Presentation To Inland Waterways Users Board
OLMSTED LOCKS & DAM – Status, PACR, Funding Alternatives, Cost Update, and Construction Methodology

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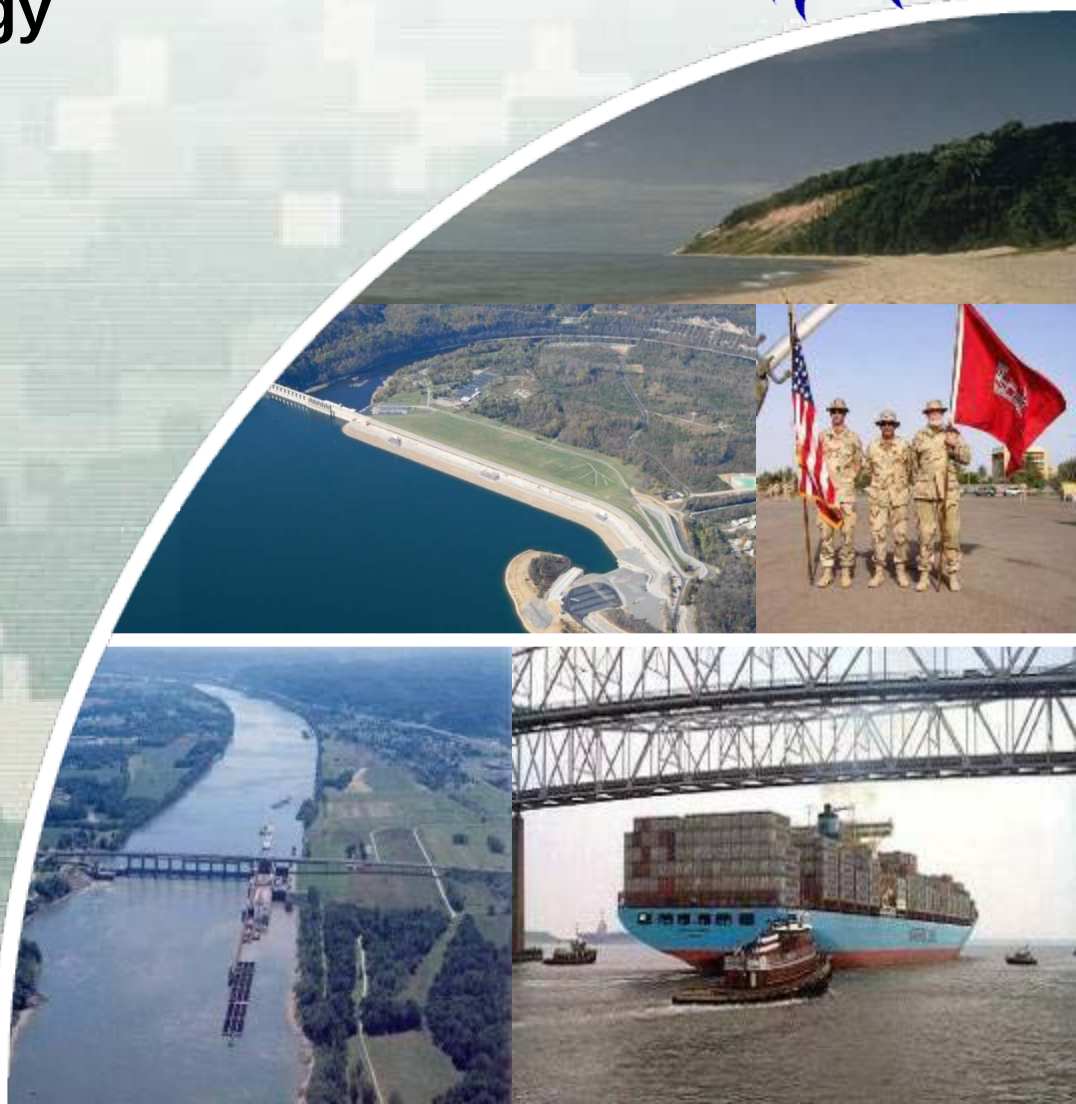
Great Lakes & Ohio River Division

