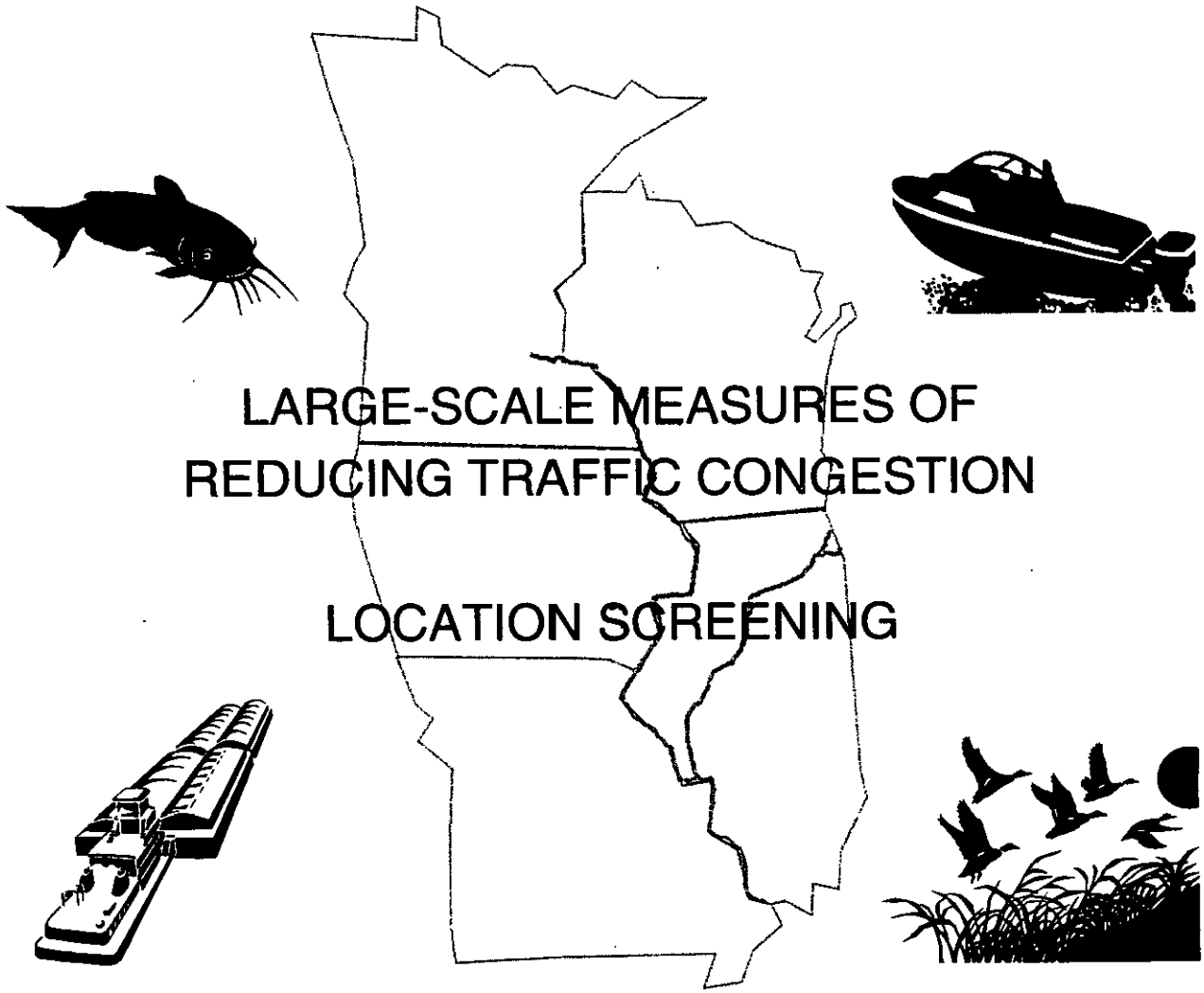
Lundberg
MVR

Upper Mississippi River - Illinois Waterway System Navigation Study



LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION

LOCATION SCREENING

INTERIM REPORT

July 1999

US Army Corps of Engineers

Rock Island District
St. Louis District
St. Paul District

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION

LOCATION SCREENING

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION

LOCATION SCREENING

EXECUTIVE SUMMARY

UMR-IWW Navigation Study - Statement of Purpose (abbreviated). The ongoing UMR-IWW System Navigation Study ("Navigation Study") is addressing navigation improvement planning for the Upper Mississippi River and Illinois Waterway System for the years 2000-2050.

Scope of this Report. This report documents the first phase of evaluating site locations for potential new locks conducted during fiscal years 1994 and 1995. The report presents the results of a qualitative process to screen and eliminate locations for potential new lock construction (1,200 or 600 feet long) at the 16 existing lock and dam sites under study for large-scale navigation improvements. However, the final product of the System Navigation Study is the feasibility report, which will constitute the decision document for processing to Congress. The 16 sites identified during the Reconnaissance Study as having potential economic justification for improvements during the above planning period include Locks and Dams (L/Ds) 11 through 25 on the Mississippi River (there is no L/D 23) and Peoria and La Grange Locks on the Illinois Waterway. The engineering product tree following the Executive Summary will help orient the reader to this report's relationship to the other engineering work.

Alternative Locations. Six potential locations were identified for possible new lock construction at each of the 16 lock and dam study sites. These six locations cover all possible lock placements that make use of the existing dam. Location 1 is landward of the existing lock. Location 2 is an extension of the existing lock. Location 3 is at the existing auxiliary gate/lock location (where applicable). Location 4 is anywhere along the gated section of the dam. Location 5 is anywhere along the overflow spillway/non-overflow section of the dam (where applicable). Location 6 is on the opposite shore from where the existing lock is located. The potential locations under study totaled 96 (16 sites times 6 locations per site). Present pool elevations are to remain the same, and no new dams are to be built.

Screening Approach. Multi-disciplined study teams in the Rock Island and St. Louis Districts representing construction, environmental, geotechnical, hydraulics, operations, real estate, civil engineering, and structural design were involved in the screening process. Site visits were made to each lock and dam. The pros and cons of the locations were discussed with the lockmasters and those invited representatives who attended from the U.S. Fish and Wildlife Service, State resource agencies, and the River Industry Action

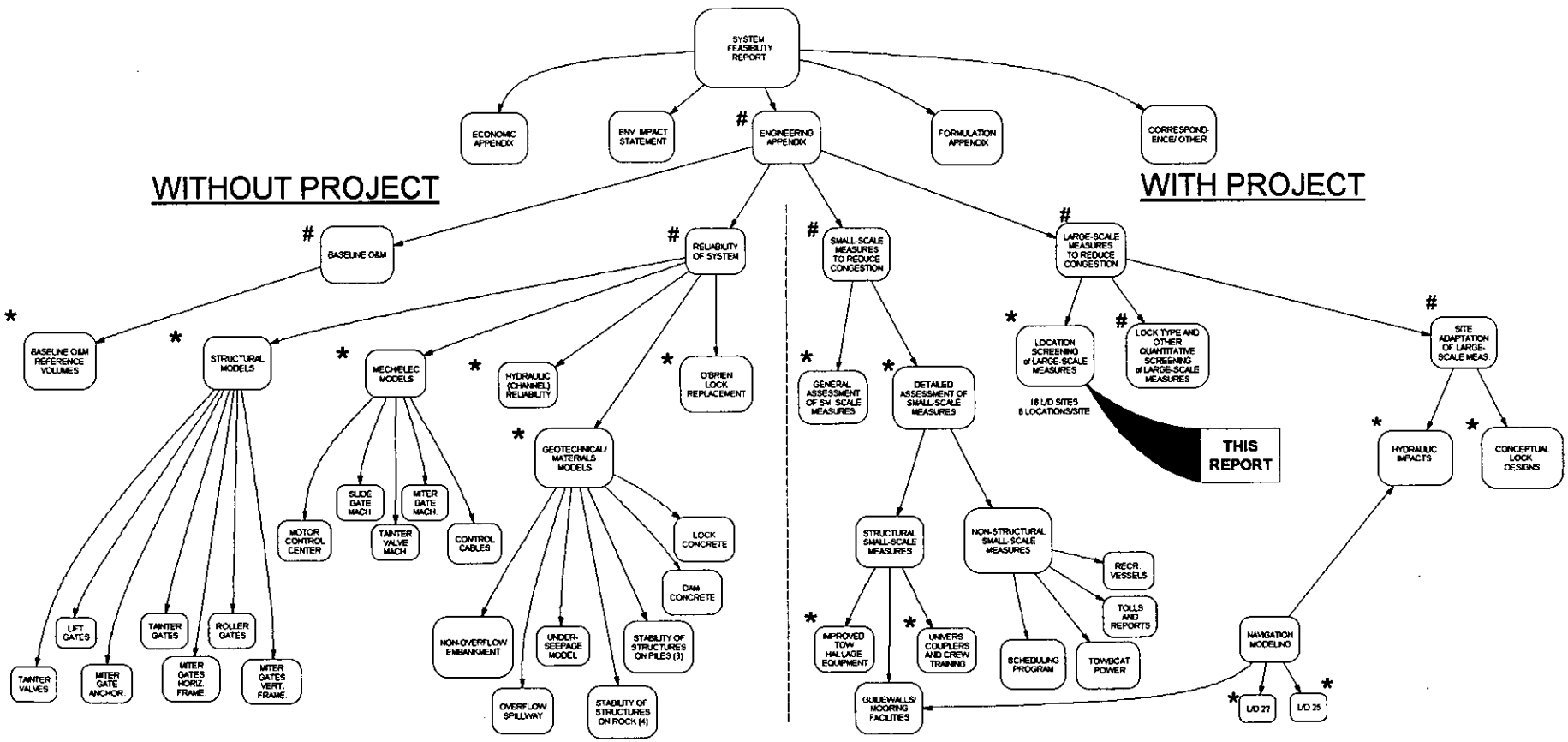
Committee. Evaluation criteria then were used by the study teams to rate each location at each study site. Those locations that were rated lowest at the sites, being dominated by more favorable locations, were eliminated. In addition to the ratings, in some cases additional qualitative factors were considered in either eliminating or keeping a location for further consideration.

Summary of Results. Fifty of the 96 initial locations were eliminated by the multi-disciplined study teams. Location 1 was eliminated at all sites except at L/Ds 17, 25, Peoria, and La Grange. Locations 2, 3, and 4 were generally the highest rated locations. They generally present the best navigation conditions and construction opportunity that would present less impact to the environment. Construction under traffic at Location 2 will require innovative construction techniques to minimize economic impact on the navigation industry. The smaller recreation lock at L/D 14 was eliminated as a possible Location 3 improvement, and Location 3 does not exist at Peoria and La Grange. Location 4 was eliminated at L/D 11 due to concern over endangered species impacts and flow replacement, at L/D 15 because of bridge interference, and at Peoria and La Grange because it impacts the open pass condition. L/D 19 has a 1,200-foot lock, and only Location 3 is under consideration for a supplemental 600- or 1,200-foot lock. Locations 5 and 6 were eliminated at all sites because of high environmental impacts and the costs to relocate the navigation channel and resulting impacts to the existing lock approaches and flow characteristics at the dam.

Surviving Locations for Further Study						
	Location Number					
Lock and Dam Site	**1**	**2**	**3**	**4**	**5**	**6**
L/D 11		•	•			
L/D 12		•	•	•		
L/D 13		•	•	•		
L/D 14		•		•		
L/D 15		•	•			
L/D 16		•	•	•		
L/D 17	•	•	•	•		
L/D 18		•	•	•		
L/D 19			•			
L/D 20		•	•	•		
L/D 21		•	•	•		
L/D 22		•	•	•		
L/D 24		•	•	•		
L/D 25	•	•	•	•		
Peoria	•	•				
La Grange	•	•				

Those 43 locations identified above which were not eliminated by this first phase of screening will be evaluated in greater detail in a subsequent site adaptation effort which will provide engineering feasibility and cost information for new lock construction at all 16 sites in the system navigation study.

UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY



NOTES:

1. THIS PRODUCT TREE IS A SIMPLIFIED REPRESENTATION OF THE ENGINEERING ACTIVITIES/PRODUCTS FOR THE UMR& IWW SYSTEM NAVIGATION FEASIBILITY STUDY.
2. IN GENERAL, THE ARROWS POINT IN THE DIRECTION ONE WOULD NORMALLY READ WHEN THE SYSTEM FEASIBILITY REPORT IS COMPLETE, I.E., FROM GENERAL TO SPECIFIC.
3. # INDICATES A PRODUCT (WRITE UP) THAT IS AN INTEGRAL PART OF THE ENGINEERING APPENDIX.
4. * INDICATES A PRODUCT THAT IS A "STAND-ALONE", SEPARATE BOUND VOLUME, INCLUDED IN THE ENGINEERING APPENDIX IN SUMMARY FASHION OR BY REFERENCE ONLY.

ORGANIZATION OF ENGINEERING PRODUCTS FOR THE FEASIBILITY REPORT

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

CONTENTS

Paragraph	Subject	Page
	Executive Summary	i
	Navigation Study Engineering Product Tree	iii
	Contents	iv
	MAIN REPORT	
1	Purpose of this Report	1
2	Purpose of the Navigation Study	1
3	Alternative Locations of New Locks	1
4	Process to Screen Locations for New Lock Construction	2
4a	First Impression Ranking	2
	(1) Procedure	2
	(2) Conclusions from First Impression Ranking	2
4b	Lock and Dam Site Visits and Post-Site Visit Ranking	5
	(1) Scope and Purpose	5
	(2) Procedure	5
	(3) Post-Site Visit Ranking	5
	(4) Conclusions from Lock and Dam Site Visits	6
4c	Overall Location Rating by Individual Discipline	8
	(1) Description	8
	(2) Conclusions of Overall Rating Effort	8
5	Rationale for Eliminating Locations 5 and 6	11
5a	Channel Impacts for Locations 5 and 6	11
5b	Environmental Impacts for Locations 5 and 6	12
5c	Estimated Total Magnitude of Impacts for Locations 5 and 6	12
5d	Assessment of Location 4	12
6	Screening Results for Locations 1 through 6 at Lock and Dam Study Sites	13

CONTENTS (Cont'd)

Paragraph	Subject	Page
	Mississippi River	
6a	Lock and Dam 11	13
6b	Lock and Dam 12	13
6c	Lock and Dam 13	16
6d	Lock and Dam 14	16
6e	Lock and Dam 15	16
6f	Lock and Dam 16	17
6g	Lock and Dam 17	17
6h	Lock and Dam 18	17
6i	Lock and Dam 19	17
6j	Lock and Dam 20	18
6k	Lock and Dam 21	18
6l	Lock and Dam 22	18
6m	Lock and Dam 24	19
6n	Lock and Dam 25	19
	Illinois Waterway	
6o	Peoria Lock and Dam	19
6p	La Grange Lock and Dam	20
7	Quantitative Documentation for Locations Eliminated	20
7a	Justification of Present Qualitative Approach	20
7b	Quantitative Justification for Locations Eliminated	20
8	Locations Not Eliminated by Screening Process	22
9	Conclusion	23

Tables

1	First Impression Ranking of Locations for Lock Placement	3
2	Criteria for Evaluating New Lock Locations	4
3	Post-Site Visit Ranking versus First Impression Ranking of Locations for Lock Placement	6
4	Overall Rating of Alternative New Lock Locations	9
5	Summary Ranking & Rating of Alternative New Lock Locations	14
6	Preliminary Costs Other than New Lock Construction	21
7	Surviving Locations for Further Study	23

CONTENTS (Cont'd)

Plates

1	The Six Locations
2	Lock and Dam 22 - Locations 5 & 6, Channel Alignments
3	Lock and Dam 11 - Locations Eliminated
4	Lock and Dam 12 - Locations Eliminated
5	Lock and Dam 13 - Locations Eliminated
6	Lock and Dam 14 - Locations Eliminated
7	Lock and Dam 15 - Locations Eliminated
8	Lock and Dam 16 - Locations Eliminated
9	Lock and Dam 17 - Locations Eliminated
10	Lock and Dam 18 - Locations Eliminated
11	Lock and Dam 19 - Locations Eliminated
12	Lock and Dam 20 - Locations Eliminated
13	Lock and Dam 21 - Locations Eliminated
14	Lock and Dam 22 - Locations Eliminated
15	Lock and Dam 24 - Locations Eliminated
16	Lock and Dam 25 - Locations Eliminated
17	Peoria Lock and Dam - Locations Eliminated
18	La Grange Lock and Dam - Locations Eliminated

Appendix A - Documentation of Lock and Dam Site Visits

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION

LOCATION SCREENING

1. Purpose of this Report. The purpose of this report is to provide results of the screening of site locations for new locks conducted in fiscal years 1994 and 1995. The intention of this investigation is to narrow the number of locations for potential new lock construction at the 16 lock and dam sites found to have potential economic justification for navigation improvements as identified in the *Upper Mississippi River Navigation Study Reconnaissance Report*, dated June 1991, and the *Illinois Waterway Navigation Study Reconnaissance Report*, dated October 1990. This report discusses the process used to screen locations and identifies those locations eliminated at this time from further consideration.

2. Purpose of the Navigation Study. The Upper Mississippi River - Illinois Waterway System Navigation Study (Navigation Study) is a feasibility study addressing the need for navigation improvements for the Upper Mississippi River and Illinois Waterway (UMR-IWW) System for the years 2000-2050. This study assesses the need for navigation improvements at 29 locks on the Upper Mississippi River and 8 locks on the Illinois Waterway and the impacts of providing these improvements. More specifically, the principal problem being addressed is the potential for significant traffic delays on the system within the 50-year planning horizon, resulting in economic losses to the Nation.

3. Alternative Locations of New Locks. Plate 1 relates to a generic lock and dam site and shows new locks, 1,200 feet long, at the six locations under study for large-scale navigation improvements. These six locations generally cover all possible lock placements that make use of the existing dam. Present pool elevations will remain the same and no new dams will be built. *Location 1* is landward of the existing lock on the same side of the river as the existing lock. *Location 2* is an extension of the existing lock, shown in Plate 1 as a downstream extension. *Location 3* is at the existing auxiliary gate/lock location (where applicable). *Location 4* is anywhere along the gated section of the dam. Plate 1 shows a new lock placed at the dam gates nearest to the auxiliary gate. It is presently assumed that dam gates permanently lost to new lock construction at Location 4 would have to be replaced to maintain existing flow capacity through the dam and keep upstream water surface profiles the same. The auxiliary gate and/or the overflow spillway/non-overflow area are possible locations for adding gates. A *Location 5* lock is anywhere along the overflow spillway/non-overflow section of the dam. On Plate 1 it is shown close to the gated section of the dam. *Location 6* is on the opposite shore from where the existing lock is located. The potential locations for all lock and dam sites under study total 96 (16 sites times 6 locations at each site).

4. Process to Screen Locations for New Lock Construction. Multi-disciplined study teams in the Rock Island and St. Louis Districts evaluated the potential 96 locations to determine the most favorable locations for new lock construction at each of the lock and dam study sites. The locations were evaluated based on potential environmental impacts, navigational concerns (mainly vessel entrance and exit conditions), operational concerns for lock personnel, civil and structural design concerns, real estate needs, and hydraulic design concerns (including flow patterns and siltation for both the construction and normal operating condition). The multi-disciplined study teams used a 3-step screening process to evaluate locations at the 16 specific sites. The screening process included: (1) "First Impression" ranking, (2) lock and dam site visits and post-site visit ranking, and (3) overall location rating by individual discipline. Each of these activities is discussed in further detail below.

a. First Impression Ranking.

(1) Procedure. This ranking was made collectively by a multi-disciplined study team using a qualitative approach. The team used available information for each lock and dam site including drawings, maps, navigation charts, photographs, and individual knowledge of the area to arrive at a general consensus on the preferential ranking of Locations 1 through 6 for new lock construction at each lock and dam site. The purpose was to eliminate locations obviously unsuited for a new lock because of existing constraints that by observation alone make those locations undesirable. This "First Impression" ranking is shown in Table 1. A rank of "1" is the best location, a rank of "2" is second best, and so on to a rank of "6" for the least desirable location for a new lock. An "x" signifies total unacceptability of the location due to some high cost or severe adverse impact that could be avoided at another lock location. The votes of all disciplines, including construction, environmental, geotechnical, hydraulics, operations, real estate, civil engineering, and structural design, were given equal weight. Table 2 shows by discipline the general criteria used for this first screening.

(2) Conclusions from First Impression Ranking. The following are tentative conclusions from the "first impression" ranking:

(a) Any new lock construction should be done as economically as possible while maintaining navigation. To this end, it is assumed that new construction at any location be done under traffic as much as possible.

(b) The closer new lock construction is to the existing navigation channel, the less impact there would be to the environment and river hydraulics, while the impact would be greater to the constructibility of the lock done under traffic.

(c) Some locations have a tied ranking based on this qualitative screening process, and others (mainly Locations 5 and 6) are recommended for elimination because of the anticipated high cost to relocate the navigation channel and the resulting impact to the environment and the existing lock.

(d) Location 3 was ranked highest most often, followed by Location 4.

(e) Location 1 was promising at sites where major physical constraints were not present. This was at L/Ds 14, 16, 17, and 25.

(f) Location 1 appeared viable at L/D 18 if adjacent wetland impacts could be minimized and Henderson Creek was relocated away from a new approach channel.

(g) At L/Ds 20 and 21, a Location 1 lock was thought possible pending needed relocation requirements for industrial/urban areas.

TABLE 1. FIRST IMPRESSION RANKING OF LOCATIONS FOR LOCK PLACEMENT

	Location Number					
Lock and Dam Site	**1**	**2**	**3**	**4**	**5**	**6**
L/D 11	X	3	1	2	X	X
L/D 12	X	2	1	X	X	X
L/D 13	X	3	1	2	X	X
L/D 14	2	3	3	1	X	X
L/D 15	X	2	1	X	N/A	X
L/D 16	2	4	1	3	X	X
L/D 17	1	3	1	X	X	X
L/D 18	3	4	1	2	X	X
L/D 19	X	N/A	X	X	N/A	X
L/D 20	3	4	1	2	N/A	X
L/D 21	3	4	1	2	X	X
L/D 22	X	3	1	2	X	X
L/D 24	5	4	2	1	3	6
L/D 25	3	4	2	1	5	6
Peoria	1	2	N/A	X	N/A	X
La Grange	1	2	N/A	X	N/A	X

Rankings were made by the general consensus of a multi-disciplined team.

1 = best 6 = worst
X = apparently infeasible N/A = not applicable (the location does not exist)

TABLE 2. CRITERIA FOR EVALUATING NEW LOCK LOCATIONS

CONSTRUCTION
- -Land access to construction site (Are more roads needed?)
- -Water access to construction site (Is dredging needed for access?)
- -Existing navigation impacts on work areas
- -Cofferdam constructibility
- -Project constructibility

ENVIRONMENTAL
- -Existing Federal/State wildlife sanctuaries
- -Mitigation opportunities
- -Threatened and Endangered Species
- -Identified habitats of concern
- -National Historic Register sites
- -Known or potential historic properties
- -Recreational activity/adjacent recreation areas

GEOTECHNICAL
- -Geological profile of sites
- -Depth to sound rock
- -Rock/soil excavation limits
- -Major weak soil lenses
- -Anticipated rock/soil permeabilities
- -Anticipated soil stability problems

HYDRAULICS
- -Existing channel alignment
- -Better location for channel
- -Locations of frequent channel maintenance (dredging)
- -Channel approach conditions
- -New channel requirements (wing dams, weirs, etc.)
- -Magnitude of excavation/dredging for new channel
- -Existing hydraulic constraints at L/D
- -Can gates be added to maintain existing flow capacity
- -Filling/emptying requirements (one or two channels)

OPERATIONS
- -Access for operating personnel and equipment
- -Existing maneuvering problems at lock entrance/exit
- -Centralization/separation of operating personnel
- -Guidewall requirements
- -Maintenance of two channels (lock separation)
- -Ice flow characteristics
- -Land access for recreation boating and related activities
- -Safety concerns with expanded lock operations

REAL ESTATE
- -Existing Government-owned property
- -Real estate needs
- -Extent of property development adjacent to L/D sites

CIVIL/STRUCTURAL
- -Adjacent land topography
- -Required relocations (HWY/RR/utilities/drainage)
- -Existing bridge restrictions on navigation channel
- -Disposal sites for maintenance dredging
- -Hazardous, toxic, and radioactive waste potential
- -Impacts to completed L/D rehabilitation work
- -Special needs to accommodate location
- -Construction sequencing and impacts on navigation
- -Impacts to existing lock and dam structure, stability, etc.
- -Compatibility with existing structures
- -Costs

b. Lock and Dam Site Visits and Post-Site Visit Ranking.

(1) Scope and Purpose. Site visits were made in summer/fall 1994 to each of the 16 locks and dams under study for large-scale navigation improvements. These visits were made to familiarize Corps study team members with site-specific characteristics of each site and to gain pertinent information from the lockmasters. Only a representative number of the study team members made the visits to limit travel cost. However, team members from the environmental, hydraulics, and civil disciplines went on every visit. Participation from the operations discipline was made by lock personnel. Area offices of the U.S. Fish and Wildlife Service and State resource agencies were invited to send representatives to the visits. Also, the River Industry Action Committee (RIAC) was invited to send a representative to each site visit. These towing industry participants provided insight on existing approach/exit conditions through the lock and gave input on advantages and disadvantages of the alternative new lock locations.

(2) Procedure. The site visits generally began with a meeting at the lock house. With the aid of aerial photography, the team members reviewed the six locations under study for lock construction pertinent to the site and identified the apparent pros and cons of each location. The lockmaster at each site talked about the overall locking process and the general path of tows approaching the lock downbound and upbound. Conditions associated with time delays or tow maneuvering were discussed, such as outdraft and distance from the lock that tows wait for an ongoing lockage. RIAC representatives, who included present or former tow pilots, discussed their own experiences and knowledge about approach conditions and other subtleties at the site. Their insight in discussing river currents and flanking maneuvers required during a lock approach was valuable in comparing the relative merits of new lock locations. On most of the visits, after the initial meeting, the visitors and the lockmaster walked the full length of the dam including the overflow spillway. The environmental significance of areas beyond the gated section of the dam (where Locations 5 and 6 are) was often discussed during these walks. In some cases, following the walk across the dam, a summary discussion was held to review previous points discussed or to clarify new issues. All visits were documented in writing, and a copy of the Memorandum for Record (MFR) for each visit is at Appendix A.

