Section 5 Navigation System Development

Summary of System Optimum Development

General

This section explains the maintenance, construction, and planning optimum actions in the years FY 10-FY 14 contributing towards reducing risk, improving reliability and efficiency. The summary statement of optimum actions to be accomplished is complimented by detailed information in the project fact sheets for respective system Navigation locks & dams' maintenance, channels' maintenance, construction projects, and planning studies.

A key component to the historic and continued reliability of the Ohio River & Tributaries Navigation System has been a proactive preventative maintenance program. This program consists of a systematic approach which reviews historical and future service demands (operating cycles), the actual operating condition of each component at a facility, and projected costs of repair and replacement of the components. Based upon these factors a maintenance and repair schedule along with an appropriate inspection program is then developed to reduce the risk of unscheduled failures and maximize the benefit of available funds. This proactive maintenance plan has been intended to include scheduled repair or replacement of miter gates, dam gates, valves, associated operating components and the repair of other critical facility components.

Rationale is presented for developing the system, priorities of the actions, and what the major activities sequence should be. This section ties the individual projects together to facilitate gaining perspective of the activities necessary to increase the reliability, efficiency, and effectiveness of this major Navigation system.

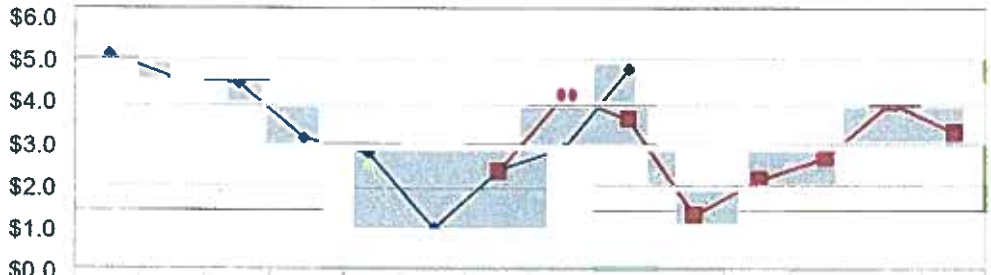
System-Wide Optimum Investigations and Assessments

Comprehensive investigations, condition assessments, and risk analysis are optimum management measures to enable attaining the Navigation system goals. For the mainstem of the Ohio River Navigation System, the products from the Ohio River Mainstem Study (ORMSS) are complete.

Optimum investigations include the folJowing, shown in chronological priority order to ensure continuity to develop and manage the system.

1. Continue Upper Ohio Navigation Study (Emsworth, Dashields, and Montgomery) for completion in FY 11.
2. Start Tennessee-Cumberland River Systems Study in FY 11
3. Start Kentucky River Locks 1-4 Disposition Study in FY11
4. Continue Inland Waterways Transportation Economics to assess economic impacts of unscheduled closures as input to the risk assessments.

Ohio River & Tributaries Navigation Investigations
$Millions



	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14
Actual Funding	$5.2	$4.6	$4.5	$3.2	$2.8	$1.0	$2.4	$3.0	$4.8					
Optimum Funding							$2.4	$4.2	$3.6	$1.4	$2.2	$2.7	$4.0	$3.3
President's Budget					$2.6	$0.0	$0.0	$0.0	$0.0	$0.0				

Upper Ohio River Navigation Study: Emsworth, Dashields & Montgomery (EDM) L&D. The Ohio River Mainstem System Study Investment Plan identified Emsworth, Dashields and Montgomery Locks and Dams as the highest priority on the Ohio River. The Upper Ohio River Navigation Study will begin the process for recommending the long term system investment requirements of these facilities.

These facilities are 70+ years of age and exhibit signs of significant structural degradation. Delays in planning solutions to the extensive structural degradation problems at these facilites will threaten the integrity of the Ohio River Navigation System. Studies performed in 2004 showed that there are 33,500 jobs providing income of $1.5 billion dollars that are highly dependent on the safe and reliable operation of the Upper *Ohio* River facilities. Additional maintenance funds are required to keep these older facilities operating and funding requirements will continue to increase as these structures age. Increased maintenance at these facilities also leads to traffic delays easily reaching 40 hours per tow with a planned closure. At a cost to the navigation industry of $400/hour/tow, the economic impacts become extensive. As these facilities continue to age, unplanned closures will become more frequent and more costly. In 2005, Emsworth, Dashields, and Montgomery Locks processed over 22 million tons of cargo which represents $172.9 million in transportation savings (benefits). An operating cost of approximately $6M results in a net benefit of $167M.

