# UPPER MISSISSIPPI RIVER SYSTEM
# ENVIRONMENTAL MANAGEMENT PROGRAM
# DEFINITE PROJECT REPORT/ENVIRONMENTAL ASSESSMENT (SP-17)

## MISSISSIPPI RIVER BANK STABILIZATION

## HABITAT REHABILITATION AND ENHANCEMENT PROJECT
## POOLS 5-10, UPPER MISSISSIPPI RIVER
## MINNESOTA, WISCONSIN, AND IOWA

ST. PAUL DISTRICT, CORPS OF ENGINEERS
ARMY CORPS OF ENGINEERS CENTRE
190 FIFTH STREET EAST
ST. PAUL, MINNESOTA 55101-1638
AUGUST 1995

EXECUTIVE SUMMARY

Mississippi River Bank Stabilization
Habitat Rehabilitation and Enhancement Project

The bank stabilization sites investigated are located along the Mississippi River or its side channels from near Alma, Wisconsin, in pool 5 to Guttenberg, Iowa, in pool 10. The sites are located on both sides of the navigation channel and are all in the Upper Mississippi River National Wildlife and Fish Refuge. About 90 percent of the 200,000-acre study area is aquatic/wetland in nature. Erosion of existing islands and side channels allows increased wave action and/or flow into backwater areas. The associated sediment and turbidity are contributing to the degradation in quality of the wildlife and fish habitat in the backwaters.

The ultimate goal is to preserve, restore, and enhance backwater fish and migratory bird habitat on the Upper Mississippi River Wildlife and Fish Refuge. Specific project objectives include: maintaining existing island shoreline; reducing flow in side channels or between islands; and eliminating normal flow through breaches in existing islands. Fifty-five critical erosion sites were initially submitted by the U.S. Fish and Wildlife Service and the Wisconsin, Minnesota, and Iowa Departments of Natural Resources for consideration.

The plan formulation process considered several physical alternatives to control flow and prevent erosion of islands or riverbanks. These included shoreline protection, partial closures, offshore rock mounds, constriction of side channel openings, and reshaping of the riverbanks. Stabilization of each erosion site was evaluated to determine cost, the degree of habitat improvement, and constructability. Based on the cost for habitat benefits gained, agency priorities, location, construction considerations, and available funds, a total of 12 sites were selected for stabilization.

The selected plan addresses the project objectives by reducing erosion of side channels; limiting or reducing flows into side channels; and preventing erosion of existing barrier islands near the navigation channel. The plan of action includes constructing rockfill bank stabilization or closures in pools 6 through 10 (2 sites in pool 6, 1 site in pool 7, 1 site in pool 8, 3 sites in pool 9, and 5 sites in pool 10). The type of stabilization depends on physical conditions at the site, but would basically use rockfill in the form of wedges along the riverbank, offshore mounds, riprap on the riverbank, and groins. About 28,000 cubic yards of rockfill would be used to stabilize 12,000 feet of shoreline. It is estimated that up to 18,000 cubic yards of material may need to be dredged to gain construction access at the sites. This material would be used in the bank stabilization structure, placed behind the structure, or transported to an upland site. The total estimated direct construction cost of the project is $1,949,000. Indirect costs for planning, engineering, and design efforts and construction supervision and administration bring the total project cost to $2,539,000. Average annual operation and maintenance costs of the project are estimated to be $4,920 and would be the responsibility of the U.S. Fish and Wildlife Service.

The selected plan would directly affect 1,500 acres of backwater habitat. The backwater habitat would be improved as a result of less sediment input into the backwater. Stabilization of existing islands and riverbanks would prevent increased wave action so that the quality of the backwater habitat would be maintained or preserved. Fish habitat would be improved by increasing habitat diversity and dredging for construction access would provide about 3 acres of additional deepwater habitat for species such as bluegill, crappies, and largemouth bass. The increased stability of the aquatic plant beds would lead to increased use of the areas by waterfowl because of the food provided and increased habitat diversity. No archaeological or historical sites listed on the National Register are known to be affected by the proposed project.

Three of the sites selected may be accomplished by the U.S. Fish and Wildlife Service using funds made available to repair flood damage on the Refuge caused by the 1993 flood. These sites were not eliminated from the selected plan because implementation has not been completed. If these sites are completed before the preparation of plans and specifications or if project costs are less than the current estimate, additional sites from the initial projects list would be selected to utilize funds allocated for the Bank Stabilization project. The selected sites would be coordinated with the partner agencies and the proper supplemental environmental documentation would be done.

The proposed project has been coordinated with the U.S. Fish and Wildlife Service, the Wisconsin, Iowa, and Minnesota Departments of Natural Resources, and the State Historic Preservation Offices. Water quality certification from the Wisconsin Department of Natural Resources will be requested during the preparation of plans and specifications. An environmental assessment and Finding of No Significant Impact have been prepared in accordance with the requirements of the National Environmental Policy Act. A Section 404(b)(1) evaluation has also been prepared in compliance with the Clean Water Act of 1977.

The St. Paul District Engineer has weighed the proposed project accomplishments against its cost and has determined that implementation of the selected plan is a justified expenditure of Federal funds. Therefore, approval of construction by the Secretary of the Army of this Bank Stabilization project in pools 6 through 10 is recommended by the District Engineer at a 100-percent Federal total project cost estimated to be $2,539,000.

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# MISSISSIPPI RIVER BANK STABILIZATION
# DEFINITE PROJECT REPORT/ENVIRONMENTAL ASSESSMENT (SP-17)

## INTRODUCTION

### AUTHORITY

The authority for this report is provided by Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The proposed project would be funded and constructed under this authorization. Section 1103 is summarized as follows:

Section 1103. UPPER MISSISSIPPI RIVER PLAN

(a)(1) This section may be cited as the Upper Mississippi River Management Act of 1986.

(2) To ensure the coordinated development and enhancement of the Upper Mississippi River system, it is hereby declared to be the intent of the Congress to recognize that system as a nationally significant ecosystem and a nationally significant commercial navigation system....The system shall be administered and regulated in recognition of its several purposes.

(e)(1) The Secretary, in consultation with the Secretary of the Interior and the states of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, is authorized to undertake, as identified in the Master Plan -

(A) a program for the planning, construction, and evaluation of measures for fish and wildlife habitat rehabilitation and enhancement....

A design memorandum (or implementation document) did not exist at the time of the enactment of Section 1103. Therefore, the North Central Division, U.S. Army Corps of Engineers, completed a "General Plan" for implementation of the Upper Mississippi River System Environmental Management Program (UMRS-EMP) in January 1986. The U.S. Fish and Wildlife Service (USFWS), Region 3, and the five affected States (Illinois, Iowa, Minnesota, Missouri, and Wisconsin) participated through the Upper Mississippi River Basin Association. Programmatic updates of the General Plan for budget planning and policy development are accomplished through Annual Addendums.

Coordination with the States and the USFWS during the preparation of the General Plan and Annual Addendums led to an examination of the Comprehensive Master Plan for the Management of the Upper Mississippi River System. The Master Plan, completed by the Upper Mississippi River Basin Commission in 1981, was the basis of the recommendations enacted into law in Section 1103. The Master Plan report and the General Plan identified examples of potential habitat rehabilitation and enhancement techniques. Consideration of the Federal interest and Federal policies has resulted in the conclusions below:

Project Eligibility Criteria -

a. (First Annual Addendum). The Master Plan report...and the authorizing legislation do not pose explicit constraints on the kinds of projects to be implemented under the UMRS-EMP. For habitat projects, the main eligibility criterion should be that a direct relationship should exist between the project and the central problem as defined by the Master Plan; i.e., the sedimentation of backwaters and side channels of the Upper Mississippi River System (UMRS). Other criteria include geographic proximity to the river (for erosion control), other agency missions, and whether the condition is the result of deferred maintenance....

b. (Second Annual Addendum).

(1) The types of projects that are definitely within the realm of Corps of Engineers implementation authorities include the following:

- backwater dredging
- dike and levee construction
- island construction
- bank stabilization
- side channel openings/closures
- wing and closing dam modifications
- aeration and water control systems
- waterfowl nesting cover (as a complement to one of the other project types)
- limited acquisition of wildlife lands (allowed per a 30 November 1994 letter from the Headquarters, U.S. Army Corps of Engineers)

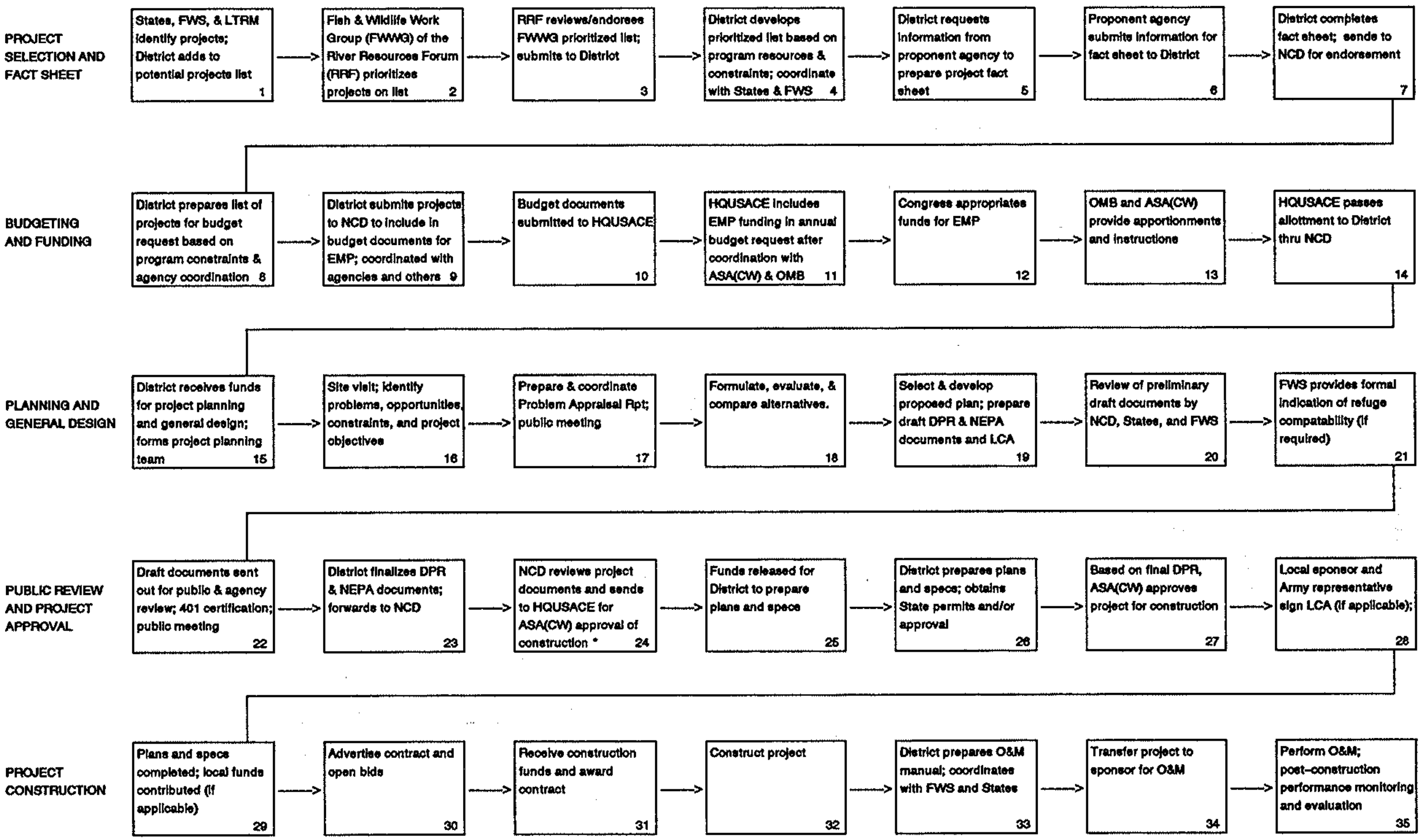
(2) A number of innovative structural and nonstructural solutions that address human-induced impacts, particularly those related to navigation traffic and operation and maintenance of the navigation system, could result in significant long-term protection of UMRS habitat. Therefore, proposed projects which include such measures will not be categorically excluded from consideration, but the policy and technical feasibility of each of these measures will be investigated on a case-by-case basis and the measures will be recommended only after consideration of system-wide effects.

PROJECT IMPLEMENTATION PROCESS

Figure DPR-1 is a flow chart that illustrates the implementation process for habitat projects that is used in the St. Paul District. The major steps in project implementation include: project selection and fact sheet preparation; budgeting and funding of the project; planning and general design; public review and project approval; and project construction and monitoring. The Mississippi River Bank Stabilization project has progressed to box #23 on the flow chart.

## FIGURE DPR-1 – FLOW CHART FOR THE IMPLEMENTATION OF HABITAT REHABILITATION AND ENHANCEMENT PROJECTS

### Upper Mississippi River System – Environmental Management Program (EMP) – St. Paul District




KEY

States = Minnesota, Wisconsin, and/or Iowa Departments of Natural Resources
FWS = U.S. Fish and Wildlife Service
LTRM = Long Term Resource Monitoring element of EMP
NCD = North Central Division, Corps of Engineers
HQUSACE = Headquarters U.S. Army Corps of Engineers
ASA(CW) = Assistant Secretary of the Army for Civil Works
OMB = Office of Management and Budget
DPR = Definite Project Report
NEPA = National Environmental Policy Act
LCA = Local cooperation agreement
O&M = Operation and maintenance

* NCD has authority to approve projects < $2M

16 September 1994

## PROJECT SELECTION PROCESS

Projects are nominated for inclusion in the District's habitat program by the respective State natural resource agency and the U.S. Fish and Wildlife Service based on agency management objectives. In September 1986, the States and USFWS agreed to utilize the expertise of the Fish and Wildlife Work Group (FWWG) of the River Resources Forum (RRF) to assist the District in the project selection process. The FWWG consists of field level biologists responsible for managing the river for their respective agency. The FWWG were directed to consider critical habitat needs along the Mississippi River and prioritize nominated projects on a biological basis.

In phase one, the individual projects proposed by the various Federal and State agencies were ranked within each pool according to the prioritized resource problems that the individual projects addressed and other ranking factors. The resource problems identified and prioritized in a pool included (in order of importance): backwater sedimentation; water quality; shoreline erosion; lack of important habitat; lack of habitat protection; and lack of public land base. The other ranking factors included anticipated fishery benefits, wildlife benefits, habitat diversity, ease of implementation, potential for innovative or experimental construction techniques, project longevity, maintenance, and socioeconomic benefits. The second phase of the evaluation involved the development of a prioritized list of the top 20 projects from the entire river system within the St. Paul District. The prioritized list was based on the following factors: numerical ranking from phase one; the desire to implement and evaluate a variety of habitat rehabilitation and enhancement techniques; the application of the LTRM component to habitat project development; and the evaluation of existing habitat projects and those under construction. This biological ranking was forwarded to the RRF for consideration of the broader policy perspectives and river management objectives of the agencies involved. The RRF submitted the coordinated ranking to the District and each agency officially notified the District of its views on the ranking. The District then formulated and submitted a program consistent with the overall program guidance as described in the UMRS-EMP General Plan, Annual Addenda, and additional guidance provided by the North Central Division, Corps of Engineers. New habitat project proposals continue to be submitted to the FWWG for ranking and the prioritized list is updated annually to guide the project selection process for each budget cycle.

Projects consequently have been screened by biologists closely acquainted with the river. Resource needs and deficiencies have been considered on a pool-by-pool basis to ensure that regional needs are being met and that the best expertise available is being used to optimize the habitat benefits created at the most suitable locations. Through this process the Mississippi River Bank Stabilization project was recommended and supported as capable of providing significant habitat benefits.

The Bank Stabilization project was recommended for study by the U.S. Fish and Wildlife Service (USFWS). In February, 1988, the RRF listing of habitat project priorities for fiscal year 1990 ranked the Mississippi River Bank Stabilization project as number 13. Table DPR-1 shows the RRF project priorities for fiscal year 1990 and the most recent ranking (December 1994) for the fiscal year 1997.

Table DPR-1 - Priority Listing of HREP's

| | PRIORITY LISTING FOR FY 90 | | | PRIORITY LISTING FOR FY 96 | | |
|---|---|---|---|---|---|---|
| RANK | POOL | PROJECT | SCORE | POOL | PROJECT | SCORE |
| 1 | 5 | Spring Lake, WI | 39 | 8 | Pool 8 Ph III-IV, WI | 38 |
| 2 | 5A | Polander Lake, MN | 38 | 9 | Bluff Slough, MN | 35 |
| 3 | 8 | Lower Pool 8, WI | 38 | 9 | Winneshiek Lk Isl, WI | 27 |
| 4 | 2 | Spring Lake, MN | 38 | 7 | Black River Delta, WI | 29 |
| 5 | 7 | Long Lake, WI | 28 | 8 | Running Slough, WI | 35 |
| 6 | 9 | Harper's Slough, IA | 37 | 9 | Lower Pool 9 Isl, IA | 27 |
| 7 | 9 | Capoli Slough, WI | 37 | 7 | Richmond Island, MN | 26 |
| 8 | 3 | Sturgeon Lake, MN | 37 | 7 | Lk Onalaska Bar, WI | 28 |
| 9 | 8 | East Channel, WI/MN | 35 | 5 | Fisher Island, MN | 26 |
| 10 | 6 | Blackbird Slough, MN | 35 | 5 | Half Moon Lake, MN | 26 |
| 11 | 6 | Trempealeau NWR, WI | 27 | 5 | Kruger Slough, MN | 25 |
| 12 | 8 | Fr.&Smith Slough, WI | 34 | 4 | Hershey Slough, MN | 25 |
| **13** | **5-10** | **Bank Stabilization** | **29** | | | |
| 14 | MV | Bank Stabilization,MN | 31 | | | |
| 15 | 8 | Wildcat Landing, MN | 31 | *MR | Blackdog Lake, MN | 27 |
| 16 | 4 | Bay City, WI | 30 | *10 | Gremore Lake, WI | 24 |
| 17 | 8 | Root River, MN | 29 | *5A | Fishway Project, WI | 22 |
| 18 | 9 | Old Raft Channel, MN | 29 | | | |
| 19 | 4 | Wabasha Channel, MN | 29 | | | |
| 20 | MV | Rice Lake, MN | 28 | | *Unranked (wildcard projects) | |

Based on the RRF priority list, public interest, the value of the resources, the opportunity for rehabilitation and enhancement, agency priorities, and program funding constraints and levels, the Bank Stabilization project was placed on the habitat project schedule and funds were made available to begin general design in fiscal year 1992. Other habitat projects on the priority listing for fiscal year 1992 that also received funding for general design included Peterson Lake, MN, North Lake, MN, and Spring Lake, MN. The Peterson Lake project began construction in July 1995. Planning for North and Spring Lakes was initiated, but then deferred because the state of Minnesota (the local sponsor) was unable to assume the cost sharing responsibilities associated with projects not located on a national wildlife refuge.

## PARTICIPANTS AND COORDINATION

Direct participants in the planning process included the Upper Mississippi River Wildlife and Fish Refuge (Winona, La Crosse, and McGregor Districts) and Region 3 Office of the U.S. Fish and Wildlife Service (USFWS), the Iowa, Minnesota, and Wisconsin Departments of Natural Resources (IDNR, MDNR, and WDNR), and the St. Paul District, U.S. Army Corps of Engineers (COE). The USFWS was a cooperating agency throughout the process as required by regulations developed by the Council on Environmental Quality for the implementation of the National Environmental Policy Act (40 CFR 1500-1508). The following study team members visited one or more of the sites in 1992 to discuss problems, objectives, and site characteristics. Many of the members were involved in the preparation and/or review of this report:

| Team Member | Expertise | Agency | Date(s) of visit |
|---|---|---|---|
| Don Powell | Technical Manager | COE | 5/7,5/18,6/22-23,7/21-22 |
| Dennis Anderson | Fisheries Biologist | COE | 5/7 |
| Pete Fasbender | Wildlife Biologist | COE | 5/18,6/22-23,7/21-22 |
| Jon Hendrickson | Hydraulic Engineer | COE | 5/7,5/18,6/22-23,7/21-22 |
| Al Kean | Geotechnical Engineer | COE | 5/7,5/18,6/22-23,7/21-22 |
| Joel Face | Geotechnical Engineer | COE | |
| Keith Beseke | EMP Coordinator | USFWS | 5/7,5/18,6/22-23,7/21-22 |
| Jim Fisher | Refuge Complex Mgr | USFWS | 5/18,7/22 |
| Bob Drieslein | Winona District Mgr | USFWS | 5/7,7/22 |
| Jim Nissen | La Crosse District Mgr | USFWS | 5/18,7/22 |
| Bill Thrune | La Crosse District | USFWS | 7/21 |
| John Lyons | McGregor District Mgr | USFWS | 6/22-231 |
| Ken Dulik | McGregor District | USFWS | 7/21 |
| Jeff Janvrin | EMP Coordinator | WDNR | 5/7,5/18,6/22-23,7/21-22 |
| Kurt Welke | Fisheries Biologist | WDNR | 6/22 |
| Ron Benjamin | Fisheries Biologist | WDNR | |
| Scot Johnson | Hydrologist | MDNR | 5/7 |
| Dan Dieterman | Fisheries Biologist | MDNR | 5/18,7/21 |
| Mike Davis | EMP Coordinator | MDNR | 5/18 |
| Gary Ackerman | Fisheries Biologist | IDNR | 6/22-23,7/21 |
| Art Roseland | Wildlife Biologist | IDNR | 6/22-23,7/21 |
| Mike Griffin | Miss River Biologist | IDNR | |

During the erosion site visits, information about each site was collected by the team to document the extent of erosion; describe the physical and habitat conditions; identify possible causes of erosion and erosion control measures; and assess the suitability of protecting the site.

Correspondence was exchanged between the agencies to coordinate the project at various stages of development. Several additional meetings were held with the USFWS and state team members during the planning and general design phase to develop a habitat model for selecting sites to pursue.

Initial public meetings were held at Prairie du Chien, La Crosse, and Winona on September 29, September 30, and October 4, 1993, respectively. A total of about 30 people attended the meetings to hear about the site selection process, the sites selected, and to provide input to the study.

A draft of this report was sent to the agencies and the public for review and comment. Public meetings were held at La Crosse and Prairie du Chien on June 19 and June 20, 1995, respectively. A total of about 45 people attended the meetings to discuss the proposed project. The public comments and the results of meetings with the agencies and the public were used to develop and select the final plan. Information about the public meetings and the comments received are included in attachment 5. This report includes the environmental assessment, Finding of No Significant Impact (attachment 2), Section 404(b)(1) Evaluation (attachment 3), and public notice (attachment 5). The draft Definite Project Report/Environmental Assessment and/or public notice was sent to the agencies and interests listed in attachment 7.

## PROJECT LOCATION AND PURPOSE

The potential bank stabilization sites in the study are located along the Mississippi River or its side channels from the upper end of pool 5 near Alma, Wisconsin to lower pool 10 near Guttenberg, Iowa (see Plate 1). The sites are located on both sides of the Mississippi River channel (see Plate 2) and are all in the Upper Mississippi River National Wildlife and Fish Refuge (UMRWFR). The Refuge includes about 200,000 acres in Mississippi River pools 5 through 14. The portion of the Refuge included in this study extends to just below lock and dam 10 (the downstream limit of the St. Paul District). The project area is owned by the USFWS or the COE and cooperatively managed and administered by the USFWS as part of the UMRWFR. The area was originally acquired for the development and operation of the navigation system by the COE and for the preservation and management of fish and wildlife resources by the USFWS.

The overall purpose or goal of this study and project is to preserve, restore and enhance backwater fish and migratory bird habitat on the Upper Mississippi River Refuge. This is consistent with the designated goals of the Refuge as described below.

## FISH AND WILDLIFE MANAGEMENT GOALS IN THE PROJECT AREA

The USFWS, WDNR, MDNR, IDNR, and COE have direct management responsibilities for the UMRWFR. The following describes the resource management goals of each agency for the project area.

U.S. Fish and Wildlife Service - Fish and wildlife management goals for the area are defined in the Upper Mississippi River Wildlife and Fish Refuge Master Plan (USFWS 1988). The Master Plan specifically recommended that action be taken to upgrade existing wildlife and fish habitat through selected development and/or management options. The management goals listed in the Master Plan that most directly apply to the study area include:

* Reduce the adverse impacts of sedimentation and turbidity entering the river system.
* Eliminate or reduce adverse impacts of water quality degradation.
* Preserve unique and/or representative ecotypes.
* Restore species that are in critical condition and achieve the national population or distribution objectives.
* Maintain or improve habitat of migrating waterfowl using the UMR.
* Maintain or increase the populations and distribution of colonial nesting birds.
* Increase production of historically nesting waterfowl.
* Contribute to the achievement of the national population and distribution objectives identified in the North American Waterfowl Management Plan and flyway management plans.
* Maintain and enhance, in cooperation with the States, the habitat of fish and other aquatic life on the UMR.
* Maintain or increase the species diversity and abundance of wildlife.
* Maintain and enhance habitat used by threatened and endangered species.
* Carry out endangered species recovery plans.
* Maintain furbearer populations at levels compatible with fisheries and waterfowl management and other management objectives to provide a resource for recreation.
* Provide outdoor recreation opportunities.

Wisconsin, Minnesota, and Iowa Departments of Natural Resources - The state DNR's manage the fisheries in the study area in cooperation with the USFWS. State DNR conservation officers regulate hunting, fishing, and recreational boating on their respective portions of the Mississippi River. They also manage water quality and regulate activities that affect waters of their state. State DNR management goals for the study area include:

* Improve water quality.
* Improve fish and wildlife habitat conditions.
* Improve opportunity for all recreational uses of fish and wildlife (fishing, hunting, trapping, etc).
* Maintain access for recreational boating.
* Limit redistribution of in-place pollutants.
* Avoid increases in flood stages.

Corps of Engineers - The St. Paul District, Corps of Engineers (COE) has responsibility for operation and maintenance of the 9-foot channel navigation system within the study area. The COE also has management responsibilities for project lands. COE management goals for the study area include:

* Reduce dredging requirements in the pools.
* Manage resource capabilities wisely in relation to multiple-purpose resource demand.
* Minimize user conflicts and optimize public safety and access.
* Maximize COE management actions for the greatest economic, social, or environmental benefit to the public.
* Conserve and enhance river-related natural resources.
* Maximize beneficial use of dredged material.
* Minimize cost of channel maintenance.
* Improve fish and wildlife habitat and water quality conditions.
* Maintain locks, dams, and dikes for navigation.

These management objectives, together with additional input from state and Federal agency natural resource managers, were used to guide the development of specific project objectives. These objectives are presented in a subsequent section of this report. However, this project forms only one part of a much larger cooperative natural resource management effort on the river.

# EXISTING CONDITIONS

## PHYSICAL SETTING

In 1824 Congress authorized the COE to confine the Mississippi River flows to the main channel and to remove snags, shoals, rocks, and sandbars to aid navigation. In 1878 Congress authorized the COE to maintain a 4.5-foot-deep channel from the mouth of the Missouri River to St. Paul, Minnesota; and the Rivers and Harbors Act of 1907 increased the authorized depth to 6 feet. The Upper Mississippi River National Wildlife and Fish Refuge (UMRWFR) was established by act of Congress in 1924. The UMRWFR is located in pools 4 through 13 of the Upper Mississippi River primarily in the states of Minnesota, Wisconsin, and Iowa. The Rivers and Harbors Act of 1930 authorized construction and maintenance of the current 9-foot channel by a system of locks and dams. The study area includes erosion sites in pools 5 through 10 (see Plate 1). The study area includes about 138 river miles and the associated backwater and side channel areas. The total area of study includes about 200,000 acres. Generally, the river valley varies from 2 to 5 miles wide and is bordered by forested bluffs rising 400 to 500 feet above the valley floor. The UMRWFR is usually bounded by railroad grades or highways on both sides of the river valley. The area was once part of an extensive floodplain complex consisting of secondary and tertiary channels, floodplain forest, abandoned channel lakes, marsh and meadow. Seven locks and dams constructed in the 1930's within the study area have formed a series of pools that range from 10 to 33 miles long. The dams have raised water levels, creating a maze of channels, sloughs, marshlands, and open lakes over the bottomlands. The navigation locks allow passage of recreational and commercial boats through the system. Almost 90% of the Refuge is aquatic/wetland in nature.

Increased water surface elevations and decreased current velocities through the river system have changed the configuration of the riverbed since impoundment. Higher water levels have caused erosion of islands bordering the main channel, exposing other islands in the backwater area to greater wind fetch and wave action. The islands have been reduced over time by wave action and flood events. Wave action and flood events have also leveled the topographic relief of the backwater areas by reducing the height, number, and areal extent of islands and filling deeper areas. An influx of sand has filled some of the floodplain channels and formed deltas in the backwater areas. Vertical accretion of fine grained materials further filled in some areas.

## WATER RESOURCES

The main channel of the river generally meanders within the railroad and/or highway grades. Like the rest of the Upper Mississippi River, the project area experiences annual high water, generally between March and July. The primary source of floodwaters is spring snowmelt combined with the increased precipitation that usually occurs during these months. Culverts and bridges in the railroad and highway grades allow flow from the drainage basin. The major tributaries to the Mississippi River in the study area include the Zumbro, Whitewater, Trempealeau, Black, Root, Bad Axe, Upper Iowa, Yellow, and Wisconsin Rivers.

Water surface elevations in the study area are controlled by river discharge and the operation of locks and dams 4 through 10. Project pool elevations vary from 660 feet to 603 feet Mean Sea Level (1912). Gates in the dams control pool levels in times of normal and low flows. The operation and maintenance of the pools includes gate adjustments to raise, steady, or lower water levels. Project pool elevations are maintained at the control point, usually near the middle of the pool. The water surface profile of the pool will tend to pivot about the control point as the flow in the pool varies. At low and intermediate flows, the velocity in the upper end of a pool is generally greater than in the lower end. During flood periods the gates are lifted entirely above the water level, and the dam structure then causes only slight obstruction to the river flow.

## GEOLOGY AND SOILS

<u>Geology</u> - The most significant geologic event explaining the nature of the Mississippi River in the vicinity of the project area occurred at the end of the Pleistocene glaciation approximately 10,000 years ago. During the retreat of the glaciers, tremendous volumes of glacial meltwater, primarily from the Red River Valley's Glacial Lake Agassiz, eroded the preglacial Minnesota and Mississippi River valleys. As meltwaters diminished, the deeply eroded river valleys aggraded substantially to about the present levels. Sediments composed of sand and gravel were deposited in the river valley, forming the basis for present Refuge soils. Since post-glacial times, a braided stream environment has dominated this reach of the Mississippi River, due to the river's low gradient and oversupply of sediment from its tributaries. Prior to construction of the locks and dams in the 1930's, the broad floodplain of the river was characterized by this braided stream system that consisted of swampy depressions, sloughs, natural levees, islands, and shallow lakes. Since impoundment, a relatively thin veneer of silts, clays, or sands has been deposited over most of the river bottom in the pools.

Soils - Soils within the study area range from alluvial types in the wetlands to finely eroded sands on the steeper uplands. Varying depths of silt overlie sand and gravel sediments in the wetlands. The main river channel portions have a sandy bottom with traces of gravel. In pools 5, 5A, and 6 the strata are composed of clay, silt, sand, and gravel, and are irregular. Sand and gravel strips border most sloughs, but the larger elevated areas between the sloughs are covered with heavy silty loam underlain with sand or gravel. In pools 7 and 8, weathering of the glacial till has taken place under different vegetative influences, resulting in several soil types. Podalic soils have formed under deciduous trees with grass cover; bog soils are comprised of muck and peat and are predominant on the lower edges of terraces in the river basins; and alluvial soils are formed from material recently deposited in floodplains. Soil types in pool 9 contain a high percentage of shallow limestone soils with the limestone often exposed on steep slopes, making them susceptible to erosion. This eroded material is carried into the navigation channel and backwaters by the tributaries. The major soil type of islands and upland peninsulas is Dorchester silt loam. Upland soils of pool 10 vary from deep rich loam to leached podzolic soils. The bottomlands are composed of layers of sand, silt, and clays deposited by flooding events. A grey layer of sticky fine clay with blue-green mottling from reduced iron is present in all bottomland soils.

Sediment Transport and Substrate Type - Sediment is transported by water as suspended load or as bedload. The suspended load consists of fine particles, such as clay, silt, and fine sand, held in suspension by the turbulence of flowing water or by colloidal suspension. Bedload consists of coarser particles that roll, slide, or bounce along the streambed. Generally, erosion of uplands is the primary source of fine materials, while channel erosion contributes coarser particles. Upland erosion is the major source of sediment to the UMR. Bedload is generally about 10 percent of the total sediment being transported and normally remains almost entirely within the main channel, except during flood conditions. A number of factors have changed the sediment transport along the UMR. Wing dams were built after Congress authorized the Corps to maintain a 6-foot navigation channel in 1907. The wing dams constrict flow to the middle of the channel, allowing material to be transported downstream. Since construction of the locks and dams in the 1930's, channel maintenance of the authorized 9-foot navigation channel prevents any island formation along the main channel border because of main channel dredging and placement of the material on existing islands along the main channel. These changes have also reduced the overall biodiversity within the UMR. Suspended solids concentrations in the study area vary seasonally and with river discharge. The average concentration of suspended solids in the main channel of the river at Winona, Minnesota is 24 mg/l (Tornes 1986). Bedload transport through lock and dam 5 is probably in the range of 200,000 to 300,000 tons per year and at lock and dam 10 about 488,000 tons per year.

Since the sediment transport rate is largely dependent on the flow velocity, the sediment transport rate at the upper end of a pool is greater than at the lower end and is also greater than the supply rate from the pool immediately upstream. Thus, bed erosion occurs in the upper reach of a pool and deposition occurs in the lower reach. During high flows with the gates at the dams opened above the water level, the portion of the river that was eroded at low flow carries less sediment than that supplied from upstream, resulting in deposition in the upper end of a pool. In contrast, erosion occurs in the portion of the river that was aggraded at low flow (the lower end of the pool). This erosion and deposition occurs on a yearly cycle.

The substrate in the study area is highly variable. Main channel sediment consists of mostly sand, but in certain areas sediment can contain considerable amounts of fines and gravel. Backwater areas also contain variable sediment types, but generally contain more fine sediment than main channel areas. Fine-grained suspended sediments are carried deeper into the backwater areas than bedload sediments. These fine-grained sediments settle out in the backwaters as flow velocities decrease.

Sediment Quality - There is much historical data on main channel sediment. Results of analyses of sediment at several locations in the study area are included in Appendix B. Sediment samples have been collected from many locations and subjected to bulk chemical analysis. These samples were collected from depths ranging from 5 to 20 feet. A limited amount of surficial backwater sediment quality data is also available, but no depth stratified data are available. No pesticides were detected in any of the samples collected either in the main channel or in backwaters. PCB's were not detected above 50 ug/kg in any of the samples. Recent surveys of both the main channel and the backwaters have recorded substantially lower values of mercury than in previous years. In addition to the limited backwater metals data collected by the various agencies, other metal studies have been conducted in the study area. None of the mean values reported by the investigators exceeded the mean values plus 2 standard deviations calculated for the agencies' backwater data. However, as indicated by the maximum values reported by these investigators, at least some samples for copper, chromium, and nickel exceeded these values.

## NATURAL RESOURCES

Habitat Types and Distribution - Habitat within the study area can be classified into terrestrial and aquatic and further characterized by vegetation. Excellent stands of aquatic plants have developed, creating habitat for waterfowl and other wildlife. The study area includes about 86,000 acres of aquatic habitats (main and side channels, sloughs, lakes, etc), 87,000 acres of wetlands (bottomland forest and other wetlands), and 31,000 acres of upland habitats (urban, rural, agricultural, dredged material, etc).

The system of locks and dams has created an extensive series of pools. In each of the pools, three distinct zones occur. The upper end of each pool remains essentially like the original river where the water levels are not raised appreciably and the old condition of deep sloughs and wooded islands is found. In the middle portion of each pool, water backs up over the islands and old meadows, spreading out and forming large areas of comparatively shallow water. In the lower end of the pool and immediately above each dam, a deeper open water area with limited aquatic vegetation growth exists. Prior to inundation, the forests at the foot of each pool were clear cut, leaving expansive fields of submerged or partially submerged stumps.

Vegetation - The aquatic vegetation in the pools and backwaters varies from very dense to complete absence. There are known to be 91 species of aquatic plants and wetland plants in the study area. Marsh and aquatic vegetation cover about 43% of the study area. Open water covers about 42% of the study area.

Most of the UMR is contained within an ecotone between prairie vegetation types and mixed deciduous-coniferous forests. The forested parts in the area are of two types: the upland xeric southern forests; and the lowland forests of the floodplain. Thirty-nine tree and 29 shrub species have be documented in the study area. Bottomland forest covers about 11% of the UMRWFR and is dominated by silver maple, black willow, cottonwood, American elm, river birch, swamp white oak, elm, and black ash. Upland forest covers about 5% of the Refuge and is dominated by red oak, black locust, and ash with some scattered stands of pine. The upland shrub community covers about 2% of the UMRWFR, consisting primarily of black locust, oak, boxelder, ash, cherry, and dogwood.

About 260 species of understory and herbaceous plants are recorded in the study area. Grassland covers about 6% of the UMRWFR with tame grasses such as bluegrass and brome grass predominant. Management efforts are focusing on encouraging the re-establishment of native species such as big and little bluestem, switch grass, Indian grass, side-oats grama, prairie junegrass, and green needlegrass.

Habitat Conditions - In general, the existing habitat conditions in the study area are declining because of sedimentation in the backwater areas, the effects of man-made changes to the river system, and natural processes. Sedimentation in the backwaters has been increasing because of the loss of border islands along the main channel and the enlargement of side channel openings. These conditions allow additional sediment-laden flow and wave action into the backwater area. This leads to degradation of habitat that a number of species desire. The once valuable habitat becomes monotypic, shallow, and windswept with little vegetation or depth diversity.

A contributing factor in the decline of riverine habitat in the study area is the man-made changes to the river system associated with the establishment of the 9-foot navigation channel. Three components of the navigation system include construction of the locks and dams, construction of channel training structures, and periodic channel dredging. Lock and dam construction has resulted in water levels being stabilized at higher than normal elevations for low to average flow conditions, and a decrease in water surface slopes and sediment transport potential during flood conditions. The stable water surface slopes have resulted in a continuously inundated floodplain and the long term degradation of vegetation communities adapted to moist soil conditions with only seasonal flooding. The decreased sediment transport potential has resulted in sediment deposition in large areas of the floodplain and reduced the potential for scour during floods. Although channel training structures originally locked the main channel and many of the secondary channels in a relatively static position, the construction of the locks and dams decreased the effectiveness of these structures. Placement of dredged material along the navigation channel has focused flow into secondary channels which tend to erode. The combination of these three components has contributed to the decline in river habitat and is responsible for two recent trends being addressed by the Bank Stabilization project. The first trend is that of increasing discharges into backwater areas through eroding secondary channels. The second trend is the loss of floodplain forest due to island erosion from flow or wave action with downstream accretions usually taking the form of shallow sandbars, or if emerged, will thickets.

There is also a loss of bottomland hardwoods as the heads and shorelines of islands erode. Although sand bars form at the downstream end of the islands, the vegetation that becomes established consists of willows and shrubs, rather than the bottomland hardwoods.

<u>Fish and Wildlife</u> - About 133 species of birds, 44 species of mammals, 35 species of amphibians and reptiles, 111 species of fish, and 48 mussel species are found in the study area.

Most fish occurring in the study area are of warm water type. Game fish that are common to the study area include walleye, sauger, largemouth bass, smallmouth bass, white bass, northern pike, bluegill, crappie, perch, and pumpkinseed. The river supports a commercial fishery for species such as buffalo, sheepshead, carp, catfish, bullheads, and drum.

Centrarchids are the most abundant fish sampled in the backwater areas of the Mississippi River (commonly over 50 percent of the total catch). The maintenance of these areas is a management concern because these backwater nursery areas are important in maintaining populations of large surrounding areas. In addition, recent research indicates that the availability of suitable overwintering fish habitat is a limiting factor in many backwaters. The study area includes important overwintering habitat for a variety of backwater fish species. Fish species state-listed as special concern in the area include the mimic shiner, goldeye, and the black buffalo.

The UMR contains a large, complex assemblage of invertebrate species, related to the wide variety of habitat in the area. The insect fauna is dominated by immature stages of mayflies, midges, and caddisflies, indicating that the water retains high dissolved oxygen levels. The aquatic insects are important food organisms for a large number of fish and waterfowl species.

More species of freshwater mussels are found in the UMR basin than any other river basin in the United States. The mussel species of the area are in two distinct groups: the Sphaeriidae or fingernail clams; and the Unionidae. Fingernail clams are found in a wide variety of substrate in water depths up to 20 feet and are often an important food base for a variety of fish, waterfowl, and turtles. The Unionidae are larger mussels requiring a stable substrate of sand and gravel. This group is a food item for raccoon, muskrat, mink, and otter, and were also important commercially for the pearl button industry. The Unionidae are currently used commercially in the cultured pearl industry. Clam populations are generally sparse along most of the UMR, but populations in some areas are extremely dense and support commercial harvest.

The major use of open water areas for waterfowl (mainly divers) is for fall feeding and loafing, but smaller secluded areas serve as pair ponds for breeding waterfowl. Emergent vegetation areas provide nesting and brood rearing habitat for waterfowl; feeding areas for mink, muskrat, and beaver; nesting and feeding areas for songbirds; and feeding areas for wading birds, such as great blue herons. Islands with dense vegetative cover provide nesting areas for puddle ducks and other ground nesting birds; cover for small mammals, reptiles, and amphibians; and denning sites for mink. The UMR valley is a major migratory corridor for waterfowl. Common waterfowl species include the mallard, coot, blue-winged teal, and wood ducks. The heaviest use of the area is during spring and fall migration when large numbers of mallards, canvasbacks, coot, tundra swans, Canada geese, and widgeon occur. Up to 75 percent of the canvasback continental population have been seen on pools 7 and 8 alone. Other diving ducks (principally lesser scaup, ringnecks, redheads, buffleheads, and ruddies) gather on open pools above the dams. Mallards, wigeon, gadwall, teal, and other surface-feeding species are found in the shallow backwaters along the river banks. Thousands of wood ducks feed in the protected sloughs and shallows and nest in the hollow trees along the islands and bluffs. Also, thousands of tundra swans stop at favorite resting areas during the spring flight.

Migrations of other birds noted during the spring and fall are warblers, vireos, thrushes, and sparrows. The spotted sandpiper is the most common shorebird in the area. Other common species include the mourning dove, tree swallow, robin, grackle, and the red-winged blackbird. The bald eagle winters in the study area, usually concentrated below the dams or near the mouths of tributaries. Whippoor-wills and pileated woodpeckers are found in the remote woodland areas. The bottomlands harbor myriads of marsh and water birds such as herons, egrets, bitterns, and rails. Many large rookeries can be found in more remote reaches where hundreds of great blue herons and egrets raise their young.

Major furbearers along the Mississippi River include muskrat, mink, beaver, otter, raccoon, skunk, weasel, and fox. Other species of mammals that have been observed are the white-footed mouse, short-tail shrew, nutria, gray and fox squirrels, cottontails, jackrabbits, and white-tailed deer.

Little information exists on the status of amphibians and reptiles. Species observed include: the leopard frog; American toad; spring peepers; painted, soft-shell, and snapping turtles; salamanders; and the water snake.

Threatened and Endangered Species - Four Federally listed species occur in this portion of the Upper Mississippi River valley: the bald eagle; the peregrine falcon; the Higgins' eye pearly mussel; and the Iowa Pleistocene snail. The bald eagle regularly uses the study area during migration and also nests on the UMRWFR. The peregrine falcon is an occasional visitor during migration. The Higgins' eye pearly mussel has been found in pools 7 through 10, most commonly in sand and gravel beds. The highest densities of these mussels have been found in the East Channel at Prairie du Chien, Wisconsin. The Iowa Pleistocene snail is found in the algific talus slopes of pool 10. No other federally-listed endangered or threatened species or any species proposed to be listed are known to be in the project area. Additional species classified by the states as threatened (T) or endangered (E) include the following:

| Wisconsin | Iowa | Minnesota |
|---|---|---|
| Wood turtle - T | Wood turtle - E | Wood turtle - T |
| Blandings turtle - T | Ohio River pigtoe - E | Blandings turtle - T |
| Bullhead mussel - E | Bullhead mussel - E | |
| Butterfly mussel - E | Butterfly mussel - T | |
| Yellow sandshell - E | Yellow sandshell - E | |
| Rock pocketbook - T | | |
| Monkeyface mussel - T | | |
| Wartyback mussel - T | | |
| Buckhorn mussel - T | | |
| Purple wartyback - E | | |
| Black buffalo fish - T | | |
| Paddlefish - T | | |
| Blue sucker - T | | |
| Skipjack herring - E | | |
| Goldeye - E | | |

Water Quality - The study area generally has relatively good water quality. The dissolved oxygen levels remain high year-round, except in isolated sloughs and backwater lakes. Water temperature in the main channel correlates with air temperature. Maximum water temperature occurs in mid-summer, and remains close to zero degrees Centigrade during the winter. Water in the shallow areas attains a slightly higher temperature than the main channel, cools faster in the evening, and results in greater swings in diel temperature than occur in other flowing areas of the river. The water is warmer in the shallow areas due to suspended solids, the dark bottom, and smaller volume of water.

Phytoplankton in the Mississippi River follows a seasonal progression of species composition typical of north-temperate eutrophic water bodies, a strong spring diatom bloom giving way to blue-green algae blooms dominated by Aphanizomenon. Plant nutrient concentrations during the open water season normally exceed levels that allow nuisance blooms of algae to develop. Inorganic nitrogen and available phosphorus concentrations occasionally fall below limiting concentrations during intense algal blooms. Physical conditions of light penetration, mixing, filtering by aquatic plant beds, wind, flow path, and dilution have a great effect on phytoplankton concentrations at any point in the river.

CULTURAL RESOURCES

In accordance with the National Historic Preservation Act of 1966, as amended, the National Register of Historic Places has been consulted. As of 1 October 1990, there are no National Register sites listed at any of the potential bank stabilization sites in the study area. A list of historic structures and archaeological sites that have been reported within or near the UMRWFR was provided by John Dobrovolny, Regional Historic Preservation Officer for the USFWS.

Many Clovis projectile points and the later Folsom points have been found in upland areas adjacent to the river valley, but very few artifacts dating to this period have been found in the floodplain of the UMR. Fluted points from early Paleo-Indian cultures have been reported from the Trempealeau area (pool 6). Three Late Paleo-Indian sites are known to exist in pools 6, 8, and 9. Evidence at some sites suggests that Late Paleo-Indian and Early Archaic populations may have occupied the river valley at the same time. One Early Archaic site, 4 Middle Archaic sites, and 14 Late Archaic sites (9,000 to 1,000 B.C.) are known in the study area. Over 1,000 archeological sites from the Woodland Periods (1,000 B.C. to 1634) are known along the UMR between pools 2 and 10. Most of the sites are located in pool 10.

The Oneota peoples (A.D. 900 to 1,000) occupied relatively large permanent villages along the terraces within the UMR valley. In the study area the villages are primarily in the La Crosse, Wisconsin area (31 sites).

Early evidence for historic Native American occupation of the UMR valley dates from the early 17th century. The Eastern Dakota tribe claimed and controlled all of the river within the study area. They fished, trapped, and hunted in the marshes and bottomlands, and traveled the river extensively in canoes. The principal villages of the tribe sat on the banks of the river and later evolved into permanent Euro-American settlements, such as Winona, Minnesota. Other tribes in or near the study area included the Ojibwa, Ottawa, Fox, and Sauk. Battles between various tribes occupying the valley, especially the Eastern Dakota and Ojibwa, frequently occurred on or near the UMR.

The French were the first Europeans in the area (early 17th century). They built forts and trading posts along the river and traveled the UMR in their bateaux and pirogues, carrying furs and trade goods. The most prominent and successful French post on the river was Prairie du Chien, Wisconsin, in pool 10.

## RECREATION/AESTHETIC RESOURCES

The study area offers many opportunities for sightseeing, outdoor recreation, and nature study. It accommodates about 3 million visitors annually for such activities as wildlife observation, environmental education, boating, fishing, hunting, bird study, and sightseeing. A continuous system of highways designated as the Great River Road closely follows the UMRWFR boundaries. Scenic views of the river valley can be seen from river bluffs at Winona and LaCrescent, Minnesota; Alma, La Crosse, and Lynxville, Wisconsin; and Lansing and McGregor, Iowa.

The St. Paul District, with assistance from Region 3 of the USFWS and various regional, state, and local agencies that have an interest in the river, developed a land use allocation plan for the Upper Mississippi River. The purpose of the plan is to balance and enhance public recreational use and fish and wildlife management while maintaining the river navigation system. This plan shows 14 sites designated as intensive use recreational areas and 94 sites designated as low-density recreational areas in pools 5 through 10.

Many residents in the study area own boats that they trailer to the river. At least 119 boat landings are located in the study area (Minnesota - 39, Wisconsin - 66, Iowa - 14). There are about 40 marinas in the study area (Minnesota - 11, Wisconsin - 20, Iowa - 9) with over 2,900 slips for permanent docking of boats. Several other marinas, landings, and municipal boatyards in the study area provide boat rentals and excursion trips along the river. Year-round fishing for walleye, northern pike, sauger, bass, perch, crappies, sunfish, and catfish is popular below the dams, in sloughs, and in side channels.

Modern campgrounds are available at various federal, state, municipal, and commercial parks on both sides of the river. Primitive camping on the UMRWFR islands and beaches is also permitted. Thousands of visitors use the sandbars and beaches along the main channel for picnicking and swimming.

Much of the study area is open to public hunting during state seasons.

## SOCIOECONOMIC RESOURCES

Major cities in the study area and their populations include: Winona, Minnesota - 25,000; La Crosse, Wisconsin - 62,000; Lansing, Iowa - 1,200; Prairie du Chien, Wisconsin - 5,700; and Guttenberg, Iowa - 2,500.

# FUTURE WITHOUT PROJECT CONDITIONS

## HISTORICALLY DOCUMENTED CHANGES IN HABITAT

Without argument, the most dramatic change in the UMR has been the construction of the locks and dams, permanently raising the water levels. This is most pronounced immediately upstream of each dam where large pools were created. Areas that were originally high and dry during normal flows are now permanently inundated or have become islands. Within the lower area of the pools, the water is open and deep, and while aquatic vegetation may grow, there is practically no marsh development. Island habitat was once dynamic in nature along the UMR. Prior to the construction of the locks and dams, when water currents eroded an island in one area, it deposited material elsewhere in the channel, forming sand bars. The sand bars would eventually form into an island as more sediment was deposited and as the vegetation became more established. However, island habitat along the UMR is being lost and it is not being replaced.

Although the project area is important for many species of fish and wildlife, declines in habitat values have been noted in recent years. As part of the GREAT I study in the late 1970's, the Sediment and Erosion Work Group found that approximately one-fourth of the open water present when the lock and dam system was completed has become marshland and that all reaches of the study area are rapidly aggrading. This has been documented through Cs-137 (Cesium-137 - a radioactive isotope) dating, spud surveys, fathometer recordings, and resurveys. Through the efforts of the Sediment and Erosion Work Group, maps were prepared using aerial photographs from 1939 and 1973 to compare the types of vegetation and to delineate the areas of open water that have been lost to emergent aquatic habitat and vice versa. Areas that changed from open water to emergent vegetation were determined to be the locations of fine sediment deposition. Locations that showed shifts from emergent plants to open water were assumed to be erosion or scour areas. The data presented by this technique clearly demonstrated that habitat changes have occurred and that sediment entering the system is filling in backwater areas. Reductions in the fisheries output and aquatic plant bed areas have also been observed.

## FACTORS INFLUENCING HABITAT CHANGE

The factors affecting habitat quality in the study area are numerous, complex, and interrelated, but the dominant factors influencing habitat change result from: flood events; flow conditions; location within a pool; location of tributaries and islands; and erosion of islands, side channels, and uplands. Sedimentation causes changes in depths, producing a more uniform bottom which leads to decreased plant species diversity. Gradual conversion from open water to marsh because of sedimentation also changes habitat conditions. Island erosion results in the loss of bottomland hardwoods and the subsequent creation of downstream sandbars with willows and shrubs as the primary vegetation.

Wind-induced waves and the feeding activity of rough fish can also resuspend sediment and increase turbidity. Restriction of light penetration is the greatest impact of turbid waters. Light transmission to the lake bottom is essential for the growth of submergent aquatic plants, especially early in the growing season. High turbidity indirectly affects fish and wildlife by depressing the growth of aquatic vegetation and directly affects fish community diversity by favoring rough fish over game fish. It affects game fish through diminished sight feeding ability, depression of planktonic food resources, and loss of shelter. An example of how changes in suspended sediment can affect vegetative growth is demonstrated by pool 8 data that showed a two-fold increase in ambient suspended sediment concentrations (increase from 20 mg/l to 40 mg/l) would decrease the 1-percent photic depth from 133 cm to 105 cm (a 27-percent decrease)(C.E.Korschgen, unpublished. Northern Prairie Wildlife Research Center, U.S. Fish and Wildlife Service, La Crosse, Wisconsin, Field Station).

## ESTIMATED FUTURE HABITAT TYPES AND DISTRIBUTION

Habitat changes can be expected to occur over the next 50 years that will result in a continued decrease in habitat value for fish and wildlife in the study area. These physical changes would affect geomorphology, hydrology, sediment transport, water quality, vegetation, and various types of aquatic and terrestrial habitat.

Geomorphology - Wave action, normal flow, and flood events will continue to erode the islands that remain, further flattening the topographic relief of the area. The deep aquatic areas can be expected to gradually fill in. Wave action will level the bottom, eroding the high spots and filling in the deep areas, and resuspend fine sediments. Existing low or small islands and beds of emergent aquatic plants will become large shallow flats. The work done by the Sediment and Erosion Work Group during the GREAT I study in the 1970's showed that computed average annual sedimentation rates ranged from 0.1 to 4.7 centimeters per year. Almost all the sampling sites were relatively shallow, slack-water areas where water depth was less than 5 meters. Few of the backwaters exceed a depth of 3 meters, so it is clear that backwater areas will continue to be reduced in depth and extent.

Hydrology - Lacking any unforeseen change in dam operation, the water level regime in the study area will remain the same. The flow pattern through the study area will probably change, though, as the existing islands continue to erode and side channel openings become larger.

Sediment Transport - Suspended sediment will continue to be carried into the backwater areas as the side channel openings erode and become larger. A reduction in sediment input from upland erosion may occur as a result of improved soil conservation and land use practices, but the input will still be the primary source of fine sediments in the river. Bedload movement is expected to continue at the same rate and is dependent on flow conditions and the frequency of floods.

Water Quality - Suspended solids concentration in the backwaters will increase due to the greater influence of inflowing water through eroding side channel openings and increased resuspension of bottom sediment by wave action as barrier islands and islands within a pool erode and disappear. Winter water temperature in the backwater areas will decrease because of increased flows.

Vegetation - Floodplain forest vegetation (bottomland hardwoods) will decline as island erosion continues. Less desirable willows and shrubs will appear on the downstream end of islands as sandbars develop and become terrestrial habitat. As the islands along the main channel erode, the aquatic vegetation now protected by the islands will be subjected to increased wave action. Aquatic plant beds will become increasingly limited by light penetration and can be expected to decrease over time. Uprooting of aquatic plants will occur with increased wave action in the backwaters.

Habitat Types and Distribution - Habitat conditions in the backwater areas will be characterized by increased shallow open water areas with higher flows and reduced island and aquatic plant bed areas. Areas of desirable winter fishery habitat will be reduced as current velocities increase, depths decrease, and water temperature decreases. Habitat variability will gradually decrease as the topographic relief and water quality decline, and shallow open water area predominates.

## PROBLEM IDENTIFICATION

### EXISTING HABITAT DEFICIENCIES

Habitat deficiencies must be viewed in the context of the desired conditions or management goals of a particular area. What may be viewed as a deficiency for one species may be excellent habitat for another. Management goals for the UMRWFR vary by management area or pool. These management goals were discussed previously in this report.

The loss and degradation of high quality fish and wildlife habitat on the Upper Mississippi River (UMR) is evident and well documented. There are many causes, including: shoreline erosion; sedimentation; changed land use patterns within the drainage system; impoundment of the river for navigation; increased river traffic; changes in flow conditions due to floods; and point and non-point input of contaminants.

Existing habitat conditions in the study area are deficient in meeting management goals. Winter water quality in some of the backwater areas limits suitable fish habitat. The lack of rock, gravel, and riffle habitat in the flowing channels limits a number of fish species. The primary wildlife habitat deficiency is the increasing lack of aquatic vegetation in the open water areas due to the loss of islands and associated wave action.

## ESTIMATED FUTURE HABITAT DEFICIENCIES

Increases in wave action and flow into the backwater areas will increase suspended solids concentration and sedimentation and further limit light penetration. The reduced photic zone will further limit growth of aquatic plants. Sedimentation will continue and accelerate as the islands erode and side channels enlarge. Future fish habitat conditions will include areas with high flows deficient in aquatic vegetation and its interspersion with open water. The increase in suspended solids occurring from more flow and wave action will decrease fish habitat during the open water season. The loss of wildlife habitat will continue due to increased water flow and wave action; reduced light penetration caused by the resuspension of fine sediment; and loss of barrier islands. Wave action will have a greater effect on vegetation because of shallower depths. The decreases in aquatic vegetation, water:land interspersion, light penetration, and water depth diversity will cause a similar decrease in the fish and wildlife use of the area. The land to water ratio and aquatic vegetation acreage will need to be increased for wildlife habitat. Prime terrestrial habitat (especially bottomland hardwoods) will be lost as barrier islands continue to erode and disappear. This bottomland hardwood habitat is not being re-established naturally.

## PLANNING OPPORTUNITIES

The principal purpose of plan formulation is to develop a plan that provides the best use, or combination of uses, of water and land resources to meet the project objectives. The plan formulation process must also consider the identified planning opportunities and constraints.

Planning opportunities are physical conditions, plans by others, and available resources considered in formulating alternative plans to address the management objectives for the project area. Characteristics of the study area are considered during the design of alternative plans to address the objectives. Whenever possible, existing physical conditions and material availability should be used to conserve non-renewable resources and in the design of project features.

For example, underwater sand deposits downstream of eroding islands could be used to replenish the head of an island and provide a base for rock protection to stabilize the island.

## PLANNING CONSTRAINTS

A plan to maintain or improve habitat in the study area must be compatible with a number of constraints.

### HYDROLOGIC

1. Structures must be designed with consideration of the hydrologic regime and water regulation of each pool. Any structures should be designed to withstand forces of water currents and wave action associated with conditions up to a 50-year recurrence interval flood event.

2. Structures must not induce increased flood elevations of more than 0.01 feet during a 100-year recurrence interval flood event.

3. Interference with current pool operating procedures must be minimized. Any operational modifications must be approved by all applicable interests.

### ENGINEERING

1. Any dredged material must be placed at an approved placement site or used beneficially.

2. Construction access must be possible for normal construction equipment.

3. Project features must be designed for a minimum 50-year life.

4. Construction materials are limited to the physical characteristics of material in the vicinity of the erosion site or at existing placement sites.

5. Construction equipment must be available that can handle the borrow or construction material.

6. Operation and maintenance requirements must be minimized.

### ECOLOGICAL

1. Construction should be conducted to minimize redistribution of existing unconsolidated fine sediments and contaminants.

2. Plans for improvement should maximize the areal extent and quality of aquatic vegetation.

3. Any modifications to existing islands or side channel openings should not result in long-term water quality degradation in the Mississippi River.

4. Efforts to improve migratory birds, furbearer, and fishery habitat should not adversely impact on UMRWFR objectives of higher priority.

RECREATION

1. Existing recreational access must be maintained.

2. Boat access to the main channel must be maintained.

LEGAL

1. The plan must comply with all Federal and State laws and regulations.

2. Project features must be constructed on lands owned by the Federal Government or a local sponsor. Long-term easements must be acquired by a local sponsor for construction on private property.

ECONOMIC

1. The cost of project features must be reasonable for the specific site when compared to the habitat improvements estimated. Tools used to quantify economic efficiency will be the application of incremental analysis and habitat evaluation procedures.

2. A recommended plan has to be incorporated into the overall EMP funding limitations.

CULTURAL RESOURCES

1. A cultural resource literature search and/or investigation would have to be made of any sites proposed for stabilization.

2. Any known important cultural resource sites would have to be avoided or, if disturbed, appropriate mitigation measures would have to be provided.

INSTITUTIONAL

1. The project would be located within the UMRWFR and, as such, must be compatible with the primary purposes of the Refuge and be consistent with the Refuge's management objectives.

## PROJECT OBJECTIVES

The ultimate goal of the project is to preserve, restore, and enhance backwater fish and migratory bird habitat on the Upper Mississippi River Wildlife and Fish Refuge. This could be accomplished by reducing erosion of side channels; limiting or reducing flows into side channels; and preventing erosion of existing barrier islands along the main navigation channel. For purposes of design and future evaluation, specific project objectives were developed. Because of the type of habitat project being pursued under the EMP authority and the size of the study area, general goals were used to develop a habitat-based model and to guide the screening and selection of sites to be implemented. Specific goals are required for an engineered solution to the habitat problems at a specific site. Therefore, after selection of the specific sites to further pursue, more specific objectives would be developed for each of the selected sites. The overall habitat improvement objectives for the 50-year future period follow.

Fisheries Habitat Improvement Objectives - Aquatic habitat improvement objectives to meet fisheries management goals are:

* Decrease or prevent increases in flow entering selected backwater areas.
* Maintain or increase the areal extent, interspersion, density, and species composition of macrophyte beds.
* Maintain or increase the island shoreline length.
* Maintain an interspersion of flowing channel habitat.
* Provide rock and gravel in flowing channels for lithophilic species.
* Decrease suspended solids concentrations.

Migratory Bird Habitat Improvement Objectives - The target species for management are nesting and migrating waterfowl. Management for these species would provide habitat to a variety of wildlife. Habitat improvement objectives to meet wildlife management goals are:

* Maintain or increase the areal extent, interspersion, density, and species composition of macrophyte beds.
* Maintain or increase the length of shoreline and the area of islands.
* Decrease suspended solids concentrations.

The specific objectives for each of the selected sites will be presented later in this report.

# PLAN FORMULATION

The principal purpose of plan formulation is to develop a plan that would provide the best use, or combination of uses, of water and land resources to meet the project objectives. Early in the plan formulation process, the USFWS and states were asked to identify sites on the UMR where continued riverbank erosion will cause significant degradation of fish and/or wildlife habitat. There are literally hundreds of erosion sites that exist in the study area. Many of the sites are adversely affecting fish and wildlife habitat. The agencies examined dozens of sites that were identified during the GREAT I study; were brought to the attention of the agency by the public; and were discovered by field biologists during normal natural resource management activities. Fifty-five high potential sites were submitted by the three states and the USFWS for consideration. A name and an identification number were assigned to each of the sites which specifies the pool location, river mile, and left or right descending bank. Table DPR-2 lists the sites that were submitted for each pool.

## ALTERNATIVES CONSIDERED

Since the project objectives all relate to the effects of flow and wave action on backwater areas or riverbanks, the physical alternatives identified consist primarily of features that would control flows and prevent erosion of islands or riverbanks. This includes shoreline protection, partial closures, offshore rock mounds, constriction of side channel openings, and reshaping of the river bank. Alternatives for shoreline protection could include one or more of the following methods of bank stabilization, depending on the location and physical characteristics of the site and the severity of erosion:

1) shaping or filling of the eroded bank to provide an even slope for the placement of rock riprap;
2) shaping or filling of the eroded bank to provide a slope for topsoil and seeding;
3) bio-engineering methods of bank stabilization (ie. vegetative mats, willow plantings, anchored tree trunks, etc);
4) placing a rockfill wedge along the toe of the eroded bank;
5) constructing an offshore rock mound in shallow water;
6) placing rock groins perpendicular to the eroding shoreline at appropriate intervals to trap eroding material between the groins;
7) placing rockfill partial closures in the side channel openings;
8) constricting side channel openings by using fill to narrow the opening and protecting with rock riprap; and
9) no action. With this alternative (#9), no bank stabilization would be implemented using Federal funds. Erosion would continue and habitat conditions would decline as described in previous section of this report.

# Table DPR-2 - Erosion Sites

| | Sites in Pool 5 | | Sites in Pool 5A | | Sites in Pool 6 | | Sites in Pool 7 | | Sites in Pool 8 | | Sites in Pool 9 | | Sites in Pool 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Name | Number | Name | Number | Name | Number | Name | Number | Name | Number | Name | Number | Name |
| 1 | 5-749.7-R | Island 42 Closure | 5A-736.8-R | Small Island | 6-718.6-R | Blacksmith Slough | 7-713.3-L | Long Lake Inlet Island | 8-699.3-L | N. Taylor Island | 9-677.4-R | Dark Slough | 10-646.5-L | Gordon Bay Inlet |
| 2 | 5-746.7-L | Roebuck's Run | 5A-736.7-R | Head of Burleigh Slough | 6-715.8-R | Trempealeau Daymark | 7-712.3-R | Richmond Island | 8-698.5-L | S. Taylor Island | 9-676.7-R | Twin Island | 10-646.4-R | Billy Slough |
| 3 | 5-745.6-L | Sand Run | 5A-736.5-L | Kieselhorse | | | 7-707.6-L | Island 91 | 8-698.2-R | W. Channel Island | 9-673.5-R | Side Chute (Island 135) | 10-644.3-L | Jackson Island |
| 4 | 5-745.5-R | Fisher Island Daymark | 5A-735.7-R | Island 56 | | | 7-703.8-L | Old Cormorant Island 1 Island 2 | 8-696.4-R | Broken Arrow (Target Lake) | 9-671.1-L | Head of Battle Island | 10-643.1-L | Gordon Bay Upper Daymark |
| 5 | 5-744.5-L | Lost Island Chute | 5A-735.2-R | Island 57 | | | 7-703.5-L | N. Red Oak Ridge | 8-693.8-R | Root River | 9-671.0-L | Battle Island | 10-641.1-L | Island 166 |
| 6 | 5-741.5-R | Minneiska Island | | | | | 7-703.1-L | S. Red Oak Ridge | 8-688.4-L | Brownsville Daymark | 9-666.1-R | Hummingbird Slough | 10-637.8-L | Roseau Slough |
| 7 | | | | | | | 7-703.0-L | L. Onalaska Island B Island C | 8-685.2-L | East Island | 9-664.9-R | Lansing Light | 10-636.4-L | East Channel |
| 8 | | | | | | | | | 8-685.0-R | Heron & Trapping Islands | 9-654.1-R | Upper Harper's Slough | 10-631.8-L | Snake Island |
| 9 | | | | | | | | | | | 9-653.4-R | Middle Harper's Slough | 10-628.7-L | Wyalusing Upper Light |
| 10 | | | | | | | | | | | 9-652.6-R | Lower Harper's Slough | 10-628.0-R | Norwegian Slough |
| 11 | | | | | | | | | | | 9-648.0-R | Dam 9 Island | 10-626.5-R | Island 177 |
| 12 | | | | | | | | | | | | | 10-625.5-L | Island 181 (Catfish Slough) |
| 13 | | | | | | | | | | | | | 10-623.3-L | Hovie Island |
| 14 | | | | | | | | | | | | | 10-621.0-L | Duck Lake Chute |
| 15 | | | | | | | | | | | | | 10-620.1-L | Frenchtown Light (Hole in the Wall) |
| 16 | | | | | | | | | | | | | 10-616.0-L | Ferry Slough Light |

## ALTERNATIVES ELIMINATED FROM FURTHER CONSIDERATION

Much discussion between the project proponents and designers centered around achieving the desired project objectives with the lowest first costs and minimal operation and maintenance requirements. During the site investigations, it was decided that some of the above alternatives for stabilization would not be practical, primarily because of the severity of erosion and the harsh conditions at the sites. Alternatives eliminated included: (#2) shaping or filling of the eroded bank for topsoil and seeding because of the severe erosive conditions at the sites being considered; and (#8) using fill to constrict side channel openings because of the potential impact on flood levels and construction difficulties associated with high flows. Bio-engineering methods (#3) were also eliminated as a sole means of erosion control. A low level of confidence in the success of bio-engineering exists because it has produced sporadic results at other locations in the region, especially under the severe conditions existing at the erosion sites being considered. However, during the preparation of more detailed plans and specifications for some of the selected sites, bio-engineering features may be used in conjunction with other methods. For example, tree planting at the top of the bank could be used to provide future additional stabilization or portions of the project site that are not subject to severe erosive conditions could use some sort of bio-engineering method.

## ALTERNATIVES CONSIDERED FURTHER

Only the bank stabilization alternatives that use rock for protection (#1, #4, #5, #6, and #7) were considered further because they are the most predictable and dependable methods for stabilization. Also, the operation and maintenance would be minimal. Typical cross-sections of the potential bank stabilization alternatives are shown on Plates 14 and 15. A detailed alternatives study or evaluation was not done because of the nature of the proposed project. Many of the decisions concerning the actions needed at each site were made together by the study team during the site visits based on their overall technical expertise. These decisions were based on the physical characteristics of the site as recorded on the data sheets (see appendix A) and summarized in table DPR-3. As explained above, bio-engineering techniques may be used in conjunction with the rock protection at some sites, but this will be evaluated in more detail during future design work.

The no action alternative (#9) was also considered for each site. With this alternative, erosion would continue and no project objectives would be met because habitat conditions would decline. This plan would be selected only if no feasible action alternative could be found.

SITE INVESTIGATIONS

Not all sites that are deteriorating due to erosion were investigated for this study. Sites that were identified as the responsibility of the channel maintenance program or Operational Management Plan were not visited by the study team. For example, several sites recommended for stabilization in the GREAT reports are associated with dredged material placement sites and, therefore, were considered to the responsibility of channel maintenance. Other areas that were not included were sites where it was obvious that access to the site would be cost prohibitive. Also, sites that were known to be located on lands owned and managed by a State were not pursued because of the potential to delay implementation of the entire project. Each agency did their own preliminary evaluation and screening of the hundreds of known erosion sites and submitted only the sites that were of highest priority and applicability. The 55 potential bank stabilization sites that were submitted by the agencies were visited during the summer of 1992 by the interagency study team to document site conditions and to evaluate the potential for habitat degradation. The location of each site is shown on Plates 3 through 13. The study team members and the dates of the involvement by each team member are documented in the PARTICIPANTS AND COORDINATION section of this report. Information that was documented during the site visits included: location by pool, river mile, and left or right descending bank; water surface elevation; flow discharge in the main channel; estimated stabilization length and proposed type; height, slope, and water depth at the toe of the bank; cross-section of the river bank from shoreline to deep (6'+) water; soil characteristics; relative rate of erosion; apparent causes of erosion; type and density of vegetation; habitat types; construction and access considerations; photographs; and cultural resources potential. A summary of the physical characteristics for each site is shown in table DPR-3. The actual data sheets are included in appendix A. These site visits allowed the study team to reduce the number of sites for more detailed evaluation to 34. Reasons for not pursuing some of the initial sites submitted included one or more of the following: a field determination by the team members that there would be low habitat gain; the site was located on state lands and the state would be unable to provide the cost share commitment; the site was located on private lands and no lands would be acquired for this project; erosion was not critical enough (compared to the other sites) to be included at this time; the site could be incorporated into another habitat project; or, the site had completely eroded and was gone. Sites that were pursued for more detailed evaluation (described later in this report) are marked with an asterisk in table DPR-3.

## Table DPR-3 – Erosion Site Physical Characteristics

| Site Number | Site Name | Length of area to stab (ft) | Width of island (ft) | Water depth (ft) | Height of bank (ft) | Stabilization proposed: Type | Stabilization proposed: Length(ft) or # | Ease of access (Dif/ Mod/ Easy) | Dredging req'd? (Y/N) | Corps Fee Title? (Y/N) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-749.7-R | Island 42 | 900<br>(closure) | NA<br>100 | 12<br>4 | 3<br>2.5 | Riprap<br>Riprap | 700<br>200 | E<br>M | N<br>N | N<br>N | * |
| 5-746.7-L | Roebuck's Run | 1000 | NA | 6+ | 4–8 | Riprap | 1000 | M | N | Y | * |
| 5-745.6-L | Sand Run | 800 | NA | 3–6 | 3–10 | Riprap head<br>Groins | 150<br>4 | M | N | Y | * |
| 5-745.5-R | Fisher Island Daymark | 250 | NA | 6 | 2–8 | Riprap | 250 | M | N | Y | * |
| 5-744.5-L | Lost Island Chute | 500 | NA | 4 | 7 | Riprap | 500 | D | N | Y | * |
| 5-741.5-R | Minneiska Island | 320 | 300 | 2 | 3–9 | Offshore mound | 400 | M | Y | N | |
| Total Pool 5 | | 3770 | | | | | | | | | |
| 5A-736.8-R | Small island | 100 | 70 | 10 | 2 | Riprap | 150 | E | N | State | |
| 5A-736.7-R | Head of Burleigh Slu | 300 | NA | 3 | 2 | Riprap | 300 | M | Y | Y | * |
| 5A-736.5-L | Kieselhorse | 1300 | 400 | 6 | 3–5 | Riprap head<br>Groins | 300<br>6 | M<br>D | Y<br>Y | N<br>State | |
| 5A-735.7-R | Island 56 | 400 | NA | 3–4 | 2–7 | Riprap head<br>Offshore mound | 200<br>200 | M<br>M | Y<br>N | N<br>N | * |
| 5A-735.2-R | Island 57 | 1000 | NA | 3 | 3–12 | Riprap | 1000 | D | Y | Y | * |
| Total Pool 5A | | 3100 | | | | | | | | | |
| 6-718.6-R | Blacksmith Slough | 700 | NA | 2–3 | 3 | Riprap head<br>Partial closure | 400<br>300 | D<br>D | Y<br>Y | N<br>N | * |
| 6-715.8-R | Trempealeau Daymark | 2000 | | 4 | 4 | Riprap | 2000 | M | N | N | * |
| Total Pool 6 | | 2700 | | | | | | | | | |
| 7-713.3-L | Long Lake Inlet Island | 300 | 200 | 3–4 | 3–6 | Riprap | 300 | M | Y | N | * |
| 7-712.3-R | Richmond Island | 600 | 10 | 5 | 2 | Riprap east side | 600 | E | N | Y | * |
| 7-707.6-L | Island 91 | 400 | NA | | 3 | Riprap | 400 | M | N | State | |
| 7-703.8-L | Old Cormorant | (1) 100<br>(2) 100 | 100<br>100 | 2–3<br>2–3 | 1–2<br>1–2 | Offshore mound<br>Offshore mound | 200<br>200 | M<br>M | Y<br>Y | N<br>Y | * |
| 7-703.5-L | N. Red Oak Ridge | 500 | 400 | 1 | 20–30 | Offshore mound | 500 | D | Y | Y | * |
| 7-703.1-L | S. Red Oak Ridge | 600 | 400 | 1–2 | 10–30 | Offshore mound | 600 | D | Y | Y | * |
| 7-703.0-L | Lake Onalaska | (B) 800<br>(C) 700 | 5–25<br>15–40 | 1<br>1 | 1–2<br>1–2 | Offshore<br>Offshore | 800<br>700 | D<br>D | Y<br>Y | N<br>Y | * |
| Total Pool 7 | | 2400 | | | | | | | | | |
| 8-699.3-L | N. Taylor Island | 1300 | NA | 2–4 | 5 | Riprap<br>Offshore mound | 400<br>900 | E<br>M | N<br>N | N<br>N | * |
| 8-698.5-L | S. Taylor Island | 250 | NA | 4 | 3 | Riprap | 250 | M | N | N | * |
| 8-698.2-R | W. Channel Island | 800 | 500 | 5–10 | 4–5 | Riprap | 800 | E | N | N | |
| 8-696.4-R | Broken Arrow (Target Lake) | 600 | NA | 1–6 | 2–3 | Groins | 3 | D | Y | N | * |
| 8-693.8-R | Root River | Deferred in field – Erosion minor and relatively stable | | | | | | | | N | |
| 8-688.4-L | Brownsville Daymark | Deferred in field – Channel maintenance placement site | | | | | | | | Y | |
| 8-685.2-L | East Island | Deferred in field – Include in Pool 8 Phase II Islands project | | | | | | | | Y/N | |
| 8-685.0-R | Heron & Trapping Islands | 250 | 100 | 2–3 | 1–2 | Riprap head<br>Groin | 250<br>1 | D | Y | Y | * |
| Total Pool 8 | | 3200 | | | | | | | | | |

* Site pursued for more detailed evaluation.

Table DPR-3 – Erosion Site Physical Characteristics (continued)

| Site Number | Name | Length of area to stab (ft) | Width of island (ft) | Water depth (ft) | Height of bank (ft) | Stabilization proposed: Type | Stabilization proposed: Length/# (ft/#) | Ease of access (Dif/ Mod/ Easy) | Dredging req'd? (Y/N) | Corps Fee Title? (Y/N) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9-677.4-R | Dark Slough | 2000 | NA | 4–12 | 4 | Riprap | 2000 | E | N | N | * |
| 9-676.7-R | Twin Island | 800 | NA | 5 | 5 | Riprap | 800 | E | N | N | |
| 9-673.5-R | Side Chute (Island 135) | 700 | NA | 6 | 3–4 | Riprap | 700 | M | N | N | |
| 9-671.1-L | Head of Battle Island | 500 | 500 | 3–8 | 1–5 | Riprap | 500 | E | N | non-Fed | |
| 9-671.0-L | Battle Island | Deferred in field – Non-Federal property | | | | | | | | non-Fed | |
| 9-666.1-R | Hummingbird Slough | 500 | NA | 8 | 1–3 | Riprap | 500 | E | N | Y | * |
| 9-664.9-R | Lansing Light | 800 | NA | 4–12 | 4 | Riprap | 800 | E | N | N | * |
| 9-654.1-R | Upper Harper's Slough | 2000 | 100 | 1–2 | 1–2 | Offshore mound | 2000 | M | Y | N | * |
| 9-653.4-R | Middle Harper's Slu | 200 | 100 | 5–12 | 2 | Riprap | 200 | E | N | N | * |
| 9-652.6-R | Lower Harper's Slough | 2900 | 100<br>NA | 2<br>2 | 1–2<br>2 | Offshore mound<br>Offshore mound | 2500<br>400 | E<br>M | N<br>N | N<br>N | * |
| 9-648.0-R | Dam 9 Island | 300 | 150 | 2 | 2–3 | Offshore mound | 300 | M | Y | N | * |
| Total Pool 9 | | 10700 | | | | | | | | | |
| 10-646.5-L | Gordon Bay Inlet | Deleted in field – Private ownership | | | | | | | | private | |
| 10-646.4-R | Billy Slough | 650 | NA<br>100<br>150 | 15<br>15<br>4 | NA<br>2<br>2 | Rock closure<br>Riprap-ds<br>Riprap-us | 200<br>300<br>150 | E<br>E<br>E | N<br>N<br>N | N<br>N<br>N | * |
| 10-644.3-L | Jackson Island | Deleted in field – Private ownership | | | | | | | | private | |
| 10-643.1-L | Gordon Bay Upper Daymark | Deleted in field – Private ownership | | | | | | | | private | |
| 10-641.1-L | Island 166 | 4000 | NA | 4 | 2–4 | Riprap | 4000 | M | N | N | |
| 10-637.8-L | Roseau Slough | 300 | NA | 5 | 2–3 | Riprap | 300 | M | Y | N | * |
| 10-636.4-L | East Channel | 1000 | NA | 4 | 2 | Riprap | 1000 | M | Y | N | * |
| 10-631.8-L | Snake Island | Deleted in field – Island is gone | | | | | | | | N | |
| 10-628.7-L | Wyalusing Upper Light | 300 | 100 | 6 | 2 | Riprap | 300 | M | N | N | * |
| 10-628.0-R | Norwegian Slough | 300 | 40 | 12 | 3 | Riprap<br>Closure | 200<br>100 | M<br>M | N<br>N | N<br>N | * |
| 10-626.5-R | Island 177 | 300 | NA | 5 | 1–2 | Riprap | 300 | E | N | Y | |
| 10-625.5-L | Island 181 (Catfish Slu) | 300 | NA | 4 | 2–3 | Riprap | 300 | M | N | Y | * |
| 10-623.3-L | Hovie Island | Deferred in field – Primarily recreational benefits | | | | | | | | Y | |
| 10-621.0-L | Duck Lake Chute | 400 | NA | 2–6 | 2–4 | Riprap | 400 | M | N | N | * |
| 10-620.1-L | Frenchtown Light (Hole in the Wall) | Deferred in field – Relatively stable with low habitat benefits | | | | | | | | N | |
| 10-616.0-L | Ferry Slough Light | Deferred in field – Relatively stable with low habitat benefits | | | | | | | | N | |
| Total Pool 10 | | 7550 | | | | | | | | | |
| Total for all pools | | 33420 | | | | | | | | | |

* Site pursued for more detailed evaluation.

SITE SELECTION PROCESS

The large number of sites identified for potential bank stabilization and the limited financial resources made it necessary to develop a process whereby it would be possible to implement bank stabilization on a priority basis for addressing the most critical erosion sites first and the sites where continued loss of habitat would be the greatest. Habitat Evaluation Procedures (HEP) is a method used to document the quality and quantity of available habitat, both present and in the future. Previous HEP applications in the EMP have involved the use of several individual species models to analyze impacts on a small, local scale. Both the use of single species and the local scale of application created concerns that these assessments may miss important impacts to the broader wildlife community occupying a larger area. Assessments restricted to local site impacts may be insensitive to changes in wildlife that occur at larger scales. Structural and physical features of habitat are measurable and, because vegetational succession is predictable, future habitat values can be projected with some confidence. HEP provides information for two general types of comparisons: the relative value of different areas at the same point in time; and the relative value of the same area at future points in time. By combining the two types of comparisons, the impact of proposed or anticipated land and water use changes on habitat can be quantified. The differences in quality (habitat suitability index, or HSI) and quantity (area) between existing habitat conditions (baseline) and various projected future sets of conditions document project-related impacts to selected evaluation species or their habitat.

During the field site investigations for the proposed bank stabilization project, it became evident that selecting potential project sites, ranking selected sites, and quantifying the habitat benefits associated with the sites could not be performed using an existing HSI model. The sites investigated and the different ways the sites functioned within the system were numerous. Policy constraints made it necessary to compare all the sites to each other. The existing HSI models could not address the habitat variability of the erosion sites. The only common physical feature at the sites was the eroding shoreline. The value of the physical structure at the site to fish and wildlife was so variable (vegetation types, soil conditions, location within the pool, size of the area, and function within the area) that a conventional model would not work.

The first step in the construction of a model was to establish the model goals. Then the habitat variables related to the model goal were defined. The next step was to define model relationships that combine measurements of the variables to achieve model goals. Model goals included two general aspects: output specifications and a definition of potential variables the field biologist is able to measure. The ideal output for an HSI model is a measure of habitat suitability per unit area. Models should be based on easily measured physical, chemical, or vegetative variables.

The goal for the bank stabilization model was to develop it as a habitat approach to impact assessment. The evaluation involves using the same key habitat components to compare existing habitat conditions and optimum habitat conditions for the species of interest. Setting wildlife resource objectives is the first step in determining if community and landscape level analyses are important in the HEP study effort. If the objective was only related to white-tailed deer, it might be appropriate to allow mitigation in non-bottomland forest habitats. However, if the objective was related to protecting bottomlands, such mitigation would be inappropriate. A habitat-based HEP was needed for this project.

The model was developed by the study team participants (biologists from the COE, USFWS, and the state departments of natural resources). The study team are experts on the UMR, know its habitats, and also familiar with HEP. The purposes of the evaluation were to determine the average annual habitat unit benefits of bank stabilization at each of the sites and to assist in the site selection process. The model was developed by rating six environmental factors. Some of these factors were then combined and four suitability index (SI) variables were selected for use in the model. Following is a description of the SI variables used for the model.

**$SI_1$** - This variable values the existing vegetation at the immediate site. There are basically four site classifications used in assigning the values. Based on the classification defined by J.T. Curtis in "The Vegetation of Wisconsin" (Univ. Wis. Press, 1959), the southern forest type was used.

The wet southern forest is dominated by silver maple, black willow, cottonwood, American elm, and river birch. The soils of this area are composed of fine grained sand or silt. Of the island types along the UMR, these sites are the lowest in relation to the water level and are most likely flooded for at least a short period of time during most years. Because this soil is fine-grained, it also tends to be cohesive, making these sites more stable. This leads to the fact that this forest type is by far the most common on the UMR (pools 5-10). Due to its stability, frequency of occurrence, and the absence of multi-layer forest habitat, the SI value assigned to it is 0.4.

The wet-mesic southern forest and is dominated by American elm, silver maple, green ash, basswood, and black ash. These sites are slightly better drained than the wet southern forest due to higher elevation and larger particle size soils. Flooding frequency is less and duration is not as long as the wet southern forest. Although the wet-mesic southern forest is also even-aged, it often contains more habitat layers than the wet southern forest because of less disturbance from flooding. With a higher layering of habitat types, more wildlife habitat niches are present. The wet-mesic southern forest is also less stable and less common on the UMR than is the wet southern forest. The SI value assigned to it is 0.6.

The southern mesic forest is drier and better drained than both the southern wet and wet-mesic sites. This forest type is dominated by sugar maple, basswood, American beech, slippery elm, and northern red oak. Again, the soils are more coarse than the wet and wet-mesic and are also less cohesive and stable. This forest type is characterized by many different layers developed within the stand. Many more niches are provided because of the multi-layered forest. Since this type is more unique to the study area and desired by many species in the UMR, it was assigned a higher SI value of 0.8.

The dry-mesic sites are probably the most unique sites in the study area and are dominated by northern red oak, white oak, basswood, sugar maple, and slippery elm. The dry-mesic sites are normally higher above the river, have excellent drainage and the dominant soil type is coarse sand to gravel. Because of the physical composition of these sites they are highly unstable and erode quite easily. They are mainly found in the lower ends of the pool. Many of these sites were located on the primary terrace prior to inundation. Due to the higher water levels in this area of the pool, these highly erodible islands are quite scarce. Mast and other seed production on these sites is high with associated high production of food items, so the wildlife use of these sites is also high. The SI value for these sites is 1.0.

The assigned values for the terrestrial habitat types are based on the unique quality of the area. Common bottomland hardwoods get the lowest values, while sites with walnut, oaks, etc. would rank higher. An island dominated by reed canary grass or other forbs has a SI of 0.2. If an island under study becomes completely eroded, its value becomes 0.1. No site is given a SI of 0.0 because it would always have some value as habitat.

Direct Impacts - $SI_1$
(at site)

| Vegetation Type | Assigned SI Value | |
|---|---|---|
| Not used | 0.0 | lowest |
| Completely eroded | 0.1 | |
| Forbs only | 0.2 | |
| | 0.3 | |
| Wet southern forest | 0.4 | |
| | 0.5 | |
| Wet-mesic southern forest | 0.6 | |
| | 0.7 | |
| Mesic southern forest | 0.8 | |
| | 0.9 | |
| Dry-mesic southern forest | 1.0 | highest |

$SI_2$ - This variable is the relative importance of the habitat of the area indirectly influenced by the eroding site. For example, what would happen to downstream or adjacent areas if the site completely erodes and disappears? It could cause increased flow to a backwater wetland, or it may have no impact other than the site disappearing. This is the most important variable in the model because it potentially impacts such a large area.

There are three broadly defined habitat types within the UMR considered for this model: main channel, side channel and backwater lakes and ponds. The main channel habitat along the UMR receives comparatively low fish and wildlife use. This is due to a number of factors, including recreational and commercial traffic and little or no vegetation. It is also the most maintained habitat type within the UMR. Main channel habitat will never be a limiting factor for fish and wildlife. Side channel habitat is usually not maintained and receives no commercial traffic and less recreational traffic than the main channel. Because there is no regular maintenance within the side channels, fish and wildlife use is higher. Mussel beds are much more prevalent in side channels than in the main channel. The backwater systems (lakes, ponds and sloughs) are the most valued of all habitats within the UMR. The ponds are often shallow and support extensive aquatic vegetation beds. The lakes support submergent vegetation and are also very important winter fishery areas due warmer water temperatures and low flow velocities. The running sloughs support diverse assemblages of mussel species. All areas are prime fish nursery areas, support high numbers of shorebirds, and are the most important staging areas for migrating waterfowl within the Mississippi Flyway.

Indirect Impacts - $SI_2$
(downstream or adjacent to site)

| Habitat Type | Assigned SI Value | |
|---|---|---|
| Not used | 0.0 | lowest |
| | 0.1 | |
| Main channel only | 0.2 | |
| | 0.3 | |
| Side channel only | 0.4 | |
| Main and side channel | 0.5 | |
| Backwater area only | 0.6 | |
| | 0.7 | |
| Backwater and side channel | 0.8 | |
| | 0.9 | |
| Backwater and main & side channel | 1.0 | highest |

$SI_3$ - This variable is the combination of the relative value of the area on a landscape scale and the site location within the pool. Are there many islands in the area, or is it a unique site? The isolated islands receive a higher value than an island in the midst of many others. Since islands are more scarce in the lower ends of the pools, their protection should be a higher priority than protecting a site in the upper pool portions. Again, this places a higher value on the more unique sites located in the lower end of the pool.

This value is determined by measuring the distance from the site to the next island. SI values are calculated by measuring distances to the nearest 100 feet to the next island. Each increment of 100 feet is 0.1 SI. Distances between islands over 1000 feet would have an SI of 1.0. Additional points are given to sites located downstream of mid-pool. Sites located within mid-pool are given an additional 0.1, while sites in the lower pool are given 0.2. For example, a site in the mid-pool area located 600 feet from another island would have a SI=0.7. A site in the lower pool located 500 feet from another island would also have a SI=0.7.

Site Location - $SI_3$
(relative uniqueness)

$$\text{Assigned SI Value} = \left|\begin{matrix}\text{Distance to the} \\ \text{nearest island} \\ \text{(100's of feet)}\end{matrix}\right| + \left|\begin{matrix}\text{0.0 (in upper pool)} \\ \text{0.1 (in middle pool)} \\ \text{0.2 (in lower pool)}\end{matrix}\right|$$

$SI_4$ - This variable measures the species richness of the site. The SI ranges from 0.2 - 1.0, and are classified into 3 categories: low, medium, and high. The areas classified low in species richness are those sites that have ordinary habitat conditions supporting common fish and wildlife species. The medium category supported either threatened and endangered species, had high species diversity, or supports a unique fish and wildlife function (eg. islands important for duck nesting). High species richness category includes documented threatened and endangered species and high species diversity.

To determine $SI_4$, sites were placed into the three categories (low, medium, and high) as described above. The sites within a category were compared to determine their ranking. Sites free from human disturbance (i.e. closed areas of the Upper Mississippi Wildlife and Fish Refuge) received the highest rating within their categories because of the importance of the area to concentrate wildlife during the hunting season. Within-category comparisons were needed because of the large number of sites that were investigated and the need to compare one to another.

If no fish or wildlife species were present, the site would be assigned a SI of 0.1. The SI ranges within the in the low category ranged from 0.2 - 0.4. Most of the sites here were typically long linear islands or small islands at the heads of side channels. Medium ranked sites ranged from 0.5 to 0.7 and were commonly duck or turtle nesting islands, or areas supporting multiple species. High ranked sites ranged from 0.8 to 1.0 and were areas of multiple species and threatened and endangered species.

Species Richness - $SI_4$
(threatened & endangered or unique function)

| Habitat Type | | Assigned SI Value | |
|---|---|---|---|
| Not used | | 0.0 | lowest |
| No fish or wildlife species present | | 0.1 | |
| | Open area, few species | 0.2 | |
| Supports common fish & wildlife species | | 0.3 | |
| | Closed area | 0.4 | |
| Supports threatened & endangered species/high species diversity/ unique fish and wildlife function | Open area, few species | 0.5 | |
| | | 0.6 | |
| | Closed area | 0.7 | |
| | Open area, few species | 0.8 | |
| Documented threatened & endangered species/high species diversity | | 0.9 | |
| | Closed area | 1.0 | highest |

<u>HSI Calculation</u> - The compensatory method is the technique used to calculate the HSI because of the relationship of the variables. The factors have a compensatory relationship because of the various influences that the sites have on adjacent areas. Often at these sites, a variable with low habitat suitability was offset by the high habitat suitability of another variable.

Geometric mean was used instead of arithmetic mean because a weak compensatory relationship was perceived by the study team. Averaging functions is insensitive to very high or very low values. The geometric mean also usually produces a smaller HSI score than the arithmetic mean because low values influence the score to a higher degree.

The following equation was developed to calculate the HSI value of each site:

$$HSI = ((SI_1 \times SI_3)^{1/2} \times SI_2 \times SI_4)^{1/3}. \quad \text{Where:}$$

#1) $(SI_1 \times SI_3)^{1/2}$ is the square root of the product of the two values; and

#2) HSI is then calculated as the cube root of the product of $SI_2$, $SI_4$, and #1.

The HSI formula is separated into an upland and wetland component consisting of the island area that would be saved and an affected area component consisting of the area protected by the presence of the island. The HSI's are independent. The adequacy of the above HSI formula was tested by using a site that most river experts would agree was obviously of prime habitat value to the area and a site obviously of low habitat value. The two sites were ranked according to the above procedure and compared used the appropriate number of acres affected by the sites. The result of the ranking was reasonable and as expected. Therefore, the study team was satisfied with the formula developed for the analysis.

The HEP model was used to evaluate the habitat affected at each of the 34 bank erosion sites. The HSI was computed for existing conditions at the sites, future without a project, and future with a project. A future of 50 years was used. The number of acres of habitat affected at each of the sites was determined using the professional judgement of the team members. The habitat value of stabilizing the site was then computed in terms of average annual habitat units (AAHU) and the number of habitat units gained over the project life was calculated. Detailed information on the results of the HEP analysis is included in appendix B.

The cost to stabilize each site was estimated based on the physical characteristics of the site. Three basic types of stabilization techniques were selected depending on the offshore depths and location of the erosion at the site: 1) shaping or filling of the eroded bank and placement of rock riprap on the slope at the head of islands or where offshore depths were more than 4 feet; 2) constructing an offshore rock mound where offshore depths were less than 4 feet; and 3) placing rock groins perpendicular to the eroding shoreline where offshore depths were shallow and where littoral drift could be utilized. Construction items used to estimate costs were: rockfill ($35/CY); filter fabric ($3/SY); random fill ($7/CY); and dredging or excavation ($7/CY). For the purposes of plan formulation and consistency, the unit prices used are the same for each site because it was determined that only small differences in the unit price would occur at the various sites. Based on the unit prices, the construction cost was calculated and then doubled to account for construction contingencies, engineering and design, and construction administration. The total construction cost was converted to an average annual cost using an 8-1/4% interest rate with a 50-year life. Finally, the estimated annual O&M cost was added to the average annual construction cost. Using the results of the habitat and cost analyses, the total cost per average annual habitat unit for each site was calculated. A summary of the cost and habitat analyses is shown on table DPR-4.

The costs shown in table DPR-4 were used for the preliminary evaluation and comparison of alternatives during the formulation of the project. These costs do not necessarily agree with the costs of the selected plan that was more fully developed as described later in this report. A more detailed cost breakdown is included in Appendix C.

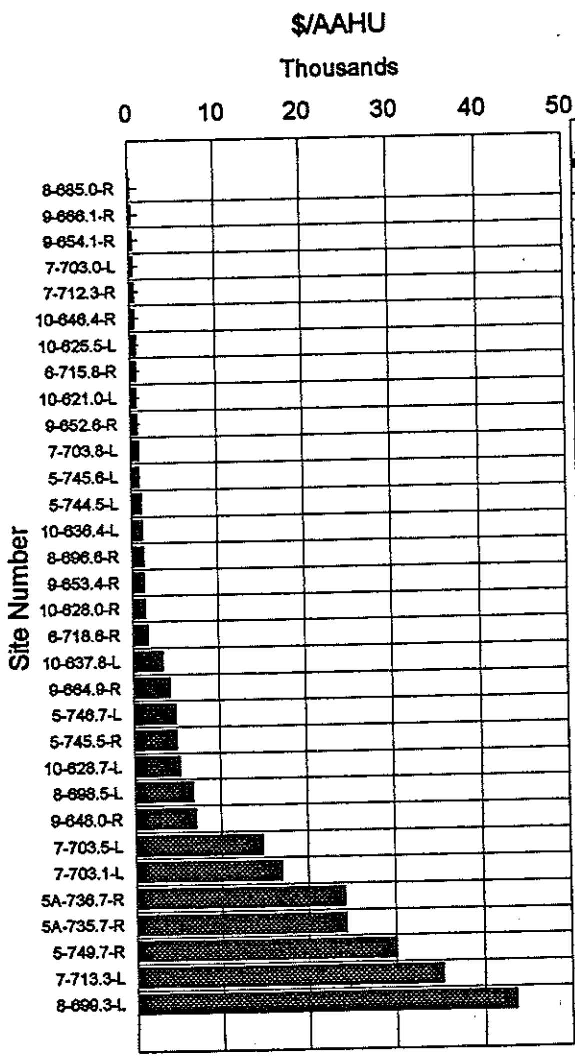
## Table DPR-4 – Cost and Habitat Analyses

| Site Number | Site Name | Type of stabilization proposed | Quantities: Rockfill @$35 (CY) | Quantities: Filter fab@$3 (SY) | Quantities: Random fill@$7 (CY) | Quantities: Dredge/ exc.@$7 (CY) | Total Cost ($000) | Annual O&M Cost ($) | Habitat value of stabilization: Acres affected | Habitat value of stabilization: AAHU gain | Habitat value of stabilization: Cost/ AAHU |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-749.7-R | Island 42 | Riprap – head | 2600 | 3700 | 8300 | 0 | 320 | 600 | | | |
| | | Riprap – lower | 300 | 500 | 400 | 0 | 30 | 100 | 40 | 1.002 | $30,070 |
| 5-746.7-L | Roebuck's Run | Riprap | 2300 | 3600 | 0 | 0 | 183 | 400 | 40 | 3.174 | $4,960 |
| 5-745.6-L | Sand Run | Riprap head | 900 | 500 | 0 | 0 | 66 | 100 | | | |
| | | Groins | 1000 | 0 | 0 | 0 | 70 | 100 | 120 | 12.114 | $960 |
| 5-745.5-R | Fisher Island Day | Riprap | 600 | 900 | 0 | 0 | 47 | 100 | 10 | 0.813 | $5,030 |
| 5-744.5-L | Lost Island Chute | Riprap | 900 | 1400 | 0 | 1300 | 90 | 200 | 100 | 6.571 | $1,180 |
| Total Pool 5 | | | 8,600 | 10,600 | 8,700 | 1,300 | 806 | 1,600 | 310 | | |
| 5A-736.7-R | Head Burleigh Slu | Riprap | 400 | 600 | 0 | 600 | 40 | 100 | 5 | 0.143 | $24,220 |
| 5A-735.7-R | Island 56 | Riprap head | 300 | 600 | 0 | 800 | 36 | 100 | | | |
| | | Offshore mound | 800 | 0 | 0 | 0 | 56 | 100 | 10 | 0.325 | $24,370 |
| 5A-735.2-R | Island 57 | Riprap | 1400 | 2100 | 0 | 12500 | 286 | 600 | 10 | 0.325 | $75,750 |
| Total Pool 5A | | | 2,900 | 3,300 | 0 | 13,900 | 417 | 900 | 25 | | |
| 6-718.6-R | Blacksmith Slough | Riprap head | 500 | 800 | 0 | 3300 | 86 | 200 | | | |
| | | Partial closure | 900 | 0 | 0 | 2200 | 94 | 200 | 60 | 8.630 | $1,800 |
| 6-715.8-R | Trempealeau Day | Riprap | 3800 | 4900 | 0 | 0 | 295 | 600 | 125 | 32.506 | $780 |
| Total Pool 6 | | | 5,200 | 5,700 | 0 | 5,500 | 475 | 1,000 | 185 | | |
| 7-713.3-L | Long Lake Inlet Isl | Riprap | 500 | 700 | 0 | 900 | 52 | 100 | 5 | 0.126 | $35,370 |
| 7-712.3-R | Richmond Island | Riprap east | 1000 | 1500 | 0 | 0 | 79 | 200 | 55 | 11.414 | $600 |
| 7-703.8-L | Old Cormorant | Offshore mound | 600 | 0 | 0 | 0 | 42 | 100 | | | |
| | | Offshore mound | 600 | 0 | 0 | 0 | 42 | 100 | 40 | 7.583 | $960 |
| 7-703.5-L | N. Red Oak Ridge | Offshore mound | 1400 | 0 | 0 | 3300 | 144 | 300 | 10 | 0.840 | $14,790 |
| 7-703.1-L | S. Red Oak Ridge | Offshore mound | 1200 | 0 | 0 | 5900 | 167 | 300 | 10 | 0.840 | $17,040 |
| 7-703.0-L | Lake Onalaska | Offshore mound | 1000 | 0 | 0 | 4400 | 132 | 300 | | | |
| | | Offshore mound | 900 | 0 | 0 | 4400 | 125 | 200 | 190 | 42.913 | $510 |
| Total Pool 7 | | | 7,200 | 2,200 | 0 | 18,900 | 782 | 1,600 | 310 | | |
| 8-699.3-L | N. Taylor Island | Riprap | 800 | 1200 | 0 | 0 | 63 | 100 | | | |
| | | Offshore mound | 2500 | 0 | 0 | 600 | 183 | 400 | 10 | 0.486 | $43,700 |
| 8-698.5-L | S. Taylor Island | Riprap | 400 | 500 | 0 | 0 | 31 | 100 | 15 | 0.398 | $6,800 |
| 8-696.6-R | Broken Arrow(Targ) | Riprap | 800 | 1200 | 0 | 0 | 63 | 100 | 45 | 3.839 | $1,410 |
| 8-685.0-R | Heron&Trapping Isl | Riprap/groin | 450 | 400 | 0 | 1100 | 49 | 100 | 115 | 16.243 | $260 |
| Total Pool 8 | | | 4,950 | 3,300 | 0 | 1,700 | 390 | 800 | 185 | | |
| 9-677.4-R | Dark Slough | Riprap | 4100 | 6200 | 0 | 0 | 324 | 600 | 5 | 0.052 | $535,850 |
| 9-666.1-R | Hummingbird Slu | Riprap | 300 | 400 | 700 | 0 | 33 | 100 | | | |
| | | Partial closure | 700 | | | | 49 | 100 | 120 | 17.372 | $410 |
| 9-664.9-R | Lansing Light | Riprap | 2300 | 3400 | 5300 | 0 | 256 | 500 | 40 | 5.113 | $4,300 |
| 9-654.1-R | Up Harpers Slough | Offshore mound | 4000 | 0 | 0 | 0 | 280 | 600 | 250 | 57.184 | $420 |
| 9-653.4-R | Mid Harpers Slough | Riprap | 500 | 700 | 0 | 0 | 39 | 100 | 10 | 2.354 | $1,440 |
| 9-652.6-R | Low Harpers Sloug | Offshore mound | 4800 | 0 | 0 | 0 | 336 | 700 | 150 | 35.344 | $820 |
| 9-648.0-R | Dam 9 Island | Offshore mound | 600 | 0 | 0 | 1100 | 57 | 100 | 5 | 0.695 | $7,090 |
| Total Pool 9 | | | 17,300 | 10,700 | 6,000 | 1,100 | 1,375 | 2,800 | 580 | | |
| 10-646.4-R | Billy Slough | Rock closure | 6000 | 0 | 0 | 0 | 420 | 800 | | | |
| | | Riprap-us & ds | 1600 | 2200 | 2800 | 200 | 167 | 300 | 350 | 79.224 | $640 |
| 10-637.8-L | Roseau Slough | Riprap | 600 | 800 | 0 | 900 | 59 | 100 | 35 | 1.456 | $3,500 |
| 10-636.4-L | East Channel | Riprap | 1400 | 2100 | 2000 | 2400 | 172 | 300 | 65 | 11.167 | $1,320 |
| 10-628.7-L | Wyalusing Upper Lt | Riprap | 600 | 800 | 0 | 300 | 51 | 100 | 25 | 0.824 | $5,330 |
| 10-628.0-R | Norwegian Slough | Riprap | 400 | 500 | 1200 | 0 | 48 | 100 | | | |
| | | Closure | 200 | 0 | 0 | 0 | 14 | 0 | 70 | 3.496 | $1,520 |
| 10-625.5-L | Island 181 (Catfish) | Riprap | 500 | 700 | 0 | 0 | 39 | 100 | 55 | 4.670 | $730 |
| 10-621.0-L | Duck Lake Chute | Riprap | 200 | 300 | 0 | 200 | 19 | 0 | | | |
| | | Partial closure | 700 | | | | 49 | 100 | 45 | 7.349 | $790 |
| Total Pool 10 | | | 12,200 | 7,400 | 6,000 | 4,000 | 1,038 | 1,900 | 645 | | |
| Total for all pools | | | 58,350 | 43,200 | 20,700 | 46,400 | 5,283 | 10,600 | 2,240 | | |

## INCREMENTAL ANALYSIS

A detailed incremental analysis for each of the sites was not done. The study team made bank stabilization length and location decisions during the field visits that would result in optimum habitat benefits at each site. A more exact determination of the design would be made after more detailed field surveys for the preparation of plans and specifications. However, an incremental analysis was made of the aggregate of the sites to reduce the number of sites being considered as explained later. The results of the incremental analysis are shown in Figure DPR-2. The two highest cost/AAHU sites were not plotted so that the graph would show more detail for the rest of the sites. A discussion of the sites to select for implementation follows.

Figure DPR-2 - Incremental Analysis




| Site Name | Cost | Acres Affect | Cost/ AAHU | Select? |
|---|---|---|---|---|
| Heron & Trapping | 49,000 | 115 | 260 | * |
| Hummingbird Sl | 82,000 | 120 | 410 | ** |
| Upper Harpers | 280,000 | 250 | 420 | * |
| Lake Onalaska | 257,000 | 190 | 510 | * |
| Richmond Isl | 79,000 | 55 | 600 | ** |
| Billy Slough | 587,000 | 350 | 640 | * |
| Catfish Slough | 39,000 | 55 | 730 | * |
| Trempealeau Day | 295,000 | 125 | 780 | * |
| Duck Lake Chute | 68,000 | 45 | 790 | * |
| Lower Harpers | 336,000 | 150 | 820 | * |
| Old Cormorant | 84,000 | 40 | 960 | **** |
| Sand Run | 136,000 | 120 | 960 | ** |
| Lost Island | 90,000 | 100 | 1,180 | ** |
| East Island | 172,000 | 65 | 1,320 | * |
| Broken Arrow | 63,000 | 45 | 1,410 | * |
| Middle Harpers | 39,000 | 10 | 1,440 | * |
| Norwegian Sl | 62,000 | 70 | 1,520 | * |
| Blacksmith Sl | 180,000 | 60 | 1,800 | * |
| Roseau Slough | 59,000 | 35 | 3,500 | |
| Lansing Light | 256,000 | 40 | 4,300 | |
| Roebucks Run | 183,000 | 40 | 4,960 | ** |
| Fisher Island Day | 47,000 | 10 | 5,030 | ** |
| Wyalusing Light | 51,000 | 25 | 5,330 | |
| S Taylor Island | 31,000 | 15 | 6,800 | |
| Dam 9 Island | 57,000 | 5 | 7,090 | |
| N Red Oak Ridge | 144,000 | 10 | 14,790 | ** |
| S Red Oak Ridge | 167,000 | 10 | 17,040 | ** |
| Burleigh Slough | 40,000 | 5 | 24,220 | |
| Island 56 | 92,000 | 10 | 24,370 | |
| Island 42 | 350,000 | 40 | 30,070 | |
| Long Lake Inlet | 52,000 | 5 | 35,370 | |
| N Taylor Island | 246,000 | 10 | 43,700 | |
| Island 57 | 286,000 | 10 | 75,750 | |
| Dark Slough | 324,000 | 5 | 535,850 | |

*Environmental Management Program
**Operational Management Plan
***Channel Maintenance Program
****Others

## SITE SELECTION

The final evaluation of the thirty-four sites was based on cost, the habitat benefits gained, other available programs or authorities, agency priorities, and available funds. The site location and construction considerations would also have a bearing on the construction sequence and scheduling. The next step in the site selection process was accomplished by screening out those sites that were estimated to have a unit cost of more than $2,000 per average annual habitat unit, computed as explained above. This cost per average annual habitat unit was used as a guideline to help reduce the number of sites under consideration, assuming a $2.5 million upper limit of available funding for the project. It was recognized that other factors may override cost and should be considered when determining the reasonableness of the cost per habitat unit. Just because a site has the lowest cost per average annual habitat unit does not mean that it is the highest priority site. Use of the $2,000 limit for habitat unit cost does not imply that sites with a higher cost are less valuable from a habitat standpoint and that they should not be considered for future implementation. Use of this method of HEP was a tool used in the planning of this habitat project and should not be used to compare with other habitat projects. However, because of the large number of sites and to continue the screening process, it was decided to establish $2,000 as the upper limit. This reduced the number of sites to 18.

An analysis was then made of the potential to accomplish stabilization at some of the sites under other programs or authorities. Channel modifications and bank stabilization could be performed as part of the channel maintenance program for the 9-foot navigation channel. Work could be accomplished under this authority if there are beneficial impacts to navigation or if it reduces the cost of channel maintenance. Two sites in pool 5 would be appropriate for stabilization under this authority (sites 5-746.7-L and 5-745.5-R in pool 5). However, one of the sites exceeded the $2,000 limit criteria used in the screening process for bank stabilization. The other is currently being studied for possible modification under the channel maintenance program.

Bank stabilization could also be accomplished through the Operational Management Plan (OMP). Existing Corps of Engineers' regulations provide authorization to perform fish and wildlife management under the Corps' general resource management stewardship responsibilities. The Master Plan for Public Use Development and Resource Management, dated September 1988, includes programmatic goals of: a) managing resource capabilities wisely in relation to multiple-purpose resource demand (including recreation, fish and wildlife, and navigation interests); b) maximizing Corps management actions for the greatest economic, social, or environmental benefit to the public; and c) considering the implications of Corps planning and management activities on the UMRWFR with the objective of conserving and enhancing river-related natural resources. The OMP further defines the above goals and outlines specific management strategies to reach them. The OMP includes the more specific goal of eliminating or reducing adverse impacts to water quality. Under this goal project areas are to be identified where erosion is having detrimental effects on water quality and remedial actions are to be evaluated for further action. One of the requirements is that the erosion sites must be located on Corps fee title lands. Sites evaluated by the study team that would be eligible and may be appropriate for stabilization under this plan include two in pool 5 (sites 5-745.6-L and 5-744.5-L), three in pool 7 (sites 7-712.3-R, 7-703.5-L, and 7-703.1-L), and one in pool 9 (site 9-666.1-R). Two of the sites (sites 7-703.5-L and 7-703.1-L) exceeded the $2,000 limit set for the habitat value screening. This process reduced the number of sites to 14.

Since conducting the field investigations, one of the sites (7-703.8-L) has been stabilized. An opportunity arose during the 1993 flood that permitted the work to be done by Corps labor in conjunction with other work in the area. The cost of the stabilization was funded by the USFWS. This reduced the number of sites to 13. The USFWS has also received funds to repair flood damage on the Refuge caused by the 1993 flood. Sites that the USFWS is pursuing for stabilization using these funds include 6-715.8-R, 8-685.0-R, and 10-625.5-L. However, these sites were not eliminated from the selection process because implementation has not been completed.

Some of the agencies involved in the study developed their own list of site priorities independent of the analyses done by the Corps. The Minnesota DNR did not do an independent prioritization and the Iowa DNR prioritized only the sites located in the Iowa portion of the study area. These priorities are shown in table DPR-5 for the 34 sites evaluated in more detail, not just those that passed the $2,000 limit for the habitat value screening. All the other sites that were deferred earlier were ranked low priority by the agencies. A comparison of the agency priorities and the sites selected through the habitat model screening process indicated that the agencies gave low priority to site 8-696.6-R. Therefore, that site was deferred from implementation, even though the cost per habitat unit was less than $2,000. This reduced the number of sites for implementation under the Mississippi River Bank Stabilization project to 12 and resulted in a total first cost of about $2.4 million. This number and cost is near the funding level originally scheduled for the project. The selected sites are located in pool 6 (2 sites), pool 7 (1 site), pool 8 (1 site), pool 9 (3 sites), and pool 10 (5 sites). A total of about 28,000 cubic yards of rock would be used to stabilize about 12,000 linear feet of eroding islands and shoreline, directly impacting about 1,500 acres of side channel and backwater habitat. All but one of the higher priority sites (site 9-664.9-R) designated by the agencies would be addressed by this array of bank stabilization sites. This site is in an area where other development activities could affect the site. However, because of the relatively low estimated cost to stabilize this site, there is a potential opportunity to include this site in a recommended plan for stabilization if more detailed cost estimates indicate that total required resources are within the funding constraints. A summary of the information used for site selection is shown in table DPR-5.

## Table DPR-5 – Site Selection Information

| Site Number | Site Name | Total Cost ($000) | O&M Cost ($/yr) | Habitat value: Acres affected | Habitat value: AAHU gain | Habitat value: Cost/AAHU | Agency Priority (Hi/Med/Lo): COE | FWS | MN | WI | IA | Final site selection: Select/Defer | Program * | Reason(s) selected or deferred |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5-749.7-R | Island 42 | 350 | 700 | 40 | 1.002 | $30,070 | H | - | - | H | - | Defer | - | >$2K/HU; low habitat gain |
| 5-746.7-L | Roebucks Run | 183 | 400 | 40 | 3.174 | $4,960 | - | - | - | L | - | Select | CMP | CMP may do in FY 94/95 (likely) |
| 5-745.6-L | Sand Run | 136 | 200 | 120 | 12.114 | $960 | H | H 5 | - | L | - | Select | OMP | High agency priority; fee title land; good OMP candidate |
| 5-745.5-R | Fisher Island Daymark | 47 | 100 | 10 | 0.813 | $5,030 | H | - | - | L | - | Select | CMP | Low cost; on Corps fee title land; good CMP candidate |
| 5-744.5-L | Lost Island Chute | 90 | 200 | 100 | 6.571 | $1,180 | H | H 8 | - | L | - | Select | OMP | High agency priority; fee title land; good OMP candidate |
| Total Pool 5 | | 806 | 1,600 | 310 | | | | | | | | | | EMP=$0 |
| 5A-736.7-R | Burleigh Slu | 40 | 100 | 5 | 0.143 | $24,220 | - | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 5A-735.7-R | Island 56 | 92 | 200 | 10 | 0.325 | $24,370 | H | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 5A-735.2-R | Island 57 | 286 | 600 | 10 | 0.325 | $75,750 | H | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| Total Pool 5A | | 418 | 900 | 25 | | | | | | | | | | EMP=$0 |
| 6-718.6-R | Blacksmith Slough | 180 | 400 | 60 | 8.630 | $1,800 | H | - | - | M | - | Select | EMP | Moderate habitat gain & agency suppor near high priority site |
| 6-715.8-R | Trempealeau Daymark | 295 | 600 | 125 | 32.506 | $780 | H | H 4 | - | H | - | Select | EMP | High agency priority, habitat gain, and area affected |
| Total Pool 6 | | 475 | 1,000 | 185 | | | | | | | | | | EMP=$475,000 |
| 7-713.3-L | Long Lake Inle | 52 | 100 | 5 | 0.126 | $35,370 | - | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 7-712.3-R | Richmond Island | 79 | 200 | 55 | 11.414 | $600 | H | H 3 | - | L | - | Select | OMP | High agency priority; fee title land; good OMP candidate |
| 7-703.8-L | Old Cormorant | 84 | 200 | 40 | 7.583 | $960 | - | - | - | - | - | Done | - | Completed in FY93 by CMP; (USFWS) |
| 7-703.5-L | N. Red Oak Ridge | 144 | 300 | 10 | 0.840 | $14,790 | H | H 9 | - | L | - | Select | OMP | Cultural resources; fee title land; in FY95 OMP budget |
| 7-703.1-L | S. Red Oak Ridge | 167 | 300 | 10 | 0.840 | $17,040 | H | H 9 | - | L | - | Select | OMP | Cultural resources; fee title land; in FY95 OMP budget |
| 7-703.0-L | L. Onalaska Island B & C | 257 | 500 | 190 | 42.913 | $510 | H | H 7 | - | M | - | Select | EMP | Large area affected; high agency priority & habitat gain |
| Total Pool 7 | | 783 | 1,600 | 310 | | | | | | | | | | EMP=$256,000 |
| 8-699.3-L | N. Taylor Island | 246 | 500 | 10 | 0.486 | $43,700 | H | - | - | L | - | Defer | - | >$2K/HU; low habitat gain, agency priority, & area affected |
| 8-698.5-L | S. Taylor Island | 31 | 100 | 15 | 0.398 | $6,800 | L | - | - | L | - | Defer | - | >$2K/HU; low habitat gain, agency priority, & area affected |
| 8-696.6-R | Broken Arrow (Target Lake) | 63 | 100 | 45 | 3.839 | $1,410 | H | - | - | L | - | Defer | - | Low agency priority; low cost; <$2K/HU add if funds permit |
| 8-685.0-R | Heron & Trapping Isl | 49 | 100 | 115 | 16.243 | $260 | H | H 6 | - | H | - | Select | EMP | High agency priority, habitat benefits, and area affected |
| Total Pool 8 | | 390 | 800 | 185 | | | | | | | | | | EMP=$49,000 |
| 9-677.4-R | Dark Slough | 324 | 600 | 5 | 0.052 | $535,850 | - | - | - | M | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 9-666.1-R | Hummingbird Slough | 82 | 200 | 120 | 17.372 | $410 | - | - | - | L | H 3 | Select | OMP | Lg area affected; high agency priority; good OMP candidate |
| 9-664.9-R | Lansing Light | 256 | 500 | 40 | 5.113 | $4,300 | - | - | - | M | H 4 | Defer | - | >$2K/HU; low habitat gain |
| 9-654.1-R | Upper Harper's Slu | 280 | 600 | 250 | 57.184 | $420 | H | H 1 | - | H | H 5 | Select | EMP | High agency priority, habitat gain, and area affected |
| 9-653.4-R | Middle Harper's Slu | 39 | 100 | 10 | 2.354 | $1,440 | H | H 1 | - | H | H 5 | Select | EMP | High agency priority; near other high priority sites |
| 9-652.6-R | Lower Harper's Slu | 336 | 700 | 150 | 35.344 | $820 | H | H 1 | - | H | H 5 | Select | EMP | High agency priority, habitat gain, and area affected |
| 9-648.0-R | Dam 9 Island | 57 | 100 | 5 | 0.695 | $7,090 | L | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| Total Pool 9 | | 1,374 | 2,800 | 580 | | | | | | | | | | EMP=$655,000 |
| 10-646.4-R | Billy Slough | 587 | 1100 | 350 | 79.224 | $640 | H | H 2 | - | H | H | Select | EMP | High agency priority, habitat gain, and area affected |
| 10-637.8-L | Roseau Slough | 59 | 100 | 35 | 1.456 | $3,500 | - | - | - | M | M 9 | Defer | - | Marginal habitat gain; agency support; add if funds permit |
| 10-636.4-L | East Channel | 172 | 300 | 65 | 11.167 | $1,320 | - | - | - | H | H 2 | Select | EMP | High agency priority; moderate habitat gain & cost |
| 10-628.7-L | Wyalusing Up | 51 | 100 | 25 | 0.824 | $5,330 | - | - | - | M | - | Defer | - | >$2K/HU; low habitat gain; med suppor |
| 10-628.0-R | Norwegian Slough | 62 | 100 | 70 | 3.496 | $1,520 | - | - | - | - | M 6 | Select | EMP | Moderate habitat gain & agency suppo low cost |
| 10-625.5-L | Isl 181 (Catfish | 39 | 100 | 55 | 4.670 | $730 | - | - | - | H | - | Select | EMP | Lg area affect; low cost; hi agncy pric |
| 10-621.0-L | Duck Lake Chu | 68 | 100 | 45 | 7.349 | $790 | H | - | - | H | H | Select | EMP | Hi hab. benefits & agency priority; low $ |
| Total Pool 10 | | 1,039 | 1,900 | 645 | | | | | | | | | | EMP=$928,000 |

*EMP=Environmental Management Program; OMP=Operational Management Plan; CMP=Channel Maintenance Program

## SPECIFIC OBJECTIVES

Current guidance on project evaluation indicates the prime focus should be on measurable chemical and physical parameters, with limited monitoring of biological features (i.e., vegetation studies only). Therefore, the stated project objectives were narrowly defined to reflect the aspects of the project that could be designed for future monitoring and evaluation. Meeting these objectives will also produce positive effects in other aspects and outside the project area. Based on design factors that affect project area habitats and future project performance assessment, the specific project objectives for each of the potential sites described above are summarized in table DPR-6.

TABLE DPR-6

Project Goals, Objectives, and Alternative Enhancement Features

| Site Number | Site Name | Project Objective | Potential Enhancement Alternative | Unit of Measure | ENHANCEMENT POTENTIAL Existing | Future w/o Project (2044) | Future with Project |
|---|---|---|---|---|---|---|---|
| 6-718.6-R | Blacksmith Slough | Maintain existing island shoreline | Riprap | lin ft | 700 | 300 | 700 |
| | | Reduce flow between islands | Partial closure | cfs | 10K | 20K | 10K |
| 6-715.8-R | Trempealeau Daymark | Maintain existing island shoreline | Riprap | lin ft | 2000 | 1500 | 2000 |
| 7-703.0-L | Lake Onalaska- Isl B | Maintain existing island shoreline | Offshore mound | lin ft | 800 | 500 | 800 |
| | Isl C | Maintain existing island shoreline | Offshore mound | lin ft | 700 | 100 | 700 |
| 8-685.0-R | Heron & Trapping Isl | Maintain existing island shoreline | Rock wedge, groin | lin ft | 250 | 0 | 250 |
| 9-654.1-R | Upper Harpers Slough | Maintain existing island shoreline | Offshore mound | lin ft | 2000 | 1000 | 2000 |
| 9-653.4-R | Middle Harpers Slough | Maintain existing island shoreline | Riprap | lin ft | 200 | 0 | 200 |
| 9-652.6-R | Lower Harpers Slough | Maintain existing island shoreline | Offshore mound | lin ft | 2000 | 1000 | 2000 |
| 10-646.4-R | Billy Slough | Eliminate normal flow thru breach | Rock closure | cfs | 6000 | 12000 | 0 |
| | | Maintain existing island shoreline | Riprap | lin ft | 500 | 200 | 500 |
| 10-636.4-L | East Channel | Maintain existing island shoreline | Riprap | lin ft | 1000 | 600 | 1000 |
| 10-628.0-R | Norwegian Slough | Maintain existing island shoreline | Riprap | lin ft | 100 | 0 | 100 |
| | | Eliminate normal flow thru breach | Rock closure | cfs | 5000 | 10000 | 0 |
| 10-625.5-L | Island 181 (Catfish) | Maintain existing island shoreline | Riprap | lin ft | 300 | 0 | 300 |
| 10-621.0-L | Duck Lake Chute | Maintain existing island shoreline | Riprap | lin ft | 100 | 0 | 100 |
| | | Eliminate normal flow thru breach | Partial closure | cfs | 3000 | 6000 | 3000 |

## SELECTED PLAN OF ACTION

Plan Description - The plan that best satisfies the immediate agency and public goals, habitat improvement objectives, and planning opportunities and constraints includes the sites shown in table DPR-7 and on Plate 16. Pertinent information about each site is also included in the table. Specific locations of the selected sites and the areas affected by implementation of bank stabilization are shown on Plates 17 through 24. Typical cross-sections of the selected bank stabilization alternative at each site are shown on Plates 14 and 15 and are referenced on table DPR-7.

Table DPR-7
Sites Selected for Stabilization

| Site Number | Site Name | Length (Ft) | Type of Stabilization | Typical X-sec | Rockfill Quantity (CY) | Total Cost (1000) | O&M Cost ($/yr) | Area Affected (Ac) | Cost/ AAHU |
|---|---|---|---|---|---|---|---|---|---|
| 6-718.6-R | Blacksmith Slough | 700 | Riprap at head | #1 | 500 | $ 86 | 200 | | |
| | | | Partial closure | #7 | 900 | 94 | 200 | 60 | $1,500 |
| 6-715.8-R | Trempealeau Daymark | 2,000 | Riprap | #1 | 3,800 | 295 | 600 | 125 | 600 |
| TOTAL POOL 6 | | 2,700 | | | 5,200 | 475 | 1,000 | 185 | |
| 7-703.0-L | Lake Onalaska- Isl B | 800 | Offshore mound | #5 | 1,000 | 132 | 300 | | |
| | Isl C | 700 | Offshore mound | #5 | 900 | 125 | 200 | 190 | 490 |
| TOTAL POOL 7 | | 1,500 | | | 1,900 | 256 | 500 | 190 | |
| 8-685.0-R | Heron & Trapping Isl | 250 | Rock wedge/ groin | #4/#6 | 450 | 49 | 100 | 115 | 220 |
| TOTAL POOL 8 | | 250 | | | 450 | 49 | 100 | 115 | |
| 9-654.1-R | Upper Harpers Slough | 2,000 | Offshore mound | #5 | 4,000 | 280 | 600 | 250 | 370 |
| 9-653.4-R | Middle Harpers Slough | 200 | Riprap | #1 | 500 | 39 | 100 | 10 | 1,400 |
| 9-652.6-R | Lower Harpers Slough | 2,900 | Offshore mound | #5 | 4,800 | 336 | 700 | 150 | 800 |
| TOTAL POOL 9 | | 5,100 | | | 9,300 | 655 | 1,400 | 410 | |
| 10-646.4-R | Billy Slough | 650 | Rock closure | #5 | 6,000 | 420 | 800 | | |
| | | | Riprap-us & ds | #1 | 1,600 | 167 | 300 | 350 | 630 |
| 10-636.4-L | East Channel | 1,000 | Riprap | #1 | 1,400 | 172 | 300 | 65 | 1,730 |
| 10-628.0-R | Norwegian Slough | 300 | Riprap | #1 | 400 | 48 | 100 | | |
| | | | Closure | #5 | 200 | 14 | 0 | 70 | 1,820 |
| 10-625.5-L | Island 181 (Catfish) | 300 | Riprap | #1 | 500 | 39 | 100 | 55 | 840 |
| 10-621.0-L | Duck Lake Chute | 400 | Riprap | #1 | 200 | 19 | 0 | | |
| | | | Partial closure | #7 | 700 | 49 | 100 | 45 | 900 |
| TOTAL POOL 10 | | 2,650 | | | 11,000 | 928 | 1,700 | 585 | |
| TOTAL FOR ALL POOLS | | 12,200 | | | 27,850 | 2,363 | 4,700 | 1,485 | |

As noted earlier in this report, some of the above selected sites are in the process of being implemented by the USFWS. If some of the sites are completed by others before the plans and specifications are prepared under this EMP authority or if actual project costs are less than the current estimate, additional sites from the initial list would be selected for implementation to utilize available funds scheduled for the Bank Stabilization project. Selection of the additional sites would be accomplished using criteria similar to that used for this study. The selected sites would be coordinated with the partner agencies and the appropriate supplemental environmental documentation would be done. At this time, it appears that sites 6-715.8-R, 8-685.0-R, and 10-625.5-L will be implemented by USFWS, making about $380,000 of Bank Stabilization project funds available for the implementation of additional sites (depending on the more detailed cost estimates of the remaining selected sites). The potential candidate sites that could be considered include: 5-749.7-R, 5-746.7-L, 5-745.6-L, 5-745.5-R, 5-744.5-L, 7-712.3-R, 8-696.6-R, 9-666.1-R, 10-637.8-L, and 10-628.7-L (listed in order of river mile, not priority). The number of additional sites pursued is highly dependent on more detailed surveys of the selected sites, updated cost estimates, and coordination with the participating agencies.

Sources of Fill Material - Riprap would come from established quarries in the area. The Wisconsin DNR requests that the source of rock be a non-Mississippi River facing bluff (not visible from the river). Fill material to flatten the slopes of the banks at some of the sites would be obtained by dredging in or near the main channel of the Mississippi River close to the stabilization site, from areas of sand built up on the downstream end of selected islands, or from undetermined upland sources.

Construction Methods - Placement of rock at each of the selected sites would be done using marine plant. Rock would be hauled by barge to the site and placed using a barge mounted crane. Dredging of channels to access the sites would be permitted only where necessary. This dredged material would be placed on the island, behind the rock protection, or transported to placement sites as determined during the preparation of plans and specifications.

Project Support - The participants in the planning process provided written and verbal suggestions that were considered fully during plan development and selection. Their written comments and letters of support are included in attachment 5.

Project Accomplishments - The proposed project has been designed to meet or address the project objectives shown in table DPR-6.

Real Estate Requirements - No non-Federal lands would be required because all the selected sites for the project are located on land owned and managed by the USFWS as a national wildlife refuge. Appropriate agreements would be made with the USFWS for the construction and operation and maintenance of the project.

## ENVIRONMENTAL ASSESSMENT

An environmental assessment has been conducted for the proposed action, and a discussion of the impacts on habitat conditions follows. As specified by Section 122 of the 1970 Rivers and Harbors Act, the categories of impacts in the impact assessment matrix (table DPR-8) were reviewed and considered in arriving at the final determination. In accordance with Corps of Engineers regulations (33 CFR 323.4(a)(2)), a Section 404(b)(1) evaluation was prepared (attachment 3). Application will be made to the State of Wisconsin for water quality certification under section 401 of the Clean Water Act during the

# Table DPR-8 – IMPACT ASSESSMENT MATRIX

| NAME OF PARAMETER | INCREASING BENEFICIAL IMPACT: SIGNIFICANT | INCREASING BENEFICIAL IMPACT: SUBSTANTIAL | INCREASING BENEFICIAL IMPACT: MINOR | NO APPRECIABLE EFFECT | INCREASING ADVERSE IMPACT: MINOR | INCREASING ADVERSE IMPACT: SUBSTANTIAL | INCREASING ADVERSE IMPACT: SIGNIFICANT |
|---|---|---|---|---|---|---|---|
| **A. SOCIAL EFFECTS** | | | | | | | |
| 1. Noise Levels | | | | X | | | |
| 2. Aesthetic Values | | | | X | | | |
| 3. Recreational Opportunities | | | | X | | | |
| 4. Transportation | | | | X | | | |
| 5. Public Health and Safety | | | | X | | | |
| 6. Community Cohesion (Sense of Unity) | | | | X | | | |
| 7. Community Growth & Development | | | | X | | | |
| 8. Business and Home Relocations | | | | X | | | |
| 9. Existing/Potential Land Use | | | | X | | | |
| 10. Controversy | | | | X | | | |
| **B. ECONOMIC EFFECTS** | | | | | | | |
| 1. Property Values | | | | X | | | |
| 2. Tax Revenues | | | | X | | | |
| 3. Public Facilities and Services | | | | X | | | |
| 4. Regional Growth | | | | X | | | |
| 5. Employment | | | | X | | | |
| 6. Business Activity | | | | X | | | |
| 7. Farmland/Food Supply | | | | X | | | |
| 8. Commercial Navigation | | | | X | | | |
| 9. Flooding Effects | | | | X | | | |
| 10. Energy Needs and Resources | | | | X | | | |
| **C. NATURAL RESOURCE EFFECTS** | | | | | | | |
| 1. Air Quality | | | | | X | | |
| 2. Terrestrial Habitat | | | | | X | | |
| 3. Wetlands | | X | | | | | |
| 4. Aquatic Habitat | | X | | | | | |
| 5. Habitat Diversity and Interspersion | | X | | | | | |
| 6. Biological Productivity | | X | | | | | |
| 7. Surface Water Quality | | | | | X | | |
| 8. Water Supply | | | | X | | | |
| 9. Groundwater | | | | X | | | |
| 10. Soils | | | | X | | | |
| 11. Threatened or Endangered Species | | | | X | | | |
| **D. CULTURAL EFFECTS** | | | | | | | |
| 1. Historic Architectural Values | | | | X | | | |
| 2. Pre-Hist & Historic Archeological Values | | | X | | | | |

preparation of final plans and specifications for each segment of construction. The Finding of No Significant Impact (attachment 2) was signed after the public review period elapsed. No significant impacts were identified by the public review.

## RELATIONSHIP TO ENVIRONMENTAL REQUIREMENTS

The proposed action would comply with all applicable Federal environmental laws, executive orders, and policies, and State and local laws and policies including the Clean Air Act, as amended; the Clean Water Act of 1977, as amended; the Endangered Species Act of 1973, as amended; the Land and Water Conservation Fund Act of 1965, as amended, the National Environmental Policy Act of 1969, as amended, the Fish and Wildlife Conservation Act of 1958, as amended, the National Wildlife Refuge System Administration Act; Executive Order 11988 - Floodplain Management; and Executive Order 11990 - Protection of Wetlands. The proposed action would not result in the conversion of farmland to non-agricultural uses. Therefore, the Farmland Protection Policy Act of 1981 does not apply to this project.

## NATURAL RESOURCES

Habitat - The proposed actions would improve fish and wildlife habitat on the Upper Mississippi River. In terms of a quantified habitat evaluation, about 304 average annual habitat units would be gained from implementation of the selected project, affecting about 1,500 acres. One HU is defined as one acre of optimum habitat. A detailed discussion of the habitat evaluation procedures conducted for this project is included in the Plan Formulation section of this report and appendix B.

Terrestrial Habitat - Short-term impacts on terrestrial habitat would be negligible. Construction of the project would result in some disturbance impacts resulting from vegetation clearing and earth moving. However, long-term impacts would be beneficial because the loss of bottomland hardwoods would be reduced and over one mile of shoreline would be preserved over the life of the project. Placement of access dredged material would be done only where beneficial or no impacts would be obtained.

Aquatic Habitat - Approximately 1,500 acres of aquatic habitat would be positively affected by the selected plan as shown on table DPR-4.

Water Quality - Detailed effects of the project on water quality are described in the attached Section 404(b)(1) Evaluation (attachment 3). Potential construction related negative effects on water quality would be from the construction of partial closures and fill placed against eroding banks. Using pervious material dredged for access as backfill for the riprap and using rockfill for stabilization would reduce impacts on water quality. Local turbidity plumes would be generated from construction, but releases of contaminants should be minimal due to the relatively uncontaminated material. Excavation and placement of material would be done mechanically. The long-term impact on water quality is expected to be positive because of the lower flow velocities entering the backwater areas.

Fish and Wildlife - The project is designed to benefit fish and wildlife habitat, and the benefits associated with the project have been discussed previously in this report. Therefore, this discussion will only briefly summarize the anticipated benefits and discuss the unavoidable trade-offs. The rock protection of side channel openings and the partial closure structures would reduce the sediment load into the backwater areas and protect future loss of prime centrarchid habitat. Rock riprap would provide a coarse substrate to improve the value of the area for lithophilic fish species, such as smallmouth bass. Rock substrate is at least 10 times as productive for macroinvertebrates, including crayfish (an important food source for smallmouth bass), as the sand substrate it would be replacing. Where possible, inclusion of structure (bio-engineering in the form of trees, brush, etc) would be included in the bank stabilization design to increase the habitat value for macroinvertebrates and fish. The construction of the partial closure structures and dredging in the vicinity of the main channel would at least temporarily disturb fish use of the area. Use of the area by fish may be reduced during construction activities, especially in the areas of elevated suspended sediment. No toxic effects are expected on fish or other aquatic organisms. Overall, fish spawning, nursery, and wintering habitat values would be improved by the project. A mussel survey of the selected dredge areas will be completed during the preparation of plans and specifications. Some burrowing mammals and reptiles could be killed or displaced by construction activities. Overall, the impacts should not be substantial because of the relatively small area of habitat that would be affected by construction. The long-term impacts are expected to be positive.

Air Quality - The proposed actions would have minor negative effects on air quality. Exhaust emissions from construction equipment would degrade air quality slightly for short periods. This temporary change in air quality could disturb people using adjacent areas of the river, but the overall effect on people, vegetation, and wildlife would be negligible.

Threatened and Endangered Species - The proposed project would not have substantial impacts on threatened or endangered species. No state-listed or federally listed threatened or endangered species would be adversely affected by the project. Bald eagles use the area, mainly for wintering and during migrations. The construction activities would not affect the suitability of the existing nesting sites for either bald eagles or ospreys on the Refuge. The immediate project area does not provide the kind of habitat preferred by peregrine falcons, and no impacts are expected. Critical habitat for the state-listed wood turtle and the Blanding's turtle would not be affected by the proposed construction activities. The absence of Higgins' eye pearly mussels and the other state-listed threatened or endangered species from recent surveys in and adjacent to any of the project sites would indicate that the project should not have any significant impact on these species. The Iowa-listed Butterfly mussel was found between the islands at site 8-685.0-R, but no construction would take place in that area and the site is also not located in Iowa. The USFWS supports this determination of no significant impacts (see attachment 4).

## CULTURAL RESOURCES

In accordance with the National Historic Preservation Act of 1966, as amended, the National Register of Historic Places has been consulted. As of October 1, 1990, there are no sites on or determined eligible for the Register in the immediate project area. Cultural investigations would be made at each of the sites during development of plans and specifications.

## SOCIOECONOMIC FACTORS

The proposed project would have minimal or no impacts on the following Section 122 (1970 Rivers and Harbors Act) socioeconomic categories: transportation, public health and safety, community cohesion, community growth and development, business or home relocations, land use, property values, tax revenues, regional growth, employment, business activity, food supply, navigation, flooding effects, or energy resources.

Noise Pollution - The immediate vicinity around the project areas would be temporarily disrupted by construction activities. Some disturbance may occur from noise and human activity, although these impacts are temporary, and adverse impacts to the general public would be short-term and insignificant.

Recreation and Aesthetic Values - The presence of construction equipment would have a temporary negative effect on aesthetic values in the area.

# PROJECT REQUIREMENTS

## OPERATION AND MAINTENANCE

After construction of the project, annual operation and maintenance (O&M) of the project would be the responsibility of the USFWS. Generally, it is anticipated that O&M requirements would include annual inspections and replacement of displaced rock.

An O&M manual detailing the specific requirements of the project would be prepared by the COE during the plans and specifications phase. Development of the manual would be coordinated with the USFWS and the Minnesota, Wisconsin, and Iowa Departments of Natural Resources. Over the 50-year project life, the estimated average annual O&M cost for each pool is shown in table DPR-9.

Table DPR-9 - Estimated Average Annual O&M Costs

| | Average annual cost |
|---|---|
| **Pool 6** | |
| Inspection and reports (1 mn-dy/yr @ $250/mn-dy) | $ 250 |
| Rockfill replacement (ave. 10 CY/yr @ $70/CY) | 700 |
| TOTAL ANNUAL O&M COST FOR POOL 6 | $ 950 |
| **Pool 7** | |
| Inspection and reports (1 mn-dy/yr @ $250/mn-dy) | $ 250 |
| Rockfill replacement (ave. 3 CY/yr @ $70/CY) | 210 |
| TOTAL ANNUAL O&M COST FOR POOL 7 | $ 460 |
| **Pool 8** | |
| Inspection and reports (1 mn-dy/yr @ $250/mn-dy) | $ 250 |
| Rock replacement (ave. 1 CY/yr @ $70/CY) | 70 |
| TOTAL ANNUAL O&M COST FOR POOL 8 | $ 320 |
| **Pool 9** | |
| Inspection and reports (1 mn-dy/yr @ $250/mn-dy) | $ 250 |
| Rock replacement (ave. 21 CY/yr @ $60/CY) | 1,260 |
| TOTAL ANNUAL O&M COST FOR POOL 9 | $1,510 |
| **Pool 10** | |
| Inspection and reports (1 mn-dy/yr @ $250/mn-dy) | $ 250 |
| Rock replacement (ave. 22 CY/yr @ $65/CY) | 1,430 |
| TOTAL ANNUAL O&M COST FOR POOL 10 | $1,680 |
| TOTAL ANNUAL O&M COST FOR SELECTED PLAN | $4,920 |

## COST ESTIMATE

A cost estimate for the project is shown in table DPR-10. This cost estimate differs from the estimate shown earlier in this report because more detailed design and analyses were used to develop it. Extensions are rounded to the nearest $100 and column totals to the nearest $1,000. A more detailed cost estimate is included in attachment 8.

