to dredge in backwater areas for restorative purposes.
* Improved predictive capability to forecast biological and chemical changes that would result from physical modifications.

Two issues that have received only limited attention by GREAT I are aesthetic management and wilderness-type designation.

HUMAN RESOURCES

GREAT addressed human resource needs principally as they relate to floodplain management, commercial navigation, recreation, and cultural resources.

GREAT concluded that future management of the floodplain is hampered by lack of uniform standards and lack of base-line data (topographic and hydrographic maps). These needs must be met to ensure that floodplain management programs are executed in the best interest of the total river resource.

Commercial navigation, GREAT concluded, is essential to the economy of the Midwest, and it should continue to be provided for in future river resouce management planning. GREAT identified several constraints to the efficient operation of this industry:

* The multiplicity and lack of coordination of Federal, State, and local laws dealing with commercial facility development.
* Congestion at locks and dams 2 and 3 as a result of recreational/ commercial competition.
* Obstructive and poorly operating bridges.
* Inadequate maintenance of the navigational aid system.
* Lack of knowledge regarding potentially acceptable fleeting areas.
* Potential for user fees being used to pay for nonnavigational programs on the river.

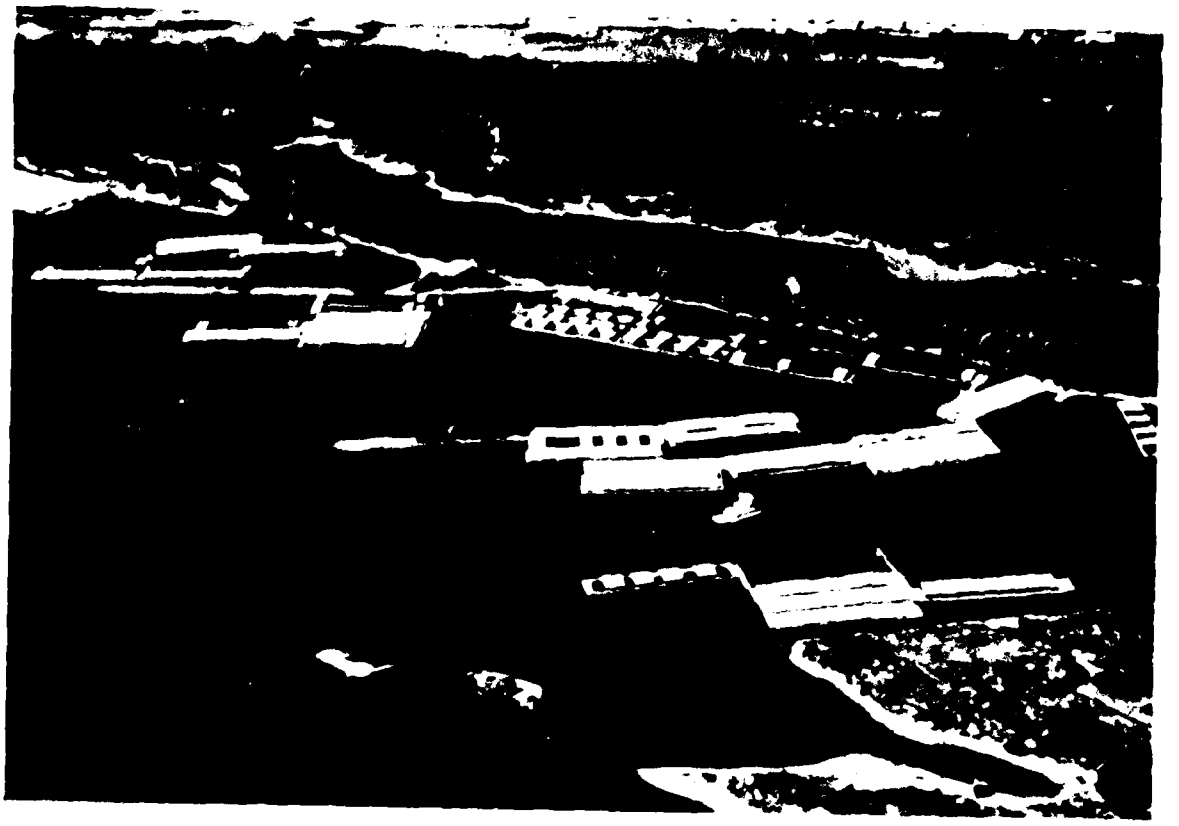
These constraints need to be minimized to encourage more efficient operation by the commercial navigation industry.

Recreational use of the Upper Mississippi River has largely been a by-product of the refuge system, creation of sand islands resulting from dredged material placement, and private developments. No agency has developed and implemented a specific recreation plan that considers all resource uses; yet recreation is a major use of the river. Because recreation is not a mandate of any agency, little historical information was available to determine what type of recreational activities were preferred, what type of facilities were desired, or how fast the use was changing, much less how to best manage the river to provide the optimum recreation experience.

Thus, GREAT research required starting from the ground up. Surveys were carried out to assess recreational needs and demands, inventories were made of facilities, and projections were made for future growth. On the basis of this work, GREAT determined numerous site-specific improvements can be made immediately - principally related to maintenance of sandbars and development of facilities.

Further study needs (regarding site-specific improvements) have also been identified. These recommendations are contained in the next chapter.

Numerous marinas are in the GREAT I study area.



The development of new fleeting areas is hampered by the lack of sufficient knowledge about environmental and economic impacts.

GREAT concludes that there is a need to establish and maintain an ongoing monitoring program to provide current data for future recreation planning programs and has identified future planning needs. They are summarized as follows:

* Recreational management needs to stress maintaining diversity within the system.

* Conflicts need to be identified and water surface use in pools zoned.

* Additional or improved public facilities such as bikeways, a canoe route, boat launching areas, etc., need to be established.

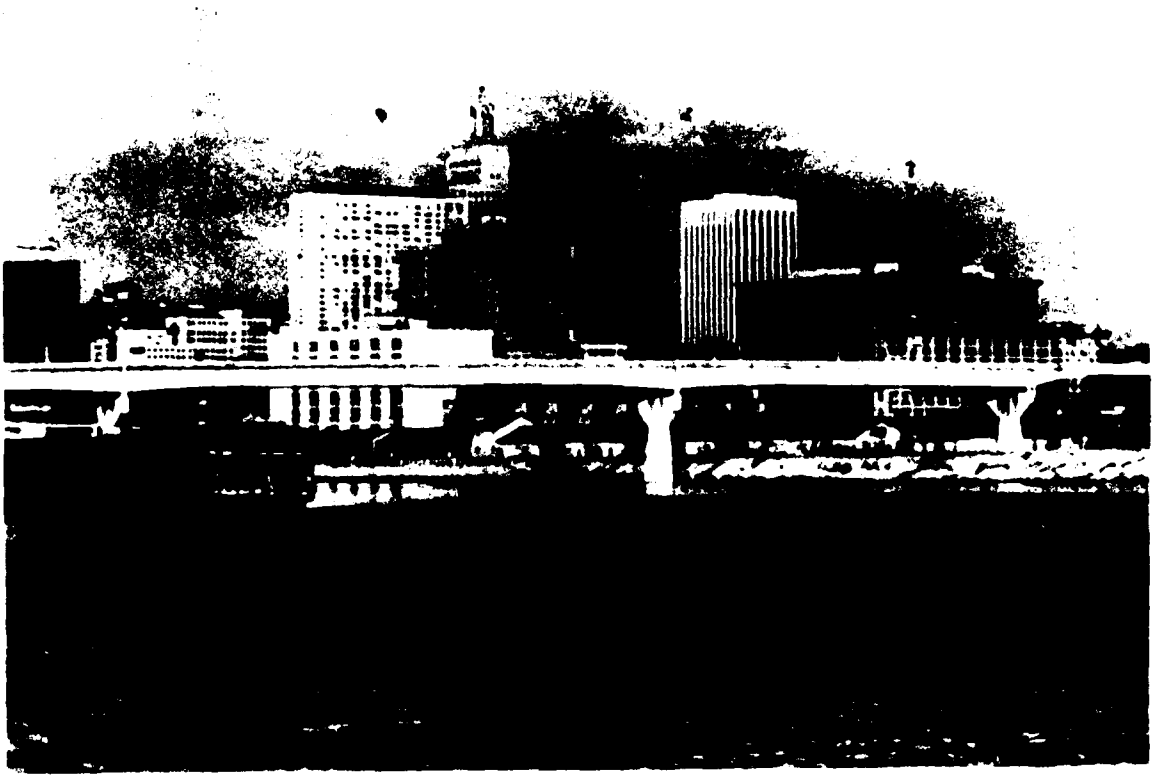
* More information needs to be provided to users to alert them to facilities, safety rules and regulations, accident prevention, and the unique character of this resource.

GREAT did little research on the cultural resources along the river even though general information indicates the river is rich in cultural and archeological resources. GREAT concluded that extensive cultural resource studies are needed to identify and assess this part of the river system.

REFERENCES

The recommendations contained in Chapter VII were developed from studies and discussions carried out by one or more work groups in GREAT I. To aid the reader in researching the justification for the recommendations, Exhibit 4 lists the major documents which were developed by GREAT I, its work groups, or contractors working for GREAT I. The table in Exhibit 4 lists the recommendations with the references, which contain supporting information. The table also contains, where appropriate, editor's remarks to assist the reader or clarify justifying information. All documents listed are either stored at the St. Paul District, Army Corps of Engineers, offices or study personnel there can direct the reader to the office/agency where the documents are on file.

"A balance must be reached in attaining desired environmental levels and commercial use of the river. We must not degrade our environment for our own sake as well as future generations. However if we materially hamper commercial navigation to the economic detriment of the area, and consequent loss of jobs, we have failed. It will be hard for a citizen without a job to worry about recreation facilities or the pristine state of the environment. It is truly a problem for a 'Solomon'. We must achieve a balance between the two needs of our country." Frank Stegbauer, Executive Vice President, Southern Towing Company, Memphis, TN



RECOMMENDATIONS

CHAPTER VII

CHAPTER VII

RECOMMENDATIONS

DEVELOPMENT AND DISPLAY OF RECOMMENDATIONS

The products of the GREAT I study are described in this chapter. The end result of the plan formulation process is a set of recommendations advocating needed implementable actions, further studies, or policy changes that become apparent as a result of one or more tasks completed within the GREAT I study.

The recommendations displayed in this chapter are those that the GREAT I Team has officially adopted and endorsed. The iterative process which resulted in this set of recommendations is summarized below and described in more detail in the Plan Formulation Work Group Appendix.

1. Individual work groups, as a result of completed studies and discussions, developed conclusions and, subsequently, recommendations related to the resource area under their jurisdiction. These conclusions and recommendations can be reviewed in detail in the individual work group appendixes.

2. Members of the Plan Formulation Work Group (PFWG) (all work group chairmen) reviewed the recommendations and voted on each one on the basis of their own work group's criteria. Only those recommendations approved unanimously were forwarded to the Team for further consideration.

3. During PFWG review, some work group recommendations were revised, and work group chairmen, exercising interdisciplinary compromise, unanimously approved the revised recommendations. In a few cases, the PFWG developed totally new recommendations on the basis of interdisciplinary discussions to fill identified gaps in the plan formulation process.

4. All recommendations approved by the PFWG were displayed in a public and agency review draft report (GREAT I, 1979) and were subjected to an intensive agency and public review from November 1979 through March 1980. All comments received were made available to members of the GREAT I Team for their use and consideration in revising the report.

5. On the basis of public and agency comments and positions, the GREAT I Team again reviewed the recommendations and either approved, modified, or deleted recommendations. In some cases, two or more recommendations were combined. In voting on recommendations, the Team attempted to reach unanimous agreement. Where unanimous agreement was not achieved, the Team voted by State and Federal caucus. Where a recommendation voted on in this manner was approved by at least a majority of State members and a majority of Federal members, the recommendation was considered approved for inclusion in the final report. The Plan Formulation Work Group Appendix documents the action taken on recommendations contained in the draft report and identifies which recommendations were approved unanimously and which were approved by majority vote. Members abstaining on unanimous votes or objecting on majority caucus votes are also identified.

6. The list of approved recommendations was provided to the GREAT I Report Writer/Editor for categorization, grouping, and editing on the basis of appropriate component.

7. The GREAT I Team, at its final meeting, approved this document, making changes it felt were appropriate.

As discussed in Chapter IV, the lack of coordination between State and Federal agencies having management

responsibility on the river has caused conflicts in management which have contributed to the decline of economic and environmental values of the river. In the same manner that the GREAT I Team has attempted to resolve these conflicts in arriving at the actions it is recommending, carrying out those actions can only be successful if it is done using a fully cooperative process. It is, therefore, necessary that the actions described in this chapter, whether for immediate implementation or for continued study, be fully coordinated with all affected Federal, State, and local authorities to minimize future conflicts and achieve compliance with laws and policies.

RECOMMENDATION CATEGORIES

The recommendations are displayed in the 10 previously discussed components under 3 broad categories: (1) implementable actions, (2) policy changes, and (3) further study needs. The principal implementable action approved by GREAT is the channel maintenance plan. It is summarized in the next section. Maps show approved dredged material placement sites. It is described in more detail in the Channel Maintenance Appendix (Volume 8, Parts I-V).

Implementable actions are those items which GREAT has studied in sufficient depth to enable it to request that they be implemented (without need for further study) upon receipt of sufficient State and/or Federal funding.

Further study and policy items are GREAT I recommendations for funds to carry out additional needed studies or requests for policy changes which GREAT feels are needed to allow implementation of long term recommendations.

Figure 3 is a guide to the recommendations contained and discussed in this chapter. It contains a brief description of each recommendation, its designated reference, and the page number on which it can be found in this chapter.

RECOMMENDATIONS

CHANNEL MAINTENANCE

OVERVIEW

One of the important uses of the Mississippi River, as noted earlier, is commercial navigation. To provide for this use, the Corps of Engineers has taken two significant actions.

1. In the 1930's, it completed a series of locks and dams to regulate water flows and depths in the pools created by the locks and dams.

2. Because the river system, as a result of both natural sedimentation and man's actions, accumulates sediment, periodic dredging in the designated navigation channel must be carried out to ensure continued safe passage of commercial vessels. Inherent in the dredging operation is a need for suitable placement sites.

GREAT I considered the continued operation of the locks and dams a "given", recognizing their importance to continued commercial navigation and their contribution to an expanded aquatic environment. Changes to the existing lock and dam system were considered to be beyond the scope of the GREAT I study. GREAT recognized as one of its early objectives that the issues of dredging and dredged material placement must be addressed. GREAT determined that ways had to be found to:

FIGURE 3

SUMMARY OF GREAT I
RECOMMENDATIONS

Component	Designated Reference	Brief Description	Page Number
Channel Maintenance	Action Item 1	Site specific material placement plan	VII-10
Channel Maintenance	Action Item 2	Interim channel maintenance guidelines	VII-11
Channel Maintenance	Action Item 3	Main stem shoreline protection	VII-11
Channel Maintenance	Action Item 4	Reduced-depth dredging	VII-13
Channel Maintenance	Action Item 5	Purchase of efficient dredging equipment	VII-14
Channel Maintenance	Action Item 6	Quantitative floodplain analysis	VII-15
Channel Maintenance	Action Item 7	Placement for beneficial use	VII-15
Channel Maintenance	Action Item 8	Temporary placement sites	VII-16
Channel Maintenance	Action Item 9	Criteria for sediment and water quality	VII-17
Channel Maintenance	Action Item 10	Placement site development plans	VII-20
Channel Maintenance	Action Item 11	Chippewa River sediment reduction	VII-20
Channel Maintenance	Policy/Funding Item 1	Continued maintenance of navigation channel	VII-21
Channel Maintenance	Policy/Funding Item 2	Funding to implement GREAT I CMP	VII-21
Channel Maintenance	Policy/Funding Item 3	Emergency dredging definition	VII-21
Channel Maintenance	Policy/Funding Item 4	Emergency dredging capability	VII-22
Channel Maintenance	Policy/Funding Item 5	Sale of dredged material	VII-23
Channel Maintenance	Policy/Funding Item 6	Acquisition of private land for material placement	VII-23

FIGURE 3

Component	Designated Reference	Brief Description	Page Number
Channel Maintenance	Policy/Funding Item 7	Allow recreation and fish and wildlife enhancement in the floodplain and implement channel maintenance plan.	VII-23
Channel Maintenance	Policy/Funding Item 8	Depth of navigation channel definition	VII-24
Channel Maintenance	Further Study Item 1	Demonstration dredging projects	VII-25
Channel Maintenance	Further Study Item 2	Use river sediment transport capability	VII-25
Channel Maintenance	Further Study Item 3	Sediment transport models	VII-26
Channel Maintenance	Further Study Item 4	Monitor tributary deltas	VII-26
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Channel Maintenance	Further Study Item 6	Sediment management by river stage control	VII-27
Channel Maintenance	Further Study Item 7	Dredging by sand and gravel companies	VII-27
Channel Maintenance	Further Study Item 8	Monitor dredging and material placement impacts on water quality	VII-28
Channel Maintenance	Further Study Item 9	Tributary streambank erosion control	VII-28
Channel Maintenance	Further Study Item 10	Sediment control on streams entering Pool 3 from Wisconsin side	VII-28
Channel Maintenance	Further Study Item 11	Riverine placement	VII-29
Channel Maintenance	Further Study Item 12	Removing material from floodway	VII-29
Channel Maintenance	Further Study Item 13	Transporting material to areas of high demand	VII-29
Channel Maintenance	Further Study Item 14	Private enterprise transporting sand	VII-30

FIGURE 3

Component	Designated Reference	Brief Description	Page Number
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Channel Maintenance	Further Study Item 16	Beneficial use of organic sediment	VII-30
Sediment & Erosion Control	Action Item 12	Increased soil erosion control practices	VII-31
Sediment & Erosion Control	Further Study Item 17	Conservation tillage program	VII-32
Sediment & Erosion Control	Further Study Item 18	Monitoring sediment inflow	VII-32
Water Quality	Action Item 13	Regulations on hazardous materials	VII-33
Water Quality	Action Item 14	Sanitary pumpouts and trash pickup	VII-34
Fish and Wildlife	Action Item 15	Increased staff and budget allocations	VII-35
Fish and Wildlife	Action Item 16	Culverts at L/D #4	VII-35
Fish and Wildlife	Action Item 17	Culverts at L/D #10	VII-35
Fish and Wildlife	Action Item 18	Continue bicentennial land heritage program	VII-36
Fish and Wildlife	Policy/Funding Item 9	Comprehensive plan for management of UMRWLF Refuge	VII-36
Fish and Wildlife	Policy/Funding Item 10	Manage river as an ecological unit	VII-36
Fish and Wildlife	Policy/Funding Item 11	Authority for Corps to assist with fish and wildlife and recreation projects	VII-37
Fish and Wildlife	Policy/Funding Item 12	Separate line items on budgets	VII-38
Fish and Wildlife	Policy/Funding Item 13	User data for cost allocations	VII-38
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Fish and Wildlife	Policy/Funding Item 15	Introduction of non-native species	VII-39

FIGURE 3

Component	Designated Reference	Brief Description	Page Number
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Fish and Wildlife	Further Study Item 21	Weaver Bottoms rehabilitation	VII-40
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Fish and Wildlife	Further Study Item 23	Reducing fine sediment flow into Big Slough	VII-42
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Fish and Wildlife	Further Study Item 25	Spring Lake rehabilitation	VII-42
Fish and Wildlife	Further Study Item 26	Monitoring at Kruger Slough and Island 42	VII-43
Fish and Wildlife	Further Study Item 27	Mapping of aquatic vegetation	VII-43
Fish and Wildlife	Further Study Item 28	Controlling pool levels for fish and wildlife and recreation	VII-43
Fish and Wildlife	Further Study Item 29	Designating primitive or natural areas	VII-44
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Fish and Wildlife	Further Study Item 31	Bottomland hardwood management	VII-45
Fish and Wildlife	Further Study Item 32	Life history of fishes	VII-45
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Commercial Navigation	Policy/Funding Item 17	Amendments to bridge acts	VII-47

FIGURE 3

Component	Designated Reference	Brief Description	Page Number
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Commercial Navigation	Further Study Item 35	Regulatory activities applicable to river transportation	VII-48
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Recreation	Action Item 23	Marking control structures	VII-52
Recreation	Action Item 24	Uniform boat noise levels	VII-52
Recreation	Action Item 25	Bikeways	VII-52
Recreation	Action Item 26	Canoe trails	VII-52
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Recreation	Action Item 28	Educate recreational boaters - State and Federal agencies	VII-53
Recreation	Action Item 29	Educate recreational boaters - boating clubs	VII-53
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FIGURE 3

Component	Designated Reference	Brief Description	Page Number
Recreation	Action Item 32	Packing out trash	VII-54
Recreation	Policy/Funding Item 19	Enforcing boathouse permits	VII-54
Recreation	Policy/Funding Item 20	Monitor application of lockage regulations	VII-54
Recreation	Policy/Funding Item 21	Discourage high impact recreational developments	VII-55
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Floodplain Management	Action Item 34	Address project induced flood flow and sediment transport impacts	VII-59
Floodplain Management	Policy/Funding Item 25	Uniform floodplain management standards	VII-59
Floodplain Management	Further Study Item 44	Mathematical floodplain management models	VII-59
Cultural Resources	Further Study Item 45	Comprehensive cultural resources inventory	VII-61
Public Participation	Action Item 35	Information and education programs	VII-61
On-Going Planning/ Coordination	Action Item 36	Coordination of implementation of GREAT I recommendations	VII-62

FIGURE 3

Component	Designated Reference	Brief Description	Page Number
On-Going Planning/ Coordination	Action Item 37	Coordination mechanism	VII-63
On-Going Planning/ Coordination	Action Item 38	Minnesota-Wisconsin Boundary Area Commission monitoring implementation of GREAT I recommendations	VII-63
On-Going Planning/ Coordination	Action Item 39	On-going planning coordination - total river resource management plan	VII-63
On-Going Planning/ Coordination	Policy/Funding Item 26	UMRBC guidelines for monitoring GREAT	VII-64
On-Going Planning/ Coordination	Further Study Item 46	Geographical information system	VII-64
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1. Minimize the impact of dredged material placement through selection of placement sites that would be less damaging to the environment.

2. Reduce, if possible, the need for dredging and thus reduce dredging volumes and material placement impacts.

3. Develop guidelines for use and placement at the selected sites so that, even when these sites are used, the best interests of the total resource are considered.

The Channel Maintenance recommendations developed in response to the identified needs and approved by GREAT I contain:

1. Selected, mapped dredged material placement sites to accommodate all projected dredging volumes for the time frame 1985-2025.

2. Recommendations addressing ways to reduce dredging volumes.

3. Guidelines for use of sites included in the plan.

4. Comparison of environmental and economic impacts of implementation of this plan versus nonimplementation.

DREDGED MATERIAL PLACEMENT

The damaging effects of dredged material placement were one of the chief public and agency concerns prompting the GREAT study. The most extensive and detailed product of GREAT I is a site-specific dredged material placement plan. On the basis of Corps of Engineers records and projections through the year 2025, GREAT I identified probable dredge cuts and annual volumes for each cut. For each cut, GREAT identified potential sites available for placement of dredged material. Sites were identified on the basis of location; potential beneficial use; impacts on flood flows; potential for site erosion; impacts on water quality, fish and wildlife resources, and recreation; costs of use; and public opinion. (See detailed criteria in the Channel Maintenance Appendix.) From the initial inventory, a set of sites was adopted for inclusion in the plan.

The Channel Maintenance Appendix contains a detailed discussion of how placement sites were selected. The sites were approved using the same procedures described earlier for approval of recommendations. The Team attempted to reach unanimous agreement on all sites. Where that was not possible, the Team voted by State and Federal caucuses, and sites were considered approved by the Team if they were approved by a majority of both caucuses.

Although specific sites have been approved by the GREAT I Team, not all of the necessary details have been worked out for use of those sites. Specific details including placement site design, regulatory approvals, and arrangements with site owners will have to be worked out between the Corps of Engineers and the appropriate Federal, State, and local authorities to achieve compliance with laws and policies.

ACTION ITEM 1(1)

Recommendation

The Corps of Engineers should implement the dredged material placement plan proposed by GREAT I.

Rationale

The dredged material placement plan displays 105 separate locations or dredge cuts that will need periodic dredging between 1985 and 2025 and 93 selected placement sites, which will be used in accordance with implementation criteria for the plan. The sites will accommodate a projected 35,964,000 cubic yards of material anticipated to be dredged between 1985 and 2025 (average of 911,000 cubic yards per year).

(1) Implementable Action will be displayed and identified by an action item number. Action items will be listed by consecutive numbers for further reference in the Implementation Chapter.

Use of the sites in accordance with implementation guidelines will significantly reduce negative environmental impacts, while achieving continued operation and maintenance of the 9-foot navigation channel. Table 8 is a summary of the dredged material placement plan. The maps and pool-by-pool summaries shown at the end of chapter VII describe and display the major elements of this plan. In addition to the material placement plan, the maps show other information and recommendations relating to the GREAT I study as identified in the legend. More information on the material placement plan is in the Channel Maintenance Appendix.

ACTION ITEM 2

Recommendation

The Corps of Engineers should follow the interim guidelines for dredged material placement developed by GREAT I.

Rationale

Until the Corps of Engineers can gear up for full implementation of the recommended material placement plan (anticipated 1986), interim guidelines for dredged material placement have been developed. The interim guidelines are basically the procedures GREAT I used in recommending placement sites to the Corps of Engineers during the study. The guidelines are shown in Exhibit 5 and in the Channel Maintenance Appendix.

REDUCTION IN DREDGING VOLUMES

The following methods can be used to reduce dredging volumes:

1. Reduce bed load yields from tributary streams and main stem shorelines.

2. Manage river flows to cause bed load to settle in areas not requiring maintenance dredging.

3. Establish criteria for determining more definitely the point at which dredging should be initiated.

Therefore, GREAT I recommends that the following actions be implemented as a means of reducing dredging volumes.

ACTION ITEM 3

Recommendation

The Corps of Engineers should continue restoring and establishing main stem shoreline protection on a yearly basis following the priority list prepared by GREAT I (Lovejoy, T. A. and D. M. Kennedy, 1979, attachment to the Fish and Wildlife Work Group Appendix) until completion. In place of funding and equipment capability on an as-available basis only to perform these tasks, the specific authority and funding should be provided to the Corps to stabilize a minimum of 5 miles annually.

Rationale

Shoreline erosion results in:

a. The direct loss of public and private lands.

b. The loss of fish and wildlife habitat.

c. Increased sediment load.

d. Increased channel maintenance requirements.

The Corps began a program of shoreline protection in the St. Paul District during the GREAT program. The Dredging Requirements, Sediment and Erosion, and Fish and Wildlife Work Groups provided the Corps with a priority list of old and new sites where such work should be done. Restoring and creating shoreline

TABLE 8

Summary of GREAT I Channel Maintenance Plan

Pool	Number of cuts	Total volume dredged (cubic yards)	Potential beneficial use from selected sites (1986-2025) (cubic yards)	Number of sites	Recreational enhancement sites	Number of sites with impacts: To cultural resources	Number of sites with impacts: To endangered species	Total area (acres)	Acres of habitat impacted: Types 1 and 2 wetland	Acres of habitat impacted: Types 3, 4, and 5 wetland	Total average annual cost[5]
MN	5	720,000	117,500	5	1	U	0	114[1]	7	0	$115,800
SC	3	1,269,000	679,000	16	14	U	0	83.5	18	4	121,000
USAF	3	1,505,000	1,505,000	2	0	U	0	10	0	0	429,000
1	7	3,034,000	3,034,000	1	0	U	0	3.5	0	0	429,400
2	10	4,136,000	5,473,000	11	1	U	0	185	98[3]	30[3]	459,100
3	9	2,733,500	1,676,000	7	3	U	0	102	70	4	290,900
4	11	6,249,000	2,427,000	13	6	U	0	170	9	0	1,209,000
5	8	3,061,500	2,640,000	5	1	U	0	76+	15	76	335,400
5A	6	2,369,500	140,800	4	2	U	0	49	19	29	241,100
6	6	1,184,500	2,920,000	5	2	U	0	38	1	21	157,200
7	7	2,172,500	1,327,400	5	2	U	0	36[2]	9	22	234,100
8	10	3,679,000	3,629,500	4	3	U	0	107	26	11	391,700
9	10	2,322,000	860,200	10	5	U	0	112	25	43	243,400
10	10	1,528,500	565,000	8	1	U	0	72.5	12.5	8	153,800
Total	105	35,964,000	26,994,400	96	41	U[4]	0	1,158.5	309.5	248	4,810,900

(1) Not all acreage will be required.

(2) Use of site 8.06 would add 44 acres to pool 7 total.

(3) Assumes use of site 2.14 (80 acres types 1 and 2, 30 acres types 3 and 4 wetland). GREAT approves using site only if permits are approved for the runway development.

(4) Unknown. Many of the placement sites have not had archeological surveys to determine cultural resources.

(5) Costs are for dredging the material from each cut to the primary placement site including mobilization, land acquisition, erosion protection, and use of the most economical dredging method. Totals shown should not be used as the cost of implementing the GREAT I channel maintenance plan. This would require assumptions regarding dredging fleet requirements which were not made.

protection in limited areas has been shown to benefit the river's fish and the maintenance of the navigation channel. However, in areas where riprap becomes the dominant habitat, diversity is lost and the value of riprap as habitat decreases.

Existing Corps of Engineers funding sources and equipment are not adequate to complete the needed shoreline protection priority list.

Quarry-run riprap or irregularly shaped riprap made from dredged material should receive primary consideration for shoreline protection.

ACTION ITEM 4

Recommendation

Average annual dredging quantities should be minimized through application of technically supported reduced-depth dredging and maintenance of minimum channel widths suitable for navigation consistent with the following guidelines:

a. Dredging depths in approaches to rigid structures should be determined by technically supported safety criteria.

b. Dredging depths at other locations should be determined based on potential for increase in frequency of dredging, impacts on the transportation industry, and the demand for dredged material in the area.

A literature search and necessary supplemental research should be conducted to document the impact of channel depth on required channel width to maintain navigational safety.

Rationale

Depth of dredging will be determined by the best technology available including historic dredging experience, site characteristics, mathematical sediment transport modeling, and physical modeling. The objectives of reducing dredging depths and widths are to minimize impacts from placement of dredged material and minimize the cost of channel maintenance. Where it can be shown that the reduction in depth and width do not accomplish these objectives, they should not be reduced. A site-by-site evaluation needs to be made to determine if the proposed reduction will increase dredging frequency and, over a longer period of time, result in greater average annual dredging quantities and costs. The potential adverse impacts on the transportation industry should also be considered. These include increased risk of grounding, environmental and economic impacts, and increased operating costs. If demand for material in the area is great enough, thus eliminating the potential impacts from material placement, the depth or width to be maintained can be based primarily on channel maintenance and navigational economy.

Reduced depths may result in loss of a motor vessel operator's capability to respond to changing river conditions. For this reason, where the required dredging is in an approach to a rigid structure such as a lock, bridge, or pier, the depth or width to be maintained should be based primarily on technically supported safety criteria. Some applicable criteria are given in "Push Tows in Canals," (Koster, 1975; Dredging Requirements Appendix). Also, additional research should be done to determine the potential safety impacts of reduced-depth dredging and the potential trade-off between depth and width to provide an acceptable level of vessel safety.

GREAT I has also developed further study recommendations which address the objective of reduced dredging volumes. These are discussed in the section on further studies.

DREDGING AND PLACEMENT IMPLEMENTABLE ACTION

In conjunction with implementation of both the interim guidelines and long-range material placement plan, GREAT I has adopted recommendations that will optimize the use of placement sites and ensure that dredging and placement are carried out with full consideration of other resource uses. The following action items are part of the plan and serve as guidelines for all future dredging and placement operations. The following action items can be initiated when this document is approved and should apply to all dredging activities.

ACTION ITEM 5

Recommendation

The Corps of Engineers should request the necessary appropriations to purchase efficient dredging equipment to best accomplish all the objectives of the GREAT I Channel Maintenance Plan. Until this equipment is available the Corps should emphasize contract dredging to meet those objectives.

Rationale

The multipurpose objectives of the GREAT I channel maintenance plan cannot be accomplished with present Corps dredging equipment. Preliminary computations show that about 47 percent of the expected dredging volumes can be removed with existing Corps equipment. The Corps will have to purchase new equipment or use contract dredging to meet the objectives of the channel maintenance plan.

The Dredge Thompson, for example, is not suited for implementing the entire channel maintenance plan because:

a. It cannot reach all of the selected placement sites.

b. Some placement sites cannot accept hydraulically pumped material because of the limited size of the sites.

c. The 20-inch cutterhead is excessive for the shallower dredge cuts recommended by GREAT I. This inefficient operation of the dredge produces a large volume of water and a high water to solids ratio which makes containment difficult

d. Wetlands and backwaters cannot be crossed with discharge pipes without major disturbances.

e. The set-up time required to do small volume jobs is not cost effective.

Modifications to the Thompson might make it more efficient and environmentally suitable. For instance, Goodier (1980) suggested replacing the cutterhead with a dustpan head to provide a lower water to solids ratio. Goodier (1980) also discusses hydraulic loading of barges using the Thompson.

Corps mechanical dredging equipment, such as the Derrickbarge Hauser, is unsuitable for reaching some selected channel maintanenance sites because of the relatively low volume of material that can be dredged daily and the lack of enough barges to haul material long distances.

The GREAT I Team reviewed many types of equipment; however, equipment was not demonstrated and tested because of funding and time constraints. The equipment that is considered to have the highest potential for successful demonstration projects has been identified. GREAT I has recommended (Further Study Item 1) that demonstration projects to determine the feasibility of hydraulic and mechanical loading and unloading of barges be carried out. In addition, riverine

placement studies should be carried out (Further Study Item 12). Wing dam modifications and modifications to the Thompson should also be determined and tested where feasible.

GREAT I estimates that about 47 percent of the selected channel maintenance plan can be accomplished using present dredging equipment. If contract dredging is a feasible and economic alternative, all, or a significantly large portion, of the GREAT I channel maintenance plan can be accomplished without the purchase of new equipment.

ACTION ITEM 6

Recommendation

In every case where in-floodplain placement of dredged material is proposed, a quantitative analysis of the effects of that placement must be made. This analysis must include a computation of the effect of any encroachment into the floodway by assuming an equal degree of hydraulic encroachment on the other side of the river for a significant hydraulic reach. Variances to State standards requiring an equal degree of encroachment should be considered where the Federal Government owns the land on both sides of the river within the significant hydraulic reach. Until a quantitative analysis is conducted, the following guidelines will be used:

a. Dredged material should be placed out of the floodplain of the Mississippi River and tributary streams.

b. In those cases where in-floodplain placement is proposed, the material should be placed in the flood fringe rather than the floodway or effective flow area.

c. Placement in the floodway or effective flow area may be conducted on a temporary basis and the material removed from the floodway before the seasonal high water in accordance with written agreements between the State or local floodplain regulatory agencies and affected landowners.

Rationale

Presidential Executive Order 11988 requires that agencies proposing an action that will take place in a floodplain make "adequate provisions for the evaluation and consideration of flood hazards" and "include a statement indicating whether the action conforms to applicable State of local floodplain protection standards". This recommendation is based on conclusions reached after evaluation of Executive Order 11988. If the evaluation shows that hydraulic and hydrologic effects are within the limits of applicable State standards, the site will be deemed to comply with Executive Order 11988. Furthermore, the Floodplain Management Work Group has adopted as its purpose Great River Study objective F: "Strive to comply with State floodplain management standards". The guidelines listed in this recommendation are consistent with those standards.

PLACEMENT GUIDELINES

The following action items can be initiated when this document is approved and should apply to all placement activities.

ACTION ITEM 7

Recommendation

Whenever reasonable, material dredged during channel maintenance should be placed at areas accessible for removal for beneficial purposes. Where known demand for dredged material exists, stockpile sites should be established to maximize the economic and social benefits made possible by having sand available for beneficial uses. A process should be

developed and approved by an interagency management committee to quickly identify and use new placement sites in order to satisfy new demands (either on a one-time or recurring basis) as they occur.

Rationale

If made available, dredged material could be used for a variety of beneficial purposes including construction projects, fill projects, road ice control, and land reclamation. Under optimum conditions (primarily sand particle size), dredged material may also be suitable for mixture to produce concrete, asphalt, and soil conditioner. Enhancement projects for fish and wildlife habitat development and recreational facility development can also be considered beneficial uses; however, implementation of such projects must be consistent with the concerns of affected States and agencies.

Incorporation of reusable beneficial use placement sites (as material is removed from the site, its capabity is maintained for future placement) would minimize the number of sites needed. By doing so, the environmental damage caused by habitat coverage and potential erosion of material into backwater areas would be reduced. Erosion of placement sites can also increase future dredging requirements and channel maintenance costs. Placement of material at beneficial use stockpile sites may increase placement costs, but should be used when these costs can be outweighed by the resulting environmental mitigation and the economic and social benefits provided (such public benefits as road safety and local industrial and economic development). Public use facilities, such as the Great River Road project, can be serviced in part by using free dredged material for fill. If stockpiled to reduce trucking costs, this would result in significant savings compared to the purchase and trucking costs of using quarry-run sand.

Because beneficial use demands are often short-lived and require near immediate satisfaction, routine permitting procedures can cause time delays which can prevent placement sites use and realization of large volume beneficial use demands for dredged material. By developing a fast response process to allow dredged material placement at or near the demand area expeditiously, these demands for dredged material can be met.

ACTION ITEM 8

Recommendation

Temporary material placement sites will be used when private or Government dredging capability to reach the GREAT I recommended channel maintenance plan sites is not expected to be available before dredging is required. These sites should also be considered for use in emergency and imminent closure dredging situations as defined by GREAT I. In the selection and use of temporary sites, the following criteria shall apply:

a. Temporary sites approved by GREAT I are listed in the rationale.

b. The annual notice will include a site plan for all temporary sites showing material placement and removal plans and appearance of the site after its use.

c. Material stockpiled at these sites will be removed by the following spring high water or as soon as possible under time and/or equipment limitations.

d. Material removed will be taken to the channel maintenance plan approved sites.

e. Temporary placement sites are not endorsed by GREAT I unless the material is excavated before any additional material placement. The additional amount placed is not to exceed the volume removed.

Rationale

Temporary sites are intended for use under clearly defined circumstances. Under these circumstances, as described in the recommendation, it is critical that they be available for use. Their use can, however, be detrimental to the resource unless the recommendation is followed. In addition, unless the recommendation is followed and the sites are excavated, there will be no room for additional placement. Temporary sites approved by GREAT I are shown on the maps at the end of chapter VII and are listed below:

	Site
Pool 1	
Cut 5 - Below Franklin Avenue	1.07
Cut 3/4 - Above and below Lake Street	1.03
Cut 1 - Upper approach to L/D 1	1.02
Pool 3	
Cut 3 - Morgans Coulee	3.14
Cut 2 - Coulers Island	3.12
Pool 4 - Lower	
Cut 5 - Reads Landing	4.29
Cut 3 - Teepeeota Point	4.13
Cut 2 - Grand Encampment	4.10
Pool 5	
Cut 7 - Mule Bend	5.18
Cut 6 - West Newton	5.18
Cut 5 - Below West Newton	5.12
Pool 5A	
Cut 5 - Island 58	5A.14
Cut 4 - Fountain City	5A.14
Cut 2 - Wilds Bend	5A.08
Pool 7	
Cut 4 - Winters Landing	7.11LB
Cut 3 - Dakota	7.12RD
Pool 8	
Cut 6 - Above Brownsville	8.17
Pool 9	
Cut 9 - Island 126	9.21
Cut 8 - Twin Island	9.20
Cut 4 - Indian Camp Light	9.18
Cut 3 - Lansing Upper Light	9.17
Pool 10	
Cut 8 - Jackson Island	10.22

ACTION ITEM 9

Recommendation

Criteria for sediment and water quality as they relate to dredging and material placement should be developed by the Environmental Protection Agency in consultation with the appropriate State and Federal agencies. Using these criteria, the States should develop uniform regulations for the control of dredging and dredged material placement. In the interim, the following guidelines should be used to determine proper methods for dredged material placement:

a. An adequate bottom sediment data base at frequently dredged locations should be developed and maintained.

b. It should be determined if the material to be dredged is contaminated using 40 CFR 230, Interim Guidance for Section 404(b) of Public Law 92-500, Implementation Manual for Section 103 of Public Law 92-532, Environmental Protection Agency "Working Guidelines for Sediment Classification" (Great Lakes Criteria), and any other appropriate information in coordination with the affected States and agencies.

c. Contaminated dredged material shall be placed in an environmentally safe containment area.

d. Uncontaminated material shall be placed in accordance with the GREAT I channel maintenance plan. If the channel maintenance plan site cannot be used, an alternative site shall be selected in coordination with the affected States and agencies including using the On-Site Inspection Team process. Open-water placement or beach nourishment may be considered as an alternative.

e. Water quality during dredging and placement should be monitored whenever dredged material or supernatant is returned to the water. Treated effluents shall be monitored for total suspended solids, turbidity, and other appropriate parameters of concern. Open-water placement shall be monitored emphasizing the use of indicator parameters, water quality standard parameters, and toxic substance scans. Water quality and sediment monitoring programs should be coordinated among affected States and agencies.

f. Where contaminated material cannot be adequately contained, appropriate warnings to recreationists shall be posted for a distance of 2 miles downstream of the placement sites. When contaminated materials are dredged, designated recreation areas within 1,000 feet downstream of the dredging operation should be posted.

Rationale

The evaluation of the water quality impacts of dredging and material placement is in its infant stages as a science. Many of the procedures that have been developed are very costly and time consuming and are still in the developmental stages. Because of the time and money limits inherent in the system, many decisions relating to water quality impacts are based on limited data and professional judgments. This is especially evident in the area of contaminated sediments. There are questions concerning what constitutes contaminated sediments, how and when are these contaminants released into the water, and what are their ecological and human health impacts. The development of ecologically sound criteria for sediment quality applicable to the Upper Mississippi River would be an important and necessary step in providing for sound evaluation of the water quality impacts associated with dredging and material placement operations.

The State water quality criteria and standards that apply to the Upper Mississippi River are not consistent with each other and were not necessarily developed to deal with dredging and material placement. In some instances, existing regulations are more stringent than ecologically necessary resulting in placement methods that can sometimes degrade or at least do not enhance other resource values. The development of consistent water quality regulations by the States and Environmental Protection Agency to deal directly with the problems of dredging and placement is needed to provide for sound resource management of the river.

The development of sediment quality criteria and other evaluation techniques will take time as would the needed changes in State water quality regulations. What is needed now is a defined procedure for the protection and maintenance of water quality while ensuring that other resource values are also considered in the decision-making process on dredging and material placement. The development of a sediment data base at frequently dredged locations is a primary necessity because knowledge of the physical and chemical character of the sediments to be dredged is needed in any water quality impact evaluation. Because the sediment analysis process is time consuming and dredging-related decisions must at times be made on short notice, it is necessary to develop the data base in advance to have the needed information on hand when decisions have to be made.

The interim procedures for determination of sediment contamination should rely on state-of-the art techniques with the adoption of new procedures and techniques as they are developed and proven reliable. There also is a need to call on the collective expertise in the States and Federal agencies for input in this process to ensure all available resources are used.

If the sediments are determined to be contaminated, they should be placed in an environmentally safe containment area agreed upon by the Corps and affected States and agencies through the normal regulatory and on-site inspection team processes. The GREAT I channel maintenance plan attempted to take into consideration and plan for the containment of sediments in areas of known contamination. Future conditions may dictate the selection of a site other than the channel maintenance plan site to ensure adequate containment of contaminated sediments.

If the sediments are not contaminated, they should be placed in the channel maintenance plan site. If for some reason that site is not available for use, a new site should be selected using established coordination and on-site inspection team procedures. Open-water placement or beach nourishment may be considered as an alternative in these cases.

In those cases where dredged material is placed in the water or there is a return of effluent from a contained placement site, water quality of the effluent should be monitored. This monitoring should be designed to cover the expected area of impact.

Effluents are regulated by the States, and the State permits designate the parameters to be monitored. In most instances, the parameters are suspended solids and turbidity. Occasionally, other parameters are added because of unique site-specific conditions.

Monitoring of open-water placement should emphasize the use of:

1. Indicator parameters, such as total suspended solids, turbidity, iron, and manganese, to keep costs reasonable while still getting the necessary data.

2. Water quality standard parameters (dissolved oxygen, pH, temperature, etc.) because these parameters are generally of critical importance to aquatic life.

3. Toxic substance scans for contaminants such as pesticides and PCB's which are known hazards.

All monitoring should be coordinated among affected States and agencies to ensure all available expertise is tapped and regulations are being complied with and to facilitate the flow of data and information.

Limited monitoring in the past has shown that dredging and placement of sediments contaminated with fecal coliforms disperse fecal coliforms in the water in concentrations exceeding State health standards. The impact appears to be relatively localized, but much more information is needed in this area. In the interim, procedures are needed to ensure that public health is not jeopardized. Where sediments are contaminated by fecal coliforms greater than 100 fecal coliforms per gram, dry weight, they would be contained under procedures for handling contaminated sediments. However, in emergency dredging situations where the materials cannot be contained, steps should be taken to warn the public of the potential problem at designated public recreation areas. Based on present studies, a 2-mile downstream distance for posting is considered conservative to protect human health. For the dredging operation itself, available data indicate that 1,000 feet would be a conservative distance for posting.

ACTION

ACTION ITEM 10

Recommendation

The Corps of Engineers should prepare and implement, after appropriate interagency evaluation, site development plans for all historic and proposed dredged material placement sites. The following guidelines should be used for preparation of the plans:

a. Use landscape architecture skills.

b. Prepare plans before on-site inspection team meetings.

c. Identify proposed uses and management.

d. Consider equipment availability and mobilization.

e. Consider needs for revegetation.

f, Consider needs for erosion control.

Rationale

Dredged material placement sites are used extensively for recreation. They are also a potential source for erosion of material back into backwater areas or into the main channel requiring additional channel maintenance. Development plans should be prepared to provide for the anticipated recreation use and prevent erosion. The development plans should identify proposed uses including continued material placement, recreation, fish and wildlife enhancement, and aesthetic protection. The plan should consider cost effectiveness of the dredging operation, equipment availability, erosion potential, and management requirements. Revegetation using composting or other applicable measures should be considered for historic sites which will no longer be used for material placement and for infrequently used sites which would have the opportunigy to revegetate between uses.

ACTION ITEM 11

Recommendation

Bank stabilization and establishment of sediment traps or low-head dams near the mouth have been identified as potential alternatives for sediment control on the Chippewa River and should be further evaluated and implemented as soon as possible.

Rationale

The Corps of Engineers Chippewa River Basin Study has identified low-head dams, sediment traps, and bank stabilization as potentially viable alternatives for sediment control on the Chippewa River. This is based on work done under contract by Colorado State University. The physical model of the confluence of the Chippewa and Mississippi Rivers, constructed by the University of Minnesota under contract with GREAT I, also showed that dredging of a sediment trap at the mouth of the Chippewa River would reduce downstream dredging requirements. In addition to the Chippewa River Basin Study, the Corps of Engineers is implementing a streambank erosion demonstration project on the lower Chippewa River. The demonstration project is intended to show the applicability and practicability of low cost, experimental streambank erosion control measures. The Corps of Engineers Chippewa River basin study should be completed as soon as possible so feasible actions can be implemented. The streambank erosion demonstration project should be monitored so the results can be applied on the Chippewa River and other streams.

LONG-TERM NEEDS

Long-term development and implementation of operation and maintenance of the 9-foot navigation project in the best interests of the total river resource will require the adoption of policies and completion of further study items listed below.

POLICY/FUNDING ITEM 1

Recommendation

Congress should continue to authorize the maintenance of the navigation channel to meet current and future needs of commercial navigation consistent with other resource requirements.

Rationale

GREAT studies have documented the importance of commercial navigation to regional and national economies. To maintain the economic and social well-being of the area, continuous Government support of the navigation project is required.

POLICY/FUNDING ITEM 2

Recommendation

The necessary funding and personnel should be provided to the Corps of Engineers for preparation of long-term plans to implement the GREAT I channel maintenance plan. These long-term plans should include scheduling of necessary interagency coordination, permit applications, and land acquisitions. Additional specific coordinating activities should be initiated when it becomes apparent that dredging will be required during the dredging season.

Rationale

Orderly implementation of the GREAT I channel maintenance plan will require considerable planning and coordination by the Corps of Engineers. The Corps should identify those placement sites that have the highest priority of early use and program permit application and land acquisition procedures for those sites first. There should be enough flexibility so necessary coordination can be initiated on any site as soon as it is apparent that the site will be needed. The Corps does not presently have the funding or personnel to accomplish the necessary planning and coordination.

POLICY/FUNDING ITEM 3

Recommendation

Emergency dredging should be defined as dredging required to free a grounded vessel or remove shoals in the channel as a result of a vessel freeing itself. The emergency will continue only until an adequate channel depth and width, as determined by the Corps of Engineers, is restored to allow vessel passage.

Imminent closure should be defined as:

a. The actual water depth is projected by the District Engineer to be 10 feet or less within 14 days or less or

b. The channel width is less than 85 percent of the normally maintained width.

Rationale

Maintaining a reliable and safe channel is in the public interest from all aspects of river resource management. Section 404(t) of the Federal Clean Water Act of 1977 which requires the Corps of Engineers to comply with certain State laws and regulations states: "This section shall not be construed as affecting or impairing the authority of the Secretary to maintain navigation." There must be a reasonable point at which dredging activities pass from routine situations in which the Corps must comply with State law and regulations to those situations and circumstances under which the Corps must act immediately to maintain navigation in a way that may not conform with State regulations. This recommendation is intended to standardize the definition of emergency dredging and imminent closure between the Corps of Engineers and the States.

When the Corps of Engineers determines that emergency dredging, as defined in the recommendation, is required,

immediate notice will be given to the U.S. Coast Guard, the appropriate Federal and State regulatory agencies, and representatives of the On-Site Inspection Team for that pool. Equipment will be mobilized directly to the site and dredging will be accomplished as expeditiously as possible to restore navigation. The selection procedure of a placement site for emergency dredging is:

a. GREAT approved sites in the Channel Maintenance Plan.

b. GREAT approved temporary placement sites as defined by Action Item 8.

c. Other sites as determined by the Corps of Engineers.

The placement site selection process will include use of the On-Site Inspection Team, coordination with regulatory agencies, and consideration of environmental values to the extent practical under the existing conditions.

The imminent closure provision is intended to avoid the need for emergency dredging by preventing foreseeable closures of the navigation channel. When an imminent closure condition, as defined in the recommendation, is recognized, the Corps will follow the same notification procedure used for emergency dredging, including furnishing appropriate agencies scientific information justifying the imminent closure projection. Before beginning dredging, however, the Corps will take an additional depth measurement at the site to ensure the site will not stabilize at a depth of 10 feet or greater. The site selection procedure for imminent closure is:

a. GREAT approved sites in the channel maintenance plan.

b. GREAT approved temporary placement as defined by Action Item 8.

c. Other appropriate regulatory agency approved temporary sites with removal to the channel maintenance plan approved sites.

Within 30 days of the emergency of imminent closure dredging, the Corps will provide the following information to appropriate regulatory agencies: (1) nature of occurrence that necessitated the emergency or imminent closure dredging, (2) sounding data, (3) dredging depths, (4) volume of dredged material, (5) type(s) of dredging equipment used, (6) method(s) of dredged material placement, (7) available data concerning the chemical and physical composition of the sediment, (8) duration of dredging operation, including beginning and end dates, (9) project alternatives considered including alternative dredging methods and placement sites, (10) discussion of mitigative measures that were considered and used, (11) discussion of any biological effects, and (12) written projections of water surface and depth.

POLICY/FUNDING ITEM 4

Recommendation

The Corps of Engineers should maintain sufficient dredging capability in the St. Paul District to perform emergency and national defense dredging.

Rationale

A preliminary finding of the Minimum Fleet Report Ad Hoc Committee (Public Law 96-269) indicates that a medium to large hydraulic dredge will be required for "emergency and national defense dredging in at least the Upper Mississippi and Illinois Rivers." To maintain a minimum fleet in a ready condition, a given amount of maintenance dredging will be reserved for it. In addition to minimum

dredging for readiness purposes, the dredging fleet will also compete with private industry for all dredging jobs for which it is capable. If further studies indicate other types of equipment can provide the required capability at lower cost or with lesser environmental impacts, such equipment should be considered for use by the Corps of Engineers.

POLICY/FUNDING ITEM 5

Recommendation

The Corps of Engineers should attempt to sell dredged material to sand and gravel companies.

Rationale

Rather than competing against the Corps, the sand and gravel companies would have an incentive to use dredged material. The costs to the companies would be less than what they presently pay to obtain comparable quality sand. The companies would have the necessary equipment to upgrade the quality of the dredged sand, making it suitable for many additional uses and increasing its market value.

POLICY/FUNDING ITEM 6

Recommendation

The Corps of Engineers should change its policy and allow acquisition of private lands for stockpiling of dredged material to implement the channel maintenance plan and make material available for beneficial use.

Rationale

Corps of Engineers policy prohibits acquisition of private land for placement of dredged material. This policy has prevented the stockpiling of dredged sand for beneficial use and has made location of placement sites difficult in various stretches of the river. Placement on federally owned islands results in the dredged material being unavailable to the users and detrimental to floodplain standards and the environment. It also promotes erosion.

Although many private landowners along the river have indicated a desire to obtain Corps dredged material, these owners may have future plans for use of these lands that would preclude public use for dredged material stockpiling and removal. In some cases, landowners plan developments for these properties that would be subject to property damage during floods and are clearly in opposition to the goals of floodplain management.

POLICY/FUNDING ITEM 7

Recommendation

State and Federal agencies should seek modification of their laws and requirements to allow creation and maintenance of interagency recommended recreation and fish and wildlife enhancement within the floodplain and implementation of the channel maintenance plan.

Rationale

State and Federal laws and policies concerning floodplain management, wetland preservation, open-water placement, water quality, etc., limit many activities within the river corridor even when such activities may be desirable. These restrictions, aimed at minimizing flood stages and potential social, economic, and environmental damages, also prevent allowance of in-floodplain placement for recreation and fish and wildlife management purposes and certain channel maintenance activities.

Primitive island/beach areas are a major recreational attraction on the river. To sustain their use, these areas must be maintained or created on a limited basis as recreational

pressure dictates and in concert with the other multiple uses of the river. GREAT has identified a site-specific list of areas which should be developed/maintained for recreational purposes, using dredged material or other suitable means. Before such actions can be implemented, present laws and policies with respect to open water placement, water quality standards, and in-floodplain placement must be modified.

Specific fish and wildlife enhancement projects which GREAT has recommended would also violate State and Federal regulations. However, implementation of these projects is necessary to sustain habitat and recreational values and prevent further deterioration caused by sedimentation. Present laws and policies regarding open-water and in-floodplain placement, wetland destruction, and water quality must be modified before such enhancement projects can be implemented.

The channel maintenance plan developed by GREAT considers both economics and environmental protection and has incorporated site-specific recreation and fish and wildlife enhancement projects in an effort to provide resource management benefits for a number of activities on the river. This concept and economic considerations also demanded selection of some dredged material placement sites which violate the aforementioned laws and policies. Such sites may not provide recreation or habitat enhancement benefits, but do represent a balanced plan. When appropriate, the existing laws which would be affected by such activities should be modified to allow the balanced plan to be implemented.

Modification of existing laws and requirements should be allowed only for site-specific projects that have been recommended through the interagency review process. In this process, appropriate State and Federal agencies should compare the resource management benefits to be gained by each project and the cost with the possible adverse impacts on the resource. When it can be shown that the project is in the best interest of the river, from a total resource management standpoint, exemption to existing laws and policies should be allowed.

POLICY/FUNDING ITEM 8

Recommendation

Congress should define the Mississippi River 9-foot navigation project as that necessary to afford safe navigation for vessels with a draft no greater than 9 feet.

Rationale

This recommendation is intended to clarify the meaning of project depth to eliminate further controversy and confusion. The definition is taken in part from the Congressional Record H-12693 dated 13 October 1978 that approved locks and dam 26.

The project should include dredging allowances required for dredging tolerances, squat, and trim for the class of vessels for which the project is currently used, wave action, shoaling rates, and other overdepth dredging allowances. Environmental concerns (floodplain, water quality, fish and wildlife, recreation, etc.) should also be considered in determining actual depths to be dredged.

GREAT studies, recommendations, and the channel maintenance plan are all based on continued operation and maintenance of the 9-foot navigation project.

Economical transportation will become increasingly important to national and regional objectives as energy constraints continue. Water transportation will help meet those objectives as the most fuel-efficient transportation mode.

FURTHER STUDY ITEM 1

Recommendation

A demonstration dredging project should be conducted during 1980 or 1981 by the St. Paul and Rock Island Districts, Corps of Engineers, to determine the feasibility and cost effectiveness of accomplishing channel maintenance by the following methods.

1. Mechanical dredging with a backhoe directly loading onto barges.

2. Hydraulic dredging with direct loading onto barges.

3. Mechanical unloading at placement sites.

4. Hydraulic unloading at placement sites.

Rationale

Because of the nature of the river corridor, the number of placement sites which minimize the impacts on flood flows and wetlands and have access for beneficial use removal are limited in certain stretches of the river and are often beyond existing equipment capability. Barges are considered to be one of the most efficient methods of moving relatively small quantities of dredged material over distances greater than 1 mile. Both the GREAT I and GREAT II MENWG's considered the feasibility of accomplishing channel maintenance by the two proposed methods. However, because of funding and time constraints, feasibility studies were never conducted.

Studies and investigations by the GREAT I and GREAT II MENWG's (MENWG Appendixes, UMRBC Dredging Symposium, 1979, and Goodier, Thompson, and Cutting, 1980) and contacts with private contractors indicate the possibility that dredging techniques which used barging to move dredged material long distances may be cost effective and environmentally sound. This view, however, is not widely accepted because of the lack of field trials under actual channel maintenance conditions. The Team also recognized that any recommendation to purchase this type of equipment is premature because these techniques have not been adequately tested during actual channel maintenance dredging operations. A dredging demonstration project to determine the feasibility of this method is recommended.

The demonstration project should be conducted by contracting with private firms using equipment rented by the Corps of Engineers. Exact details (i.e., dredge cuts, volumes, location of placement sites, tests to determine turbidity levels, etc.) of the project should be established by the St. Paul and Rock Island Districts and should be reviewed and approved before implementation by all agencies participating in GREAT I and II. Particular attention should be paid to evaluating the equipment's production rates for various face cuts, loading position, time, and dredging channel obstructions while dredging, reliability loading, unloading and transportation costs, fuel efficiency, and other operational parameters.

Participants in the Upper Mississippi River System Master Plan being conducted by the Upper Mississippi River Basin Commission should be consulted to determine if funding and expertise are available to assist in the recommended demonstration project.

Further studies recommended relating to dredging and reduction of dredging volumes are listed below.

FURTHER STUDY ITEM 2

Recommendation

A plan should be developed to use the river's sediment transport capability to cause necessary dredging requirements to occur near long-term placement sites as environmentally and economically feasible.

Rationale

GREAT I has identified sites for placement of dredged material through the year 2025. Many of these sites have been located so that the material can be made available for beneficial use. The Corps of Engineers should pursue modification of the existing wing dam and closing dam system to cause material to deposit near selected placement sites where there is a high demand for material, rather than at historic dredge cuts. This would reduce the cost of channel maintenance and make more material available for beneficial use. Present technology and sediment transport models existing or being developed should be used to evaluate the feasibility of this approach. Economic and environmental impacts should be evaluated, and the system should be planned so navigation is not impeded.

FURTHER STUDY ITEM 3

Recommendation

The Corps of Engineers should continue to develop computerized sediment transport models of the Mississippi River 9-foot navigation system. As models become operational, they should be used to determine optimum depth for dredging at each dredge cut, possible changes in the wing dam system, and other means for reducing dredging requirements.

Rationale

A one-dimensional sediment transport model from lower pool 4 through pool 8 and a two-dimensional sediment transport model in lower pool 4 were developed. A physical model of lower pool 4 successfully calibrated the mathematical sediment transport models. The one-dimensional model should provide a reasonable estimate of the sediment transport continuity throughout the system. The two-dimensional model should be developed so it can be applied at any location in the system where additional information is needed. The two-dimensional model uses information from the one-dimensional model to determine the sediment coming into, and going out of, the area of concern and then determines the distribution of sediment flow throughout the area.

The Vicksburg District of the Corps of Engineers is also developing a model based on the concept of unit stream power and the theory of minimum rate of energy expenditure. This theory treats a river as a system to determine optimum channel geometry, pattern, and profile under different hydraulic, hydrologic, geologic, and man-made constraints.

The application of computer models of the Mississippi River has the potential for elevating the present art of dredging and material placement to a scientific discipline. The St. Paul District should continue the development of the one- and two-dimensional mathematical models and should apply them to dredging practices as appropriate. It should also monitor the development of the unit stream power model and consider its application to the Upper Mississippi River system.

FURTHER STUDY ITEM 4

Recommendation

The Corps of Engineers should initiate dredging at dredge sites below the confluence of major bed load supplying tributaries when the technical relationships indicate a high risk of potential channel closure. The Corps of Engineers should monitor the deltas at the confluence of such tributaries to determine the technical relationships of delta conditions, hydrologic occurrences, and risk to downstream channel conditions. The relationships should be applied to determine dredging activities. When a high risk of potential channel closure is determined to exist, dredging should be accomplished with full consideration of the environmental impacts of the dredging and material placement.

Rationale

The University of Minnesota physical model has illustrated that the 100,000-cubic yard dredge cut made in May 1978 can fill in within 36 days when the delta condition is adverse, with a flow of 19,000 cfs (cubic feet per second) in the Mississippi River and 30,000 cfs in the Chippewa River. When an additional 100,000-cubic yard dredge cut is made in the Chippewa River delta, similar shoaling at Reads Landing with the same discharge relationship takes 60 days to fill in. Development of the delta relationships with suitable preventive dredging by the Corps of Engineers could reduce emergency dredging occurrences, allow improved advance coordination of dredging, and greatly improve the reliability of navigation. To allow implementation, the technical relationships should be completed for the Chippewa River and programmed for other tributaries. Data collection at the Cannon, Zumbro, Root, Upper Iowa, and Wisconsin Rivers should be initiated as soon as feasible to provide a better data base in developing delta relationships. The implementing agency would be the Corps of Engineers.

FURTHER STUDY ITEM 5

Recommendation

The condition of all wing dams and closing dams at all historic dredging sites in the St. Paul District should be identified to determine the need for repair and/or modification.

Rationale

Repair and/or modification based on the one-dimensional sediment transport math model should be considered. Site-specific recommendations for individual sites using the two-dimensional math model should be developed. Considering future deterioration, impact on dredging quantity and placement at long-range placement sites identified by GREAT, and the net environmental impact, the Corps of Engineers should request funding and schedule any justified rehabilitation. Dredging quantity and placement impact could be reduced to the benefit of the total system. The existing system was constructed before the 9-foot channel project. Limited field surveys accomplished by the Corps justify review at Winters Landing (pool 7), Sand Slough (pool 8), Lansing Upper Light (pool 9), and Wyalusing (pool 10). Conclusion CMDR 19 lists the wing dams and closing dams that show significant evidence of deterioration.

FURTHER STUDY ITEM 6

Recommendation

To reduce dredging requirements, operation of main stem dams or construction of low-head tributary dams to create a more favorable Mississippi River stage in relation to tributary stages should be investigated.

Rationale

The physical/mathematical model research shows the Mississippi River stage is a critical factor governing the sediment contribution of the Chippewa River. Minor stage adjustments in pool 4 could at least temporarily minimize dredging requirements. The sediment might be trapped for dredging at the delta or naturally assimilated during the next spring high flow.

FURTHER STUDY ITEM 7

Recommendation

The Corps of Engineers should investigate the possibility of sand and gravel companies accomplishing the dredging required for channel maintenance.

Rationale

Rather than competing against the Corps, the sand and gravel companies should have an incentive to use dredged material. The costs to the companies would be less than what they presently pay to obtain comparable quality sand.

The companies would have the necessary equipment to upgrade the quality of the dredged sand, making it suitable for many additional uses and increasing its market value.

FURTHER STUDY ITEM 8

Recommendation

The Corps of Engineers should continue monitoring dredging and material placement to further determine impacts on water quality. Parameters tested, as agreed to by an interagency coordinating committee, should be used in correlation with the existing knowledge base and with site-specific sediment and hydraulic characteristics to develop a predictive capability of water quality impacts related to dredging and material placement. When such predictive capability is established, water quality criteria and standards should be reviewed and revised.

Rationale

Such information would add to the strength of the routine monitoring data base and would provide new and better information to be used in the interpretation of routine monitoring.

Future studies to determine water quality impacts from dredging and material placement, emphasizing the use of indicator parameters (total suspended solids, turbidity, iron, manganese, chemical oxygen demand, reduction-oxidation potential), water quality standards parameters (fecal coliform, dissolved oxygen, temperature, pH), and toxic substance scans (metals and organics) would provide easily interpreted information to add to an existing data base. Use of discrete water samples, correlation analysis between selected parameters, and reliable flow data would also be effective for determining water quality impacts.

Knowledge gained from such monitoring would facilitate adoption of water quality criteria and standards relating to dredging and material placement.

FURTHER STUDY ITEM 9

Recommendation

A follow-up to the Corps of Engineers "Streambank Erosion Site Inventory" should be conducted cooperatively between the Soil Conservation Service and the Corps of Engineers to determine and classify streambank erosion sites not previously identified. Alternatives for bank erosion control should be developed and analyzed for economic and environmental impacts. Implementation authority and cost-sharing criteria should be developed so that control alternatives can be implemented.

Rationale

Streambank erosion from tributary sources has been identified as the principal source of coarse sediments entering the Mississippi River corridor. Control measures applied on identified high coarse sediment contributing tributaries will reduce channel maintenance requirements and the potential secondary impacts on fish and wildlife habitat associated with dredged material placement. State legislatures should support cost-sharing programs that will accelerate the application of streambank erosion control practices.

FURTHER STUDY ITEM 10

Recommendation

The feasibility of bed load sediment entrapment structures (rock gabions, low-head dams, etc.) should be investigated on lower reaches of intermittent or seasonally dry tributaries on the Wisconsin side of pool 3.

Rationale

The 13-mile stretch in pool 3 between Diamond Bluff and Prescott is projected to require relatively high volumes of dredging. The investigation and ultimate implementation of entrapment structures could reduce these volumes and, therefore, reduce dredging costs. The priority of streams which should be investigated for potential placement of structures is:

a. Morgan's Creek.

b. Big River.

c. Pine Creek.

d. Dry Run Slough.

FURTHER STUDY ITEM 11

Recommendation

Riverine placement should be investigated where beneficial uses are unavailable and secondary environmental impacts of riverine placement are less than impacts at alternate placement sites. The investigations should be carried out at no more than two sites and should be subject to the approval of the affected States. Environmental impact conclusions should be considered site specific unless proven otherwise.

Rationale

GREAT II has documented a net loss of nearly 500,000 cubic yards of bottom sediments in less than 1 mile of channel in a 6-week period. Riverine placement would not be recommended where it would increase downstream dredging requirements.

FURTHER STUDY ITEM 12

Recommendation

The feasibility of removing material from existing placement sites in the floodway, where there is potential for flood flow impacts, should be investigated.

Rationale

In many locations of the river, dredged material continues to accumulate in the effective flow area of the floodplain where it is subject to erosion either back into the channel (where it eventually must be redredged) or into backwater habitat areas. Also, the continued accumulation of material in the effective flow area would affect flood flows by increasing water surface elevations during floods.

FURTHER STUDY ITEM 13

Recommendation

When the need for transporting dredged material to an area of high demand has been identified at a specific site, a feasibility study should be made to determine the best means of providing the desired material. Sources to be considered for the material should include historic placement sites as well as proposed dredging operations. All potential methods of moving the material should be considered including rail, truck, pipeline, and barge. Such studies will involve an assessment of environmental impacts.

Rationale

Studies made by GREAT I have identified a large demand for dredged material. However, the cost of transporting the material to the area of demand often exceeds the value of the material.

Additional studies should be made of the economics of providing permanent facilities for transporting material from potential areas of supply, such as existing placement sites or areas of frequent dredging, to areas of high demand. Permanent installations designed to be used over a long period of time may have economic advantages over short-term, temporary operations. The potential reduction in channel maintenance costs should be considered.

FURTHER STUDY ITEM 14

Recommendation

Private enterprise should be encouraged to explore the economic feasibility of transporting sand from dredged material islands to the area of demand.

Rationale

Portions of the river have large sand islands that were regularly used as placement sites. La Crosse, Brownsville, Reads Landing, and Red Wing are examples of such areas where the dredged material could be put to beneficial use.

FURTHER STUDY ITEM 15

Recommendation

The feasibility of using riprap made with dredged material and cement should be investigated.

Rationale

Making riprap from dredged material and cement would provide an additional beneficial use and may result in large amounts of riprap becoming available at a cheaper cost. The riprap would be applied to unstable banks or previous placement areas. Riprap provides a very desirable habitat for many species of fish, wildlife, and benthic organisms when used in the proper locations. A description of a potential method for making riprap or soil cement from dredged material can be found in a report by D. B. Simons and Y. H. Chen of Colorado State University entitled "Erosion Control Measures for the Erosion Demonstration Program, Lower Chippewa River Basin." The report was prepared under contract for the St. Paul District, Corps of Engineers, and is dated March 1978.

FURTHER STUDY ITEM 16

Recommendation

The potential beneficial uses of fine organic sediments should be studied. The study should address the problems of contaminants and dewatering, often associated with fine organic material, and the possible effects dredging may have on biological productivity at the dredging site.

Rationale

The Fish and Wildlife Work Group recommended dredging in certain backwaters containing fine organic sediments. The potential uses of organic sediments may include fertilizers, black dirt fill, or soil additives. If the organic sediments are unsuitable in dredged form, the study should determine if upgrading is economically feasible. Upgrading may include the addition of lime to raise a low pH or the addition of nitrogen, phosphorus, potassium, etc., to supplement nutrient deficiencies.

SEDIMENT AND EROSION CONTROL

OVERVIEW

Erosion of the earth's surface is a continuous natural process. It results from wind and water action. This process has been affected by man's disturbance of the earth's surface by agricultural and construction activities. These

activities when carried out improperly speed up the natural process and increase sediment yield to the river system from upland and streambank areas. This problem has been further intensified by the placement of the locks and dams in the river corridor. While the initial result of placement of the locks and dams was an increase in aquatic habitat area, the long-term effect has been to cause additional accumulations of sediment in the river, principally the backwater areas. While man, through his actions, has hastened the filling of the riverbed, he can also slow down the process and prolong the life of the river system.

Resolution of this problem will require:

a. A reduction in upland and streambank erosion and subsequent sediment yields to the river system.

b. Corrective or mitigative actions to restore lost aquatic habitat or reduce the impacts of sedimentation.

A reduction in sedimentation has a positive effect on water quality, fish and wildlife, recreation, and floodplain management. Actions which address each of these resource components specifically are discussed within each of those components in the following sections. Because streambank erosion is so closely linked to reduction in dredging quantities, it was discussed in the previous section. To address the overall problem at its source, the following action is recommended for immediate implementation.

