



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

**Upper Mississippi River System
Environmental Management Program**

OPERATION AND MAINTENANCE MANUAL

LANSING BIG LAKE

**HABITAT REHABILITATION AND
ENHANCEMENT PROJECT**

Pool 9
Upper Mississippi River
Allamakee County, Iowa

September 1998

INTRODUCTION

This manual has been prepared to serve as a guide for the operation and maintenance of the Lansing Big Lake Habitat Rehabilitation and Enhancement Project in Allamakee County, Iowa. Operation and maintenance instructions for the major features of the project are presented. These instructions are consistent with the general procedures found in the Lansing Big Lake Definite Project Report dated March 1991.

There are no structures that need to be operated for the project. The intent of the maintenance instructions is to present preventive maintenance information consisting of systematic inspections and subsequent corrective actions to ensure long-term use of project features. A timely maintenance program prevents major damage to constructed features by early corrective action.

For ease in using this manual, it has been divided into three sections:

- | | |
|------------|---|
| Part I | This section describes the project features and provides background information on the project. |
| Part II | This section gives details on the operation and maintenance of the project. |
| Appendices | This section provides project specific details regarding the project drawings, M.O.U. , replacement specifications, and monitoring plans. |

PART I

PROJECT FEATURES AND CONSTRUCTION HISTORY

AUTHORIZATION AND LOCATION

The Lansing Big Lake project was authorized under the provisions of Section 1103 of the Water Resources Development Act of 1986 (Public Law 99- 662). The Lansing Big Lake project area is located in pool 9 of the Upper Mississippi River, across the river and downstream from Blackhawk Park. It is in the upper part of the pool on the right descending side of the navigation channel beginning at approximately river mile 670. The project lies within the Upper Mississippi River National Wildlife and Fish Refuge. Project drawings (appendix A) show the location of project features.

Because the Lansing Big Lake project is located on Federal lands managed as a National Wildlife Refuge, operation and maintenance are to be carried out in compliance with Section 107(b) of the 1992 Water Resources Development Act.

DESCRIPTION OF PROJECT

General

The Lansing Big Lake backwater area comprises 9,755 acres and is one of the major geographical components of the pool 9 system. This backwater area is divided between terrestrial (6,619 acres) and aquatic (3,136 acres) habitat. The upstream portion of the area is dominated by floodplain forest habitat intermixed with sloughs and shallow marshes. The lower portion of the area is more aquatic and is dominated by Big Lake proper, the largest backwater lake in the pool. This lower portion also contains numerous side channels, sloughs, sunken islands, non-flowing lakes and marshes, and ponds/depressions that are landlocked at normal pool levels. Although Big Lake is a natural body of water that predates the construction of lock and dam 9, it became about 78 percent larger after construction of the dam. The lake is affected by wind driven wave action which has resulted in some lakeshore erosion. In 1973, Big Lake proper had approximately 630 acres of open water, a mean depth of about 35 inches and a maximum depth of about 75 inches, and a volume of 1,842 acre-feet of water. Today, Big Lake is somewhat shallower and smaller due to continued sedimentation. Big Lake has a relatively short residence time of 10.9 hours and the water quality is usually relatively good. The remainder of the Big Lake backwater area is backwater bottoms comprised of an irregularly braided slough system dividing lowland marshes and floodplain forests/swamps. Big Lake backwater areas are too shallow and windblown to stratify. The Lansing Big Lake Habitat Rehabilitation and Enhancement project (HREP) extends over 6 miles from river mile (RM) 664 to RM 670. The project area is bounded on the west by Highway 26, on the east and south by the main channel of the Mississippi River, and on the north by the Upper Iowa River.

The numerous side channel openings that connect the Big Lake backwaters to the Mississippi River main channel vary greatly in width and depth; some are hundreds of feet wide and have depths of 30 feet or more and others resemble small seasonal creeks. For Mississippi River discharges up to approximately a 1 year flood event (80,000 cfs), most of the inflows enter the Big Lake area through these sloughs. During Mississippi River discharges in excess of 80,000 cfs, portions of the natural levee are overtopped and flows into the Big Lake area occur at many sites. Four major sloughs exist in this backwater area: Big Slough at RM 670.6 (referred to in the Definite Project Report as site 1); Little Slough at RM 670.1 (site 2); an unnamed slough at RM 669.5 (site 6); and Hummingbird Slough at RM 666.1 (site 15). These four sloughs account for 12 to 14 percent of the total Mississippi River flow for pre-project conditions (applies to Mississippi River discharges up to 70,000 cfs). Historically, Big Slough (site 1) has been the largest slough into the Lansing Big Lake area. In recent years, however, the unnamed slough located at RM 669.5 (site 6) had eroded and enlarged to the point where it carried the most flow. The trend towards accelerated enlargement of some side channels, especially at site 6, was a source of increasing resource management concern.

The primary objective of the Lansing Big Lake HREP is to protect and preserve existing high quality backwater habitat at Big Lake from future cumulative degradation associated with ongoing backwater sedimentation. The historic sedimentation rate in Big Lake averaged between 0.5 inch and 1.0 inch per year (Aspelmeier, pers comm, Eckblad, 1981). Previous studies estimated that approximately 1,000 acres of aquatic habitat was converted from open water to emergent aquatic or terrestrial habitat from 1937 to 1973. Since 1973, resource managers observed that additional sedimentation had occurred in the Big Lake backwater area and that main channel water inflows into the backwaters increased significantly.

The project formulated and constructed at Lansing Big Lake combines a number of design features (e.g., earthen berms, side channel closures, shoreline riprapping, offshore rockfill, and rock-lined partial closure structures) that serve to stabilize or restrict water inflows into the Big Lake backwaters from the Mississippi River and/or Upper Iowa River and thereby decrease the amount of suspended sediments entering the backwater areas. The reduced inflows will help to preserve the existing high quality backwater aquatic habitat.

The Definite Project Report/Environmental Assessment (SP-9), Lansing Big Lake Habitat Rehabilitation and Enhancement Project, March 1991, provides additional details regarding the overall project and the habitat benefits associated with its implementation.

Design Considerations

The following key planning constraints were instrumental in defining and formulating the Lansing Big Lake HREP.

1. The project must comply with State and Federal floodplain laws and regulations.
2. Adequate dissolved oxygen levels in the backwaters and fish escape routes from the shallow backwaters to the main channel must be maintained.

3. Any solution should not adversely affect operation of the 9-foot navigation channel project.
4. Any solution should not significantly increase discharges and associated sediments into the Winneshiek backwater area (an increase in discharge of greater than 10% is considered significant).
5. The project must maintain adequate boating access to the Big Lake backwater areas.

CONSTRUCTION HISTORY

Construction of the project was initiated in the spring of 1994 by the Corps hired labor crews from Fountain City, Wisconsin, using quarry rock fill materials acquired via competitive bidding contracts. Sand fill used to construct the berms and closure structures was dredged from the vicinity of the main channel. Before the project could be completed, flooding by the Mississippi River in the fall and spring caused a delay in construction until the summer of 1995. It was then found that a number of the project structures had been damaged by the flooding. As a result of these flooding events, it was determined that riprapping of portions of the project structures was necessary. Plans to reinforce and stabilize the structures were developed and coordinated with the interagency team. The interagency team determined that some additional restriction of inflows passing through partial closure sites 2 and 6 would be desirable and better address the project objectives. Designs for additional reductions in flow were developed and coordinated with the interagency team and the public in 1996. Repair and revisions to the project were completed in September 1996. High water in 1997 overtopped the structures, but the rockfill structures were not damaged and only minor erosion occurred at a half dozen locations on the dikes. The erosion was repaired by the U.S. Fish and Wildlife Service.

PART II

OPERATION AND MAINTENANCE

GENERAL RESPONSIBILITIES AND PROCEDURES

Approved Responsibilities

Operation and maintenance responsibilities for the Lansing Big Lake habitat project were originally outlined in the Definite Project Report. These responsibilities were formally accepted by an agreement between the U.S. Fish and Wildlife Service (USFWS) and the St. Paul District, Corps of Engineers, fully executed on 14 May 1993 (appendix B). The capability of the USFWS to carry out the maintenance responsibilities described below will be contingent upon the passage of sufficient appropriations by Congress.

District Manager

Typically, the USFWS operation and maintenance responsibility for habitat projects is given to the district manager in charge of that portion of the appropriate National Wildlife Refuge. For the Lansing Big Lake project, the current address is: District Manager, U.S. Fish and Wildlife Service, P.O. Box 460, McGregor, Iowa 52157; telephone # 319-873-3423. Hereafter, for the purposes of this manual, when describing responsibilities, etc., the term "District Manager" will be used.

Improvements or Alterations

Prior to any improvements or alterations to any portion of the habitat project that would affect the functional ability of that element to meet the project's habitat goals and objectives as intended, the USFWS should coordinate the action with other involved agencies. These agencies are the Corps St. Paul District and the Iowa and Wisconsin Departments of Natural Resources.

Inspections

The following inspections of the project should be made by the District Manager.

Natural High Ground Between the Backwaters and Main Channel: The inspection should include the monitoring of any non-project area "blowout" channel that may begin to form along the natural high ground. If these become large, the interagency team should be informed so that appropriate actions can be taken by the managing agencies to protect the integrity of the project.

Berms and Rockfill Closure Structures: The sandfill vegetated berms and offshore rockfill structures should be inspected visually for the purpose of identifying and evaluating erosion, displacement, and settling of the structures, and to define appropriate remedial maintenance and/or rehabilitation actions that may be desirable.

Partial Closure Rock-Lined Channel: Inspections should be accomplished to identify any substantial loss of rock from project structures or significant scour at sites 1,2, and 6.

Time and Frequency of Inspections

Inspections by the District Manager should be conducted a minimum of once a year for the high ground and project structures. The established points and times for the required inspections were developed through coordination between the Corps of Engineers and the USFWS. After the habitat project has been in operation for 5 years, the Corps and the USFWS will review these inspection activities for adequacy. The frequency and nature of the inspections may be modified by mutual written agreement.

Annual Report

A checklist report covering inspection, operation, and maintenance of the habitat project shall be submitted each year to the District Engineer. The USFWS may send the Lansing Big Lake report in conjunction with reports on other habitat projects for which it has responsibility. A copy of the checklist (including a project drawing) is included in appendix C. Note that the checklist requests a brief summary of the condition of the project and a description of any maintenance work done during the past one-year period.

Procedure for Reviewing Operation and Maintenance Activities

The District Engineer or his/her representative will be kept informed on operation and maintenance activities for the Lansing Big Lake habitat project through a periodic inspection of the project by the Corps and through analysis of an annual inspection checklist submitted by the USFWS. The Corps will inspect the project with a USFWS representative at least once every five years and at other times as may be required. The Corps should contact the District Manager so that a mutually convenient date can be set up for the joint inspection. The District Manager is encouraged to invite the Iowa and Wisconsin Departments of Natural Resources to participate in the inspection.

The findings of these inspections will be transmitted to the USFWS and, if appropriate, will include recommendations for any remedial work considered necessary to maintain the habitat project in a satisfactory operating condition. Any agreed upon remedial work should be completed as soon as possible by the USFWS as provided in the Memorandum of Agreement between the USFWS and the Corps.

OPERATION

There are no operational requirements associated with the Lansing Big Lake project.

MAINTENANCE

General

Maintenance of the project structures was anticipated during the design of the project. The anticipated average annual cost of project maintenance was estimated to be \$2,500 (Definite Project Report dated March 1991).

Should inspections reveal that maintenance is necessary to repair project features, the following procedures should be used.