Table DPR-10 - Cost Estimate for the Selected Plan

| FEATURE | QUANTITY | UNIT PRICE | AMOUNT $ | CONTINGENCY AMOUNT$ | (%) | TOTAL AMOUNT |
|---|---|---|---|---|---|---|
| POOL 6 (2 sites) | | | | | | |
| Mob & demob | 1 JB | 10,000 | 10,000 | 5,000 | 50 | $ 15,000 |
| Dredging (I) | 3,000 CY | 5.00 | 15,000 | 7,500 | 50 | 52,500 |
| Dredging (II) | 2,500 CY | 8.00 | 20,000 | 10,000 | 50 | 30,000 |
| Filter fabric | 5,700 SY | 3.00 | 17,100 | 8,600 | 50 | 25,700 |
| Rockfill | 5,200 CY | 35.00 | 182,000 | 91,000 | 50 | 273,000 |
| SUBTOTAL DIRECT CONSTRUCTION COSTS | | | 244,000 | 122,000 | 50 | 366,000 |
| ENGINEERING AND DESIGN | | | 65,000 | 8,000 | 12 | 73,000 |
| SUPERVISION & INSPECTION | | | 22,000 | 4,000 | 18 | 26,000 |
| TOTAL CONSTRUCTION COST FOR POOL 6 | | | | | | $ 465,000 |
| POOL 7 (1 site) | | | | | | |
| Mob & demob | 1 JB | 10,000 | 10,000 | 5,000 | 50 | $ 15,000 |
| Dredging | 8,800 CY | 7.00 | 61,600 | 30,800 | 50 | 92,400 |
| Rockfill | 1,900 CY | 35.00 | 66,500 | 33,300 | 50 | 99,800 |
| SUBTOTAL DIRECT CONSTRUCTION COSTS | | | 138,000 | 69,000 | 50 | 207,000 |
| ENGINEERING AND DESIGN | | | 47,000 | 5,000 | 10 | 52,000 |
| SUPERVISION & INSPECTION | | | 12,000 | 2,000 | 16 | 14,000 |
| TOTAL CONSTRUCTION COST FOR POOL 7 | | | | | | $ 273,000 |
| POOL 8 (1 site) | | | | | | |
| Mob & demob | 1 JB | 10,000 | 10,000 | 5,000 | 50 | $ 15,000 |
| Dredging | 400 CY | 5.00 | 2,000 | 1,000 | 50 | 3,000 |
| Rockfill | 2,000 CY | 37.00 | 74,000 | 37,000 | 50 | 111,000 |
| SUBTOTAL DIRECT CONSTRUCTION COSTS | | | 86,000 | 43,000 | 50 | 129,000 |
| ENGINEERING AND DESIGN | | | 14,000 | 2,000 | 14 | 16,000 |
| SUPERVISION & INSPECTION | | | 8,000 | 1,000 | 13 | 9,000 |
| TOTAL CONSTRUCTION COST FOR POOL 8 | | | | | | $ 154,000 |

Table DPR-10 - Cost Estimate for the Selected Plan (continued)

| FEATURE | QUANTITY | UNIT PRICE | AMOUNT $ | CONTINGENCY AMOUNT$ | (%) | TOTAL AMOUNT |
|---|---|---|---|---|---|---|
| POOL 9 (3 sites) | | | | | | |
| Mob & demob | 1 JB | 10,000 | 10,000 | 5,000 | 50 | $ 15,000 |
| Rockfill | 9,300 CY | 36.00 | 334,800 | 167,400 | 50 | 502,200 |
| SUBTOTAL DIRECT CONSTRUCTION COSTS | | | 345,000 | 173,000 | 50 | 518,000 |
| ENGINEERING AND DESIGN | | | 114,000 | 15,000 | 14 | 129,000 |
| SUPERVISION & INSPECTION | | | 32,000 | 4,000 | 13 | 36,000 |
| TOTAL CONSTRUCTION COST FOR POOL 9 | | | | | | $ 683,000 |
| POOL 10 (5 sites) | | | | | | |
| Mob & demob | 1 JB | 16,000 | 16,000 | 8,000 | 50 | $ 24,000 |
| Dredging (I) | 200 CY | 5.00 | 1,000 | 500 | 50 | 1,500 |
| Dredging (II) | 2,600 CY | 7.00 | 18,200 | 9,100 | 50 | 27,300 |
| Pervious fill | 6,000 CY | 7.00 | 42,000 | 21,000 | 50 | 63,000 |
| Filter fabric | 5,800 SY | 3.00 | 17,400 | 8,700 | 50 | 26,100 |
| Rockfill (I) | 8,500 CY | 35.00 | 297,500 | 148,800 | 50 | 446,300 |
| Rockfill (II) | 1,400 CY | 36.00 | 50,400 | 25,200 | 50 | 75,600 |
| Rockfill (III) | 600 CY | 39.00 | 23,400 | 11,700 | 50 | 35,100 |
| Rockfill (IV) | 500 CY | 41.00 | 20,500 | 10,200 | 50 | 30,700 |
| SUBTOTAL DIRECT CONSTRUCTION COSTS | | | 486,000 | 243,000 | 50 | 729,000 |
| ENGINEERING AND DESIGN | | | 154,000 | 28,000 | 18 | 182,000 |
| SUPERVISION & INSPECTION | | | 44,000 | 7,000 | 16 | 51,000 |
| TOTAL CONSTRUCTION COST FOR POOL 10 | | | | | | $ 962,000 |
| SELECTED PLAN | | | | | | |
| TOTAL DIRECT CONSTRUCTION COST | | | 1,299,000 | 650,000 | 50 | $1,949,000 |
| ENGINEERING AND DESIGN | | | 394,000 | 60,000 | 15 | 454,000 |
| SUPERVISION & INSPECTION | | | 118,000 | 18,000 | 15 | 136,000 |
| TOTAL CONSTRUCTION COST OF SELECTED PLAN | | | $1,811,000 | $728,000 | | $2,539,000 |

Reasons for contingencies: Quantity unknowns (based on available information); unit price unknowns; unknown site conditions; and undefined requirements.

NOTE:

General design (planning) allocations have totaled $173,000. Annualized first costs (based upon a 50-year economic life and an 8% discount rate) would amount to $207,400. With the addition of annual operation and maintenance costs, the total average annual costs are estimated to be $212,300. Performance evaluation costs are shown in table DPR-12.

PERFORMANCE EVALUATION

The principal types, purposes, and responsibilities of project monitoring and performance evaluation are shown in table DPR-11.

Table DPR-11

## UMRS-EMP Monitoring and Performance Evaluation Matrix

| Type of Activity | Purpose | Responsible Agency | Implementing Agency | Funding Source | Remarks |
|---|---|---|---|---|---|
| Sedimentation Problem Analysis | Sedimentation Research Strategy. /1 | USFWS | NBS(EMTC) | LTRM | Lead into pre-project monitoring; define desired conditions for plan formulation. |
| Pre-project Monitoring | Identify and define problems at specific sites. | Sponsor | Sponsor | Sponsor | Should attempt to begin defining baseline. |
| Baseline Monitoring | Establish baseline for performance evaluation and inventory basic habitat conditions for project planning. | Corps of Engineers | Field stations or sponsors thru Cooperative Agreements, or Corps. /2 | HREP | Over several years to reconcile perturbations. Project should be in "Active" portion of Spreadsheet. |
| Data Collection for Design | 1. Identify project objectives.<br>2. Design of project.<br>3. Develop Performance Evaluation Plan. | Corps of Engineers | Corps of Engineers | HREP | |
| Performance Evaluation Monitoring | Determine success of projects. | Corps of Engineers | Field stations or sponsors thru Cooperative Agreements, sponsor thru O&M, /3 or Corps. /2 | HREP | After construction. |
| Analysis of Biological Responses to Projects | 1. Species abundance monitoring and internal UMRS cause-effect relationsips. Reevaluate design criteria assumptions. | Corps of Engineers | Corps/NBS(EMTC)/ Others | HREP | Biological Response Study tasks beyond scope of Performance Evaluation, Problem Analysis, and Trend Analysis. |
| | 2. System-wide applicability of Level 1 results. | USFWS | NBS(EMTC)/ Others | LTRM | Problem Analysis and Trend Analysis studies of habitat projects. |

1/ Refers to Sedimentation Research Strategy 1.2.1, Final Draft LTRM Operating Plan.

2/ Choice depends on logistics. When done by the States under a Cooperative Agreement, the role of the EMTC will be to: (1) advise and assist in assuring QA/QC consistency; (2) review and comment on reasonableness of cost estimates; and (3) be the financial manager. If a private firm or state is funded by contract, coordination with the EMTC is required to assure QA/QC consistency.

3/ Some limited reporting of information for some projects (e.g., waterfowl management areas) could be furnished by on-site personnel as part of O&M.

Pre- and post-construction plans to monitor the performance of the project were designed to directly measure the degree of attainment of project objectives. For each objective, an appropriate monitoring parameter was chosen. The parameter to be measured for each objective is shown in table DPR-12. All monitoring would be done once pre- and at 3 and 10 years post-construction. Monitoring activities would be closely coordinated with any similar efforts by the Long Term Resource Monitoring program component and could be modified in the future based on field observations. Some limited biological monitoring (fish and migratory bird response) would likely be done by Refuge personnel as part of normal Refuge management activities. However, biological monitoring is not part of formal performance evaluation activities proposed for the project and is not included in the estimated cost.

Table DPR-12 - Pre- and Post-Construction Measurements

| Site Number and Name | Project Objective | Enhancement Feature | Unit of Measure | Measurement Plan | Cost/ Effort | Field Observation |
|---|---|---|---|---|---|---|
| 6-718.6-R Blacksmith Slough | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| | Reduce flow between islands | Partial closure | cfs | Measure flow | $2000 | Sedimentation & structure |
| 6-715.8-R Trempealeau Daymark | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| 7-703.0-L Lake Onalaska -Isl B | Maintain existing island shoreline | Offshore mound | lin ft | Measure isl shoreline | $100 | Condition of rockfill |
| -Isl C | Maintain existing island shoreline | Offshore mound | lin ft | Measure isl shoreline | $100 | Condition of rockfill |
| 8-685.0-R Heron & Trapping Isl | Maintain existing island shoreline | Rock wedge, groin | lin ft | Measure isl shoreline | $100 | Condition of rockfill |
| 9-654.1-R Upper Harpers Slough | Maintain existing island shoreline | Offshore mound | lin ft | Measure isl shoreline | $100 | Condition of rockfill |
| 9-653.4-R Middle Harpers Slou | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| 9-652.6-R Lower Harpers Slough | Maintain existing island shoreline | Offshore mound | lin ft | Measure isl shoreline | $100 | Condition of rockfill |
| 10-646.4-R Billy Slough | Eliminate normal flow thru breach | Rock closure | cfs | Measure flow | $1400 | Condition of rockfill |
| | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| 10-636.4-L East Channel | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| 10-628.0-R Norwegian Slough | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| | Eliminate normal flow thru breach | Rock closure | cfs | Measure flow | $1400 | Condition of rockfill |
| 10-625.5-L Island 181 (Catfish) | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| 10-621.0-L Duck Lake Chute | Maintain existing island shoreline | Riprap | lin ft | Measure isl shoreline | $100 | Condition of riprap |
| | Eliminate normal flow thru breach | Partial closure | cfs | Measure flow | $1400 | Condition of rockfill |

Average annual monitoring cost over the 50-year project life = $450

# PROJECT IMPLEMENTATION

## DIVISION OF PLAN RESPONSIBILITIES

The responsibilities for plan implementation and construction fall to the COE as the lead Federal agency. Operation and maintenance (included minor repair and replacement) of the completed project would be the responsibility of the USFWS. Should rehabilitation of the project which exceeds the annual maintenance requirements be needed (as a result of a specific storm or flood event) the Federal share will be a responsibility of the COE. Project performance evaluation and major rehabilitation would be the responsibility of the COE. Some project performance monitoring (field observations) would be accomplished by the USFWS during normal management efforts in the area. This will be more specifically coordinated and defined in the future O&M manual.

## COST APPORTIONMENT

Construction - All project construction activities would be conducted on lands managed as part of a National Wildlife Refuge. Therefore, in accordance with Section 906(e)(3) of Public Law 99-662, the first costs for construction of the project would be 100-percent Federal and would be borne by the COE.

Operation and Maintenance - After construction of the project, annual management operations would be conducted by the USFWS. A draft Memorandum of Agreement for operation and maintenance is included as attachment 6. The USFWS would assume 100-percent of the operation and maintenance responsibilities in conformance with Section 107(b) of the Water Resources Development Act of 1992. A letter of intent from the USFWS is included in attachment 4. Specific operation and maintenance features would be defined in a project O&M manual which would be prepared by the COE and coordinated with the involved agencies during the plans and specifications phase.

Rehabilitation - Rehabilitation of the project cannot be accurately estimated. The COE will be responsible for 75 percent of the cost of rehabilitation work that is mutually agreed upon and determined necessary for the project or functional portion. The non-Federal sponsor is responsible for the remaining 25 percent of rehabilitation cost, in accordance with Section 906(e) of the Water Resources Development Act of 1986.

## STEPS PRIOR TO PROJECT CONSTRUCTION

After submittal of the final report to higher authority, the preparation of plans and specifications for the first construction contract would begin. As described in this report, this work would include: ground surveys and limited bathymetry in pools 6, 7, 8, 9, and 10 (beginning in pool 10); locating placement sites and fill sources as necessary; cultural resource investigations; and, final design of the bank stabilization features. Detailed field surveys have not been done in order to save resources since conditions can change rapidly at the sites.

The current schedule is to begin preparing plans and specifications in 1995. Construction contracts would be prepared on a pool-wide basis and would be advertised by the competitive bid process. Multiple contracts would be used, depending on the funding available. The first contract would be awarded in 1996. Work in all the pools would be completed by September 1999.

## RECOMMENDATIONS

I have weighed the accomplishments to be obtained from construction of this habitat improvement project against its cost and have considered the alternatives, impacts, and scope of the proposed project. In my judgment, the proposed project is a justified expenditure of Federal funds. I recommend that the this Bank Stabilization project in pools 5 through 10 of the UMR in Minnesota, Wisconsin, and Iowa for habitat rehabilitation and enhancement be approved for construction. The total estimated project cost is $2,539,000, which amount would be a 100-percent Federal cost according to Section 906(e)(3) of Public Law 99-662.

J. M. Wonsik
Colonel, Corps of Engineers
District Engineer

Attachments:
1. Plates (24)
2. Finding of No Significant Impact
3. Section 404(b)(1) Evaluation
4. Letter of Intent
5. Coordination
6. Draft MOA for O&M
7. Distribution List
8. Detailed Cost Estimate

Attachment 1

Plates

# UPPER MISSISSIPPI RIVER SYSTEM
# ENVIRONMENTAL MANAGEMENT PROGRAM

MISSISSIPPI RIVER BANK STABILIZATION

## HABITAT REHABILITATION AND ENHANCEMENT PROJECT


LOCATION MAP

PLATE 1

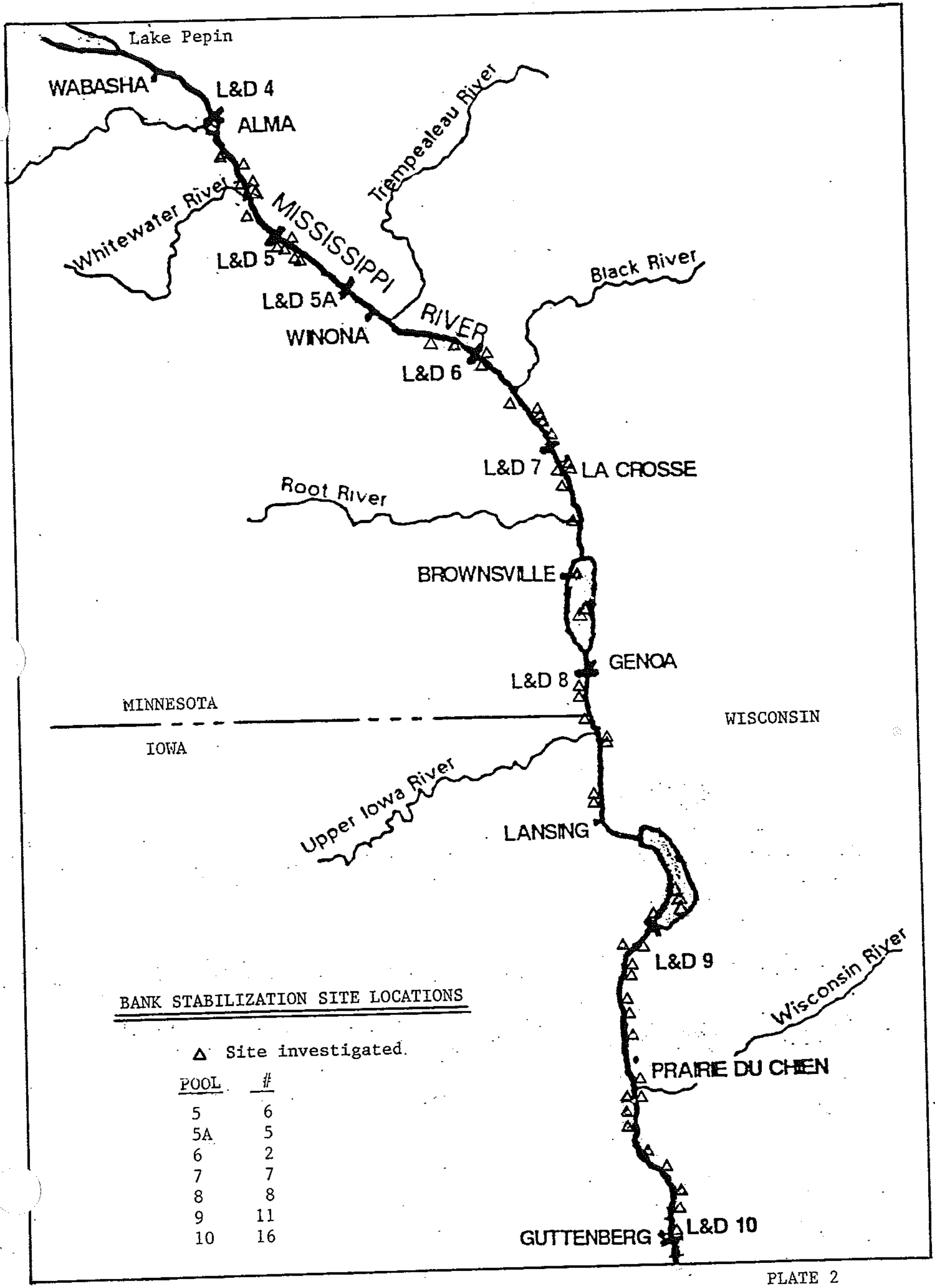
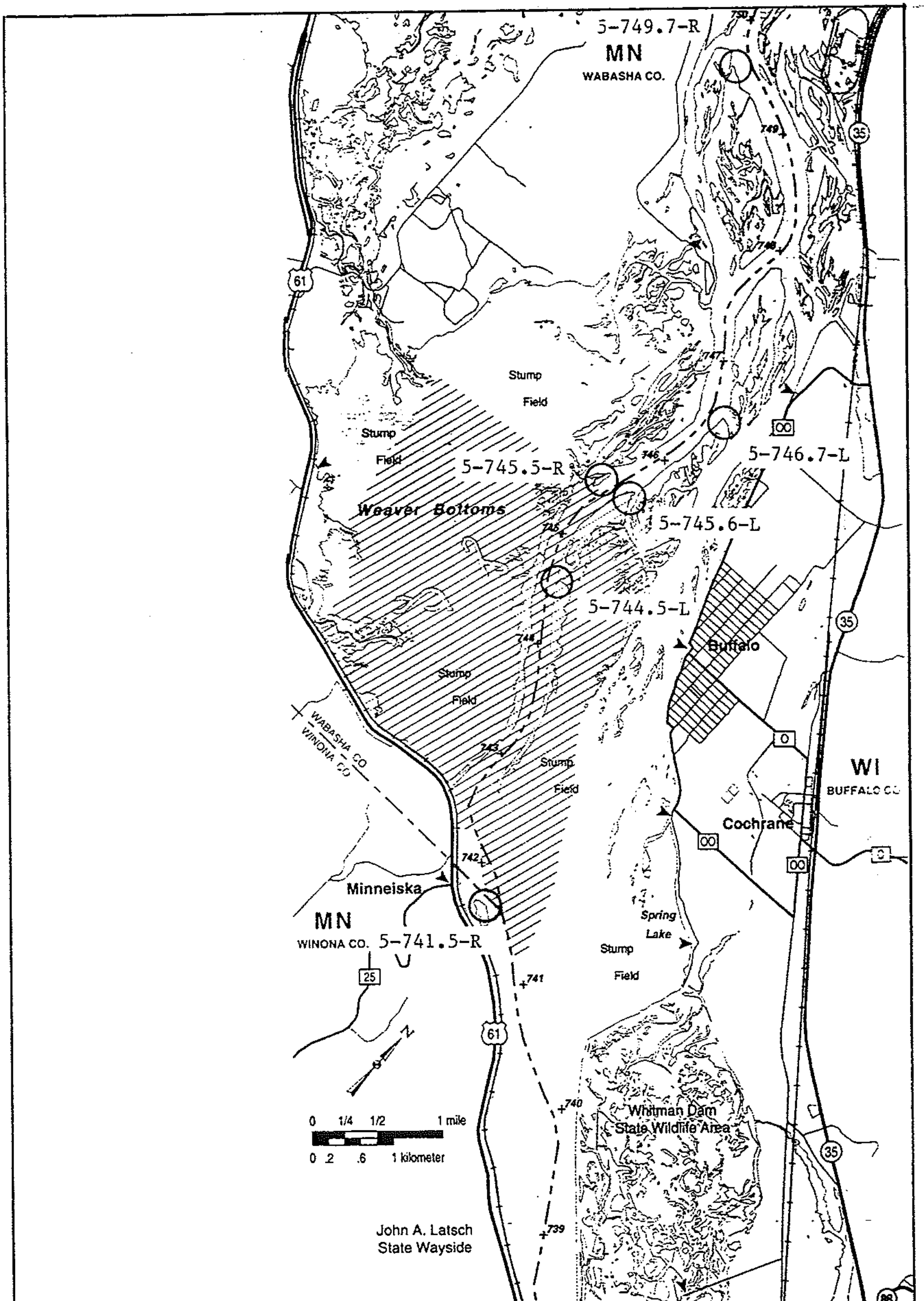
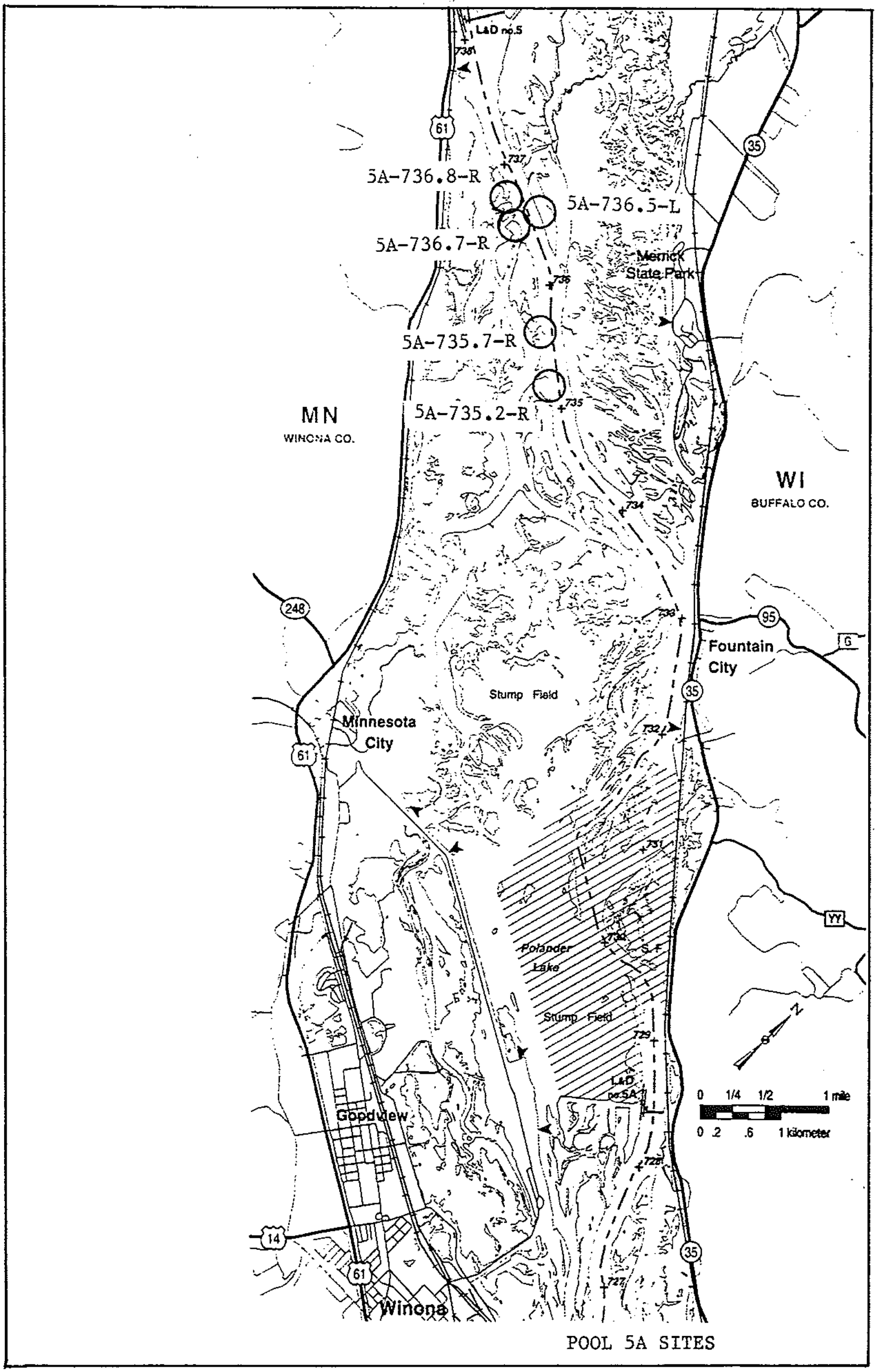

Lake Pepin
WABASHA
L&D 4
ALMA
Trempealeau River
Whitewater River
MISSISSIPPI
RIVER
L&D 5
L&D 5A
WINONA
Black River
L&D 6
L&D 7
LA CROSSE
Root River
BROWNSVILLE
GENOA
L&D 8
MINNESOTA
IOWA
WISCONSIN
Upper Iowa River
LANSING
L&D 9
Wisconsin River
PRAIRIE DU CHIEN
GUTTENBERG
L&D 10
BANK STABILIZATION SITE LOCATIONS
Site investigated
POOL #
5 6
5A 5
6 2
7 7
8 8
9 11
10 16

PLATE 2



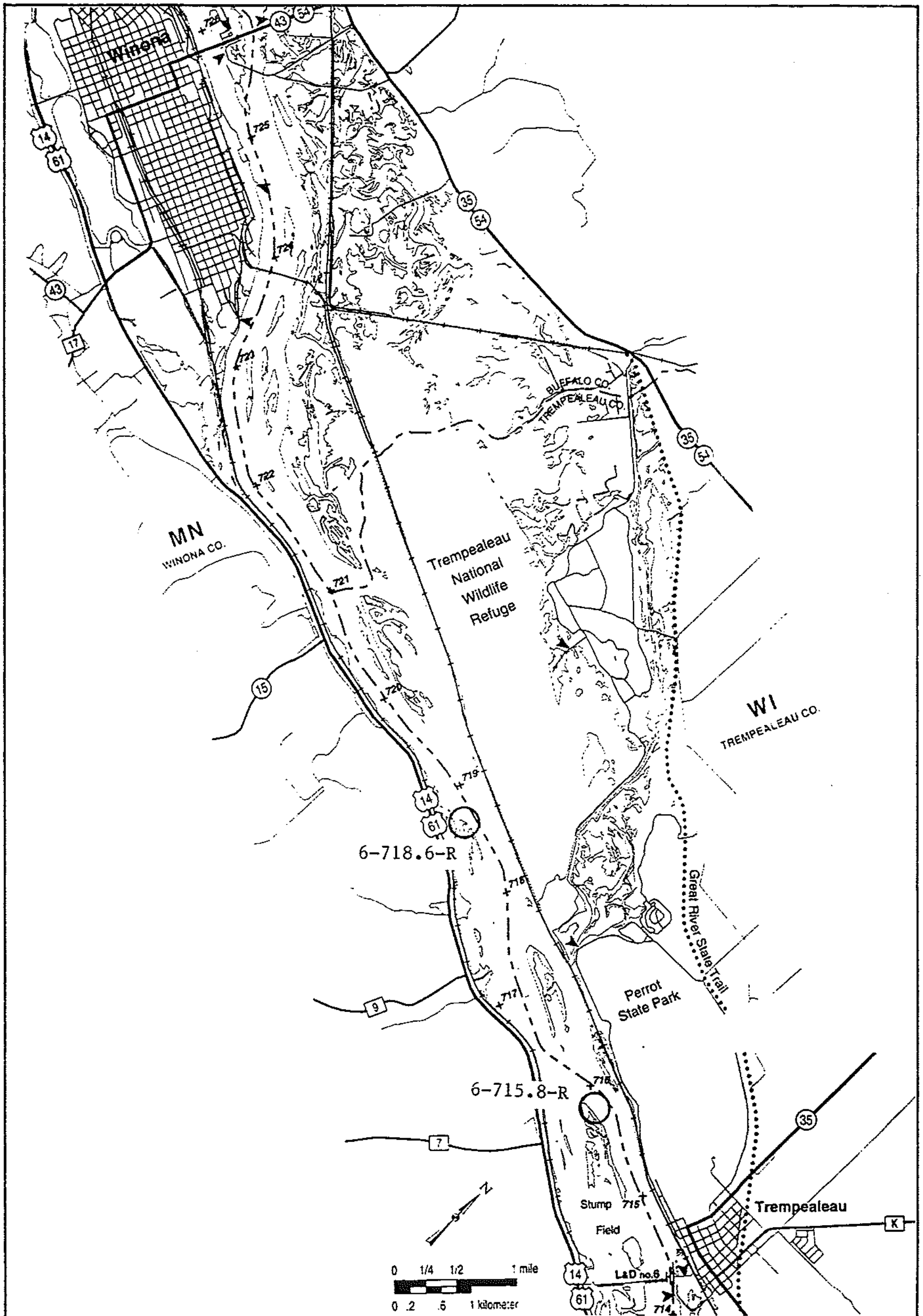

POOL 5 SITES

PLATE 3



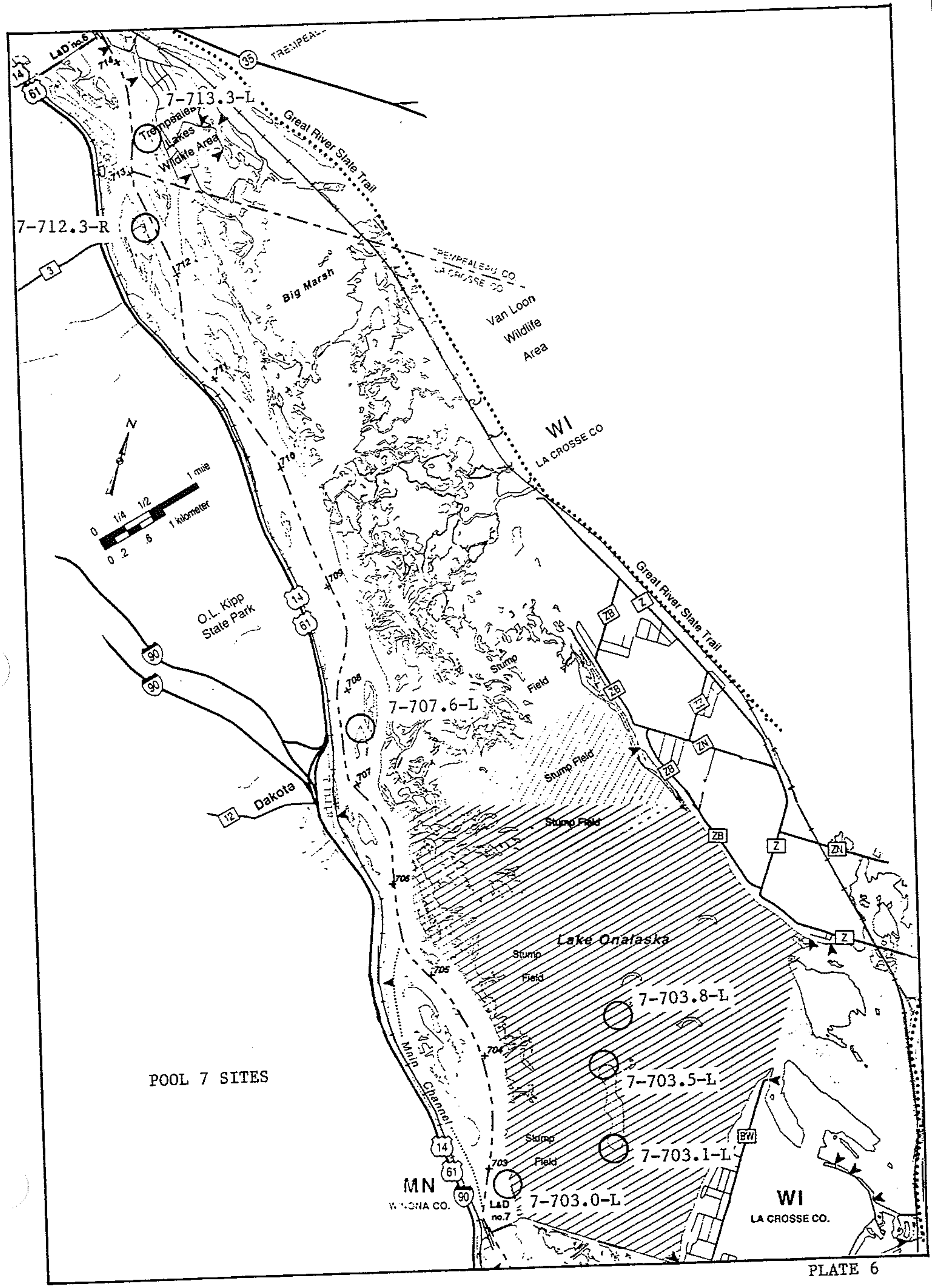
L&D no.5
5A-736.8-R
5A-736.5-L
5A-736.7-R
Merrick State Park
5A-735.7-R
5A-735.2-R
MN
WINONA CO.
WI
BUFFALO CO.
Fountain City
Stump Field
Minnesota City
Polander Lake
Stump Field
L&D no.5A
Goodview
Winona
0 1/4 1/2 1 mile
0 .2 .6 1 kilometer
POOL 5A SITES


PLATE 4



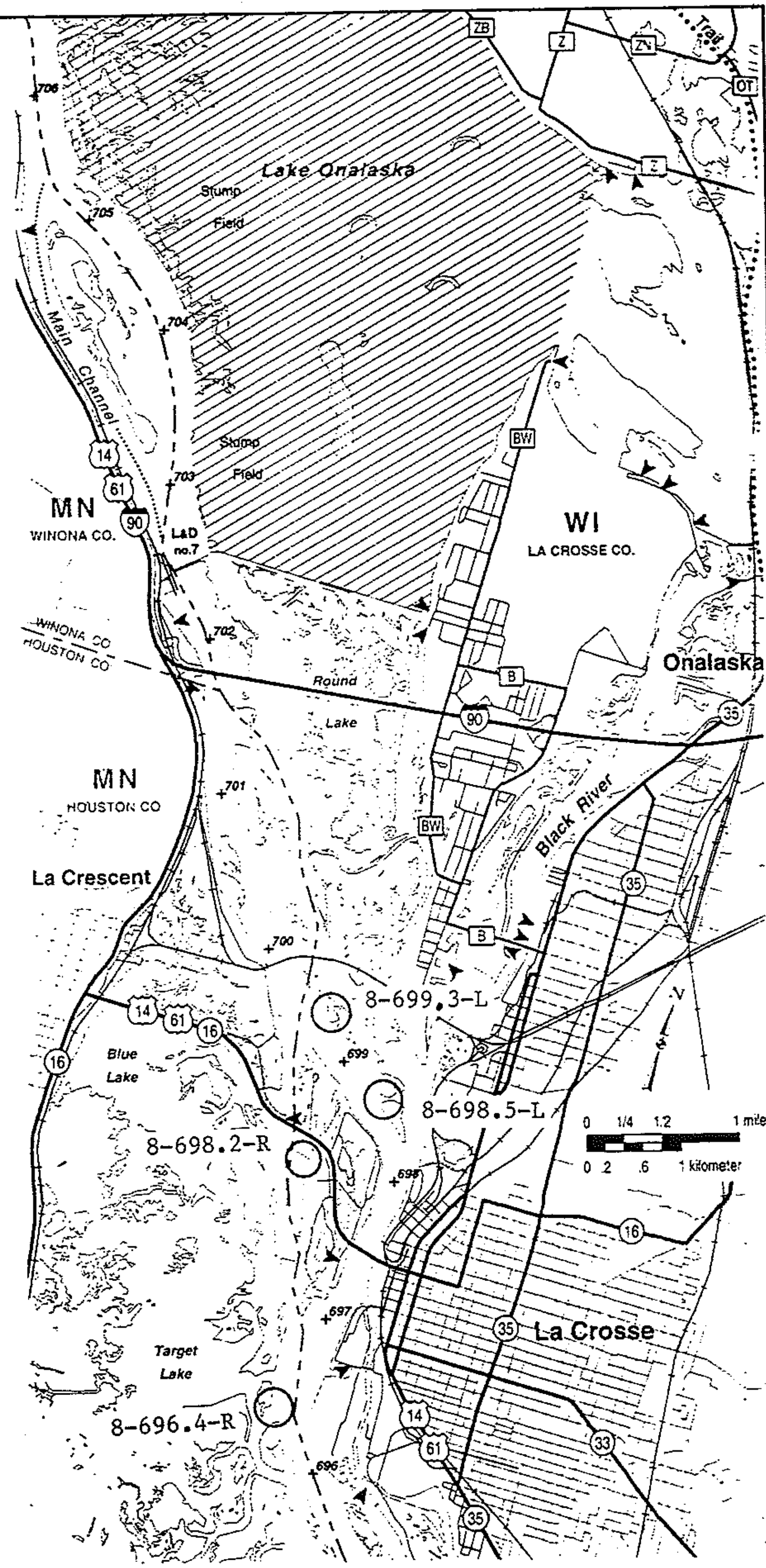

POOL 6 SITES

PLATE 5

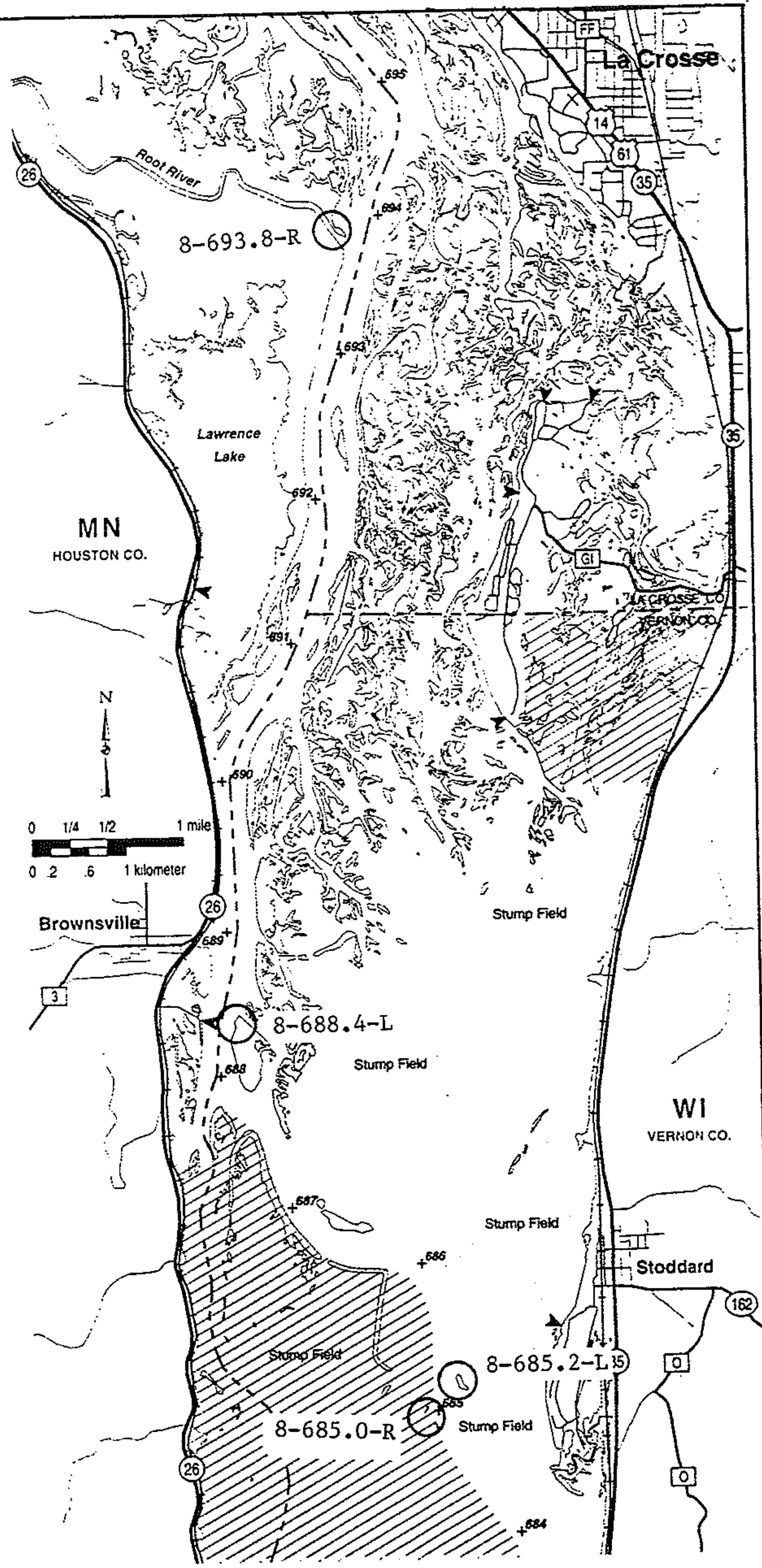


L&D no.6
Trempealeau Lakes Wildlife Area
Great River State Trail
7-713.3-L
7-712.3-R
Trempealeau Co.
La Crosse Co.
Big Marsh
Van Loon Wildlife Area
WI
LA CROSSE CO
1 mile
1/4
1/2
1 kilometer
O.L. Kipp State Park
Dakota
Stump Field
7-707.6-L
Lake Onalaska
7-703.8-L
7-703.5-L
7-703.1-L
7-703.0-L
Main Channel
MN
WINONA CO.
L&D no.7
WI
LA CROSSE CO.
POOL 7 SITES

PLATE 6

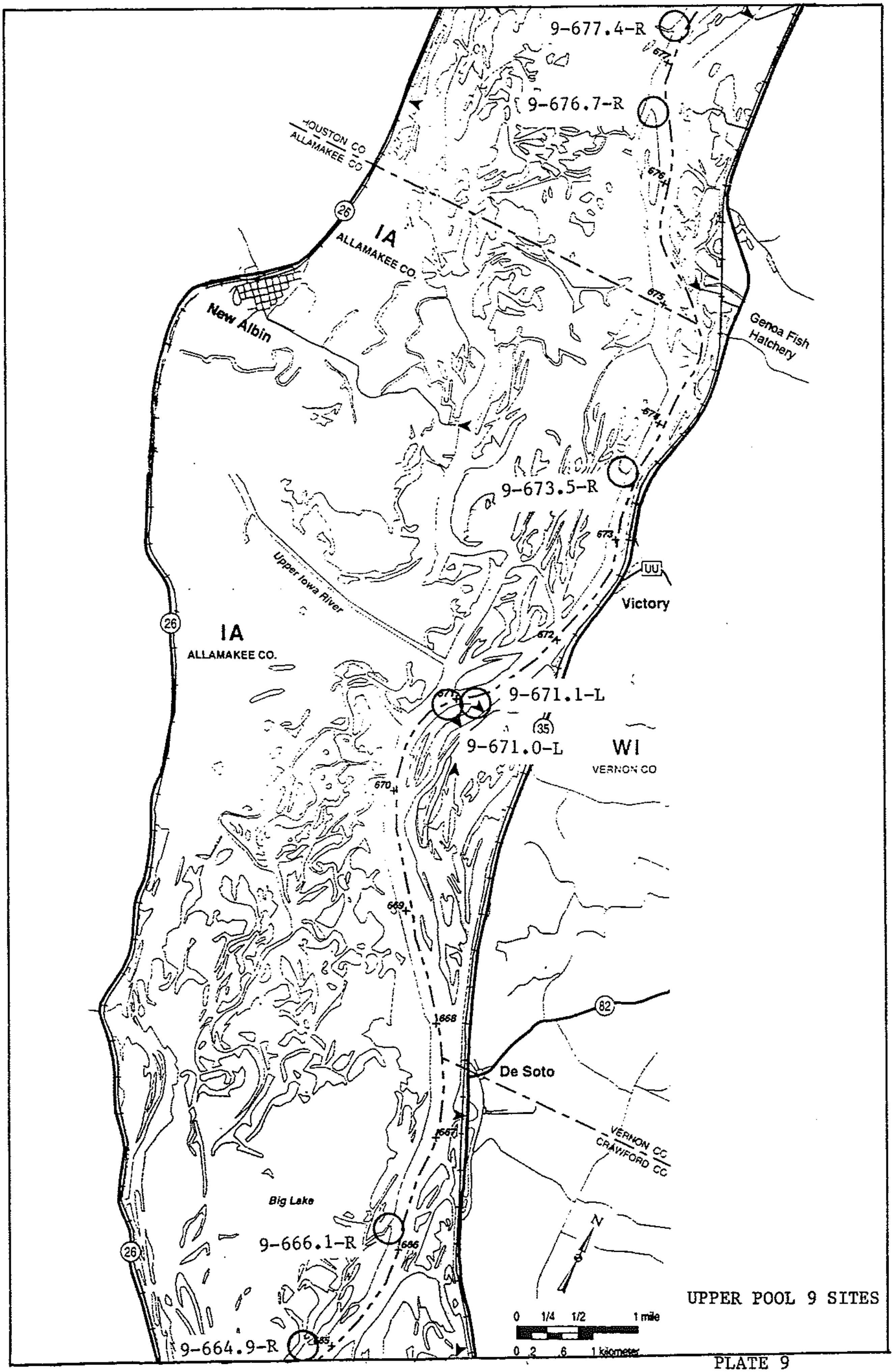



UPPER POOL 8 SITES




LOWER POOL 8 SITES

PLATE 8




UPPER POOL 9 SITES

PLATE 9

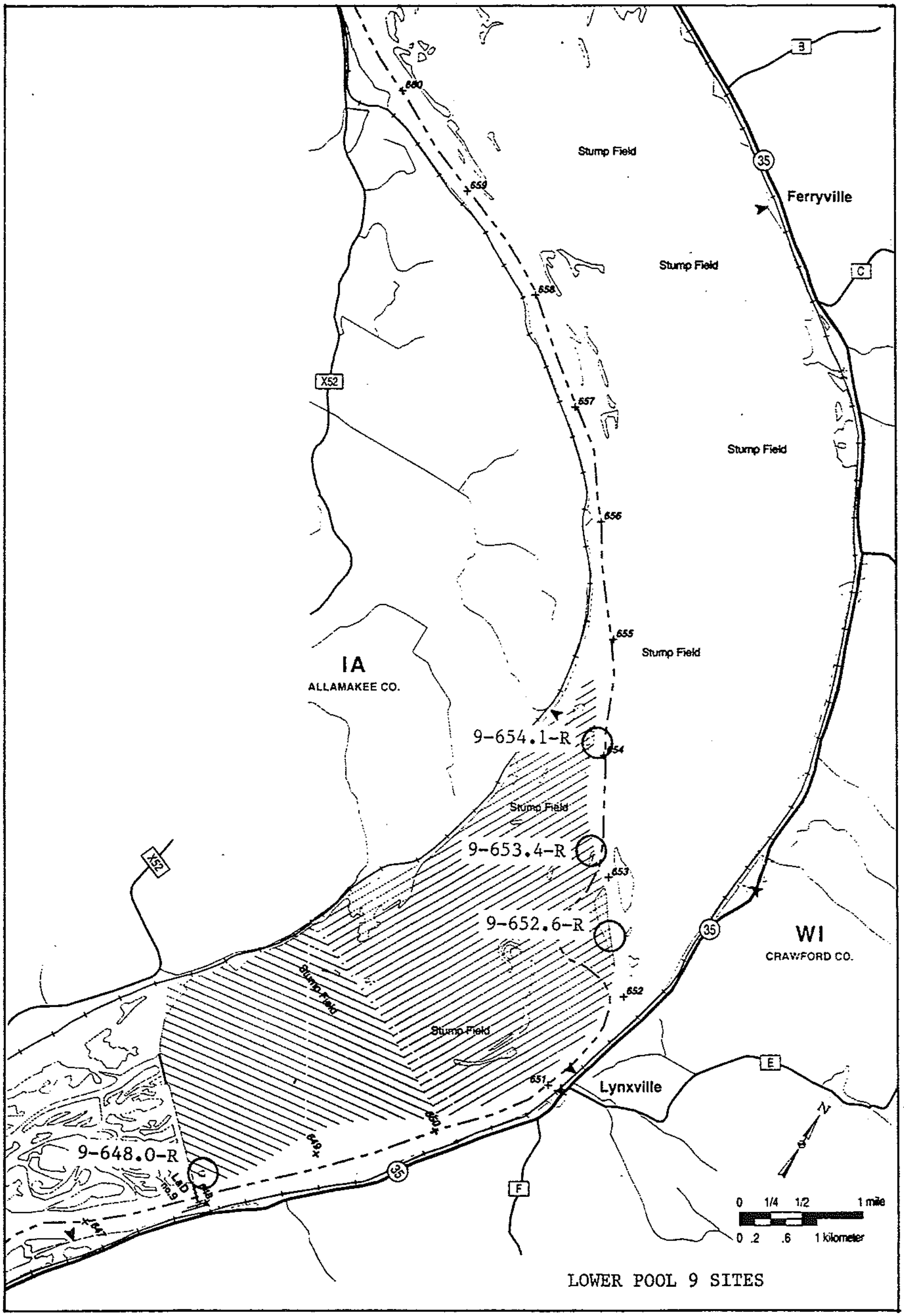
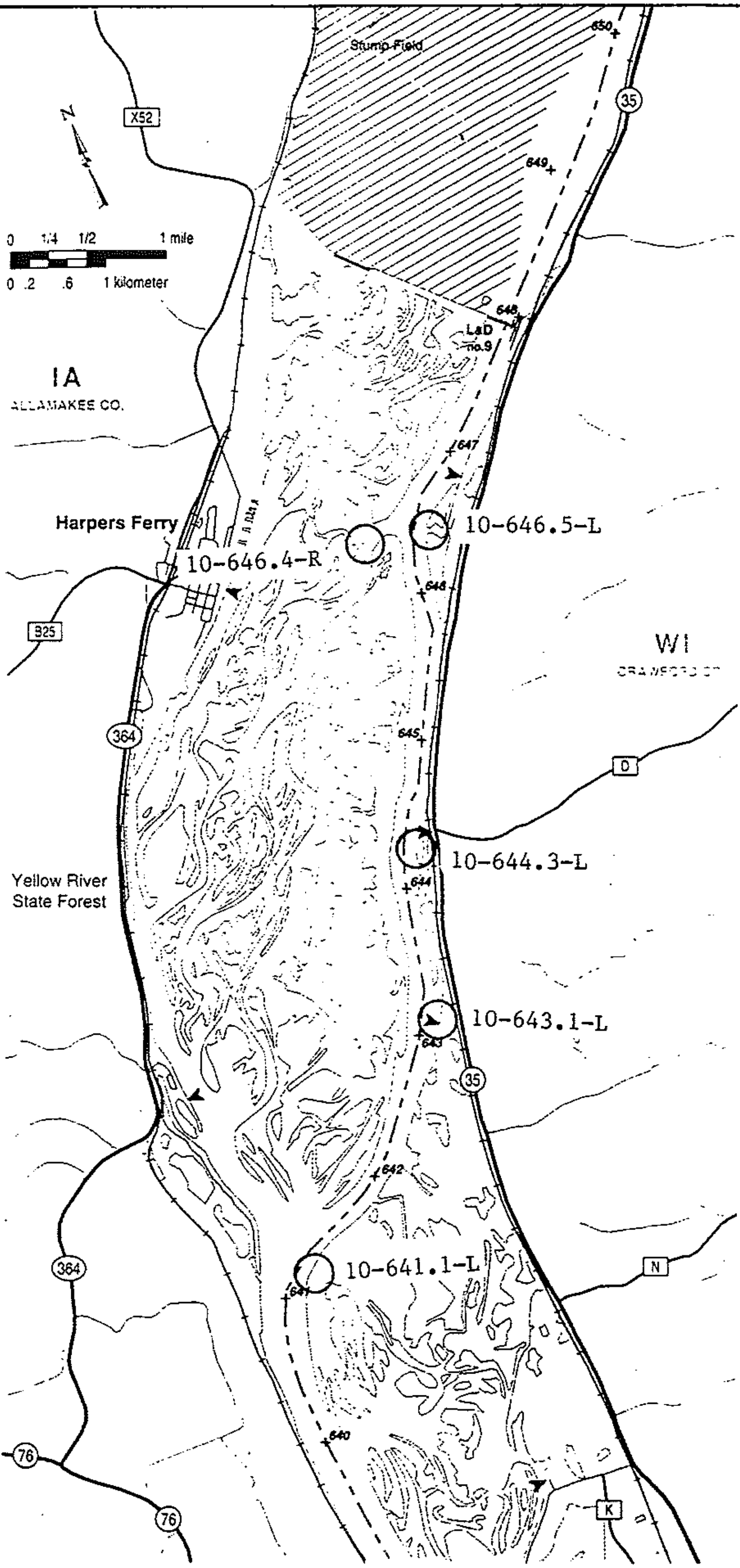
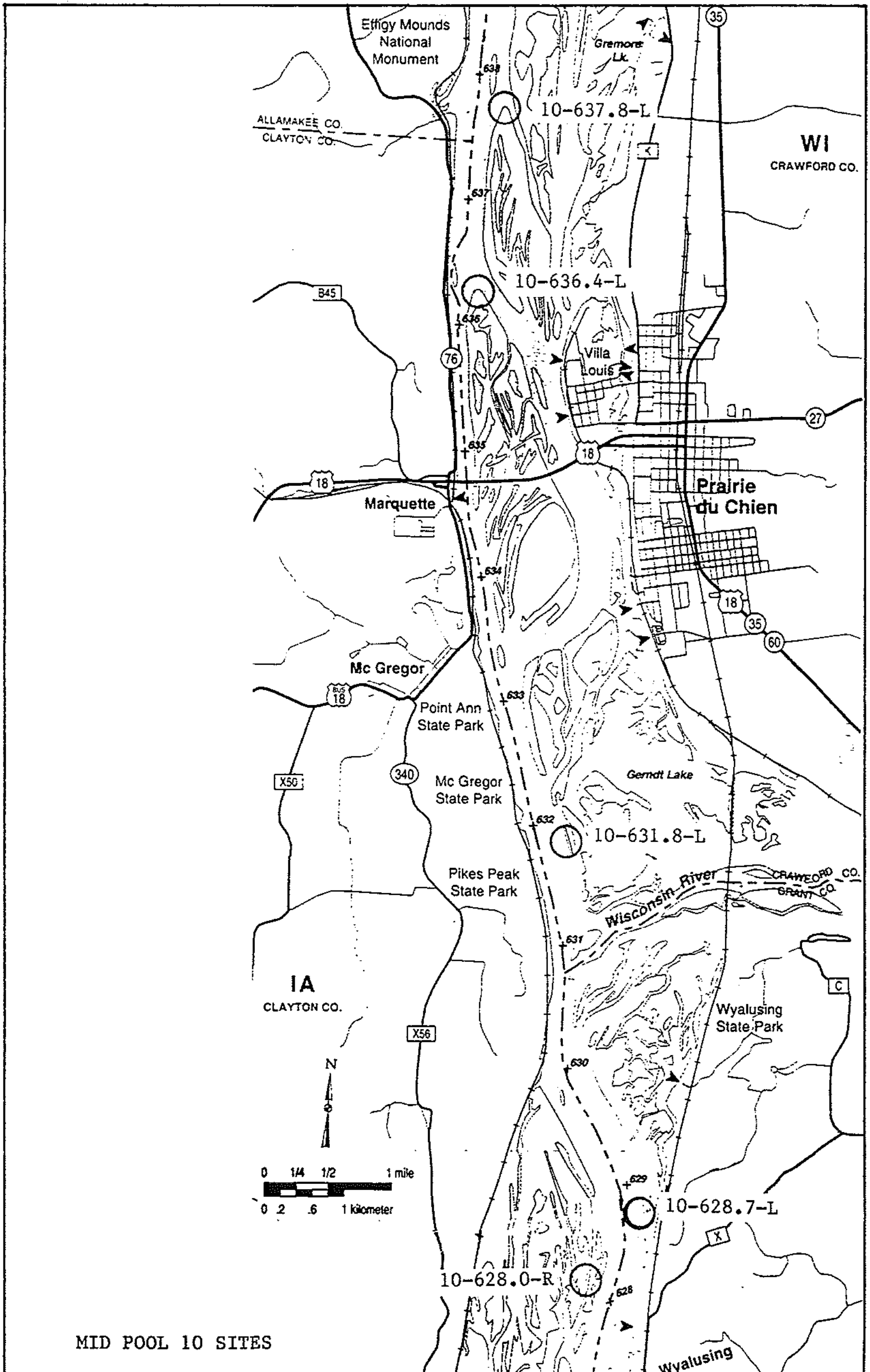

Stump Field
Ferryville
Stump Field
Stump Field
Stump Field
IA
ALLAMAKEE CO.
9-654.1-R
Stump Field
9-653.4-R
9-652.6-R
WI
CRAWFORD CO.
Stump Field
Stump Field
Lynxville
9-648.0-R
0 1/4 1/2 1 mile
0 .2 .6 1 kilometer
LOWER POOL 9 SITES

PLATE 10




UPPER POOL 10 SITES

PLATE 11




MID POOL 10 SITES

PLATE 12

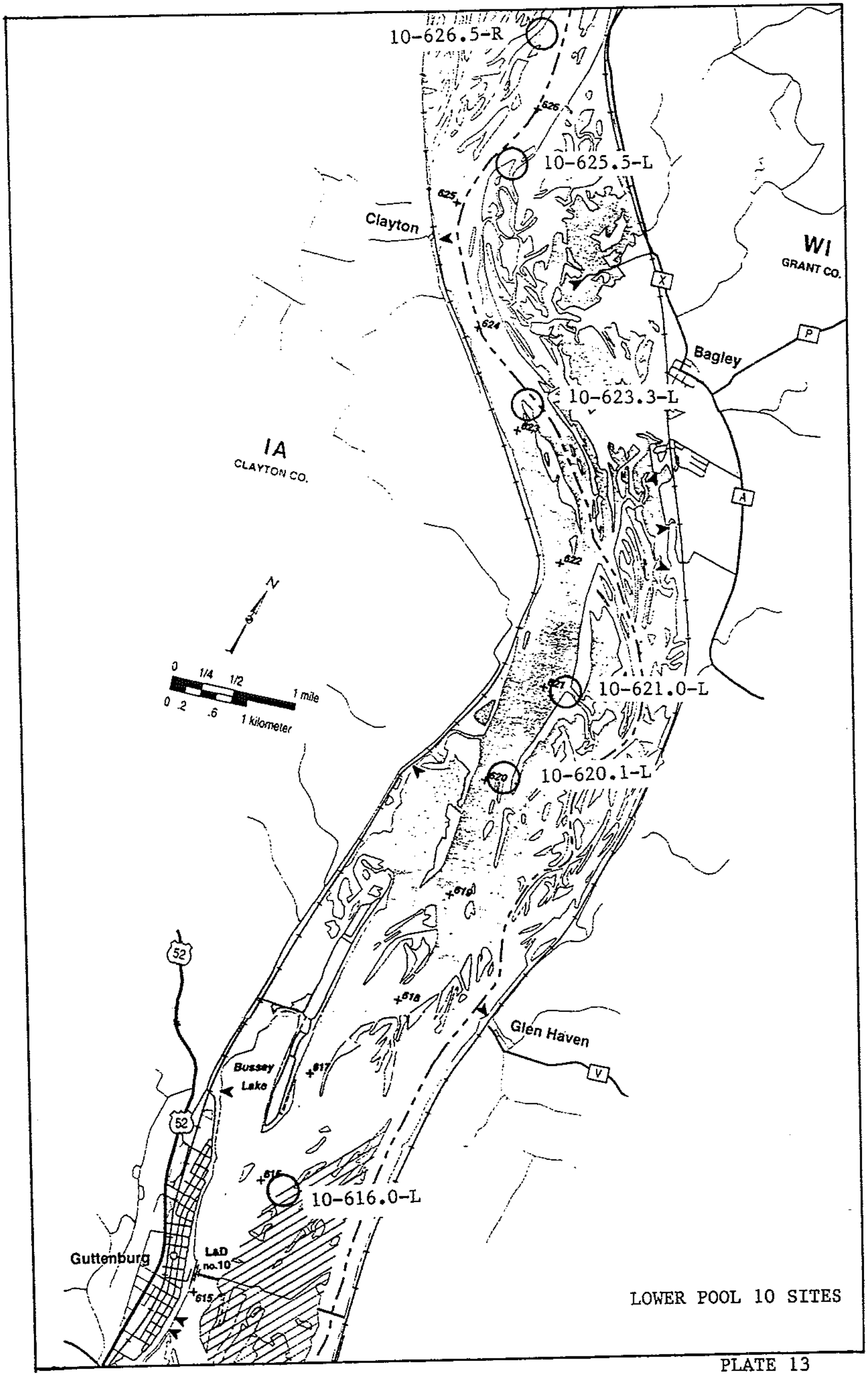
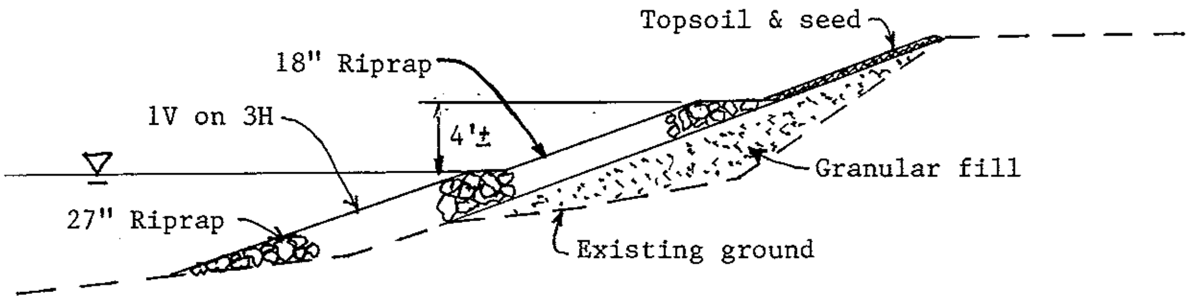
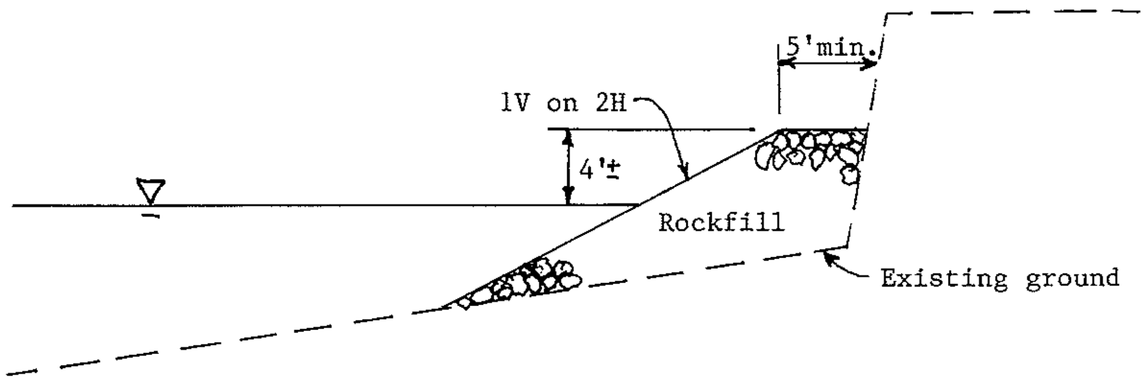

10-626.5-R
10-625.5-L
Clayton
WI
GRANT CO.
Bagley
10-623.3-L
IA
CLAYTON CO.
N
0
1/4
1/2
1 mile
0
.2
.6
1 kilometer
10-621.0-L
10-620.1-L
Glen Haven
Bussey
Lake
52
10-616.0-L
Guttenburg
L&D
no.10
LOWER POOL 10 SITES

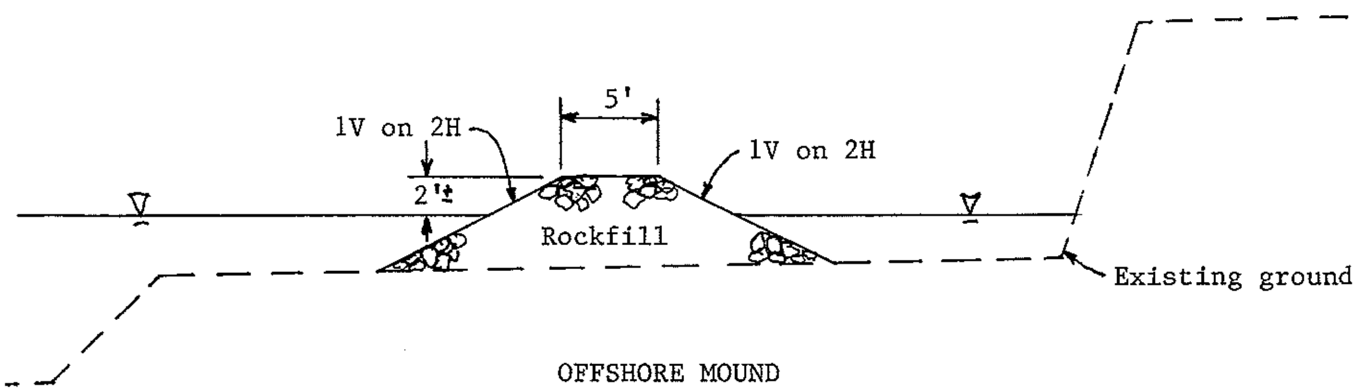
PLATE 13




RIPRAP
(#1)



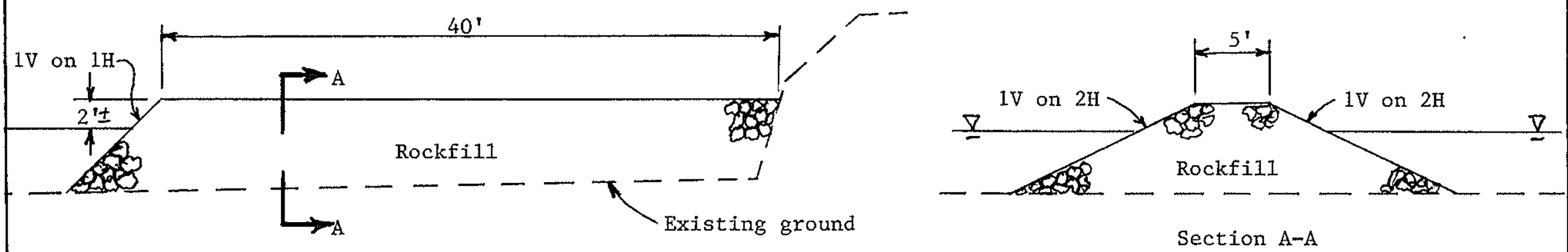

ROCK WEDGE
(#4)



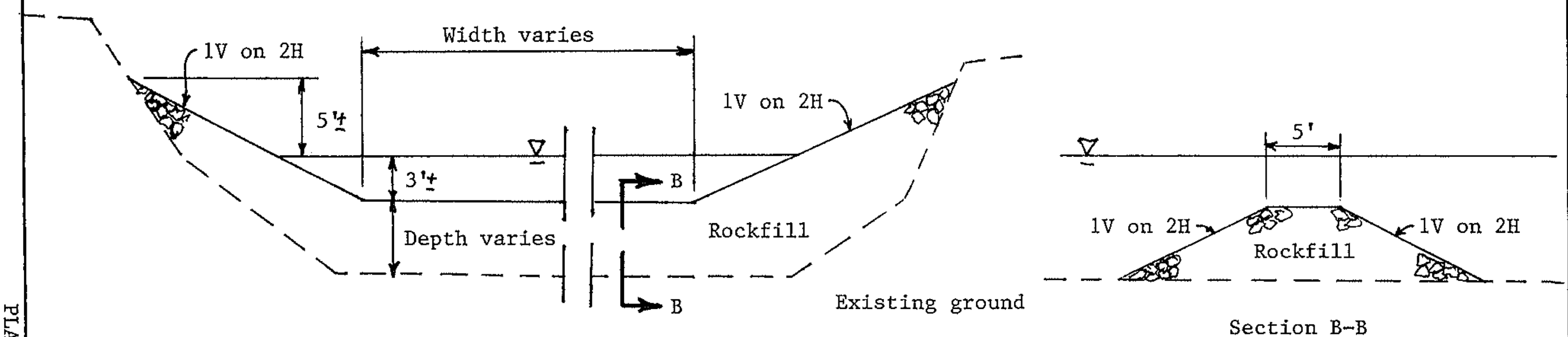

OFFSHORE MOUND
(#5)

(Same cross-section used for rock closure)

STABILIZATION ALTERNATIVES
(Riprap, rock wedge, & offshore mound)



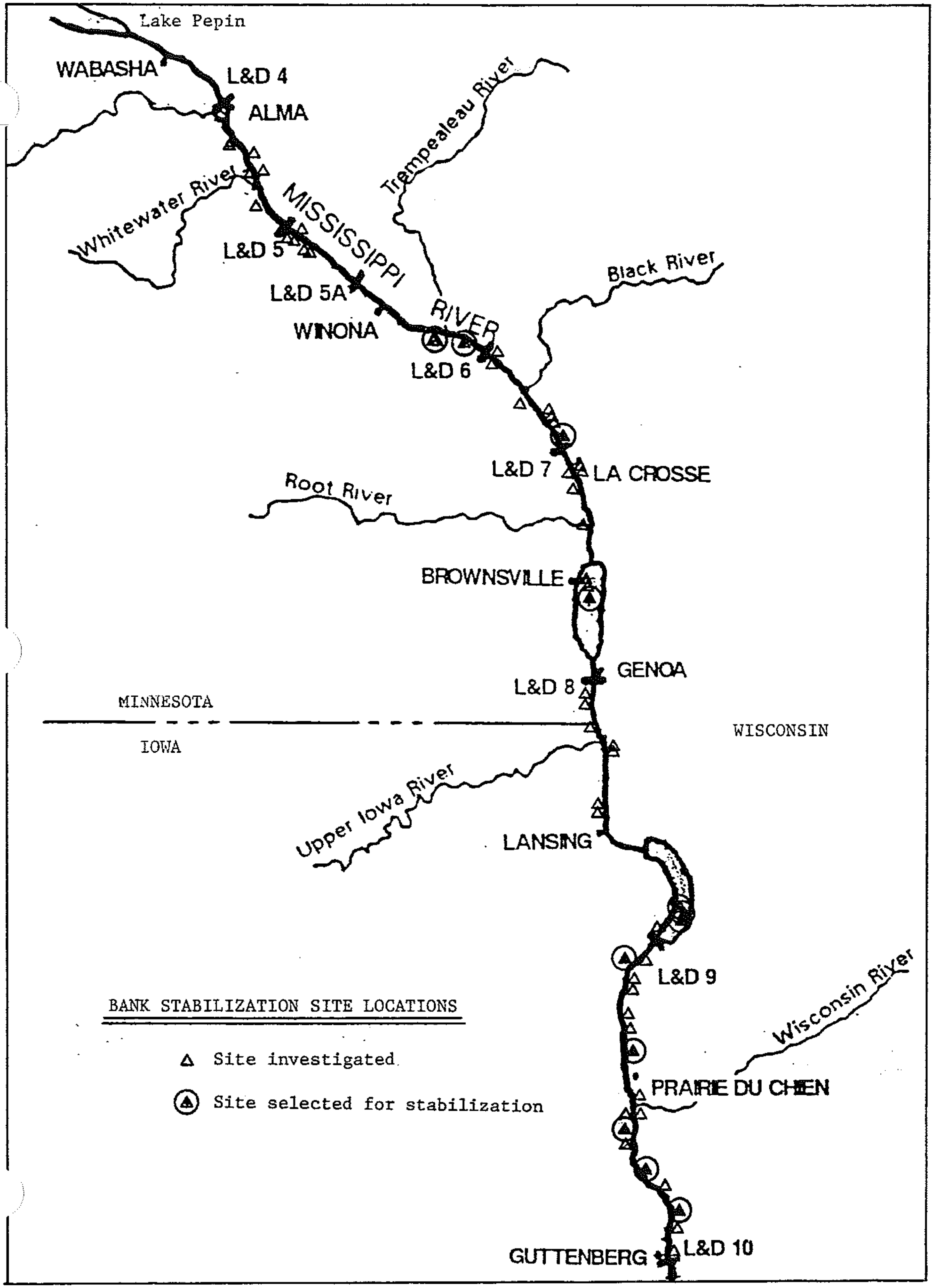

GROINS
(placed perpendicular to shoreline)
(#6)

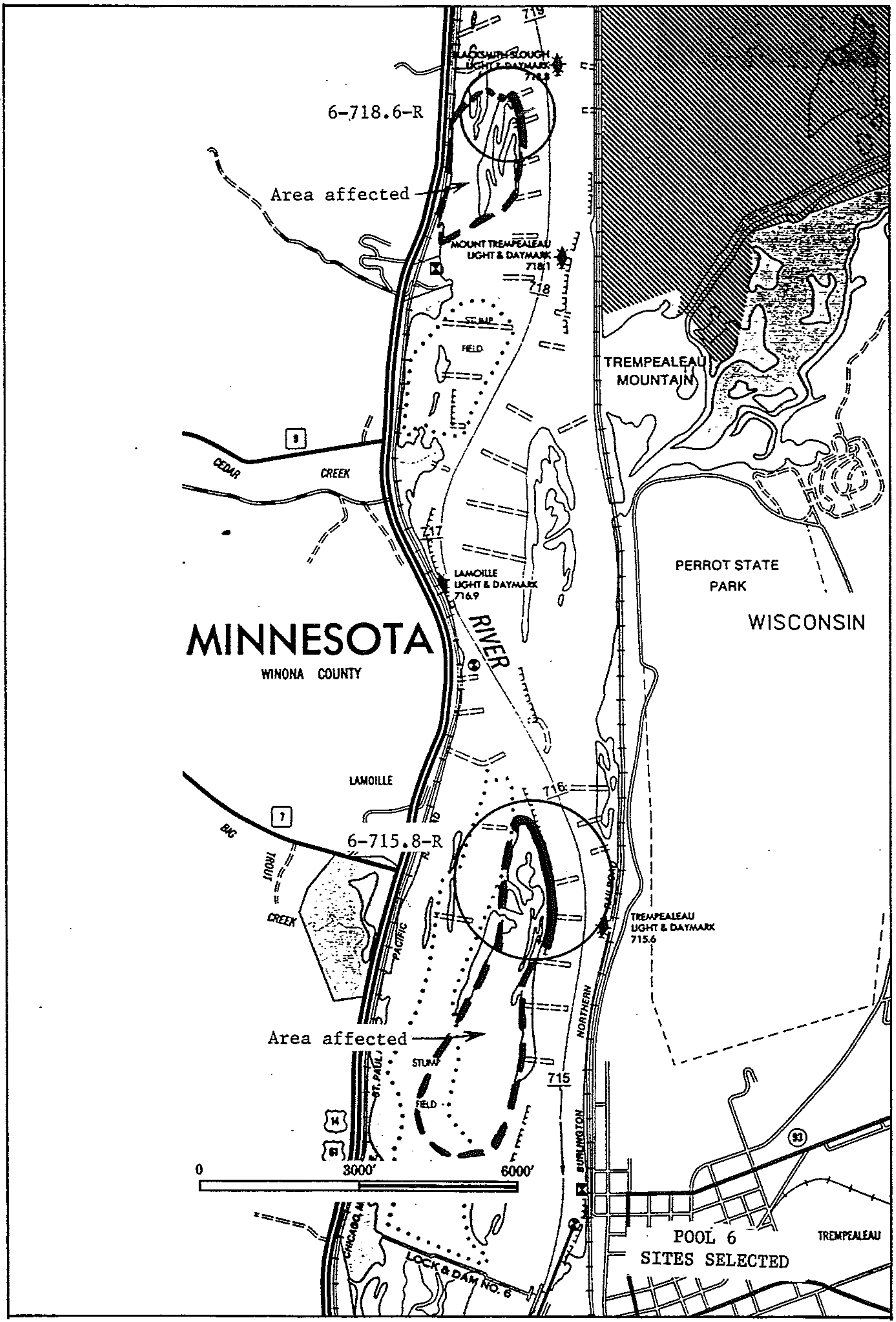



SIDE CHANNEL PARTIAL CLOSURE
(#7)

STABILIZATION ALTERNATIVES

(Groins & side channel partial closure)


Lake Pepin
WABASHA
L&D 4
ALMA
Trempealeau River
Whitewater River
MISSISSIPPI
RIVER
L&D 5
L&D 5A
WINONA
Black River
L&D 6
L&D 7
LA CROSSE
Root River
BROWNSVILLE
GENOA
L&D 8
MINNESOTA
IOWA
WISCONSIN
Upper Iowa River
LANSING
L&D 9
Wisconsin River
PRAIRIE DU CHIEN
GUTTENBERG
L&D 10
BANK STABILIZATION SITE LOCATIONS
Site investigated
Site selected for stabilization



6-718.6-R
BLACKSMITH SLOUGH LIGHT & DAYMARK 718.5
Area affected
MOUNT TREMPEALEAU LIGHT & DAYMARK 718.1
718
TREMPEALEAU MOUNTAIN
CEDAR CREEK
717
LAMOILLE LIGHT & DAYMARK 716.9
RIVER
PERROT STATE PARK
WISCONSIN
MINNESOTA
WINONA COUNTY
LAMOILLE
716
BIG TROUT CREEK
6-715.8-R
TREMPEALEAU LIGHT & DAYMARK 715.6
Area affected
STUMP FIELD
715
NORTHERN
BURLINGTON
0
3000'
6000'
LOCK & DAM NO. 6
TREMPEALEAU
POOL 6
SITES SELECTED


PLATE 17

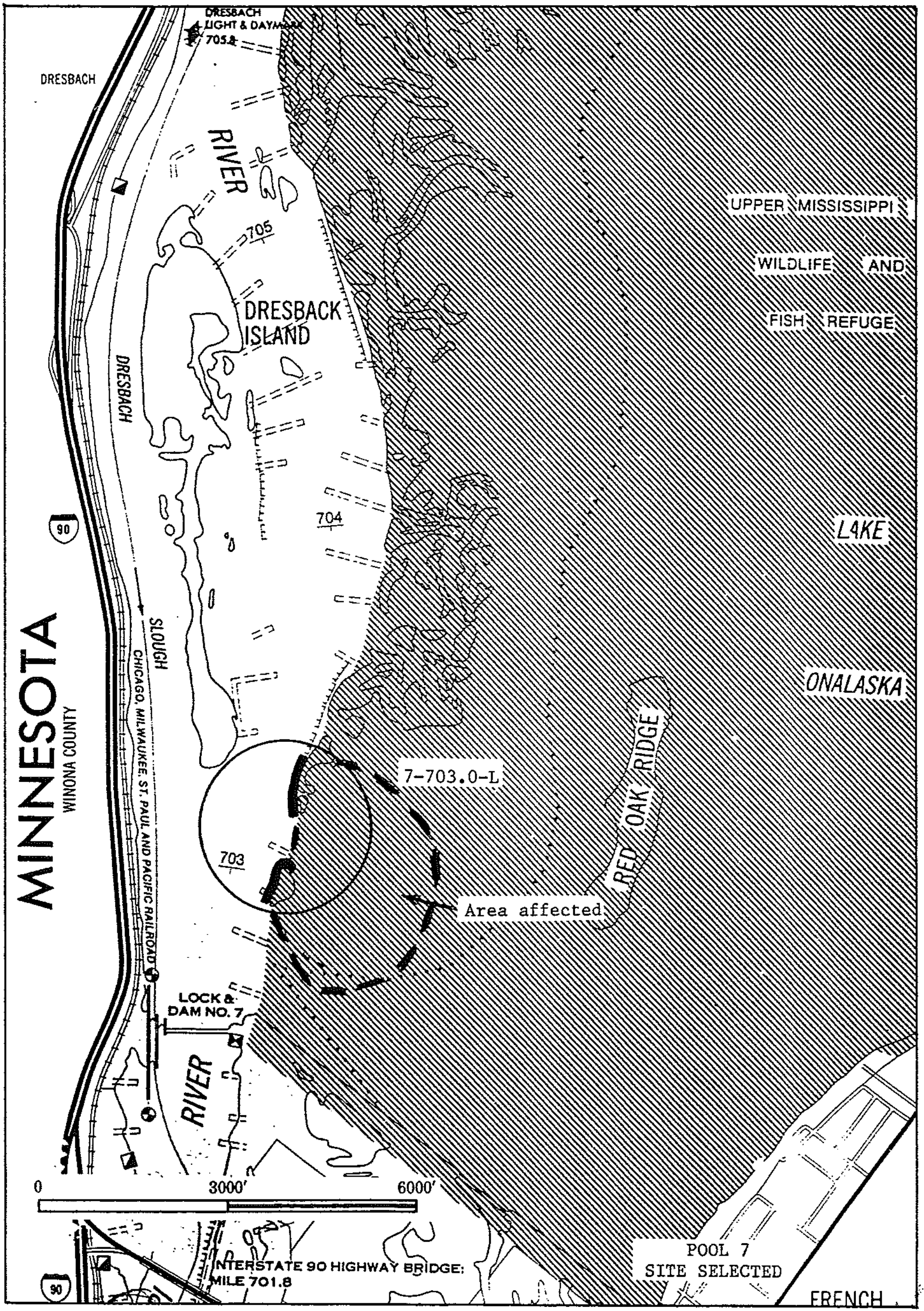

DRESBACH LIGHT & DAYMARK 705.8
DRESBACH
RIVER
705
DRESBACK ISLAND
DRESBACH
SLOUGH
CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD
MINNESOTA
WINONA COUNTY
90
704
703
UPPER MISSISSIPPI
WILDLIFE AND
FISH REFUGE
LAKE
ONALASKA
RED OAK RIDGE
7-703.0-L
Area affected
LOCK & DAM NO. 7
RIVER
0
3000'
6000'
INTERSTATE 90 HIGHWAY BRIDGE: MILE 701.8
POOL 7
SITE SELECTED
FRENCH

PLATE 18

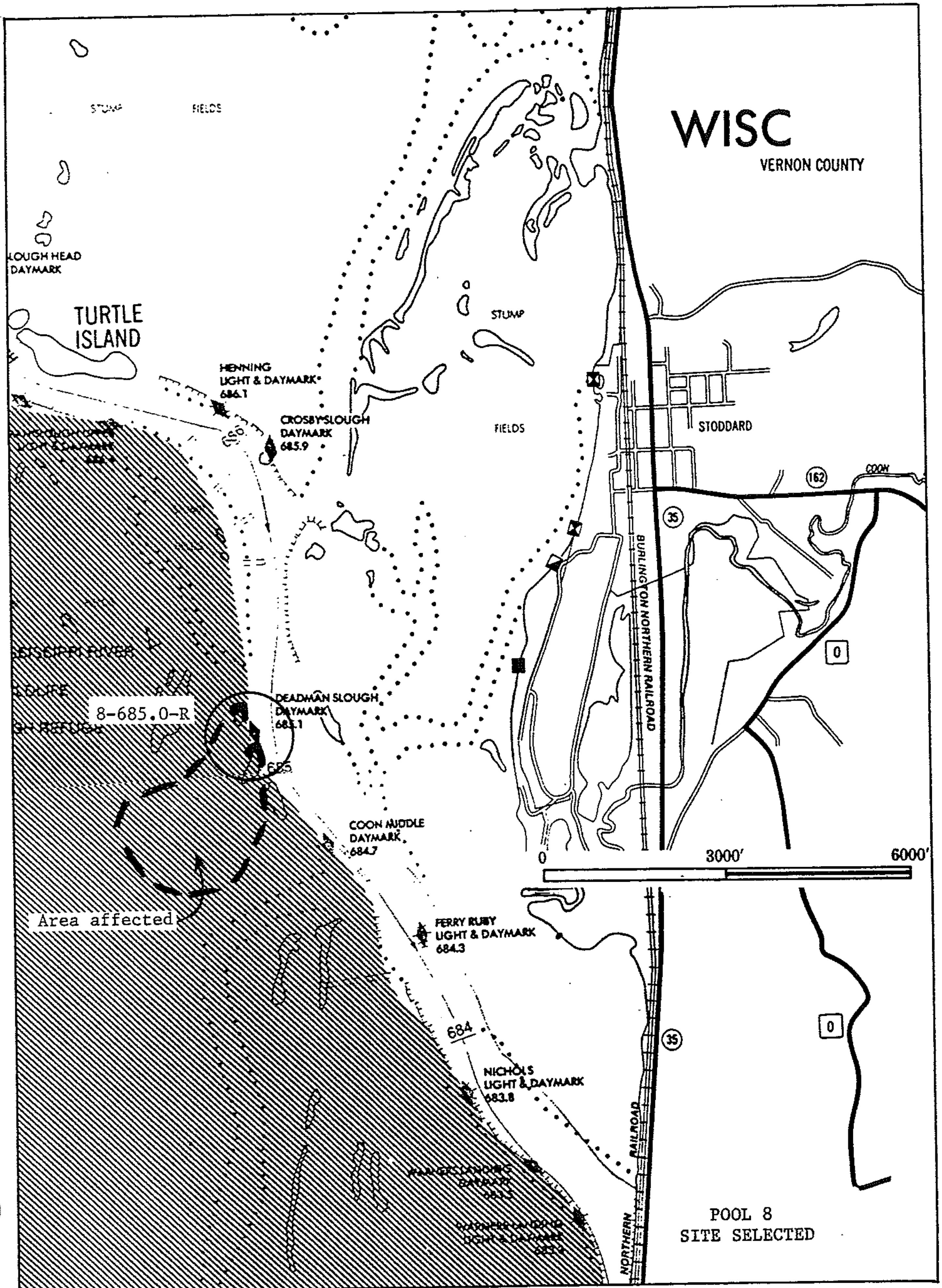
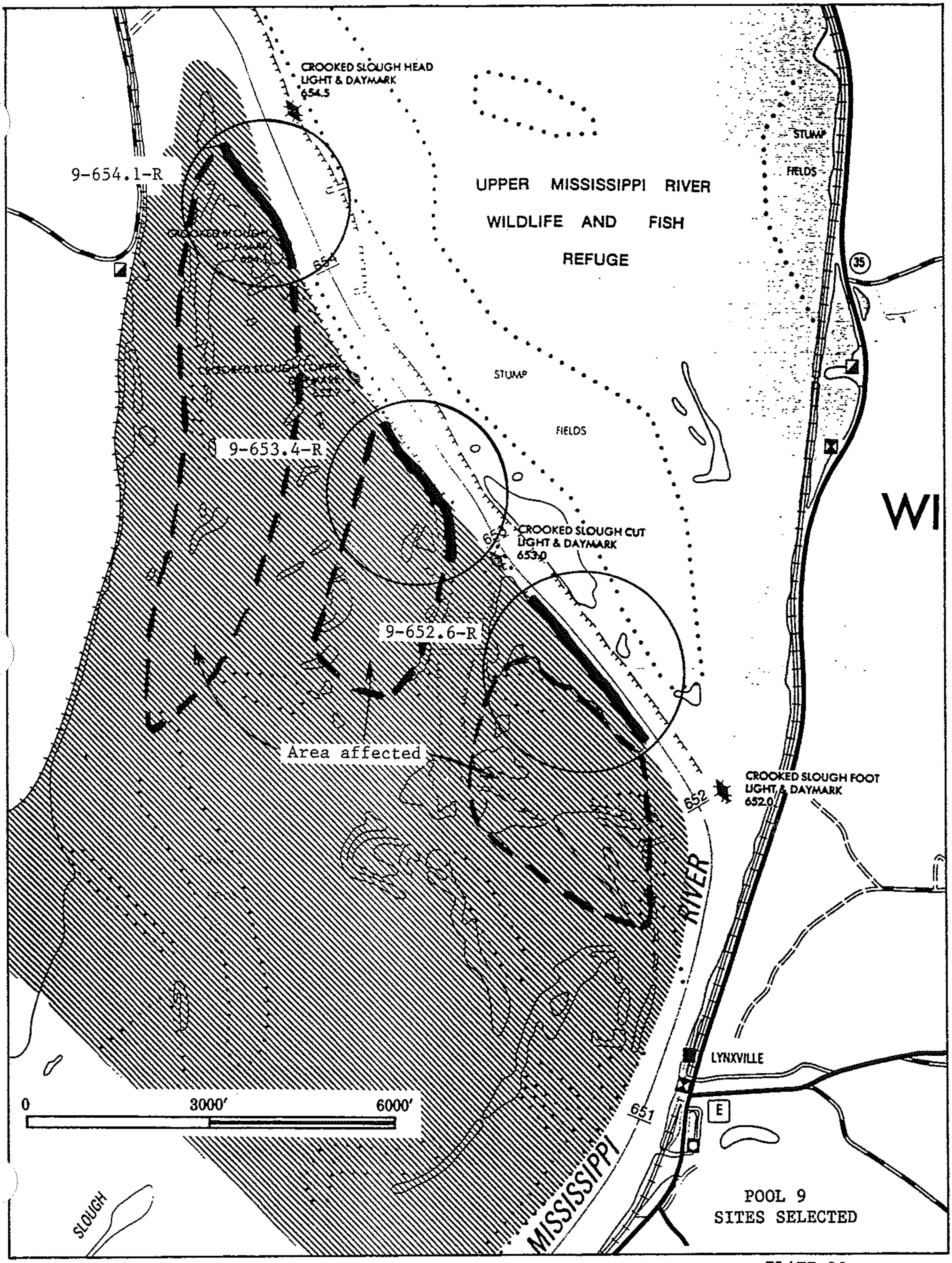

WISC
VERNON COUNTY
STUMP
FIELDS
LOUGH HEAD
DAYMARK
TURTLE
ISLAND
HENNING
LIGHT & DAYMARK
686.1
CROSBY SLOUGH
DAYMARK
685.9
STUMP
FIELDS
STODDARD
162
COON
35
BURLINGTON NORTHERN RAILROAD
0
8-685.0-R
DEADMAN SLOUGH
DAYMARK
685.1
685
COON MIDDLE
DAYMARK
684.7
0
3000'
6000'
Area affected
FERRY RUBY
LIGHT & DAYMARK
684.3
684
35
0
NICHOLS
LIGHT & DAYMARK
683.8
RAILROAD
NORTHERN
POOL 8
SITE SELECTED

PLATE 19

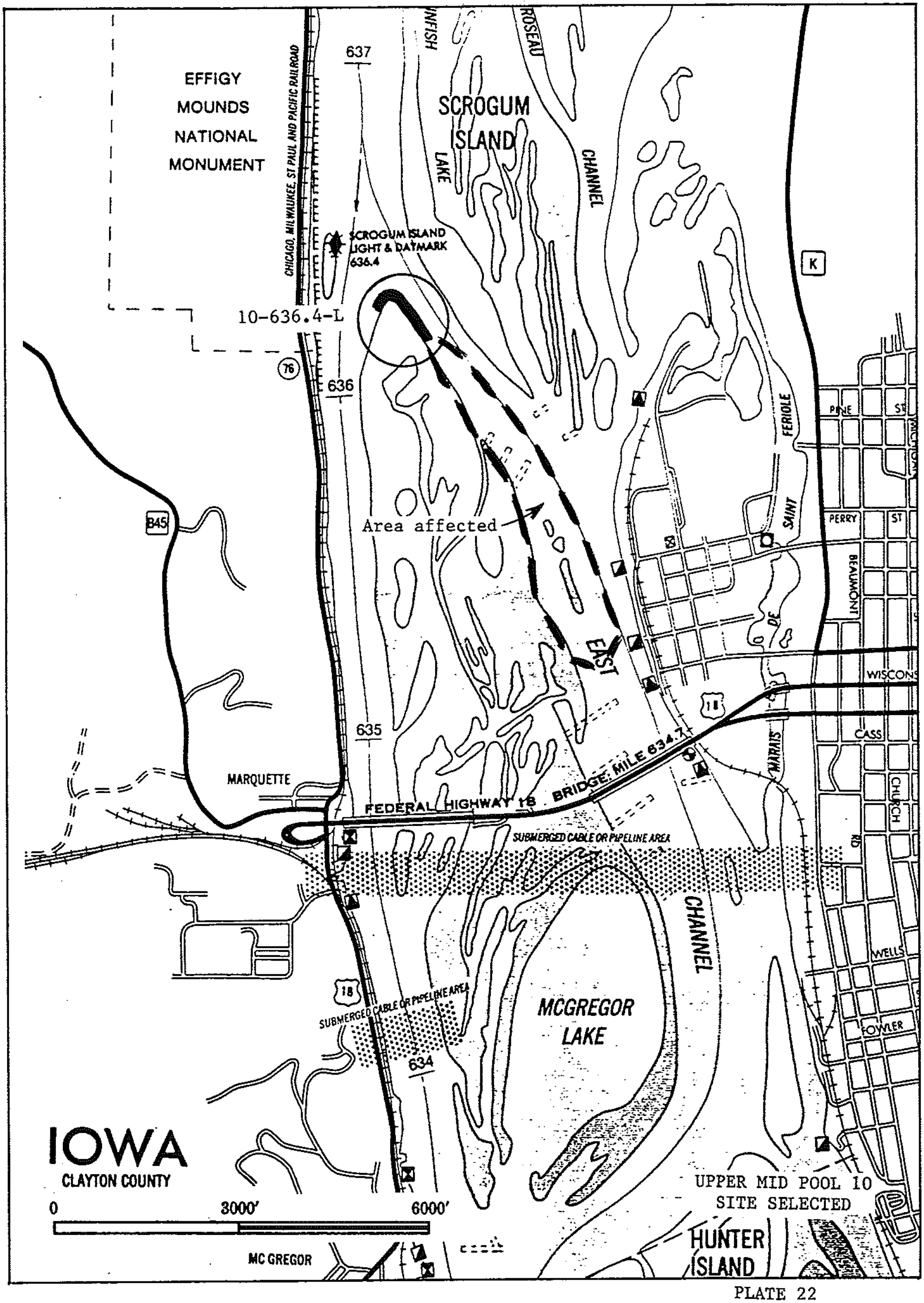


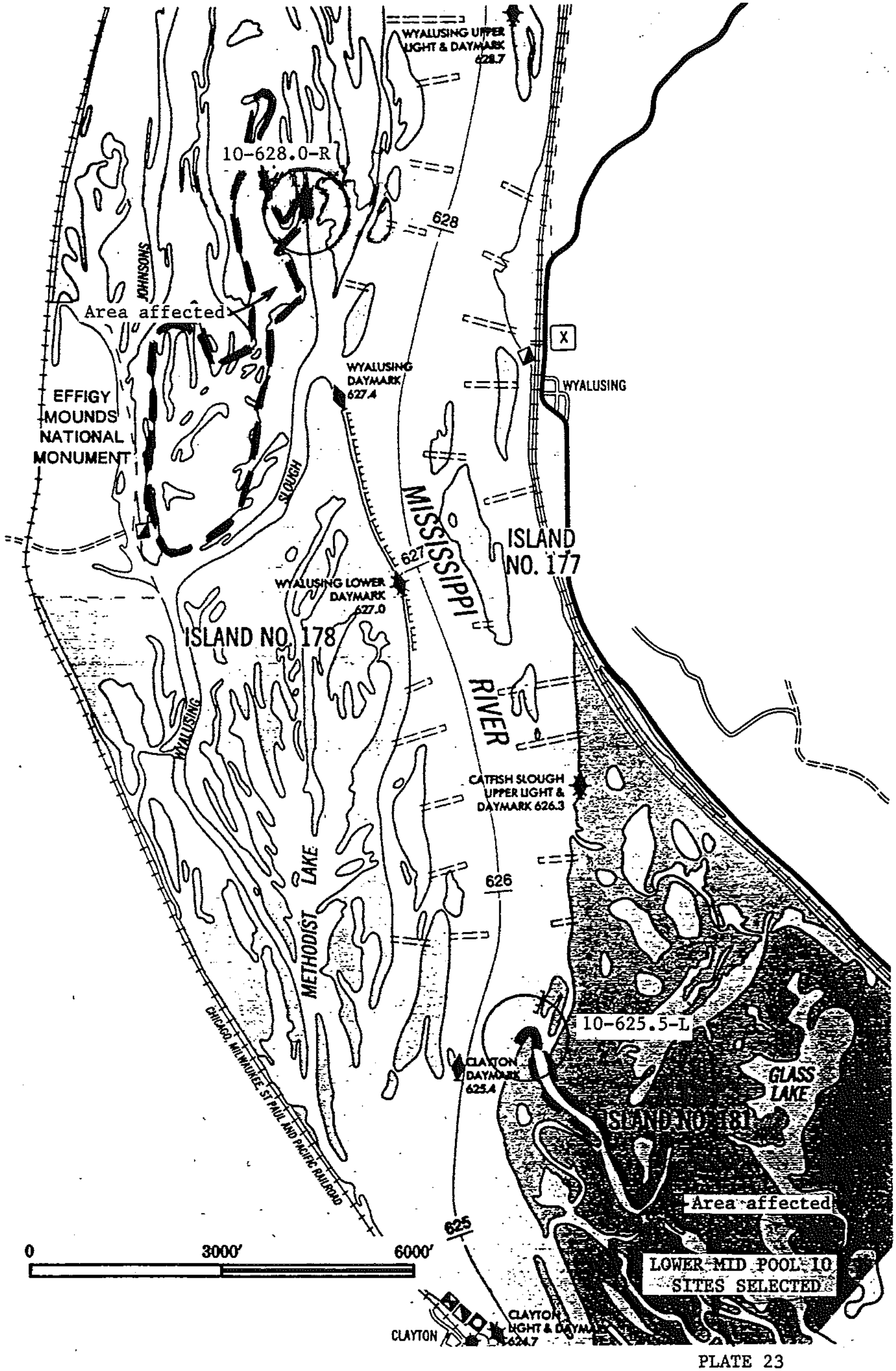
CROOKED SLOUGH HEAD
LIGHT & DAYMARK
654.5
9-654.1-R
UPPER MISSISSIPPI RIVER
WILDLIFE AND FISH
REFUGE
STUMP
FIELDS
35
STUMP
FIELDS
WI
9-653.4-R
CROOKED SLOUGH CUT
LIGHT & DAYMARK
653.0
9-652.6-R
Area affected
CROOKED SLOUGH FOOT
LIGHT & DAYMARK
652.0
652
RIVER
LYNXVILLE
E
651
MISSISSIPPI
SLOUGH
0
3000′
6000′
POOL 9
SITES SELECTED


PLATE 20


LOCK & DAM NO. 9
GIMMEL LAKE
MARTELLE LAKE
JOYCE LAKE
BUTTER LAKE
RITTENHOUSE LAKE
POLLY BAY LIGHT & DAYMARK 646.8
647
35
GORDON BAY
RIVER
10-646.4-R
SLOUGH
X52
646
HARPERS FERRY
JACKSON ISLAND
RYAN ISLAND
HARPERS ISLAND
SLOUGH
Area affected
364
645
GORDON BAY LIGHT & DAYMARK 644.9
TAYLOR LAKES
DELPHEY
MCDONALD
JAPAN SLOUGH
BURLINGTON NORTHERN RAILROAD
0
3000'
6000'
JACKSON ISLAND DAYMARK
MURRAY ISLAND
UPPER POOL 10
SITE SELECTED
644

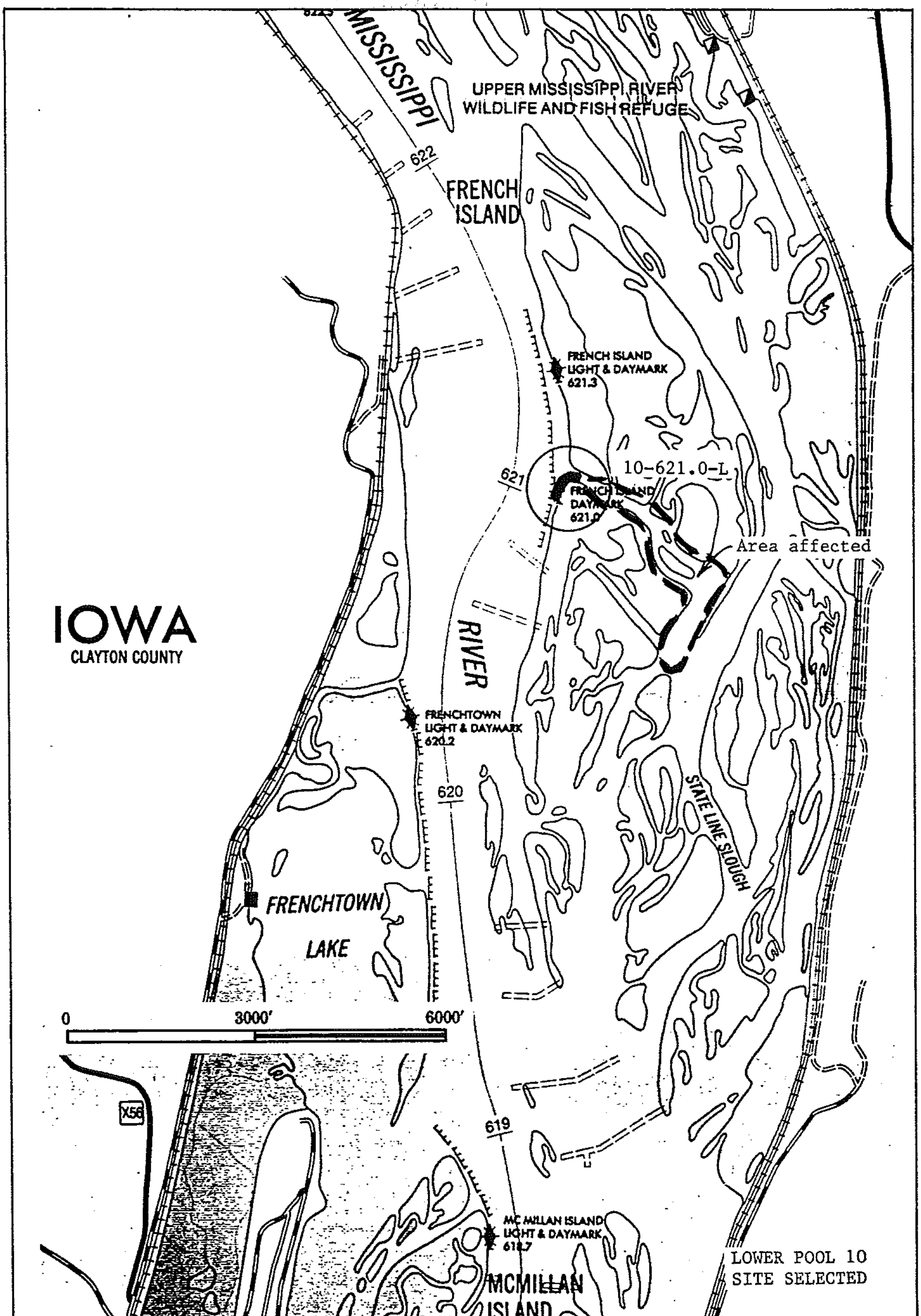
PLATE 21


EFFIGY
MOUNDS
NATIONAL
MONUMENT
CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC RAILROAD
637
SCROGUM
ISLAND
LAKE
CHANNEL
SCROGUM ISLAND
LIGHT & DAYMARK
636.4
10-636.4-L
76
636
K
PINE ST
FERIOLE
SAINT
PERRY ST
Area affected
B45
BEAUMONT
DE
EAST
WISCONS
18
CASS
635
BRIDGE MILE 634.7
MARAIS
MARQUETTE
FEDERAL HIGHWAY 18
CHURCH
SUBMERGED CABLE OR PIPELINE AREA
CHANNEL
WELLS
18
SUBMERGED CABLE OR PIPELINE AREA
MCGREGOR
LAKE
FOWLER
634
IOWA
CLAYTON COUNTY
0
3000'
6000'
UPPER MID POOL 10
SITE SELECTED
HUNTER
ISLAND
MC GREGOR



WYALUSING UPPER LIGHT & DAYMARK 628.7
10-628.0-R
628
JOHNSONS
Area affected
X
WYALUSING DAYMARK 627.4
WYALUSING
EFFIGY MOUNDS NATIONAL MONUMENT
SLOUGH
MISSISSIPPI RIVER
ISLAND NO. 177
627
WYALUSING LOWER DAYMARK 627.0
ISLAND NO. 178
WYALUSING
CATFISH SLOUGH UPPER LIGHT & DAYMARK 626.3
METHODIST LAKE
626
10-625.5-L
CLAYTON DAYMARK 625.4
GLASS LAKE
CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC RAILROAD
Area affected
0
3000′
6000′
625
LOWER MID POOL 10
SITES SELECTED
CLAYTON


PLATE 23




LOWER POOL 10
SITE SELECTED

PLATE 24

Attachment 2

Finding of No Significant Impact

Environmental Resources Branch
Planning Division

## FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act of 1969, the St. Paul District, Corps of Engineers has assessed the environmental impacts of the following project.

MISSISSIPPI RIVER BANK STABILIZATION
HABITAT REHABILITATION AND ENHANCEMENT PROJECT
POOLS 5 - 10, UPPER MISSISSIPPI RIVER
MINNESOTA, WISCONSIN, AND IOWA

The proposed action involves the stabilization of several existing islands in pools 6 through 10 of the Upper Mississippi River. The shorelines would be stabilized using various rockfill methods and bio-engineering techniques. The purpose of the project is to improve breeding, resting and feeding habitat for migratory birds and marsh wildlife and to improve fishery habitat on portions of the refuge by reducing erosion and backwater sedimentation. The project would improve approximately 1,500 acres of backwater habitat by stabilizing about 12,000 linear feet of existing shoreline. A description of the proposed action is contained in the alternatives section of the environmental assessment.

The finding of no significant impact is based on the following factors: (1) the proposed project would have substantial beneficial impacts on wildlife and fishery resources; (2) the project would have minor beneficial impacts on the cultural environment; (3) the project would have no appreciable effects on the social environment; (4) the project would have no appreciable effects on the aesthetic/recreation environment; and (5) continued coordination will be maintained with the appropriate State and Federal agencies. The environmental effects of the proposed project are discussed in the environmental effects section of the environmental assessment.

The environmental review process indicates that the proposed action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement will not be prepared.

31 Aug 95
Date

J. M. Wonsik
Colonel, Corps of Engineers
District Engineer

Attachment 3

Section 404(b)(1) Evaluation

SECTION 404(b)(1) EVALUATION

MISSISSIPPI RIVER BANK STABILIZATION
POOLS 5 - 10, UPPER MISSISSIPPI RIVER
MINNESOTA, WISCONSIN, AND IOWA

## I. PROJECT DESCRIPTION

A. Location and Background - Numerous shoreline erosion sites are located in pools 5 through 10 on the Minnesota, Wisconsin, and Iowa sides of the Mississippi River. All of the sites lie within the Upper Mississippi River Wildlife and Fish Refuge. The Refuge includes about 86,000 acres of aquatic habitats (main and side channels, sloughs, lakes, etc), 87,000 acres of wetlands (bottomland forest and other wetlands), and 31,000 acres of upland habitats (urban, rural, agricultural, dredged material, etc).

The Corps of Engineers is proposing to stabilize the shoreline of several existing islands in pools 6 through 10 of the Upper Mississippi River. Severe erosion is occurring at many locations, affecting backwater areas and habitat because of the loss of landmass and the associated increases in flow and/or sedimentation. Aquatic habitat is being lost and becoming shallower in the adjacent backwaters. Adverse effects to circulation patterns and water quality in the backwaters are also occurring. The general overall purpose of the proposed project is to preserve, restore and enhance fish and migratory waterfowl habitat on the refuge by reducing shoreline erosion and backwater sedimentation.

B. General Description - The proposed action involves the stabilization of about 12,000 feet of existing island shoreline in pool 6 (2 sites), pool 7 (1 site), pool 8 (1 site), pool 9 (3 sites), and pool 10 (5 sites). The stabilization would be accomplished using rockfill with the incorporation of bio-engineering techniques at some locations. Various methods would be used including: riprap; full or partial closures; offshore mounds; rock wedge; and groins. About 28,000 cubic yards of rockfill would be used to complete the work. Construction would take place using marine equipment. It is estimated that about 18,000 cubic yards of material may need to be dredged for access to the various sites.

C. Authority and Purpose - This project would be constructed under authority of Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662). The primary purpose of the proposed project is to preserve, restore and enhance fish and migratory bird habitat.

D. General Description of Dredged and Fill Material

1. General Characteristics of the Material - The stabilization material will be comprised of rockfill. Additional pervious fill may be placed in some locations to provide a foundation for riprap bank protection. At some of the sites bio-engineering stabilization techniques may also be used (i.e. trees or brush) in conjunction with the rockfill.

2. Quantity of Material - The current estimated quantities of various fill materials are as follows: Pervious (sand) fill - 6,000 cubic yards; rockfill - 27,850 cubic yards; trees or brush - unknown at this time.

3. Source of the Material - The pervious fill would be obtained from underwater locations near the erosion site (likely to be downstream of the existing island or eroding shoreline). The rockfill would be obtained from local operating quarries in Minnesota, Wisconsin, and/or Iowa.

E. Description of the Proposed Discharge Site

1. Location - The proposed fill activities would be located in pools 6 through 10 of the Upper Mississippi River at areas where erosion of the river banks is occurring, frequently adjacent to the main navigation channel.

2. Size - The areas where rockfill would be placed vary in length from 250 feet to about 3,000 feet of shoreline. Rockfill or pervious fill would be placed on about 4 acres of aquatic and less than an acre of terrestrial habitat.

3. Type of Site - The proposed discharge sites are eroding Mississippi River banks. The banks are usually near vertical and lack vegetation, both on the bank and offshore. The top of the banks frequently have hardwood trees, brush, and grasses. Immediate offshore depths range from 1 to 5 feet with depths up to 12 feet further away from the shore. One island breach has depths of over 15 feet.

4. Types of Habitat - The habitat at the proposed discharge site is a mix of bottomland forest, shrubs, grasses, and aquatic. Most of the areas directly affected by the fill activities provide low value habitat for fish and waterfowl.

5. Timing and Duration - The proposed discharge is expected to take place during the construction seasons of 1996 through 1999, usually for about a 7 month period.

F. Description of Disposal Method - The bank stabilization would be accomplished by obtaining rock from quarries and barging the rockfill to the site and placing it with a barge mounted crane. Dredging of material for construction access or for pervious fill would be done mechanically, placed into barges, transported to the placement site, and unloaded mechanically. Use of hydraulic dredging equipment is not anticipated.

II. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations - The substrate at the proposed discharge sites vary from fine silts and clays to sand. The bank stabilization would cover about 4 acres of this substrate, about 3 acres of which would be elevated to the point that it would be above the normal pool elevation.

B. Water Circulation, Fluctuation, and Salinity Determinations

1. Water

a. Salinity - Not applicable.

b. Water Chemistry - The proposed discharge activities would have no impact on water chemistry.

c. Clarity - During construction there may be localized short term reductions in water clarity due to turbidity. Over the long term, water clarity in the backwater areas would be improved because of the protection afforded by the islands and shoreline.

d. Color - The proposed discharge activities would have no impact on water color.

e. Odor - The proposed discharge activities would have no impact on water odor.

f. Taste - The proposed discharge activities would have no impact on water taste.

g. Dissolved Gas Levels - The proposed discharge activities would have no impact on dissolved gas levels.

h. Nutrients - The proposed discharge activities would have no impact on nutrient levels.

i. Eutrophication - The proposed discharge activities would have no impact on eutrophication.

j. Temperature - The proposed discharge activities would have no impact on water temperature.

2. Current Patterns and Circulation

a. Current Patterns and Flow - The proposed action would alter current patterns in the side channel areas where a partial or complete closure is proposed but would have no impacts on existing current patterns or flow where islands or shoreline is stabilized.

b. Velocity - In areas of partial or complete closures, current velocities into the backwater would be reduced. At the other locations, no adverse effects on adjacent areas is expected.

c. Stratification - The proposed discharge activities should have no impact on stratification.

d. Hydrologic Regime - The proposed discharge activities should have no impact on the hydrologic regime.

3. Normal Water Level Fluctuations - The proposed discharge activities would have no impact on normal water level fluctuations.

4. Salinity Gradients - Not applicable.

5. Actions Taken to Minimize Impacts - No special actions would be taken to minimize impacts.

C. Suspended Particulate/Turbidity Determinations - Bank stabilization would likely result in some temporary localized increases in turbidity during construction. Levels of turbidity would return to normal after construction.

D. Contaminant Determination - The pervious fill would be sand and would not introduce contaminants into the aquatic system. The rockfill for stabilization would come from a quarry and should be relatively contaminant free. There would be no contaminant effects associated with the placement of rockfill. Any bio-engineering techniques would also have no contaminant effects.

E. Aquatic Ecosystem and Organisms Determinations

1. Effects on Plankton - The proposed actions would have no effect on plankton.

2. Effects on Benthos - Some minor losses of benthos would result during the placement of the fill materials because about 4 acres of shallow water habitat would be affected. However, the overall purpose of the project is to improve the habitat quality of the remaining aquatic habitat.

3. Effects on Fish and Wildlife - The proposed activity would result in the direct conversion of 4 acres of shallow aquatic habitat to rockfill. This loss would have a negligible effect on the aquatic ecosystem of the Upper Mississippi River. Overall, the project should have a substantial beneficial effect on the fish and wildlife resources, thereby increasing the quality of habitat for both fish and wildlife.

4. Effects on Aquatic Food Web - The proposed action would have no appreciable effect on the aquatic food web.

5. Effects on Special Aquatic Sites

a. Sanctuaries and Refuges - The project area is a National Wildlife Refuge. The proposed action would improve habitat for fish and migratory birds.

b. Wetlands, Mudflats and Vegetated Shallows - Approximately 4 acres of aquatic habitat would be lost with the placement of rockfill material. This tradeoff is considered acceptable for the capability to reduce sedimentation in the backwater areas.

6. Threatened and Endangered Species - The proposed activity would have no appreciable effect on State or Federally listed threatened or endangered species. The proposed activities would not affect the suitability of the existing nesting sites for either bald eagles or ospreys on the refuge. There is no suitable habitat for Higgin's eye pearly mussel on the refuge. Critical habitat for the Higgins' eye pearly mussels the State listed threatened or endangered species would not be affected by the proposed construction activities.

7. Actions Taken to Minimize Impacts - If necessary, construction activities would be restricted during the fall and spring migration periods to minimize disturbance to waterfowl.

F. Proposed Disposal Site Determination

1. Mixing Zone Determination - Because the area of impact is expected to be very small and limited to the immediate area of construction, no mixing zone was calculated.

2. Determination of Compliance with Applicable Water Quality Standards - The proposed fill activity is expected to comply with applicable state water quality standards. Water quality certification will be obtained from the appropriate states and any imposed conditions would be complied with.

3. Potential Effects on Human Use Characteristics - The proposed fill activity would not have any adverse effect on human use of the project area.

G. Determination of Cumulative Effects on the Aquatic Ecosystem - The proposed action would result in the conversion of about 4 acres of shallow aquatic habitat to rockfill to improve the habitat quality of approximately 1,500 acres of aquatic habitat. This conversion would have no negative affect on the aquatic ecosystem of the refuge.

F. Determination of Secondary Effects on the Aquatic Ecosystem - No significant negative affects would result from the proposed project. The stabilization of shorelines would result in long-term benefits to aquatic vegetation and water quality and related secondary benefits to fish and wildlife are expected.

III. FINDINGS OF COMPLIANCE

The proposed discharge of dredged material would comply with the Section 404 (b) (1) guidelines of the Clean Water Act. No significant adaptations to the Section 404(b)(1) guidelines were made for this evaluation. No alternatives were identified that would accomplish the purposes of the proposed stabilization that would not involve the deposition of fill. Other alternatives considered included different bank stabilization procedures. They were not selected because they were not a effective.

The proposed discharge of dredged material would comply with all State water quality standards, Section 307 of the Clean Water Act, and the Endangered Species Act of 1973, as amended. The proposed action would have no adverse impacts on human health or welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, wildlife, and special aquatic sites. The life stages of aquatic organisms and other wildlife would not be adversely affected. No significant adverse effects on aquatic ecosystem diversity, productivity and stability, or on recreational, aesthetic, and economic values would occur.

On the basis of this evaluation, I specify that the proposed action complies with the requirements of the guidelines for discharge of dredged material.

AUG 31 1995
Date

J. M. Wonsik
Colonel, Corps of Engineers
District Engineer

Attachment 4

Letter of Intent

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111-4056

IN REPLY REFER TO:
FWS/ARW-SS

SEP - 8 1995

Colonel J.M. Wonsik
District Engineer
Saint Paul District, U.S. Army Corps of Engineers
Army Corps of Engineers Center
190 Fifth Street East
Saint Paul, Minnesota 55101-1638

Dear Colonel Wonsik:

Based on the draft Definite Project Report/Environmental Assessment (SP-17), "Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement Project" dated May 1995, the U.S. Fish and Wildlife Service (Service) will assure operation and maintenance requirements of the project will be accomplished in accordance with Section 906(e) of the Water Resources Development Act of 1986. In accordance with the policies stated in the Fourth Annual Addendum, the Service will perform the operation and maintenance requirements for this project as listed on page 57.

This project is located on Refuge lands. Therefore, the Service has completed its finding of no significant impact based on your letter of August 17, 1995, that the public review period produced no substantive changes in the Definite Project Report/Environmental Assessment.

The Agreement for Operation, Maintenance, and Rehabilitation will be signed upon receipt of the final version of that document. We look forward to continued progress on this project.

Sincerely,

John A. Blankenship Jr.

John A. Blankenship
Acting Regional Director

Enclosure: FONSI

# FINDING OF NO SIGNIFICANT IMPACT

For the reasons presented below and based on an evaluation of the information contained in the supporting references, I have determined that the Environmental Management Program project, Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement, is not a major Federal action that would significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. An Environmental Impact Statement will, accordingly, not be prepared.

## Reasons

The project purposes are to (1) preserve, restore, and enhance backwater fish and migratory bird habitat, including improving water quality, and (2) maintain a diversity of indigenous plan and animal communities on the Upper Mississippi River.

Alternatives considered included no Federal action and one action alternative. The selected plan includes placement of riprap on and off shore of islands eroding in the Mississippi River. Initially, 55 erosion areas were considered in Pools 5 through 10. Twelve project areas were selected, although some have since been stabilized through other projects, so an additional eight areas are being considered.

The project will not affect federally-listed endangered or threatened species nor their critical habitat. Bald eagles use the area, mainly for wintering and during migrations.. State-listed species are also found in the area. Levee construction work will be scheduled as necessary to avoid disturbance during sensitive months.

No standing structures would be affected by the project. The Iowa, Minnesota, and Wisconsin Historic Preservation Officers have made determinations of no effect on significant cultural resources for the original 12 project areas. Any additional selected project areas will require additional consideration for historic properties.

Unavoidable but negligible adverse effects would be the clearing of trees and earthmoving, and perhaps some dredging for access, and related minor construction impacts. Adverse effects would be more than offset by reduced erosion, improved water quality, and enhanced fish and wildlife habitat.

## Supporting References

1. Definite Project Report/Environmental Assessment (SP-17)
2. Compatibility Determination

John A. Blankenship 9/8/95

Acting Regional Director Date

Attachment 5

Coordination

W/18 FPM

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN DEPT. OF NATURAL RESOURCES

George E. Meyer
Secretary

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
TELEFAX 608-267-3579
TDD 608-267-6897

August 7, 1995

Colonel J. M. Wonsik
St. Paul District, U. S. Army Corps of Engineers
190 Fifth Street, East
St. Paul, Minnesota 55101-1638

Colonel

Dear ~~Colonel~~ Wonsik:

The Wisconsin Department of Natural Resources supports construction of the Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement Project, Pools 5-10, Upper Mississippi River.

Upon completion and final acceptance of the project by the Corps of Engineers and the U. S. Fish and Wildlife Service, the Wisconsin Department of Natural Resources will cooperate with the U. S. Fish and Wildlife Service to assure that operation and maintenance, and any mutually agreed upon rehabilitation, will be accomplished in accordance with section 906(e) of the Water Resources Development Act of 1986 and the current guidance contained in the Sixth Annual Addendum, May 1991, Appendix D, Section III.A.9 (pp. 21-22).

I look forward to completion of the Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement Project and the benefits it will provide to the Upper Mississippi River System.

Sincerely,

George

George E. Meyer
Secretary

a very important project
Thank you.

c: William Hartwig, Regional Director, USFWS
Terry Moe, Wisconsin DNR, La Crosse

United States Department of Agriculture

Natural Resources Conservation Service

6515 Watts Road, Suite 200
Madison, WI 53719-2726
(608) 264-5341

June 26, 1995

Mr. James T. Scott, District Engineer
COE, St. Paul District
ATTN: CENCS-PE-M-CW
190 Fifth Street East
St. Paul, MN 55101-1638

Dear Mr. Scott:

Subject: Definite Project Report/Environmental Assessment (SP-17)
Mississippi River Bank Stabilization - Habitat Rehabilitation & Enhancement Project
Pools 5-10, Upper Mississippi River

The Natural Resources Conservation Service (NRCS) staff has reviewed the environmental assessment, received June 19, 1995, with respect to requirements of the Farmland Protection Policy Act (FPPA).

Because the proposed construction will not irreversibly convert prime or unique farmland to non-agricultural use, provisions of the FPPA do not apply and submission of a Farmland Conversion Impact Rating (form AD-1006) is not required.

Thank you for the opportunity to comment on this proposed project. Please note that services formerly provided by the Soil Conservation Service are now the responsibility of the Natural Resources Conservation Service.

Sincerely,

for

PATRICIA S. LEAVENWORTH
State Conservationist

cc:
D. L. Omernik, ARSS, NRCS, Richland Center, WI
L. L. Natzke, ARSS, NRCS, Eau Claire, WI
K. W. Lubich, SSS, NRCS, Madison, WI
C. E. Wacker, ASSS, NRCS, Madison, WI

# Vernon County Board of Supervisors

COURT HOUSE
Viroqua, Wisconsin 54665

**Chairman:** GERALD SANDRY
County Office: Courthouse Annex, Viroqua 54665
608-637-7338
Residence: De Soto, WI 54624
608-648-3359

**Vice-Chairman:** LARRY A. SIEGER
Residence: 406 W. Decker St.
Viroqua, WI 54665
608-637-3995

**Clerk:** ROGER W. NOVY
Business: Courthouse Annex, Viroqua 54665
608-637-3569
Residence: Rt. 1, Hillsboro, WI 54634
608-489-3129

July 18, 1995

Mr. Don Powell, Corp. Engineer
Attn.: CENCS PE M-CW, District Engineer
US Corp. of Engineers, St. Paul District
190 5TH St. East
St. Paul, MN 55101-1638

Dear Mr. Powell:

The Mississippi River Boundary Waters Advisory Committee met on June 29, 1995 to discuss items pertaining to Mississippi River boundary waters and Vernon County.

We understand that the Mississippi River Bank Stabilization Program is now in progress. Our understanding is that 1/2 of the funding is for the cost of the study and 1/2 for the actual work. The committee would like to recommend cutting back on funding for the study and putting more of the money into stabilization work on the shoreline by using a Rip Rap type of shoreline.

We would be willing to meet with you to discuss our recommendations in this area. Please feel free to call me at (608) 648-3359 or leave a message at my office (608) 637-7338.

Sincerely,

Gerald Sandry
Vernon County Board Chairman

GS/bh

PE-M/Powell
fn:sandry

**DEPARTMENT OF THE ARMY**


ST. PAUL DISTRICT, CORPS OF ENGINEERS
ARMY CORPS OF ENGINEERS CENTRE
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638


August 15, 1995

REPLY TO
ATTENTION OF

Management and Evaluation Branch
Engineering and Planning Division

Mr. Gerald Sandry
Vernon County Board Chairman
Courthouse Annex
Viroqua, Wisconsin 54665

Dear Mr. Sandry:

Thank you for your letter of July 19, 1995, in response to the Mississippi River Bank Stabilization project that is currently being pursued by the Corps of Engineers. Because of the numerous erosion locations that had to be investigated and evaluated by the study team, the cost to accomplish the study may appear to be relatively high. However, the study cost to date is less than 8 percent of the estimated construction cost to stabilize the twelve selected island sites. After construction approval is received, field surveys will be obtained at each site so that plans and specifications can be prepared for the solicitation of construction bids. As with any project, engineering and design is necessary to determine what type of stabilization is necessary at each site and then to specify to a contractor what the structure should look like. The total of all these costs may be nearly 25 percent of the construction cost. We are working to keep these design costs to a minimum.

We are planning to use rock along the shoreline of the islands in the form of riprap, groins, or offshore mounds. Some bio-engineering concepts may also be incorporated into the design at specific sites, depending on location. The rock design will depend on the physical characteristics at the site. The most efficient rock design will be used. Detailed design will not begin until the final report is prepared and submitted to our Division Office (scheduled for early September). It is expected that construction at sites in Pool 10 will be accomplished in 1996 and sites in Pool 9 in 1997, depending on the availability of construction funds.

If you need any additional information, please contact Mr. Don Powell at the above address or by calling 612-290-5402. Thank you for your interest.

Sincerely,

Robert F. Post, P.E.
Chief, Engineering and Planning Division

PE-M

MINNESOTA HISTORICAL SOCIETY

July 10, 1995

Colonel James T. Scott
Corps of Engineers, Regulatory Branch
190 Fifth Street East
St. Paul, Minnesota 55101

Dear Colonel Scott:

Re: Upper Mississippi River System Environmental Management Program,
River Bank Stabilization, Habitat Rehabilitation and Enhancement
Pools 5-10
SHPO Number: 95-2973

Thank you for the opportunity to review and comment on the above program. It has been reviewed pursuant to the responsibilities given the State Historic Preservation Officer by the National Historic Preservation Act of 1966 and the Procedures of the Advisory Council on Historic Preservation (36CFR800).

The narrative on page DPR-25 indicates that literature searches and/or surveys of project areas will be necessary. However, the Environmental Assessment narrative on DPR-50 only mentions that there are no National Register listed or eligible sites in the project area. The need for further consideration of specific project sites should be acknowledged.

If you have any questions regarding our review of this project, please contact our Review and Compliance Section at 612-296-5462.

Sincerely,

Dennis A. Gimmestad
Government Programs and Compliance Officer

DAG:dmb

345 KELLOGG BOULEVARD WEST / SAINT PAUL, MINNESOTA 55102-1906 / TELEPHONE: 612-296-6126

**WILLIAM BURKE**
P.O. Box 399
Lansing, IA 52151

6-20-95

U.S. Corps of Engineers
Pool 9 EMP.

Please Consider this letter as input for the June meetings being held on the bank stabilization projects in Pool 9.

Two sites north of Lansing on the west bank were considered for some kind of man-made intervention. Myself and many others that duck hunt, X-Country ski and Canoe this area strongly recommend against any island building, diking or rip rapping in this very natural and wild area, particularly the Conway lake area. Some of the clearest water in pool 9 is in Conway lake. Beaver dams protect it from intrusion of silt from other water. Also, it is presently a very esthetic view from the River Road and artificial land forms, tree cutting, rock etc would blemish it for many people. High priority areas should be the protection of existing islands and shorelines bordering the Channel where most silt is being placed into the water and where the greatest prop wash damage is occurring. Thanks for your Consideration.

Sincerely, Bill Burke. Lansing Iowa

CORPS RESPONSE: The sites referred to in the Conway Lake area were not on the list of potential sites in the study. Sites considered and selected for stabilization are primarily along the main channel of the river.

US Army Corps of Engineers
St.Paul District

# Public Notice

**Project:** Mississippi River Bank Stabilization - Habitat Rehabilitation and Enhancement Project; Pool 5-10, Upper Mississippi River

**Date:** May 24, 1995

**In Reply Refer to:** Management & Evaluation Branch, Engineering & Planning Division

1. Project Location. The proposed project is located on the Upper Mississippi River National Wildlife and Fish Refuge in Pools 5-10. About 90 percent of the 200,000-acre study area is aquatic/wetland in nature. The remainder of the area is upland forest, urban, agricultural, and grasslands. Erosion of islands and side channels is allowing increased flow and associated sediments into backwater areas. This is contributing to the degradation in quality of the wildlife and fish habitat in the backwaters.

2. Project Authority. Section 1103 of the Water Resources Development Act of 1986 (Public Law 99-662) provides authorization and appropriations for an environmental management program for the Upper Mississippi River system that includes fish and wildlife habitat rehabilitation and enhancement. The proposed project would be funded and constructed under this authorization.

3. Project Purpose. The proposed project would reduce erosion of side channels; limit or reduce flows into side channels; and prevent erosion of existing barrier islands near the main navigation channel. The intent is to preserve, restore, and enhance backwater fish and migratory bird habitat and maintain or improve water quality in the backwaters.

4. Proposed Project. The selected plan of action would consist of rockfill bank stabilization or closures at several locations in Pools 6 through 10. The sites and pertinent information about each are shown on the back of this notice. The type of stabilization varies at each site, depending on the physical conditions at the site, but would basically use rockfill in the form of wedges along the bank, offshore mounds, riprap on the bank, and groins. About 28,000 cubic yards of rockfill would be used to stabilize 12,000 linear feet of shoreline, directly affecting 1,500 acres of backwater habitat. It is estimated that up to 18,000 cubic yards of material may need to be dredged to gain construction access at the sites. This material would be used in the bank stabilization structure or transported to an upland site. The estimated total direct construction cost of the project is $1.9 million.

5. Permits/Coordination.

a. General. The proposed project has been coordinated with the U.S. Fish and Wildlife Service and the Wisconsin, Iowa, and Minnesota Departments of Natural Resources.

b. State. The filling required for the proposed project is subject to regulation by the Wisconsin and Iowa Departments of Natural Resources in accordance with Section 401 and 404(t) of the Clean Water Act. A request for water quality certification will be made to the States of Wisconsin and Iowa.

c. Federal. An environmental assessment and Finding of No Significant Impact have been prepared in accordance with the requirements of the National Environmental Policy Act. The U.S. Fish and Wildlife Service was a cooperating agency throughout the process required by the Fish and Wildlife Coordination Act. As required by the Clean Water Act of 1977, a Section 404(b)(1) evaluation has been prepared.

6. <u>Summary of Environmental Impacts</u>.

a. <u>General</u>. Stated in Project Purpose Section.

b. <u>Water Quality</u>. The proposed project would have short-term construction related adverse effects because of access dredging and fill actions of bank stabilization. This is expected to cause an increase in suspended particulates during construction. No increase in contaminants in the aquatic environment is expected from the proposed placement of closures or rockfill stabilization structures. Long-term beneficial impacts on water clarity in the backwater areas should occur because of reduced erosion, control of side channel flows, and prevention of increased wave action associated with the loss of islands.

c. <u>Benthos</u>. The bank stabilization project would have a deleterious effect on the existing benthos because approximately 4 acres of aquatic area would be removed from benthic production. The only impacts of material removal in the project area would be experienced where construction access is needed (about 3 acres). These losses would be partially offset with the benthic recolonization of the rockfill areas.

d. <u>Fish</u>. Reducing or maintaining existing flows into the backwater areas would improve fish habitat. Dredging for construction access would provide about 3 acres of additional deepwater fish habitat for such species as bluegill, crappies, and largemouth bass. About 12,000 linear feet of rockfill would provide more diversity of habitat for species such as smallmouth bass, rock bass, walleye, and sauger.

e. <u>Wildlife</u>. The increased stability of the aquatic plant beds in the backwater areas that would be promoted by the bank stabilization would lead to increased use of the areas by waterfowl because of the food provided. Habitat diversity would also be increased.

f. <u>Archaeological-Historical</u>. No archaeological or historical sites listed on the National Register are known to be affected by the proposed project.

g. <u>Noise Pollution, Air Quality</u>. Minor short-term noise and air quality impacts would occur during project construction. No significant adverse impacts to the general public should occur because none of the construction sites are in the immediate vicinity of any residences.

7. <u>Applicable Federal Laws and Regulations</u>.

National Historic Preservation Act of 1966, as amended
Clean Air Act, as amended
Clean Water Act of 1977, as amended
National Environmental Policy Act of 1969, as amended
Fish and Wildlife Coordination Act of 1958, as amended
Endangered Species Act of 1973, as amended
National Wildlife Refuge System Administration Act
Land and Water Conservation Fund Act of 1965, as amended
Executive Order 11988, Floodplain Management, May 24, 1977
Executive Order 11990, Protection of Wetlands, May 24, 1977

8. <u>Report</u>. A Definite Project Report/Environmental Assessment is available to the public that describes the project and environmental impacts in detail. The report includes project drawings, a Finding of No Significant Impact, a Section 404(b)(1) evaluation, and letters of coordination with the U.S. Fish and Wildlife Service and the Wisconsin and Iowa Departments of Natural Resources. A free copy of this report or additional information can be obtained by writing to the address below or contacting Mr. Don Powell at (612) 290-5402.

9. <u>Request for a Public Hearing</u>. Any person may request a public hearing on the project. The request must be submitted in writing to the District Engineer within 30 days of the date of this notice. The request must clearly set forth the interest that may be affected and how the interest may be affected by this activity. <u>Public meetings</u> to discuss the proposed project and respond to questions have been tentatively scheduled for June 19 and June 20, 1995, in La Crosse and Prairie du Chien, Wisconsin, respectively. As soon as the dates and locations are firmly established, a separate notice will be sent to the individuals receiving this public notice.

10. <u>Public Comment Period</u>. Interested parties are invited to submit to this office written facts, arguments, or objections to this project within 30 days of the date of this notice. These statements should bear upon the suitability of the location and the adequacy of the plans and should, if appropriate, suggest any changes deemed desirable. All statements, oral or written, will become part of the official project file and will be available for public examination. All replies should be addressed to the **District Engineer, Corps of Engineers, St. Paul District, 190 Fifth Street East, St. Paul, Minnesota 55101-1638, <u>ATTN: CENCS-PE-M-CW</u>**.

James T. Scott
Colonel, Corps of Engineers
District Engineer

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ARMY CORPS OF ENGINEERS CENTRE
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

May 26, 1995

Management and Evaluation Branch
Engineering and Planning Division.

Enclosed is the Upper Mississippi River System-Environmental Management Program (UMRS-EMP) Draft Definite Project Report/Environmental Assessment for the Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement Project. This report was authorized by Section 1103 of the Water Resources Development Act of 1986. The initial list of potential stabilization sites was submitted by the U.S. Fish and Wildlife Service and the Minnesota, Wisconsin, and Iowa Departments of Natural Resources. The site selection process and general design of the project was conducted by the U.S. Army Corps of Engineers in cooperation with the participating agencies.

The 200,000-acre area is located on the Upper Mississippi River National Wildlife and Fish Refuge in pools 5-10. About 90 percent of the study area is aquatic/wetland in nature. The remainder of the area is upland forest, urban, agricultural, and grasslands. Erosion of islands and side channels is allowing increased flow and associated sediments into the backwater areas. This is contributing to the degradation in quality of the wildlife and fish habitat in the backwaters. The proposed project would reduce erosion of side channels; limit or reduce flows into side channels; and prevent erosion of existing barrier islands near the main navigation channel. The intent is to preserve, restore, and enhance backwater fish and migratory bird habitat and maintain or improve water quality in the backwaters. These objectives would be realized by stabilizing existing banks or by constructing closures at sites in pools 6 through 10. The method of bank stabilization depends on the physical conditions at the site, but would basically use rockfill to construct wedges, offshore mounds, riprap, or groins along the bank. About 28,000 cubic yards of rockfill would be used to stabilize 12,000 linear feet of shoreline, directly affecting 1,500 acres of backwater habitat. It is estimated that up to 18,000 cubic yards of material may need to be dredged to gain construction access at the sites. The estimated total direct construction cost of the project is $1.9 million.

The enclosed report includes project drawings, a Finding of No Significant Impact, a Section 404(b)(1) evaluation, and letters of coordination with the U.S. Fish and Wildlife Service and the Wisconsin and Iowa Departments of Natural Resources. Any questions regarding the report may be directed to Mr. Don Powell at (612) 290-5402 or the address below. Any written comments should be sent to the following address within 30 days of the date of this letter: District Engineer, Corps of Engineers, St. Paul District, 190 Fifth Street East, St. Paul, Minnesota 55101-1638, ATTN: CENCS-PE-M-CW.

Sincerely,

James T. Scott
Colonel, Corps of Engineers
District Engineer

Enclosure

# PUBLIC MEETINGS
## for the
## MISSISSIPPI RIVER BANK STABILIZATION PROJECT
## ENVIRONMENTAL MANAGEMENT PROGRAM

The U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service (USFWS), and the Minnesota, Wisconsin, and Iowa Departments of Natural Resources have been involved in a study of bank erosion sites in pools 5 through 10 of the Mississippi River. The study was conducted as part of the Upper Mississippi River System Environmental Management Program that was authorized by Congress in 1986. Many of the eroding sites are affecting backwater areas because of the loss of landmass and the associated increases in flow, sedimentation, and turbidity. This is degrading the quality of the wildlife and fish habitat in the backwater areas. The bank stabilization study investigated 34 sites submitted by the States and USFWS and evaluated the effect on the backwater area of stabilizing each site. Using habitat analyses and cost evaluation procedures, 12 of the sites were selected for implementation to rehabilitate and enhance backwater habitat. The selection was also based on the cost for the habitat benefits gained, agency priorities, location, available funds, and construction considerations. The selected sites are located in pools 6, 7, 8, 9, and 10. The general locations of the sites and pertinent information are shown on the other side of this sheet. The total cost to stabilize the 12 sites is estimated to be about $1.9 million.

Prior to requesting construction approval, we would like to discuss the proposed project, answer your questions, and obtain your input. In order to do this, two public meetings will be held at the places shown below.

| Date | City | Location |
|---|---|---|
| June 19, 1995 | La Crosse, WI | U.S. Fish and Wildlife Service Resource Center 555 Lester Avenue (see map) |
| June 20, 1995 | Prairie du Chien, WI | Peoples State Bank 301 E. Blackhawk Ave |

Each of the meetings will begin at 7:00 pm. Representatives from the agencies will be present to informally discuss the proposed project with you and respond to your questions. Copies of the draft Definite Project Report/Environmental Assessment for the proposed project will also be available. Please tell others that may be interested in this project about the meetings. If you have comments but are unable to attend either of the meetings, please send your comments to the District Engineer, Corps of Engineers, St. Paul District, 190 Fifth Street East, St. Paul, Minnesota 55101-1638, ATTN: CENCS-PE-M-CW, or contact Mr. Don Powell at 612-290-5402.

US Army Corps
of Engineers®
St. Paul District

# News Release

Release # PA-18-95
June 7, 1995

*For immediate release*

Peter Verstegen 612/290-5202 (o)
612/430-0316 (h)
Don Powell 612/290-5402 (o)

## Corps seeks public comment on bank stabilization project

The U.S. Army Corps of Engineers seeks public comment on 12 sites selected for a bank stabilization project designed to control erosion and to improve fish and wildlife habitat along the Mississippi River between Trempealeau, Wis., and Guttenberg, Iowa. The project is part of the Environmental Management Program.

Selected project locations are Blacksmith Slough, Trempealeau Daymark, Heron and Trapping Islands, Upper Harpers Slough, Middle Harpers Slough, Lower Harpers Slough, Billy Slough, East Channel in Pool 10, Norwegian Slough, Island 181 (Catfish Slough), and Duck Lake Chute.

