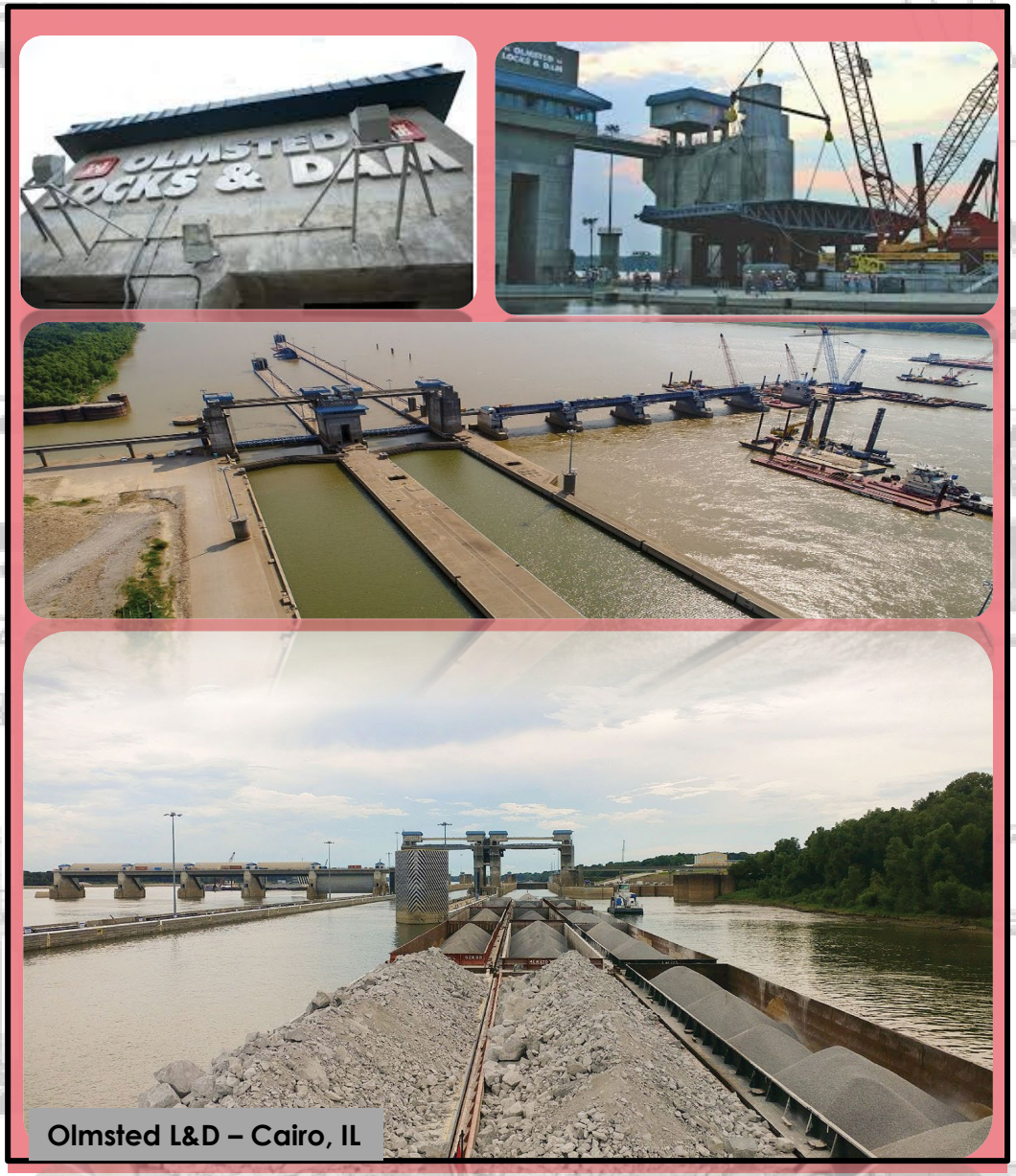
INLAND NAVIGATION PLANNING AND RISK INFORMED MANAGEMENT

PCoP Webinar Series

Presented by:
Planning Center of Expertise for Inland Navigation and Risk-Informed Economics Division (PCXIN-RED)
Date: 06 August 2020



Olmsted L&D – Cairo, IL

US Army Corps of Engineers®

PRESENTATION TOPICS

- PCXIN-RED Mission & Significance
- PCXIN-RED Overview
- General Inland Navigation Policy Guidance
- Inland Navigation Planning and Plan Formulation
- Costs & Cost Sharing
- Inland Navigation Economics
- Engineering Design Considerations
- Risk and Uncertainty Considerations
- Unique Inland Navigation Project Considerations
- Summary

INLAND NAVIGATION MISSION

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

INLAND NAVIGATION PROJECTS:

Great Lakes and inland or coastal navigation channels with depths less than 14-feet (ER 1105-2-100)

FEDERAL INTEREST IN NAVIGATION:

Federal interest is established by the Commerce Clause of the Constitution… *and, subsequent court decisions defining the right of the Federal Government to regulate navigation and improve navigable waterways. In* 1824 Congress designated U.S. Army Corps of Engineers as the Federal agency responsible for the Nation's navigation system.

CORPS OF ENGINEERS ROLE IN NAVIGATION:

The role of the U. S. Army Corps of Engineers with respect to navigation is to provide safe, reliable, and efficient waterborne transportation systems (channels, harbors, and waterways) for movement of commerce, national security needs, and recreation. The Corps accomplishes this mission through a combination of capital improvements and the operation and maintenance of existing projects." (ER 1105-2-100)

INLAND NAVIGATION MISSION

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

Inland Waterways

5 Corps MSCs touching the Inland Marine Transportation System (IMTS)

IMTS consists of congressionally mandated fuel taxed waterways to support Inland Waterways Trust Fund (IWTF)

