US Army Corps of Engineers
Louisville District

J.T. Myers Lock Improvements Project

Infrastructure Conference

St. Louis

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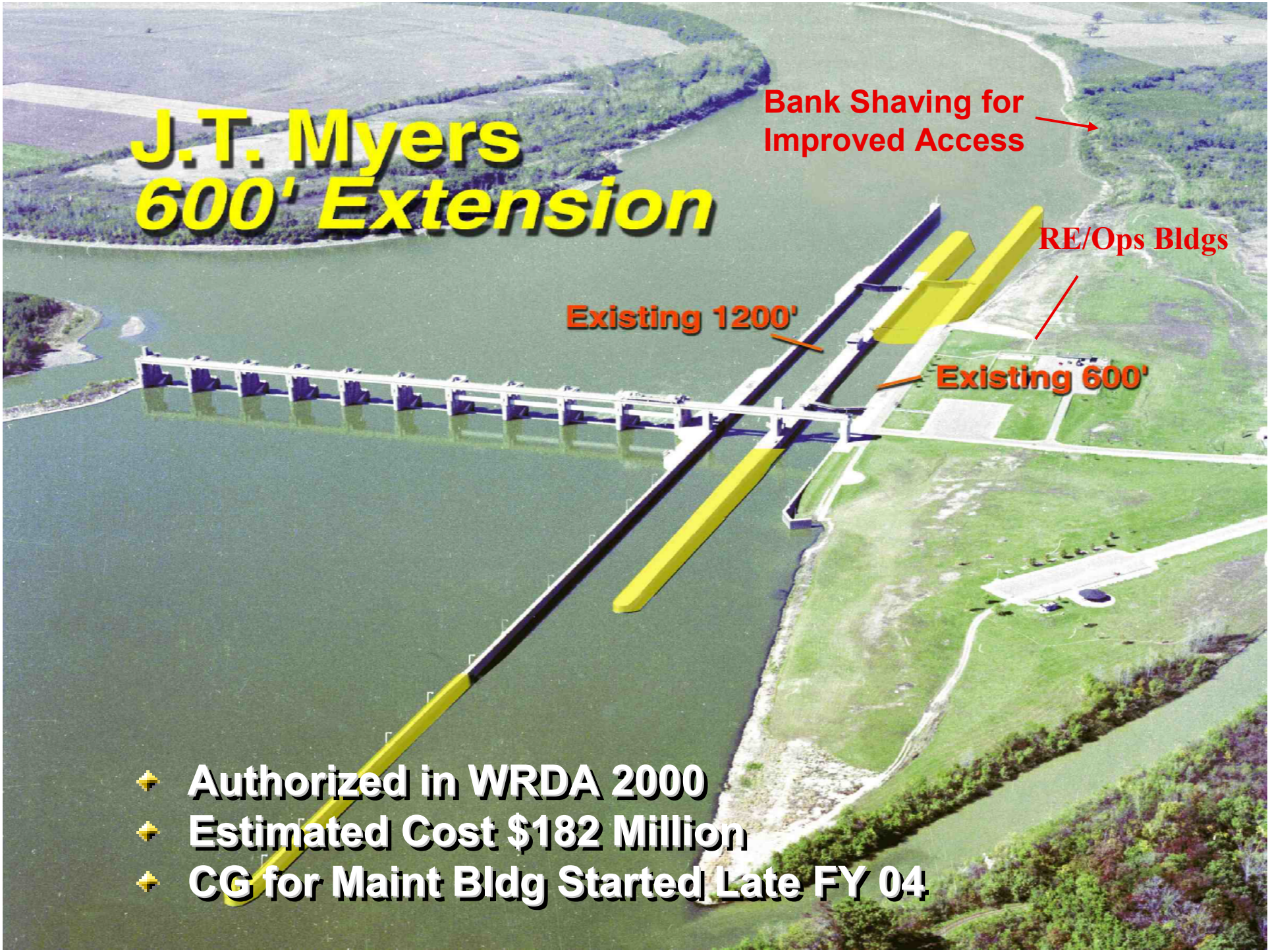

J.T. Myers
600' Extension
Bank Shaving for
Improved Access
RE/Ops Bldgs
Existing 1200'
Existing 600'
Authorized in WRDA 2000
Estimated Cost $182 Million
CG for Maint Bldg Started Late FY 04

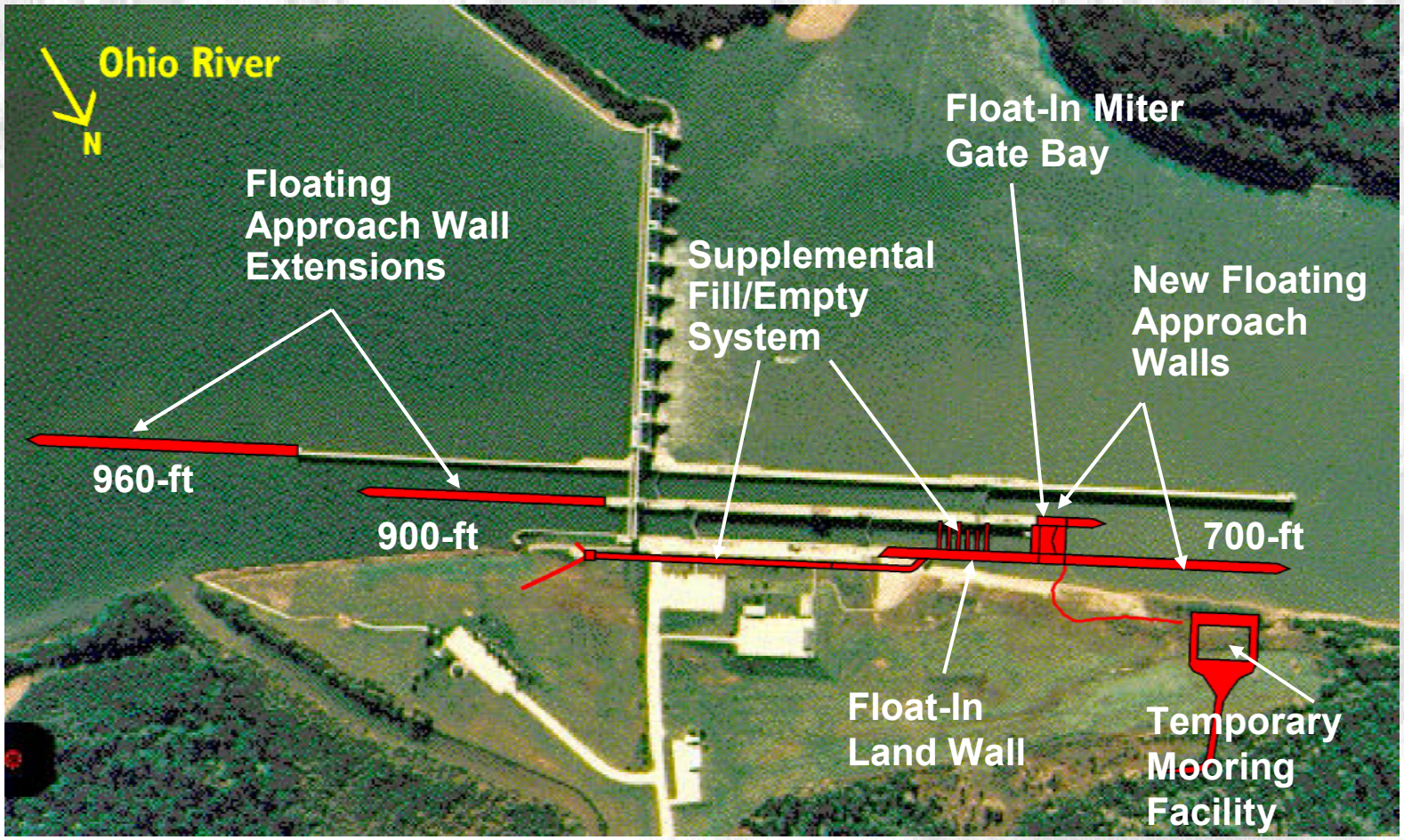
J.T. Myers Locks Improvements Project

Major Project Features As Authorized

- ***Extend Auxiliary Chamber to Nominal 1200-ft Length***
- ***Supplemental Wrap Around Filling/Emptying System for Extended Auxiliary Chamber***
- ***Approach Wall Modifications***
  - Floating extensions to upstream walls
  - New lower middle and land floating walls
- ***Shave Downstream Bank for Improved Access***
- ***New Miter Gates for Extended Chamber, Existing Lower Auxiliary Gates Rehabilitated and Serve as Project Spares and MG Storage Pier***
- ***Aquatic Mitigation Features***