REDUCTION IN UPLAND EROSION

ACTION ITEM 12

Recommendation

Application of soil erosion control practices and/or best management practices for nonpoint sources should be increased in the critical sediment source area of the Mississippi River to the extent possible, through the use of programs administered by the U.S. Department of Agriculture (Soil Conservation Service and Agricultural Stabilization and Conservation Service) and similar State programs. Congress and the State legislatures should continue support of ongoing programs. The Rural Clean Water Program should be extended and funded to the level previously authorized ($400,000,000 per year).

Rationale

A serious threat to the longevity of fish and wildlife resources of the Upper Mississippi River is the accumulation in the backwaters of fine sediment that erodes from upland agricultural areas (McHenry et al., 1978). This conclusion is based on the evaluation of the results of the following work group studies:

1. Particle size analysis of geologic borings.

2. Re-sounding of Lake Pepin.

3. Cs-137 sediment dating process.

4. Aquatic habitat comparison study.

According to Soil Conservation Service standards, 46 percent of the land in critical sediment source areas is adequately protected. Studies indicate the backwaters will survive for approximately 30 to 50 years before habitat diversity is reduced to predominantly type 2 and 3 wetlands. Acceleration of the application of existing land treatment practices would decrease gross erosion from agricultural areas and the ultimate deposition of this eroded material in the backwaters. The land treatment analysis indicates that an 80-percent level of adequate protection would result in a one-third decrease in upland erosion. The highest priority must be given to sediment reduction if the rich diversity of the river as we

know it is to survive. The critical sediment source areas identified on the "GREAT I Sediment Source Map" at the end of this chapter should have top priority for funding and implementation in the GREAT I drainage area.

Additional potential means of addressing this problem are listed below.

FURTHER STUDY ITEM 17

Recommendation

A concurrent two-part program should be conducted in the GREAT I critical sediment source area to determine the feasibility of large-scale use of conservation tillage farming systems to reduce the sediment yield to the Mississippi River.

Rationale

The Sediment and Erosion Work Group determined that the life expectancy of several of the pools is very short - 50 to 250 years. The maximum erosion reduction theoretically possible with current soil conservation practices is 50 percent. Therefore, to preserve the pools for the long run, it will be necessary to develop soil conservation technology that will reduce erosion above and beyond the limits of the current program. Because of the urgent nature of the sedimentation problem, immediate implementation of part two of the demonstration should be conducted concurrent with part one.

Part one of the program should include a strong program of information and education promoting the advantages of conservation tillage and be designed to determine:

1. Potential reduction in soil loss with the use of conservation tillage farming systems.

2. Changes in farming practices required by a change to no-till farming. This would include studies of types of chemicals, rates of applications, timing of applications, changes in management practices, changes in types of machinery and equipment, and other adaptations required by a conversion to conservation tillage farming.

3. Changes in yields and net returns which would result from a conversion to conservation tillage farming.

4. Types and amounts of economic incentives needed to reduce a widespread conversion to conservation tillage or alternative soil conservation practices.

5. The impact on sediment deposition in backwaters.

Part two of the program would be an on-the-ground demonstration project in a watershed area identified as a significant sediment source to the Mississippi River. The demonstration watershed would be closely monitored to determine the benefits of land treatment and conservation tillage farming. Gaging stations would be established to monitor sediment delivery before and during the project.

FURTHER STUDY ITEM 18

Recommendation

Monitoring of sediment inflow from major tributaries should be continued and additional stations established. The Corps of Engineers should review all tributaries with a coordinating committee to establish priorities for additional sediment sampling stations.

Rationale

The existing monitoring program of the Corps of Engineers and the U.S. Geological Survey provides base-line information regarding the tributary sediment contributions to the river corridor. New stations would provide additional information. These data will be useful

for identifying priority watersheds for implementation of upland erosion control practices and streambank protection measures. Gaging station data should be used to determine site selection of the upland treatment demonstration project recommended in this report.

WATER QUALITY

OVERVIEW

The quality of the water in the system affects the quality of fish and wildlife habitat and quality and safety of use of the water by humans for consumptive and recreational uses. Water quality is affected by the type and quantity of substances added to it. In the Upper Mississippi River system the water is a recipient of chemicals attached to sediment washed into the river and groundwater from upland areas (principally agricultural herbicides, pesticides, and synthetic fertilizers). This is commonly called "nonpoint source" pollution. Chemicals and organic wastes enter the river as treated or untreated effluent from "point source" discharges directly from residential, commercial, and industrial outflows and municipal and regional wastewater treatment plants.

Because pollution of water is such a pervasive problem, its remedy lies in preventing pollutants from entering the river rather than massive corrective measures within the system. Resolution of this problem will require:

a. Control of application of chemicals to upland soils combined with minimization of upland erosion.

b. Monitoring and regulation of point source pollution discharges of all forms.

c. Because the Upper Mississippi River is a part of a national inland waterway system for barge transport of bulk commodities, and a heavily used recreation resource, special efforts must also be made to ensure this activity is regulated by preventing accidental spills or prohibiting transport of especially toxic chemicals and through regulation of recreational discharges and littering.

d. Further, it is recognized that the act of dredging and placement of dredged material in the floodplain resuspends already polluted sediments (when they exist). Resolution of this problem must include control of this activity.

Application of agricultural chemical use controls and sediment and erosion control measures previously noted (through continued application of improved agricultural practices and through continued funding and implementation of the 208 Water Quality Planning Program) addresses the problem of nonpoint source pollution. Environmental Protection Agency and State programs related to point source discharge monitoring and permitting procedures and financial aid to local governments, if stringently applied and sufficiently funded, are adequate to address the problem of point source pollution (item b. above). Item d. is addressed in the channel maintenance plan.

Resolution of problems noted in item c. should be achieved by the following recommended actions.

MAINTENANCE OF WATER QUALITY

ACTION ITEM 13

Recommendation

The Environmental Protection Agency should maintain a list of all substances that would significantly threaten the riverine environment if a spill occurred. The U.S. Coast Guard should continue to develop and enforce regulations on the shipment of hazardous materials includ-

ing prohibitions, where necessary.

Rationale

This recommendation represents current procedures of the respective agencies; however, GREAT makes this recommendation to endorse these procedures recognizing the potential for accidental spills of hazardous substances on the river and the threat such a spill would present to the river environment. Further, as a means of implementing this recommendation, alternative modes of shipment of hazardous materials should be investigated by the U.S. Department of Transportation to meet the demands for transport of hazardous substances in the future.

ACTION ITEM 14

Recommendation

Sanitary pump-outs and trash pick-up points should be established in suitable areas.

Rationale

The water quality and aesthetic appearance of the river can be enhanced through the exclusion of waste disposal in and adjacent to the water.

Availability of convenient off-loading points for vessels will encourage recreation users to export their trash. Requiring such facilities in conjunction with leased facilities requires further study and implementation.

The Mississippi River above Hastings has been designated by the Environmental Protection Agency as an area of no discharge for sanitary wastes under the provisions of Section 312 of the Clean Water Act upon application by the State. Therefore, vessels with sanitary facilities are required to have holding tanks in those areas. However, because adequate facilities are lacking, the application for the Minnesota-Wisconsin boundary waters was denied. Rapid implementation is encouraged because boats will be required to install holding tank or treatment devices; the former is preferred.

Other recommendations associated primarily with minimizing water quality impacts of dredging were discussed as further study items under channel maintenance.

Fish and Wildlife Resources

OVERVIEW

The geographic area which is called the Upper Mississippi River has served as habitat for fish and wildlife as long as these life forms have existed. (The river as we know it has existed for about 14,000 years - since the last glacier.) Natural changes in the system dictated the types and abundance of fish and wildlife habitat and its resident species until the late 1800's at which time man and his activities began to influence this natural balance. Water pollution, high density human residence, and subsequent human development along with physical modification of the matural river system have all affected this natural balance. Perhaps no action has more dramatically affected the fish and wildlife resources than the placement of the 13 locks and dams in the GREAT I area.

The placement of the locks and dams initially resulted in expansion of aquatic habitat. The long-term impact has been trapping of sediment in the pools (as noted earlier). Further, dredged material placement practices have destroyed or impaired the quality of habitat in many areas.

Resolution of these problems will require:

a. Sediment and erosion control measures to address the problem at its source.

b. Control of water pollution (point and nonpoint source).

c. More environmentally sound channel operation and maintenance practices.

d. Improved resource management practices on the Upper Mississippi River Wild Life and Fish Refuge as well as nonrefuge lands and waters.

e. Management of conflicts between fish and wildlife resources and recreational and commercial uses.

Items a., b., and c. were discussed in previous sections. Item e. will be discussed under the recreation, commercial transportation, and overall river resource management sections. Item d. is addressed through the action and policy items noted below.

FISH AND WILDLIFE MANAGEMENT

ACTION ITEM 15

Recommendation

Each State and Federal agency contributing to the natural resource management of the Upper Mississippi River should place more emphasis on the river by increasing staff and budget allocations to the work on the fish and wildlife resources on the river.

Rationale

The Upper Mississippi River faces many problems in the near future requiring prompt and adequate response from the agencies managing it. The completion of the GREAT I program will probably result in these agencies reducing their staffs and funding allocations just when implementation of the GREAT I recommendations requires additional allocation. Given that present agency commitment of staff and funding to the river is not adequate to maintain and protect the river's natural resources, there is a definite need for increasing agency allocations for dealing with the future problems and issues on the river.

ACTION ITEM 16

Recommendation

Gated culverts should be placed through the dike of lock and dam 4.

Rationale

GREAT unanimously endorsed this project in a letter sent to the St. Paul District in 1978 (Attachment "L", Fish and Wildlife Work Group, GREAT I, September 1980). The critical need for additional water flow in the area immediately downstream from the dike was well documented in that letter. The Minnesota Department of Natural Resources provided much of the data documenting the problems in the area. Freshwater flows are needed to restore the quality of fish habitat.

ACTION ITEM 17

Recommendation

A gated culvert should be constructed through the dike of lock and dam 10 to provide a water supply to the waterfowl in pool 11.

Rationale

One of the first recommendations of the Side Channel Work Group was that a culvert with a control gate be placed through the dike of lock and dam 10 at Guttenberg to convert a series of old fish ponds into a productive waterfowl resting and feeding area. This project was not attempted during the GREAT program because other projects were more urgent. However, the culvert is still considered very important to restoring the ponds to productive uses and restoring the freshwater flows to the adjacent

sloughs that were cut off when the lock and dam were built.

ACTION ITEM 18

Recommendation

The U.S. Fish and Wildlife Service should continue to upgrade and expand facilities of the Upper Mississippi River Wild Life and Fish Refuge under the Bicentennial Land Heritage Program and other potential funding sources.

Rationale

Much of the future demand for additional recreational opportunities is consistent with the Fish and Wildlife Service management objectives and can be met on areas proposed under the Bicentennial Land Heritage Program.

POLICY/FUNDING ITEM 9

Recommendation

The Fish and Wildlife Service in coordination with the States and the Corps of Engineers should develop and implement a comprehensive plan for the management of the Upper Mississippi River Wild Life and Fish Refuge that considers all the fish and wildlife resources of the area and consists of the necessary strategic and operational components to make explicit the background, authorities, and justification for the refuge and objectives, policies, coordination measures, and procedures by which it will be operated.

Rationale

A specific and explicit plan for the Upper Mississippi River Wild Life and Fish Refuge would be the basis for effective and efficient actions to achieve necessary objectives, whether they are for waterfowl, fish, or furbearers. Further, it is the best communication and coordination mechanism for operation programs in this multijurisdiction effort.

A specific and explicit plan for the refuge is prerequisite as the frame of reference on which to base objective program evaluations and redirections.

Presently, no comprehensive or consistent plan or policy directs the actions of individuals and agencies involved in managing the fish and wildlife resources of the Upper Mississippi River Wild Life and Fish Refuge. Each pursues proposed accomplishments perceived individually as desirable with only loose coordination and direction of effort. The result is unnecessary misunderstanding between persons and agencies, loss of effectiveness and efficiency, and the inability to optimize because objectives and alternative approaches are not identified.

The need to provide improved input by State fisheries and wildlife biologists is recognized and will provide valuable field experience and knowledge of the river's management potential to the planning process. The Corps of Engineers input to the plan is critical to ensure uniform application of the plan to all portions of the refuge.

POLICY/FUNDING ITEM 10

Recommendation

State and Federal natural resource agencies should develop their management plans cooperatively and implement their management programs so that the Upper Mississippi River is managed as an ecological unit.

Rationale

Fish and wildlife management on the Mississippi River has historically been a piecemeal process. State and Federal agencies have conducted their own programs, pursuing their own objectives independently, occasionally opposing the management programs and objectives

of the other agencies working on the river. As a result, fish and wildlife resources have not been effectively enhanced or protected because of political boundaries.

Cooperative development and implementation of management plans should alleviate these problems of fragmented management of the river. Natural resources may be enhanced by giving consideration to the whole of the river's resource when developing plans for any specific area. The river is a biological unit to the fish and wildlife and it should be managed as such by the agencies that regulate this resource.

POLICY/FUNDING ITEM 11

Recommendation

Congress should provide the Corps of Engineers with definitive authority and funding to assist the Fish and Wildlife Service and States in accomplishing fish and wildlife conservation and recreation projects on the Upper Mississippi River.

Rationale

Congress designated the Upper Mississippi River as a National Wildlife Refuge to serve as a sanctuary for wildlife, wildflowers, and fish in 1924. Several years later, Congress authorized the Corps of Engineers to develop a 9-foot navigation project on this same stretch of river. Although the value of both projects has continued to grow, the navigation project has become the dominant feature on the river. Further, operation and maintenance of the navigation project have had definite adverse impacts on the refuge values. These adverse impacts include destruction of fish spawning and feeding areas and wildlife and recreation areas, destruction and reduction of waterfowl feeding areas, and general modification of wetland habitat to upland.

The Fish and Wildlife Service and the States are attempting to maintain the values of the refuge and adjacent river habitats and contend with the side effects of the navigation project. However, the effort to maintain this national resource would be greatly enhanced if the Corps of Engineers had the authority and means to cooperate in the effort.

The Corps of Engineers has limited authority to cooperate in protecting and maintaining the river's fish and wildlife resources without State or local cost sharing. The Corps of Engineers cannot barge dredged material, open side channels or boat accesses, alter wing dams or blocking dams, construct partial blocking dams, construct berms, modify placement sites, obtain additional dredging equipment, or hire private dredging contractors if the work or equipment is to solely or primarily benefit fish, wildlife, or recreation resources without State or local cost sharing. However, the Corps has the equipment and expertise to perform these necessary functions for the States and Fish and Wildlife Service.

Therefore, it is the intent of this recommendation to provide the Corps with the authority to conduct this type of work to assist the Fish and Wildlife Service and States to protect the river's nationally recognized natural resources. The intent is to provide the Corps with 100-percent funding for such projects.

Authority is sought for assisting both the Fish and Wildlife Service and States because of their overlapping jurisdictions and roles in managing the river's resources. The U.S. Fish and Wildlife Service is the manager of the Upper Mississippi River Wild Life and Fish Refuge and has primary authority within the refuge boundaries. The States also have management authorities within the refuge boundaries on water surface areas as well as in many areas adjacent to the refuge. Therefore, the

Corps needs authority to assist both managing entities to make the Corps efforts most effective.

GREAT I demonstrated several examples of the type of work that might be requested of the Corps under this authority. These pilot projects included:

1. A partial blocking dam constructed at Devil's Cut in pool 5A (Wisconsin), $65,500, 1977.

2. A set of culverts built in the dike of lock and dam 5 (Wisconsin), $230,000, 1978.

3. A side channel opening at Mule Bend (Minnesota) in pool 5, $30,000, 1974.

4. A side channel opening at Buffalo City, Wisconsin, in pool 5, $30,000, 1975.

5. A side channel opening at Blackbird Slough (Minnesota) in pool 6, $9,650, 1976.

6. A side channel opening at Wyalusing Slough (Iowa) in pool 10, $140,000, 1978.

7. A side channel opening at Fort Snelling State Park (Minnesota) in pool 2, $16,000, 1976.

The proposed Weaver Bottoms rehabilitation project in pool 5 (Nielsen et al., 1978) is a further example of the type of project the Corps might be asked to conduct under the authority requested in this recommendation.

In summary, the authorization requested will allow the Corps to fully participate in protecting and maintaining a resource specifically recognized and invested in by Congress. Further, the authority will allow the Corps to take the measures necessary to safeguard this resource while also providing for navigation maintenance. Some of the enhancement projects which would be requested by the Fish and Wildlife Service and the States would be intended to mitigate or compensate for effects of the Corps navigation project on the river's fish and wildlife resources.

POLICY/FUNDING ITEM 12

Recommendation

Future Mississippi River management budgets should show, as separate line items, those programs that request funds to benefit recreation or fish and wildlife and are not required to maintain the 9-foot navigation project.

Rationale

GREAT is recommending additional authorities and funding for the Corps of Engineers to maintain areas of the Upper Mississippi River for purposes other than navigation. While the Corps of Engineers may have the funding capability and expertise to perform these functions, it is important that separate authorizations be made by Congress to ensure that the proper level of funds is being expended to accomplish those tasks, and that the costs are not allocated as costs for maintaining the navigation channel.

POLICY/FUNDING ITEM 13

Recommendation

Beneficiary/user data should be developed and used by appropriate agencies in managing water resources and developing cost allocation programs.

Rationale

The present Federal administration favors user charges for water resource projects. This program has been initiated in the fuel tax for commercial navigation required by Public Law 95-502. Further cost recovery programs are being considered. Although cost recovery may

not be instituted in all cases, a system of cost allocation should be developed to identify user/beneficiary costs. To equitably assess user charges in any area, the implementation of this recommendation is necessary.

POLICY/FUNDING ITEM 14

Recommendation

Unified management objectives (recreation, fish and wildlife, commercial, etc.) should be developed for each pool or segment of pools. The development of unified management objectives must be consistent with legislative mandates for management of National Wildlife Refuges.

Rationale

Unified management objectives would serve to guide overall development and management of the Mississippi River. Public funds would be better spent and needed opportunities and/or protection would be provided. Unified management objectives would also reduce conflicts between commercial/industrial/ residential developments and recreational areas (including aesthetic and habitat protection).

Unified management objectives may require modifications to existing State and Federal authorities (for example, the Mississippi River Wild Life and Fish Refuge Act). Public Law 95-502 requires the Upper Mississippi River Basin Commission to identify river system requirement objectives as part of its master planning efforts.

The development of a coordinated comprehensive plan for fish and wildlife resource management (principally the refuge area) will include preliminary data already developed in the GREAT I study. In addition, several specific items that should be funded for further study as an aid to overall management are listed below.

POLICY/FUNDING ITEM 15

Recommendation

Organisms not native to the Upper Mississippi River corridor should be cooperatively analyzed to determine compatibility with the integrity of the native communities before they are introduced.

Rationale

An agreement between agencies should be established through the Upper Mississippi River Conservation Committee for providing direction for new species introductions. Suitability for continued use of already established exotic species should be determined, and a restrictive list should be created for those found not desirable.

The river should be managed from an ecosystem approach to protect the resource. Because exotic species introductions have jeopardized the ecological balance in the past, any proposed future introductions or control measures for already present exotic species should have consensus support from all concerned agencies before implementation. Special interests with limited concerns within limited geographical boundaries cannot be allowed to interfere with the overall management objectives of the river system. Any proposal should have supporting documentation that thoroughly addresses any potential impacts so that interested parties can evaluate the proposal for all environmental and economic concerns.

FURTHER STUDY ITEM 19

Recommendation

The feasibility of protecting critical backwater areas from sedimentation should be studied.

Rationale

Examination of the Meyer data (Meyer et al., 1977; vegetative inventory) in areas where dikes and levees exist indicates that the diking of backwater areas is a workable means of preserving critical fish and wildlife areas. The extent of fine sedimentation in backwater areas immediately behind dikes was considerably less than the sedimentation in areas not protected by dikes.

FURTHER STUDY ITEM 20

Recommendation

A program to evaluate dredging and island creation in backwater areas for restoration purposes should be developed.

Rationale

Because sedimentation threatens the life expectancy of backwater areas, dredging operations may be necessary for prolonging and/or restoring their biological productivity. This practice has been very successful in many areas of the United States.

Islands associated with deep water, low-flow, and away-from-main channel conditions should be constructed with backwater sediments, not channel maintenance materials. This will extend the life expectancy of critical backwater areas.

This method of backwater restoration has a dual benefit to the environment. The islands created from these fine sediments have unlimited revegetation potential which could produce a highly acceptable waterfowl habitat. The holes left from dredging would enhance fishery habitat in the backwaters.

The investigation of dredging and island creation in backwaters might be accomplished in conjunction with the Phase II and III projects in the Weaver Bottoms (see Attachment "O" to the Fish and Wildlife Work Group Report, p. 47). The Interagency Coordinating Committee should determine if it can be accomplished through the Weaver Bottoms projects or will require a separate investigation.

GREAT I has done preliminary work and/or recommends site-specific efforts to address the problem of backwater/side channel rehabilitation at the following locations.

FURTHER STUDY ITEM 21

Recommendation

The Weaver Bottoms rehabilitation proposal (Nielson et al., 1978) should be implemented when it can be documented that the impacts, including those on flood stages, water quality, biological productivity, and sedimentation, are acceptable to the affected States and Federal agencies. (See the Special Features Section of the Channel Maintenance Appendix.

Rationale

One effect of the 9-foot channel project has been to change the habitat quality of large marshes and backwaters (Carlander, 1954; Green, 1960; U.S. Army Corps of Engineers, 1978). Initially, the habitat value of many of these areas improved as the project created more water surface and more stable water conditions. However, presently the effects of the navigation project appear to be negatively affecting the resource values of the areas. Areas once having rich vegetation beds and productive benthic characteristics have lost both. Combinations of sedimentation, turbidity, current, and wave action have greatly reduced habitat values in these backwaters.

A primary charge of GREAT was to determine means for rehabilitating these major backwater areas of the Mississippi River to their previous high value fish and wildlife habitat. GREAT began a pilot program for rehabilitation in the Weaver Bottoms of pool 5. A comprehensive study was conducted (Fremling et al., 1976, and Nielsen et al., 1978) to establish base-line data for the area

and determine what physical modifications should be made to foster habitat improvement in the bottoms.

The study report provided recommendations for rehabilitative changes which have been adopted by GREAT in this recommendation. Implementing these changes will be the second step in the pilot program. The changes consist of closing or partially closing side channels leading to the backwater and possibly building several islands in the open water area.

The pilot program could then be concluded by monitoring the effects of the physical changes and determining if the changes actually did improve habitat values. If the pilot program is successful, the Fish and Wildlife Service and the State natural resource agencies can determine if the rehabilitation measures used on the Weaver Bottoms should be attempted in other major backwaters.

Aside from the value of this proposal as a pilot for developing improved management techniques, the proposal should be implemented for the good it will do in the Weaver Bottoms. During the recent past this area has been the most heavily used waterfowl hunting and fishing area on this portion of the Upper Mississippi River. It is also a heavily used trapping area and a bird-watchers' haven. Eagles, osprey, herons, egrets, and cormorants frequent the Weaver Bottoms. The Bottoms also hosts the largest concentration of whistling swans in the United States during spring and fall migrations (Fremling et al., 1976).

The Weaver Bottoms has a tremendous potential. During the 1940's and 50's, this potential was realized. In the most recent decades, however, the habitat values have substantially declined (Fremling et al., 1976). The extraordinary value of this area demands that any rehabilitative measures which may be available should be implemented.

FURTHER STUDY ITEM 22

Recommendation

The potential of using the Finger Lakes at the dike of lock and dam 4 as a "physical model" for backwater management techniques which have been and may be proposed for the future should be investigated.

Rationale

Although the Fish and Wildlife Work Group has investigated the potential use of numerous backwater management techniques during the term of GREAT, some techniques were not tested. Some that were tested are still subject to some question. The ability to test some of these techniques in a well controlled situation would be very beneficial in responding to concerns of citizens and agencies.

GREAT has requested that the Corps of Engineers install a system of culverts into the series of lakes (Attachment "L", Fish and Wildlife Work Group Final Report), which would result in control of water flow into all five of the lakes. When these culverts are in place, the Finger Lakes will become an ideal real world model which could test numerous rehabilitation techniques being considered for backwaters. Water flows could be altered, channels could be altered, structures could be placed, and other techniques could be tried in a small scale system, where control systems could be established immediately next to the test system.

FURTHER STUDY ITEM 23

Recommendation

The best means for reducing fine sediment flow into Big Slough (river mile 670.5, Iowa) while keeping the slough open to fishing boats should be determined and implemented.

Rationale

The primary inlet to Lansing Big Lake (pool 9) is Big Slough (river mile 670.5). Big Slough is immediately below a major source of fine sediments, the Upper Iowa River, and on the outside of a bend of the Mississippi River. The result is that the slough is carrying large quantities of both fine and coarse sediments into Lansing Big Lake (Eckblad et al., 1977; personal communication with Doug Mullen). The situation closely resembles that of Murphy's Cut at the upper end of the Weaver Bottoms in pool 5 where GREAT has recommended remedial work as a pilot project (Nielsen et al., 1978).

FURTHER STUDY ITEM 24

Recommendation

The impact of altering the cuts between the islands separating Lake Onalaska from the main channel of the Mississippi River should be investigated. Structural measures should be built if the results of the investigation determine that the alterations would benefit Lake Onalaska.

Rationale

The loss of depth and diversity within Lake Onalaska is indisputable (Claflin and Weinzierl, 1978). The primary cause is the transport of fine sediments into the lake from the main channel, especially during floods. The vast majority of these sediments enter the lake through three side channels from the main river channel (Claflin and Weinzierl, 1978). Therefore, it is essential for the maintenance of the excellent fish and wildlife habitat in Lake Onalaska that the possible effects of altering these three side channels be investigated and the alteration be accomplished if it appears promising. The suggested measures must be considered only if they are consistent with the master plan for the Upper Mississippi River Wild Life and Fish Refuge.

FURTHER STUDY ITEM 25

Recommendation

Congress should provide funds to the Corps of Engineers to study the feasibility of rehabilitating the Spring Lake area of pool 2. (See the Special Features Section of the Channel Maintenance Appendix.)

Rationale

Spring Lake, between river miles 820.5 and 823.5, is a shallow backwater lake in pool 2. Preliminary studies commissioned by the Metropolitan Council indicate that, if properly rehabilitated, Spring Lake could be an important regional, water-based recreation area (Einsweiler, 1973). Spring Lake has very poor water quality because of its location approximately 10 miles downstream from the Pig's Eye Wastewater Treatment Plant. Numerous stump fields in the lake make small-boat navigation hazardous.

Rehabilitation measures would have to include construction of some type of structure along the west and north (main channel) sides of the lake to eliminate the normal flow of river water through the lake. It is possible that material from main channel maintenance dredging could be used.

The feasibility study should address the following items:

a. Whether the rehabilitated area should be managed primarily for fish and wildlife habitat or water-based recreation.

b. The effects of the dike construction on water quality.

c. The effects of the dike on flood stages and various alternatives designed to minimize flood stages.

d. The extent to which State regulations will allow for major in-floodplain construction.

e. Alternative dike construction methods.

f. Coordination with Dakota County regional park development.

In conducting the feasibility study, the Weaver Bottoms rehabilitation study should be consulted (Fremling et al., 1976, and Nielson et al., 1978).

FURTHER STUDY ITEM 26

Recommendation

The monitoring program at Kruger Slough and Island 42 should be continued to document effects of opening side channels.

Rationale

Obtaining quantitative and qualitative data on the effects of side channel openings is crucial to justify such work on the river. Side channel openings may be a very valuable tool for backwater management. Presently, GREAT has very limited documentation of the effects of side channel openings. However, GREAT has opened two side channels in pool 5 and has obtained extensive preopening data at the sites (Fremling et al., 1979). Therefore, it is crucial to future backwater management programs that follow-up monitoring be conducted at these openings.

Other areas of investigation which are necessary to provide data leading to comprehensive plan development include:

FURTHER STUDY ITEM 27

Recommendation

The distribution of submerged aquatic vegetation, invertebrates (including clams), bottom types and depths, and submerged physical features of the river should be mapped.

Rationale

This information is essential to properly manage the Upper Mississippi River. Riverine data are crucial in the development of a comprehensive management plan for the river's natural resources. Although some inventory work was accomplished by the Fish and Wildlife Work Group during the GREAT program, much of the work did not deal with submerged habitat; that which did was for limited areas. Work done by GREAT II should be considered in developing a program for mapping submerged habitat.

FURTHER STUDY ITEM 28

Recommendation

The means of controlling the pool water levels for the benefit of fish and wildlife and recreation in harmony with the 9-foot channel project should be investigated. If such control is found feasible, the Corps of Engineers, Fish and Wildlife Service, and the States should pursue an agreement to implement this practice. In the interim, fish and wildlife should be considered in pool fluctuations presently being done for other purposes on the river.

Rationale

For many years, the fluctuation of water levels in the river has been a matter of substantial concern to agencies

responsible for fish and wildlife management. Some fluctuations have resulted from the abundance or dearth of precipitation; however, some are caused by artificial manipulation at the dams along the river. It is these artificially caused fluctuations occurring at inopportune times which are of most concern. These fluctuations result in stress, loss of habitat, and sometimes death to fish and wildlife (Vanderford, 1977).

Regulations and agreements to control pool level fluctuations have been developed to protect fish and wildlife (16 U.S. Code 665A; Carlander, 1954). However, on many occasions, the Corps of Engineers changes a pool stage when it is important to have relatively stable pool levels for spawning fish, nesting birds, or den-building furbearers. These critical times are primarily in the early spring and late fall.

An agreement to control these pool level fluctuations is needed to reduce the amount of stress experienced by fish and wildlife. The importance of this agreement will grow through the next several decades as the amount of spawning, nesting, and lodge building habitat is reduced by siltation. Such an agreement would reduce the adverse impacts of the 9-foot channel project on the fish and wildlife resources and make it possible to enhance the habitat.

As part of the investigation to determine means of reducing pool level fluctuations, the benefits and detriments of changing pool control points should be investigated. Changing the pool control points from their present location near the center of the pool to some other location has been proposed by several interests. GREAT I did not give this issue a high priority, so it was not included in the study. However, GREAT I does feel that this concept should be investigated as a river management (multipurpose) tool.

FURTHER STUDY ITEM 29

Recommendation

Primitive or natural areas should be identified and follow-up designations made where appropriate.

Rationale

Many individuals and agencies have shown an interest in managing areas for a wilderness experience. There is inconsistency, however, between State and Federal designations. Areas may be more appropriately designated under one agency's definition than another. It is generally believed that a "wilderness" designation would restrict needed management actions. However, a designation could protect particular areas from intrusions such as power lines, roads, and dredged material placement. Some areas may be appropriately maintained as "bench marks" of succession. Encroachment problems should be handled within existing authorities. Future management options and mandates must be carefully considered before any designation.

FURTHER STUDY ITEM 30

Recommendation

Forest management should be considered in the Upper Mississippi River Basin Commission River System Master Plan.

Rationale

Properly managed forest land enhances the productivity of the forest. There is a significant demand for forest products and values along the river. Projections indicate an increase in

demands for forest products and values. Proper management of the forest lands is needed to meet these demands.

FURTHER STUDY ITEM 31

Recommendation

A study should be conducted to determine the most effective techniques for management of bottomland hardwoods for wildlife.

Rationale

The major emphasis on wildlife management on the Mississippi River has centered on aquatic ecosystems. A major portion of the river's corridor is in bottomland and hardwood timber. Information is needed on the extent of use of the habitat type by all species of wildlife and optimum management measures which can be applied to enhance this use. The southeastern section of the country is a good example of a region which has developed methods for effectively managing bottomland woodlands for maximum benefit for wildlife. If similar methods are developed on the Upper Mississippi River, the river's bottomland forests could be manipulated to provide much more habitat for wildlife.

FURTHER STUDY ITEM 32

Recommendation

The life history of the fishes of the Upper Mississippi River should be studied.

Rationale

The life histories of river fishes are significantly different than those of lake resident fishes. The knowledge of life behavior of these river fishes is essential to develop an effective protection and management program for fish on the river.

FURTHER STUDY ITEM 33

Recommendation

The Corps of Engineers, Wisconsin Department of Natural Resources, U.S. Fish and Wildlife Service, and Vernon County should develop an agreement for placing culverts and opening side channels to Blackhawk County Park near Victory in pool 9.

Rationale

When Blackhawk County Park was built, numerous side channels and sloughs were cut off by the construction of roads and placing of fill material.

AESTHETICS

OVERVIEW

The aesthetic quality of the Upper Mississippi River as a resource value in its own right has historically been given little significance in agency resource management and planning efforts. This area has been addressed to some extent on a project by project basis through use of landscape architectural skills for site-specific developments and through the environmental impact statement process implemented as a result of the National Environmental Policy Act of 1969. Given the assumption that the natural beauty of the river corridor is a valid resource objective, resolution of this problem must address the following issues:

a. Continued consideration of aesthetics in all project actions by Federal, State, and local units of government.

b. Consideration of aesthetics in all comprehensive planning efforts for the corridor.

c. Designation and land acquisition or scenic easement acquisition of areas identified as critical contributions to the natural beauty of the area.

Item a. is currently being carried out by the various units of government (although consistency varies). Items b. and c. are addressed through the following recommendations.

AESTHETIC MANAGEMENT

POLICY/FUNDING ITEM 16

Recommendation

Scenic easements/acquisitions should receive a higher priority in conjunction with the implementation of the Great River Road and other applicable State and Federal programs.

Rationale

Great River Road legislation authorizes the acquisition of areas to protect their scenic quality in conjunction with the Mississippi River Parkway (Great River Road). This protection would serve not only the traveling tourist but the general public, recreationists, and the river resource.

FURTHER STUDY ITEM 34

Recommendation

Aesthetics of the area should be protected as part of any management plan for the Mississippi River.

Rationale

Many of the natural and aesthetic areas within the river corridor are being lost to development and visual impacts. The natural beauty of the river is one of the region's major attractions. These areas should be identified using the aesthetic management planning process proposed in the Recreation Work Group Appendix.

COMMERCIAL NAVIGATION

OVERVIEW

The use of the Upper Mississippi River as a channel for commercial navigation is an essential link in the intermodal transportation system. The economy of the Upper Midwest heavily depends on this system to bring needed commodities such as coal, fertilizer, and petroleum products and deliver agricultural output to domestic and foreign markets. The tonnage of commodities transported on the river has increased and will continue to increase as our need for receipt and delivery of products increases. The extent to which this transportation mode can meet this expanding need depends on the following factors (among others):

a. Continued operation and maintenance of the 9-foot navigation project to allow safe passage of vessels.

b. Maintenance of favorable economic conditions allowing commercial navigation to operate profitably and competitively with other modes.

c. Determination of future changes in the level of this use of the river and any corresponding development needs.

d. Minimization of regulatory and physical constraints to operation and growth of the industry in the free market, giving consideration to other river resource values. (These include government permitting procedures, lockage procedures, navigation and maintenance, and physical obstructions such as bridges, etc.)

e. An identification of conflicts that exist or may exist in the future between this use and other resource values.

GREAT recognizes commercial navigation as a needed use of the river and supports its continuation. Item a. is addressed by GREAT in its channel maintenance plan. Items b. and c. were not addressed by GREAT because they are beyond the scope of the study. Items d. and e. were partially addressed through the following recommendations.

RECOMMENDATIONS

To minimize constraints caused by obstructive bridges and poorly operating movable bridges, the following policy changes are necessary.

POLICY/FUNDING ITEM 17

Recommendation

So that operating regulations for fixed and opening bridges can be vigorously enforced by the U.S. Coast Guard, the Act of August 18, 1864, Act of March 3, 1899, Bridge Act of 1906, and the General Bridge Act of 1946 should be amended to provide for civil penalties in certain circumstances and for other purposes as recommended by the U.S. Coast Guard.

Rationale

Fixed and movable bridges restrict navigation. In accepting a bridge permit, the bridge owner agrees to comply with regulations governing the construction and operation of the bridge to minimize the obstruction to navigation. The work group also felt that existing regulations governing the operation of drawbridges provide for the reasonable needs of navigation, but they must be vigorously enforced. Those regulations, enforced by the U.S. Coast Guard, provide only for criminal penalties when the bridge owner or operator is in violation. The imposition of criminal penalties for minor offenses, and even some of the more serious ones, is not pursued because of the low priority assigned to this area by the U.S. Attorney's office. As a result, the Coast Guard is effectively powerless to enforce bridge regulations. It is therefore recommended that present laws be amended to provide for administrative penalties for the less serious violations. This action is intended to include bridge lighting, fendering systems, sound signals, etc., as well as the actual operation of the draw span.

POLICY/FUNDING ITEM 18

Recommendation

Obstructive bridges should be rebuilt to provide adequate horizontal and vertical clearances. The Truman-Hobbs Act should:

a. Continue to be used in rebuilding bridges on the basis of navigation needs.

b. Be amended to include replacement or repair of bridge protection systems.

c. Be amended to include benefits to land as well as marine interests. Because public money is being spent, the total public benefit should be considered in benefit-cost ratios.

Rationale

Bridges constructed over navigable waters often become an unreasonable obstruction to navigation because of changes in highway, water, or rail traffic patterns, vessel sizes, water levels, etc. The U.S. Coast Guard performs an evaluation under the Truman-Hobbs Act to determine if replacement is warranted. Replacement under this act provides for cost sharing between the bridge owner and the Federal Government. Marine benefits should remain as the primary criteria for Truman-Hobbs action, but it is important to include total public benefits in the benefit-cost analysis because public money is being spent. The act has not included bridge pier protection systems that are important for bridge and vessel safety.

To minimize constraints caused by other factors, GREAT has identified additional needed studies.

FURTHER STUDY ITEM 35

Recommendation

Congress should direct the Department of Transportation or the Corps of Engineers to review Federal, State, and local regulations pertaining to commercial navigation, terminals, and support facilities with a view toward defining more clearly the areas of jurisdiction and proposing the elimination of conflict areas as appropriate.

Rationale

The myriad of Federal, State, and local government agency involvement and/or regulations affecting water transportation, terminals, and support facilities has resulted in duplication, contradiction, confusion, and unnecessary delays. This is particularly evident in the obtaining of fleeting area, terminal, and dredging permits.

Regulatory constraints on the development of new or expanded commercial shore, terminal, and support facilities have adversely affected the economy.

FURTHER STUDY ITEM 36

Recommendation

A study to identify acceptable fleeting areas to meet present regional shortages and future regional needs should be conducted.

Rationale

Fleeting areas are insufficient to satisfy present industry needs and meet future growth (Commercial Transportation Work Group Appendix). The permitting process for fleeting can be costly and time consuming for industry and does not adequately look at alternatives. This study would identify potential fleeting areas near existing or planned terminals to assist industry, concerned State and Federal agencies, and the permitting agency to evaluate fleeting permit applications. The study should be composed of three parts:

a. Part I - A physical inventory of potential fleeting areas that can be used with no modification and those with moderate modification. Maps indicating the distance from the nearest terminal, water depths, and anticipated capacity of the site should be produced.

b. Part II - An environmental assessment of each potential fleeting area and a relative rating of the sites in each geographic area.

c. Part III - An economic evaluation of energy and other economic costs for incremental distances from the terminal facility.

FURTHER STUDY ITEM 37

Recommendation

The Coast Guard should study the feasibility of establishing a marked channel for commercial transportation vessels in Lake Pepin.

Rationale

There is conflict between recreational sailboats and barges on weekends during summer months.

FURTHER STUDY ITEM 38

Recommendation

The Corps of Engineers should conduct feasibility studies and make recommendations to Congress which address projected capacity limitations at locks and dams 2 and 3 caused by demand increases for commercial and recreational craft.

Rationale

Commercial river transportation is a vital link in the total GREAT I transportation network. Waterway commerce for the Upper Mississippi River has exceeded Corps of Engineers Upper Mississippi River Comprehensive Basin Study high growth projections from Cairo to St. Paul every year since 1964 and exceeded predictions by 9 1/2 million tons in 1974 (River Transportation in Iowa, Iowa Department of Transportation, May 1978). Mid-American Ports Study, Recreation Lock Study, and GREAT I Recreation Work Group concerns should be considered.

Traffic congestions at locks and dams 2 and 3 could become a serious problem during peak use periods by recreational craft.

FURTHER STUDY ITEM 39

Recommendation

The U.S. Coast Guard should reassess its capability to operate and maintain the navigation aid system within its currently available resources and seek additional capability if necessary.

Rationale

The Second Coast Guard District has one buoy tender (Wyaconda) assigned to maintain over 500 miles of channel aids in the St. Paul and Rock Island Districts. During spring breakup, hundreds of buoys are displaced. During 1978, several groundings occurred at Dakota, Minnesota, as a result of severe demands on the Wyaconda in other critical reaches. A significant increase in navigational safety would result if the Coast Guard capability were increased. Over recent years, several permanent navigational aids have been destroyed because of inadequate pier riprap (rock) protection maintenance.

RECREATION

OVERVIEW

Man has used the river as a recreational resource since he has inhabited this area. As our population has increased and the amount of disposable income and leisure time has increased, so has the use of the river for recreational activities. This use, at times, competes and conflicts with other uses. As the number of boaters, campers, hunters, fishermen, and other recreationists continues to grow, there will be an increasing need to provide for yet manage this use. Recreational use of the river to date has been provided for in a largely uncoordinated fashion by local, State, and Federal agencies. Likewise, management of this use has been piecemeal and inadequate. Provision of recreational facilities to meet growing demands, on one hand, serves the recreational interests; on the other hand, overdevelopment and overuse will reduce the quality of some recreational experiences and affect other uses of the resource. Resolution of these problems must address the following issues.

a. A determination of existing and future demands (for all types of water related recreational use) and how well these demands are being met and how well they can be met in the future.

b. An identification of conflicts that exist or may exist in the future between recreational uses and other resource values on the river and a determination of how these conflicts can be resolved.

c. There is a need to provide for increased awareness by recreationists of the special hazards and conflicts that exist relative to use of a multipurpose river system. In particular, recreationists need to have a good understanding of the operational methods

of commercial vessels, the lock and dam system, and aids to navigation system; and they need to be aware of such hazards as submerged wing dams and closing dams. Further, recreationists need to develop an increased awareness of the unique river refuge system and the values that are associated with it.

The above issues indicate that the provision for and management of this use will require a comprehensive approach - an approach that, to date, has been lacking. GREAT has addressed all of the factors noted in items a. - c. above. None of them have been fully resolved.

On the basis of work done to date, resolution of these issues is addressed, in part, by the action items noted below. Long-term resolution can result only if the additional further study items noted in the following section are also implemented.

RECOMMENDATIONS

GREAT recognizes that the paramount need in recreation management is the development and implementation of a comprehensive recreation plan for the river. That is, in fact, recommended as a further study item. GREAT, however, also recognizes that there are some recreation resource activities that can be implemented in the interim to address items a. and b. above. The following actions have been reviewed by the interagency GREAT I Team and approved for immediate implementation as interim management measures.

ACTION ITEM 19

Recommendation

Primitive recreational use sites should be maintained on an interim basis until implementation of comprehensive management plans.

Rationale

Dredged material placement areas are major attractions to recreationists. Approximately 352,000 people used some 130 dredged material placement areas in GREAT I in 1978. The average visit is 3.6 days. Each user visits these areas an average of three times during the year. Placement area users contribute significantly to local economics.

When comprehensive management plans, specifically fish and wildlife and recreation master plans, are developed, site-specific review of all recreational use sites should occur. Recreational developments should be altered as necessary to conform with the management plans. It should be understood that all recreational use areas will be considered in the formulation of comprehensive management plans.

Maintenance of primitive island, shore, beach, and camp areas can be accomplished through the placement of small quantities of dredged material and/or landscape shaping. Dredged material, when used, should be free of contaminants and result from a proximate dredging requirement. Maintenance and, as necessary, redevelopment of these areas should be in accordance with (a) the recommendations of the interagency on-site inspection teams and (b) the guidelines presented in the Recreation Work Group Appendix.

Site plans should be developed for the following areas:

Pool	River Mile
2	824.1L (maintain)
2	827.8R (maintain)
2	828.1L (maintain)
3	807.5R (maintain)
3	805.5R (maintain)
3	802.3R (maintain)
3	799.4R (maintain)
4	789.6R (redevelop)
4	784.7R (redevelop)
4	762.4R (redevelop)
4	759.5L (without additional fill)
4	756.2R (redevelop)
4	753.3R (redevelop)
5	749.7L (without additional fill)
5	743.6R (maintain)
5	741.6R (maintain)
7	714.0R (redevelop)
7	712.8L (without additional fill)
7	712.0R (redevelop)
7	709.0L (without additional fill)
7	706.5R (redevelop)
7	705.0L (redevelop-consider sensitive habitat situation)
7	703.3R (redevelop)
8	702.3L (without additional fill)
8	686-689LR (without additional fill)
9	678.9R (maintain)
9	665-665.5R (maintain)
9	664.5L (maintain)
9	664.0R (maintain)
10	622.8L (redevelop)

These areas are shown on the maps at the end of chapter VII.

ACTION ITEM 20

Recommendation

"Lockage waiting areas" should be developed where suitable to reduce hazards associated with recreational lockages.

Rationale

Large numbers of recreational craft often must wait to get through locks. These craft are forced to anchor, circle about in the area, or leave and return. Lockage waiting areas could provide safe waiting areas for these craft.

Lockage waiting areas in the form of mooring dolphins, buoys, anchorages, islands, or beach areas are alternatives to be considered.

ACTION ITEM 21

Recommendation

Detailed uniform recreational facility guides in a format which includes information unique to the Mississippi River (boating hazards, special regulations, refuge management, locking procedures, etc.) should be provided.

Rationale

Several studies (GREAT Boating Safety Report, June 1978; Recreation Trails Analysis, December 1974; Recreation Facility Inventory, July 1978; and others) have pointed to the need for detailed recreational facility guides. The guides should include information on boating safety such as lockage procedures, the Uniform Marking System, hazards of regulatory structures, debris hazards, areas of congestion, and hazards of encountering barge tows. The format of the brochures should be easily understood with sketches, diagrams, and limited wording.

The Upper Mississippi River Conservation Committee has developed boating safety information in conjunction with its facility inventory guide (this information is included in the chapter on Boating Safety, Recreation Work Group Appendix). The States and agencies should draw upon this information in developing future recreational facility guides for public distribution.

ACTION

Special regulations and management information should be distributed more readily to make the general public more aware.

ACTION ITEM 22

Recommendation

Uniform and/or upgraded signing of recreation areas should be provided.

Rationale

Many recreation areas are unidentified or the signs are difficult to read. Better signing would provide directional information to the user and could provide general information about the area and the managing entities. Uniform signs would be readily identified.

ACTION ITEM 23

Recommendation

Control structures should be marked or modified where appropriate to reduce hazards to recreational navigation.

Rationale

Approximately 18 percent of the boating accidents in the GREAT I area are attributed to hitting objects - many of which are channel control structures. Modifying these structures (notching, lowering, or limited marking) would provide for safe recreational boating passage but not detract from the valuable fisheries habitat provided by these structures. Structure modifications must also consider impacts on river hydraulics.

ACTION ITEM 24

Recommendation

States should adopt and enforce uniform noise levels for recreation boats and other vehicles.

Rationale

Many areas experience high noise levels which distract from the recreational experience. Some large powerboats have unmuffled engines that create noise disturbance. Some States (including Minnesota) enforce noise standards for powerboats. The National Association of State Boating Administrators has adopted a model standard which should be examined for incorporation into Upper Mississippi River recreation boating management.

ACTION ITEM 25

Recommendation

A bikeway should be provided in conjunction with the Great River Road developments.

Rationale

Great River Road legislation provides authorization for bikeway development. Many organizations support a bikeway the entire length of the Great River Road. The heavy use of bikeways in Wisconsin, annual bicycle rides in Iowa, etc., attest to the recreation potential of such a bikeway. A Great River Road Bikeway could tie into the North-South Bikeway being proposed by the Youth Hostel Association between Kenosha and La Crosse.

ACTION ITEM 26

Recommendation

A system of canoe trails should be developed through selected backwater areas as a feature of appropriate recreation planning efforts.

Rationale

Canoeing can safely take place in selected backwater areas. The labyrinth character of many of these areas makes passage difficult, however.

Canoe trails could also be used to explain and interpret natural and cultural features of the areas.

ACTION ITEM 27

Recommendation

The Fort Snelling back channel under the Mendota Bridge should be opened to the picnic and swimming areas.

Rationale

The Fort Snelling Plan (June 1978) includes this opening, but the Minnesota Department of Natural Resources needs the Corps to support this opening in the same manner that GREAT and the Corps participated in a partial opening, in this same spot, for a boat ramp. The initial side channel opening announced by GREAT was a disappointment when boaters discovered that there was no accessible beaching area in the park after developing the launching. The opening should be designed so that it will not silt in as easily or so it can be easily maintained by a dragline cleaning a silt trap.

To minimize boater accidents on the river the following actions are recommended.

ACTION ITEM 28

Recommendation

State and Federal agencies concerned with boating safety should intensify efforts to educate recreational boaters on rules of the road and lighting requirements applicable to commercial and recreational vessels.

Rationale

GREAT I addressed both commercial and recreational vessel safety. On the basis of an analysis of accidents, reflective coatings on barges would have no practical beneficial impact for recreational boaters. Existing laws and regulations concerning vessel safety and lighting are adequate, but an intensive program of boater education is necessary to inform vessel operators of those laws and regulations.

ACTION ITEM 29

Recommendation

The U.S. Coast Guard Auxiliary, boating clubs, and others concerned with boater education should intensify their education efforts on safety, navigation, and hazards peculiar to vessel operation on the Upper Mississippi River.

Rationale

Many boating accidents occur because of the vessel operators' unfamiliarity with wing dams, locks, towboat operation, aids to navigation markers, and rules of the nautical road. There are many good education programs that need to reach more people and focus on the unique problems of river navigation.

ACTION ITEM 30

Recommendation

Rental agencies should be required to better brief their patrons on how to handle their boats, river hazards, rules of the road, courtesy, and lockage procedures.

Rationale

Boats of almost any size can be rented by persons with no previous boating experience or training. While a vessel operator may exercise due care, many hidden hazards can cause serious vessel accidents and personal injury. A basic knowledge of vessel operating procedures and hazards is required to reduce such accidents. The most effective way to reach the boat renter is to require the rental agency to provide this basic information.

ACTION

ACTION ITEM 31

Recommendation

Additional water patrol personnel should be assigned to the Mississippi River, especially in heavily used areas and high accident areas. Coordination of enforcement programs should continue.

Rationale

Existing boating laws appear to be adequate, but water patrol personnel are either nonexistent or drawn extremely thin on various segments of the river. Lack of adequate water patrol has created a safety imbalance between pools. Refer to the chap.er on boating safety in the Recreation Work Group Appendix.

To minimize the problem of litter by all recreationists the following action is recommended.

ACTION ITEM 32

Recommendation

The "packing out" of trash should be encouraged through educational pamphlets, programs, and signing.

Rationale

Litter is a problem in many areas along the river used by recreationists. Over the years, many approaches have been tried or suggested to deal with this problem. Volunteer cleanup projects sponsored by local service organizations and boating clubs have met with some success, but they are often sporadic attempts. Cleanup operations conducted by public agencies are usually effective, but are very expensive to maintain over the long term. Providing trash cans at heavily used recreation areas seems to compound the problem because of overflowing, vandalism, and animal disturbances. Also, trash can emptying is very expensive, particularly for island sites without land access.

One of the current approaches to litter control is the "if you pack it in, you can pack it out" approach. This program, implemented through public education techniques, encourages recreationists to take their litter back home with them where it can be properly disposed of. This method is the most practical for application on the river where much of the recreation activity occurs in nondesignated or noncontrolled areas. GREAT sees an educated public as the best long-term solution to litter problems on the river.

The following policy/funding changes are recommended to improve recreation management on the Upper Mississippi River.

POLICY/FUNDING ITEM 19

Recommendation

Boathouse permits should be carefully controlled and enforced to prevent extended residency, sanitary discharge, and aesthetic impacts.

Rationale

Boathouses are permitted to provide a mooring space and shelter for boats. The use of boathouses as living facilities is not in keeping with the intent of the permit. The approval of boathouse permits should be carefully considered with respect to other uses of the river resource.

POLICY/FUNDING ITEM 20

Recommendation

The Corps of Engineers should monitor lockages to ensure the proper application of existing lockage regulations and identify specific problem areas. If problems are identified, consideration should be given to providing signage, low power radio transmissions (AM, CB, and/or Marine) near the locks to dispense information, and/or lockage waiting areas. Information on designated times should be widely publicized.

Rationale

Recreational craft lockages are projected to increase dramatically especially at locks near metropolitan areas (locks 1 - 4, 7, and 10) to the year 2000. Commercial craft lockages are also projected to increase over this time.

Approximately 49 percent of recreational craft lockage users are on trips of 3 days or more. The average number of locks used per trip is 9.1.

Many recreational boaters (20 percent of those in a recent survey) have complained of long waits at locks (2 hours is not uncommon), bad service, technical problems, and conflicts with barges which adversely affect the recreational experience. This problem appears to be aggravated by the improper application of existing regulations by lock personnel or other conditions that restrict the normal flow of traffic. The Corps can address the first aspect by conducting periodic inspections to ensure that locking procedures are being correctly interpreted and followed by lock personnel. The second aspect should be addressed by the Corps in consultation with the towing industry and local recreational interests.

POLICY/FUNDING ITEM 21

Recommendation

High impact recreational development such as large powerboat accesses or marinas should be discouraged in or adjacent to areas identified as exceptionally good for hunting, trapping, and fishing or "closed refuge areas."

Rationale

Hunting, trapping, and fishing provide many recreational opportunities along the river. These experiences should be protected from further degradation and/or conflicting uses. Large powerboats often conflict with hunting and fishing use. Buffers should be provided to protect the hunting, trapping, and fishing opportunities and to protect developed recreation area users from hunters' gunfire. This protection can be achieved in part by permit review and clear management objectives.

POLICY/FUNDING ITEM 22

Recommendation

River management agencies should increase their efforts to work together cooperatively in undertaking site-specific intensive recreation surveys and continuous annual sample data collection for input into a recreation resource monitoring program. Methods developed by the GREAT I and GREAT II Recreation Work Groups should be used in these efforts.

Rationale

Accurate information on recreational use is needed to professionally manage the Mississippi River resources to reduce recreational use conflicts and related environmental impacts and enhance recreational opportunities. A computerized monitoring program should be developed to use existing ongoing data collection efforts (e.g., park attendance records, vehicle axle counts, lodging receipts, etc.) and carefully designed annual primary data collection (e.g., aerial surveys, 8-mm cameras, spot user interviews). This system, having input from all involved managing agencies, should provide the necessary data to enable resource planners and operators to respond to changing resource use conditions. The Upper Mississippi River Conservation Committee schedule for pool-by-pool recreation use surveys (10+ year cycle) must be expedited and coordinated with an overall monitoring program of the entire river system including the Corps of Engineers performance monitoring system. The performance monitoring system provides limited reliable data on recreation traffic flows through the pools. We recommend that the data base be modified to handle periodic data inputs to be provided

by recreation interviewers on an annual sampling basis. This periodic data would include such variables as user origin and destination locations, size and type of craft, and activities participated in. The ability to combine this information with year-round counts of recreation craft lockages and directions within one automated data system will allow recreation planners to better correlate these reliable "indicator" data with other types of information. This modification of the PMS data base will greatly assist in the development of the above recommended resources monitoring system.

POLICY/FUNDING ITEM 23

Recommendation

A diversity of recreational opportunities should be provided within the river corridor in developing any management plans.

Rationale

Each recreational area cannot (and should not) provide for all types of recreation. A diversity of areas and opportunities helps reduce user conflicts and makes available a diversity of experience for the user.

POLICY/FUNDING ITEM 24

Recommendation

Publicly owned recreational boat launching accesses should not be allowed to deteriorate but should be maintained at historic sites when feasible.

Rationale

Many boating accesses are becoming impassable because of sedimentation. Much of the future demand for recreational opportunities can be met by improving existing recreational areas. Where the use of existing boat launching facilities can be shown to have caused serious conflicts with the management of the Upper Mississippi River Wild Life and Fish Refuge, consideration should be given to relocating the facility.

GREAT I has carried out extensive investigations regarding potential site-specific recreation developments that would meet already identified recreation facility needs. The following recommendations need further study before implementation. They should be studied as part of the current Recreation Master Plan activities of the U.S. Army Corps of Engineers in cooperation with the U.S. Fish and Wildlife Service and the States of Iowa, Minnesota, and Wisconsin.

FURTHER STUDY ITEM 40

Recommendation

The Upper Mississippi River Basin Commission should coordinate the development of a recreation master plan for the Upper Mississippi River System for implementation by appropriate lead agencies.

Rationale

Recreation demand has been estimated through 1985. However, the demand analysis did not sufficiently consider wildlife oriented (hunting, fishing, nature study) uses or projected uses of the resources. The site-specific recommendations of the Recreation Work Group were made to satisfy documented needs for additional opportunities. Detailed environmental, economic, and engineering evaluations are required before implementation. Recreation development to meet past recreation needs has been uncoordinated. As a result of these factors, recreational user needs have not been fully satisfied or recreation uses may have had a negative effect on other resource values without proper consideration of such values. To meet future recreation demand and protect the integrity of the resource values, a recreation Master Plan is needed. This plan would be coordinated by the Upper Mississippi River Basin Commission.

Current and ongoing recreation planning efforts of existing local, State, and Federal agencies (including Corps of Engineers, Fish and Wildlife Service, and master planning efforts) will be coordinated by the Upper Mississippi River Basin Commission so that a consistent overall plan results.

FURTHER STUDY ITEM 41

Recommendation

A determination should be made based on unified resource management objectives (phase I of recreation master planning development) of the feasibility and acceptability of the recreation sites listed in Exhibit 6 to determine which should be funded for implementation to meet existing recreational demand and need. When determined appropriate, specific recreational developments should be immediately implemented.

Rationale

The site specific recommendations of the Recreation Work Group were made to satisfy documented needs for additional opportunities. Detailed environmental, economic, and engineering evaluations are required before implementation. These evaluations would be coordinated by the Upper Mississippi River Basin Commission. Current and ongoing recreation planning efforts of existing local, State, and Federal agencies (including the Corps of Engineers, Fish and Wildlife Service, and master planning efforts) will be coordinated by the Upper Mississippi River Basin Commission so that a consistent overall plan results.

FURTHER STUDY ITEM 42

Recommendation

Water surface use in pools or portions of pools where conflicts exist should be identified and zoned. No wake zones or restricted use areas should be established in constricted areas and/or where heavy recreation use occurs.

Rationale

Zoning (spacial or temporal) would reduce safety hazards and conflicts between multiple uses of the river system. Temporal zoning may be the only enforceable means of restricting use in some areas. Zoning could be expanded to protect sensitive fish and wildlife habitat. Regulations in effect on the lower St. Croix River could be used as a model for this practice.

Wakes created by large powerboats, cruisers, some houseboats, and barges create extreme safety hazards (swamping, capsizing) in some areas. Restrictions need to be enforced in these areas to reduce this hazard. Zones would apply to commercial and recreational navigation. Commercial transportation interests should be involved in zoning decisions on a site-specific basis.

FURTHER STUDY ITEM 43

Recommendation

Further studies which focus on the economic and social benefits and environmental impacts of private leases on Federal land should be conducted. Such leases should be phased out when a needed public use can be demonstrated.

Rationale

Many of these private lease areas (cottages, homes, etc.) are in areas where additional public access and/or fish and wildlife protection are needed. Termination of these leases where appropriate would make these areas available to the general public.

The land must be restored to beneficial habitat. Past policies of authorizing or tolerating develcpment of private uses, such as upland and floating cabins and docks, have removed many aspects of public ownership of affected lands, destroyed habitat, and created centers of human activity which disturb or decrease wildlife activity and use.

Floodplain Management

OVERVIEW

Man has encroached on the natural floodplain of the Upper Mississippi River through residential, commercial, and industrial development as well as through construction of levees and floodwalls. The result has been periodic damage to property and threat to human safety. In addition the continual filling of the river with sediment has reduced (to an unknown degree) the flood storage capacity of the remaining river floodplain. Flooding will continue to be a threat to human life and property in the future. Continued filling of the floodplain by natural and human actions will only increase the potential hazards associated with this phenomenon. Resolution of this problem will require:

a. Regulation of further floodplain development to minimize impacts on the flood storage capability of the system.

b. Associated with a. above, there is a need for better base-line data and an improved predictive capability to forecast or measure the impacts of proposed alterations to the floodplain by human development and channel maintenance, fish and wildlife, and recreation enhancement projects previously mentioned in this chapter.

Item a. is being addressed by existing Federal, State, and local floodplain management laws and regulations, but there are problems with uniformity of the laws and of their application. This problem is addressed below. Item b. is also partially addressed below in recommendations resulting from GREAT research.

RECOMMENDATIONS

The following implementable actions and policy changes can be initiated immediately to assess the impacts of proposed projects.

ACTION ITEM 33

Recommendation

Detailed topographic and hydrographic maps of the Upper Mississippi River bottomlands in the GREAT I area (at a scale no smaller than 1:12,000; or 1 inch equals 1,000 feet; on an orthophoto base with a contour interval of 2 feet) should be produced.

Rationale

These maps would have several purposes related to management of the Mississippi River bottomlands. The information could be used to define cross-section dimensions for floodplain management math modeling. The alternative to obtaining cross sections from maps is to conduct field surveys as needed. The maps would also be useful to recreational users of the river, especially fishermen and hunters. Fish and wildlife managers could use the maps to quantify existing habitat and plan improvements or creation of additional habitat in critical areas. This information base would also meet the needs of State agencies and local units of government in planning, management, and regulatory activities. The maps should be produced in a format facilitating their use by the general public. Costs of production should be recovered through sale to the general public. There has already been an identified demand for recently produced GREAT I base maps by the public. It is estimated that partial costs of producing the maps could be offset by selling the published maps to the general public. This approach is currently used by the Geological Survey in production of topo-

graphic quadrangle sheets. An appropriate format for the maps would be one similar to the navigation chart booklets published by the Corps of Engineers.

ACTION ITEM 34

Recommendation

Water resource projects on tributaries of the Upper Mississippi River in the GREAT I area should address:

a. Project-induced potential changes in tributary discharges during floods.

b. Project-induced potential changes in the bed load sediment transport capability of the tributary streams.

Rationale

The Floodplain Management Work Group concluded that stream channelization projects that result in increased tributary discharges could increase flood flows on the main stem by increasing the hydrograph peak of slope of the hydrograph. Increased bed load transport capability of tributaries could result in greater dredging requirements in the navigation channel which, in turn, could increase the amounts of dredged material placed in the floodplain. These potential impacts must be weighed as costs of construction in planning these projects.

POLICY/FUNDING ITEM 25

Recommendation

Uniform standards for floodplain management should be developed for States and municipalities along the GREAT I portion of the Mississippi River. Changes in enabling legislation may be necessary.

Rationale

Allowable floodplain encroachment limits are different in each of the three States. However, the effects on water stages of administration of standards on one side of the river are the same on both sides of the river. There is no existing framework for resolution of inconsistencies in standards other than through the courts. Effective floodplain management cannot be applied by the municipalities if standards for encroachment are not uniform across the floodplain.

The Floodplain Management Work Group addressed this issue and recognizes the need for consistency in application of standards on both sides of the river.

FURTHER STUDY NEEDS

Long-term resolution of floodplain management problems requires further study of potentially useful predictive capabilities and cooperative efforts on the part of the State and municipalities involved in floodplain regulations. The following further study items address these long-term needs.

FURTHER STUDY ITEM 44

Recommendation

Funds should be provided to the Upper Mississippi River Basin Commission to study the feasibility of mathematical models for floodplain management, including the Compound Stream Flow Model, and develop a model(s) based on the findings and recommendations of the study.

Rationale

The Floodplain Management Technical Task Force of the Commission has recommended that floodplain management math models be studied to determine their feasibility. Justification for the feasibility study is contained in task force reports dated June 1978 and April

1980 and the draft Main Stem Level B Study report.

Several mathematical models have been developed that would be appropriate for use on the Upper Mississippi River. The Floodplain Management Technical Task Force has prepared a list and description of the various models (Upper Mississippi River Basin Commission, June 1978). On the basis of investigations conducted by the GREAT I Floodplain Management Work Group, the Compound Stream Flow Model has been found to be suitable for this purpose and should be investigated as part of the feasibility study.

The purposes of such a model would be to evaluate the impacts of long-term dredged material placement or other encroachment on the flood-carrying capacity of the river.

A math model of the river for floodplain management would solve the following problems in the Mississippi River floodplain:

- Lack of knowledge of effects of long-term (50-year) placement of dredged material in the floodplain.
- Lack of definition of the hydraulic floodway and encroachment limits for most reaches of the river.
- Lack of knowledge of flood elevations between gaging stations.
- Time and expense involved in case-by-case review and evaluation of individual proposed development projects.
- Inability of local municipalities to provide the necessary resources to deal with floodplain management problems.
- Frequent challenges to decisions to restrict floodplain development which are made without adequate objective data. (Source: "Recommendations and Supporting Information for a Feasibility Study on Math Modeling of the Mississippi River for Floodplain Management Purposes", unpublished draft, Upper Mississippi River Basin Commission, June 1978.)

After the model is developed, it will be necessary to ensure that all floodplain projects are entered in the model to keep the data base current and evaluate the cumulative impacts of floodplain development. Consequently, public regulatory agencies will have to forward relevant data on floodplain projects to the agency responsible for the model's operation. Any runs of the model that do not include up-to-date data on floodplain development will not accurately predict river conditions during floods.

CULTURAL RESOURCES

OVERVIEW

GREAT recognizes the importance of our cultural resources as a valid resource value in its own right along with the other resource values already mentioned. The remains of past human habitation in the Upper Mississippi River area provide us with important information about the area's development and, in some cases, with the only means of determining our heritage. From a social and academic standpoint, these resources are important and should be considered as we continue to alter our landscape.

Little has been done by GREAT to address this issue because of (1) limited time and funds, (2) low priority in comparison to other more imminent issues, and (3) existing Federal regulations that require that this value be considered in projects on all Federal lands.

Nonetheless, there continues to be a lack of knowledge about this value and the extent to which important cultural resources exist in the study area.

RECOMMENDATION

To supplement existing regulations, provide us with better base-line information, and ensure that cultural resources are considered more fully in total river resource planning, GREAT makes the following recommendation.

FURTHER STUDY ITEM 45

Recommendation

A comprehensive cultural resources inventory of known sites in the GREAT I area should be done as input to future management decisions.

Rationale

Identification and assessment of historic properties on all Federal lands are required by Executive Order 11593, and review of any Federal action involving potentially significant historic properties is required by Public Law 89-665, as amended. Dredged material placement sites, both existing and future, are subject to these requirements, as are all other Federal lands. Management of important cultural properties is also required.

PUBLIC PARTICIPATION

OVERVIEW

In the last two decades, the public has become increasingly involved in the Federal and State decision-making processes through project-specific or agency-specific information, education, and participation programs. Public information programs stressing the value of the Upper Mississippi River as a significant multipurpose resource are often lacking in agency-specific or project-specific programs.

GREAT has developed and carried out a public participation program using this multipurpose perspective. The Upper Mississippi River Basin Commission is taking a similar approach in conjunction with its master plan study. Both of these programs are funded within the appropriations for these two studies. Termination of these studies will also result in termination of these public participation programs. Resolution of this matter in the long run will require a project-independent ongoing program.

RECOMMENDATION

The following action should be implemented to resolve the above issue.

ACTION ITEM 35

Recommendation

The Upper Mississippi River Basin Commission should encourage and coordinate efforts to develop information and education programs for the Upper Mississippi River. Such programs should focus on the multiple uses and values of the resource.

Rationale

The Mississippi River with its associated uses is a unique resource to the Nation. To better understand and interpret this resource, information and education programs addressing its uses and benefits must be provided. A better understanding should reduce conflicts and promote support for needed programs.

ONGOING PLANNING COORDINATION

OVERVIEW

When GREAT was established in 1974, it had potential to be a new way of doing business for the many agencies, States, and citizens with authority and interest in river management. The concept of cooperative research and plan

ACTION

formulation on an interagency and interdisciplinary basis was fostered by GREAT during the entire study. The recommendations for the previous 10 components are the product of the GREAT I Team.

Many of the recommendations contain language either in the recommendation or rationale indicating that ongoing coordination and cooperation are essential to the implementation of the recommendations. Numerous alternatives were discussed as to how this might best be accomplished. The adopted procedure is reflected in the following recommendations and further developed in Chapter VIII - Guide to Implementation.

The following recommendations are based on a recognized need for:

a. Continued interagency coordination in all long-range planning efforts of the Federal agencies and States - leading eventually to a total river resource management plan.

b. Continued interagency coordination in the implementation of the GREAT I implementable recommendations to ensure that the interests of all affected parties are taken into consideration. Foremost of these is implementation of the channel maintenance plan.

c. Continued sharing of research findings and development of management techniques that have been tested by GREAT and are recommended for further development (namely, the computerized Geographic Information System).

To meet these needs, GREAT makes the following recommendations.

ONGOING COORDINATION OF IMPLEMENTATION

Recommendations in the previous components that are labeled "action items" will be implemented by the lead agencies identified in the implementation chapter. Many of these items depend on continued coordination of agencies affected by the recommendations. In examining the mandate of the Upper Mississippi River Basin Commission it was determined that the Commission did not have the authority to implement recommendations but does have the authority to "monitor" implementation progress. Thus, if interagency coordination is to take place, there is a need to establish agreements among the agencies to work together in implementing those recommendations which call for such. (The most extensive of these is the channel maintenance plan.) To accomplish this, GREAT recommends:

ACTION ITEM 36

Recommendation

The agencies represented in GREAT I, by letter of agreement, should continue to coordinate implementation of the channel maintenance plan and all other implementable recommendations through the continuation of an ongoing interagency management coordination team. The U.S. Fish and Wildlife Service and the Corps of Engineers would be the initial cochairs. Chairmanship would then be rotated among participating agencies. Participation in this activity will be staffed and funded by individual agency contributions. Agencies will request additional appropriations within existing programs where necessary to accomplish this effort.

Rationale

Many recommendations require continued coordination during the implementation process. GREAT has proven the value of regular communications and cooperative efforts among agencies in carrying out their respective mandates. Detailed procedures for initiation and implementation of this process are discussed in Chapter VIII.

In requesting funds to implement actions recommended by GREAT I, each

agency should note the following recommendation.

ACTION ITEM 37

Recommendation

As part of the above activity/ organization the following coordination mechanisms should be used:

a. The interagency On-Site Inspection Team recommended by GREAT I should be continued to provide consultation in the site-specific implementation of the channel maintenance plan and to aid in resolution of new problems which may develop during the annual dredging seasons. Exhibit 1 shows guidelines for continuation of the on-site inspection team.

b. A channel dimensions review committee should be established, consisting of representatives of the Corps of Engineers, U.S. Coast Guard, the navigation industry, and representatives from other concerned State and Federal agencies that have expertise in hydraulics or vessel navigation requirements. The task of the committee will be to review industry needs for channel widths and advise the Corps of Engineers in establishing acceptable channel widths and thus guiding dredging operations at affected sites.

c. The existing independent Upper Mississippi River Conservation Committee is encouraged to participate in the ongoing interagency management coordination team. It is suggested they evaluate their role in this effort and participate in a manner they feel appropriate.

Finally, GREAT I recognizes that the Minnesota Wisconsin Boundary Area Commission has played a significant role in the establishment and implementation of the GREAT I study. As a staffed citizen body appointed and funded by the States of Minnesota and Wisconsin, concerned about the overall management of the border rivers (St. Croix and Upper Mississippi), it is appropriate that it continue to monitor the implementation of GREAT I recommendations.

