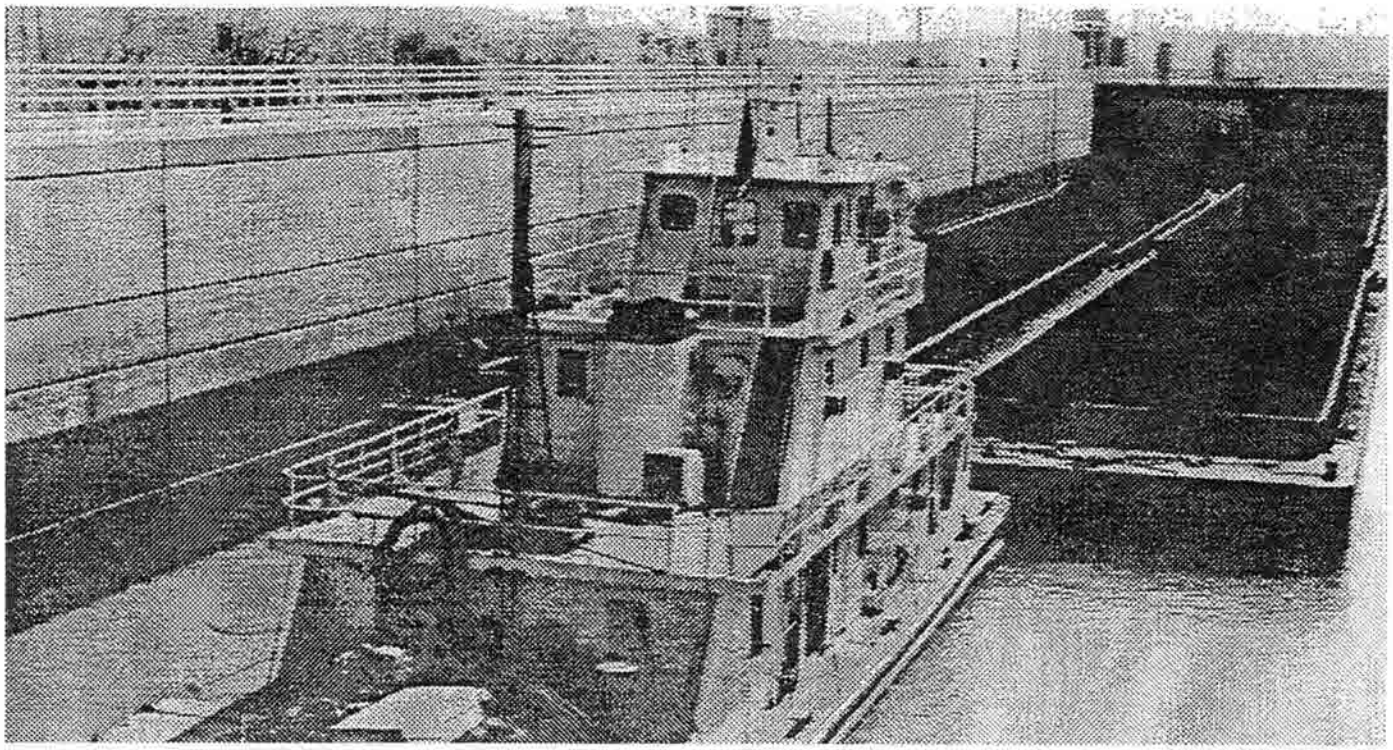
MELVIN PRICE LOCKS AND DAM
UPPER MISSISSIPPI RIVER BASIN
MISSISSIPPI RIVER — MISSOURI AND ILLINOIS



DESIGN MEMORANDUM NO. 24
AVOID AND MINIMIZE MEASURES

GOOD ENGINEERING ENHANCES THE ENVIRONMENT

US Army Corps of Engineers
St. Louis District
Partners in Progress

OCTOBER 1992

CELMV-ED-TS (CELMS-PM/1 Oct 92) (1105-2-10c) 1st End
Mr. Cox/cc/601-634-5934
SUBJECT: Design Memorandum No. 24, Avoid and Minimize Measures, Melvin Price Locks and Dam, Mississippi River - Missouri and Illinois

CDR, Lower Mississippi Valley Division, Vicksburg, MS 39181-0080
24 DEC '92

FOR Commander, St. Louis District, ATTN: CELMS-PM

The subject design memorandum is approved subject to the following comments:

Basic Memorandum.

a. Paras 1, 2 and 3. Implementation of Avoid and Minimize measures through an identified Avoid and Minimize Program should continue as described in paragraph 2-05 of the Design Memorandum. Avoid and Minimize Measures outlined in Table 5-1, Schedule of O&M and PRIP Funds, should be introduced into each budget cycle properly described for competition with the rest of O&M requirements. Reprogramming should be used to accomplish these items as opportunities present themselves. In preparation of your Operations and Maintenance FY 1995 Initial Budget Request in April 1993, you should prioritize work covered in this Design Memorandum. Qualifying items for waivers under the Avoid and Minimize Program should be submitted as appropriate.

Design Memorandum.

b. General.

(1) ER 1110-2-265, Engineering and Design for Civil Works Projects, and ER 1110-2-1150, Engineering After Feasibility Studies, require that a design memorandum include a brief discussion addressing required additional NEPA documentation, status of cultural resource investigations or coordination, status of required endangered species coordination, Section 404/ 401 Water Quality Certification, etc. These topics should be addressed in Section III.

(2) Costs for preparing required environmental documentation should be incorporated in Appendix B, M-CACES Cost Estimate.

c. Paras 3-03 and 3-04, pages 3-1 and 3-2, respectively. As you are aware, your dustpan dredge POTTER is primarily designed to work in dredging applications downstream of the

canalized portion of the Mississippi River. Therefore, the proposal to purchase dredge pipe and a booster for the POTTER for the work included in measures A-10 and A-11 should be reconsidered. The work described in these measures could better be accomplished by a cutterhead dredge such as the St. Paul District's W. A. THOMPSON or by a contract cutterhead dredge.

d. Table 5-1, Section V. The description of measure A-10 in paragraph 3-03 and the cost estimate indicate that a booster pump is required. However, this table indicates that measure A-10 only includes purchase of pipe and maintaining rock armor. The discrepancy between requirements for A-10 listed in paragraph 3-03 and those identified in this table should be reconciled and appropriate corrections made considering the above comment on paragraphs 3-03 and 3-04.

e. Appendix B. The M-CACES cost estimate presents Accounts 30 and 31, Planning, Engineering and Design and Construction Management, respectively, as lump sum items. You should furnish revised pages with a revised format which gives a cost breakdown for the major items included in these accounts.

FOR THE COMMANDER:

Roland J. Schumacher
for FRED H. BAYLEY III
Director of Engineering

Encl wd

CELMS-PM-M (CELMV-ED-TS/24 Dec 92) (1105-2019c) 2nd End
Mr. Koller/sr/314-331-8033
SUBJECT: Design Memorandum No. 24, Avoid and Minimize Measures, Melvin Price Locks and Dam, Mississippi River - Missouri and Illinois

CDR, Corps of Engineers, St. Louis District, ATTN: CELMS-PM-M, 1222 Spruce St., St. Louis, MO 63103-2833 02 FEB 1993

FOR Commander, Lower Mississippi Valley Division, ATTN: CELMV-ED-TS, Vicksburg, MS 3981-0080

The following is in response to comments made in the previous endorsement.

a. Para. 1a. Concur.

b. Para. 1b(1). The following should be inserted following paragraph 3-01.b. in the report:

c. Environmental Compliance.

(1) The St. Louis District issued two Environmental Impact Statements (EIS) in 1975 and 1976 on the District portion of the Mississippi and Illinois Rivers. The EIS on the pools covers Mississippi River mile 203 (old L&D 26) to the base of L&D 22, mile 301.1 and on the Illinois River from mile 0 to mile 80 (Pool 26). The Final Environmental Statement, Operation and Maintenance Pools 24, 25 and 26, Mississippi and Illinois Rivers was issued in September 1975. The EIS for the middle Mississippi River extends from mile 0.0, at the mouth of the Ohio, to mile 195 at the mouth of the Missouri River. The Final Environmental Statement, Mississippi River Between the Ohio and Missouri Rivers, Regulating Works was issued in April 1976. Several EIS's were produced as a result of the construction of Locks and Dam 26, (Replacement) and the Second Lock. The most recent EIS was the Final Environmental Impact Statement, Second Lock at Locks and Dam No. 26 (Replacement) Mississippi River, Alton, Illinois and Missouri, issued in July 1988. An example of other projects which included environmental analysis was Upper Mississippi River System-Environmental Management Program, Definite Project Report (SL-3) with Integrated Environmental Assessment, Pharrs Island Habitat Rehabilitation Project, Pool 24 Upper Mississippi River, Pike County, Missouri, Final, issued in June 1990. Thus, the St. Louis District has conducted several studies on construction and operation and maintenance activities in the last 18 years which address the National Environmental Policy Act, Endangered Species

Act and the National HistoricPreservation Act and which cover the items in this A&M report (Table I (Encl 1)).

(2) A Statement of Findings (SOF) for channel maintenance dredging for Section 404 of the Water Pollution Control Act was issued in May 1983. The finding covered the discharge of dredged material into navigable waters from mile 0.0 to mile 300.0 on the Mississippi River and mile 0.0 to mile 80.0 on the Illinois River. This effort was coordinated with federal, state and local agencies, environmental groups and the general public. A nationwide permit was issued to the Corps concerning the placement of stone in the rivers. In addition, a SOF was prepared by the District for the placement of stone. Table II (Encl 2) presents the Section 404 and 401 permits which cover the various A&M measures.

(3) Section 401, of the Water Quality Act Amendments of 1972, is regulated, locally, by the States of Illinois and Missouri. The State of Missouri issued certification for dredging in July 1979 through the Missouri Department of Natural Resources. Annual data is submitted to the MDNR. The Illinois Environmental Protection Agency issues maintenance dredging certification under the Illinois Environmental Protection Act. Certification must be renewed on an annual basis. The most recent application was accepted in June 1992 and extends to May 1993. Stone is considered a non-biodegradable material, thus it is considered exempt from 401 certification.

c. Para. 1b(2). Costs for preparing environmental assessments (if required) for those measures which the District has recognized to be recent innovations in river operations and maintenance and project improvement have been added to the M-CACES estimate (Encl 3) and Table 5-1 (Encl 4). Measures A-13, A-16, A-17 and A-19 are partially covered in the existing O&M EIS, but the measures are to be monitored both physically and biologically, as stated in the design memorandum. The additional costs are only for preparation of an environmental assessment and it is assumed that the physical and biological monitoring reveal that possible environmental impacts and/or positive or negative changes have occurred as a result of placement of materials in the riverine environment.

d. Para. c. Concur. The cost of the pipe and booster have been deleted.

e. Para. d. The cost of the booster pipe was included in the table in the cost indicated for "Purchase Pipe (PRIP)." The pipe and the booster have been deleted from the estimate.

f. Para. e. Concur. A revised M-CACES estimate is enclosed.

FOR THE COMMANDER:

for JACK R. NIEMI
Deputy District Engineer
for Project Management

5 Encls
1. nc
Added 4 encls

CELMV-ED-TS (CELMS-PM/1 Oct 92) (1105-2-10c) 3d End
Mr. Cox/cc/601-634-5934
SUBJECT: Design Memorandum No. 24, Avoid and Minimize Measures, Melvin Price Locks and Dam, Mississippi River - Missouri and Illinois

CDR, Lower Mississippi Valley Division, Vicksburg, MS 39181-0080

25 FEB '93
FOR Commander, St. Louis District, ATTN: CELMS-PM

1. The disposition of comments is satisfactory subject to the following comment:

"Funds to accomplish Avoid and Minimize (A&M) measures were not included in the FY 94 Budget Request, but you have expressed FY 94 capability to implement the measures. As you are aware, if Congress does not add this capability, you will have to reprogram FY 94 funds to implement A&M measures during FY 94. Funding for outstanding A&M measures needing to be implemented in FY 95 should be included in the FY 95 Budget Request."

2. Response to the comment contained herein is not required.

FOR THE COMMANDER:

5 Encls
wd encls 2-5

FRED H. BAYLEY III
Director of Engineering

TABLE I

SELECTED A&M MEASURES AND ENVIRONMENTAL COMPLIANCE

MEASURE	NEPA COMPLIANCE
A-3, Mooring Sites	Not addressed specifically in environmental documents to date. See Appendix B in Appendix A, DM 24 for an evaluation of lock approach waiting areas.
A-10, Dredge Material Beaches.	Addressed in O&M Statement for the Pools, 1975.
A-11, Dredge Material Disposal-Create Wetlands.	Open water disposal addressed in O&M statements, 1975 and 1976. Bullnose dikes addressed in Pharrs Island EA.
A-13, Dredge Material Disposal in Thalweg.	Methodology discussed in O&M Statement for the Pools, 1975. Aquatic field work now underway. Funds requested in DM for biological impacts and possible EA.
A-16, Dike Configuration Studies.	Addressed in SOF, following public review. Notched dikes addressed in Middle River O&M Statement, 1976. Bullnose dikes addressed in Pharrs Island EA. Biological monitoring called for in the DM. EA may follow if needed.
A-17, Offshore Revetment Placement.	Revetment placement addressed in both O&M Statements. Biological evaluation presented in DM, Appendix C in Appendix A. Addressed in SOF following public review procedures.
A-19, Bendway Weirs.	Bendway weirs are an underwater dike and are considered addressed in the SOF. Addressed in DM, Appendix B in Appendix A. Biological monitoring initiated in 1992. Additional monitoring called for in the DM. Possible EA.
B-8, Tow Waiting Time Study.	Outcome of study unknown at this time. NEPA requirements will be addressed as needed.

ENCL. 1

TABLE II

SELECTED A&M MEASURES AND ENVIRONMENTAL COMPLIANCE

MEASURE	SECTION 404 AND 401
A-3, Mooring Sites.	Not Applicable (N\A).
A-10, Dredge Material Beaches.	Addressed in SOF and certification from the States of Illinois and Missouri.
A-11, Dredge Material Disposal-Create Wetlands.	Same as A-10.
A-13, Dredge Material Disposal in Thalweg.	Same as A-10.
A-16, Dike Configuration Studies.	Nationwide permit and stone exempt. SOF prepared by District.
A-17, Offshore Revetment Placement.	Same as A-16.
A-19, Bendway Weirs	Same as A-16.
B-8, Tow Waiting Time Study.	N\A.

ENCL. 2

** PROJECT OWNER SUMMARY - LEVEL 1 **

		QUANTITY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
06	FISH AND WILDLIFE FACILITIES			4,081,455	804,570	4,886,025	
09	CHANNELS AND CANALS			4,337,437	1,046,731	5,384,167	
30	PLANNING,ENGINEERING & DESIGN			1,260,000	185,000	1,445,000	
31	CONSTRUCTION MANAGEMENT			606,850	91,028	697,878	
	AVOID/MINIMIZE - SECOND LOCK	1.00	EA	10,285,742	2,127,329	12,413,070	12413070

TABLE 5-1
AVOID AND MINIMIZE MEASURES
SCHEDULE OF O&M AND PRIP FUNDS
($000)

MEASURE	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	Total
A-3								
Construct Buoys	90.8	100.0						190.8
Maintain Buoys	31.9	35.0	35.0	35.0	35.0	35.0	35.0	241.9
A-10								
Rock Armorment		600.0		600.0		602.9		1802.9
A-11								
Vegetation					50.0	30.0	30.6	110.6
Rock Armorment	600.0		600.0		600.0		603.9	2403.9
A-13								
Monitoring	96.0	96.0	96.0	96.0	96.0	96.0	101.3	677.3
A-16								
Stone Dikes	450.0	450.0	450.0	450.0	450.0	450.0	447.5	3147.5
Monitoring	69.0	69.0	69.0	69.0	69.0	69.0	69.8	483.8
A-17								
Monitoring	69.0	69.0	69.0	69.0	69.0	69.0	69.8	483.8
A-19								
Monitoring	103.0	103.0	103.0	103.0	103.0	103.0	107.7	725.7
B-8								
Perform Tow Study	30.0	60.0	10.0	10.0	10.0	10.0	10.0	140.0
PED	175.0	255.0	175.0	175.0	175.0	175.0	175.0	1305.0
Construction Mgmt.	100.0	100.0	100.0	100.0	100.0	100.0	97.9	697.9
TOTAL	1814.7	1937.0	1707.0	1707.0	1757.0	1739.9	1748.5	12411.1

Note: All funds are O&M.

Encl 4

REV. Jan 93

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
1222 SPRUCE STREET
ST. LOUIS, MISSOURI 63103-2833

REPLY TO
ATTENTION OF

CELMS-PM

1 Oct 1992

MEMORANDUM FOR Commander, Lower Mississippi Valley Division,
ATTN: CELMV-ED-PG

SUBJECT: Design Memorandum No. 24, Avoid and Minimize Measures, Melvin Price Locks and Dam, Mississippi River - Missouri and Illinois

1. The enclosed design memorandum, subject as above, is submitted for review and approval. This memorandum was requested in the 1st Endorsement to the letter, CELMS-PD-A to CELMV-ED-PG, 21 November 1990, subject: Requested Supplement to Letter Report, Avoid and Minimize Measures, Melvin Price Locks and Dam, Stage III. The memorandum presents the planning progress through September 1992 and recommends eight measures for implementation. The plan extends to the year 2000 so that many of the Avoid and Minimize measures can become a normal part of the operation and maintenance program.

2. The Avoid and Minimize program has been planned and will be implemented as a result of discussion in the Second Lock EIS (Environmental Impact Statement) and a commitment made in the Record of Decision to the Second Lock EIS.

3. In FY 1993, planning for implementation of the Avoid and Minimize program will continue utilizing Construction General/Inland Waterways Trust Fund funding from the Melvin Price Second Lock project. It is proposed to initiate the recommended measures in FY 1994 by reprogramming O&M funds pending approval of this report. Funding for the measures will be requested in the O&M budget for FY 1995-2000. Previously, SLD submitted some Avoid and Minimize measures in the FY 1994 O&M budget, however, USACE deleted the work stating the work was not authorized or approved under O&M.

4. It is recommended that this design memorandum be approved.

FOR THE COMMANDER:

Encl (22 copies)

JACK R. NIEMI
Deputy District Engineer
for Project Management

AVOID & MINIMIZE MEASURES

DESIGN MEMORANDUM NO. 24

MELVIN PRICE LOCKS AND DAM

MISSISSIPPI RIVER - MISSOURI AND ILLINOIS

Prepared By:

U.S. Army Engineer District, St. Louis

1222 Spruce Street

St. Louis, Mo. 63103-2833

AVOID AND MINIMIZE PROGRAM

EXECUTIVE SUMMARY

In the Record of Decision for Melvin Price Locks and Dam, Second Lock (Locks and Dam No. 26, Replacement, Second Lock) the Corps of Engineers agreed to establish an Avoid and Minimize (A&M) Program as a result of possible environmental impacts of increased navigation traffic due to the second lock. The U.S. Fish and Wildlife Service (USFWS) submitted a supplemental draft Coordination Report in which they listed 26 A&M measures for possible implementation. The implementation groups are the Corps, Coast Guard and the towing industry.

The staff of the St. Louis District consider the recommended measures to be a dynamic listing and added 17 measures, for a total of 43 to be considered during the planning period. From 1988 to Aug. 1992, staff of the St. Louis District, with coordination with the St. Paul and Rock Island Districts, Coast Guard and the River Industry Action Committee (RIAC), worked with the review agencies (USFWS, Illinois and Missouri Departments of Conservation) to establish a plan to implement measures to avoid and minimize environmental impacts.

Eight measures were chosen as the most important for the A&M program to address. Several of the 43 measures are being studied or being implemented under other programs (i.e., the Master Plans), or could not be implemented or have already been implemented. Several of the recommended measures for implementation are already a part of on-going District operation and maintenance procedures. In the opinion of the A&M review and implementation team, these O&M procedures could be enhanced and become an A&M measure with additional funds and effort.

This design memorandum describes the progress to date for completing the mandate of the Record of Decision for the Second Lock Environmental Impact Statement and a plan for implementation of eight selected measures to reduce the possible impacts of river navigation on the river systems. The goal is to absorb the A&M program into normal O&M practice.

MELVIN PRICE LOCKS AND DAM
MISSISSIPPI RIVER - MISSOURI AND ILLINOIS
DESIGN MEMORANDUM NO. 24
AVOID AND MINIMIZE MEASURES

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MELVIN PRICE LOCKS AND DAM
STATUS OF DESIGN MEMORANDUMS

Previously Issued Design Memorandums

Design Memo No.	Title	Submittal Date	Approved
1	Hydrology	Jun 71	Nov 71
2	General Design Memorandum	Jul 72	Mar 73
3	Real Estate Requirements	Jul 72	Dec 72
3A	Acquisition of Seepage Lands	Dec 84	Jun 85
4	Materials	Sep 72	Jan 73
5	Relocations - Utilities and Pipe Lines	Jan 73	Aug 73
6	Spur Dike and Access Road	Feb 73	Apr 73
7	Cofferdam - Phase I	Jul 73	Aug 73
8	Architectural Treatment and Site Development	Nov 73	Mar 74
9	Feature Design - Dam	Dec 73	May 74
10	Automatic Operating and Control System	Jun 74	Sep 74
11	Formulation Evaluation Report	Jun 75	Aug 75
12	Lock	May 82	Aug 82
13	Piasa Sewer Alterations	Jan 83	Apr 83

14	Road Alterations	May 84	Nov 84
15	Railroad Bridge Alterations	Mar 85	Jul 85
16	Wood River Drainage and Levee District Alteration	Mar 85	Jun 85
17	Spare Miter Gates for Locks 19, 26(R), and 27	Apr 85	Nov 85
18	County Road and Utility Alterations	Jun 85	Jul 85
19	Third Stage Cofferdam	Sep 86	Nov 86
20	Existing Structure Removal	Jan 87	Mar 87
21	Auxiliary Lock and Remainder of Dam	Apr 87	Jun 87
22	The Minimimum Facilities Plan	Feb 90	Aug 90
23	Administration/Maintenance Building With Visitor Center	Feb 92	Jun 92

LIST OF CONTRIBUTORS

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Tom Seals (River Industry Action Committee)

MELVIN PRICE LOCKS AND DAM

PERTINENT DATA

a. Project Description. The project is located on the Mississippi River 200.78 miles upstream from the confluence of the Mississippi and the Ohio Rivers, and about two miles downstream from the former Locks and Dam No. 26 site. The project plan provides for the construction of one 1,200-foot main lock, one 600-foot auxiliary lock, and a new gated dam with nine tainter gates and an overflow dike; removal of a portion of the existing locks and dam; and abandonment and demolition of the Burlington Northern Railroad bridge. Minimum facilities for public health and safety will be provided. Mitigation lands will be provided to compensate for wildlife losses due to creation of a new pool for the two mile distance downstream. An environmental demonstration area has been established immediately across the river from the proposed visitor center. Public use will be provided as a part of the project plan although at present there is no local sponsor for recreation.

b. Type of Project. Non-navigable, gated dam with medium lift 110 by 1,200- foot and 110 by 600-foot navigation locks.

c. Purpose. To replace existing Locks and Dam No. 26 of the Upper Mississippi River navigation system to ensure continued, efficient maintenance and operation of the system.

d. Authorization. The new dam and 1,200-foot lock were authorized by Public Law 95-502, Title I - Replacement of Locks and Dam No. 26, Upper Mississippi River System Comprehensive Master Plan, 21 October 1978; and the 600-foot lock was authorized by Public Law 99-88, Supplemental Appropriations Act for 1985, 15 August 1985.

e. Physical Data.

Stream Data

Drainage area above dam site, square miles	171,500
Maximum stage of record at dam site, elevation (1973)	432.2*
Maximum stage modified by existing and proposed levees, approximate elevation (proposed site)	444.2
Maximum peak discharge at dam site, cfs (1858)	537,000
Average annual flow, approximate, cfs	97,560
Maximum average monthly,cfs (April 1973)	392,200
Minimum average monthly flow, cfs (September 1976)	21,360
Minimum flow, cfs (1948)	7,960
Minimum stage elevation (1954)	390.5**
Project flood design flow, cfs	650,000

Pool Data

Maximum regulated pool elevation	419.0
Minimum pool elevation	413.2
Minimum tail water elevation	395.0***
Maximum lift, feet	24.0

Pool Lengths

To Lock No. 25 (Miss. River), mile 241.4 (miles)	40.6
To Grafton, Illinois, (Miss. River), mile 218.0 (miles)	17.1****
Grafton, Illinois, to La Grange Lock (Ill. River), mile 80.1 (miles)	80.1

Dam

Type	Non-navigable, gated
Length, gated section (feet)	1,160
Upper pool elevation	419.0
Lower pool elevation, minimum	395.0
Maximum head (feet)	24.0
Gate sill elevation	379.0
Number of gates	9
Type of gates	Open frame tainter
Width and height of gates (feet)	110 x 42
Clearance of gates above maximum high water when fully raised (feet)	0.8
Type of emergency closure	Four-section bulkhead placed in gate bay by traveling crane
Type of construction	Concrete, founded on steel H-piles to rock

* All elevations in this memorandum are based on feet, National Geodetic Vertical Datum (NGVD).
** Prior to completion of Chain of Rocks low water dam in 1963.
*** Since completion of Chain of Rocks low water dam in 1963.
**** Grafton, Illinois, is at the confluence of the Mississippi and Illinois Rivers.

Locks

Number	2
Location, main lock	Towards the Illinois bank
Location, auxiliary lock	Adjacent to the Illinois bank
Maximum lift (feet)	24

Size of Chambers (feet)	
Main lock	110 x 1,200
Auxiliary lock	110 x 600
Project Design Depth (feet)	9
Arrangement of Locks	Separated 344 feet by two gate bays of the dam.
Type of Construction	Concrete, U-frame founded on steel H-piles to rock.
Top of Wall Elevation	434.5
Maximum Locking Stage Elevation	432.5
Type of Service Gates	
Upper - main lock	Lift
Upper - auxiliary lock	Miter
Lower - both locks	Miter
Type of Emergency Closure	Steel Bulkheads
Length of Locks and Guidewalls (feet)	
Lock wall - main lock	1,489
Upper guidewall - main lock	1,499
Lower guidewall - main lock	900
Lock wall - auxiliary lock	931
Upper guidewall - auxiliary lock	1,188
Lower guidewall - auxiliary lock	1,188
Service Gate Sill Elevations	
Upper sill - main lock	396.0
Upper sill - auxiliary lock	377.0
Lower sill - main lock	377.0
Lower sill - auxiliary lock	377.0
Emergency Bulkhead Sill Elevations	
Main lock	386.0
Auxiliary lock	377.0
Lock Floor Elevation	374.0

Height of Gates (feet)

Vertical lift gate	25.0
Miter gates	57.5
Emergency bulkhead (same as used in dam)	44.0

Overflow Dike

Length (feet)	2,000
Top elevation	422.0
Type of construction	Rock and impervious fill with sheet pile wall cutoff.

Spur Dike and Access Road

Length, mile	2.4
Top elevation	430.0
Side slopes	1V on 3H and 1V on 4H
Berm width, landside (feet)	0 to 330
Type of construction - spur dike	Clay and sand fill
Road width (feet)	24
Shoulder width, each side (feet)	8
Type of construction - road	Stone base with asphaltic concrete surface.

Wood River Drainage and Levee District

Alton Pump Station - pump capacity, cubic feet per second	223

MELVIN PRICE LOCKS AND DAM
MISSISSIPPI RIVER - MISSOURI AND ILLINOIS
DESIGN MEMORANDUM NO. 24
AVOID AND MINIMIZE MEASURES

SECTION I - INTRODUCTION

1-01. PURPOSE AND SCOPE

a. Purpose. This design memorandum presents a plan to avoid and minimize (A&M) the possible environmental impacts of increased navigation traffic on the Upper Mississippi River System due to the second lock at the Melvin Price Locks and Dam. The Corps of Engineers, the U.S. Coast Guard and the towing industry have included environmental sensitivity in standard operation and maintenance procedures for many years to reduce the impacts of channel improvement, lock and dam and navigation operations on the river ecosystems. ER 1105-2-100, Policy and Planning, Guidance for Conducting Civil Works-Planning Studies, 28 Dec 90, defines avoid and minimize under the term "mitigation." Mitigation includes:

(1) Avoiding the impact altogether by not taking a certain action or part of an action;

(2) Minimizing impacts by limiting the degree or magnitude of the action and its implementation; .... Avoiding and minimizing environmental impacts is the first level of mitigation in planning and developing Corps projects.

b. Scope. The scope of this design memorandum is to present the planning and coordination that has occurred to date regarding A&M and to identify those A&M measures that are recommended for implementation. The recommended measures are from a list of 22 measures submitted by the Fish and Wildlife Service in their July 1987 Fish and Wildlife Coordination Report for the Melvin Price Second Lock and an additional 17 measures proposed by the St. Louis District. The measures were divided into four categories:

(1) measures related to the operation of the navigation channel and locks;

(2) measures related to tow operation;

(3) measures related to induced development; and

(4) measures to rectify impacts.

The FWS was requested to evaluate the environmental benefits of each of the measures. As a result of that evaluation, eight A&M

measures are recommended for implementation. Portions of these measures, as well as other measures, are standard operating procedures of the Corps of Engineers, and, as such, will be funded through the Operation & Maintenance (O&M) program. The measures recommended in this design memorandum are over and above what would be accomplished under ordinary O&M. The cost estimate is for implementation of A&M measures in the St. Louis District (SLD).

1-02. LOCATION

The A&M program addresses potential system wide environmental impacts of navigation on the Upper Mississippi River System. At this time, the major effort has been concentrated on the main stem. This design memorandum is primarily for work in the SLD, although the measures are applicable to other portions of the river.

1-03. REFERENCES

a. U. S. Fish and Wildlife Service, Rock Island Ecological Services Field Office, Supplemental Draft-Fish and Wildlife Coordination Act Report for: Lock and Dam 26 (Replacement), Second Lock, Draft Environmental Impact Statement, July 1987.

b. COE, Final Environmental Impact Statement, Second Lock at Locks and Dam No. 26 (Replacement), Vol. II, Appendix A, July 1988.

c. COE, Record of Decision for Melvin Price Locks and Dam, Second Lock (Locks and Dam No. 26, Replacement, Second Lock), Mississippi River, Alton, Illinois and Missouri, 23 Nov. 1988.

d. Multi-Party Memorandum of Understanding among the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Army Corps of Engineers, Involving Second Lock Final Environmental Impact Statement, Locks and Dam 26 (R), undated.

e. Letter, CELMS to CELMV, Subject: Letter Report, Avoid and Minimize Measures, Melvin Price Locks and Dam, Stage III, 27 Sep 90.

f. Letter, CELMS to CELMV, Subject: Requested Supplement to Letter Report, Avoid and Minimize Measures, Melvin Price Locks and Dam, Stage III, 21 Nov 90.

g. ER 1105-2-50, Planning-Environmental Resources, 1 Aug 84.

h. ER 1105-2-100, Policy and Planning, Conducting Civil Works-Planning Studies, 28 Dec 90.