J.T. Myers Locks Improvements Project

Major Lock Features of Authorized Project



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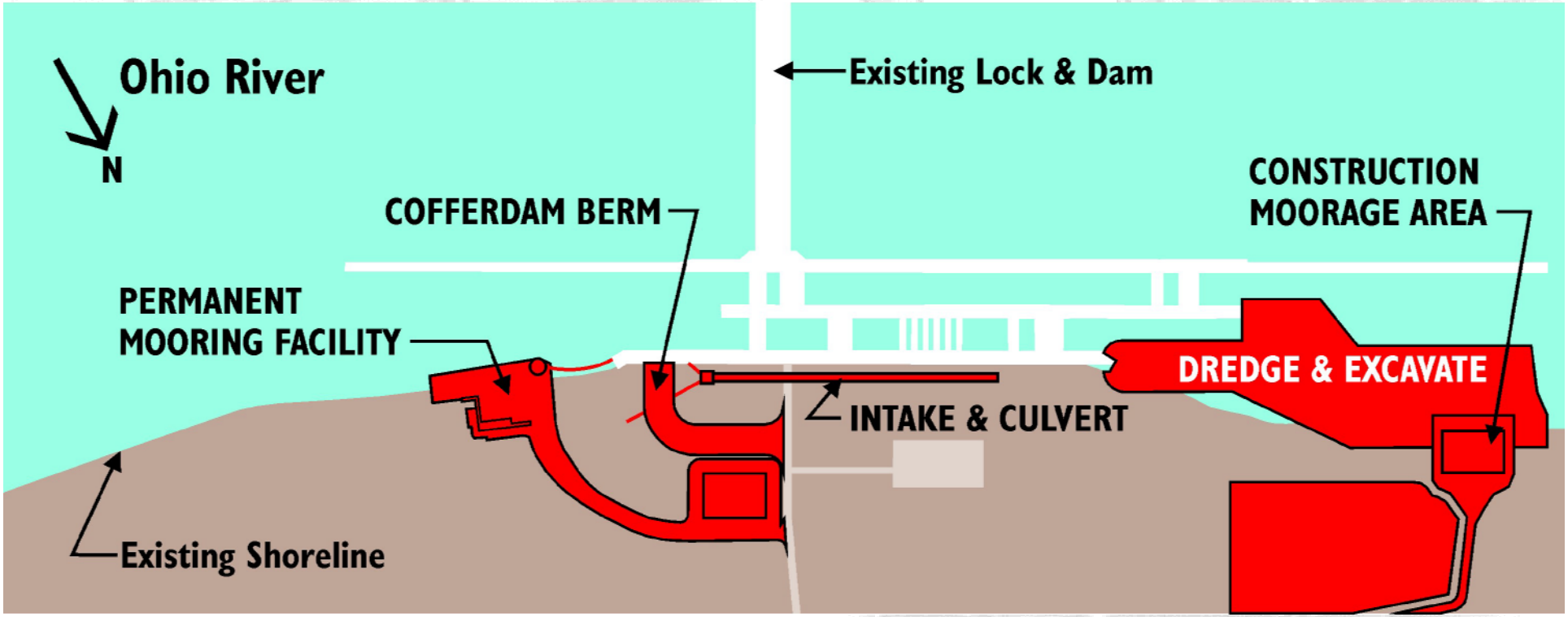
Innovations Associated with Authorized Project

- ***Auxiliary lock extension provides opportunity to improve project capacity while minimizing construction costs and schedules***
- ***Lock extension designed for float-in/lift-in technology***
  - Eliminates need for cofferdam
  - Reduces interference with main chamber traffic
  - Opportunity to open auxiliary traffic in an emergency
- ***Approach wall extensions utilize floating walls***
  - Allows for most construction off-site and out of way of river traffic
  - Reduces cost compared to fixed wall alternatives

Construction Sequence
Stage - 1



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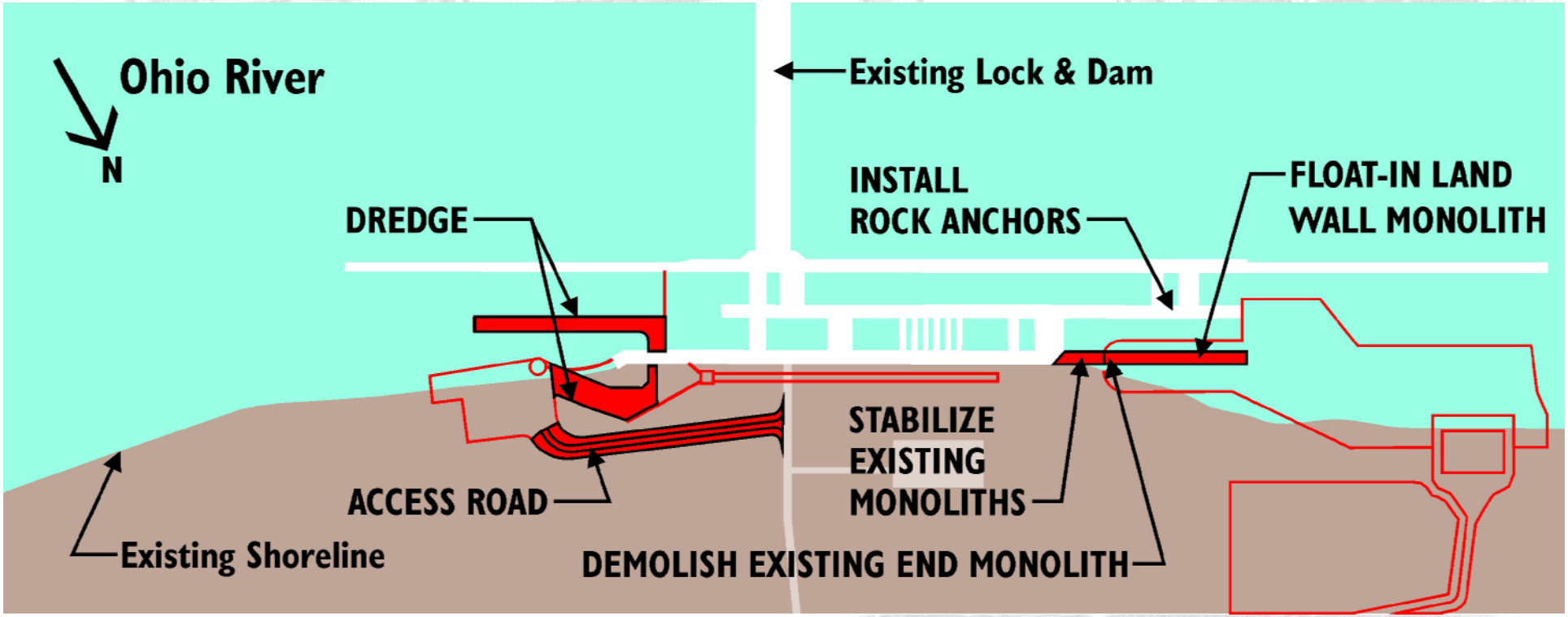
Construction Sequence
Stage - 2



