Upper Mississippi River - Illinois Waterway System Feasibility Study
Engineering Coordinating Committee Meeting
St. Louis District Office
November 14, 1997

Agenda

		Speaker
8:30 - 8:50	**Overview of the Navigation Study**	**Tipple**

- Purpose and Objectives
- Timeline of Study, Milestones
- Work Groups

8:50 - 10:20 Engineering Work Group — **Hughey**

- Overview and Status
  - Baseline
    - Results
  - Reliability
    - Scope, Methodology, Results
  - Small Scale Improvements
    - Scope, Screening, Cost and Performance Results
  - Large Scale Improvements
    - Scope, Screening, Cost and Performance Results

10:20 - 10:50 Plan Formulation Work Group — **Tipple**

- Overview and Status
- Environmental Work Group Overview

10:50 - 11:30 Economics Work Group — **Sweeney**

- Overview and Status

11:30 - 12:00 Discussion — **Group**

12:00 Adjourn

CEMVR-ED-DM (1110-2-1150a) 9 January 1998

MEMORANDUM FOR RECORD

SUBJECT: Upper Mississippi River & Illinois Waterway System Navigation Study, Engineering Coordinating Committee (ENCC) Meeting No. 3, 14 November 1997, St. Louis, MO

1. On 14 November 1997, the subject meeting was held in St. Louis, MO. The agenda and attendance list are attached as Enclosures 1 and 2, respectively. Note that Mr. Brad Thompson spoke in place of Mr. Dave Tipple, contrary to the agenda.

2. The primary purpose of the meeting was to present a status report of engineering activities and the engineering findings of the study that are published in the draft engineering appendix of the feasibility study. Updates were also given on the activities of the other work groups.

3. Mr. Bob Hughey opened the meeting and provided an overview of the study and of the Engineering Work Group Findings. His overheads (Enclosure 3) capture the main points of his presentation. Mr. Hughey noted that the draft Engineering Appendix would be available to order in January 1998. *[Note: This report is now expected to be available in February 1998 because it is undergoing some clarifying revisions.]* . The following discussion was generated by his presentation.

a. Remake Facilities. Mr. Bob Goodwin and Mr. Wayne Williams said that they prefer extended guidewalls to remote remake facilities. They said that it is difficult to get properly aligned at a remote remake facility. It was suggested that self-help with a DeLong pier guidewall extension would be a good option to remote remake. Mr. Goodwin questioned the low timesaving (1 minute net) that was presented for the "Extended Guidewalls" approach improvement.

b. Study Authorizations to be sought. Mr. Jim Hall asked that if small-scale measures are sufficient to handle the traffic growth for 15 years, would we still seek (from the system study) authorization to begin construction of new locks 15 years out (rather than have to go through another process to seek authorization in the future). Mr. Bob Hughey said that the authorizations to be sought from the study have not been determined exactly, but that the Plan Formulation Steering Committee will be making that determination.

c. Powered Ratchets. Mr. Williams noted that powered ratchets are heavy and cumbersome to move around and that they may be less safe than the steamboat ratchets more commonly in use.

d. Siltation with Approach Channel Improvements. Mr. Williams asked if changes in siltation would be a problem when the approach channel measures are implemented. While this is not expected to be a problem, Mr. Jeff Stamper noted that at Lock 24 the

approach improvements will be implemented incrementally to monitor the effects produced.

d. Economic Impacts to Navigation during Construction. Mr. Hughey noted that the economic impacts to navigation during construction are a very significant screening factor. He added that because of their importance, impacts to navigation will be examined further as part of the Engineering Work Group's FY 98 activity.

5. Economics Update. Mr. Don Sweeney provided a status report of the Economic Work Group's activities. Mr. Sweeney noted that the main task of the Economics Work Group is the development of the National Economic Development (NED) plan, which is scheduled to be determined in April 1998. The work group is also working on the Regional Economic Development (RED) plan. He said that the traffic forecasts (determined by an independent contractor through the Institute for Water Resources) came out lower than previously expected. The new forecasted growth in demand averages about 1.1 percent annually over the next 50 years. He said that he is working on a preliminary NED analysis, however, not all of the relevant information is yet available for finalizing the NED plan. Of particular importance, he said, is the consideration of impacts to alternative modes of transportation. Mr. Sweeney said that a study is being conducted to determine if rail can handle the increased demand without the tremendous costs to expand rail lines. The report is expected in early January 1998. Until that information is available and all other inputs are finalized the NED plan cannot be determined.

Mr. Goodwin asked who would pay for the additional helper boats if this measure were to be adopted. Mr. Sweeney said that, from the national perspective (i.e., for determination of the NED plan), it does not matter who pays. Mr. Goodwin said that it matters to industry whether it is government furnished or industry furnished.

Mr. Hall said that there is an apparent discrepancy in the treatment the Corps and Congress gives to the Ohio River versus the Mississippi River. Mr. Jerry Foster said that his office (at Headquarters of the Corps) is responsible for assuring equity within the Corps, and will be reviewing both system studies. Mr. Sweeney said that his economic model, which is new as of this year, was shown to economists from Ohio River Corps Districts and received favorably. He said that the model is applicable to the Ohio River system, but he doesn't know whether they will use it. Mr. Sweeney noted that there is a disparity concerning the Inland Waterway Trust Fund. He said that the UMR&IWW system generates 40 percent of the Trust Fund revenues, but only receives 5-15 percent of the Trust Fund outlays.

6. If you have any questions, please contact the undersigned at (309) 794-5778.

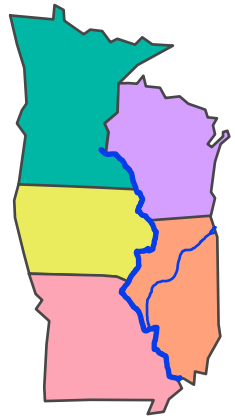
David R. Wehrley, P.E.
Technical Management Section

Enclosures:
1. Meeting Agenda
2. Attendance List
3. Engineering Presentation

Distribution:

Chris Brescia	MARC 2000
Robert Goodwin	Maritime Administration
James Hall	Iowa DOT
Jack Hynes	Missouri Dept of Trans
Wayne Williams	Alter Barge Line

Jerry Foster	CECW-ED	Gary Loss	CEMVR-ED
Malcolm Dove	CEMVD-ED-EW	Kevin Landwehr	CEMVR-ED-H
Vic Agostinelli	CEMVD-ET-ES	Denny Lundberg	CEMVR-ED-DM
Tony Young	CEMVD-ET-EG	Dave Wehrley	CEMVR-ED-DM
Steve Ellis	CEMVD-ET-ET	Joe Ross	CEMVR-ED-DM
Tom Sully	CEMVP-PE-D	Dale Rossmiller	CEMVR-ED-D
Bob Hughey	CEMVS-ED-D	Mark Gmitro	CEMVR-PP-M
Billy Arthur	CEMVS-ED-H	Dave Tipple	CEMVR-PD-W
Jeff Stamper	CEMVS-ED-DA	Brad Thompson	CEMVR-PD-W
Ed Demsky	CEMVS-ED-GE	Ken Barr	CEMVR-PD-E
Don Sweeney	CEMVS-PD-E		

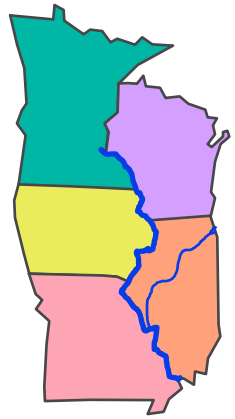


Upper Mississippi River Illinois Waterway System Feasibility Study

Engineering Coordinating Committee

14 November 1997

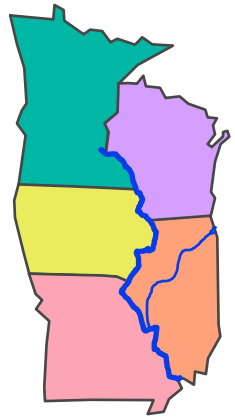
Upper Mississippi River - Illinois Waterway System Feasibility Study
Engineering Coordinating Committee Meeting
St. Louis District Office
November 14, 1997



Agenda

		Speaker
8:30 - 10:20	**Engineering Work Group**	**Hughey**
	Overview and Status	
	Baseline	
	Results	
	Reliability	
	Scope, Methodology, Results	
	Small Scale Improvements	
	Scope, Screening, Cost and Performance Results	
	Large Scale Improvements	
	Scope, Screening, Cost and Performance Results	
10:20 - 10:50	**Economics Work Group**	**Sweeney**
	Overview and Status	
10:50 - 11:30	**Plan Formulation Work Group**	**Thompson**
	Overview and Status	
	Environmental Work Group Overview	
11:30 - 12:00	**Discussion**	**Group**
12:00	**Adjourn**	

Meeting Purpose



Present the findings of the Engineering Work Group

Engineering Cast

Technical Supervision

Dick Atkinson **George Mech**
John Dierker ***S. K. Nanda***
Bob Hughey **Dale Rossmiller**
Gary Loss ***Tom Quigley***
uigley
igley

ng Appendix Production

duction

Writer
riter

thout-Project Write-Up

Ed Demsky **Roger Less**
m Sully ***Jeff Stamper***
Stamper
Stamper

oe Ross ***Brad Thompson***
Thompson
Thompson

vin Landwehr ***Joe Ross***
f Stamper Dave Wehrley

Other Contributors

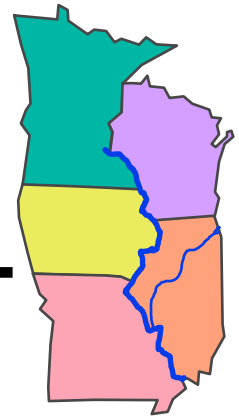
All UMR&IWW Lockmasters ***Dan Johnson***
Billy Arthur **Nathan Kathir**
Rich Astrack ***Ken Koller***
Jim Bartek **Paul Kornberger**
Jim Bigham ***Paul Kosterman***
Brian Catus **Jeff Marmorstein**
Matt Clark **Dan Marshall**
Mike Cummings **Jeff McGrath**
Cory DeLong ***Dave Norgren***
Ed Demsky **Tim Paulus**
Hans Drehsler ***Nick Peschang***
Rich Fristik **Bryan Radtke**
Dick Gosney ***Jerry Rapp***
Rick Granados **Bruno Schiller**
Bill Gretten ***Toni Serena***
Tom Sully **Tim Grundhofer**
Tom Wirtz ***Fred Joers***
Ron Wooley **Shirley Johnson**
Sibte Zaidi ***Carl Johnson***