6 June 2012



US Army Corps of Engineers

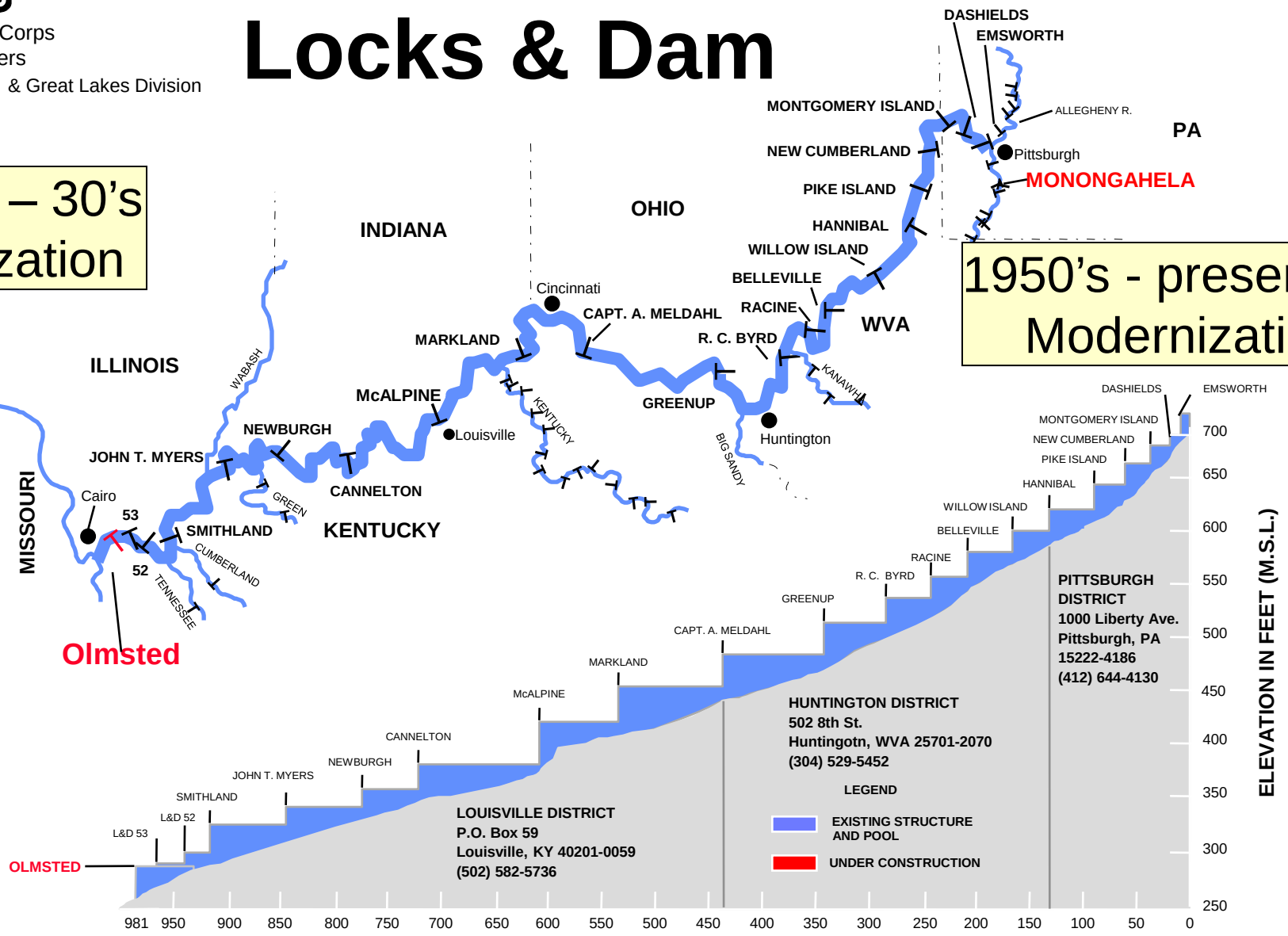
BUILDING STRONG®

Ohio River Main Stem Locks & Dam

US Army Corps
of Engineers
Ohio River & Great Lakes Division

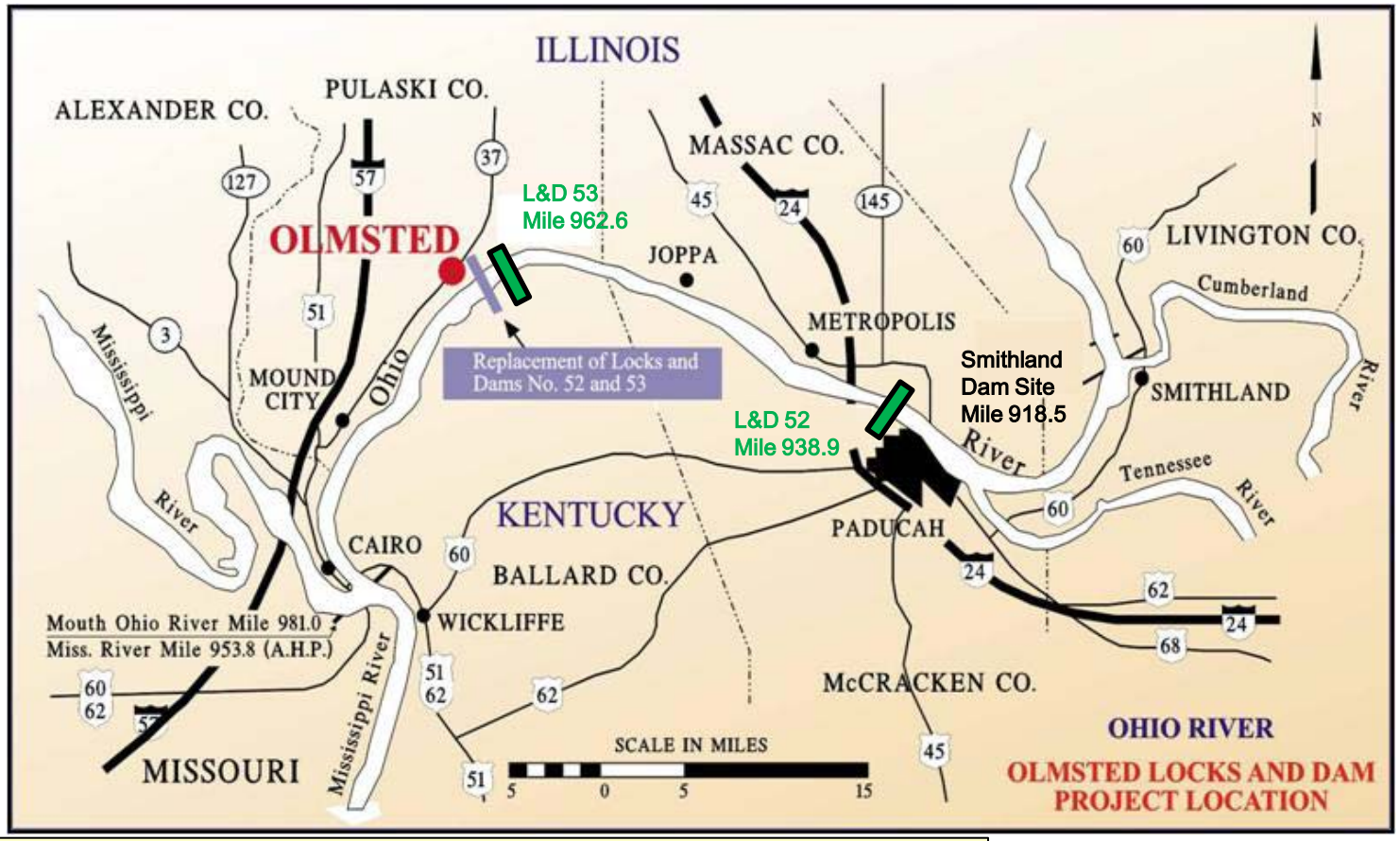
1920's – 30's
Canalization

1950's - present
Modernization



BUILDING STRONG®

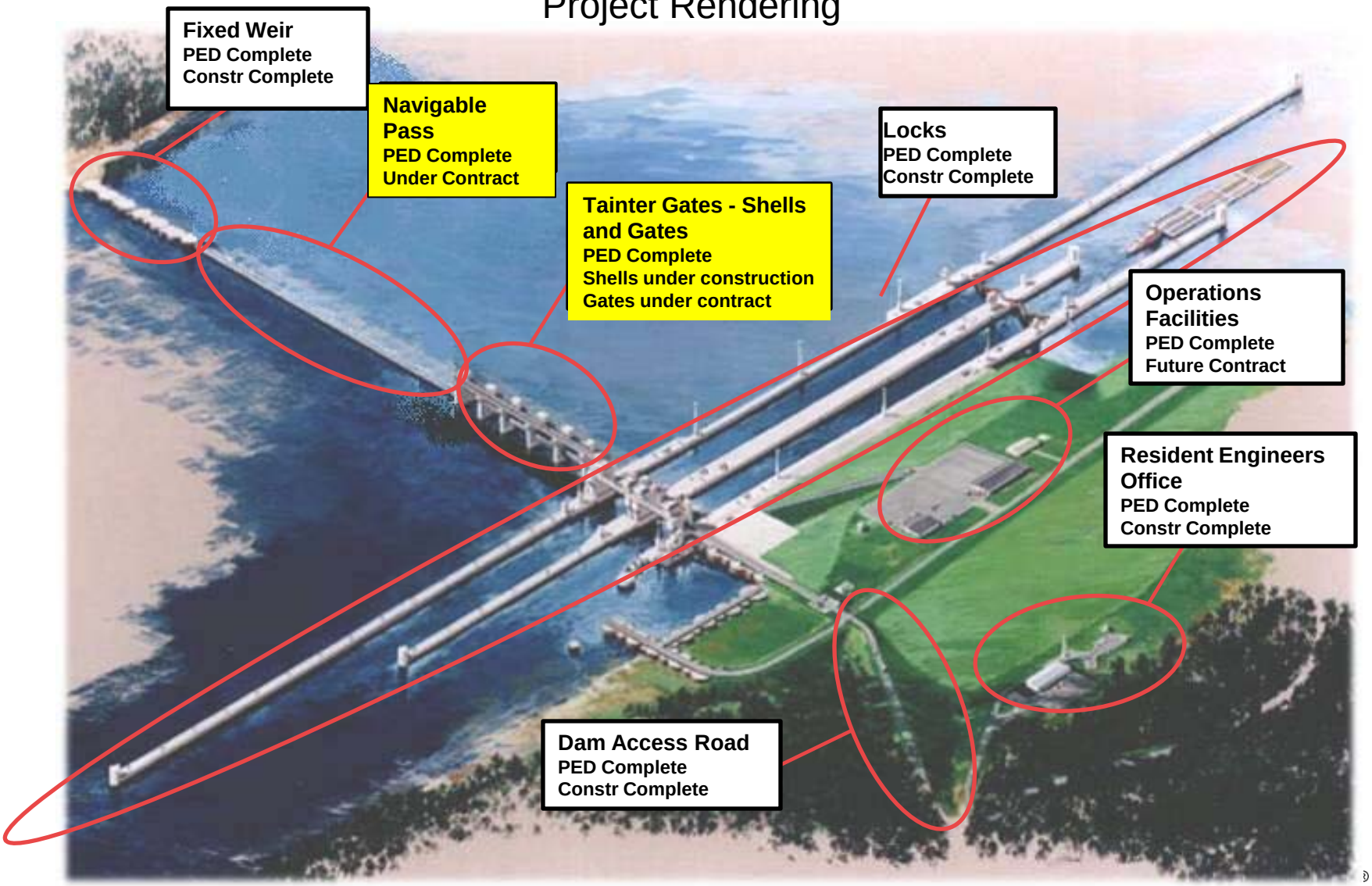
Olmsted Locks & Dam Project



1928/1929: L&D 52 & 53 in service
1949-1957: Miscellaneous studies
1969: L&D 52 1,200-ft Chamber operational (temporary chamber)
1977: Recon Report for Major Rehab L&D 52 & 53
1980: L&D 53 1,200-ft Chamber operational (temporary chamber)
1985: Feasibility Report
1988: Authorization

Olmsted Locks & Dam Project

Project Rendering



Under Contract / Construction

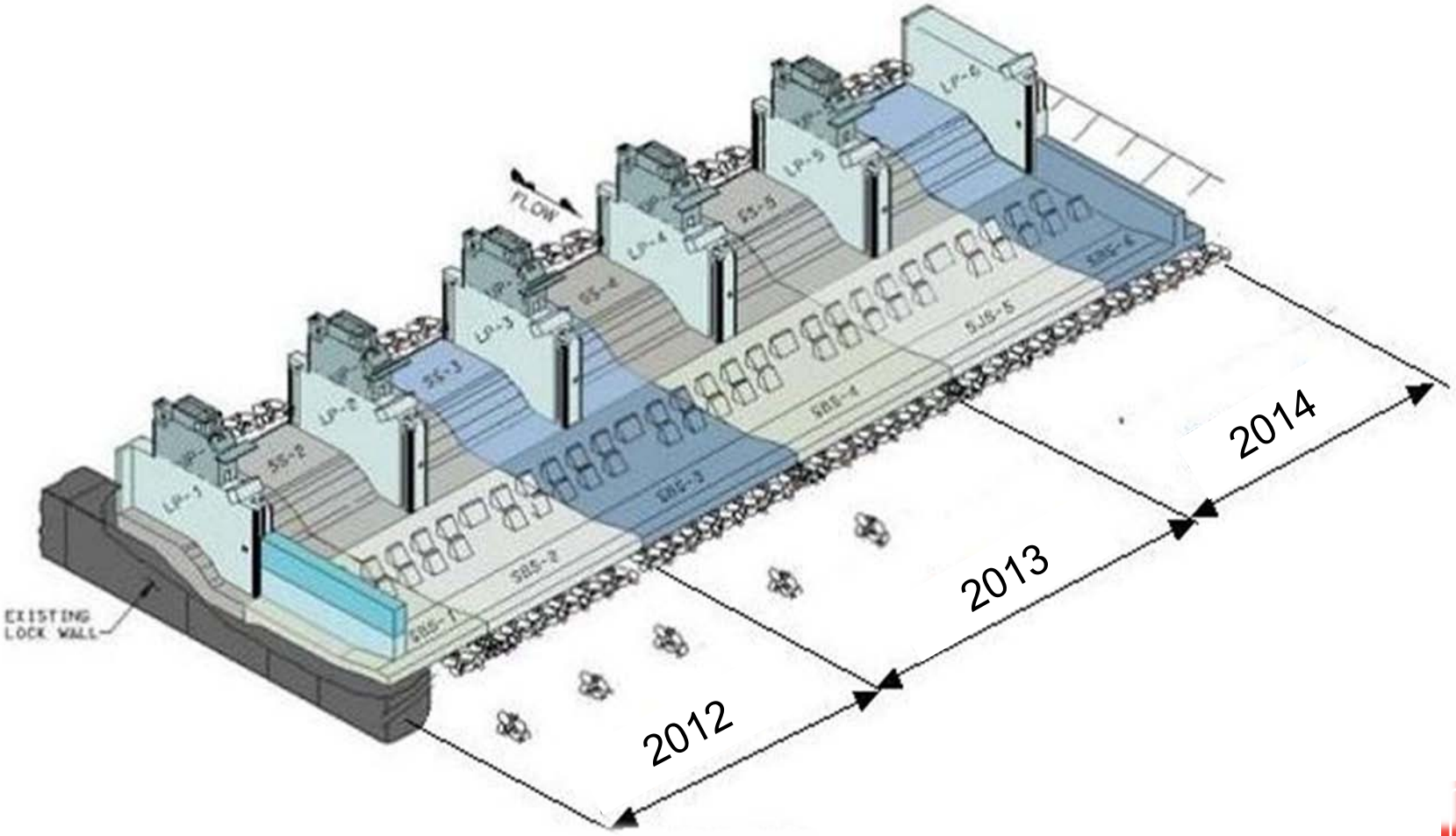
BUILDING STRONG®

Table of Contents

Status and Cost Update

- Currently Constructing Tainter Gate section of Dam
- Major components include 18 concrete shells and 5 gates.
- Began placing concrete shells in-the-wet in summer 2010 (8 shells placed to date)
- Four shells to be fabricated and placed in 2012. Six shells in 2013.