ACTION ITEM 38

Recommendation

Monitoring of GREAT I implementation from an independent citizen perspective should be continued by the Minnesota-Wisconsin Boundary Area Commission. The States of Minnesota and Wisconsin should fund this effort as a work item of the MWBAC.

Rationale

The MWBAC serves as an important link with citizens in the GREAT I area. It has demonstrated, as well, that it can be a significant force in communicating citizen and agency needs to State and Federal legislative bodies. The MWBAC can play an important role in ensuring implementation of GREAT recommendations in the best interests of the total resource.

ONGOING COORDINATION OF PLANNING

The recommendations in the previous components do not represent a "total river resource management plan." They do represent important contributions that should be used in the development of such a plan, particularly the policy and further study items. The results of the GREAT studies and the current Upper Mississippi River Basin Commission master plan are important input into that process. To continue the long-term development of a comprehensive plan for river management, the following recommendations are made.

ACTION ITEM 39

Recommendation

The Upper Mississippi River Basin

ACTION

Commission through its Great River Study Committee should develop a total river resource management plan. As resources for this plan, the Upper Mississippi River Basin Commission should use the products of GREAT's I, II, and III and the master plan reports as well as other relevant data.

Rationale

The Commission is already a body composed of all States and Federal agencies involved in the GREAT studies. Inherent in the development of the plan is a process for continued interagency and public cooperation and coordination of river planning activities. (Additional rationale and procedural guidelines are presented in Chapter VIII.)

As part of this planning effort, certain recommendations of GREAT I should be incorporated into the planning process.

POLICY/FUNDING ITEM 26

Recommendation

As part of the ongoing monitoring of GREAT I recommendations, the guidelines adopted by the Upper Mississippi River Basin Commission are endorsed and reprinted below:

1. The final team report of each GREAT shall be submitted to the Commission through the Great River Study Committee for appropriate Commission action.

2. The Great River Study Committee will prepare a transmittal report including results of Commission action for submission to the Water Resources Council.

3. If the Commission chooses to include GREAT reports as components of the approved "regional plan," the GREAT reports must undergo all Public Law 89-80 requirements (including formal 90-day review, revision, and EIS).

4. If the Commission chooses to accept the GREAT reports and not include the entire package as a component of the "regional plan," the products will be provided to the CCJP Priorities Committee for selective inclusion of the recommendations of GREAT into the approved regional plan. In this case only those components of GREAT that will be included in the regional plan must undergo all Public Law 89-80 requirements (including formal 90-day review, revision, and EIS).

5. The GREAT reports shall be submitted forward through appropriate channels to Washington and the State governments by the Commission, U.S. Army Corps of Engineers, participating Federal agencies, and States. EIS's may be required for specific actions. These EIS's will be prepared and filed by the appropriate implementing agencies.

6. The Commission, through the CCJP Priorities Committee, shall monitor progress of the States and Federal agencies in implementing the recommendations of the final GREAT report through its preparation of the annual priorities report.

The Upper Mississippi River Basin Commission adopted the above guidelines to direct the activities of the Great River Study Committee and the Commission in the coordination of implementation of the reports of GREATS I, II, and III.

The GIS has been tested by GREAT I as a pilot project in lower pools 4 and 5. The project proved that the system may be useful for ongoing interagency planning if it can be refined.

FURTHER STUDY ITEM 46

Recommendation

The Upper Mississippi River Basin

Commission should examine the feasibility of using the Geographic Information System (GIS) as a land and water use management tool.

Rationale

Multiobjective management of a resource as vast and with as many demands on it as the Upper Mississippi River requires readily available data to judge the implications of a given action. The GIS can provide this capability. However, a number of inadequacies and concerns in using the system for multiple objectives have been identified. Further investigations should include and consider the following:

a. Suitability model refinement (i.e., dredged material placement, commercial navigation facilities).

b. Incorporating subsurface water data (i.e., depth, substrate, flow, submergent aquatics). (GREAT II has conducted investigations in this area. This work should be considered.)

c. Integrating other automated river management models (i.e., one-dimensional sediment model).

d. Assuring cooperative use of the system by all affected entities.

e. Providing access for all concerned management agencies.

f. Ensuring a program of regular updating of the system's data.

g. Providing full-time professional personnel for system management.

h. Providing user training programs.

A major data deficiency needed for complete development of the GIS as well as other planning efforts is a determination of land ownership and management responsibilities.

FURTHER STUDY ITEM 47

Recommendation

Land ownership and management responsibilities within the river corridor should be documented.

Rationale

Details of ownership and management responsibility are lacking in many areas. Lack of this information makes management difficult. The entire corridor should be reviewed for completeness of information (especially between the Fish and Wildlife Service and the Corps of Engineers.

FURTHER STUDY

Quick reference summary of channel maintenance plan

Pool	Cut No	River mile	Recommended width (feet)	Number of times dredged (1986-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1986-2025)	Site No.	Approximate distance from cut (feet)	Ownership	Cover (percent)(1) Up-land	Wet-land	Open water	Area (Acres)	Area (Ft)	Flood-plain location	Conditions on use of site	Habitat alteration Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1986-2025)	Cultural resources	Endangered (and threatened) species	Water quality
Dredge cuts																	**Description**				**Disposal sites**	**Impacts**	
Minn	1	0.0 - 0.5	300	12	9,800	117,900	2.18	6,500	Private	100	-	-	1	10	Out	Mech. rehandles with landmovers equipment	0	0	None	All (Shiely)	Unknown	None	None
(Mouth of Minn. River)																							
Minn	2	4.0 - 4.7	300	4	20,000	80,000	MN08	3,000	MDNR	100	-	-	18	35	Floodway	-	0	0	Enhance	None identified	Unknown	None	Possible runoff
(4-mile cut)																							
Minn	3	11.2 - 12.8	300	10	38,800	387,900	MN30	10,000	Private	50	-	50	65	15	Out	-	-	-	None	None identified	Unknown	None	None
(Petersen Bar)																							
							MN06	8,000	Private	100	-	-	24	35	Floodplain	-	-	-	None	None	Unknown	None	None
Minn	4	13.8 - 13.5	300	12	8,800	33,900	MN03	4,000	Private	0	100	-	7	15	Floodplain	Ind. Dev. may occur	7	-	None	None identified	Unknown	None	None
(Cargill)																							
Minn	5	14.3 - 14.7	300	16	6,300	101,900	MN03	7,000	Private	0	100	-	7	15	Floodplain	Ind. Dev. may occur	7	-	None	None identified	Unknown	None	None
(Savage Bridge)																							
St. Croix	1	5.8 - 6.2	300	16	28,800	461,000	SC12	1,000	MDNR	100	-	0	17	5	Floodway	No connection to private island	-	0	Enhance	None	Lost	None	None expected
(Kinnickinnic Bar)																							
							SC13	1,000	MDNR	100	-	0	9	5	Floodway	No connection	-	0	Enhance	None	Lost	None	None expected
							SC16	33,000	Minn	-	-	100	3.5	15	Floodway	Erosion control necessary	-	-	Enhance	None	None	None	None expected
							SC06	38,000	Wash Co.	50	-	50	5	10	Floodway	None	0	0	Enhance	None	Unknown	None	None
							3.34	36,000	Public	60	40	0	10	85	Out	Stockpile fill	0	4	None	240,000	Unknown	None	None
St. Croix	2	11.5 - 12.2	300	2	21,[illegible]	44,000	SC21	7,000	Public	100	0	0	5	10	Floodway	-	0	0	Enhance	None identified	Unknown	None	None expected
(Catfish Bar)																							
							SC27	20,000	MDNR		100		2	20	Floodway	-	2	0	Enhance	None identified	Unknown	None	None expected
St. Croix	3	16.2 - 17.8	300	6	127,300	764,000	SC01	4,000	Wis.	90	0	10	7	*Minimal	Floodway	Rec. Enhancement only	0	0	Enhance	None	Lost	None	None expected
(Hudson)							SC22	4,000	Hudson	100	0	0	3	15	Floodplain	Ind. dev. may occur	-	-	None	None identified	Unknown	None	None expected
							SC18	6,000		33	0	67	6	5	Floodway	None	0	0	Enhance	None identified	Unknown	None	None expected
							SC03	4,000	Wis.	100	0	0	*Minimal		Floodway	Rec. Enhancement only	0	0	Enhance	None identified	Unknown	None	None expected
							SC04	4,000	Wis.	100	0	0	*Minimal		Floodway	Rec. Enhancement only	0	0	Enhance	None identified	Unknown	None	None expected
							SC05	4,000	Wis.	100	0	0	*Minimal		Floodway	Rec. Enhancement only	0	0	Enhance	None identified	Unknown	None	None expected
							SC06	4,000	Wis.	100	0	0	*Minimal		Floodway	Rec. Enhancement only	0	0	Enhance	None identified	Unknown	None	None expected
							SC08	4,000	Wis.	100	0	0	*Minimal		Floodway	Rec. Enhancement only	0	0	Enhance	None identified	Unknown	None	None expected
							SC09	20,000	Private	40	60	0	16	20	Floodway	Ind. Dev. may occur	16	0	None	None identified	Unknown	None	None expected

* Only enough material allowed on site to prevent [illegible]

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Recommended width (feet)	Number of times dredged (1988-2037)	Average volume per dredging (cubic yards)	Total volume dredged (1988-2037)	Site No.	Approximate distance from cut (feet)	Ownership	Cover (percent)(1) Upland	Wetland	Open water	Area (Acres)	@ (Ft)	Flood-plain location	Conditions on use of site	Habitat alteration Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1988-2037)	Cultural resources	Endangered (and threatened) species	Water quality
Dredge cuts										**Description**							**Disposal sites**				**Impacts**		
USAF	1	854.0 - 855.6		26	13,600	352,500	U02	15,000	Mpls.	100	0	0	3	20	Out	Removal before seasonal high water	0	0	None	All-city of Mpls.	None	None	None expected
		(Broadway - Plymouth Ave)																					
							U03	5,000	Private	100	0	0	7	20	Out	Stockpile fill	0	0	None	All-land owners	Lost	None	None expected
USAF	2	855.7 - 856.7		22	32,100	706,500	U02	4,000	Mpls.	100	0	0	3	20	Out	Removal before seasonal high water	0	0	None	All-city of Mpls	None	None	None expected
		(Lowry Ave)																					
							U03	10,000	Private	100	0	0	7	20	Out	Stockpile fill	0	0	None	All-land owners	Lost	None	None expected
USAF	3	856.8 - 857.7		14	31,800	446,000	U02	1,000	Mpls.	100	0	0	3	20	Out	Removal before seasonal high water	0	0	None	All-city of Mpls.	None	None	None expected
		(Soo Line R. R. Bridge)																					
							U03	12,000	Private	100	0	0	7	20	Out	Stockpile fill	0	0	None	All-land owners	Lost	None	None expected
1	1	847.7 - 848.4		12	24,000	287,500	1.01	25,000	Mpls.	100	0	0	3.5	25	Out	Must be removed annually	0	0	None	All-city of Mpls.	None	None	None expected
		(U.s. L/D 1)																					
1	2	848.5 - 848.9		8	8,300	65,500	1.01	20,000	Mpls.	100	0	0	3.5	25	Out	Must be removed annually	0	0	None	All-city of Mpls.	None	None	None expected
		(St. Paul Daymark)																					
1	3	848.9 - 849.9		22	17,800	391,500	1.01	15,000	Mpls.	100	0	0	3.5	25	Out	Must be removed annually	0	0	None	All-city of Mpls.	None	None	None expected
		(Below Lake Street)																					
1	4	849.9 - 850.5		20	28,400	569,000	1.01	12,000	Mpls.	100	0	0	3.5	25	Out	Must be removed annually	0	0	None	All-city of Mpls.	None	None	None expected
		(Above Lake Street)																					
1	5	850.7 - 851.4		18	27,200	489,000	1.01	9,000	Mpls.	100	0	0	3.5	25	Out	Must be removed annually	0	0	None	All-city of Mpls.	None	None	None expected
		(Below Franklin Ave)																					
1	6	851.7 - 852.4		22	26,800	589,000	1.01	4,000	Mpls.	100	0	0	3.5	25	Out	Must be removed annually	0	0	None	All-city of Mpls.	None	None	None expected
		(Above Franklin Ave)																					
1	7	852.6 - 853.4		36	17,800	642,500	1.01	2,000	Mpls.	100	0	0	3.5	25	Out	Must be removed annually	0	0	None	All-city of Mpls.	None	None	None expected
		(Below St. Anthony)																					
2	1	815.5 - 815.9		4	10,400	41,500	2.30	4,000	Federal	0	100	0	3.5	10	Floodway	Removal to maintain capacity	3.5	0	Enhance with shaping, etc.	2,420,000	Unknown	None	Difficult to achieve 7-day retension time
		(Upper Approach L/D 2)																					
2	2	819.0 - 819.8		4	60,100	240,500	2.35	7,000	Private	100	0	0	25	25	Out	-	0	0	Enhance	240,000	Unknown	None	None if retention time is maintained
		(Boulanger Bend Lower Light)																					
2	3	820.8 - 821.4		4	111,900	455,500	2.35	4,000	Private	100	0	0	25	25	Out	-	0	0	Enhance	240,000	Unknown	None	None if retention time is maintained
		(Boulanger Bend)																					

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Recommended width (feet)	Number of times dredged (1986-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1986-2025)	Site No.	Approximate distance from cut (feet)	Ownership	Cover (percent)(1) Upland	Wetland	Open water	Area (Acres)	@ (ft)	Floodplain location	Conditions on use of site	Habitat alteration Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1986-2025)	Cultural resources	Endangered (and threatened) species	Water quality
Dredge cuts							**Disposal sites**										**Impacts**						
2	4	822.7 - 823.7	10	38,000	379,500	2.10	47,000	So. St. Paul	100	0	0	25	25	Out	Unloading device necessary	0	0	None	1,900,000	Uknown	None	Loss of settling basin for industrial site runoff
	(Pine Bend)																						
2	5	827.5 - 828.3	8	35,200	282,000	2.10	25,000	So. St. Paul	100	0	0	25	25	Out	Unloading device necessary	0	0	None	1,900,000	Unknown	None	Loss of settling basin for industrial site runoff
	(Grey Cloud)																						
2	6	831.0 - 832.4	8	11,700	93,500	2.10	5,000	So. St. Paul	100	0	0	25	25	Out	Unloading device necessary	0	0	None	1,900,000	Unknown	None	Loss of settling basin for industrial site runoff
	(Pine)																						
2	7	836.6 - 837.8	24	84,400	2,028,000	2.14a(1)	6,000	MAC*	0	100	0	110	10	Floodplain	Use only as part of construction of runway extension	0	110	None	All material on site	Unknown	None	Loss of filtering effect of wetland on overland runoff
	(St. Paul Barge Terminal)																						
							2.15	6,000	St. Paul Port Auth.	100	0	0	5.5	10	Out	Owner may limit use to one dredging	0	0	None	1,900,000	Unknown	None	None if retention time is maintained
							2.13	8,000	MAC	0	100	0	18	10	Floodplain	Stabilize material on site	18	0	None	1,900,000	Unknown	None	Loss of filtering effect of wetland on overland runoff
							2.40	1,500	Minnesota	0	0	100	28	30	Floodway	Sheet piling required	0	0	None	3,233,000	Unknown	None	None expected if sheet piling is used
							2.02	4,000	St. Paul/ B.N.R.R.	100	0	0	69	20	Out		0	0	None	200,000	Unknown	None	None if retention time is maintained
2	8	838.4 - 839.7	24	12,400	199,000	2.16	7,000	St. Paul	100	0	0	3.4	25	Floodplain	Removal required to retain capacity	0	0	None	200,000	Unknown	None	None if retention time is maintained
	(Harriet Island)																						
2	9	840.0 - 841.4	10	11,900	356,500	2.17	5,000	N.S.P.	100	0	0	7	20	Floodplain	Removal required to retain capacity	0	0	None	200,000	Unknown	None	None if retention time is maintained
	(Smith Ave. Bridge)																						
2	10	847.7 - 848.4	18	3,900	60,000	2.18	27,000	Shiely Co.	100	0	0	(2)	(2)	Out	Mech. rehandling w/landowners equipment	0	0	None	All-Landowners	Unknown	None	None
	(L.A. to L/D 1)																						

(1) Site 2.14 is not endorsed for use by GREAT I.

(2) Landowner has offered to unload barges and stockpile material on the site with his own equipment.

Quick reference summary of channel maintenance plan

Dredge cuts							Description								Disposal sites					Impacts	
									Cover (percent)(1)			Area (Acres) @ (%)			Habitat alteration						
Pool	Cut No	River mile	Recommended width (feet)	Number of times dredged (1986-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1986-2025)	Site No.	Approximate distance from cut (feet)	Ownership	Upland	Wetland	Open water			Flood-plain location	Conditions on use of site	Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1986-2025)	Cultural resources	Endangered (and threatened) species	Water quality
3	1	798.9 - 800.5	350	10	45,500	455,500	3.09	3,000	Private	0	100	0	35	25	Out	-	35	-	None	258,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
		(Diamond Bluff)																					
3	2	800.8 - 801.8	300	8	34,100	272,500	3.09	10,000	Private	0	100	0	35	25	Out	-	35	-	None	258,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
		(Coulter's Island)																					
3	3	801.9 - 803.0	300	8	57,100	457,000	3.09	16,000	Private	0	100	0	35	25	Out	-	35	-	None	258,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
		(Morgan's Coulee)																					
3	4	804.2 - 806.1	300	12	34,600	415,500	3.27	20,000	Private	0	100	0	31	10	Effective flow area of tributary	-	31	-	None	254,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
		(Big River)																					
							3.09	30,000	Private	0	100	0	35	25	Out	-	35	-	None	258,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
							3.34	50,000	Public	60	40	0	10	25	Out	-	-	4	Facility Enhancement	240,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
							3.46	40,000	Private	100	0	0	11	12	Floodway	-	0	0	Enhance	2,420,000	Unknown	None	No effect if adequate retention
3	5	807.0 - 808.6	350	12	49,200	590,500	3.27	5,000	Private	0	100	0	31	10	Effective flow area of tributary	-	31	0	None	254,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
		(4-Mile Isle & Truedale Slough)																					
							3.09	45,000	Private	0	100	0	35	25	Out	-	35	0	None	258,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
							3.34	35,000	Public	60	40	0	10	25	Out	-	-	4	Facility Enhancement	240,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained
							3.46	25,000	Private	100	0	0	11	12	Floodway	-	0	0	Enhance	2,429,000	Unknown	None	Some loss of overland runoff filtration. No other effect if adequate retention time is maintained

Quick reference summary of channel maintenance plan

Dredge cuts							Disposal sites: Description								Disposal sites: Impacts						
									Cover (percent)(1)							Habitat alteration					
Pool	Cut No	River mile	Recommended width (feet)	Number of times dredged (1986-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1986-2025)	Site No.	Approximate distance from cut (feet)	Ownership	Upland	Wetland	Open water	Area (Acres)	@ (Ft)	Floodplain location	Conditions on use of site	Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1986-2025)	Cultural resources	Endangered (and threatened) species	Water quality
1	A	809.5 - 809.8	100	4	36,800	147,000	3.27	7,500	Private	0	100	0	31	10	Effective flow area of tributary	-	31	0	None	254,000	Unknown	None	Some loss of overland runoff filtration. No other if adequate retention time is maintained
	(Pine Coulee)						3.09	50,000	Private	0	100	0	35	25	Out	-	35	0	None	258,000	Unknown	None	Some loss of overland runoff filtration. No other if adequate retention time is maintained
							3.34	25,000	Public	60	40	0	10	25	Out	-	0	4	Facility Enhancement	240,000	Unknown	None	Some loss of overland runoff filtration. No other if adequate retention time is maintained
							[illegible](1)	18,000	Private	100	0	0	11	12	Floodway	-	0	0	Enhance	2,420,000	Unknown	None	Some loss of overland runoff filtration. No other if adequate retention time is maintained
1	7	813.4 - 813.7	450	12	20,400	122,000	3.34	6,000	Public	60	40	0	10	15	Out	-	0	4	Facility Enhancement	-	Unknown	None	Some loss of overland runoff filtration. No other if adequate retention time is maintained
	Treasure)						3.36	15,000	Private	100	0	0	11	12	Floodway	-	0	0	Enhance	2,420,000	Unknown	None	No effect if adequate retention time is maintained
1	4	814.1 - 814.2	100	4	1,000	12,000	3.38	1,000	Private	100	0	0	11	12	Floodway	-	0	0	Enhance	2,420,000	Unknown	None	No effect if adequate retention time is maintained
	(Vermillion)																						
1	3	814.9 - 815.2	100	4	10,200	61,500	3.47	3,000	Hastings	100	0	0	1.5	12	Floodway	-	0	0	Enhance	2,420,000	Unknown	None	None expected
							Lake Rebecca	3,000	Public	100	0	0	(2)	(2)	Floodplain	Stockpile site only	0	0	Some Adverse	2,420,000	Unknown	None	None expected
(1) Land owner has offered to unload barges and stockpile material on the site with his own equipment							3.42	2,000	Private	0	50	50	8.5	5	Floodway	-	4	0	Enhance	-	Unknown	None	Short-term violation of turbidity and suspended solid standards
							(2) Depends on beneficial use removed by Hastings																
4	1	753.5 - 754.0	400	16	14,700	235,000	4.01	4,000	Federal	0	0	100	10.3	30	Floodway	-	0	0	Enhance	1,982,000	Unknown	Fanshell & Mussel	None expected
	Reef Slough)						4.20	30,000	Private	100	0	0	6.4	20	Floodway	-	0	0	Enhance	85,000	Unknown	None	None expected

Quick reference summary of channel maintenance plan

Dredge cuts							Description							Disposal sites					Impacts		
								Cover (percent)(1)													
Pool	Cut No	River mile	Recommended width (feet)	Number of times dredged 1996-2025	Average volume per dredging (cubic yards)	Total volume dredged 1996-2025	Site No	Approximate distance from cut (feet)	Ownership	Dry land	Wet land	Open water	Area (Acres)	@ (ft)	Floodplain location	Conditions on use of site	Habitat alteration Types 1 and 2 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1996-2025)	Cultural resources	Endangered (and threatened) species	Water quality
4	4	555.1 - 556.4	500	14	37,400	521,500	4.02	13,000	Federal	0	0	100	19.4	30	Floodway	-	0	0	Enhance	1,982,000	Unknown	Possible mussel bed	None expected
	Grand Encampment																						
							4.20	14,000	Private	100	0	0	6.4	20	Floodway	-	0	0	Enhance	85,000	Unknown	None	None expected
4	4	555.1 - 556.4	500	68	37,400	971,900	4.02	22,000	City of Alma	0	0	100	19.4		Floodway	-			Enhance	1,982,000	Unknown	Possible mussel bed	None expected
	Twelve Mile Point																						
							4.20	12,000	Private	100	0	0	6.4	20	Floodway	-	0	0	Enhance	85,000	Unknown	None	None expected
							4.18		Private	100	0	0	3	20	Floodway	Rehandling site only	0	0	Enhance	0	Unknown	None	None expected
4	4	555.5 - 556.4	500	24	28,600	600,500	4.25	13,000	Private	100	0	0	18	30	Out	-	0	0	None	85,000	Unknown	None	None expected
	Reid's Landing																						
							4.24	15,000	Milwaukee Road	100	0	0	60	25	Out	Rehandling site necessary	0	0	None	85,000	Unknown	None	None expected
							4.20	5,000	Private	100	0	0	6.4	20	Out	-	0	0	Enhance	85,000	Unknown	None	None expected
							4.19	4,000	Private	100	0	0	5.7	25	Floodplain	-	0	0	None	85,000	Unknown	None	None expected
							4.18	4,000	Private	100	0	0	3	20	Floodway	Rehandling site only	0	0	Enhance	0	Unknown	None	None expected
4	5	561.8 - 563.4	550	28	47,100	2,124,000	4.24	10,000	Milwaukee Road	100	0	0	60	25	Out	-	0	-	None	85,000	Unknown	None	None expected
	Reid's Landing																						
							4.25	15,000	Private	100	0	0	18	30	Out	-	0	0	None	85,000	Unknown	None	None expected
4	6	563.8 - 565.5	550	4	68,500	274,000	4.37	20,000	Private	100	0	0	8	*	Out	-	0	0	None	0	Unknown	None	Known water quality concerns
	Red Wing Bridges																						
							4.34	10,000	Misn	100	0	0	5	*	Out	-	0	0	None	0	None	None	None expected
4		564.1 - 565.5	550	13	49,600	645,500	4.37	11,000	City of Red Wing	100	0	0	16	25	Floodway	Close coordination with Red Wing Harbor Commission	0	0	None	360,000	Unknown	None	None expected
	Red Wing Bridges																						
							4.34	5,000	Izaak Walton League	0	100	0	8	25	Floodway	-	6	0	Enhance	All material on site	Unknown	None	Short-term violation of turbidity and suspended solid standards
							4.37	5,000	City of Red Wing	50	50	0	11	5	Floodway	-	6	0	Enhance	360,000	Unknown	None	None expected
							4.34	10,000	City of Red Wing	60	40	0	8	25	Floodplain	Ind. Dev. may occurr	4	0	None	360,000	Unknown	None	None expected
4	8	390.8 - 391.2	500	4	21,400	85,500	4.37	5,000	City of Red Wing	100	0	0	16	25	Floodway	Close coordination with Red Wing Harbor Commission	0	0	None	360,000	Unknown	None	None expected
	Above Red Wing Bridges																						
4	9	565.5 - 566.0	500	4	51,400	427,500	4.37	5,000	City of Red Wing	100	0	0	16	25	Floodway	Close coordination with Red Wing Harbor Commission	0	0	None	360,000	None	None	None expected
	Diamond Bluff																						
4	10	566.0 - 566.4	500	4	44,400	179,000	4.43	5,000	Red Wing Yacht Club	60	40	0	11	8	Floodway	-	0	0	Enhance	360,000	Unknown	None	Short-term violation of turbidity and suspended solid standards
	Treasure Island																						
4	11	566.4 - 567.0	500	4	71,400	285,500	4.37	5,000	City of Red Wing	100	0	0	16	25	Floodway	Close coordination with Red Wing Harbor Commission	0	0	None	360,000	Unknown	None	None expected
	Lake Pepin																						

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Dredge cuts: Recommended width (feet)	Number of times dredged (1985-2045)	Average volume per dredging (cubic yards)	Total volume dredged (1985-2045)	Description: Site No.	Approximate distance from cut (feet)	Owner ship	Cover (percent)(1): Upland	Wetland	Open water	Area (Acres) @ (Ft)		Flood-plain location	Conditions on use of site	Disposal sites: Habitat alteration Types 1, 2, and 3 wetland	Habitat alteration Types 4 and 5 wetland	Impacts: Recreation activities	Possible removal for beneficial use (1985-2045)	Cultural resources	Endangered (and threatened) species	Water quality
5	1	741.2 - 741.6	300	6	22,800	136,500	5.30	12,000	U.M.R. F.W.R.	0	100	0	76	15	Floodway	Specific details to be resolved	0	76	Enhance	All-on Site	Unknown	None	Short-term violation of turbidity and suspended solids standards
	(Mt. Vernon Light)																						
5	2	742.7 - 743.8	400	12	27,700	332,000	5.30	7,500	U.M.R. F.W.R.	0	100	0	76	15	Floodway	Specific details to be resolved	0	76	Enhance	All-on Site	Unknown	None	Short-term violation of turbidity and suspended solids standards
	(Sommerfield Island)																						
5	3	744.0 - 744.7	300	24	21,700	520,000	5.30	3,000	U.M.R. F.W.R.	0	100	0	76	15	Floodway	Specific details to be resolved	0	76	Enhance	All-on Site	Unknown	None	Short-term violation of turbidity and suspended solids standards
	(Lower Zumbro)																						
5	4	745.8 - 746.0	500	26	25,800	671,000	5.30	5,000	U.M.R. F.W.R.	0	100	0	76	15	Floodway	Specific details to be resolved	0	76	Enhance	All-on Site	Unknown	None	Short-term violation of turbidity and suspended solids standards
	(Fisher Island)																						
5	5	746.0 - 746.8	400	26	14,700	381,500	5.26A	25,000	Dairyland Power	0	100	0	15	25	Floodway	Detailed Economic & Environmental comparison of 4 selected sites to be completed before use. (Preferential order may change)	15	0	None	1,664,000	Unknown	Bald Eagle Roost	None expected, may lose settling effect of wetland during flood conditions
	(Below West Newton)																						
							5.24	8,000	Private	100	0	0	36	25	Out	See 5.26A	0	0	None	41,000	Unknown	None	None expected
							5.26	25,000	Dairyland Power	0	100	0	15	25	Out	See 5.26A	15	0	None	1,664,000	Unknown	None	None expected, may lose settling effect of wetland during flood conditions
							5.28	12,000	Private	100	0	0	15	25	Out	See 5.26A	0	0	None	1,674,000	Unknown	None	None expected
5	6	747.2 - 748.2	500	14	19,800	557,000	5.26A	21,000	Dairyland Power	0	100	0	15	25	Floodway	Detailed Economic & Environmental comparison of 4 selected sites to be completed before use (Preferential order may change)	15	0	None	1,664,000	Unkown	Bald Eagle Roost	None expected, may lose settling effect of wetland during flood conditions
	(West Newton)																						
							5.24	14,000	Private	100	0	0	36	25	Out	See 5.26A	0	0	None	41,000	Unknown	None	None expected
							5.26	21,000	Dairyland Power	0	100	0	15	25	Out	See 5.26A	15	0	None	1,664,000	Unknown	None	None expected, may lose settling effect of wetland during flood conditions
							5.28	8,000	Private	100	0	0	15	25	Out	See 5.26A	0	0	None	1,674,000	Unknown	None	None expected
5	7	748.6 - 749.6	550	10	35,800	358,000	5.26A	14,000	Dairyland Power	0		0	15	25	Floodway	Detailed Economic & Environmental comparison of 4 selected sites to be completed before use (Preferential order may change)	15	0	None	1,664,000	Unknown	Bald Eagle Roost	None expected, may lose settling effect of wetland during flood conditions
	(Mule Bend)																						

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Recommended width (feet)	Number of times dredged (1986-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1986-2025)	Site No.	Approximate distance from cut (feet)	Ownership	Cover (percent)(1) Upland	Wetland	Open water	Area (Acres) @ (Ft)		Floodplain location	Conditions on use of site	Habitat alteration Types 1, 2, and 3 wetland	Habitat alteration Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1986-2025)	Cultural resources	Endangered (and threatened) species	Water quality
							5.24	10,000	Private	100	0	0	36	25	Out	See 5.26A	0	0	None	41,000	Unknown	None	None expected
							5.26	20,000	Dairyland Power	0	100	0	15	25	Out	See 5.26A	15	0	None	1,664,000	Unknown	None	None expected, may lose settling effect of wetland during flood conditions
							5.28	15,000	Private	100	0	0	15	25	Out	See 5.26A	0	0	None	1,674,000	Unknown	None	None expected
5	8	752.6 - 752.8	300	12	8,800	105,000	5.26A	7,000	Dairyland Power	0	100	0	15	25	Floodway	Detailed Economic & Environmental comparison of 4 selected sites to be completed before use (Preferential order may change)	15	0	None	1,664,000	Unknown	Bald Eagle Roost	None expected, may lose settling effect of wetland during flood conditions
							5.24	13,000	Private	100	0	0	36	25	Out	See 5.26A	0	0	None	41,000	Unknown	None	None expected
							5.26	7,000	Dairyland Power	0	100	0	15	25	Out	See 5.26A	15	0	None	1,664,000	Unknown	None	None expected, may lose settling effect of wetland during flood conditions
							5.28	30,000	Private	100	0	0	15	25	Out	See 5.26A	15	0	None	1,674,000	Unknown	None	None expected
5A	1	728.5 - 729.5	300	10	45,200	451,500	5A.32	15,000	City of Fountain City	0	100	0	34	25	Floodfringe	Retain vegetative buffer strip	5	29	Limited	1,540,000	Unknown	None	None expected, may lose settling effect of wetland during flood conditions
		(Upper Approach L/D 5A)																					
							5A.25	15,000	Private	0	100	0	6	25	Floodway	Removal required to retain capacity	5	0	Enhance with treatment	1,594,000	Unknown	None	None expected
5A	2	730.0 - 730.8	450	14	19,800	276,000	5A.32	9,000	City of Fountain City	0	100	0	34	25	Floodfringe	Retain vegetative buffer strip	5	29	Limited	1,540,000	Unknown	None	None expected, may lose settling effect of wetland during flood conditions
		(Wild's Bend)																					
							5A.25	9,000	Private	0	100	0	6	25	Floodway	Removal required to maintain capacity	5	0	Enhance with treatment	1540,000	Unknown	None	None expected
5A	3	731.8 - 732.2	550	14	32,900	461,000	5A.32	4,000	City of Fountain City	0	100	0	34	25	Floodfringe	Retain vegetative buffer strip	5	29	Limited	1,540,000	Unknown	None	None expected, may lose settling effect of wetland during flood conditions
		(Betsy Slough)																					
5A	4	733.4 - 733.9	300	12	34,000	407,500	5A.25	9,000	Private	0	100	0	6	25	Floodway	Removal required to maintain capacity	5	0	Enhance with treatment	1,540,000	Unknown	None	None expected
		(Fountain City)																					
5A	5	734.0 - 735.2	500	20	36,200	724,000	5A.23	18,000	Private	0	100	0	7	25	Floodway	Close coordination with Minn. DNR for boat access point	7	0	Enhance with treatment	60,000	Unknown	None	None expected
		(Island 58)																					

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Recommended width (feet)	Number of times dredged (1985-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1985-2025)	Site No.	Approximate distance from cut (feet)	Ownership	Cover (percent)(1) Upland	Wetland	Open water	Area (Acres) @ (Ft)		Floodplain location	Conditions on use of site	Habitat alteration Types 1, 2, and 3 wetland	Habitat alteration Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1985-2025)	Cultural resources	Endangered (and threatened) species	Water quality
							SA.36	20,000	Federal	50	50	0	2	25	Floodway	Lock and Dam Dev.	1	0	Minimal	60,000	Unknown	None	None expected
5A	6	737.7 - 738.1	300	2	24,800	49,500	SA.23	2,000	Private	0	100	0	7	25	Floodway	Close coordination with Minn. DNR for boat access point.	7	0	Enhance with treatment	60,000	Unknown	None	None expected
		(L.A. L/D 5)																					
6	1	720.0 - 721.0	300	12	22,700	272,500	6.17	19,000	Winona Port Authority	0	100	0	21	25	Out	Ind. Div. May occur	0	21	None	2,920,000	Unknown	None	None expected, may lose settling effect of wetlands during flood conditions
		(Homer Point)																					
							6.11	3,000	Private	90	10	0	11	15	Floodway	Removal before seasonal high water	1	0	Enhance	920,000	Unknown	None	None expected
6	2	721.9 - 722.1	500	5	13,300	80,000	6.17	9,000	Winona Port Authority	0	100	0	21	25	Out*	Ind. Dev. May occur	0	21	None	2,920,000	Unknown	None	None expected, may lose settling effect of wetlands during flood conditions
		(Gravel Point)																					
6	3	722.5 - 723.8	300	12	36,200	434,000	6.17	4,000	Winona Port Authority	0	100	0	21	25	Out	Ind. Dev. May Occur	0	21	None	2,920,000	Unknown	None	None expected, may lose settling effect of wetlands during flood conditions
		(Below Winona R.R. Bridge)																					
6	4	723.9 - 724.2	300	8	21,400	171,000	6.19	3,000	City of Winona	100	0	0	2.5	15	Out*	Removal required to retain capacity	0	0	None	920,000	Unknown	None	None expected
		(Above Winona R.R. Bridge)																					
							6.20	3,000	City of Winona	100	0	0	2.5	15	Out*	Removal Required to retain capacity	0	0	None	920,000	Unknown	None	None expected
							6.17	6,000	Winona Port Authority	0	100	0	21	25	Out*	Ind. Dev. may occur	0	21	None	2,920,000	Unknown	None	None expected, may lose settling effect of wetlands during flood conditions
6	5	726.1 - 726.5	450	12	8,100	97,500	6.22	2,000	City of Winona	100	0	0	.5	15	Floodway	Removal before seasonal high water	0	0	Enhance	920,000	Unknown	None	None expected
		(Island 31)																					
6	6	727.7 - 728.1	300	16	8,100	129,500	6.22	10,000	City of Winona	100	0	0	.5	15	Floodway	Removal before seasonal high water	0	0	Enhance	920,000	Unknown	None	None expected
		(L.A. L/D 5A)																					
7	1	703.5 - 703.7	300	4	35,600	142,500	7.20	4,000	Federal	100	0	0	1.7	20	Floodplain	Removal Required to retain capacity	0	0	None	100,000	Unknown	Possible Bald Eagle Roost	None expected
		(Upper Approach L/D 7)																					
							7.01	13,000	Private	100	0	0	1.2	15	Out	Limited capacity, may have to be removed during dredging	0	0	None	109,900	Unknown	None	None expected
7	2	704.0 - 705.1	300	10	35,800	358,000	7.20	14,000	Federal	100	0	0	1.7	20	Floodplain	Removal required to retain capacity	0	0	None	100,000	Unknown	Possible Bald Eagle Roost	None expected
		(Head of Brushbach Cut)																					
							7.01	13,000	Private	100	0	0	1.2	15	Out	Limited capacity, may have to be removed during dredging	0	0	None	109,900	Unknown	None	None expected
							7.05	55,000	Federal	0	100	0	21	30	Out	-	7	14	Enhance with treatment	1,216,000	Unknown	None	None expected, may lose settling effect of wetland during flood flows

* With completion of Winona flood control project now under construction.

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Dredge cuts: Recommended width (feet)	Number of times dredged (1986-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1985-2025)	Disposal sites: Site No.	Approximate distance from cut (feet)	Description: Ownership	Cover (percent)(1): Upland	Wetland	Open water	Area: Acres	Area: # (Ft)	Floodplain location	Conditions on use of site	Impacts: Habitat alteration Types 1, 2, and 3 wetland	Habitat alteration Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1986-2025)	Cultural resources	Endangered (and threatened) species	Water quality
							7.05	45,000	State of Minnesota	15	85	0	12	15	Floodway	-	2	8	Enhance	101,500	Unknown	Clam bed habitat	None expected
							8.06	47,000	City of LaCrosse	100	0	0	44	35	Out	Mechanical unloading required	0	0	Enhance with treatment	2,082,500	Unknown	None	None expected
7	3	706.1 - 706.6	400	18	20,800	374,400	7.06	40,000	Federal	0	100	0	21	30	Out	-	7	14	Enhance with treatment	1,216,000	Unknown	None	None expected, may lose settling effect of wetland during flood flows
		(Dakota)																					
7	4	707.9 - 709.3	400	16	29,200	467,500	7.06	30,000	Federal	0	100	0	21	30	Out	-	7	14	Enhance with treatment	1,216,000	Unknown	None	None expected, may lose settling effect of wetland during flood flows
		(Winter's Landing)																					
7	5	710.3 - 710.7	500	4	21,400	85,500	7.06	20,000	Federal	0	100	0	21	30	Out	-	7	14	Enhance with treatment	1,216,000	Unknown	None	None expected, may lose settling effect of wetland during flood flows
		(Below Queen's Bluff)																					
7	6	711.4 - 712.3	300	14	46,600	652,500	7.05	10,000	State of Minnesota	15	85	0	12	15	Floodway	-	2	8	Enhance	101,500	Unknown	Clam bed habitat	None expected
		(Richmond Island)																					
7	7	714.0 - 714.8	300	4	23,400	94,500	7.06	1,000	Federal	0	100	0	21	30	Out	-	7	14	Enhance with treatment	1,216,500	Unknown	None	None expected, may lose settling effect of wetland during flood flows
		(L.A. L/D 5)																					
	1	683.5 - 683.8	400	2	20,800	41,500	8.22	7,000	Private	100	0	0	4	15	Out	Avoid Known cultural resources	0	0	None	468,500	None with caution	None	None expected
		(Warner's Landing)																					
8	2	684.7 - 685.1	400	2	22,800	45,500	8.22	8,000	Private	100	0	0	4	15	Out	Avoid known cultural resources	0	0	None	468,500	None with caution	None	None expected
		(Crosby Slough)																					
8	3	686.5 - 687.5	400	6	34,800	239,000	8.30	10,000	Federal (with leases and sub-leases)	40	60	0	55	60	Floodway	-	22	11	Enhance with treatment	645,000	Unknown	None	None expected
		(Below Raft Channel)																					
8	4	687.5 - 688.5	400	20	50,900	1,018,000	8.30	3,000	Federal (with leases and sub-leases)	40	60	0	55	30	Floodway	-	22	11	Enhance with treatment	645,000	Unknown	None	None expected
		Head of Raft Channel)																					
8	5	688.7 - 689.4	400	22	29,400	646,800	8.30	8,000	Federal (with leases and sub-leases)	40	60	0	55	30	Floodway	-	22	11	Enhance with treatment	645,000	Unknown	None	None expected
		(Brownsville)																					
8	6	689.9 - 690.8	450	24	47,300	994,200	8.06	14,000	City of LaCrosse	100	0	0	44	15	Out	Mechanical unloading required	0	0	Enhance with treatment	2,082,500	Unknown	None	None expected
		(Above Brownsville)																					

Quick reference summary of channel maintenance plan

Pool	Cut No	River mile	Recommended width (feet)	Number of times dredged (1986-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1986-2025)	Site No.	Approximate distance from cut (feet)	Owner-ship	Description: Cover (percent)(1) Up-land	Wet-land	Open water	Area (Acres) @ (Ft)		Flood-plain location	Conditions on use of site	Disposal sites: Habitat alteration Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Impacts: Recreation activities	Possible removal for beneficial use (1986-2025)	Cultural resources	Endangered (and threatened) species	Water quality
8	7	691.4 - 691.8	300	6	35,200	211,000	8.06	25,000	City of LaCrosse	100	0	0	44	35	Out	Mechanical unloading required	0	0	Enhance with treatment	2,082,500	Unknown	None	None expected
		(Pleasure Island)																					
8	8	692.2 - 693.1	500	4	28,400	113,500	8.06	18,000	City of LaCrosse	100	0	0	44	35	Out	Mechanical unloading required	0	0	Enhance with treatment	2,082,500	Unknown	None	None expected
		(Root River)																					
8	9	694.3 - 695.0	400	8	21,400	171,000	8.06	10,000	City of LaCrosse	100	0	0	44	35	Out	Mechanical unloading required	0	-	Enhance with treatment	2,082,500	Unknown	None	None expected
		(Sand Slough)																					
8	10	699.6 - 700.4	300	10	28,000	280,500	8.28	2,000	Private	0	100	0	4	5	Floodway	Limited capacity, fill around building foundations	-	0	Enhance	626,000	Unknown	None	Temporary violation of state turbidity suspended solids & anti-degradation standards
		(LaCrosse R.R. Bridge					8.06	20,000	City of LaCrosse	100	0	0	44	35	Out	Mechanical unloading required	-	0	Enhance with treatment	2,082,500	Unknown	None	None expected
4	1	653.6 - 654.6	300	2	26,000	52,000	9.47	28,000	Private	100	0	0	1	10	Floodplain	Material must be removed to retain capacity	0	0	None	126,000	Unknown	None	None
		(Above Cr[illegible] Slough)					[illegible]	[illegible]		50	50	0	9	10	Floodplain		-	0	None	126,000	Adverse	None	None
9	2	660.3 - 660.8	300	2	24,400	49,000	[illegible]	[illegible]	Private	100	0	0	1	10	[illegible]	Material must be removed to retain capacity	0	0	None	126,000	Unknown	Adjacent	None
		(Above Atchafalaya)					9.26	18,000	Federal	0	0	100	22		Floodway	-	-	0	Enhance	821,000	Unknown	Unknown	Moderate
9	3	663.8 - 665.0	400	24	124,500	469,000	9.26	4,000	Federal	0	0	100	22	5	Floodway	-	0	0	Enhance	821,000	Unknown	Unknown	Moderate
		Lansing Upper Light)					9.47	20,000	Private	100	0	0	1	10	Floodplain	Material must be removed to retain capacity	-	0	None	126,000	Unknown	None	None
							9.51	[illegible]	Unknown	100	0	0	4	10	Floodplain (of Clear Creek)	-	0	0	Enhance	55,000	None	None	None expected
							[illegible]	[illegible]	[illegible]	-	-	90	1	11	Floodway (Village Creek)		1	11	None		Unknown	None	None

[illegible]

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Recommended width (feet)	Number of times dredged (1985-2045)	Average volume per dredging (cubic yards)	Total volume dredged (1985-2045)	Site No.	Approximate distance from cut (feet)	Ownership	Cover (percent)(1) Upland	Wetland	Open water	Area (Acres)	(%)	Floodplain location	Conditions on use of site	Habitat alteration Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Beneficial activities	Possible removal for beneficial use (1985-2045)	Cultural resources	Endangered (and threatened) species	Water quality
Dredge cuts							**Description**										**Disposal sites**				**Impacts**		
9	4	665.0 - 665.8	300	10	51,700	517,000	9.07		Private	0	100	0	13		Floodplain	Material must be removed to retain capacity	3	10	None	30,000 to 250,000	Unknown	None	None
	(Indian Camplight)																						
							8.06	164,000	City of LaCrosse	100	0	0	44	35	Out	-	0	0	Enhance with treatment	1,982,000	Unknown	None	None
9	5	667.4 - 668.5	300	2	50,800	101,500	9.07		Private	0	100	0	13	25	Floodplain	Material must be removed to retain capacity	3	10	None	30,000 to 25,000	Unknown	None	None
	(DeSoto)																						
							8.06	150,000	City of LaCrosse	100	0	0	44	35	Out	-	0	0	Enhance with treatment	1,982,000	Unknown	None	None
9	6	671.0 - 672.0	450	12	30,300	363,500	9.11		Private	10	90	0	5	5	Floodway	-	5	0	Enhance	256,000	Unknown	None	Minor
	(Head of Battle Island)																						
							9.33	3,000	Private	0	100	0	13	20	Floodway	-	13	0	Enhance	256,000	Unknown	None	None
9	7	675.4 - 675.9	300	2	6,000	12,000	9.15	12,000	Public	100	0	0	1	20	Floodway	Material must be removed as it is delivered	0	0	None	180,000	Unknown	None	None
	(Below Twin Island)																						
							9.11		Private	10	90	0	5	5	Floodway	-	5	0	Enhance	256,000	Unknown	None	Minor
							9.33	20,000	Private	0	100	0	13	20	Floodway	-	13	0	Enhance	256,000	Unknown	None	None
							8.06	111,000	City of LaCrosse	100	0	0	44	35	Out	-	0	0	Enhance with treatment	1,982,000	Unknown	None	None
9	8	676.0 - 676.6	400	18	20,100	362,000	9.15	8,000	Public	100	0	0	1	20	Floodway	Material must be removed as it is delivered	0	0	-	180,000	Unknown	None	None
	(Twin Island)																						
							9.11		Private	10	90	0	5	5	Floodway	-	5	0	Enhance	256,000	Unknown	None	Minor
							9.33	31,000	Private	0	100	0	13	20	Floodway	-	13	0	Enhance	256,000	Unknown	None	None
							8.06	107,000	City of LaCrosse	100	0	0	44	35	Out	-	0	0	Enhance with treatment	1,982,000	Unknown	None	None
9	9	677.4 - 678.3	400	10	30,200	302,000	9.15	3,000	Public	100	0	0	1	20	Floodway	Material must be removed as it is delivered	0	0	-	180,000	Unknown	None	None
	(Island 126)																						
							9.11		Private	10	90	0	5	5	Floodway	-	5	0	Enhance	256,000	Unknown	None	Minor
							9.33	31,000	Private	0	100	0	13	20	Floodway	-	13	0	Enhance	256,000	Unknown	None	None
							8.06	100,000	City of LaCrosse	100	0	0	44	35	Out	-	0	0	Enhance with treatment	1,982,000	Unknown	None	None

Quick reference summary of channel maintenance plan

Pool	Cut No.	River mile	Recommended width (feet)	Number of times dredged (1985-2025)	Average volume per dredging (cubic yards)	Total volume dredged (1985-2025)	Site No.	Approximate distance from cut (feet)	Ownership	Cover (percent)(1) Upland	Wetland	Open water	Area (Acres)	Depth (ft)	Floodplain location	Conditions on use of site	Habitat alteration Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1985-2025)	Cultural resources	Endangered (and threatened) species	Water quality
9	10	678.7 - 679.2	300	4	23,400	93,500	9.15	4,000	Public	100	0	0	1	20	Floodway	Material must be removed as it is delivered	0	0	None	180,000	Unknown	None	None
		(Lower Approach L/D 8)																					
							9.11		Private	10	90	0	5	5	Floodway	-	5	0	Enhance	256,000	Unknown	None	Minor
							9.33	36,000	Private	0	100	0	13	20	Floodway	-	13	0	Enhance	256,000	Unknown	None	None
							8.06	95,000	City of LaCrosse	100	0	0	44	35	Out	-	0	0	Enhance with treatment	1,982,000	Unknown	None	None
10	1	615.1 - 616.0	450	2	26,800	53,500	10.02	4,000	City of Guttenberg	100	0	0	6	15	Out	-	0	0	None	12,000	Unknown	None	None
		(Upper Approach L/D 10)																					
							10.03	15,000	?	100	0	0	10	15	Out	-	0	0	None	12,000	Unknown	None	None
10	2	618.3 - 619.2	500	8	25,900	207,000	10.04	6,000	Private	0	100	0	8	25	Floodplain	-	0	8	None	None	None	None	Minor
		(McMillan Island)																					
10	3	627.3 - 628.0	400	12	10,300	123,000	10.01	3,000	State of Wisconsin/ Private (B.N.R.R.)	100	0	0	8	60	Out	-	0	0	None	62,000	Unknown	None	None
		(Wyalusing)																					
10	4	628.9 - 629.3	400	2	8,800	17,500	10.01	6,000	State of Wisconsin/ Private (B.N.R.R.)	100	0	0	8	60	Out	-	0	0	None	62,000	Unknown	None	None
		(Wyalusing Bend Light)																					
10	5	633.2 - 637.5	300	2	32,800	65,500	10.41	15,000		0	100	0	4.5	15	Floodway of Bloody Run Creek	Riprap creek edge	4.5	0	None	170,000	Unknown	None	None
		(McGregor)																					
10	6	633.3 - 635.8	300	2	70,800	141,500	No site selected, GREAT questions need for dredging citing low frequency and total volume, limited traffic volume, access now provided at downstream end of East Channel and the presence of the Higgin's Eye mussel in the channel.																		
		(East Channel)																					
10	7	642.7 - 643.3	450	4	40,800	163,000	10.40	2,000	Private	100	0	0	26	25	Floodplain	-	0	0	None	300,000	Unknown	None	None
		(Mississippi Gardens)																					
10	8	643.7 - 644.7	300	10	47,700	477,000	10.40	7,000	Private	100	0	0	26	25	Floodplain	-	0	0	None	300,000	Unknown	None	None
		(Jackmon Island)																					

Quick reference summary of channel maintenance plan

Project reach									Description							Disposal sites						Remarks	
										Cover (percent)(1)			Area				Habitat alteration						
Feat	Cut No.	River mile	Recommended width (feet)	Number of times dredged (1985-2047)	Average volume per dredging (cubic yards)	Total volume dredged (1985-2047)	Site No.	Approximate distance from cut (feet)	Ownership	Upland	Wetland	Open water	Acres	ft (ft)	Floodplain location	Conditions on use of site	Types 1, 2, and 3 wetland	Types 4 and 5 wetland	Recreation activities	Possible removal for beneficial use (1985-2047)	Cultural resources	Endangered (and threatened) species	Water quality
10	9	646.0 - 646.6	300	10	27,200	272,500	10.16	2,000	Unknown	0	100	0	6	10	Floodway	Removal before high water or stabilization of material on site	6	0	Enhance	300,000	Unknown	None	Moderate
	(Hay Point)																						
							10.40	15,000	Private	100	0	0	26	25	Floodplain	-	0	0	None	300,000	Unknown	None	None
10	10	647.8 - 647.9	300	2	4,000	8,000	10.17	3,000	Private	40	60	0	4	10	Floodway	Removal before high water or stabilization of material on site	2	0	None	300,000	Unknown	None	Minor
	(Lower Approach L/D 9)																						
							10.40		Private	100	0	0	26	25	Floodplain	-	0	0	None	300,000	Unknown	None	None

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECOMMENDED CHANNEL MAINTENANCE

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

FS = Side channel modification for fish and wildlife

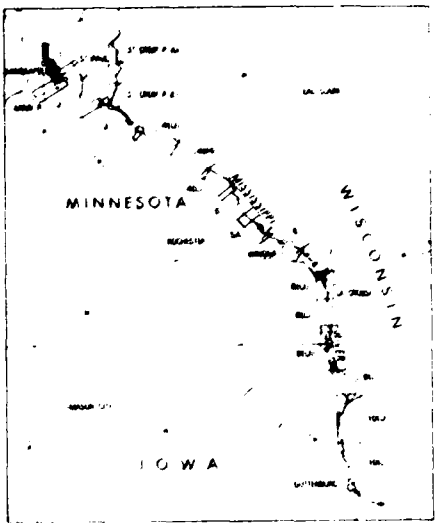
RS = Side channel modification for recreation

C = Water control culverts

SP = Shoreline protection

SCALE: 1" = 4,000'

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929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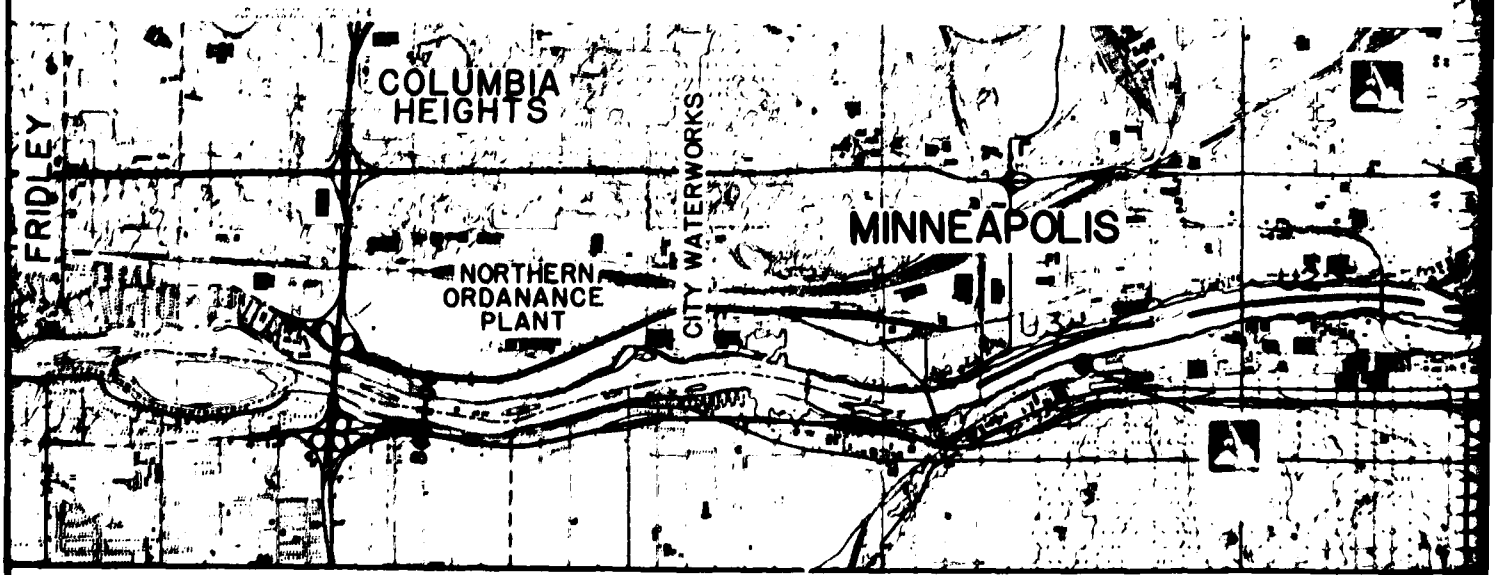
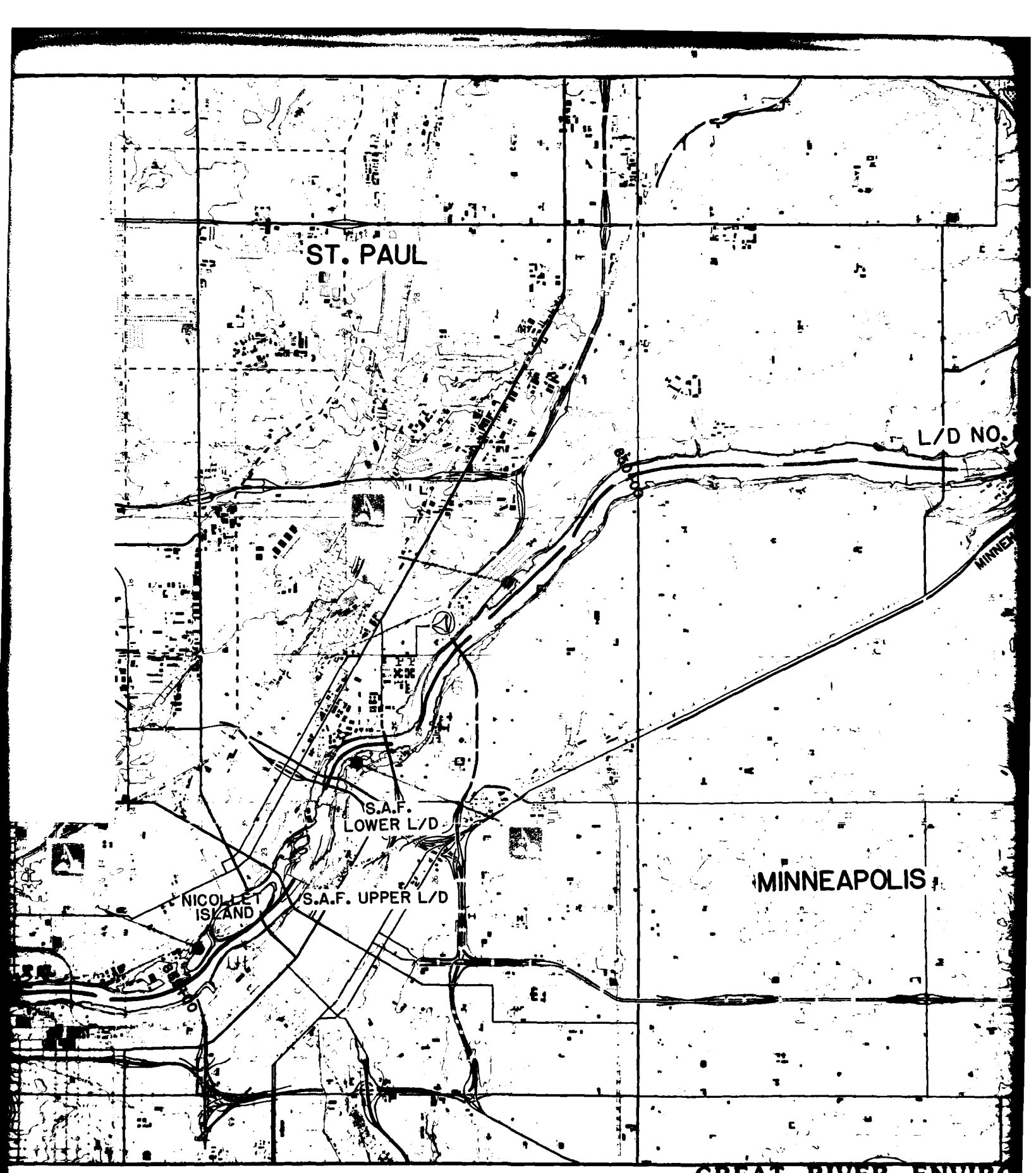
WISCONSIN
IOWA

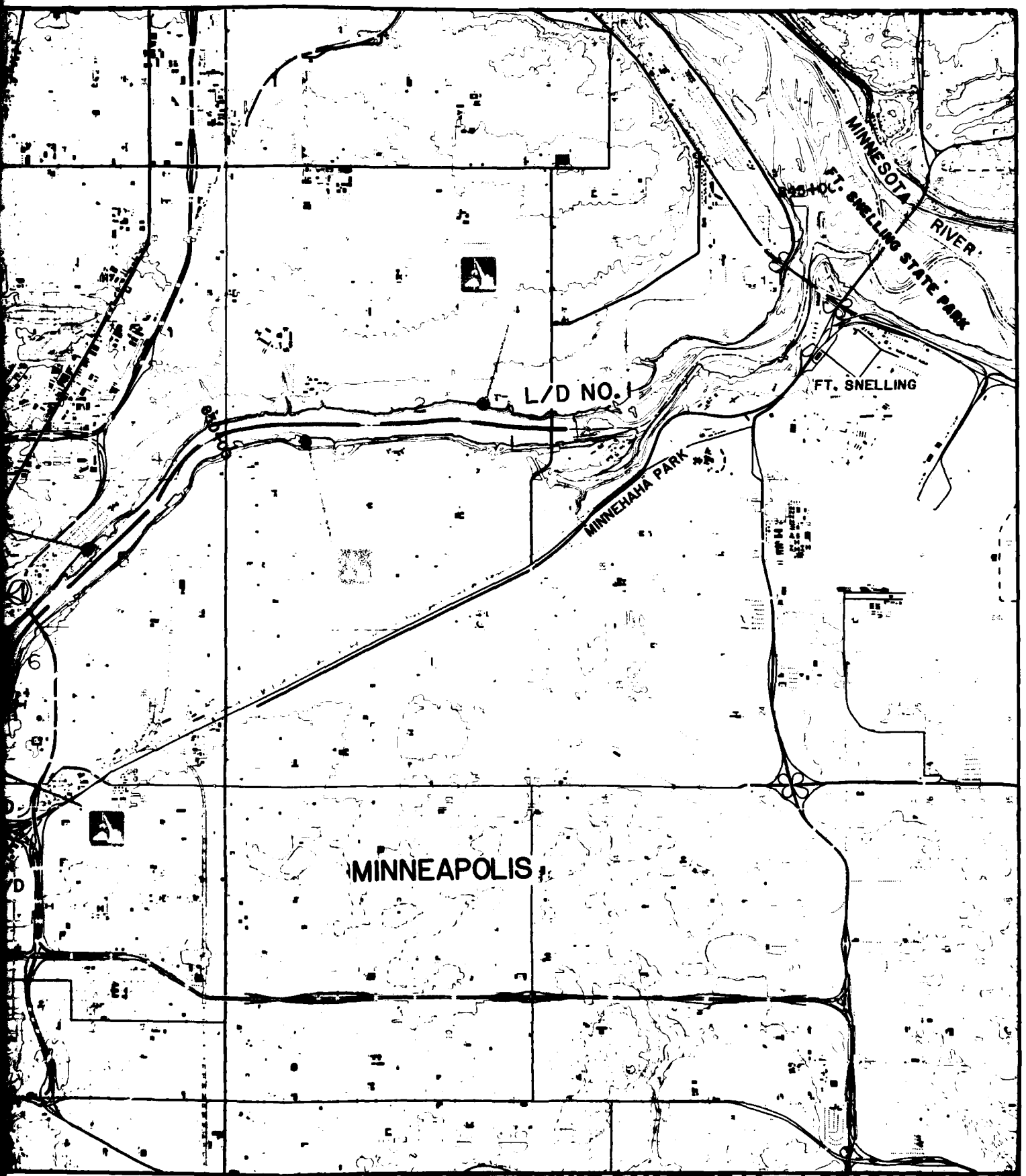

COLUMBIA HEIGHTS
FRIDLEY
CITY WATERWORKS
MINNEAPOLIS
NORTHERN ORDANANCE PLANT



GREAT RIVER ENVIRO

UPPER MIS

(POOL 1-MILE



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 1–MILE 845 TO MILE 860)

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

FS = Side channel modification for fish and wildlife

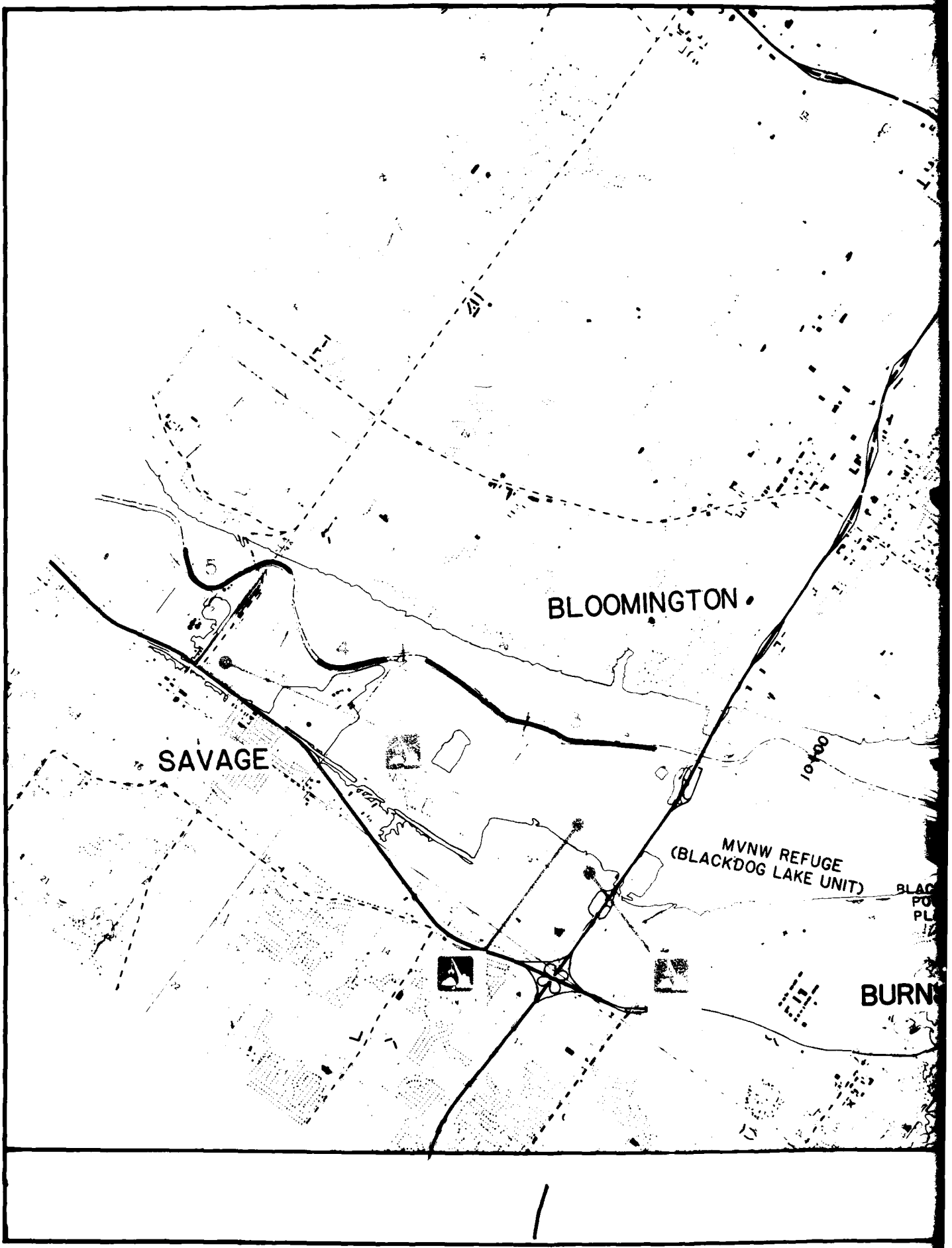
RS = Side channel modification for recreation

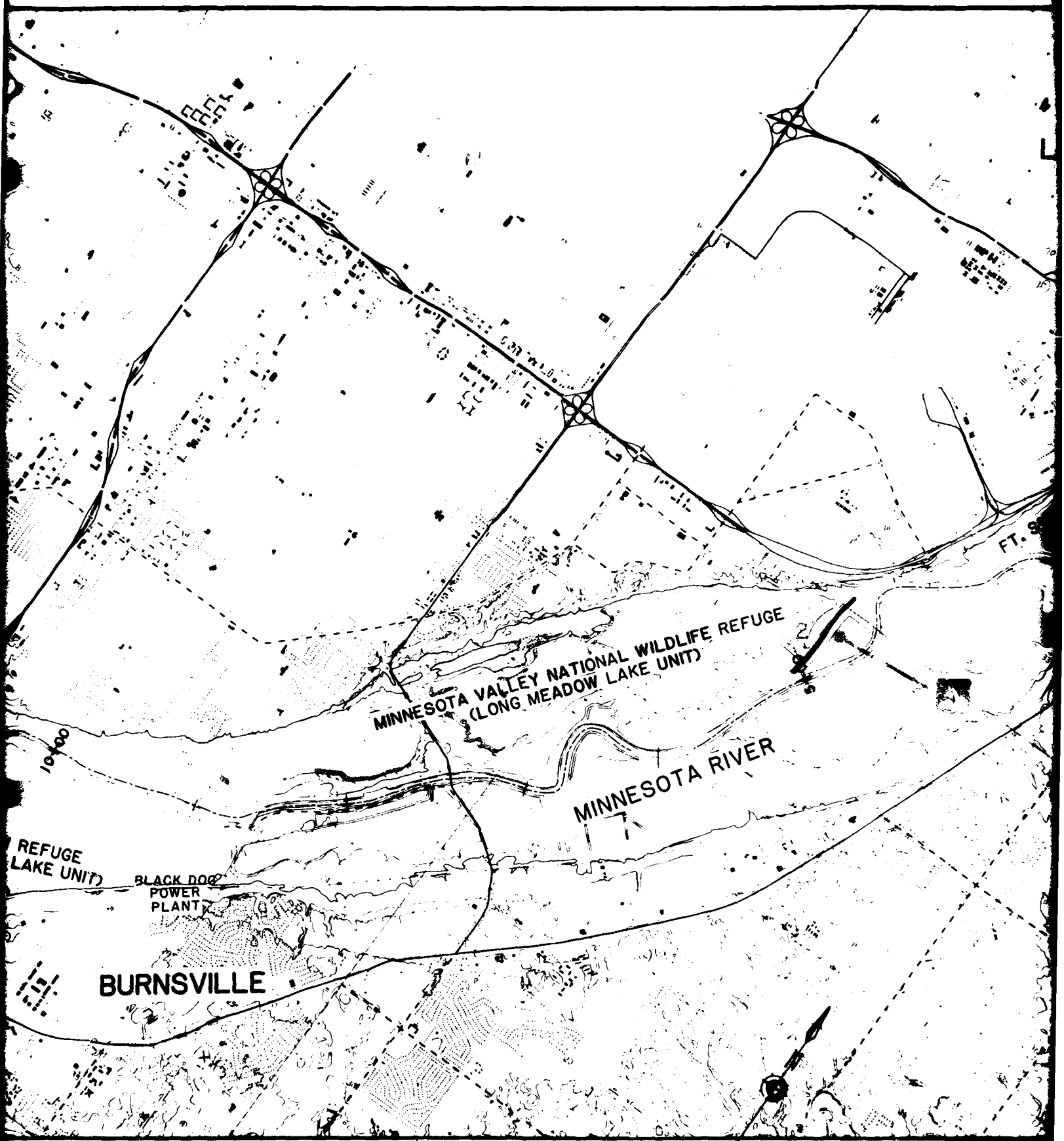
C = Water control culverts

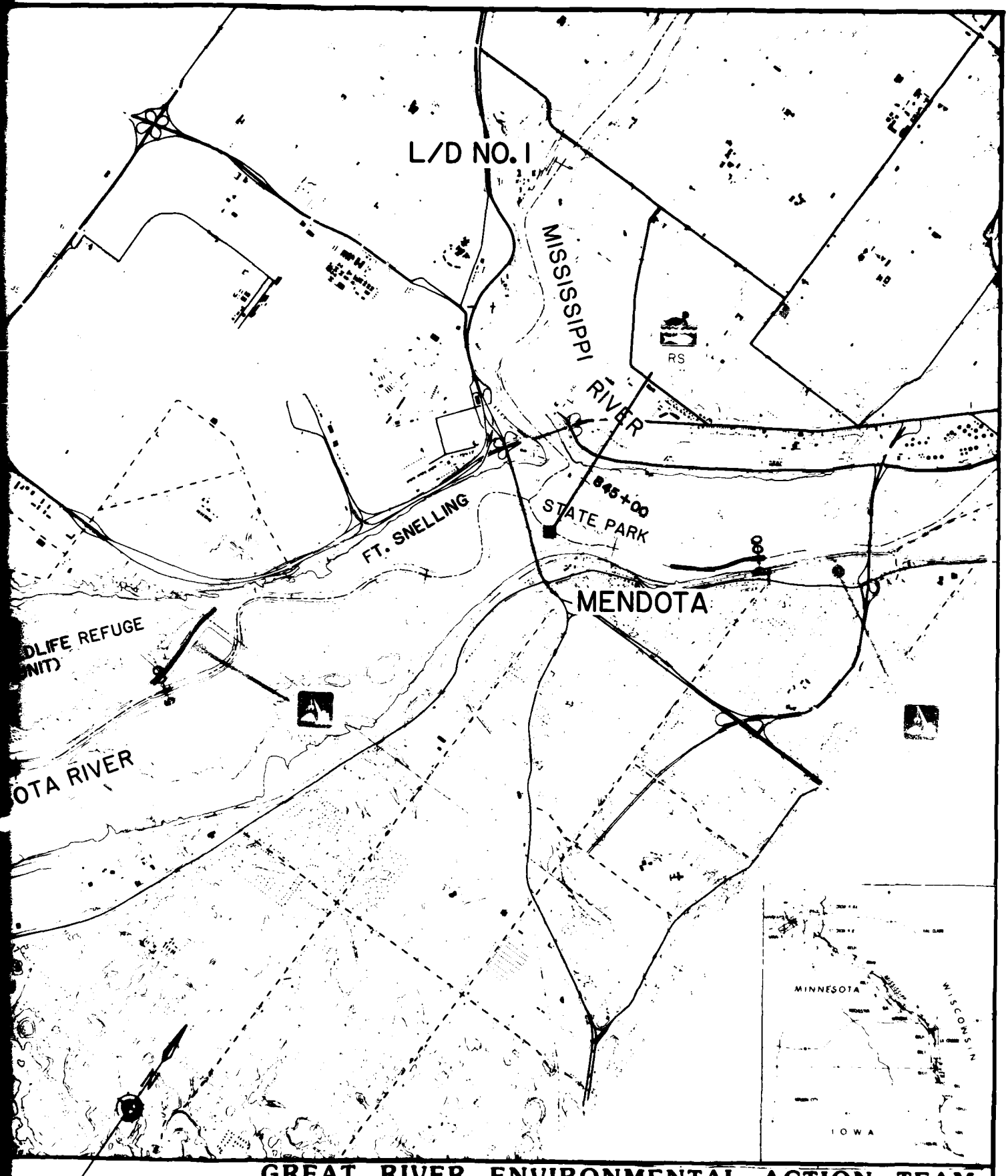
SP = Shoreline protection

SCALE: 1" = 4,000'