WES ***CERL*** ***Ben C. Gerwick, Inc***
CM&T ***Shannon and Wilson***
Sverdrup

Study Scope

- 37 Navigation Locks
- 32 Navigation Dams
- 1250 Miles of Navigable Channel

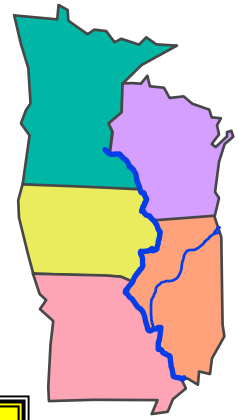
Engineering Work Group Introduction



Public Input and Coordination:

- ***Public Meetings 1994, 1995, 1998***
- ***Engineering Coordinating Committee Meetings***
- ***6 Technical Review Conferences***
- ***Continuous Coordination among Study Work Groups***

Interrelationship of Work Groups



Engineering Work Group

Engineering Coordinating Committee

Economics Work Group

Plan Formulation Work Group

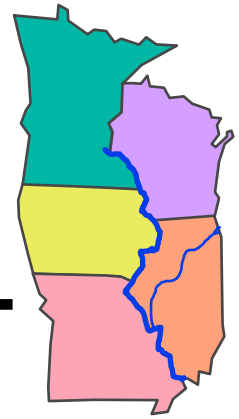
Environmental and Historic Work Groups

Public Involvement Work Group

Economics Coordination Committee

Navigation Environmental Coordination Committee

Engineering Workgroup Objectives



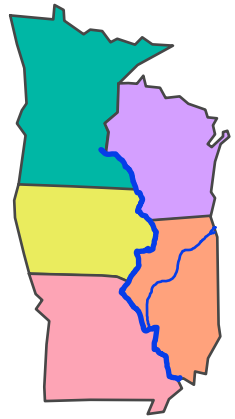
WITHOUT-PROJECT OBJECTIVES

- ***Baseline O&M (Historical)***
- ***Future O&M Needs (Major Rehabilitation)***

WITH-PROJECT OBJECTIVES

- ***Small-Scale Navigation Improvements***
- ***Large-Scale Navigation Improvements***
- ***Site Specific Engineering for Recommended Plan***

INTRODUCTION

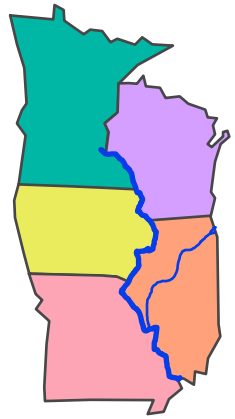


Without-Project Condition:

the future condition of the navigation system if no new navigation improvements are implemented

- ***existing authorities***
- ***limited or no delay reduction***

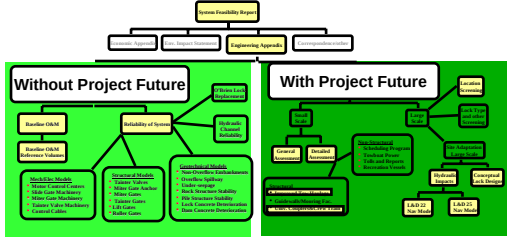
INTRODUCTION



With-Project Condition:

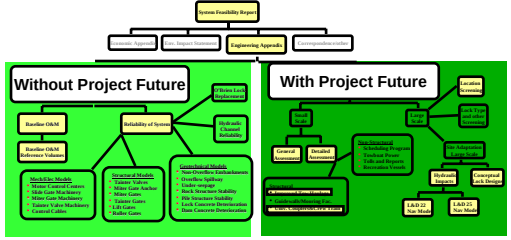
the future condition of the navigation system with new navigation improvements to address the congestion problem

- ***authorization & appropriation needed***
- ***delay reduction accomplished***



Engineering Products

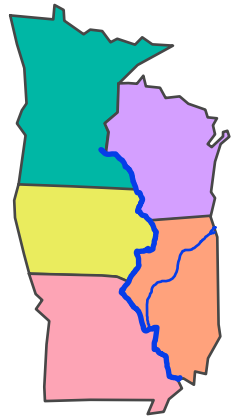
- System Feasibility Report
  - Economic Appendix
  - Env. Impact Statement
  - Engineering Appendix
    - Without Project Future
      - Baseline O&M
        - Baseline O&M Reference Volumes
      - Reliability of System
        - O'Brien Lock Replacement
        - Hydraulic Channel Reliability
        - Mech/Elec Models
          - Motor Control Centers
          - Slide Gate Machinery
          - Miter Gate Machinery
          - Tainter Valve Machinery
          - Control Cables
        - Structural Models
          - Tainter Valves
          - Miter Gate Anchor
          - Miter Gates
          - Tainter Gates
          - Lift Gates
          - Roller Gates
        - Geotechnical Models
          - Non-Overflow Embankments
          - Overflow Spillway
          - Under-seepage
          - Rock Structure Stability
          - Pile Structure Stability
          - Lock Concrete Deterioration
          - Dam Concrete Deterioration
  - Correspondence/other



Engineering Products

- System Feasibility Report
  - Economic Appendix
  - Env. Impact Statement
  - Engineering Appendix
    - With Project Future
      - Small Scale
        - General Assessment
        - Detailed Assessment
          - Non-Structural
            - Scheduling Program
            - Towboat Power
            - Tolls and Reports
            - Recreation Vessels
          - Structural
            - Improved Tow Haulage
            - Guidewalls/Mooring Fac.
            - Univ. Couplers&Crew Train
      - Large Scale
        - Location Screening
        - Lock Type and other Screening
        - Site Adaptation Large Scale
          - Hydraulic Impacts
            - L&D 22 Nav Model
            - L&D 25 Nav Model
          - Conceptual Lock Designs
  - Correspondence/other

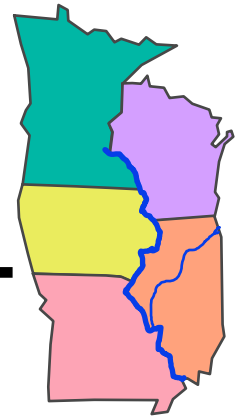
WITHOUT-PROJECT



SYSTEM BASELINE:

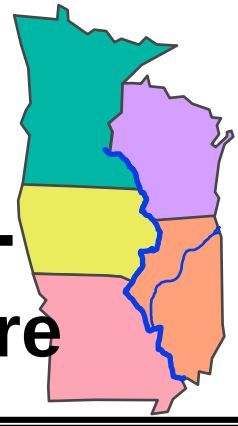
FUNCTIONS AND COSTS

System Baseline: Assumptions

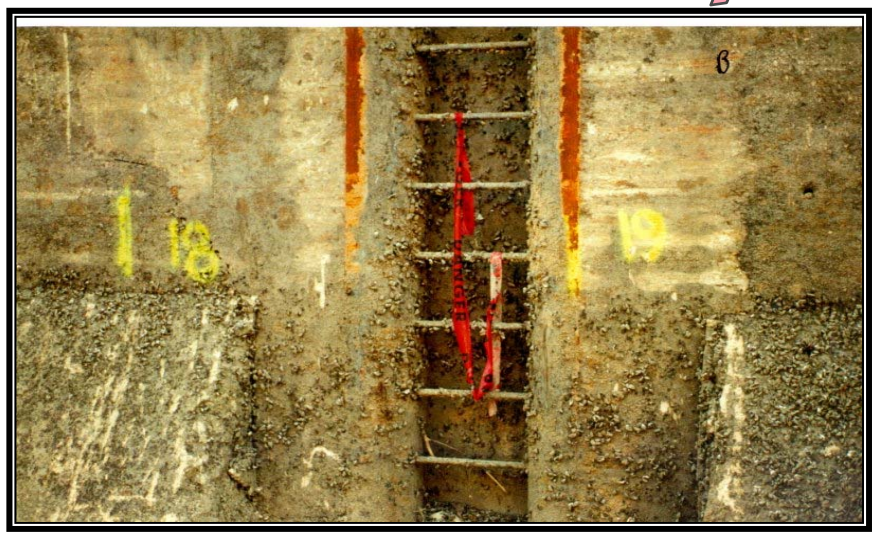


- Past policies and practices for O&M used to determine costs
- Projecting future O&M investments is based on historical costs
- O&M funding levels **remain constant**
- System will continue to deteriorate

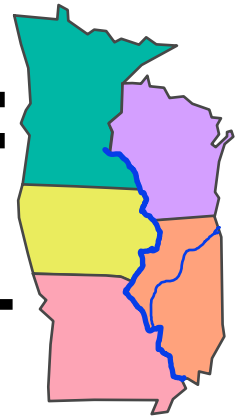
Baseline Investigation: Status



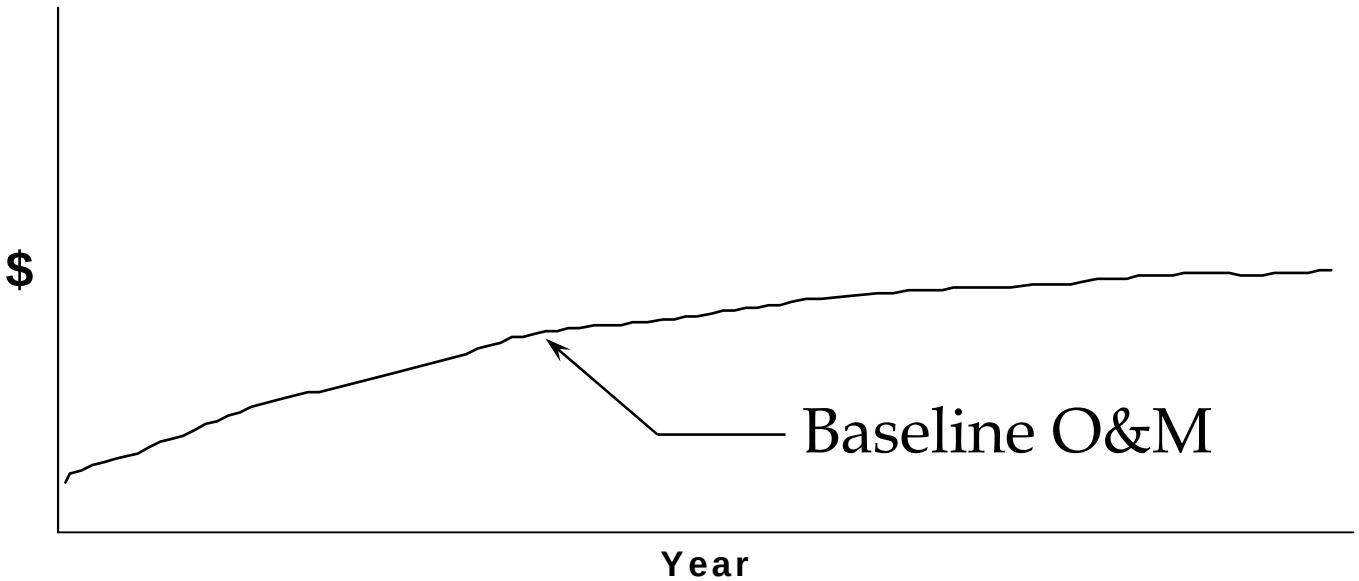
- **Report Complete, Includes Costs for Future Impacts of:**
  - **Dredge Disposal**
  - ***Environmental Regulations***
  - **Zebra Mussels**
  - ***Traffic Growth on O & M***



