Olmsted Locks and Dam – Heritage In Transportation Engineering

TEAM 2018 Conference

Presenter:

Sharon Hoffmann, P.E.

March 8, 2018

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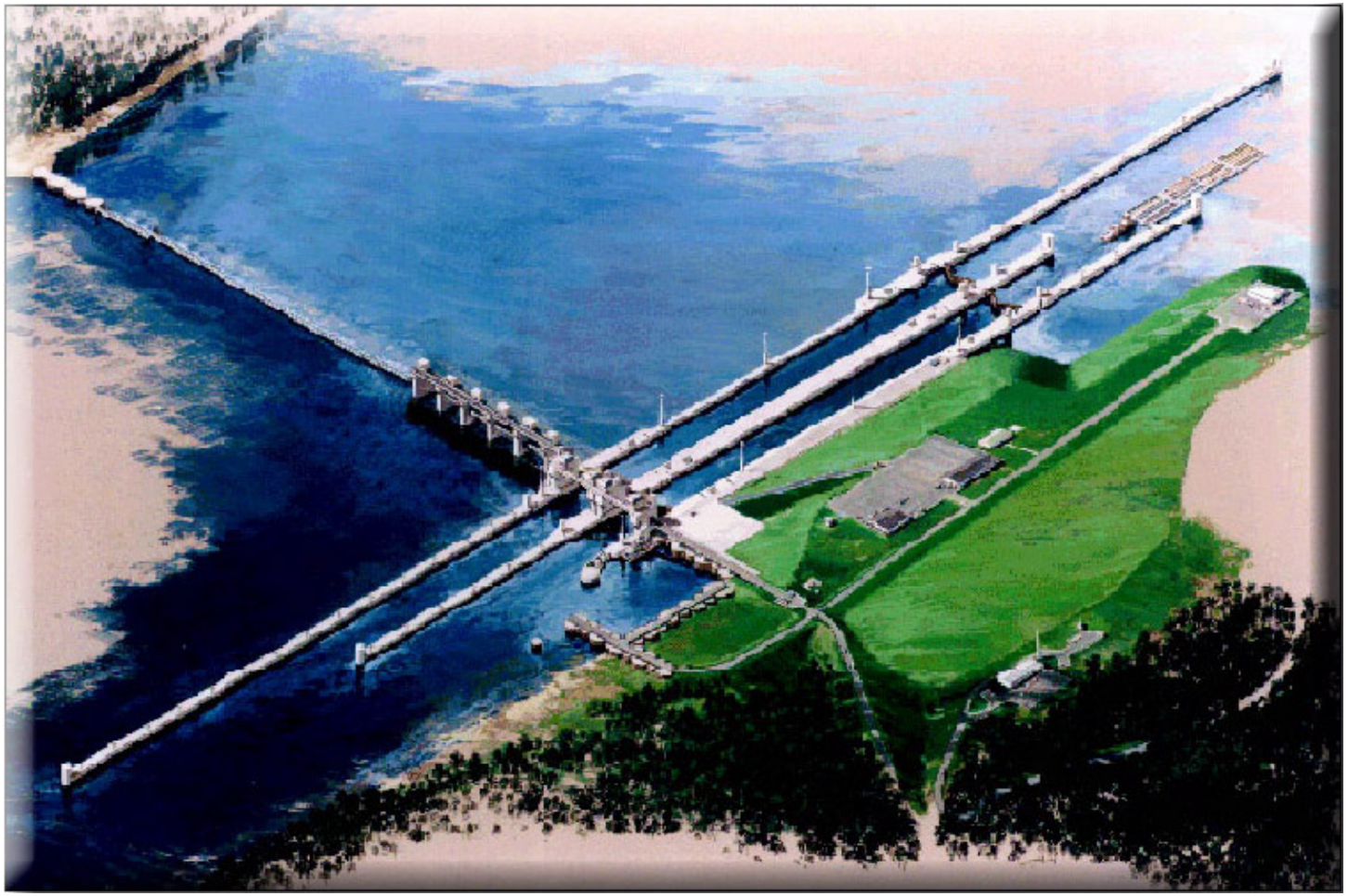
Olmsted Locks & Dam Replacement Project



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Olmsted Locks and Dam on the Ohio River

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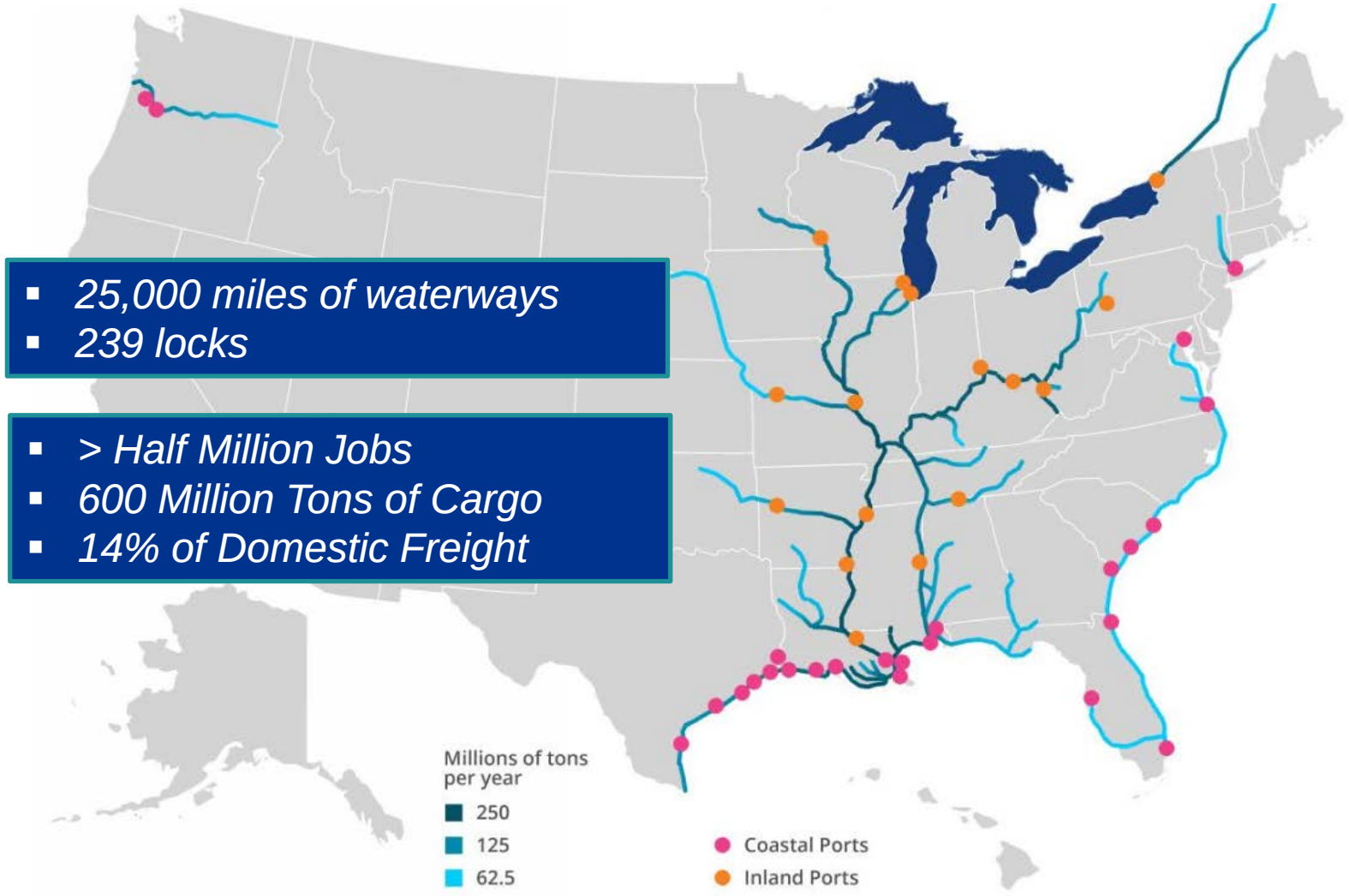
Agenda

1. Overview of Inland Waterway System
2. Inland Waterway System Current Condition & Necessary Improvements
3. Ohio River Demand & Olmsted's Importance to the Nation
4. Olmsted Dam's Design & Innovative Method of Construction

Heritage of the U.S Inland & Intracoastal Waterways



- *25,000 miles of waterways*
- *239 locks*

- *> Half Million Jobs*
- *600 Million Tons of Cargo*
- *14% of Domestic Freight*

Source: ASCE Infrastructure Report Card

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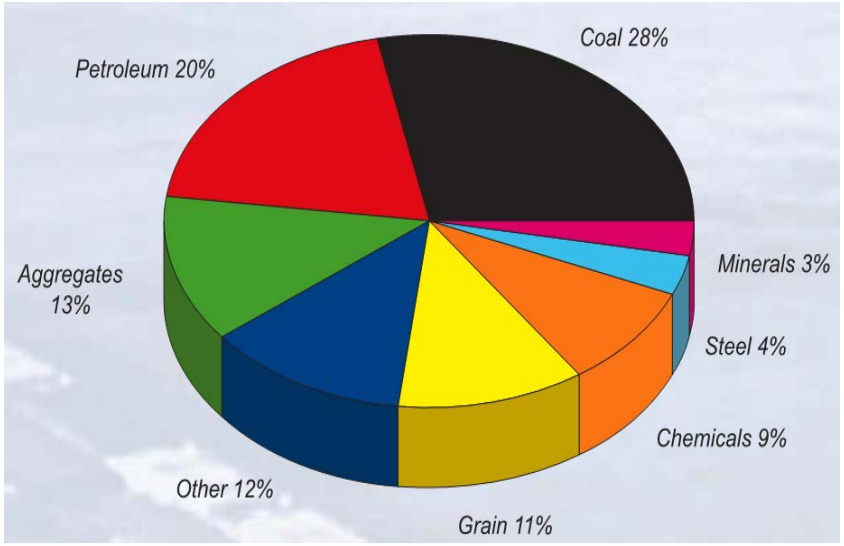
Nation's Freight Network