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929


BLOOMINGTON
SAVAGE
MVNW REFUGE
(BLACKDOG LAKE UNIT)
5
10
35


MINNESOTA VALLEY NATIONAL WILDLIFE REFUGE
(LONG MEADOW LAKE UNIT)
MINNESOTA RIVER
REFUGE
LAKE UNIT)
BLACK DOG
POWER
PLANT
BURNSVILLE
GREAT R

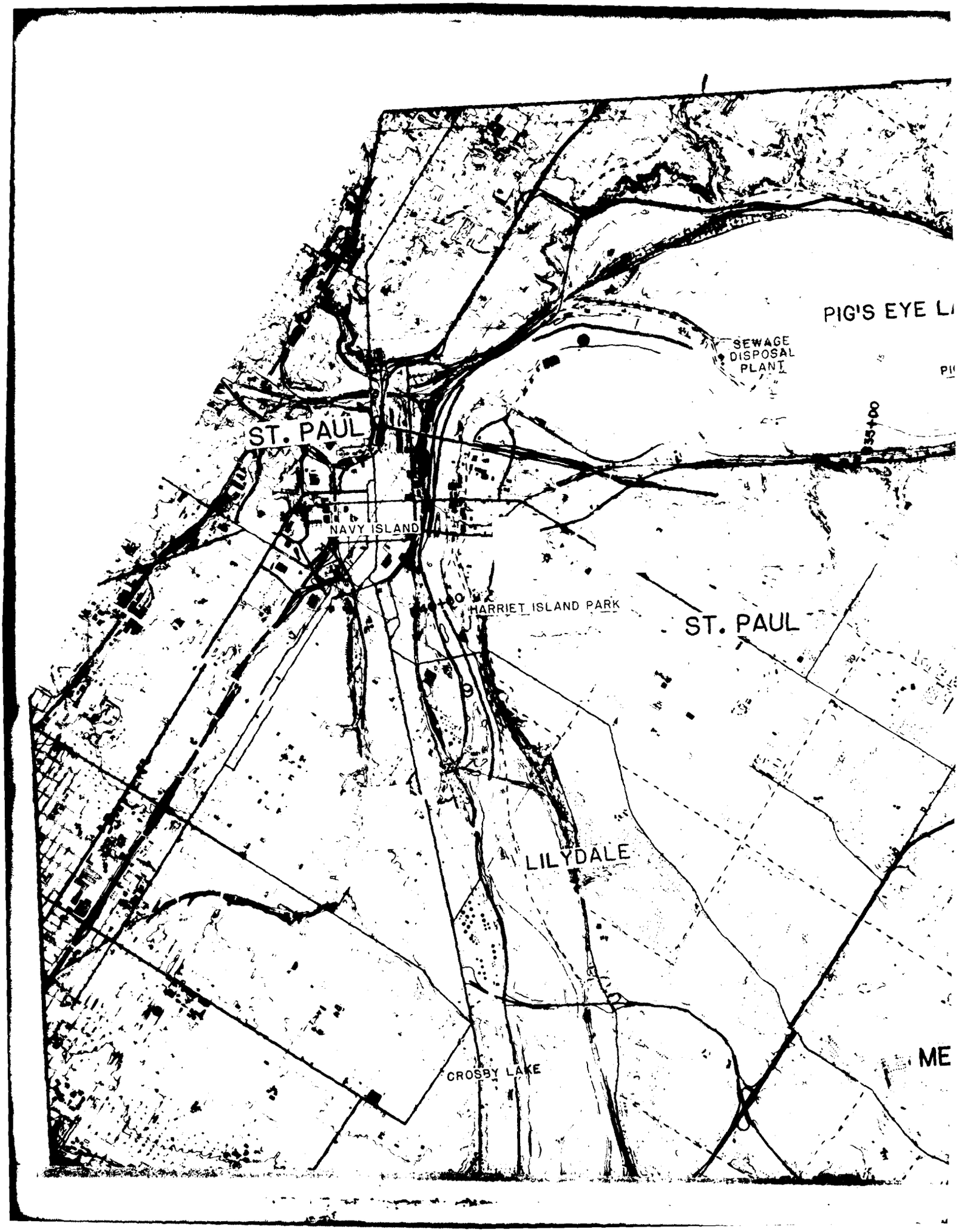


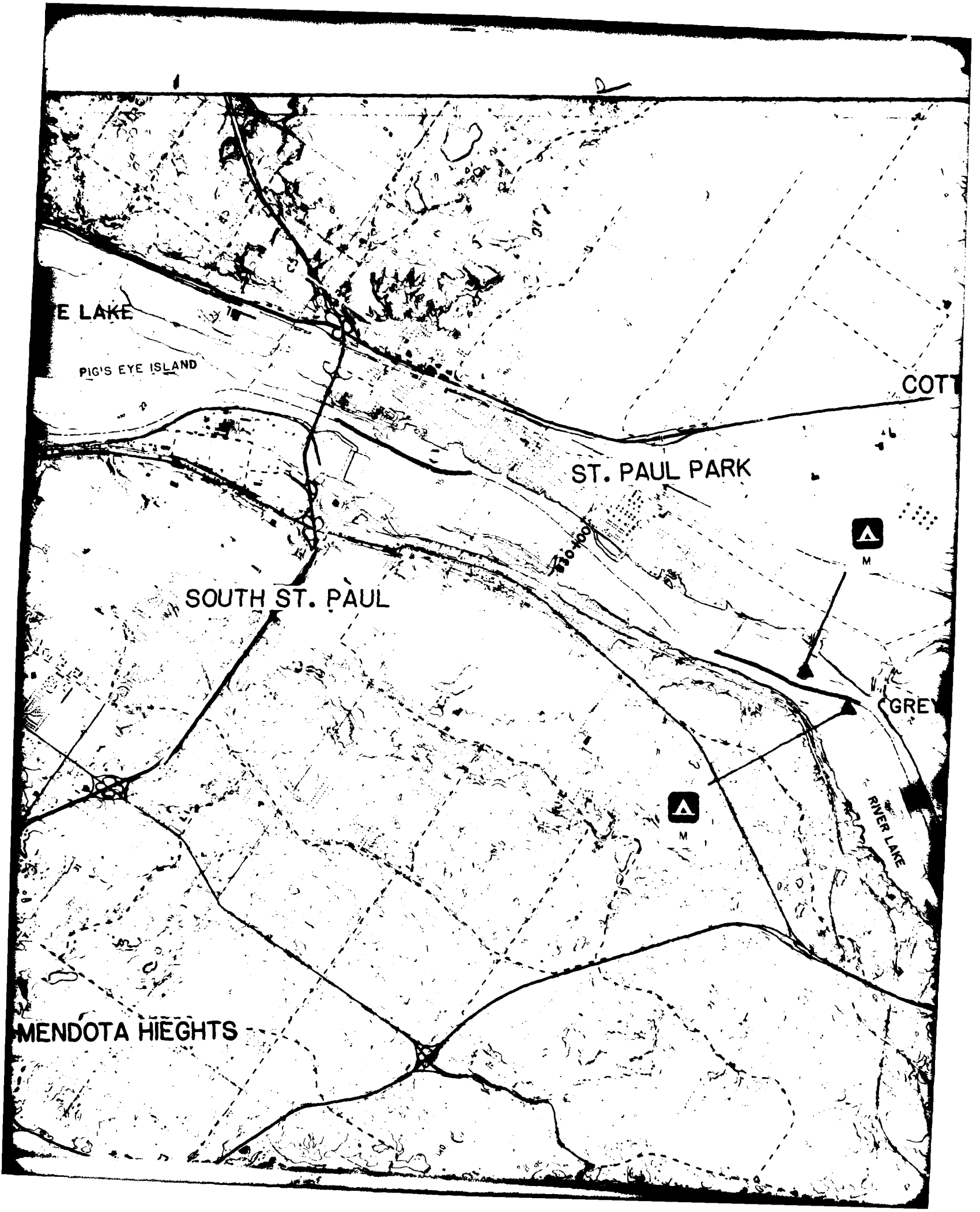
GREAT RIVER ENVIRONMENTAL ACTION TEAM

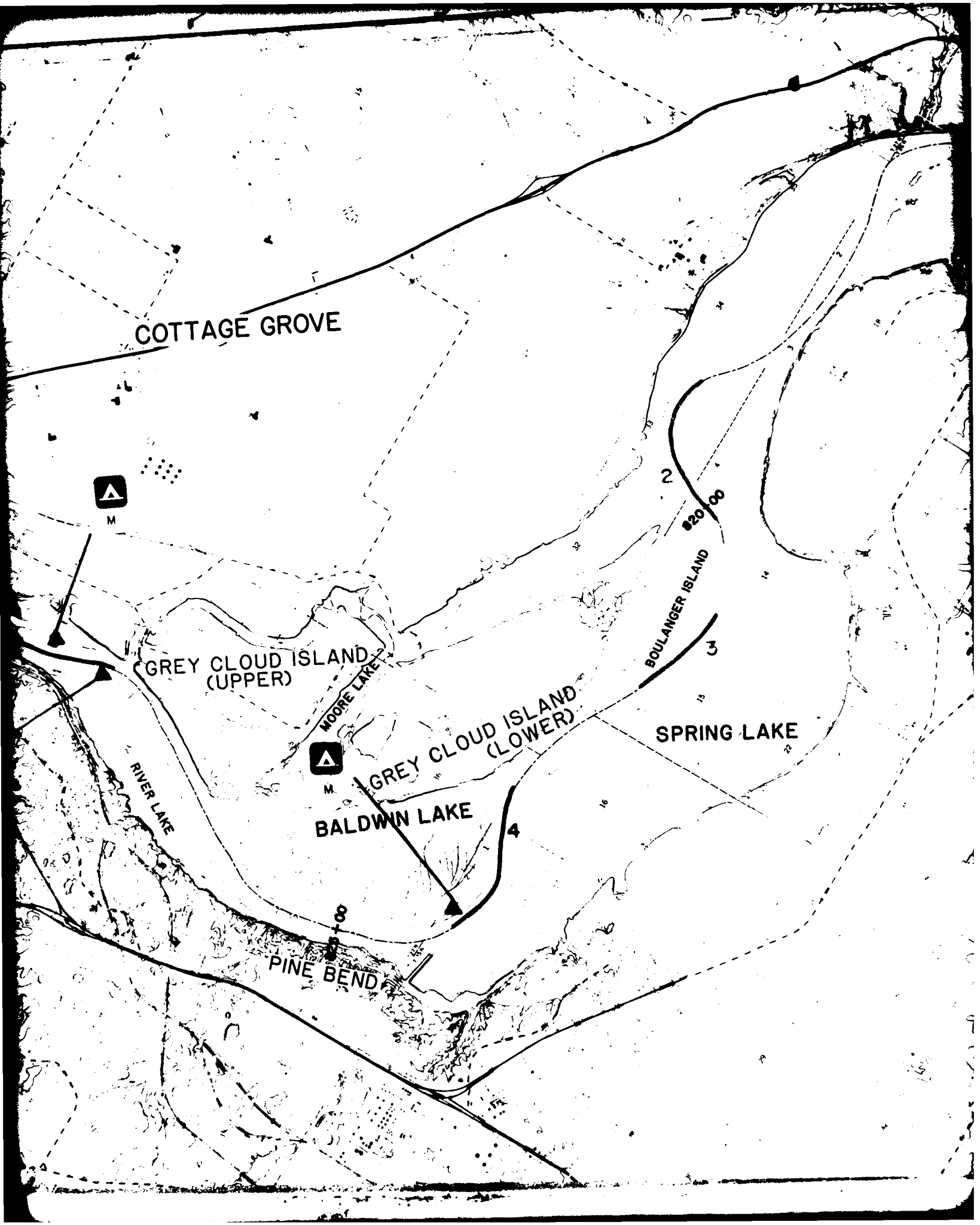
MINNESOTA RIVER

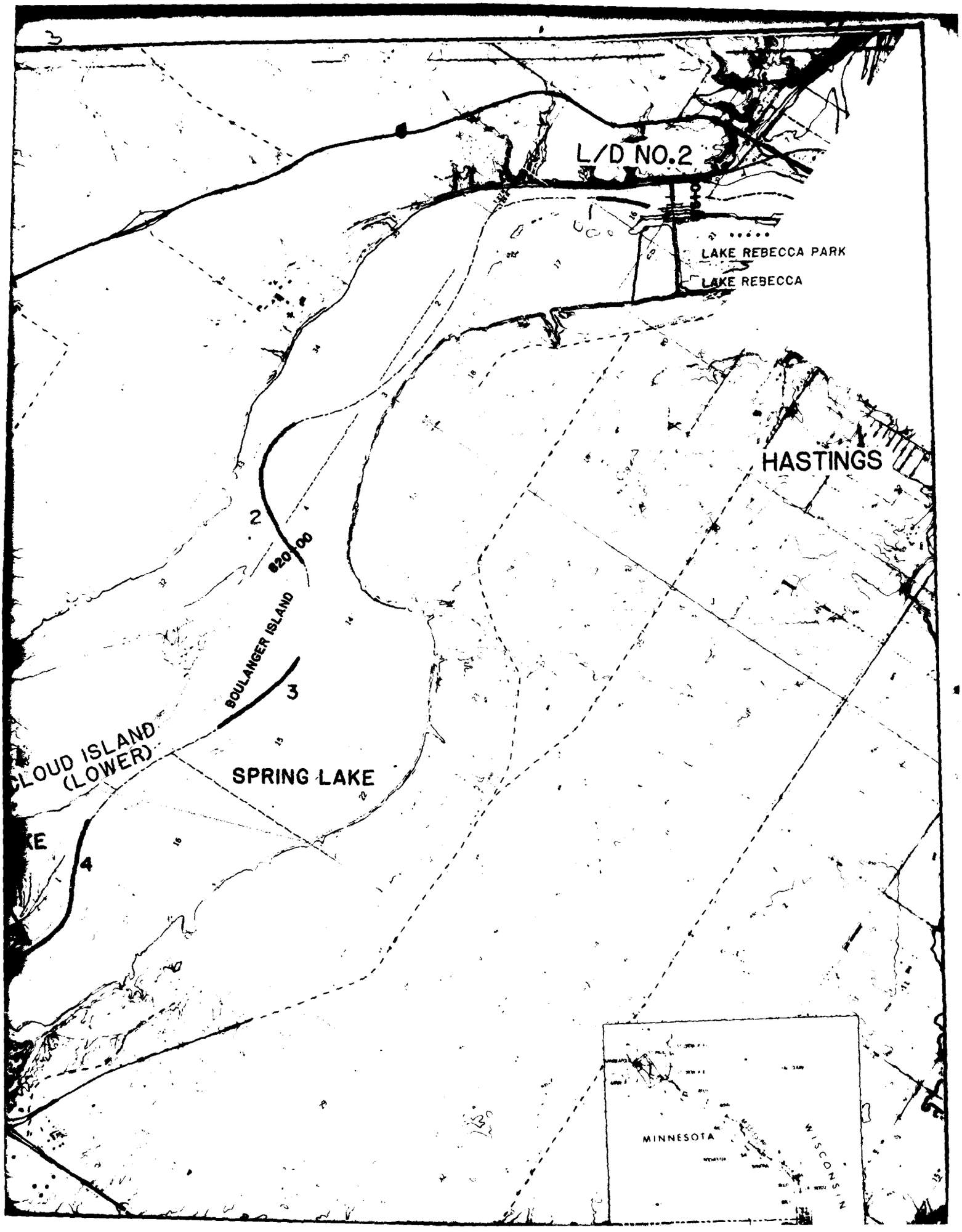
(MILE 0 TO MILE 15)

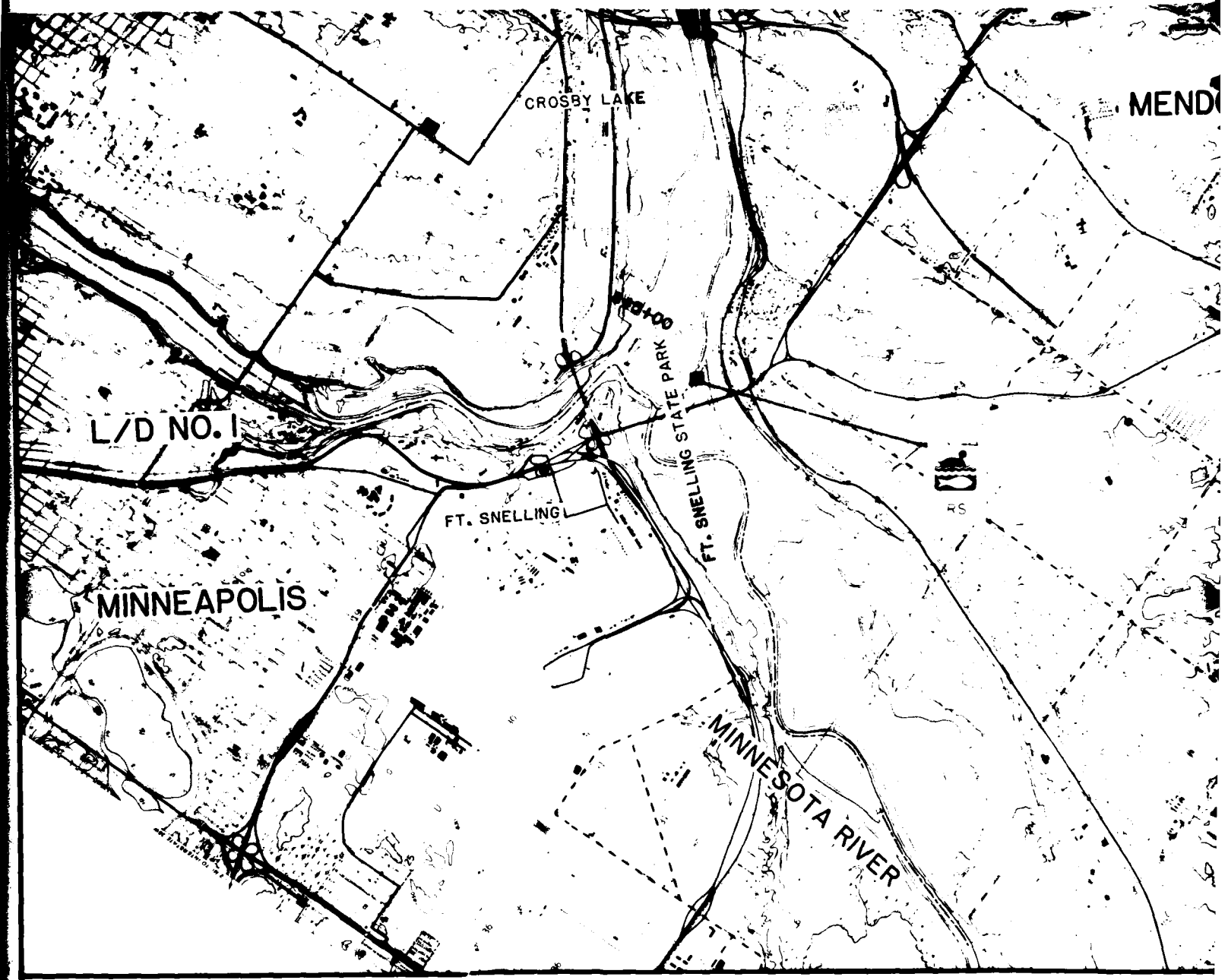
3

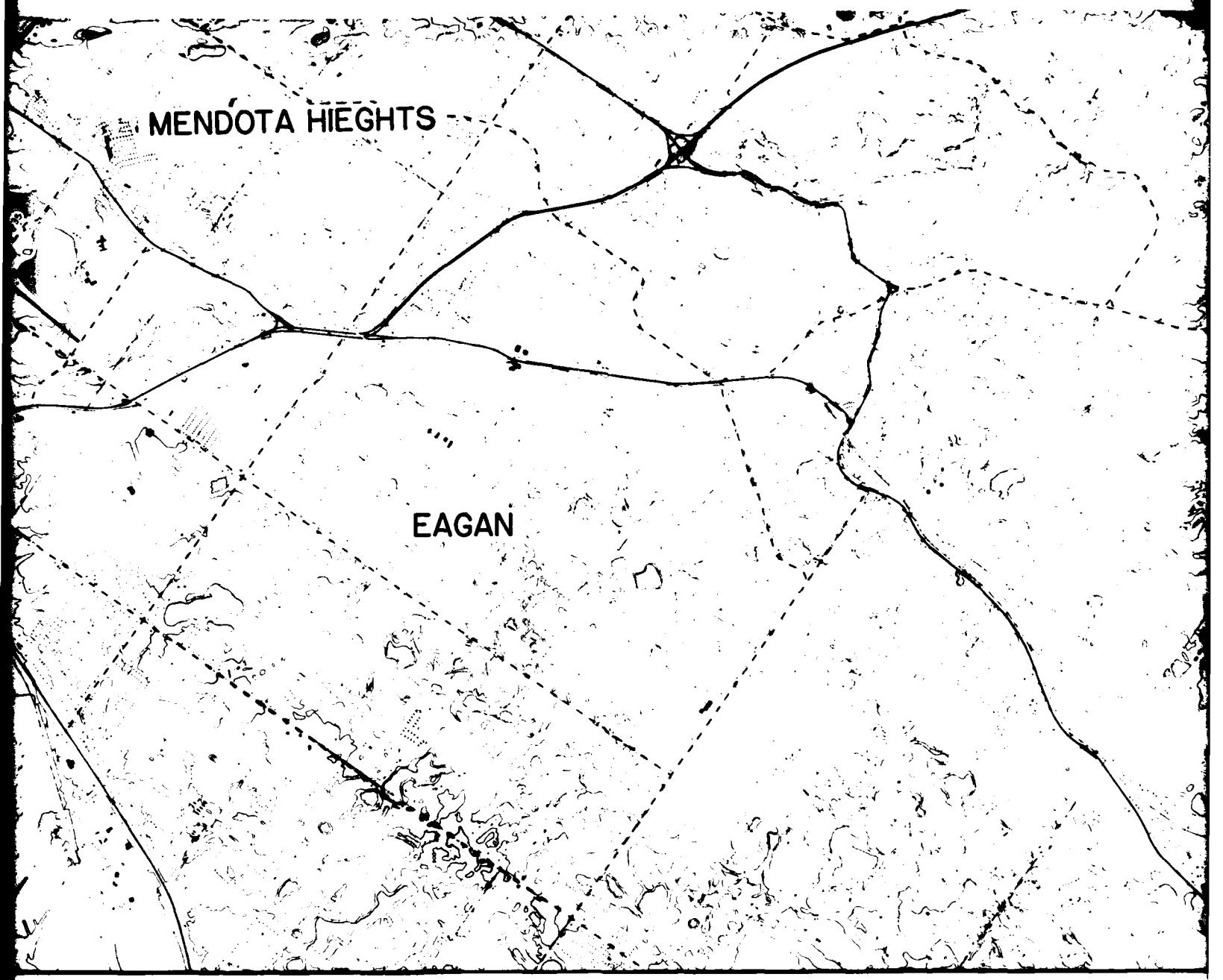

PIG'S EYE LI
SEWAGE
DISPOSAL
PLANT
ST. PAUL
NAVY ISLAND
HARRIET ISLAND PARK
ST. PAUL
LILYDALE
CROSBY LAKE
ME

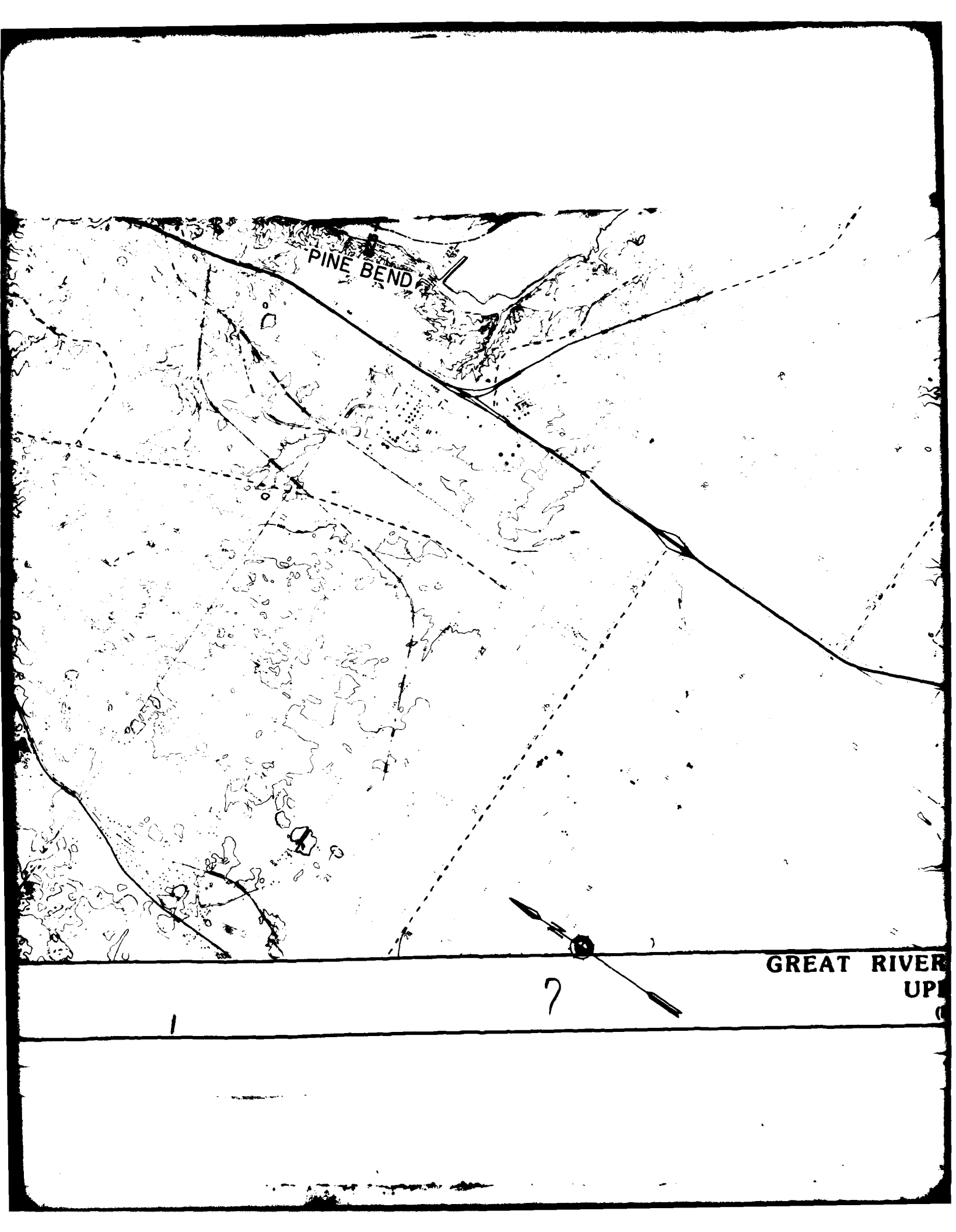

E LAKE
PIG'S EYE ISLAND
COTT
ST. PAUL PARK
SOUTH ST. PAUL
GREY
RIVER LAKE
MENDOTA HIEGHTS

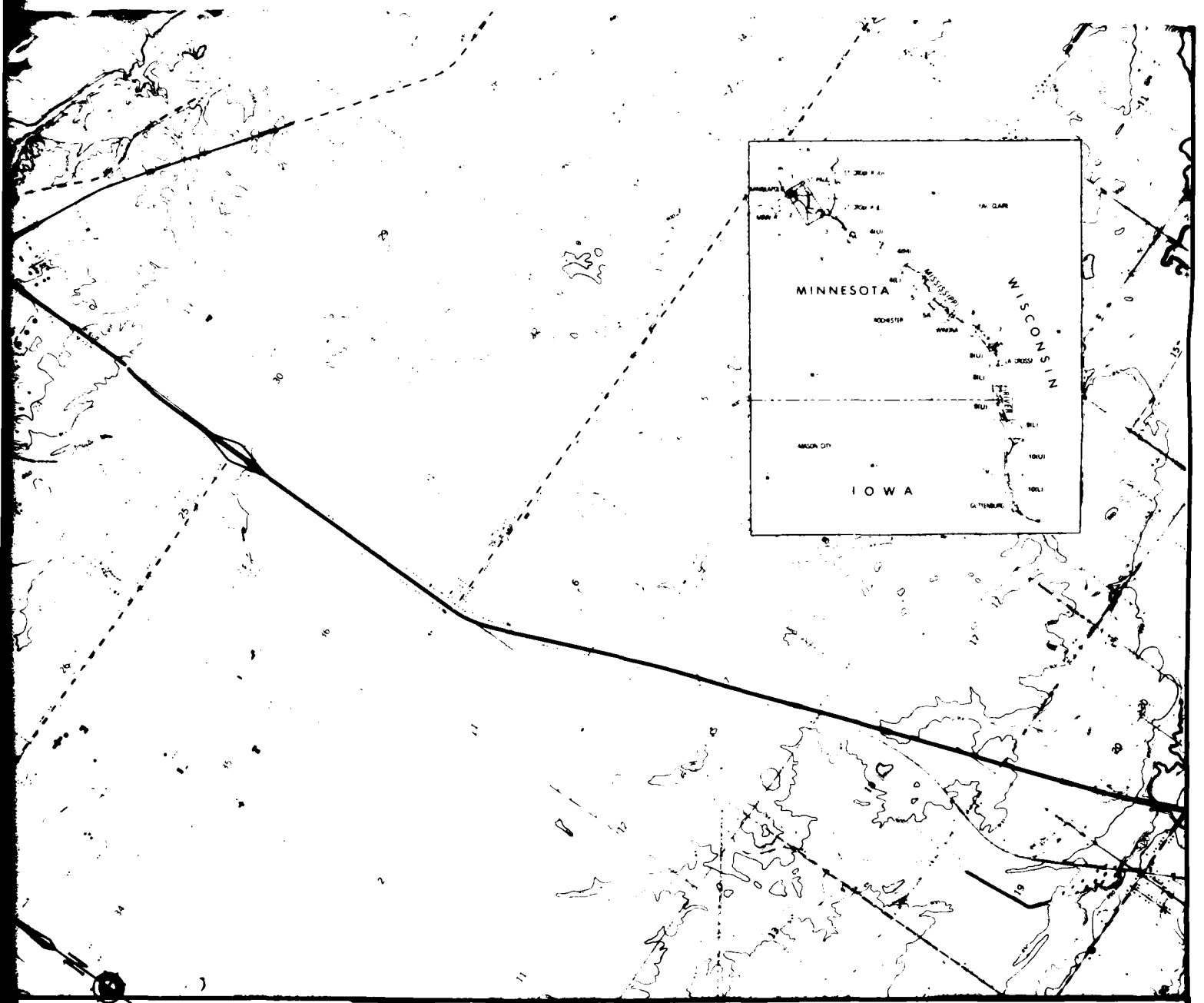

COTTAGE GROVE
GREY CLOUD ISLAND (UPPER)
MOORE LAKE
GREY CLOUD ISLAND (LOWER)
BOULANGER ISLAND
SPRING LAKE
RIVER LAKE
BALDWIN LAKE
PINE BEND
M
M
2
3
4
8


L/D NO.2
LAKE REBECCA PARK
LAKE REBECCA
HASTINGS
2
$20.00
BOULANGER ISLAND
3
CLOUD ISLAND
(LOWER)
SPRING LAKE
4
MINNESOTA
WISCONSIN


CROSBY LAKE
MEND
L/D NO. 1
FT. SNELLING
FT. SNELLING STATE PARK
MINNEAPOLIS
MINNESOTA RIVER
RS


MENDOTA HIEGHTS
EAGAN


PINE BEND
GREAT RIVER
UP
7
1



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 2–MILE 815 TO MILE 848)

7

LEGEND

FLOODPLAIN

RECREATION

RW

Primitive camping areas

Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

FS

Project location

Type of project

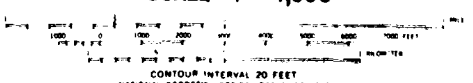
FS = Side channel modification for fish and wildlife

RS = Side channel modification for recreation

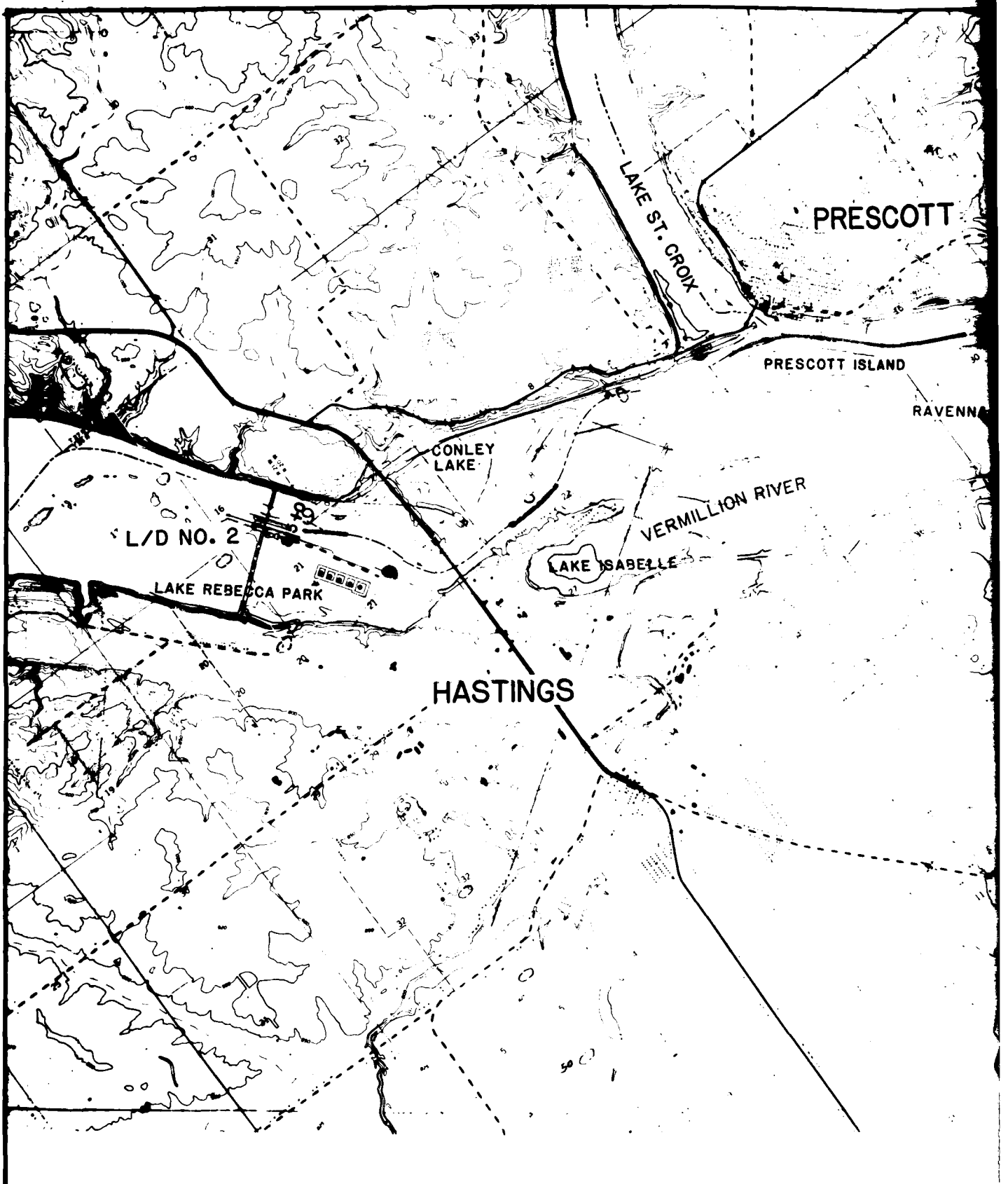
C = Water control culverts

SP = Shoreline protection

SCALE: 1" = 4,000'



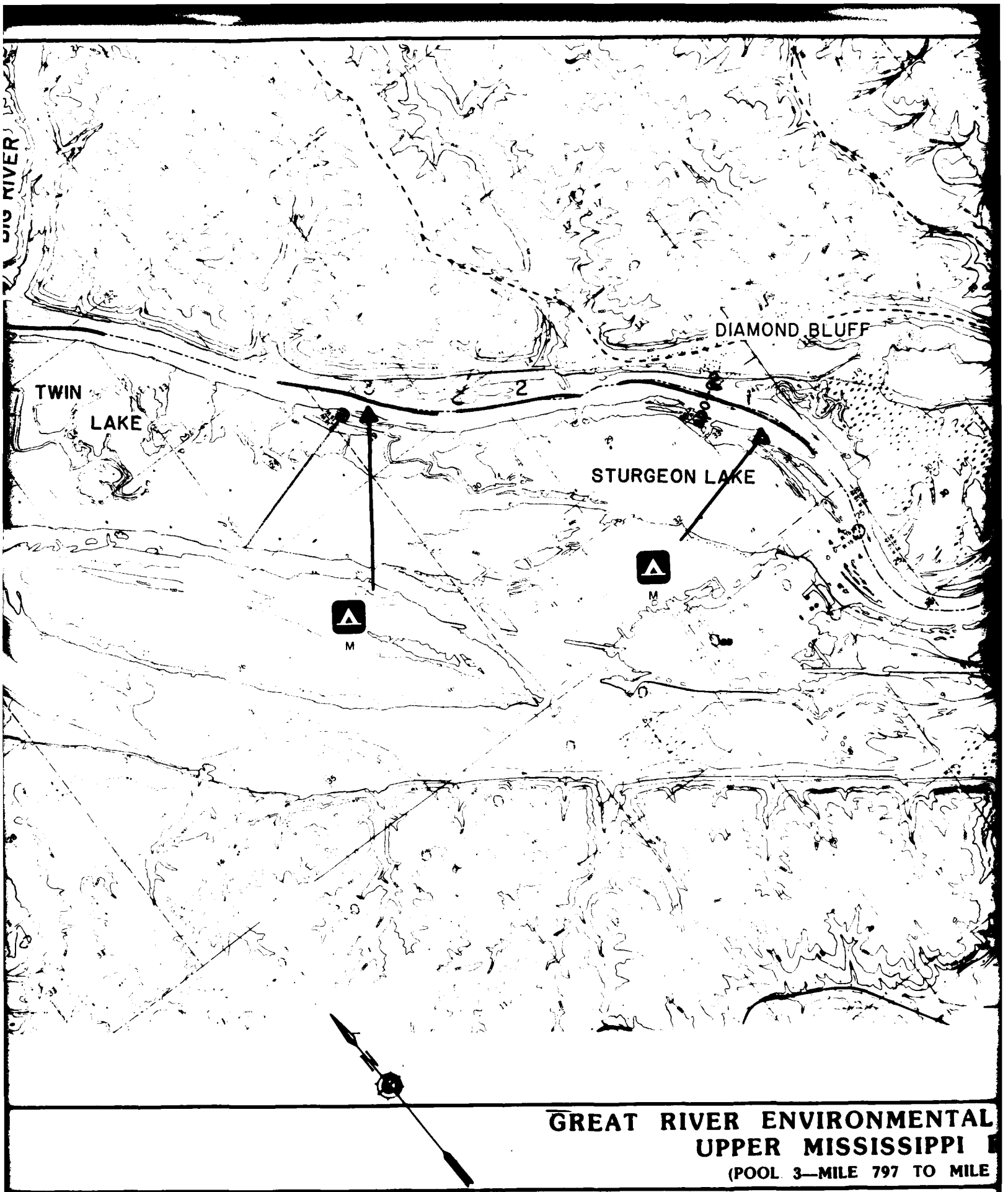
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929


LAKE ST. CROIX
PRESCOTT
PRESCOTT ISLAND
RAVENNA
CONLEY LAKE
VERMILLION RIVER
L/D NO. 2
LAKE ISABELLE
LAKE REBECCA PARK
HASTINGS

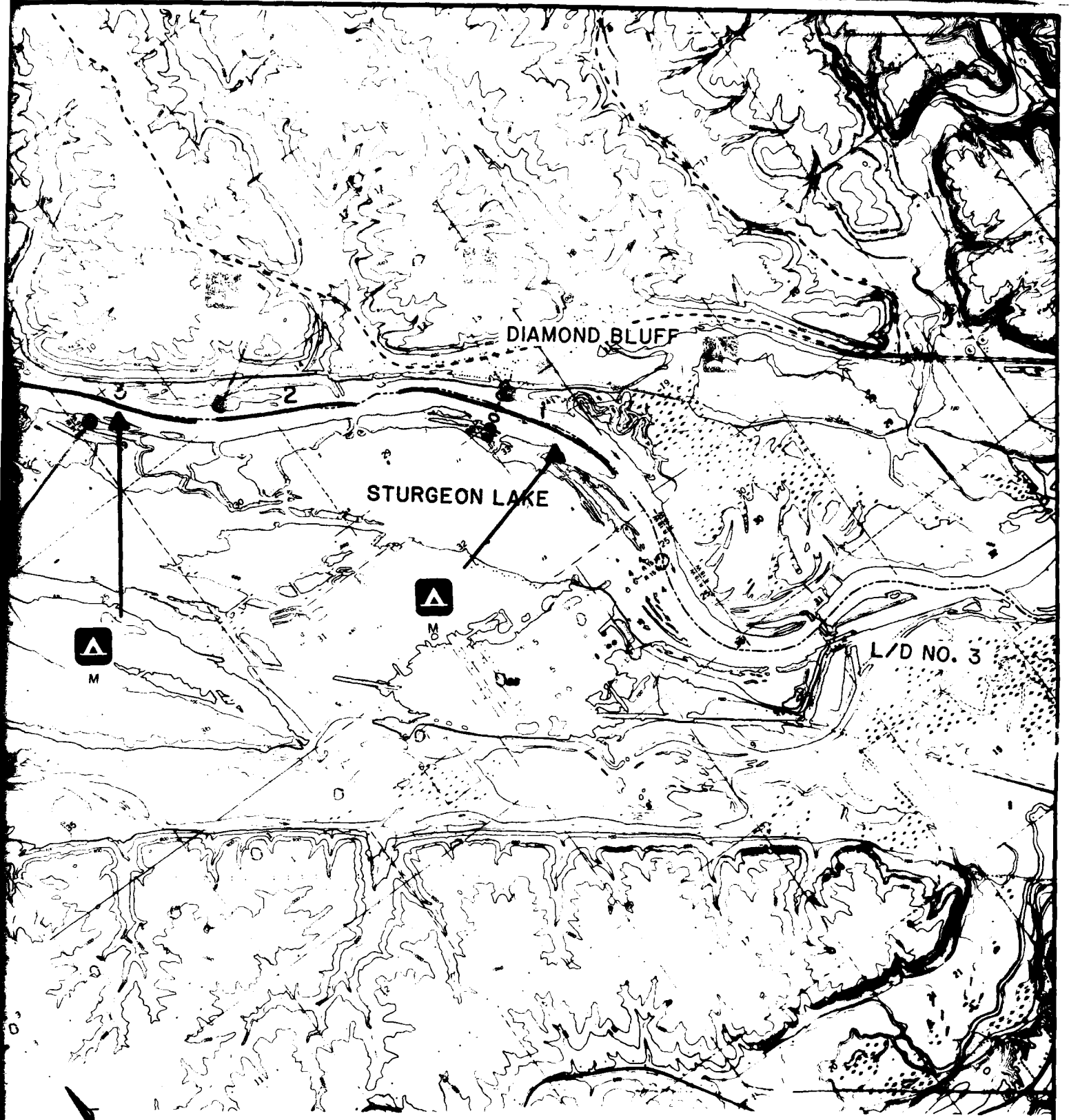
RESCOTT
DRY RUN SLOUGH
BIG RIVER
CARTER SLOUGH
TRUEDALE SLOUGH
ISLAND
RAVENNA WILDLIFE MANAGEMENT AREA
GORES WILDLIFE MANAGEMENT AREA
TWIN
LAK
VERMILLION RIVER
M
M
MINNESOTA
WISCONSIN
IOWA

1

2



GREAT RIVER ENVIRONMENTAL
UPPER MISSISSIPPI
(POOL 3—MILE 797 TO MILE



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 3—MILE 797 TO MILE 816)

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECOMMENDED CHANNEL MAINTENANCE PLAN

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

FS = Side channel modification for fish and wildlife

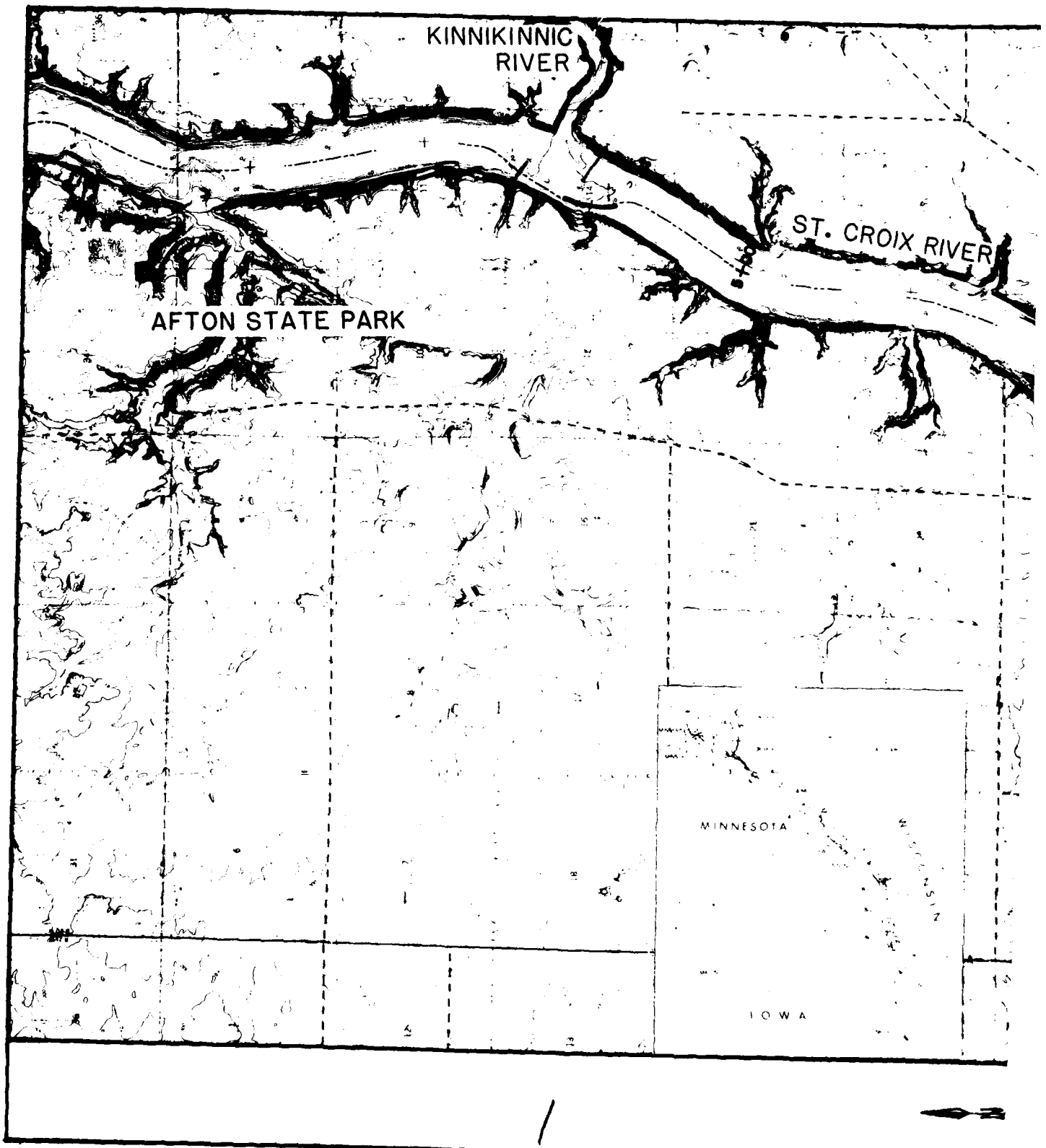
RS = Side channel modification for recreation

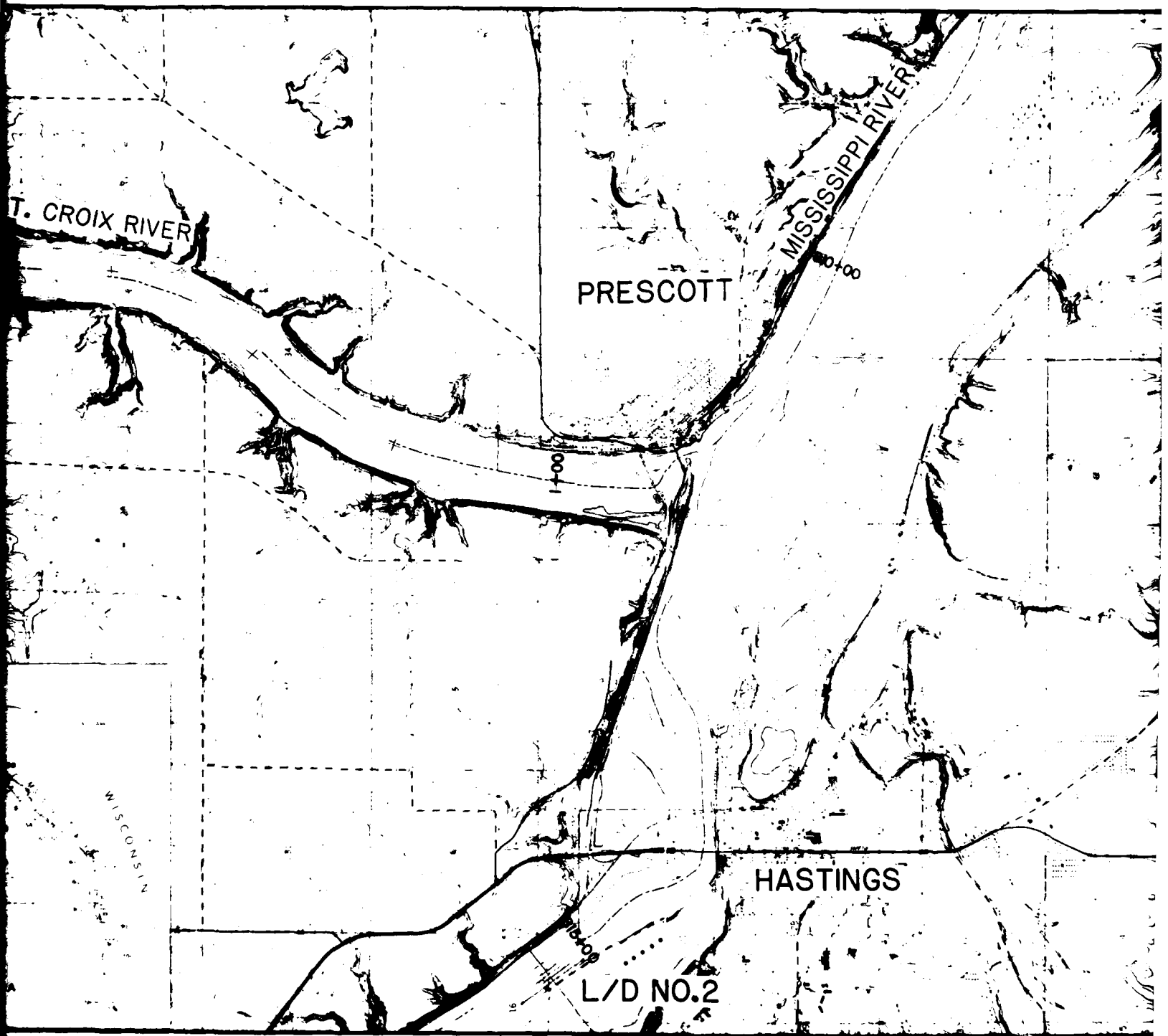
C = Water control culverts

SP = Shoreline protection

SCALE: 1" = 4,000'

CONTOUR INTERVAL 20 FEET

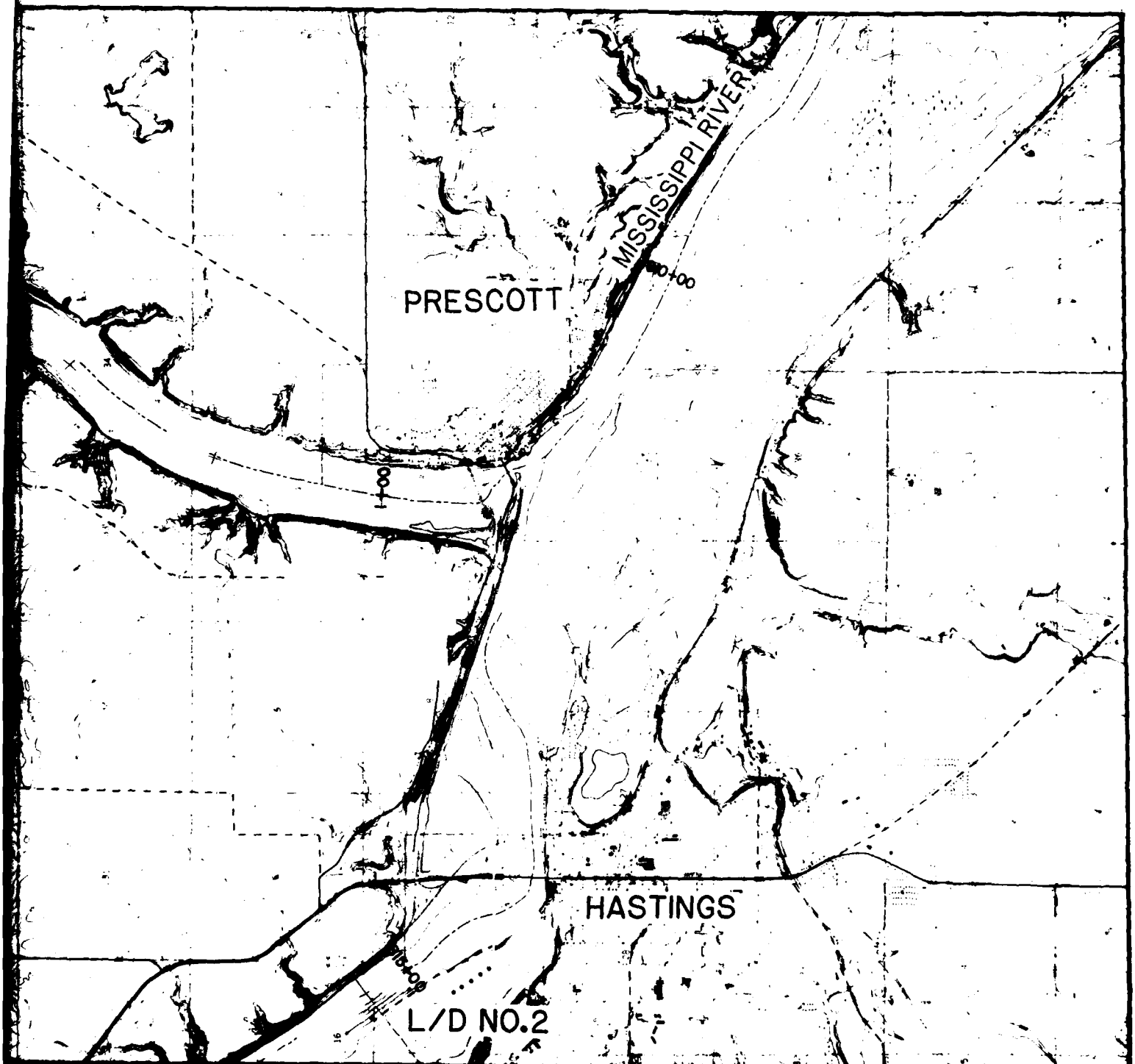

KINNIKINNIC
RIVER
ST. CROIX RIVER
AFTON STATE PARK
MINNESOTA
IOWA



GREAT RIVER ENVIRONMENTAL ACTION

ST. CROIX RIVER (L)

(MILE 0 TO MILE 9)



GREAT RIVER ENVIRONMENTAL ACTION TEAM
ST. CROIX RIVER (L)
(MILE 0 TO MILE 9)

LEGEND

[illegible]

RECREATION

Primitive camping areas

Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

Type of project

FS = Side channel modification for fish and wildlife

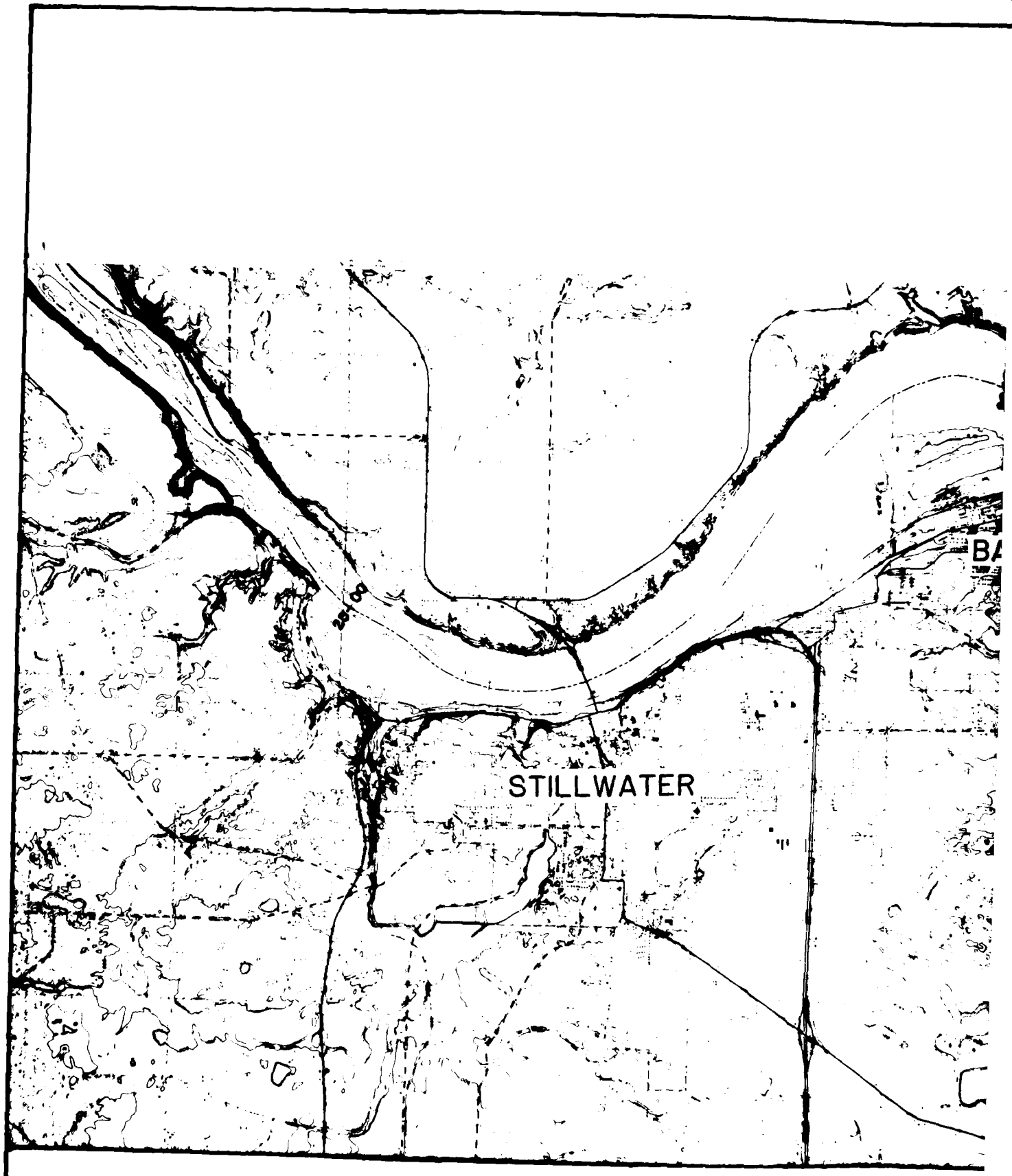
RS = Side channel modification for recreation

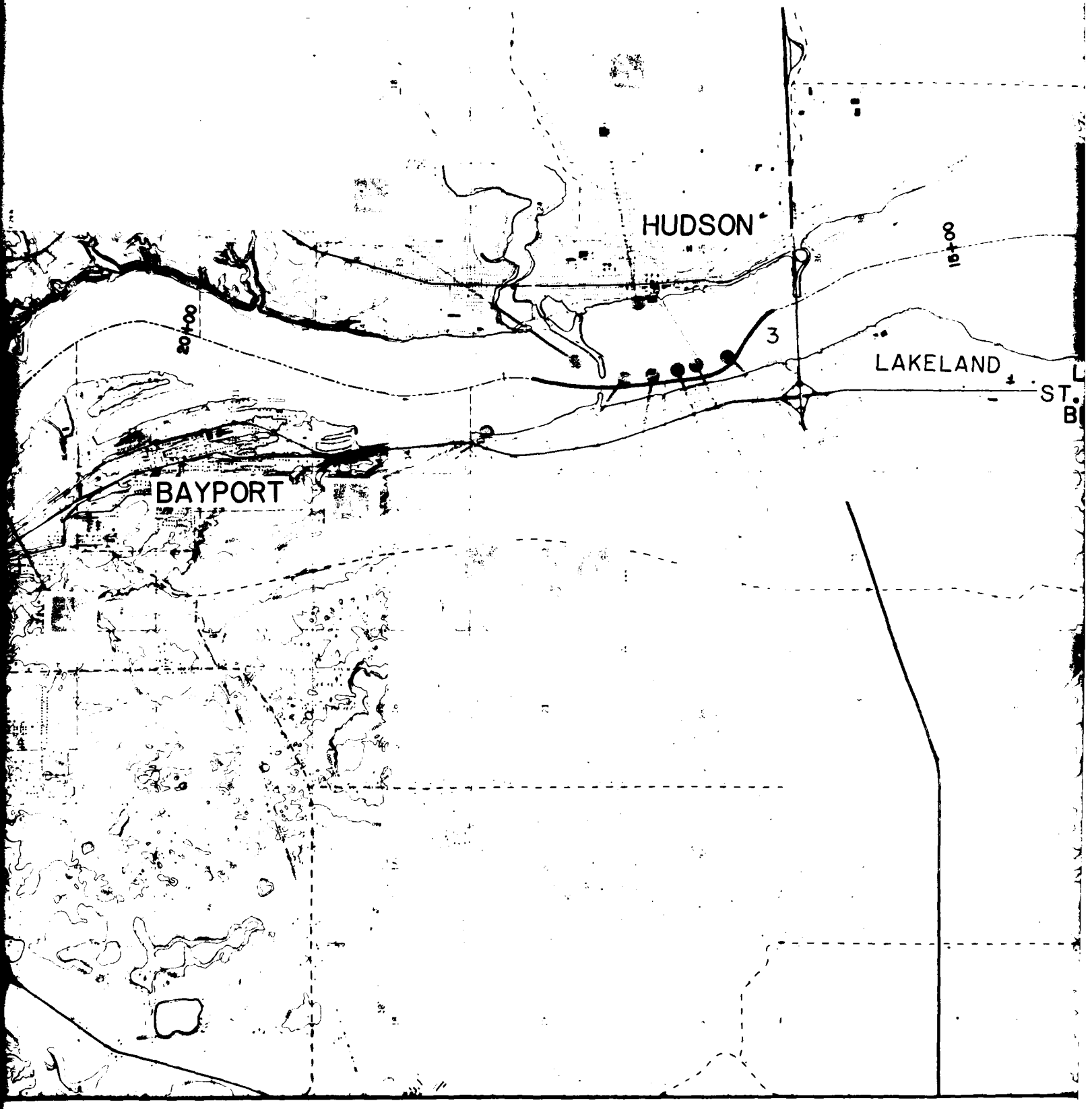
C = Water control culverts

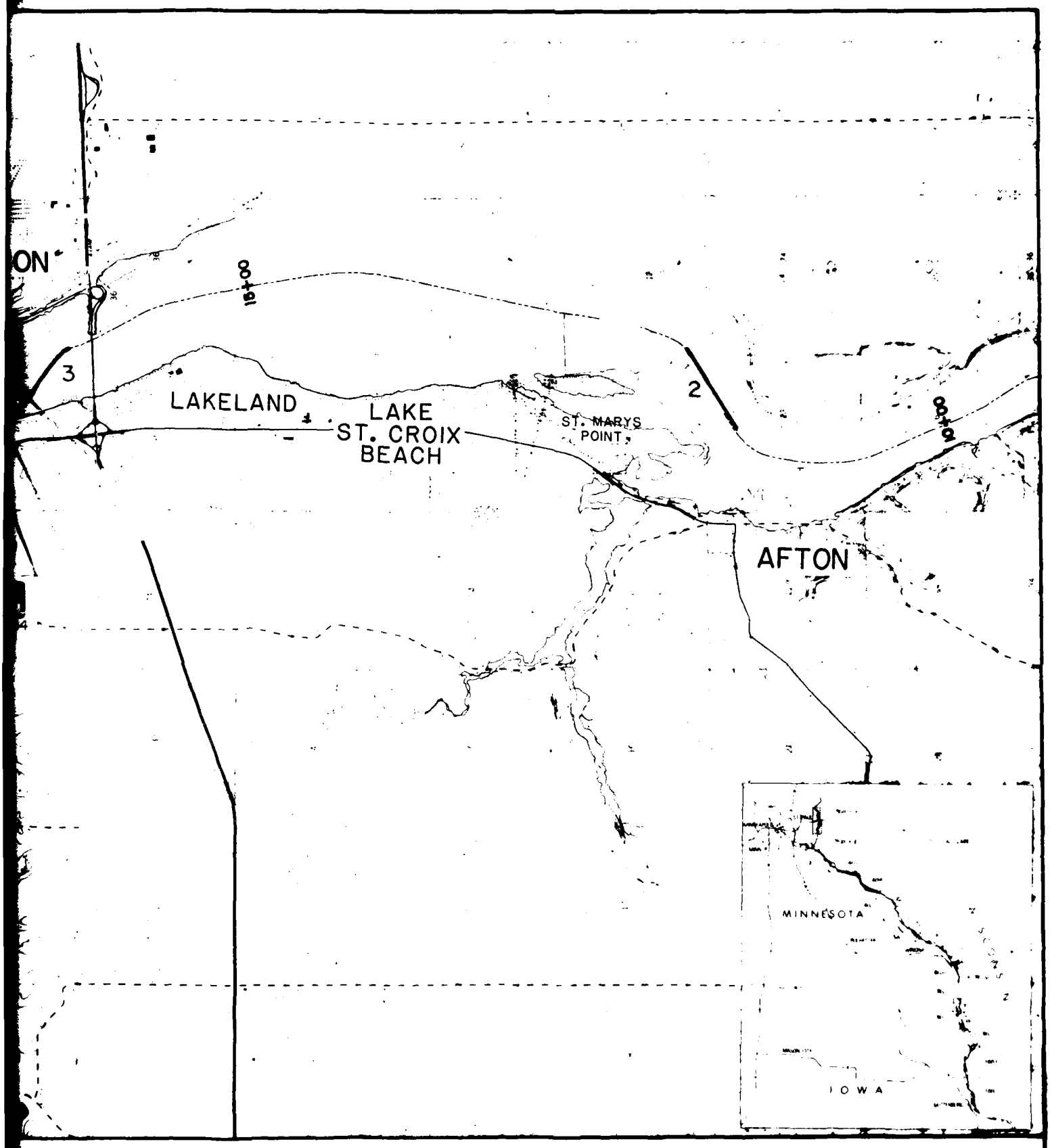
SP = Shoreline protection

SCALE: 1" = 4,000'

[illegible]


STILLWATER


HUDSON
LAKELAND
ST.
BAYPORT
3
GREA1



GREAT RIVER ENVIRONMENTAL ACTION TEAM
ST. CROIX RIVER (U)
(MILE 10 TO MILE 24)