Berms and Offshore Rockfill: If inspections identify erosion and/or significant settling of these structures, remedial actions will include reshaping and filling the eroded area with rock, sand, and/or topsoil, with seeding/revegetating, as appropriate to prevent erosion. Erosion and/or settling beyond the scope of normal expectations will be evaluated by the Corps and USFWS.

Partial Closure Rock-Lined Channel: Rockfill repairs are not expected to be needed at the rock-lined structures. However, if inspections find substantial losses of rock from these structures, repairs to the structures will need to be evaluated by the Corps and USFWS.

Repair Materials

Specifications for rockfill for maintenance of the rock-lined partial closures and riprapped areas are given in appendix D. Rockfill needed for repairs should be obtained from local pit sources. Project drawings should be consulted for placement and thickness of rock. Any fill material needed for repairs to berm areas should be obtained from channel maintenance or on-site sources.

Repairs that require earthwork and/or topsoiling should also include seeding to encourage the growth of vegetation and help stabilize exposed soils. A ground cover seed mixture of selected species such as reed canarygrass, sand dropseed, smooth brome grass, perennial rye, and switchgrass should be used for such revegetation efforts. The revegetation efforts should be done as early as possible in the growing season to allow the vegetation to become established before winter. In the first year of revegetation and a month after the seed mixture has germinated, fertilization is strongly recommended. The fertilizer used should be a nutrient balanced slow release granular fertilizer and should be broadcast at the manufacturer's recommended application rate. Optionally, the seed source for revegetating eroded areas may be taken from adjacent topsoil sources and fertilized as above.

INSPECTIONS, TESTS, AND OPERATIONS FOLLOWING MAJOR STORMS OR FLOODS

General

As stated in the Memorandum of Agreement between the USFWS and the Corps, the Corps will be responsible for any mutually agreed upon repair and rehabilitation of the Lansing Big Lake project that exceeds the annual maintenance requirements (i.e., average annual operation and maintenance costs of \$2,500) and that is needed as a result of a specific storm or flood event.

Project Rehabilitation/Abandonment

Should inspection of the project area following a major flood or natural disaster disclose substantial damage to the project that appears to exceed the annual operation and maintenance as specified in this manual, the Corps, USFWS, and States will meet and discuss the appropriate course of action in light of original project design. The inspections by the District Manager and the joint inspections with the Corps will be the basis for determining maintenance responsibility by the USFWS versus potential rehabilitation by the Corps. With regard to the latter, the options of rehabilitation or abandonment of the project may be considered at this time. Any decision would be carried forth only upon written mutual agreement of the USFWS and the Corps.

Project Monitoring and Evaluation

An evaluation plan has been established for the Lansing Big Lake project to help determine the extent to which the design meets the habitat improvement objectives. This plan is included in appendix E. Information from the evaluation will also be used, if required, when ascertaining whether rehabilitation or abandonment of portions of this project would be the wisest choice. Project monitoring is a Corps responsibility and is limited to measuring changes in physical, water quality, and vegetation conditions. Monitoring beyond the scope of the Corps' project evaluation (i.e., to determine the response of fish and wildlife to habitat changes, for a longer duration, or in a larger area) will be conducted at the discretion of the sponsoring agency. The Corps monitoring plan is presented in appendix E of this manual.

PREFACE

The Lansing Big Lake Habitat Rehabilitation and Enhancement Project was constructed by the Corps of Engineers and completed in September 1994. In accordance with Section 107(b) of the Water Resources Development Act of 1992, the U.S. Fish and Wildlife Service has the responsibility for operation and maintenance of the project. The Corps of Engineers has prepared this manual to assist in fulfilling the operation and maintenance tasks.

The manual and appendices contain the latest approved agreements, maps, drawings, tables, and references pertinent to operation and maintenance of this project. Project evaluation features, a Corps responsibility, have also been included in order to provide a full perspective of post-construction project activities.

The project as designed and constructed will help to slow down the sedimentation rate in Lansing Big Lake and thereby improve fish and wildlife habitat in key backwater areas in pool 9. However, continued successful functioning of this project will depend upon the manner in which the project is maintained. Careful inspection and proper maintenance can help accomplish that goal.

The planning, design, and construction of the project was the result of an extensive cooperative effort on the part of the involved Federal and State agencies and the public. The continuation of this cooperation and coordination as part of the operation and maintenance of the project will be important to the success of the project and is strongly recommended.

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PROJECT DRAWINGS

DRAWING INDEX			
DRAWING NO.	SHT.	DESCRIPTION	CAD NAME
M-P9-10/13	1	DRAWING INDEX, LOCATION MAP & VICINITY MAP	MX04P760.DGN
M-P9-61/13	2	GENERAL PLAN & HORIZONTAL CONTROL DATA	MX04P761.DGN
M-P9-61/14	3	PLAN - SITE 1 ROCKFILL	MX04P762.DGN
M-P9-61/15	4	PROFILE & DETAILS - SITE 1	MX04P763.DGN
M-P9-61/16	5	PLAN - SITE 2 ROCKFILL	MX04P764.DGN
M-P9-61/17	6	PROFILE & DETAIL - SITE 2	MX04P765.DGN
M-P9-61/18	7	PLAN - SITE 3A, 3-1 & 3-2 SAND PLUGS	MX04P766.DGN
M-P9-61/19	8	SECTION & PROFILES SITE 3-1 & 3-2	MX04P767.DGN
M-P9-61/20	9	SECTION & PROFILE SITE 3A	MX04P768.DGN
M-P9-61/21	10	PLAN - SITE 4, 5, 5A & 5B SAND PLUGS	MX04P769.DGN
M-P9-61/22	11	SECTIONS & PROFILES - SITE 4, 5, 5A & 5B	MX04P770.DGN
M-P9-61/23	12	PLAN - SITE 6 ROCKFILL	MX04P771.DGN
M-P9-61/24	13	SECTION - SITE 6	MX04P772.DGN
M-P9-61/25	14	PLAN - SITE 7, 8 & 8A SAND PLUGS	MX04P773.DGN
M-P9-61/26	15	SECTIONS & PROFILES SITE 7, 8 & 8A	MX04P774.DGN
M-P9-61/27	16	PLAN - SAND BERMS B1 & B2	MX04P775.DGN
M-P9-61/28	17	SECTION & PROFILE - SAND BERM B1 STA. 0+00 TO 11+25	MX04P776.DGN
M-P9-61/29	18	SECTION & PROFILE - SAND BERM B2 STA. 0+00 TO 13+50	MX04P777.DGN
M-P9-61/30	19	PLAN - SAND BERM B2	MX04P778.DGN
M-P9-61/31	20	SECTIONS & PROFILES - SAND BERM B2 STA. 13+50 TO 25+50	MX04P779.DGN

PROJECT NOTES:

CLEARING METHODS WOULD INCLUDE THE FOLLOWING:

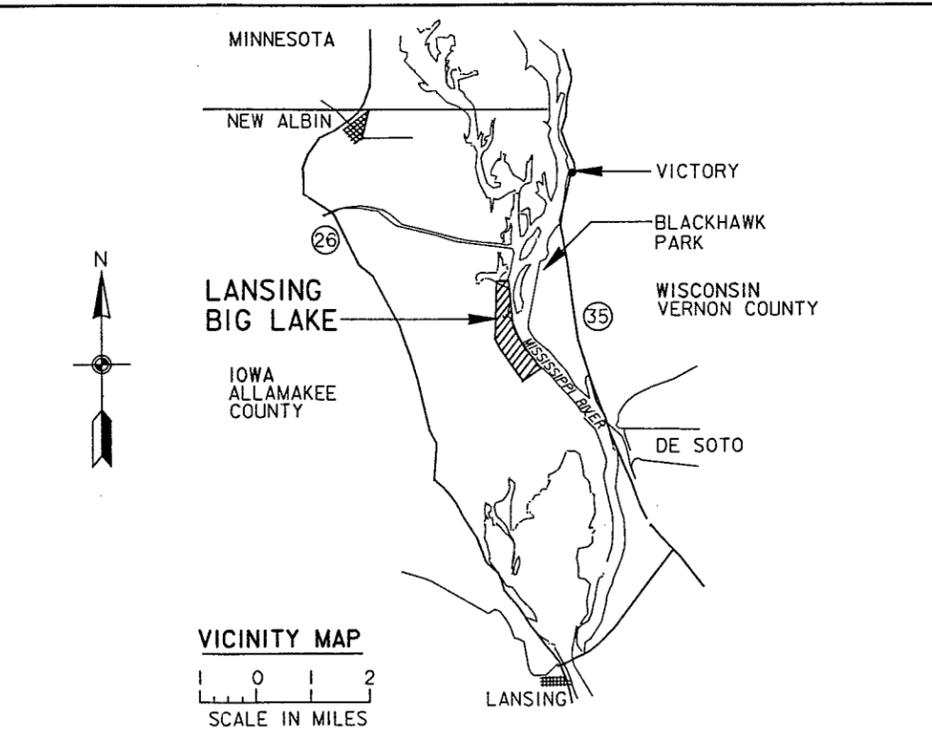
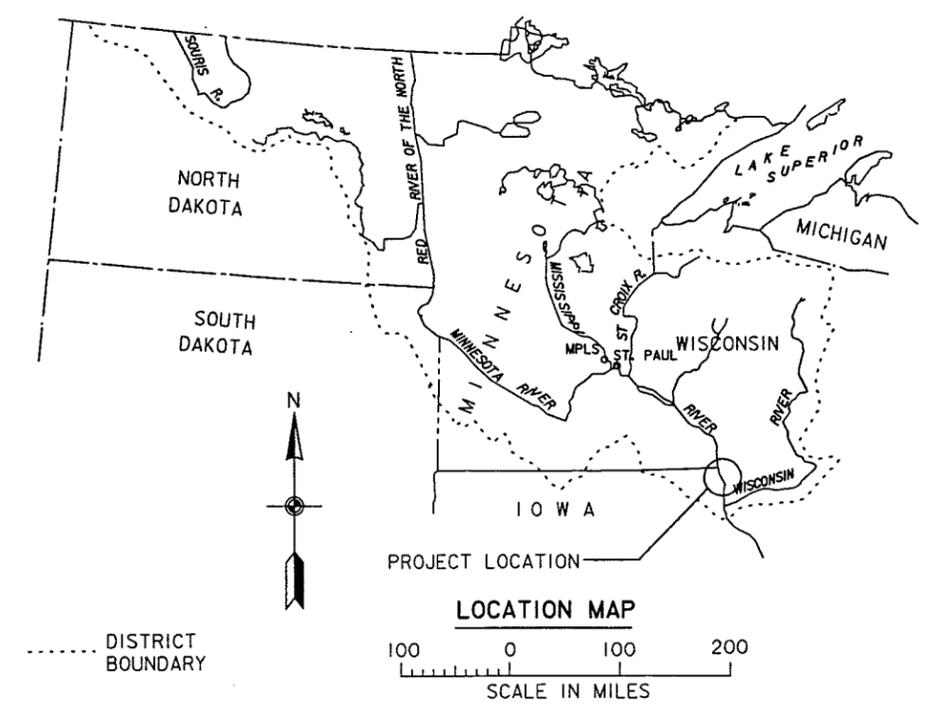
1. LARGE WOODY DEBRIS SHOULD BE REMOVED FROM THE WITHIN ALIGNMENTS OF THE BERM AND PLUG SITES.
2. FELLING TREES AND MOVING THEM OUTSIDE OF WORK LIMITS SHOULD NOT DAMAGE ANY BLUE-MARKED TREES.
3. THE WOOD MAY BE PLACED DOWNSTREAM OF THE PLUG SITES OUTSIDE WORK LIMITS AND LANDWARD (TOWARDS BIG LAKE) OF THE BERM SITES OUTSIDE THE WORK LIMITS. IF DOING SO WOULD DAMAGE BLUE-MARKED TREES, THE WOOD SHOULD BE PLACED IN ANY OPEN AREA.