Inland Waterways

- Shared by only 38 states
- Maintained by the USACE
- ~12,000 miles constitute the Commercially Active Inland and Intracoastal Waterway System
- 575 million tons of Cargo
- $229 Billion



Source: USACE and ASCE Infrastructure Report Card

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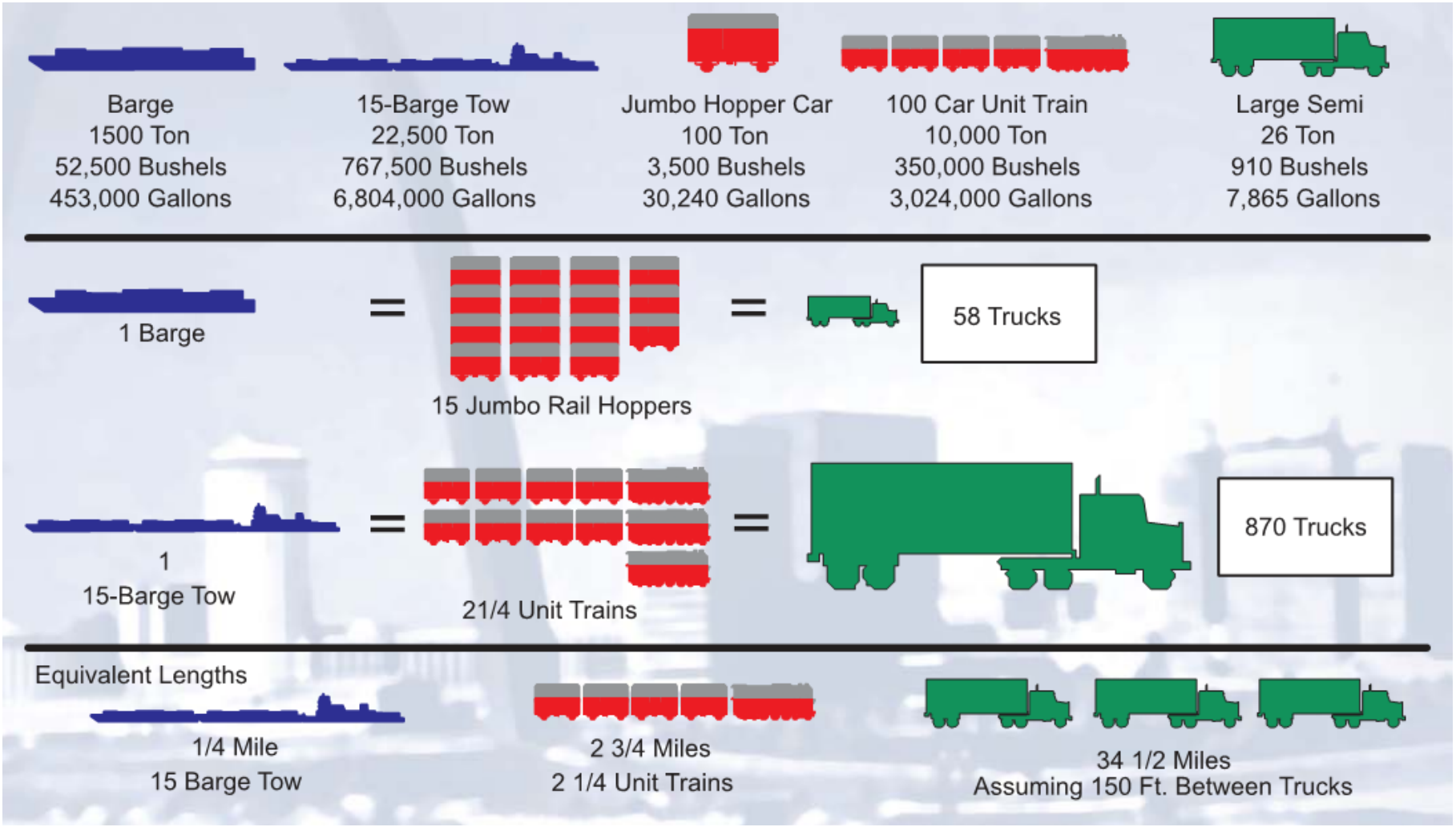
Alternate Transportation Mode Comparison



Source: USACE

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Federal Role Supporting Navigation

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Federal Role Supporting Navigation

U.S. Department of Transportation (DOT)

- U.S. Coast Guard
  - Vessel and Navigation Safety
  - Provides Navigation Aids
  - Search and Rescue Services
- Maritime Administration
  - U.S. ports
  - Intermodal Systems
  - Domestic Shipping

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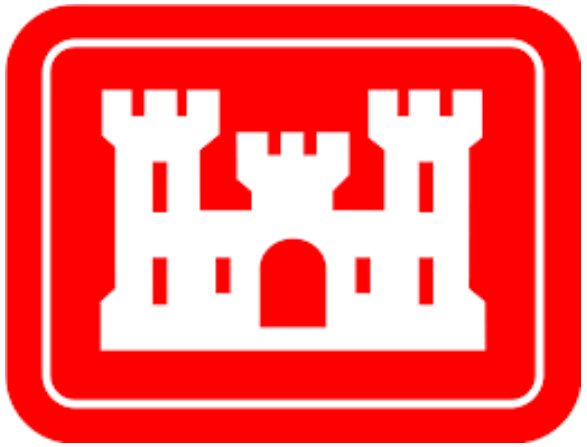
Federal Role Supporting Navigation

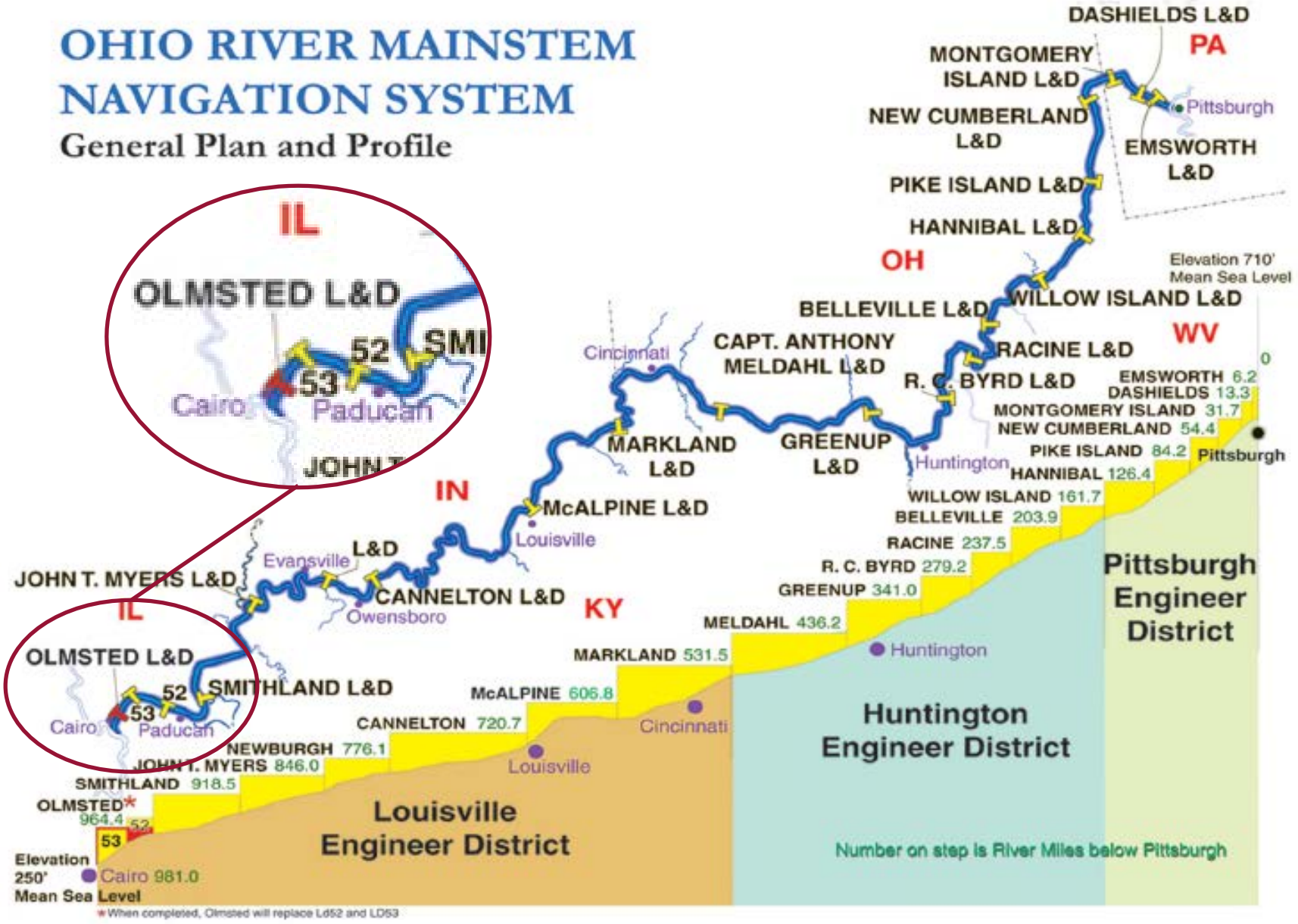


U.S. Army Corps of Engineers (USACE)

- Facilitates the safe, reliable and economically efficient movement of vessels by constructing and maintaining navigation channels and harbors, and regulating water levels on inland waterways.