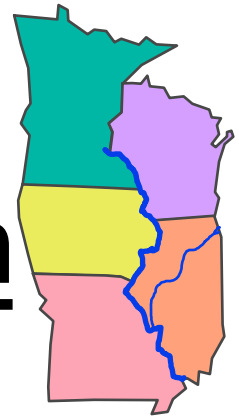
Baseline Expenditures: General



Labor, Routine Maint, Equip, Painting, Major Repair. etc



Baseline Historic Expenditures by Reach



Year	Reach 1 $1000	Reach 2 $1000	Reach 3 $1000	Reach 4 $1000
1988-1993 avg.	22,000	28,000	24,200	15,800

Total = $90,000,000

Notes:

Reach 1 - USAF thru Lock 10

Reach 2 - Lock 11 thru 22

Reach 3 - Lock 24 to confluence with Ohio River

Reach 4 - Illinois Waterway, 8 locks and channel

Baseline Future Expenditures Total

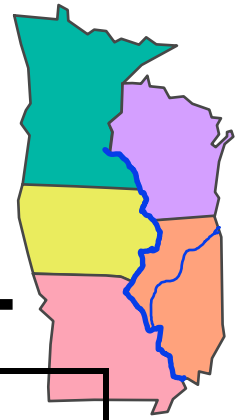
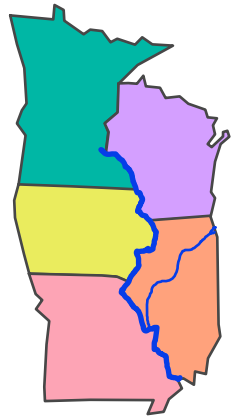


TABLE ENG-3: ANNUAL BASELINE O&M COST PROJECTION (FY00 DOLLARS)	
CATERGORY	**PROJECTED COSTS**
Lock and Dam Operations	**$45,000,000**
Dredging Costs	***$32,000,000***
Maintenance Expenses	**$23,500,000**
Contract Maintenance Expenses	***$13,000,000***
Engineering Costs	**$1,500,000**
TOTAL	**$115,000,000**

WITHOUT PROJECT



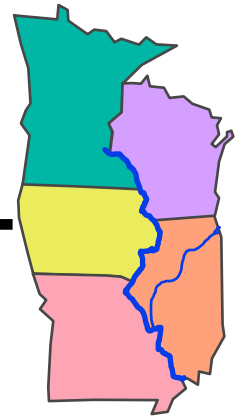
FUTURE O&M NEEDS

(MAJOR REHABILITATION)

RELIABILITY OF EXISTING NAVIGATION SYSTEM:

PERFORMANCE AND COSTS

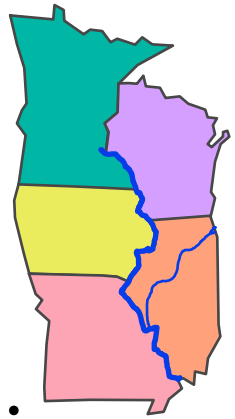
Major Investment Needs w/o Project



Basic Objectives:

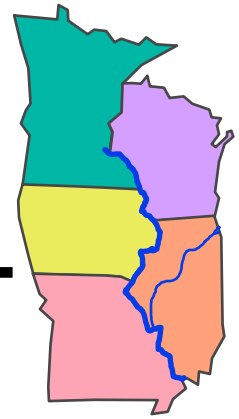
- Future Component Rehabilitation Costs
- Effect of Enhanced Component Maintenance
- Future Project Replacement

Major Investment Needs: Assumptions



- Current Major Rehab mostly done by year 2000
- Existing level of maintenance will continue as a minimum
- Grouping of components accurate for system analysis
- Future performance based on factors affecting past performance
- Uncertainty of future performance captured by Reliability Analysis for more critical components
- Future performance of less critical components based on historical records of repair

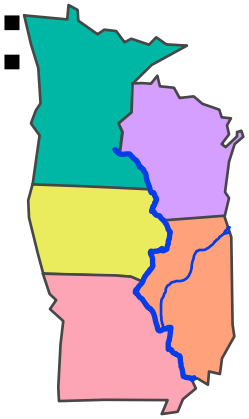
Reliability Analysis Methodology



- **72 Lock and Dam Components Ranked**
  - **Ranking criteria:**
    - » ***number of components in system***
    - » ***criticality to navigation if component fails***
    - » ***system cost***
    - » ***system-wide consequences***
    - » ***likelihood of problem***

cont.

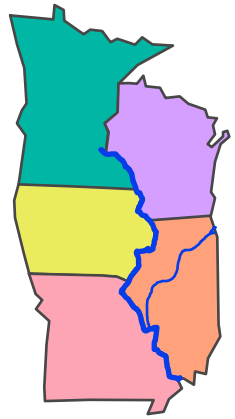
Future Investment Needs: Critical Components



Reliability Models Developed for the Following Components:

- **Structural**
  - **Miter Gates**
  - ***Lift Gates***
  - **Tainter Gates**
  - ***Roller Gates***
  - **Tainter Valves**
- **Mech/Elec**
  - **Miter Gate Machinery**
  - ***Tainter Gate Machinery***
  - **Motor Control Centers**
  - ***Control Cables***
- **Geotechnical**
  - ***Earth Embankments***
  - **Gravity Structure Stability**
  - ***Pile Foundation Stability***
  - **Scour Protection**
  - ***Lockwall Concrete Deterioration***
  - **Dam Pier Concrete Deterioration**
  - ***Spillway Concrete Deterioration***
- **Hydraulics**
  - **Navigation Channel**

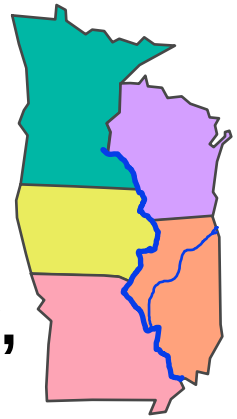
Reliability Analysis Methodology (cont.)



- **Engineering Reliability models developed for the most critical components**
  - **General Model Description:**
    - » **quantifiable performance modes or limit states**
    - » ***variable input parameters based on historical data and engineering judgment***
    - » **component performance can degrade with time**
    - » ***probabilistic outcomes of component future***
    - » **similar components among projects grouped for system analysis**
    - » ***Model results calibrated with field observations***

cont.

Reliability Analysis Methodology (cont.)

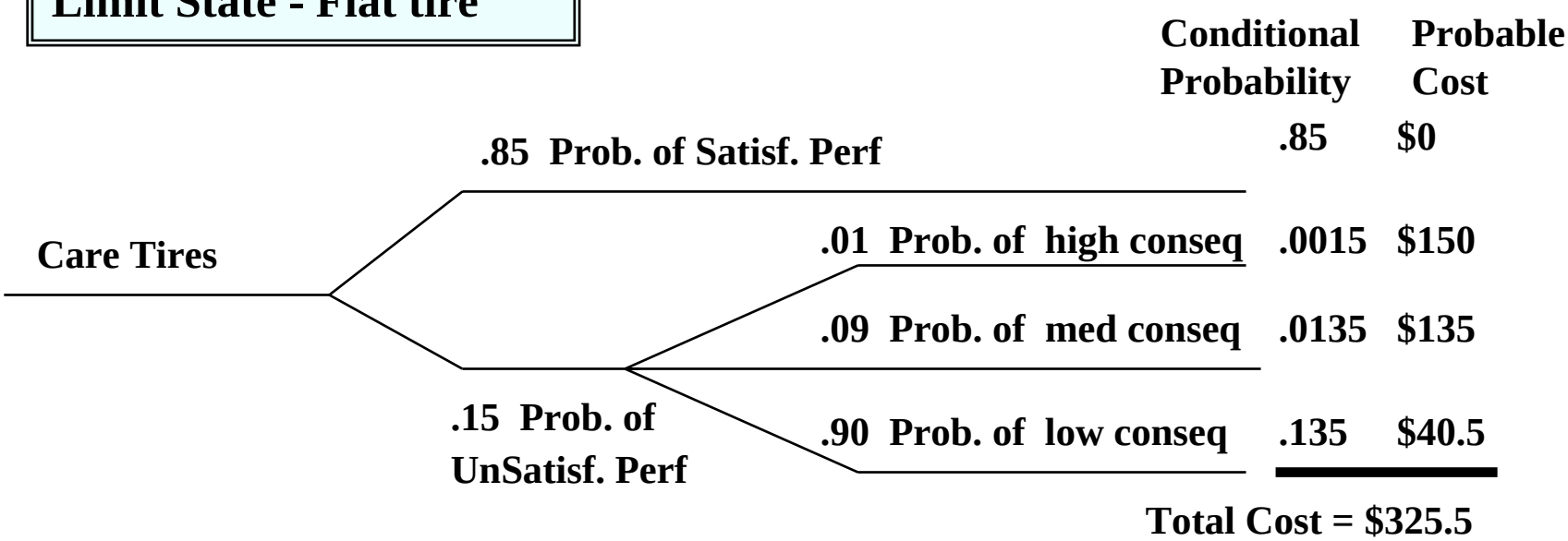


- **Performance of components can have zero, low, medium, and high levels of consequences**
- **Economic losses determined for each level of consequences. Losses include:**
  - ***lockage slowdown times***
  - ***emergency repair costs***
  - ***lock closures times***
- **Component Repair/Replacement costs determined**
- **Enhanced Maint. costs and effects on adding component life considered**

Future Investment Needs: Example

Component - Care Tires

Limit State - Flat tire



High Consequence: Car goes out of control, Hospital and car = $100,000 damage

Med Consequence: Car goes out of control, hit tree = $10,000 damage

Low Consequences : Flat in Garage, new tire = $300 damage

Economic Analysis:

4 new tires = $1200 > $325.5 ----- Can't Economically Justify new tires yet.