LEGEND

FLOODPLAIN

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

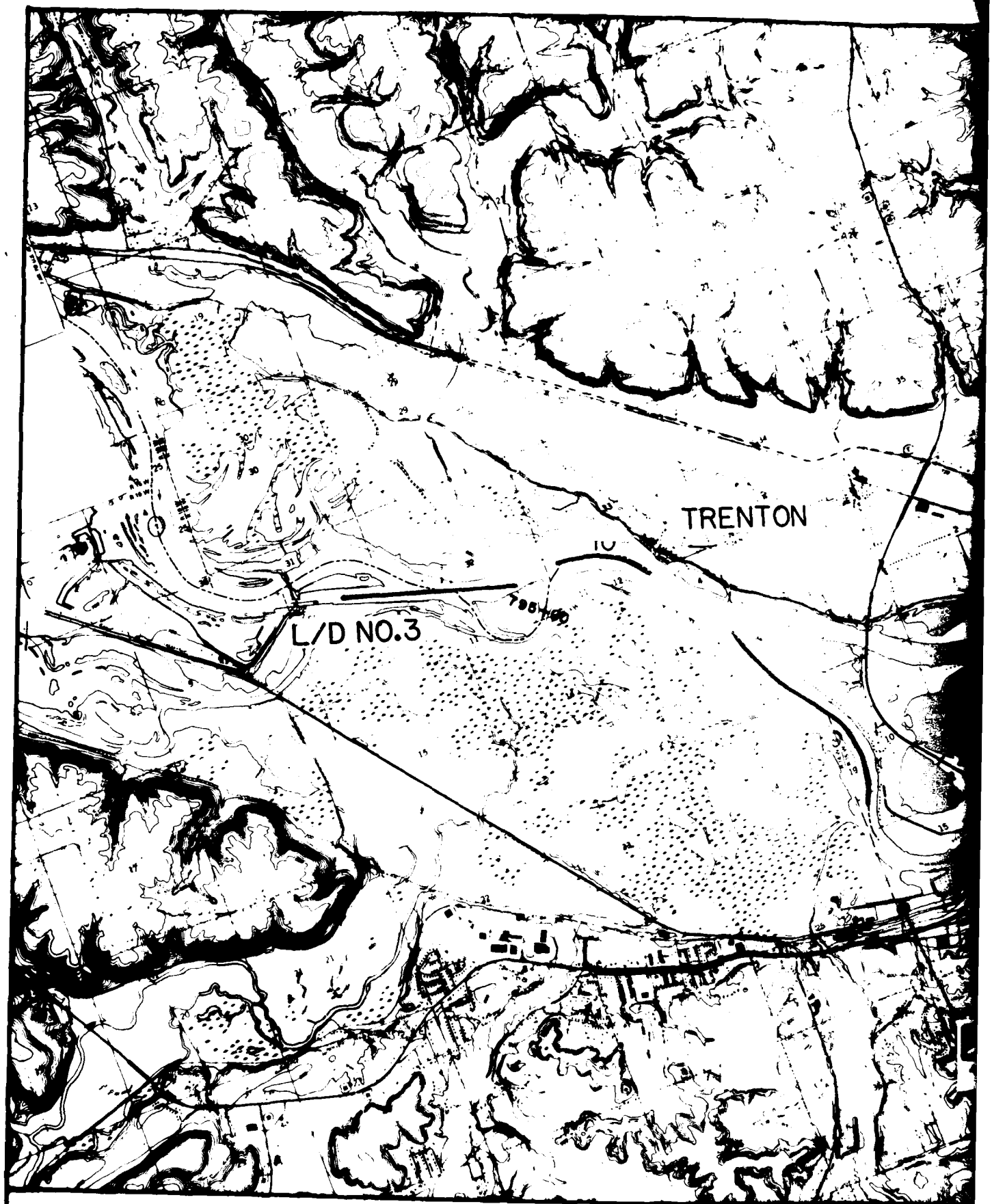
FS = Side channel modification for fish and wildlife

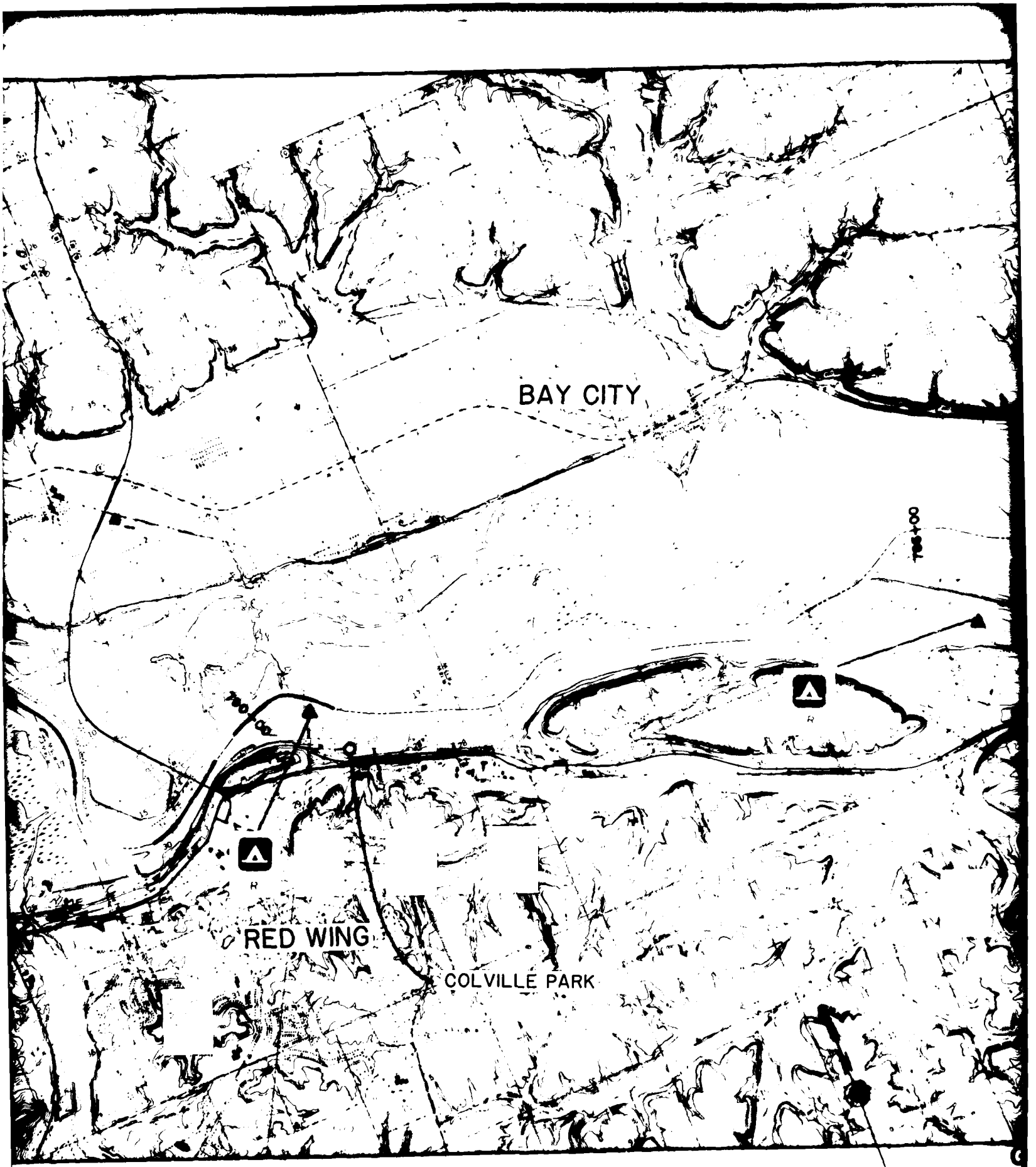
RS = Side channel modification for recreation

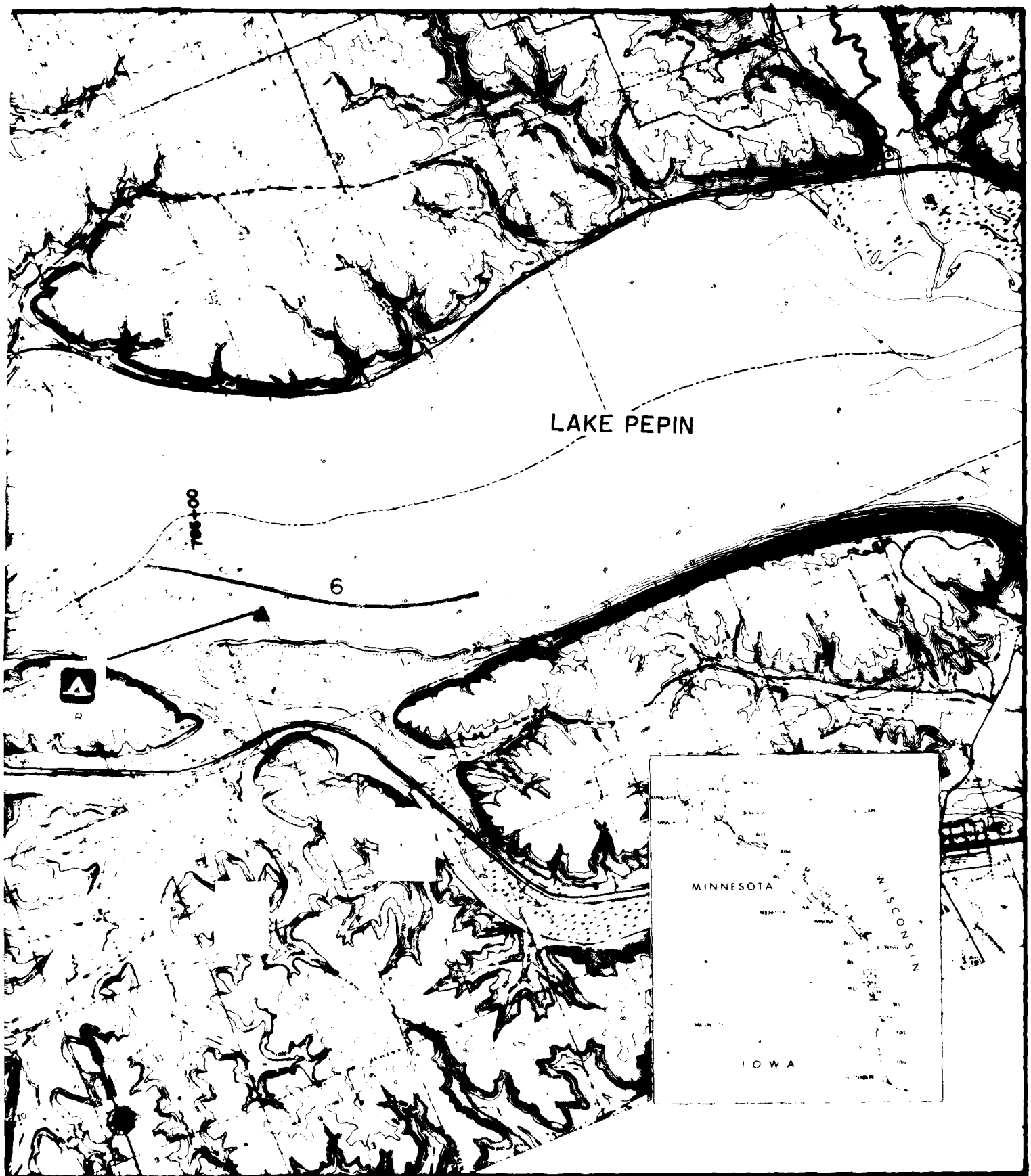
C = Water control culverts

SP = Shoreline protection

SCALE: 1" = 4,000'


TRENTON
L/D NO.3


BAY CITY
RED WING
COLVILLE PARK



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 4(U)—MILE 781 TO MILE 797)

LEGEND

RECREATION

Primitive camping areas

Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional [illegible]

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

Type of project

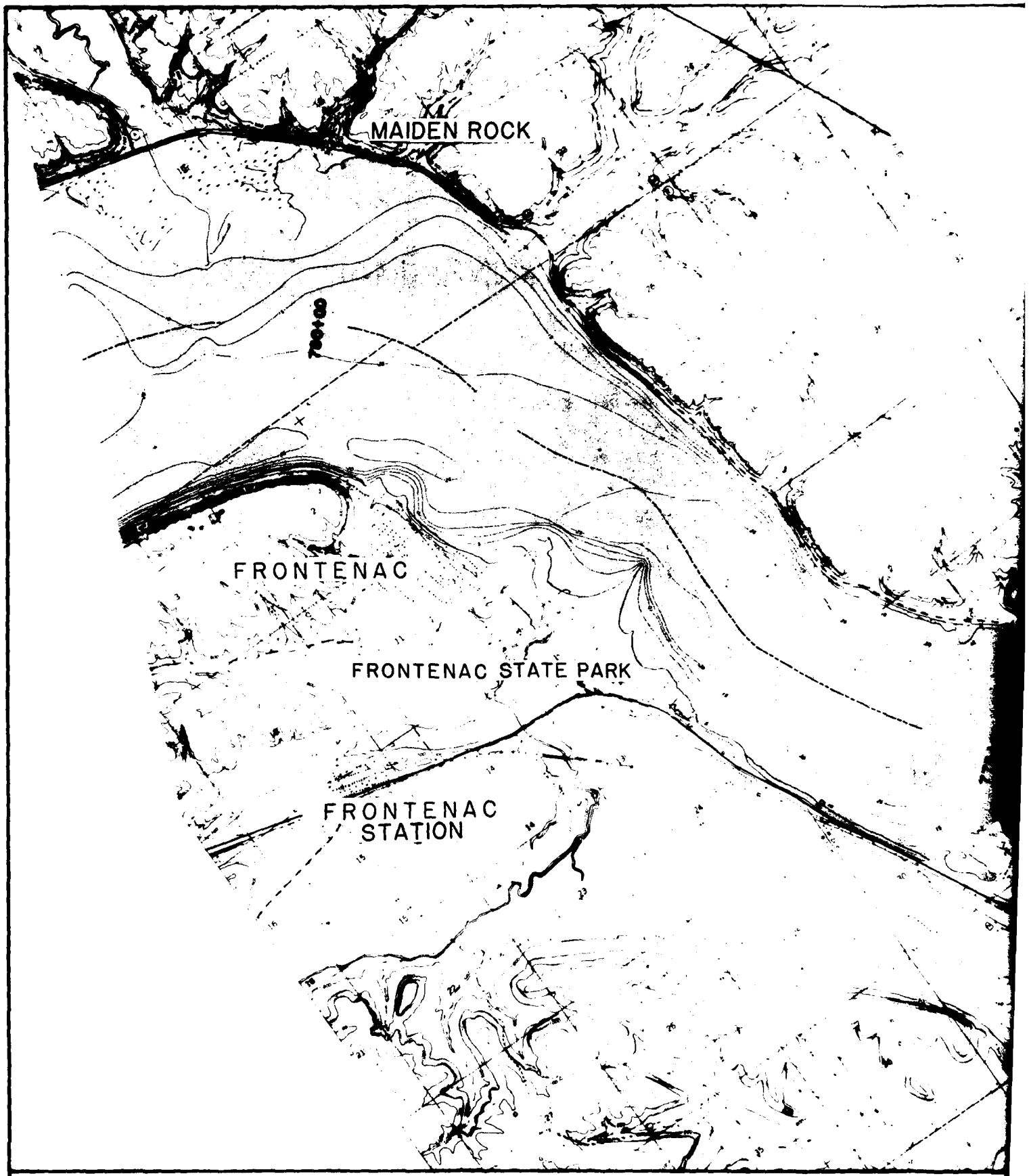
FS = Side channel modification for fish and wildlife

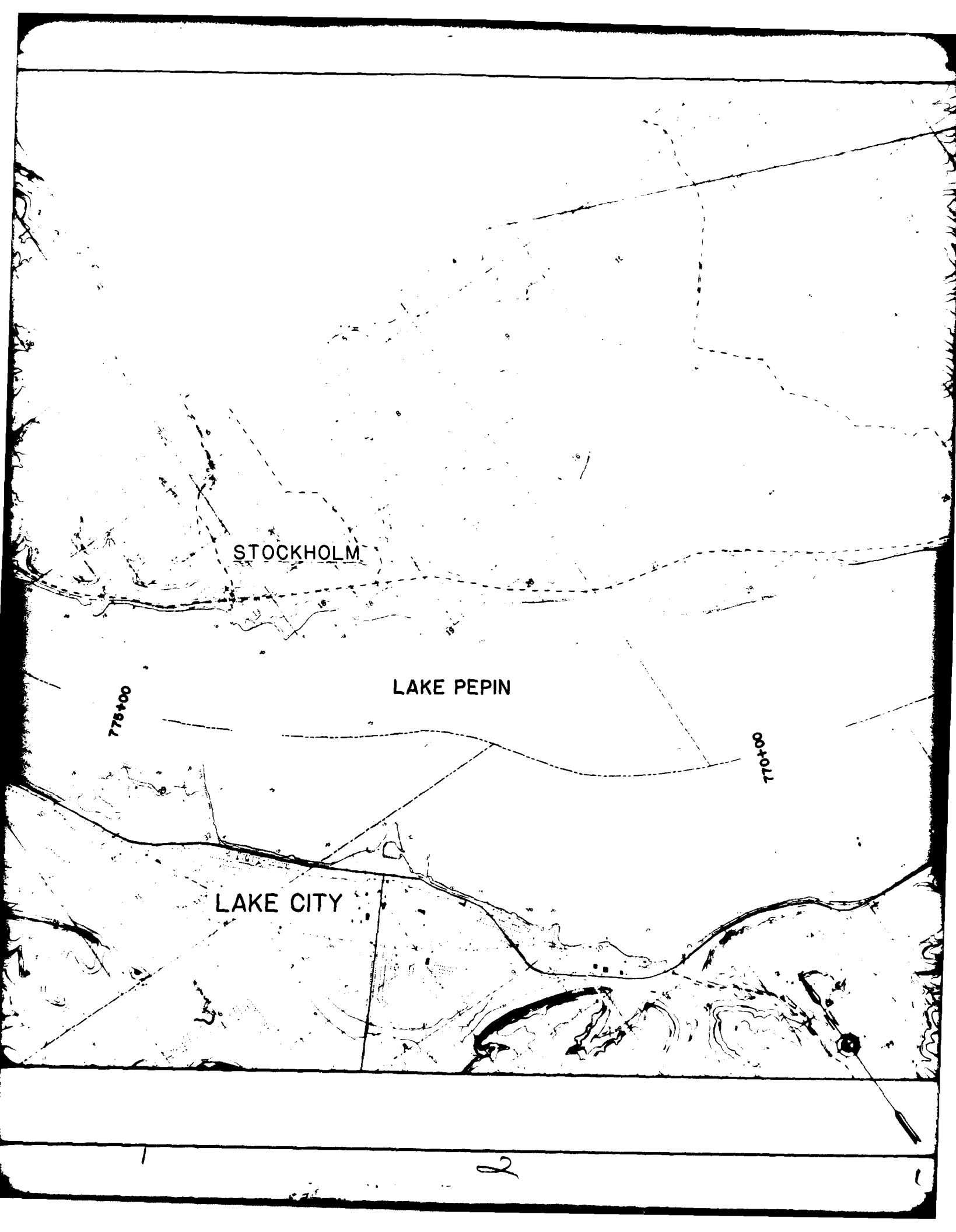
RS = Side channel modification for recreation

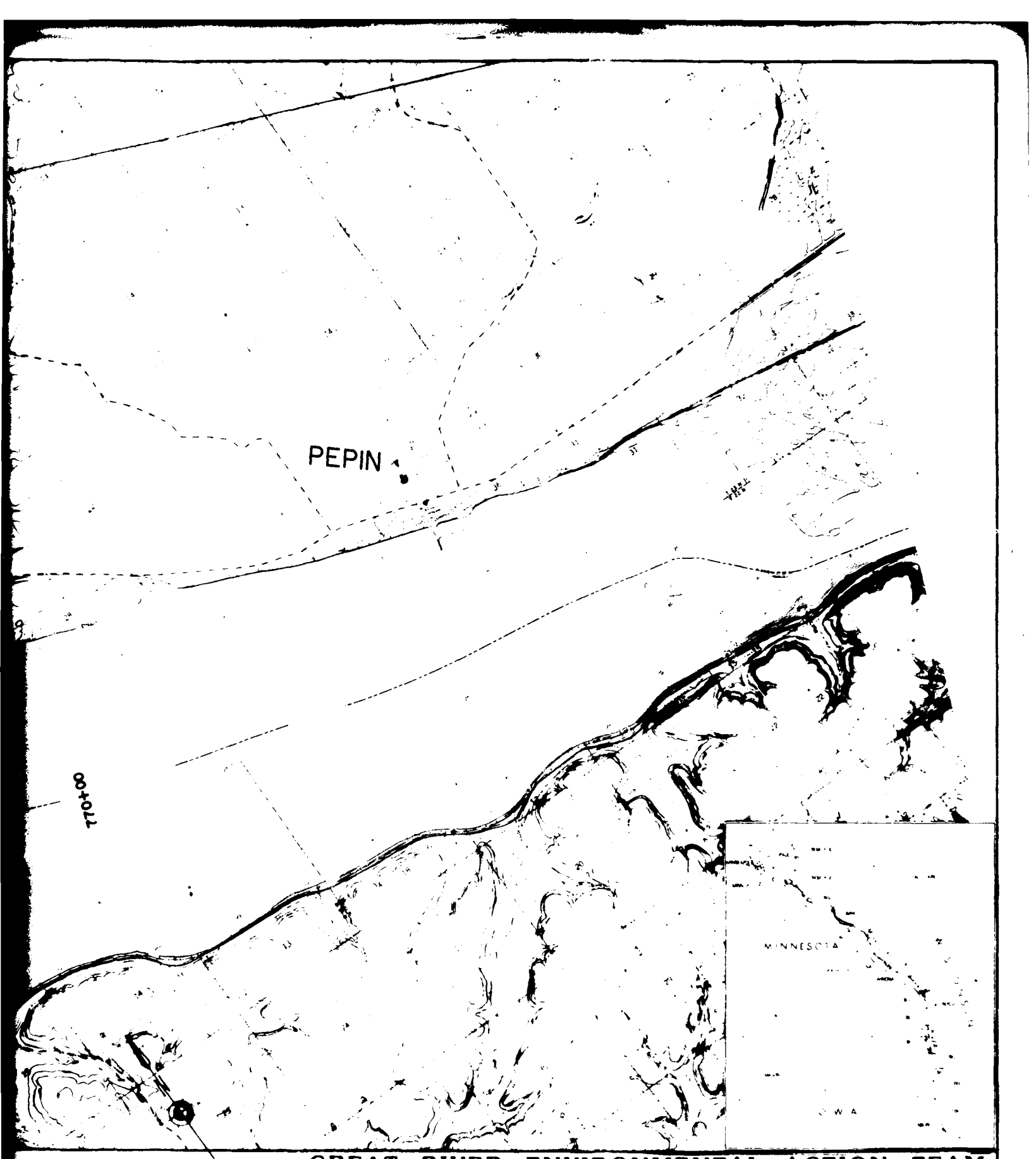
C = Water control culverts

SP = Shoreline protection

SCALE: 1" = 4,000'


MAIDEN ROCK
700
FRONTENAC
FRONTENAC STATE PARK
FRONTENAC
STATION


STOCKHOLM
LAKE PEPIN
778+00
770+00
LAKE CITY



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 4(M)-MILE 766 TO MILE 780)

LEGEND

FLOODPLAIN

RECREATION

RW — Recommended action

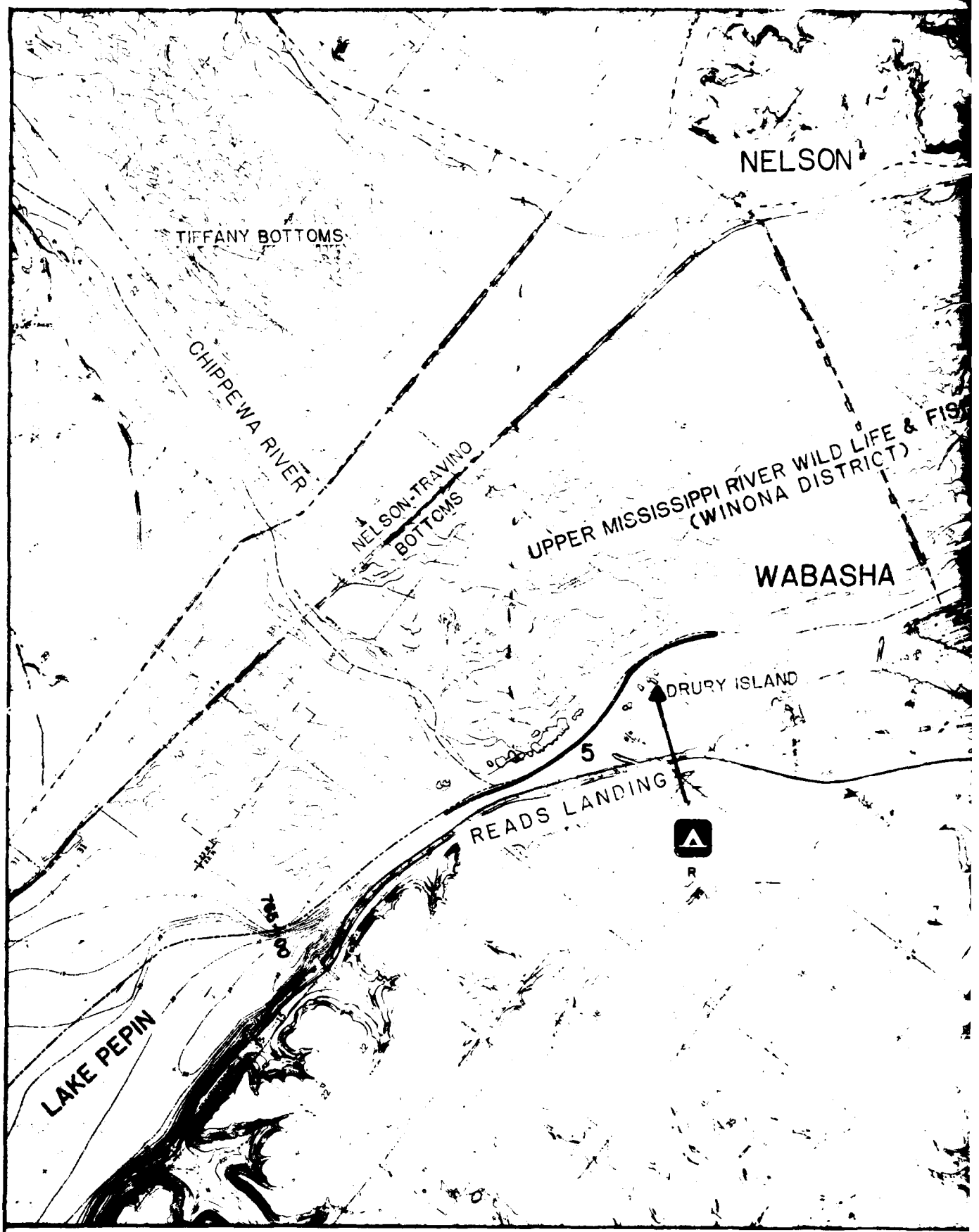
PROJECTS ACCOMPLISHED THROUGH GREAT I

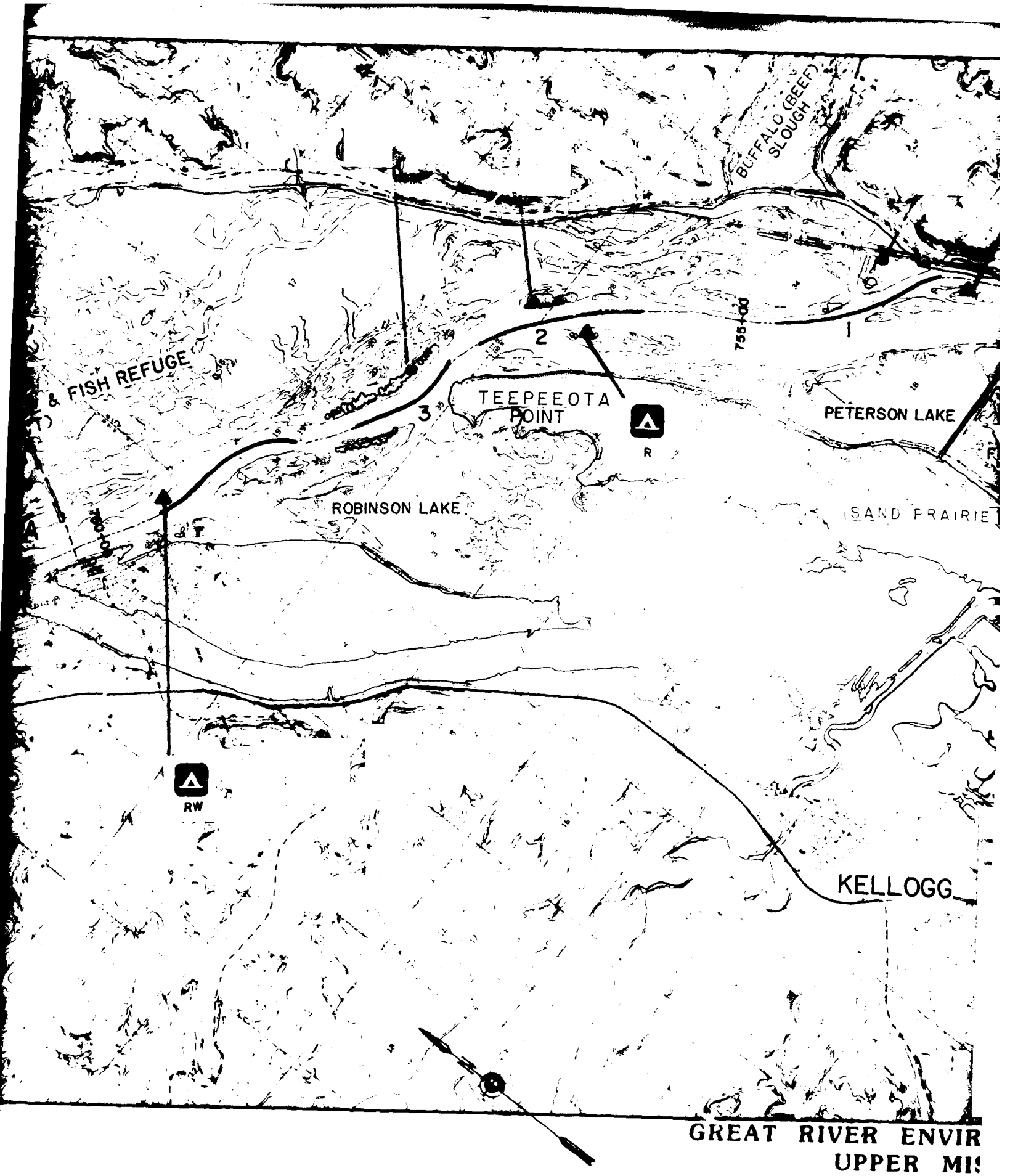
FS — Type of project

FS = Side channel modification for fish and wildlife
RS = Side channel modification for recreation
C = Water control culverts
SP = Shoreline protection

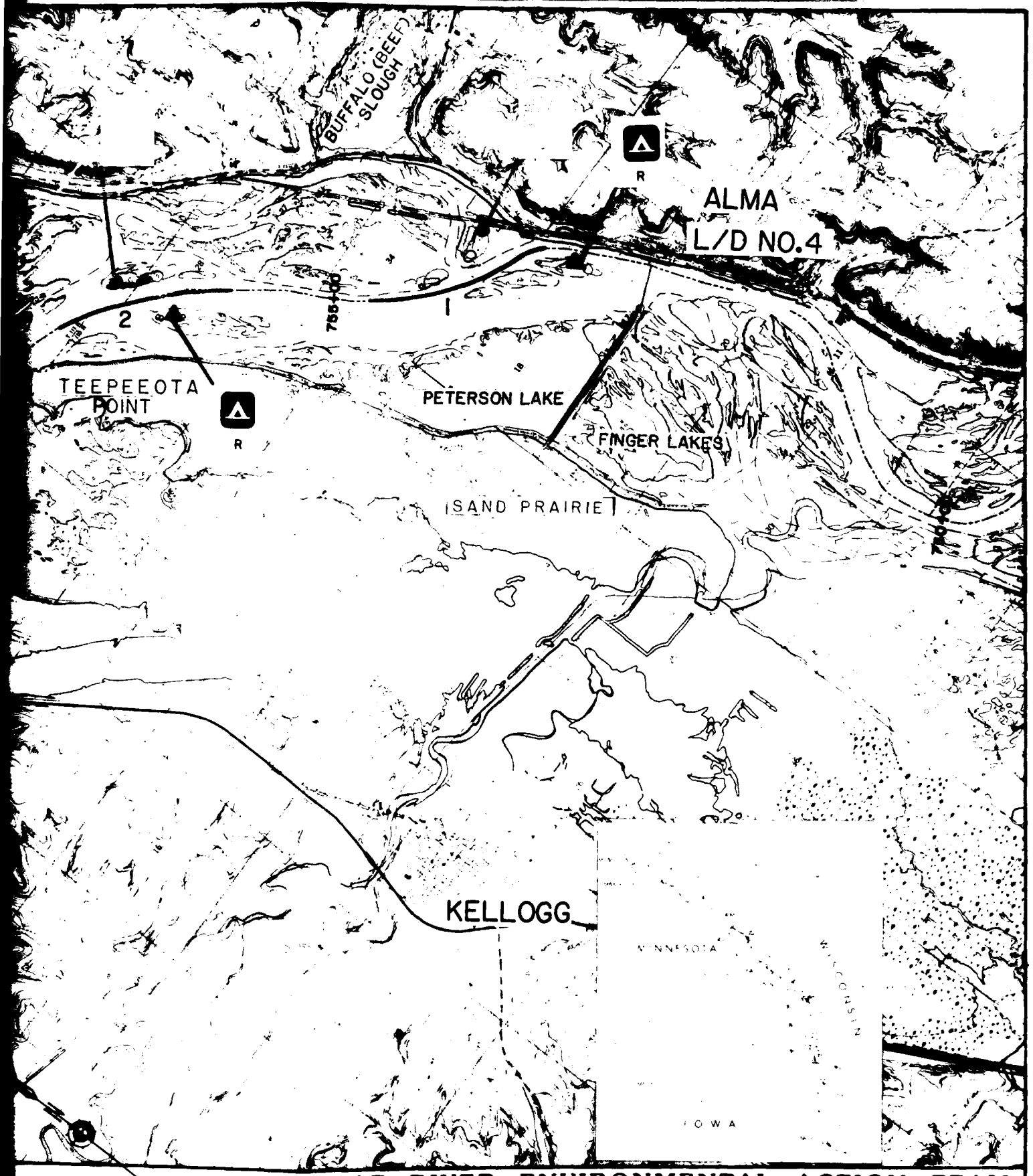
SCALE: 1" = 4,000'

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929


NELSON
TIFFANY BOTTOMS
CHIPPEWA RIVER
NELSON-TRAVINO BOTTOMS
UPPER MISSISSIPPI RIVER WILD LIFE & FIS
(WINONA DISTRICT)
WABASHA
DRURY ISLAND
5
READS LANDING
R
765
LAKE PEPIN



GREAT RIVER ENVIR
UPPER MI
(POOL 4(L)-MI



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 4(L)-MILE 752 TO MILE 766)

2 1 3

LEGEND

FLOODPLAIN

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

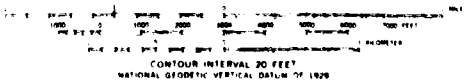
FS = Side channel modification for fish and wildlife

RS = Side channel modification for recreation

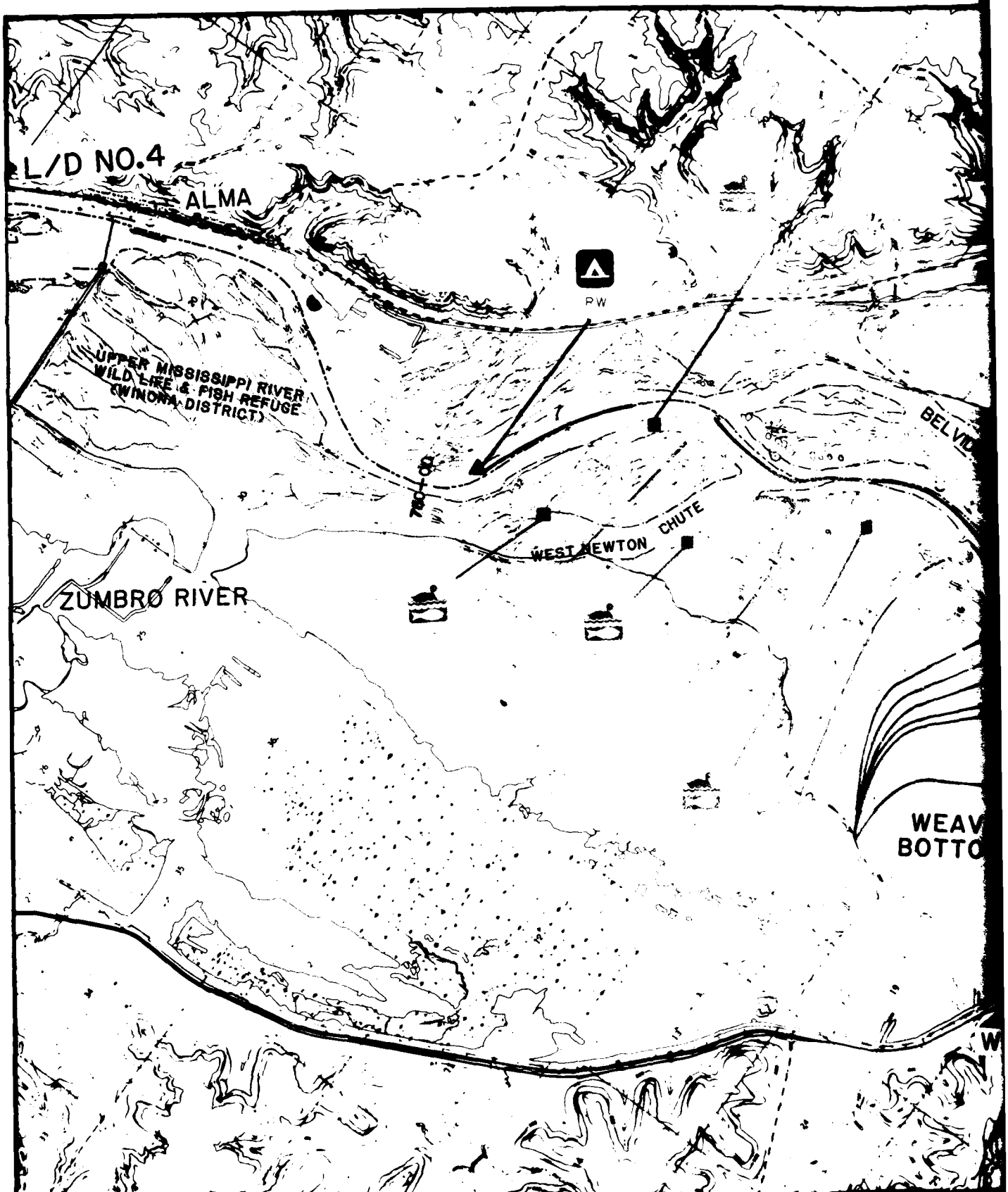
C = Water control culverts

SP = Shoreline protection

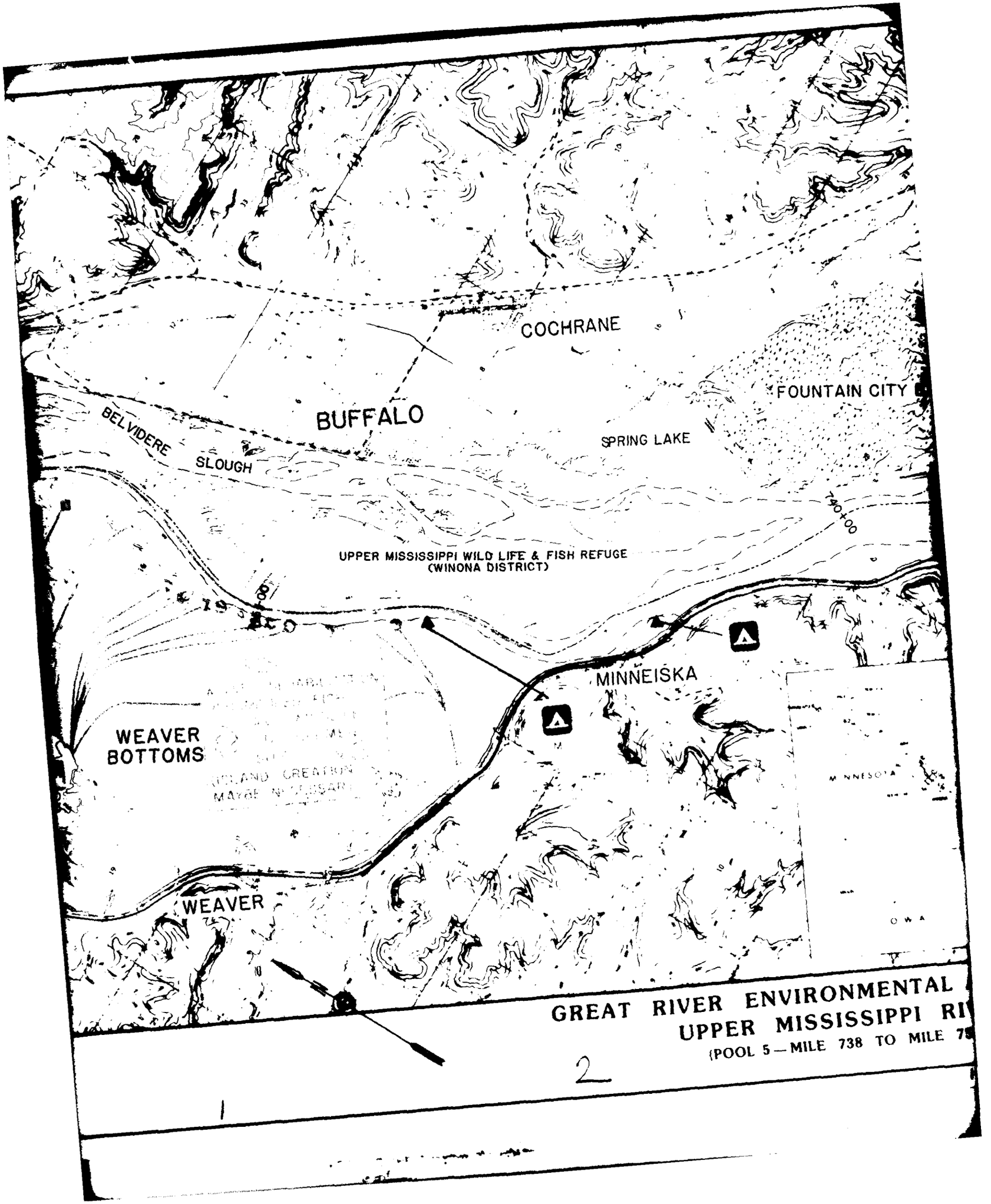
SCALE: 1" = 4,000'

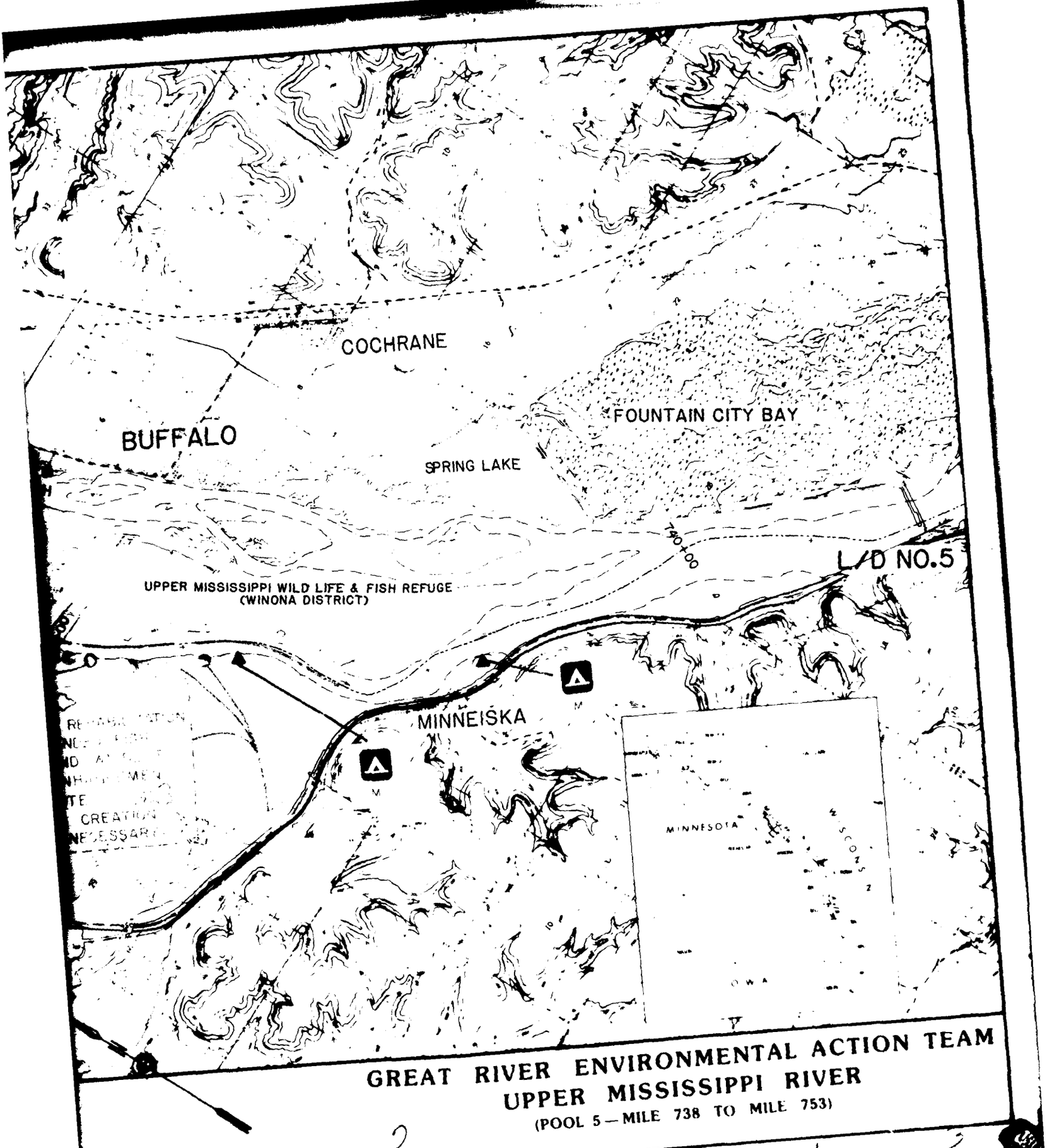


CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929


L/D NO.4
ALMA
PW
UPPER MISSISSIPPI RIVER
WILD LIFE & FISH REFUGE
(WINONA DISTRICT)
WEST NEWTON CHUTE
ZUMBRO RIVER

1


COCHRANE
FOUNTAIN CITY
BUFFALO
BELVIDERE
SLOUGH
SPRING LAKE
740+00
UPPER MISSISSIPPI WILD LIFE & FISH REFUGE
(WINONA DISTRICT)
MINNEISKA
WEAVER
BOTTOMS
WEAVER
GREAT RIVER ENVIRONMENTAL
UPPER MISSISSIPPI RI
(POOL 5 — MILE 738 TO MILE 7
2
1



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 5 — MILE 738 TO MILE 753)

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

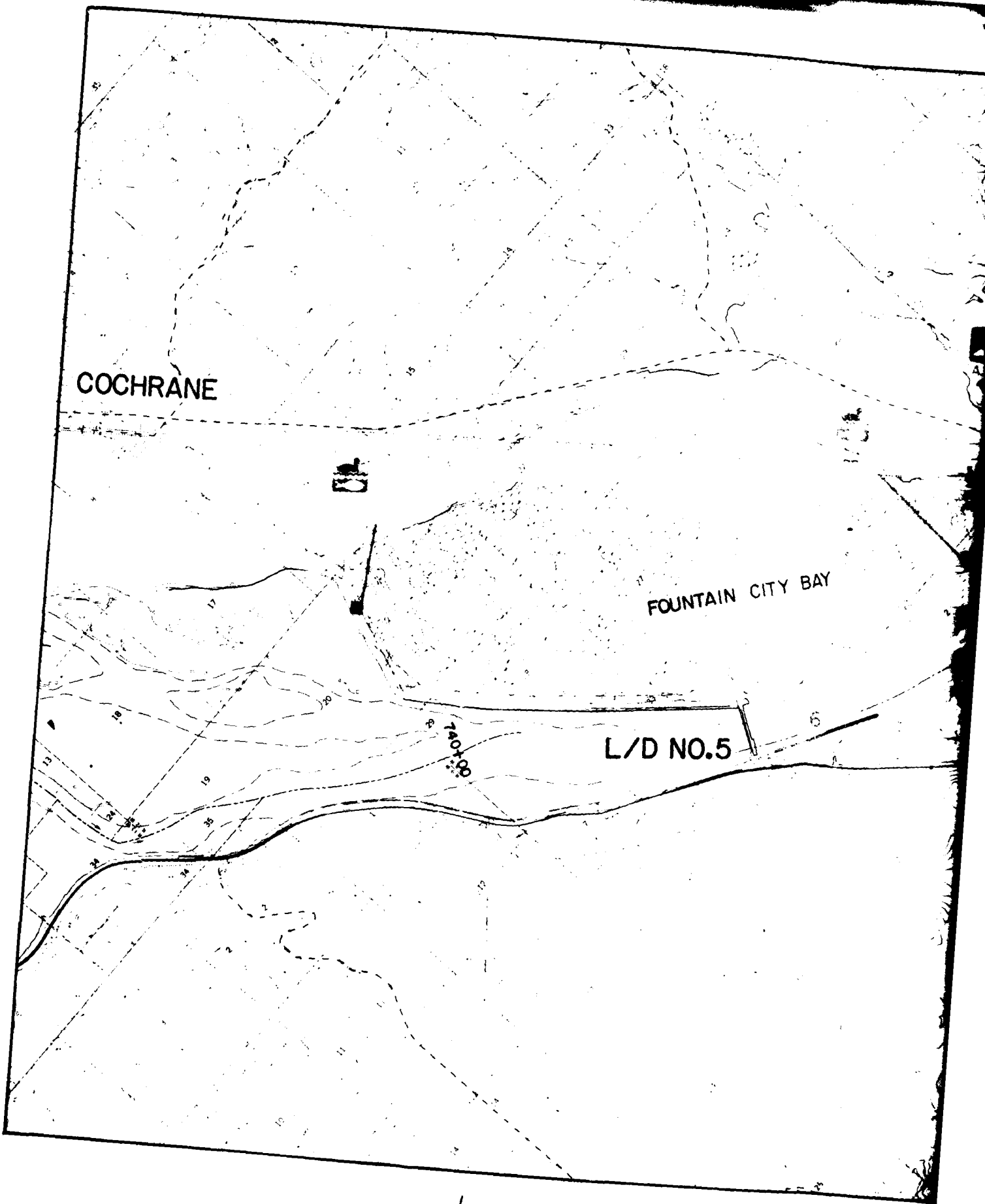
FS = Side channel modification for fish and wildlife

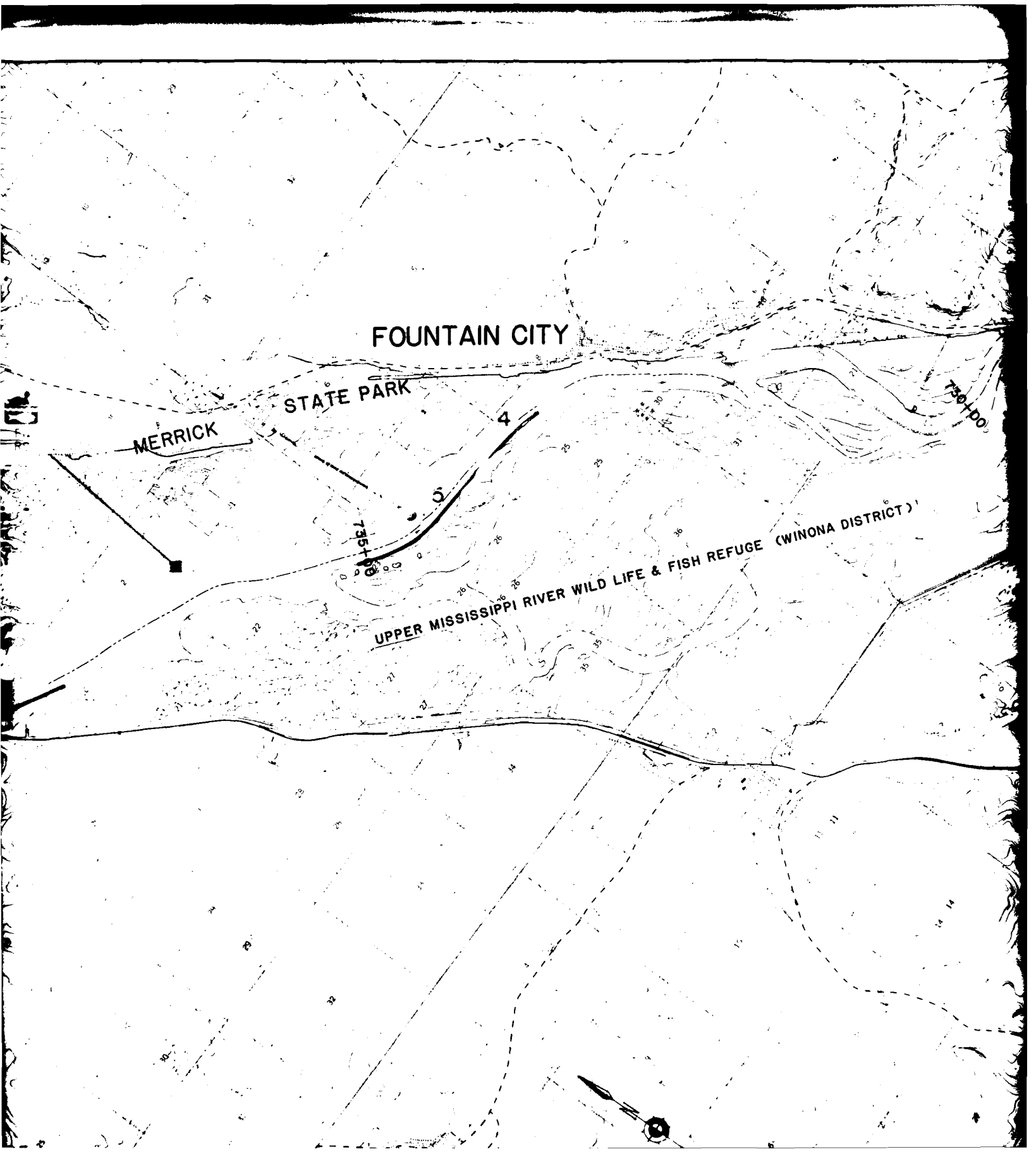
RS = Side channel modification for recreation

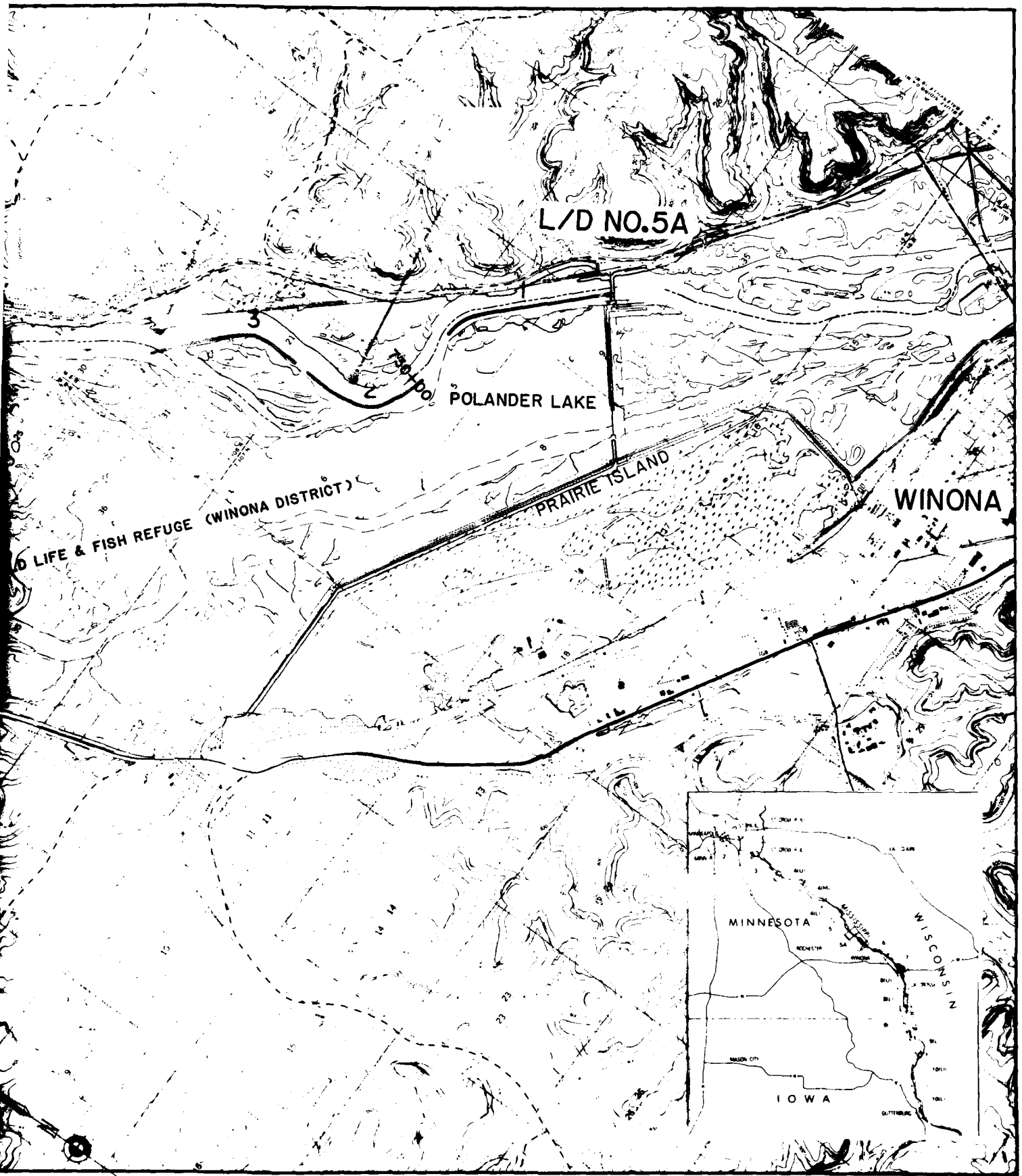
C = Water control culverts

SP = Shoreline protection

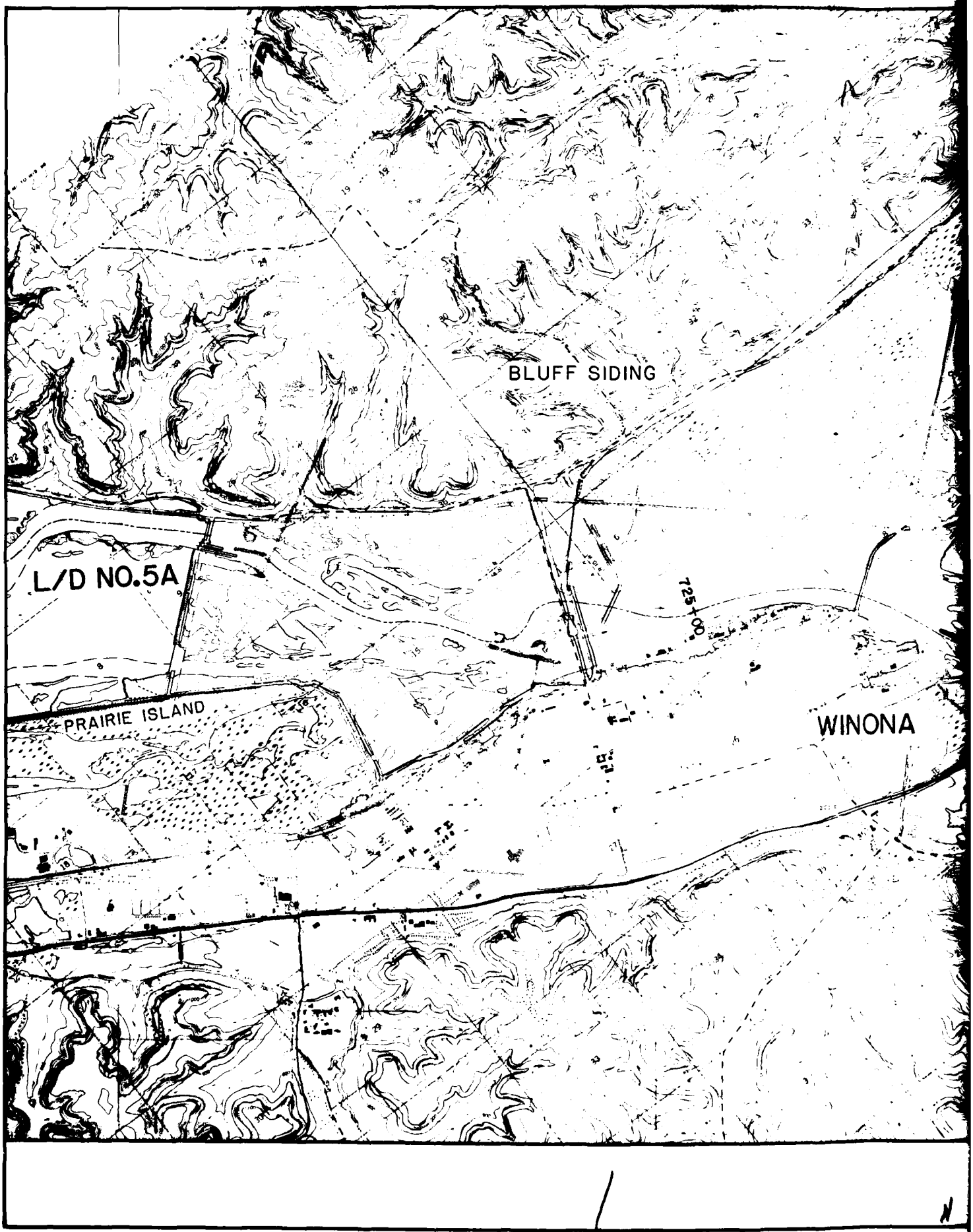
SCALE 1" = 4,000'

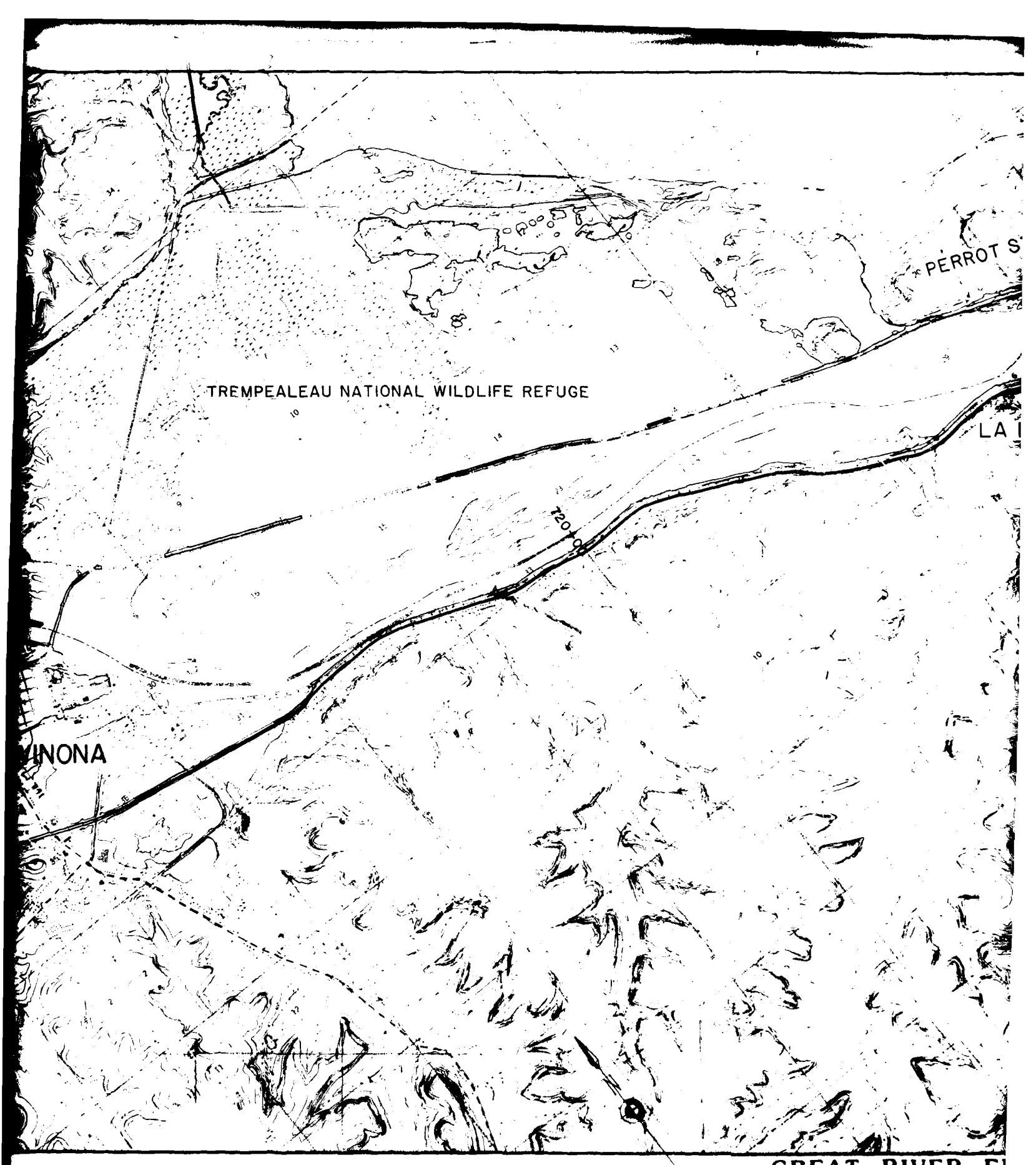

COCHRANE
FOUNTAIN CITY BAY
L/D NO.5
740+80


FOUNTAIN CITY
STATE PARK
MERRICK
4
5
735+00
730+00
UPPER MISSISSIPPI RIVER WILD LIFE & FISH REFUGE (WINONA DISTRICT)



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 5A-MILE 728 TO MILE 742)