Tainter Gate Precast Elements



Construction of Shells

Olmsted Cost Increase History

Year	Events	Annual Cost Est. ($M Price Level Oct 2011)	Annual Cost Est. ($M Price in Actual Year)
1985	Final Feasibility Report	$1,165.0	$549.9
1988	WRDA Authorization	$1,580.0	$775.0
1990	General Design Memo Supp.	$1,580.0	$816.0
1995	Award Lock Contract	$1,520.0	$902.0
1997	Dam In-the-Wet Decision	$1,459.3	$928.0
2002	Lock Complete	$1,454.7	$1,020.0
2004	Award Dam Contract	$1,734.0	$1,382.0
2008	LRD Economic Update	$2,184.0	$1,991.0
2011	Draft PACR - Revised Estimate w/Cost Risk Analysis	TBD	TBD

KEY EVENTS

1988: Project Authorization
1990: GDM Supplement
1993: Award Cofferdam Contract
1995: Award Lock Contract
1997: Dam In-The-Wet Decision
1999: Begin Approach Walls Constr.
2002: Lock Contract Complete; Dam advertised as FFP
2004: Dam Awarded as Cost Reimb.
2005: Approach Walls Complete

Post Authorization Change Report (PACR)

- Recommend Authorization Increase to: $2,918M
- Initial Authorization (1988): $775M
- Current Section 902b Limit: $1,745M (likely hit in 2014)
- BCR for authorization at 4% discount rate: 9.9
- BCR for budget development at 7% discount (OMB): 3.7
- Estimated Lock and Dam Operational: FY 2020
- Estimated Dam Construction Complete: FY 2021
- Estimated Contract Complete: FY 2024

Olmsted Project 902 Limit

Appropriated thru FY-11	**$1,358,000,000**
ARRA Funding to date	**$ 29,436,000**
FY-12 Work Plan (obligated)	**$ 138,000,000 (est)**
FY-13 PresBud	**$ 144,000,000**
PROJECTED TOTAL	**$1,669,436,000**
Maximum Cost Limit (based on July 2011 estimate)	**$1,745,000,000**
Delta Available in FY-14	**$ 74,564,000**
Estimated FY-14 (IWTF constrained)	**$ 150,000,000**

CONCLUSION : 902 additional authorization required by 2nd quarter FY-14.

PACR Facts & Assumptions

Fact – No scope change from the original authorization in 1988

Fact – Dam estimate is based on 2011 re-baseline and productivity from 1st year shells (2010)

Fact - A CSRA established an 80% confidence level for the Certified Cost Estimate. The 80% confidence level is the recommended level for USACE cost estimates

Fact - Sunk cost as of 30 Sep 2011 is $1,358M

Assumption - Funding stream limited to $150M per year

Assumption - OMB will submit for authorization in the FY13 President's budget

Assumption - Dam contract, including navigable pass, will continue "in-the-wet"

Assumption - Dam contract will continue to perform under a cost reimbursement contract

Total Project Cost vs. “Fully-Funded” Cost

- Total Project Cost at 1 Oct 2011 price level:
  - $2,918,000,00
- “Fully-Funded” Cost with projected future inflation (through 2024):
  - $3,099,000,000

Annual Benefits vs. Net Annual Benefits

- Stream of future benefits/costs discounted to present value, amortized to generate “Annual” estimates
- Discounting approximates “time value” of costs/benefits
  - A dollar today worth more than one 50 years from now
  - Performed using multiple “discount rates”
- Annual Benefits – Annual Costs = Net Annual Benefits

Cost/Benefit Analysis – 7.0% Discount Rate

Annualized Benefits	
Transportation Benefits	$823,272,341
Fuel Tax Revenues	$19,976,006
Less WOPC Normal O&M	$7,664,548
Less LD 52 Repairs	$12,291,092
Less LD 53 Repairs	$11,860,808
Incremental Annual Benefits	$875,064,795
Annualized Costs	
Construction	$211,450,732
Interest During Construction	$19,093,734
Normal O&M	$3,832,274
Main Chamber Maintenance	$277,669
Aux Chamber Maintenance	$314,605
Dam Maintenance	$60,200
Incremental Annual Costs	$235,029,214
Net Annual Project Benefits	$640,035,580
BENEFIT - COST RATIO	**3.7**

Benefit/Cost Categories

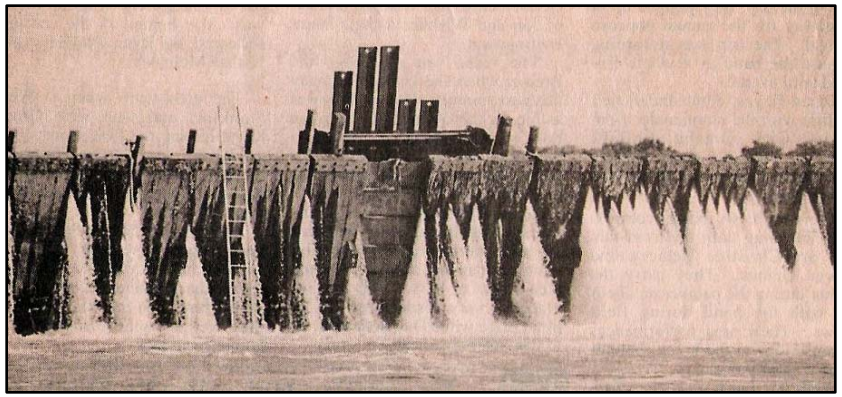
- Primary benefit categories:
  - Transportation rate savings
  - Locks and Dams 52 and 53 repair avoidance
  - O&M reductions
  - Fuel tax revenues
- Primary cost categories:
  - Construction cost (w/ IDC)
  - Olmsted future maintenance/repair cost

Locks & Dams 52 & 53

- Key Points
  - Classified as in a failed/near failure condition
  - L&D 52 - wicket dam is sagging approximately four to five inches
  - Typical O&M costs to operate 52&53 is $4.7 million/year
  - Average extraordinary O&M for 52&53 = $3.4 million/year.
  - The locks at 52 are typically required 40% of the year…. 10% for L&D 53
  - Uncertainties include: condition of the dam foundation and extent of hydraulic piping corrosion on through the locks

L&D 52 Today

Locks & Dams 52 & 53



Wicket repairs ~1990

- Major Rehab of L/D 52/53
  - A major rehabilitation report has not been prepared
    - Will not meet the seismic requirements without a total replacement of the dam and locks
    - Extending the life of these 50 years cannot be achieved without a total replacement
  - The Feasibility Report alternatives assumed full replacement of both facilities

Reliable L&D #52 and #53

	10 Yrs	20 Yrs	30 Yrs
L&D #52	$150M	$450M	Major Rehab Required
L&D #53	$100M	$300M	Major Rehab Required

Contingency Plan for Failure

- Dam Failure
  - Fill Gap with Rock to re-establish pool
  - Evaluate extent and locations of failure
  - Establish long range plan working with Industry

- Lock Wall Failure (1200’ Chamber)
  - Use 600’ chamber

Olmsted Funding Alternatives

- Key Assumptions
  - Priorities were based on updated priorities from IMTS Capital Projects Business Model
  - Based on current (in-the-wet) construction
  - Based on current contract type/method
  - A continuous funding mechanism will exist in the future for the alternatives considered
  - Olmsted 902 limit (authorization) increased
  - Locks and Dam 52 & 53 will continue to operate

Olmsted Funding Alternatives

Alternative 1: Olmsted Status Quo (per PACR)

- Estimated Project Cost $2.9B (FY12 price level)
- Remaining Project Cost $1.5B (FY12 price level)
- $150M/year Funding Stream
- Assumes $75M/yr from IWTF
- $875M Annual Benefits ($640M Net Benefits)
- Olmsted – (Operational 2020/Complete 2024)
- Lower Mon - Complete 2033 (Phase 1 operational 2027 – 85% of annual benefits achieved)
- Kentucky Lock – Complete 2040

Olmsted Funding Alternatives

Alternative 2: Optimal Funding Stream

- $215M/yr for 6 years (Capability-level funding)
- Saves $250M
- Operational 2018 / Complete 2020
- Advancing project schedule 2 years generates $1.7B of Annual Benefits
- Assumes availability of IWTF funds
- No adverse impacts to other projects

Olmsted Funding Alternatives

Alternative 3: Olmsted Slowdown

- 2, 4 and 6 years evaluated
- Assume $50M/year to Olmsted
- 3 Options ($100M diverted to other projects)

Option 1: Focus on New Construction in CPBM priority order

Option 2: Focus on Major Rehabs in CPBM priority order

Option 3: Focus on mix of Major Rehab and New Construction in CPBM priority order

Olmsted Funding Alternatives

Alternative 4: Olmsted Pause

- 2, 4 and 6 years evaluated
- Assume $10M/year to Olmsted for “caretaker” status
- 3 Options ($140M diverted to other projects)

Option 1: Focus on New Construction in CPBM priority order

Option 2: Focus on Major Rehabs in CPBM priority order

Option 3: Focus on mix of Major Rehab and New Construction in CPBM priority order

COST ANALYSIS ASSUMPTIONS

- If Alternative Project estimate had a Risk Based Cost Estimate – No adjustment to estimate
- If Alternative Project had a Detailed Cost Estimate (MCACES) - Estimate Increased by 15%
- If Alternative Project had a Rough Order of Magnitude Cost Estimate – Estimate increased by 25%
- Note: Emsworth was not included In the analysis because it is scheduled to complete in FY14

IMTS CPBM Priority Lists

Rank	All Projects	Construction	Rehabilitation
1	Olmsted L/D Construction	Olmsted L/D Construction	Emsworth Major Rehab (dam safety)
2	Lower Mon 2,3, & 4 Replacement	Lower Mon 2,3, & 4 Replacement	L/D 25 Upper MS Dam Major Rehab
3	Emsworth Major Rehab (dam safety)	Kentucky Lock Addition	Lagrange Major Rehab
4	Kentucky Lock Addition	Chickamauga Replacement Lock	Lower Monumental Major Rehab
5	Chickamauga Replacement Lock	L/D 25 Upper MS 1200' Lock Addition	ILL WW Thomas O'Brien L/D Major Rehab
6	L/D 25 Upper MS Dam Major Rehab	High Island to Brazos River, TX	Greenup Dam Rehab PED and Const
7	L/D 25 Upper MS 1200' Lock Addition	Lagrange 1200' Lock Addition	JT Myers Dam Major Rehab
8	High Island to Brazos River, TX	Inner Harbor Lock Replacement	Meldahl Dam Rehab
9	Lagrange 1200' Lock Addition	L/D 22 Upper MS 1200' Lock Addition	Montgomery Major Rehab
10	Inner Harbor Lock Replacement	L/D 24 Upper MS 1200' Lock Addition	Mel Price Upper MS Major Rehab
11	L/D 22 Upper MS 1200' Lock Addition		No. 2 Lock AR Lock Wall/Bank Slope Rehab
12	L/D 24 Upper MS 1200' Lock Addition		Willow Island Dam Rehab PED and Const
13	Lagrange Major Rehab		Marmet Dam Rehab
14	Lower Monumental Major Rehab		
15	ILL WW Thomas O'Brien L/D Major Rehab		
16	Greenup Dam Rehab PED and Const		
17	JT Myers Dam Major Rehab		
18	Meldahl Dam Rehab		
19	Montgomery Major Rehab		
20	Mel Price Upper MS Major Rehab		
21	No. 2 Lock AR Lock Wall/Bank Slope Rehab		
22	Willow Island Dam Rehab PED and Const		
23	Marmet Dam Rehab		