As tires get older, Probability of unsatisfactory performance goes up as does probable cost.

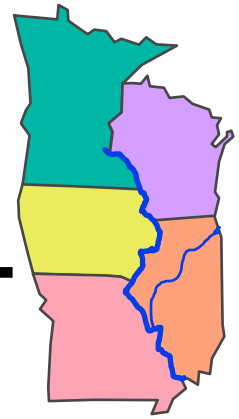
Future Investment Needs

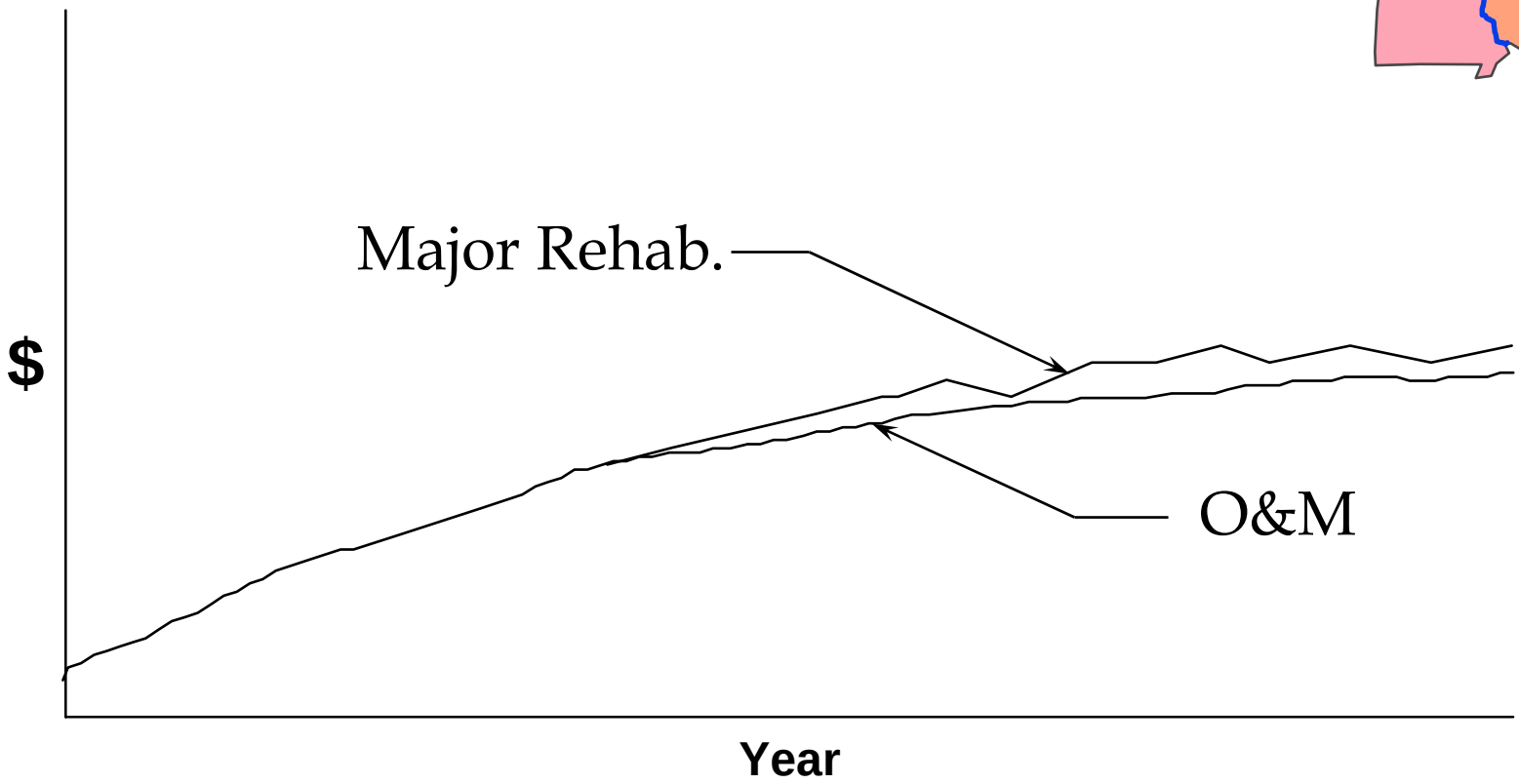
In General, if:

Rehab Cost < Cost of consequences, then incur Rehab Costs

Rehab Cost > Cost of Consequences, then incur Consequences

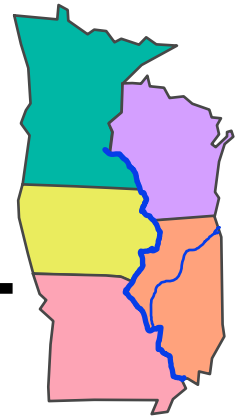
Major Rehab. Investment: General





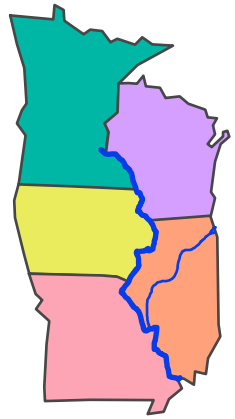
Note: Major Rehab Costs are above those for Normal O&M.

Reliability of System - Conclusions



- Component Performance, Delays, Cost of consequences, and Cost of Rehab. provided to Economics
- Next significant Major Rehab Cycle probably starts in 25 years
- Future condition, consequences and costs provided to Economics for O'Brien L/D
  - repair handled with a very large rehab
- Site specific Major Rehab Reports will be developed as needed for funding authorization.

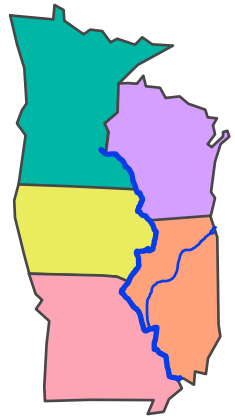
WITH-PROJECT



SMALL-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION:

PERFORMANCE, COSTS and RESULTS

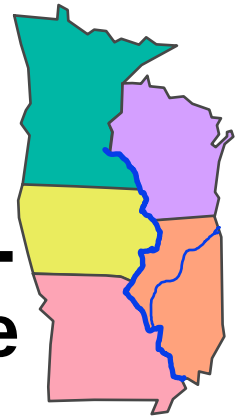
Small Scale Measures:



- **Definition:** All improvements to reduce lockage time other than increasing the size of the lock.

- **Objective:** Determine the Engineering Feasibility, Performance and Costs for Structural and Non-structural Measures.

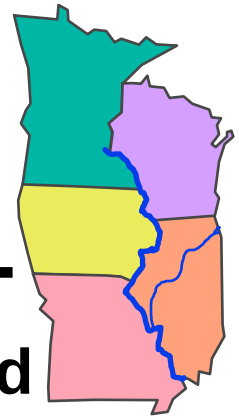
Small Scale Measures Investigation



- **General Assessment of Small Scale Measures**
  - *Identified 92 measures*
  - *Qualitatively screened*
- **Detailed Assessment Includes:**
  - *Costs*[1]
  - *Performance*
- **Quantitative Screening**
  - *Most beneficial measures survive*

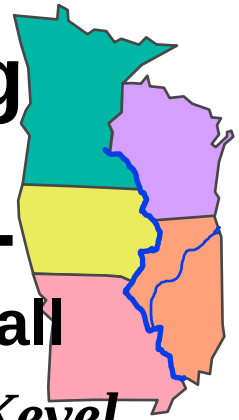
Note: 1. Costs exclude impacts to navigation during construction and environmental costs

Small Scale Measures - Qualitative Screening



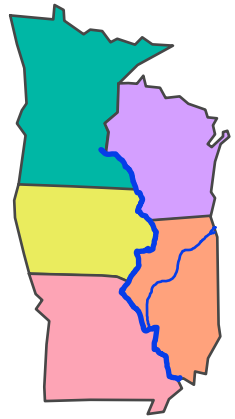
- **Universe of Small Scale measures was screened <u>qualitatively</u>**
- **Screening Criteria Included:**
  - **No Delay Reduction …….Add guide cells**
  - ***Not Technically Feasible……...Clear ice from barges***
  - **Not Safe……..wicket gates in miter gates**
  - ***Not Environmentally Acceptable……...deepen river upstream of gates***
  - **Cost Effectiveness……..ready to serve**
  - ***Economic Efficiency……...wind deflectors***
  - **Industry Cooperation/Acceptance……tow standardization**
  - ***In Corps O&M Program…….N-up and N-down***

Small Scale Measures Surviving Qualitative Screening



- Helper Boat
- *Switch Boat*
- Industry Self Help
- *Congestion Tolls*
- Excess Time Charges
- *Lockage Time Charges*
- Publish Lockage Times
- *Scheduling Rec Craft*
- Rec. Craft Landings
- *Scheduling Program*
- Extended Guidewall
- *Powered Traveling Kevel*
- Endless Cable
- *Unpowered Kevels*
- Adjacent Moorings
- *Univ Coupler/Deck Winch*
- Min. Size & Crew Training
- *Additional Personnel*
- Permanent Deck Winches
- *Powered Ratchets*
- Approach Improvements

WITH-PROJECT



SMALL-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION:

QUANTIFICATION OF PERFORMANCE and COSTS FOR SURVIVORS

Towboat Power

Measure	Time Savings	Annual Cost per Site
• Helperboats[2] w/Temp G-wall	22 min upbound[3] 27 min downbound[3]	$1.9 mil
• *Switchboats[2] w/Remote Moor*	*22 min upbound* *27 min downbound*	*$2.6 mil*
• Ind. Self Help w/Moorings	18 min upbound 23 min downbound	$1.1 mil

Notes:

1. Screening did not eliminate any measures.
2. Potential to provide approach time savings of up to 11 minutes per downbound lockage on site specific basis.
3. Only applicable to turnback lockages.
4. Costs exclude impacts to navigation during construction and environmental costs

Tolls and Reports

Measures	Time Savings	Annual Costs
• Congestion Tolls	NQ	$280k*
• *Excess Time Charges*	*NQ*	*$280k**
• Lockage Time Charges	NQ	$280k*
• *Publish Lockage Times*	*NQ*	*$65k**

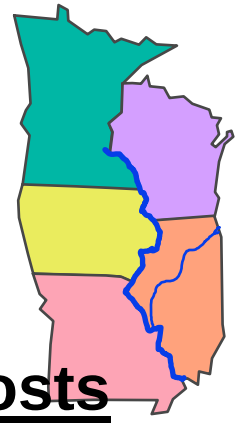
Notes:

1. Screening Eliminated Excess Lockage Time Charges & Publish Lockage Times.

2. Others carried forward for additional analysis using the system models.

*** Cost covers entire system.**

Recreational Vessels



Measures	Time Savings	Annual Costs
• Scheduling Rec Craft	None on Lower sites Some on Upper sites	$85k*
• Rec Craft Landings	NQ	$39k/site

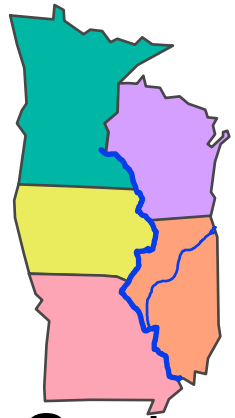
Notes:

1. Screening eliminated both measures on the cost effectiveness criteria.

2. While formal Rec Measures were screened, reductions in congestion from other measures benefit rec. traffic, too.

* Cost covers entire system.