12,000 miles; 9' – 14' draft

240 Lock Chambers

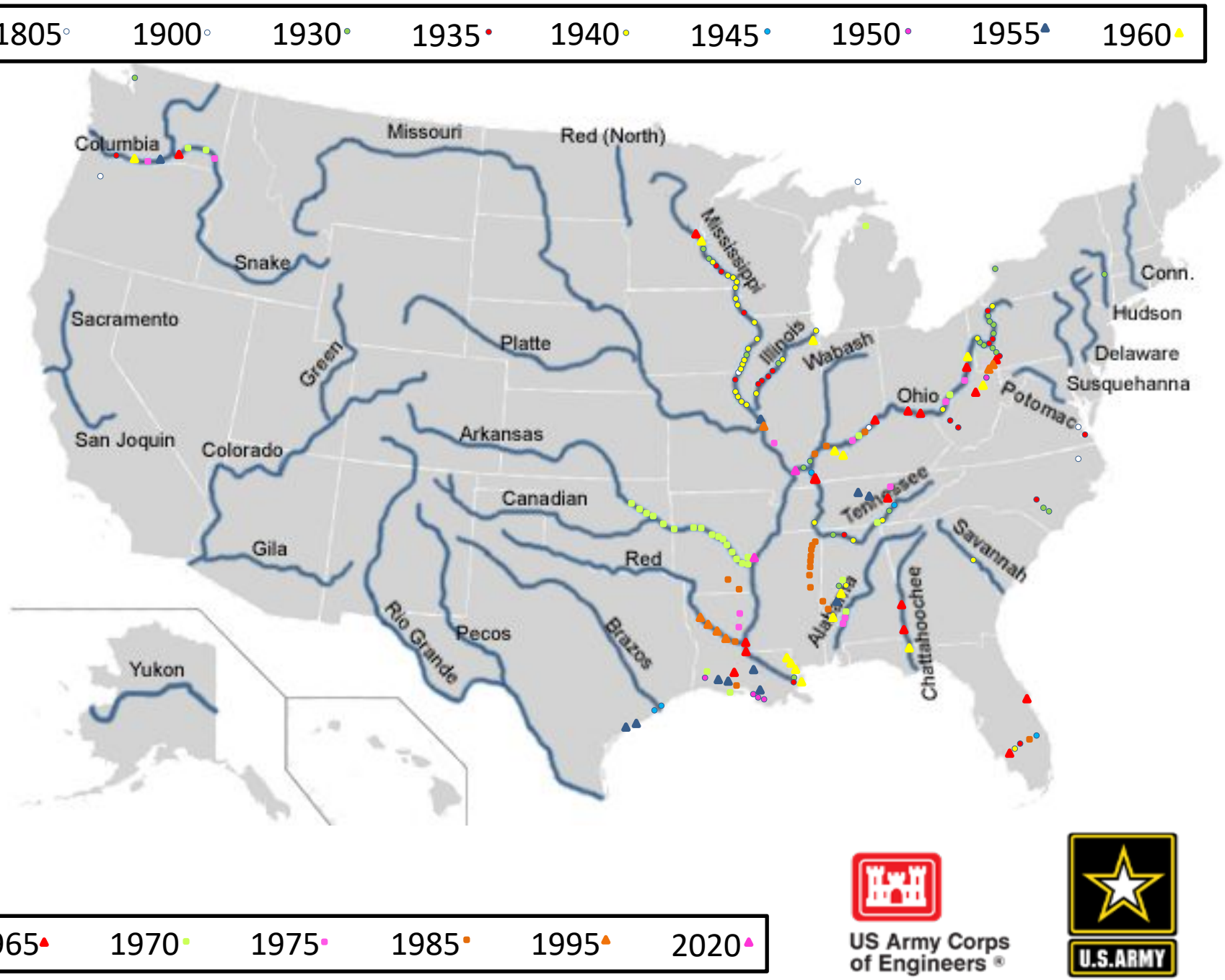
Great Lakes channels and ports

Flood and sediment control structures

USACE owned and operated bridges across navigation channels in Northeast

U.S. Inland Waterway System

Development of the Inland Navigation System of the United States



US Army Corps of Engineers ®

U.S.ARMY


GREAT LAKES
(LAURENTIAN) BASIN
Drainage Basin Boundary
International Boundary
State Boundary
River
Lake
Selected City
0
200 km
N
The Ogoki River sub-basin and the Long Lake sub-basin are diverted into the Great Lakes Basin by human intervention.
The flow of the Chicago River was diverted out of the Great Lakes Basin in 1900 with the construction of the Sanitary and Ship Canal.
Boundaries and locations are approximate.
CANADA
USA
Minnesota
Wisconsin
Michigan
Illinois
Indiana
Ohio
Pennsylvania
New York
Ontario
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
Thunder Bay
Duluth
Green Bay
Milwaukee
Chicago
Toledo
Detroit
Cleveland
Buffalo
Rochester
Toronto
Straits of Mackinac
Lake Nipigon
Lake Nipissing
Georgian Bay
Lake Simcoe
Niagara Falls
Finger Lakes
Ogoki R.
Long Lake
Pic R.
White R.
Nipigon R.
Montreal R.
Mississagi R.
Mississippi R.
Escanaba R.
Menominee R.
Fox R.
Wolf R.
Manistee R.
Au Sable R.
Saginaw Bay
Muskegon R.
Grand R.
St. Joseph R.
Maumee R.
Sandusky R.
Cuyahoga R.
Thames R.
Genesee R.
Black R.
St. Lawrence R.
Trent R.
St. Clair R.
Lake St. Clair
Seguin R.


EDMUND FITZGERALD

INLAND NAVIGATION MISSION – GREAT LAKES

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

- International System jointly operated by U.S. and Canada
- System of waterways
  - St. Lawrence River/Seaway
    - Connects Lake Ontario and the Atlantic Ocean
    - 7 locks
    - Access to Quebec City and Montreal
  - Welland Canal
    - Connects Lake Ontario to Lake Erie
    - 8 locks
    - Access to Toronto, Buffalo, Erie, Cleveland, Toledo, Detroit, etc.
  - Great Lakes Waterway
    - Connect Lake Erie to Lakes Huron, Michigan, and Superior
    - Access to Chicago, Milwaukee, Green Bay, Duluth, Thunder Bay, etc.

INLAND NAVIGATION – PCXIN-RED

PLANNING CENTER OF EXPERTISE FOR INLAND NAVIGATION AND RISK-INFORMED ECONOMICS DIVISION (PCXIN-RED)

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

OVERVIEW:

Located in Huntington District, Lakes and Rivers Division (LRD)

The primary mission of the PCXIN-RED is to improve the quality and timeliness of Corps inland navigation planning studies and products

The purpose is to develop, maintain and apply the best and most appropriate national and regional expertise and science and engineering technology to the planning of inland navigation projects across the nation.

Mandatory Review Management Organization (RMO) for Inland Navigation
Mandatory Center for Inland Navigation Economic Updates

Mandatory Production Center for Inland Navigation Economic Analysis (LRD)

History	
Two Ohio River Division (ORD) Navigation Centers in 1982 LRH - System Models/Data & LRP LRL - Capacity/Environmental & LRN	FY 92 - One Navigation Center in LRH System Funding Plan Started
FY 99 - LRD Navigation Planning Center Great Lakes and the Ohio River Systems	August 2003 - Planning Center of Expertise for Inland Navigation (PCXIN) included the Great Lakes (1 of 7 Planning Centers)
September 2013 – Renamed and Realigned to Planning Center of Expertise for Inland Navigation and Risk-Informed Economics Division	

Patrick Donovan
Chief PCXIN-RED
304-399-5038
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INLAND NAVIGATION – PCXIN-RED

PLANNING CENTER OF EXPERTISE FOR INLAND NAVIGATION AND RISK-INFORMED ECONOMICS DIVISION (PCXIN-RED)

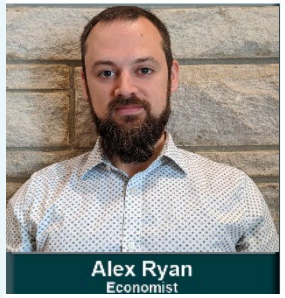
PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

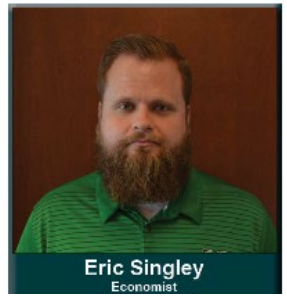
Navigation Planning Branch:

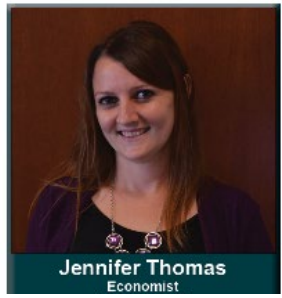
- The Navigation Planning Branch consists of economists and planners specializing in formulation and production of economic analyses for inland navigation projects across the nation.
- Mandatory Review Management Organization (RMO) for Inland Navigation Planning Products
  - ATR, IEPR, Model Review and Certification

RMO Lead – Beth Cade

1 RTS Inland Navigation Economist – Eric Singley
1 Economic Model Developer – Alex Ryan





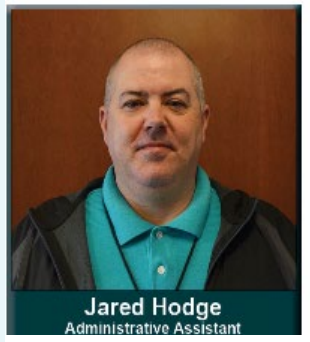


INLAND NAVIGATION – PCXIN-RED

PLANNING CENTER OF EXPERTISE FOR INLAND NAVIGATION AND RISK-INFORMED ECONOMICS DIVISION (PCXIN-RED)

Data Management Branch:

- The Planning Center of Expertise for Inland Navigation (PCXIN), Data Management Branch (LRH-PX-DM)
  - Collects statistical data for vessel movements
  - Conveys value of the inland waterway system
  - Provide technical advice regarding navigation data



INLAND NAVIGATION – PCXIN-RED

PLANNING CENTER OF EXPERTISE FOR INLAND NAVIGATION AND RISK-INFORMED ECONOMICS DIVISION (PCXIN-RED)

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

MMC Consequences Branch:

- Provides support to the Critical Infrastructure Protection and Resilience (CIPR) and Dam and Levee Safety programs
- Develops a series of consequence assessment studies.
- Results of these studies are used to assist in implementing a Dams consequence-based top screen (CTS) methodology within USACE and identifying critical facilities within the USACE dams and locks portfolio.