1-04. BACKGROUND INFORMATION

a. The term "avoid and minimize" is included in the "Regulations for Implementation of the Procedural Provisions of the National Environmental Policy Act" Section 1508.20, "Mitigation". The Fish and Wildlife Service (USFWS) and the state natural resource agencies of the Upper Mississippi River Basin submitted a list of A&M measures as a part of the fish and wildlife coordination report for the second lock environmental impact statement (EIS). The original listing, submitted in 1986, was reworded and some items were deleted in the 1987 report (Ref. 1-03a). The agencies submitted the list of recommended items for possible implementation by the COE, Coast Guard and the towing industry. The FWS recommended that the implementing groups study the feasibility of implementation of each measure.

b. In the final EIS (Ref. 1-03b), the COE further reviewed the submitted A&M measures and noted "While there is considerable concern expressed by the FWS and others over the biological effects of commercial traffic, there are few studies that demonstrate conclusively that such impacts exist, let alone present quantitative data as to the magnitude of such impacts. This being the case, the following criteria, in addition to safety and operational and engineering feasibility, were used to evaluate the proposed measures:

(1) the measure not disrupt navigation operations;

(2) the measure not involve excessive cost;

(3) the measure is within the authority of the Corps.

c. SLD has coordinated the effort with the Rock Island (RID) and St. Paul (SPD) Districts. Also, the proposals of the three districts were coordinated with the Coast Guard and the towing industry.

d. In the Record of Decision (Ref. 1-03c), the Division Engineer stated that "Increases in navigation traffic produce the primary impacts of the project ... The Corps has initiated a comprehensive program to evaluate and implement measures to avoid and minimize potential impacts." In the Memorandum of Understanding (Ref. 1-03d), the St. Louis District Engineer agreed to: ... "address all issues raised by reviewers of the SDEIS"... (Supplemental Draft Environmental Impact Statement).

e. An informal A&M program was initiated in SLD in 1988, without an approved plan and budget. Meetings were held with the resource agencies and three ship anchors were placed as mooring points for barges. In the fall of 1990, letter reports (Ref. 1-03e and f) were submitted to LMVD with a plan and budget to initiate an A&M study. LMVD approved the study on 26 Dec 90 and indicated that a design memorandum be prepared.

SECTION II - PLANNING AND IMPLEMENTATION - 1988 to 1992

2-01. GENERAL

This section contains a discussion of the planning and implementation of the A&M program performed by the St. Louis District (SLD) in the years 1988 through 1992. The discussion includes the A&M measures studied, the coordination performed with other agencies, the measures implemented during those years, an evaluation of the A&M measures, and a listing of the A&M measures recommended for further implementation.

2-02. A&M MEASURES STUDIED

A list of A&M measures was submitted by the USFWS in 1987 in its Coordination Act supplement in 1987 (Ref. 1-03a). SLD staff added 17 other measures, some of which are now part of standard engineering and operation and maintenance practice. TABLE 2-1 shows the A&M measures.

2-03. COORDINATION WITH OTHER AGENCIES AND INDUSTRY

a. General. Coordination was continued with other agencies throughout the period. These agencies included the SPD and RID of the Corps of Engineers, the USFWS, the Coast Guard (CG), the US Environmental Protection Agency (USEPA), the Departments of Conservation from Missouri and Illinois, and the River Industry Action Committee (RIAC). The following are examples of coordination for the mooring sites and the Biologist on Board! program and an industry viewpoint.

b. Mooring Sites. During 1988-90, several meetings were held with the natural resource agencies, Coast Guard and representatives of the towing industry. It was mutually agreed that selection of critical mooring areas was of major concern to all parties and should be addressed immediately. SLD purchased five ship anchors. The multidiscipline team selected three sites on Government land for placement of the mooring anchors and chains. Three anchors were buried at: 1) River Mile 275.1 R, on the Clarksville State Game Refuge above L&D 24; and 2) Mile 244.6 R and Mile 242.1 R above L&D 25. Industry is using the mooring anchors. The other two anchors have not yet been installed. The other sites chosen by the team were on private property.

c. Biologist on Board! The SLD, USEPA, American Waterways Operators (AWO) and the USFWS initiated the Biologist On Board! program in 1988. The USFWS took the lead to place state and federal biologists on operating tows to learn and share information and concerns with rivermen. The program is most successful and is still continuing. The Kansas City office of

TABLE 2 - 1

AVOID/MINIMIZE MEASURES
IMPACTS, SECOND LOCK - MELVIN PRICE LOCKS & DAM
GROUP A - OPERATIONS OF THE LOCKS AND NAVIGATION CHANNEL

A-1. Reduce navigation channel in biologically sensitive areas.

A-2. Implement monetary fines for navigation outside marked channels, during hazardous conditions and negligence in spills.

A-3. Designate locks approach waiting areas or provide special mooring sites.

A-4. Monitor channel depth more frequently in known problem areas.

A-5. Limit and/or close navigation based on water stage, ice conditions, level of turbidity.

A-6. Enforce a maximum 9 foot draft in channel.

A-7. Restrict traffic until buoys are in place at the start of each towing season.

A-8. Correct bridge design deficiencies.

A-9. Improve lock approach to avoid hazards.

A-10. Reduce open water dredge material disposal - create beaches.

A-11. Reduce open water dredge material disposal, create wetlands.

A-12. Side channel dredging/create wetlands.

A-13. Thalweg placement of dredge material.

A-14. Comprehensive information program.

A-15. Install lock guidewall extensions on selected UMR locks.

A-16. Continue dike modification studies (i.e., notched, chevron and bullnose dikes) and environmental monitoring.

A-17. Field design & research of off-bank revetment placement on islands.

A-18. Establish stable thalweg line with minimal regulation works.

A-19. Construct bendway weirs.

A-20. The dredge material placement team - continuing effort.

AVOID/MINIMIZE MEASURES
IMPACTS, SECOND LOCK - MELVIN PRICE LOCKS & DAM
GROUP B - MEASURES RELATED TO TOW OPERATION

B-1. Improve tow and/or barge design.

B-2. Reduce speed in sensitive areas.

B-3. Limit horsepower to 4,500 above L&D 26.

B-4. Passing & meeting regulations in sensitive areas.

B-5. Employ a gradual increase in power when leaving lock.

B-6. Reduce draft in critical periods.

B-7. Reduce tow size in critical periods.

B-8. Develop non-structural alternative to reduce waiting times.

B-9. Accomplish design study of barge couplings.

(TABLE 2 - 1 CONTINUED)

AVOID/MINIMIZE MEASURES - IMPACTS, SECOND LOCK - MELVIN PRICE LOCKS & DAM GROUP C - MEASURES RELATED TO INDUCED DEVELOPMENT

C-1. Require contingency plans at terminals and cargo handling facilities.

C-2. Strategically locate pollution response equipment throughout the UMRS.

C-3. Require all fleeting to be located at mooring cells, deadmen, anchors, and/or in accordance with appropriate permits.

C-4. Designate no fleeting in sensitive resource areas or in unpermitted areas.

C-5. Where unregulated, establish fleeting regulations that take environmental planning into account.

C-6. Complete waterfront development plans in urban areas.

C-7. Complete shoreline management plans.

C-8. Revise navigation pools Master Plans.

C-9. Develop a Master Plan for resource management of Pool 27 lands and waters.

C-10. Develop detailed operational management plans for all lands & waters under Riverlands jurisdiction.

AVOID/MINIMIZE MEASURES - IMPACTS, SECOND LOCK - MELVIN PRICE LOCKS & DAM GROUP D - MEASURES TO RECTIFY IMPACTS

D-1. Shoreline protection in highly erodible areas to minimize erosion and enhance fish & wildlife habitat.

D-2. Build diversion structures to reduce sediment input into backwater.

D-3. Construct barrier islands to reduce wave impact to off-channel areas.

D-4. Modify wing dikes to reduce accretion.

the USEPA and AWO cooperated to produce an A&M video for the industry. Four hundred copies have been distributed and most are now on tows for viewing by the crews.

d. Industry Viewpoint. The following quotes, contained in correspondence from river industry representatives to the St. Louis District, demonstrate a cooperative attitude to advance the prospect for further productive accomplishments.

"RIAC feels that the industry needs guidelines for self help programs set up that lockmasters can initiate when backlogs of boats arrive at their lock facility. These self-help programs have been negotiated by a cross section of industry pilots."

"We, the members of RIAC wish to have the local lockmaster at each facility, implement these programs when the situation arises. If need be, we will come to the lock site and help get it started. Once initiated, it should work smoothly with lock personnel and boat personnel cooperation."

"Every towboat Captain should make every effort to have experienced deck crews working aboard his vessel. Realizing that all companies carry green deck hands at times the captain should be willing to get an experienced mate from the opposite watch to work over and assist in these types of situations."

"Single tow lockages should be utilized to our advantage to speed up turn around times at the different locks."

"Lockmasters should work closely with other locks on either side of his location to ensure that they are aware of boats either coming to them or going away from them, so that the lock master at the next location will know how to plan for these boats on arrival relative to cue lists and locking conditions."

Although the above excerpts do not directly address environmental concerns, they do contain implications of safety concerns and possible avoidance of accidents, spills etc. Also, they demonstrate a desire for cooperation between operators and the Corps and give indications of possible future agreements in the areas of non-structural alternatives, waiting sites and willingness to provide "hands on" help in an effort to make conceptual plans operational realities. Transportation resource cost savings to the nation, resulting from mutually agreed upon efficiencies at locks will also decrease systemic exposure to potential environmental problems. A more efficient system, will result in less time in the system for any given movement and, therefore, less unit opportunity for environmental damage.

2-04. MEASURES IMPLEMENTED DURING 1988-1992

a. General. SLD, in coordination with other agencies, implemented a number of measures under the O&M program during 1988 to 1992. Some of the measures were implemented as the smart thing to do from a navigation viewpoint. However, as an additional benefit, these measures also enhanced the environment.

b. Biologist on Board!. The program began in 1990, with primary coordination between the Fish and Wildlife Service (USFWS) and the American Waterways Operators. The USFWS has produced an annual summary report for 1989 and 1990. The SLD provided financial support in 1991.

c. Mooring Facilities. The purpose of establishing permanent mooring points near the locks is to prevent tying to trees, many of which are utilized as perching sites for bald eagles, concentrate bankline disturbance and in the case of mooring buoys, keep tows in the main channel during waiting times for lockage. As previously mentioned, three ship anchors were placed on Government property in 1989. Other sites on private property were identified by the coordination team. SLD has begun a preliminary investigation of private land ownership. During the spring 1991, SLD refurbished two anchor buoys which had been placed below old L&D 26. Discussions with natural resource agencies personnel and RIAC resulted in placement of the mooring buoys below L&D 24 and 25. Input from industry was solicited by the lockmasters and as a result, the buoys have been moved twice. Tow captains have indicated that the anchors are difficult to tie onto from an empty barge, and District personnel have solved the problem. At this time, the onshore ship anchors work best in the pool above the dams, while the buoys are preferred below the dams. SLD will watch the buoys during the winter to determine the effects of ice. SPD and RID are also studying mooring sites at their locks and dams. A special problem exists below L&D 22. The Missouri Department of Conservation has established a mussel sanctuary from River Mile 301 to 298 R. This area is also a sampling site for the SLD\WES (Waterways Experiment Station) mussel study. Tows traditionally moor over these beds. A field trip was held in July 1991 to identify alternate areas for onshore anchor placement. With assistance from the lockmaster, two sites on the left bank were discussed, neither of which was satisfactory from an industry viewpoint. There are several sites which all parties concerned agree to placement of a floating mooring buoy. SLD and RID are presently working with the river industry and the USFWS to solve this problem and investigating purchase of additional buoys.

d. Information Program. In addition to coordinating the A&M program with participating groups, an important part of the A&M planning effort is to inform the interested public and the towing

industry about the program. SLD has furnished five articles about ongoing environmental initiatives to the Waterways Journal for their consideration; two have been published. SLD staff delivered a paper, with a USFWS co-author, at the 47th annual meeting of the Upper Mississippi Conservation Committee, Spring 1991. An USEPA sponsored A&M video was released at that time. A paper, concerning the program, was presented at the annual American Water Resources Association (AWRA), Ill. Section conference in October 1991. The paper was co-authored by SLD, CG and RIAC personnel. A "Resource Alert" handout for Pools 24, 25 and 26 has been prepared and reviewed by all concerned (Appendix C). The handout is available at District L&Ds and was delivered to RIAC for distribution to the tow captains in Fall 1991.

e. Dredging. Corps Districts have conducted dredging coordination with natural resource agencies for many years. As a result, only minor concerns with dredge operations have been expressed by the natural resource agencies during the A&M review. SLD is presently initiating a review of District dredging practices to determine if more engineering of dredge cuts can reduce the amount of material moved. In most instances in the St. Louis District, dredge material is cast to the side of the main channel or thalweg. This area, called the main channel border, is more sensitive environmentally than the main channel, with its shifting sand bottom. Placing the dredge material immediately down stream of a shallow crossing into a deep pool is called thalweg disposal and may be less damaging to the river ecology. The RID is presently utilizing thalweg disposal under certain stream flow conditions. The St. Louis District conducted trial thalweg disposal of dredge material at River Mile 225 and River Mile 250, Upper Mississippi River (UMR) in July of 1992. The results are presently under review.

f. Bendway Weirs. The bendway weir concept is a series of level-crested submerged rock weirs built around the bend to widen the navigation channel and reduce dredging. The weir is submerged and does not have a visual impact on the aesthetics of the river. This river engineering innovation won the Corps national Award of Excellence for civil works. It is the best example of Corps staff "just doing their job", yet making a major A&M contribution. The weir was designed by SLD and WES staffs. The structural prototype was constructed at Dogtooth Bend, River Mile 20, UMR.

g. Chevron Dikes. This concept is again an ongoing Corps research program in river engineering. SLD and WES have worked together to model the rock placement design. SLD staff introduced the idea during the spring 1991 coordination trip with the natural resource agencies. SLD will build a prototype in late 1992 at River Mile 289.5 in Pool 24. This is a troublesome reach of the river with a split channel and a point bar

encroaching on the thalweg, requiring a major dredging effort annually. The chevron shaped dikes will also be areas in which dredge material will be placed and after a period of time will result in an island. The natural resource agencies are most supportive of the program due to increased habitat diversity and less dredging of the reach in the future.

h. Waiting Time Study. One of the measures recommended by the SLD staff was a study of staging tow arrival at the locks and dams. Preliminary discussions with the river industry reveals that the measure is feasible.

i. Master Plans for the Pools. Several A&M measures recommended by the USFWS may best be addressed by the Master Planning process. The District is updating the plans with completion scheduled in FY 1995. In FY 91 the drawings were prepared for the Federal lands of Pool 27. The lands and waters on Pool 27 have been zoned on an interim basis to coordinate land uses on the project until completion of the Comprehensive Riverlands Master Plan. The Master Plan was initiated with an interagency meeting and numerous public workshops are being held in September 1992 to establish objectives for the Master Plan and needs of the study area.

2-05. INTEGRATED RIVER MANAGEMENT

The A&M program described in this design memorandum falls within the scope of the Integrated River Management (IRM) program. The purpose of IRM is to manage our river-related resources in a safe, dependable and environmentally responsive manner, with least long-term cost and adverse impacts on other water resource activities. The activities involved include regulating works, dredging, land management, data collection, hydrologic analysis, river stage forecasting, barge fleeting, environmental management, recreational development, operation of navigation locks and dams, reservoir regulation, regulatory functions, and budgeting and cost control. A team composed of various SLD offices meets to oversee and coordinate district opreations. Initially, IRM was adopted help decide when to mobilize dredges, where to dredge, how much material to remove and where to dispose of the excavated material. The dredging portion of IRM consists of essentially five major elements: (1) Control of the overall SLD water budget by an automated data collection network which allows for long range river forecasts and setting of gates during low flow conditions; (2) Computer analysis of dredging histories; (3) Innovative utilization of dikes and weirs (the bendway weir and the chevron dikes are examples of innovation); (4) Data collection of river bottom profiles with new surveying techniques; and (5) Research of dredging techniques to obtain results from dredging operations, including thalweg disposal.

Attempts to improve dredging efficiency also complemented the regulating works program, in which dikes and revetment are employed to reduce the amount of dredging required at critical sites.

2-06. EVALUATION OF AVOID AND MINIMIZE MEASURES CONSIDERED

Each measure was reviewed by the various agencies involved. For example, SLD reviewed items related to locks, the towing industry reviewed items related to towboats, and the Coast Guard reviewed items related to bridges and buoy placement. The USFWS was asked to provide a qualitative analysis of the habitat gains or benefits to species of special interest for each measure. At a meeting held on 19 May 1992 with SLD, CG, USFWS, and MO and IL Departments of Conservation, each measure was reviewed for its fish and wildlife value. The group was not able to qualitatively provide a value but rather graded the measures according to a ranking system. See Appendix A for the USFWS Report. The following is the result of the technical and environmental evaluation.

a. Group A - Measures Related to Operation of the Navigation Channel and Locks

(1) A-1. Reduce navigation channel in biologically sensitive areas.

Background: In 1930, Congress authorized a navigation channel with a 9 ft. minimum depth and a minimum width of 300 ft. for the Upper Mississippi River Basin (UMRB). In some instances, such as difficult bends in the rivers, a 400 ft. wide channel is maintained for safety reasons. Because the width of the channel is established by law, the Corps must observe the 300 foot width requirement. In discussions with the resource agencies, USFWS and the Departments of Conservation for Missouri and Illinois, it was decided to provide a document which would alert the river boat captains to environmentally sensitive areas in the pools in the SLD. A "Resource Alert" (Appendix C) was delivered to the River Industry Action Committee (RIAC) in St. Louis in August 1991 for placement on tows. The handouts are also available at Melvin Price Locks and Dam and at L&Ds 25 and 24. The river industry is now utilizing the information. The Alert has also been placed on SLD dredges and patrol boats.

Coordination: The biologically sensitive areas in the three pools were identified by the USFWS and biologists from the states of Illinois and Missouri. The Alert was prepared by the USFWS and edited and printed by SLD staff. The Alert has been provided to the Rock Island and St. Paul Districts.

Advocacy Action: During the last two spring navigation conferences and at two RIAC meetings the "Resource Alert" has been discussed and the committee chairmen and SLD personnel have requested that the tow captains utilize the Alert.

Fish and Wildlife Value: See Appendix A for a more complete discussion of fish and wildlife values for all measures. The "Resource Alert" calls attention to mussel beds, heron rookeries, and seasonally sensitive areas, such as fish spawning beds. Now the tow captains know locations and can attempt to avoid these areas. Benefits will be cumulative in time and the measure can be considered as a good management practice performed by the towing industry.

Economic Value: This measure is considered to have a neutral economic value, in that, the channel or thalweg is not considered to be an important sensitive area.

Disposition: An annual meeting will take place with the resource agencies and the river industry to determine if the Alert needs to be updated. Since this item is already in practice, the measure is not recommended for implementation under the A&M program.

(2) A-2. Implement monetary fines for navigation outside marked channels, during hazardous conditions and negligence in spills.

Background: Lead agencies are the USEPA and the Coast Guard. It is their opinion that sufficient rules exist at this time to protect the river systems. Spills should be reported to the National Response Center, Coast Guard or EPA. Civil penalties can be imposed by the Coast Guard District hearing officer and in severe cases, pilots may risk loss of their license for failure to utilize safety rules.

Coordination: The Second District of the Coast Guard has been active throughout the A&M planning period.

Advocacy Action: The Corps supports the Coast Guard in enforcing their authority on the rivers.

Fish and Wildlife Value: The resource agencies consider this measure to have an indirect but important value due to reduced spills and groundings.

Disposition: No further action by the Corps is required.

(3) A-3. Designate locks approach waiting areas or provide special mooring sites.

Background: Traditionally, tows have tied to trees, both below and above the locks during waiting times. Field studies revealed that the cables have girdled trees and have killed them or tows have pulled them into the river. Mooring buoys and on-bank anchors and chains avoid this problem and provide waiting tows a safe mooring point close to the lock. All three Upper Mississippi River Basin Corps Districts are working to address this problem. The SLD has placed floating mooring buoys below L&D 24 and 25 and a buoy will be placed in the upper portion of Pool 24 to help protect a mussel sanctuary on the right bank. The buoys have been moved on three occasions to meet requests from the industry and from the lock masters. The towing industry is utilizing the buoys, and because of the positioning immediately below the dams, access to the locks is easier and the tows are largely moving within the confines of the thalweg. Thus, the tows are not nosing into the bank, tying up to trees and creating disturbance along the banks and in the main channel border. The SLD has placed three buried ship anchors on government property, above Locks and Dams 24 and 25. Cables have been removed from trees and an experimental sign has been designed denoting the location of the anchors and requesting the industry to not tie up to trees.

Coordination: The three Corps districts in the UMRB have coordinated this effort and have shared information on design of mooring points. The resource agencies and the towing industry have cooperated in choosing placement sites.

Fish and Wildlife Value: (See Appendix A) The biologists on the A&M resource agency team consider that the cessation of random mooring around the locks and dams will significantly improve aquatic habitats and may double the standing crop of aquatic organisms.

Economic Value: The floating mooring buoys provide a safe, secure point for mooring close to the locks and a position whereby less power needs to be applied during waiting time. Buried ship anchors are more secure mooring points than trees. One of the anchors is positioned in an L dike, thus the tow is not moored close to the shore. An anchor in a L dike allows easier and more efficient access to the locks. A site in a more advantageous navigational position than that previously used will result in decreased approach times, possibly decreased exit times, and resulting decreased operational costs. Placement locations do not necessarily have to be closer to the locks, although this could be a prime consideration. Traffic congestion, backing off, and flanking maneuvers and the like can cause inordinate approach time experiences. If a mooring point could save 30 minutes for an Upper Mississippi River tow, this would result in an approximate $200 reduction in operational cost. This reduction is for one tow, in one direction, at one

lock. Thus, if a mooring point was chosen that had a fish and wildlife value and an economic and safety value, both environmental and economic benefits would result.

Disposition: At this time, the St. Louis District proposes to construct and place at least two mooring buoys near each lock and dam. The most critical area is in upper Pool 24 where tows are mooring over a mussel sanctuary which has been chosen by the Corps as a site for a five year monitoring program. Additional bank anchors will also be placed in selected locations. Annual maintenance of the buoys will be required.

(4) A-4. Monitor channel depth more frequently in known problem areas.

Background: This is not considered a problem at this time. In the last few years, all three Corps Districts have continued to update the survey craft and to improve data gathering and analysis with modern technology. New fast, channel-sweep survey systems, geo-positioning techniques and GIS (geographic information system) displays will greatly improve channel depth prediction and problem location identification.

Fish and Wildlife Value: It is hoped, that from better knowledge of channel depths and the geomorphology of river change, better dredge material placement and possibly less dredging will occur. Because the program is new in the SLD the measure cannot be quantified at this time, but may be in the future.

Economic Value: This measure is a part of standard O&M practice in the three Corps Districts at this time and insufficient data exists today to quantify the innovations and cost savings that may arise from the utilization of the new equipment.

Disposition: No further action is required under A&M as this item is already a part of normal O&M.

(5) A-5. Limit and/or close navigation based on water stage, ice conditions, level of turbidity.

Background: The Coast Guard can close the river, set up safety zones, or impose a mandatory reduction in tow size during low water (i.e., droughts of 1988 and 1989). The hazard of navigation in heavy ice essentially stops navigation in a typical winter on the pools of the UMR. Dates of termination of navigation will vary with weather conditions. There are no restrictions to navigation due to increases in turbidity and there are no plans to study or impose such a restriction due to lack of scientific data that an environmental impact occurs.

Advocacy Action: The Corps supports the Coast Guard in enforcing their authority on the rivers.

Fish and Wildlife Value: In the opinion of the natural resource agencies this measure cannot be quantified.

Recommendation: No further action is required by the Corps of Engineers under the A&M program.

(6) A-6. Enforce a maximum 9 foot draft in channel.

Background: The Corps has a Congressional mandate to maintain, not enforce a 9 foot channel. The Coast Guard has the authority to take action against vessel operators that become grounded in the channel and impede navigation if they have an overdraft.

Advocacy Action: The Corps supports the Coast Guard in enforcing their authority on the rivers. The Corps will continue to work with the Coast Guard and the river industry in addressing this problem when it arises.

Fish and Wildlife Value: The natural resource review agencies support the concept of this measure but cannot place a fish and wildlife value other than to observe that the benefits to the resource would be indirect with less groundings.

Economic Value: The over-drafting or under-drafting of a barge is an economic decision of the towing industry. It is also obvious that over-drafting of a barge and a grounding has severe economic effect when the channel is blocked. Self regulation by the tow operators to reduce groundings is a means of enforcement.

Disposition: No further action is required by the Corps under the A&M program.

(7) A-7. Restrict traffic until buoys are in place at the start of each towing season.

Background: The Coast Guard has responsibility in marking the channel. Buoys cannot be kept on station in ice. When commercial navigation resumes in the spring, commercial vessels may operate before the ice is gone and the Coast Guard has replaced or repositioned the floating aids to navigation.

Coordination: The three Corps Districts, on the Upper Mississippi River system, cooperate with the Coast Guard and the towing industry as to the opening of the navigation season in the spring. (There is no formal open or closed season; the locks remain open year-round for any traffic wanting to lock through.)

The present system is working adequately at this time and there is no apparent reason to alter a methodology that has proven successful in the past.

Advocacy Action: The three Corps Districts will continue to cooperate with the Coast Guard and the towing industry.

Fish and Wildlife Value: The review team noted that it would be impossible to quantify benefits without a risk analysis of impact producing events that would be prevented. This type of analysis is outside the scope of the A&M program.

Economic Value: The implementing groups in the A&M program have a suitable, flexible program for the opening of the spring navigation system. Further restrictions and rules would have a negative impact on the towing industry.

Disposition: There is no further need for the Corps to address this measure.

(8) A-8. Correct bridge design deficiencies.

Disposition: The Coast Guard has an on-going program to address this problem under the Truman-Hobbs Act.

Coordination: The Act has been in place since 1940 and agency rules and experience require adequate coordination.

Advocacy Action: The Corps will work with the Coast Guard, when assistance is requested, to correct problems with bridges that may obstruct navigation.

Fish and Wildlife Value: Benefits to the natural resources of the rivers will be enhanced when accidents and spills are reduced.

Economic Value: The A&M implementing groups all have positive economic benefits when obstructive bridges are replaced.

Disposition: Continuing cooperation by the Corps, as a part of normal O&M, will take place in the future.

(9) A-9. Improve lock approach to avoid hazards.

Background: SLD is studying this problem and an L extension to the dike at River Mile 273.8R may be proposed to direct current away from Lock 24. At this time, a helper boat is utilized to assist tows gain safe entry into the lock. SLD is also studying placement of a ship anchor and chain in the L dike similar to the one above L&D 25. The three Corps Districts are undertaking studies to address this problem. As the locks and gates age and

traffic increases, collisions with navigation structures are of utmost concern to the Corps and the towing industry.

Fish and Wildlife Value: Removal of any type of navigation hazard is of major importance to all parties working on the A&M program. Safety, avoidance of spills, collisions and groundings is in everyone's interest and has a positive fish and wildlife value.

Economic Value: This measure is a part of every day O&M practice on the river systems and improvements which reduce hazards around the locks is of a positive benefit.

Disposition: No further action by the Corps, under the A&M program is anticipated. Any improvements will be conducted under the O&M program.

(10) A-10. Reduce open water dredge material disposal - create beaches.

Background: The three Corps Districts in the UMRB have created sand beaches and islands for years as a result of dredge disposal. Thus, ordinary O&M pracitces have created a beneficial use of dredge material by providing sandy areas utilized by the recreational community. The sites are usually easy to reach with standard pipe lengths and close to areas which must be dredged. In many cases, the Corps is contacted by boating or swimming groups who request the creation of dredge material beaches. The St. Louis Post-Dispatch, in a 19 July 1992 article, chose a dredge material island at River Mile 224, Pool 26, as the best sand beach in the St. Louis area.

Coordination: State and Federal resource agencies are contacted by the Corps to review the sites where dredging of the main channel must occur and the disposal site. In most cases, the review agencies approve the long term placement sites and are aware of the public desire for such areas.

Fish and Wildlife Value: Because the dredge material is largely placed on previous beach areas and largely on land, the benefit to the aquatic environment in the main channel border is positive. The review team recommended that the measure be deleted and be combined with A-11. However, in this report, the measures will be kept separate since different quantities and costs are required for implementation.

Economic Value: The costs of creating a beach, in the SLD, and open water disposal is approximately the same.

Disposition: The SLD will continue to create sand beaches as a part of normal O&M practice for dredge disposal. SLD, through

the A&M program, will purchase additional plant equipment (flexible pipe) to increase the range of the Dredge Potter. Also, selected islands of dredge material should be stabilized by rip-rap placement on the nose, which should minimize return of the sand material moving back into the channel. Thus, through a combination of normal O&M funds and additional A&M funds more beneficial utilization of dredge material can be achieved.

(11) A-11. Reduce open water dredge material disposal, create wetlands.

Background: It is considered an avoid and minimize measure to dispose of dredge material in an on bank position or to create new islands (with bullnose dike protection) with the material. To achieve this, there may be a need to use the flexible dredge pipe proposed for acquisition under Measure A-10. In addition, the interior of the sand area may be shaped to create the proper elevations for a wetland. Seeding of selected wetland species in these areas may be necessary. Thus, by additional effort the dredge material has a beneficial use and aquatic impacts are avoided or minimized.

Coordination: All three districts are sharing information, studies and, in some cases, equipment. Research is still ongoing at the Corps Waterways Experiment Station on the environmental effects of dredging.

Fish and Wildlife Value: All of the recommended and on-going efforts by the SLD to reduce open water placement of dredge material, beneficial utilization of dredge material and reducing dredging scored high in terms of benefits to fish and wildlife resources.

Economic Value: It is hoped that the IRM program will reduce the amount of dredging required in selected reaches of the river and will allow disposal placement in other reaches to be conducted in a more environmentally acceptable manner.

Disposition: Under the A&M program, islands created from the deposition of dredge material will be formed into wetlands. Grading, seeding and stone armorment would be an A&M cost; dredged sand placement would be under ordinary O&M.