SOURCE: IMTS CPBM: Updated as of Mar 2012

YEARS OF ADVANCEMENT / DELAY
BY PROJECT BY FUNDING SCENARIO

	Project	Alt. 1 STATUS QUO completion year	Alt. 2 OPTIMAL OLMSTED FUNDING	Alt. 4 Pause Olmsted							
				Alt. 4a OLMSTED PAUSE 2 YEARS		Alt. 4b OLMSTED PAUSE 4 YEARS			Alt. 4c OLMSTED PAUSE 6 YEARS		
				Option 1	Option 2	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
	Olmsted L/D Construction	2020	2	-4	-4	-6	-6	-6	-9	-9	-9
New Construction	Lower Mon 2,3, & 4 Replacement, phase 1	2027	0	-1	-4	10	-8	0	10	-11	0
New Construction	Kentucky Lock Addition	2041	0	-2	-2	-4	-4	-4	-6	-6	22
New Construction	Chickamauga Replacement Lock	2051	0	-2	-2	-4	-4	-4	-6	-6	-6
New Construction	L/D 25 Upper MS 1200' Lock Addition	2064	0	-2	-2	-4	-4	47	-6	-6	-6
New Construction	High Island to Brazos River, TX	2053	0	-2	38	-4	38	38	-6	38	-6
New Construction	Lagrange 1200' Lock Addition	2070	0	-2	-2	-4	-4	-4	-6	-6	-6
New Construction	Inner Harbor Lock Replacement	2077	0	-2	-2	-4	-4	-4	-6	-6	-6
New Construction	L/D 22 Upper MS 1200' Lock Addition	2083	0	-2	-2	-4	-4	-4	-6	-6	-6
New Construction	L/D 24 Upper MS 1200' Lock Addition	2090	0	-2	-2	-4	-4	-4	-6	-6	-6
Major Rehabilitation	L/D 25 Upper MS Dam Major Rehab	2053	0	-2	38	-4	38	-4	-6	38	38
Major Rehabilitation	Lagrange Major Rehab	2064	0	-2	50	-4	50	50	-6	49	50
Major Rehabilitation	Lower Monumental Major Rehab	2065	0	-2	50	-4	50	-4	-6	46	46
Major Rehabilitation	ILL WW Thomas O'Brien L/D Major Rehab	2065	0	-2	51	-4	50	-4	-6	50	50
Major Rehabilitation	Greenup Dam Rehab PED and Const	2079	0	-2	-2	-4	62	-4	-6	60	-6
Major Rehabilitation	JT Myers Dam Major Rehab	2081	0	-2	66	-4	66	-4	-6	64	64
Major Rehabilitation	Meldahl Dam Rehab	2079	0	-2	-2	-4	-4	-4	-6	60	-6
Major Rehabilitation	Montgomery Major Rehab	2084	0	-2	-2	-4	-4	-4	-6	-6	-6
Major Rehabilitation	Mel Price Upper MS Major Rehab	2086	0	-2	-2	-4	69	-4	-6	69	-6
Major Rehabilitation	No. 2 Lock AR Lock Wall/Bank Slope Rehab	2085	0	-2	-2	-4	-4	-4	-6	-6	-6
Major Rehabilitation	Willow Island Dam Rehab PED and Const	2089	0	-2	-2	-4	-4	-4	-6	-6	-6
Major Rehabilitation	Marmet Dam Rehab	2090	0	-2	-2	-4	-4	-4	-6	71	-6

* When channel work is completed and 85% of benefits are obtained.

BENEFIT BY PROJECT FUNDING SCENARIO Alt. 4A – 2 Year Pause

- **Alternative 4A (pause 2yrs), Option 1 (divert funds to construction) would allow no construction or rehabilitations to be completed sooner.**

- **Alternative 4A (pause 2yrs), Option 2 (divert funds to rehabs) would allow 1 construction and 5 major rehab projects to be completed sooner.**
  - *High Island advanced 38 years from 2053 to 2015 operational ($5.7M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational ($9.6M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational ($10.2M annual benefit).*
  - *Lower Monumental rehab advanced 50 yrs from 2065 to 2015 operational ($3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 51 yrs from 2065 to 2014 operational ($4.9M annual benefit).*
  - *Myers rehab advanced 66 yrs from 2081 to 2015 operational ($9.2M annual benefit).*

BENEFIT BY PROJECT FUNDING SCENARIO Alt. 4B – 4 Year Pause

- **Alternative 4B (pause 4yrs), Option 1 (divert funds to construction) would allow 1 construction project to be completed sooner.**
  - *Lower Monongahela phase 1 advanced 10 yrs from 2027 to 2017 operational ($187.0M annual benefit).*

- **Alternative 4B (pause 4yrs), Option 2 (divert funds to rehabs) would allow 1 construction and 7 major rehab projects to be completed sooner.**
  - *High Island advanced 38 years from 2053 to 2015 operational ($5.7M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational ($9.6M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational ($10.2M annual benefit).*
  - *Lower Monumental rehab advanced 50 yrs from 2065 to 2015 operational ($3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational ($4.9M annual benefit).*
  - *Greenup L/D rehab advanced 62 yrs from 2079 to 2017 operational ($19.0M annual benefit).*
  - *Myers rehab advanced 66 yrs from 2081 to 2015 operational ($9.1M annual benefit).*
  - *Mel Price rehab advanced 69 yrs from 2086 to 2017 operational ($7.6M annual benefit).*

- **Alternative 4B (pause 4yrs), Option 3 (divert to priority list) would allow 2 construction and 1 major rehab projects to be completed sooner.**
  - *L/D 25 Upper MS 1200' Lock addition advanced 47 years from 2064 to 2017 operational ($54.9M annual benefit).*
  - *High Island advanced 38 years from 2053 to 2015 operational ($5.7M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational ($53.1M annual benefit).*

BENEFIT BY PROJECT FUNDING SCENARIO Alt. 4C – 6 Year Pause

- **Alternative 4C (pause 6yrs), Option 1 (divert funds to construction) would allow 1 construction project to be completed sooner.**
  - *Lower Monongahela phase 1 advanced 10 yrs from 2027 to 2017 operational ($187.0M annual benefit).*

- **Alternative 4C (pause 6yrs), Option 2 (divert funds to rehabs) would allow 1 construction and 9 major rehab projects to be completed sooner.**
  - *High Island advanced 38 years from 2053 to 2015 operational ($5.7M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational ($9.6M annual benefit).*
  - *Lagrange rehab advanced 49 yrs from 2064 to 2015 operational ($10.2M annual benefit).*
  - *Lower Monumental rehab advanced 46 yrs from 2065 to 2019 operational ($3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational ($4.9M annual benefit).*
  - *Greenup L/D rehab advanced 60 yrs from 2079 to 2019 operational ($19.0M annual benefit).*
  - *Myers rehab advanced 64 yrs from 2081 to 2017 operational ($9.1M annual benefit).*
  - *Meldahl Dam rehab advanced 60 years from 2079 to 2019 operational ($19.0M annual benefit)*
  - *Mel Price rehab advanced 69 yrs from 2086 to 2017 operational ($7.6M annual benefit).*
  - *Marmet dam rehab advanced 71 yrs from 2090 to 2019 operational ($11.3 annual benefit).*

- **Alternative 4C (pause 6yrs), Option 3 (divert to priority list) would allow 1 construction and 5 major rehab projects to be completed sooner.**
  - *Kentucky Lock addition advanced 22 years from 2041 to 2019 operational ($66.1M annual benefit).*
  - *LD 25 Upper MS rehab advanced 38 yrs from 2053 to 2015 operational ($9.6M annual benefit).*
  - *Lagrange rehab advanced 50 yrs from 2064 to 2014 operational ($10.2M annual benefit).*
  - *Lower Monumental rehab advanced 46 yrs from 2065 to 2019 operational ($3.3M annual benefit).*
  - *O'Brien L/D rehab advanced 50 yrs from 2065 to 2015 operational ($4.9M annual benefit).*
  - *Myers rehab advanced 64 yrs from 2081 to 2017 operational ($9.1M annual benefit).*

Division	District	Project	Benefits	
			Average Annual	Source
LRD	LRL	Olmsted L/D Construction	$ 875,064,795	Report
LRD	LRH	Greenup Dam Rehab PED and Const	$ 18,960,343	Estimated
LRD	LRH	Meldahl Dam Rehab	$ 18,960,343	Estimated
LRD	LRH	Willow Island Dam Rehab PED and Const	$ 11,886,264	Estimated
LRD	LRH	Marmet Dam Rehab	$ 11,344,108	Estimated
LRD	LRL	JT Myers Dam Major Rehab	$ 9,142,532	Est*
LRD	LRN	Kentucky Lock Addition	$ 66,057,052	Report
LRD	LRN	Chickamauga Replacement Lock	$ 93,288,706	Est*
LRD	LRP	Lower Mon 2,3, & 4 Replacement **	$ 220,032,000	Report
LRD	LRP	Montgomery Major Rehab	$ 24,887,347	Estimated
MVD	MVN	Inner Harbor Lock Replacement	$ 160,056,231	Est*
MVD	MVR	Lagrange 1200' Lock Addition	$ 53,060,000	Report
MVD	MVR	L/D 22 Upper MS 1200' Lock Addition	$ 45,799,413	Est*
MVD	MVR	Lagrange Major Rehab	$ 10,178,239	Estimated
MVD	MVR	ILL WW Thomas O'Brien L/D Major Rehab	$ 4,875,803	Estimated
MVD	MVS	L/D 25 Upper MS 1200' Lock Addition	$ 54,854,226	Est*
MVD	MVS	L/D 24 Upper MS 1200' Lock Addition	$ 49,869,093	Est*
MVD	MVS	L/D 25 Upper MS Dam Major Rehab	$ 9,634,988	Estimated
MVD	MVS	Mel Price Upper MS Major Rehab	$ 7,596,594	Estimated
NWD	NWW	Lower Monumental Major Rehab	$ 3,304,068	Est*
SWD	SWG	High Island to Brazos River, TX	$ 5,666,000	Report
SWD	SWL	No. 2 Lock AR Lock Wall/Bank Slope Rehab	$ 22,685,480	Estimated

* An analysis has been completed for this project, however, the benefit estimating proceedure (3 x Av. Annual Equivalent Capability Cost) produced a higher value.