Inland Waterways Transportation Economics. The economic and analytical engineering technologies developed for that effort will be used and extended to the balance of the system using the Inland Waterway Navigation Risk Assessments explained in Section 3 and in Appendix 2. See also the separate project fact sheet for the newest initiative titled the Inland Waterway Transportation Economics which is composed in 3 sub-projects being Inland Waterway Navigation Risk Assessments, National Inland Waterway Traffic Forecasts, and the National Inland Waterway Transportation Rate Data. This key program develops the data to assess the economic benefits for maintaining the Navigation systems.

System-Wide Optimum Construction

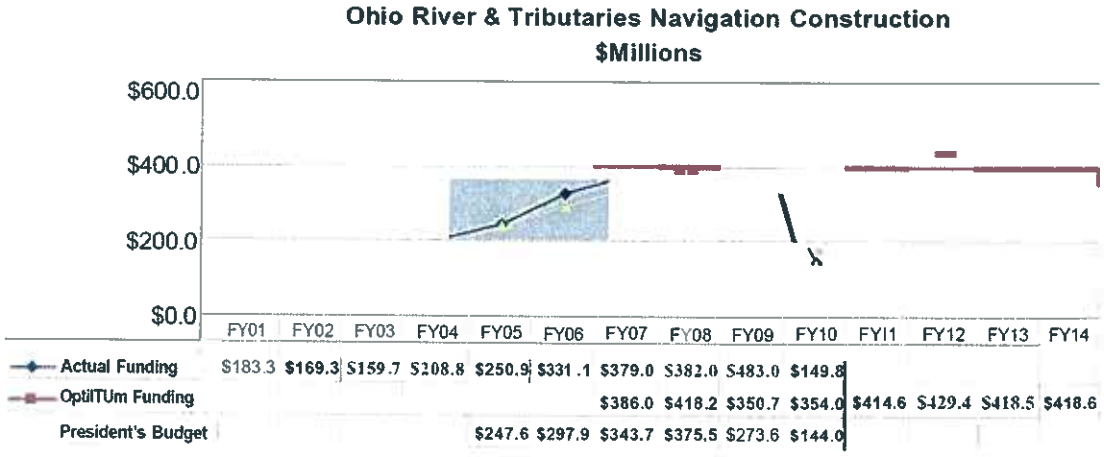
Constrained funding precludes efficiently completing ongoing construction of major projects, and the cost to construct will needlessly be increased. Future projects identified by the sophisticated methodologies being developed will be deprived of timely completion as well. The funding needs to be predictable, planned in concert with all construction projects, such that the needs of the system can be budgeted in the most efficient manner. With proper scheduling of projects, features such as pre-cast yards and specialized construction equipment could be reused to reduce costs for follow-on projects. As an example, the cost of the Olmsted Dam could increase by 40 percent if lack of funding stretches out the construction period by a similar amount. The benefits for the new project will not be realized without the completion of the facility, and the facility(s) to be replaced will need more attention to be kept functional - even then, more risk for major traffic interruption exists.

Optimum construction for completing projects currently underway includes the following, shown in efficient chronological completion order to ensure continuity to develop and improve the efficiency and reliability of the Navigation system.

Construction Optimum Objectives

11. Complete Markland Major Rehabilitation in FY11.
12. Start JT Myers Dam major rehabilitation effectively in FY11.
13. Start JT Myers Lock Extension effectively in FY11.
14. Start Greenup Lock Extension effectively in FY11.
15. Start Marmet Dam major rehabilitation effectively in FY11.
16. Complete Emsworth rehabilitation in FY13.
17. Continue Kentucky lock addition without interruption.
18. Complete Chickamauga Replacement Lock without interruption.
19. Achieve Olmsted Lock and Dam operational in FY16.
20. Continue Lower Mon 2, 3, and 4 construction without interruption.