INLAND NAVIGATION – POLICY AND GUIDANCE

Key Inland Navigation Policy and Guidance:

- Federal Interest – Commerce Clause
- 42 USC §1962a-2(b) – "the primary direct navigation benefits of a water resource project are defined as the product of the savings to shippers using the waterway and the estimated traffic that would use the waterway."
- 1950 Green Book - Proposed benefit estimation procedures for federal river projects
- 1970s Office of Chief of Engineers – System of Locks and Dams requires System Analysis
- 2000 Planning Guidance Notebook

INLAND NAVIGATION – POLICY AND GUIDANCE

National Economic Development Benefits – The base economic benefit of a navigation project is the reduction in the value of resources required to transport commodities.

- Efficiency Improvements – "Cost reduction benefits for commodities for same origin, destination, and mode of transit..."
- Shift of Mode – "The economic benefit to the national economy is the savings in resources from not having to use a more costly mode or point of transport..."
- Shift in Origin/Destination – "Provide benefits by either reducing the cost of transport, if a new origin is used or by increasing net revenue of the producer, if a change in destination is realized..."
- New Movement Benefits – "Claimed when there are additional movements in a commodity or there are new commodities transported due to decreased transportation costs. The new movement benefit is defined as the increase in producer and consumer surplus..."
- Induced Movements – "The value of a delivered commodity less production and transportation costs when a commodity or additional quantities of a commodity are produced and consumed due to lower transportation costs..."

INLAND NAVIGATION – FORMULATION

Without-Project Condition – The following specific assumptions are part of the projected without-project condition.

- All reasonably expected nonstructural practices within the discretion of the operating agency, port agencies, other public agencies and the transportation industry are implemented at the appropriate time.
- For inland navigation, only waterway investments currently in place or under construction are assumed to be in place over the period of analysis.
- Normal operation and maintenance practices are assumed to be performed over the period of analysis.
- In projecting commodity movements involving intermodal movements and in projecting traffic movements on other modes, sufficient capacity of the hinterland transportation and related facilities and the alternative modes is normally assumed.
- For inland navigation, user charges and/or taxes required by law are part of the without-project condition.
- Advances in technology affecting the transportation industry over the period of analysis should be considered, within reason.

INLAND NAVIGATION – FORMULATION

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

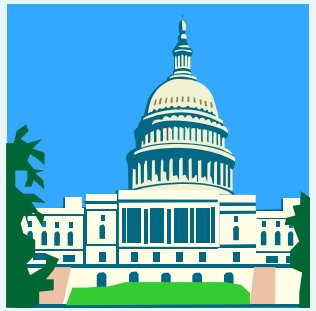
Primary Study Types:

- **General Feasibility**
  New start system analysis involving new lock(s) construction or expansion of existing project profile
- **Major Rehabilitation Evaluation Report**
  Identify opportunities to significantly improve RELIABILITY or CAPACITY of existing projects within the existing project profile
- **Economic Updates**
  CWPM 12-001 – Economic updates must be performed at 3-year intervals for unimplemented New Construction and 5-years for projects underway
- **Dredged Material Management Plan**
  Federal navigation projects must be able to demonstrate cost-effective disposal of dredged materials for at least a twenty-year horizon
- **Disposition of Federal Navigation Structure**
  Study evaluating the remaining federal interest and options for federal government to dispose or cede ownership

INLAND NAVIGATION – INLAND WATERWAYS USERS BOARD

Water Resources Development Act of 1986

- Established Inland Waterways Users Board (IWUB)
  - Section 302(a)
- Subject to FACA
  - Section 302(c)
- Authorized expenditures from Inland Waterways Trust Fund (IWTF) for 8 lock & dam projects
- Precedent for 50% Gen Treasury/50% IWTF construction funding
- Increase tax to 20 cents/gal by 1995; no inflation consideration



"Users Pay, Users Say" - Linked to fuel tax and IWTF

INLAND NAVIGATION – INLAND WATERWAYS USERS BOARD

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

Water Resources Development Act of 1992

- 50% Gen Treasury/50% IWTF funding for Major Rehabilitations
- Criteria for Major Rehabilitations
- Threshold for Major Rehabilitations – includes cost escalation

WRRDA of 2014

- Changed Major Rehab Threshold to $20 million
- Changed Olmsted funding from 50/50% to 85% Gen Treasury/15% IWTF

ABLE Act of 2014

- Increase tax from 20 cents/gal to 29 cents/gal
- 45% increase – estimated to generate another ~$30M-$35M/year
- First increase since 1995

Purpose

Provide independent advice to the Army and Congress

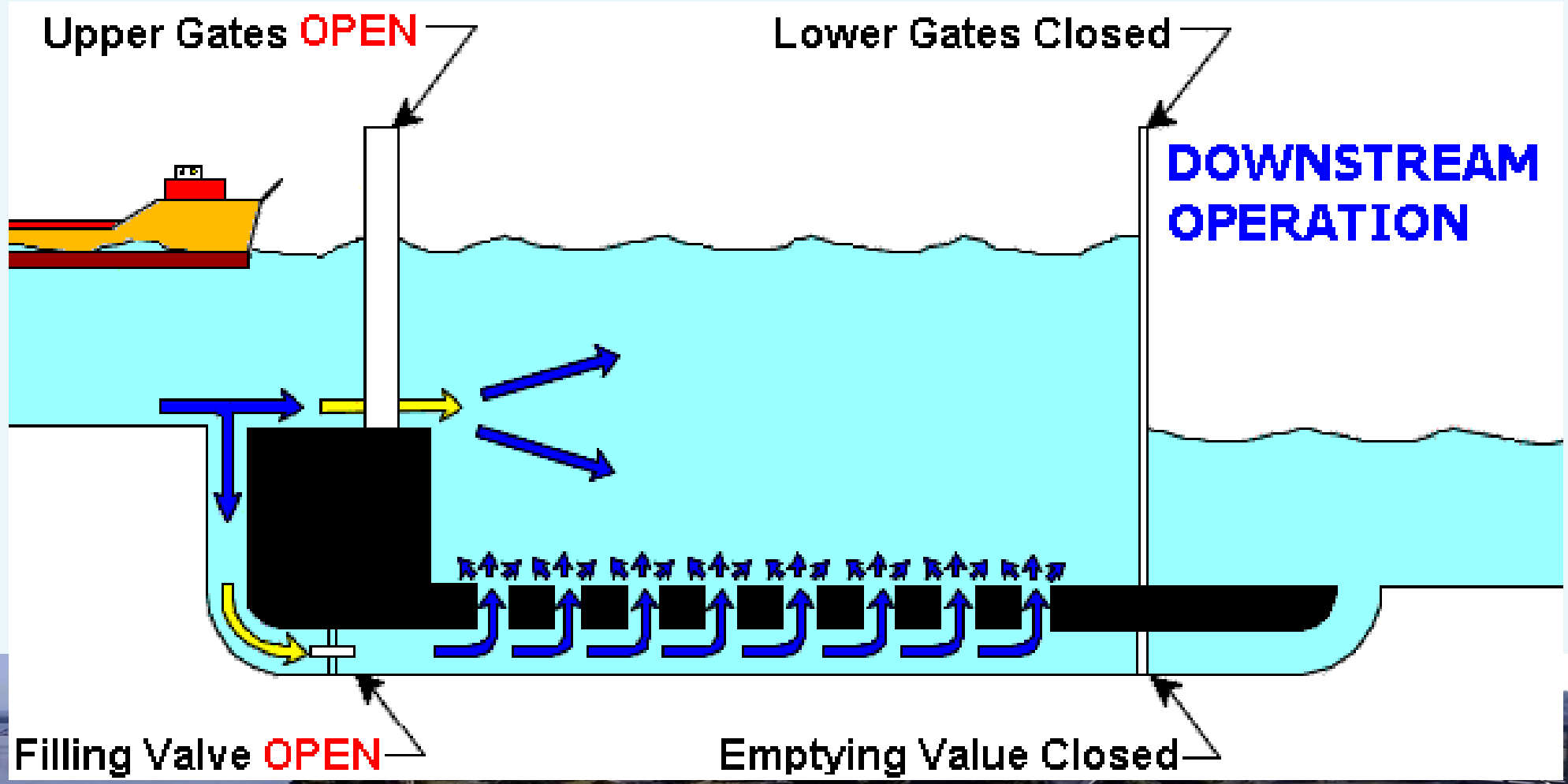
- WRDA 1986 Section 302(b)

Investment Recommendations for construction and rehabilitation of IWTF Cost-shared Projects

- Annual Report to Congress and Army
- Advice & Recommendations on CW President's Budget

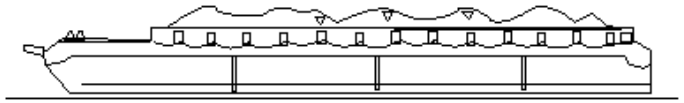
Other matters related to the Inland Waterways System

What happens when the tow transits the lock?