(12) A-12. Side channel dredging/create wetlands.

Background: The Corps has no authority to conduct dredging of side channels. In the SLD consideration is being given to investigate the possibility of dredging of selected side channel openings along the Kaskaskia Navigation Canal through the Environmental Management Program (EMP). If these projects are

chosen and funded as a habitat rehabilitation and enhancement project, they will be to counteract side channel and backwater sedimentation.

Fish and Wildlife Value: The natural resource review team recommended deletion of this measure as it may be considered a compensation measure and could be better addressed under EMP.

Disposition: This measure will be deleted as an A&M measure and will be advocated to the proper planning function as a possible EMP action.

(13) A-13. Thalweg placement of dredge material.

Background: Studies by the RID reveal that this method can be successful under certain conditions. SLD has initiated trial thalweg (main channel) disposal in 1992. D.B. Simons, et.al., modeled the effects of thalweg disposal for the SLD and reported the results in a 1975 WES report. SLD has initiated a model study at WES to determine if the method can reduce environmental impacts to the main channel border by leaving the material in the channel.

Coordination: SLD staff is coordinating the trial program in the open river with resource agencies and in particular, the Long Term Research Monitoring (LTRM) team at Cape Girardeau, Missouri.

Fish and Wildlife Value: The resource agencies consider the fish and wildlife value of this measure to be positive due to a reduction of open water placement in the main channel border. They recommended that the value of the item be measured on a case by case basis.

Economic Value: Because the program is experimental at this time, it is not known if cost savings will occur.

Disposition: Because thalweg placement of dredge material could have positive effects on the biota of the river, SLD will monitor the physical and biological impacts and benefits of this method of dredge material placement under the A&M program. Dredging will continue to be funded under standard O&M.

(14) A-14. Comprehensive information program.

Background: Three hundred copies of the EPA and AWO "Avoid and Minimize" video have been distributed to the river industry. Coupled with the "Resource Alert," industry has participated in educating towboat crews and has shown concern and cooperation with the resource agencies. The Biologist On Board! program has been active for three years and has been a major education program for resource agency personnel and towboat crews.

Articles concerning the A&M program are being published in the Waterways Journal explaining the environmental initiatives by the Corps. Three professional papers have been delivered at river seminars by the USFWS and the Corps and by the Corps, Coast Guard and representatives of the industry.

Coordination: Discussions with other agencies and groups will continue and information concerning the program will continue to be released.

Advocacy Action: The Corps and the Coast Guard encourage the natural resource agency personnel and the towing industry crews to continue to communicate and to attempt to understand each others concerns.

Fish and Wildlife Value: This program is viewed as a major contribution to good management practice by the towing industry. Because most of the A&M measures are non-structural and are measures that can be implemented by the people who work on the rivers, the information program has and will continue to contribute to the lessening of the impacts of navigation.

Economic Value: The major economic impact of exchanging information has fallen rather evenly among the implementation and review agencies.

Disposition: The additional funds requested for A&M planning should cover a continuation of the information program when it is meshed with normal public relations of the District.

(15) A-15. Install lock guidewall extensions on selected UMR locks.

Background: The three Corps Districts are pursuing major rehabilitation projects on selected locks on the UMR. Guidewall extensions have been proposed for some of these projects. If guidewall extensions are constructed they will serve to increase safety and reduce collisions. Because lock guidewall extensions can keep traffic flowing, reduce mooring times, reduce environmental impacts near the locks and possibly increase efficiencies of the towing industry this measure should be a high priority for implementation.

Coordination: The three Corps Districts have and will continue to share information. Input from industry will continue to be solicited.

Fish and Wildlife Value: See Measure A-9.

Economic Value: See Measure A-9.

Recommendation: No action will be taken under the A&M program other than encourage implementation through other authorities and or initiatives.

(16) A-16. Continue dike modification studies (i.e., notched, chevron and bullnose dikes) and environmental monitoring.

Background: The Integrated River Management program in the SLD is addressing the engineering and physical systems portion of this item. The greatest need at this time is to establish "before and after" environmental conditions with the placement, modification or repair of the dike system. The St. Louis District will construct a chevron dike in Pool 24 in 1992. This mid-water chevron shaped rock structure will receive dredge material behind the dike and will eventually become an island.

Coordination: The SLD has coordinated the dike program with the resource agencies for many years. The agencies have conducted environmental studies in coordination with dike placement and modification.

Fish and Wildlife Value: The A&M review team views this 20 year old effort by the St. Louis District as a measure that will continue to significantly enhance fish and benthic resources.

Economic Value: As previously stated, the IRM program is new and the economic benefits will be calculated in the future as data becomes available.

Disposition: SLD proposes to monitor the environmental changes in and around the dikes and dike fields to establish the fish and wildlife benefits of these rock structures. Construction of chevron and bullnose dikes will be an A&M cost.

(17) A-17. Field design & research of off-bank revetment placement on islands.

Background: The SLD has placed revetment off-shore for several years. This innovative method of bankline protection almost eliminates bank clearing and provides an aquatic area with two types of habitat and a still water area. Studies show that biological diversity has been increased as a result. Regulations require that the placement of revetment be associated with the operation and maintenance of the navigation channel. Revetment work is an on-going operation and maintenance procedure and is dependent upon funding.

Fish and Wildlife Value: In the opinion of the A&M review team, this measure scored the highest in potential fish and wildlife

benefits. Appendix A contains a detailed analysis of the benefits of a revetment area that was sampled in 1991.

Economic Value: The method reduces cost because clearing of banks does not take place. Increases in stone costs are minimal.

Disposition: Some fish and wildlife benefit evaluation of off-bank revetment has taken place with field sampling by the Illinois Department of Conservation. Through the A&M program, SLD would increase this monitoring effort to other sites.

(18) A-18. Establish stable thalweg line with minimal regulation works.

Background: This is a major goal of the Integrated River Management program, which is still in the development stage. It would be premature to attempt to establish economic and fish and wildlife benefits at this time, even though the IRM program could result in a high level of benefits for the environment.

Fish and Wildlife Value: The natural resource review group has some concerns with a stable thalweg line. They also recommended that the measure be deleted because of duplication with other measures which are part of the Integrated River Management Program.

Economic Value: See Measure A-16.

Disposition: No action under the A&M program is needed as funding will be from existing programs.

(19) A-19. Construct bendway weirs.

Background: Bendway weirs are a series of level-crested, submerged rock weirs built around the bend to widen the navigation channel and reduce dredging. This river engineering innovation won the Corps "National Award of Excellence" for Civil Works in 1991. SLD and WES staff worked together to complete the model and design. The structural prototype was constructed at Dogtooth Bend, River Mile 20. Now that it has been proven that the bendway structure works in selected locations, more are planned in the SLD and the two downstream districts are interested in the concept.

Fish and Wildlife Value: SLD will conduct a fisheries study of two bendway weir locations in 1992. District staff, assisted by staff from WES and Southern Illinois University-Carbondale, will investigate two locations with bendway weirs and two locations without, with similar physical and aquatic environments in the

Mississippi River. Results of the research will be available in 1993. It is the professional opinion of biologists that the placement of weirs will significantly improve aquatic habitats.

Economic Value: In 1990, a brief analysis of delay losses to the towing industry at river bends was accomplished after drought related low river stages on the Lower and Middle Mississippi River during 1988-89. During normal water stages, between St. Louis and Cairo, the river industry has average annual delay losses of $8.9 million. During the drought conditions this was increased 33 percent to $13.4 million. The bendway weirs will probably reduce these delays. Thus, it appears that the bendway weir results in both fish and wildlife and economic benefits.

Disposition: Model studies, design and construction will continue as normal District procedure. Through the A&M program, SLD will monitoring before-and-after habitat changes and fish and wildlife benefits.

(20) A-20. The dredge material placement team - continuing effort.

Background: The dredge material placement team is an informal group of SLD personnel and state and Federal conservation agencies that meets annually to discuss the previous year's dredging program and suggested improvements for the following year. Similarly, a river regulatory team meets to discuss dikes and revetment. During the summer of 1991 these teams were combined and the proposed chevron dike construction in Pool 24 was reviewed in the field. This important effort allows professionals from the natural resource agencies (USFWS and Departments of Conservation from Missouri and Illinois) and the Corps to interact concerning efforts to operate and maintain the navigation channel. The coordination effort will continue.

Fish and Wildlife Benefits: The review team considers the coordination effort to be a good management practice which should be continued and has resulted and will continue to provide positive benefits to the natural resources of the rivers.

Economic Value: It is difficult to quantify this management practice, but it is considered important to work with the review agencies.

Disposition: No additional funds are required under the A&M program as the item is already standard O&M practice.

b. Group B- Measures Related to Tow Operation.

General: The following items were addressed by the River Industry Action Committee. The American Waterways Operators also

commented concerning certain items in the Final Environmental Impact Statement, Vol. III, Second Lock, July 1988. The river industry has coordinated with the Corps and the Coast Guard for many years. Recently, the industry has opened more communication with the natural resource agencies and both find that their appreciation of river resources are similar.

Disposition: Only item B-8 will be pursued in the future by the Corps.

(1) B-1. Improve tow and/or barge design.

Background: Industry continues to strive for efficiencies in improved tow and barge designs. As the economics improve, industry will work towards improvement in this area.

Advocacy Action: The Corps of Engineers and the Coast Guard encourage the industry to continue with their program to improve designs of vessels.

Fish and Wildlife Value: In the opinion of the resource agencies, the measure is not quantifiable, but is encouraged.

(2) B-2. Reduce speed in sensitive areas.

Background: Given that safety of life, limb and property is the first operating priority, industry will attempt to navigate these sensitive areas as delicately as possible. Tows normally travel at reduced speeds due to water depth and other natural restrictions through most of the pools on the upper Mississippi and Illinois Rivers. Industry welcomes updated information pertinent to sensitive areas, such as the "Resource Alert" provided for Pools 24, 25 and 26.

Advocacy Action: The Corps and the Coast Guard encourage the industry to always place safety first and to be aware of the sensitive environmental areas, fish and wildlife and their valuable habitats.

Fish and Wildlife Value: Calling attention to sensitive areas through the "Resource Alert" is the best means of information transfer. As explained in item A-1, following the recommendations in the alert is a good management practice and over time will yield positive benefits to the natural resources of the rivers.

(3) B-3. Limit horsepower to 4,500 above L&D 26.

Background: Industry has built large horsepower boats to allow efficient towing on the lower Mississippi River. However, it is very seldom if ever, that this much horsepower is used on the UMR

and the Illinois River except in emergency situations where drastic measures are needed to prevent disasters. Most towboats travel at reduced speeds because of river and economic conditions. To restrict horsepower on the UMR would cripple industry's ability to survive elsewhere in the system.

Advocacy Action: Neither the Corps nor the Coast Guard have authority to limit horsepower in the UMR. The economics of the industry will dictate adherence to this recommendation.

Fish and Wildlife Value: It is the opinion of the review team that this measure be deleted as it is impractical and safety is the major concern of both the review and implementing groups.

(4) B-4. Passing & meeting regulations in sensitive areas.

Background: Industry strives to be good citizens and must view safety as its number one priority both to itself and the environment. As "Resource Alerts" are given to towboat pilots at each lock, pilots will adhere to this information as much as possible.

Advocacy Action: The Coast Guard and the Corps encourage the river industry to observe the sensitive areas that are noted in the Resource Alert for Pools 24, 25 and 26.

Fish and Wildlife Value: The "Resource Alert" for the pools in the SLD is the best means of addressing this measure.

(5) B-5. Employ a gradual increase in power when leaving lock.

Background: Industry does practice gradual power increase while departing locks, but due to unexpected condition changes, it is impossible to do this at all times.

Advocacy Action: The Corps and the industry work together in keeping the locking procedure as safe as possible.

Fish and Wildlife Value: The resource agencies recommend deletion of this measure, in that, safety concerns far exceed resource benefits.

(6) B-6. Reduce draft in critical periods.

Background: The river industry, Coast Guard and the Corps continually work together during critical periods to preserve the channels in threatened periods areas. This practice will be continued into the future.

Advocacy Action: It is within the authority of the Coast Guard to take action against vessel operators that go aground and block navigation. The Coast Guard, industry and the Corps will continue to address this measure.

Fish and Wildlife Value: The natural resource agencies recommend that this measure be eliminated as it is unenforceable and impractical.

(7) B-7. Reduce tow size in critical periods.

Background: The river industry regulates itself during extreme high water and works with the Coast Guard and the Corps to reduce dangers to all parties during low water periods.

Advocacy Action: The three groups will continue to cooperate.

Fish and Wildlife Value: The review agencies recommend that the measure be deleted because it is unenforceable and self regulation is already occurring.

(8) B-8. Develop non-structural alternative to reduce waiting times.

Background: Waiting time at locks, also known as delay time, results in higher transportation costs and environmental degradation above and below the locks. Delay time is due to congestion of river tows which largely originates from volume of traffic or problems with the lock. Measure A-3 contains a discussion of SLD efforts to provide mooring facilities to reduce propeller wash against banks, tying off to trees and attempting to keep waiting tows in the channel to reduce environmental impacts. Congestion of waiting vessels can be alleviated by infrastructure facility rehabilitation and/or replacement, cooperative use of powered equipment, tow make-up operations and other means of industry cooperation. Lock operation procedures, such as, N-up/N-down (locking N number of tows in one direction before locking tows in the other direction) and industry self-help (towboats awaiting lockage assisting tows being locked), can reduce delays. Congestion can also be reduced through operator to operator and operator to infrastructure communications. Preliminary contacts with water industry representatives have revealed an opportunity for cooperative investigation of lockage scheduling with both reduction of waiting times and/or environmental enhancement as goals. Additionally, the Corps of Engineers encourages the towing industry to utilize voluntary self-help (such as helper boats) and directional sequencing of tows when back logs develop.

Coordination: Staff from the SLD have begun discussions with river industry representatives to determine if a locking sequence for tows can be achieved by Corps/industry communication.

Advocacy Action: The SLD encourages the industry to work with the Corps in the future to determine if waiting times and mooring close to the locks can be reduced.

Fish and Wildlife Value: The review agencies encourage the Corps and industry to pursue the possibility of implementation of this measure.

Economic Value: If implemented, the measure could reduce environmental impacts of waiting tows and possibly reduce costs to the industry.

Disposition: It is recommended that a study be initiated to investigate a communication system or procedure to better space tow arrival times at locks. The SLD wishes to continue discussions with industry for possible implementation of the measure. At this time, it is expected that the system/procedures implementation costs would be borne by industry and the Corps, and would consist of possible expansion of communication equipment and/or computer systems. Industry voluntary self-help on pulling "cuts" on multiple lockages will be continued as operational situations warrant.

(9) B-9. Accomplish design study of barge couplings.

Background: In the opinion of industry, technology does not currently exist that will improve on the successful methods currently utilized. For years, industry has looked at other designs and no economical and reliable replacement has been proven. A recent article in the Waterways Journal noted a new barge connector which is a 40-ton, low profile winch that will make or break a tow in less than half the time needed with conventional ratchet turnbuckles.

Advocacy Action: The Corps encourages the towing industry and the service industries which work with the river industry to continue innovation which will improve lockage time and safety.

Fish and Wildlife Value: In item A-3, the natural resource agency team recognized the importance of smooth, safe transfer of barges through the locking procedure. Thus, better and faster couplings will assist in less congestion around the locks and less disturbance of aquatic organisms.

Economic Value: Safe, quicker joining of barges will save time in the locking procedure. The potential for reduction of costly delays is great.

c. Group C- Measures Related to Induced Development

(1) C-1. Require contingency plans at terminals and cargo handling facilities.

Background: The USEPA and the Coast Guard have primary responsibility for this item. Along with several of the states, these organizations already require this type of planning. The Corps requires an environmental analysis as part of the permit process and Section 10 permits require a facility operation plan and a spill plan.

Coordination: Because other federal and state agencies have responsibility for this measure, they will coordinate with industry and the natural resource agencies.

Advocacy Action: The Corps encourages the above noted groups to continue to work together.

Fish and Wildlife Value: The review team stated that there are definite benefits to fish and wildlife resources from the increased ability of facilities to quickly contain and cleanup oil and chemical spills. Benefits to the aquatic resources would be difficult to quantify.

Disposition: No further action by the Corps is anticipated.

(2) C-2. Strategically locate pollution response equipment throughout the UMRB.

Disposition: The Coast Guard and the USEPA are largely responsible for this item. But, as a part of the permit process, the permit applicant must determine what equipment is needed to clean spills and where the equipment should be located. The Coast Guard has staged large amounts of boom at several locations along the Upper Mississippi River.

Coordination: All the implementing agencies will continue to cooperate.

Advocacy Action: Through the permit process, the Corps plays a minor role in this program.

Fish and Wildlife Value: The natural resource agencies recognize that there are definite positive benefits to having the pollution response equipment readily available if needed. The actual benefits are difficult to quantify.

Disposition: No further action by the Corps of Engineers is anticipated.

(3) C-3. Require all fleeting to be located at mooring cells, deadmen, anchors, and/or in accordance with appropriate permits.

Background: The Corps regulatory program is responsible for issuing and enforcing fleeting permits under Section 10 of the Rivers and Harbors Act of 1899. Fleets with deadmen above ordinary high water are not regulated unless attached to a captive barge or if the District deems the fleet is an obstruction to navigation. A master plan update was begun in 1991 and will be completed in 1994-95. The plan for Pools 24, 25, 26 and 27 will include consideration of fleeting use of the navigation pools.

Coordination: The regulatory program has established procedures which allow for review by concerned parties and the public of fleeting permits. The master plan effort also has a public involvement segment.

Fish and Wildlife Value: It is the opinion of the natural resource agencies that enforcement is a problem. The SLD does not agree with this statement and will continue to work with the natural resource agencies and the public to allow adequate review of fleeting activities through the permitting and master plan process.

Disposition: Program is in place and no further action is required, other than possible revision as a result of Master Plan development.

(4) C-4. Designate no fleeting in sensitive resource areas or in unpermitted areas.

Background: The Corps does not regulate fleeting if a permit is not required. Sensitive areas have now been identified in the "Resource Alert" for Pools 24, 25 and 26 and, where the Corps has authority, the regulatory program allows for extensive review of proposed areas for permits.

Coordination: The river industry were given copies of the Alert and are aware of the location of sensitive areas in Pools 24, 25 and 26.

Advocacy Action: The Corps does not encourage fleeting in identified sensitive environmental areas.

Fish and Wildlife Value: There are positive environmental benefits if fleeting does not occur in identified sensitive areas.

Disposition: No further action is required under the A&M program.

(5) C-5. Where unregulated, establish fleeting regulations that take environmental planning into account.

Background: Even though the Corps does not regulate fleeting if a permit is not required, the Section 10 permit process does address the support shore facilities for most fleeting activities and it is possible that interference with the navigation system may occur. Sufficient regulations and environmental planning procedures (Master Plan) are in place to address this concern.

Coordination: There are sufficient Corps regulations in place at this time to address the environmental planning concerns.

Fish and Wildlife Value: See C-3.

Disposition: No further action is required under the A&M program. Master Plan revision is proceeding.

(6) C-6. Complete waterfront development plans in urban areas.

Background: The urban areas listed by the USFWS in the Melvin Price, Second Lock, Fish and Wildlife Coordination Report are not located in the SLD. The master planning effort will include a discussion of the on-going planning by the cities of St. Louis, East St. Louis and Alton of their riverfront areas.

Advocacy Action: Recommend that the St. Paul and Rock Island Districts provide the requested information to the Fish and Wildlife Service.

Fish and Wildlife Value: The natural resource review team states that the benefits to natural resources are indirect and unmeasurable. Long term urban planning activities prevent potential haphazard development of natural resources.

Disposition: It is not anticipated that further work will take place under the A&M program and the concern will be addressed by the Master Plan.

(7) C-7. Complete shoreline management plans.

Background: The master plan will include shore line management plans which will be administered by the Riverlands Management office of the SLD.

Fish and Wildlife Value: Benefits are considered to be long term and indirect. The team endorses this planning effort.

Disposition: There is not an identified need for the A&M program to participate in this measure as the Master Plan update will adequately address this concern.

(8) C-8. Revise navigation pools Master Plans.

Background: The Master Plans for Pools 24, 25 and 26 are presently being updated and will be complete by 1995.

Coordination: The Corps regulations require an extensive coordination effort with all interested parties.

Fish and Wildlife Value: The natural resource review team endorsed the measure because of potential long term benefits.

Disposition: No additional work under the A&M program will take place.

(9) C-9. Develop a Master Plan for resource management of Pool 27 lands and waters.

Background: An interim land classification plan, that will address the lands obtained for the Chain of Rocks Canal and Lock 27, is being developed. The plan will be completed in late 1992 and will cover the management and use of the government lands and waters of Pool 27. The plan will be used as a guide for the management of those lands until the Riverlands Master Plan for the Navigation Pools is completed.

Coordination: Because the SLD had not developed a Master Plan for the lands and waters of Pool 27 and the Chain of Rocks Canal, the interim plan was coordinated with appropriate agencies and publics as will be the Master Plan for the pools.

Fish and Wildlife Value: The natural resource review team endorses the efforts by the SLD because of the long term benefits to the resource base.

Disposition: The program is on-going and no A&M action is needed.

(10) C-10. Develop detailed operational management plans for all lands and waters under Riverlands jurisdiction.

Background: The Riverlands Master Plan for the navigation pools of the District will detail an operational management plan.

Coordination: The Master Plan will be coordinated with state and federal agencies and the public.

Fish and Wildlife Value: The review team endorses the on-going actions by the SLD.

Disposition: There is no need for the A&M program to assist in this planning effort.

d. Group D- Measures to Rectify Impacts

(1) D-1. Shoreline protection in highly erodible areas to minimize erosion and enhance fish & wildlife habitat.

Background: The Corps of Engineers has an on-going program to provide bank stabilization, but the main goal has been to protect the navigation channel. SLD has innovated with off-shore protection to reduce bank clearing and construction activity. These off-shore structures, parallel to the shore, have created excellent habitats in the calm water section between the revetment and the shore. At this time, no backwater protection has been attempted. See A-17 for a further discussion of this measure.

(2) D-2. Build diversion structures to reduce sediment input into backwater.

Background: Backwater sedimentation occurs at a maximum rate during flood conditions. Any structure designed for sediment diversion under these conditions would be large in size and expensive to build and maintain. At this time, the Corps has no plans to pursue this recommendation, other than those areas which are EMP projects that involve construction of structures for environmental purposes.

Fish and Wildlife Value: The team of natural resource specialists recommends that this measure be deleted. The team recognizes that little sediment enter backwaters as a result of navigation activities.

Disposition: Because the item was deleted by the review team, no further activity under the A&M program is anticipated.

(3) D-3. Construct barrier islands to reduce wave impact to off-channel areas.

Background: The chevron dike program (see A-16) in the SLD would qualify as a barrier island after vegetation begins to grow on the dredge materials. Also, dredge material islands are proposed to be armored on the nose to make them more stable. Once stabilized it is proposed to leave the dredge material piles as recreational beaches (see A-10) or the material can be shaped and

seeded to create wetlands (see A-11). The off-bank revetment program is also important, in that this method of island protection stabilizes existing islands.

Fish and Wildlife Value: See A-10, A-11 and A-16.

Disposition: See A-10, A-11 and A-16.

(4) D-4. Modify wing dikes to reduce accretion.

Background: This item has been an ongoing program in the SLD for the last 20 years. The program will continue.

Disposition: See measure A-16 for a complete discussion of this measure.

2-07. SUMMARY OF A&M MEASURES RECOMMENDED FOR IMPLEMENTATION

The following measures are recommended for implementation under the A&M program:

A-3. Designate locks approach waiting areas or provide special mooring sites.

A-10. Reduce open water dredge material disposal - create recreation beaches.

A-11. Reduce open water dredge material disposal - create wetlands.

A-13. Place dredge material in the thalweg.

A-16. Continue dike configuration studies (i.e., notched dikes, chevrons and bullnose dikes).

A-17. Place off-bank revetment on islands.

A-19. Construct bendway weirs.

B-8. Study reduction of tow waiting times.

SECTION III - A&M MEASURES RECOMMENDED FOR IMPLEMENTATION

3-01. GENERAL

a. The following measures are recommended for implementation under the A&M program. Measures that are already being implemented under ongoing programs are not in the recommended list. In addition, portions of the recommended measures that are being implemented under the ordinary O&M program are not part of the recommendation. The costs for the recommended measures are only those costs over and above the costs included in ordinary O&M. Design of all items would be utilizing standard details. Mooring buoys would be similar to those already in place at Locks 24 and 25, and anchors would be obtained from those commercially available. Flexible pipe would consist of commercially available pipe. Stone dikes would follow typical methodology for design.

b. The A&M and the Integrated River Management (IRM) Programs in the SLD have developed several innovative river engineering concepts. Some of these initiatives were tried 20 years ago (notched dikes) and proved to be successful from a physical and engineering viewpoint. But, the Corps has been remiss in not establishing the possible biological or fish and wildlife benefits. Baseline monitoring of before and after conditions of aquatic habitats has been called for by Corps biologists and the environmental community for years. Under the A&M program the SLD has both the need and opportunity to conduct investigations on several items to be put in place in the next several years. A brief description of each of the proposed studies is described below. Contractual scopes of work will be developed for each of these investigations.

3-02. MEASURE A-3. DESIGNATE LOCKS APPROACH WAITING AREAS OR PROVIDE SPECIAL MOORING SITES.

The purpose would be to eliminate tows from tying up to trees while awaiting lockage. In addition, mooring buoys or anchors would provide for faster lockage by allowing the tow to wait close to the lock and would minimize lock idle time. To implement this measure, four new buoys are proposed (two are in place): two each downstream of Locks 22, 24, and 25. See FIGURE 3-1 for a sketch of a typical mooring buoy. Also, four new anchors with chains would be purchased and installed upstream of Locks 24 and 25. Annual maintenance, primarily on the buoys to repair damage due to ice or impact with barges, would be required.

3-03. MEASURE A-10. REDUCE OPEN WATER DREDGE MATERIAL DISPOSAL - CREATE BEACHES.

Dredge material is normally deposited in the river out of the main channel to form islands, which can be used as beaches. To create islands or beaches in areas presently not accessible due to dredge discharge pipe limitations, SLD will acquire approximately 3,000 feet of pipe with associated hardware and a booster pump under the A&M program. Rock armorment would be used to stabilize the newly created islands and reduce the chance of the material returning to the channel. All dredging to form the island beaches would funded through ordinary O&M.

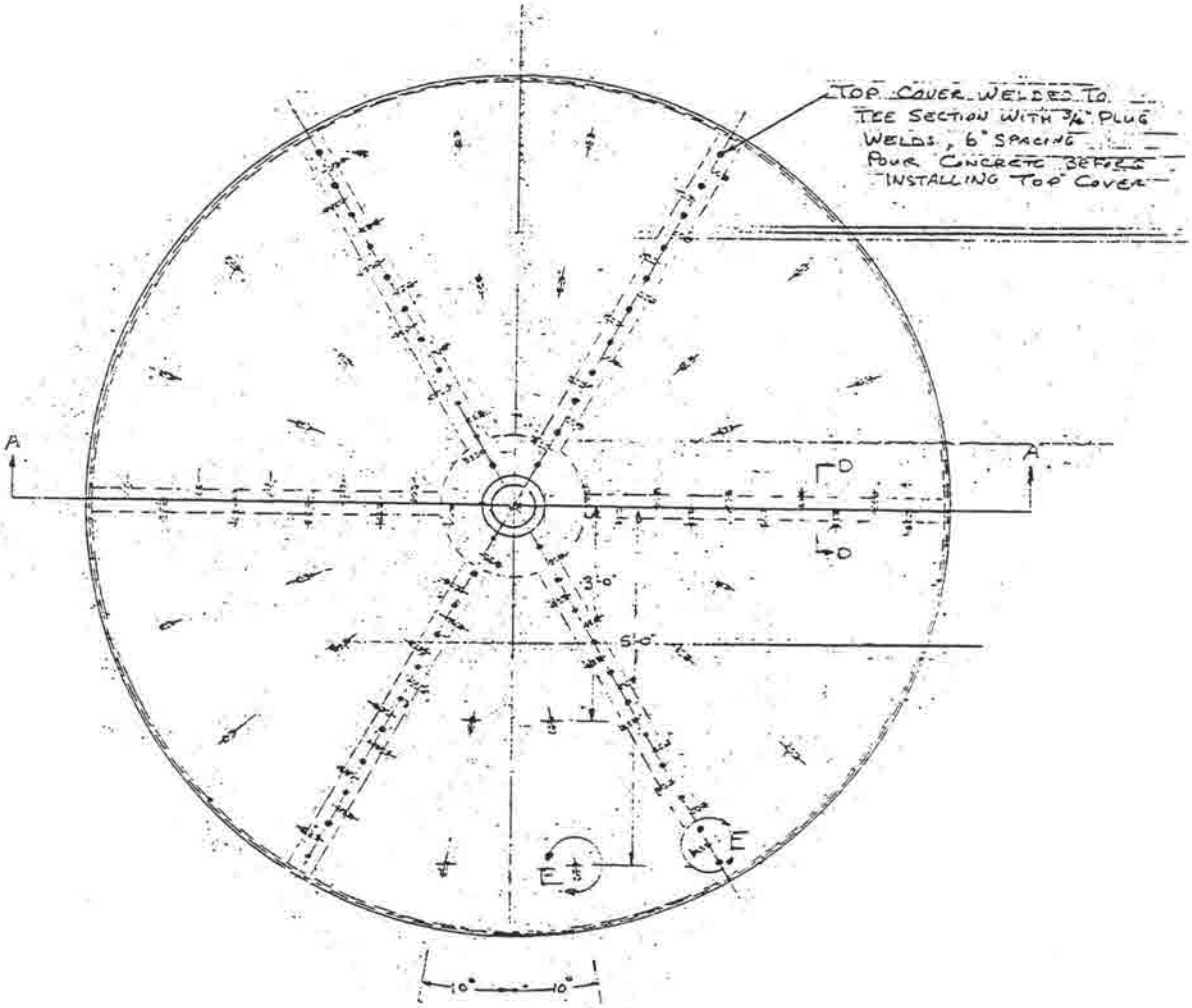
3-04. MEASURE A-11. REDUCE OPEN WATER DREDGE MATERIAL DISPOSAL - CREATE WETLANDS.

Once dredge material is deposited to form an island, some grading will be required to properly shape the material to the proper elevations and the area must be seeded to promote wildlife and minimize erosion. Placement of dredge material would be funded under the ordinary O&M program. Since it would require more than one dredging season to build up an area, seeding and grading was assumed starting in FY 98. Rock armorment would be placed to stabilize the newly created wetlands.