** Lower Monongahela replacement benefits are phased.

In-The-Dry Alternative

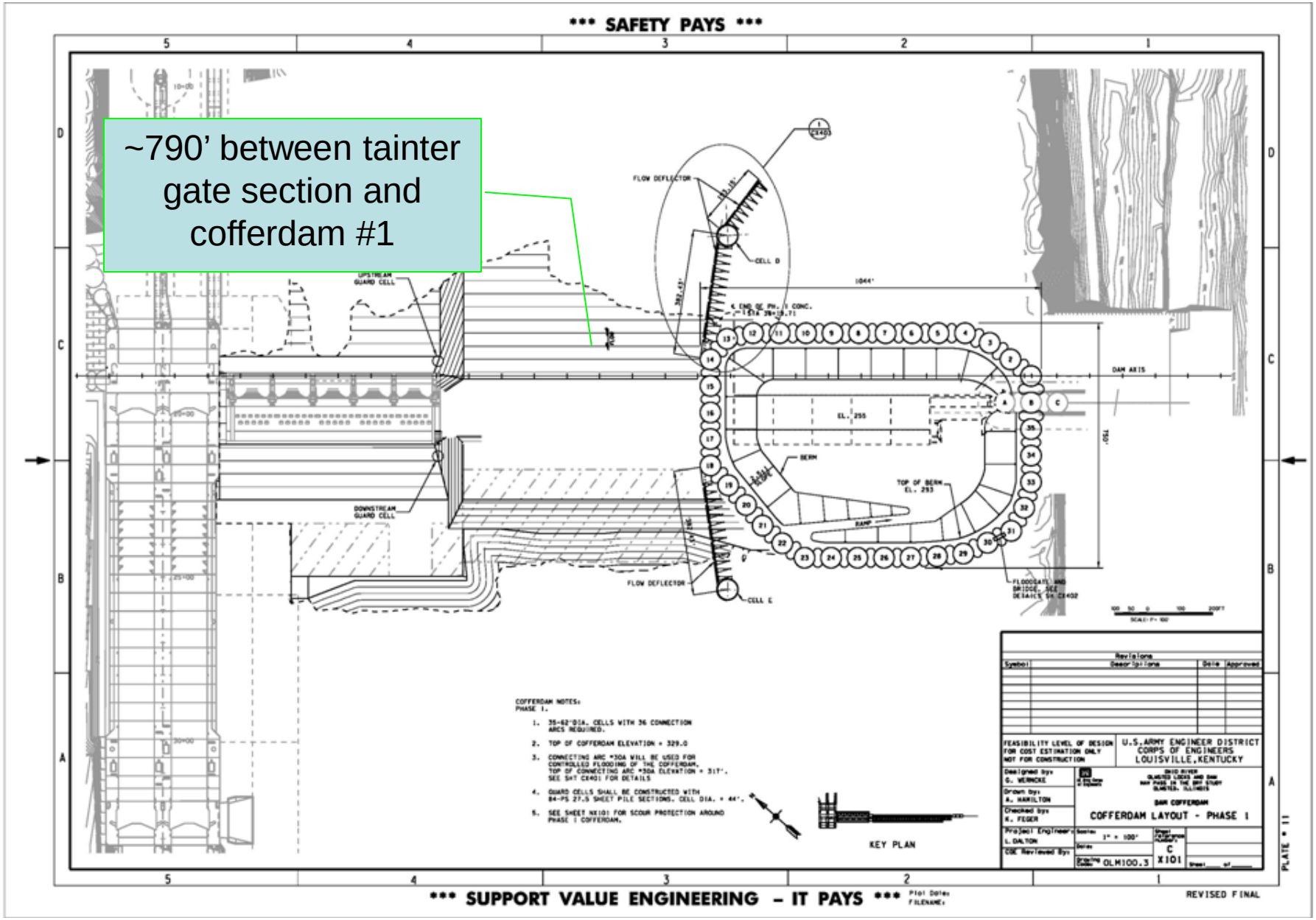
- Develop design basis for constructing the Olmsted Dam Navigable Pass In-The-Dry
- Utilize conventional construction techniques within one or more cofferdams
- Similar but less detailed than a Feasibility Study
- Prepare a cost estimate for the In-The-Dry construction
- Prepare a cost estimate for the current contract with the Navigable Pass work deleted
- Prepare a construction schedule
- Determine economic benefits based on schedule
- Complete the ITD study in 120 days

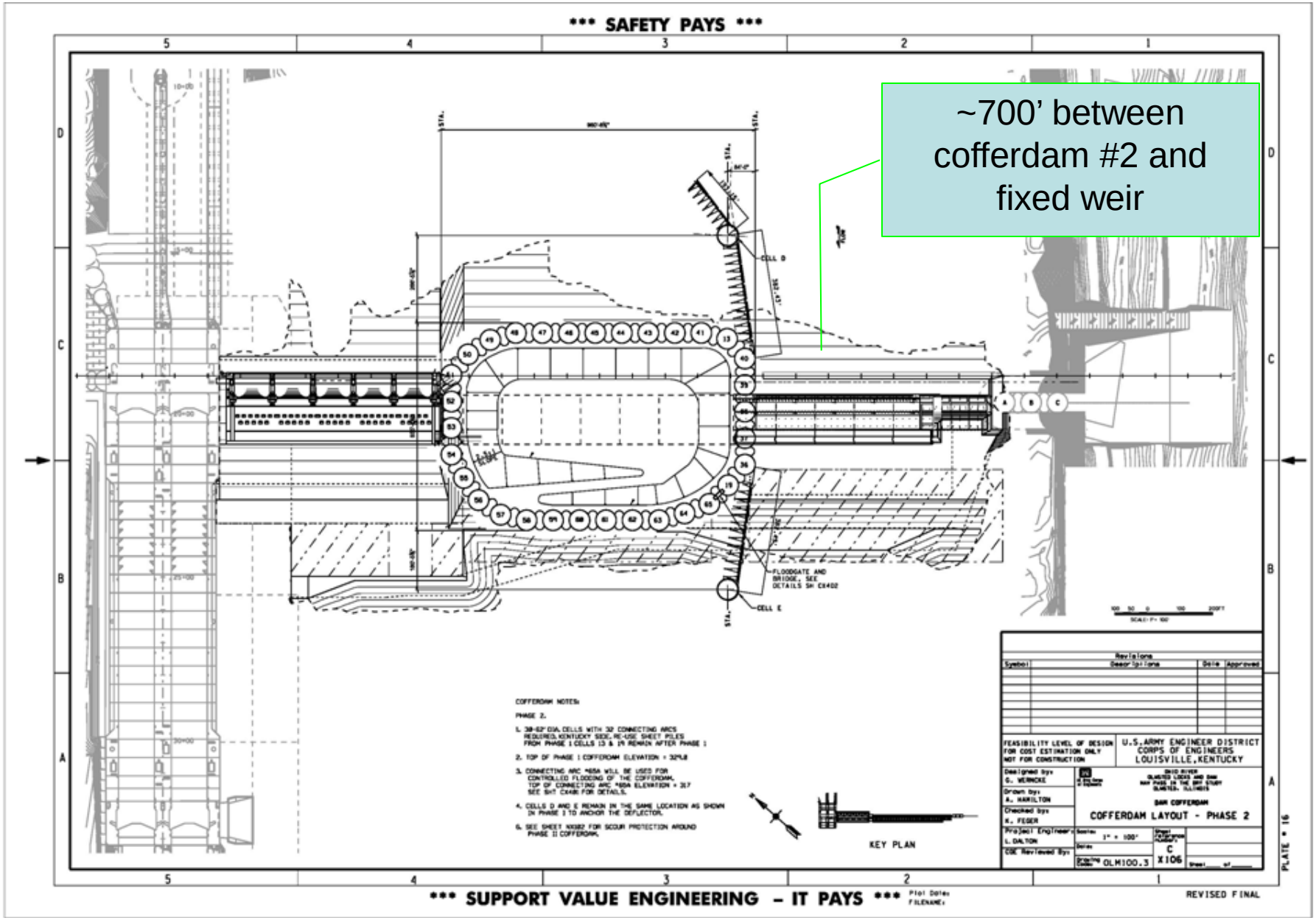
Key Assumptions

- No significant change in configuration of navigable pass
- Don’t constrain the alternative study based on acquisition method or Incremental funding restrictions
- Assume funding level of $150 million per year
- Tainter Gate portion of Dam to be completed In-The-Wet
- Decision on In-The-Wet vs. In-The-Dry approach must be made by 1 Oct 2012

Cofferdam Height Determination

- Insufficient time to do a complete economic assessment
- Cofferdam Height Study of 1989 concluded Nav Pass cofferdam top should be at El. 327
- Successful lock cofferdam built with top at El. 329
- Cofferdam Height Study of 1997 concluded Nav Pass cofferdam should be at El. 329
- Water elevation-frequency curves are now higher than those used in 1989 or 1997 studies
- Cost of added cofferdam height would be limited by cost of cofferdam flooding and clean up