Before construction begins, the Corps and other federal and agencies are requesting public comment at two public meetings about the projects. Both meetings begin at 7 p.m.

The first meeting is in Onalaska, Wis. on June 19 at the U.S. Fish and Wildlife Service Resource Center, 555 Lester Ave.

The second meeting is in Prairie du Chien on June 20 at Peoples State Bank, 301 E. Blackhawk Ave.

Representatives from the Corps, the U.S. Fish and Wildlife Service, and Departments of Natural Resources for Iowa, Minnesota and Wisconsin will be at the meetings to present an overview of the projects and to answer questions.

Project construction includes stabilizing the shoreline with rock, modifying side channel openings, and building groins. A groin is a structure that projects out from the shoreline into the water to protect against bank erosion.

Those unable to attend either meeting may write to:

District Engineer
U.S. Army Corps of Engineers
St. Paul District
Attn. CENCS-PE-M-CW
190 Fifth St., East
St. Paul, MN 55101-1638

Individuals may also phone Don Powell, the technical manager, at 612-290-5402.

###

MISSISSIPPI RIVER BANK STABILIZATION
PUBLIC MEETINGS
6/19/95 & 6/20/95
ENVIRONMENTAL MANAGEMENT PROGRAM

AGENDA

Welcome and Introductions

Purposes of Meeting

Project Description

Schedule

Discussion

# MISSISSIPPI RIVER BANK STABILIZATION PROJECT
## ENVIRONMENTAL MANAGEMENT PROGRAM

PROJECT PURPOSE
- Stabilize erosion sites to reduce loss of fish and wildlife habitat

STUDY PARTICIPANTS
- U.S. Corps of Engineers, St. Paul District
- U.S. Fish and Wildlife Service (Winona, La Crosse, McGregor)
- Minnesota Department of Natural Resources (Lake City)
- Wisconsin Department of Natural Resources (La Crosse, Prairie du Chien)
- Iowa Department of Natural Resources (Guttenberg)

AUTHORIZATION
- Upper Mississippi River System Environmental Management Program (EMP)

AREA OF STUDY
- Mississippi River pools 5 through 10

EROSION SITES
- 55 initial sites were considered
- Field visits reduced to 34 sites
- Evaluation selected 12 sites based on:
  - cost for habitat benefits received
  - agency priorities
  - site location
  - construction considerations
  - available funds

SELECTED SITES
- 12 sites (2 in pool 6; 1 in pool 7; 1 in pool 8; 3 in pool 9; 5 in pool 10)
- Stabilization techniques:
  - shaping bank and placing rock riprap
  - rockfill wedge at toe of bank
  - offshore rock mound
  - rock groins perpendicular to shoreline
  - bio-engineering (vegetation, mats, trees, etc)
- 28,000 cubic yards of rockfill to reduce erosion of 12,000 of shoreline
- Positive affects to 1,500 acres of aquatic backwater habitat
- Total construction cost = $1.9 million
- If some sites completed by other means, additional sites could be selected

CONSTRUCTION SCHEDULE
- Next 4 years (through 1999)
- Sequence = (1) pool 10; (2) pools 8 & 9; (3) pool 6; (4) pool 7

COMMENTS/QUESTIONS
- ATTN: CENCS-PE-M-CW
  District Engineer
  U.S. Corps of Engineers, St Paul District
  190 Fifth Street East
  St. Paul, MN 55101-1638

- Don Powell (612-290-5402)

6/15/95

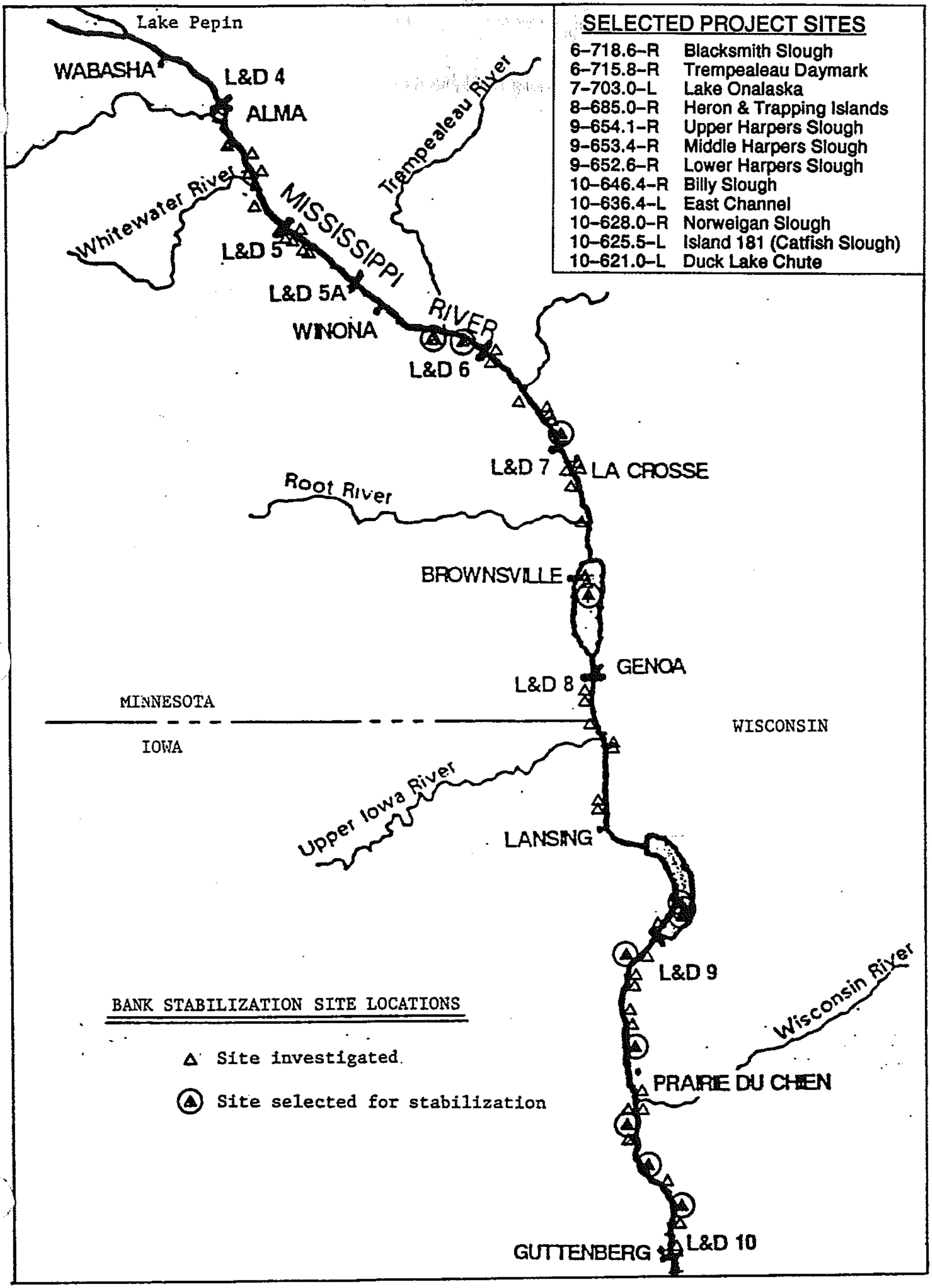
# Erosion Sites

| | Sites in Pool 5 | | Sites in Pool 5A | | Sites in Pool 6 | | Sites in Pool 7 | | Sites in Pool 8 | | Sites in Pool 9 | | Sites in Pool 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Name | Number | Name | Number | Name | Number | Name | Number | Name | Number | Name | Number | Name |
| 1 | 5-749.7-R | Island 42 Closure | 5A-736.8-R | Small Island | 6-718.6-R | Blacksmith Slough | 7-713.3-L | Long Lake Inlet Island | 8-699.3-L | N. Taylor Island | 9-677.4-R | Dark Slough | 10-646.5-L | Gordon Bay Inlet |
| 2 | 5-746.7-L | Roebuck's Run | 5A-736.7-R | Head of Burleigh Slough | 6-715.8-R | Trempealeau Daymark | 7-712.3-R | Richmond Island | 8-698.5-L | S. Taylor Island | 9-676.7-R | Twin Island | 10-646.4-R | Billy Slough |
| 3 | 5-745.6-L | Sand Run | 5A-736.5-L | Kieselhorse | | | 7-707.6-L | Island 91 | 8-698.2-R | W. Channel Island | 9-673.5-R | Side Chute (Island 135) | 10-644.3-L | Jackson Island |
| 4 | 5-745.5-R | Fisher Island Daymark | 5A-735.7-R | Island 56 | | | 7-703.8-L | Old Cormorant Island 1 Island 2 | 8-696.4-R | Broken Arrow (Target Lake) | 9-671.1-L | Head of Battle Island | 10-643.1-L | Gordon Bay Upper Daymark |
| 5 | 5-744.5-L | Lost Island Chute | 5A-735.2-R | Island 57 | | | 7-703.5-L | N. Red Oak Ridge | 8-693.8-R | Root River | 9-671.0-L | Battle Island | 10-641.1-L | Island 166 |
| 6 | 5-741.5-R | Minneiska Island | | | | | 7-703.1-L | S. Red Oak Ridge | 8-688.4-L | Brownsville Daymark | 9-666.1-R | Hummingbird Slough | 10-637.8-L | Roseau Slough |
| 7 | | | | | | | 7-703.0-L | L. Onalaska Island B Island C | 8-685.2-L | East Island | 9-664.9-R | Lansing Light | 10-636.4-L | East Channel |
| 8 | | | | | | | | | 8-685.0-R | Heron & Trapping Islands | 9-654.1-R | Upper Harper's Slough | 10-631.8-L | Snake Island |
| 9 | | | | | | | | | | | 9-653.4-R | Middle Harper's Slough | 10-628.7-L | Wyalusing Upper Light |
| 10 | | | | | | | | | | | 9-652.6-R | Lower Harper's Slough | 10-628.0-R | Norwegian Slough |
| 11 | | | | | | | | | | | 9-648.0-R | Dam 9 Island | 10-626.5-R | Island 177 |
| 12 | | | | | | | | | | | | | 10-625.5-L | Island 181 (Catfish Slough) |
| 13 | | | | | | | | | | | | | 10-623.3-L | Hovie Island |
| 14 | | | | | | | | | | | | | 10-621.0-L | Duck Lake Chute |
| 15 | | | | | | | | | | | | | 10-620.1-L | Frenchtown Light (Hole in the Wall) |
| 16 | | | | | | | | | | | | | 10-616.0-L | Ferry Slough Light |

## Site Selection Information

| Site | | Total Cost | O&M Cost | Habitat value | | | Agency Priority (Hi/Med/Lo) | | | | | Final site selection | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number | Name | ($000) | ($/yr) | Acres affected | AAHU gain | Cost/ AAHU | COE | FWS | MN | WI | IA | Select/ Defer | Program * | Reason(s) selected or deferred |
| 5-749.7-R | Island 42 | 350 | 700 | 40 | 1.002 | $30,070 | H | - | - | H | - | Defer | - | >$2K/HU; low habitat gain |
| 5-746.7-L | Roebucks Run | 183 | 400 | 40 | 3.174 | $4,960 | - | - | - | L | - | Select | CMP | CMP may do in FY 94/95 (likely) |
| 5-745.8-L | Sand Run | 136 | 200 | 120 | 12.114 | $960 | H | H 5 | - | L | - | Select | OMP | High agency priority; fee title land; good OMP candidate |
| 5-745.5-R | Fisher Island Daymark | 47 | 100 | 10 | 0.813 | $5,030 | H | - | - | L | - | Select | CMP | Low cost; on Corps fee title land; good CMP candidate |
| 5-744.5-L | Lost Island Chute | 90 | 200 | 100 | 6.571 | $1,180 | H | H 8 | - | L | - | Select | OMP | High agency priority; fee title land; good OMP candidate |
| Total Pool 5 | | 806 | 1,600 | 310 | | | | | | | | | EMP=$0 | |
| 5A-736.7-R | Burleigh Slu | 40 | 100 | 5 | 0.143 | $24,220 | - | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 5A-735.7-R | Island 56 | 92 | 200 | 10 | 0.325 | $24,370 | H | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 5A-735.2-R | Island 57 | 286 | 600 | 10 | 0.325 | $75,750 | H | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| Total Pool 5A | | 418 | 900 | 25 | | | | | | | | | EMP=$0 | |
| 6-718.6-R | Blacksmith Slough | 180 | 400 | 60 | 8.630 | $1,800 | H | - | - | M | - | Select | EMP | Moderate habitat gain & agency suppor near high priority site |
| 6-715.8-R | Trempealeau Daymark | 295 | 600 | 125 | 32.506 | $780 | H | H 4 | - | H | - | Select | EMP | High agency priority, habitat gain, and area affected |
| Total Pool 6 | | 475 | 1,000 | 185 | | | | | | | | | EMP=$475,000 | |
| 7-713.3-L | Long Lake Inle | 52 | 100 | 5 | 0.126 | $35,370 | - | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 7-712.3-R | Richmond Island | 79 | 200 | 55 | 11.414 | $600 | H | H 3 | - | L | - | Select | OMP | High agency priority; fee title land; good OMP candidate |
| 7-703.8-L | Old Cormorant | 84 | 200 | 40 | 7.583 | $960 | - | - | - | - | - | Done | - | Completed in FY93 by CMP; (USFWS) |
| 7-703.5-L | N. Red Oak Ridge | 144 | 300 | 10 | 0.840 | $14,790 | H | H 9 | - | L | - | Select | OMP | Cultural resources; fee title land; in FY95 OMP budget |
| 7-703.1-L | S. Red Oak Ridge | 167 | 300 | 10 | 0.840 | $17,040 | H | H 9 | - | L | - | Select | OMP | Cultural resources; fee title land; in FY95 OMP budget |
| 7-703.0-L | L. Onalaska Island B & C | 257 | 500 | 190 | 42.913 | $510 | H | H 7 | - | M | - | Select | EMP | Large area affected; high agency priority & habitat gain |
| Total Pool 7 | | 783 | 1,600 | 310 | | | | | | | | | EMP=$256,000 | |
| 8-699.3-L | N. Taylor Island | 246 | 500 | 10 | 0.486 | $43,700 | H | - | - | L | - | Defer | - | >$2K/HU; low habitat gain, agency priority, & area affected |
| 8-698.5-L | S. Taylor Island | 31 | 100 | 15 | 0.398 | $6,800 | L | - | - | L | - | Defer | - | >$2K/HU; low habitat gain, agency priority, & area affected |
| 8-696.6-R | Broken Arrow (Target Lake) | 63 | 100 | 45 | 3.839 | $1,410 | H | - | - | L | - | Defer | - | Low agency priority; low cost; <$2K/HU add if funds permit |
| 8-685.0-R | Heron & Trapping Isl | 49 | 100 | 115 | 16.243 | $260 | H | H 6 | - | H | - | Select | EMP | High agency priority, habitat benefits, and area affected |
| Total Pool 8 | | 390 | 800 | 185 | | | | | | | | | EMP=$49,000 | |
| 9-677.4-R | Dark Slough | 324 | 600 | 5 | 0.052 | $535,850 | - | - | - | M | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| 9-666.1-R | Hummingbird Slough | 82 | 200 | 120 | 17.372 | $410 | - | - | - | L | H 3 | Select | OMP | Lg area affected; high agency priority; good OMP candidate |
| 9-664.9-R | Lansing Light | 256 | 500 | 40 | 5.113 | $4,300 | - | - | - | M | H 4 | Defer | - | >$2K/HU; low habitat gain |
| 9-654.1-R | Upper Harper's Slu | 280 | 600 | 250 | 57.184 | $420 | H | H 1 | - | H | H 5 | Select | EMP | High agency priority, habitat gain, and area affected |
| 9-653.4-R | Middle Harper's Slu | 39 | 100 | 10 | 2.354 | $1,440 | H | H 1 | - | H | H 5 | Select | EMP | High agency priority; near other high priority sites |
| 9-652.6-R | Lower Harper's Slu | 336 | 700 | 150 | 35.344 | $820 | H | H 1 | - | H | H 5 | Select | EMP | High agency priority, habitat gain, and area affected |
| 9-648.0-R | Dam 9 Island | 57 | 100 | 5 | 0.695 | $7,090 | L | - | - | L | - | Defer | - | >$2K/HU; low habitat gain & area affect |
| Total Pool 9 | | 1,374 | 2,800 | 580 | | | | | | | | | EMP=$655,000 | |
| 10-646.4-R | Billy Slough | 587 | 1100 | 350 | 79.224 | $640 | H | H 2 | - | H | H | Select | EMP | High agency priority, habitat gain, and area affected |
| 10-637.8-L | Roseau Slough | 59 | 100 | 35 | 1.456 | $3,500 | - | - | - | M | M 9 | Defer | - | Marginal habitat gain; agency support; add if funds permit |
| 10-636.4-L | East Channel | 172 | 300 | 65 | 11.167 | $1,320 | - | - | - | H | H 2 | Select | EMP | High agency priority; moderate habitat gain & cost |
| 10-628.7-L | Wyalusing Up | 51 | 100 | 25 | 0.824 | $5,330 | - | - | - | M | - | Defer | - | >$2K/HU; low habitat gain; med suppor |
| 10-628.0-R | Norwegian Slough | 62 | 100 | 70 | 3.496 | $1,520 | - | - | - | - | M 6 | Select | EMP | Moderate habitat gain & agency suppor low cost |
| 10-625.5-L | Isl 181 (Catfish | 39 | 100 | 55 | 4.670 | $730 | - | - | - | H | - | Select | EMP | Lg area affect; low cost; hi agncy pr |
| 10-621.0-L | Duck Lake Chu | 68 | 100 | 45 | 7.349 | $790 | H | - | - | H | H | Select | EMP | Hi hab. benefits & agency priority; lo |
| Total Pool 10 | | 1,039 | 1,900 | 645 | | | | | | | | | EMP=$928,000 | |

*EMP=Environmental Management Program; OMP=Operational Management Plan; CMP=Channel Maintenance Program


SELECTED PROJECT SITES
6-718.6-R Blacksmith Slough
6-715.8-R Trempealeau Daymark
7-703.0-L Lake Onalaska
8-685.0-R Heron & Trapping Islands
9-654.1-R Upper Harpers Slough
9-653.4-R Middle Harpers Slough
9-652.6-R Lower Harpers Slough
10-646.4-R Billy Slough
10-636.4-L East Channel
10-628.0-R Norweigan Slough
10-625.5-L Island 181 (Catfish Slough)
10-621.0-L Duck Lake Chute
Lake Pepin
WABASHA
L&D 4
ALMA
Trempealeau River
Whitewater River
MISSISSIPPI RIVER
L&D 5
L&D 5A
WINONA
L&D 6
L&D 7
LA CROSSE
Root River
BROWNSVILLE
GENOA
L&D 8
MINNESOTA
IOWA
WISCONSIN
Upper Iowa River
LANSING
L&D 9
Wisconsin River
PRAIRIE DU CHIEN
GUTTENBERG
L&D 10
BANK STABILIZATION SITE LOCATIONS
Site investigated
Site selected for stabilization

# MISSISSIPPI RIVER BANK STABILIZATION ENVIRONMENTAL MANAGEMENT PROGRAM

## ACCOMPLISHMENTS

- Stabilize 12,000 feet of shoreline
- Save 5,500 feet of shoreline during life of project
- Reduce sediment–laden flow into some backwater areas
- Improve or maintain 1,500 acres of backwater habitat

## CONSTRUCTION COST

| | |
|---|---|
| POOL 6 | $372,000 |
| POOL 7 | $207,000 |
| POOL 8 | $52,000 |
| POOL 9 | $549,000 |
| POOL 10 | $720,000 |
| TOTAL CONSTRUCTION | $1,900,000 |
| ENGINEERING | $475,000 |
| INSPECTION | $132,000 |
| TOTAL PROJECT COST | $2,507,000 |

TOTAL O&M COST

$4,900/yr

## SCHEDULE

| | |
|---|---|
| Final DPR | July '95 |
| Advertise | Winter '96 |
| Construction | 1996–99 |

MISSISSIPPI RIVER BANK STABILIZATION PROJECT
ENVIRONMENTAL MANAGEMENT PROGRAM

Summary of Questions and Answers at the Public Meetings

**Onalaska Meeting**
June 19, 1995

Q: Which island is Broken Arrow (Target Lake)?
A: The island is located upstream of the opening.

Q: Is Red Oak Island going to be completed this year?
A: Stabilization of the north end of the island is currently out for construction bids to be completed under the Operational Management Plan. If the bid is low enough, the south end will also be done.

Q: When is Old Cormorant going to be finished?
A: It was completed during the 1993 flood. The other small islands in the area will not be stabilized.

Q: Why wasn't Island 91 chosen for this project?
A: The island is owned by the state of Wisconsin and the WI DNR wants to stabilize it, but not using EMP funds. The necessary agreements and funding procedures were not completed to permit stabilization by the WI DNR this fiscal year.

Q: Could cost sharing be setup for possibly doing additional sites?
A: No. All the selected sites are located on Federal land. Therefore, cost sharing would only delay and complicate the project implementation.

Q: Why wasn't Dresbach Island chosen for this project?
A: Dresbach Island was not submitted by the agencies as a possible site because they felt that it should be addressed under the Channel Maintenance program (not use EMP funds).

Q: Is this bank stabilization project strictly for wildlife habitat?
A: Yes, wildlife and fish habitat.

Q: What are the plans for Blackbird Slough?
A: The plans for this habitat project are to possibly remove the shoal across the mouth of the slough and design a stabilization feature that would prevent it from shoaling again in the future.

Q: Do you ask for the money or the project first?
A: Projects are submitted to get funds for planning and general design. Then Definite Project Report is the vehicle used to request construction approval and subsequent funds for construction.

Q: What permits do you need to obtain for the Trempealeau project?
A: Permits are needed from the railroads because we are connecting dikes to their land.

Q: Why not look at stabilizing private land?
A: Because stabilizing private land is not within the government's authority for the EMP. The land would have to be made available by the State or other local entity and cost sharing would be required. Because of potential difficulties and delays to make the appropriate arrangements, no private lands were included in the sites investigated.

Q: Why can't we riprap our own land and use broken concrete?
A: You must acquire the same permits as the Corps does and some states do not allow the use of broken concrete.

Q: Is there only one Corps of Engineers hydraulic dredge in this area?
A: No, there are two, the Thompson and the Dubuque.

Q: Why are we given only a couple of weeks from this meeting to comment on this project when work started in 1986?
A: The first set of meetings to solicit public comments on this project were held almost 2 years ago. The public notice describing the selected project and announcing the availability of the Definite Project Report was sent out in May.

Q: Is all the money going to the study? Will there be money left for construction?
A: The study required extensive coordination and review and will require surveys and development of plans and specifications for a construction contract. There is about $2 million available for construction.

Q: Who makes the decision that you can't use concrete to riprap?
A: Typically, the states set the standards. The chemicals in the concrete can lead to pollution. There are also aesthetic and safety concerns.

Q: Are there any beaches left on the Wisconsin side?
A: Yes.

Q: Why can't you have party beaches?
A: (USFWS) We want smaller beaches for more quality experiences.

Q: Will COE, DNRs, and USFWS help private home owners fix their shore lines?
A: Not unless Congress authorizes and allocates money to fix your property. Otherwise, the Corps can only provide limited technical assistance.

Q: What habitats/species will this protect?
A: Bottomland hardwoods, aquatic vegetation, floodplain forests, island habitat, aquatic life, nursery areas for young fish.

Q: I assume that with this deteriorating habitat another habitat is not forming elsewhere?
A: That's right. In the case of the selected sites, there is a net loss of habitat.

Q: What is the feasibility of using dredged material to rebuild habitat and/or beaches?
A: We have to be able to know where sand will erode away because it could possibly hurt another species. We have used dredged material for construction of some portions of the habitat projects, both from the main channel and the backwaters.

Q: Why has recreation not been funded?
A: The administration has not given it high priority in the funding process.

Q: What effect can soil conservation on agricultural lands have on the river?
A: Soil conservation on agricultural lands can slow filling in of the navigation channel and backwaters.

**Prairie du Chien Meeting**
June 20, 1995

Q: What happened with Hummingbird Slough?
A: Still trying to implement using other programs.

Q: Could you review the projects planned in Pools 9 & 10, especially those affecting Prairie du Chien?
A: (We reviewed each of the selected sites to describe type and length of stabilization and area affected).

Q: How high above river stage will you riprap?
A: Two to three feet above normal or average pool level.

Q: What's normal pool level?
A: Each pool's normal level is different at various locations.

Q: Why was Guttenberg dam was open and Genoa half-open this spring?
A: Each pool is managed differently, depending on flows and control point. (Water level management concerns were referred to Corps' Water Control Section)

Q: What is going on with the island construction in Pool 9?
A: (Explained the Pool 9 Island construction project, rebuilding and saving existing islands).

Q: Do you believe Pool 9 islands will stay with ice movement?
A: Hydraulics experts believe so. We used larger rock than normal and had mounds placed at the corners and bends for ease in locating the structure during high water.

Q: When is the additional $2 million expected from Congress for small habitat projects?
A: It's not in the plan and we are not aware of any intent to provide more than is authorized for EMP.

# COMMENTS

**Mississippi River Bank Stabilization Habitat Project 6/19/95 and 6/20/95** Prairie du Chie

Name (optional) ______________________________

I am always impressed at the knowledge you
people have in managing these projects - It
seems to me that what you have is an almost
impossible job - yet you are enthusiastic and
hopeful about what you see needing to be done.
and you are always courteous and patient to
explain when sometimes I think I'd slap some
of these guys (the smart aleck ones) in the mouth -
Keep up the good work - I know you can't fix up
the whole river (esp. when you're subject to
money allocated by the government - ugh - always
touchy!) but you are doing lots of good -
and I give you a big pat on the back instead
of griping about everything that doesn't fix the
river where I am! I am sorry that more
people don't come to these meetings -

**Please leave this sheet at the meeting or mail your comments to:**

**Mr. Don Powell, CENCS-PE-M-CW**
**U.S. Corps of Engineers**
**190 Fifth Street East**
**St. Paul, MN 55101-1638**

# COMMENTS

Mississippi River Bank Stabilization Habitat Project 6/19/95 and 6/20/95

Name (optional) Donald N. Higgins

See Attached

Please leave this sheet at the meeting or mail your comments to:
Mr. Don Powell, CENCS–PE–M–CW
U.S. Corps of Engineers
190 Fifth Street East
St. Paul, MN 55101–1638

I

Donald N. Higgins
R4, Box 220
Cliffwood Drive
Prairie du Chien, WI 53821

Tel: 608-326-4128

Extended periods of time with water levels of 10 to 13½ feet at PDC weakens & softens the shorelines & soil on the islands i.e. following stages & dates:

| | Stage |
|---|---|
| March 9, 95 - | 7:12 |
| " 14, 95 - | 9:08 |
| " 27, 95 - | 12:67 |
| " 30, 95 - | 13.06 |
| April 4, 95 - | 12.59 |
| " 8, 95 - | 11.98 |
| " 14, 95 - | 11.48 |
| " 18 95 - | 11.24 |
| " 23 95 - | 12.11 |
| " 26 95 - | 13.19 |
| May 4, 95 - | 12.95 |
| " 7, 95 - | 12.41 |
| " 13, 95 - | 11.42 |
| " 16, 95 - | 11.62 |
| " 21, 95 - | 11.93 |
| " 24, 95 | 11.99 |

Todays stage at PDC June 20 is 9.41.

Stages as listed above would have presented a real flood problem had there been a moderate to heavy snow melt, and run off this past spring. As it is the 10 to 13½ foot level at this time of the year, creates much loss of shore line, and

Donald N. Higgins
R4, Box 220
Cliffwood Drive
Prairie du Chien, WI 53821

II

loss of submerged islands with the wakes from increased boat traffic. Proof of loss is on my small piece of property on the Ambro Road. Last fall in October a survey stake on the water side of my property is at the waters edge at the 11.8 stage, was level with the top of the ground. Now there is approximately 3 inches of the stake exposed above ground.

It appears that the majority of time the level of the river at PDC is controlled. Usually, the indication of a raise in water level starts with a stoppage of the current in the river, then a raise at Dubuque, Prairie du Chien and lastly La Crosse, which would indicate a gate closing at Dubque, or beyond, and possible gate opening at Genoa & La Crosse.

The extended higher water levels accompanied by an attempt at forest management in a swamp area has resulted in a number of up-rooted trees. The removal of many mature trees in a swamp area has eliminated much of the wind break that the trees provided for each other. The soft ground with less wind break results in up-rooted trees.

III

Donald N. Higgins
R4, Box 220
Cliffwood Drive
Prairie du Chien, WI 53821

It would also be a great benefit to the people along the river if the Corps of Engineers would Co-Ordinate, or Combine their efforts in river level forecasting with the National Weather Bureau.

Several times this past spring, I have called the Weather Bureau in La Crosse at 784-1930 for river level forecasts. The forecasts were usually very much in error. In questioning people at the weather bureau, they had no idea where the gates at Lock & Dam's 7, 8, 9, 10, & 11 were positioned. Without this info, it would be impossible to forecast a river stage.

It would be much simpler if the Corps would issue the forecast coupling the gate positions with the weather forecast.

Very Truly yours
Donald N. Higgins

# RECORD OF ATTENDANCE

Meeting – Mississippi River Bank Stabilization at Onalaska

Date – June 19, 1995

This information will be used for the purpose of knowing who attended this meeting.
Please include your address if you wish to be on the project mailing list. Thank you.

| NAME (please print) | ADDRESS (optional) | REPRESENTING |
|---|---|---|
| LEO R. SMITH Jr | 1208 WEST 7th ST 55987 WINONA, MN | Myself |
| Charles R. Smith | RT 1 BOX 1902 WINONA MN 55987 | Ply-Wolf Farm, |
| Leo Leahy | 443 Campfire Dr. West Salem, Wis 54669 | EDWARD Kraemer & Sons |
| Cathy Onsager | 115 5th Ave S Suite 414 LaX | Sen Brian Rude |
| Ron Otto | 2323 Dune La Crosse | Self |
| LES MANSKE | STODDARD WIS. RT 1 BOX 244 | SELF |
| Emeron Christensen | 806 Rachel Place Onalaska, WI 54650 | Christen Engineering |
| Randy Urich | 300 S. First La Crescent, MN 55947 | COE - La Crescent |
| DAVE HANIFL | 238 SHORE ACRES LA CRESCENT MN 55947 | SELF |
| Dick Mial | 401 N. 3rd St. La Crosse Wis. 54601 | La Crosse Tribune |
| mail → JACK BLASK Jack Blask | R 1 GENOA WIS R1 BOX 217 54632-9780 | VERNON COUNTY CONSERVATION CONGRESS |
| 2 appendix DARLENE RAY | " " " " | " " |

# RECORD OF ATTENDANCE

Meeting – Mississippi River Bank Stabilization at Onalaska    Date – June 19, 1995

This information will be used for the purpose of knowing who attended this meeting.
Please include your address if you wish to be on the project mailing list. Thank you.

on database
new address

| NAME (please print) | ADDRESS (optional) | REPRESENTING |
|---|---|---|
| CLAUDE C. DECK | 2244 Evenson DR. Onalaska WI | - Self |
| Barbara Frank | N1965 Valley Rd. Lax | Sierra Club |
| Mary R. Craig | 320 S. Losey Blvd | Myself |
| Marc A. Schutz | 300 North Forth st. Lax | U.W. Ext Lax Co. |
| Jamie Hoeschler | 2019 Old mill Rd. Dresbach. mn. 55947 | Dresbach. Homeowner |
| Tom Young | 2020 OLD MILL Rd DRESbach MN 55947 | Dresbach Homeowner |
| Fred Funk | W7431 CTH ZB Onalaska | Self |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

5-28

# RECORD OF ATTENDANCE

Meeting – Mississippi River Bank Stabilization at Prairie du Chien    Date – June 20, 1995

This information will be used for the purpose of knowing who attended this meeting.
Please include your address if you wish to be on the project mailing list. Thank you.

| NAME (please print) | ADDRESS (optional) | REPRESENTING |
|---|---|---|
| PHILIP SCHLESSELMAN | P.O. Box 8<br>AURORA, IOWA 50607-0008 | MYSELF |
| William H. Hane | Box 149<br>PdC 53821 | Yes all |
| Doris M. Lund | #751 Hwy 364<br>52146<br>Harpers Ferry, Ia | myself |
| Carl R Lund | " " | Myself |
| JOHN MEDINGER<br>John Medinger | 425 STATE ST.<br>ROOM 232<br>LACROSSE, WISC. 54601 | U.S. SENATOR RUSS FEINGOLD |
| Don Higgins | R4-Box 220 Cliffwood<br>Prairie du Chien Wi. 53821 | Self |
| Ralph Mohn | R.R.1<br>Harpers Ferry IA. | |
| Kurt Welke | 111 West Dunn<br>PdC, WI 53821 | WI DNR |
| Carole Goerke | RR1 Box 387-C | PDC |
| [illegible] | P.D.C. | |
| Dennis Latimer | 1609 Winnebago St<br>LaCrosse WI 54601 | Pool 8 |
| | | |

# RECORD OF ATTENDANCE

Meeting – Mississippi River Bank Stabilization at Prairie du Chien Date – June 20, 1995

This information will be used for the purpose of knowing who attended this meeting. Please include your address if you wish to be on the project mailing list. Thank you.

| NAME (please print) | ADDRESS (optional) | REPRESENTING |
|---|---|---|
| LARRY B. McLEESE | P O Box 103 Harpers Ferry Ia. | Self |
| X send map CONNIE + HARLAN SANDERSON | 1508 LAUREL DR. DECORAH, IA 52101 | self |
| Gary Ackerman | | IA DNR |
| | | |
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WISCONSIN
DEPT. OF NATURAL RESOURCES
George E. Meyer
Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

State Office Building
3550 Mormon Coulee Road
La Crosse, WI 54601
TELEPHONE 608-785-9000
TELEFAX 608-785-9990

December 16, 1994

St. Paul District, Corps of Engineers
Floodplain Management and Small Projects, Planning Division
ATTN: Mr. Don Powell
190 Fifth Street East
St. Paul, MN 55101-1638

Dear Mr. Powell:

We have completed review of the preliminary draft Definite Project Report/Environmental Assessment for the Mississippi River Bank Stabilization HREP, dated September 1994. You did an excellent job of compiling a report for a project that includes many different sites along the River.

The report recommends rock protection for all sites to be stabilized. We do not agree that rock protection, in the form of either groins, rock mounds or rock wedges, is the only feasible alternative for all sites. We believe there are locations where bio-engineering can be used to stabilize eroding sites. However, we acknowledge there are some sites where the only feasible alternative is rock protection. Final determination of the type of stabilization method to be used should be made after selected sites are looked at in greater detail during preparation of plans and specs. The DPR must include bio-engineering as an option for all sites.

<u>DPR-13</u>: Sediment Quality. Location, agency and author references are needed to make this section understandable. Is this discussion based on sediment samples taken for this HREP or is it intended to be a summary of Mississippi River main channel and backwater sediment bulk chemical analysis for the entire study reach? Please clarify this section.

<u>DPR-13</u>: Habitat Types... There are missing values.

<u>DPR-14</u>: Habitat Conditions. This section should include a discussion of the impacts of channel training structures (wingdams, closing dams, etc.) on preventing the formation of river islands and accelerating erosion of some islands. A contributing factor to the decline of riverine habitat in the study area is maintenance of the Mississippi River for commercial navigation, alteration of the natural hydrograph and aging of the impoundments.

The habitat on the River is continuing to degrade due to sedimentation and activities aimed at maintaining a 9-foot channel for commercial navigation. In many areas it is becoming monotypic, shallow, windswept areas with little vegetation, depth diversity or habitat for fish and wildlife. Before the river was "tamed" to suit the needs of providing consistent water levels for navigation, new islands were being created and backwaters were rejuvenated and deepened by periodic floods during the spring and fall and low water during the summer. Today, the only force of a free-flowing river left is that of a flood. However, only major floods, 100-year floods for example, have the potential to recreate and rejuvenate the floodplain and backwaters. In the study reach, the forces of smaller, more frequent floods are no longer capable of maintaining the diversity of habitats needed for the ecosystem of the Mississippi River to sustain itself. This is because wingdams, closing dams, rip-rap, and the locks and dams have constrained the Mississippi River to the point that the natural processes that formed the backwaters and islands of the River no longer exist.

DPR-15: Paragraph 5. The industry currently utilizing Unionidae commercially is the cultured pearl industry, not the pearl button industry. Please make correction.

DPR-15: Paragraph 6. The Mississippi River is also an important spring migration route for waterbirds.

DPR-16: Paragraph 3. Snapping turtle is listed twice.

DPR-16: Threatened and Endangered Species. There are several more species that should be included on the list for Wisconsin. Please review the enclosed list.

DPR-28: The bio-engineering alternatives 2 and 3 should not be eliminated at this time. Rewrite this section to include bio-engineering as an option. The Section 404(b)(1) Evaluation will also need to be revised to include bio-engineering as an alternative.

DPR-29: Site Investigations. A sentence should be added to state that this project and DPR did not set out to document all areas within the study reach that are deteriorating due to erosion. Several sites easily identified as the responsibility of the channel maintenance program or Operational Management Plan were not even visited by the study team. For example, many of the areas in pools 3 and 4 were not considered for this HREP because preliminary field visits showed that the most severe erosion in these pools was associated dredge material placement sites. These sites were recommended for stabilization in the GREAT reports and therefore the responsibility of channel maintenance. Other areas were also not included in the original list because preliminary field visits indicated that access to these eroding sites would be cost prohibitive.

Sites located on lands owned and managed by the State of Wisconsin were not pursued because we were concerned that inclusion of these areas would delay approval and construction of the entire HREP while agreements between the COE and our agency were being negotiated.

DPR-31: Table DPR-3. On November 16, 1994, our Department visited the site referred to as 9-653.4-R Middle Harper's Slough. This site has only 1 small island at approx. river mile 653.2 RDB that would require <200 linear feet of protection, not the 2000 feet stated. There are no other islands in the referenced area. According to Table DPR-4 on page DPR-38, the cost of protecting non-existing islands in the Middle Harpers Slough area is $376,000; 14% of the projected cost of the Bank Stabilization HREP. The purpose of this HREP is to stabilize and protect existing features, not construct new islands out of rock. We recommend the remaining island at 653.2 RDB be combined with Lower Harpers Slough, Middle Harpers Slough area be eliminated since no islands exist here, and the next projects in order be added to the list of site to be stabilized. These sites would include site numbers 9-664.9-R, 9-648.0-R, 10-637.8-L, and 10-628.7-L and potentially others.

DPR-35 & 36: SI4. One important value of closed areas to wildlife is low human disturbance. It is this lack of disturbance which concentrates waterfowl in these areas during the hunting season. This is the function of closed areas that we considered important enough to be weighted higher than similar adjacent habitat that is "open" to hunting. While USFWS closed areas often concentrate waterfowl, they do not necessarily provide high quality habitat for fish species or concentrate fish. Please make the following editorial change. Page DPR-36, first para., third sentence: "...importance of the area to concentrate wildlife during the hunting season due to low human disturbance in these areas."

DPR-39 & 40: Site Selection. This discussion does not accurately reflect our intentions during selection of the proposed sites. The WDNR does not support the use of habitat evaluation procedures (HEP) to justify minimum and maximum costs per AAHU from other approved HREPs to set limits on new projects. HEP is meant to be one of the tools used to evaluate alternatives for a single site or project. Use of HEP and cost per AAHU to compare different sites is inappropriate. While we agreed to using HEP and cost per AAHU to aide in selection of sites to be stabilized, we are apprehensive about using HEP this way and do not endorse this approach for future projects. Our understanding of the site selection process, and why HEP was used for this purpose, is presented below. At this point, the Wisconsin Department of Natural Resources cannot support inclusion of the Middle Harper's Slough site in the bank stabilization project.

The $2,000 per AAHU was used only as a guideline to help reduce the number of sites for initial consideration since the planning team assumed that only approximately $2.5 million will be available for this HREP. Use of this limit does not imply that sites with a higher cost per AAHU are less valuable from a habitat standpoint and should be dropped from any further consideration. With a limited amount of funds available, the planning team sought to achieve the greatest acres benefitted for the cost. The methods used to narrow down the list of sites were just tools used for planning this HREP. Just because a site has the lowest cost per AAHU does not mean that it is the highest priority site. If adequate funds were available, we would support the stabilization of almost all of the sites.

The method used to arrive at the estimated construction costs may not accurately reflect the actual cost per AAHU. Page DPR-37 states, "Based on the unit prices, the construction cost was calculated and then doubled to account for construction contingencies, engineering and design, and construction administration." We acknowledge the difficulty in estimating actual costs of a project of this size and complexity without detailed site specific information. Adjustments to the selected list may be appropriate after completion of Appendix C, Cost Analysis, or during development of plans and specs.

DPR-44: Sources of fill material. Please include language within the DPR to state the source of rock will be from a non-Mississippi River facing bluff (where the quarry would be visible from the Mississippi River).

DPR-47: Fish and Wildlife. While it is true rock substrate is more productive for macroinvertebrates than sand, rock is not as productive for macroinvertebrates as woody debris and detritus. Inclusion of structure, in the form of trees, into the design of the bank stabilization alternative would greatly increase the habitat for macroinvertebrates and fish.

Attachment 3: Section 404 (b)(1) Evaluation. Make appropriate revisions to include bio-engineering as a stabilization technique.

Appendixes: Appendix B; Habitat Analyses. Variable SI4. See comment for DPR-35 & 36 and make same changes on page B-9, first full para., third sentence.

General Comments:

After reviewing the Bank Stabilization DPR, it became apparent that there must be a mutually agreed upon procedure, developed by the cooperating agencies and approved by Corps Higher Authority, for amending the bank stabilization list presented in the final DPR. We are recommending that a procedure be developed and approved for activating sites listed as deferred in Table DPR-5 if any of the selected sites in Table DPR-7 (sites selected for stabilization) are done by another agency, COE authority, or constructed significantly below the DPR cost estimate. Please consider this proposal and inform us of the COE's decision on this matter.

We appreciated the opportunity to review the preliminary draft Bank Stabilization DPR. If you have any questions regarding our comments, please contact me at (608) 785-9005.

Sincerely,

Jeffrey A. Janvrin
Mississippi River Habitat Specialist

Enclosure

c: Keith Beseke, USFWS
Gary Ackerman, Iowa DNR
Art Roseland, Iowa DNR
Mike Davis, MN DNR

Corps Responses to Wisconsin DNR Letter dated December 16, 1994

Rock Protection: Concur. Bio-engineering will be considered as a supplement to rock protection at sites where erosive forces tend to be weaker. The locations and types will be determined during the preparation of plans and specifications. However, bio-engineering is not expected to be the sole means of controlling bank erosion. The appropriate sections of the DPR have been revised to include the above information.

DPR-13 - Sediment Quality: It is a summary of Upper Mississippi River sediment bulk chemical data. The text has been revised and a sediment quality table has been included in Appendix B.

DPR-13 - Habitat Types: Values have been added.

DPR-14 - Habitat Conditions: A paragraph has been added (page DPR-15) to discuss the impacts of man-made changes to the river system.

DPR-15 - Para 5: Correction for the Unionidae has been made.

DPR-15 - Para 6: Concur. Inserted "spring and".

DPR-16 - Para 3: Corrected by deleting one snapping turtle.

DPR-16 - T&E Species: We used the list provided to add 4 endangered and 4 threatened species.

DPR-28 - Bio-engineering: See response under "Rock Protection".

DPR-29 - Site Investigations: Suggested additions were made.

DPR-31 - Table DPR-3: The Middle Harpers Slough site has been modified to reflect only 200 linear feet of rock protection, rather than 2000 feet, and only 10 acres affected. We prefer not to delete it from the list of selected sites at this time because if there is an island remaining we want to include it in the list. It is also necessary to maintain consistency in the evaluation process. A final decision can be made after additional field investigations and/or survey information determines whether enough landmass remains for protection.

DPR-35 & 36 - SI4: Concur. After discussions with you and others, the habitat analysis was reworked and rewritten to more accurately reflect the contribution of the human disturbance factor.

DPR-39 & 40 - Site Selection: This section has been rewritten (pages DPR-41 & 42) to include the aspects of site selection that you stated and to make clear that there are still many other sites in need of stabilization. The discussion also cautions that the cost per AAHU should not be compared to other habitat projects. The selected list can be adjusted during the preparation of plans and specifications using the procedure explained under the "Selected Plan of Action" section on page DPR-46. Coordination of site changes with team members and agencies is the key to successfully adjusting the selected list.

DPR-44 - Sources of fill material: Your request for non-river facing bluffs has been included in the paragraph.

DPR-47 - Fish and Wildlife: Reference has been made to using bio-engineering as a way to increase habitat value.

Attachment 3: The requested revisions have been made to the 404 Evaluation.

Appendixes: The requested changes have been made.

General Comments: See response to DPR-39 & 40.

# United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

Upper Mississippi River National Wildlife and Fish Refuge
51 East 4th Street
Winona, Minnesota 55987


January 10, 1995

Mr. Don Powell
St. Paul District, Corps of Engineers
NCS-PE-M
190 Fifth Street East
St. Paul, Minnesota 55101

Dear Mr. Powell:

This provides U.S. Fish and Wildlife Service (Service) comments on the draft Definite Project Report and Environmental Documentation (SP-17) for the Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement Project. This project will benefit the biological resources of the Upper Mississippi River National Wildlife and Fish Refuge (Refuge).

The project is being built on federal lands managed as part of the Refuge. Therefore, a Refuge compatibility determination and Refuge approval is required before the project can be constructed. Enclosed is a signed compatibility determination for the selected alternative discussed in this draft report. Approval of the project will be formally provided by the Regional Director after completion of the final project report.

The final draft definite project report must include a copy of the draft Memorandum of Agreement for the operation, maintenance, and rehabilitation. The Service will cover operation and maintenance costs as discussed in this report for the selected sites. The Services operation and maintenance dollars will be allocated for selected sites based on the Services priority outlined in Table DPR 5. The Regional Director's letter on the final draft definite project report will include the certification of support for operation and maintenance.

As stated on DPR-40, the Service is considering stabilizing 5 sites because of damage caused by the 1993 Flood. If this work is completed, adjustments will have to be made to the DPR to reflect the savings. There also maybe other factors which will cause readjustment of sites such as changed cost, changed site conditions, etc. How will the Corps of Engineers (Corps) factor in these changes in relation to new sites selected?

We assume that before construction, complete coordination between our agencies and the state Historic Preservation Officers and others, as appropriate, will occur to insure complete compliance with the National Historic Preservation Act.

The Service places a high priority on the Sand Run, Lost Island Chute, and Richmond Island and we would like to see work on these sites begun as soon as possible. These sites were not selected as part of this EMP project but were listed to be completed under the Operation Management Plan. Please provide us with estimated completion dates for this work.

Based on information contained in the Preliminary Draft Definite Project Report/Environmental Assessment and the nature of the proposed projects, their location, and the habitat requirements of the federally threatened bald eagle (*Haliaeetus leucocephalus*), endangered peregrine falcon (*Falco peregrinus*), endangered Higgins' eye pearly mussel (*Lampsilis higginsi*), and endangered Iowa pleistocene snail (*Discus macclintocki*), we support your determination that the proposed project elements are not likely to affect federally listed threatened or endangered species. Should these projects be modified or new information indicates that listed species may be affected, consultation with the Service's Twin Cities Field Office should be reinitiated.

These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), the National Environmental Policy Act of 1969 (42 U.S.C. 4321-4327), the Endangered Species Act of 1973, (16 U.S.C. 1531-1543), as amended.

This report illustrates the cooperation evident between the Corps and the Service. The cooperative efforts on this project and the Environmental Management Program as a whole ensure that progress in this area will continue on the Upper Mississippi River System.

Sincerely,

James R. Fisher

James Fisher
Complex Manager

Enclosures

cc: TCFO
La Crosse FRO
MN DNR/ WI DNR/ IA DNR
Winona, La Crosse, McGregor
Districts
RO--SS

c:\wp51\kb\1-mrbs.dpr\dw

# Upper Mississippi River National Wildlife and Fish Refuge Established 1924 Compatibility Determination Mississippi River Bank Stabilization Rehabilitation and Enhancement Project

## Establishment Authority:

Public Law No. 268, 68th Congress, The Upper Mississippi River Wild Life and Fish Refuge Act.

## Purposes for Which the Refuge was Established:

"... (a) as a refuge and breeding place for migratory birds... (b)...as a refuge and breeding place for other wild birds, game animals, fur-bearing animals, and for the conservation of wild flowers and aquatic plants, and (c)...as a refuge and breeding place for fish and other aquatic animal life." 43 Stat. 650, dated June 7, 1924

"... shall be administered by him (Secretary of the Interior) directly or in accordance with cooperative agreements ... and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife resources thereof, and its habitat thereon, ... "16 U.S.C. 664 (Fish and Wildlife Coordination Act)

"... suitable for--(1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ..." 16 U.S.C. 460k-1 "...the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors..." 16 U.S.C. 460k-2 [Refuge Recreation Act (16 U.S.C. 460k-460k-4), as amended]

"... particular value in carrying out the national migratory bird management program." 16 U.S.C. 667b (An act Authorizing the Transfer of Certain Real Property for Wildlife, or other purposes)

## Description of Proposed Use:

The proposal is a Habitat Rehabilitation and Enhancement project authorized by the Water Resource Development Act of 1986 (Pub. L. 99-662). The proposed project will be to maintain existing shoreline at specific sites throughout the Upper Mississippi River National Wildlife and Fish Refuge from the upper end of Pool 6 near Winona, Minnesota to lower Pool 10 near Guttenberg, Iowa.

Fifty-five potential bank stabilization sites were evaluated by an interagency study team to document site conditions and to evaluate the potential for habitat degradation. Based on environmental analysis of all the sites and limited funds available the following twelve sites were selected.

| SITE NUMBER | SITE NAME | PROJECT OBJECTIVE | POTENTIAL ENHANCEMENT ALTERNATIVE |
|---|---|---|---|
| 6-718.6-R | Blacksmith Slough | Maintain existing island shoreline | Riprap |
| | | Reduce flow between islands | Partial closure |
| 6-715.8-R | Trempealeau Daymark | Maintain existing island shoreline | Riprap |
| 7-703.0-L | Lake Onalaska | | |
| | Island B | Maintain existing island shoreline | Offshore mound |
| | Island C | Maintain existing island shoreline | Offshore mound |
| 8-685.0-R | Heron & Trapping | Maintain existing island shoreline | Rock wedge,groin |
| 9-654.1-R | Upper Harpers Slough | Maintain existing island shoreline | Offshore mound |
| 9-653.4-R | Middle Harpers Slough | Maintain existing island shoreline | Riprap |
| 9-652.6-R | Lower Harpers Slough | Maintain existing island shoreline | Offshore mound |
| 10-646.4-R | Billy Slough | Eliminate normal flow thru breach | Rock closure |
| | | Maintain existing island shoreline | Riprap |
| 10-636.4-L | East Channel | Maintain existing island shoreline | Riprap |
| 10-628.0-R | Norwegian Slough | Maintain existing island shoreline | Riprap |
| | | Eliminate normal flow thru breach | Rock closure |
| 10-625.5-L | Island 181 (Catfish) | Maintain existing island shoreline | Riprap |
| 10-621.0-L | Duck Lake Chute | Maintain existing island shoreline | Riprap |
| | | Eliminate normal flow thru breach | Partial closure |

More details of the project, including maps and engineering drawings, are contained in the draft report entitled, "Upper Mississippi River System Environmental Management Program Definite Project Report With Integrated Environmental Assessment (SP-17) Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement, Pool 5 - 10, Upper Mississippi River, Minnesota, Wisconsin, and Iowa," prepared by the St. Paul District, Corps of Engineers.

Anticipated Impacts on Refuge Purposes:

As a result of the project fish and wildlife populations should increase which will be a direct benefit toward maintaining and accomplishing refuge purposes. A summary of impacts to the natural resources of the Refuge are as follows:

RELATIONSHIP TO ENVIRONMENTAL REQUIREMENTS

The proposed action would comply with all applicable Federal environmental laws, executive orders, and policies, and State and local laws and policies including the Clean Air Act, as amended; the Clean Water Act of 1977, as amended; the Endangered Species Act of 1973, as amended; and Land and Water Conservation Fund Act of 1965, as amended; the National Environmental Policy Act of 1969, as amended; the Fish and Wildlife Conservation Act of 1958, as amended; the National Wildlife Refuge System Administration Act; Executive Order 11988 - Floodplain Management; and Executive Order 11990 - Protection of Wetlands. The proposed action would not result in the conversion of farmland to non-agricultural uses. Therefore, the Farmland Protection Policy Act of 1981 does not apply to this project.

NATURAL RESOURCES

Fish and Wildlife - The project is designed to benefit fish and wildlife habitat. The rock protection of side channel openings and the partial closure structures would reduce the sediment load into the backwater areas and protect future loss of hundreds of acres of prime centrarchid habitat. Rock riprap would provide a coarse substrate to improve the value of the area for lithophilic fish species, such as smallmouth bass. Rock substrate is at least 10 times as productive for macroinvertebrates, including crayfish (an important food source for smallmouth bass), as the sand substrate it would be replacing. The construction of the partial closure structures and dredging in the vicinity of the main channel would at least temporarily disturb fish use of the area. Use of the area by fish may be reduced during construction activities, especially in the areas of elevated suspended sediment. No toxic effects are expected on fish or other aquatic organisms. Overall, fish spawning, nursery, and wintering habitat values would be improved by the project.

Threatened and Endangered Species - The proposed project would not have substantial impacts on threatened or endangered species. No state-listed or federally listed threatened or endangered species would be adversely affected by the project. Bald eagles use the area, mainly for wintering and during migrations. The construction activities would not affect the suitability of the existing nesting sites for either bald eagles or ospreys on the Refuge. The immediate project area does not provide the kind of habitat preferred by peregrine falcons, and no impacts are expected. Critical habitat for the state-listed wood turtle and the Blanding's turtle would not be affected by the proposed construction activities. The absence of Higgins' eye pearly mussels and the other state-listed threatened or endangered species from recent surveys in and adjacent to any of the project sites would indicate that the project should not have any significant impact on these species.

Terrestrial Habitat - Short-term impacts on terrestrial habitat would be negligible. Construction of the project would result in some disturbance impacts resulting from vegetation clearing and earth moving. However, long-term impacts would be beneficial because the loss of bottomland hardwoods would be reduced. Placement of access dredged material would be done only where no or positive impacts would be obtained.

Aquatic Habitat - Approximately 1,560 acres of aquatic habitat would be positively affected by the selected plan.

Water Quality - Potential construction related negative effects on water quality would be from the construction of partial closures and fill placed against eroding banks. Using previous material dredged for access as backfill for the riprap and using rockfill for stabilization would reduce impacts on water quality. Local turbidity plumes would be generated from construction, but releases of contaminants should be minimal due to the relatively uncontaminated material. Excavation and placement of material would be done mechanically. The long-term impact on water quality will be positive because of the lower flow velocities entering the backwater areas.

Justification:

The proposed project works toward the accomplishment of the stated objectives of the refuge by stabilizing the shoreline of existing islands in several pools of the Upper Mississippi River. Severe erosion is occurring at many locations, affecting backwater areas and habitat because of the loss of landmass and the associated increases in flow and/or sedimentation. Aquatic habitat is being lost and becoming shallower in the adjacent backwaters. Adverse effects to circulation patterns and water quality in the backwaters are also occurring. The general overall purpose of the proposed project is to preserve, restore and enhance fish and wildlife habitat on the refuge by reducing shoreline erosion and backwater sedimentation.

Determination: The proposed use is ___/_ is not ___ compatible with the purposes for which the refuge was established.

Determined by: James R. Fisher Date: 1/5/95
Complex Manager

Reviewed by: [signature] Date: 1/5/95
Wildlife Associate Manager

Concurred by: [signature] Date: 1/5/95
Assistant Regional Director

Corps Responses to USFWS Letter dated January 10, 1995

Draft MOA: A draft MOA for operation and maintenance is included in attachment 6.

Selected Site Changes: The selected list can be adjusted during the preparation of plans and specifications using the procedure explained under the "Selected Plan of Action" section on page DPR-46. Coordination of site changes with team members and agencies is the key to successfully adjusting the selected list.

State Historic Preservation Officers: Cultural resource investigations will be coordinated with the appropriate Federal and state agencies during the early stages of the preparation of plans and specifications.

High priority sites: Sand Run and Lost Island Chute are both within the area of an on-going channel maintenance study. It is likely that Sand Run, especially, would be stabilized in the future. The study and preparation of plans and specifications is scheduled for next fiscal year, with possible construction in fiscal year 1997. The Richmond Island site has been scheduled for stabilization under the Operational Management Plan in fiscal year 1996.

STATE OF IOWA

TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

Department of Natural Resources
NE Regional Office
RR 2 Box 269
Manchester IA 52057

January 17, 1995

St. Paul District, Corps of Engineers
Floodplain Mgmt. & Small Projects, Planning Div.
ATTN: Mr. Don Powell
190 Fifth St E
St. Paul MN 55101-1638

Dear Mr. Powell:

Iowa DNR participants in the proposed Mississippi River Bank Stabilization Habitat Rehabilitation and Enhancement Project have reviewed the preliminary draft of the Definite Project Report/Environmental Assessment. Comparative analysis of resources and problems at the proposed sites in the Pool 4-10 reach was challenging. St. Paul District personnel provided effective leadership in that effort as evidenced within this inclusive report.

Although analysis tools were not precise, we believe the site review process worked very well to critique and prioritize nominated sites. It should be recognized, however, that there are many sites where erosion threatens net loss of aquatic resources and where bankline stabilization is justified. The selected sites represent only a priority of nominated locations.

Several comments are warranted as follows:

- DPR Main Report, Plate 23: The location of Site 10-628.0-R is not correct. It is properly identified in the DPR/EA Appendixes.

- We believe there should be sufficient flexibility in project administration to assure use of budgeted funds. If estimates exceed eventual project costs, there should be a mechanism to complete appropriate sites currently listed as "Deferred". If it is necessary for the DPR to specifically identify all sites which may be completed, more sites should be prioritized.

  A procedure to add sites is especially appropriate in consideration of Harper's Slough. The DPR description of 2,000 feet of existing shoreline protection on Middle Harper's, with commensurate cost estimate, is high. Construction of rock mounds in Harper's Slough, beyond extent of remaining island remnants, can best be considered in the context of a larger area analysis and, if warranted, be incorporated into the proposed Harper's Slough HREP. In the interim, checking erosion on remaining Harper's Slough island remnants, consistent with comparative analysis of all sites, should be the goal.

- DPR-9 (*DNR Management Goals*): The third through fifth listed items could be more accurately stated, "Improve opportunity for all recreational uses of fish and wildlife."

- DPR-6: Please list Roseland (IDNR) as a Wildlife Biologist, not EMP Coordinator. Also, Mr. Michael Griffin has recently been assigned as the Department's Mississippi River Biologist. Please add him to your list of team members for future coordination.

Address/Phone: DNR/Mississippi River Station
206 Rose Street
Bellevue IA 52031
319-872-5495

Thank you for the opportunity to review and comment on the Preliminary Draft of the DPR/EA the Bank Stabilization HREP. We look forward to future coordination and the construction of these projects.

Sincerely,

Art Roseland

Art Roseland
District Wildlife Supervisor

AR/sau

Corps Responses to Iowa DNR Letter dated January 17, 1995

Plate 23: The location of Site 10-628.0-R and area affected has been corrected.

Deferred sites: The selected list can be adjusted during the preparation of plans and specifications using the procedure explained under the "Selected Plan of Action" section on page DPR-46. Coordination of site changes with team members and agencies is the key to successfully adjusting the selected list.

Harpers Slough: The length of stabilization proposed for Middle Harpers Slough has been reduced to 200 feet and the associated cost was also reduced, accordingly. If no island landmass exists when the detailed design stage begins, then no rock stabilization would be accomplished. As stated in your letter, any construction beyond the scope of the Bank Stabilization project would be accomplished in the Harpers Slough HREP.

DPR-9: The change in management goals has been made as you suggested.

DPR-6: Revisions to personnel have been made.

**DEPARTMENT OF THE ARMY**
ST. PAUL DISTRICT, CORPS OF ENGINEERS
ARMY CORPS OF ENGINEERS CENTRE
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

January 25, 1995

Management and Evaluation Branch
Engineering and Planning Division

Mr. Mike Davis
Minnesota Department of Natural Resources
1801 South Oak Street
Lake City, Minnesota 55041

Dear Mr. Davis:

Thank you for your review of the preliminary draft definite project report for the Mississippi River Bank Stabilization project. The project is being pursued under the Environmental Management Program. As you indicated in your telephone conversation with Mr. Don Powell on January 10, your office had no comments on the report. We are currently preparing the draft report to be available for public review in March 1995. Public meetings will be scheduled at appropriate locations after the report is available. The dates and places of the meetings will be coordinated with your office.

Thank you again for the involvement of your office in the planning and site selection process for this project. We look forward to your continued participation as we move closer to the implementation phase.

Sincerely,

for Charles E. Crist
Chief, Management and Evaluation Branch
Engineering and Planning Division

PUBLIC MEETINGS SCHEDULED
for the
MISSISSIPPI RIVER BANK STABILIZATION PROJECT
ENVIRONMENTAL MANAGEMENT PROGRAM

The U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and the Minnesota, Wisconsin, and Iowa Departments of Natural Resources have been involved in a study of bank erosion sites along the Mississippi River. The study is being conducted as part of the Upper Mississippi River System Environmental Management Program that was authorized by Congress in 1986. The erosion sites are located in pools 5 through 10 of the Mississippi River. The sites are affecting backwater areas and habitat because of the loss of landmass and the associated increases in flow and/or sedimentation. The intent of a future project would be to stabilize the sites so that loss of habitat is reduced. Fifty-five sites were listed for consideration and were visited by the study team to determine erosion rates and to estimate the habitat degradation potential. The field visits allowed the study team to reduce the number of sites for more detailed evaluation to 34. Information, such as rate of erosion, water depth, height and length of eroding banks, and construction equipment access, was gathered by the study team during the site visits. Due to the large number of sites and limited funds, a habitat evaluation system was developed to rank the sites. The evaluation was based on habitat quality, uniqueness, and protection provided by the site. The cost to stabilize the sites was compared to the habitat benefits gained. Based on the cost for the habitat benefits gained, agency priorities, location, available funds, and construction considerations, a total of 12 sites were selected for the proposed bank stabilization project. The selected sites are located in pools 6, 7, 8, 9, and 10. The general locations of the sites are shown on the map on the other side. The total cost to stabilize the 12 sites is estimated to be about $2.7 million.

In order to more completely explain the selection process, describe the sites, and obtain your input, a series of public meetings will be held at the places shown below.

| Date | City | Place |
|---|---|---|
| September 29, 1993 | Prairie du Chien, WI | Peoples State Bank Community Room 301 E. Blackhawk Ave |
| September 30, 1993 | Onalaska, WI | Environmental Management Technical Center 575 Lester Ave (see map) |
| October 4, 1993 | Winona, MN | Winona Co. Office Bldg Conference Room A 202 W 3rd Street |

All meetings will begin at 7:00 pm. Representatives from the agencies will be present to discuss the proposed project with you and respond to your questions. Please tell others that may be interested in this proposed project about the meetings. If you are unable to attend any of the meetings, feel free to send your comments to the District Engineer, Corps of Engineers, St. Paul District, 180 Kellogg Blvd E, Rm 1421, St. Paul, Minnesota 55101-1479, ATTN: CENCS-PD-WR, or contact Mr. Don Powell at 612-220-0402.

MISSISSIPPI RIVER BANK STABILIZATION
PUBLIC MEETINGS
9/29, 9/30, & 10/4/93
ENVIRONMENTAL MANAGEMENT PROGRAM

AGENDA

Welcome and Introductions

Purposes of Meeting

Program Authority and Description

Bank Stabilization Sites

- Physical Characteristics
- Project Objectives
- Site Visits
- Costs and Habitat Benefits
- Site Selection
- Proposed Project Sites
- Costs

Schedule

Accomplishments

Discussion/Questions

# MISSISSIPPI RIVER BANK STABILIZATION PROJECT
# ENVIRONMENTAL MANAGEMENT PROGRAM

## Summary of Discussion and Questions at the Public Meetings

### Public Meeting held at Prairie du Chien, Wisconsin
### September 29, 1993

Q: After these are finished, what's next? Another 30 or so?
A: We have enough through 2002. The 12 selected eat up all $2.5 million available right now.

Q: How much State property is involved?
A: No State or private lands; just on Fed lands.

Q: Did you look at Gremore Lake?
A: It was not on the list for stabilization.

Q: What is Ambro Slough project status? The flow is too slow.
A: It is separate from Bank Stabilization project. Scheduled for general design in 1995. Goal is to stop sediment-laden water. Looking at combining Gremore Lake and Ambro Slough efforts.

Q: Does Corps have enforcement capabilities - no wake zones, etc. - to save islands from erosion?
A: Corps doesn't. Probably WDNR. [John Lyons (USFWS) comment: When local unit of govt passes such a law, it's their responsibility to enforce it.]

Q [Bill Howe]: Dispose of materials from projects on low islands to raise them, then plant trees (swamp oak and walnuts) for future generations to enjoy. Good experimental areas to see how they do with minimal shoreline protection. Few large/old oaks & walnuts left. Corps & USFWS have obligation.
A: Noted.

Q: Success with planting willows? In old days, lots of willows.
A: At Pool 8 - 2' willows are doing very well. 90% survival. [Lyons comment: Willows are full sunlight species that die out when other trees shadow them.]

Q: What about revetments in north part of Pool 9?
A: Open pool had higher priority with greater habitat benefits.

Q: Stage of pools when surveyed?
A: Normal. [Jeff Janvrin (WDNR) comment: Tow wakes responsible, too.]

Q: Corps should be obligated to protect along the main channel. Sites are eroding with sediment going into backwaters. Large area condemned by your judgment. Re-use eroded rock and reinforce shoreline. Reno Bottoms being destroyed; same with Island 126.
A: In the Harpers Slough area we would be building off a bench of old riprap. All sites mentioned were looked at but eliminated for one reason or another. [Janvrin says: Limited funds forced selection of worst (highest priority) sites. Used the word 'Deferred' versus 'delayed'; in case additional funds become available, can pick those sites up.] Earlier in EMP, bank stabilization wasn't

even considered a legitimate option versus island creation or dredging. [Audience comment: Disagreed; he was on Cong. Gunderson committee which identified erosion prevention as high priority.] Rock salvage is more costly than acquiring new; questionable quality and quantity. [Audience comment: A 40-foot wide band of rock was placed along the river.] Size was smaller; wood in rock; lack good records from when wing dams were built. Cost of recovery is higher than requarrying.

Howe comment: Perturbed by underutilized EMP funds over the years. Used those funds on projects other than the Mississippi River. Cong. Gunderson's office says about $6 million EMP funds never used on Mississippi River or habitat projects. COE, USFWS, States have obligation to return to EMP. We'll go to D.C., etc. to channel those funds into EMP.
Response: Higher Authority has assured us that if we can utilize the money, it'll be made available. [Keith Beseke (USFWS) comment: DPR review time of 1 year throws budget schedules off.] [Audience comment: We'll send letters to Governors, etc.]

Howe Q: Need new listing of additional bank stabilization sites. We'll ask WDNR and IDNR to help develop off-public [lands?] list of sites. How about videos of sites for public education.
Janvrin A: Many sites were already videoed; would have to queue up and document for presentation purposes. [Curt Welke (WDNR) comment: High water may have changed recommended sites. Need to look at again.]

Q: Dredging problem below L&D 10 at Guttenberg. Could you put dredged spoil behind existing riprap and stabilize eroded bank on a spot basis?
A: Maintenance people have limitations on where to put it. Because of the number of sites, we will probably have to place it into approved sites only.

Q: Duck Lake - will project slow water into the backwater?
A: Yes.

Audience comment: In 20 years, we won't have islands across from Guttenberg.
Curt A: They were looked at.

Audience comment: Frenchtown Lake erosion is affecting fish. Sediment has made boat passage impossible.
A: Written off as too far gone. [Beseke comment: You're going through the same process the project team did. So many sites: How to select? What's the cause? Who's responsible?]

Howe comment: Corps said they're continuing with $40 billion to rebuild lock & dams. When L&D 26 was built, $19 million was to go for Upper Miss R. Now millions of dollars are going for study only!

Q: In high water, groins may direct floodwater right into backwater.
A: They worked well in Pool 8. The effectiveness depends on the height of bank, etc.

Public Meeting held at Onalaska, Wisconsin
September 29, 1993

Howe Q: What about the shallow end of Dead Man's Slough.
Beseke A: Can now boat up it; to the new pond. Swift Slough was opened up to get material for another project.

Howe Q: What kind of filter is used under the riprap? Honeycomb?
Powell A: Rather than graded sand-gravel-rock, we use a plastic cloth-type filter fabric with holes to pass water but prevent riprap from settling into the sand and losing its protective value.

Q: What's a HU?
Janvrin A: Habitat is rated from 0 to 1 (1 for "ideal habitat"). Multiply the habitat rating times the acres affected to get the number of Habitat Units at that site.

Q: What is the solution for Red Oak Ridge? If you protected the whole bank it would take all $7 million.
A: A rock wedge at the toe of the slope was proposed.

Q: What is cost per foot of the selected sites?
A: We didn't calculate it that way. There is site length information on the other data sheets, and it could be calculated.

Howe/Janvrin discussion: Original list (from GREAT) was 150-200 sites.

Q: Would there be a second round of construction after 1997?
A: Depends on funding of this particular EMP activity.

Fred Funk Q: Commends Corps and USFWS for swift action on fixing islands on Lake Onalaska. Is Sumner Chute, etc. under the channel maintenance program?
A: Yes.

Funk Q: In pool 7, No Name Chute riprap is being lost by high flow. Repair under different program?
Janvrin A: No Name is a Corps responsibility. Jon Hendrickson of the Corps was given a tour. There is a good chance it will be fixed under channel maintenance by piggybacking under Jimmy's Island/Island 91.

Funk Q: Will the Lake Onalaska problems in the dredged area be handled under the Onalaska spillway project?
A: Yes. We're looking at adjusting flow through the Onalaska spillway rather than building something additional. If this is unsuccessful, we will have a public meeting about other options, e.g., emergent rock structure or closure.

Discussion on status of French Lake funding for engineering. Funk & Marc Schultz indicated that they were "told" 1993 funding.

Howe Q: Corps and other agencies allowed $6 million in EMP funds to be diverted. The funds should be used for these island protection projects. Corps should insist that the money be reinstated. Funk, Howe, others went to Washington, and were not told that funds would not be re-directed. State of WI and MWBAC (and, hopefully, MN & Iowa) will direct letters to Washington.

Q: Does the Corps allow 10% to lapse?
A: 10% (or a similar amount) is diverted to savings and slippage for "expected" delays and problems.

Discussion: 10% of $19 million = $1.9 million. So, $6 million means other moneys were also diverted.
Beseke comment: EMP will not compete well against post-1993 flood agricultural levee and infrastructure rehabilitation engineering, particularly in the St. Louis and Rock Island Districts.
Janvrin comment: A 1-year delay on the approval to do just the Problem Appraisal Report for East Channel is an example of types of delays that can be encountered.
Beseke comment: Probably will "lose" closer to $6 million than $4 million next year.
Powell comment: A couple of big projects were not awarded by other Districts because of 1993 flood. There are similar problems (savings & slippage, delays, etc.) in programs other than EMP.

Schultz Q: Have you tried having a backlog of projects?
Beseke A: We have tried having projects on shelf.

## Public Meeting held at Winona, Minnesota
October 4, 1993

Q: Will you riprap the river side of Richmond Island in pool 7?
A: Yes.

Q: What about the inside? That is where it is washing. You have a sand pile at Richmond Island. The front end is deteriorating. You should protect the inside; the whole bank is going. If you do something on the outside, you have to do something on the inside.
A: There is a separate Richmond Island project.

Q: Does that come under Maintenance?
A: Yes, it does. It would be done with Operation and Maintenance money, not habitat money.

Q: Where does the funding for these projects come from? Revenue?
A: No, general taxation.

Q: How did the EMP projects do as a result of the flood last summer?
A: We are pleased with how the islands came out. At pool 8, the seed had just taken hold. The islands were overtopped, but there was only minor erosion. No cause for alarm. Weaver Bottoms, which is not part of EMP, experienced some damage, but that project had a different design. EMP projects took the flood very well. We had good success. Here, we had about a 16-year flood.

Q: Concerning Weaver Bottoms, I have read articles that it is not a success.
A: FWS representative: It doesn't look good. Vegetation has been dying since 1989 in the river as a whole. The Weaver Bottoms project was justified under the Operation and Maintenance program. The Corps used a lot of sand to build the islands, and they were built much higher than other islands in the river. The funding authority for the EMP projects, on the other hand, is to save habitat.

Q: You said that the annual funding for the EMP program is $20 million. When the authority was extended, did they appropriate more money?
A: The annual funds stayed the same, but the schedule was extended to the year 2002.

Q: Why are you against helping private land?
A: It would mean acquiring land, and we can't acquire land under the EMP program.
Q: I don't mean acquiring land, I mean helping private land. The Corps tells us you can't put rock below the water line or above land. This year, trees went down on our property. The Corps won't let us put rock in the water. We would spend our own money. We have the same goal you have - to protect islands. Two islands have disappeared. We own from the railroad tracks to the center line of the channel below 5A on the Wisconsin side. The Corps said the water wouldn't affect our land. The Corps paid us no flowage rights when they flooded the pool.
A: Send us a sketch and background information on your situation and we will look into it.

Q: Are you using a 1:3 slope for stabilization?
A: The slope would be 1:3 where standard riprap is used and 1:2 for other stabilization techniques; or we would put in a rock wedge.

Q: You said the Fish and Wildlife Service will be responsible for maintenance. What maintenance is needed?
A: Replacing some rock. Ice may push some rock out of place and we may have to replace it.

Q: Will private contractors do the work?
A: Yes, it looks like contractors will do it.

Q: It looks like most of the work will be done in pool 10. Are the conditions there bad or is it just politics?
A: No, not politics. The conditions are bad. We did some on-site surveys. We had teams of engineers and biologists who went out in boats and surveyed all the islands from pool 5 through pool 10. We are looking to protect unique areas such as brood rearing areas for waterfowl or spawning and feeding areas for fish. Pool 10 also creates habitat for Higgins' eye pearly mussels, an endangered species of mussel. Pool 10 has more of this habitat than the other pools.

Q: Upper project - Trempealeau Mountain - Blacksmith Slough: What are you doing there?
A: Putting in a partial closure structure.

Q: Where do you get the rock from?
A: Operating quarries in the area.

Comment: At Sand Run, they dropped in boulders. That is bad for propellers.

# COMMENTS

Mississippi River Bank Stabilization Habitat Project 9/29, 9/30, 10/4/93

Name (optional) ______________________________

No Comment Sheets were received.

Please leave this sheet at the meeting or mail your comments to:
Mr. Don Powell, CENCS-PD-WR
U.S. Corps of Engineers
180 Kellogg Blvd E, Rm 1421
St. Paul, MN 55101-1479

# RECORD OF ATTENDANCE

Mississippi River Bank Stabilization Public Meeting at Prairie du Chien, WI September 29, 1993

This information will be used for the purpose of knowing who attended this meeting.

Please include your address if you wish to be on the project mailing list. Thank you.

| NAME (please print) | ADDRESS (optional) | REPRESENTING (self, agency, etc) |
|---|---|---|
| Keith Beseke | | USFWS |
| DON POWELL | | Corps |
| Pete Fasbender | | Corps |
| Tom Raster | | Corps |
| John R Lyons | | FWS |
| JEFF JANVRIN | | WDNR |
| William Howe | Box 149 PdC | WIS Conservation Congress |
| CHARLES M. CAIN | GUTTENBERG IA | SELF |
| DALE F. CAIN | GUTTENBERG IA | SELF |
| Joe Ihm | Guttenberg Ia | Self |
| Kathy Maycroft | Upper Miss River NWFR McGregor District | USFWS |
| Carl + Doris Freund | McGregor, Iowa 52157 | Self |

# RECORD OF ATTENDANCE

Mississippi River Bank Stabilization Public Meeting at Prairie du Chien, WI September 29, 1993

This information will be used for the purpose of knowing who attended this meeting.

Please include your address if you wish to be on the project mailing list. Thank you.

| NAME (please print) | ADDRESS (optional) | REPRESENTING (self, agency, etc) |
|---|---|---|
| Allen & Dorothy Ackerson | PdC. R#1. | Self |
| Kurt Welke | PdC | Wis DNR |
| JACK BLASK | R1 BOX 217 GENOA W.S. 54632-9780 | Com Fish Conservation Congress |
| [illegible] | PdC | |
| Gary Ackerman | 317 S. RiverPark Dr Guttenberg IA 52052-0250 | IDNR |
| Donald M. Higgins | R4-Box 220 Cliffwood Drive PDC. | Self |
| 6 | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# RECORD OF ATTENDANCE

Mississippi River Bank Stabilization Public Meeting at La Crosse, WI — September 30, 1993

This information will be used for the purpose of knowing who attended this meeting.
Please include your address if you wish to be on the project mailing list. Thank you.

| NAME (please print) | ADDRESS (optional) | REPRESENTING (self, agency, etc) |
|---|---|---|
| KEITH BESEKE | | USFWS |
| DON POWELL | | COE |
| TOM RASTER | | COE |
| Jim Fisher | | fws |
| BILL THRUNE | | FWS |
| PETE FASBENDER | | COE |
| Bob Kopp | Trempealeau WI | |
| [illegible] | | WDNR |
| BILL HOWE | PdC Box 149 | ~~[illegible]~~ Minn Wis BAC |
| Harold Craig | LaCrosse | MWBAC La Crosse County Harbor Comm |
| Marc A. Schultz | 300 N. 4th st Lax | U.W. Extension |
| Fred [illegible] | W7931 CTH ZB Onalaska | Lake District Onalaska |

# RECORD OF ATTENDANCE

Mississippi River Bank Stabilization Public Meeting at Winona, MN October 4, 1993

This information will be used for the purpose of knowing who attended this meeting.

Please include your address if you wish to be on the project mailing list. Thank you.

| NAME (please print) | ADDRESS (optional) | REPRESENTING (self, agency, etc) |
|---|---|---|
| Leo R. Smith SR | 1208 W 7th | Self |
| Chas R. Smith | RT 1 Box 1902 | Self |
| Solomon Simon | P.O. 435 Winona MN. 55987 | Self & (Miss. River Revival) |
| Sharon Gates Hill | Tim Penny's Office Box 368 Owatonna MN | |
| Rob Drieslein | | WDN |
| [illegible] | 450 W 24 St Buffalo City | Wis |
| Jon Ritter | 4525 7th St WINONA, MN. | MINN City Boat Harbor President |
| Brian Brecka | (Alma, WI) Buffalo Cty. Courthouse | WDNR |
| Dave Napiecek | 261 CoachliteCts | Mathy Const |
| Allen Schulze | Caledonia MN | Mathy Const |
| [illegible] | LAX | WDNR |
| [illegible] | 310 W 2nd St [illegible] | [illegible] |

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Upper Mississippi River Refuge Complex
51 East 4th Street
Winona, Minnesota 55987


IN REPLY REFER TO:

August 4, 1992

Don Powell
Project Manager
1135 U.S. Post Office & Custom House
180 E. Kellogg Boulevard
St. Paul, Minnesota 55101

Dear Mr. Powell:

As you are aware we have just completed our field review with you and other members of the Corps of Engineers and State DNR staffs of approximately 45 potential riprap sites being considered in the Bank Stabilization Environmental Management Program (EMP) project. Based on this review and the biology of the area the following sites are the Refuge staff's endorsement for highest priority to be included in this EMP project. This review does not include sites not located on the Refuge.

**BEST OF THE BEST**
(Ranked in order of highest to lowest priority)

| | Site | Ranking Factors |
|---|---|---|
| 1. | Harper's Slough (all), Pool 9 | Protects 1000+ acres of marsh complex in closed area; good access |
| 2. | Billy Slough, Pool 10 | Protects large running slough complex with important fishery values; closure dam may create access problems |
| 3. | Richmond Island, Pool 7 | Protects running slough and marsh complex; good access |
| 4. | Trempealeau Daymark, Pool 6 | Protects excellent island vegetation plus marsh complex and slough |
| 5. | Head of Sand Run, Pool 5 | Eroding sand appears to be depositing directly into closed area marsh complex; small job with good access |

6. Heron and Trapping Islands, Pool 8 (combined) — Small nesting islands in need of fast action; very small job with fair access

7. Lake Onalaska Barrier Islands, Pool 7 — Protects lake marsh complex and backwater sloughs; in need of fast action

8. Lost Island Side Channel, Pool 5 — Eroding sand appears to be depositing directly into closed area marsh complex; small job with good access

9. Red Oak (both sides) and Cormorant Islands, Pool 7 — Important inter-lake islands; access problems

If you have any questions please contact Keith Beseke, EMP Coordinator, at (507)452-4232.

Sincerely,

James R. Fisher

James R. Fisher
Complex Manager

cc: Steve Johnson, MDNR
Jeff Janvrin, WDNR
Gary Ackerman, IDNR
Art Roseland, IDNR
District Managers--
(Winona, La Crosse, McGregor)

WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

State Office Building, Room 104
3550 Mormon Coulee Road
La Crosse, WI 54601
TELEPHONE 608-785-9000
TELEFAX 608-785-9990

February 5, 1992 File Ref: 1600-1-3

St. Paul District, Corps of Engineers
ATTN: Mr. Don Powell, Planning Division
180 Kellogg Boulevard East, Room 1421
St. Paul, MN 55101-1479

Dear Mr. Powell:

An updated selection of bank stabilization sites has been conducted by the U.S Fish and Wildlife Service, Iowa DNR, Minnesota DNR and Wisconsin DNR. Due to river conditions and scheduling conflicts, we were unable to visit potential sites in Pools 8 and 10. We will most likely do site selections for these pools this spring when river and weather conditions allow.

The enclosed list of bank stabilization projects has been reviewed by agency representatives that went on field visits to the sites. Included in the site descriptions are priorities on a pool by pool basis and approximate area benefited. A more detailed description of benefits will need to be coordinated among agencies after the final sites are selected.

Sincerely,

Jeffrey A. Janvrin
Mississippi River Habitat Specialist

c: Bob Drieslein, FWS
Gary Ackerman, IDNR
Mike Davis, MNDNR
Keith Beseke, FWS
John Lyons, FWS
Jim Nissen, FWS

Enclosure

JAJ

STATE OF IOWA
TERRY E. BRANSTAD, GOVERNOR
DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

Department of the Army
St. Paul District, COE
Mr. Don Powell
180 E. Kellog Blvd
St. Paul, MN 55101-1479

Re: Bank Stabilization HREP - Acreages of impact area

Dear Don:

Several of those projects along Iowa had poorly defined areas of impact and incorrect acreages. Those that we in Fisheries Bureau submitted have been carefully reviewed for accuracy, and then we calculated the acreages of impact by planimeter (we used the LUAP maps for reference).

We wish the following projects be reconsidered, and the AAHAG'S recalculated as based on these acreages: Maps of the impact areas are inclosed.

| | |
|---|---|
| Duck Lake, Pool 10 | 215 A. |
| Norwegian Slough, Pool 10 | 176 A. |
| Billy Slough, Pool 10 | 545 A. |

Previously Art Roseland prepared similar maps which included several other sites. Those should remain exactly as he submitted them as they are precise and accurate representations of the impact areas of individual projects.

In the event the USFWS wishes to review our work, please provide that agency or state copies of it. In the event the USFWS changes or alters any acreages, especially those of those three Harpers Slough Islands, we would like to review their methodology; i.e. mapping of impact sites and the acreages of them. Should any acreages differ greater than ten percent, we would like to compromise those issues before the Bank Stabilization Project is prepared for review.

Without these consistencies, any prioritization of Bank Stabilization Projects using AAHAG'S methodology would be an impossible task.

Thank you for your considerations,

Gary Ackerman

Gary Ackerman
Fishery Biologist

cc: Art Roseland, Dave Moeller, Dean Dalziel, Jeff Janvrin (WIDNR).

Encl: Map of Norwegian, Harpers Slough & Duck Lake

STEVE GUNDERSON
3D DISTRICT WISCONSIN

MEMBER
AGRICULTURE COMMITTEE
ON AND LABOR
MMITTEE

227 CANNON HOUSE OFFICE BUILDING
WASHINGTON DC 20515-4903
202-225-5506

DISTRICT OFFICE
P O BOX 247
438 NORTH WATER STREET
BLACK RIVER FALLS WI 54615-0247
1-800-472-6612
715-284-7431

**Congress of the United States**
**House of Representatives**
**Washington, DC 20515-4903**

April 23, 1990

General Jude W. P. Patin
Commander, North Central Division
Corps of Engineers
Department of the Army
536 South Clark Street
Chicago, Ill 60605-1592

Dear General Patin:

I appreciate your placing the erosion control projects for the Environmental Management Program in the St. Paul District on the high priority list. This should alleviate some of the concerns expressed to me by many constituents. However, I would like you to consider going one step further by seeking a policy change to allow each District about $50,000 annually in EMP funds to address small environmental problems. There are many small projects that need funding without going through the elaborate studies and project reports necessary for larger projects.

I would appreciate it if you would discuss this concept with your staff and higher authority to seek a policy change. Let me know if I can be of any assistance on this matter.

Best regards,

Steve Gunderson

Steve Gunderson
Member of Congress

SG:dka

Attachment 6

Draft Memorandum of Agreement
for
Operation and Maintenance

DRAFT

MEMORANDUM OF AGREEMENT

BETWEEN

THE UNITED STATES FISH AND WILDLIFE SERVICE

AND

THE DEPARTMENT OF THE ARMY

FOR

ENHANCING FISH AND WILDLIFE RESOURCES

OF THE

UPPER MISSISSIPPI RIVER SYSTEM

AT THE

MISSISSIPPI RIVER BANK STABILIZATION

MINNESOTA, WISCONSIN, AND IOWA

## I. PURPOSE

The purpose of this memorandum of agreement (MOA) is to establish the relationships, arrangements, and general procedures under which the U.S. Fish and Wildlife Service (USFWS) and the Department of the Army (DOA) will operate in constructing, operating, maintaining, repairing, and rehabilitating the Mississippi River Bank Stabilization (MRBS) separable element of the Upper Mississippi River System - Environmental Management Program (UMRS-EMP).

## II. BACKGROUND

Section 1103 of the Water Resources Development Act of 1986, Public Law 99-662, authorizes construction of measures for the purpose of enhancing fish and wildlife resources in the Upper Mississippi River System. The project area is managed by the USFWS and is on land managed as a national wildlife refuge. Under conditions of Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, all construction costs of those fish and wildlife features for the MRBS project are 100 percent Federal, and pursuant to Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580, all costs of operation and maintenance for the MRBS project are 100 percent Federal.

III. GENERAL SCOPE

The project to be accomplished pursuant to this MOA shall consist of rehabilitating and improving the fish and wildlife habitat on the Upper Mississippi River Wildlife and Fish Refuge by stabilizing several shoreline sites that are eroding. This would involve the placement of rockfill at about 12 locations in pools 6 through 10 to prevent further shoreline erosion and related backwater sedimentation. The project would improve backwater habitat on approximately 1,500 acres of the Refuge by reducing sediment-laden flow into the backwater and/or maintaining islands that are protecting backwater habitat. Depending on sites already implemented and construction costs, additional locations in pools 5 through 10 may also be included in the project, up to about $2 million in construction costs.

IV. RESPONSIBILITIES

A. DOA is responsible for:

1. <u>Construction</u>: Construction of the project which currently consists of stabilizing about 12,000 feet of existing island shoreline in pool 6 (2 sites), pool 7 (1 site), pool 8 (1 site), pool 9 (3 sites), and pool 10 (5 sites). About 28,000 cubic yards of rockfill would be used to complete the work. Rockfill to accomplish the work would be obtained from local operating quarries and transported to the sites via barge.

2. <u>Major Rehabilitation</u>: The Federal share of any mutually agreed upon rehabilitation of the project that exceeds the annual operation and maintenance requirements identified in the Definite Project Report and that is needed as a result of specific storm or flood events.

3. <u>Construction Management</u>: Subject to and using funds appropriated by the Congress of the United States, and in accordance with Section 906(e) of the Water Resources Development Act of 1986, Public Law 99-662, DOA will construct the MRBS project as described in the Definite Project Report/Environmental Assessment, Mississippi River Bank Stabilization, Habitat Rehabilitation and Enhancement Project, dated xxxxxxxx 1995, applying those

procedures usually followed or applied in Federal projects, pursuant to Federal laws, regulations, and policies. The USFWS will be afforded the opportunity to review and comment on all modifications and change orders prior to the issuance to the contractor of a Notice to Proceed. If DOA encounters potential delays related to construction of the project, DOA will promptly notify USFWS of such delays.

4. Maintenance of Records. The DOA will keep books, records, documents, and other evidence pertaining to costs and expenses incurred in connection with construction of the project to the extent and in such detail as will properly reflect total costs. The DOA shall maintain such books, records, documents, and other evidence for a minimum of three years after completion of construction of the project and resolution of all relevant claims arising therefrom, and shall make available at its offices, at reasonable times, such books, records, documents, and other evidence for inspection and audit by authorized representatives of the USFWS.

B. USFWS is responsible for operation, maintenance, and repair: Upon completion of construction as determined by the District Engineer, St. Paul, the USFWS shall accept the project and shall operate, maintain, and repair the project as defined in the Definite Project Report/Environmental Assessment entitled "Mississippi River Bank Stabilization, Habitat Rehabilitation and Enhancement Project," dated xxxxxxxx 1995, in accordance with Section 107(b) of the Water Resources Development Act of 1992, Public Law 102-580.

## V. MODIFICATION AND TERMINATION

This MOA may be modified or terminated at any time by mutual agreement of the parties. Any such modification or termination must be in writing. Unless otherwise modified or terminated, this MOA shall remain in effect for a period of no more than 50 years after initiation of construction of the project.

VI. REPRESENTATIVES

The following individuals or their designated representatives shall have authority to act under this MOA for their respective parties.

USFWS: Regional Director
U.S. Fish and Wildlife Service
Bishop Henry Whipple Federal Building
1 Federal Drive
Fort Snelling, Minnesota 55111-4056

DOA: District Engineer
U.S. Corps of Engineers, St. Paul District
Army Corps of Engineers Centre
190 Fifth Street East
St. Paul, Minnesota 55101-1638

VII. EFFECTIVE DATE OF MOA

This MOA shall become effective when signed by the appropriate representatives of both parties.

THE DEPARTMENT OF THE ARMY

BY: ______________________
(signature)
JAMES T. SCOTT
Colonel, Corps of Engineers
St. Paul District

DATE: ________________

THE U.S. FISH AND WILDLIFE SERVICE

BY: ______________________
(signature)
WILLIAM HARTWIG
Regional Director
U.S. Fish and Wildlife Service

DATE: ________________

Attachment 7

Distribution List

Attachment 7

Distribution List

ATTACHMENT 8

DETAILED COST ESTIMATE

TABLE OF CONTENTS

ATTACHMENT 8

# DETAILED COST ESTIMATE

## 8.1 GENERAL

1. This appendix contains the detailed project cost estimate prepared for the construction of the Mississippi River Bank Stabilization HREP project at Pools 5-10 on the Mississippi River. The estimate has been prepared based on experience and historical data for similar work. Results are presented on a spread sheet showing costs and contingencies. This write-up is prepared to explain cost relationships and development of the contingencies. Guidance for preparation of this appendix was obtained from ER 1110-2-1150, Engineering and Design for Civil Works Projects, and ER 1110-2-1302, Civil Works Cost Engineering. The estimate is in the Civil Works Breakdown Structure format as directed by ER 1110-2-1302.

## 8.2 PRICE LEVEL

1. Estimated costs are based on August 1995 price levels. These costs are considered fair and reasonable to a prudent and capable contractor. Estimated costs on the Total Project Cost Summary Sheet are rounded to the nearest $1,000.00.

## 8.3 PROJECT DESCRIPTION

1. The purpose of the project is to preserve, restore, and enhance backwater fish and migratory bird habitat on the UMRWFR and maintain or improve water quality in the backwaters.

2. The project includes the placement of rockfill at the sites selected to accomplish the above purpose. The selected sites are in Pools 6, 7, 8, 9, and 10. Some of the sites will require access dredging for placement of the rockfill. Some of the sites will require the placement of fill material to build up eroded areas prior to placement of the rockfill. Fill materials will be obtained from mechanical dredging within the area. Filter fabric is used where rockfill is placed on a slope to provide erosion protection.

## 8.4 CONSTRUCTION METHODS

1. Marine access to all of the sites is available. However, dredging for access will be necessary at some of the sites. Normal construction procedures will be used to stabilize the sites.

2. It is anticipated that access dredging will be accomplished by a hydraulic excavator on a barge. Dredged material will be placed on a material barge and transported to the nearest placement site. Dredged material will be unloaded with front end loaders and placed in the disposal site. At

Blacksmith Slough, it is anticipated that the dredge material will be transported upland a distance of 5 miles or less.

3. Dredging for pervious fill will be required at several locations. It is assumed that a site for this dredging will be found within 1 mile of the placement site.

4. Rockfill placement will be accomplished with the same equipment used for dredging. Generally, loading docks at Lock & Dams will be used for loading rockfill onto barges.

8.5 COST RELATIONSHIPS

1. It is assumed that all of the work will be accomplished by a general contractor. Costs for mobilization and demobilization are estimated and included as an item of work.

2. The work at each site is very similar. Costs vary for similar items of work generally based on the distances from the work sites to the placement sites and loading dock facilities.

8.6 CONTINGENCIES

1. The contingencies for all items of work have been set at 50% to account for uncertainties in the required quantity of access dredging, pervious fill, and rockfill. Limited survey information was obtained at each site in 1992 and was used to determine the rockfill design and quantities. The work is anticipated to begin in 1996 and will extend through 1999. Flow conditions in the river, between the time when the survey data was obtained and the work begins, may be extreme such that the areas where the work is to be done could be significantly altered by erosion or sedimentation.

2. Feature 30, Planning, Engineering and Design. Costs and contingencies are provided by the technical manager for each separate engineering function and are based on experience with similar type projects.

3. Feature 31, Construction Management. Costs and contingencies are based on experience with similar type projects.

8.7 ATTACHMENTS.

1. The first attachment is the Total Project Cost Summary. This shows the fully funded project cost estimate. It is prepared in accordance with Project Management guidelines and includes costs for construction, engineering and design, and construction management along with the appropriate contingencies and inflation index associated with each of these activities through project completion. For this project, there will be no Non-Federal costs since the project is for the rehabilitation of Federally owned property.

2. The second attachment is the backup to the Total Project Cost Summary. This shows detailed unit costs and detailed contingencies.

TOTAL - MISSISSIPPI RIVER BANK STABILIZATION EMP HABITAT PROJECT **** TOTAL PROJECT COST SUMMARIES ****

PROJECT: MISSISSIPPI RIVER BANK STABILIZATION PROJECT, EMP — PREPARED BY: GARY SMITH , CENCS-PE-D

LOCATION: POOLS 6, 7, 8, 9, 10 MISSISSIPPI RIVER, MN, WI, IA — SELECTED PLAN

DATE PREPARED: 28 AUGUST, 1995 — REVIEWED AND APPROVED BY: ALLEN L. GEISEN , SECTION CHIEF

| ACCOUNT NUMBER | ITEM DESCRIPTION | ESTIMATED COST($) (EPD) | CONTINGENCY AMOUNT($) | % | TOTAL EST COST (EPD) | % | OMB INDEX TO 10/95 AMOUNT | MID POINT OF FEATURE | OMB (%) INDEX (+/-) | INDEXED COST AMOUNT ($) | INDEXED CONTG. AMT. ($) | FULLY FUNDED COST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 06--- | FISH AND WILDLIFE FACILITIES | 1,299,000 | 650,000 | 50% | 1,949,000 | 0.5% | 1,959,000 | DEC 96 | 3.90% | 1,356,000 | 679,000 | 2,035,000 |
| | TOTAL CONSTRUCTION COSTS =====> | 1,299,000 | 650,000 | 50% | 1,949,000 | | 1,959,000 | | | 1,356,000 | 679,000 | 2,035,000 |
| 01--- | LANDS AND DAMAGES | | | | | | | | | | | |
| 30--- | PLANNING, ENGINEERING AND DESIGN | | | | | | | | | | | |
| | PRIOR TO 8/95 | 173,000 | | 0% | 173,000 | | 173,000 | | 0.00% | 173,000 | 0 | |
| | AFTER 8/95 | 394,000 | 60,000 | 15% | 454,000 | 0.7% | 457,000 | JUN 96 | 3.80% | 412,000 | 63,000 | |
| | TOTAL PED | 567,000 | 60,000 | 11% | 627,000 | | 630,000 | | | 585,000 | 63,000 | 648,000 |
| 31--- | CONSTRUCTION MANAGEMENT | 118,000 | 18,000 | 15% | 136,000 | 0.7% | 137,000 | DEC 96 | 5.70% | 126,000 | 19,000 | 145,000 |
| | TOTAL PROJECT COSTS ======> | 1,984,000 | 728,000 | 37% | 2,712,000 | | 2,726,000 | | | 2,067,000 | 761,000 | 2,828,000 |
| | | | | | | | | | | | | 2,828,000 |

NOTES:

1. Prices are at August 1995 price levels.

| ACCOUNT CODE | ITEM | UNIT | QUANTITY | UNIT PRICE | AMOUNT | CONTINGENCIES AMOUNT | PERCENT | REASON | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| 06.--.--.-- | FISH AND WILDLIFE FACILITIES | | | | | | | | |
| 06.03.--.-- | WILDLIFE FACILITIES & SANCTUARY | | | | | | | | |
| 06.03.73.-- | HABITAT AND FEEDING FACILITIES | | | | | | | | |
| 06.03.73.02 | SITEWORK | | | | | | | | |
| 06.03.73.02 | POOL 6 (2 SITES) | | | | 244,100 | | | | |
| 06.03.73.02 | MOB AND DEMOB | JB | 1 | 10,000 | 10,000 | 5,000 | 50.00% | 3 | |
| 06.03.73.02 | BLACKSMITH SLOUGH | | | | | | | | |
| 06.03.73.02 | DREDGING | CY | 3,000 | 5.00 | 15,000 | 7,500 | 50.00% | 1,2,3,4 | DISPOSE AT THE SITE, BEHIND THE ROCKFILL STRUCTURE |
| 06.03.73.02 | DREDGING | CY | 2,500 | 8.00 | 20,000 | 10,000 | 50.00% | 1,2,3,4 | DISPOSAL BY BARGE TO WINONA, UPLAND 5 MILES |
| 06.03.73.02 | FILTER FABRIC | SY | 800 | 3.00 | 2,400 | 1,200 | 50.00% | 1,2,3,4 | (5 MILES TO WINONA) |
| 06.03.73.02 | ROCKFILL | CY | 1,400 | 35.00 | 49,000 | 24,500 | 50.00% | 1,2,3,4 | LESS THAN 4 MILES TO LOADING DOCK AT LD 6 |
| 06.03.73.02 | TREMPEALEAU DAY | | | | | | | | |
| 06.03.73.02 | FILTER FABRIC | SY | 4,900 | 3.00 | 14,700 | 7,350 | 50.00% | 1,2,3,4 | |
| 06.03.73.02 | ROCKFILL | CY | 3,800 | 35.00 | 133,000 | 66,500 | 50.00% | 1,2,3,4 | LESS THAN 4 MILES TO LOADING DOCK AT LD 6 |
| 06.03.73.02 | POOL 7 (1 SITE) | | | | 138,100 | | | | |
| 06.03.73.02 | MOB AND DEMOB | JB | 1 | 10,000 | 10,000 | 5,000 | 50.00% | 3 | |
| 06.03.73.02 | LAKE ONALASKA | | | | | | | | |
| 06.03.73.02 | DREDGING | CY | 8,800 | 7.00 | 61,600 | 30,800 | 50.00% | 1,2,3,4 | DISPOSAL SITE 3 MILES, NO UPLAND HAUL |
| 06.03.73.02 | ROCKFILL | CY | 1,900 | 35.00 | 66,500 | 33,250 | 50.00% | 1,2,3,4 | LESS THAN 4 MILES TO LOADING DOCK AT LD 7 |
| 06.03.73.02 | POOL 8 (1 SITE) | | | | 86,000 | | | | |
| 06.03.73.02 | MOB AND DEMOB | JB | 1 | 10,000 | 10,000 | 5,000 | 50.00% | 3 | |
| 06.03.73.02 | HERON & TRAPPING ISL | | | | | | | | |
| 06.03.73.02 | DREDGING | CY | 400 | 5.00 | 2,000 | 1,000 | 50.00% | 1,2,3,4 | MATERIAL PLACED BEHIND OFF SHORE MOUND |
| 06.03.73.02 | ROCKFILL | CY | 2,000 | 37.00 | 74,000 | 37,000 | 50.00% | 1,2,3,4 | 6 MILES TO LOADING DOCK ABOVE LD 8 |
| 06.03.73.02 | POOL 9 (3 SITES) | | | | 344,800 | | | | |
| 06.03.73.02 | MOB AND DEMOB | JB | 1 | 10,000 | 10,000 | 5,000 | 50.00% | 3 | |
| 06.03.73.02 | UP HARPERS SLOUGH | | | | | | | | |
| 06.03.73.02 | ROCKFILL | CY | 4,000 | 36.00 | 144,000 | 72,000 | 50.00% | 1,2,3,4 | 5 MILES TO LOADING DOCK ABOVE LD 9 |
| 06.03.73.02 | MID HARPERS SLOUGH | | | | | | | | |

| ACCOUNT CODE | ITEM | UNIT | QUANTITY | UNIT PRICE | AMOUNT | CONTINGENCIES AMOUNT | PERCENT | REASON | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| 06.03.73.02 | ROCKFILL | CY | 500 | 36.00 | 18,000 | 9,000 | 50.00% | 1,2,3,4 | 5 MILES TO LOADING DOCK ABOVE LD 9 |
| 06.03.73.02 | LOW HARPERS SLOUGH | | | | | | | | |
| 06.03.73.02 | ROCKFILL | CY | 4,800 | 36.00 | 172,800 | 86,400 | 50.00% | 1,2,3,4 | 5 MILES TO LOADING DOCK ABOVE LD 9 |
| 06.03.73.02 | POOL 10 (5 SITES) | | | | 486,400 | | | | |
| 06.03.73.02 | MOB AND DEMOB | JB | 1 | 16,000 | 16,000 | 8,000 | 50.00% | 3 | |
| 06.03.73.02 | BILLY SLOUGH | | | | | | | | |
| 06.03.73.02 | DREDGING | CY | 200 | 5.00 | 1,000 | 500 | 50.00% | 1,2,3,4 | PLACE IN THE FILL SECTIONS |
| 06.03.73.02 | PERVIOUS FILL | CY | 2,800 | 7.00 | 19,600 | 9,800 | 50.00% | 1,2,3,4 | OBTAINED WITHIN 2 MILES |
| 06.03.73.02 | FILTER FABRIC | SY | 2,200 | 3.00 | 6,600 | 3,300 | 50.00% | 1,2,3,4 | |
| 06.03.73.02 | ROCKFILL | CY | 7,600 | 35.00 | 266,000 | 133,000 | 50.00% | 1,2,3,4 | 2 MILES TO LOADING DOCK AT LD 9 |
| 06.03.73.02 | EAST CHANNEL | | | | | | | | |
| 06.03.73.02 | DREDGING | CY | 2,400 | 7.00 | 16,800 | 8,400 | 50.00% | 1,2,3,4 | ASSUME DISPOSAL WITHIN 4 MILES |
| 06.03.73.02 | PERVIOUS FILL | CY | 2,000 | 7.00 | 14,000 | 7,000 | 50.00% | 1,2,3,4 | OBTAINED WITHIN 2 MILES |
| 06.03.73.02 | FILTER FABRIC | SY | 2,100 | 3.00 | 6,300 | 3,150 | 50.00% | 1,2,3,4 | |
| 06.03.73.02 | ROCKFILL | CY | 1,400 | 36.00 | 50,400 | 25,200 | 50.00% | 1,2,3,4 | ASSUME LOADING DOCK WITHIN 5 MILES |
| 06.03.73.02 | NORWEGIAN SLOUGH | | | | | | | | |
| 06.03.73.02 | PERVIOUS FILL | CY | 1,200 | 7.00 | 8,400 | 4,200 | 50.00% | 1,2,3,4 | OBTAINED WITHIN 2 MILES |
| 06.03.73.02 | FILTER FABRIC | SY | 500 | 3.00 | 1,500 | 750 | 50.00% | 1,2,3,4 | |
| 06.03.73.02 | ROCKFILL | CY | 600 | 39.00 | 23,400 | 11,700 | 50.00% | 1,2,3,4 | LOADING DOCK AT PRAIRIE, 8 MILES |
| 06.03.73.02 | ISLAND 181 (CATFISH) | | | | | | | | |
| 06.03.73.02 | FILTER FABRIC | SY | 700 | 3.00 | 2,100 | 1,050 | 50.00% | 1,2,3,4 | |
| 06.03.73.02 | ROCKFILL | CY | 500 | 41.00 | 20,500 | 10,250 | 50.00% | 1,2,3,4 | LOADING DOCK AT PRAIRIE, 10 MILES |
| 06.03.73.02 | DUCK LAKE CHUTE | | | | | | | | |
| 06.03.73.02 | DREDGING | CY | 200 | 7.00 | 1,400 | 700 | 50.00% | 1,2,3,4 | ASSUME DISPOSAL 2 MILES AT MCMILLIAN ISLAND |
| 06.03.73.02 | FILTER FABRIC | SY | 300 | 3.00 | 900 | 450 | 50.00% | 1,2,3,4 | |
| 06.03.73.02 | ROCKFILL | CY | 900 | 35.00 | 31,500 | 15,750 | 50.00% | 1,2,3,4 | ASSUME A LOADING DOCK WITHIN 4 MILES |

| | | | |
|---|---|---|---|
| SUBTOTAL CONSTRUCTION COSTS | | $1,299,400 | |
| SUBTOTAL CONTINGENCIES | 50.0% | | $649,700 |
| TOTAL 06. FISH AND WILDLIFE FACILITIES | | | $1,949,100 |

| ACCOUNT CODE | ITEM | UNIT | QUANTITY | UNIT PRICE | AMOUNT | CONTINGENCIES AMOUNT | PERCENT | REASON | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|

REASONS FOR CONTINGENCIES

1. QUANTITY UNKNOWNS
2. SITE CONDITIONS
3. HAUL DISTANCE
4. UNIT PRICES
5. LEGAL COSTS
6. LAND PRICES
7. PRODUCTION/DURATION
8. MATERIALS
9. INSIGNIFICANT AMOUNT
10. NOT APPLICABLE

| ACCOUNT CODE | ITEM | UNIT | QUANTITY | UNIT PRICE | AMOUNT | CONTINGENCIES AMOUNT | CONTINGENCIES PERCENT | REASON | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| 30.-.-.- | PLANNING, ENGINEERING AND DESIGN | | | | | | | | |
| 30.B.-.- | ENGINEERING AND DESIGN PRIOR TO 8/95 | | | | | | | | |
| 30.B.4.- | DESIGN BY DISTRICT | JOB | 1 | 172,700 | 172,700 | 0 | 0.0% | 7 | |
| 30.H.-.- | PLANS AND SPECIFICATIONS | | | | | | | | |
| 30.H.B.- | FINAL DESIGN (IN-HOUSE) | JOB | 1 | 377,000 | 377,000 | 56,550 | 15.0% | 7 | |
| 30.J.-.- | ENG. DURING CONSTRUCTION | | | | | | | | |
| 30.J.9.- | ALL OTHER ENGINEERING | JOB | 1 | 12,000 | 12,000 | 2,040 | 17.0% | 7 | |
| 30.N.-.- | CONSTR. & AWARD ACTIVITY | | | | | | | | |
| 30.N.9.- | PREP. BIDDING DOCUMENTS | JOB | 1 | 5,000 | 5,000 | 1,000 | 20.0% | 7 | |

| | | | |
|---|---|---|---|
| SUBTOTAL CONSTRUCTION COSTS | | $566,700 | |
| SUBTOTAL CONTINGENCIES | 10.5% | | $59,590 |
| TOTAL 30. PLANNING, ENGINEERING AND DESIGN | | | $626,290 |

REASONS FOR CONTINGENCIES

7. PRODUCTION/DURATION

| ACCOUNT CODE | ITEM | UNIT | QUANTITY | UNIT PRICE | AMOUNT | CONTINGENCIES AMOUNT | CONTINGENCIES PERCENT | REASON | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| 31.-.-.- | CONSTRUCTION MANAGEMENT (S&I) | | 1 | 118,000 | 118,000 | 17,700 | 15.0% | | |

| | | | |
|---|---|---|---|
| SUBTOTAL CONSTRUCTION COSTS | | $118,000 | |
| SUBTOTAL CONTINGENCIES | 15.0% | | $17,700 |
| TOTAL 31. CONSTRUCTION MANAGEMENT (S&I) | | | $135,700 |

REASONS FOR CONTINGENCIES

7. PRODUCTION/DURATION

NOTES

A. UNIT PRICES AT DECEMBER 1994 PRICE LEVEL.

The Draft Definite Project Report/Environmental Assessment and/or Public Notice was sent to the following agencies and interests:

Congressional

Sen. Paul Wellstone (St. Paul)*
Sen. Rod Grams (Anoka)*
Rep. Gil Gutknecht (Rochester)*
Sen. Russell Feingold (Middletown)*
Sen. Herb Kohl (Madison)*
Rep. Steve Gunderson (Bl Riv Falls)*
Sen. Tom Harkin (Des Moines)*
Sen. Charles Grassley (Davenport)*
Rep. Jim Nussle (Wash DC)*

Federal

U.S. Fish and Wildlife Service (Bloomington- Lewis*; Winona- Fisher*, Beseke, Drieslein*; Fort Snelling-Hartwig*, Dobrovolny; La Crosse- Korschgen*; McGregor- Maycroft*, Onalaska- Nissen*)
Corps of Engineers (LMS- Hawickhorst, Cotner*; LMV- Arnold; NCD- Albert; NCR- Skalak; NCS-Fountain City-Krumholz; LaCrescent- Urich; L&D 4*; L&D 5*; L&D 5A*; L&D 6*; L&D 7*; L&D 8*; L&D 9*; L&D 10*; St. Paul- Cin*, Face, Fasbender, D.Foley*, Gulan, Hendrickson, Johannessen, Powell, Smith; Onalaska- Thomsen*; Winona- Glaeser*, Morris*, Peterson*)
Environmental Protection Agency (Chicago)
U.S. Geological Survey (Moundsview; Madison)*
Soil Conservation Service (Madison, St. Paul)*
Office of Environmental Compliance-DOE (Wash DC)*
National Biological Service (Onalaska)
U.S. Coast Guard (St. Louis)*
National Park Service (Omaha)
Advisory Council on Historic Preservation (Wash DC)
Office of Environ. Project Review-DOI (Wash DC)

State of Minnesota

Department of Natural Resources (Lake City- Davis, Johnson; St. Paul- Johnson; Winona- Gulden*)
Pollution Control Agency
Department of Transportation*
State Archeologist
Water and Soil Resources Board*
Department of Administration*
State Historic Preservation Officer
State Planning Agency*

State of Wisconsin

Department of Natural Resources (Madison- Meyer*; La Crosse- Janvrin, Moe; Alma- Brecka; Prairie du Chien-Welke; Eau Claire- Bourget; Black River Falls- Talley*)
Governor Tommy Thompson (Madison)*
Department of Agriculture (Madison)*
Department of Transportation (La Crosse)*
State Archeologist (Madison)
Department of Administration (Madison)*
Department of Health and Social Services (Madison)*
State Historic Preservation Officer (Madison)
Bureau of Water Reg & Zoning (Madison)*

State of Iowa

Department of Natural Resources (Des Moines- Szcodronski; Farris*; Guttenberg- Ackerman; Manchester- Roseland)
State Archaeologist (Iowa City)*
State Historic Preservation Officer (Des Moines)*
Department of Transportation (Ames)*
Department of Administration (Des Moines)*

Local

| | | | |
|---|---|---|---|
| Allamakee Co Engineer* | Alma Post Office* | Alma Public Library | Brownsville Post Office* |
| Buffalo City Bait Shop* | Buffalo City Clerk* | Buffalo Co Cnsvtnist* | Cochrane Post Office* |
| Crawford Co Engineer* | Desoto Post Office* | Ferryville Post Office* | Fountain City Clerk* |
| Fountain City Post Office* | Galesville Public Library | Genoa Post Office* | Guttenberg Post Office* |
| Guttenberg Public Library | LaCrescent City Clerk* | La Crosse Post Office* | La Crosse Public Library |
| Lansing City Clerk* | Lansing Marina* | Lansing Post Office* | Lansing Public Library |
| Larry's Landing* | Marquette Clerk* | Marquette Post Office* | Mathy Construction* |
| McGregor Clerk* | McGregor Post Office* | McGregor Public Library | Stoddard Post Office* |
| Trempealeau Cham Commer* | Trempealeau Co Clerk* | Trempealeau Post Office* | Winona Post Office* |
| Winona Public Library | | | |

Other Interests

| | | |
|---|---|---|
| Allamekee Jrnl/Lansing Mir* | Badger State Sportsmen (LaX)* | Bass Masters (La Crosse)* |
| Big River (Winona)* | Burlington Northern Railroad* | Cochrane-Fountain City Recorder* |
| Courier Press (Prairie du Chien)* | Ducks Unlimited (La Crosse)* | Galesville Republican* |
| Guttenberg Press* | Houston County News* | KAGE, KWNO, KQAL Radio (Winona)* |
| KNEI Radio (Waukon)* | La Crosse Co Ext Office(LaCrosse)* | La Crosse Tribune* |
| Larry's Landing | MN/WI Boundary Area Comm (Hudson) | National Audubon Society (St.Paul)* |
| Nature Conservancy (Madison,Mpls)* | North Iowa Times* | Peoples State Bank* |
| Perrot State Park* | St. Mary's College (Winona)* | Sierra Club (Madison, Mpls)* |
| U of Wisc Extension Office* | Univ of Wisc (La Crosse) | Upper Miss R Basin As (St.Paul)* |
| Upper Miss Riv Cons Com (Rock Isl) | Vernon Co Broadcaster* | Waukon Newspapers* |
| Whitehall Times* | Winona Daily News* | Winona State University* |
| Wisc Winnebago Business Comm* | WKBT, WLAX, WXOW TV (La Crosse)* | WKTY, WLSU, WLXR Radio(La Crosse)* |
| WPRE Radio (Prairie du Chien)* | | |

*Public Notice Only

Individuals*

Blaine- Anne Powell
Brownsville- Rick Denstad; Keri Schaller
Buffalo City- Edward Anniuk; Warren Barth; Dave Becker; Willard Blank; David Brandon; Roger Burmeister; Larry Comero; Jack Deneff; Steven Engler; Herb Fandrey; David Fritsch; Wes Herbst; Milford Herreid; John Hilt; Dan Jacquart; William Krause; Ralph Leahy; Alfred Lorenz; Bill Meyer; Gary Nissalke; Sandra Piechowski; Aaron Reuter; Peter Rothering; Dennis Schmidtknecht; Kevin Solem; Jack Walz; Randy Wieczorek
Cochrane- Clifton Adler; Barry Auer; Rich Baures; Brian Bjorke; Clifford Burmeister; Steven Burmeister; Randy Dienger; Steven Duellman; Gerald Earney; John Fandrey; David Fettling; Dick Graettinger; Ed Helmueller; Carl Hinz; Gordon Jensen; Marceda Jensen; Kermit Keller; George Kletzke; Allen Kochenderfer; Tom Krumholz; Alvin Lieth; Dick Lieth; Duane Loewenhagen; Bob Lovas; John Matson; Robert Miller; Curtis Morem; John Moss; William Powell; Myron Schwanke; Edward Squires; Henry Stankiewicz; Ardine Steckling; Virgil Stinocher; John Weber; Rudy Zeller
Desoto- Delmer Backhaus; Gerald Sindy
Dyersville- Kurt Burbach; Joseph Ertl
Eastman- Peter Biermenapp; Allen Christensen; DuWayne Jonsrud
Eau Claire- Jack Mettler
Elm Grove- Jim Kexel
Fayette- Bernard Pattison
Ferryville- Truman Anderson; Fritz Bechtel; John Diehl; Don Hempy; Stuart Johnston; Larry Knutson; William McCormick; George Olson; Paul Sampson; James Volk
Fountain City- Kirsten Almo; Ralph Czaplewski; Roger Czaplewski; Robert Sieker
Galesville- Rebecca Barnes; George Walski
Gays Mills- Ron Leys; Leonard Olson; Minnie Olson; Thomas Olson
Genoa- Jack & George Blask; Raymond Klafke; Raymond McKelatti
Guttenberg- Charles Cain; Laird Cline; Doug Geuder; Mickey Healy; Joe Ihm; John Kuempel; Howard Miller; Ray Nitzki; Gary Stirn; Leland Tomkins; Michael Tujetsch; Eldon Vorwald; Chris Zach; Roger Zach; Donald Zerley
Harpers Ferry- Carl Lund
Hazelton- Leo Howard
Hokah- Arnold Idecker
Holmen- Joni Jackson; Jerry Pryor; Virgil Roberts; Harvey Neilson
La Crosse- Joe Bronk; Claude Deck; Frank Hodge; Fred Lesher; Art Lotz; Harry Meinking; Neil Pomeroy; Bill Steinmetz; Kathy Tabbert; Dean Young
LaCrescent- Jerry Kathar; Don Krohn
Lansing- Barr; J.W. Bowker; Bill Burke; D.J. Delaney; Gus Kerndt; Leslie Livingood; C.E. Loomis; Orville Meyers; Mohn; Ray Taylor; Donald Weymiller
Lynxville- Nathan Burgin; Ron Coleman; Bob Hagensick; Stan Hagensick; Lawrence Henkel; Mark Withey
Marion- Harold Bogert; Kenneth Fry; Douglas Hutchins; Kent Lofton
McGregor- Carl Lund
Minnesota City- Warren Matzke; Wayne Purtzer; Don Riedeman; Henry Rollinger; Leroy Tibesar; Ed Tomashek; Rich Twait
Oakdale- Carl Stephan
Onalaska- Carl Behringer; Mike Dvorack; Harlan Edmunds; Willis Fernholz; David Fonger; Fred Funk (DPR); Glen Gran; Ed Gray; Wm Hawkins; Bill Heinz; Tom Laufenverg; Charles Lukwitz; Timothy Maier; Leif Marking; Jim Noel; Ronald Page; Merlin Pandler; Gene Pankonien; Leonard Pralle; Patrick Smith; Sue Stranc; Chuck Vogel; Al Wernecke; David Wilson
Prairie du Chien- Allen Ackerson, Donald Higgin, William Howe (DPR); David Miller; Carl Noel; Glen Palmer; Paul Porvaznik; Bob Ziel
Prairie du Sac- Harvey Paul
Stoddard- Calvin Barstow; Paul Gettelman; Tom Gianoli; Kevin Gobel; George Goodsell; Clarence Haydysch; Richard Jensen; Norm Krause; Eugene Loeffler; Pat Middleton; David Peterson; Gary Raabel; Daryl Steinke; Jim Willenberg; Bob Woodhouse; Rudy Wopat
Trempealeau- Orville Auseth; Jonathon Bald; Archie Chase; Dale Critzman; Hubert Drugan; Jeff Duncan; Herman Eichman; Phillip Foss; Alvin Gilberg; Kenneth Hovell; Tom Hunter; Sanford Ilstrup; Lynda James; Steve Kiedrowski; Bob Koba; Ruth Lamke; Pete Leavitt; Forest Mason; Morgan McDonah; Blake Nelson; Gordon P. Olson; Dan Peplinski; John Reynolds; George Richtman; Doris Schindler; Grant Shorrel; John Siger; Al Skroska; Bea Stellpflug; Wendell Stephan; David Tranberg; Terry Uhl; Randy Van Vleet; Nate Vernon; Kenneth Wilber; James Wojciechowski; John Zimmerman
Winona- Jim Bambenek; Jon Bitu; Helen Davis; Pat Deninger; William Drazkowski; James Drier; Pam Eyden; Bruce Fuller; Dick Gordon; Dan Gray; Bill Green; Lloyd Livingstone; John Kane; Mike Kolstad; Charles Kubicek; Scott Lee; Reggie McLeod; James Nowlan; Robert Olson; Bob Pohl; Nancy Reynolds; Joanne Riska; Henry Romer; Michael Rompa; John Ruggeberg; Solomon Simon; Charles Smith; Leo Smith; Will Snyder; Eric Sorensen; Eugene Sxeazy; John Tweedy

*Public Notice Only, unless noted

Attachment 8

Detailed Cost Estimate

# APPENDIXES

# APPENDIX A

# FIELD INVESTIGATION DATA SHEETS

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: Island 42 | | | Site number (pool–river mile–l/r bank): 5-749.7-R |
| Date investigated: 5/7/92 | Time: 0930 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 4 | Tailwater Elev. = [illegible] | Flow = [illegible] | |
| Downstream L&D No. = 5 | Headwater Elev. = [illegible] | Flow = [illegible] | |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 62.5 | Flow velocity (location, depth, fps): 1 fps @ 2'd. [illegible] |

Location type (check all applicable)

main channel X
side channel inlet ___
backwater channel ___
backwater lake ___
head of island or peninsula X
outside of channel bend X
inside of channel bend ___
straight reach of channel ___

| | |
|---|---|
| Proposed length of stabilization: +200' at closure | Wing or closing dams in area: No |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Midway 1 | 150 ds. head 002 00 | Head 3 | 4 | Closure 5 25' bel |
|---|---|---|---|---|
| 0 / 2.5 | 6.0 / 2.6 | 00 / 5.5 | / | 0 / 0 |
| 10.0 / 4.2 | 9.0 / 3.0 | ~5.0 / 6.5 | / | 5 / 1.0 |
| 15.0 / 9.4 | 15.0 / 9.8 | 10 / 6.0 | / | 10 / 2.7 |
| 12.0 / 4.7 | 18.0 / 13.0 | 12 / 8.0 | / | 15 / 3.3 |
| 20.0 / 12.0 | / | / | / | 18 / 4.2 |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 3'

Slope length above water: 3'

Slope above water: 1V on 0 H

Water depth at toe of bank: 1/2'

Nearshore bottom slope: 1V on ___ H

| | |
|---|---|
| Photo numbers | Fetch direction(s): NNW AND N — Length |
| | Site alignment with respect to fetch direction |

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein sp? | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

| Observations | Site Number 5-749.7-R |
|---|---|

Bank material: clay ___ silt ___ topsoil X (f)(c) sand X M

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: (number in order of cause) river flows X 1 prop wash 2 wind waves ___ ___ boat waves 3 ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material SAND

Existing vegetation: (density, type)
- nearshore -
- shoreline - Equisetum, Flood plain Forest
- bank - " " "
- top of bank - " " "

Trees (fallen, species, size range, average size, location, number)
1
Silver maple, cottonwood, ASH DBH 18"-24"

Habitat type and species impacted by continued erosion
main channel border habitat
bottom land forest

Quality of affected habitat (low, medium, high)
low

Area protected by island (shadow zone)
None

Other impacts of erosion (future conditions)
Potential impact on Island 42 project

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? yes Source? maintenance material
other

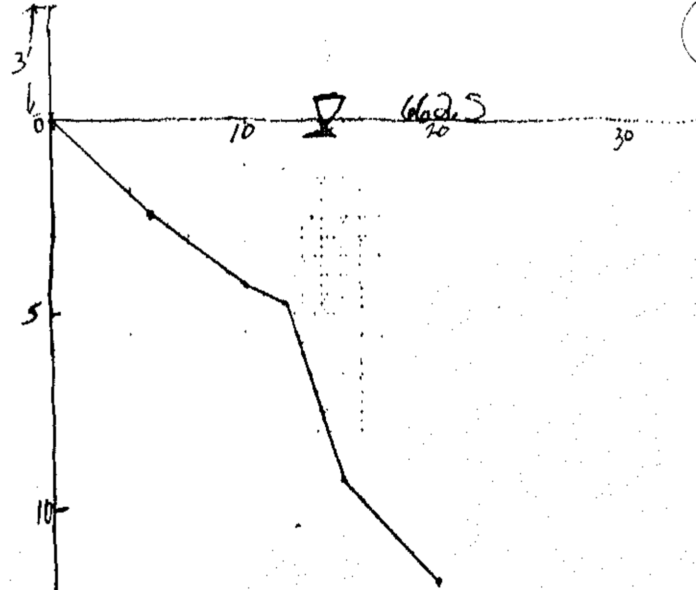
Bank shaping required?

Construction access considerations or problems?
No problem - deep water

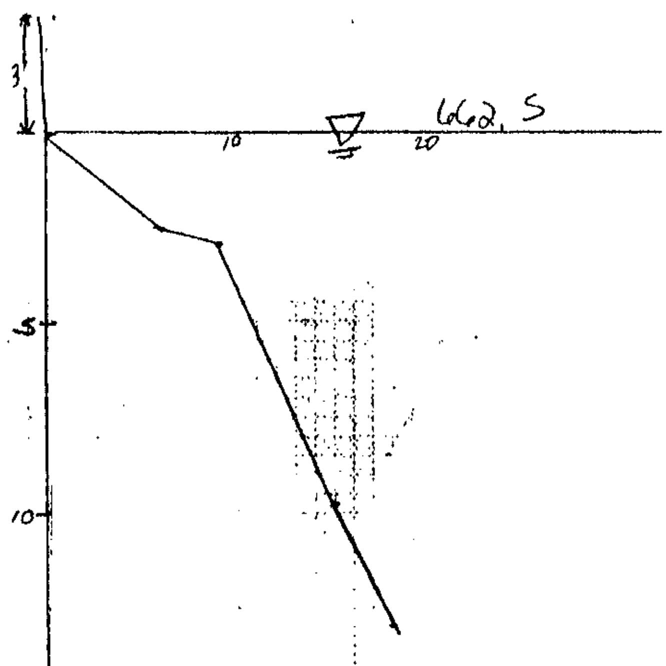
Cultural resources? Probable

Other information
Mussel survey probable

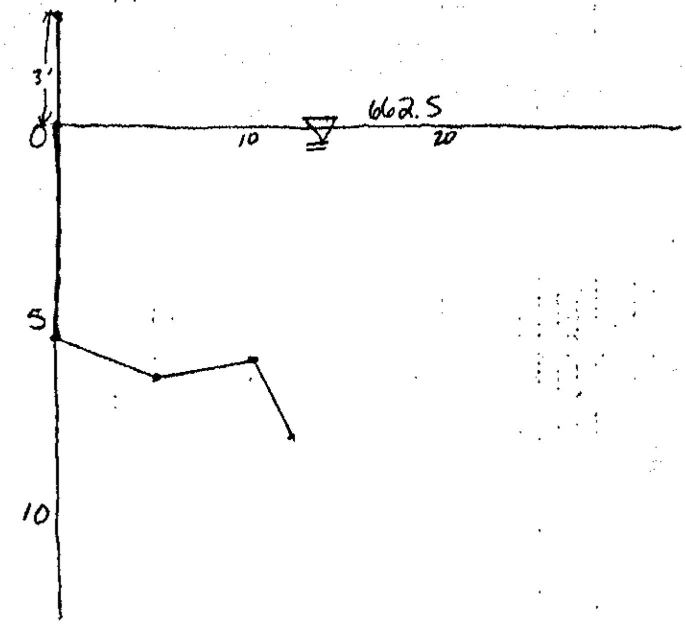
5-7-R




#1 Midway Along




#2 150' downstream of Head




#3 Head

# Mississippi River Bank Stabilization EMP Habitat Project
## Field Investigation Data

| | | |
|---|---|---|
| Site Name: Roebuck's Run | | Site number (pool–river mile–l/r bank): 5-746.7-L |
| Date investigated: 5/7/92 | Time: 10:45am | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 4 | Tailwater Elev. = 7.2 | Flow = 54000 |
| Downstream L&D No. = 5 | Headwater Elev. = 59.7 | Flow = 55000 |
| Other water surface elev. data in pool | | |
| Estimated water surface elev. at site: 1.7 | Flow velocity (location, depth, fps): 5400 | |

Location type (check all applicable)

main channel ___ backwater lake ___ inside of channel bend ___
side channel inlet X head of island or peninsula ___ straight reach of channel ___
backwater channel ___ outside of channel bend X ___________ ___

Proposed length of stabilization ~~300'~~ 450' X low point 240' | 380'

Wing or closing dams in area

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 100' from head Roebucks | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 0 / 0.0 | [illegible] | / | / | / |
| 5.0 / 0.9 | 0 / 0.5 | / | / | / |
| 10.0 / 1.4 | 5 / 1.3 | / | / | / |
| 15.0 / 3.8 | 10 / 2.3 | / | / | / |
| 19.0 / 5.6 | 15 / 3.8 | / | / | / |
| / | 18 / 6.2 | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 8.0ft @ 1 4.5 @ 2

Slope length above water: 12.0

Slope above water: .5 to 1.0 to 1.0:1.0 1V on ____ H

Water depth at toe of bank: 0.5

Nearshore bottom slope 1V on ____ H

Photo numbers: 1-11, 1-12

Fetch direction(s): NNW Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

| Observations | Site Number 5-746.7-L |
|---|---|

Bank material: clay ___ silt ___ topsoil X (f) (c) sand X
(f) (m) (c) gravel ___ cobbles ___ other info: F-M

Existing bank protection? No

Apparent causes of erosion: river flows 1 wind waves 2 boat waves ___
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material F-M Sand

Existing vegetation: nearshore – None
(density, type) shoreline –
bank – trees
top of bank – trees, grass, brush

Trees (fallen, species, size range, average size, location, number)

Ash Silver maple 4-12"

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: Sand Run | | Site number (pool–river mile–l/r bank): 5-745.6-L | |
| Date investigated: 5/7/92 | Time: 11:15-11:30 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 4 | Tailwater Elev. = [illegible] | Flow = [illegible] | |
| Downstream L&D No. = 5 | Headwater Elev. = [illegible] | Flow = [illegible] | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site | | Flow velocity (location, depth, fps) [illegible] | |

Location type (check all applicable)

- main channel ___
- side channel inlet X
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend X
- inside of channel bend ___
- straight reach of channel ___
- ___

| | |
|---|---|
| Proposed length of stabilization: 50' Blowout 730' | Wing or closing dams in area: Wingdam along main channel |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / 3.0 | 0 / 0 | 0 / 0 | / | / |
| 5 / 3.8 | 6 / 1.8 | 2 / 1.2 | / | / |
| 10 / 4.8 | 11 / 4.0 | 5 / 1.3 | / | / |
| 14 / 4.8 | 14 / 5.0 | 10 / 1.9 | / | / |
| 17 / 6.2 | 15 / 5.3 | 15 / 2.7 | / | / |
| / | / | 18 / 3.3 | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface) 2'-10'
3'@1 6'@2 10'@3

Slope length above water

Slope above water 35° - 45° 1V on 1 H

Water depth at toe of bank 3.0

Nearshore bottom slope 1V on ____ H

Photo numbers 1-13, 1-14, 1-15

Fetch direction(s): N-NE, SW-W — Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin-WDNR |
| Al Kean | Bob Drieslein | Scot Johnson-MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

Observations | Site Number 5-745.6-L

Bank material: clay ___ silt ? topsoil X (f) (c) sand X
(f) (m) (c) gravel ___ cobbles ___ other info: F-M

Existing bank protection? Wingdams along main channel.

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 3
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream none)

Bottom material Silt - sand @ 1 sand @ 2 & 3

Existing vegetation: nearshore - None
(density, type) shoreline - trees & roots
bank - " "
top of bank - " " grass, brush

Trees (fallen, species, size range, average size, location, number)
6" - 12" silver maple, willow, ash, river birch. - predominate

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

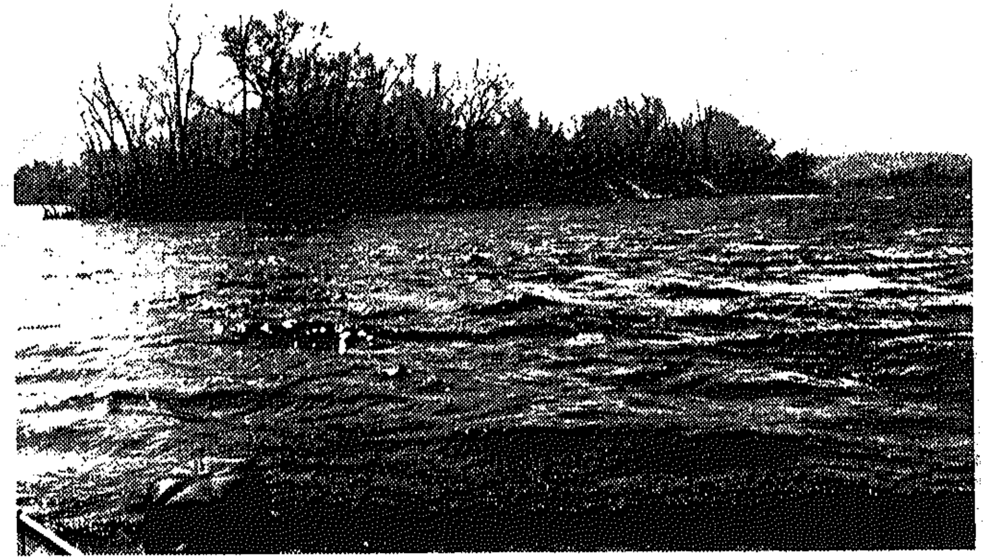
Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

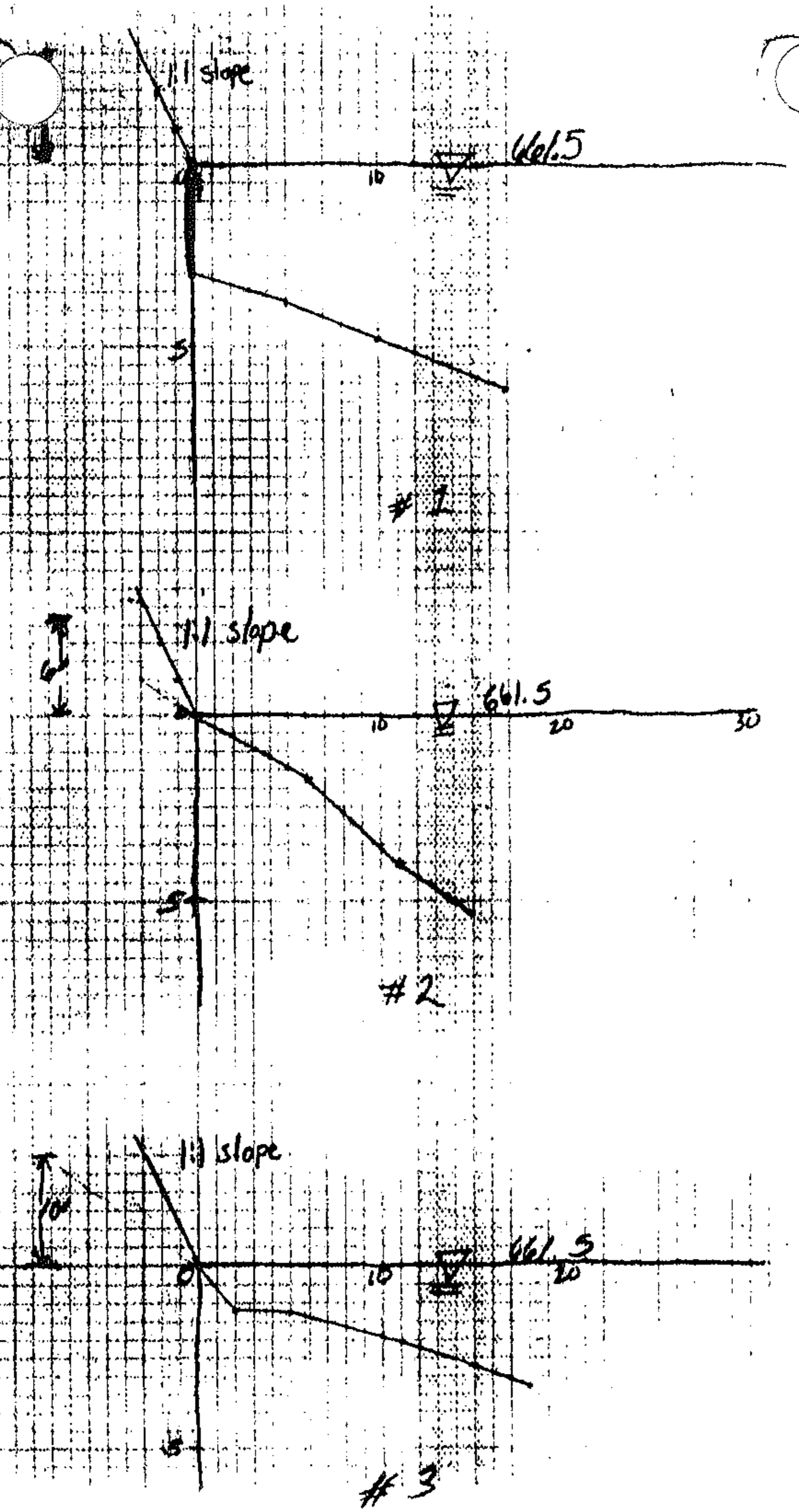
Cultural resources?

Other information



A-12

5-[redacted]-4



1:1 slope
661.5
10
5
#1
1:1 slope
6'
661.5
10
20
30
5
#2
1:1 slope
10'
661.5
0
10
20
5
#3

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: Fisher Island Daymark | | | Site number (pool–river mile–l/r bank): 5-745.5-R |
| Date investigated: 5/7/92 | Time: 12:10 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 4 | Tailwater Elev. = 63.2 | Flow = 53000 | |
| Downstream L&D No. = 5 | Headwater Elev. = 59.7 | Flow = 53000 | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site: 61.5 | | Flow velocity (location, depth, fps): 54/150 | |

Location type (check all applicable)

main channel ✓ backwater lake ___ inside of channel bend ___
side channel inlet ___ head of island or peninsula ___ straight reach of channel ___
backwater channel ___ outside of channel bend ___ ________________ ___

| | |
|---|---|
| Proposed length of stabilization: 250' | Wing or closing dams in area: Yes 2-upstream |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / 10 | / | / | / | / |
| 5 / 10.8 | / | / | / | / |
| 10 / 11.9 | / | / | / | / |
| 15 / 14.3 | / | / | / | / |
| 20 / 16.7 | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 2-8'

Slope length above water

Slope above water: 33°-57° 1V on _____ H

Water depth at toe of bank: N.A.

Nearshore bottom slope 1V on _____ H

Photo numbers: 1-16

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |
| | | |
| | | |

| Observations | Site Number 5-745.5-R |
|---|---|

Bank material: clay ___ silt ___ topsoil little (f) (c) sand X F-M
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows 1 wind waves 3 boat waves 2
(number in order of cause) prop wash ___ ______ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material F-M sand

Existing vegetation: nearshore - none
(density, type) shoreline - "
bank - "
top of bank - grass, sparse trees + brush

Trees (fallen, species, size range, average size, location, number)

few fallen

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

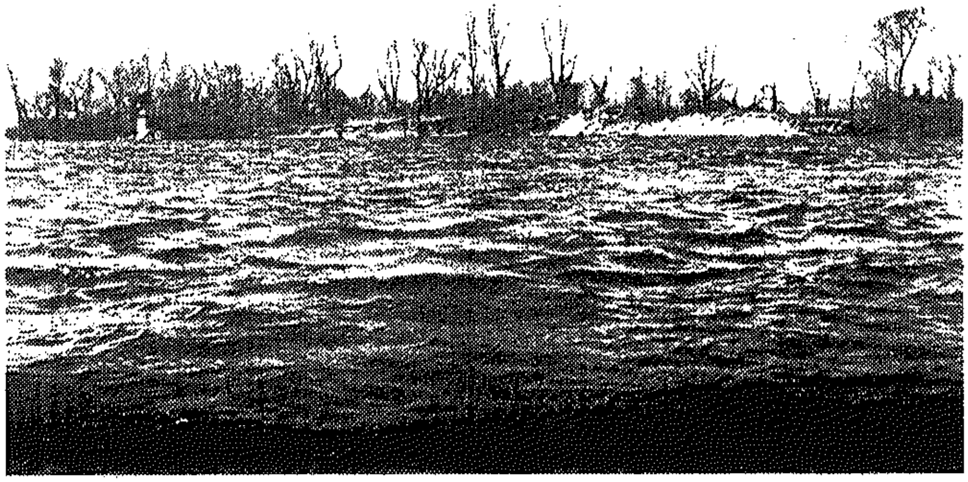
Fill required? Source?