STRIPPING WOULD INCLUDE THE FOLLOWING:

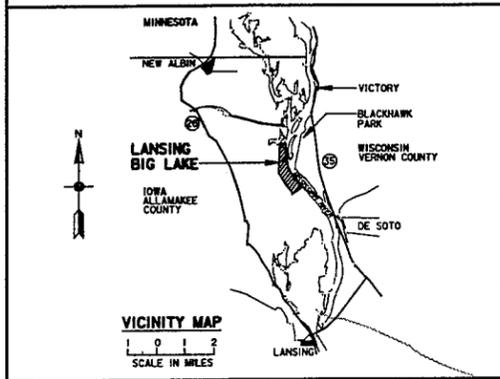
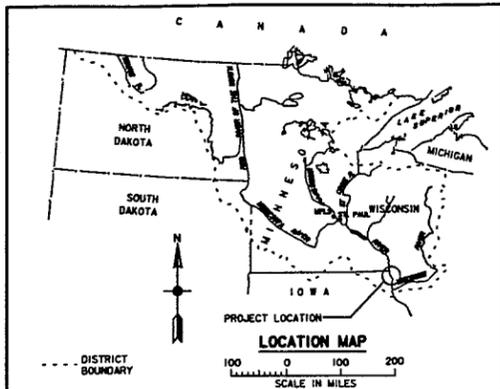
1. THE AREA WITHIN THE BERM ALIGNMENT UNDER THE DRIPLINES OF BLUE-MARKED TREES SHALL NOT BE STRIPPED.
2. REMAINING AREAS WITHIN THE BERM ALIGNMENT SHALL BE STRIPPED TO A MAXIMUM DEPTH OF 12 INCHES.
3. IF ADDITIONAL TOPDRESSING IS NEEDED FOR THE BERM, MATERIAL WILL BE OBTAINED FROM REED CANARY GRASS MEADOWS ADJACENT TO BUT OUTSIDE THE WORK LIMITS.
4. THE BERMS AND PLUGS SHOULD BE TOPDRESSED WITH 3 TO 4 INCHES OF ORGANIC MATERIAL FROM THE STRIPPING WORK.

TOPDRESSING/SEEDING

1. THE BERM ALIGNMENT MOVES THROUGH SOME WOODED AREAS. WHILE WE WILL BE REMOVING SOME OF THE CANOPY, THEY MIGHT NOT BE OPEN ENOUGH TO SUPPORT REED CANARY GRASS. A SEED MIXTURE WILL BE DEVELOPED AND USED AS NECESSARY ON THE BERM THROUGH THE WOODED AREAS. ORGANICS FROM THE ADJACENT WOODED AREA, FROM SHAPING OF THE ROCKFILL AREA AT SITE 6 AND NEARBY REED CANARY GRASS MEADOWS WILL BE USED FOR TOPDRESSING. THE FWS WILL BE ONSITE DURING HARVESTING MATERIAL FOR TOPDRESSING.



SIGNATURES AFFIXED BELOW INDICATE OFFICIAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET, AS INDEXED ON THIS SHEET.		ENGINEER MANAGER			
APPROVAL RECOMMENDED BY:		CHIEF SPECS. & TECH. SUPPORT SECTION		SYMBOL	
CHIEF	ED-D	BRANCH	CHIEF GENERAL ENGINEERING SECTION	DESCRIPTION	
			N/A	DATE	
CHIEF	ED-GH	BRANCH	CHIEF STRUCTURAL SECTION	APPROVAL	
			N/A		
CHIEF	ENGINEERING	DIVISION	CHIEF MECH/ELEC/ARCH SECTION	DEPARTMENT OF THE ARMY	
			N/A	ST. PAUL DISTRICT, CORPS OF ENGINEERS	
APPROVED BY:		CHIEF HYDRAULICS SECTION		CONTRACT DRAWING	
		CHIEF HYDROLOGY SECTION		LANSING BIG LAKE, IA	
COL., CORPS OF ENGINEERS		CHIEF GEOTECHNICAL DESIGN SECTION		ENVIRONMENTAL MANAGEMENT PROGRAM	
				MISSISSIPPI RIVER	
				POOL #9	
				ALLAMAKEE COUNTY, IOWA	
				DRAWING INDEX, LOCATION MAP & VICINITY MAP	
DESIGNED: GRB	CHECKED: RGB	DATE: 06-13-94	CAD FILE NAME: MX04P760.DGN	DRAWING NUMBER: M-P9-10/13	SHT 1
DRAWN: T.J.	CHECKED: XXX/XXX	SOL. NO: DACW37-90-B-0000			OF 20



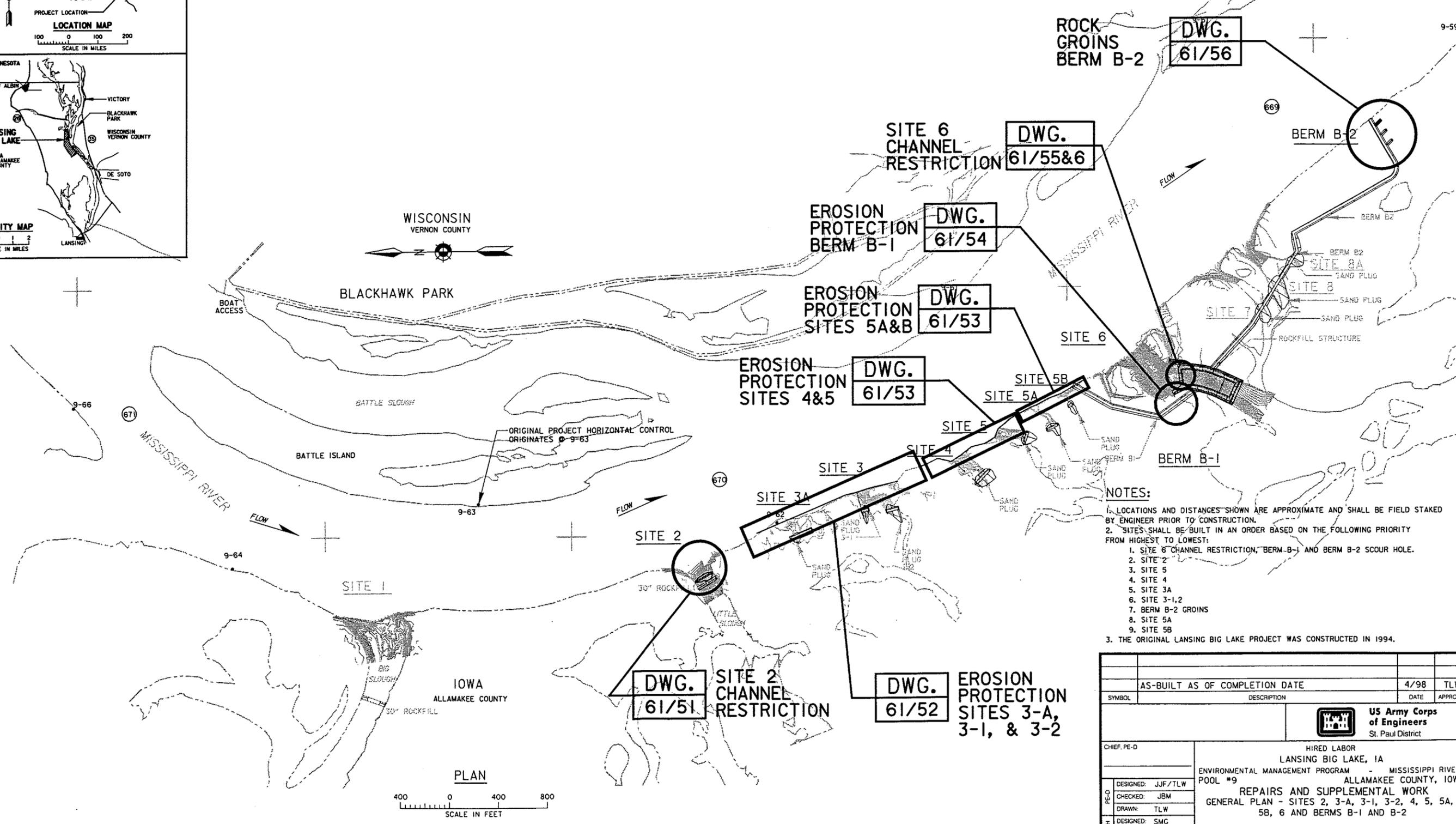
DRAWING INDEX			
DRAWING NO.	SHT.	DESCRIPTION	CAD NAME
M-P9-10/21	1	DRAWING INDEX, LOCATION MAP, VICINITY MAP & GENERAL PLAN	TWFIX.DGN
M-P9-61/51	2	PLAN - SITE 2	LANCES.DGN
M-P9-61/52	3	PLAN AND TYPICAL SECTIONS - SITES 3A, 3-1 & 3-2	SITE3.DGN
M-P9-61/53	4	PLAN - SITES 4, 5, 5A & 5B	SITES.DGN
M-P9-61/54	5	PLAN AND TYPICAL SECTIONS - BERM B-1 & B-2 SCOUR HOLE	LANCE15.DGN
M-P9-61/55	6	PLAN - SITE 6	LANCE11.DGN
M-P9-61/56	7	TYPICAL SECTIONS - SITES 6 & BERM B-2 GROINS	LANCE12.DGN

MISS. RIVER HORZ. CONTROL					
HUB	AZIMUTH	DISTANCE	NORTHING	EASTING	ELEV.
9-59			712,740.77	2,606,035.87	
9-61			716,937.46	2,603,889.40	
9-62	127°56'53"	2,264.46	718,329.98	2,602,103.72	
9-63	183°42'45"	2,418.98	720,743.88	2,602,260.35	
9-64	165°37'34"	2,053.27	722,732.88	2,601,750.63	
9-66			724,027.34	2,603,048.32	

COORDINATES BASED ON IOWA STATE PLANE GRID SYSTEM, NORTH ZONE

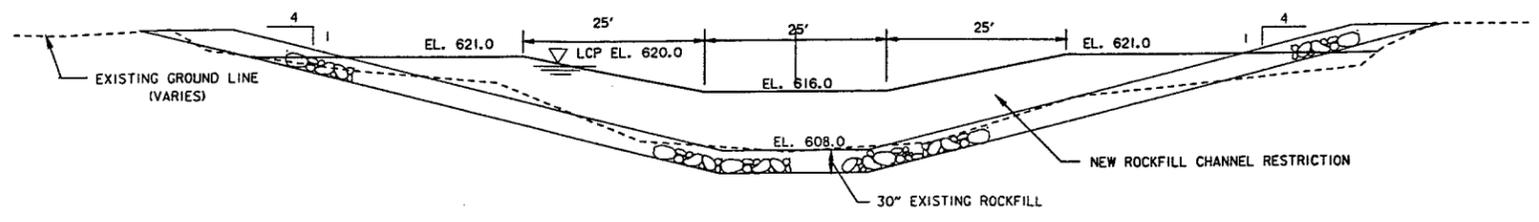
GENERAL LEGEND

- ⊗ (TBM)
- ▲— DENOTES FILL
- ⊙ RIVER MILE

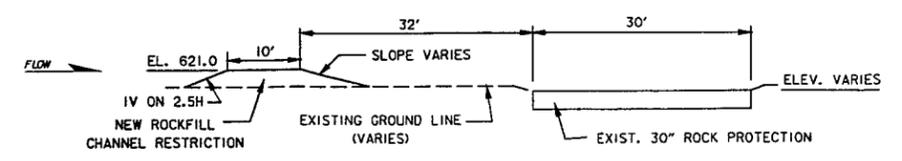


- NOTES:
1. LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE AND SHALL BE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.
 2. SITES SHALL BE BUILT IN AN ORDER BASED ON THE FOLLOWING PRIORITY FROM HIGHEST TO LOWEST:
 1. SITE 6 CHANNEL RESTRICTION, BERM B-1 AND BERM B-2 SCOUR HOLE.
 2. SITE 2
 3. SITE 5
 4. SITE 4
 5. SITE 3A
 6. SITE 3-1,2
 7. BERM B-2 GROINS
 8. SITE 5A
 9. SITE 5B
 3. THE ORIGINAL LANSING BIG LAKE PROJECT WAS CONSTRUCTED IN 1994.