(3) Post-Site Visit Ranking. Table 3 includes the post-site visit ranking made by the study team following the site visits. Again, the ranking is "1" for the best location down to a rank of "6" for the least desirable location for a new lock. This ranking considers information learned from the site visits that helped to qualitatively assess locations relative to one other for each of the lock and dam sites. For comparison, Table 3 also shows the first impression ranking.

TABLE 3. POST-SITE VISIT RANKING VERSUS FIRST IMPRESSION RANKING OF LOCATIONS FOR LOCK PLACEMENT

	Location Number											
Lock and Dam Site	**1**		**2**		**3**		**4**		**5**		**6**	
L/D 11	X	X	3	3	1	2	2	1	X	X	X	X
L/D 12	X	X	2	3	1	1	X	2	X	3	X	X
L/D 13	X	X	3	3	1	1	2	1	X	X	X	X
L/D 14	2	2	3	3	3	4	1	1	X	X	X	X
L/D 15	X	X	2	2	1	1	X	X	N/A		X	X
L/D 16	2	4	4	3	1	2	3	1	X	5	X	X
L/D 17	1	2	3	3	1	1	X	4,W	X	W	X	X
L/D 18	3	X	4	3	1	2	2	1	X	X	X	X
L/D 19	X	X	N/A		X	IC	X	X	N/A		X	X
L/D 20	3	3	4	4	1	1	2	2,W	N/A		X	X
L/D 21	3	4	4	5	1	1	2	3	X	2	X	X
L/D 22	X	X	3	3	1	2	2	1	X	X	X	X
L/D 24	5	X	4	3	2	2	1	1	3	X	6	X
L/D 25	3	3	4	4	2	2	1	1	5	X	6	X
Peoria	1	1	2	2	N/A		X	X	N/A		X	X
La Grange	1	1	2	2	N/A		X	X	N/A		X	X

Post-Site Visit Rankings are on the **right** in each column
First Impression Rankings are on the **left** in each column

Rankings were made by the general consensus of a multi-disciplined team.

1 = best 6 = worst
X = apparently infeasible N/A = not applicable (the location does not exist)
IC = ice chute has potential to improve navigation conditions
W = wicket dam a possibility at this site and location (when a ranking is also given, a new lock at this location is also a possibility)

(4) Conclusions from Lock and Dam Site Visits. The following are general conclusions from the site visits and post-site visit ranking:

(a) In most cases, the post-site visit ranking agrees with the first impression ranking, or only differs slightly.

(b) Outdrafts are common during moderate to high flows requiring the use of industry-furnished helper boats to help guide the tow into the lock. (Outdrafts are flows that tend to pull downbound tows away from the lock and toward the dam.)

(c) Location 1 is not viable at most sites because present site conditions require relocation of railroads, highways, town features, or extensive channel excavation through high bluff topography. Also, this location does not help to improve many already difficult downbound approaches.

(d) Locations 2, 3, and 4 present the best navigation condition opportunities and were typically ranked highest.[1] Placing a Location 4 lock as close as possible to the auxiliary gate was considered most advantageous. Dam gates could be placed in the auxiliary lock bay to help make up the flow capacity lost because of new lock construction at Location 4. Gates placed there might help to pass ice.

(e) A lock at Location 6 would significantly impact the environment and is not practical at any site. Moving the river channel to the opposite side of the river would be costly and impacts the existing lock approaches since wing dikes needed to deflect the current to the other side of the river cross the existing channel.[2]

(f) Location 5 is not practical for the same reasons listed for Location 6, but to a lesser extent. However, some interest was expressed during the site visits for a Location 5 lock at L/Ds 12, 16, and 21. This interest is explained later in the summary paragraphs on each lock and dam site.

(g) The addition of wicket gates to replace some of the dam gates at L/Ds 17 and 20 could provide a navigable pass condition which exists at these sites about 25 to 30 percent of the time.[3] The wicket gate potential for these two sites will be considered further in the site adapting process following this initial screening.

(h) Lock 19 is different from all other sites. Among other differences, it already has a 1,200-foot-long lock. An ice chute in the Location 3 area would be expected to improve locking efficiency for the existing lock.

---

[1] During the first impression ranking, Location 4 at L/D 12 was eliminated due to the presence of deep scour holes downstream of the dam. Upon reconsideration, it is believed that this condition could be overcome without great expense. The site visit indicated that Location 4 at L/D 12 presents good navigation conditions; therefore, this location is back in consideration.

[2] The only remote interest expressed in Location 6 was at the L/D 15 site visit. The tow pilot (RIAC representative) on the visit said that if we could start from scratch, a lock located on the Iowa shore upstream a mile or so from the existing Lock 15 at Arsenal Island would better align with the natural tow path in this river stretch. However, this location is economically infeasible in view of the existing development along the Davenport, Iowa, riverfront.

[3] Wicket gates in the raised position hold the upstream pool but do not pass flow. During high river flows, when there is little difference between the upstream and downstream water elevations, these gates can be lowered and allow tows to pass over them and bypass the lock, thus saving transit time.

c. Overall Location Rating by Individual Discipline.

(1) Description. This rating represents the third step in the site location evaluation process. Study team members, by discipline, assigned a value for each location at each lock and dam according to the overall rating scale on Table 4. Values range from 5 for an excellent location to construct a new lock down to 1 for a poor location. The overall rating is the summation of the individual discipline ratings. The higher the numerical overall rating, the more favorable the site location is to the study team as a group. Team members referred to the criteria at Table 2 in assessing the locations. This screening uses qualitative analysis by the individual discipline to show relative favorability of one location to another when evaluated by consistent criteria for each discipline. This methodology provides a relative comparison of the locations at lock and dam sites by the individual disciplines resulting in a group consensus as to which locations are most favorable and which locations should be eliminated from further consideration. This helps to narrow the scope of work in preparing cost estimates for those remaining locations that survive this initial screening.

(2) Conclusions of Overall Rating Effort. The following general conclusions were made from this overall location rating:

(a) Many Locations 5 and 6 were given an environmental rating of "X" to indicate unacceptability for the location. The other disciplines also gave low ratings to Locations 5 and 6, resulting in a low composite rating for these locations.

(b) Locations 2, 3, and 4 generally received the higher overall numerical rating.

(c) Location 1 was highly rated at some lock and dam sites, but was generally low rated.

(d) It was difficult to keep some criteria from overlapping disciplines such as project constructibility being considered by both the construction and structural disciplines; channel dredging by both hydraulics and civil; recreation by environmental and operations; and relative costs which concerned all disciplines.

(e) The real estate concerns/costs are anticipated to be minor for Locations 2, 3, and 4, but are contingent on defining the navigational servitude or the limits of the riverbed.

TABLE 4
UMR&IWW SYSTEM NAVIGATION STUDY
OVERALL RATING OF ALTERNATIVE NEW LOCK LOCATIONS

LOCK&DAM NO.	LOCK LOCATION NUMBER											
	1		2		3		4		5		6	
11	3	18	4	27	4	30	4	27	5	20	5	15
	3		4		4		2		X		X	
	4		4		4		4		4		4	
	1		4		4		4		1		1	
	1		2		4		3		1		1	
	1		4		4		4		3		1	
	1/4		3/2		4/2		4/2		2/4		1/2	
12	4	17	4	26	4	30	4	25	5	18	5	15
	1		4		4		2		X		X	
	4		4		4		4		4		4	
	1		3		4		2		1		1	
	1		2		4		3		1		1	
	1		4		4		4		1		1	
	1/4		3/2		4/2		4/2		2/4		1/2	
13	5	20	4	27	4	29	4	29	5	21	5	15
	X		5		3		3		X		X	
	4		4		4		4		4		4	
	1		3		4		4		1		1	
	1		2		4		3		1		1	
	4		4		4		4		4		1	
	1/4		3/2		4/2		5/2		2/4		1/2	
14	4	25	4	28	4	17	4	32	5	22	5	19
	3		5		X		3		X		X	
	5		5		5		5		4		5	
	1		3		2		5		1		1	
	2		2		X		3		2		1	
	4		4		4		4		5		2	
	2/4		3/2		1/1		5/3		1/4		1/4	
15	3	16	4	28	4	27	4	19	N/A	N/A	2	17
	X		5		1		1		N/A		5	
	5		5		5		5		N/A		5	
	1		3		3		1		N/A		1	
	1		2		5		2		N/A		1	
	1		4		4		4		N/A		1	
	1/4		3/2		3/2		1/1		N/A		1/1	
16	5	24	4	25	4	29	4	30	5	26	5	18
	3		5		3		3		X		X	
	4		4		4		4		5		5	
	1		1		4		5		3		1	
	1		2		4		3		2		1	
	4		4		4		4		5		1	
	2/4		3/2		4/2		5/2		2/4		1/4	
17	5	27	4	27	4	30	4	29	5	23	5	19
	2		4		4		2		X		X	
	4		4		4		4		4		4	
	3		4		4		5		2		2	
	1		2		4		3		1		1	
	4		4		4		4		5		2	
	4/4		3/2		4/2		5/2		2/4		1/4	
18	5	21	4	26	4	30	4	29	5	25	5	20
	X		3		3		2		X		X	
	4		4		4		4		4		4	
	3		4		5		5		3		2	
	1		2		4		3		2		1	
	3		4		4		4		5		3	
	1/4		3/2		4/2		5/2		2/4		1/4	

CONSTRUCTION	OVERALL RATING
ENVIRONMENTAL	
GEOTECHNICAL	
HYDRAULICS	
OPERATIONS	
REAL ESTATE	
CIVIL/STRUCTURAL	

OVERALL RATING SCALE:
- 5 - EXCELLENT LOCATION
- 4 - MINOR CONCERNS
- 3 - MANY MINOR/FEW MAJOR CONCERNS
- 2 - SEVERAL MAJOR CONCERNS
- 1 - POOR LOCATION

X = ELIMINATE
N/A = NOT APPLICABLE

TABLE 4 (CON'T)
UMR&IWW SYSTEM NAVIGATION STUDY
OVERALL RATING OF ALTERNATIVE NEW LOCK LOCATIONS

LOCK&DAM NO.	LOCK LOCATION NUMBER 1		2		3		4		5		6	
19	5	20	N/A	N/A	4	30	4	15	N/A	N/A	N/A	8
	5		N/A		3		1		N/A		X	
	5		N/A		5		X		N/A		X	
	1		N/A		4		1		N/A		1	
	1		N/A		3		1		N/A		1	
	1		N/A		4		4		N/A		1	
	1/1		N/A		4/3		1/3		N/A		1/4	
20	5	26	4	31	4	31	4	29	N/A	N/A	5	20
	3		5		3		3		N/A		1	
	5		5		5		4		N/A		4	
	3		5		5		4		N/A		1	
	2		2		4		3		N/A		2	
	3		4		4		4		N/A		2	
	1/4		3/3		4/2		4/3		N/A		1/4	
21	5	22	4	26	4	30	4	29	5	23	5	20
	4		5		3		3		X		X	
	4		4		4		4		4		4	
	2		2		5		4		1		1	
	1		2		4		3		2		1	
	1		4		4		4		5		4	
	1/4		3/2		4/2		5/2		2/4		1/4	
22	5	18	4	29	4	31	4	32	5	23	5	20
	X		5		3		3		X		X	
	5		5		5		5		4		4	
	1		3		4		5		1		1	
	1		2		4		3		2		1	
	1		4		4		4		5		4	
	1/4		3/3		4/3		5/3		2/4		1/4	
24	4	20	1	21	2	29	5	36	2	21	1	14
	3		5		5		5		1		1	
	1		1		3		4		5		1	
	2		4		4		5		1		1	
	3		1		4		5		1		1	
	1		5		5		5		5		1	
	1/5		3/1		5/1		5/2		2/4		5/3	
25	4	25	1	22	4	34	5	34	2	20	1	10
	3		5		5		5		1		1	
	5		1		2		3		4		1	
	2		4		4		5		1		1	
	1		2		4		5		1		1	
	4		5		5		5		5		1	
	1/5		3/1		5/1		4/2		2/4		1/3	
PEORIA	3	20	4	26	N/A	N/A	4	18	N/A	N/A	3	10
	2		3		N/A		3		N/A		1	
	4		4		N/A		X		N/A		X	
	5		4		N/A		1		N/A		1	
	2		2		N/A		2		N/A		2	
	1		4		N/A		4		N/A		1	
	2/1		3/2		N/A		2/2		N/A		1/1	
LA GRANGE	5	35	4	28	N/A	N/A	4	18	N/A	N/A	3	15
	5		5		N/A		3		N/A		X	
	4		4		N/A		X		N/A		X	
	5		4		N/A		1		N/A		1	
	2		2		N/A		2		N/A		1	
	4		4		N/A		4		N/A		4	
	5/5		3/2		N/A		2/2		N/A		1/5	

OVERALL RATING SCALE:
- 5 - EXCELLENT LOCATION
- 4 - MINOR CONCERNS
- 3 - MANY MINOR/FEW MAJOR CONCERNS
- 2 - SEVERAL MAJOR CONCERNS
- 1 - POOR LOCATION

CONSTRUCTION	OVERALL RATING
ENVIRONMENTAL	
GEOTECHNICAL	
HYDRAULICS	
OPERATIONS	
REAL ESTATE	
CIVIL/STRUCTURAL	

X = ELIMINATE
N/A = NOT APPLICABLE

5. Rationale for Eliminating Locations 5 and 6.

a. Channel Impacts for Locations 5 and 6. As mentioned above, Locations 5 and 6 were not considered good sites for new lock construction. Plate 2 shows this rationale by using L/D 22 as an example.

L/D 22 and the adjacent agricultural land use in the Location 6 area is typical of many of the lock and dam sites on the Upper Mississippi River. Plate 2 shows the relationship between the existing lock on the Missouri side of the Mississippi River, a Location 5 lock and navigation channel through the non-overflow section of the dam, and a Location 6 lock and navigation channel on the Illinois side of the river. Of particular note is the relationship of the navigation channels for these lock locations. The existing channel is close to the Missouri shore and aligns with the existing lock. For a Location 5 lock, the navigation channel would be relocated to the other side of the dam, and for a lock at Location 6, the navigation channel would be relocated to the Illinois side of the river.

It is estimated that the transition from one side of the river to the other would take up to 3 years to complete, and it would impact the immediate area 3 miles upstream and downstream from the dam. Lasting impacts would affect a much larger area, especially downstream. Transition time and impacts for a navigation channel at Location 5 would be less than at Location 6, although still significant.

A new navigation channel would require a minimum width of 300 feet and should be in straight alignment with the lock for a distance of three tow lengths upstream of the lock guidewall/guardwall, or a distance of 3,600 feet. While a straight approach of three tow lengths is preferred for optimum safety, a minimum of two tow lengths (or 2,400 feet) is considered acceptable. The upbound approach can have a shorter straight segment depending on site-specific flow characteristics. Relocating the existing channel to a Location 5 or 6 channel alignment would require extensive dredging to achieve the necessary channel dimensions and extensive river training works (wing dams, weirs, etc.) to direct the river current to the new channel.

For L/D 22, this channel work is estimated to cost $12.4 million for a Location 5 lock and $52 million for a Location 6 lock, including maintenance dredging. Maintenance dredging of the new Location 6 channel would be extensive because flow would continue to pass through the existing dam gates on the other side of the river, and the new channel would tend to silt in. The new lock approach to Location 6 would be a slackwater area because there would be no significant flow on that side of the river. Wing dams constructed on the existing lock side of the river would impact the approaches of the existing lock. As plate 2 shows, wing dams placed in this manner could cause the existing lock to silt in and thereby make it usable by only recreational boaters.

While maintenance dredging would be less for Location 5, the shorter wing dams required would still impact the use of the existing lock, restricting use to recreational traffic at best. The potential danger from these wing dams to recreational traffic during their lock approach would have to be assessed. An additional concern is the effect that the wing

dams would have on the flow characteristics through the existing dam. The resulting adverse flow conditions would be difficult to mitigate.

b. Environmental Impacts for Locations 5 and 6. Constructing new locks at Locations 5 or 6 is envisioned to have considerable impact due primarily to the large amount of dredging and land excavation required to establish a new channel. Specific resource impacts were considered only very generally in this initial screening. For comparative purposes, a replacement cost approach was used to estimate mitigation costs for these locations, considering only dredging and terrestrial excavation. These costs are preliminary and do not consider resource agency participation and technical practicality or cost of dredged material placement and acquisition of land for this purpose. Computations were based on average per acre replacement costs for aquatic, semi-aquatic, and terrestrial habitats as determined from a database of nearly 1,000 mitigation projects. Figures are in 1996 dollars. For Location 5 at L/D 22, the estimated mitigation cost is $39.2 million. For Location 6, the estimated mitigation cost is $30.5 million. These costs do not include costs for cultural/historical investigations or its mitigation.

c. Estimated Total Magnitude of Impacts for Locations 5 and 6. At L/D 22, the cost (not including new lock construction) for just channel work and environmental mitigation (exclusive of cultural/historical impacts) is estimated at $52 million for a Location 5 lock and $82 million for a Location 6 lock. Costs for real estate, site access, and additional operation cost for separated locks would be added for a total cost exclusive of new lock construction. Similar impacts and costs are anticipated for all Locations 5 and 6 at all lock and dam study sites. At some lock and dam sites where urbanization is in the Location 6 area, such as at L/Ds 13, 15, 16, 19, and 20, real estate and relocation costs would be high and add to the Location 6 site costs. See paragraph 7 for further discussion of costs for the six different locations at each of the lower five Mississippi River sites (L/Ds 20 to 25).

d. Assessment of Location 4. Location 4 dominates Location 5 in that Location 4 does not require major realignment of the navigation channel. In fact, a Location 4 lock close to the existing lock requires very little channel realignment. Consequently, costs for realigning the channel would be minimal and environmental impacts would be lower. More importantly, the flow characteristics through the dam remain similar to the existing condition with no additional training dikes (wing dams) or lengthening of existing dikes to maintain a Location 4 channel. This would allow for continued use of the existing lock by recreational traffic and industry during an emergency closure of a Location 4 lock. At L/D 22, the Location 4 channel and environmental mitigation costs are each estimated at $7 million for a total of $14 million. This cost is much less than the Location 5 and Location 6 costs reported above. It is anticipated that Location 4, compared to Locations 5 and 6, would have the least channel relocation and environmental mitigation costs at all the other lock study sites. For these reasons and because both were rated low following the lock and dam site visits, Locations 5 and 6 are eliminated from further consideration as potential new lock placement locations.

6. Screening Results for Locations 1 through 6 at Lock and Dam Study Sites. The following paragraphs and Table 5 summarize the screening results for potential new lock construction. At each lock and dam study site, both 600- and 1,200-foot-long locks were considered at Locations 1 through 6, as applicable.[4] Table 5 combines the information from Tables 1, 3, and 4. A large "X" designates the locations that are eliminated from further consideration for new lock construction as a result of this initial screening. Fifty of the initial 96 locations were eliminated.

Some general remarks apply to most or all sites. Constructing a lock at either Location 2 or 3 would require innovative construction techniques to minimize disruption to navigation traffic during construction. Constructing a lock at Location 2 would result in only one lock, whereas constructing a new lock at any of the other locations would result in two functioning locks. Construction at Location 4 would require replacement of the dam gates that are replaced. In general, placing a Location 4 lock near the existing lock end of the dam is more advantageous for personnel access, proximity to the existing channel, and fewer changes to the existing flow patterns. The displaced gates could be placed in the overflow/non-overflow section and/or in the auxiliary lock gate bay, if present. The later location may offer the benefit of providing an ice passage capability. Each of the lock locations presents challenges to protecting the existing structures, but constructing at Location 4 presents significant engineering challenges, especially for pile-founded dams. The new lock represents a breach in the dam, yet the water retention capability of the dam must be maintained through all phases of construction.

a. Lock and Dam 11 (plate 3). Location 3 is the highest rated alternative location. Location 3 is considered least disruptive to the environment. Location 2 is another surviving location, being moderately rated. While receiving the same rating as Location 2, Location 4 is eliminated due to concerns with potential endangered species impacts and flow replacement because this site has one of the shortest dams on the river system. In addition, flow replacement associated with adding dam gates in the overflow spillway/non-overflow (Location 5 area) may be disruptive to the environment. Location 1 is eliminated because of the high bluff topography and needed railroad relocation. Locations 5 and 6 are eliminated because of channel dredging through the Upper Mississippi River Wildlife and Fish Refuge area and the high cost of relocating the channel from the Iowa side to the Wisconsin side.

b. Lock and Dam 12 (plate 4). The lockmaster and a tow pilot described this lock as a very hard lock to navigate because of the upstream outdraft and downstream approach/exit conditions. Location 3 is highest rated, but a new lock may have to be extended 1,200 feet into the upper pool rather than extended downstream which is usually more economical. Such an arrangement may leave the present lock suitable for only recreation craft. Similarly, a Location 2 upstream extension would be better suited to deal with downstream restrictions. Location 4 presents the best navigation conditions, but it impacts the environment more. Also, dealing with the large 40- to 90-foot-deep scour hole

[4] All the study sites except Lock 19 have a 600-foot-long lock at Location 2. Therefore, a new 600-foot-long lock at Location 2 is not an alternative, nor is it an alternative at Lock 19, which already has a 1,200-foot-long lock at Location 2.

TABLE 5
UMR&IWW SYSTEM NAVIGATION STUDY
SUMMARY RANKING & RATING
OF ALTERNATIVE NEW LOCK LOCATIONS

LOCK&DAM NO.	LOCK LOCATION NUMBER 1		2		3		4		5		6	
11	3	X	4	3	4	1	4	2	5	X	5	X
	3		4		4		2		X		X	
	4		4		4		4		4		4	
	1	18	4	27	4	30	4	27	1	20	1	15
	1		2		4		3		1		1	
	1		4		4		4		3		1	
	1/4	X	3/2	3	4/2	2	4/2	1	2/4	X	1/2	X
12	4	X	4	2	4	1	4	X	5	X	5	X
	1		4		4		2		X		X	
	4		4		4		4		4		4	
	1	17	3	26	4	30	2	25	1	18	1	15
	1		2		4		3		1		1	
	1		4		4		4		1		1	
	1/4	X	3/2	3	4/2	1	4/2	2	2/4	3	1/2	X
13	5	X	4	3	4	1	4	2	5	X	5	X
	X		5		3		3		X		X	
	4		4		4		4		4		4	
	1	20	3	27	4	29	4	29	1	21	1	15
	1		2		4		3		1		1	
	1		4		4		4		1		1	
	1/4	X	3/2	3	4/2	1	5/2	1	2/4	X	1/2	X
14	4	2	4	3	4	3	4	1	5	X	5	X
	3		5		X		3		X		X	
	5		5		5		5		4		5	
	1	25	3	28	2	17	5	32	1	22	1	19
	2		2		X		3		2		1	
	4		4		2		4		2		2	
	2/4	2	3/2	3	1/1	4	5/3	1	1/4	X	1/4	X
15	3	X	4	2	4	1	4	X	N/A		2	X
	X		5		1		1		N/A		5	
	5		5		5		5		N/A		5	
	1	16	3	28	3	27	1	19	N/A	N/A	1	17
	1		2		5		2		N/A		1	
	1		4		4		1		N/A		1	
	1/4	X	3/2	2	3/2	1	1/1	X	N/A		1/1	X
16	5	2	4	4	4	1	4	3	5	X	5	X
	3		5		3		3		X		X	
	4		4		4		4		5		5	
	1	24	1	25	4	29	5	30	3	26	1	18
	1		2		4		3		2		1	
	1		4		4		4		2		1	
	2/4	4	3/2	3	4/2	2	5/2	1	2/4	5	1/4	X
17	5	1	4	3	4	1	4	X	5	X	5	X
	2		4		4		2		X		X	
	4		4		4		4		4		4	
	3	27	4	27	4	30	5	29	2	23	2	19
	1		2		4		3	WICKET GATES	1		1	
	4		4		4		4		2	WICKET GATES	2	
	4/4	2	3/2	3	4/2	1	5/2	4	2/4		1/4	X
18	5	3	4	4	4	1	4	2	5	X	5	X
	X		3		3		2		X		X	
	4		4		4		4		4		4	
	3	21	4	26	5	30	5	29	3	25	2	20
	1		2		4		3		2		1	
	3		4		4		4		3		2	
	1/4	X	3/2	3	4/2	2	5/2	1	2/4	X	1/4	X

OVERALL RATING SCALE:	
	5 - EXCELLENT LOCATION
	4 - MINOR CONCERNS
	3 - MANY MINOR/FEW MAJOR CONCERNS
	2 - SEVERAL MAJOR CONCERNS
	1 - POOR LOCATION

CONSTRUCTION	"FIRST IMPRESSION" RANKING (1 = MOST PREFERRED, 6 = LEAST PREFERRED)
ENVIRONMENTAL	
GEOTECHNICAL	OVERALL RATING
HYDRAULICS	
OPERATIONS	
REAL ESTATE	POST SITE VISIT RANKING (1 = MOST PREFERRED, 6 = LEAST PREFERRED)
CIVIL/STRUCTURAL	