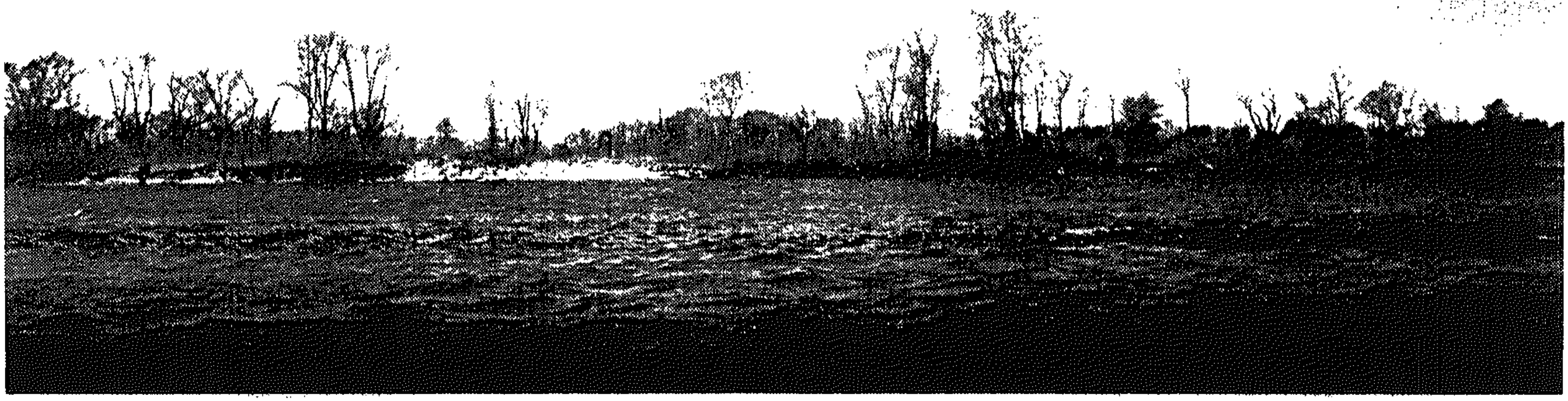
Bank shaping required?

Construction access considerations or problems?

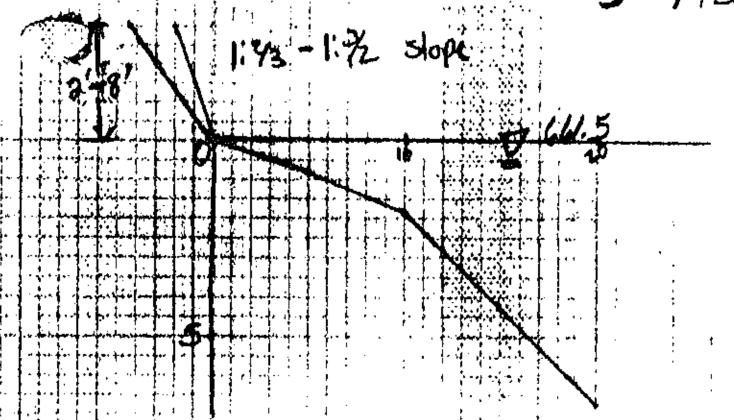
Cultural resources?

Other information



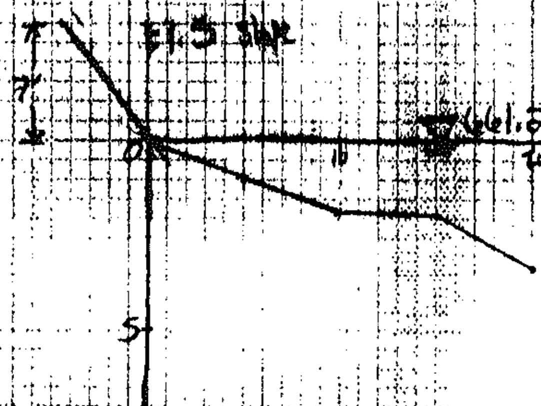


5-745.5-R

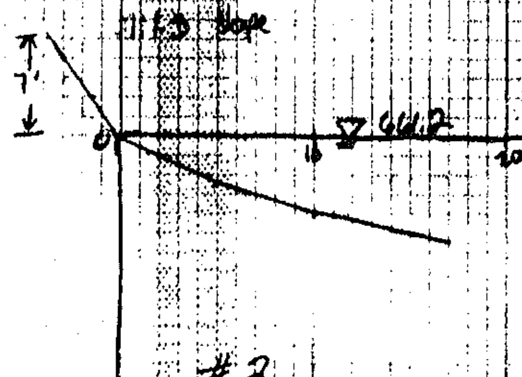



#1

5-744.5-L




#1




#2

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name<br>Lost Island Chute Wisconsin 5 | | | Site number (pool-river mile-l/r bank)<br>5-744.5-L |
| Date investigated<br>5/7/92 | Time<br>12:30-12:50 | Year(s) of aerial photos (A) or maps (M) available<br>(A) (M) | |
| Upstream L&D No. = 4 | Tailwater Elev. = 603.2 | Flow = 53000 | |
| Downstream L&D No. = 5 | Headwater Elev. = 59.7 | Flow = 55000 | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site<br>61.2 | | Flow velocity (location, depth, fps)<br>54/100 | |

Location type (check all applicable)

- main channel X
- side channel inlet X
- backwater channel ___
- backwater lake ___
- head of island or peninsula X
- outside of channel bend ___
- inside of channel bend X
- straight reach of channel ___
- ______________ ___

| | |
|---|---|
| Proposed length of stabilization<br>~~130'~~ 360' | Wing or closing dams in area<br>Yes possible old wing dam in opening at head of island |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 0/1.0 | 0/0 | / | / | / |
| 5/1.3 | 5/1.2 | / | / | / |
| 10/1.8 | 10/2.0 | / | / | / |
| 15/1.9 | 17/2.7 | / | / | / |
| 20/3.4 | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)
7'

Slope length above water

Slope above water
vertical → 33° 1V on _____ H

Water depth at toe of bank

Nearshore bottom slope
1V on _____ H

Photo numbers
1-17
1-18
1-19

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

Observations

| Site Number | 5-744.5-L |
|---|---|

Bank material: clay ___ silt ___ topsoil none (f) (c) sand x

(f) (m) (c) gravel ___ cobbles ___ other info: F-C

Existing bank protection?

Apparent causes of erosion: river flows 1 wind waves 3 boat waves 2

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material F-C Sand

Existing vegetation: nearshore – none

(density, type) shoreline – "

bank – "

top of bank – Sparse grass & brush

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

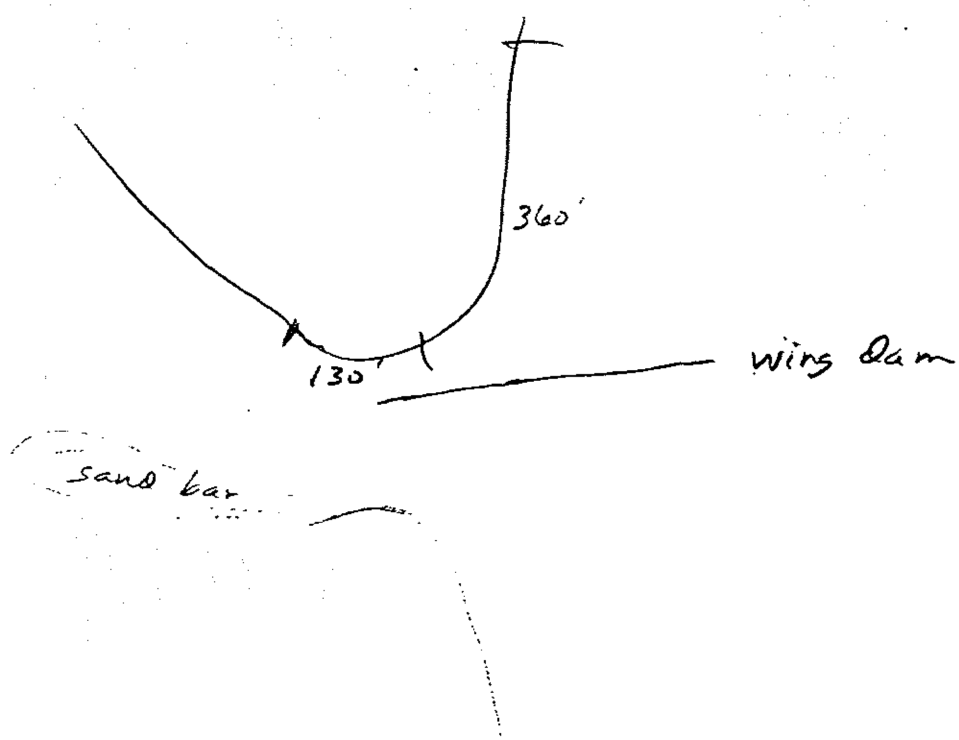
Cultural resources?

Other information

Site Sketches

| Site Number | 5-744.5-L |
|---|---|

Plan view




Typical bank cross-section

A-23

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| Island 49 - Minnieska Island | 5-741.5-R |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 5-7-92 | 1300 | (A) (M) |

| | | |
|---|---|---|
| Upstream L&D No. = 4 | Tailwater Elev. = 13.2 | Flow = 55000 |
| Downstream L&D No. = 5 | Headwater Elev. = 59.[illegible] | Flow = 55000 |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| [illegible].5 | [illegible] |

Location type (check all applicable)

main channel X
backwater lake ___
inside of channel bend ___
side channel inlet ___
head of island or peninsula X
straight reach of channel ___
backwater channel ___
outside of channel bend ___
___ ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| 320' 160' 160' | |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / 0 | 45 / 2.8 | / | / | / |
| 5 / 0.7 | 50 / 3.0 | / | / | / |
| 10 / 1.2 | / | / | / | / |
| 15 / 1.8 | / | / | / | / |
| 20 / 1.6 | / | / | / | / |
| 25 / 1.9 | / | / | / | / |
| 30 / 2.2 | / | / | / | / |

Height of bank (top of bank to water surface): 3' - 9'

Slope length above water

Slope above water: 33° 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers
1-20
1-21
1-22
1-23

Fetch direction(s): NW
Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

| Observations | Site Number 5-741.5-R |
|---|---|

Bank material: clay ___ silt ___ topsoil None (f) (c) sand X
(f) (m) (c) gravel ___ cobbles ___ other info: F - C

Existing bank protection? None

Apparent causes of erosion: river flows 3 wind waves 1 boat waves 2
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material Sand

Existing vegetation: (density, type)
nearshore - none
shoreline - "
bank - "
top of bank - Sparse grass

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

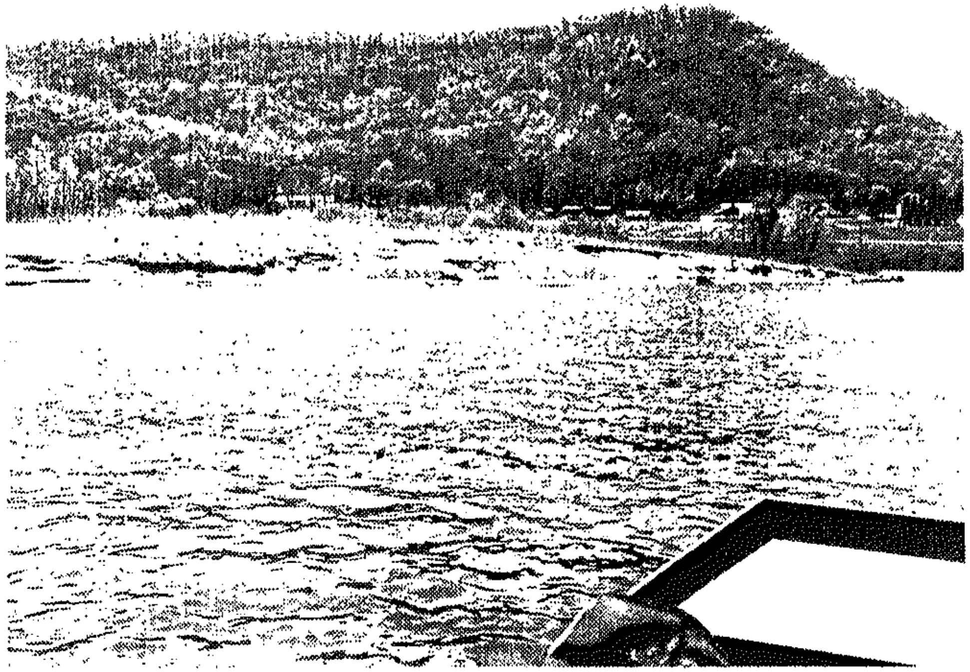
Bank shaping required?

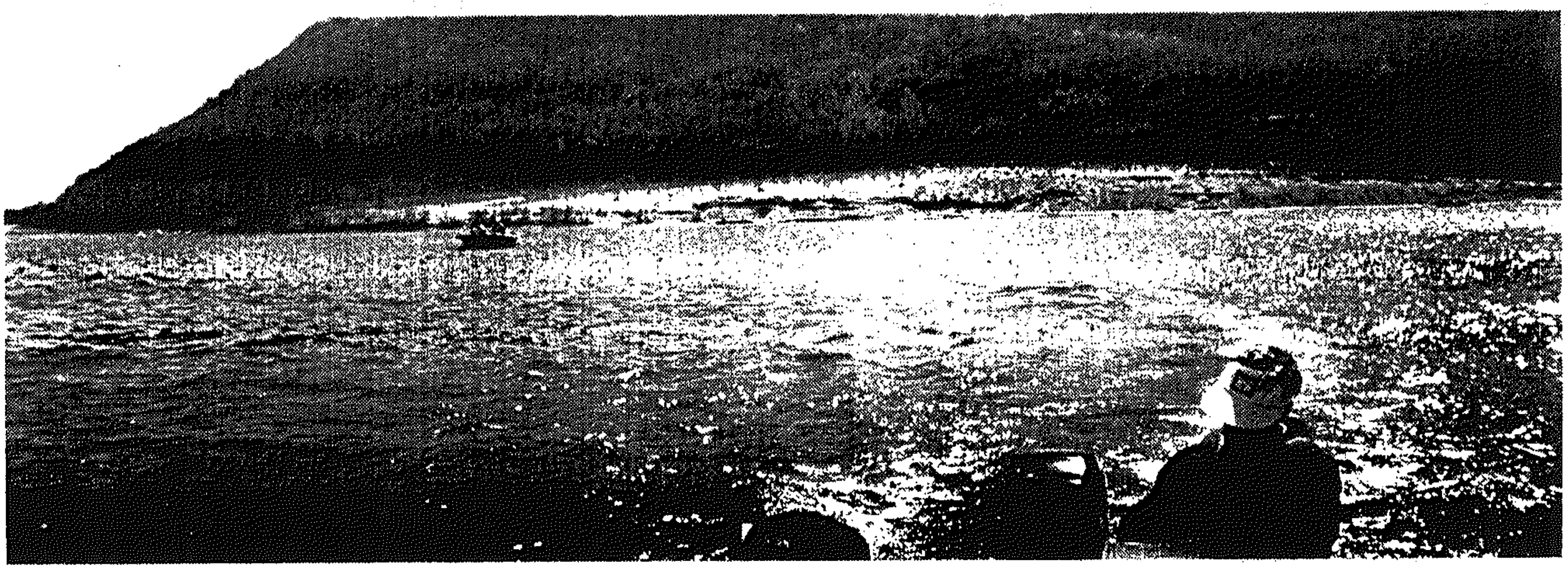
Construction access considerations or problems?

Cultural resources?

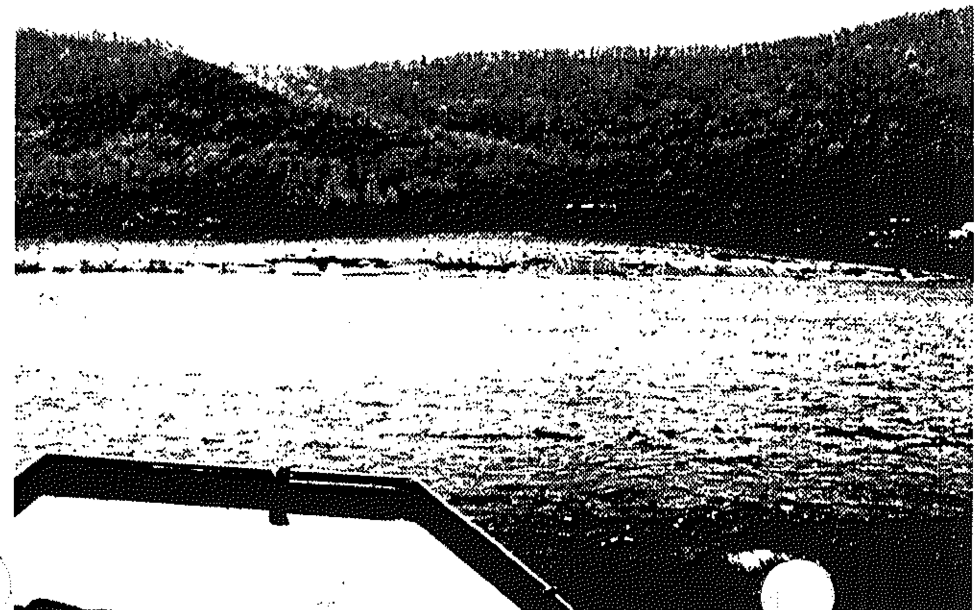
Other information

A-27





A-28



# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name: Small Island | Site number (pool–river mile–l/r bank): 5A-736.8-R |
| Date investigated: 5-7-92 | Time: 15:30 |
| Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 5 | Tailwater Elev. = [illegible] |
| Flow = [illegible] | |
| Downstream L&D No. = 5A | Headwater Elev. = [illegible] |
| Flow = [illegible] | |
| Other water surface elev. data in pool | |
| Estimated water surface elev. at site | Flow velocity (location, depth, fps) [illegible] |

**Location type (check all applicable)**

- main channel X
- backwater lake ___
- inside of channel bend ___
- side channel inlet X
- head of island or peninsula X
- straight reach of channel ___
- backwater channel ___
- outside of channel bend ___

| | |
|---|---|
| Proposed length of stabilization: 100 + | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

**Nearshore data (dist from shoreline/water depth)**

| @ head of small island | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 1 / 4.0 | / | / | / | / |
| 5 / 6.3 | / | / | / | / |
| 10 / 9.3 | / | / | / | / |
| 15 / >11 | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 2' @ 1

Slope length above water

Slope above water: vertical 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers: 2-8, 2-9

Fetch direction(s) Length

Site alignment with respect to fetch direction

**Names of investigators** (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

| Observations | Site Number 5A-736B-R |
|---|---|

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore - none
(density, type) shoreline - root mat
bank - " "
top of bank - Trees, grass

Trees (fallen, species, size range, average size, location, number)
6"-18" Silver maple

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

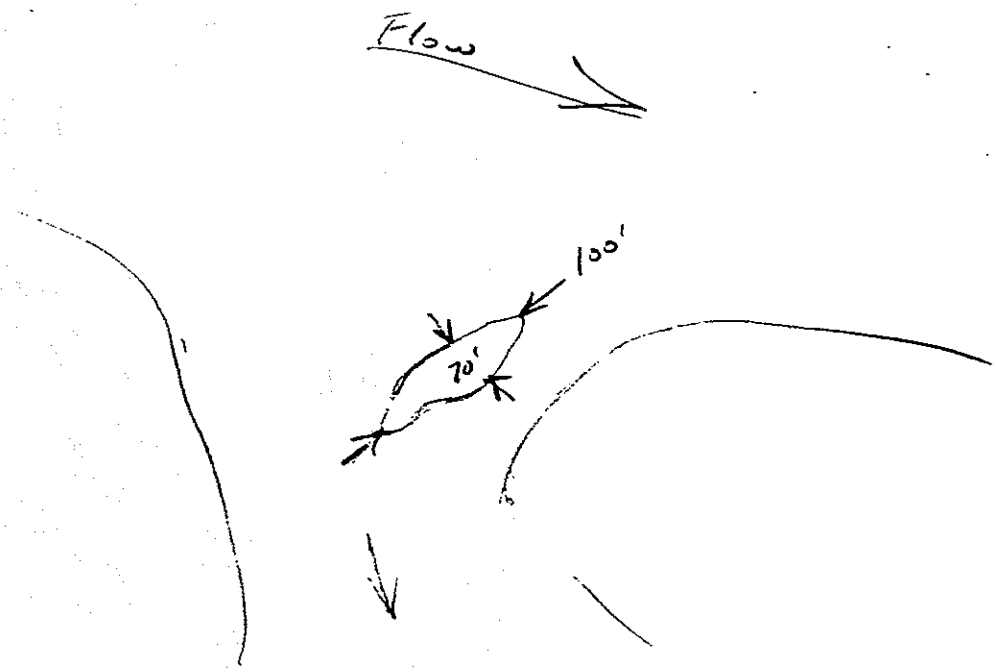
Cultural resources?

Other information

Site Sketches

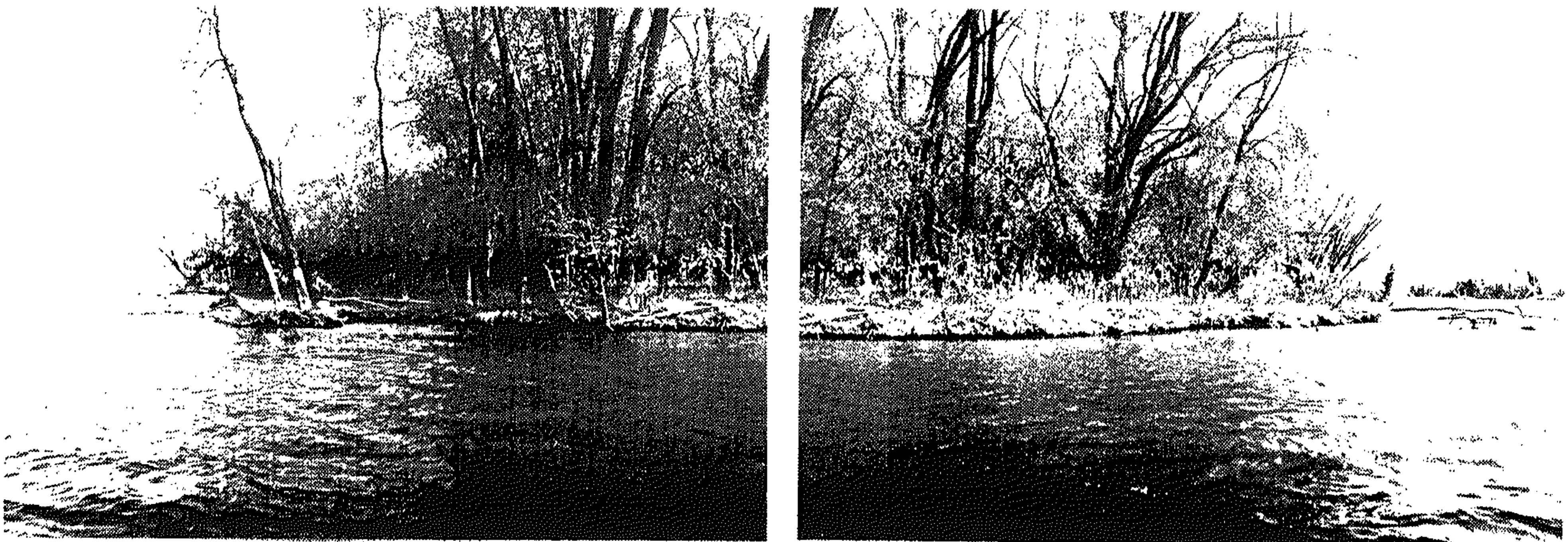
| Site Number | 5A-736.B-R |
|---|---|

Plan view




Typical bank cross-section

A-32



# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name: Head of Burleigh Slough | Site number (pool–river mile–l/r bank): 5A-7367-R |

| | | |
|---|---|---|
| Date investigated: 5-7-92 | Time: 15:45 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 5 | Tailwater Elev. = 64.0 | Flow = 55000 |
| Downstream L&D No. = 5A | Headwater Elev. = 50.3 | Flow = 56000 |

Other water surface elev. data in pool
Low = 651.

| | |
|---|---|
| Estimated water surface elev. at site: 53.4 | Flow velocity (location, depth, fps): 55000 |

Location type (check all applicable)

- main channel X
- side channel inlet X
- backwater channel ___
- backwater lake ___
- head of island or peninsula X
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ___
- ______________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 (@ head of island) | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / 0.3 | / | / | / | / |
| 5 / 2.0 | / | / | / | / |
| 10 / 3.4 | / | / | / | / |
| 15 / 3.5 | / | / | / | / |
| 18 / 3.8 | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 2'

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers: 2-10

Fetch direction(s) — Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |
| | | |
| | | |
| | | |
| | | |

| Observations | Site Number 5A-736.7-R |
|---|---|

Bank material: clay ___ silt ___ topsoil 12-4" (f) (c) sand ___
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: nearshore – none
(density, type) shoreline – root mat
bank – " "
top of bank – trees, root mat some grass

Trees (fallen, species, size range, average size, location, number)
silver maple 4-18" elm

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name: Kieselhorse | Site number (pool–river mile–l/r bank): 5A - 736.5 - L |

| | | |
|---|---|---|
| Date investigated: 5/7/92 | Time: 3:45 PM | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 5 | Tailwater Elev. = [illegible] | Flow = [illegible] |
| Downstream L&D No. = 5A | Headwater Elev. = [illegible] | Flow = [illegible] |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 53.[illegible] | Flow velocity (location, depth, fps): 55000 |

Location type (check all applicable)

main channel ✓ | backwater lake ___ | inside of channel bend ___
side channel inlet ___ | head of island or peninsula ___ | straight reach of channel ___
backwater channel ___ | outside of channel bend ___ | ___________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 0/0 | / | / | / | / |
| 5/1.1 | / | / | / | / |
| 10/2.5 | / | / | / | / |
| 15/3.6 | / | / | / | / |
| 1[illegible]/5.5 | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface) 3-5'
4' @ 1

Slope length above water

Slope above water
1V on _____ H

Water depth at toe of bank

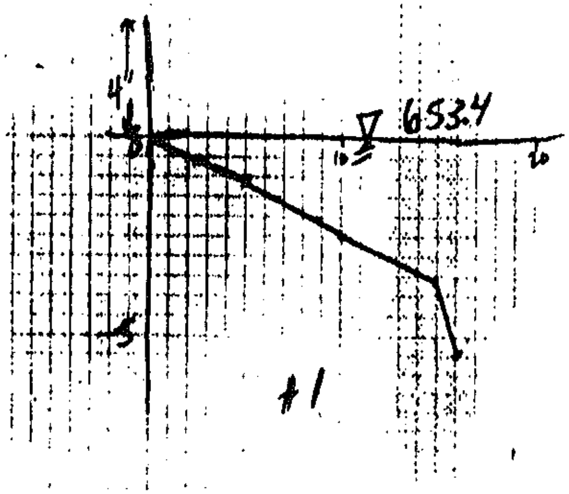
Nearshore bottom slope
1V on _____ H

| | |
|---|---|
| Photo numbers: 2-11 | Fetch direction(s) Length |
| | Site alignment with respect to fetch direction |

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |
| | | |
| | | |

5A-736.5-L




# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: Island 56 | | | Site number (pool–river mile–l/r bank): 5A-735.7-R |
| Date investigated: 5-7-92 | Time: 1500 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 5 | Tailwater Elev. = 54.0 | | Flow = 55000 |
| Downstream L&D No. = 5A | Headwater Elev. = 50.3 | | Flow = 57000 |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site: 53.1 | | Flow velocity (location, depth, fps): 56000 | |

Location type (check all applicable)

- main channel X
- side channel inlet X
- backwater channel ___
- backwater lake ___
- head of island or peninsula X
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ___
- ____________________ ___

| | |
|---|---|
| Proposed length of stabilization: 30 350' | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| rcd at [illegible] 1 | in eroded cove 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible]/2.0 | 0/0 | / | / | / |
| 5/4.2 | 5/0.9 | / | / | / |
| 10/4.2 | 10/1.7 | / | / | / |
| 15/4.1 | 15/2.3 | / | / | / |
| 19/3.4 | 19/2.9 | / | / | / |
| / | 28/5.0 | / | / | / |
| / | 43/9.3 | / | / | / |

Height of bank (top of bank to water surface) 2 - 7'
5' @ 1   7' @ 2

Slope length above water

Slope above water 1V on _____ H

Water depth at toe of bank

Nearshore bottom slope 1V on _____ H

Photo numbers 2-6
2-7

Fetch direction(s) Length

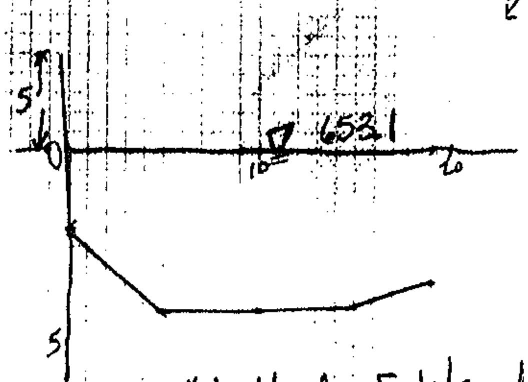
Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

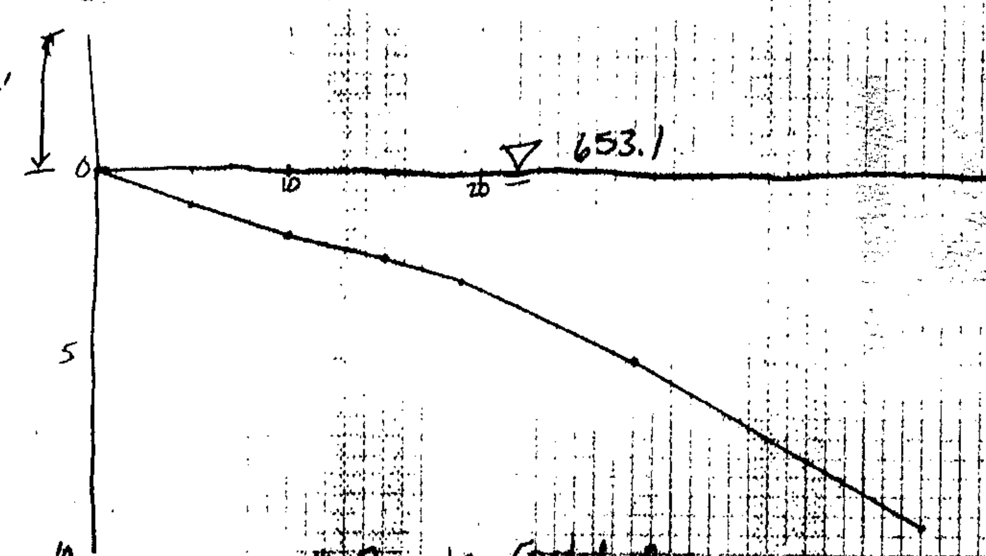
| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

A-40

5A-735.7-R




#1 Head of Island




#2 In Eroded Cave

# Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data**

| | |
|---|---|
| Site Name: Island 57 | Site number (pool–river mile–l/r bank): 5A-735.2-R |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 5-7-92 | 14:45 | (A) (M) |
| Upstream L&D No. = | Tailwater Elev. = 654.0 | Flow = 55000 |
| Downstream L&D No. = | Headwater Elev. = 650.3 | Flow = 57000 |

Other water surface elev. data in pool: Low = 651

Estimated water surface elev. at site: 652.9

Flow velocity (location, depth, fps): 56500

Location type (check all applicable)

- main channel X
- backwater lake ___
- inside of channel bend ___
- side channel inlet X
- head of island or peninsula X
- straight reach of channel ___
- backwater channel ___
- outside of channel bend ___
- ___________ ___

Proposed length of stabilization: 1000'

Wing or closing dams in area:

## Physical Data

Coordinates for horizontal positioning:

Nearshore data (dist from shoreline/water depth) at head

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 1 / 1.0 | 0 / 0 | 0 / 0 | / | / |
| 5 / 2.8 | 5 / 1.0 | 5 / 1.5 | / | / |
| 10 / 3.4 | 9 / 1.7 | 9 / 2.0 | / | / |
| 15 / 3.9 | 14 / 2.6 | 13 / 2.4 | / | / |
| 19 / 4.7 | 16 / 3.0 | 16 / 2.8 | / | / |
| / | 20 / 3.04 | 20 / 3.2 | / | / |
| / | / | 50 / 6? | / | / |

Height of bank (top of bank to water surface): 3' @ 1   12' @ 3

Slope length above water:

Slope above water: near vertical   1V on ____ H

Water depth at toe of bank:

Nearshore bottom slope:   1V on ____ H

Photo numbers: 2-1, 2-2, 2-3, 2-4, 2-5

Fetch direction(s):   Length

Site alignment with respect to fetch direction:

Names of investigators   (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke | Jeff Janvrin - WDNR |
| Al Kean | Bob Drieslein | Scot Johnson - MDNR |
| Jon Hendrickson | | |
| Dennis Anderson | | |

River Bank S[illegible]

Observations

| Site Number | 5A-735.2-R |
|---|---|

Bank material: clay ___ silt ___ topsoil ≈ 1' (f) (c) sand X

(f) (m) (c) gravel ___ cobbles ___ other info: F-M

Existing bank protection?

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 3
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore – none
(density, type) shoreline – tree roots
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)

silver maple 5" – 16" cottonwood

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

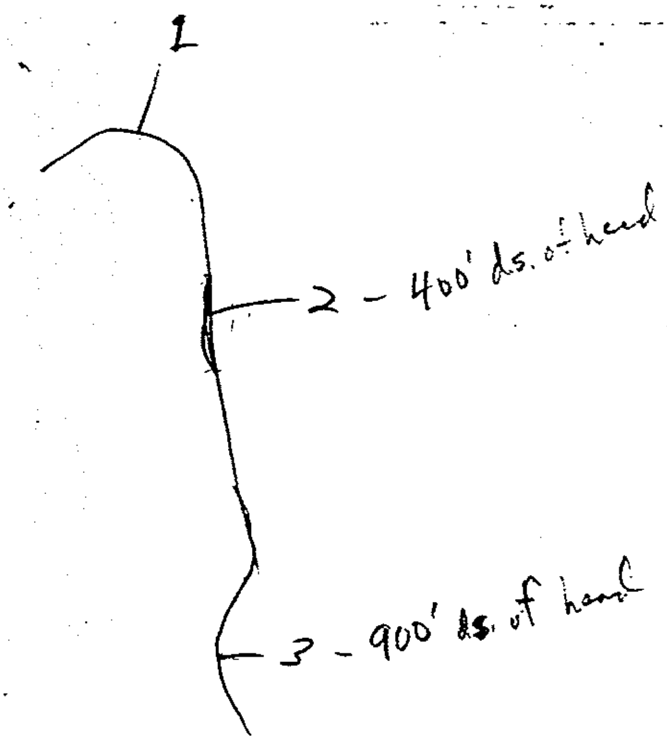
Cultural resources?

Other information

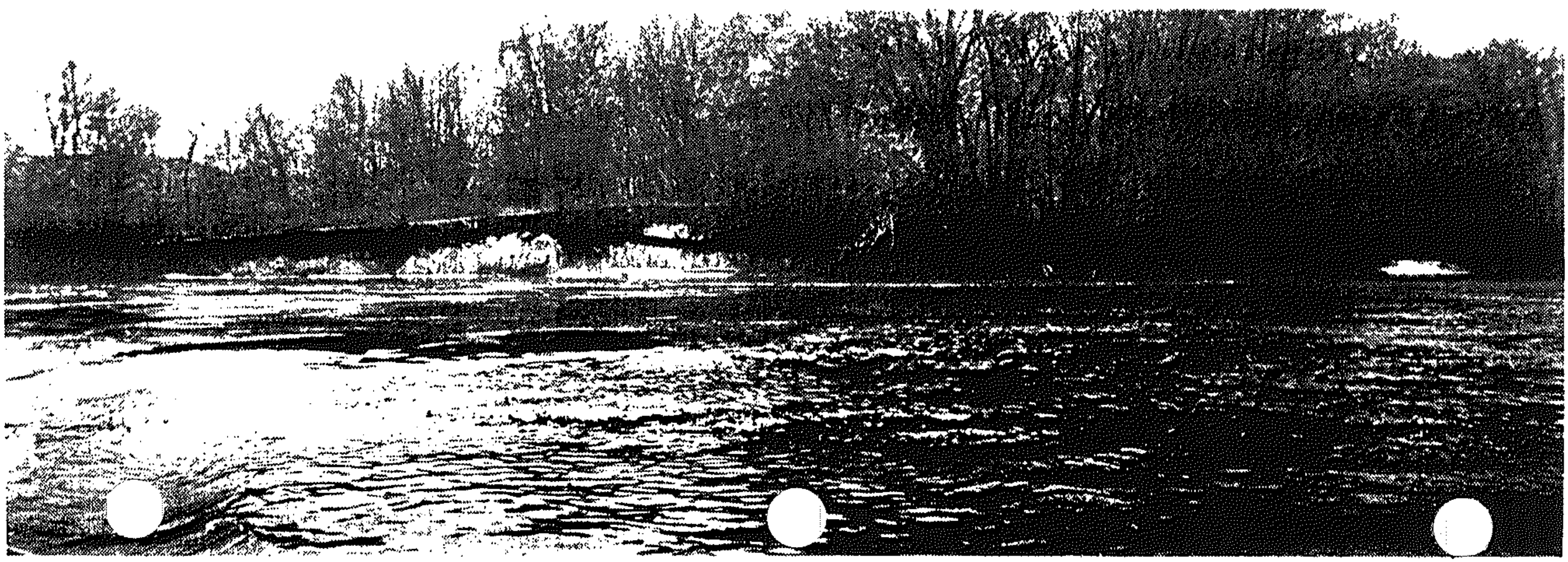
## Site Sketches

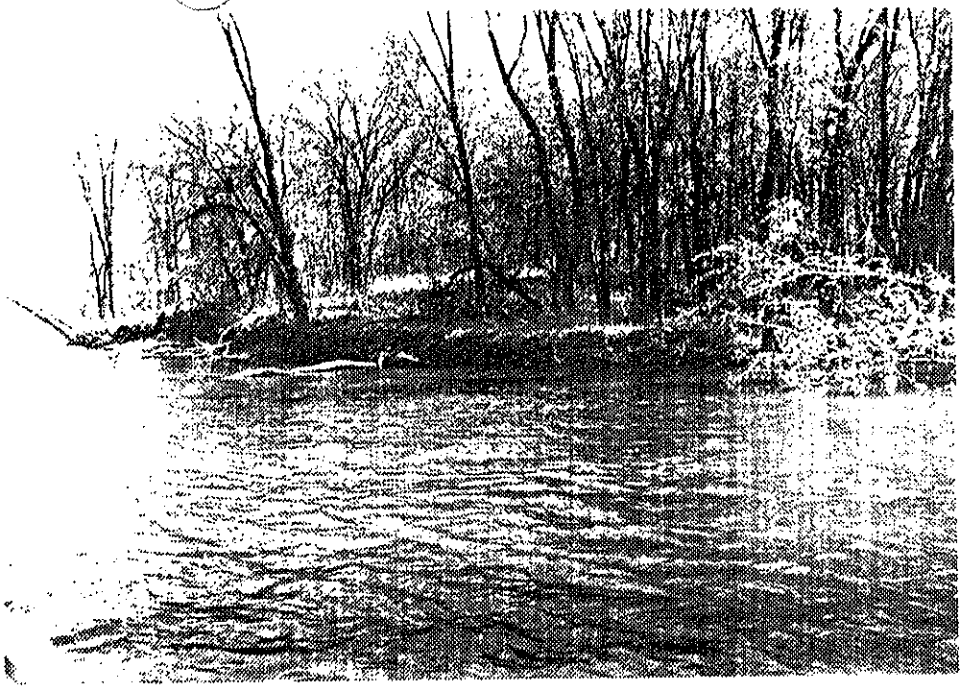
Site Number 5A-735,2-R

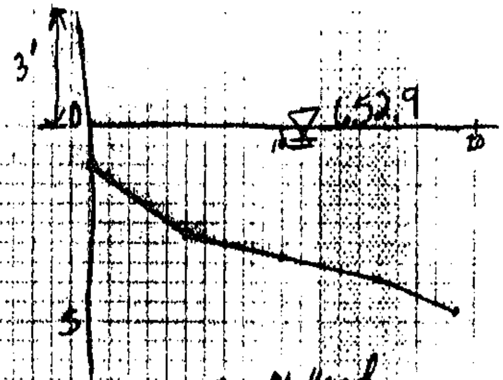
### Plan view




### Typical bank cross-section

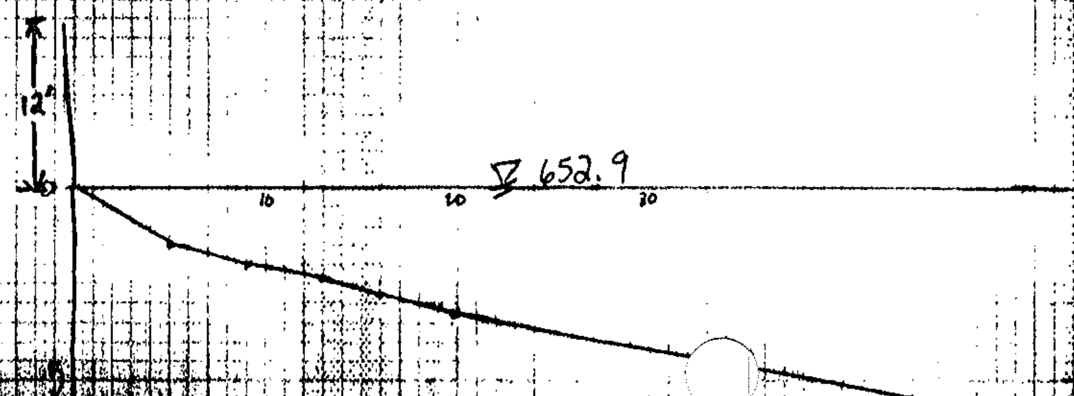







#1 At Head


#2 400' downstream of head




#3 900' downstream of head

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| Blacksmith Slough | 6-718.6-R |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 7-22-92 | 11:30 | (A) (M) |

| | | |
|---|---|---|
| Upstream L&D No. = 5A | Tailwater Elev. = [illegible] | Flow = 43000 |
| Downstream L&D No. = 6 | Headwater Elev. = [illegible] | Flow = 42000 |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| [illegible] | [illegible] |

Location type (check all applicable)

- main channel ✓
- side channel inlet ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ___
- inside of channel bend ✓
- straight reach of channel ___
- ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| | 1 wingdams<br>2 [illegible] |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / 8 | 15 / 9.9 | / | / | / |
| 7 / 0.8 | 3 / 2.[illegible] | / | / | / |
| 19 / 1.5 | 50 / [illegible] | / | / | / |
| [illegible] / 1.9 | [illegible] / [illegible] | / | / | / |
| [illegible] / 2.[illegible] | [illegible] / [illegible] | / | / | / |
| [illegible] / 2.3 | / | / | / | / |
| 70 / 3 | / | / | / | / |

Height of bank (top of bank to water surface): 2'

Slope length above water

Slope above water: 1V on [illegible] H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers

99 3 2-2
110 3 216 7 2-2
130 4 2-22
150 4.4 2-22

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Keen | Jim Fisher - " | Dan Dieterman - MDNR |
| Jon Hendrickson | Jim Nissen - La Crosse | |
| Pete Fasbender | | |

Observations

Site Number 6-718.6-R

Bank material: clay ___ silt ___ topsoil 1.0' (f) (c) sand ✓ m

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? (/o

Apparent causes of erosion: river flows 2 wind waves 1 boat waves ___

(number in order of cause) prop wash ___ ___ ice action 3

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material Sand

Existing vegetation: nearshore – Some sago pondweed

(density, type) shoreline –

bank –

top of bank – F. F.

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems? Yes, shallow out quite far

Cultural resources?

Other information [illegible] backwater [illegible] & channel EMP job?

WI DNR thinking closing dam behind

Partial closure at head of channel?

Observations

| Site Number | 6-718.6-R |
|---|---|

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___

(m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –
(density, type) shoreline –
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)
downstream island is actively eroding -- many exposed tree roots, etc

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions) site appears to be mainly impacted by high water events

Type(s) of stabilization proposed closure structure betw. 2 islands, RR the head of island

Other type(s) of stabilization possible stabilizing head of island
this project may be too large — may be separate EMP project

Fill required? Source?

Bank shaping required?

Construction access considerations or problems? shallow depths on island side

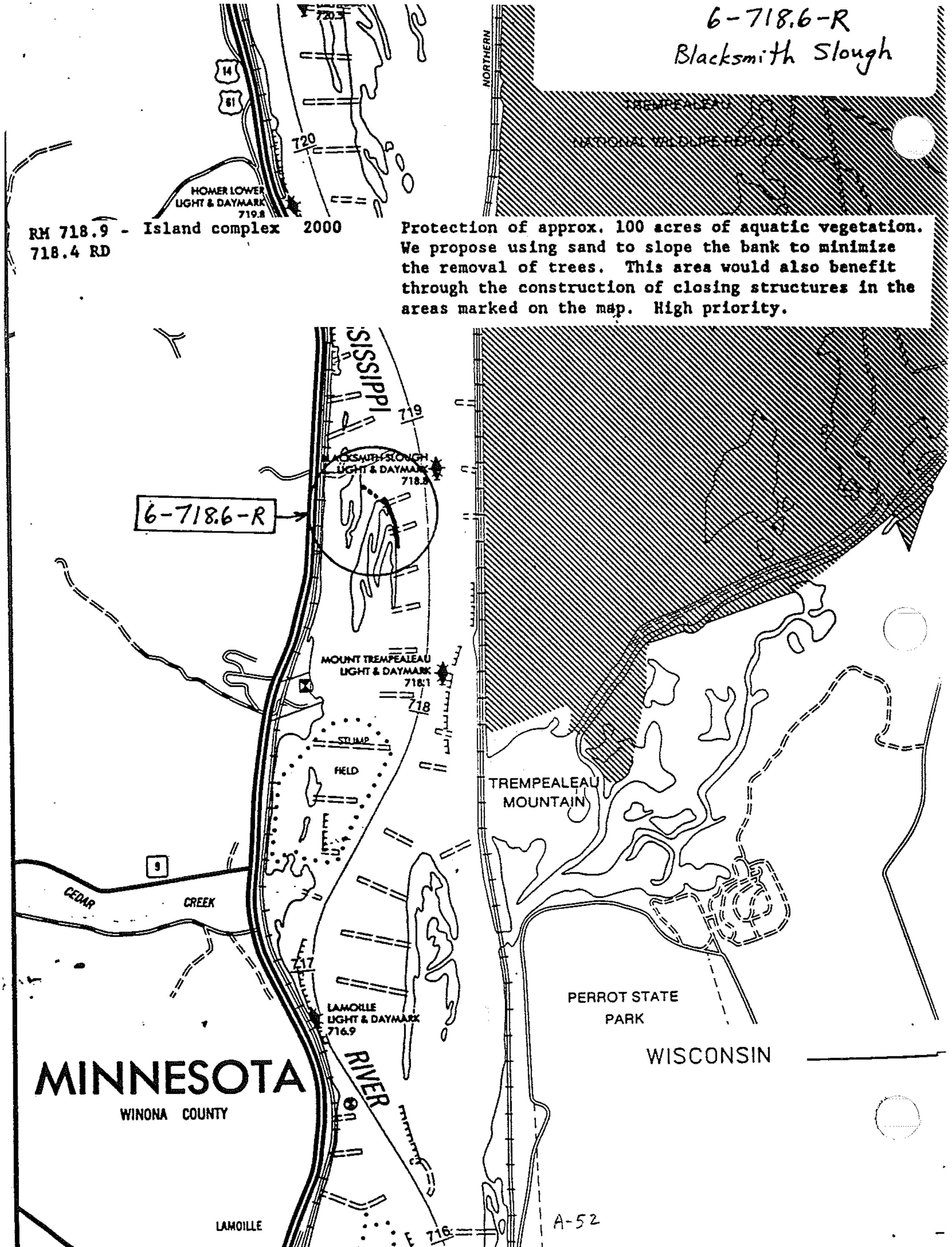
Cultural resources?

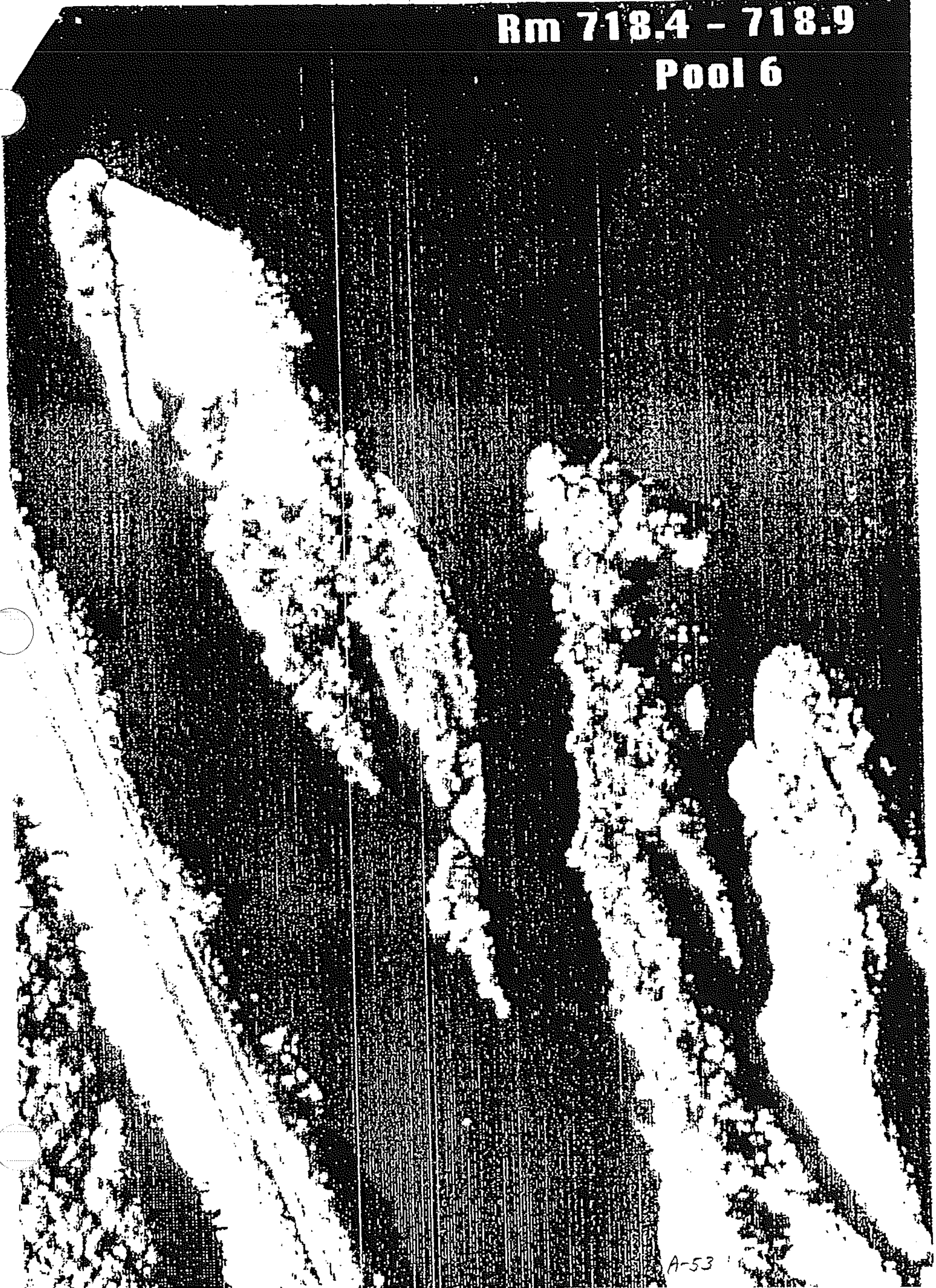
Other information

6-718.6-R
Blacksmith Slough

RM 718.9 - Island complex 2000
718.4 RD

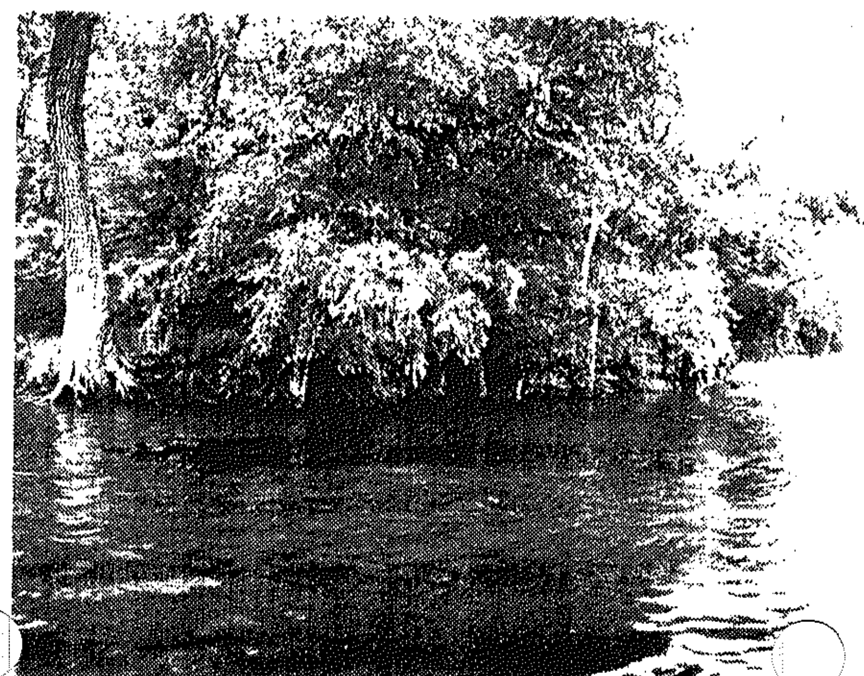
Protection of approx. 100 acres of aquatic vegetation. We propose using sand to slope the bank to minimize the removal of trees. This area would also benefit through the construction of closing structures in the areas marked on the map. High priority.



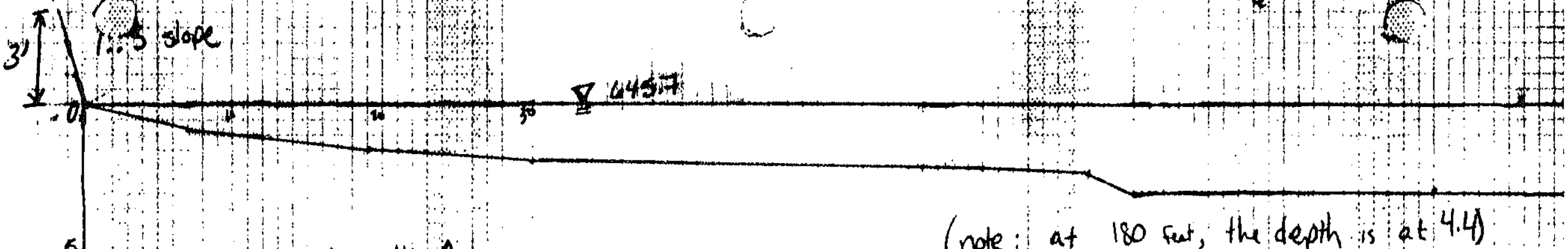



A-53

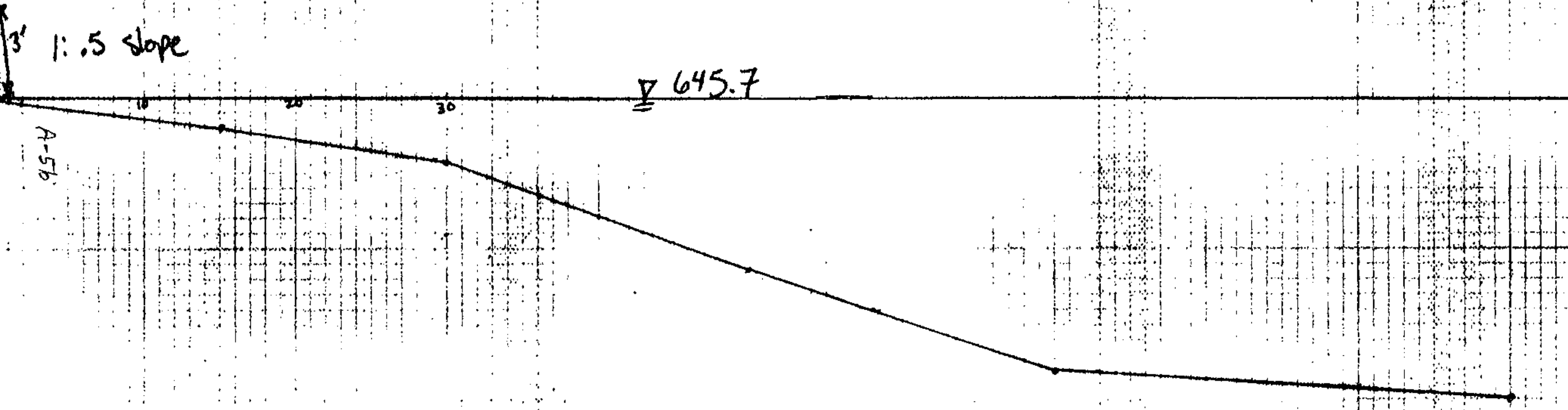
A-54



6-718.6-B




#1 Head




#2 Side

A-5b

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| Trempealeau Daymark | 6 - 715.8 - R |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 7-22-93 | 12:00 | (A) (M) |

| | | |
|---|---|---|
| Upstream L&D No. = 5A | Tailwater Elev. = [illegible] | Flow = 43500 |
| Downstream L&D No. = 6 | Headwater Elev. = | Flow = 42500 |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| 45.0 | 42500 |

Location type (check all applicable)

main channel ✓ backwater lake ___ inside of channel bend ✓

side channel inlet ___ head of island or peninsula ✓ straight reach of channel ___

backwater channel ___ outside of channel bend ___ ______________ ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| | 50ft |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 Depth | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / [illegible] | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| [illegible] / | / | / | / | / |
| [illegible] / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on _____ H

Water depth at toe of bank

Nearshore bottom slope 1V on _____ H

| Photo numbers | Fetch direction(s) Length |
|---|---|
| 2-25 | |

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Fisher - " | Dan Dieterman - MDNR |
| Jon Hendrickson | Jim Nissen - La Crosse | |
| Pete Fasbender | | |

Observations

Site Number 6-715.8-R

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ✓
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? Yes.

Apparent causes of erosion: river flows 1 wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: nearshore –
(density, type) shoreline –
bank –
top of bank – F.F.

Trees (fallen, species, size range, average size, location, number)
much fallen timber along main channel shoreline

Habitat type and species impacted by continued erosion
the shoreline serves to protect the backwater – is getting narrow in spots and
could breach

Quality of affected habitat (low, medium, high) → high quality wetland habitat

Area protected by island (shadow zone) good backwater marsh

Other impacts of erosion (future conditions) w/o protection the wetland could be lost
very unique upland vegetation – a natural levee is an island w/
unique veg. (Green dragon, oak, ash, butternut) basswood, hickory

Type(s) of stabilization proposed
shoreline RR. 2000 ft

~~Other type(s) of stabilization possible~~ key out Black Ash
→ ash tree leaves looked like walnut/butternut

Fill required? Source?

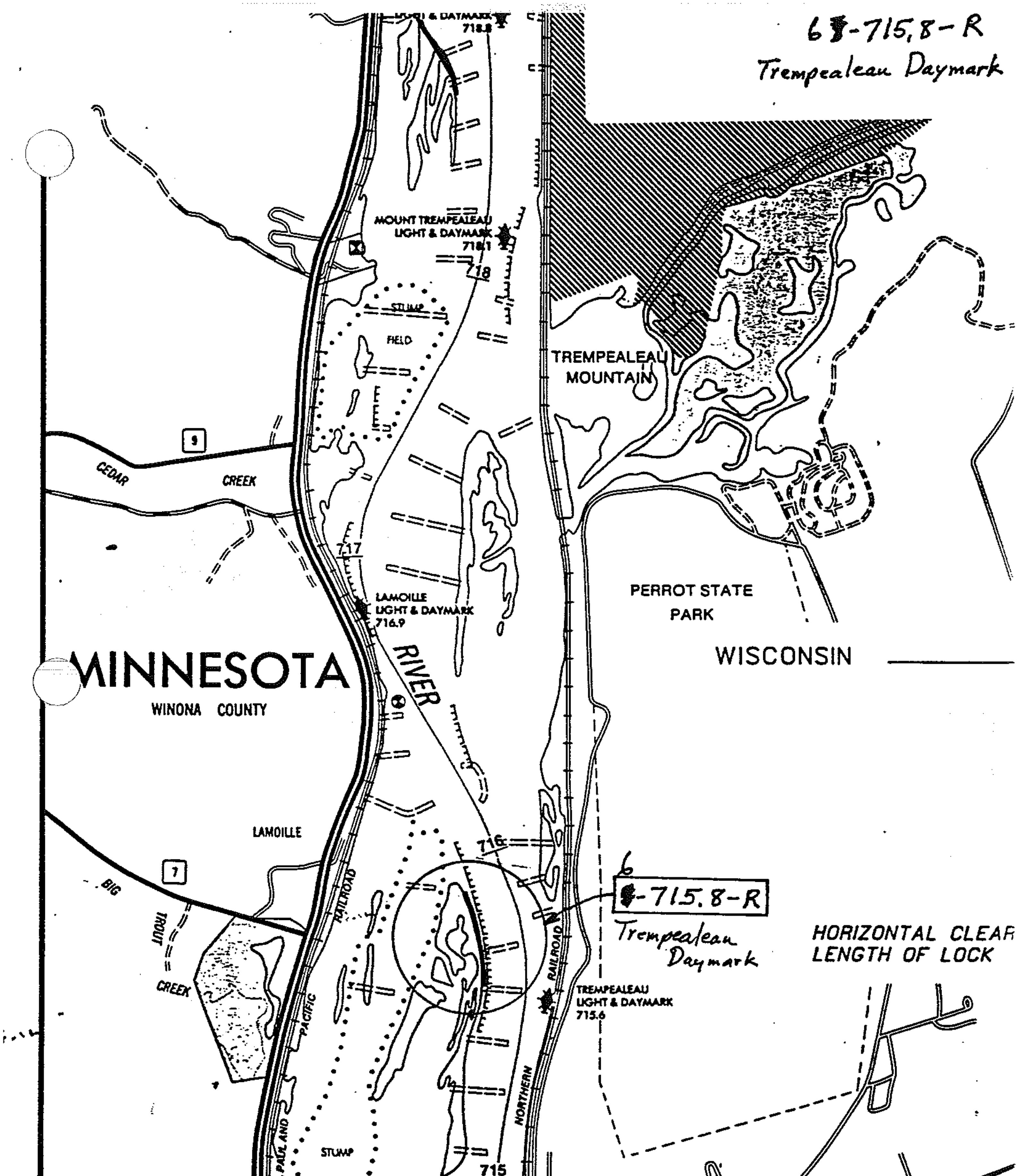
Bank shaping required?

Construction access considerations or problems?

Cultural resources?

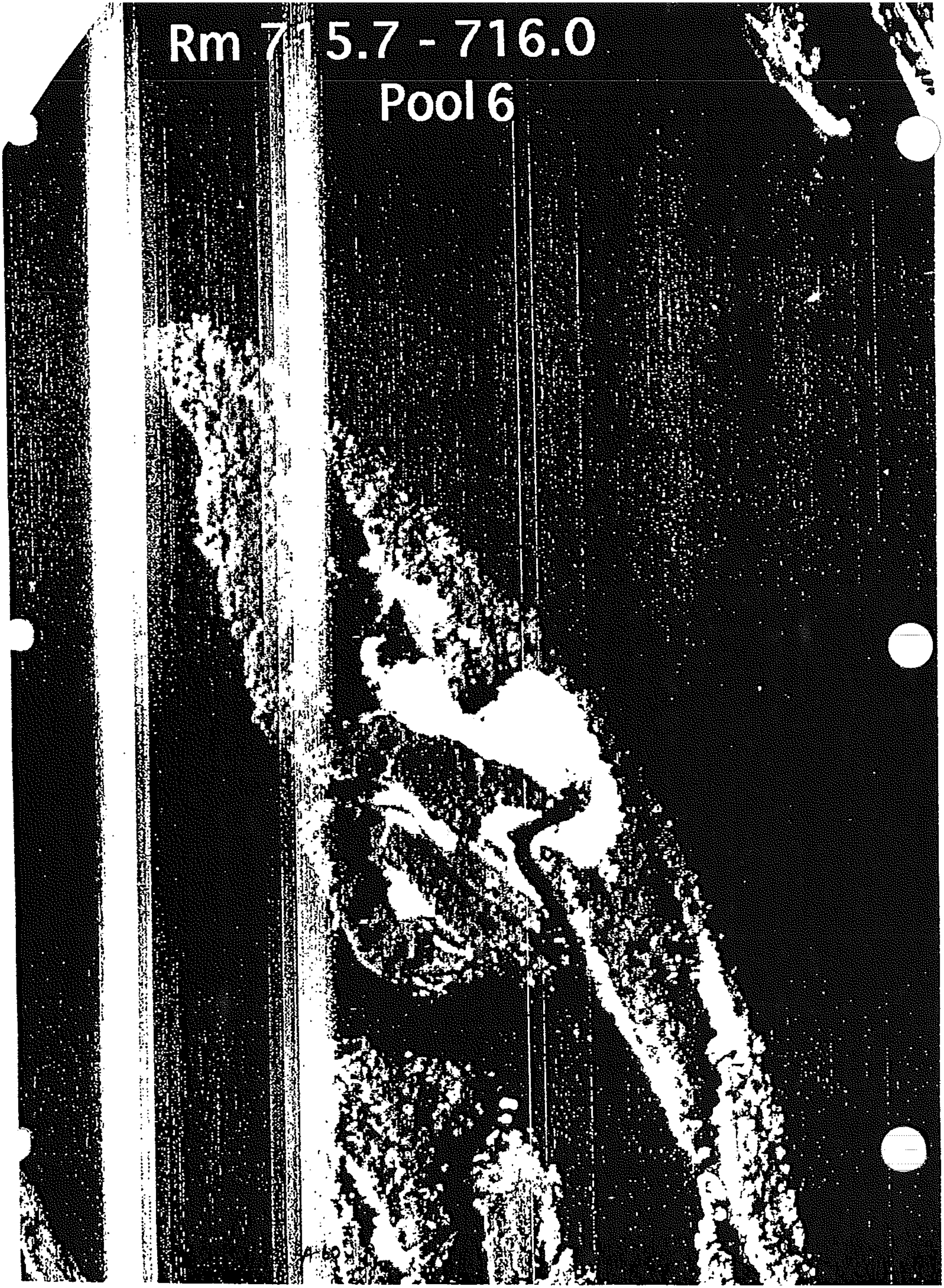
Other information backwater aq. veg extensive & diverse (milfoil, W.C., coontail, P. c[illegible],
P. zosteriformes, P. pectinatus, elodea). very important backwater – emergent
vegetation

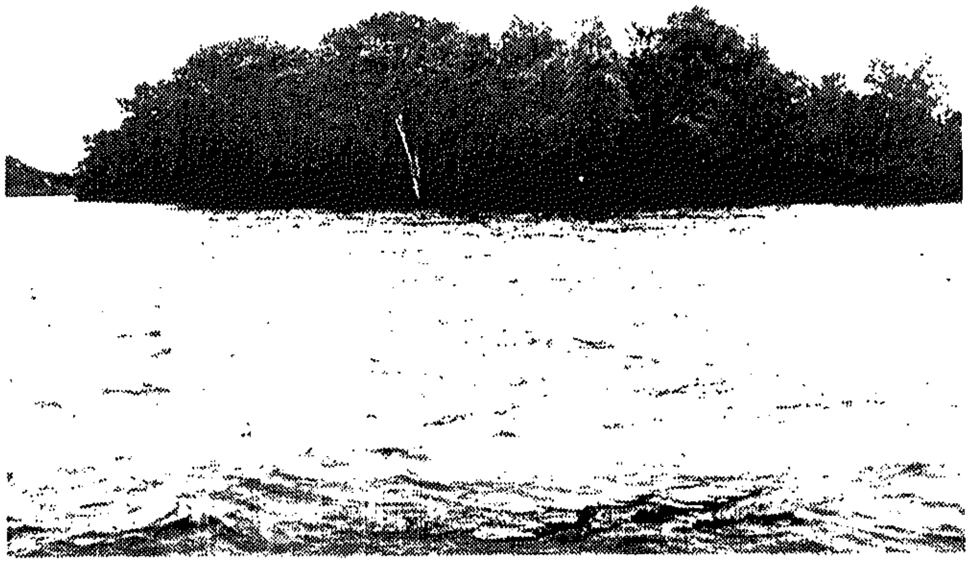
6-715,8-R
Trempealeau Daymark



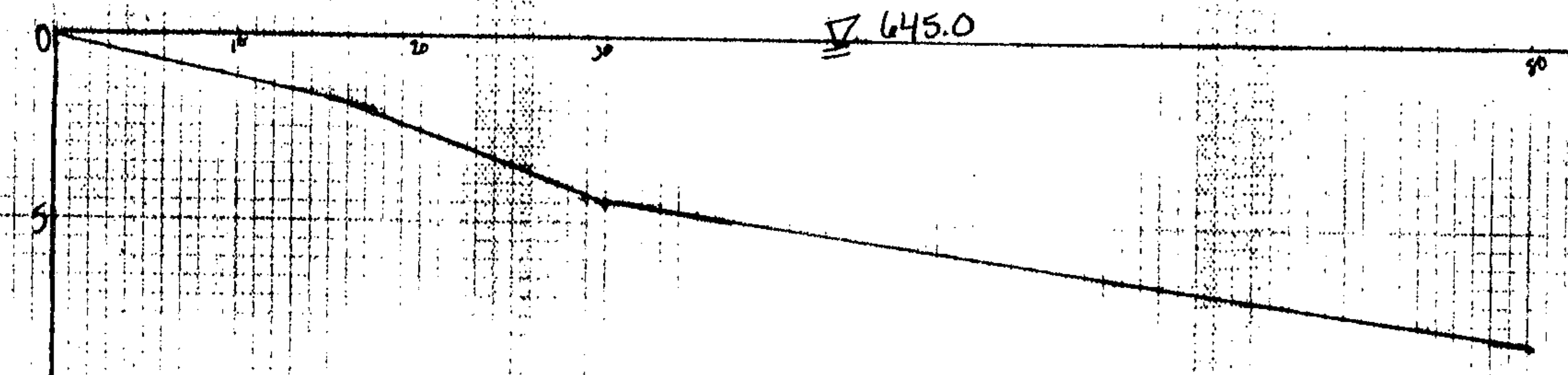

716.0 - Island complex 1000
7 RD

Protection of approx. 100 acres of aquatic vegetation. The banks in some areas are nearly vertical, therefore, we propose using sand to slope the bank to minimize the removal of trees. High priority. Interior wetland is in imminent peril.


Rm 715.7 - 716.0
Pool 6

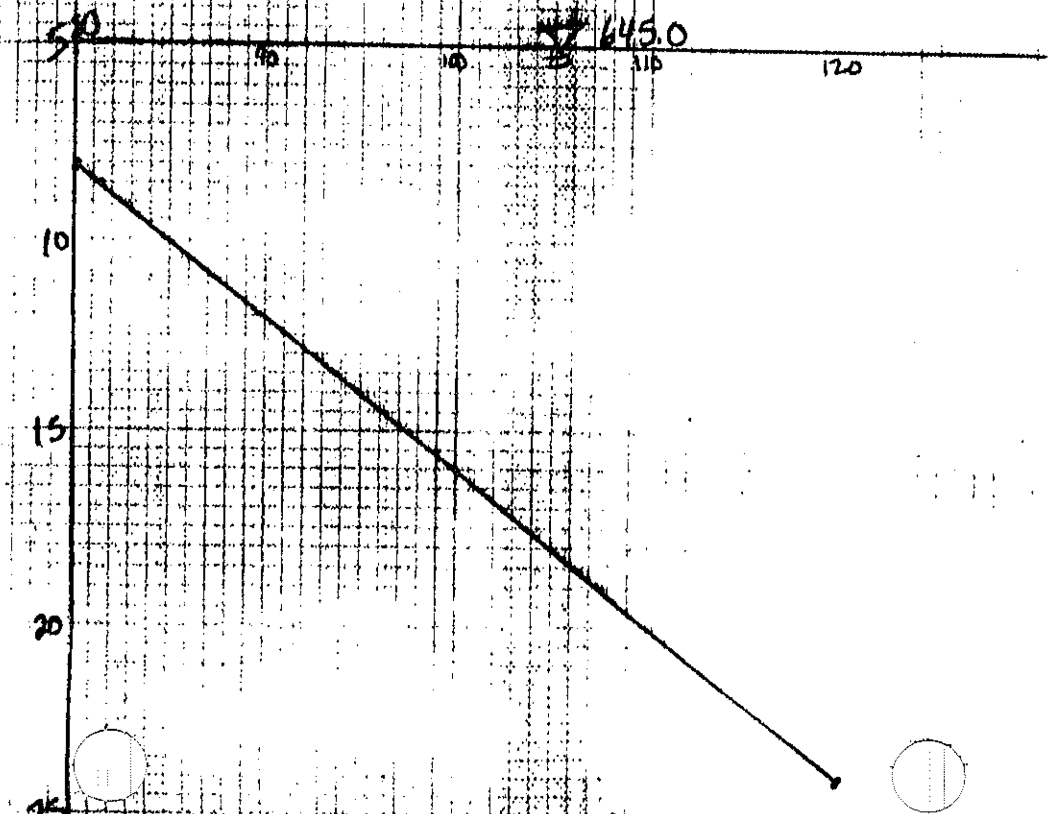


6-71[illegible]-R




#1 100' Downstream of Head

A-62




#1 (Con't)

# Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data** 7-713.3-L

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| ~~Richmond Island~~ Long Lake Inlet Island | ~~7-718.3 R~~ |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 7-22-92 | 8:30 | (A) (M) |

| | | |
|---|---|---|
| Upstream L&D No. = 6 | Tailwater Elev. = 40.9 | Flow = 43000 |
| Downstream L&D No. = 7 | Headwater Elev. = 38.4 | Flow = [illegible] |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| 40.7 | 43000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ___
- ___________________ ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| 250+250 | Yes |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| @ head Dist / Depth | 100' d.s. river side 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 0 / 1.5 | 0 / 1.0 | / | / | / |
| 6 / 1.0 | 6 / 1.2 | / | / | / |
| 12 / 1.8 | 13 / 2.0 | / | / | / |
| 20 / 2.3 | 22 / 4.0 | / | / | / |
| 28 / 2.7 | 43 / 4.7 | / | / | / |
| 36 / 2.9 | 62 / 7.7 | / | / | / |
| 47 / 2.9 | 71 / 8 | / | / | / |

Height of bank (top of bank to water surface): 3-6

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers

[illegible] 85 8

71 3.0 [illegible] 7 [illegible]

[illegible] 3.2 [illegible]

[illegible] 3.7

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Fisher - " | Dan Dieterman - MDNR |
| Jon Hendrickson | Jim Nissen - La Crosse | |
| Pete Fasbender | | |

Observations

| Site Number | 7-713.3-L |
|---|---|

Bank material: clay ___ silt ___ topsoil ___ (f)(c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? No.

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 4

(number in order of cause) prop wash ___ ___ ice action 3

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

protection of this site is at best medium

Source of local sediment transport (upstream, none)

Bottom material Sand

Existing vegetation: nearshore - none

(density, type) shoreline -

bank - tree lined, grass, underbrush, tree roots

top of bank - F.F.

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

eagle roosting

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Loss to the head of the island

Type(s) of stabilization proposed

rock at the head

- appears to be erosion on shore side caused by eddy current - no one thought it was that big of deal

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

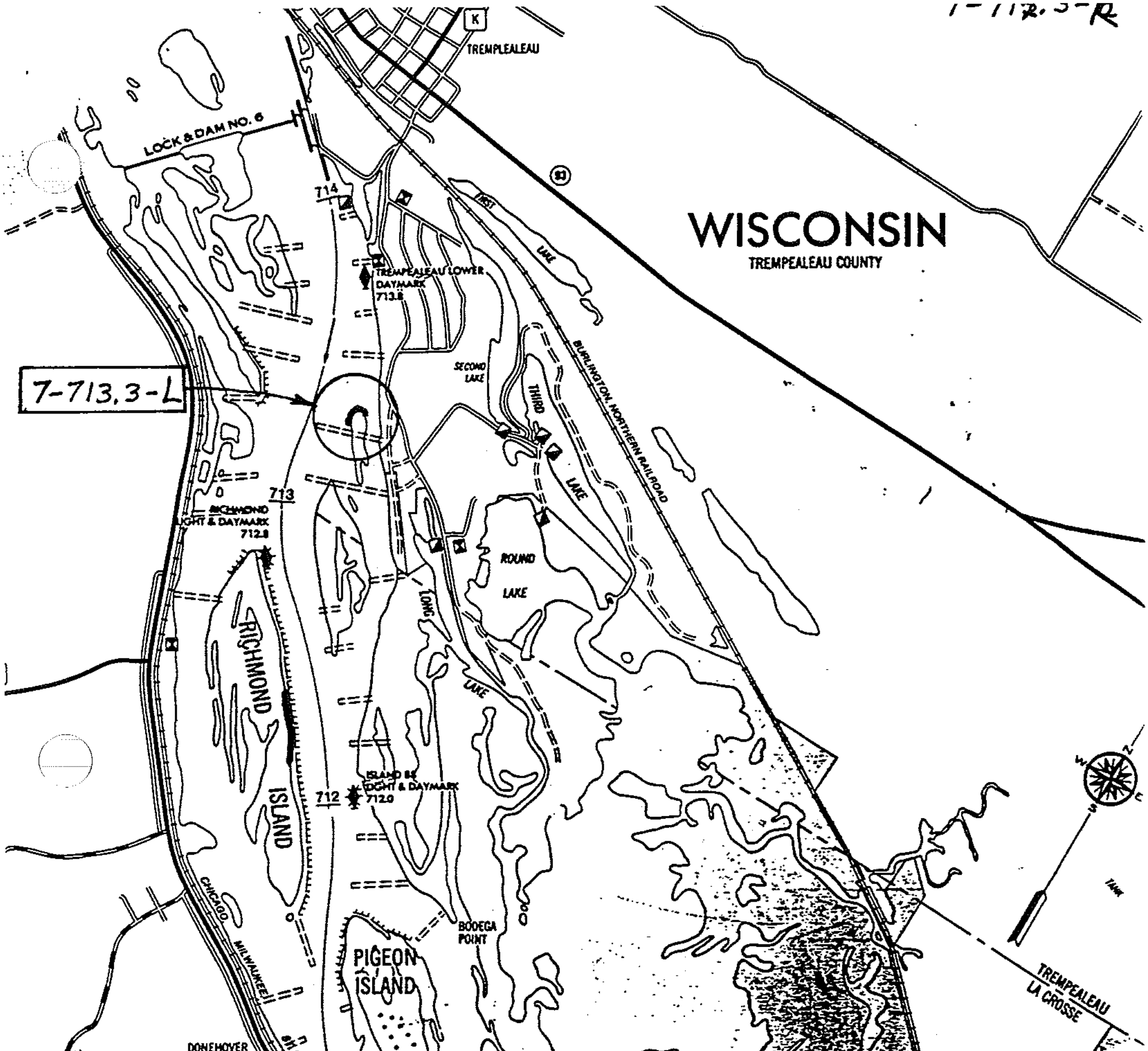
Not bad

Cultural resources?

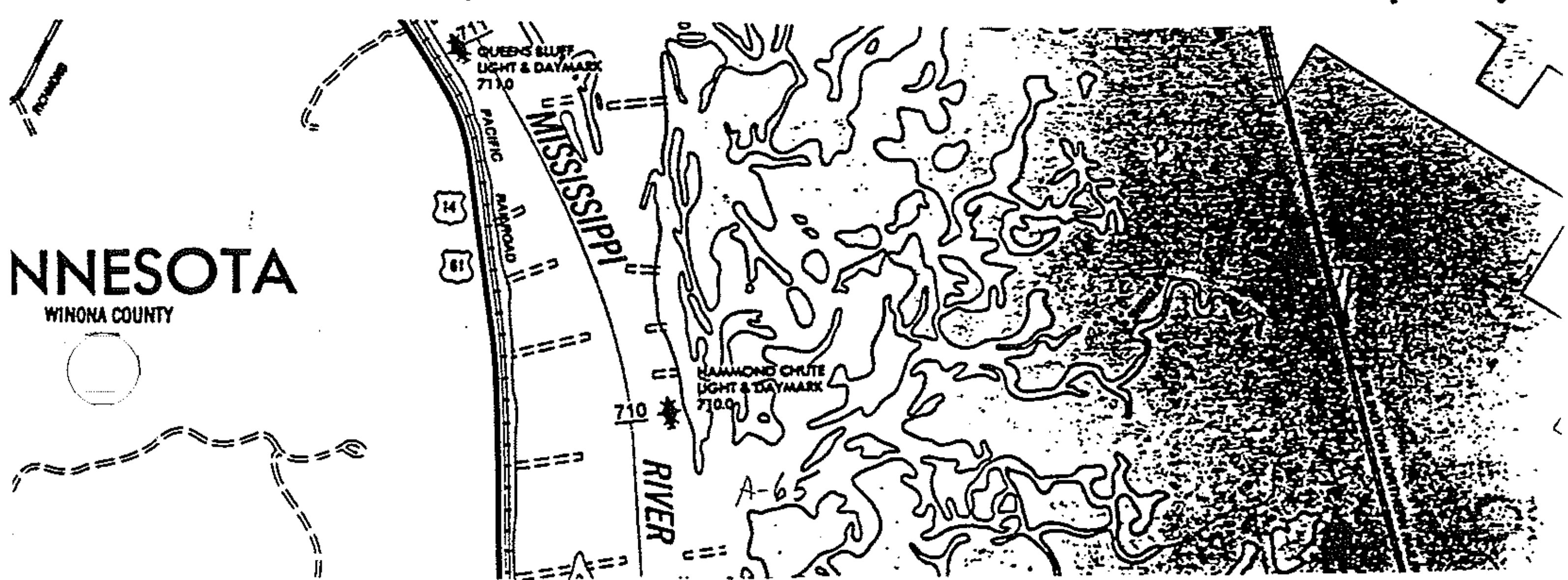
Other information main channel side of island at the head there was active erosion occurring uprooted trees and much root exposure

250 ft of RR along the main channel side

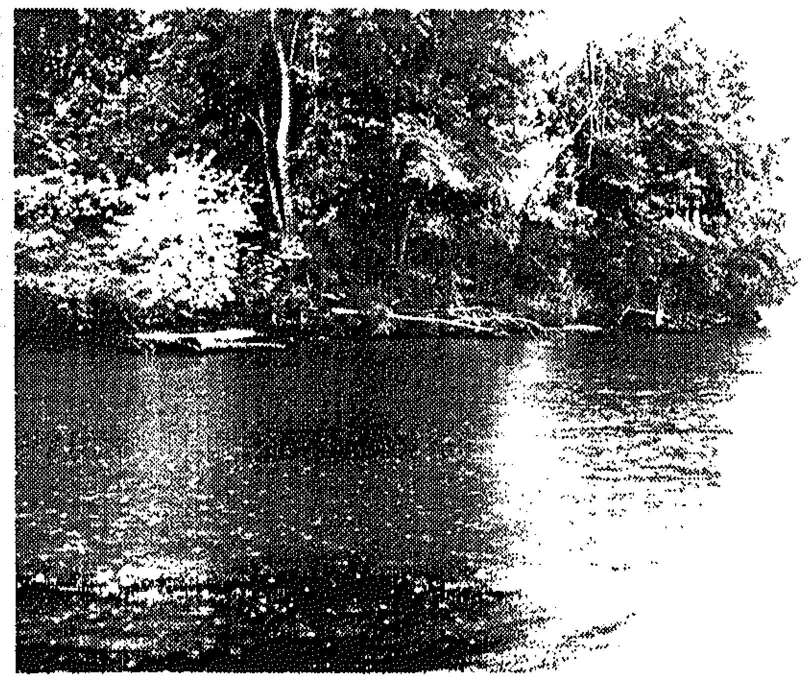
7-712.3-R




RM 713.3 LD N. tip of unnamed island 100 Who owns this island? Low priority.



A-66



# Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data**

7-712.3-R

| Site Name | Site number (pool-river mile-l/r bank) |
|---|---|
| Richmond Island | ~~7-713.3-L~~ |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 7-22-92 | 9:00 | (A) (M) |

| | | |
|---|---|---|
| Upstream L&D No. = 6 | Tailwater Elev. = 40.9 | Flow = 43000 |
| Downstream L&D No. = 7 | Headwater Elev. = 38.9 | Flow = [illegible] |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| 40.0 | 43000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ___ ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ✓
- inside of channel bend ___
- straight reach of channel ___
- ___________ ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| 600' | |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / [illegible] | [illegible] / [illegible] | / | / | / |
| 5 / [illegible] | [illegible] / [illegible] | / | / | / |
| 9 / 1.5 | 2 / 3 | / | / | / |
| [illegible] / [illegible] | [illegible] / [illegible] | / | / | / |
| [illegible] / [illegible] | 32 / 4 | / | / | / |
| [illegible] / [illegible] | [illegible] / [illegible] | / | / | / |
| 42 / 17 | 50 / 9 | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on _____ H

Water depth at toe of bank

Nearshore bottom slope 1V on _____ H

Photo numbers

50 15 40 [illegible] 2-[illegible], 13, [illegible], 2, 3
60 20 70 15
85 20

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Von Hendrickson | Jim Fisher - " | Dan Dieterman - MDNR |
| Pete Fesbender | Jim Nissen - La Crosse | |
| Al Kean | | |

**Observations**

**Site Number** 7-7123-R

| | | | |
|---|---|---|---|
| Bank material: | clay ___ | silt ___ | topsoil ___ |
| (f) (c) sand ✓ | | | |
| (f) (m) (c) gravel ___ | cobbles ___ | other info: | [illegible] |

Existing bank protection? Yes , failing

| | | | |
|---|---|---|---|
| Apparent causes of erosion: (number in order of cause) | river flows 1 | wind waves ___ | boat waves 2 |
| | prop wash 1 | ___ | ice action 3 |

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: (density, type)
- nearshore –
- shoreline –
- bank –
- top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed revetment & possible [illegible] or [illegible]

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information [illegible] spacing ≈ [illegible] [illegible] backwater

Observations

Site Number 7-712.3-R

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ________________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore – Sago, W.C., arrowhead
(density, type) shoreline –
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)
Silver Maple, River Birch, swamp W.O.

Habitat type and species impacted by continued erosion
Richmond Island wetland habitat would be severely impacted

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)
loss of high quality wetland habit

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

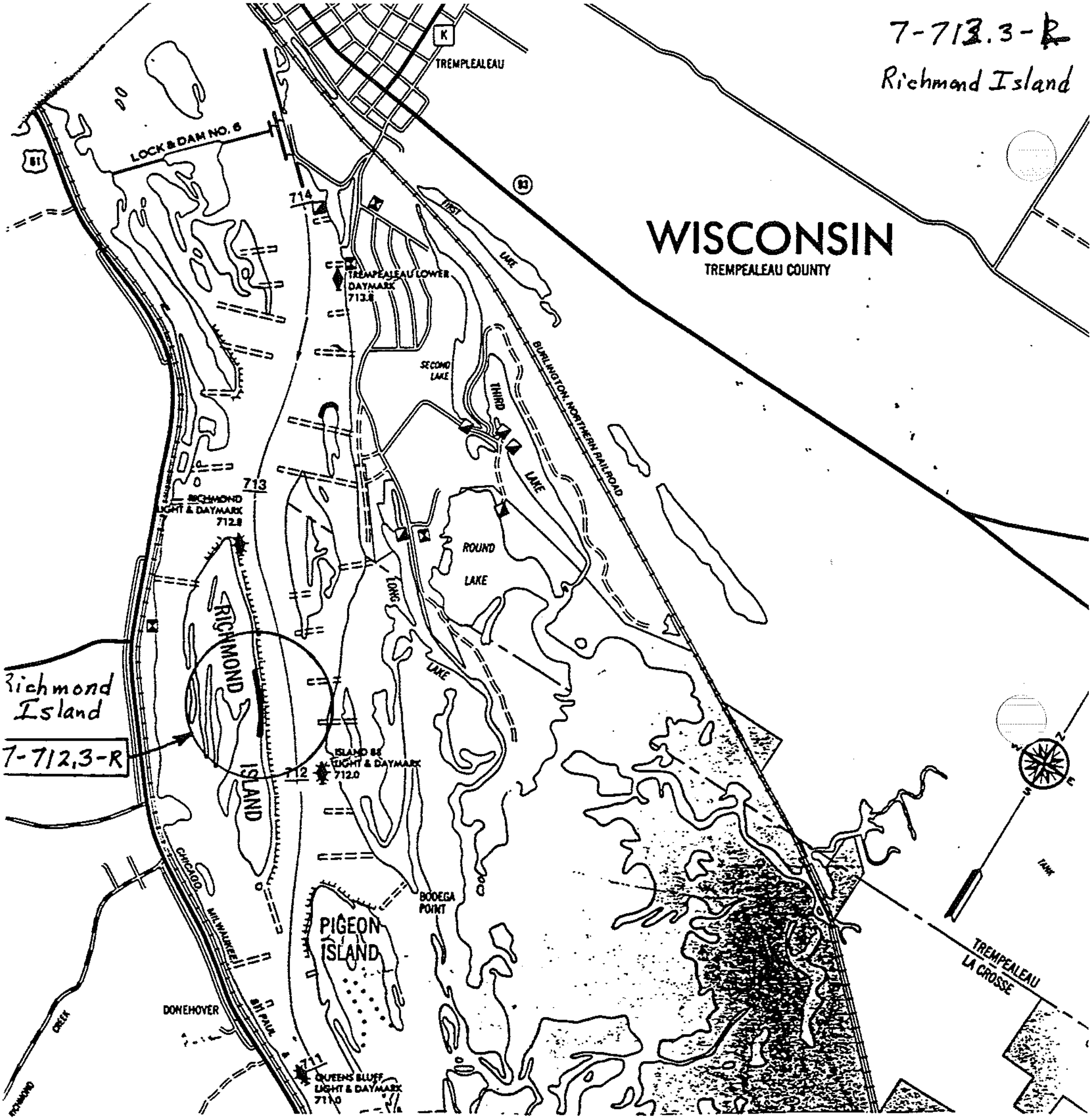
Bank shaping required?

Construction access considerations or problems?

Cultural resources?

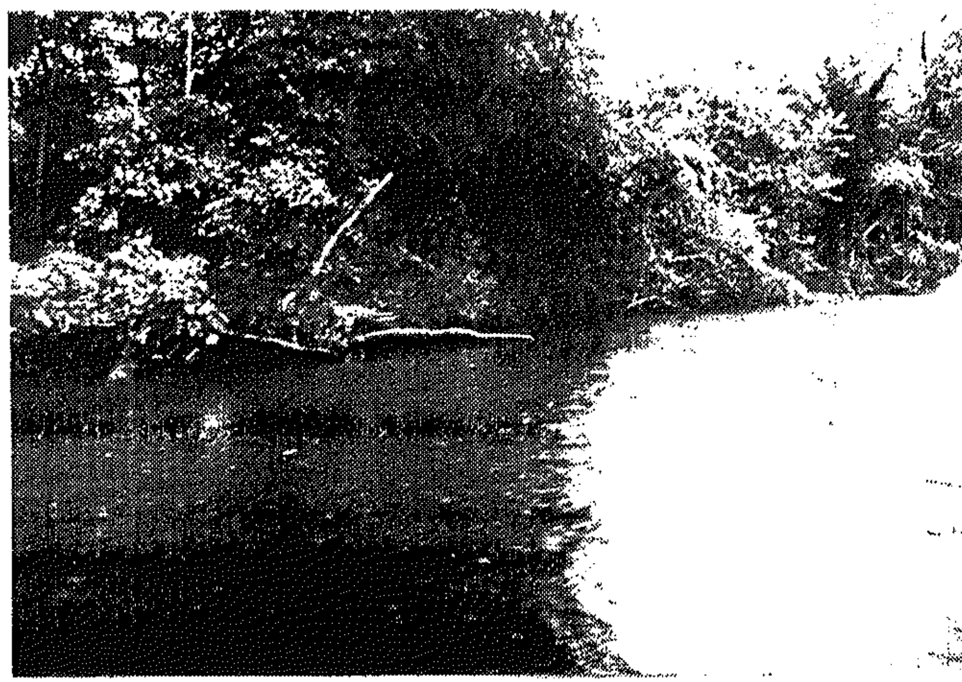
Other information
appears much of the erosional damage is from barge traffic
damage to trees from barge tie-off – may also be scoured from prop wash

7-713.3-R
Richmond Island



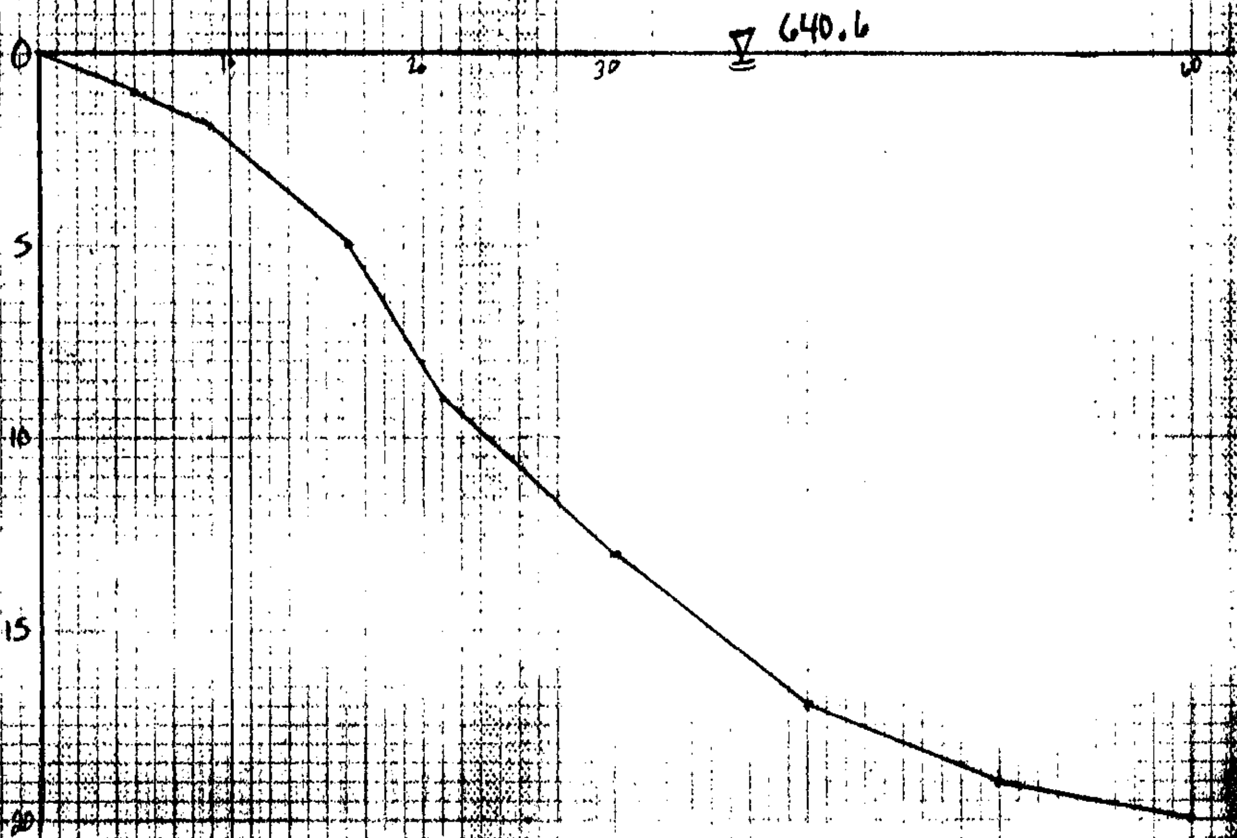

| | | |
|---|---|---|
| RM 712.3 RD | Richmond Island 400 | Protection of bottomland hardwoods and 20 acres of backwater. A breach in the island allows river flow into small backwaters behind island. High priority. |

A-71

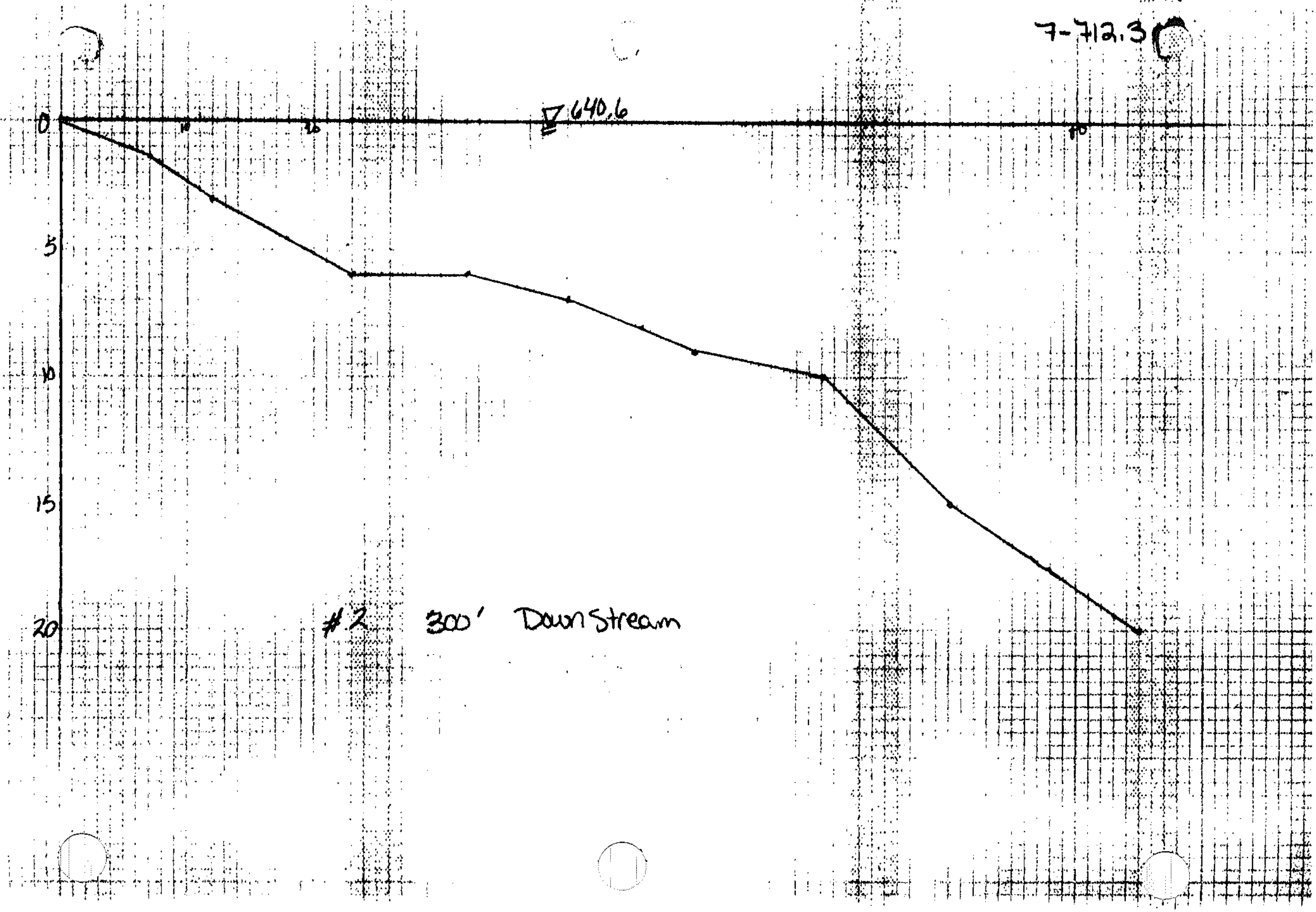


A-72

7-712.3-R




#1 100' upstream of opening


7-712.3
640.6
0
5
10
15
20
#2 300' DownStream

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | |
|---|---|---|
| Site Name Dakota (Island 91) | | Site number (pool–river mile–l/r bank) 7-707.6-L |
| Date investigated 7-22-92 | Time 9:30 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 6 | Tailwater Elev. = 43.7 | Flow = 42,000 |
| Downstream L&D No. = 7 | Headwater Elev. = 38.7 | Flow = 42,000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site 39.8 | Flow velocity (location, depth, fps) 42,000 |

Location type (check all applicable)

main channel ✓ | backwater lake ___ | inside of channel bend ___
side channel inlet ___ | head of island or peninsula ✓ | straight reach of channel ✓
backwater channel ___ | outside of channel bend ___ | ____________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface) 3'

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers 2-14, 15, 16, 17, 18, 19

Fetch direction(s) Length

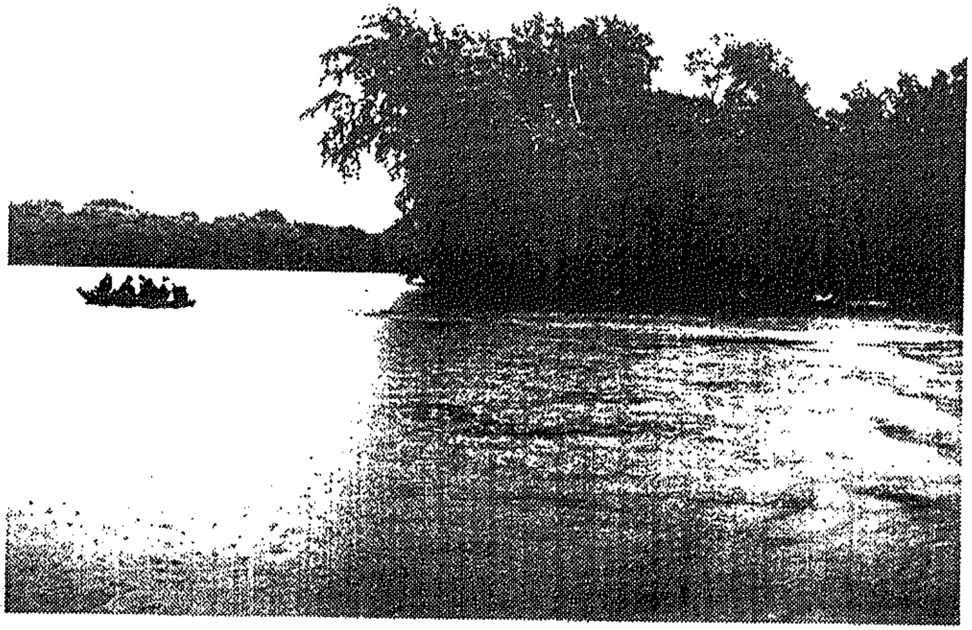
Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Jon Hendrickson | Jim Fisher - Winona | Dan Dieterman - MDNR |
| Pete Fasbender | Jim Nissen - La Crosse | |
| Al Kean | | |
| | | |
| | | |
| | | |

**Observations** | **Site Number**

| | | | | |
|---|---|---|---|---|
| Bank material: | clay ___ | silt ___ | topsoil ___ 10' | (f) (c) sand ✓ |
| (f) (m) (c) gravel ___ | cobbles ___ | other info: | | |
| Existing bank protection? | | | | |
| Apparent causes of erosion: | river flows 1 | wind waves 2 | | boat waves ___ |
| (number in order of cause) | prop wash ___ | ___ | ___ | ice action 3 |
| Estimated rate of erosion or erodibility (low, moderate, high) (future rate) | | | | |
| Source of local sediment transport (upstream, none) | | | | |
| Bottom material | | | | |
| Existing vegetation: | nearshore – | | | |
| (density, type) | shoreline – | | | |
| | bank – | | | |
| | top of bank – | | | |
| Trees (fallen, species, size range, average size, location, number) | | | | |
| Habitat type and species impacted by continued erosion | | | | |
| Quality of affected habitat (low, medium, high) | | | | |
| Area protected by island (shadow zone) | | | | |
| Other impacts of erosion (future conditions) | | | | |
| Type(s) of stabilization proposed | revetment | | | |
| Other type(s) of stabilization possible | | | | |
| Fill required? | Source? | | | |
| Bank shaping required? | | | | |
| Construction access considerations or problems? | | | | |
| Cultural resources? | | | | |
| Other information | State owned island<br>nice backwater marsh<br>inside island | | | |



Made part of larger project

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name | | Site number (pool–river mile–l/r bank) 7-706.0-L | |
| Date investigated 5-18-92 | Time 3:30 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 6 | Tailwater Elev. = 40.6 | Flow = 38,000 | |
| Downstream L&D No. = 7 | Headwater Elev. = 39.1 | Flow = 40,000 | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site 39.3 | | Flow velocity (location, depth, fps) 40000 | |

Location type (check all applicable)

- main channel ✓
- side channel inlet ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ______________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers

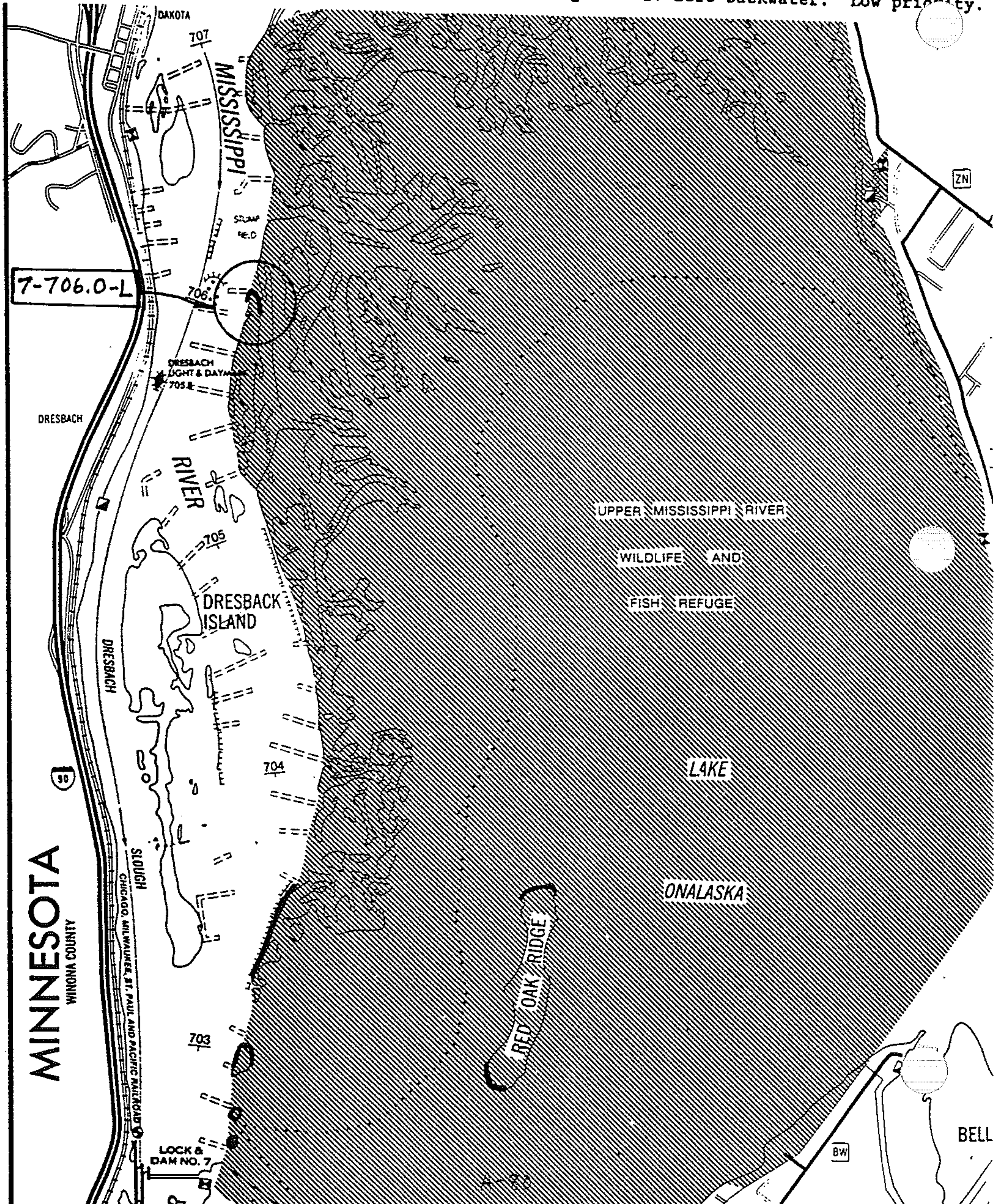
Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Pete Fasbender | Jim Nissen - LaCrosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Al Kean | | |
| | | |
| | | |


RM 706.0 LD    N. tip of island    150    Eroding into 10 acre backwater.  Low priority.



# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | |
|---|---|
| Site Name: Old Cormorant | Site number (pool–river mile–l/r bank): 7-703.8-L |

| | | |
|---|---|---|
| Date investigated: 5-18-92 | Time: 3:30 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 6 | Tailwater Elev. = 40.6 | Flow = 38000 |
| Downstream L&D No. = 7 | Headwater Elev. = 39.1 | Flow = 40.000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 39.2 | Flow velocity (location, depth, fps): 40,000 |

Location type (check all applicable)

main channel ___ backwater lake ✓ inside of channel bend ___
side channel inlet ___ head of island or peninsula ___ straight reach of channel ___
backwater channel ___ outside of channel bend ___ ______________ ___

| | |
|---|---|
| Proposed length of stabilization: 100' + 100' | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 1-2'

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank: 2'-3'

Nearshore bottom slope: 1V on ____ H

| | |
|---|---|
| Photo numbers: 1-24, 1-25 | Fetch direction(s) Length |
| | Site alignment with respect to fetch direction |

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

| Observations | Site Number 7-703.8-L |
|---|---|

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? Some rock on ends

Apparent causes of erosion: river flows ___ wind waves 1 boat waves 3

(number in order of cause) prop wash ___ ________ ___ ice action 2

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material Silt

Existing vegetation: nearshore – submerged

(density, type) shoreline – none

bank – —

top of bank – Dead Trees

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Rock wedge or offshore mound

Other type(s) of stabilization possible

Fill required? No. Source?

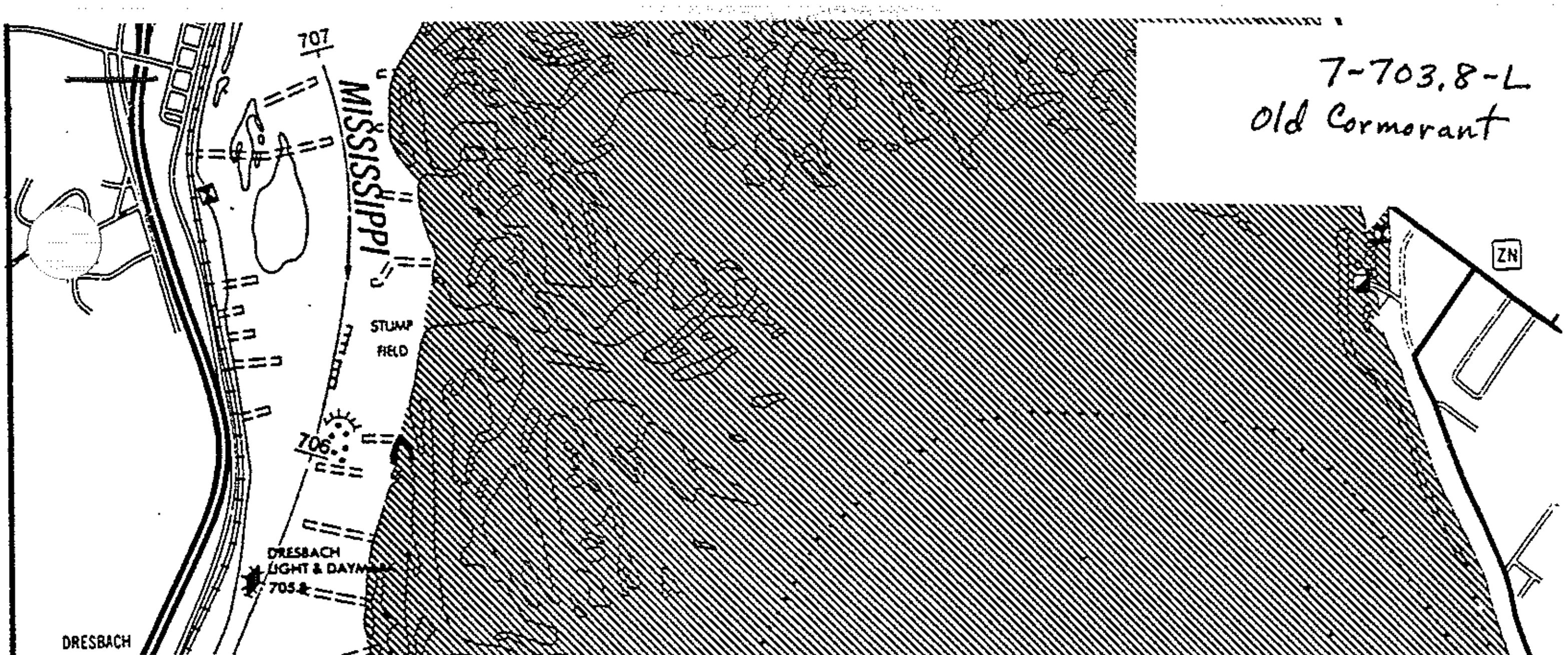
Bank shaping required? No.

Construction access considerations or problems? Only 3' depths.

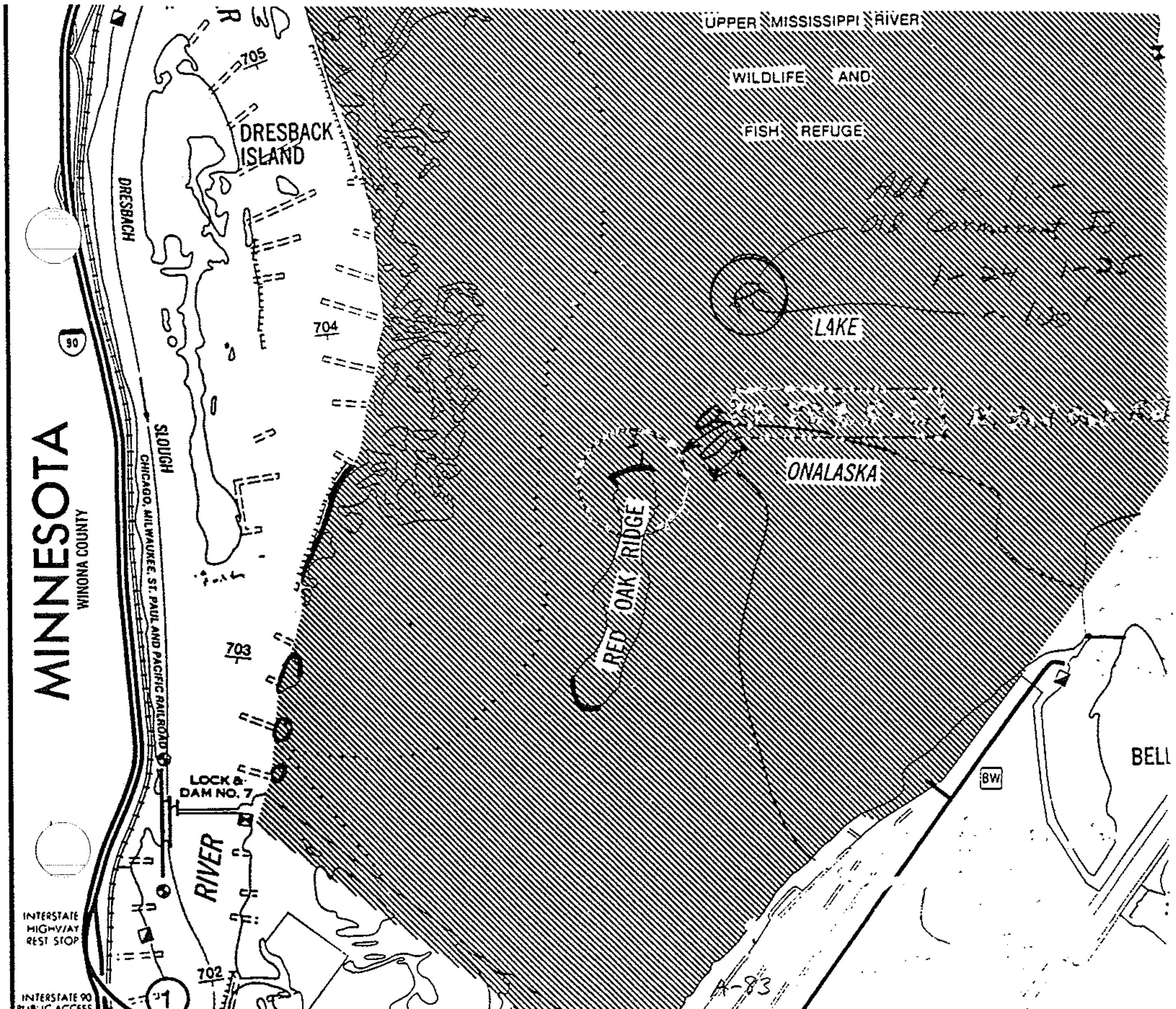
Cultural resources?

Other information

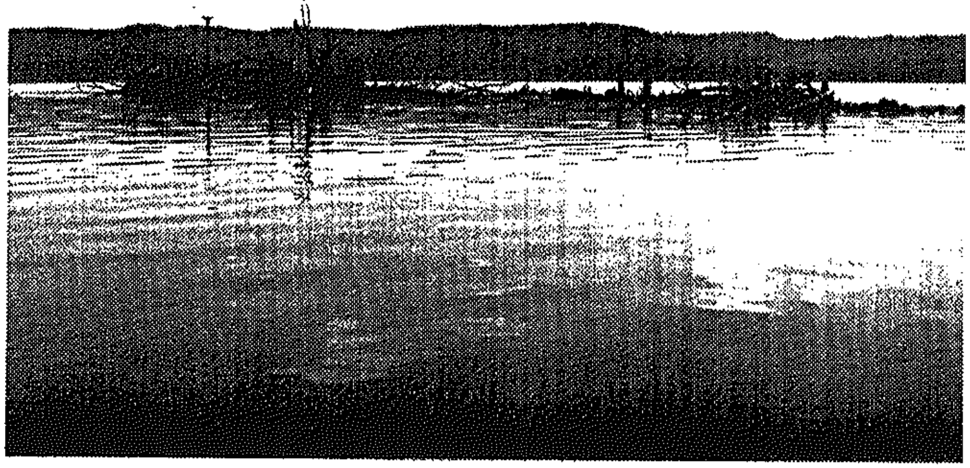
7-703.8-L
Old Cormorant

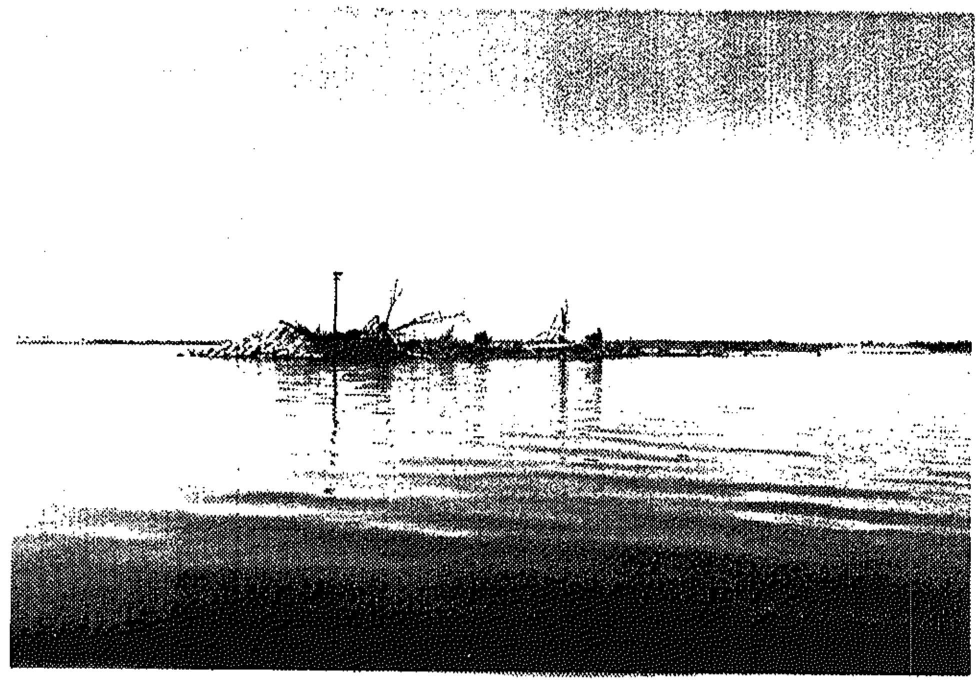



| | | | |
|---|---|---|---|
| RM 703.5 | N. tip Red Oak Ridge - Lake Onalaska | 300 | Protection of significant cultural resources an bottomland forest. High priority. |



A-84





# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: N. Red Oak Ridge | | | Site number (pool–river mile–l/r bank): 7-703.5-L |
| Date investigated: 5-18-92 | Time: 3:00 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 6 | Tailwater Elev. = 40.6 | Flow = 38,000 | |
| Downstream L&D No. = 7 | Headwater Elev. = 39.1 | Flow = 35,000 | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site: 39.7 | | Flow velocity (location, depth, fps): 40,000 | |

Location type (check all applicable)

- main channel ___
- side channel inlet ___
- backwater channel ___
- backwater lake ✓
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ___
- ___________________ ___

Proposed length of stabilization: 300' +

Wing or closing dams in area:

## Physical Data

Coordinates for horizontal positioning:

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 1/0 | / | / | / | / |
| 5/0.6 | / | / | / | / |
| 10/1.0 | / | / | / | / |
| 15/1.1 | / | / | / | / |
| 20/1.5 | / | / | / | / |
| 35/2.2 | / | / | / | / |
| 60/2.7 | / | / | / | / |

Height of bank (top of bank to water surface): 20 - 30'

Slope length above water:

Slope above water: 36° — 1V on _____ H

Water depth at toe of bank:

Nearshore bottom slope: 1V on _____ H

Photo numbers: 1-20, 1-21
R5 / 3.0

Fetch direction(s) — Length

Site alignment with respect to fetch direction:

Names of investigators — (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

**Observations**

**Site Number** 7-703.5-L

Bank material: clay ___ silt ___ topsoil ___ (f)(m)(c) sand ✓

(f)(m)(c) gravel ✓ a little cobbles ___ other info:

Existing bank protection? none

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material f-c sand & some gravel

Existing vegetation: nearshore - none

(density, type) shoreline - none to some indigo bush & elm & canary grass

bank - " " " " "

top of bank - trees grass cherry

Trees (fallen, species, size range, average size, location, number)

elm, oak, sumac

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

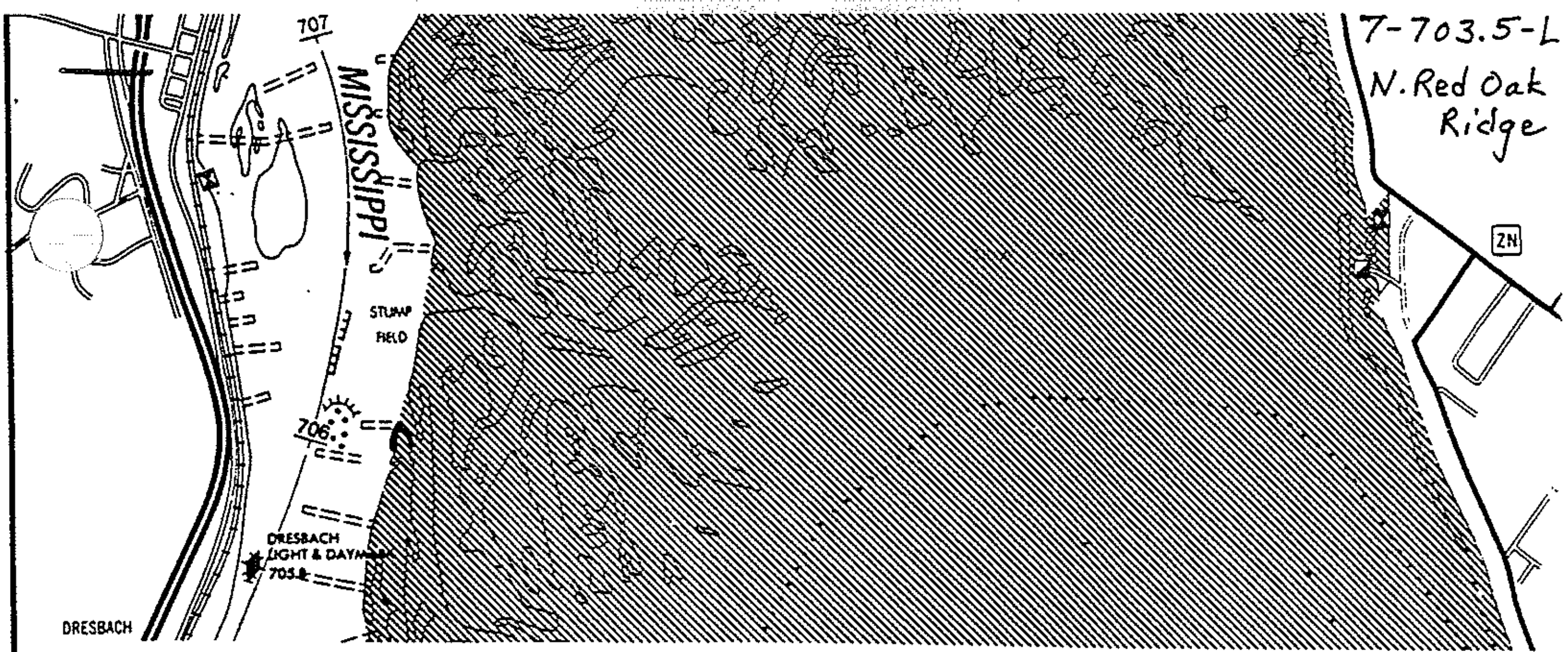
Fill required? Source?

Bank shaping required?

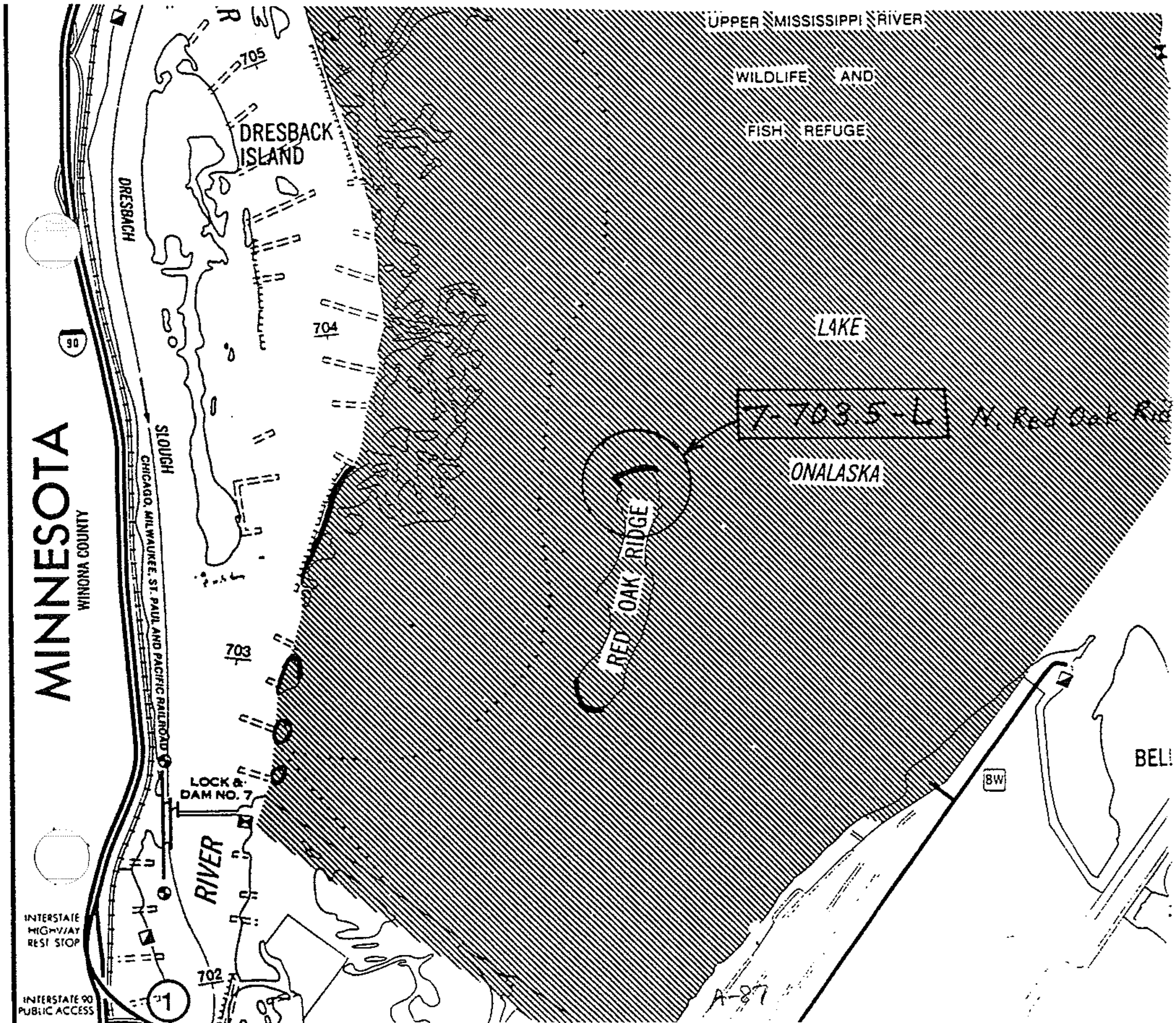
Construction access considerations or problems?

Cultural resources?

Other information



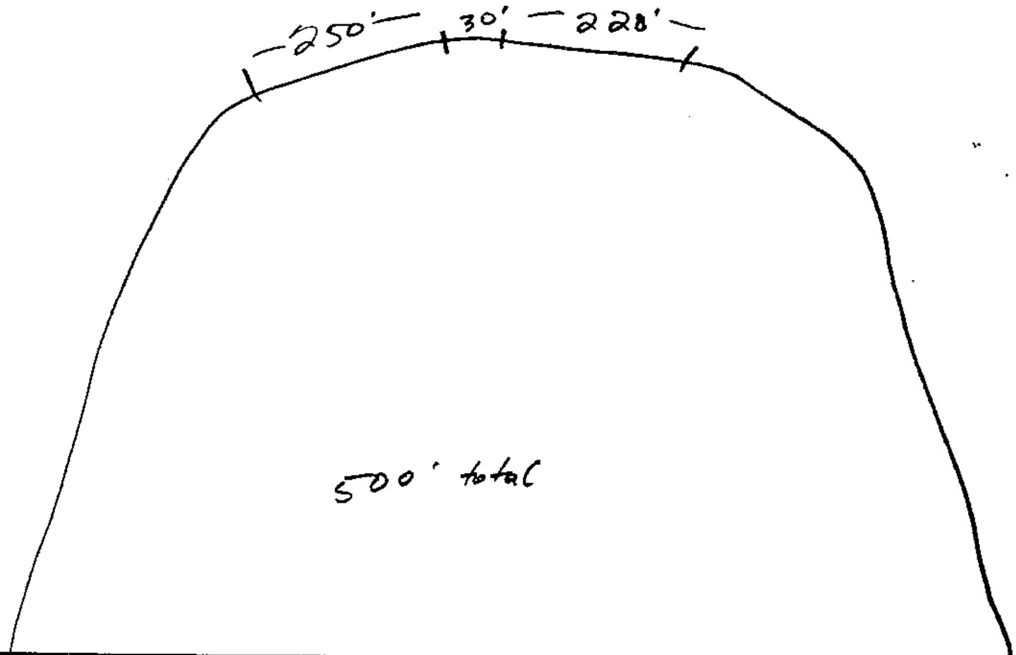

| | | | |
|---|---|---|---|
| RM 703.5 | N. tip Red Oak Ridge - Lake Onalaska | 300 | Protection of significant cultural resources an bottomland forest. High priority. |



Site Sketches

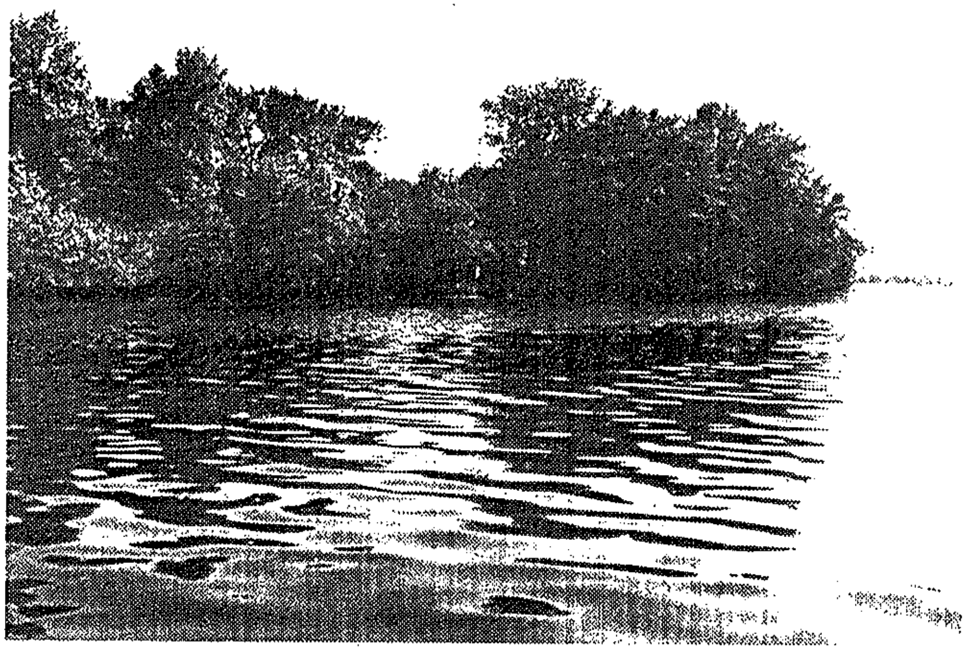
| Site Number | 7-703.5-L |
| --- | --- |

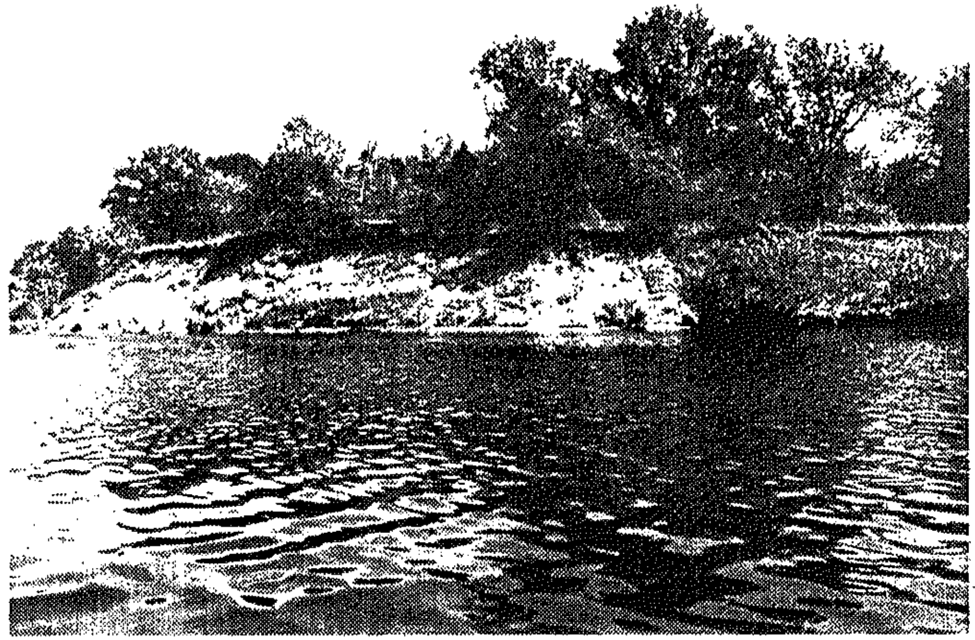
## Plan view




## ~~Typical bank cross-section~~

Small Island just east of Red Oak







# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

**Site Name:** S. Red Oak Ridge

**Site number (pool–river mile–l/r bank):** 7-703.1-L

**Date investigated:** 5-18-92

**Time:** 2:30

**Year(s) of aerial photos (A) or maps (M) available:** (A) | (M)

**Upstream L&D No. =** 6

**Tailwater Elev. =** 40.6

**Flow =** 38000

**Downstream L&D No. =** 7

**Headwater Elev. =** 37.1

**Flow =** 20000

**Other water surface elev. data in pool:**

**Estimated water surface elev. at site:** 39.2

**Flow velocity (location, depth, fps):** 40000

**Location type (check all applicable)**

- main channel ___
- side channel inlet ___
- backwater channel ___
- backwater lake ✓
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ___
- ______________ ___

**Proposed length of stabilization:** 600'+

**Wing or closing dams in area:**

## Physical Data

**Coordinates for horizontal positioning:**

**Nearshore data (dist from shoreline/water depth)**

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / 0 | 0 / 0 | / | / | / |
| 50 / 2 | 20 / 1.2 | / | / | / |
| / 2.5 | 40 / 1.6 | / | / | / |
| 125 / 5 | 55 / 4 | / | / | / |
| 230 / 6 | 74 / 4 | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

**Height of bank (top of bank to water surface):** 10-30'

**Slope length above water:**

**Slope above water:** 1V on 1 H

**Water depth at toe of bank:**

**Nearshore bottom slope:** 1V on ____ H

**Photo numbers:** 1-14, 1-15, 1-16, 1-17, 1-18, 1-19 on west side at headland between bays

**Fetch direction(s):** S.W. S, SE.

**Length:**

**Site alignment with respect to fetch direction:**

**Names of investigators** (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

| Observations | Site Number 7-703.1-L |
|---|---|

| | | | |
|---|---|---|---|
| Bank material: clay ___ | silt ___ | topsoil ___ | (f)(c) sand ✓ |
| (f) (m) (c) gravel ___ | cobbles ___ | other info: | |

Existing bank protection? no

| | | | |
|---|---|---|---|
| Apparent causes of erosion: | river flows ___ | wind waves 1 | boat waves ___ |
| (number in order of cause) | prop wash ___ | ___ | ice action 2 |

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material fine sand

Existing vegetation: (density, type)
- nearshore - ~~none~~ sago
- shoreline - roots, fallen trees, indigo bush, RCG canary grass
- bank - cheat grass, trees RCG
- top of bank - basswood, red oak, Am. elm high diversity

Trees (fallen, species, size range, average size, location, number)
Oak, elm

Habitat type and species impacted by continued erosion
high

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

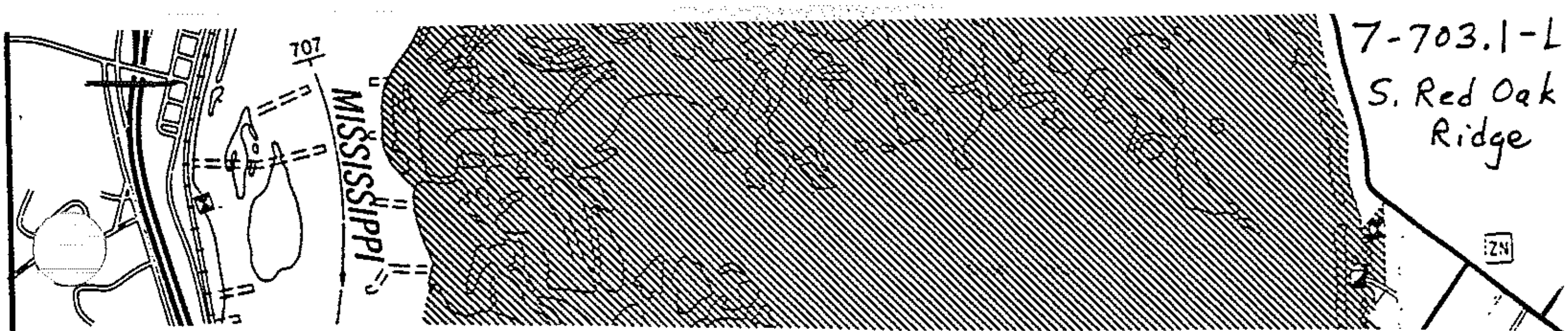
Fill required? Source?