OHIO RIVER MAINSTEM NAVIGATION SYSTEM

General Plan and Profile



Source: USACE

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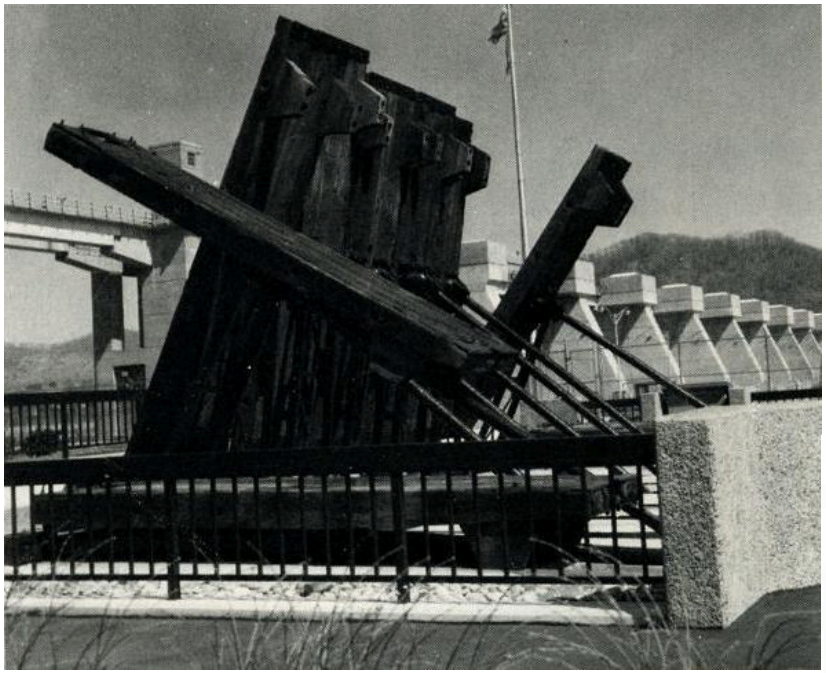
Historical Wicket Gates of the Navigable Pass



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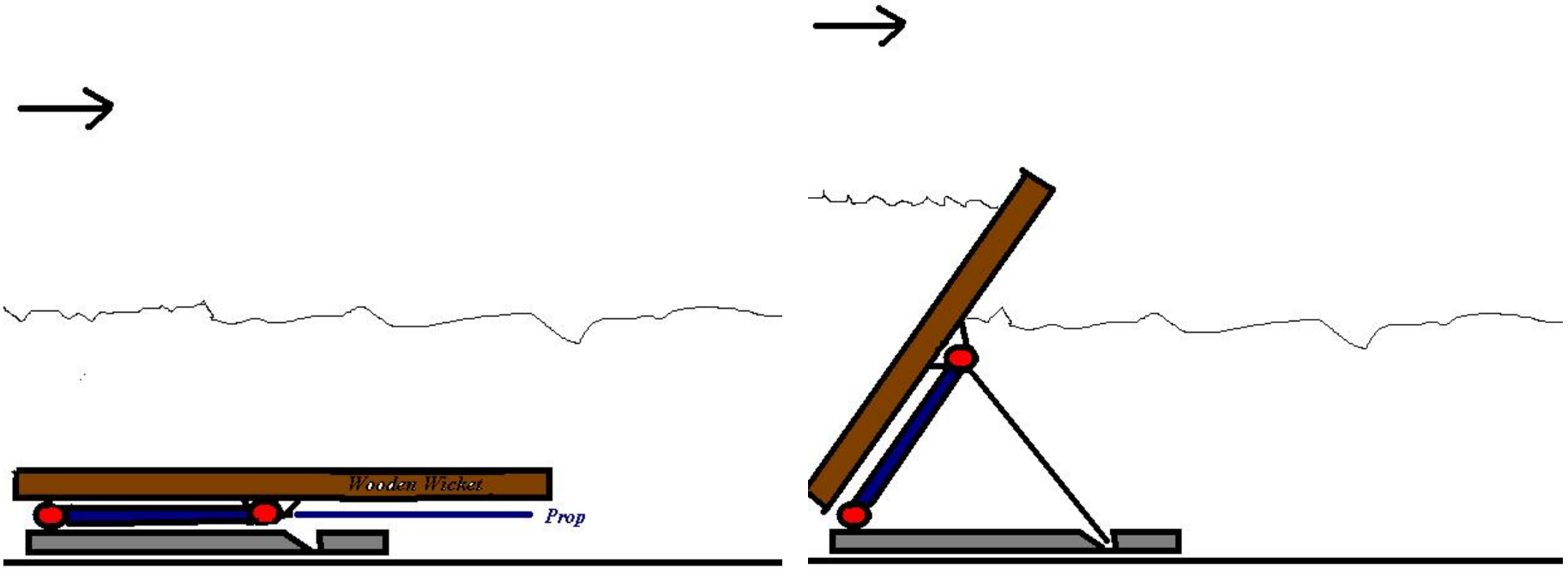
Wicket Gates of the Navigable Pass



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Historical Wicket Gates of the Navigable Pass

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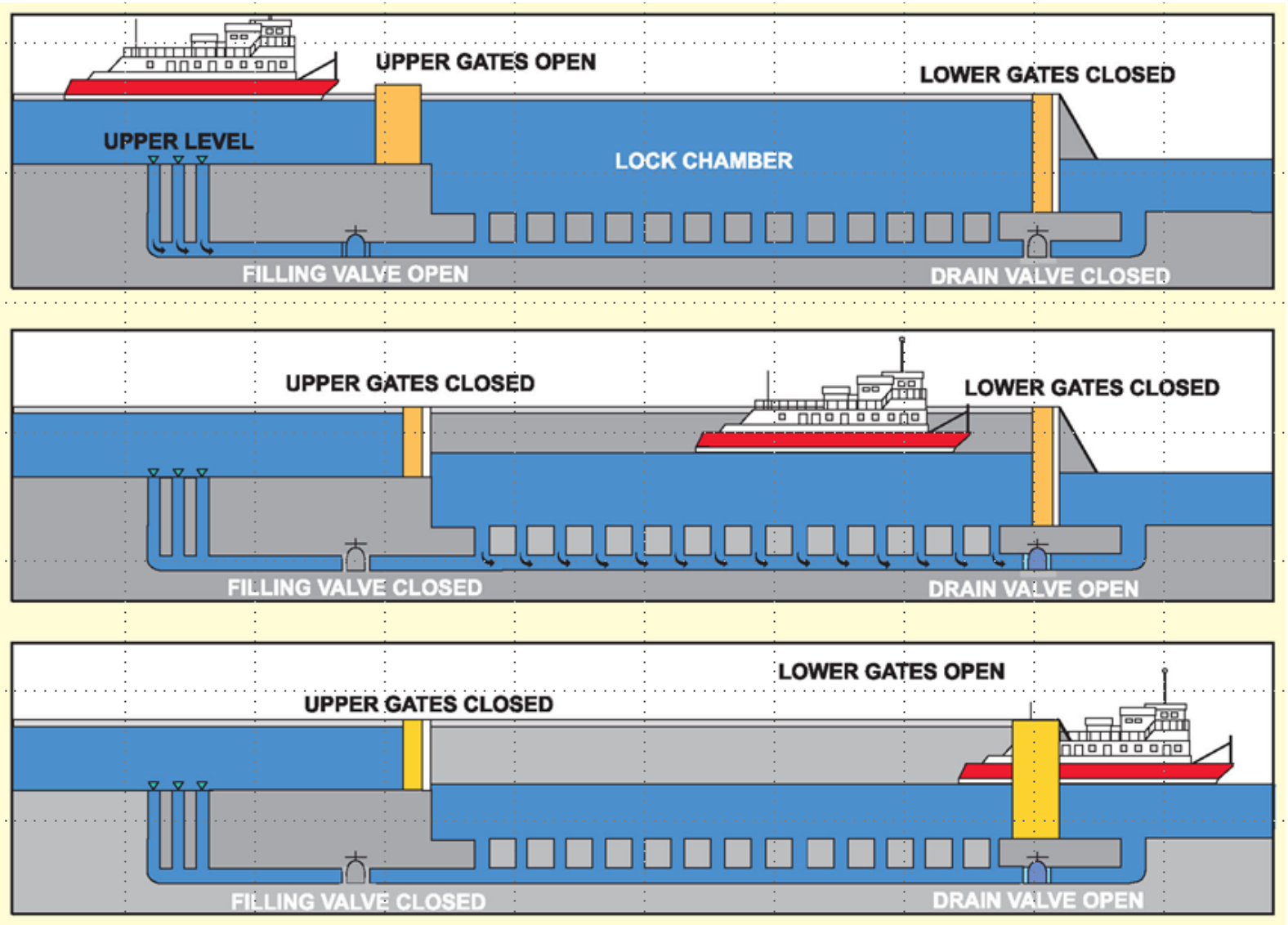
Lock Chamber