X = ELIMINATE
N/A = NOT APPLICABLE

TABLE 5 (CON'T)
UMR&IWW SYSTEM NAVIGATION STUDY
SUMMARY RANKING & RATING
OF ALTERNATIVE NEW LOCK LOCATIONS

LOCK&DAM NO.	LOCK LOCATION NUMBER 1		2		3		4		5		6	
19	5 5 5 1 1 1 1/1	X 20 X	N/A N/A N/A N/A N/A N/A N/A	N/A HAS 1200' LOCK	4 3 5 4 3 4 4/3	X 30 ICE CHUTE	4 1 X 1 1 1 1/3	X 15 X	N/A N/A N/A N/A N/A N/A N/A	N/A	X X X 1 1 1 1/4	X 8 X
20	5 3 5 3 2 3 1/4	3 26 3	4 5 5 5 2 4 3/3	4 31 4	4 3 5 5 4 4 4/2	1 31 1	4 3 4 4 3 4 4/3	2 29 WICKETS 2	N/A N/A N/A N/A N/A N/A N/A	N/A	5 1 4 1 2 2 1/4	X 20 X
21	5 4 4 2 1 1 1/4	3 22 4	4 5 4 2 2 4 3/2	4 26 5	4 3 4 5 4 4 4/2	1 30 1	4 3 4 4 3 4 5/2	2 29 3	5 X 4 1 2 3 2/4	X 23 2	5 X 4 1 1 4 1/4	X 20 X
22	5 X 5 1 1 1 1/4	X 18 X	4 5 5 3 2 4 3/3	3 29 3	4 3 5 4 4 4 4/3	1 31 2	4 3 5 5 3 4 5/3	2 32 1	5 X 4 1 2 3 2/4	X 23 X	5 X 4 1 1 4 1/4	X 20 X
24	4 3 1 2 3 1 1/5	5 20 X	1 5 1 4 1 5 3/1	4 21 3	2 5 3 4 4 5 5/1	2 29 2	5 5 4 5 5 5 5/2	1 36 1	2 1 5 1 1 3 2/4	3 21 X	1 1 1 1 1 1 5/3	6 14 X
25	4 3 5 2 1 4 1/5	3 25 3	1 5 1 4 2 5 3/1	4 22 4	4 5 2 4 4 5 5/1	2 34 2	5 5 3 5 5 5 4/2	1 34 1	2 1 4 1 1 3 2/4	5 20 X	1 1 1 1 1 1 1/3	6 10 X
PEORIA	3 2 4 5 2 1 2/1	1 20 1	4 3 4 4 2 4 3/2	2 26 2	N/A N/A N/A N/A N/A N/A N/A	N/A	4 3 X 1 2 1 2/2	X 18 X	N/A N/A N/A N/A N/A N/A N/A	N/A	3 1 X 1 2 1 1/1	X 10 X
LA GRANGE	5 5 4 5 2 4 5/5	1 35 1	4 5 4 4 2 4 3/2	2 28 2	N/A N/A N/A N/A N/A N/A N/A	N/A	4 3 X 1 2 1 2/2	X 18 X	N/A N/A N/A N/A N/A N/A N/A	N/A	3 X X 1 1 4 1/5	X 15 X

OVERALL RATING SCALE:	
	5 - EXCELLENT LOCATION
	4 - MINOR CONCERNS
	3 - MANY MINOR/FEW MAJOR CONCERNS
	2 - SEVERAL MAJOR CONCERNS
	1 - POOR LOCATION

CONSTRUCTION	"FIRST IMPRESSION" RANKING 1 = MOST PREFERRED 6 = LEAST PREFERRED
ENVIRONMENTAL	
GEOTECHNICAL	OVERALL RATING
HYDRAULICS	
OPERATIONS	
REAL ESTATE	POST SITE VISIT RANKING
CIVIL/STRUCTURAL	1 = MOST PREFERRED 6 = LEAST PREFERRED

X = ELIMINATE
N/A = NOT APPLICABLE

downstream of the gated section of the dam would add costs to construction at this location. Locating a new lock landward of the existing lock (i.e., Location 1) retains or worsens difficult approach conditions and requires relocations within the town of Bellevue, Iowa; thus, Location 1 is not feasible. Due to some problems with other locations, Location 5 with its attendant mitigation requirements was considered following the site visit. However, Locations 5 and 6 are both eliminated because of extensive channelization through wetlands and the cost to move and maintain the channel in a shallow, slackwater area.

c. Lock and Dam 13 (plate 5). This lock was described as one of the easiest to navigate. Locations 3 or 4 are the highest rated locations. Both locations present some environmental concerns. Location 2 would be least disruptive to the environment. Location 1 is eliminated because of channelization through a wetland area, including the Potters Marsh Wildlife area. Location 5 is eliminated because of the impacts to the environment and the cost to move the channel from a location that is now very navigable. Location 6 is eliminated for the same reasons as Location 5, plus the rock bluffs and needed railroad relocation on the Iowa side make this location totally infeasible.

d. Lock and Dam 14 (plate 6). Location 4 is the highest rated location as it presents the best navigation conditions and, other than Location 2, is the least disruptive to the environment. Location 2 would require an upstream extension so as not to interfere with the downstream approach/exit at the smaller Le Claire Lock. Location 1 is eliminated because this site would result in worse approach conditions, environmental impacts, and potential effects to the historic Le Claire Canal. Location 3 is considered to be at the smaller Le Claire Lock, which is used by recreational boaters and is eliminated because of extensive cost for channel construction and the very negative cultural/historical and natural resource impacts associated with this location. Locations 5 and 6 are eliminated because of the associated environmental impacts and the cost, including rock excavation, to relocate the channel.

e. Lock and Dam 15 (plate 7). This unique site is in the highly developed area between the Rock Island Arsenal and Davenport, Iowa. The locations available for lock improvements are limited to the existing lock, Location 2, and the existing auxiliary lock, Location 3. A downstream extension of either location with an extended upstream riverward guardwall should help with the existing dam outdraft and difficult downbound approach. A negative result of extending a riverward guardwall would be the additional funneling of ice to the lock. The Sylvan Slough outdraft is a concern with any downstream lock extension. Further review of the channel approach conditions may require an upstream extension at either location. Location 1 anywhere landward of the existing lock, across Arsenal Island and Sylvan Slough to the city of Rock Island, Illinois, is eliminated because of impacts to urban development as well as both cultural/historical and natural resource impacts. Also, there is a mussel sanctuary in Sylvan Slough. Location 4 is eliminated because of the high construction costs of modifying or replacing the Government Bridge (which is on the National Historic Register) and because of the absence of space for replacement dam gates. There is no Location 5 at this site.

Location 6 is eliminated because of impacts that would result to the downtown development in Davenport, Iowa.

f. Lock and Dam 16 (plate 8). Location 4 is the highest rated location as it presents the best navigation conditions and is considered least disruptive to the environment, other than Location 2. This dam does not have submersible gates, making it more difficult to pass ice. Submersible gates placed at the auxiliary gate (Location 3) to recover flow capacity lost from a new lock at Location 4 may help to pass ice. Location 3 also would be expected to have minor environmental impacts. Extending the existing lock, Location 2, should to be least disruptive to the environment but retains the same approach maneuvering problems. Location 1 is eliminated because it makes the approach/exit angles worse and there is evidence of possible hazardous waste in the area. During the site visit, Location 5 was considered a possibility to make use of flow patterns and to improve the tow track through this reach of the river. However, both Locations 5 and 6 are eliminated because of wetland impacts and cost of relocating the channel from the Illinois side to the Iowa side.

g. Lock and Dam 17 (plate 9). The hydraulic flow capacity of this dam is limited by a narrow floodway and adjacent island land masses. The highest rated location for new lock construction is Location 3. It would be expected to have the least disruption to the environment. Location 4 presents the best navigation conditions, but additional dam gates in the non-overflow section of the dam (Location 5) would require extensive channel cleanout upstream and downstream in an environmentally sensitive area. Adding dam gates in the auxiliary lock bay area would have less impact on the environment. Replacing some of the dam gates with wicket gates in the Location 4 area would allow for a navigable pass that would exist about 25 to 30 percent of the time. This will be investigated as part of the site-adaptation effort to follow this initial screening. Extending the main lock, Location 2, is considered to have minor environmental concerns. Location 1 requires channel work and relocation of a drainage district levee. Locations 5 and 6 are deemed infeasible because of wetland impacts and anticipated impacts to Lake Odessa and the adjacent Mark Twain National Wildlife Refuge.

h. Lock and Dam 18 (plate 10). Locations 3 and 4 are the highest rated locations. Location 3 presents the least disruption to the environment. River currents and approach conditions favor Location 4. Location 2 was moderately rated. Location 1 is eliminated because of construction in the wetlands and outdraft from the Henderson River downstream. Locations 5 and 6 are eliminated because of dredging impacts to wetlands and a mussel sanctuary and the high cost of relocating and maintaining a new channel.

i. Lock and Dam 19 (plate 11). A 1,200-foot lock was constructed at this site in 1957; therefore, a Location 2 lock extension is not applicable as indicated in Table 5. Only a second lock 600 feet long would be considered for parity with other sites. Lock 19 is a unique site. An abandoned dry dock and lock, both having historical significance, are riverward, adjacent to the lock. These structures then tie into the Union Electric Power Dam with flow regulating gates across the full width of the river. There is no Location 5 at this site. Location 3 through the old dry dock/lock site is considered to be the only

practical location for new construction, whether it be a supplemental 600-foot lock or a small-scale improvement such as an ice chute which the lock personnel believe would be an effective operational improvement. Location 1 is eliminated because of high bluff topography, railroad relocation, and proximity to the city of Keokuk, Iowa. Location 4 is eliminated because of the power dam and downstream bridge restrictions. Location 6 is eliminated because of channel rock excavation, downstream bridge restrictions, and relocations in the town of Hamilton, Illinois.

j. Lock and Dam 20 (plate 12). Locations 2 and 3 are the highest rated locations for lock improvements. Location 2 is expected to least impact the environment. Location 4 presents the best navigation conditions, but finding space for replacement dam gates would be a problem since gates presently span the full width of the river. The auxiliary gate location (Location 3) could possibly be used for placement of dam gates, also providing ice passage capability that is currently lacking. Lock 20 is one of the first locks to go out of operation during high water. Replacing some of the dam gates with wicket gates in the Location 4 area would allow for a navigable pass that would operate about 25 to 30 percent of the time. This will be investigated as part of the site-adaptation effort to follow this initial screening. There is no Location 5 at L/D 20. Location 6 is eliminated because of relocations in the village of Meyer, Illinois, known archaeological sites, and the high cost of relocating the channel from the Missouri side to the Illinois side. Location 1 was eliminated due to its lower overall rating and high relocations, real estate, and site impacts.

k. Lock and Dam 21 (plate 13). Locations 3 and 4 are the highest rated locations. Location 4 appears to present the best navigation conditions. Constructing a new lock at either Location 3 or 4 would reduce the outdraft effect on downbound traffic commonly experienced today. Construction at Location 3 could pose problems with traffic at the adjacent lock. A Location 2 extension of the existing lock was moderately rated and is considered least disruptive to the environment. Location 1 is eliminated because it would retain the difficult downbound approach and require relocation of the wastewater treatment plant for the city of Quincy, Illinois. A Location 5 lock at the storage yard was considered a possibility during the site visit because of the existing river flow characteristics, expanse of river available, and isolation from existing tow traffic. Both Locations 5 and 6 are eliminated; however, because of the high cost for channel relocation, impacts on the existing lock from river training works, excavation in wetlands, and anticipated environmental impacts.

l. Lock and Dam 22 (plate 14). Location 4 is the highest rated location. The existing upstream approach channel is narrow, but could be utilized by a new lock constructed at Location 4 with minimal dredging if placed as close as possible to the existing lock. Extending the existing lock, Location 2, is considered least disruptive to the environment but it would retain the existing outdraft problem. Location 1 is eliminated because of bluff topography, a railroad relocation, several property relocations, and unacceptable environmental impacts to a mussel sanctuary downstream of the dam along the Missouri shoreline. The term "unacceptable" as it is used here relates the impacts to this sensitive area and the fact that replicating or replacing the ecological conditions that

exist now may not be achievable at any cost. The sanctuary may also harbor some endangered mussel species. Locations 5 and 6 are eliminated because of the high cost to relocate the channel from the Missouri side to the Illinois side and the anticipated high environmental impacts.

m. Lock and Dam 24 (plate 15). The highest rated location is Location 4 as it would present the best navigation conditions and, like Locations 2 and 3, is considered to be minimally disruptive to the environment. Constructing a Location 3 lock at L/D 24 would require the atypical cost for extensive repair of existing lock concrete on the existing I-wall because the concrete is in poor condition. Location 2 was moderately rated. Location 1 is not deemed feasible considering that: the town of Clarksville is located on the Missouri bank adjacent to the lock and dam, the required railroad and highway relocations, and the need for a large amount of rock excavation. Locations 5 and 6 are deemed infeasible because of construction in wetlands and the high cost of relocating the channel from the Missouri side to the Illinois side.

n. Lock and Dam 25 (plate 16). The highest rated location is Location 4 since it would present the best navigation conditions and, like Locations 2 and 3, is considered to be minimally disruptive to the environment. Locating the new lock landward of the existing lock, Location 1, would retain a difficult downstream approach condition. Location 2 was moderately rated. Location 5 would impact wetlands and would require extensive dike work and dredging to relocate the channel from the Missouri side to the Illinois side. Due to the rock bluffs on the Illinois side, Location 6 is deemed infeasible.

o. Peoria Lock and Dam (plate 17). The I-474 bridge, 1,000 feet upstream from the site, impacts many of the locations for new lock construction. The dam consists of a tainter gate 80 feet wide and 108 wicket gates, each 4 feet wide. An open pass condition exists approximately 40 percent of the time based on past records. The highest rated location is Location 2, the downstream extension of the existing lock. Potential problems are with the upper guidewall extension, which does not align well with the I-474 bridge piers, and the lower guidewall could constrict river flow requiring some channel widening. A lock at Location 1 may be best located just downstream of the dam to improve the downbound approach alignment. There may be clearance problems with the I-474 bridge pier and bridge deck, which is sloping down at this location, and there are major relocations including part of an oil tank farm. Also, Location 1 could result in significant environmental impacts depending on the alignment of a new navigation channel through the existing bottomland forested area along the left descending riverbank. There is no Location 3 at this site. Location 4 is eliminated because it impacts the open pass condition and its associated benefits in the narrow width of the dam and the location of added flow capacity is uncertain. There is no Location 5 at this site. Location 6 is eliminated because the I-474 bridge impacts this location more than any other with low clearance and bridge pier positioning. The downbound approach would be an "S" curve, the existing slip to Keystone Steel and Wire would have to be relocated, and maintenance dredging costs would increase.

p. La Grange Lock and Dam (plate 18). The dam consists of a tainter gate 80 feet wide and 109 wicket gates, each 4 feet wide. Open pass conditions are present approximately 50 percent of the time based on past records. The highest rated location is Location 1. It appears to present the best navigation conditions and, like Location 2, appears to be less disruptive to the environment than other lock locations. A concern may be the extent of channel work needed for a good approach condition. This will be investigated in the site-adaptation effort to follow this initial screening. The existing riverward lockwall is in poor condition, requiring major rehab work as part of any potential new lock construction. There is no Location 3 at La Grange. Location 4 is eliminated because it would eliminate the open pass condition and its associated benefits in the narrow width of the dam. In addition, mitigating one-third to one-half the flow capacity would be costly and present environmental concerns. There is no Location 5 at this site. Location 6 is eliminated because of the associated environmental impacts and high cost of relocating the channel from the west side of the river to the east side when its natural tendency is to move west.

7. Quantitative Documentation for Locations Eliminated.

a. Justification of Present Qualitative Approach. The screening process used for eliminating locations shown at Table 5 is qualitative and subjective. However, it is expected that additional review will validate the recommended elimination of those locations as reported herein. This assertion is supported by the following: (1) the conclusions are a consensus of multi-disciplined study teams, (2) locations are eliminated because they are dominated by more favorable locations when comparisons are made using the same criteria, (3) the criteria were consistently applied to all lock and dam study sites as well as locations within a lock and dam site, (4) recommendations consider information gained firsthand from the site visits, and (5) Locations 5 and 6 are eliminated due to the anticipated high cost for channel relocation and the environmental impacts.

b. Quantitative Justification for Locations Eliminated. Some preliminary quantitative work was done in 1994 and 1995 in addition to the qualitative screening for justifying the elimination of potential new lock construction locations at the lower five lock study sites. While not shown in this report, the costs for surviving locations have subsequently been revised and updated as part of continued study efforts. Apart from the costs of basic lock chamber and guidewall construction, costs were estimated for all locations at L/Ds 20, 21, 22, 24, and 25. These "other" costs, shown in Table 6, include costs for real estate, relocations, dam modifications, access roads, navigation channel work, levees and environmental mitigation.[5] These costs do not include disposal of dredged material on adjacent agricultural fields. These non-lock costs are higher for Locations 1, 5, and 6 and are the quantitative basis for confirming the elimination of these locations at the lower five locks. These "other" costs are thought to be representative of the non-lock costs for matching locations at the other lock sites. Table 6 data were found to support the overall qualitative screening summarized at Table 5.

[5] Further detailed quantitative assessment of environmental impacts was conducted. The results are included within Environmental Report 7, dated September 1998, "Site Specific Habitat Assessment."

TABLE 6. PRELIMINARY COSTS OTHER THAN NEW LOCK CONSTRUCTION ($1,000'S)

L/D 20

	Lock Location					
	1	2	3	4	5	6
Real Estate	10,700	2,500	2,000	20		6,300
Relocations	3,000	0	0	0		0
Dam	0	0	0	0		0
Lock					N/A	
Roads	0	0	0	0		100
Channel	37,900	12,300	10,200	6,200		26,000
Levees	2,800	600	0	0		1,700
Envir Mit	Not Incl	0	0	2,500		19,900
Total	54,400	15,400	12,200	8,720	N/A	54,000

L/D 21

	Lock Location					
	1	2	3	4	5	6
Real Estate	72,000	40	40	20	50	250
Relocations	170	0	0	0	0	0
Dam[1]	0	0	0	25,000	0	0
Lock						
Roads	0	0	0	0	0	600
Channel	16,200	2,000	2,300	5,500	12,500*	49,800
Levees	2,100	0	0	0	0	3,200
Envir Mit	7,400	0	0	2,500	10,300*	25,100
Total	97,870	2,040	2,340	33,020*	22,850*	78,950

L/D 22

	Lock Location					
	1	2	3	4	5	6
Real Estate	2,300	20	20	20	48	400
Relocations	4,100	0	0	0	0	520
Dam[1]	0	0	0	25,000	0	0
Lock						
Roads	0	0	0	0	0	0
Channel	17,000	4,800	5,100	7,000	12,400	52,000
Levees	0	0	0	0	0	7,500
Envir Mit	Avoid	0	0	6,940	39,200	30,500
Total	23,400	4,820	5,120	38,960	51,648	90,920

* Note: Location 4 is still preferred over Location 5 at L/D 21 because, as noted in the text, the channel and environmental mitigation costs are not all inclusive (disposal, lost nav. time during channel relocation, etc.) and because the first cost of a Location 5 lock is higher than that for a Location 4 lock (as indicated from the concurrent development of lock concepts). In addition, maintenance costs would be higher for a Location 5 lock as well as being less accessible to the operations crew.

TABLE 6 (Continued)

L/D 24	Lock Location					
	1	2	3	4	5	6
Real Estate	High	30	30	30	1,800	7,600
Relocations	8,400	0	0	0	0	1,500
Dam[1]	0	0	0	25,000	0	0
Lock						
Roads	0	0	0	0	750	Not Incl
Channel	1,800	830	830	830	13,100	47,600
Levees	0	0	0	0	0	4,400
Envir Mit	Not Incl	Not Incl	Not Incl	Not Incl	High[2]	High[2]
Total	10,200	860	860	25,860	15,650	61,100

L/D 25	Lock Location					
	1	2	3	4	5	6
Real Estate	2,400	230	30	30	4,500	9,500
Relocations	450	0	0	0	0	0
Dam[1]	0	0	0	25,000	0	0
Lock						
Roads	0	0	0	0	0	2,000
Channel	5,800	1,020	1,020	0	181,500	229,500
Levees	3,600	0	0	0	0	0
Envir Mit	9,000	1,000	1,000	1,000	High[2]	High[2]
Total	21,250	2,250	2,050	26,030	186,000	241,000

Notes:
1. The Location 4 cost of $25 million for Dam is for adding two replacement dam gates in the non-overflow section of the dam to replace gates lost to new lock construction at Location 4.
2. Although the environmental mitigation costs for L/D's 24 and 25 were not quantified, the impacts are by observation high enough to eliminate Locations 5 and 6 in comparison to Location 4.

8. Locations Not Eliminated by Screening Process. Those locations that are not crossed-out in Table 5 have survived the initial screening process. These locations scored highest in the overall rating by the study teams. These higher scores resulted generally because the locations would have the least impact on the environment, would provide the best navigation conditions, would be hydraulically acceptable, and would not require major relocations. Since these locations (Locations 2, 3, 4 and some Location 1's) are closest to the existing navigation channel, they would require innovative design and construction techniques to minimize disruption to tows and other traffic during the construction period. Table 7 below identifies the surviving 43 locations. The ratings in this report were made only to serve a screening function in order to eliminate some alternatives. The surviving locations will be given equal consideration in the next phase of the study. The site-adaptation effort will provide additional engineering feasibility and cost information for

new lock construction for the surviving locations. The ranking of lock locations emerging from that effort may be different than indicated by the ratings made in this report.

TABLE 7. SURVIVING LOCATIONS FOR FURTHER STUDY

	Location Number					
Lock and Dam Site	**1**	**2**	**3**	**4**	**5**	**6**
L/D 11		•	•			
L/D 12		•	•	•		
L/D 13		•	•	•		
L/D 14		•		•		
L/D 15		•	•			
L/D 16		•	•	•		
L/D 17	•	•	•	•		
L/D 18		•	•	•		
L/D 19			•			
L/D 20		•	•	•		
L/D 21		•	•	•		
L/D 22		•	•	•		
L/D 24		•	•	•		
L/D 25	•	•	•	•		
Peoria	•	•				
La Grange	•	•				

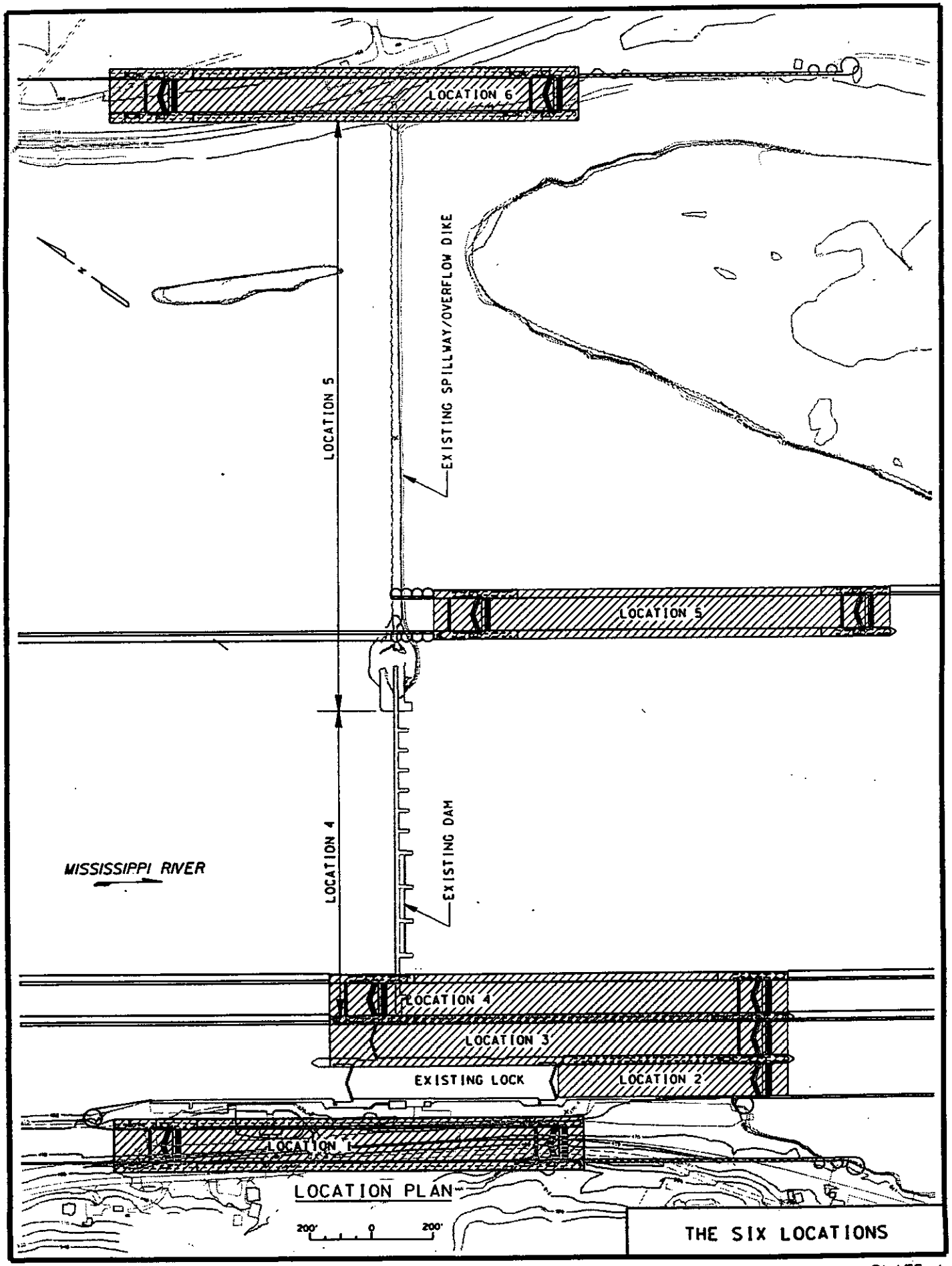
9. Conclusion. The present initial screening report examined six alternative lock locations at each of 16 lock and dam sites to narrow the field of alternatives for further study. A multi-disciplined approach was used with review team members from the following backgrounds represented: construction, environmental, geotechnical, hydraulics, operations, real estate, and civil/structural engineering. This level of screening looked for the more obvious detrimental or costly impacts. The result is that the number of alternative lock sites was reduced from 96 to 43 alternatives, and these surviving locations will be further screened in subsequent quantitative studies.