Optimizing Decisions



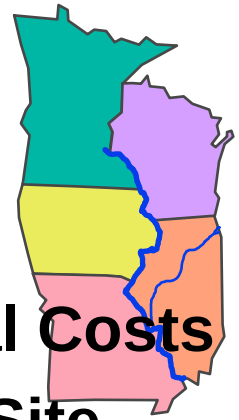
Measure	Time Savings	Annual Cost
• Scheduling Program	NQ	$88K*

Notes:

1. Screening eliminated both measures on the cost effectiveness criteria. Nearly all benefits are currently being used.

*** Cost covers entire system.**

Extended Guidewall & Tow Haulage



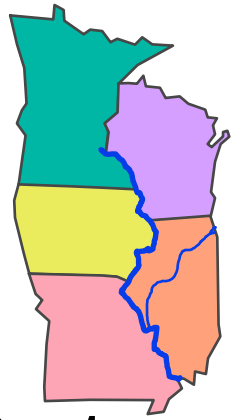
Measures	Time Savings	Annual Costs per Site
• Guidewall Ext (1200') w/ Helperboat	22 min upbound 27 min dnbound	$3.6 mil
• *With Powered Kevel*	*11 min upbound* *14 min dnbound*	*$2.5 mil*
• W/unpowered Kevel	6 min upbound 6 min dnbound	$2.6 mil

Notes:

1. Screening eliminated all measures on efficiency except temporary guidewall extension in combination with towboat assist.

2. Costs exclude impacts to navigation during construction and environmental costs

Mooring Facilities



Measure	Time Savings	Annual Costs per Site
• Adjacent Moorings	7-13 min	$32k/buoy $137k/cell

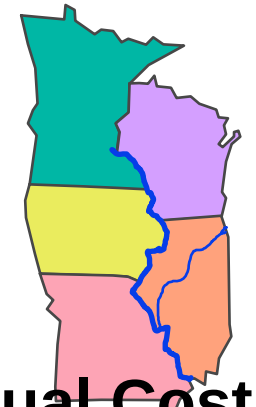
Notes:

1. Provides benefits for exchange lockages at Locks 12,14,18, 20, 22, 24, 25, Mel Price, and LaGrange.

2. Recommended for further consideration.

3. Costs exclude impacts to navigation during construction and environmental costs

Crew Elements

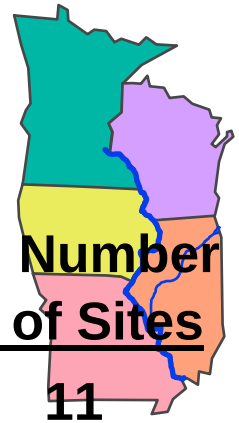


Measures	Time Savings	Annual Costs
• Univ. Couplers	NA	NA
• *Crew Size & Training*	*NA*	*NA*
• Perm. Deck Winches	4 min all	$10.3 mil
• *Add. Personnel*	*3 min all*	*$6.7 mil*
• Powered Ratchet on tows	5 min all	$0.6 mil

Notes:

1. Screening eliminated all but powered ratchet alternate on effectiveness criteria.

Approach Improvements

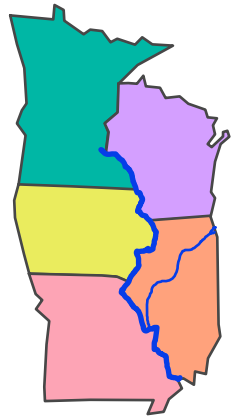


MEASURES	Time Savings	Annual Costs	Number of Sites
Extended guidewalls	1 min	$ 1.2	11
Channel improvements	*3 min*	*$ 0.6*	*11*
Extended guidewalls plus channel imp	3 min	$ 1.7	10
Location 3 guardwall alone	*3 min*	*$ 1.5*	*6*
Location 2 guardwall alone	6 min	$ 1.8	4
Channel imp. + L3 guardwall	*5 min*	*$ 2.3*	*9*
Extend gdwall, chan imp, & L3 grdwall	5 min	$ 3.4	9
Channel imp + location 2 guardwall	*7 min*	*$ 2.3*	*10*

Notes:

1. **Screening eliminated all but channel improvements on efficiency.**
2. **Costs exclude impacts to navigation during construction and environmental costs**

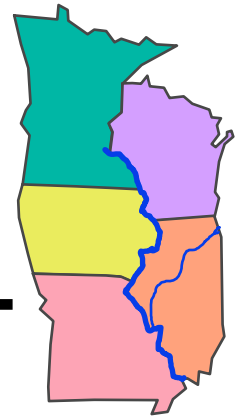
UMR-IWS Navigation Study



Small Scale Measures:

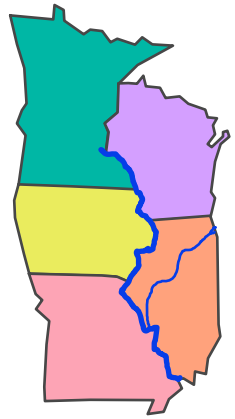
Results

Small Scale Measures - Quantitative Analysis and Screening



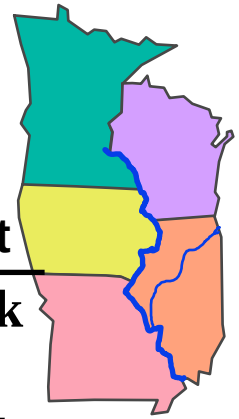
- **Small Scale Costs and Performances were quantified using:**
  - **Existing Corps Reports & Studies**
  - ***Timing Study from Old L&D 26***
  - **Timings from earlier Nav Study Efforts (Mel Price)**
  - ***LPMS Data (1990)***
  - **Interviews and Site Visits with Lockmasters & Industry**
  - ***Expert Elicitation***
- **Measures were Screened. Criteria Included:**
  - **Cost Effectiveness**
  - ***Economic Efficiency***

Remaining Small Scale Measures



- **Helper Boats**
- ***Switch Boats***
- **Industry Self Help**
- ***Congestion Tolls***
- **Lockage Time Charges**
- ***Adjacent Mooring Facilities***
- **Powered Ratchets**
- ***Approach Improvements***

Small Scale Survivors

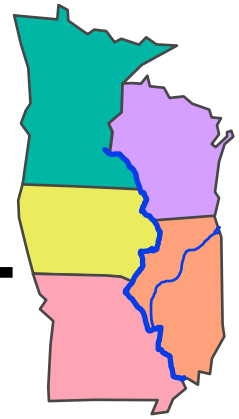


Measure	Time Savings	Annual Cost
2 Helperboats[1] w/Temp G-wall	22 min upbound[2] 27 min downbound[2]	$1.9 mil/lock
2 Switchboats[1] w/Remote Moor	*22 min upbound* *27 min downbound*	*$2.6 mil/lock*
Ind. Self Help w/Moorings	18 min upbound 23 min downbound	$1.1 mil/lock
Congestion Tolls	*Not Quantified*	*$280k/system*
Lockage Time Charges	Not Quantified	$280k/system
Adjacent Moorings	*7-13 min/exchange*	*$32k/buoy* *$137k/cell*
Power Ratchet on tows	5 min all	$0.6 mil/system
Improve Channel	*3 min downbound*	*$600k (11 Sites)*

Notes:

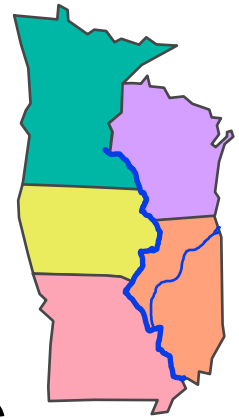
1. **Potential to provide approach time savings of 11 minutes per downbound lockage.**
2. **Only applicable to turnback lockages.**
3. **Costs exclude impacts to navigation during construction and environmental costs**

Small Scale Measures - Status



- **Report: *General Assessment of Small Scale Measures* -Complete**
- **Report: *Detailed Assessment of Small Scale Measures* -Complete**
- **Cost and Performance Data to Economics**

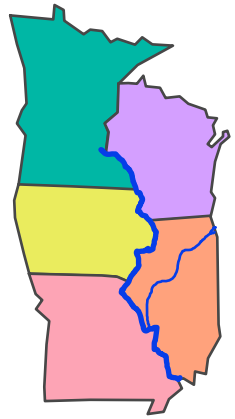
WITH-PROJECT (CONT.)