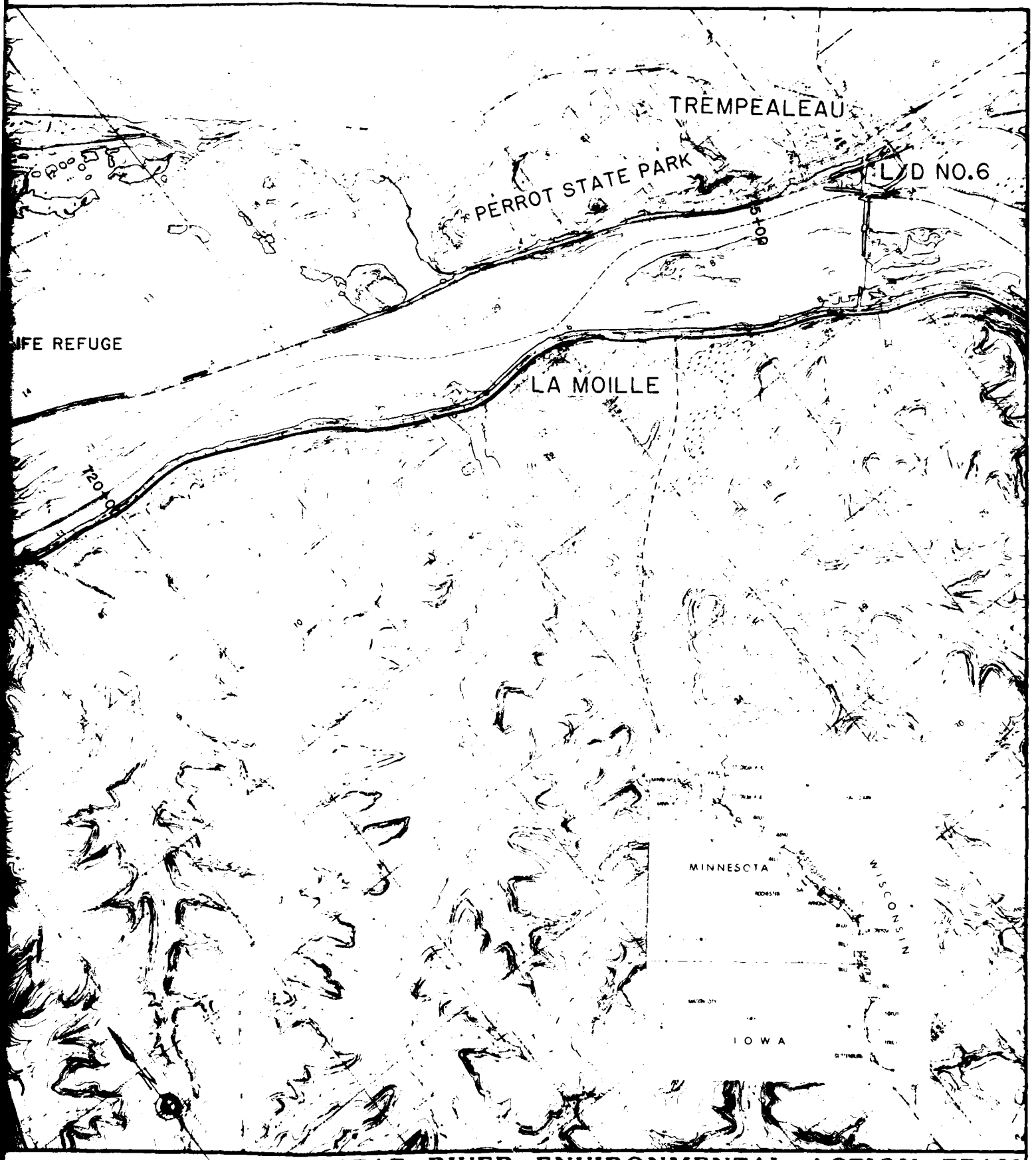

BLUFF SIDING
L/D NO.5A
725+00
PRAIRIE ISLAND
WINONA
N



GREAT RIVER E
UPPER
(POOL

N

2

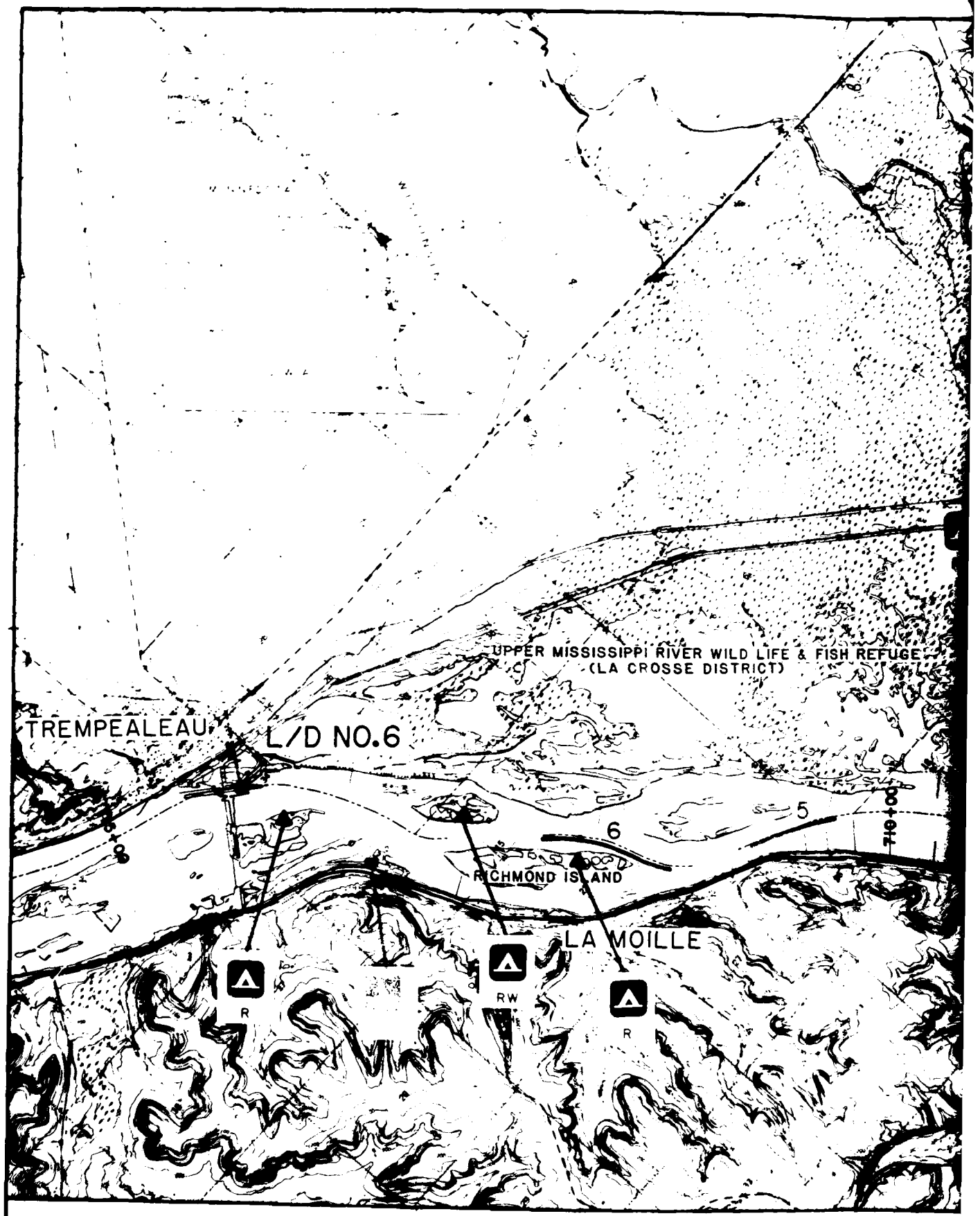


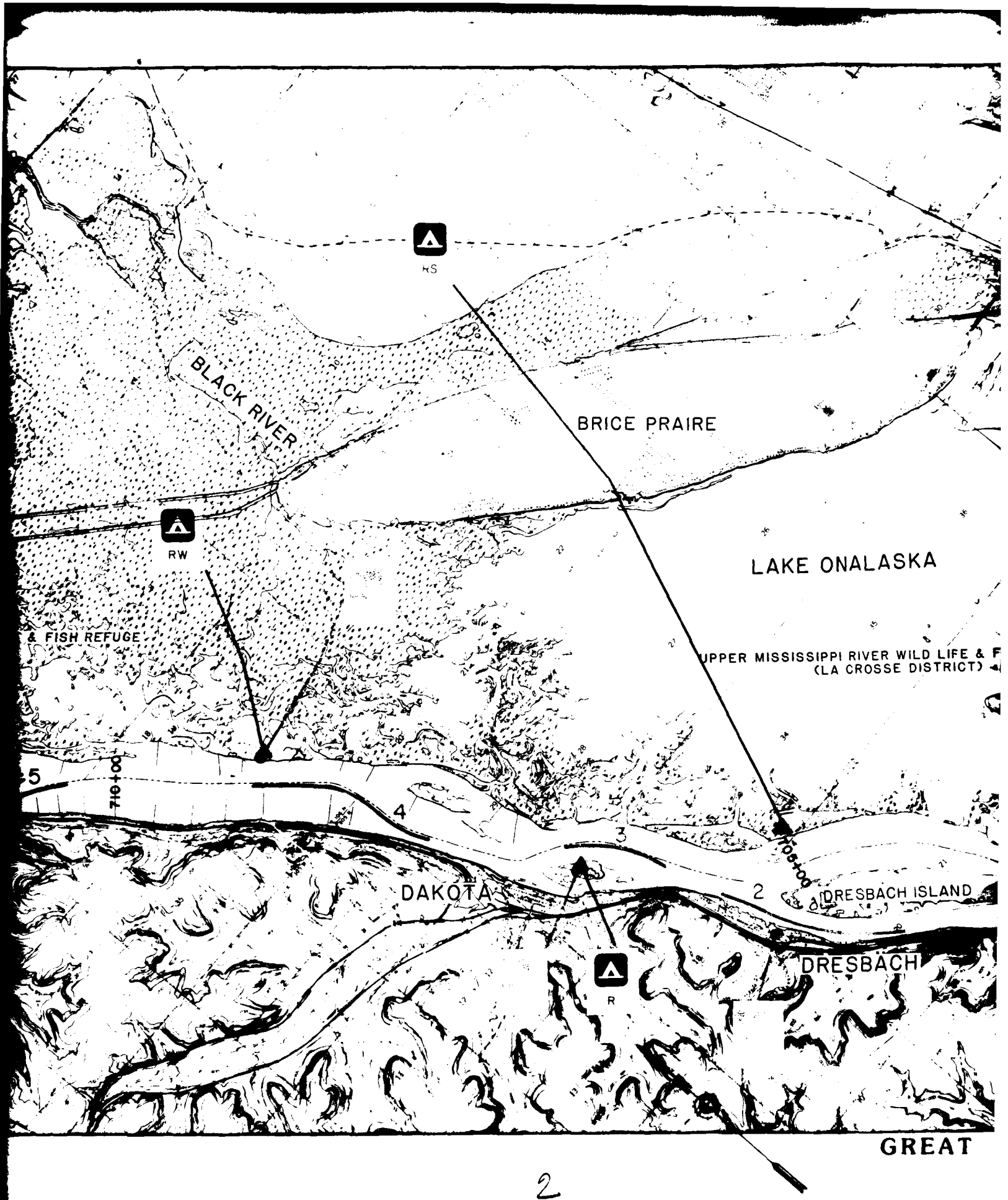
GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 6 - MILE 714 TO MILE 729)

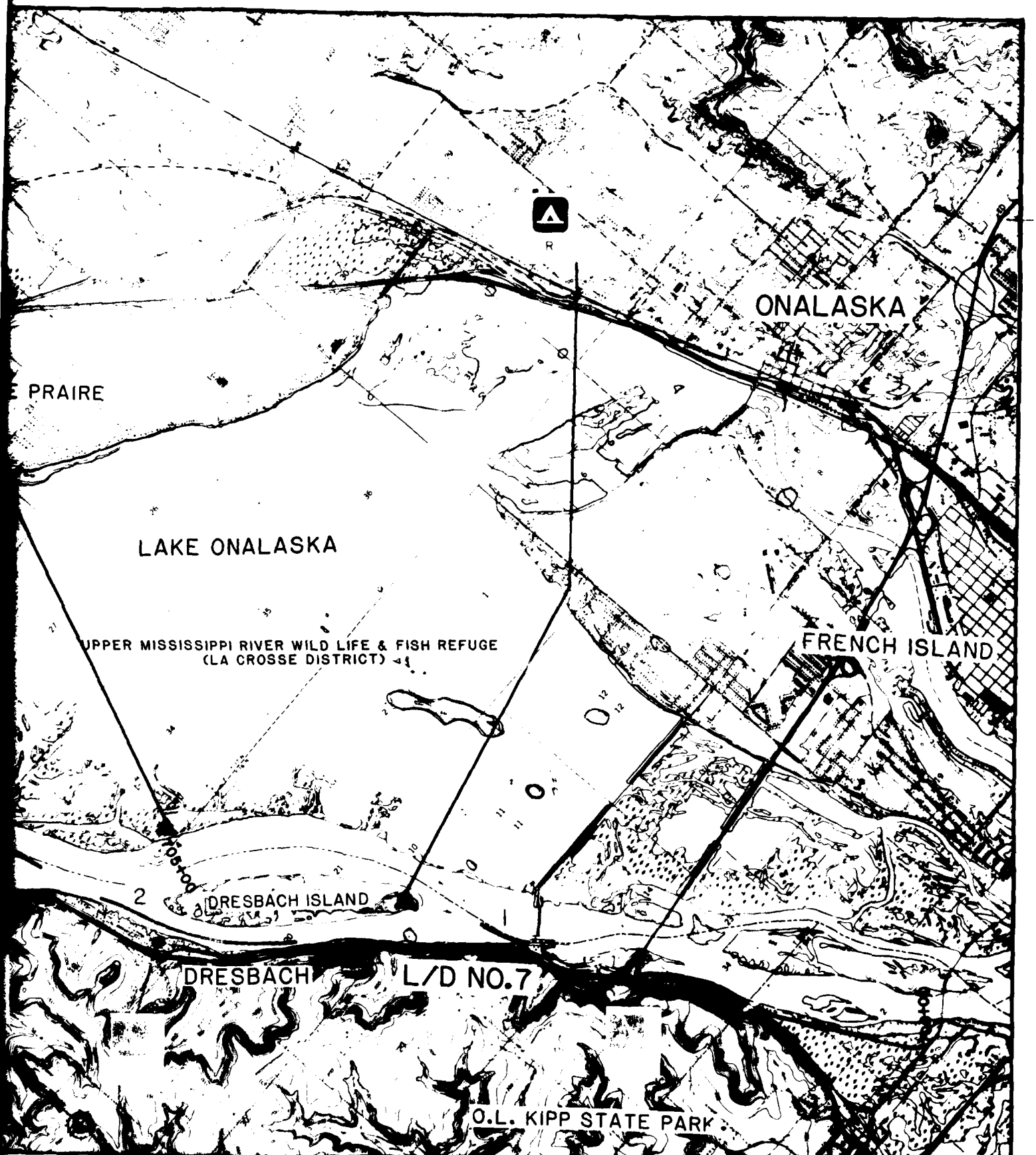
2

1

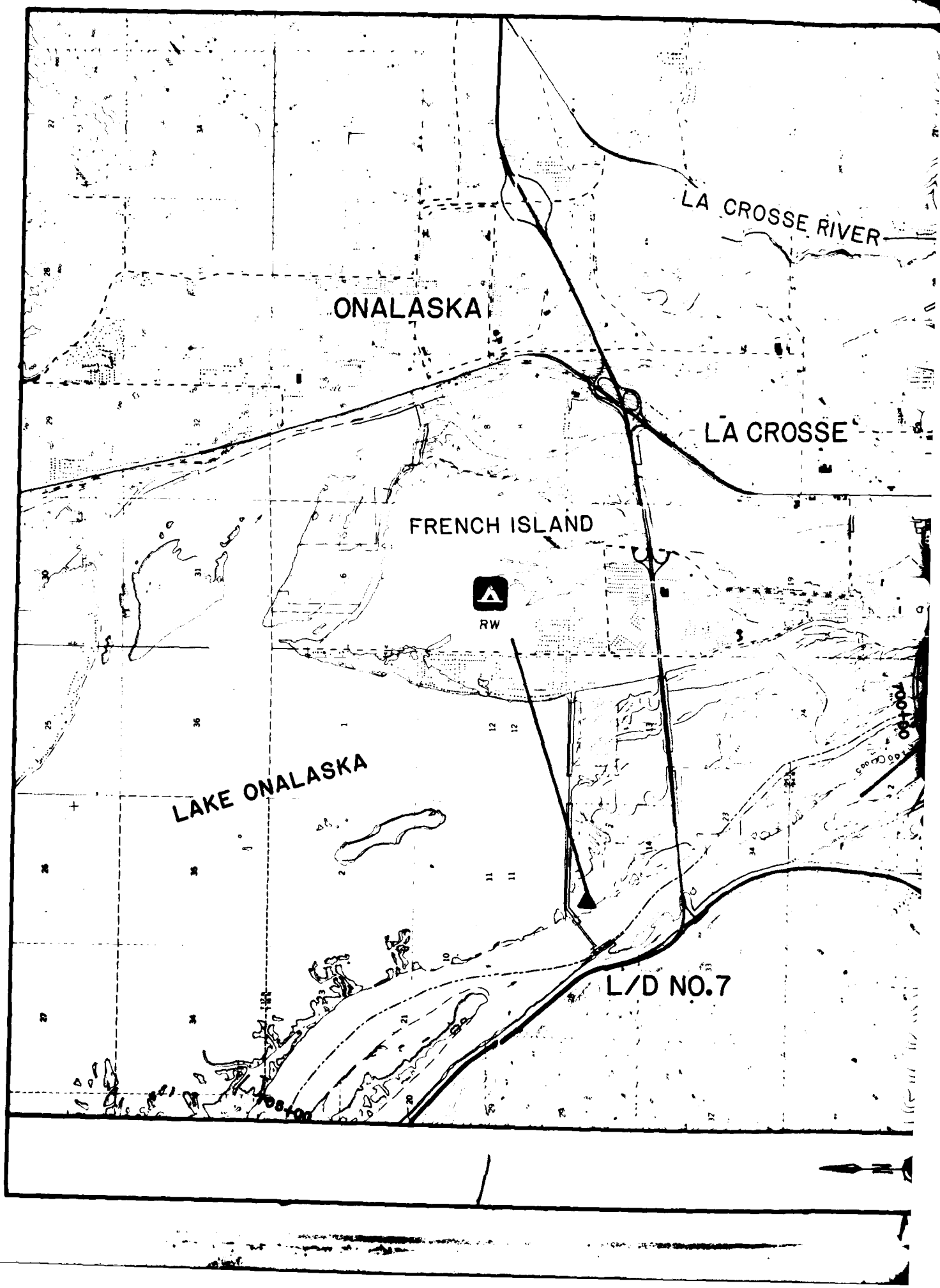
3

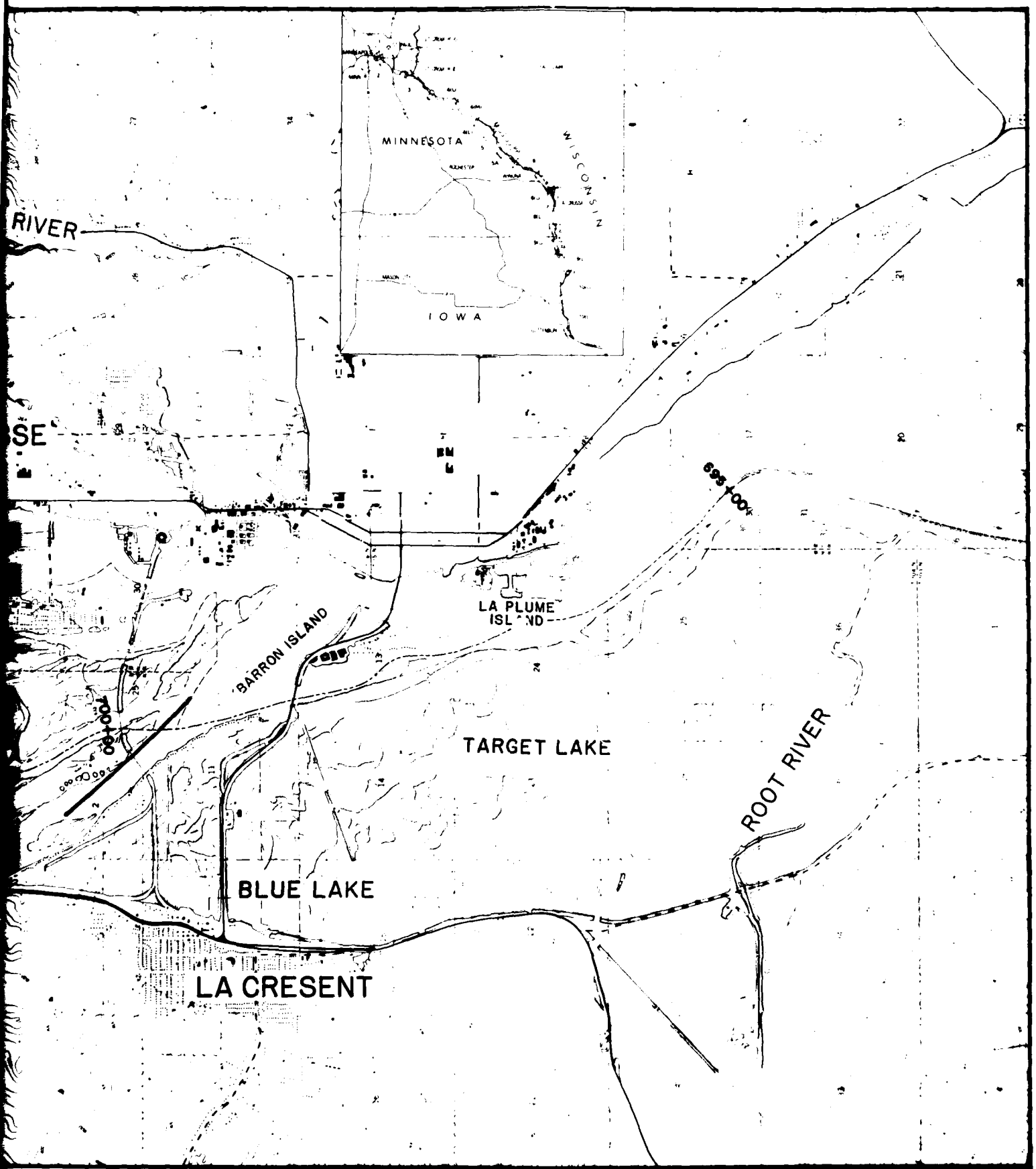

UPPER MISSISSIPPI RIVER WILD LIFE & FISH REFUGE
(LA CROSSE DISTRICT)
TREMPEALEAU
L/D NO.6
6
5
RICHMOND ISLAND
LA MOILLE
R
RW
R


RS
BLACK RIVER
BRICE PRAIRE
RW
LAKE ONALASKA
& FISH REFUGE
UPPER MISSISSIPPI RIVER WILD LIFE & F
(LA CROSSE DISTRICT)
5
4
3
2
DAKOTA
DRESBACH ISLAND
DRESBACH
R
GREAT



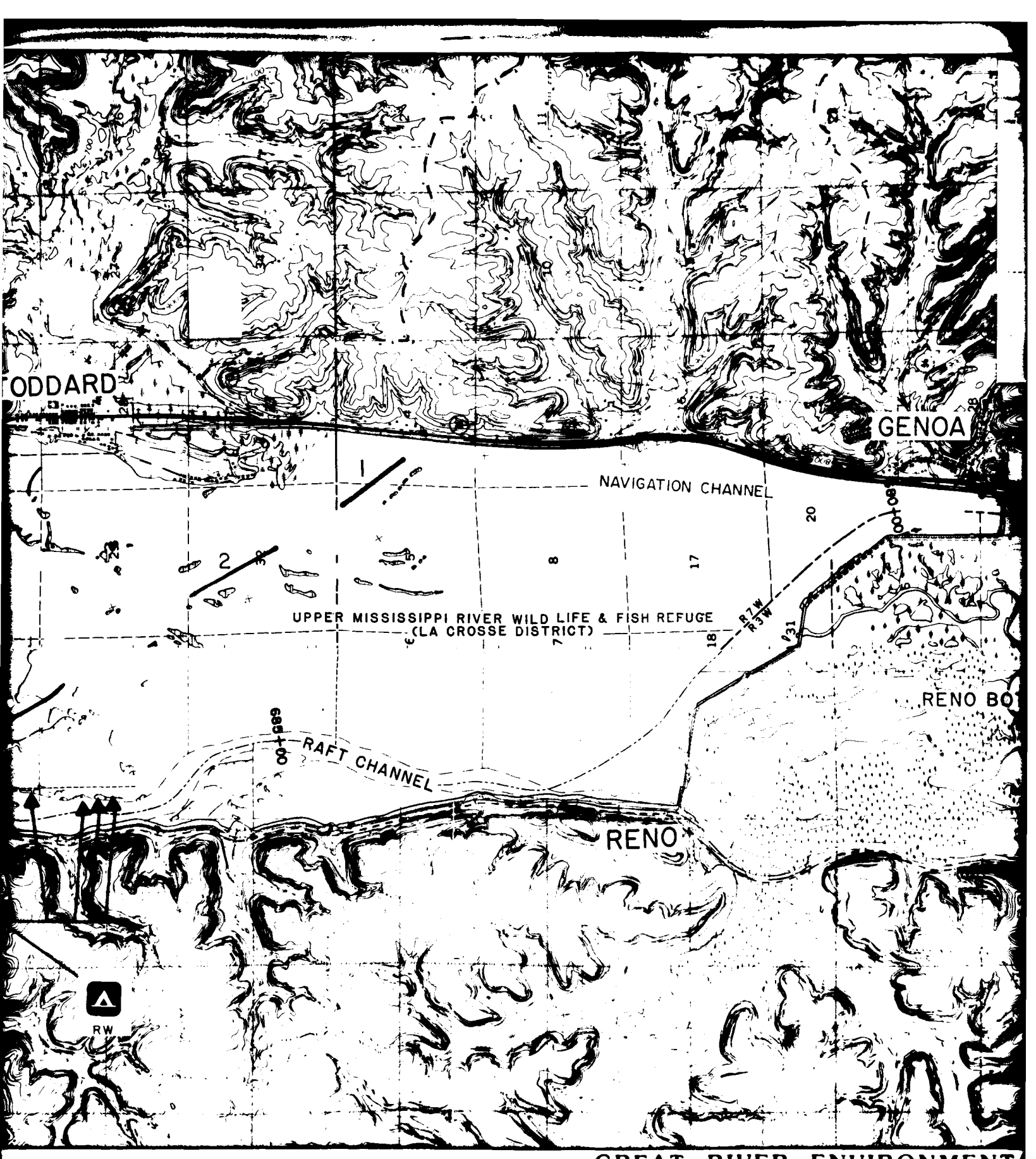
GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 7-MILE 701 TO MILE 714)


LA CROSSE RIVER
ONALASKA
LA CROSSE
FRENCH ISLAND
RW
LAKE ONALASKA
L/D NO.7



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 8(U)-MILE 693 TO MILE 704)

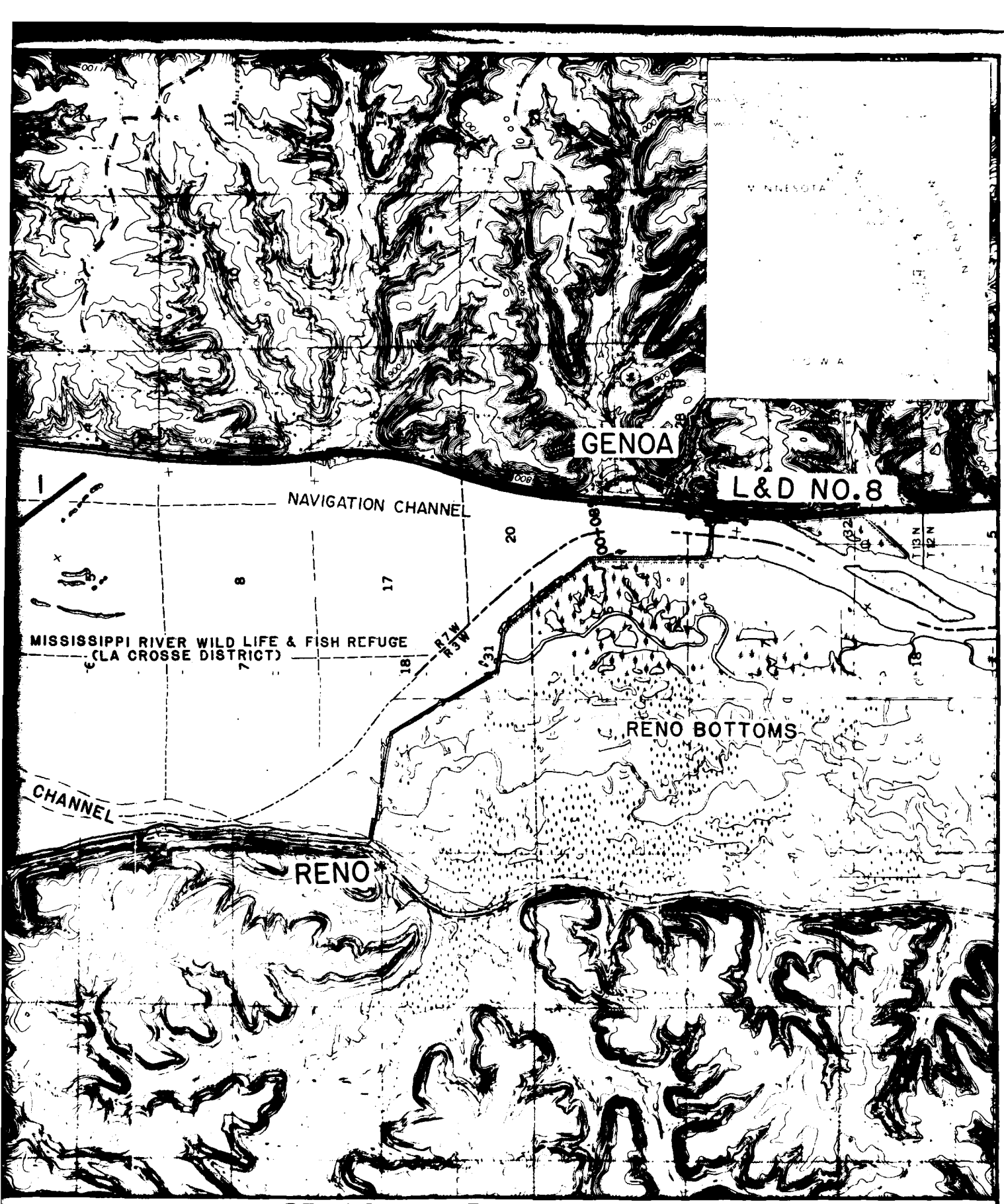
STODDARD
GOOSE ISLAND
UPPER MISSISSIPPI RIVER WILD LIFE & FISH REFUGE
(LA CROSSE DISTRICT)
LAWRENCE LAKE
BROWNSVILLE
RW



GREAT RIVER ENVIRONMENT

UPPER MISSISSIPPI

(POOL 8(L) MILE 679 TO



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 8(L) MILE 679 TO MILE 692)

2 1 3

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

FS = Side channel modification for fish and wildlife

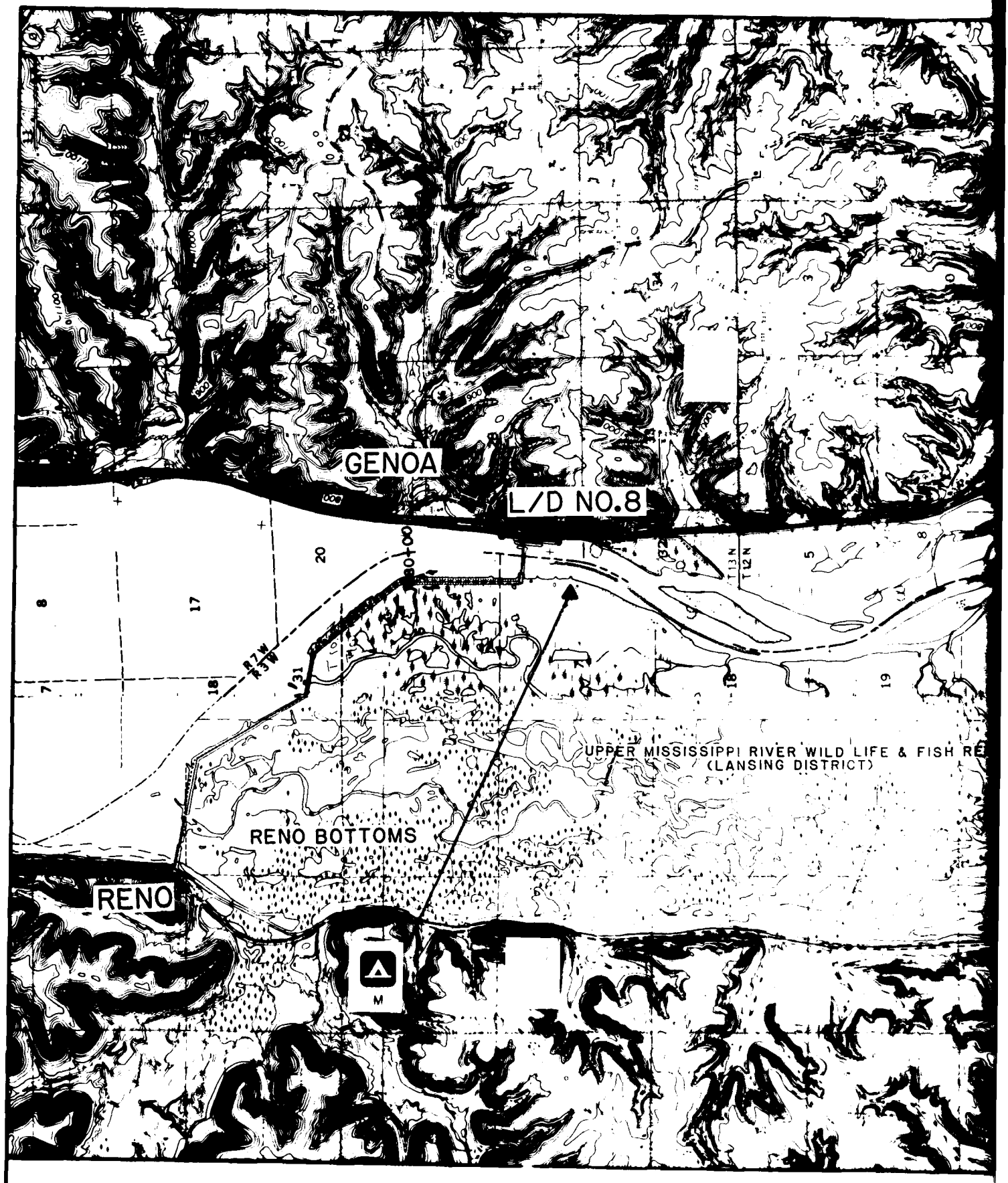
RS = Side channel modification for recreation

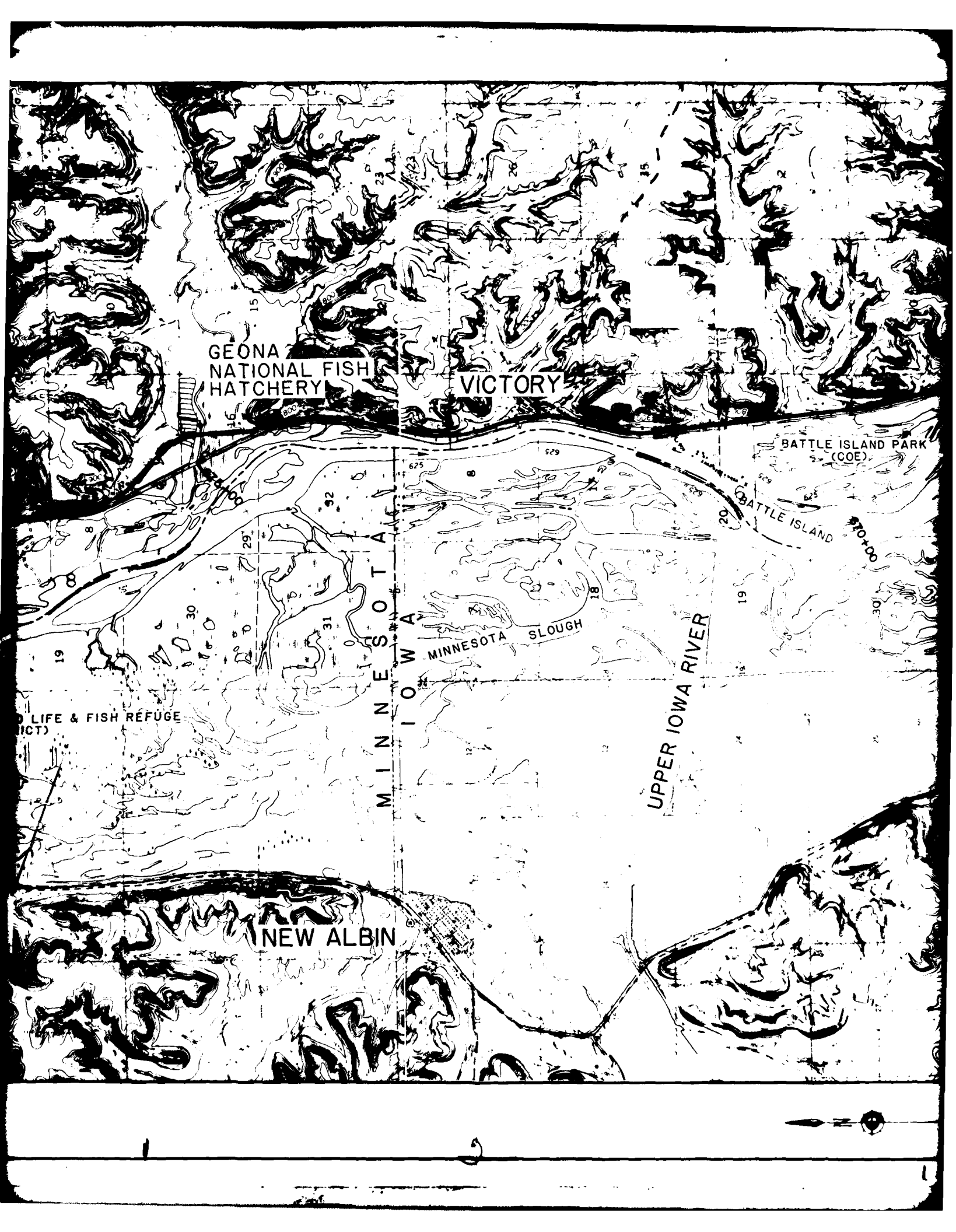
C = Water control culverts

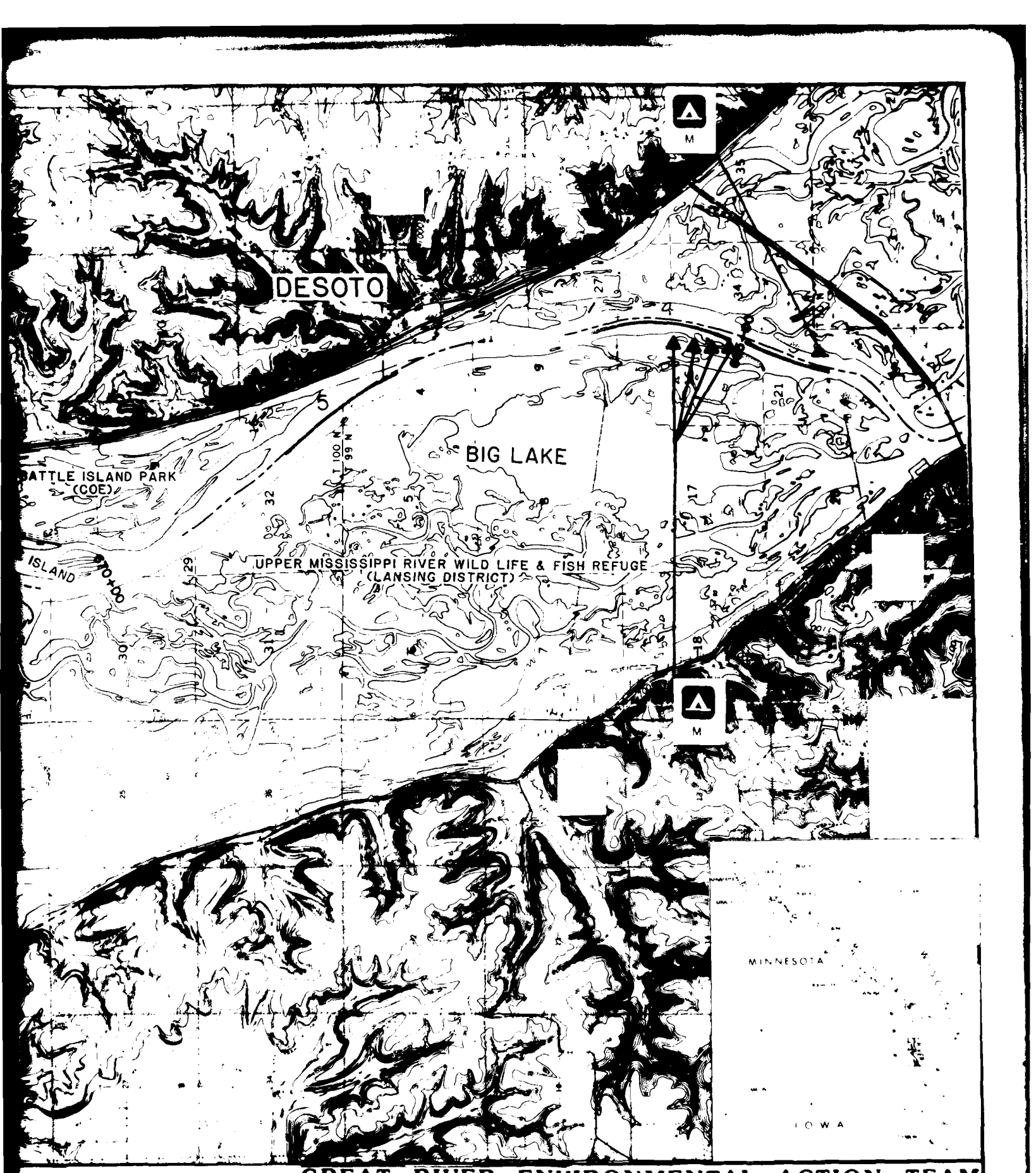
SP = Shoreline protection

SCALE: 1" = 4,000'

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929


GENOA
L/D NO.8
RENO BOTTOMS
RENO
UPPER MISSISSIPPI RIVER WILD LIFE & FISH RE
(LANSING DISTRICT)
T13N
T12N
R7W
R8W
20
17
18
19
5
8
7
31


GEONA
NATIONAL FISH
HATCHERY
VICTORY
BATTLE ISLAND PARK
(COE)
BATTLE ISLAND
970+00
MINNESOTA
MINNESOTA SLOUGH
UPPER IOWA RIVER
LIFE & FISH REFUGE
NEW ALBIN



GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 9(U) - MILE 665 TO MILE 681)

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

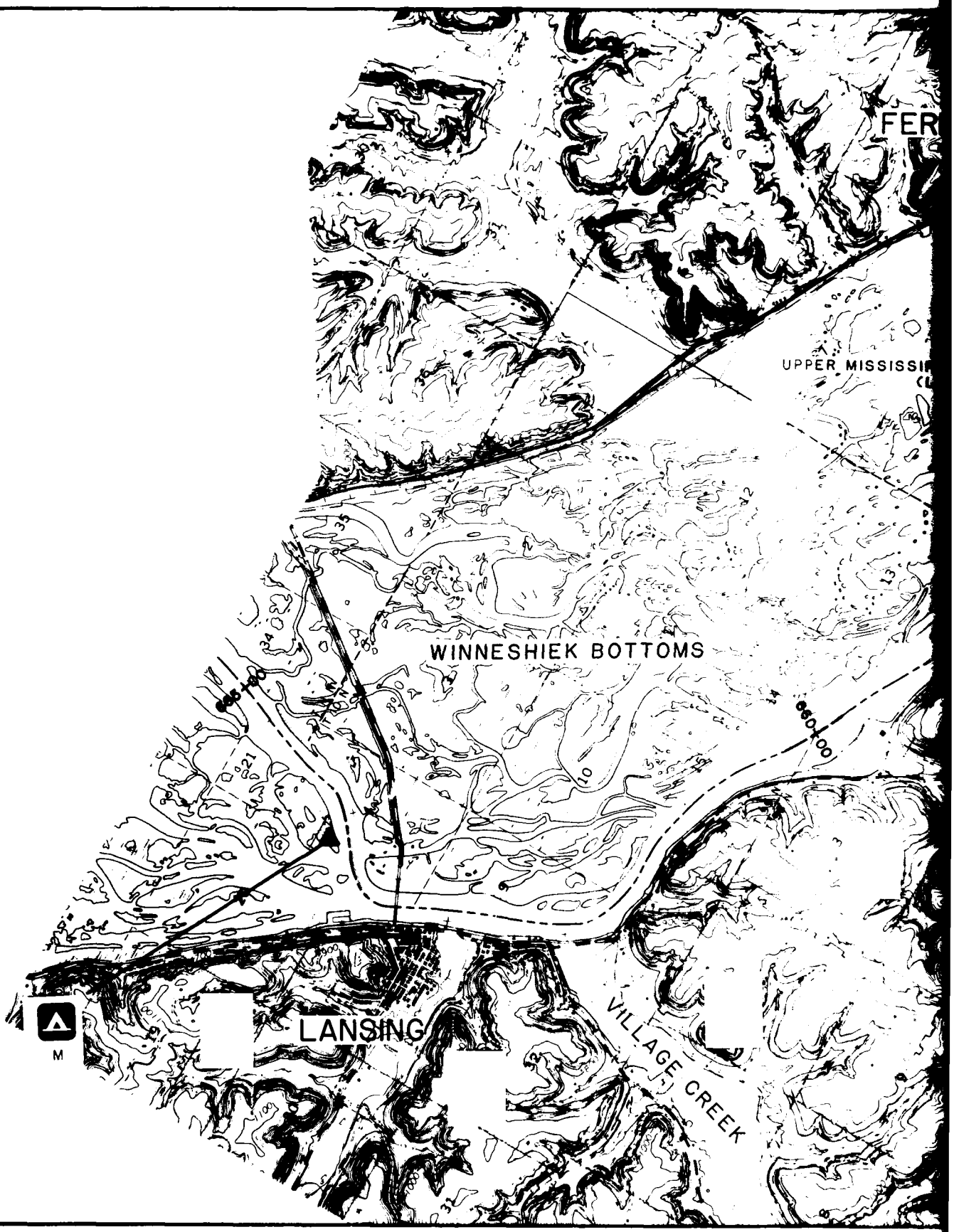
FS = Side [illegible] modification for fish and wildlife

RS = Side [illegible] modification for recreation

Water control culverts

Shoreline protection

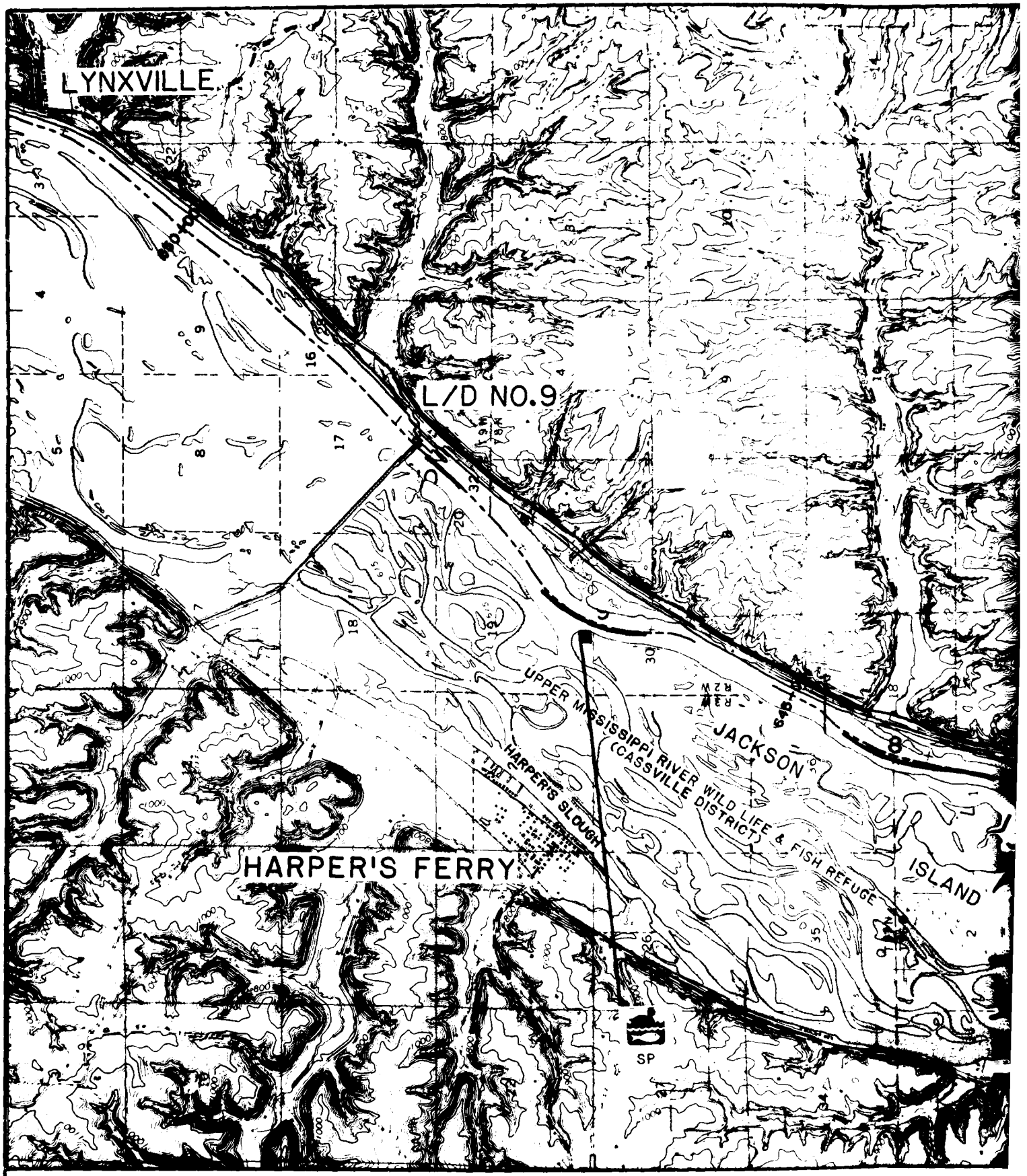
SCALE: 1" = 4,000'


FER
UPPER MISSISSI
WINNESHIEK BOTTOMS
LANSING
VILLAGE CREEK
M

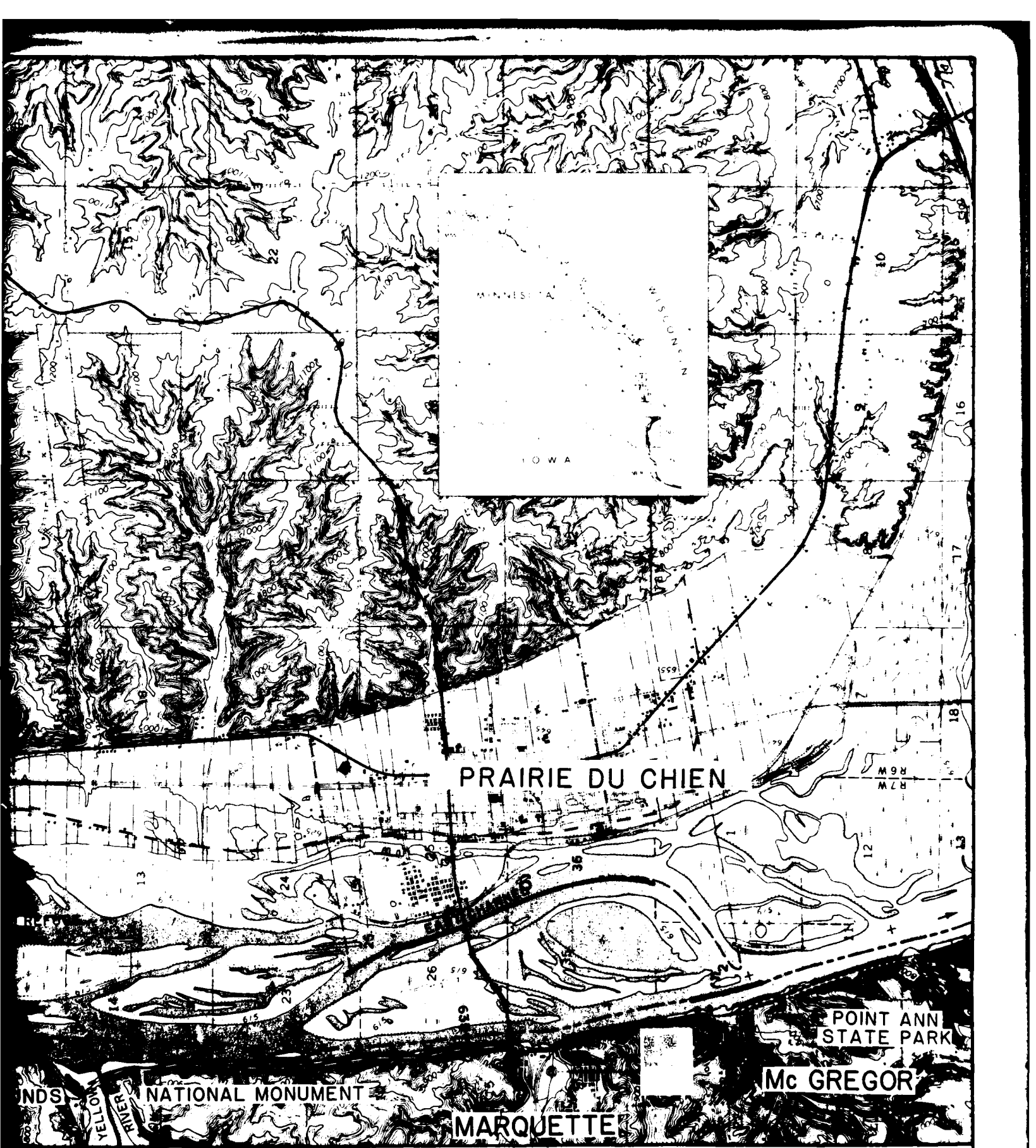
FERRYVILLE
ER MISSISSIPPI RIVER WILD LIFE & FISH REFUGE
(LANSING DISTRICT)
MINNESOTA
GREAT RIVER
UPPE
(POO

GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 9(L) - MILE 647 TO MILE 664)

2


LYNXVILLE
L/D NO.9
HARPER'S FERRY
UPPER MISSISSIPPI RIVER WILD LIFE & FISH REFUGE
(CASSVILLE DISTRICT)
HARPER'S SLOUGH
JACKSON
ISLAND
SP

ISLAND
GREMORE LAKE
EFFIGY MOUNDS



GREAT RIVER ENVIRONMENTAL ACTION TEAM

UPPER MISSISSIPPI RIVER

(POOL 10(U) - MILE 632 TO MILE 651)

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECREATION

RW — Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

FS — Project location

FS — Type of project

FS = Side channel modification for fish and wildlife

RS = Side channel modification for recreation

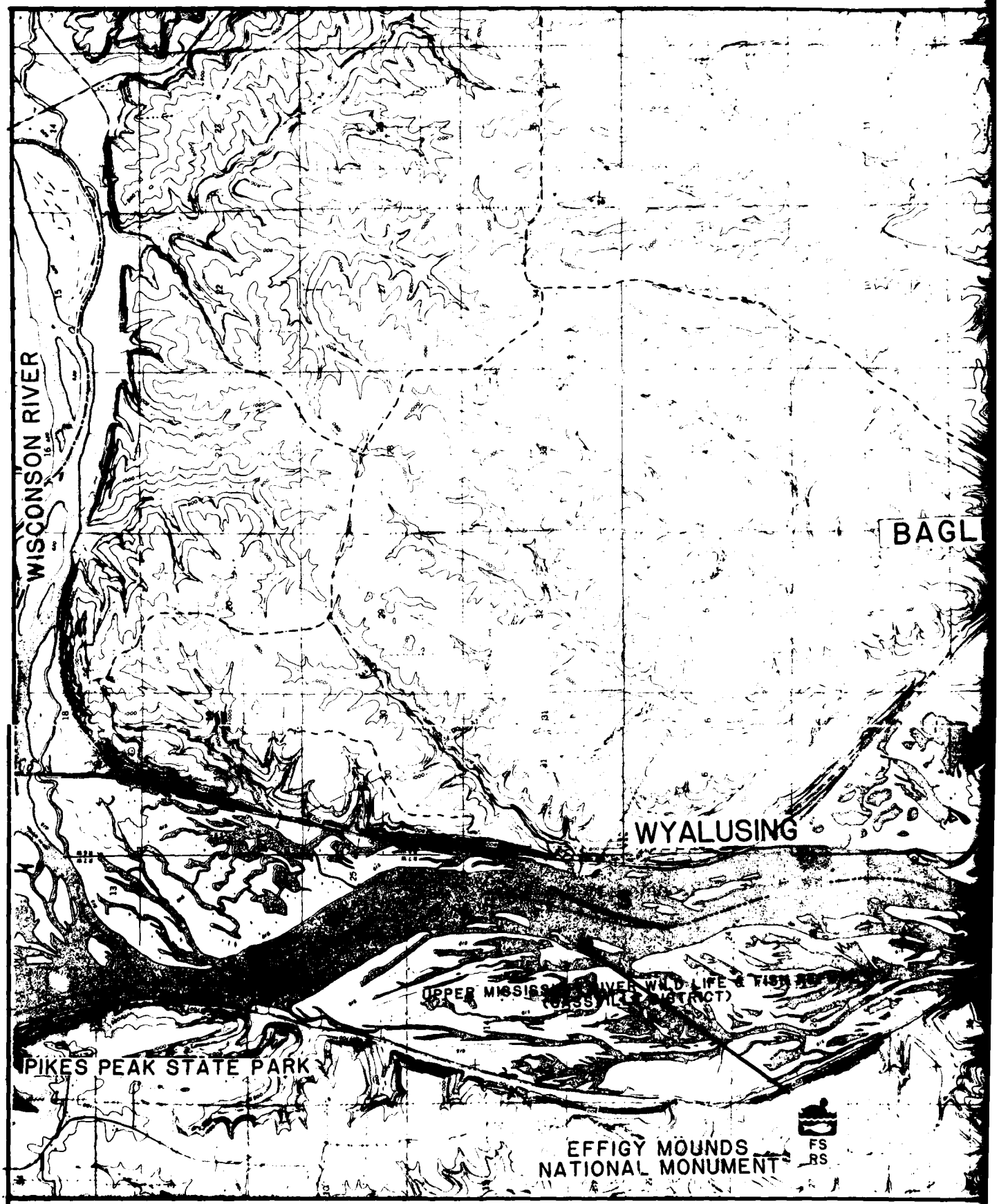
C = Water control culverts

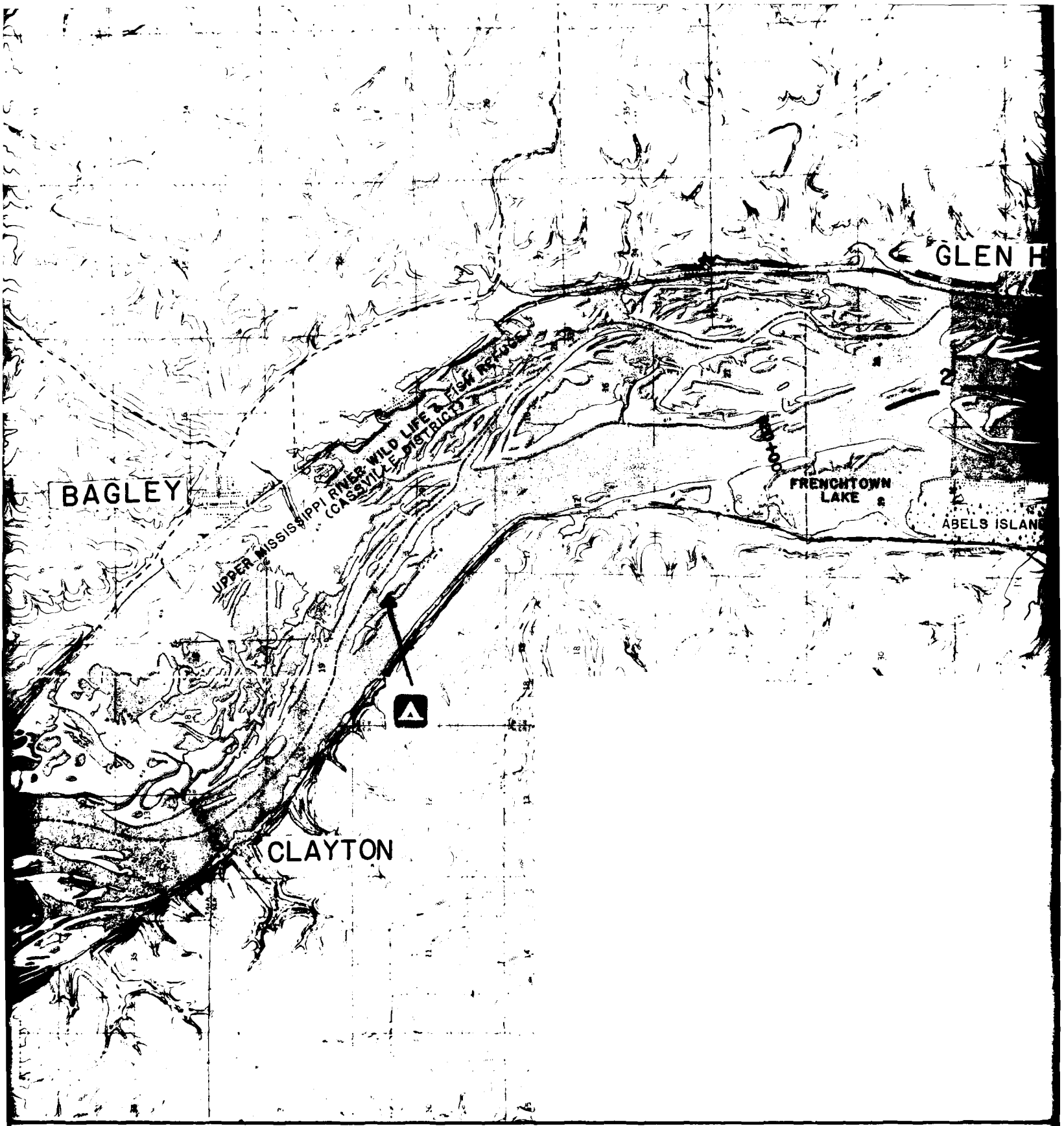
SP = Shoreline protection

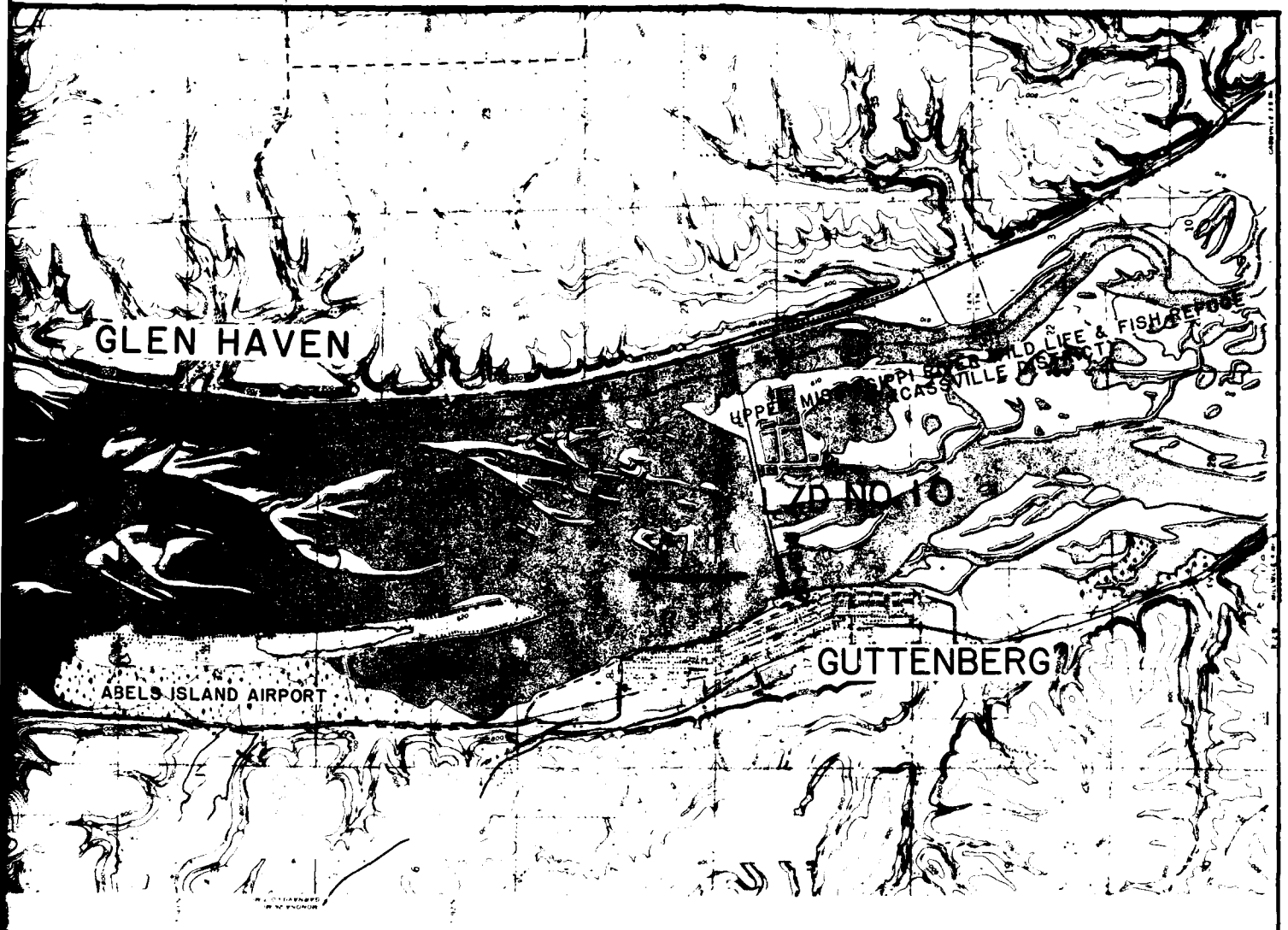
SCALE: 1" = 4,000'

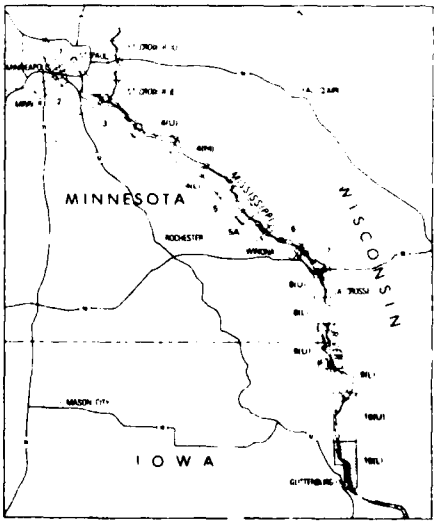
CONTOUR INTERVAL 20 FEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929


WISCONSON RIVER
BAGL
WYALUSING
PIKES PEAK STATE PARK
EFFIGY MOUNDS
NATIONAL MONUMENT
FS
RS


GLEN H
BAGLEY
UPPER MISSISSIPPI RIVER WILD LIFE & FISH REFUGE
(CASSVILLE DISTRICT)
FRENCHTOWN
LAKE
ABELS ISLAN
CLAYTON





GREAT RIVER ENVIRONMENTAL ACTION TEAM
UPPER MISSISSIPPI RIVER
(POOL 10(L)-MILE 613 TO MILE 631)

LEGEND

FLOODPLAIN

Limit of April 1965 flood

RECREATION

Primitive camping areas

RW — Recommended action

M = Maintain

R = Redevelop

RW = Redevelop without additional fill

RS = Redevelop with special wildlife habitat considerations

PROJECTS ACCOMPLISHED THROUGH GREAT I

Project location

FS — Type of project

FS = Side channel modification for fish and wildlife

RS = Side channel modification for recreation

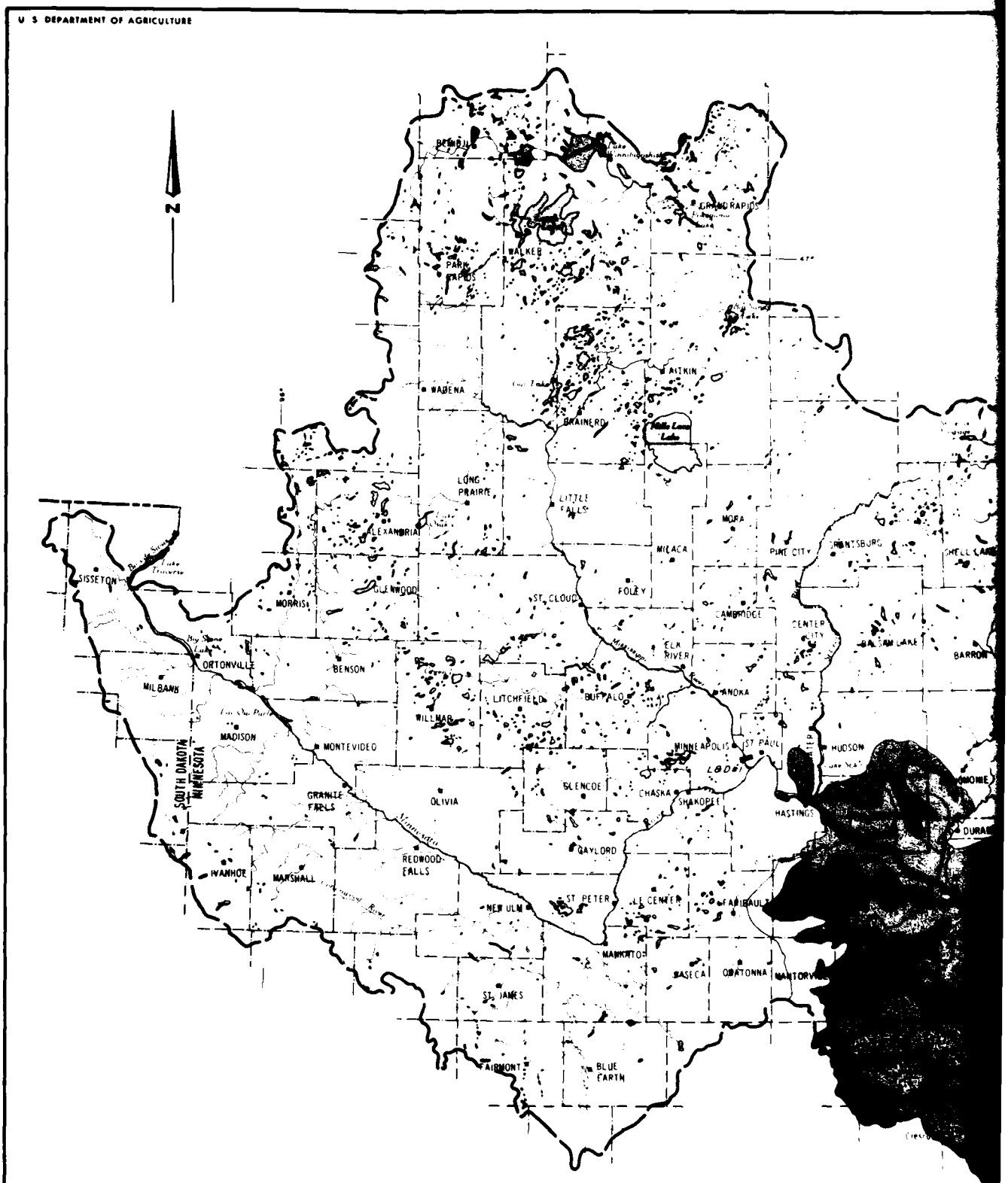
C = Water control culverts

SP = Shoreline protection

SCALE: 1" = 4,000'

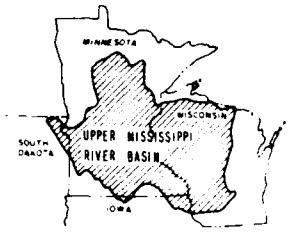
CONTOUR INTERVAL 20 FEET

U S DEPARTMENT OF AGRICULTURE



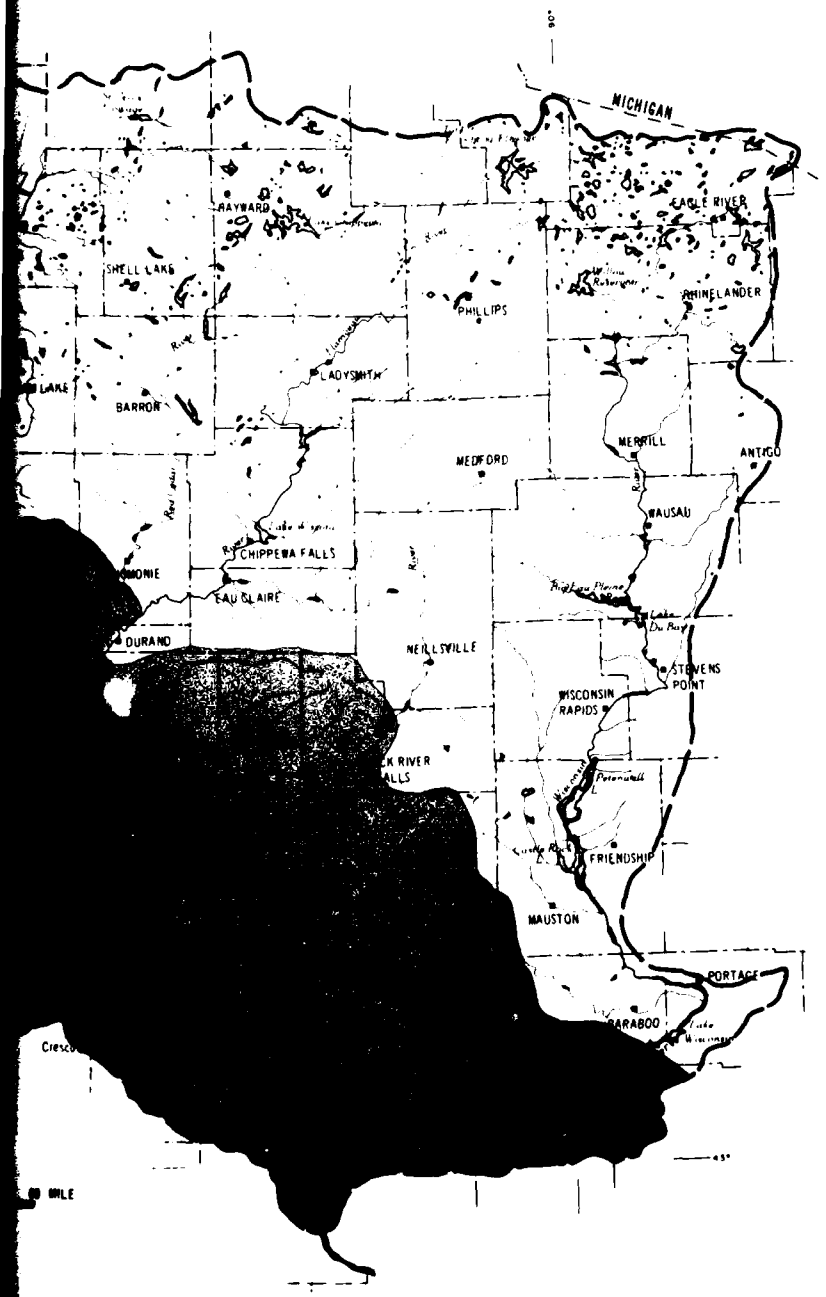
SCALE 10 0 10 20 30 40 50 60 MILE
1/2,400,000

SOURCE
SCS DRAWING S,R-36,568 AND
INFORMATION FROM FIELD TECHNICIANS
ALBERS EQUAL AREA PROJECTION



SOURCE OF SILT AND CLAY SEDIMENTS
EROSION HAZARD

- SEVERE
- SERIOUS
- MODERATE
- SLIGHT TO NONE



GREAT 1

SEDIMENT SOURCE MAP

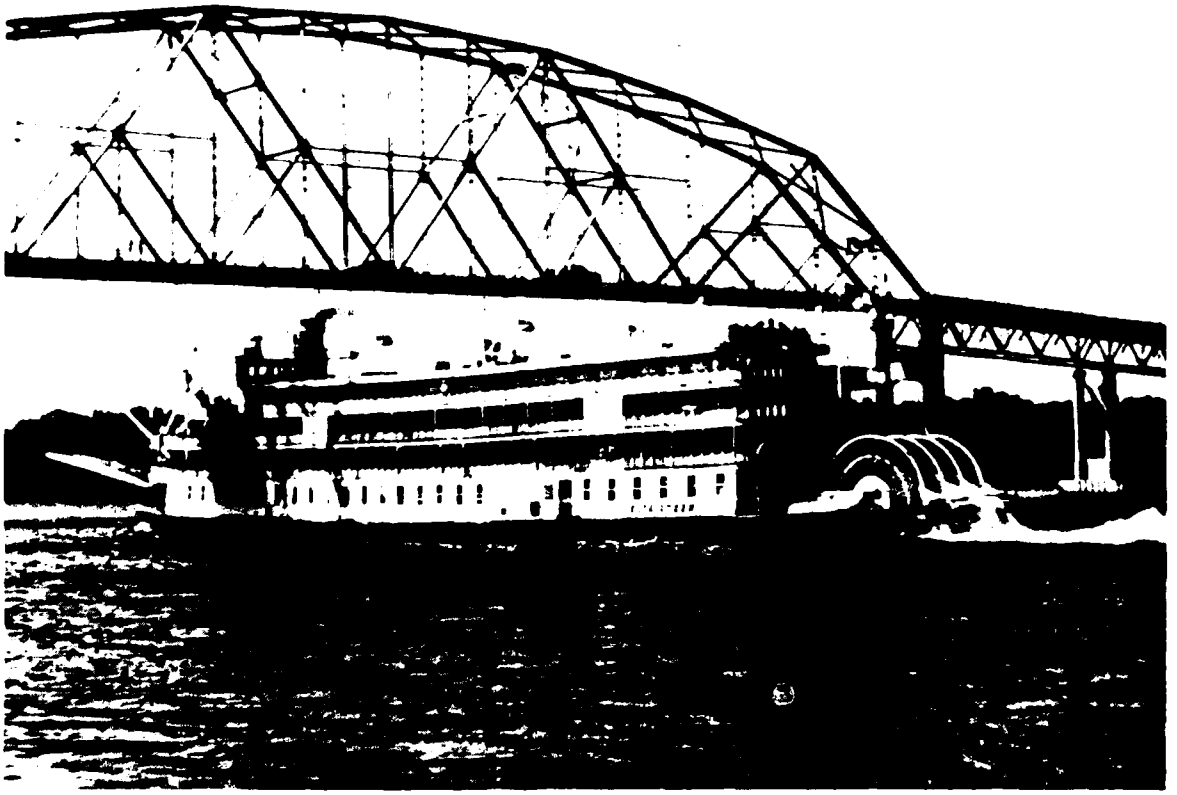
UPPER MISSISSIPPI RIVER BASIN

IOWA, MINNESOTA, SOUTH DAKOTA AND WISCONSIN

11-4-77
5,S-36,578

"But it's a big river - the Mississippi - and studies alone aren't the answer to its problems. ...You can do one study after another and you really get nowhere. What is needed is follow-up action."