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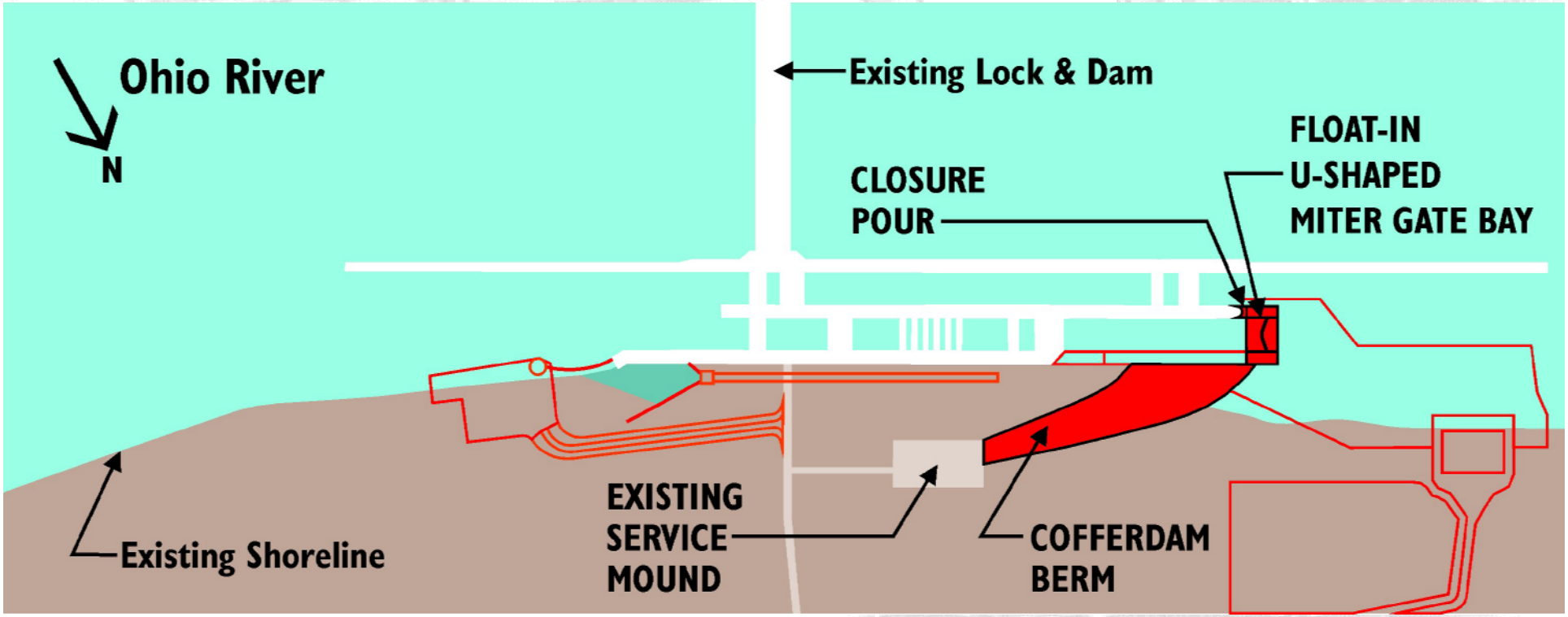
Construction Sequence
Stage - 3



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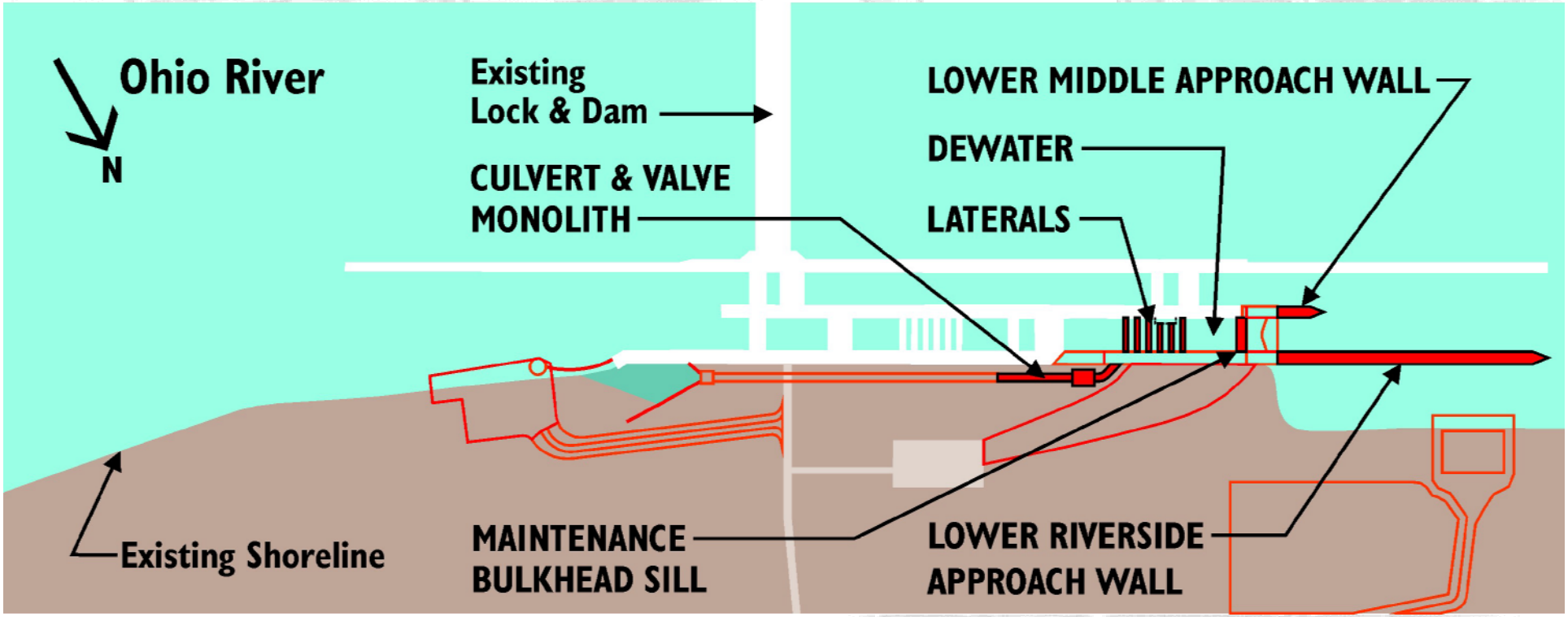
Construction Sequence
Stage - 4



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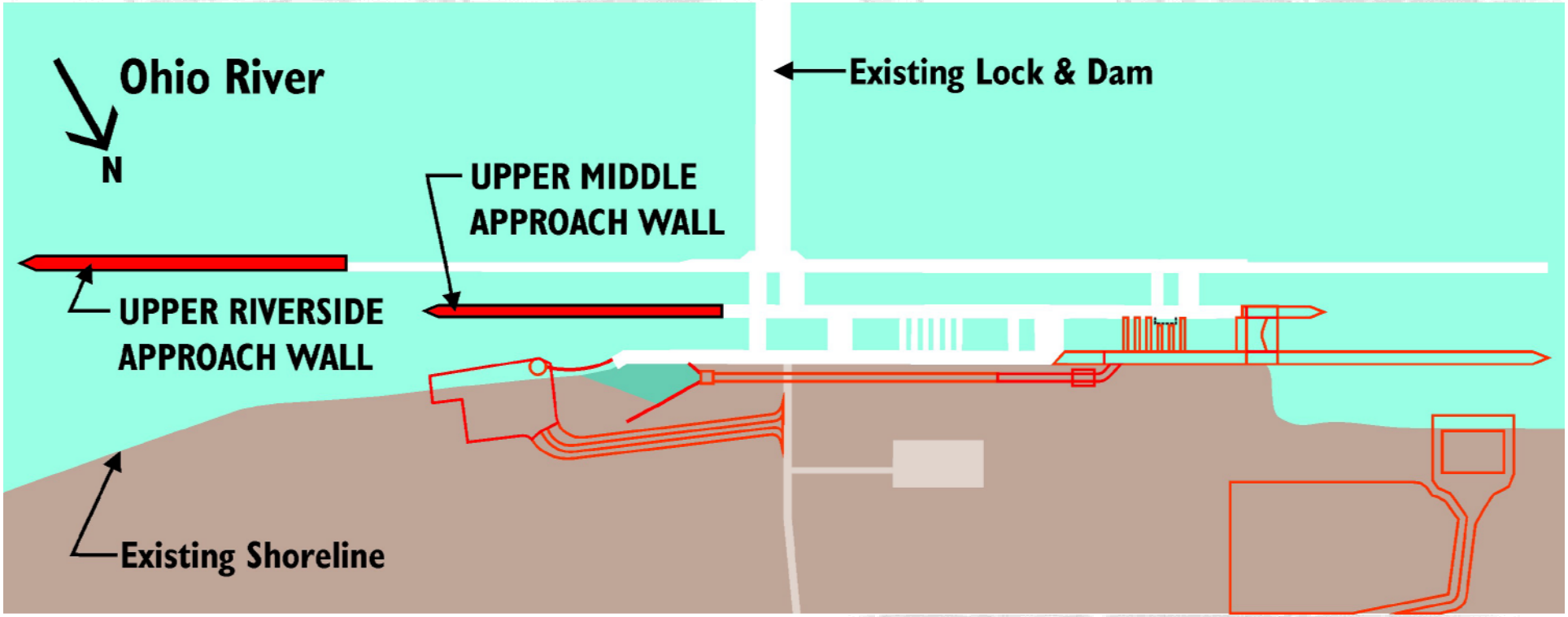
Construction Sequence
Stage - 5