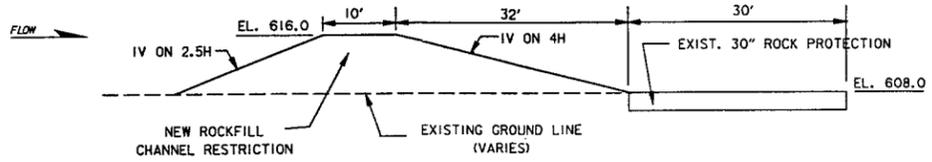
AS-BUILT AS OF COMPLETION DATE		4/98	TLW
SYMBOL	DESCRIPTION	DATE	APPROVAL
		 US Army Corps of Engineers St. Paul District	
DESIGNED: JJF/TLW	HIRED LABOR		
CHECKED: JBM	LANSING BIG LAKE, IA		
DRAWN: TLW	ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER POOL #9		
DESIGNED: SMG	ALLAMAKEE COUNTY, IOWA		
CHECKED:	REPAIRS AND SUPPLEMENTAL WORK		
DATE: 08-16-96	GENERAL PLAN - SITES 2, 3-A, 3-1, 3-2, 4, 5, 5A, 5B, 6 AND BERMS B-1 AND B-2		
CAD FILE NAME: TWFIX.DGN	DRAWING NUMBER:	SHT 1	
SOL NO: NOT APPLICABLE	M-P9-10/21	OF 7	



PROFILE
 NEW CHANNEL RESTRICTION
 EXIST. 30" ROCK PROTECTION
 SCALE: NONE

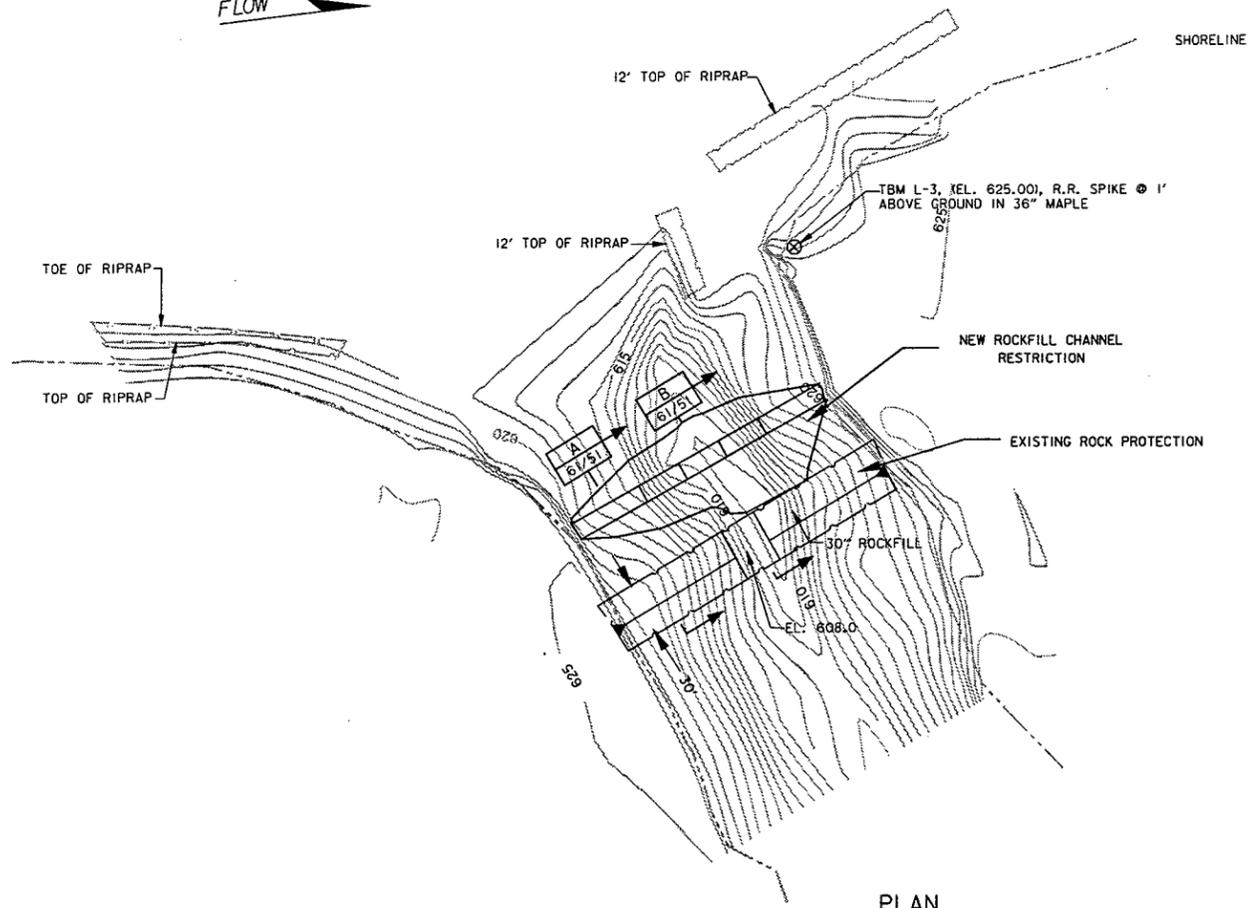


SECTION A
 NEW CHANNEL RESTRICTION
 EXIST. 30" ROCK PROTECTION
 SCALE: NONE



SECTION B
 NEW CHANNEL RESTRICTION
 EXIST. 30" ROCK PROTECTION
 SCALE: NONE

MISSISSIPPI RIVER
 FLOW



PLAN
 SCALE IN FEET
 0 50 100

NOTES:

1. LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE AND SHALL BE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.
2. LOCATION OF EXISTING ROCK PROTECTION UNKNOWN. POSITION NEW CHANNEL RESTRICTION RIVERWARD OF THE EXISTING ROCK LINER AS SHOWN ON SECTIONS.

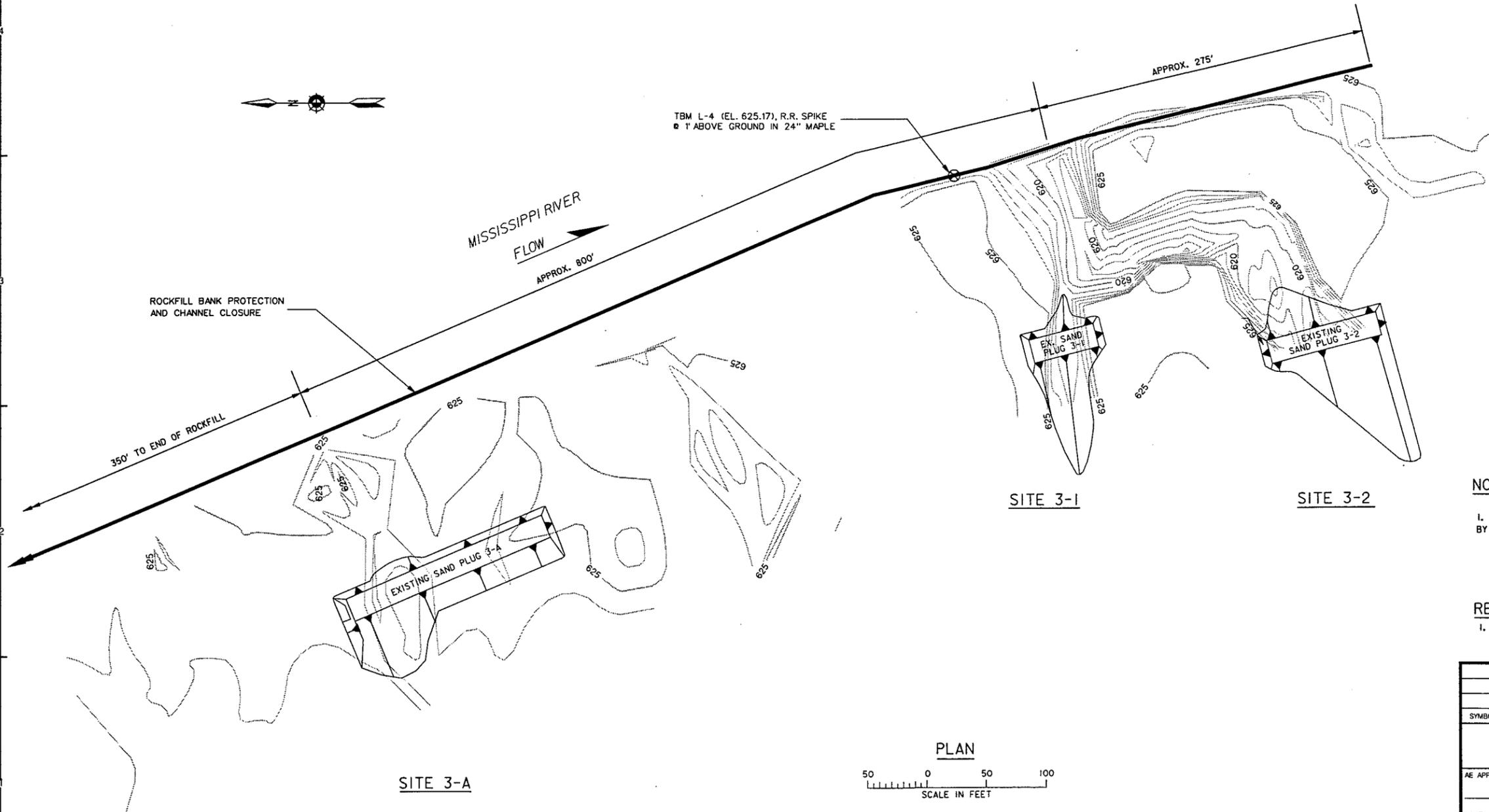
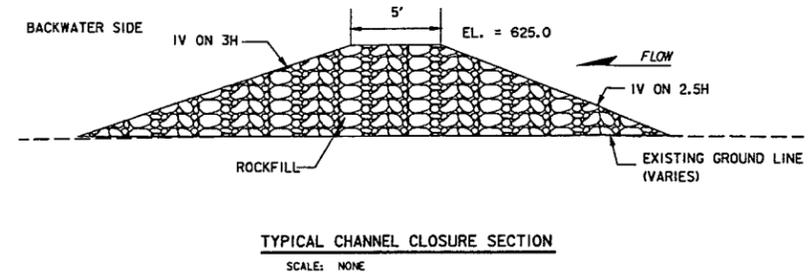
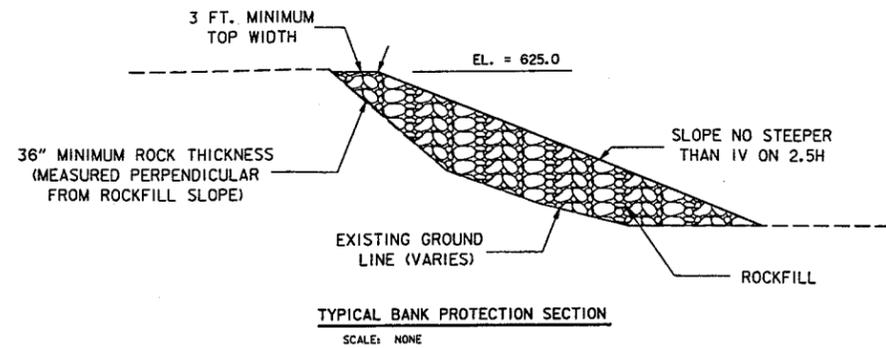
REFERENCES:

1. GENERAL PLAN

DWG. NO.