Calvin R. Fremling



GUIDE TO IMPLEMENTATION

CHAPTER VIII

Chapter VIII

GUIDE TO IMPLEMENTATION

ORGANIZATIONAL FRAMEWORK

The products of the GREAT I Study consist of:

1. An implementable channel maintenance plan.

2. Other agency-specific implementable actions resulting from GREAT I studies and discussions.

3. Recommendation for long-range study needs and policy changes essential as part of long-range planning on the Upper Mississippi River system.

Another important product of the GREAT I Study has been a significant opening of the lines of communication among the States, agencies, and the public. While each State and agency, under its existing authorities must continue to carry out its responsibilities, the GREAT effort has demonstrated that the States and agencies can no longer afford to do so without benefit of close communication with their other "partners" on the river. The day-to-day communication by State and agency personnel in carrying out their activities - as fostered by GREAT - is a significant product and is both a philosophy and a process that should continue. An ongoing structure and specific actions providing for such a process is described in this chapter. This structure would coordinate the implementation of the channel maintenance plan and the other implementable actions recommended by GREAT I.

GREAT I made a significant contribution toward the identification of needed policy changes and further study needs that would aid in the development of a total river resource management plan for the study area. Because of time and funding limits, GREAT I did not develop a total river resource management plan to the detail necessary. GREAT I recognizes the need to continue to strive toward that goal. Later in this chapter a suggested structure and specific needed actions are described that would provide for the long-range planning needs for the Upper Mississippi River. This structure would seek not only the further studies identified by GREAT I, but would provide the mechanism for completion of a total river resource management plan using the products of the GREAT I, II, and III studies; the master plan studies of the Upper Mississippi River Basin Commission; and other studies being done on the Upper Mississippi River.

In proposing the following structures for post-GREAT implementation and planning coordination, GREAT recognizes that:

1. The Upper Mississippi River Basin Commission has authority to carry out and coordinate ongoing planning in the basin and include the GREAT I report or portions of it as components of the approved "regional plan." The Commission does not have authority for implementation of management actions or physical changes to the river environment.

2. The funding and authority for implementation actions are vested in the States and Federal agencies on the basis of their individually mandated State or Federal statutes and subsequent department policies, programs, rules, and regulations.

3. The funding and authority for ongoing planning of specific programs (for example the Fish and Wildlife Service refuge master plan) is vested in the

States and Federal agencies on the basis of their individually mandated State or Federal statutes and subsequent department policies, programs, rules, and regulations.

4. Extensive benefits are to be gained through coordination of both ongoing planning and studies as well as the agency-oriented implementation of post-GREAT actions on the river system.

Individual but linked structures are proposed to carry out the post-GREAT implementation and planning efforts. They are described in detail in the next two sections of this chapter.

ONGOING COORDINATION OF IMPLEMENTATION

The components of the GREAT I recommended plan that have reached the level of detail enabling them to be readily implementable (pending sufficient appropriations) are identified in Chapter VII. The principal item is the channel maintenance plan. Items from other components are listed as well. Inherent to almost all of these items is the philosophy that these actions should be implemented by a lead agency in consultation with other appropriate agencies who would be affected by the actions. To ensure that this consultation/coordination does occur, there is a need for a structure for ongoing coordination much in the same manner that the GREAT effort operated.

STRUCTURE

1. Ongoing coordination involves the same States and agencies that were involved in the GREAT I effort. (This structure could be expanded to cover the States involved in GREAT II and III pending completion of their efforts.) The diagram in figure 4 displays the proposed structure. The "Ongoing River Resource Management Team" would be made up of one individual from each of the States and agencies represented.

2. The Fish and Wildlife Service and Corps of Engineers would be responsible for establishing and initially cochairing the team. Once the Team was functioning, the chairmanship would rotate among the participants. The chairman would be responsible for calling meetings and maintaining minutes and the offices of the chairman would serve as "headquarters" for the team's coordination.

3. The team would meet no less than quarterly and more frequently if needed to ensure that adequate coordination of agency implementation activities are being carried out.

4. To initiate this structure, the following actions should be carried out immediately:

a. The two initial cochair agencies should prepare and circulate a memorandum of agreement among the team member agencies requesting their participation and the identification of specific individuals assigned to represent their State or agency.

b. Each State or agency should assign one person to serve on the team and authorize and fund that person to represent the State or agency and attend meetings.

c. Within each State or agency a strategy should be developed for interdepartmental communication to ensure that the team member can represent the State or agency viewpoints.

RESPONSIBILITIES

1.. The primary responsibility of the Ongoing River Resource Management Team will be to review the funding and implementation schedule contained at the end of this section and determine, in more detail, what each agency member must do to begin implementation. On the basis of this review, an annual team plan of action would be prepared for submittal

POST-GREAT INTERAGENCY COORDINATION

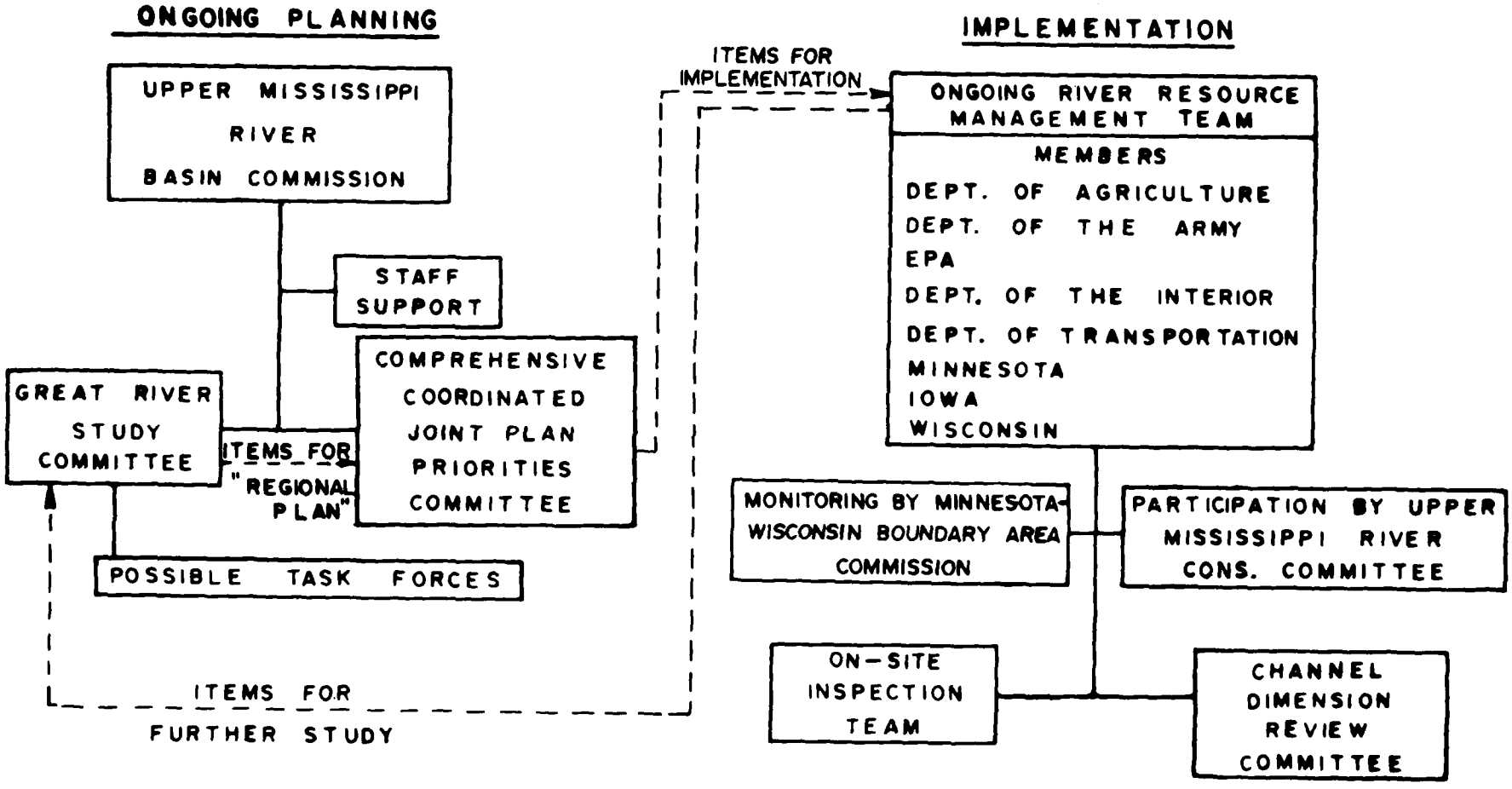


FIGURE 4

to each member agency. The plan would identify those actions which should be jointly funded and jointly implemented and/or coordinated.

2. Each agency should develop an annual plan of action (beginning with FY 1981) outlining very specific actions, personnel requirements, and funding needs for implementing items under its jurisdiction. The plan should outline how and where the implementable actions fit into existing budgets and programs.

3. Upon completion of annual plans, the team should meet to compare the proposed team plan to the plan adopted by the agencies or States. Items unable to be accomplished by an agency should be reviewed and a determination made as to appropriate action (for example, inclusion in a subsequent plan, etc.).

4. As newly identified "action items" are identified by any State or agency as a result of some administrative action or study findings, those items should be "entered" into the review/coordination cycle of the team. These items would include implementable actions recommended as a result of completion of GREAT II, GREAT III, master plan, and Corps of Engineers and Fish and Wildlife Service recreation and refuge master planning activities.

Funding and Schedule

Table 9 lists the recommendations of GREAT I, identifies the responsible agency, and presents estimated costs. Table 10 shows the proposed implementation schedule by agency. The tables are provided as a guide for the agencies and team in developing annual plans of action and are not meant to be a final determination of manpower requirements or budget needs.

Ongoing River Resource Planning

The components of the GREAT I recommended plan that call for policy changes or further study are identified in Chapter VII. They cover nearly all aspects of the river system. A mechanism exists to coordinate planning activities on the Upper Mississippi River, namely the Upper Mississippi River Basin Commission. This organization is composed of all of the State and Federal agencies working on the river. Through its Great River Study Committee (GRSC), the GREAT I, II, and III studies and the master plan were initiated. In addition, the Commission, through its Comprehensive Coordinated Joint Planning process, is preparing regional water resource management plans. It also prepares an annual priorities report recommending projects on an annual basis. It is logical, therefore, that the items recommended by GREAT I for further study and policy changes should be directed to the UMRBC for its consideration as part of its planning activities.

Structure

1. To facilitate the integration of GREAT products into the broader planning/coordination activities of the Upper Mississippi River Basin Commission, the Commission through the Great River Study Committee should develop a total river resource management plan. For purposes of division of labor, we recommend that the Great River Study Committee consider these major study areas:

a. River system management (related to overall interagency, interresource coordination) data organization needs.

b. Natural resources related principally to sedimentation, fish and wildlife, water quality, etc.

c. Human resources/uses related principally to floodplain management, commercial navigation, channel maintenance, recreation, and cultural and aesthetic resources.

2. Figure 4 displays the proposed structure. The Great River Study Committee

would continue to operate as it currently exists; however, its responsibilities would be expanded to provide more intensive coordination. The Upper Mississippi River Basin Commission offices would serve as headquarters for ongoing planning coordination with staff support by the Commission. The committee would continue to meet quarterly or more frequently, if required.

3. To initiate this structure, the following actions should be carried out immediately.

a. The Great River Study Committee should hold a special meeting to review the GREAT I products, particularly this implementation chapter.

b. The committee should consider establishing three permanent task forces (as noted on figure 4) and by letter of agreement solicit participation of the appropriate State and Federal agencies. Task force membership would be drawn from existing agency personnel with additional staff assistance from the Commission. Each State or agency should assign one person to the task force(s) for each representation slot.

c. Within the represented State and Federal agencies, that entity's representative on the committee would serve as the contact/coordination person for interdepartmental communication.

RESPONSIBILITIES

The committee would:

1. Be responsible for the completion of a total river resource management plan. It would incorporate results of completed studies, ongoing studies, and new studies (including those recommended as a result of G[illegible] I, II, and III and the master plan).

2. Monitor implementation of the plans once developed.

3. Ensure adequate levels of public participation in development of subplans and the total river resource management plan.

4. Identify and recommend to the Commission the need for any new cooperative agreements between State and Federal agencies for consistency in river resource management.

5. Assist agencies and States in securing new authorities and/or appropriations, as necessary, to implement plans as adopted.

TABLE 9

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Action item									
1 - Site specific material placement plan	X								$4,810,900 per year. See Channel Maintenance Appendix for details.
2 - Interim channel maintenance guidelines	X								Costs during interim period will vary between present cost and cost shown for action 1.
3 - Main stem shoreline protection	X								$3,765,000 per year for 5 miles of shoreline.
4 - Reduced-depth dredging	X								Included in action 1.
5 - Purchase of efficient dredging equipment	X								Included in action 1.
6 - Quantitative floodplain analysis	X								No additional cost.
7 - Placement for beneficial use	X								Included in action 1.
8 - Temporary placement sites	X								$1,000 per site.
9 - Criteria for sediment and water quality	X		X			X			Fixed - $1,500,000 Annual - 1,000 Per site - 11,000 to 31,000
10 - Placement site development plans	X								$1,000,000 - initial. $1,000 per site.
11 - Chippewa River sediment reduction	X								$100,000 study 300,000 implementation per site.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Action item (cont)									
12 - Increased soil erosion control practices					X				$243,000,000 installation cost plus $44,000,000 annual operating cost.
13 - Regulations on hazardous materials			X	X					$50,000
14 - Sanitary pump-outs and trash pickup	X	X							$15,000 installation per lock. $4,000 annual maintenance per lock. $2,000 annual pickup cost per lock.
15 - Increased staff and budget allocations	X	X				X			$80,000 per year.
16 - Culverts at L/D 4	X								$500,000 design and construction.
17 - Culverts at L/D 10	X								$150,000 - construct single-gated culvert.
18 - Continue bicentennial land heritage program		X							$5,000,000 annually for 6 years.
19 - Primitive recreation use sites	X								$55,000 review. $2,500 per site plan. $600 per site development.
20 - Lockage waiting areas	X								$20,000 - $100,000 construction per site. $5,000 - $25,000 annual maintenance per site.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Action Item (cont)									
21 - Recreational facility guides	X	X				X			$50,000 for study.
22 - Uniform recreation signing	X	X				X			$72,000.
23 - Marking control structures	X								Included with further study 41.
24 - Uniform boat noise levels						X		Local	Negligible.
25 - Bikeways	X	X							$10,000 study. $40,000 per mile construction.
26 - Canoe trails	X	X							$20,000 - study. $3,000 - construction, etc., per trail.
27 - Fort Snelling back channel	X								$130,000.
28 - Educate recreational boaters - State and Federal agencies	X	X		X		X			$20,000 - plan of action. $80,000 - annual cost.
29 - Educate recreational boaters - boating clubs				X				Boating clubs	$20,000.
30 - Educate recreational boaters - rental agencies						X		Local	Negligible.
31 - Additional water patrol		X		X		X		Local	$300,000 - annual.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Action item (cont)									
32 - Packing out trash	X	X				X			$20,000 - implementation. $100,000 - annual.
33 - Detailed topographic and hydrographic maps								USGS	$2,500,000
34 - Address project induced flood flow and sediment transport impacts	X				X				$1,000 each document.
35 - Information and education programs							X		$20,000 - planning. 185,000 - annual.
36 - Coordination of implementation of GREAT I recommendations	X	X	X	X	X	X			$36,000 - annual included in action item 37.
37 - Coordination mechanism	X	X	X	X	X	X			$111,000 - annual including $36,000 for item 36.
38 - Minnesota-Wisconsin Boundary Area Commission monitoring implementation of GREAT I recommendations								MWBAC	$5,000 - annual
39 - Ongoing planning coordination - total river resource management plan	X	X	X	X	X	X	X		$200,000 - annual and current master plan and GREAT funding.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Policy/funding item									
1 - Continued maintenance of navigation channel	X							Congress	Addressed in Channel Maintenance Appendix.
2 - Funding to implement GREAT I CMP	X								$6,400,000 annual.
3 - Emergency dredging definition	X					X			No cost.
4 - Emergency dredging capability	X								Not applicable.
5 - Sale of dredged material	X								$10,000 - legal assessment. $200-$300 per site.
6 - Acquisition of private land for material placement	X								$1,000.
7 - Allow recreation and fish and wildlife enhancement in the floodplain and implement channel maintenance plan	X					X			Not applicable.
8 - Depth of navigation channel definition	X							Congress	Not applicable.
9 - Comprehensive plan for management of UMRWLF Refuge		X							$500,000.
10 - Manage river as an ecological unit	X	X				X			$100,000 - initial cost. 105,000 - annual.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Policy/funding item (cont)									
11 - Authority for Corps to assist with fish and wildlife and recreation projects	X							Congress	Policy change - no cost.
12 - Separate line items on budgets	X								No cost.
13 - User data for cost allocations	X	X							$20,000 each participating agency.
14 - Unified management objective	X	X				X			No cost.
15 - Introduction of nonnative species		X				X			$10,000 per organism - included in master planning.
16 - Scenic easements/acquisitions								Fed. Hwy. Adm.	$100,000 - evaluation. $100,000,000 - acquisition.
17 - Amendments to bridge acts				X					Not applicable.
18 - Rebuilding obstructive bridges				X					Legislative action - no cost.
19 - Enforcing boathouse permits	X	X				X			Not applicable.
20 - Monitor application of lockage regulations	X								$10,000 - annual.
21 - Discourage high impact recreational developments	X	X							Not applicable.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Policy/funding item (cont)									
22 - Cooperative recreation data collection	X	X				X			$95,000 - study.
23 - Diversity of recreation opportunity	X	X				X	X		Not applicable.
24 - Maintaining boat launching accesses	X	X				X		Local	$50,000 - study.
25 - Uniform floodplain management standards						X			Not applicable.
26 - UMRBC guidelines for monitoring GREAT							X		Not applicable.
Further study item									
1 - Demonstration dredging projects	X								$180,000 - mechanical loading and unloading only.
2 - Use river sediment transport capability	X								$150,000 - study.
3 - Sediment transport models	X								$150,000 - model completion. $15,000 per pool optimum channel geometry ident.
4 - Monitor tributary deltas	X								$40,000 - initial. 30,000 - annual.
5 - Repair or modifications of wing dams	X								$100,000 - study. 200,000 - per site.
6 - Low-head tributary dams	X								$60,000 per pool.
7 - Dredging by sand and gravel companies	X								$70,000.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[i]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Further study item (cont)									
8 - Monitor dredging and material placement impacts on water quality	X		X						$2,000,000.
9 - Tributary stream bank erosion control	X				X				$2,500,000 - study.
10 - Sediment control on streams entering pool 3 from Wisconsin side	X								$150,000 - study.
11 - Riverine placement	X								$30,000 - study. 200,000 - implementation.
12 - Removing material from floodway	X								$30,000.
13 - Transporting material to areas of high demand	X								$25,000 - study.
14 - Private enterprise transporting sand	X								$500 - $5,000 - dependent on site complexity.
15 - Making riprap with dredged material	X								$10,000 - study.
16 - Beneficial use of organic sediment	X								$10,000 - $15,000.
17 - Conservation tillage program					X	X			$500,000 - phase I. $2,000,000 - phase II.
18 - Monitoring sediment inflow	X								$100,000 - study. 20,000 - per station.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Further study item (cont)									
19 - Protecting backwaters from sedimentation	X	X							$500,000 - study.
20 - Island creation in backwaters		X							$438,000.
21 - Weaver Bottoms rehabilitation	X	X				X			$1,010,000.
22 - Finger Lakes as physical model	X	X							$60,000 - study.
23 - Reducing fine sediment flow into Big Slough		X							$35,000 - study. 150,000 - implementation.
24 - Lake Onalaska rehabilitation	X	X							$35,000 - study. 300,000 - implementation.
25 - Spring Lake rehabilitation	X								$35,000 - study.
26 - Monitoring at Kruger Slough and Island 42		X							$3,000.
27 - Mapping of aquatic vegetation		X							$1,230,000.
28 - Controlling pool levels for fish and wildlife and recreation	X	X							$5,000.
29 - Designating primitive or natural areas	X	X				X			$150,000 - included in Master Planning.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Further study item (cont)									
30 - Forest land management							X		No cost.
31 - Bottomland hardwood management		X							$20,000.
32 - Life history of fishes		X				X			$260,000.
33 - Opening side channels at Blackhawk County Park	X					X		Local	$85,000.
34 - Aesthetics in management plans	X	X					X		$100,000 - included in Master Planning.
35 - Regulatory activities applicable to river transportation				X					$30,000 and UMRBC Master Plan Information.
36 - Identify acceptable fleeting areas				X					$20,000.
37 - Marked channel in Lake Pepin				X					$10,000.
38 - Capacity limitations at L/D's 2 and 3	X								$400,000 - study. $2,875,000 - construction - L/D 2. $4,045,000 - construction - L/D 3.
39 - Coast Guard capability to maintain navigation aid system				X					$3,370,000 - initial. 1,200,000 - annual.
40 - Coordinated recreation master planning	X	X					X		No cost.

TABLE 9 (cont)

GREAT I Recommendations

Lead Agency Implementation and Cost Summary

Recommendation	Responsible agency								Estimated cost[1]
	COE	FWS	EPA	DOT	SCS	States	UMRBC	Other	
Further study item (cont)									
41 - Feasibility of identified recreation sites	X	X				X	X		No cost for study - to be done in COE Recreation Master Plan.
42 - Zoning water surface use				X		X		Local	$10,000 - study 60,000 - implementation
43 - Impacts of private leases on Federal land	X	X							No cost.
44 - Mathematical floodplain management models	X						X		$100,000 - study. 30,000 - annual.
45 - Comprehensive cultural resources inventory								Heritage Cons. Rec. Service	$100,000.
46 - Geographical information system							X		$190,000.
47 - Document land ownership	X						X		$75,000.

(1) "Best guess" cost estimates based on available information. More detailed estimates should be made by lead agency before implementation or initiation of studies.

TABLE 10

Implementation Schedule (by agency)

U.S. Army Corps of Engineers

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items					
Channel maintenance					
1 - Site specific material placement plan					
2 - Interim channel maintenance guidelines					
3 - Main stem shoreline protection - 5 miles annually					
4 - Reduced-depth dredging					
Literature search					
Annual action					
5 - Purchase of efficient dredging equipment					
6 - Quantitative floodplain analysis					
7 - Placement for beneficial use					
8 - Temporary placement sites					
9 - Criteria for sediment and water quality					
Follow interim guidelines					
Follow criteria developed by EPA and States					
10 - Placement site development plans					
11 - Chippewa River sediment reduction study					
Complete study					
Implement recommended actions					
Water quality					
14 - Sanitary pumpouts and trash pick up - install and maintain					

TABLE 10

Implementation Schedule (by agency)

Corps of Engineers (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items (cont)					
Fish and wildlife					
15 - Increased staff and budget allocations					
16 - Culverts at L/D 4	—				
17 - Culverts at L/D 10	—				
Recreation					
19 - Primitive recreation use sites - interim maintenance					
20 - Develop lockage waiting areas	—				
21 - Develop recreational facility guides					
Initial guides	—				
Update as needed		—	—	—	—
22 - Develop uniform recreation signing					
23 - Mark hazardous control structures					
25 - Develop bikeways - consider in master planning					
26 - Develop canoe trails					
Consider in master planning	—				
Implement		—			
Maintain		—	—	—	—
27 - Open Fort Snelling back channel	—	—			
28 - Educate recreational boaters					
32 - Provide education on packing out trash					
Floodplain management					
34 - Address project-induced flood flow and sediment transport impacts					

TABLE 10

Implementation Schedule (by agency)

Corps of Engineers (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items (cont)					
Ongoing planning/coordination					
36 and 37 - Coordination of implementation of GREAT I recommendations					
39 - Continue ongoing planning coordination toward the development of total river resource management plan					
Policy/funding items					
Channel maintenance					
1 - Continued maintenance of navigation channel					
2 - Funding to implement GREAT I CMP					
3 - Emergency dredging definition					
4 - Emergency dredging capability					
5 - Sell dredged material Establish policy Implement					
6 - Acquisition of private land for material placement					
7 - Modify laws and regulations to allow recreation and fish and wildlife enhancement in the floodplain and implement channel maintenance plan					
8 - Depth of navigation channel definition Recommend to Congress Continue to implement					

TABLE 10

Implementation Schedule (by agency)

Corps of Engineers (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Policy/funding items (cont)					
Fish and wildlife					
10 - Manage river as an ecological unit					
11 - Authority for Corps to assist with fish and wildlife and recreation projects					
Seek authority and funding					
Identify and implement actions					
12 - Separate line items on budgets					
13 - Use user data for cost allocations					
14 - Develop and use unified management objectives					
Recreation					
19 - Enforce boathouse permits					
20 - Monitor application of lockage regulations					
21 - Discourage high impact recreational developments					
22 - Cooperative recreation data collection					
23 - Provide diversity of recreation opportunity					
24 - Maintain boat launching accesses					
Further study items					
Channel maintenance					
1 - Demonstration dredging projects					
2 - Use of river sediment transport capability					
3 - Sediment transport models					
Complete development					
Use for channel maintenance					

TABLE 10

Implementation Schedule (by agency)

Corps of Engineers (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study items (cont)					
Channel maintenance (cont)					
4 - Monitor tributary deltas					
5 - Repair or modification of wing dams					
Identify needed modifications					
Implement					
6 - Low-head tributary dams - study impacts on dredging requirements					
7 - Feasibility of dredging by sand and gravel companies					
8 - Monitor dredging and material placement impacts on water quality					
Monitor dredging					
Develop predictive capability					
Revise standards					
9 - Evaluate tributary stream bank erosion control					
10 - Study need for sediment control on streams entering pool 3 from Wisconsin side					
11 - Investigate riverine placement of dredged material					
12 - Investigate feasibility of removing material from floodway					
13 - Study feasibility of transporting material to areas of high demand					
14 - Study private enterprise transporting sand					
15 - Investigate making riprap with dredged material					
16 - Investigate beneficial use of organic sediment					

TABLE 10

Implementation Schedule (by agency)

Corps of Engineers (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study items (cont)					
Sediment and erosion control					
18 - Monitoring sediment inflow					
Review and establish priorities	—				
Continue monitoring	—	—	—	—	—
Fish and wildlife					
19 - Study feasibility of protecting backwaters from sedimentation	—				
21 - Weaver Bottoms rehabilitation					
Identify impacts	—				
Implement as part of channel maintenance plan	—	—	—	—	—
22 - Evaluate Finger Lakes as physical model	—	—			
24 - Evaluate Lake Onalaska rehabilitation	—				
25 - Evaluate Spring Lake rehabilitation	—				
28 - Investigate controlling pool levels for fish and wildlife and recreation	—				
29 - Consider designating primitive or natural areas	—				
33 - Investigate opening side channels at Blackhawk County Park	—				
Aesthetics					
34 - Consider aesthetics in management plans	—	—	—	—	—
Commercial navigation					
38 - Investigate capacity limitations at L/D's 2 and 3	—				

TABLE 10

Implementation Schedule (by agency)

Corps of Engineers (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study items (cont)					
Recreation					
40 - Coordinate recreation master planning					
41 - Evaluate feasibility of identified recreation sites					
43 - Evaluate impacts of private leases on Federal land					
Floodplain management					
44 - Evaluate mathematical floodplain management models					
Ongoing Planning/Coordination					
47 - Document land ownership and management entities					

TABLE 10

Implementation Schedule (by agency)

Fish and Wildlife Service

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items					
Water quality					
14 - Sanitary pumpouts and trash pickup-install and maintain					
Fish and wildlife					
15 - Increased staff and budget allocations					
18 - Continue Bicentennial Land Heritage Program					
Recreation					
21 - Develop recreational facilities guides					
Initial guides					
Update as needed		—	—	—	—
22 - Develop uniform signing					
25 - Develop bikeways - consider in master planning					
26 - Develop canoe trails					
Consider in master planning					
Implement		—			
Maintain		—			
28 - Educate recreational boaters					
32 - Provide education on packing out trash					
Ongoing planning/coordination					
36 and 37 - Coordination of - implementation of - GREAT I recommendations					
39 - Continual ongoing planning coordination toward the development of total river resource management plan					

TABLE 10

Implementation Schedule (by agency)

Fish and Wildlife Service (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Policy/funding items Fish and wildlife					
9 - Comprehensive plan for management of UMRWLF Refuge					
10 - Manage river as an ecological unit					
13 - Use user data for cost allocation					
14 - Develop and use unified management objectives					
15 - Study of nonnative organisms before introduction					
Recreation					
19 - Enforce boathouse permits					
21 - Discourage high impact recreation development					
22 - Cooperative recreation data collection					
23 - Provide diversity of recreation opportunity					
24 - Maintain boat launching accesses					
Further study items Fish and wildlife					
19 - Study feasibility of protecting backwaters from sedimentation					
20 - Study feasibility of island creation in backwaters					
21 - Identify impacts of Weaver Bottoms rehabilitation					
22 - Evaluate Finger Lakes as physical model					
23 - Study ways of reducing fine sediment flow into Big Slough					
24 - Evaluate Lake Onala ca rehabilitation					

TABLE 10

Implementation Schedule (by agency)

Fish and Wildlife Service (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study items (cont)					
Fish and wildlife (cont)					
26 - Monitoring at Kruger Slough and Island 42					
27 - Mapping of aquatic vegetation					
28 - Investigate controlling pool levels for fish and wildlife and recreation					
29 - Consider designating primitive or natural areas					
31 - Determine technique for bottomland hardwood management					
32 - Study the life history of fishes					
Aesthetics					
34 - Consider aesthetics in management plans					
Recreation					
40 - Coordinated recreation master planning					
41 - Evaluate feasibility of identified recreation sites					
43 - Evaluate impacts of private leases on Federal land					

TABLE 10

Implementation Schedule (by agency)

Environmental Protection Agency

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items					
Channel maintenance					
9 - Develop criteria for sediment and water quality	—				
Water quality					
13 - Develop and maintain list of hazardous materials	—				
Ongoing planning/coordination					
36 and 37 - Coordination of implementation of GREAT I channel maintenance plan	—				
39 - Continue ongoing planning coordination toward the development of total river resource management plan	—				
Further study items					
Channel maintenance					
8 - Monitor dredging and material placement impacts on water quality					
Monitor dredging	—				
Develop predictive capability		—			
Revise standards		—			

TABLE 10

Implementation Schedule (by agency)

U.S. Department of Transportation - Coast Guard

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items					
Water quality					
13 - Develop and enforce regulations on transport of hazardous materials					
Recreation					
28 - Educate recreational boaters					
29 - Assist boating clubs to educate recreational boaters					
31 - Assign additional water patrol personnel to river					
Ongoing planning/coordination					
36 - Coordination of and 37 implementation of GREAT I recommendations					
39 - Continued ongoing planning coordination toward the development of total river resource management plan					
Policy/funding items					
Commercial navigation					
17 - Seek amendments to bridge acts to provide for civil penalties					
18 - Rebuild obstructive bridges Amend Truman-Hobbs Act Continue using					
Further study					
Commercial navigation					
35 - Review regulations applicable to river transportation					
36 - Identify acceptable fleeting areas					
37 - Study need for marked channel in Lake Pepin					

TABLE 10

Implementation Schedule (by agency)

U.S. Department of Transportation - Coast Guard (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study (cont)					
Commercial navigation (cont)					
39 - Reassess Coast Guard capability to operate and maintain navigation aid system					
42 - Identify and zone water surface uses					

TABLE 10

Implementation Schedule (by agency)

U.S. Department of Agriculture - Soil Conservation Service

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items					
Sediment and erosion control					
12 - Increase soil erosion control practices					
Floodplain management					
34 - Address project induced flood flow and sediment transport impacts					
Ongoing planning/coordination					
36 - Coordinate implementation and of GREAT I recommendations 37					
39 - Continue ongoing planning coordination toward the development of total river resource management plan					
Further study items					
Channel maintenance					
9 - Evaluate tributary stream bank erosion control					
17 - Conduct two-part study of feasibility of conservation tillage					
Evaluation and education program	—	—			
Demonstration project	—	—	—		

TABLE 10

Implementation Schedule (by agency)

States of Iowa, Minnesota, and Wisconsin

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items					
Channel maintenance					
9 - Develop criteria for sediment and water quality					
Fish and wildlife					
15 - Increase staff and budget allocations					
Recreation					
21 - Develop recreation facility guides					
Initial guides					
Update as needed		—	—	—	—
22 - Develop uniform signing					
24 - Adopt and enforce uniform noise level regulations					
28 - Educate recreational boaters					
30 - Require rental agencies to educate boat users					
31 - Assign additional water patrol personnel to Mississippi River					
32 - Provide education on packing out trash					
Ongoing planning/coordination					
36 - Coordinate implementation and of GREAT I recommendations					
37					
39 - Continue ongoing planning coordination toward the development of total river resource management plan					

TABLE 10

Implementation Schedule (by agency)

States of Iowa, Minnesota, and Wisconsin (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Policy/funding items					
Channel maintenance					
3 - Emergency dredging definition					
7 - Modify laws and regulations to allow for recreation and fish and wildlife enhancement and implementation of GREAT I CMP					
Fish and wildlife					
10 - Manage river as an ecological unit					
14 - Develop and use unified management objectives					
15 - Study of nonnative organisms before introduction					
Recreation					
19 - Enforce boathouse regulations					
22 - Cooperative recreation data collection					
23 - Provide diversity of recreation opportunity					
24 - Maintain boat launching accesses					
Floodplain management					
25 - Develop uniform floodplain management standards					
Further study items					
Sediment and erosion control					
17 - Two-part study of conservation tillage					
Evacuation and education program	—	—			
Demonstration project	—		—		

TABLE 10

Implementation Schedule (by agency)

States of Iowa, Minnesota, and Wisconsin (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study items (cont)					
Fish and wildlife					
22 - Evaluate Finger Lakes as physical model	———	———			
29 - Consider designating primitive or natural areas	———				
32 - Study the life history of fishes	———				
33 - Investigate opening side channels at Blackhawk County Park	———				
Recreation					
41 - Evaluate feasibility of identified recreation sites	———				
42 - Identify and zone water surface uses	———				

TABLE 10

Implementation Schedule (by agency)

Upper Mississippi River Basin Commission

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items Public participation 35 - Continue information and education programs					
Ongoing planning/coordination 39 - Continue ongoing planning coordination toward the development of total river resource management plan					
Policy/funding items Recreation 23 - Provide for a diversity of recreation opportunity in management plans					
Ongoing planning/coordination 26 - Apply guidelines for monitoring GREAT					
Further study items Fish and wildlife 30 - Consider forest land management in master plans					
Aesthetics 34 - Consider aesthetics in management plans					
Recreation 40 - Coordinate recreation master planning					
41 - Evaluate feasibility of identified recreation site					
Floodplain management 44 - Evaluate floodplain management models					

TABLE 10

Implementation Schedule (by agency)

Upper Mississippi River Basin Commission (cont)

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study items (cont)					
Ongoing planning/coordination					
46 - Examine feasibility of using GIS as a land and water management tool					
47 - Document land ownership and management entities					

TABLE 10

Implementation Schedule (by agency)

Other - local, county, or municipal governments

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items Recreation					
24 - Adopt and enforce uniform noise level regulations					
30 - Require rental agencies to educate boat users					
31 - Assign additional water patrol personnel to Mississippi River					
Policy/funding items Recreation					
24 - Maintain boat launching accesses					
Further study items Fish and wildlife					
33 - Investigate opening side channels at Blackhawk County Park					
Recreation					
42 - Identify and zone water surface uses					

TABLE 10

Implementation Schedule (by agency)

Boating clubs

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items Recreation 29 - Educate recreational boaters					

TABLE 10

Implementation Schedule (by agency)

U.S. Geological Survey

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items Floodplain management					
33 - Prepare detailed topographic and hydrographic maps	———	———			

TABLE 10

Implementation Schedule (by agency)

Minnesota-Wisconsin Boundary Area Commission

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Action items Ongoing coordination/planning 38 - Serve as citizen participant in coordinating implementation of GREAT I recommendations					

TABLE 10

Implementation Schedule (by agency)

United States Congress

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Policy/funding items					
Channel maintenance					
1 - Provide authorization and funding for continued maintenance of navigation channel					
8 - Define navigation channel project depth	——	——			
Fish and wildlife					
11 - Provide authority and funding for Corps to assist with fish and wildlife and recreation projects	——	——			

TABLE 10

Implementation Schedule (by agency)

Federal Highway Administration

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Policy/funding items Aesthetics 16 - Give priority to providing scenic easements or acquisitions in connection with Great River Road and other applicable programs					

TABLE 10

Implementation Schedule (by agency)

U.S. Heritage Conservation and Recreation Service

Recommendation	Short term 1981-85	Midterm 1986-90	Midterm 1991-95	Midterm 1996-2000	Long term 2001-25
Further study items Cultural resources					
45 - Prepare a comprehensive cultural resources inventory					

EXHIBIT 1

LETTERS OF ENDORSEMENT

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STATE OF WISCONSIN
OFFICE OF THE GOVERNOR
STATE CAPITOL
MADISON, 53702

LEE SHERMAN DREYFUS

Telephone Number
(608) 266-1212

July 25, 1980

Mr. Wayne Knott, Co-Chairman
U.S. Army Corps of Engineers
U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Mr. Knott:

The Upper Mississippi River performs many functions for the people of Wisconsin, our neighbors and visitors. It has tremendous economic values as a low cost transportation network to exchange our products for needed commodities and to provide jobs. It provides many valuable benefits by supplying water for our industries and utilities, diluting waste products, buffering flood flows and providing recreational opportunities. Its environmental values are unparalleled. Its abundant plant, fish and animal life are a resource we can all share and enjoy in our own way.

Wisconsin recognizes that the uses we demand from the river must be managed in such a way as to preserve the environmental integrity of this resource, but still maintain the economic values the river has to offer. The river is an essential element to the well-being of this state and the entire nation. Both values can and must be preserved and enhanced.

The Great River Environmental Action Team has, through an unprecedented interagency cooperative process, made significant progress in understanding the intricate features of the river and its environment. For the first time state and federal agencies having management responsibilities on the river have communicated the goals which they seek to accomplish and the methods used to reach those goals. These efforts have resulted in a more knowledgeable approach to future management efforts so that all the uses we demand of the river can occur now and in the future without jeopardizing the values we rely on.

Wisconsin supports both the interagency cooperation concept and the product that the GREAT I study has produced. Any minor problems that remain can be resolved through interagency cooperation. We urge Congress to accept this report and to take necessary steps to insure successful management of this resource and its values for future generations.

Sincerely,

Lee Sherman Dreyfus
GOVERNOR

ljh

ALBERT H. QUIE
GOVERNOR

STATE OF MINNESOTA

OFFICE OF THE GOVERNOR

ST. PAUL 55155

September 25, 1980

Mr. Wayne A. Knott, Co-Chairman
Mr. Michael J. Vanderford, Co-Chairman
Great River Environmental Action Team-I
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Gentlemen:

It is my understanding that GREAT I has completed its task of studying the problems associated with the multi-purpose use of the Mississippi River below our Twin Cities and developing recommended actions to improve its management. As one who supported the federal legislation to authorize and fund this work, I have a deep interest in the outcome of this extensive study.

My interest in supporting GREAT I lies in the importance of that stretch of the Mississippi which provides so many benefits for such a wide variety of our people. Its economic value, particularly for commercial navigation, supports several leading industries. The recreational potential as well as environmental assets of this river are also extremely important, especially to our southeastern residents and their visitors.

From the initiation of GREAT, I have felt that this inter-agency effort provided the best opportunity to seek solutions to the many inter-jurisdictional disputes which have originated on this multiple use river and its valley. It is yet my belief that the Mississippi River must be managed under a river system management plan incorporating total river resource requirements.

The State of Minnesota has supported the GREAT I study and the co-partnership study process since 1974. The Team deserves credit for completing this difficult task in what I consider a unique and exemplary organization.

The Study Report and Recommendations should be submitted to the Congress and the Water Resources Council to expedite the necessary action needed to implement an environmentally and economically balanced river resource management plan. The

AN EQUAL OPPORTUNITY EMPLOYER

Channel Maintenance Plan should be re-evaluated to insure that the environmental and all economic factors are truly balanced before it is submitted for further implementation. I support continued agency coordination to resolve any remaining policy and management differences in the continued spirit of inter-agency cooperation that GREAT has fostered.

Sincerely,

ALBERT H. QUIE
GOVERNOR

AHQ:gbw

United States Department of Agriculture
Soil Conservation Service
316 North Robert St., Room 200
St. Paul, Minnesota
55101

September 12, 1980

Mr. Wayne A. Knott
Mr. Michael J. Vanderford
Co-Chairmen
Great River Environmental Action Team
1135 Post Office Bldg. & Custom House
St. Paul, Minnesota 55101

Gentlemen:

The Mississippi River is a vital resource to the people of the Midwest. The river provided the path for the original settlement of this area. Much of the fish and wildlife in the region relies on the river for food and cover. Even today a major portion of the products of the upper Midwest are carried to market on the Mississippi. It is essential that we take the steps needed to protect the Mississippi and preserve our heritage.

Throughout the GREAT I Study, the public has focused attention on the problems of erosion and sedimentation. The technical studies carried out by the GREAT Team have substantiated the public's view that sediment resulting from upland and streambank erosion is the most serious single threat to the river environment. Fine sediment from the uplands is rapidly filling the river's biologically productive backwaters and coarse sediment from tributary streambanks poses a chronic problem to the navigation channel.

Implementation of the GREAT recommendations calling for acceleration of upland and streambank erosion control is essential to the preservation of the Mississippi River as we know it. The Soil Conservation Service stands ready to do its part to implement these vital recommendations.

Sincerely,

Harry M. Major
State Conservationist

The Soil Conservation Service is an agency of the Department of Agriculture

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:
RA

AUG 29 1980

Mr. Wayne A. Knott and
Mr. Michael J. Vanderford
Co-Chairmen
Great River Environmental Action Team-I
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Gentlemen:

We are submitting this letter for inclusion in the GREAT-I Final Report to the Upper Mississippi River Basin Commission and the U.S. Army Corps of Engineers. This describes the Department of the Interior's specific reservations with the GREAT-I approved recommendations and details the conditions of our support for the implementation of these recommendations. Such conditional statements were provided for in the Team approved motion proclaiming formal acceptance of the GREAT-I Final Report, a motion the Department of the Interior supported.

The Department of the Interior has strongly supported the GREAT-I program since its inception as the Saint Paul Partnership Team in September of 1974. We have supplied thousands of man-hours of effort to the program, providing a Team Co-Chairman and two work group chairmen for the entire term of the program, as well as many additional personnel for carrying on many specific phases of the GREAT-I program. Our representatives have worked openly and cooperatively with all member agencies of the GREAT-I in developing both the Dredged Material Disposal Plan and the 112 recommendations approved by the TEAM. In both policy and action, the Department has championed the GREAT-I effort for six years.

Our reservations are centered on two major areas:

1. We cannot support the Ongoing River Resource Management Team as now described in the "Guide to Implementation," Chapter 8 of the Final Report.

2. We cannot support the concept of unlimited growth potential for commercial navigation presented in the Executive Summary.

The ongoing River Resource Management Team is intended to coordinate and facilitate the implementation of the Channel Maintenance Plan and the other recommendations of the GREAT-I which are ready to implement (Action Items). We concur with creating such a specific group to coordinate this effort. This is essential to making effective use of the work and products of the GREAT-I. However, the description of the team designed to

fill this role implies that the team has authorities which are unacceptable to the Department of the Interior.

Quoting from the "Guide to Implementation", the first responsibility assigned the team states:

> "The primary responsibility of the Ongoing River Resource Management Team will be to review the funding and implementation schedule contained at the end of this section and determine, in more detail, what each agency member must do to begin implementation. On the basis of this review, an annual team plan of action would be prepared for submittal to each member agency. The plan would identify those actions which should be jointly funded and jointly implemented and/or coordinated".

This assigned responsibility strongly implies that the Ongoing River Resource Management Team will have authority to (1) determine what must be done by the member agencies of the team to implement the GREAT-I recommendations, and (2) direct these agencies to take the appropriate action. We believe this implied authority goes beyond that needed to effectively coordinate the implementation of the recommendations. Further, we believe this authority conflicts with Congressionally mandated responsibilities given the Department's Fish and Wildlife Service and other Federal agencies. Such authority, whether explicit or implied, is inappropriate for the coordination team and is unacceptable to the Department of the Interior.

Congress has directed the Department of the Interior, through the Upper Mississippi River Wild Life and Fish Refuge Act and the National Wildlife Refuge System Administration Act of 1966, to manage those sections of the river within the Upper Mississippi River Wild Life and Fish Refuge for a set of specific objectives. These objectives provide for the conservation of migratory birds, game animals, furbearers, wildflowers, and aquatic plants. The Migratory Bird Treaty Act of 1918 provides additional direction to manage these refuge lands as a breeding and feeding area for migratory waterfowl. In addition, the Endangered Species Act of 1973, among other things, requires the Department to list endangered and threatened species and their range and to protect such species and their habitat. Although we welcome input and assistance from other agencies and the states in determining what actions we should take, we cannot accept the kind of interagency direction called for in the GREAT-I Final Report.

The Department of the Interior requested, in comments on the Draft Report, that a recommendation for an intensive study (which addresses the concept of placing limits on development along the Upper Mississippi River) be included in the final report. The Department believes that this ultimately may be a useful device to stabilize resource values and provide for continued future high quality fish and wildlife populations on the river. The GREAT-I Final Report does not address this issue, and continues to support the concept of unlimited growth through the removal or minimizing of constraints on commercial navigation. The Department of Interior cannot approve this approach and will continue to object to direct or indirect implications that the river can support unlimited development and still remain a viable fish and wildlife resource for future generations.

The Department of the Interior remains committed to the success of the GREAT-I program. We feel as strongly as ever that the new way of doing business on the river must continue in order to safeguard the river's natural resources. Interagency cooperation and coordination is essential. However, the responsibility and authority of the Ongoing River Resource Management Team must be explicitly limited to coordinating and assisting roles. The Department will be pleased to participate in this essential interagency coordinating effort when this clarification of responsibility is made.

Thank you for including this conditional statement in the GREAT-I Final Report.

Sincerely yours,

Harvey K. Nelson

Harvey K. Nelson
Regional Director

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT, CORPS OF ENGINEERS
1135 U S POST OFFICE & CUSTOM HOUSE
ST PAUL, MINNESOTA 55101

REPLY TO
ATTENTION OF:
NCSED-PB

29 September 1980

Mr. Wayne A. Knott
Mr. Michael J. Vanderford
Cochairmen, Great River
Environmental Action Team
1135 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Messrs. Knott and Vanderford:

The St. Paul District, Corps of Engineers was involved in the formation of GREAT I and has actively participated throughout the study. The GREAT I study process has been a unique venture in interagency planning and I am pleased with the cooperation and communication which has been established.

My staff is analyzing the GREAT I recommendations and separating those that have been identified for Corps implementation into three categories: (1) those we believe we can incorporate into our basic program without major changes in funding levels or policy, (2) those on which we plan to place a first priority for implementation but which will require changes in policies or funding, and (3) those that will require more detailed descriptions of impacts and effects to provide for early implementation.

We are finding that many of the recommendations are now being implemented or can easily be incorporated into our basic program. A number of other recommendations can be implemented with increased funding levels and a few policy changes. To implement some of the recommendations, however, will require very high investments and major changes in policy. Nevertheless, it is our intent to comply to the extent practicable with the recommendations contained in the GREAT I report.

The information we are now gathering will be contained in an implementation report I intend to send forward with the GREAT I report through Corps of Engineers review channels. The report will also contain our assessment of the equipment and costs required for implementation of the recommended channel maintenance plan. A draft of my report will be furnished to members of GREAT I for their review and comment.

NCSED-PB 29 September 1980
Messrs. Knott and Vanderford

I am looking forward to continued cooperation with GREAT I member agencies. We all have a responsibility to see that the Mississippi River can continue to satisfy the many uses we have imposed on it.

Sincerely,

WILLIAM W. BADGER
Colonel, Corps of Engineers
District Engineer

• Cost was not the only factor that caused the channel maintenance plan developed by the plan formulation work group to be unbalanced. Many of the basic criteria for selecting NED sites were the same as the criteria for EQ site selection. NED sites were not evaluated for environmental values until after the decision making process was completed, and then only those NED sites selected for the recommended plan received an environmental evaluation. Other NED sites did not receive this consideration although they may actually have had a better combination of environmental and economic values. Beneficial use of dredged material was a major criteria for site selection, so much so that alternative sites during the Plan Formulation review would not be approved unless they had a beneficial use. The determination of whether or not the use of dredged material is an economic benefit must be made according to Principles and Standards. The concept that dredged material is a beneficial use if access exists for someone, someday, to possibly use the material is not supported. If a real beneficial use does exist, can the Corps dredge deeper to satisfy that demand and provide a safer channel? The beneficial use demand for dredged material is grossly overstated. Demand figures for dredged material include a one time use, such as road construction, that cannot be satisfied with current dredging frequencies. After disposal site selection was completed there should have been a sensitivity analysis performed to determine how close the dredged material was being placed to the actual use site. Some responses to the beneficial use questionaire indicated a willingness to travel 35 miles for material. This does not appear feasible. GREAT I estimated truck transportation costs at 35¢ per cubic yard per mile. We do not envision local governments paying $12.25 a yard for sand when it can be obtained locally at a fraction of the cost.

Equipment cost evaluations were not properly conducted. The computer program for developing cost has had major problems, and after each change and further analysis, gross errors have been detected. The main problem, however, is with the inputs into the program. Information available indicates that hydraulic dredging is the most efficient dredging method since it includes a high production rate and a method of transport. Mechanical dredging involves excavation, loading, barge transportation, unloading and rehandling. These factors add significant costs to the total operation. Mechanical dredging is not fuel efficient either.

•Our major problem with the study in general was its inability to overcome the obvious bias of its members in objectively looking at alternatives. Riverine disposal is a prime example where the group failed to seriously consider all the options in its study. The Channel Maintenance Plan does not consider all of the alternatives available. It was assumed from the outset that a reduced depth dredging program would be instituted without properly anaylizing the impacts on navigation. Certainly one of the plans developed should have been based on normal dredging volumes with the material disposed of at an environmentally acceptable site. The most probable future without GREAT scenario comes closest to this plan, but it is based on reduced volumes.

DOT is supportive of the general recommendations in the GREAT I main report and will work to help implement those pertinent to the Department.

J. G. GLASGOW
Captain
U.S. Coast Guard
GREAT I Team Member

cc: Wayne Knott

We support the interdisciplinary approach to water resources management planning. The State of Iowa will continue to be actively involved in the planning and decision-making process related to the Mississippi River and its future.

Sincerely,

Robert D. Ray
Governor

RDR:kjd

EXHIBIT 2

RESOLUTION BY GREAT I
RELATING TO
WILDERNESS ON THE UPPER MISSISSIPPI RIVER

NOW THEREFORE BE IT RESOLVED THAT THE GREAT I Team recommends:

(1) That no wilderness under the federal definition be designated on the Upper Mississippi River, but further investigation should be made to determine if alternate designations are possible, such as semi-wilderness, natural areas or special management areas that preclude major intrusions, but allow necessary and needed types of management.

In making this recommendation GREAT I recognizes that the Upper Mississippi River Basin Commission (UMRBC), under Section 101 of P.L. 95-502, may make further recommendations concerning wilderness on the river. In developing a Master Plan for the Upper Mississippi River System as directed by P.L. 95-502 the UMRBC will evaluate the impact of existing navigation, operation and maintenance, and any expanded navigational capacity on wilderness.

(2) Until such designation or rejection, interim protection be provided to potential wilderness areas as found in the Citizens proposal in the following manner:

a. The Fish and Wildlife Service should provide interim protection until the Master Plan is completed as called for P.L. 95-502 to all of these potential wilderness areas that are refuge lands by using its management authority and permit review authority to prevent unnecessary intrusions.

b. The Corps of Engineers should agree to avoid deposition of spoil material on all such areas that are not included as part of the approved channel maintenance plan developed by GREAT I or GREAT II. Until channel maintenance plans are implemented, existing criteria should be used.

(3) The GREAT I plan formulation work group will review all such areas in relation to its channel maintenance plan that is developed during the coming year and will recommend the protection provided in item 2 above for those that are not in conflict with the channel maintenance plan.

(4) The recommendations included in this resolution will be a part of the final report of GREAT I.

EXHIBIT 3

GREAT I WORK GROUP ACTIVITIES

EXHIBIT 3

GREAT I WORK GROUP ACTIVITIES

I RIVER RESOURCE MANAGEMENT ACTIVITIES

A. Activities undertaken to facilitate study process and for short-term recommendations.

RRM 1	Annual channel dredging and disposal recommendations	An annual set of guidelines for that year's channel maintenance program was developed to minimize adverse environmental and economic impacts for the near term.	A task force was appointed annually by the Plan Formulation Work Group.	Near-term impacts of dredging, CT none	See discussions in Channel Maintenance Appendix.
RRM 2	OSIT annual activity	OSIT made annual inspections of dredging sites and forwarded recommendations to GREAT and the Corps. Primary emphasis of recommendations was to minimize impacts on fish and wildlife habitat.	Special On-Site Inspection Teams were established by the Fish and Wildlife Work Group and monitored by the Plan Formulation Work Group.	SCWG 1 FWWG 2 PFWG 5	See OSIT discussion in this report and Floodplain Management Work Group Appendix.
RRM 3	Public education and public information presentations.	Two slide shows depicting river problems and GREAT activities were developed. Numerous presentations were made to interested groups. Public Participation and Information Work Group coordinator traveled approximately 30,000 miles doing liaison work for GREAT.	Consultant - GREAT I Team - TCR Productions	PPI 2,3,4, 5,6,7 Other - for public	See Public Participation & Information Work Group Appendix.
RRM 4	Town meetings	Town meetings were held in 1975 with reports provided to GREAT.	GREAT I Team - Upper Mississippi River Basin Commission	P I -2	See Public Participation & Information Work Group Appendix.
RRM 5	Workshops and special informational meetings	17 workshops and special informational meetings were held in 1977 and 1978.	Public Participation & Information Work Group	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix.

RRM 6	Boat tour of river with public information input stops	A boat trip with stops in 24 communities was made in September 1978. A follow-up report was made to GREAT.	Public Participation & Information Work Group consultant	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix.
RRM 7	Public Participation & Information Work Group Executive Board Workshop interview of all work group chairmen	A 3-day workshop held by Public Participation & Information Work Group with Plan Formulation Work Group members as guests.	Public Participation & Information Work Group consultant and Public Participation & Information Work Group Executive Board	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix.
RRM 8	A public survey (evaluation) of individual work group recommendations.	Recommendations were sent to over 2500 people with a December 1978 newsletter. Survey responses were compiled into a special position paper to GREAT.	Public Participation & Information Work Group consultant	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix.
RRM 9	Information contacts by letter and telephone with numerous groups and individuals throughout the study.	Public Participation & Information Work Group Coordinator files document this activity.	Upper Mississippi River Basin Commission and Public Participation & Information Work Group consultant.	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix.
RRM 10	Public Participation & Information Work Group special position paper.	Two special position papers were provided to the Team outlining public concerns.	Public Participation & Information Work Group consultant and Executive Board	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix.

RRM 11	"Soundings" bulletin	"Soundings" bulletin was issued periodically to a mailing list of about 2,500.	Upper Mississippi River Basin Commission - Corps of Engineers-Public Participation & Information Work Group.	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix
RRM 12	Public Participation & Information Work Group contractor's progress report	Monthly progress reports and four annual phase reports were submitted to GREAT detailing Public Participation & Information Work Group activities.	Public Participation & Information Work Group consultant	PPI 2,3,4, 5,6,7	See Public Participation & Information Work Group Appendix.
RRM 13	Base maps preparation	Base maps were developed for the entire study area for use by all work groups in analysis of their own activities.	Floodplain Management Work Group - Plan Formulation Work Group - Iowa Geological Survey	FPM 2	See Floodplain Management Work Group Appendix
RRM 14	Floodplain Management legal and institutional framework study	The report is a description document summarizing floodplain laws of the States and Federal agencies in GREAT I area.	Floodplain Management Work Group	FPM 3	See Floodplain Management Work Group Appendix.
RRM 15	Floodplain and floodway maps	Maps were prepared showing the floodplain and floodway for the study area.	Floodplain Management Work Group	FPM 1,2,4	See Floodplain Management Work Group Appendix.

B. Activities undertaken to provide information for Final Report.

RRM 16	Channel maintenance plan	A detailed plan for pools 1 through 10, Upper and Lower St. Anthony Falls, and navigable portions of the St. Croix, Minnesota, and Black River was completed suggesting disposal sites, methods, criteria, and related recommendations.	The Plan Formulation Work Group appointed task force. Plan Formulation Work Group and Team review followed.	GREAT's primary concern	See Channel Maintenance section of this report and Channel Maintenance Appendix.
RRM 17	Develop a list of available dredging equipment types	All known equipment types available in the public or private sectors were listed.	Material and Equipment Needs Work Group	MEN 3	See Material and Equipment Needs Work Group Appendix.
RRM 18	Review of possible new dredging equipment types	Work group chairmen reviewed new equipment data for equipment such as pneuma pump and ladder-bucket dredge.	Material and Equipment Needs Work Group	MEN 3	See Material and Equipment Needs Work Group Appendix.
RRM 19	Dredging costs and equipment needs for selected channel maintenance plan.	Estimated costs and equipment needs were developed as part of economic analysis for channel maintenance plan.	Material and Equipment Needs Work Group	MEN 2 & none	See Channel Maintenance Plan
RRM 20	Identification of potential uses of dredged material	Six reports were prepared to determine the suitability of the material for: a. Fill b. Ice control c. Concrete d. Bituminous mix e. Soil conditioner (pilot study at Grey Cloud Island)	Dredged Material Uses Work Group	DMU 2	See Dredged Material Uses Work Group Appendix.
RRM 21	Identification of potential users of dredged material	Surveys were completed to determine markets for fill and ice control; pilot projects were undertaken where users were found. The Dredged Material Uses Work Group used these data to support suggested sites in the channel maintenance plan.	Dredged Material Uses Work Group	DMU 3	See Dredged Material Uses Work Group Appendix.

RRM 22	Identification of stockpile sites for beneficial use of dredged material	During the course of GREAT, the work group completed a field inspection of the entire study area and photographed, described, and mapped potential stockpile sites for consideration by GREAT in the development of its channel maintenance plan.	Dredged Material Uses Work Group	DMU	See Dredged Material Uses Work Group Appendix.
RRM 23	Other river management activities equipment needs report	Equipment needs for side channel modifications and other resource management activities were determined.	Material and Equipment Needs Work Group	MEN 2	Not completed.
RRM 24	Computerized Geographical Information System	A pilot study was made consisting of an inventory of natural/cultural characteristics in lower pool 4 and pool 5. Suitability models were developed for various uses.	The Plan Formulation Work Group, through a contract between the Fish and Wildlfie Service and ESRI, Inc.	CT none Other - for planning	See GIS discussion in Plan Formulation Work Group Appendix.
RRM 25	Future river resource coordination statement.	A recommendation was made for future river resource management after GREAT.	Task Force of the Plan Formulation Work Group	Other - for future Management	See future river resource coordination discussion in the implementation chapter of this report.
RRM 26	Recreation legal and institutional framework study, March 1976	This study identifies existing Federal and State programs and authorities regarding recreation.	Recreation Work Group, Heritage Conservation and Recreation Service	R none	See Recreation Work Group Appendix.
RRM 27	Legal and institutional framework for waterborne transportation.	Agencies that have control over waterborne transportation mode were surveyed.	Commercial Transportation Work Group report developed by chairman, approved by work group.	CT 4	See Commercial Transportation Work Group Appendix.

RRM 28	Impacts of legislation on commercial transportation.	Statement indicates concern for impacts of legislation and lack of study before implementation.	Commercial Transportation Work Group	CT 4,5	See Commercial Transportation Work Group Appendix.
RRM 29	Night lighting at docks and fleeting areas	The Commercial Transportation Work Group addressed this matter at the request of the Public Participation and Information Work Group.	Commercial Transportation Work Group	CT 177 Table 2	See Commercial Transportation Work Group Appendix.
II	**ECOLOGICAL RESOURCE ACTIVITIES**				
ER 1	Reduced-depth dredging at specific locations	Dredging to a depth less than the depth considered normal under historic practices was accomplished at 35 to 49 sites during the 1974-1978 dredging seasons.	Recommendation was included in annual recommendations made to the Corps of Engineers.	DR 1,6	Commercial Transportation Work Group
ER 2	Recommendations on dredging width changes	Report includes chart noting possible bend width changes but notes that further study is needed before any actual implementation.	Commercial Transportation Work Group surveyed 10 experienced towboat pilots.	CT 3, DR 1	See Dredging Requirements Work Group Appendix for details.
ER 3	Riverine disposal pilot test	A pilot test was done at Reads Landing in 1975.	Dredging Requirements Work Group and Corps of Engineers conducted the test.		See Dredging Requirements Work Group Appendix.
ER 4	Skip pattern dredging pilot project	A skip pattern dredging operation was accomplished in 1976 to determine if it could increase the efficiency of Derrickbarge Hauser.	Dredging Requirements Work Group and Corps of Engineers conducted this project.	DR 1	See Dredging Requirements Work Group Appendix.

ER 5	Sediment transport studies, pools 4 through 8	Study included obtaining cross sections accomplishing geomorphology studies and developing a one-dimensional math model to define the sediment transportation capabilities of the river system within the study area. Lower pool 4 was done first as a pilot area.	Dredging Requirements Work Group contracted with Colorado State University.	DR 1	See Dredging Requirements Work Group Appendix.
ER 6	Two-dimensional math model of lower pool 4	Following pilot study of lower pool 4 one-dimensional math model, a two-dimensional math model was developed to better predict effects of various hydraulic techniques on sediment transport capability.	Dredging Requirements Work Group contracted with Colorado State University	DR 1,3	See Dredging Requirements Work Group Appendix.
ER 7	Physical model of lower pool 4 and Chippewa River confluence	The physical model was used to test math models and obtain more knowledge of river hydraulics in the pool 4 area.	Dredging Requirements Work Group contracted with University of Minnesota	DR 1	See Dredging Requirements Work Group Appendix.
ER 8	Wing dam hydraulics	Data were obtained on the value of wing dams in further channel modifications to minimize dredging.	Dredging Requirements Work Group contracted with the University of Minnesota (completed in 1976).	DR 1	See Dredging Requirements Work Group Appendix.
ER 9	Dredging records analysis	1960-1974 dredging records were analyzed to determine likely effects of reduced depth dredging.	Dredging Requirements Work Group performed the analysis	DR 1,2	See Dredging Requirements Work Group Appendix.
ER 10	A study on the effects of hydraulic dredging and disposal on water quality of the Upper Mississippi River at Grey Cloud Island.	A study was conducted in association with hydraulic dredging near Grey Cloud Island (pool 2) in 1976. Findings were summarized for turbidity, suspended solids. Chemical and biological parameter sampling techniques were also assessed.	Water Quality Work Group with assistance from other GREAT personnel	WQ 2,4	See Water Quality Work Group Appendix.

ER 11	A study of the effects of mechanical dredging and disposal on Boulanger Bend water quality (1978)	A clamshell dredging operation was monitored downstream from Grey Cloud Island (pool 2) in 1977. Physical/biological/chemical parameters were assessed. Arterial-color and infrared photography were used.	Water Quality Work Group with assistance from other GREAT personnel.	WQ 2,4	See Water Quality Work Group Appendix.
ER 12	Grey Cloud Island pilot project	In 1976, the Corps deposited dredged material high in organics on Grey Cloud Island, pool 2. The site was seeded and monitored for vegetative growth.	Dredged Material Uses Work Group - Corps of Engineers - J.F. Shiely Co.	DMU 4	See Dredged Material Uses Work Group Appendix.
ER 13	Brownsville revegetation study	Fly ash was added to dredged material at a site near Brownsville, Minnesota (pool 8).	Dredged Material Uses Work Group	DMU 2	See Dredged Material Uses Work Group Appendix.
ER 14	Bottom sediment sampling and analysis	104 bottom sediment samples were collected from the main channel and 9 disposal sites. Materials were subjected to sieve and chemical analysis.	Dredged Material Uses Work Group - Corps of Engineers - Serco Labs	DMU 1	See Dredged Material Uses Work Group Appendix.
ER 15	Dredging seminar	A 2-day seminar to discuss dredging equipment needs relative to the Upper Mississippi River was held in St. Paul-January 31 and February 1, 1979.	Upper Mississippi River Basin Commission - GREAT I and Western Dredging Association		See Material and Equipment Needs Work Group Appendix and seminar proceedings.

ER 16	Pilot projects to investigate methods to preserve, protect, and enhance the fish and wildlife resources. a. Partial closing dam at Devils Cut b. 3 gated culverts at lock and dam 5 c. Side channel opening at lower end of Blackbird Slough d. Kruger Slough e. Island 42 f. Old John's Ditch g. Buffalo City h. Fort Snelling	Sites were selected by the Fish and Wildlife Work Group; reports on findings were prepared by contract or by the work group.	Sites were opened by U.S. Army Corps of Engineers or GREAT I, with before and after opening monitoring by a team of biologists from Winona State University/St. Mary's College of Winona, Minnesota or by the Fish and Wildlife Work Group.	FW 3 SC 2	See Fish and Wildlife Work Group Appendix.
ER 17	Identify crucial problem areas related to fish and wildlife management and conduct in-depth investigations to determine cause of problem. a. Weaver Bottoms b. Lake Onalaska c. Lansing Big Lake	Problem areas were identified by the Fish and Wildlife Work Group. a. A Phase I report describing Weaver Bottoms problems/potential solutions and a Phase II in-depth analysis was completed. b. Lake Onalaska was studied by River Studies Center as part of testing of a predictive mode. c. In-depth investigations of Lansing Big Lake was not accomplished.	a. St. Mary's College and Winona State University completed two extensive studies of Weaver Bottoms. b. Lake Onalaska was studied by River Studies Center, university of LaCrosse.	SC 1,2 FW 1,3	See Fish and Wildlife Work Group Appendix.
ER 18	Develop ways to predict biological responses to specific backwater changes.	A physical/biological predictive model was developed in pool 8 and tested in Fountain City Bay. A logical predictive capability was verified in work performed at pools 5 and 5A. Work continues at Kruger Slough and Island 42.	River Studies Center, University of LaCrosse, developed predictive model. Winona State University and St. Mary's College conducted studies.	FW 3 SC 2	A user manual was prepared to accompany the computer model. See Fish and Wildlife Work Group Appendix.

ER 19	Determine and quantify the abundance and distribution of fish and wildlife habitat	Using aerial photography interpretation, the contractor provided a set of maps for pools 3 through 10 with vegetative data overlays and quantified descriptions of vegetation by pools. Information on submergent vegetation is not included.	Fish and Wildlife Work Group contracted with the University of Minnesota.	FW 2	See Fish and Wildlife Work Group Appendix
ER 20	Wilderness recommendation	The GREAT I Team considered the need for special designation of some portions of the river system as wilderness areas and adopted a resolution stating its position.	Fish and Wildlife Work Group with assistance from other GREAT personnel.	FW 1	See other portions of this report.
ER 21	A study of the effects of first tow of the navigation season on Lake Pepin water quality	A monitoring study of water quality impacts of the first tow through Lake Pepin was done in 1978. Turbidity, suspended solids, and related parameters were measured.	Water Quality Work Group with assistance from other GREAT personnel.	WQ 3	See Water Quality Work Group Appendix.
ER 22	A literature review of the effects of navigation on water quality.	A summary analysis of studies already done was accomplished in cooperation with the Upper Mississippi River Basin Commission Main Stem Level B Study.	Water Quality Work Group - Upper Mississippi River Basin Commission	WQ 3	See Water Quality Work Group Appendix.
ER 23	A review of water quality standards and conditions	A summary of water quality standards/criteria in the study was done on a general level.	Water Quality Work Group	WQ 1	See channel maintenance plan
ER 24	Review of water quality problem areas on Upper Mississippi River.	The work group compiled existing data from various sources.	Water Quality Work Group	WQ 1	See Water Quality Work Group Appendix.