Source: USACE

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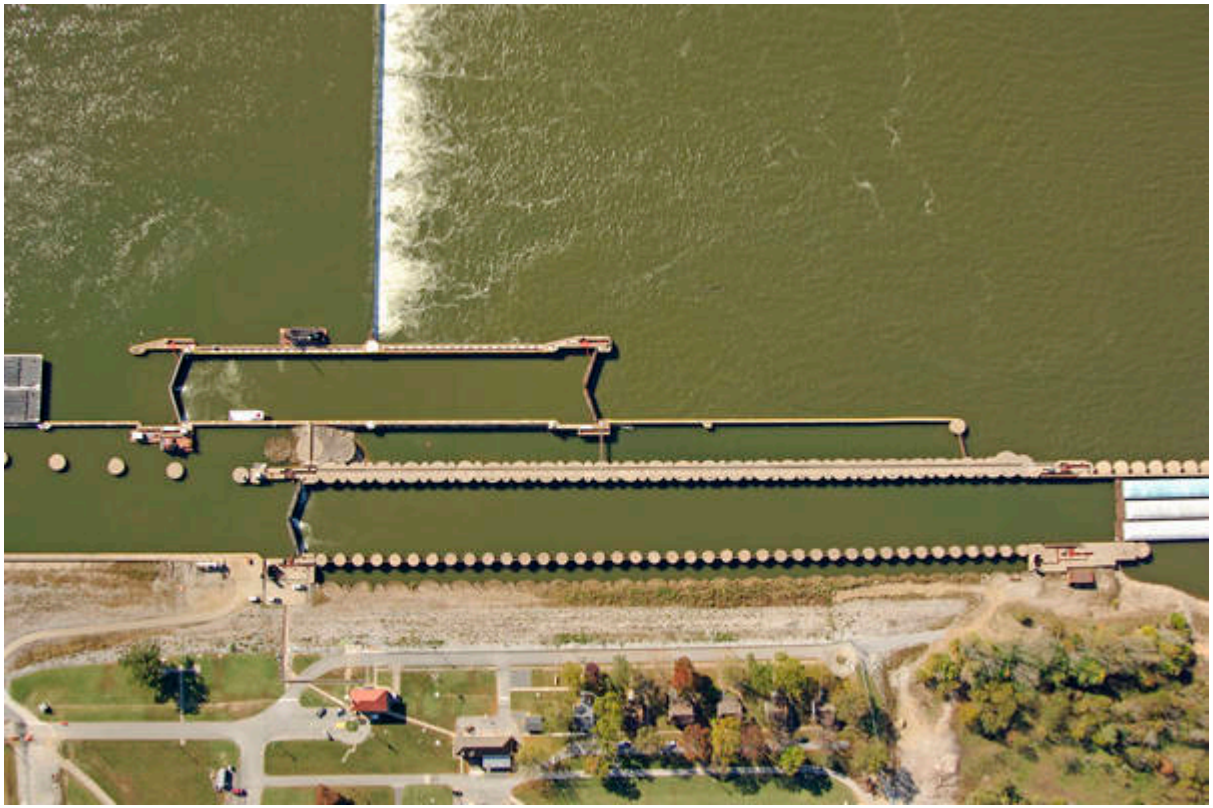
Modern Day Improvements
Lock Chambers – 600 ft to 1200 ft



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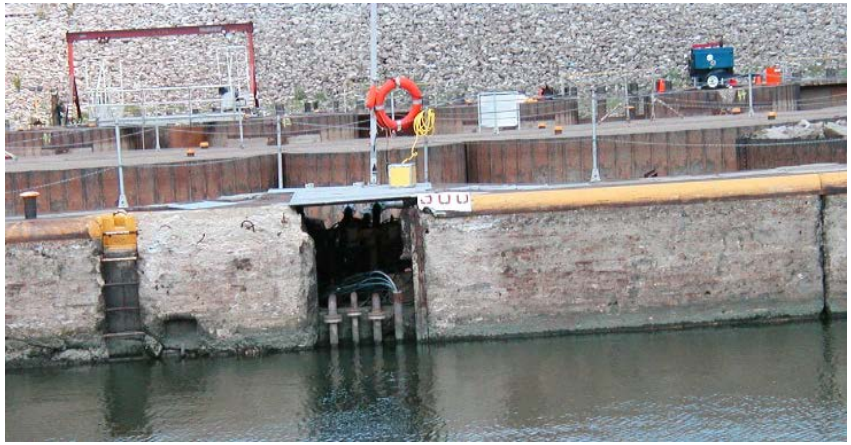
Ohio River - Lock & Dam 52 Beyond Service Life



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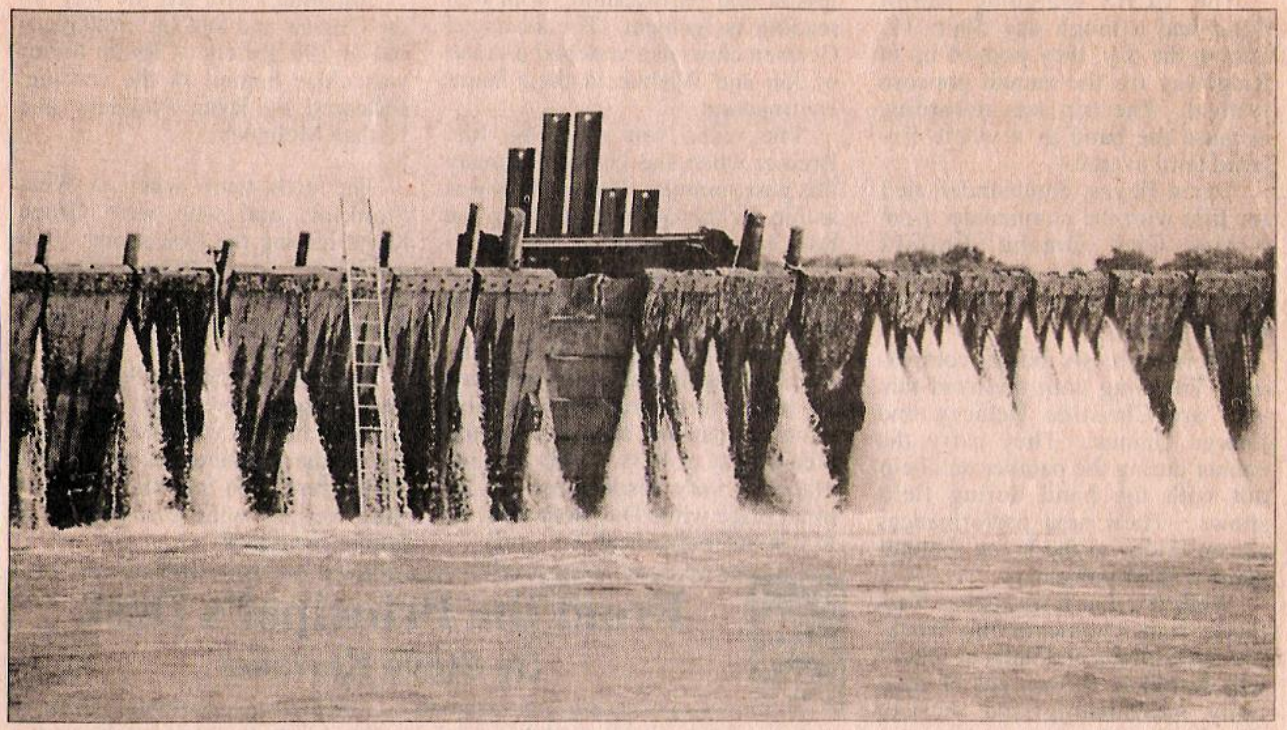
Ohio River - Lock & Dam 52 Beyond Service Life

Page 10A: Metropolis Planet, September 22, 1999



Repairing the wicket

The Lock and Dam 52 is undergoing repairs, according to Lock Master Ron Hall. In the center a missing wooden wicket can be detected. Hall said that every year repairs have to be made to the wickets, which are 20 years old. Repairs must be done, regardless of water levels.

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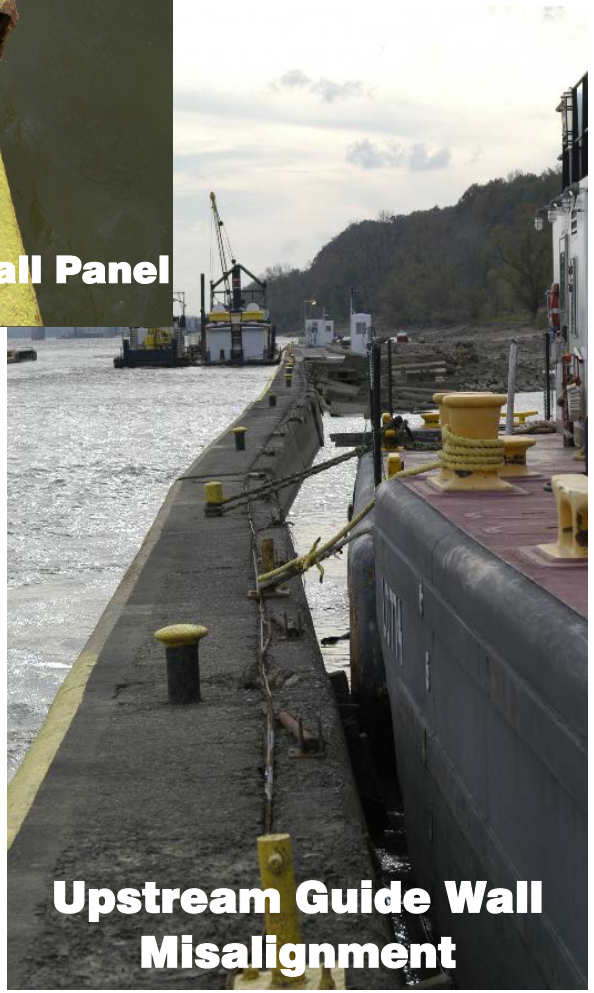
Ohio River - Lock & Dam 53 Beyond Service Life