10/21

AS-BUILT AS OF COMPLETION DATE		4/98	TLW
SYMBOL	DESCRIPTION	DATE	APPROVAL
		 US Army Corps of Engineers St. Paul District	
AE APPROVING OFFICIAL: DESIGNED: JJF/TLW CHECKED: JBM DRAWN: TLW		HIRED LABOR LANSING BIG LAKE, IA ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER POOL #9 ALLAMAKEE COUNTY, IOWA CHANNEL RESTRICTION PLAN AND TYPICAL SECTION SITE 2	
DESIGNED: SMC CHECKED: XXX DATE: 08-16-96	CAD FILE NAME: LANCES.DGN SOL NO.: NOT APPLICABLE	DRAWING NUMBER: M-P9-61/51	SHT 2 OF 7



NOTES:

1. LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE AND SHALL BE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.

REFERENCES:

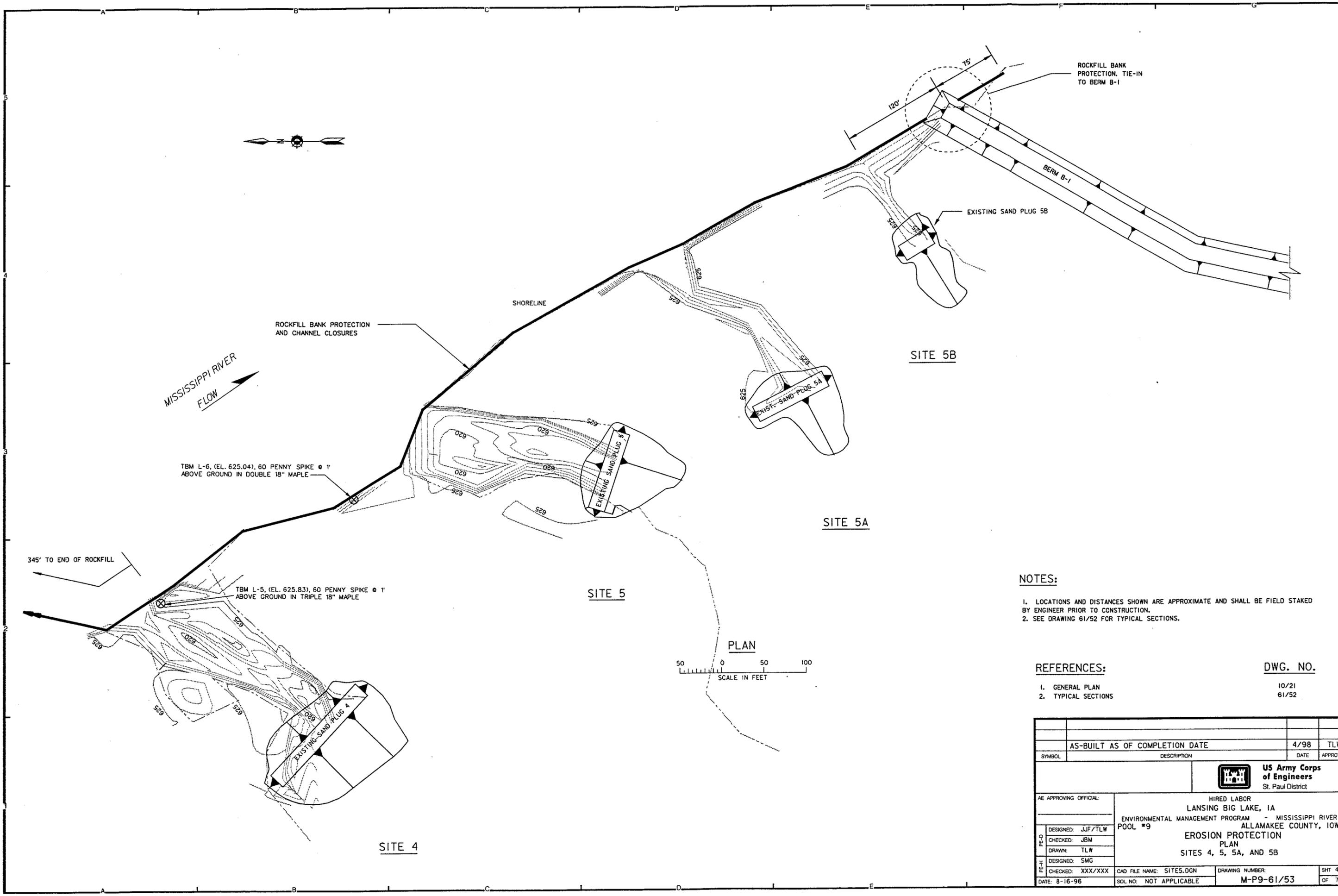
1. GENERAL PLAN

DWG. NO.

10/21



AS-BUILT AS OF COMPLETION DATE		4/98	TLW
SYMBOL	DESCRIPTION	DATE	APPROVAL
		US Army Corps of Engineers St. Paul District	
AE APPROVING OFFICIAL:		HIRED LABOR	
		LANSING BIG LAKE, IA	
		ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER	
		POOL #9	
		EROSION PROTECTION	
		PLAN AND TYPICAL SECTIONS	
		SITE 3A, 3-1 & 3-2 SAND PLUGS	
DESIGNED: JJF/TLW	CAD FILE NAME: SITE3.DGN	DRAWING NUMBER:	SHT 3
CHECKED: JBM	SOL. NO: NOT APPLICABLE	M-P9-61/52	OF 7
DRAWN: TLW			
DESIGNED: SMG			
CHECKED:			
DATE: 08-16-96			



MISSISSIPPI RIVER
FLOW

ROCKFILL BANK PROTECTION
AND CHANNEL CLOSURES

TBM L-6, (EL. 625.04), 60 PENNY SPIKE 1" ABOVE GROUND IN DOUBLE 18" MAPLE

TBM L-5, (EL. 625.83), 60 PENNY SPIKE 1" ABOVE GROUND IN TRIPLE 18" MAPLE

345' TO END OF ROCKFILL

SHORELINE

ROCKFILL BANK PROTECTION. TIE-IN TO BERM B-1

EXISTING SAND PLUG 5B

SITE 5B

EXISTING SAND PLUG 5A

SITE 5A

SITE 5

EXISTING SAND PLUG 4

SITE 4



NOTES:

1. LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE AND SHALL BE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.
2. SEE DRAWING 61/52 FOR TYPICAL SECTIONS.

REFERENCES:

1. GENERAL PLAN
2. TYPICAL SECTIONS

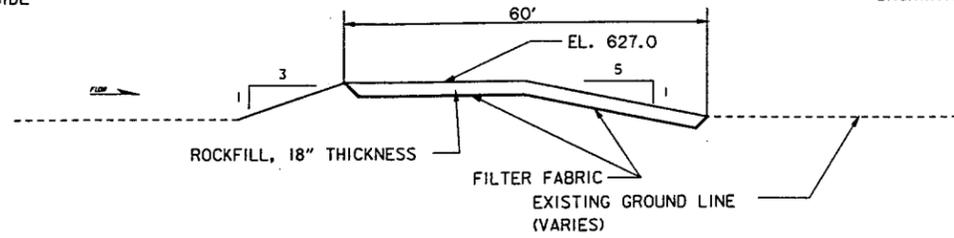
DWG. NO.

10/21
61/52

AS-BUILT AS OF COMPLETION DATE		4/98	TLW
SYMBOL	DESCRIPTION	DATE	APPROVAL
		US Army Corps of Engineers St. Paul District	
AE APPROVING OFFICIAL:		HIRED LABOR	
		LANSING BIG LAKE, IA	
		ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER	
		POOL #9	
		EROSION PROTECTION	
		PLAN	
		SITES 4, 5, 5A, AND 5B	
DESIGNED: JJF/TLW	CHECKED: JBM	DATE: 8-16-96	CAD FILE NAME: SITES.DGN
DRAWN: TLW	DESIGNED: SMG	SOL NO: NOT APPLICABLE	DRAWING NUMBER: M-P9-61/53
CHECKED: XXX/XXX			SHT 4 OF 7