ER 25	Fort Snelling and Buffalo City side channel opening	The longevity of dredged side channel openings was tested. A small rented "Mudcat" dredge was also tested as part of these openings and the results were documented.	Material and Equipment Needs Work Group - Dredged Material Uses Work Group - Recreation Work Group - Side Channel Work Group.	FWMWG 3 SCWG 1,2 DMU 2 MEN none	See work group appendixes.
ER 26	Sediment source maps	Maps were completed documenting critical fine and coarse sediment sources.	Sediment and Erosion Work Group	SE 1,3	See Sediment and Erosion Work Group Appendix.
ER 27	Tributary monitoring stations	Stations were established and data gathered to use in making findings for activity.	Sediment and Erosion Work Group	SE 1	See Sediment and Erosion Work Group Appendix
ER 28	Monitor sediment rate in backwater and Lake Pepin	Report on sedimentation rates in lake based on borings analysis and map analysis was made.	Sediment and Erosion Work Group and U.S. Soil Conservation Service	SE 5	See Sediment and Erosion Work Group Appendix.
ER 29	Vegetative gain/loss maps	Maps were completed depicting backwater gain/loss in pools 4-10.	Sediment and Erosion Work Group	SE 3,6,8	See Sediment and Erosion Work Group Appendix.
ER 30	Shoreline protection needs evaluation	Recommendations were made to the Corps for needed shoreline protection.	Sediment and Erosion Work Group, Fish and Wildlife Work Group	SE 2	See Sediment and Erosion Work Group Appendix
ER 31	Research and evaluate erosion and land treatment alternatives	Costs and benefits of alternative soil conservation measures were detailed.	Sediment and Erosion Work Group	SE 1-8	See Sediment and Erosion Work Group Appendix.

ER 32	Review Chippewa River demonstration project	Work group worked with the Corps to develop pilot project for streambank erosion control.	Sediment and Erosion Work Group	SE 1	See U.S. Army Corps of Engineers Chippewa River Basin studies.
III	HUMAN RESOURCE ACTIVITIES				
HR 1	Flood impact math model	A math model of pool 4 between river miles 765 and 753 was completed to determine the impact of dredged material placement on flood stages.	Floodplain Management Work Group contracted with Owen Ayres and Associates	FPM 5	See Floodplain Management Work Group Appendix.
HR 2	Economics of: a. Inadequate channel b. Barge draft and channel dimensions c. Groundings d. Dredging techniques	a. Costs of actual blockages were discussed using Reads Landing (1978) as an example. b. Costs of transport for different drafts and channel dimensions were analyzed. c. Groundings from Coast Guard records and relationships to water levels were analyzed. d. Impacts on commercial navigation of various dredging techniques were discussed.	Members of the Commercial Transportation Work Group, based on their collective experience, discussed these issues and developed statements for final appendix.	CT 1,9,10	See Commercial Transportation Work Group Appendix.
HR 3	Legal study of use of dredged material	The study addressed liability of Corps if sand/gravel companies are adversely affected by public availability of dredged material.	Dredged Material Uses Work Group	DMU none	See Dredged Material Uses Work Group Appendix
HR 4	Demand for commercial transportation study	The report makes projections for barge requirements, lockage requirements, and lockage use under five possible futures, plus an analysis of effect of user charges on 1975 barge costs.	Commercial Transportation Work Group, contract, University of Minnesota	CT 11	See Commercial Transportation Work Group Appendix.

HR 5	Identify and document movements of bulk commodities on the river, determine magnitude of traffic and roles of different transportation modes.	The report looks at existing commodity movements (i.e., coal, grain, fertilizer, petroleum), magnitudes and direction of each, and magnitudes within intermodal system.	Commercial Transportation Work Group, contract with University of Minnesota	CT 11	See Commercial Transportation Work Group Appendix.
HR 6	Capacity of river for commercial transportation	Using historic data, work group discussed relationship of capacity to dredging, lockage capacity, etc.	Commercial Transportation Work Group expertise used to develop discussion of this issue.	CT 11	See Commercial Transportation Work Group Appendix.
HR 7	Barge fleeting area shortage	Current permitted fleeting areas, their adequacy, and need for additional fleeting were discussed.	Commercial Transportation Work Group	CT 2	See Commercial Transportation Work Group Appendix.
HR 8	Impact of industrial development constraints on commercial transportation	A four-pronged study was suggested to look at this issue further.	Commercial Transportation Work Group	CT 6	See Commercial Transportation Work Group Appendix.
HR 9	Bridge clearances for commercial transportation	57 bridges over the river were reviewed. The work group described 10 that cause problems to navigation.	Commercial Transportation Work Group	CT 8	See Commercial Transportation Work Group Appendix.
HR 10	Barge tie-off procedures	The Commercial Transportation Work Group addressed this matter at the request of the Public Participation and Information Work Group.	Commercial Transportation Work Group	CT 176 Table 2	See Commercial Transportation Work Group Appendix.

HR 11	Reflective coating on barges	The Commercial Transportation Work Group addressed this matter at the request of Public Participation and Information Work Group.	Commercial Transportation Work Group	CT 175 Table 2	See Commercial Transportation Work Group Appendix.
HR 12	Night lighting at docks and fleeting areas	The Commercial Transportation Work Group addressed this matter at the request of the Public Participation and Information Work Group.	Commercial Transportation Work Group	CT 177 Table 2	See Commercial Transportation Work Group Appendix.
HR 13	Closed navigation season	The Commercial Transportation Work Group addressed this matter at the request of the Public Participation and Information Work Group.	Commercial Transportation Work Group	CT 178 Table 2	See Commercial Transportation Work Group Appendix.
HR 14	Recreation and public use projections revised February 1978	The report estimated recreation demand for 12 activities and gives related data.	Recreation Work Group - Corps of Engineers	R 5	See Recreation Work Group Appendix.
HR 15	Aerial recreation use survey - September 1978	Report summarizes aerial photo interpretation by pool and activities and discusses future.	Recreation Work Group	R 2	See Recreation Work Group Appendix.
HR 16	Recreation facility and cultural resources inventory - July 1978	The report consists of completed recreation facility inventory forms summarized by pool and study area, definitions of recreation terms and map symbols, and cultural inventory with definitions.	Upper Mississippi River Basin Commission - Heritage Conservation and Recreation Service	R 4	See Recreation Work Group Appendix.
HR 17	Determine means of enhancing and maintaining beach recreation areas with dredged material - June 1978	Study analyzed physical site characteristics, determined which enhance recreation experiences, and presents guidelines for maintenance enhancement.	Recreation Work Group Consultant	R 8	See Recreation Work Group Appendix.

HR 18	Pool by pool recommendations for recreation September 1978	On pool by pool basis, resource capabilities of each pool are assessed.	Recreation Work Group	R 7-13	See Recreation Work Group Appendix.
HR 19	Recreation facility needs analysis-September 1978	Document summarizes recreational facility needs for entire area and pool by pool, with overall comparison of needs.	Recreation Work Group	R 5	See Recreation Work Group Appendix.
RM 20	Dredged material disposal site recreation use assessment, November 1978	Assessment contains data concerning origin of river trips, actual observed activities, activity preference, motivations, user characteristics and perception and further analysis.	Recreation Work Group - Corps of Engineers - University of Wisconsin		See Recreation Work Group Appendix.
RM 21	Recreational craft locks study	This study is part of an ongoing study of lock usage, demands, and feasibility of various alternatives.	Corps of Engineers	R 10	See Recreation Work Group Appendix.
RM 22	Barge and recreational craft safety	Report contains detailed data on recreation boating accidents, suggest boating safety practices.	Recreation Work Group	CT 7, R 9	See Recreation Work Group Appendix.
HR 23	Description of floodplain permit application approval process	A citizen's guide to the permit process in Iowa, Minnesota, and Wisconsin and through Federal channels was prepared.	Floodplain Management Work Group	FPM 3	See Floodplain Management Work Group Appendix.

EXHIBIT 4

BIBLIOGRAPHY AND REFERENCES

EXHIBIT 4

BIBLIOGRAPHY AND REFERENCES

BIBLIOGRAPHY

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REFERENCES FOR GREAT I RECOMMENDATIONS

Recommendation*	Bibliography Document Number	Remarks
Channel Maintenance		
A-1 Site specific material placement plan	42	The Channel Maintenance Plan is contained in this document with all background information.
A-2 Interim channel maintenance guidelines	42	See also Exhibit 5.
A-3 Main stem shoreline protection	27, 32, 53, 76	Also see meeting minutes of these work groups.
A-4 Reduced-depth dredging	27, 77, 78, 81, 82, 85	See Chapters VI and VII of reference 27 for extensive discussion of channel widths and depths.
A-5 Purchase of efficient dredging equipment	37, 52, 51, 58, 84	The specific wording of this recommendation was generated as a result of Team discussions in May/June 1980. It is based on a lack of definitive conclusions made by the Material & Equipment Needs Work Group.
A-6 Quantitative flood-plain analyses	33	Also see Executive Order 11988.
A-7 Placement for beneficial use	26, 42	-
A-8 Temporary placement sites	42	This recommendation based primarily on GREAT I Team discussions about the final Channel Maintenance Plan.
A-9 Criteria for sediment and water quality	86, 87, 89	While this recommendation originated from work of the Water Quality Work Group, the recommendation and rationale were developed primarily as a result of team discussions in consultation with the U.S. Army Corps of Engineers, Minnesota, and Minnesota Pollution Control Agency.
A-10 Placement site development plans	5, 24, 72	Reference 24 includes an extensive discussion about this specific subject.
A-11 Chippewa River sediment reduction	19, 76, 78 80, 82	Primary reference is No. 19.

Recommendation	Bibliograpy Document Number	Remarks
Channel Maintenance (cont)		
P/F 1 Continued maintenance of navigation channel	11, 17, 43, 45, 46	-
P/F 2 Funding to implement GREAT I CMP	42	-
P/F 3 Emergency dredging definition	-	This recommendation was developed primarily through discussions by the GREAT I Plan Formulation Work Group and GREAT I Team. Meeting minutes may also be consulted.
P/F 4 Emergency dredging capability	58	Also see Public Law 95-269 as cited.
P/F 5 Sale of dredged material	26	-
P/F 6 Acquisition of private land for material placement	26, 42	-
P/F 7 Allow recreation and fish and wildlife enhancement in the floodplain and implement channel maintenance plan.	32, 42, 72	All references note site-specific material placement recommendations which, in some cases, violate current laws.
P/F 8 Depth of navigation channel definition	11, 13, 27, 77	-
FS 1 Demonstration dredging projects	42, 58, 87	This recommendation developed by the GREAT I Team after review of data of these work groups and a determination that data did not justify making specific equipment recommendations at this time.
FS 2 Use river sediment transport capability	27, 77, 80, 81	-
FS 3 Sediment transport models	27, 78, 80, 81, 82	-
FS 4 Monitor tributary deltas	27, 82	-
FS 5 Repair or modifications of wing dams	27, 78, 80, 81, 82, 83	-
FS 6 Low-head tributary dams	27, 78, 80, 81, 82	-

	Recommendation	Bibliography Document Number	Remarks
Channel Maintenance (cont)			
FS 7	Dredging by sand and gravel companies	26	-
FS 8	Monitor dredging and material placement impacts on water quality	87	-
			-
FS 9	Tributary streambank erosion control	76	-
FS 10	Sediment control on streams entering pool 3 from Wisconsin side	42, 76	-
			-
FS 11	Riverine placement	27, 32, 77	-
FS 12	Removing material from floodway	33, 77	-
FS 13	Transporting material to areas of high demand	26, 58	-
FS 14	Private enterprise transporting sand	26, 58	Also see reference in rationale of this recommendation.
FS 15	Making riprap with dredged material	26	-
FS 16	Beneficial use of organic sediment	26, 52	-
			-
Sediment and Erosion Control			
A 12	Increased soil erosion control practices	54, 55, 3, 25 75, 56, 57, 76	-
			-
FS 17	Conservation tillage program	54, 55, 3, 25 75, 56, 57, 76	-
FS 18	Monitoring sediment inflow	17, 19, 76	-
Water Quality			-
A 13	Regulations on hazardous materials	11, 32, 87	-
A 14	Sanitary pumpouts and trash pickup	17, 87	-

Recommendation	Bibliography Document Number	Remarks
Fish and Wildlife		
A 15 Increased staff and budget allocations	32	This recommendation is based on a recognized lack of sufficient funding and long-range planning capability for Fish and Wildlife Resources, a problem which, in a broad context, is tied to many other more specific recommendations.
A 16 Culverts at L/D 4	32, 34	-
A 17 Culverts at L/D 10	32, 34	-
A 18 Continue bicenntial land heritage program	32	-
P/F 9 Comprehensive plan for management of UMRWLF Refuge	32	See remarks for A-15.
P/F 10 Manage river as an ecological unit	32	See remarks for A-15.
P/F 11 Authority for Corps to assist with fish and wildlife and recreation projects	17, 32, 34, 35 50, 52, 61, 72	This recommendation, in final form, is a product of GREAT I Team discussions and reflects the collective thinking of the Team as well as data contained in the reference documents.
P/F 12 Separate line items on budgets	-	Based upon Team discussions - see meeting minutes.
P/F 13 User data for cost allocations	-	Based upon Team discussions - see meeting minutes.
P/F 14 Unified management objectives	32, 73	-
P/F 15 Introduction of non-native species	32	-
FS 19 Protecting backwaters from sedimentation	3, 17, 25, 32, 34, 35, 54, 55, 56, 57, 75, 76	-
FS 20 Island creation in backwaters	17, 32, 34, 50, 52, 61	-
FS 21 Weaver Bottoms rehabilitation	17, 32, 34, 35 42, 61	Also see other references cited in rationale of recommendation.
FS 22 Finger Lakes as physical model	32, 34, 35, 61	-
FS 23 Reducing fine sediment flow into Big Slough	32, 34, 35, 61	Also see other references cited in rational of recommendation.

Recommendation	Bibliography Document Number	Remarks
Fish and Wildlife (Cont.)		
FS 24 Lake Onalaska rehabilitation	9, 10, 32	-
FS 25 Spring Lake rehabilitation	28, 32, 34, 35, 61, 67	Also see other references cited in rationale of recommendation.
FS 26 Monitoring at Kruger Slough and Island 42	32, 34	-
FS 27 Mapping of aquatic vegetation	30, 32, 59, 62, 63, 64	-
FS 28 Controlling pool levels for fish and wildlife and recreation	32, 85	-
FS 29 Designating primitive or natural areas	-	This recommendation is a product of numerous discussions by the GREAT I Team and PFWG. Minutes of these groups should be reviewed to determine basis for this recommendation. See also exhibit 1.
FS 30 Forest land management	32	-
FS 31 Bottomland hardwood management	32	-
FS 32 Life history of fishes	32	-
FS 33 Opening side channels at Blackhawk County Park	32, 34, 35	-
Aesthetics		
P/F 16 Scenic easements/acquisitions	72	-
FS 34 Aesthetics in management plans	72	-
Commercial Navigation		
P/F 17 Amendments to bridge acts	11	-
P/F 18 Rebuilding obstructive bridges	11	-
FS 35 Regulatory activities applicable to river transportation	11, 13	-
FS 36 Identify acceptable fleeting areas	11, 12, 36, 45 46, 47	-
FS 37 Marked channel in Lake Pepin	11, 72	-

Recommendation		Bibliography Document Number	Remarks
Commercial Navigation (cont)			
FS 38	Capacity limitations at L/D's 2 and 3	11, 18, 21, 36, 45, 46, 47, 60, 73	See also references cited in rationale.
FS 39	Coast Guard capability to maintain navigation aid system	11	-
Recreation			
A 19	Primitive recreation use sites	72	-
A 20	Lockage waiting areas	11, 18, 21, 48, 49, 72	-
A 21	Recreational facility guides	18, 22, 72, 73, 74	See also references cited in rationale.
A 22	Uniform recreation signing	72	-
A 23	Marking control structures	72	-
A 24	Uniform boat noise levels	72	-
A 25	Bikeways	72	-
A 26	Canoe trails	72	-
A 27	Fort Snelling back channel	32, 72	-
A 28	Educate recreational boaters - State and Federal agencies	13, 72	-
A 29	Educate recreational boaters - boating clubs	72	-
A 30	Educate recreational boaters - rental agencies	72	-
A 31	Additional water patrol	72	-
A 32	Packing out trash	72	-
P/F 19	Enforcing boathouse permits	72	-
P/F 20	Monitor application of lockage regulations	11, 18, 21, 36 45, 46, 47, 72	-
P/F 21	Discourage high impact recreational developments	32, 72	-
P/F 22	Cooperative recreation data collection	72	-

Recommendation		Bibliography Document Number	Remarks
Recreation (cont)			
P/F 23	Diversity of recreation opportunity	72	-
P/F 24	Maintaining boat launching accesses	32, 72	-
FS 40	Coordinated recreation master planning	72	-
FS 41	Feasibility of identified recreation sites	72	-
FS 42	Zoning water surface use	72	-
FS 43	Impacts of private leases on Federal land	32, 72	-
Floodplain Management			
A 33	Detailed topographic and hydrographic maps	33, 42, 68	-
A 34	Address project induced flood flow and sediment transport impacts	33	-
P/F 25	Uniform floodplain management standards	33	-
FS 44	Mathematical floodplain management models	33	-
Cultural Resources			
FS 45	Comprehensive cultural resources inventory	72	Also see references cited in rationale. -
Public Participation			
A 35	Information and education programs	69	-
Ongoing Planning/Coordination			
A 36	Coordination of implementation of GREAT I recommendations	-	Based upon Team discussions - see Team meeting minutes.
A 37	Coordination mechanism	11, 32, 68	Based upon Team discussions - see meeting minutes.
A 38	Minnesota-Wisconsin Boundary Area Commission monitoring implementation of GREAT I recommendations		Based upon Team discussions, see meeting minutes.
A 39	Ongoing planning coordination - total river resource management plan	- -	Based upon Team discussions. See meeting minutes.
P/F 26	UMRBC guidelines for monitoring GREAT	-	Provided by UMRBC
FS 46	Geographical information system	29, 30, 68	-
FS 47	Document land ownership	32, 42, 72	-

EXHIBIT 5

INTERIM GUIDELINES (1980-1985) FOR
DREDGED MATERIAL PLACEMENT

EXHIBIT 5

INTERIM GUIDELINES (1980-1985)

FOR DREDGED MATERIAL PLACEMENT

Purpose

The interim plan is to guide the Corps of Engineers in dredging and dredged material placement through 1985. After 1985, full compliance with the GREAT I Channel Maintenance Plan (CMP) will be possible. What is provided is a recommended procedure for the Corps and affected States and agencies to follow when dealing with dredging and dredged material placement.

Procedure

1. The primary guide for the interim is the long-range CMP approved by GREAT I. The placement sites and methods detailed in the CMP should be used in the interim whenever possible. Where the Corps does not have control over approved CMP sites, a systematic acquisition program should be immediately initiated. The CMP has been thoroughly evaluated and debated by GREAT and warrants highest priority.

2. When the CMP cannot be followed, the On-Site Inspection Team (OSIT) should determine the best material placement method and site. The OSIT and its procedures are described in detail in another section of this report. This interagency team should have the experience and perspective to make wise and viable recommendations regarding dredged material placement.

   a. Beneficial use sites have the highest priority when the CMP placement sites cannot be used. Short-term beneficial uses for dredged material may arise in the interim. If such uses do materialize, dredged material should be provided whenever possible.

   b. The second priority for placement site selection when the recommended CMP sites cannot be used is placement of material on existing sites. In such cases, the OSIT will specify what measures should be taken to substantially limit erosion or secondary movement from such sites.

   c. Temporary material placement sites and existing containment sites can be used in the interim if the CMP site is not attainable. However, as specified in the CMP, these sites should be emptied periodically to assure the integrity of the dikes and the capacity to handle emergency dredging volumes. If the OSIT concludes that a particular containment site cannot be used without a high risk of further wetland loss, an alternative site should be chosen.

3. When the Corps' equipment is not adequate or available for a given project, privately-owned equipment should be sought and the recommended CMP site or the OSIT's highest priority site should be used. All potential contractors should be directly contacted in such cases.

4. Reduced-depth dredging should continue to be used and evaluated during the interim period.

Summary

In the interim (1980-1985), the GREAT I CMP should be implemented whenever and wherever possible. When equipment or cost limitations make use of the CMP for a given site impossible, the OSIT procedure (as described in this report) should be used to determine the best placement site and method. Private equipment and reduced-depth dredging are to be used in the interim where appropriate.

EXHIBIT 6

LOCATIONS FOR STUDY IN COMPLIANCE WITH
FURTHER STUDY RECOMMENDATION NUMBER 42

EXHIBIT 6

LOCATIONS FOR STUDY IN COMPLIANCE WITH FURTHER STUDY RECOMMENDATION NUMBER 42

Pool	River mile	Further study	Lead agency
1	848.1L	Lockage holding area	COE
2	847.4L	Lockage waiting area	COE
2	830.5	Jolly Roger Marina expansion	Private
2	823-831	Purchasing islands for recreation and/or wildlife management	COE, MDNR, and FWS
2	820.7R	Camping, Spring Lake Park	Dakota County, MN
2	815.4R	Public use area	COE
3	814.9L	Lockage waiting area	COE
3	814.1	Expanding Hub's Bait	Private
3	813.8R	Expanding King;s Cove Marina	Private
3	813.2	Expanding Hastings Marina	Private
3	808.5L	New boat access	WDNR
3	807.3	Upgrading Vermillion River accesses	COE
3	804.1	Expanding North Lake public access	MDNR
3	800.1L	Upgrading Diamond Bluff beach	Private
3	798.5R	Expanding Sturgeon Lake public access	COE
3	797.4L	Island camp/beach area, lockage waiting area	COE
3	797.3	Facilities, Commissary Point	COE
3	N/A	Multipurpose trails, bluffs	WDNR

Pool	River Mile	Further study	Lead agency
4	N/A	Visitor contact station, Hwy 25	FWS
4	796.9L	Lockage waiting area	COE
4	791.3R	Island camp/beach area	COE
5	N/A	Modify demand/needs projections based on pool 5 recreation use survey	COE
5	752.5R	Lockage waiting area	COE
5	757.0R	Public access, Teepeota Point	FWS
5	747.8L	Island camp/beach area	COE
5	739.0L	Lockage waiting area	COE
5a	N/A	Expanding facilities, Latsch Prairie Island Park	City of Winona, MDNR
5a	N/A	Additional trails, Merrick Park	WDNR
5a	737.7L	Lockage waiting area	COE
5a	737.7R	Public access, Bass Camp	MDNR
5a	734.0R	Redevelop recreation access	COE
5a	731.5R	Access channel, Minnesota Boat Club	Private, COE
5a	729.0R	Lockage waiting area	COE
6	N/A	Expanding facilities, Latsch Prairie Island Park	City of Winona
6	N/A	Trails, Perrot State Park	WDNR
6	N/A	Latsch Prairie Island Park	City of Winona, MDNR
6	728.0L	Island camp/beach area	COE
6	724.7R	Expanding facilities, St. Charles Boat Ramp	City of Winona
6	723.8R	Upgrading east boat harbor	City of Winona
6	722.3R	New boat access	COE
6	720.8R	Expanding boat ramp, Homer	COE, City of Homer
6	717.5L	Island camp/beach area	COE
6	715.2R	Upgrading Big Trout Creek access	FWS
6	715. R	Island camp/beach area	COE
6	714.7L	Island camp/beach area	COE
7	N/A	Hiking trails, O. L. Kipp State Park	MDNR
7	N/A	Hiking trails, Long Lake-Lone Tree	FWS
7	714.2L	Island camp/beach area	COE
7	714.1R	Public access, Sunset Bay	MDNR
7	712.0L	Upgrading Lone Tree Landing	FWS
7	712.0L	Island camp/beach area	COE
7	704.5L	Upgrading Brice's Prairie	
near		Lower Landing	FWS
7	707.0R	Recreation area development	COE, Town of Dakota
8	702.0R	Upgrading South I-90 ramp	FWS
8	692.0L	Upgrading Goose Island ramp	FWS
8	680.0R	Island camp/beach area	COE

Pool	River mile	Further study	Lead agency
9	N/A	Day-use area, Lansing-Desoto Causeway	COE, FWS, States of Wisconsin and Iowa
9	676.5R	Recreation area, Twin Island	COE
9	672.7L	Upgrade Victory Landing	Town of Victory
9	671.5R	Recreation area, Black Hawk Island	COE
9	670.5L	Battle Island	COE, FWS, WDNR Crawford County
9	667.3L	Upgrade DeSoto Landing	State of Wisconsin
9	662-663R	Boat access/storage, Lansing area	State of Iowa
9	Near 654.R	Boat access, Heytman's Station	State of Iowa
9	Near 652.9R	Island camp/beach area	COE
9	651.3L	Upgrade Lynxville depot ramp	Village of Lynxville
9	648.5R	Lockage waiting area	COE
10	647.7R	Lockage waiting area	COE
10	646-647L	Recreation area, Gordon's Bay	COE WDNR
10	644-644.5L	Recreation area, DuCharme Creek	COE WDNR
10	637.7R	Boat access to interpretive area, Effigy Mounds	National Park Service
10	636.2L	Island beach/camp area	COE
10	616.0R	Island beach/camp area	COE
10	614.8R	Lockage waiting area	COE

EXHIBIT 7

GUIDELINES FOR NOTIFICATION AND
COORDINATION OF MISSISSIPPI RIVER CHANNEL
MAINTENANCE PROJECTS IN THE ST. PAUL DISTRICT

EXHIBIT 7

GUIDELINES FOR NOTIFICATION AND COORDINATION OF MISSISSIPPI RIVER CHANNEL MAINTENANCE PROJECTS IN THE ST. PAUL DISTRICT

I. INTRODUCTION.

During the term of the Great River Environmental Action Team I (GREAT I), a procedure was developed to coordinate decision making and actions of the Corps of Engineers regarding maintenance dredging of the Mississippi, Minnesota, and Saint Croix Rivers. The procedure gave the Fedral and State natural resource management agencies direct input into the Corps decision making process. The procedure also gave the Corps immediate feedback from these agencies on dredging projects and facilitated resolution to problems when present. The procedure involved the use of On-Site Inspection Teams (OSIT's) for each dredging event.

The guidelines contained in this document describe the OSIT procedure to be used in the future. They are to provide for notification and coordination of Mississippi River channel maintenance projects beginning with the 1980 dredging season. The guidelines are consistent with the recommendations of GREAT I. It is understood that the Corps of Engineers will obtain necessary permits from State and Federal regulatory agencies. The guidelines should also be used to implement the GREAT I Interim Channel Maintenance Guidelines (1980-1985) and Long-Term Channel Maintenance Plan (1985-2025).

To ensure the success of the GREAT I channel maintenance plan and these guidelines, the Corps should immediately take actions to implement the GREAT I dredged material placement plans and recommendations. These actions include implementing immediately those recommendations that are within present funding and equipment constraints, seeking funds where necessary, and developing those recommendations needing further work.

II. OSIT PARTICIPATION.

Dredging projects on the Mississippi, Minnesota, and Saint Croix Rivers affect resources that several agencies and interests are charged with managing. Therefore, the OSIT participants should include representatives of:

1. U.S. Army Corps of Engineers
2. U.S. Fish and Wildlife Service
3. U.S. Environmental Protection Agency
4. U.S. Coast Guard
5. Minnesota Pollution Control Agency
6. Minnesota Department of Natural Resources
7. Wisconsin Department of Natural Resources

8. Iowa Conservation Commission

9. Iowa Natural Resources Council

10. Iowa Department of Environmental Quality

11. Lower St. Croix Management Commission

12. Regional conservation and/or hunting and fishing organizations

These agencies and organizations are suggested based on past participation in the GREAT I on-site inspection process, vested interest in Corps activities, and regulatory functions governing material placement. Other agencies have interests and concerns in channel maintenance operations. These agencies will be coordinated with as necessary or are invited to join in active participation on the on-site inspection team.

The representation of the agencies on the OSIT will change from the approach used during the term of GREAT. Each agency on the OSIT will have one or two primary representatives for the entire Saint Paul District. These representatives may call on local agency staff to provide specific knowledge of an area, but the primary representative(s) will set the final policy for his or her agency.

For OSIT assignments, the District will be divided into two regions. One region is the portion upstream of Lake City, Minnesota (Cairo mile 733.0), and includes the Minnesota and Saint Croix Rivers. The second region includes the Lake City small-boat harbor and that portion of the District downstream to Guttenberg, Iowa. Participating organizations should designate a coordinator and one alternate for each region or preferably one coordinator to serve both regions if possible. This will allow the OSIT to provide imput to the Corps on the priority and allocation of equipment to meet dredging and disposal needs for the District.

Participating agencies should notify the Saint Paul District's Dredging Coordinator by April 15 of each year to designate their primary OSIT coordinator(s).. A secondary agency contact should also be designated at this time.

III. OSIT FUNCTION.

1. Dredging and Dredged Material Placement Decisions

The On-Site Inspection Team's function will be to provide input and guidance to the Saint Paul District for making dredging and dredged material placement decisions. The OSIT will determine and recommend how to best implement the GREAT I dredged material placement plan for any given dredge cut. The District's Dredging Coordinator will present the final OSIT dredging disposal recommendation to the District for a final decision.

In cases where placement site design or special safeguards needed to protect wetlands are in question, the OSIT will serve as the primary advisor to the coordinator. In these cases, the OSIT will also serve as the avenue for expressing agency regulatory requirements.

2. Appealing Decisions.

The OSIT will also serve as a means for the natural resource agencies to jointly appeal to the District Engineer the Corps intended action. The OSIT's appeal function will provide an opportunity for legitimate questions to be further investigated and documented.

The appeal process will begin when a majority of the OSIT members (one vote per state or federal agency) vote to appeal a decision of the District. The Fish and Wildlife Service OSIT representative will notify the District Engineer of this appeal immediately by telephone and set a date approximately one week later for a hearing by the District Engineer. The District Engineer will be further informed during the telephone call of the specific items being appealed. If possible, the COE should postpone any dredging action under appeal until the conclusion of this hearing.

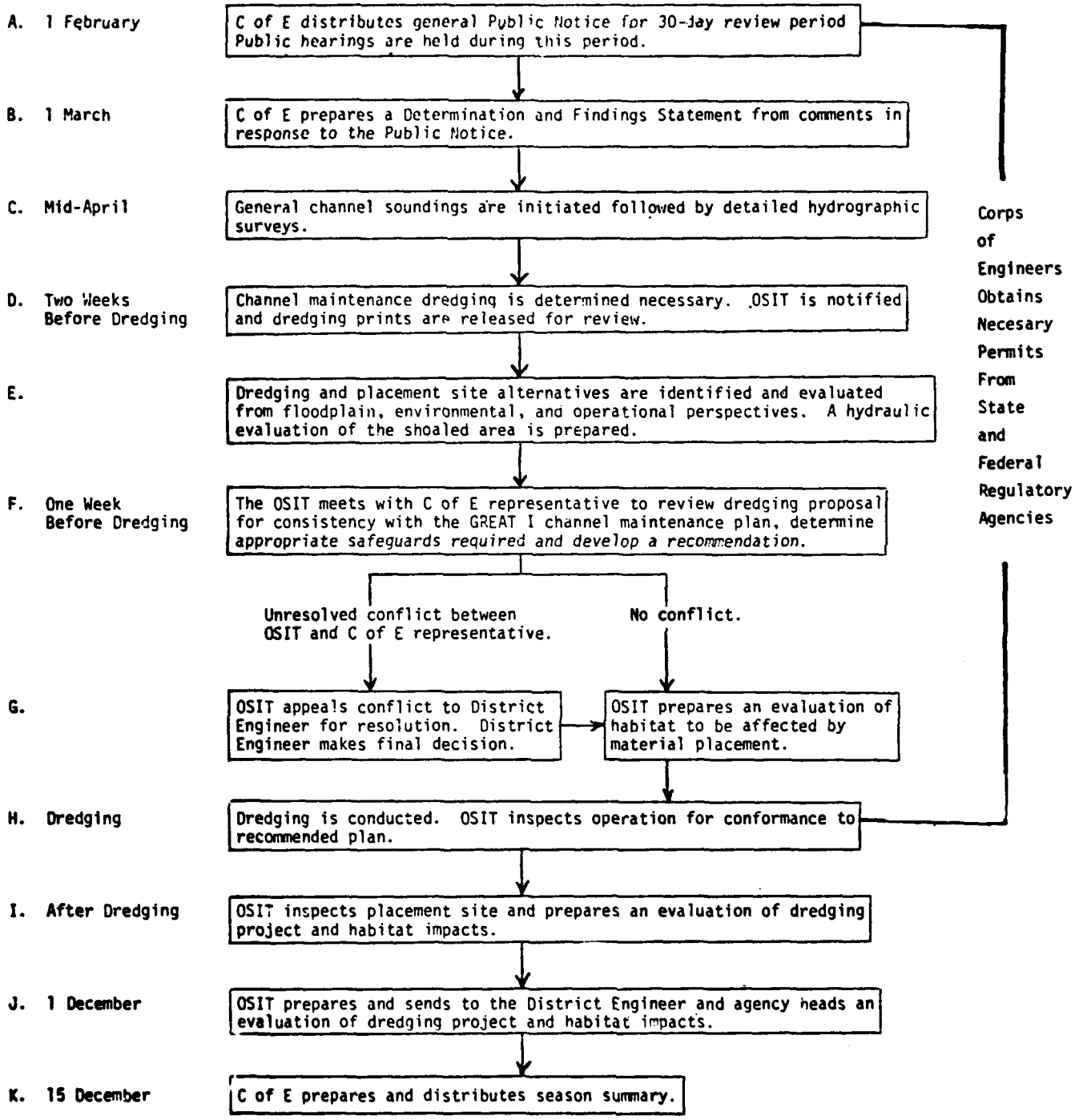
The Fish and Wildlife Service OSIT representative will coordinate the development of the appeal case and materials to present to the District Engineer, with all OSIT members having an opportunity to fully participate in the development. The OSIT will select a member of the team to make the presentation to the District Engineer, and possibly recommend the presence of specific agency chiefs at the hearing.

The hearing before the District Engineer will provide for the OSIT to make a full presentation of its case, and the COE's Operation and Maintenance Branch to provide response. After an open discussion period the District Engineer will make a final decision on the appeal subject or postpone a decision pending the gathering of more information. The District Engineer's decision at the conclusion of the hearing will conclude the appeal process.

3. Annual Evaluation.

The OSIT will also be responsible for preparing an evaluation of each year's dredging season. This evaluation will represent the OSIT's perception of the COE's efforts to achieve the CMP. The evaluations may further contain recommendations to modify the CMP or the COE's methods of accomplishing the CMP. The Fish and Wildlife Service representative of the OSIT will be responsible for coordinating the development of the annual evaluation, having January 15 as the deadline for completing and distributing the document.

IV. ON-SITE INSPECTION TEAM (OSIT) PROCEDURE FOR DREDGING AND MATERIAL PLACEMENT DECISIONS



May 1980

Saint Paul District
On-Site Inspection Team Report Form
for Dredging and Dredged Material Placement Activities
on the Mississippi, Minnesota, and Saint Croix Rivers

NOTE: This report should be completed for each dredging or dredging related project commenced by the Saint Paul District Corps of Engineers. The reports are to be used to document the environmental impacts of maintenance dredging subsequent to the GREAT I program.

A. Dredge Cut Name:

B. Disposal Site Location:

R.M._____ Pool_____ GREAT I No._____

C. Type of Activity:

- ☐ Emergency Dredging
- ☐ Regular Maintenance Dredging
- ☐ Placement Site Development
- ☐ Rehandling of Dredged Material
- ☐ Other (Specify)_____

D. OSIT Members Contributing:

- ☐ U.S. Army Corps of Engineers-ERB
- ☐ U.S. Fish and Wildlife Service
- ☐ Minnesota Pollution Control Agency
- ☐ Minnesota Dept. of Natural Resources
- ☐ Wisconsin Dept. of Natural Resources
- ☐ Iowa Conservation Commission
- ☐ U.S. Environmental Protection Agency
- ☐ U.S. Coast Guard
- ☐ Public

E. OSIT Meeting.

☐ Adequate project and meeting notice provided to OSIT; if no, specify problem:_____

_____

☐ OSIT meeting held; if no, why not_____

_____

☐ OSIT and COE Dredging Coordinator agreed on procedure to follow in project; if no, specify conflict:_____

_____

☐ OSIT appeal made to the District Engineer.

☐ Mutually acceptable resolution to appeal reached; if no, specify remaining conflicts:_____

_____

F. Dredging Project.

☐ Dredging accomplished; if no, reasons for cancelling:_____

_____

_____

_____

Volume dredged:_____

Depth dredged:

☐ 11 feet
☐ 12 feet
☐ 13 feet

Width dredged:_____

Number of years since cut last dredged:_____

Equipment used:

☐ Thompson

☐ Thompson and booster

☐ Hauser

☐ Dubuque

☐ Contracted hydraulic

☐ Contracted mechanical

☐ Other (specify)_____

Distance dredged material moved to placement site_____

☐ Removal from floodplain placement site.

☐ GREAT I selected placement site used(if no, why not)_____

_____

☐ Special dredging or placement methods used(specify)_____

_____

Placement site measures:

☐ Directional berming

☐ Inclosed berming

☐ 100% containment

☐ Strengthening berm walls

☐ Drop structure

☐ Other (specify)_____

G. Placement Site Impacts:

☐ Aquatic or wetland habitat lost (if yes, type)_____

_____

Acres of each:_____

☐ Terrestrial habitat lost (if yes, type)_____

_____

Acres of each:_____

☐ Habitat enhanced or created (if yes, type)_____

_____

Acres of each:_____

Probable indirect effects of dredged material placement (what effect, when and how?):

☐ On terrestrial habitat_____

_____

_____

_____

☐ On aquatic habitat_____

_____

_____

_____

☐ On recreational resources_____

_____

_____

_____

☐ Special habitat value on or adjacent to placement site(if yes, specify).

_____

_____

_____

K. Sketch of Placement Site and Proximity to Dredging Cut.

EXHIBIT 8

STUDY PARTICIPANTS

EXHIBIT 8

STUDY PARTICIPANTS

GREAT I VOTING MEMBERS

Corps of Engineers - Cochairman

William Pearson	1974-77	St. Paul District
Wayne A. Knott	1977-80	1135 U.S. Post Office & Custom House
		St. Paul, Minnesota 55101

Fish and Wildlife Service - Cochairman

Joseph F. Scott, Jr.	1974-77	530 Federal Courts Building
Richard F. Berry	1977	St. Paul, Minnesota 55101
Donald J. Peterson	1977-78	
John P. Wolflin	1978-80	
Michael J. Vanderford	1980	

State of Iowa

G. F. Schnepf	1974-78	Iowa Conservation Committee
Mark Ackelson	1978-79	Wallace State Office Building
Arnie Sohn	1980	East Ninth and Grand
		Des Moines, Iowa 50319

State of Minnesota

Jerome A. Kuehn	1974-80	Minnesota Department of Natural Resources
		300 Centennial Building
		St. Paul, Minnesota 55155

State of Wisconsin

Larry Larson	1974-75	Wisconsin Department of Natural Resources
Linda Reivetz	1975-76	
Jim Lissack	1977-80	1300 West Clairmont Avenue
		Eau Claire, Wisconsin 54701

Environmental Protection Agency

John Mosesso	1974-75	Office of Federal Activities
John-Erick Stenson	1976-77	230 South Dearborn Street
Harlan Hirt	1977-80	Chicago, Illinois 60604

U.S. Department of Agriculture

Herman Calhoun	1974-75	Soil Conservation Service
Chester Weldon	1975-78	Federal Courts Building
Gary Le Page	1978-80	316 North Robert Street
		St. Paul, Minnesota 55101

U.S. Department of Transportation

Commander Ralph W. H. Bartels	1974-75	Second Coast Guard District
Captain James G. Glasgow	1975-80	1430 Olive Street
		St. Louis, Missouri 63103

GREAT I NONVOTING MEMBERS

Minnesota-Wisconsin Boundary Area Commission

James Harrison, Executive Director	619 Second Street
	Hudson, Wisconsin 54016

Upper Mississippi River Basin Commission

Paul Solsted	1974-77	7920 Cedar Avenue South
Shirley Hunt	1974-	Minneapolis, Minnesota 55420
Dan Galloway	1977-80	
Bill Crews	1978-80	

Upper Mississippi River Conservation Committee

Charles Kulp	1974-75	U.S. Fish and Wildlife Service
Kent Keenlyne	1975	1830 Second Avenue
David Parsons	1976	Rock Island, Illinois 61201
Jerry Rasmussen	1977-80	

WORK GROUP CHAIRMEN

Commercial Transportation (U.S. Department of Transportation, United States Coast Guard)

Commander Ralph Bartels	1974-75
Lieutenant Commander Carmin Yannone	1975-76
Lieutenant Commander Charles Gower	1976-78
Captain Richard Walton	1978-80

Dredged Material Uses (Wisconsin Department of Natural Resources)

Mark A. Riebau	1975-77
Scot J. Ironside	1977-79
Thomas A. Lovejoy	1979-80

Dredging Requirements (St. Paul District, Corps of Engineers)

Dennis Cin (cochairman)	1974-77
W. Grant Westall (cochairman)	1977-79
Patrick Foley (cochairman)	1979-80

Fish and Wildlife (Fish and Wildlife Service)
combined Fish and Wildlife Management and
Side Channel Openings Work Groups

Fish and Wildlife Management

Donald F. La Pointe	1974-75
Joseph F. Scott	1975
Dennis E. Chase	1975
Michael J. Vanderford	1976
John P. Wolflin	1977-78

Side Channel Openings

Joseph F. Scott	1974-75
Michael Vanderford	1975-78

Fish and Wildlife

John P. Wolflin	1978
Michael J. Vanderford	1978-80

Floodplain Management (Minnesota Department of Natural Resources)

Jerome H. Kuehn	1974-75
Donald Buckhout	1975-80

Material and Equipment Needs (St. Paul District, Corps of Engineers)

Raymond Sanford	1974-77
Donald Wadleigh	1977-80

Plan Formulation (Corps of Engineers)

James Forsyth (coordinator)	1975-80

Public Participation and Information

Shirley Hunt (UMRBC coordinator)	1974-76
Daniel W. McGuiness (contract coordinator)	1976-79
Mary Swanger (cochairman)	1976-79
William H. Howe (cochairman)	1976-79

Recreation (Iowa)

G. F. Schnepf	1974-75
Mark C. Ackelson	1975-79

Sediment and Erosion (Soil Conservation Service)

Chester Weldon	1975-78
Gary LePage	1978-80

Water Quality (St. Paul District, Corps of Engineers - Environmental Protection Agency)

John Mosesso (cochairman)	1974-75
Robert Whiting (cochairman)	1974-80
Peter Smith (cochairman)	1976
John Helvig (cochairman)	1976-78

OTHER CONTRIBUTORS

David Kennedy, Wisconsin Department of Natural Resources	1977-80
Al Fenger, Dan McGuiness and Associates	1978-80
Keith Larson, Fish and Wildlife Service	1974-75
Daniel Krumholz, St. Paul District, Corps of Engineers	1977-80
Gary Palesh, St. Paul District, Corps of Engineers	1978-80

☆ U.S.GPO:1980-665-155/47-6

Recommendation	Bibliography Document Number	Remarks
Fish and Wildlife (Cont.)		
FS 24 Lake Onalaska rehabilitation	9, 10, 32	-
FS 25 Spring Lake rehabilitation	28, 32, 34, 35, 61, 67	Also see other references cited in rationale of recommendation.
FS 26 Monitoring at Kruger Slough and Island 42	32, 34	-
FS 27 Mapping of aquatic vegetation	30, 32, 59, 62, 63, 64	-
FS 28 Controlling pool levels for fish and wildlife and recreation	32, 85	-
FS 29 Designating primitive or natural areas	-	This recommendation is a product of numerous discussions by the GREAT I Team and PFWG. Minutes of these groups should be reviewed to determine basis for this recommendation. See also exhibit 1.
FS 30 Forest land management	32	-
FS 31 Bottomland hardwood management	32	-
FS 32 Life history of fishes	32	-
FS 33 Opening side channels at Blackhawk County Park	32, 34, 35	-
Aesthetics		
P/F 16 Scenic easements/acquisitions	72	-
FS 34 Aesthetics in management plans	72	-
Commercial Navigation		
P/F Amendments to bridge acts 17	11	-
P/F 18 Rebuilding obstructive bridges	11	-
FS 35 Regulatory activities applicable to river transportation	11, 13	-
FS 36 Identify acceptable fleeting areas	11, 12, 36, 45 46, 47	-
FS 37 Marked channel in Lake Pepin	11, 72	-

Recommendation		Bibliography Document Number	Remarks
Commercial Navigation (cont)			
FS 38	Capacity limitations at L/D's 2 and 3	11, 18, 21, 36, 45, 46, 47, 60, 73	See also references cited in rationale.
FS 39	Coast Guard capability to maintain navigation aid system	11	-
Recreation			
A 19	Primitive recreation use sites	72	-
A 20	Lockage waiting areas	11, 18, 21, 48, 49, 72	-
A 21	Recreational facility guides	18, 22, 72, 73, 74	See also references cited in rationale.
A 22	Uniform recreation signing	72	-
A 23	Marking control structures	72	-
A 24	Uniform boat noise levels	72	-
A 25	Bikeways	72	-
A 26	Canoe trails	72	-
A 27	Fort Snelling back channel	32, 72	-
A 28	Educate recreational boaters - State and Federal agencies	13, 72	-
A 29	Educate recreational boaters - boating clubs	72	-
A 30	Educate recreational boaters - rental agencies	72	-
A 31	Additional water patrol	72	-
A 32	Packing out trash	72	-
P/F 19	Enforcing boathouse permits	72	-
P/F 20	Monitor application of lockage regulations	11, 18, 21, 36 45, 46, 47, 72	-
P/F 21	Discourage high impact recreational developments	32, 72	-
P/F 22	Cooperative recreation data collection	72	-

Recommendation		Bibliography Document Number	Remarks
Recreation (cont)			
P/F 23	Diversity of recreation opportunity	72	-
P/F 24	Maintaining boat launching accesses	32, 72	-
FS 40	Coordinated recreation master planning	72	-
FS 41	Feasibility of identified recreation sites	72	-
FS 42	Zoning water surface use	72	-
FS 43	Impacts of private leases on Federal land	32, 72	-
Floodplain Management			
A 33	Detailed topographic and hydrographic maps	33, 42, 68	-
A 34	Address project induced flood flow and sediment transport impacts	33	-
P/F 25	Uniform floodplain management standards	33	-
FS 44	Mathematical floodplain management models	33	-
Cultural Resources			
FS 45	Comprehensive cultural resources inventory	72	Also see references cited in rationale. -
Public Participation			
A 35	Information and education programs	69	-
Ongoing Planning/Coordination			
A 36	Coordination of implementation of GREAT I recommendations	-	Based upon Team discussions - see Team meeting minutes.
A 37	Coordination mechanism	11, 32, 68	Based upon Team discussions - see meeting minutes.
A 38	Minnesota-Wisconsin Boundary Area Commission monitoring implementation of GREAT I recommendations		Based upon Team discussions, see meeting minutes.
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DREDGED MATERIAL PLACEMENT

EXHIBIT 5

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FOR DREDGED MATERIAL PLACEMENT

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    b. The second priority for placement site selection when the recommended CMP sites cannot be used is placement of material on existing sites. In such cases, the OSIT will specify what measures should be taken to substantially limit erosion or secondary movement from such sites.

    c. Temporary material placement sites and existing containment sites can be used in the interim if the CMP site is not attainable. However, as specified in the CMP, these sites should be emptied periodically to assure the integrity of the dikes and the capacity to handle emergency dredging volumes. If the OSIT concludes that a particular containment site cannot be used without a high risk of further wetland loss, an alternative site should be chosen.

3. When the Corps' equipment is not adequate or available for a given project, privately-owned equipment should be sought and the recommended CMP site or the OSIT's highest priority site should be used. All potential contractors should be directly contacted in such cases.

4. Reduced-depth dredging should continue to be used and evaluated during the interim period.

Summary

In the interim (1980-1985), the GREAT I CMP should be implemented whenever and wherever possible. When equipment or cost limitations make use of the CMP for a given site impossible, the OSIT procedure (as described in this report) should be used to determine the best placement site and method. Private equipment and reduced-depth dredging are to be used in the interim where appropriate.

EXHIBIT 6

LOCATIONS FOR STUDY IN COMPLIANCE WITH
FURTHER STUDY RECOMMENDATION NUMBER 42

EXHIBIT 6

LOCATIONS FOR STUDY IN COMPLIANCE WITH FURTHER STUDY RECOMMENDATION NUMBER 42

Pool	River mile	Further study	Lead agency
1	848.1L	Lockage holding area	COE
2	847.4L	Lockage waiting area	COE
2	830.5	Jolly Roger Marina expansion	Private
2	823-831	Purchasing islands for recreation and/or wildlife management	COE, MDNR, and FWS
2	820.7R	Camping, Spring Lake Park	Dakota County, MN
2	815.4R	Public use area	COE
3	814.9L	Lockage waiting area	COE
3	814.1	Expanding Hub's Bait	Private
3	813.8R	Expanding King;s Cove Marina	Private
3	813.2	Expanding Hastings Marina	Private
3	808.5L	New boat access	WDNR
3	807.3	Upgrading Vermillion River accesses	COE
3	804.1	Expanding North Lake public access	MDNR
3	800.1L	Upgrading Diamond Bluff beach	Private-
3	798.5R	Expanding Sturgeon Lake public access	COE
3	797.4L	Island camp/beach area, lockage waiting area	COE
3	797.3	Facilities, Commissary Point	COE
3	N/A	Multipurpose trails, bluffs	WDNR

Pool	River Mile	Further study	Lead agency
4	N/A	Visitor contact station, Hwy 25	FWS
4	796.9L	Lockage waiting area	COE
4	791.3R	Island camp/beach area	COE
5	N/A	Modify demand/needs projections based on pool 5 recreation use survey	COE
5	752.5R	Lockage waiting area	COE
5	757.0R	Public access, Teepeota Point	FWS
5	747.8L	Island camp/beach area	COE
5	739.0L	Lockage waiting area	COE
5a	N/A	Expanding facilities, Latsch Prairie Island Park	City of Winona, MDNR
5a	N/A	Additional trails, Merrick Park	WDNR
5a	737.7L	Lockage waiting area	COE
5a	737.7R	Public access, Bass Camp	MDNR
5a	734.0R	Redevelop recreation access	COE
5a	731.5R	Access channel, Minnesota Boat Club	Private, COE
5a	729.0R	Lockage waiting area	COE
6	N/A	Expanding facilities, Latsch Prairie Island Park	City of Winona
6	N/A	Trails, Perrot State Park	WDNR
6	N/A	Latsch Prairie Island Park	City of Winona, MDNR
6	728.0L	Island camp/beach area	COE
6	724.7R	Expanding facilities, St. Charles Boat Ramp	City of Winona
6	723.8R	Upgrading east boat harbor	City of Winona
6	722.3R	New boat access	COE
6	720.8R	Expanding boat ramp, Homer	COE City of Homer
6	717.5L	Island camp/beach area	COE
6	715.2R	Upgrading Big Trout Creek access	FWS
6	715. R	Island camp/beach area	COE
6	714.7L	Island camp/beach area	COE
7	N/A	Hiking trails, O. L. Kipp State Park	MDNR
7	N/A	Hiking trails, Long Lake-Lone Tree	FWS
7	714.2L	Island camp/beach area	COE
7	714.1R	Public access, Sunset Bay	MDNR
7	712.0L	Upgrading Lone Tree Landing	FWS
7	712.0L	Island camp/beach area	COE
7	704.5L	Upgrading Brice's Prairie Lower Landing	FWS
near 7	707.0R	Recreation area development	COE Town of Dakota
8	702.0R	Upgrading South I-90 ramp	FWS
8	692.0L	Upgrading Goose Island ramp	FWS
8	680.0R	Island camp/beach area	COE

Pool	River mile	Further study	Lead agency
9	N/A	Day-use area, Lansing-Desoto Causeway	COE, FWS, States of Wisconsin and Iowa
9	676.5R	Recreation area, Twin Island	COE
9	672.7L	Upgrade Victory Landing	Town of Victory
9	671.5R	Recreation area, Black Hawk Island	COE
9	670.5L	Battle Island	COE, FWS, WDNR Crawford County
9	667.3L	Upgrade DeSoto Landing	State of Wisconsin
9	662-663R	Boat access/storage, Lansing area	State of Iowa
9	Near 654.R	Boat access, Heytman's Station	State of Iowa
9	Near 652.9R	Island camp/beach area	COE
9	651.3L	Upgrade Lynxville depot ramp	Village of Lynxville
9	648.5R	Lockage waiting area	COE
10	647.7R	Lockage waiting area	COE
10	646-647L	Recreation area, Gordon's Bay	COE WDNR
10	644-644.5L	Recreation area, DuCharme Creek	COE WDNR
10	637.7R	Boat access to interpretive area, Effigy Mounds	National Park Service
10	636.2L	Island beach/camp area	COE
10	616.0R	Island beach/camp area	COE
10	614.8R	Lockage waiting area	COE

EXHIBIT 7

GUIDELINES FOR NOTIFICATION AND
COORDINATION OF MISSISSIPPI RIVER CHANNEL
MAINTENANCE PROJECTS IN THE ST. PAUL DISTRICT

EXHIBIT 7

GUIDELINES FOR NOTIFICATION AND COORDINATION OF MISSISSIPPI RIVER CHANNEL MAINTENANCE PROJECTS IN THE ST. PAUL DISTRICT

I. INTRODUCTION.

During the term of the Great River Environmental Action Team I (GREAT I), a procedure was developed to coordinate decision making and actions of the Corps of Engineers regarding maintenance dredging of the Mississippi, Minnesota, and Saint Croix Rivers. The procedure gave the Fedral and State natural resource management agencies direct input into the Corps decision making process. The procedure also gave the Corps immediate feedback from these agencies on dredging projects and facilitated resolution to problems when present. The procedure involved the use of On-Site Inspection Teams (OSIT's) for each dredging event.

The guidelines contained in this document describe the OSIT procedure to be used in the future. They are to provide for notification and coordination of Mississippi River channel maintenance projects beginning with the 1980 dredging season. The guidelines are consistent with the recommendations of GREAT I. It is understood that the Corps of Engineers will obtain necessary permits from State and Federal regulatory agencies. The guidelines should also be used to implement the GREAT I Interim Channel Maintenance Guidelines (1980-1985) and Long-Term Channel Maintenance Plan (1985-2025).

To ensure the success of the GREAT I channel maintenance plan and these guidelines, the Corps should immediately take actions to implement the GREAT I dredged material placement plans and recommendations. These actions include implementing immediately those recommendations that are within present funding and equipment constraints, seeking funds where necessary, and developing those recommendations needing further work.

II. OSIT PARTICIPATION.

Dredging projects on the Mississippi, Minnesota, and Saint Croix Rivers affect resources that several agencies and interests are charged with managing. Therefore, the OSIT participants should include representatives of:

1. U.S. Army Corps of Engineers
2. U.S. Fish and Wildlife Service
3. U.S. Environmental Protection Agency
4. U.S. Coast Guard
5. Minnesota Pollution Control Agency
6. Minnesota Department of Natural Resources
7. Wisconsin Department of Natural Resources

8. Iowa Conservation Commission

9. Iowa Natural Resour[illegible] Council

10. Iowa Department of Environmental Quality

11. Lower St. Croix Management Commission

12. Regional conservation and/or hunting and fishing organizations

These agencies and organizations are suggested based on past participation in the GREAT I on-site inspection process, vested interest in Corps activities, and regulatory functions governing material placement. Other agencies have interests and concerns in channel maintenance operations. These agencies will be coordinated with as necessary or are invited to join in active participation on the on-site inspection team.

The representation of the agencies on the OSIT will change from the approach used during the term of GREAT. Each agency on the OSIT will have one or two primary representatives for the entire Saint Paul District. These representatives may call on local agency staff to provide specific knowledge of an area, but the primary representative(s) will set the final policy for his or her agency.

For OSIT assignments, the District will be divided into two regions. One region is the portion upstream of Lake City, Minnesota (Cairo mile 733.0), and includes the Minnesota and Saint Croix Rivers. The second region includes the Lake City small-boat harbor and that portion of the District downstream to Guttenberg, Iowa. Participating organizations should designate a coordinator and one alternate for each region or preferably one coordinator to serve both regions if possible. This will allow the OSIT to provide imput to the Corps on the priority and allocation of equipment to meet dredging and disposal needs for the District.

Participating agencies should notify the Saint Paul District's Dredging Coordinator by April 15 of each year to designate their primary OSIT coordinator(s).. A secondary agency contact should also be designated at this time.

III. OSIT FUNCTION.

1. Dredging and Dredged Material Placement Decisions

The On-Site Inspection Team's function will be to provide input and guidance to the Saint Paul District for making dredging and dredged material placement decisions. The OSIT will determine and recommend how to best implement the GREAT I dredged material placement plan for any given dredge cut. The District's Dredging Coordinator will present the final OSIT dredging disposal recommendation to the District for a final decision.

In cases where placement site design or special safeguards needed to protect wetlands are in question, the OSIT will serve as the primary advisor to the coordinator. In these cases, the OSIT will also serve as the avenue for expressing agency regulatory requirements.

2. Appealing Decisions.

The OSIT will also serve as a means for the natural resource agencies to jointly appeal to the District Engineer the Corps intended action. The OSIT's appeal function will provide an opportunity for legitimate questions to be further investigated and documented.

The appeal process will begin when a majority of the OSIT members (one vote per state or federal agency) vote to appeal a decision of the District. The Fish and Wildlife Service OSIT representative will notify the District Engineer of this appeal immediately by telephone and set a date approximately one week later for a hearing by the District Engineer. The District Engineer will be further informed during the telephone call of the specific items being appealed. If possible, the COE should postpone any dredging action under appeal until the conclusion of this hearing.

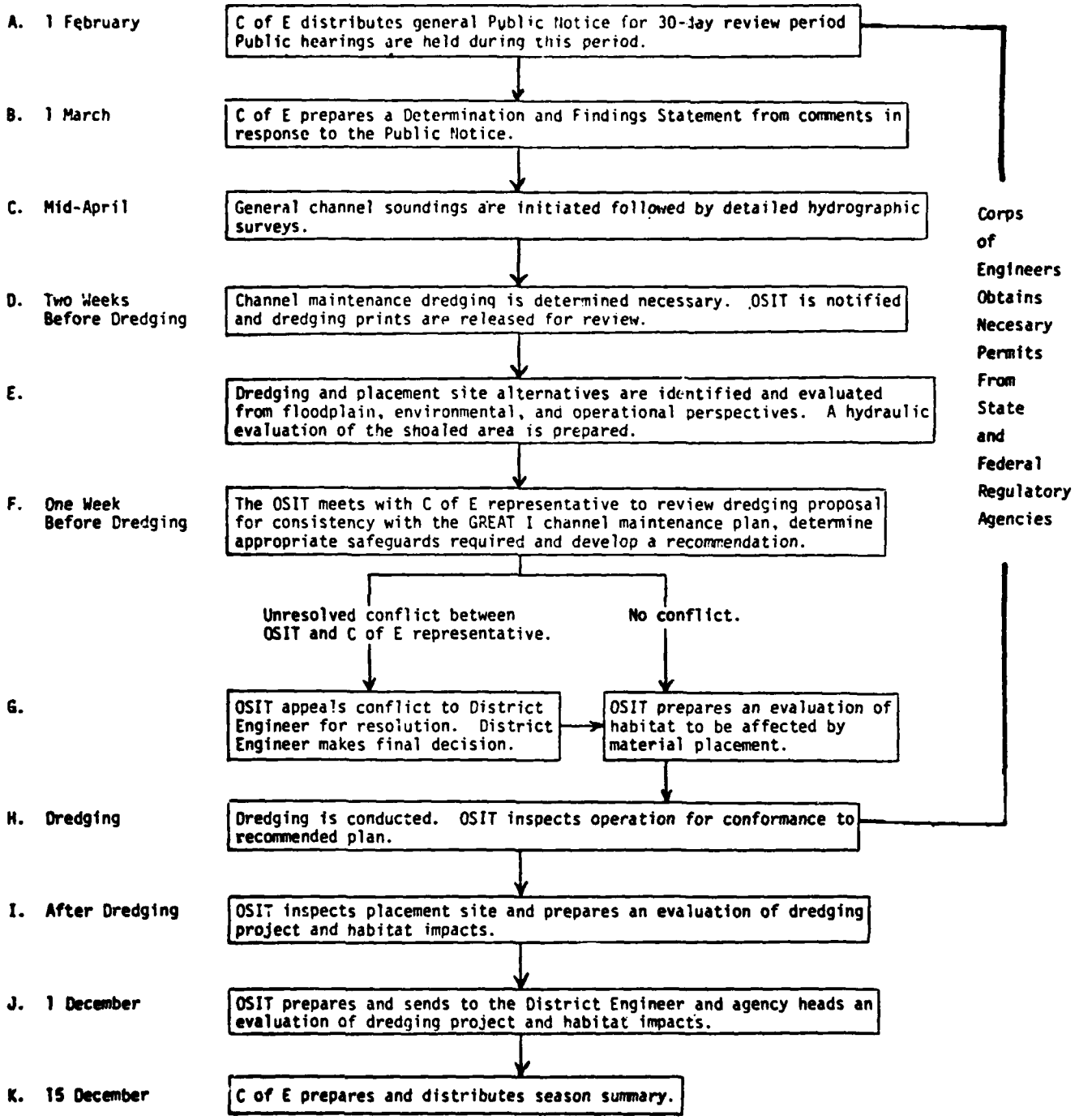
The Fish and Wildlife Service OSIT representative will coordinate the development of the appeal case and materials to present to the District Engineer, with all OSIT members having an opportunity to fully participate in the development. The OSIT will select a member of the team to make the presentation to the District Engineer, and possibly recommend the presence of specific agency chiefs at the hearing.

The hearing before the District Engineer will provide for the OSIT to make a full presentation of its case, and the COE's Operation and Maintenance Branch to provide response. After an open discussion period the District Engineer will make a final decision on the appeal subject or postpone a decision pending the gathering of more information. The District Engineer's decision at the conclusion of the hearing will conclude the appeal process.

3. Annual Evaluation.

The OSIT will also be responsible for preparing an evaluation of each year's dredging season. This evaluation will represent the OSIT's perception of the COE's efforts to achieve the CMP. The evaluations may further contain recommendations to modify the CMP or the COE's methods of accomplishing the CMP. The Fish and Wildlife Service representative of the OSIT will be responsible for coordinating the development of the annual evaluation, having January 15 as the deadline for completing and distributing the document.

IV. ON-SITE INSPECTION TEAM (OSIT) PROCEDURE FOR DREDGING AND MATERIAL PLACEMENT DECISIONS



May 1980

Saint Paul District
On-Site Inspection Team Report Form
for Dredging and Dredged Material Placement Activities
on the Mississippi, Minnesota, and Saint Croix Rivers

NOTE: This report should be completed for each dredging or dredging related project commenced by the Saint Paul District Corps of Engineers. The reports are to be used to document the environmental impacts of maintenance dredging subsequent to the GREAT I program.

A. Dredge Cut Name:

B. Disposal Site Location:

R.M._____ Pool_____ GREAT I No._____

C. Type of Activity:

- ☐ Emergency Dredging
- ☐ Regular Maintenance Dredging
- ☐ Placement Site Development
- ☐ Rehandling of Dredged Material
- ☐ Other (Specify)_____

D. OSIT Members Contributing:

- ☐ U.S. Army Corps of Engineers-ERB
- ☐ U.S. Fish and Wildlife Service
- ☐ Minnesota Pollution Control Agency
- ☐ Minnesota Dept. of Natural Resources
- ☐ Wisconsin Dept. of Natural Resources
- ☐ Iowa Conservation Commission
- ☐ U.S. Environmental Protection Agency
- ☐ U.S. Coast Guard
- ☐ Public

E. OSIT Meeting.

☐ Adequate project and meeting notice provided to OSIT; if no, specify problem:_____

_____

☐ OSIT meeting held; if no, why not_____

_____

☐ OSIT and COE Dredging Coordinator agreed on procedure to follow in project; if no, specify conflict:_____

_____

☐ OSIT appeal made to the District Engineer.

☐ Mutually acceptable resolution to appeal reached; if no, specify remaining conflicts:_____

_____

F. Dredging Project.

☐ Dredging accomplished; if no, reasons for cancelling:_____

_____

_____

_____

Volume dredged:_____

Depth dredged:

☐ 11 feet
☐ 12 feet
☐ 13 feet

Width dredged:_____

Number of years since cut last dredged:_____

Equipment used:

☐ Thompson

☐ Thompson and booster

☐ Hauser

☐ Dubuque

☐ Contracted hydraulic

☐ Contracted mechanical

☐ Other (specify)_____

Distance dredged material moved to placement site_____

☐ Removal from floodplain placement site.

☐ GREAT I selected placement site used(if no, why not)_____

_____

☐ Special dredging or placement methods used(specify)_____

_____

Placement site measures:

☐ Directional berming

☐ Inclosed berming

☐ 100% containment

☐ Strengthening berm walls

☐ Drop structure

☐ Other (specify)_____

G. Placement Site Impacts:

☐ Aquatic or wetland habitat lost (if yes, type)_____

_____

Acres of each:_____

☐ Terrestrial habitat lost (if yes, type)_____

_____

Acres of each:_____

☐ Habitat enhanced or created (if yes, type)_____

_____

Acres of each:_____

Probable indirect effects of dredged material placement (what effect, when and how?):

☐ On terrestrial habitat_____

_____

_____

_____

☐ On aquatic habitat_____

_____

_____

_____

☐ On recreational resources_____

_____

_____

_____

☐ Special habitat value on or adjacent to placement site(if yes, specify).

_____

_____

_____

K. Sketch of Placement Site and Proximity to Dredging Cut.

EXHIBIT 8

STUDY PARTICIPANTS

EXHIBIT 8

STUDY PARTICIPANTS

GREAT I VOTING MEMBERS

Corps of Engineers - Cochairman

William Pearson	1974-77	St. Paul District
Wayne A. Knqtt	1977-80	1135 U.S. Post Office & Custom House St. Paul, Minnesota 55101

Fish and Wildlife Service - Cochairman

Joseph F. Scott, Jr.	1974-77	530 Federal Courts Building
Richard F. Berry	1977	St. Paul, Minnesota 55101
Donald J. Peterson	1977-78	
John P. Wolflin	1978-80	
Michael J. Vanderford	1980	

State of Iowa

G. F. Schnepf	1974-78	Iowa Conservation Committee
Mark Ackelson	1978-79	Wallace State Office Building
Arnie Sohn	1980	East Ninth and Grand Des Moines, Iowa 50319

State of Minnesota

Jerome A. Kuehn	1974-80	Minnesota Department of Natural Resources 300 Centennial Building St. Paul, Minnesota 55155

State of Wisconsin

Larry Larson	1974-75	Wisconsin Department of Natural Resources
Linda Reivetz	1975-76	1300 West Clairmont Avenue
Jim Lissack	1977-80	Eau Claire, Wisconsin 54701

Environmental Protection Agency

John Mosesso	1974-75	Office of Federal Activities
John-Erick Stenson	1976-77	230 South Dearborn Street
Harlan Hirt	1977-80	Chicago, Illinois 60604

U.S. Department of Agriculture

Herman Calhoun	1974-75	Soil Conservation Service
Chester Weldon	1975-78	Federal Courts Building
Gary Le Page	1978-80	316 North Robert Street
		St. Paul, Minnesota 55101

U.S. Department of Transportation

Commander Ralph W. H. Bartels	1974-75	Second Coast Guard District
Captain James G. Glasgow	1975-80	1430 Olive Street
		St. Louis, Missouri 63103

GREAT I NONVOTING MEMBERS

Minnesota-Wisconsin Boundary Area Commission

James Harrison, Executive Director	619 Second Street
	Hudson, Wisconsin 54016

Upper Mississippi River Basin Commission

Paul Solsted	1974-77	7920 Cedar Avenue South
Shirley Hunt	1974-76	Minneapolis, Minnesota 55420
Dan Galloway	1977-80	
Bill Crews	1978-80	

Upper Mississippi River Conservation Committee

Charles Kulp	1974-75	U.S. Fish and Wildlife Service
Kent Keenlyne	1975	1830 Second Avenue
David Parsons	1976	Rock Island, Illinois 61201
Jerry Rasmussen	1977-80	

WORK GROUP CHAIRMEN

Commercial Transportation (U.S. Department of Transportation, United States Coast Guard)

Commander Ralph Bartels	1974-75
Lieutenant Commander Carmin Yannone	1975-76
Lieutenant Commander Charles Gower	1976-78
Captain Richard Walton	1978-80

Dredged Material Uses (Wisconsin Department of Natural Resources)

Mark A. Riebau	1975-77
Scot J. Ironside	1977-79
Thomas A. Lovejoy	1979-80

Dredging Requirements (St. Paul District, Corps of Engineers)

Dennis Cin (cochairman)	1974-77
W. Grant Westall (cochairman)	1977-79
Patrick Foley (cochairman)	1979-80

Fish and Wildlife (Fish and Wildlife Service)
combined Fish and Wildlife Management and
Side Channel Openings Work Groups

Fish and Wildlife Management

Donald F. La Pointe	1974-75
Joseph F. Scott	1975
Dennis E. Chase	1975
Michael J. Vanderford	1976
John P. Wolflin	1977-78

Side Channel Openings

Joseph F. Scott	1974-75
Michael Vanderford	1975-78

Fish and Wildlife

John P. Wolflin	1978
Michael J. Vanderford	1978-80

Floodplain Management (Minnesota Department of Natural Resources)

Jerome H. Kuehn	1974-75
Donald Buckhout	1975-80

Material and Equipment Needs (St. Paul District, Corps of Engineers)

Raymond Sanford	1974-77
Donald Wadleigh	1977-80

Plan Formulation (Corps of Engineers)

James Forsyth (coordinator)	1975-80

Public Participation and Information

Shirley Hunt (UMRBC coordinator)	1974-76
Daniel W. McGuiness (contract coordinator)	1976-79
Mary Swanger (cochairman)	1976-79
William H. Howe (cochairman)	1976-79

Recreation (Iowa)

G. F. Schnepf	1974-75
Mark C. Ackelson	1975-79

Sediment and Erosion (Soil Conservation Service)

Chester Weldon	1975-78
Gary LePage	1978-80

Water Quality (St. Paul District, Corps of Engineers - Environmental Protection Agency)

John Mosesso (cochairman)	1974-75
Robert Whiting (cochairman)	1974-80
Peter Smith (cochairman)	1976
John Helvig (cochairman)	1976-78

OTHER CONTRIBUTORS

David Kennedy, Wisconsin Department of Natural Resources	*1977-80*
Al Fenger, Dan McGuiness and Associates	1978-80
Keith Larson, Fish and Wildlife Service	1974-75
Daniel Krumholz, St. Paul District, Corps of Engineers	1977-80
Gary Palesh, St. Paul District, Corps of Engineers	1978-80

☆ U.S.GPO:1980-665-155/47-6