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

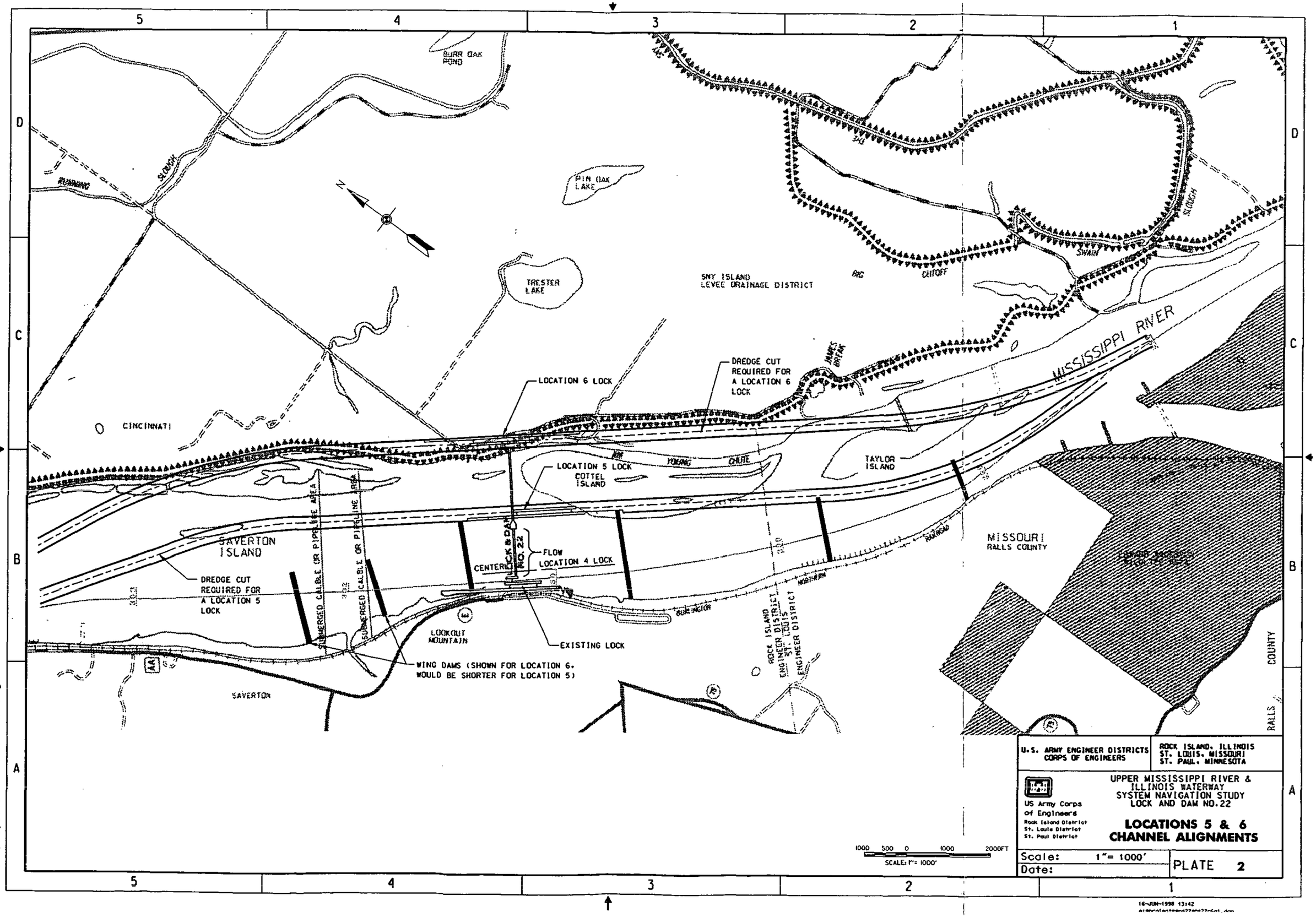
PLATES

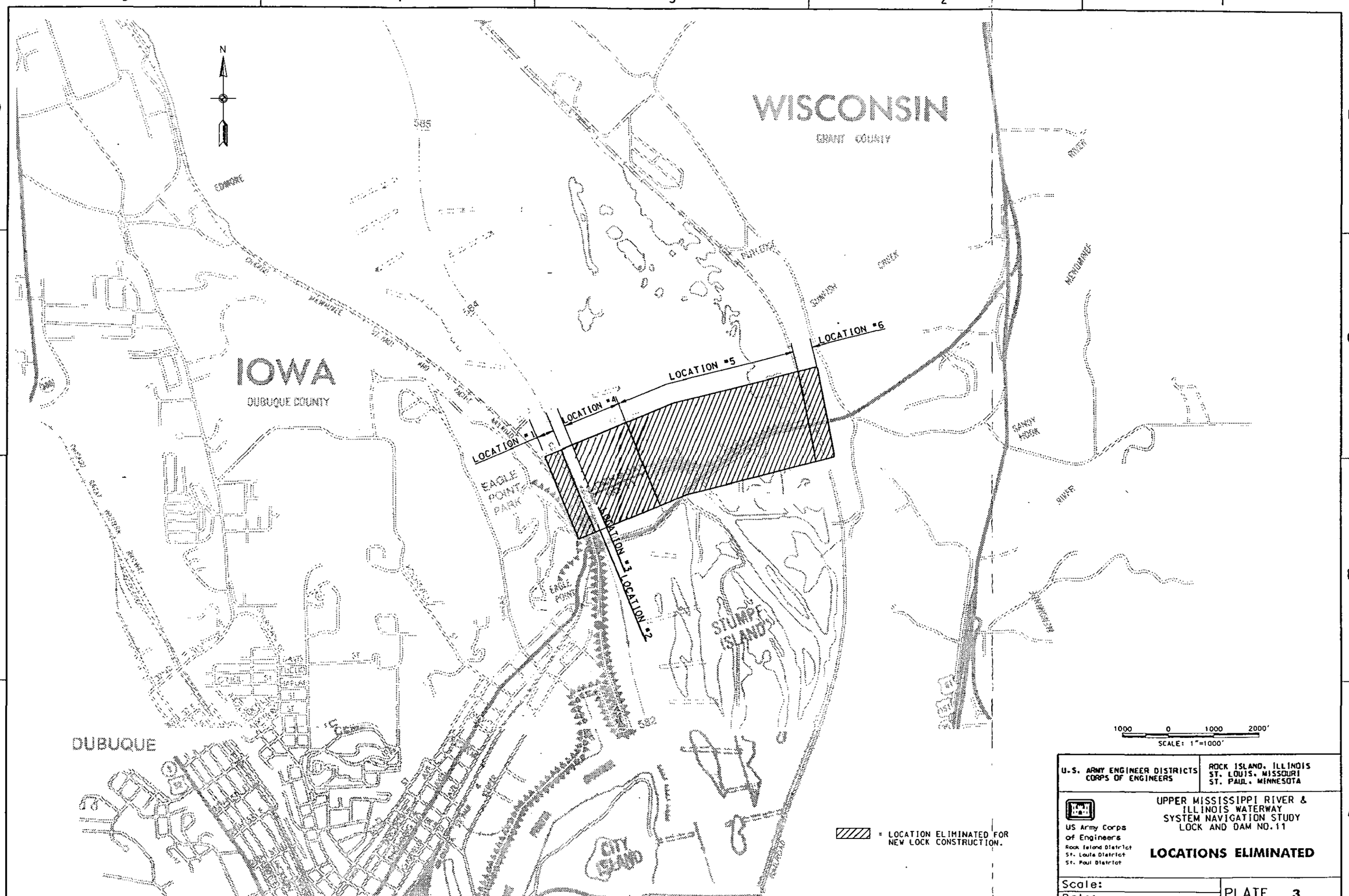
U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS



THE SIX LOCATIONS

PLATE 1


BURR OAK POND
RUNNING SLOUGH
PIN OAK LAKE
TRESTER LAKE
SNY ISLAND LEVEE DRAINAGE DISTRICT
BIG CUTOFF
SWAIN SLOUGH
MISSISSIPPI RIVER
JAMES CREEK
DREDGE CUT REQUIRED FOR A LOCATION 6 LOCK
LOCATION 6 LOCK
CINCINNATI
YOUNG CHUTE
LOCATION 5 LOCK
COTTEL ISLAND
TAYLOR ISLAND
SAVERTON ISLAND
SUBMERGED CABLE OR PIPELINE AREA
SUBMERGED CABLE OR PIPELINE AREA
LOCK & DAM NO. 22
CENTERLINE
FLOW
LOCATION 4 LOCK
DREDGE CUT REQUIRED FOR A LOCATION 5 LOCK
LOCKOUT MOUNTAIN
EXISTING LOCK
WING DAMS (SHOWN FOR LOCATION 6. WOULD BE SHORTER FOR LOCATION 5)
SAVERTON
ROCK ISLAND ENGINEER DISTRICT
ST. LOUIS ENGINEER DISTRICT
BURLINGTON NORTHERN RAILROAD
MISSOURI
RALLS COUNTY
LOWER JAMES CREEK
1000 500 0 1000 2000FT
SCALE: 1"= 1000'
U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA
US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District
UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO.22
LOCATIONS 5 & 6
CHANNEL ALIGNMENTS
Scale: 1"= 1000'
Date:
PLATE 2
16-JUN-1998 13:42
e:*projects*ns22*ns22c6a1.dgn



U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS

ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA

US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District

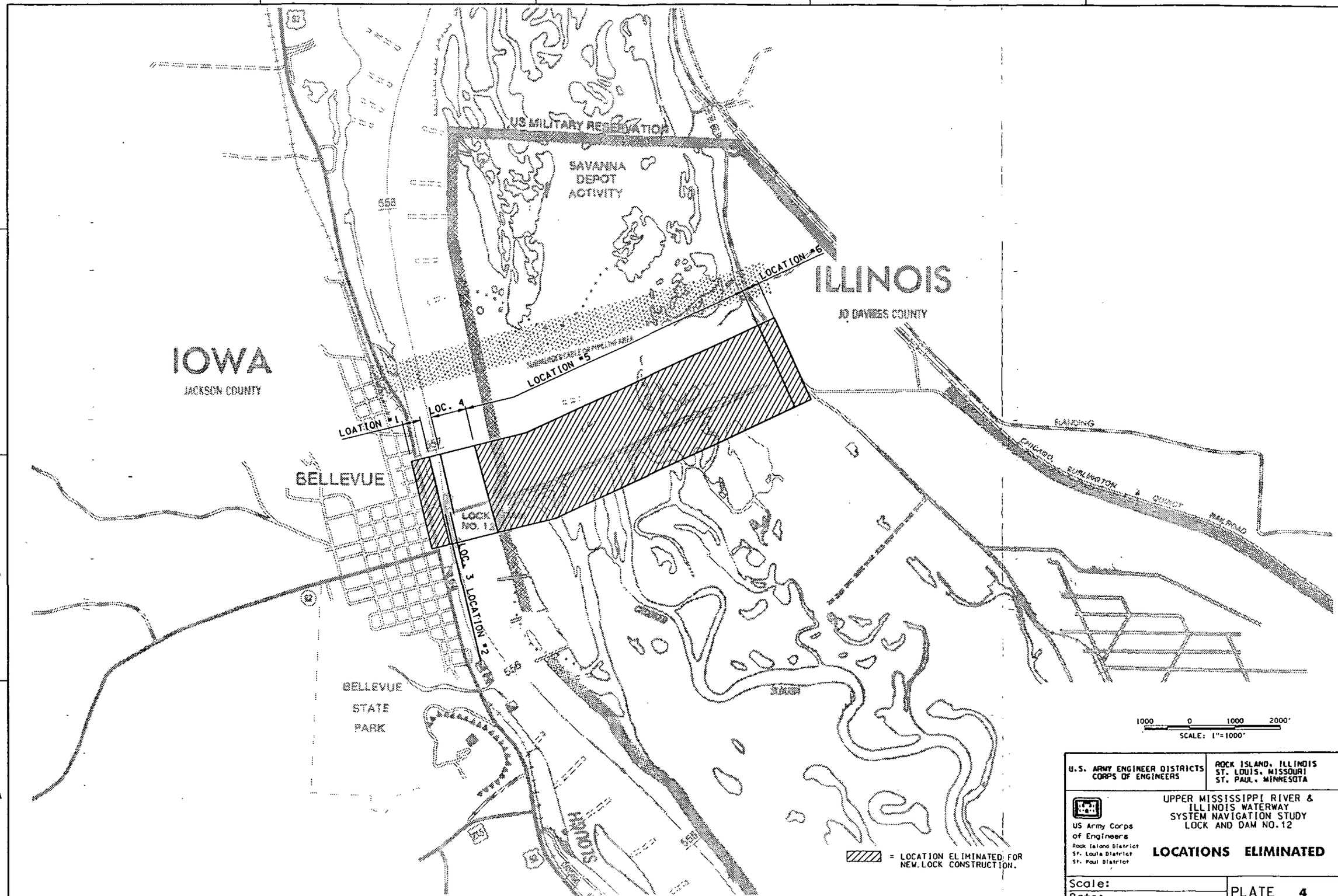
UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO. 11

LOCATIONS ELIMINATED

Scale:
Date:

PLATE 3

1-NOV-1995 09:59
/usr3/cray/projects/ns11/ns11ob05.dgn



U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS

ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA

US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District

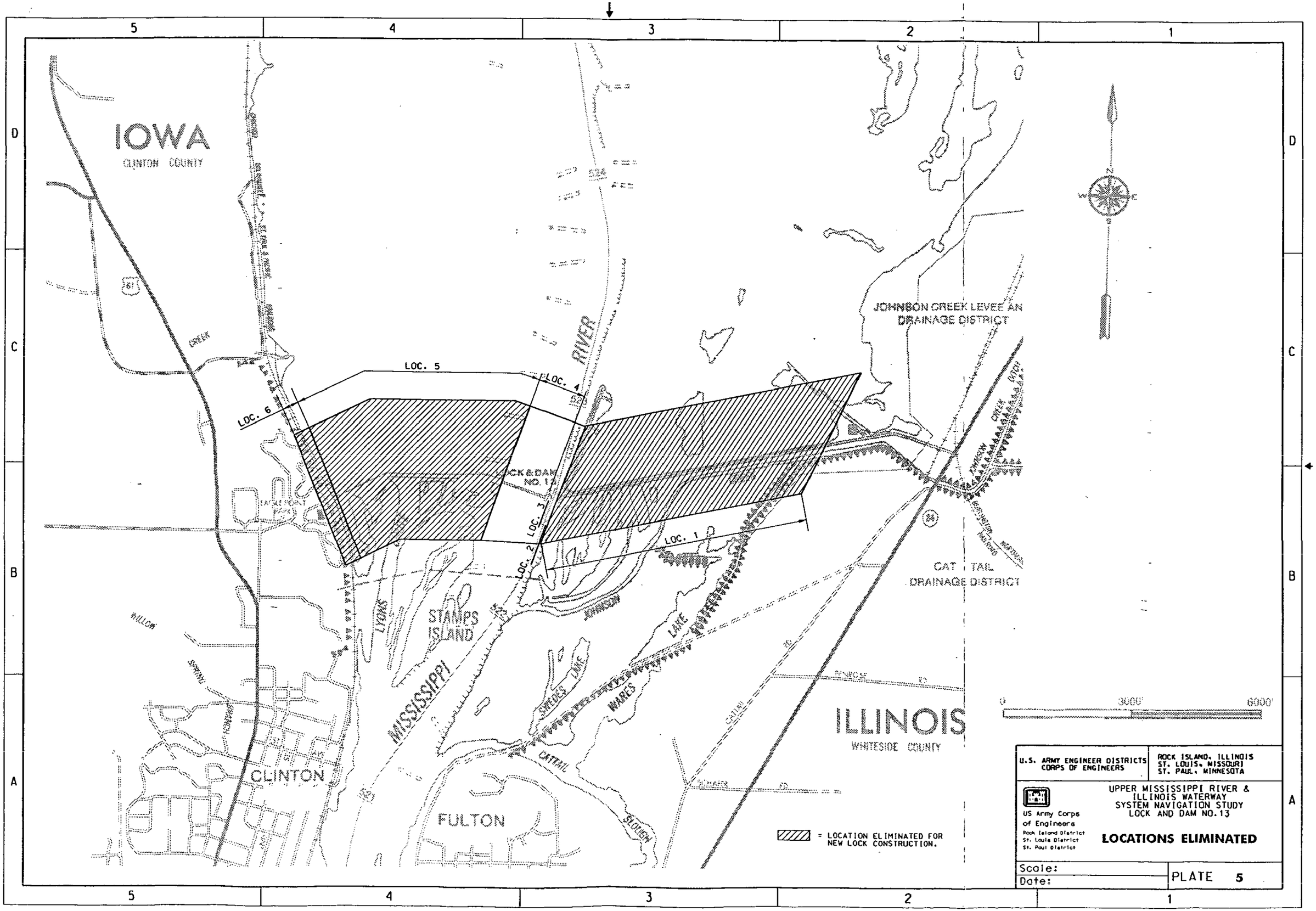
UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO. 12

LOCATIONS ELIMINATED

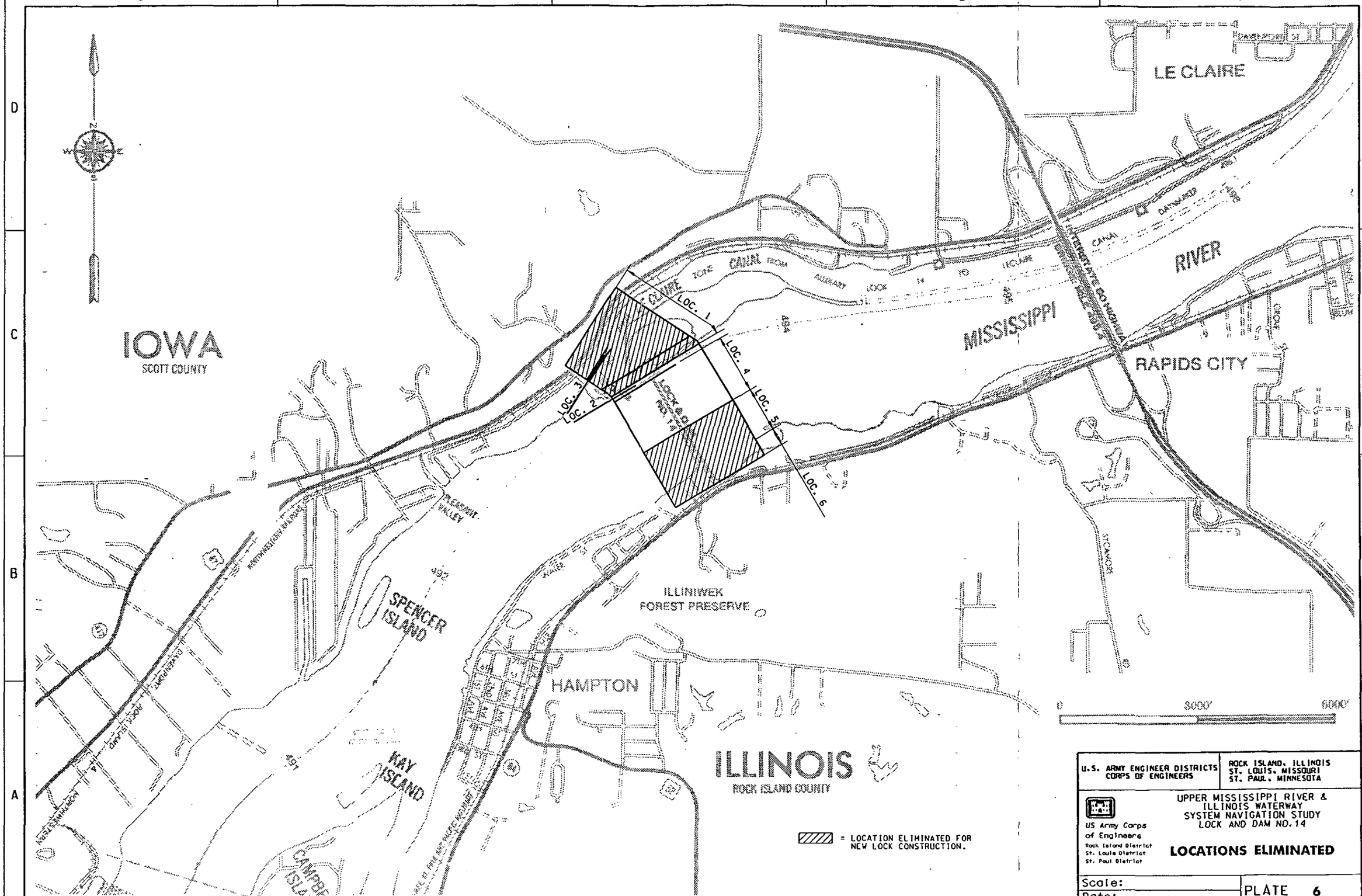
Scale:
Date:

PLATE 4

25-OCT-1995 13:11
/usr3/cray/projects/ns12/ns12ob06.dgn



25-OCT-1995 13:13
/usr3/cray/projects/ns13/ns13ob07.dgn



U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS

ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA

US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District

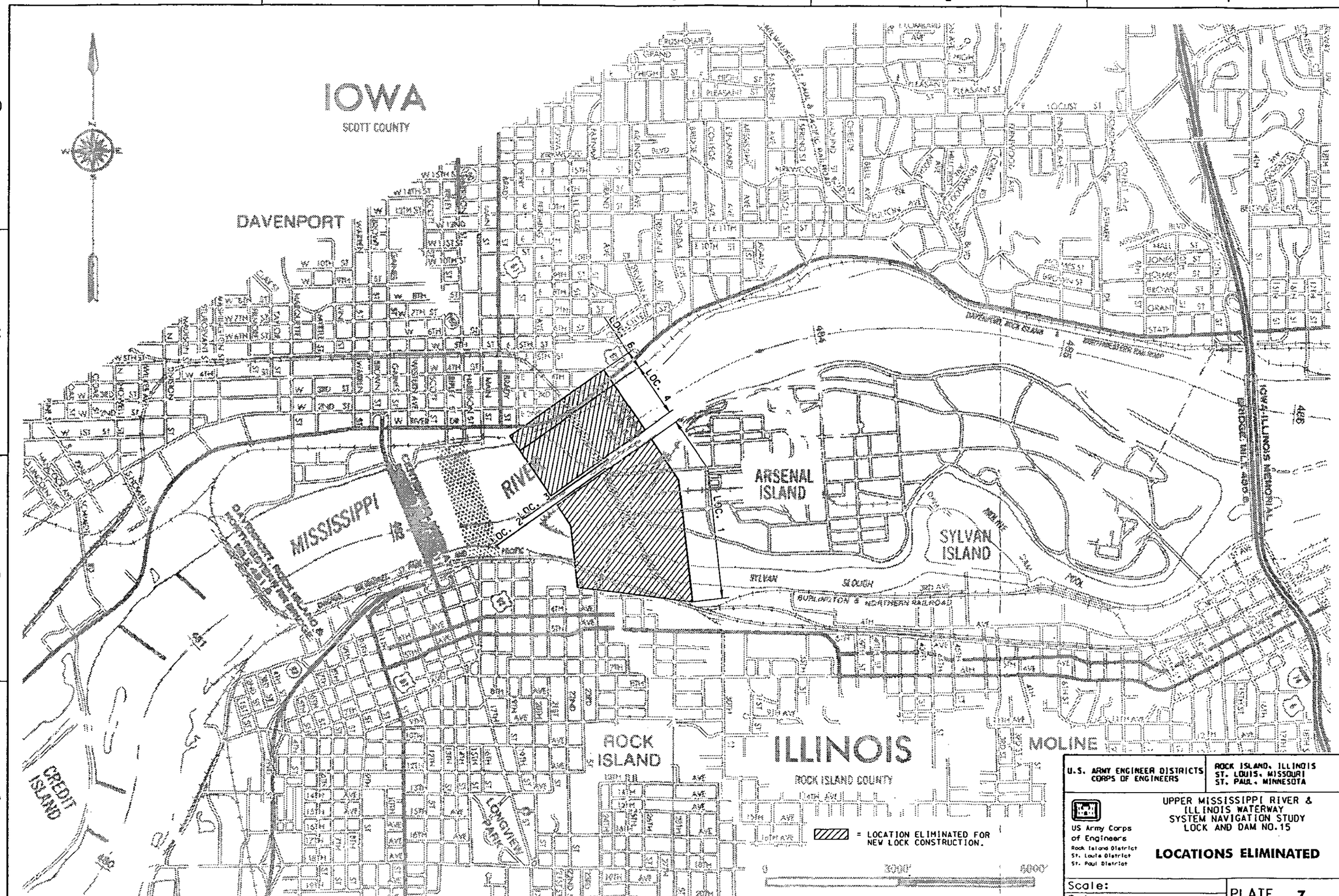
UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO. 14

LOCATIONS ELIMINATED

Scale:
Date:

PLATE 6

25-OCT-1995 14:12
/usr3/cray/projects/ns14/ns14ob08.dgn



U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS

ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA

US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District

UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO. 15

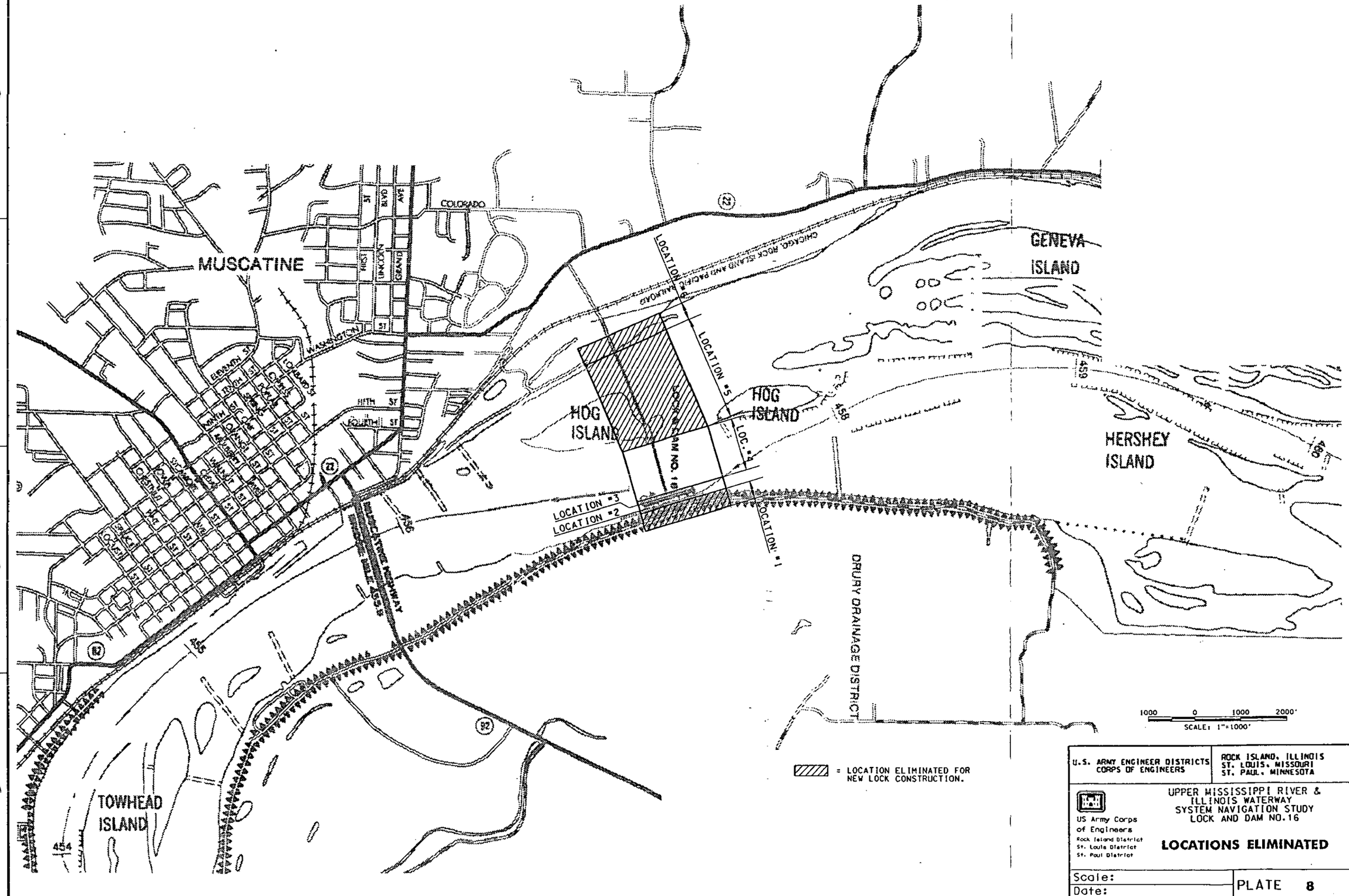
LOCATIONS ELIMINATED

Scale:
Date:

PLATE 7

25-OCT-1995 13:19
/usr3/cray/projects/ns15/ns15ob09.dgn

25-OCT-1995 13:19



U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS

ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA

US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District

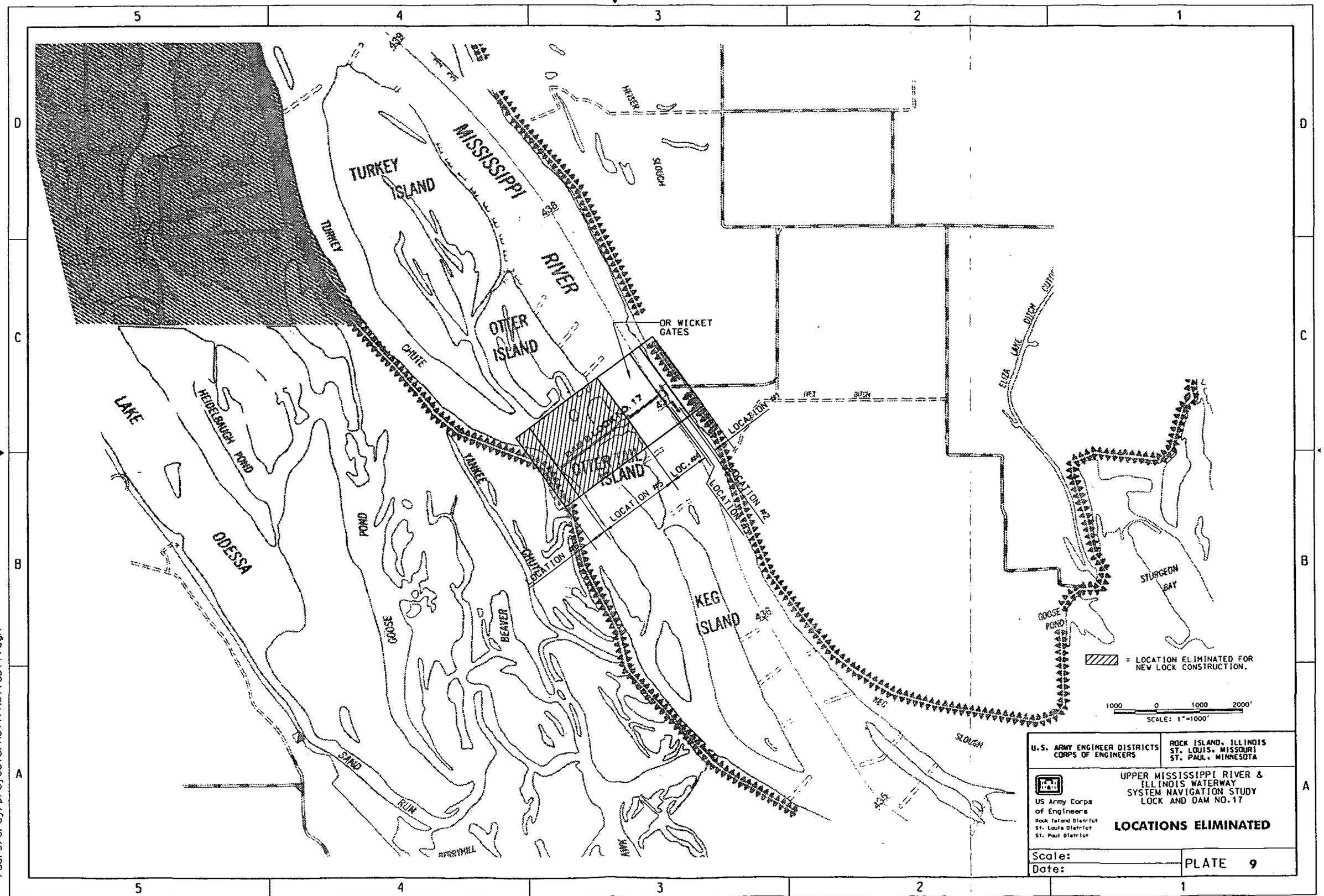
UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO.16

LOCATIONS ELIMINATED

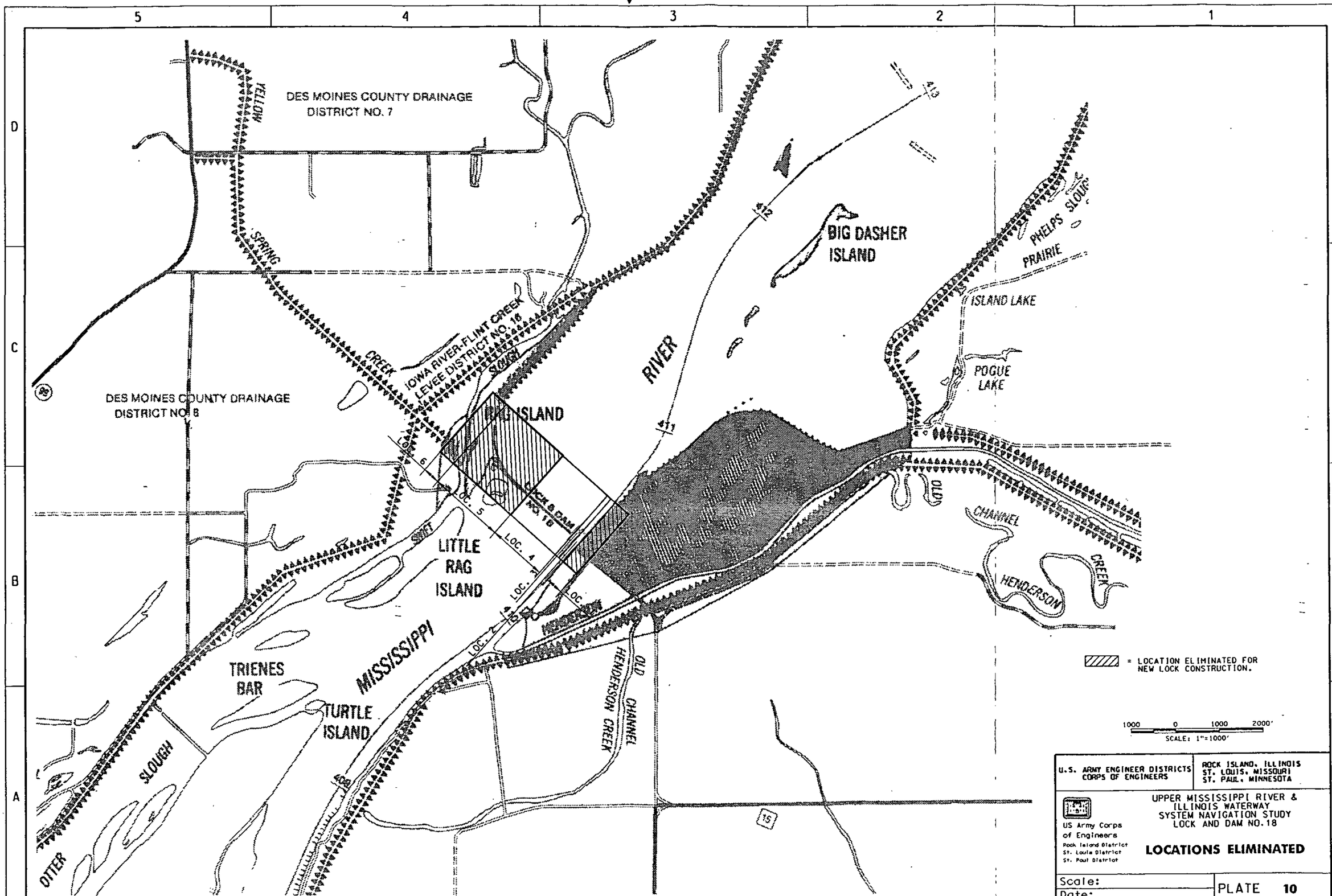
Scale:
Date:

PLATE 8

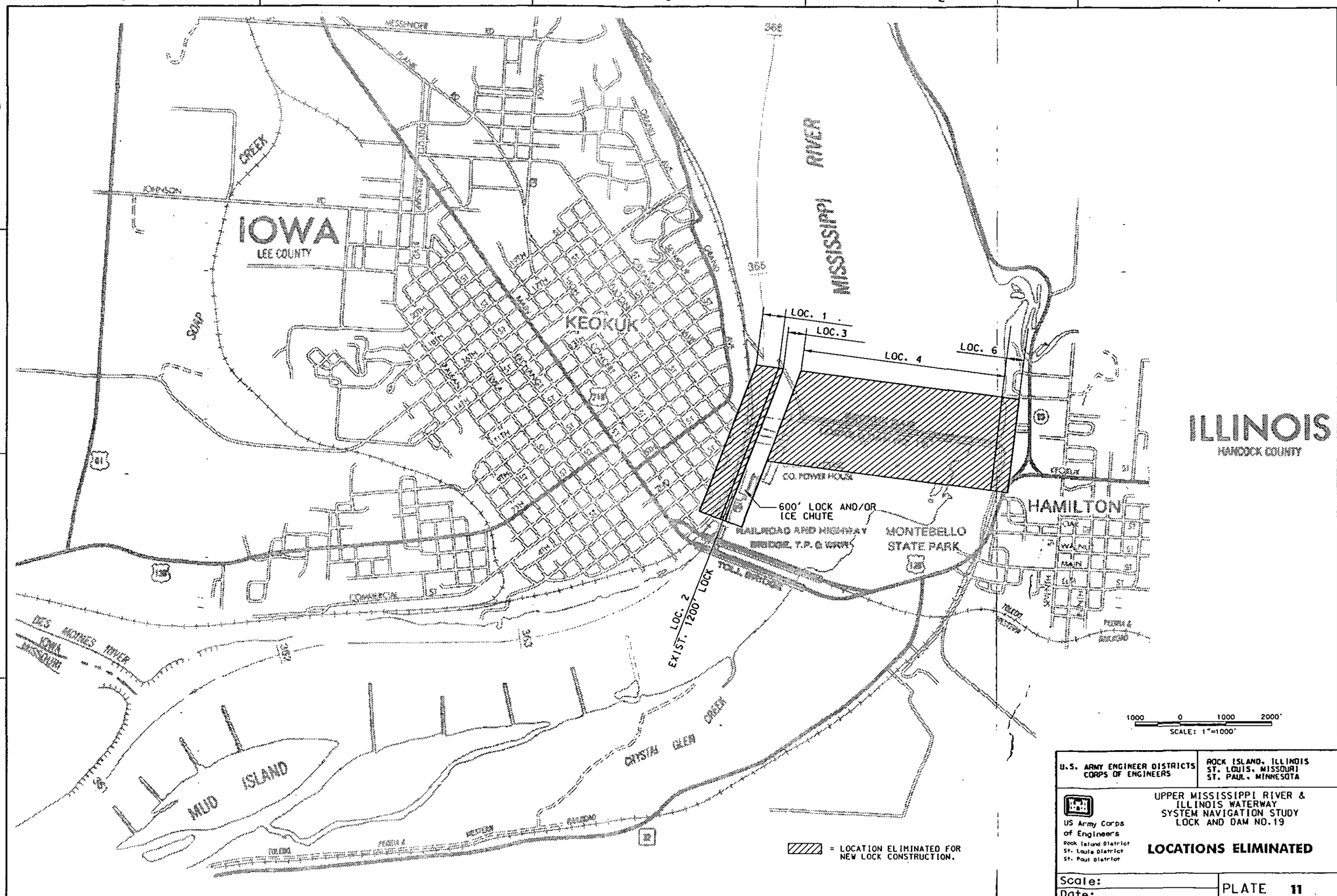
26-OCT-1995 14:22
/usr3/cray/projects/ns16/ns16ob10.dgn



26-OCT-1995 14:20
/usr3/cray/projects/ns17/ns17ob11.dgn



26-OCT-1995 14:19
/usr3/cray/projects/ns18/ns18ob12.dgn



U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS

ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA

US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District

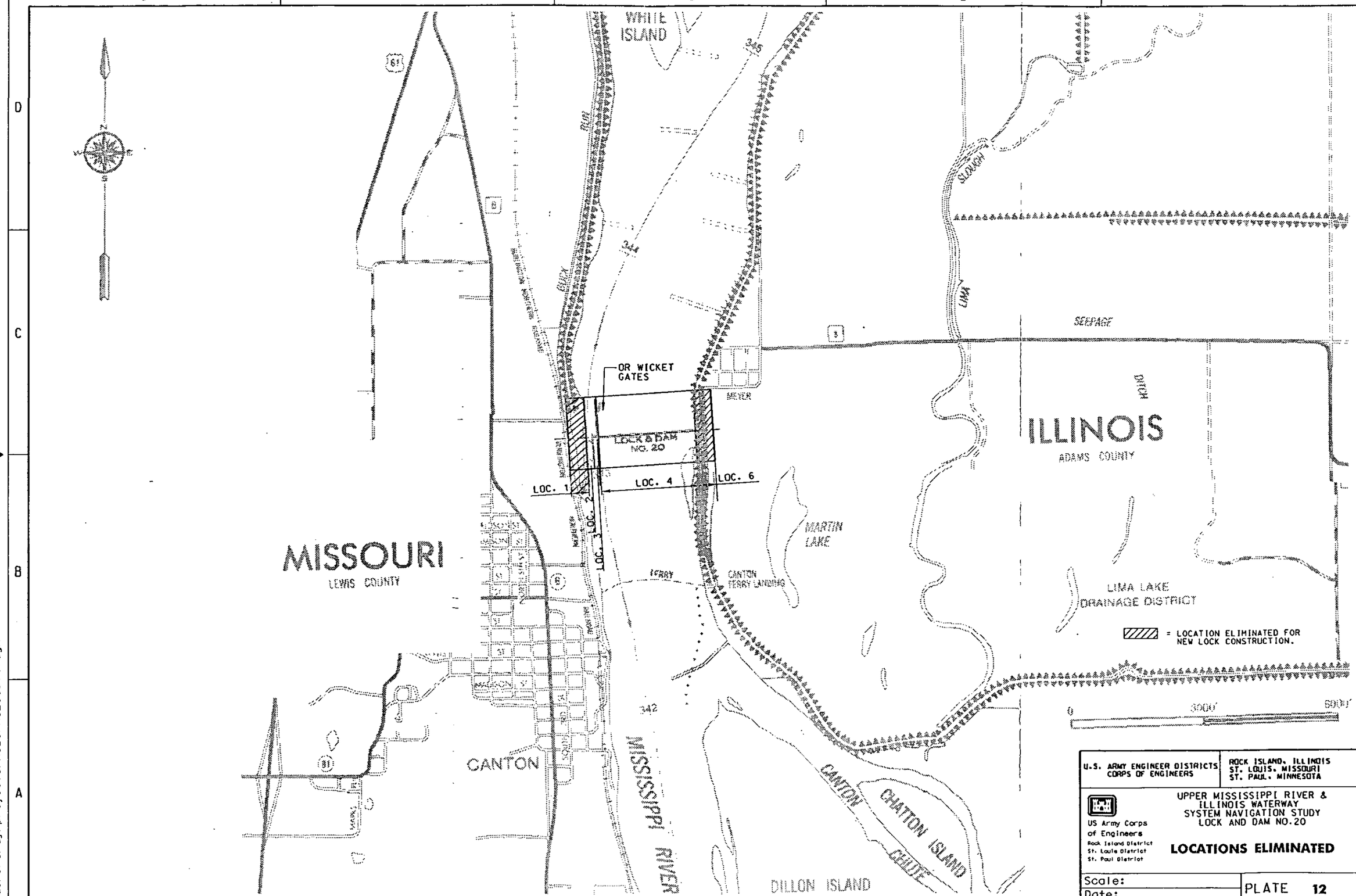
UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO.19

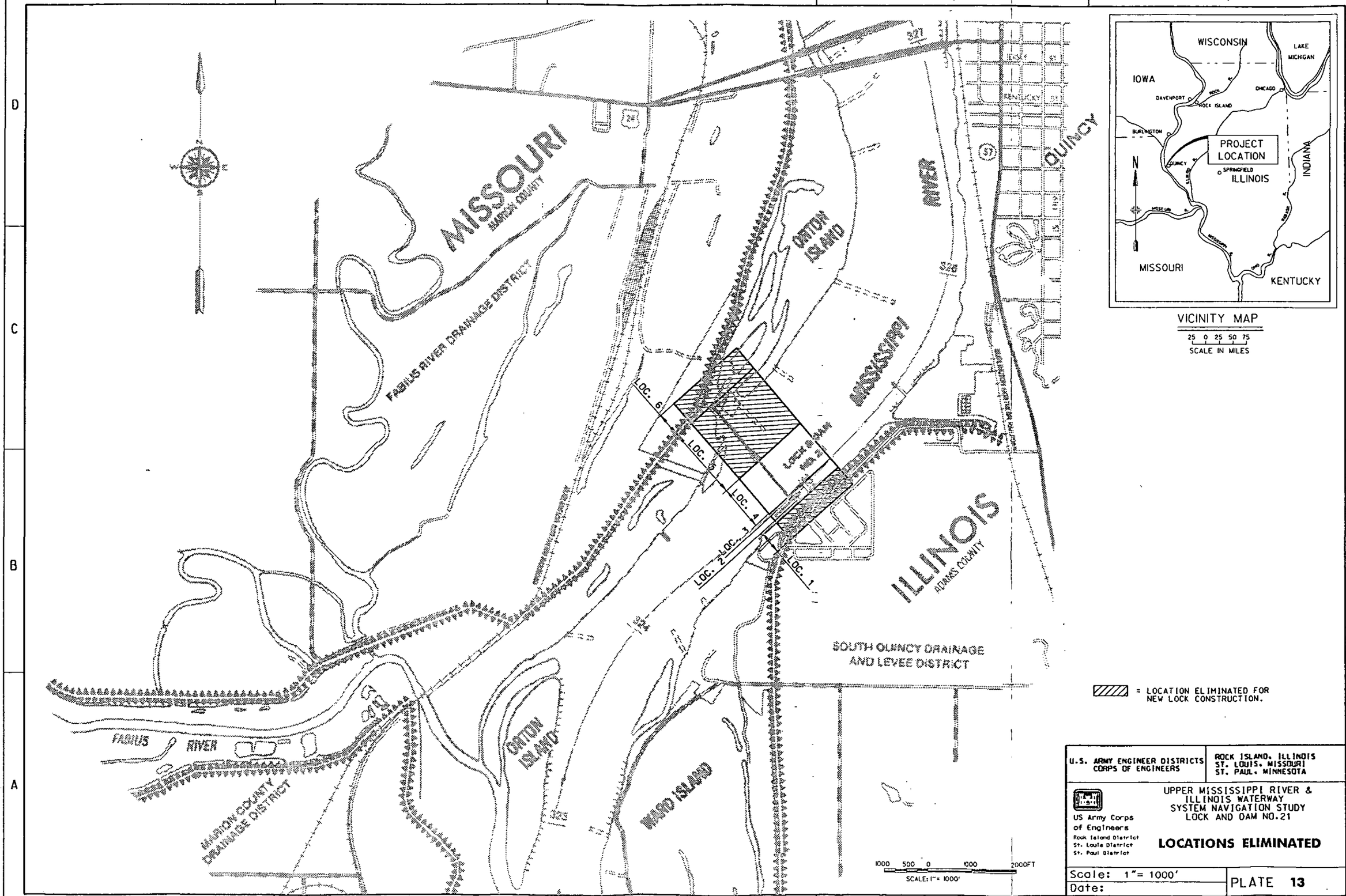
LOCATIONS ELIMINATED

Scale:
Date:

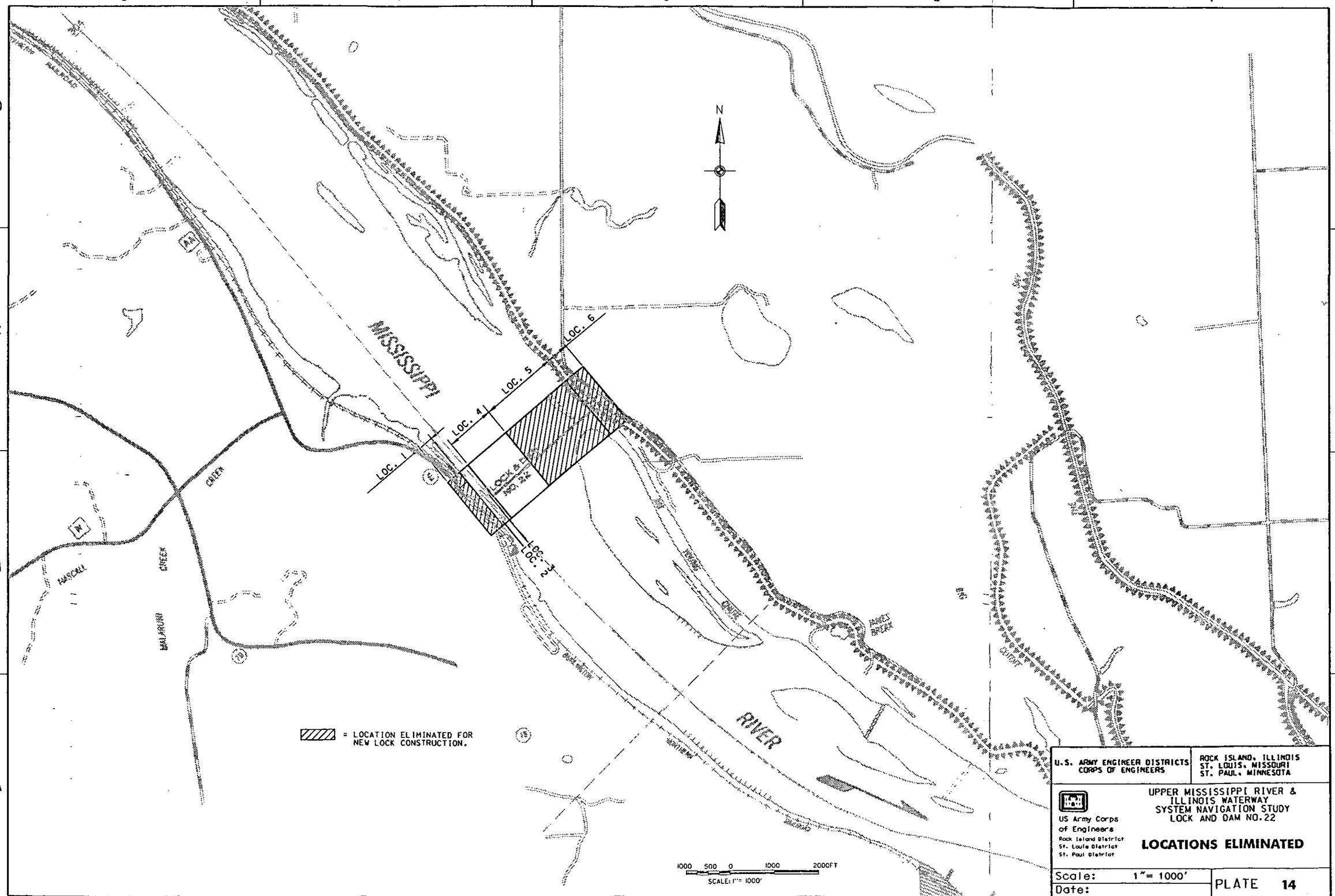
PLATE **11**

26-OCT-1995 14:17
/usr3/cray/projects/ns19/ns19ob13.dgn

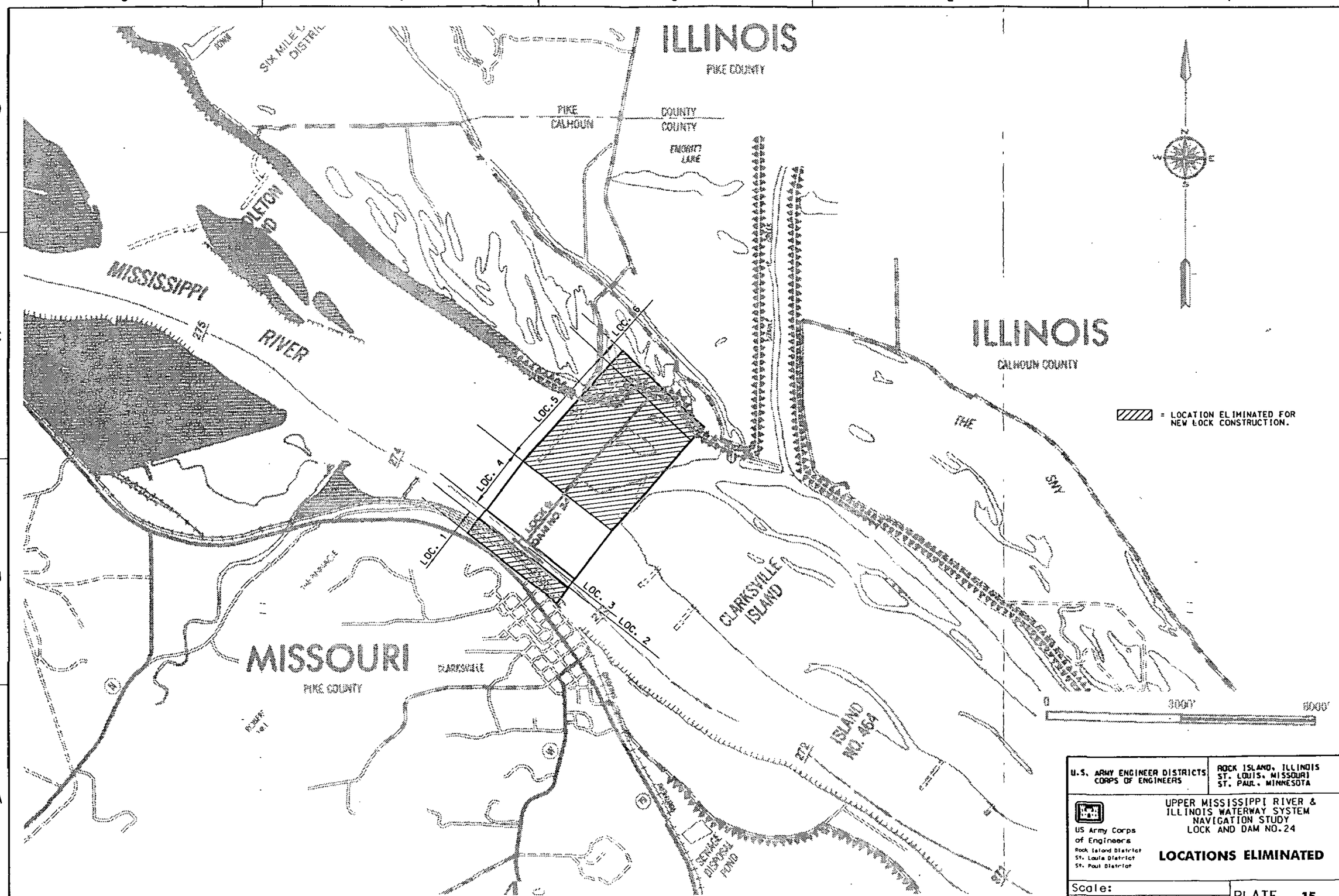

WHITE ISLAND
OR WICKET GATES
LOCK & DAM NO. 20
LOC. 1
LOC. 2
LOC. 3
LOC. 4
LOC. 6
MISSOURI
LEWIS COUNTY
CANTON
MISSISSIPPI RIVER
FERRY
CANTON FERRY LANDING
MARTIN LAKE
SEEPAGE
DITCH
ILLINOIS
ADAMS COUNTY
LIMA LAKE DRAINAGE DISTRICT
= LOCATION ELIMINATED FOR NEW LOCK CONSTRUCTION.
0
3000'
6000'
CANTON CHUTE
CHATTON ISLAND
DILLON ISLAND
U.S. ARMY ENGINEER DISTRICTS
CORPS OF ENGINEERS
ROCK ISLAND, ILLINOIS
ST. LOUIS, MISSOURI
ST. PAUL, MINNESOTA
US Army Corps of Engineers
Rock Island District
St. Louis District
St. Paul District
UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY
LOCK AND DAM NO. 20
LOCATIONS ELIMINATED
Scale:
Date:
PLATE 12
26-OCT-1995 07:31
/usr3/cray/projects/ns20/ns20ob14.dgn



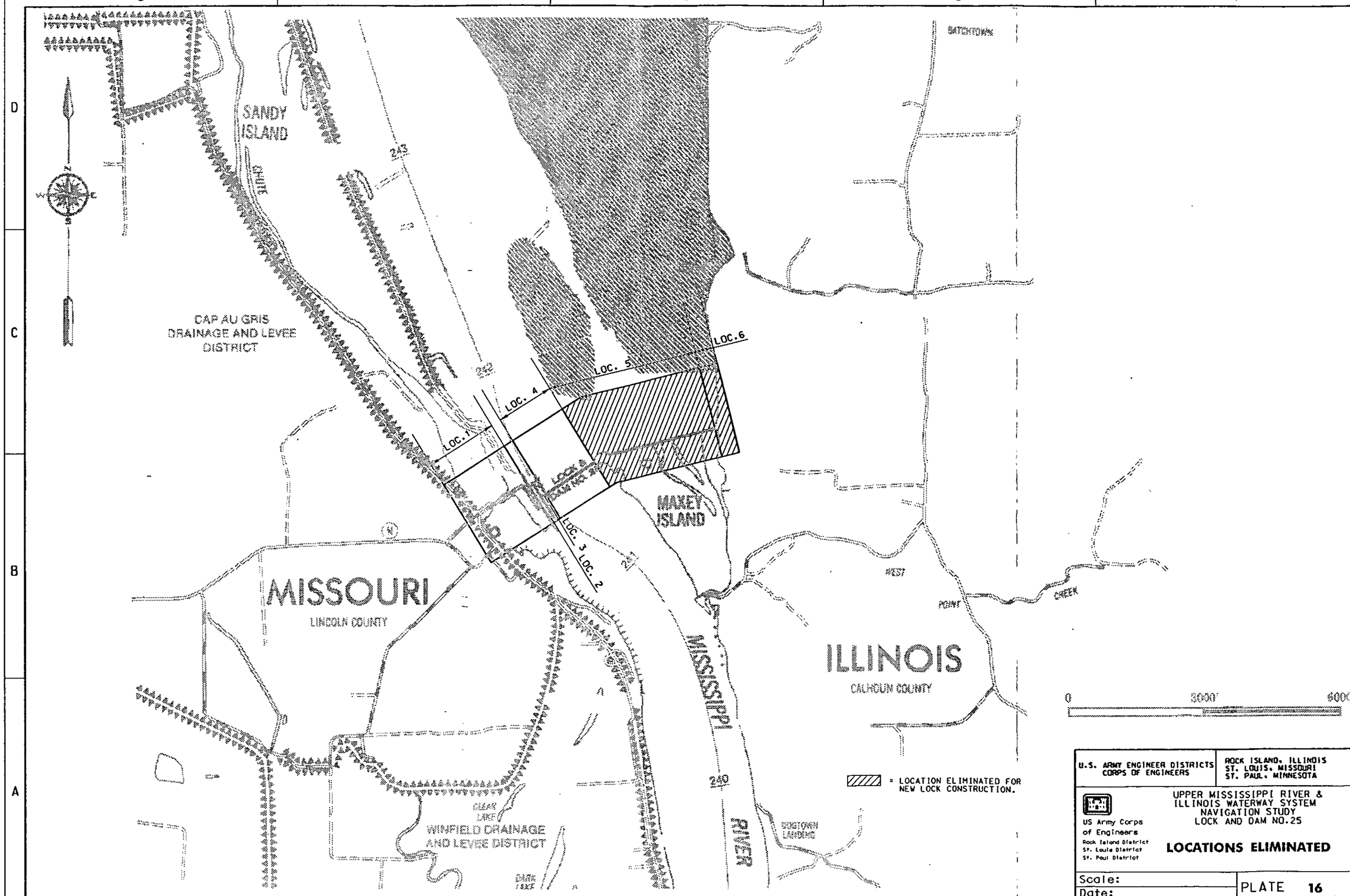
26-OCT-1995 07:56
/usr3/cray/projects/ns21/ns21ob15.dgn



26-OCT-1995 08:01
/usr3/cray/projects/ns22/ns22ob16.dgn

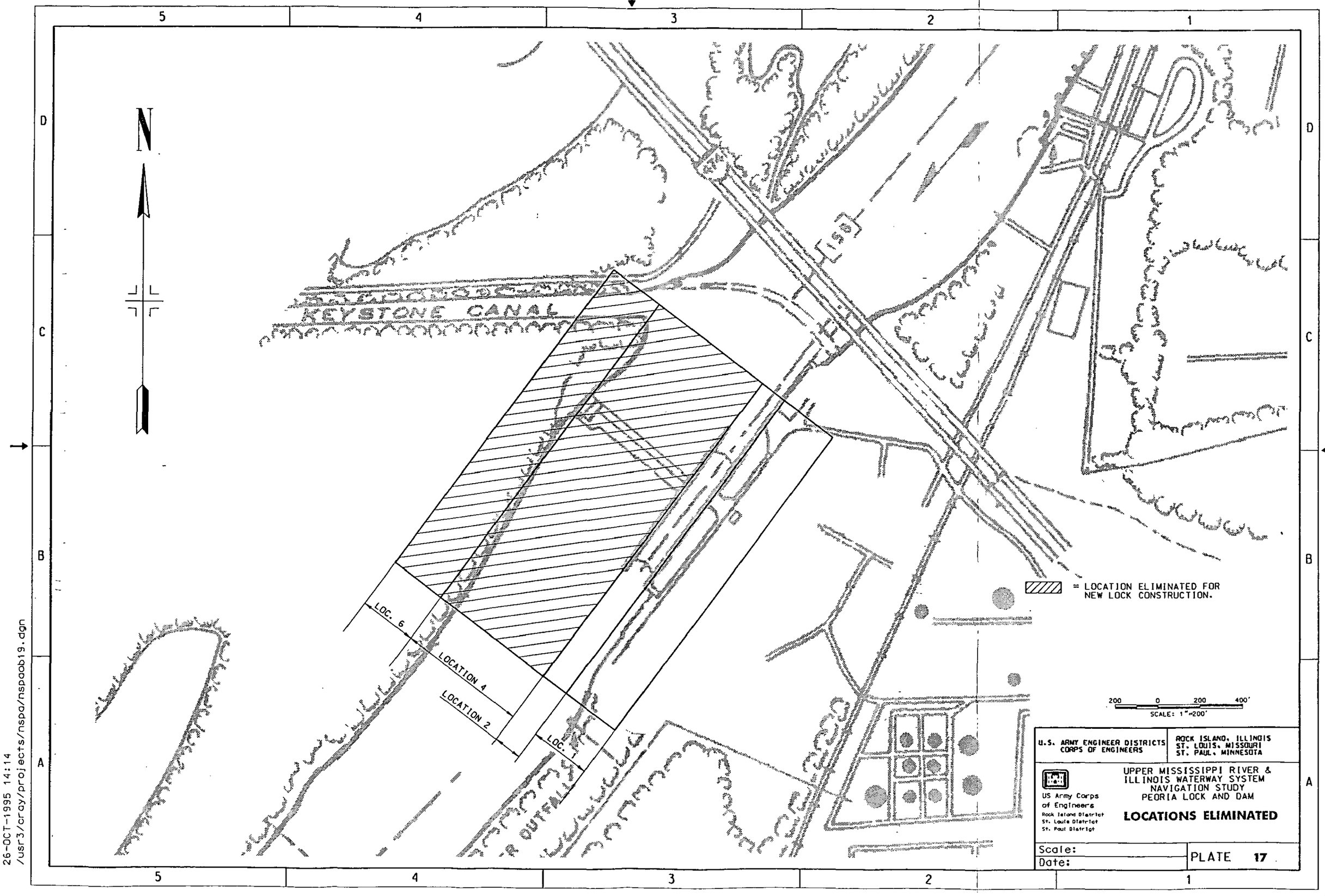


26-OCT-1995 08:02
/usr3/cray/projects/ns24/ns24pl01.dgn

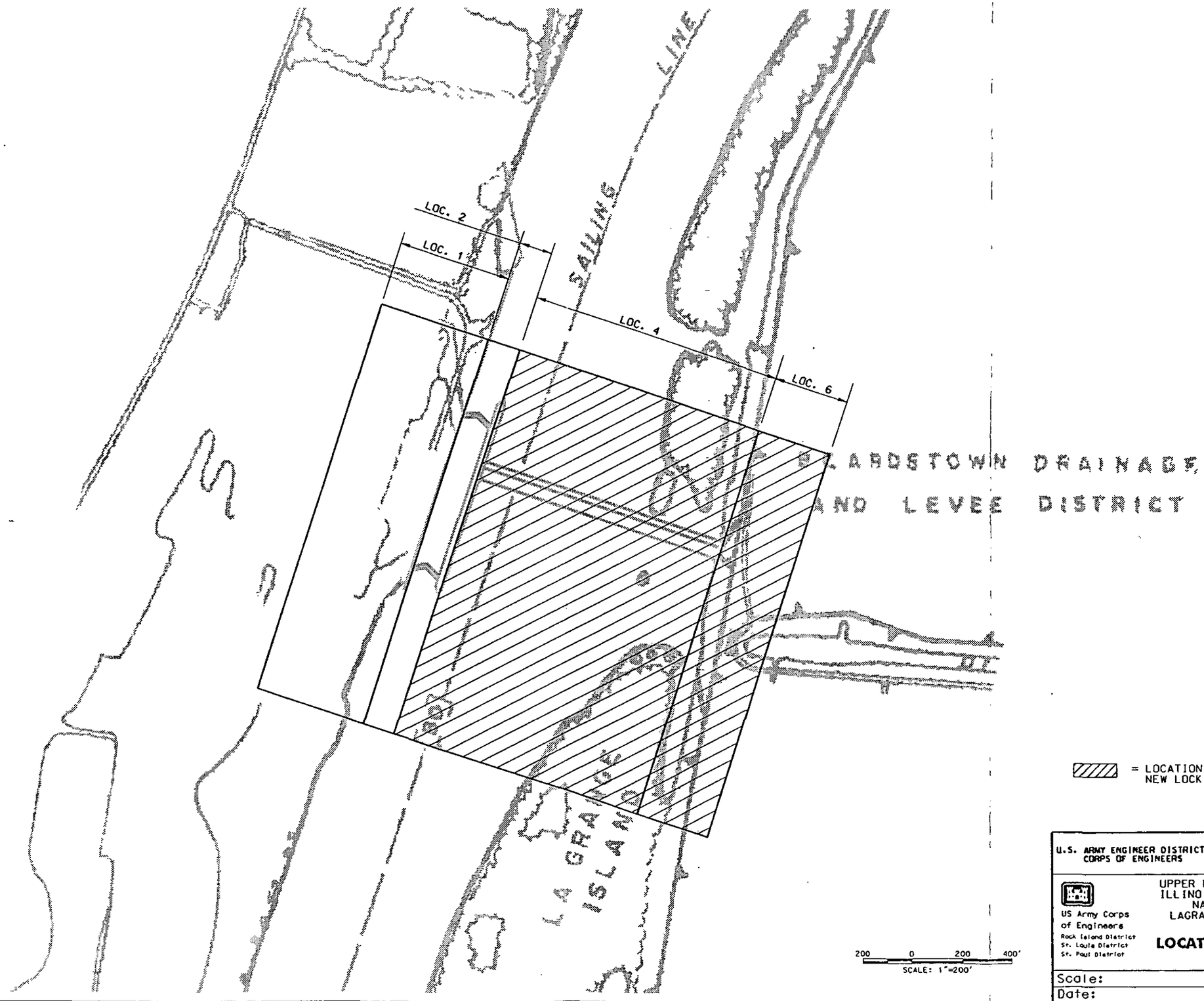


U.S. ARMY ENGINEER DISTRICTS CORPS OF ENGINEERS	ROCK ISLAND, ILLINOIS ST. LOUIS, MISSOURI ST. PAUL, MINNESOTA
US Army Corps of Engineers Rock Island District St. Louis District St. Paul District	UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY LOCK AND DAM NO.25 **LOCATIONS ELIMINATED**
Scale: Date:	PLATE **16**

26-OCT-1995 08:04
/usr3/cray/projects/ns25/ns25p101.dgn



26-OCT-1995 14:14
/usr3/cray/projects/nspa/nspaob19.dgn



= LOCATION ELIMINATED FOR NEW LOCK CONSTRUCTION.

U.S. ARMY ENGINEER DISTRICTS CORPS OF ENGINEERS	ROCK ISLAND, ILLINOIS ST. LOUIS, MISSOURI ST. PAUL, MINNESOTA
US Army Corps of Engineers Rock Island District St. Louis District St. Paul District	UPPER MISSISSIPPI RIVER & ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY LAGRANGE LOCK AND DAM
	LOCATIONS ELIMINATED
Scale:	PLATE **18**
Date:	

26-OCT-1995 14:12
/usr3/cray/projects/nslg/nslgab20.dgn

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCKS AND DAMS 11 & 12

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

(Revised 20 September 1994)

CENCR-ED-DM

29 August 1994
Mr. Wehrley/dw/5245

MEMORANDUM FOR RECORD

SUBJECT: UMR&IW Navigation Study, Engineering Objective 4b, Site Visits to L/D's 11 and 12

1. On 23 August 1994, the following personnel met at L/D's 11 and 12 to consider alternative locations for constructing new large-scale enhancements (i.e., new 600 or 1200' locks):

		Sites Visited	
Name	Organization	L/D 11	L/D12
Nicholas Bainbridge	L/D 11	X	
Leonard Ernst	L/D 11	X	
Ken Barr	PD-E	X	X
George Staley	ED-HH	X	X
Dave Wehrley	ED-DM	X	X
Scott Estergard	Fish & Wildlife Service	X	X
Kurt Welke	Wis. DNR - Fisheries	X	X
Lorin Hager	L/D 12		X
Bill Hainstock	L/D 12		X

This effort was made under Objective 4b of the Upper Mississippi River and Illinois Waterway Navigation Study. This MFR provides a summary of discussions and findings.

L/D 11 Findings

2. Location 1. A new lock at Location 1 would be a tight squeeze at best. The tightest spot is approximately in line with the lower gates of the existing lock. I paced the distance between the landside of the existing landwall and the railroad tracks and there is approximately 150 feet available (only 120 feet to the fence/property line). With a conventional lock design, 170 feet would be required (110' lock plus 30'-wide walls). So slender walls would be required and such an alignment would cutoff vehicle access to the site and be very challenging during construction. The adjacent rail line is heavily used and probably could not be closed for very long. If the rail line had to be relocated, this alternative location would definitely be eliminated because of the economic impact to the railroad plus the cost of cutting back the high rock bluff landward of the track. A Location 1 lock could be constructed further upstream (where there is more area available for construction) so that only the lower guidewall would pass through the narrowest point. But again, land access would be limited.

Mr. Bainbridge said they have a "terrible" outdraft problem that draws downbound tows toward the dam. This would have to be dealt with for a Location 1 lock as well. A

Location 1 lock would require some channel work including removing a wing dam upstream of the lock.

Overall, it appears that Location 1 is an undesirable lock location because of the problems noted above. The solutions to these problems could be quantified in monetary terms if desired.

3. Location 2. Extending the existing lock appears to be among the final contenders for a new 1200' lock at L/D 11. The aforementioned existing outdraft problem would have to be investigated. Mr. Welke suggested removal of the upstream wing dam. I noted that the original and present function of this wing dam would have to be investigated to determine if removing the wing dam would improve or hinder navigation. It appears that no new approach problems would result from extending the lock by 600 feet.

4. Location 3. A new lock at Location 3 would probably result in a slight attenuation of the outdraft problem and provide good overall approaches otherwise. Location 3 is also a feasible location for a new lock.

5. Location 4. The preferred location of Mr. Bainbridge, Lockmaster, is Location 4 and toward the east end of the gated section. He believes that this location would result in the best downstream approach, alleviating the present outdraft problem. When we viewed this location from atop the service bridge, it appeared that the downstream approach would not be as good as at present without considerable channel work. Mr. Welke said that Lampsillus Higgins Eye is present along the east shore just downstream of the storage yard and this same area is also a popular fishery. A Location 4 lock may be more viable toward the west end of the gated section (adjacent to the auxiliary lock bay). We briefly discussed how to mitigate the loss of gated capacity. Mr. Staley said that we could provide a fixed weir overflow section. Alternatively we could construct a dam gate (possibly a vertical lift gate) in the auxiliary lock bay. The water depths downstream of the dam need to be examined to see if Location 4 construction would be cost-prohibitive if a large scour hole had to be filled.

6. Location 5. A new lock through the non-overflow section is not feasible with the possible exception of immediately adjacent to the storage yard (and this location would have considerable environmental impacts). Elsewhere in the non-overflow section, a lock would be too far from the gated section of the dam. Being in a slackwater area, the lock would require frequent regular dredging to maintain navigable depths. In addition, there are a number of islands downstream that would have to be removed causing significant environmental damage.

Mr. Welke noted that he would like to see the 6' culvert through the non-overflow section restored to provide freshwater downstream. I told him that in our earlier review of the as-built drawings that there was no reference to such a culvert, only some 18" shoulder drain culverts. However, when we walked along the downstream side of the road downstream of the non-overflow section, Mr. Staley found the approximately 6'

culvert somewhat hidden by vegetation. Evidently the culvert was plugged prior to or during construction of the non-overflow embankment. Mr. Welke said that during the winter the shallow water among the islands becomes anaerobic and thus unsuitable for fish. He would like to establish flow through that area to enhance the water for game fish such as bass and crappie.

Mr. Welke said that he is also working with Ms. Barb Kimler and Mr. Jerry Skalak, both of CENCR, on an EMP project to enhance the environmental quality of the shallow area upstream of the non-overflow dike.

7. Location 6. A lock at Location 6 is infeasible for the same reasons that Location 5 is infeasible, only to a greater extent (i.e., a channel to the lock could not be maintained and there would be huge environmental damages).

8. Other Comments/Observations at L/D 11

a. Mr. Welke inquired about the possibility of scheduling tow traffic to avoid congestion at the locks. I said that this will be investigated under Engineering Objective 3 which will also look at other non-structural and structural "small-scale enhancements." Mr. Bainbridge said that there already is a certain amount of coordination by radio between the pilots. He knows when tows leave Locks 10 and 12 enroute to Lock 11, but he doesn't know how long it will take them to arrive (it depends on a number of factors).

b. Mr. Bainbridge was asked how he would handle recreation craft if the implemented improvement was an extension of the existing lock rather than construction of a second lock. He said that he is required by law to take one double and 1 single and then lock any waiting recreation craft. In actual practice, he lets recreation craft through after one double. He said, barring a change in the law, that this practice would continue.

c. I asked where tows tie up while waiting for another tow to clear the lock and pass the waiting tow. Mr. Ernst said that in the downstream approach tows simply push into the bank. He said that in the upstream approach toes tie off about 200 feet from the upstream end of the doglegged section of the upper guidewall. Upbound tows are able to pull away from the wall and push by the waiting tow due to the dogleg.

L/D 12 Findings

9. The findings at L/D 12 are similar to those at L/D 11, i.e., locations 1, (most of) 5, and 6 are not practical and locations 2 and 3 are probably best. Mr. Hager reports a similar outdraft problem in the upstream approach. He said that the currents head toward the right bank far above the upper guidewall and then sweep toward the dam by the time they reach the end of the upper guidewall. These latter currents draw tows away from the wall and toward the dam. Mr. Hager said the outdraft is especially acute when the head on the dam is 7 feet or greater. The specifics of each location are further discussed below.

10. Location 1. Construction of a lock at Location 1 would require relocation of all properties on the riverside of Riverview St. (Hwy. 52) through Bellevue, Iowa. Without this relocation, the owners would be able to fish in the lock out of their back windows. There are a variety of utility and other relocations for a Location 1 lock including relocation of a sewage lift station, emergency generator and building, the lock maintenance building, and water, electric, and telephone. The present upstream outdraft problem may become worse for a new lock at this location. The downstream approach would be worse than at present (see description under Location 2). Overall, Location 1 is not considered viable.

11. Location 2. Besides the upstream outdraft problem mentioned above, there is a poor exit condition going downstream. As 1200' downbound tows leave the lock, they have to "flank out", i.e., maneuver in a "Z" shape to get away from the wall. This is needed because they need to make a strong portside turn to avoid a wing dam just below Mill Creek on the Iowa side. To make this turn directly from the lock, tows have to use too much power which has caused scour along the lower guidewall. That's why Mr. Hager requires the flanking maneuver. An additional problem in the lower approach is the interference between commercial navigation and recreational uses. Just downstream of the lock there are two boat liveries and a city dock. A Location 2 downstream extension of the existing lock would partially or completely shut off access to the recreational facilities. More importantly, Mr. Hager notes that tows would never make it back into the channel exiting 600 feet downstream of their present exit. Thus only an upstream extension of the existing lock can be considered for Location 2.

Mr. Hager suggested that the upstream outdraft problem could be solved with a 1000-foot solid (not ported) extension of the landside upper guidewall. He believes this would cut off any cross currents and keep any water from getting between the barges and the wall. He suggested that this could be implemented for the existing condition (an Objective 3 "Small-Scale Enhancement") and for a new 1200 foot lock at Location 2.

12. Location 3. Because of the downstream approach/exit conditions (which would be similar for Location 3 as they are at present), a Location 3 Lock could not be extended downstream 1200 feet (downbound tows could not make it back into the channel). Either the new lock could be constructed extending 1200 feet into the upper pool, or split 600 feet downstream and 600 feet upstream. Such placements may leave the present lock suitable only for recreation craft; model studies may be needed for a more certain determination. The navigation conditions during construction may be unacceptable as well.