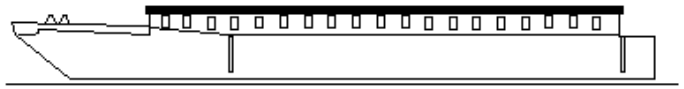
INLAND NAVIGATION

Common Barge Types



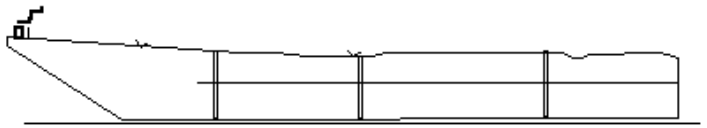
OPEN HOPPER BARGES

TYPE	LENGTH FEET	BREADTH FEET	DRAFT FEET	CAPACITY TONS
Standard	175	26	9	1000
Jumbo	195-200	35	9	1600
Super Jumbo	250-290	40-52	9	2100-3300



COVERED HOPPER BARGES

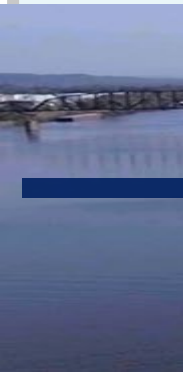
TYPE	LENGTH FEET	BREADTH FEET	DRAFT FEET	CAPACITY TONS
Standard	175	26	9	1000
Jumbo	195-200	35	9	1600

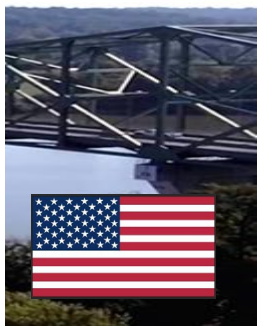


INTEGRATED CHEMICAL AND PETROLEUM BARGES

TYPE	LENGTH FEET	BREADTH FEET	DRAFT FEET	CAPACITY TONS
Tanker	150-300	35-54	9	1400-3300

INLAND NAVIGATION - ECONOMICS





COMPARE ...

CARGO CAPACITY

ONE BARGE
1,750 TON
58,333 BUSHELS
1,555,000 GALLONS

ONE 15-BARGE TOW
26,250 TON
874,995 BUSHELS
23,325,000 GALLONS

ONE RAIL CAR
110 TON
4,000 BUSHELS
33,870 GALLONS

ONE 108-CAR TRAIN
11,880 TON
400,000 BUSHELS
3,387,000 GALLONS

ONE LARGE SEMI
25 TON
910 BUSHELS
7,865 GALLONS

EQUIVALENT UNITS

ONE BARGE

16 RAIL CARS

70 LARGE SEMIS/TRACTOR TRAILERS

ONE 15-BARGE TOW AND TOW BOAT

6 LOCOMOTIVES AND 216 RAIL CARS

1,050 LARGE SEMIS/TRACTOR TRAILERS

EQUIVALENT LENGTHS

ONE 15-BARGE TOW
0.25 MILE

TWO 108-CAR TRAINS
2.6 MILES

1,050 LARGE SEMIS/TRACTOR TRAILERS
13.9 MILES (BUMPER TO BUMPER)

INLAND NAVIGATION - ECONOMICS

Emsworth Locks and Dam – Pittsburgh, PA
First locks project at head of Ohio River. Construction began 1919. First chamber opened 1921. 600-feet long by 110-feet wide main chamber. 360-feet long by 56-feet wide auxiliary chamber

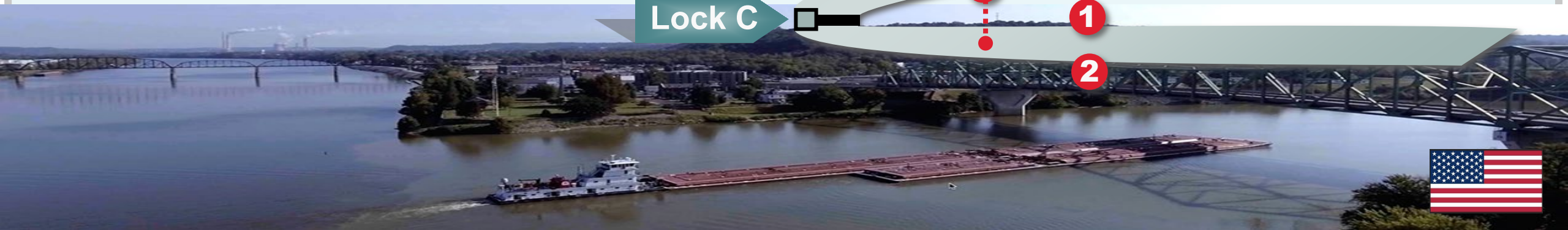
Olmsted Locks and Dam – Olmsted, IL
Last locks project near mouth of Ohio River. Opened August 2019. Twin 1200-feet long by 110-feet wide chambers and navigable pass over the wicket dam during high water season