~790’ between tainter gate section and cofferdam #1
FLOW DEFLECTOR
CELL D
UPSTREAM GUARD CELL
DOWNSTREAM GUARD CELL
DAM AXIS
EL. 255
BERM
TOP OF BERM EL. 293
RAMP
FLOW DEFLECTOR
CELL E
COFFERDAM NOTES:
PHASE I.
1. 35-62'DIA. CELLS WITH 36 CONNECTION ARCS REQUIRED.
2. TOP OF COFFERDAM ELEVATION = 329.0
3. CONNECTING ARC #30A WILL BE USED FOR CONTROLLED FLOODING OF THE COFFERDAM, TOP OF CONNECTING ARC #30A ELEVATION = 317'. SEE SHT CX401 FOR DETAILS
4. GUARD CELLS SHALL BE CONSTRUCTED WITH 84-PS 27.5 SHEET PILE SECTIONS. CELL DIA. = 44'.
5. SEE SHEET NX101 FOR SCOUR PROTECTION AROUND PHASE I COFFERDAM.
KEY PLAN
Revisions
Symbol | Description | Date | Approved
FEASIBILITY LEVEL OF DESIGN FOR COST ESTIMATION ONLY NOT FOR CONSTRUCTION
U.S.ARMY ENGINEER DISTRICT CORPS OF ENGINEERS LOUISVILLE,KENTUCKY
Designed by: G. WERNCKE
Drawn by: A. HAMILTON
Checked by: K. FEGER
Project Engineer: L. DALTON
COE Reviewed By:
OHIO RIVER LOCKS AND DAMS NAVIGATION STUDY
DAM COFFERDAM
COFFERDAM LAYOUT - PHASE I
Scale: 1" = 100'
Date:
Project No. OLM100.3
Sheet No. C X101
PLATE # 11
REVISED FINAL


~700’ between cofferdam #2 and fixed weir
CELL D
CELL E
FLOODGATE AND BRIDGE, SEE DETAILS SH CX402
COFFERDAM NOTES:
PHASE 2.
1. 38-62' DIA CELLS WITH 32' CONNECTING ARCS REQUIRED, KENTUCKY SIDE, RE-USE SHEET PILES FROM PHASE 1 CELLS 13 & 29 REMAIN AFTER PHASE 1
2. TOP OF PHASE 1 COFFERDAM ELEVATION = 325.8
3. CONNECTING ARC "65A WILL BE USED FOR CONTROLLED FLOODING OF THE COFFERDAM. TOP OF CONNECTING ARC "65A ELEVATION = 317 SEE SHT CX406 FOR DETAILS.
4. CELLS D AND E REMAIN IN THE SAME LOCATION AS SHOWN IN PHASE 1 TO ANCHOR THE DEFLECTOR.
5. SEE SHEET XX002 FOR SCOUR PROTECTION AROUND PHASE II COFFERDAM.
KEY PLAN
Revisions
Symbol | Description | Date | Approved
FEASIBILITY LEVEL OF DESIGN FOR COST ESTIMATION ONLY NOT FOR CONSTRUCTION
U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS LOUISVILLE, KENTUCKY
Designed by: G. WERNCKE
Drawn by: A. HAMILTON
Checked by: K. FEGER
Project Engineer: L. DALTON
CDC Reviewed By:
OHIO RIVER
DAM COFFERDAM
COFFERDAM LAYOUT - PHASE 2
Scales: 1" = 100'
Drawing Number: OLM100.3
C
X106
PLATE # 16
REVISED FINAL

ITD Construction Findings

- Cost for ITD Construction using traditional cofferdams is competitive with ITW costs assuming no delays are experience due to a supplemental EIS, acquisition changes, or Incremental funding restrictions.

- The Schedule for ITD Construction will cause a delay of 12+ months in completion of the Dam portion of the contract and realization of project benefits of $875 million per year.

Beyond Olmsted– Alternatives and Impacts to Long Term Investment

- At the current funding level of $150 million per year, it will take until 2024 to finish Olmsted L/D, 2033 to finish Lower Mon L/D, and 2040 to finish Kentucky L/D. This is assuming that no significant failure of the system occurs in the next 28 years – a bad assumption.
- The Top 23 projects in the IMTS Inventory will not be completed in well over the next 100 years with status quo funding.
- CONCLUSION: The System is not sustainable.

Inland Navigation's Future…

	Annual Program	Total Proj	Total Cost	Funded, FY2012-32	Total Not Funded
CPBM, 2010	$380M	110	$18B	27 @ $7.6B	83 @ $10.4B
IWTF, 2010	$170M	110	$18B	6 @ $3.4B	104 @ $14.6B
CPBM, 2012	$380M	110	$19B	17 @ $7.6B	93 @ $11.4B
IWTF, 2012	$170M	110	$19B	2 @$3.4B	108 @ $15.6B

ASSUMPTION: 110 urgent maintenance needs continue to serve without catastrophic failure for the next 20 years. Is this a reasonable expectation? If not, what should we do? Examples:

Unfunded Projects	Risk	Consequences
New Upper Miss Lock 21	Aging single 600-ft lock at risk of failure	Traffic delays mechanical failures
Calcasieu Lock	62-yr old lock Traffic Congestion	Continued traffic delays
Bayou Sorrel Lock	Traffic Congestion	Continued traffic delays

Beyond Olmsted– Alternatives and Impacts to Long Term Investment

- OPTIONS - Changing the Model
  - Must generate a sustainable funding stream. Fix the IWTF or somehow change the funding mechanism.
  - $380 million a year according to the IMTS CPBM. $445 million per year to cover the CPBM projects plus finishing Olmsted 2 years early.
  - Explore Public/Private Partnerships
  - The Panama Canal Authority generates nearly $1 billion per year via transit fees.
  - Consider the Private development model for funding with reimbursement thru operations (Military Model)

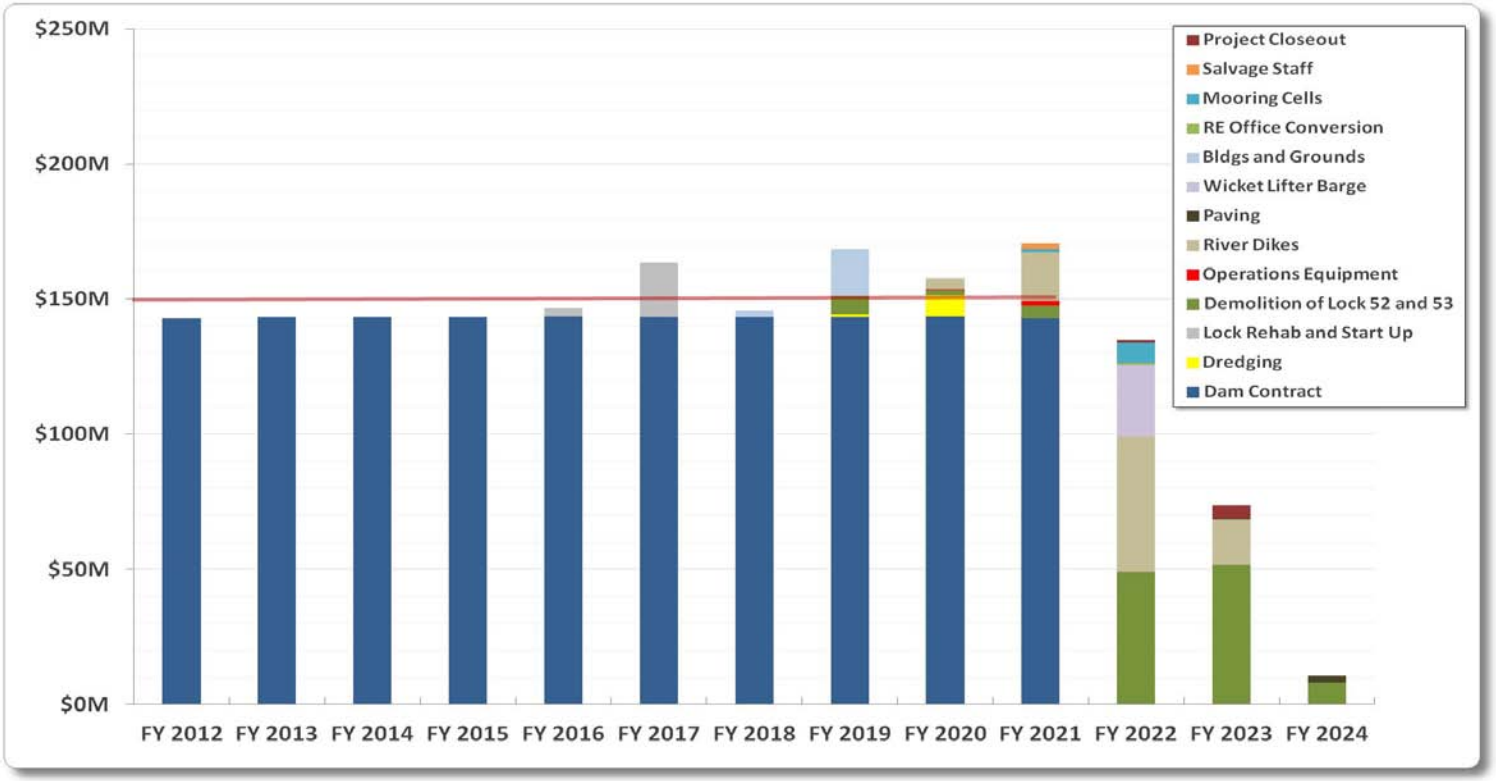
BACK UP SLIDES

Benefit-Cost Ratio Summary

	For Authorization		For Budget Development	
	Authorized Project Last Approved Report / 1990 Benefit Update (1 Oct 1990 price level)	Recommended Project PACR / 2007 Economics Update, Revised Nov 2011 (1 Oct 2011 price level)	Authorized Project Last Approved Report / 1990 Benefit Update (1 Oct 1990 price level)	Recommended Project PACR / 2007 Economics Update, Revised Nov 2011 (1 Oct 2011 price level)
	LAR 8.875%	Current 4.000%	OMB 7.000%	OMB 7.000%
Annualized Benefits				
Transportation Benefits	$ 539,300,000	$ 780,748,662	$ 530,845,211	$ 823,272,341
Fuel Tax Revenues	$ -	$ 16,376,787	$ -	$ 19,976,006
Less WOPC Normal O&M	$ 5,000,000	$ 7,664,547	$ 5,000,000	$ 7,664,547
Less LD 52 Repairs	$ 28,350,000	$ 10,462,184	$ 28,350,000	$ 12,291,092
Less LD 53 Repairs	$ 27,050,000	$ 9,947,814	$ 27,050,000	$ 11,860,808
Incremental Annual Benefits	$ 599,700,000	$ 825,199,996	$ 591,245,211	$ 875,064,795
Annualized Costs				
Construction	$ 74,906,874	$ 72,621,757	$ 60,286,595	$ 211,450,732
Interest During Construction	$ 81,166,154	$ 6,383,499	$ 46,991,789	$ 19,093,734
Normal O&M	$ 2,500,000	$ 3,832,274	$ 2,500,000	$ 3,832,274
Main Chamber Maintenance	$ -	$ 295,393	$ -	$ 277,669
Aux Chamber Maintenance	$ -	$ 314,515	$ -	$ 314,605
Dam Maintenance	$ -	$ 71,621	$ -	$ 60,200
Incremental Annual Costs	$ 158,573,029	$ 83,519,059	$ 109,778,384	$ 235,029,214
Net Annual Project Benefits	$ 441,126,971	$ 741,680,937	$ 481,466,826	$ 640,035,580
BENEFIT - COST RATIO	**3.8**	**9.9**	**5.4**	**3.7**