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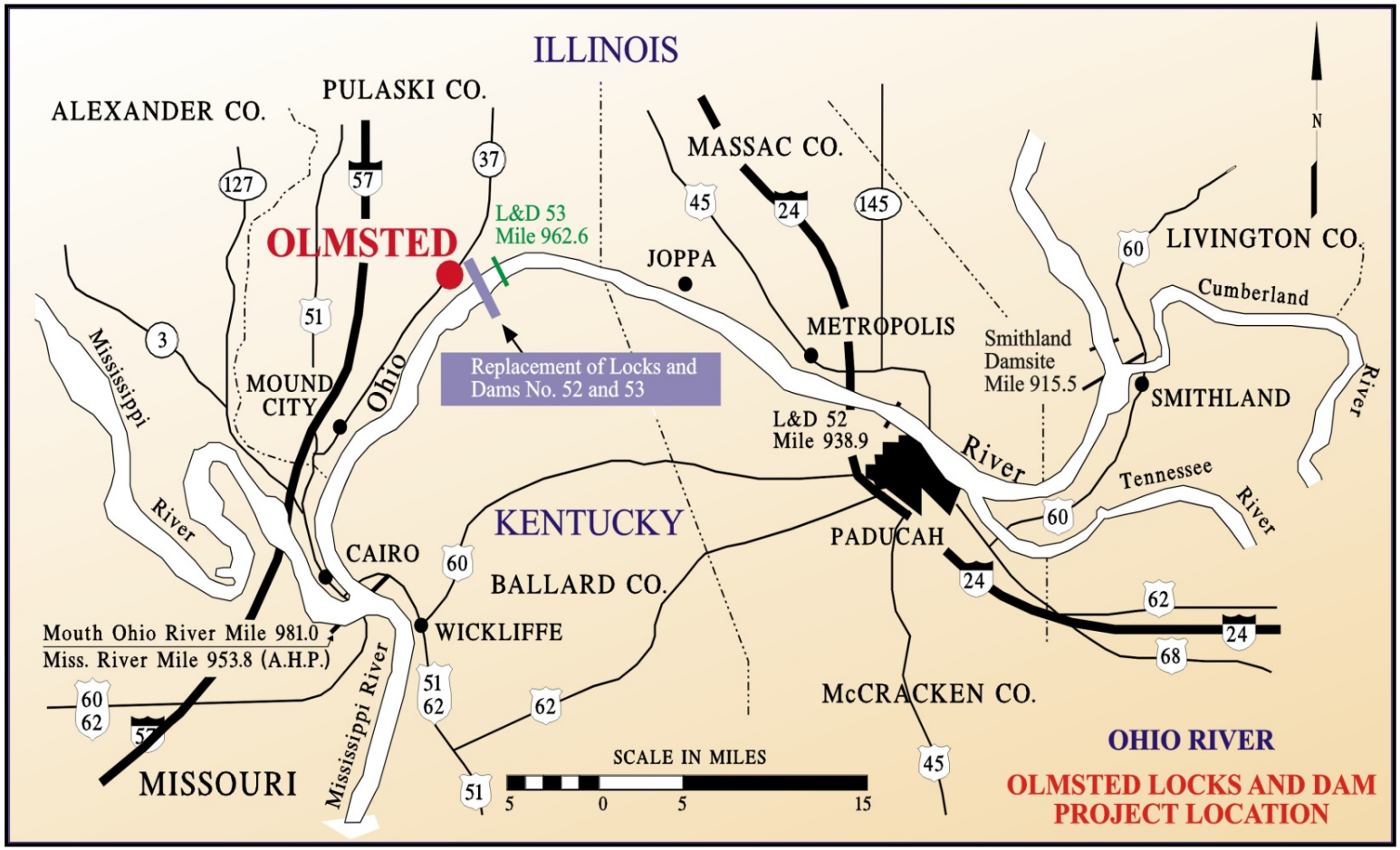
Ohio River – Olmsted Locks & Dam
Importance to the Nation

Major Hub Connecting
Mississippi, Tennessee, Cumberland and Ohio Rivers



Source: USACE

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Ohio River – Importance to the Nation

More tonnage passes this point than any other place in America's inland navigation system.

$22 billion

Most-used locks and dams of the inland navigation system

SITE	LOCATION	RIVER	2015 TONNAGE IN MILLIONS
Lock and Dam 52	Brookport, Ill.	OHIO	80.8
Lock and Dam 53	Grand Chain, Ill.	OHIO	72.3
Soo Locks	Sault Ste. Marie, Mich.	ST. MARYS	69.6
Newburgh Lock and Dam	Newburgh, Ind.	OHIO	69.1
Smithland Lock and Dam	Hamletsburg, Ill.	OHIO	63.7
McAlpine Locks and Dam	Louisville, Ky.	OHIO	62.0
Cannelton Locks and Dam	Cannelton, Ind.	OHIO	61.8
Lock and Dam 27	Granite City, Ill.	MISSISSIPPI	60.3
John T. Myers Locks and Dam	Mt. Vernon, Ind.	OHIO	56.5
Melvin Price Locks and Dam	East Alton, Ill.	MISSISSIPPI	53.7

Source: USACE

Ohio River – Importance to the Nation
Locks & Dams 52 & 53 Condition & Closures

September 6 to November 10, 2017

*~ 19 days of **TOTAL RIVER CLOSURE***

*~ 1,117 tows moving 11,574 barges **DELAYED** 58.83 hours*

*~ 3050 **LOST** boat days*

*~ **$5,000 A DAY** to run a towboat*

*~**3.4 million tons** of capacity out of the system*

$40+million due to delays

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Ohio River – Importance to the Nation
Olmsted Locks & Dam Replacement Project

Annual** Economic Benefits To The Nation **> $640 Million

*Operation and Maintenance Costs **Reduced***

*Barge Traffic Will Move **Faster***

Currently at 52 & 53 – 5 hours

vs.

New Olmsted Locks – 1 hour

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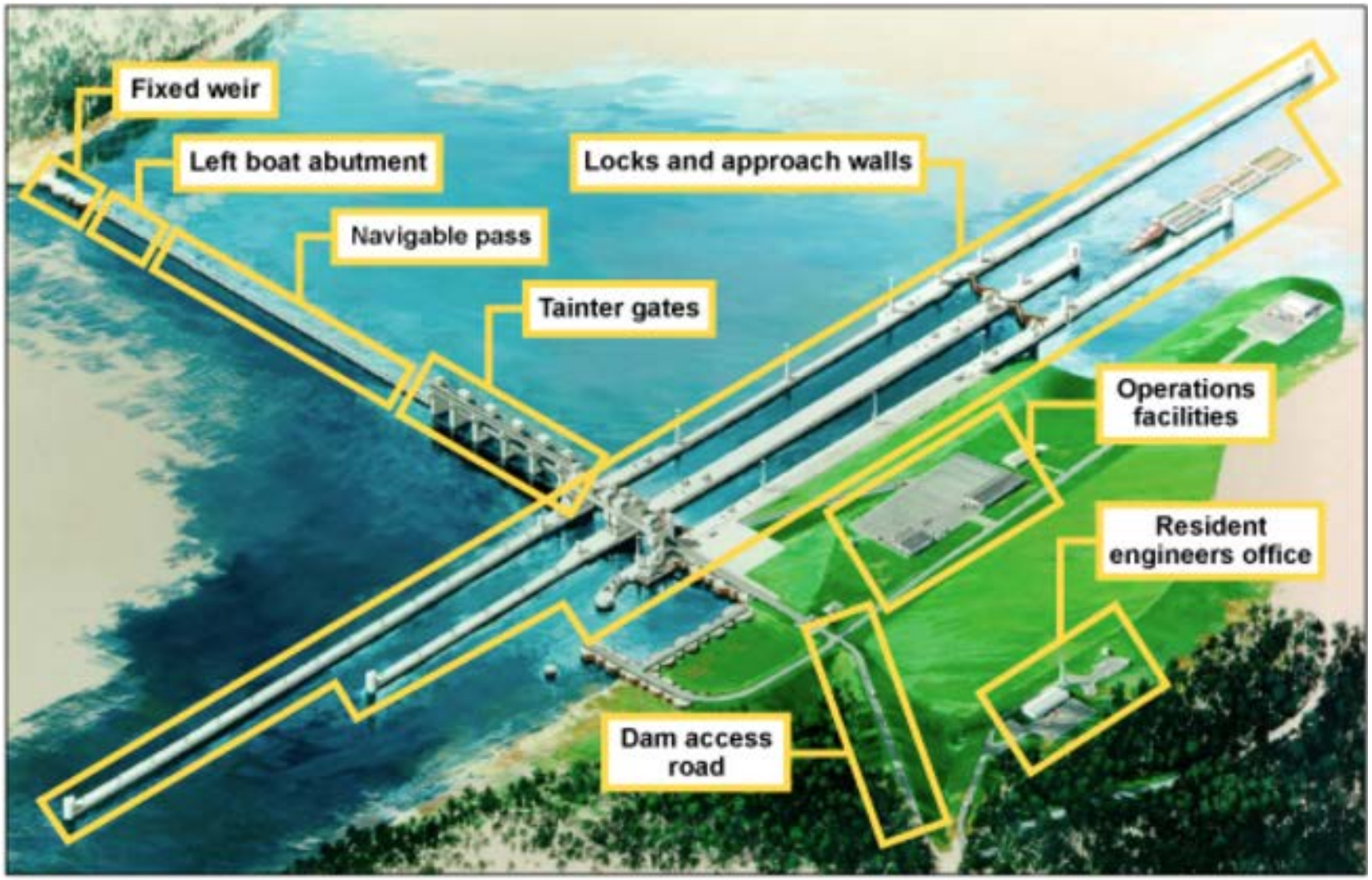
Olmsted Locks & Dams - Components



Source: U.S. Army Corps of Engineers. | GAO-17-147

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Olmsted Locks & Dam Timeline

Construction of Locks 2002

Dam design **Jacobs/COWI** 2002

Dam construction 2004 - present

Dam completion 2018

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Dam Method of Construction
In-the-Dry vs In-the-Wet

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Dam Method of Construction
In-the-Dry

Red River Lock and Dam No. 4
USACE – Vicksburg District

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Olmsted Dam Method of Construction
Lock Construction In-the-Dry

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Olmsted Dam Method of Construction
Lock Construction In-the-Dry

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Olmsted Dam Method of Construction
Lock Construction In-the-Dry