LARGE-SCALE MEASURES OF REDUCING TRAFFIC CONGESTION:

PERFORMANCE, COSTS and RESULTS

LARGE-SCALE MEASURES



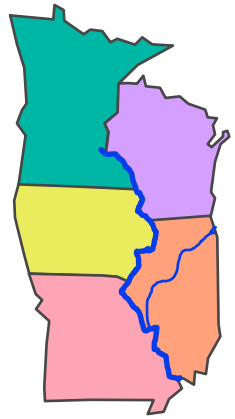
Definitions:

- New lock
- Extend existing lock
- Navigable dam (L&D 17 $63,000,000 and L&D 20 $86,000,000, not addressed further)

Objectives:

- develop an array of technically feasible new lock alternatives
- estimate the life cycle costs
- determine the impacts during construction
- determine the performance improvements

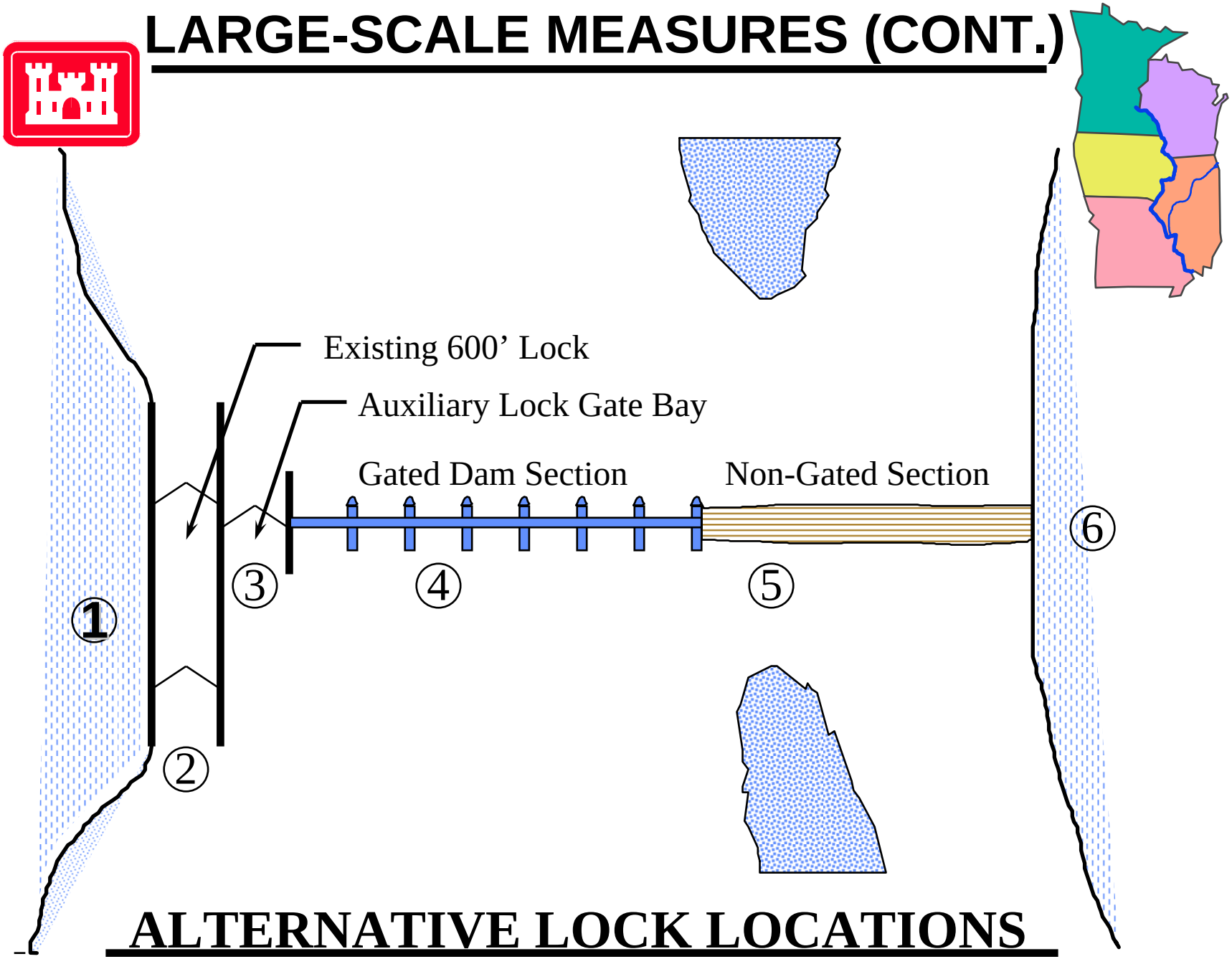
LARGE-SCALE MEASURES (CONT.)



Universe of Large-Scale Measures:

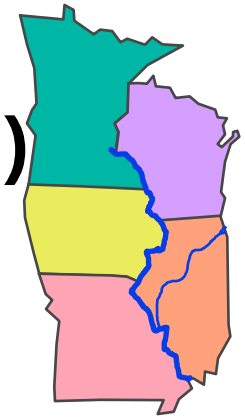
- **16 L/D sites considered**
  - ***11-25, Peoria, LaGrange***
- **6 lock locations per site**
- **3 lock types per location**
  - ***Types A, B, C***
- **600 ft and 1200 ft long locks**

LARGE-SCALE MEASURES (CONT.)



ALTERNATIVE LOCK LOCATIONS

LARGE-SCALE MEASURES (CONT.)



Alternative Investment Levels:

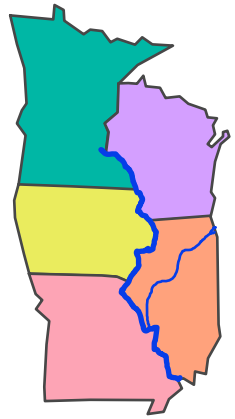
Lock Type	Cost	Performance
A	3	1
B	2	2
C	1	3

- Type A Lock-Traditional Construction
- Type B Lock-Innovative Construction
- Type C Lock-Lowest First Cost Construction

Rankings 1-3

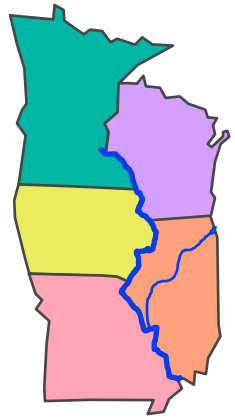
- 1 - Best
- 3 - Worst

Large Scale Innovations



- **Slurry wall lockwall construction**
- ***Center Fill System***
- **Modular lockwall construction -- float-in or crane barge placement**
- ***Float-in miter gate monolith***
- **Cellular sheetpile lockwalls with precast concrete rubbing panels**
- ***Guardwall design with greater cell spacing using prestressed concrete beams***
- **Through-the-sill filling system**
- ***Slender wall construction for sand foundations***
- **Placing a lock through an existing dam**
- ***Extending an existing 600' lock to 1200-ft under intermittent traffic interruptions***

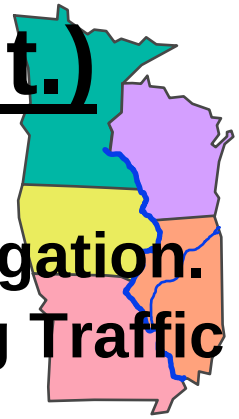
Large Scale Screening



- Part of formulation
- Done with multi-disciplinary teams
- Both qualitative and quantitative
- Enables focus on more attractive alternatives
- Optimizes use of resources
- Types of Large Scale Screening
  - *Lock Locations*
  - *Lock Types*
  - *Lock Lengths*
- Survivors of all screening will be fully quantified for economic comparison

Cont.

Large Scale Screening (cont.)

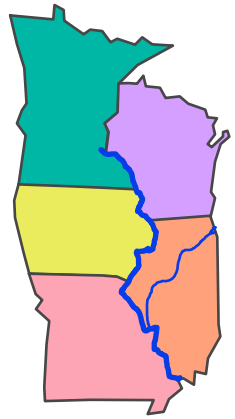


Lock Location Screening - A qualitative investigation.

- **Report: Large Scale Measures of Reducing Traffic Congestion, Location Screening**
- **Disciplines and Criteria:**
  - **Construction - access, constructibility**
  - ***Environmental - existing habitat, Archaeological sites, HazMat***
  - **Geotechnical - Sound rock, weak soil, excavation limits**
  - ***Hydraulics - Channel alignment, approaches, F/E***
  - **Operations - Permanent access, channel maint, ice, safety**
  - ***Real Estate - Govt. Prop., Needed Real Estate***
  - **Civil/Structural - Land topo, costs, impacts to nav.**

Cont.

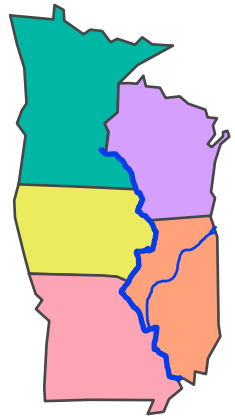
Large Scale Screening (cont.)



- **Lock Size Screening**
  - **Done by Economics Work Group**
  - **Longer, Shorter, wider and narrower locks considered**
  - **Survivors:**
    - » **110ft x 600ft**
    - » **110ft x 1200ft**
  - **Documented in Formulation Appendix**

Cont.

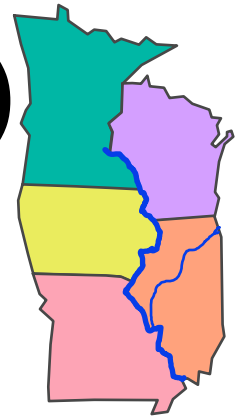
Large Scale Screening (cont.)



- **Lock Type Screening**
  - **Quantitative Analysis**
  - **Comparison of types A, B, and C based on cost**
  - **The Lock Types eliminated clearly dominated by a less costly alternative**

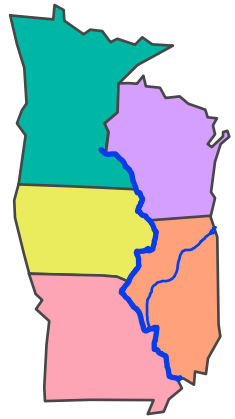
Cont.

Large Scale Screening Survivors (cont.)



Lock & Dam Site	Surviving Locations and Types					
	1	2	3	4	5	6
L/D 11		B	C			
L/D 12		*B*	*C*	*B,C*		
L/D 13		B	C	B,C		
L/D 14		*B,C*		*B,C*		
L/D 15		B,C	B,C			
L/D 16		*B*	*C*	*B,C*		
L/D 17	C	B	C	B,C		
L/D 18		*B*	*C*	*B,C*		
L/D 19			B,C			
L/D 20		*B,C*	*B,C*	*B,C*		
L/D 21		B	C	B,C		
L/D 22		*B,C*	*B,C*	*B,C*		
L/D 24		B,C	B,C	B,C		
L/D 25	*C*	*B*	*C*	*B,C*		
Peoria	C	B				
LaGrange	*C*	*B*				

LOCK DESIGN
EVALUATION FACTORS



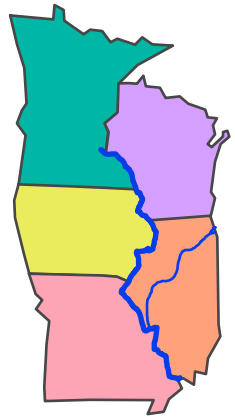
- **The Makeup of the Costs and Performance of New Locks**

- **Survivors of screening will have cost and performance quantified.**

Cont.