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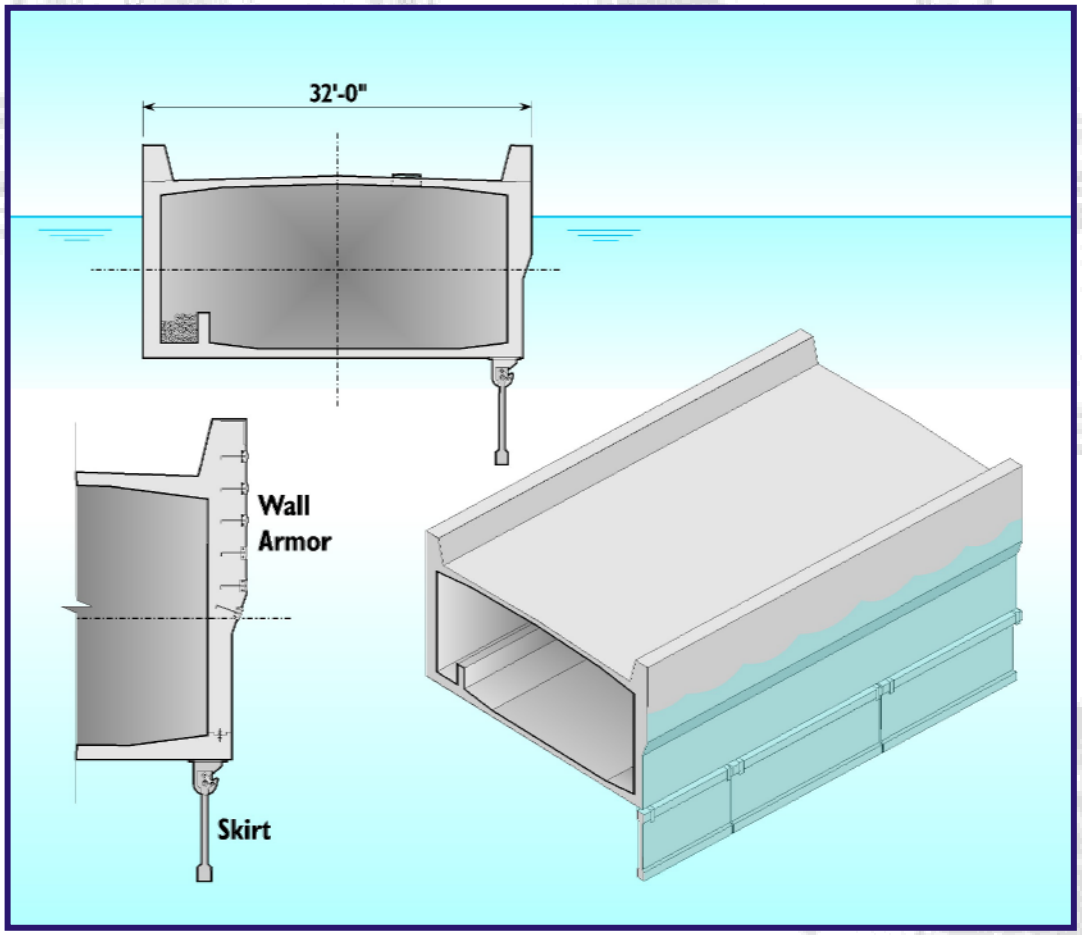
Currently Based Upon Olmsted Design



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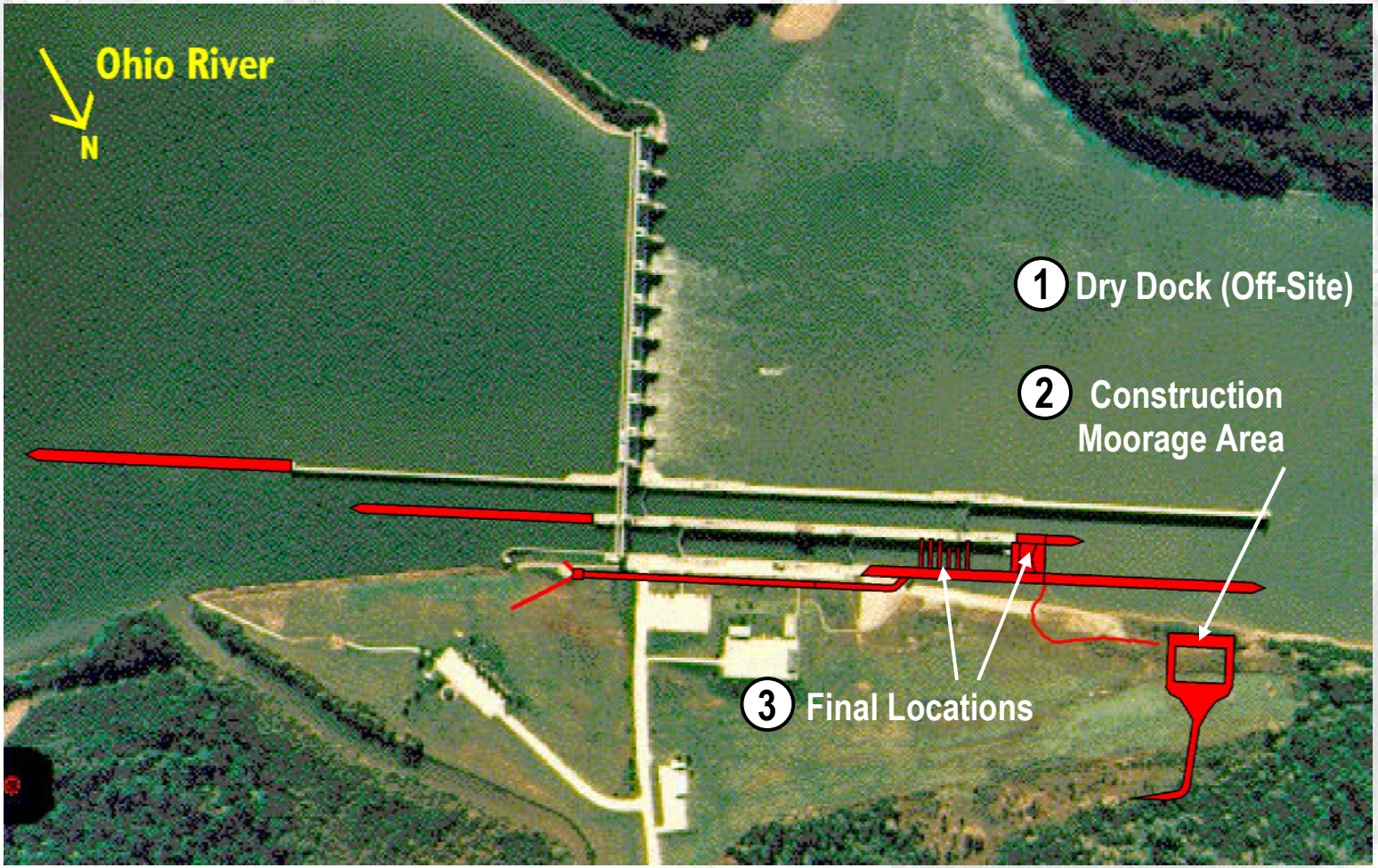
Construction Sequence for Authorized Project



John T. Myers Locks Improvements Project

Recent Changes to Authorized Project

J.T. Myers Locks Improvements Project

Changes from Authorized Project

- *Authorized Project Was Fairly Conservative with Respect to Supplemental F/E Systems and Approach Wall Extensions*
- *Investigate More Economical Ways to Extend Auxiliary Lock Chambers for Other Sites (ORMSS)*
- *Improved Designs During PED*
- *Use of Physical Hydraulic Models Originally Funded Through ORMSS then Turned Over to J.T. Myers Project*