INLAND NAVIGATION - ECONOMICS

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

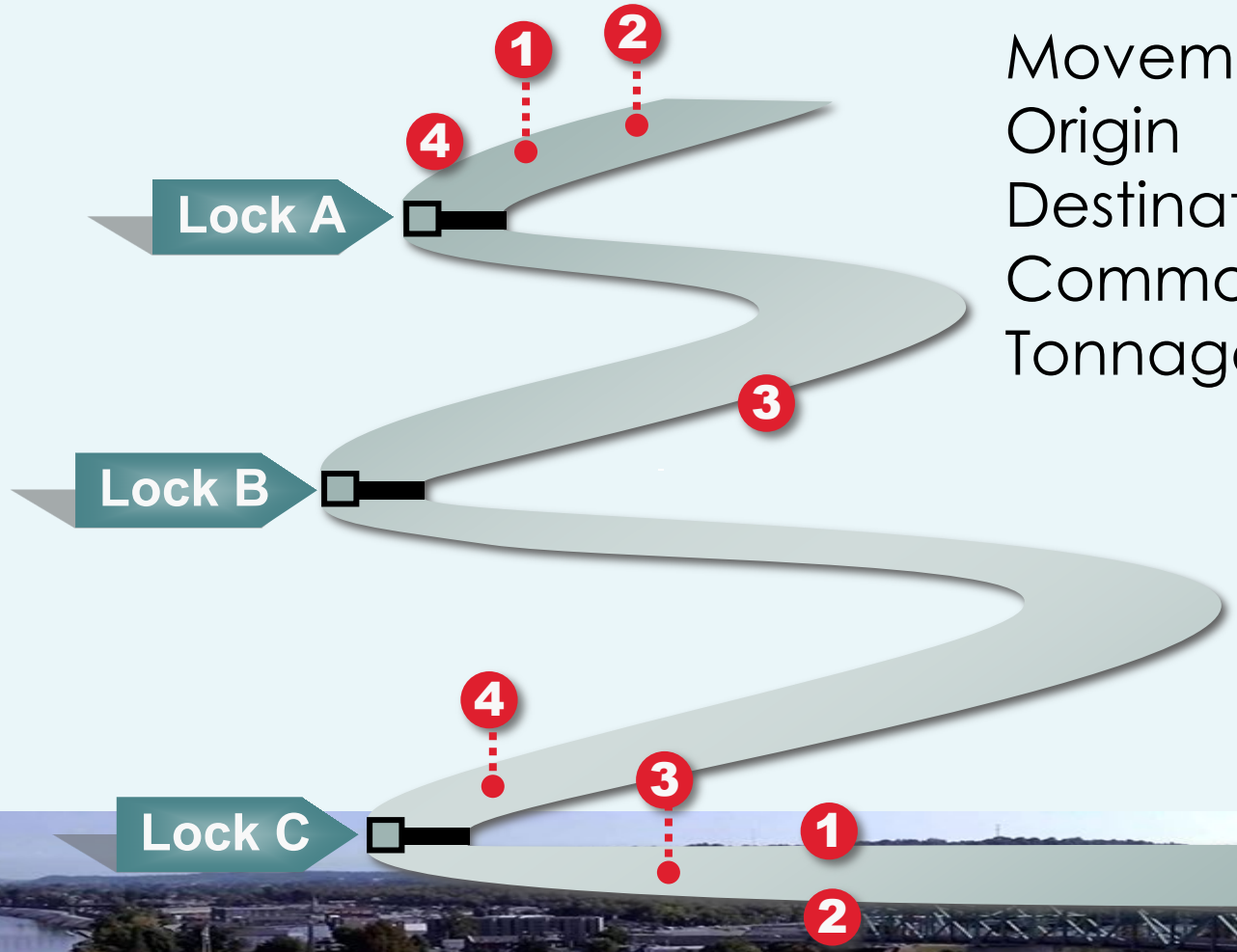
INLAND NAVIGATION – ECONOMICS 101

System Benefits Example



INLAND NAVIGATION – ECONOMICS 101

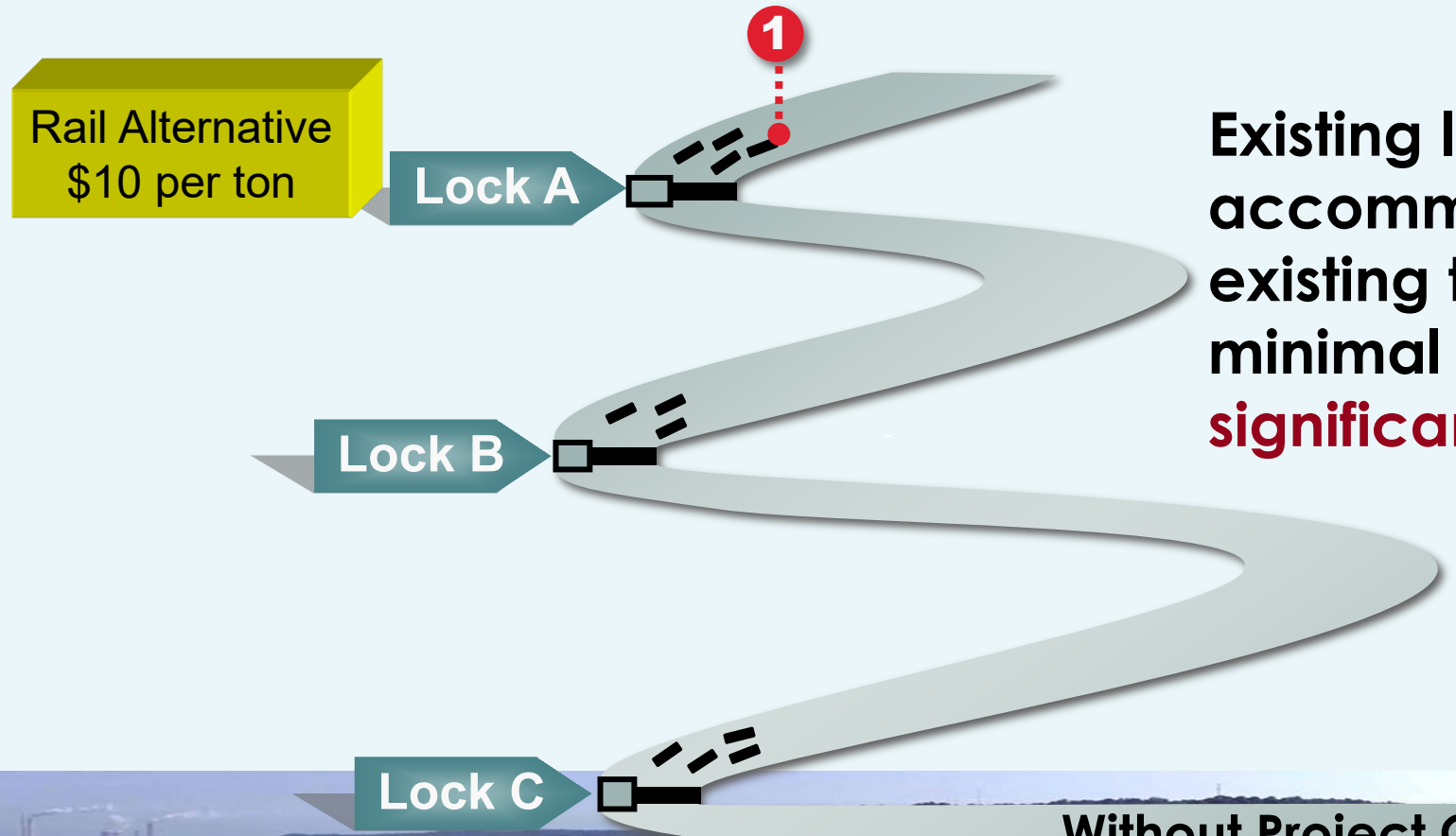
4 movements for year 2020



Movements by:
Origin
Destination
Commodity
Tonnage

INLAND NAVIGATION – ECONOMICS 101

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION



Existing locks may accommodate existing tons with minimal delay and significant savings