Bank shaping required?

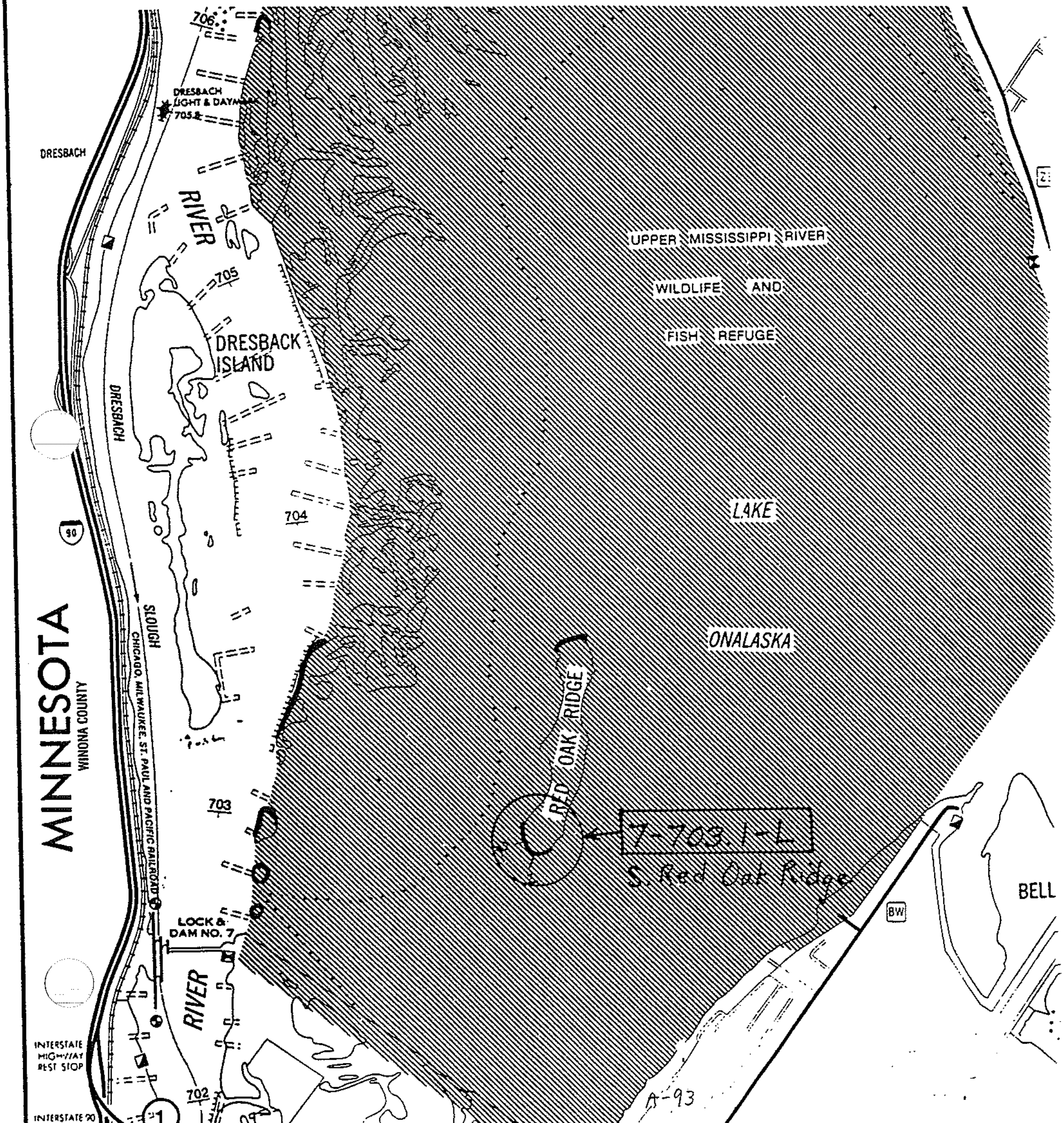
Construction access considerations or problems?

Cultural resources? Yes Significant resources - burial mounds, graves, etc.

Other information



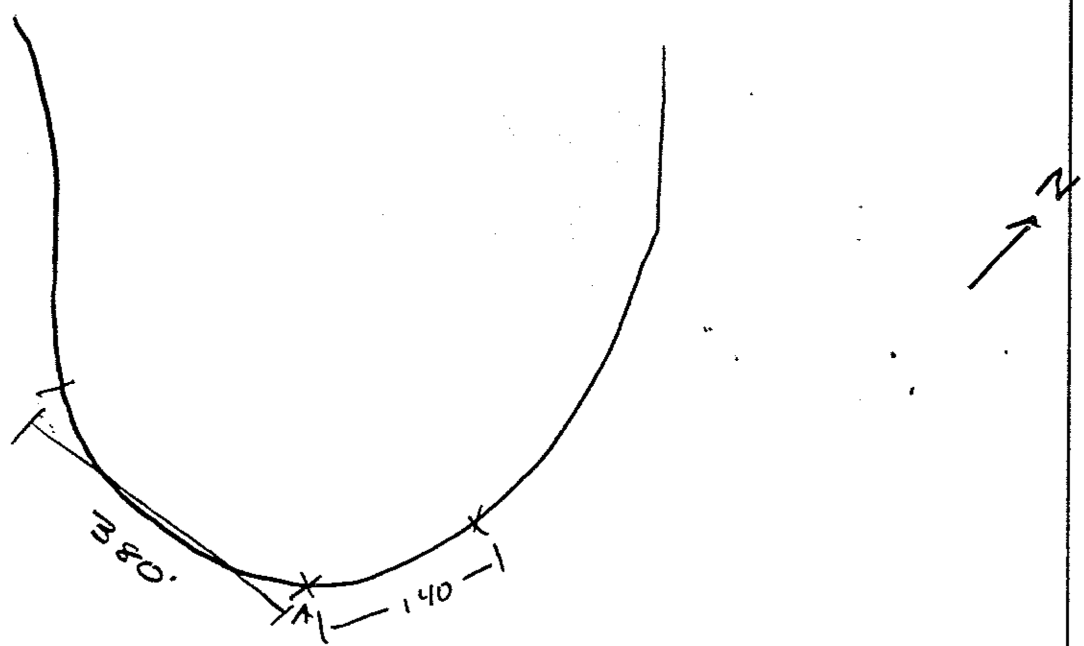

RM 703.0 S. tip Red Oak Ridge - Lake Onalaska | 300 | Protection of significant cultural resources and bottomland forest. High priority.



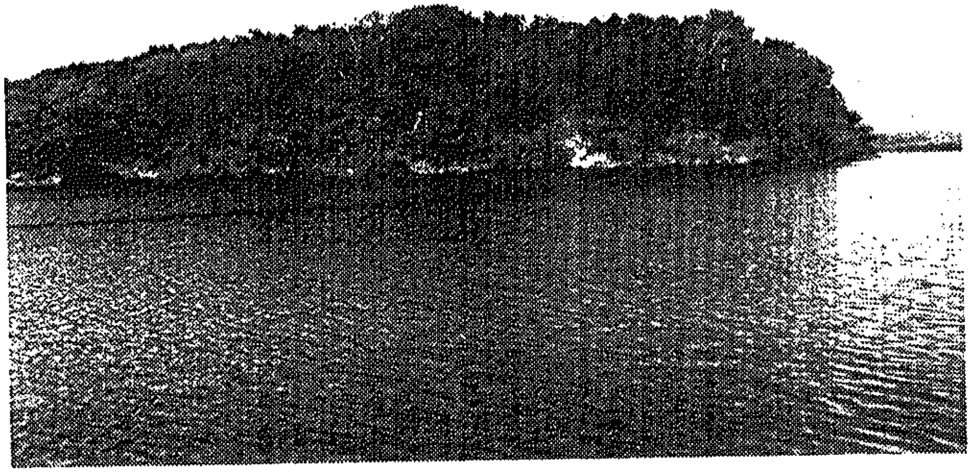
Site Sketches

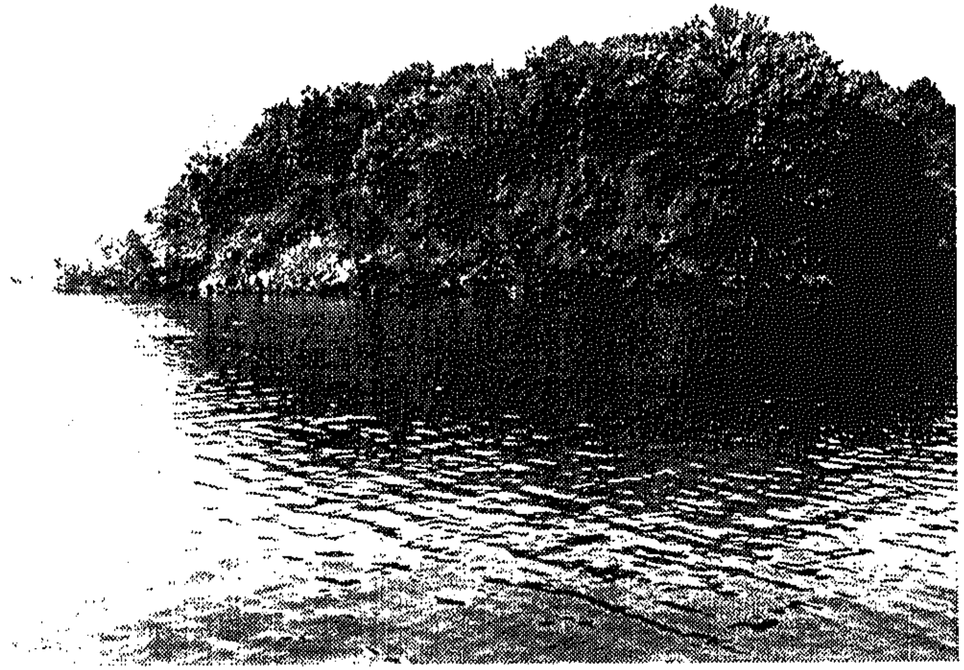
| Site Number | 7-703.1-L |
|---|---|

Plan view

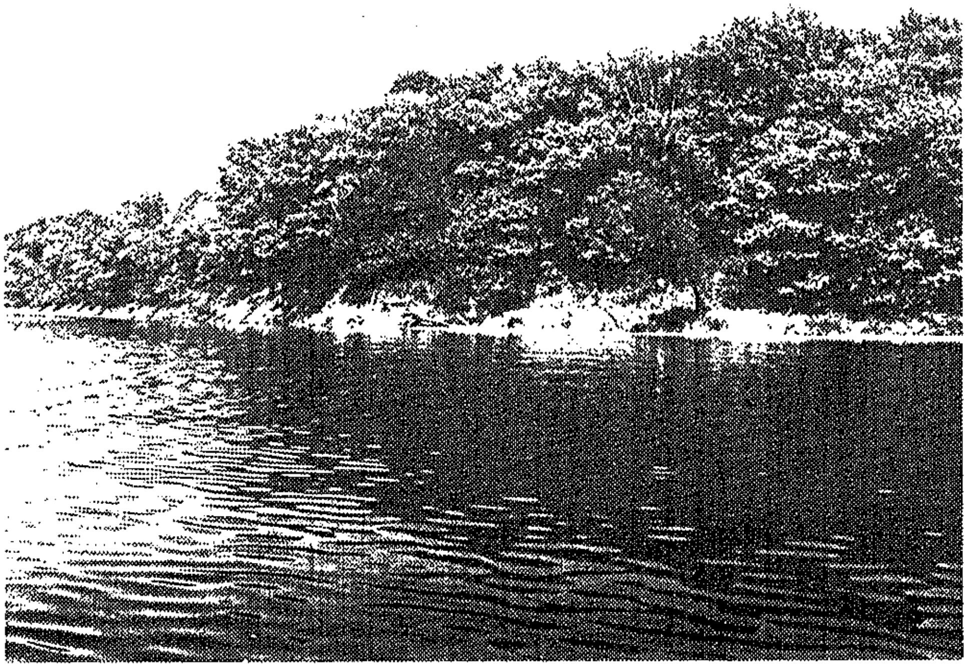


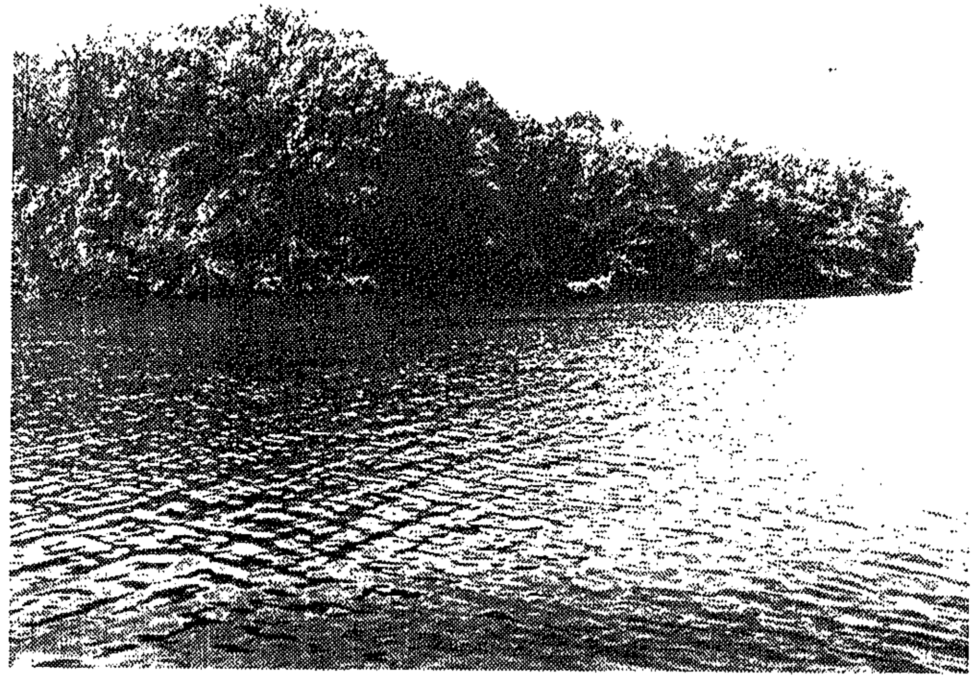

Typical bank cross-section



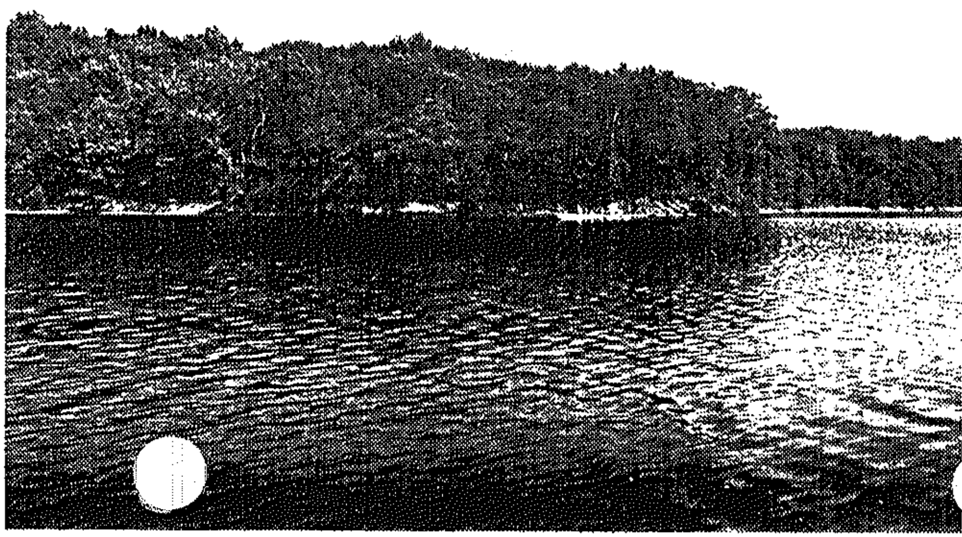


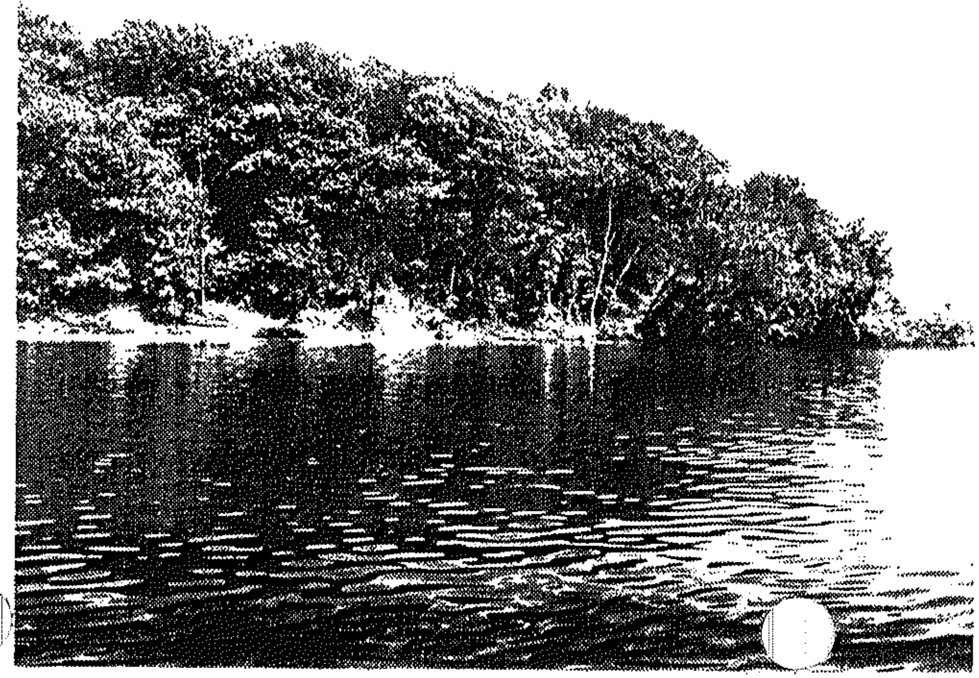












# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name: Lake Onalaska | Site number (pool–river mile–l/r bank): 7-703.0-L |

| | | |
|---|---|---|
| Date investigated: 5-18-92 | Time: 4:00 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 6 | Tailwater Elev. = 40.6 | Flow = 38000 |
| Downstream L&D No. = 7 | Headwater Elev. = 39.1 | Flow = 40000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 39.2 | Flow velocity (location, depth, fps): 40,000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ___

| | |
|---|---|
| Proposed length of stabilization: 770 ~800' = Island B; 660 ~700 = " C | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Dist 1 Depth | Dist 2 Depth | Dist 3 Depth | 4 | 5 |
|---|---|---|---|---|
| 0 / 0 | 0 / 0 | 0 / 0 | / | / |
| 6 / 0.8 | 8 / 0.9 | 7 / 0.8 | / | / |
| 12 / 1.1 | 15 / 1.0 | 11 / 1.0 | / | / |
| 18 / 1.2 | 25 / 1.0 | 19 / 1.2 | / | / |
| 25 / 1.4 | 35 / 1.0 | 31 / 1.5 | / | / |
| 37 / 1.5 | 47 / 1.1 | 42 / 1.7 | / | / |
| 49 / 1.6 | 66 / 1.6 | 55 / 2.0 | / | / |

Height of bank (top of bank to water surface): 1-2'

Slope length above water

Slope above water: 1V on ___ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ___ H

Photo numbers
56/1.7 79/9 70/3.1
67/2.4 81/5
80/2.8

2-1, 2-2 Island B
2-3, 2-4, 2-5, 2-6 C
2-7, 2-8 D looking d.s.

Fetch direction(s) — Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

| Observations | Site Number 7-703.0-L |
|---|---|

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: (density, type)
nearshore – none
shoreline – roots, brush
bank –
top of bank – trees, brush

Trees (fallen, species, size range, average size, location, number)
elm, maple, hackberry, linden basswood

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed nearshore breakwater? shore-parallel

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information
Island B width ~ 5-25'
" C " ~15-40'

Observations

Site Number 7-703.0-L

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –

(density, type) shoreline – RCG on the ~~low~~ lower end

bank –

top of bank –

Trees (fallen, species, size range, average size, location, number)

elm

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

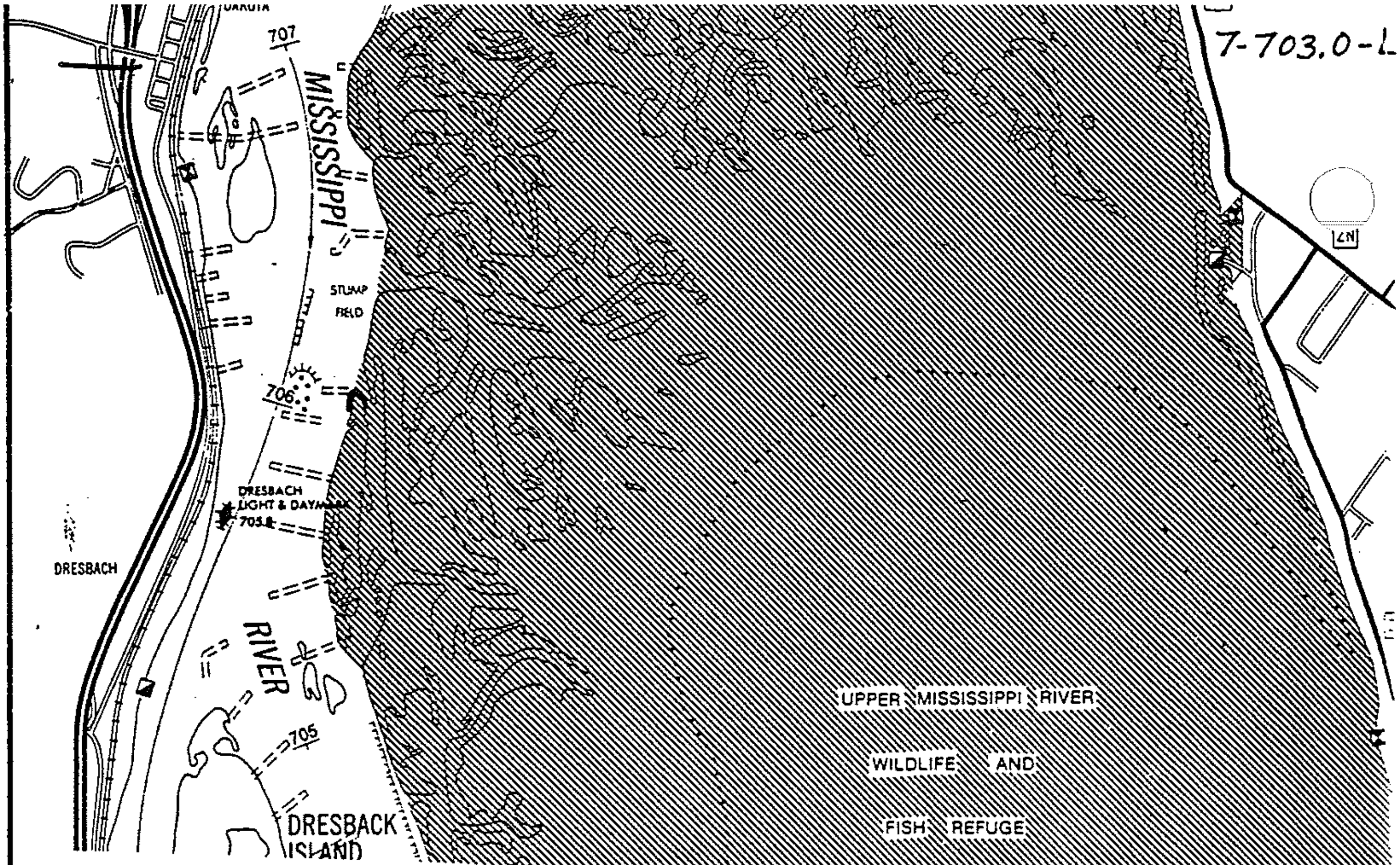
Cultural resources?

Other information

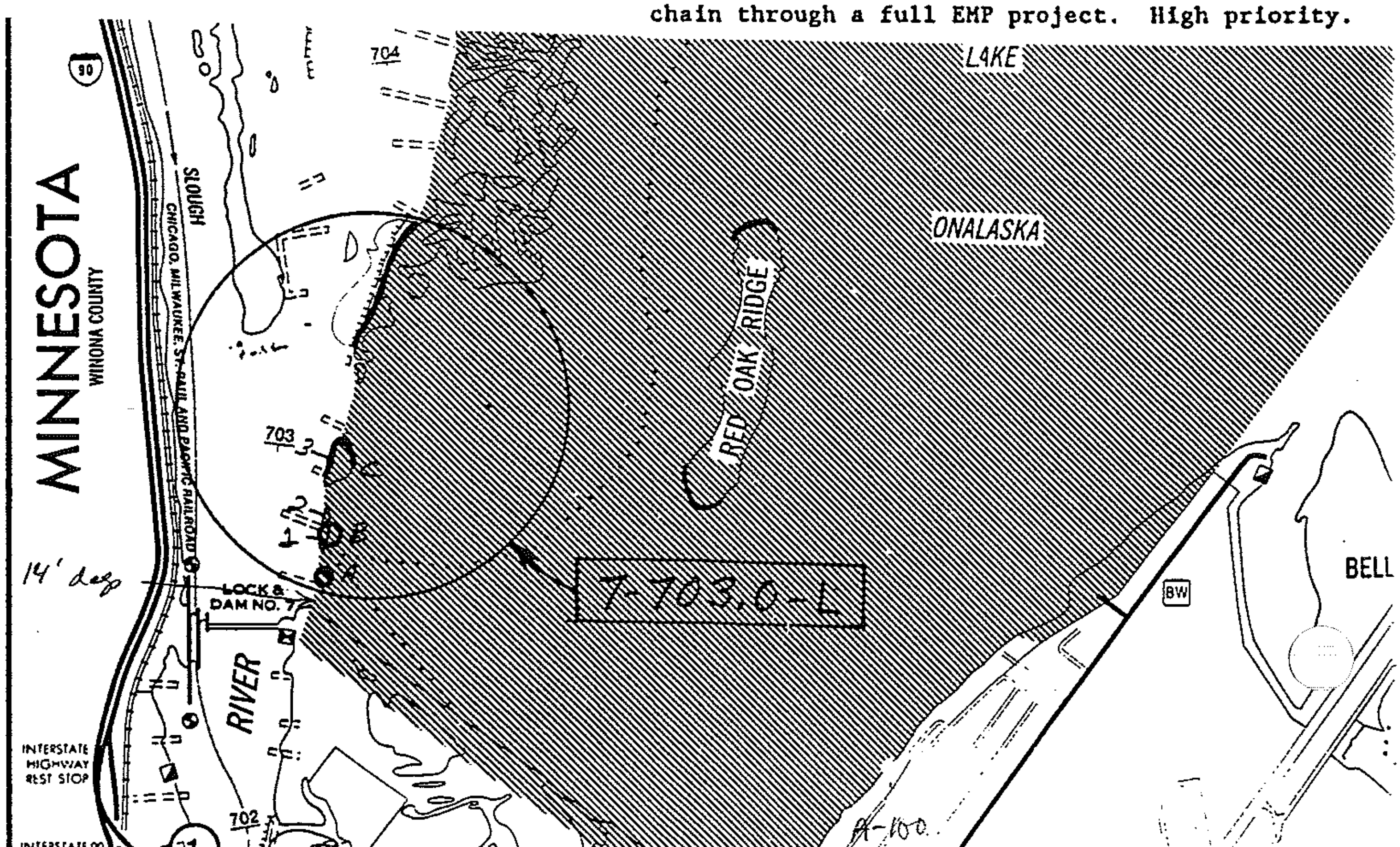
Downstream island was 770'; deep on the main channel side – 3 ft on Onalaska side

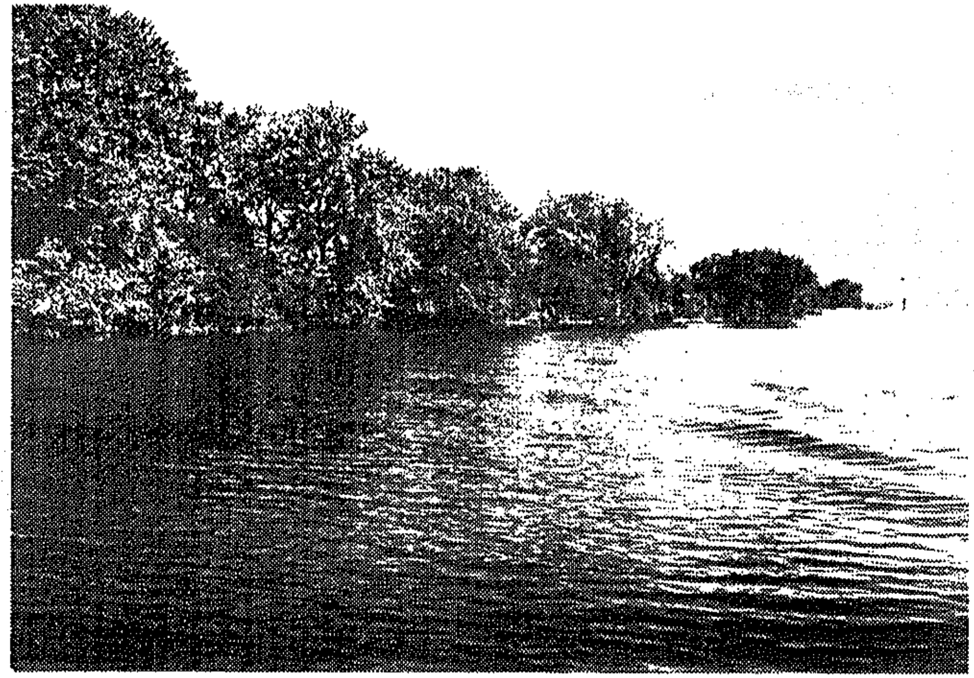
Onalaska side of the upstream island was eroded the worst (North end at least)

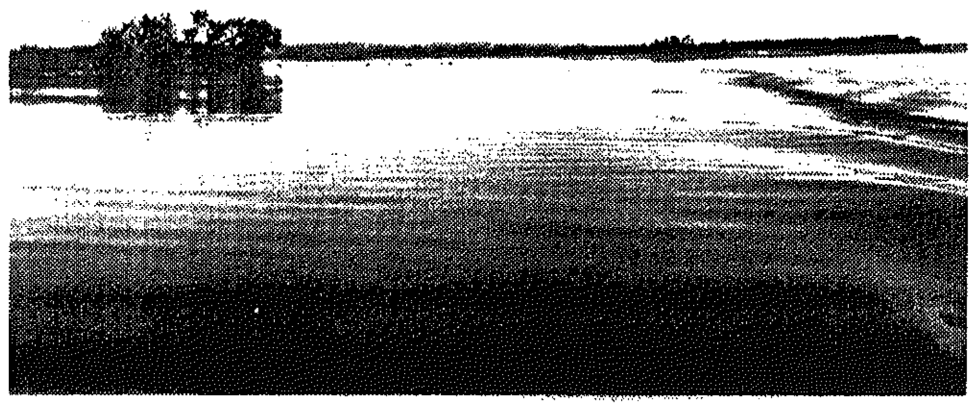
7-703.0-L

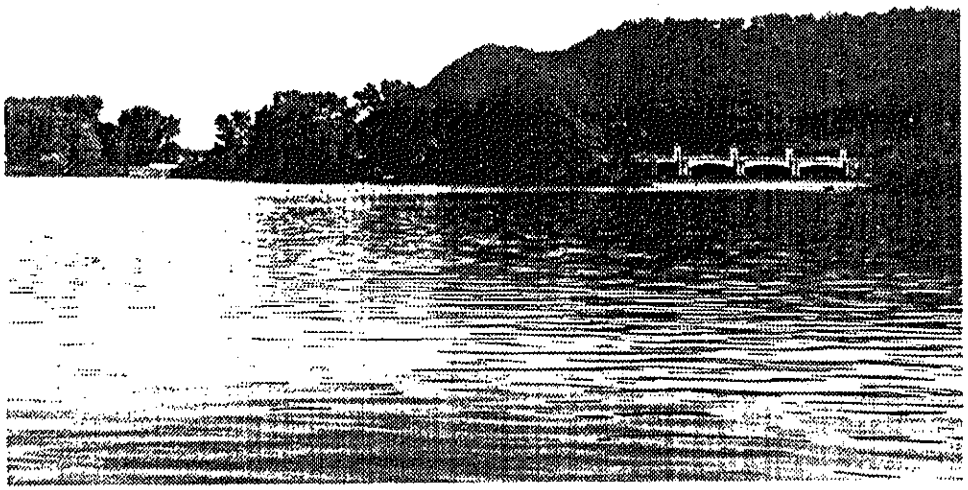



| | | | |
|---|---|---|---|
| RM 703.1 - 702.6 LD | Barrier islands between Lake Onalaska and Main Channel | >1200 | Protection of approx. 100 acres of aquatic vegetation. 3 or more islands need channel s[illegible] protection for continued existence. Possibly p[illegible]tec strategic spots now and address other islands in the chain through a full EMP project. High priority. |











## Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data**

699.3

| | | |
|---|---|---|
| Site Name: N. ~~S~~. Taylor Island | | Site number (pool–river mile–l/r bank): 8-~~698.5~~-L |
| Date investigated: 5-18-92 | Time: 12:30 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 7 | Tailwater Elev. = 33.1 | Flow = 45,500 |
| Downstream L&D No. = 8 | Headwater Elev. = 30.3 | Flow = 44,500 |
| Other water surface elev. data in pool | | |
| Estimated water surface elev. at site: 32.7 | | Flow velocity (location, depth, fps): 41,500 |

**Location type (check all applicable)**

- main channel ✓
- side channel inlet ✓
- backwater channel ✓
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ___
- ___________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| T1 Depth | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 0 / 0 | 0 / 0 | / | / | / |
| 5 / 3 | 5 / 1.2 | / | / | / |
| 10 / 4 | 10 / 1.9 | / | / | / |
| 18 / 6 | 17 / 3 | / | / | / |
| 30 / 6 | 25 / 3 | / | / | / |
| 50 / 7 | 32 / 4 | / | / | / |
| 63 / 8 | 40 / 5 | / | / | / |

Height of bank (top of bank to water surface): 5'

Slope length above water

Slope above water: @ 1 1V: 0.5-1H; @ 2 1V on 1 H

Water depth at toe of bank

Nearshore bottom slope: 1V on ___ H

Photo numbers: 68/5; 83/5 1-11; 200 4' @ head of island 1-12

Fetch direction(s) — Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke-Winona | Jeff Janvrin-WDNR |
| Al Kean | Jim Nissen-La Crosse | Mike Davis-MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

699.3

| Observations | Site Number ~~8-698.5~~-L |
|---|---|

Bank material: clay ___ silt ___ topsoil 1' (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? no

Apparent causes of erosion: river flows 1 wind waves ___ boat waves 2

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: nearshore – none to some grass & fallen trees

(density, type) shoreline – " " " "

bank – some grass

top of bank – canary grass @ 1
" " & willow @ 2

Trees (fallen, species, size range, average size, location, number)

Willow maple

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

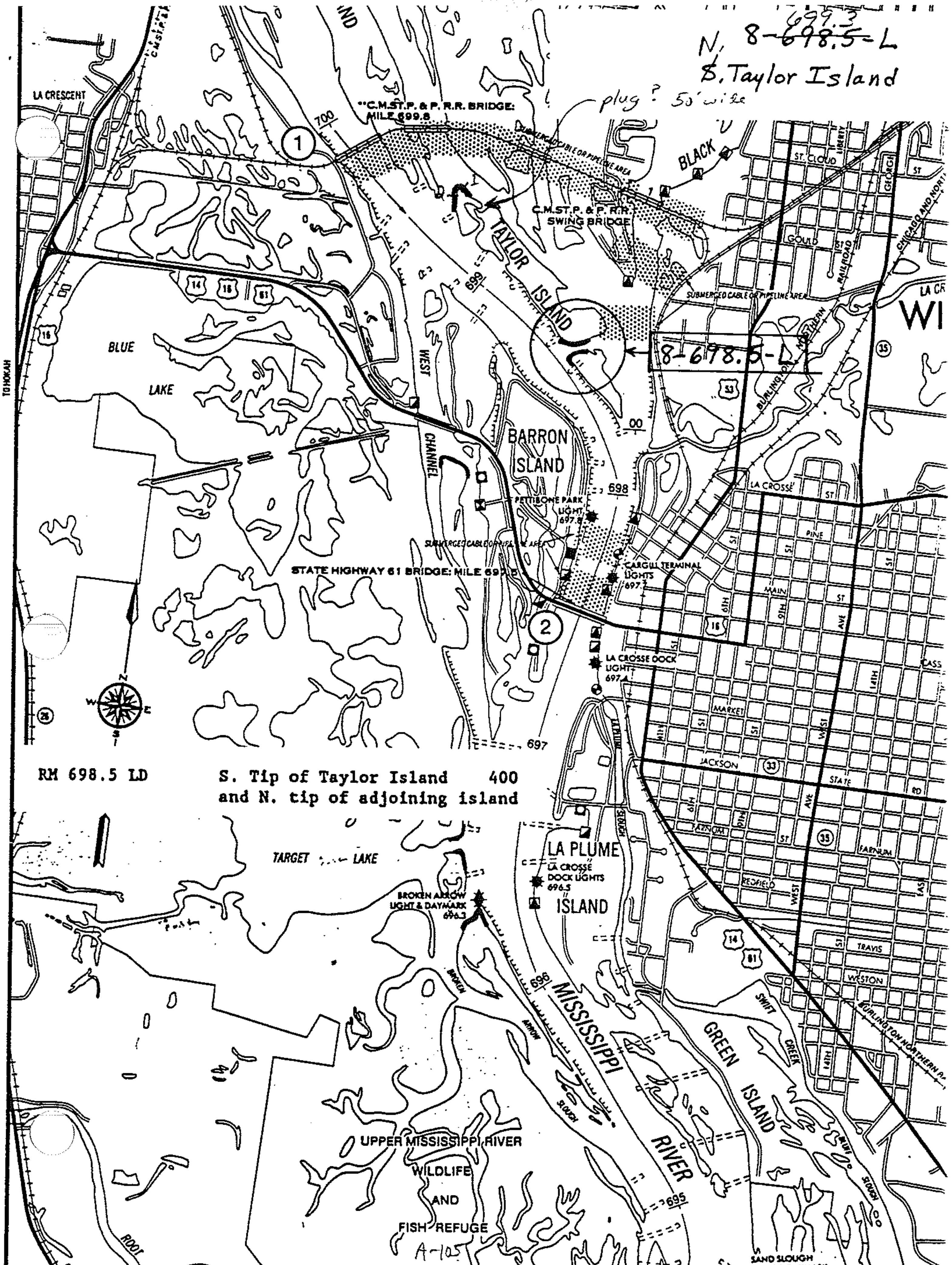
Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

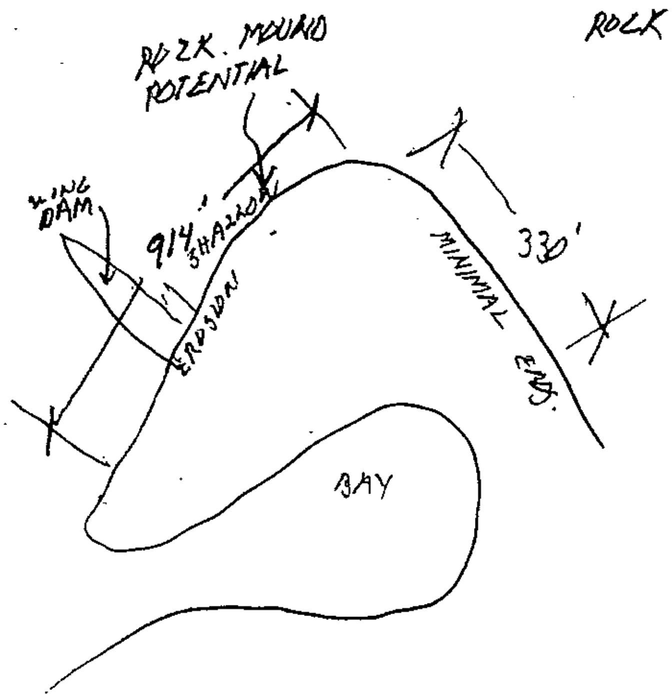
Other information



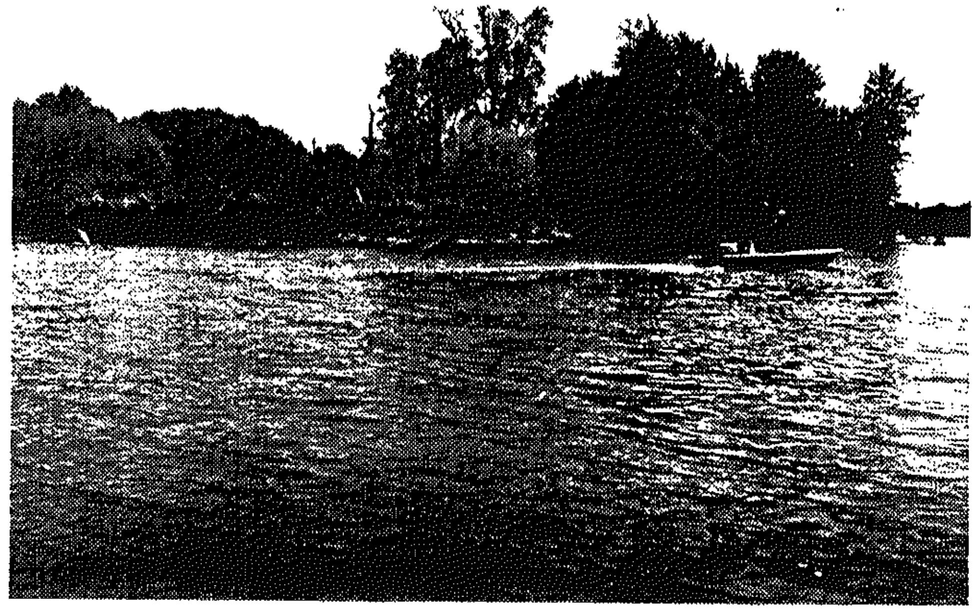

RM 698.5 LD S. Tip of Taylor Island 400
and N. tip of adjoining island

Site Sketches | Site Number 8-699.3-L

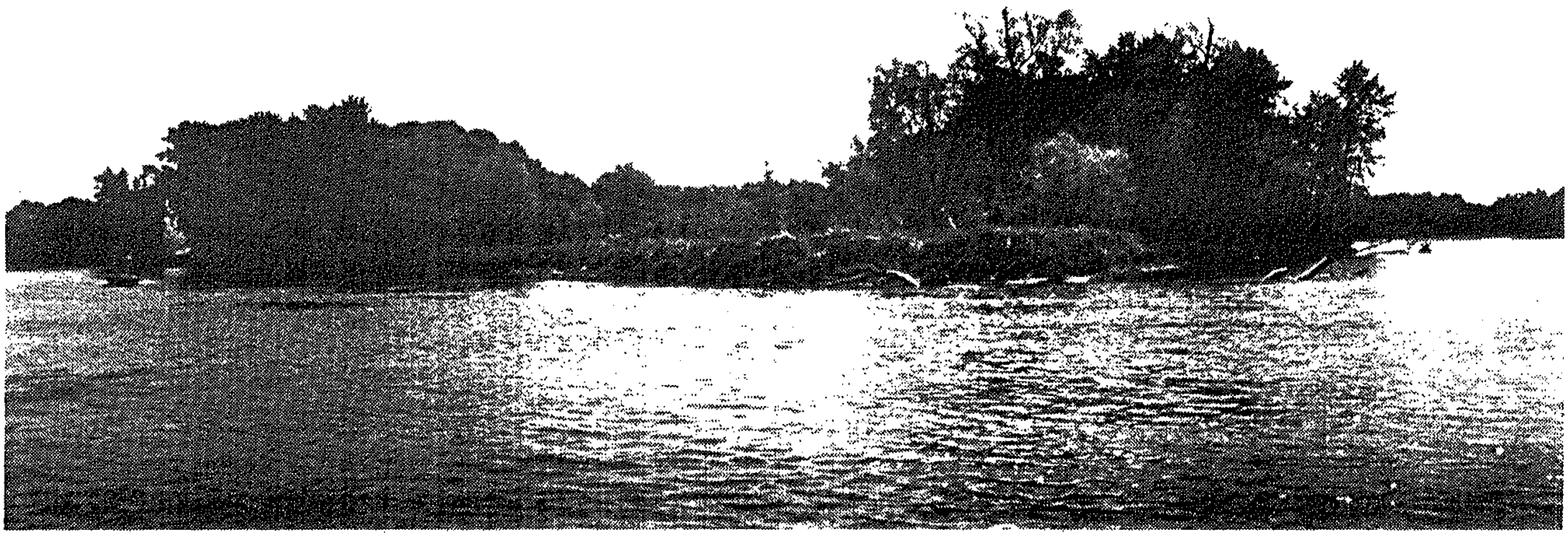
Plan view



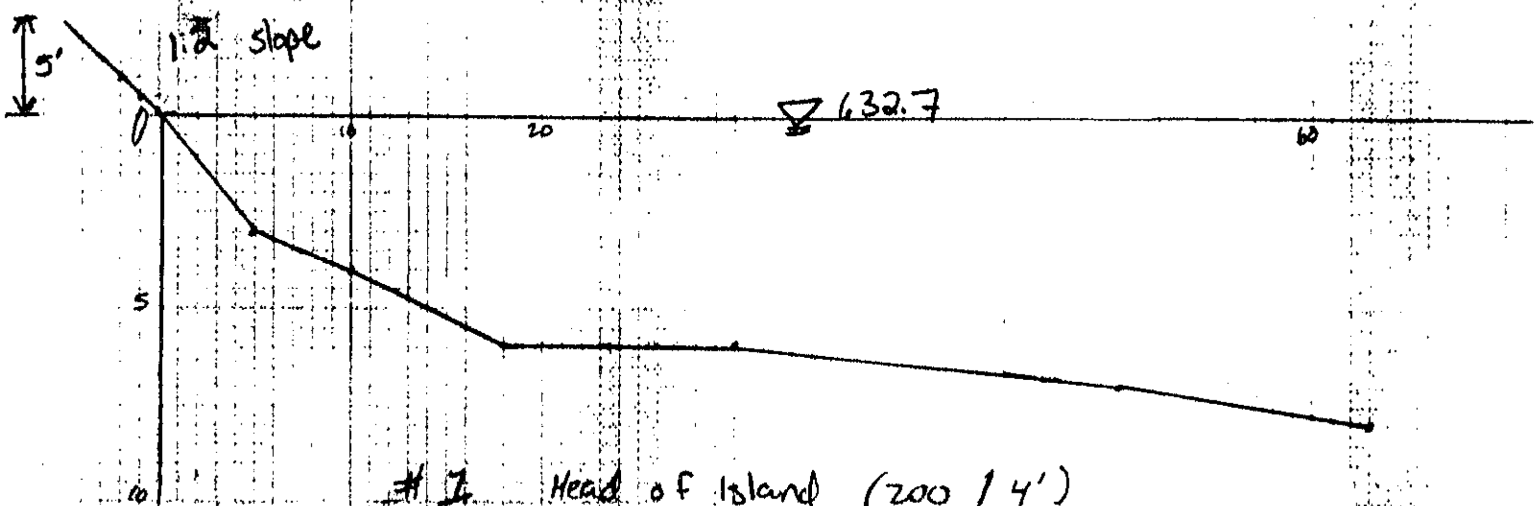

Typical bank cross-section



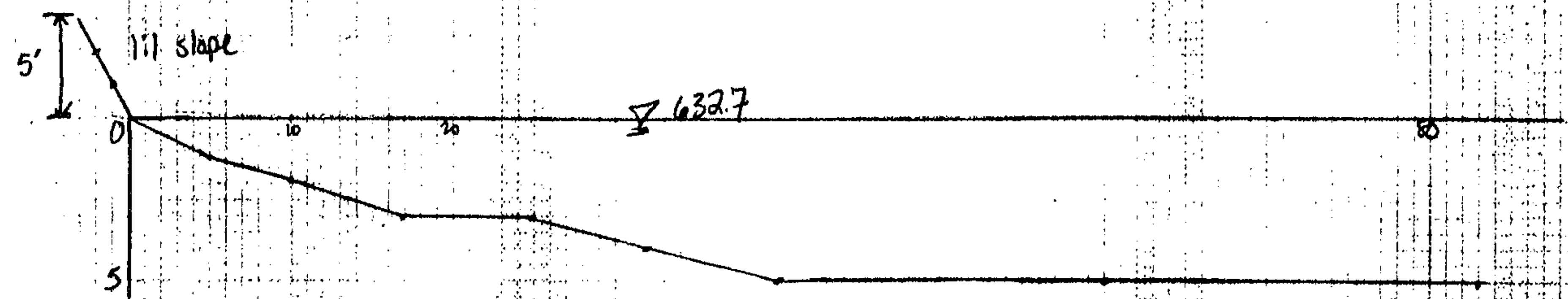
A-107



8-699.3




#1 Head of Island (200 / 4')




#2

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | |
|---|---|---|
| Site Name S. ~~M.~~ Taylor Island | | Site number (pool–river mile–l/r bank) 8 - ~~677.5~~ 698.5 - L |
| Date investigated 5-18-92 | Time 1:00 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 7 | Tailwater Elev. = 33.1 | Flow = 46000 |
| Downstream L&D No. = 8 | Headwater Elev. = 30.3 | Flow = 44200 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site 32.0 | Flow velocity (location, depth, fps) 41,000 |

Location type (check all applicable)

| | | |
|---|---|---|
| main channel ___ | backwater lake ___ | inside of channel bend ___ |
| side channel inlet ✓ | head of island or peninsula ✓ | straight reach of channel ___ |
| backwater channel ___ | outside of channel bend ___ | ___ |

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers 1-13 head of island @ side channel inlet

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

698.5

| Observations | Site Number 8-~~699.3~~-L |
|---|---|

Bank material: clay ___ silt ___ topsoil 0.5'-1' (f)(c) sand ✓
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? no

Apparent causes of erosion: river flows 1 wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: (density, type)
nearshore – none
shoreline – "
bank – roots, brush, fallen trees RCG
top of bank – brush, trees RCG

Trees (fallen, species, size range, average size, location, number)
maple

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

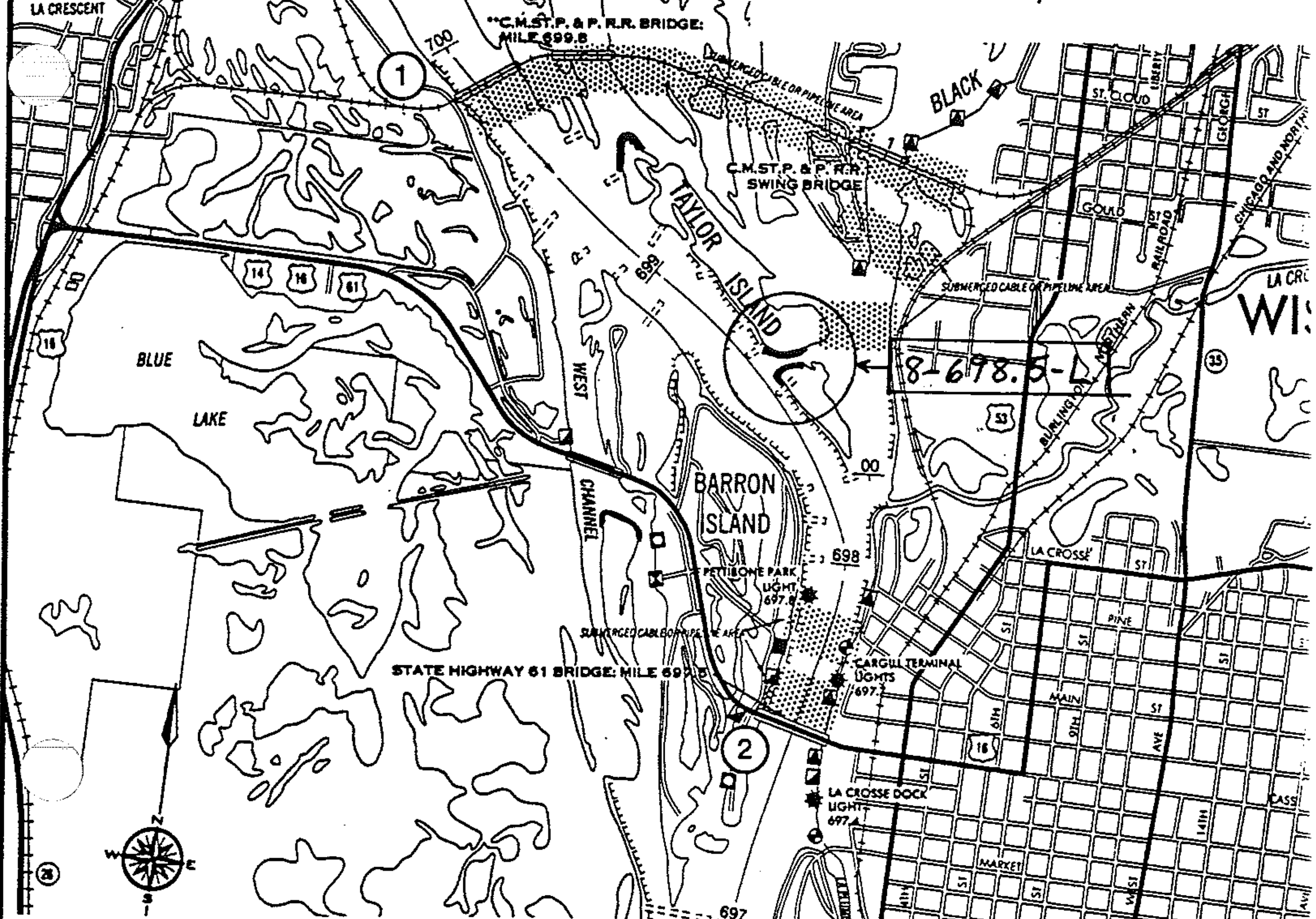
Bank shaping required?

Construction access considerations or problems?

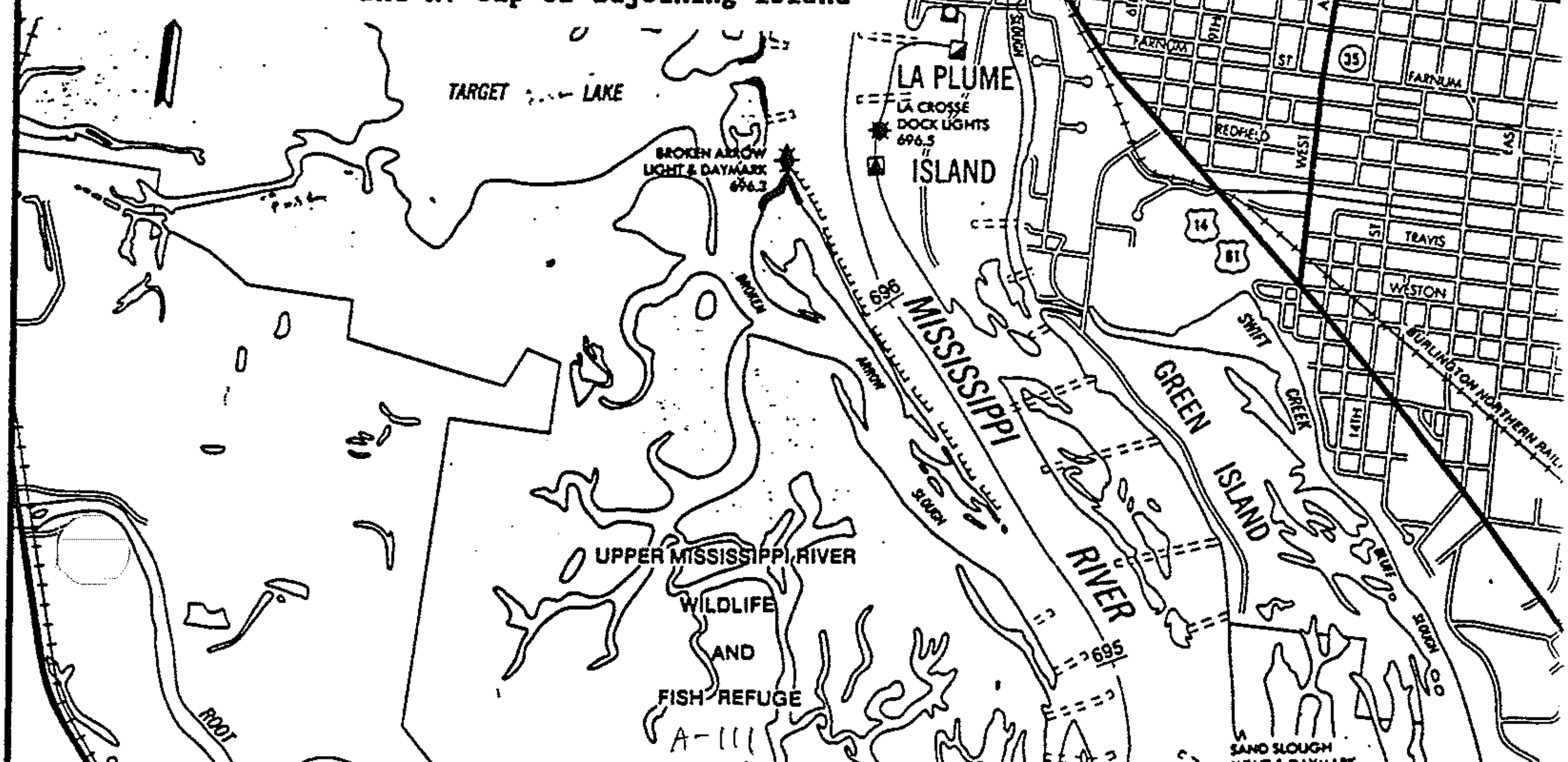
Cultural resources?

Other information Doesn't appear to be any need to protect upstream side of side channel inlet

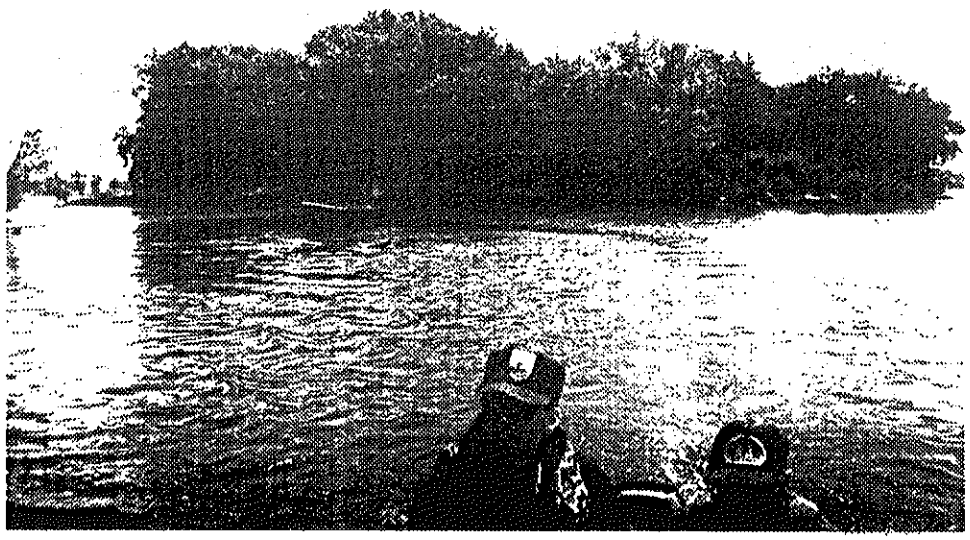
8-698.5-L
S. Taylor Island




RM 698.5 LD S. Tip of Taylor Island 400
and N. tip of adjoining island




A-111



# Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data**

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| West Channel Island | 8-698.2-R |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 5-18-92 | 12:00 | (A) (M) |
| Upstream L&D No. = 7 | Tailwater Elev. = 33.1 | Flow = 40000 |
| Downstream L&D No. = 8 | Headwater Elev. = 30.3 | Flow = 44000 |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| 32.6 | 4'000 |

Location type (check all applicable)

main channel ___ backwater lake ___ inside of channel bend ___
side channel inlet ___ head of island or peninsula ✓ straight reach of channel ___
backwater channel ✓ outside of channel bend ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| 430+ | |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Dist 1 Depth | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 1 / 3 | 0 / 0 | / | / | / |
| 5 / 5 | 5 / 2.5 | / | / | / |
| 10 / 7 | 10 / 3.6 | / | / | / |
| 15 / 8 | 15 / 5 | / | / | / |
| 25 / 9 | 20 / 5 | / | / | / |
| 30 / 10 | 32 / 6 | / | / | / |
| 38 / 10 | 44 / 6 | / | / | / |

Height of bank (top of bank to water surface): 4'-5'

Slope length above water

Slope above water @1 1V: 0.5
@2 1V on 1 H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers
55 / 9 56 / 6
70 / 8 70 / 6
1-7 @ N.E head looking S.
1-8 " " " S.
1-9 @ N.W. head looking S.E.
1-10 @ " " " S.

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

Observations

| Site Number | 8-698.2-R |
|---|---|

Bank material: clay ___ silt ___ topsoil 1-2' (f)(c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? no

Apparent causes of erosion: river flows ✓ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate) ?

Source of local sediment transport (upstream, none)

Bottom material sand ?

Existing vegetation: nearshore - none

(density, type) shoreline - roots

bank - roots

top of bank - trees, brush, grass

Trees (fallen, species, size range, average size, location, number) Some of the Trees 20+ dbh
Silver Maple, elm, Cottonwood dense good habitat
Overhanging trees (a few down) and much root exposure.

Habitat type and species impacted by continued erosion
Eagle roosting Grass, +vines was common along the shoreline.

Quality of affected habitat (low, medium, high)
The forested portions were dense (pileated orioles, owl birds - exe bird habitat)

Area protected by island (shadow zone)
none

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed revetment (rockfill?)

Other type(s) of stabilization possible

Fill required? Source?

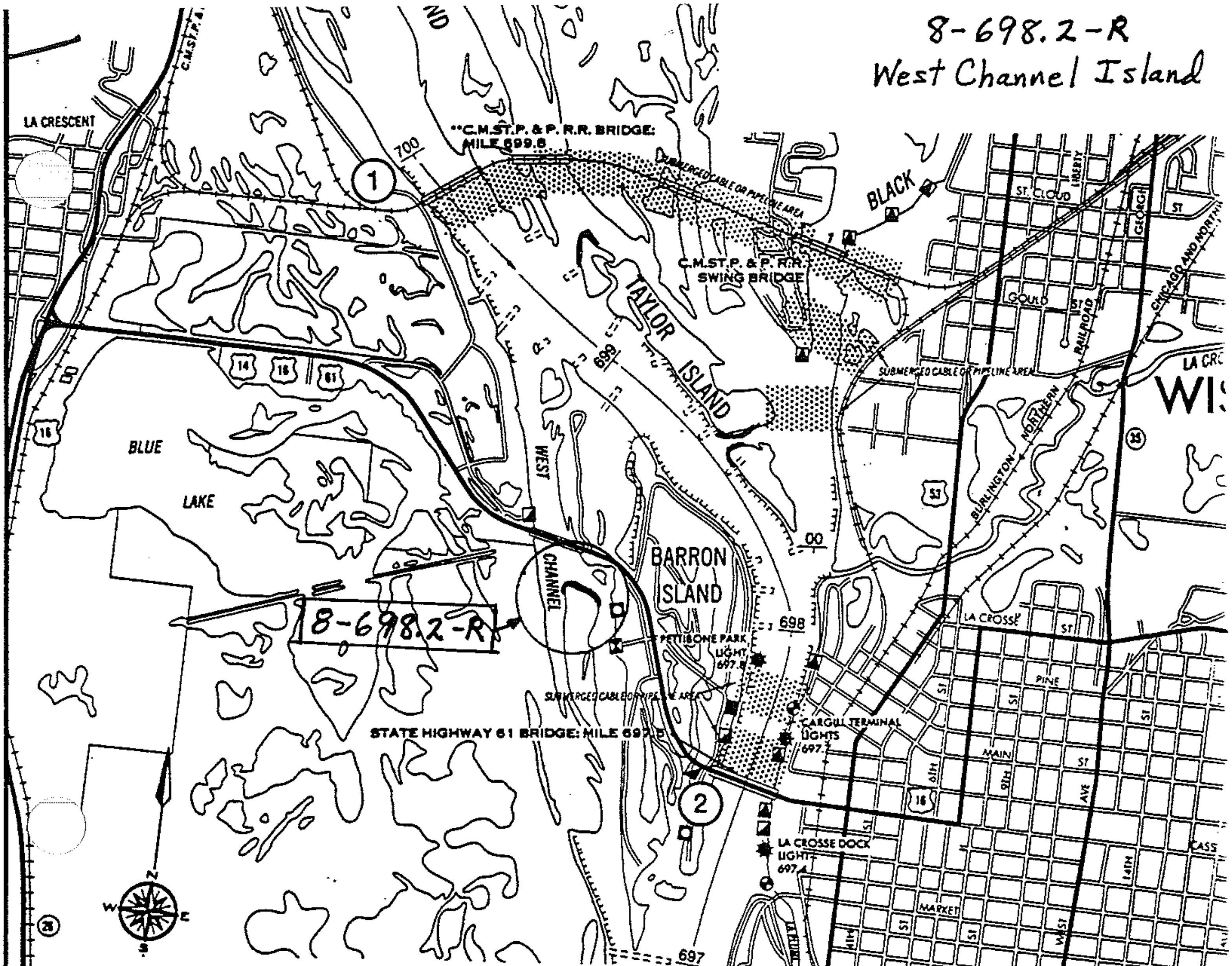
Bank shaping required?

Construction access considerations or problems? shouldn't be.

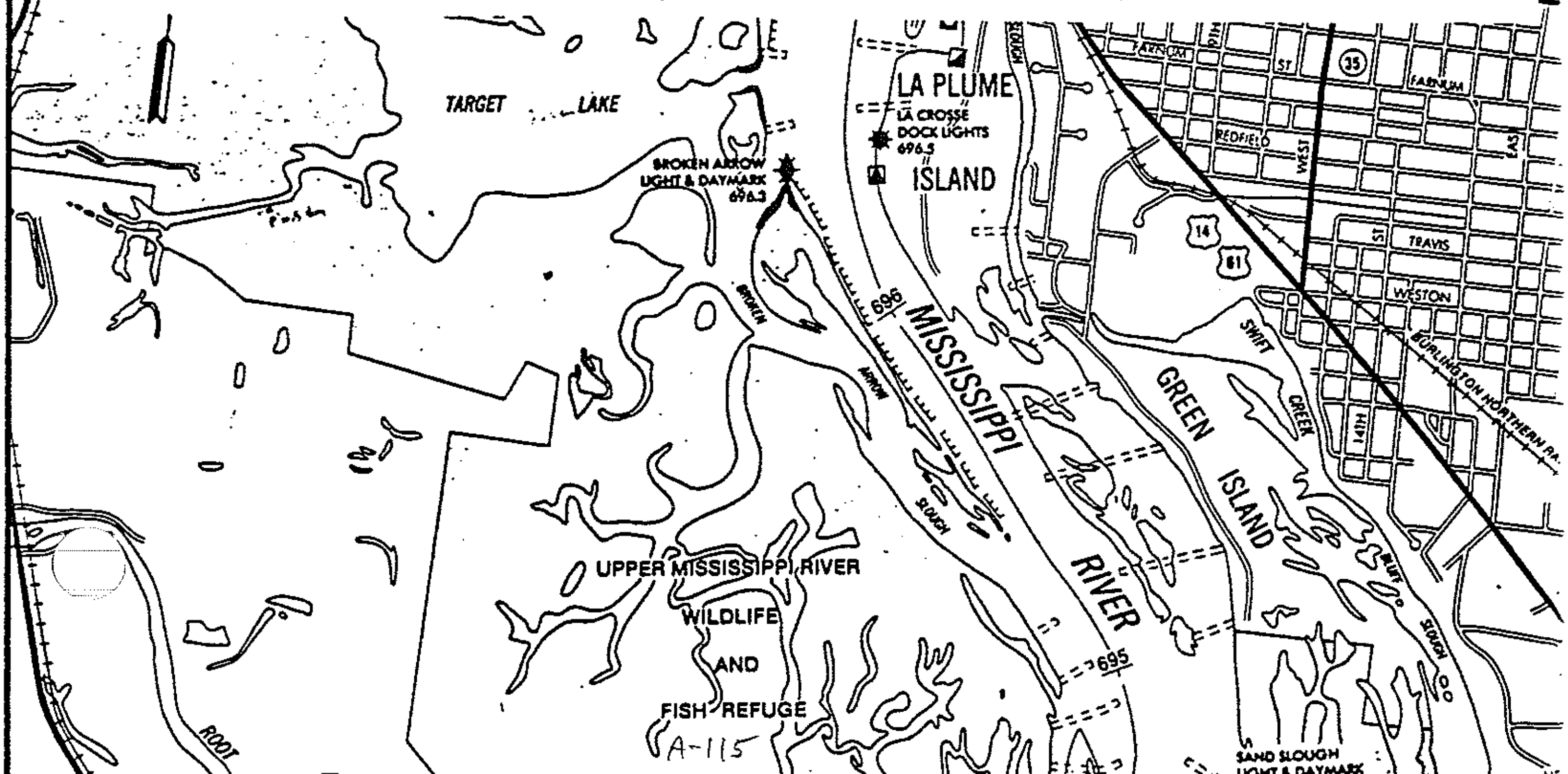
Cultural resources?

Other information

8-698.2-R
West Channel Island

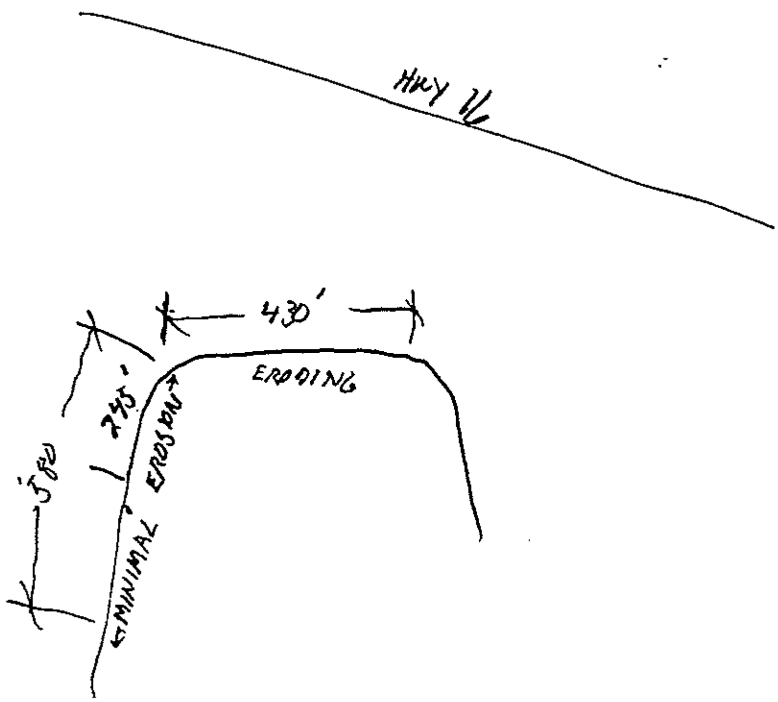



| | | | |
|---|---|---|---|
| RM 698.0 RD | N. Tip of island below West Channel Bridge | 300 | Protection of bottomland hardwoods. FWS-owned. |



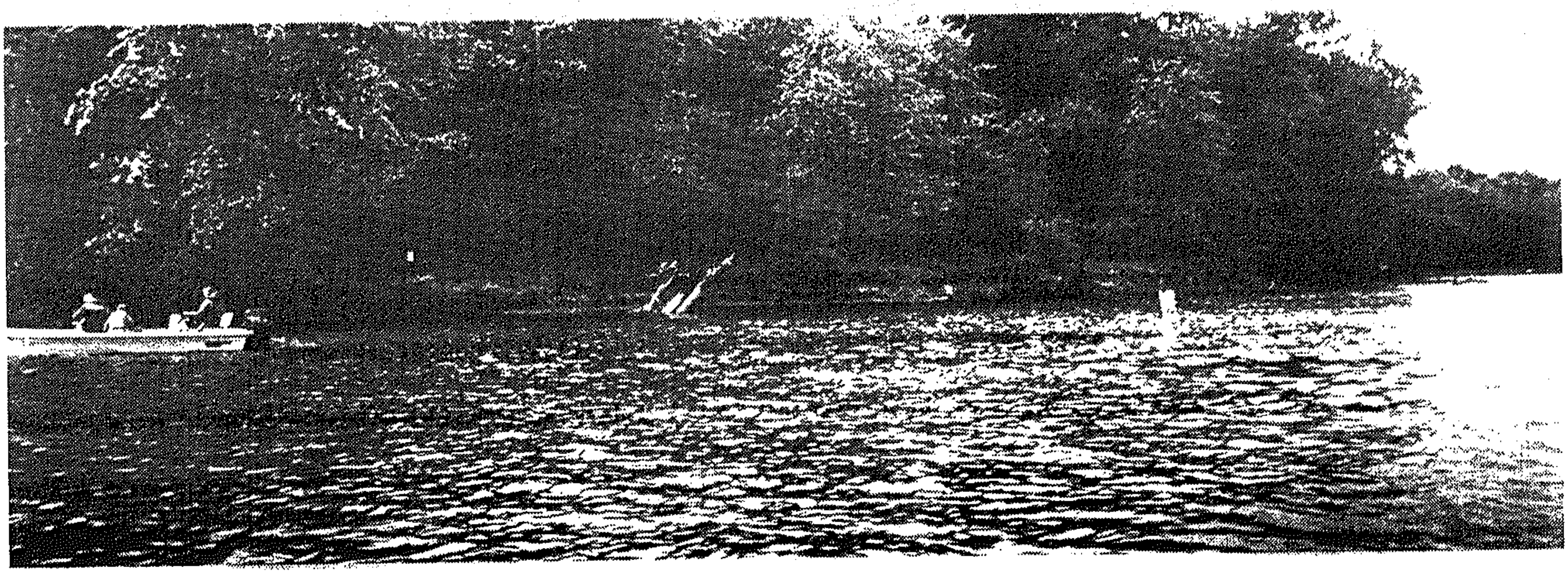
Site Sketches | Site Number 8-698.2-R

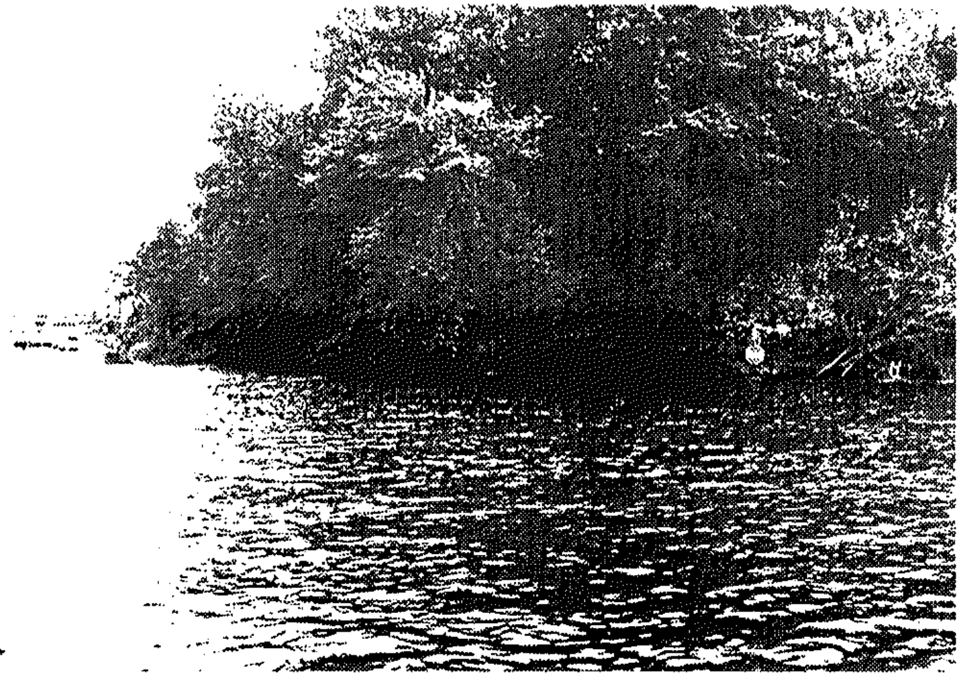
## Plan view

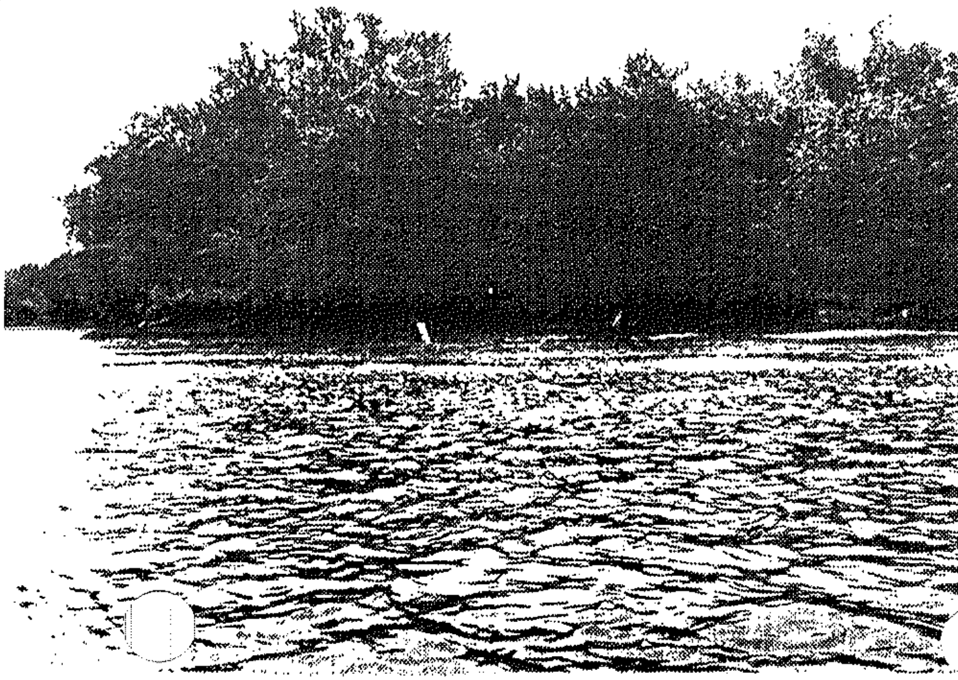
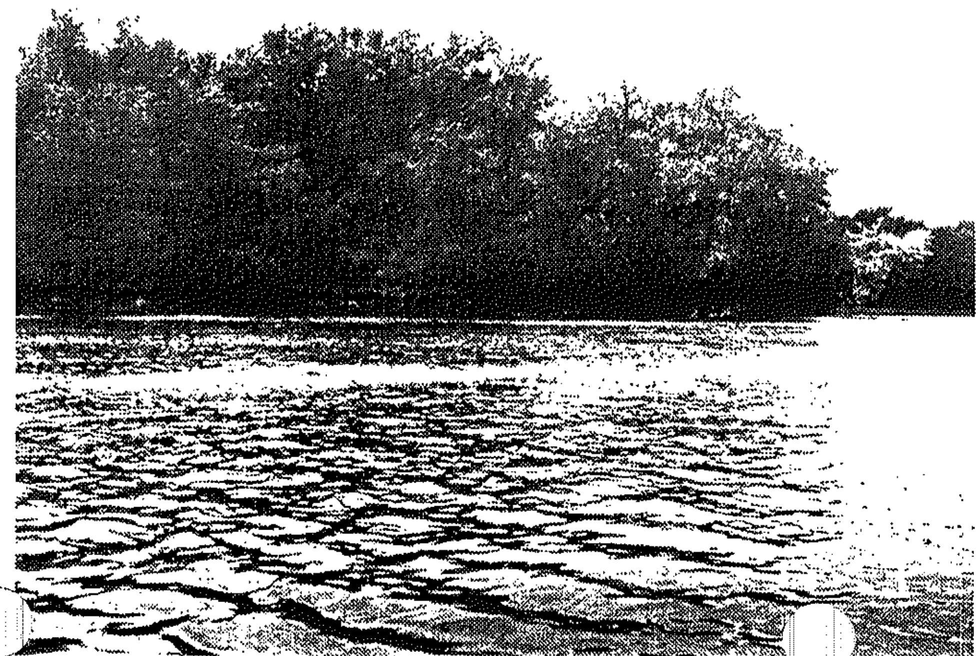



## Typical bank cross-section

A-117





# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: Broken Arrow (Target Lake) | | Site number (pool–river mile–l/r bank): 8-696.~~#~~-R | |
| Date investigated: 5-18-92 | Time: 11:00 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 7 | Tailwater Elev. = 33.1 | Flow = 40000 | |
| Downstream L&D No. = 8 | Headwater Elev. = 30.3 | Flow = 44000 | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site: 32 | | Flow velocity (location, depth, fps): 41000 | |

Location type (check all applicable)

main channel ✓  
side channel inlet ✓  
backwater channel ___  
backwater lake ___  
head of island or peninsula ___  
outside of channel bend ___  
inside of channel bend ___  
straight reach of channel ___  
________________ ___

| | |
|---|---|
| Proposed length of stabilization: 310'+526' | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Dist 1 Depth | 2 (@ head) | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / 2 | 0 / 0 | 0 / 0 | / | / |
| [illegible] / 4 | 5 / 0.5 | 5 / 0.7 | / | / |
| 10 / 6 | 10 / 0.5 | 10 / 1.4 | / | / |
| 14 / 6 | 15 / 0.5 | 15 / 2.0 | / | / |
| 20 / 8 | 20 / 0.6 | 21 / 2.2 | / | / |
| 33 / 9 | 38 / 0.8 | 39 / 2.6 | / | / |
| 48 / 8 | 50 / 1.0 | 170 / 3.0 | / | / |

Height of bank (top of bank to water surface): 2.5'

Slope length above water

Slope above water: 1V : 0.5H @ 1; 1V : 2H; 1V on 2-3 H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers 250 11.0

1-4 @ head looking D.S.  
1-5 @ head looking toward Target L.  
1-6 d.s. end of island

Fetch direction(s) | Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

| Observations | Site Number 8-696.4-R |
|---|---|

Bank material: clay ___ silt ___ topsoil 1-2' (f) (c) sand ✓
(f) (m) (c) gravel ___ cobbles ___ other info: f-m

Existing bank protection? no.

Apparent causes of erosion: river flows 1 wind waves 3 boat waves 2
(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)
somewhere btw low & moderate

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: nearshore - none
(density, type) shoreline - roots, some grass
bank - " " "
top of bank - Trees

Trees (fallen, species, size range, average size, location, number)
Silver Maple, 7-10 dead and/or dying trees on north ~~bank~~ bank of the island / much root
Elm and cottonwood some dead & dying trees on the ~~[illegible]~~ north / exposure
Many large ↗ on island,

Habitat type and species impacted by continued erosion
Continued erosion may lead to adverse affects to Target Lake
Eagle nesting

Quality of affected habitat (low, medium, high)
high quality habitat

Area protected by island (shadow zone)
Target Lake

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

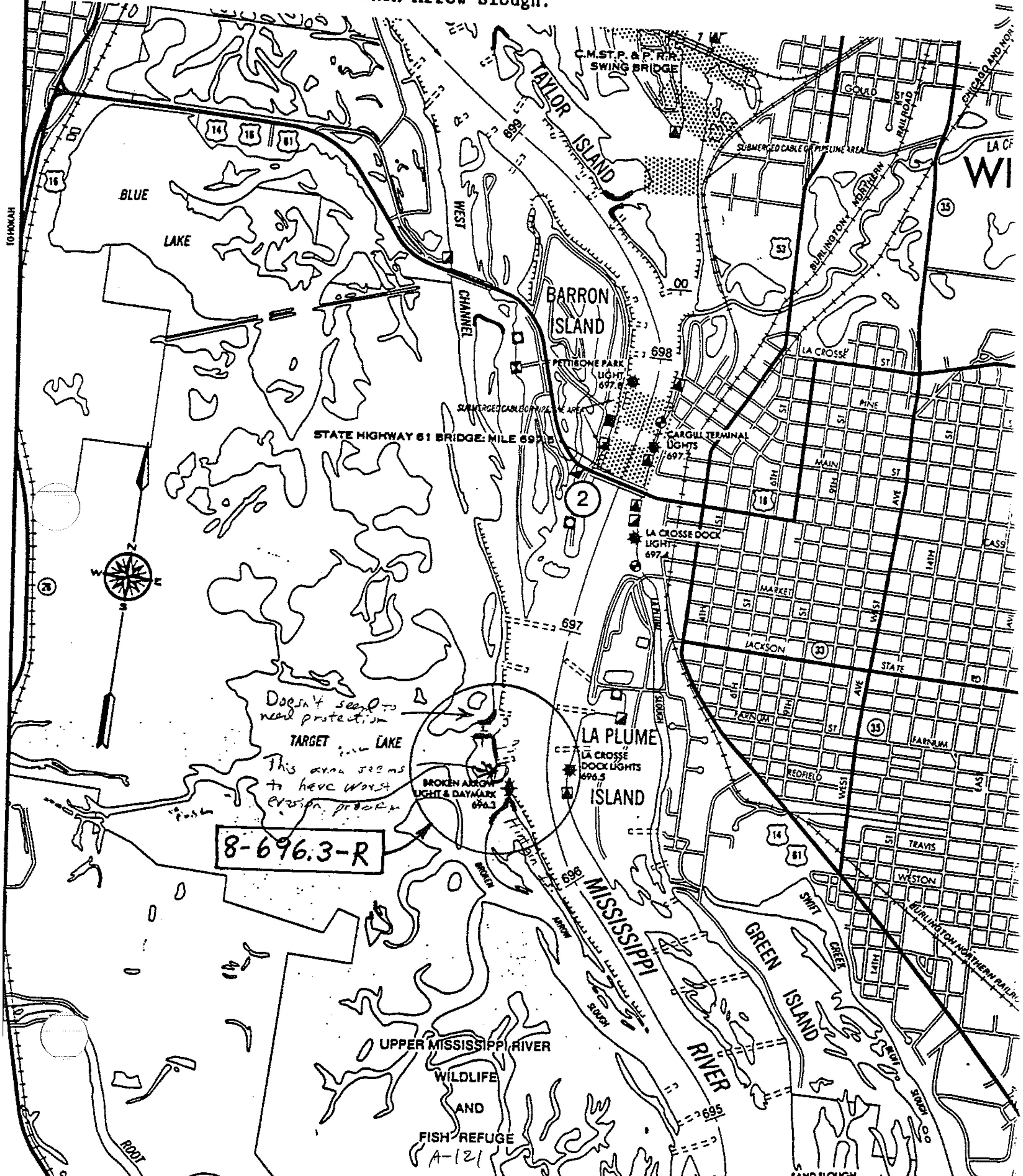
Cultural resources?

Other information
Hintgen Island apparently now belongs to La Crosse Co. for barge fleeting.

Continued erosion to Target Lake

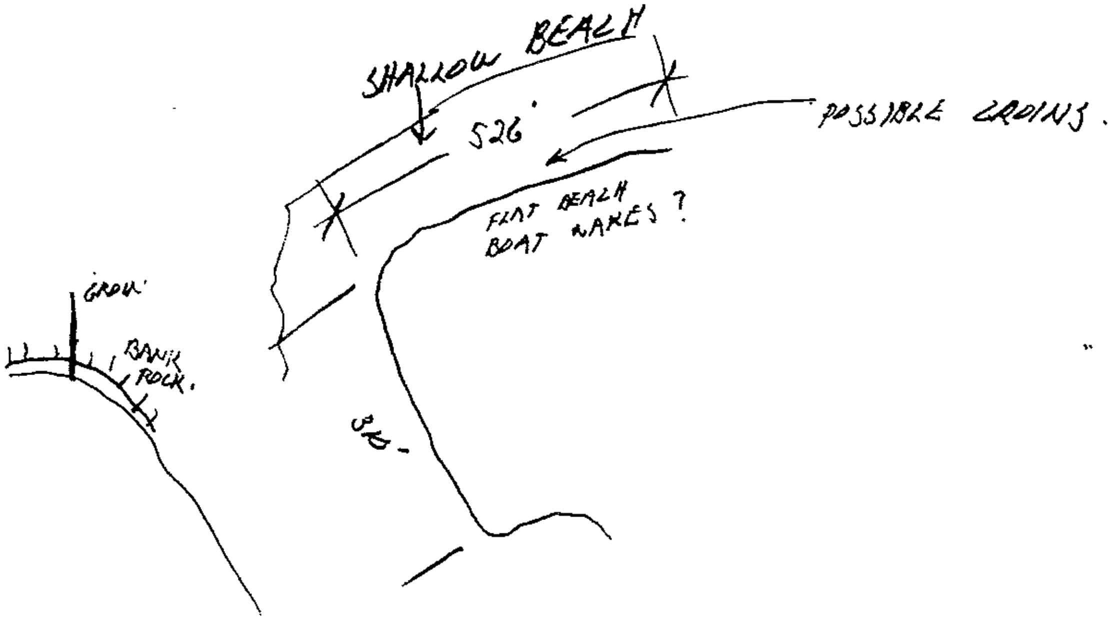
8-696.3-R
Broken Arrow (Target Lake)

| | | | |
|---|---|---|---|
| RM 697.0 - 695.0 RD | Islands at entrance to Target Lake and West Shore of Broken Arrow Slough. | 30007 | Protect backwaters. High priority. |



Site Sketches | Site Number 8-696.~~4~~-R

## Plan view

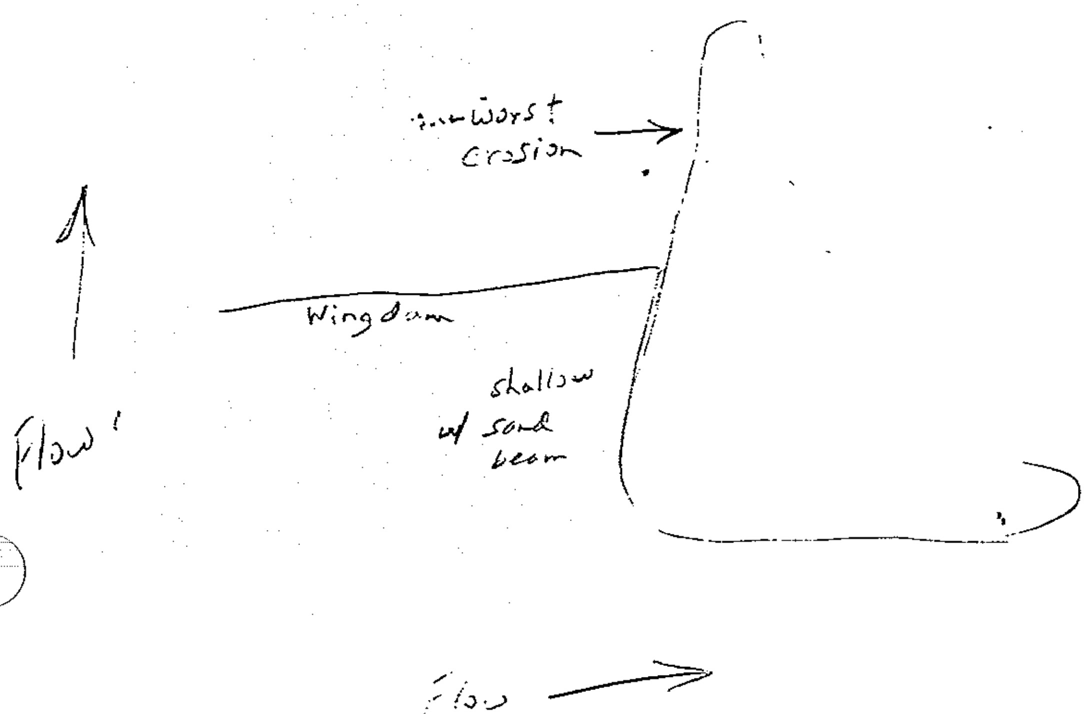



## Typical bank cross-section

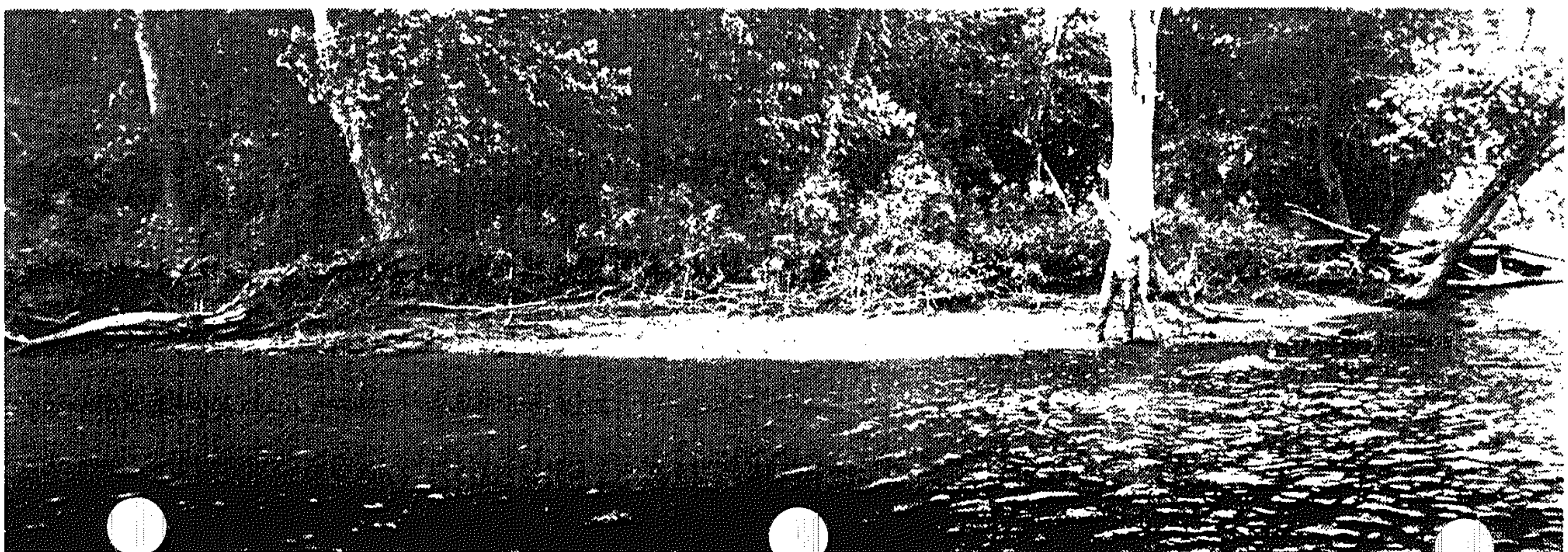
Site Sketches | Site Number 8-696.4-R

## Plan view

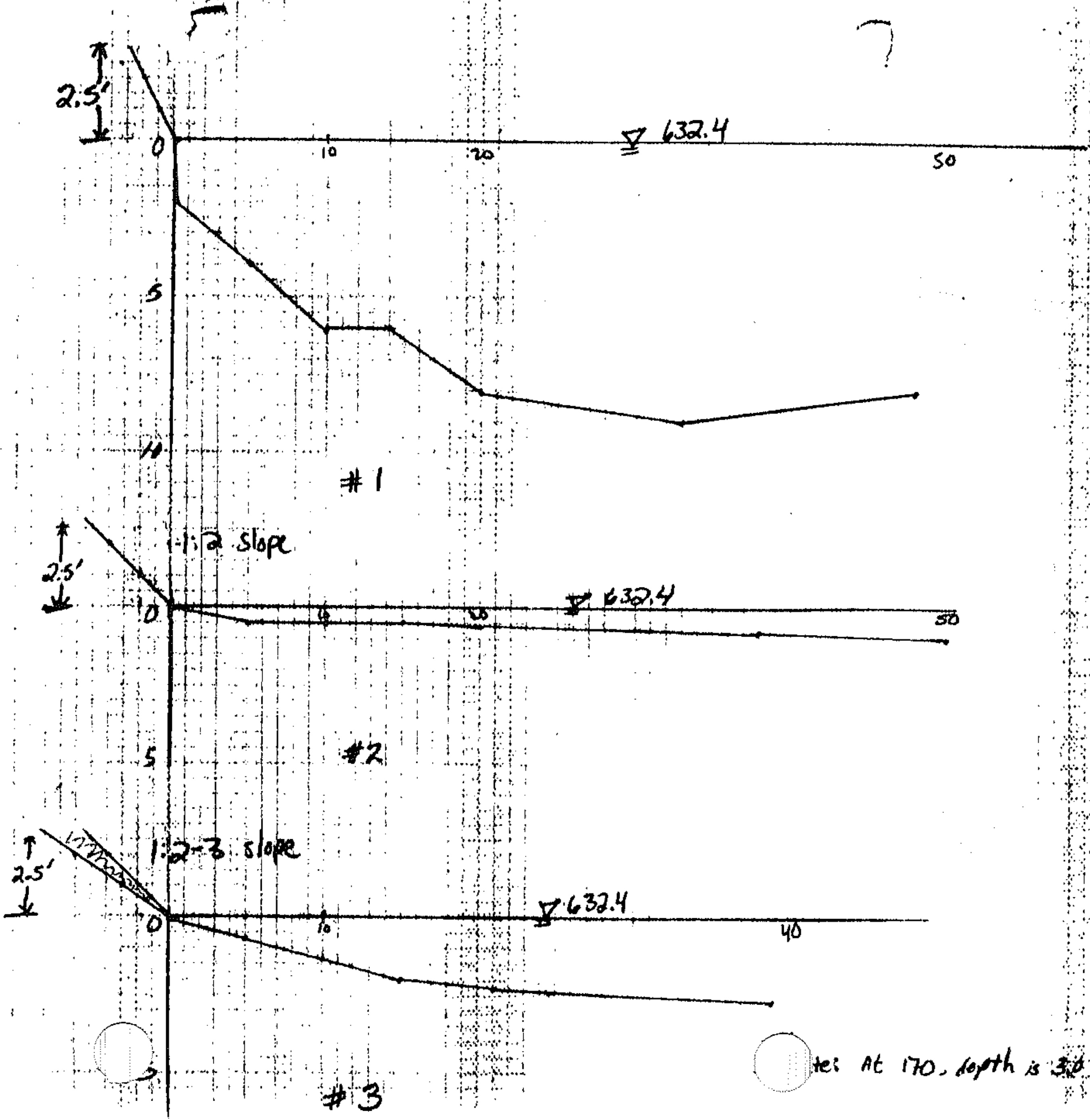
## Typical bank cross-section



7-124



8-696.#




te: At 170, depth is 3.0 & at 250, depth [illegible]

# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | |
|---|---|
| Site Name: Root River | Site number (pool–river mile–l/r bank): 8-693.8-R |

| | | |
|---|---|---|
| Date investigated: 5-18-92 | Time: 10:30 | Year(s) of aerial photos (A) or maps (M) available (A) \| (M) |
| Upstream L&D No. = 7 | Tailwater Elev. = 33.1 | Flow = 41,000 |
| Downstream L&D No. = 8 | Headwater Elev. = 30.3 | Flow = 44,000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 32.1 | Flow velocity (location, depth, fps): 41,000 |

Location type (check all applicable)

main channel ✓ of Root R — backwater lake ___ — inside of channel bend ___
side channel inlet ___ — head of island or peninsula ___ — straight reach of channel ___
backwater channel ___ — outside of channel bend ___ — ___________ ___

| | |
|---|---|
| Proposed length of stabilization: Consensus was to drop from list, because bank erosion problems quite minor. | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers
1-1 Upstream of major bend
1-2 Looking D.S. at major bend
1-3 Looking D.S. from point ~100 yds. d.s. of major bend

Fetch direction(s) — Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Pete Fasbender | Jim Nissen - La Crosse | Mike Davis - MDNR |
| Jon Hendrickson | | |
| Al Kean | | |

| Observations | Site Number 8-693.8-R |
|---|---|

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ______________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –
(density, type) shoreline –
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

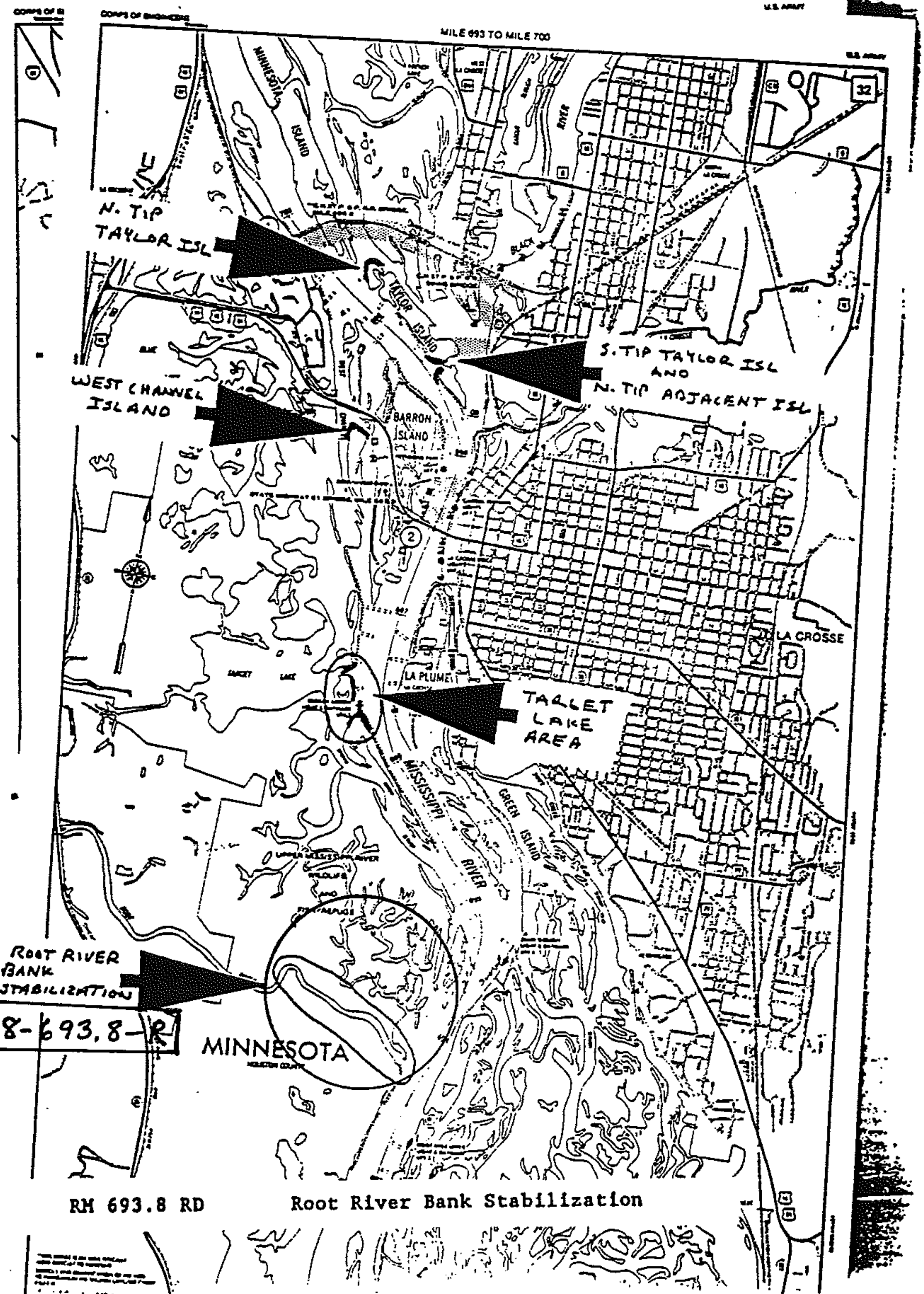
Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information
bank erosion was not apparent. A few small areas along the banks were ero[ded] but no major areas. The Root River was dropped for further considerati[on].

8-693.8-R
Root River



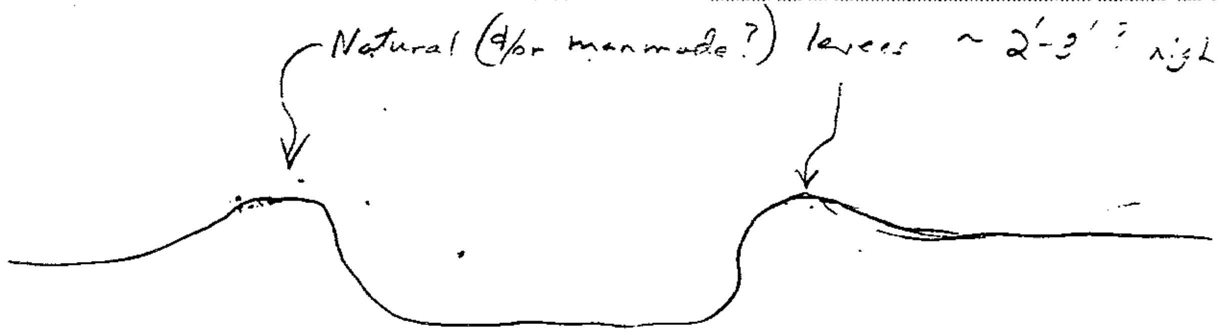

RM 693.8 RD Root River Bank Stabilization

## Site Sketches

| Site Number | 8-693.8-R |
|---|---|

### Plan view

### Typical bank cross-section



A-131

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name: Brownsville Daymark | Site number (pool–river mile–l/r bank): 8-688.4-L |

| | | |
|---|---|---|
| Date investigated: 7-21-92 | Time: 11:15 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 7 | Tailwater Elev. = 33.5 | Flow = 43,000 |
| Downstream L&D No. = 8 | Headwater Elev. = 29.9 | Flow = 49 000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 31.3 | Flow velocity (location, depth, fps): 47000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ______________________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

@ 1700?

| Dist 1 Depth | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| 50' / 11' | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 10'

Slope length above water: ~ 1V : 0.5H

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers: 1-7, 1-8

Fetch direction(s): N.N.W. Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Bill Thrune - La Crosse | Dan Dieterman - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

Observations

Site Number 8-688.4-L

Bank material: clay ___ silt ___ topsoil none (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows 1 wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material Sand

Existing vegetation: nearshore –

(density, type) shoreline –

bank –

top of bank – F.F.

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed Rock placement at head of island

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Access would be no problem – deep water to head of site.

Cultural resources?

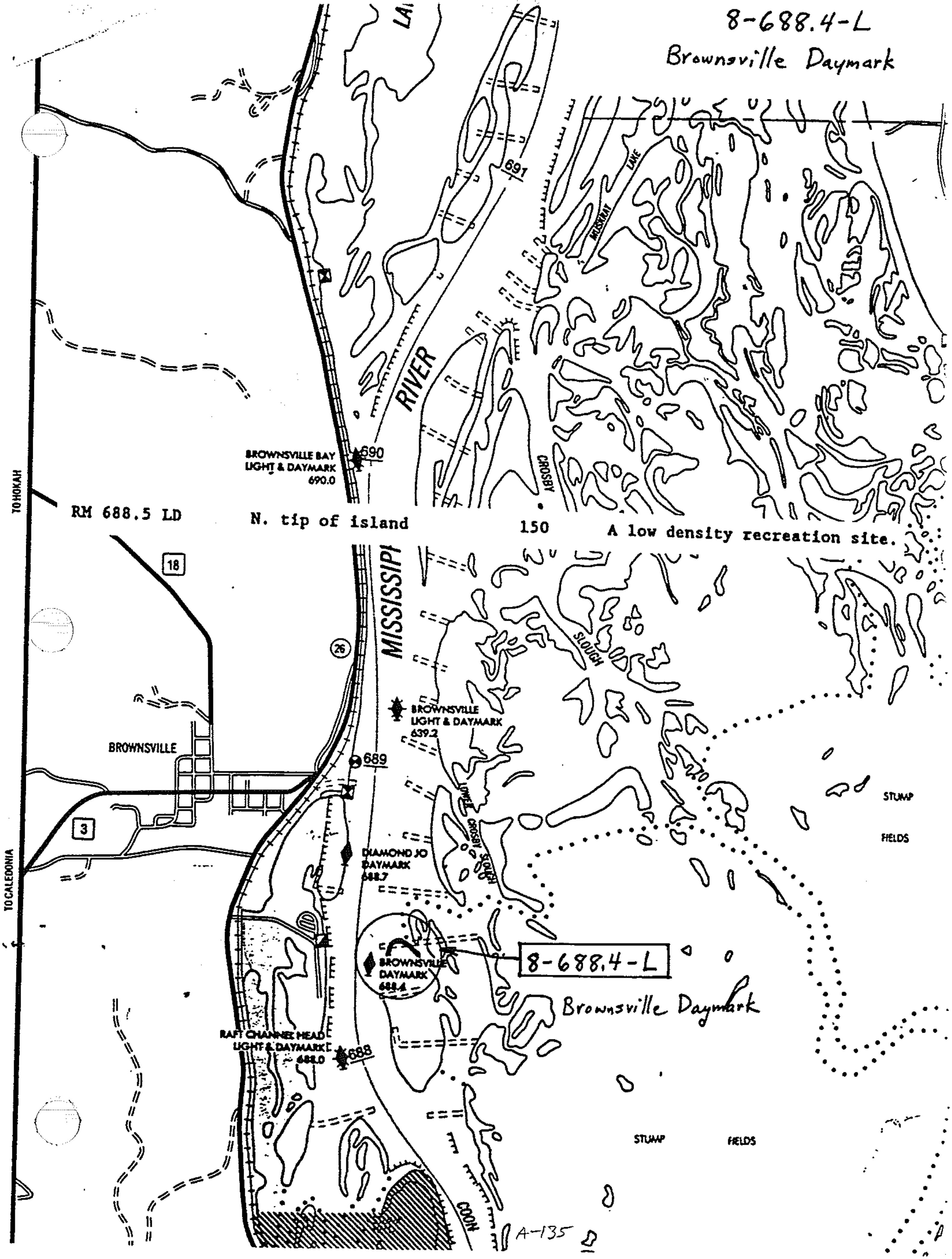
Other information

This site is not an EMP site, but should be d[one] under O & M (Dave Krumholtz)

Stabilize head to reduce erosion of dredged sand & deposition.

High recreational use.

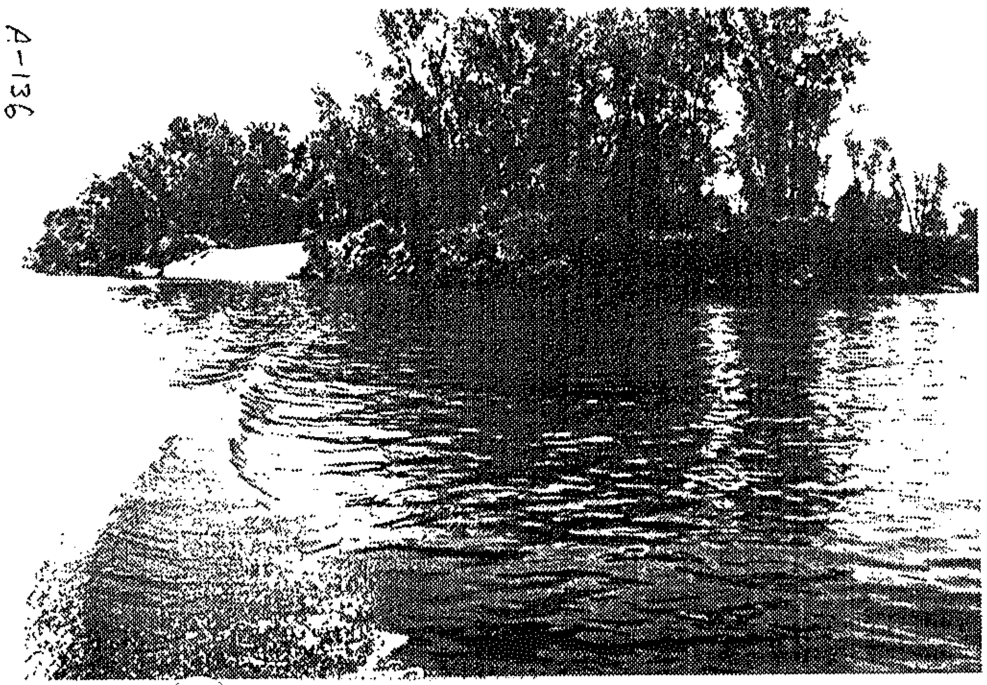
8-688.4-L
Brownsville Daymark

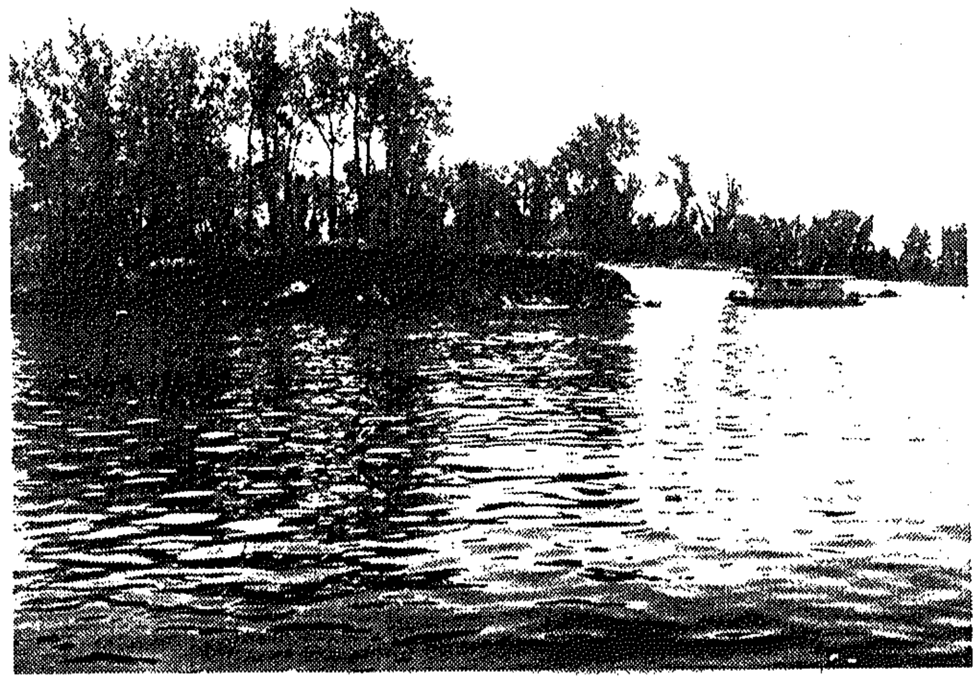



RM 688.5 LD N. tip of island 150 A low density recreation site.

A-135 D

A-136





## Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data**

| | | | |
|---|---|---|---|
| Site Name East Island | | | Site number (pool–river mile–l/r bank) 8-685.2-L |
| Date investigated 7-21-92 | Time 11:00 | Year(s) of aerial photos (A) or maps (M) available (A) | (M) |
| Upstream L&D No. = 7 | Tailwater Elev. = 33.6 | Flow = 42000 | |
| Downstream L&D No. = 8 | Headwater Elev. = 29.9 | Flow = 49500 | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site 30.9 | | Flow velocity (location, depth, fps) 47000 | |

**Location type (check all applicable)**

| | | |
|---|---|---|
| main channel ✓ | backwater lake ___ | inside of channel bend ___ |
| side channel inlet ___ | head of island or peninsula ✓ | straight reach of channel ___ |
| backwater channel ___ | outside of channel bend ✓ | ___ |

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

| Nearshore data (dist from shoreline/water depth) | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | Height of bank (top of bank to water surface) 3' |
| / | / | / | / | / | Slope length above water |
| / | / | / | / | / | |
| / | / | / | / | / | Slope above water 1V on ___ H |
| / | / | / | / | / | |
| / | / | / | / | / | Water depth at toe of bank |
| / | / | / | / | / | Nearshore bottom slope |
| / | / | / | / | / | 1V on ___ H |

| | |
|---|---|
| Photo numbers 1-6 | Fetch direction(s) Length |
| | Site alignment with respect to fetch direction |

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Bill Thrune - La Crosse | Dan Dieterman - MDNR |
| Jon Hendrickson | | |
| Pete Fasbender | | |

Observations

Site Number 8-685.2-L

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ✓ +m

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? No.

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 4

(number in order of cause) prop wash ___ ___ ice action 3

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material Sand

Existing vegetation: nearshore -

(density, type) shoreline -

bank -

top of bank - Floodplain forest, except where dredged sand has apparently been placed.

Trees (fallen, species, size range, average size, location, number) elm + silver maple. No severe erosion occurring. Island is in good shape. East side of island has somewhat of a lagoon

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed None or groins?

(Much rec use N + S ends)

Other type(s) of stabilization possible It was suggested to not pursue any actions at this time as it could be addressed during Phase II Pool 8 Islands if warranted

Fill required? Source?

Bank shaping required?

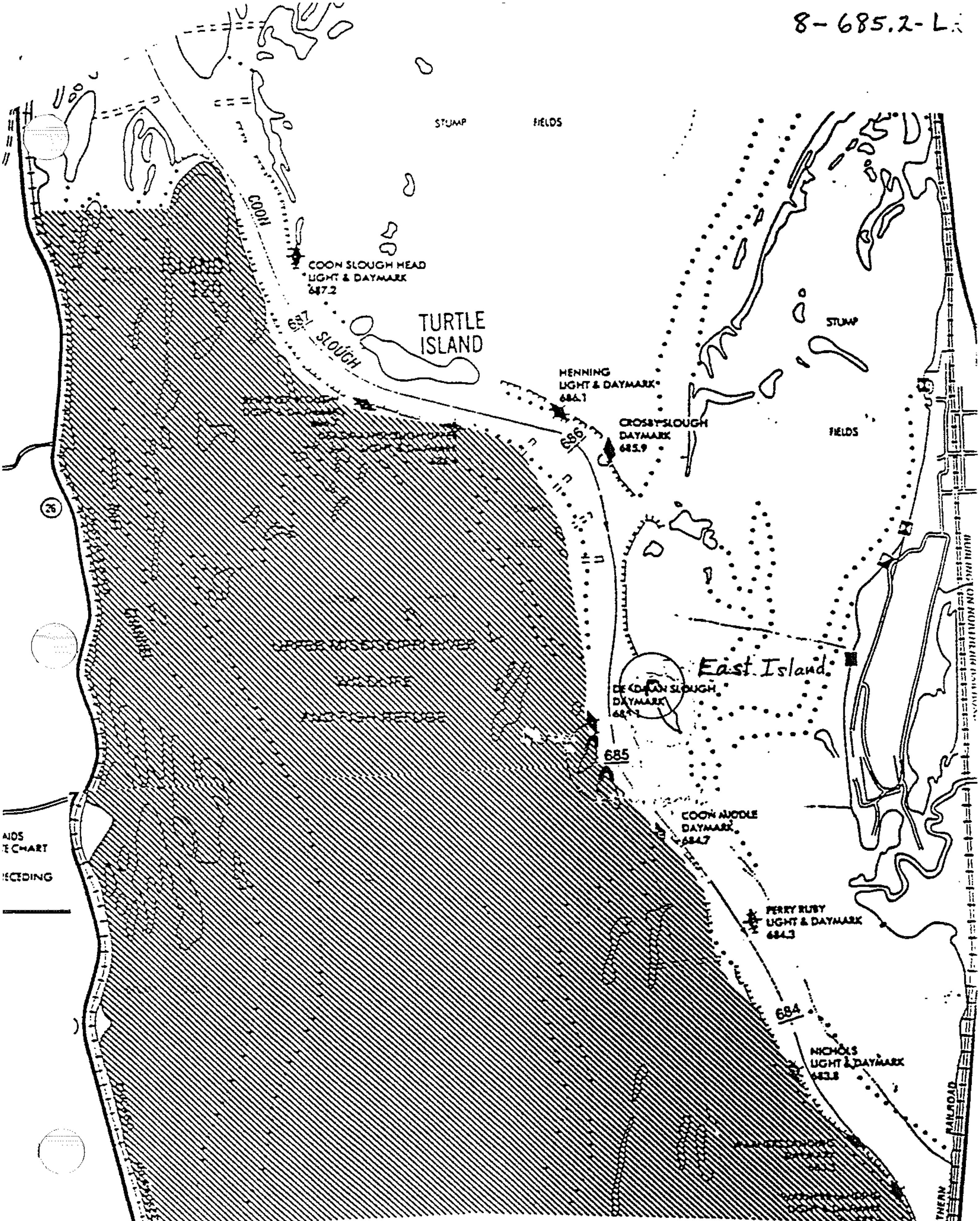
Construction access considerations or problems? 3-4' at N end. Good access from west side.

Cultural resources?

Other information Island is much higher than trapping as huron

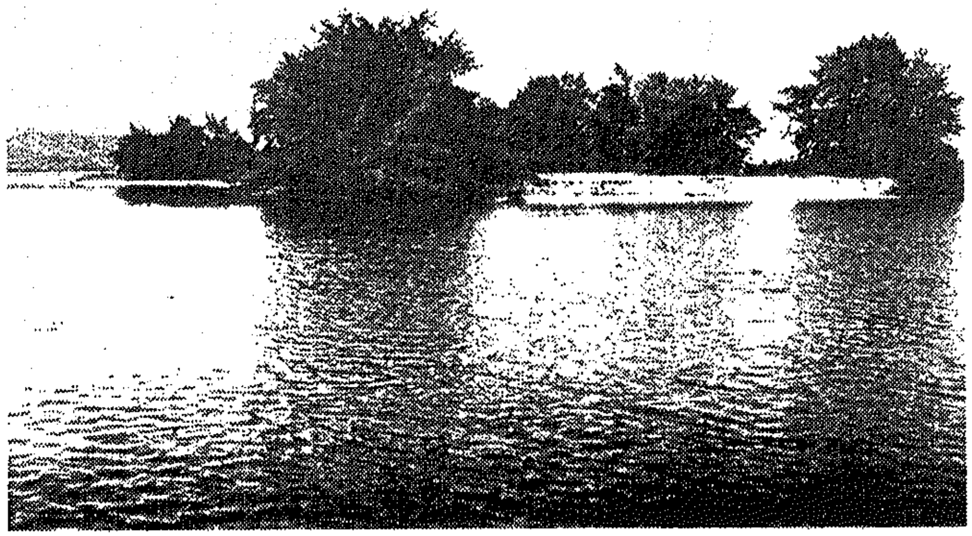
Look at as part of Pool 8 HREP?

planning during phase 2 of




RM 686.0 - 683.8 Scattered islands in Pool 8 (7) 7 Protect duck nesting islands from further erosion.

A-140



# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name: Heron + Trapping Islands | Site number (pool–river mile–l/r bank): 8-685.0-R |
| Date investigated: 7/21/92 / Time: 10:00 | Year(s) of aerial photos (A) or maps (M) available (A) (M) |
| Upstream L&D No. = 7 / Tailwater Elev. = 33[illegible] | Flow = 44000 |
| Downstream L&D No. = 8 / Headwater Elev. = [illegible]99 | Flow = 50000 |
| Other water surface elev. data in pool | |
| Estimated water surface elev. at site: [illegible] | Flow velocity (location, depth, fps): 49,000 |

**Location type (check all applicable)**

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ✓
- inside of channel bend ___
- straight reach of channel ___
- ______________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth) Head of Trapping / Head of Heron

| Trapping Dist 1 Depth | 2 | 3 | 4 | Dist 5 Depth |
|---|---|---|---|---|
| [illegible] / 0.6 | / | / | / | [illegible] / [illegible] |
| 10 / 1.9 | / | / | / | 8 / [illegible] |
| 15 / 2.6 | / | / | / | [illegible] / 1.3 |
| 22 / 2.8 | / | / | / | 22 / 1.2 |
| 32 / 2.9 | / | / | / | 25 / 1.3 |
| 37 / 3.3 | / | / | / | 4[illegible] / 2.2 |
| 47 / 3.0 | / | / | / | 47 / 2.3 |
| | | | | [illegible] / [illegible] |

Height of bank (top of bank to water surface): Trapping 2' Heron 1'

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers: Trapping 1-1, 1-2, 1-3; Heron 1-4, 1-5

50 2.7
60 2.7
75 3.0
90 3.5
120 3.7
120 5-6
150 12

Fetch direction(s): N., N.E. Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell, Don | Besecke, Keith - Winona | Dieterman, Dan - MDNR |
| Fasbender, Pete | Thrune, Bill - LaCrosse | Janvrin, Jeff - WDNR |
| Kean, Al | | |
| Hendrickson, Jon | | |

Observations | Site Number 8 - 685.0 - R

Bank material: clay ___ silt ___ topsoil 0- 0.5' (f) (c) sand ✓
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? No

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 4
(number in order of cause) prop wash ___ ___ ice action 3

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –
(density, type) shoreline –
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed Revetment at head with groin out to N.W. to build more sand bar behind it. (Trapping)

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems? Shallow out to main channel ~3' near island ~6' 200' from Island (Trapping); 2-4'

Cultural resources?

Other information

Observations

Site Number 8-685.0-R

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___

(m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore – Topping – celery, sago

(density, type) shoreline – devoid of veg up to top of ridge

bank – willow, bulrush, blue, vervain, Smartweed, milkweed, P. loosestrife, cottonwood, arrowhead, RC

top of bank – silver maple, elm, locust

Trees (fallen, species, size range, average size, location, number)

active erosion along upstream 1/3 of Heron Island

Habitat type and species impacted by continued erosion

two spits ~~area~~ that are forming are creating a lagoon - backwater → white lily – excellent invertebrate area

Quality of affected habitat (low, medium, high)

the islands protect submergent vegetation (Sago, W. celery)

Area protected by island (shadow zone) it appears from aerial photos these small areas are protecting ~~water~~ veg. areas by diverting flows

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

protecting head of the island. It appears active island formation is occurring so the head is really the only part needing riprap

~~Other type(s) of stabilization possible~~

Heron Island – low shrubby island eroding from head & building at toe

Fill required? ~~RR~~ Source?

Bank shaping required?

Construction access considerations or problems?

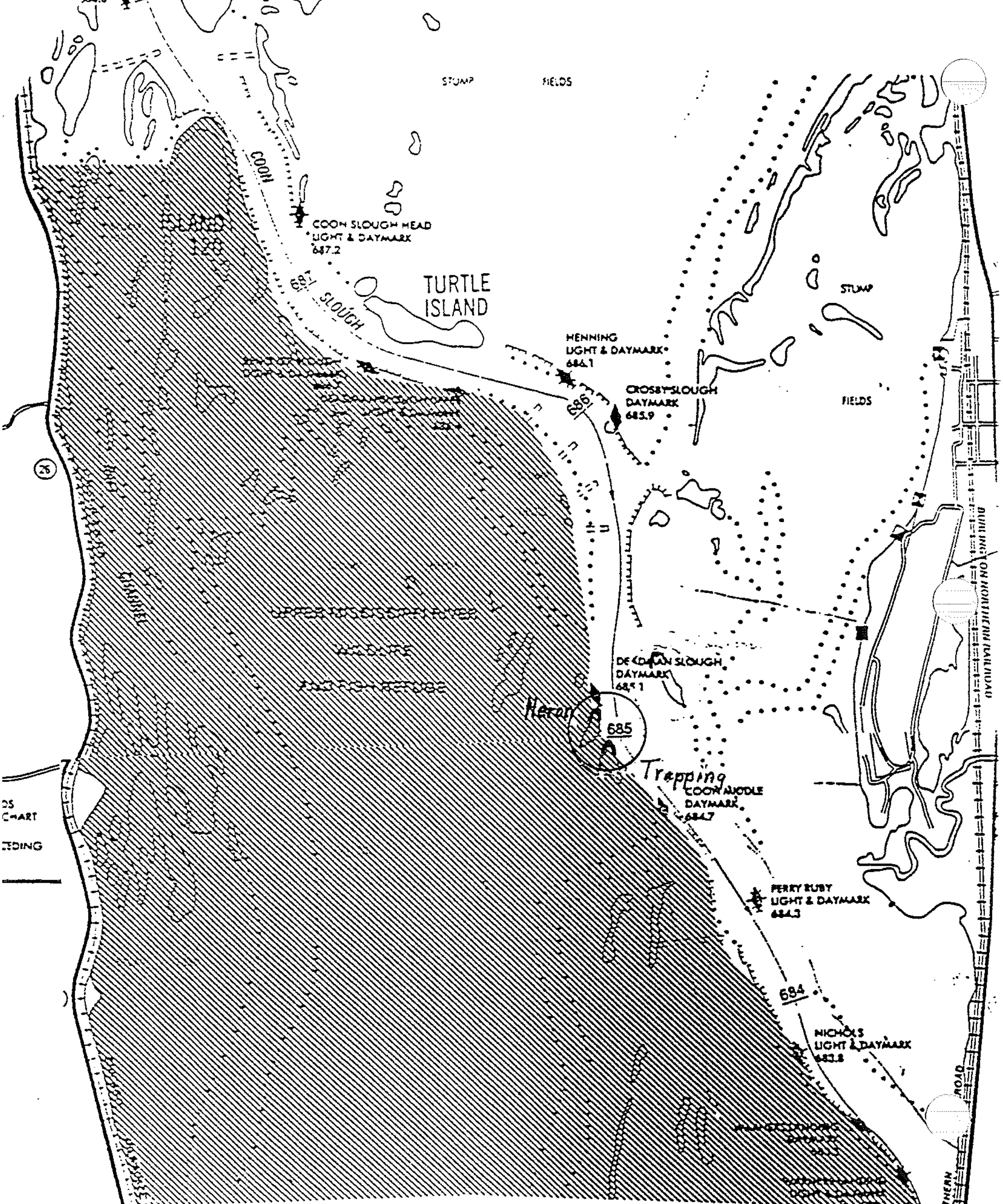
access may be difficult due to shallow depth (2-3.5') at island head

Cultural resources?

Other information

these islands support heavy mallard nesting

8-685.0-R



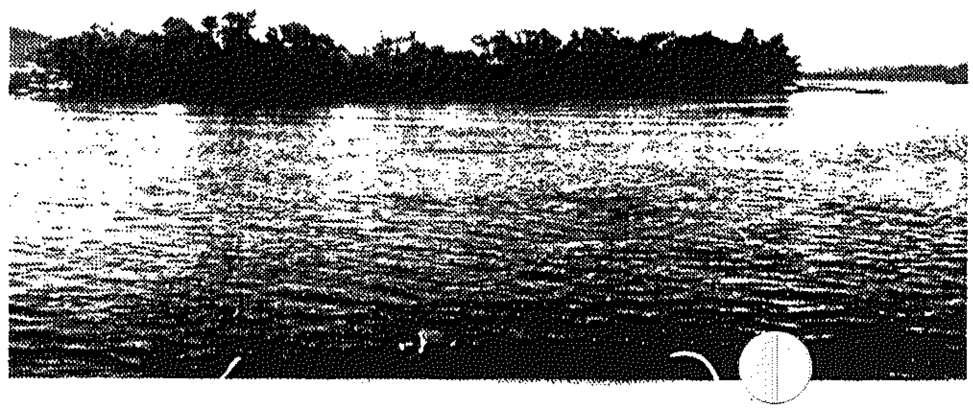

RM 686.0 - 683.8 Scattered islands in Pool 8 (7)

7 Protect duck nesting islands from further erosion.

A-144

A-145

A-146



# Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data**

| | | | |
|---|---|---|---|
| Site Name: Dark Slough | | | Site number (pool–river mile–l/r bank): 9 - 677.4 - R |
| Date investigated: 7-21-91 | Time: 4:30 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/5/89 (43-34) | (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = 24.9 | Flow = 48000 | |
| Downstream L&D No. = 9 | Headwater Elev. = 19.1 | Flow = 49000 | |

Other water surface elev. data in pool

Estimated water surface elev. at site: 24.6

Flow velocity (location, depth, fps): 48000

Location type (check all applicable)

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ✓
- inside of channel bend ___
- straight reach of channel ___
- ______________ ___

Proposed length of stabilization: 2000' ?

Wing or closing dams in area

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 (near U.S. end) Dist / Depth | 2 (1000' d.s.) | 3 | 4 | 5 |
|---|---|---|---|---|
| 0 / 0 | 0 / 0 | / | / | / |
| 5 / 2 | 5 / 3 | / | / | / |
| 10 / 4 | 20 / 8 | / | / | / |
| 20 / 4 | 30 / 12 | / | / | / |
| 30 / 8 | 40 / 13 | / | / | / |
| 40 / 9 | 60 / 15 | / | / | / |
| 50 / 9 | 80 / 16 | / | / | / |

Height of bank (top of bank to water surface): 4

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers
100 16
40 10
70 11
80 11
100 10
2-6, 2-7

Fetch direction(s) — Length

Site alignment with respect to fetch direction

Names of investigators — (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Ken Dulik - McGregor | Gary Ackerman - IDNR |
| Jon Hendrickson | | Dan Dieterman - MDNR |
| Pete Fasbender | | |

Observations

Site Number 9-677.4-R

Bank material: clay ___ silt ✓ topsoil 1-4' (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? no

Apparent causes of erosion: river flows 1 wind waves ___ boat waves ___

(number in order of cause) prop wash 2 ___ ___ ice action ___

Estimated rate of erosion or erodibility ~~(low, moderate,~~ high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material Sand with thin silt layer on top

Existing vegetation: nearshore - none

(density, type) shoreline - to some grass

bank -

top of bank - F. F. / canary grass

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed revetment

Other type(s) of stabilization possible

Fill required? Source?

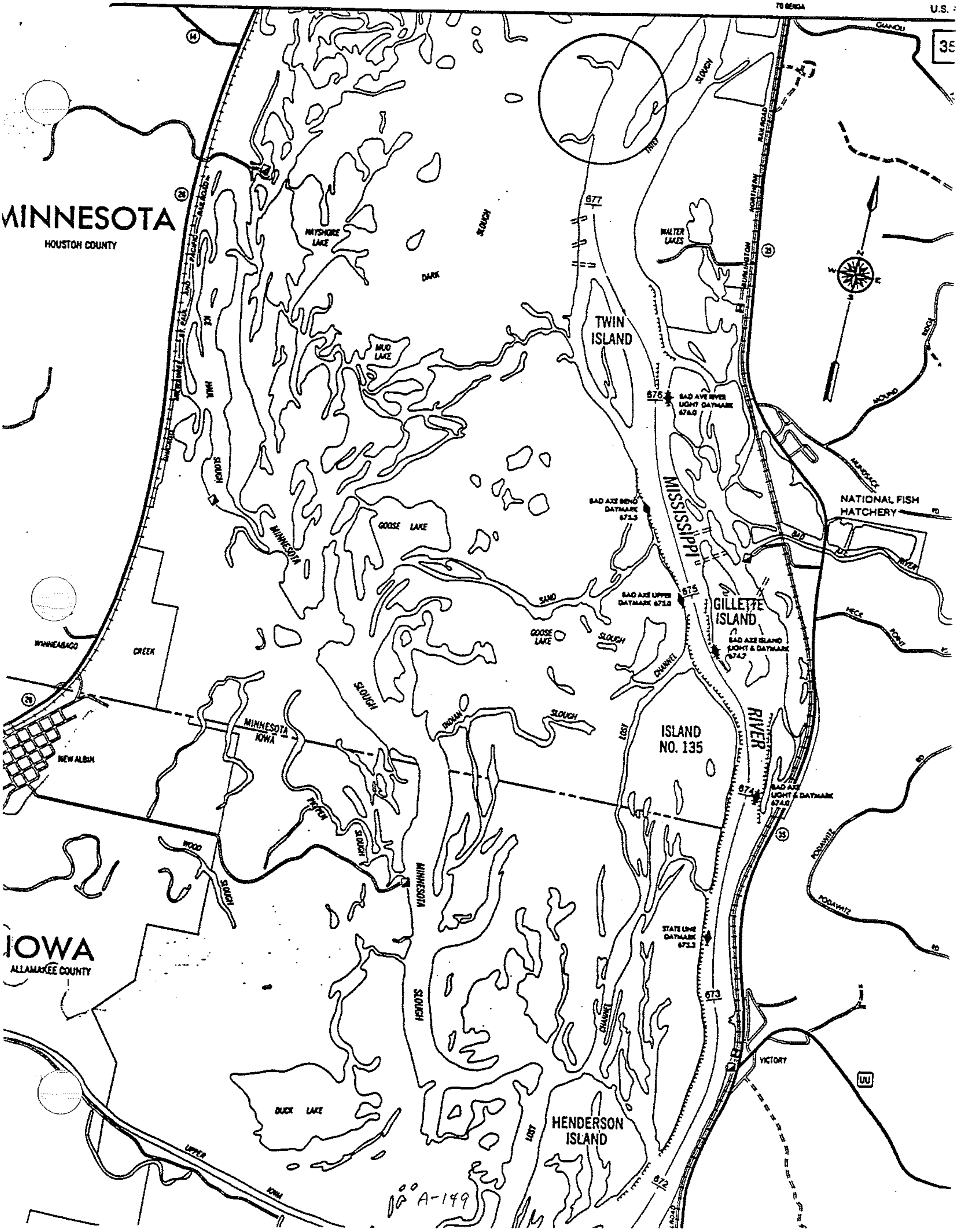
Bank shaping required?

Construction access considerations or problems? no

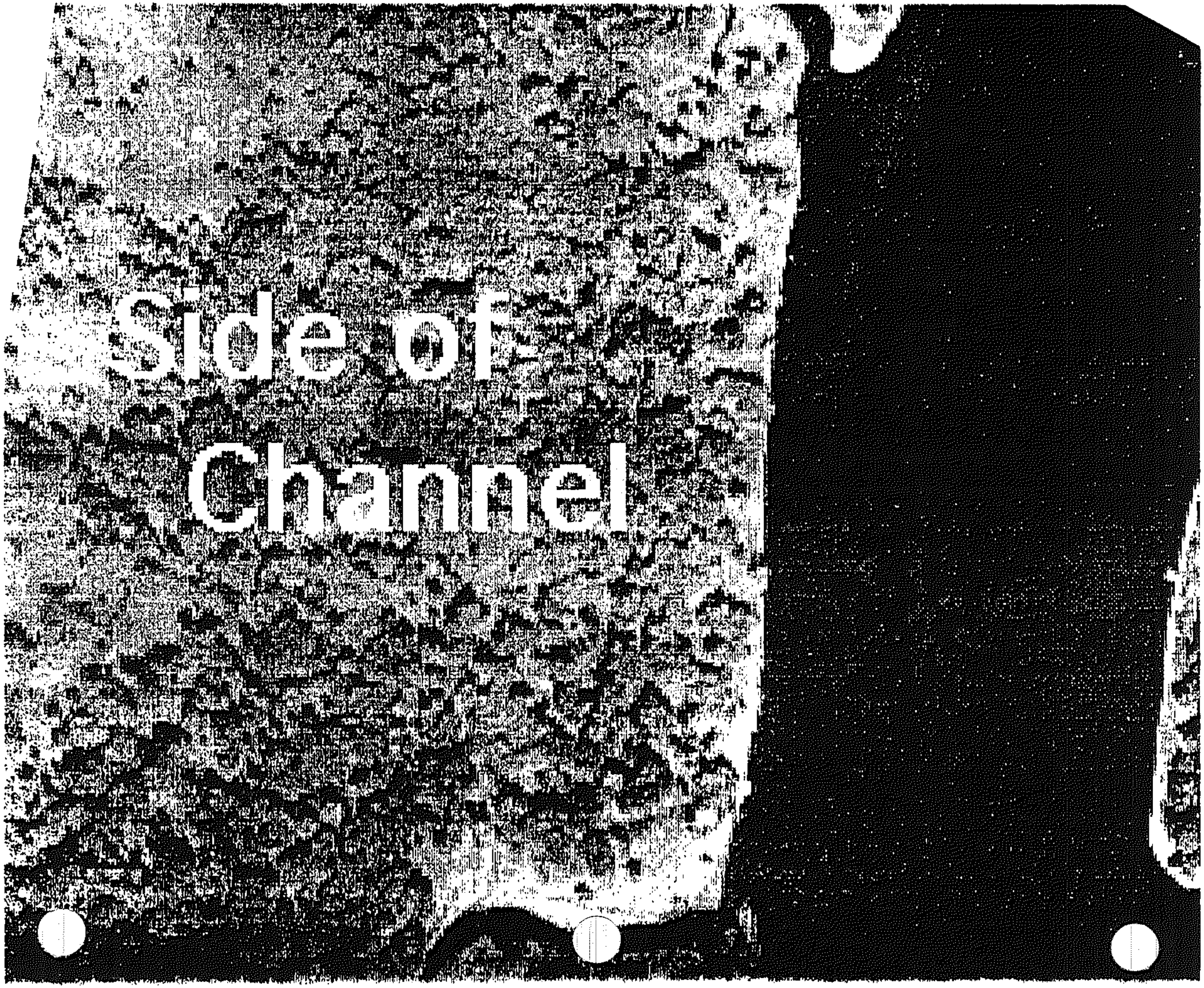
Cultural resources?