J.T. Myers Locks Improvements Project

Opportunities for Additional Savings

- ***Authorized Project Rough Cost Breakdown***
  - 1/3 Land Wall Extension and Miter Gate Bay
  - 1/3 Wrap Around Supplemental Culvert
  - 1/3 Floating Approach Walls and Extensions
- ***Use of Physical Hydraulic Models at WES***
  - Investigate alternative F/E systems (1:25 Scale)
  - Investigate approach conditions for various configurations of approach walls (1:100 Scale)
  - Investigate need for bank shaving on both approaches (1:100 Scale)
- ***Lock Panel Evaluation by Team of Experts***
  - Float-in Gate Bay vs, Conventional Construction
  - Float-In Monolith vs. Convention Cast In Place

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Features of Alternative F/E System

- ***Provide supplemental system for lower end***
- ***Investigated multiple configurations***
  - Utilize only the existing system (potentially unsafe)
  - Extend existing system to lower end (very slow)
- ***Filling provided by twin "slender" triple box culverts through existing upper miter gates sill and over top of existing upstream lateral field***
- ***No butterfly valves (reverse tainters in new wall)***
- ***New downstream lateral field for distribution***
- ***Landside diffuser below floating lower guide wall***

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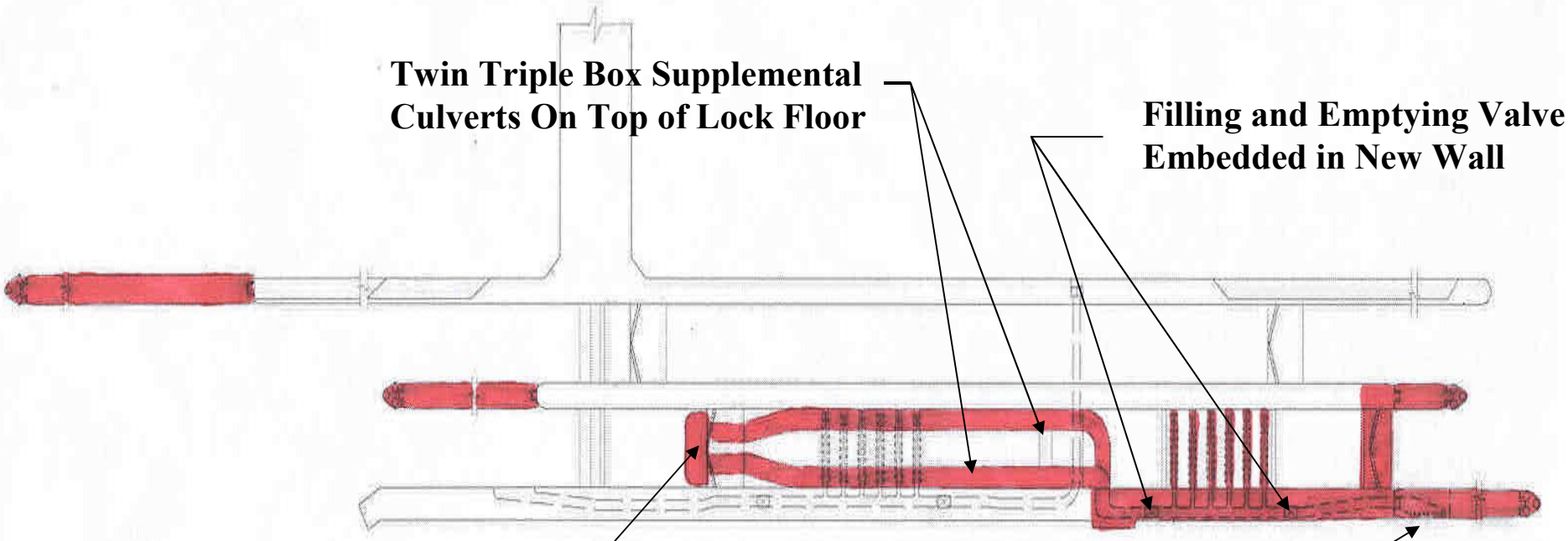
Features of Alternative F/E System



New Project Features Shown in RED

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1:25 Filling and Emptying Hydraulic Model

- ***Physical 1:25 scale model test new F/E system***
- ***Model originally started to investigate more economic F/E systems***
- ***Model under went three series of modifications for testing in the 1:25 F/E model***
  - Extension tested using existing system only (unsafe/slow operation)
  - Type 1 design the individual culverts each measured 4'-6" high x 8'0" wide with 11'-6" minimum clearance (good performance but high hydraulic losses)
  - Type 2 modification dropped culvert top to 12-6" minimum clearance and increased opening to 5'-6" high. This provided very good performance with reduced hydraulic losses)

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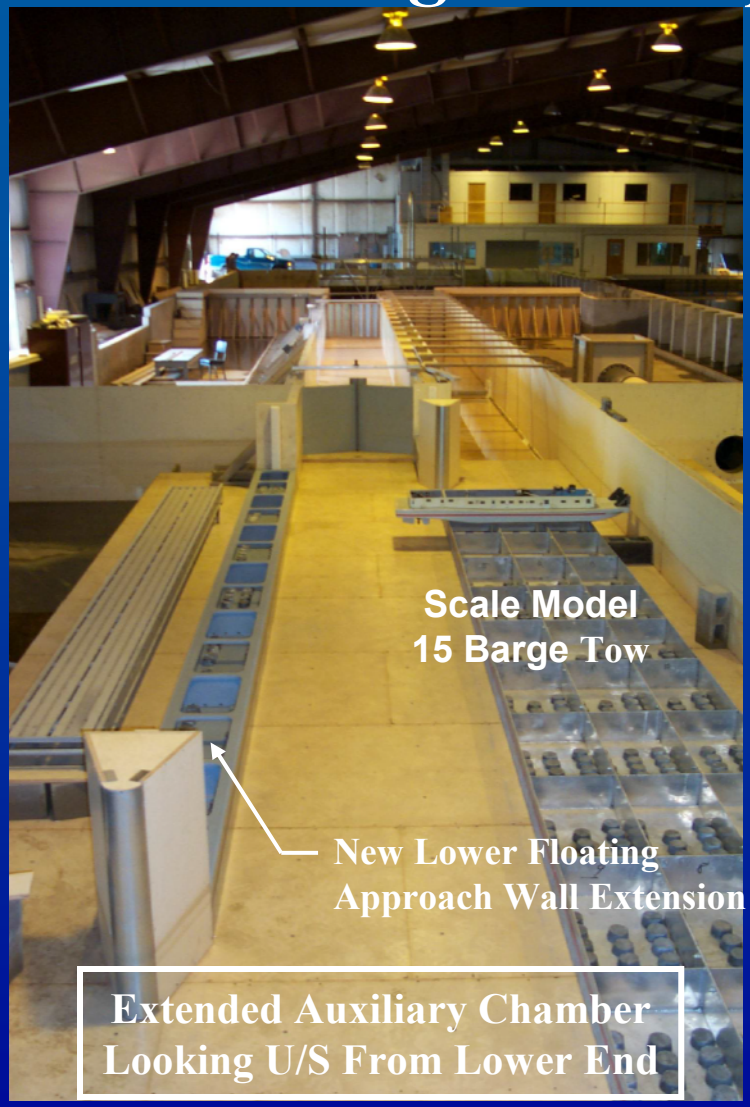
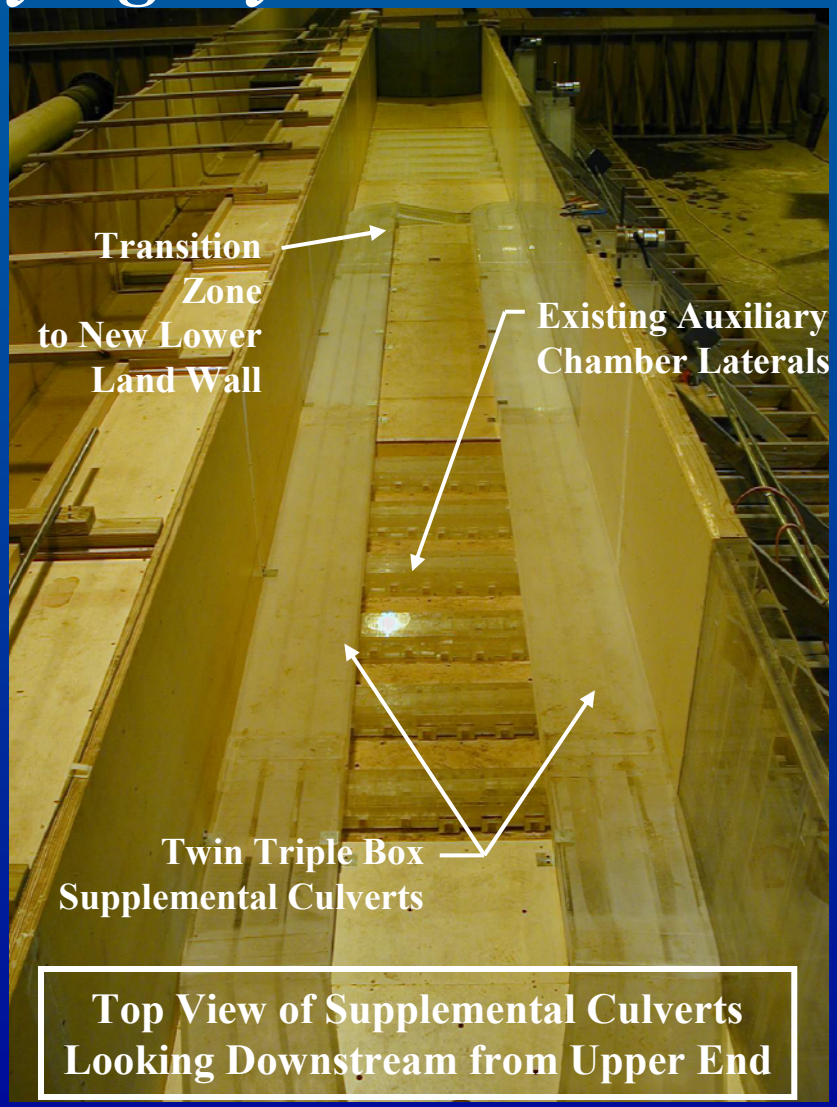
1:25 Filling and Emptying Hydraulic Model