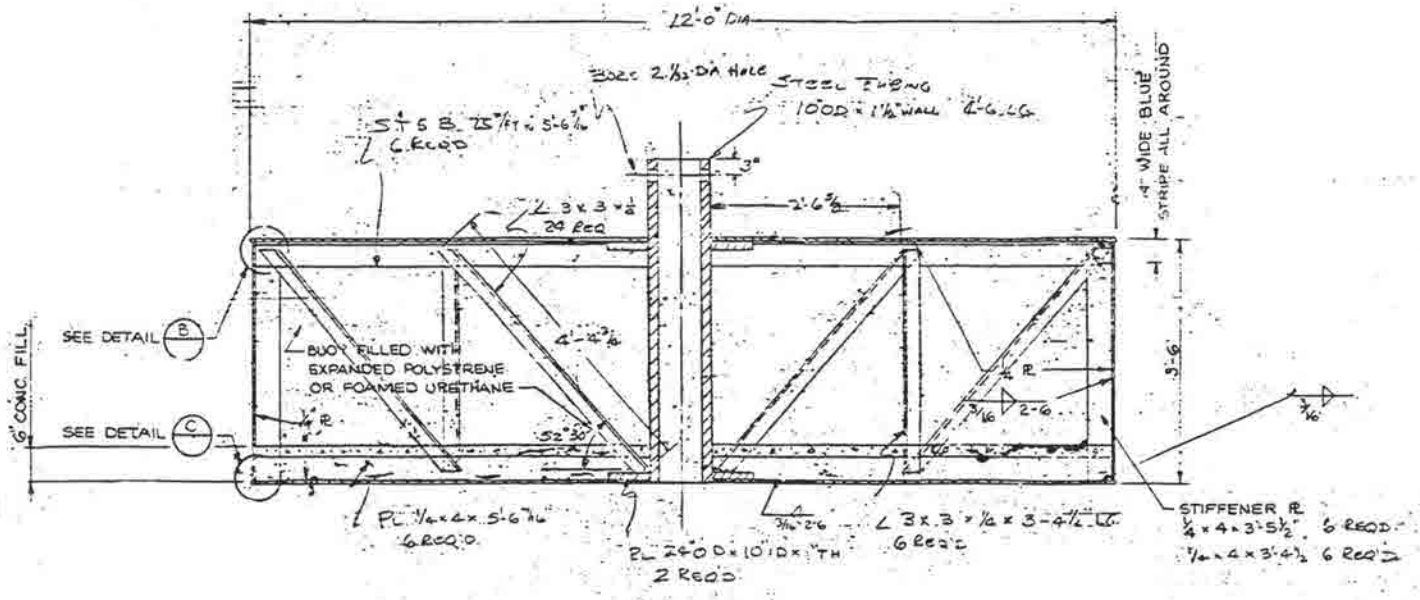
3-05. MEASURE A-13. PLACE DREDGE MATERIAL IN THE THALWEG.

a. Thalweg placement of dredge material will be studied under the A&M program. If successful, thalweg disposal will reduce the amount of dredging required and will minimize material placement in more environmentally sensitive areas. Dredging will be part of the ordinary O&M program; the only A&M costs would be for additional engineering and biological monitoring.

b. Physical monitoring of the movement of dredge material placed from a crossing into a downstream pool has been conducted by both the Rock Island and the SLD. In the Rock Island District, material was actually tagged with dyes and tracked during a flow event. This study proved to be rather expensive. The conclusion stated that the study found no adverse impacts to disposal in the navigation channel, including the downstream crossing, and that thalweg disposal in the pools was a viable alternative. In the SLD, tests were conducted on thalweg disposal on a moveable bed model at WES; results have been encouraging. A thalweg disposal test has been performed on the Mississippi River at Bolter's Bar, River Mile 225. Soundings, velocity isovels, and flow nets were taken to monitor the test. Results have indicated no adverse impact to the navigation channel. Additional monitoring will continue over the seven year period of the A&M program to build a data base. Monitoring will be accomplished under different river conditions (low, medium and high stages) to determine trends before any conclusions can be made.



PLAN
SCALE: 3/4" = 1'-0"



SECTION A
SCALE: 3/4" = 1'-0"

MOORING BUOY

FIGURE 3-1

c. There is a need to establish if there is a biological impact of placing material in the downstream pool and if fisheries benefits are gained from not casting the dredge material in the main channel border. To evaluate this question, fish densities per a prespecified unit area will be determined using hydroacoustic techniques before and after dredge material is placed in the main channel border. If adverse impacts result from main channel border placement, reduced densities of fish would be anticipated. Various techniques could be used to quantify the adverse impact. For example, habitat units based on reduced habitat value could be computed or economic value based on reductions in commercial or recreational value could be computed. Hydroacoustic studies of fish densities would also be utilized to determine the biological importance of the deep water thalwag habitat, "deep holes". If it is determined that there are little or no environmental impacts (i.e., reduced densities of fish populations) from thalweg placement, this would be the preferred method of disposal. A comparison, using habitat units or dollar value, between the two disposal methods could then be made to quantify the benefits from modification of disposal practices.

3-06. MEASURE A-16. CONTINUE DIKE CONFIGURATION STUDIES (I.E., NOTCHED DIKES, CHEVRONS AND BULLNOSE DIKES).

a. Stone will be required for notched dikes, chevrons and bullnose dikes. Notched dikes are being implemented under the ordinary O&M program. Chevrons will be placed at various locations, and dredged material will be placed downstream of the chevrons. Bullnose dikes will be placed upstream of dredge disposal islands used for beaches and wetlands to protect them from erosion. (See Measures A-10 and A-11.) Approximately 60,000 tons of stone will be required annually. Placement of the dredged material will be funded through the ordinary O&M program. (See FIGURES 3-2 and 3-3 for sketches of chevron and bullnose dikes).

b. Biological monitoring will be required. The A&M review team of natural resource agencies have stated that the efforts that the Corps has made in the past and are proposing for the future have positive fish and wildlife benefits. This empirical knowledge needs to be backed up with field studies and monitoring. The first chevron dike is to be constructed in Pool 24 during the summer of 1992. The natural resource agencies "think" that the placement of stone and creation of new islands and the possible reduction of dredging will have positive benefits. The missing part of this equation is a long term monitoring of the changes in habitats which will result from the construction of new structures and the modification of old dikes. For monitoring, fish densities will be measured, using either electrofishing or hydroacoustic techniques, in the area of chevron and bull nose dike construction prior to rock placement

and at prescribed periods after construction. Quantification of potential benefits can be accomplished by computing habitat unit changes based on fish densities or monetary units based commercial/recreational fishery changes.

3-07. MEASURE A-17. CONSTRUCT OFF-BANK REVETMENT ON EXISTING ISLANDS.

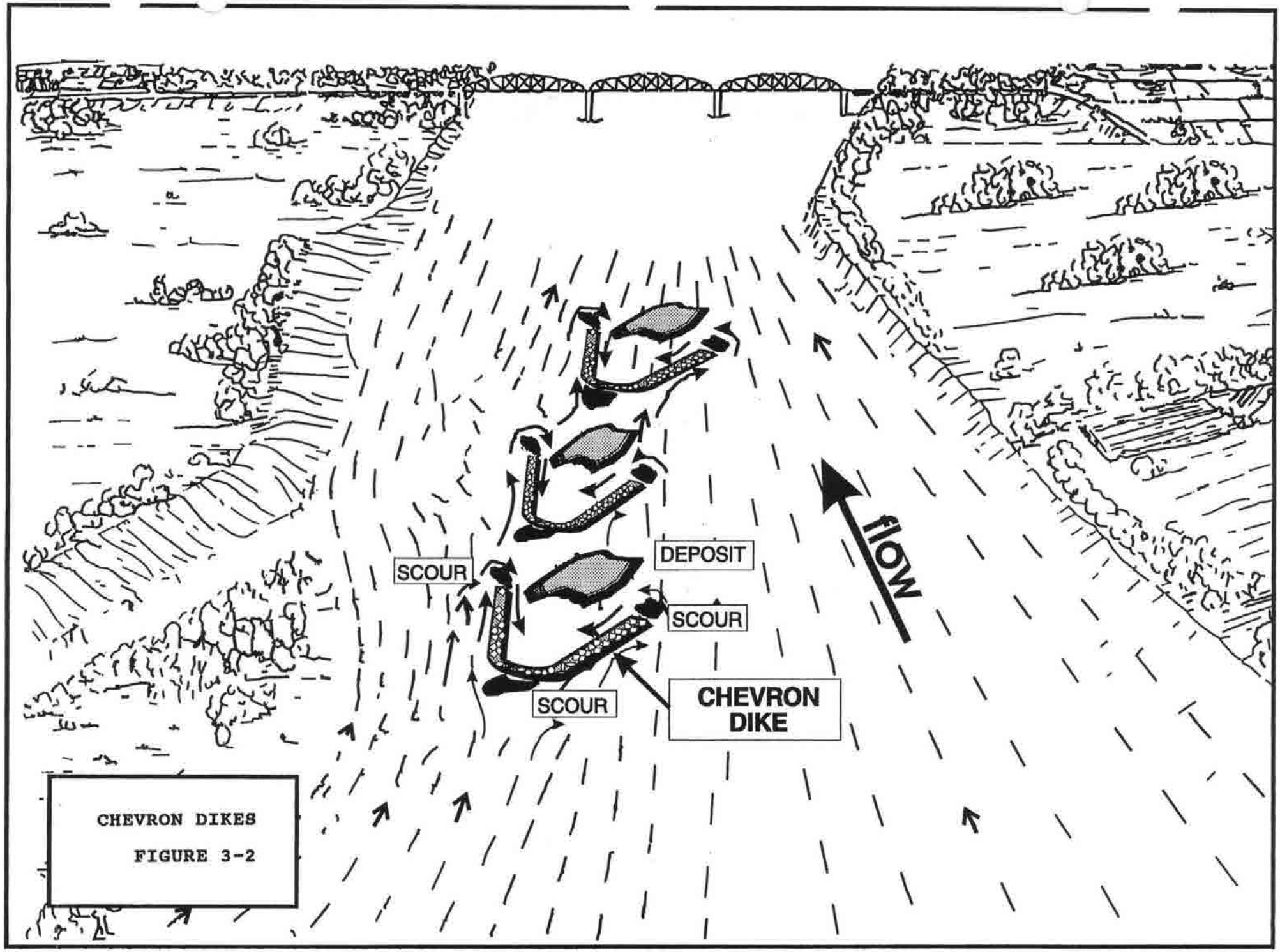
a. Revetment stone will be placed off-bank and parallel to the bankline on existing islands. The islands would serve to protect the bank from scour due to river currents and would provide a quiet area between the bank and the island. Stone placement would be under the ordinary O&M program; engineering and biological monitoring would be part of the A&M program. See FIGURE 3-4 for a photo of off-bank revetment.

b. Engineering monitoring would consist of obtaining soundings, velocity flow nets, and velocity isovels. Monitoring would continue over the seven year period for differing river stages to determine trends and effectiveness.

c. There has been one study, conducted by a biologist from the Ill. Dept. of Conservation, of a reveted island in Pool 24. The results revealed positive fisheries benefits due to the new configuration of placing stone off shore. There is a need to expand on this one study (see App. C in App. A) and to begin long term monitoring.

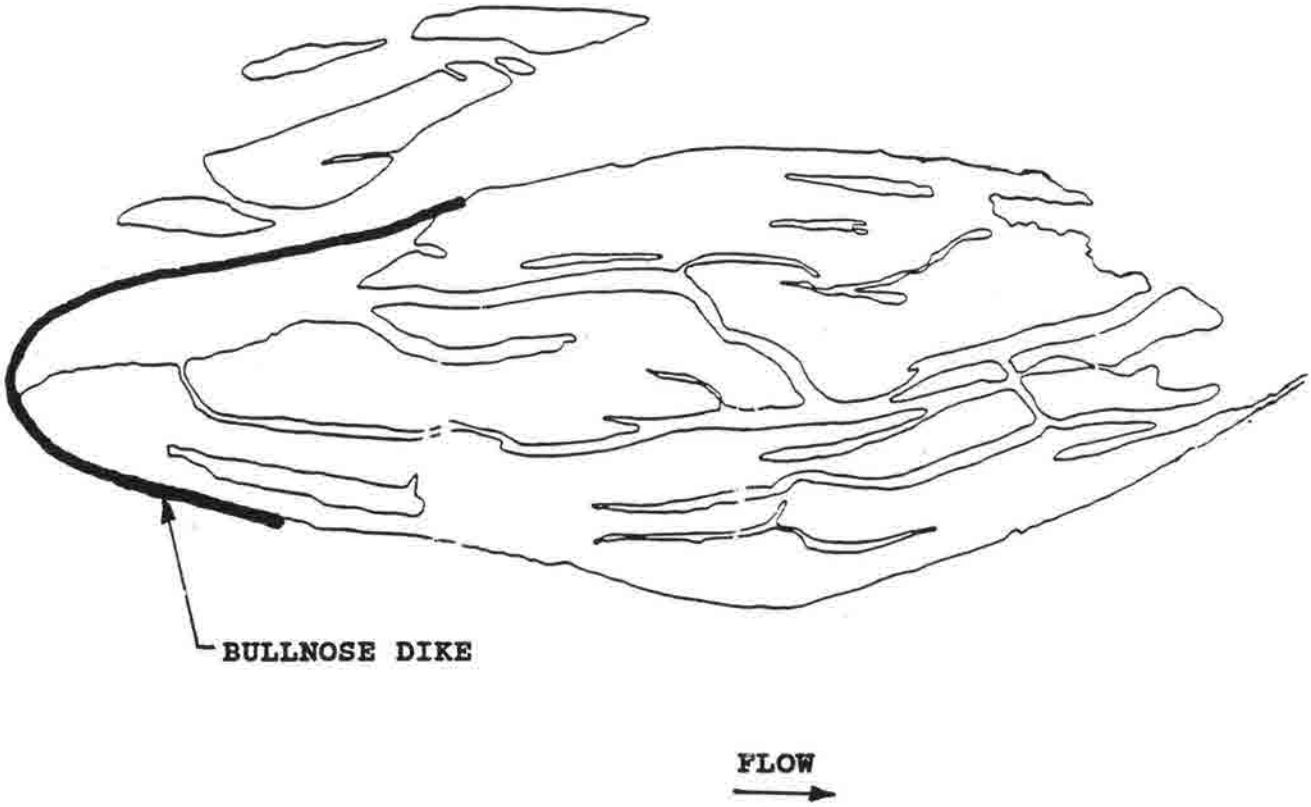
3-08. MEASURE A-19. CONSTRUCT BENDWAY WIERS.

a. A bendway weir is a low level, totally submerged rock structure that is positioned from the outside bankline of the riverbend, angled upstream toward the flow. See FIGURE 3-5. These underwater structures extend directly into the navigation channel underneath passing tows. Their unique position and alignment alter the river's secondary currents in a manner which controls excessive channel deepening and reduces adjacent riverbank erosion on the outside bendway. Because excessive river depths are controlled, the opposite side of the riverbend is widened naturally. This results in a wider and safer navigation channel through the bend without the need for periodic maintenance dredging. After bendway weir construction, the wider, shallower channel where currents move more slowly provide and enhanced aquatic environment for many species of fish. In addition, the weirs act as underwater reefs and create sites for aquatic invertebrate. The rocks of the weirs, by always being submerged, offer more attachment sites for micro-organisms upon which fish feed. Construction of the bendway weirs would be under the ordinary O&M program, however, engineering and biological monitoring would be under the A&M program.



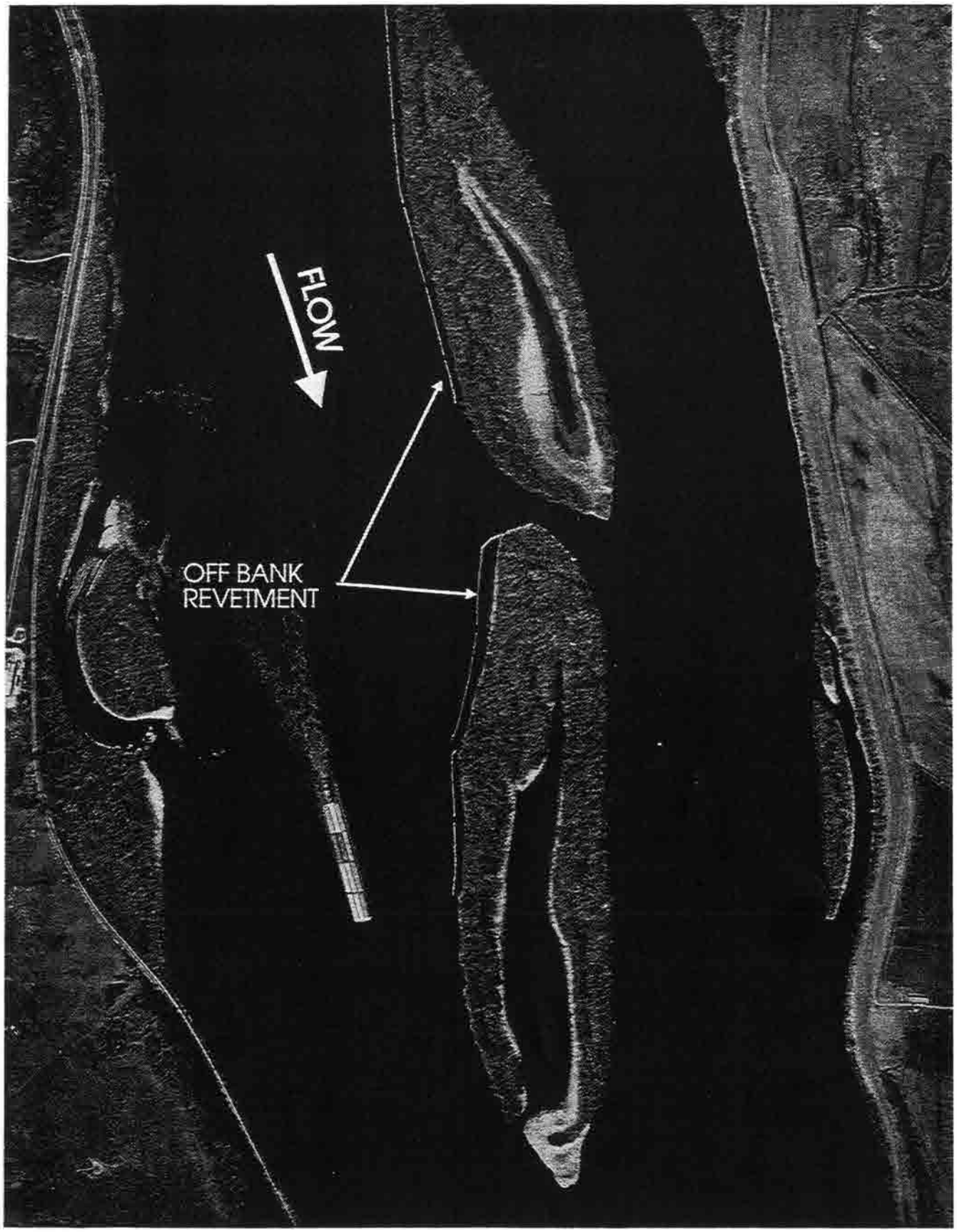
CHEVRON DIKES

FIGURE 3-2



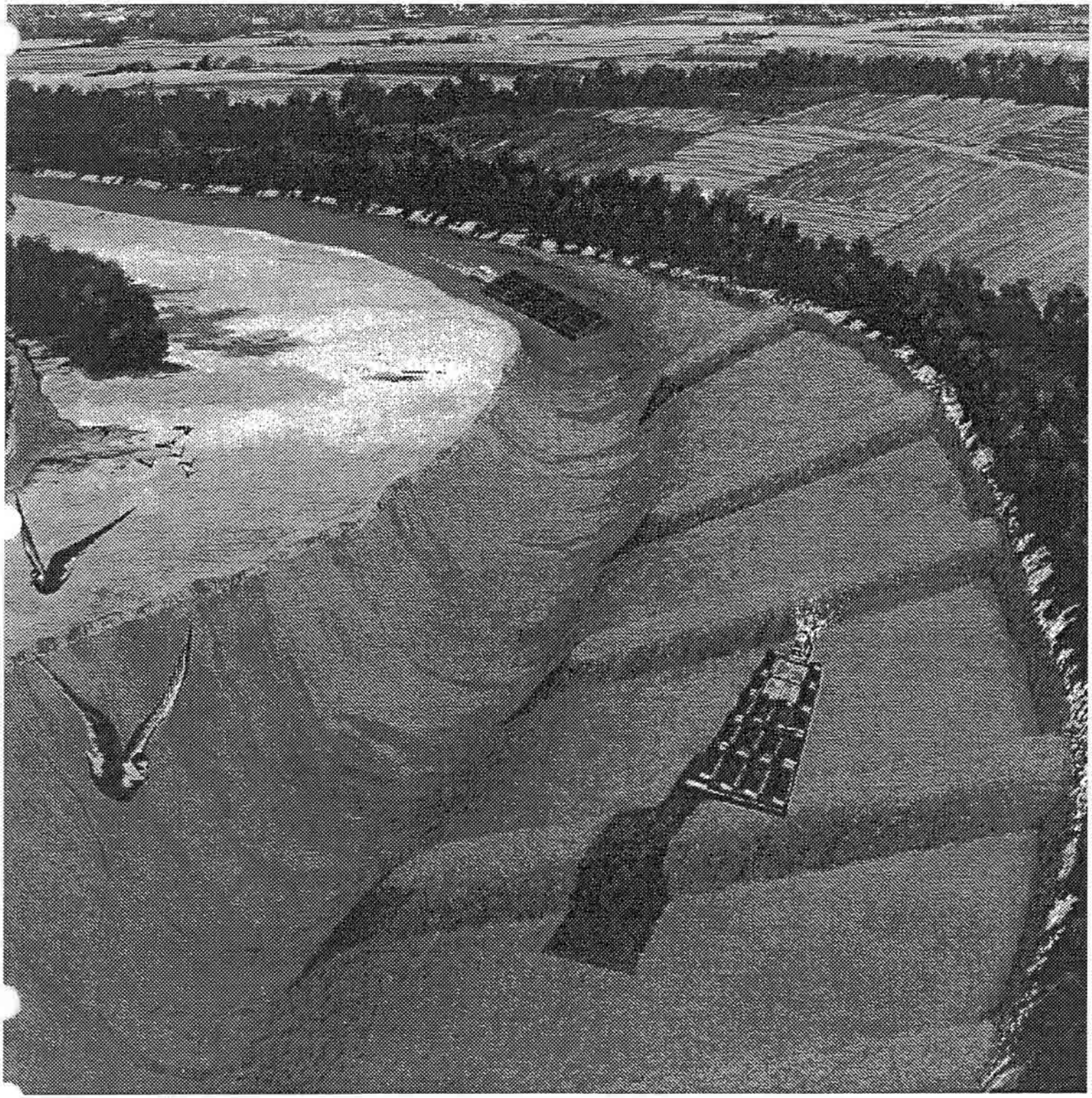
BULLNOSE DIKE

FIGURE 3-3



OFF BANK REVETMENT

FIGURE 3-4



BENDWAY WEIRS

FIGURE 3-5

b. Engineering monitoring would consist of obtaining soundings, velocity flow nets, and velocity isovels. Monitoring would continue over the seven year period for differing river stages to determine trends and effectiveness.

c. In 1992, monitoring will be initiated to determine the improvement in aquatic habitat as a result of the placement of stone and the stabilization of the bendway. There is a need to continue the biological monitoring program because of the possible wide spread utilization of the weir. Fish densities, per unit of area, at two bendway weirs and in two bendways without weirs will be determined using hydroacoustic surveys. The potential benefit of the bendway weirs can be assessed by using either differences, in habitat units or monetary value of the potential commercial/recreational fishery, between bendways with and without weirs.

3-09. MEASURE B-8. STUDY REDUCTION OF TOW WAITING TIMES.

A study will be undertaken to determine if there are methods or procedures of reducing tow waiting time at locks by better spacing arrival times. Less waiting at the locks could reduce environmental damage. New methods or procedures could require better communication between tows and between tows and the locks. The study will gather data from tow operators and government agencies involved with the inland waterway system; survey potential means of communication, censorship capabilities, investment and operation costs; formulate possible alternatives; and compute savings and costs to waterway operators. The work would be conducted over a two year period and would take seasonal fluctuations and conditions in consideration. The cost of the study would be under the A&M program.

SECTION IV - BASIS OF ESTIMATE

4-01. GENERAL

This cost estimate has been developed using previous cost estimates, current designs and quantity take-offs, recent bid abstracts for projects in the area, detailed cost estimates and estimator judgement. This cost estimate was prepared in the WBS (Work Breakdown Structure) format. MCACES (a PC program) was utilized to prepare this cost estimate with a contingency applied to each line item. See Appendix B for the MCACES estimate. The Price Level for this estimate is October 1992. All funding used for this project will come from O&M Funds, except the funding used to purchase the flexible pipe which will come from PRIP (Plant Replacement and Improvement Program) Funds.

4-02. DISCUSSION OF RELIABILITY OF DESIGNS, QUANTITIES, AND UNIT PRICES

a. Fish and Wildlife Facilities. The improvements in this area are based on preliminary designs. This estimate was developed by assuming that 80,000 tons of stone would be placed for each of four alternating years during a 7-year period to protect the creation of wetland areas. The unit price is in line with current stone prices in the Upper River portion of the Mississippi River. It is assumed that 13 acres of vegetation will be established per wetland area in the year following the wetland area creation. These unit prices for vegetation are in line with current prices for similar quantities. All specified monitoring is shown as a lump sum amount based on assumed anticipated quantities.

b. Channels and Canals. The improvements in this area are based on preliminary designs. This estimate was developed by assuming that 80,000 tons of stone would be placed for each of three alternating years during a 7-year period to protect the creation of beaches. The unit price is in line with current stone prices in the Upper River. Maintenance Stone, used to maintain dikes, is assumed to be 60,000 tons per year and also is comparable to current prices. The lock approach waiting areas consist of four anchor and chain assemblies, and six mooring buoys. The anchor and chain assemblies are assumed to be purchased used. The costs in this estimate are for material only. It is assumed that they will be installed during routine operations of Corps personnel. The mooring buoys costs consists of material and labor at the Corps Service Base. These buoys also will be installed during routine operations of Corps personnel. The maintenance of the mooring buoys consists of replacing one per year plus miscellaneous maintenance. The

flexible pipe material is assumed to be bought with PRIP Funds. The unit price of the flexible pipe is based on experience gained from another federal agency. All supporting items and labor and equipment to set up for first time use will come from O&M Funds.

4-03. DISCUSSION OF VARIABLE CONTINGENCIES

The cost estimate on this project includes contingencies ranging from 15% to 25%. Assigned contingencies are based on the degree of difficulty in visualizing and quantifing different aspects of work. Generally a contingency of 15% was used for this project which was felt to be reasonable at this stage of development.

JOHN W. DIERKER
Chief, Cost Engineering Branch

SECTION V - SCHEDULE

5-01. SCHEDULE OF IMPLEMENTATION

Implementation of A&M measures is scheduled for FY 1994 through FY 2000 in this design memorandum. However, A&M will be a continuing operation that will become a part of the ordinary O&M program. A schedule has been prepared showing implementation of the eight recommended measures. See CHART 5-1. In general, the measures are scheduled as follows.

A-3. Fabrication of the mooring buoys, purchase of the anchors, and placement at the sites will be in FY 1994 and FY 1995, and maintenance will be required annually.

A-10 and A-11. Beaches and wetlands will be created with material obtained during ordinary dredging for maintenance of the nine foot channel. As the areas are built up, bullnose dikes will be constructed or the areas will be armored with stone; areas for wetlands will be graded and seeded. These items will be implemented throughout the seven year period as dredge material becomes available.

A-13. Monitoring of the material placed in the thalweg will occur over the seven year period covered by this design memorandum.

A-16. Stone for the various dike configurations will be placed annually, and biological monitoring will also occur during this period.

A-17 and A-19. Engineering and biological monitoring of the stone placed off bank will be conducted annually during the seven year duration.

B-8. The study to reduce waiting time of tows at locks is expected to be completed in 18 months.

5-02. SCHEDULE OF FUNDS

TABLE 5-1 shows the expenditures of funds by fiscal year and A&M measure. All costs will be funded by O&M except for the flexible dredge pipe. The additional flexible dredge pipe will be funded through the Plant Replacement and Improvement Program (PRIP).

OPEN PLAN (R)

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A&M MEASURES

Army Corps of Engineers, St. Louis,

ACTIVITY	01 JAN 94	01 JAN 95	01 JAN 96	01 JAN 97	01 JAN 98	01 JAN 99	01 JAN 00	01 JAN 01	01 JAN 02
1	START								
100								RED	
999					A&M COMPLETION (INITIAL)				
A10.1	PLEXIBLE PIPE PURCHASE								
A10.2A		STONE FOR BEACHES - A-10							
A10.2B				STONE FOR BEACHES					
A10.2C						STONE FOR BEACHES			
A11.1		SEEDING AND GRADING							
A11.2A	STONE FOR WETLANDS A-11								
A11.2B			STONE FOR WETLANDS						
A11.2C					STONE FOR WETLANDS				
A11.2D					STONE FOR WETLANDS				
A13.1								THALWEG PLACEMENT	
A16.1								DIKE CONSTRUCTION	
A16.2								A-16 MONITORING	
A17.1								REVETMENT PLACEME	
A17.2								A-17 MONITORING	
A19.1								A-19 MONITORING	
A3.1	A-3 MOORING BUOYS. ANCHORAGES								
A3.2								MOORING MAINTENAN	
B8.1		WAITING TIME RED. STUDY B-8							

SCHEDULE

CHART 5-1

Legend
- In progress
- Planned
- Critical

Bar Chart Key: Early Dates

Signatures

Prep: _____

Apry: _____

TABLE 5-1
AVOID AND MINIMIZE MEASURES
SCHEDULE OF O&M AND PRIP FUNDS
($000)

MEASURE	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	Total
A-3								
Construct Buoys	90.8	100.0						190.8
Maintain Buoys	31.9	35.0	35.0	35.0	35.0	35.0	35.0	241.9
A-10								
Purchase Pipe(PRIP)	1222.6							1222.6
Maintain Pipe	80.0	80.0	80.0	80.0	80.0	80.0	82.5	562.5
Rock Armorment		600.0		600.0		602.9		1802.9
A-11								
Vegetation					50.0	30.0	30.6	110.6
Rock Armorment	600.0		600.0		600.0		603.9	2403.9
A-13								
Monitoring	96.0	96.0	96.0	96.0	96.0	96.0	101.3	677.3
A-16								
Stone Dikes	450.0	450.0	450.0	450.0	450.0	450.0	447.5	3147.5
Monitoring	69.0	69.0	69.0	69.0	69.0	69.0	69.8	483.8
A-17								
Monitoring	69.0	69.0	69.0	69.0	69.0	69.0	69.8	483.8
A-19								
Monitoring	103.0	103.0	103.0	103.0	103.0	103.0	107.7	725.7
B-8								
Perform Tow Study	30.0	60.0	10.0	10.0	10.0	10.0	10.0	140.0
PED	175.0	175.0	175.0	175.0	175.0	175.0	175.0	1225.0
Construction Mgmt.	100.0	100.0	100.0	100.0	100.0	100.0	97.9	697.9
Subtotal - PRIP	1222.6							1222.6
Subtotal - O&M	1894.7	1937.0	1787.0	1787.0	1837.0	1819.9	1831.0	12893.6
TOTAL	3117.3	1937.0	1787.0	1787.0	1837.0	1819.9	1831.0	14116.2

Note: All funds are O&M unless otherwise noted.