RIVER SIDE

BACKWATER SIDE

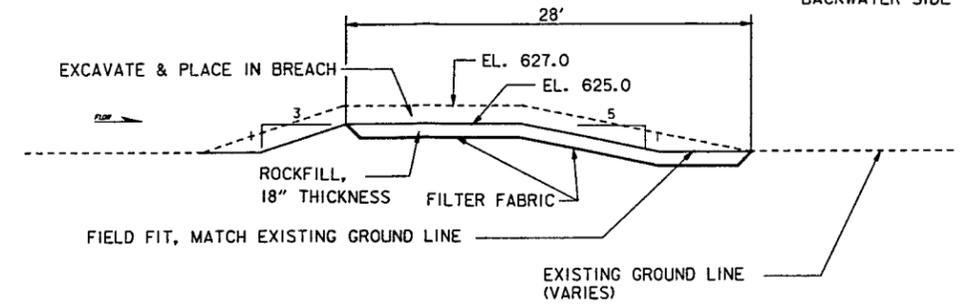


TYPICAL SECTION A
 EROSION PROTECTION, BERM B-1
 SCALE: NONE

• USE FROM DOWNSTREAM FACE OF BREACH 1 TO TIE-IN AT SITE 6

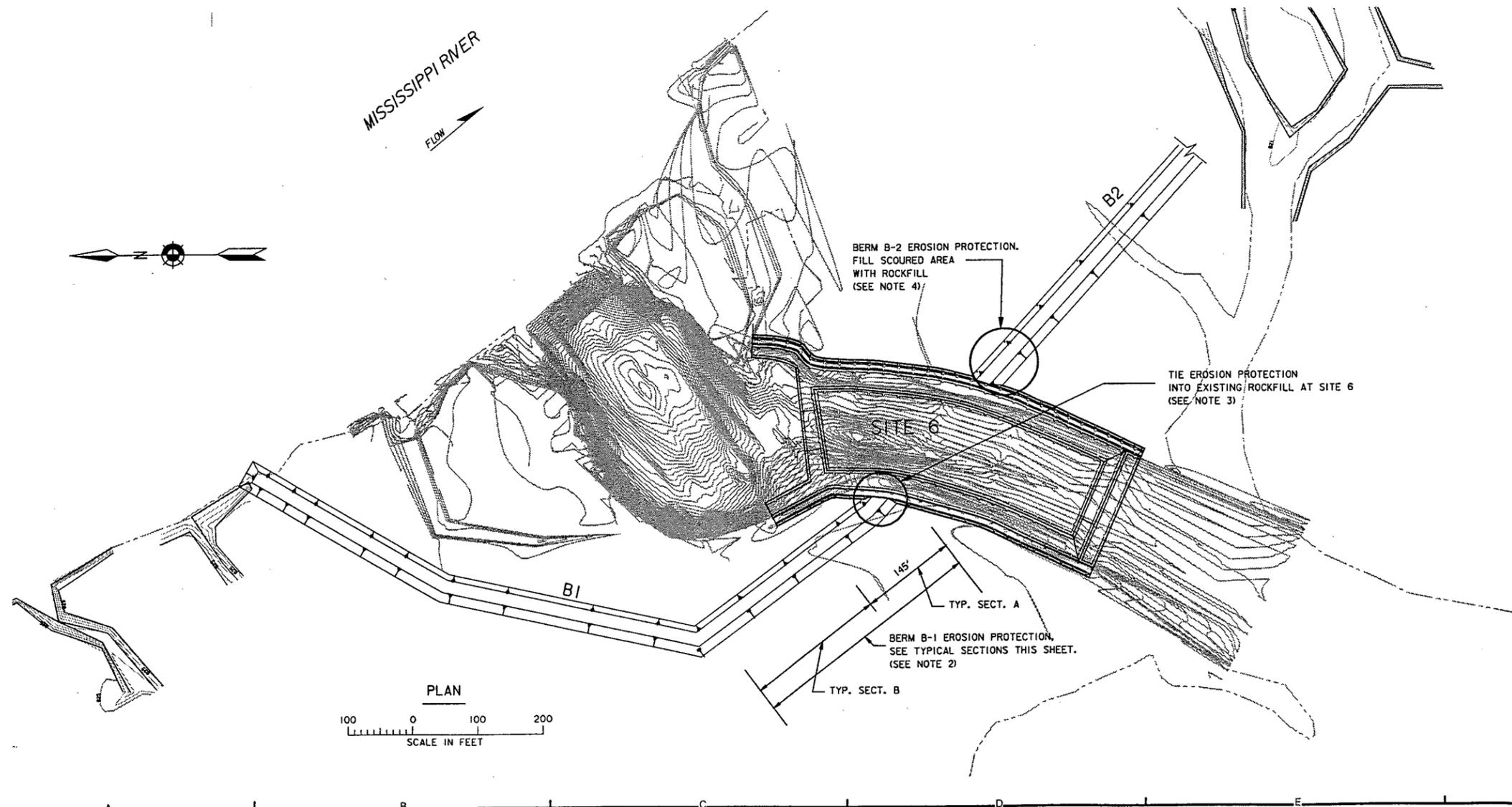
RIVER SIDE

BACKWATER SIDE



TYPICAL SECTION B
 EROSION PROTECTION, BERM B-1
 SCALE: NONE

• USE FROM DOWNSTREAM FACE OF BREACH 1 THROUGH UPSTREAM FACE OF BREACH 3



- NOTES:**
1. LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE AND SHALL BE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.
 2. APPROXIMATE LENGTH OF BERM B-1 EROSION PROTECTION = 440 FEET FROM SITE 6 TIE-IN TO UPSTREAM FACE OF BREACH 3.
 3. TIE-IN TO SITE 6 DOES NOT REQUIRE RESHAPING OF EXISTING ROCKFILL.
 4. ROCKFILL SHALL BE PLACED AND SHAPED TO SAME CONFIGURATION AS ADJACENT BERM B-2 THAT IS STILL INTACT. TIE-IN TO SITE 6 DOES NOT REQUIRE RESHAPING OF EXISTING ROCKFILL.

AS-BUILT AS OF COMPLETION DATE		4/98	TLW
SYMBOL	DESCRIPTION	DATE	APPROVAL
		 US Army Corps of Engineers St. Paul District	
AE APPROVING OFFICIAL:		HIRED LABOR LANSING BIG LAKE, IA ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER POOL #9 ALLAMAKEE COUNTY, IOWA	
DESIGNED: JJF/TLW	EROSION PROTECTION PLAN AND TYPICAL SECTIONS SAND BERM B-1, BERM B-2 SCOUR HOLE		
CHECKED: JBM			
DRAWN: TLW			
DESIGNED: SMG			
CHECKED: XXX	CAD FILE NAME: LANCE15.DGN	DRAWING NUMBER:	SHT 5
DATE: 08-16-96	SOL NO: NOT APPLICABLE	M-P9-61/54	OF 7

MISSISSIPPI RIVER
FLOW

TBM L-7 (EL. 628.87) 60" PENNY SPIKE 1"
ABOVE GROUND IN 36" MAPLE

A
61/56

100'
BANK PROTECTION

CHANNEL RESTRICTION DETAIL

ROCKFILL CHANNEL RESTRICTION

EXISTING ROCKFILL LINED CHANNEL

100'
BANK PROTECTION

25'
TRANSITION

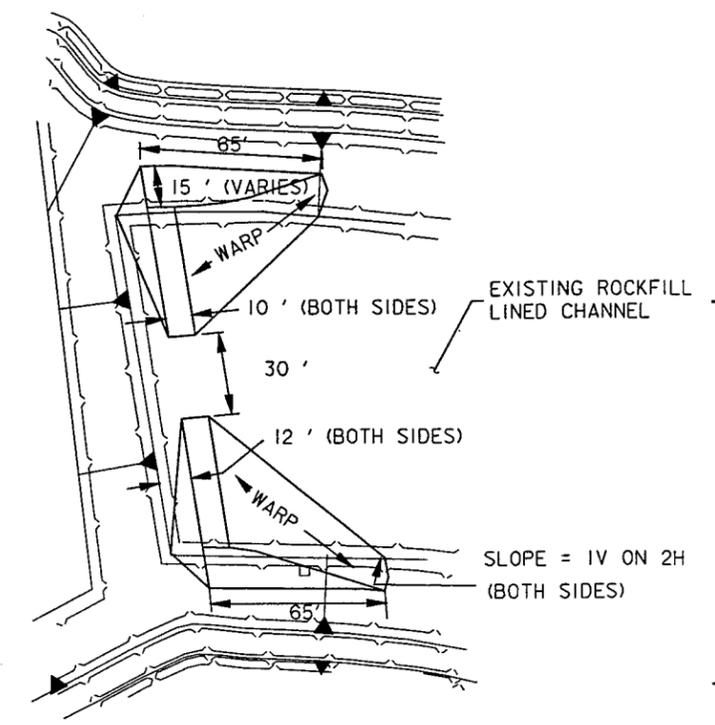
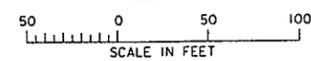
400'

25'
TRANSITION

25'
ROCKFILL



PLAN



CHANNEL RESTRICTION DETAIL

NO SCALE

NOTES:

1. LOCATIONS AND DISTANCES ARE APPROXIMATE AND SHALL BE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.

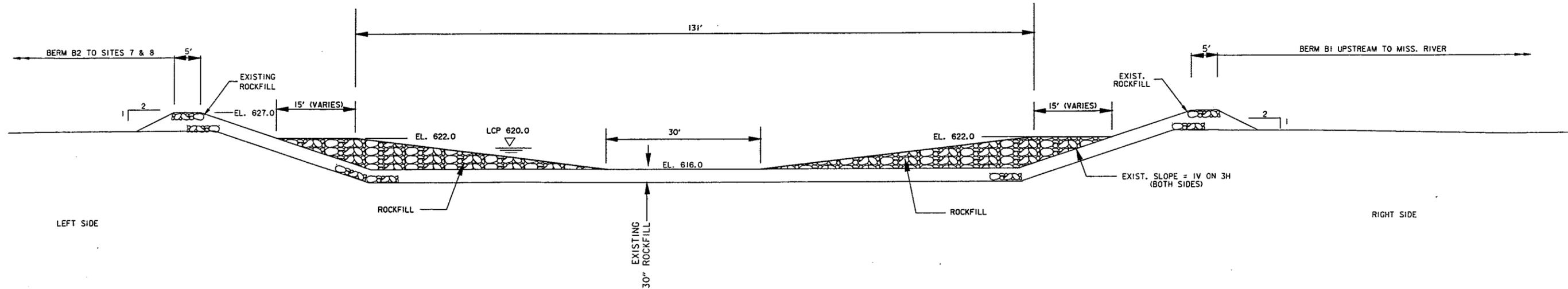
REFERENCES:

I. TYPICAL SECTION

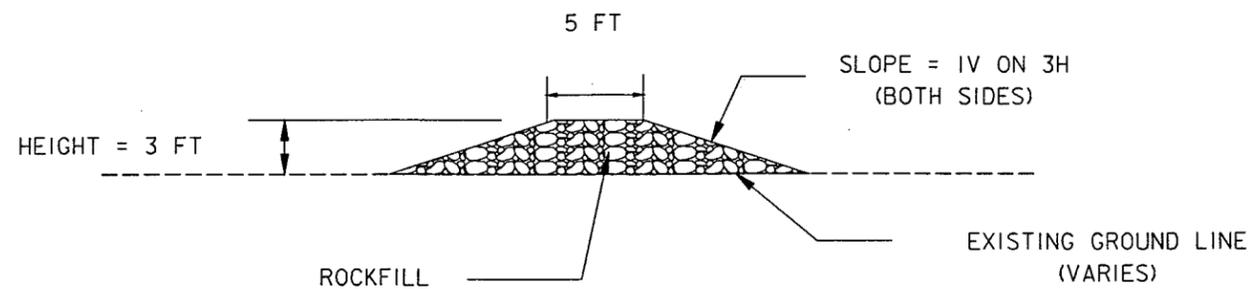
DWG. NO.

61/56

AS-BUILT AS OF COMPLETION DATE		4/98	TLW
SYMBOL	DESCRIPTION	DATE	APPROVAL
		 US Army Corps of Engineers St. Paul District	
AE APPROVING OFFICIAL:		HIRED LABOR LANSING BIG LAKE, IA ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER POOL #9 ALLAMAKEE COUNTY, IOWA	
DESIGNED:	JJF/TLW	CHANNEL RESTRICTION PLAN SITE 6	
CHECKED:	JBM		
DRAWN:	TLW		
DESIGNED:	SMG		
CHECKED:	XXX	CAD FILE NAME: LANCE11.DGN	DRAWING NUMBER: M-P9-61/55
DATE: 08-16-96	SOL NO: NOT APPLICABLE		SHT 6 OF 7



TYPICAL SECTION A
 CHANNEL RESTRICTION - SITE 6 61/55
 SCALE: NONE



TYPICAL SECTION

ROCKFILL GROIN, BERM B-2
 SCALE: NONE

NOTES FOR ROCK GROINS:

- * 3 REQ'D AT DOWNSTREAM END OF BERM B-2.
- * LENGTH OF EACH GROIN = 50 FEET
- * ANGLE EACH GROIN 70 DEGREES IN A DOWNSTREAM DIRECTION FROM BERM B-2.
- * TIE GROIN INTO BERM B-2. NO EXCAVATION REQUIRED.
- * ACTUAL LOCATION OF GROINS TO BE STAKED IN FIELD BY ENGINEER.

NOTES:

1. LOCATIONS AND DISTANCES SHOWN ARE APPROXIMATE AND SHALL BE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.

REFERENCES:

GENERAL PLAN

DWG. NO.