Extended Auxiliary Chamber
Looking U/S From Lower End



Top View of Supplemental Culverts
Looking Downstream from Upper End

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1:25 Filling and Emptying Hydraulic Model

Thru-the-Sill Intake

Now 70’ U/S of MG Sill

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Information Gathered From 1:25 F/E Model

- ***Chamber filling and emptying times***
  - Fills in approximately 11 minutes. Empties in 8 minutes.
- ***Hawser forces in the extended lock chamber***
  - All hawser forces below 5 tons for above times
- ***Barge clearance and tow squatting issues at minimum pool elevations that leave 12.5' of clearance (13.5' over 90% of the time)***
- ***Tow processing speeds in and out of lock chamber during minimum pool levels***
- ***Barge performance and hawser forces in lower approach with landside diffuser***

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New 1:25 Outlet Diffuser & Lower Approach Model

- J.T. Myers 1:25 F/E model was turned over to the Huntington District for modeling on Greenup
- Unresolved issues associated with lower approach and the outlet diffuser performance
- New 1:25 outlet diffuser and lower approach model for J.T. Myers constructed to address unresolved issues
- New model utilized flume previously occupied for Braddock Dam
- Model will assist both LRL (J.T. Myers) and LRH (Greenup) with design of outlet diffusers

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New 1:25 Outlet Diffuser & Lower Approach Model

Diffuser Design from Authorized Project

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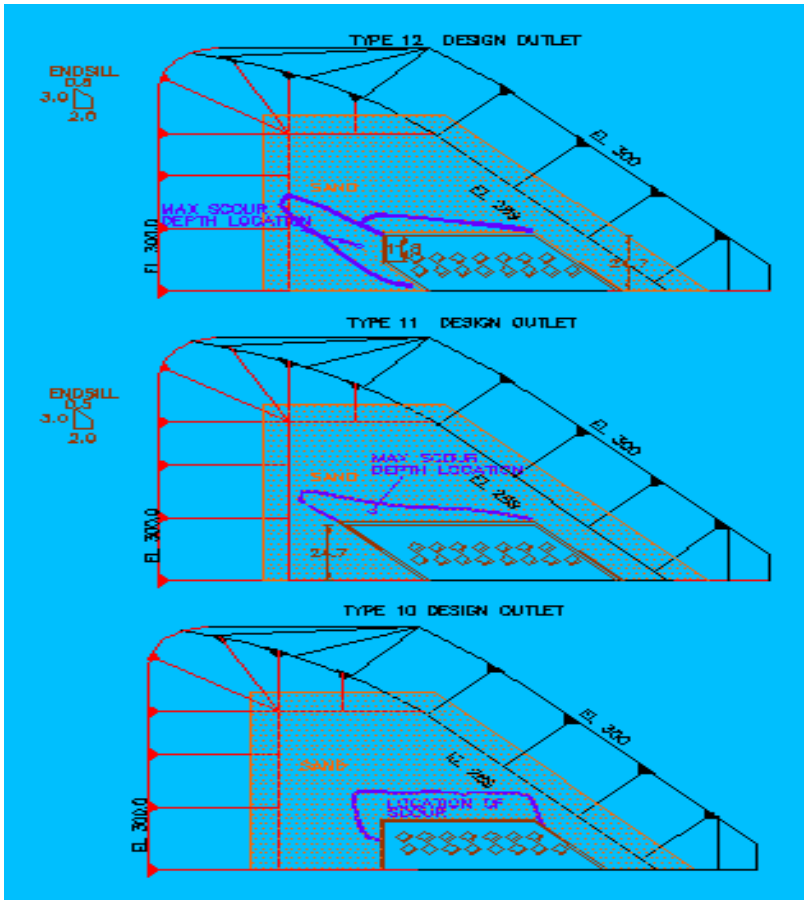
1:25 Outlet Diffuser Model Changes



- Diffuser with baffle block system to break jet
- Realignment of port outlet to redirect and distribute flow
- Riprap around diffuser area for scour protection
- Reshape bank line around diffuser area
- Comparison between floating and fixed walls in lower approach

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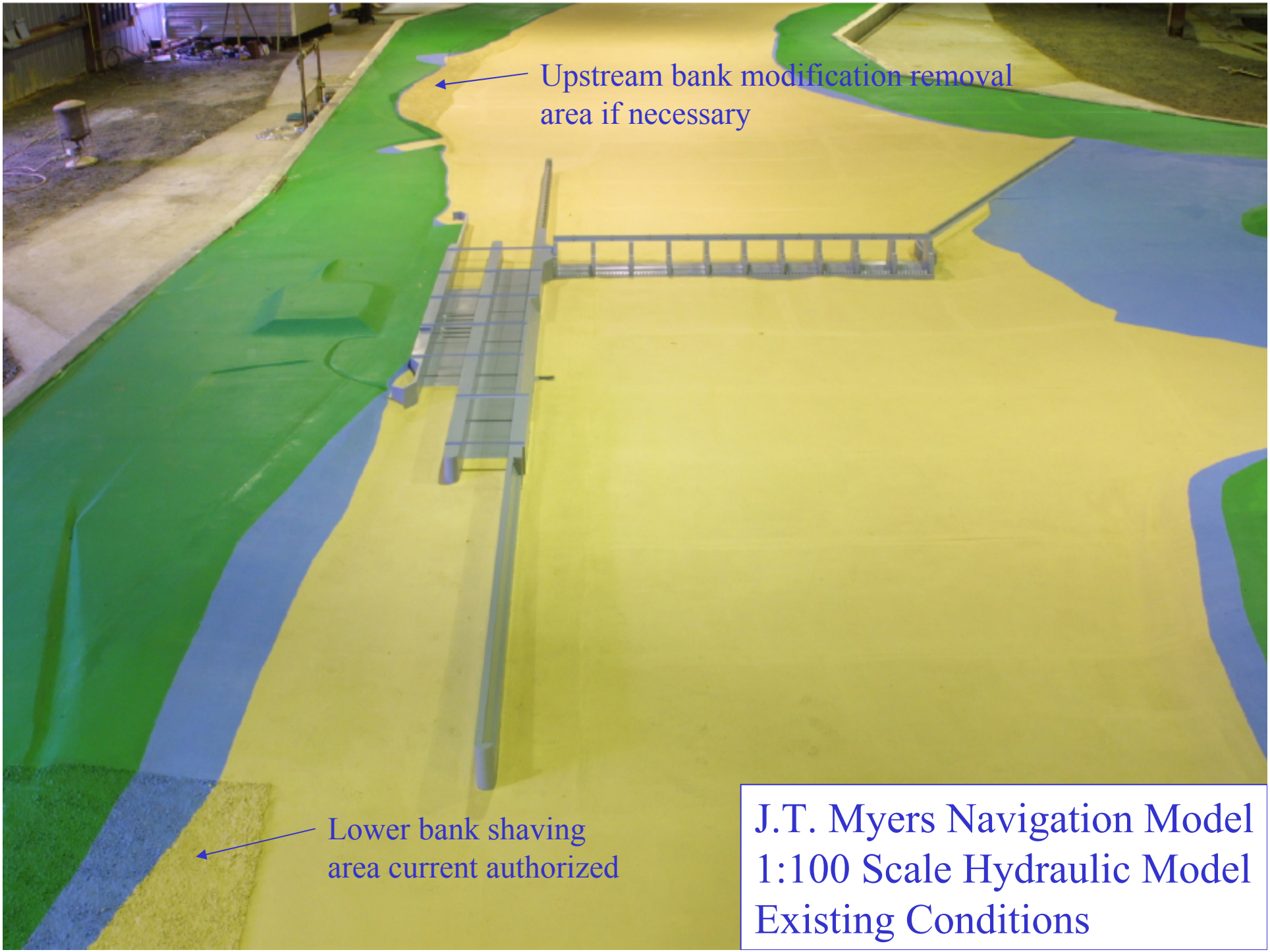
Navigation Model – Existing Conditions