SECTION VI - FUTURE ACTIONS

6-01. PLANNING TO FISCAL YEAR 2000

A&M implementation is scheduled to begin in FY 1994 and continue to FY 2000 when the program will be completely absorbed into normal O&M procedures or will be a part of the Integrated River Management Program. There is a need for continual coordination and monitoring of A&M activities during the seven year period because A&M is considered a dynamic activity. The "Resource Alert" will need to be updated and natural resource agencies will need to be kept informed concerning implementation of the program.

6-02. SUPPLEMENTS TO THE DESIGN MEMORANDUM

As planning and implementation continue on the A&M program, it is expected that changes to the program will occur. Significant changes will be documented as supplements to this design memorandum prior to implementation. Input from natural resource agencies will be solicited before any changes are recommended.

SECTION VII - SUMMARY AND RECOMMENDATIONS

7-01. SUMMARY.

Avoid and minimize is a form of mitigation. For the Melvin Price Second Lock project, various measures, which were submitted by the USFWS and added to by the SLD, were reviewed and evaluated for their technical and wildlife benefit. The cost of implementing the eight recommended measures from FY 1994 through FY 2000 is estimated to be $14,116,176.

7-02. RECOMMENDATIONS.

The following measures are recommended for implementation under the A&M program. Measures that are already being implemented under ongoing programs are not in the recommended list. In addition, portions of the recommended measures that are being implemented under the ordinary O&M program are not part of the recommendation. The costs for the recommended measures are only those costs over and above the costs included in ordinary O&M.

A-3. Designate locks approach waiting areas or provide special mooring sites. To implement this measure, six buoys are proposed: two each downstream of Locks 22, 24, and 25. Also, four new anchors with chains would be purchased and installed upstream of Locks 24 and 25. Annual maintenance, primarily on the buoys to repair damage due to ice or impact with barges, would be required.

A-10. Reduce open water dredge material disposal - create beaches. Sections of flexible pipe will be acquired to fully implement this measure. Stone armorment or bullnoses will be required to protect the islands/beaches formed by disposal of dredge material. All dredging to form the islands would funded through ordinary O&M.

A-11. Reduce open water dredge material disposal - wetlands creation. Grading and seeding will be required to create the wetlands from islands created from dredge material. Stone armorment or bullnoses will be required to protect the islands. Placement of dredge material would be funded under the ordinary O&M program.

A-13. Place dredge material in the thalweg. Thalweg placement of dredge material will be initiated under the A&M program. Dredging will be part of the ordinary O&M program; the only A&M costs would be for additional engineering and biological monitoring.

A-16. Continue dike configuration studies (i.e., notched dikes, chevrons and bullnose dikes). Stone will be required for notched

dikes, chevrons and bullnose dikes; biological monitoring will be performed. Placement of the dredged material will be funded through the ordinary O&M program.

A-17. Place revetment islands. Revetment stone will be placed off-bank to form islands parallel to the bankline. Stone placement would be under the ordinary O&M program; engineering and biological monitoring would be required under the A&M program.

A-19. Construct bendway weirs. Construction of the bendway weirs would be under the ordinary O&M program, however, engineering and biological monitoring would be under the A&M program.

B-8. Study reduction of tow waiting times. A study will be undertaken to determine if there are methods or procedures of reducing tow waiting time at locks by better spacing arrival times. The cost of the study would be under the A&M program.

APPENDIX A

FISH AND WILDLIFE REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Rock Island Field Office (ES)
4469 - 48th Avenue Court
Rock Island, Illinois 61201

IN REPLY REFER TO:

309/793-5800

August 6, 1992

Mr. Owen Dutt, Chief
Planning Division
Attn: Ron Yarbrough
U.S. Army Engineer District
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Mr. Dutt:

In fulfillment of our transfer fund agreement dated 10 February 1992, I am enclosing a copy of our final report "An Evaluation of Natural Resource Benefits Likely to Occur from the Implementation of Measures to Avoid and Minimize Navigation Effects." This report is the result of a coordinated effort among the State and Federal river biologists to objectively evaluate potential natural resource benefits from the 43 proposed measures to avoid and minimize navigation impacts. The Service strongly supports and commends your efforts to implement the Avoid & Minimize measures recommended in the report. We look forward to working further with you toward their implementation.

Sincerely,

Richard C. Nelson
Field Supervisor

Enclosure

cc: W/encl.
RIFO
Avoid and Minimize Team:
Dewayne Knott
Norman Stucky
Gordon Farabee
Butch Atwood
Chuck Suprenant
Dr. Rip Sparks
Dr. Ken Lubinski
Ken Brummet
Tom Keevin
MISO
Bill Bertrand
Gene Bugelwicz

JD:sjg

An Evaluation of Natural Resource Benefits Likely to Occur from the Implementation of Measures to Avoid & Minimize Navigation Impacts

Prepared by

U.S. Fish & Wildlife Service
Ecological Services Office
Rock Island, Illinois

for
U.S. Army Corps of Engineers
St. Louis District

July 1992

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I. BACKGROUND

The Draft Fish and Wildlife Service's Draft Coordination Act Report (DCAR) (dated June 1986) for the Environmental Impact Statement (EIS) for the Second Lock at Locks and Dam No. 26 Replacement Mississippi River, first identified several measures to avoid and minimize navigation effects associated with increased navigation traffic resulting from operation of the Second Lock. That list was subsequently reviewed by the St. Louis District and commercial navigation interests and then revised for the Supplemental Fish and Wildlife Coordination Act Report dated August 10, 1987. Eight of the Fish and Wildlife Service recommended measures were accepted and included as Appendix E - "Fish and Wildlife Mitigation Planning" in the Final Environmental Impact Statement (FEIS) dated July 1988.

In the Record Of Decision (ROD) for that EIS, the St. Louis District indicated their intent to implement " a...comprehensive program to evaluate and implement measures to avoid and minimize potential impacts." Since completion of the Second Lock EIS, the St. Louis District has pursued this program through their coordination with the Fish and Wildlife Service, state resource agencies, the navigation industry, U.S. Coast Guard and the Rock Island and St. Paul Districts. Through this coordination process, the list of potential Avoid and Minimize (A&M) measures has been repeatedly revised. Prior to this review by the Avoid and Minimize Team there were 43 recommended measures in 4 categories: (1) Operations of the Locks and Navigation Channel, (2) Measures Related to Tow Operation, (3) Measures related to Induced Development, and (4) Measures to Rectify Impacts.

The Fish and Wildlife Service was requested by the St. Louis District Corps of Engineers to assist them in evaluating the potential benefits to fish and wildlife resources resulting from the avoid and minimize measures. Initially, the desire was to quantify the A&M measures in some fashion, but it became apparent that this would require a much more significant level of effort. An avoid and minimize team of biologists and planners from the Corps of Engineers, US Coast Guard, Missouri Department of Conservation, Illinois Department of Conservation, Fish and Wildlife Service, and Illinois Natural History Survey was organized to perform the evaluation.

II. PURPOSE

The primary purpose of this evaluation is to review the current list of A&M measures and recommend those with the highest potential natural resource benefits for immediate implementation or further study. Based on existing resource information and professional judgement, the avoid and minimize team will also estimate the relative benefits of selected measures for a with and without project condition.

III. EVALUATION METHODOLOGY

It would be highly desirable in the Corps' planning efforts if the fish and wildlife benefits of the recommended avoid and minimize measures could be evaluated using a traditional cost benefit analysis. Justification for implementing those measures that met the 1:1 ratio would be simplified. However, this has been tried for similar natural resource enhancement efforts such as the Upper Mississippi River Environmental Management Program (EMP) habitat enhancement projects with limited success.

For EMP projects, the evaluation/comparison of fish and wildlife enhancement features is based on a comparison of average annual habitat units (Habitat Units = Acres X Habitat Suitability Index) to the average annual dollar cost of the enhancement feature. Project features having the lowest dollar cost per habitat unit are theoretically the best investment. The avoid and minimize team considered using the same evaluation methodology for the A&M measures. The team concluded that this technique could not be used for two reasons: (1) several of the A&M measures involved non-construction items where benefits to natural resources would be indirect only (i.e. enforce 9-foot maximum draft in main channel), and (2) a lack of site specific information both in terms of project designs and natural resources. At this time there are no site specific design alternatives for most of these measures.

The manner in which each of the avoid and minimize measures could potentially benefit resources is so dissimilar that a one to one comparison appears impossible. Some measures benefit resources directly through their implementation or construction, others provide benefits through reduction of the risk of impacts to existing resources. This makes comparison and prioritization among the measures difficult. For instance how do you compare off-bankline revetment (A-17) to enforcement of a 9-foot draft for barges (A-6)? Off-bankline revetment can directly increase the production of fish and wildlife resources, which can be quantitatively measured by biological sampling programs. Instituting a 9-foot draft limitation would not directly increase any resources, rather it reduces the risk of impact to existing resources. For this reason the team found it practically impossible to prioritize measures based on their benefits to natural resources alone. This is why all 43 measures could not be ranked from the least to most desirable.

If one is to ultimately quantify the natural resource benefits of a particular A&M measure, the "without A&M condition" should be compared to the "with A&M condition" in place. In addition, the "without navigation" condition (which consists of current traffic levels plus any increases not due to the second lock) must also be compared to the "with navigation" condition (which includes future traffic increases from the second lock), if navigation

specific impacts on a given site's resources are to be quantified. This second comparison is necessary if the benefits of avoid and minimize measures are to be "credited" against navigation impacts, since navigation impacts may be inconsequential at a given site compared to other factors (natural or man induced).

All of these unknowns led the team to conclude that a defensible prioritization and quantification of all 43 measures could not be completed at this time. In order to complete a meaningful evaluation of the proposed measures the group made some assumptions: (1) navigation activities are impacting riverine resources, (2) the avoid and minimize measures can be compared based on their predicted benefit to a variety of important resources.

The team decided that the best approach would be to develop a set of evaluation criteria that would subjectively compare how well each A&M measure could enhance/mitigate certain fish and wildlife resources. In essence we were evaluating how well a given measure would benefit a range of natural resource parameters and characteristics. Those avoid and minimize measures that would benefit the most resource categories would therefore rank the highest. Each criteria was assigned a maximum point value. Each A&M measure was then assigned points according to how well it met the criteria. The criteria used for this evaluation was based on those used for evaluating the EMP habitat enhancement projects. Some additions and deletions were made to those criteria to suit the nature of the avoid and minimize measures. In addition to judging the avoid and minimize measures against the criteria, each measure was judged according to whether or not it could be quantitatively evaluated. The team identified those measures whose natural resource benefits could be quantitatively evaluated when more specific design and project location data are available.

A&M measures were evaluated using a matrix format. All measures in the matrix were evaluated without regard to specific UMR locations. A&M measures evaluated in Appendices B and C were based on more specific locations. Point values for each criteria for each measure were assigned by team consensus. Points for each measure were then totaled.

Avoid and Minimize Evaluation Criteria

A&M measures were assessed according to how much they would benefit the following natural resource factors. Point values ranged from a high of 3 points down to -3 points for adverse impacts.

1. (0-3) Benefits Threatened or Endangered Species: Rating 3 - Directly benefits existing populations of State or Federal

endangered species by creating or enhancing essential habitat.

Rating 2 - Indirectly benefits existing populations of endangered or threatened species (i.e., an action decreases potential threats to a population or its habitat).

Rating 1 - Actions provides questionable benefits to existing endangered species or creates habitat that could potentially be colonized by endangered species.

Rating 0 - No potential value to endangered species.

2. (0-3) Fishery benefits: Rating 3 - Direct fishery benefits as a major project purpose including rehabilitation of a backwater through increasing flow or depth and/or placement of fish habitat improvement structures.

Rating 2 - Significant improvements to water quality, enabling spawning or prolonging nursery or over-wintering benefits.

Rating 1 - Some improvements to fish habitat by placing rip-rap or fish structures, etc.

Rating 0 - No fishery benefits, no improvement of water quality (i.e., a levee improvement project which will not reduce flood frequency or increase the interior depth through dredging for borrow).

3. (0-3) Wildlife benefits: Rating 3 - Direct wildlife benefits as a major project purpose including creation of wildlife habitat or intensive management.

Rating 2 - Significant improvements to wildlife habitat including increasing the food base or prolonging the life of an area.

Rating 1 - Some wildlife benefits as in increased water clarity and therefore, an increase in aquatic vegetation as waterfowl food source.

Rating 0 - No wildlife benefits (no examples).

4. (0-3) Innovative/experimental: Innovative measures were rated higher because of the potential to provide new habitat types or conditions that may not currently exist. Rating 3 - A very innovative idea (i.e. bendway weirs).

Rating 2 - Some innovative ideas involved in the development of the project.

Rating 1 - Some small attempt at a new idea.

Rating 0 - Tried and true (no examples).

5. (0-3) Longevity (Long-term benefits): Rating 3 - One of the project purposes is to prolong habitat productivity.

   Rating 2 - Project is not completely protected, but project will extend habitat productivity to some degree.

   Rating 1 - Not expected to last too long beyond natural conditions.

   Rating 0 - Not worth the trouble (no examples).

6. (0-3) Maintenance: Rating 3 - Very little maintenance required.

   Rating 2 - Some maintenance required.

   Rating 1 - Regular maintenance required (no examples).

   Rating 0 - Heavy maintenance requirements (no examples).

7. (0-3) Habitat diversity: Rating 3 - Major increase in habitat diversity as in flooding a farm field to create a wetland.

   Rating 2 - Significant increase in habitat diversity such as dredging out potholes in shallow waters or possibly creating islands.

   Rating 1 - Some increase in habitat diversity as in planting mast producers or putting up wood duck boxes.

   Rating 0 - No increase in habitat diversity (no examples).

8. [0-(-3)] Adverse Impacts: Rating 3 Severe adverse impacts resulting from project construction (no examples).

   Rating 2 - Adverse impacts expected. These may result from such things as altered hydraulics which may actually increase sedimentation rate.

   Rating 1 - Some adverse impacts, may be due to difficulty in dredged material disposal or encroachment into wetlands from levee building.

   Rating 0 - No significant adverse impacts.

9. Water Quality: Rating 3 - Directly improves water quality increasing dissolved oxygen, decreases turbidity (i.e., reduces bank erosion or substrate scouring by boats), or creates off channel deepwater areas.

   Rating 2 - Indirectly improves water quality (i.e., reduced dredging requirements would decrease effluent discharges).

   Rating 1 - Would provide minimal or questionable benefits to water quality improvement.

   Rating 0 - No improvement to water quality.

IV. RESULTS

Results of the group evaluation for individual measures are shown in Appendix A. Out of the original 43 measures, the team could only apply the matrix criteria to 12 (see Appendix A). Assigning matrix values to the other 31 measures proved futile in many cases because their benefit value relies on a variety of unpredictable circumstances that were impossible for this group to evaluate. The un-ranked measures generally fell into 2 categories loosely labeled either "Good Resource Management" practices or "Risk Avoidance". Good Management practices are those non-construction measures that could potentially be implemented with little monetary investment other than the man-hours needed to implement them. Implementation of "risk avoidance" measures often requires voluntary compliance on someone's part, tow boat pilots in particular. The degree of benefits to natural resources would depend upon the degree of compliance with a given recommendation. Risk avoidance measures would reduce the frequency of occurrence of chemical spills, channel dredging, and other activities or events that would directly or indirectly cause aquatic impacts. Some risk avoidance measures could potentially be quantified if the magnitude of that risk reduction could be determined (i.e. how many spills at a given location would be avoided over a period of time). Measures were evaluated in the matrix without respect to the specific authorities needed to implement them. Changes in authorities, regulations, etc. beyond the current A&M authority may be needed to achieve the full benefits indicated in the matrix.

Quantifiable Measures - The team was able to evaluate the following 12 measures against the matrix criteria. The total possible points was 24. The measures with the higher point totals do not necessarily rank higher in terms of total natural resource benefits generated. This cannot be determined without site specific information and application of some habitat quantification methodology. Rather it indicates those measures with the highest potential to enhance a wide range of resources. In addition the team felt the fish and wildlife benefits of these measures could be quantified in some fashion when more specific information regarding design and location was available.

QUANTIFIED MEASURES

AVOID & MINIMIZE MEASURE	POINT VALUE
A-17 Off Bank-Line Revetment	19
A-16 Dike Modification	17
D-1 Shoreline Protection in highly erodible areas	17
D-2 Build Diversion Structures to reduce sediment to backwaters	17
D-3 Construct Barrier Islands to Reduce Wave Impact	17
D-4 Modify Wing Dikes to Reduce Accretion	17
A-11 Reduced Open Water Disposal Wetland Creation	15
A-3 Designate Lock Approach Waiting Areas	13
A-19 Construct Bendway Weirs	13
A-10 Reduce Open Water Disposal Create recreation beaches	12
B-8 Develop Non-structural Alternatives To Reduce Waiting Lines	12
A-13 Thalweg Placement of Dredged Material	7

The following measures were identified by the team as being measures that would benefit natural resources, but would be difficult to quantify or determine which natural resource elements would benefit most. The team thought that these measures should be implemented simply because it is good management.

GOOD MANAGEMENT PRACTICE

A-1	Reduce Navigation in Sensitive Areas
A-4	Monitor Channel Depth More Frequently
A-14	Comprehensive Information Program
A-20	Continue the Dredged Material Placement Team
B-2	Reduce Speed in Sensitive Areas
B-4	Passing & Meeting Regulations in Sensitive Areas
C-1	Require Contingency Plans at Terminals and Cargo Handling Facilities
C-2	Strategically Locate Pollution Response Equipment Throughout the UMRS
C-3	Require All Fleeting to be Located at Mooring Cells, Deadmen Anchors, in Accordance With Appropriate Permits
C-4	Designate No Fleeting in Sensitive Resource Areas or in Unpermitted Areas

The following discussion regarding each avoid and minimize measure is based on the team's discussion of these items with regard to: (1) their ability to be quantified in terms of natural resource benefits and (2) practicality and effectiveness. The biological rationale for these items has already been described in the Supplemental Draft Coordination Act Report prepared in July 1987.

A-1 Reduce Channel in Biologically Sensitive Areas - The location of sensitive river resources undoubtedly changes over a period of time. Attempting to protect biologically sensitive areas through channel marking is probably impractical. To be effective this measure requires cooperation by tow boat operators. Attempting to enforce compliance by setting arbitrary channel limits would be an enforcement problem (who's watching the river enough to be effective?) and it promotes an antagonistic attitude between resource and navigation interests. This measure could also require a full-time effort to reset buoys etc. every time a new sensitive area is identified or an old one removed. A very sensitive location one year (or season) may not be sensitive next year. The group recommended an alternative approach in solving this problem. A more practical and desirable modification of this measure would be to include all sensitive areas in the "Resource Alert" handouts given to pilots at opportune locations such as the navigation locks. This will be updated by the A&M Team. In addition it also makes the navigation interests a partner in protecting the resource which is probably more effective in the long term than trying to enforce compliance.

Fish and wildlife benefits from this measure would be particularly difficult to quantify at any given time. Benefits would probably be unmeasurable in any given year but would be cumulative over time. This measure falls under the heading of "Good Resource Management Practice" and should be implemented regardless of its benefits.

A-2 Implement Monetary Fines for Navigation Outside Marked Channels, During Hazardous Conditions - This measure is already essentially in effect. Groundings and other incidents are already required to be reported to the Coast Guard. In severe cases, pilots risk loss of their license for failure to comply. This is probably even more of an incentive than monetary fines. Fish and wildlife benefits from any additional measures would be indirect due to decreased incidents of spills, groundings, resource harassment,etc.

A-3 Designate Lock Approach Waiting Areas or Provide Special Mooring Sites - Designated mooring areas can provide significant site specific benefits to both aquatic resources and navigation interests. Calculation of benefits for this measure can be made directly once specific locations are determined. All waiting areas should be examined for the presence (or potential) of significant resources, and if present, investigated for alternative waiting areas to alleviate those impacts. Appendix B of the Supplemental Draft CAR lists 8 potential locations for this measure. This list should be updated.

A-4 Monitor Channel Depth More Frequently in Problem Areas - According to the Corps of Engineers, this measure is already ongoing. More frequent monitoring of the channel may eliminate unnecessary dredging or reduce dredging by locating problem areas before groundings occur. Benefits to resources would be indirect because of reduced dredging frequency and impacts associated with grounded tows. This measure could potentially be quantified if a risk analysis could predict how much dredging requirements and groundings would be reduced.

A-5 Limit and/or Close Navigation Based on Water Stage, Ice Condition, Level of Turbidity - This is a safety issue where benefits to resources would result primarily from reduced risk of accidents during dangerous water conditions (ice, flood, etc.). Impacts to aquatic resources from ice build-up, scouring, etc. would also be reduced. Developing firm criteria for closing the channel may be impractical and unenforceable. For example, setting a thickness of ice probably could not be done because ice thickness varies considerably from pool to pool. In addition prohibiting navigation could lead to greater impacts if tows are forced to overwinter on the river. Quantification is potentially possible if a risk analysis can predict the reduction in stranded tows, accidents, spills, etc.

A-6 Enforce a 9 Foot Draft in the Channel - Benefits to resources would be indirect due to decreased number of groundings, spills, etc. Quantification is possible if a risk analysis can show decreases in numbers of tow incidents such as groundings, accidents, or decreased dredging frequency. The practicality of such a measure is also questionable. Legislation is likely needed to enforce a mandatory nine-foot draft limit. A risk analysis would probably give some basis for a quantitative analysis. Additional benefits would come from decreased scouring of the river bottom. This could probably be quantified also but could require such an exhaustive effort to make its measurement questionable. The frequency of overdrafting would have to be calculated along with representative stretches of river. Next, one would have to compare the physical effects of overloaded fleets to those which are not overloaded to a wide variety of water depths.

The team strongly endorsed this measure in spite of the implementation and enforcement problems. The team also noted that there appears to be strong economic incentives for this measure because of the significant dollar cost to navigation interests when a channel closure results from an overloaded fleet of barges.

A-7 Restrict Traffic Until Buoys are in Place at Start of Towing Season - Implementation and enforcement of this measure would be difficult. Indirect benefits to fish and wildlife resources would result from a decreased frequency of tow incidents such as groundings, collisions, spills, etc. Quantifying benefits would be impossible without a risk analysis to estimate the number and kind of impact producing incidents that would be prevented.

A-8 Correct Bridge Design Deficiencies - This measure is already being implemented by the Coast Guard. Benefits to fish and wildlife resources would be directly related to the number of tow accidents, spills, etc. that would be avoided.

A-9 Improve COE Lock Approaches to Avoid Hazards - The St. Louis District is already implementing this measure. Benefits to natural resources would be indirect and not easily quantifiable. Benefits could be determined if a risk analysis could show the number of accidents prevented and associated impacts.

A-10 Reduce Open Water Dredged Material Disposal-Create Recreation Beaches - The team recommended that the reference to beach creation be deleted so that the measure was concerned solely with the elimination of open water disposal. Compared to other measures, the team felt that given a number of open water disposal events, a quantification of benefits such as performed for EMP habitat projects was possible.

A-11 Reduce Open Water Dredged Material Disposal-Create Wetlands - Same as A-10. This measure could be combined with A-10.

A-12 Side Channel Dredging-Create Wetlands - The team recommended that this measure be deleted because it appears to be a compensation measure rather than avoidance of navigation impacts.

A-13 Thalweg Disposal of Dredged Material - Proper placement of dredged material in the river thalweg would directly benefit fish and wildlife resource through the avoidance of impacts to other riverine habitats. These would have to be measured on a case by case basis.

A-14 Comprehensive Information Program - Educational materials that would sensitize navigation interests to specific sensitive areas and damaging activities would provide indirect and unquantifiable benefits.

A-15 Install Lock Guidewall Extensions on Selected UMR Locks - This measure would have the same benefits as A-9 and should be combined with that measure.

A-16 Continue Dike Configuration Studies - The team recommended that this measure should be reworded to read "Dike Modification". Benefits from dike modification could be calculated similar to the manner they are currently done for EMP habitat projects. This measure could significantly enhance fish and benthic resources.

A-17 Field Design and Research-Revetment Placement on Islands - The team recommended that this measure should be reworded to read "Off-Bank Line Revetment." The team felt that this measure has the potential to produce significant direct benefits to riverine resources (see more detailed discussion in Appendix C).

A-18 Establish Stable Thalweg Line with Minimal Regulation Works - The team recommended that this measure be deleted. Any resource benefits gained from reduced dredging could be exceeded by long term impacts generated from a too stable thalweg (i.e. Missouri River). Most components considered under this measure can be included with other measure.

A-19 Construct Bendway Weirs - Bendway weirs can potentially generate significant benefits to main channel aquatic resources, in much the same way that wing-dikes already contribute to UMR fishery resources. Benefits from bendway weirs could be quantified given specific locations and design (see more detailed discussion in Appendix B).

A-20 The Dredged Material Placement Team - This measure probably cannot be quantified or measured in any manner. The Dredged Material Placement Team should continue as a matter of good management practice among the resource agencies. In the long-term, natural resources will benefit from the timely coordination of dredging related matters.

B-1 Improve Tow and/or Barge Design - This measure is probably not quantifiable. Equipment innovations, such as Kort nozzles and double hulls, should be strongly encouraged. Future design studies in this regard should be implemented voluntarily by the navigation industry as partners in wise stewardship of our riverine environment.

B-2 Reduce Speed in Sensitive Areas - This measure should be combined with A-1 and accomplished in a similar manner through resource alerts. Enforcement through policing is probably impractical.

B-3 Limit Towboat Horsepower to 4,500 above L&D 26 - This measure is impractical and would probably provide minimal benefits. Safety concerns probably exceed potential natural resource benefits. The team recommended elimination of this measure.

B-4 Passing and Meeting Regulations in Sensitive Areas - This measure is similar to A-1 and B-2 and should be implemented through resource alerts, etc.

B-5 Employ a Gradual Increase in Power When Leaving The Lock - This measure is impractical and unenforceable. Safety concerns probably far exceed resource benefits. The team recommended that this measure be deleted.

B-6 Reduce Draft in Critical Periods - This measure is impractical and likely unenforceable. To some degree it would be self-regulating. During low water periods, tows would be much less likely to stray into any sensitive off-channel locations. This measure should be eliminated.

B-7 Reduce Tow Size in Critical Periods - This measure is probably impractical and unenforceable. To some degree this is already in effect. During recent droughts in the open river portion of the UMR, tows were reduced in size to meet reduced channel dimensions. This measure should be eliminated.

B-8 Develop Non-Structural Alternatives to Reduce Waiting - Alternative schemes to implement this measure should be investigated. This might include such alternatives such as assigning lock priorities farther in advance to allow boats to adjust travel time to coincide more closely with their turn to lock through. Once waiting areas are identified, benefits to

aquatic resources can probably be quantified based on the reduced physical impacts that would occur.

B-9 Accomplish Design Study of Barge Couplings - The team was somewhat confused about the nature of this measure, although it seems related to the break-up of barges from tows during groundings, collisions, etc. Benefits to fish and wildlife resources are related to risk reduction of spills, etc. and are not easily measured.

C-1 Require Contingency Plans at Terminals and Cargo Facilities - This measure is already being implemented by the Coast Guard. There are definite benefits to fish and wildlife resources from the increased ability of facilities to quickly contain and clean-up chemical spills etc. Benefits might be difficult to quantify even with risk analysis.

C-2 Strategically Locate Pollution Response Equipment Throughout UMR - This is already being implemented by the Coast Guard. Benefits would be similar to C-1.

C-3 Require all Fleeting to be Located at Mooring Cells, Deadmen, Anchors, and/or in Accordance With Appropriate Permits - This measure has already been implemented to some extent. Enforcement is a significant problem. This measure should be implemented as a matter of good management and through the existing permit system. Benefits to resources could be measured in site specific locations where undesired fleeting is occurring. This measure could generate significant benefits to terrestrial and aquatic resources.

C-4 Designate No Fleeting in Sensitive Areas - This measure is similar to C-3 and could be combined with it.

C-5 Where Unregulated, Establish Fleeting Regulations that Take Environmental Planning into Account - This measure should be combined with C-3.

C-6 Complete Waterfront Development Plans in Urban Areas - Benefits to natural resources are indirect and unmeasurable. The St. Louis District is already implementing such plans in urban areas. The team supports such planning because it will prevent the potentially haphazard development of natural resources. This measure and the following 4 could provide significant long-term benefits to multiple river resources. Good land-use planning helps eliminate haphazard development which decreases the effectiveness of both resource protection and commercial development.

C-7 Complete Shoreline Management Plans - Benefits to natural resources are long-term and indirect. Implementation of such measures (including C-6) have the potential to avoid an

accumulation of navigation development impacts over time. The team endorsed such planning as a good management practical that should be accomplished quickly.

C-8 Revise Navigation Pools Master Plans - Benefits to resources are similar to C-6 and C-7. The team endorsed the measure because of potential long-term benefits.

C-9 Develop a Master Plan for Resource Management of Pool 27 Lands and Waters - Benefits are similar to the previous three measures. The team endorsed this measure for its long-term benefits to resources.

C-10 Develop Detailed Operational Management Plans for All Lands and Waters under Riverlands Jurisdiction - This measure is already being implemented by the St. Louis District and is endorsed by the team.

D-1 Shoreline Protection in Highly Erodible Areas to Minimize Erosion and Enhance Fish and Wildlife Habitat - Benefits are similar to A-16 and A-17. Benefits to aquatic resources would be direct and quantifiable. As for similar measures, the type and quantity of benefits would be site specific. There is the potential for adverse impacts due to habitat trade-offs. Excessive shoreline protection along some reaches of river can also have cumulative adverse effects due to elimination of the natural shoreline.