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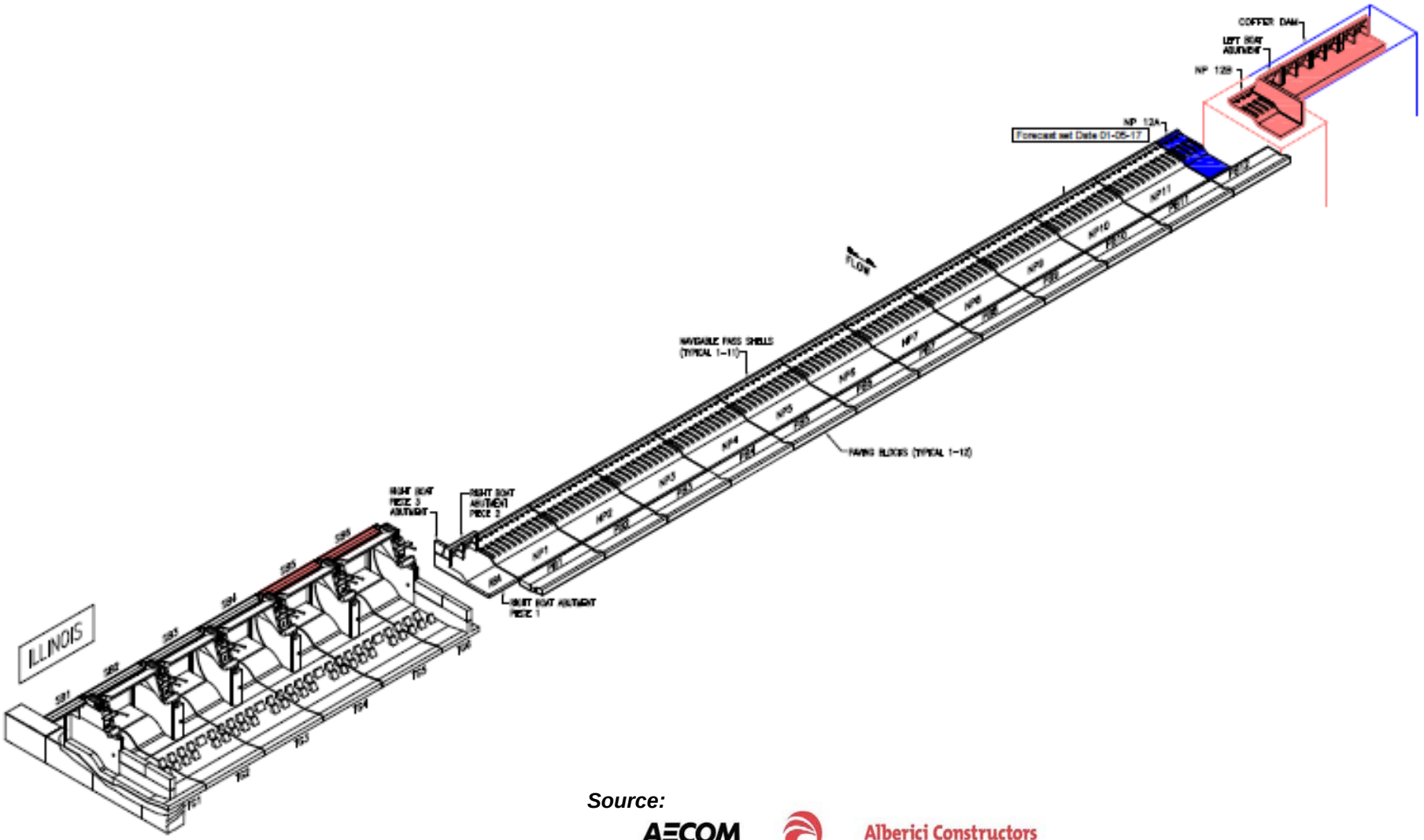
Olmsted Dam Method of Construction
In-the-Wet



Source:

AECOM Alberici Constructors AN ALBERICI ENTERPRISE

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Olmsted Construction Site Overview

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Olmsted Construction Site Overview

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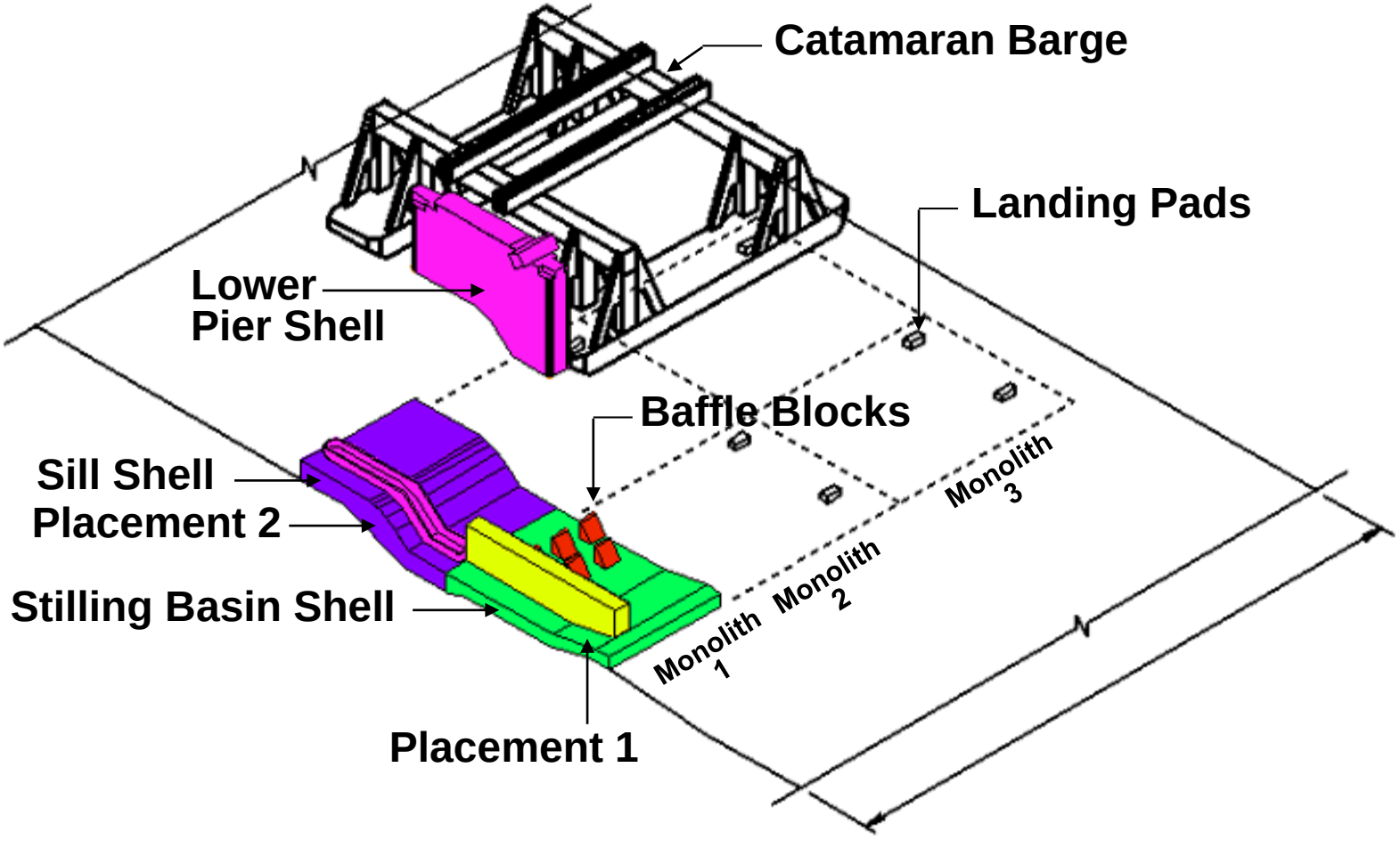
Shell Set Down on River Bottom



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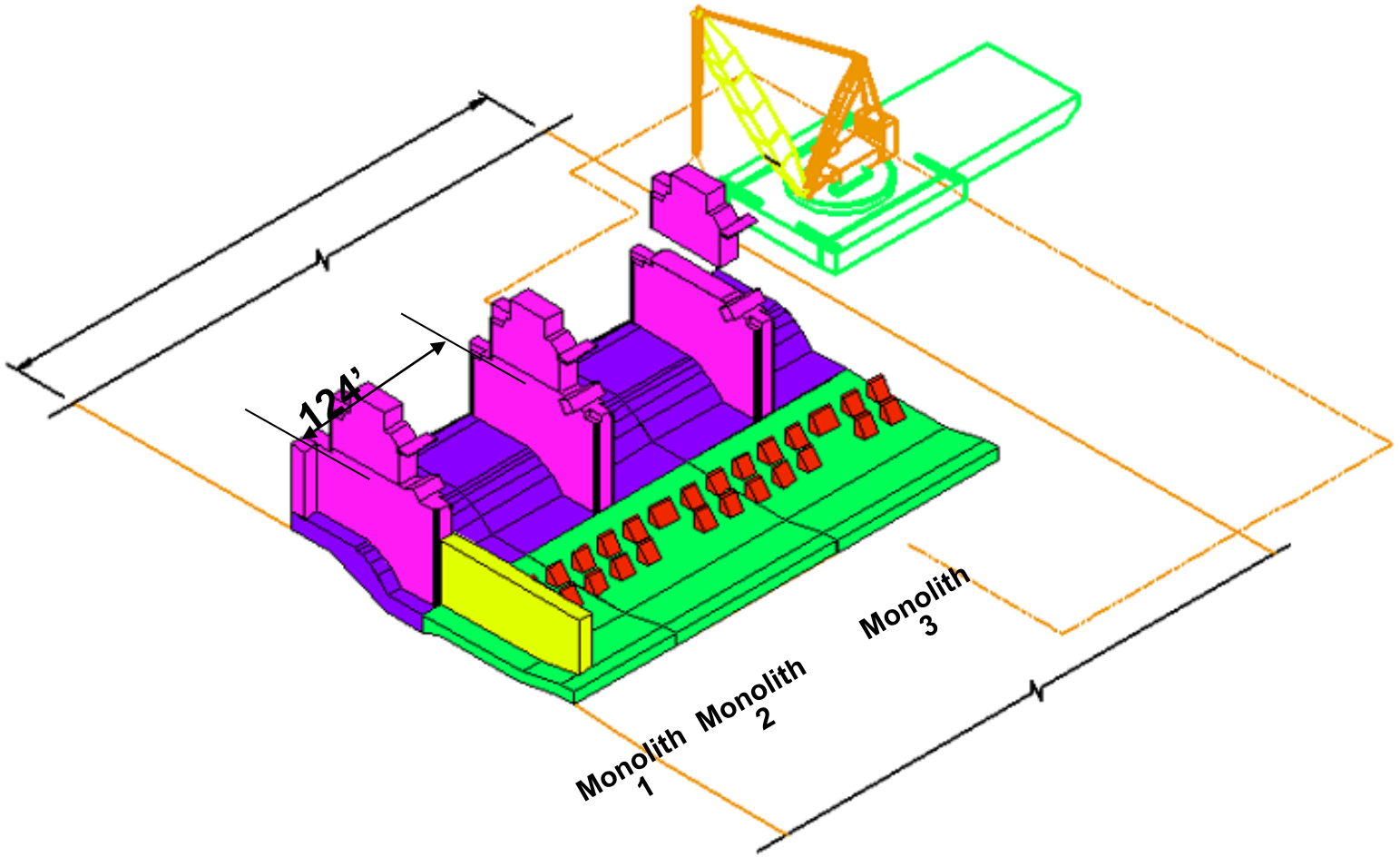
Shell Set Down on River Bottom