Without Project Condition

1

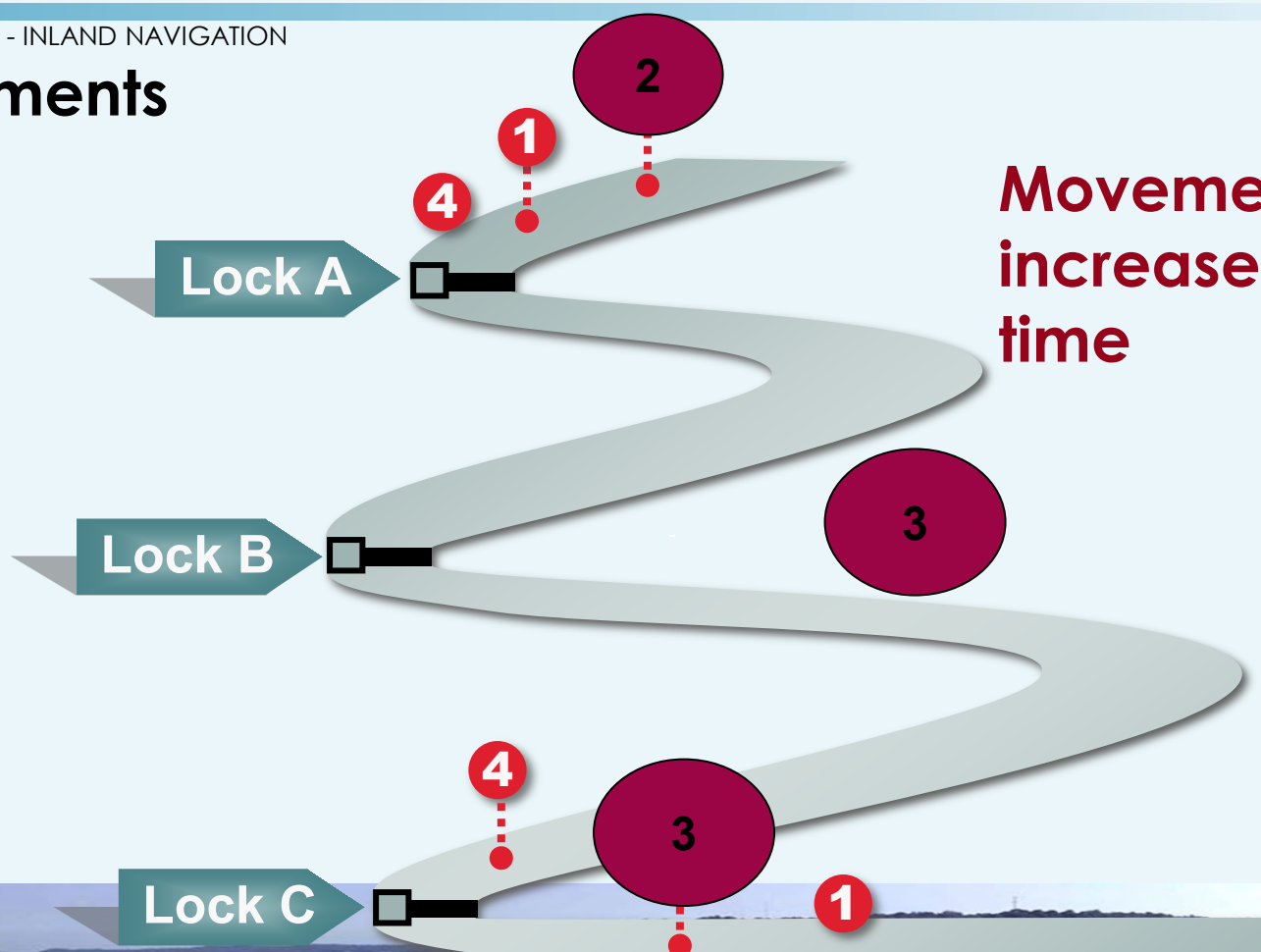
A $5 per ton benefit

Water Rate $5 per ton

INLAND NAVIGATION – ECONOMICS 101

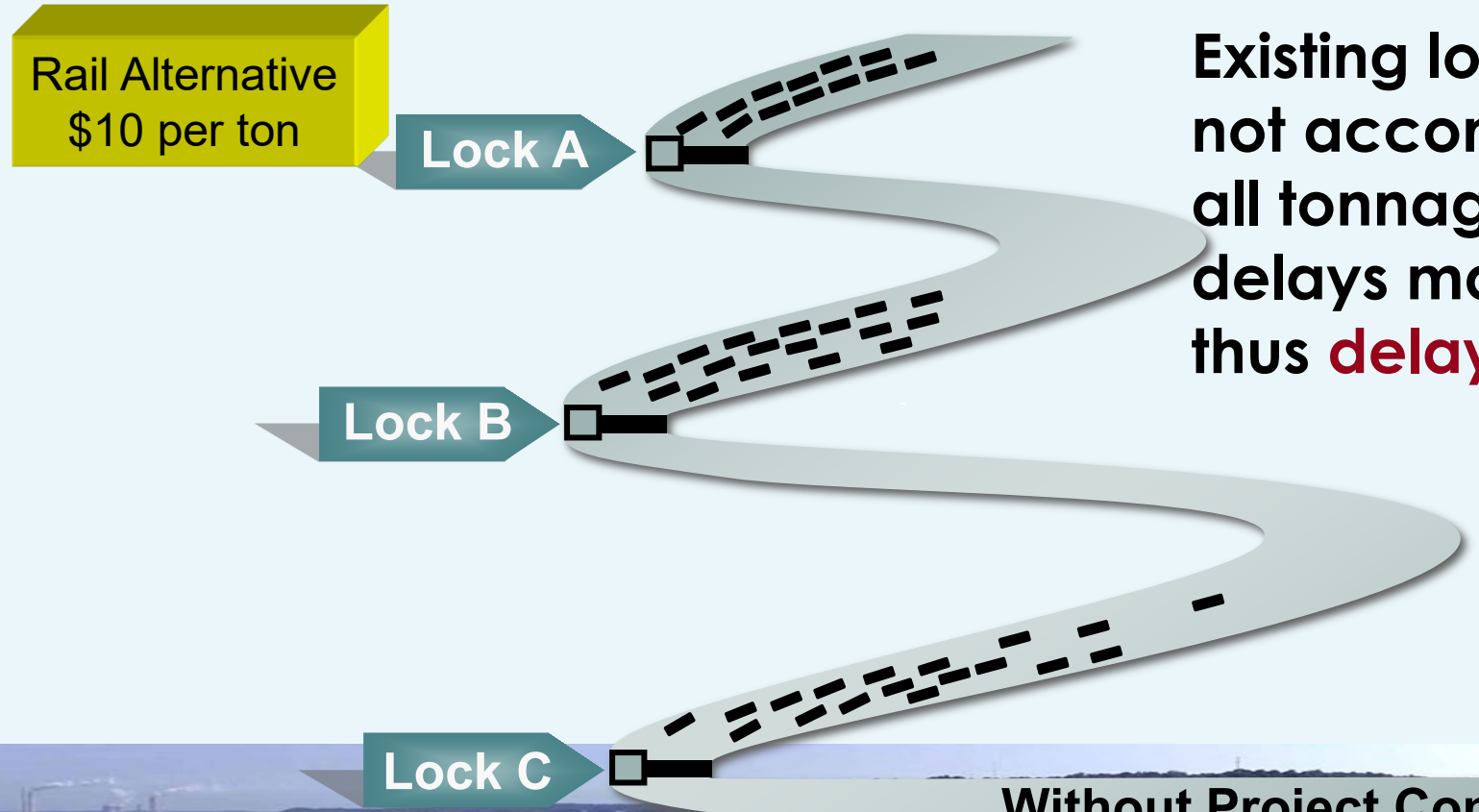
PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

Same 4 movements for year 2030



Movements may increase over time

INLAND NAVIGATION – ECONOMICS 101



Existing locks may not accommodate all tonnage -- long delays may occur—thus delay costs

Water Rate $5 per ton + $6 Congestion Costs: $11 Effectively

INLAND NAVIGATION – ECONOMICS 101

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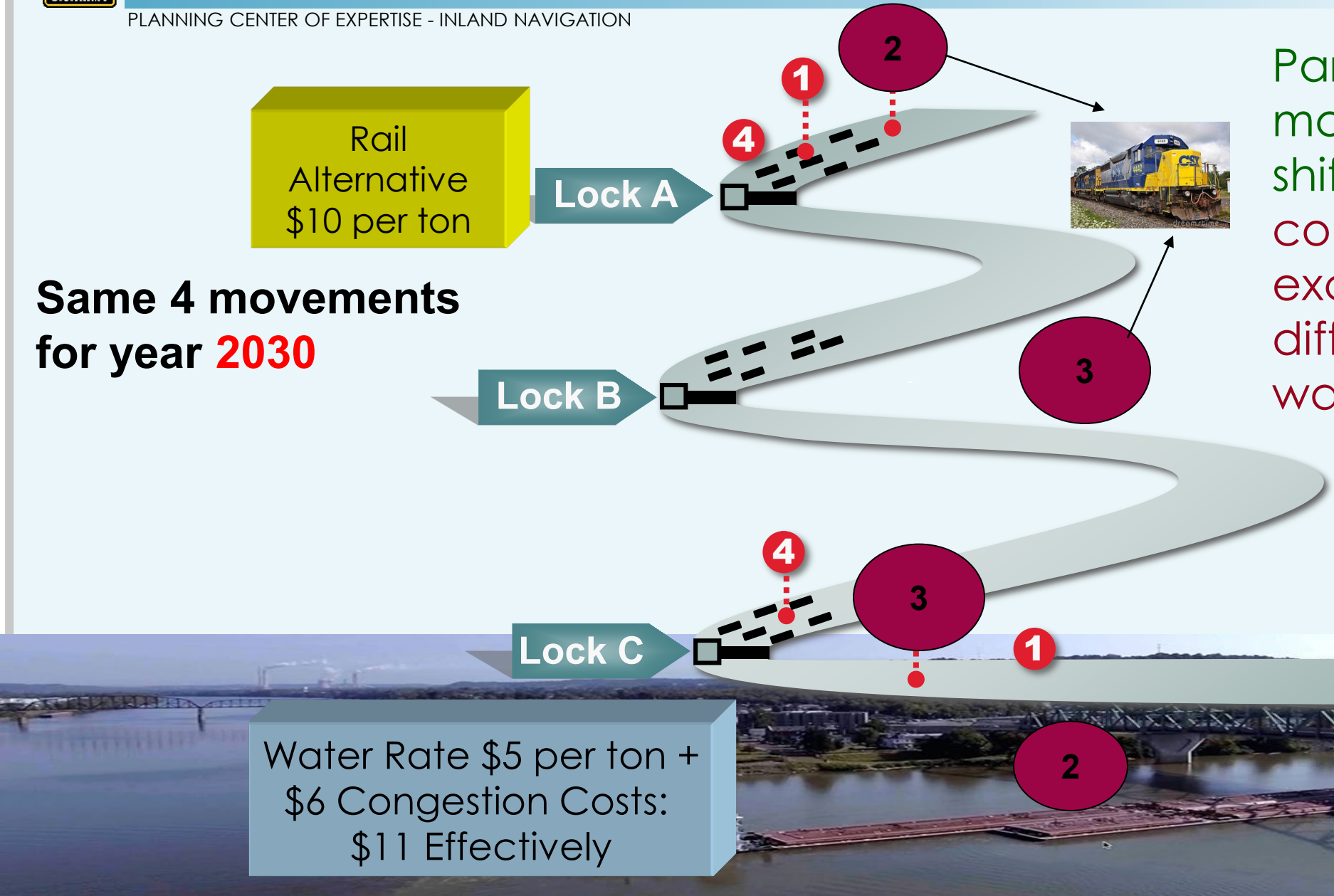
Rail Alternative $10 per ton