D-2 Build Diversion Structures to Reduce Sediment Input Into Backwaters - Benefits to resources could be significant depending upon the particular location. Benefits could also be quantified on a site-specific basis. However, justifying this as an avoid and minimize measure attributable solely to tow operation and other navigation development could be difficult. Most sediment entering a backwater is probably not due to any navigation related activity. Designing an alternative that would avoid or minimize only navigation related sediment contributions may be difficult. For this reason it may be more appropriate to consider this action as a potential enhancement or mitigation measure rather than "avoid and minimize".

D-3 Construct Barrier Islands to Reduce Wave Impact of Off-Channel Areas - Benefits to fish and wildlife resources are potentially quantifiable as in D-2. As in D-2 however, separating enhancement benefits from avoid and minimize benefits would be difficult. The completion of the POS physical effects studies should provide information on the apportioning of such benefits.

D-4 Modify Wing Dikes to Reduce Accretion - This measure is similar to A-16 and should be combined or eliminated.

V. ESTIMATED RELATIVE BENEFITS OF SELECTED AVOID AND MINIMIZE MEASURES

For three of the 43 measures, a subjective quantitative evaluation was attempted. This was done to illustrate the potential complexity in conducting a more extensive quantification of their benefits and to demonstrate two possible approaches to quantifying benefits: (1) through a habitat analysis evaluation such as that done for Environmental Management Program projects and (2) estimating change in a resource's population based on an ongoing fishery investigation.

Measures A-3 (Designate Lock Approach Waiting Areas) and A-19 (Construction of Bendway Weirs) were subjectively evaluated on a Habitat Suitability Index (HSI) scale of 1 - 10. Using some gross assumptions, it was estimated that roughly 70 acres in a "typical pool" might be impacted by waiting tows. On a scale of 1 - 10, the existing habitat rates a 3. With measure A-3 in place, it is estimated that the habitat value would more than double to 7. Appendix B discusses this in more detail.

Major bendways of the open river section of the UMR are an extremely unstable environment for aquatic organisms. Under existing conditions they are estimated to rate a 1 on the HSI scale. Previous fish investigations estimate that the standing stock of fish in such environments is less than 100 pounds per acre. With the construction of bendway weirs it is estimated that the HSI value might increase to 7. Based on fish surveys conducted in similar type habitats such as wing-dikes, the standing fish stock could increase up to 500 pounds per acre. Appendix B discusses this in more detail.

The Illinois Department of Conservation has been investigating the effect of off-bankline revetment (Avoid and Minimize Measure A-17) on fish populations. Preliminary results of this investigation are presented in Appendix C. In terms of benefits to the fishery resource alone, the preliminary results show that the estimated monetary value of the fish population at an off-bankline revetment site increased 2.14 times compared to that at a conventional bank revetment.

VI. DISCUSSION

Appendix B of the Fish and Wildlife Service Supplemental Draft Coordination Act Report July 1987 for the Second Lock was the first and most recent documentation regarding the fish and wildlife benefits of A&M measures. The biological rationale given in that report remains valid for most of the recommended measures still in the current list.

Few of the A&M measures have yet been defined in a manner that lends itself to evaluation. For most measures the description

consists of only a brief general narrative lacking specifics on design or an implementation strategy. This has caused considerable difficulty in attempting to evaluate/quantify natural resource benefits. For example, in Appendix B of the Service's 1987 Supplemental Draft CAR, a discussion of measure D-1 (Protect shorelines in highly erodible areas...) identifies 37 reaches of river where protection is needed. However, the significance of fish and wildlife resources at these locations is mostly unknown. Undoubtedly only a few are significant enough to warrant remedial actions such as rip-rap or possible channel realignment.

It is probably impossible to compare those measures labeled "risk avoidance" against those which can be quantified such as off-bankline revetments. All the directly quantifiable measures that could be built or implemented would probably not approach the actual compensation needed for a major chemical spill, which could have been avoided by implementation of a measure concerned with tow operation and safety.

The variety of locations and differences in resource significance make it very difficult to evaluate or quantify the overall fish and wildlife value of a "generic" measure without considering specific riverine locations. This becomes even more important if these actions are to be considered as mitigation for current or future navigation impacts. An accounting of fish and wildlife benefits on a site by site basis seems necessary if benefits are to be credited against measurable navigation impacts.

VII. CONCLUSIONS AND RECOMMENDATIONS

The intended purpose of this report was to evaluate and prioritize the current list of 43 measures to avoid and minimize navigation impacts to UMR natural resources. The avoid and minimize evaluation team concluded that using existing information and evaluation techniques it was not possible to perform an objective analysis for all 43 measures. The manner in which these measures benefit natural resources does not lend itself to a one to one comparison of the recommended measures. Twelve of the measures were ranked according to their ability to benefit the widest range of Upper Mississippi River natural resources. To determine which measures would provide the most fish and wildlife benefits per dollar cost, the team concluded that this could only be accomplished on a site by site basis. The team also concluded that it is possible to quantify the fish and wildlife benefits for at least 12 of the measures given sufficient site specific information and project design information. The team recommended that measures which could not be scored in the matrix should be implemented not on the basis of their demonstrated or quantified benefits, but because they are prudent and logical components of any good natural resource management program.

In order to establish a rank or priority for the list of 43 it is recommended that an evaluation and monitoring program similar to that now in place for the Upper Mississippi River Environmental Management Program should be implemented. Site specific A&M measures should be identified first. This initial list should then be screened by an interagency team of biologists to identify those measures and locations anticipated to return the highest benefit. Similar to EMP habitat enhancement projects, comparing the dollar cost against the fish and wildlife benefits (for those measures identified as having quantifiable benefits) could then be performed. Projects with "acceptable" cost versus benefits should be constructed and monitored.

Monitoring is also extremely critical. Undoubtedly these same measures may be considered a second time in the combined navigation improvement study now underway in all 3 UMR Corps of Engineer Districts. An analysis of their effectiveness should be completed before they are considered again.

APPENDIX A

AVOID AND MINIMIZE EVALUATION MATRIX

	CRITERIA FOR AVOID AND MINIMIZE MEASURES										COMMENTS
	Benefits Endangered or Threatened Species	Fishery Benefits	Wildlife Benefits	Innovative/Unique	Will Provide Long-Term Benefits	Maintenance	Habitat Diversity	Adverse Impacts	Water Quality	Benefits could potentially be measured Quantitatively	
Avoid & Minimize Measures Group A	0-3	0-3	0-3	0-3	0-3	0-3	0-3	0-(-3)	0-3	YES or NO	
1. Reduce Navigation in sensitive areas.			GOOD MANAGEMENT PRACTICE							NO	Implement by Resource Alerts
2. Implement fines for navigating outside channel.										NO	Essentially already in place with existing regulations
3. Designate lock approach waiting areas.	3	2	1	2	3	1	0	0	1	YES	
4. Monitor channel depth more frequently.			GOOD MANAGEMENT PRACTICE							NO	Ongoing
5. Limit/or close navigation based on conditions.			RISK AVOIDANCE - INDIRECT BENEFITS							NO	Not Practical
6. Enforce maximum 9-foot draft in channel.			RISK AVOIDANCE - INDIRECT BENEFITS							NO	May require new Legislation

Avoid & Minimize Measures Group A	END SP 0-3	FISH0 -3	WLDLF 0-3	UNIQUE 0-3	LONG-TERM 0-3	MAINT 0-3	DIVERSITY 0-3	ADVERSE IMPACT 0-(-3)	WATER QUALITY 0-3	YES or NO	
7. Restrict Traffic until buoys are in place at start of towing season.			RISK AVOIDANCE AND GOOD MANAGEMENT							NO	Indirect benefits may be impractical
8. Correct bridge design deficiencies.											Ongoing by Coast Guard
9. Improve CE lock approach to avoid hazards.			RISK AVOIDANCE							NO	Needs Risk Analysis
10. Reduce open water dredge material disposal-create recreation beaches.	1	2	1	0	1	3	2	-1	3	YES	Eliminate "create beaches"
11. Reduce open water dredge material disposal-wetlands creation.	1	3	3	2	2	1	3	-1	1	YES	
12. Side channel dredging/create wetlands.										NO	No apparent connection to A&M
13. Thalweg placement of dredge material.	2	1	0	1	1	3	0	-1	0	YES	
14. Comprehensive information program.			GOOD MANAGEMENT PRACTICE							NO	
15. Install lock guidewall extensions on selected UMR locks.			RISK AVOIDANCE								Needs Risk Analysis

Avoid & Minimize Measures Group A	END SP 0-3	FISH 0-3	WLDLF 0-3	UNIQUE 0-3	LONG-TERM 0-3	MAINT 0-3	DIVERSITY 0-3	ADVERSE IMPACT 0-(-3)	WATER QUALITY 0-3	YES or NO	
16. Continue dike modification (i.e., Bullnose or Pharrs I, notched dikes) and environmental studies.	2	3	1	3	3	2	3	-1	1	YES	Change "configuration" to "modification"
17. Off bank revetment placement on islands.	1	3	3	2	3	3	3	0	1	YES	Reword to "off-bank line revetment"
18. Establish stable Thalweg line with minimal regulation works.										NO	May cause more F&W impacts. Recommend deletion
19. Construct bendway weirs.	1	2	0	3	3	3	2	-1	0	YES	
20. The dredge material placement team - continuing effort.				GOOD MANAGEMENT PRACTICE							Benefits similar to A-10 & A-11
Avoid & Minimize Measures Group B	END SP 0-3	FISH 0-3	WLDLF 0-3	UNIQUE 0-3	LONG-TERM 0-3	MAINT 0-3	DIVERSITY 0-3	ADVERSE IMPACT 0-(-3)	WATER QUALITY 0-3	YES or NO	
1. Improve tow and/or barge design.										NO	Ongoing to an extent
2. Reduce speed in sensitive areas.				GOOD MANAGEMENT PRACTICE						NO	Similar to A-1 - delete
3. Limit horsepower to 4,500 above L&D 26.										NO	Not practical - delete
4. Passing & meeting regulations in sensitive areas.				GOOD MANAGEMENT PRACTICE						NO	Already in place - Safety takes precedence

Avoid & Minimize Measures Group B	END SP 0-3	FISH0 -3	WLDLF 0-3	UNIQUE 0-3	LONG-TERM 0-3	MAINT 0-3	DIVERSITY 0-3	ADVERSE IMPACT 0-(-3)	WATER QUALITY 0-3	YES or NO	
5. Employ a gradual increase in power when leaving lock.										NO	Safety takes precedence - not practical in most cases
6. Reduce draft in critical periods.										NO	Safety takes precedence - not practical in most cases
7. Reduce tow size in critical periods.										NO	Safety takes precedence - not practical in most cases
8. Develop non-structural alternative to reduce waiting lines.	2	1	1	3	2	2	0	0	1	YES	Indirect benefits
9. Accomplish design study of barge couplings.										NO	Fail to see F&W benefits
Avoid & Minimize Measures Group C	END SP 0-3	FISH0 -3	WLDLF 0-3	UNIQUE 0-3	LONG-TERM 0-3	MAINT 0-3	DIVERSITY 0-3	ADVERSE IMPACT 0-(-3)	WATER QUALITY 0-3	YES or NO	
1. Require contingency plans at terminals and cargo handling facilities.			GOOD MANAGEMENT PRACTICE							NO	Required now! CG has these facilities
2. Strategically locate pollution response equipment throughout the UMRS.			GOOD MANAGEMENT PRACTICE							NO	Region Response Team of C.G. is now doing this in some locations
3. Require all fleeting to be located at mooring cells, deadmen, anchors, and/or in accordance with appropriate permits.			GOOD MANAGEMENT PRACTICE							NO	Ongoing

Avoid & Minimize Measures Group C	END SP 0-3	FISH 0-3	WLDLF 0-3	UNIQUE 0-3	LONG-TERM 0-3	MAINT 0-3	DIVERSITY 0-3	ADVERSE IMPACT 0-(-3)	WATER QUALITY 0-3	YES or NO	
4. Designate no fleeting in sensitive resource areas or in unpermitted areas.				GOOD MANAGEMENT PRACTICE						NO	
5. Where unregulated, establish fleeting regulations that take environmental planning into account.										NO	Combine with C-3
6. Complete waterfront development plans in urban areas.										NO	Combine with C-7 to C-10
7. Complete shoreline management plans.										NO	Ongoing by St. Louis District
8. Revise navigation pools Master Plans.										NO	Ongoing
9. Develop a Master Plan for resource management of Pool 27 lands and waters.										NO	Ongoing
10. Develop detailed operational management plans for all lands and waters under riverlands jurisdiction.										NO	Ongoing

Avoid & Minimize Measures Group D	END SP 0-3	FISH0 -3	WLDLF 0-3	UNIQUE 0-3	LONG-TERM 0-3	MAINT 0-3	DIVERSITY 0-3	ADVERSE IMPACT 0-(-3)	WATER QUALITY 0-3	YES or NO	
1. Shoreline protection in highly erodible areas to minimize erosion and enhance fish and wildlife habitat.	2	3	1	3	3	2	3	-1	1	YES	Benefits similar to A-16, A17
2. Build diversion structures to reduce sediment input into backwater.	2	3	1	3	3	2	3	-1	1	YES	Benefits similar to A-16, A17
3. Construct barrier islands to reduce wave impact to off-channel areas.	2	3	1	3	3	2	3	-1	1	YES	Benefits similar to A-16, A17
4. Modify wing dikes to reduce accretion.	2	3	1	3	3	2	3	-1	1	YES	Benefits similar to A-16

APPENDIX B

AN EVALUATION OF DESIGNATED LOCK APPROACH WAITING AREAS AND BENDWAY WEIRS

prepared by

Norm Stucky and Gordon Farabee
Missouri Department of Conservation

APPENDIX B

A.3 DESIGNATE LOCK APPROACH WAITING AREAS

A. Physical Conditions Without Waiting Areas:

- Impacts to main channel border:

Physical:

1. Prop wash generated high velocity and turbulence.
2. Increased erosion and bank instability.
3. Increase in turbidity.
4. Re-suspension of contaminants.

Biological:

1. Benthic organisms dislodged from substrate or crushed under barges.
2. Fish eggs, fry, and fingerlings subject to adverse physical forces.
3. Spawning disrupted by physical forces.
4. Aquatic habitat altered by physical forces.
5. Riparian timber destroyed by cables and chains.
6. Federally listed and endangered bald eagles adversely impacted by loss of roosting and perching habitat.

Assumptions:
It is assumed that approximately 70 acres of main channel border habitat per pool are impacted by random waiting and tie-off. This assumption is based on an average pool length of 30 miles and an average main channel border width of 100 feet.

Habitat Suitability Index: 3

It is our professional opinion as biologists that main channel border habitat is degraded by frequent (daily) waiting or tie-offs and would rank no higher than 3 on a suitability index scale of 1 to 10. We would expect impacted main channel border areas to have a relatively low standing crop of aquatic organisms.

B. Main Channel Border Conditions With Designated Waiting Areas:

Physical:

1. High velocity and turbulence caused by prop wash is eliminated.
2. Bankline stable, erosion reduced.
3. Increased water clarity due to absence of sediment re-suspension.

Biological:

1. Stable, productive benthic community.
2. Productive fish spawning and nursery habitat.
3. Stable aquatic habitat.
4. Riparian trees/vegetation not impacted by cables and chains.
5. Roosting/perching trees available for federally listed and endangered bald eagle.

Conclusions/Predictions:
Diversity and abundance of aquatic and terrestrial organisms inhabiting an estimated 70 acres per pool of main channel border habitat, including riparian timber, will increase significantly due to absence of physical forces associated with random tow waiting and tie-off.

Habitat Suitability Index: 7

It is our professional opinion as biologists that the absence of random tow waiting and tie-off will significantly improve the suitability of main channel border aquatic habitat. The standing crop of aquatic organisms could double. Response by terrestrial organisms is expected to be positive, though not quantifiable.

(A-19) CONSTRUCTION OF BENDWAY WEIRS

A. Physical Conditions Without Weirs:

- High velocity and turbulence on outside bend causing bank instability
- Unstable, moving bed load; benthic habitat lacking
- Sandbar encroaching on inside of bend
- Degradation occurring on outside of bend

Assumptions:
Shallow, low velocity water on inside of bend provides suitable habitat for minnows and perhaps some young-of-year fishes. Main channel is assumed to have very low standing crop of fishes due to moving bed load and lack of habitat (structure). High velocity and turbulence on outside bend creates marginal main channel border habitat.

Habitat Suitability Index: 1

It is our professional opinion as biologists that these habitat conditions would rank no higher than 1 on a suitability index scale of 1 to 10. We would expect a reach of river with these conditions to have a very low standing crop of fishes estimated to be less than 100 pounds per acre.

B. Physical Conditions With Weirs:

- High velocity and turbulence on outside bend has been redirected toward inside of bend.
- Unstable, moving bed load has been replaced with large rock substrate suitable for colonization by various aquatic organisms.
- Sandbar on inside of bend may be eroding during high flow conditions.
- Degradation no longer occurring on outside of bend.

Conclusions/Predictions:
Shallow, low velocity sandbar habitat on inside of bend may be degraded with increased erosive forces. Diversity and abundance of aquatic organisms inhabiting main channel will increase substantially due to habitat created by large rock substrate. Reduced velocity and turbulence on outside of bend will improve suitability of main channel border habitat for various aquatic organisms.

Habitat Suitability Index: 7

It is our professional opinion as biologists that bend-way weirs significantly improve aquatic habitat. It is assumed the standing crop of fishes in a reach of river with bendway weirs could be as high as 500 pounds per acre.

APPENDIX C

AN EVALUATION OF OFF-BANKLINE REVETMENT

prepared by

Butch Atwood
Illinois Department of Conservation

COMPARATIVE VALUE OF OFF-BANKLINE REVETMENT VS. CONVENTIONAL BANK REVETMENT TO FISHERIES RESOURCES IN THE MISSISSIPPI RIVER.

Introduction

Since the mid-1970's the St. Louis District COE, in cooperation with the USFWS and the states of Missouri and Illinois, has designed and constructed an innovative type of bank revetment of several locations within Pools 24-26 of the Mississippi River. Dubbed off-bankline revetment (OBR) by District river engineers, these structures are constructed of large grade stone (graded "A" stone). The stone is placed in the river between 15 and 30 meters from, and parallel to, the natural bankline. At selected locations, 15-30 meter wide notches are left in the structure which allows communication between the river and water behind the OBR. The top elevation of the structure is typically approximately 0.5 meters above "normal pool" elevation. The head end of the OBR is tied into the bankline, the foot end usually remains open to the river. Unlike the construction procedure for conventional stone revetment, the natural bankline is left undamaged by this construction technique.

The water area thus created behind these structures becomes a flowing backwater below the upstream-most notch and quite backwater from the uppermost notch and the head end of the structure. Three distinct habitat types are created with these structures: natural bankline, rock inside the OBR and rock on the river side of the OBR. Figure 1 shows an aerial view of OBR at Gosline and Crider Islands in Pool 24.

During the summer of 1991 the Illinois Department of Conservation and the St. Louis District began a study to evaluate the fisheries benefit of OBR. The data presented in this assessment were collected during the first six months (July - December, 1991) of this study at the Gosline Island study site and control site in Pool 24 (Figure 2). Another site in Pool 24 (Turner Landing site) is also being evaluated, but due to time constraints, these data were not included in this assessment.

Materials and Methods

Fish were collected via A.C. electrofishing (230V, 3000 & 4000 Watt generator, triple electrode configuration). Two 15 minute electrofishing runs each were made along the inside and outside (river side) of the OBR and along a control reach. These sites were sampled one time per month from July through December, 1991. (The 1992 sampling began in March and will be conducted through October.) The control reach was a conventionally reveted bankline with same sized stone as the OBR. After each 15 minute sampling segment fish were identified, measured for length, weighed and returned to the river. Fish were worked up some distance from the sampling site so as not to be recaptured in

subsequent sampling segments. Data were recorded on standard field forms. Fishes not readily identified in the field were preserved for later examination in the laboratory.

For this assessment all fish data collected during the reporting period (July-December, 1991) were pooled by sampling station (inside OBR, outside OBR and control). The data for each fish species were separated by size class. The number of fishes in each size class were tabulated (by sampling station). A monetary value was assigned to each size class of weight (whichever was applicable) by using the "Standard price list of fish for Illinois pollution fish kills (March 1983)" taken from the IDOC Manual of Operations. This price list was adapted from the "1982 Monetary Value of Freshwater Fish" prepared by the American Fisheries Society. Thus, an estimated value of all fish collected at each sampling station was obtained by multiplying the assigned price by the number of fishes in that particular size or the number of pounds of fish in the size class (whichever was applicable), and then summing over all size classes.

Results

During the reporting period a total of 2220 fishes representing 31 species were collected from the Gosline Island OBR and control sites. At the control site, 316 fishes of 20 species were collected; 694 fishes of 24 species were collected outside the OBR and 1210 fishes of 24 species were collected inside the OBR.

The estimated monetary value for fishes collected from the control site (conventionally revetted bankline) was $174.97 (Table 1). For outside OBR the value was $336.40 (Table 2) and the inside OBR value was $414.07 (Table 3), for a grand total of $750.47 for the OBR. However, since the control site received half as much sampling effort as did the inside and outside OBR combined, the estimated value for fishes at the control site was doubled ($349.94). In these terms, the value of the OBR to the fisheries resources was 2.14 times greater than that of the conventional revetment (large stone).

Discussion

It must be noted at the outset that these are only preliminary estimates of the relative value of the OBR to the conventional revetment. It must also be noted that the efficiency of electrofishing is not 100%, so that only a portion of the fish populations at each site was sampled.

Estimates of electrofishing efficiency from the fisheries literature range anywhere from 10 - 50% depending on type of water sampled (pond, lake, creek or river), water temperature, conductivity, water velocity, etc, etc. Therefore, no attempt was made here to expand the fish sampling data to a total

population estimate. The monetary values presented here should only be considered as a method to estimate the relative value of each habitat type.

Caution must be exercised in the interpretation of these data over the entire spectrum of habitat types available to fishes in the Mississippi River. The sampling efficiency of electrofishing was probably greater inside the OBR than outside or at the control reach because of shallower water depth and reduced current velocity. However, this probably increased efficiency may have been offset by a reduction in electrical field strength due to contact or near contact of electrodes with the substrate. Without more detailed investigations into the effects these various physical parameters have on electrofishing efficiency, there's no way to tell how reliable these data really are with respect to the relative value of one habitat type over another.

On the positive side, the data appear to indicate that more fish and more species of fish are utilizing the OBR than the conventionally revetted bankline. The size structure of fishes collected behind the OBR also appear to indicate that this habitat is a very important fish nursery area. It may also be an important spawning area for certain fish species, particularly centrarchids (sunfish), and may provide overwintering habitat for young of year fishes.

All things considered, the data presented herein represents a good 'first cut' estimate of the relative value of off-bankline revetment to fishes. As more data become available (fish sampling is scheduled to continue through 1993) and are analyzed in greater detail, much better estimates will be available.

Submitted by:
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Illinois Department of Conservation

Table 1. Price of fishes collected from revetted bankline (control site of off bankline revetment study).

species	size class	no. fish/ size class or no. lbs.	price/ size class or /lb.	total price
American eel	all	2.41	$5.00	$12.03
Bigmouth buffalo	10.0	2	$0.29	$0.58
	11.0	1	$0.34	$0.34
Black crappie	4.0	1	$0.48	$0.48
Bluegill	1.0	2	$0.20	$0.40
	2.0	5	$0.41	$2.05
	3.0	10	$0.47	$4.70
	4.0	8	$0.59	$4.72
	5.0	7	$0.69	$4.83
	6.0	13	$1.00	$13.00
	7.0	3	$1.10	$3.30
Bullhead minnow	all	4	$0.06	$0.24
Carp	over 11	92	$0.19	$17.48
Channel catfish	1.0	2	$0.04	$0.08
	13.0	2	$0.80	$1.60
	14.0	3	$1.00	$3.00
	15.0	1	$1.24	$1.24
	over 15	18	$1.24	$22.28
Carp x goldfish	all	1	$0.06	$0.06
Emerald shiner	all	1	$0.06	$0.06
Flathead catfish	10.0	1	$0.65	$0.65
	12.0	1	$0.76	$0.76
Freshwater drum	1 - 3	16	$0.08	$1.28
	4 - 6	14	$0.13	$1.82
	7 - 8	19	$0.19	$3.61
	9 - 10	32	$0.27	$8.64
	11.0	4	$0.32	$1.28
	12.0	1	$0.37	$0.37
	over 12	4.91	$0.37	$1.82
Green sunfish	2.0	2	$0.41	$0.82
	3.0	3	$0.47	$1.41
	4.0	1	$0.59	$0.59
Gizzard shad	1 - 3	28	$0.60	$1.68
	4 - 6	53	$0.14	$7.42
	7 - 8	3	$0.19	$0.57
	9 - 10	2	$0.24	$0.48
	11 - 13	1	$0.25	$0.25

Table 7. Continued

species	size class	no. fish/ size class or no. lbs.	price/ size class or /lb.	total price
Largemouth bass	3.0	2	$0.76	$1.52
	6.0	1	$1.30	$1.30
	11.0	3	$3.50	$10.50
	12.0	2	$4.00	$8.00
	over 12	3.74	$4.00	$14.95
River carpsucker	over 12	2.65	$0.19	$0.50
Smallmouth buffalo	7 - 9	1	$0.21	$0.21
	10.0	3	$0.29	$0.87
	11.0	6	$0.34	$2.04
	12.0	3	$0.42	$1.26
	over 12	1.81	$0.42	$0.76
Spotfin shiner	all	1	$0.06	$0.06
Smallmouth bass	4.0	2	$0.86	$1.72
Silver chub	all	2	$0.06	$0.12
White bass	2.0	2	$0.21	$0.42
	3.0	3	$0.27	$0.81
	4.0	5	$0.53	$2.65
	8.0	1	$0.93	$0.93
White crappie	2 - 3	1	$0.43	$0.43
Total price of fish				$174.97

Table 2. Price of fishes collected outside off bankline revetment.

species	size class (in.)	no. fish/ size class or no. lbs.	price/ size class or /lb.	total price
American eel	all	1.65	$5.00	$8.50
Bigmouth buffalo	over 12	5.79	$0.42	$2.40
Black buffalo	7 - 9	1	$0.21	$0.21
Bluegill	1.0	3	$0.20	$0.60
	2.0	12	$0.41	$4.92
	3.0	6	$0.47	$2.82
	4.0	7	$0.59	$4.13
	5.0	14	$0.69	$9.66
	6.0	14	$1.00	$14.00
	7.0	5	$1.10	$5.50
Bullhead minnow	all	6	$0.06	$0.36
Carp	over 11	384.53	$0.19	$73.06
Channel catfish	1.0	1	$0.04	$0.04
	11.0	1	$0.71	$0.71
	12.0	3	$0.76	$2.28
	13.0	2	$0.80	$1.60
	14.0	5	$1.00	$5.00
	15.0	10	$1.24	$12.40
	over 15	32.08	$1.24	$39.78
Emerald shiner	all	7	$0.06	$0.42
Flathead catfish	4.0	2	$0.19	$0.38
	5.0	1	$0.21	$0.21
	6.0	1	$0.28	$0.28
	7.0	1	$0.37	$0.37
	8.0	2	$0.41	$0.82
	9.0	2	$0.59	$1.18
	10.0	3	$0.65	$1.95
	11.0	2	$0.71	$1.42
	13.0	2	$0.80	$1.60
	14.0	2	$1.00	$2.00
	15.0	1	$1.24	$1.24
Freshwater drum	1 - 3	5	$0.08	$0.40
	4 - 6	35	$0.13	$4.55
	7 - 8	15	$0.19	$2.85
	9 - 10	36	$0.27	$9.72
	11.0	11	$0.32	$3.52
	12.0	4	$0.37	$1.48
	over 12	14.67	$0.37	$5.43

Table 2. Continued

species	size class (in.)	no. fish/ size class or no. lbs.	price/ size class or /lb.	total price
Green sunfish	1.0	2	$0.20	$0.40
	2.0	1	$0.41	$0.41
	3.0	5	$0.47	$2.35
Gizzard shad	1 - 3	101	$0.06	$6.06
	4 - 6	222	$0.14	$31.08
	7 - 8	11	$0.19	$2.09
	11 - 13	2	$0.25	$0.50
Largemouth bass	5.0	1	$1.12	$1.12
	6.0	1	$2.43	$2.43
	11.0	1	$3.50	$3.50
	12.0	4	$4.00	$16.00
	over 12	7.35	$4.00	$29.41
Logperch	all	1	$0.06	$0.06
Red shiner	all	4	$0.06	$0.24
River carpsucker	11.0	1	$0.16	$0.16
	12.0	1	$0.19	$0.19
Smallmouth buffalo	10.0	1	$0.29	$0.29
	11.0	4	$0.34	$1.36
	12.0	4	$0.42	$1.68
	over 12	10.33	$0.42	$4.34
Spotfin shiner	all	2	$0.06	$0.12
Slenderhead darter	all	1	$0.06	$0.06
Smallmouth bass	4.0	1	$0.86	$0.86
Silver chub	all	1	$0.06	$0.06
White bass	4.0	1	$0.40	$0.40
	6.0	1	$0.66	$0.66
White crappie	9 - 12	1	$2.00	$2.00
Yellow bass	7.0	1	$0.77	$0.77
Total price of fish				$336.40

Table 3. Price of fishes collected inside off bankline revetment.