Note - Gates not shown for clarity

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Precast Yard – Shell Construction

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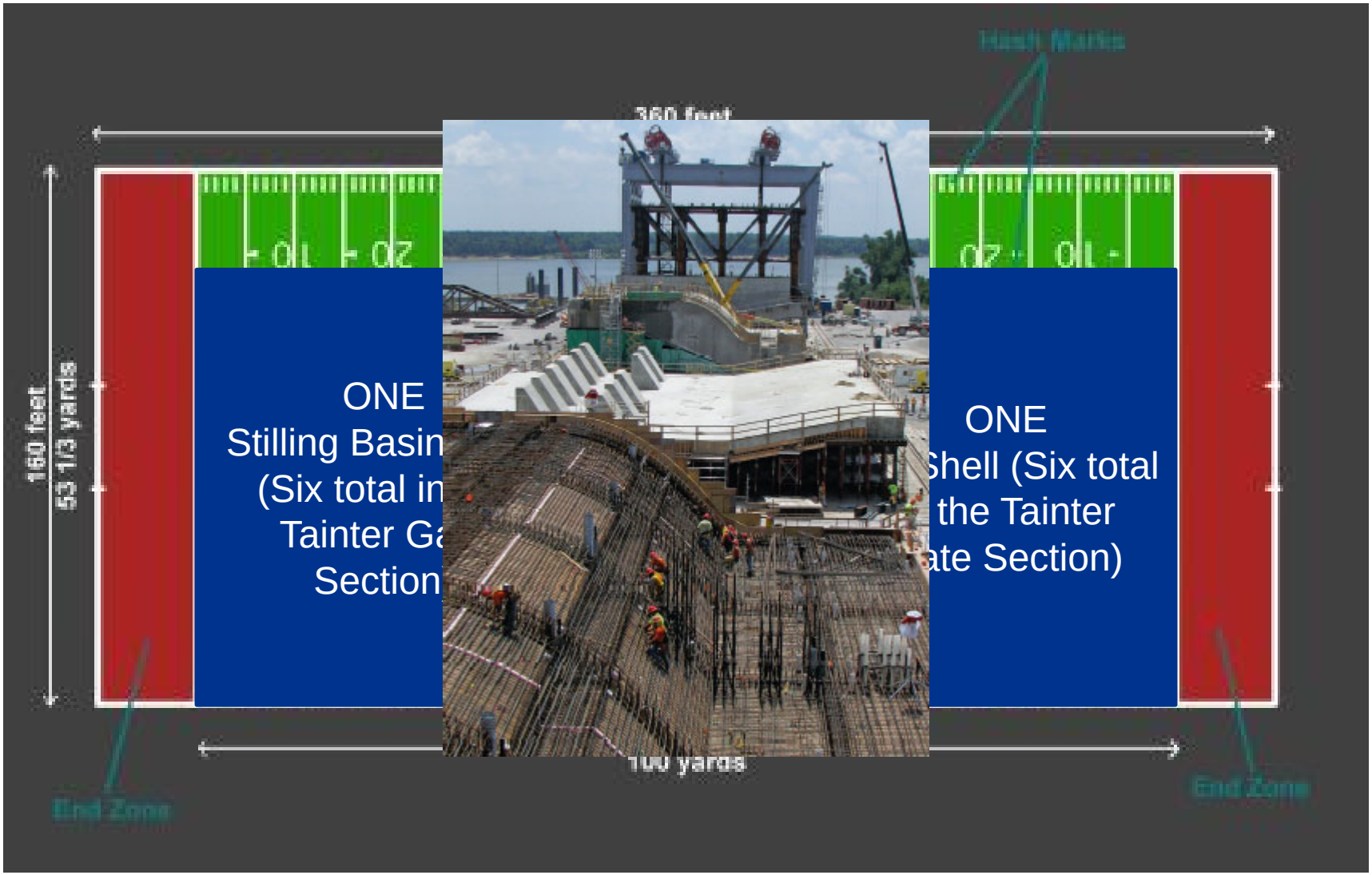
Precast Shell Size



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Precast Shell Size

ONE
Pier Shell
(Six total in the Tainter Gate Section)

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Precast Yard – Sill Shell Lift by Super Gantry Crane

Size - 125’ x 102’ x 30’ tall

Shell Dry Weight - 4100 tons

Shell & Lift Frame – 4900 tons

Shell Submerged Weight - 2600 tons

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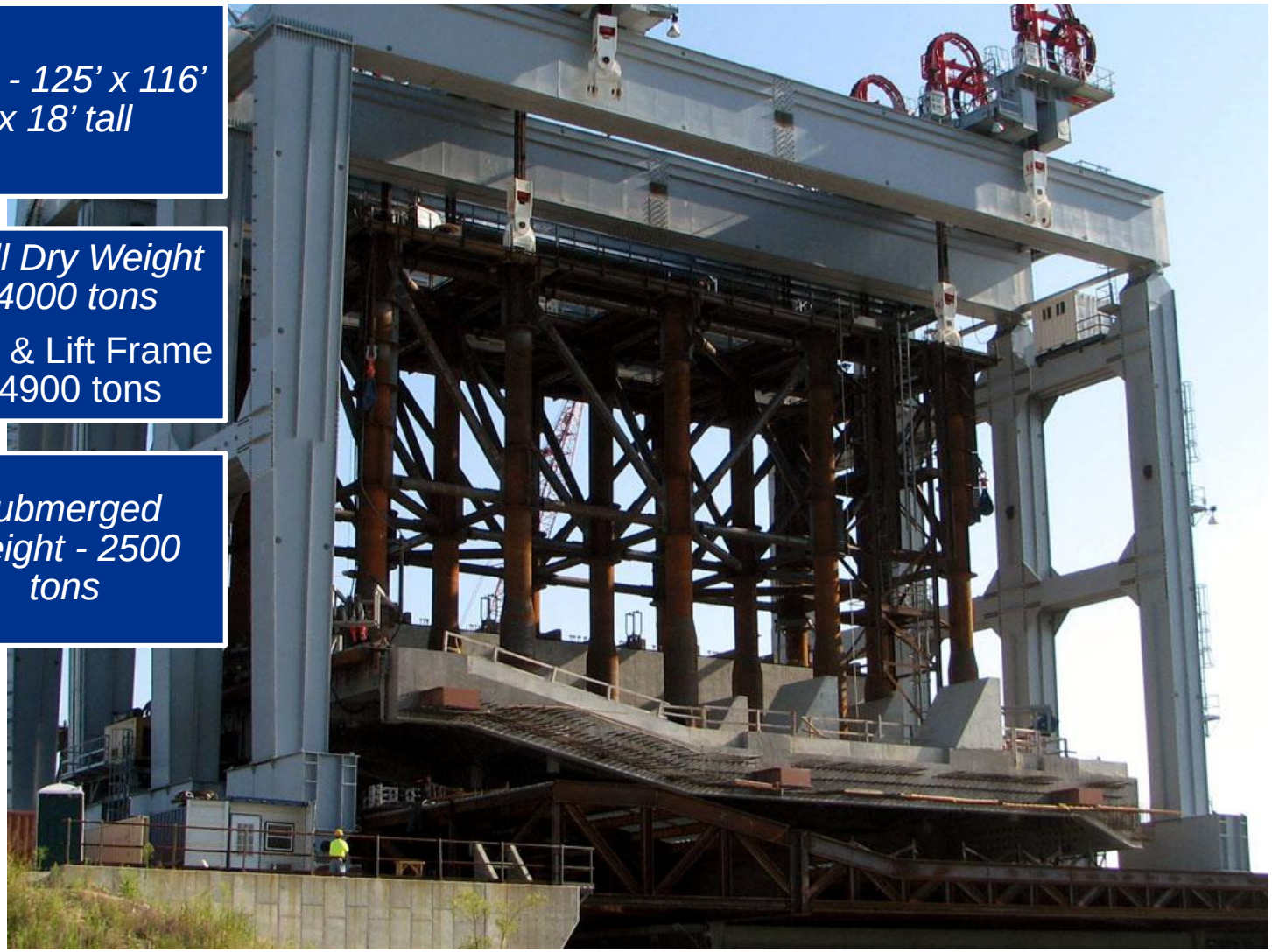
Precast Yard – Stilling Basin Shell Lift by Super Gantry Crane