13. Location 4. While a lock at location 4 would probably result in the best approach conditions, there is a scour hole ranging from 40 to 90 feet deep downstream of the gated section of the dam. It may be possible to build a Location 4 lock upstream of the dam, but the downstream guidewall construction would still have to deal with the scour hole. Also,

if the lower gates are near the dam axis, downstream guidewalls would probably be required on both sides of the lock to protect tows from high velocity flows exiting the dam gates. The area downstream of the dam is also a popular fishery. Filling the scour hole even partially, while expected to be very costly and possibly resulting in an unsuitable foundation, would also be unpopular with fisherman.

14. Location 5. A Location 5 lock would have significant adverse environmental effects in removing islands and creating new channels. In addition, unless the lock was located very near the gated section (and even then a closer look is needed), the approach channels would need regular and frequent dredging to maintain navigable depths. Due to the problems with the other locations, this alternative may have to be considered with its attendant mitigation requirements.

15. Location 6. A lock at Location 6 is out of the question because a channel could not be maintained to such a slackwater area that is 1000's of feet away from the flow (at the gated section of the dam).

16. Other Comments/ Observations at L/D 12.

a. The L/D 12 pool limits 11.4 to 12.0 on their staff gage, however, they try to hold as close to 11.8 as possible.

b. Mr. Hager noted that the Flood of '93 deposited a tremendous amount of silt in slackwater areas. Some areas that were previously six feet deep are now only two feet deep.

17. RIAC Input. The following comments on L/D's 11 and 12 were received on 24 August 1994, from Mr. Jack Libbey, Tow Captain for Conti Carriers, while on a site visit to L/D 16 (reported by Mr. Joe Ross).

a. L/D 11. Location 3 or 4 with an extended riverward guidewall would be the best location for a 1200 ft. lock. Location 1 is restricted by railroad tracks and bluff topography. Locations 5 and 6 would exaggerate the zigzag approach/exit to or from the lock without major channelization through the UMR Fish and Wildlife Refuge. Major river training works and maintenance dredging would be required. Location 2 is feasible but 3 or 4 would best handle the outdraft condition. Small scale improvements would include mooring cells upstream to accommodate the existing waiting problem. Once cell at river mile 584 and another at river mile 592 (Specht's Landing), where many tows wait, would help. A properly placed mooring cell downstream would lessen the dangerous situation with recreation traffic in the area.

b. L/D 12. Location 4 as close as possible to Location 3 is the preferred location for new lock construction. Additional flow gates at location 3 should help to pass ice.

Location 5 next to the dam is another possibility. This is one of the hardest locks to make an approach to with the upstream outdraft and the downstream exit (see description in paragraphs 9-11 above). The existing mooring cell upstream of the lock is well-placed. Small scale improvements would be a deadman at river mile 555.2 below the lock on the Illinois side of the channel and a mooring cell at river mile 555.5 also on the Illinois side of the channel. The city boat ramp causes some problems with safety downstream. Mr. Libbey said that in general there should always be extended riverside guidewalls with new lock construction.

18. Summary (for both L/D 11 and 12). As indicated above, there are no lock locations completely problem-free (especially at L/D 12), however, some hold more promise than others. The comments of the RIAC representative appear to generally agree with the comments of those who attended the L/D 11 and 12 site visits. It was mentioned during our site visit that, by the time new locks at L/D 11 and 12 are justified (2030?), that many design considerations could change. The current objective 4B philosophy is to quantify (in $ terms) the obstacles to a given lock placement. This will be done to the extent possible, however, some locations appear to be eliminated "by observation."

David R Wehrley

DAVID R. WEHRLEY, P.E.
Technical Management Section

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCK AND DAM 13

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-HH 25 August 1994

FOR ED-DM (Joe Ross)

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 13

1. At 8:30 AM on Thursday, 18 August, Joe Ross (ED-DM), Lonn McGuire (PD-E), George Staley (ED-HH), and Scott Estergard (F&W) arrived at Lock and Dam 13 to interview employees about navigation peculiarities of the site. Richard Samson and Larry Garner talked with us for about an hour. Key points of the conversation follow. Since it was raining intensely we did not inspect the site.

2. Dam 13 is unique because it has a wide pool. The large fetch can result in strong winds and high waves. There have been times when low powered tugs pushing a full set (15) of empty barges have not had enough power to continue upstream. Strong winds can also accumulate ice around the upstream lock gates.

3. Out draft is not a problem at this site. The lock is one of the most makeable locks within the district. However the current is strong near the upstream gates. Mr. Samson believed conditions could be improved by building a guide cell 300 feet upstream of the intermediate wall or extending the bull nose intermediate wall.

4. Because the site is so wide the generic options 1 and 6 would intrude upon environmental areas and encounter more resistance than at other locations on the river. The options would also require maintenance dredging that is not necessary at the existing 600 foot long lock. Option 6 would require pricing the relocation of an existing railroad and require large bluff cuts.

5. Option 4 designs should address potential problems from strong channel currents.

6. Islands and a small slough are downstream of the spillway section. Two advantages of option 5 are that wind and waves would be weaker here than at the site of the existing lock. The location would be ideal for recreational traffic. However maintenance dredging would be required for barge traffic.

7. Mr. Samson's description of the path tows use leaving and entering the upstream gates differs with the navigation charts. He believes boats take a zigzag route going farther west than the route shown on the navigation charts.

CENCR-ED-HH 25 August 1994

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 13

8. A discussion on 24 August with Mr. Jack Libbey, Tow Captain for Conti Carriers representing RIAC, confirmed that outdraft is not a problem. The lock is easy to make and tows do make a zigzag approach/exit upstream of the lock but it is not severe. Wind can be severe toward the lock. Mr. Libbey said the mooring cell upstream of the lock is well placed. He said a cell downstream for tie-off would be beneficial. Location 4 close to 3 or 3 are reasonable locations for new lock construction.

George Staley
ED-HH

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCK AND DAM 14

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-HH 25 August 1994

FOR ED-DM (Joe Ross)

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 14

1. At 12:30 PM on Thursday, 18 August, Joe Ross (ED-DM), Lonn McGuire (PD-E), George Staley (ED-HH), and Scott Estegard (F&W) arrived at Lock and Dam 14 to interview employees about navigation peculiarities of the site. Lockmaster Merle Bielema and Steve Felderman talked with us for about an hour. Key points of the conversation follow. After the discussion we walked over the site.

2. Barges coming downstream to the existing lock (option 2) leave the main channel with its stronger current and angle into the slower moving water above the lock. Then they stop, pull the stern eastward to line up with the lock, and continue downstream. Barges coming upstream to the lock cross the main channel with is stronger current. Once they cross the main channel a secondary current pushes the barge (west) toward the downstream wall. This aligns the barge for the lockage. This same current requires pilots to maneuver their barges as they exit the lock and move downstream. Otherwise the current pushes then aground downstream of the lock.

3. Out draft is a problem above 7 feet.

4. There is no area near the lock for upstream or downstream tows to wait. To relieve congestion downstream bound tows usually wait at the I-80 bridge. Parking closer to the lock requires more maneuvering and wastes time. Upstream bound tows wait at the Campbell's Island light (river mile 491). Both lock employees felt a mooring cell in this area would help navigation traffic. They have submitted this suggestion to operations division in the past. Tows also wait at Dynamite Island.

5. The auxiliary lock (Option 3) is landward of the main lock (option 1). It is mainly used only on weekends for recreation traffic. During the rest of the time this traffic is directed through the main lock. The auxiliary channel is only about 5.5 feet deep so if this site were used for a larger lock it would be necessary to excavate and widen the channel. Part of this route is along the old Le Claire Canal which is environmentally and historically sensitive.

6. Boat pilots have told lock employees that the first and second tainter gate bays would make a good location for a lock.

This site (option 4) would eliminate much of the maneuvering required with the present main lock.

7. Options 5 and 6 would require rock excavation since the dam is on rock. These options could be in the vicinity of a possible hydropower plant or block access to the plant. However while a permit has been granted no plans exist.

8. A discussion on 24 August with Mr. Jack Libbey, Tow Captain for Conti Carriers representing RIAC, confirmed that there are no good waiting spots for upbound or downbound traffic near the lock. He said the river between Lock 14 and Lock 15 at times is the most congested area on the Upper Mississippi. Mr. Libbey said a mooring cell downstream in the "wide spot" just upstream of Campbell's Light and Day Mark should be a No. 1 priority. Another cell downstream at Dynamite Island would help. "Tie-off buoys are not as good as cells". Downbound traffic would benefit with mooring cells just upstream of the lock at RM 493.5 and at RM 494.5 where small boats enter the LeClaire Canal. Also, Mr. Libbey suggested cells at RM 496.5 and 498. Cells upstream would make for a safer condition where tows could tie-off during emergency situations downstream.

9. Mr Libbey thought the best location for a new 1200 ft. lock would be location 4 close to the existing 600 ft. lock

George Staley
ED-HH

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCKS AND DAM 15

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 25 August 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 15

1. On 24 August the following people met at L/D 15 to discuss information pertinent to the subject navigation study and L/D 15 site specific characteristics:

Mark Cornish	Iowa DNR, Fairport
Scott Estergard	USFWS (RIFO)
Jack Libbey (Tow Captain)	RIAC (Conti Carriers)
James Morgan	Lockmaster
Shirley Johnson	CENCR-ED-HH
Lonn McGuire	CENCR-PD-E
Joe Ross	CENCR-ED-DM

2. Mr. Morgan said congestion is a problem. River current is strong and a helper boat is used when water level approaches flood stage. The outdraft problem is one of the worst in the Rock Island District. Mr. Libbey agreed that congestion is a problem and said mooring cells downstream and upstream would help. He favors stationary cells over floating mooring cells. Approach conditions would probably be better if the lock was a little further upstream and on the opposite shoreline.

3. Options for major new lock construction are limited by the existing urban development in the area and site geography. Location 1 is restricted by the hydropower dams, Moline, Rock Island and railroad viaducts, historical properties on Arsenal Island and mussel sanctuary along entire length of Sylvan Slough. Location 4 is impacted by the Government Bridge and lack of room for addtional flow gates to replace those lost from new construction. Location 6 through downtown Davenport is not pratical. There is no location 5. Extending the 600 ft. downstream, location 2, would be best as it would be better to have a 1200 ft. on the inside with an extended riverside guidewall to contend with the outdraft. Ice funneling and the Sylvan Slough current are concerns. Any extension of the downstream guidewall should consider the fact that boats are presently pushed away from the wall by eddy currents and Sylvan Slough currents. Extending the auxiliary lock downstream with an extended upstream guidewall is the next option for a 1200 ft. lock, though the outdraft and ice funneling would be worse to contend with.

4. A model study of currents and constructability of sites 2 and 3 is recommended.

5. Mr. Libbey iterated the fact that the reach of river from Lock 15 to Lock 14 can be the most congested area on the Upper Mississippi River. Small scale improvements would be mooring cells

upstream and downstream of Lock 15. A downstream cell would aid in moving traffic. Upbound traffic waits at RM 480 along the Illinois shore. Tows with loaded barges tend to get hungup there. A mooring cell between the Crescent RR Bridge and the Centennial Bridge would help and cut down the transit time to the lock. Upstream cells are better for safety. They offer a place to tie-off during emergency situations downstream at the lock. A mooring cell near RM 484 would help. Currently many tows nudge the riverbank and wait near Quarters 1 on Arsenal Island. This can be a security issue.

6. For additional comments, see the attached notes and map of the area from Shirley Johnson.

Joseph H. Ross, P.E.
Technical Management Section

Encls as

UMR-IWW SYSTEM NAVIGATION STUDY.....OBJECTIVE 4B

Lock and Dam No. 15 Site Visit.....

Site 1 .....

Sylvan Slough .....mussel sanctuary, hydropower dams, Moline viaduct

Site 2 .....

Extend existing lock downstream..... Sylvan Slough outdraft a concern

Site 3 .....

--Extend auxiliary lock downstream and extend upstream riverside guidewall (needed for dam outdraft).

--Extended upstream guidewall with openings.... (Mel Price....tows get "sucked" to the guidewall).....needs physical model study.

--Extended upstream guidewall may catch ice.....

Constructability at sites 2 or 3 will required modeling of existing outdraft problems..... Lock and Dam No. 15 has one of the worst outdrafts within the Rock Island District.

Site 4 .....

--All the pool gates are needed at this location to maintain pool (the dam was constructed diagonally to accommodate an extra gate) .....gates can not be removed for a new lock location site (there is no room for gate replacement).

--Of course, the government bridge would be relocated for a lock at this site.

Site 5 .....

There is not an overflow section at Lock and Dam No. 15.

Site 6 .....

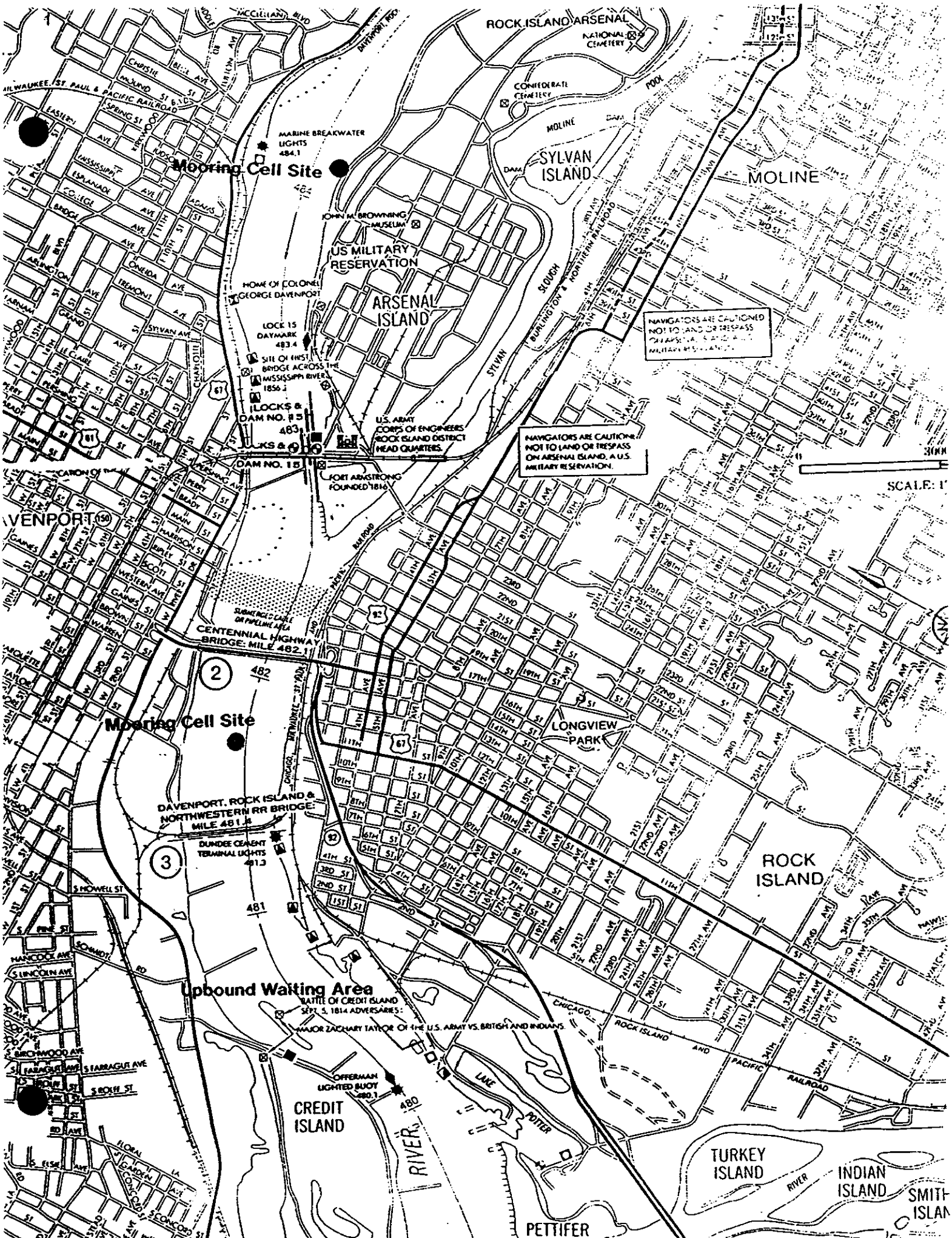
MAJOR relocations would be necessary for this site.....not a possibility.

Small Scale Enhancements .....

--Mooring cells for both upstream and downstream approaches. (Currently upbound tows wait downstream of the Crescent Railroad Bridge..... adding about an hour to the transit time! Sometimes as many as three tows are waiting--just upstream of Lake Potter--maneuvering becomes a problem.)

--High flows at all lock and dam sites make navigation difficult.....model test for high flow conditions in addition to normal flow conditions.

Mel Price.....Lessons Learned.....follow up on flow conditions when roller gates between the locks becomes operational.


ROCK ISLAND ARSENAL
NATIONAL CEMETERY
CONFEDERATE CEMETERY
MOLINE DAM
SYLVAN ISLAND
MOLINE
MARINE BREAKWATER LIGHTS 484.1
Mooring Cell Site
JOHN M. BROWNING MUSEUM
US MILITARY RESERVATION
ARSENAL ISLAND
HOME OF COLONEL GEORGE DAVENPORT
LOCK 15 DAYMARK 483.4
SITE OF FIRST BRIDGE ACROSS THE MISSISSIPPI RIVER 1856
LOCKS & DAM NO. 15
483
U.S. ARMY CORPS OF ENGINEERS ROCK ISLAND DISTRICT HEAD QUARTERS
DAM NO. 15
FORT ARMSTRONG FOUNDED 1816
NAVIGATORS ARE CAUTIONED NOT TO LAND OR TRESPASS ON ARSENAL ISLAND, A U.S. MILITARY RESERVATION.
NAVIGATORS ARE CAUTIONED NOT TO LAND OR TRESPASS
SCALE: 1"
DAVENPORT
SUBMERGED CABLE OR PIPELINE AREA
CENTENNIAL HIGHWAY BRIDGE: MILE 482.1
482
Mooring Cell Site
LONGVIEW PARK
DAVENPORT, ROCK ISLAND & NORTHWESTERN RR BRIDGE: MILE 481.4
DUNDEE CEMENT TERMINAL LIGHTS 481.3
481
ROCK ISLAND
Upbound Waiting Area
BATTLE OF CREDIT ISLAND SEPT. 5, 1814 ADVERSARIES: MAJOR ZACHARY TAYLOR OF THE U.S. ARMY VS. BRITISH AND INDIANS
OFFERMAN LIGHTED BUOY 480.1
480
CREDIT ISLAND
RIVER
LAKE POTTER
TURKEY ISLAND
INDIAN ISLAND
PETTIFER
CHICAGO, ROCK ISLAND AND PACIFIC RAILROAD

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCK AND DAM 16

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 26 August 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 16

1. On 24 August the following people met at L/D 16 to discuss information pertinent to the subject navigation study and L/D 16 site specific characteristics:

Mark Cornish	Iowa DNR, Fairport
Scott Estergard	USFWS (RIFO)
Jack Libbey (Tow Captain)	RIAC (Conti Carriers)
Harvey Vance	Lockmaster
George Staley	CENCR-ED-HH
Lonn McGuire	CENCR-PD-E
Joe Ross	CENCR-ED-DM

2. Downbound traffic crosses the current and heads to the upper gate. Then it backs up toward the wingdam above the lock to align better on the lock and then enters the lock. The wingdam reduces the current and makes it easier to enter the lock. Mr. Libbey said the lock is a makeable lock as is now but a mooring cell or deadman for tie-off in the pocket of water above the lock where the tows back up would help. Downbound traffic can take an hour or so longer to get to the lock than it takes to lock through. Also, if the riverward wall were longer or had a cell 50 to 75 feet upstream of the bullnose, traffic would not glance off the wall and hit the upstream gate as it often does now. Most hits are from downbound traffic. When leaving the lock some tows start turning before they clear the lock and have damaged gates by brushing them.

3. Location 1 would make it harder to enter and exit the lock. It exaggerates the in and out problem that now exist. Its the approach angles that makes this location undesirable.

4. Location 2 has the maneuvering problem as mentioned above.

5. Location 4 with extended riverward guidewalls is the preferred location for new lock construction. It aligns best with river currents and added gates at location 3 would help to pass ice which is a real problem. Location 3 is the second choice for new construction.

6. Location 5 has environmental concerns.

7. Location 6 would require a dredged channel in Wyoming Slough as well as extensive maintenance dredging in an environmentally sensitive area. Could also have similar in and out problems like the existing lock when dealing with the approach to the highway bridge just downstream of the dam.

8. Upbound traffic would benefit with a mooring cell just downstream of the lock toward the middle of the river. During the ongoing rehab work it was noted that closing the first two gates causes an eddy current which pulls tows off the guidewall.

9. The dam does not have submersible gates and this makes it more difficult to pass ice. Ice would move better with gates added to the auxiliary gate opening in conjunction with a new lock at location 4. The existing gates can freeze-in. Many gate support beams have been replaced because they are bent due to ice pressure. Some gates are operted every 8 hours to keep them from freezing. Mr. Vance noted that ice goes out of Wyoming Slough before the channel area, concluding that perhaps there is more flow there and maybe from this standpoint its not a bad idea to consider location 5 for new lock construction.

Joseph H. Ross, P.E.
Technical Management Section

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCK AND DAM 17

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 31 August 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 17

1. On 30 August the following people met at L/D 17 to discuss information pertinent to the subject navigation study and L/D 17 site specific characteristics:

Scott Estergard	USFWS (RIFO)
Gretchen Benjamin	WDNR-LaCrosse, WI
Jack Libbey (Tow Captain)	RIAC (Conti Carriers)
Jon Merritt	Lockmaster
Dennis Boone	Asst. Lockmaster
Rich Fristik	CENCR-PD-E
John Burant	CENCR-ED-HH
Joe Ross	CENCR-ED-DM

2. There is always an outdraft requiring downbound traffic to flank their approach to the lock. A helper boat is usually used when the tailwater approaches 7 or 8 feet.

3. Location 1 could be feasible but a downstream extension would require additional channelization due to existing ground topography. An extended riverside guidewall would help with the outdraft situation. Mr. Merritt and Mr. Libbey questioned the practicality of this location but as pointed out, a savings in cofferdam cost could make this a viable location.

4. Locations 2 or 3 would accommodate a 1200 ft. lock. Constructability under traffic is a question. Mr. Merritt thought that location 3 was the most logical place for new lock construction and is a preferred location.

5. Location 4 is okay provided the already limited flow capacity of the dam can be maintained with additional gates to replace those lost to the new construction. Pool levels are to remain the same. Even though all the existing gates are submersible, additional submersible gates at location 3 in conjunction with new construction at location 4 would help to pass ice.

6. Locations 5 and 6 require channelization and maintenance dredging and would impact the Louisa Refuge Area. These locations are not thought to be viable locations for new lock construction. River access is limited and land access is nonexistent through the refuge area.

7. Locks 17 and 20 are the first to go out of operation during high water. An improvement to navigation on a smaller scale could be an open pass condition using wicket gates at location 5 close to 4. It was roughly estimated that the open pass mode could exist

upwards of 30 percent of the time at L/D 17. While this plan would necessitate some channelization to provide a needed estimated 200 ft. wide channel with line cells, the plan could benefit fish passage which is an environmental concern as well as ice passage.

8. Ms. Benjamin noted that the original authorizing legislation for construction of the lock and dam system included a provision whereby fish passage was not to be hampered by the lock system. She said the lock system has in fact hampered fish passage and this is a major point of contention with any new construction.

9. Mr. Merritt noted that at many locks with low head differential including Lock 17, tows could have open pass with helper boat assistance and a guide cell 75 to 100 feet above the bullnose during high water while the miter gates remained opened. At Lock 17 this condition could exist a significant amount of time. This has been discussed before. A model study may be needed.

10. Small scale improvements would include mooring cells upstream and downstream and a guide cell 75 to 100 feet above the bullnose. Mr. Libbey suggested mooring cells upstream at RM 438.5 and 439 and downstream at RM 436.4 at Keg Island and at RM 436. Mr. Libbey stated that upstream cells make for a safer condition whereby tows have a positive tie-off during emergency situations downstream to which they can lend assistance. Mr. Estergard noted that tows currently wait upstream in an area where historical records indicate the presence of the Higgins' eye pearly mussel (Lampsilis higginsi), an endangered species.

11. I asked Mr. Libbey for his opinion on the hardest locks to make under normal river conditions on the Upper Mississippi, which does not necessarily equate to longest transit time. On a scale of 1 to 10 with 1 being easy, he said Lock 3 was a 12; Locks 24 and 12 are a 9; Lock 15 is an 8; and by far the easiest lock to make is Lock 13.

Joseph H. Ross, P.E.
Technical Management Section

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCK AND DAM 18

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 2 September 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 18

1. On 30 August the following people met at L/D 18 to discuss information pertinent to the subject navigation study and L/D 18 site specific characteristics:

Scott Estergard	USFWS (RIFO)
Jack Libbey (Tow Captain)	RIAC (Conti Carriers)
Frank Robbins	Lockmaster
Rich Fristik	CENCR-PD-E
John Burant	CENCR-ED-HH
Joe Ross	CENCR-ED-DM

2. There is an outdraft but it is not severe. The downbound lock approach crosses the channel current and wind can be a problem.

3. Location 1 requires extensive channelization through the Oquawka State Wildlife Refuge. Henderson Creek outlet may have to be relocated. Construction in this wet marsh area would require extensive dewatering and perhaps cofferdam work which negates a major cost benefit for location 1 which is construction without extensive cofferdam work in a relatively dry condition. Environmentaly this location is unacceptable.

4. Location 2 extended downstream and location 3 are both viable sites but constructability under traffic is a concern. Mr. Libbey said the towing industry, if need be, could handle lockages restricted to two barges wide if sufficient boats were on site to assist with breakdown and reassembly.

5. River currents and approach conditions favor location 4 for new lock construction. Mr. Robbins preference was to locate a new lock in the area of the roller dams rather than the tainter gates. This arrangement would be more beneficial for passing ice. A model test was suggested to confirm proper placement. Mr. Libbey said in general he prefers locks closer to the riverbank but had no real problem with location 4 here.