LOCK DESIGN

EVALUATION FACTORS (cont.)



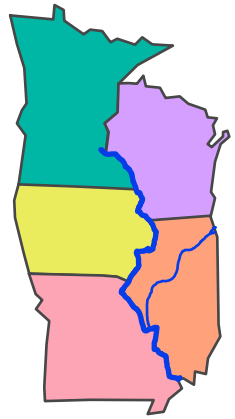
Cost Factors

- Life Cycle Costs
  - First Costs
    - *Basic Lock & Guidewall Construction*
    - *Channel Work and Levees (as needed)*
    - *Relocation & Real Estate Requirements*
  - Replacement Costs (as needed)
  - Maintenance Costs
    - *Routine Maintenance*
    - *Major Rehabilitation*
  - Operation Costs
- Time Delays to Navigation During Construction (reduced lock availability and closures)
- Environmental Resource Impacts
- Cultural and Historic Resource Impacts

Benefits Factors

- Performance
  - Lock Transit Time
  - Disposition of Existing Lock

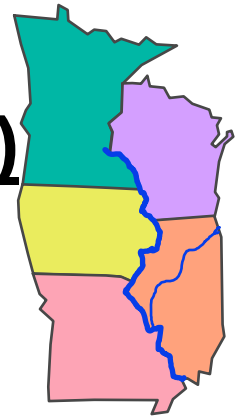
Large Scale Measures - Status



- **Report:** Conceptual Lock Design - Complete
  - Details developed for:
    - L/D 22 - Rock foundation
    - L/D 25 - Pile foundation
    - Three alternative types of lock construction were studied at each location:
      - » *Least first-cost lock*
      - » *Intermediate cost lock*
      - » *Traditional lock*
- **Report:** Initial Location Screening - Complete
  - In general, locations 5 an 6 eliminated, some 1's

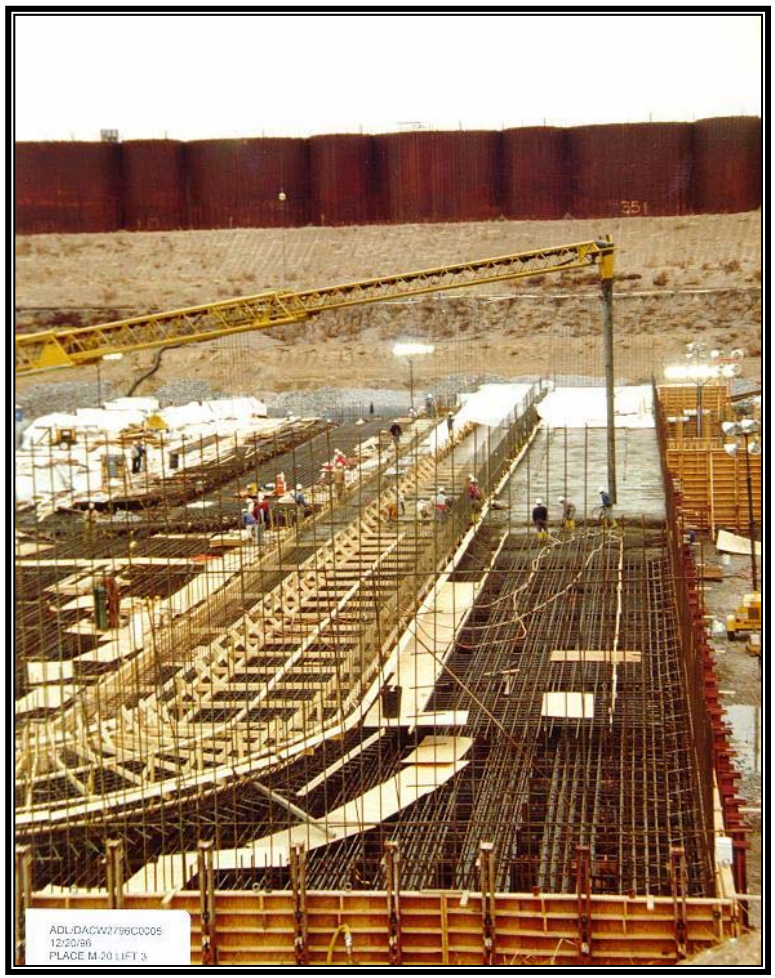
status cont.

Large Scale Measures - Status(cont.)



- **Site Specific Adaption - Complete**
  - **11 thru 21, 24, Peoria, LaGrange**
- **Report:** ***Hydraulic Impacts of New Lock Construction*** **- Complete**
- **MFR and Meeting: Impacts to Navigation using Expert Elicitation process.**
- **Quantitative Screening - Complete**
- **Report:** ***Navigation Model Study for Lock and Dam 22*** **- Complete**
- **Report:** ***Navigation Model Study for Lock and Dam 25*** **- Complete**
- **Costs, Performance, and Impacts to Navigation During Construction Given to Economics**

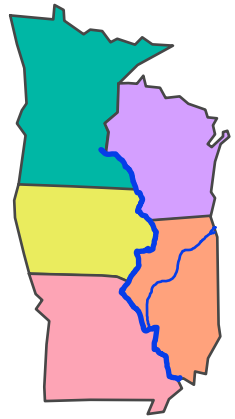
UMR-IWS Navigation Study



Large Scale Measures:

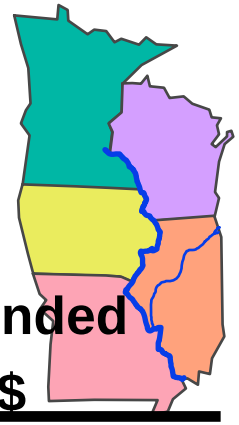
Results

First Costs of Surviving 1200 ft. Long Lock Alternatives



Lock Location and Type		Pile-Founded Lock Costs	Rock-Founded Lock Costs
Location 1	~~Type A~~	~~325,000,000~~	{No surviving Loc. 1 rock-founded sites}
	~~Type B~~	~~219,000,000~~	
	Type C	178,000,000	
Location 2	Type B	173,000,000	126,000,000
	Type C	~~151,000,000~~	119,000,000
Location 3	Type B	~~200,000,000~~	141,000,000
	Type C	211,000,000	134,000,000
Location 4	~~Type A~~	~~373,000,000~~	~~226,000,000~~
	Type B	305,000,000	210,000,000
	Type C	268,000,000	197,000,000

Life-Cycle Costs of Surviving 1200 ft. Long Lock Alternatives



Location	Type	Pile-Founded Costs $	Rock-Founded Costs $
Location 1	Type C	211,000,000	{No surviving Loc. 1 rock-founded sites}
Location 2	Type B	187,450,000	144,330,000
	Type C	Screened Out	138,330,000
Location 3	Type B	Screened Out	165,530,000
	Type C	232,130,000	161,530,000
Location 4	Type B	324,030,000	236,530,000
	Type C	297,730,000	228,730,000

Costs include: Construction, Channel, Real Estate, O&M, Present Worth of Future Major Rehab.

Costs exclude: Impacts to Nav., Environmental Mitigation

Impacts to Navigation During Construction

NAV. DELAYS DURING CONSTR. OF 1200' PILE FOUNDED LOCKS	
Location and Type	Duration of Delays
Location 1	
Type C	Negligible
Location 2	
Type B	3 winter closures (90, 90, 113 days); 550 days of 9-minute delays to upbound exchange; 72 weeks of 8 hr./day x 5 days/week closures
Type C	Same as Type B, *plus* the third winter closure would be about 17 days longer
Location 3	
Type B	See note 1.
Type C	4 winter closures (90, 90, 107, 75 days); 808 days of 9-minute delays to upbound exchanges; 533 days of 11-min. delays to downbound exchanges; one 7-day closure; 51 weeks of 8 hr./day x 5 days/week closures
Location 4	
Types B and C	Negligible

Notes:
1. The Location 3, Type B lock cost more than the Location 3, Type C lock and it has greater impacts to navigation to construct.

cont.

Impacts to Nav. During Construction (cont.)

NAV. DELAYS DURING CONSTR. OF 1200' ROCK FOUNDED LOCKS	
Location and Type	Duration of Delays
Location 2	
Type B	3 winter closures (90, 90, 80 days); 550 days of 9-min. delays to upbound exchange; 51 wks of 8 hr./day x 5 days/wk closures
Type C	3 winter closures (90, 129, 90 days); 504 days of 9-min. delays to upbound exchanges; one 7-day closure; 52 wks of 8 hr./day x 5 days/wk closures
Location 3	
Type B	3 winter closures (90, 90, 100 days); 610 days of 9-min. delays to upbound exchanges; 610 days of 11-min. delays to downbound exchanges; 21 wks of 8 hr./day x 5 days/wk closures; and 9 wks of double F/E times.
Type C	3-90 day winter closures; 640 days of 9-min. delays to upbound exchanges; 640 days of 11-min. delays to downbound exchanges; 28 wks of 8 hr./day x 5 days/wk closures; and 12 wks of double F/E times.
Location 4	
Types B and C	See note 2.

Notes:

1. The timing of the closures is important in addition to their duration.
2. The Location 4 rock-founded concept lock was placed where it would only remove 1 dam gate to minimize first costs. With this placement a Location 4 lock would have similar impacts to a Location 3 lock. To avoid these impacts, the lock could be placed further from the existing lock.