- Physical 1:100 scale model to test approach conditions associated with new configuration
- Model limits are approximately 2-1/2 miles upstream and 2 miles downstream of the dam
- Effects of fixed weir and Wabash Island included in the island by splitting flow down main channel
- Utilizing cameras and digital mapping to calibrate tow tracks, speeds, etc...



J.T. Myers Navigation Model
1:100 Scale Hydraulic Model
Existing Conditions

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Navigation Model – Existing Conditions

- ***Initial tests were done to calibrate the model to the existing conditions in terms of flows, approach conditions, and tow movements***

- ***Industry brought down to ensure model was calibrated to existing conditions***

- ***Five flow conditions calibrated in model***
  - 32,700 cfs (11 feet dam opening) – 17’ pool differential
  - 160,000 cfs (80 feet dam opening) – 9’ pool differential
  - 295,000 cfs (200 feet dam opening) – 2.5’ pool differential
  - 360,000 cfs (dam all open) headwater at top fixed weir
  - 636,000 cfs (dam all open) headwater near top of walls

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Navigation Model – Improvement Features

- ***Multiple variations in approach wall lengths tested for all approach walls and extensions***
  - 100-ft segments tested to determine optimal configuration for approach conditions
  - Industry consulted on final configuration for wall lengths
- ***Bank shaving requirements investigated on both the upstream and downstream approaches***
  - Originally planned for only lower approach
  - Model tests revealed need along upper bank line with reduced amounts on lower end

1:100 Navigation Model Testing

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Navigation Model – Improvement Features

- ***Approach Wall Lengths Were Shortened***
  - Upper river wall went from 960 feet to 500 feet
  - Upper middle wall went from 900 feet to 800 feet
  - Lower land wall went from 700 feet to 400 feet
  - Lower middle wall remained unchanged

- ***Bank shaving requirements lessened considerably from authorized project since very little required on lower end***

J.T. Myers Locks Improvements Project

Summary of Changes

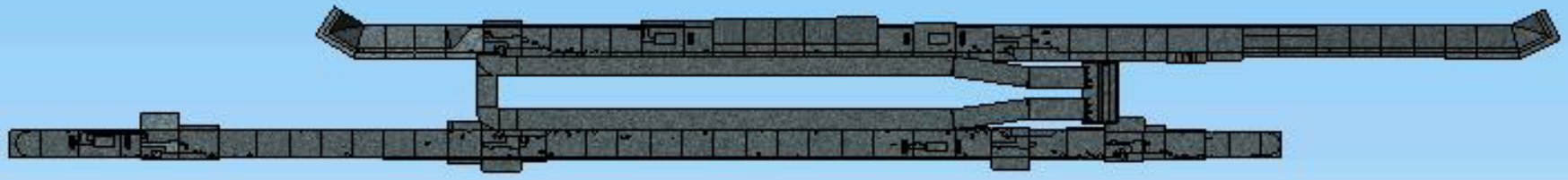
- New through-the-sill supplemental filling and emptying system supplying water to extended chamber
- New outlet diffuser configuration
- Evaluation of fixed approach walls on lower end
- Approach wall lengths shortened considerably
- Bank line reshaping in upper approach but only minimal work required in lower approach. Net change is considerably less removal of material

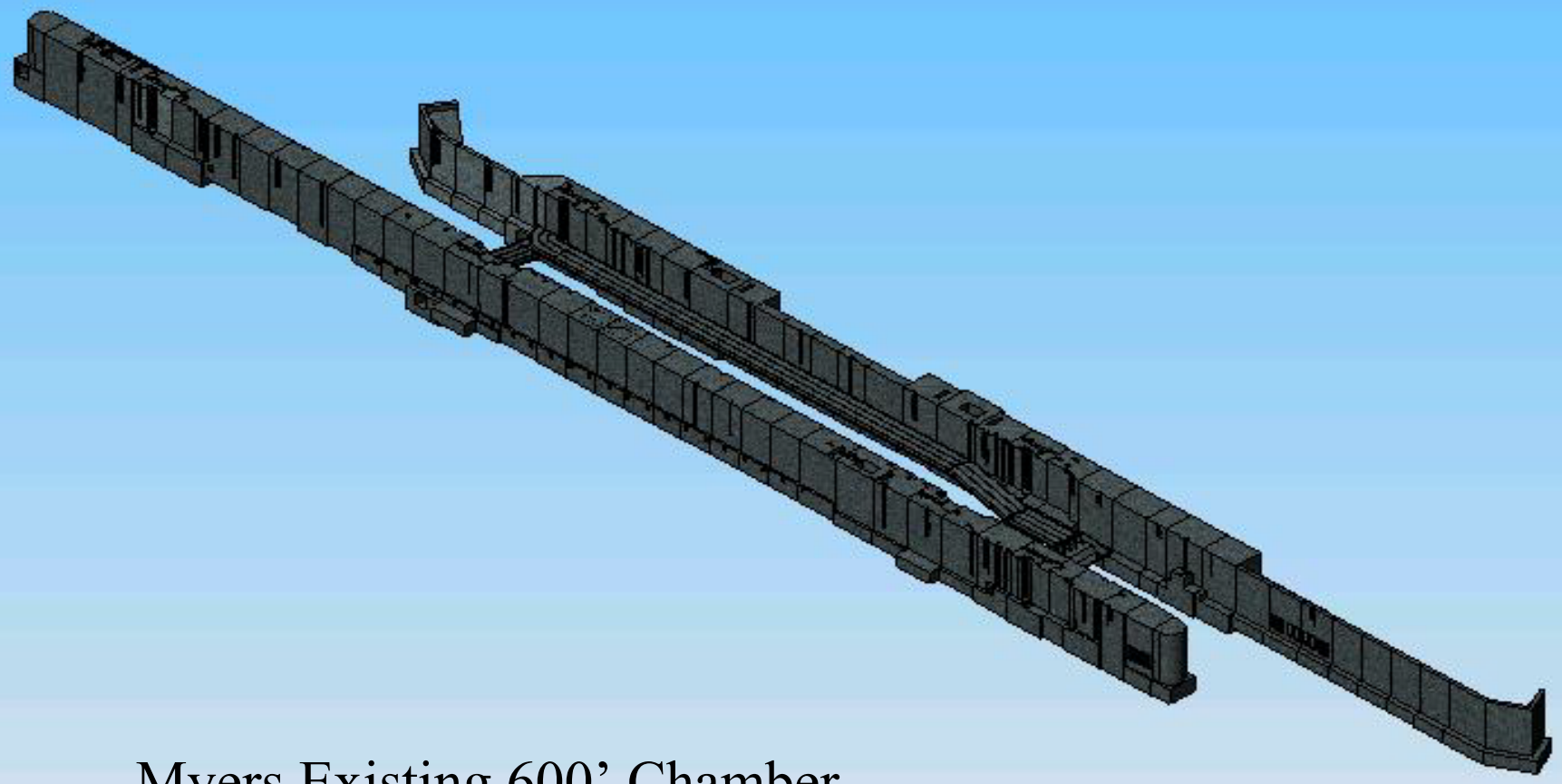
J.T. Myers Locks Improvements Project

Solid Works 3D Modelling

- 3D Model allows designers to visualize final structure
- Can create physical construction sequence model
- Can use model to cut section/details into MicroStation
- Model can be imported for Finite Element analysis