Olmsted Funding Alternatives

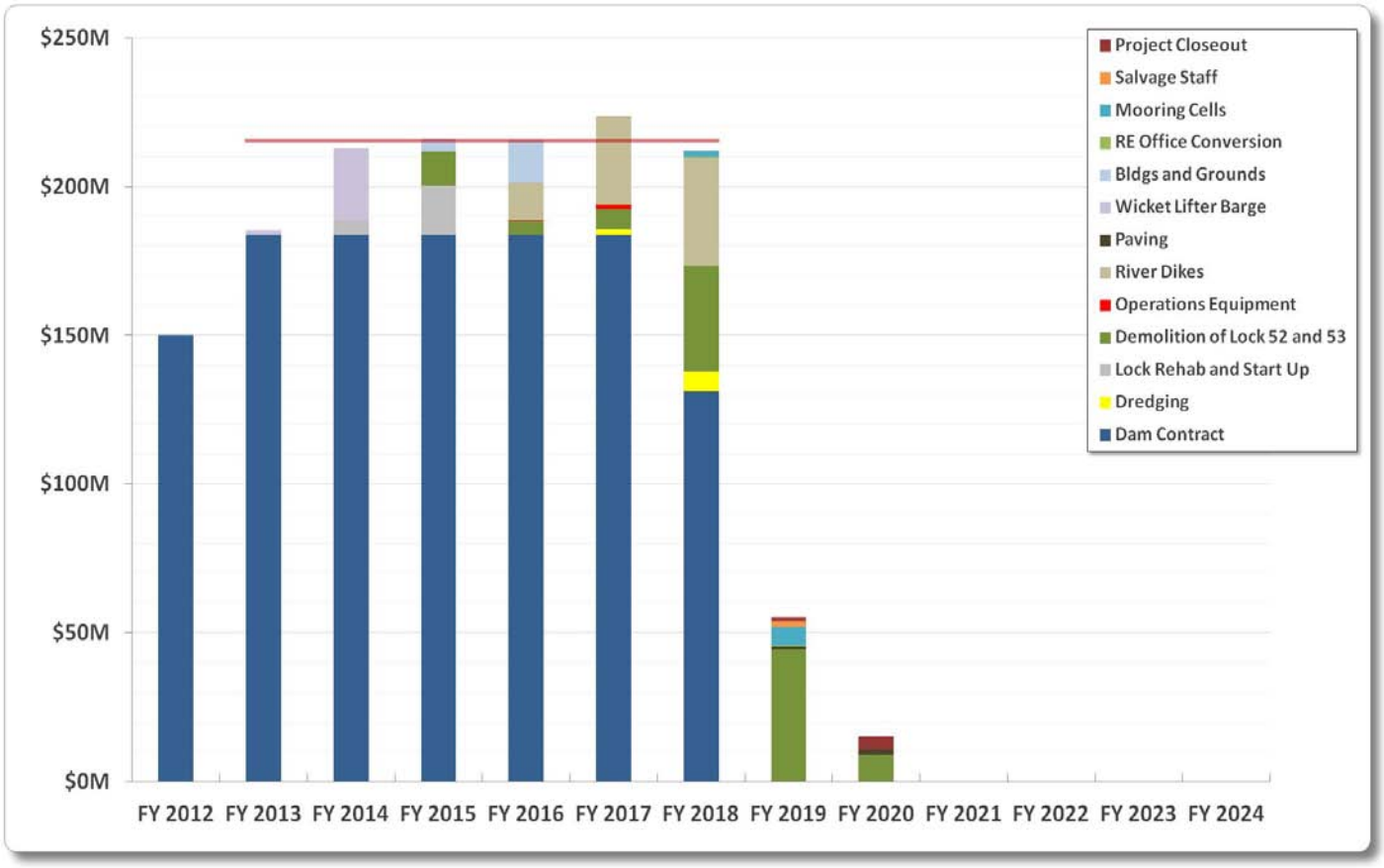
Olmsted Status Quo $150M/year



Source: April 2012 PACR

Olmsted Funding Alternatives

Optimal Funding Stream



Source: April 2012 PACR

OLMSTED COSTS

(1 October 2012 Price Level, millions)

Metric	Alt. 1 STATUS QUO	Alt. 2 OPTIMAL OLMSTED FUNDING	Alt. 3 Slowdown Olmsted			Alt. 4 Pause Olmsted		
			Alt. 3a OLMSTED SLOWDOWN 2 YEARS	Alt. 3b OLMSTED SLOWDOWN 4 YEARS	Alt. 3c OLMSTED SLOWDOWN 6 YEARS	Alt. 4a OLMSTED PAUSE 2 YEARS	Alt. 4b OLMSTED PAUSE 4 YEARS	Alt. 4c OLMSTED PAUSE 6 YEARS
OPERATIONAL / COMPLETION								
Project 100% Operational Yr	2020	2018	2023	2026	2029	2024	2026	2029
Years Advanced		2	(3)	(6)	(9)	(4)	(6)	(9)
Project Completion Year	2024	2020	2026	2029	2032	2026	2029	2032
Remaining Constr Duration	13	9	15	18	21	15	18	21
CONSTRUCTION EXPENDITURES								
Remaining Base Cost	$1,528.3	$1,392.9	$1,659.4	$1,758.7	$1,858.0	$1,620.1	$1,640.1	$1,660.8
Over Status Quo	*na*	($135.5)	$131.0	$230.4	$329.7	$91.8	$111.7	$132.4
Remaining Fully Funded (est) *	$1,733.9	$1,500.8	$1,987.4	$2,217.4	$2,468.9	$1,962.1	$2,105.6	$2,263.0
Over Status Quo	*na*	($233.1)	$253.5	$483.5	$735.1	$228.2	$371.7	$529.1
PV Base Cost (Yr 2014) **	$1,194.4	$1,198.5	$1,169.5	$1,131.8	$1,097.3	$1,115.7	$1,015.8	$929.5
Over Status Quo	*na*	$4.0	($25.0)	($62.6)	($97.1)	($78.7)	($178.7)	($264.9)
Average Annual Cost **	$86.5	$86.8	$84.7	$82.0	$79.5	$80.8	$73.6	$67.4
Over Status Quo	*na*	$0.3	($1.8)	($4.5)	($7.0)	($5.7)	($12.9)	($19.2)

SOURCE: CELRH-EC-T.

* Assumes 3% annually for years 2014 on.

** Using a 7% discount/amortization rate over 50 years (for years 2012-2063).

SYSTEM COSTS

(1 October 2012 Price Level, millions)

Metric	Alt. 1 STATUS QUO	Alt. 2 OPTIMAL OLMSTED FUNDING	Alt. 4 Pause Olmsted								
			Alt. 4a OLMSTED PAUSE 2 YEARS		Alt. 4b OLMSTED PAUSE 4 YEARS			Alt. 4c OLMSTED PAUSE 6 YEARS		
			Option 1 - divert funds to prioritied constr.	Option 2 - divert funds to prioritied rehabs	Option 1 - divert funds to prioritied constr.	Option 2 - divert funds to prioritied rehabs	Option 3 - divert funds to prioritied completions	Option 1 - divert funds to prioritied constr.	Option 2 - divert funds to prioritied rehabs	Option 3 - divert funds to prioritied completions
SYSTEM EXPENDITURES										
Remaining Base Cost	$7,694.2	$7,558.8	$7,786.0	$7,789.6	$7,805.7	$7,806.6	$7,806.0	$7,826.7	$7,849.7	$7,828.4
Over Status Quo	*na*	($135.5)	$91.8	$95.4	$111.4	$112.3	$111.7	$132.4	$155.4	$134.2
Remaining Fully Funded *	$31,109.6	$30,876.5	$31,280.6	$30,618.9	$31,318.3	$29,679.8	$30,076.4	$31,358.4	$28,599.5	$30,283.7
Over Status Quo	*na*	($233.1)	$171.0	($490.7)	$208.7	($1,429.8)	($1,033.2)	$248.8	($2,510.1)	($825.9)
PV Base Cost (Yr 2014) **	$1,802.3	$1,806.3	$1,824.3	$1,862.2	$1,828.7	$1,874.0	$2,027.4	$1,833.6	$1,907.7	$2,045.6
Over Status Quo	*na*	$4.0	$22.0	$59.9	$26.5	$71.8	$225.2	$31.3	$105.4	$243.3
Average Annual Cost **	$130.6	$130.9	$132.2	$134.9	$132.5	$135.8	$146.9	$132.9	$138.2	$148.2
Over Status Quo	*na*	$0.3	$1.6	$4.3	$1.9	$5.2	$16.3	$2.3	$7.6	$17.6

SOURCE: Olmsted base costs received from CELRH-EC-T. Other project costs compiled by IMTS from MSCs.

* Assumes 3% annually for years 2014 on.