Other information

# MILE 670 TO MILE 677




A-149


Side of
Channel

151-7

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: Twin Island | | Site number (pool–river mile–l/r bank): 9-676.7-R | |
| Date investigated: 7-21-92 | Time: 4:00 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/5/89 (43-34) | (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = 24.9 | Flow = 48000 | |
| Downstream L&D No. = 9 | Headwater Elev. = 19.1 | Flow = 49000 | |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 24.4 | Flow velocity (location, depth, fps): 48000 |

Location type (check all applicable)

main channel ✓ | backwater lake ___ | inside of channel bend ___
side channel inlet ___ | head of island or peninsula ✓ | straight reach of channel ___
backwater channel ___ | outside of channel bend ✓ | ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| near Head Dist 1 Dept | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 2 / 3 | 0 / 0 | / | / | / |
| 5 / 2 | 8 / 2 | / | / | / |
| 22 / 4 | 20 / 5 | / | / | / |
| 30 / 5 | 30 / 10 | / | / | / |
| 45 / 5 | 40 / 14 | / | / | / |
| 50 / 6 | 55 / 16 | / | / | / |
| 65 / 6 | 70 / 19 | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers
75 7' 100 21
90 8'

2-1, 2, 3, 4, 5

Fetch direction(s) | Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Pete Fasbender | Ken Dulik - McGregor | Gary Ackerman - IDNR |
| Jon Hendrickson | | Dan Dieterman - MDNR |
| Pete Fasbender | | |

| Observations | Site Number 9-676.7-R |
|---|---|

Bank material: clay ___ silt ___ topsoil very little (f) (c) sand ✓
(f) (m) (c) gravel ___ cobbles ___ other info: appears to be dredge sand disposal

Existing bank protection? no

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 3
(number in order of cause) prop wash ___ ___ ice action 4

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –
(density, type) shoreline –
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

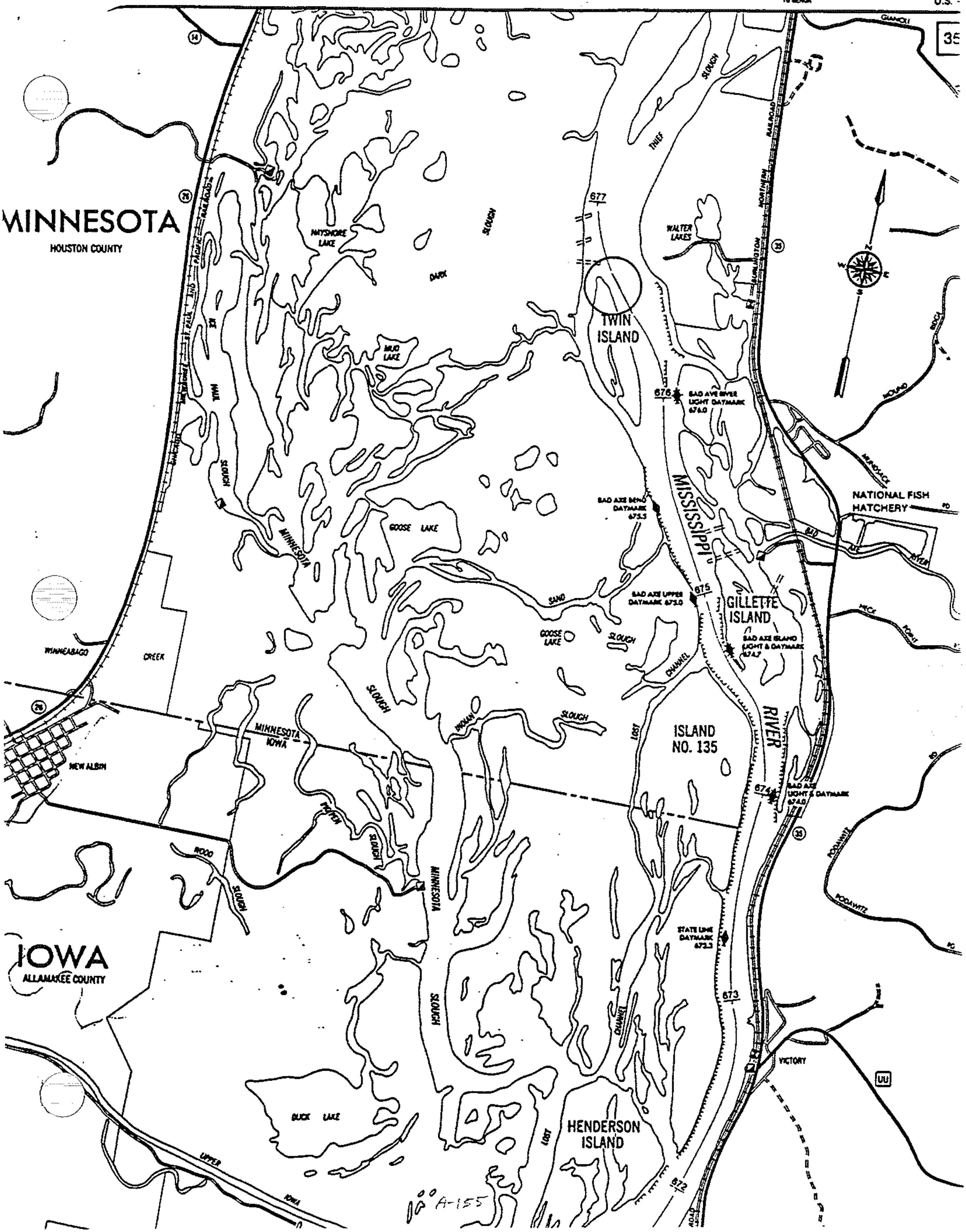
Fill required? Source?

Bank shaping required?

Construction access considetations or problems?

Cultural resources?

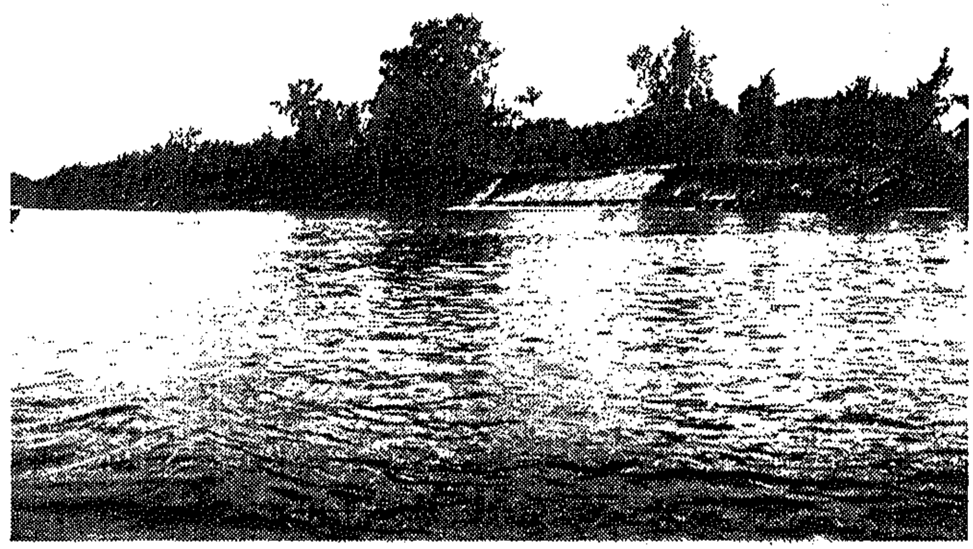
Other information


TO RENO
TO GENOA
U.S. -
35
MINNESOTA
HOUSTON COUNTY
IOWA
ALLAMAKEE COUNTY
TWIN ISLAND
GILLETTE ISLAND
ISLAND NO. 135
HENDERSON ISLAND
MISSISSIPPI
RIVER
NATIONAL FISH HATCHERY
NEW ALBIN
VICTORY
GOOSE LAKE
DUCK LAKE
MUD LAKE
WALTER LAKES
THIEF SLOUGH
MINNESOTA
IOWA
677
676
675
674
673
672
UU

A-155


A-156





# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | |
|---|---|
| Site Name: Side Chute (Isl. 135) | Site number (pool–river mile–l/r bank): 9 – 673.5 – R |

| | | |
|---|---|---|
| Date investigated: 7-21-92 | Time: 3:45 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/5/89 (44-26) (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = 24.9 | Flow = 48000 |
| Downstream L&D No. = 9 | Headwater Elev. = 19.1 | Flow = 47000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 23.5 | Flow velocity (location, depth, fps): 42000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ______ ___

| | |
|---|---|
| Proposed length of stabilization: 500 - 700 | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

@ Head

| Dist 1 Depth | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 0 / 0 | / | / | / | / |
| 5 / 3 | / | / | / | / |
| 15 / 9 | / | / | / | / |
| 20 / 10 | / | / | / | / |
| 55 / 5' | / | / | / | / |
| 70 / 5' | / | / | / | / |
| 97 / 6' | / | / | / | / |

Height of bank (top of bank to water surface): 3 - 4'

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers
100 6'
1-20
21
22
23
24
25

Fetch direction(s) — Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Pete Fasbender | Ken Dulik - McGregor | Dan Dieterman - MDNR |
| Jon Hendrickson | | Gary Ackerman - IDNR |
| Al Kean | | |

| Observations | Site Number 9-673.5-R |
|---|---|

Bank material: clay ___ silt ✓ topsoil ___ (f) (c) sand ___
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? No

Apparent causes of erosion: river flows 1 wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –
(density, type) shoreline –
bank – trees, roots, grass
top of bank – F.F

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed revetment

Other type(s) of stabilization possible

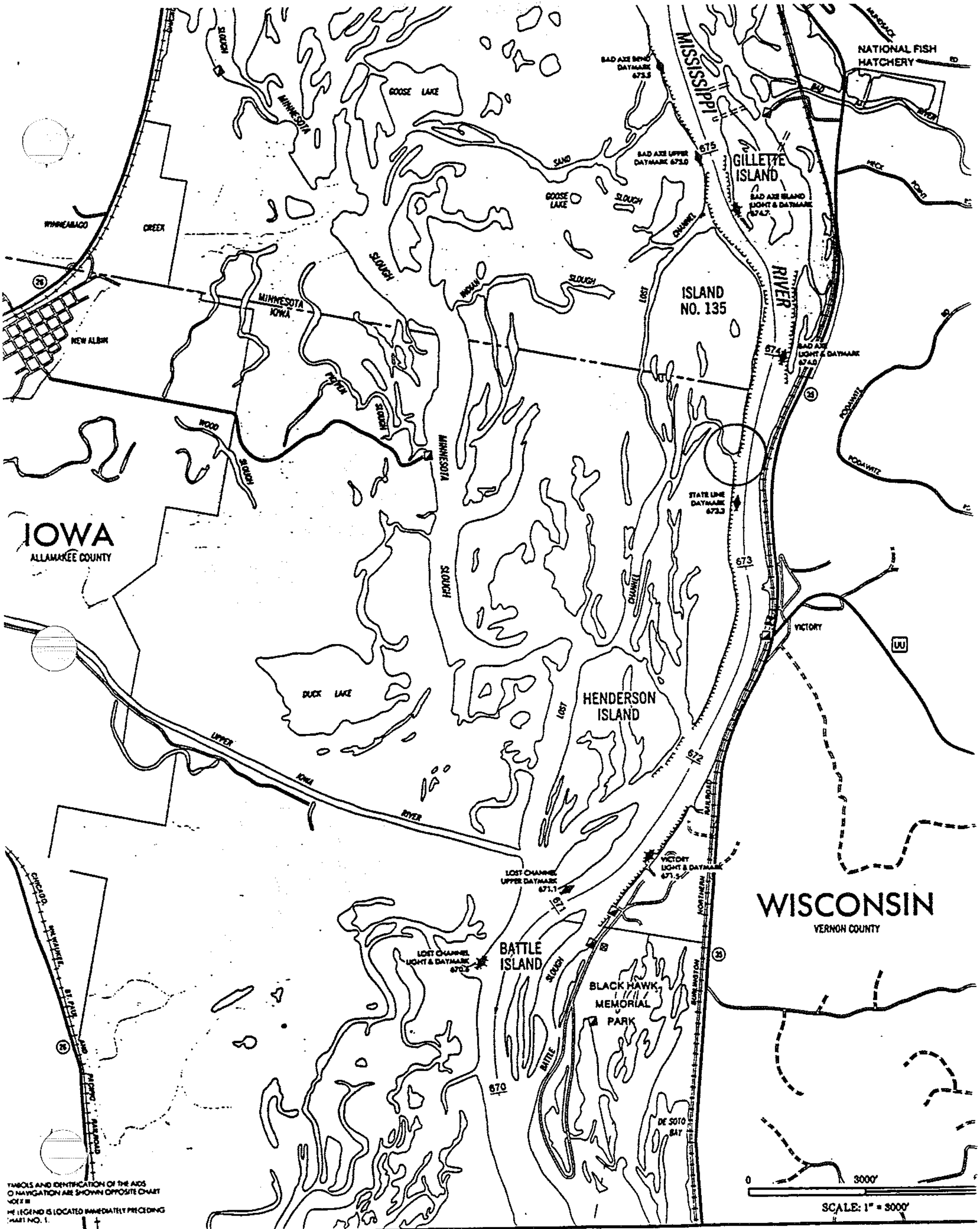
Fill required? Source?

Bank shaping required?

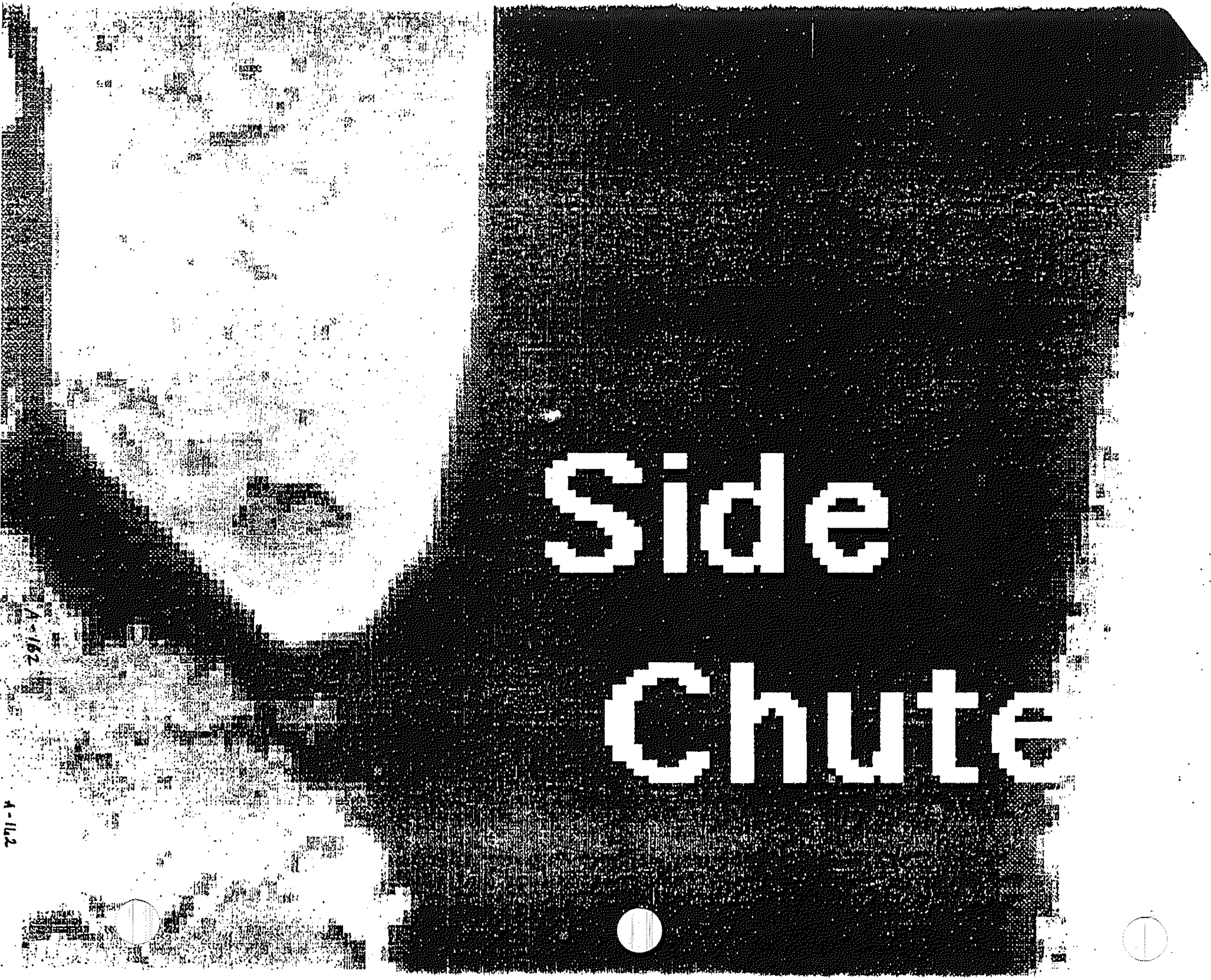
Construction access considerations or problems? No

Cultural resources?

Other information channel width = 105'


IOWA
ALLAMAKEE COUNTY
WISCONSIN
VERNON COUNTY
MISSISSIPPI
RIVER
NATIONAL FISH
HATCHERY
GILLETTE
ISLAND
ISLAND
NO. 135
HENDERSON
ISLAND
BATTLE
ISLAND
BLACK HAWK
MEMORIAL
PARK
DE SOTO
BAY
GOOSE LAKE
DUCK LAKE
NEW ALBIN
WINNEBAGO
CREEK
MINNESOTA
IOWA
MINNESOTA SLOUGH
UPPER IOWA RIVER
WOOD SLOUGH
LOST CHANNEL
VICTORY
UU
675
674
673
672
671
670
STATE LINE
DAYMARK
673.3
VICTORY
LIGHT & DAYMARK
671.5
LOST CHANNEL
UPPER DAYMARK
671.1
LOST CHANNEL
LIGHT & DAYMARK
670.5
BAD AXE ISLAND
LIGHT & DAYMARK
674.7
BAD AXE UPPER
DAYMARK 675.0
BAD AXE BEND
DAYMARK
675.5
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC RAILROAD
BURLINGTON NORTHERN RAILROAD
TO LANSING
TO DE SOTO
0
3000'
SCALE: 1" = 3000'

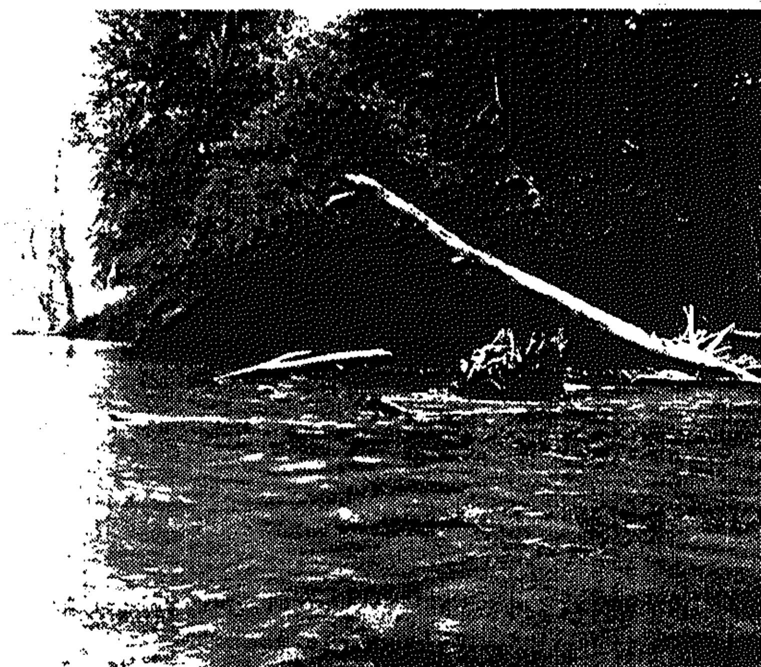
A-161



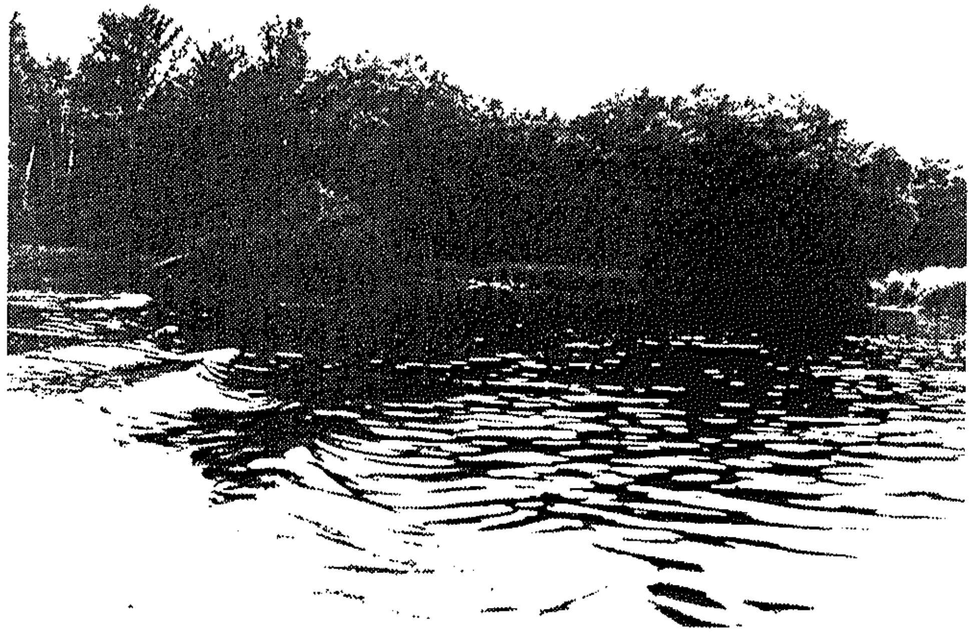

A-162

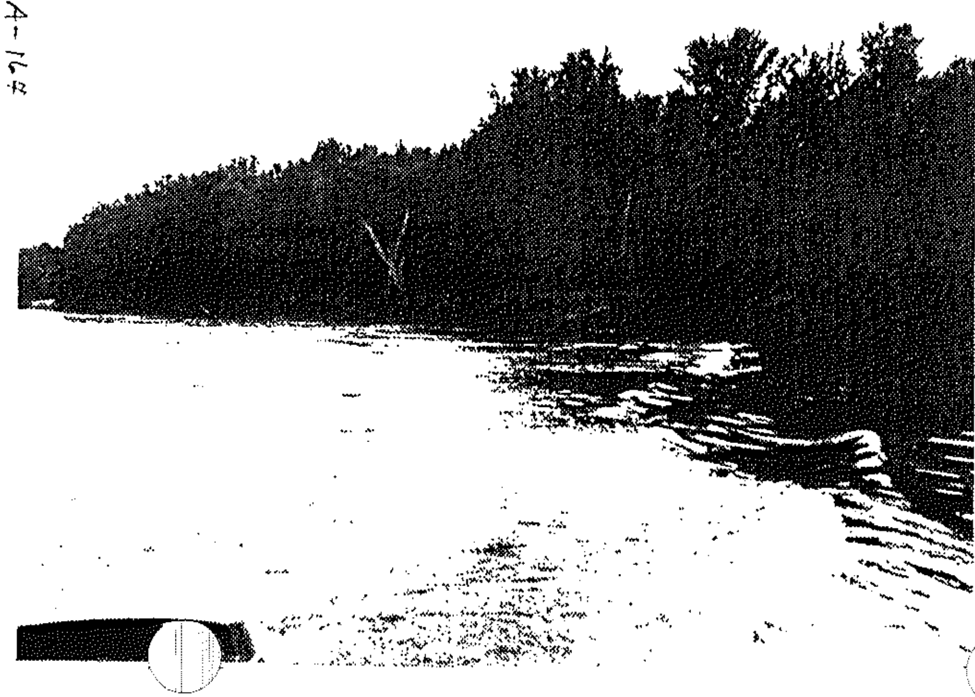
4-162

A-163



A-167





# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name: Head of Battle Island | Site number (pool–river mile–l/r bank): 9 – 671.1 – L |

| | | |
|---|---|---|
| Date investigated: 7/21/92 | Time: 3:00 | Year(s) of aerial photos (A) or maps (M) available (A) \| (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = [illegible] | Flow = 48000 |
| Downstream L&D No. = 9 | Headwater Elev. = 19.1 | Flow = 49000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 23.4 | Flow velocity (location, depth, fps): 18000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ✓
- inside of channel bend ___
- straight reach of channel ___
- ______________ ___

| | |
|---|---|
| Proposed length of stabilization: 500' d.s from head on river side | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 (400 d.s.) Dist | 1 Depth | 2 (100' d.s.) Dist | 2 Depth | 3 (@ head) Dist | 3 Depth | 4 | 5 |
|---|---|---|---|---|---|---|---|
| 0 | 3 | 0 | 0 | 0 | 0 | / | / |
| 13 | 1.9 | 7 | 3 | 10 | 3 | / | / |
| 25 | 2.8 | 15 / 25 | 3 / 5 | | | / | / |
| 27 | 3 | 40 | 7 | 50 | 12 | / | / |
| 35 / 45 | 7 / 11 | 50 | 13 | 65 | 9 | / | / |
| 60 | 17 | 55 | 15 | 70 | 10 | / | / |
| 67 | 18 | | | 80 / 90 / 105 / 135 / 120 | 9' / 4' / 6' / 15' | / | / |

Height of bank (top of bank to water surface): 1 – 5

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank: 3 – 8' @ head of island

Nearshore bottom slope: drop off to 20-30' 100' from shore 1V on ____ H

Photo numbers: 1-16, 1-17, 1-18, 1-19

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Ken Dulik - McGregor | Dan Dieterman - MDNR |
| Jon Hendrickson | | Gary Ackerman - IDNR |
| Pete Fasbender | | |

| Observations | Site Number 9-671.1-L |
|---|---|

| | | | |
|---|---|---|---|
| Bank material: clay ___ | silt ✓ | topsoil 1-3' | (f) (c) sand ✓ m |
| (f) (m) (c) gravel ___ | cobbles ___ | other info: | |
| Existing bank protection? some submerged rock | | | |
| Apparent causes of erosion: (number in order of cause) | river flows 1 / prop wash ___ | wind waves 2 / ___ ___ | boat waves 3 / ice action ___ |

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: (density, type)
- nearshore – none
- shoreline – "
- bank – tree roots
- top of bank – F.F.

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed revetment

Other type(s) of stabilization possible

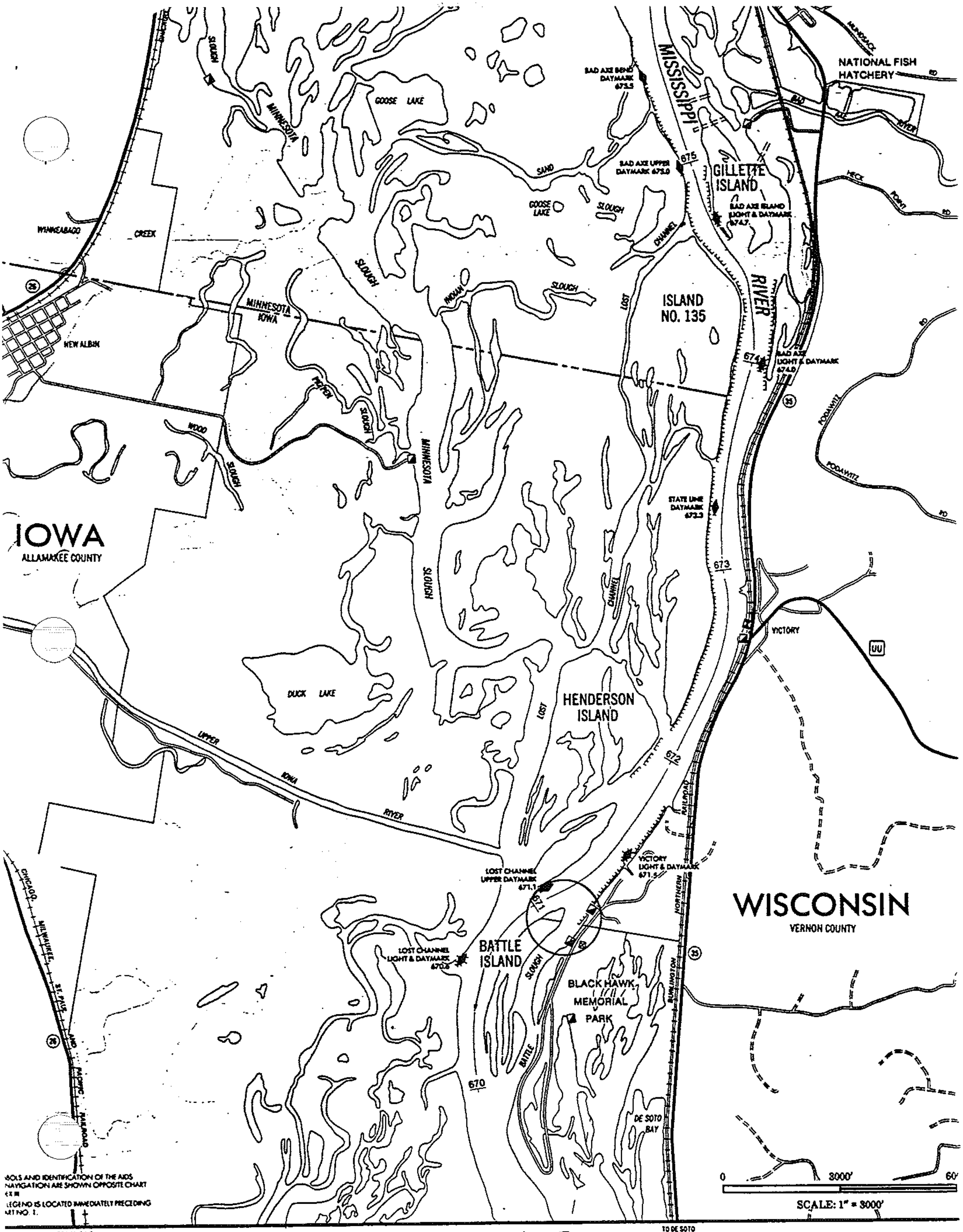
Fill required? Source?

Bank shaping required?

Construction access considerations or problems? No

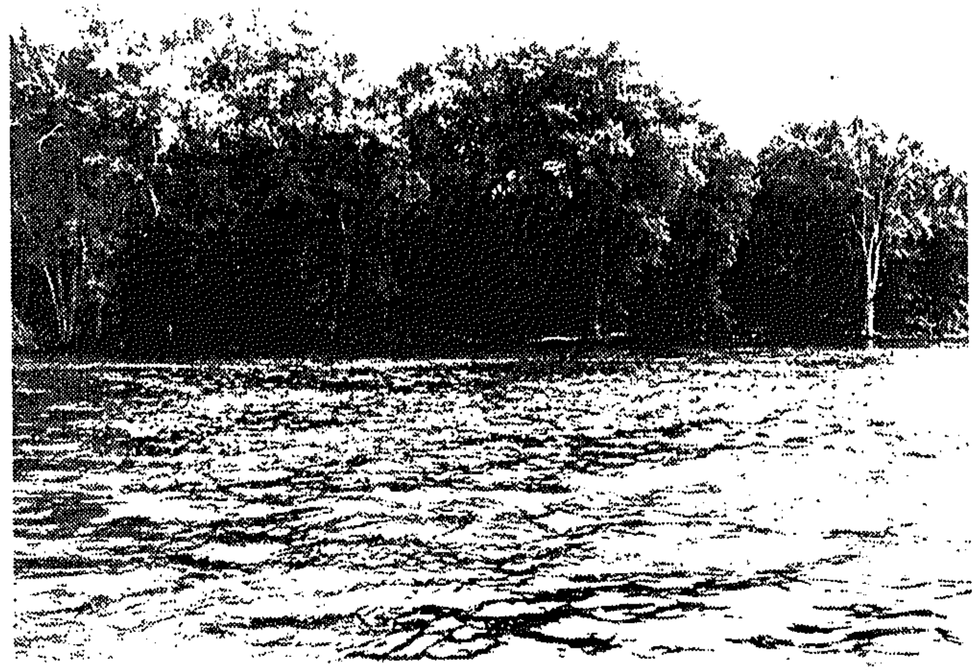
Cultural resources?

Other information


IOWA
ALLAMAKEE COUNTY
WISCONSIN
VERNON COUNTY
MISSISSIPPI
RIVER
NATIONAL FISH
HATCHERY
GILLETTE
ISLAND
ISLAND
NO. 135
HENDERSON
ISLAND
BATTLE
ISLAND
BLACK HAWK
MEMORIAL
PARK
DE SOTO
BAY
NEW ALBIN
WINNEABAGO
CREEK
MINNESOTA
IOWA
GOOSE LAKE
DUCK LAKE
UPPER
IOWA
RIVER
SAND
SLOUGH
LOST
CHANNEL
VICTORY
BAD AXE BEND
DAYMARK
675.5
BAD AXE UPPER
DAYMARK 675.0
BAD AXE ISLAND
LIGHT & DAYMARK
674.7
BAD AXE
LIGHT & DAYMARK
674.0
STATE LINE
DAYMARK
673.3
VICTORY
LIGHT & DAYMARK
671.5
LOST CHANNEL
UPPER DAYMARK
671.1
LOST CHANNEL
LIGHT & DAYMARK
670.6
675
674
673
672
671
670
CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD
NORTHERN
BURLINGTON
RAILROAD
PODAWITZ
HECK
POINT
RD
BAD AXE RIVER
UU
35
26
BOLS AND IDENTIFICATION OF THE AIDS
NAVIGATION ARE SHOWN OPPOSITE CHART
LEGEND IS LOCATED IMMEDIATELY PRECEDING
ART NO. 1.
0
3000'
SCALE: 1" = 3000'
TO LAN SING
TO DE SOTO

A-167.


A-162

A-169


# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | |
|---|---|
| te Name: Battle Island | Site number (pool–river mile–l/r bank): 9-671.0-L |

| | | |
|---|---|---|
| Date investigated 7/21/92 | Time 3:00 | Year(s) of aerial photos (A) or maps (M) available (A) 9/5/89 (43-41) (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = 24.9 | Flow = 48000 |
| Downstream L&D No. = 9 | Headwater Elev. = 19.1 | Flow = 49000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site 23.4 | Flow velocity (location, depth, fps) 48000 |

Location type (check all applicable)

main channel ✓
side channel inlet ✓
backwater channel ___
backwater lake ___
head of island or peninsula ___
outside of channel bend ___
inside of channel bend ✓
straight reach of channel ___
_______________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water
1V on _____ H

Water depth at toe of bank

Nearshore bottom slope
1V on _____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Jon Hendrickson | Ken Dulik - McGregor | Dan Dieterman - MDNR |
| Pete Fasbender | | Gary Ackerman - IDNR |
| Al Kean | | |

Observations

Site Number 9-671.0-L

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ________________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –

(density, type) shoreline –

bank –

top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information Non-Fed.

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name Hummingbird Slough | | Site number (pool-river mile-l/r bank) 9-666.1-R | |
| Date investigated 7-21-92 | Time 2:15 | Year(s) of aerial photos (A) or maps (M) available (A) 9/5/89 (44-34) | (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = 21.7 | Flow = 48500. | |
| Downstream L&D No. = 9 | Headwater Elev. = 19.1 | Flow = 49000 | |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site 22.5 | Flow velocity (location, depth, fps) quite high 48700 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ______________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Dist 1 Depth | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| 0 / 3 8 | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface) 1-3'

Slope length above water

Slope above water 1'-3' 1V on 0 H

Water depth at toe of bank 8' [illegible]

Nearshore bottom slope 1V on ____ H

| | |
|---|---|
| Photo numbers 1-12<br>1-13<br>1-14<br>1-15 | Fetch direction(s) Length |
| | Site alignment with respect to fetch direction |

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Al Kean | Ken Dulik - McGregor | Gary Ackerman - IDNR |
| Pete Fasbender | | Dan Dieterman - MDNR |
| Jon Hendrickson | | |

Observations

Site Number 9-666.1-R

Bank material: clay ___ silt ✓? topsoil ___ (f) (c) sand ___

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? some riprap at head

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 2

(number in order of cause) prop wash ___ ______ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore – none

(density, type) shoreline – none - grass - trees

bank – " " "

top of bank – F.F.

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed revetment at head of island & ~3-400' d.s. on river side & 100' d.s. on slough side & possibly partial closure or rock sill ~170' across inlet which is ~13-15' deep

Other type(s) of stabilization possible

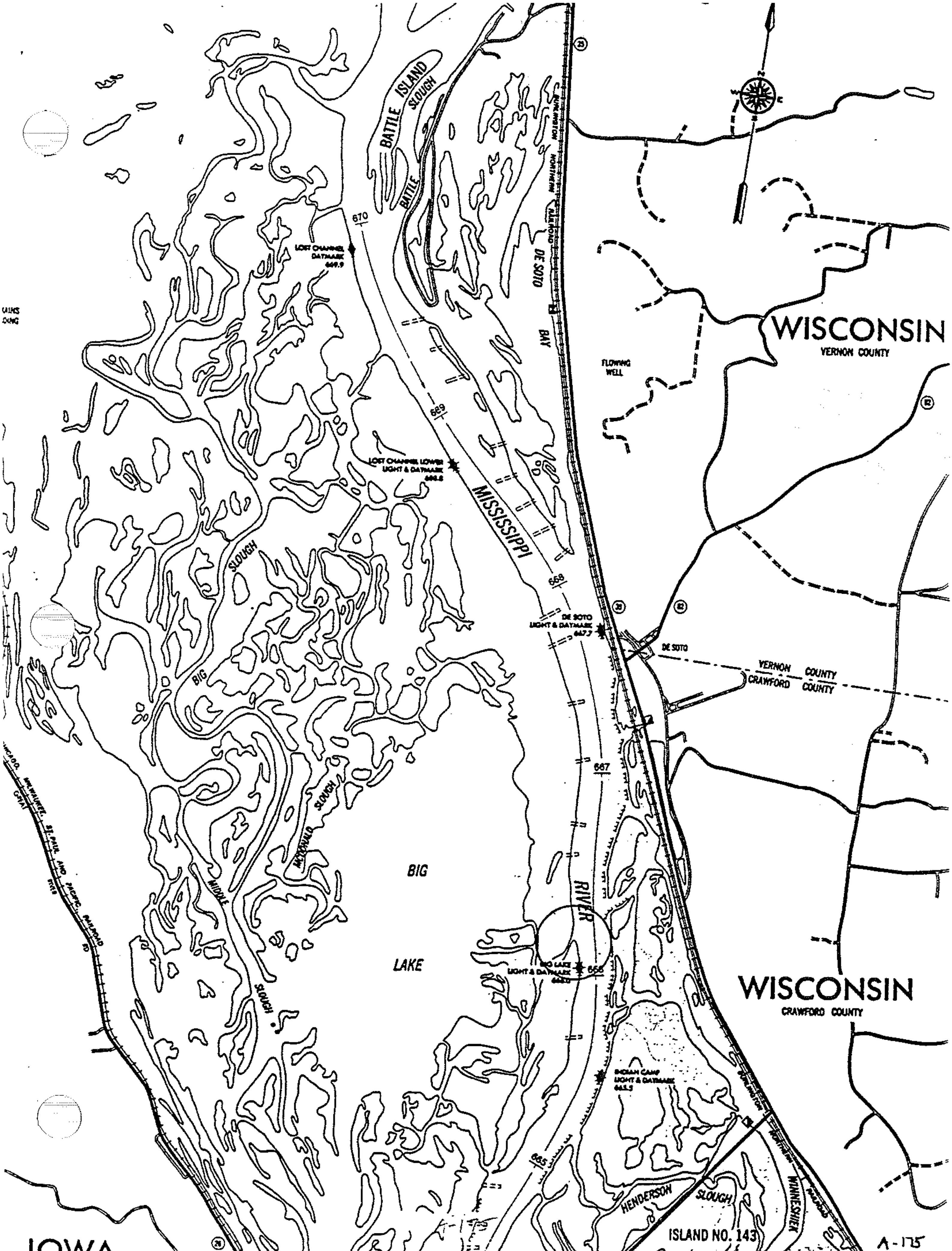
Fill required? Source?

Bank shaping required?

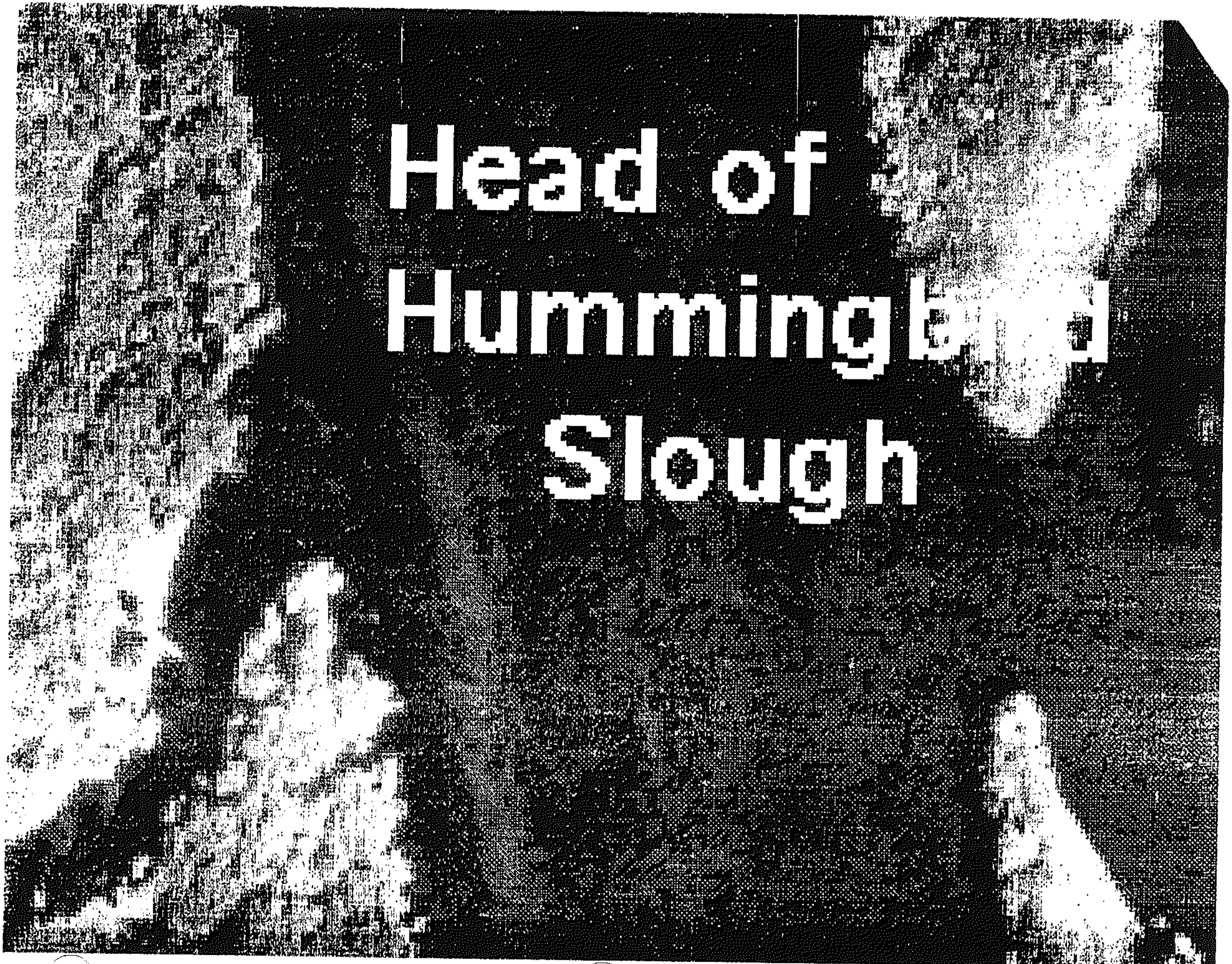
Construction access considerations or problems?

Cultural resources?

Other information

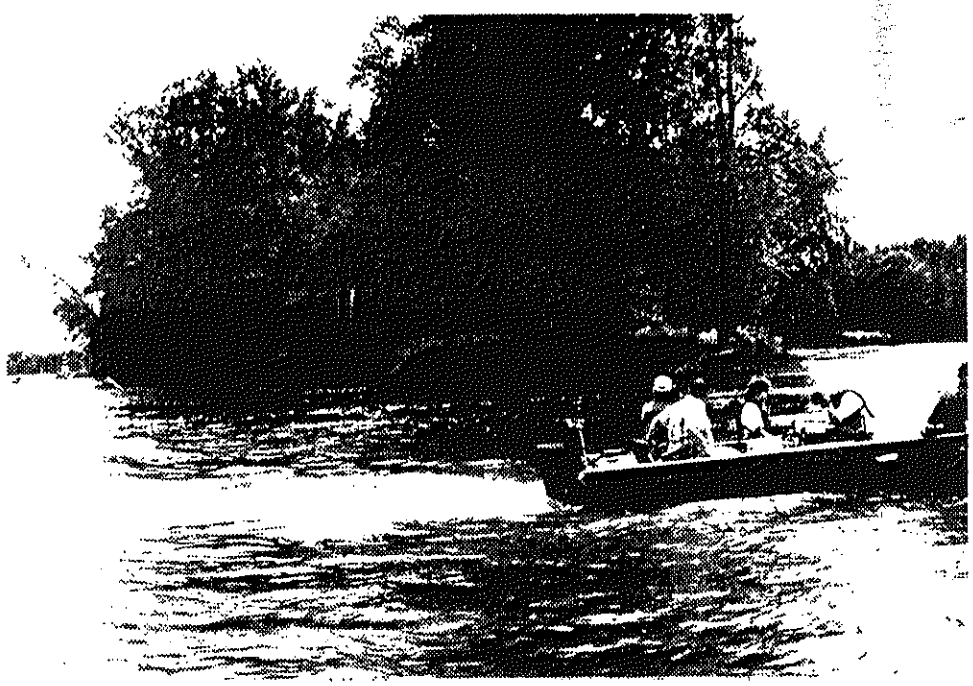

BATTLE ISLAND SLOUGH
BATTLE
BURLINGTON NORTHERN RAILROAD
DE SOTO BAY
670
LOST CHANNEL DAYMARK
669.9
WISCONSIN
VERNON COUNTY
FLOWING WELL
669
LOST CHANNEL LOWER LIGHT & DAYMARK
MISSISSIPPI
668
DE SOTO LIGHT & DAYMARK
667.7
DE SOTO
VERNON COUNTY
CRAWFORD COUNTY
BIG SLOUGH
667
McDONALD SLOUGH
MIDDLE SLOUGH
BIG LAKE
RIVER
BIG LAKE LIGHT & DAYMARK
666
WISCONSIN
CRAWFORD COUNTY
INDIAN CAMP LIGHT & DAYMARK
665
HENDERSON SLOUGH
ISLAND NO. 143
WINNESHIEK
IOWA
CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD

A-175




A-176





# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | |
|---|---|---|
| Site Name: Lansing Light | | Site number (pool–river mile–l/r bank): 9-664.9-R |
| Date investigated: 7-21-92 | Time: 2:00 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/5/89 (44-34) (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = 2[illegible] | Flow = 4[illegible]500 |
| Downstream L&D No. = 9 | Headwater Elev. = [illegible] | Flow = [illegible]9000 |

Other water surface elev. data in pool

Estimated water surface elev. at site: 22.3

Flow velocity (location, depth, fps): [illegible]

Location type (check all applicable)

- main channel ___
- side channel inlet ✓
- backwater channel ✓
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ✓
- straight reach of channel ___
- __________ ___

Proposed length of stabilization

Wing or closing dams in area

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers
1-9
1-10
1-11 upstream inlet of 2

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell, Don | Beseke, Keith - Winona | Ackerman, Gary - IDNR |
| Kean, Al | Dulik, Ken - McGregor | Janvrin, Jeff - WDNR |
| Fasbender, Pete | | Dieterman, Dan - MDNR |
| Hendrickson, Jon | | |

Observations

Site Number 9-664.9-R

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –

(density, type) shoreline –

bank –

top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

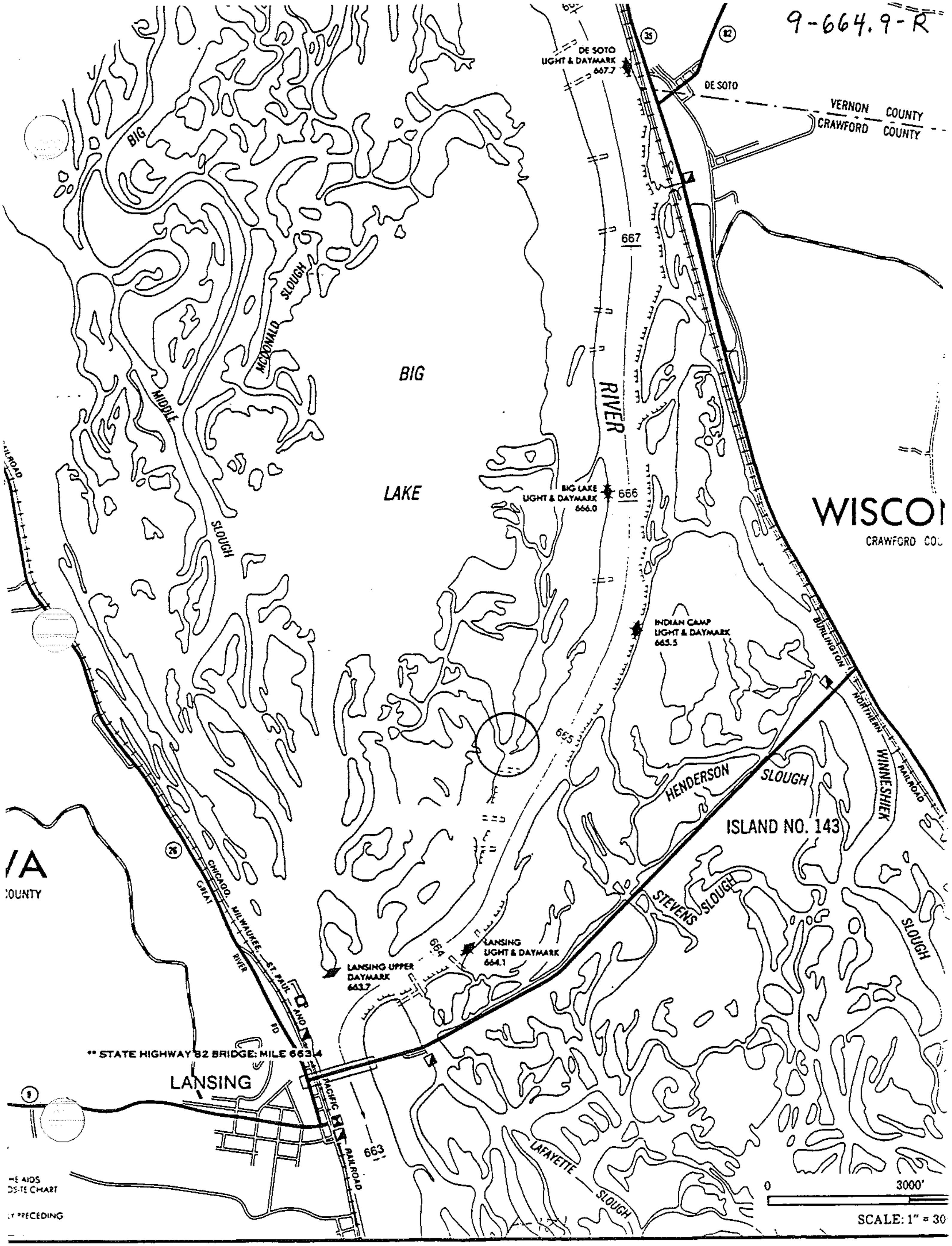
Bank shaping required?

Construction access considerations or problems?

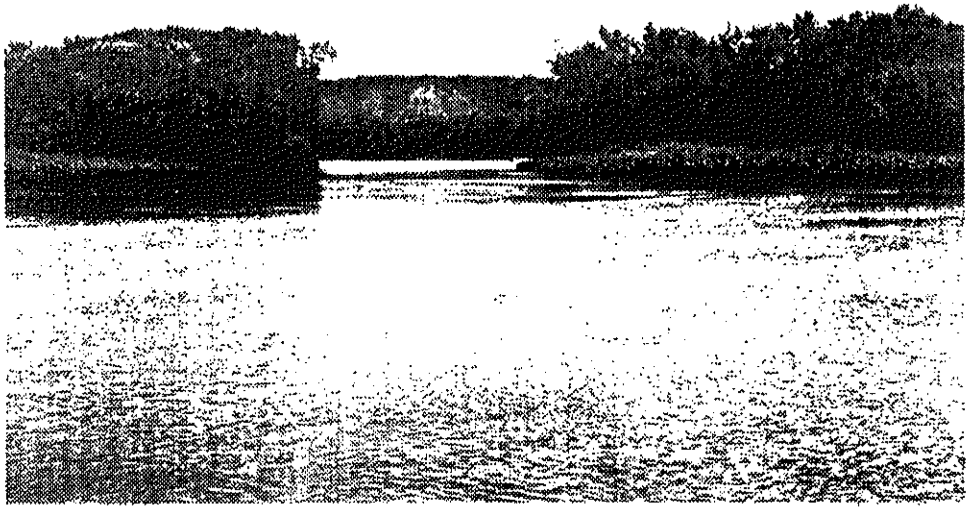
Cultural resources?

Other information Not sure what the locals consider to be the problem, but could be that these sloughs have deepened since construction of new wingdams (i.e. more flow through them) (~15' deep near heads of channels) (Swift current in sloughs) Gary A. believes these cuts used to be quite small. Looks like O&M concern, but should get discharge measurements.

9-664.9-R



DE SOTO LIGHT & DAYMARK 667.7
DE SOTO
VERNON COUNTY
CRAWFORD COUNTY
BIG
McDONALD SLOUGH
MIDDLE
SLOUGH
BIG
LAKE
RIVER
667
BIG LAKE LIGHT & DAYMARK 666.0
666
WISCO
CRAWFORD CO
INDIAN CAMP LIGHT & DAYMARK 665.5
BURLINGTON
NORTHERN RAILROAD
665
HENDERSON SLOUGH
WINNESHIEK
ISLAND NO. 143
STEVENS SLOUGH
SLOUGH
A
COUNTY
CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD
GREAT RIVER RD
664
LANSING LIGHT & DAYMARK 664.1
LANSING UPPER DAYMARK 663.7
** STATE HIGHWAY 82 BRIDGE: MILE 663.4
LANSING
663
LAFAYETTE SLOUGH
0
3000'
SCALE: 1" = 30



# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name<br>Upper Harpers Slough - See Lower | | Site number (pool–river mile–l/r bank)<br>9-653.7-R<br>9-654.1-R Upper<br>9-653.4-R Middle | |
| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available<br>(A) 9/10/89 (48-2) (M) | |
| Upstream L&D No. = 8 | Tailwater Elev. = | Flow = | |
| Downstream L&D No. = 9 | Headwater Elev. = | Flow = | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site | | Flow velocity (location, depth, fps) | |

Location type (check all applicable)

| | | |
|---|---|---|
| main channel ___ | backwater lake ___ | inside of channel bend ___ |
| side channel inlet ___ | head of island or peninsula ___ | straight reach of channel ___ |
| backwater channel ___ | outside of channel bend ___ | ___________ ___ |

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on _____ H

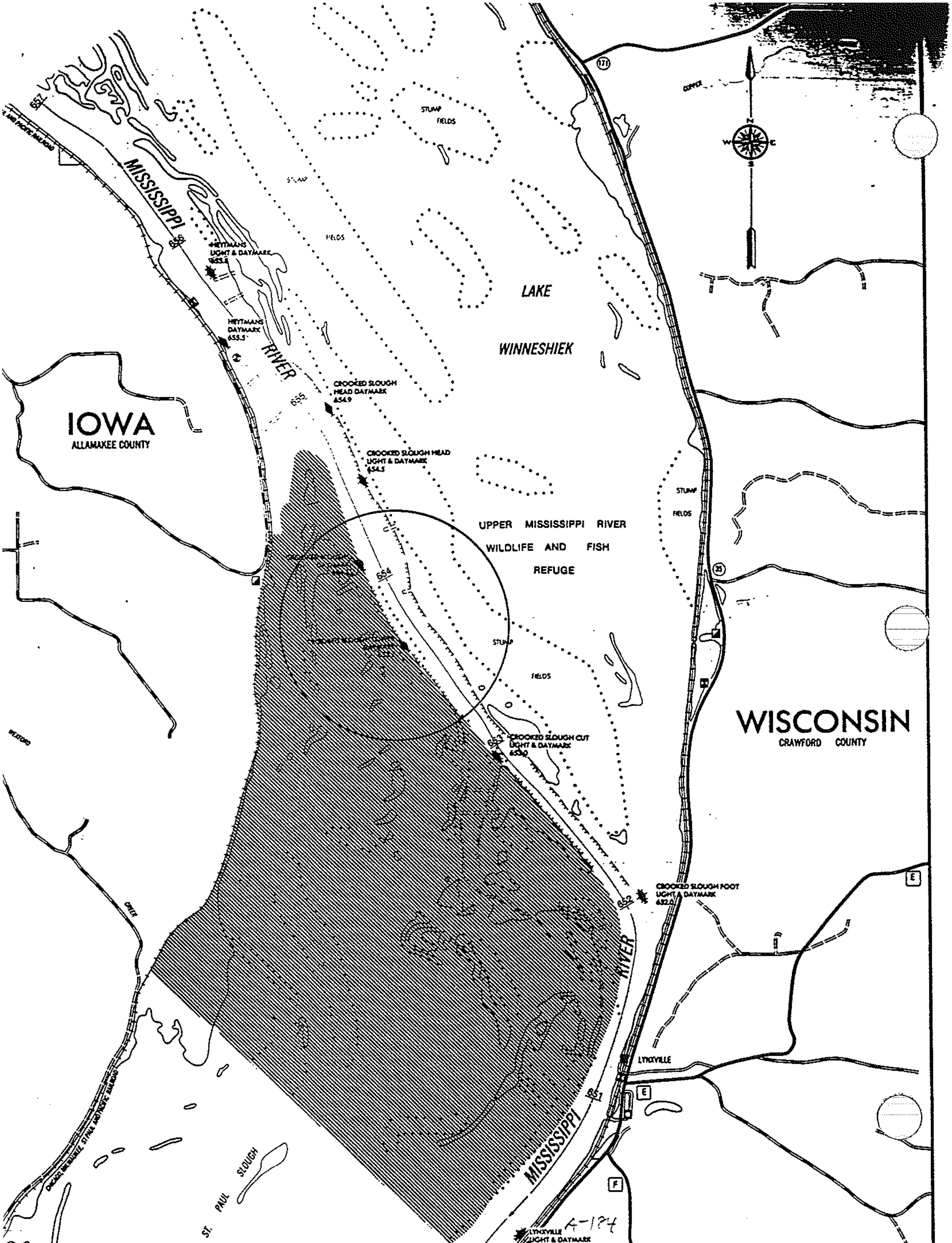
Water depth at toe of bank

Nearshore bottom slope 1V on _____ H

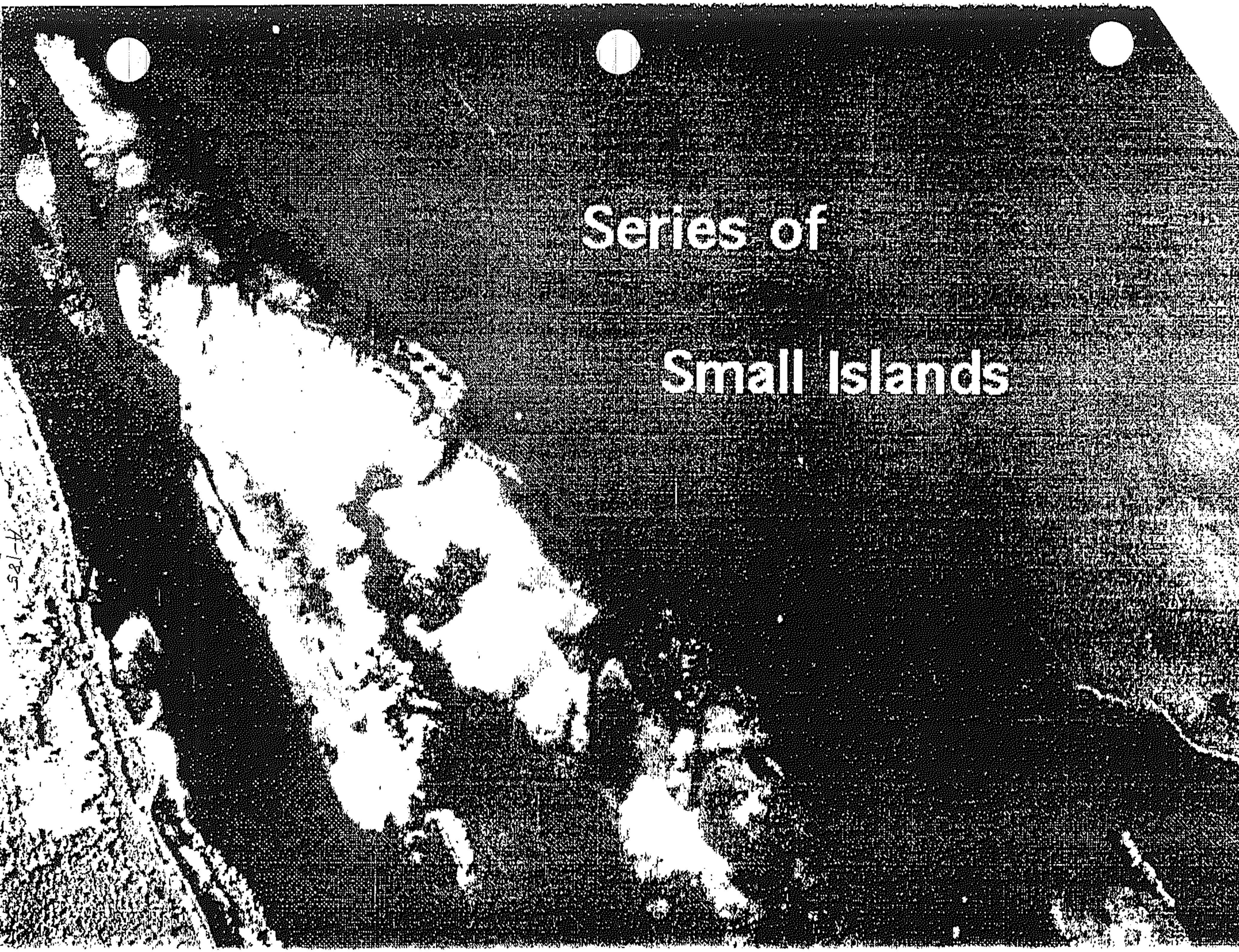
| | |
|---|---|
| Photo numbers | Fetch direction(s) Length |
| | Site alignment with respect to fetch direction |

Names of investigators (R)=Recorder of data

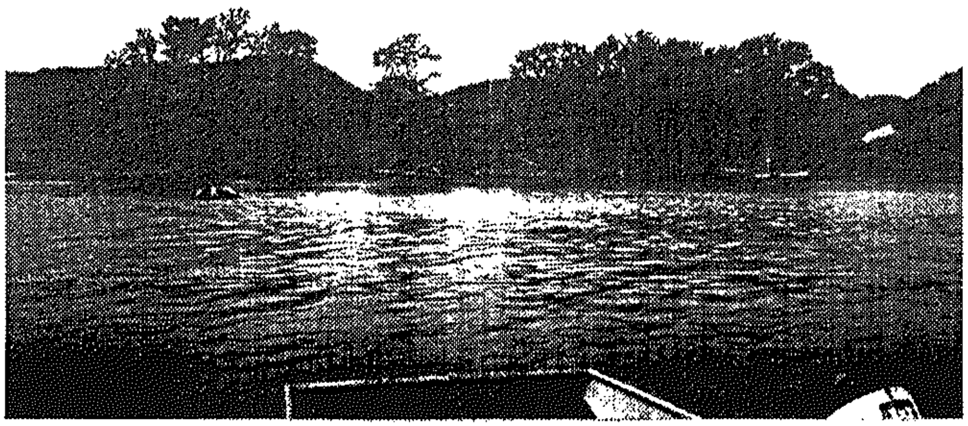
| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

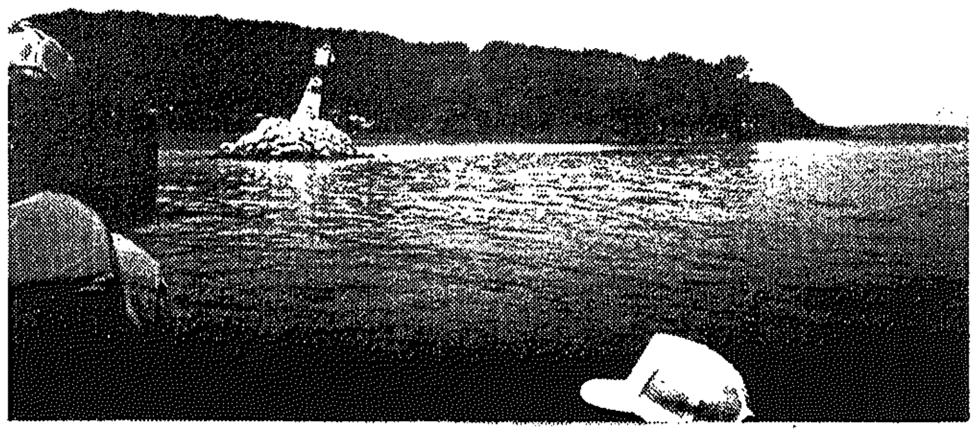


IOWA
ALLAMAKEE COUNTY
WISCONSIN
CRAWFORD COUNTY
LAKE
WINNESHIEK
UPPER MISSISSIPPI RIVER
WILDLIFE AND FISH
REFUGE
MISSISSIPPI
RIVER
STUMP
FIELDS
HEYTMANS LIGHT & DAYMARK
HEYTMANS DAYMARK 655.5
CROOKED SLOUGH HEAD DAYMARK 654.9
CROOKED SLOUGH HEAD LIGHT & DAYMARK 654.5
CROOKED SLOUGH CUT LIGHT & DAYMARK 653.0
CROOKED SLOUGH FOOT LIGHT & DAYMARK 652.0
LYNXVILLE
LYNXVILLE LIGHT & DAYMARK
ST. PAUL SLOUGH
657
656
655
654
653
652
651
A-174


Series of
Small Islands

A-126





# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | |
|---|---|---|
| Site Name: Lower Harper's Slough | | Site number (pool–river mile–l/r bank): 9 – 652.6 – R |
| Date investigated: 6-23-92 | Time: 11:15 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/10/89 (49-5) (M) |
| Upstream L&D No. = 8 | Tailwater Elev. = 23.2 | Flow = 37000 |
| Downstream L&D No. = 9 | Headwater Elev. = 19.4 | Flow = 38000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 20.0 | Flow velocity (location, depth, fps): 38000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ______________________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Dep/1 Dist | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / 0 | 2 / 2 | / | / | / |
| 0.5 / 5 | [illegible] / [illegible] | / | / | / |
| 0.7 / 10 | 13 / 13 | / | / | / |
| 1.1 / [illegible] | 1.4 / [illegible] | / | / | / |
| 0.9 / 20 | [illegible] / [illegible] | / | / | / |
| 1.2 / 25 | | | | |
| 1.7 / 30 | 1.7 / [illegible] | / | / | / |
| 2.2 / 40 | 23 / 30 | / | / | / |

Height of bank (top of bank to water surface): 1-2

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers: 7, 8, 22, 23, 28, 31

| | |
|---|---|
| Fetch direction(s) | Length |

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | • Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Pete Fasbender | John Lyons - McGregor | Gary Ackerman - IDNR |
| Jon Hendrickson | | Art Roseland - " |
| Al Kean | | |

Observations

Site Number 9-652.5-R

Bank material: clay ___ silt ___ topsoil ✓ 1' (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? yes, submerged

Apparent causes of erosion: river flows 3 wind waves 2 boat waves 1
(number in order of cause) prop wash ___ ___ ice action 4

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

?

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: nearshore – none
(density, type) shoreline – "
bank – trees, grass, roots
top of bank – " "

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion loss of backwater vegetation & associated habitat

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone) large backwater areas

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed revetment/breakwater on Top of old riprap bank protection

Other type(s) of stabilization possible

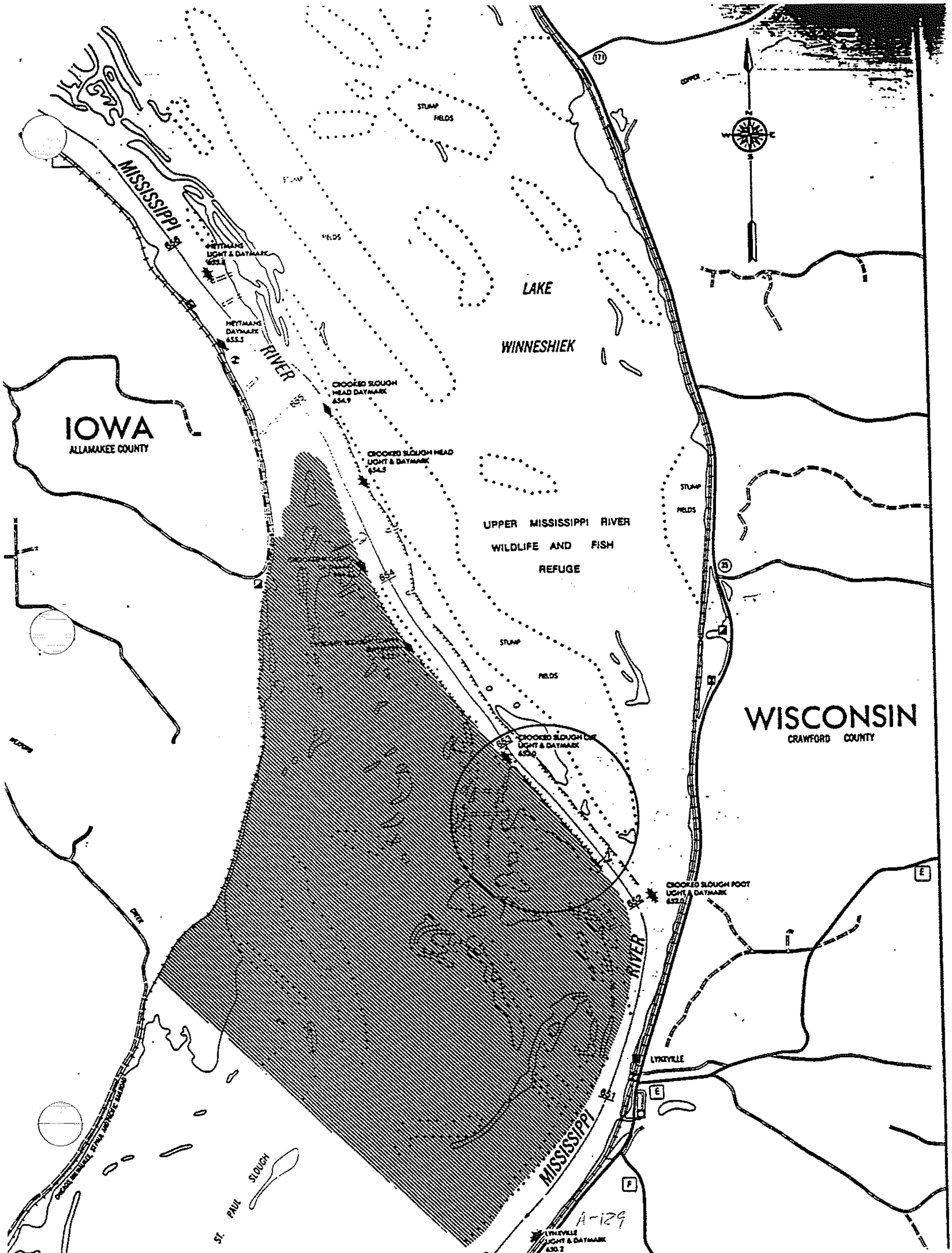
Fill required? Source?

Bank shaping required?

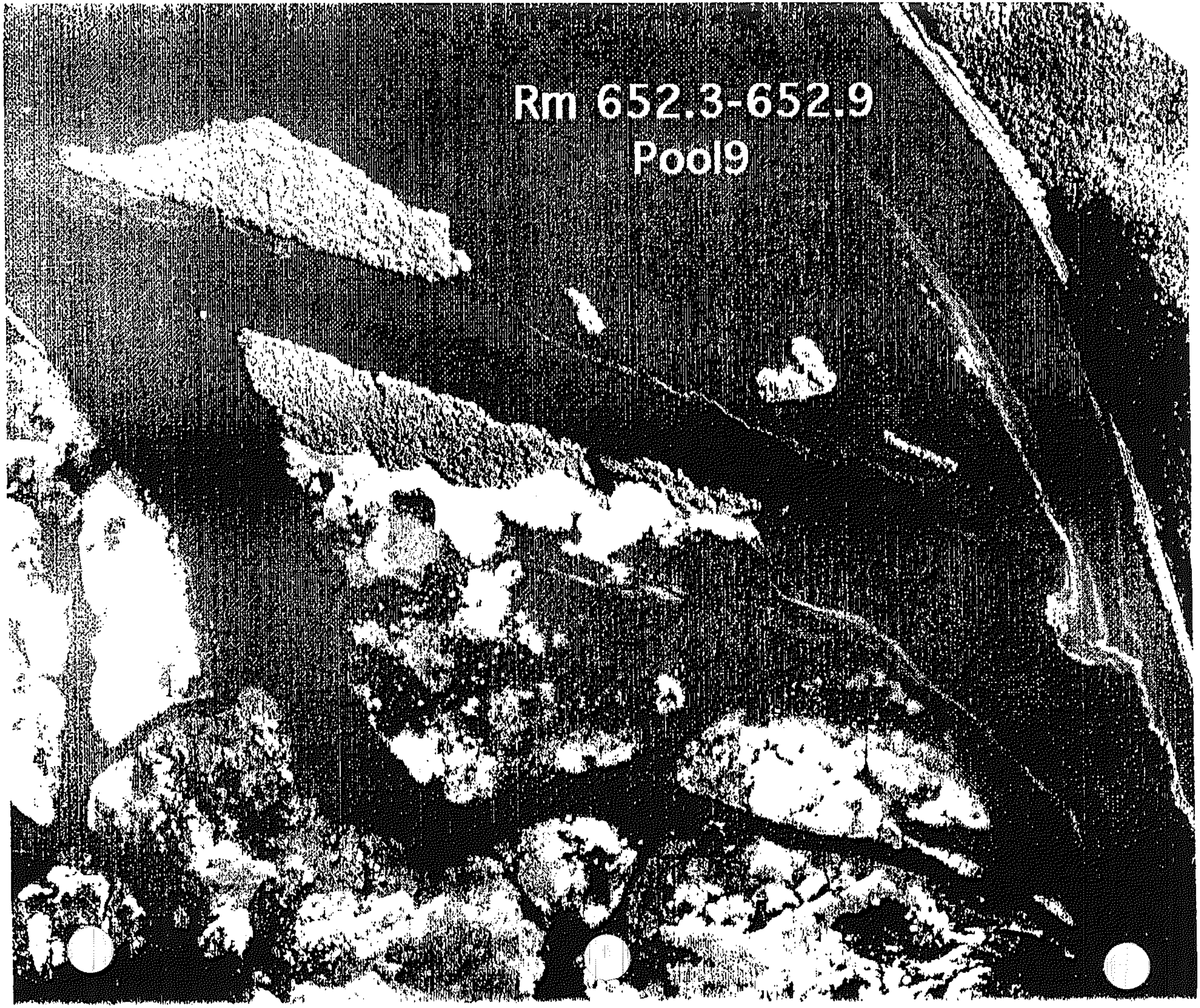
Construction access considerations or problems?

Cultural resources?

Other information


IOWA
ALLAMAKEE COUNTY
WISCONSIN
CRAWFORD COUNTY
LAKE
WINNESHIEK
UPPER MISSISSIPPI RIVER
WILDLIFE AND FISH
REFUGE
MISSISSIPPI
RIVER
STUMP
FIELDS
HEYTMANS
LIGHT & DAYMARK
HEYTMANS
DAYMARK
655.5
CROOKED SLOUGH
HEAD DAYMARK
654.9
CROOKED SLOUGH HEAD
LIGHT & DAYMARK
654.5
CROOKED SLOUGH CUT
LIGHT & DAYMARK
CROOKED SLOUGH FOOT
LIGHT & DAYMARK
652.0
LYNXVILLE
LYNXVILLE
LIGHT & DAYMARK
ST. PAUL SLOUGH
656
655
654
653
652
651
171
35
E
E
F
N
S
W
E

A-129


Rm 652.3-652.9
Pool9

## Mississippi River Bank Stabilization EMP Habitat Project

### Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name<br>Dam 9 Island | | | Site number (pool–river mile–l/r bank)<br>9 – 648. – R |
| Date investigated<br>6-23-92 | Time | Year(s) of aerial photos (A) or maps (M) available<br>(A) 9/10/89 (49-9) \| (M) | |
| Upstream L&D No. = 8 | Tailwater Elev. = | Flow = | |
| Downstream L&D No. = 9 | Headwater Elev. = | Flow = | |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |

Location type (check all applicable)

- main channel ✓
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ______________________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area<br>No |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Depth 1 Dist | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| .3 / 0 | / | / | / | / |
| [illegible] / 5 | / | / | / | / |
| 1.3 / 10 | / | / | / | / |
| 1.[illegible] / [illegible] | / | / | / | / |
| 2.3 / 19 | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| 5.5 / [illegible] | / | / | / | / |

Height of bank (top of bank to water surface)
2'-3'

Slope length above water

Slope above water
1V on _____ H

Water depth at toe of bank

Nearshore bottom slope
1V on _____ H

Photo numbers
( 4-5' 30' out from shore at head of island
7 [illegible]
7 [illegible]
7 [illegible]
7 [illegible]

Fetch direction(s) Length
[illegible] – E.

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke-Winona | Jeff Janvrin-WDNR |
| Pete Fasbender | John Lyons-McGregor | Gary Ackerman-IDNR |
| Jon Hendrickson | | Art Roseland - |
| Al Kean | | |

Observations

Site Number 9-648. -R

Bank material: clay ___ silt ___ topsoil ✓ 0.5-1.0 (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? yes, at n.w. corner only (~30')

Apparent causes of erosion: river flows ___ wind waves 1 boat waves ___

(number in order of cause) prop wash ___ ___ ice action 2

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore – none

(density, type) shoreline – none

bank – grasses, vines

top of bank – trees, brush, vines

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion eagle roosting, fish spawning? celery beds behind island

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed offshore rock breakwater

Other type(s) of stabilization possible

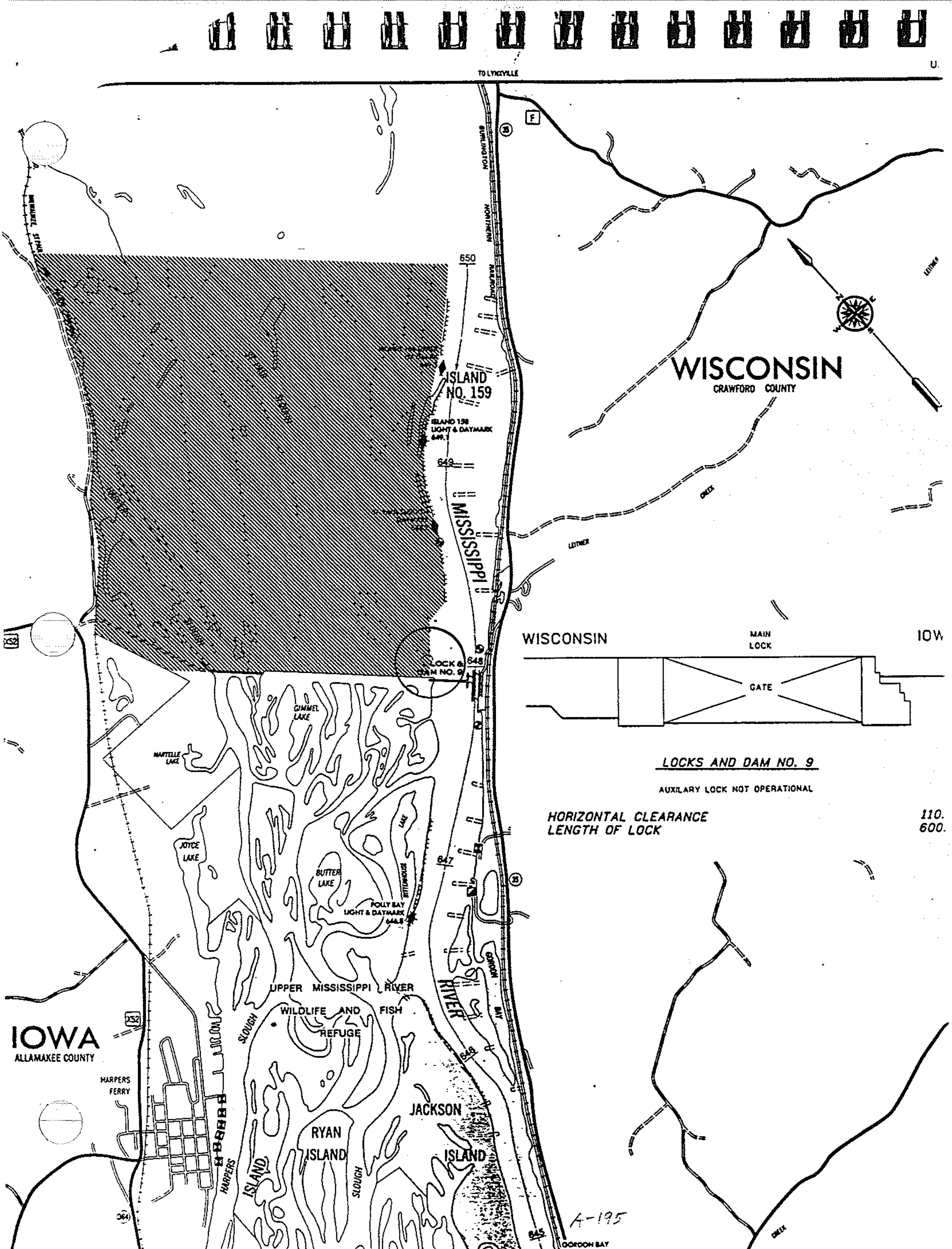
Fill required? Source?

Bank shaping required?

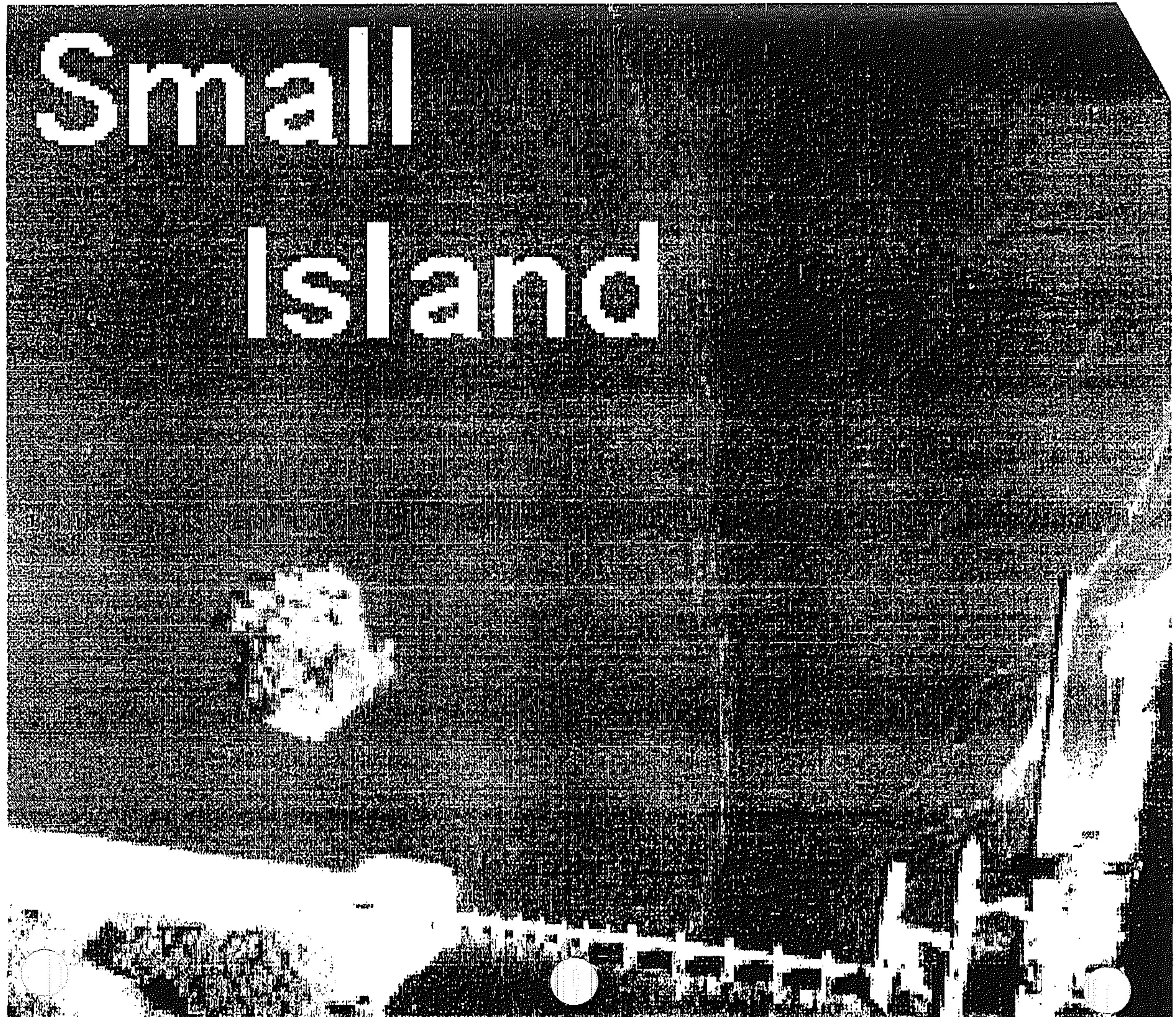
Construction access considerations or problems? probable access problems due to shallow water

Cultural resources?

Other information


TO LYNXVILLE
U.
WISCONSIN
CRAWFORD COUNTY
IOWA
ALLAMAKEE COUNTY
HARPERS
FERRY
650
649
648
647
646
645
ISLAND
NO. 159
ISLAND 158
LIGHT & DAYMARK
649.1
MISSISSIPPI
RIVER
LOCK &
DAM NO. 9
GIMMEL
LAKE
MARTELLE
LAKE
JOYCE
LAKE
BUTTER
LAKE
POLLY BAY
LIGHT & DAYMARK
646.6
UPPER MISSISSIPPI RIVER
WILDLIFE AND FISH
REFUGE
SLOUGH
JACKSON
ISLAND
RYAN
ISLAND
HARPERS
GORDON
BAY
GORDON BAY
BURLINGTON
NORTHERN
RAILROAD
LOTHER
CREEK
X52
35
F
364
WISCONSIN
MAIN
LOCK
IOW
GATE
LOCKS AND DAM NO. 9
AUXILARY LOCK NOT OPERATIONAL
HORIZONTAL CLEARANCE 110.
LENGTH OF LOCK 600.
A-195

A-196



A-197

PRIVATE OWNERSHIP

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

Site Name: Gordon Bay Inlet

Site number (pool–river mile–l/r bank): 10-646.5-L

Date investigated: 6-23-92

Time:

Year(s) of aerial photos (A) or maps (M) available: (A) 9/10/89 (49-12) (M)

Upstream L&D No. = 9

Tailwater Elev. =

Flow =

Downstream L&D No. = 10

Headwater Elev. =

Flow =

Other water surface elev. data in pool

Estimated water surface elev. at site

Flow velocity (location, depth, fps)

Location type (check all applicable)

main channel ___
side channel inlet ___
backwater channel ___
backwater lake ___
head of island or peninsula ___
outside of channel bend ___
inside of channel bend ___
straight reach of channel ___
________________ ___

Proposed length of stabilization

Wing or closing dams in area

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water: 1V on ___ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ___ H

Photo numbers

Fetch direction(s)

Length

Site alignment with respect to fetch direction

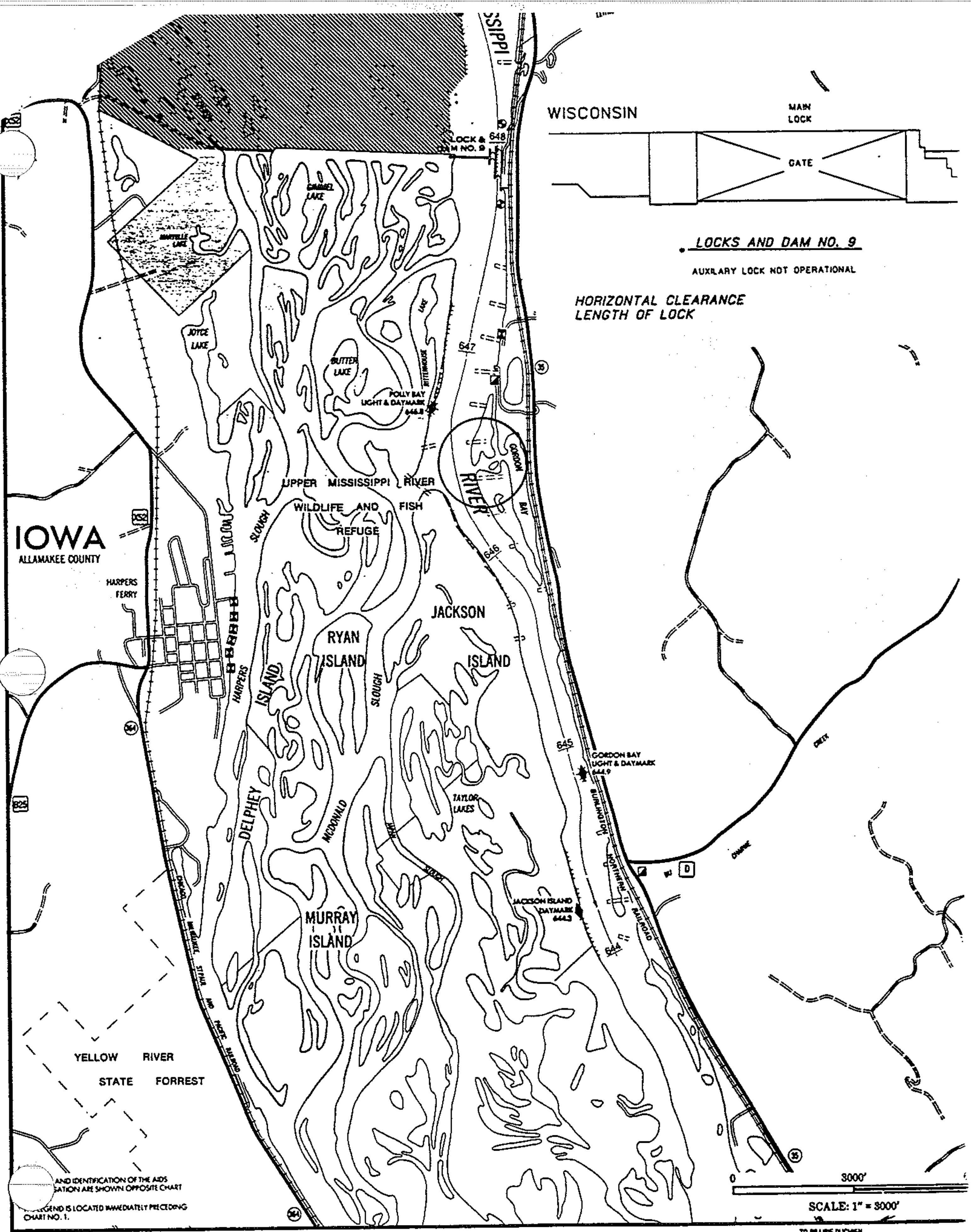
Names of investigators

(R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell | Besele | Janvrin |
| Hendrickson | Lyons | Ackerman |
| Kean | | Rosclund |
| Fasbender | | |

| Observations | Site Number 10-646.5-L |
|---|---|

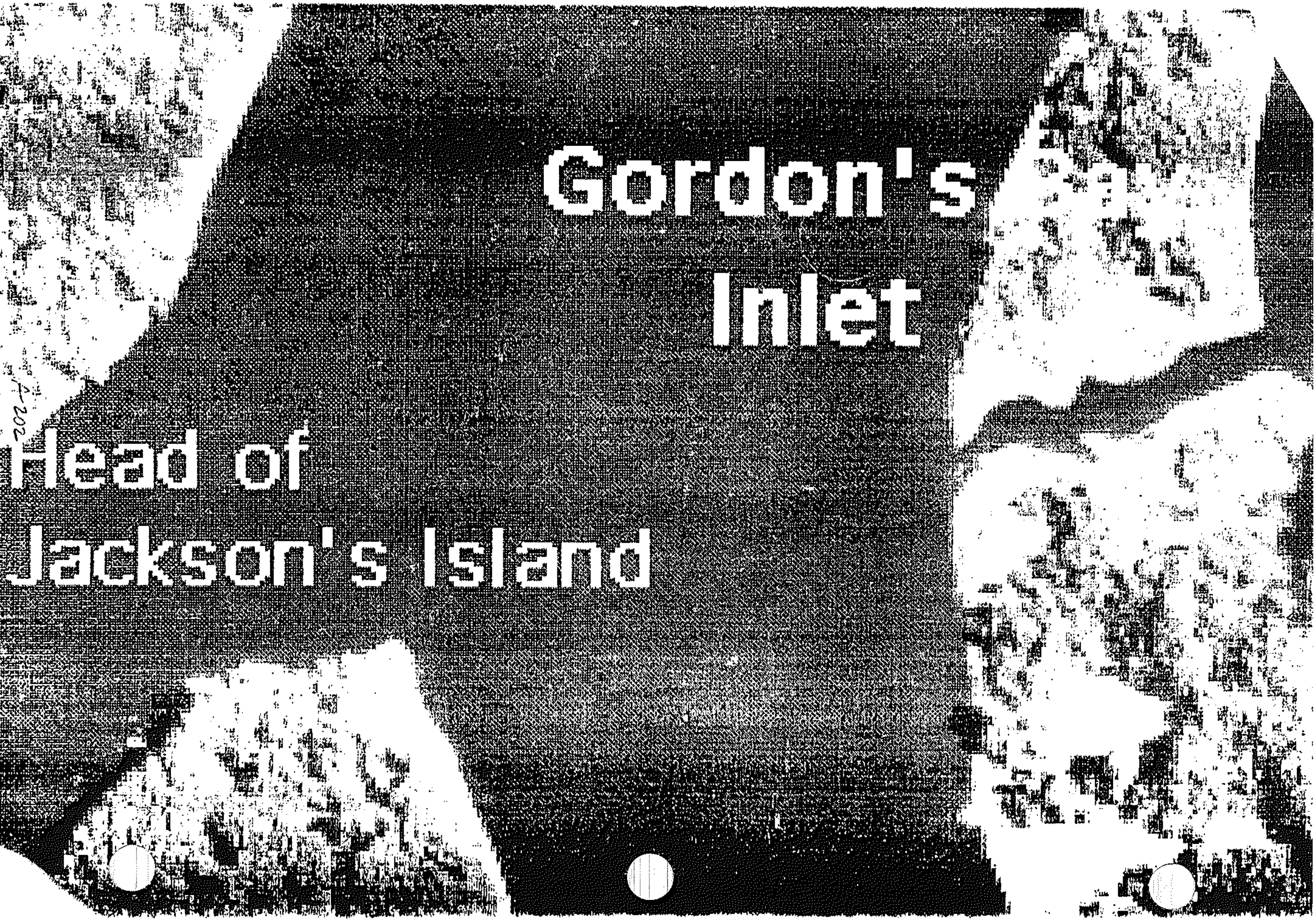
| | | | |
|---|---|---|---|
| Bank material: clay ___ | silt ___ | topsoil ___ | (f) (c) sand ___ |
| (f) (m) (c) gravel ___ | cobbles ___ | other info: | |
| Existing bank protection? | | | |
| Apparent causes of erosion: | river flows ___ | wind waves ___ | boat waves ___ |
| (number in order of cause) | prop wash ___ | ___________ ___ | ice action ___ |
| Estimated rate of erosion or erodibility (low, moderate, high) (future rate) | | | |
| Source of local sediment transport (upstream, none) | | | |
| Bottom material | | | |
| Existing vegetation: | nearshore – | | |
| (density, type) | shoreline – | | |
| | bank – | | |
| | top of bank – | | |
| Trees (fallen, species, size range, average size, location, number) | | | |
| Habitat type and species impacted by continued erosion | | | |
| Quality of affected habitat (low, medium, high) | | | |
| Area protected by island (shadow zone) | | | |
| Other impacts of erosion (future conditions) | | | |
| Type(s) of stabilization proposed | | | |
| Other type(s) of stabilization possible | | | |
| Fill required? | Source? | | |
| Bank shaping required? | | | |
| Construction access considerations or problems? | | | |
| Cultural resources? | | | |
| Other information Non-Federal. | | | |




MILE 644 TO MILE 650

A-201

A-202



# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| Billy Slough | 10 – 646.4 – R |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 6-23-92 | 9:00 | (A) 9/10/89 (49-12) (M) |

| | | |
|---|---|---|
| Upstream L&D No. = 9 | Tailwater Elev. = 15[illegible] | Flow = 35[illegible] |
| Downstream L&D No. = 10 | Headwater Elev. = 11.3 | Flow = 47000 |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| 15.[illegible] | 38000 |

Location type (check all applicable)

main channel ___
side channel inlet ___
backwater channel ✓
backwater lake ___
head of island or peninsula ___
outside of channel bend ___
inside of channel bend ___
straight reach of channel ___
_______________ ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| | |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / [illegible] | [illegible] / [illegible] | [illegible] / [illegible] | / | / |
| 7 / [illegible] | [illegible] / [illegible] | [illegible] / [illegible] | / | / |
| 14 / [illegible] | [illegible] / [illegible] | [illegible] / [illegible] | / | / |
| 14 / [illegible] | 2 / [illegible] | 2.[illegible] / [illegible] | / | / |
| / | [illegible] / [illegible] | [illegible] / [illegible] | / | / |
| / | / | [illegible] / [illegible] | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface) 2'

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Jon Hendrickson | John Lyons - McGregor | Art Roseland - IDNR |
| Pete Fasbender | | Gary Ackerman - " |
| Al Kean | | |

| Observations | Site Number 10-64.6.4-R |
|---|---|

Bank material: clay ___ silt ___ topsoil ✓ 0.5-1.0 (f) (c) sand ✓
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? no

Apparent causes of erosion: river flows 1 wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –
(density, type) shoreline –
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion
Harpers Slough is currently being impacted by the erosion of this site and the introduction of bed load. Important habitat includes diverse mussel beds and nursery areas for the fisheries

Quality of affected habitat (low, medium, high)
again important fish nursery and v. important mussel habitat (Lampsilis) wash

Area protected by island (shadow zone)
important backwater areas

Other impacts of erosion (future conditions)
increased sedimentation by movement of bedload

Type(s) of stabilization proposed
rock protection across the face

Other type(s) of stabilization possible
just upstream of the main blow-out, there is another erosion site where action may be warranted.

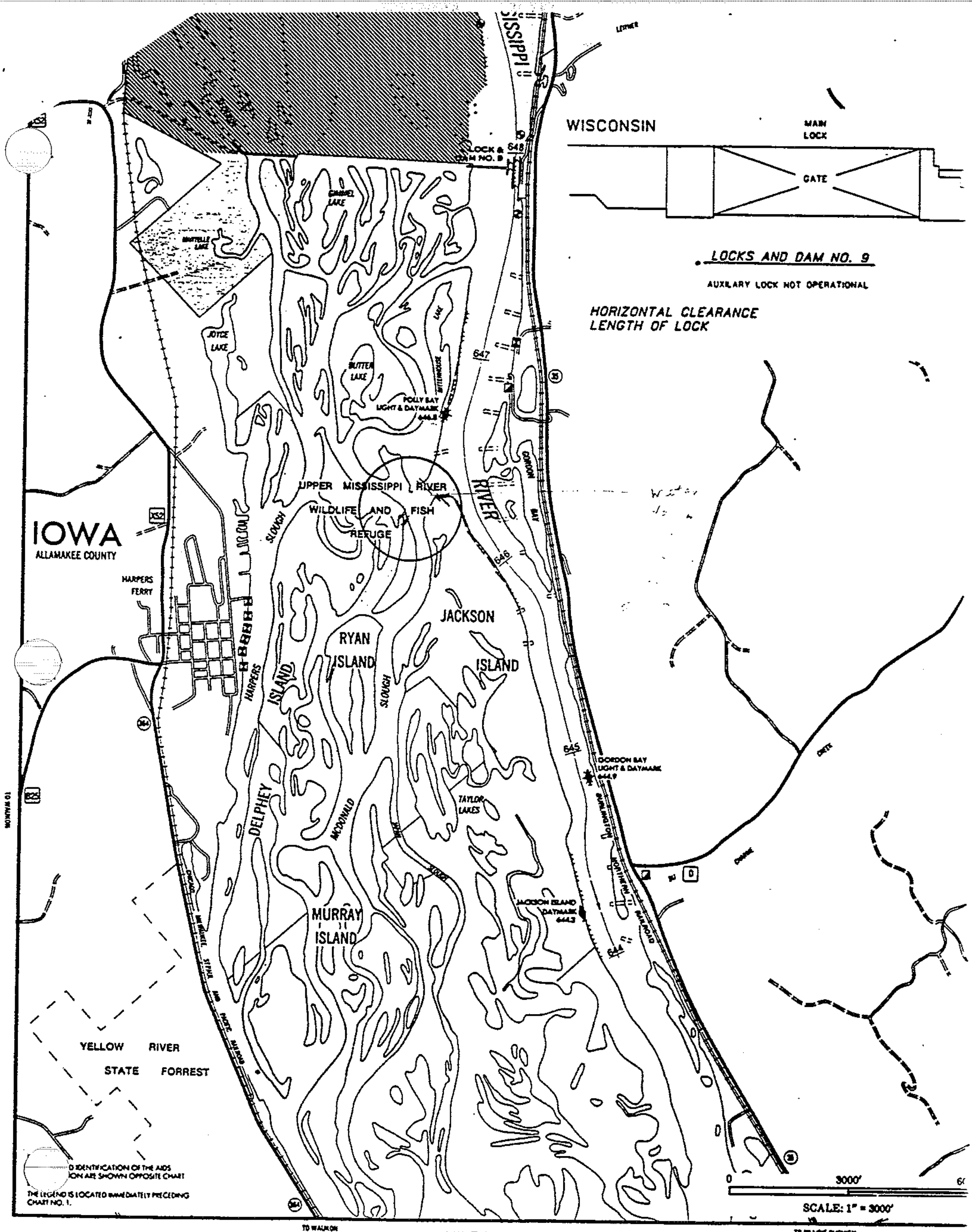
Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information

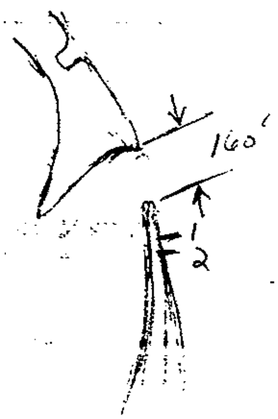



MILE 644 TO MILE 650

A-205

**Site Sketches** | **Site Number** 10-646.4-R

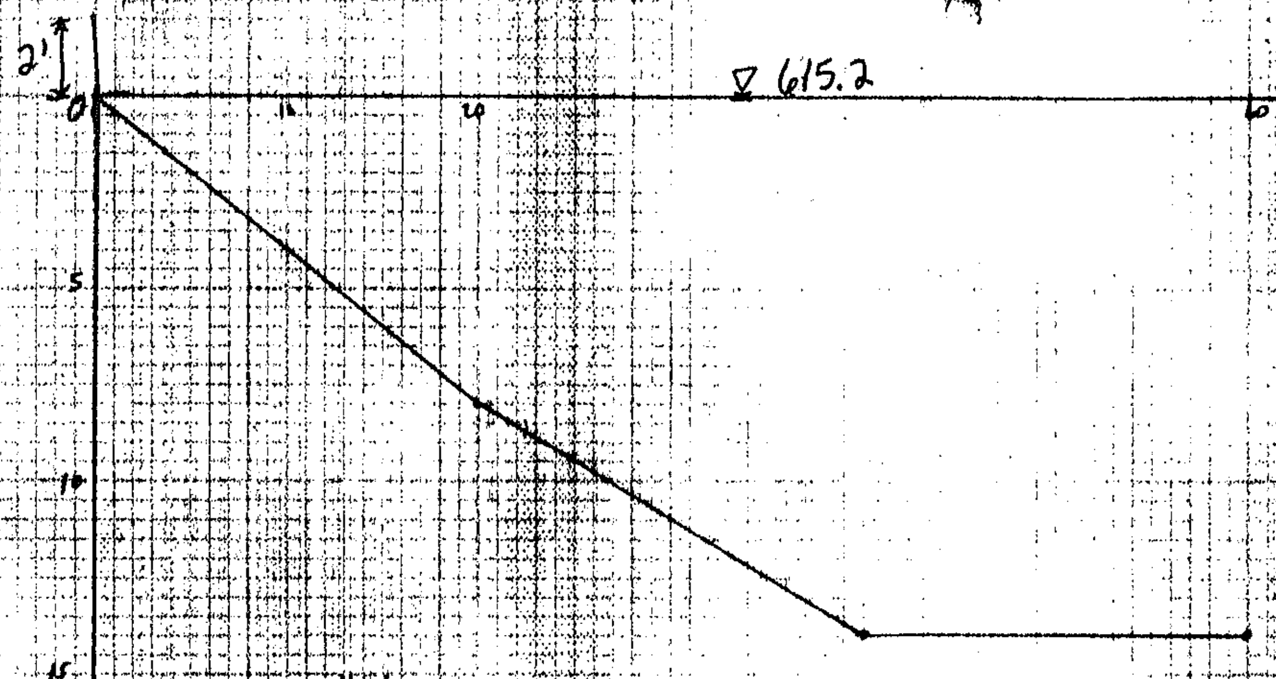
### Plan view



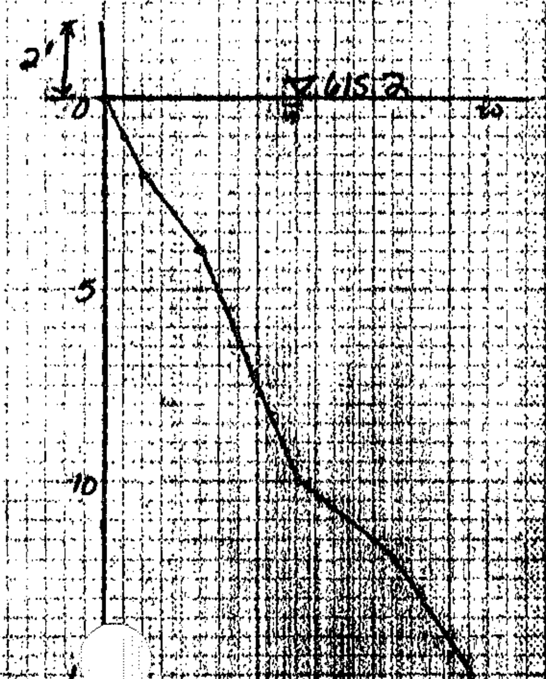

Ave. depth ≃ 15'

### Typical bank cross-section

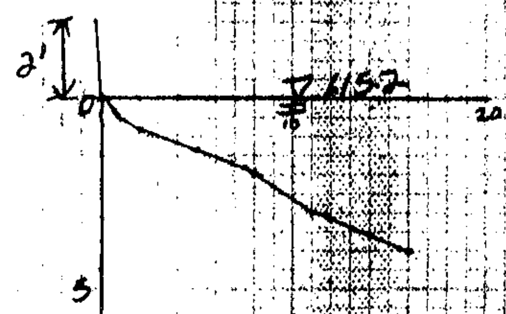
A-207




#1




#2




#3

A-208

PRIVATE

# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name Jackson Island | | Site number (pool–river mile–l/r bank) 10-644.3-L | |
| Date investigated 6-23-92 | Time | Year(s) of aerial photos (A) or maps (M) available (A) 9/10/89 (49-14) (M) | |
| Upstream L&D No. = 9 | Tailwater Elev. = | Flow = | |
| Downstream L&D No. = 10 | Headwater Elev. = | Flow = | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site | | Flow velocity (location, depth, fps) | |

Location type (check all applicable)

main channel ___ backwater lake ___ inside of channel bend ___
side channel inlet ___ head of island or peninsula ___ straight reach of channel ___
backwater channel ___ outside of channel bend ___ ______ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell | Beseke | Janvrin |
| Fasbender | Lyons | Ackerman |
| Hendrickson | | Roseland |
| Kean | | |

Observations

Site Number 10-644.3-L

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –
(density, type) shoreline –
bank –
top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

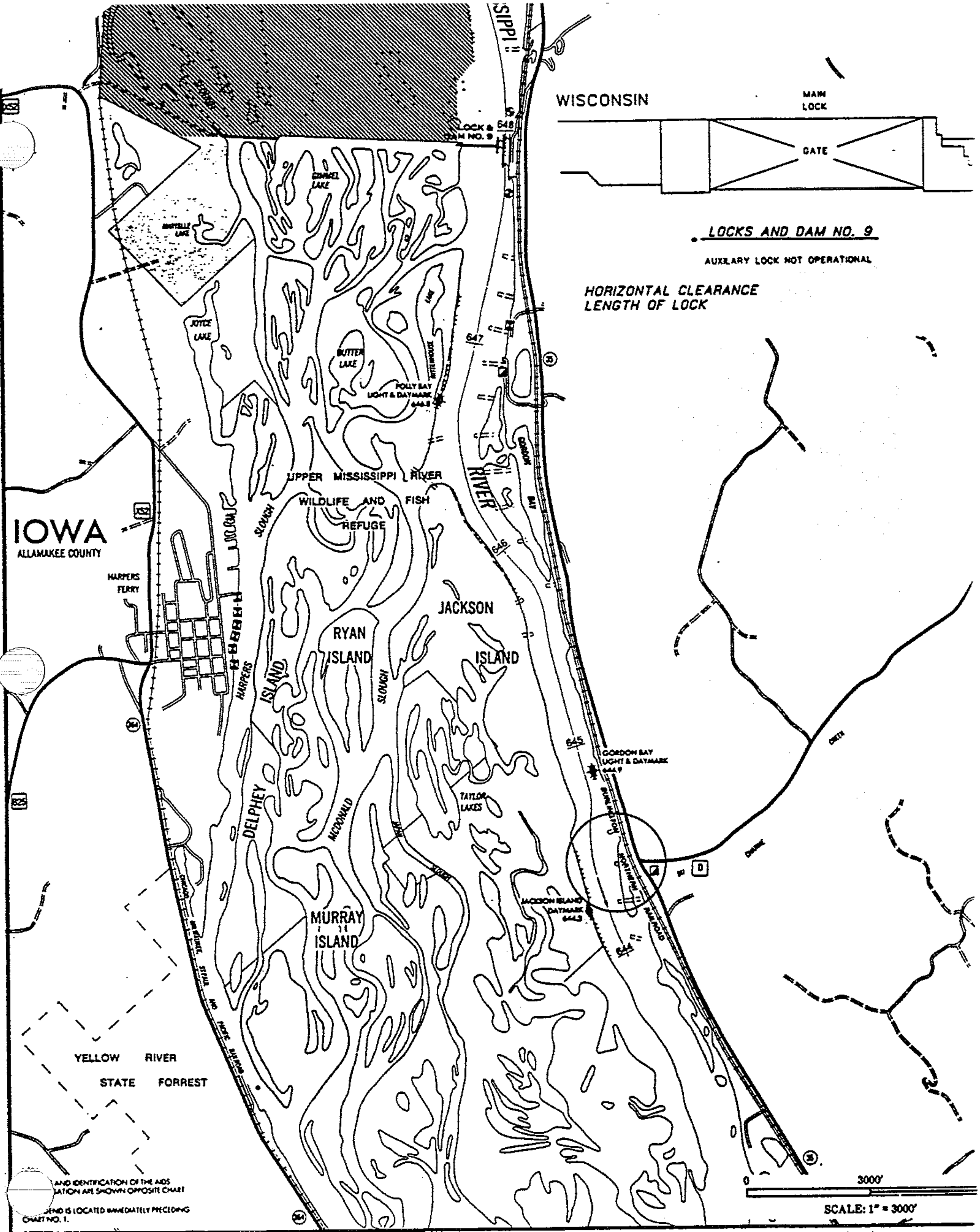
Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

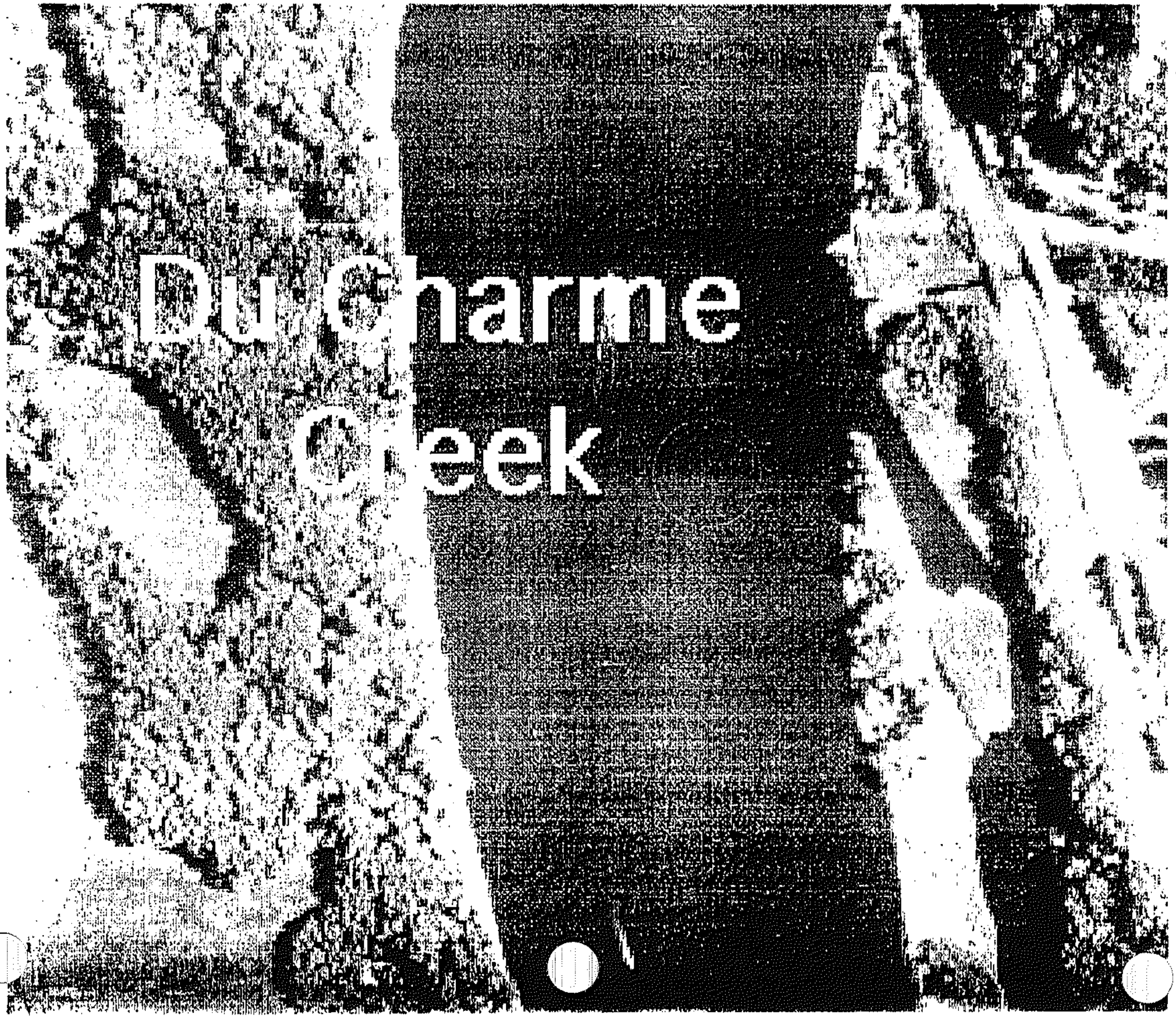
Cultural resources?

Other information Non-Federal.




MILE 644 TO MILE 650

A-211




A-212

PRIVATE

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | | Site number (pool–river mile–l/r bank) |
|---|---|---|
| Gordon Bay Upper Daymark | | 10 – 643.1 – L |
| Date investigated 6-23-94 | Time | Year(s) of aerial photos (A) or maps (M) available (A) 9/10/89 (49-14) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = | Flow = |
| Downstream L&D No. = 10 | Headwater Elev. = | Flow = |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|

Location type (check all applicable)

main channel ___ backwater lake ___ inside of channel bend ___
side channel inlet ___ head of island or peninsula ___ straight reach of channel ___
backwater channel ___ outside of channel bend ___ ______________ ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on _____ H

Water depth at toe of bank

Nearshore bottom slope 1V on _____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell | Beseke | Janvrin |
| Hendrickson | Lyons | Ackerman |
| Fasbender | | Roseland |
| Kean | | |

Observations

Site Number 10-643.1-L

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ___

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore –

(density, type) shoreline –

bank –

top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

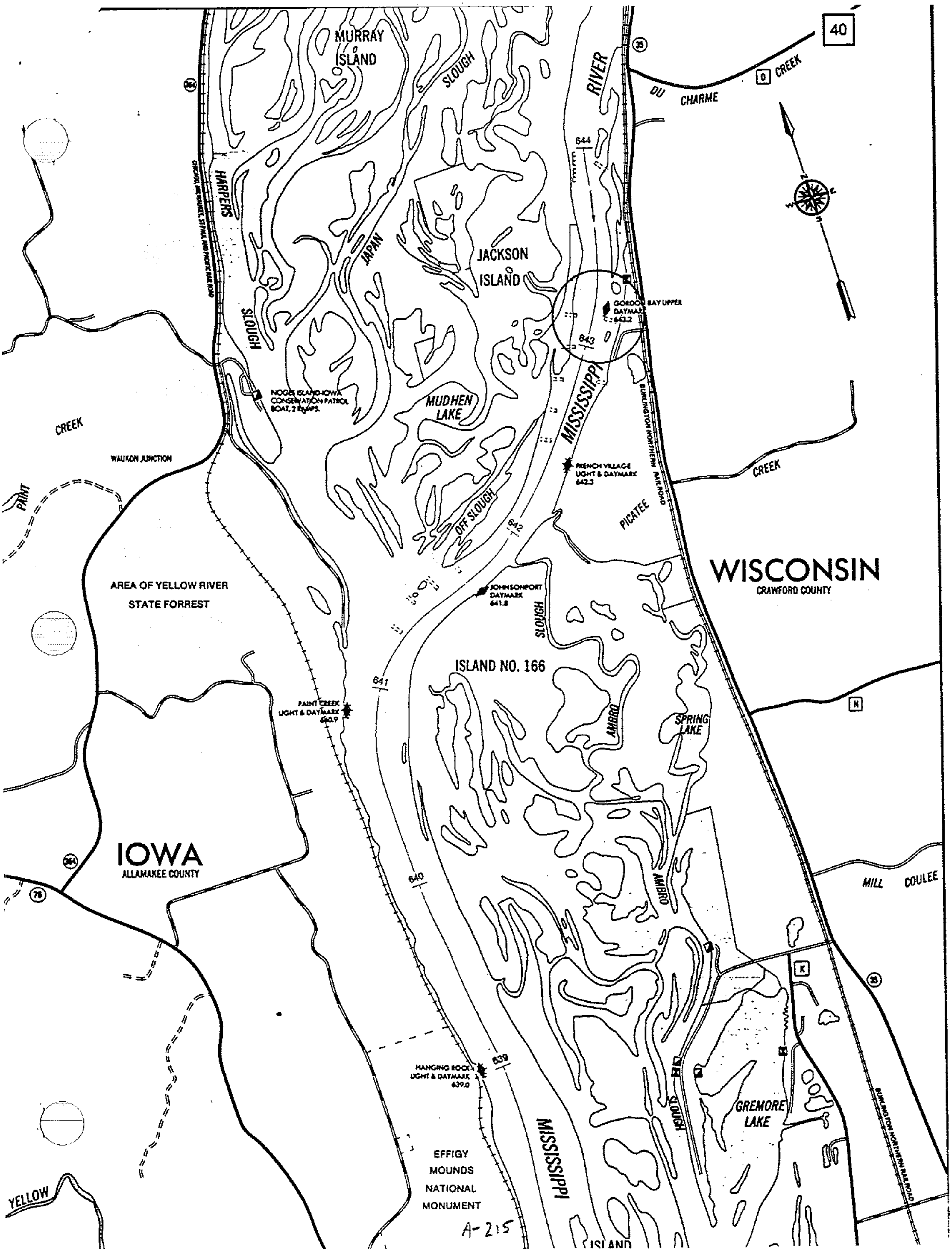
Fill required? Source?

Bank shaping required?

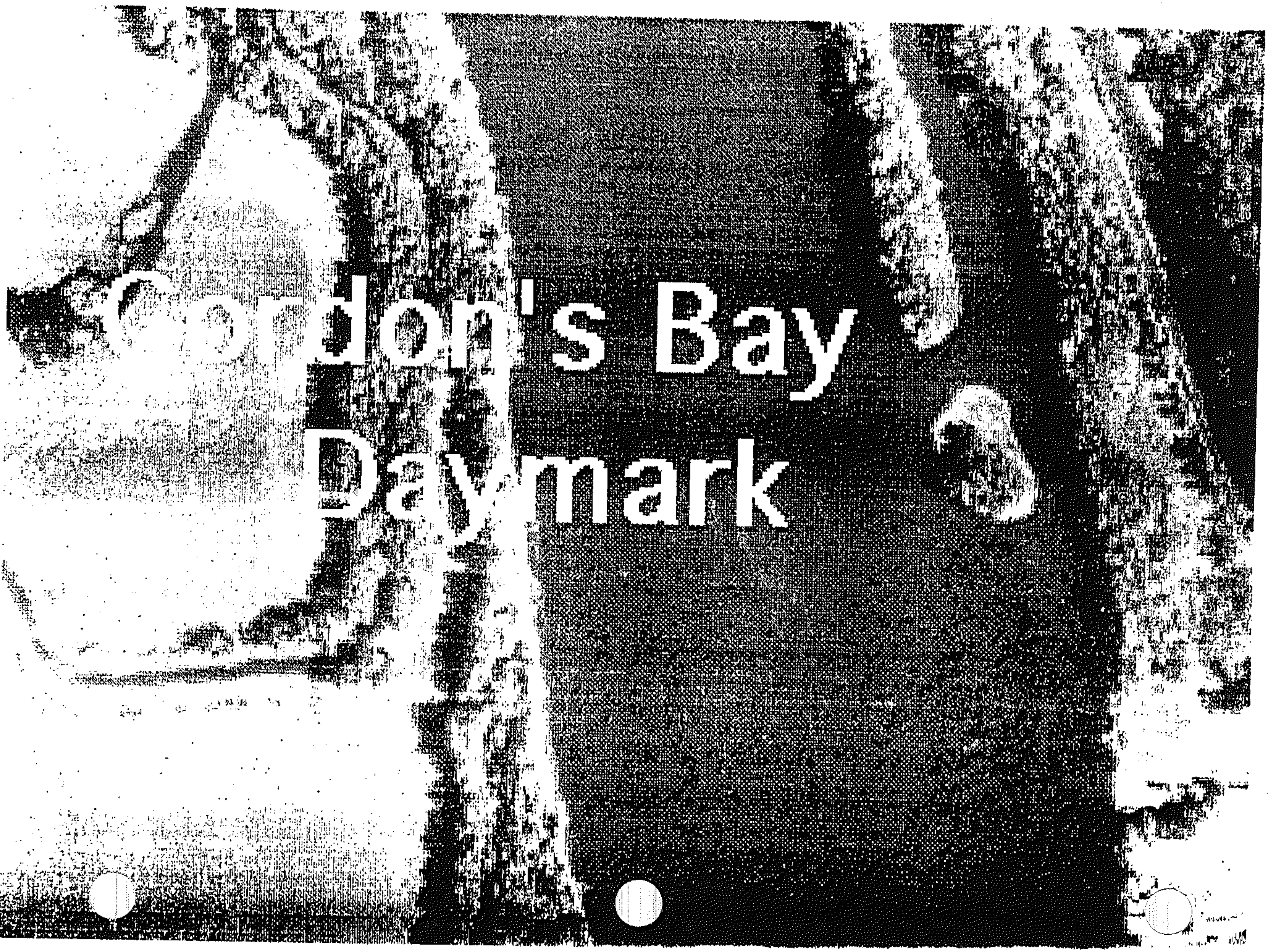
Construction access considerations or problems?

Cultural resources?

Other information Non-Federal


MURRAY ISLAND
SLOUGH
RIVER
DU CHARME CREEK
D
35
364
644
HARPERS SLOUGH
CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC RAILROAD
JAPAN
JACKSON ISLAND
SLOUGH
BAY UPPER DAYMARK 643.2
643
BOAT, 2
MUDHEN LAKE
MISSISSIPPI
CREEK
WAUKON JUNCTION
FRENCH VILLAGE LIGHT & DAYMARK 642.3
BURLINGTON NORTHERN RAILROAD
CREEK
PAINT
PICATEE
OFF SLOUGH
642
WISCONSIN
CRAWFORD COUNTY
AREA OF YELLOW RIVER
STATE FORREST
JOHNSONPORT DAYMARK 641.8
SLOUGH
ISLAND NO. 166
641
PAINT CREEK LIGHT & DAYMARK 640.9
AMBRO
SPRING LAKE
K
IOWA
ALLAMAKEE COUNTY
364
76
640
AMBRO
MILL COULEE
K
35
HANGING ROCK LIGHT & DAYMARK 639.0
639
SLOUGH
GREMORE LAKE
BURLINGTON NORTHERN RAILROAD
EFFIGY MOUNDS NATIONAL MONUMENT
MISSISSIPPI
YELLOW
ISLAND

A-215




A-216

## Mississippi River Bank Stabilization EMP Habitat Project

### Field Investigation Data

| | |
|---|---|
| Site Name: Island No. 166 | Site number (pool–river mile–l/r bank): 10-641.1-L |

| | | |
|---|---|---|
| Date investigated: 6-23-92 | Time: 8:30 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/10/89 (49-18) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.6 | Flow = 35000 |
| Downstream L&D No. = 10 | Headwater Elev. = 11.3 | Flow = 47000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site: 14.5 | Flow velocity (location, depth, fps): 45000 |

Location type (check all applicable)

main channel ✓
side channel inlet ___
backwater channel ___
backwater lake ___
head of island or peninsula ___
outside of channel bend ___
inside of channel bend ✓
straight reach of channel ✓
___________________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 2'-4'

Slope length above water

Slope above water: 1V on - H

Water depth at toe of bank

Nearshore bottom slope: 1V on _____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Dan Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| [illegible] Kean | John Lyons - McGregor | ~~[illegible]~~ " |
| [illegible] Fasbender | | Gary Ackerman - IDNR |
| Jim Hendrickson | | Art Roseland - " |

Observations

Site Number 10-641.1-L

Bank material: clay ___ silt ___ topsoil ___ (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info: appears to be dredge sand on top of island

Existing bank protection? yes, at upstream end

Apparent causes of erosion: river flows 1 wind waves 2 boat waves 3

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: nearshore - none

(density, type) shoreline - tree roots, trees

bank - " "

top of bank - trees

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone) parallel sloughs & floodplain forest

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed groins with some beach nourishment?

Other type(s) of stabilization possible revetment

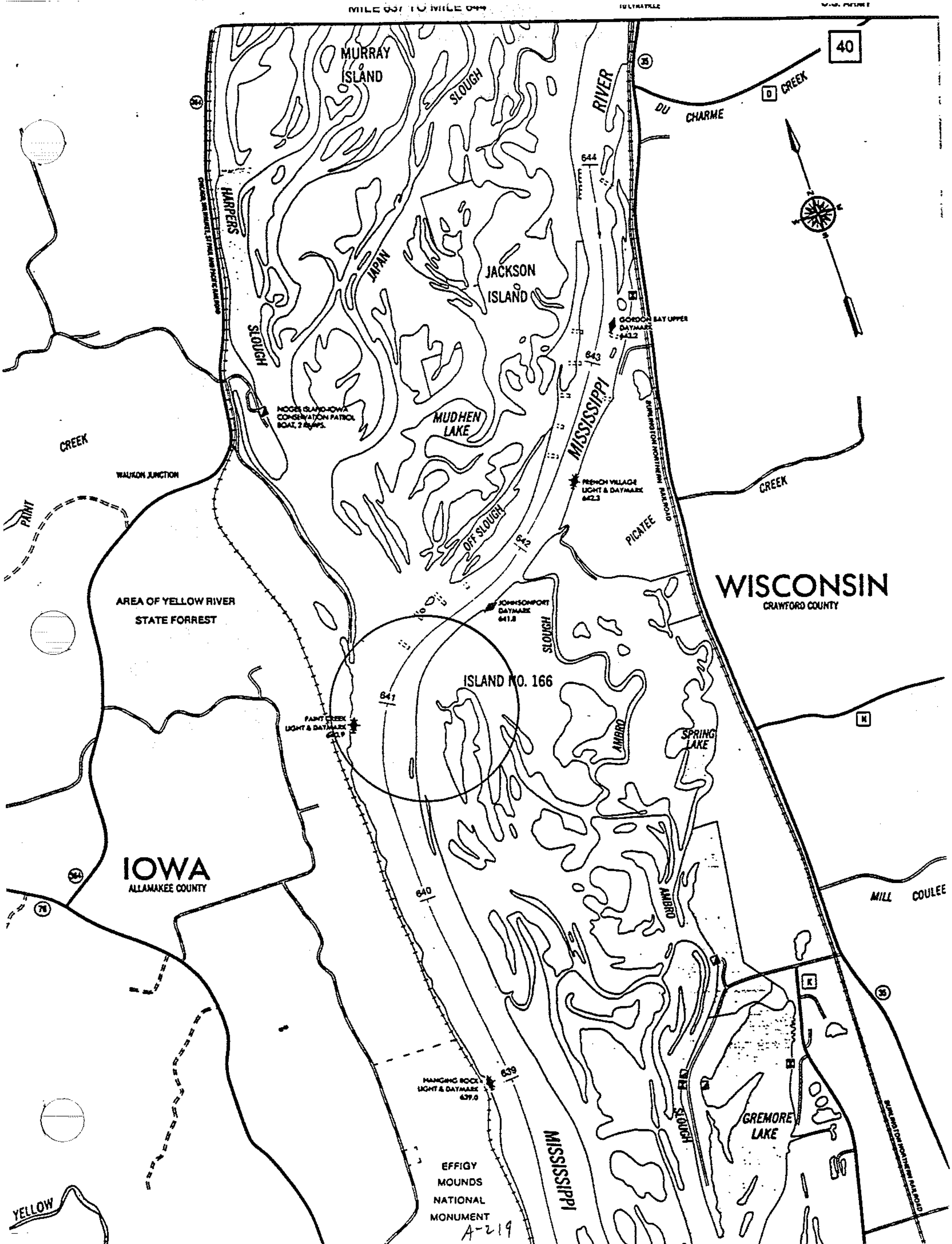
Fill required? Source?
No

Bank shaping required? No

Construction access considerations or problems? water depths appear to be good (>4' up to approx. 30' from shore)

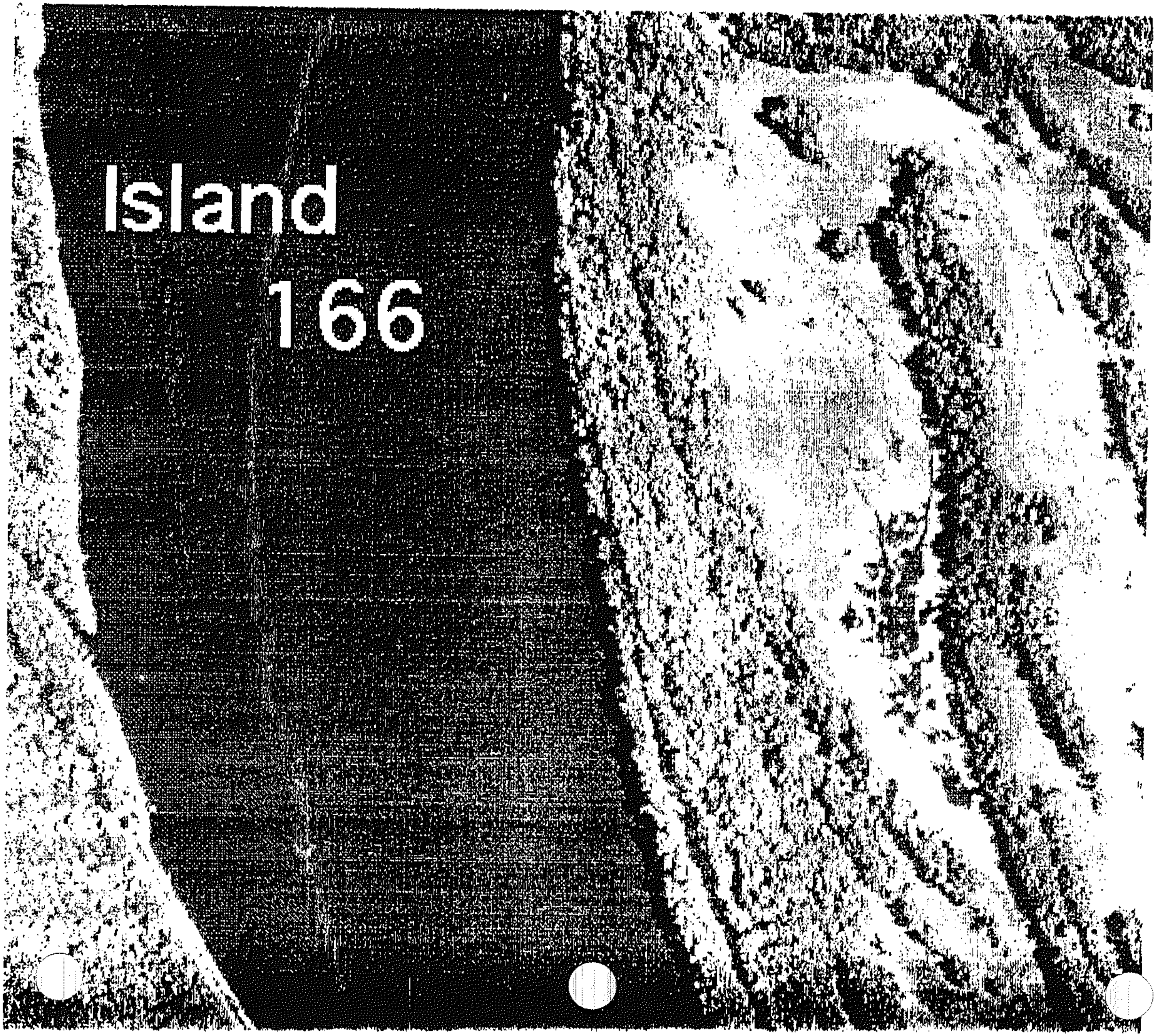
Cultural resources?