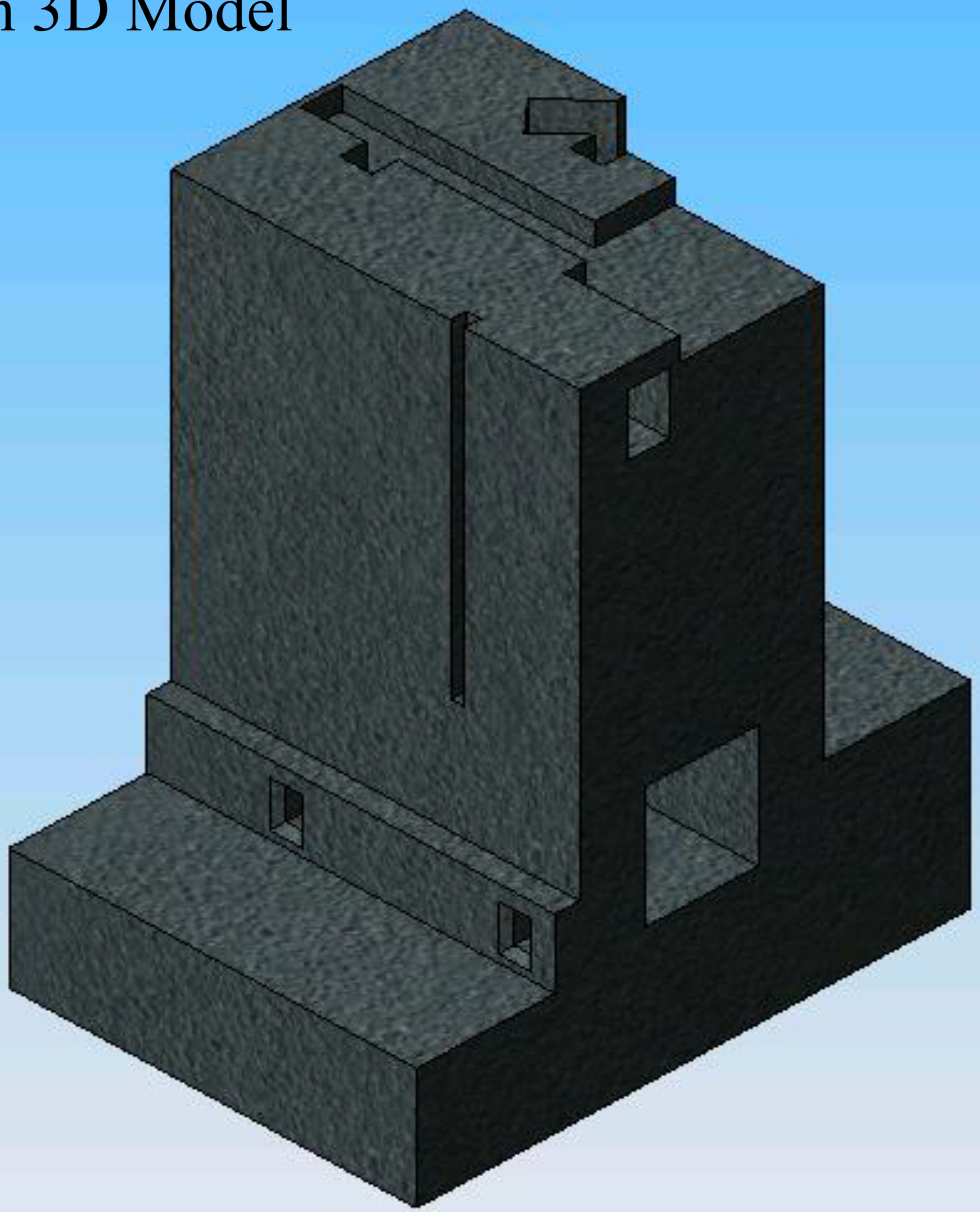
Myers Plan View

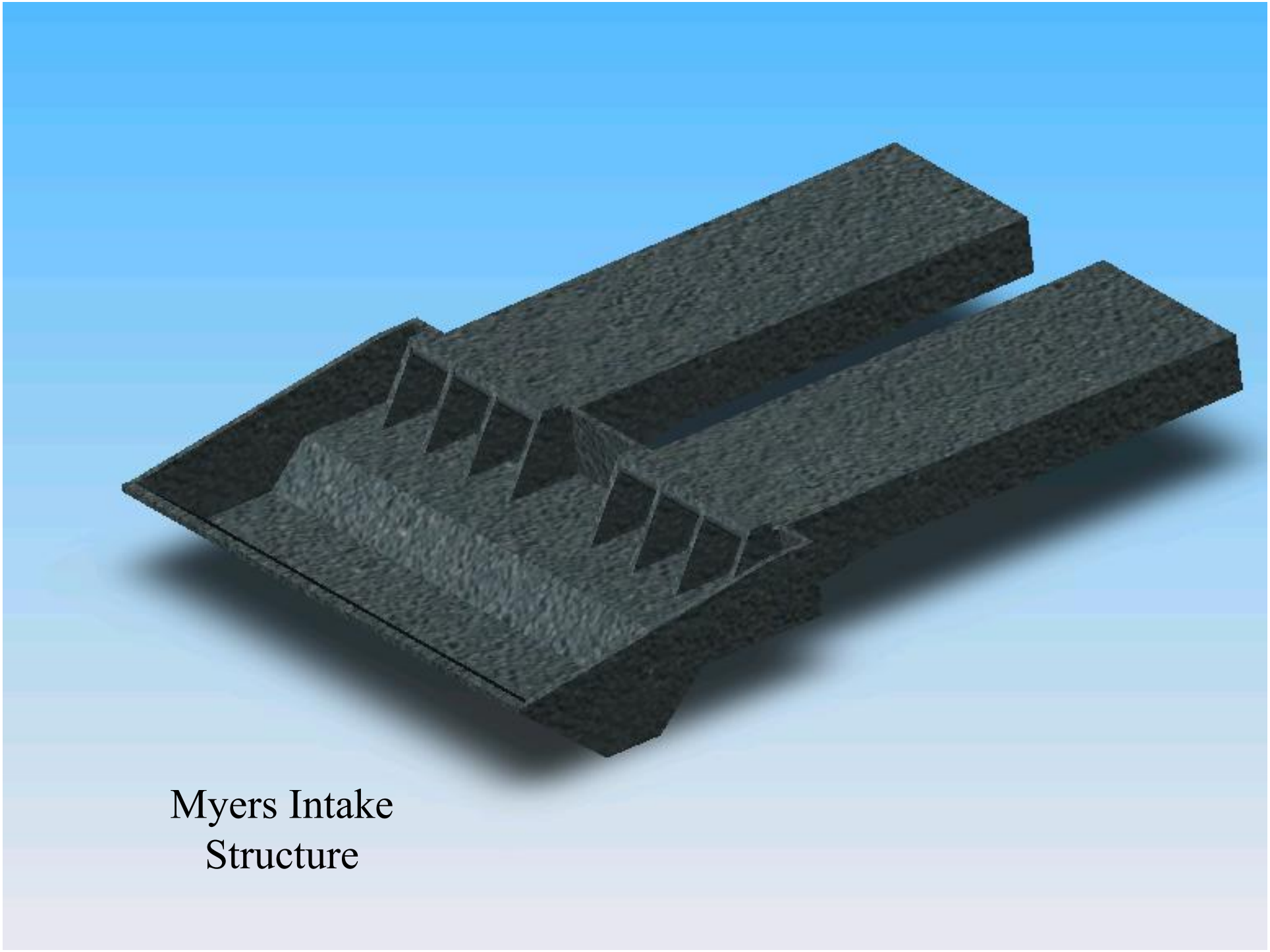




Myers Existing 600’ Chamber

Myers Monolith 3D Model





Myers Intake Structure

Myers Intake and Culverts

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Louisville District

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Questions?