** Using a 7% discount/amortization rate over 50 years (for years 2012-2063).

Number of Projects Advanced and Delayed Over "Status Quo" by Funding Scenario

Metric	Alt. 2	Alt. 4 Pause							
		Alt. 4a 2-years		Alt. 4b 4-years			Alt. 4c 6-years		
		Opt. 1	Opt. 2	Opt. 1	Opt. 2	Opt. 3	Opt. 1	Opt. 2	Opt. 3
No. of New Constructions Completed Earlier :	1	0	1	1	1	2	1	1	1
No. of New Constructions Delayed :	0	10	9	9	9	7	9	9	8
No. of Rehabilitations Completed Earlier :	0	0	5	0	7	1	0	9	5
No. of Rehabilitations Delayed :	0	12	7	12	5	11	12	3	7

OLMSTED BENEFITS

(1 October 2012 Price Level, millions)

Metric	Alt. 1 STATUS QUO	Alt. 2 OPTIMAL OLMSTED FUNDING	Alt. 4 Pause Olmsted		
			Alt. 4a OLMSTED PAUSE 2 YEARS	Alt. 4b OLMSTED PAUSE 4 YEARS	Alt. 4c OLMSTED PAUSE 6 YEARS
No. of Years Advanced		2	(4)	(6)	(9)
Straight Sum (no.yrs x AAB)	$64,754.8	$66,504.9	$61,254.5	$59,504.4	$56,879.2
Over Status Quo	*na*	$1,750.1	($3,500.3)	($5,250.4)	($7,875.6)
Present Value, year 2014	$7,905.5	$9,112.5	$5,930.5	$5,126.2	$4,106.5
Over Status Quo	*na*	$1,207.0	($1,975.1)	($2,779.3)	($3,799.0)
Average Annual *	$572.8	$660.3	$429.7	$371.4	$297.6
Over Status Quo	*na*	$87.5	($143.1)	($201.4)	($275.3)

* Amortized at 7% discount/amortization rate over 50 years (years 2012-2063).

INCREMENTAL BENEFIT / LOSS BY PROJECT BY FUNDING SCENARIO

Straight Sum (millions) *

	Project	Alt. 4 Pause Olmsted							
		Alt. 4a OLMSTED PAUSE 2		Alt. 4b OLMSTED PAUSE 4 YEARS			Alt. 4c OLMSTED PAUSE 6 YEARS		
		Option 1	Option 2	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
New Construction	Lower Mon 2,3, & 4 Replacement	($253.0)	($913.1)	$1,804.3	($1,793.3)	($132.0)	$1,804.3	($2,519.4)	($198.0)
	Kentucky Lock Addition	($198.2)	($198.2)	($330.3)	($330.3)	($330.3)	($462.4)	($462.4)	$1,387.2
	Chickamauga Replacement Lock	($186.6)	($186.6)	($373.2)	($373.2)	($373.2)	($559.7)	($559.7)	($559.7)
	L/D 25 Upper MS 1200' Lock Addition	($109.7)	($109.7)	($219.4)	($219.4)	$2,578.1	($329.1)	($329.1)	($329.1)
	High Island to Brazos River, TX	($11.3)	$215.3	($22.7)	$215.3	$215.3	($34.0)	$215.3	($34.0)
	Lagrange 1200' Lock Addition	($106.1)	($106.1)	($212.2)	($212.2)	($212.2)	($318.4)	($318.4)	($318.4)
	Inner Harbor Lock Replacement	($320.1)	($320.1)	($640.2)	($640.2)	($640.2)	($960.3)	($960.3)	($960.3)
	L/D 22 Upper MS 1200' Lock Addition	($91.6)	($91.6)	($183.2)	($183.2)	($183.2)	($274.8)	($274.8)	($274.8)
	L/D 24 Upper MS 1200' Lock Addition	($99.7)	($99.7)	($199.5)	($199.5)	($199.5)	($199.5)	($199.5)	($199.5)
Major Rehabilitation	L/D 25 Upper MS Dam Major Rehab	($19.3)	$366.1	($38.5)	$366.1	($38.5)	($57.8)	$366.1	$366.1
	Lagrange Major Rehab	($20.4)	$508.9	($40.7)	$508.9	$508.9	($61.1)	$498.7	$508.9
	Lower Monumental Major Rehab	($6.6)	$165.2	($13.2)	$165.2	($13.2)	($19.8)	$152.0	$152.0
	ILL WW Thomas O'Brien L/D Major Rehab	($9.8)	$248.7	($19.5)	$243.8	($19.5)	($29.3)	$243.8	$243.8
	Greenup Dam Rehab PED and Const	($37.9)	($37.9)	($75.8)	$1,175.5	($75.8)	($113.8)	$1,137.6	($113.8)
	JT Myers Dam Major Rehab	($18.3)	$603.4	($36.6)	$603.4	($36.6)	($54.9)	$585.1	$585.1
	Meldahl Dam Rehab	($37.9)	($37.9)	($75.8)	($75.8)	($75.8)	($113.8)	$1,137.6	($113.8)
	Montgomery Major Rehab	($49.8)	($49.8)	($99.5)	($99.5)	($99.5)	($149.3)	($149.3)	($149.3)
	Mel Price Upper MS Major Rehab	($15.2)	($15.2)	($30.4)	$524.2	($30.4)	($45.6)	$524.2	($45.6)
	No. 2 Lock AR Lock Wall/Bank Slope Rehab	($45.4)	($45.4)	($90.7)	($90.7)	($90.7)	($136.1)	($136.1)	($136.1)
	Willow Island Dam Rehab PED and Const	($23.8)	($23.8)	($47.5)	($47.5)	($47.5)	($59.4)	($59.4)	($59.4)
	Marmet Dam Rehab	($22.7)	($22.7)	($45.4)	($45.4)	($45.4)	($45.4)	$805.4	($45.4)
	TOTAL BENEFIT GAIN:	($1,683.3)	($150.2)	($990.2)	($507.9)	$658.7	($2,220.1)	($302.6)	($294.1)
	Benefits Foregone:								
	Olmsted L/D Construction	($3,500.3)	($3,500.3)	($5,250.4)	($5,250.4)	($5,250.4)	($7,875.6)	($7,875.6)	($7,875.6)

* Number of years of advancement or delay multiplied by the average annual benefit.

SYSTEM BENEFITS

(1 October 2012 Price Level, millions)

Metric	Alt. 1 STATUS QUO	Alt. 2 OPTIMAL OLMSTED FUNDING	Alt. 4 Pause Olmsted							
			Alt. 4a OLMSTED PAUSE 2 YEARS		Alt. 4b OLMSTED PAUSE 4 YEARS			Alt. 4c OLMSTED PAUSE 6 YEARS		
			Option 1	Option 2	Option 1	Option 2	Option 3	Option 1	Option 2	Option 3
Present Value (2014)	$9,240.3	$10,447.3	$7,130.6	$7,477.9	$7,440.6	$6,714.4	$7,178.7	$6,394.2	$5,761.3	$6,326.1
Over Status Quo	*na*	$1,207.0	($2,109.7)	($1,762.4)	($1,799.7)	($2,525.9)	($2,061.7)	($2,846.1)	($3,479.1)	($2,914.2)
Average Annual *	$669.6	$757.0	$516.7	$541.8	$539.1	$486.5	$520.2	$463.3	$417.5	$458.4
Over Status Quo	*na*	$87.5	($152.9)	($127.7)	($130.4)	($183.0)	($149.4)	($206.2)	($252.1)	($211.2)

* Amortized at 7% discount/amortization rate over 50 years (years 2012-2063).

COST-BENEFIT ANALYSIS OF FUNDING ALTERNATIVES

OLMSTED LOCKS AND DAM

(1 October 2012 Price Level, millions)

Funding Strategy Alternative / Option			Olmsted				
			Total Construction Expenditures (Base Cost)	Interest During Construction (to lock operational year)	Net Benefits (7% Discount Rate)		Benefit-Cost Ratio
					2012-2063 Present Value	Average Annual (50 years, eoy)	
Alt. 1		STATUS QUO *	$1,528.3	$264.2	$6,711.1	$486.3	6.6
Alt. 2		OPTIMAL OLMSTED FUNDING *	$1,392.9	$178.1	**$7,914.1**	**$573.5**	**7.6**
Alt. 4a	Opt. 1-2	OLMSTED PAUSE 2 YEARS - divert funds to prioritied construction	$1,620.1	$574.6	$4,814.8	$348.9	5.3
Alt. 4b	Opt. 1-3	OLMSTED PAUSE 4 YEARS - divert funds to prioritied construction	$1,640.1	$647.6	$4,110.4	$297.8	5.0
Alt. 4c	Opt. 1-3	OLMSTED PAUSE 6 YEARS - divert funds to prioritied construction	$1,660.8	$903.8	$3,177.0	$230.2	4.4

* Constructed from approved Olmsted PACR dated April 2012.

COST-BENEFIT ANALYSIS OF FUNDING ALTERNATIVES

SYSTEM **

(1 October 2012 Price Level, millions)

Funding Strategy Alternatives	Total Construction Expenditures (Base Cost), All Projects	Interest During Construction (to each projects lock operational year)	Net Benefits (7% Discount Rate)		Benefit-Cost Ratio
			2012-2063 Present Value	Average Annual (50 years, eoy)	
Alt. 1 STATUS QUO *	$7,694.2	$1,933.0	$7,438.1	$539.0	5.1
Alt. 2 OPTIMAL OLMSTED FUNDING *	$7,558.8	$1,846.9	**$8,641.0**	**$626.1**	**5.8**
Alt. 4a Opt. 1 OLMSTED PAUSE 2 YEARS - divert funds to prioritied construction	$7,786.0	$3,845.3	$5,306.3	$384.5	3.9
Alt. 4a Opt. 2 OLMSTED PAUSE 2 YEARS - divert funds to prioritied rehabilitation	$7,789.6	$3,323.7	$5,615.7	$406.9	4.0
Alt. 4b Opt. 1 OLMSTED PAUSE 4 YEARS - divert funds to prioritied construction	$7,805.7	$5,412.9	$5,611.9	$406.6	4.1
Alt. 4b Opt. 2 OLMSTED PAUSE 4 YEARS - divert funds to prioritied rehabilitation	$7,806.6	$4,456.1	$4,840.4	$350.7	3.6
Alt. 4b Opt. 3 OLMSTED PAUSE 4 YEARS - prioritize project completions	$7,806.0	$4,426.8	$5,151.2	$373.3	3.5
Alt. 4c Opt. 1 OLMSTED PAUSE 6 YEARS - divert funds to prioritied construction	$7,826.7	$7,262.1	$4,560.7	$330.5	3.5
Alt. 4c Opt. 2 OLMSTED PAUSE 6 YEARS - divert funds to prioritied rehabilitation	$7,849.7	$6,029.9	$3,853.6	$279.2	3.0
Alt. 4c Opt. 3 OLMSTED PAUSE 6 YEARS - prioritize project completions	$7,828.4	$6,030.9	$4,280.5	$310.2	3.1

* Olmsted data constructed from approved Olmsted PACR dated April 2012.

** The system includes only projects whose funding streams and/or operational dates were adjusted. Project completion and/or operational date may or may not have been altered.