Species	size class (in.)	no. fish/ size class or no. lbs	price/ size class or /lb	Total Price
Hybrid sunfish	3.0	1	$0.47	$0.47
Black crappie	6.0	2	$1.00	$2.00
	8.0	1	$1.43	$1.43
	9.0	1	$2.00	$2.00
Bluegill	1.0	41	$0.20	$8.20
	2.0	66	$0.41	$27.06
	3.0	25	$0.47	$11.75
	4.0	7	$0.59	$4.13
	5.0	4	$0.69	$2.76
	6.0	18	$1.00	$18.00
	7.0	13	$1.10	$14.30
Blackstripe topminnow	all	2	$0.06	$0.12
Bullhead minnow	all	15	$0.06	$0.90
Carp	1 - 6	6	$0.06	$0.36
	over 11	94.99	$0.19	$18.05
Channel catfish	11.0	2	$0.71	$1.42
	12.0	7	$0.76	$5.32
	13.0	7	$0.80	$5.60
	14.0	6	$1.00	$6.00
	15.0	11	$1.24	$13.64
	over 15	29.90	$1.24	$37.08
Emerald shiner	all	44	$0.06	$2.64
Flathead catfish	11.0	1	$0.71	$0.71
Freshwater drum	1 - 3	8	$0.08	$0.64
	4 - 6	11	$0.13	$1.43
	7 - 8	22	$0.19	$4.18
	9 - 10	36	$0.27	$9.72
	11.0	7	$0.32	$2.24
	12.0	2	$0.37	$0.74
Goldfish	all	1	$0.06	$0.06
Green sunfish	1.0	1	$0.20	$0.20
	2.0	12	$0.41	$4.92
	3.0	7	$0.47	$3.29
	4.0	3	$0.59	$1.77
Gizzard shad	1 - 3	406	$0.06	$24.36
	4 - 6	252	$0.14	$35.28

Table 3. Continued

Species	size class (in.)	no. fish/ size class or no. lbs	price/ size class or /lb	Total Price
G. shad (con't)	7 - 8	3	$0.19	0.57
	9 - 10	2	$0.24	$0.48
	11 - 13	5	$0.25	$1.25
Largemouth bass	2.0	4	$0.58	$2.32
	3.0	3	$0.76	$2.28
	4.0	3	$0.86	$2.58
	5.0	3	$1.12	$3.36
	6.0	2	$1.30	$2.60
	7.0	3	$1.70	$5.10
	8.0	3	$2.07	$6.21
	9.0	2	$2.43	$4.86
	10.0	1	$3.07	$3.07
	11.0	15	$3.50	$52.50
	12.0	5	$4.00	$20.00
	over 12	4.87	$4.00	$19.49
Mosquitofish	all	2	$0.06	$0.12
Shiner spp.	all	1	$0.06	$0.06
Red shiner	all	3	$0.06	$0.18
River carpsucker	1 - 3	1	$0.04	$0.04
	4 - 6	2	$0.05	$0.10
	9 - 10	9	$0.12	$1.08
	11.0	11	$0.16	$1.76
	12.0	3	$0.19	$0.57
	over 12	3.78	$0.19	$0.72
River shiner	all	1	$0.06	$0.06
Smallmouth buffalo	7 - 9	1	$0.21	$0.21
	10.0	2	$0.29	$0.58
	11.0	6	$0.34	$2.04
	12.0	4	$0.42	$1.68
	over 12	1.21	$0.42	$0.51
Spotfin shiner	all	1	$0.06	$0.06
Shorthead redhorse	over 12	1.30	$0.40	$0.52
Quillback	11.0	1	$0.16	$0.16
	12.0	2	$0.19	$0.38

Table 3. Continued

Species	size class (in.)	no. fish/ size class or no. lbs	price/ size class or /lb	Total Price
White bass	3.0	1	$0.27	$0.27
	4.0	2	$0.40	$0.80
White crappie	7.0	1	$1.20	$1.20
Yellow bass	7.0	2	$0.77	$1.54
Total price of fish				$414.07

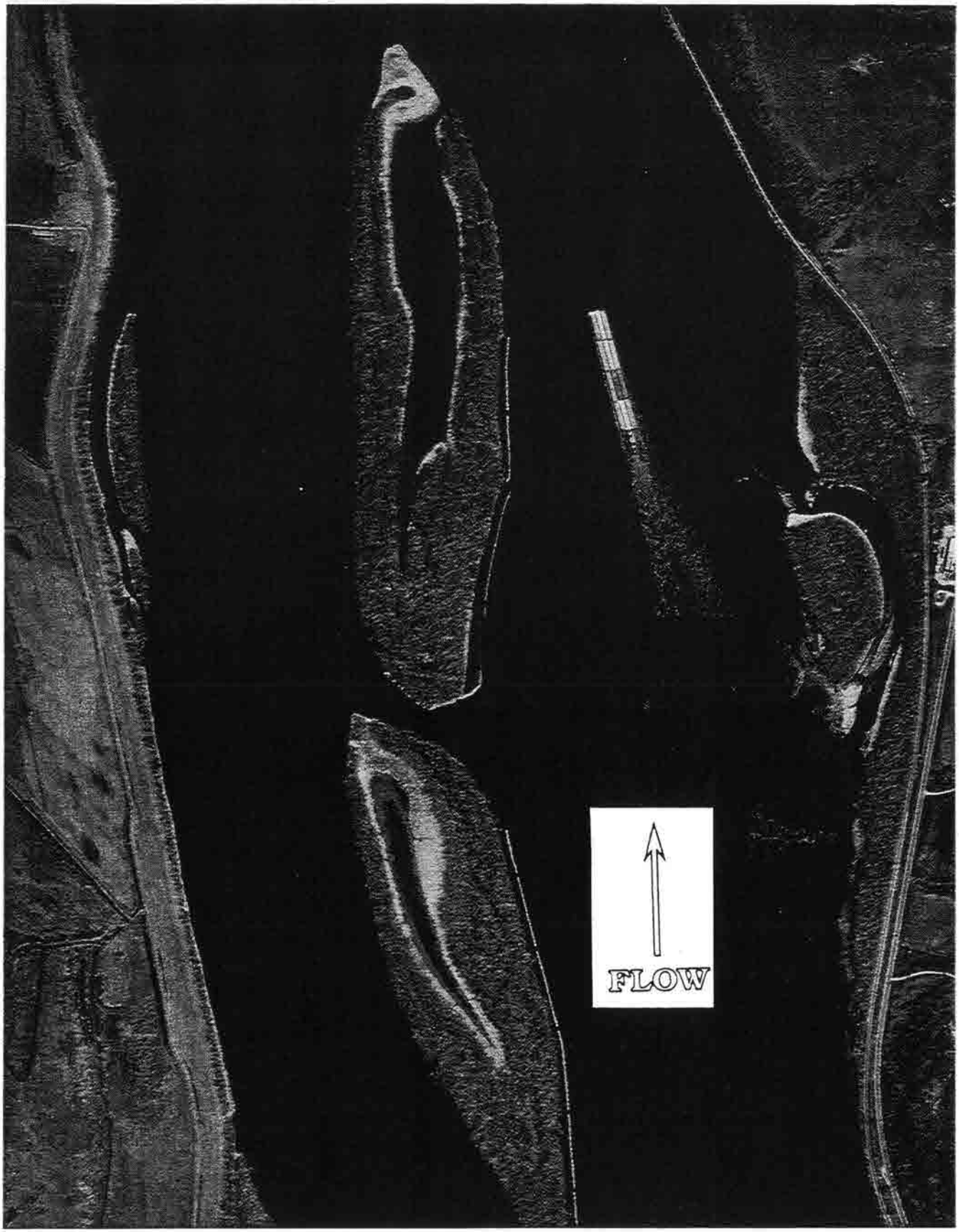

Figure 1. Aereal view of off bankline revetment, Pool 24, UMR.

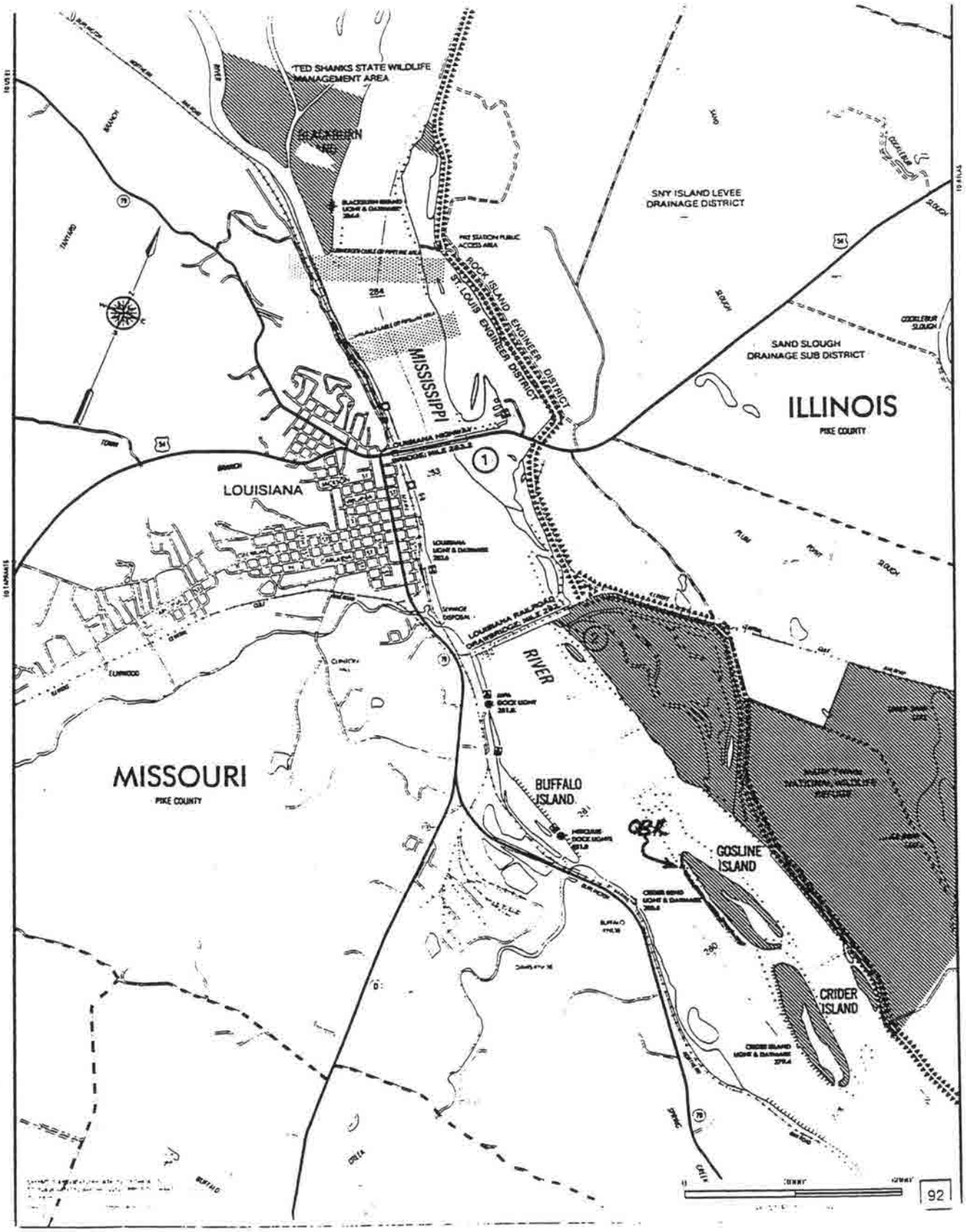

Figure 2. OBR at Gosline Island study site.

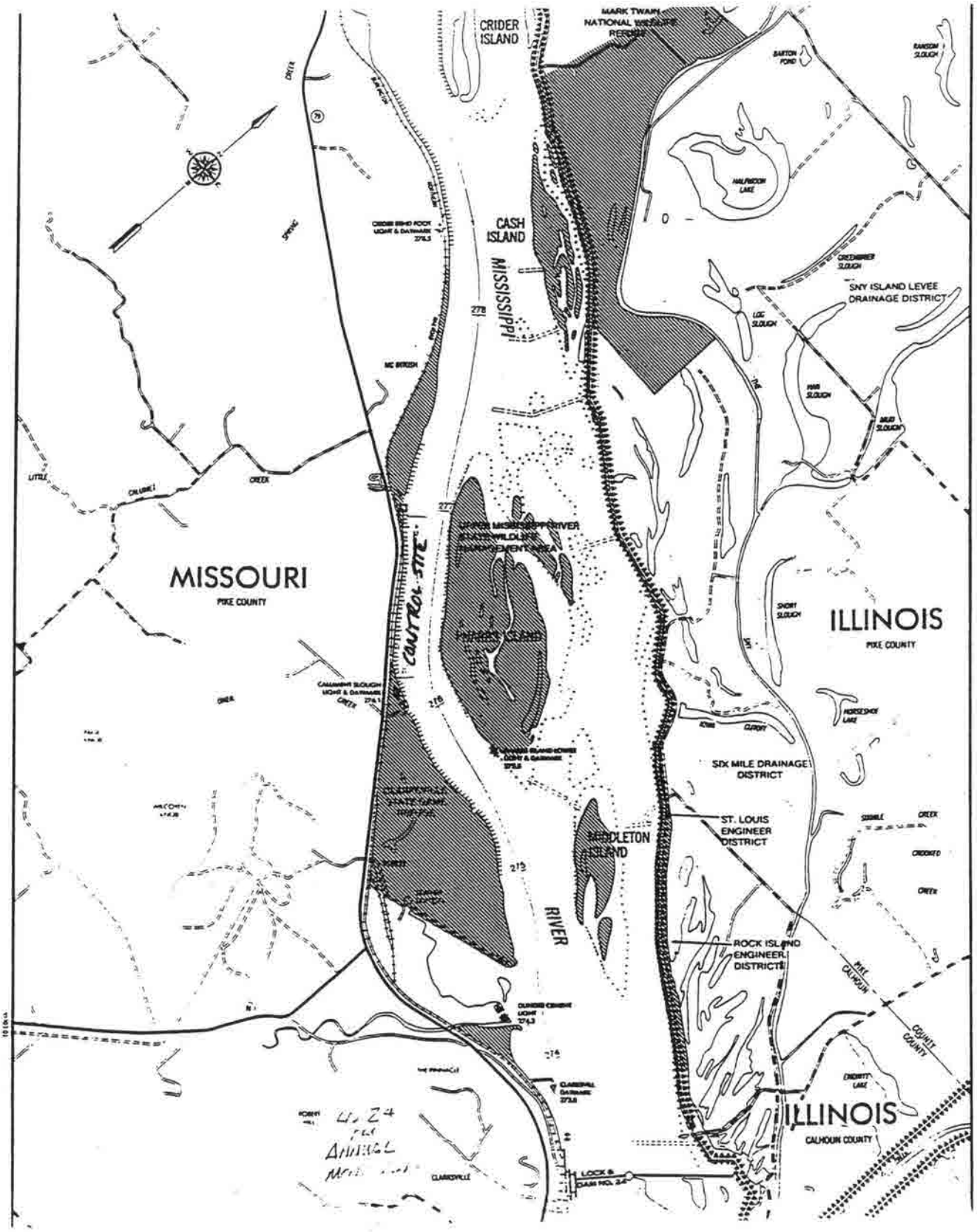

Figure 2 (Con't). Control site for Gosline Island Study Site.

APPENDIX B

MCACES COST ESTIMATE

AVOID/MINIMIZE - SECOND LOCK
IMPACTS, SECOND LOCK - MELVIN
PRICE LOCKS AND DAM

Designed By: R. YARBROUGH
Estimated By: C. MUELLER AND J. DIERKER

Prepared By: U.S. ARMY CORPS OF ENGINEERS
ST. LOUIS, MISSOURI DISTRICT

Date: 08/07/92

M C A C E S G O L D E D I T I O N
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** PROJECT OWNER SUMMARY - LEVEL 1 **

		QUANTITY	UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
06	FISH AND WILDLIFE FACILITIES			4,080,623	804,406	4,885,030	
09	CHANNELS AND CANALS			5,824,218	1,344,050	7,168,268	
30	PLANNING,ENGINEERING & DESIGN			1,190,000	175,000	1,365,000	
31	CONSTRUCTION MANAGEMENT			606,850	91,028	697,878	
	AVOID/MINIMIZE - SECOND LOCK	1.00	EA	11,701,691	2,414,485	14,116,176	14116176

		QUANTITY UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
06 FISH AND WILDLIFE FACILITIES						
0603 WILDLIFE FACILITY & SANCTUARY						
060373 Habitat and Feeding Facilities						
06037302	Site Work					
06037302AA	Rock Armorment	320000.00 TON	1,923,128	480,782	2,403,910	7.51
06037302AB	Vegetation	52.00 ACR	96,156	14,423	110,579	2126.52
06037302AC	Monitoring		2,061,340	309,201	2,370,541	
	Site Work		4,080,623	804,406	4,885,030	
	Habitat and Feeding Facilities		4,080,623	804,406	4,885,030	
	WILDLIFE FACILITY & SANCTUARY		4,080,623	804,406	4,885,030	
	FISH AND WILDLIFE FACILITIES		4,080,623	804,406	4,885,030	
09 CHANNELS AND CANALS						
0901 CHANNELS						
090113 Traffic Control:						
09011302	Site Work					
09011302AA	Lock Approach Waiting Areas		376,210	56,431	432,641	
	Site Work		376,210	56,431	432,641	
	Traffic Control:		376,210	56,431	432,641	
090116 Pipeline Dredging						
09011602	Site Work					
09011602AA	Rock Armorment	240000.00 TON	1,442,337	360,584	1,802,921	7.51
09011602AB	Flexible Pipe	3000.00 LF	1,487,665	297,533	1,785,198	595.07
	Site Work		2,930,002	658,117	3,588,119	
	Pipeline Dredging		2,930,002	658,117	3,588,119	
090130 Bank Stabilization						

	QUANTITY UOM	CONTRACT	CONTINGN	TOTAL COST	UNIT COST
09013002 Site Work					
09013002AA Maintenance Stone	420000.00 TON	2,518,007	629,502	3,147,508	7.49
Site Work		2,518,007	629,502	3,147,508	
Bank Stabilization		2,518,007	629,502	3,147,508	
CHANNELS		5,824,218	1,344,050	7,168,268	
CHANNELS AND CANALS		5,824,218	1,344,050	7,168,268	
30 PLANNING,ENGINEERING & DESIGN					
PLANNING,ENGINEERING & DESIGN		1,190,000	175,000	1,365,000	
31 CONSTRUCTION MANAGEMENT					
CONSTRUCTION MANAGEMENT		606,850	91,028	697,878	
AVOID/MINIMIZE - SECOND LOCK	1.00 EA	11,701,691	2,414,485	14,116,176	14116176

** PROJECT INDIRECT SUMMARY - LEVEL 1 **

	QUANTITY UOM	DIRECT	OVERHEAD	BOND	PROFIT	TOTAL COST	UNIT COST
06 FISH AND WILDLIFE FACILITIES		3,395,010	339,501	21,240	324,872	4,080,623	
09 CHANNELS AND CANALS		4,845,651	484,565	30,315	463,686	5,824,218	
30 PLANNING,ENGINEERING & DESIGN		1,190,000	0	0	0	1,190,000	
31 CONSTRUCTION MANAGEMENT		606,850	0	0	0	606,850	
AVOID/MINIMIZE - SECOND LOCK	1.00 EA	10,037,511	824,066	51,555	788,558	11,701,691	11701691
% Contingencies						2,414,485	
TOTAL INCL OWNER COSTS						14,116,176	

		QUANTITY UOM	DIRECT	OVERHEAD	BOND	PROFIT	TOTAL COST	UNIT COST
06 FISH AND WILDLIFE FACILITIES								
0603 WILDLIFE FACILITY & SANCTUARY								
060373 Habitat and Feeding Facilities								
06037302	Site Work							
06037302AA	Rock Armorment	320000.00 TON	1,600,010	160,001	10,010	153,107	1,923,128	6.01
06037302AB	Vegetation	52.00 ACR	80,000	8,000	500	7,655	96,156	1849.15
06037302AC	Monitoring		1,715,000	171,500	10,729	164,110	2,061,340	
	Site Work		3,395,010	339,501	21,240	324,872	4,080,623	
	Habitat and Feeding Facilities		3,395,010	339,501	21,240	324,872	4,080,623	
	WILDLIFE FACILITY & SANCTUARY		3,395,010	339,501	21,240	324,872	4,080,623	
	FISH AND WILDLIFE FACILITIES		3,395,010	339,501	21,240	324,872	4,080,623	
09 CHANNELS AND CANALS								
0901 CHANNELS								
090113 Traffic Control:								
09011302 Site Work								
09011302AA	Lock Approach Waiting Areas		313,000	31,300	1,958	29,951	376,210	
	Site Work		313,000	31,300	1,958	29,951	376,210	
	Traffic Control:		313,000	31,300	1,958	29,951	376,210	
090116 Pipeline Dredging								
09011602 Site Work								
09011602AA	Rock Armorment	240000.00 TON	1,200,000	120,000	7,507	114,829	1,442,337	6.01
09011602AB	Flexible Pipe	3000.00 LF	1,237,712	123,771	7,743	118,438	1,487,665	495.89
	Site Work		2,437,712	243,771	15,251	233,267	2,930,002	
	Pipeline Dredging		2,437,712	243,771	15,251	233,267	2,930,002	
090130 Bank Stabilization								

** PROJECT INDIRECT SUMMARY - LEVEL 5 **

	QUANTITY UOM	DIRECT	OVERHEAD	BOND	PROFIT	TOTAL COST	UNIT COS
09013002 Site Work							
09013002AA Maintenance Stone	420000.00 TON	2,094,939	209,494	13,106	200,467	2,518,007	6.00
Site Work		2,094,939	209,494	13,106	200,467	2,518,007	
Bank Stabilization		2,094,939	209,494	13,106	200,467	2,518,007	
CHANNELS		4,845,651	484,565	30,315	463,686	5,824,218	
CHANNELS AND CANALS		4,845,651	484,565	30,315	463,686	5,824,218	
30 PLANNING,ENGINEERING & DESIGN							
PLANNING,ENGINEERING & DESIGN		1,190,000	0	0	0	1,190,000	
31 CONSTRUCTION MANAGEMENT							
CONSTRUCTION MANAGEMENT		606,850	0	0	0	606,850	
AVOID/MINIMIZE - SECOND LOCK	1.00 EA	10,037,511	824,066	51,555	788,558	11,701,691	11701
% Contingencies						2,414,485	
TOTAL INCL OWNER COSTS						14,116,176	

WILDLIFE FACILITY & SANCTUARY	QUANTY UOM CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COST
FISH AND WILDLIFE FACILITIES							
WILDLIFE FACILITY & SANCTUARY							
Habitat and Feeding Facilities							
Site Work							
Rock Armorment							
This item corresponds with Recommendations--COE, Group A, No. 11. The rock will be placed in the river near frequently dredged sites. The rock will protect dredged material that is placed downstream of the rock. This material will build up over the years to become permanent wetland area. Need only the money for the rock; dredging is already covered. There will be 4 wetland areas to be created. These will be created at the rate of one every other year, alternating with beach creation. An amount of 80,000 tons per wetland area is assumed.							
Mob/Demob (Placement Crew)	100.00 MI WC01B	3,750	4,078	0	0	7,828	78.28
Mob/Demob (Shuttle Crew)	100.00 MI WC02C	2,500	5,909	0	0	8,409	84.09
Stone Shuttle	320000 TON WC02A	81,239	150,885	1,104,000	0	1,336,124	4.18
Stone Placement	320000 TON WC01A	121,858	125,790	0	0	247,649	0.77
Rock Armorment	320000 TON	209,347	286,663	1,104,000	0	1,600,010	5.00
Vegetation							
This item corresponds with Recommendations--COE, Group A, No. 11. This acreage consists of 13 acres per wetland and there are 4 wetland areas. This will be done after the wetland is fully created.							
Establish Vegetation	52.00 ACR CA02A	62,086	10,086	7,827	0	80,000	1538.46
Vegetation	52.00 ACR	62,086	10,086	7,827	0	80,000	1538.46
Monitoring							
The items listed below are associated with the detail items under this heading, respectively.							
01 Recommendations--COE, Group A, No. 13							
02 Recommendations--COE, Group A, No. 16							
03 Recommendations--COE, Group A, No. 17							
04 Recommendations--COE, Group A, No. 19							
Eng. & Biological Monitoring This monitoring covers the thalweg placement of dredge material. This total consists of $70,000 per year for 7 years.	1.00 LS	0	0	0	490,000	490,000	490000.00
Eng. & Biological Monitoring This monitoring covers dike configuration studies and environmental studies. This total consists of $50,000	1.00 LS	0	0	0	350,000	350,000	350000.00

WILDLIFE FACILITY & SANCTUARY	QUANTY UOM CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COS
per year for 7 years.							
Eng. & Biological Monitoring This monitoring covers field design and research for revetment placement on islands. This total consists of $50,000 per year for 7 years.	1.00 LS	0	0	0	350,000	350,000	350000.0
Eng. & Biological Monitoring This monitoring covers the bendway weirs. This total consists of $75,000 per year for 7 years.	1.00 LS	0	0	0	525,000	525,000	525000.00
Monitoring		0	0	0	1,715,000	1,715,000	
Site Work		271,434	296,749	1,111,827	1,715,000	3,395,010	
Habitat and Feeding Facilities		271,434	296,749	1,111,827	1,715,000	3,395,010	
WILDLIFE FACILITY & SANCTUARY		271,434	296,749	1,111,827	1,715,000	3,395,010	
FISH AND WILDLIFE FACILITIES		271,434	296,749	1,111,827	1,715,000	3,395,010	

CHANNELS	QUANTY	UOM	CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COST
CHANNELS AND CANALS									
(Except Navigation Ports and Harbors)									
CHANNELS									
Traffic Control:									
Site Work									
Lock Approach Waiting Areas									
This item corresponds with Recommendations—COE, Group A, No. 3.									
Anchor, 10,000# Danforth	4.00	EA		0	0	0	38,800	38,800	9700.00
Chain Assembly, 75' Long	4.00	EA		0	0	0	9,200	9,200	2300.00
Mooring Buoy	6.00	EA		0	0	0	90,000	90,000	15000.00
Annual Maint. of Mooring Buoys	7.00	YR		0	0	0	175,000	175,000	25000.00
Lock Approach Waiting Areas				0	0	0	313,000	313,000	
Site Work				0	0	0	313,000	313,000	
Traffic Control:				0	0	0	313,000	313,000	
Pipeline Dredging									
Site Work									
Rock Armorment									
This item corresponds with Recommendations--COE, Group A, No. 10. The rock will be placed in the river near frequently dredged sites. The rock will protect dredged material that is placed downstream of the rock. This material will build up over the years to become a permanent beach. Need only the money for the rock; dredging is already covered. There will be 3 beach areas to be created. These will be done at the rate of one every other year, alternating with wetland creation. An amount of 80,000 tons per beach is assumed.									
Mob/Demob (Placement Crew)	100.00	MI	WC01B	3,750	4,078	0	0	7,828	78.28
Mob/Demob (Shuttle Crew)	100.00	MI	WC02C	2,500	5,909	0	0	8,409	84.09
Stone Shuttle	240000	TON	WC02A	61,460	114,149	820,800	0	996,409	4.15
Stone Placement	240000	TON	WC01A	92,190	95,164	0	0	187,354	0.78
Rock Armorment	240000	TON		159,899	219,301	820,800	0	1,200,000	5.00

CHANNELS	QUANTY	UOM	CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COS.
Flexible Pipe									
This item corresponds with Recommendations--COE, Group A, No. 10.									
For all preparation operations, these assumptions are used:									
American Crane at					$160/Hr				
Pettibone Crane at					$150/Hr				
M/V Grandtower at					$ 70/Hr				
Operator at					$ 55/Hr				
36" Pipe Fuser with 32" Adapter	1.00	EA		0	0	105,000	0	105,000	105000.00
32" Plexco Polyethylene Pipe	3000.00	LF		0	0	94,560	0	94,560	31.52
Each piece is 40' long.									
36" Booster Pump	1.00	EA		0	0	212,000	0	212,000	212000.00
Diesel Power Supply, CAT 3512	1.00	EA		0	0	45,000	0	45,000	45000.00
1100 HP, 240 rpm									
Handling 40' Lengths From Yard	1.00	LS		3,960	3,600	0	0	7,560	7560.00
Labor:									
3 Men * 8 Hrs/Day * 3 Days * $55/hr/man = $3,960.00									
Equipment:									
3 Days * 8 Hrs/Day * $150/Hr = $3,600.00									
Fuse Pipe	1.00	LS		19,800	27,600	0	0	47,400	47400.00
This pipe will be fused into sections which will be approx. 120' long, so as to be able to store on a barge.									
Labor:									
3 men * 8 hrs/day * 15 days * $55/hr/man = $19,800.00									
Equipment:									
15 days * 8 hrs * $160/hr = $19,200.00									
15 days * 8 hrs * $70/hr = $ 8,400.00									
Install Pipe on Flotation Drums	1.00	LS		13,200	18,400	0	0	31,600	31600.00
Labor:									
3 men * 8 Hr/day * 10 days * $55/hr/man = $13,200.00									
Equipment:									
10 days * 8 hr/day * $160/hr = $12,800.00									
10 days * 8 hr/day * $70/hr = $ 5,600.00									
Install Pump on Barge	1.00	LS		88,000	18,400	10,000	0	116,400	116400.00
Labor:									
10 men * 8 hr/day * 20 days * $55/hr/man = $88,000.00									
Equipment:									
10 days * 8 hr/day * $160/hr = $12,800.00									
10 days * 8 hr/day * $70/hr = $ 5,600.00									

CHANNELS	QUANTY	UOM	CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COST
Miscellaneous Material:									
SUM JOB = $10,000.00									
Install Diesel Engine on Barge	1.00	LS		88,000	18,400	10,000	0	116,400	116400.00
Labor:									
10 men * 8 hr/day * 20 days *									
$55/hr/man = $88,000.00									
Equipment:									
10 days * 8 hr/day * $160/hr =									
$12,800.00									
10 days * 8 hr/day * $70/hr =									
$ 5,600.00									
Miscellaneous Material:									
SUM JOB = $10,000.00									
Transition From Plastic to Steel	1.00	LS		6,600	5,520	5,000	0	17,120	17120.00
Labor:									
3 men * 8 hr/day * 5 days *									
$55/hr = $ 6,600.00									
Equipment:									
3 days * 8 hr/day * $160/hr =									
$ 3,840.00									
3 days * 8 hr/day * $70/hr =									
$ 1,680.00									
Miscellaneous Material:									
SUM JOB = $ 5,000.00									
Install Suction/Discharge For Booster Pump	1.00	LS		13,200	9,200	5,000	0	27,400	27400.00
Labor:									
3 men * 8 hr/day * 10 days *									
$55/man = $13,200.00									
Equipment:									
5 days * 8 hr/day * $160/hr =									
$ 6,400.00									
5 days * 8 hr/day * $70/hr =									
$ 2,800.00									
Miscellaneous Material:									
SUM JOB = $ 5,000.00									
Install Pipe on Discharge Barge	1.00	LS		13,200	9,200	5,000	0	27,400	27400.00
Labor:									
3 men * 8 hr/day * 10 days *									
$55/hr = $13,200.00									
Equipment:									
5 days * 8 hr/day * $160/hr =									
$ 6,400.00									
5 days * 8 hr/day * $70/hr =									
$ 2,800.00									
Miscellaneous Material:									
SUM JOB = $ 5,000.00									