Lock A

Lock B

Lock C



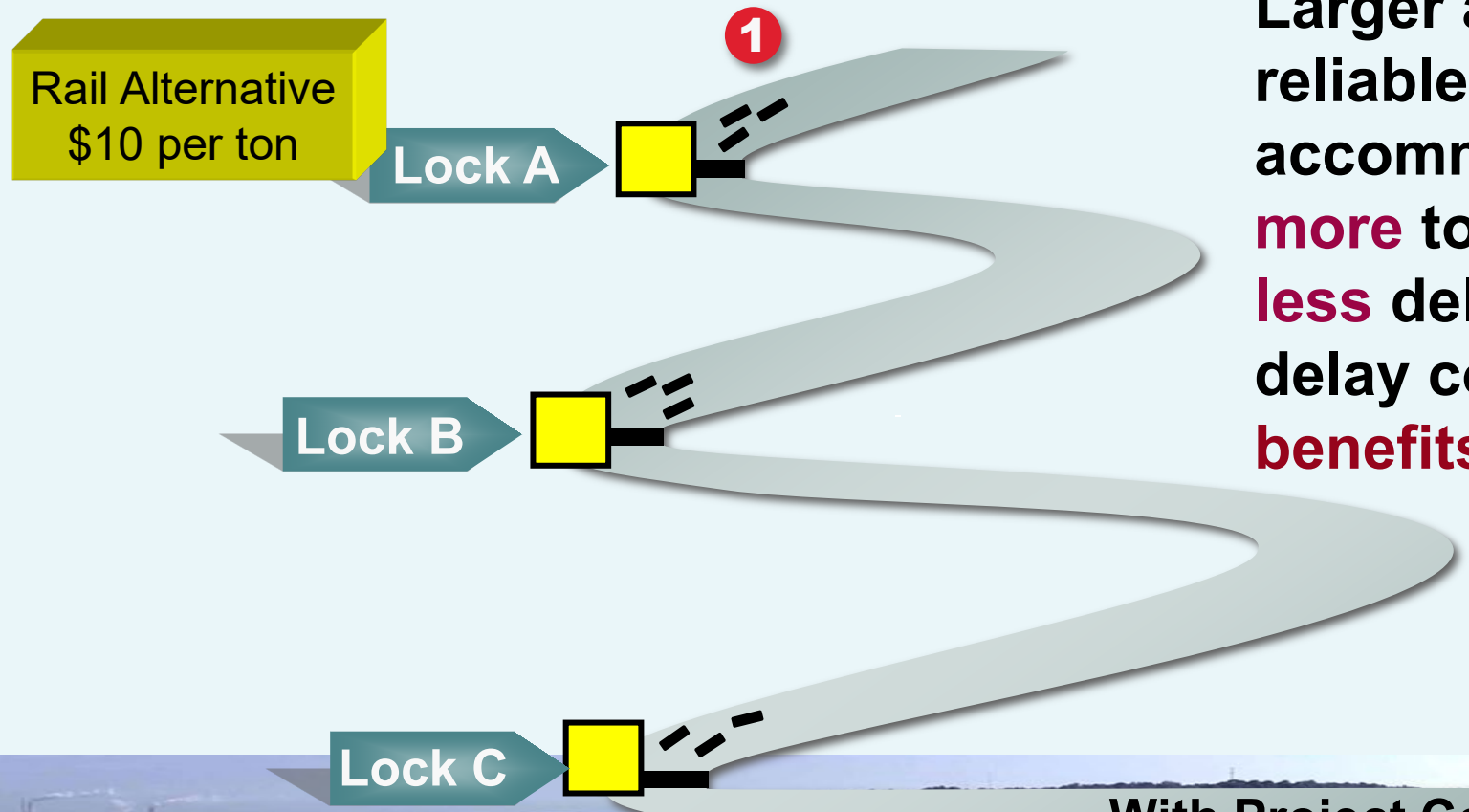
Same 4 movements for year 2030

Part or all of the movements may shift to rail if congestion costs exceed the rate difference between water and rail

Water Rate $5 per ton + $6 Congestion Costs: $11 Effectively

INLAND NAVIGATION – ECONOMICS 101

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION



Larger and more reliable locks will accommodate more tons with less delay and delay costs— thus benefits

INLAND NAVIGATION - ECONOMICS

Key Considerations:

Lock Performance
- Time – lock processing and delay times
- Closures – scheduled and unscheduled project closures
- O&M – performance plans and lifecycle costs

Traffic Characteristics
- Fleet – size of barges and towboats
- Commodity Mix - types of barges and special requirements (hazardous cargoes)
- Origin-Destination – routing and modal options available for shippers
- Minimum draft requirements
- Commodity projections

INLAND NAVIGATION - ECONOMICS

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

Primary data source is reports of domestic movements to the Waterborne Commerce Statistics Center (WCSC).
Commodity values are estimates and applicable only to shallow draft

U.S. Inland Waterway System

Shallow Draft IMTS

Year	Tonnage (1,000 tons)	Commodity Value ($ millions)
2014	650,324.6	126,079.2
2015	607,305.7	121,542.2
2016	593,827.7	119,392.8
2017	606,183.0	120,415.6
2018	614,118.9	123,037.4

Great Lakes

Year	Tonnage (1,000 tons)	Commodity Value ($ millions)
2014	130,041.6	6,307.1
2015	121,784.0	5,739.7
2016	115,301.7	5,865.9
2017	122,191.8	5,883.5
2018	118,945.7	5,740.2

PLANNING PROCESS OVERVIEW

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

- Step 1: Identify POOCs
- Step 2: Step 2: Inventory Existing/FWOP
- Step 3: Step 3: Formulation Alternative Plans
- Step 4: Step 4: Evaluate Alternative Plans
- Step 5: Step 5: Compare Alternative Plans
- Step 6: Step 6: Select Plan

POOCs – Problems, Opportunities, Objectives, Constraints
FWOP – Future Without Project Condition
FWP – Future With Project Condition
LPP – Locally Preferred Plan
NEPA – National Environmental Policy Act

Engineering/Ops:
- Physical conditions
- Component Lifecycle
- General Design
- O&M Plan
- Event Trees

Economics:
- Commodity and fleet data & projections
- Rate savings and shipper response
- Lock capacity assessment

Team assumptions with Environmental & Plan formulation

Economic model runs => FWOP

Team assumptions with Environmental & Plan formulation

Economic model runs => FWP

Team assumptions with Environmental & Plan formulation

National Economic Development Plan (NED) – the plan that reasonably maximizes net benefits to the nation from cost savings.