Other information



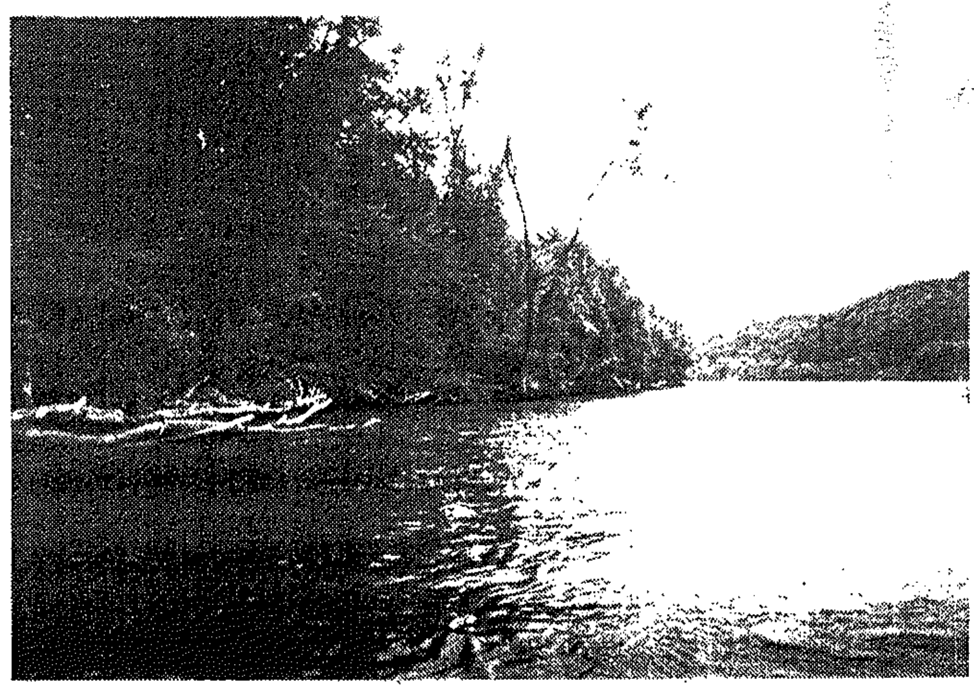
40
MURRAY ISLAND
SLOUGH
RIVER
DU CHARME CREEK
D
HARPERS SLOUGH
JAPAN
JACKSON ISLAND
644
GORDON BAY UPPER DAYMARK
643
MUDHEN LAKE
MISSISSIPPI
CREEK
WAUKON JUNCTION
PAINT
FRENCH VILLAGE LIGHT & DAYMARK
CREEK
PICATEE
OFF SLOUGH
642
WISCONSIN
CRAWFORD COUNTY
AREA OF YELLOW RIVER
STATE FORREST
JOHNSONPORT DAYMARK 641.8
SLOUGH
ISLAND NO. 166
641
K
AMBRO
SPRING LAKE
IOWA
ALLAMAKEE COUNTY
640
AMBRO
MILL COULEE
K
HANGING ROCK LIGHT & DAYMARK 639.0
639
SLOUGH
GREMORE LAKE
MISSISSIPPI
EFFIGY
MOUNDS
NATIONAL
MONUMENT
YELLOW


A-219




A-220

4221



# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | |
|---|---|
| Site Name Roseau Slough ~~Head of Scrogum Island (Isl. 169)~~ | Site number (pool–river mile–l/r bank) 10 – 637.8 – L |

| | | |
|---|---|---|
| Date investigated 6-22-92 | Time 4:30 | Year(s) of aerial photos (A) or maps (M) available (A) 9/10/89 (60-5) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.3 | Flow = 40000 |
| Downstream L&D No. = 10 | Headwater Elev. = 11.4 | Flow = 41000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site 14.1 | Flow velocity (location, depth, fps) 42000 |

Location type (check all applicable)

- main channel ✓
- side channel inlet ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ✓
- ______ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | 1.0 / 1.5 | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| 3 / | / | / | / | / |
| / | / | / | / | / |
| 7 / | 2 / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface) 2'-3'

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Pete Fasbender | John Lyons - McGregor | Kurt Welke - " |
| Jon Hendrickson | | Gary Ackerman - IDNR |
| Al Kean | | Art Roseland - " |

Observations

Site Number 10- 637.8 -L

| | | | |
|---|---|---|---|
| Bank material: clay ___ | silt ___ | topsoil ✓ | (f) (c) sand ✓ |
| (f) (m) (c) gravel ___ | cobbles ___ | other info: | |
| Existing bank protection? | | | |
| Apparent causes of erosion: | river flows 1 | wind waves 3 | boat waves ___ |
| (number in order of cause) | prop wash ___ | ___ ___ | ice action 2 |

Estimated rate of erosion or erodibility (low, ~~moderate~~, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material Sand

Existing vegetation: (density, type)
- nearshore –
- shoreline –
- bank –
- top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

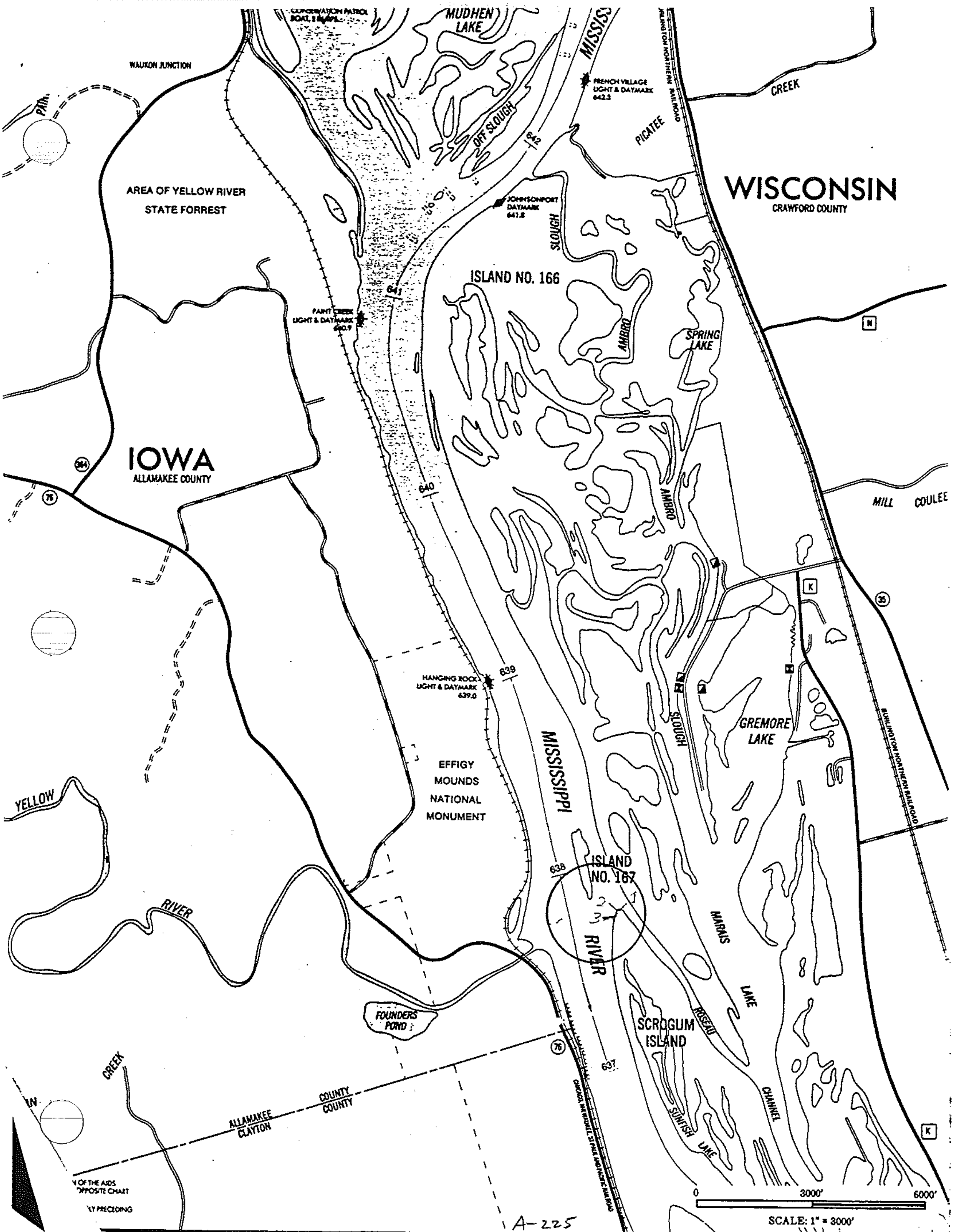
Fill required? Source?

Bank shaping required?

Construction access considerations or problems? relatively shallow nearshore

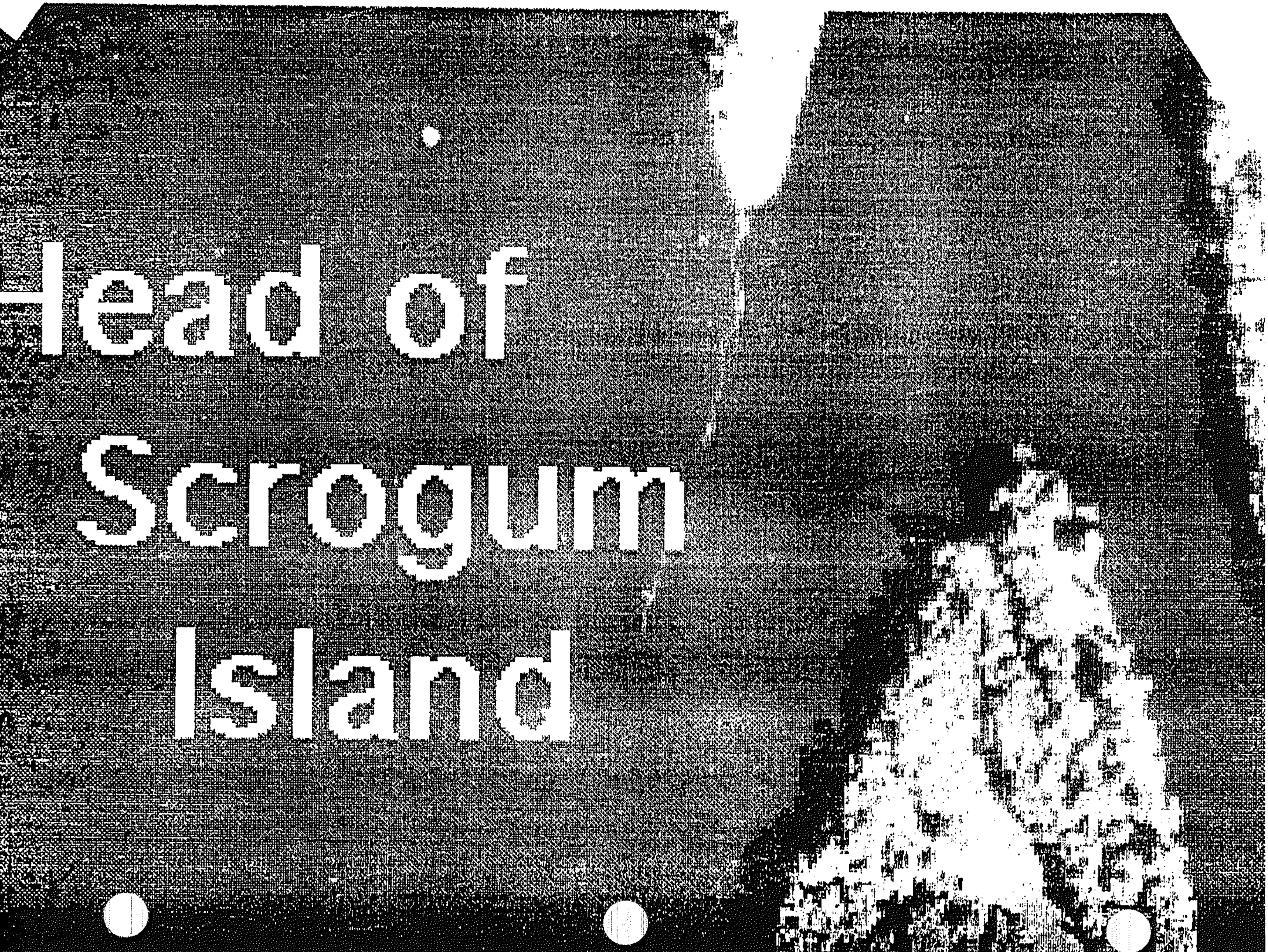
Cultural resources?

Other information

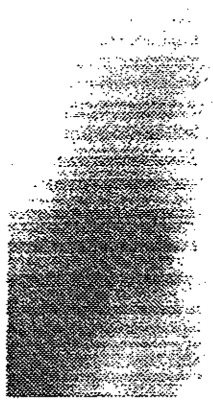


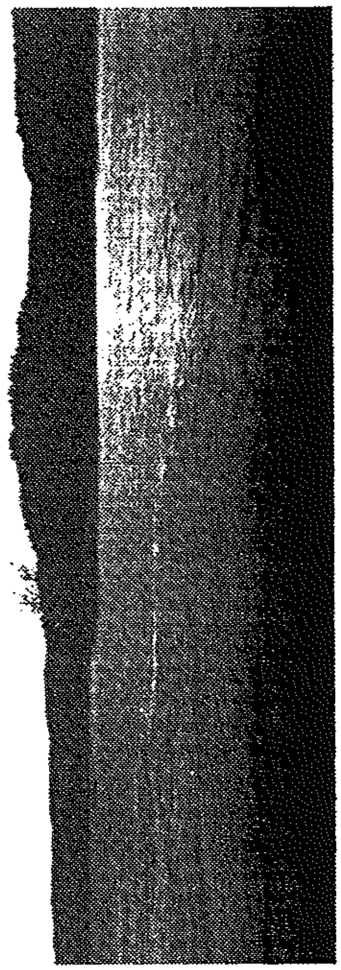
MUDHEN LAKE
MISSISSIPPI
WAUKON JUNCTION
FRENCH VILLAGE LIGHT & DAYMARK 642.3
CREEK
OFF SLOUGH
642
PICATEE
WISCONSIN
CRAWFORD COUNTY
AREA OF YELLOW RIVER STATE FORREST
JOHNSONPORT DAYMARK 641.8
SLOUGH
ISLAND NO. 166
641
PAINT CREEK LIGHT & DAYMARK 640.9
AMBRO
SPRING LAKE
IOWA
ALLAMAKEE COUNTY
640
AMBRO
MILL COULEE
HANGING ROCK LIGHT & DAYMARK 639.0
639
MISSISSIPPI
SLOUGH
GREMORE LAKE
EFFIGY MOUNDS NATIONAL MONUMENT
BURLINGTON NORTHERN RAILROAD
YELLOW
638
ISLAND NO. 167
RIVER
MARAIS
RIVER
LAKE
FOUNDERS POND
SCROGUM ISLAND
ROSEAU
CREEK
637
CHANNEL
SUNFISH LAKE
ALLAMAKEE COUNTY
CLAYTON COUNTY
0
3000′
6000′
SCALE: 1″ = 3000′


A-225




A-226





# Mississippi River Bank Stabilization EMP Habitat Project

Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name East Channel ~~Scrogum Island (Est. 169)~~ | | Site number (pool–river mile–l/r bank) 10-636.4-L | |
| Date investigated 6-22-92 | Time 4:00 | Year(s) of aerial photos (A) or maps (M) available (A) 9/10/89 (50-6) (M) | |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.3 | Flow = 41000 | |
| Downstream L&D No. = 10 | Headwater Elev. = 11.4 | Flow = 41000 | |
| Other water surface elev. data in pool | | | |
| Estimated water surface elev. at site 13.9 | | Flow velocity (location, depth, fps) 43000 | |

Location type (check all applicable)

| | | |
|---|---|---|
| main channel ✓ | backwater lake ___ | inside of channel bend ___ |
| side channel inlet ___ | head of island or peninsula ___ | straight reach of channel ✓ |
| backwater channel ___ | outside of channel bend ___ | ____________ ___ |

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Depth 1 Dist | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| [illegible] / [illegible] | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| 4 / [illegible] | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| 7 / [illegible] | / | / | / | / |

Height of bank (top of bank to water surface) 1.5'-2'

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

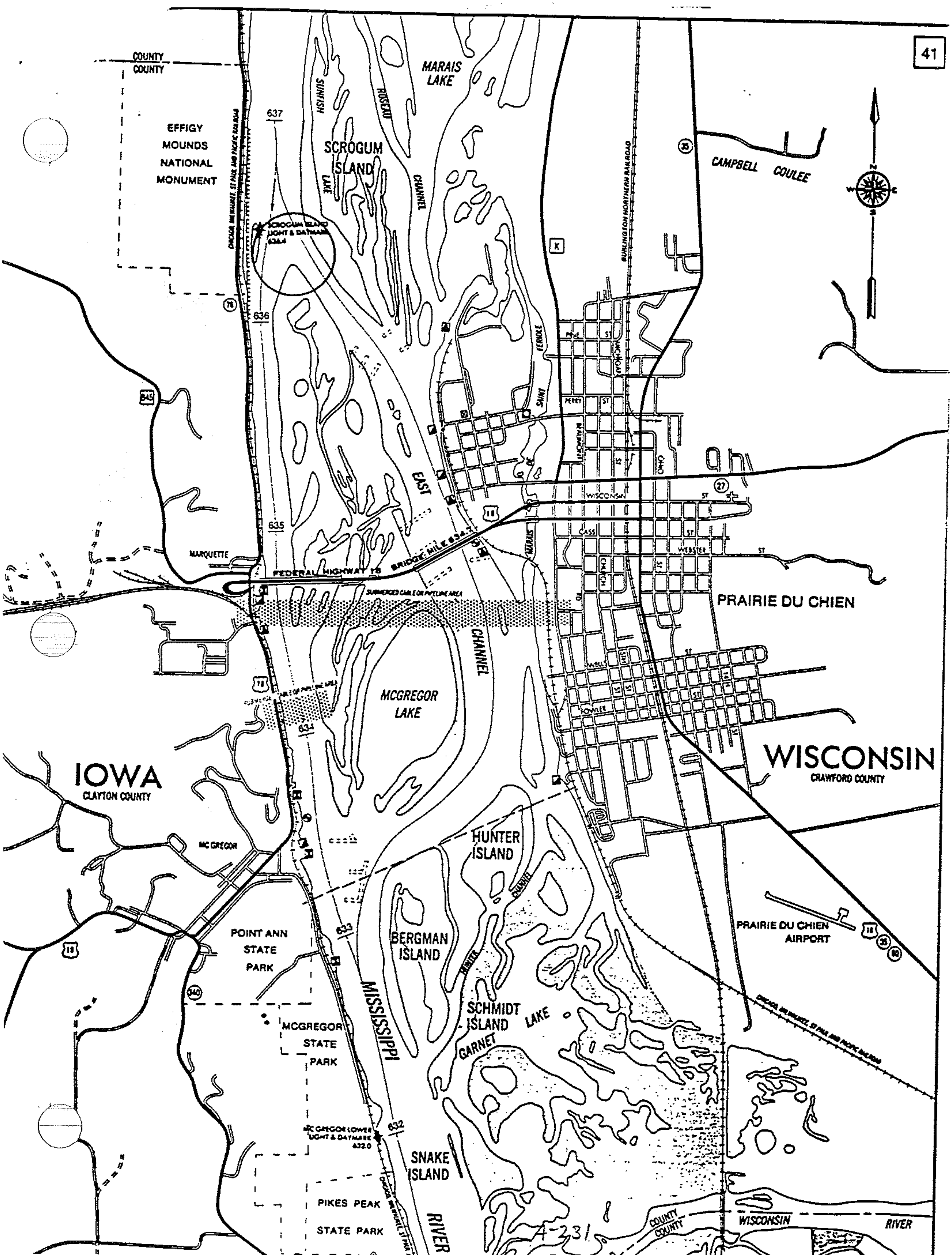
| | |
|---|---|
| Photo numbers | Fetch direction(s) Length |
| | Site alignment with respect to fetch direction |

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Pete Fasbender | John Lyons - McGregor | Kurt Welke - " |
| Jon Hendrickson | | Art Roseland - IDNR |
| Al Kean | | Gary Ackerman - " |

| Observations | Site Number 10-636.4-L |
|---|---|

| | | | |
|---|---|---|---|
| Bank material: clay ___ | silt ___ | topsoil ✓ | (f) (c) sand ✓ |
| (f) (m) (c) gravel ___ | cobbles ___ | other info: | |
| Existing bank protection? | | | |
| Apparent causes of erosion: | river flows 2 | wind waves ___ | boat waves 1 |
| (number in order of cause) | prop wash ___ | ___ ___ | ice action ___ |
| Estimated rate of erosion or erodibility (low, moderate, high) (future rate) | | | |
| Source of local sediment transport (~~upstream, none~~) | | | |
| Bottom material Sand | | | |
| Existing vegetation: | nearshore – | | |
| (density, type) | shoreline – | | |
| | bank – | | |
| | top of bank – | | |
| Trees (fallen, species, size range, average size, location, number) | | | |
| Habitat type and species impacted by continued erosion | | | |
| Quality of affected habitat (low, medium, high) | | | |
| Area protected by island (shadow zone) | | | |
| Other impacts of erosion (future conditions) | | | |
| Type(s) of stabilization proposed | | | |
| Other type(s) of stabilization possible | | | |
| Fill required? | Source? | | |
| Bank shaping required? | | | |
| Construction access considerations or problems? | | | |
| Cultural resources? | | | |
| Other information | | | |


41
COUNTY
COUNTY
EFFIGY
MOUNDS
NATIONAL
MONUMENT
SUNFISH
LAKE
ROSEAU
CHANNEL
MARAIS
LAKE
SCROGUM
ISLAND
637
636
635
634
633
632
SCROGUM ISLAND
LIGHT & DAYMARK
634.4
CAMPBELL COULEE
BURLINGTON NORTHERN RAILROAD
FERRIOLE
SAINT
PINE ST
MICHIGAN
PERRY ST
BEAUMONT
OHIO
EAST
CHANNEL
WISCONSIN ST
CASS ST
WEBSTER ST
CHURCH
MARAIS
MARQUETTE
FEDERAL HIGHWAY 18 BRIDGE MILE 634.7
SUBMERGED CABLE OR PIPELINE AREA
PRAIRIE DU CHIEN
WELLS
FOWLER
MCGREGOR
LAKE
IOWA
CLAYTON COUNTY
WISCONSIN
CRAWFORD COUNTY
MC GREGOR
HUNTER
ISLAND
POINT ANN
STATE
PARK
BERGMAN
ISLAND
PRAIRIE DU CHIEN
AIRPORT
SCHMIDT
ISLAND
LAKE
GARNET
MCGREGOR
STATE
PARK
MISSISSIPPI
RIVER
CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC RAILROAD
MC GREGOR LOWER
LIGHT & DAYMARK
632.0
SNAKE
ISLAND
PIKES PEAK
STATE PARK
COUNTY
COUNTY
WISCONSIN
RIVER
4-231


A-232

A-233

Gone

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| Snake Island | 10-631.8-L |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 6-22-92 | | (A) 9/10/89 (50-12) (M) |

| | | |
|---|---|---|
| Upstream L&D No. = 9 | Tailwater Elev. = | Flow = |
| Downstream L&D No. = 10 | Headwater Elev. = | Flow = |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| | |

Location type (check all applicable)

| | | |
|---|---|---|
| main channel ___ | backwater lake ___ | inside of channel bend ___ |
| side channel inlet ___ | head of island or peninsula ___ | straight reach of channel ___ |
| backwater channel ___ | outside of channel bend ___ | ___ |

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| | |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

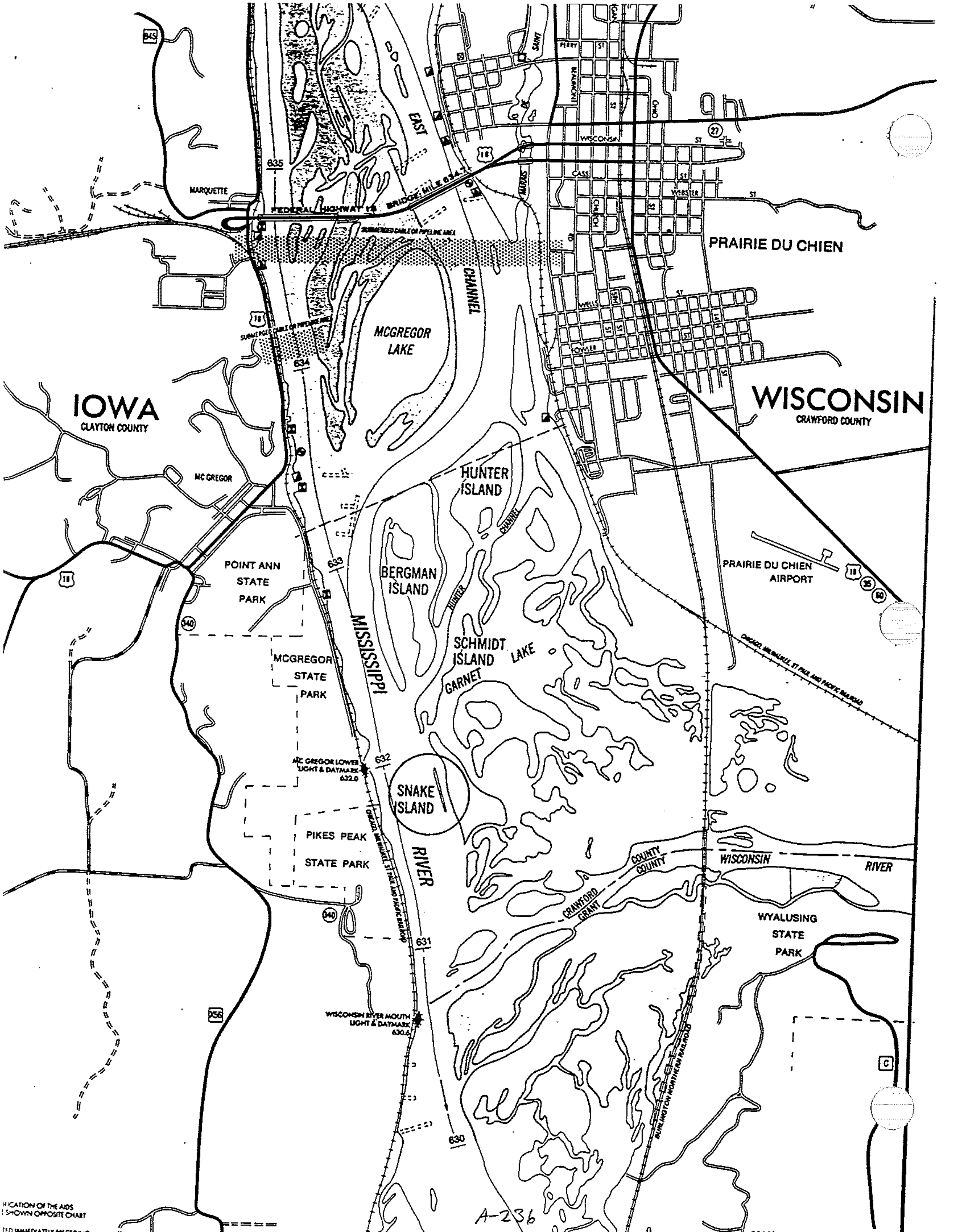
Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell | Besecke | Ackerman |
| Fasbender | Lyons | Roseland |
| Kean | | Janvrin |
| Hendrickson | | Welke |



IOWA
CLAYTON COUNTY
WISCONSIN
CRAWFORD COUNTY
PRAIRIE DU CHIEN
MARQUETTE
MC GREGOR
FEDERAL HIGHWAY 18 BRIDGE MILE 634.7
SUBMERGED CABLE OR PIPELINE AREA
EAST
CHANNEL
MCGREGOR
LAKE
HUNTER
ISLAND
BERGMAN
ISLAND
SCHMIDT
ISLAND
GARNET
LAKE
SNAKE
ISLAND
MISSISSIPPI
RIVER
WISCONSIN
RIVER
POINT ANN
STATE
PARK
MCGREGOR
STATE
PARK
PIKES PEAK
STATE PARK
WYALUSING
STATE
PARK
PRAIRIE DU CHIEN
AIRPORT
CRAWFORD
COUNTY
GRANT
COUNTY
MC GREGOR LOWER
LIGHT & DAYMARK
632.0
WISCONSIN RIVER MOUTH
LIGHT & DAYMARK
630.6
CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC RAILROAD
BURLINGTON NORTHERN RAILROAD
635
634
633
632
631
630
WISCONSIN
CASS
WEBSTER
WELLS
FOWLER
CHURCH
BEAUMONT
OHIO
PERRY
ST

A-236

# Mississippi River Bank Stabilization EMP Habitat Project

**Field Investigation Data**

| | | |
|---|---|---|
| Site Name: Wyalusing Upper Light | | Site number (pool–river mile–l/r bank): 10-628.7-L |
| Date investigated: 6-22-92 | Time: 3:30 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/10/89 (51-18) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.3 | Flow = 40000 |
| Downstream L&D No. = 10 | Headwater Elev. = 11.4 | Flow = 46000 |
| Other water surface elev. data in pool | | |
| Estimated water surface elev. at site: 13.0 | | Flow velocity (location, depth, fps): [illegible] |

Location type (check all applicable)

- main channel ___
- side channel inlet ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ✓
- inside of channel bend ___
- straight reach of channel ___
- ___________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 2'

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Jon Hendrickson | John Lyons - McGregor | Kurt Welke - " |
| Pete Fasbender | | Art Roseland - IDNR |
| Al Kean | | Gary Ackerman - " |

| Observations | Site Number 10-628.7-L |
|---|---|

Bank material: clay ___ silt ___ topsoil ✓ 1-1.5' (f) (c) sand ✓
(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows 1 wind waves ___ boat waves ___
(number in order of cause) prop wash ___ ___ ice action 2 ?

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand

Existing vegetation: nearshore -
(density, type) shoreline -
bank -
top of bank -

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

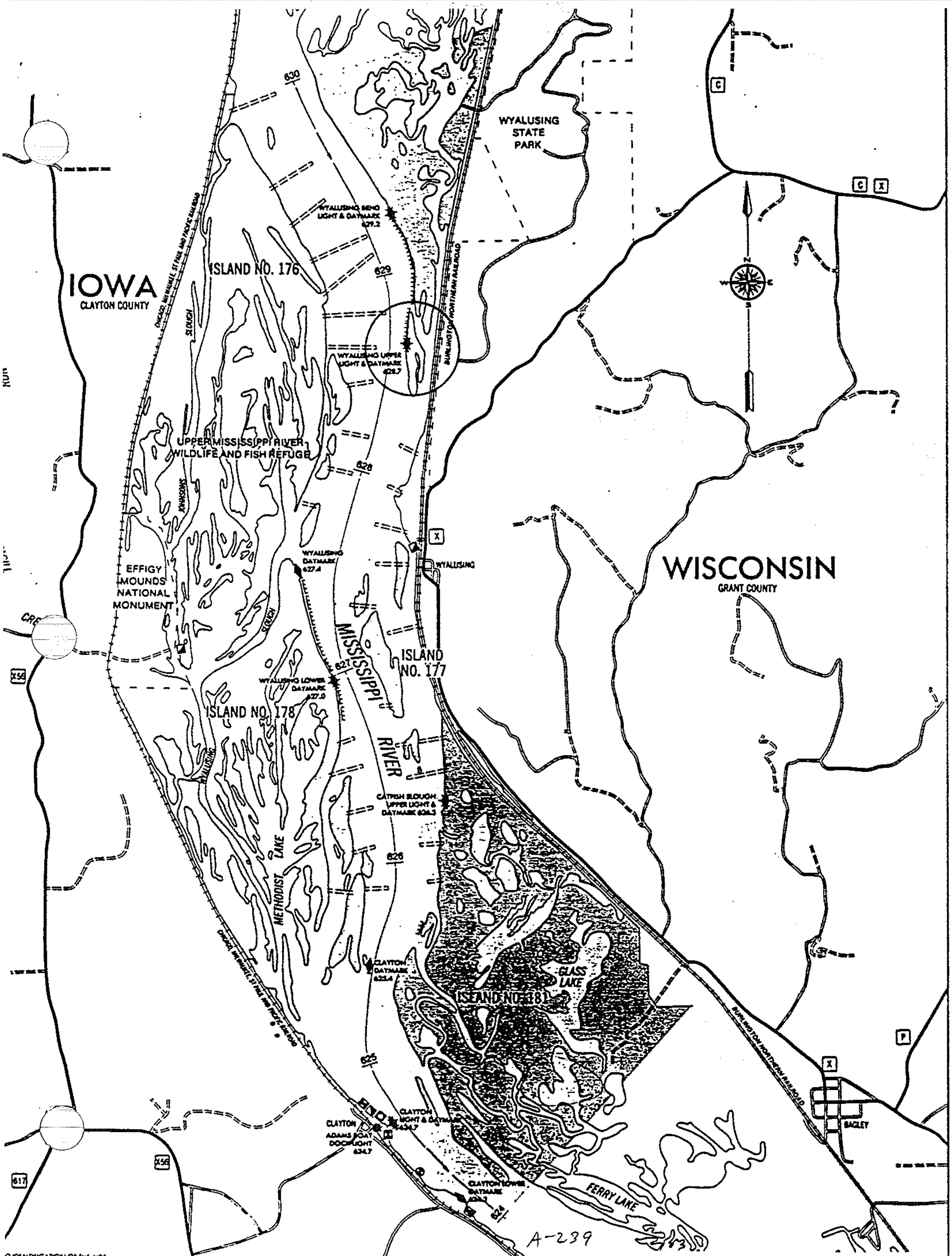
Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information


IOWA
CLAYTON COUNTY
WISCONSIN
GRANT COUNTY
WYALUSING STATE PARK
ISLAND NO. 176
ISLAND NO. 177
ISLAND NO. 178
ISLAND NO. 181
UPPER MISSISSIPPI RIVER WILDLIFE AND FISH REFUGE
EFFIGY MOUNDS NATIONAL MONUMENT
MISSISSIPPI RIVER
JOHNSONS SLOUGH
METHODIST LAKE
GLASS LAKE
FERRY LAKE
WYALUSING
CLAYTON
BAGLEY
WYALUSING BEND LIGHT & DAYMARK 629.2
WYALUSING UPPER LIGHT & DAYMARK 628.7
WYALUSING DAYMARK 627.4
WYALUSING LOWER DAYMARK 627.0
CATFISH SLOUGH UPPER LIGHT & DAYMARK 626.3
CLAYTON DAYMARK 625.4
CLAYTON LIGHT & DAYMARK 624.7
ADAMS BOAT DOCK LIGHT 624.7
CLAYTON LOWER DAYMARK
BURLINGTON NORTHERN RAILROAD
CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC RAILROAD
630
629
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626
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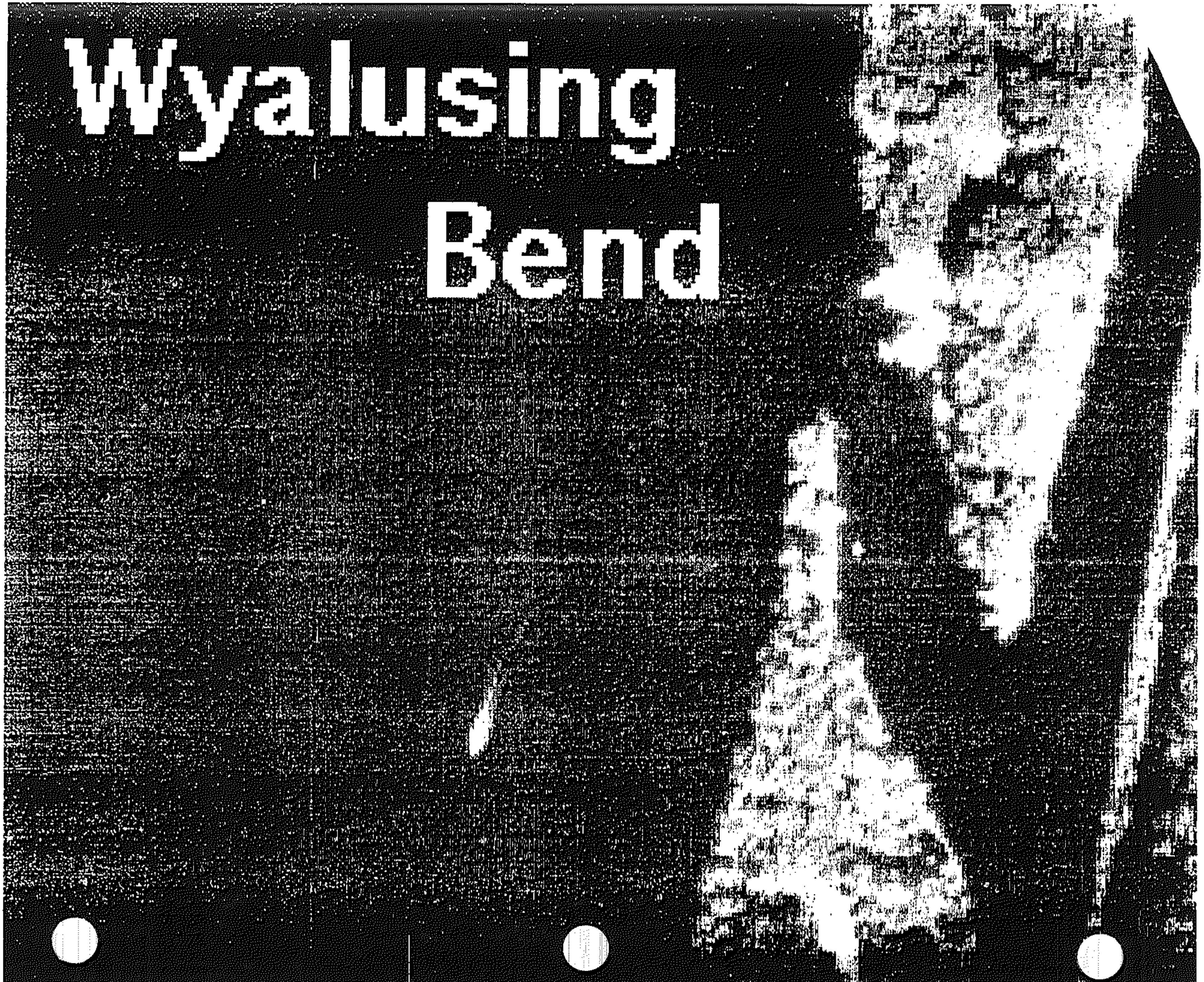
X56
X
C
P

A-239




A-240

A-241

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | | |
|---|---|---|---|
| Site Name: Norwegian Slough | | | Site number (pool–river mile–l/r bank): 10-628.0-R |
| Date investigated: 6-22-92 | Time: 3:00 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/10/89 (M) | |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.3 | Flow = 40,000 | |
| Downstream L&D No. = 10 | Headwater Elev. = 11.4 | Flow = 46,000 | |
| Other water surface elev. data in pool: Low = 611 | | | |
| Estimated water surface elev. at site: 613.0 | | Flow ~~velocity~~ (location, depth, fps): 44,000 cfs | |

Location type (check all applicable)

main channel ___ backwater lake ✓ inside of channel bend ___
side channel inlet ___ head of island or peninsula ___ straight reach of channel ___
backwater channel ✓ outside of channel bend ___ ______________ ___

| | |
|---|---|
| Proposed length of stabilization: 300 | Wing or closing dams in area: in main side channel |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 3'

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank: 12'

Nearshore bottom slope: 1V on ____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Gary Ackerman - IDNR |
| Pete Fasbender | John Lyons - McGregor | Art Roseland - " |
| Al Kean | | Jeff Janvrin - WDNR |
| Jon Hendrickson | | Kurt Welke - " |

Observations

Site Number 10 - 628.0 - R

Bank material: clay ___ silt ✓ topsoil ✓ (f) (c) sand ___

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? No.

Apparent causes of erosion: river flows 1 wind waves 4 boat waves 3

(number in order of cause) prop wash ___ ___ ice action 2

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Moderate

Source of local sediment transport (upstream, none)

Bottom material Silt on interior side, sand on outer side.

Existing vegetation: nearshore –

(density, type) shoreline –

bank –

top of bank – trees

Trees (fallen, species, size range, average size, location, number)

4-12"

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone) lake

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed Rock closure.
Riprap up + dn.

Other type(s) of stabilization possible

Fill required? Yes. Source?

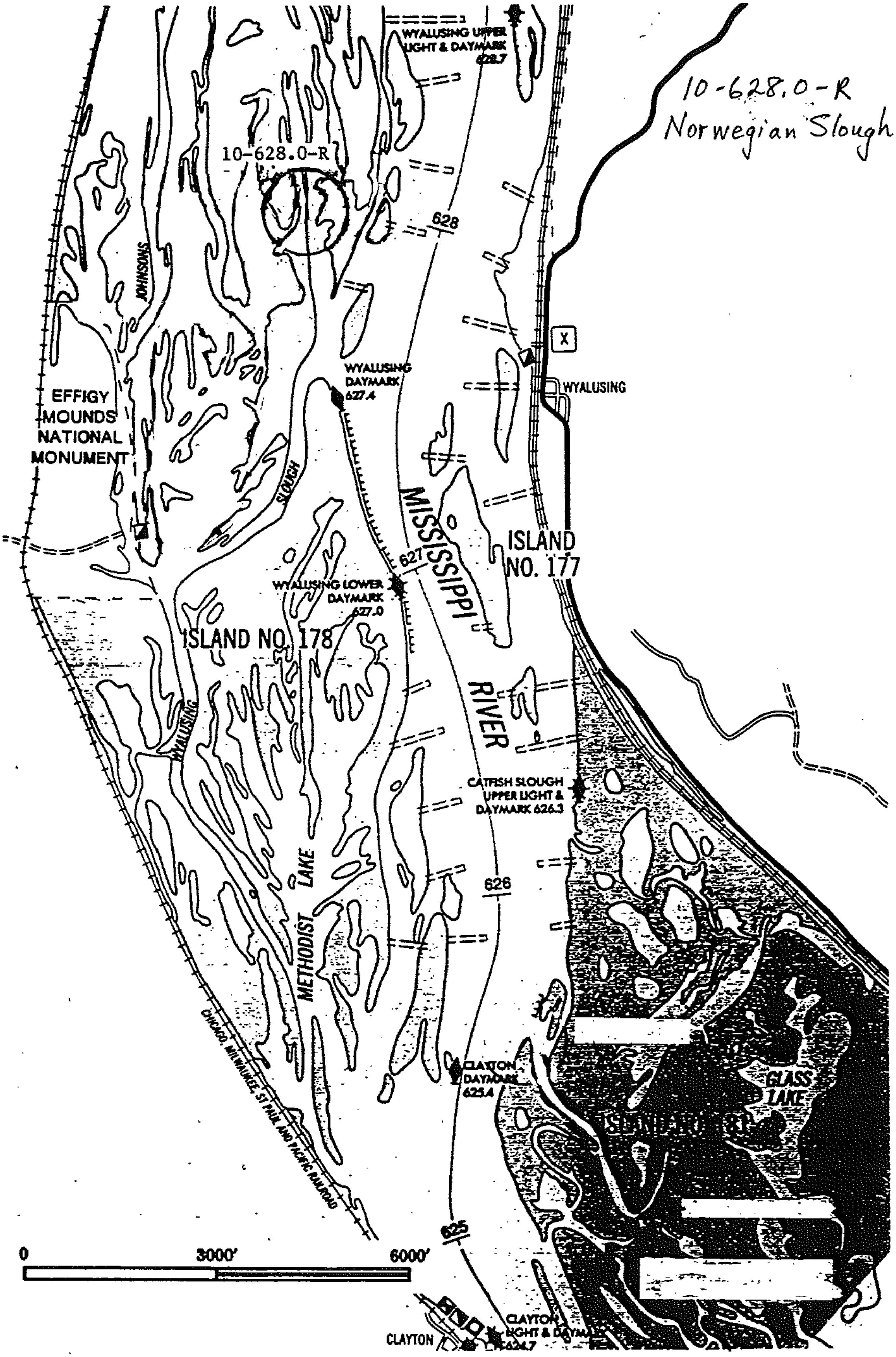
Bank shaping required? No.

Construction access considerations or problems? ~~[illegible]~~ Wingdam in side channel.

Cultural resources?

Other information

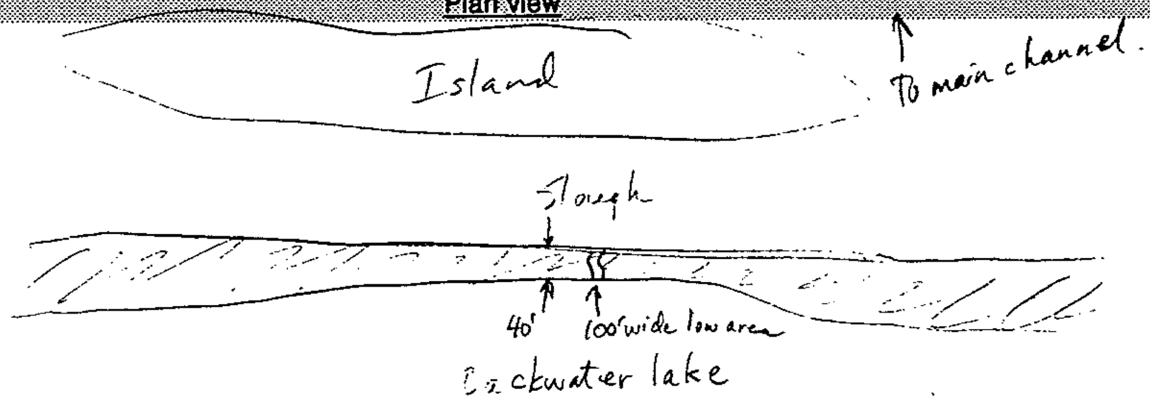
10-628.0-R
Norwegian Slough



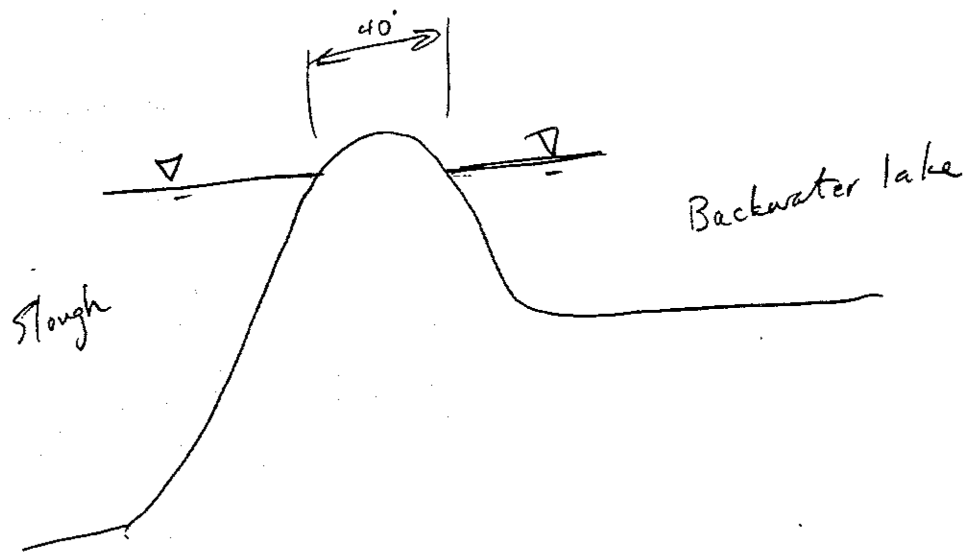
Site Sketches

| Site Number | 10-628.0-R |
| --- | --- |

Plan view




Typical bank cross-section



Low Priority

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | |
|---|---|---|
| Site Name: Island No. 177 | | Site number (pool–river mile–l/r bank): 10 – 626.5 – R |
| Date investigated: 6-22-92 | Time: 2:30 | Year(s) of aerial photos (A) or maps (M) available: (A) 9/10/89 (51-21) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.3 | Flow = 40000 |
| Downstream L&D No. = 10 | Headwater Elev. = 11.4 | Flow = 46000 |
| Other water surface elev. data in pool | | |
| Estimated water surface elev. at site: 12.7 | | Flow velocity (location, depth, fps): 4700 |

Location type (check all applicable)

main channel ✓ backwater lake ___ inside of channel bend ✓
side channel inlet ✓ head of island or peninsula ___ straight reach of channel ___
backwater channel ___ outside of channel bend ___ ______ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| Depth / Dist | Depth / Dist | 3 | 4 | 5 |
|---|---|---|---|---|
| 0 / 0 | / | / | / | / |
| 4 / 2 | / | / | / | / |
| / | / | / | / | / |
| / | 10 / 50 | / | / | / |
| 7 / 50 | 12 / 72 | / | / | / |
| 10 / 110 | 13 / 90 | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 1 - 2'

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Jon Hendrickson | John Lyons - McGregor | Kurt Welke - " |
| Pete Fasbender | | Art Roseland - IDNR |
| Al Kean | | Gary Ackerman - " |

Observations

Site Number 10-626.5-L

Bank material: clay ___ silt ___ topsoil ✓ 0.5' (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? no

Apparent causes of erosion: river flows 1 wind waves 2 boat waves ___

(number in order of cause) prop wash ___ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore – none

(density, type) shoreline – grass

bank –

top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

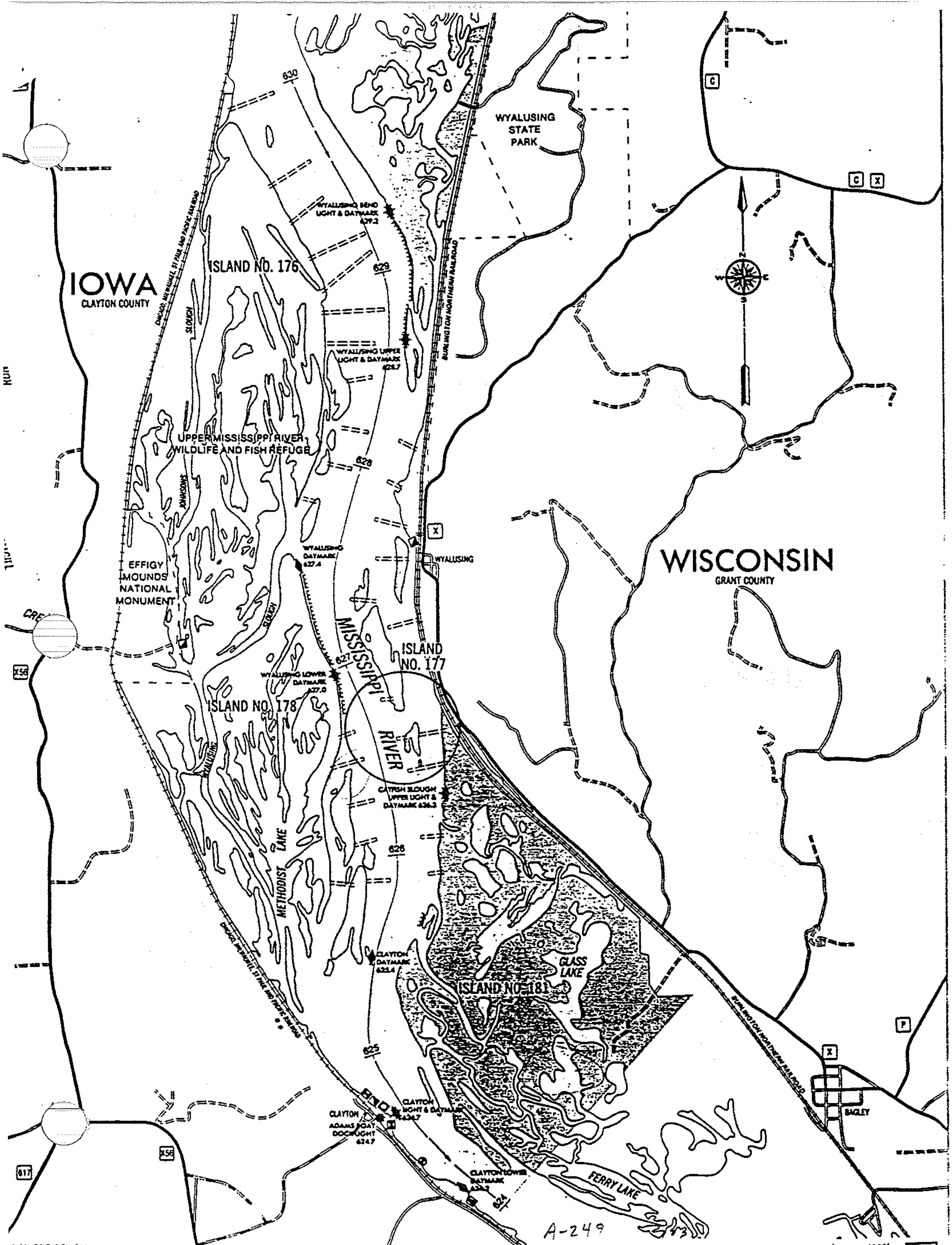
Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

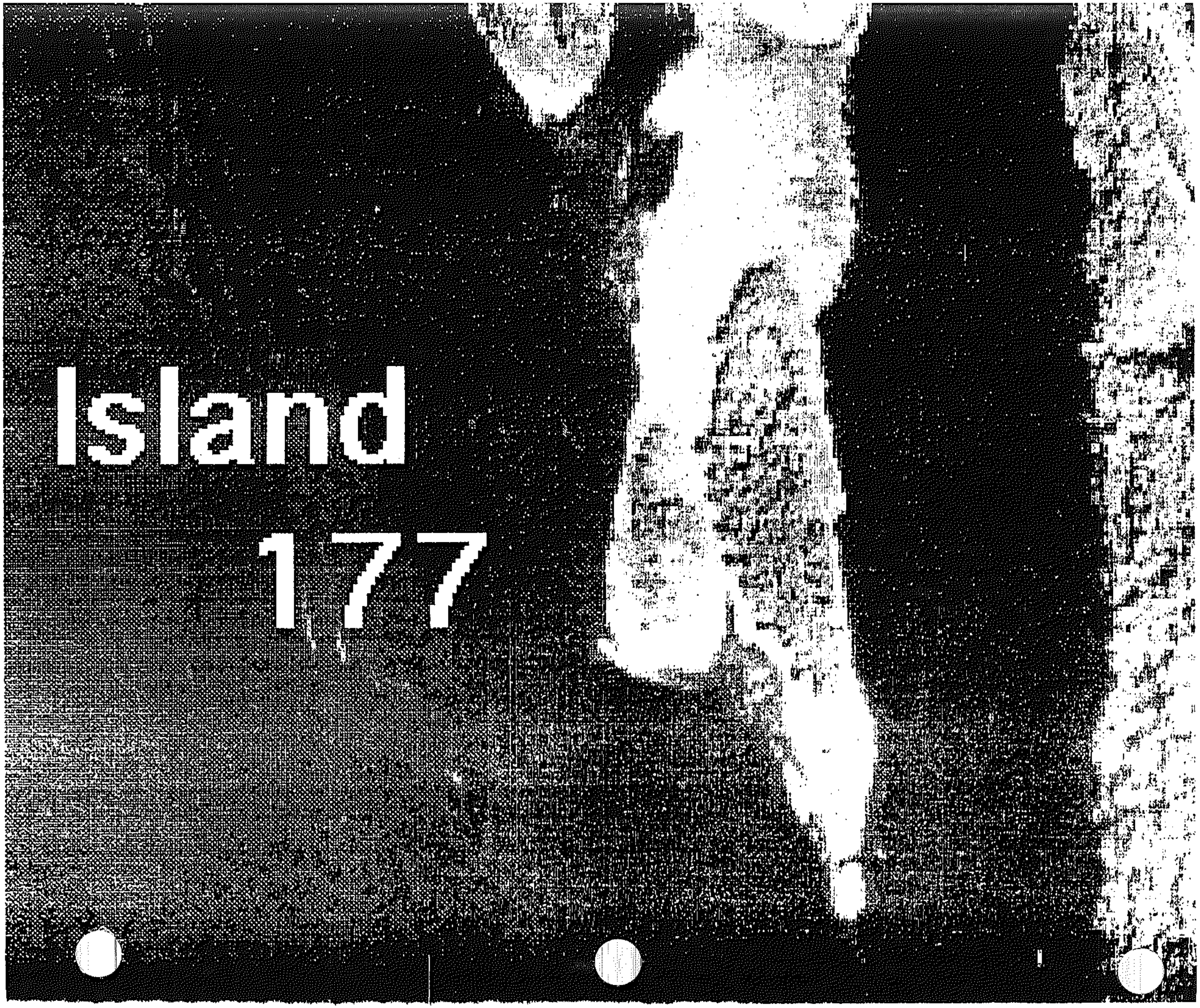
Cultural resources?

Other information


IOWA
CLAYTON COUNTY
WISCONSIN
GRANT COUNTY
WYALUSING
STATE
PARK
ISLAND NO. 176
ISLAND
NO. 177
ISLAND NO. 178
ISLAND NO. 181
UPPER MISSISSIPPI RIVER
WILDLIFE AND FISH REFUGE
EFFIGY
MOUNDS
NATIONAL
MONUMENT
MISSISSIPPI
RIVER
SLOUGH
JOHNSONS
WYALUSING
METHODIST
LAKE
GLASS
LAKE
FERRY LAKE
WYALUSING BEND
LIGHT & DAYMARK
629.2
WYALUSING UPPER
LIGHT & DAYMARK
628.7
WYALUSING
DAYMARK
627.4
WYALUSING LOWER
DAYMARK
627.0
CATFISH SLOUGH
UPPER LIGHT &
DAYMARK 626.3
CLAYTON
DAYMARK
625.4
CLAYTON
LIGHT & DAYMARK
624.7
CLAYTON
ADAMS BOAT
DOCK LIGHT
624.7
CLAYTON LOWER
DAYMARK
630
629
628
627
626
625
624
WYALUSING
BAGLEY
CHICAGO, MILWAUKEE, ST PAUL AND PACIFIC RAIL ROAD
BURLINGTON NORTHERN RAIL ROAD
C
X
P
X56
617
N
S
W
E

A-249

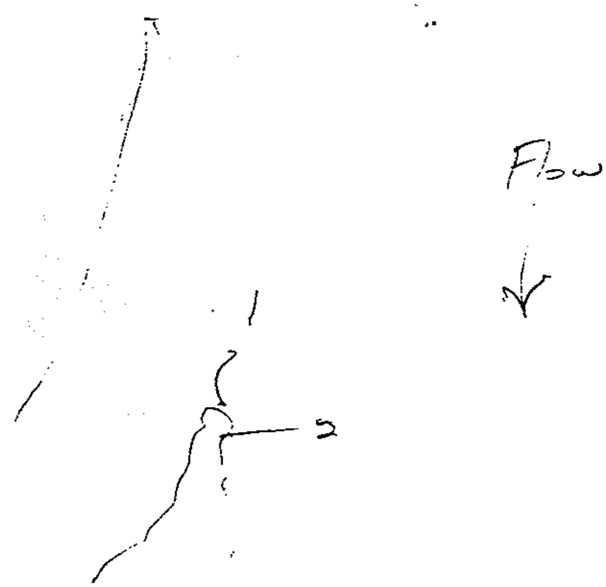
A-250



Site Sketches

Site Number 10-626.5-L

Plan view




Typical bank cross-section

A-252

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | |
|---|---|---|
| Site Name: Island No. 181 / Head of Catfish Slough | | Site number (pool–river mile–l/r bank): 10-625.5-L |
| Date investigated: 6-22-92 | Time: 2:00 | Year(s) of aerial photos (A) or maps (M) available (A) 9/10/89 (51-22) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.4 | Flow = 39,000 |
| Downstream L&D No. = 10 | Headwater Elev. = 11.4 | Flow = 41,000 |
| Other water surface elev. data in pool | | |
| Estimated water surface elev. at site: 12.4 | | Flow velocity (location, depth, fps): 44,000 |

**Location type (check all applicable)**

- main channel ✓
- side channel inlet ✓
- backwater channel ___
- backwater lake ___
- head of island or peninsula ✓
- outside of channel bend ✓
- inside of channel bend ___
- straight reach of channel ___
- ______ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / [illegible] | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| [illegible] / | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| [illegible] / [illegible] | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface): 2 - 3

Slope length above water

Slope above water: 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope: 1V on ____ H

Photo numbers

Fetch direction(s) | Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Jeff Janvrin - WDNR |
| Jon Hendrickson | John Lyons - McGregor | Kurt Welke - " |
| Pete Fasbender | | Gary Ackerman - IDNR |
| Al Kean | | Art Rosclaud - " |

Observations

Site Number 10-625.5-L

Bank material: clay ___ silt ___ topsoil ✓ (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection?

Apparent causes of erosion: river flows 1 wind waves 2 boat waves ___

(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material sand old riprap silt in gap

Existing vegetation: nearshore – none

(density, type) shoreline –

bank –

top of bank – floodplain forest

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

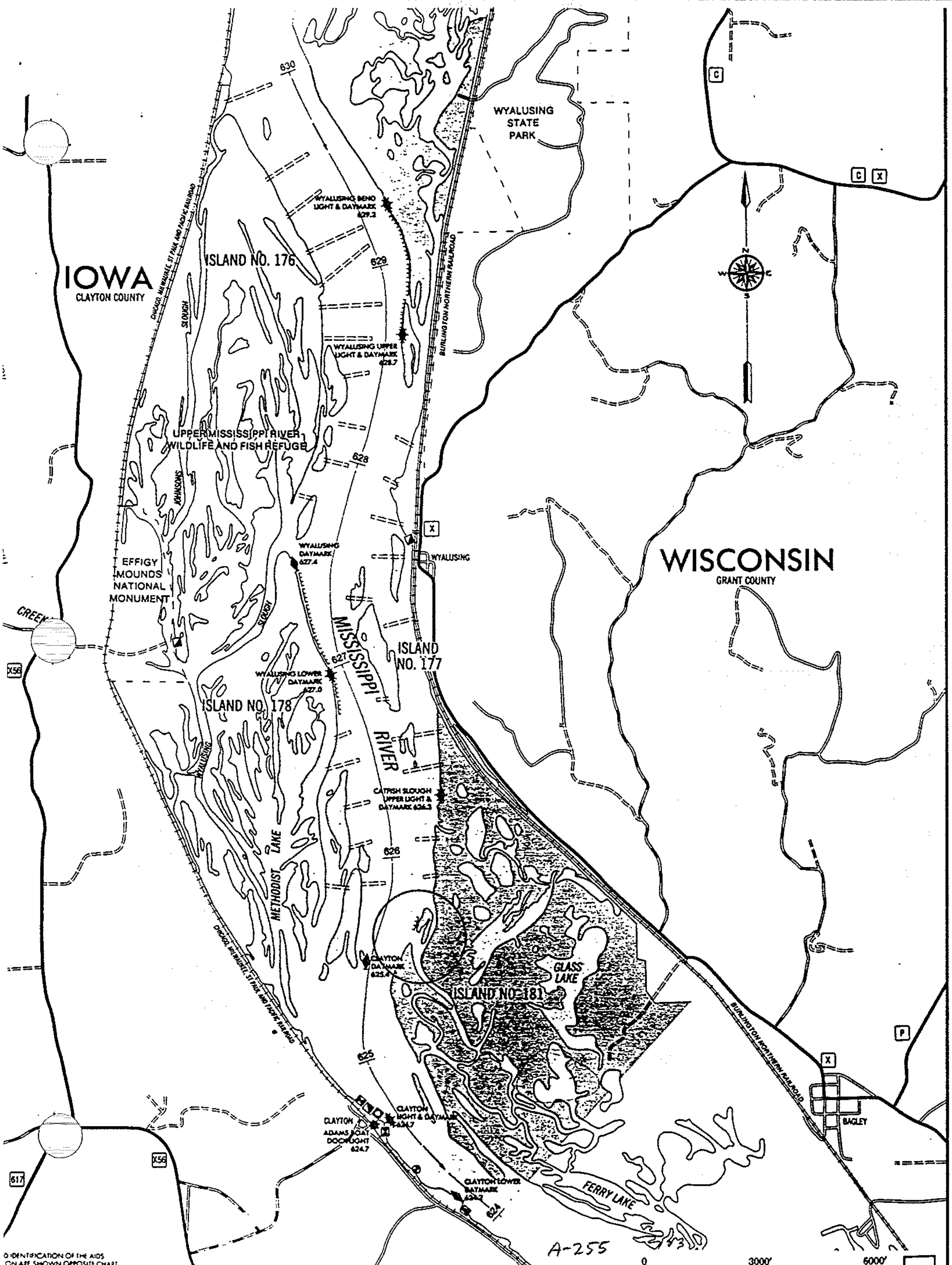
Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

Cultural resources?

Other information

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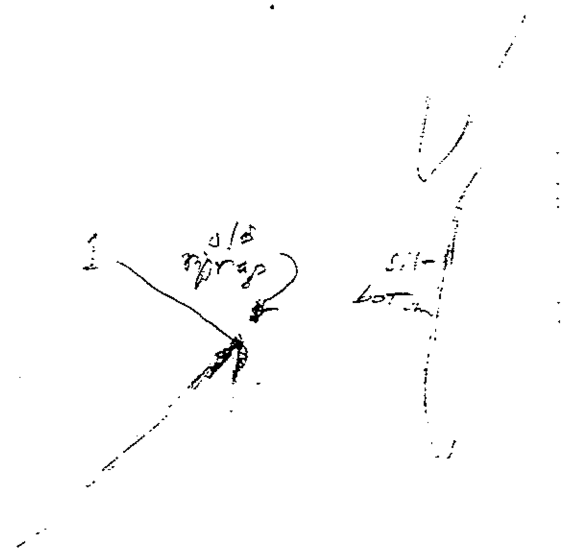
ON ARE SHOWN OPPOSITE CHART


A-256

Site Sketches

Site Number 10 - 625.5-L

## Plan view




## Typical bank cross-section

A-258

Rec.
Minimal habitat prot.

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | Site number (pool–river mile–l/r bank) |
|---|---|
| Hovie Island | 10 – 623.3 – L |

| Date investigated | Time | Year(s) of aerial photos (A) or maps (M) available |
|---|---|---|
| 6-22-92 | | (A) 8/30/89 (52-2) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = | Flow = |
| Downstream L&D No. = 10 | Headwater Elev. = | Flow = |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| | |

Location type (check all applicable)

main channel ___ backwater lake ___ inside of channel bend ___
side channel inlet ___ head of island or peninsula ___ straight reach of channel ___
backwater channel ___ outside of channel bend ___ ______________ ___

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| | |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on _____ H

Water depth at toe of bank

Nearshore bottom slope 1V on _____ H

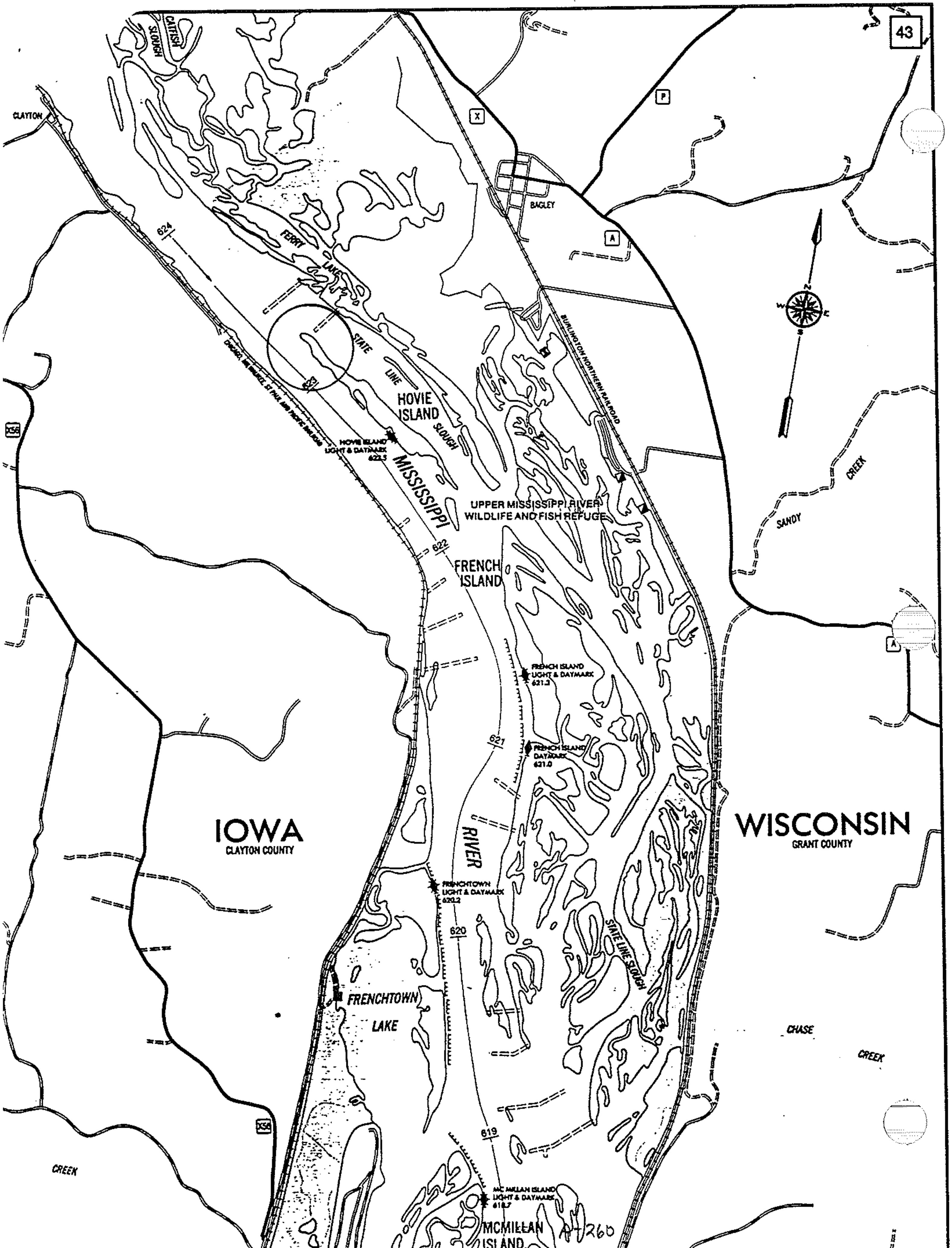
Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell | Bescke | Ackerman |
| Fasbender | Lyons | Roseland |
| Kean | | Janvrin |
| Hendrickson | | Welke |


CATFISH
SLOUGH
CLAYTON
X
P
BAGLEY
A
624
FERRY
LAKE
STATE
LINE
623
HOVIE
ISLAND
SLOUGH
CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD
BURLINGTON NORTHERN RAILROAD
X56
HOVIE ISLAND
LIGHT & DAYMARK
623.5
MISSISSIPPI
UPPER MISSISSIPPI RIVER
WILDLIFE AND FISH REFUGE
SANDY
CREEK
622
FRENCH
ISLAND
A
FRENCH ISLAND
LIGHT & DAYMARK
621.3
621
FRENCH ISLAND
DAYMARK
621.0
IOWA
CLAYTON COUNTY
RIVER
WISCONSIN
GRANT COUNTY
FRENCHTOWN
LIGHT & DAYMARK
620.2
620
STATE LINE SLOUGH
FRENCHTOWN
LAKE
CHASE
CREEK
X56
619
CREEK
MC MILLAN ISLAND
LIGHT & DAYMARK
618.7
MCMILLAN
ISLAND
A-260

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | |
|---|---|
| Site Name<br>Duck Lake Chute | Site number (pool–river mile–l/r bank)<br>10 - 621.0 - L |

| | | |
|---|---|---|
| Date investigated<br>6-22-92 | Time<br>12:45 | Year(s) of aerial photos (A) or maps (M) available<br>(A) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = 15.4 | Flow = 37000 |
| Downstream L&D No. = 10 | Headwater Elev. = 11.4 | Flow = 46000 |

Other water surface elev. data in pool

| | |
|---|---|
| Estimated water surface elev. at site<br>11.3 | Flow velocity (location, depth, fps)<br>45000 |

Location type (check all applicable)

main channel ___
side channel inlet ✓
backwater channel ___
backwater lake ___
head of island or peninsula ___
outside of channel bend ✓
inside of channel bend ___
straight reach of channel ___
_______________ ___

| | |
|---|---|
| Proposed length of stabilization | Wing or closing dams in area<br>½ d.r. of chute ~500 – 800' |

## Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 Dist / Depth | 2 Dist / Depth | 3 Dist / Depth | 4 | 5 |
|---|---|---|---|---|
| / | / | 0 / 0 | / | / |
| / [illegible] | / | 5 / 0.7 | / | / |
| [illegible] / [illegible] | / | [illegible] / 1.0 | / | / |
| [illegible] / [illegible] | 6 / 9 | [illegible] / 1.5 | / | / |
| [illegible] / [illegible] | [illegible] / 11 | 20 / 2.1 | / | / |
| [illegible] / [illegible] | [illegible] / [illegible] | [illegible] / 9 | / | / |
| / | / | 70 / 12 | / | / |

Height of bank (top of bank to water surface)
2 - 4'

Slope length above water

Slope above water
1V on 1 H

Water depth at toe of bank

Nearshore bottom slope
1V on ____ H

Photo numbers 95 13

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Don Powell | Keith Beseke - Winona | Gary Ackerman - IDNR |
| Pete Fasbender | John Lyons - McGregor | Art Roseland - " |
| Al Kean | | Jeff Janvrin - WDNR |
| Jon Hendrickson | | Kurt Welke - " |

Observations | Site Number 10-621.0-L

ank material: clay ___ silt ___ topsoil ✓ (f) (c) sand ✓

(f) (m) (c) gravel ___ cobbles ___ other info:

Existing bank protection? Yes, apparently now offshore.

Apparent causes of erosion: river flows ___ wind waves ___ boat waves ___

(number in order of cause) prop wash ___ ___________ ___ ice action ___

Estimated rate of erosion or erodibility (low, moderate, high) (future rate)

Source of local sediment transport (upstream, none)

Bottom material

Existing vegetation: nearshore – none

(density, type) shoreline –

bank –

top of bank –

Trees (fallen, species, size range, average size, location, number)

Habitat type and species impacted by continued erosion

Quality of affected habitat (low, medium, high)

Area protected by island (shadow zone)

Other impacts of erosion (future conditions)

Type(s) of stabilization proposed

Other type(s) of stabilization possible

Fill required? Source?

Bank shaping required?

Construction access considerations or problems?

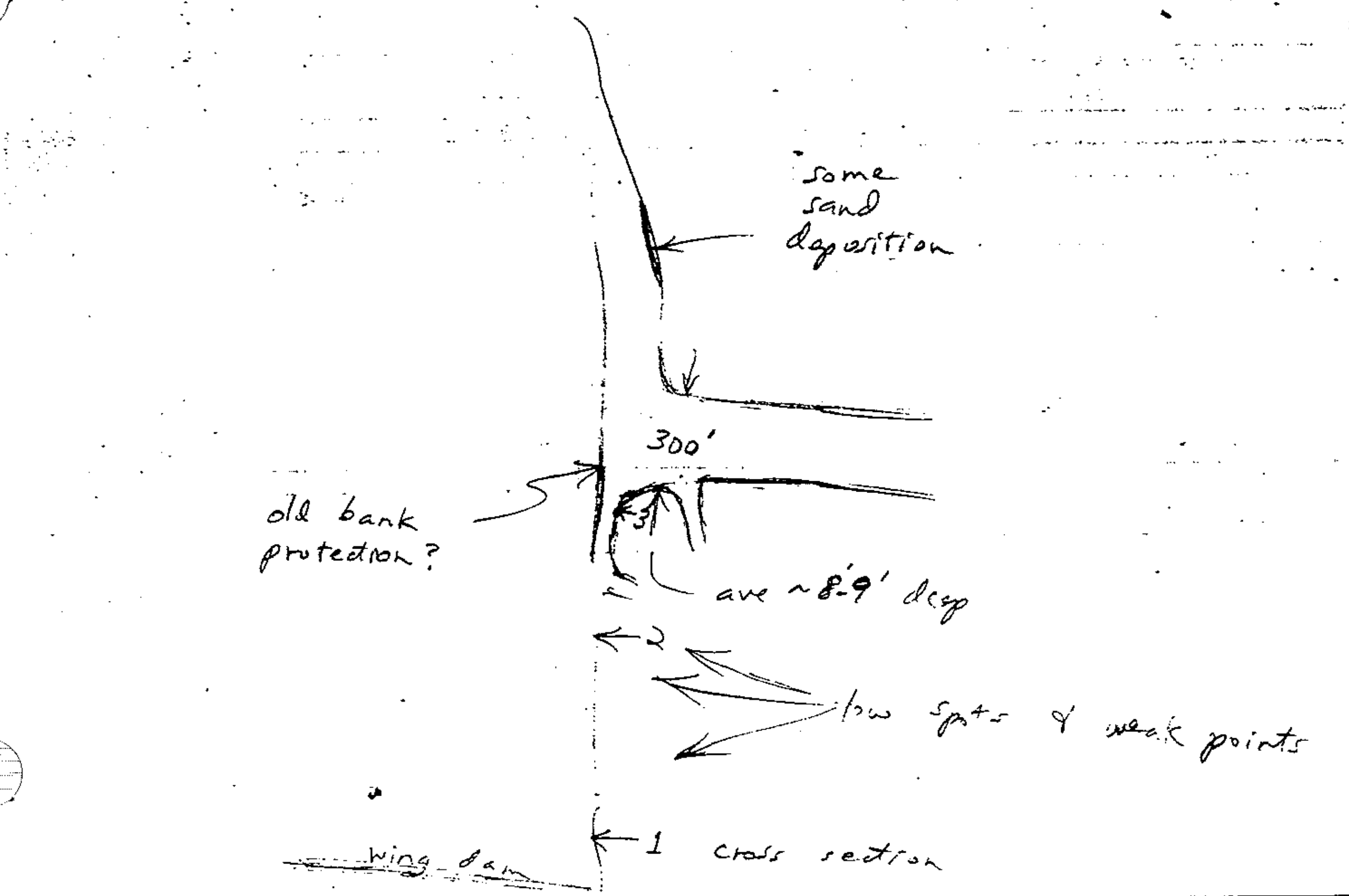
Cultural resources?

Other information

## Site Sketches

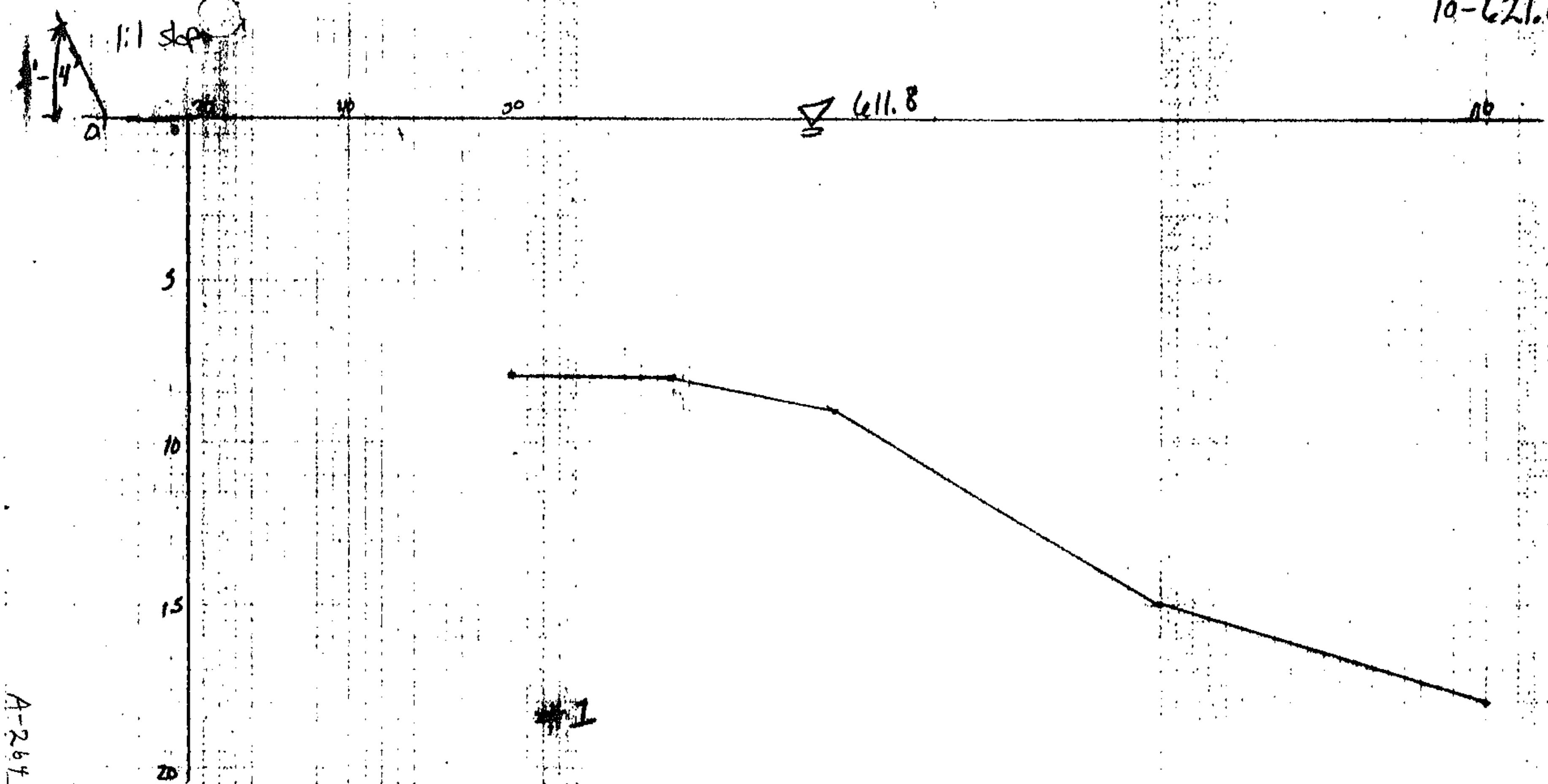
**Site Number** 10-621.0-L

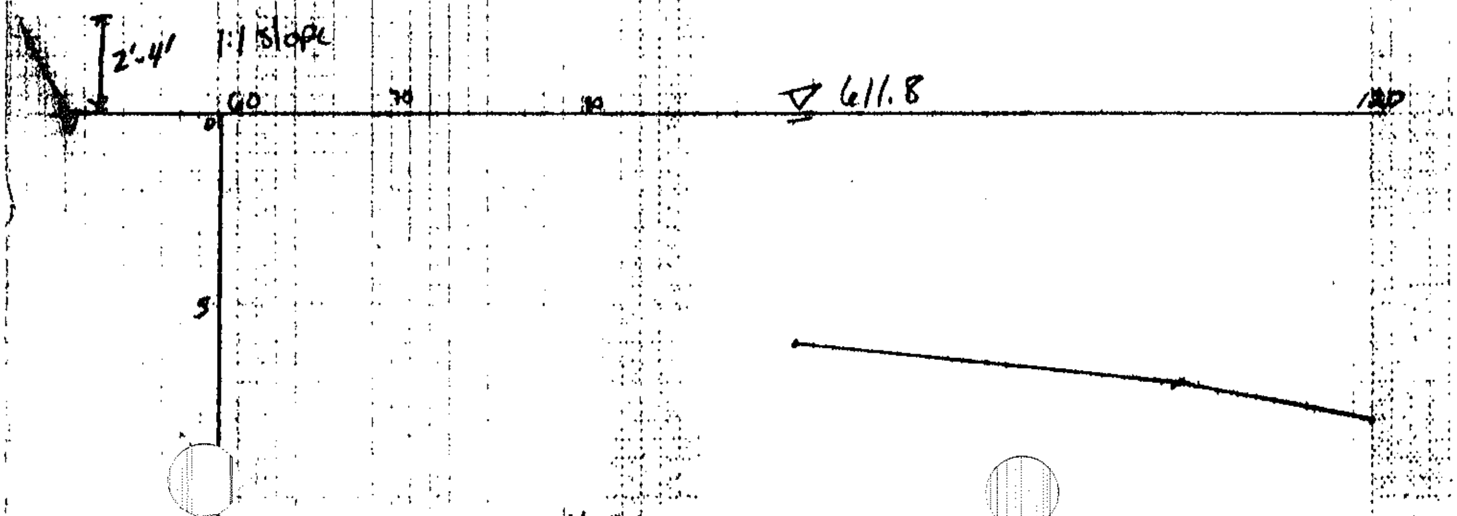
### Plan view




### Typical bank cross-section

10-621.0 ft

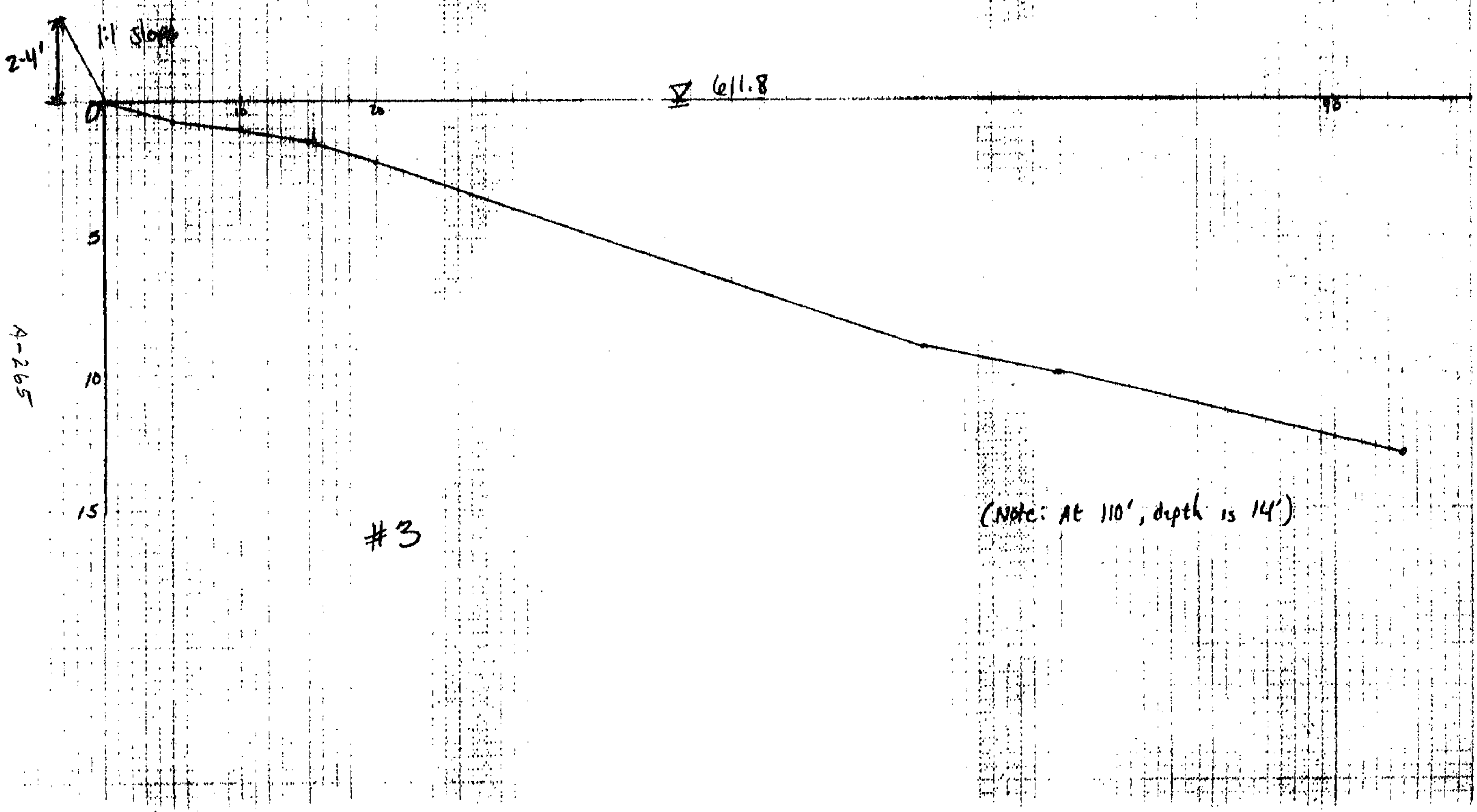



#2

A-264

10-6210




A-265

Low habitat benefits
Stable

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| Site Name | | Site number (pool–river mile–l/r bank) |
|---|---|---|
| Frenchtown Light (Hole in the Wall) | | 10-620.1-L |
| Date investigated: 6-22-92 | Time | Year(s) of aerial photos (A) or maps (M) available: (A) 8/30/89 (52-5) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = | Flow = |
| Downstream L&D No. = 10 | Headwater Elev. = | Flow = |

Other water surface elev. data in pool

| Estimated water surface elev. at site | Flow velocity (location, depth, fps) |
|---|---|
| | |

Location type (check all applicable)

| | | |
|---|---|---|
| main channel ___ | backwater lake ___ | inside of channel bend ___ |
| side channel inlet ___ | head of island or peninsula ___ | straight reach of channel ___ |
| backwater channel ___ | outside of channel bend ___ | ______________ ___ |

| Proposed length of stabilization | Wing or closing dams in area |
|---|---|
| | |

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water
1V on ____ H

Water depth at toe of bank

Nearshore bottom slope
1V on ____ H

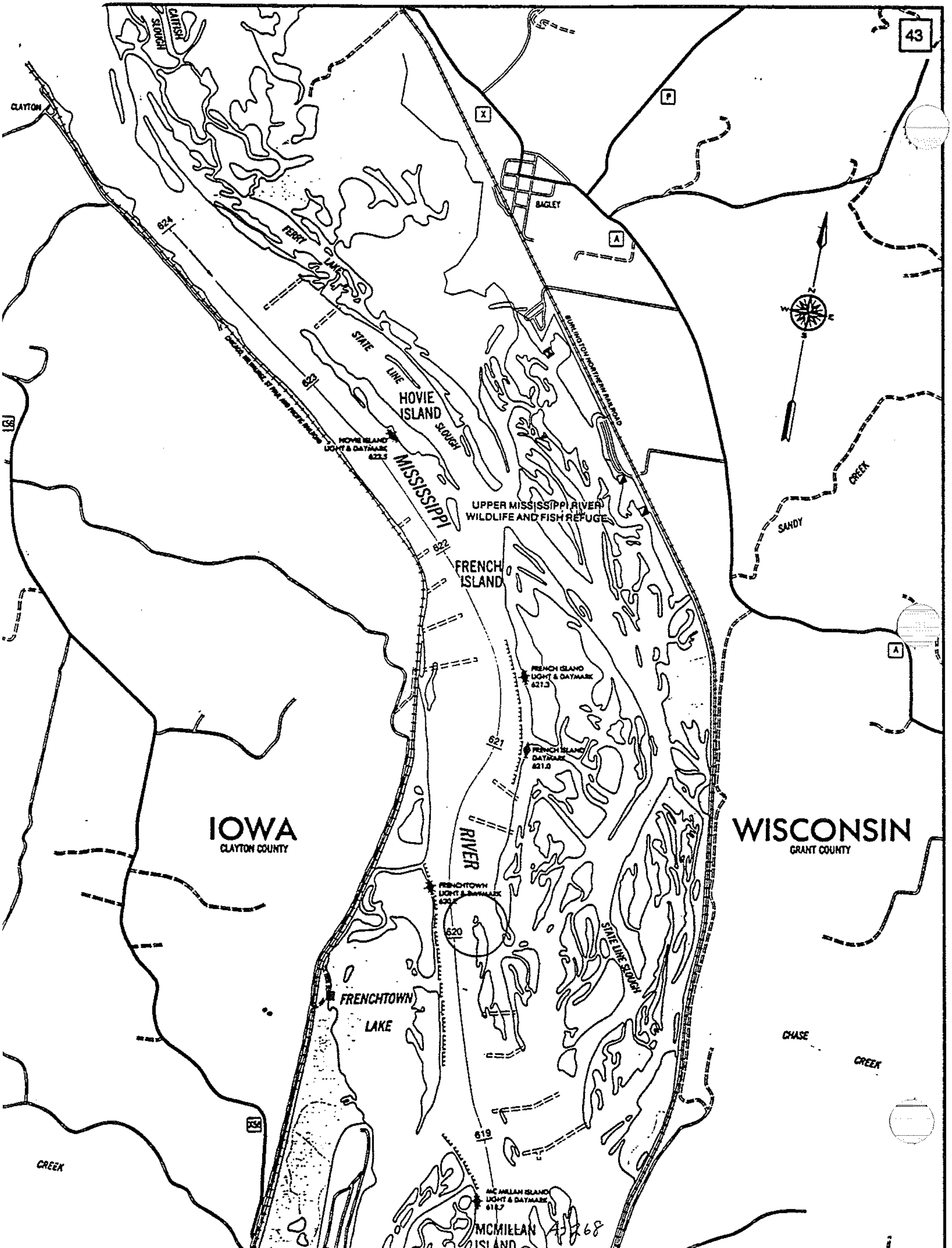
Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell | Beseke | Ackerman |
| Fasbender | Lyons | Janvrin |
| Kean | | Welke |
| Hendrickson | | Roseland |


43
CATFISH SLOUGH
CLAYTON
X
P
BAGLEY
A
624
FERRY LAKE
STATE LINE
BURLINGTON NORTHERN RAILROAD
623
HOVIE ISLAND
SLOUGH
HOVIE ISLAND LIGHT & DAYMARK 622.5
MISSISSIPPI
UPPER MISSISSIPPI RIVER WILDLIFE AND FISH REFUGE
SANDY CREEK
622
FRENCH ISLAND
FRENCH ISLAND LIGHT & DAYMARK 621.3
621
FRENCH ISLAND DAYMARK 621.0
IOWA
CLAYTON COUNTY
RIVER
WISCONSIN
GRANT COUNTY
620
STATE LINE SLOUGH
FRENCHTOWN
LAKE
CHASE CREEK
CREEK
619
MC MILLAN ISLAND LIGHT & DAYMARK 618.7
MCMILLAN ISLAND

Stable
Low habitat value

# Mississippi River Bank Stabilization EMP Habitat Project

## Field Investigation Data

| | | |
|---|---|---|
| Site Name: Ferry Slough Light | | Site number (pool-river mile-l/r bank): 10 - 616. - L |
| Date investigated: 6-22-92 | Time | Year(s) of aerial photos (A) or maps (M) available: (A) 8/30/89 (52-10) (M) |
| Upstream L&D No. = 9 | Tailwater Elev. = | Flow = |
| Downstream L&D No. = 10 | Headwater Elev. = | Flow = |

Other water surface elev. data in pool

Estimated water surface elev. at site

Flow velocity (location, depth, fps)

Location type (check all applicable)

- main channel ___
- side channel inlet ___
- backwater channel ___
- backwater lake ___
- head of island or peninsula ___
- outside of channel bend ___
- inside of channel bend ___
- straight reach of channel ___
- ______________________ ___

Proposed length of stabilization

Wing or closing dams in area

### Physical Data

Coordinates for horizontal positioning

Nearshore data (dist from shoreline/water depth)

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |
| / | / | / | / | / |

Height of bank (top of bank to water surface)

Slope length above water

Slope above water 1V on ____ H

Water depth at toe of bank

Nearshore bottom slope 1V on ____ H

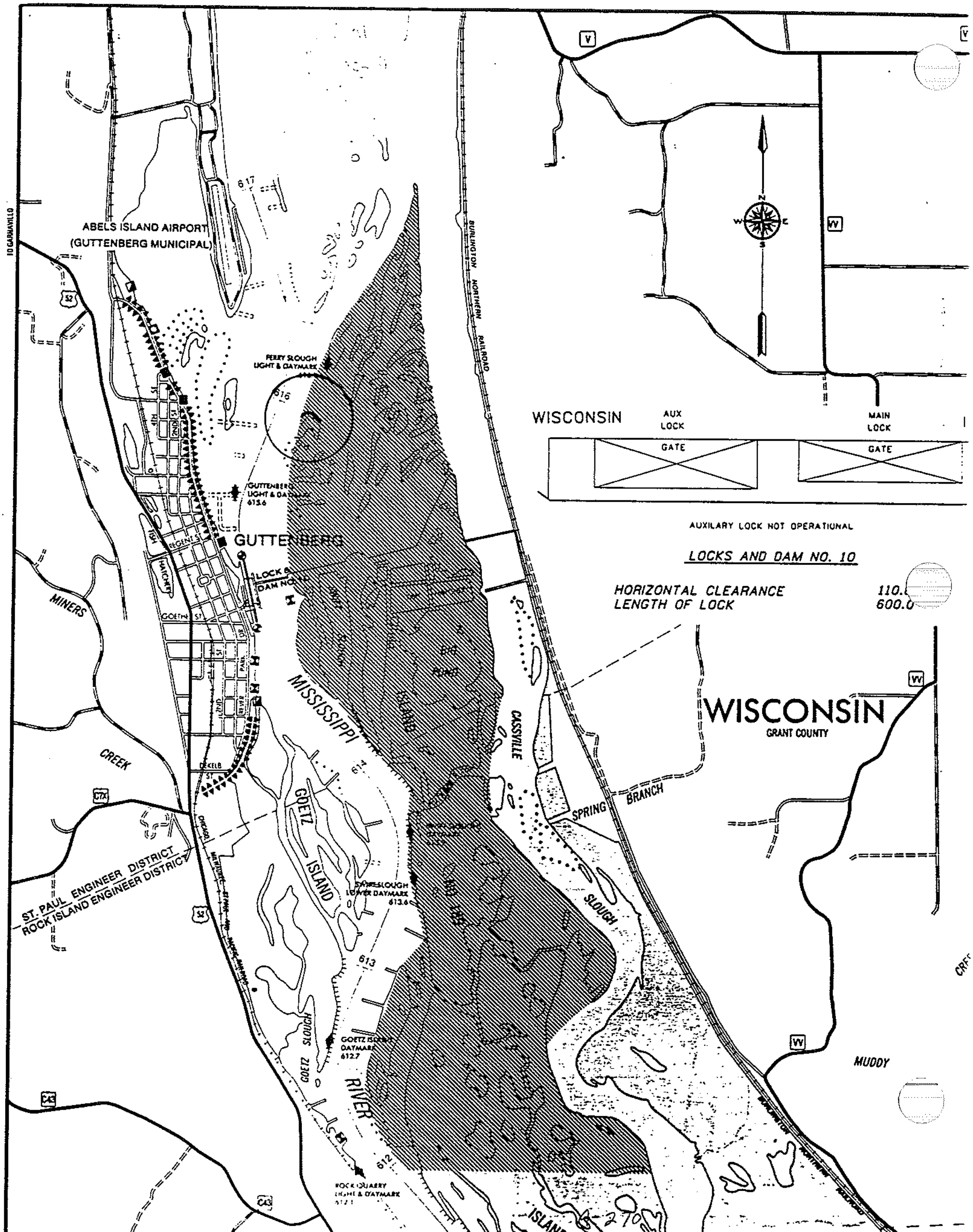
Photo numbers

Fetch direction(s) Length

Site alignment with respect to fetch direction

Names of investigators (R)=Recorder of data

| Corps of Engineers | U.S. Fish & Wildlife Service | States and others |
|---|---|---|
| Powell | Bescke | Ackerman |
| Fasbender | Lyons | Janvrin |
| Kean | | Welke |
| Hendrickson | | Roseland |


ABELS ISLAND AIRPORT
(GUTTENBERG MUNICIPAL)
TO GARNAVILLO
BURLINGTON NORTHERN RAILROAD
PERRY SLOUGH LIGHT & DAYMARK
GUTTENBERG LIGHT & DAYMARK 615.6
GUTTENBERG
LOCK & DAM NO. 10
REGENT ST
GOETHE ST
DEKELB ST
MINERS
CREEK
BIG POND
MISSISSIPPI
RIVER
ISLAND
GOETZ ISLAND
GOETZ SLOUGH
CASSVILLE SLOUGH
SPRING BRANCH
ST. PAUL ENGINEER DISTRICT
ROCK ISLAND ENGINEER DISTRICT
GOETZ ISLAND DAYMARK 612.7
ROCK QUARRY LIGHT & DAYMARK
617
616
614
613
612
WISCONSIN
AUX LOCK
MAIN LOCK
GATE
GATE
AUXILARY LOCK NOT OPERATIONAL
LOCKS AND DAM NO. 10
HORIZONTAL CLEARANCE 110.
LENGTH OF LOCK 600.0
WISCONSIN
GRANT COUNTY
MUDDY
V
VV
52
C7X
C43

# APPENDIX B

# HABITAT ANALYSES AND SEDIMENT DATA

## HABITAT EVALUATION PROCEDURE MODEL
## MISSISSIPPI RIVER BANK STABILIZATION
## ENVIRONMENTAL MANAGEMENT PROGRAM

The loss and degradation of high quality fish and wildlife habitat on the Upper Mississippi River (UMR) is evident and well documented. There are many causes including changed land use patterns within the drainage system, impoundment of the river for navigation, and point and non-point input of contaminants. Without argument, the most dramatic change in the UMR has been the construction of the locks and dams, permanently raising the water levels. This is most pronounced immediately upstream of each dam where the water level has been raised the greatest. Areas normally high and dry during normal flows, are now permanently inundated or have become islands. Within the lower area of the pools, the water is open and deep, and while aquatic vegetation may grow, there is practically no marsh development. Island habitat was once dynamic in nature along the UMR. Prior to the construction of the locks and dams, water currents eroded an island in one area, and deposited material elsewhere in the channel, forming sand bars. The sand bars would eventually form into an island as more sediment was deposited and as the vegetation became more established.

Island habitat along the UMR is being lost due to erosion and it is not being replaced. A number of factors have changed the sediment transport along the UMR. Wing dams were built when Congress authorized the Corps to maintain a 6-foot navigation channel in 1907. The wing dams direct flow to the middle of the channel allowing material to be transported downstream. The construction of the locks and dams decreased flow velocities in many areas of the river. There is high sediment deposition rates in slow velocity portions of the river. The Corps' channel maintenance program prevents any island formation along the main channel border by dredging and depositing the material on an existing island along the main channel. These changes have also reduced the overall biodiversity within the UMR.

The continuing loss of species and habitats across the United States has created interest in preserving biodiversity. In response to this interest, more fish and wildlife research and development activities have been directed toward landscape ecology, habitat fragmentation, genetic diversity, and cumulative impact studies. The major issue in these studies is to direct efforts towards communities and landscape systems, at a much larger scale than in the past. Previous habitat evaluation procedures (HEP) applications have involved the use of several individual species models to analyze impacts on a small, local scale.

Both the use of single species and the local scale of application create concerns these assessments may be missing important impacts to the broader wildlife community occupying a larger area. Also, species impacts can often be mitigated through methods that do not protect the original community of which they were part. Assessments restricted to local site impacts may be insensitive to changes in wildlife that occur at larger scales.

Habitat has been defined to incorporate concepts dealing with space, time, and function. It is the place occupied by a population within a community of populations, and often characterized by a dominant plant form or some physical characteristic. Structural and physical features of habitat are measurable and because vegetational succession is predictable, future habitat values can be projected with some confidence.

HEP is a method used to document the quality and quantity of available habitat and provides information for two general types of comparisons: the relative value of different areas at the same point in time; and the relative value of the same area at future points in time. By combining the two types of comparisons, the impact of proposed or anticipated land and water use changes on habitat can be quantified. The differences in quality (habitat suitability index, or HSI) and quantity (area) between existing habitat conditions (baseline) and various projected future sets of conditions, document project-related impacts to selected evaluation species or their habitat.

Habitat assessments involve measurement and description of habitat conditions for baseline assessments and impact assessments (future with and without action). For baseline assessments, different areas can be compared in terms of habitat units (HU's) as a guide to further land use planning. Baseline assessments are point-in-time comparisons. For impact assessments, alternative future land use actions can be compared on predicted future availability of HU's. The net impact of a proposed land use action is the difference in predicted HU's between the future with the action and the future without the action.

Baseline assessments are used to describe existing ecological conditions. The results provide a reference point from which resource planners can compare existing conditions in two or more areas in order to define management capabilities or as a guide to future land use planning. One can also predict and compare changes that may occur without the proposed action, with the proposed action, or with compensation measures, and design monitoring studies.

During the field site investigations for the Mississippi River Bank Stabilization project it became evident selecting potential project sites, ranking selected sites, and quantifying the habitat benefits associated with the sites, could not be performed using an existing HSI model. The sites investigated and the different ways the sites functioned within the system were numerous. Policy constraints made it necessary to compare all the sites to each other. The existing models could not address the habitat variability of the erosion sites. The only common physical feature at the sites investigated was shoreline erosion. The value of the physical structure at the site to fish and wildlife was so variable as to the vegetation types, soil conditions, location within the pool, size of the area, and function within the area that a conventional model would not work.

The first step in the construction of a model is to establish the model goals. After the model goals are set, the habitat variables related to the model goal are defined. The third step is to define model relationships that combine measurements of the variables to achieve model goals. Model goals include two general aspects: output specifications and a definition of potential variables the field biologist is able to measure. The ideal output for an HSI model is a measure of habitat suitability per unit area. Models should be based on easily measured physical, chemical, or vegetative variables.

The goal for the Bank Stabilization model was to develop it as a habitat approach to impact assessment. The evaluation involves using the same key habitat components to compare existing habitat conditions and optimum habitat conditions for the species of interest. Setting wildlife resource objectives is the first step in determining if community and landscape level analyses are important in the HEP study effort. If the objective was only related to white-tailed deer, it might be appropriate to allow mitigation in non-bottomland forest habitats. However, if the objective was related to protecting bottomlands, such mitigation would be inappropriate. A habitat-based HEP was needed for this project.

The habitat variables used in this model were selected and approved by biologists with the St. Paul District, U.S. Fish and Wildlife Service, and the Iowa, Minnesota, and Wisconsin Department's of Natural Resources. The participating biologists included experts familiar with the UMR and its habitats. The purpose of this evaluation is to determine the habitat unit benefits and to assist in the selection process for the Bank Stabilization sites. The model used was developed by rating four suitability indices (SI). Following, is a description of the SI's used.

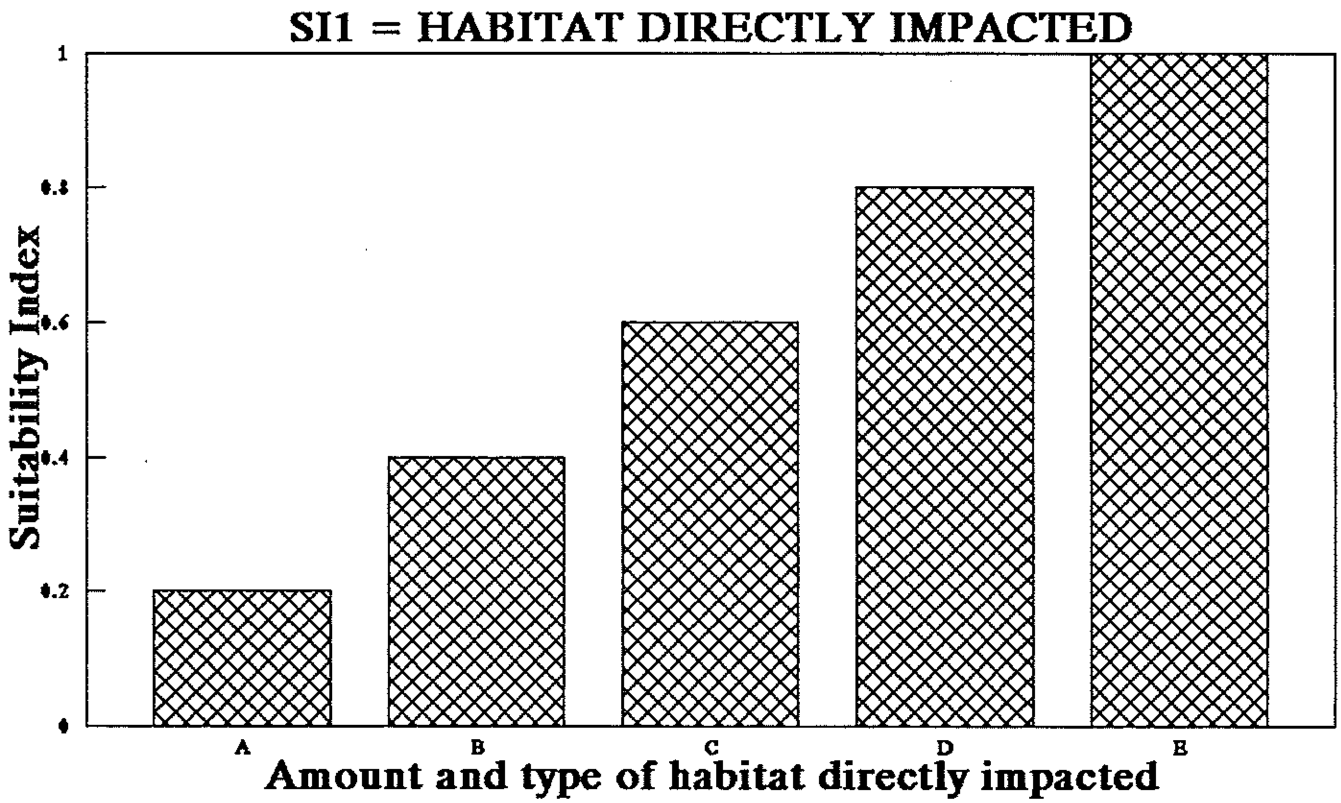
$SI_1$ - This variable values the existing vegetation at the immediate site. There are basically four site classifications used in assigning the values. The southern forest type was used based on the classification defined by Curtis (1959).

The wet southern forest is dominated by *Acer saccarinum, Salix nigra, Populus deltoides, Ulmus americana,* and *Betula nigra.* The soil characteristics of this area is composed of fine grained sand or silt. Of the island types along the UMR, these sites are the lowest in relation to the water level and are most likely flooded for at least a short period of time during most years. Because this soil is fine grained it also tends to be cohesive, making these sites more stable. This leads to the fact this forest type is by far the most common on the UMR (pools 4-10). Many of these areas are even-aged stands with little development in understory age classes. Shrubs species utilized by wildlife for food are therefore absent. Due to its stability, frequency of occurrence, and the absence of multi-layer forest habitat, the SI value assigned to it is 0.4.

The wet-mesic southern forest and is dominated by *Ulmus americana, Acer saccarinum, Fraxinus pennsylvanica, Tilia americana,* and *Fraxinus nigra.* These sites are slightly better drained than the wet southern forest due to higher elevation and larger particle size soil. Flooding frequency is less and duration is not as long as the wet southern forest. Although this forest type is also even-aged, it often contains more habitat layers than the wet southern forest due to less disturbance from flooding. With a higher layering of habitat types, more wildlife habitat niches are present. The wet-mesic southern forest is also less stable and less common on the UMR than is the wet southern forest. The SI value assigned to it is 0.6.

The southern mesic forest is drier and better drained than both the southern wet and wet-mesic sites. This forest type is dominated by *Acer saccharum, Tilia americana, Fagus grandifolia, Ulmus rubra,* and *Quercus rubra.* Again, the soils are more coarse than the wet and wet-mesic and are also less cohesive and stable. This forest type is characterized by many different layers developed within the stand. Many more niches are provided because of the multi-layered forest. Since this type is more unique to the study area, it has a higher SI value of 0.8.

The dry-mesic sites are probably the most unique sites in the study area and are dominated by *Quercus rubra, Q. alba, Tilia americana, Acer saccharum,* and *Ulmus rubra.* The dry-mesic sites are normally higher above the river, have excellent drainage and the dominant soil type is coarse sand to gravel. Because of the physical composition of these sites they are highly unstable and erode quite easily. Many of these sites were located on the primary terrace prior to inundation. Due to the higher water levels in this area of the pool, these highly erodible islands are quite scarce. Mast and other seed production on these sites is high. Because of the high production of food items, the wildlife use of these sites is also high. The SI value for these sites is 1.0.




A = Low–lying or previously eroded island. Vegetation absent or dominated by Salix and Phalaris arundinaceae.

B = Wet southern forest. Canopy dominated by Acer saccarinum, Salix nigra, Populus deltoides, Ulmus americana, and Betula nigra.

C = Wet–mesic southern forest. Canopy dominated by Ulmus americana, Acer saccarir Fraxinus pennsylvanica, Tilia americana, and Fraxinus nigra.

D = Southern mesic forest. Canopy dominated by Acer saccharum, Tilia americana, Fagus grandifolia, Ulmus rubra, and Quercus rubra.

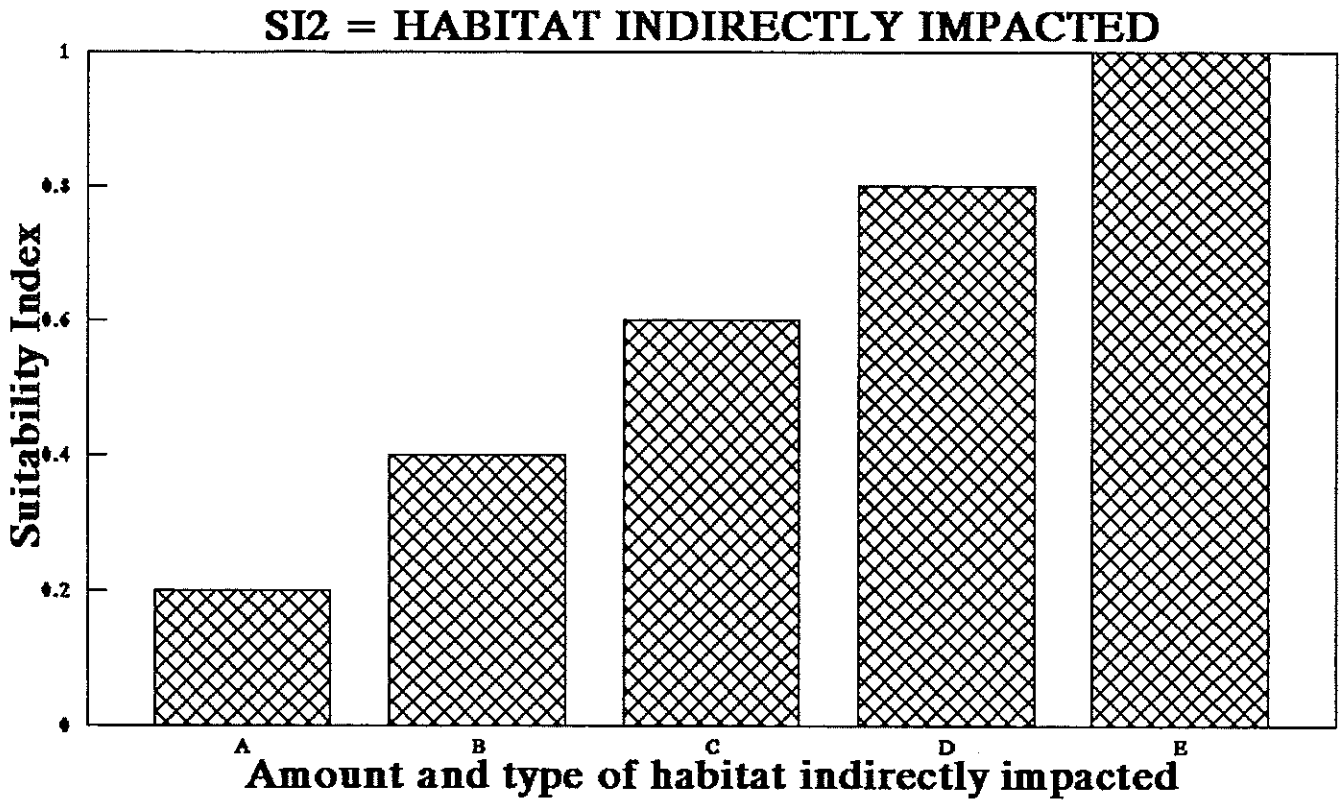
E = Dry mesic southern forest. Canopy dominated by Quercus rubra, Q. alba, Tilia americana, Acer saccharum, and Ulmus rubra.

The assigned values for the habitat types is based on the unique quality of the area. Common bottomland hardwoods get the lowest values, while sites with walnut, oaks, etc. would rank higher. An island dominated by reed canary grass or other forbs has a SI of 0.2. If an island under study becomes eroded, its value becomes 0.1. No site is given a SI of 0.0 because it would always have some value as habitat.

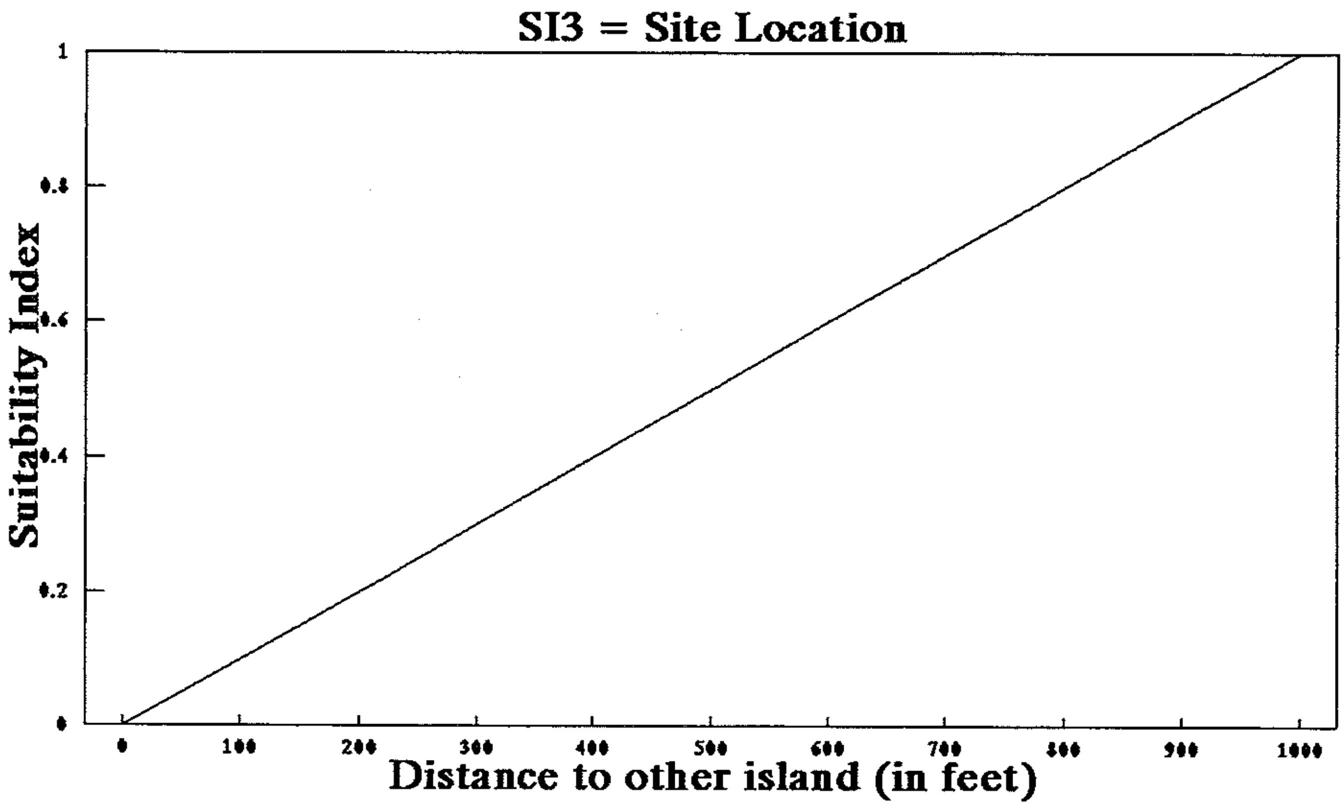
$SI_2$ - This variable is the relative importance of the habitat of the area indirectly impacted by the eroding site. For example, what would happen to downstream or adjacent areas if the site completely erodes and disappears? This could cause increased flow to a backwater wetland, or may not have any impact other than the site disappearing. This is the most important variable in the model because it potentially impacts such a large area.

There are three broadly defined habitat types within the UMR considered for this model: main channel, side channel, and backwater lakes and ponds. The main channel habitat along the UMR receives comparatively low fish and wildlife use. This is due to a number of factors, including recreational and commercial traffic and little or no vegetation. It is also the most maintained habitat type within the UMR. Main channel habitat will never be a limiting factor for fish and wildlife. Side channel habitat is usually not maintained and receives no commercial traffic and less recreational traffic than the main channel. Because there is no regular maintenance within the side channels, fish and wildlife use is higher. Mussel beds are much more prevalent in side channels than in the main channel. The backwater systems (lakes, ponds and sloughs) are the most valued of all habitats within the UMR. The ponds are often shallow and support extensive aquatic vegetation beds. The lakes support submergent vegetation and are also very important winter fishery areas due warmer water temperatures and low flow velocities. The running sloughs support diverse assemblages of mussel species. All areas are prime fish nursery areas, support high numbers of shorebirds, and are the most important staging areas for migrating waterfowl within the Mississippi Flyway.

$SI_3$ - This variable is the combination of the relative value of the area on a landscape scale and the site location within the pool. Are there many islands in the area, or is it a unique site? The isolated islands receive a higher value than an island in the midst of many others. Since islands are more scarce in the lower ends of the pools, their protection should be a higher priority than protecting a site in the upper pool portions. Again, this places a higher value on the more unique sites located in the lower end of the pool.




A = Main or side channel habitat. Vegetation types include Salix and aquatic vegetation beds less than 1 acre.
B = Main or side channel habitat. Vegetation types include Salix, Phalaris, Polygonum, Vallisnaria, and Potamogeton stands less than 5 acres.
C = Side channel and slough habitat. Vegetation types include Salix, Phalaris, Polygonum, Vallisnaria, and Potamogeton stands in stable conditions.
D = Side channel and slough habitat. Vegetation types include Salix, Phalaris, Polygonum, Vallisnaria, and Potamogeton in large (>20 acres) stands.
E = Side channel, slough, and lake habitat. Vegetation types include Salix, Phalaris, Polygonum, Vallisnaria, and Potamogeton in very large (>80 acres) stands.




** Add 0.1 to SI (if SI < 1) if site is within mid-pool

** Add 0.2 to SI (if SI < 1) if site is within lower pool

** SI can not be greater than 1.0

This value is determined by measuring the distance from the site to the next island. SI values are calculated by measuring distances to the nearest 100 feet to the next island. Each increment of 100 feet is 0.1 SI. Distances between islands over 1000 feet would have an SI of 1.0. Additional points are given to sites located downstream of mid-pool. Sites located within mid-pool are given an additional 0.1, while sites in the lower pool are given 0.2. For example, a site located in the mid-pool area 600 feet from another island would have a SI=0.7. A site in the lower pool 500 feet from another island would have a SI=0.7.

$SI_4$ - This variable measures the species richness of the site. The SI ranges from 0.2 - 1.0, and are classified into 3 categories: low, medium, and high. The areas classified low in species richness are those sites that have ordinary habitat conditions supporting common fish and wildlife species. The medium category supported either threatened and endangered species, had high species diversity, or supports a unique fish and wildlife function (eg. islands important for duck nesting). High species richness category includes documented threatened and endangered species and high species diversity.

To determine $SI_4$, sites were placed into the three categories (low, medium, and high) as described above. The sites within a category, were compared to determine their ranking. Sites free from human disturbance (i.e. closed areas) received the highest rating within their categories because of the importance of the area to fish and wildlife. Within-category comparisons were needed because of the large number of sites investigated and the need to compare one to another.

If no fish or wildlife species were present, the site would be assigned a SI of 0.1. The SI ranges within the in the low category ranged from 0.2 - 0.4. Most of the sites here were typically long linear islands or small islands at the heads of side channels. Medium ranked sites ranged from 0.5 to 0.7 and were commonly duck or turtle nesting islands, or areas supporting multiple species. High ranked sites range from 0.8 to 1.0 and were areas of multiple species and threatened and endangered species.

HSI CALCULATION

There are three basic techniques or relationships between SI values to calculate the HSI. The first is the Limiting Factor method. This type of relationship exists when the lowest SI overrides the others in terms of limiting factor relationships and allows one variable to be an absolute limiting factor. Cumulative relationships occur when thresholds exist and can be met by any one of several variables or their combination. Compensatory relationships occur when variables with marginal or low suitability are offset by the higher values of other variables.

Variable SI4
Species Richness
(threatened & endangered or unique function)

| Category | | Assigned SI Value | |
|---|---|---|---|
| Not used | | 0.0 | lowest |
| No fish or wildlife species present | | 0.1 | |
| Supports common fish & wildlife species | Open area, few species | 0.2 | |
| | | 0.3 | |
| | Closed area | 0.4 | |
| Supports threatened & endangered/high diversity/unique fish or wildlife function | Open area, few species | 0.5 | |
| | | 0.6 | |
| | Closed area | 0.7 | |
| Documented threatened & endangered/ high species diversity | Open area, few species | 0.8 | |
| | | 0.9 | |
| | Closed area | 1.0 | highest |

Because of the relationship of the variables, the compensatory method was chosen over the limiting and cumulative. Limiting factor was determined not to be an issue because there are no actual limiting factors to these sites and there is a relationship between the factors. The factors have a compensatory relationship because of the various influences sites have on adjacent areas. Often at these sites, a variable with low habitat suitability was offset by the high habitat suitability of another variable.

The geometric mean was used over the arithmetic means because the compensatory relationship was perceived weak by the study team. Averaging functions also become insensitive to very high or very low values. The geometric mean also usually produces a smaller HSI score than the arithmetic mean because low values influence the score to a higher degree. The following equation was used to calculate the HSI value of each site:

$$HSI = (((SI_1 \times SI_3)1/2) \times SI_2 \times SI_4)1/3)$$

Whereas:

#1) $(SI_1 \times SI_3)1/2$ is the square root of the product of the values.

#2) HSI is then calculated as the cube root of the product of $SI_2$, $SI_4$ and #1).

The HSI formula is separated into an upland and wetland component consisting of the island area that would be saved, and an affected area component consisting of the area protected by the presence of the island. The HSI's are independent even though the presence of the island drives the maintenance of the HSI in the affected area. This was tested by using a site that river experts agreed was of prime habitat value and a site of obviously low habitat value. The sites were ranked according to the above procedure and compared using the appropriate figure for the acres affected. The study team was satisfied with the results of the study.

**LITERATURE CITED**

Curtis, J.T. 1959. The vegetation of Wisconsin. Univ. Wis. Press. 657 pp.