CHANNELS	QUANTY UOM CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COS
Annual Operation Costs	7.00 YR	0	0	0	244,006	244,006	34858.00
These consists of:							
Diesel Power Supply Cost = $ 6,858							
Daily Rental of 150' x 35' Discharge Spud Barge for 45 Days = $14,000							
Daily Rental of 100' x 35' Booster Pump Spud Barge for 45 Days = $14,000							
Annual Maintenance Costs	7.00 YR	0	0	0	145,866	145,866	20838.00
These consists of:							
320 Feet of Replacement Pipe per Year = $10,086							
Flotation Devices (7 for 320' at $22/EA) = $ 154							
Flashing Lights (4 for 7 Drums) = $ 198							
Booster Pump = $ 5,200							
Diesel Power Supply= $ 5,200							
Flexible Pipe	3000.00 LF	245,960	110,320	491,560	389,872	1,237,712	412.57
Site Work		405,859	329,621	1,312,360	389,872	2,437,712	
Pipeline Dredging		405,859	329,621	1,312,360	389,872	2,437,712	
Bank Stabilization							
Dikes and Jetties:							
Site Work							
Maintenance Stone							
This item corresponds with Recommendations--CDE, Group A, No. 16. This stone will be used to maintain the notched dikes, chevrons, and bullnose dikes. The quantity is a total for the 7 year period consisting of 60,000 tons per year.							
Mob/Demob (Placement Crew)	100.00 MI WC01B	3,750	4,078	0	0	7,828	78.28
Mob/Demob (Shuttle Crew)	100.00 MI WC02C	2,500	5,909	0	0	8,409	84.09
Stone Shuttle	420000 TON WC02A	106,626	198,037	1,449,000	0	1,753,663	4.18
Stone Placement	420000 TON WC01A	159,939	165,100	0	0	325,039	0.77
Maintenance Stone	420000 TON	272,815	373,124	1,449,000	0	2,094,939	4.99
Site Work		272,815	373,124	1,449,000	0	2,094,939	
Bank Stabilization		272,815	373,124	1,449,000	0	2,094,939	

CHANNELS	QUANTY UOM CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COST
CHANNELS		678,674	702,745	2,761,360	702,872	4,845,651	
CHANNELS AND CANALS		678,674	702,745	2,761,360	702,872	4,845,651	

	QUANTY	UOM	CREW ID	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST	UNIT COS
PLANNING,ENGINEERING & DESIGN									
The following items have been put in as a lump sum. This estimate has been done using the Work Breakdown Structure and for the 30 and 31 accounts there were no further details. This amount reflects a total of the following items:									
Planning - $175,000 for 7 years.									
($175,000) * (7) =				$1,225,000					
Non-Structural Alternatives to Reduce Waiting Times -									
For 1994 -				$ 30,000					
For 1995 -				$ 60,000					
For 1996 -				$ 10,000					
For 1997 -				$ 10,000					
For 1998 -				$ 10,000					
For 1999 -				$ 10,000					
For 2000-				$ 10,000					
TOTAL INCLUDING CONTINGENCIES				$1,365,000					
15% Contingency (approx)				- 175,000					
Total Before Contingency				$1,190,000					
PLANNING,ENGINEERING & DESIGN				1,190,000	0	0	0	1,190,000	
CONSTRUCTION MANAGEMENT									
The following items have been put in as a lump sum. This estimate has been done using the Work Breakdown Structure and for the 30 and 31 accounts there were no further details. This amount reflects a total of the following items for the 7-year period:									
Contract Administration =				$235,348					
Review of Shop Drawings =				11,500					
Inspection and Quality Assurance =				40,250					
Project Office Operation =				405,950					
Project Management =				4,830					
TOTAL				$697,878					
Contingency				- 91,028					
Total Before Contingency				606,850					
CONSTRUCTION MANAGEMENT				606,850	0	0	0	606,850	
AVOID/MINIMIZE - SECOND LOCK	1.00	EA		2,746,958	999,494	3,873,187	2,417,872	10,037,511	10037511

SRC	ITEM ID	DESCRIPTION	NO.	UOM	RATE	**** LABOR **** HOURS	COST	**** EQUIP **** HOURS	COST	TOTAL COST
	CA02A	Establishment of Turf			PROD = 100%				CREW HOURS =	965
MIL	T25JD001	E TRACTOR,WH,FARM, JD-2155	1.00	HR	5.77					
MIL	T40XX014	E TRUCK OPT,FLATBED, 8' x 12.0'	1.00	HR	0.52			1.00	0.52	0.52KUP..
MIL	T50F0006	E TRK, HWY,F600,21,000 GVW, 2 AXL	1.00	HR	14.62			1.00	14.62	14.62KUP..
MIL	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00	HR	30.00	1.00	30.00			30.00KUP..
MIL	X-TRKDVRHVL	Outside Truck Dr. Heavy	1.00	HR	23.21	1.00	23.21			23.21KUP..
MIL	X-LABORER L	Outside Laborer (Semi-Skilled)	2.00	HR	25.00	2.00	50.00			50.00KUP..
MIL	X-LABORER F	Labor Foreman	1.00	HR	25.50	1.00	25.50			25.50KUP..
	TOTAL					5.00	128.71	3.00	20.91	149.62
	WC01A	Stone Placement Crew			PROD = 100%				CREW HOURS =	4986
MIL	XX0XX004	E Push Boat 350 hp.	1.00	HR	34.71			1.00	34.71	34.71KUP..
MIL *	XX0XX013	E Work Barge	1.00	HR	8.50			1.00	8.50	8.50KUP..
MIL *	XX0XX011	E Spud Barge	1.00	HR	20.00			1.00	20.00	20.00KUP..
MIL	CB5MA001	E CR,DRAG/CLAM,3.5CY,100'B,ADD BK	1.00	HR	85.10			1.00	85.10	85.10KUP..
MIL	B25ES011	E BKT,CLAM,4CY, GEN PURP/SQ NOSE	1.00	HR	6.53			1.00	6.53	6.53KUP..
MIL	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00	HR	30.00	2.00	60.00			60.00KUP..
MIL	X-EQOPROILL	Outside Oiler	2.00	HR	20.00	2.00	40.00			40.00KUP..
MIL	X-LABORER L	Deckhand	2.00	HR	25.00	2.00	50.00			50.00KUP..
	TOTAL					6.00	150.00	5.00	154.84	304.84
	WC01B	Mob/Demob Stone Placement			PROD = 100%				CREW HOURS =	150
MIL *	B25ES011	E BKT,CLAM,4CY, GEN PURP/SQ NOSE	1.00	HR	6.53			1.00	6.53	6.53KUP..
MIL *	CB5MA001	E CR,DRAG/CLAM,3.5CY,100'B,ADD BK	1.00	HR	85.10			1.00	85.10	85.10KUP..
MIL *	XX0XX004	E Push Boat 350hp	1.00	HR	34.71			1.00	34.71	34.71KUP..
MIL *	XX0XX005	E 115' Work Barge	3.00	HR	12.27			3.00	36.80	36.80KUP..
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	2.00	HR	30.00	2.00	60.00			60.00KUP..
MIL *	X-EQOPROILL	Outside Oiler	2.00	HR	20.00	2.00	40.00			40.00KUP..
MIL *	X-LABORER L	Outside Laborer (Deckhand)	2.00	HR	25.00	2.00	50.00			50.00KUP..
	TOTAL					6.00	150.00	6.00	163.14	313.14
	WC02A	Stone Shuttle Crew			PROD = 100%				CREW HOURS =	4986
MIL	XX0XX002	E Tow Boat 750 hp.	1.00	HR	84.45			1.00	84.45	84.45KUP..
MIL *	XX0XX012	E Stone Barge	6.00	HR	16.88			6.00	101.28	101.28KUP..
MIL	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00	HR	30.00	1.00	30.00			30.00KUP..
MIL *	X-EQOPROILL	Outside Oiler	1.00	HR	20.00	1.00	20.00			20.00KUP..
MIL *	X-LABORER L	Deckhand	2.00	HR	25.00	2.00	50.00			50.00KUP.
	TOTAL					4.00	100.00	7.00	185.73	285.73
	WC02C	Mob/Demob Shuttle Crew			PROD = 100%				CREW HOURS =	150
MIL *	XX0XX002	E Tow Boat 750hp	1.00	HR	84.45			1.00	84.45	84.45KUP.
MIL *	XX0XX012	E Stone Barge	9.00	HR	16.88			9.00	151.92	151.92KUP.
MIL *	X-EQOPRHVYL	Outside Equip. Op. Heavy	1.00	HR	30.00	1.00	30.00			30.00KUP.
MIL *	X-EQOPROILL	Outside Oiler	1.00	HR	20.00	1.00	20.00			20.00KUP.
MIL *	X-LABORER L	Outside Laborer (Deckhand)	2.00	HR	25.00	2.00	50.00			50.00KUP.
	TOTAL					4.00	100.00	10.00	236.37	336.37

** LABOR BACKUP **

SRC	LABOR ID	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	RATE	UOM	UPDATE	DEFAULT	**** TOTAL *** HOURS
MIL	X-EQOPRHVY	Equipment Operator - Heavy	30.00	0.0%	0.0%	0.00	0.00	30.00	HR	07/22/92	0.00	1637[illegible]P.
MIL	X-EQOPROIL	Oiler	20.00	0.0%	0.0%	0.00	0.00	20.00	HR	07/22/92	0.00	1540[illegible]JP.
MIL	X-LABORER	Laborer	25.00	0.0%	0.0%	0.00	0.00	25.00	HR	07/22/92	0.00	23440 CKUP.

** EQUIPMENT BACKUP **

SRC	EQUIP ID	DESCRIPTION	DEPR	CAPT	FUEL	FOG	EQ REP	TR WR	TR REP	TOTAL	UOM	** TOTAL ** HOURS	
MIL	B25ES011	BKT,CLAM,4CY, GEN PURP/SQ NOSE	3.01	1.01			2.51	B		6.53	HR	5136MENT	BAC
MIL	C85MA001	CR,DRAG/CLAM,3.5CY,100'B,ADD BKT	29.00	15.02			34.57			85.10	HR	5136	T BAC
MIL	T25JD001	TRACTOR,WH,FARM, JD-2155	1.55	0.47			2.20			5.77	HR	965	T BAC
MIL	T40XX014	TRUCK OPT,FLATBED, 8' x 12.0'	0.25	0.08			0.19			0.52	HR	965	T BAC
MIL	T50F0006	TRK, HWY,F600,21,000 GVW, 2 AXLE	2.25	0.80			4.60			14.62	HR	965	T BAC
MIL	XX0XX002	750hp Push Boat	84.45							84.45	HR	5136	T BAC
MIL	XX0XX004	350hp Push Boat	34.71							34.71	HR	5136	T BAC
MIL	XX0XX005	100 To 300 Ton Barge	12.27							12.27	HR	450	T BAC
USR	XX0XX011	Spud Barge	20.00							20.00	HR	4986	T BAC
USR	XX0XX012	Stone Barge	16.88							16.88	HR	31269	T BAC
USR	XX0XX013	Work Barge	8.50							8.50	HR	4986	T BAC

No errors detected...

* * * END OF ERROR REPORT * * *

T BAC

APPENDIX C

RESOURCE ALERT

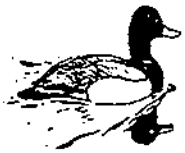
RESOURCE ALERT !

May 1991

The following information has been compiled to advise tow captains and crews concerning sensitive fish and wildlife areas on the Upper Mississippi River. Please avoid or take precaution when navigating these areas at all times especially when noted. Potential measures you may take are listed on the back of this sheet. You are encouraged to enter this information on your navigation charts.

POOL 24		POOL 25		POOL 26	
River Mile	Resource	River Mile	Resource	River Mile	Resource
301.0-298.0(R)	Mussel sanctuary	273.5-271.0	Bald eagle perch trees	241.5-240.0	Bald eagle perch trees
301.0-296.0	Bald eagle perch trees	273.0-272.0(L)	Great blue heron rookery	240.7-238.4(L)	Mussel sanctuary
		266.0-264.0(L)	Riprap Landing Fish and Wildlife Area		
300.9(L)	Preferred lock waiting area	264.0-261.0(R)	Clarence Cannon National Wildlife Refuge	236.0-235.0(L)	Great blue heron rookery (March-July)
				234.5-233.8(L)	Mussel bed
298.0-285.0(R)	Ted Shanks Wildlife Management Area	261.0-259.0(L)	Wildlife Management Area	231.0-230.0(R)	Mussel bed
				221.5(R)	Mussel bed
		259.8-258.7(L)	Mussel bed	223.0-220.0(L)	Fish and Wildlife Management Area
297.2-294.5(L&R)	Mussel beds	253.7(L)	Egret rookery (March-July)	220.0-219.0(L)	Great blue heron rookery (March-July)
292.5(L)	Great blue heron rookery (nesting area March to July)	254.0-253.0(R)	Mussel bed	219.8-218.2(R)	Mussel bed
				217.0-214.0(L)	Mussel bed
292.4-292.2(R)	Mussel bed	248.0-247.0(L)	Mussel bed	208.0-206.0(R)	Fish spawning (May-October)
288.0-287.1(R)	Mussel bed				
286.5(L)	Mussel bed				
285.7-285.0(L)	Mussel bed				
284.0-282.5(R)	Mussel bed				
281.8-277.6(L)	Mark Twain National Wildlife Refuge	251.5-245.5(L)	Mark Twain National Wildlife Refuge	204.0-203.0(R)	Fish spawning (May-October)
277.5-277.0(R)	Clarksville Refuge (avoid tieing to trees)	246.0(R)	Mussel bed	203.7-203.3(L)	Mussel bed
		246.0-243.0(L)	Fish and Wildlife Management Area		
277.0-276.0(R)	Mussel bed	244.0-242.0(L)	Large number of migrating ducks (spring and summer)		
277.0(L)	Wildlife Management Area				
274.4-273.4(R)	Large numbers of migrating ducks (Spring and Fall)			203.0-198.0(R)	Mel Price Locks and Dam Waterfowl Refuge

For more information, contact: U.S. Army Corps of Engineers, 1222 Spruce St., St. Louis, MO 63103 (314/331-8460) or U.S. Fish and Wildlife Service, R.R. #3, Box 328, Marion, IL 62959 (618/997-5491).



RESOURCE ALERT GUIDANCE

The Upper Mississippi River has been designated by Congress as both a nationally significant commercial transportation system and a nationally significant ecosystem. In addition to the Corps of Engineers 9-foot channel and 27 locks and dams, the Upper Miss is also home to three National Wildlife Refuges and over 60 State wildlife management areas.

The Resource Alert is to advise tow pilots and crews of important fish and wildlife areas that may be affected by the operation of a tow. Resource Alerts are prepared for specific pools and updated when conditions warrant (i.e. fish spawning period or duck migration). The Resource Alert is to compliment the Biologists Onboard Program.

Some of the measures that the tow captain or pilot may consider when navigating in or near important fish and wildlife areas include:

- **Use mooring anchors or cells where available for tieoff.** Using these cells will reduce turbulence and erosion and save on fuel. The Corps is installing additional mooring anchors and buoys.
- **Avoid tree tieoffs.** Where tree tieoffs are necessary, protect the tree by using chafing timbers or nylon rope near the base of the tree. This will protect trees used by bald eagles in the winter and used by great blue herons and other colonial birds for nesting.
- **Avoid disturbing areas important to migratory birds.** Reduce arc of search light and minimize pointing the light towards the shore when not in use. During the spring, early summer and fall, birds such as migrating ducks or nesting great blue herons may be disturbed by tow lights. Do not use horn unnecessarily as frequent and excessive noise may cause birds to abandon their nests.
- **Stay on the sailing line.** Concentrating tow operation to the sailing line and within the navigation channel as marked by the Coast Guard will reduce aquatic disturbances. Disturbances to resting waterfowl are also minimized.
- **Minimize effect of prop wash.** Turbulence can increase erosive energy. Eroding shorelines result in loss of bald eagle perch trees, loss of fish cover, and sedimentation downstream. Also, turbulence adjacent to freshwater mussel beds can disturb these communities.
- **Avoid any spill of oil or hazardous materials.** These chemicals can kill aquatic species and may result in permanent loss of important habitat. Report any spills seen on the river to U.S. Coast Guard Group Upper Mississippi at Keokuk - Channel 16. Your help in reporting non-tow related spills is appreciated.
- **Exiting the locks.** When exiting a lock, safety is the most important consideration. Use power as needed to maintain control of vessel.
- **Reduce overall speed when possible.** Use a speed which maximizes safety and minimizes fuel usage. Racing to a lock only to wait for another tow not only wastes fuel, but also results in more aquatic disturbance and possibly bank erosion.
- **Dispose of all trash properly.** Federal regulation prohibits the dumping of waste into the river. Consider separating your trash for recycling.

Additional ideas?

Contact the U.S. Fish and Wildlife Service, 1830 Second Ave., Rock Island, IL 61201 (309/793-5800, FAX 309/793-5804).

Take PRIDE in the MISSISSIPPI

APPENDIX D

LETTERS FROM NATIONAL RESOURCE AGENCIES

United States Department of the Interior

Fish and Wildlife Service
Marion Field Office (ES)
Rural Route 3, Box 328
Marion, Illinois 62959

TAKE PRIDE IN AMERICA

In Reply Refer to:

July 1, 1991

Colonel James E. Corbin
U.S. Army Corps of Engineers
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Colonel Corbin:

The recent interagency coordination meeting on the "avoid and minimize measures" which was held on the Corps of Engineers towboat and barge was an excellent outing and means to show and discuss channel maintenance issues.

The proposed installation of off-shore anchors with floating mooring cells below Lock and Dam 24 at Clarksville will protect main channel border habitat and will improve the navigation concerns between tows using the locks at this site. We fully support and encourage the off-shore mooring proposal as you "fine tune" the actual locations to benefit the towing industry. The anchors should have a minor impact on any mussel beds in the area.

The Fish and Wildlife Service (Service) concurs with Bill Dieffenbach's discussion in his May 23 letter to Ron Yarbrough on the placement of additional anchors and construction of an emergent off-shore dike above Lock and Dam 25 in the Clarksville Refuge area.

The Service commends the St. Louis District and specifically Ron Yarbrough for the innovative thinking and proactive approach to addressing a subject that has environmental and towing industry interests. The off-shore mooring cells and emergent dike are excellent ideas.

We appreciate the opportunity to review and comment on the "avoid and minimize measures." Tim Santel and I look forward to working with your staff on these measures.

Sincerely,

Thomas M. Groutage

Thomas M. Groutage
Assistant Field Supervisor

cc: IDOC (Atwood, Lutz)
MDOC (Stucky)

MISSOURI DEPARTMENT OF CONSERVATION

MAILING ADDRESS
P.O. Box 180
Jefferson City, Missouri 65102-0180

STREET LOCATION
2901 West Truman Boulevard
Jefferson City, Missouri

Telephone: 314/751-4115
JERRY J. PRESLEY, Director

May 23, 1991

Dr. Ronald Yarbrough
St. Louis District, Corps of Engineers
1222 Spruce St.
St. Louis, Missouri 63103-2833

Dear Dr. Yarbrough:

Staff Member Mr. Norman P. Stucky reports that an excellent interagency onsite coordination meeting regarding "avoid and minimize" measures took place May 16, 1991, on the Mississippi River at Clarksville. It is particularly gratifying to hear that floating mooring cells have been placed just downstream of the Locks and Dam. We encourage you to continue working with towing interests to "fine tune" the locations of these cells so their use will offer an advantage to industry.

While the primary purpose of anchors or mooring cells is to protect valuable riparian timber, it should be noted that they may also function to minimize adverse impacts to sensitive areas, including main channel border habitat. The value and productivity of this habitat has long been recognized. In most cases, the farther offshore these cells are located, the less likely main channel border habitat will be disrupted.

As was discussed at the meeting, the need for additional anchors above Locks and Dam 25 in the Clarksville Refuge reach is recognized. Our biologists, however, are concerned that anchoring along the refuge border may not be compatible with management objectives for the refuge. The idea of constructing an emergent dike offshore, to the left of the main channel, is excellent and should be further explored. Such a structure, if properly located, would not only provide industry an alternative mooring site and improved approach to the lock chamber, it could also provide aquatic habitat benefits. Large stone on the back or left side would provide substrate and niches for benthic organisms. Additionally, trees could be anchored or incorporated into the dike to provide habitat structure for fishes.

COMMISSION

JERRY P. COMBS
Kennett

ANDY DALTON
Springfield

JAY HENGES
St. Louis

JOHN POWELL
Rolla

Again, we salute the St. Louis District for actively seeking to implement measures that will avoid and minimize adverse impacts of commercial navigation traffic. We look forward to continued coordination on this matter. Mr. Stucky is available to work with you on this effort.

Sincerely,

W. H. Deffenbach

for DAN F. DICKNEITE
PLANNING SECTION CHIEF

cc: Mr. Butch Atwood, Illinois Department of Conservation
Mr. Tom Groutage, U. S. Fish and Wildlife Service, Marion, IL
Ms. Gail Carmody, U. S. Fish and Wildlife Service, Rock Island, IL

Super job Gang!!

DX-1 DT/PD/ED/ OD

DX= Ltr for signature to Brent

Illinois Department of Conservation

life and land together

'91 JUL -3 P2:55

LINCOLN TOWER PLAZA • 524 SOUTH SECOND STREET • SPRINGFIELD 62701-1787
CHICAGO OFFICE • ROOM 4-300 • 100 WEST RANDOLPH 60601

[redacted]

BRENT MANNING, DIRECTOR

Be sure to follow up & make it happen in real time w/ interim feedback to all participants

June 28, 1991

Colonel James E. Corbin
District Engineer
St. Louis District, Corps of Engineers
1222 Spruce Street
St. Louis, Missouri 83103-2833

Call 8 Jul 91

Dear Colonel Corbin:

Reference is made to a recent (May 16, 1991) interagency coordination meeting held at Clarksville, Missouri, regarding avoid and minimize measures intended to reduce adverse navigation traffic related impacts on the natural resources of the Mississippi River.

We are very encouraged to learn that floating mooring bouys and anchors have been installed in mid-stream below Lock and Dam 24 and 25, and that the feasibility of a similar arrangement is being explored at Lock and Dam 22. We also understand that your staff continues to work with the towing industry and natural resource agencies so that optimal benefits will be achieved for all concerned interests.

By placing the bouys and anchors in the relatively deep waters of the thalweg, you've achieved a two-fold benefit to the river's natural resources. First, the bouys encourage waiting tows to moor at that location and not to tie off to riparian trees, thus protecting this valuable resource. Second, mooring in mid-stream also protects the very productive aquatic habitat of the main channel border (MCB). The flowing littoral zone of the MCB provides spawning, rearing, feeding and resting habitat for numerous riverine fishes and is also home for many aquatic macroinvertebrates, including several species of aquatic insects and freshwater unionid mussels. Under appropriate conditions, aquatic macrophytes can flourish in this habitat as well. The continued preservation and conservation of all these aquatic organisms is needed to maintain the ecological integrity of the Upper Mississippi River.

The possibility of designing mid-channel mooring devices to accommodate tows waiting upstream of locks and dams was also discussed at the meeting. For the same reasons listed above, we would strongly encourage you to pursue any reasonable structural alternative that can achieve this goal.

is Department applauds your efforts in finding alternatives that will avoid and minimize the adverse impacts commercial navigation traffic has on the natural resources of the Mississippi River and we look forward to continued cooperation and coordination in this regard. Please feel free to contact Butch Atwood of our Streams Program as the need arises.

Sincerely,

Brent Manning

Brent Manning
Director

BM/BA/jw

cc: Mr. Mike Conlin, Chief of Fisheries, Department of Conservation
Mr. Norm Stucky, Missouri Department of Conservation
Mr. Tom Groutage, USFWS, Marion, Illinois
Mr. Rick Nelson, USFWS, Rock Island, Illinois

bcc: Jim Allen
Bill Bertrand
Butch Atwood

United States Department of the Interior

Fish and Wildlife Service
Marion Field Office (ES)
Rural Route 3, Box 328
Marion, Illinois 62959

TAKE PRIDE IN AMERICA

In Reply Refer to:

91 JUL -2 A10:14
EXECUTIVE
ST. LOUIS DIST

Short will do note for my signature.

July 1, 1991

Colonel James E. Corbin
U.S. Army Corps of Engineers
1222 Spruce Street
St. Louis, Missouri 63103-2833

Dear Colonel Corbin:

During the recent "avoid and minimize" work day on the Corps of Engineers towboat and barge below Lock and Dam 24, we discussed channel maintenance activities. Claude Strauser and Steve Dierker gave a presentation on the use of "chevrons" at strategic locations. These chevrons will provide sites for disposal of dredged material and structures to direct and control water flow with the goal of reducing the need for maintenance dredging.

These men have developed an excellent concept that has direct applicability to the Mississippi River. The Fish and Wildlife Service fully supports and encourages the use of chevrons and other flow-control devices that would reduce channel maintenance costs and adverse impacts and maintain diverse, high quality aquatic habitat. We appreciate and applaud Claude's and Steve's efforts.

This office would like to be involved in the development of the siting plans for the placement of chevrons.

Sincerely,

Thomas M. Groutage
Assistant Field Supervisor

cc: IDOC (Atwood)
MDOC (Stucky)

APPENDIX E

SHIP ANCHOR LIABILITY OPINION

Office of Counsel (27-1a) 26 Mar 91

MEMORANDUM THRU CELMS-PD

FOR CELMS-PD-A

SUBJECT: Possible Government Liability Stemming from Employed Anchors

1. As part of the on-going "Avoid and Minimize" study, the suggestion has been offered that anchors be emplaced by the Government against which tows in transit could and would be allowed to tie-off for limited periods of time. This would be environmentally preferable to any past (and current) practice of tieing-off to large trees, etc.

2. Several questions have been informally presented to this office for consideration in conjunction with such a plan. First, whether the Government can accept such anchors as a donation? Secondly, whether the Government can contract for the placement of such anchors at various location in the waterways? Thirdly, what are the liabilities, if any, assumed by the Government by implementing such a plan as an aid to navigation?

3. In regard to accepting such anchors, the answer is in the affirmative. There are provisions whereby the Government can accept certain donated goods or services (volunteer services at our lakes is a perfect example). The one cautionary note here would be that the donation be totally without any future obligation on the part of the Government as to the donor. No consideration (using the term in a legal sense of supporting a legal obligation) can be given to the donor for such anchors.

4. The second question becomes more involved in that while the Government could contract for the suitable emplacement of the anchors, the contract would have to be structured to allow for maximum competition and not sole-sourced. While the donor(s) would not be precluded from bidding on such a contract, it would have to be emphasized that no preferential treatment could be given to such original donor(s). Naturally the latter could also donate their services in placing the anchors but then that would require them to obtain the applicable Sec.10 and Sec. 404 permits. Besides, while they might be willing to donate the anchors, they wouldn't want to assume any possibility of liabilities resulting from breakaway tows, etc. This they would prefer the Government to assume.

5. This then brings us to the third and most difficult question to answer, namely the possibility of Government liabilities. A quick search of the U. S. Code dealing with navigation and related topics, and the various cases decided thereunder, fail to reveal

any specific duty on the part of the Government to place anchors for mooring as part of our obligation to maintain navigable channels in "the waters of the United States". The closest analogy that can be found is the U. S. Coast Guard's mandate to establish and mark navigational channels and provide such aids to navigation as may be required (e.g., buoys, etc.). Accordingly, in the absence of any more definitive guidance in this area of concern, we might for discussion purposes look to some other basic legal principles to see how Government liability might arise, particularly the "Suits in Admiralty Act".

6. Generally speaking, the Government acting in its sovereign capacity is immune from being sued and cannot be successfully sued unless it has specifically waived that immunity. But there are exceptions to this general proposition. One example might be the Federal Tort Claims Act (FTCA) which allows lawsuits in certain instances involving personal injuries; and for instance when the Government contracts for goods and services. In the latter instance, the Government in entering the market place waives its right to immunity from lawsuits and is treated as any other contracting party would be treated under like circumstances.

7. Now under FTCA, there is a clause entitled the "discretionary function exception" which provides a legal defense for the Government against liabilities for damages when the latter, working through its employees, is performing an action falling under the protective umbrella of that clause. Now any Government liabilities stemming from these anchor emplacements would have to be brought under the "Suits in Admiralty Act". While there is no comparable specific "discretionary function exception" written into that Act, many cases have held that such a protective umbrella is implied and so, the Government is immune from any liabilities while performing an official function that would otherwise be protected. Further, the Courts in their decisions seem to have created a line of demarcation between a "planning level" and an "operational level". The planning level efforts are protected under the discretionary function exception but the operational level efforts are not. What this all translates into is a situation where the Government's decision to place the anchors (planning level) are protected under the implied discretionary function exception of the Suits in Admiralty Act, the actual placement (operational level) is not so protected and the Government could risk liabilities if this was done in a negligent manner.

8. Aside from the discretionary function issue, as stated above, a negligent act or omission is one prerequisite for liability both under the FTCA and the Suits in Admiralty Act. Actually for any

liability to arise based upon negligence, there are several key elements that must be present. First there must be a duty or obligation to perform some action. Secondly, there must be a breach of that duty or obligation. Thirdly, there must be actual damages sustained. Fourthly, there must be some causal relation between the damages sustained and the breach of the duty or obligation. We must examine each of these elements individually.

9. As we said before, we find no specific duty or obligation on the part of the Government to place the anchors. While the reason for doing so is quite meritorious - minimize environmental damage to the river banks and trees - at best the only authority for doing so might be found in some of the environmental statutes (e.g., NEPA, CERCLA, RCRA, etc.) to the effect that the Government should take whatever actions are required to minimize adverse effect on the environment. But this is a very tenuous authority for saying the Government has a duty or obligation to proceed as suggested. On the other hand, once the Government voluntarily assumes a duty or obligation (as long as it isn't specifically constitutionally prohibited), then we have a different set of ground rules. Once the obligation is assumed, then it must be accomplished in a safe and proper manner. It is against this new standard then that the actions must be judged if negligence is to be the basis of any resultant liabilities.

10. Having established this new standard that the assumed duty or obligation must be accomplished in a safe and proper manner, then any failure to do so, i.e., a breach, then sets the stage for a negligence claim if the remaining elements are also present. The elements of "damages" and "causal relationship" are rather self-explanatory and need not be considered in detail. Suffice to say that when all of the key elements are present concurrently, then an argument can be made that the Government is going to be held liable in a Court of Law in the event of some tow breakaway, etc.

11. We recognize that this is a somewhat roundabout response to your questions but we wanted to show that definite liability risks are present. We have contacted LMVD to see if any more detailed guidance is available and we will convey this information if any is received. For the time being, however, we do feel that some argument could be made that if the anchors were not carefully monitored, properly maintained and to some extent policed, the Government could be opening itself up to some degree of liability in the event of a mishap that could be traced to some negligence on the part of the Government.

ROBERT J. MUFFLER
Assistant District Counsel

CF:
CELMS_DD

END OF DOCUMENT