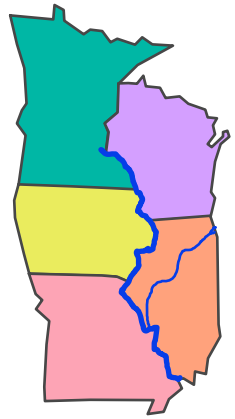
Benefits: Downbound Approach Times

LOCK APPROACH TIMES[1] (Downbound fly in minutes)		
Lock No.	Existing[2]	New[3]
L/D 11	$\mu = 28$ $\sigma = 12$	$\mu = 19$ $\sigma = 8$
L/D 12	$\mu = 20$ $\sigma = 10$	$\mu = 14$ $\sigma = 7$
L/D 13	$\mu = 18$ $\sigma = 8$	$\mu = 18$ $\sigma = 8$
L/D 14	$\mu = 24$ $\sigma = 12$	$\mu = 19$ $\sigma = 10$
L/D 15	$\mu = 24$ $\sigma = 15$	$\mu = 16$ $\sigma = 10$
L/D 16	$\mu = 32$ $\sigma = 15$	$\mu = 21$ $\sigma = 10$
L/D 17	$\mu = 40$ $\sigma = 15$	$\mu = 27$ $\sigma = 10$
L/D 18	$\mu = 32$ $\sigma = 14$	$\mu = 28$ $\sigma = 12$ for Loc.s 2 & 3 [$\mu = 22$ $\sigma = 10$ for loc 4][4]
L/D 19	$\mu = 18$ $\sigma = 14$	$\mu = 15$ $\sigma = 12$
L/D 20	$\mu = 32$ $\sigma = 15$	$\mu = 21$ $\sigma = 10$
L/D 21	$\mu = 33$ $\sigma = 14$	$\mu = 23$ $\sigma = 10$
L/D 22	$\mu = 50$ $\sigma = 16$	$\mu = 32$ $\sigma = 10$
L/D 24	$\mu = 22$ $\sigma = 12$	$\mu = 15$ $\sigma = 8$
L/D 25	$\mu = 24$ $\sigma = 13$	$\mu = 16$ $\sigma = 8$
Peoria L/D	$\mu = 19$ $\sigma = 10$	$\mu = 16$ $\sigma = 9$
LaGrange L/D	$\mu = 20$ $\sigma = 11$	$\mu = 14$ $\sigma = 8$

NOTES:

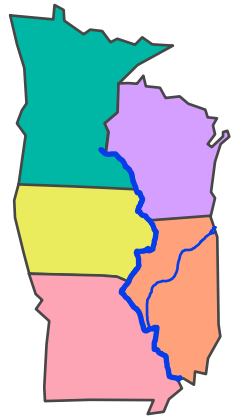
1. μ is the mean or average approach time. σ is the standard deviation
2. 1990 data on downbound fly approaches. Nineteen-ninety is considered a representative year.
3. In general, the "new" times are for any of the lock locations. However, for the new Location 2 locks, there are two options (to be compared by a separate economic analysis). One option assumes the upstream approach conditions (and times) would remain unchanged. The other assumes that an improved channel, plus a riverside guardwall, are constructed resulting in the reduced approach times shown but higher first costs and economic impacts to navigation during construction.
4. Channel constraints on Locations 2 and 3 at L/D 18 are not a restriction to a Location 4 lock.

Independent Technical Review



- **Review Conducted August 11 - 15, 1997**
- **Participants from many Districts:**
- **Comments are being incorporated into Engineering Documents**

UMR-IWS
Navigation Study



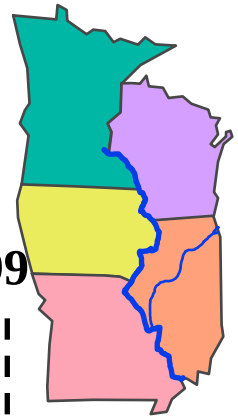
Study Schedule:

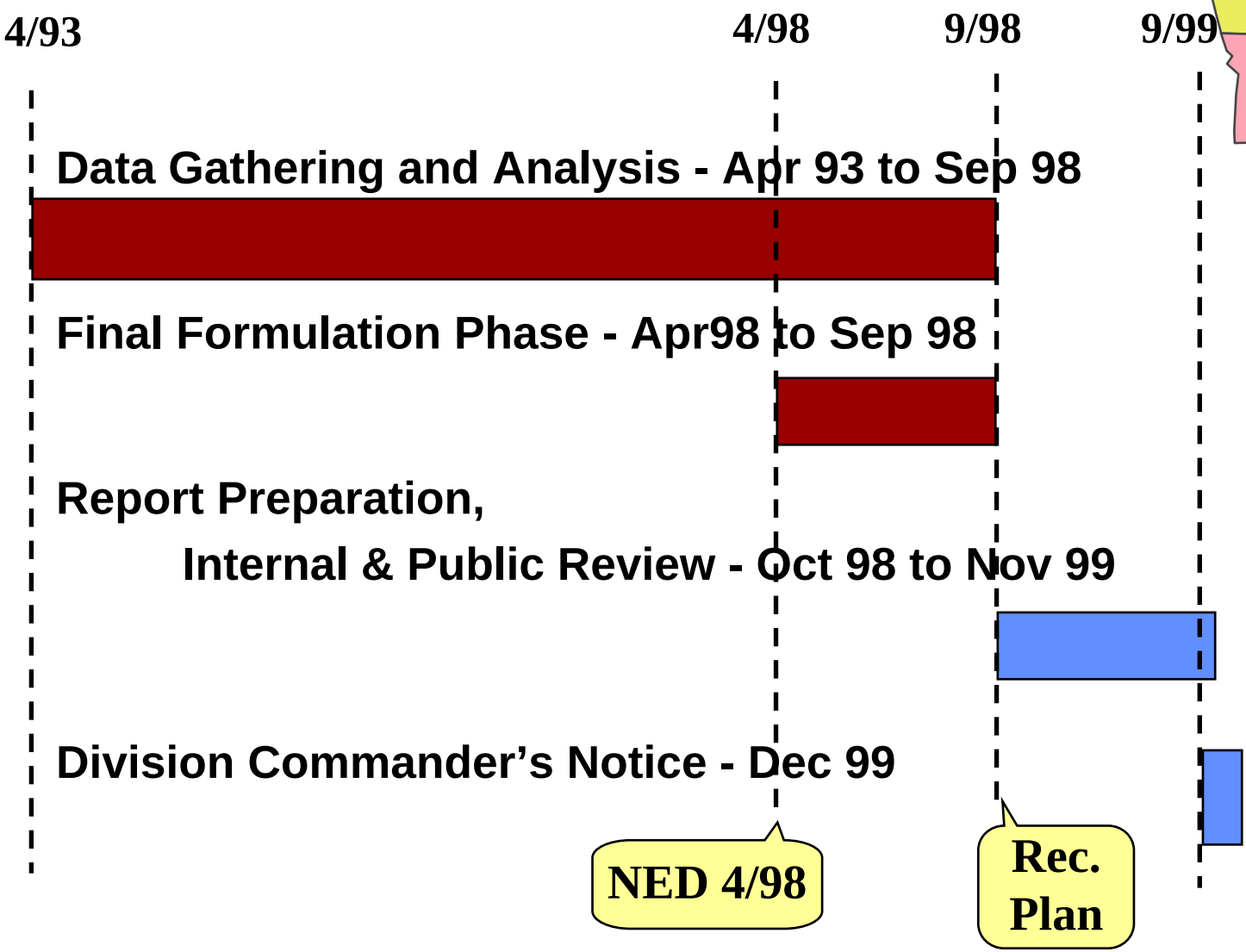
FY 98 WORK

and

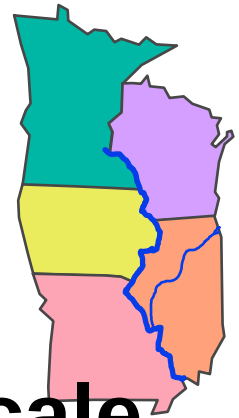
BEYOND

Current Study Schedule





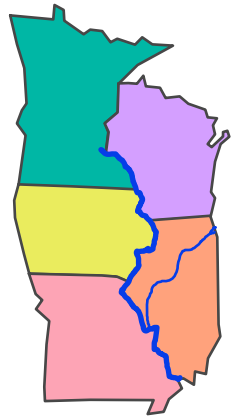
FY98 - Engineering <u>Work Plan, General</u>



- Reduce the first Cost of Large Scale Measures
- Reduce the Impacts to Navigation during Construction[1]
- Review Cost and Performance of Small Scale Measures
- Support Plan Formulation Process

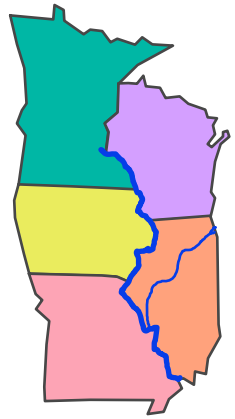
Note: 1. Impacts to Navigation holds the strongest potential for overall cost reduction.

Site-Specific Engineering - Status



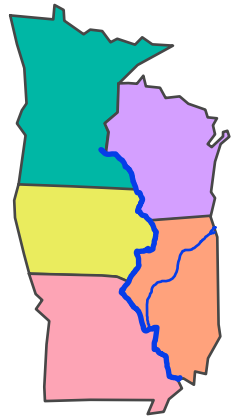
- Site Specific Engineering will not be initiated until after selection of the Recommended Plan

Site Specific Engineering for <u>Recommended Plan</u>



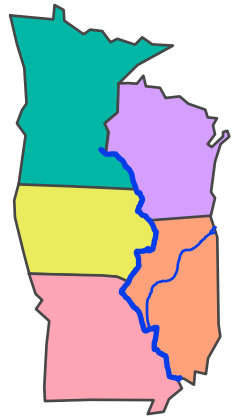
- Site Specific Engineering and Design Activities
- Baseline Cost Estimate for Appropriation

Uncertainties of Site <u>Specific Investigation</u>



- Recommended Plan-Small scale, large scale or combination?
- Which Site or Sites?
- Which Lock Location?
- Innovative E & D costs?

Site Specific
Recommended Plan?



- *Scenario 1-No action*
- **Scenario 2-Small Scale Measures**
- ***Scenario 3-Large Scale Measure***
- **Scenario 4-Combination of large and small scale**

Upper Mississippi River & Illinois Waterway
System Navigation Study
Engineering Coordinating Committee Meeting
St. Louis, Missouri
November 14, 1997

Attendance

Chris Brescia	MARC 2000
Robert Goodwin	Maritime Administration
James Hall	Iowa DOT
Jack Hynes	Missouri Dept of Trans
Wayne Williams	Alter Barge Line
Jerry Foster	Corps of Engineers, Headquarters
Bob Hughey	Corps of Engineers, St. Louis District
Jeff Stamper	Corps of Engineers, St. Louis District
Ed Demsky	Corps of Engineers, St. Louis District
Don Sweeney	Corps of Engineers, St. Louis District
Brad Thompson	Corps of Engineers, Rock Island District
Dave Wehrley	Corps of Engineers, Rock Island District