6. Locations 5 and 6 are environmentaly unacceptable requiring extensive channel dredging in a known mussel habitat and impacting the Skipjack Herring whose population has been adversely affected by its unability to pass upstream beyond Lock 19. Land access is limited requiring major road construction to these locations. Also, the drainage canal from the Des Moines County Drainage District No. 7 would have to be relocated.

7. Mr. Robbins suggested a tainter gate arrangement be considered for the upper lock gate of a new lock design. It could be used for

filling, passing ice, and would not be as susceptible to hits. He said St. Anthony Falls has a tainter gate at the upper end of the lock in conjunction he thought with miter gates. Mr. Robbins is opposed to vertical lift gates vs tainter gates and thought the minimum depth of sill should be 15 feet. Mr. Libbey said the deeper the sill, the better the conditions especially for maneuvering in ice. It was pointed out that depth of sill relates to cost.

8. Small scale improvements include mooring cells upstream and downstream and a guide cell 50 to 75 feet above the bullnose. Cells were recommended upstream at RM 411 and at RM 411.8 if the draft there is adequate. Also, a cell, deadman, or rock protection along the riverbank at RM 416 at Oquawka would ease the long term problem of tows suspect of contributing to riverbank erosion as they fleet there while waiting to lock through.

9. Mr. Robbins said that everyplace tows touch ground downstream in Pool 19 is private property. Some tows wait at Otter Island which is owned by the City of Burlington who apparently do not object. Mr. Libbey suggested mooring cell placement at RM 409 off of Otter Island and two cells just below the dam at RM 410.2. When possible two cells properly placed are better than one according to Mr. Libbey to keep the tow from swinging around.

Joseph H. Ross, P.E.
Technical Management Section

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCK 19

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 16 September 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Lock and Dam 19

1. On 9 September the following people met at L/D 19 to discuss information pertinent to the subject navigation study and L/D 19 site specific characteristics:

Scott Estergard	USFWS (RIFO)
Rogger Harroun	Lockmaster
J. Alan Dickerson	Asst. Lockmaster
Lonn McGuire	CENCR-PD-E
George Staley	CENCR-ED-HH
Joe Ross	CENCR-ED-DM

2. On 30 August, while on a site visit to L/D 18, the following people also gave input on L/D 19 site specific characteristics: Mr. Jack Libbey, Tow Captain for Conti Carriers representing RIAC and Mr. Frank Robbins, Lockmaster at L/D 18 who was previously Lockmaster at L/D 19. The following is a summation of both discussions.

3. A 1200 ft. lock was constructed at this site in 1957 and ties into the Union Electric Power Dam which has flow gates across the full width of the river. Between the two structures are the historical remains of the old 358 ft. by 110 ft wide lock and 463 ft. by 150 ft. wide dry dock which were built in 1913. The area attracks many tourists. Even though there is a 1200 ft. lock at this site, there are problems and delays associated with both downbound and upbound lockages due to the approach/exit conditions and ice accummulation.

4. During the 1993 Flood there was about 12 ft. of head at the dam with all the gates opened but for a couple of gates on the Illinois side that were silted in. There was a maximum pool rise of about 1.5 ft. in the pocket forebay area above the lock. Upstream of the dam on the Illinois side the water level was about 4 ft. lower as the gates were passing water through the dam faster than water could get there over the silted in "hump area" above the dam.

5. Water in the forebay area upstream of the lock is used by the lock, the powerhouse, and the City of Keokuk who has their raw water intake there. The city currently has a 24 and 36 inch intake and plans to add a new 48 inch intake line for which they will be submitting a permit. Apparently the city cannot get the rights-of-way to go further upstream. The landside wall, which Union Electric owns upstream of the lock, leaks and the power company has plans to improve the wall as their funding allows. The Corps is going to move their WSEG from that wall to the angle wall above the lock which the Corps owns.

6. Any major new lock construction such as a supplemental 600 ft. lock to benefit increased efficiency, recreation traffic, ice passage, etc., could be added at location 3 using the present location of the historical lock and or drydock though there are major significant historic properties impacts and earlier indications of significant fish and wildlife impacts as well. All other locations for supplemental lock construction are eliminated from further consideration. High bluff topography, Burlington Northern Railroad relocation, and the City of Keokuk's water treatment plant eliminate location 1. The hydropower dam and channel rock excavation eliminate location 4. There is no location 5. Location 6 is eliminated because of the extensive land acquisition in the town of Hamilton, IL., channel dredging in a heavily silted area upstream of the dam, channel rock excavation below the dam and the physical restrictions of the downstream railroad and highway bridges. However, to make lockages with the existing 1200 ft. lock more efficient, smaller scale improvements are of more concern than supplemental lock construction, specifically: ice removal provisions and improvements to upstream and downstream approach conditions.

7. The powerhouse intake creates an outdraft condition and together with the narrow channel opening upstream of the lock makes for difficult approach/exit conditions for tows. Upbound tows must swing their stern toward the powerhouse to make the exit while fighting the outdraft toward the powerhouse. A study was made a few years ago for an extended riverward guidewall. While the study showed this wall to be expensive, the present general consensus is that a new guidewall should extend the full length from the lock to the upstream opening and not just a few hundred feet or so as this would make maneuvering conditions worse. While properly spaced cells may help, the lock personnel think a ported guidewall to pass water to the powerhouse and ice to a badly needed ice chute is the better solution.

8. Mr. Libbey said that as a Tow Captain he would gennerally prefer to travel downstream through the lock rather than upstream. He said the mooring cells upstream are well placed. Tows use the cells downstream but downbound traffic does not like to see tows there as the narrow channel, shoaling, and strong currents force the downbounds into the waiting upbounds. Upbounds usually wait at RM 362 near the mouth of the Des Moines River since there is no room to pass upstream to the lock. Then it can take up to 45 minutes to get to the lock fighting a cross current and narrow channel with shallow water to the starboard side where there is a rock bottom and only 4 to 5 feet of water. It may take another 30 minutes to make the lock as the bow is nosed into the lower riverside guidewall and the stern is swung around to align with the lock.

9. Small scale improvements to improve the overall transit time through the 1200 ft. lock are more desirable than supplemental lock construction. The major problem is ice removal. Lock 19 was the

main bottleneck on the river for two years in a row because of ice. The lockmaster showed a video of tows fighting the ice a couple of years ago in December. According to the lockmaster, an ice chute should be the top priority at Lock 19. A study by CRREL recommended a 60 ft. wide chute be placed at the present location of the 6 ft. wide debris chute. Ice packs under the vertical lift gate which does not have a shear edge at the bottom and plugs the upstream valve gate operators. The 15 ft. depth of sill at the upper end may also be a contributing factor. A properly placed ice chute is a must for increased efficiency. Other small scale improvements according to Mr. Libbey would include additional mooring cells upstream at RM 365.5. Traffic would benefit by a wider channel downstream of the lock or a passing zone there, however, channel excavation would be in rock. Also, a rock dike or berm extending maybe 300 to 600 ft. downstream of the highway bridge would block the cross current on the tows making for safer navigating and speeding up transit time to the lock for upbound tows. Dredging is required downstream of the lock but is no worse there than most other lock sites.

10. Access to the L/D was a problem during the 1993 flood. A dike constructed downstream with a road on top would provide access for L/D and powerhouse personnel as well as protect the city's water treatment plant. The city is apparently interested in such a plan.

11. Pictures were taken of the area.

Joseph H. Ross, P.E.
Technical Management Section

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCKS AND DAMS 20, 21, & 22

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 11 July 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW Navigation Study - Objective 4b, Site Selection of New Locks, Site Visits to L/Ds 22, 21 and 20.

Lock and Dam 22

1. On 6 June 94, the following people met at L/D 22 to discuss information pertinent to the subject navigation study and L/D 22 site specific characteristics.

Bill Bertrand	IL Dept. of Conservation
Melanie Kruse	U.S. Fish & Wildlife (RIFO)
John Schliekelman	CENCR-ED-HH
Lonn McGuire	CENCR-PD-E
Gary Clark	Lockmaster
Joe Ross	CENCR-ED-DM

During subsequent meetings the following people representing the River Industry Action Committee (RIAC) provided comments for L/D 22:

Tim Robinson		American Commercial Barge Line
Kevin Kelly	(Tow Captain)	American Commercial Barge Line
Buddy Compton	(Former Tow Captain)	RIAC
John Patterson		RIAC

2. Downbound traffic fights an outdraft as it slows to make the lock approach. A helper boat is used most of the time when the tailwater is 8 to 9 feet or more. Mr. Kelly and Mr. Compton said the mooring cell approximately 3500 feet upstream is not used because it is hard to get to and since the river channel is narrow in this area, most downbound traffic wait about 3 miles upstream until upbound traffic passes. Both agreed that channel maintenance is a problem upstream and downstream of the dam. (The Dredge Thompson was dredging just downstream of the lock while we were there) Mr. Kelly said that the upstream flow control point sometimes makes for low draft conditions where tows don't have sufficient water to navigate in a safe condition. Sometimes there is only 3 feet of water below the boat, whereas he would like to have 5 to 7 feet of water under the boat which would be a safer condition.

3. Some upbound traffic fleet on the west riverbank in a known mussel sanctuary while waiting for a downbound lockage. The degree of impact is not known. Mr. Clark noted that the St. Louis District was at one time--and it still may be in the works--going to place a buoy or cell for tie-off which would lessen the impact on the mussel sanctuary. Melanie Kruse noted that there are about 11 different mussel species upstream of the dam and

about 17 species downstream. The likelihood of impacting an endangered mussel species is very low. Mr. Kelly thought that the buoys in the St. Paul District are okay but they are hard to chase around and tie-up to. In general, the RIAC representatives felt that a mooring cell would be easier to work with than a floating buoy although Mr. Compton indicated that the Louisville District has some well designed buoys on the Ohio River. They have "arms" projecting from them which makes it easier to tie-up to.

4. Mr. Clark said that the guide cell below the intermediate wall helps protect the gates. Ice flow is a problem. New lock construction at location 3 or location 4 as close to 3 as possible should help to flush ice through the structure. Separation of any new lock construction from the existing lock, such as at location 5 or 6, would be harder to operate with limited personnel.

5. Mr Bertrand said that there are some 20 years of fish data from 36 monitoring stations on the upper Mississippi. One station is located on the L/D 22 tailwater.

6. The general consensus is that for any recommended new lock construction, locations 1,5 and 6 are not good. Location 4 is the preferred location in conjunction perhaps with a mooring cell downstream. Locations 3 and 2 are next preferred. If major construction is not recommended, RIAC would like to see the guidewalls extended as small scale improvements.

7. During a walk across the dam Mr. Clark pointed out the severe erosion along Cottel Island from the 93 Flood.

Lock and Dam 21

1. On 7 June 94 the following people met at L/D 21 to discuss information pertinent to the subject navigation study and L/D 21 site specific characteristics.

Bill Bertrand	IL Dept. of Conservation
Melanie Kruse	U.S. Fish & Wildlife (RIFO)
John Schliekelman	CENCR-ED-HH
Lonn McGuire	CENCR-PD-E
Tom Dunker	Lockmaster
Joe Ross	CENCR-ED-DM
Kevin Kelly (Tow Captain)	American Commercial Barge Line
Tim Robinson	Amercian Commercial Barge Line

During a subsequent meeting the following people representing the River Industry Action Committee (RIAC) provided comments for L/D 21:

Buddy Compton (Former Tow Captain) RIAC

John Patterson RIAC
Mr. Kelly and Mr. Robinson were also representing RIAC

2. Downbound traffic fights an outdraft and Mr. Kelly said the current can carry the stern around the end of the intermediate wall if your not careful with the flanking approach. Mr. Kelly also mentioned that he thought L/D 24 was the most dangerous lock in the lower reach. Mr. Dunker said a helper boat is needed when the tailwater is high, approaching flood stage. And of course, it is always easier to maneuver when you have 1200 ft. guidewalls. Any recommended new construction for location 1 should have extended riverside guidewalls like those on the Ohio River as the flow is actually further toward the center of the river. Location 4 is better here than at L/D 22 because there is more navigable channel to work with. Mr. Kelly said, however, that an underbar upstream of the dam would have to be removed in conjunction with any new lock construction at location 4.

3. Mr. Dunker said he would like to see a guide cell 100 feet or so upstream of the intermediate wall. Also would like to see 1200 ft. landward guidewalls. Mr. Robinson thought that a combination of a cell upstream of the intermediate wall extended would be beneficial as a small scale improvement. Mr. Dunker mentioned that the existing guidewalls funnel ice, creating a problem when trying to flush the ice through the structure. Also, during high water upbound traffic often slams into the lower guidewall.

4. The general consensus of the group is that location 3 is the preferred place for any recommended new lock construction with the next being further out into the structure. Location 5 through the storage yard at the end of the gated section of the dam was thought to be a good second choice because of the existing river flow characteristics and the expanse of river available. Added gates to maintain the existing flow capacity of the dam would not be needed since no existing gated opening is lost with new construction there.

5. Mr. Robinson said that ACBL is looking at the possibility of using Spectraline to replace cable. It has a higher first cost and is somewhat elastic but is 1/6 the weight of cable and much easier to handle.

6. Mr. Kelly stated that the "pins" (floating mooring bitts) at Mel Price do not line up well for a 15 tow lockage. The floating bitts do not match the wider walkway surfaces where barges are connected. This makes for a more unsafe work condition for deckhands. Kelly also stated that it's hard to read the river currents at Mel Price but time and familiarity should solve this problem. He also thought that the landward guidewalls at the Ohio River locks provide good approach conditions. Mr. Kelly said Smithland Lock on the Ohio River is a "model lock". It has

2 - 1200ft. locks with narrow separation between them. The greater depths of the Ohio River allow for good maneuvering.

7. After the meeting Mr. Dunker accompanied the group on a walk across the dam and spillway.

Lock and Dam 20

1. On 8 June 94 the following people met at L/D 20 to discuss information pertinent to the subject navigation study and L/D 20 site specific characteristics.

Melanie Kruse	U.S. Fish & Wildlife (RIFO)
Dan Johnson	CENCR-ED-HH
Lonn McGuire	CENCR-PD-E
Bill Robinson	Lockmaster
Joe Ross	CENCR-ED-DM
Buddy Compton (Former Tow Cpt.)	RIAC
John Patterson	RIAC

During the meeting on 7 June the following people representing RIAC were asked to comment on L/D 20:

Kevin Kelly (Tow Captain)	American Commercial Barge Line
Tim Robinson	American Commercial Barge Line

Mr. Bill Bertrand, IL Dept. of Conservation, was not able to attend this meeting but he walked the dam the previous day with COE personnel and Melanie Kruse.

2. Mr. Robinson said that upbound traffic takes up to 45 minutes to make approach after a downbound lockage because they wait quite a distance downstream. A downstream mooring cell could help the situation. A helper boat is usually needed at a tailwater of 8 feet and higher. Mr. Robinson said that the lock is one of the first to go out of operation during high water and that in 1990 it was the only one out of operation in the lower reach. He would like to see higher lock walls with any recommended new lock construction.

3. There is no non-overflow or spillway section (location 5) at this site; there are flow gates across the full width of the river. The RIAC representatives thought there was adequate water to locate any new recommended lock construction anywhere in the dam structure.

4. The downbound approach is somewhat similar to L/D 21 in that there is a pocket of water just upstream which requires flanking during the approach. However, unlike L/D 21, Mr. Kelly said the water tends to "suck you to the riverbank".

5. Mr. Compton suggested that in genneral extended guidewalls would allow the second cut to clear the chamber so that a waiting like bound tow could use the chamber while the reconnect is made.

6. The general consensus of the group is that location 3 is preferred for new lock construction and that location 4 as close as possible to the auxiliary gate is the next choice. New flow gates at location 3 would hopefully make up the difference for lost flow capacity due to new lock construction at location 4. New construction near the Illinois side of the dam is objectionable from an environmental standpoint.

7. Mr. Compton said that if new lock construction is not recommended, lengthening guidewalls would be a definite improvement at many L/D sites.

Joseph H. Ross, P.E.
Technical Management Section

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LOCKS AND DAMS 24 & 25

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CELMS-PM-M (1110-2-1150a) 9 February 1996

MEMORANDUM FOR FILE

SUBJECT: Site Visit, Objective 4B, UMR Nav. Study

1. Site visits were made to Lock and Dam Nos. 24 and 25 on 15 Sep 94 to evaluate new locks at the various locations and to receive comments from resource agencies. The following were in attendance (Legend: 1 = LD24; 2 = LD25):

Corps of Engineers:

Tom Keevin 1,2	Chris Morgan 1	Toni Serena 1,2
Paul Boyd 2	Rich Fristik NCR 1,2	Rich Astrack 1,2
Ken Koller 1,2	Jeff Stamper 1,2	David Nulsen 1
Joe Ross NCR 1	Jerry Rapp 1	Jerry Stroud 2

Resource Agencies:
Scott Estergard USFWS 1,2 Jon Duyvejonck USFWS 1,2
Norm Stucky MO DOC

Industry representatives were invited but were unable to attend.

2. The purpose of the meeting was to review each location, determine if there are any major obstacles to proceeding with further evaluation of the site, and to obtain the viewpoints of the resource agencies. At each site, the group met and the proposed six locations were explained and discussed. After an inspection of the site, the group reconvened to discuss any additional observations.

3. Lock and Dam No. 24. The following comments were offered.

a. Site #1. This site would worsen the outdraft condition, would have extensive rock excavation, would require railroad and highway relocation; would have detrimental social effects to Clarksville, and would require considerable dredging.

b. Site #2. Precast concrete blocks, set in place with cranes, would be used to extend the 600 ft. lock. The blocks would be filled with concrete with minimal interference with traffic. Helper boats would be required. A shutdown would occur in winter for pile driving operations for the lower miter gate monolith. The existing lock would have to be rehabilitated for a 50 year life. Cross currents now pose a problem for downstream exits. Minimal environmental damage would occur.

c. Site #3. Outdraft somewhat lessened at this site; an extended riverside guidewall could be constructed upstream.

Different construction techniques could be employed from Site #2. Minimal environmental damage would occur.

d. Site #4. Construction activities could cause problems for the existing structure. A submersible gate could be constructed in the auxiliary lock location which would be capable of skimming ice and debris from the upstream lock approach area. This gate location would also be less environmental damaging than adding dam gates in the overflow dike, which would require extensive excavation of wooded areas downstream.

e. Sites #5 & #6. Extensive dredging would be required, with land based disposal probably required initially (or opportunities for alternative uses) and thalweg disposal possible for maintenance dredging. Dike construction would disrupt river traffic. These sites would pose major environmental disruption.

4. Lock and Dam No. 25. The following comments were offered.

a. Site #1. The lock would be constructed on land rather than in Sandy Slough; this would cause less environmental damage. Fill could be temporarily placed in Sandy Slough to enlarge the land area for construction purposes but it would have to be removed. Sandy Slough is a significant eagle feeding area. There is an opportunity for allowing flow into the upper end of Sandy Slough, a mitigation measure. A ferry and grain elevator would have to be relocated.

b. Sites #2, #3 and #4. Same comments at for LD 24.

c. Site #5. A rock bluff would have to be removed at the downstream end of the exit channel. A lock on the Illinois side would cause difficulties for operations, especially for materials and supplies. There is a mussel bed upstream of the overflow dike.

d. Site #6. This site was deemed not practical due to the rock bluffs on the Illinois side.

5. The environmental agencies preferred Sites #1 through #4; nothing in these plans could not be mitigated for. Sites #5 and #6 would pose too much environmental disruption.

6. Small Scale Improvements. The following were suggested as possible small scale improvements.

Mooring cells, buoys, or listing barges (for easy tie-ups)
Extended riverside guidewalls

Extended landside guidewalls to allow remaking of tows outside the lock chamber

Powered mules

Radar at lock control houses

Improved upstream waiting area at LD 24 (possibly cells in area of the rock shelf or an L-dike at the rock shelf)

KENNETH R. KOLLER
Project Manager

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

PEORIA LOCK AND DAM

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 23 September 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to Peoria Lock and Dam

1. On 14 September the following people met at Peoria L/D to discuss information pertinent to the subject navigation study and Peoria L/D site specific characteristics:

Scott Estergard	USFWS (RIFO)
John Shue	Consolidated Grain & Barge, Hennepin, IL
Jack Schuiteman	Lockmaster
Richard Moss	Asst. Lockmaster
Lonn McGuire	CENCR-PD-E
John Schliekelman	CENCR-ED-HH
Joe Ross	CENCR-ED-DM

Major Findings

2. The I-474 bridge 1000 feet upstream impacts many of the site locations for new lock construction. Also, 24 inch and 22 inch submarine gas line crossings are 2500 feet and 7000 feet respectively downstream from the lock. The submergible tainter gate passes ice much better in the raised position. Perhaps a non-submergible gate would have sufficed.

General

3. The dam consist of an 80 ft. wide tainter gate and 108 wicket gates 4 ft. wide. The open pass condition exist an estimated 40 percent of the time. Mr. Shue said in general there is not much of a problem with time delay. Dredging is needed just downstream of the lock about every 10 years or so. Lick Creek downstream is also the site of frequent dredging. A helper boat is needed to help with the outdraft when the tainter opening exceeds 6 feet.

Location Discussions

4. Location 1. Problem with the I-474 bridge clearance which is sloping down at this point. A 1200 ft. lock would be best located toward the downstream side of the dam. This could improve the channel alignment for the downbound approach. Have some major relocations including an oil tank farm. Some homes could also be impacted.

5. Location 2. Would be best to extend downstream for a 1200 ft. lock. The upper guidewall extension and I-474 bridge do not align well. The lower guidewall could constrict river flow requiring some channel widening.

6. Location 3. N/A at this site.

7. Location 4. The open pass condition and all the benefits associated with it would be impacted with a new lock here in the short width of dam. The location of added flow capacity is problematic.

8. Location 5. N/A at this site.

9. Location 6. The I-474 bridge impacts this location more than any other with low clearance and bridge pier positioning. The downbound approach would be an "S" curve and existing bathymetry indicates a hole 40 to 100 feet deep on the alignment of a new channel/lock. An existing slip to Keystone Steel and Wire would have to be relocated and this area including the new navigation channel would be prone to increased maintenance dredging.

10. In summary, location 1 is preferred and location 2 is the next choice. Recommend all other locations be eliminated from further consideration. A possible disposal site for excavated material is Pekin Lake at RM 153.5.

Small Scale Improvements

11. A floating buoy which is onsite will be placed per input from RIAC upstream of the lock. Upbound tows lean on the riverbank at RM 157. Anything in the middle of the river impacts open pass. Hydraulic operated wickets is a possibility.

Joseph H. Ross, P.E.
Technical Management Section

UPPER MISSISSIPPI RIVER - ILLINOIS WATERWAY SYSTEM NAVIGATION STUDY

LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION LOCATION SCREENING

APPENDIX A: LOCK AND DAM SITE VISITS

LA GRANGE LOCK AND DAM

U. S. ARMY ENGINEER DISTRICTS,
ROCK ISLAND, ST. LOUIS, ST. PAUL
CORPS OF ENGINEERS

CENCR-ED-DM 26 September 1994

MEMORANDUM FOR RECORD

SUBJECT: UMR-IWW System Navigation Study, Obj. 4b, Site Visit to La Grange Lock and Dam

1. On 14 September the following people met at La Grange L/D to discuss information pertinent to the subject navigation study and La Grange L/D site specific characteristics.

Scott Estergard	USFWS (RIFO)
Jeff Stamper	CELMS-ED-DA
Ken Koller	CELMS-PM-M
Stan Wallace	Lockmaster
Dave Hood	Asst. Lockmaster
Lonn McGuire	CENCR-PD-E
John Schliekelman	CENCR-ED-HH
Joe Ross	CENCR-ED-DM

Major Findings

2. The submergible tainter gate passes ice better in the raised position. Tows push ice toward the gate. Perhaps a non-submergible gate would have sufficed. Mr. Schliekelman thought the WES model was apparently misleading in describing ice passage. It is suspected that the paraffin used in the model was much more buoyant than is ice.

3. When the flood waters receded, the area was covered with Zebra mussels. This is the first massive infestation in the Rock Island District.

General

4. The dam consist of an 80 ft. wide tainter gate and 109 wicket gates 4 ft. wide. The open pass condition exist more than 50 percent of the time. Annual dredging is required below the lock. Since the tainter was installed, holes below the dam have stabilized. A helper boat is recommended to help with the outdraft when the tainter opening exceeds 5 or 6 feet. The tainter has lessen the magnitude of the cross current at the downbound approach induced by the flow regulating valves at the far side of the dam. The future reliability of the wicket dam without major rehab work would have to be addressed in conjunction with any recommended new lock construction.

Location Discussions

5. Location 1. Looks good. This alignment appears to be an improvement over the existing. Downbound tows tuck into the "pocket" upstream of the upper guidewall on their approach and the existing channel, already against the west bank below the lock, is

tended to move further west. Buying a disposal site in the adjacent unprotected agricultural land use area for the excavated sand material from new channel construction could have merit.

6. Location 2. Could be feasible. Preference would be to extend the lock downstream. The intermediate wall is in bad shape requiring major rehab work. This wall, ported and extended upstream, would help with the outdraft.

7. Location 3. N/A at this site.

8. Location 4. A lock here would impact the open pass condition and the benefits associated with it. Mitigating 1/3 to 1/2 the flow capacity is very questionable. There are environmental concerns here also.

9. Location 5. N/A at this site.

10. Location 6. Does not align well with the natural tendency of the river to move west. Would require extensive channel construction through an environmentally sensitive area and added river training works which do not exist now.

11. In summary, location 1 is preferred and location 2 is the next choice. Recommend all other locations be eliminated from further consideration.

Small Scale Improvements

12. A floating buoy was placed upstream of the lock per input from RIAC. There is no cell or bouy downstream near Indian Creek where upbounds wait. Recently, when 6 tows were waiting downstream, the last one was clear down by Meredosia. This lock has the highest number of 15 barge tows on the Illinois River. The landside guidewall extended upstream and/or downstream or cells would help with double cuts.

Joseph H. Ross, P.E.
Technical Management Section