10/21

AS-BUILT AS OF COMPLETION DATE		4/98	TLW
SYMBOL	DESCRIPTION	DATE	APPROVAL
		 US Army Corps of Engineers St. Paul District	
AE APPROVING OFFICIAL:		HIRED LABOR LANSING BIG LAKE, IA ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER POOL #9 ALLAMAKEE COUNTY, IOWA CHANNEL RESTRICTION AND GROINS TYPICAL SECTIONS - SITES 6 AND BERM B-2 GROINS	
DESIGNED: JJF/TLW	CHECKED: JBM	DESIGNED: SMG/JJF	CHECKED: XXX
	DRAWN: TLW		CHECKED: XXX
DATE: 08-16-96	SOL. NO.: NOT APPLICABLE	CAD FILE NAME: LANCE12.DGN	DRAWING NUMBER: M-P9-61/56 SHEET: 7 OF 7

APPENDIX B

MEMORANDUM OF AGREEMENT

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
LANSING BIG LAKE
ALLAMAKEE COUNTY, 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 Lansing Big Lake 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 lands managed as a national wildlife refuge by the USFWS. 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 Lansing Big Lake 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 Lansing Big Lake project are 100 percent Federal.

III. GENERAL SCOPE

The Lansing Big Lake project provides for the construction of partial and complete closure structures on 10 side channel openings that enter the upstream portion of the Lansing Big Lake backwater area. This would decrease the overall sediment deposition in the Big Lake complex, thereby delaying the conversion of this aquatic habitat to floodplain forest. This would benefit diversity and interspersions in the project area.

IV. RESPONSIBILITIES

A. DOA is responsible for:

1. Construction: Construction of the project which consists of installing three rock liners for the largest upstream side channel openings and constructing sand plugs/closures at seven additional small side channel openings.

2. Major Rehabilitation: 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. Construction Management: 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 Lansing Big Lake project as described in the Definite Project Report (SP-9) Lansing Big Lake, Habitat Rehabilitation and Enhancement Project, dated March 1991, 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: 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. 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 entitled "Lansing Big Lake, Habitat Rehabilitation and Enhancement," dated March 1991, 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:

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

DOA: District Engineer
Department of the Army Corps of Engineers, St. Paul District
180 Kellogg Boulevard East, Room 1421
St. Paul, Minnesota 55101-1479

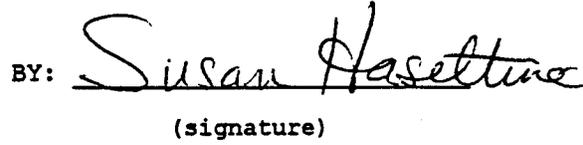
VII. EFFECTIVE DATE OF MOA

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

THE DEPARTMENT OF THE ARMY

THE U.S. FISH AND WILDLIFE SERVICE

BY: 
(signature)

BY: 
(signature)

RICHARD W. CRAIG
Colonel, Corps of Engineers
St. Paul District

Acting Regional Director
SAM MARLER
Regional Director
U.S. Fish & Wildlife Service

Date: 14 May 93

Date: 4/23/93

APPENDIX C

INSPECTION CHECKLIST

INSPECTION CHECKLIST

LANSING BIG LAKE
Habitat Rehabilitation and Enhancement Project
Environmental Management Program
Pool 9 - Upper Mississippi River

TO: U.S. Army Corps of Engineers
ATTN: CEMVP-CO-TS
Army Corps of Engineers Centre
190 Fifth Street East
St. Paul, Minnesota 55101-1638

Inspected by: _____ Date: _____

Type of Inspection: () Annual () Flood () Major Storm
() Other _____

Note: Show any problem areas on the attached project drawing.

I. SITE 1

- () No major problems
- () Displaced rockfill - location _____
- () Settlement - location _____
- () Rockfill needed - estimate of quantity _____ CY
- () Erosion at riverbank tie-in

II. SITE 2

- () No major problems
- () Displaced rockfill - location _____
- () Settlement - location _____
- () Rockfill needed - estimate of quantity _____ CY
- () Erosion at riverbank tie-in

III. SITES 3A thru 5B (Offshore rockfill)

- () No major problems
- () Displaced rockfill - location(s) _____
- () Settlement - location(s) _____
- () Rockfill needed - estimate of quantity _____ CY
- () Blowout at site(s) _____

IV. BERM B-1

- () No major problems
- () Erosion - location(s) _____

- () Settlement - location(s) _____

- () Fill needed - estimate of quantity _____ CY

V. SITE 6

- () No major problems
- () Displaced rockfill - location _____

- () Settlement - location _____

- () Rockfill needed - estimate of quantity _____ CY

VI. BERM B-2

- () No major problems
- () Erosion - location(s) _____

- () Settlement - location(s) _____

- () Fill needed - estimate of quantity _____ CY
- () Displaced rockfill @ groins
- () Rockfill needed - estimate of quantity _____ CY

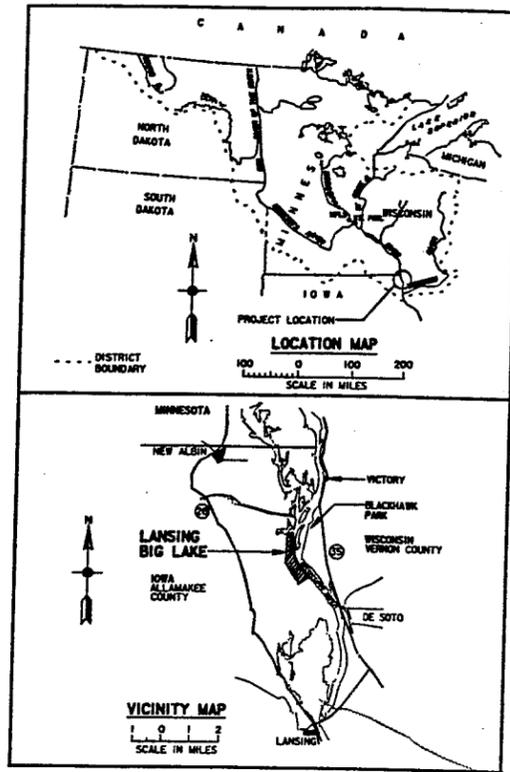
VII. OTHER ITEMS (List)

A. Areas needing special attention (describe and show on the attached project drawing):

B. Maintenance performed during the past year (include location of work, volume of rockfill placed, and cost):

C. Maintenance needed (include itemized estimate of cost to repair):

D. Other comments (brief summary of the condition of the project):



MISS. RIVER HORZ. CONTROL					
HUB	AZIMUTH	DISTANCE	NORTHING	EASTING	ELEV.
9-59			712,740.77	2,606,035.87	
9-61	127°56'53"	2,264.46	716,937.46	2,603,889.40	
9-62	183°42'45"	2,418.98	718,329.98	2,602,103.72	
9-63	165°37'34"	2,053.27	720,743.88	2,602,280.35	
9-64			722,732.88	2,601,750.63	
9-66			724,027.34	2,603,048.32	

COORDINATES BASED ON IOWA STATE PLANE GRID SYSTEM, NORTH ZONE

GENERAL LEGEND

- DENOTES FILL
- RIVER MILE

LOCATION MAP
SCALE IN MILES

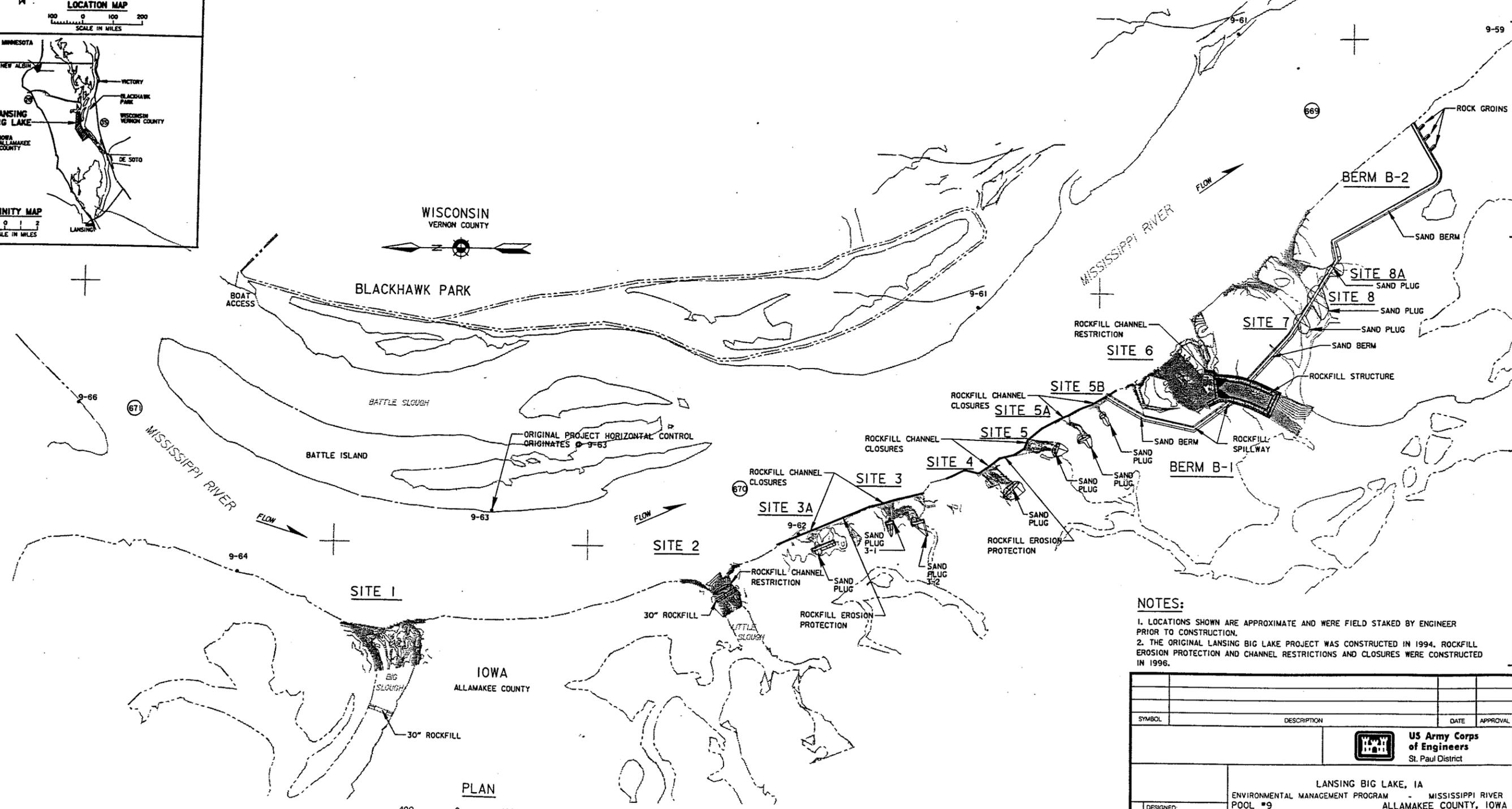
VICINITY MAP
SCALE IN MILES

WISCONSIN
VERNON COUNTY

IOWA
ALLAMAKEE COUNTY

PLAN

SCALE IN FEET



- NOTES:
1. LOCATIONS SHOWN ARE APPROXIMATE AND WERE FIELD STAKED BY ENGINEER PRIOR TO CONSTRUCTION.
 2. THE ORIGINAL LANSING BIG LAKE PROJECT WAS CONSTRUCTED IN 1994. ROCKFILL EROSION PROTECTION AND CHANNEL RESTRICTIONS AND CLOSURES WERE CONSTRUCTED IN 1996.