# MISSISSIPPI RIVER BANK STABILIZATION - UMRS-EMP
# EROSION SITE INFORMATION - Biological Factors

| SI=Suitability Index V#=Value Category | | Existing Conditions | | | | | Future without Project | | | | | Future with Project | | | | | HSI Gain with project | Total acres affected | Habitat value of stabilization | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site | | Direct impacts | Indirect impacts | Site location | Species richness | | Direct impacts | Indirect impacts | Site location | Species richness | | Direct impacts | Indirect impacts | Site location | Species richness | | | | AAHU gain | Cost/ AAHU |
| Number | Name | SI V1 | SI V2 | SI V3 | SI V4 | HSI | SI V1 | SI V2 | SI V3 | SI V4 | HSI | SI V1 | SI V2 | SI V3 | SI V4 | HSI | | | | |
| 5-749.7-R | Island 42 Closure | 0.4 | 0.4 | 0.2 | 0.7 | 0.43 | 0.3 | 0.4 | 0.2 | 0.6 | 0.39 | 0.4 | 0.4 | 0.2 | 0.7 | 0.43 | 0.025 | 40 | 1.002 | $30,090 |
| 5-746.7-L | Roebuck's Run | 0.4 | 0.4 | 0.4 | 0.5 | 0.43 | 0.2 | 0.3 | 0.4 | 0.4 | 0.32 | 0.4 | 0.5 | 0.4 | 0.5 | 0.46 | 0.079 | 40 | 3.174 | $4,960 |
| 5-745.6-L | Sand Run | 0.4 | 0.6 | 0.4 | 0.5 | 0.49 | 0.3 | 0.3 | 0.4 | 0.4 | 0.35 | 0.4 | 0.7 | 0.4 | 0.5 | 0.52 | 0.101 | 120 | 12.114 | $960 |
| 5-745.5-R | Fisher Island Daymark | 0.3 | 0.4 | 0.4 | 0.6 | 0.44 | 0.2 | 0.2 | 0.4 | 0.5 | 0.30 | 0.3 | 0.4 | 0.4 | 0.6 | 0.44 | 0.081 | 10 | 0.813 | $5,030 |
| 5-744.5-L | Lost Island Chute | 0.2 | 0.5 | 0.4 | 0.5 | 0.41 | 0.2 | 0.3 | 0.4 | 0.4 | 0.32 | 0.2 | 0.6 | 0.4 | 0.5 | 0.44 | 0.066 | 100 | 6.571 | $1,180 |
| 5-741.5-R | Minneiska Island | 0.2 | 0.2 | 0.3 | - | 0.00 | 0.2 | 0.2 | 0.3 | - | 0.00 | 0.2 | 0.2 | 0.3 | - | 0.00 | 0.000 | - | | |
| Total Pool 5 | | | | | | | | | | | | | | | | | | 310 | | |
| 5A-736.8-R | Small island | 0.2 | 0.4 | 0.3 | 0.2 | 0.27 | 0.2 | 0.4 | 0.3 | 0.2 | 0.27 | 0.2 | 0.4 | 0.3 | 0.2 | 0.27 | 0.000 | - | | |
| 5A-736.7-R | Head of Burleigh Slu | 0.4 | 0.4 | 0.3 | 0.3 | 0.35 | 0.3 | 0.3 | 0.3 | 0.3 | 0.30 | 0.4 | 0.4 | 0.3 | 0.3 | 0.35 | 0.029 | 5 | 0.143 | $24,210 |
| 5A-736.5-L | Kieselhorse | 0.2 | 0.2 | 0.3 | - | 0.00 | 0.2 | 0.2 | 0.3 | - | 0.00 | 0.2 | 0.2 | 0.3 | - | 0.00 | 0.000 | - | | |
| 5A-735.7-R | Island 56 | 0.4 | 0.3 | 0.3 | 0.3 | 0.31 | 0.3 | 0.2 | 0.3 | 0.3 | 0.26 | 0.4 | 0.3 | 0.3 | 0.3 | 0.31 | 0.032 | 10 | 0.325 | $24,390 |
| 5A-735.2-R | Island 57 | 0.4 | 0.3 | 0.3 | 0.3 | 0.31 | 0.3 | 0.2 | 0.3 | 0.3 | 0.26 | 0.4 | 0.3 | 0.3 | 0.3 | 0.31 | 0.032 | 10 | 0.325 | $75,810 |
| Total Pool 5A | | | | | | | | | | | | | | | | | | 25 | | |
| 6-718.6-R | Blacksmith Slough | 0.6 | 0.7 | 0.8 | 0.6 | 0.66 | 0.4 | 0.4 | 0.8 | 0.4 | 0.45 | 0.6 | 0.8 | 0.8 | 0.6 | 0.69 | 0.144 | 60 | 8.630 | $1,800 |
| 6-715.8-R | Trempealeau Daymark | 0.6 | 1.0 | 0.9 | 0.8 | 0.84 | 0.4 | 0.3 | 0.9 | 0.4 | 0.42 | 0.6 | 1.0 | 0.9 | 0.8 | 0.84 | 0.260 | 125 | 32.506 | $780 |
| Total Pool 6 | | | | | | | | | | | | | | | | | | 185 | | |
| 7-713.3-L | Long Lake Inlet Island | 0.4 | 0.3 | 0.3 | 0.6 | 0.40 | 0.3 | 0.3 | 0.3 | 0.5 | 0.36 | 0.4 | 0.3 | 0.3 | 0.6 | 0.40 | 0.025 | 5 | 0.126 | $35,380 |
| 7-712.3-R | Richmond Island | 0.6 | 1.0 | 0.4 | 0.7 | 0.70 | 0.4 | 0.3 | 0.4 | 0.4 | 0.36 | 0.6 | 1.0 | 0.4 | 0.7 | 0.70 | 0.208 | 55 | 11.414 | $600 |
| 7-707.6-L | Island 91 | 0.2 | 1.0 | 0.2 | - | 0.00 | 0.2 | 1.0 | 0.2 | - | 0.00 | 0.2 | 1.0 | 0.2 | - | 0.00 | 0.000 | - | | |
| 7-703.8-L | Old Cormorant Island 1 & 2 | 0.2 | 0.7 | 0.9 | 0.6 | 0.56 | 0.1 | 0.3 | 0.9 | 0.3 | 0.30 | 0.4 | 0.7 | 0.9 | 0.6 | 0.63 | 0.190 | 40 | 7.583 | $960 |
| 7-703.5-L | N. Red Oak Ridge | 1.0 | 0.3 | 0.8 | 0.7 | 0.57 | 0.6 | 0.3 | 0.8 | 0.4 | 0.44 | 1.0 | 0.3 | 0.8 | 0.7 | 0.57 | 0.084 | 10 | 0.840 | $14,790 |
| 7-703.1-L | S. Red Oak Ridge | 1.0 | 0.3 | 0.8 | 0.7 | 0.57 | 0.6 | 0.3 | 0.8 | 0.4 | 0.44 | 1.0 | 0.3 | 0.8 | 0.7 | 0.57 | 0.084 | 10 | 0.840 | $17,030 |
| 7-703.0-L | L. Onalaska Island B & C | 0.4 | 0.9 | 0.8 | 0.6 | 0.67 | 0.1 | 0.4 | 0.8 | 0.3 | 0.32 | 0.5 | 0.9 | 0.8 | 0.6 | 0.70 | 0.226 | 190 | 42.913 | $510 |
| Total Po[illegible] | | | | | | | | | | | | | | | | | | 310 | | |

# MISSISSIPPI RIVER BANK STABILIZATION - UMRS-EMP
## EROSION SITE INFORMATION - Biological Factors

| SI=Suitability Index V#=Value Category | | Existing Conditions | | | | | Future without Project | | | | | Future with Project | | | | | HSI Gain with project | Total acres affected | Habitat value of stabilization | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site | | Direct impacts | Indirect impacts | Site location | Species richness | | Direct impacts | Indirect impacts | Site location | Species richness | | Direct impacts | Indirect impacts | Site location | Species richness | | | | AAHU gain | Cost/ AAHU |
| Number | Name | SI V1 | SI V2 | SI V3 | SI V4 | HSI | SI V1 | SI V2 | SI V3 | SI V4 | HSI | SI V1 | SI V2 | SI V3 | SI V4 | HSI | | | | |
| 8-699.3-L | N. Taylor Island | 0.4 | 0.4 | 0.2 | 0.3 | 0.32 | 0.3 | 0.3 | 0.2 | 0.2 | 0.24 | 0.4 | 0.4 | 0.2 | 0.3 | 0.32 | 0.049 | 10 | 0.486 | $43,690 |
| 8-698.5-L | S. Taylor Island | 0.4 | 0.2 | 0.2 | 0.3 | 0.26 | 0.3 | 0.2 | 0.2 | 0.2 | 0.21 | 0.4 | 0.2 | 0.2 | 0.3 | 0.26 | 0.027 | 15 | 0.398 | $6,810 |
| 8-698.2-R | W. Channel Island | 0.5 | 0.4 | 0.2 | - | 0.00 | 0.5 | 0.4 | 0.2 | - | 0.00 | 0.5 | 0.4 | 0.2 | - | 0.00 | 0.000 | - | | |
| 8-696.6-R | Broken Arrow (Target Lake) | 0.5 | 0.6 | 0.5 | 0.6 | 0.56 | 0.3 | 0.4 | 0.5 | 0.5 | 0.43 | 0.5 | 0.6 | 0.5 | 0.6 | 0.56 | 0.085 | 45 | 3.839 | $1,410 |
| 8-693.8-R | Root River | 0.2 | 0.2 | 0.2 | - | 0.00 | 0.2 | 0.2 | 0.2 | - | 0.00 | 0.2 | 0.2 | 0.2 | - | 0.00 | 0.000 | - | | |
| 8-688.4-L | Brownsville Daymark | 0.2 | 0.3 | 0.5 | - | 0.00 | 0.2 | 0.3 | 0.5 | - | 0.00 | 0.2 | 0.3 | 0.5 | - | 0.00 | 0.000 | - | | |
| 8-685.2-L | East Island | 0.2 | 0.4 | 1.0 | - | 0.00 | 0.2 | 0.4 | 1.0 | - | 0.00 | 0.2 | 0.4 | 1.0 | - | 0.00 | 0.000 | - | | |
| 8-685.0-R | Heron & Trapping Isl | 0.4 | 0.8 | 1.0 | 0.7 | 0.71 | 0.3 | 0.4 | 1.0 | 0.5 | 0.48 | 0.4 | 0.8 | 1.0 | 0.7 | 0.71 | 0.141 | 115 | 16.243 | $260 |
| Total Pool 8 | | | | | | | | | | | | | | | | | | 185 | | |
| 9-677.4-R | Dark Slough | 0.6 | 0.2 | 0.3 | 0.2 | 0.26 | 0.4 | 0.2 | 0.3 | 0.2 | 0.24 | 0.6 | 0.2 | 0.3 | 0.2 | 0.26 | 0.010 | 5 | 0.052 | $538,170 |
| 9-676.7-R | Twin Island | 0.2 | 1.0 | 0.5 | - | 0.00 | 0.2 | 1.0 | 0.5 | - | 0.00 | 0.2 | 1.0 | 0.5 | - | 0.00 | 0.000 | - | | |
| 9-673.5-R | Side Chute (Island 135) | 0.2 | 0.2 | 0.2 | - | 0.00 | 0.2 | 0.2 | 0.2 | - | 0.00 | 0.2 | 0.2 | 0.2 | - | 0.00 | 0.000 | - | | |
| 9-671.1-L | Head of Battle Island | 0.2 | 0.5 | 0.4 | - | 0.00 | 0.2 | 0.5 | 0.4 | - | 0.00 | 0.2 | 0.5 | 0.4 | - | 0.00 | 0.000 | - | | |
| 9-671.0-L | Battle Island | 0.2 | 0.5 | 0.4 | - | 0.00 | 0.2 | 0.5 | 0.4 | - | 0.00 | 0.2 | 0.5 | 0.4 | - | 0.00 | 0.000 | - | | |
| 9-666.1-R | Hummingbird Slough | 0.2 | 0.9 | 0.6 | 0.7 | 0.60 | 0.2 | 0.4 | 0.6 | 0.4 | 0.38 | 0.2 | 1.0 | 0.6 | 0.7 | 0.62 | 0.145 | 120 | 17.372 | $410 |
| 9-664.9-R | Lansing Light | 0.2 | 0.7 | 0.6 | 0.7 | 0.55 | 0.2 | 0.3 | 0.6 | 0.4 | 0.35 | 0.2 | 0.7 | 0.6 | 0.7 | 0.55 | 0.128 | 40 | 5.113 | $4,300 |
| 9-654.1-R | Upper Harpers Sloug | 0.4 | 0.9 | 1.0 | 0.8 | 0.77 | 0.1 | 0.4 | 1.0 | 0.5 | 0.40 | 0.4 | 0.9 | 1.0 | 0.8 | 0.77 | 0.229 | 250 | 57.184 | $420 |
| 9-653.4-R | Middle Harpers Sloug | 0.2 | 0.9 | 1.0 | 0.8 | 0.69 | 0.1 | 0.4 | 1.0 | 0.5 | 0.40 | 0.3 | 0.9 | 1.0 | 0.8 | 0.73 | 0.196 | 12 | 2.354 | $1,440 |
| 9-652.6-R | Lower Harpers Sloug | 0.4 | 0.8 | 0.9 | 0.7 | 0.70 | 0.1 | 0.3 | 0.9 | 0.4 | 0.33 | 0.5 | 0.8 | 0.9 | 0.7 | 0.72 | 0.236 | 150 | 35.344 | $820 |
| 9-648.0-R | Dam 9 Island | 0.4 | 0.4 | 0.6 | 0.7 | 0.52 | 0.1 | 0.2 | 0.6 | 0.5 | 0.29 | 0.4 | 0.4 | 0.6 | 0.7 | 0.52 | 0.139 | 5 | 0.695 | $7,090 |
| Total Pool 9 | | | | | | | | | | | | | | | | | | 582 | | |

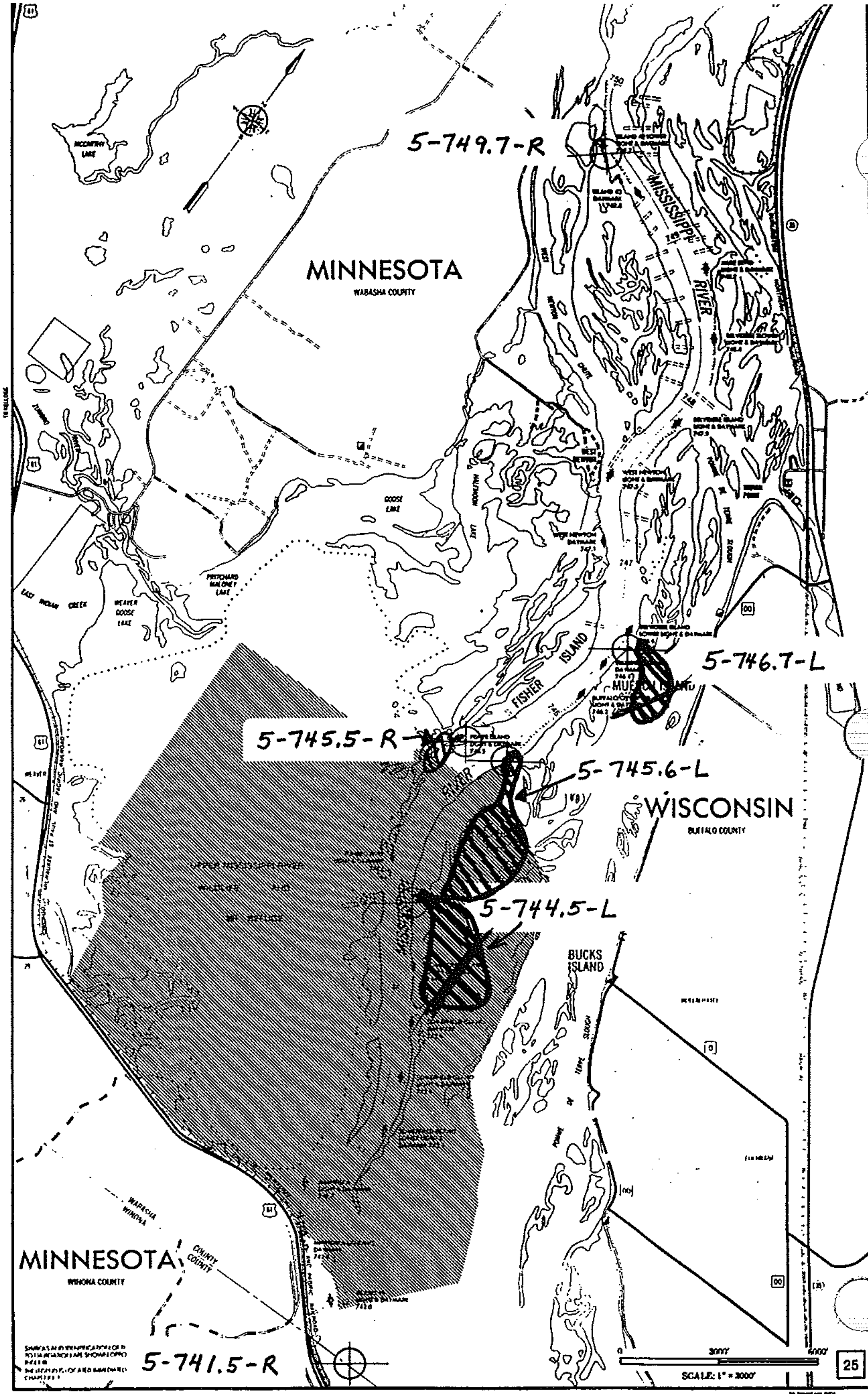
# MISSISSIPPI RIVER BANK STABILIZATION - UMRS-EMP
## EROSION SITE INFORMATION - Biological Factors

| SI=Suitability Index V#=Value Category | | Existing Conditions | | | | | Future without Project | | | | | Future with Project | | | | | HSI Gain with project | Total acres affected | Habitat value of stabilization | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site | | Direct impacts | Indirect impacts | Site location | Species richness | | Direct impacts | Indirect impacts | Site location | Species richness | | Direct impacts | Indirect impacts | Site location | Species richness | | | | AAHU gain | Cost/ AAHU |
| Number | Name | SI V1 | SI V2 | SI V3 | SI V4 | HSI | SI V1 | SI V2 | SI V3 | SI V4 | HSI | SI V1 | SI V2 | SI V3 | SI V4 | HSI | | | | |
| 10-646.5-L | Gordon Bay Inlet | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| 10-646.4-R | Billy Slough | 0.4 | 0.8 | 0.7 | 1.0 | 0.75 | 0.2 | 0.4 | 0.7 | 0.5 | 0.42 | 0.4 | 1.0 | 0.7 | 1.0 | 0.81 | 0.226 | 350 | 79.224 | $640 |
| 10-644.3-L | Jackson Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| 10-643.1-L | Gordon Bay Upper Daymk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| 10-641.1-L | Island 166 | 0.3 | 1.0 | 0.4 | - | 0.00 | 0.3 | 1.0 | 0.4 | - | 0.00 | 0.3 | 1.0 | 0.4 | - | 0.00 | 0.000 | - | | |
| 10-637.8-L | Roseau Slough | 0.4 | 0.5 | 0.4 | 0.4 | 0.43 | 0.4 | 0.3 | 0.4 | 0.4 | 0.36 | 0.4 | 0.5 | 0.4 | 0.4 | 0.43 | 0.042 | 35 | 1.456 | $3,500 |
| 10-636.4-L | East Channel | 0.4 | 0.8 | 0.4 | 0.8 | 0.63 | 0.2 | 0.4 | 0.4 | 0.4 | 0.36 | 0.4 | 0.8 | 0.4 | 0.8 | 0.63 | 0.172 | 65 | 11.167 | $1,320 |
| 10-631.8-L | Snake Island | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | | |
| 10-628.7-L | Wyalusing Upper Light | 0.4 | 0.5 | 0.4 | 0.5 | 0.46 | 0.3 | 0.4 | 0.4 | 0.5 | 0.41 | 0.4 | 0.5 | 0.4 | 0.5 | 0.46 | 0.033 | 25 | 0.824 | $5,330 |
| 10-628.0-R | Norweigan Slough | 0.4 | 0.5 | 0.3 | 0.4 | 0.41 | 0.4 | 0.3 | 0.3 | 0.4 | 0.35 | 0.4 | 0.6 | 0.3 | 0.4 | 0.44 | 0.050 | 70 | 3.496 | $1,520 |
| 10-626.5-R | Island 177 | 0.2 | 0.8 | 0.7 | - | 0.00 | 0.2 | 0.8 | 0.7 | - | 0.00 | 0.2 | 0.8 | 0.7 | - | 0.00 | 0.000 | - | | |
| 10-625.5-L | Island 181 (Catfish Sl) | 0.4 | 0.6 | 0.5 | 0.6 | 0.54 | 0.4 | 0.3 | 0.5 | 0.5 | 0.41 | 0.4 | 0.6 | 0.5 | 0.6 | 0.54 | 0.085 | 55 | 4.670 | $730 |
| 10-623.3-L | Hovie Island | 0.2 | 0.3 | 0.4 | - | 0.00 | 0.2 | 0.3 | 0.4 | - | 0.00 | 0.2 | 0.3 | 0.4 | - | 0.00 | 0.000 | - | | |
| 10-621.0-L | Duck Lake Chute | 0.3 | 0.8 | 0.6 | 0.7 | 0.62 | 0.3 | 0.3 | 0.6 | 0.4 | 0.37 | 0.3 | 0.9 | 0.6 | 0.7 | 0.64 | 0.163 | 45 | 7.349 | $790 |
| 10-620.1-L | Frenchtown Light | 0.2 | 0.4 | 0.5 | - | 0.00 | 0.2 | 0.4 | 0.5 | - | 0.00 | 0.2 | 0.4 | 0.5 | - | 0.00 | 0.000 | - | | |
| 10-616.0-L | Ferry Slough Light | 0.2 | 0.8 | 0.7 | - | 0.00 | 0.2 | 0.8 | 0.7 | - | 0.00 | 0.2 | 0.8 | 0.7 | - | 0.00 | 0.000 | - | | |
| Total Pool 10 | | | | | | | | | | | | | | | | | | 645 | | |

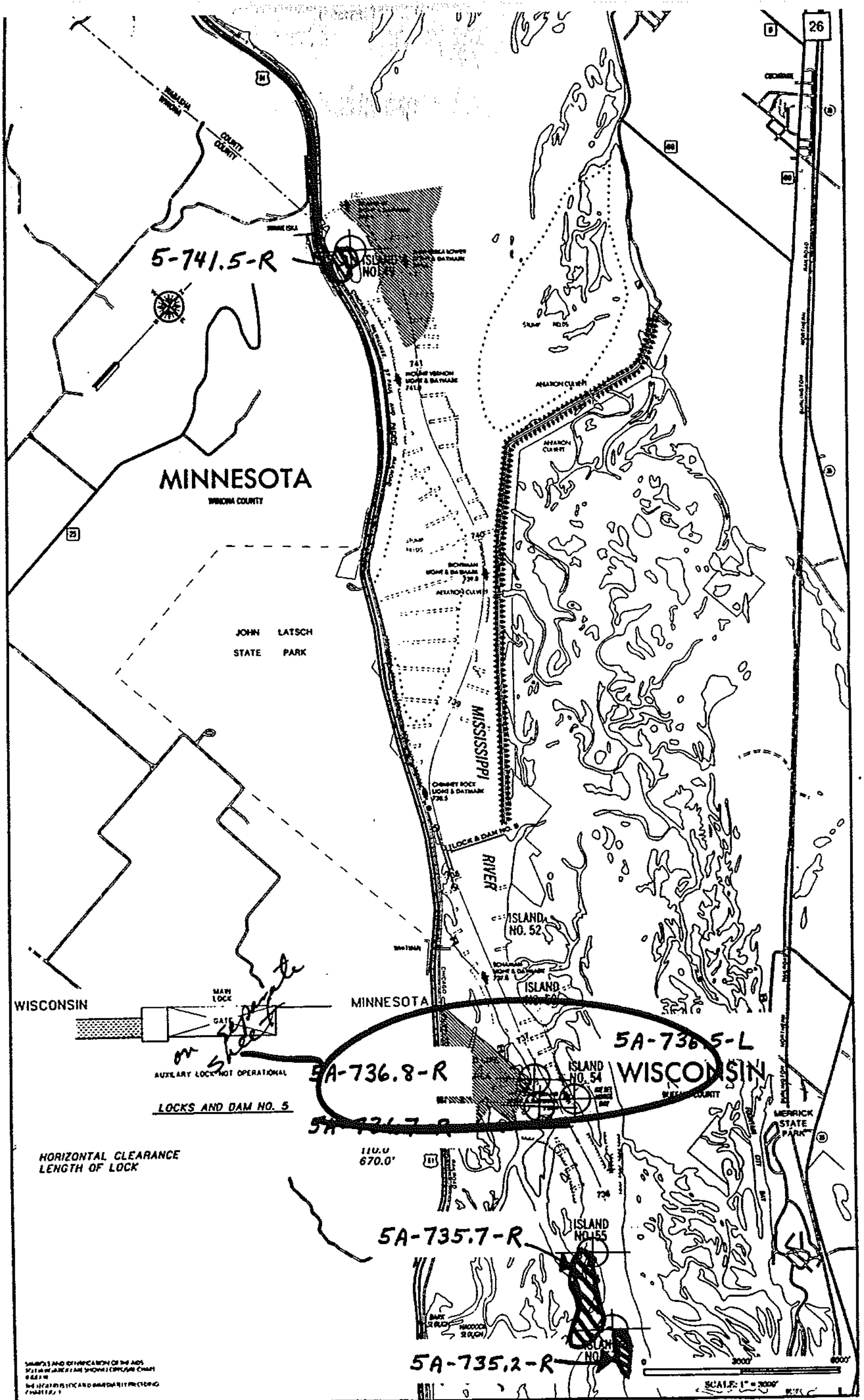
MAPS OF AREAS AFFECTED

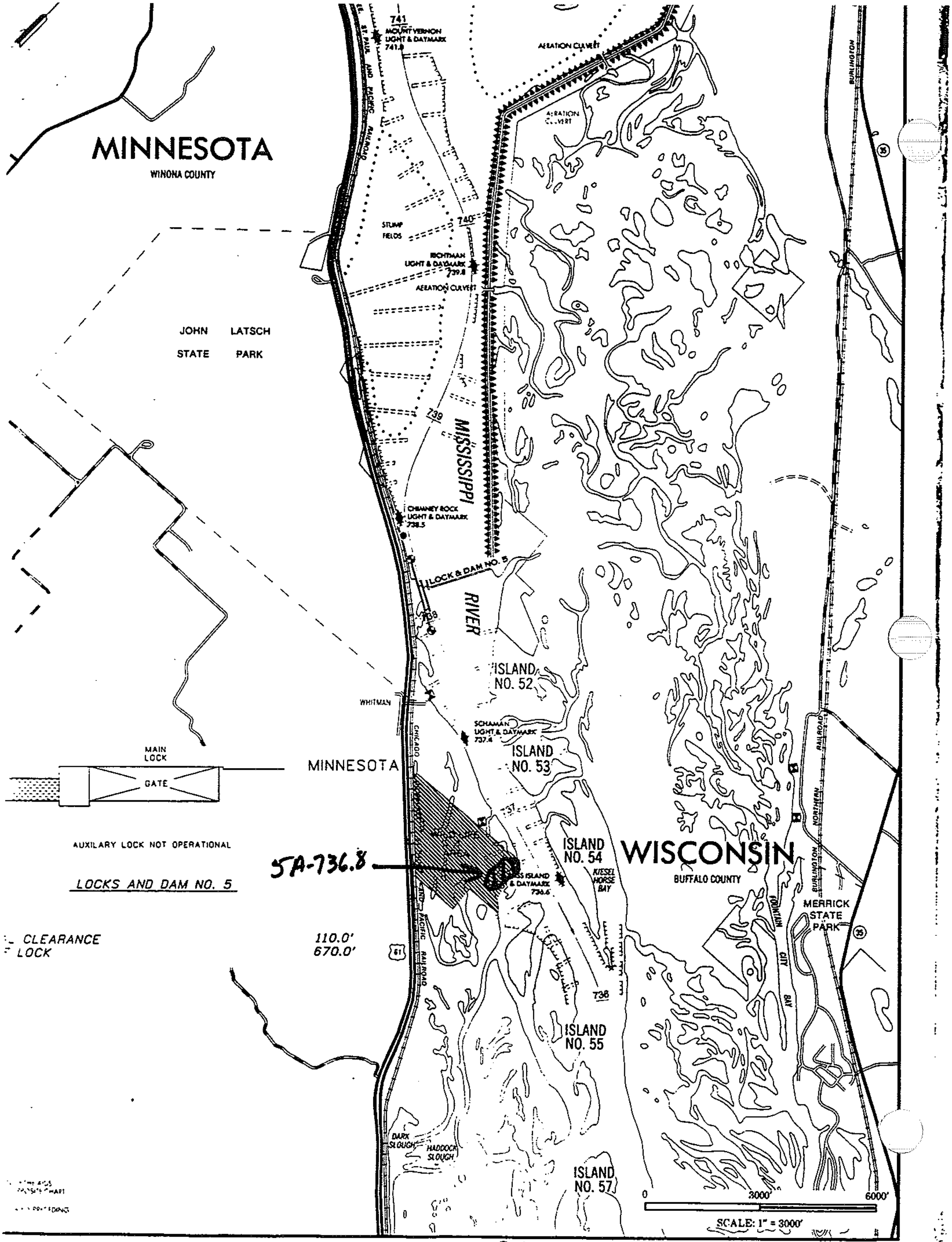
AT EACH STABILIZATION SITE

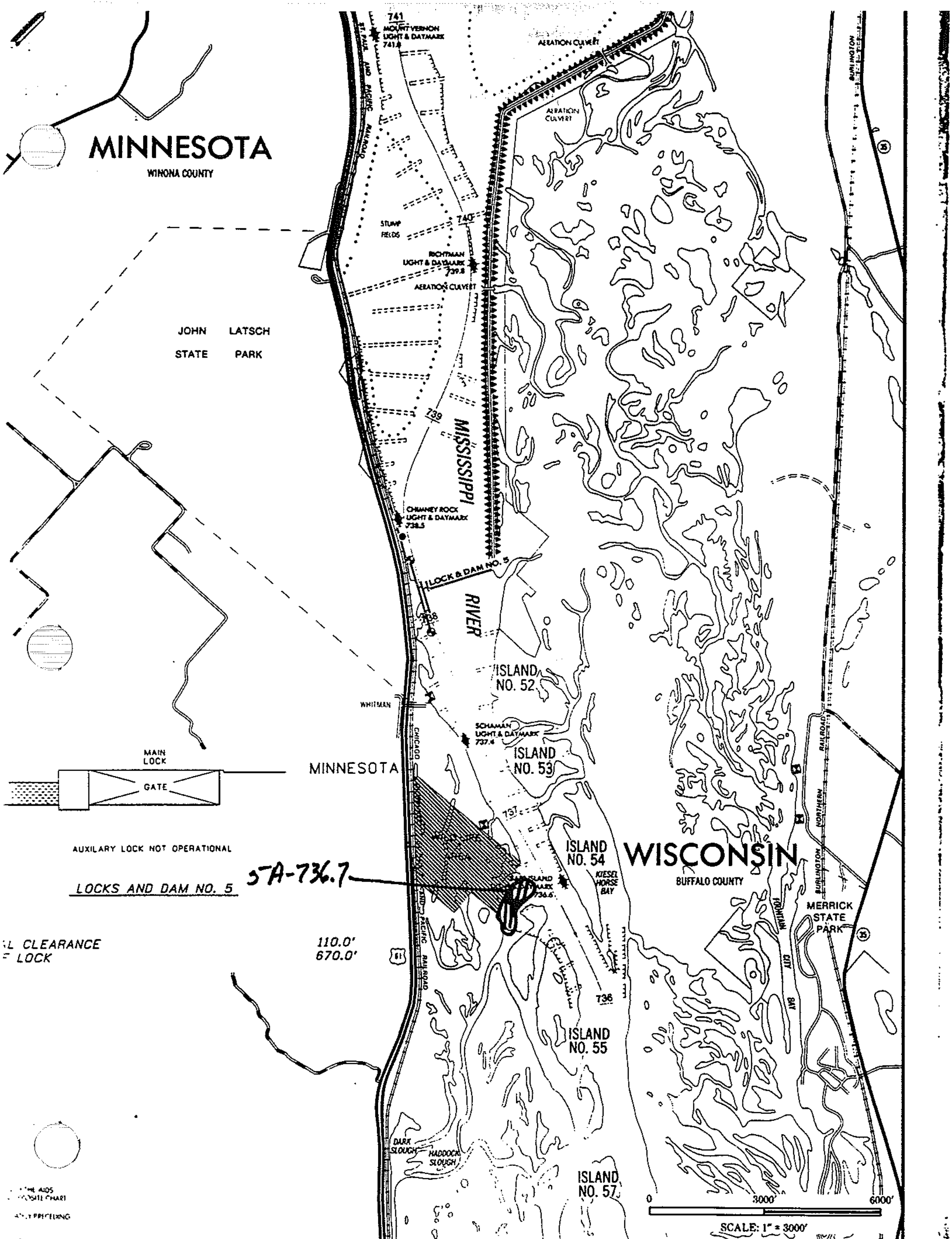
update the audience plas



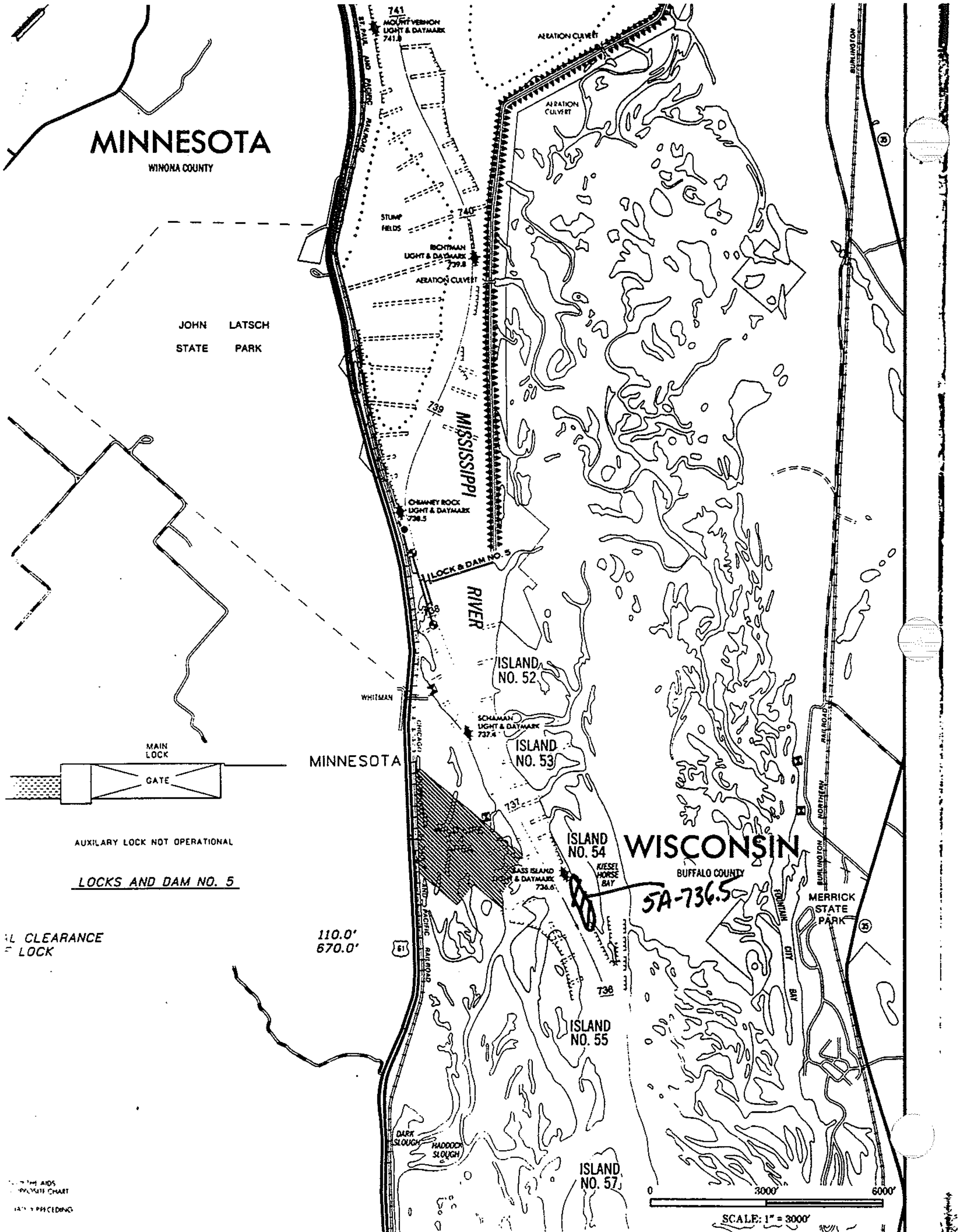

MILE 742 TO MILE 750


5-741.5-R
MINNESOTA
WINONA COUNTY
JOHN LATSCH
STATE PARK
MISSISSIPPI
RIVER
LOCK & DAM NO. 5
ISLAND NO. 52
WISCONSIN
MINNESOTA
MAIN LOCK
GATE
AUXILARY LOCK NOT OPERATIONAL
LOCKS AND DAM NO. 5
5A-736.8-R
5A-736.5-L
ISLAND NO. 54
WISCONSIN
BUFFALO COUNTY
HORIZONTAL CLEARANCE
LENGTH OF LOCK
110.0
670.0'
MERRICK STATE PARK
ISLAND NO. 55
5A-735.7-R
5A-735.2-R
0
3000'
6000'
SCALE: 1" = 3000'
26

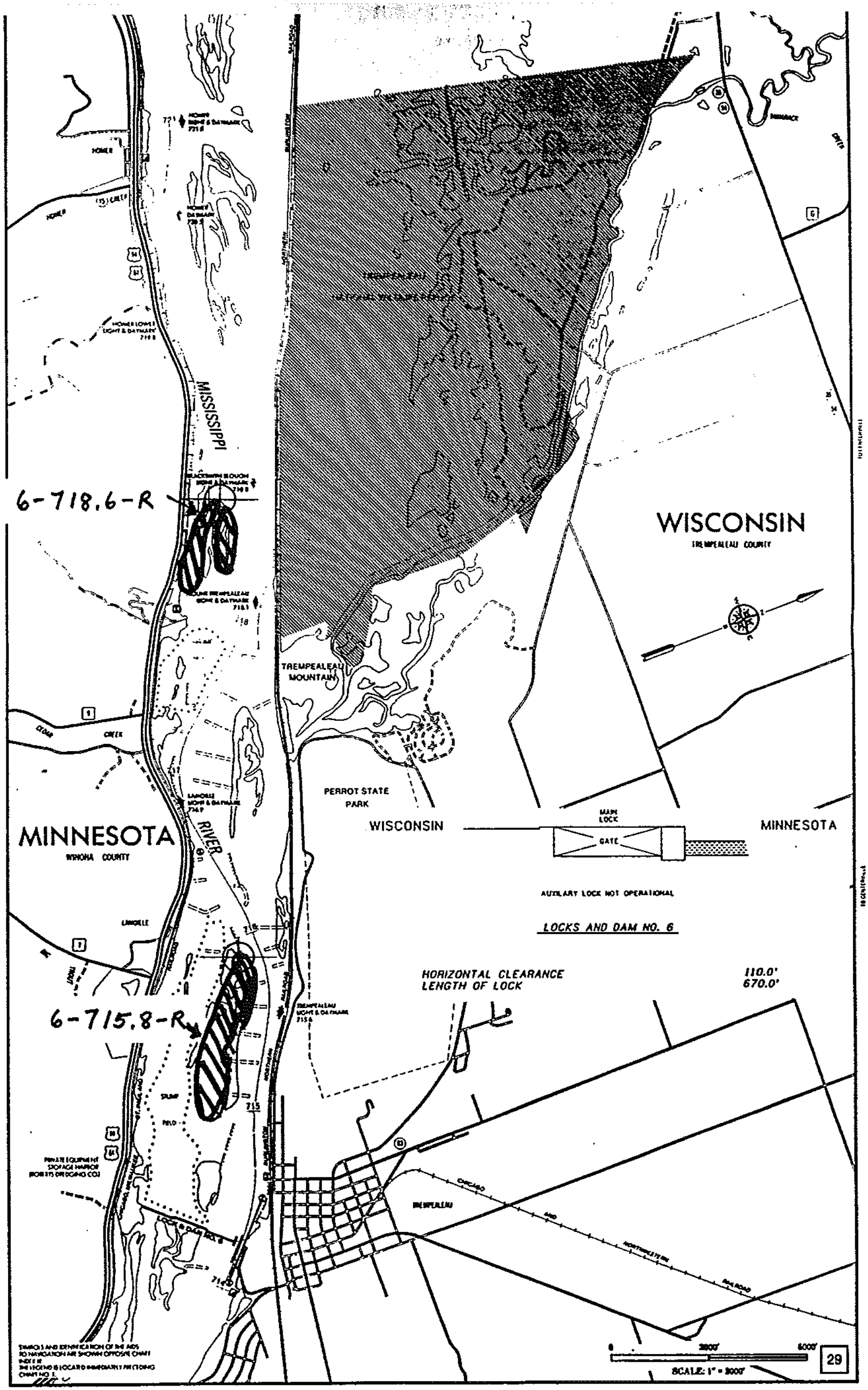

MINNESOTA
WINONA COUNTY
JOHN LATSCH
STATE PARK
MOUNT VERNON LIGHT & DAYMARK 741.8
AERATION CULVERT
STUMP FIELDS
RICHTMAN LIGHT & DAYMARK 739.8
CHIMNEY ROCK LIGHT & DAYMARK 738.5
LOCK & DAM NO. 5
MISSISSIPPI
RIVER
WHITMAN
ISLAND NO. 52
SCHAMAN LIGHT & DAYMARK 737.4
ISLAND NO. 53
MINNESOTA
MAIN LOCK
GATE
AUXILARY LOCK NOT OPERATIONAL
LOCKS AND DAM NO. 5
CLEARANCE 110.0'
LOCK 670.0'
5A-736.8
ISLAND NO. 54
KIESEL HORSE BAY
WISCONSIN
BUFFALO COUNTY
FOUNTAIN CITY BAY
MERRICK STATE PARK
BURLINGTON NORTHERN RAILROAD
CHICAGO ... AND PACIFIC RAILROAD
ST. PAUL AND PACIFIC RAILROAD
ISLAND NO. 55
DARK SLOUGH
HADDOCK SLOUGH
ISLAND NO. 57
0
3000'
6000'
SCALE: 1" = 3000'



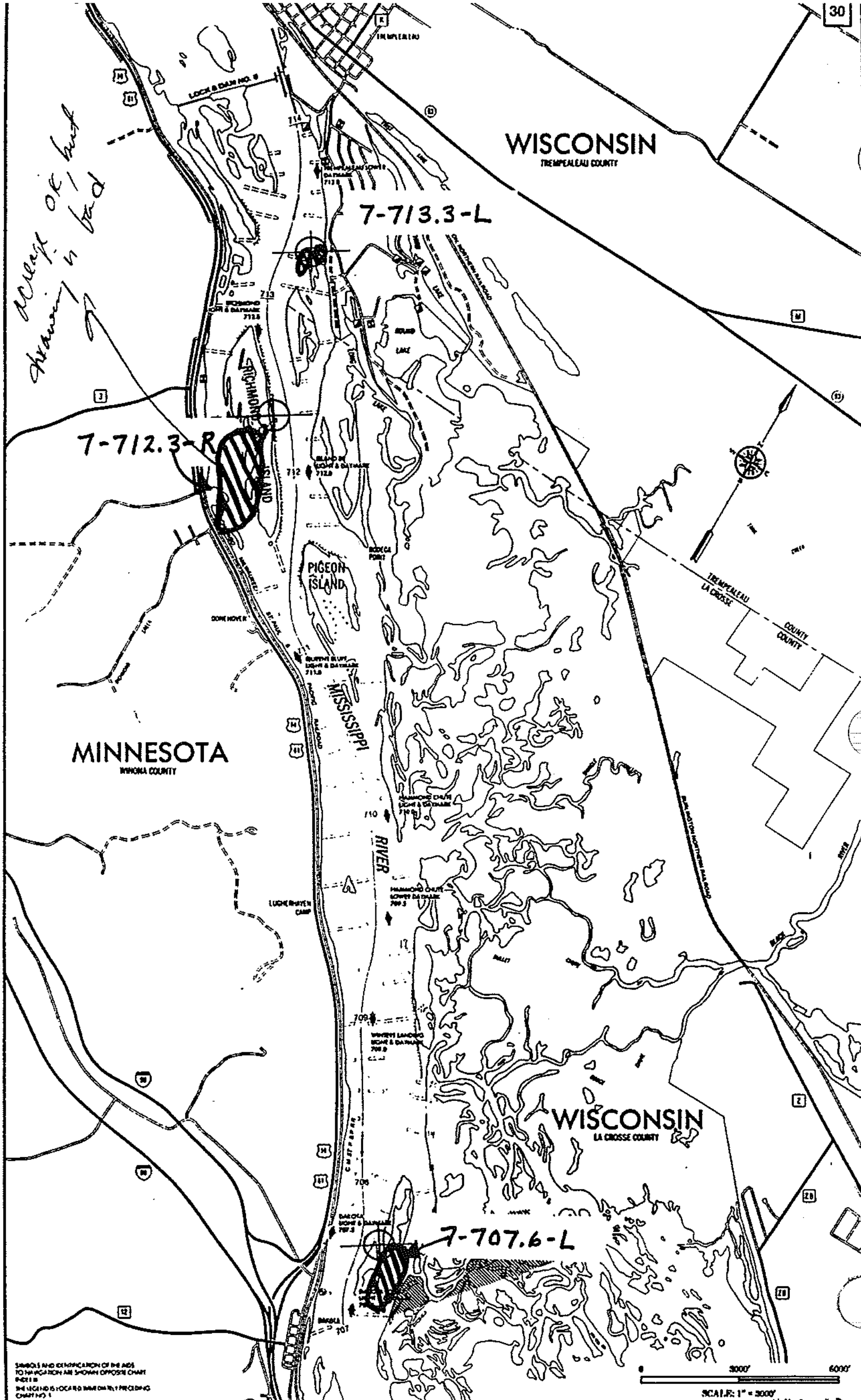
MINNESOTA
WINONA COUNTY
JOHN LATSCH
STATE PARK
741
MOUNT VERNON LIGHT & DAYMARK 741.8
AERATION CULVERT
STUMP FIELDS
740
RICHTMAN LIGHT & DAYMARK 739.8
739
MISSISSIPPI
RIVER
CHIMNEY ROCK LIGHT & DAYMARK 738.5
LOCK & DAM NO. 5
738
ISLAND NO. 52
WHITMAN
SCHAMAN LIGHT & DAYMARK 737.4
ISLAND NO. 53
MAIN LOCK
GATE
MINNESOTA
737
AUXILARY LOCK NOT OPERATIONAL
ISLAND NO. 54
WISCONSIN
BUFFALO COUNTY
KIESEL HORSE BAY
LOCKS AND DAM NO. 5
5-A-736.7
CLEARANCE
LOCK
110.0'
670.0'
61
736
MERRICK STATE PARK
35
FOUNTAIN CITY BAY
BURLINGTON NORTHERN RAILROAD
CHICAGO
RAILROAD
ISLAND NO. 55
DARK SLOUGH
HADDOCK SLOUGH
ISLAND NO. 57
0
3000'
6000'
SCALE: 1" = 3000'

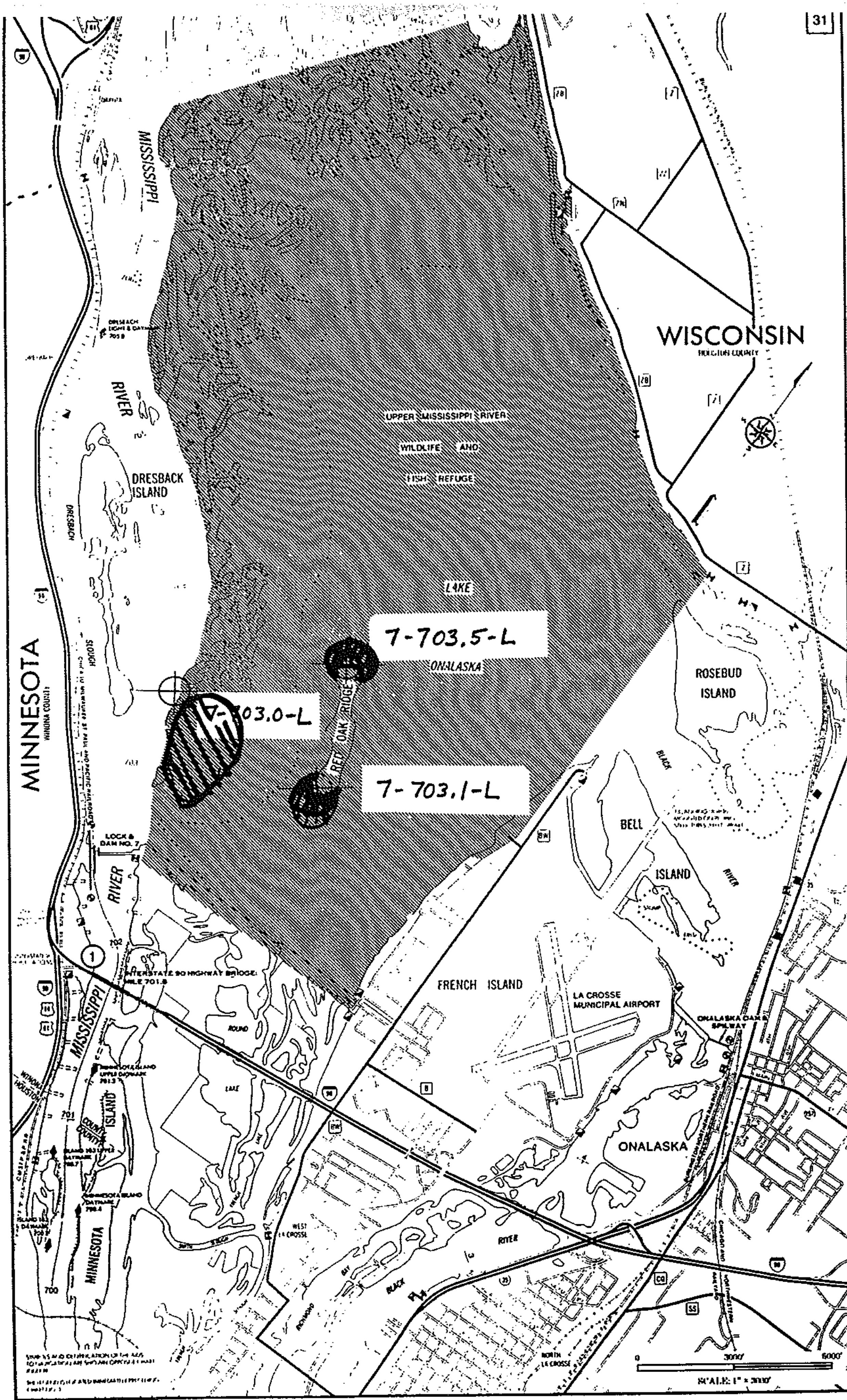


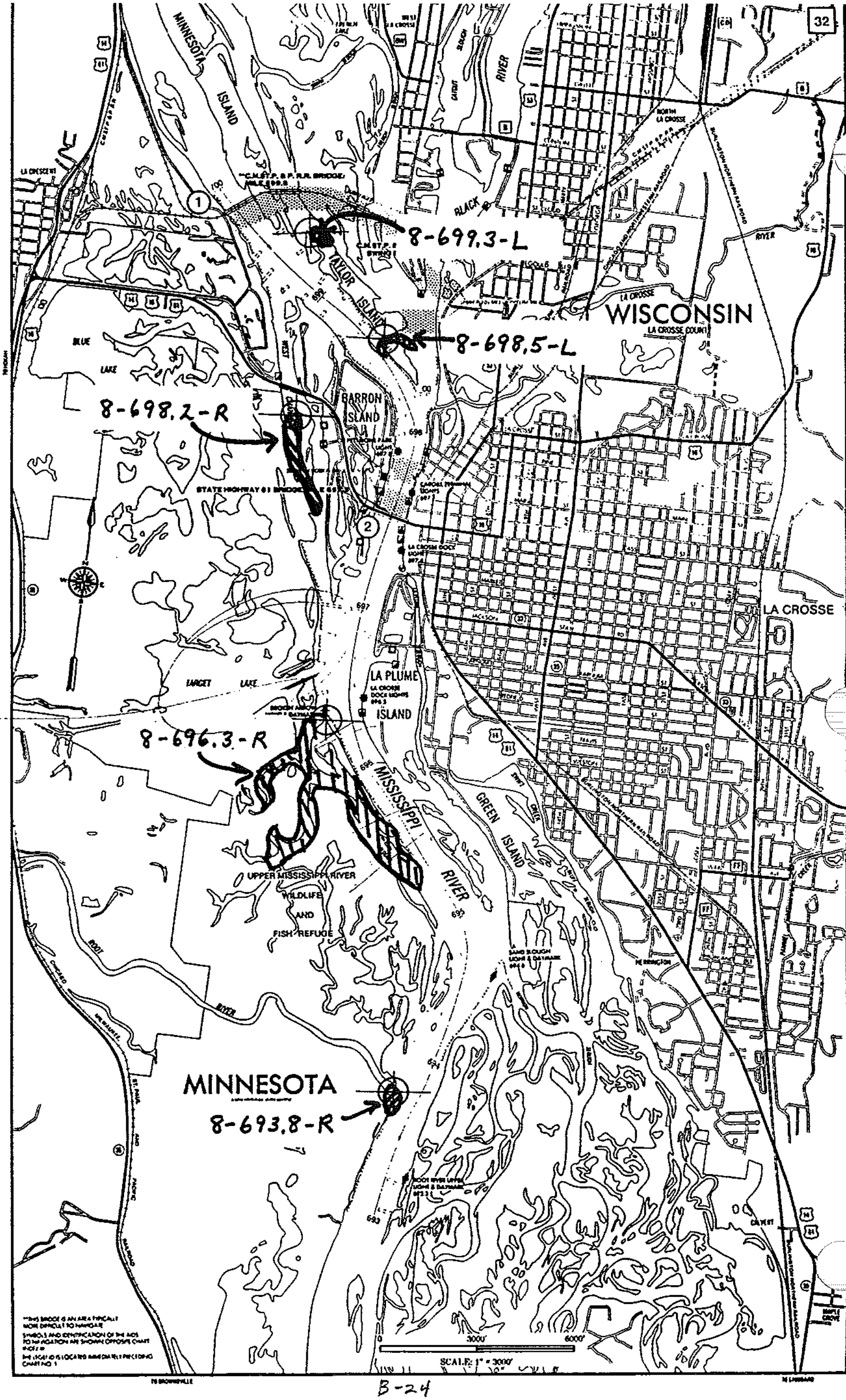
MINNESOTA
WINONA COUNTY
JOHN LATSCH
STATE PARK
741
MOUNT VERNON LIGHT & DAYMARK 741.0
AERATION CULVERT
AERATION CULVERT
STUMP FIELDS
740
RICHTMAN LIGHT & DAYMARK 739.8
AERATION CULVERT
739
MISSISSIPPI
CHIMNEY ROCK LIGHT & DAYMARK 738.5
LOCK & DAM NO. 5
RIVER
738
ISLAND NO. 52
WHITMAN
SCHAMAN LIGHT & DAYMARK 737.6
ISLAND NO. 53
MINNESOTA
737
ISLAND NO. 54
WISCONSIN
BUFFALO COUNTY
KIESEL HORSE BAY
BASS ISLAND LIGHT & DAYMARK 736.6
5A-736.5
FOUNTAIN CITY BAY
MERRICK STATE PARK
35
61
736
ISLAND NO. 55
DARK SLOUGH
HADDOCK SLOUGH
ISLAND NO. 57
0
3000'
6000'
SCALE: 1" = 3000'
BURLINGTON NORTHERN RAILROAD
CHICAGO ... AND PACIFIC RAILROAD
ST. PAUL AND PACIFIC RAILROAD
MAIN LOCK
GATE
AUXILARY LOCK NOT OPERATIONAL
LOCKS AND DAM NO. 5
L CLEARANCE
F LOCK
110.0'
670.0'



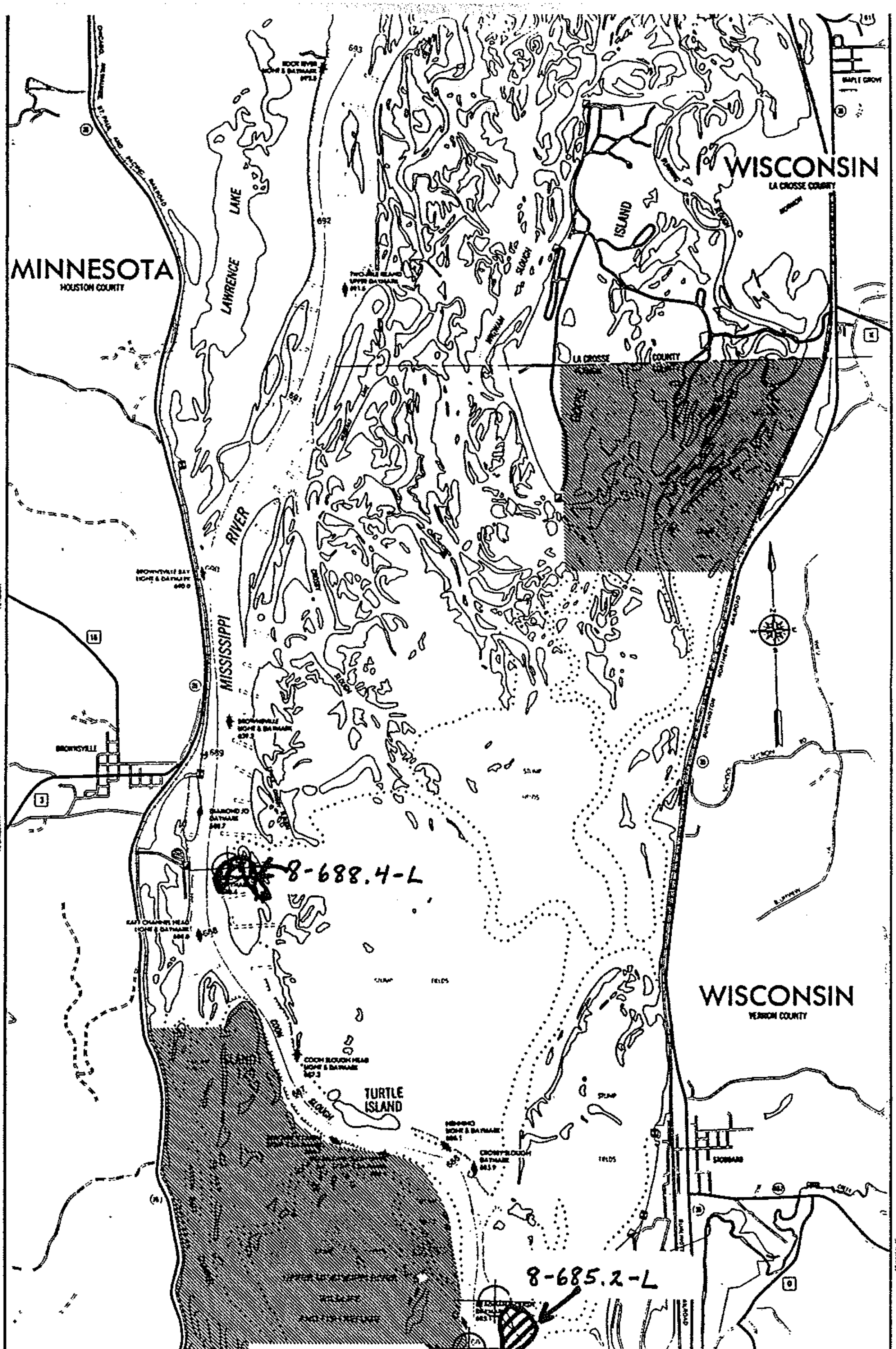

MILE 714 TO MILE 721


WISCONSIN
TREMPEALEAU COUNTY
LOCK & DAM NO. 6
7-713.3-L
accuracy ok, but drawing is bad
7-712.3-R
RICHMOND ISLAND
PIGEON ISLAND
MISSISSIPPI
RIVER
MINNESOTA
WINONA COUNTY
TREMPEALEAU
LA CROSSE
COUNTY
COUNTY
WISCONSIN
LA CROSSE COUNTY
7-707.6-L
0
3000'
6000'
SCALE: 1" = 3000'


31
MISSISSIPPI
RIVER
DRESBACK
ISLAND
MINNESOTA
WINONA COUNTY
WISCONSIN
UPPER MISSISSIPPI RIVER
WILDLIFE AND
FISH REFUGE
LAKE
ONALASKA
7-703.5-L
7-703.0-L
7-703.1-L
RED OAK RIDGE
ROSEBUD
ISLAND
BLACK
BELL
ISLAND
RIVER
LOCK & DAM NO. 7
INTERSTATE 90 HIGHWAY BRIDGE: MILE 701.8
FRENCH ISLAND
LA CROSSE
MUNICIPAL AIRPORT
ONALASKA DAM & SPILLWAY
ONALASKA
MISSISSIPPI
ISLAND
MINNESOTA
WEST LA CROSSE
BLACK
RIVER
NORTH LA CROSSE
SCALE 1" = 3000'

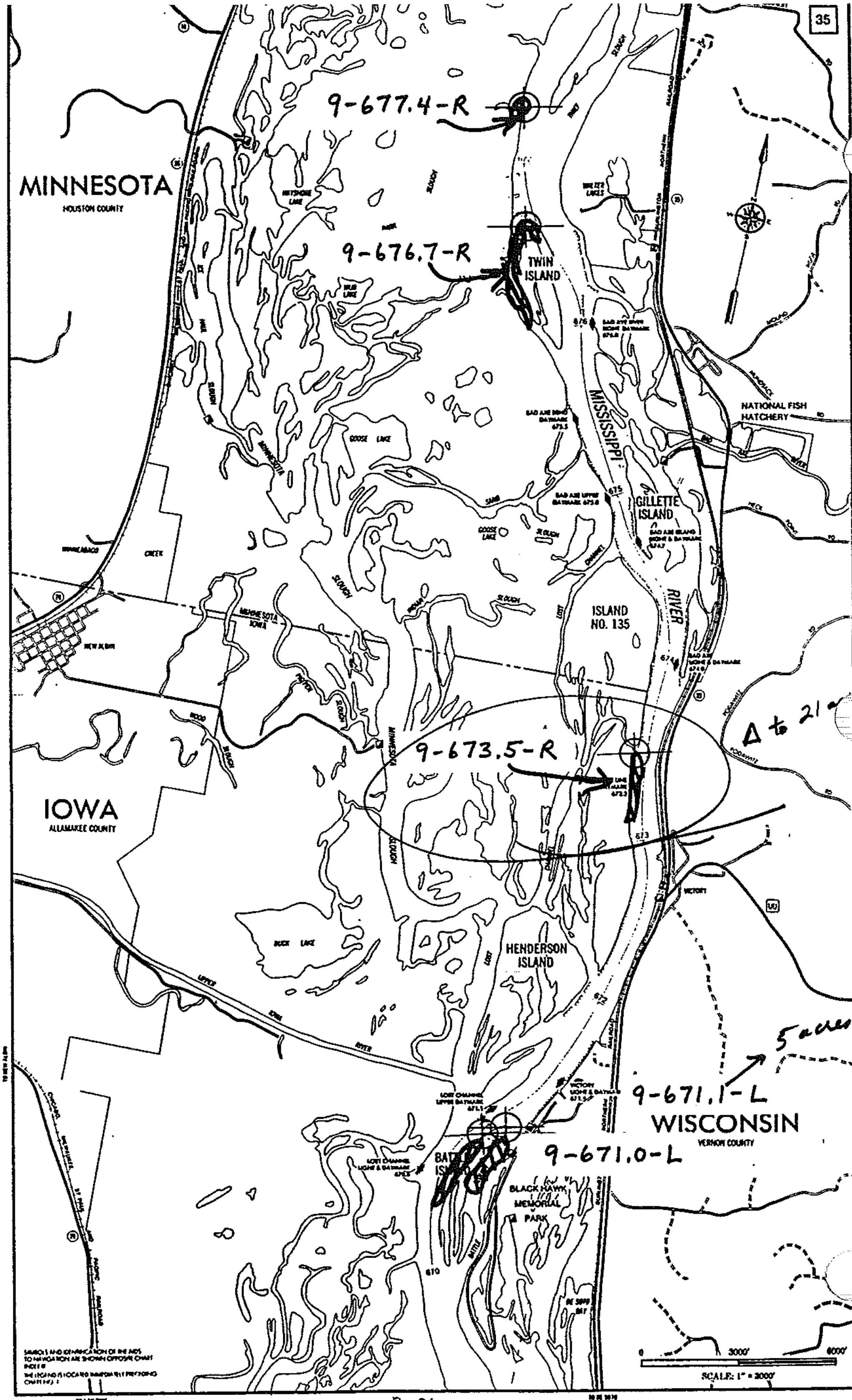



this is the project area

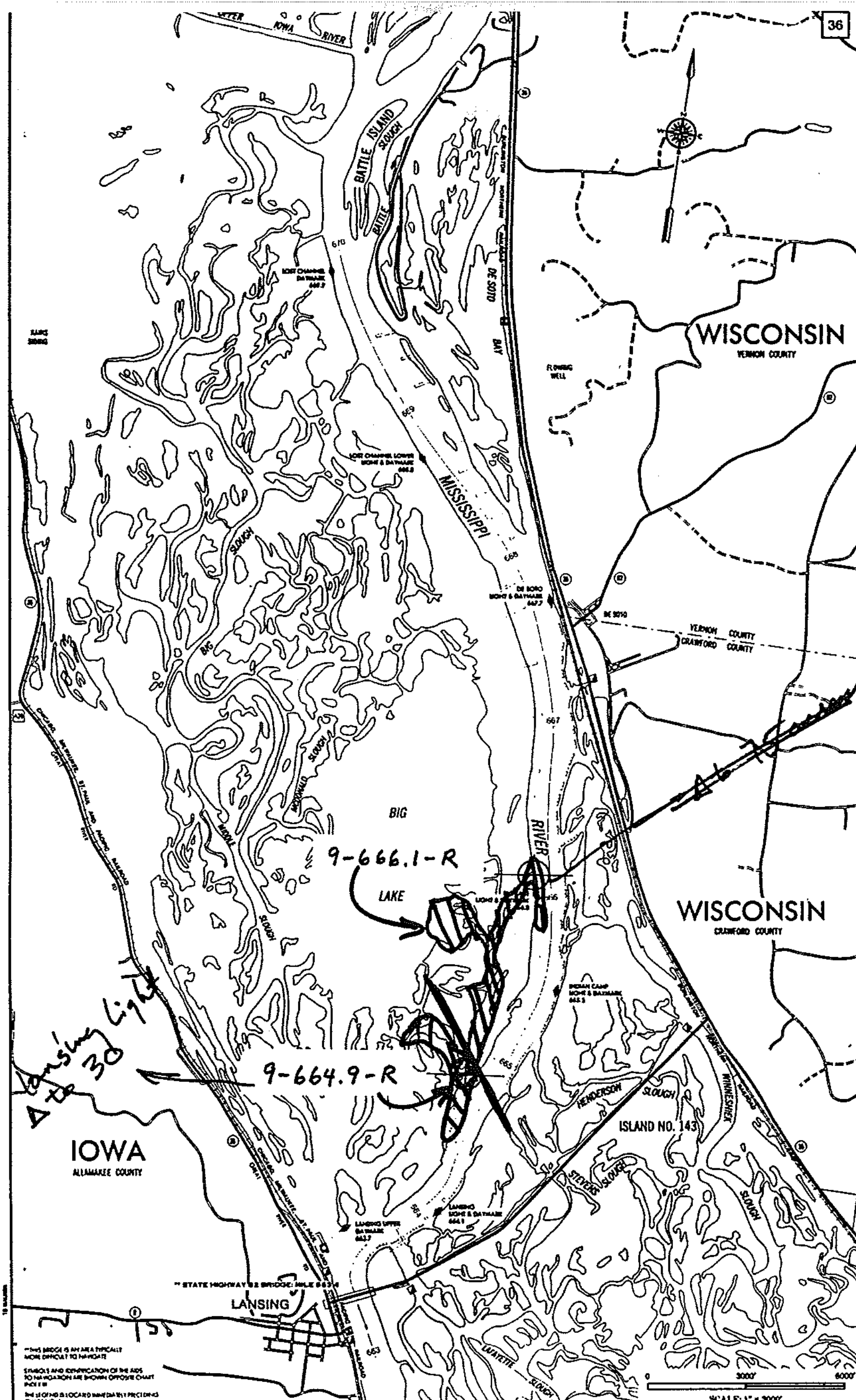


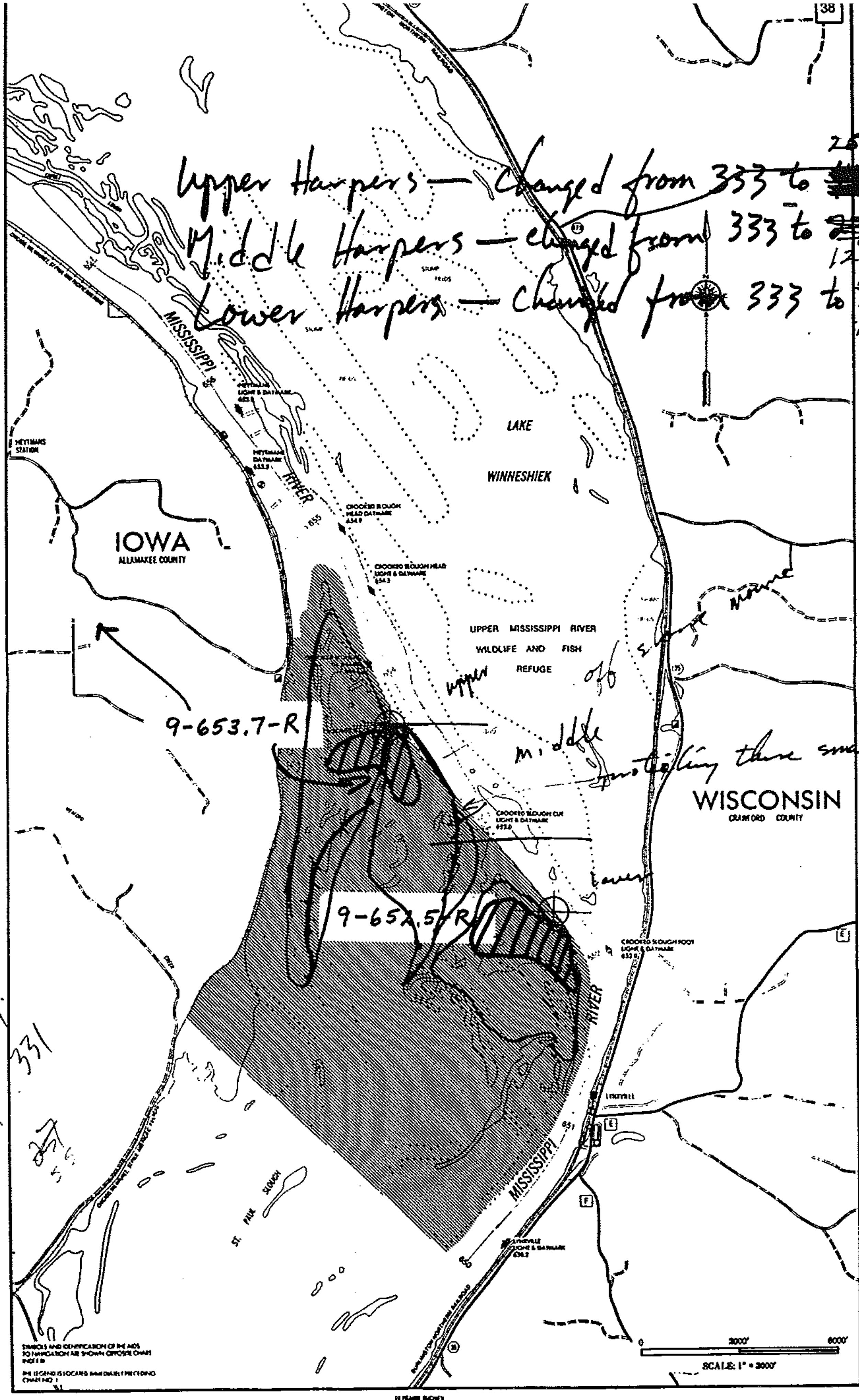

MILE 685 TO MILE 693

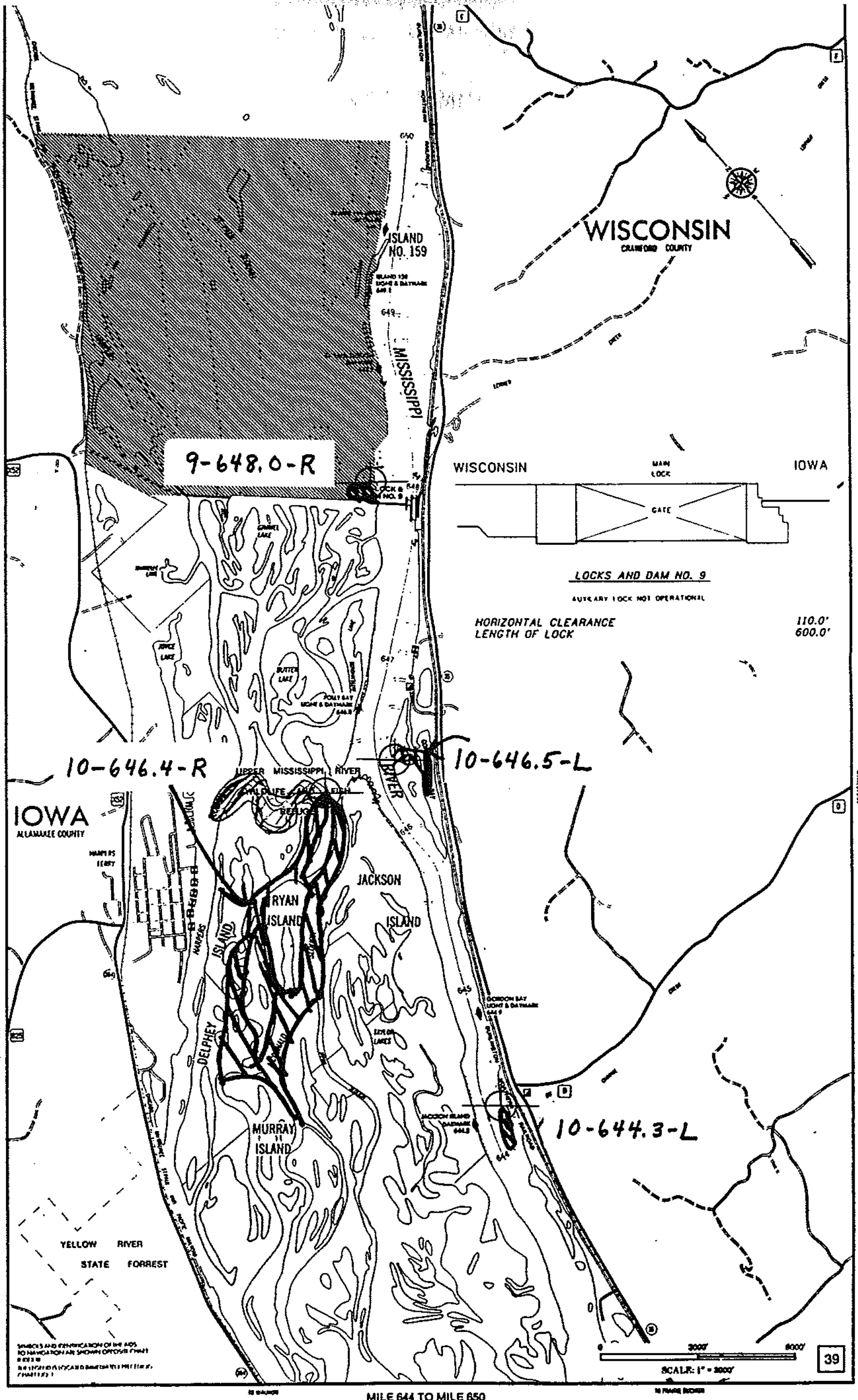
B-25



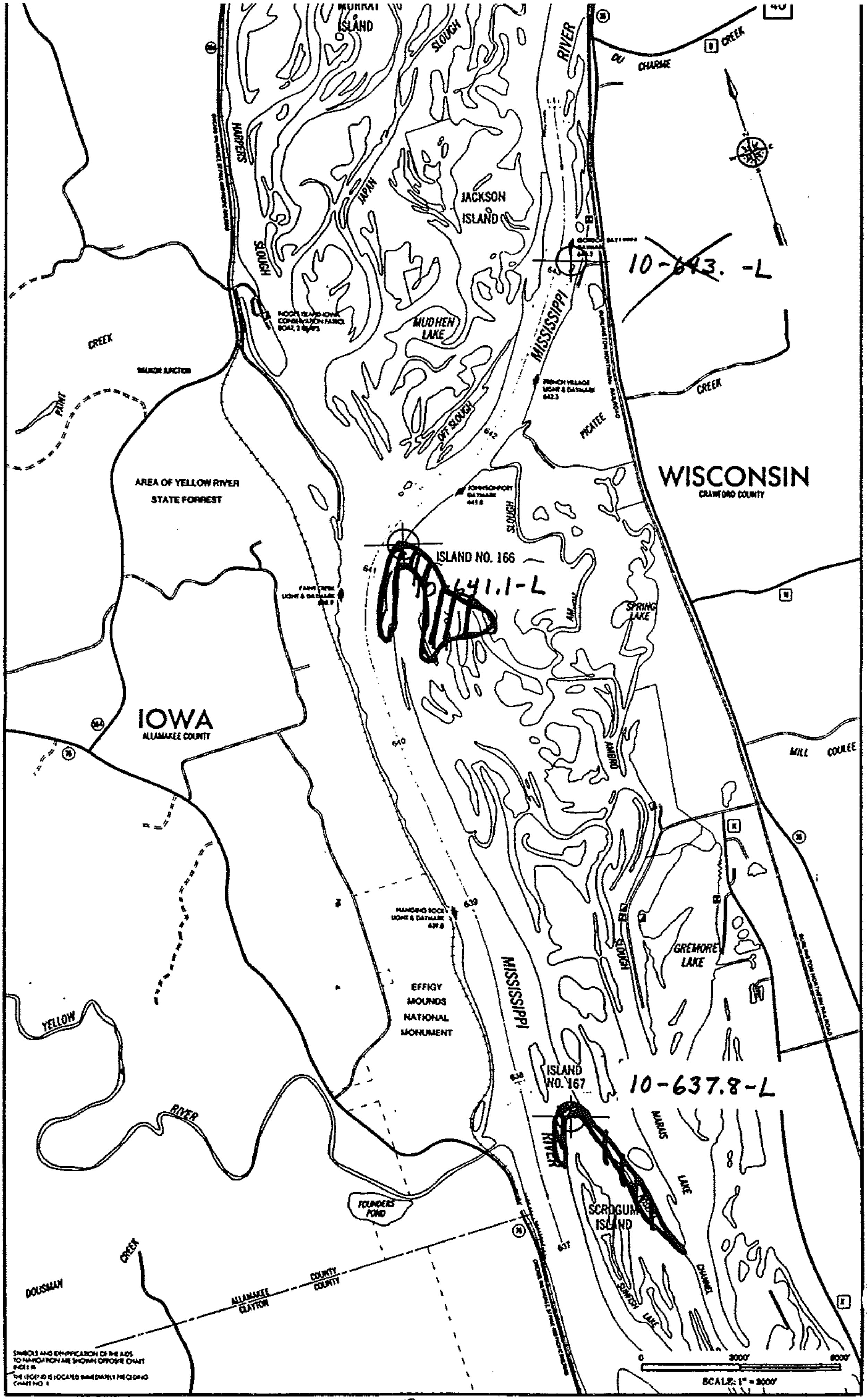
35
MINNESOTA
HOUSTON COUNTY
IOWA
ALLAMAKEE COUNTY
WISCONSIN
VERNON COUNTY
MISSISSIPPI
RIVER
TWIN ISLAND
GILLETTE ISLAND
ISLAND NO. 135
HENDERSON ISLAND
BLACK HAWK MEMORIAL PARK
NATIONAL FISH HATCHERY
GOOSE LAKE
BUCK LAKE
UPPER IOWA RIVER
9-677.4-R
9-676.7-R
9-673.5-R
Δ to 21 acres
5 acres
9-671.1-L
9-671.0-L
SCALE: 1" = 3000'


UPPER IOWA RIVER
BATTLE ISLAND
SLOUGH
BATTLE
DE SOTO
BAY
WISCONSIN
VERNON COUNTY
MISSISSIPPI
669
668
667
666
665
664
663
DE SOTO
VERNON COUNTY
CRAWFORD COUNTY
BIG SLOUGH
MIDDLE SLOUGH
McDONALD SLOUGH
BIG
LAKE
RIVER
9-666.1-R
9-664.9-R
Lansing Light
Δ to 30
WISCONSIN
CRAWFORD COUNTY
INDIAN CAMP
HENDERSON SLOUGH
ISLAND NO. 143
WINNESHIEK SLOUGH
STEVENS SLOUGH
IOWA
ALLAMAKEE COUNTY
LANSING
LAFAYETTE SLOUGH
STATE HIGHWAY 82 BRIDGE: MILE 663.4
SCALE: 1" = 3000'
0
3000'
6000'

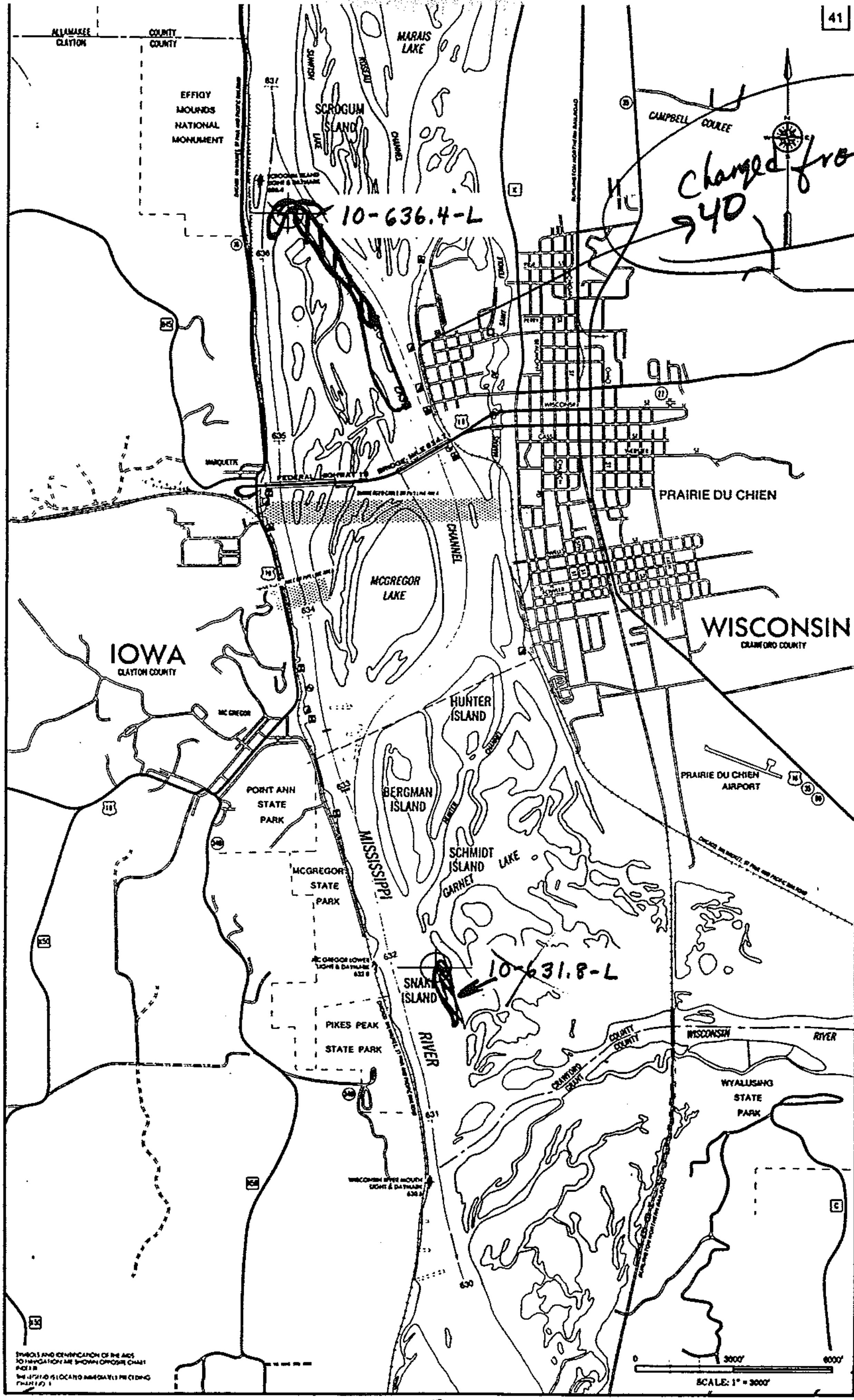

38
Upper Harpers — Changed from 333 to 250
Middle Harpers — changed from 333 to ~~277~~ 120
Lower Harpers — Changed from 333 to ~~337~~ 150
MISSISSIPPI
RIVER
LAKE
WINNESHIEK
IOWA
ALLAMAKEE COUNTY
UPPER MISSISSIPPI RIVER
WILDLIFE AND FISH
REFUGE
upper
middle
lower
off shore mound
mobilizing these small islan
9-653.7-R
9-652.5-R
WISCONSIN
CRAWFORD COUNTY
CROOKED SLOUGH HEAD DAYMARK
CROOKED SLOUGH HEAD LIGHT & DAYMARK
CROOKED SLOUGH CUT LIGHT & DAYMARK
CROOKED SLOUGH FOOT LIGHT & DAYMARK
HEYTMANS STATION
HEYTMANS DAYMARK
ST. PAUL SLOUGH
SCALE: 1" = 3000'
0
3000'
6000'
81
103
184
118
144
331
271
422
277
56

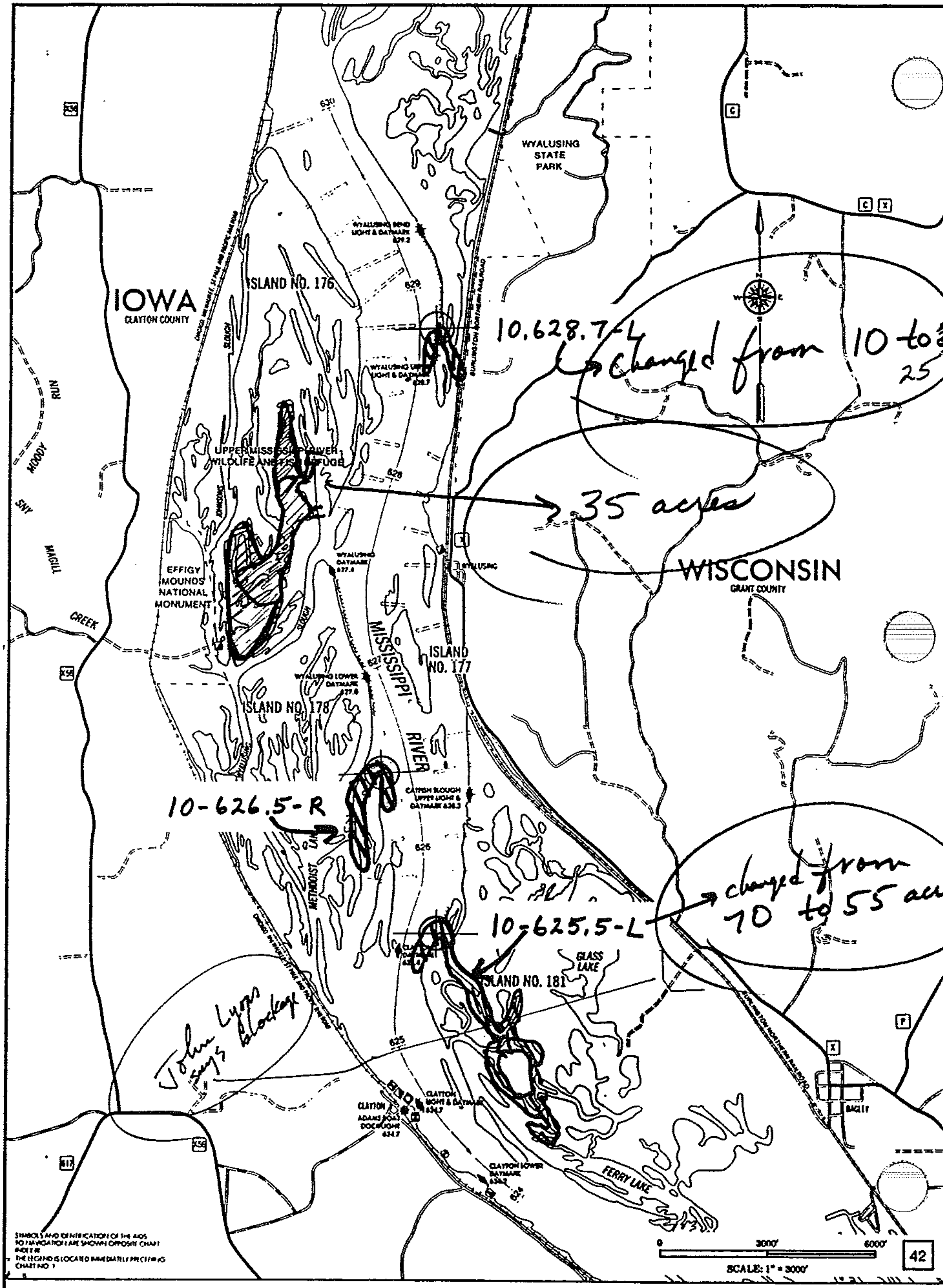


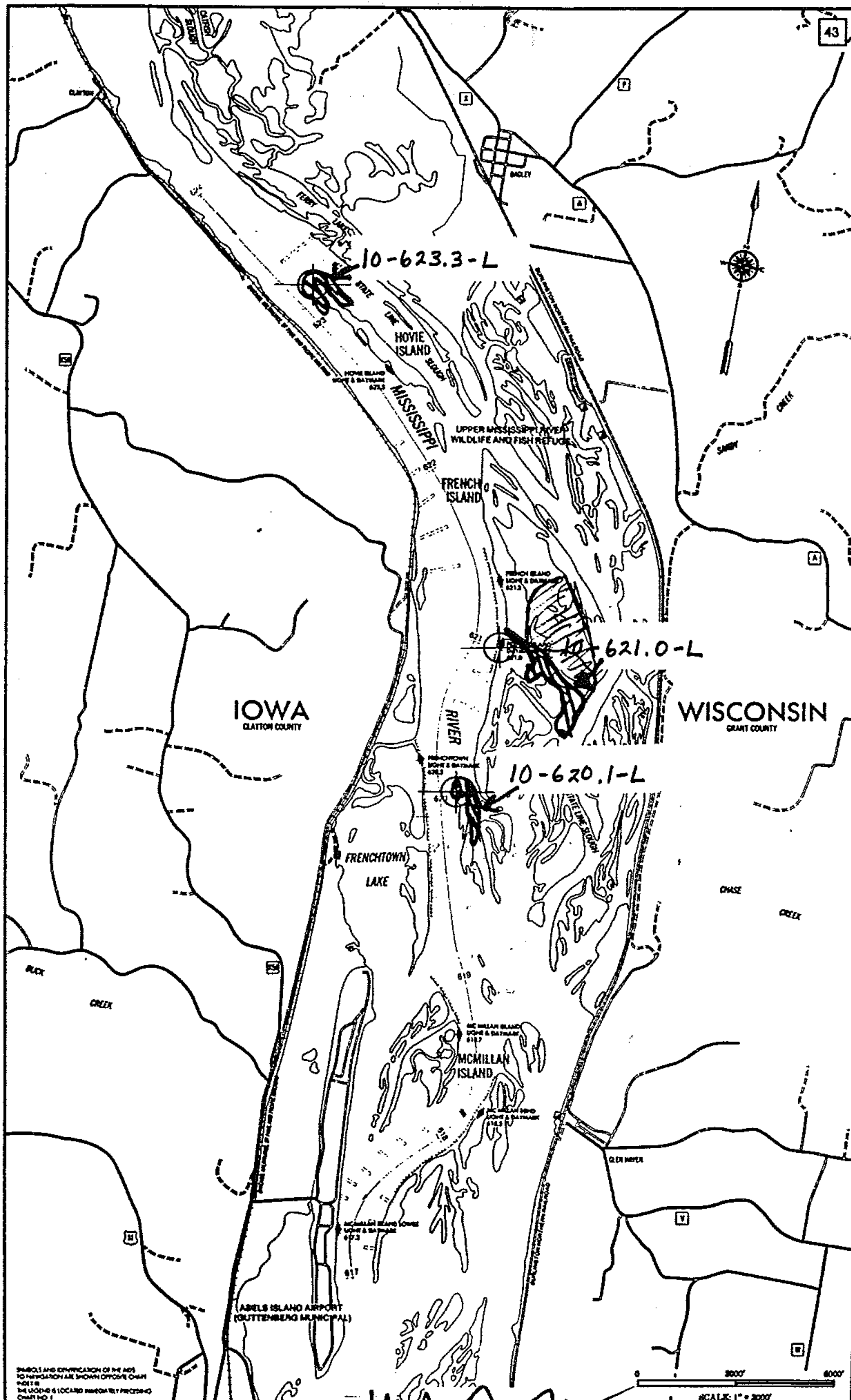
MILE 644 TO MILE 650



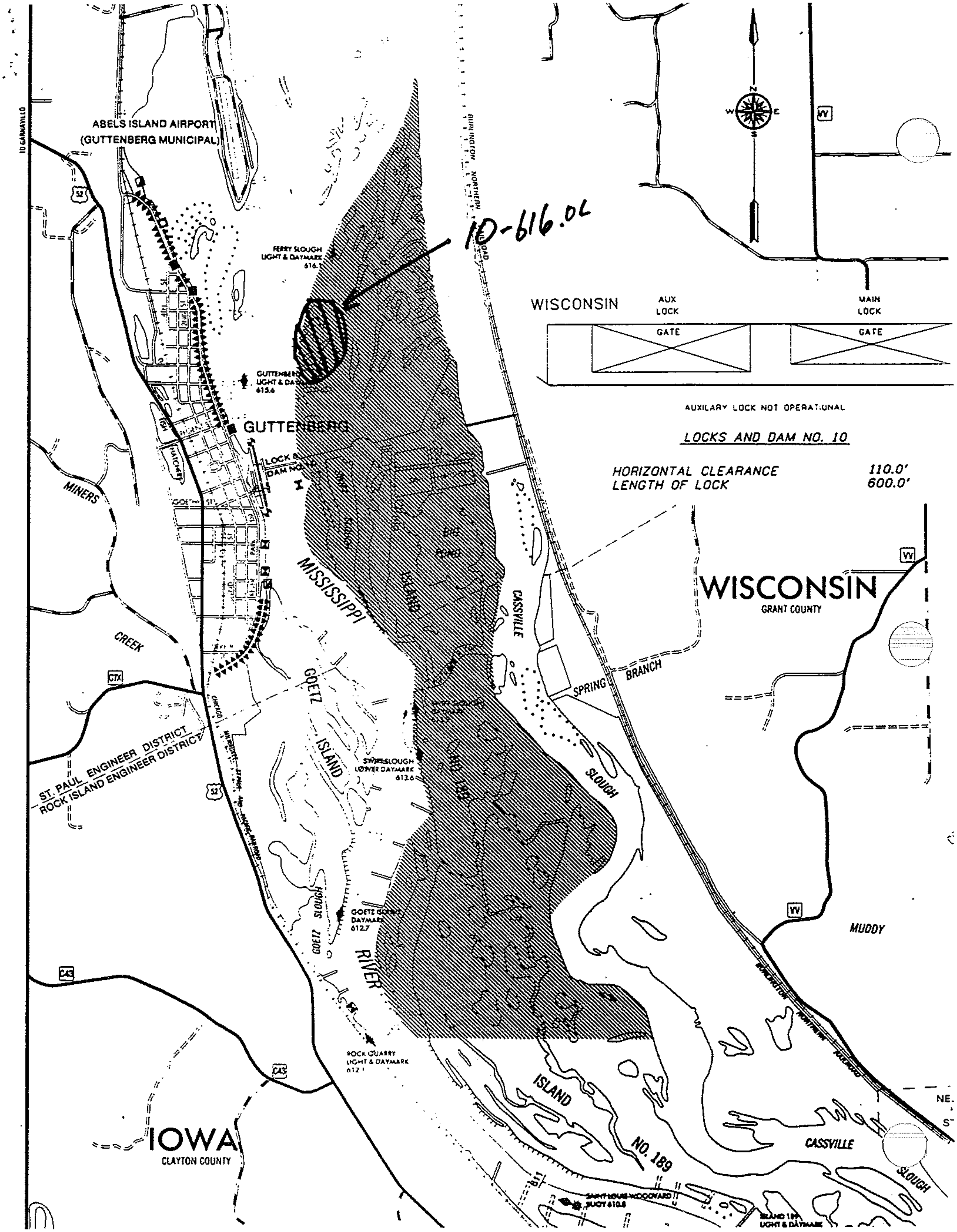
MURRAY ISLAND
SLOUGH
RIVER
DU CHARME
CREEK
HARPERS
JAPAN
SLOUGH
JACKSON ISLAND
10-643. -L
MUDHEN LAKE
MISSISSIPPI
CREEK
WALKER JUNCTION
PAINT
OFF SLOUGH
CREEK
PICATEE
WISCONSIN
CRAWFORD COUNTY
AREA OF YELLOW RIVER STATE FORREST
SLOUGH
ISLAND NO. 166
10-641.1-L
SPRING LAKE
IOWA
ALLAMAKEE COUNTY
MILL COULEE
AMBRO
EFFIGY MOUNDS NATIONAL MONUMENT
MISSISSIPPI
SLOUGH
GREMORE LAKE
YELLOW
ISLAND NO. 167
10-637.8-L
RIVER
MARAIS
LAKE
SCROGUM ISLAND
FOUNDERS POND
CREEK
DOUSMAN
ALLAMAKEE COUNTY
CLAYTON COUNTY
CHANNEL
SCALE: 1" = 2000'


ALLAMAKEE COUNTY
CLAYTON COUNTY
EFFIGY MOUNDS NATIONAL MONUMENT
MARAIS LAKE
SCROGUM ISLAND
CAMPBELL COULEE
10-636.4-L
Changed from 25 to 40
PRAIRIE DU CHIEN
MCGREGOR LAKE
CHANNEL
IOWA
CLAYTON COUNTY
WISCONSIN
CRAWFORD COUNTY
HUNTER ISLAND
BERGMAN ISLAND
SCHMIDT ISLAND
GARNET LAKE
PRAIRIE DU CHIEN AIRPORT
POINT ANN STATE PARK
MCGREGOR STATE PARK
MISSISSIPPI RIVER
PIKES PEAK STATE PARK
SNAKE ISLAND
10-631.8-L
WISCONSIN RIVER
WYALUSING STATE PARK
MARQUETTE
MC GREGOR
SCALE: 1" = 3000'


IOWA
CLAYTON COUNTY
WISCONSIN
GRANT COUNTY
WYALUSING STATE PARK
ISLAND NO. 176
ISLAND NO. 177
ISLAND NO. 178
ISLAND NO. 181
UPPER MISSISSIPPI RIVER WILDLIFE AND FISH REFUGE
EFFIGY MOUNDS NATIONAL MONUMENT
MISSISSIPPI RIVER
GLASS LAKE
FERRY LAKE
METHODIST
SLOUGH
CREEK
MOODY
SNY
MAGILL
RUN
WYALUSING
BAGLEY
CLAYTON
630
629
628
627
626
625
10.628.7-L
changed from 10 to 25
35 acres
10-626.5-R
10-625.5-L
changed from 10 to 55 acres
John Lyons says blockage
SCALE: 1" = 3000'
0
3000'
6000'
42


43
10-623.3-L
10-621.0-L
10-620.1-L
CLAYTON
BAGLEY
HOVIE ISLAND
HOVIE ISLAND SLOUGH
STATE LINE
MISSISSIPPI
RIVER
UPPER MISSISSIPPI RIVER WILDLIFE AND FISH REFUGE
FRENCH ISLAND
IOWA
CLAYTON COUNTY
WISCONSIN
GRANT COUNTY
FRENCHTOWN LAKE
SANDY CREEK
CHASE CREEK
BUCK CREEK
MCMILLAN ISLAND
GLEN HAVEN
ABELS ISLAND AIRPORT (GUTTENBERG MUNICIPAL)
SCALE: 1" = 3000'
0
3000'
6000'

B-33


10-616.0L
ABELS ISLAND AIRPORT
(GUTTENBERG MUNICIPAL)
FERRY SLOUGH LIGHT & DAYMARK
GUTTENBERG
LOCK &
DAM NO
MINERS
CREEK
MISSISSIPPI
ISLAND
GOETZ
ISLAND
GOETZ SLOUGH
RIVER
CASSVILLE
SPRING
BRANCH
SLOUGH
ST. PAUL ENGINEER DISTRICT
ROCK ISLAND ENGINEER DISTRICT
IOWA
CLAYTON COUNTY
WISCONSIN
GRANT COUNTY
MUDDY
ISLAND
NO. 189
CASSVILLE
SLOUGH
ROCK QUARRY LIGHT & DAYMARK
WISCONSIN
AUX LOCK
MAIN LOCK
GATE
GATE
AUXILARY LOCK NOT OPERATIONAL
LOCKS AND DAM NO. 10
HORIZONTAL CLEARANCE 110.0'
LENGTH OF LOCK 600.0'

SEDIMENT DATA

Table 4. Combined bulk sediment physical and nutrient data for Upper Mississippi River & tributaries.

| SAMPLE DESCRIPTORS | | | | | | | | | | SETTLEABILITY TESTS | | | | PARTICLE SIZE DISTRIBUTION: SILT OR CLAY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REC. # | River Mile | Location | Sample Year | SYS | Hab. Type | Pool | Sec. [illegible] | Sample Depth (cm) | Data Coll. Cit. | Suspended Solids (mg/l) 0 HRS | Suspended Solids (mg/l) 4 HRS | Turbidity (FTU) 0 HRS | Turbidity (FTU) 4 HRS | Hydrometer .005 mm | Hydrometer .020 mm |
| 169 | 745.3 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | -- | -- | -- | -- | -- | -- |
| 170 | 745.3 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 171 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 172 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 173 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 174 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 177 | 744.3 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | 984 | 200 | 82 | 22 | 0 | 2 |
| 178 | 744.3 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | 1024 | 232 | 80 | 25 | 0 | 2 |
| 179 | 743.9 | R-WEAVER BOTTOMS | 1984 | 1 | 3 | 5 | 1 | 10 | COE | -- | -- | -- | -- | 27 | 40 |
| 224 | 721.1 | HOMER | 1982 | 1 | 1 | 6 | 1 | 10 | COE | 88 | 28 | 74 | 42 | 0 | 2 |
| 225 | 721.0 | HOMER | 1982 | 1 | 1 | 6 | 1 | 10 | COE | 58 | 6 | 78 | 43 | 0 | 1 |
| 226 | 720.9 | HOMER | 1979 | 1 | 1 | 6 | 1 | 10 | COE | 132 | 76 | 33 | 20 | 0 | 0 |
| 227 | 720.9 | HOMER | 1979 | 1 | 1 | 6 | 1 | 10 | COE | 612 | 48 | 152 | 40 | 0 | 0 |
| 228 | 720.9 | HOMER | 1974 | 1 | 1 | 6 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 231 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | 206 | 108 | 26 | 10 | 0 | 0 |
| 232 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | 862 | 232 | 88 | 21 | 0 | 0 |
| 233 | 712.0 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | 72 | 0 | 44 | 0 | 0 | 0 |
| 234 | 711.6 | RICHMOND ISLAND | 1974 | 1 | 1 | 7 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 235 | 711.5 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | 108 | 0 | 56 | 35 | 0 | 0 |
| 248 | 704.6 | HEAD OF DRESBACH CUT | 1974 | 1 | 1 | 7 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 249 | 704.3 | HEAD OF DRESBACH CUT | 1980 | 1 | 1 | 7 | 1 | 10 | COE | 98 | 0 | 50 | 27 | 0 | 0 |
| 250 | 699.9 | AB&BW LACROSSE RR BR | 1979 | 1 | 1 | 8 | 1 | 10 | COE | 320 | 175 | 34 | 12 | 0 | 0 |
| 251 | 699.9 | AB&BW LACROSSE RR BR | 1979 | 1 | 1 | 8 | 1 | 10 | COE | 308 | 160 | 48 | 13 | 0 | 0 |
| 252 | 694.6 | SAND SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | 100 | -- | 30 | -- | 0 | 0 |
| 265 | 688.5 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | 292 | 80 | 79 | 45 | 0 | 0 |
| 266 | 688.1 | HEAD OF RAFT CHANNEL | 1974 | 1 | 1 | 8 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 267 | 687.8 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | 80 | 24 | 170 | 55 | 0 | 0 |
| 268 | 687.3 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | 1450 | 78 | 150 | 74 | 0 | 0 |
| 269 | 686.7 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | 7324 | 272 | 780 | 150 | 0 | 0 |
| 270 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | 144 | 112 | 53 | 30 | 0 | 1 |
| 280 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | 84 | 84 | 57 | 26 | 0 | 0 |
| 281 | 665.4 | INDIAN CAMP LIGHT | 1979 | 1 | 1 | 9 | 1 | 10 | COE | 269 | 20 | 50 | 28 | 0 | 0 |
| 282 | 665.4 | INDIAN CAMP LIGHT | 1979 | 1 | 1 | 9 | 1 | 10 | COE | 264 | 12 | 48 | 21 | 0 | 0 |
| 288 | 651.6 | | 1974 | 1 | 1 | 9 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 289 | 646.6 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | 449 | 80 | 78 | 48 | 0 | 0 |
| 290 | 646.3 | HAY POINT | 1974 | 1 | 1 | 10 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 291 | 646.1 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 297 | 633.2 | McGREGOR | 1974 | 1 | 1 | 10 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 298 | 627.8 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 299 | 627.5 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |
| 300 | 619.6 | McMILLAN | 1974 | 1 | 1 | 10 | 1 | 10 | COE | -- | -- | -- | -- | 0 | 0 |

| REC. # | SILT OR CLAY (U.S. Standard Mesh Sizes) 270 | 200 | FINE SAND 140 | 100 | 80 | 70 | 60 | 40 | MEDIUM SAND 30 | 20 | 16 | 10 | COARSE SAND 8 | 4 | FINE GRAVEL 3/8 in | 3/4 in | COARSE GRAVEL 3/2 in | 3 in | Moisture % | Volatile Solids (mg/kg) | Total Organic Carbon % | Chemical Oxygen Demand (mg/kg) | Ammonia Nitrogen (mg/kg) | Kjeldahl Nitrogen (mg/kg) | Total Phosph. (mg/kg) | Oil & Grease (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 169 | -- | 3 | | 4 | -- | -- | -- | 37 | -- | -- | 98 | -- | 98 | 100 | 100 | 100 | 100 | 100 | | [illegible] | | 2816 | -- | -- | -- | 673 |
| 170 | -- | 0 | | 1 | -- | -- | -- | 40 | -- | -- | 65 | -- | 98 | 98 | 100 | 100 | 100 | 100 | | 15000 | | 1274 | -- | -- | -- | 20 |
| 171 | -- | 0 | | 0 | -- | -- | -- | 20 | -- | -- | 99 | -- | 100 | 100 | 100 | 100 | 100 | 100 | | 15000 | | 1183 | -- | -- | -- | 15 |
| 172 | -- | 0 | | 0 | -- | -- | -- | 28 | -- | -- | 99 | -- | 100 | 100 | 100 | 100 | 100 | 100 | | 14000 | | 1226 | -- | -- | -- | 62 |
| 173 | -- | 0 | | 0 | -- | -- | -- | 71 | -- | -- | 97 | -- | 99 | 100 | 100 | 100 | 100 | 100 | | 3000 | | 1278 | -- | 52 | 104 | < 8 |
| 174 | -- | 0 | | 0 | -- | -- | -- | 71 | -- | -- | 97 | -- | 99 | 100 | 100 | 100 | 100 | 100 | | 4000 | | 984 | -- | 134 | 110 | < 8 |
| 177 | -- | 2 | | -- | 11 | -- | -- | 88 | -- | 100 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | | 2230 | | 1400 | 4.4 | 500 | 100 | 6 |
| 178 | -- | 3 | | -- | 10 | -- | -- | 83 | -- | 100 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | | 2200 | | 1000 | 5.2 | 380 | 100 | 6 |
| 179 | 99 | 97 | | 98 | 97 | 97 | 97 | 98 | 98 | 98 | 98 | 98 | 99 | 99 | 99 | 100 | 100 | 100 | | 5430 | | 41600 | < 10.00 | 2300 | 14000 | 38000 |
| 224 | 15 | 16 | | 15 | -- | 17 | 27 | 51 | 78 | -- | 87 | -- | 99 | 100 | 100 | 100 | 100 | -- | < 50 | 3780 | | 320 | < 0.20 | 52 | 80 | |
| 225 | 12 | 12 | | 12 | -- | 13 | 16 | 31 | 50 | -- | 78 | -- | 98 | 94 | 99 | 100 | 100 | -- | < 50 | 5400 | | 1120 | < 0.20 | 41 | 222 | |
| 226 | -- | 1 | | -- | 3 | -- | -- | 51 | -- | 94 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 0 | 5750 | | 1800 | 1.1 | 240 | 230 | |
| 227 | -- | 1 | | -- | 2 | -- | -- | 55 | -- | 94 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 0 | 4120 | | 2100 | 1.0 | 800 | 74 | |
| 228 | -- | 0 | | 0 | -- | -- | -- | 8 | -- | -- | 90 | -- | 95 | 99 | 100 | 100 | 100 | 100 | 462 | 8000 | | 484 | -- | 190 | 187 | |
| 231 | -- | 1 | | -- | 2 | -- | -- | 16 | -- | 61 | -- | 90 | -- | 90 | 100 | 100 | 100 | 100 | 100 | 4000 | | 1700 | 7.9 | 120 | 170 | |
| 232 | -- | 1 | | -- | 3 | -- | -- | 52 | -- | 80 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 0 | 3650 | | 1200 | 6.1 | 320 | 42 | |
| 233 | -- | 0 | | 0 | -- | -- | -- | 20 | -- | -- | 83 | -- | 85 | 98 | 100 | 100 | 100 | 100 | 0 | 3810 | | 1500 | 5.0 | 88 | -- | |
| 234 | -- | 0 | | 0 | -- | -- | -- | 11 | -- | -- | 91 | -- | 93 | 98 | 100 | 100 | 100 | 100 | 430 | 4000 | | < 481 | -- | 11 | 209 | |
| 235 | -- | 0 | | 0 | -- | -- | -- | 2 | -- | -- | 77 | -- | 95 | 100 | 100 | 100 | 100 | 100 | 0 | 3710 | | 1500 | 5.4 | 129 | -- | |
| 248 | -- | 0 | | 0 | -- | -- | -- | 10 | -- | -- | 77 | -- | 94 | 100 | 100 | 100 | 100 | 100 | 130 | 8000 | | 475 | -- | 108 | 376 | |
| 249 | -- | 0 | | 0 | -- | -- | -- | 83 | -- | -- | 98 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 0 | 3730 | | 750 | 4.1 | 1210 | -- | |
| 250 | -- | 1 | | -- | 2 | -- | -- | 18 | -- | 78 | -- | 98 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 5070 | | 1000 | 5.5 | 300 | 280 | |
| 251 | -- | 1 | | -- | 1 | -- | -- | 12 | -- | 87 | -- | 94 | -- | 98 | 100 | 100 | 100 | 100 | 0 | 4820 | | 1300 | 5.6 | 180 | 220 | |
| 252 | 0 | 0 | | 0 | -- | 1 | 8 | 15 | 58 | -- | 82 | -- | 99 | 100 | 100 | 100 | 100 | -- | 100 | 2560 | | 1300 | 3.4 | 206 | -- | |
| 265 | -- | 0 | | 1 | -- | -- | -- | 48 | -- | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 0 | 2490 | | 1700 | 6.1 | 130 | -- | |
| 266 | -- | 0 | | 0 | -- | -- | -- | 88 | -- | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 536 | 3000 | | 1333 | -- | 106 | 101 | |
| 267 | -- | 0 | | 0 | -- | -- | -- | 73 | -- | -- | 98 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 0 | 2580 | | 1400 | 5.5 | 58 | -- | |
| 268 | 0 | 1 | | 4 | -- | 21 | 80 | 93 | 98 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | -- | 0 | 2200 | | 1700 | 8.9 | 245 | -- | |
| 269 | 2 | 4 | | 7 | -- | 24 | 50 | 74 | 98 | -- | 97 | -- | 99 | 100 | 100 | 100 | 100 | -- | 100 | 5200 | | 2700 | 8.9 | 724 | -- | |
| 270 | 2 | 2 | | 2 | -- | 5 | 24 | 88 | 88 | -- | 97 | -- | 99 | 100 | 100 | 100 | 100 | -- | < 50 | 5450 | | 984 | < 0.20 | 130 | 110 | |
| 280 | 1 | 1 | | 2 | -- | 14 | 59 | 89 | 97 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | -- | < 50 | 2750 | | 690 | < 0.20 | 40 | 73 | |
| 281 | -- | 1 | | -- | 5 | -- | -- | 84 | -- | 98 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 0 | 2400 | | 2700 | 0.9 | 22 | 170 | |
| 282 | -- | 0 | | -- | 2 | -- | -- | 86 | -- | 97 | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 0 | 2560 | | 120 | 0.7 | 88 | 18 | |
| 288 | -- | 3 | | 4 | -- | -- | -- | 57 | -- | -- | 99 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 11 | 5600 | | 5797 | -- | 180 | 184 | |
| 289 | 0 | 0 | | 0 | -- | 4 | 19 | 50 | 70 | -- | 92 | -- | 97 | 100 | 100 | 100 | 100 | -- | 0 | 2190 | | 1800 | 2.8 | 224 | -- | |
| 290 | -- | 0 | | 0 | -- | -- | -- | 84 | -- | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 330 | 3000 | | 3271 | -- | 90 | 102 | |
| 291 | 0 | 0 | | 0 | -- | 4 | 23 | 54 | 59 | -- | 94 | -- | 99 | 100 | 100 | 100 | 100 | -- | 0 | 1860 | | 1800 | 3.6 | 288 | -- | |
| 297 | -- | 0 | | 0 | -- | -- | -- | 47 | -- | -- | 100 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 393 | 17000 | | 12705 | -- | 379 | 358 | |
| 298 | -- | 0 | | 0 | -- | -- | -- | 27 | -- | -- | 87 | -- | 95 | 100 | 100 | 100 | 100 | 100 | 327 | 4000 | | 1545 | -- | 155 | 140 | |
| 299 | -- | 0 | | 0 | -- | -- | -- | 27 | -- | -- | 87 | -- | 95 | 100 | 100 | 100 | 100 | 100 | 625 | 3000 | | 2190 | -- | 135 | 158 | |
| 300 | -- | 0 | | 0 | -- | -- | -- | 58 | -- | -- | 88 | -- | 100 | 100 | 100 | 100 | 100 | 100 | 312 | 3000 | | 3514 | -- | 75 | 82 | |

| Key | | |
|---|---|---|
| Sys = Navigation System | Hab. Type = Habitat type | Data Coll. Cit. = Data Collection Citation |
| 1 = Mississippi River | 1 = Main channel | COE = St. Paul District, U.S. Army Corps of Engineers |
| 2 = Minnesota River | 2 = Boat Harbors | FWS = U.S. Fish and Wildlife Service |
| 3 = St. Croix River | 3 = Backwaters | WDNR = Wisconsin Department of Natural Resources |

PCB Re[illegible]kg dry weight) bottom sediment surveys of dredging areas

| Samp. No. | [illegible] | Location | Year | Sys. | Hab. Type | Pool | Sam. Gear | Depth (cm) | Coll. Cit. | PCBs AR-1016 | AR-[illegible] | AR-1232 | AR-1242 | AR-1248 | AR-1254 | AR-1260 | Total PCBs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 450 | [illegible]5.8 | FISCHER ISLAND | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 1.48 | < 1.48 | < 1.48 | < 1.48 | < 1.48 | < 3.08 | < 3.08 | 0.0 |
| 169 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 170 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 171 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 172 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 173 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 174 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 175 | 744.9 | FISCHER ISLAND | 1980 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 6.0 |
| 451 | 744.9 | LOWER ZUMBRO | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 1.45 | < 1.45 | < 1.45 | < 1.45 | < 1.45 | < 3.03 | < 3.03 | 0.0 |
| 177 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 178 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | 0.0 |
| 452 | 744.2 | SOMERFIELD ISLAND | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 1.44 | < 1.44 | < 1.44 | < 1.44 | < 1.44 | < 3 | < 3 | 0.0 |
| 475 | 721.0 | HOMER | 1989 | 1 | 1 | 6 | 1 | 10 | COE | < 1.39 | < 1.39 | < 1.39 | < 1.39 | < 1.39 | < 2.9 | < 2.9 | 0.0 |
| 226 | 720.8 | HOMER | 1978 | 1 | 1 | 6 | 1 | 10 | COE | | | | | | | | 0.0 |
| 227 | 720.8 | HOMER | 1978 | 1 | 1 | 6 | 1 | 10 | COE | | | | | | | | 0.0 |
| 228 | 720.5 | HOMER | 1974 | 1 | 1 | 6 | 1 | 10 | COE | | | | | | | | 0.0 |
| 476 | 720.5 | HOMER | 1989 | 1 | 1 | 6 | 1 | 10 | COE | < 1.43 | < 1.43 | < 1.43 | < 1.43 | < 1.43 | < 2.98 | < 2.98 | 0.0 |
| 231 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | 0.0 |
| 232 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | 0.0 |
| 233 | 712.0 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | 0.0 |
| 524 | 712.0 | RICHMOND ISLAND | 1989 | 1 | 1 | 7 | 1 | 10 | COE | < 1.42 | < 1.42 | < 1.42 | < 1.42 | < 1.42 | < 2.95 | < 2.95 | 0.0 |
| 234 | 711.6 | RICHMOND ISLAND | 1974 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | 0.0 |
| 235 | 711.5 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | 0.0 |
| 523 | 711.4 | RICHMOND ISLAND | 1989 | 1 | 1 | 7 | 1 | 10 | COE | < 1.43 | < 1.43 | < 1.43 | < 1.43 | < 1.43 | < 2.98 | < 2.98 | 0.0 |
| 764 | 704.4 | L-Lk Onalaska-celery-2 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 760 | 704.2 | L-Lk Onalaska-celery-5 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 763 | 704.2 | L-Lk Onalaska-celery-1 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 701 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 702 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 703 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 704 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 700 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 722 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 723 | 703.8 | L-Confluence 1/2 mi. Cr. | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 762 | 703.5 | L-Lk Onalaska-celery-7 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 761 | 703.3 | L-Lk Onalaska-celery-6 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | 0.0 |
| 516 | 700.3 | AB&BW LACROSSE RR BR | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 1.39 | < 1.39 | < 1.39 | < 1.39 | < 1.39 | < 2.9 | < 2.9 | 0.0 |
| 252 | 694.9 | SAND SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | 0.0 |
| 513 | 688.5 | HEAD OF RAFT CHANNEL | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 14.64 | < 14.64 | < 14.64 | < 14.64 | < 14.64 | < 3.05 | < 3.05 | 0.0 |
| 266 | 688.1 | HEAD OF RAFT CHANNEL | 1974 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | 0.0 |
| 514 | 687.9 | HEAD OF RAFT CHANNEL | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 1.45 | < 1.45 | < 1.45 | < 1.45 | < 1.45 | < 3.03 | < 3.03 | 0.0 |
| 267 | 687.8 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | 0.0 |
| 268 | 687.3 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | 0.0 |
| 269 | 686.7 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | 0.0 |
| 497 | 665.8 | INDIAN CAMP LIGHT | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 1.40 | < 1.40 | < 1.40 | < 1.40 | < 1.40 | < 2.93 | < 2.93 | 0.0 |
| 279 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | 0.0 |
| 280 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | 0.0 |
| 281 | 665.4 | INDIAN CAMP LIGHT | 1978 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | 0.0 |
| 282 | 665.4 | INDIAN CAMP LIGHT | 1978 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | 0.0 |
| 498 | 665.2 | INDIAN CAMP LIGHT | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 1.44 | < 1.44 | < 1.44 | < 1.44 | < 1.44 | < 3 | < 3 | 0.0 |
| 501 | 654.8 | AB CROOKED SLOUGH | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 1.92 | < 1.92 | < 1.92 | < 1.92 | < 1.92 | < 4 | < 4 | 0.0 |
| 288 | 651.0 | | 1974 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | 0.0 |
| 289 | 646.5 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | 0.0 |
| 290 | 646.2 | HAY POINT | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | 0.0 |
| 291 | 646.1 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | 0.0 |
| 297 | 633.2 | McGREGOR | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | 0.0 |
| 443 | 627.8 | WYALUSING | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 3.25 | < 3.25 | 0.0 |
| 298 | 627.6 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | 0.0 |
| 299 | 627.5 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | 0.0 |
| 444 | 627.2 | WYALUSING | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 3.25 | < 3.25 | 0.0 |
| 441 | 619.3 | McMILLAN | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 3.25 | < 3.25 | 0.0 |
| 300 | 618.6 | McMILLAN | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | 0.0 |
| 442 | 618.5 | McMILLAN | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 1.56 | < 3.25 | < 3.25 | 0.0 |

Total PCBs values for MWCC collected data are sums of arochlors with the three main arochlors (half of detection limits used).

KEYS:

HABITAT
1 Main Channel
2 Harbor
3 Backwater

SYSTEM
1 Mississippi River
2 Minnesota River
3 St. Croix River
4 Black River
5 Root River

SAMPLING GEAR
1 Ponar
2 Petit Ponar
3 Eckman Dredge
4 Coring Device

DATA COLLECTION CITATION
COE U.S. Army Corps of Engineers
FWS U.S. Fish and Wildlife Service
MWCC Metropolitan Waste Control Commission
WDNR Wisconsin Department of Natural Resources

Combined Bulk Chemical Data.

| Record # | Mile | Location | Year | Sys | Hab. Type | Pool | Sam. Gear | Sam. Depth (cm) | Data Coll. Cit. | CYANIDE | AMMONIA NITROGEN | ORGANIC CARBON | MOISTURE (%) | TOTAL SOLIDS (%) | VOLATILE SOLIDS (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 450 | 745.8 | FISCHER ISLAND | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 0.62 | 0.37 | 377 | 19.9 | 80.1 | 0.4 |
| 169 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 170 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 171 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 172 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 173 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 174 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 175 | 744.9 | FISCHER ISLAND | 1980 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 451 | 744.9 | LOWER ZUMBRO | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 0.62 | 0.31 | 277 | 19.6 | 80.4 | 0.3 |
| 177 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 178 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | |
| 452 | 744.2 | SOMERFIELD ISLAND | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 0.62 | 0.87 | 880 | 19.8 | 80.2 | 0.6 |
| 475 | 721.0 | HOMER | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.61 | < 0.24 | 146 | 16.8 | 83.2 | 0.5 |
| 226 | 720.8 | HOMER | 1978 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 227 | 720.8 | HOMER | 1978 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 228 | 720.5 | HOMER | 1974 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 476 | 720.5 | HOMER | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.58 | 1.60 | 5773 | 14.0 | 86.0 | 0.7 |
| 231 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | |
| 232 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | |
| 233 | 712.0 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | |
| 524 | 712.0 | RICHMOND ISLAND | 1989 | 1 | 1 | 7 | 1 | 10 | COE | < 0.60 | < 0.24 | 453 | 16.5 | 83.5 | 0.4 |
| 234 | 711.6 | RICHMOND ISLAND | 1974 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | |
| 235 | 711.5 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | |
| 523 | 711.4 | RICHMOND ISLAND | 1989 | 1 | 1 | 7 | 1 | 10 | COE | < 0.60 | < 0.24 | 172 | 16.5 | 83.5 | 0.4 |
| 764 | 704.4 | L-Lk Onalaska-celery-2 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 763 | 704.2 | L-Lk Onalaska-celery-1 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 760 | 704.2 | L-Lk Onalaska-celery-5 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 700 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 704 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 702 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 703 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 701 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 722 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 723 | 703.8 | L-Confluence 1/2 mi. Cr. | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 762 | 703.5 | L-Lk Onalaska-celery-7 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 761 | 703.3 | L-Lk Onalaska-celery-6 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | |
| 515 | 699.8 | AB&BW LACROSSE RR BR | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.60 | 0.50 | 456 | 17.1 | 82.9 | 0.4 |
| 252 | 694.9 | SAND SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 513 | 688.5 | HEAD OF RAFT CHANNEL | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.63 | 0.30 | 984 | 20.0 | 80.0 | 0.4 |
| 286 | 688.1 | HEAD OF RAFT CHANNEL | 1974 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 514 | 687.9 | HEAD OF RAFT CHANNEL | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.61 | < 0.24 | 600 | 18.5 | 81.5 | 0.4 |
| 287 | 687.8 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 288 | 687.3 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 289 | 686.7 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | |
| 497 | 685.8 | INDIAN CAMP LIGHT | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 0.58 | < 0.23 | 183 | 13.3 | 86.7 | 0.4 |
| 279 | 685.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | |
| 280 | 685.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | |
| 281 | 685.4 | INDIAN CAMP LIGHT | 1978 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | |
| 282 | 685.4 | INDIAN CAMP LIGHT | 1978 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | |
| 498 | 685.2 | INDIAN CAMP LIGHT | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 0.58 | < 0.23 | 840 | 14.2 | 85.8 | 0.4 |
| 502 | 655.1 | AB CROOKED SLOUGH | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.59 | 1.50 | 1560 | 14.7 | 85.3 | 0.8 |
| 357 | 655.0 | Lower pool 9 - 1 | 1987 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | |
| 501 | 654.8 | AB CROOKED SLOUGH | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.83 | 15.00 | 24700 | 40.0 | 60.0 | 3.2 |
| 288 | 651.0 | | 1974 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | |
| 289 | 648.5 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | |
| 290 | 648.2 | HAY POINT | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | |
| 291 | 648.1 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | |
| 297 | 633.2 | McGREGOR | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | |
| 443 | 627.8 | WYALUSING | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.63 | 1.50 | 132 | 19.7 | 80.3 | 0.3 |
| 298 | 627.8 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | |
| 299 | 627.5 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | |
| 444 | 627.2 | WYALUSING | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.62 | 0.62 | 251 | 19.3 | 80.7 | 0.2 |
| 441 | 619.3 | McMILLAN | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.64 | 1.30 | 323 | 21.7 | 78.3 | 0.2 |
| 300 | 618.8 | McMILLAN | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | |
| 442 | 618.5 | McMILLAN | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.63 | 0.62 | 178 | 20.5 | 79.5 | 0.2 |

KEYS

HABITAT TYPE
1 Main Channel
2 Harbor
3 Backwater

SYSTEM
1 Mississippi River
2 Minnesota River
3 St. Croix River
4 Black River
5 Root River

SAMPLING GEAR
1 Ponar
2 Pettit Ponar
3 Eckman Dredge
4 Coring Device

DATA COLLECTION CITATION
COE U.S. Army Corps of Engineers
FWS U.S. Fish and Wildlife Service
MWCC Metropolitan Waste Control Commission
WDNR Wisconsin Department of Natural Resources

Combined Bulk Chemical Metals Data.

METALS (ug/g dry weight unless otherwise specified)

| Record # | Mile | Location | Year | Sys | Hab. Type | Pool | Sam. Gear | Sam. Depth (cm) | Data Coll. Cit. | Ag | Al | As | B | Ba | Be | Cd | Cr | Cu | Fe | Hg | Mg | Mn | Mo | Ni | Pb | Sb | Se | Sn | Sr | Tl | Zn | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 450 | 745.8 | FISCHER ISLAND | 1980 | 1 | 1 | 5 | 1 | 10 | COE | | | 1.10 | | | | < 1.100 | 5.5 | 7.0 | | < 0.120 | | 315.0 | | 8.4 | 0.6 | | < 0.87 | | | | 15.5 | |
| 169 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.38 | | | | < 0.100 | 5.9 | 5.7 | | 0.031 | | | | | < 0.1 | | | | | | 19.0 | |
| 170 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.45 | | | | < 0.100 | 5.8 | 5.4 | | 0.029 | | | | | < 0.1 | | | | | | 18.4 | |
| 171 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.41 | | | | < 0.100 | 4.9 | 6.0 | | 0.035 | | | | | < 0.1 | | | | | | 16.2 | |
| 172 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.40 | | | | < 0.100 | 5.9 | 6.6 | | 0.036 | | | | | < 0.1 | | | | | | 24.5 | |
| 173 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | 10.90 | | | | < 1.000 | 5.0 | 10.0 | | 0.300 | | | | 5.0 | < 10.0 | | | | | | 13.0 | |
| 174 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.90 | | | | < 1.000 | 5.0 | 8.0 | | 0.200 | | | | 5.0 | < 10.0 | | | | | | 13.0 | |
| 175 | 744.9 | FISCHER ISLAND | 1980 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.00 | | 30.0 | | < 10.000 | < 10.0 | < 10.0 | 1500 | 0.000 | | 190.0 | | < 10.0 | < 10.0 | | | | | | 7.8 | |
| 451 | 744.9 | LOWER ZUMBRO | 1980 | 1 | 1 | 5 | 1 | 10 | COE | | | 1.20 | | | | < 1.100 | 7.1 | 5.8 | | < 0.120 | | 245.0 | | < 5.7 | 0.7 | | < 0.87 | | | | 31.1 | |
| 177 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.00 | | 30.0 | | < 10.000 | < 10.0 | < 10.0 | 2400 | 0.000 | | 100.0 | | < 10.0 | < 10.0 | | | | | | 10.0 | |
| 178 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | 0.00 | | 20.0 | | < 10.000 | < 10.0 | < 10.0 | 2100 | 0.000 | | 100.0 | | < 10.0 | < 10.0 | | | | | | < 10.0 | |
| 452 | 744.2 | SOMERFIELD ISLAND | 1980 | 1 | 1 | 5 | 1 | 10 | COE | | | 2.10 | | | | < 1.100 | 7.5 | 6.9 | | < 0.120 | | 477.0 | | 7.4 | 1.3 | | < 0.87 | | | | 19.0 | |
| 475 | 721.0 | HOMER | 1980 | 1 | 1 | 6 | 1 | 10 | COE | | | 1.30 | | | | < 1.100 | 5.3 | < 1.4 | | < 0.120 | | 302.0 | | 8.1 | 1.5 | | < 0.84 | | | | 13.6 | |
| 226 | 720.8 | HOMER | 1978 | 1 | 1 | 6 | 1 | 10 | COE | | | 0.00 | | 30.0 | | < 10.000 | < 10.0 | < 10.0 | 2200 | 0.000 | | 42.0 | | < 10.0 | < 10.0 | | | | | | 10.0 | |
| 227 | 720.8 | HOMER | 1978 | 1 | 1 | 6 | 1 | 10 | COE | | | 0.00 | | 10.0 | | < 10.000 | < 10.0 | < 10.0 | 1900 | 0.000 | | 35.0 | | < 10.0 | 30.0 | | | | | | 10.0 | |
| 228 | 720.5 | HOMER | 1974 | 1 | 1 | 6 | 1 | 10 | COE | | | < 0.70 | | | | < 1.000 | 7.0 | 5.0 | | 0.200 | | | | 5.0 | < 9.0 | | | | | | 17.0 | |
| 476 | 720.5 | HOMER | 1980 | 1 | 1 | 6 | 1 | 10 | COE | | | 1.40 | | | | < 1.100 | 8.3 | 2.0 | | < 0.120 | | 330.0 | | 7.1 | 2.1 | | < 0.81 | | | | 15.8 | |
| 231 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | 1.00 | | 30.0 | | < 10.000 | < 10.0 | < 10.0 | 4800 | 0.000 | | 220.0 | | < 10.0 | < 10.0 | | | | | | 10.0 | |
| 232 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | 0.00 | | 20.0 | | < 10.000 | < 10.0 | < 10.0 | 3200 | 0.000 | | 150.0 | | < 10.0 | < 10.0 | | | | | | < 10.0 | |
| 233 | 712.0 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | 0.00 | | 10.0 | | < 10.000 | < 10.0 | < 10.0 | 2400 | 0.000 | | 270.0 | | < 10.0 | < 10.0 | | | | | | 13.0 | |
| 524 | 712.0 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | 1.20 | | | | < 1.100 | 3.3 | < 1.4 | | < 0.010 | | 809.0 | | < 5.5 | 1.1 | | < 0.84 | | | | 12.2 | |
| 234 | 711.8 | RICHMOND ISLAND | 1974 | 1 | 1 | 7 | 1 | 10 | COE | | | < 0.90 | | | | < 1.000 | 7.0 | 5.0 | | 0.200 | | | | 9.0 | < 9.0 | | | | | | 16.0 | |
| 235 | 711.5 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | 0.00 | | 10.0 | | < 10.000 | < 10.0 | < 10.0 | 2300 | 0.000 | | 230.0 | | < 10.0 | < 10.0 | | | | | | 17.0 | |
| 523 | 711.4 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | < 1.00 | | | | < 1.100 | 3.3 | 1.9 | | < 0.010 | | 234.0 | | < 5.5 | 0.9 | | < 0.84 | | | | 13.0 | |
| 764 | 704.4 | L-Lk Onalaska-celery-2 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | < 1.000 | 1162 | < 40.00 | < 5.0 | 15.0 | < 0.100 | 0.150 | 3.9 | < 1.0 | 3152 | < 0.050 | 374 | < 77.0 | 2.0 | 2.0 | 2.4 | < 40.0 | < 20.00 | < 20.0 | 3.9 | 20.0 | 8.7 | < 8.7 |
| 763 | 704.2 | L-Lk Onalaska-celery-1 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | < 1.000 | 19872 | < 40.00 | < 5.0 | 251.0 | 0.680 | 0.680 | 28.8 | 25.9 | 34580 | < 0.050 | 4696 | < 950.0 | 2.0 | 27.1 | 26.6 | < 40.0 | < 20.00 | < 20.0 | 43.2 | 20.0 | 100.6 | < 100.6 |
| 760 | 704.2 | L-Lk Onalaska-celery-5 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | 1.800 | 6880 | < 40.00 | < 5.0 | 104.0 | 0.380 | 0.580 | 16.6 | 12.2 | 15120 | < 0.050 | 3080 | < 466.0 | 2.0 | 13.0 | 13.1 | < 40.0 | < 20.00 | < 20.0 | 14.2 | 20.0 | 50.4 | < 50.4 |
| 700 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | < 1.000 | 13200 | < 40.00 | 7.0 | 203.0 | 0.960 | 0.420 | 20.0 | 22.0 | 34300 | 0.050 | 5830 | < 2010.0 | 3.0 | 22.0 | 30.0 | < 40.0 | < 20.00 | < 20.0 | 38.0 | 20.0 | 86.0 | 29.0 |
| 704 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | < 1.000 | 15900 | < 40.00 | 7.0 | 215.0 | 1.000 | 0.440 | 24.0 | 23.0 | 36900 | 0.050 | 6060 | < 2070.0 | 3.0 | 24.0 | 32.0 | < 40.0 | < 20.00 | < 20.0 | 39.0 | 20.0 | 94.0 | 33.0 |
| 702 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | < 1.000 | 6440 | < 40.00 | 4.0 | 82.0 | 0.410 | 0.230 | 11.0 | 10.0 | 13400 | 0.050 | 2940 | < 718.0 | 2.0 | 11.0 | 12.0 | < 40.0 | < 20.00 | < 20.0 | 15.0 | 20.0 | 43.0 | < 15.0 |
| 703 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | < 1.000 | 5730 | < 40.00 | 4.0 | 82.0 | 0.410 | 0.210 | 10.0 | 10.0 | 13300 | 0.050 | 2850 | < 711.0 | 2.0 | 11.0 | 11.0 | < 40.0 | < 20.00 | < 20.0 | 15.0 | 20.0 | 42.0 | < 15.0 |
| 701 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | < 1.000 | 11000 | < 40.00 | 4.0 | 195.0 | 0.620 | 0.610 | 18.0 | 19.0 | 27000 | 0.050 | 3480 | < 1340.0 | 3.0 | 20.0 | 27.0 | < 40.0 | < 20.00 | < 20.0 | 30.0 | 20.0 | 78.0 | 26.0 |
| 722 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | < 0.500 | 13100 | < 8.00 | 6.0 | 159.0 | 0.740 | 0.400 | 21.0 | 23.0 | 27700 | 0.070 | 4160 | < 2030.0 | 3.0 | 19.0 | 20.0 | < 4.0 | < 10.00 | < 2.0 | 53.0 | 20.0 | 85.1 | < 28.0 |
| 723 | 703.8 | L-Confluence 1/2 mi. Cr. | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | < 0.500 | 12900 | < 8.00 | 7.0 | 189.0 | 0.610 | < 0.300 | 23.0 | 23.0 | 27700 | 0.140 | 4450 | < 1970.0 | 3.0 | 20.0 | 23.0 | < 4.0 | < 10.00 | < 2.0 | 27.2 | 20.0 | 88.3 | < 18.0 |
| 762 | 703.5 | L-Lk Onalaska-celery-7 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | 3.040 | 6360 | < 40.00 | < 5.0 | 108.0 | < 0.100 | 0.350 | 16.7 | 9.0 | 15046 | < 0.050 | 1976 | < 304.0 | 2.0 | 11.4 | 9.9 | < 40.0 | < 20.00 | < 20.0 | 14.0 | 20.0 | 42.6 | < 42.6 |
| 761 | 703.3 | L-Lk Onalaska-celery-6 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | 1.510 | 9664 | < 40.00 | < 5.0 | 149.0 | 0.450 | 0.390 | 22.6 | 16.6 | 21140 | < 0.050 | 3020 | < 544.0 | 2.0 | 13.7 | 9.1 | < 40.0 | < 20.00 | < 20.0 | 16.6 | 20.0 | 57.4 | < 57.4 |
| 515 | 699.8 | AB&BW LACROSSE RR BR | 1980 | 1 | 1 | 8 | 1 | 10 | COE | | | < 1.01 | | | | < 1.110 | 2.8 | < 1.5 | | < 0.010 | | 170.0 | | < 5.5 | < 0.8 | | < 0.84 | | | | 8.0 | |
| 252 | 694.9 | SAND SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | 2.00 | | 20.0 | | < 1.000 | < 10.0 | < 10.0 | 2800 | < 0.010 | | 190.0 | | < 10.0 | < 10.0 | | | | | | 10.0 | |
| 513 | 688.5 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | | | < 1.03 | | | | < 1.120 | < 1.8 | < 1.5 | | < 0.010 | | 156.0 | | < 5.8 | 1.1 | | < 0.86 | | | | 7.5 | |
| 266 | 688.1 | HEAD OF RAFT CHANNEL | 1974 | 1 | 1 | 8 | 1 | 10 | COE | | | < 0.80 | | | | 0.900 | 106.0 | 7.0 | | 0.300 | | | | 36.0 | < 9.0 | | | | | | 16.0 | |
| 514 | 687.9 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | | | 2.90 | | | | < 1.110 | 3.2 | < 1.5 | | < 0.010 | | 203.0 | | 6.4 | 1.3 | | < 0.84 | | | | 10.5 | |
| 267 | 687.6 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | | | 0.00 | | 10.0 | | < 10.000 | < 10.0 | < 10.0 | 3000 | 0.000 | | 16.0 | | < 10.0 | < 10.0 | | | | | | 20.0 | |
| 268 | 687.3 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | 3.00 | | 10.0 | | < 1.000 | < 10.0 | < 10.0 | 1100 | < 0.010 | | 95.0 | | < 10.0 | < 10.0 | | | | | | 7.0 | |
| 269 | 686.7 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | 3.00 | | 10.0 | | < 1.000 | < 10.0 | < 10.0 | 1600 | < 0.010 | | 170.0 | | < 10.0 | < 10.0 | | | | | | 8.0 | |
| 497 | 665.8 | INDIAN CAMP LIGHT | 1980 | 1 | 1 | 9 | 1 | 10 | COE | | | < 0.97 | | | | < 1.080 | 2.1 | < 1.4 | | < 0.010 | | 281.0 | | < 5.3 | 1.3 | | < 0.81 | | | | 8.5 | |
| 279 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | 1.30 | | | | < 0.170 | 2.8 | 1.7 | 3800 | 0.018 | | | | 3.0 | 2.0 | | | | | | 9.0 | |
| 280 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | 0.87 | | | | < 0.190 | 1.9 | 0.9 | 2400 | 0.013 | | | | 3.0 | 2.0 | | | | | | 2.0 | |
| 281 | 665.4 | INDIAN CAMP LIGHT | 1978 | 1 | 1 | 9 | 1 | 10 | COE | | | 1.00 | | 10.0 | | < 10.000 | < 10.0 | < 10.0 | 1900 | 0.040 | | 240.0 | | < 100.0 | 20.0 | | | | | | < 10.0 | |
| 282 | 665.4 | INDIAN CAMP LIGHT | 1978 | 1 | 1 | 9 | 1 | 10 | COE | | | 0.00 | | 10.0 | | < 10.000 | < 10.0 | < 10.0 | 1600 | 0.000 | | 280.0 | | < 100.0 | 20.0 | | | | | | < 10.0 | |
| 498 | 665.2 | INDIAN CAMP LIGHT | 1980 | 1 | 1 | 9 | 1 | 10 | COE | | | < 0.72 | | | | < 1.080 | 2.3 | < 1.4 | | < 0.010 | | 231.0 | | < 5.3 | 0.8 | | < 0.82 | | | | 9.1 | |
| 502 | 656.1 | AB CROOKED SLOUGH | 1980 | 1 | 1 | 9 | 1 | 10 | COE | | | < 1.04 | | | | < 1.130 | 2.4 | < 1.5 | | < 0.010 | | 152.0 | | < 5.8 | 1.1 | | < 0.86 | | | | 8.9 | |
| 357 | 655.0 | Lower pool 9 - 1 | 1987 | 1 | 1 | 9 | 1 | 10 | COE | | | < 2.20 | | | | 5.800 | 9.6 | 11.5 | | < 0.800 | | 432.1 | | < 25.0 | 14.7 | | | | | | 23.7 | |
| 501 | 654.8 | AB CROOKED SLOUGH | 1980 | 1 | 1 | 9 | 1 | 10 | COE | | | < 1.55 | | | | < 1.700 | 8.1 | 3.2 | | < 0.020 | | 544.0 | | 9.3 | 3.7 | | < 1.29 | | | | 30.8 | |
| 288 | 651.0 | | 1974 | 1 | 1 | 9 | 1 | 10 | COE | | | < 0.80 | | | | 0.900 | 11.0 | 4.0 | | 0.200 | | | | 4.0 | < 9.0 | | | | | | 13.0 | |
| 289 | 648.5 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | 3.00 | | 40.0 | | < 1.000 | < 10.0 | < 10.0 | 3200 | < 0.010 | | 480.0 | | < 10.0 | < 10.0 | | | | | | 8.0 | |
| 290 | 648.2 | HAY POINT | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.80 | | | | < 0.900 | 4.0 | 2.0 | | 0.600 | | | | 4.0 | < 9.0 | | | | | | 9.0 | |
| 291 | 648.1 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | 2.00 | | 40.0 | | < 1.000 | < 10.0 | < 10.0 | 3700 | < 0.010 | | 620.0 | | < 10.0 | < 10.0 | | | | | | 8.0 | |
| 297 | 633.2 | McGREGOR | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | 0.90 | | | | 1.000 | 94.0 | 5.0 | | 0.200 | | | | 28.0 | 11.0 | | | | | | 25.0 | |
| 443 | 627.8 | WYALUSING | 1980 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.75 | | | | 1.100 | 3.4 | 3.5 | | < 0.120 | | 178.0 | | < 5.7 | 0.9 | | < 0.87 | | | | 14.8 | |
| 298 | 627.8 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.80 | | | | < 0.900 | 9.0 | 2.0 | | < 0.100 | | | | 2.0 | < 9.0 | | | | | | 11.0 | |
| 299 | 627.5 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.90 | | | | < 0.900 | 9.0 | 2.0 | | < 0.100 | | | | 2.0 | < 9.0 | | | | | | 11.0 | |
| 444 | 627.2 | WYALUSING | 1980 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.74 | | | | < 1.100 | 4.1 | 1.7 | | < 0.120 | | 155.0 | | < 5.7 | 0.7 | | < 0.87 | | | | 7.6 | |
| 441 | 619.3 | McMILLAN | 1980 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.77 | | | | < 1.200 | 4.0 | 5.5 | | < 0.130 | | 168.0 | | < 5.9 | 1.6 | | < 0.89 | | | | 10.5 | |
| 300 | 618.8 | McMILLAN | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.80 | | | | < 0.900 | 4.0 | 2.0 | | 0.300 | | | | 2.0 | < 9.0 | | | | | | 10.0 | |
| 442 | 618.5 | McMILLAN | 1980 | 1 | 1 | 10 | 1 | 10 | COE | | | < 0.78 | | | | < 1.200 | 4.5 | 4.4 | | < 0.120 | | 198.0 | | < 5.8 | 0.9 | | < 0.88 | | | | 11.8 | |

*Values shaded exceed the mean value plus 2 standard deviations for backwaters.

KEYS

HABITAT TYPE
1 Main Channel
2 Harbor
3 Backwater

SYSTEM
1 Mississippi River
2 Minnesota River
3 St. Croix River
4 Black River
5 Root River

SAMPLING GEAR
1 Ponar
2 Pettit Ponar
3 Eckman Dredge
4 Coring Device

DATA COLLECTION CITATION
COE U.S. Army Corps of Engineers
FWS U.S. Fish and Wildlife Service
MWCC Metropolitan Waste Control Commission
WDNR Wisconsin Department of Natural Resources

Pesticide results (ug/kg dry weight) bottom sediment surveys of dredging areas.

| Sample No. # | River Mile | Location | Year | Sys | Hab. Type | Pool | Sam. Gear | Depth (cm) | Coll. Cit. | Alpha BHC | Beta BHC | BHC | Gamma BHC (lindane) | Hepta-chlor | Aldrin | Hepta-chlor epoxide | Endo-sulfan I | Dieldrin | 4,4'-DDE | Endrin | Endo-sulfan II | 4,4'-DDD | Endrin aldehyde | sulfan sulfate | 4,4'-DDT | Methoxy-chlor | Endrin-ketone | Chloro-dane | Toxa-phene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 450 | 745.8 | FISCHER ISLAND | 1989 | 1 | 1 | 5 | 1 | 10 | COE | 0 0.070 | < 0.150 | < 0.22 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.22 | < 0.25 | < 0.27 | < 0.27 | < 0.27 | < 0.32 | < 0.54 | < 0.27 | < 1.48 | < 1.48 |
| 169 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | | | | | | | | | | | | |
| 170 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | | | | | | | | | | | | |
| 171 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | | | | | | | | | | | | |
| 172 | 745.2 | FISCHER ISLAND | 1975 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | | | | | | | | | | | | |
| 173 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 174 | 745.0 | FISCHER ISLAND | 1974 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 175 | 744.9 | FISCHER ISLAND | 1980 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 451 | 744.9 | LOWER ZUMBRO | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 0.070 | < 0.150 | < 0.22 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.22 | < 0.24 | < 0.27 | < 0.27 | < 0.27 | < 0.31 | < 0.53 | < 0.27 | < 1.45 | < 1.45 |
| 177 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 178 | 744.2 | LOWER ZUMBRO | 1979 | 1 | 1 | 5 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 452 | 744.2 | SOMERFIELD ISLAND | 1989 | 1 | 1 | 5 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.22 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.22 | < 0.24 | < 0.26 | < 0.26 | < 0.26 | < 0.31 | < 0.53 | < 0.26 | < 1.44 | < 1.44 |
| 475 | 721.0 | HOMER | 1989 | 1 | 1 | 6 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.21 | < 0.090 | < 0.070 | < 0.09 | < 0.12 | < 0.12 | < 0.12 | < 0.09 | < 0.21 | < 0.23 | < 0.26 | < 0.26 | < 0.26 | < 0.30 | < 0.51 | < 0.26 | < 1.39 | < 1.39 |
| 226 | 720.8 | HOMER | 1978 | 1 | 1 | 6 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 227 | 720.8 | HOMER | 1978 | 1 | 1 | 6 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 228 | 720.5 | HOMER | 1974 | 1 | 1 | 6 | 1 | 10 | COE | | | | | | | | | < 10.00 | 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 476 | 720.5 | HOMER | 1989 | 1 | 1 | 6 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.21 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.21 | < 0.24 | < 0.26 | < 0.26 | < 0.26 | < 0.31 | < 0.52 | < 0.26 | < 1.43 | < 1.43 |
| 231 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 232 | 712.7 | HEAD OF RICHMOND IS. | 1979 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 233 | 712.0 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 524 | 712.0 | RICHMOND ISLAND | 1989 | 1 | 1 | 7 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.21 | < 0.090 | < 0.070 | < 0.09 | < 0.12 | < 0.12 | < 0.12 | < 0.09 | < 0.21 | < 0.24 | < 0.26 | < 0.26 | < 0.26 | < 0.31 | < 0.52 | < 0.26 | < 1.42 | < 1.42 |
| 234 | 711.8 | RICHMOND ISLAND | 1974 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | | < 10.00 | 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 235 | 711.5 | RICHMOND ISLAND | 1980 | 1 | 1 | 7 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 523 | 711.4 | RICHMOND ISLAND | 1989 | 1 | 1 | 7 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.21 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.21 | < 0.24 | < 0.26 | < 0.26 | < 0.26 | < 0.31 | < 0.52 | < 0.26 | < 1.43 | < 1.43 |
| 764 | 704.4 | L-Lk Onalaska-celery-2 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 760 | 704.2 | L-Lk Onalaska-celery-5 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 763 | 704.2 | L-Lk Onalaska-celery-1 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 701 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 702 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 703 | 704.0 | L-Lake Onalaska/Halfway | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 704 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 700 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1984 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 722 | 704.0 | L-Lk Onalaska/Rosebud Isl | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | < 10.000 | < 10.000 | | < 10.000 | < 10.000 | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 723 | 703.8 | L-Confluence 1/2 mi. Cr. | 1985 | 1 | 3 | 7 | 2 | 10 | FWS | < 10.000 | < 10.000 | | < 10.000 | < 10.000 | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 762 | 703.5 | L-Lk Onalaska-celery-7 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 761 | 703.3 | L-Lk Onalaska-celery-6 | 1983 | 1 | 3 | 7 | 2 | 10 | FWS | | | | | | | | | | | | | | | | | | | | |
| 515 | 699.8 | AB&BW LACROSSE RR BR | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.21 | < 0.090 | < 0.070 | < 0.09 | < 0.12 | < 0.12 | < 0.12 | < 0.09 | < 0.21 | < 0.24 | < 0.26 | < 0.26 | < 0.26 | < 0.31 | < 0.52 | < 0.26 | < 1.42 | < 1.42 |
| 252 | 694.9 | SAND SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | | < 0.10 | < 0.10 | < 0.10 | | < 0.10 | | | < 0.10 | | | < 1.00 | |
| 513 | 688.5 | HEAD OF RAFT CHANNEL | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.730 | < 1.460 | < 2.20 | < 0.980 | < 0.730 | < 0.99 | < 1.22 | < 1.22 | < 1.22 | < 0.98 | < 2.20 | < 2.44 | < 2.68 | < 2.69 | < 2.68 | < 3.17 | < 5.37 | < 2.68 | < 14.64 | < 14.64 |
| 266 | 688.1 | HEAD OF RAFT CHANNEL | 1974 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 514 | 687.9 | HEAD OF RAFT CHANNEL | 1989 | 1 | 1 | 8 | 1 | 10 | COE | < 0.070 | < 0.150 | < 0.22 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.22 | < 0.24 | < 0.27 | < 0.27 | < 0.27 | < 0.31 | < 0.53 | < 0.27 | < 1.45 | < 1.45 |
| 267 | 687.8 | HEAD OF RAFT CHANNEL | 1980 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 268 | 687.3 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | | < 0.10 | < 0.10 | < 0.10 | | < 0.10 | | | < 0.10 | | | < 1.00 | |
| 269 | 686.7 | DEADMANS SLOUGH | 1981 | 1 | 1 | 8 | 1 | 10 | COE | | | | | | | | | < 0.10 | < 0.10 | < 0.10 | | < 0.10 | | | < 0.10 | | | < 1.00 | |
| 497 | 665.8 | INDIAN CAMP LIGHT | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.21 | < 0.090 | < 0.070 | < 0.09 | < 0.12 | < 0.12 | < 0.12 | < 0.09 | < 0.21 | < 0.23 | < 0.26 | < 0.26 | < 0.26 | < 0.30 | < 0.51 | < 0.26 | < 1.40 | < 1.40 |
| 279 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | | < 0.10 | < 0.10 | < 0.10 | | < 0.10 | | | < 0.10 | | | < 1.00 | |
| 280 | 665.7 | INDIAN CAMP LIGHT | 1982 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | | < 0.10 | < 0.10 | < 0.10 | | < 0.10 | | | < 0.10 | | | < 1.00 | |
| 281 | 665.4 | INDIAN CAMP LIGHT | 1979 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | | | | | | | | | | | | | |
| 282 | 665.4 | INDIAN CAMP LIGHT | 1978 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | | 0.00 | 0.00 | 0.00 | | 0.00 | | | 0.00 | | | 0.00 | |
| 498 | 665.2 | INDIAN CAMP LIGHT | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.22 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.22 | < 0.24 | < 0.26 | < 0.26 | < 0.26 | < 0.31 | < 0.53 | < 0.26 | < 1.44 | < 1.44 |
| 502 | 656.1 | AB CROOKED SLOUGH | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 0.070 | < 0.140 | < 0.22 | < 0.100 | < 0.070 | < 0.10 | < 0.12 | < 0.12 | < 0.12 | < 0.10 | < 0.22 | < 0.24 | < 0.26 | < 0.26 | < 0.26 | < 0.31 | < 0.53 | < 0.26 | < 1.44 | < 1.44 |
| 357 | 655.0 | Lower pool 9 - 1 | 1987 | 1 | 1 | 9 | 1 | 10 | COE | < 5.000 | < 5.000 | | < 5.000 | < 5.000 | | | | < 5.00 | < 5.00 | < 5.00 | | < 5.00 | | | < 5.00 | | | < 5.00 | |
| 501 | 654.9 | AB CROOKED SLOUGH | 1989 | 1 | 1 | 9 | 1 | 10 | COE | < 0.100 | < 0.190 | < 0.29 | < 0.130 | < 0.100 | < 0.13 | < 0.16 | < 0.16 | < 0.16 | < 0.13 | < 0.29 | < 0.32 | < 0.35 | < 0.35 | < 0.35 | < 0.42 | < 0.70 | < 0.35 | < 1.92 | < 1.92 |
| 288 | 651.0 | | 1974 | 1 | 1 | 9 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 289 | 646.5 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | | < 0.10 | < 0.10 | < 0.10 | | < 0.10 | | | < 0.10 | | | < 1.00 | |
| 290 | 646.2 | HAY POINT | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 291 | 646.1 | HAY POINT | 1981 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | | < 0.10 | < 0.10 | < 0.10 | | < 0.10 | | | < 0.10 | | | < 1.00 | |
| 297 | 633.2 | McGREGOR | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 443 | 627.8 | WYALUSING | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.080 | < 0.160 | < 0.23 | < 0.100 | < 0.080 | < 0.10 | < 0.13 | < 0.13 | < 0.13 | < 0.10 | < 0.23 | < 0.26 | < 0.29 | < 0.29 | < 0.29 | < 0.34 | < 0.57 | < 0.29 | < 1.58 | < 1.58 |
| 298 | 627.6 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 299 | 627.5 | WYALUSING | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 444 | 627.2 | WYALUSING | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.080 | < 0.160 | < 0.23 | < 0.100 | < 0.080 | < 0.10 | < 0.13 | < 0.13 | < 0.13 | < 0.10 | < 0.23 | < 0.26 | < 0.29 | < 0.29 | < 0.29 | < 0.34 | < 0.57 | < 0.29 | < 1.58 | < 1.58 |
| 441 | 619.3 | McMILLAN | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.080 | < 0.160 | < 0.23 | < 0.100 | < 0.080 | < 0.10 | < 0.13 | < 0.13 | < 0.13 | < 0.10 | < 0.23 | < 0.26 | < 0.29 | < 0.29 | < 0.29 | < 0.34 | < 0.57 | < 0.29 | < 1.58 | < 1.58 |
| 300 | 618.6 | McMILLAN | 1974 | 1 | 1 | 10 | 1 | 10 | COE | | | | | | | | | < 10.00 | < 10.00 | < 10.00 | | < 10.00 | | | < 10.00 | | | < 10.00 | |
| 442 | 618.5 | McMILLAN | 1989 | 1 | 1 | 10 | 1 | 10 | COE | < 0.080 | < 0.160 | < 0.23 | < 0.100 | < 0.080 | < 0.10 | < 0.13 | < 0.13 | < 0.13 | < 0.10 | < 0.23 | < 0.26 | < 0.29 | < 0.29 | < 0.29 | < 0.34 | < 0.57 | < 0.29 | < 1.56 | < 1.56 |

KEYS:

| HABITAT | | SYSTEM | | SAMPLING GEAR | | DATA COLLECTION CITATION | |
|---|---|---|---|---|---|---|---|
| 1 | Main Channel | 1 | Mississippi River | 1 | Ponar | COE | U.S. Army Corps of Engineers |
| 2 | Harbor | 2 | Minnesota River | 2 | Petit Ponar | FWS | U.S. Fish and Wildlife Service |
| 3 | Backwater | 3 | St. Croix River | 3 | Eckman Dredge | MWCC | Metropolitan Waste Control Commission |
| | | 4 | Black River | 4 | Coring Device | WDNR | Wisconsin Department of Natural Resources |
| | | 5 | Root River | | | | |