Size - 125' x 116' x 18' tall

Shell Dry Weight - 4000 tons

Shell & Lift Frame – 4900 tons

Submerged Weight - 2500 tons



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Precast Yard – Lower Pier Shell Construction

Size - 102’ x 69’ tall x 14’ wide

Shell Dry Weight - 2300 tons

Submerged Weight - 1500 tons

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Precast Yard – Lower Pier Shell Lift by Super Gantry Crane

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Cradle Transport Equipment System

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Cradle Transport Equipment System

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Cradle Transport Equipment System

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Tainter Gate Section Construction

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Pier Shell In Place - Prior to Tremie Placement

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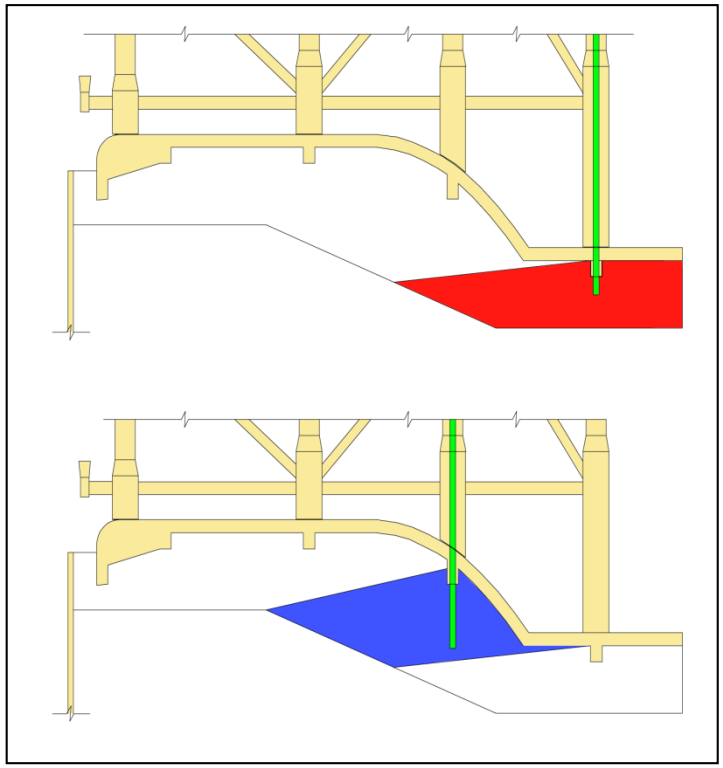
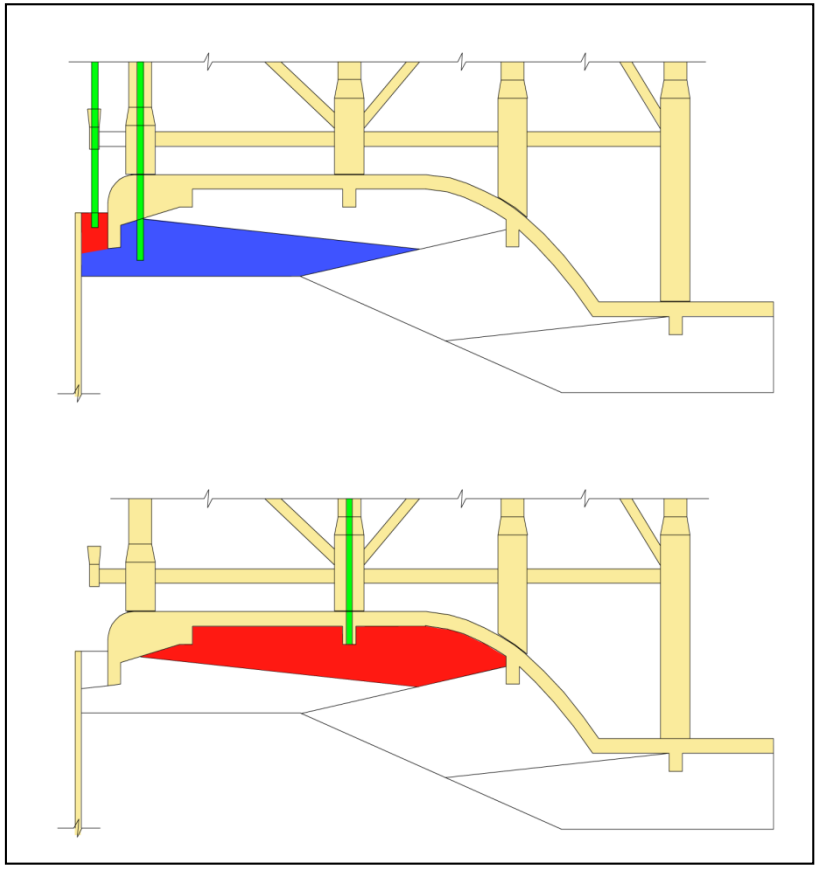
Filling the Shells with Tremie Concrete





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Olmsted Dam Construction – From precast yard to river bed

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Design Considerations – Load Conditions for Shell Design

- *Fabrication & On-Shore Handling*
- *Pick-up and Transport*
- *Set Down In-the-Wet*
- *Tremie Placement*
- *Final Configuration Service Loadings*
  - *Dead Load*
  - *Stream Forces*
  - *Barge Impact*
  - *Gate Bay Dewatering*
  - *Seismic*

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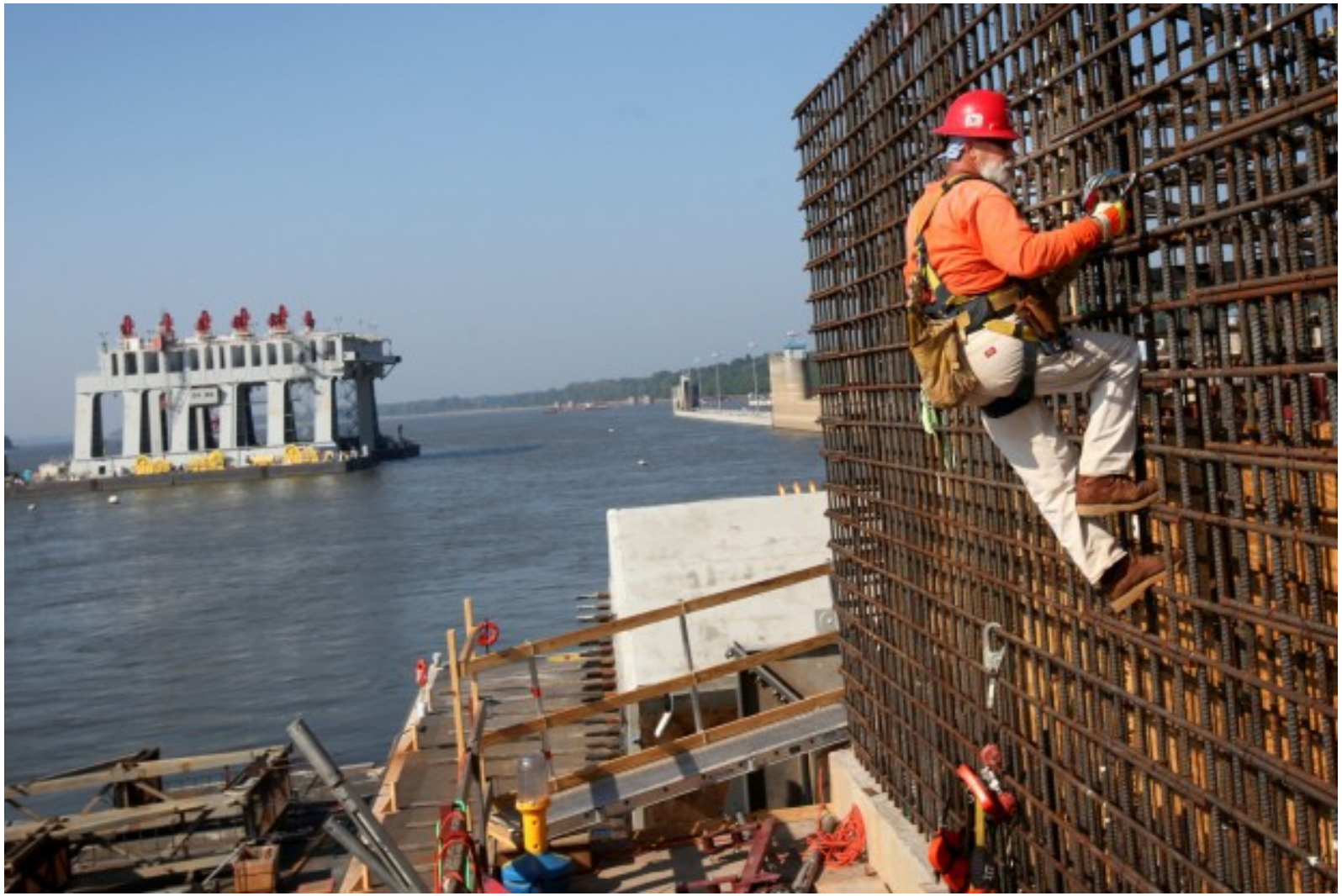
Design Considerations – Method of Construction

- *Dual role for shells: tremie form and flow surface*
- *Shell weight & dimensions critical for sizing marine equipment*
- *Localized loadings on lifted shells*
- *Load reversal in areas of shells*
- *Design for flexure and shear vs. mass concrete*
- *Result: stiffened plate elements, 12” to 24” thick, reinforcing on both faces, dowels for composite action with tremie infill*

Olmsted Dam Tainter Gate Section
Upper Pier Construction



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Tainter Gate Installation

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Tainter Gate Installation

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Tainter Gate Installation

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Tainter Gate Installation

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Olmsted Dam Navigable Section
Wicket Gates

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Olmsted Dam Navigable Section
Wicket Gates

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Olmsted Locks & Dam Project – A Heritage in Transportation

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Thank you!

Sharon Hoffmann

March 17, 2018

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