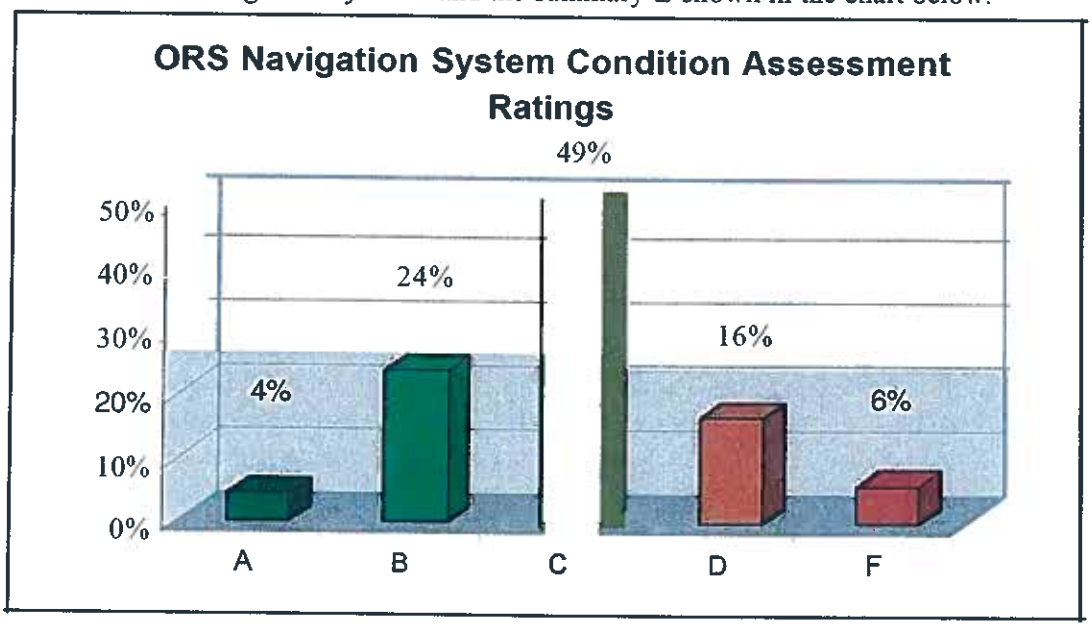
Optimum funding provides for efficient construction and the earliest achievement of benefits. The following chart shows the actual funding FYOI - FY 10, and optimum funding FY07 - FY14. Summary of each project is available on Project Fact Sheets in Appendix 3.



System-Wide **Optimum** Maintenance

Nearly all of the Locks and Dams which comprise the system are between 25 and 80 years old. The maintenance requirements will continue to accelerate as the cycles of operation continue to increase, as paint systems deteriorate, as mechanical and electrical systems become worn out and obsolete, and as the concrete and steel structures are exposed to impacts, water, ice, corrosion and other deterioration. The cost to operate and maintain these complex facilities is not expected to remain a constant. The effects of inflation, the increasing age of the facilities, increased traffic levels and the need to be able to cope with operating and maintaining both new and old technology equipment will require enhanced knowledge and capability at each project. The new electronic systems which *control* opening and closing lock gates and valves, moving dam gates and monitoring these features along with the security of the project will require enhanced technical capability by project personnel and a growing need for field engineers with intimate knowledge of this very unique infrastructure.

The constrained funding for maintenance of navigation projects has caused a decline in the reliability of the older locks in the system. As part of this Five Year Development Plan, the system continues to need a comprehensive maintenance schedule for its navigation facilities. Current condition assessment of the system's lock and dams reveals that 100% are below an "A" rating (except for channels and Olmsted locks which have not yet been put into service). The assessment for each site is shown in the table "FY 10 - FY14 Optimum Program for Ohio River Navigation System" and the summary is shown in the chart below:

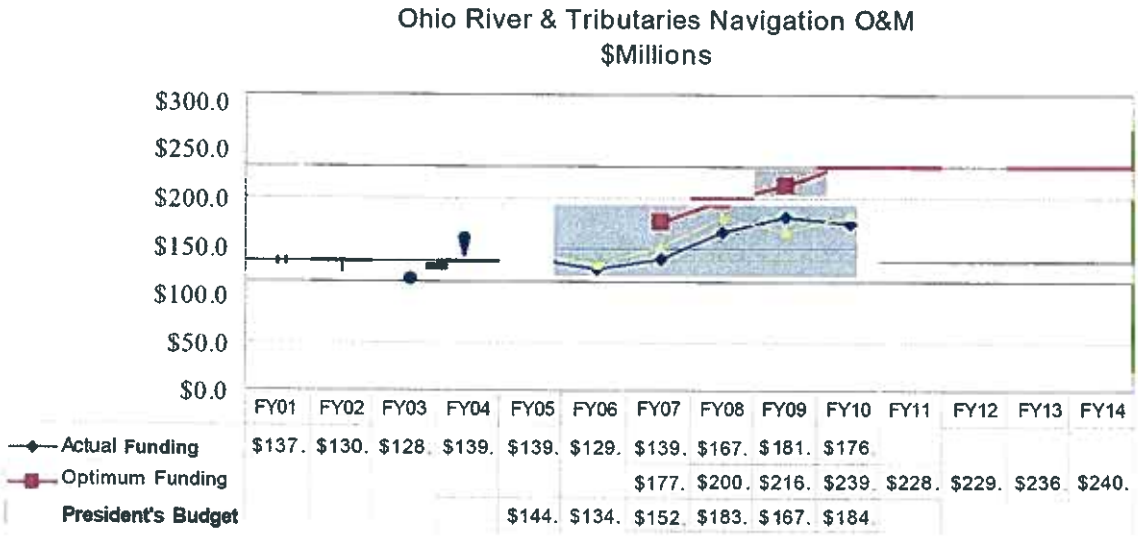


On a regional basis to integrate the resources of the 4 Ohio River districts, the Navigation Locks and Dams Maintenance Standard was implemented in January 2006. The purpose of the standard is to optimize and distribute the available resources to maintain a reliable transportation system. Some key components of this include evaluate, repair, renovate and replace the miter gates, valves, dam gates and operating components. Listed below are some of the more significant major maintenance program groups that are considered essential to assuring the optimum reliability of the Navigation system over the next five years. The optimum investments

to achieve acceptable levels of risk for the fiscal years FY I0 through FY 14 are shown on the table at the end of this Section 5.

Several initiatives have been identified to reduce the risk and improve the reliability, efficiency, economic advantages, and environmental benefits for this system. In addition to normal operation and maintenance requirements, several systemic problems will need to be addressed at multiple-site locations. These are planned to be performed as major maintenance programs, subject to the availability of appropriations.

Optimum funding provides for maintenance to meet the system's risk reduction and reliability goals. The following chart shows the actual funding FYOI - FYIO, and optimum funding FY07 - FYI4. Summary of each project is available on Project Fact Sheets in Appendix 3.



Miter Gates Replacement. One of the most significant is the need to replace worn-out miter gates at several locks in a Gate Replacement Program. Prioritization based on probability of failure and the economic consequences of gate failure has been established in this program. The sequence has begun starting FY07 with Markland and Meldahl; other projects are planning in order is risk for future years. In 2004, severe cracking of the miter gates at McAlpine Lock resulted in a previously un-scheduled closure which closed the Ohio River for Navigation traffic for the II-day duration of the repair. In 2003, major problems with similar gates resulted in a 52-day unscheduled closure at Greenup L&D with and estimated total cost of $42 million. The same problem is currently being experienced at Meldahl L&D. These projects are all high tonnage (over 50 mil tons/yr).

Navigation Dams Erosion Repair. Erosion below or within dam stilling basins is another systemic problem. Left uncorrected, such erosion could result in failure of the dam and loss of the navigation pool which would also impact incidental features such as water intake systems for communities and power generating facilities, as well as cause severe environmental damage. Erosion just downstream of the stilling basin at Emsworth Dam is indicative of the problem as is

erosion discovered in the stilling basins of J.T. Myers Dam. This erosion is the result of the flow of the river through the dam gate bays and the rocks and other debris which is carried with the water. These problems are difficult to discover because they are generally under water. They are also difficult to repair because many of the problem areas are outside of the areas which can be dewatered with existing bulkheads. A new bulkhead which would facilitate such repair and which can be made adaptable to other dam sites is included with the J.T. Myers Major Rehabilitation Study. This problem must be dealt with in a preemptive manner because of seasonal requirements of the dam - these stilling basins can typically only be repaired during the "low flow "season. Failure to fund and execute on this infrastructure need in a timely/efficient manner may lead to catastrophic consequences.

Wall Armor Repair. Another significant systemic problem is the deterioration of wall armor on the locks approach walls. This armor is critical to the safe/efficient operation of the lock and consists of steel strips embedded in the concrete which provide a "rub" surface for tows using the long guide walls to line up the tows as well as when inside the lock chamber. As this wall armor degrades and cannot protect the concrete wall the unprotected concrete deteriorates rapidly which will ultimately lead to a need to rebuild the wall- a major expense which results in huge impact to the Towing Industry due to lengthy closure of the chamber. What may be far more significant in the short term is the danger a degrading wall armor system presents to the tows because of the snags of extremely hard steel which can open up a barge like a can opener- fluctuating lower pools compound this danger by hiding these snags below water which can cause damage below the waterline of the barge. The degradation of the wall armor system is the result of impacts and then freeze-thaw degradation and typically relates closely to how much heavy commercial use there is at the project.

Submerged Emergency Gates Repair. Eight of the twenty Navigation Projects on the Ohio River utilize submerged emergency gates for passing ice and drift to keep the upper approaches to the locks navigable. On the Ohio River there are approximately 29 of these cables operated steel structures which weigh approx. 400 tons each. The oldest are almost 50 yrs old while the "newer ones" are close to 40yrs old. None of these structures have been reconditioned to date. These structures MUST be maintained in a preemptive manner - unscheduled failures will close the lock chambers to traffic for lengthy periods.