PLANNING & ECONOMIC CONSIDERATIONS

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

- Primary benefits of Federal involvement in inland waterways improvements involve transportation cost savings.
- Cost savings accrue from reducing transporation cost associated with the movement of commodities
  - Reduced cost of existing movement
  - Larger and/or more efficient tow packages
  - Shift of transporation mode
  - Shift of Origin/Destination
  - New movements

PRIMARY BENEFITS: TRANSPORTATION COST SAVINGS

BENEFITS = ESTIMATED $ Transportation Cost WITHOUT PROJECT - ESTIMATED $ Transportation Cost WITH PROJECT

NET BENEFITS = BENEFITS - COSTS

A Recommended Plan represents the alternative which most reasonably maximizes NED benefits and is environmentally acceptable

National Economic Development Plan (NED)– the plan that reasonably maximizes net benefits to the nation from cost savings.

$$\frac{\text{BENEFITS}}{\text{COSTS}} > 1$$

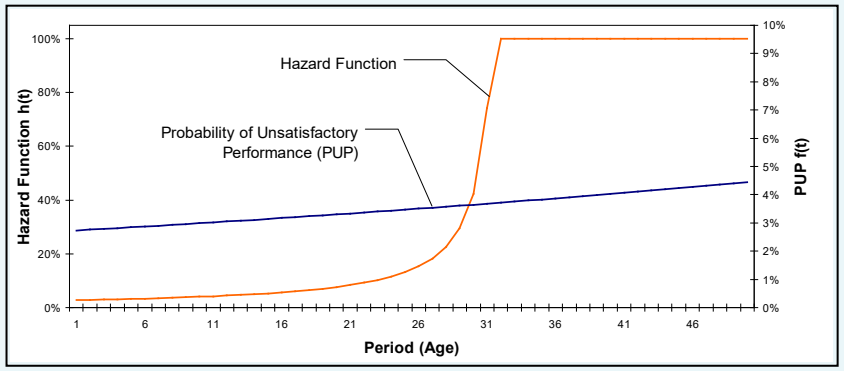
In addition, plans must have a benefit to cost ratio greater than 1.

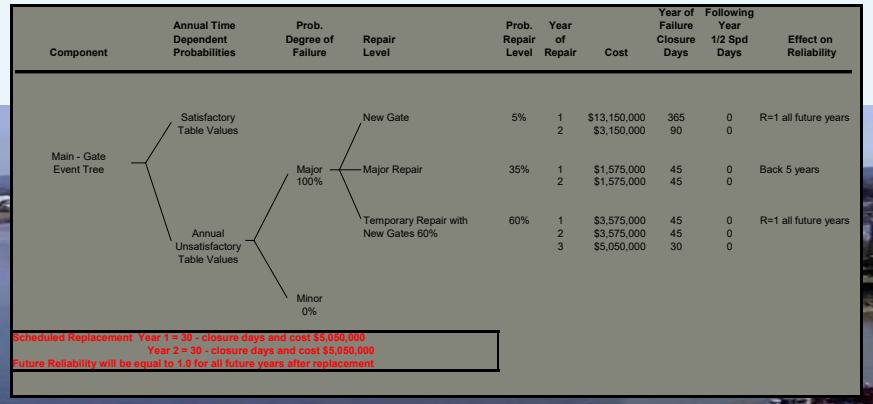
ENGINEERING & DESIGN CONSIDERATIONS

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

General Lock Design:

- Fill/spill design must take into account water availability, port design/location, and Hawser forces
- Future performance characteristics (timing)
- Tow interference in multi-chamber projects
- Possibility of Nav/Open Passs





Engineering Lifecycle and Risk:

- Assessment of component lifecycles, failure modes, and failure levels
- Assessment of response times to restore service
- Lifecycle costs of maintaining components and assessments of ability to replace or upgrade
- Event Trees are a critical feasibility input

DREDGE MATERIAL MANAGEMENT PLANS & PLACEMENT AREAS

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

Base Plan/Federal Standard

- Determine the least cost and environmentally acceptable alternative

Dredged Material Management Plans (DMMP)

- All Federally maintained navigation projects must demonstrate that there is sufficient dredged material placement capacity for a minimum of 20 years.
- Will the proposed navigation improvement require additional capacity over the next 20 years for O&M material?
  - ➢ No: Tell the story in the main report, and an additional appendix if needed.
  - ➢ Yes: Create a DMMP - alternatives may include:
    - Open Disposal (River/Lake/Gulf)
    - Confined Disposal Facilities (Upland Disposal)
    - Beneficial Uses/Regional Sediment Management (RSM)

ENVIRONMENTAL COMPLIANCE

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

- National Environmental Policy Act (NEPA)of 1969
  - Analyzes the effects of the Recommended Plan, alternative plans, and the No Action alternative on the human environment, including considerations for cultural resources and environmental mitigation if appropriate
  - Coordination with Federal agencies including NMFS, USFWS, and USEPA, as well as appropriate state agencies
  - Includes coordination under other environmental laws, including EFH, CWA, NHPA, **ESA**, MBTA, **MMPA**, CAA, FWCA, and CZMA
- Beneficial Use of Dredged Material
  - ER 1105-2-100: "Where environmentally beneficial use of dredged material is the least cost, environmentally acceptable method of disposal, it is cost shared as a navigation cost. Section 204 of the WRDA of 1992, as amended, provides programmatic authority for selection of a disposal method for authorized projects, that provides aquatic restoration or environmental shoreline erosion benefits when that is not the least costly method of disposal. The incremental cost of the disposal for ecosystem restoration purposes over the least cost method of disposal is cost shared, with a non-Federal sponsor responsible for 25 percent of the costs."
- Other considerations:
  - Mitigation if needed
  - Environmental windows
  - Existing restrictions (dredge types, etc)

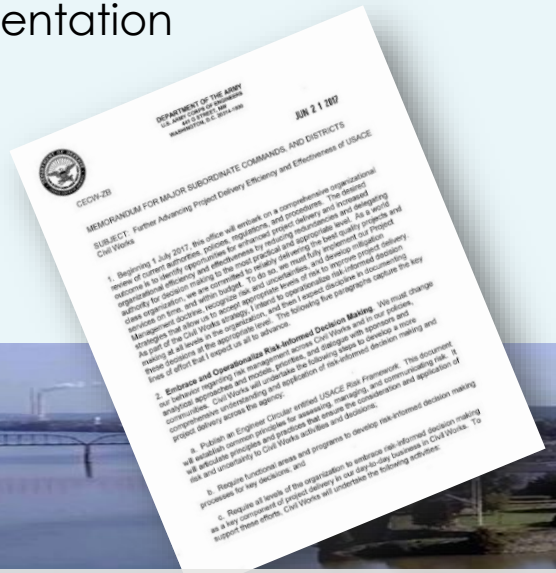
AREAS OF RISK & UNCERTAINTY

PLANNING CENTER OF EXPERTISE - INLAND NAVIGATION

RISK INFORMED PLANNING

June 21, 2017 Memo: Further Advancing Project Delivery Efficiency and Effectiveness of USACE Civil Works

- Embrace and Operationalize Risk-Informed Decision Making
- Incorporate Social and Environmental Benefits into Plan Formulation, Design, and Implementation



IWR APT site can help you document & manage risks: https://iwr-apt.planusace.us/login

IDENTIFICATION OF RISK & UNCERTAINTY

- Example of Typical Risks & Uncertainty:
  - Engineering Risk
  - Uncertainty with future commodities and barge types
  - Lack of time to do additional modeling
  - Lack of time and funding for Transportation Rate assessments
  - Assumptions with environmental data for mitigation in advance of surveys later in PED
  - Assumptions with existing geotech or cultural resource information (pushing surveys and analysis to PED)
  - Sea level rise assumptions
- Early study risks
  - Screening
  - Risk Register
  - Qualitative, should inform early decisions and should have management options to reduce or buy down risk throughout the study
- Project risks
  - Cost and Schedule Risk Assessment (CSRA)
  - Quantitative

QUESTIONS