SYMBOL	DESCRIPTION	DATE	APPROVAL
US Army Corps of Engineers St. Paul District			
LANSING BIG LAKE, IA ENVIRONMENTAL MANAGEMENT PROGRAM - MISSISSIPPI RIVER POOL #9 ALLAMAKEE COUNTY, IOWA PROJECT AND SUPPLEMENTAL WORK GENERAL PLAN			
DESIGNED:			
CHECKED:			
DRAWN:	TLW		
DESIGNED:			
CHECKED:			
DATE:	04-16-98	CAO FILE NAME: LANSO&M.DGN SOL. NO.: NOT APPLICABLE	DRAWING NUMBER: NA
			SHT 1 OF 1

APPENDIX D

REPLACEMENT SPECIFICATIONS

6. MATERIALS.

6.1 Rockfill shall be rough quarry stone of suitable quality to ensure permanence in the Upper Mississippi River environment. Stone shall be free from cracks, seams and other defects that would unduly increase its deterioration.

6.1.1 Specific gravity. Stone shall have a specific gravity of not less than 2.55 and not more than 2.75.

6.1.2 Shape. Neither the breadth nor thickness of any individual stone shall be less than one-third its length.

6.1.3 Gradation. A Rockfill gradation curve is provided in SECTION: J. The Rockfill shall be reasonably well graded within the limits specified on the curve to permit construction of relatively dense rock fills. Inclusion of objectionable quantities of dirt, sand, clay, rock fines or other deleterious materials will not be allowed.

6.1.4 Processing. The Contractor shall submit for approval a method of processing rockfill at the quarry that will preclude the inclusion of objectionable amounts of fine material. All rockfill shall be processed in accordance with the method approved. Quarry-run rockfill will not be accepted. All rock designated for use as rockfill shall be processed over a vibratory grizzly or by an approved alternate method to insure the exclusion of poor quality rock.

6.2 Material Sources are provided in *attachment 1*. Materials may be furnished from any of the sources in *attachment 2*.

7. TESTS FOR ACCEPTABILITY.

7.1 Tests. Quality tests and service records will be used to determine the acceptability of stone materials. In the event suitable test reports and satisfactory service records are not available, the material will be tested to determine acceptability. Tests to which materials may be subjected include petrographic analysis, specific gravity, soundness, abrasion, absorption, freezing and thawing, and other tests necessary to demonstrate acceptability.

8. TESTS FOR GRADATION.

8.1 Gradation tests shall be performed by and at the expense of the Contractor.

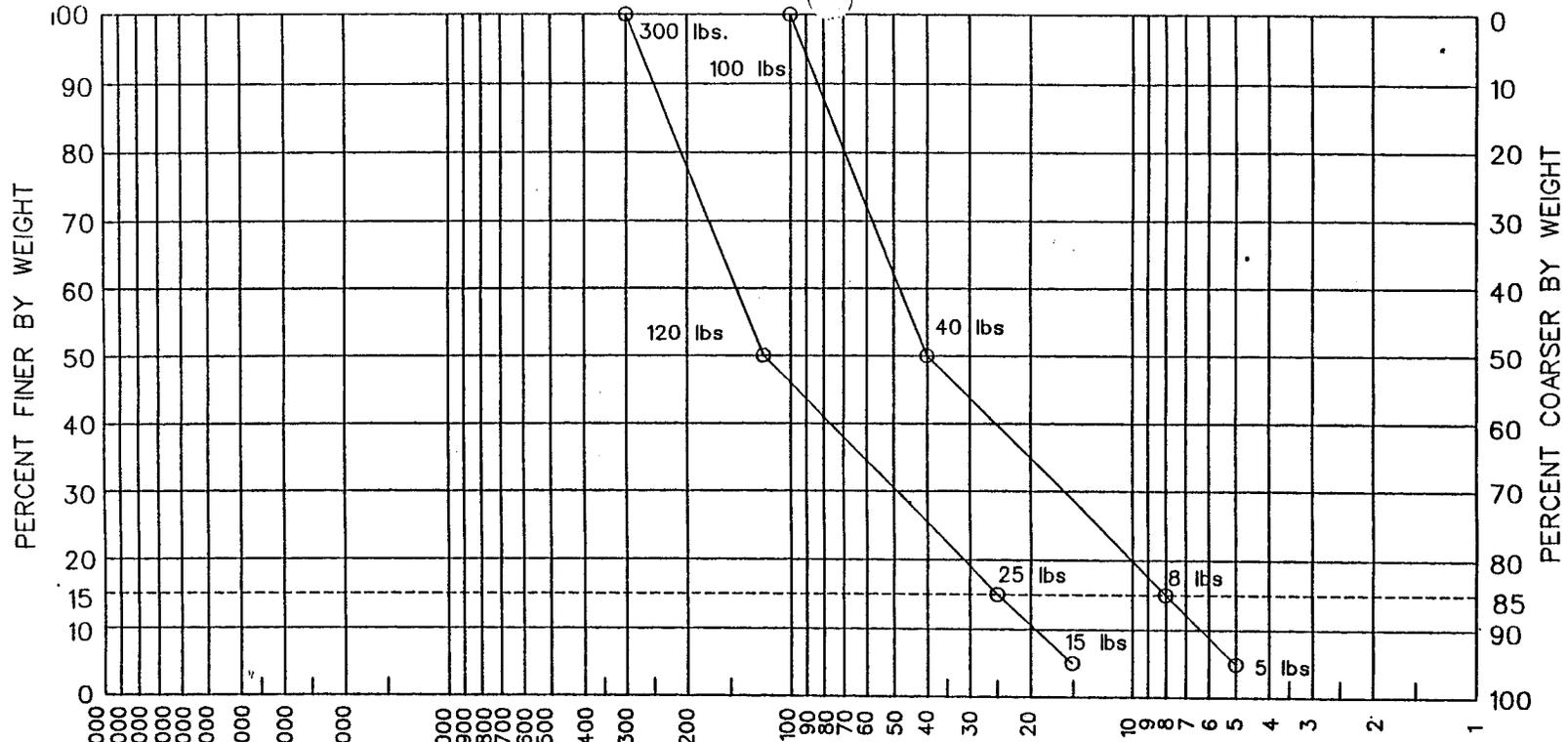
8.1.1 Rockfill. A minimum of five weight classes shall be selected by the Contractor to yield approximately 75, 50 and 30 percent finer by weight gradation points, as well as the percent finer than 5 pounds.

8.2 Frequency.

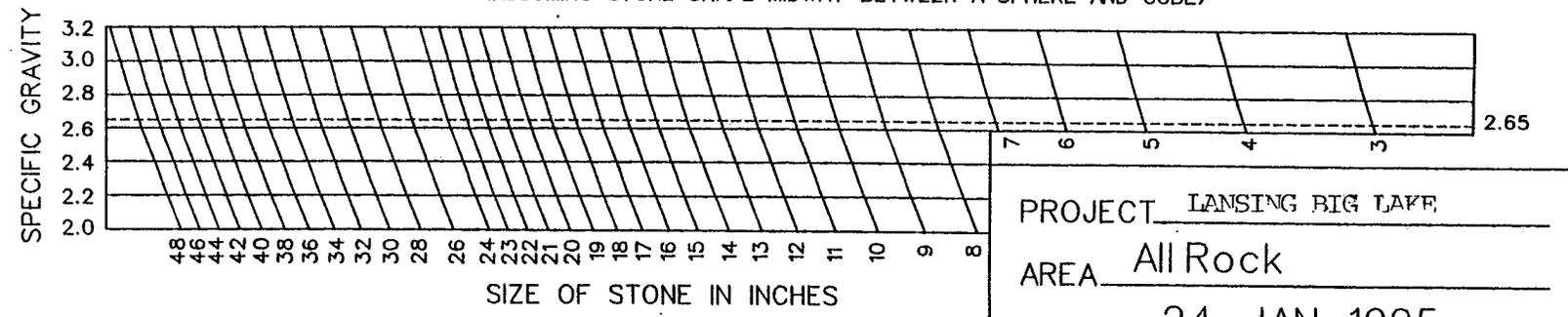
Gradation Testing

<u>Material</u>	<u>Minimum Sample Size</u>	<u>Minimum Number of Tests</u>
Rockfill	5 tons	One Prior to delivery + 1 per 5,000 ton or fraction thereof.

The Contractor shall take as many additional tests under the Contractor's quality control program as are needed to ensure gradation requirements are met.



WEIGHT OF STONES IN POUNDS
(ASSUMING STONE SHAPE MIDWAY BETWEEN A SPHERE AND CUBE)



SPECIFIC GRAVITY OF STONE = 2.65

PROJECT LANSING BIG LAKE
 AREA All Rock
 DATE 24 JAN. 1995

ROCKFILL GRADATION CURVE

ATTACHMENT 2

MATERIAL SOURCES

<u>QUARRY</u>	<u>LOCATION</u>	<u>OWNER/OPERATOR</u>
Wetzel	Sec 31, T7N, R6W Crawford Co., WI	Edward Kraemer & Sons, Inc. One Plainview Road Plain, WI 53577 (608) 546-2311
Morarend	Sec 35, T92N, R3W Clayton Co., IA	Roverud Construction Co., Inc. Hwy 44 E., Box 606 Spring Grove, MN 55974 (507) 498-3377
Osterdock	NW 1/4, SE 1/4, Sec 2, T91N, R3W Clayton Co., IA	Kuhlman Construction Co. Box 126 Colesburg, IA 52035 (319) 856-3535
Pattison	NW 1/4, Sec 7, T93N, R2W Clayton Co., IA	Pattison Bros. Investments, Inc. R.R. 2 Clayton, IA 52049 (319) 964-2651

"Production from the Osterdock and Morarend quarries shall be restricted to unweathered portions of the Stewartville Member of the Galena Formation".

APPENDIX E

EVALUATION AND MONITORING PLAN

(Corps monitoring plan as presented in the Definite Project Report dated March 1991)

Project Performance Evaluation

Goal	Monitoring Accomplishment	Unit of Measure	Monitoring Plan	Monitoring Interval	Cost/Effort
Protect & preserve existing aquatic habitat in the Big Lake Area	Measure sedimentation in the Big Lake & Winnesheik Lake areas	inch	Measure sedimentation at cross sections established by IDNR (Aspelmeier) Includes sites 5, 6, 9, and 16.	1, 5, 10, 20, 30, 40, and 50 years	\$2,000
			Measure sedimentation at cross sections at sites 10, 11, 12, 13, and 14 (duplicates the transects B,C,D,E, and F done by Eckblad in 1973 and 1974.	1, 5, 15, 25, 35, & 50 years	\$2,500
			Measure sedimentation at cross sections at sites 3, 4, and 20.	1, 5, 15, 25, 35, & 50 years	\$2,000
			Measure sedimentation at cross sections at sites 21, 22, & 23 (sites located outside the immediate project site). These correspond to transects 10 and 11 of study done by Sedimentation Laboratory, Oxford Mississippi, McHenry and Ritchie, 1977.	1, 5, 15, 25, 35, & 50 years	\$2,000
	Measure change in secondary channel geometry and capacity at key locations	c.f.s.	Measure change in channel capacity at sites 1, 2, 4, 7, 15, 17, 18, and 19. Use broad sweep fathometer system for sites 17 & 18. Duplicate pool 9 Study (Rada) for cross section 19. Sites 7, 8, and 15 duplicates previous LBL survey.	2, 5, 15, 25, 35, and 50 years	\$3,000

Continued -

Project Performance Evaluation

Goal	Monitoring Accomplishment	Unit of Measure	Monitoring Plan	Monitoring Interval	Cost/ Effort
	Establish the base condition habitat (include Big Lake and Winnesheik areas	acre	Use aerial photos to map pre-project vege- tation and use GIS to analyze habitat areas. Includes LBL area and adjacent downstream areas.	initial year	\$15,000
	Measure loss of aquatic habitat	acre	Use aerial photos and GIS to identify and evaluate post project habitat changes. Includes sites 1 through 23.	Every 10 years	\$3,500