Dam Emergency Bulkheads Repair. A major systemic need will be to rehabilitate dam emergency bulkheads and the operating equipment necessary to set these bulkheads (generally an existing crane on each dam).

Tainter Gates and Hoist Machinery. Tainter gate (or similar gate) hoist machinery which controls the flow of the river past the dam will require rehabilitation. As an example of deterioration, the discovery of broken hoist cables at Markland Dam led to the replacement of aU stainless steel cables on the facility.

Concrete Deterioration. Some problems such as "growing concrete" or alkali reaction in the concrete, as has occurred at Chickamauga Lock and Dam, may result in an unusable facility over time.

Risk Reduction Measures. See the Project Fact Sheets for maintenance in Appendix 3 for planned risk-reducing maintenance measures planned for the next five years.

Optimum Resource Levels Summary

General.

Enabling and optimizing system management requires an understanding of the optimum resource levels necessary to maintain, build, and plan the system's future. This section provides applied performance definitions shown in tabular format which show each node, Acceptable Level of Performance for the node, Current Performance Level, 3-year historical allocation, and optimum funding for at least 5 years. This table includes all existing projects requiring maintenance, all projects in construction, and studies necessary to ensure that the system's visionary use is preserved to support the nation's economy.

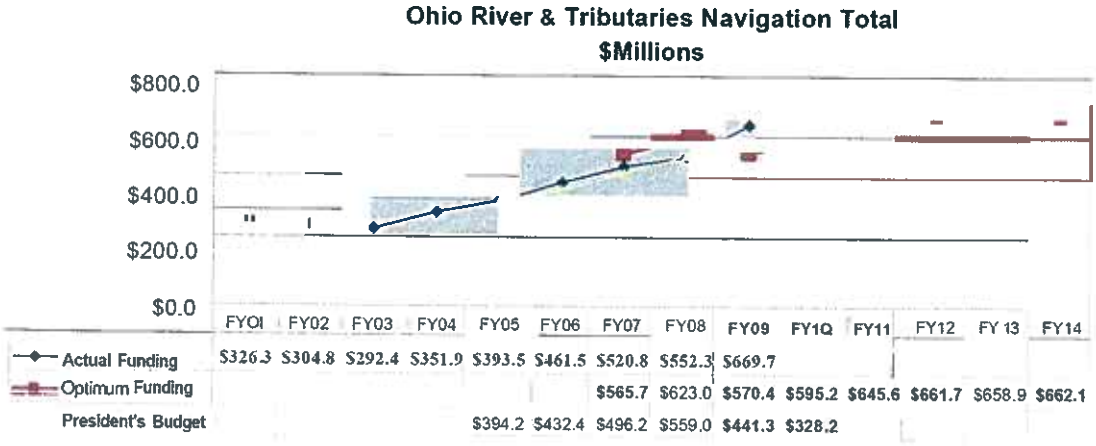
"Optimum" funding is defined as the investment needed for achieving or maintaining the Acceptable Level of Performance; anything less is termed a "constrained" funding level. Each node in the Navigation system is shown with summary figures according to the authorized project to which the nodes belong. The "Optimum Performance Table" summarizes the entire Ohio River and Tributaries Navigation system accounting for all system nodes upstream of Cairo, IL.

Historical Actual and Future Optimum System Resources

Average actual FYOI to FYIO and optimum FY07 to FYI4 allocations, i.e. funding needed to achieve acceptable levels of risk, reliability, and efficiency for the Ohio River & Tributaries Navigation System are shown in the table below.

Averages:	O&M	C	I	Total
Actual FY01-FY10	$133.8	$245.2	$3.0	$382.0
Optimum FY07-FY14	$221.1	$398.7	$3.0	$622.8

The system is funded in 3 categories; Operations and Maintenance (O&M), Construction General (CG), and General Investigations (GI). Historical actual funding allocations for FYO I - FYIO are available but not in this FYDP. Optimum funding for FYIO – FYI4, which are summarized from the detailed project site funding on the following pages, are shown on the summary graph below.


Ohio River & Tributaries Navigation Total
$Millions
$800.0
$600.0
$400.0
$200.0
$0.0
FY01 FY02 FY03 FY04 FY05 FY06 FY07 FY08 FY09 FY1Q FY11 FY12 FY 13 FY14
Actual Funding $326.3 $304.8 $292.4 $351.9 $393.5 $461.5 $520.8 $552.3 $669.7
Optimum Funding $565.7 $623.0 $570.4 $595.2 $645.6 $661.7 $658.9 $662.1
President's Budget $394.2 $432.4 $496.2 $559.0 $441.3 $328.2